

VolleyBoast

User Manual

VoBo GP-1



VoBo HL-1



VoBo Overview

The VoBo is a universal industrial grade general purpose LoRaWAN endpoint that converts wired process instruments into LoRaWAN enabled instrumentation. The VoBo is available as a general-purpose device (the GP-1) and as a device that is certified to be located in Hazardous Areas (the HL-1). It operates on a timed wake/sleep cycle: it wakes up periodically to take and transmit sensor readings and minimizes power consumption when it is “sleeping”. A primary D cell powers the VoBo and the connected analog sensors. This configuration allows for operational data to be collected inexpensively and transmitted to the User Interface (cloud based or local server) for further analysis and reporting.

Highlights/Features

- Provides three analog inputs, three discrete digital inputs, one “wake-up” input, one RS-485 input (for Modbus RTU devices), and one open drain output.
- The GP-1 is provided with three entry points for sensor cables and the HL-1 has two entry points. The VoBo comes equipped with cord grips and hole plug (s) to replace unused cord grips. The HL-1 entry points will also accept ½ inch conduit fittings.
- Analog output can be adjusted for gain and offset.
- Designed for rugged outdoor use.
- Expected battery life under normal operating conditions is 2 to 4 years when providing power to analog terminal blocks. Battery life expected to be in excess of 7 years when only used to retrieve data from sensors/transmitters/analyzers.
- Range is up to 10 miles line-of-site to any LoRaWAN compliant gateway. From the gateway, data can then be forwarded to the user’s database or reporting system.
- Configuration can be done over-the-air or locally through a RS-232 connection.

Manufactured in Houston TX from US and non-US supplied components

Important



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If assistance is desired, it is best to confirm an appointment ahead of the actual installation effort.

The Volley Boast Terms and Conditions of Sale can be found at:

(<https://volleyboast.com/documentation/latest/termsandconditions-sale>). The warranty covers VolleyBoast supplied hardware and software.



The VoBo is rated to IP66, NEMA 4X standards. These standards require that the gasket be properly positioned, and the screws tightened to 8.00 in-lbs. Do not over tighten the screws.

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SET UP OVERVIEW

There are four key steps to setting up a VoBo, they are:

1. Connect the VoBo to the gateway.
2. Configure the VoBo software.
3. Arrange the jumpers.
4. Field Installation (connect the transmitters/sensors and install the VoBo)

Steps (1) thru (3) are best accomplished in the office or lab. It is recommended that the steps be performed in the order they are listed.

Connect the VoBo to the Gateway

Input the connection information for the VoBo into your gateway:

- Device ID (DevEUI)
- Application EUI (AppEUI)
- Application KEY (AppKey)

This information can be found on the paperwork included with the VoBo. The DevEUI is also provided on a label affixed to the exterior of the VoBo. The AppEUI (also referred to as the JoinEUI) is used for joining the VoBo to a gateway. The AppEUI for all VoBo GP-1's and HL-1's is the same. It is "56-4F-42-4F-32-30-31-36". The AppKey is used for encryption purposes and should remain strictly confidential.

Please contact the gateway vendor or network provider for instructions regarding entering this information on their respective platforms.

The following connection parameters are set as defaults on the VoBo:

- Class: A
- Network Mode: Public
- LoRaWAN 1.0.4

The join process starts at FSB 2, after 3 failed join attempts it will cycle through each FSB, beginning at FSB 1 and attempt to join 3 more times at each FSB. If all the FSB's have been attempted and the VoBo has failed to join the device will take the configured readings, store them to flash, and sleep for the remaining of your set cycle time. If there is less than 10 minutes remaining in your cycle time it will sleep for 10 minutes before waking up and starting the join process again. When the VoBo successfully joins a gateway, it will store the FSB it joined with and start at this FSB the next time it goes through a join process.

The gateway or network server should reflect the connection parameters. The remaining parameters are fixed.

