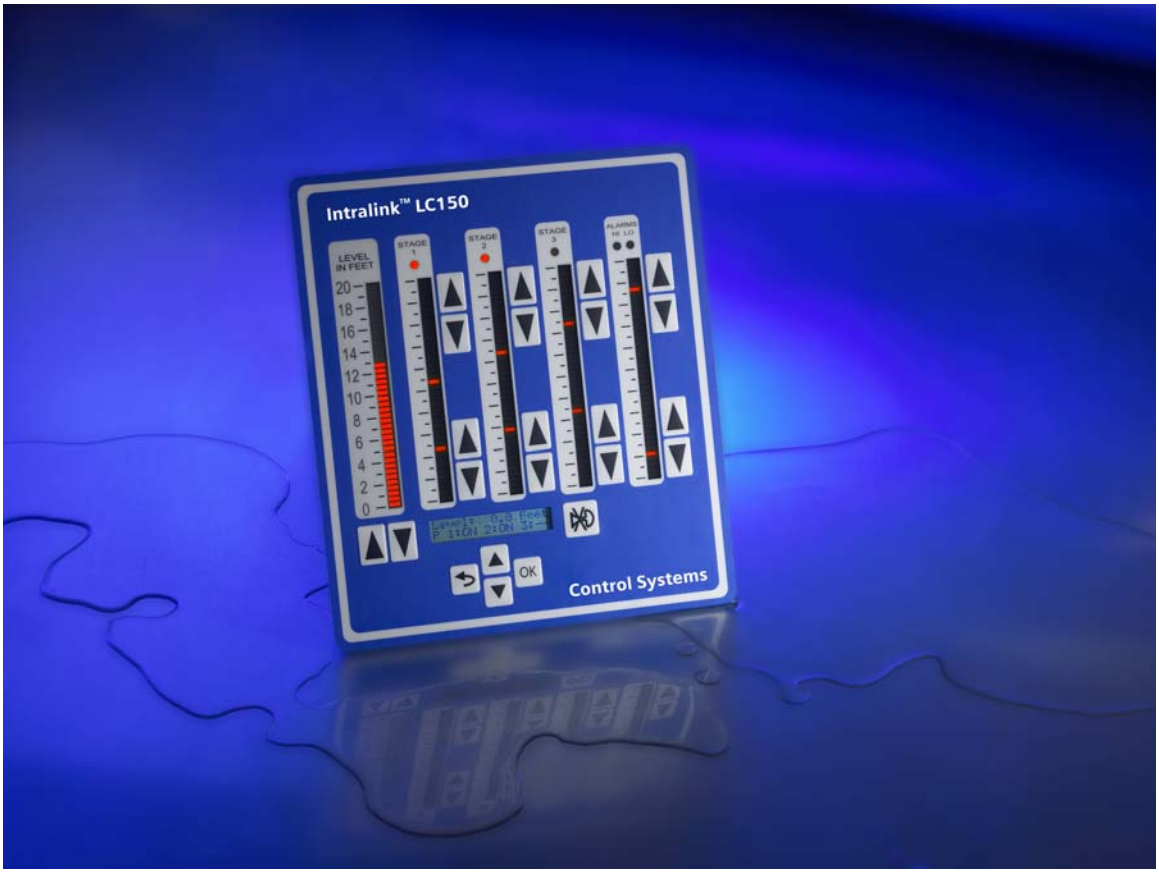
LC150 Pump Controller
Users Manual



Part Numbers: ILK-LC150001-02 (Base Unit)
ILK-LC150020-01 (Operator Interface)

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STATEMENT OF LIMITED WARRANTY

The limited warranty applicable to the IntraLink products is set forth in Siemens Water Technologies standard terms of sale, that are made applicable to the purchase of these products.

INSTALLATION AND HAZARDOUS AREA WARNINGS

These products should not be used to replace proper safety interlocking. No software-based device (or any other solid-state device) should be designed to be responsible for the maintenance of consequential equipment or personnel safety. In particular, Siemens Water Technologies disclaims any responsibility for damages, either direct or consequential, that result from the use of this equipment in any application.

All power, input and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods and in accordance with the authority having jurisdiction.

WARNING – EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

WARNING – EXPLOSION HAZARD – WHEN IN HAZARDOUS LOCATIONS, DISCONNECT POWER BEFORE REPLACING OR WIRING MODULES.

WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

1.0 Product Overview

The LC150 is Siemens Water Technologies Control System's newest "View at a Glance" pump controller, providing a complete pump control solution for applications using from 1 to 3 pumps. The LC150 is the ideal solution for sewage or storm-water lift stations, booster pump stations, or well pump stations. The LC150 can operate as a standalone controller, as part of larger SCADA system or as part of the Link2Site Cellular/Internet based monitoring system.

The LC150 is packaged as two modules. The "View at a Glance" operator interface (OI) module is typically mounted on a door, while the base unit is usually DIN rail mounted on the panel chassis. For retro-fit applications the base unit can be piggy backed on the OI unit. The two modules are connected via a standard Ethernet patch cable.

The OI is designed to allow quick and easy indication of system status and simple adjustment of the critical setpoints. The process variable (well or tank level), the stage ON/OFF setpoints, and the High/Low Level alarm setpoints are all displayed as scaled values in engineering units on LED columns. The OI is offered in three standard ranges; 0-10, 0-20 and 0-40 foot. Custom ranges can also be accommodated. The stage and level alarm setpoints can be adjusted by simply pressing the associated UP/DOWN keys to change the position of the setpoint. Because all the critical information can be seen at once, referenced to the well/tank level, the operator can easily understand the system's operation without scrolling through multiple displays. For startup verification and troubleshooting, the operator can temporarily simulate the level using the simulate keys on the OI. The OI includes a 2 line x 16 character LCD with a 4 key keypad for configuring the system and for viewing more advanced information about the pump station. Security can be enabled requiring an operator to logon via the LCD or via an iAccess electronic key, before changes can be made to the controller. The security feature can be paired with a door switch or motion sensor to form an intrusion detection/authorization device.

The base unit contains all of the power and I/O connections needed to control the pump station. The LC150 operates off of 120 VAC or 10-30 VDC and can trickle charge a battery. The base unit supplies power to the OI module. All of the control logic is executed by the base unit including pump staging, pump alternation, alarm handling, flow calculations, pump performance monitoring, and telemetry.

The LC150 features sophisticated failure handling and alarm processing. Over temperature, seal failure, power quality, and pump run statuses are monitored during operation of the pumps. If a pump fails, it is taken out of service and a replacement is called for. In addition to pump failures, the LC150 monitors the process for high or low level conditions. Built in alarm logic energizes the common alarm output and audible alarm outputs appropriately when a failure condition is detected. Audible alarms can be silenced using the Alarm Silence on the OI. Latching pump fail alarms can be reset by toggling an HOA switch wired to the controllers HOA inputs or by toggling the soft

HOA in the controller. Failure conditions are also annunciated on the LCD. A time/date stamped message describing the conditions flashes on the LCD when alarms are active. The operator can also scroll through a historical event log to aid in system troubleshooting. The historical event log contains a time/date stamped list of all alarm, return to normal, and operator initiated events. This information greatly enhances the operator's ability to efficiently troubleshoot a station failure.

The LC150 works with a wide range of level sensing instruments. Control System's own A1000 and A1000i submersible pressure sensors, other pressure transmitters, bubblers, ultrasonic level transmitters, radar level transmitters, or any linear level-proportional device producing a 4-20 ma, 0-5 VDC, or 0-10 VDC output can be used. The LC150 provides an isolated sensor excitation voltage, software calibration, and adjustable analog input filtering permitting precise control over the desired operating range of the process.

The LC150 can control Variable Speed pumps by using its 1-5 VDC analog output as the speed control signal. The controller uses a series of ramps to determine the speed of the pumps. The analog output can also be configured to follow the level input.

The LC150 can calculate flow without the need for a separate flow meter. The LC150 performs a volumetric flow calculation which uses level excursions in a linear vessel and time to determine flow rate. This calculated flow data forms the basis for a package of pump and station diagnostics and flow information. The LC150's second analog input can be connected to a flow meter and used as the source for flow measuring instead of the volumetric flow calculation. This type of information is especially valuable for maintenance planning and pump troubleshooting.

The LC150 tracks many pump operating statistics such as pump run time totals, number of starts, average starts per day, and max starts per hour. Like the flow information this data is valuable for maintenance and pump troubleshooting.

The LC150 has two built in RS232 ports for use in a telemetry system. Licensed frequency radios, spread spectrum radios, leased line modems, or the Link2Site cellular modem can be connected to these ports for remote access. The LC150 functions as a remote telemetry unit in a SCADA system, sending operating statuses to, and accepting setpoint changes and override commands from a master unit such as an LC3000 controller or the Link2Site server. With two telemetry ports, the LC150 can support primary and redundant SCADA systems. The process variable (tank or well level) can be telemetered to the LC150, allowing it to function in a water system where the tank is not located near the pumps. The LC150 supports Modbus, DF1 and IntraLink Open protocols on both telemetry ports.

2.0 System Operation

2. 1 Process Input

The LC150 controls its pumps based on the level in a well or tank. The level measurement is normally obtained via analog input one (4-20 ma, 0-5 VDC or 0-10 VDC) on the base unit that is wired to a level sensing device. The LC150 monitors the analog signal and converts it into a scaled measurement in engineering units (usually feet). The level value can also be temporarily simulated using the UP/DOWN keys under the level LED bar graph. The LC150 can also be configured to accept a level value from a remote station via the telemetry port. The process level value is displayed on a vertical LED bar graph and on the LCD.

2.2 Pump Staging

The LC150 controller can operate in either a pump up or pump down mode.

In pump up mode (typical in a water system) the controller activates a pump when the level falls to the stage ON setpoint and deactivates the pump when the level rises to the stage OFF setpoint. If the low level float opens (optional) the controller will turn ON all the pumps. If the high level float closes the controller will turn OFF all the pumps.

In pump down mode (typical in a wastewater system) the controller activates a pump when the level rises to the stage ON setpoint and deactivates the pump when the level falls to the stage OFF setpoint. If the low level float opens (optional) the controller will turn OFF all the pumps. If the high level float closes the controller will turn ON all the pumps.

The LC150 provides up to three stages of control. Each stage has individual ON and OFF setpoints. The stage setpoints are displayed as lighted LEDs on the appropriate stage LED bar graph. As the level changes, stages are activated and deactivated. Adjustable stage delay timers allow the staggering of pump starts when multiple pumps would be called simultaneously. An active stage will have its stage LED turned ON. The stages are operated independently.

2.3 Alternation

The LC150 provides five methods to link a pump relay output to a stage. The simplest choice is a fixed sequence, where a specific pump is permanently linked to a specific stage. Alternating approaches vary the pump order from cycle to cycle.

Fixed: The pumps are turned ON and OFF in the order selected. The alternator does not change the pumping order from cycle to cycle.

FOFO: The pumps will be started in sequence. The order in which the pumps are started will be the order in which the pumps are turned off. The lead pump on the next cycle will be the pump that has been off the longest.

Rotary: Pumps will be started in sequence. Pumps are turned off in the reverse order that they were started. The lead pump on the next cycle will advance to the next pump in sequence.

Jockey: Only practical in a three-pump system, in this mode the alternator will always call for the first pump in the order when the first stage becomes active. The other two pumps are alternated in a rotary fashion and are alternated only when the second and third pumps have stopped.

Emerg: Only practical in a three-pump system, the emergency mode will alternate the first two pumps in a rotary fashion (when both of those pumps have stopped). The third pump is not rotated, and will be called when the third stage is active.

Figure 2.1 shows an example of pumping cycles for each method of alternation. Assume 3 pumps with a selected order of 1-2-3.

	FOFO	Rotary	Fixed	Jockey	Emerg
Cycle 1 – 1 pump(Lead) required:	1	1	1	1	1
Cycle 1 – 2 pumps (Lag) required:	1-2	1-2	1-2	1-2	1-2
Cycle 1 - 1 pump required:	2	1	1	1	1
Cycle 1 - 0 pumps required:					
Cycle 2 - 1 pump(Lead) required:	3	2	1	1	2
Cycle 2 - 2 pumps(Lag) required:	3-1	2-3	1-2	1-3	2-1
Cycle 2 - 3 pumps (Lag2) required:	3-1-2	2-3-1	1-2-3	1-3-2	2-1-3
Cycle 2 - 2 Pumps required	1-2	2-3	1-2	1-3	2-1
Cycle 2 - 1 pump required:	2	2	1	1	2
Cycle 2 – 0 pumps required					
Cycle 3 - 1 pump(Lead) required:	3	3	1	1	1
Cycle 3 - 2 pumps(Lag) required:	3-2	3-1	1-2	1-2	1-2
Cycle 3 – 1 Pump required	2	3	1	1	1
Cycle 3 - 0 pumps required:					
Cycle 4 - 1 pump(Lead) required:	1	1	1	1	2
Cycle 4 - 2 pumps(Lag) required:	1-3	1-2	1-2	1-3	2-1
Cycle 4 – 1 Pump required	3	1	1	1	2
Cycle 4 - 0 pumps required:					

Figure 2.1 – Pumping Cycle Example

The controller will replace pumps that have failed with the next pump in the sequence and it will not use pumps that have been taken out of service. The individual pump statuses are displayed on the LCD home screen.

Once the controller calls for a pump to start, the corresponding pump relay output is energized. If the pump run inputs are enabled, the run input must go active within an adjustable pump fail delay time or the pump will be declared failed and the relay will be de-energized. The controller will shut off the pump on any of the following failure conditions: pump over temperature input active (optional), pump seal fail input active (optional), power quality input active, or pump inhibit input active. A pump may be taken out of service by setting its software Hand-Off-Auto (HOA) switch to the OFF position or by setting the hardware HOA switch (if supplied and connected to the HOA monitoring inputs) to the not-AUTO position.

2.4 Alarm Processing

The LC150 has two alarm relay outputs and two open collector level alarm outputs to annunciate fault conditions. The common alarm relay is energized whenever any of the following alarm conditions are present.

- Pump 1 Overtemp
- Pump 2 Overtemp
- Pump 3 Overtemp
- Pump 1 Seal Fail
- Pump 2 Seal Fail
- Pump 3 Seal Fail
- Pump 1 Failure to start
- Pump 2 Failure to start
- Pump 3 Failure to start
- Analog Input 1 High Level
- Analog Input 1 Low Level
- Analog Input 2 High Level
- Analog Input 2 Low Level
- Analog Input 1 Sensor Failure
- Analog Input 2 Sensor Failure
- High Float Active
- Low Float Active
- Phase Fail/Reversal
- AC Power Fail
- Intrusion alarm
- Communications failure (if telemetered control is enabled)
- DC Low Voltage
- P1 Low Flow Rate
- P2 Low Flow Rate
- P3 Low Flow Rate
- Flow Low Level
- Flow High Level

It is de-energized when all alarm conditions have cleared. The audible alarm output is energized when any of the following critical alarm condition exists:

- high/low level
- high/low float active
- pump over temperature
- pump run failure
- level sensor failure
- intrusion (optional)
- Phase Fail/Reversal
- pump seal failure (selectable)
- Communications failure (if telemetered control is enabled)

The audible alarm relay remains energized until it is silenced. The audible alarm can be silenced by pressing the Alarm Silence on the OI, by the activation of alarm silence input, or by a remote command via the telemetry port. The high level alarm output energizes when the level (analog input 1) exceeds the high alarm setpoint or when the high level float goes active (optional). The output is turned off when the high level condition clears. Likewise the low level output energizes when the level falls below the low level alarm setpoint or when the low level float opens. The low level output turns off when the low level conditions clears. An adjustable dead-band is used to prevent short cycling of the level alarms.

Pump over temperature and pump run failure alarms are latching conditions and require a reset before the controller will return the pump to service. To reset a latching alarm, toggle the internal "soft" HOA to the OFF position and back to the Auto position. Alternatively, if external HOA switches are being monitored by the controller, toggling the HOA switch to a non-Auto position and back to the auto position will reset the associated pump's latched alarms and return the locked out pump to service.

2.5 Event Log

The event log contains a historical account of alarms and their return to normal events. The log will contain the date and time of the alarm/event and a text message describing the event. The event log is 100 alarms/events deep. When the maximum number of events is reached the oldest event will be discarded to make room for the newest. The event log is stored in non-volatile memory and can be cleared from either the operator interface or the PC configuration software.

The scope of recordable events shall include all alarm conditions as well as user initiated actions. Operational events (pump starts etc) are not recordable events. Table 2.2 describes the list of recordable alarms/events:

Event Description	Event Type	Event/Alarm Log Text
Pump 1 Overtemp	Alarm	P1 Overtemp ALM(RTN)
Pump 2 Overtemp	Alarm	P2 Overtemp ALM(RTN)
Pump 3 Overtemp	Alarm	P3 Overtemp ALM(RTN)
Pump 1 Seal Fail	Alarm	P1 Seal Fail ALM(RTN)
Pump 2 Seal Fail	Alarm	P2 Seal Fail ALM(RTN)
Pump 3 Seal Fail	Alarm	P2 Seal Fail ALM(RTN)
Pump 1 Failure to start	Alarm	P1 Run Fail ALM(RTN)
Pump 2 Failure to start	Alarm	P2 Run Fail ALM(RTN)
Pump 3 Failure to start	Alarm	P3 Run Fail ALM(RTN)
Analog Input 1 High Level	Alarm	AI1 High Level ALM(RTN)
Analog Input 1 Low Level	Alarm	AI1 Low Level ALM(RTN)
Analog Input 1 Sensor Failure	Alarm	AI1 Sensor Fail ALM(RTN)
Analog Input 2 High Level	Alarm	AI2 High Level ALM(RTN)
Analog Input 2 Low Level	Alarm	AI2 Low Level ALM(RTN)
Analog Input 2 Sensor Failure	Alarm	AI2 Sensor Fail ALM(RTN)
High Float Active	Alarm	High Float ALM(RTN)
Low Float Active	Alarm	Low Float ALM(RTN)
Phase Fail/Reversal	Alarm	Phase Fail ALM(RTN)
AC Power Fail (when battery backed)	Alarm	AC Power FL ALM(RTN)
Intrusion alarm	Alarm	Intrusion ALM(RTN)
Communications	Alarm	Tele Comm FL ALM(RTN)
Low DC Voltage (when battery backed)	Alarm	Low DC Voltage ALM(RTN)
Pump 1 Low Flow Rate	Alarm	P1 Low Flow ALM(RTN)
Pump 2 Low Flow Rate	Alarm	P2 Low Flow ALM(RTN)
Pump 3 Low Flow Rate	Alarm	P3 Low Flow ALM(RTN)
Flow Low Level	Alarm	Flow Low Lvl ALM(RTN)
Flow High Level	Alarm	Flw High Lvl ALM(RTN)
Generator Fail Alarm	Alarm	Generator FL ALM(RTN)
Operator Login	Event	Level (0,1,2) Log-In
Operator Logout	Event	Logout
Simulation active	Event	Simulation Activ
Simulation Cancel	Event	Simulation Cancl
Alarms silenced (via key on OI)	Event	Alm Silenced Loc
Alarms Acknowledged (via key on OI)	Event	Alm Acked Local
Alarms Silenced/Acknowledged Remotely	Event	Alm Slc/Ack Tele
Pump Inhibit Input change of state	Event	Pump Inhibit (ON, OFF)
Intrusion switch change of state	Event	Door (Open, Close)
Pump 1 HOA not in Auto	Event	P1 Not In Auto (P1 in Auto)
Pump 2 HOA not in Auto	Event	P2 Not In Auto (P2 in Auto)
Pump 3 HOA not in Auto	Event	P3 Not In Auto (P3 in Auto)
Multi Pump Flow Calibration	Event	
OI Connection Events	Event	OI Connected (Not Connected)

System Reset (powerfail)	Event	System Reset
Event Log Reset	Event	Event Log Reset
Pump Statistics Cleared	Event	Clear Pump Data
Flow Statistics Cleared	Event	Clear Flow Data
EEPROM Fault	Event	EEPROM Read Err
System reset to default configuration	Event	Reset to Default
Telemetry Connection Status	Event	Tele Connected (Not Connected)
Telemetry Pump Control Active	Event	Tele Pump Ctrl
Telemetry Stage Control Active	Event	Tele Stage Ctrl
Telemetry Level Control Active	Event	Tele Level Ctrl
Telemetry Control Inactive	Event	Exit Tele Ctrl

Table 2.2 – Alarm and Event List

2.6 Security

The LC150 provides 3 levels of security. The security feature may also be disabled, allowing any change to occur without logging in.

> Level 0 – This level authorizes intrusion (if enabled). If intrusion is not enabled this level is not used. The OI will always permit view only access, even without logging in.
>
> Level 1 – In addition to intrusion authorization, this level grants the operator change rights to the stage and level alarm setpoints, the Alarm Silence/Acknowledge button, and the simulation buttons.
>
> Level 2 – This level allows the user to view and change all settings, and authorizes intrusion.

