SINGER VALVE
Result-Based Solutions. Globally.™

Tank Level Controller (LCP-TP)

Instruction, Operation, and Maintenance Manual

IOM A-9131A
FOR USE WITH 120VAC MODEL ONLY
Revision 0.0

Table of Contents

Health and Safety: Read First

Read the health and safety information before using the LCP-TP Tank Level Controller.

This manual is produced to enable a competent user to install, operate, program, and calibrate the LCP-TP. The electrical installation and use of device should be carried out in accordance with the National Legislation and Statutory Provisions relating to the safe use of this equipment, applicable to the site of installation.

Only persons competent by virtue of their training or experience should be allowed to install, program, and/or operate the product. Work undertaken must be carried out according to the instructions in this manual. Users working on this equipment should be familiar with their responsibilities under any statutory provisions relating to the health and safety of their workplace.

Where appropriate, the user must ensure that the LCP-TP is suitably protected against its operating environment.

WARNING: When installing, operating, and maintaining equipment where hazards may be present, you must protect yourself by wearing Personal Protective Equipment (PPE) and be trained to enter confined spaces.

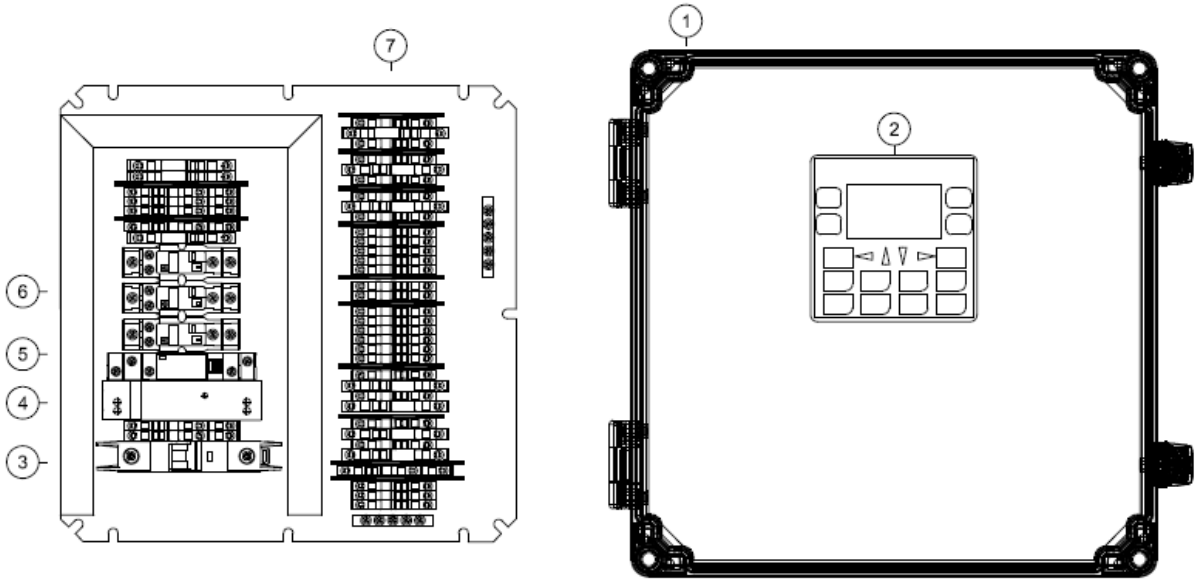
General Description:

The LCP-TP Tank Level Controller is a single process controller designed to complement Singer's Single Solenoid Operated/Override Control Valves. The LCP-TP is capable of On/Off level control using input from either level switches or level transmitters.

The LCP-TP includes the following features:

- Controller programmed with Singer Level Control Algorithm
- Black and white screen display (HMI) w/ Singer Level Control Display
- Keypad interface
- 120VAC, 240VAC, or 24VDC External Power Connection, 50-60Hz
- 24VDC Internal Power Supply
- Solid State Relay Control for Valve Mounted Solenoid
- Surge Protection
- 4 – 20mA Analog Input Signals for Level Transmitter and Remote Control Setpoint
- 4 – 20mA Analog Output Signals for Level Retransmission
- Dry Contact Alarm System Outputs
- Local or Remote Manual Override Valve Control
- Terminal Block Connections for Solenoids, Level, Remote Set Points, Alarms and others
- Data and alarm logging to removable media
- Data trend display

Standard Control Panel Layout:



1. Enclosure
2. Controller
3. Circuit Breaker
4. Power Supply
5. Solid State Relay
6. Mechanical Relay
7. Field Wiring Terminal Strip

Technical Specification:

Standard Equipment:

Display:	Black & White interactive display (standard) 3.5” 20-key keypad and numeric entry capability (128x64)
Input Power Supply:	120VAC, 60 Hz, Typical Load: 0.5A, Full Load: 5A Max 240VAC, 50 Hz, Typical Load: 0.3A, Full Load: 5A Max 24VDC, Typical Load: 1A, Full Load: 5A Max
Sensor DC Supply:	AC Model: 24VDC, 2.5A Max DC Model: Isolated 24VDC, 1A Max
Operating Ambient:	0 to +50ºC (32 to 122 ºF)
Storage temperature:	-10 to +60ºC (14 to 140 ºF)
Relative Humidity:	5 to 90% RH non-condensing
Enclosure Material:	Polycarbonate (standard)
Enclosure Rating:	NEMA Type 4, 4X, 12, 13 IEC 60529, IP66, IP67
Safety standard:	UL 508A Industrial Control Panel
Installation Location:	Not suitable for use in hazardous locations or for use with devices that are installed in hazardous locations
Atmospheres:	Not suitable for use above 2000m or in explosive or corrosive atmospheres. Electrically conductive pollution must be excluded from the cabinet in which this controller is mounted
Digital Input Rating:	24VDC, 2.4mA Max
Alarm Output Rating:	min: 24VDC, 1.5A Max
(Dry Contacts)	max: 250VAC, 1.5A Max
Solenoid Relay Output	
Rating:	120VAC, 1A Max
(Solid State Relays)	240VAC, 1A Max 24VDC, 1.5A Max
Analog Inputs:	
Process Variable:	4-20mA. All configurable between limits
Remote Setpoint:	4-20mA. All configurable between limits
Analog Output:	
Signal Type:	Scaleable 4-20mA signal (non-isolated)
Retransmission Options:	Process variable
Resolution:	12 bits
Clock Accuracy:	+/- Seven Minutes/Month at 20ºC
Datalogging:	Yes
Removable Media:	MicroSD card (not included)
Communication:	Modbus over Serial
Dimensions Enclosure:	11.34” (288mm) Length x 11.34” (288mm) Width x 6.81” (173mm) Height

Installation

Refer to drawing number A-9131A for wiring field connections.

1. Mount the panel in a suitable location according to all local and federal regulations.
2. Check the valve mounted pilot solenoid for orientation and voltage.
3. Before wiring any connection to panel ensure all hubs or fittings used have the same environmental rating as the enclosure.
4. Wire the solenoids to the panel as required.
5. Wire process variable transmitters to panel as required.
6. Wire remote set point to panel as required.
7. Wire process variable retransmission as required.
8. Wire alarm contacts as required.
9. Verify that correct terminal wiring connections have been made.
10. Confirm the power input voltage available is 120VAC.
11. Following all local and federal codes, connect the power to the panel

Field Wiring Terminal Strip:

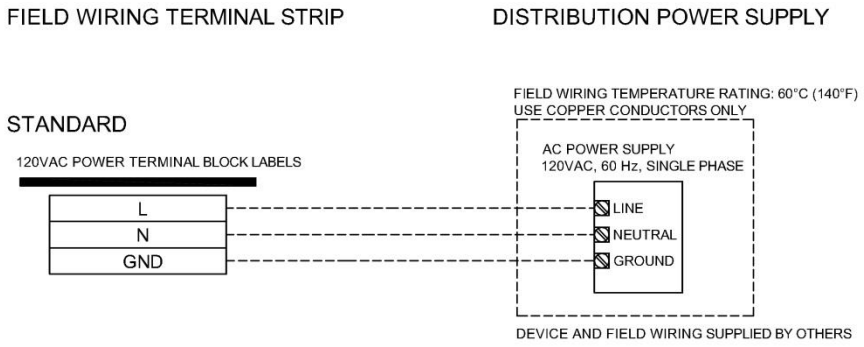
For ease of use, all field connections are to be terminated at the terminal strip. The terminal strip uses spring-cage terminal blocks to eliminate the need for torque requirements of screwed connections and guarantees a vibration-proof connection with long-term stability. The terminal blocks accept wire sizes from 0.08 to 4 mm^2 (28 – 12 AWG).