To test whether the VoBo successfully joins the network:

1. Remove the enclosure top.
2. Ensure that the slider switch by the battery holder is switched to "OFF".

3. Install the battery, ensuring the polarity is correct.
4. Move the slider switch to the “ON” position.

IMPORTANT: The VoBo firmware uses a feature called automatic data rate (ADR). This balances the tradeoff between signal strength and battery life, providing enough transmit power to ensure a robust connection while preserving battery life. It takes some time for this adjustment to be made. ***It is good practice to cycle power when relocating the VoBo to a new location. This will permit the VoBo to begin at the highest transmit power and then adjust downwards to the optimum level for that location.***

Check LED for status. The LED will light green for 1 second following successful initialization of the VoBo. The LED will briefly flash green each time the VoBo attempts to join the network. Note, the VoBo starts the join process on the default FSB 2, after three attempts to join at this FSB it will start to iterate through all the FSBs, beginning with FSB 1 and continuing until it is successful or reaches FSB 8. It will attempt to join three times at each FSB. The VoBo will store the last FSB it successfully joined at and begin with that FSB the next time power is cycled off and on. Potentially you may see up to 27 brief green flashes of the LED. If the VoBo fails to join after the 27 attempts, it will flash a 1 second red light. The LED briefly flashes red if the VoBo is joined with the gateway, makes a transmission and the payload (the data) fails to fit into the transmitted packet. It is normal to see one or two red flashes due to the number of MAC commands being sent to the gateway during the join process. This may also occur if the VoBo is near its maximum transmission range. The LED will light green for 1 second upon successfully transmitting a payload (data) and receiving a confirmation back from the gateway. If the VoBo fails to join with the gateway it will go into its sleep cycle and try again after it completes its sleep cycle or in ten minutes (whichever is a greater length of time).

Note the LED only functions upon powering up the VoBo. It is not designed to function after a successful join process or after it has gone to sleep (after an unsuccessful join process)

The VoBo will send transmissions at the default cycle time of 30 minutes (as described below). Pressing the WUP button any time the VoBo is connected interrupts the cycle time and sends a transmission immediately. The cycle can be changed using either the online or local configuration manager.

Configure the Software

The VoBo can be configured either remotely or locally.

Remote Configuration

The VolleyBoast configuration portal (“The VoBo Configurator”) is accessed through VolleyBoast’s customer portal found at: <https://portal.volleyboast.com>.

The VoBo Configurator creates hexadecimal messages which are downloaded through network servers to the gateways. Each time a message is sent to the gateway, the VoBo checks to determine if a downlink message is waiting for it. If there is a configuration message, the VoBo will receive it and update its configuration.

The VoBo Configurator can be used to configure VoBos deployed on networks managed by VolleyBoast (through its Remote Monitoring Service) as well as those deployed on third-party networks.

Hexadecimal formatted configuration information derived by the VoBo Configurator can be copied or downloaded and provided to third-party networks.

The VoBo Configurator also provides a management system for the VoBos. It tracks the most recent configuration file “sent” from the portal and organizes the VoBos by groups and sites.

Configuration Process

Initial Account Setup Step 1: Go to <https://portal.volleyboast.com/>

Step 2: Select “Register”

Step 3: Enter account information

Step 4: Click the link on the confirmation email to activate the account

Step 5: Add users to the account via the “Account Information” tab on the portal

Adding VoBos

Step 1: Select “VoBo Configurator”

Step 2: Select “Device Management”

Step 3: In the Add Device section, select the desired “Group” and “Site”. It is optional to use Groups and Sites. If they are used, they need to be set up first within the respective tabs found in the main menu. Once a VoBo is added the only way it can be removed is from Device Management.

Step 4: Enter the name you have chosen for the VoBo.

Step 5: Enter the DevEUI of the VoBo.

Step 6: If desired, enter a description.

Step 7: Select “Save Device”

Step 8: Repeat steps 1-7 for each additional VoBo

Configuring VoBos

Step 1: Select VoBo Configuration in the dropdown menu

Step 2: Click the target Group and/or Site

Step 3: Select the VoBo

Step 4: Change default values where necessary

Step 5: A hexadecimal-equivalent string reflecting updates to the configuration changes dynamically as data is entered

Step 6: Select “Send Configuration” to transmit the configuration message to the selected Network Server Provider or to create a local download. This also saves the configuration for the chosen node for future use.

Note: The VoBo receives the updated configuration file the next time it communicates with the network. The VoBo will transmit its current payload, before receiving the message. The configuration changes will be implemented in the next wake-up cycle.

Local Configuration

It is important to follow all the steps outlined below.

