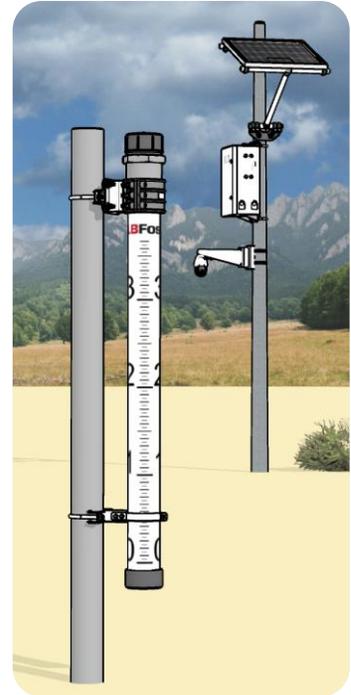


DOCUMENT VERSION

001

LAST UPDATED

7 February 2024



**Mk3-5
Inline Flood
Monitoring
System**

User Manual

LB Foster®

Document Change Log

Version	Date	By	Changes	Authorized
001	7 th February 2024	KK	Original Document	MC
002	5 th March 2024	MC	Updates to FCC ID details on page 6	MC

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Front Matter

Preface

This manual describes how to install and maintain the LBFoster® Mk3.5 Inline Flood Monitoring System. The main units of the system are custom designed and optimized to suit the site requirements, and the detailed specification may vary to this User Manual. But the system units and principles of operation will be the same. This manual is aimed at specialist service providers. This manual does not cover:

- > Testing of the flood poles after installation
- > Supply and installation of a new utility pole
- > Use of hole drilling equipment, elevated work platform (bucket truck, cherry picker), or other construction and earth moving plant and equipment.

Safety



⚠ NOTICE

Before starting any work, personnel must read and understand this manual and all related safety instructions before installing and maintaining the equipment.



⚠ WARNING

Only competent and authorized personnel can: install, operate, maintain, or repair the system; and only using the correct tools, equipment, and procedures.



⚠ DANGER

Working on operational infrastructure is hazardous. The following are needed: risk assessment, permit to work, and safe work procedures.



⚠ NOTICE

A utility pole is required for installing the Master Node and Solar Panel. An existing utility pole must be in suitable condition and regularly maintained, to ensure the safety and integrity of the system. LBFoster hold no responsibility for any maintenance or repair work on the existing utility pole. LBFoster recommended that a new purpose-designed utility pole with a concrete base is installed and maintained.

Signals and Statements

Signals, symbols, and precautionary statements are used in this manual to comply with safety standards: ANSI Z535, OSHA 1910, ISO 3864, and ISO 7010. They refer to important instructions and information that must be followed for safety reasons.

⚠ DANGER

A hazardous situation that if not avoided, WILL result in: death or serious injury; and can include major property damage.

⚠ WARNING

A hazardous situation that if not avoided, CAN result in: death or serious injury; and can include major property damage.

⚠ CAUTION

A hazardous situation that if not avoided, CAN result in: minor injury, moderate injury; and can include minor property damage.

⚠ NOTICE

A situation that if not avoided, can result in property damage, if ignored.

📌 TIP

Important or useful information is highlighted by: TIP or IMPORTANT

Product Manufacturer

This product is made by TEW Engineering Ltd of the LBFoster® Group of Companies.

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FCC Compliance



FCC ID 2BDI4FLDA021, contains FCC ID 2ASEORFM95C & XMR201903EG2SG.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference; and,
- (2) this device must accept any interference received, including interference that may cause undesired operation.

This device and its antenna(s) must not be collocated or operating in conjunction with any other antenna or transmitter.

Note:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

Modifications

No modifications may be made to the product without prior notification and approval by the manufacturer. Otherwise the product warranty will be null and void.

Disclaimer

The material in this manual is for informational purposes only. The products it describes are subject to change without prior notice, due to the manufacturer's continuous development program. LBFoster makes no representations or warranties with respect to this manual or with respect to the products described herein. LBFoster shall not be liable for any damages, losses, costs or expenses, direct, indirect or incidental, consequential or special, arising out of, or related to the use of this material or the products described here.

Glossary and Abbreviations

Term	Definition
ANSI	American National Standards Institute. A private, not-for-profit organization dedicated to supporting the U.S. voluntary standards and conformity assessment system.
DC	Direct Current, such as from a battery
FCC	Federal Communications Commission regulates interstate and international communications through cable, radio, television, satellite and wire.
ft	Feet / foot. 1 ft (12 inches) is 304.8 mm
IoT	Internet of Things
ISO	International Standards Organization. International standard-setting body of representatives from various national standards organizations.
ISP	Internet Service Provider. A company that provides access to the Internet.
LRU	Line Replaceable Unit
mm	Millimeter. 1 mm is 0.039 inch. 25.4 mm is 1 inch
Network	The phone/cell network which includes access to the Internet via an ISP
OSHA	Occupational Health and Safety Administration. A U.S Agency that sets and enforces standards for workplace health and safety.
SIM card	Subscriber Identity Module card

Introduction

System Description

The LBFoster® Mk3.5 Inline Flood Monitoring System is supplied as an installation kit to suit specific site requirements. The illustration below shows the main units of a typical system.

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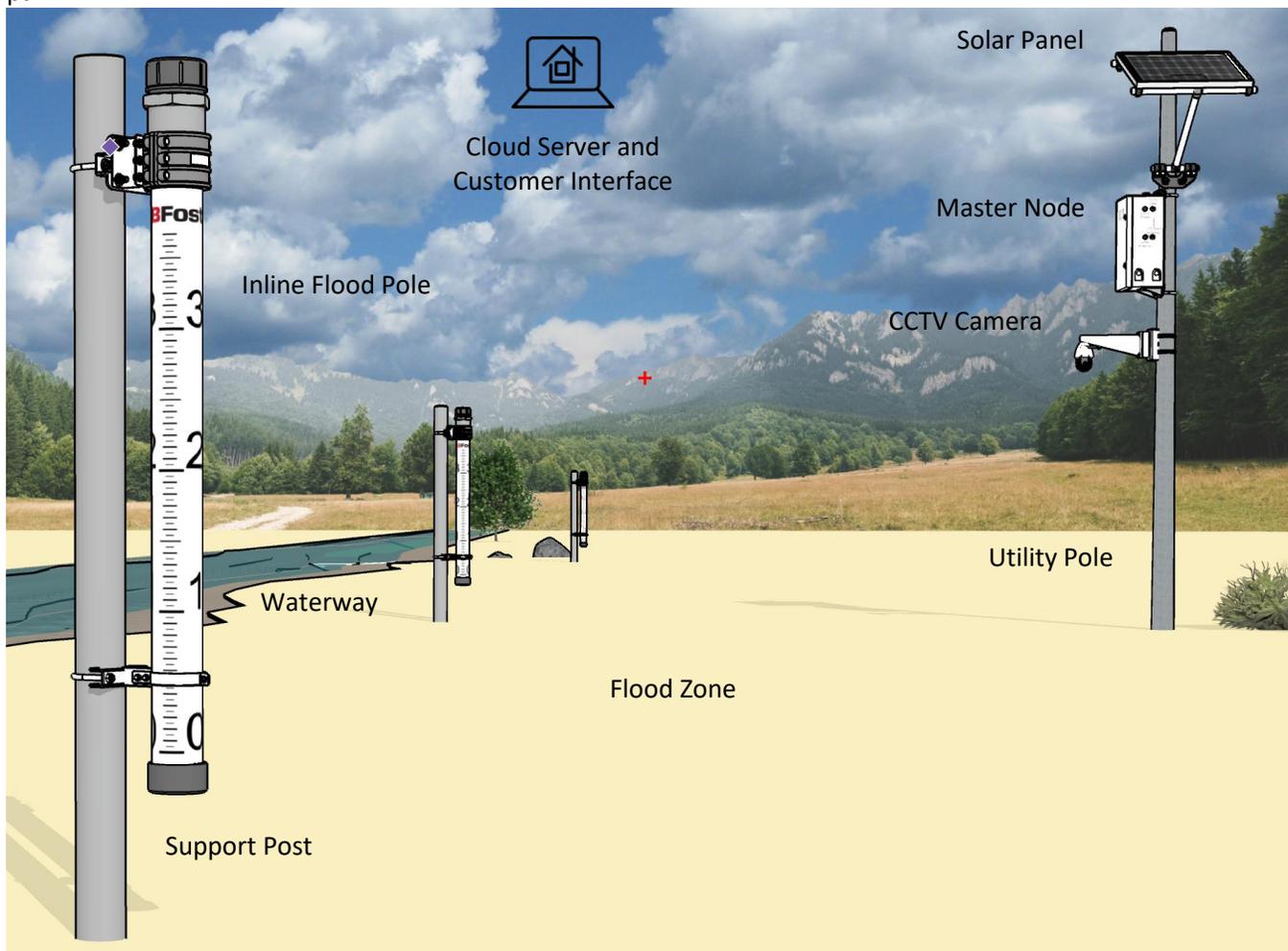


Fig 1: Main units of the Mk3.5 Inline Flood Monitoring System

Inline Flood Poles are placed at strategic locations in the dry flood plain or dry riverbed. They are not for immersing in water as that would trigger the alarm. Each inline flood pole is powered by long-life batteries that can last for several years. The inline flood poles contain sophisticated electronics that use capacitance sensor technology to detect if water is present and at what depth. The inline flood poles are factory calibrated for use.

Affixed to the utility pole are the Master Node and a solar panel. The Master Node is powered by solar energy with a 12-volt storage battery. The Master Node communicates with all the poles using line of sight radio; and communicates with the cloud server and Customer Interface via the cellular phone network. An optional CCTV Camera is available to remotely monitor the site and to capture photos for emailing during an alarm.

System Operation

The Mk3.5 Inline Flood Monitoring System operates as follows:

- > There are two flood level sensors and alarms on the inline flood pole: Zero Level and Variable Level.
- > If water is detected at the Zero Level Alarm, the system will send a message to the nominated email(s), and update the Customer Interface. This warning will also enable the Variable Level Sensor to begin detecting the water level as it rises/falls. If the optional CCTV is installed, photos of the site are also emailed.
- > If the water level is detected at the Variable Level Alarm Point, the system will begin detecting the level as it rises and falls. In this alarm state, an email alarm with site photos will be sent to the nominated email(s), and live video will be enabled on the web portal. If the optional CCTV is installed, photos of the site are also emailed.
- > The operational status of the flood detection system is monitored by the cloud server. If it does not receive adequate pole data or any communications from the Master Node, then approximately every hour, it will send a Condition Status Alert to the nominated email(s).

System Units

The main units of the Mk3.5 Inline Flood Monitoring System are custom designed and optimized to suit the site requirements. That means the detailed specification may vary slightly to this User Manual, but the main units and system principles of operation will be the same. The main units include: Inline Flood Poles (on support posts), Master Node, optional Solar Panel (DC supply instead), Customer Interface, and optional CCTV Camera.

