
WASTEWATER LEVEL

Keeping it underground

FOGRod & LIT MANUAL V3.1



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PLEASE NOTE: THIS LATEST VERSION MANUAL SUPERCEDES ALL PRIOR MANUAL REVISIONS. CONFLICTING INFORMATION BETWEEN MANUAL VERSIONS SHOULD BE IGNORED AND ONLY THIS VERSION USED FOR REFERENCE.

Scan the QR Code or visit our website, <http://wastewater-level.com/wp-content/uploads/2016/05/FOGRod-LIT-manual-v3.1.pdf>, to download this version manual in PDF format.



INTRODUCTION

Thank you for choosing the FOGRod & Level Indicator Transmitter (LIT) system!

You have purchased one of the most feature rich and reliable systems on the market today. Our products are designed to help free up your time.

We value your feedback! We are always interested in hearing about your product improvement suggestions and areas of the manual that you think need improvement.

We are always here to support you! Contact us at any time to ask questions about the system or to receive assistance in resolving any system issues you may have.

Speaking directly with a technical expert at Wastewater Level is quite easy. If for some reason we are unavailable when you call, we will call you back within a few minutes or, in exceptional circumstances, in a few hours.

You are the customer. We are serious about making your life easier and freeing up your time.

The FOGRod & LIT can replace floats, a pressure transducer, a bubbler or an ultrasonic. In most cases, the replacement can take place without re-configuration of any control panel logic.

HOW THIS MANUAL IS ORGANIZED

We have organized the manual in a way that will allow you to get your FOGRod and LIT system up and running as quickly as possible. After a brief system description and list of common installation issues, the manual will jump right into FOGRod and LIT installation. Each of those sections include a 'Quick Installation' list for those installers that need little guidance. More detailed installation instructions are included right after the Quick Install sections.

We'll cover just the basic features of the FOGRod and LIT system in the early part of this manual, but for those who are interested in the full suite of functions and features the system can provide, that detail is provided later in this manual.

A valuable troubleshooting reference is included later in the manual that should address most issues that may occur during installation and operation.



**CRITICAL INFORMATION RELATED TO PROPER
SYSTEM OPERATION, SAFETY OR EQUIPMENT
DAMAGE WILL BE SHOWN THIS WAY**

*Important information related to installation or operation
will be shown this way*

FOGRod and LIT SYSTEM FEATURES

- The FOGRod has 10 metal contacts spaced evenly apart. The LIT detects when each of these contacts become wet or dry.
- Level in the well is indicated on the LIT front panel using 10 LEDs that correspond to each metal contact on the FOGRod.
- All connections into the LIT are made using screw terminal blocks that are mounted inside the LIT.
- The LIT has ten relay switches. Each independent switch is a simple 2 terminal single-pole, single-throw switch capable of handling a wide range of AC and DC voltages and current. Each relay switch is dedicated to one metal contact on the FOGRod. When a FOGRod contact becomes wet or dry, the relay switch for that contact will Open or Close. Level Relay Switch #1 is dedicated to FOGRod contact #1, Switch #2 to Contact #2, etc.
- The LIT has an industry standard 2-wire 4-20mA analog output transmitter that provides Well level data that is in sync with the Level Relay Switches and front panel LED indications.
- The LIT has two Fault Relay Switches that Open and Close when FOGRod/LIT system issues occur. Refer to page 64 for the specifications of these relays and the Level Relays.
- The LIT has four front panel LEDs that turn ON to indicate when Informative non-critical system issues occur.
- The LIT detects when rags are hanging on the FOGRod or when there is grease buildup over multiple contacts. (when feature is turned ON)
- The LIT provides a 10 second delayed level registration to filter out wavy, splashing conditions in the well. (when feature is turned ON)
- UL Approved
- Intrinsically Safe for use in Hazardous Locations when connected using approved Safety Barriers.

The LIT does NOT provide alternation or latching relay functions

Refer to page 38 for additional detail on system features and functions.

SYSTEM INSTALLATION

BEFORE jumping into system installation, it will be helpful for you to know the most common reasons the system doesn't work reliably after installation. Knowing these issues ahead of time should help you avoid them during your installation.

MOST COMMON INSTALL ERRORS

- ***Overtightening terminal block screws*** on LIT-100. This results in internal damage to the circuit board. ***Solution:*** tighten screws just snug enough so wires don't fall out.
- ***LIT-100 power supply wires and/or FOGRod Return wire routed inside cable channels/troughs with AC power wires or routed very near AC power wires.*** This results in the system picking up electrical noise causing system instability. ***Solution:*** Never route these wires in channels or troughs that contain AC power wires.
- ***Connecting the LIT-100 'Lightning bolt' input to panel ground.*** This results in blown internal LIT-100 fuses. ***Solution:*** Only in rare situations should the Lightning Bolt input be connected to anything. Refer to page 17 for more information.
- ***LIT-100 FOGRod Return input wire too long.*** This results in the system picking up electrical noise causing system instability. ***Solution:*** FOGRod return wire should be as short as possible and never routed with AC power wires. It should be connected directly to the panel for optimum noise rejection.
- ***LIT-100 DC- (minus) input connected to panel ground.*** This can result in system instability and blown internal LIT-100 fuses. ***Solution:*** Only use a dedicated-ground isolated power supply to provide power to the LIT-100. Never connected DC- to panel ground.
- ***LIT-100 4-20mA Analog Output powered by same power supply as LIT-100.*** This could result in system instability and/or blown internal LIT-100 fuses as well as PLC/Controller damage. ***Solution:*** Either your PLC/Controller or a dedicated power supply should provide power to the 4-20mA Analog Output. See page 30 for more information.
- ***LIT-100 power supply NOT isolated from panel ground.*** This results in blown internal LIT-100 fuses or system instability. ***Solution:*** With LIT ***NOT*** connected to power supply, use a DVM to check for voltage between power supply DC+ and Panel Ground. It should be less than 0.1vdc. Change supply or wiring if it's not isolated.

BASIC SYSTEM FUNCTIONS AFTER INSTALLATION

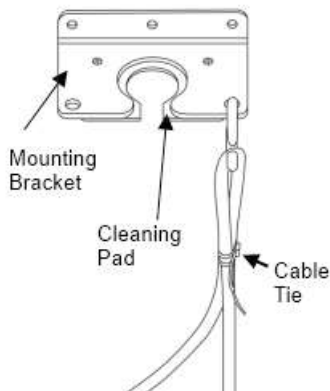
- LIT Level LEDs will turn ON indicating the level in the well.
- Lead pump will start when FOGRod contact #5 becomes submerged in the well.
- Lag pump will start when FOGRod contact #7 becomes submerged in the well.
- Pumps turn OFF when level in well falls below FOGRod contact #1.
- Customer's High-Level Alarm activates when level in the well goes above FOGRod contact #9.
- LIT front panel provides indications when minor system issues occur.

Any of the ten Level Relay Switches can be used for 'Pump OFF', Lead Pump ON, Lag Pump ON and Alarm points. More than two pumps can also be controlled using the Level Relay Switches. The installation configurations included in this manual are only our recommendation. Each site should be evaluated to determine the best configuration.

If at any time during or after installation you run into issues or problems, you can refer to the troubleshoot section on page 51 or you can contact us directly for support.

FOGRod QUICK INSTALL

- **Install Mounting/Cleaning bracket** so FOGRod will hang into the more *turbulent* part of the well. *Avoid* hanging in an area exposed to constant splashing. Ideally the FOGRod should not hang in quiet/still parts of the well. FOGRod should hang freely and NOT touch anything.
- **Hang the FOGRod** from the bracket and make sure to leave enough slack in the cable so the FOGRod can be pulled up through the cleaning pad. Run FOGRod cable back to LIT.



Common FOGRod Installation issues

The following issues have been found to be the most common when installing the FOGRod. **Watch out for these issues.** Refer to the troubleshooting section on page 51 for other possible issues and causes.

- Too close to inflow splashing which causes false level readings.
- Located in still part of well, causing large build up on the FOGRod resulting in false or no level readings.
- FOGRod cable is spliced together inside junction boxes containing high power pump control wiring. The FOGRod splice is made poorly causing the FOGRod wires to pick up electrical noise caused by pumps and other high-power equipment. This may cause LIT and FOGRod system instability.

*Wastewater Level offers a compact **Cable Splice Shield kit** for those applications requiring longer runs with spliced cables. It's fast and easy to install and provides excellent protection against radiated noise from pumps and other high-power equipment.*

LIT QUICK INSTALL



Over-tightening terminal block screws will damage the internal circuit board of the LIT. Use the small flat blade screwdriver provided to make all wire connections.

- **Mount** LIT-100 to DIN rail or other secure location
- **Connect FOGRod Return** input (upper left) to Control Panel Ground. ***This is a critical connection.*** The LIT & FOGRod system will NOT detect level properly if this connection is not made.

FOGRod Return input wire should be kept as short as possible. Never route this wire in a cable channel/trough and always keep away from AC power wires.

- **Connect the FOGRod cable** wires to the LIT as shown on page 18. Make sure to match colors on the wires to the colors on the LIT front panel. Connect the bare cable wire to the terminal marked *shield*, next to the *FS* terminal.

*Connect FOGRod wires directly into LIT when possible to avoid introduction of electrical noise into the FOGRod & LIT system. Using a **standard Landing/Terminal Strip** between the FOGRod and LIT is OK but take care to **keep FOGRod wires away from AC power wires and do not connect the bare wire to ground.***

- **Connect Pump and High-Level Alarm controls:** Connect pump OFF control to Level Relay Switch 1, Lead pump control to Level Relay Switch 5, Lag Pump control to Level Relay Switch 7 and High Alarm to Relay Switch 9 or 10. * *This is only a recommended configuration** Refer to page 26 for more detail.
- **Set Front Panel Defaults:** Set the LIT slide switches and the conductivity threshold to Default. Refer to the table on page 20 listing the LIT Front Panel Control settings.

-
- **FOGRod in well.** If the FOGRod is not already installed in the well, install it now.
 - **Confirm LIT-100 power supply is isolated from panel ground;** Use a DVM to check for voltage between the power supply DC+ and Panel Ground. LIT-100 should NOT be connected to the power supply. Power supply should be ON. Change power supply or correct wiring if it measures more than 0.1VDC.
 - **LAST STEP, connect a DEDICATED ground isolated DC power source,** 10-30vdc/6 watt minimum to the LIT DC+/- terminals

NOTE: If the 'Clean FOGRod Alert' switch is in the ON position and the LIT is already powered ON before you hang the FOGRod in the well, you will create a 'Clean FOGRod' alert. Simply slide the 'Clean FOGRod Alert' switch to OFF then back to ON to clear the alert.



Do not connect DC- to earth ground or panel ground. Doing so may result in unstable system operation and possible damage.

- **OPTIONAL-External Fuses:** Installing two inline fuses between the DC Power supply and the LIT-100 will prevent the LIT-100 internal fuses from blowing in the event of a power surge. See page 21 & 22 for more details.

The LIT does NOT provide pump alternation or latching relay functions. The LIT Level Relay Switches operate like float switches. They turn ON when the level is above a point and turn OFF when below a point.

****The LIT and FOGRod system is now functional****

Refer to the section 'Verifying Correct System Operation' on page 24 to ensure your newly installed system is functioning properly.

Common LIT Installation issues

The following issues have been found to be the most common when installing the LIT. **Watch out for these issues.** Refer to the troubleshooting section on page 51 for other possible issues and solutions.

- FOGRod Return connections are poor, intermittent, or bad. The system **will intermittently read level in the well** or may **not read any level in the well** with this issue.
- AC power connected to LIT instead of DC Power. This will permanently damage the LIT. Use only a **DC POWER SUPPLY** to provide power to the LIT.
- +DC voltage accidentally touched to FOGRod Return input or Lightning input. This will blow the internal fuses of the LIT. These fuses are not user replaceable.
- Terminal block screws on LIT are way over-tightened breaking the internal circuit board and internal mounting posts.

FOGRod INSTALLATION DETAIL

For detail not covered in the following section, refer to page 38 'FOGRod and LIT system detail' later in this manual.

Install Mounting Bracket

The FOGRod comes with a **mounting-cleaning bracket**. Refer to figure on page 9. The bracket is used for hanging the FOGRod into the well. It also can be used for periodic cleaning of the FOGRod. Simply unhook the FOGRod from the bracket and pull up through the cleaning pad. This will clean off any fats, oils and grease (FOG) that may have built up on the FOGRod.

The FOGRod cable and the connection into the FOGRod can support over 180lbs. Do not worry about pulling too hard on the FOGRod cable. You will not damage it.