See Control Panel Wiring Schematic for full Terminal Strip details.

Power Supply Wiring Diagram:

Note: Check the control panel nameplate for power supply requirements.

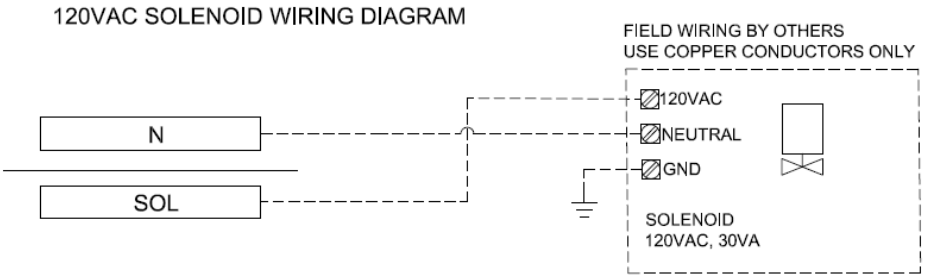
Note: The electrical installation and use of the device should be carried out in accordance with the National Legislation and Statutory Provisions relating to the safe use of this equipment, applicable to the site of installation.



Solenoid Wiring Diagram:

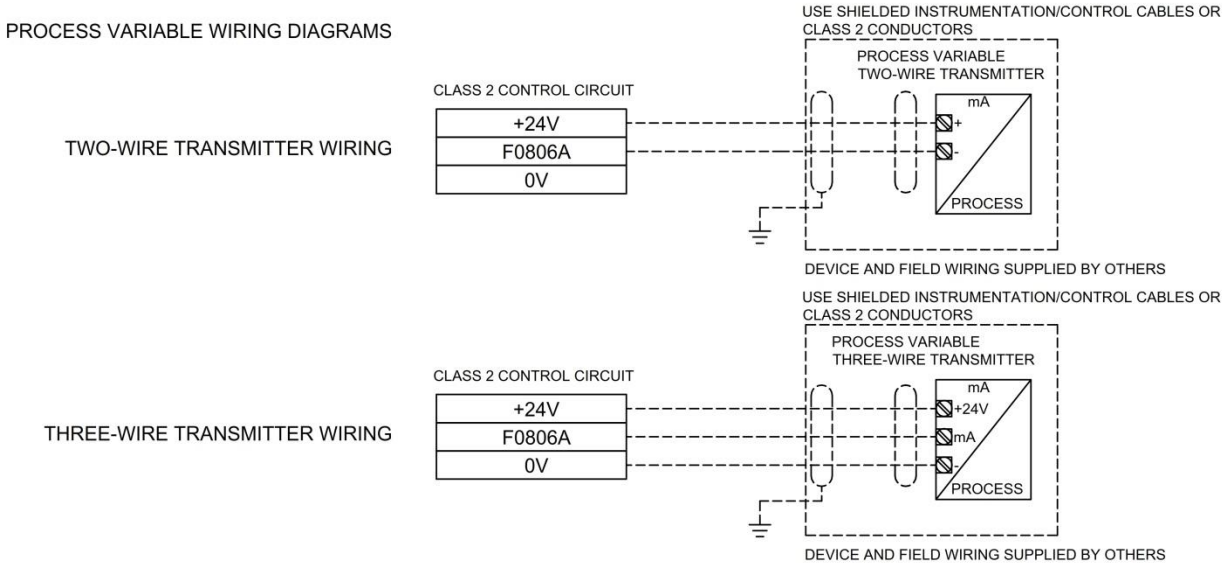
WARNING: Before wiring the solenoid, confirm the solenoid voltage. The supply voltage of the control panel and the solenoid should be the same for the system to operate properly. Failure to comply will result in solenoid malfunction and/or failure.

CAUTION: Do not wire solenoids that exceed the voltage, amp, or volt-amp ratings specified on the wiring diagram.



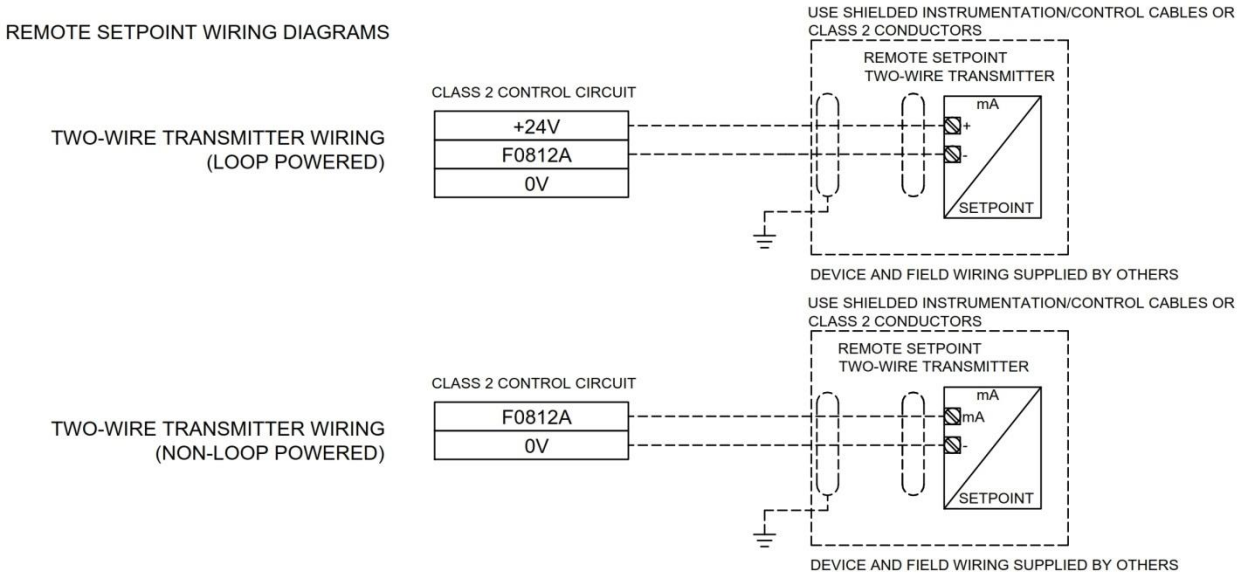
Transmitter Wiring Diagram:

The transmitter input of the LCP-TP uses a 4-20mA signal.