- 1) Turn the power switch to the off position



- 2) After ensuring all power is disconnected from the VoBo, connect a computer to the SERIAL (UART) terminal on the VoBo with a USB to RS-232 cable. (note: FTDI manufactures a RS232 to USB connector that works well for this purpose. The part number is TTL-232R-RP I). For ease of repeated use – it may be beneficial to connect the individual wires to a RS-232 connector housing (Molex part number 50-57-9403). The Molex part number for the respective crimp connectors is 16020102. Please contact VolleyBoast if you would like to purchase a preassembled connector.
- 3) Set the SERIAL switch to "ENABLE".
- 4) Restore power to the VoBo by switching the power switch to "ON".
- 5) Open a communication software such as TeraTerm or Putty.
- 6) Set the following:
 - Baud Rate = 9,600
 - Data bits = 8
 - Parity = N
 - Stop bits = 1
 - Flow Control = Off
- 7) When connecting to the screen you should have a blank screen.
- 8) Type "volleyboast" and then "enter" or "return".
- 9) Follow the prompts on your screen to change the configuration. Note, after typing the item number/letter you wish to modify, you must then click "enter" or "return" to enter the prompt.
- 10) Once the changes have been made, follow the prompts to exit the local configuration mode and resume normal operation.

Note: The serial switch must be set to "DISABLE" before exiting the local configuration mode. The VoBo will not resume normal operation if the serial switch is not set to "DISABLE".

Remove the USB-RS232 cable.



Configurable Fields

Cycle Time

- Time between readings
- Default: 30
- Units: Minutes
- Range: 5 – 2880
- Source: user determined

Voltage Input

- Voltage applied to sensors ADC channels
- Default: 12
- Units: Volts
- Range: 5 – 24 (whole numbers)
- Source: sensor documentation

Analog Power Time

- Time necessary for sensors to be sufficiently powered to take an accurate reading
- Default: 1.0
- Units: Seconds
- Range: 0.1 – 20.0
- Source: sensor documentation

Resend Attempts

- Number of times node will attempt to resend readings not acknowledged by gateway
- Default: 1
- Range: 0 - 3
- Source: user determined

Resend Delay

- Time delay between resend attempts
- Default: 5
- Units: Seconds
- Range: 1 - 10
- Source: user determined

Failed Transmissions Before Rejoin

- Number of failed send attempts allowed before initiating a new join process
- Default: 1
- Range: 1 – 3
- Source: user determined

Frequency Sub-Band (local configuration only)

- FSB Default: 2
- Range: 1 – 8
- Source: network provider

- The Default FSB is the FSB the VoBo will use first. If it does not join at the default FSB it will cycle through the remainder of them, beginning at FSB and skipping the default FSB. Setting your Default FSB to match the FSB of the Gateway you wish it to join will provide for a quicker join process, but it is not necessary. The VoBo will automatically store the FSB it last joined with as the starting point the next time the VoBo initiates a join process.

Modbus Configuration

- Modbus Enable - The Modbus functionality must be enabled to read Modbus RTU registers. Enter “yes” to enable. If not reading a Modbus device the Modbus functionality should be disabled.
- Modbus Address - Slave devices are assigned addresses in the range 1 – 247. Enter a 1 if you have one slave device, unless you are aware of a particular address that has been set for the slave device.
- Modbus Delay - The transducer’s data sheet specifies the minimum delay between transactions to return the content of the registers. Typically, between 200 to 300 ms. The VoBo should be configured for a greater length of time. The VoBo will terminate its delay period after it receives a transmission from the instrument.
- Modbus Parity - This can be configured to be 0 (None), 1 (odd), or 2 (Even).
- Modbus Stop Bits - This may be set to 1 or 2.
- Modbus Baud - The Baud rate for which the process instrument is configured for.
- Modbus Register Count - Enter the number of 16-bit Modbus RTU registers you wish to read from the slave device. The Vobo will read up to 41 16-Bit registers. If a register has 32 bits, generally they are located in successive 16-bit registers and can be read by entering the register address and then the successive register number and then combining the Bits.
- Modbus Register - This is the register for the data that is to be returned. Modbus registers that begin with a 3 are input registers and those that begin with a 4 are holding registers. The remaining digits specify the register where the data is located. Data addresses in Modbus registers are referenced to zero. Therefore, as a practical matter, enter a number that is one less than the register number provided on your device’s data sheet. A Modbus register of 30302 would be an input register and it would be addressed as register 301.

(Note: The VoBo serial communication for Modbus requires the use of 8 Data Bits)

Analog Calibration

- Adjusts the output from the analog terminals for Gain and Offset. Additionally, the output can be modified to report in engineering units instead of raw ADC counts (or millivolts)
- Default: Gain =1, Offset = 0.
- Range: Positive or negative number up to 5 significant digits

DECODING THE PAYLOAD

Payload Structure

The VoBo sends an 11-byte payload. If multiple Modbus registers are read, the VoBo will transmit the data in multiple 11-byte payloads. The VoBo utilizes a Port field (FPort or Port) within the MAC command to distinguish between the different payloads. A FPort of 1 denotes the first payload, which includes the data received by the analog and discrete terminals as well as the first Modbus register, if Modbus has been enabled. A FPort of 2 denotes the second payload which contains Modbus registers 2

through 6, FPort 3 includes Modbus registers 7 through 11, and so on. Each subsequent payload containing 5 Modbus registers.

