

# CORMIT USER MANUAL

## Overview

Cormit is an integrated hardware/software system for remote monitoring and control. The hardware consists of a datalogger (“field node”) to which various sensors are connected. The software consists of a database/analytic engine hosted on Amazon Web Services and an associated front-end dashboard.

### ***Monitoring***

In principle, Cormit is capable of monitoring and analyzing any time-series data stream. Currently, it can connect to sensors for water flow, water depth, temperature/humidity/LUX, and soil moisture/temperature.

### ***Control***

In addition to its monitoring functions, Cormit can also maintain water level in a tank or reservoir by controlling the operation of a well pump.

### ***Key features of the Cormit system***

- ◆ Datalogging using Cormit field nodes
- ◆ Cloud-based database/analytic engine
- ◆ Browser-based dashboard
- ◆ Advanced well/aquifer monitoring and analytics
- ◆ Environmental monitoring
- ◆ User-defined alerts
- ◆ Control of well pumps to maintain water level in tank/reservoir

## Hardware—field nodes and sensors

### Field node specifications



<b>Power</b>	115V / 230V
<b>Sensor interfaces</b>	RS-485 ModBus Pulse (for water meter)
<b>Internet connectivity</b>	WiFi Cellular (using cellular router)
<b>Cloud communications</b>	Bi-directional
<b>Enclosure</b>	IP-67 rating Pole mount or onto backboard
<b>Firmware updates</b>	OTA (over-the-air)
<b>Control of well pumps</b>	12V wired interface to pump relay

### Sensors

Cormit connects to various third-party sensors.

- ◆ Water flow
- ◆ Depth of water (tank, reservoir, well)
- ◆ Ambient temperature and humidity
- ◆ LUX
- ◆ Soil moisture and temperature

#### WATER FLOW METER

- ◆ Pulse water meters
  - Any pulse output water meter will work with Cormit.
  - We have tested Cormit with Netafim M series and with Arad's MasterMeter pulse output water flow meters.

- ❑ Pulse water meters have different gallons-to-pulse ratios; meters designed for higher flow rates have higher gallons-to-pulse ratios. When setting up the local nodes in the cloud system, you will need to input the gallons-to-pulse ratio.
- ◆ RS-485 ModBus water meter interface
  - ❑ Cormit will connect to a water meter with a RS-485 ModBus output.

#### DEPTH SENSOR—FOR WELL, WATER TANK, RESERVOIR

- ◆ Cormit is configured to work with APG’s PT-500-C depth sensors with RS-485 ModBus interface. This is a submersible pressure transducer. It is an industrial grade, reliable product, priced about \$600 (plus cost of cable if over 40 feet).
- ◆ APG web site: [www.apgsensors.com](http://www.apgsensors.com)
- ◆ Ordering info: contact APG directly: [sales@@apgsensors.com](mailto:sales@@apgsensors.com) or (877)373-5940
  - ❑ Cormit connects to the RS-485 ModBus version of the PT-500. Order by phone to be sure to get the correct version. Also, a phone order is necessary if you need a custom length cable.
  - ❑ Specify the depth you will be measuring when ordering: The submersible pressure sensors come in different versions depending on the maximum depth of water into which they will be placed. You will need to specify this when ordering.
  - ❑ Specify the length of cable you will need.
- ◆ When installing depth sensor in a well, a port may have to be installed on the well cap with a cable gland for the depth sensor cable.

#### AMBIENT TEMPERATURE/HUMIDITY AND LUX

- ◆ Cormit is configured to work with Seeed Studios’ SenseCAP ORCH S4-AIB multifunction sensor. This is available from Mouser Electronics for \$187. Be sure to order exactly this model as it comes with the aviator connector that plugs directly into the field nodes.

#### SOIL MOISTURE/TEMPERATURE

- ◆ Cormit is configured to work with Seeed Studio’s S-Soil MT-02A sensor. This is available from Seeed Studio for \$79. Be sure to order the version with the aviation connector as this will plug directly into the field nodes.

#### OTHER SENSORS

- ◆ Cormit can be configured to work with virtually any sensor with RS-R85 ModBus communications interface.

## Getting started

### Component requirements

#### SENSORS

The table below shows which sensors you will need for your application.