Remote Setpoint Wiring Diagram:

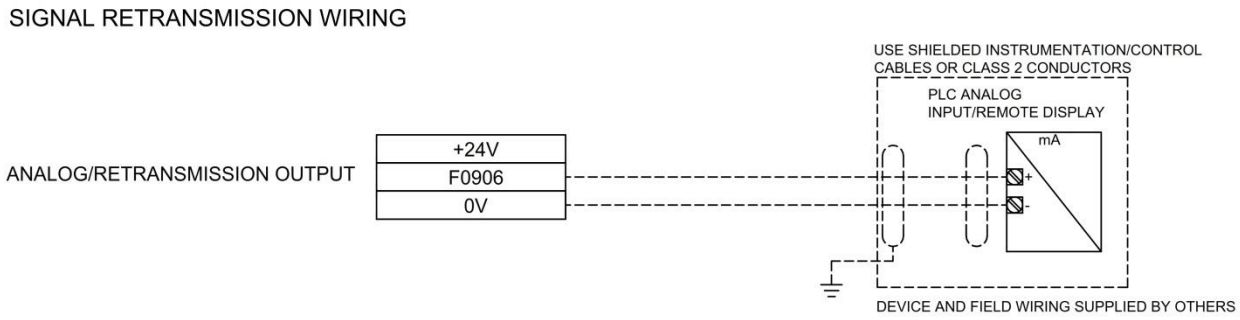
The remote setpoint input of the LCP-TP uses a 4-20mA signal.



Note: The control panel monitors the health of the control signals and its loss is indicated by an alarm. An alarm relay can be set to remotely monitor the status of the process variable and remote setpoint.

Signal Retransmission Wiring Diagram:

The analog output can be used to retransmit the process variable to eliminate the need for a signal splitter. It can be wired to a PLC analog input or a remote display.



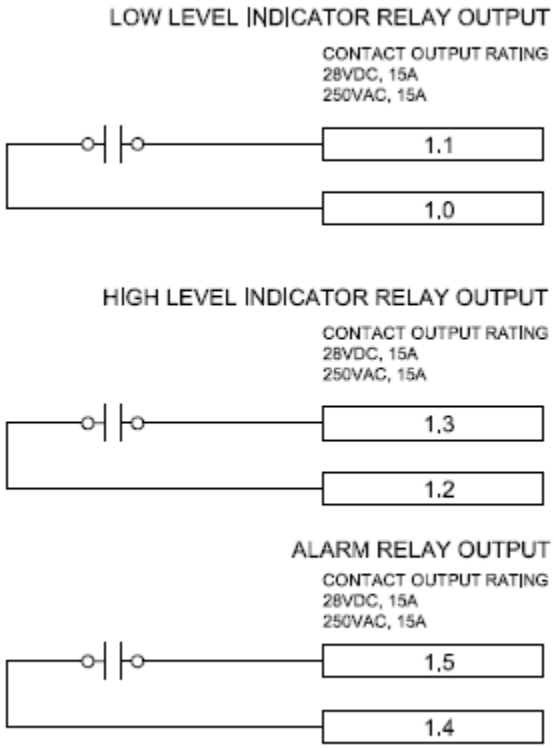
Alarm Wiring/Digital Output Wiring:

The controller is equipped with two mechanical relays for alarms, indication, or control. Device and field wiring shall be supplied by installer.

WARNING:

1. **Do not wire loads that exceed the contact ratings**
2. **For AC general use, use loads with a steady state current draw of up to 10% of the contact rating or 1.5A maximum**
3. **For DC general use, use loads with a steady state current draw of up to 10% of the contact rating or 1.5A maximum**
4. **If using a voltage source external to the control panel, use a properly-sized overcurrent protection device.**

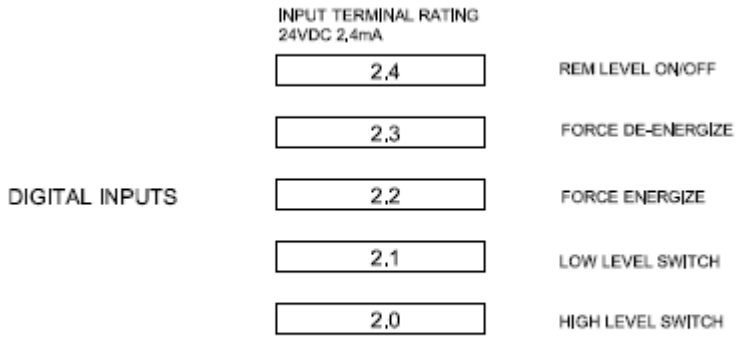
   Disconnecting means and/or branch circuit protection shall be provided by installer.



Controller Override/Digital Input Wiring:

The controller has built-in hardware overrides. Device and field wiring shall be supplied by installer.

WARNING: The digital inputs can take 24VDC ONLY. Wiring an AC voltage to the input will immediately damage the controller.



On/Off Control for Single Solenoid Control Valves:

An On/Off controller is a closed-loop feedback mechanism that only switches between two states: On or Off. An On/Off Controller does not modulate the pulse of the solenoids. For this type of control, the solenoids are either fully on or off; in turn, this allows the control valve to go fully open or fully closed.

On/Off Control: How it Controls the Solenoid

The On/Off controller is designed to actuate one solenoid based on a level setpoint and drawdown. The controller allows the tank to fill until its level hits the setpoint and then drain to the specified drawdown before filling again. The chart below depicts how the level would modulate between the setpoint and drawdown. The controller can use either a level transmitter with a 4 –20mA signal or two level switches to determine tank level.

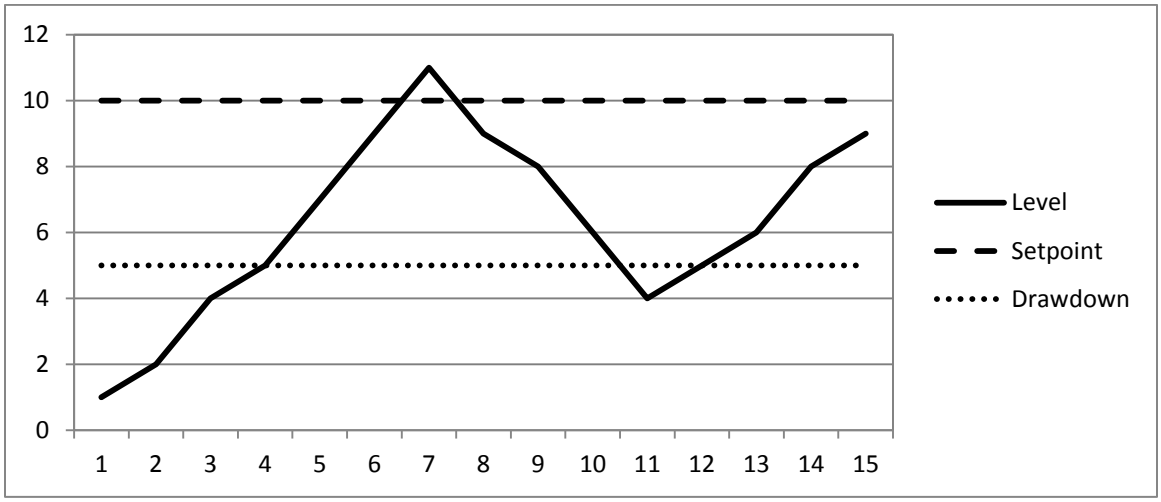


Figure 1: Example of Level Modulation with On/Off Control

On/Off Control with a Level Transmitter

If a level transmitter is being used, the controller compares the 4 –20mA input from the transmitter with the user specified setpoint and drawdown.

For normally open valves, the solenoid remains de-energized until the level signal rises above the setpoint. The solenoid then energizes to close the valve and remains energized until the level falls below the drawdown. The solenoid then de-energizes and the cycle begins again.

For normally closed valves, the solenoid remains energized until the level signal rises above the setpoint. The solenoid then de-energizes to close the valve and remains de-energized until the level falls below the drawdown. The solenoid then energizes and the cycle begins again.

In both cases, the controller will default to opening the valve if level control is started when the level is between the setpoint and drawdown.

On/Off Control with Level Switches
If level switches are being used, one switch must be placed at the desired high level (setpoint) and another at the low level (drawdown). Both signals go to the controller as digital inputs.