There are two possible methods for logging into the LC150:

Password entry – Used only when an LC150 OI is present. The user may log in by directly navigating to the login screen and entering a password (see Quick Start section) or the user will be prompted (via the LCD) to login if he attempts to change a value requiring a higher level access.

iAccess - The user may also login via an electronic, iAccess key. The LC150, when equipped with an iAccess reader, utilizes an electronic key FOB to log a user in or to authorize intrusion. A user must be setup on the LC150 using either PCCS software or the Link2Site solution. Each user is assigned a login level and an electronic key serial number. To login a user touches the electronic key to the reader. If the LC150 recognizes the key's serial number, the LED on the reader is turned on and the user is logged into the system at the assigned security level.

If the controller is already in the logged on state and the user touches the electronic key to the reader, the user will be logged out and the LED will turn off. The system will automatically log a user off within an adjustable time delay. The reader LED will flash prior to automatic log off.

If intrusion is enabled, and no one is logged in and the door switch activates, a user must login (using either method) within an adjustable delay time or the controller will generate an Intrusion Alarm.

2.7 Float Backup Operation

Float operation can be set to one of three states; disabled, monitoring only or backup control. Also both float inputs are invertible. See Section 8.2 for configuration information.

If float inputs are disabled, the digital float inputs will have no effect on the control of the LC150, nor will they generate any alarms or events. The unused inputs are available, however, via telemetry, to be used as general-purpose inputs. They will not be displayed on the OI as their use is undefined.

If the float inputs are set to monitoring only, the LC150 will monitor the condition of the float inputs, and generate alarms if they activate. However the LC150 will not control pumps based on the states of the floats.

If backup control is selected, the LC150 will use the digital float inputs as both alarm and control points. In Pump-Up mode, the controller will use the low float to turn pumps ON and the high float to turn pumps OFF. In Pump-Down mode, the controller will use the high float to turn pumps ON and the low float to turn pumps OFF.
If, while operating normally, the controller detects either the high or low float going active, it will enter into the float backup mode and will remain in that mode until:

- The level returns to where neither float is active
- There is no sensor error
- The float alarm has been silenced/acknowledged.

The float alarm must be acknowledged (press Silence key) after the first two conditions are met in order for the controller to exit float backup mode.

A typical scenario might be like this: The controller is operating normally in a pump down mode using an analog transducer to control the staging and pumps. The sensor fails and the controller sees zero volts (or milliamps) as its input. A low-level alarm is generated as well as a sensor failure alarm. The low alarm open-collector output goes active and the audible beeper begins to annunciate the alarm condition. The level in the tank continues to rise until the high float goes active. A high float alarm is generated, the high alarm open-collector output goes active and the controller immediately enters the float backup mode. Based on the stage on-delay timing, pumps will be called until either all available pumps are called, or until the high float becomes inactive. When the level drops to the level where the low float becomes active, the pumps are shut off (also based on the stage off timing). Since the controller is in float backup mode, both of the open-collector level alarm outputs will remain active. (This will allow an auto-dialer to notify an operator of the current condition without re-calling every time the floats become active). The controller will continue to operate in this mode until the analog sensor is repaired and the alarm is silenced/acknowledged.

Note that if the controller is connected to a host via telemetry and the alarm is silenced via telemetry, the alarm will be silenced at the host but remain at the LC150 until the sensor is repaired and generates a valid signal.

Also note that when the controller enters the float backup mode, only one high float alarm and one low float alarm will be generated and stored in the event log. Alarms will not be regenerated as the level rises and falls causing the floats to repeatedly go active and inactive.

Using the event logger, an operator will easily be able to determine whether the float backup control was entered due to an unusually large influent surge vs. a sensor failure simply by seeing if a sensor failure alarm was entered into the log prior to the float alarms.

When the controller is in the float backup mode, the OI will not show its normal tank level display, but will instead display "Float Cntrl Mode" on the top line. The bottom line still displays the pump statuses.

2.8 Low Battery Operation

The LC150 monitors the battery (DC) voltage. If the 120 VAC power is not present and the battery/DC voltage drops below 10.3 volts, the LC150 goes into sleep mode. The controller must be configured for DC as the primary power source. The low battery shutdown event is recorded in the event log. The controller remains in sleep mode until the DC voltage rises above 10.5 volts or until AC power is restored.

3.0 Quick Start Guide

3.1 Home Screen

The Home screen is the first screen in the Main Ring and is shown when the display is idle (no keys have been pressed). Pressing the RETURN key multiple times will return the display to the Home screen.

```
Level:   6.2 Feet
P 1:ON 2:-- 3:--
```

The first line shows the process level (analog input 1) being used by the controller to stage the pumps. This value is normally the scaled version of the controller's analog input. The second line shows the status of the pumps. The pump status fields will be in one of the following three states:

"--" A dash will shown if the pump is in service but currently OFF
"CL" will be display if the pump has been called but is not yet confirmed to be running.
"ON" will be displayed if the pump is currently ON. If VFD control is enabled and a pump is ON, the speed in % will be shown instead of "ON" until the speed reaches 100% at which time "ON" will be displayed.
"FL" will be shown if the pump failed to start
"OT" will be shown if the pump has failed due to an over temperature condition
"SL" will be shown if the pump is in a seal failure condition
"NA" will be shown if either the soft HOA is not in Auto or if a monitored hard HOA switch is not in Auto.

Note: If the pump is ON while one of the abnormal conditions is present the pump status field will alternate between "ON" and the condition.

3.2 Logging In

If security has been enabled for the controller you must log in via the OI or an iAccess electronic key to make changes. If an intrusion system has been configured for the station, you must login to authorize entry.

To login via the OI, press the UP arrow key from the Home Screen. The following screen will be displayed:

```
User Logged OFF
<OK> to Log On
```

Press OK. The following screen will be displayed:

```
PSWD:   ----
<OK> to shift
```

The active digit will be flashing. Use the UP/DOWN keys to scroll the digit to the correct value. Press the OK key to shift right to the next digit, use the RETURN key to shift to the left. When the least significant digit is flashing (right most digit) the display will change to:

```
PSWD:   3333
<OK> to Finish
```

Pressing OK will enter the password shown. The display will change from edit mode back to navigation mode showing the following screen:

```
Logged ON LVL 2
<OK> to Log OFF
```

You are now logged into the controller.

Note: The exact password and login level shown will vary according to the configuration of the controller. Default passwords are:

Intrusion Password:	1111
Level 1 Password:	2222
Level 2 Password:	3333

3.3 Handling Alarms

If there is an active alarm, the common alarm output will be on and the Home screen will be alternating with an alarm screen(s). If the alarm is a critical alarm, the audible alarm output will be on and the controller will be beeping.

To turn OFF the audible alarm output and silence the beeping, press the Alarm Silence/Reset key. If security is enabled you must login first.

The Home screen will alternate with each active alarm screen. A typical alarm screen is shown:

```
P1 Seal Fail ALM

Feb 05  07:45 PM
```

To view all active alarms, press the DOWN key from the Home screen. The following conditional screen will be displayed.

```
Active Alarms
<OK> to enter
```

Pressing OK will advance the display to the active alarm ring. Use the UP/DOWN arrows to scroll through the active alarm screens. If there are no active alarms, the following display will be shown:

```
No Active Alarm!
  <- To RETURN
```

When an alarm condition clears, the associated alarm screen will be removed from the active alarm ring.

Alarms that have cleared may leave the controller with its audible alarm output ON, but no active alarms. In this case, review the Event Log to determine what happened and when.

Resetting Latching Alarms

Pump Over-temperature and failure to run alarms are latching alarms. The alarm condition must be cleared and the alarm must be reset before the associated pump can be started.
A latching pump alarm may be reset by either of two methods.

If the pumps hardware HOA switch is being monitored by the controller (HOA auxiliary contacts are connected to the LC150 HOA inputs), then moving the HOA switch to a non-Auto position and back to Auto will reset the latching alarm.

A latching pump alarm may also be reset by toggling the associated soft HOA switch to OFF and back to auto.

From the Home screen, scroll down (using the DOWN arrow key) to the Pump Status screen.

Pump Status <OK> to enter

Press OK to advance to the Pump Status ring. Scroll down to the desired pump status screen.

Pump 1 Status <OK> to enter

Press OK to advance to the Pump 1 Status ring. Scroll down to the Pump 1 HOA screen

Pump1 HOA: AUTO <OK> to change

Press the OK key and then use the UP or DOWN arrow key to toggle the flashing HOA field to the OFF state.

Pump1 HOA: OFF <OK> to finish

Press OK to finish the change.

Change the Pump back to AUTO by repeating the last two steps and selecting AUTO instead of OFF.

The latching alarms for the pump will now be reset and the pump will be returned to service. Latching alarms will remain in the active alarm list until the condition has cleared and the alarms have been reset.

3.4 Viewing the Event Log

The Event Log contains a list of the last 100 events in reverse chronological order. To view the event log press the DOWN arrow key twice from the Home screen. The following screen will be displayed:

Event Log <OK> to enter

Pressing OK will advance the display to the Event Log ring. Use the UP/DOWN arrows to scroll through the screens in the Event Log ring. The following is a sample screen:

P1 Seal Fail RTN Feb 05 07:45 PM

The first line of an event screen describes the event. If the event is an alarm condition, the second field on the first line will be in one of two states:

ALM - going into alarm event
RTN - return to normal event

The second line shows the date and time that the event occurred.

3.5 Changing Stage Setpoints

To change a setpoint, use the UP/DOWN arrow keys alongside the setpoint bar graphs. If security is enabled, you must login first. Pressing the UP/DOWN keys will raise/lower the associated ON/OFF setpoint. The setpoint value is denoted by a lighted LED. The LCD display will also advance to the corresponding setpoint screen and show the value of the setpoint as you change it. It is not necessary to press the OK key to get the controller to accept changes via the stage and level UP/DOWN keys.

If the controller is configured for 2 pumps, the third stage setpoint LED column will not have any LEDs lit. The system will not respond to pressing the third stage setpoint UP/DOWN keys.

If a controller is configured as a "Monitor Only" unit, none of the stage setpoint LED columns will have a lighted LED.

3.6 Simulating a Level

To simulate the process level press the simulation UP/DOWN key(s) located below the level bar graph. The first time a simulation key is pressed the LCD will prompt you to confirm that you want to go into simulation mode. The following screen will be displayed:

Simulation: OFF <OK> to Simulate

Pressing OK will put the controller into simulation mode. Use the UP/DOWN simulation keys to change the process level. The Home screen while in simulation mode will alternate between the following two screens:

Sim Lvl: 8.0 Ft P 1:ON 2:ON 3:--

Level: 6.2 Feet P 1:ON 2:ON 3:--

To cancel level simulation, press the DOWN arrow key from the Home screen to advance the LCD to the following screen:

Simulation: Actv <OK> to cancel

Pressing OK will cause the controller to exit the simulation mode and resume using the real analog input as the process level. If neither simulation key is pressed in 2 minutes, the controller will automatically cancel the simulation mode.

Warning

The controller will turn ON pump and alarm outputs in response to simulated levels. Care must be taken to avoid damaging pumps or causing undesirable process conditions through the use of simulated levels.

3.7 Disabling a Pump

Pumps can be taken out of service by setting their soft HOA switch to the OFF position. The software HOA switches for the pumps can be accessed through the LCD.

From the Home screen, scroll down (using the DOWN arrow key) to the Pump Status screen.

Pump Status <OK> to enter

Press OK to advance to the Pump Status ring. Scroll down to the desired pump setpoints screen.

Pump 1 Status <OK> to enter

Press OK to advance to the Pump 1 Status ring. Scroll down to the Pump 1 HOA screen

Pump1 HOA: AUTO <OK> to change

Press the OK key and then use the UP or DOWN arrow key to toggle the flashing HOA field to the OFF state.

Pump1 HOA: OFF <OK> to finish

Press OK to finish the change. Pump 1 is now taken out of service. The controller will take the pump out of sequence and not try to start it.

When a pump is determined to be not in the Auto state (either through the controller's internal HOA switches or through monitored hardwired HOA switches) the Home Screen will show "NA" in the pump status field.

3.8 View Pump Statistics

A pump's run statistics can be viewed from the Pump Status ring
From the Home screen, scroll down (using the DOWN arrow key) to the Pump Status screen.

Pump STATUS <OK> TO ENTER

Press OK to advance to the Pump Status ring. Scroll down to the desired pump status screen and press "OK" to view information for the pump.

Pump 1 STATUS <OK> TO ENTER

The first screen in the Pump x ring is the HOA screen. This screen presents software HOA status and allows an operator to locally put the pump in Hand/Auto/Off.

Pump1 HOA: AUTO <OK> TO CHANGE

Pressing OK from this screen puts the operator in edit mode. The changeable value will be flashing and the UP/DOWN arrow keys can be used to select the desired action for the software pump HOA.

Pump1 HOA: AUTO <OK> TO FINISH

Scroll past the HOA screen to the Pump Run Time screen

```
P1 RT:    10.2Hr
 <OK> TO CHANGE
```

This screen shows the total time in hours and tenths of hours that the pump has ran. The pump run time may be preset by pressing OK from the Pump Run Time screen. The following data entry screen will be displayed.

```
P1 RT:    10.2Hr
<OK> TO FINISH
```

The run time value will be flashing. Use the UP/DOWN arrow keys below the LCD to adjust the run time to the correct pre-set value. Press the OK key to accept the change.

The next screen in the Pump Status ring is the Average Daily number of starts screen. This is a running average of the daily number of starts for the pump. This is a view only screen.

```
Avg Daily Starts
        24
```

The next screen in the Pump Status ring is the Maximum number of starts in one hours screen. This is the maximum number of starts that have occurred in one hour for the pump. This is a view only screen.

```
Max Hourly Start
        3
```

The last screen in the Pump Status ring is the Total number of starts screen. This is a total number of starts for the pump since the controller pump statistics was last reset. This is a view only screen.

```
P1 Total Starts
        345
```

3.9 Viewing Flow Information

Station flow, influent flow and individual pump flow information can be viewed from the Flow Status ring. From the Home screen scroll down (using the DOWN arrow key) to the Flow Status screen.

FLOW STATUS <OK> TO ENTER

There are five menus in this ring. The operator may enter any of these menus by pressing "OK" on the appropriate screen

STATION STATUS <OK> TO ENTER

INFLUENT STATUS <OK> TO ENTER

PMP1 FLOW STATUS <OK> TO ENTER

PMP2 FLOW STATUS <OK> TO ENTER

PMP3 FLOW STATUS <OK> TO ENTER

After entering a status ring, the operator must use the UP/DOWN arrow keys to scroll through the information screens in the ring.

The Station Status ring has the following informational screens:

Total Statn Flow 0.0

Today's Totl Flow 0.0

Yesterday's Flow 0.0

Average Totl Flow 0.0

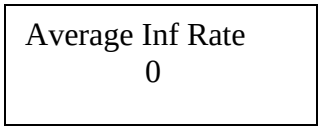
Max Totl Flow 0.0

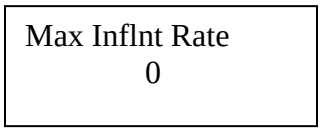
The Influent Flow status ring has the following information screens:

Current Inf Rate 0

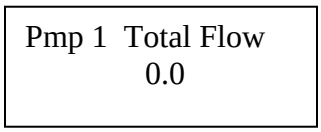
Last Inflnt Rate 0

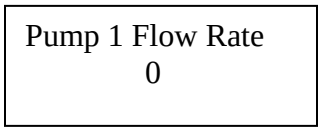
Pumping Inf Rate 0





Each Pump Flow status ring has the following information screens:





3.10 Viewing System Status Information

Analog input 2 value, rainfall information, generator monitoring information, and Link2Site communication information are all viewable in the System Status ring.

From the Home screen scroll down (using the DOWN arrow key) to the System Status screen.

SYSTEM STATUS <OK> TO ENTER

AIN2 EU Value Lvl 0.0 Ft

Rainfall 0.3 <OK> TO CHANGE

This screen shows the total rainfall. The value may be changed to preset the rainfall total.

Rainfall 0.3 <OK> TO CHANGE

Today's Rainfall 0.00

Yestd's Rainfall 0.03

The following screens show Link2Site communications information. These screens are not used if the Link2Site solution is not being used.

Signal Qulty 2 Network Stat 1

Signal Quality is equivalent to cellular signal strength

- 0 = no signal
- 1 = poor signal strength
- 2 = fair signal strength
- 3 = good signal strength
- 4 = good signal strength
- 5 = Excellent signal strength

Network Status shows whether the remote is connected to the Link2Site server.

- 0 = Not connected
- 1 = Connected

Today Out Msg 35 Today GoodMsg 35

Ystdy Out Msg 98 Ystdy GoodMsg 98

These two screens report communications statistics for the current day and yesterday. The screen shows the number of attempts to communicate with the Link2Site server and the number of successful attempts.

Last Out Attempt Nov15, 07 09:40AM

This screen shows the time and date of the last attempt to communicate with the Link2site server.

4.0 Installation

General Safety Notice

Potentially hazardous voltages are present at the terminals of the LC150. Remove all electrical power to the unit before connecting or disconnecting wiring. Do not exceed the input or output ratings as stated in the specifications. This device should be installed and serviced by qualified personnel.

4.1 Mounting the Unit

The LC150 base unit is normally snapped onto DIN rails mounted to the sub-panel of a suitable enclosure. If required the base unit may be snapped onto DIN rails that are fastened to the back of the LC150 OI unit. A 6" length of DIN rail can be mounted to the back of the OI unit using the #10x ¼", self-tapping screws and the holes provided.

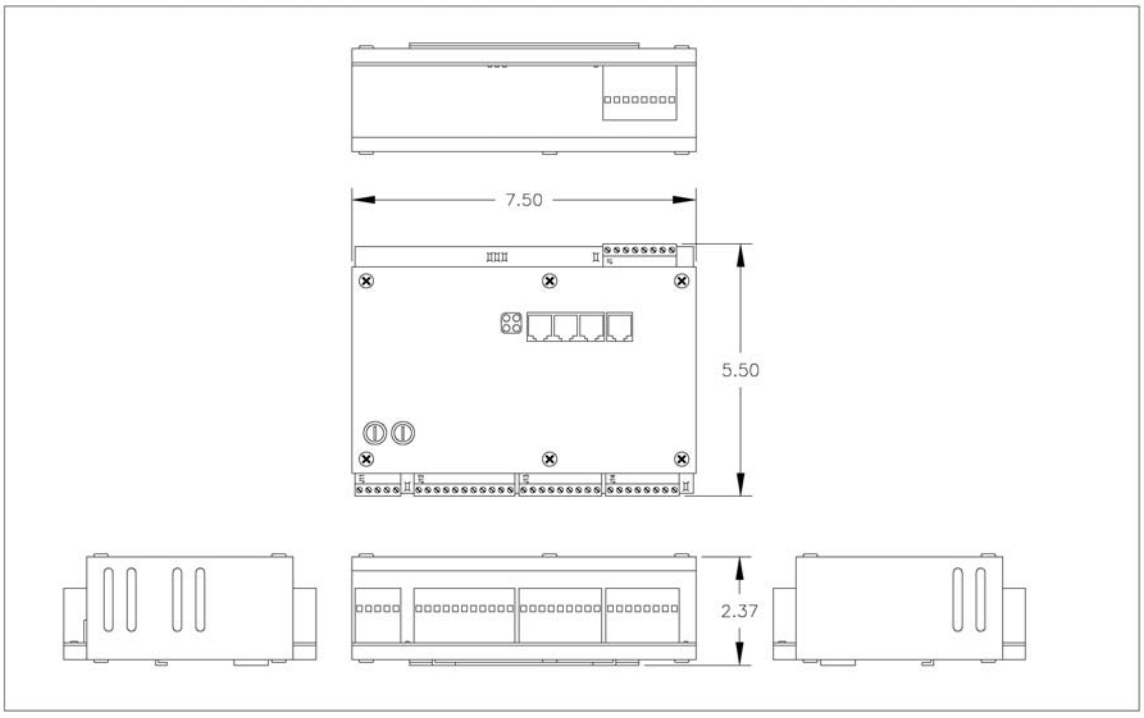


Figure 4.1 – LC150 Base Unit Dimensions

The LC150 OI unit is normally mounted to an inner or outer door using the cutout and mounting holes as specified in figure 4.2. The OI unit's dimensions are shown in Figure 4.3. When installing the OI unit, the mounting screws must be tightened equally to ensure that the OI unit's gasket seals properly to the door.