If the slave returns an error or there are other communication issues, the VoBo payload for the registers which could not be read will be “9999” to indicate an error. If the VoBo is not communicating with the slave and fails to read the first 4 registers, it will stop trying to read any subsequent registers in order to minimize power consumption. It will try again on its next scheduled cycle.

The microprocessor uses a little-endian format. The tables below map out how the payloads are structured.

FPort 1 Payload

BYTE	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
1	Last 4 Bits of adcCh1				WKUP	DI3	DI2	DI1
2	First 8 Bits of adcCh1							
3	Last 8 Bits of adcCh2							
4	Last 4 Bits of adcCh3				First 4 Bits of adcCh2			
5	First 8 Bits of adcCh3							
6	Last 8 Bits of adcCh4							
7	Last 4 Bits of adcTemperature				First 4 Bits of adcCh4			
8	First 8 Bits of adcTemperature							
9	Last 8 Bits of Modbus Register 1							
10	First 8 Bits of Modbus Register 1							
11	Reserved for Future Use							

Notes:

- Digital Inputs - when circuit is open (or voltage is not detected) the payload is 1, when closed (or voltage is detected) the payload is 0.
- WKUP - when the circuit is open the payload is 0, when closed the payload is 1.
- adcCh1, adcCh2, adcCh3 correspond to the AI1, AI2, and AI3 analog terminal blocks.
- adcCh4 is raw battery voltage. Raw battery voltage * 4 = actual battery voltage (millivolts). The battery voltage is read while analog terminals are powered.
- adcTemperature is the reading from the temperature sensor integrated into the ADC. Temperature is in Celsius. When the first bit (left most) in the adcTemperature[0] is 0, the temperature is greater than zero. To convert to temperature multiply by 0.125. When the first bit in adcTemperature [0] is 1 the temperature is below zero and use $[(4096 - \text{adcTemperature}) * (-1) * 0.125]$ to get the temperature.

Breakdown of FPort 1 Payload

Base64 string - “8zA/EwBKlwvSBAA=”

Converted to Binary

11110011 00110000 00111111 00010011 00000000 01001010 00100011 00001011 11010010
00000100 00000000

Using the payload structure detailed above and keeping in mind the use of little-endian, the payload is broken up as follows:

Din1 – 1 - “1”
 Din2 – 1 - “1”
 Din3 – 0 - “0”
 WKUP – 0 - “0”
 adcCh1 – 001100001111 - “783”
 adcCh2 – 001100111111 - “831”
 adcCh3 – 000000000001 - “1”
 adcCh4 – 001101001010 - “842”
 adcTemperature – 000010110010 - “178”
 modbus register 1 – 0000010011010010 - “1234”

FPort 2 Payload

BYTE	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
1	Last 8 Bits of Modbus Register 2							
2	First 8 Bits of Modbus Register 2							
3	Last 8 Bits of Modbus Register 3							
4	First 8 Bits of Modbus Register 3							
5	Last 8 Bits of Modbus Register 4							
6	First 8 Bits of Modbus Register 4							
7	Last 8 Bits of Modbus Register 5							
8	First 8 Bits of Modbus Register 5							
9	Last 8 Bits of Modbus Register 6							
10	First 8 Bits of Modbus Register 6							
11	Reserved for Future Use							

Breakdown of Fport 2 Payload

Base64 string - “VxLDOBIAzRigFgA=”

Converted to Binary

01010111 00010010 11000011 00111000 00010010 00000000 11001101 00011000 10100000
00010110 00000000

Using the payload structure detailed above and keeping in mind the use of little-endian, the payload is broken up as follows:

modbus register 2 – 00010010 01010111 - “4695”
 modbus register 3 – 00111000 11000011 - “14531”
 modbus register 4 – 00000000 00010010 - “18”

modbus register 5 – 00011000 11001101 - “6349”

modbus register 6 – 00010110 10100000 - “5792”

Note: the 11th Byte (Reserved For Future Use) is 0000 0000.

Analog Channels

Each analog channel is read by a 12-bit ADC. Each channel can be configured with jumpers to go through one of three different circuits.

The circuit for reading a 0-5V sensor includes a voltage divider (R2 = 20,000 ohm, R1 = 30,000 ohm). The actual voltage output from a 0-5V sensor is reduced by 2/5 at the ADC input. The ADC output (adcChx) for a 0-5V sensor then will have a scale of between 0 and 2000 raw counts.