For normally open valves, the solenoid remains de-energized until both the low and high switches are active. When the high switch becomes active (water has risen to high switch level), the solenoid energizes and remains energized until both the low and high switches are inactive. When the low switch becomes inactive (water has fallen below low switch level), the solenoid de-energizes and the cycle begins again.

For normally closed valves, the solenoid remains energized until both the low and high switches are active. When the high switch becomes active (water has risen to high switch level), the solenoid de-energizes and remains de-energized until both the low and high switches are inactive. When the low switch becomes inactive (water has fallen below low switch level), the solenoid energizes and the cycle begins again.

In both cases, the controller will default to opening the valve if level control is started when the level is between the high and low switches

Controller Operation

The LCP-TP panel is equipped with a black and white screen and keypad interface. All supervisory and control features are accessed through this HMI (human machine interface). Most graphics and all buttons are interactive. Buttons are activated by pressing their corresponding soft key to the left or right of the screen. The four arrow buttons below the screen are used to navigate menus and screens with multiple fields.

Login Screen:

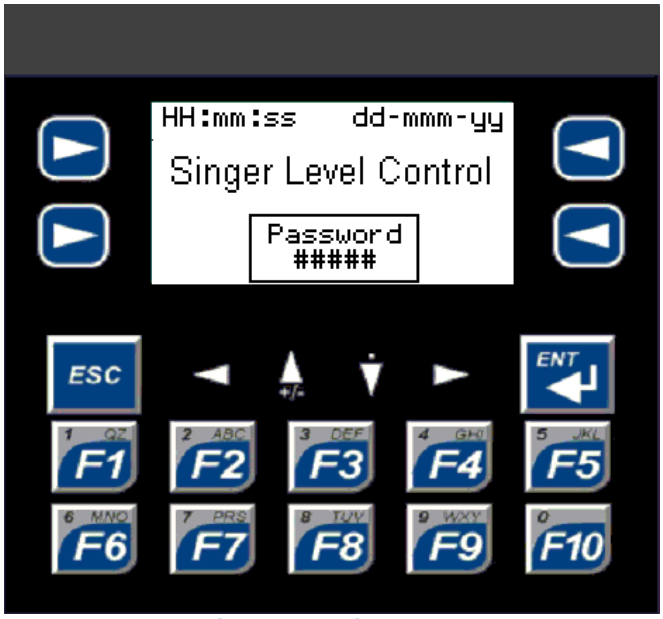


Figure 2: Login Screen

This is the first screen to display on start up. Press ENT to access the password input. Use the arrow keys or number keys to enter the password. Press ENT to submit password, or ESC to cancel. If password is correct, the Main System Screen will display. There are two security levels: Operator and Administrator.

- The default passwords are:
  - Operator: 9999
  - Administrator: 9998

The passwords can be changed by administrator only in the menu.

Operators have restricted access and can adjust the following options:

- Enable/Disable Level Control
- Enable/Disable Manual Override Control

Administrators have full access to the following configuration options in addition to operator options:

- Configure system to use Level Transmitter or Level Switches
- Enable/Disable Remote Control
- Configure Level Transmitter Ranges and Calibration Factors
- Configure Remote Set Point Input Ranges and Calibration Factors
- Configure Control System Settings
- View Error Menu
- Enable/Disable Data Logging
- Enable/Disable Alarms & Notifications

Main System Screen:

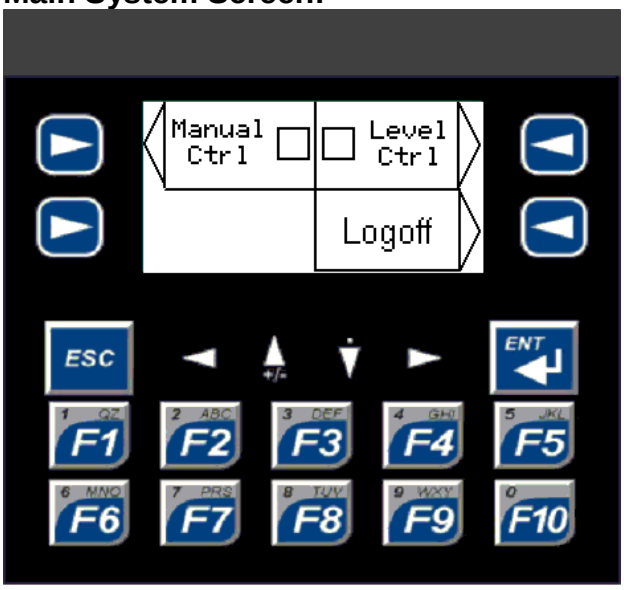


Figure 3: Main Screen as Operator

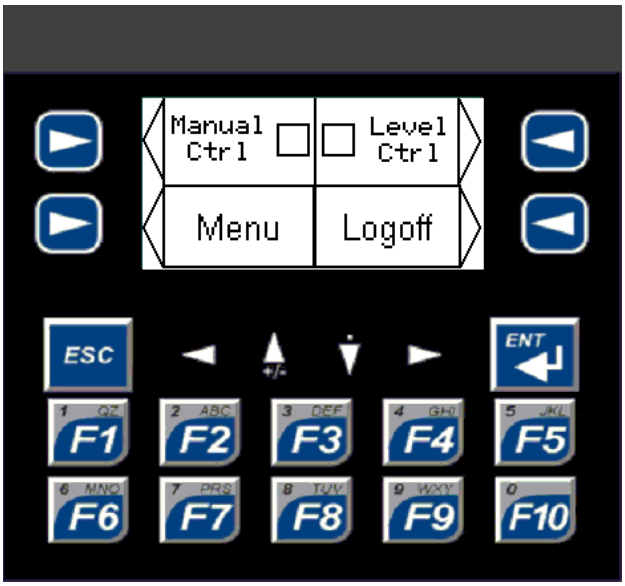


Figure 4: Main Screen as Administrator

The Main System Screen consists of four buttons: Manual Ctrl, Level Ctrl, Menu, and Logoff. They access the Manual Override Control, Level Control, Menu, and Login screens respectively. The Logoff button also clears the current security level when pressed. The Menu button is only visible when logged in as administrator.

The Manual Ctrl and Level Ctrl buttons have indicators to show when those control modes are active. The small square on the button is filled in when its control mode is ON.

Level Control:

There are two control modes: Level Switch Mode and Level Transmitter Mode. These are selectable in the menu. Both modes have their own screen, which displays based on the currently selected mode. These are shown below.