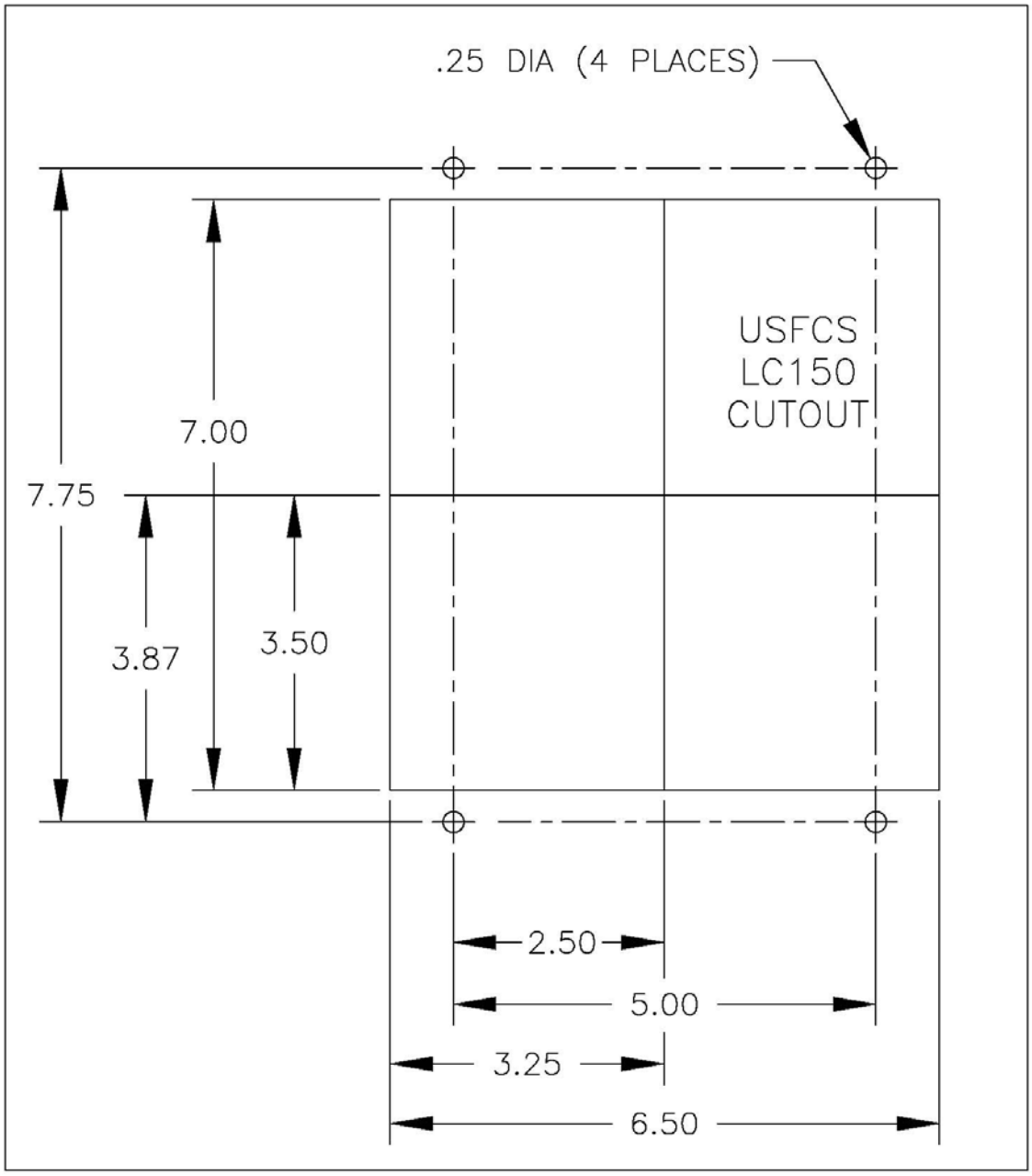


Figure 4.2 – Door cutout Dimensions for LC150 Operator Interface

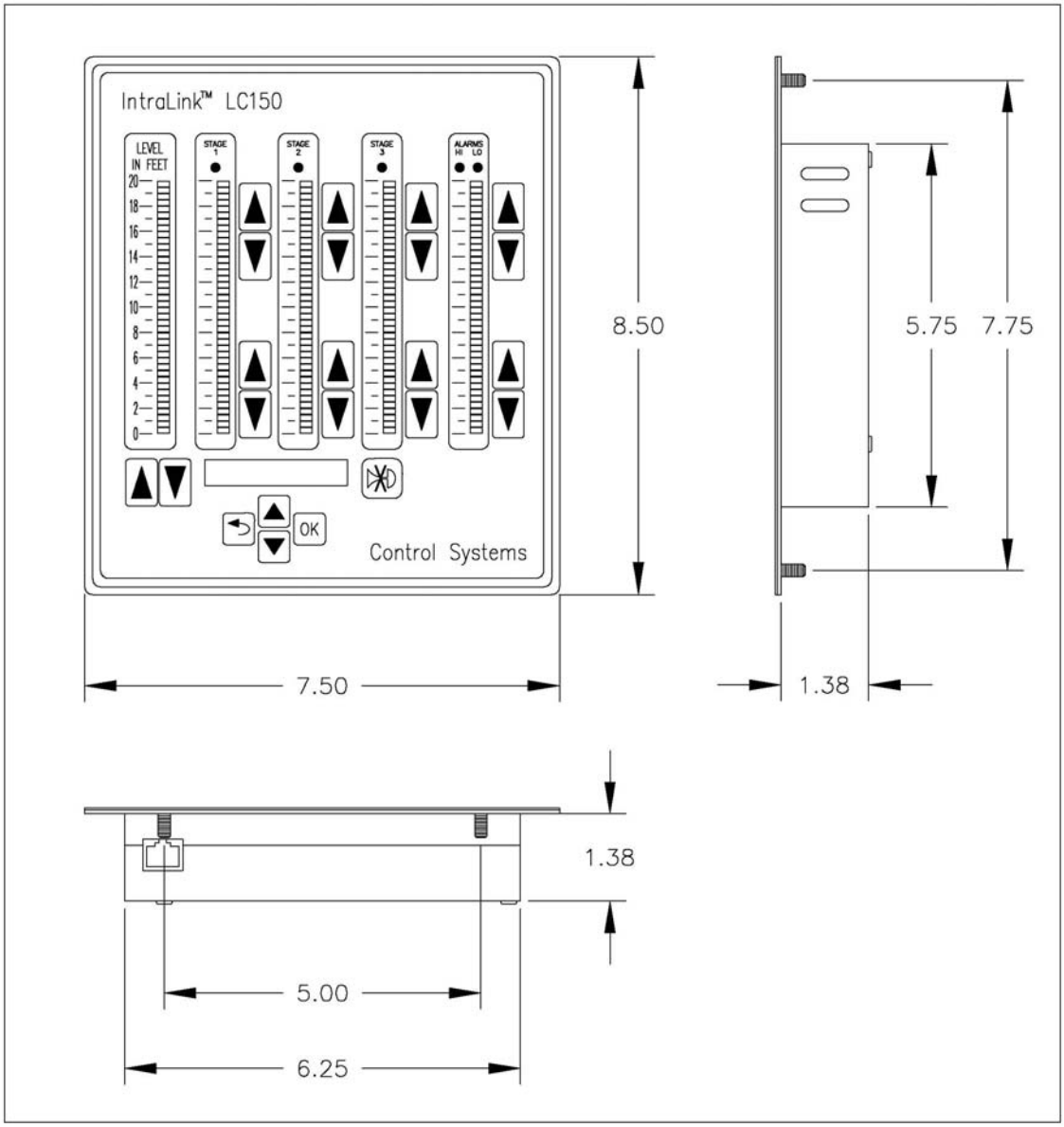


Figure 4.3 – LC150 Operator Interface Dimensioned Drawing

4.2 Power Connections

The LC150 can be powered from a 120 VAC, from a 10-30 VDC or from a battery source. The unit can trickle charge the battery and provide a 12 VDC auxiliary power source. The auxiliary power source supplies nominal 13.8 VDC when the primary power is 120 VAC. The auxiliary power source will supply the same voltage present at the DC+ input if the unit is operating on DC power. The unit's 120 VAC input and Battery/DC+ inputs are both fused.
Figure 4.4 shows the typical power connections for a unit using 120 VAC as its primary power source and a battery as its backup source.

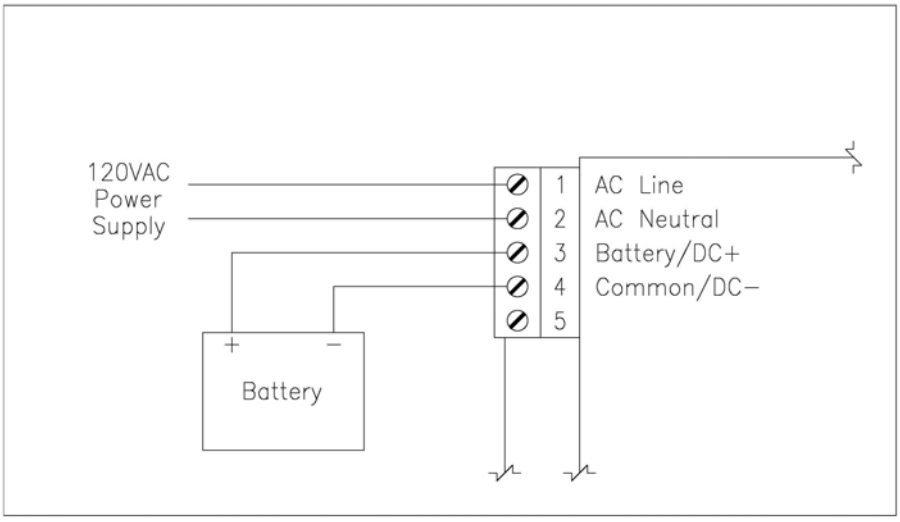


Figure 4.4 – 120 VAC Power Connections

Figure 4.5 shows the typical power connections for a unit using an external DC power supply as its primary power source.

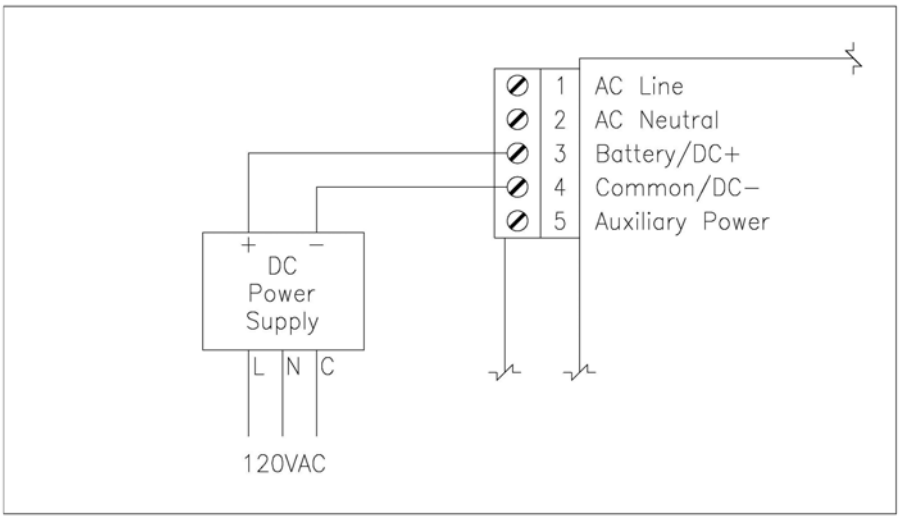


Figure 4.5 – DC Power Connections

The LC150 OI unit receives its power from the base unit through the communications cable. A standard Ethernet patch cable (male RJ45 connectors on each end, 8 conductors) can be used to connect the base unit with the OI unit. The maximum cable length is 25 feet.

Output Connections
Connect Output wiring in accordance with the wiring diagram shown in figure 4.6

Discrete Input Connections
Connect discrete input wiring in accordance with the wiring diagram shown in figure 4.6

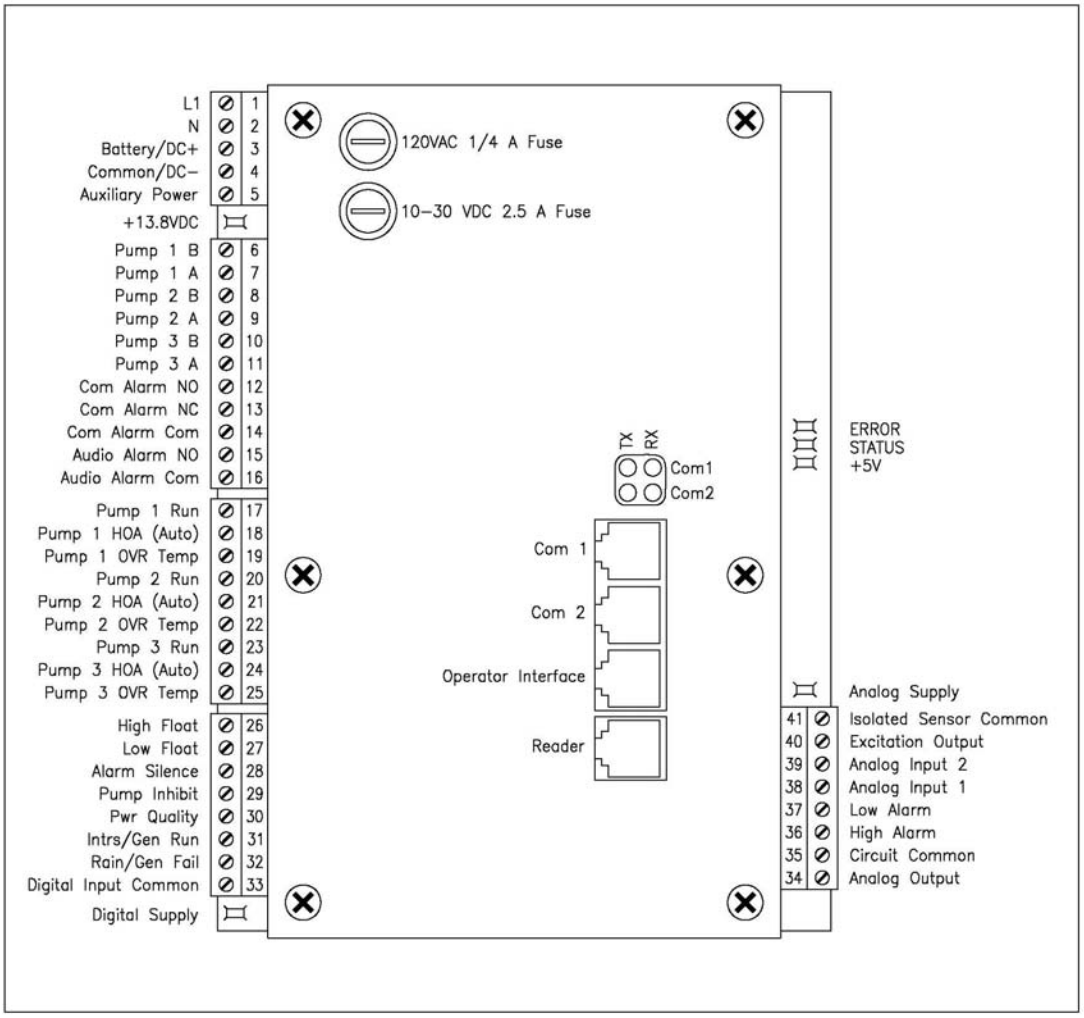
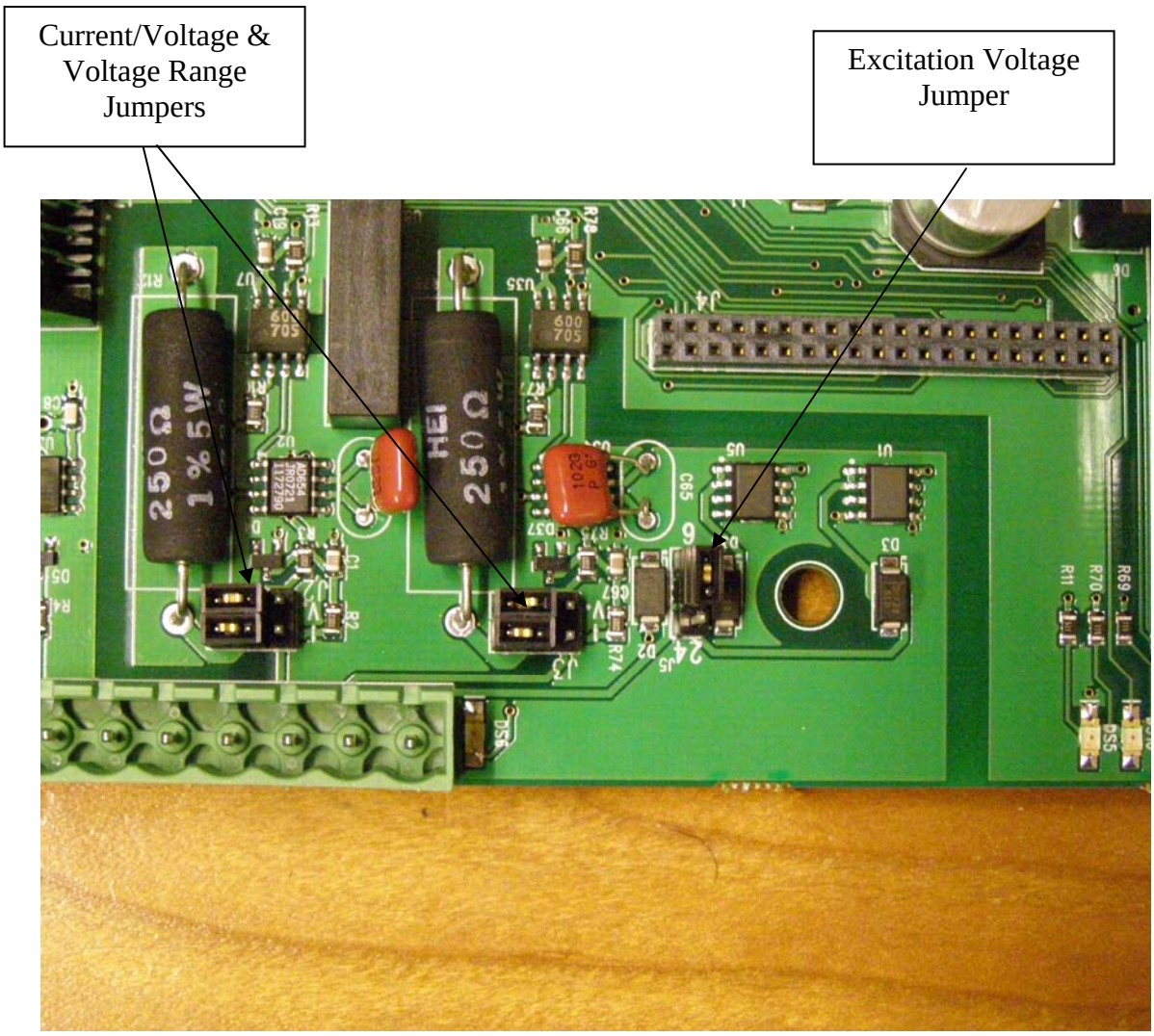


Figure 4.6 – Terminal Designations

5.0 Analog Input(s) Setup & Calibration

5.1 Analog Input Hardware Configuration

Each analog input has two jumpers that control the processing of the electronic signal. There also is a jumper to control the voltage level of the excitation voltage supply. The cover of the base unit must be removed to access these jumpers. These jumpers must be set properly before wiring and calibrating the sensors.



Note: The picture shows both analog inputs set for voltage operation with a 0 – 5 VDC range. The excitation voltage is set for 6 VDC. This is the default setting from the factory.

Jumper set J2 controls analog input 1 and jumper set J3 controls analog input 2. The first step is to configure the analog inputs for current or voltage operation. For current operation (4-20 ma), the "I" jumper must be installed and the V jumper must be out.

For voltage operation, the "I" jumper must be out. If a 0-10 VDC range is desired, the V jumper should be in.

If a 0-5 VDC range is desired (used for connecting Control System's A1000 Submersible Level Sensor), the "I" jumper must be out and the V jumper must be out.

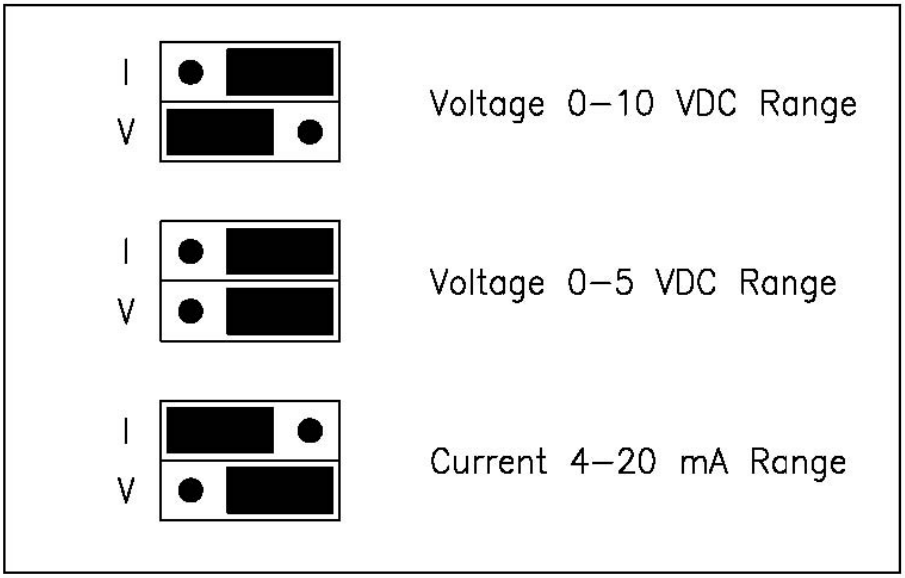


Figure 5.2 – Analog Input Jumper Settings

The excitation voltage present at terminal 40 is determined by the position of jumper J5. Install the jumper in the "24" position for 24 VDC excitation voltage. Install the jumper in the "6" position for 6.0 VDC excitation voltage (used with A1000 sensors).

5.2 Wiring Sensors

A typical 2-wire, 4-20 ma current loop sensor connection is wired as show in Figure 5.3. A second sensor may be wired to analog input 2 in a similar fashion, with both sensors sharing the excitation voltage.