The FOGRod mounting bracket should be installed in a position that will allow the FOGRod to hang in the **turbulent** part of the wet well, typically near the inflow, but **NOT** directly in the path of the inflow. You do not want the FOGRod to be splashed by the inflow as this might cause false level indications. The FOGRod is very tough and will not break if it gets banged around a bit. The FOGRod should **hang freely and not touch anything** in the well like ladders, pipes etc.

The FOGRod should **not** be installed in the same area of the well where floats were previously hanging.

To **install the bracket**, follow these steps:

- Use the bracket as a template to mark the location of the three mounting holes.
- Using a concrete drill bit, drill three holes.
- Mount the bracket using the three concrete screws and lock washers included in the bracket kit.

Hang the FOGRod

To **hang the FOGRod**, follow these steps:

- Make a loop in the FOGRod cable at a place on the cable where you know the FOGRod will hang with the bottom #1 contact corresponding to pump stop level.

-
- Install the provided zip-tie on the cable to fix the cable loop in place
 - Using the provided 'S' hook, hang the FOGRod from the mounting bracket into the well.
 - Leave enough slack in the cable so the FOGRod can be pulled all the way up through the cleaning pad.
 - Route the FOGRod cable back to the LIT-100 in the control panel.

*The FOGRod must be installed in **the turbulent part of the well**, but not directly under the inflow.*

Why the turbulent part of the well?

In the turbulent part of the well, the fats, oils and grease (FOG) are broken up. The FOGRod will operate normally in this part of the well. If the FOGRod were installed in the *still/quiet* part of the well where the FOG is generally very "thick", substantial buildup on the FOGRod may occur and the system may have difficulty operating normally.

We do not recommend installing the FOGRod in a **stilling tube** when used in wastewater applications. This technique typically creates a grease and rags trap that will cause problems with the FOGRod. Do not hesitate to contact us to discuss your application.

Extending the FOGRod Cable

Extending the FOGRod cable by splicing it together with another length of cable is acceptable, however, care must be taken to ensure the RF shielding provided by the internal braided wire of the FOGRod cable is maintained. Not doing so may cause system instability.

Wastewater Level supplies a Splice Shield kit for installations that require splicing. The kit is easy to use and once installed maintains a secure and radiated-electrical-noise resistant splice.

Contact WasteWater Level for more information on the **FOGRod Cable Splice Shield**.

LIT INSTALLATION DETAIL

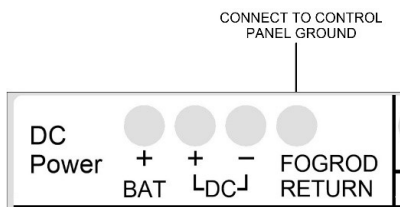
For detail not covered in the following section, refer to the section 'FOGRod & LIT System Detail' on page 38.

Mount LIT

Find space in your panel for the LIT and clip it onto the DIN rail, remembering that you need to route the FOGRod wires and connect them to the LIT. The LIT has a moveable clip on its bottom for locking to the DIN rail. The clip slides up and down. Use a screwdriver to slide the clip down, then hook the LIT on the DIN rail and push the clip up to hold the LIT in place.

FOGRod Return

Connect the *FOGRod RETURN* input to panel ground. Route as direct and short as possible. Keep away from AC power wires. Do not route in cable channels/troughs. This is a **critical connection** as the LIT and FOGRod system depend upon this electrical connection to detect level in the well.



If the FOGRod Return input is not connected to panel ground, the system will NOT operate properly. Make shortest connection possible.



NEVER route this wire inside a channel/trough and never route near AC power wires. Keep it short as possible.



DO NOT connect any other wires to the FOGRod RETURN Input or permanent damage may occur to the LIT.

Control Panel NOT bonded/grounded to well: If the liquid and pump in the well are not bonded to the control panel (as might be the case inside a plastic tank) then you **must** put a metal rod into the tank liquid and connect this back to the FOGROD RETURN terminal. Refer to page 50 for installation details.

Lightning bolt connection

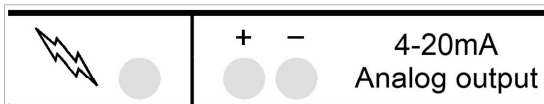
This connection should only be used when a site is known to have frequent equipment issues caused by nearby lightning strikes and large static surges.

Typical surges and static discharges are easily handled by the LIT even when the lightning bolt input is not connected.

In rare cases when it is necessary, connect the lightning terminal shown below to an appropriate dedicated lightning rod as close to the panel as possible.



DO NOT connect to this input unless the site is known for chronic lightning strike damage.



CONNECT TO GOOD QUALITY
GROUND ROD NEAR PANEL



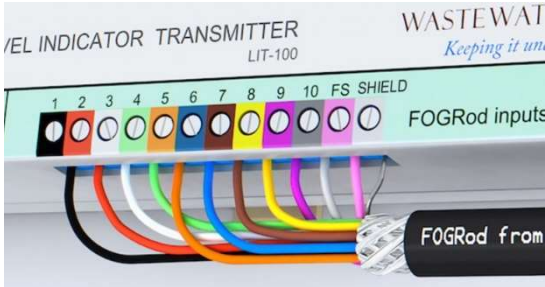
DO NOT connect the lightning bolt input to panel ground. Doing so may damage the LIT-100.



DO NOT connect any other wires to the lightning bolt Input or permanent damage may occur to the LIT.

FOGRod cable connections

Wire the FOGRod cable wires to the LIT inputs. The wires are color coded to simplify the connections. If you get two wires mixed up you will not damage the system, however, the LIT will not indicate levels correctly.



Ensure you have connected the drain wire (bare wire) to the SHIELD terminal. This is necessary to ensure system immunity to electrical noise.



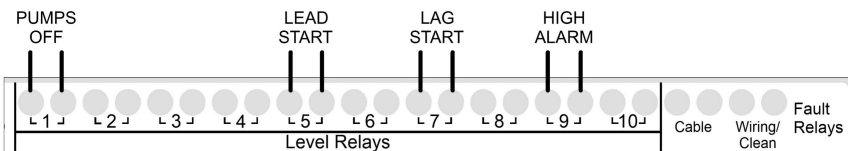
Inside the FOGRod cable is a special braided wire jacket that prevents radiated electrical noise from getting into the cable wires. Damaging this braided wire jacket could result in unstable system operation.

If you plan on splicing the FOGRod cable inside a junction box, please refer to the section on page 23 for special considerations.

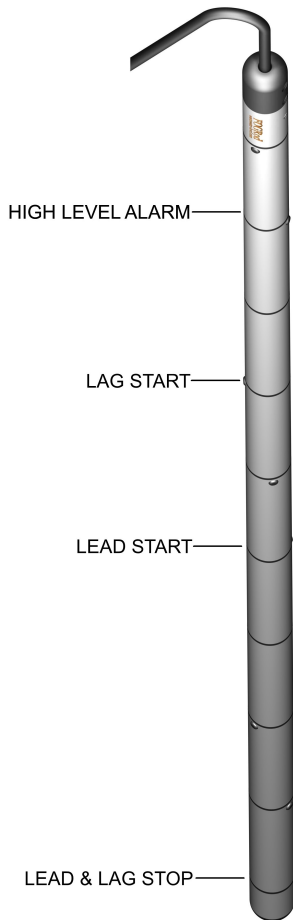
Connect Pump and High-Level Alarm Controls

The connections shown below indicate one possible configuration for controlling pumps and high-level alarm. This configuration is **ONLY A RECOMMENDATION**. After evaluating your specific installation requirements, you can use any Level Relay Switch necessary for your specific configuration. Refer to the 'Pump & Alarms-Configurations and Control' section on page 26 for additional options and detail.

The figure below shows how the Level Relay Switches will be wired if you use the configuration covered in the quick installation section.



Notice how the Relay connections correspond to the FOGRod contacts. See the figure below illustrating the FOGRod contact locations.



QUICK INSTALLATION CONFIGURATION

FOGRod CONTACT #	CORRESPONDING LEVEL RELAY	PUMP ACTION or ALARM ACTION
1	1	LEAD & LAG PUMP OFF
5	5	LEAD PUMP START
7	7	LAG PUMP START
9	9	HIGH ALARM

LIT Front Panel Control settings

All Front Panel controls should be set to 'Default' at startup. These settings can be changed once the system is up and running.

DESCRIPTION	SETTINGS & DETAIL
Conductivity Threshold <i>Adjustable POT</i>	Default = 50k Range= 3k-300k ohms
Level Relays Slide Switch <i>N/O or N/C</i>	Default = N/O Controls the state of the Level Relay switches; Normally Open (N/O) or Normally Closed (N/C), when deactivated (not wet).
Fault Relays Slide Switch <i>N/O or N/C</i>	Default = N/O Controls the state of the Fault Relay switches; Normally Open (N/O) or Normally Closed (N/C) when deactivated (No Fault).
Delay-Level Relays Slide Switch <i>1 or 10 seconds</i>	Default = 1 Controls the amount of time between a contact becoming wet and when the LIT actually reports that contact being wet.
Clean FOGRod Alert Slide Switch <i>OFF or ON</i>	Default = OFF Turn ON to detect rags and grease and minimize short-cycling when these occur. <i>Slide OFF then ON to CLEAR ALERTS</i>

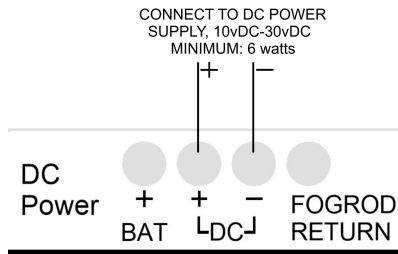
Hang FOGRod in well

At this point, the FOGRod should already be hanging in the well, if not, hang the FOGRod now. Before connecting the LIT to DC power, observe the FOGRod in the well so you know how many contacts are submerged.

Connect DC Power Source

BEFORE connecting the DC power supply, make sure it is isolated from panel ground. If it's not isolated, it could blow fuses in the LIT or cause system instability. With the power supply ON, use a DVM to make sure the voltage between supply DC+ and panel ground is less than 0.1VDC.

Once you've confirmed the supply is isolated from ground, Connect the **DC power** supply to DC+ and DC- as shown below. The LIT should be supplied by **DC voltage** between 10v - 30v. The LIT will consume a maximum of 4W when running and a surge of 6 watts when first turned ON.



Do not connect DC- to earth ground or panel ground. Doing so may result in unstable system operation and possible damage.

Like most current technology products, the LIT expects a DC power supply input that is isolated from earth ground. Most all current technology power supplies provide an isolated output. Connecting DC- to earth ground may cause FOGRod and LIT system instability, possible damage, and may compromise the UL approved electrical safety of the system

External Fuses: Installing two inline fuses between the DC Power supply and the LIT-100 will prevent the LIT-100 internal fuses from blowing in the event of a power surge. Use two slow-blow type fuses with a value from 750mA-800mA.



800mA slow-blow Glass Fuse
McMaster-CARR PN: 6978K746
www.Mcmaster.com



Inline holder for glass type fuse,
Size 5mm x 20mm
McMaster-CARR PN: 7696K1
www.Mcmaster.com

EXTERNAL FUSE & FUSE HOLDER

When DC power is connected, the **LIT will immediately turn ON** and will perform an LED test turning all front panel LEDs ON then OFF. The LIT will then flash two Level LEDs ON and OFF to indicate the firmware version. As an example, if the 10% LED turns ON then OFF, then the 80% turns ON then OFF, the firmware version is 1.8. The green power LED will stay ON after the firmware version is displayed. The Level LEDs will turn ON up to the level in the well. No other LEDs should be ON. You will also hear the Level Relays activating up to the level in the well.



Connecting AC power to the LIT will permanently damage it.



Do not connect DC- to the FOGROD RETURN connection. This may cause unstable system operation and possible damage.

****The LIT and FOGRod system are now functional****

FOGRod contacts that are submerged in the well will be detected by the LIT. The LIT will then turn ON the appropriate Level LEDs indicating the level in the well. The associated level relay switches will also be activated. The 4-20mA analog output will transmit the current level in the well.

Follow the steps listed in the next section '**verify correct system operation**' to confirm full and proper operation of your newly installed system.

If the system does not immediately function as expected, please refer to the troubleshoot section on page 51 or feel free to contact us immediately for support.

The FOGRod and LIT system have many additional functions and features you may consider taking advantage of. Refer to page 38 for more details.

FOGRod cable splicing and junction boxes

Splicing a FOGRod cable to another cable for longer runs is OK when implemented properly.