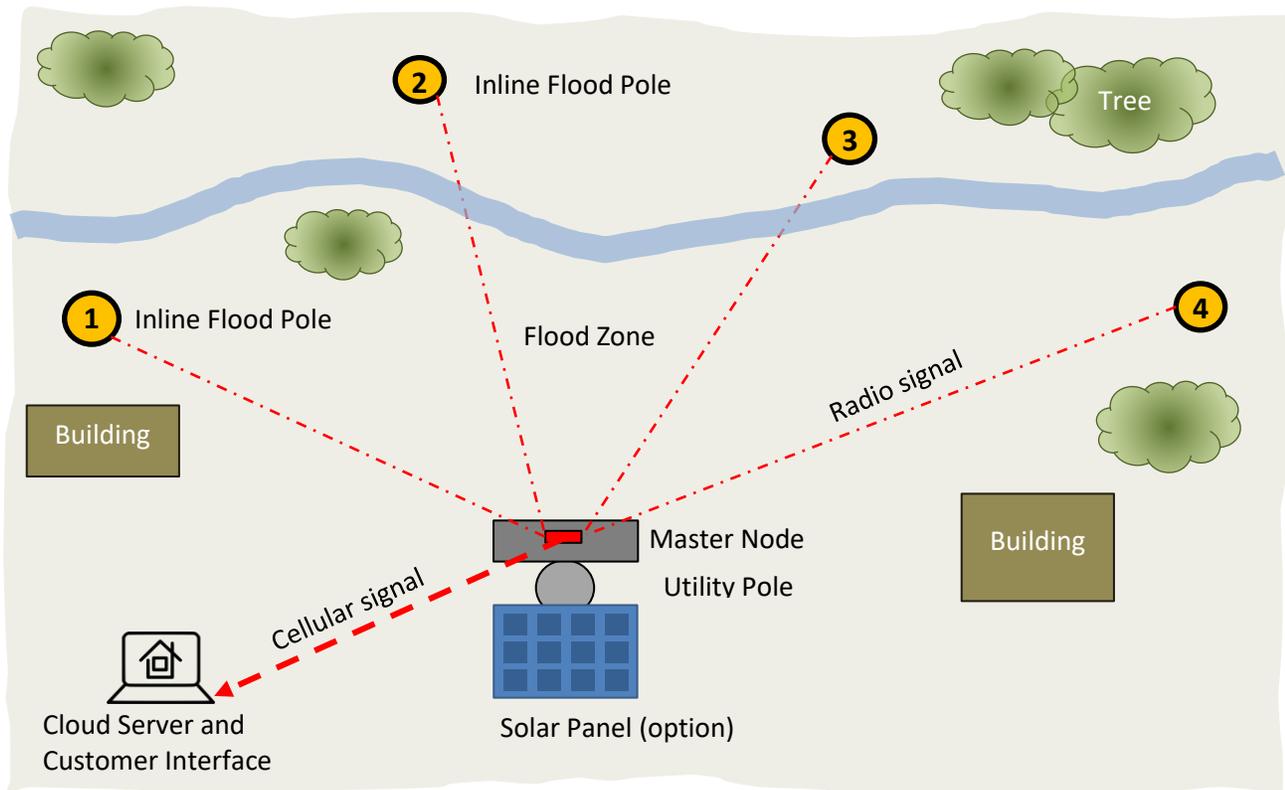


Fig 2: Plan view of a typical Mk3.5 Inline Flood Monitoring System

Inline Flood Poles

Inline flood poles are tubes of sophisticated electronics with a visual depth gauge along the side. They contain the aerial, electronics, water level sensors, and battery. Each is clamped to a rigid support post installed in concrete.

The poles are placed at strategic locations in the dry flood plain. The quantity and layout are determined to suit the: topography, site characteristics, expected water levels, ground level and stability.

Inline Flood Poles send their status, alerts, and alarms to the Master Node via a LoRa radio channel. There are two flood alarm sensors: Zero and Variable.

Zero Sensor: Detects the presence of water at Zero on the pole, to an accuracy of +/- 0.5 inch (13 mm). An alarm is sent when water reaches the zero level alarm point. When activated it activates the variable alarm sensor to detect the water level.

Variable Sensor: Detects the water level (height) on the pole, to an accuracy of +/- 0.5 inch (13 mm). An alarm is sent when water reaches the variable level alarm point.

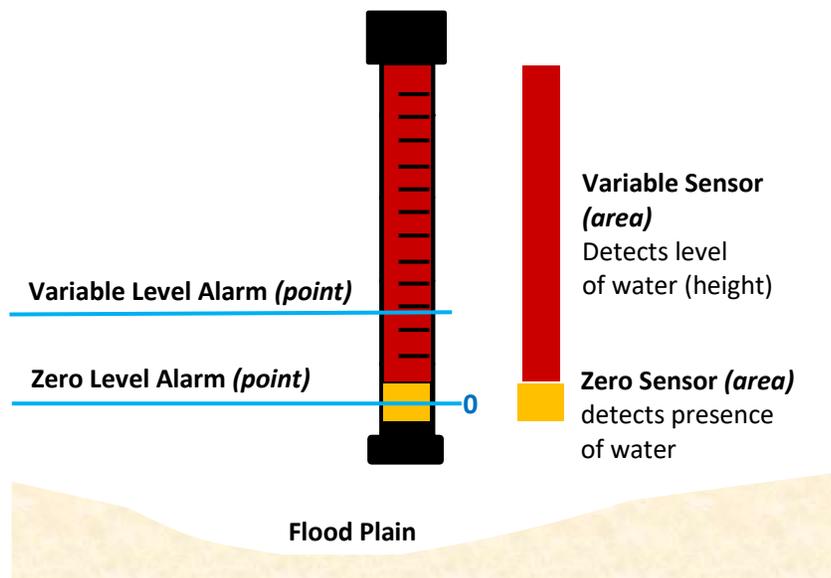


Fig 3: Alarms and sensors

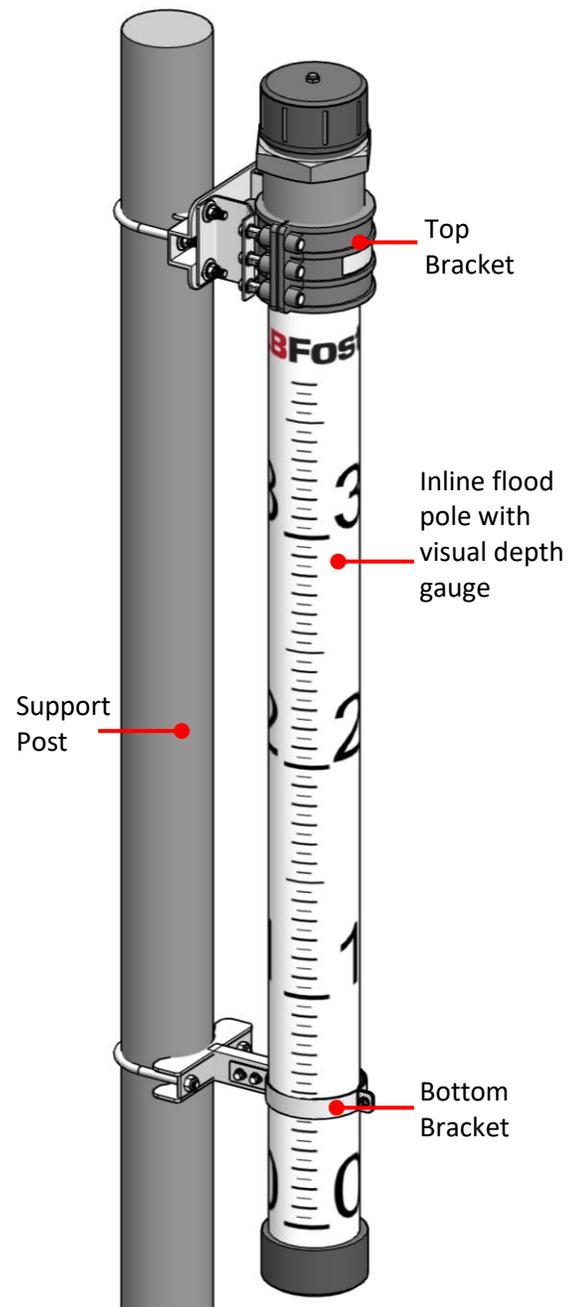


Fig 4: Inline flood pole and post

Master Node

The Master Node is fixed to the utility pole and comprises these main units:

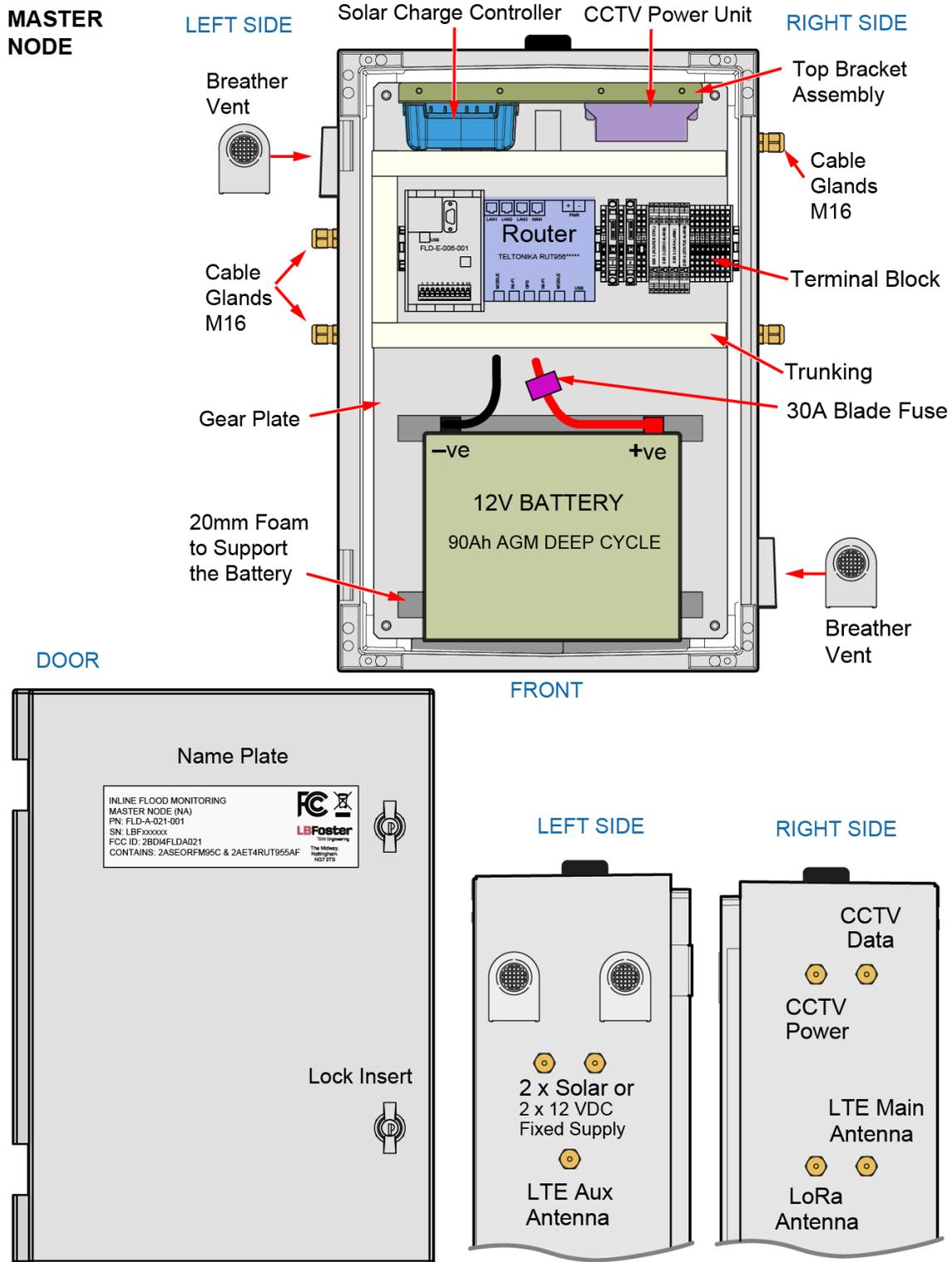


Fig 5: View inside a typical Master Node

Line Replaceable Units

The Master Node Housing contains the following Line Replaceable Units (LRUs):

- > Battery
- > Router
- > Sim Card

Router

On top of the housing is a radio aerial, which is connected to a router which contains a SIM card to communicate with the local cellular network. It turns on every hour for 5 minutes to upload one hour of site data from all flood poles. It is turned on for an hour during a flood alarm.