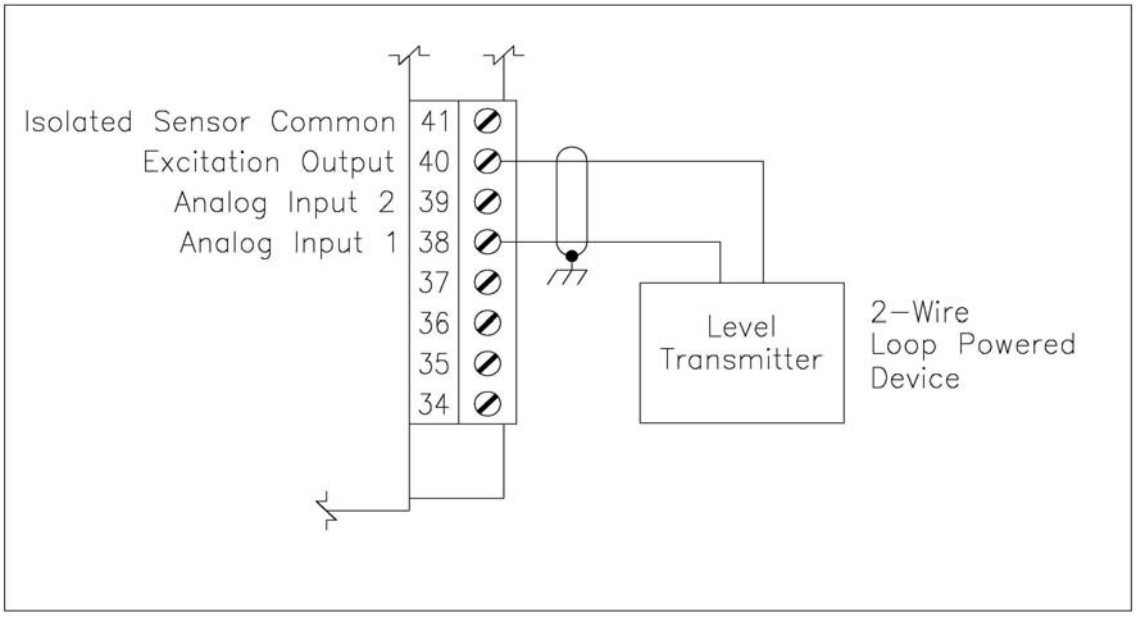


Figure 5.3 – 2 wire, 4-20 ma Sensor Connections

A typical 4-wire, 4-20 ma current loop sensor connection is shown is figure 5.4. A second sensor may be wired to analog input 2, with both sensors sharing the sensor common terminal.

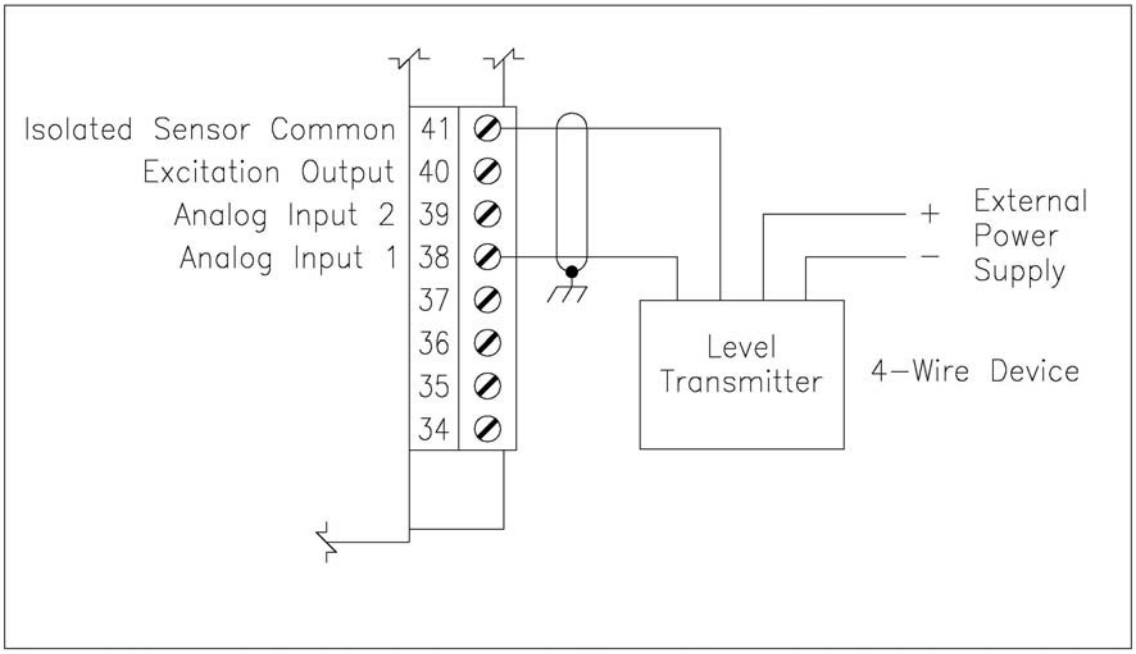


Figure 5.4 – 4-wire, 4-20 ma Sensor Connections

A typical voltage sensor connection is shown in figure 5.5.

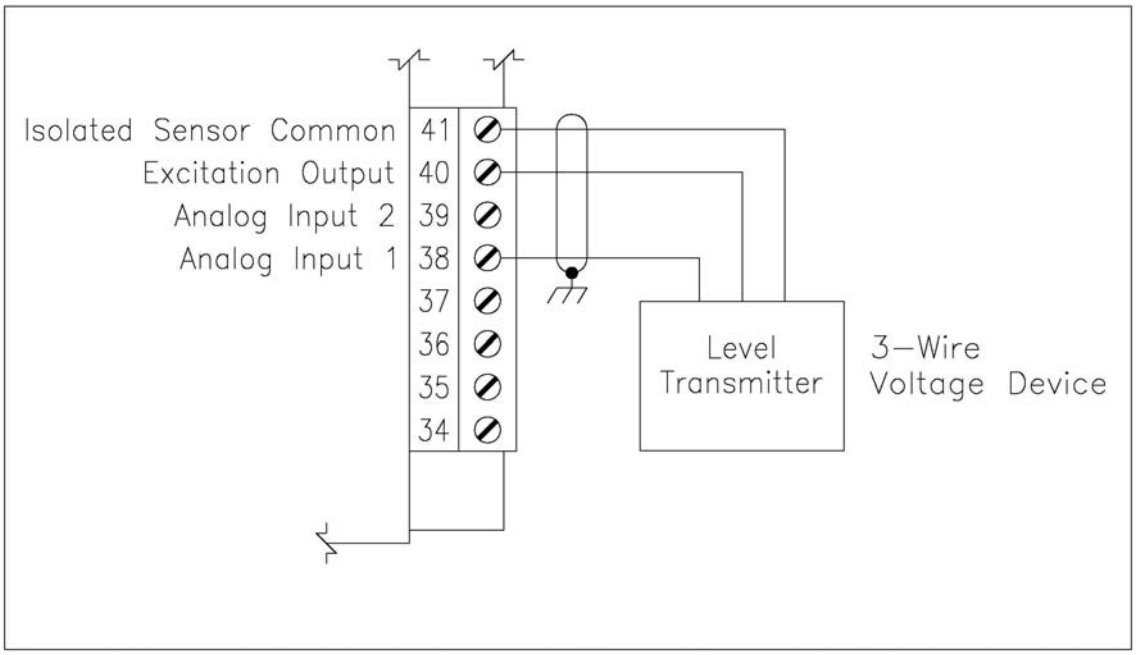


Figure 5.5 – 3-wire Voltage Sensor Connections

Note: Connect the A1000's color coded wires as follows:

Sensor Common	–	A1000 Black wire
Sensor Excitation	–	A1000 Red wire
Sensor Signal	-	A1000 White wire

5.3 Calibrating Analog Input 1 (Level Sensor)

Analog input 1 is always the wired to the sensor used by the LC150 for control of the pumps. The process level from analog input 1 is shown on the LED bar graph and the LCD home screen.

Once the analog input 1 hardware is properly configured, and the sensor is properly wired to analog input 1, the sensor can be calibrated via the LCD and keypad on the OI unit.

From the Home Screen, scroll down to the Configuration Menu and enter it, then scroll down to the Calibration Menu and enter it. Now Enter Analog Input 1 setup. The LCD is now in the Calibration menu for analog input 1.

The first screen is used to set the range of the connected level sensor. If there is no process offset, setting this value correctly will get the calibration very close and may be the only setting needed for most applications.

```
Sensor Rng:  11.5
 <OK> to change
```

The transducer range is usually in entered in feet. This number is the maximum level that can be read by the sensor. The controller will equate this value to the maximum signal from the analog input. The following table provides a quick conversion from a pressure sensor in PSI to a range in feet (when measuring water or other liquid of the same density).

Pressure rating of Sensor (in PSI)	**Equivalent range in feet of water**
1.5 PSI	3.5 ft of water
5 PSI	11.5 ft of water
15 PSI	34.7 ft of water
30 PSI	69.3 ft of water

The controller uses a two point method for calibration of analog input 1. The low point is established when the user presses OK to finish the change of the EU Low value. The high point is established when the user accepts the change to the EU High value. The controller uses the two points established by the EU Low and EU high values to calculate the span and offset for the sensor.

Changing the Engineering Units (EU) low value allows the user to adjust the zero setting or add an offset to the scaled value. To adjust the zero setting, create a zero process level condition (for example by removing the level sensor from the media, or emptying the tank or well). Once the sensor is at a known low level, adjust the reading on the EU Low screen until it reads 0.0 and press OK to finish.

AIN1 EU Low: 0.0
<OK> to change

To add an offset to the scaled value, simply adjust the EU Low to include the desired offset. Pressing OK from this screen will equate the raw analog input value currently being read to the EU value entered on the screen.

To complete the calibration create a known process level (preferably near its maximum level) condition. While the process variable is at a known level, adjust the EU High reading until it matches the known process level. Pressing OK from this screen will equate the raw analog input value currently being read to the EU value shown on the screen.

AIN1 EU High: 10.6
<OK> to change

The final step to calibrating the analog input is to set the quelling level. The quell rate setting is used to dampen surges in the input signal. The quell rate setting has 10 levels: 0 equals no quelling, 10 is maximum dampening. Normally the quell rate is left at the default of setting of 0, unless lengthy surges in level are encountered.

AIN1 Quell Lvl: 0
<OK> to change

Quell Level	Full Scale Response Time
0	1 Second
1	3 Seconds
2	6 Seconds
3	10 Seconds
4	30 Seconds
5	60 Seconds
6	90 Seconds
7	120 Seconds
8	150 Seconds
9	180 Seconds
10	240 Seconds

The following screens may be useful in troubleshooting an analog input problem.

```
Raw High:  4500
Raw Low:    500
```

The Raw High and Raw Low values show the raw analog-to-digital output values that correspond with the EU High and EU low engineering unit values.

```
Raw AIN1:  2319
EU AIN1:     3.5
```

The raw level is the filtered analog to digital converter output. Each count represents a milli-volt. With a current sensor each 1000 counts represents 4 ma. It can sometimes be useful to know what voltage value the controller is read at the analog input terminal (referenced to Sensor Common).

5.4 Calibrating Analog Input 2

Analog input 2 is optional on the LC150. If enabled it may used to monitor a level, pressure, value in percentage or flow. Only the flow function enables further processing in the LC150. The other settings enable the LC150 to monitor the sensor, display the value and alarm on high or low limits.

From the Home Screen, scroll down to the Configuration Menu and enter it, then scroll down to the Calibration Menu and enter it. Now Enter Analog Input 2 setup. The LCD is now in the Calibration menu for analog input 2.

FUNC: DISABLE <OK> TO CHANGE

The first screen is used to assign a function to the input. To use analog input 2 its function must be changed from Disable to one of the following choices: Level, Percent, Suction PSI, Discharge PSI, or Flow.

This parameter must be set to Flow in order for the Flow Logic application to use it as the source of its flow data.

To scale and calibrate analog input 2, the operator must assign two pairs of points that the controller will use convert the electrical signal to a real value in the designated engineering units. Each pair consists of a scaled value in engineering units and a corresponding value in electronic (analog to digital conversion) counts. On the LC150, each count represents a milli-volt or when using a current sensor each 1000 counts represent 4 ma. Typically one pair is at or near the lower end of the sensors range and the other is at or near the high end of the sensor's range.

AIN2 EU Lo: 0.0 <OK> TO CHANGE

Enter the value in engineering units for the low end conversion pair. This is typically 0.0 but it may be set to something else if an offset is desired.

AIN2 RAW Lo: 0000
<OK> TO CHANGE

Enter the value in electronic counts for the low end conversion pair. For example, if flow is selected as the function for analog input 2, and the flow meter is a 4-20 ma device with a range of 0 – 3000 GPM, enter 0.0 for the EU low value and 1000 (4 ma) as the Raw Low value.

AIN2 EU Hi: 0.0
<OK> TO CHANGE

Enter the value in engineering units for the high end conversion pair. This is typically the maximum range of the sensor.

AIN2 RAW Hi: 0000
<OK> TO CHANGE

Enter the value in electronic counts for the high end conversion pair. For example, if flow is selected as the function for analog input 2, and the flow meter is a 4-20 ma device with a range of 0 – 3000 GPM, enter 3000 for the EU high value and 5000 (20 ma) as the Raw high value.

Raw AIN2: 2319
EU AIN2: 3.5

This screen can be a useful trouble shooting screen. It displays the current sensor reading in raw counts and scaled engineering units. The raw level is the filtered analog to digital converter output. Each count represents a milli-volt. With a current sensor each 1000 counts represents 4 ma.

The quell level for analog input 2 is set using the same criteria as analog input 1. See section 5.3 above for details.

6.0 Front Panel Operator Interface Functions

6.1 Bar Graphs

The LC150 Operator Interface (OI) uses five LED bar graphs to show process level, stage setpoints and alarm setpoints. Each bar graph contains 40 LED segments. All four setpoint bar graphs are referenced to the scale alongside the process level bar graph.

The process level will be shown with all the LED segments lit up to the actual process level.

The three stage setpoint bar graphs will have a single LED lit for the ON setpoint another LED lit for the OFF setpoint. If the controller is not configured for three stages, the stage 3 bar graph will not have any LEDs lit.

The alarm bar graph will have one LED lit for the HIGH and one for the LOW level alarm setpoints.

6.2 Stage/Alarm Level Setpoint Adjustment Keys

Each stage ON and OFF setpoint, and each alarm level setpoint has an associated pair of UP/DOWN arrow keys. Use the associated pair of arrow keys to raise or lower the setpoint. Setpoints cannot be crossed. If the controller is not configured for a third stage, pressing the Stage 3 setpoint adjust keys will have no effect.

6.3 Alarm Silence/Reset Key

Pressing the Alarm silence/Reset key will turn off the audible alarm output and silence the controller's internal beeper. See section 2.4 for a description of alarm behaviors.

6.4 Simulation Keys

Pressing the UP/DOWN arrow keys below the process level bar graph will put the controller into simulated level mode. The operator must press the OK key to continue in the simulation mode. Pressing these keys will artificially change the process level. The controller will respond to the simulated level changes as if they were real level excursions. This may cause outputs to change state and alarms to occur. The operator must press the OK to exit the simulation mode. The controller will automatically exit the simulation mode if the UP/DOWN keys haven't been pressed in two minutes.

6.5 Stage and Alarm LEDs

The LED at the top of each stage setpoint bar graph will be ON if the controller has called for that stage to be active. The HI alarm LED will be on if the process level is above the high level alarm setpoint or if the high level float is active. Similarly the LO alarm LED will be ON if the process level is below the low level alarm setpoint or if the low level float opens.

6.6 Liquid Crystal Display (LCD)

The LC150's LCD is used in conjunction with the 4-key keypad to show more advanced information and it is used to configure the controller.

Each 2 line x 16 character display is a screen. A group of linked screens is called a Ring. Pressing the UP/DOWN arrow keys scrolls the LCD through the screens in the RING.

There are three types of screens:

- Navigation – Pressing the OK key from a navigation screen advances the LCD to a child Ring.
- Data – Data screens contain only viewable information.
- Setpoint – Setpoint screens contain one modifiable parameter.

6.7 Display Keypad

The LCD keypad contains four keys:

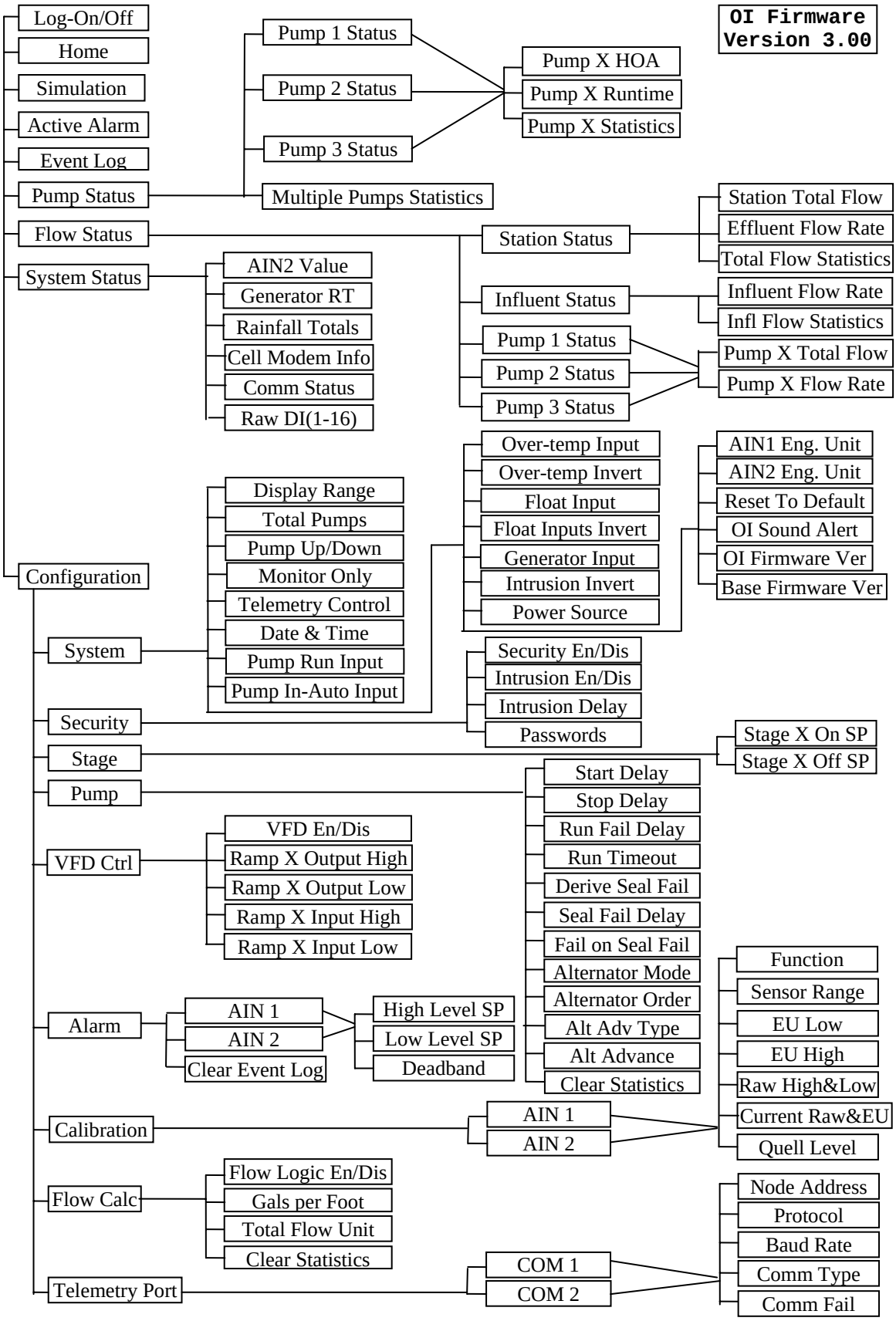
UP/DOWN keys – In navigation mode, the UP/DOWN keys will scroll through the screens within the current Ring. In edit mode, the UP/DOWN key will increase/decrease an analog value or toggle the state of a discrete parameter.

OK key – Pressing the OK key from a navigation screen will advance the LCD to a child Ring. Pressing OK from a setpoint screen will put the LCD into edit mode. Pressing OK while in edit mode will accept the change.

Return key – Pressing the return key while in navigation mode will back the display up to the previous Ring. Pressing the Return key while in edit mode will cancel the change and take the display out of edit mode. Repeatedly pressing the Return key will return the display to the Home screen.

7.0 LCD Navigation Map

The following map summarizes the LCD rings and screens.



8.0 Configuration of Options

The LC150 offers two methods for configuring the operation of the controller. PC based LC150 Utility software may be used to configure the controller. The use of this software is covered in LC150 Utility Software Users Manual. The LCD and 4-key keypad found on the Operator Interface unit may also be used to configure the controller.

Scroll through the main ring until you see the Configuration screen.

Configuration <OK> to Enter

There are 8 navigation screens in the Configuration ring:

- System
- Security
- Stage
- Pump Settings
- VFD Settings
- Alarm Settings
- Calibration
- Flow Calculation
- Telemetry Port

8.1 System Configuration

Display Range **Default: 20.0**

The display range screen relates the height of the LED columns to the level, stage setpoints and alarm setpoints. This setting must match the highest number shown on the level LED column. For standard products this setting is 10, 20, or 40 feet.