The FOGRod cable is a specially shielded cable. The cable has an inner braided wire jacket that surrounds the entire bundle of FOGRod wires inside the cable. This braided wire jacket protects the FOGRod wires from unwanted electrical noise transmitted by pumps and other high power equipment.



LIT & FOGRod operation may become unstable if electrical pump noise is picked up by un-shielded FOGRod wires.

When you splice to the FOGRod cable, you must use a similar cable that also has an inner foil or braided shield. You need to make sure the FOGRod cable shield connects to your spliced cable shield. The FOGRod cable has a bare drain wire that can be used to make this connection, assuming your cable also has a bare drain wire, or braided wire jacket you can connect to. Connecting to foil is not possible unless a drain wire is present in your cable. The splice must be located inside its own **METAL** junction box. The metal junction box shields the spliced FOGRod wires inside.



The spliced FOGRod cable cannot share the same junction box as other High Power AC equipment wires. LIT and FOGRod system operation may become unstable.

In most cases, it is OK for a spliced FOGRod cable to share a metal junction box with other low power DC control wires.

Wastewater Level supplies genuine FOGRod cable for those times when you need to extend the FOGRod cable run.

A compact cable splice shield kit is available from Wastewater Level for those installations where RF pump noise is a concern, and you can't dedicate a metal junction box to the FOGRod splice.

VERIFYING CORRECT LIT & FOGRod OPERATION

If you followed the Quick Installation configuration, the LIT & FOGRod system will function as listed below. If you determine your installation requires using different Level Relay Switches, then your installation will function differently. Use the following section as a guideline knowing OFF, ON and Alarm points may be different for your installation.

- Turn Lead Pump ON when level covers contact 5 on the FOGRod
- Turn Lag Pump ON when level covers contact 7 on the FOGRod
- Activate High Level Alarm when level covers contact 9 on the FOGRod
- Pumps turn OFF when level drops below contact 1 on the FOGRod.

If the well level is high enough to cover all 10 contacts on the FOGRod, it is possible to perform full system verification manually and quickly.

Manually verify LIT & FOGRod system operation (LIT Front panel settings all default. Refer to page 20)

Perform the following steps to verify full LIT & FOGRod system operation. **Be aware**, following these steps will cause the Lead and Lag pumps to turn ON and OFF and will also activate the High-Level Alarm.

- Lift the FOGRod off the hook and hold it by the cable keeping FOGRod contact 1 out of the liquid in the well
- Observe the LIT front panel and confirm only the power LED is ON.
- Slowly lower the FOGRod down into the well
- As each contact touches the liquid in the well, confirm the Level LEDs on the LIT front panel turn ON. Contact 1 = Level 10%, 2=20% etc
- When you reach contact 5, make sure the Lead Pump turns ON
- When you reach contact 7, make sure the Lag Pump turns ON.
- Keep lowering the FOGRod until you reach contact 9, make sure the High-Level Alarm is activated when you reach contact 9.
- Slowly pull the FOGRod out of the well. Verify the LIT Level LEDs go OFF one by one. When contact 1 is out, verify all pumps stop.

*****LIT & FOGRod system verification is complete*****

Verify LIT & FOGRod system during normal inflow (LIT Front panel settings all default. Refer to page 20)

This verification assumes you followed the Quick Installation configuration described earlier. **Be aware**, you will need to turn off the Lead Pump and Lag Pump at specific times during the verification steps below.

- As the well fills up and covers each FOGRod contact, confirm the Level LEDs on the LIT front panel turn ON. Contact 1 = Level 10%, Contact 2 = 20% etc
- When the well fills up and covers contact 5, make sure the Lead Pump Turns ON
- Once you have confirmed the Lead Pump is working properly, manually turn it OFF so the well level will continue to rise
- When the well fills up and covers contact 7, make sure the Lag Pump turns ON
- Once you have confirmed the Lag Pump is working properly, manually turn it OFF so the well level will continue to rise
- When the well fills up and covers contact 9, make sure the High-Level Alarm activates
- Turn the Lead and Lag pumps back ON
- When level in the well is below FOGRod contact 1, make sure both pumps turn OFF.

****LIT & FOGRod system verification is complete****

*After verifying proper system operation, turn '**Clean FOGRod Alert**' **ON** by sliding the LIT front panel switch to the ON position.*

For more details on this feature, refer to page 49.

PUMPS & ALARMS- CONFIGURATION AND CONTROL

The LIT provides **two methods** for controlling pumps and alarms:

1. **Relay Switches** that can be used for pump contactor control and alarm control.
2. **Industry standard 2-wire 4-20mA Analog output** that provides real time level data for the well that can be used by your PLC/Controller to manage pumps and alarms.

*The LIT does **NOT** provide pump alternation or latching relay functions. The LIT Level Relay Switches operate like float switches. They turn ON when the level is above a point and turn OFF when below a point.*

Control using the LIT Level Relay Switches

The FOGRod and LIT system provides 10 Level Relay switches, one for each contact on the FOGRod. Bottom contact for Level Relay 1 and top contact for Level relay 10. As each FOGRod contact becomes wet and dry, the Level Relay switch for that contact activates and de-activates.

The LIT also provides two Fault Relay switches that activate and deactivate when system issues occur.

All Relay Switches are electrically isolated from each other, so different control voltages can be used on any Relay Switch.

The Relay switches are capable of handling most common AC and DC voltage and current requirements, both resistive and inductive. *Refer to the specification section on page 63 to ensure you do not exceed the limits of the Relay switches.*



Never connect a Level Relay Switch directly to a pump or motor. Doing so will permanently damage the Relay Switch.

Level Relay Switch Recommended Configuration

- **LEAD & LAG PUMP OFF** – Use Level Relay Switch #1.

Connect Level Relay Switch #1 to the appropriate circuit to turn both pumps OFF when level in the well falls below contact #1 on FOGRod.

Reason: When grease and rags are present in the well, contact #1 will provide a more predictable pump OFF control compared to using higher levels like Contact #2 or #3.

In either configuration, the pumps will always turn off. The *exact time* the pumps turn off can change if rags are hanging from the FOGRod.

Normally, when the level in the well drops below the pump OFF location, like contact 1, pumps turn OFF immediately. If a rag gets stuck on contact 1 and hangs into the water, the pumps won't turn off until there is an air gap between the end of the rag and the well water. This situation extends slightly the amount of time before the pump finally turns off.

If you use higher contacts like 2 or 3 for pump OFF, and a rag gets stuck on contact 2 or 3 and hangs down into the water, the amount of time before the pumps turn off will be a bit longer than using contact 1.

- **LEAD PUMP START** – Use Level Relay Switch #5
- **LAG PUMP START** – Use Level Relay Switch #7

Each site is a little different, so your choice of Lead and Lag Pump START location may need to be different, but many sites use #5 & #7.

Skip at least one contact between Lead Start and Lag Start locations to avoid simultaneous pump activation.

Reason: The Lead Start contact (#5 in our example) on the FOGRod usually has the worst grease buildup. This buildup can eventually insulate that FOGRod contact preventing it from detecting level and activating Level Relay 5. If you use 6 for Lag start, when level reaches contact 6, Level Relays 5 & 6 will activate simultaneously starting both pumps at the same time. If you skip one contact and connect Lag to 7, only the Lead pump will start in this example.

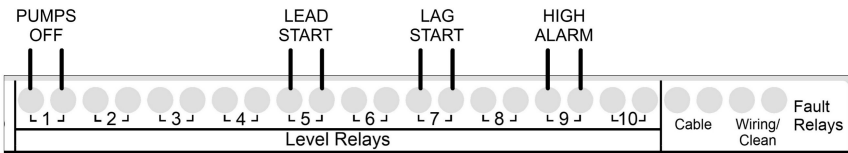
- **HIGH LEVEL ALARM** – Use Level Relay Switch #9 or #10

Level Relay 9 or 10 can be used to control a High-Level Alarm. Using 9 provides even more security against high level events because 10 becomes a redundant backup in the very unlikely event 9 has any issues.

*It is not necessary to use Level Relay 1 to activate a **Low-Level Alarm**.*

Reason: The pump OFF function provided by the LIT & FOGRod system when connected to Level Relay Switch #1 is extremely reliable. A low-level alarm is not needed.

If your site has a *requirement* to use a low-level alarm, it is recommended to use Level Relay Switch #2 for Pump OFF and Level Relay Switch #1 for Low Level Alarm.



Recommended setpoint connections to LIT

The setpoint connections shown above are only a recommendation. You can use any Level Relay Switch to control your pumps and alarms.



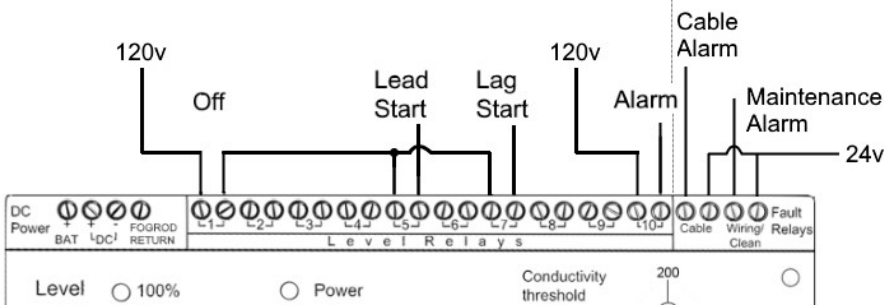
If you need to connect the LIT Relay Switches to high voltage, ensure suitably qualified personnel perform the installation.

Level Relay Activation Refresher: The LIT activates ALL Level Relay Switches below and including the highest wet FOGRod contact, regardless of the wet/dry state of the other FOGRod contacts.

Example: If contact 5 is covered in grease preventing it from detecting level, when the level reaches contact 6, Level Relay Switch 6 activates, as well as 5, 4....1. This guarantees your pumps will turn on, even if the FOGRod contact assigned to the pump is covered in grease.

Relay Switches- “What Voltage can you connect to them?”

The 10 Level Relay Switches and 2 Fault Relay Switches are all independent of each other and electrically isolated from each other. What this means is that you can connect a variety of different voltages to each relay without concern. The example below shows 120vac connected to some relays and 24vdc connected to others.



Example with different voltage on fault relays

Control using the LIT 4-20mA Analog Output

As an **alternate or supplemental** method for controlling pumps and alarms or to monitor level in the well, you can use the LIT 4-20mA Analog Output.

There are two terminal block connections for the 4-20mA Analog Output on the LIT. The output provides a standard 2-wire transmitter interface. When a DC Voltage is applied to the 4-20mA output, the LIT adjusts the electrical current in the 4-20mA loop to indicate actual level in the well. Refer to the table on page 32 for a breakdown of Current -vs- Level.

Here are a few reasons you may choose to use the Analog Output:

- Need to replace an existing 4-20mA level device. Your control system used the 4-20mA signal for alarm & pump start/stop management.
- Existing control system used the 4-20mA signal from the old level device to monitor level in the well.
- Add remote monitoring or control to your existing system

4-20mA Power Supply

The 4-20mA Analog Output on the LIT requires a dedicated power source not used by any other equipment. The 4-20mA input should NOT be connected to the same power source as the LIT-100. The 4-20mA power can be provided by a dedicated external power supply or a PLC/Controller that has a built-in power supply intended for powering remote transducers.

Refer to the next page for wiring examples.

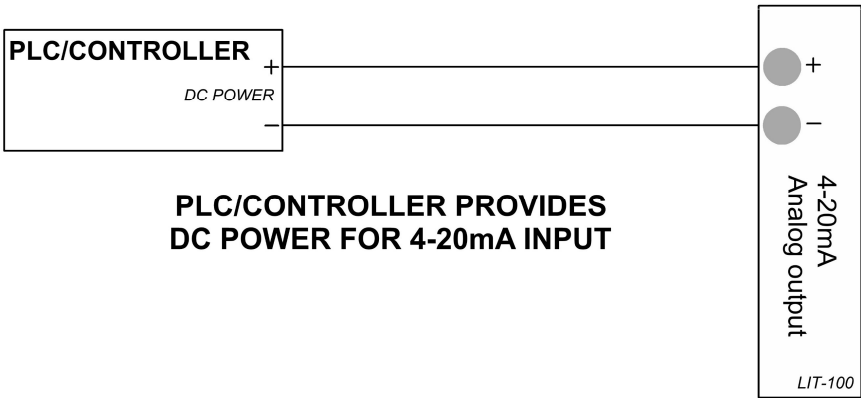
Refer to page 64 for the 4-20mA Output power supply specifications.

Your PLC/Controller or dedicated external power supply must provide DC power to the 4-20mA output on the LIT or the 4-20mA output will not function.