NOTICE: The Router is site specific and must be configured prior to commissioning. Network connection times are subject to network operator's availability, data speed, data quality, and signal strength, which are out of LBFoster's control.

SIM Card

The SIM card is multi-operator and can switch to different cellular network providers if one is busy or if the signal is not adequate. The full-size IoT SIM can either be supplied by the customer or LBFoster.

Permanent Power Supply

A 12 Volt DC power supply can be used to supply the Master Node instead of relying on solar energy.

Solar Panel

The high-efficiency solar panel converts solar energy into electricity, and charges a 12-volt battery inside the Master Node. The size of the solar panel will depend on the power requirements of the station and available sunshine for the region.

The solar panel is securely mounted to the utility pole above the Master Node to resist high winds. It is fixed at an angle to provide optimum solar efficiency. The angle and position of the panel will vary to suit the specific installation, region, and country.

Terminal block

The terminals on the right side are relay outputs to interface with local circuits to indicate: system health, zero level alarm, and the variable level alarm. Wiring is site-specific and LBFoster must be consulted for site specific wiring.



Fig 6: Solar panel on a utility pole

Utility Pole

A utility pole is required for installing the Master Node and solar panel. It can be made of steel, wood or concrete; installed to a suitable depth and foundation. An existing or new utility pole must be in suitable condition and regularly maintained, to ensure the safety and integrity of the system. Radio signals can sag so the Master Node must be installed high above ground on the utility pole, so that the radio signals can reach the inline flood poles. The height also provides security for the equipment.

Customer Interface

The Customer Interface is accessed by specific users with unique login and passwords via a web browser or smart phone application.

Power and Alarm Modes

Inline Flood Poles

The inline flood pole batteries are expected to last three years. There are no backup systems: mains, battery, or solar. Although there is only one power mode, the pole uses less power in default mode because it sends self-test data to the Master Node only every 5 minutes. During an Alarm, the poles send data to the Master Node every 20 seconds during the flood event.

Condition Status Alert

The operational status of the Mk3.5 Inline Flood Monitoring System is monitored by the cloud server. If it does not receive adequate pole data or communications from the Master Node, approximately every hour, it will send a Condition Status Alert to the nominated email(s). The router powers up for ~5 minutes to send an email.

Master Node

It is important to minimize use of energy because the Master Node relies on solar energy and battery storage. To minimize energy used by the Master Node, there are two power modes: Default (low power) and Alarm (high power). The default low power mode is where data is regularly uploaded from the Master Node to the cloud server approximately every hour. The router is turned off in low power mode, but powers up once per hour. The alarm mode turns on the router immediately for approximately one hour. The Master Node energy management system is designed to cope with several flood scenarios per day.

Power Modes

Default Mode (low power)

- > The Master Node is powered by solar energy with 12-Volt battery storage.
- > The Master Node is always powered on, but uses very little power.
- > The router is normally powered off.
- > The inline flood poles are always powered on, but use very little power. Every 20 seconds they perform self-tests for: water presence, battery condition, and communications signal. This data is accumulated and sent to the Master Node every 5 minutes (12 times an hour).
- > The router is powered approximately every hour for about 5 minutes to send pole status data to the cloud (12 sets of data per pole). It takes several minutes to boot-up and connect to the local cellular network as it tries to find the best connection and available provider. When a router is powered on, it will keep trying to make a call until it gets through.
- > The information on the Customer Interface will be between 1 and 59 minutes old.
- > The optional CCTV is normally powered off, unless requested to turn on.

Alarm Mode (high power)

- > Alert: The router is powered on for approximately 5 minutes to report an alert such as a failure of a pole to report its status.
- > Alarm: The router is powered on for approximately one hour during a flood alarm, to enable data to be sent to the Customer Interface.
- > Alarm: Poles send status data to the Master Node every 20 seconds, which sends the data to the cloud server every 20 seconds.
- > The optional CCTV is normally powered on for ~1 hour.

Unpack the Crate(s)

Notes

The units arrive in wood packing cases, protected using packing materials.

Keep all shipping documents, which can be on the outside and inside of the packing case.

Note that the metal support posts and a new utility pole are not typically supplied.

Process

1. Remove the lids from the packing cases.
2. Remove the sides of the packing cases for better access.
3. Cut open the inner packing material to reveal the equipment using safety scissors or safety cutter.
4. Check items against the packing list.

Safety

-  **CAUTION** Packing crates and items inside are heavy and may require mechanical aids. Perform a manual handling risk assessment and consider the: load, individual(s), task, and environment.
-  **CAUTION** Be safe: use PPE (gloves, eyewear) and correct tools and techniques for unpacking.
-  **CAUTION** During unpacking, avoid putting packing materials on walkways.
-  **CAUTION** Hammer down any protruding nails, to prevent causing nail injuries.
-  **CAUTION** During unpacking, care not to damage the items inside, such as when using a pry bar.
-  **CAUTION** Do not damage the surface of the flood poles. Use scissors (not a knife).
-  **IMPORTANT** If there is packing case or item damage, take photos, and contact LBFoster immediately.
-  **IMPORTANT** Keep the poles in their protective carry bags to protect them during transport to site.
-  Keep packing materials in a marked area. Re-use packing materials for transport to site. But if not, discard them in an environmentally safe way.



Use safety scissors or a safety cutter to remove soft packaging

Installation

Safety

DANGER

Follow the local safety procedures for the specific installation.

DANGER

Install equipment on the utility pole below and safely clear of overhead power wires/cables. Take precautions to eliminate the risk of electrocution from overhead electrical power wires/cables.

WARNING

Installation must only be performed by authorized and competent personnel, using the correct tools, equipment, and procedures.

WARNING

Perform a site-specific risk assessment before starting the installation work, to remove or reduce risks to as low as reasonably practicable, by applying controls.

WARNING

Installation hazards might include: remote working, remote travel, vehicles, working at height, manual handling, extreme temperatures, waterside working, using power tools, mobile plant, and abrasive/cutting wheels.

CAUTION

If a new utility pole is to be installed, it is safer to install the equipment and connect the wires when the pole is on the ground.

CAUTION

If the equipment is to be installed to an existing utility pole, it will involve working at height hazards. Use an elevated work platform. Do not use a ladder.

CAUTION

No smoking during handling or installation of the 12-volt battery. Do not remove the vent caps. The battery emits small amounts of flammable hydrogen gas. Keep the battery away from heat, sparks, open flames, and hot surfaces.

CAUTION

For lifting and carrying heavy items; perform a LITE manual handling risk assessment: Load, Individual(s), Task, and Environment.

CAUTION

The 12-Volt DC battery can create an electrical arc (flashover) due to a short circuit, which can generate intense heat leading to skin burns.

NOTICE

Check connections are correct before connecting the 12-Volt DC battery. Install the battery after the housing is secure on the utility pole.

NOTICE

Cable insulation and conduit that is used for installation must suit the ambient operating temperatures and be suitable for outdoor use.

NOTICE

Inside the inline flood pole, there are no user serviceable parts except the batteries.

NOTICE

The solar panel has a protective cover of high transmission glass. Take care not to damage the glass during transport and installation, or water will get in and cause the solar panel to not operate efficiently or at all.

NOTICE

Do not install the Master Node housing with the battery in it. Remove the battery if it is in the housing. It is easier to install the housing because it will be lighter, have more room for termination work, and be safer because it is disconnected.

Site Layout and Installation

IMPORTANT

Inline flood poles must have a clear direct line of site to the Master Node. No objects in the way such as: buildings, structures, trees, rubbish, branches, or vegetation.

Inline flood poles must be placed away from objects by at least 1.6 feet (0.5 meters) (or check with LBFoster design) including: metal posts, electrical conductors, railroad tracks, metal buildings, and vehicles. Otherwise the accuracy of the level measurement will be reduced.

Inline flood poles must only be placed in a dry flood plain or dry riverbed, not immersed in water or mud because that would trigger the flood alarm.

The maximum distance between the Master Node and each inline flood pole is 2,600 feet (800 meters).

Installation Plan

Site Survey

To ensure an optimum installation, it is recommend that LBFoster perform the site survey.

Layout Considerations

Some important considerations for the location of the inline flood poles are:

- > The location of each inline flood pole will affect the length of the support post. For example, if the bank falls away from the area by a small or large amount. Posts need to be longer if they are placed relatively lower to the area.
- > Locate inline flood poles away from objects such as: electrical conductors, railroad tracks, metal buildings, and vehicles. Otherwise level measurement accuracy will be reduced.
- > Put inline flood poles in a dry flood plain or dry riverbed, not in water or mud; or the alarms will trigger.
- > Position each inline flood pole with a clear direct line-of-site to the Master Node, up to a maximum distance of 2600 ft (800 m). The path must be clear of: buildings, structures, rubbish, trees, branches, and vegetation. This might require removal of bushes, branches, and rubbish, or re-siting the posts or Master Node.

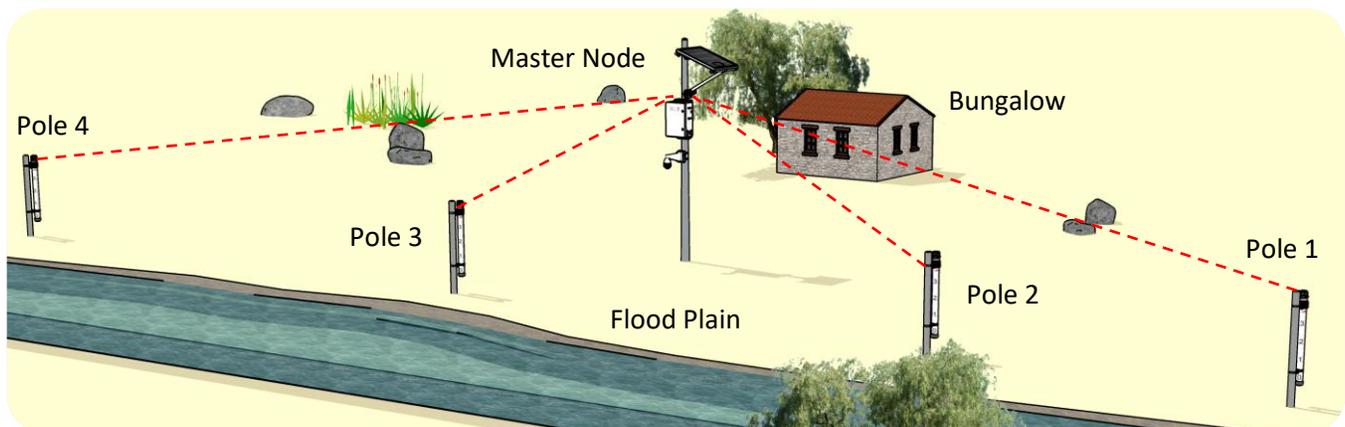


Fig 7: Lay out the site using GPS-mapping

Tools and Equipment Considerations

These metric tools are needed for typical installations, but are subject to change per installation.

