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REALM 004B Data Gateway User Manual

**USER'S
MANUAL
Data Gateway**

Revision Sheet

Release No.	Date	Revision Description
Rev. A	4/25/2018	Release

Contents

GENERAL

1.1 System Overview
The Data Gateway is the link between the edge devices in the Internet of Things (IoT) for agriculture and the cloud data server. The Data Gateway listens for data packets from edge devices and periodically makes a cellular data connection to forward the accumulated edge device packets to a server along with its own packets. The Data Gateway acknowledges packets from edge devices. The Data Gateway also holds downlink packets from the server for edge devices and sends them to the device after the next uplink packet from that device in lieu of an

acknowledgment.

1.2 Features
The Data Gateway includes the following features:

- Low power microcontroller
- Low power, long-range radio for communication with edge devices
- Cellular data modem
- GPS receiver for device location
- Non-volatile memory for configurable settings
- Non-volatile memory for uplink and downlink packet queues
- red-green-blue LED status and cellular RSSI indicators
- Accelerometer for user input
- Solar charged LiFePO4 41 W-Hr battery pack
- Powered by a 10 W Solar Panel

1.3 Acronyms and Abbreviations

Term	Description
API	Application Interface
FCC	Federal Communications Commission
GPS	Global Positioning System
Hr	Hour
ID	Unique Identification Number
IoT	Internet of Things
LED	Light Emitting Diode
LiFePO4	Lithium Iron Phosphate
QR	Quick Response
RSS	Radio Standards Specification
s	Seconds
URL	Universal Resource Locator
UTC	Universal Time Coordinated
V	Volts
W	Watt

1.4 Important FCC and IC Compliance Information
Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

This product meets the applicable FCC Part 15 rules. Operation is subject to the following two conditions:
(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
To limit RF exposure, please ensure 8 inches (20 cm) of separation from the transmitter antennas at all times.

1.5 Installation Safety

1.5.1 Pivot Safety

Do not part a vehicle in the path of the irrigation pivot towers.

Before installing the Data Gateway on a pivot, insure that power to the pivot is off.

Use a harness to tether to a solid point that could hold you weight while working up high on a pivot.

1.5.2 Ladder Safety

Read and follow all safety instructions for the ladder used to install the Data Gateway.

Do not use a ladder under overhead power wires.

Do not exceed the weight rating of the ladder.

Set the ladder on s firm surface with both legs touching the ground where they will not slip or sink. Set the ladder at the proper angle.

Ensure that both sides of the top of the ladder rest firmly against a solid surface Have a second person hold the base of the ladder.

Keep three points of contact with the ladder.

Do not overreach when working on a ladder.

1.6 Device Use Information

1.6.1 Enclosure

The Data Gateway has a sealed enclosure. It should not be opened as this may damage the seal and void the warranty.

1.6.2 Installation Packet Series

The Data Gateway will automatically send a series of four radio packets after it is powered up by connecting it to the solar panel. It sends a version packet, a status packet, a modem info packet, and a location packet. After booting it turns on its GPS receiver to acquire time and location. This is indicated with short cyan flashes every two seconds. It needs time to set its real-time clock. It also needs a location to send the location packet. IT MUST BE ABLE TO RECEIVE FROM GPS SATELLITES TO FUNCTION CORRECTLY. After acquiring time and before the location is acquired, it wakes up its cell modem, connects to a local tower, and sends the version, status, and modem info packets. Solid green indicates it is connecting to a tower. Blinking green indicates it is transferring data to the server. After acquiring the location, it sends the location packet and then goes to sleep. It keeps its radio on, in receive mode, while it is sleeping. When a radio packet is received it queues the packet and goes back to sleep. A magenta-green blink indicates it received a radio packet and sent an acknowledge.