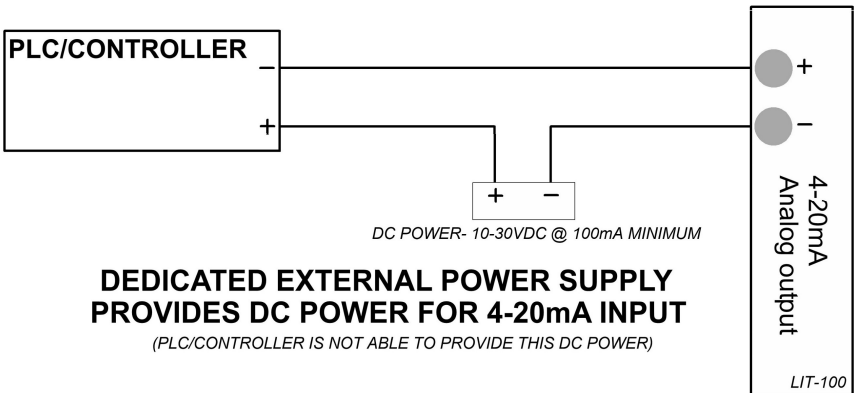
*Do **NOT** connect the LIT-100 power supply to the 4-20mA Analog output.*



When using an external power supply, make sure the PLC/Controller doesn't also provide DC power. Damage to the LIT-100 and/or PLC may occur.



If the PLC/Controller provides DC power, simply connect to the LIT-100 as shown above. Some PLC/Controllers have multiple options for connecting a 4-20mA loop. Always connect to the PLC terminals for a **2-wire transducer/transmitter**.



The diagram above illustrates how to connect an external power supply to the LIT-100 when your PLC/Controller cannot provide the required DC power for the 4-20mA output.

LEVEL INDICATED ON LIT-100 FRONT PANEL	4-20mA LOOP CURRENT SET BY LIT-100 (+/- 0.10)
No level indicated (ALL level LEDs off)	4.0
No level indicated AND there is a Cable Open Circuit or Cable Short Circuit FAULT (RED LED ON)	0.0
10%	5.0
20%	6.0
30%	7.0
40%	8.0
50%	9.0
60%	10.0
70%	11.0
80%	12.0
90%	13.0
100%	14.0



NEVER probe across the 4-20mA output with a DVM in current mode. You will blow the fuse in your DVM.

FLOATS: Replacing or as High-Level Alarm backup

If you are replacing an existing 4 float system with the FOGRod and LIT system, just connect a pair of wires from each of the 4 LIT Level Relay switches you've selected into the same points in which your 4 floats were wired, assuming they provided the same function as you plan for the FOGRod and LIT system.

If you want to use a float as an independent High Alarm backup, simply connect both the float switch and LIT Level Relay switch 9 into your High-Level Alarm control. With this configuration, either the FOGRod/LIT or the backup float will turn ON your High-Level Alarm.

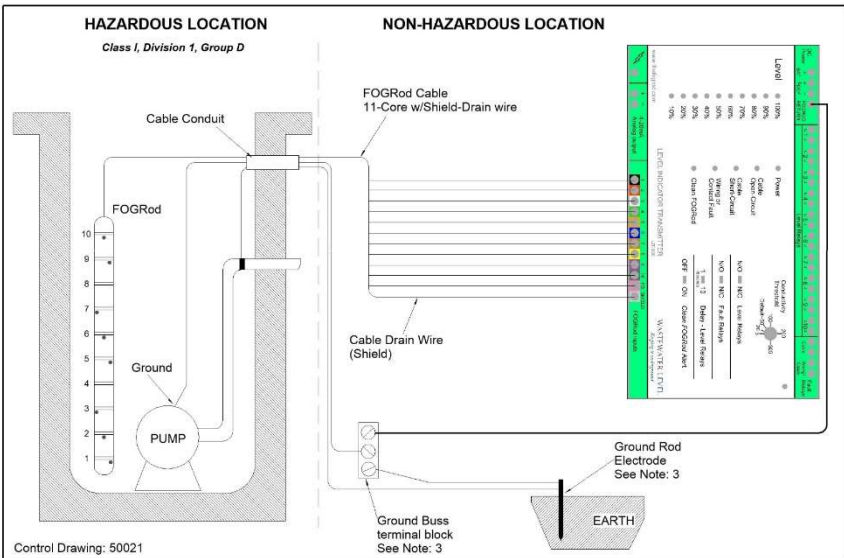
To make sure the LIT activates the High Alarm before the float, you should locate the float above the level of FOGRod contact 9 (or the contact that you have chosen for your High Alarm).

HAZARDOUS LOCATION INSTALLATIONS

Location Class I Division 2

The FOGRod is suitable for use in Class I Division 2 Group D when connected to the LIT in an unclassified area (UL file number E467390).

Combinations of equipment in your system are subject to investigation by the local Authority having jurisdiction at the time of installation.



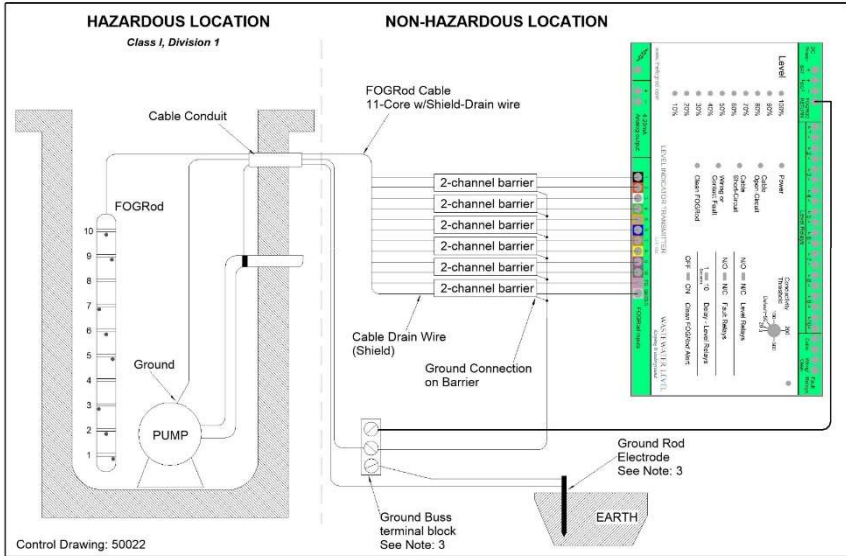
1. Installation shall be done in accordance with Control Drawing 50021 and the National Electric Code or relevant code for your location.
2. Maximum distance between the FOGRod and LIT shall be 150 feet. Cable capacitance is calculated as 60 pF/ft = 9 nF maximum; cable inductance as 0.2 uH/ft = 30 uH maximum
3. The hazardous location ground and the LIT FOGRod Return must be connected to the ground bus in the panel
4. No other devices in the hazardous area shall be connected to the LIT



WARNING - EXPLOSION HAZARD could exist if you replace the FOGRod or cable before power has been switched off or you determine the area is known to be non-hazardous

Location Class I Division 1

The FOGRod is suitable for use in Class I Division 1 locations when connected to the LIT in an unclassified area through an approved intrinsically safe barrier. Pepperl+Fuchs and R Stahl manufacture such barriers. Refer to page 35 and 36. *Wastewater Level currently supplies the Pepper+Fuchs barrier set, PN: FOG-ISB.*



1. Installation shall be done in accordance with Control Drawing 50022 and the National Electric Code or relevant code for your location.
2. Maximum distance between the FOGRod and LIT shall be 150 feet. Cable capacitance is calculated as 60 pF/ft = 9 pF maximum; cable inductance as 0.2 uH/ft = 30 uH maximum
3. The hazardous location ground and the LIT FOGRod Return must be connected to the ground bus in the panel
4. The FOGRod is a “simple apparatus” under NEC 504.2 and therefore does not need a UL listing as stated in NEC 504.4



WARNING - EXPLOSION HAZARD could exist if you replace the FOGRod or cable before power has been switched off or you determine the area is known to be non-hazardous

Wiring the Stahl 9002/77-220-146-001 barriers for Class I Division 1

The R Stahl unit is a dual-channel barrier, size: 0.5" x 4.1" x 2.8".

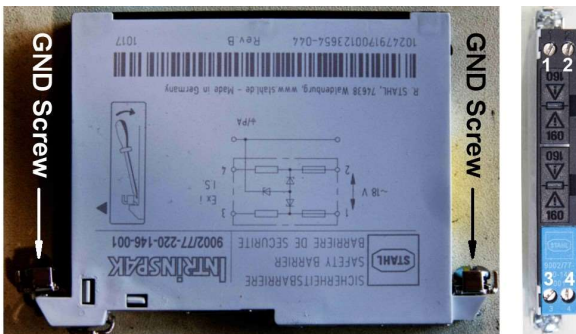
The wiring table below provides the connection details for hooking up the LIT-100 & FOGRod system using the Stahl Barrier.

A typical FOGRod & LIT-100 installation requires 6 of these barriers.

FOGRod		Stahl				LIT-100
CONTACT	WIRE COLOR	TERM.		TERM.		FOGRod INPUT
1 (BOTTOM)	Black	3		1	1	1
2	Red	4		2		2
3	White	3		1	2	3
4	Green	4		2		4
5	Orange	3		1	3	5
6	Blue	4		2		6
7	Brown	3		1	4	7
8	Yellow	4		2		8
9	Purple	3		1	5	9
10 (TOP)	Gray	4		2		10
Fail Safe	Pink	3		1	6	FS
	Shield	4		2		Shield

Barrier GND screw(s) connect to Control Panel GND
 *GND screw connection not required if barriers are mounted to a Control Panel grounded DIN Rail

WIRING TABLE FOGRod to Stahl to LIT-100



9002/77-220-146-001 FROM STAHL

Wiring the Pepperl + Fuchs Z967 barriers for Class I Division 1

The Z967 is a dual-channel barrier. size: 0.5" x 4.5" x 4.3"

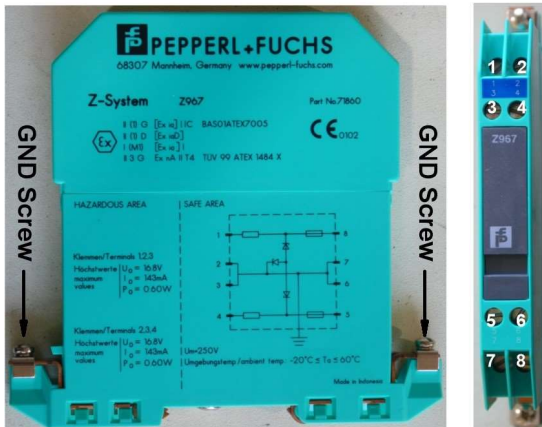
A typical FOGRod & LIT-100 installation requires 6 of these barriers. A set of 6 can be ordered directly from Wastewater Level PN: FOG-ISB.

FOGRod		Z967			LIT-100	
CONTACT	WIRE COLOR	TERM.		TERM.	Barrier #	FOGRod INPUT
1 (BOTTOM)	Black	1		8	1	1
2	Red	4		5		2
3	White	1		8	2	3
4	Green	4		5		4
5	Orange	1		8	3	5
6	Blue	4		5		6
7	Brown	1		8	4	7
8	Yellow	4		5		8
9	Purple	1		8	5	9
10 (TOP)	Gray	4		5		10
Fail Safe	Pink	1		8	6	FS
	Shield	4		5		Shield

Barrier GND screw(s) or Terminals 2 or 3 or 6 or 7 connect to Control Panel GND

*Screw or Terminal connection not required if barriers are mounted to a Control Panel grounded DIN Rail

WIRING TABLE FOGRod to Z967 to LIT-100



Z967 FROM PEPPERL + FUCHS

CLEANING THE FOGRod

Cleaning the FOGRod is very simple. The FOGRod mounting bracket includes a built in cleaning pad. The pad acts like a 'squeegee' when you pull the FOGRod up through the pad. Follow these steps to quickly clean the FOGRod:

1. Slide the 'Clean FOGRod' switch to OFF if it is normally in the ON position. You may trigger a false 'Clean FOGRod' alarm if left in the ON position.
2. Lift the FOGRod off the S-Hook it normally hangs from.
3. While you hold the cable, pull the FOGRod up through the bottom of the cleaning pad.
4. Pull all the way through the pad so you squeegee the entire length of the FOGRod starting at contact #10 all the way down to #1.
5. When finished, hang the FOGRod back on the S-Hook.
6. Return the 'Clean FOGRod' switch back to the ON position if you moved it to the OFF position in step 1.