- > Metal support posts, 3½ inch outside diameter (90 mm). Install vertically to within 5 degrees. Able to resist expected flood water flows that can contain debris.
- > New or existing utility pole for the Master Node to be mounted to. It can be made of wood, metal or concrete; to a suitable depth and foundation.
- > Power cable, single-core insulated wire to suit the site temperatures.
- > Communication cable: insulated wire to suit the site temperatures.
- > Elevated work platform for safe access the utility pole and top of the support post.
- > Battens and rope to brace the metal support post during concrete curing of the foundation.
- > Builder's spirit level for setting the support posts to plumb.
- > Selection of spare fuses.
- > Hole digging equipment for the support posts and utility pole (manual or machine).
- > Foundation materials for each metal support post:
 - Per round hole, 8.3 cubic ft (0.24 m³) of concrete/post-crete, and 1 cubic ft (30 litres) roadbase
 - Per square hole, 11.3 cubic ft (0.32 m³) concrete/post-crete, and 1 cubic ft (36 litres) roadbase.
- > Regular construction tools and equipment.
- > Wrenches and sockets to suit M12, M10 and M6.

NOTICE: On hexagon fasteners, avoid using mole grips, pipe wrenches, pliers, or stilsons, as they damage the hexagon heads/nuts.

Length of the Support Post

The length of the 3.5-inch diameter (90 mm) metal support post depends on each site’s location and how high above ground level the inline flood pole is to be installed.

- > For railroad sites, this also depends on the difference in height between the flood plain and the rail track top. This can vary due to tracks that can be: level, sloped, or banked; and the flood plain which can be: level, sloped, or undulating.

To calculate the length of the support post, determine where the Variable Level Alarm is to be. Then decide on the distance below that point, to warn when water is present i.e. the Zero Level Alarm. The Zero Alarm point will enable calculation of the length of support post required, and the height at which to mount the pole on the post.

- > To recap: there are two alarm points: the variable level and the zero level.

IMPORTANT: The inline flood pole and brackets can be moved up/down to set the Zero Alarm point.

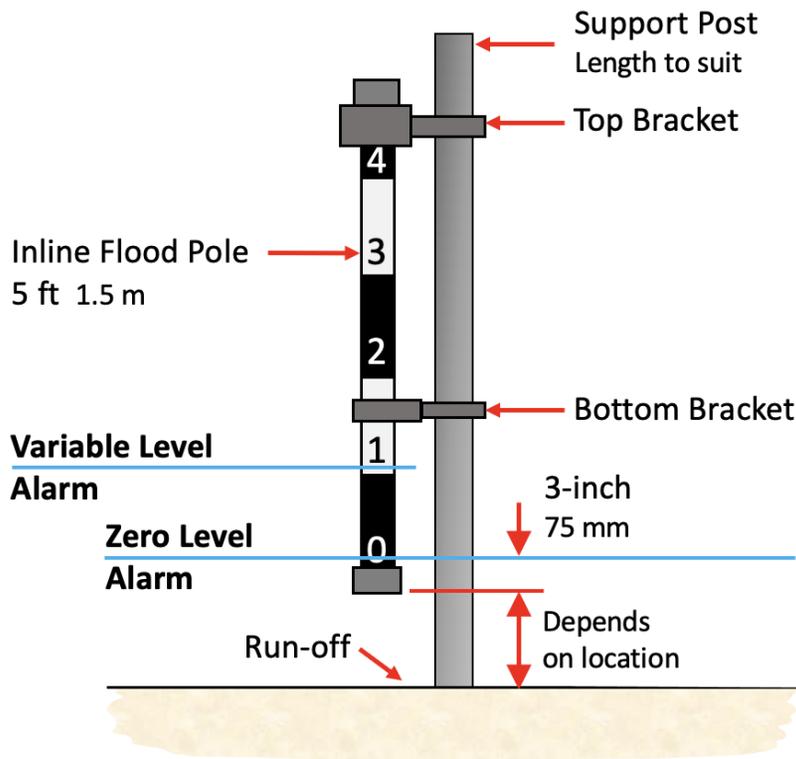


Fig 8: Typical installation for the inline flood pole and support post

Typical Installation

A typical installation includes the following tasks:

- > Create Plans including: logistics, equipment, transport, access, permissions, safety, and journey
- > Transport to site
- > Prepare the Inline Flood Poles
- > Mark the site for each inline flood pole and utility pole (if new)
- > Check for line of site and if needed modify the location or remove vegetation
- > Dig the holes and prepare the foundations for the Inline Flood Poles and Utility Pole (if new)
- > Install the Metal Support Posts
- > Install the Inline Flood Poles
- > Install the Utility Pole (if new)
- > Install the Solar Panel
- > Install the Master Node
- > Install the Master Node 12-volt Battery
- > Connect the Inline Flood Pole Battery and Align the Aerial. The Inline Flood Poles automatically add themselves to the system when powered-up. The inline flood poles are pre-calibrated in the factory.
- > Check the Mk3.5 Inline Flood Monitoring System via the Customer Interface
- > Configure the optional CCTV



Fig 9: Typical installation scene

Transport to Site

Package the units for transportation, secure and cover them on the transport vehicle.

Important: Use the supplied carry bags/boxes to protect and transport the inline flood poles.

Important: Use the supplied packing materials to protect the Master Node during transport.

The Mk3.5 Inline Flood Monitoring System, will likely be installed in a remote area so it is important to:

- > Plan the route
- > Plan for contingencies
- > Plan for emergencies
- > Advise others of your intended route
- > Check the weather forecast
- > Overnight accommodation
- > Get site access permission
- > Get keys for locked access gates
- > Take suitable clothing and PPE to suit the climate and weather
- > Take suitable vehicle to suit the terrain and weather
- > Take suitable and sufficient tools and equipment, including a first aid kit
- > Check and prepare the vehicle
- > Load up with enough provisions including extra fuel and water
- > Take communication devices and a GPS that will work in the location



Install the Support Posts

IMPORTANT: This suggested procedure depends on: equipment available, soil type, flood risk, and hole depth.

IMPORTANT: Responsibility for installing the posts is down to the Site Civil Contractor.

IMPORTANT: Support posts must be vertical to within 5 degrees.

IMPORTANT: Wait for the concrete to cure before installing the inline flood poles.

Foundation

Make the foundation hole square or round. Use hand tools a mini-excavator, or an auger. The hole needs to be 2-foot square/diameter by 3-feet deep (600 mm dia/square by 900 mm deep).

- > Round hole: concrete is 8.3 cubic feet (0.24 m³), and roadbase (crushed rock) is 1 cubic foot (30 litres).
- > Square hole: concrete is 11.3 cubic feet (0.32 m³), and roadbase (crushed rock) is 1 cubic foot (36 litres).

Set the post vertical using a spirit level, install temporary braces, and leave overnight for the concrete to cure (unless quick-setting post-crete is used).

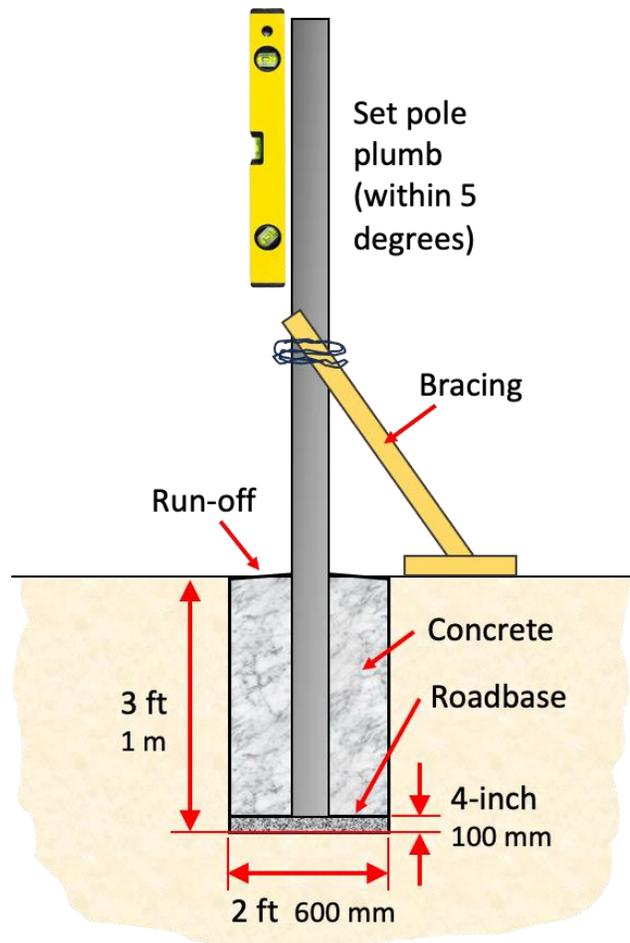


Fig 10: Typical concrete foundation

Install the Inline Flood Poles

Transport the inline flood poles in their protective carry bags from the vehicle and to the metal support post. Install the top and bottom pole brackets to the metal support post. Lightly clamp the pole to the brackets. Adjust the pole so it vertical and gently held (not clamped) evenly in the pole clamp brackets. The bottom pole clamp has a soft inner to allow thermal vertical movement of the tube.

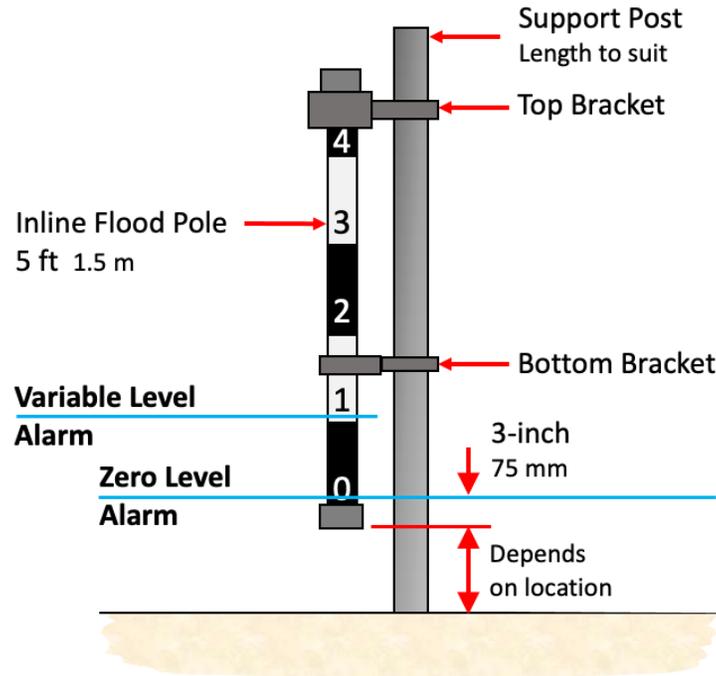


Fig 11: Two alarms for the site

Install the Utility Pole

Make the foundation hole to suit the utility pole and loadings, including a flood with debris. Set the utility pole vertical (plumb within 5-degrees) using a spirit level, install temporary braces, and leave overnight for the concrete to cure (unless quick-setting post-crete is used).

Safety

⚠ CAUTION

If a new utility pole is to be installed, it is safer to install the Master Node and connect the wires when the pole is on the ground.