1.6.3 User Input

To achieve a long battery life, the Data Gateway sleeps most of the time. It will transmit data to the cloud via a cellular connection every 15 minutes. It is set up to detect a double-tap – two taps, one immediately following the other. This will wake up the device if it is asleep. A white flash of the status indicator signals a double-tap detection. This can be used to wake the Data Gateway and verify it is powered and running if it is sleeping.

1.6.4 Indicator Description

The Data Gateway has two red-green-blue LED indicators: one for status (in the middle of the side) and one for cellular RSSI (toward the corner on the side). The table below gives the meaning of colors and flashes on the status LED.

Color	Flash Timing	Meaning
Green	0.1 s flash every 2 s	Battery good
Yellow	0.1 s flash every 2 s	Battery low
Cyan	0.1 s flash every 2 s	GPS enabled
White	Once	Double-tap detected
Magenta-Green	Once	Radio packet received and sent acknowledge
Green	On	Attempting to connect to a cellular tower
Green	0.5 s flash every 1 s	Cellular connection made, transferring data
RBGRBG	Rapid and repeating	Bootloader running
RYGY	Rapid and repeating	Booting Firmware

The RSSI LED indicator changes color to indicate cellular signal strength.

Color	Meaning
Off	The modem is sleeping or powered down
Red	Very poor signal strength – relocate Data Gateway to improve cellular reception
Yellow	Poor signal strength
Green	Okay signal strength
Cyan	Good signal strength
White	Excellent signal strength

1.**6.5 Orientation**

The bottom of the Data Gateway is V-shaped and has magnets to aid in setting on a metal pipe. The Data The gateway may be installed horizontally or vertically. When installed horizontally the antenna should be set to a right angle with the antenna pointing up. When installed vertically the antenna and connector end should be on the bottom end. The antenna should be set straight and pointed down.

1.6.6 Data Gateway Power Connection

Plugging the Solar Panel into the Data Gateway will power the Data Gateway up from its internal battery pack even if there is no sunlight to charge the battery. The Data Gateway can run through the night and through several heavily overcast days in a row when fully charged. It can be fully charged in less than one sunny day assuming the Solar Panel is oriented for good solar reception. However, due to battery shipping regulations, the Data Gateway ships with approximately 30% battery charge. It will need at least one full sun day for the battery level indicator to sync with the actual battery level (full charge). Care should be taken not to plug the Solar Panel connector into the Data Gateway upside down as this may damage the Data Gateway.
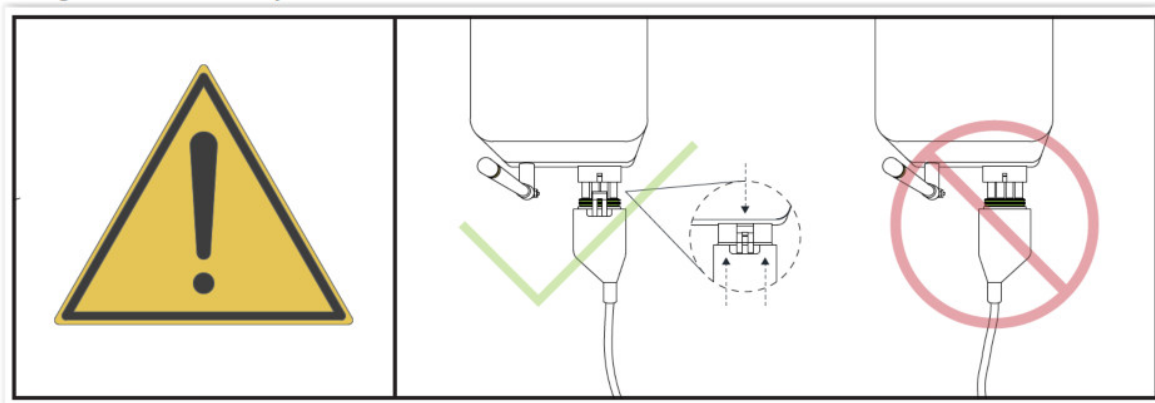
1.7 Cloud Data Services

Data from RealmFive IoT devices is stored on data servers in the cloud. The data is accessible to customers through an API allowing customer integration into their own applications and websites. Device data is also accessible through **app.realmfive.com** which is intended to aid installers with configuration and verification of device operation. Both require credentials for access. See the following section for information on how to obtain credentials.