*In extreme cases, pulling through the cleaning pad may not be sufficient. It is acceptable to **Power Wash** the FOGRod in these extreme cases.*

The FOGRod cable can support 180lbs. You will not damage the cable when pulling through the cleaning pad.

If you forget to turn the 'Clean FOGRod' switch OFF and cause a false 'Clean FOGRod' alert, simply slide the switch to OFF and back to ON to clear the alarm.

Refer to the 'Clean FOGRod' section top of page 42 for details on how this feature works.



Never use strong solvents like acetone or brake cleaner to clean the FOGRod as this may damage the seals below the metal contacts.

FOGRod AND LIT SYSTEM DETAILS

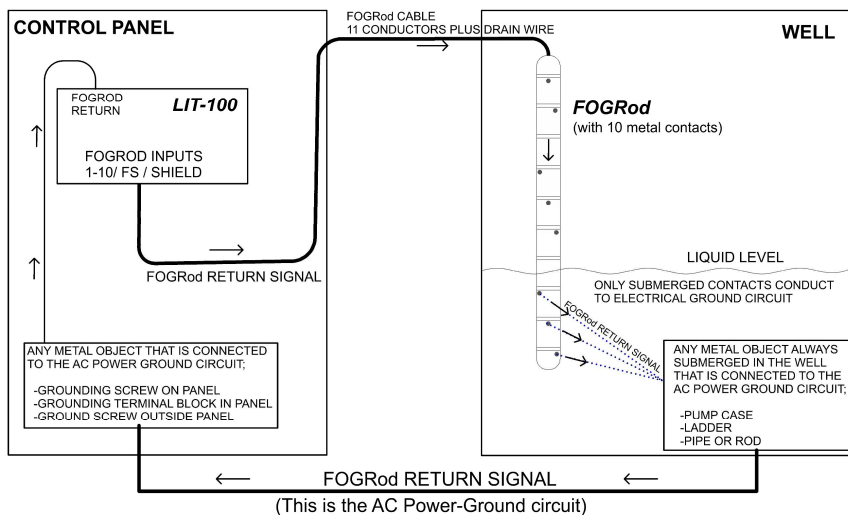
The main function of the FOGRod and LIT system is to detect the level of water in a well or tank. How does it do that?

The system design is based upon the fact that water is an electrical conductor, just like a wire. Air, for all practical purposes, is NOT an electrical conductor. Electrical current will flow through water and will not flow through air.

FOGRod Return Signal

The LIT generates a special ***FOGRod Return signal*** that travels down the 10 FOGRod cable wires to each of the 10 metal contacts on the FOGRod. If a contact becomes wet, the FOGRod Return signal will continue traveling through the water into the nearest AC Power Ground circuit point in the well (ladder, pump housing, chain in water). Once the FOGRod Return signal is in the Ground Circuit, it will travel back to the control panel ground. When the LIT's FOGRod Return terminal block input is connected to panel ground, the FOGRod Return signal will continue to travel back into the LIT, completing the signal path. The LIT then 'knows' the FOGRod contact has become wet. Every one of the 10 metal contacts on the FOGRod are individually monitored for wet/dry status.

The system will NOT detect level if the FOGRod Return signal path is broken, incomplete or has poor connections.



FOGRod Return signal path using AC Power Ground Circuit

Indicators and Control

The front panel of the LIT provides 'daylight visible' LEDs that display the level in the well and any fault conditions that might exist.

The LIT's Industry Standard 4-20mA Analog Output provides level status in the well by setting the current in the 4-20mA output loop in proportion to the level in the well.

The LIT has 10 individual Level Relay Switches assigned to each of the 10 metal contacts on the FOGRod. The 10 Level Relay switches activate and deactivate when each of the 10 metal contacts on the FOGRod become wet or dry. These relay switches are typically used by the customer for pump and alarm control.

The LIT has 2 individual Fault Relay switches. The 2 Fault Relays activate and deactivate when system issues occur.

Summary of features and functions

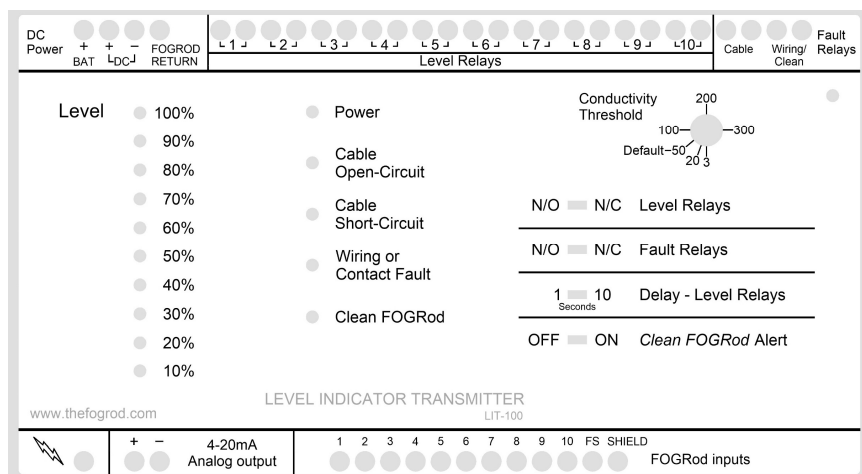
- Detect water level in wells and tanks
- 10 *daylight visible* LEDs providing level indications
- System fault monitoring and fault display using 4 front panel LEDs.
- User adjustable conductivity threshold (Pure through WasteWater)
- User selectable relay switch states; *Normally Open* or *Normally Closed*
- User selectable level detection delay, 1 or 10 seconds
- Detects grease buildup and ragging and avoids short cycling pumps
- Terminal block connections for all inputs and outputs (screwdriver included)
- Ten Relay switches that change state when level changes in the well
- Two Relay switches that change state when system issues occur
- Industry standard 4-20mA analog output provides real time level status
- Detects FOGRod cable breaks and shorts
- Detects FOGRod wiring errors and contact failures
- Resistant to electrical surges caused by lightning and other sources
- 10-30Vdc isolated power input, 4 watts maximum continuous
- Backup battery inputs
- DIN rail mountable

THE LIT-100 'LIT'

The LIT controls all system operations. When the LIT is connected to the FOGRod in the well, the LIT can 'see' into the well and detect the actual level in the well.

Once the LIT detects level in the well, the LIT responds by turning its front panel LEDs ON, activating level relays, setting the 4-20mA analog output, and managing fault LEDs and fault relays.

The following section will review in detail the purpose and function of all front panel LEDs, switches, LIT Relays and all LIT inputs and outputs.



LIT FRONT PANEL

Front Panel LEDs

When power is connected to the LIT, all front panel LEDs will immediately turn ON then turn OFF after a couple seconds. This is an LED test. Immediately after the LED test, you will see two Level LEDs turn ON and OFF to indicate the software version. EX: 10% LED goes ON & OFF, and the 80% LED goes ON then OFF, the version is V1.8. The green Power LED turns ON after the self-test is complete.

Power LED, Green

As mentioned above, once the self-tests are complete, the Power LED turns ON solid. The Power LED never blinks or flashes for any reason. If it does, this may be an indication of a system problem.

Level LEDs, Green

There are 10 LEDs on the front panel that indicate the level in the well. Each LED corresponds to contacts 1-10 on the FOGRod. When a FOGRod contact is covered in liquid, the associated Level LED turns ON. EX: Contact #3 is covered, 30% LED is ON. During normal operation, Level LEDs stay ON solid and do not blink or flash. When there is a system fault, like 'Wiring or Contact Fault' or 'Clean FOGRod Alert', the Level LEDs associated with the fault will blink ON and OFF every half second until the fault is corrected or cleared. At no time should Level LEDs flash quickly or randomly. If they do, it is an indication of a system problem.

Fault LEDs, Red

There are 4 fault LEDs on the front panel of the LIT. They are:

- **Cable Open-Circuit:** When this LED is ON, it is an indication the FOGRod cable may be damaged or cut.
- **Cable Short-Circuit:** When this LED is ON, it is an indication the FOGRod cable may be damaged and is shorting together internally.

How does Cable Open/Short Circuit work? (Failsafe Feature): Inside the FOGRod there is a 62k ohm resistor that connects the Pink FS wire to the #10 Gray FOGRod wire. The LIT software is always measuring the resistance between the FS wire and the #10 Gray wire. The allowable range of resistance is 2K ohms – 600k ohms, a very wide range that considers many variables. If the software detects below 2k, then a 'Cable Short Circuit' fault is indicated. If the software detects above 600k ohms, then a 'Cable Open Circuit' fault is indicated. When either of these fault LEDs are ON, the 'Cable' Fault Relay is activated. This fault does NOT latch and will come and go if the problem is intermittent.

- **Wiring or Contact Fault:** When this LED is ON, it is an indication the LIT is detecting dry FOGRod contacts below wet contacts, which, under normal circumstances, is not possible.

How does the Wiring or Contact Fault work?: When the FOGRod & LIT system is operating normally, it is impossible for any FOGRod contact to be dry below a wet contact. When the LIT detects this condition, a Wiring or Contact Fault is indicated. If a FOGRod wire becomes disconnected, or if a FOGRod contact is damaged, this fault will occur. Water splashing on the FOGRod can also cause this fault to occur. When this fault LED is ON, the 'Wiring/Clean' Fault Relay is activated. This fault does NOT latch and will come and go in the case of water splashing the FOGRod.

-
- **Clean FOGRod:** When this LED is ON, it is an indication there is or was a FOG event. This fault will LATCH and stay active until someone manually clears the fault with the front panel slide switch.

How does Clean FOGRod work? This feature is ONLY active when the 'Clean FOGRod Alert' slide switch is in the ON position. A 'FOG' alert condition exists when two or more contacts become wet at the same time (FOG'd). This condition is not possible under normal conditions. When this condition first occurs, the Clean FOGRod LED will start to blink. The first valid Level LED will also turn ON along with the Level Relay switch. The FOG'd contacts must stay wet for at least 3 consecutive minutes. After 3 minutes, the Clean FOGRod LED will stop blinking and go solid-ON. The Level LEDs associated with the FOG'd contacts will start to blink. The Level Relay switches associated with all FOG'd contacts will activate. Lastly, the 'Wiring/Clean' Fault Relay will Latch in the activated state. This fault can only be cleared when you manually move the front panel 'Clean FOGRod Alert' slide switch to the OFF position then back to the ON position. For more information regarding the Clean FOGRod Alert feature, refer to the 'Grease Build Up and Ragging' section on page 49.

The Clean FOGRod Alert shares the same fault relay as the Wiring/Contact fault. If you use a PLC to monitor the Wiring/Clean Fault relay, be sure to identify it as **BOTH** a wiring/Contact fault or a 'Clean FOGRod' Fault. Knowing the wiring/Contact fault does NOT latch and the 'Clean FOGRod fault DOES latch, you can tell which fault occurred by inspecting the LIT front panel to see if the Clean FOGRod LED is ON, or the PLC/controller data history.

The Clean FOGRod Fault can be cleared by sliding the switch to OFF, then back to the ON position.

Front Panel Slide Switches

Level Relays

This slide switch controls the state of the relay switches when the relays are **not** activated. EX: in the N/C position, the relay switches will be Closed when the relays are not activated (DRY). When a relay activates, the switch opens creating an open circuit.

Fault Relays

This slide switch has the same function as the Level Relays switch, except it applies to the two Fault Relays.

Delay-Level Relays

This switch sets the length of time a contact must remain continuously WET or DRY before the LIT responds. EX: 10 sec position- LIT detects contact #1 is wet and then checks continuously for 10 seconds. If contact #1 remains wet for the entire 10 second period, the 10% LED is turned ON, Level Relay #1 is activated and the 4-20mA output is set.

Setting the Delay to 10 seconds helps to prevent false readings caused by turbulence and splashing in the well and other events that could briefly cause a contact to become wet, but not actually submerged under water.

Clean FOGRod Alert

This switch controls whether the 'Clean FOGRod' feature is on or off. When this feature is ON, the system will detect and manage ragging and grease buildup that normally would cause false pump activation. This feature was designed for wastewater wells where ragging and grease buildup are common. For non-wastewater installations, this feature should be turned off. For additional details on this feature, refer to the Clean FOGRod LED paragraph top of page 42 and the Grease Build up and Ragging section on page 49.

When using this feature, sliding the switch OFF then ON again will clear any FOGRod Alerts that may be indicated.