⚠ CAUTION

If the Master Node is to be installed to an existing pole, it will involve working at height hazards. To reduce/remove the work at height risks use a bucket truck or other safe elevated work platform. Do not use a ladder because it will not be stable or strong enough for the loads.

⚠ CAUTION

Take care when handling the Master Node because it is heavy.

⚠ NOTICE

Cable insulation and conduit that is used for installation must suit the ambient operating temperatures and be suitable for outdoor use.

Install the Master Node

Install the support brackets to the utility pole. Install the Master Node housing to the brackets. Install the 12V battery (if not using a permanent DC supply). Terminate the wire connections.

Install the CCTV Camera (optional)

Install the optional CCTV Camera to the utility pole. Terminate the wire connections.

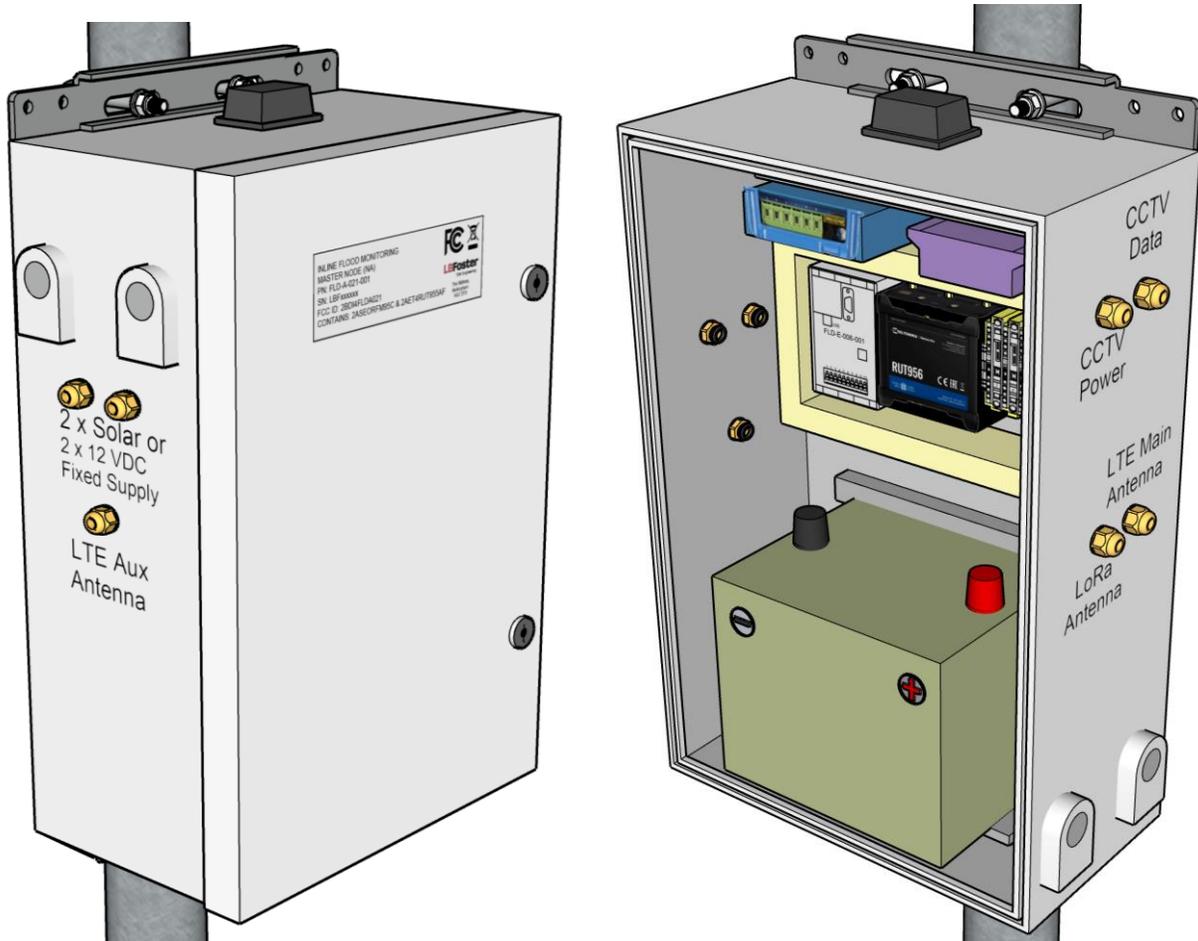


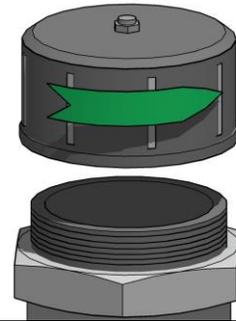
Fig 12: Master Node installed on the utility pole

Align the Pole and Connect the Battery

Remove the Top Cap

Remove the top cap.

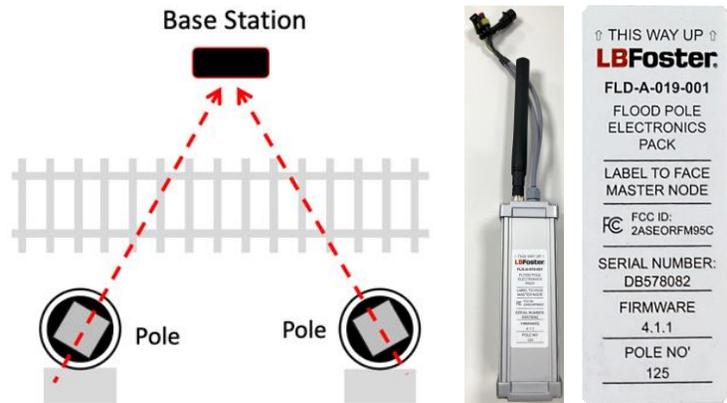
NOTICE: Do not allow rain or dust to get inside the pole or top cap.



Align with the Antenna

The label on the Aerial/PCB holder indicates the location of the pole antenna.

Turn the Aerial/PCB holder in the pole, so the label points to the direction of base station.



Connect the Battery

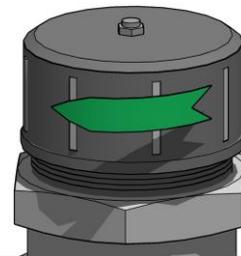
Connect the plugs and sockets together.

The pole will automatically begin to communicate with the base station and add itself to the system.



Install the Top Cap

NOTICE: Hand-tighten only.



Check Status

Check the status of the inline flood pole on the Customer Interface.

Install the 12-Volt Battery

Overview

There are several tasks:

1. Install the fuse
2. Install the battery
3. Check all connections
4. Connect the battery

Safety

⚠ CAUTION

If a new utility pole is to be installed, it is safer to install the battery and connect the wires when the pole is on the ground.

⚠ CAUTION

If the battery is to be installed to an existing pole, it will involve working at height hazards. To reduce/remove the work at height risks use a bucket truck or other safe elevated work platform. Do not use a ladder because it will not be stable or strong enough for the loads.

⚠ CAUTION

No smoking during handling or installation of the battery. Do not remove the vent caps. The battery emits small amounts of flammable hydrogen gas. Keep the battery away from heat, sparks, open flames, and hot surfaces. Hydrogen gas is colorless, odorless, lighter than air, and its flash point is 498°F (259°C).

⚠ CAUTION

Take care when handling the battery because it is heavy.

⚠ CAUTION

The battery is direct current (DC) so it can deliver a lot of Amps across the terminals and create sparks. Electrical arcing (flashover), such as from a short circuit caused by unsafe working practices, can generate intense heat leading to deep and slow-healing skin burns.

⚠ NOTICE

The power supply is a direct current 12-Volt system. Do not cause a short-circuit or connect the wrong polarity, as that could damage the equipment.

⚠ NOTICE

Check connections are correct before connecting the battery. The voltage can damage equipment if wired incorrectly or in reversed polarity.

⚠ NOTICE

Install the battery after the Master Node housing is secure on the utility pole.

⚠ NOTICE

Cable insulation and conduit that is used for installation must suit the ambient operating temperatures and be suitable for outdoor use.

⚠ NOTICE

There will be a small spark when the battery red lead is connected: this is normal and not a hazard.

Install the Fuse

Insert the supplied 30 Amp blade fuse for the battery positive wire. The fuse was removed for transport safety.

Install the battery

NOTICE

Check connections are correct before connecting the battery. The voltage can damage equipment if wired incorrectly or reversed polarity.

CAUTION

Take care when handling the battery because it is heavy.

1. Double-check the solar panel connections are correct and secure.
2. Install the battery in the Master Node, then screw-on the terminals.

NOTICE

There will a small spark when the red lead is connected: this is normal and not a hazard.

3. Connect the battery terminals. Red is + positive. Black is – negative. The wires have ring terminals and screws for the brass inserts in the terminals.
4. Install the protection covers on the terminals.

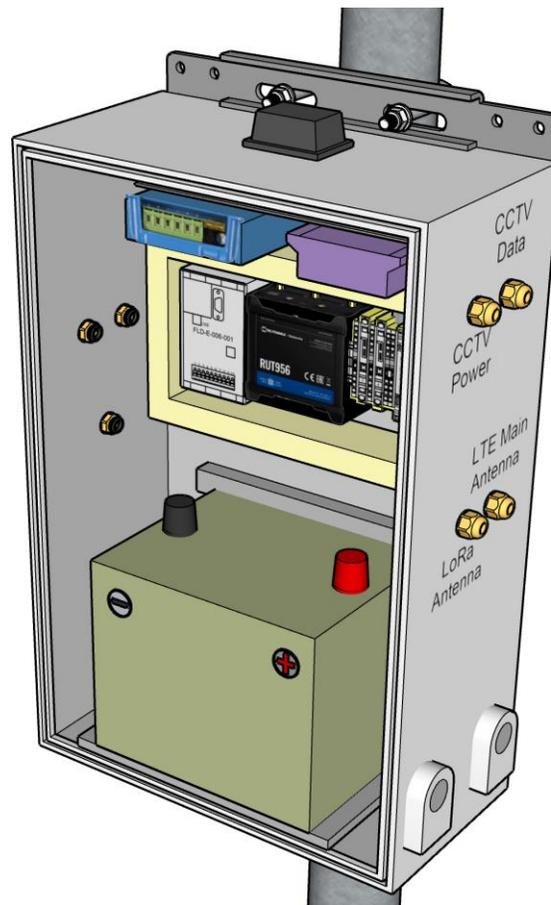


Fig 13: Battery installed in the Master Node

Connection Drawings

The connection drawings here cover the following:

- > Hardwired 12-volt Supply Connections
- > Solar and 12-volt Battery Connections
- > CCTV Camera Connections (optional)
- > Antenna Connections
- > Cable Gland Entry Points