Components you will need	--- To monitor ---					--- To control ---
	Well/aquifer performance	Ambient Temp/hum/LUX	Water flow/leaks	Water depth—well/tank/reservoir	Soil temp/humidity	Well pump
Field Node	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Water meter	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			
Depth sensor	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Multi-sensor		<input checked="" type="checkbox"/>				
Soil sensor					<input checked="" type="checkbox"/>	

*Note: Each field node can simultaneously connect to all sensors*

#### PUMP CONTROL RELAY

- ◆ **Signal cable:** Cormit be used to control a well pump to maintain water level in a tank or reservoir within desired limits. A 12V signal cable connecting the node to a relay at the power supply to the well pump is used to turn on/off power to the pump.
- ◆ **Relay:** A 230V single pole/single throw relay needs to be installed in the circuit feeding power to the pump
  - Example of relay: Schneider SSR230DIN-DC22

### Hardware Installation

#### FIELD NODES

- ◆ **Selecting location:** When choosing a location for mounting field nodes, the following should be taken into account:
  - Nodes require 115/230V power. A standard 115V or 230V receptacle is required at the location where it will be mounted.
  - To achieve a high level of data integrity, the node must be able to communicate reliably with the internet. This means a good WiFi signal should be available at the location. *[see below]*
  - To the extent possible, nodes should be located reasonably proximate to sensors
  - The field node enclosures are rated IP67 and can be mounted outdoors. While no cover or other protection from the elements is required (we have multiple nodes mounted without protection), where possible, mount the node in a location that is protected from sun and rain.
- ◆ **Mounting nodes:** The enclosures can be mounted as follows:
  - On a pole (with included adapter plate)
  - On a flat surface with screws through the back plate of the node.

## SENSOR INSTALLATION

- ◆ Your well service company should be able to install the water meters and depth sensors.

## WIRING SENSORS TO FIELD NODE (SEE EXHIBIT A)

- ◆ Some sensors are delivered with aviation plugs that connect directly to the connectors on the field node.
- ◆ Other sensors are delivered with bare wires at the end of the cable.
  - For these sensors, you will need to connect the sensor cable to a cable supplied with the field node; this field node cable has an aviation plug that will connect directly to the connectors on the field node. A small weatherproof electrical box can be used for the junction connectors.
  - Exhibit A contains a guide as to how sensors connect to the field node; in particular, it provides the wiring connections for the bare wires from the sensor cable and the bare wires from the cable going to the field node.

## WIRING 12V CONTROL CABLE TO PUMP RELAY

- ◆ If the node will be controlling the operation of a well pump, install a 2-conductor, shielded cable from the node to the relay at the pump

## Communications to cloud

- ◆ Our local nodes communicate via WiFi.
  - WiFi is a low-cost communications option and the preferred choice. However, to provide satisfactory service, the WiFi connection must be highly reliable as must the internet service which means that WiFi signal strength at the local node must be acceptable.
  - WiFi access points are available directional antennas which increase the effective signal strength at the receptor, allowing for good communications at greater distances.
- ◆ Where WiFi is not available, a cellular router will allow the node to connect to the cloud through the regional cellular network. A cellular router sets up a WiFi LAN to which the node (as well as other devices) can connect.

## Provisioning node

### INITIAL WiFi SETUP

For the initial connection of the field node to the customer WiFi system, follow the steps below:

1. **Connect smartphone to node's WiFi SSID.**
  - a. Start with node power off.
  - b. Press power button on the node.
  - c. The blue LED should start flashing. At this point, you have two minutes to set up the WiFi connection.

- d. Hold your smartphone near the node and on the smartphone go to Settings>WiFi. Select the SSID "**IOT Device**". It may take a minute or even longer for this SSID to appear.
  - e. Enter password: "**12345678**".
  - f. The smartphone should now connect to SSID named IOT Device.
- 2. Enter your site's WiFi SSID and password into node**
- a. Open a browser on the smartphone and go to the URL **192.168.5.1**.
  - b. On the screen which appears, enter the SSID name and password for the WiFi LAN at the site to which you want the node to be connected. You may need to Zoom in to expand the size of the text to make this easier.
  - c. Click on the save button
  - d. At this point, the node will connect to the WiFi LAN at the site.
- 3. Confirmation of connection:** The blue LED will now display the communications enabled pattern: Five slow flashes and then three rapid flashes. This pattern will continuously repeat so long as communication with cloud is maintained.

#### **MOVING THE NODE TO A LOCATION WITH DIFFERENT WiFi**

If the node is turned on and cannot connect to the WiFi system to which it had previously been connected, it will go to the Wi-Fi parameter setting mode and the blue LED will flash.

At this point, follow the instructions above, starting at #1(c) above.