Conductivity Threshold Adjustment

The Conductivity Threshold located on the Front Panel of the LIT is adjusted using the supplied small flat blade screwdriver. The factory default setting of 50 will be correct for most installations. This setting controls the LIT's sensitivity to when a FOGRod contact is detected as wet/submerged or dry. When dealing with very pure liquids that don't conduct well, a slightly higher setting around 100 may be needed before the LIT registers level in the well. Settings of 100 or more should only be used when dealing with the purest of liquids. Very high settings can cause false level indications when used incorrectly. The LIT will detect typical wastewater at settings around 3, but the default of 50 is best for all situations. If you're wastewater installation won't detect level unless set at 100 or higher, it may be an indication of an underlying installation issue. Refer to the troubleshoot section on page 51 for more information.

Terminal Block Connections – Inputs & Outputs

All LIT inputs and outputs are accessed using built in terminal block connections. A small flat blade screwdriver (provided) is used to secure all wires. Terminal block screws should be tightened just enough to prevent wires from pulling out. Overtightening terminal block screws will damage the internal circuit board. Refer to the specifications section on page 63 for complete technical information.

 **Do NOT overtighten terminal block screws. Doing so will damage the internal LIT circuit board**

DC +

Connect the positive (typically red) terminal of an isolated power supply to this location on the LIT. Make sure the power supply is a DC type, and NOT AC transformer type.

DC –

Connect this negative (typically black) terminal of the isolated DC power supply to this location on the LIT.

Do NOT connect the DC- input to panel ground. Instability, LIT damage and compromise of UL safety requirements might occur.

BAT +

A backup battery can be connected to this terminal. In the event your main power supply fails, the battery will provide power until the main power is back online. Connect the positive terminal of the battery to this location on the LIT. The negative terminal of the battery connects to the DC – input on the LIT. Do NOT connect DC- to panel or earth ground.

LIT supply and battery backup do NOT have to be the same voltage.

FOGRod Return

The FOGRod Return input on the LIT must be connected to the panel ground terminal or any ground terminal that has excellent connections to the submerged well grounding, like pumps, ladders, pipes etc. If ground connections to these points in the well are not possible or are unreliable, a dedicated return rod can be installed in the well. Refer to page 50 for details regarding a dedicated rod. Refer to the 'FOGRod Return Signal' section on page 38 for technical information regarding the signal.

The FOGRod Return connection is critical for stable system operation. Close attention is needed to ensure all connections are clean and secure between the LIT and the grounding in the well.

Level Relays 1-10

There is one Relay Switch associated with each of the 10 metal contacts on the FOGRod for a total of 10 Relay switches. The relay switches can be accessed via the terminal blocks on the LIT. The Level Relay switches are basic ON/OFF switches. The Level Relays activate when the corresponding metal contact on the FOGRod becomes WET. The Level Relays de-activate when the contact becomes DRY. The ON/OFF (closed/open) state of the Level Relay switches are controlled by the NO/NC switch on the front panel of the LIT. **EX:** If you want an alarm light to turn ON when level reaches 90%, you will need to make sure the LIT front panel slide switch is in the N/O position. This way, when the 90% relay activates, you know the switch will close and turn the alarm light ON.

All Relay Switches are isolated from each other which means you can connect any required voltage to any Relay Switch. It is OK to have one Relay switch switching 120vac and the Relay Switch right next to it switching 12vdc.

The LIT automatically activates all Level Relays below the highest level in the well. **EX:** Level in the well goes over Contact 6 and contacts 4 & 5 are covered in grease making them look dry to the LIT. In this case, until level reaches #6, Relay Switches #4 and #5 are NOT activated because they look dry to the LIT, but when the level goes over #6, all Level Relays from 6 down to 1 will activate, regardless of whether the LIT sees contacts 1 through 5 as wet or dry. This ensures that your Lead and/or Lag pumps will always turn ON, just at a higher level in the well.

The LIT automatically activates all Level Relays below the highest level in the well. This ensures that your Lead and/or Lag pumps will always turn ON, just at a higher level in the well.

Refer to the section “Control using the LIT Level Relay Switches” on page 26 for additional technical detail on the Relay Switches.



Never connect pumps or motors directly to the Level Relay Switches. The relay switch contacts will burn out. Refer to page 64 for complete Relay Switch specifications.

The LIT does NOT provide pump alternation or latching relay functions. The LIT Level Relay Switches operate like float switches. They turn ON when the level is above a point and turn OFF when below a point.

Fault Relays

The LIT provides two Fault Relay switches (listed below). The Fault Relays change state when faults occur as described below. Refer to the 'Fault LEDs' section on page 41 for additional details.

#1 'Cable' Fault Relay: Cable Open-Circuit or Short-Circuit fault occurs
Latching-NO

#2 'Wiring/Clean' Fault Relay: Wiring-Contact Fault occurs, *Latching - NO*, or Clean FOGRod Alert occurs, *Latching-YES*.

*The 'Wiring/Clean' Fault Relay can be activated by the 'Clean FOGRod Alert' (latches) or the 'Wiring-Contact fault (NON-latching). **Make sure remote PLC equipment identify this fault relay correctly.***

FOGRod Inputs

There are 12 terminal block connections located on the LIT for the FOGRod. There are 12 individual wires inside the FOGRod cable. The wires are color coded and match the colors on the LIT's front panel. Refer to 'The FOGRod' section on page 48 for additional details.

1-10

The FOGRod's 10 metal contacts are connected to their own uniquely colored wire inside the FOGRod cable. Connect those wires to inputs 1-10. This provides the signal path for the FOGRod Return Signal.

FS

One pink wire is used for the Failsafe Feature. Refer to the Fault LEDs section 'How does Cable Open/Short Circuit work' on page 41 for technical details regarding this feature.

SHIELD

There is a single bare (Drain) wire in the FOGRod cable. This bare wire connects to the Shield input on the LIT. ONLY the drain wire connects to this input. DO NOT connect this input to anything else, including the panel ground connection. This is NOT a ground connection.

4-20mA Analog Output

Refer to the section "Control using the LIT 4-20mA Analog Output" on page 30 for a technical description of this output.

Lightning Bolt input

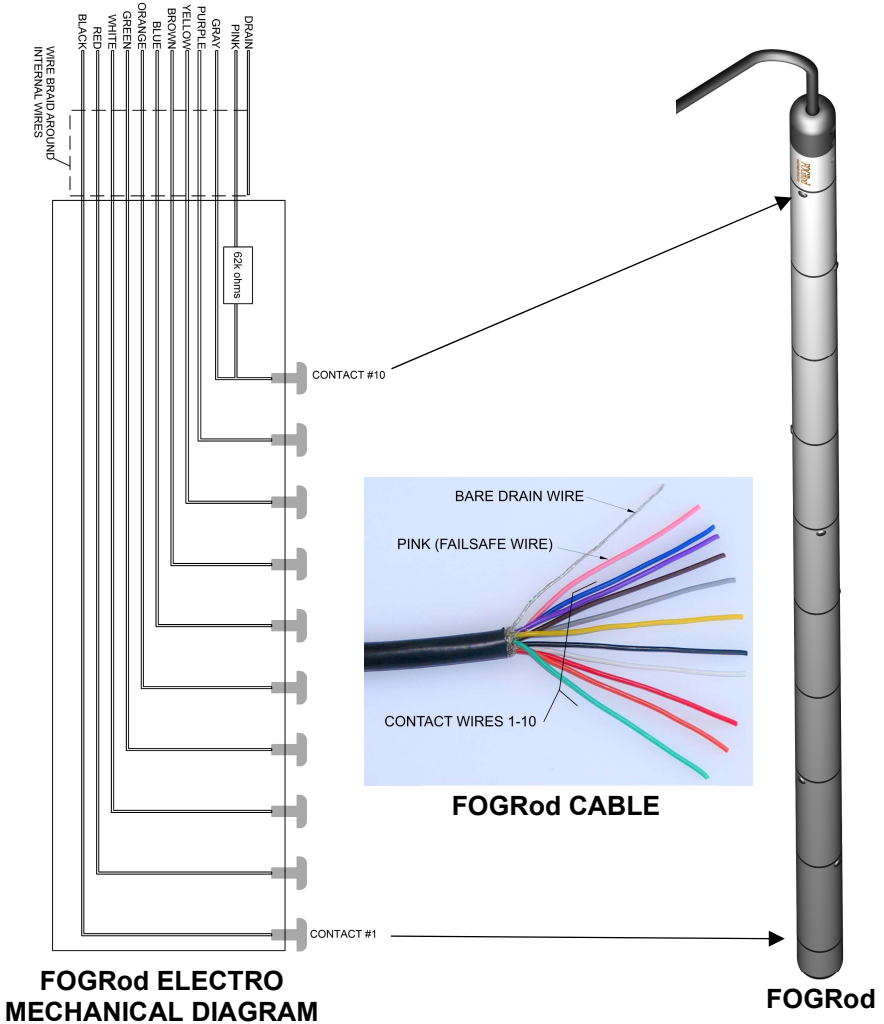
This connection should only be used when a site is known to have frequent equipment issues caused by nearby lightning strikes and large static surges.



***Do NOT connect the Lightning Bolt input to Panel Ground.
Refer to page 17 for more information.***

THE FOGRod

The FOGRod is a simple passive electrical device. It consists of 10 corrosion resistant AL6XN metal contacts, connecting wires and cable inside a single piece PVC shell. The cable and entry point into the FOGRod can withstand a pulling force of greater than 150lbs. The FOGRod has no problem bumping and banging around inside the well. It is extremely durable.



GREASE BUILD UP AND RAGGING

The LIT's '**Clean FOGRod**' feature uses patented logic to overcome and prevent common issues caused by grease build up and/or objects and rags caught on the FOGRod inside the well. These common issues include:

- Short cycling of pumps
- False readings; multiple contacts appearing wet at the same time

This feature was designed for wastewater wells where ragging and grease buildup are common. For Non-wastewater installations, this feature should be turned off.

All wells, regardless of size or inflow rate, fill up then get pumped down. No well can fill up instantly or can the well be pumped down instantly. The LIT knows this. Any time the LIT detects more than one contact going wet at the same time, or detects contacts that are wet *above* other contacts that are dry, the LIT knows this is not possible. The LIT then turns on the appropriate fault LED(s) and activates the appropriate fault relay and sets the 4-20mA output as appropriate.

Short cycling of pumps can occur on *NON*-FOGRod systems due to the issues mentioned above. Grease or a rag can basically short out all contacts from the bottom of the rod to at least the Lead Pump level. When this happens, *only* the bottom of the rod need get wet for all contacts up to the Lead Pump level to *appear* wet. The Lead pump then goes ON, and very quickly the well is pumped below the end of the rod and the pump goes off. This very fast on/off 'short cycle' will repeat and is generally very bad for pumps. The pump will go on/off until the rod is cleaned or the pump burns out.

Short cycling will not occur with the LIT-FOGRod system. ***The LIT will always wait a minimum of 3 minutes before activating level relays any time the LIT detects multiple contacts becoming wet at the same time.*** The only level relay that is immediately activated is the one associated with the *first* valid wet contact. In many cases, a rag will fall off the FOGRod *before* the 3 minute period is up in which case the LIT clears the fault and returns to normal operation. If the rag falls off *after* 3 minutes, the LIT will return to normal operation, however, the Clean FOGRod fault LED will remain ON along with the Wiring/Clean Fault Relay switch. The offending Level LEDs will blink so you know which contacts the fault occurred on.

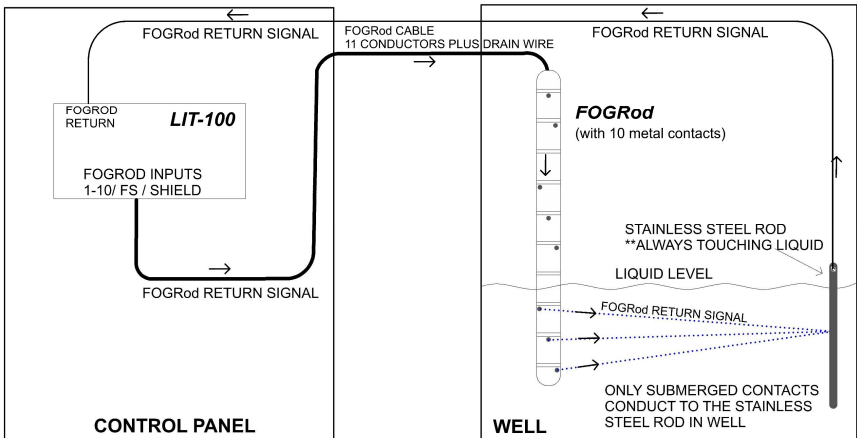
FOGRod RETURN ROD IN WELL- WELL NOT GROUNDED

The importance of a good FOGRod Return Signal path has been discussed several times in the manual. Sometimes, the typical AC Power Ground circuit will not provide an adequate signal path for the FOGRod Return Signal. Some wells may have no grounding inside the well at all.