Display Rg: 20.0ft <OK> TO CHANGE

Total Pumps **Default: 3**

This setting tells the controller how many pumps are actually installed.

Total Pumps: 2 <OK> TO CHANGE

Pump UP/DOWN **Default: Down**

This setting tells the controller whether it is filling a tank (pump UP) or emptying a well (pump DOWN). See section 2.2 for a description of pump UP/DOWN operation.

PumpUp/Down: DN <OK> TO CHANGE

Monitor Only **Default: No**

Setting this parameter to YES will prevent the controller from operating its pump relays. If this parameter is set to YES the Stage setpoint LED columns will not have any lighted LEDs. Set to YES when the LC150 is monitoring the station but not controlling any pumps. In the Monitor Only mode all other functions such as alarm processing and flow calculations will continue to operate.

Monitor Only: NO <OK> TO CHANGE

Use Telemetered Control Default: No
Setting this parameter to YES will cause the controller to look for its control signals from a remote station. If communications have failed, the controller will turn OFF all pumps and create a critical alarm. See Section 10.4 for details on telemetry control.

Use Tel Cntrl: NO <OK> TO CHANGE

System Date and Time Default: NA
This screen allows the operator to set the controllers date and time. The system date and time are used for active alarms and event log entries.

Jan 1,00 12:00AM <OK> TO CHANGE

Monitor Pump Run Inputs Default: Disable
Setting this value to ENBL will cause the controller to monitor the pump run inputs to verify pump operation. The pump run input must go true within "Run Fail Delay" seconds or the controller will fail the pump. If this parameter is disabled the controller will ignore the pump run inputs

Run Input: ENBL <OK> TO CHANGE

Monitor HOA inputs for Auto State **Default: Disable**

Setting this value to ENBL will cause the controller to monitor each pump's hardwired HOA Auto/non-Auto input. If the input signals the HOA is not in Auto, the controller will take the pump out of service.

InAuto Inpt: ENBL <OK> TO CHANGE

Monitor Pump Over-temperature Inputs Default: Disable

Setting the value to ENBL will cause the controller to monitor each pump's over-temperature inputs. If the input is Active (High or low depending on the Invert Over-temperature inputs sense setting), the controller will shut the pump OFF and take it out of service.

OvTemp Inpt:ENBL <OK> TO CHANGE

Over-temperature Input Sense **Default: No**

Set this value to NO if an over temperature condition is indicated by a True (logic level High) state at the over-temperature input.

Invert OvTmp: NO <OK> TO CHANGE

Float Mode **Default: Disable**

This setting tells the controller how it should process the high and low float inputs. Selections are Disable, Monitor, or Control. See section 2.7 for details on float backup operation.

Float In: CONTROL <OK> TO CHANGE

Invert Float Inputs **Default: No**

Setting these parameters allows the sense of the floats to be inverted. A value of NO will cause the float input to be active HIGH (closed contact).

Invrt Flt Hi: NO <OK> TO CHANGE

Invrt Flt Lo: NO <OK> TO CHANGE

Generator Monitoring **Default: Disable**

Enabling the generator monitor function will cause the controller to treat the two dual function discrete inputs as generator run and generator fail. The intrusion and rain gauge functions are disabled if generator monitoring is enabled. The controller will accumulate generator runtime based on the generator run input and it will make the generator status available to SCADA. The controller will treat an active state on the generator fail input as a critical alarm.

Gentr Input: DISA <OK> TO CHANGE

Invert Intrusion Input **Default: No**

Setting these parameters allows the sense of the intrusion input (door or motion switch) to be inverted. A value of NO will cause the float input to be active HIGH (closed contact).

Invrt Intrsn: NO <OK> TO CHANGE

Power Source **Default: AC**

Select AC if the controller's primary power source is 120 VAC. Select DC if the controller's primary power source is a 10 – 16 VDC power supply.

Power Source: AC <OK> TO CHANGE

Analog Input x Units **Default: Feet (Analog Input 1)**
Default: None (Analog Input 2)

This parameter is used to determine the units display on the LCD. Choices are: “Feet”, “GPM”, “PSI”, “Meters”, “Inches”, “%” and “ “. Changing this setting should only be done with a unit that has a customized level insert on the OI. Contact Siemens Water Technologies - Control Systems for details on customizing the LC150 for units other than “Feet”.

Sys Unit: Feet <OK> TO CHANGE

Reset Controller back to defaults **Default: No**

Changing this value to Yes will cause the controller to reset back to factory defaults.

Reset to Dft: NO <OK> TO CHANGE

OI Audible Alarm Indicator **Default: Enable**

Changing this parameter to “DISA” will disable the audible alarm beeper. There will be no audible alarm indication from the OI and the OI will not beep on key presses. Control of the Audible Alarm relay output will not be affected by this setting.

OI Snd Alrt: ENAB <OK> TO CHANGE

Firmware Version **Default: NA**

The two screens display the firmware versions currently running in the OI unit and the base controller.

OI Firmware 3.00

Base Firmware 3.00

8.2 Security Configuration

Enable/Disable Security **Default: Disable**

This parameter ENABLES/DISABLES the security function of the LC150 operator interface. When security is enabled, an operator must login to make changes. Login can be done via the operator interface or via an iAccess electronic key.

Security: ENBL <OK> to change

Passwords **Default: Level 1 = 2222, Level 2 = 3333**

Level 1 password allows the operator to view everything, change stage and alarm setpoints, acknowledge/silence alarms, and simulate levels. Level 2 password allows the operator full access for change and viewing. Entering either Level 1 or Level 2 password authorizes entry. Password configuration screens are not shown if Security is disabled.

Level 1 Pwd:2222 <OK> to change

Level 2 Pwd:3333 <OK> to change

OI Timeout **Default: 30 minutes**

The OI timeout is the amount of time of no activity before the controller automatically logs the user out. This value is also used with iAccess security. The system will log the user out automatically after this timeout expires. This parameter can only be changed via PCCS software

Enable/Disable Intrusion **Default: Disable**

Setting this parameter to ENBL will cause the controller to monitor the Intrusion Input. If the input goes True, an operator must log-in within "Intrusion Delay" seconds or the controller will generate and Intrusion Alarm. Login can be done via the operator interface or an electronic, iAccess, key.

Intrusion: ENBL <OK> to change

Intrusion Password **Default: 1111**

This password acknowledges entry but does not allow change rights like Level 1 & 2 security passwords. This screen is not shown if Intrusion is disabled.

Intrusn Pwd:1111 <OK> to change

Intrusion Delay **Default: 60 seconds**

The parameter is the amount of time in seconds the controller will wait for an Intrusion acknowledge (keypad login or Intrusion Acknowledge Input active) before generating an Intrusion Alarm. This screen is not shown if Intrusion is disabled.

Intru Delay: 60s <OK> TO CHANGE

8.2.1 iAccess Security Configuration

iAccess parameters must be configured using PCCS software or the Link2Site server. The iAccess security application supports up to 127 users. Each user is assigned a User ID, a security level (0 – 2) and a 6 digit serial number. The serial number is embossed on the face of the electronic key FOB assigned to the user. The least significant (right most) 6 digits are entered as the user's serial number.

8.3 Stage Setpoint Configuration

Stage setpoints are the control points at which a stage is activated or deactivated.

The stage setpoint configuration screens work independently and in cooperation with the stage setpoint adjustment keys located next to the stage setpoint LED bar graphs. An operator can navigate through the LCD to the stage setpoint configuration screens and make changes directly using the LCD and keypad. The stage setpoints can also be changed using the stage setpoint adjustment keys and the LED bar graphs (see section 3.4 of this manual). The LCD will automatically advance to the appropriate stage setpoint screen when the operator is using the stage setpoint adjustment keys.

Default values are show in the screen shots below.

Stage 1 Off: 5.0 <OK> to change	Stage 1 On: 11.0 <OK> to change
Stage 2 Off: 6.0 <OK> to change	Stage 1 On: 13.0 <OK> to change
Stage 3 Off: 7.0 <OK> to change	Stage 1 On: 15.0 <OK> to change

8.4 Pump Control Configuration

Pump On Delay **Default: 5 seconds**

This parameter is the amount of time in seconds the controller will wait between successive pump starts. This delay is also enforced between power up and starting the lead pump.

```
Pmp On Dly:  5s
 <OK> to change
```

Pump Off Delay **Default: 3 seconds**

This parameter is the amount of time in seconds the controller will wait between successive pump stops.

```
Pmp Off Dly:  5s
 <OK> to change
```

Run Fail Delay **Default: 10 seconds**

This is the amount of time in seconds the controller will wait after calling for a pump for the Pump Run input to go active. If the Run Input does not confirm the pump call within the Run Fail Delay seconds an alarm will be generated, the pump will be failed and a replacement pump will be called. This function must be enabled (see System Configuration section) in order to be active.

```
Run Fl Dly:  10s
 <OK> to change
```

Run Timeout **Default: 24.0 hours**

This is the amount of time in hours that the controller will allow a pump to continuously run before alternating pumps. If a pump runs longer than this timeout, the controller will stop the running pump and start an alternate pump.

Run Tout: 24.0hr <OK> to change

Derive Seal Fail **Default: No**

If YES is selected the controller will configure the pump Over temperature inputs for combined over temperature/ seal failure detection. If the seal fail function is enabled, the Over temperature function must also be enabled and the following off-board circuitry must be properly connected in order for the controller to properly handle seal failure detection:

1. The Pump-Run inputs must be enabled and properly connected. The Pump Run inputs are normally connected to auxiliary contacts on the pump motor starters.
2. An off-board over-temperature detection device such as a mini-CAS module or similar device must be connected to shut the pumps down upon detection of an over-temperature condition.

The separate over-temperature and seal fail contacts are connected to the single Over-temperature/Seal Fail input on the controller in a OR'd configuration. If the controller detects the input going True it will wait "Seal Fail Delay" seconds and check the state of the Pump Run Input. If the Pump Run Input indicates the pump has shut OFF (the external device shut the pump OFF), the controller will interpret that as an Over-temperature condition. However if the Pump Run input indicates the pump is still operating, the controller will interpret the over-temperature/Seal Fail input going True as a Seal Fail condition.

Derive Sl Fl: NO <OK> to change

Seal Fail Delay **Default: 10 seconds**

This is the amount of time in seconds the controller will wait after a Pump Over temperature/Seal fail input goes active to determine whether or not the pump has been shut down. See "Derive Seal Fail" description above for a description of the Seal Fail detection algorithm.

Seal Fl Dly: 10s <OK> to change

Fail Pump on Seal Failure **Default: No**

Setting this parameter to YES will cause the controller to fail and turn OFF a pump upon seal failure detection. See "Derive Seal Fail" description above for a description of the Seal Fail detection algorithm.

Fl on Sl Fl: No <OK> to change

Alternation Mode **Default: FOFO**

This setting controls how the controller will alternate its pumps. See section 2.0 System Operation for a description of the alternation modes.

Alt Mode: Fixed <OK> to change

Alternation Order **Default: 1-2-3**

The controller uses this setting to determine the pump order when in fixed mode and to determine the initial pump order in an alternation mode.

Alt Order: 1-2-3 <OK> to change

Alternator Advance Type **Default: Bk_B_Mk**

The controller uses this setting to determine the order to stop and start pumps when advancing the alternation order with one or more pumps running. If “make before break” (Mk_B_Bk) is selected the controller will turn on the alternate pump before turning off the running pump. If “break before make” (Bk_B_Mk) is selected the controller will shut off the running pump before starting the alternate pump

Adv Type: Mk_B_BK <OK> to change

Alternator Advance **Default: No**

This screen allows the operator to manually advance the alternator. Setting this parameter to YES will cause the controller to select the next pump in sequence as the new lead pump.

Alt Advance: NO <OK> to change

Clear Pump Statistics **Default: No**

Setting this parameter to YES will cause the controller to clear all pump run time and number of starts values

Clr Pmp Stat: NO <OK> to change

8.5 VFD Control Configuration

See Section 11.0 for VFD configuration information.

8.6 Alarm Configuration

The level alarm setpoints for both analog input 1 and 2 are configured in this menu. First select the analog input you wish to configure.

ANALOG INPUT 1 <OK> to Enter	ANALOG INPUT 2 <OK> to Enter

Analog Input 1(2) Alarm Setpoints **Default: (Analog Input 1)**
Low Level = 3.0, High Level = 17.0

The analog input alarm setpoints are the control points used by the controller to determine high and low level alarm conditions. Setting the low level alarm setpoint to zero will disable low level alarm detection. Setting the high level alarm to a value equal to the display range (AIN1) or the max sensor range (AIN2) will disable high level alarm detection.

The analog input 1 alarm setpoint screens work independently of and in conjunction with the level alarm adjustment keys next to the level alarm LED bar graph. They may be adjusted through the LCD or by using the level alarm adjustment keys and the LED bar graph. When the level alarm adjustment keys are used the LCD will automatically show the corresponding setpoint screen.

AINx Lo SP: 3.0 <OK> to change	AINx Hi SP: 17.0 <OK> to change

Alarm Deadband **Default: 5%**

The alarm deadband prevents the controller from "chattering" in and out of alarm when the level is experiencing slight fluctuations around the setpoint. For analog input 1 the deadband is expressed as a percentage of the controllers display range. For example if the controller is a 0 – 10' model, the deadband is set to 10%, and the high alarm setpoint is 9.0 feet, the level must fall to 8.0 feet before the high alarm condition returns to normal. For analog input 2 the deadband is expressed as a percentage of the EU high value.

Deadband: 5% <OK> to change

Clear Event Log **Default: No**

Setting this parameter to YES will cause the controller to clear all records from the event log. After resetting the event log the only record left in the log is the "Event Log Reset" event.

Clear Event: NO <OK> to change

8.7 Calibration

See the calibration information in Section 4.0 Level Sensor Installation and Setup

8.8 Flow Calculation

See the Flow configuration information in Section 9.0 Flow Logic Application

8.9 Telemetry Port Configuration

See Section 10.1 for Telemetry configuration information.

8.10 Rain Gauge Configuration

The LC150 support most tipping bucket style rain gauges. The tipping bucket contacts are connected to the LC150's rain gauge digital input. The input functions like a pulse counter, where each pulse equals a user settable amount of rain.

PCCS software must be used to configure the amount of rain per pulse. The parameter is entered in inches/pulse. The correct value is obtained from the rain gauge specification. Once configured the LC150 tracks daily rainfall, yesterday's rainfall, and total station rainfall. Rain data is viewable from the System Status Menu.

9.0 Flow Logic Application

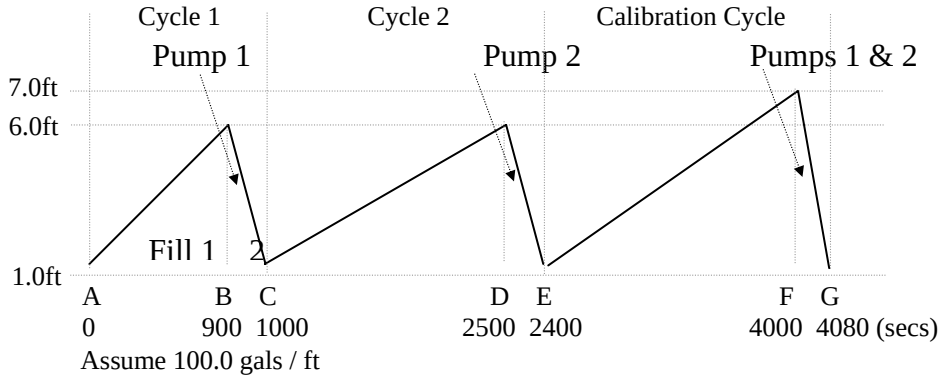
The Flow Logic application can calculate pump and station flow information based on a volumetric calculation or based on a flow meter input on analog input 2. The same package of flow totals, flow rates, etc is provided regardless of the source of the flow data. If analog input 2's function is set to flow, the Flow Logic application will use scaled engineering units value from analog input 2 as its source for flow data.

9.1 Volumetric Flow Calculation

The LC150 shall determine station flow based on level excursion. This calculation will only be valid for linear vessels where a single gallons/foot factor applies to the entire range of the vessel. The Volumetric Flow calculation will only produce valid data for constant speed pumps. If variable speed pumps are used, the flow data is invalid.

Simplified description: The station's flow is calculated by summing the effluent flow from each of the pumps. The flow and flow rate of each pump (and combination of pumps) is constantly being calculated and updated. Therefore, if we assume the following: Pump-1's rate is calculated at 100 gpm, pump-2's rate is 110 gpm and the combined rate of both pumps is 160 gpm. If the level rises to the point where pump-2 starts and runs for 3 minutes, we know that the station has just pumped 110 * 3 or 330 gallons. This value is added to the stations flow total. If, during the next cycle, pump-1 starts and runs for 1 minute, then pump-2 also starts and the two pumps run for 2 minutes, the flow is calculated as: (100 * 1) + (160 * 2) = 420 gallons. Again, this value is added to the station's flow total.

Advanced description:



- The station's influent rate is calculated in three ways:
  1. When no pumps are running – this is calculated as the average influent rate between pump cycles and is calculates as follows:
     Fill-1:

Volume = (Level B (6.0) – Level A (1.0)) * Gals per Ft = 500.0 gals
Time1 = Time B (when pump starts)(900) – Time A (0) = 15 min
Rate1 = Volume / Time (mins) = 33.33 gpm

Fill-3:

Volume = (Level D (6.0) – Level C (1.0)) * Gals per Ft = 500.0 gals
Time3 = Time D (2500) – Time C (1000) = 25 min
Rate3 = Volume / Time (mins) = 20.00 gpm

2. When a pump is running – this is calculated as the weighted average between the preceding and following fill cycles as follows:
   Fill-2 (during pump 1 run):
   Rate2 = ((Rate1*Time1) + (R3*T3)) / (Time1+Time3) = 25.00 gpm
3. The cycle's influent rate – this is calculated as the weighted average between the preceding fill cycle and its corresponding pump cycle:
   Cycle-1 (fill and pump):
   Cycle = ((Rate1*Time1) + (R2*T2)) / (Time1+Time2) = 32.49 gpm

- <u>The pump flow rates are calculated as follows:</u>

1. Any single pump's flow rate is calculated and adjusted as follows:
   Pump-n Rate:
   Gals = Gals during fill cycle + gals during pump cycle
   = 500 + (25.00 gpm * 1.67 mins) = 541.75 gals
   Rate = Gals / Pump run time = 325.06 gpm
2. If <u>enabled</u>, the flow rate of multiple pump combinations is calculated and adjusted. This procedure is only done once or twice per day during times when the observed influent rate is fairly stable. Under those conditions, the display will indicate that the controller is in a multi-pump calibration cycle. When the first stage on-setpoint is reached, the controller will then stagger-start both (or all three) pumps and calculate the combined flow rate as follows (for this example, we'll assume the influent rate during the pump run time is the same as that calculated in *Fill-2* above):
   Pump-x-y (-z) Rate:
   Gals = Gals during fill cycle + gals during pump cycle
   = 600 + (25.00 gpm * 1.33 mins) = 633.25 gals
   Rate = Gals / Pump run time = 476.13 gpm
3. If the flow rate calibration of multiple pump combinations is <u>disabled</u>, then the multi-pump flow rate is calculated by applying user-entered flow rate factors. The LC-150 provides a 2-Pump Factor and a 3-Pump Factor. Using the examples above, assume that pump-1's flow rate is 325 gpm and pump-2's flow rate is 350 gpm and that the 2-Pump Factor is 70%. The multi-pump flow rate is then calculated as follows:
   Time that both pumps ran = 1.33 mins
   Rate = ((325 + 350) * 70) /100 = 472.5 gpm
   Note: if the flow rate calibration of multiple pump combinations is disabled, then the same 2-Pump Factor will be applied to all 2-Pump combinations, whereas if the calibration is enabled, then each combination of pumps is calibrated separately.

- The station's flow is calculated as follows:

1. When a single pump has run during a cycle:
   Using the above chart and examples for cycle 1.
   Gals = Pump 1 Rate * Run Time1 = 325.00 * 1.67 = 542.00 gals
2. When multiple pumps ran during a cycle and multi-pump calibration is enabled:
   Gals = Rate (for specific pump combo) * Time
   = 476.13 gpm * 1.67 mins = 795.14 gals
3. When multiple pumps ran during a cycle and multi-pump cal is not enabled:
   Gals = ((Pump-1 Rate + Pump-2 Rate) * 2-Pump Factor) / 100 * Time
   = ((325 + 350) * 70) /100 * 1.67 mins = 789.08 gals

   Note: A cycle can only be completed when the fill rate is determined for the next cycle. (This allows information to be gathered to determine the fill rate during the pump run time) Therefore the flow is only updated when all information required to complete a cycle has been gathered.