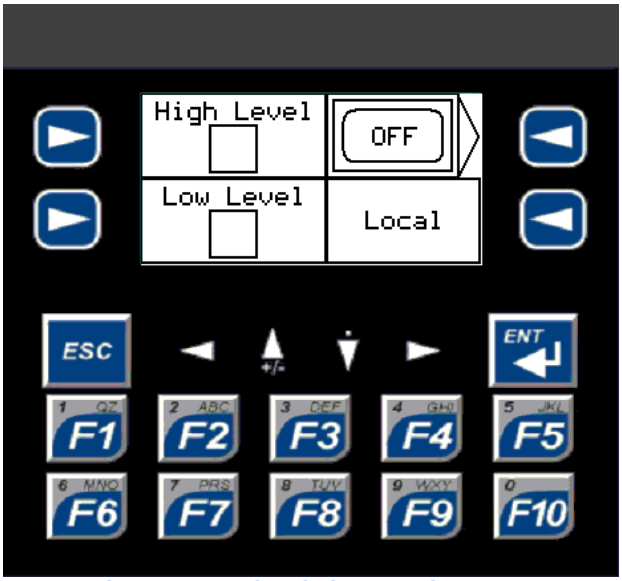


Figure 5: Level Switch Control Screen

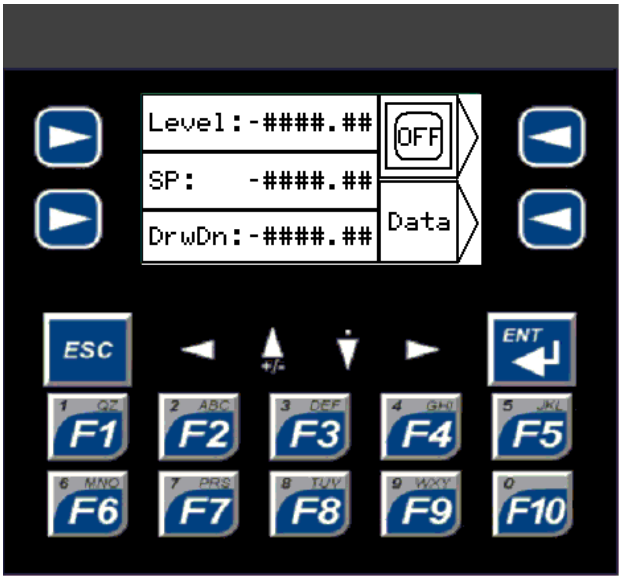


Figure 6: Level Transmitter Control Screen

In Level Switch Mode, the controller uses two digital inputs from level switches placed at an upper and lower level.

- The indicators at the left of the screen show when the high and low switches are active, and therefore when the tank level is at or above that switch.
- Use the button at the top right of the screen to toggle level control On/Off.
- The text in the bottom right indicates whether remote control is active.

Remote control allows level control On/Off to be toggled remotely.

Press ESC to return to the Main System Screen.

In Level Transmitter Mode, the controller uses a 4 –20mA analog level signal and a setpoint and drawdown input by the user. Enter the desired tank level as the setpoint and the amount below the setpoint to drain to as the drawdown.

- Use the up and down arrow keys below the screen to highlight SP to enter the Setpoint or DrwDn to enter the Drawdown.
- Press ENT to access the numeric input.
- Use the arrow keys or number keys to enter a value.
- Press ENT to submit a value, or ESC cancel.
- Use the button at the top right of the screen to toggle level control On/Off.
- Use the button at the bottom right to access the Data Trend Screen.

If Remote Control is active, only the drawdown can be entered from the screen. The setpoint field displays “Rm SP” instead of “SP” and is set remotely. The Level Control On/Off is also toggled remotely.

Press ESC to return to the Main System Screen.

Data Trend:

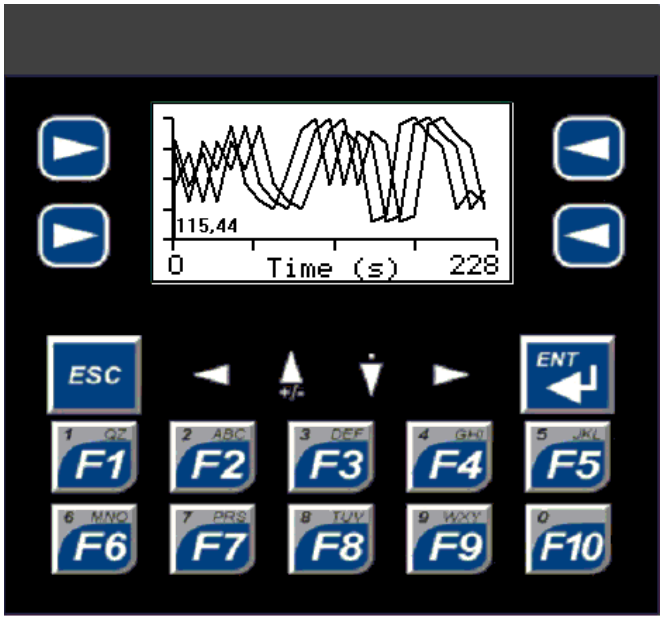


Figure 7: Data Trend

If Level Transmitter Mode is selected, the level, setpoint, and drawdown can be viewed on a graph in the Data Trend Screen. Press the Enable button in the bottom right of the screen to start trend display. Press ESC to return to the Level Control Screen.

Manual Override:

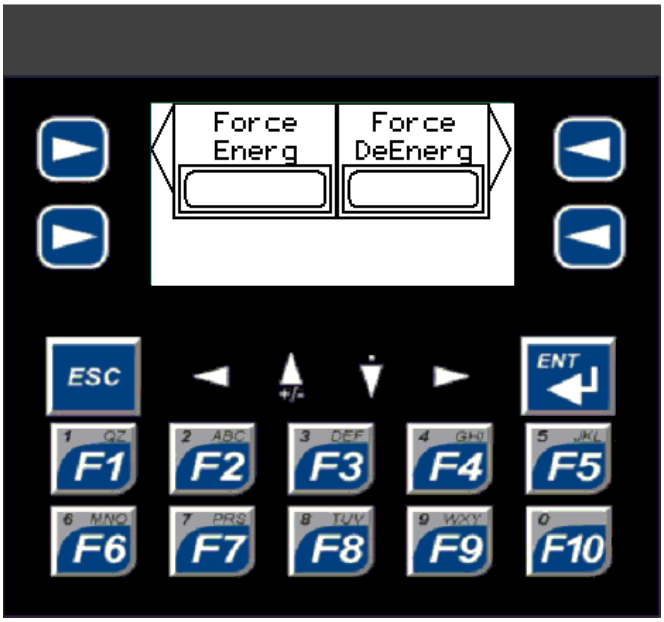


Figure 8: Manual Override

Use manual override to force the control solenoid to Energize or De-Energize regardless of control mode or failure mode. Press Force Energ to energize the solenoid and Force DeEnerg to de-energize the solenoid. Depending on valve orientation, this will drive the valve open or closed. If a remote force signal is active, it will override the local control. If remote is enabled, these buttons are disabled for local use and the solenoid force can only be activated remotely. Press ESC to return to the Main System Screen.

Menu

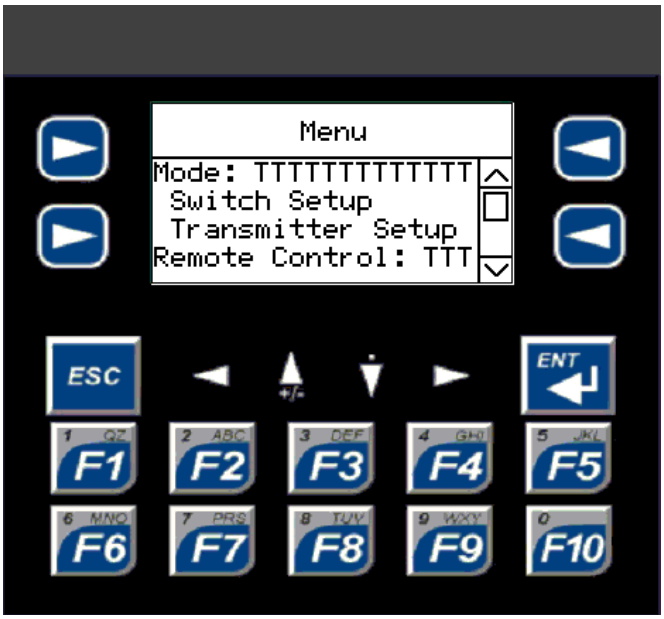


Figure 9: Menu

The Menu Screen allows access to system calibration and configuration settings.

- Use the up and down arrow keys to scroll through the menu items.
- To select a menu item, press ENT. Editable items can then be changed by pressing the up and down arrow keys to scroll through available options, or by using the number keys for numeric entry.
- Press ENT to accept the change or ESC to cancel.
- Submenu items open a submenu screen when selected.
- Press ESC to return from a Submenu.
- To return to the Main System Screen, press ESC from the Main Menu Screen.