1.8 Points of Contact

1.8.1 Installation User Interface

RealmFive's installer interface is at app.realmfive.com. A login username and password are required to access this website. Access to this website is needed to verify device installation. Please contact your administrator at least 24 hours prior to installation time to get your login set up if you do not have one.

1.8.2 Obtaining a Login

A login username and password may be obtained by emailing your administrator with the following information:
FIRST NAME
LAST NAME
PHONE NUMBER
ORGANIZATION

Your username will be your email address. You will be sent a temporary password which must be changed the first time you log in.

To log in, go to **app.realmfive.com**, or simply scan the QR code on a device, and enter your username and password.

1.8.3 Obtaining Help

Questions and problems can also be submitted via the help desk or chat link within the app. A guide to common user tasks and frequently asked questions can be found under "Support" at **app.realmfive.com**. More immediate help can be obtained through a live chat under "Support" at **app.realmfive.com**.

INSTALLATION

The Data Gateway should be installed before the end devices that will communicate with the Data Gateway.
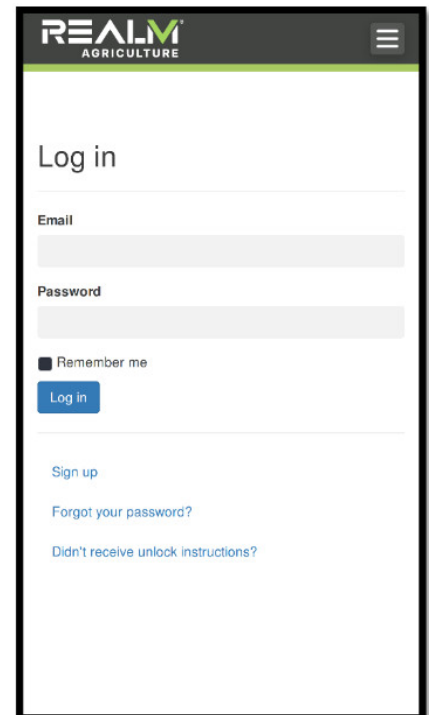
Data Gateway
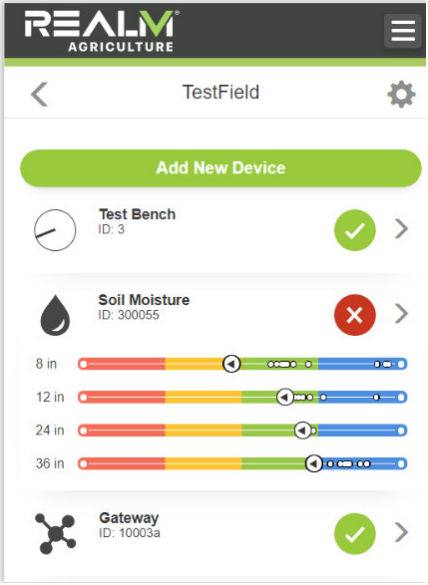
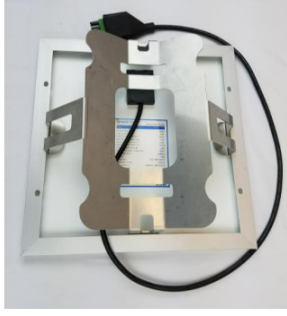|		
2.1	Prior to mounting the Data Gateway, scan the QR code on the bottom via smartphone. The QR code contains the URL of the webpage for that specific device scanning with any generic QR code scanner that should take you to the page for the device. Or go to **app.realmfive.com/devices/0x1XXXXX** where XXXXX is the balance of the ID as it appears on the label.	
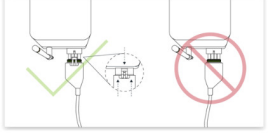
2.2	If you have not logged in to the website before, the login page will appear first. Log in to RealmFive's browser-based installation app. See Section 1.8.2 for how to obtain credentials.	