9.2 Flow Calculation Configuration

Flow Logic Enable/Disable **Default: Disable**

The Flow Logic application must be enabled before it begins to calculate flow data.

```
Flow Logic:  DISA
<OK> TO CHANGE
```

Flow Units of Measure **Default: Gals**

This selection determines the units for flow total statistics. The selections are Gallons (gals), 1000 gallons (Kgals) and 1,000,000 gallons (Mgals). Note that all flow rates are in gallons per minute (GPM)

```
Flow Unit:    Kgals
<OK> TO CHANGE
```

Clear Flow Statistics **Default: No**

Setting this value to YES resets all flow totals and calculated flow statistics to zero.

```
Clr Flw Stat:    NO
<OK> TO CHANGE
```

THE REMAINING FLOW LOGIC PARAMETERS MUST BE CONFIGURED USING PCCS SOFTWARE

Gallons per foot **Default: 100.0**

This value is the number of gallons per foot of the well or tank. The well or tank must be a linear vessel where a single value applies to the entire height or depth of the vessel.

```
GALs/FT:   100.0
<OK> TO CHANGE
```

Pump x Gallon per Minute **Default: 50**

Setting this value provides the flow algorithm a starting point to for determining the pumps capacity. If no value is entered the flow algorithm will take 3 pumping cycles (for each pump) to establish an accurate pump capacity figure.

```
Pmp1 GPM:    50
<OK> TO CHANGE
```

Pumps 1 & 2 Gallon per Minute **Default: 75**

Setting this value provides the flow algorithm a starting point to for determining pumps 1 and 2 combined capacity. If no value is entered the flow algorithm will take 3 pumping cycles (for pump combination) to establish an accurate pump capacity figure.

```
Pmp1&2 GPM:    50
<OK> TO CHANGE
```

Pumps 1 & 3 Gallon per Minute **Default: 75**

Setting this value provides the flow algorithm a starting point to for determining pumps 1 and 3 combined capacity. If no value is entered the flow algorithm will take 3 pumping cycles (for pump combination) to establish an accurate pump capacity figure.

```
Pmp1&2 GPM:    50
<OK> TO CHANGE
```

Pumps 2 & 3 Gallon per Minute **Default: 75**

Setting this value provides the flow algorithm a starting point to for determining pumps 2 and 3 combined capacity. If no value is entered the flow algorithm will take 3 pumping cycles (for pump combination) to establish an accurate pump capacity figure.

```
Pmp1&2 GPM:    50
<OK> TO CHANGE
```

Pumps 1, 2 &3 Gallon per Minute **Default: 75**

Setting this value provides the flow algorithm a starting point to for determining pumps 1, 2 and 3 combined capacity. If no value is entered the flow algorithm will take 3 pumping cycles (for the pump combination) to establish an accurate pump capacity figure.

```
P1&2&3 GPM:    50
<OK> TO CHANGE
```

Two Pump Factor **Default: 75**

If multiple pump flow calibration is disabled, the two pump factor is used to determine flow when 2 pumps are running. The factor applies to any combination of two pumps.

```
2Pmp Factor:    75%
<OK> TO CHANGE
```

Three Pump Factor **Default: 50**

If multiple pump flow calibration is disabled, the three pump factor is used to determine flow when 3 pumps are running.

```
3Pmp Factor:    50%
<OK> TO CHANGE
```

Pump x Low Flow Setpoint **Default: 0**

If the pumps calculated flow rate drops below this setpoint, a non-critical alarm will be generated and logged in the event log. Setting this value to 0 disables the Low Flow alarms.

```
P1 Low Flw:    50
<OK> TO CHANGE
```

Backflow delay time **Default: 0**

This value determines the amount of time after the last pump shuts off the controller will wait before determining the starting well level for the next cycle. Set this value if the well experiences significant backflow after a pumping cycle.

```
Bk Flw Tm:    50s
<OK> TO CHANGE
```

Tank High Level Setpoint **Default: 0**

This setpoint is used if the wet well becomes non-linear at a particular height. A well can become non-linear if the vessel changes shape or if the liquid can back up into a pipe. Set the Tank High Level Setpoint equal to height of point where the vessel changes to a non-linear shape or the height of the bottom of the pipe. The controller will generate an event if the level exceeds this point, denoting that flow values may be inaccurate. Setting this value to 0 disables the generation of this event.

```
Tk Hi Lvl:      0.0
<OK> TO CHANGE
```

Tank Low Level Setpoint **Default: 0**

This setpoint is used if the wet well has a non-linear shape near the bottom. Set the Tank Low Level Setpoint equal to point where the well becomes non-linear. The controller will generate an event if the level falls below this point, denoting that flow values may be inaccurate. Setting this value to 0 disables the generation of this event.

```
Tk Lo Lvl:      0.0
<OK> TO CHANGE
```

Multiple Pump Calibration **Default: Disable**

Enabling multiple pump calibration allows the controller to calculate flow values for multiple pump combinations. These calculated flow values will be used instead of the 2 pump and 3 pump flow factors to determine station flow. The controller will enter into a multiple pump calibration cycle when the influent flow rate is varying less than 10% over the last three fill cycles. During the calibration cycle the controller will not start a pump until the level reaches the second or third stage ON setpoint. It will then stagger start multiple pumps and determine the combined pumps flow capacity. Multi-pump calibration is typically disabled in two pump applications.

M-Pmp Calib: DISA <OK> TO CHANGE

Low Flow Cutout **Default: 0**

This parameter is only used when using an actual flow meter. This parameter is used to allow the LC150 to ignore a residual flow value that may be present, even though there is no actual flow. The value is set in GPM. Any flow value reported by the meter that is less than the Low Flow Cutout will be treated as 0 flow.

9.3 Station Flow Status Information

Station flow, influent flow and individual pump flow information can be viewed from the Flow Status ring. From the Home screen scroll down (using the DOWN arrow key) to the Flow Status screen.

FLOW STATUS <OK> TO ENTER

There are five navigation screens in this ring. The operator may enter any of these child rings by pressing "OK" on the appropriate screen

STATION STATUS <OK> TO ENTER

INFLUENT STATUS <OK> TO ENTER

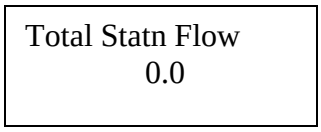
PMP1 FLOW STATUS <OK> TO ENTER

PMP2 FLOW STATUS <OK> TO ENTER

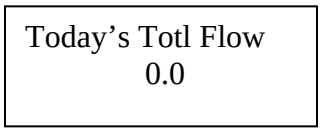
PMP3 FLOW STATUS <OK> TO ENTER

Station flow information can be computed using a volumetric flow calculation or using a flow meter connected to analog input 2. The Station Status ring has the following informational screens:

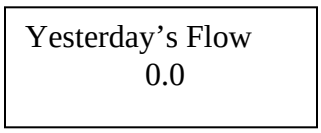
Total Station Flow (effluent)
The total station flow is the sum of the effluent flows for each pump when using volumetric flow calculations or it is the totalized value for analog input 2 when using a flow meter. Total station flow keeps accumulating until reset or until a maximum of 999,999.9. The units for the total station flow value are configurable and can be set to gallons, K gallons, or M gallons.



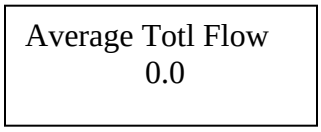
Current Day Flow Total
The current daily flow total is the total station effluent flow since 12:01 am. The units (gal, Kgal, Mgal) for current daily flow follow the flow configuration setting for the controller.



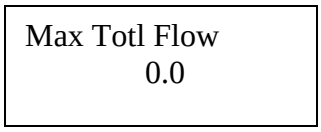
Previous Day's Flow Total
This value is the total station effluent flow for the previous day. It is updated once a day at 12:00 am or at the end of a pumping cycle nearest 12:00 am. The units (gal, Kgal, Mgal) for current daily flow follow the flow configuration setting for the controller.



Average Daily Flow
This value is a running average of the station's daily effluent flow totals. The units (gal, Kgal, Mgal) for current daily flow follow the flow configuration setting for the controller.

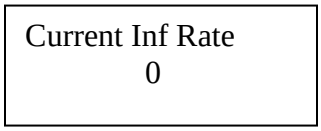


Maximum Daily Flow
The value is the highest daily flow total (effluent) since the last flow totals reset. The units (gal, Kgal, Mgal) for current daily flow follow the flow configuration setting for the controller.

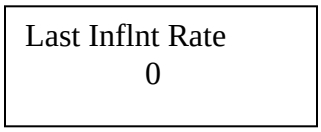


Influent flow data is always calculated using a volumetric calculation. The Influent Flow status ring has the following information screens:

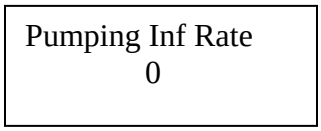
Current Cycle Influent Flow Rate
This value is the rate of influent flow in GPM for the current cycle. This value is calculated when the first pump starts on the next cycle.



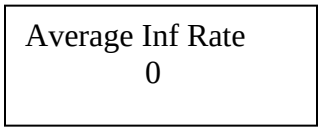
Last Cycle Influent Flow Rate
This value is the rate of influent flow in GPM over the previous cycle.



Pumping Influent Flow Rate
This value is the calculated influent flow rate during the pump down portion of the previous cycle. It is the average of current cycle rate and the last cycle rate.



Average Station Influent Rate
This value is the average of the cycle influent rates in GPM.



Maximum Station Influent rate (GPM)
This value is the maximum cycle influent rate in GPM since the last flow data reset.

Max Inflnt Rate
0

9.4 Pump Performance Information

Pump flow information can be computed using a volumetric flow calculation or using a flow meter connected to analog input 2. There is a Pump Flow status ring for each pump. Each ring has the following information screens:

Pump x Total Flow
This value is the total effluent flow for the pump since the last flow data reset. The pump flow total accumulates until 999999.9 or until reset. The units (gal, Kgal, Mgal) for pump total flow follow the flow configuration setting for the controller.

Pmp 1 Total Flow
0.0

Average Pump x Flow Rate
This value is the pumps average effluent flow rate in GPM over the pumps last three cycles.

Pump 1 Flow Rate
0

10.0 Telemetry

The LC150 supports communications with a master telemetry unit (MTU) right out of the box. The controller has two RS232 communication ports which may be used simultaneously. Each telemetry port must be configured for the correct protocol, node address, and port settings. Once configured the LC150 will respond to read requests for status information and will accept write actions to change setpoints on one or both ports.

The LC150 cannot function a as communications master (cannot initiate reads/writes) on either port

The I/O map is the same for each port. Appendix A details the Modbus, DF1 and IntraLink Open register addresses for all of the LC150's read and read/write data. The LC150's data is available in either integer format or floating point format.

10.1 Telemetry Port Configuration

Select which telemetry port you wish to configure.

COM1 SETTING <OK> TO ENTER	COM2 SETTING <OK> TO ENTER

Node Address **Default (COM1): 1**
Default (COM2): 1

This is the Modbus, DF1 or IntraLink Open communications address for the controller on this port. The address must be a unique (on the network) number between 1 and 254. The node address does not have to be the same on each port.

Node Addr: 1 <OK> TO CHANGE

Protocol **Default (COM1): IntraLink Open**
Default (COM2): Modbus RTU

This selection defines the protocol the LC150 will use to communicate on this port. The choices are: IntraLink Open, Modbus ASCII, Modbus RTU, DF1HF CRC or DF1HF BCC.

Protcl: IntraLink <OK> TO CHANGE

Baud Rate **Default (COM1): 9600**
Default (COM2): 9600

This selection defines the communication rate the LC150 will use on this communications port. The choices are: 1200, 2400, 4800, 9600, 19,200 and 38,400.

Baud Rate: 9600 <OK> TO CHANGE

The following 3 parameters are used only for COM1. COM2 port does not support hardware handshaking.

Communication Type **Default: Direct**

Select the type of RS232 interface that matches the modem or radio being used. The "Direct" selection is used for devices that do not require hardware handshaking such as smart radios. The "Hdware" selection enables the telemetry port's RTS/CTS handshaking. Use the "Hdware" setting to interface with a device such as a CMM202 modem. The "Dialup" selection is for future use. Note that the CTS signal line must be True before the controller can send data.

Comm Type: DIRECT <OK> TO CHANGE

RTS ON Delay **Default: 100 ms**

This selection only appears if the Communication Type is set to “Hdware”. This setting determines the amount of time in milliseconds the controller will assert RTS before sending the first byte of the message.

```
RTSOn Dly:  100ms
 <OK> TO CHANGE
```

RTS Off Delay **Default: 100 ms**

This selection only appears if the Communication Type is set to “Hdware”. This setting determines the amount of time in milliseconds the controller will wait after the last byte of the message is sent before de-activating RTS.

```
RTSOffDly:  100ms
 <OK> TO CHANGE
```

Communication Fail Delay **Default (COM1): 120 seconds**
Default (COM2): 0 seconds

This selection determines the amount of time after the last valid communication that the controller will wait before declaring communications failed on this port. If the “Use Telemetry for Control” function is enabled and communications fail on a port, the controller will turn off all pump outputs, activate the common and audible alarm outputs, and make an entry in the event log. If the controller is not using telemetered data for control, a communications failure will only be logged in the event log. Setting this value to zero will cause the controller to ignore communications failure on this port. The controller’s communication status can be viewed in the System Status ring.

```
CmFail Dly:  100s
 <OK> TO CHANGE
```

LINK2SITE APPLICATION NOTE:
WHEN USING AN LC150 AS PART OF A LINK2SITE SOLUTION, USE COM2 AND LEAVE THE PORT CONFIGURATION AT ITS FACTORY DEFAULTS (NODE ADDR = 1, MODBUS RTU, 9600 BAUD)

10.2 Communication Port Protocols

The LC150 supports three basic protocols: IntraLink Open, DF1 and MODBUS. Since the DF1 and MODBUS protocols are used to connect with a wide variety of third party devices, it is important to know what functions are and are not supported.

10.2.1 DF1

The LC150 supports the Half-Duplex DF1 protocol as a slave device using either the CRC or BCC check values. The LC150 responds to the two most commonly used of the Allen-Bradley SLC500 series communication functions, which are:

- Protected Typed Logical Read with Three Address Fields (function code “A2”)
- Protected Typed Logical Write with Three Address Fields (function code “AA”)

Both supported functions are of the command type “0F”. No other command types are supported and no other functions within the “0F” command type are supported. The two supported function types allow all of the LC150s registers to be read as well as the appropriate ones to be written.

Data registers may be read/written as either Integer values (file type “89”) or Floating-Point values (file type “8A”). Refer to “Appendix A – LC150 I/O Map” for the complete listing of the LC150 registers and the correct mapping of those registers for the supported protocols.

10.2.2 MODBUS

The LC150 supports the MODBUS protocol as a slave device using either the CRC or BCC check values. The LC150 responds to the eight most commonly used MODBUS function codes, which are:

- Read Coil Status (function code “01”)
- Read Input Status (function code “02”)
- Read Holding Registers (function code “03”)
- Read Input Registers (function code “04”)
- Write Single Coil (function code “05”)
- Write Single Holding Register (function code “06”)
- Write Multiple Coils (function code “15”)
- Write Multiple Holding Registers (function code “16”)

No other function codes are supported. The eight supported function types allow all of the LC150s registers to be read as well as the appropriate ones to be written.

Data registers may be read/written as either Integer values or Floating-Point values by simply using a different range of MODBUS addresses. Also note that all the I/O shares a common “register mapping”. This means that the reading/writing of a single bit (coil or input status) is simply mapped to a holding register. For example, reading holding register 40059 will return the “active stages” status bits. Reading input bits 10001 through 10003 will return the same information. Refer to “Appendix A – LC150 I/O

Map" for the complete listing of the LC150 registers and the correct mapping of those registers for the supported protocols.

10.2.3 Special register handling

The registers of the LC150 may be read as either Integer or Floating-Point values. Although most values will be identical in either format, some will not be. For example, assuming the Process Level is 12.3 feet, reading the value as an integer will automatically multiply it by 10 and it will therefore be read as 123. Reading it as a floating point value, it will be read as 12.3. Reading any RTM or Totalizer requires reading two integer registers to get the full value. However, reading *either* the low *or* high register of an RTM or Totalizer as a floating point value will automatically combine the two integer registers to create one floating point representation of the two registers. The following table lists the registers that are given "special treatment" (all others will be identical in either format):

Register Name	Special Treatment	Example value	Integer	Floating Point
Level (real or sim) in EU	Times 10	12.3	123	12.3
Level (real only) in EU	Times 10	12.3	123	12.3
Stage 1 low setpoint	Times 10	1.0	10	1.0
Stage 1 high setpoint	Times 10	6.0	60	6.0
Stage 2 low setpoint	Times 10	2.0	20	2.0
Stage 2 high setpoint	Times 10	7.0	70	7.0
Stage 3 low setpoint	Times 10	3.0	30	3.0
Stage 3 high setpoint	Times 10	8.0	80	8.0
Alarm low setpoint	Times 10	0.5	5	0.5
Alarm high setpoint	Times 10	19.5	195	19.5
Pmp run timeout	Times 10	24.0	240	24.0
Analog range	Times 10	20.0	200	20.0
Sensor range	Times 10	34.6	346	34.6
Tank gals per foot	Times 10	100.0	1000	100.0
Tank Flow surcharge	Times 10	19.0	190	19.0
Tank Flow low level	Times 10	1.0	10	1.0
Simulated well level	Times 10	12.3	123	12.3
External process level	Times 10	0.0	0	0.0
Ramp 1 high input	Times 10	7.0	70	7.0
Ramp 1 low input	Times 10	3.0	30	3.0
Ramp 2 high input	Times 10	8.0	80	8.0
Ramp 2 low input	Times 10	4.0	40	4.0
Ramp 3 high input	Times 10	9.0	90	9.0
Ramp 3 low input	Times 10	5.0	50	5.0
Base software version	Times 100	2.10	210	2.10
OI software version	Times 100	2.10	210	2.10
Today's daily flow low	RTM/Totalizer	456.7	4567	123456.7
Today's daily flow high	RTM/Totalizer	123	123	123456.7
Yesterday's daily flow low	RTM/Totalizer	678.9	6789	345678.9
Yesterday's daily flow high	RTM/Totalizer	345	345	345678.9

Average daily flow low	RTM/Totalizer	456.7	4567	123456.7
Average daily flow high	RTM/Totalizer	123	123	123456.7
Maximum daily flow low	RTM/Totalizer	678.9	6789	345678.9
Maximum daily flow high	RTM/Totalizer	345	345	345678.9
Total station flow low	RTM/Totalizer	456.7	4567	123456.7
Total station flow high	RTM/Totalizer	123	123	123456.7
P1 total flow low	RTM/Totalizer	678.9	6789	345678.9
P1 total flow high	RTM/Totalizer	345	345	345678.9
P2 total flow low	RTM/Totalizer	456.7	4567	123456.7
P2 total flow high	RTM/Totalizer	123	123	123456.7
P3 total flow low	RTM/Totalizer	678.9	6789	345678.9
P3 total flow high	RTM/Totalizer	345	345	345678.9
P1 RTM low	RTM/Totalizer	456.7	4567	123456.7
P1 RTM high	RTM/Totalizer	123	123	123456.7
P2 RTM low	RTM/Totalizer	678.9	6789	345678.9
P2 RTM high	RTM/Totalizer	345	345	345678.9
P3 RTM low	RTM/Totalizer	456.7	4567	123456.7
P3 RTM high	RTM/Totalizer	123	123	123456.7

10.3 Telemetry Port Cabling

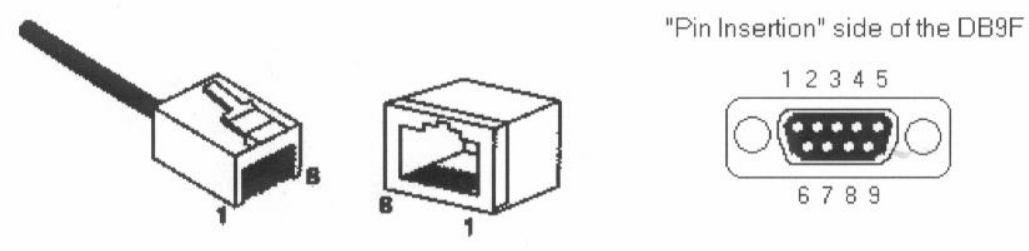
The LC150 communication ports are RS232 ports implemented on a female RJ45 connector. The communication ports are connected to a modem, radio or other communications device via a cable. The typical cable is made up of an Ethernet patch cable and a modular RJ45 to DB9 adaptor. The following pictures and table describe the pin outs and connections needed to make a LC150 telemetry cable.

Note the exact DB9F pin outs will vary depending on the communications device.

Note that COM2 does not support RTS/CTS so pins 7 and 8 are not connected.

RJ45 to DB9F Modular adapter pinout (Typical Radio Adapter)

LC150 Telemetry Port RJ45F	**Ethernet Cable Wire Color**	**Adapter Wire Color**	**Typical DB9F**
Pin 1: NC	Wht/orange	Blue	Pin 4: NC
Pin 2: NC	Orange	Orange	Pin 1: NC
Pin 3: NC	Wht/green	Black	Pin 6: NC
Pin 4: GND	Blue	Red	Pin 5: GND
Pin 5: RXD (in)	Wht/Blue	Green	Pin 3: TXD (out)
Pin 6: TXD (out)	Green	Yellow	Pin 2: RXD (in)
Pin 7: CTS (in)	Wht/Brown	Brown	Pin 7: RTS (out)
Pin 8: RTS (out)	Brown	White	Pin 8: CTS (in)



Note that when connecting the LC150 telemetry port to a CMM202C (or later), a standard “straight-through” Ethernet cable may be used. This is because the “C” version of the CMM202 includes a RJ45 jack and a jumper to connect the RTS and CTS signals. To use a standard cable, the jumper (located right behind the RJ45 connector) must be in place.