Hardwired 12-volt Supply Connections

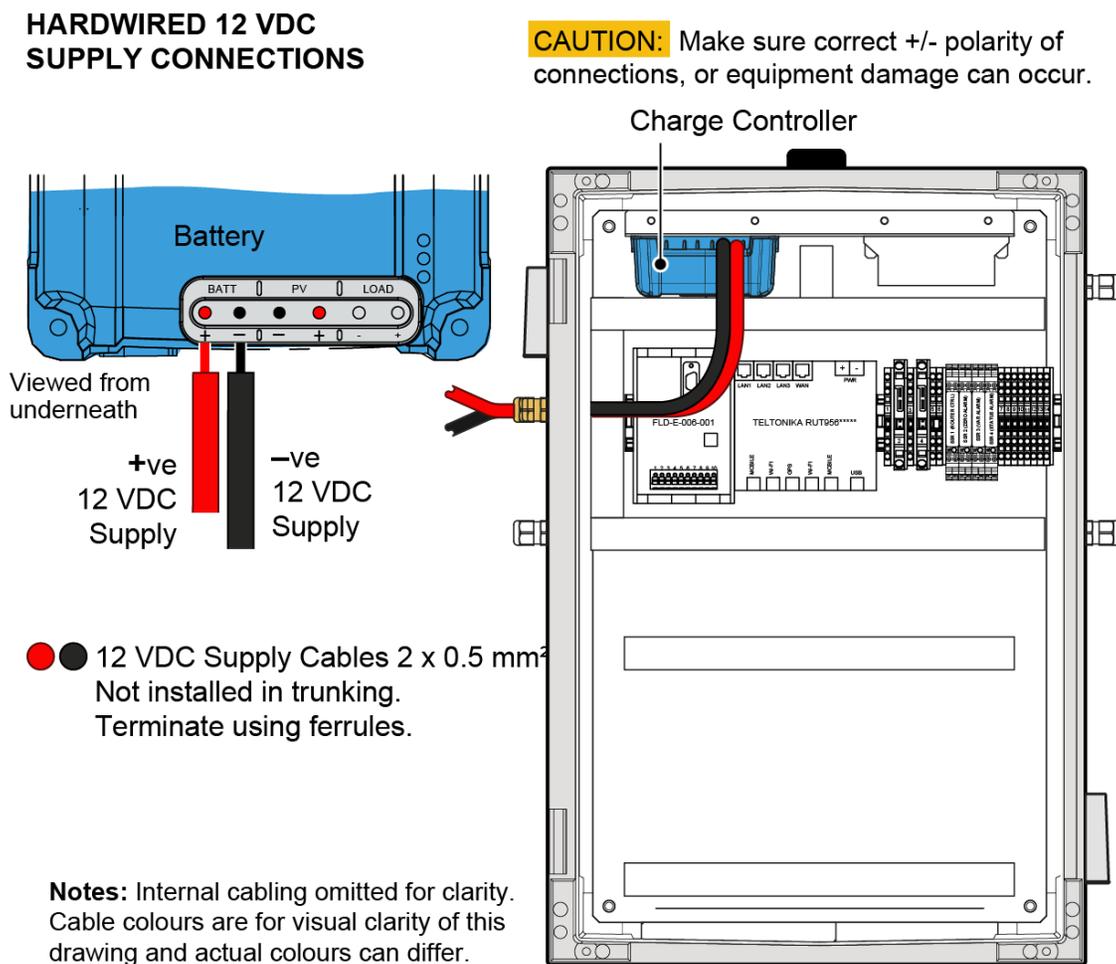


Fig 14: Hardwired 12-volt Supply Connections

Solar and 12-volt Battery Connections

SOLAR and 12 VDC BATTERY CONNECTIONS

CAUTION: Make sure correct +/- polarity of connections, or equipment damage can occur.

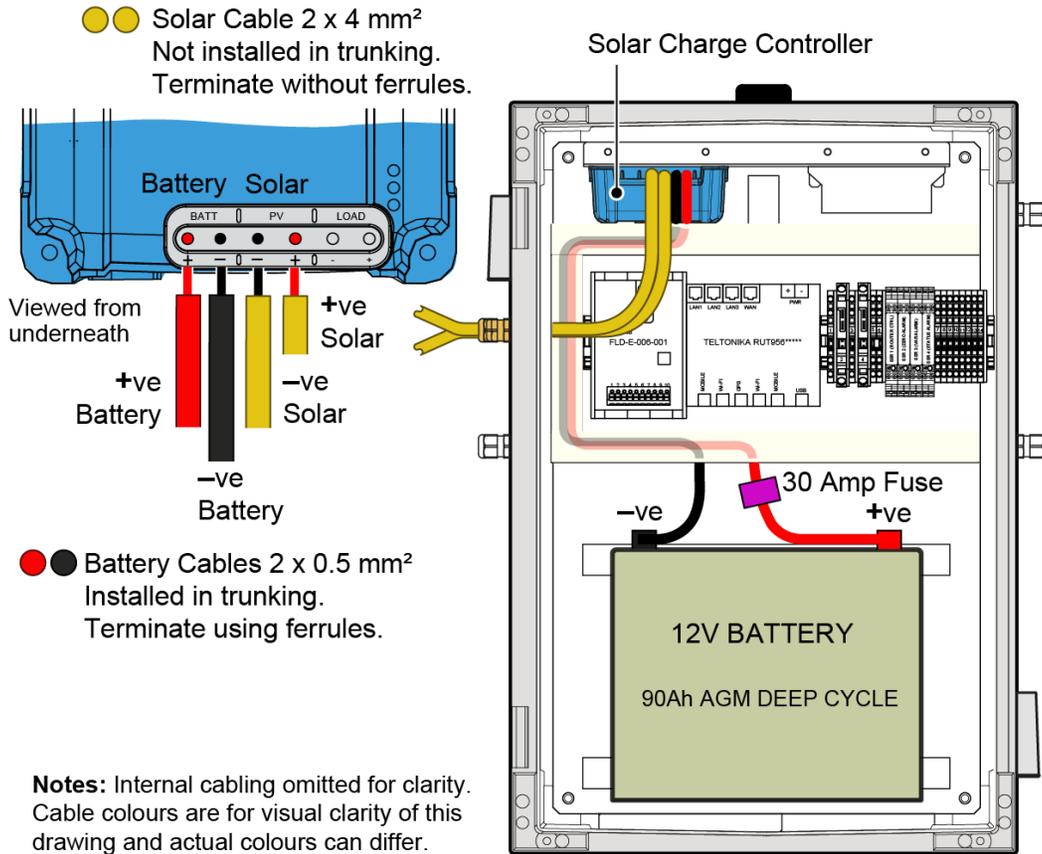
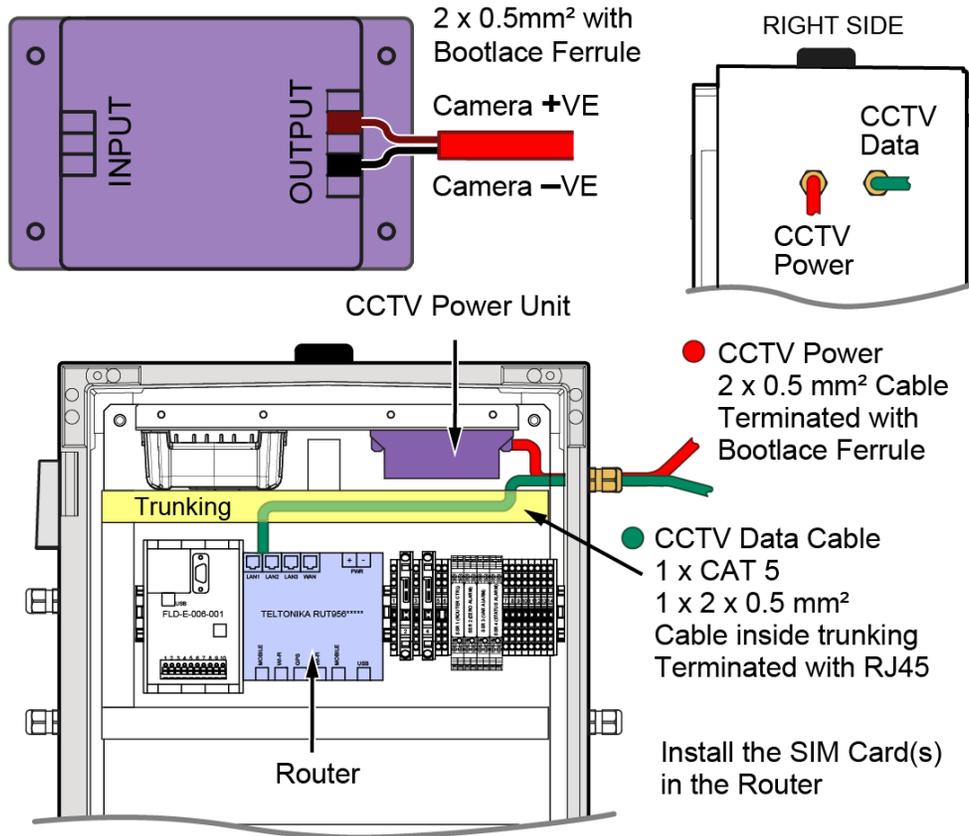


Fig 15: Solar and 12-volt Battery Connections

CCTV Camera Connections (optional)

CAMERA CONNECTIONS

CAUTION: Make sure correct +/- polarity of connections, or equipment damage can occur.



Notes: Internal cabling omitted for clarity.
Cable colours are for visual clarity of this drawing and actual colours can differ.

Fig 16: CCTV Camera Connections (optional)

Cable Gland Entry Points

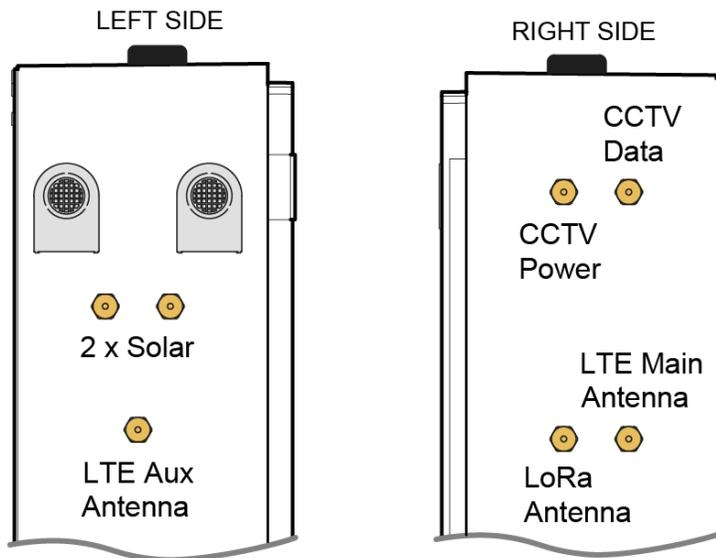
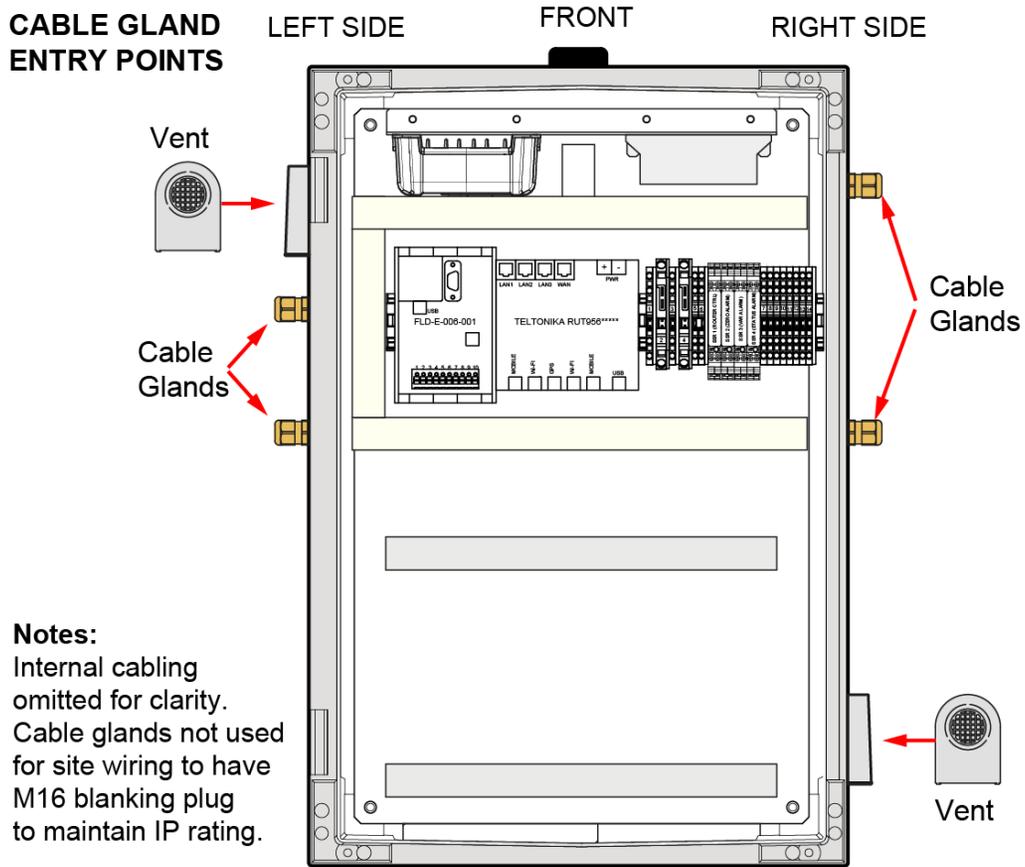