Below is a list of menu items and screens:

Main Menu

The Main Menu is the access point to the various submenus containing system calibration and configuration settings. In addition to submenu access, the main menu also contains the Control Mode selection, Failure Mode, Valve Orientation and Remote Control On/Off.

Item	Description	Operation
Mode	Choose whether the system uses level switches or a level transmitter	Level Switch/Level Transm.
Switch Setup	Level Switch Calibration	Jumps to Submenu
Transm. Setup	Analog Signal/Transmitter Calibration	Jumps to Submenu
Remote Control	Enable/ Disable remote control	OFF/ON
Fail Mode	Solenoid Setting in error case	Energ/DeEnerg
Valve Orient.	Position of valve when solenoid not energized	N.O./N.C.
Error Menu	List of active error conditions	Jumps to Submenu
Alarms/Indicators.	Enable/ Disable panel indicator outputs	Jumps to Submenu
Data Logging	Enable/ Disable and settings for logging data to external media	Jumps to Submenu
MODBUS	Setting for MODBUS RTU communication	Jumps to Submenu
Configuration	System Configuration Options	Jumps to Submenu

Switch Setup

The Switch Setup Menu allows configuration of the two level switches used in Switch Mode Operation. The level switches can be configured as either Normally Open or Normally Closed switches. Changing the switch orientation inverts its associated logic. The switch configuration must match the installed switches for correct operation.

Item	Description	Operation
High-Lvl Switch	Switch Orientation	N.O. / N.C.
Low-Lvl Switch	Switch Orientation	N.O. / N.C.

Transmitter Setup

The Transmitter Setup Menu allows access to Level Sensor and Remote Setpoint calibration.

Item	Description	Operation
Sensor Calibrate	Level Transmitter Signal Calibration	Jumps to Submenu
Remote SP Calibrate	Remote Setpoint Signal Calibration	Jumps to Submenu

Sensor Calibrate

The Sensor Calibration Menu allows the tank analog transmitter signal and tank transmitter range limits to be calibrated. The level transmitter min and max range can be adjusted at any time by selecting in the menu and entering new numbers. The min and max should correspond to the level represented by a 4mA and 20mA signal respectively.

To calibrate the analog signal:

- Ensure Level Control is Off – calibration is disabled while Level Control is On.
- Supply a 4mA level signal for Zero calibration or 20mA signal for Span calibration.
- To write the current analog value to Zero, change “Calibrate Zero?” to Yes.
- To write the current analog value to Span, change “Calibrate Span?” to Yes.
- To restore default values, change “Restore Default?” to Yes.

Item	**Description**	**Operation**
Analog Data	Displays current raw analog signal	Numeric Display
Calibrate Span?	Write current analog signal to span	Yes/No
Span	Calibrated span value	Numeric Display
Calibrate Zero?	Write current analog signal to zero	Yes/No
Zero	Calibrated Zero Value	Numeric Display
Restore Default?	Reset all calibrated values to defaults	Yes/No
Transmitter Limits		
Max Level	Displayed reading at 20mA	Numeric Input
Min Level	Displayed reading at 4mA	Numeric Input

Remote SP Calibrate

The Remote Setpoint Calibration Menu allows the analog signal to be calibrated to match the incoming remote setpoint.

To calibrate the analog signal:

- Ensure Level Control is Off – calibration is disabled while Level Control is On.
- Supply a 4mA level signal for Zero calibration or 20mA signal for Span calibration.
- To write the current analog value to Zero, change “Calibrate Zero?” to Yes.
- To write the current analog value to Span, change “Calibrate Span?” to Yes.
- To restore default values, change “Restore Default?” to Yes.

Item	Description	Operation
Analog Data	Displays current raw analog signal	Numeric Display
Calibrate Span?	Write current analog signal to span	Yes/No
Span	Calibrated span value	Numeric Display
Calibrate Zero?	Write current analog signal to zero	Yes/No
Zero	Calibrated Zero Value	Numeric Display
Restore Default?	Reset all calibrated values to defaults	Yes/No

Error Menu

The Error Menu lists all error cases and indicates which are active. If errors are active, the system may go into Failure Mode. Any Error Menu should be fixed to ensure correct system operation. For details, see Errors and Failure Mode on page 27.

Item	Description	Operation
Level Switch	Indicates invalid level switch signal combination.	OK/Error
Level Sensor	Indicates a loss of level signal transmission.	OK/Error
Remote SP	Indicates a loss of remote setpoint signal transmission	OK/Error
MODBUS	Indicates a problem with the MODBUS connection	OK/Error
High Level	High alarm triggered when tank should be draining.	OK/Error
Low Level	Low alarm triggered when tank should be filling.	OK/Error

Data Logging

The Data Logging Menu allows access to information about removable media card, settings for data logging, and logging enable/disable. Selecting “View External Media” will exit from the menu and open the External Media Screen. See Data Logging on page 29 for more details.

Item	Description	Operation
Enable?	Enable/Disable logging data to external media	Yes/No
Log Interval	Interval between data samples for level logging.	Select from the listed intervals (1s, 5s, 10s, 20s 30s 1min, 5min, 10min, 20min, 30min, 1hr)
Media Status	Status code for external media	Numeric Display 0 = Media ready for Data Logging 1 = Media not formatted 2 = Media not present 4 = Media inserted but not yet ready 5 = Media critical error 6 = Media protected
Media % Full	Percentage of external memory full	Numeric Display
View External Media	External Media options	Exit menu and go to screen

Alarms/Indicators.

The Alarms and Indicators Menu allows the user to enable/disable certain indicator outputs. The Switch Retrans settings apply to Switch Mode operation and allow the High and Low Indicator outputs to retransmit the High and Low Switch signals. The Transm Alarm settings apply to Transmitter Mode operation and allow the High and Low Indicator outputs to act as alarms tied to the High and Low Level thresholds. If tank level goes above the high threshold or below the low threshold, the appropriate alarm is activated. The thresholds are also used in error detection if enabled. The System Error Alarm output cannot be disabled. See Alarm/Indicator Output Configuration: on page 26 for more details.

Item	Description	Operation
Enabled?	Enable/Disable external indicator outputs	Yes/No
Switch Retrans		
High Level	Output high level signal from panel	Enable/Disable
Low Level	Output low level signal from panel	Enable/Disable
Transm. Alarms		
High Alarm	Output high alarm	Enable/Disable
Threshold	High Level Warning (should be higher than setpoint)	Numeric Input
Low Alarm	Output low alarm	Enable/Disable
Threshold	Low Level Warning (should be lower than drawdown)	Numeric Input

MODBUS

The MODBUS menu allows the user to enable MODBUS communication, view the current status of the connection, and choose connection settings. The controller is configured as a MODBUS slave device. Ensure settings match those in the master. See MODBUS Communication on page 31 for more details.

Item	Description	Operation
Enable?	Enable/Disable Modbus communication	Yes/No
Slave ID	Device ID number	Numeric Entry
Status	Modbus connection status	Numeric Display
Baud Rate	Connection Baud Rate	Choose available settings
Parity	Connection Parity	None/Odd/Even
Data Bits	Number of bits for data	7 / 8
Stop Bit	Number of bits for stop	1 / 2
Handshake	Handshake used	Choose available settings

Configuration

The Configuration Menu allows access to system settings for System Clock, and Passwords.

- Ensure the Valve Orientation setting matches the installed valve for correct operation.
- System Clock is used for timestamping data logs; ensure correct time/date for accurate timestamps
- Passwords are numbers up to 5 digits long. Admin Password and Operator Password should not be the same.