Use part number ILK-L2SCOMCABLE-01 or part number ILK-L2SCOMCABLE-02 to connect a LC150 to a Link2Site cellular modem.

10.4 Telemetry Control

In most LC150 telemetry applications (like lift stations), the MTU polls the LC150 on a cyclical basis for status information (alarms, wet well level, pump status etc) and occasionally writes operator initiated setpoint changes or override commands. However in some applications (like water distribution systems), the LC150 can be configured to accept process control commands from a remote MTU (see System Configuration Sec 8.2). If the system configuration parameter "Use Telemetry for Control" is enabled, the controller will look for valid communications on one or both communication ports and control based on a telemetered level stage or pump requests. If communications fail on one or both ports all pumps will be turned off and a critical alarm will be generated. Note that the controller can operate in the float backup mode (if selected) even if communications are down.

There are three critical registers that can be used to specify the control actions of the LC150. The pump request register has the highest priority. If the pump request permissive bit (bit 15 of the register) is set, the controller will operate its pumps directly based on the states of bits 0 ,1, 2. If the pump request permissive bit is clear, and the stage permissive bit (bit 15) is set, the controller will operate based on the telemetered stage request bits 0, 1, 2. If neither the pump nor the stage permissive bits are set, the controller will operate based on the telemetered level value.

When the controller is operating under telemetered pump control, the OI will not light any stage indicator, stage setpoint or level alarm LEDs and will show the text "Telm Pmp Cntrl" across the first line of the LCD home screen. When the controller is operating under telemetered stage control, the OI will not light any stage setpoint or level alarm LEDs and will show the text "Telm Stg Cntrl" across the first line of the LCD home screen. The OI will show the telemetered level value on the level LED column, when in pump or stage control. When the controller is operating under telemetered level control, the OI will be operated as if using a local level signal.

11.0 VFD Control

The LC150 is capable of controlling a VFD(s) through its 1-5 VDC analog output. The LC150 will vary the voltage of the analog output between 1 VDC (0%) and 5 VDC (100%) based on well level and the number of active stages. A single analog output is used to control up to 3 VFDs. One, two, or three voltage to current converter/isolators (such as the CMX24) are used to fan out the single voltage signal to three individual 4-20 ma VFD speed signals.

Each control stage has a ramp associated with it and the ramp that is used to determine VFD speed is the one associated with the highest active stage. The analog output is controlled based on the well level and the active ramps configuration. Therefore, in a pump-down example, if the level rises to the point where stage one goes active, the analog output will follow ramp one's configuration based on the wet well level. If the level continues to rise to the point where stage two goes active, the analog output will now follow ramp two's configuration based on the well level. The LC150 uses the "Pump-Up/Pump-Down" configuration (See section 8.1 for details) to determine the "direction" of the ramp.

- Pump-Down mode causes the ramp output to *increase* as the level *increases*.
- Pump-Up mode causes the ramp output to *increase* as the level *decreases*.

11.1 VFD Configuration

VFD Control **Default: Disable**

Setting VFD Control to "Disable" will cause the analog output to follow the level input. Setting VFD Control to "Enable" will allow the analog output to be used for VFD control and will enable the following configuration screens.

```
VFD Control: DISA
 <OK> TO CHANGE
```

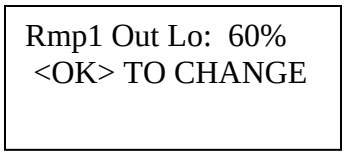
Ramp x Output High **Default: R1 = 100%, R2 = 100%, R3 = 100%**

This value is the maximum output value (in percentage) for this ramp. This value is always the maximum value regardless of pump up/down configuration. There are three Ramp Output High values, one for each ramp.

```
Rmp1 Out Hi: 100%
 <OK> TO CHANGE
```

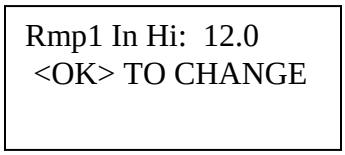
Ramp x Output Low **Default: R1 = 60%, R2 = 70%, R3 = 80%**

This value is the minimum output value (in percentage) for this ramp. This value is always the minimum value regardless of pump up/down configuration. There are three Ramp Output Low values, one for each ramp.



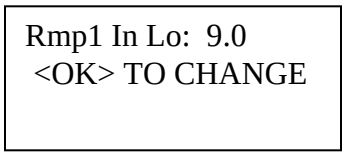
Ramp x Input High **Default: R1 = 12.0, R2 = 14.0, R3 = 16.0**

The value is the level in feet at which the ramp will be at its highest output. There are three Ramp Input High values, one for each ramp.

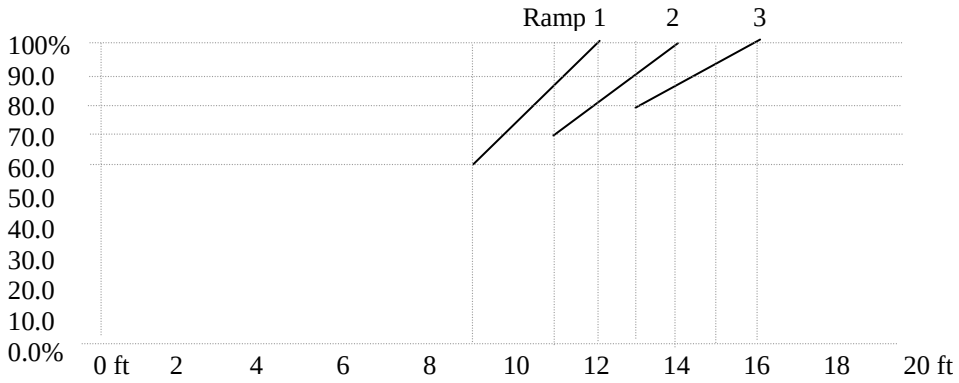


Ramp x Input Low **Default: R1 = 9.0, R2 = 11.0, R3 = 13.0**

This value is the level in feet at which the ramp will be at its lowest output. There are three Ramp Input Low values, one for each ramp.



11.2 VFD Example Applications



For example 1, assume the LC150 is in the Pump-Down mode with the level *below* stage-1's on setpoint (11ft) and with the following ramp and stage setpoints:

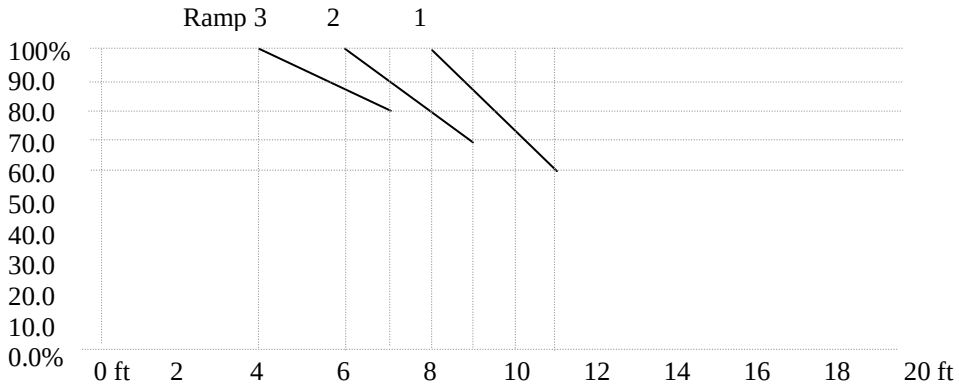
- Stage-1 On = 11.0ft, Stage-1 Off = 5.0ft
- Stage-2 On = 13.0ft, Stage-2 Off = 6.0ft
- Stage-3 On = 15.0ft, Stage-3 Off = 7.0ft
- Ramp-1 Output High (0-100.0%) = 100.0%
- Ramp-1 Output Low (0-100.0%) = 60.0%
- Ramp-1 Input High (0-Level) = 12.0 Ft.
- Ramp-1 Input Low (0-Level) = 9.0 Ft.
- Ramp-2 Output High (0-100.0%) = 100.0%
- Ramp-2 Output Low (0-100.0%) = 70.0%
- Ramp-2 Input High (0-Level) = 14.0 Ft.
- Ramp-2 Input Low (0-Level) = 11.0 Ft.
- Ramp-3 Output High (0-100.0%) = 100.0%
- Ramp-3 Output Low (0-100.0%) = 80.0%
- Ramp-3 Input High (0-Level) = 16.0 Ft.
- Ramp-3 Input Low (0-Level) = 13.0 Ft.

Since no stages are active, no ramps will be active – so their output value will be 0.0% making the analog output 1.0 volt (or 4.0 mA).

If the level then rises to 11ft where stage-1 goes active, ramp-1 will also then activate. Since the input level is 11ft, the ramp's output value will be approximately 87.0%. If the level continues to rise, the ramp's output value will also continue to rise until the level reaches 12ft where the ramp will output 100.0%. If the level continues to rise, the ramp will remain at its maximum output.

If the level rises to 13ft, stage-2 goes active, and ramp-2 will now activate. (With ramp-2 active, ramp-1 will be ignored). At 13ft, ramp-2's output will be approximately 90.0%. Now, both running pumps will operate at 90.0% of their maximum speed.

If the level begins to drop, ramp-2's output will also begin to drop. As the level drops to 11ft, the ramp's output will drop to 70.0% (its minimum output value) and will remain there until the level drops to where stage-2 turns off at 6ft. Since stage-1 is still active, ramp-1 will once again be active but since the level is now 6ft, the ramp output will be 60.0% and will remain there until the level drops to where stage-1 turns off.



For example 2, assume the LC150 is in the Pump-Up mode with the level *above* stage-1's on setpoint (9ft) and with the following ramp and stage setpoints:

- Stage-1 On = 9.0ft, Stage-1 Off = 15.0ft
- Stage-2 On = 7.0ft, Stage-2 Off = 14.0ft
- Stage-3 On = 5.0ft, Stage-3 Off = 13.0ft
- Ramp-1 Output High (0-100.0%) = 100.0%
- Ramp-1 Output Low (0-100.0%) = 60.0%
- Ramp-1 Input High (0-Level) = 11.0 Ft.
- Ramp-1 Input Low (0-Level) = 8.0 Ft.
- Ramp-2 Output High (0-100.0%) = 100.0%
- Ramp-2 Output Low (0-100.0%) = 70.0%
- Ramp-2 Input High (0-Level) = 9.0 Ft.
- Ramp-2 Input Low (0-Level) = 6.0 Ft.
- Ramp-3 Output High (0-100.0%) = 100.0%
- Ramp-3 Output Low (0-100.0%) = 80.0%
- Ramp-3 Input High (0-Level) = 7.0 Ft.
- Ramp-3 Input Low (0-Level) = 4.0 Ft.

If the level then falls to 9ft where stage-1 goes active, ramp-1 will also then activate. Since the input level is 9ft, the ramp's output value will be approximately 87.0%. If the level continues to fall, the ramp's output value will continue to rise until the level falls to 8ft where the ramp will output 100.0%. If the level continues to fall, the ramp will remain at its maximum output.

If the level falls to 7ft, stage-2 goes active, and ramp-2 will now activate. (With ramp-2 active, ramp-1 will be ignored). At 7ft, ramp-2's output will be approximately 90.0%. Now, both running pumps will operate at 90.0% of their maximum speed.

If the level begins to rise, ramp-2's output will begin to drop. As the level rises to 9ft, the ramp's output will drop to 70.0% (it's minimum output value) and will remain there until the level rises to where stage-2 turns off at 14ft. Since stage-1 is still active, ramp-1 will once again be active but since the level is now 14ft, the ramp output will be 60.0% and will remain there until the level rises to where stage-1 turns off.

12.0 Specifications

Base Unit Specifications

Power	
Input Power	120 VAC, or 10-30 VDC
Max Input Current	.25A @ 120 VAC, 1A @ 12 VDC
Auxiliary Power Supply	300 mA @ 13.8 VDC
Battery Charger	13.8 VDC float, max 300ma charging current
AC Fuse	120 VAC, ¼ Amp, Slo Blo fuse
DC Fuse	30 VDC, 2.5 Amp
General	
I/O expansion	RS232 (future)
Real time clock accuracy	±1 minute month over the entire temperature range
Programming language	None. Product is configurable not programmable
Status LEDs (power)	Battery Power, +5 VDC, Sensor Excitation Voltage, Isolated Digital Ground
Status LEDs(communications)	TX & RX for both communication ports
Diagnostic LEDs	Error, Microprocessor status

Communications	
COM1 & COM2 Ports	RJ45, RS232 Telemetry Ports
Baud Rate	1200 to 38800
Protocols (Slave)	Modbus (RTU & ASCII), IntraLink Open, DF1 Half-duplex slave
Flow control	Hardware RTS/CTS (Comm1 only))
Communications mode	Slave
OI Port	RJ45 (V+, GND, TX, RX)
Baud Rate	19200
Reader Port	RJ11
	iAccess reader port

Physical	
Mounting	DIN rail (EN50022)
Size	5.5" X 7.5" X 2.37"
Terminals	De-pluggable, 10A, 300V, 30-12AWG, Vertical, Screw Connection
Environmental	
Temperature	-40 ~ 85°C
Humidity	10 ~ 90% (non-condensing)
Electrical Safety	UL 508
EMI Emissions	FCC Part 15 Class A
EMC Immunity	FCC Part 15 Class A
Surge withstand	CE IEC61000

Discrete Inputs	**16 channels**
Guaranteed On voltage	9 VDC
Maximum voltage	30 VDC
Guaranteed Off voltage Guaranteed Off current	5.0 VDC 1.5 mA DC
Input resistance	10K Ohms
Input Current @ 24 VDC	3mA
Isolation	1KV input to system
Over-voltage protection	120VAC
Discrete Outputs	**7 channels**
4 Outputs	Form A relay, 5A @ 240 VAC
1 Output	Form C relay, 5A @ 240 VAC
2 Outputs	Open Collector, 150 mA @ 5-30 VDC
Analog Inputs	**2 Channels**
Input signal	4-20 mA, 0-10 VDC (DIP switch selectable)
A/D resolution	16 bits
Full scale accuracy	1% of range
Span and offset adjustment range	Software controlled
Input impedance	250Ω
Isolation	1KV input to system
Over-voltage protection	30VDC
Excitation voltage	+24VDC, or 6.0 VDC (DIP switch selectable)

Analog Output	**1 Channel**
Output signal	1 – 5 VDC
D/A resolution	8 bits

OI Unit Specifications

Power	
Input Power	10-30 VDC, supplied by Base Unit through cable
Power Consumption	

Serial Port	
Signal Lines	RJ45 (GND, V+, TX, RX)
Physical Port	RS232
Port Speed	19,200 baud
Physical	
Packaging	
Mounting	Direct, gasketed with 4 mounting screws
Size	8.5" X 7.5" X 1.55"
Environmental	
Temperature	-40 ~ 85°C (LCD may not display properly below -20°C)
Humidity	10 ~ 90% (non-condensing)
Enclosure rating	Type 1

Display Elements	
LCD	2 x 16 chars, backlit, high contrast
LED columns	5 columns consisting of 40 LEDs each
Keys	Tactile feedback, steel dome keys
Active Stage Indicators	Three - LEDs
Active Alarm Indicators	Two – Red, High Level Alarm LED, Red Low Level Alarm LED

13.0 Troubleshooting

13.1 LED Status Lights

COMx Yellow LEDs

RX - This LED lights when the controller starts receiving a message. The message does not have to end up being valid nor does it have to be addressed to the controller for this LED to blink.
TX - The LED lights when the controller transmits a message on the telemetry port.

DS5 – Green LED
This LED indicates the status of the 5 VDC logic power supply. It is normally ON.

DS6 – Green LED
This LED indicates the status of the isolated 6.2/24 VDC excitation voltage. This light is normally ON.

DS7 – Green LED
This light indicates the status of the 13.8 VDC battery charging power supply. This light is normally ON.

DS8 – Green LED
This light indicates the status of the 12 VDC isolated digital input voltage. This light is normally ON.

DS9 – Red LED
The red LED is lighted whenever an alarm condition is present. It mirrors the state of the common alarm output.

DS10 – Green LED
This light can be in one of three states:

Blinking – Means the controller has detected corrupt configuration data. The controller must be re-configured properly and re-calibrated. Cycle power to the controller after configuration is complete. If DS2 continues to blink, the controller's EEPROM is defective. The controller must be replaced.
OFF – Means the controller is operating normally, but no Operator Interface is connected.
ON – Means the controller is operating normally and an Operator Interface is connected. (Typical normal state)

If no status LEDs are lighted, the controller does not have power. Check AC voltage on terminals 1 and 2 or the DC voltage on terminals 3 and 4. Either 120 VAC or 10 – 30 VDC should be present. If not check upstream fuses, power supplies, or circuit breakers. If a valid input voltage is present but no status LEDs are ON, check the internal fuses. Replace blown fuses. If the unit still does not power up return it for repair.

13.2 Digital Inputs

The raw status's of the controllers digital inputs may be viewed by entering the System Status ring and scrolling to the digital input screen.

```
Raw DI (1-16)
---4---------D---
```

If the input is OFF a "-"appears. If the input is ON the input's corresponding number or letter appears. The states of the inputs are shown even if the function associated with the input is not enabled. If the input has been inverted via configuration, this screen will show the inverted state. The following shows the input to screen mapping.

Screen Designation	Input Name	Terminal Number
1	Pump 1 Run	17
2	Pump 1 HOA (Auto)	18
3	Pump 1 OverTemp	19
4	Pump 2Run	20
5	Pump 2HOA (Auto)	21
6	Pump 2OverTemp	22
7	Pump 3Run	23
8	Pump 3HOA (Auto)	24
9	Pump 3OverTemp	25
A	High Float	26
B	Low Float	27
C	Alarm Silence	28
D	Pump Inhibit	29
E	Power Quality	30
F	Intrus/Gen Run	31
G	Rain Gauge/Gen Fail	32

13.3 Level Input

If the Operator Interface (OI) is indicating 0 feet and the actual liquid level is not zero check the following:

- Is the DS6 LED (next to terminal 40) lit? If not, return the controller for repair.
- Check the excitation voltage on terminal 40 referenced to terminal 41. Does the voltage match the requirements of the level sensor? The A1000 requires an excitation voltage of 5 – 7 VDC. The A1000i and most other 4-20 ma loop powered devices require an excitation voltage of 24 VDC. If the measured voltage is 6.0 VDC and 24 VDC is required or vice versa, follow the directions in section 5.0 to configure the excitation voltage properly. If the measured excitation voltage is not approximately 6.0 or 24 VDC return the controller for repair.
- Are the voltage/current (VI) level input configuration jumpers set to match your level sensor (see section 5.0 for details regarding level input configuration).
- If the level sensor is a voltage type, measure the voltage between terminals 38 and 41. An A1000 should read approximately .5 VDC with no liquid present and approximately 4.5 VDC at full scale. Other voltage sensing devices may read 1 VDC with no liquid present and 5 VDC at full scale. If the voltages do not fall within these ranges, the sensor may be faulty, improperly wired or incorrectly configured.
- If the level sensor is a 4-20 ma current type device, measure the current going into terminal 38. It should read approximately 4 ma with no liquid present and 20 ma at full scale. If the measured current does not fall within this range, the sensor may be faulty, improperly wired or incorrectly configured.

If the OI appears to be showing a level that is twice the actual level or one half of the actual level, check the following:

- Check the Display Range parameter in the System Configuration menu (see section 8.1). It should match the value on level insert in the OI.
- Check the “Sensor Range” parameter in the Calibration menu (see section 5.3). It should match the range of your level sensor.

If the level shown on the OI is somewhat higher or lower than the actual liquid level, calibrate the controller by following the instructions in section 5.3.

13.4 Pump Outputs

If a pump does not turn ON when you expect it too, check the following:

Is the pump's HOA switch located near the motor controls in the OFF position? Set it to the Auto to allow the LC150 to control the pump or the Hand position to override the pump ON.

Is the controller's OI showing one or more Stage LEDs ON? If not, the sensed level has not reached a stage ON setpoint.

- Check the level sensor for correct operation.
- Be sure the controller is properly configured for Pump Up/Down operation (see section 8.1).
- Verify that the stage ON/OFF setpoints are set correctly.