# Dashboard settings

## Nodes settings

### GENERAL

- ◆ **Name:** Enter descriptive names for the field nodes so that users will be able to easily distinguish among your nodes
- ◆ **Serial Number:** Enter the serial number for the node. This is provided to you by DSC when you are sent the node.
- ◆ **Select users:** In the dropdown box, check which users in your organization will be able to see data for the node.
- ◆ **Alerts List:** shows you which of the Alerts you have created apply to this node. To create/manage Alerts, go to Settings>Alerts.

### WATER METER

- ◆ **Meter multiplier:** In the Water Meter Output Multiplier data entry box, enter the multiplier by which the raw output of the water sensor should be multiplied to yield gallons. Water meters may send one pulse per gallon, one pulse per ten gallons, etc. Check the specifications for your water meter.

### DEPTH SENSOR

- ◆ **Type of deployment:** Depth sensors can be deployed in a well or in a tank/reservoir. Cormit distinguishes between these two applications in terms of how the depth sensor output is used and displayed.
  - Well:** depth sensor is used (in conjunction with water meter) to generate well/aquifer metrics
  - Tank/reservoir:** Depth sensor is used to measure depth of water in tank/reservoir.
- ◆ **Sensor Output Multiplier:** If your node is connected to a depth sensor
  - Enter <Depth Sensor Output Multiplier>
  - Depending on whether your depth sensor is deployed in a well or in a tank/reservoir, enter data in one of the two boxes at the bottom of the page.
- ◆ **For node deployed in tank/reservoir:** If the depth sensor is used to control the operation of the well pump, select <Enable>. Then enter <Pump On> and <Pump Off> Thresholds. When water level in the tank/reservoir drops to the Pump On Threshold level, pump will turn on and will stay on until water rises to Pump Off Threshold level.
- ◆ **For node deployed in well:** You have the choice of having depth of water in the tank/reservoir reported as (a) measuring upwards from the sensor level or (b) measuring downward from the surface level (or, for reservoir, some reference level). For (b) you will need to enter the depth of the sensor from the surface.

## Alerts settings

- ◆ **Name the Alert:** Enter the <Alert Name>. Use a descriptive name for the alert so that users will be able to easily recognize the purpose of the alert.
- ◆ **Description:** (Optional) Enter a <Description> of the alert
- ◆ **Select <Sensor Type>**—i.e., the type of sensor to which this alert applies
- ◆ **Select nodes:** In the <Nodes To Which Alert Applies> check the boxes next to the nodes to which you want the alert to apply
- ◆ **Trigger Threshold:** Enter the <Value> of the threshold that will trigger the alert and whether the alert is triggered when the value is <Greater/Less Than> than this threshold.
- ◆ **<Trigger Active Period>**: You can have the alert active for only selected hours of the day or for all hours of the day.
  - ❑ **<Rolling Time Period>** — Cormit constantly checks whether the threshold has been met in the immediately preceding number of <Hours> that you specify. For example: if you set <Hours> to 4, Cormit will constantly look back over the past 4 hours to see if the Trigger Threshold has been met.
  - ❑ **<Specified Hours>** — Cormit checks whether threshold test has been met at any point during the hours of the day you specify. The alert will be sent as soon as the threshold has been met; Cormit will not wait until the Specified Hours period has ended. If the threshold is met outside of <Specified Hours> of the day, no alert is sent.



## Appendix A—Sensor wiring

Sensor connectors/wiring							
Parameter	Manufacturer	Model	Communications Interface	Connector on node	--- Wiring ---		Function
					Sensor	Cable	
Output to pump relay	-	-	2-conductor 12V on/off	SP-13 4-pin	Red	Brown	12V
					Black	Blue	Ground
Water Flow - Pulse Meter	Netafim	WM-075-0.1-RS-P	Pulse	SP-11 5-pin	Black	Blue	Ground
					Yellow	Brown	Pulse
					X	Red	<b>Do not connect</b>
Depth Sensor	APG	PT-500	RS-485 [Addr: 1]	SP-13 5-pin	Red	Red	5V
					Black	Blue	Ground
					Green	White	B
					White	Yellow	A
Multi-parameter*	Seeed Studio	ORCA S4	RS-485 [Addr: 8]	SP-13 5-PIN	Comes with SP-13 plug		
LUX	Seeed Studio	S-Light-02	RS-485 [Addr: 13]	SP-13 5-pin	Comes with SP-13 plug		
Soil - Multiple Parameters	Seeed Studio	S-Soil MTEC-02B	RS-485 [Addr: 18]	SP-13 -5-pin	Comes with SP-13 plug		
Internal Temperature	Maxim Integrated	DS18B20	Digital 1-wire	N/A	N/A	N/A	-
* Ambient temperature and humidity, LUX, barometric pressure							