For sites where the AC Power Ground circuit cannot provide an adequate path for the FOGRod Return Signal, a dedicated in-well metal rod can be used. The in-well rod will provide the ideal return path for the FOGRod Return Signal. The diagram below illustrates the use of the FOGRod 'Return Rod' in the well.

Key points:

- The Return Rod must hang lower than the FOGRod. The water in the well must touch the Return Rod first before the water reaches the FOGRod.
- The Return Rod should be stainless steel, so it will not corrode. Most other materials will quickly oxidize and corrode disrupting the FOGRod return signal.
- It would be best to use a stranded 18-24awg insulated wire to run from the Return Rod back to the input on the LIT. Solid wire or other size wire can be used if necessary.



FOGRod RETURN SIGNAL PATH USING A DEDICATED RETURN ROD IN THE WELL

TROUBLESHOOTING

This section is broken into two parts. One part describes how to do quick checks on the LIT and FOGRod to make sure they are working correctly. The second part includes a discussion on electrical noise and a table designed to help you track down solutions to possible issues you may run into.

If you run into an issue that is not covered in this manual or if you just need additional support, feel free to contact us at any time.

LIT-100 QUICK CHECKS

The checks described below will confirm operation of the LIT's primary inputs and outputs.

If you need to check inputs/outputs that are not covered in this section, Contact WWL for information regarding those checks.

Tools needed:

- Jumper wire, stripped at both ends, about 12 inches long and about 22awg.
- Digital Volt Meter (DVM) for measuring resistance

When you first power up the LIT, all front panel LEDs go ON, then OFF. This is an LED test to confirm all LEDs work. You will then likely see the 10% Level LED go ON then OFF, then the 80% go ON/OFF. This indicates the firmware version is V1.8. The green power LED will go ON and stay on solid and never flash or blink.

The DC+ and DC- are fused inputs, so if you can't get the LIT to turn on at all, it's likely the internal fuses are blown. The LIT will need to be sent back for repair as these fuses are not user serviceable.

FOGRod Input check

Be aware! This check will create faults and will cause Level and Fault Relays to activate and deactivate. It is assumed the LIT is already ON. Slide the 'Delay' switch on the LIT to the 1 sec position for these checks.

1. Disconnect all FOGRod wires from the LIT.
2. Connect one end of the jumper wire into the Shield input.
3. Insert the other end of the jumper wire into FOGRod Input #1. You should see the 10% LED go on after 1 sec.
4. Now insert into input #2. You should see 20% go ON. If you keep holding for 8 seconds, you will create a wiring/contact Fault.
5. Now continue and insert into each input up to #10 to make sure each Level LED will turn ON and OFF.

4-20mA Output: *If your PLC uses this output, you can monitor the PLC during the FOGRod Input check to make sure the PLC is receiving and reading level properly.*

FOGRod Return input check

Remove any wires connected to the FOGRod Return input. The FOGRod Return is a fused input. If the fuse is blown, the input will not function, and the LIT will not detect level in the well.

1. Connect the jumper wire into the FOGRod Return input.
2. Insert other end of the jumper wire into FOGRod input #1. The 10% LED should turn ON. This confirms the FOGRod Return Input is OK.

Level & Fault Relay Switch contacts check

This check will confirm the relays will activate and deactivate. It will also confirm the relay contacts are OK by measuring the contact resistance, which should be less than 0.10 ohms.

There is a simple way to activate and deactivate all the relays for this check. Moving the LIT front panel relay slide switch from N/O to N/C will change the state of ALL the relays for that slide switch. The relay switches will open/close, depending upon their initial state.

1. Remove all wires connected to the relay inputs. Turn OFF all power to the wires before removing the wires.
2. Set your DVM to measure resistance, lowest range.
3. Insert the two DVM probe ends into the inputs for Level Relay #1. Your meter will immediately display either an 'OPEN O/L' or 0 ohms.
4. While still holding the probes in place, slide the Level Relays switch back and forth. You should hear all the relays clicking inside the LIT. You should also see your meter change from reading 0 ohms to reading Open-O/L or the other way around depending upon the initial position of the front panel switch. This indicates the relay switch and contacts are OK.
5. Repeat this for all 10 Level Relay inputs.
6. Also repeat for the Fault Relay inputs. Slide the Fault Relays slide switch back and forth.

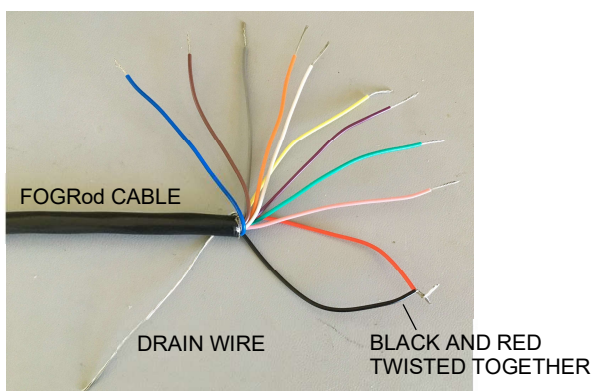
Any resistance reading greater than 0.3 ohms might be a sign the relay contacts are going bad or are already bad. Typically relay contacts only go bad when operated outside of their specifications. Refer to the specification section on page 63 to see the full relay specs. Make special note to ensure the current specification is not being exceeded.

****This concludes the verification of the LIT's primary inputs/outputs****

FOGRod QUICK CHECKS

The following steps will verify the entire FOGRod is good or bad. You will need a digital meter (DVM) to measure resistance for these checks. A *shorter easier less comprehensive check* is included on the next page and may be adequate to determine if the FOGRod is bad.

1. Disconnect the FOGRod wires from the LIT and pull the FOGRod out of the well and put it on the ground.
2. Twist the FOGRod Black and Red wires together (see table below).
3. Touch your DVM probes to FOGRod contact #1 & #2. You should measure less than 10 ohms.
4. Untwist the black and red wires until they are apart and not touching
5. Follow the table below to check the rest of the wires/contacts.



TWIST THESE TWO WIRES TOGETHER		PROBE THESE TWO CONTACTS		PASS CRITERIA	COMMENTS
Black	Red	1	2	0-10 ohms	Contact 1 is located near the bottom
White	Green	3	4	0-10 ohms	
Orange	Blue	5	6	0-10 ohms	
Brown	Yellow	7	8	0-10 ohms	
Purple	Gray	9	10	0-10 ohms	Contact 10 is located near the top
Gray	Pink			55k-65k OHMS	**Probe wire ends only. Do not twist any wires together for this check.
All wires	Drain wire			OPEN <i>no connection</i>	**Probe the wire ends only. Do not twist any wires together for this check.

Shorter-Easier Check

If only one or two Level LEDs are stuck ON or never turn ON, you can perform the following brief checks to determine if the FOGRod is bad.

Example 1: 30% level LED is **always ON** whether the contact is wet or not. 40% level works normally.

Procedure, when both 30% and 40% are above level (dry) in the well:

1. Remove 30% and 40% FOGRod wires from LIT.
2. Install 30% wire into 40%/green LIT input. Does the 40% level LED turn ON? Does the problem follow the wire?

If the problem follows the wire, then this tells you the FOGRod is bad.

Example 2: 30% level LED is **always OFF** whether the contact is wet or not. 40% level works normally.

Procedure, when both 30% and 40% are below level (wet) in the well:

1. Remove 30% and 40% FOGRod wires from LIT.
2. Install 30% wire into 40%/green LIT input. Does the 40% level LED stay OFF? Does the problem follow the wire?

If the problem follows the wire, then this tells you the FOGRod is bad.

ELECTRICAL NOISE

Electrical noise can cause the LIT & FOGRod system to become unstable. The noise can cause LEDs to flash erratically, cause incorrect level indications and false faults that randomly come and go. While it is quite uncommon for a site to have electrical noise issues, they can occur.

This section will cover common causes and solutions for electrical noise.

The most common and normal sources for electrical noise at site installations are pumps and AC power control wires. This noise always exists, but when site grounding is not correct or when AC power wires are routed near DC power and control wires or when grounding is incorrectly connected to the LIT, this noise can get inside the LIT and cause problems.

Electrical noise can travel into the LIT through direct electrical connections, or through the air as RF transmitted noise.

Refer to the next page for actual causes and solutions for electrical noise that has created problems for past customers.

CAUSE	SOLUTION	COMMENT
Pumps not correctly bonded/grounded or not grounded at all.	Check pumps for proper bonding/grounding and correct if needed.	New pump installs and pump replacements most common.
LIT Lightning Bolt input connected to panel ground.	Disconnect from panel ground.	Old manual revision incorrectly described use of this input.
LIT shield input for the FOGRod Drain wire connected to panel ground.	Disconnect shield input from everything <u>except</u> the FOGRod cable drain wire.	Terminal blocks inside panels have incorrectly connected cable drain wire to panel ground.
LIT DC- input connected to panel ground or other ground.	LIT DC- should ONLY connect to the DC- output of the power supply.	DC power supply for LIT should be the isolated type ONLY.
Excessive electrical noise on panel ground due to unknown site issues.	Connect FOGRod return directly to stainless steel rod in well.	Refer to page 50 for more detail.
Sharing FOGRod wires terminal block with AC power wires.	Connect FOGRod wires directly to LIT or dedicated terminal block.	
FOGRod cable incorrectly spliced together exposing wires in cable to noise.	Splice cable as detailed in this manual. Use cable splice shield provided by WasteWater.	Refer to page 23 for details.
FOGRod Return wire routed with AC power wires.	Route as short as possible to panel ground away from all AC power wires.	See page page 16 for details.
FOGRod wires routed near AC power wires.	Keep FOGRod wires as short as possible away from all AC power wires.	

Tracking down system issues

When tracking down causes for system issues, it is especially important to accurately assess and record the status of the system. Be specific when you record the status. Every little detail can be a clue.

Here are a couple items that frequently are *not* recorded or reported accurately by personnel trying to track down causes to system issues.

- **'Flashing' LEDs or 'Blinking' LEDs:** The LIT will 'Blink' LEDs ON and OFF to indicate faults. The blinking occurs at a regular rate of around 0.5 seconds. The LIT never 'Flashes' LEDs intentionally. Flashing LEDs will appear to turn ON and OFF very-very quickly and randomly. Flashing LEDs typically indicate an electrical noise issue.
- **'Clean FOGRod Alert':** This manual mentions in many places that two different faults can cause the wiring/Clean fault relay to activate. Your remote Controller/PLC should know this and report it as two possible faults. Frequently, PLCs are incorrectly programmed to only recognize this fault relay as a 'Clean FOGRod Alert'. You really need to look at the LIT front panel and record the actual fault LED that is ON (or not).

Remember, a 'Clean FOGRod Alert' will LATCH the wiring/clean fault relay in the active state. A 'wiring or contact fault' will NOT latch the wiring/clean fault relay. You can see which fault has occurred by looking at the LIT front panel OR the remote PLC data logs. Wiring or contact faults can come and go. FOGRod Alert faults happen once and stay active until the fault is manually cleared on the front panel of the LIT by sliding the 'Clean FOGRod Alert' switch from ON to OFF and back to ON.

The table starting on the next page will help track down causes to possible system issues you might run into. As stated earlier, if the table doesn't cover the issue you are having or you just have additional questions, please contact us directly.

SYMPTOM	POSSIBLE CAUSES	SOLUTION
LIT-100 POWER LED-Green does not go ON.	Power supply providing power to LIT-100 is not correct type, correct voltage or not able to provide enough current.	Ensure it's a DC power supply and provides between 10-30vdc and can provide a minimum of 500mA, assuming the LIT-100 is the only device connected to the power supply. If other devices are also connected to the power supply, then you must add up the current for all devices and ensure there's at least 500mA available for the LIT-100.
	Power supply incorrectly wired	Double check to make sure the positive and negative wires coming from the power supply connect to the LIT-100 DC + and DC - inputs.
	Positive voltage accidentally connected to the lightning input or FOGRod Shield input or FOGRod Return input. Doing this will blow the internal fuses in the LIT-100.	LIT-100 unit will need to be sent in for repair or replacement. Contact support@wastewater-level.com for a repair number or replacement unit.
4-20mA Analog Output not working	<ul style="list-style-type: none"> -Incorrectly wired. -Loop voltage supply missing or not correct. -PLC not configured correctly. 	Review the 4-20mA setup detailed on page 30.