If one or more Stages are being called for (Stage LEDs lighted) but no pumps are running check the following:

- Is the controller's soft HOA switch in the OFF position? The Home Screen on the LCD will show the letters "NA" after the pump number if the soft HOA is not in the Auto position. See section 3.6 for help in changing the soft HOAs.
- Is the Monitor Hard HOA function enabled and the HOA input(s) is active? The Home screen on the LCD will show "NA" after the pump number if the HOA input is false. Troubleshoot the external HOA circuit and make sure the controller is properly configured.
- Is the controller's Pump Inhibit input (terminal 29) active? The text "Pumps Inhibited" will be displayed on the LCD's 2nd line if the Pump Inhibit input is True. Correct the external wiring/logic to free the pumps to run.
- Is the controllers Power Quality input (terminal 30) active? If the Power Quality input is active and the alarm has not been silenced/acknowledged the LCD screen will be alternating between the Home screen and the "Phase Fail/Reversal alarm screen. If the alarm has already been silenced/acknowledged, the controller's alarm log will have an Entry for "Phase Fail/Reversal" (see section 3.3 for help reviewing active alarms). Correct the external wiring/logic to free the pumps to run.
- Has the controller failed the pumps? If a Pump is failed the OI LCD will show one of the following status's after the pump number: "FL" for failed to start, "OT" for overtemp and "SL" for seal fail. Make sure the controller is configured properly (see section 8.0) and troubleshoot the external wiring/logic that is connected to the Overtemp and Run inputs.
- Is Float Backup Control operation enabled and the Low (for Pump down) or High (for Pump up) Float is active? The LCD will show the text "Float Ctrol Mode" on the first line if the controller is in float backup mode. If the float alarm has not been silenced the controller will be beeping and the Home screen will be alternating with the High(Low) Float Active alarm screen. Troubleshoot the float inputs and/or check to make sure the controller is properly configured (see section 8.0)

- Is the controller running on battery backup power?

13.5 Communications

The controller's communications status may viewed by entering the System Status ring and scrolling down to the communications status screen.

OI Comm Stat 100% Tele Comm Connct

The first line shows the communications status between the OI unit and the base controller. The status should show 100% under typical conditions.

The second line shows the communications status between the LC150 and a master telemetry unit (MTU). If the LC150 has received a valid message within "Comm Fail Delay" seconds (see Section 10.1 for details) on the ports for which it has been defined, the Telemetered Communications status will be "Connct". If a valid message has not been received with "Comm Fail Delay" seconds the status will be "Discon".

If communications are disconnected check the following items:

- Does appropriate COM RX LED periodically flash? If not then the controller is not hearing any transmission from the master.
    - Check the external communications equipment (Modem, radio, antennae etc) to be sure it is correctly installed.
    - Check the cable between the LC150 serial port and the modem or radio. Make sure the pin-outs on your cable match both the LC150 serial port requirements and the communications equipment requirements. See section 10.2 for cable details.
    - Make sure the MTU is properly transmitting messages.
- If the COM RX LED flashes periodically but the controller still does not show the telemetry port is connected check the following.
    - Do the telemetry port settings (See section 10.1) match the communications equipment being used? Is the baud rate correct?
    - If the Communications Type is "Hdware" are the RTS ON/OFF delays set correctly. Trying increasing the RTS ON delay in 20 mille-second increments and see if that corrects the problem.
    - Is the node address set correctly? Is the protocol set correctly? Both setting must match the settings in the MTU.

13.6 Product Support

To obtain technical support or service for Siemens Water Technologies Control Systems products, contact your local Control Systems representative. For factory support contact Siemens Water Technologies, Control Systems and ask for technical support. Our phone numbers are:

Phone: 1 (800) 224-9474
Local: (651) 766-2700
Fax: (651) 766-2754

Our mailing address is:

Siemens Water Technologies
Control Systems
1239 Willow Lake Blvd
Vadnais Heights, MN 55110

Appendix A – LC150 I/O Map

Modbus Integer Address	Modbus Floating Point Address	Modbus Bit Address	IntraLink Open AO/FO Address	DF-1 Integer Address	DF-1 Floating Point Address	Description	Range (n: means bit "n", n= means 'if "n" equals')	R/W	Default
40021	47041	---	20	N10:20	F20:20	Today's daily flow low	0-999.9	R	0
40022	47043	---	21	N10:21	F20:21	Today's daily flow high	0-999	R	0
40023	47045	---	22	N10:22	F20:22	Yesterday's daily flow low	0-999.9	R	0
40024	47047	---	23	N10:23	F20:23	Yesterday's daily flow high	0-999	R	0
40025	47049	---	24	N10:24	F20:24	Average daily flow low	0-999.9	R	0
40026	47051	---	25	N10:25	F20:25	Average daily flow high	0-999	R	0
40027	47053	---	26	N10:26	F20:26	Maximum daily flow low	0-999.9	R	0
40028	47055	---	27	N10:27	F20:27	Maximum daily flow high	0-999	R	0
40029	47057	---	28	N10:28	F20:28	Total station flow low	0-999.9	R	0
40030	47059	---	29	N10:29	F20:29	Total station flow high	0-999	R	0
40031	47061	---	30	N10:30	F20:30	Current influent rate (GPM)	0-65535	R	0
40032	47063	---	31	N10:31	F20:31	Last influent rate (GPM)	0-65535	R	0
40033	47065	---	32	N10:32	F20:32	Calculated influent rate while pumping (GPM)	0-65535	R	0
40034	47067	---	33	N10:33	F20:33	Average influent rate (GPM)	0-65535	R	0
40035	47069	---	34	N10:34	F20:34	Maximum influent rate (GPM)	0-65535	R	0
40036	47071	---	35	N10:35	F20:35	P1 Flow Rate for last 3 cycles (GPM)	0-65535	R	0
40037	47073	---	36	N10:36	F20:36	P2 Flow Rate for last 3 cycles (GPM)	0-65535	R	0
40038	47075	---	37	N10:37	F20:37	P3 Flow Rate for last 3 cycles (GPM)	0-65535	R	0
40039	47077	---	38	N10:38	F20:38	P1 total flow low	0-999.9	R	0
40040	47079	---	39	N10:39	F20:39	P1 total flow high	0-999	R	0
40041	47081	---	40	N10:40	F20:40	P2 total flow low	0-999.9	R	0
40042	47083	---	41	N10:41	F20:41	P2 total flow high	0-999	R	0
40043	47085	---	42	N10:42	F20:42	P3 total flow low	0-999.9	R	0
40044	47087	---	43	N10:43	F20:43	P3 total flow high	0-999	R	0
40045	47089	---	44	N10:44	F20:44	Number of times 2 pumps ran	0-65535	R	0
40046	47091	---	45	N10:45	F20:45	Number of times 3 pumps ran	0-65535	R	0
40047	47093	---	46	N10:46	F20:46	P1 average starts per day	0-65535	R	0
40048	47095	---	47	N10:47	F20:47	P2 average starts per day	0-65535	R	0
40049	47097	---	48	N10:48	F20:48	P3 average starts per day	0-65535	R	0
40050	47099	---	49	N10:49	F20:49	P1 total number of starts	0-65535	R	0
40051	47101	---	50	N10:50	F20:50	P2 total number of starts	0-65535	R	0
40052	47103	---	51	N10:51	F20:51	P3 total number of starts	0-65535	R	0
40053	47105	---	52	N10:52	F20:52	P1 max starts per hour	0-65535	R	0
40054	47107	---	53	N10:53	F20:53	P2 max starts per hour	0-65535	R	0
40055	47109	---	54	N10:54	F20:54	P3 max starts per hour	0-65535	R	0
40056	47111	---	55	N10:55	F20:55	Level (real or sim) in EU	0 - Selected Analog Range	R	
40057	47113	---	56	N10:56	F20:56	Level (real only) in EU	0 - Selected Analog Range	R	
40058	47115	---	57	N10:57	F20:57	Analog output	0-100%	R	
40059	47117	10001	58	N10:58	F20:58	Num active stages	0:1=Stg-1 On, 1:1=Stg-2 On, 2:1=Stg-3 On	R	
40060	47119	10017	59	N10:59	F20:59	Pump statuses	0:P1 run 1:P2 run 2:P3 run 3:P1 seal fail 4:P2 seal fail 5:P3 seal fail 6:P1 overtemp 7:P2 overtemp 8:P3 overtemp 9:P1 run fail 10:P2 run fail 11:P3 run fail 12:P1 call 13:P2 call 14:P3 call	R	
40061	47121	10033	60	N10:60	F20:60	System statuses	0:Pump inhibit 1:High float 2:Low float 3:Pwr quality 4:Intrus Switch/Gen Run 5:Gen Fail 6:P1 in auto (also true if "use input" is disabled) 7:P2 in auto (also true if "use input" is disabled) 8:P3 in auto (also true if "use input" is disabled) 9:AC detect 10:Alarm silence 11:P1 flow rate is below alrm setpt 12:P2 flow rate is below alrm setpt 13:P3 flow rate is below alrm setpt 14:Base comm disconnect status on Telemetry Port 15:Simulation active (response from base)	R	
40062	47123	10049	61	N10:61	F20:61	Analog statuses	0:Low alarm AIN1, 1:High alarm AIN1, 2:Sensor fail AIN1 4:Low float, 5:High float, 6:Float control active 7:Rain Bucket tip 8:Low alarm AIN2, 1:High alarm AIN2, 2:Sensor fail AIN2	R	

Modbus Integer Address	Modbus Floating Point Address	Modbus Bit Address	IntraLink Open AO/FO Address	DF-1 Integer Address	DF-1 Floating Point Address	Description	Range (n: means bit "n", n= means 'if "n" equals')	R/W	Default
40063	47125	10065	62	N10:62	F20:62	Alarm statuses	0:Common, 1:Audible, 2:Ext SIL active 12:In monitor mode 13:Base comm alarm on Telemetry port 14:Low DC voltage 15:Intrusion bit	R	
40064	47127	10081	63	N10:63	F20:63	Raw debounced digital input bits	0: door switch/Gen Run 1: Gen Fail 2: p1 run 3: p2 run 4: p3 run 5: p1 in auto 6: p2 in auto 7: p3 in auto 8: pump inhibit 9: AC detected 10: p1 overtemp 11: p2 overtemp 12: p3 overtemp 13: alarm silence 14: high float 15: low float	R	
40065	47129	10097	64	N10:64	F20:64	Raw debounced digital input bits	0: power quality		
40066	47131	10113	65	N10:65	F20:65	1st 16 alarms	0: Pump 1 Overtemp 1: Pump 2 Overtemp 2: Pump 3 Overtemp 3: Pump 1 Seal Fail 4: Pump 2 Seal Fail 5: Pump 3 Seal Fail 6: Pump 1 Failure to start 7: Pump 2 Failure to start 8: Pump 3 Failure to start 9: High Level AIN1 10: Low Level AIN1 11: Sensor Failure AIN1 12: High Float Active 13: Low Float Active 14: Phase Fail/Reversal 15: Power Fail	R	
40067	47133	10129	66	N10:66	F20:66	2nd 16 alarms	0: Intrusion alarm 1: Base Comm failure 2: Pump 1 Low flow rate 3: Pump 2 Low flow rate 4: Pump 3 Low flow rate 5: Level is below low setpoint 6: Level is above high setpoint 7: Low DC voltage 8: High Level AIN2 9: Low Level AIN2 10: Sensor Fail AIN2 11: UART Fail 12: Generator Fail	R	
40068	47135	10145	67	N10:67	F20:67	Status bits for the flow logic	0: P1 flow rate is below the low flow alarm setpoint 1: P2 flow rate is below the low flow alarm setpoint 2: P3 flow rate is below the low flow alarm setpoint 3: Level is below low setpoint 4: Level is above high setpoint 7: Flow is in calibration 8: P1 + P2 needs calibration 9: P1 + P3 needs calibration 10: P2 + P3 needs calibration 11: P1, P2 + P3 needs calibration 12: P1 + P2 is being calibrated 13: P1 + P3 is being calibrated 14: P2 + P3 is being calibrated 15: P1, P2 + P3 is being calibrated	R	
40069	47137	10161	68	N10:68	F20:68	Status bits defining external control type	0 = No external control 1 = Pump control 2 = Stage control 3 = Level control	R	
40073	47145	---	72	N10:72	F20:72	Active Ramp output	0-255	R	

Modbus Integer Address	Modbus Floating Point Address	Modbus Bit Address	IntraLink Open AO/FO Address	DF-1 Integer Address	DF-1 Floating Point Address	Description	Range (n: means bit "n", n= means 'if "n" equals')	R/W	Default
40075	47149	10257	74	N10:74	F20:74	Output in EU of AIN2	0 - 6553.5	R	
40076	47151	10273	75	N10:75	F20:75	Rain Total Today	0 - 99.99 in/mm	R	
40077	47153	10289	76	N10:76	F20:76	Rain Total Yesterday	0 - 99.99 in/mm	R	

Modbus Integer Address	Modbus Floating Point Address	Modbus Bit Address	IntraLink Open AO/FO Address	DF-1 Integer Address	DF-1 Floating Point Address	Description	Range (n: means bit "n", n= means 'if "n" equals')	R/W	Default
40081	47161	---	80	N10:80	F20:80	P1 RTM low	0-999.9	R/W	0.0
40082	47163	---	81	N10:81	F20:81	P1 RTM high	0-999	R/W	0.0
40083	47165	---	82	N10:82	F20:82	P2 RTM low	0-999.9	R/W	0.0
40084	47167	---	83	N10:83	F20:83	P2 RTM high	0-999	R/W	0.0
40085	47169	---	84	N10:84	F20:84	P3 RTM low	0-999.9	R/W	0.0
40086	47171	---	85	N10:85	F20:85	P3 RTM high	0-999	R/W	0.0
40087	47173	---	86	N10:86	F20:86	Stage 1 low setpoint	0 - Stage 1 high setpoint	R/W	5.0
40088	47175	---	87	N10:87	F20:87	Stage 1 high setpoint	Stage 1 low setpoint - Analog range	R/W	11.0
40089	47177	---	88	N10:88	F20:88	Stage 2 low setpoint	0 - Stage 2 high setpoint	R/W	6.0
40090	47179	---	89	N10:89	F20:89	Stage 2 high setpoint	Stage 2 low setpoint - Analog range	R/W	13.0
40091	47181	---	90	N10:90	F20:90	Stage 3 low setpoint	0 - Stage 3 high setpoint	R/W	7.0
40092	47183	---	91	N10:91	F20:91	Stage 3 high setpoint	Stage 3 low setpoint - Analog range	R/W	15.0
40093	47185	---	92	N10:92	F20:92	Alarm low setpoint	0 - Alarm high setpoint	R/W	3.0
40094	47187	---	93	N10:93	F20:93	Alarm high setpoint	Alarm low setpoint - Analog Range	R/W	17.0
40095	47189	---	94	N10:94	F20:94	P1 HOA	0:Hand, 1:Off, 2:Auto	R/W	0x0004 (auto)
40096	47191	---	95	N10:95	F20:95	P2 HOA	0:Hand, 1:Off, 2:Auto	R/W	0x0004 (auto)
40097	47193	---	96	N10:96	F20:96	P3 HOA	0:Hand, 1:Off, 2:Auto	R/W	0x0004 (auto)
40098	47195	---	97	N10:97	F20:97	Alternator Order	Num pumps=2: 0=1, 1=2, 2=1-2, 3=2-1 / Num pumps=3: 0=1, 1=2, 2=3, 3=1-2, 4=1-3, 5=2-1, 6=2-3, 7=3-1, 8=3-2, 9=1-2-3, 10=1-3-2, 11=2-1-3, 12=2-3-1, 13=3-1-2, 14=3-2-1	R/W	9 (1-2-3)
40099	47197	---	98	N10:98	F20:98	Alternator Mode	0=Fixed, 1=FOFO, 2=Rotary, 3=Jockey, 4=Emergency	R/W	0
40100	47199	---	99	N10:99	F20:99	Stage on delay	0-9999 seconds	R/W	5
40101	47201	---	100	N10:100	F20:100	Stage off delay	0-9999 seconds	R/W	3
40102	47203	---	101	N10:101	F20:101	Seal Fail delay	0-9999 seconds	R/W	10
40103	47205	---	102	N10:102	F20:102	Pump Run Fail delay	0-9999 seconds	R/W	10
40104	47207	---	103	N10:103	F20:103	Pmp run timeout (adv alt if pmp runs too long)	0-999.9 hours	R/W	24.0
40105	47209	---	104	N10:104	F20:104	Intrusion time delay	0-9999 seconds	R/W	60
40106	47211	---	105	N10:105	F20:105	Ramp 1 output when input is high	0-100%	R/W	100
40107	47213	---	106	N10:106	F20:106	Ramp 1 output when input is low	0-100%	R/W	60
40108	47215	---	107	N10:107	F20:107	Ramp 1 high input	0 - Selected Analog Range	R/W	12.0
40109	47217	---	108	N10:108	F20:108	Ramp 1 low input	0 - Selected Analog Range	R/W	9.0
40110	47219	---	109	N10:109	F20:109	Ramp 2 output when input is high	0-100%	R/W	100
40111	47221	---	110	N10:110	F20:110	Ramp 2 output when input is low	0-100%	R/W	70
40112	47223	---	111	N10:111	F20:111	Ramp 2 high input	0 - Selected Analog Range	R/W	14.0
40113	47225	---	112	N10:112	F20:112	Ramp 2 low input	0 - Selected Analog Range	R/W	11.0
40114	47227	---	113	N10:113	F20:113	Ramp 3 output when input is high	0-100%	R/W	100
40115	47229	---	114	N10:114	F20:114	Ramp 3 output when input is low	0-100%	R/W	80
40116	47231	---	115	N10:115	F20:115	Ramp 3 high input	0 - Selected Analog Range	R/W	16.0
40117	47233	---	116	N10:116	F20:116	Ramp 3 low input	0 - Selected Analog Range	R/W	13.0
40118	47235	---	117	N10:117	F20:117	Comm test bits (usually toggle)	0-0xFFFF	R/W	
40119	47237	---	118	N10:118	F20:118	AIN2-Alarm low setpoint	0 - Alarm high setpoint	R/W	0
40120	47239	---	119	N10:119	F20:119	AIN2-Alarm high setpoint	Alarm low setpoint - High AIN2 EU calibration level	R/W	100.0
40133	47265	---	132	N10:132	F20:132	Rainfall Total low	0-999.9	R/W	
40134	47267	---	133	N10:133	F20:133	Rainfall Total high	0-999	R/W	
40135	47269	---	134	N10:134	F20:134	Generator RTM low	0-999.9	R/W	
40136	47271	---	135	N10:135	F20:135	Generator RTM high	0-999	R/W	

Modbus Integer Address	Modbus Floating Point Address	Modbus Bit Address	IntraLink Open AO/FO Address	DF-1 Integer Address	DF-1 Floating Point Address	Description	Range (n: means bit "n", n= means 'if "n" equals')	R/W	Default
40151	47301	---	150	N10:150	F20:150	Current keyboard status	0:Silence/Acknowledge key pressed 1:Telemetry Silence-ONLY input 2:Telemetry Silence & Acknowledge all alarms	R/W	
40152	47303	---	151	N10:151	F20:151	External process level	0-?????	R/W	
40153	47305	---	152	N10:152	F20:152	External Stage requests	0:1=Stg-1 On, 1:1=Stg-2 On, 2:1=Stg-3 On 15: Enable stage request mode	R/W	
40154	47307	---	153	N10:153	F20:153	External Output requests	0:1=Pump-1 Call, 1:1=Pump-2 Call, 2:1=Pump-3 Call 15: Enable pump request mode	R/W	
40164	47327	---	163	N10:163	F20:163	Alarm level deadband	0-100%	R/W	5%
40165	47329	---	164	N10:164	F20:164	Sensor fail - Low	0-6000	R/W	200
40166	47331	---	165	N10:165	F20:165	Sensor fail - High	0-6000	R/W	5300
40177	47353	---	176	N10:176	F20:176	Tank gals per foot	0-5000.0	R/W	100.0
40178	47355	---	177	N10:177	F20:177	P1 Flow Rate (GPM)	0-65535	R/W	50
40179	47357	---	178	N10:178	F20:178	P2 Flow Rate (GPM)	0-65535	R/W	50
40180	47359	---	179	N10:179	F20:179	P3 Flow Rate (GPM)	0-65535	R/W	50
40181	47361	---	180	N10:180	F20:180	P1 + P2 GPM	0-65535	R/W	75
40182	47363	---	181	N10:181	F20:181	P1 + P3 GPM	0-65535	R/W	75
40183	47365	---	182	N10:182	F20:182	P2 + P3 GPM	0-65535	R/W	75
40184	47367	---	183	N10:183	F20:183	P1 + P2 + P3 GPM	0-65535	R/W	75
40185	47369	---	184	N10:184	F20:184	2 pump factor	0-100%	R/W	75
40186	47371	---	185	N10:185	F20:185	3 pump factor	0-100%	R/W	50
40187	47373	---	186	N10:186	F20:186	Pump 1 Low flow rate alarm setpoint	0-65535	R/W	0
40188	47375	---	187	N10:187	F20:187	Pump 2 Low flow rate alarm setpoint	0-65535	R/W	0
40189	47377	---	188	N10:188	F20:188	Pump 3 Low flow rate alarm setpoint	0-65535	R/W	0
40190	47379	---	189	N10:189	F20:189	Backflow time (Secs)	0-65535	R/W	0
40191	47381	---	190	N10:190	F20:190	Tank surcharge/overflow level (for Flow calc)	0 - Selected Analog Range	R/W	0
40192	47383	---	191	N10:191	F20:191	Tank low level (for Flow calc)	0 - Selected Analog Range	R/W	0
40193	47385	---	192	N10:192	F20:192	Flow range	0=Gals, 1=Kgals, 2=MGals	R/W	0
40256	47511	---	255	N11:5	F21:5	System time (in local time)	Upper bits of 32 bit system time (seconds since 1/1/1970)	R/W	
40257	47513	---	256	N11:6	F21:6	System time (in local time)	Lower bits of 32 bit system time (seconds since 1/1/1970)	R/W	