2.3	All received devices should already be provisioned to each customer. The installer will need to assign each device to the grower and field. This is done by tapping on ☰ the in the upper right corner and selecting Organization. Then navigating to or add the grower and field as necessary. And finally, tap Add New Device and scan the QR code or type the ID.	

2.4	If a pivot is not available as a mounting site, RealmFive does offer a tripod pole mount option. Please refer to pole mounting kit installation instructions for this option.	
2.5	The Data Gateway easily attaches to a pivot pipe using molded-in magnets in the base of the enclosure. Slots in the Data Gateway base also allow for an additional zip tie to be utilized (recommended).	
2.6	Attach Solar Panel to the mounting bracket.	

2.7	RealmFive recommends installing in the first span, preferably NOT in the direct spray from the pivot. While the Data Gateway is sealed, direct spray increases the risk of water damage and mineral buildup on both the Data Gateway and the solar panel. Sprinkler drops can be installed to avoid the direct spray. Position the Data Gateway and Solar Panel on the pivot pipe within cable reach of each other. Ensure the connector on Data Gateway faces the solar panel.	
2.8	Use the supplied zip ties to secure the Solar Panel assembly and Data Gateway to the pivot pipe. Tighten the zip ties enough to prevent the device from sliding sideways on the pipe. Avoid overtightening the zip tie on the Data Gateway as this may damage the enclosure.	

2.9	Plug the solar panel cable into the Data Gateway with the latch chip on the top side as shown. This will turn the Data Gateway on. The status LED will flash multi-colored when first turns on. it will turn on its GPS receiver to acquire time and location. A short cyan blinks every two seconds indicates GPS is on. It will also initiate a cellular connection and send a series of packets to verify functionality. See section Error! Reference source not found. for a description of the installation series. Solid green indicates it is connecting to a cell tower. 50% blinking green indicates it is communicating over cellular. Immediately after booting, the Data Gateway will start listening for packets from end devices that are within range. A magenta->green blink indicates a radio packet was received. Note that several statuses LED indications can go on at the same time. The LED on the corner indicates RSSI. The installation should be relocated if this indicator stays red while connecting to cellular. Yellow indicates a poor signal. Green, cyan, or white are okay to excellent respectively.	

2.10	Once the Data Gateway completes the cellular connection, the Data Gateway's app web page should show new data from the device The signal strength number is the RSSI of the cellular connection. If the RSSI is less than -115, consider moving the Data Gateway installation higher or closer to a cell tower. On a pivot, the signal strength will vary as the pivot rotates. With poor signal strength, this should be checked prior to leaving the installation site. The timestamps on Location or Connectivity are in UTC. Tapping the timestamp will pop up the time since the last packet was received. More details about the device can be obtained by clicking the arrow to the right.	
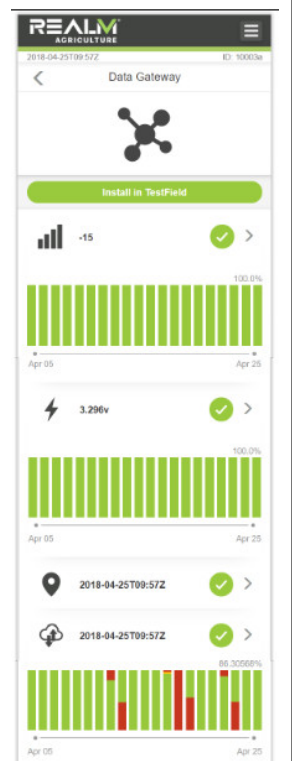
Documents / Resources

REALM 004B Data Gateway [pdf] User Manual
004B, 2AOWY-004B, 2AOWY004B, 004B, Data Gateway