Fig 18: Cable Gland Entry Points

Customer Interface

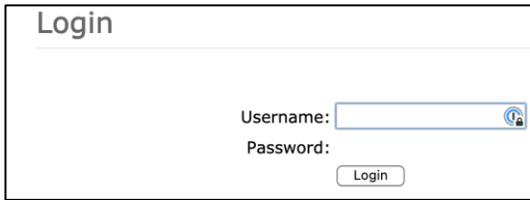
The Customer Interface enables access to monitoring information such as: test reports and alarm history. This information can be accessed by Mk3.5 Inline Flood Monitoring System personnel using a web browser.

Login

Login to the Customer Interface: <https://ivy.intelligentvideo.tv/lbfoster>

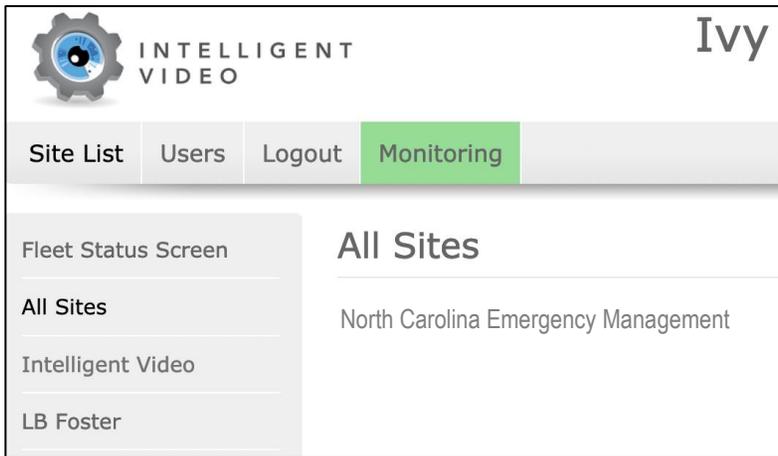
User: ncem

Password: charlotte2020



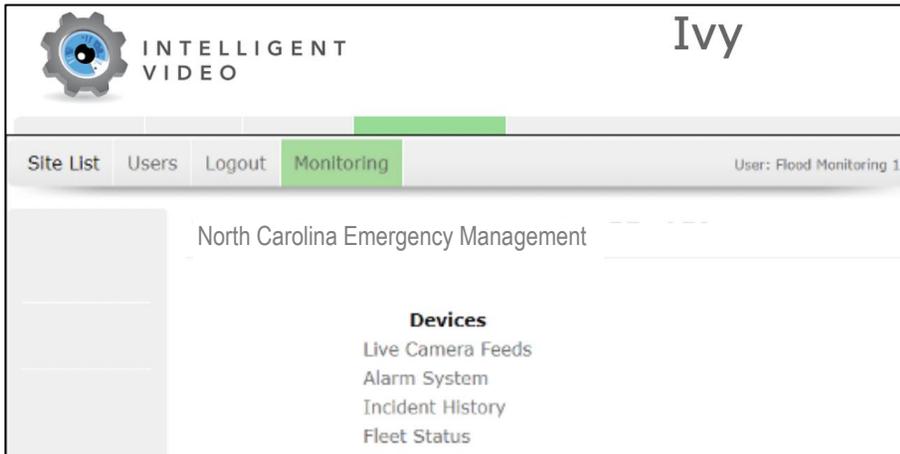
A screenshot of a web browser login page. The page has a white background with a light grey border. At the top left, the word "Login" is displayed in a bold, dark grey font. Below this, there are two input fields: "Username:" followed by a text box containing "ncem" and a small blue eye icon to its right; and "Password:" followed by a text box containing "charlotte2020" and a small blue eye icon to its right. Below the password field is a small, rounded rectangular button labeled "Login".

The main page appears. Click a specific site to see more details.



A screenshot of the main monitoring interface. At the top left is a gear icon with a camera lens inside, next to the text "INTELLIGENT VIDEO". At the top right is the word "Ivy" in a large, bold, sans-serif font. Below the header is a horizontal navigation menu with four items: "Site List", "Users", "Logout", and "Monitoring". The "Monitoring" item is highlighted with a green background. Below the navigation menu is a sidebar on the left with four menu items: "Fleet Status Screen", "All Sites", "Intelligent Video", and "LB Foster". The "All Sites" item is selected. The main content area on the right is titled "All Sites" and contains a single entry: "North Carolina Emergency Management".

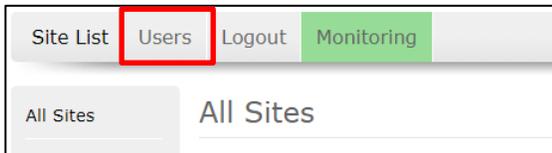
The list of devices on the site appear. Click a 'Device' to see more details.



Users

The User page allows changing the user: display name, password, and email. The email is for receiving notifications and alarms from the system.

Click on Users to see the Admin User panel.



Admin User panel.

Admin: Users

Choose:

User Name:

Display Name:

Password:

Email:

Indicator Panels

Overview

The devices for each site are displayed as indicator panels in a set of rows per site. Each indicator panel has icons that represent information and sensors, and the background changes color to suit its status. Hover over an icon or name using your cursor, and more detailed information appears in a small text box.



Status

The background color of each indicator panel indicates its status:



Data download

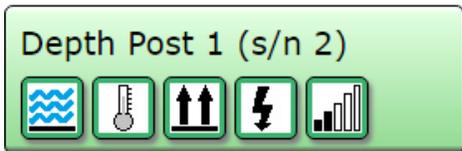
Most icons can be clicked to download a CSV file of data for that device/sensor. The CSV file can be opened using MS Excel®. Example: lbf019002-29EE2D5B-20190916-1040.csv

The filename is in four parts: site code - sensor identification - year month day - 24-hour time.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	
1	timestampreceived	timestampdata	sysid	uid	concoortypetext	batteryvoltage	batterycurrent	t	s	p	p	l	c	n	temperature	t	signalstrength	rsioffset	rszimeter	parascnoi	anrmaster	sharmstatstext	orientation1type	orientation1x	orientation1y	orientation1z	c	c	orientation2type	orientation2x	orientation2y	orientation2z	floodlevel				
3	30/07/2019 18:50	30/07/2019 18:48	dcm02100	E36E231	FLOODv1	4.45									21.5							10	Normal	accelerometer	48	243	452	msgactometer	-1	-365	443	-1					
4	30/07/2019 18:50	30/07/2019 18:31	dcm02100	E36E231	FLOODv1	4.45									21.5							10	Normal	accelerometer	48	243	452	msgactometer	-1	-365	443	-1					
5	30/07/2019 18:50	30/07/2019 18:31	dcm02100	E36E231	FLOODv1	4.45									21.5							10	Normal	accelerometer	48	243	452	msgactometer	-1	-365	443	-1					
6	30/07/2019 18:50	30/07/2019 18:32	dcm02100	E36E231	FLOODv1	4.45									21.5							10	Normal	accelerometer	48	243	452	msgactometer	-1	-365	443	-1					
7	30/07/2019 18:50	30/07/2019 18:27	dcm02100	E36E231	FLOODv1	4.45									21.5							10	Normal	accelerometer	48	243	452	msgactometer	-1	-365	443	-1					
8	30/07/2019 18:50	30/07/2019 18:22	dcm02100	E36E231	FLOODv1	4.45									21.5							10	Normal	accelerometer	48	243	452	msgactometer	-1	-365	443	-1					



Click this icon to download a CSV (Excel) file of data for the whole site.



Click any icon to download a CSV (Excel) file of data for the Depth Post (Water Depth Detector).

Hover Information

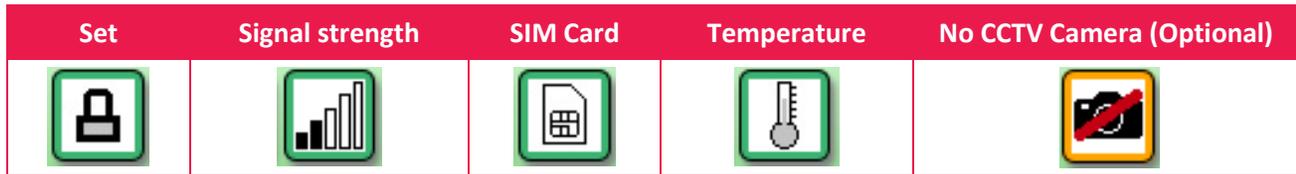
If your cursor hovers over an icon or site/post name, more detailed information appears in a text box.



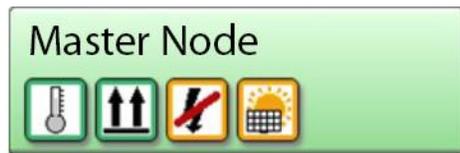
Site Panel



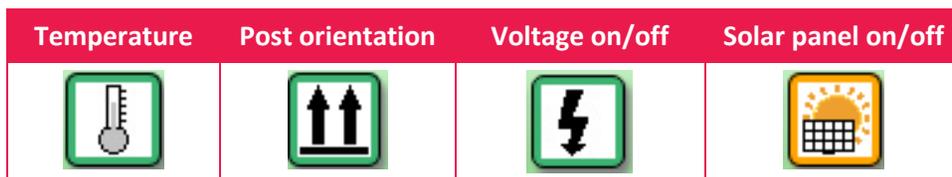
This indicator panel represents the Flood Monitoring Site. If your cursor hovers over an icon, detailed information appears. There is no CSV file for the site panel.



Master Node Panel



This indicator panel represents the status of the Master Node. If your cursor hovers over an icon, detailed information appears. If you click any icon the whole site data will be downloaded as a CSV file, of up to 1 hour.



Depth Post Panel (Water Level Detector)

This indicator panel represents the status of a Depth Post (water level detector) and its serial number. The number is the Site Number (not the post serial number). If your cursor hovers over an icon, detailed information appears. If you click an icon, up to 1 hour of depth post data will be downloaded as a CSV file.