Item	Description	Operation
Set Clock?	Set system clock	Yes/No
Time	Current time (HH:mm:ss)	Time Input
Date	Current date ()	Date Input
Passwords		
Admin	Administrator Password	Numeric Input
Operator	Operator Password	Numeric Input

Warning and Error Screen Popups

The controller is equipped with popup messages for System Warnings and Errors. Warnings provide information related to potential problems or problems with non-vital features. They can be disregarded if the associated feature is not in use. Errors indicate a problem with vital system features affecting control operation. These must be fixed to return to normal controller operation. All popup screens can be closed by pressing escape.

****NOTE: Closing a Warning or Error does not fix the associated problem.**

Data Log Warning Screen:

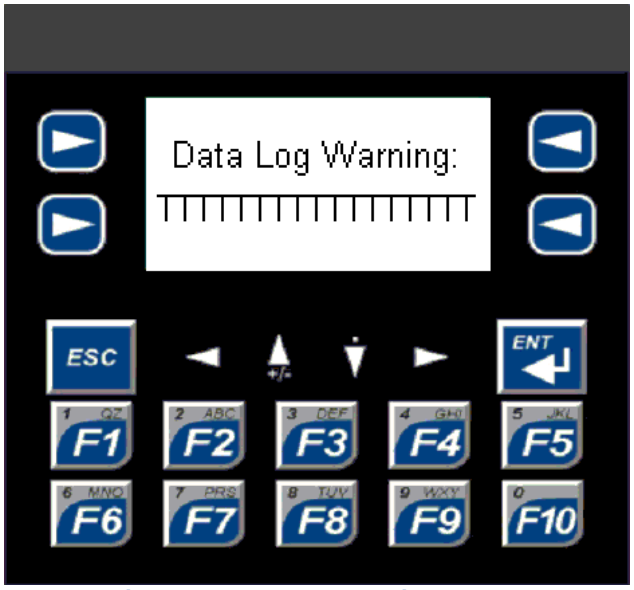


Figure 10: Data Log Warning Screen

This screen will pop up if data logging is enabled to indicate there is a problem with either the removable media or data buffers. Press ESC to close the warning message.

Message	Description
Level Buffer Full	The data buffer for level data is full. Log interval should be increased.
Switch Buffer Full	The data buffer for switch data is full. Switch signal changing too frequently.
Alarm Buffer Full	The data buffer for error data is full. Errors triggering too frequently.
Ext Media Not Ready	There is a problem with the external media. Check status code in Data Logging menu.

Error Screen:

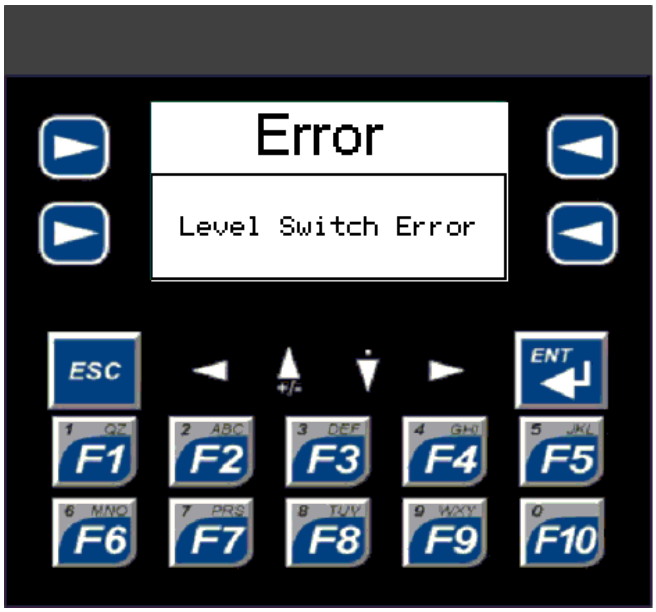


Figure 11: Error Screen

If the system encounters an error, it may go into failure mode and the Error Screen will pop up with a message describing the error. If multiple errors occur, the highest priority error will be displayed. For a full list of errors, see the Error Menu. Press ESC to exit this screen. For more details, see Errors and Failure Mode on page 27.

Message	Description
Level Switch Error	Triggered when the level switch signal combination is invalid. Switches are malfunctioning or calibrated incorrectly.
Loss of Remote Setpoint	Triggered when no remote setpoint signal is detected with Remote Level Control ON in Transmitter Mode. Remote Setpoint is malfunctioning or wired incorrectly.
MODBUS Error	Triggered when there is a problem with the MODBUS connection with MODBUS enabled and Remote Control ON in Transmitter Mode. Check connection.
Loss of Transmission	Triggered when no level signal is detected with Level Control ON in Transmitter Mode. Level Transmitter is malfunctioning or wired incorrectly.
Failure to Fill	Triggered when controller is sending signal to fill tank, but low level is reached. Tank is draining when it should be filling.
Failure to Drain	Triggered when controller is sending signal to drain tank, but high level is reached. Tank is filling when it should be draining.

****NOTE: Closing the error screen does NOT fix the encountered errors. Errors must be corrected for system to return to normal operation.**

Alarm/Indicator Output Configuration:

The LCP-TP includes 3 digital outputs used as alarms and indicators. All three are dry contact relay outputs. Indicator outputs 1 and 2 (High and Low Indicators) can be enabled/disabled from the Alarms/Indicator Menu. Indicator output 3 (Error Alarm) cannot be disabled.

Low Indicator: Low Switch Signal/ Low Level Alarm

The Low Indicator will change function depending on control mode. In Switch Mode, it can be used to indicate when the low level switch is active. In Transmitter Mode, it can be used as an alarm for the low level threshold.

High Indicator: High Switch Signal/ High Level Alarm

The High Indicator will change function depending on control mode. In Switch Mode, it can be used to indicate when the high level switch is active. In Transmitter Mode, it can be used as an alarm for the high level threshold.

Error Alarm

Indicator 3 is the Error Alarm output for all controller modes. It cannot be disabled. This alarm will output in the case of any system error and the controller may go into failure mode. Specific error information is available via error messages and the Error Menu. For more details, see Errors and Failure Mode on page 27.

Errors and Failure Mode

The LCP-TP is set up to detect a number of system errors. In the event of an error, the controller will produce an error alarm and display an error message on screen. All Error Menu can be viewed in the Error Menu. If data logging is enabled, error codes are logged whenever an error occurs or is cleared. Possible errors are:

Level Switch Error: (Switch Mode Only)	Level switch signals combination invalid. The upper switch is active while the lower switch is inactive. Switches are malfunctioning, wired incorrectly, or configured incorrectly. Activates Failure Mode.
Loss of Remote Setpoint: (Transmitter Mode Only)	The system requires a remote setpoint (remote level control is ON in Transmitter Mode and MODBUS is OFF), but signal is missing or invalid. Remote Setpoint is malfunctioning or wired incorrectly. Activates Failure Mode.
MODBUS Error (Transmitter Mode Only)	The system requires a remote setpoint from Modbus (remote level control is ON in Transmitter Mode and MODBUS is ON), but somethings is wrong with the connection. Activates Failure mode
Loss of Level Transmission: (Transmitter Mode Only)	The system requires a level signal (level control is ON in Transmitter Mode), but the signal is missing or invalid. Transmitter is malfunctioning or wired incorrectly. Activates Failure Mode.
Failure to Fill Tank: (Transmitter Mode Only)	Controller is giving signal to fill tank, but low level threshold is reached. Tank is draining when it should be filling. Solenoid or valve malfunctioning, or mechanical pilot preventing valve from opening. No Failure Mode.
Failure to Drain Tank: (Transmitter Mode Only)	Controller is giving signal to drain tank, but high level threshold is reached. Tank is filling when it should be draining. Solenoid or valve malfunctioning. No Failure Mode.