SYMPTOM	POSSIBLE CAUSES	SOLUTION
Cable Open-Circuit fault RED LED ON	Gray FOGRod wire not properly connected to LIT-100 FOGRod input #10 or wire is broken.	Double check wire to make sure it is securely installed into LIT-100 FOGRod input #10.
	Pink FOGRod wire not properly connected to LIT-100 FS input, or wire is broken.	Double check wire to make sure it is securely installed into LIT-100 FS input.
	Faulty FOGRod	Perform FOGRod quick check on page 54.
Cable Short-Circuit fault RED LED ON	FOGRod Gray wire and FOGRod Pink wires are shorted together.	Check Gray and Pink wire connections into LIT. Make sure there are no stray wire strands causing a short.
	Faulty FOGRod.	Perform FOGRod quick check on page 54.
Wiring or Contact Fault RED LED ON and one or more Level LEDs blinking	FOGRod cable wires not connected to LIT-100 in the correct order.	Ensure all wire colors match color on LIT-100 front panel. Take care with red and pink wires and orange and brown wires as these may be very similar in color.
	One pair of FOGRod wires reversed.	
	FOGRod Contact covered in grease.	Clean FOGRod using mounting bracket pad or power wash.
	FOGRod Contact missing or damaged	Replace FOGRod
	Water splashing on or running down FOGRod.	-Move a little further away from inflow. Move away from sources of water coming from above.

SYMPTOM	POSSIBLE CAUSES	SOLUTION
		-Decrease threshold in steps until false indications stop.
	Electrical Noise	Refer to page 55 for possible solutions.
Clean FOGRod RED LED ON	Conductivity Threshold set too high causing false level readings.	Turn Conductivity Threshold down to default 50. Refer to page 43 detailing the Conductivity Threshold settings.
	Rag or object caught on FOGRod	Clean FOGRod and re-check. Mount FOGRod closer to inflow so rags and cloths get dislodged from FOGRod more quickly. Do not mount FOGRod directly in the inflow path as this may cause false level readings and clean FOGRod alerts.
	FOGRod too close to inflow. Inflow splashing or directly hitting FOGRod.	Move FOGRod a little further away from inflow.
	Excessive condensation forming on FOGRod.	Turn Conductivity Threshold down slightly just below 50. Refer to page 43 for details regarding Conductivity Threshold settings.
None of the Level LEDs will go ON when FOGRod contacts are visibly submerged in well liquid.	FOGRod Return signal path broken.	Review page 38 to determine possible fault locations.
	Conductivity Threshold setting too low.	Set threshold to default 50. Refer to page 43 for more details.
	FOGRod return fuse blown.	Perform LIT-100 checks on page 52.

SYMPTOM	POSSIBLE CAUSES	SOLUTION
<p>Conductivity Threshold settings higher than 50 required for the LIT-100 to indicate any level in well.</p>	Pure liquid in Well	NONE, this is NORMAL.
	FOGRod Return signal path bad.	Review FOGRod return signal path section on page 38.
	Faulty LIT-100	Perform LIT-100 checks on page 52.
	Electrical noise getting into LIT	See the Electrical Noise detail on page 55.
<p>One or more Level LEDs not indicating correctly for submerged FOGRod contacts.</p>	FOGRod cable wires not connected correctly, or some wires reversed.	Ensure FOGRod wire colors match LIT-100 colors. Take care with red/ pink and orange/brown wires as these are very similar in color.
	Faulty FOGRod	Perform FOGRod quick check on page 54.
	Faulty LIT-100	Perform LIT-100 quick checks on page 52.
	Grease covering contact.	Clean FOGRod using mounting bracket cleaning pad.
Damaged or missing FOGRod Contact.	Inspect all FOGRod contacts. Replace FOGRod if contacts found damaged or missing.	
<p>False level readings. FOGRod contacts visibly NOT submerged (DRY) are reading a Level on the LIT-100.</p>	Conductivity Threshold set too high	Review the Conductivity Threshold settings section on page 43. Set threshold as described in that section.
	Faulty FOGRod	Perform FOGRod quick check on page 54.
	Faulty LIT-100	Perform LIT-100 quick checks on page 52.
	Condensation on FOGRod contacts	Review the Conductivity Threshold settings section on

SYMPTOM	POSSIBLE CAUSES	SOLUTION
	above level in well.	page 43. Set threshold as described in that section.
	FOGRod too close to inflow causing it to become wet above the level in the well.	Move FOGRod further away from inflow. Also , Review the Conductivity Threshold settings section on page 43. Set threshold as described in that section.
Level Relays not switching pumps or other external equipment	Relay switch contacts burned due to over spec usage.	Perform relay check on page 53. Refer to relay specifications on page 64.
LEDs <u>Flashing</u>* randomly	Electrical noise getting into LIT	Refer to Electrical noise section on page 55.

****Remember, the LIT LEDs NEVER flash. Flashing means the LEDs blink on and off very-very fast and randomly. LIT LEDs will only Blink at around .5sec intervals when some type of fault is detected.***

SPECIFICATIONS

LIT-100 - GENERAL

DESCRIPTION	SPECIFICATION
DC+/- Power Supply Input	10VDC to 30VDC, 4W max steady state Power-ON surge, 6W max
Temperature rating, Operating	-40 °F to 158 °F (-40 °C to +70 °C)
Temperature rating, Storage	-40 °F to 185 °F (-40 °C to +85 °C)
Maximum relative humidity	95%
Maximum altitude	6,560 ft, 2000 meters
Environment	Indoor use, Pollution Degree 2 and Overvoltage Category 2
Approvals	UL C-UL (CSA) CE RCM (Australia)
Dimensions	7" (W) x 4" (H) x 1.5" (D) 178mm (W) x 102mm (H) x 38mm (D)
Enclosure type	High impact ABS with DIN rail clip
Terminal Blocks	Wire Size: 22awg -14awg (0.7 - 1.6mm) Wire Rating: 194°F (90°C) or better rating only Wire type: Stranded or Solid Screw: Slot, 0.12" (3.1mm) dia. Torque: Maximum 2.6 in-lbs (0.3 Nm)

LIT-100 - INPUTS/OUTPUTS

DESCRIPTION	SPECIFICATION & DETAIL
Power Input, DC+ & DC-	10VDC to 30VDC, 4W max steady state Power-ON surge, 6W max *DO NOT CONNECT DC- TO PANEL GROUND*
Level & Fault Relays	<i>Contact Rating:</i> 240VAC / 30VDC 6A (resistive load) <i>NEMA Pilot rating:</i> B300 <i>Non-Active Open/Close State:</i> Configurable by LIT front panel slide switch
4-20mA Analog Output	Note: This output requires an external power supply to operate. The power supply must be isolated and only provide power to the 4-20mA output. <u>Do NOT</u> connect power supply negative to earth ground. <i>Power supply requirements:</i> 10VDC to 30VDC At least 100mA <i>Loop current accuracy:</i> +/- 0.10mA at each level.
FOGRod Inputs	10 inputs for contacts- 7VAC 1 input for Failsafe (FS) feature 1 input for cable drain wire (Shield) **DO NOT CONNECT TO PANEL GROUND**
Lightning Bolt input	Used to route electrical energy surges caused by lightning or other sources to earth ground rod. *DO NOT CONNECT TO PANEL GROUND*

LIT-100 - FRONT PANEL INDICATIONS and CONTROLS

DESCRIPTION	SETTINGS & DETAIL
Level LEDs	10 green LEDs. Only turn ON solid when a FOGRod contact is submerged/wet. Blinks ON/OFF during fault conditions.
Power LED	1 green LED. LED is ON at all times when power is connected to the LIT
Fault LEDs	4 red LEDs. <i>Cable Open Circuit, Cable Short Circuit, Wiring or Contact Fault, Clean FOGRod.</i> LEDs are ON solid during fault conditions. Clean FOGRod LED will blink for 3 minutes prior to going ON solid indicating a fault.
Conductivity Threshold	Default = 50k Range= 3k-300k ohms
Level Relays Slide Switch <i>N/O or N/C</i>	Controls the state of the Level Relay switches; Normally Open (N/O) or Normally Closed (N/C), when relay is non-active (not wet).
Fault Relays Slide Switch <i>N/O or N/C</i>	Controls the state of the Level Relay switches; Normally Open (N/O) or Normally Closed (N/C), when relay is non-active (no faults)
Delay-Level Relays Slide Switch <i>1 or 10 seconds</i>	Controls the amount of time between a FOGRod contact getting wet and when the LIT indicates submerged/wet. The Level LEDs, Level Relays, and 4-20mA output will not change state until the delay is complete. A contact MUST remain wet for the entire duration or it will not be indicated as wet.

FOGRod

DESCRIPTION	SPECIFICATION
Shaft, Top and Bottom Cap Material	PVC
Metal contacts	AL6XN (super-austenitic steel for extremely high corrosion resistance). 10 contacts on each -3, -5 and -7.5 model.
Physical Dimensions	<i>Diameter-</i> 1 ³ / ₈ in (35mm) <i>Total Length / Distance between contacts:</i> FOG-3 2ft 10in (863mm) / 3in (76mm) FOG-5: 5ft (1525mm) / 6in (152mm) FOG-7.5: 7ft 3in (2217mm) / 9in (229mm)
Weight	FOG-5: 5.5lbs (2.5kg), excluding cable FOG-7.5 7.7lbs (3.5kg), excluding cable FOG-3: 3lbs (1.5kg), excluding cable
Rating	NEMA 6P IP68 (10ft indefinitely)
Temperature rating	Operating: -40 °F to 158 °F (-40 °C to +70 °C) Storage: -40 °F to 185 °F (-40 °C to +85 °C)
Cable	Custom 11-conductor cable with braided shield & Drain wire, conductor size 20 AWG or greater Conductor & outer jacket insulation: PVC
Mounting bracket	Aluminum (powder coated) with polyurethane cleaning pad
Cable pull limit	180lbs MAX. This is the maximum pull force that can be applied to the cable before the cable breaks or pulls out of the FOGRod.

Specifications subject to change without notice

VERSION HISTORY

Manual

VER.		Summary of Changes	Pages Affected	Reason for Change
v2.5	July 28th, 2014	Cosmetic. Clarification for FOGRod cleaning based on customer feedback	p.8 (on half size letter version)	Minor clarification
v2.6	Feb 19th, 2015	Overlay text changed slightly. More explanation about the faults.	pp 4 & 19	Text change to LIT overlay
v2.8	April 20th, 2015	Added a history of changes. Explained new s/w features of v1.6.	All, due to slightly new page structure	New s/w version - <i>Clean FOGRod</i> alarm
v2.9	May 25th, 2015	Explained new s/w features of v1.7.	All, due to slightly new page structure	New s/w version - <i>Clean FOGRod</i> alarm
v2.1 0	Aug 18th, 2015	Added wiring details for Class I Div 1 for IS barrier from R Stahl	Added new page 24	New accessory
v2.1 1	Oct 29th, 2015	Updated troubleshooting	Updated p.27-28	Clarification
v2.1 3	Aug 12th, 2016	Add s/w v1.8. Updated commissioning, 3ft Fogrod & troubleshooting	Commissioning / Troubleshooting	New s/w version. Clarification.
v2.1 4	Oct 31st, 2016	Added approvals, including Canadian and European	p.31	Clarification
v2.1 6	Jan 19th, 2017	Updated for new lightning protection and new overlay text	pp 11 & 12	New wiring requirement
V3.0	Jul 31, 2020	Numerous updates and changes throughout.	All	
V3.1	May 15, 2022	Various updates throughout.	Many	Improve wording & clarity of text and diagrams. Highlight common install errors.

Software

VER.		
v1.5	June 4th, 2014	Minor change: Removed attempt to differentiate between bad grease build up and commissioning / cleaning of FOGRod
v1.6	April 20th, 2015	<ol style="list-style-type: none"> 1. <i>Clean FOGRod</i> alarm prevented from activating within 10 seconds of a power reset - to stop power resets activating the <i>Clean FOGRod</i> alarm 2. <i>Clean FOGRod</i> alarm “latches” (instead of resetting when the level drops below the contacts that were affected)
v1.7	May 25th, 2015	<p>Adds to the changes in v1.6 with a feature to minimize short-cycling due to grease and rags:</p> <p>When <i>Clean FOGRod</i> condition is detected, only the first new ‘wet’ contact activates a level relay, then an internal timer starts. At the end of the timer period if those same contacts are still apparently ‘wet’ the LIT activates all those level relays and latches the <i>Clean FOGRod</i> alarm</p>
v1.8	July 1st, 2016	Improved noise threshold of Cable alarms