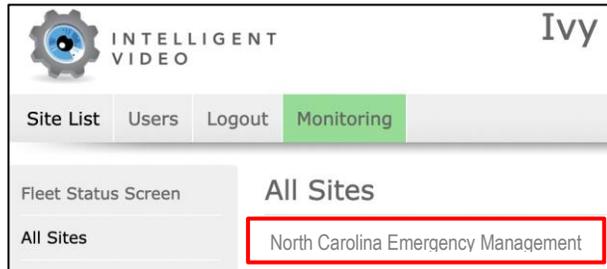


Alarm System

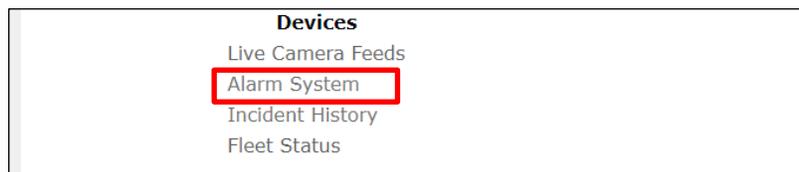
Click on 'Monitoring' to see the Alarm Monitoring page.



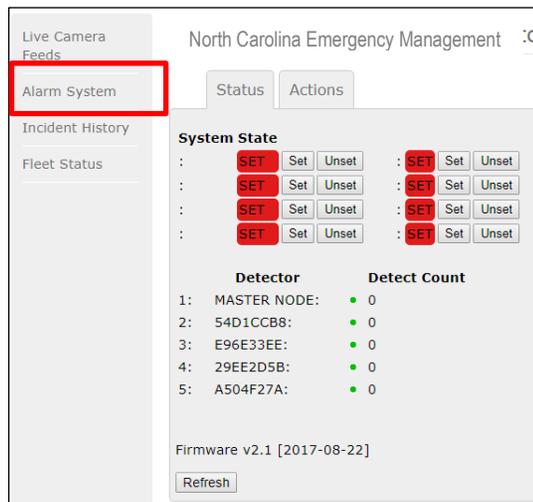
Click a specific site to see more details.



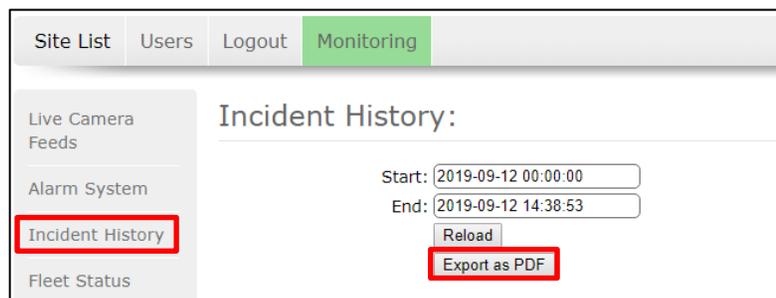
The list of Devices appears. Click on 'Alarm System' to see more details.



The Alarm System page appears.



Click on 'Incident History' to see historical incidents, which can be exported as a PDF.



Alarm Monitoring

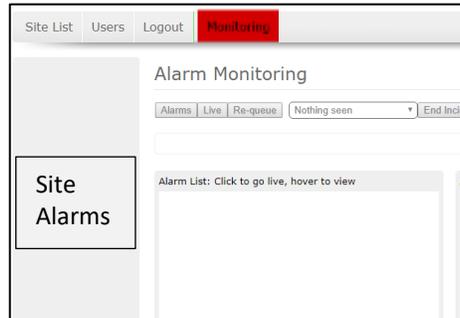
Click on 'Monitoring' to view the Alarm Monitoring page.



The Alarm Monitoring page appears.

Alarm inputs appear in the left column.

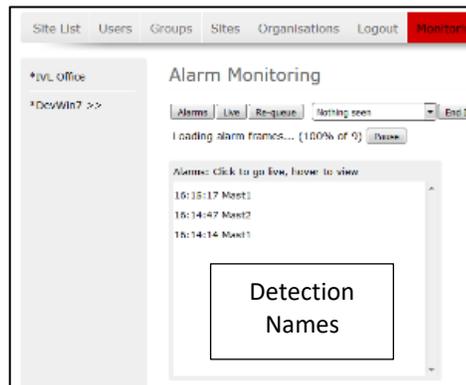
The 'Monitoring' tab will change to red, and an audible alarm will be heard.



Site alarms are shown on the left column.

Click a Site Alarm to accept the alarm.

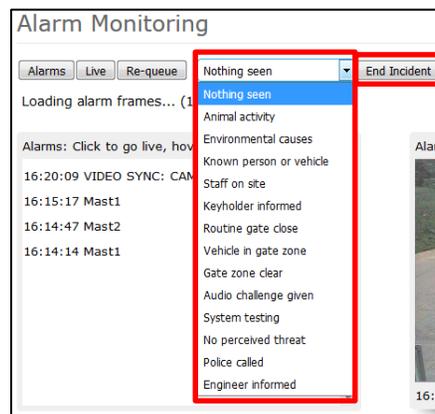
The name will change to black text, and detection names will appear in the central panel.



How to close an incident

Select a reason from the drop-down list.

Click the 'End Incident' button, or type a custom message and click 'End Using'.



Incident History

The Incident History screen shows activations received between the selected start and end dates, defaulting to today since midnight.

Select a different range using the same date-time format as shown then click on 'Reload'.

A narration of event processing is shown along with timing metrics for individual events and for the time period as a whole.

Click on 'More' to show the alarm frames. Click on 'PDF' to export a single activation as a PDF file.

To export the whole page as a PDF, click on 'Export To PDF' at the top of the screen.

Note: Alarm Frames are stored for a minimum of thirty days before being purged from our servers so it may not be possible to include images in older reports.

Site List Users Groups Sites Organisations Logout **Monitoring**

Live Camera Feeds
Alarm System
Incident History
Fleet Status

Incident History:

Start: 2019-08-12 00:00:00
End: 2019-08-12 17:20:34
Reload
Export as PDF

2019-08-12 05:24:55 Incident id:718706 Hide PDF
Closed at 05:25:14 by [redacted]: Staff on site
Queue time: 7 seconds
Handling time: 12 seconds

2019-08-12 05:24:55 Alarm arrived at server: Alarm Input 4
2019-08-12 05:25:02 [redacted] User accepted alarm
2019-08-12 05:25:14 [redacted] User end incident: Staff on site

Maintenance

Flood Event

After the waters have fully receded after a flood event, an inspection of the physical assets is recommended because:

- > The inline flood poles may have been damaged by debris that has been carried by the flood water.
- > Debris or permanent movement of structures and trees due to the flood event, can reduce the line of sight communication signal from each inline flood pole to the Master Node.
- > Silt or debris near or on the inline flood poles can negatively affect their sensitivity and operation.

Perform the following tasks:

- > Check inline flood poles and support posts for damage, especially the vinyl label of the pole.
- > Check the Master Node and utility pole for damage.
- > Take photographs of the scene pre-and post-clean up, and of any damage.
- > Check that the fasteners for the clamps and fasteners are secure.
- > Clean the pole, clamps, and post.
- > Remove debris, vegetation, and excess silt from the nearby area.
- > Perform a test of the inline flood poles.

Flood Site

Dependent on the site location and environment, periodically check for obstacles between the inline flood poles and the Master Node. It is vital that line-of-site radio communications is clear of objects. Objects include: buildings, structures, rubbish, trees, branches, and vegetation.

Dependent on the site location and environment, periodically check for nests of birds, animals, or insects on the Master Node, support posts and inline flood poles. These must be relocated or removed.

Support Post

Dependent on the site location and environment, periodically check the condition of the metal support post for: corrosion, damage, and lean (up to 5 degrees lean is acceptable). The post must be kept in good condition and must be replaced or repaired if unstable.

Periodically check the condition of the concrete foundation of the support post. Remove weeds and plants that may have begun to grow on or near the foundation, especially their root system. Check for cracks and stability. Fill small cracks with a two-part epoxy sealant to prevent water ingress and to prevent weeds/plants from establishing themselves. Larger cracks may need a structural concrete repair or a new foundation.

Periodically check the fasteners for tightness using hand tools.

Important: Do not tighten XXXX fasteners, because they have been installed using threadlock.

NOTICE: Do not use mole grips, pipe wrenches, pliers, or stilsons, because they will damage the heads/nuts.

NOTICE: Do not use electric tools to check for tightness, because they will damage the heads/nuts.

NOTICE: Use an open-ended/ring hand spanner or adjustable wrench to check tightness of the heads/nuts.

Inline Flood Pole

Clean the Inline Flood Pole

The inline flood pole is low maintenance. There are no holes to block with mud or silt. But, dependent on the site location and environment, periodically check and clean the accumulation of dirt on the inline flood pole.

The recommended cleaning equipment includes: bucket with soapy water, bucket with clean water, liquid dish/hand washing soap, large soft cloths, wiper (squeegee), and a water spray bottle.

NOTICE: Do not use cleaning chemicals to clean the inline flood pole or abrasive cloths.

Cleaning Equipment

- > Bucket with clean water
- > Large soft cloths
- > Water spray bottle



Cleaning Method

1. Spray water and allow to soak to loosen the dirt before using equipment.
2. Wipe the pole clean from top to bottom.
3. Rinse the cloth.

Remove Vegetation

Remove or prevent vegetation from growing around the flood pole to a ~1-metre radius (~3 ft). Vegetation next to the pole can reduce 'water level sensor effectiveness' and the 'radio signal quality'.

CAUTION

Do not use a brush cutter (edge trimmer) near the pole, because rotating lines and flying objects can damage the pole.

CAUTION

Do not use fire-clearing near the pole, because fires can easily get out of control, and heat and embers can damage the pole.

TIP: Inline flood poles need to be kept clear of vegetation, and a 6-foot square or 3-foot radius of weed mat around the metal support post is recommended to control growth.

IMPORTANT: Use chemical methods to remove vegetation near the pole.



Solar Panel

Clean the Solar Panel

Dependent on the location and environment, the accumulation of dirt on the solar panel will need to be removed periodically.

DANGER

During cleaning, take precautions to eliminate the risk of electrocution from overhead electrical power wires/cables. This may involve isolation of the power supply, temporary insulation of bare wires, and PPE, as per the risk assessment.

DANGER

Do not use a pressure washer to clean the solar panel, because water overspray on bare overhead electrical power wires will cause electrocution.

NOTICE

Do not use abrasive materials/sponges or wire wool, because they will scratch the glass and reduce the performance of the solar panel.

NOTICE

Do not use harsh cleaning chemicals such as solvents, because they will damage the glass and reduce the performance of the solar panel.

Access the Solar Panel

Working at height is hazardous. It is recommended to work from the ground to clean the solar panel, instead of a mobile elevated work platform (bucket truck, cherry picker).

Cleaning at Elevated Height

Access the solar panel using a mobile elevated work platform (bucket truck, cherry picker). The recommended cleaning equipment includes: bucket with soapy water, bucket with clean water, liquid dish/hand washing soap, large soft paint brush, large soft cloths, wiper (squeegee), and a water spray bottle.



Cleaning from Ground Level

Clean the solar panel from the ground using a window washing tool. The recommended cleaning equipment includes: water-fed brush and wiper (squeegee) on telescopic/extended rods, container of clean water, electric or hand water pressure pump, and liquid dish/hand washing soap.



Cleaning Tip

Spray the solar panel using soapy water and allow to soak to loosen the dirt before using equipment.

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