Error Codes

Code	Error
0	System OK
1	Level Switch Error
2	Loss of Remote Setpoint
3	MODUBS Error
4	Loss of Level Transmission
5	Failure to fill tank
6	Failure to drain tank

Failure Mode Selection:

Depending on the application, the loss of a sensor signal or a remote setpoint signal can cause the valve to fully open or close. In some situations, a fully closed or open valve can cause issues. Therefore, a failure mode is essential to allow the valve to fail in a safe manner. Failure Mode is activated for Level Switch Error, Loss of Remote Setpoint, and Loss of Transmission.

Fail Energized: The solenoid will energize when an error occurs. This will drive a Normally Closed valve towards open and a Normally Open valve towards closed.

Fail De-Energized: The solenoid will de-energize when an error occurs. This will drive a Normally Closed valve towards closed and a Normally Open valve towards open.

****NOTE: Mechanical pilots may prevent the valve from fully opening or closing.**

Data Logging

The LCP-TP is equipped with a datalogger that can record level and setpoint data, level switch signals, and alarms. The data is saved in a MicroSD card as a .CSV file that can be opened using applications such as Microsoft Excel. Level Transmitter data is sampled at the specified rate, while Level Switch and Alarm data are logged whenever they change.

How to Access the Datalogger

- From the Main Screen, go to the Menu (Admin only).
- Scroll down to the Data Logging Menu using the arrow keys.
- Press ENT to access the menu.

Below is the menu structure for the Data Logging Menu.

Item	Description	Operation
Enable?	Enable/Disable logging data to external media	Yes/No
Log Interval	Interval between data samples for level logging.	Select from the listed intervals (1s, 5s, 10s, 20s 30s 1min, 5min, 10min, 20min, 30min, 1hr)
Media Status	Status code for external media	Numeric Display 0 = Media ready for Data Logging 1 = Media not formatted 2 = Media not present 4 = Media inserted but not yet ready 5 = Media critical error 6 = Media protected
Media % Full	Percentage of external memory full	Numeric Display
View External Media	External Media options	Exit menu and go to screen

Data Logging Requirements

In order for the datalogger to operate properly, the following parameters need to be configured before data logging is enabled:

Clock: Set the clock in Configuration Menu for proper data time stamps

Log Interval: Set how often level samples are taken. This only applies to transmitter mode level samples. Level Switch and Alarm data log when triggered.

Media: A MicroSD card must be inserted and ready for logging. See format procedure. Card status and percent full are displayed in the menu.

To enable data logging, select “Enable?” and change to Yes. Logging will only start when Media Status is 0.

Removable Media Card Slot

The memory card slot is located on the back of the controller. Insert the card with the contacts facing the front of the controller. Ensure that it clicks into place.

To remove the card, push down on the card and it will pop out.

How to use the Internal Format Function

****NOTE: The MicroSD card must be in FAT16 format. The LCP-TP supports cards with up to 2GB of Flash memory.**

To format the new MicroSD card:

- In the Data Logging Menu, select View External Media. The menu will close and the Removable Media Screen will open.

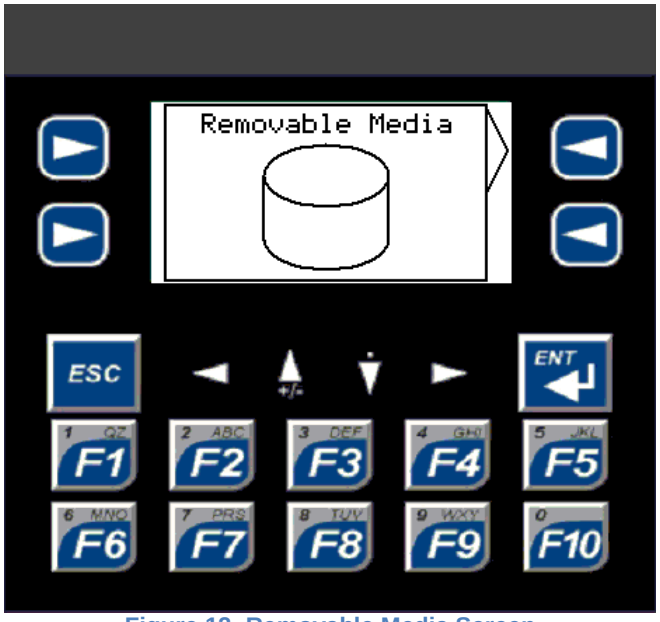


Figure 12: Removable Media Screen

- Press the upper right soft key to access Removable Media Object and its available functions
- Press any of the four soft keys beside the screen to bring up the Removable Media Menu
- Press **FORMAT,** a confirmation screen will pop-up
- Press ESC to exit or ENT to continue
- After formatting is complete, press ESC to exit

Data loss Prevention:

Data logging is only possible when a MicroSD card is inserted in the controller and ready to record. If the card is removed during logging, logging will be disabled until the card is replaced.

MODBUS Communication

The LCP-TP is capable of MODBUS-RTU communication as a slave device. MODBUS is enabled and configured from the MODBUS menu.

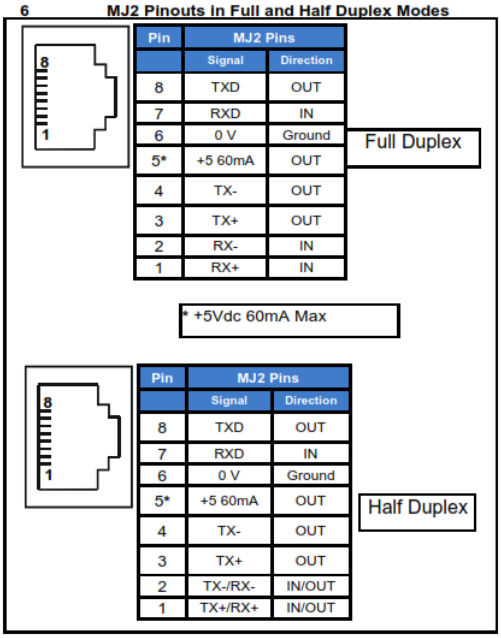
Serial Communication Requirements:

Enable: enable MODBUS
Slave ID: set slave ID

Baud Rate: set baud rate
Parity: set parity
Data Bits: set data bits
Stop Bits: set stop bit

Cable: The standard LCP-TP is set to communicate via RS-232 using the MJ2 Port. The port is an RJ45 jack. See pin connections.

Cable supplied by Installer.



MODBUS Status

The status of the current MODBUS connections is displayed in the MODBUS menu as a status code. Descriptions for each code are shown in the table below. When multiple statuses are active, their sum is displayed.

Status Code	Description
1	Inactivity timeout
2	Store and Forward command sent
4	Store and Forward response sent
8	Valid message received
16	Parity error
32	Frame error
64	Overrun error
128	Crc/Chksum error
256	Exception Message sent
512	Exception Message exceeds send buffer size
1024	Attempt to send Exception Message when transmit busy

MODBUS Address Map

Address	Read/Write	Values	Description
43001	Write	1 – enable, 0 – disable	Force Solenoid Energize
43002	Write	1 – enable, 0 – disable	Force Solenoid DeEnergize
43003	Write	1 – enable, 0 – disable	Level Control On/Off
43004	Read	Integer Value	Current Level
43005	-	-	-
43006	Write	Integer Value	Level Setpoint
43007	-	-	-
43008	Read	1 – Sensor Mode, 0 – Switch Mode	Control Mode
43009	Read	1 – Active, 0 – Inactive	Low Level Switch
43010	Read	1 – Active, 0 – Inactive	High Level Switch
43011	Read	1 – Active, 0 – Inactive	Low Level Alarm
43012	Read	1 – Active, 0 – Inactive	High Level Alarm
43013	Read	1 – Active, 0 – Inactive	System Error Alarm
43014	Read	1 – Energized, 0 – DeEnergized	Solenoid Output
43015	Read	1 – Active, 0 – Inactive	Remote Control On/Off