The circuit for reading a 0-10V sensor includes a R2 = 7,500 ohm, R1 = 30,000 voltage divider. The actual voltage output from a 0-10V sensor is reduced by 1/5 at the ADC input. The ADC output for a 0-10V sensor will also have a scale of between 0 and 2000 raw counts.

The circuit for reading a 4-20mA sensor has a current divider which includes a 250 Ohm resistor. 4mA of current from the sensor results in a voltage at the ADC input of 398mV and 20mA of current results in 1990mV at the ADC input.

Converting ADC Raw Counts to Sensor Units for a 0-5V Sensor

Example: A 0-5V pressure sensor, pressure range of 0-100psi, output load of 20,000 Ω.

Step 1: Calculate the slope (gain)

$$m = (\text{Sensor Pressure at 5V} - \text{Sensor pressure at 0V}) / (\text{Voltage Range of the Sensor}) * ((50,000 \Omega + \text{Output Load}) / 20,000 \Omega)$$

$$m = (100 / 5) * [(50000 + 20000) / 20000]$$

$$m = 70$$

Step 2: Calculate the y-intercept (offset)

$$b = (-1) * (0.4) * m * (\text{Output Voltage Min}) + (\text{Measurement Value Min})$$

$$b = (-1) * (0.4) * m * (0) + (0)$$

$$b = 0$$

Resulting Equation:

$$\text{Pressure} = 70 * (\text{ADC raw counts} / 1000)$$

Using adcCh1 raw counts of 783, sensor is measuring a pressure of 54.81psi.

Converting ADC counts to Sensor Units for a 0-10V Sensor

Example: A 0-10V pressure sensor, pressure range of 100 - 500psi, output load of 30,000 Ω.

Step 1: Calculate the slope (gain)

$$m = (\text{Sensor Pressure at 10V} - \text{Sensor pressure at 0V}) / (\text{Voltage Range of the Sensor}) * ((37,500 \Omega + \text{Output Load}) / 7,500 \Omega)$$

$$m = (400 / 10) * [(37,500 + 30,000) / 7,500]$$

$$m = 360$$

Step 2: Calculate the y-intercept (offset)

$$b = (-1) * (0.2) * m * (\text{Output Voltage Min}) + (\text{Measurement Value Min})$$

$$b = (-1) * (0.2) * m * (0) + (100)$$

$$b = 100$$

Resulting Equation:

$$\text{Pressure} = 360 * (\text{ADC raw counts}/1000) + 100$$

Using adcCh1 raw counts of 783, sensor is measuring a pressure of 381.8 psi.

Converting ADC counts to Sensor Units for a 4-20 mA Sensor

Example: A 4-20mA pressure sensor, pressure range of 0 - 2000psi.

Step 1: Calculate the slope (gain)

$$m = (\text{Sensor Pressure at 20 mA} - \text{Sensor pressure at 4 mA}) / (1.990 - 0.398)$$

$$m = (2000 / 1.592)$$

$$m = 1256.3$$

Step 2: Calculate the y-intercept (offset)

$$b = (-0.398 * m) + \text{Sensor Pressure at 4 mA}$$

$$b = (-0.398 * 1256.3) + 0$$

$$b = -500.0$$

Resulting Equation:

$$\text{Pressure} = 1256.3 * (\text{ADC raw counts}/1000) - 500.0$$

Using adcCh1 raw counts of 783, Sensor is measuring a pressure of 483.68 psi.

ANALOG CALIBRATION

The ADC raw count from the three analog terminals can be adjusted for gain and offset. This permits the storing of the calibration points at the VoBo level and using one conversion formula for a particular model sensor in the cloud or server. The gain and offset values can be entered through remote or local configuration parameters.

To have the payload report in engineering units, enter the gain expressed as (engineering units/adc raw counts) and the offset in engineering units. The engineering units should be from test instrumentation and the ADC raw counts should be the actual ADC raw counts reported from the installed sensor that correspond to the test points.

To have the payload continue to report in ADC raw counts, the gain should be expressed as (equivalent ADC raw counts from the test instrumentation/ADC raw counts from the installed sensor that corresponds to the test points). The offset should also be expressed in ADC raw counts.

Note the default Gain is set to 1 and the default Offset is set to 0. This provides the default payload explained above.

TEST POINTS

There are several voltage measurement points provided on the board.

VPP is the voltage provided to the analog terminal blocks. No voltage is applied to VPP when the VoBo is in its sleep cycle. VPP should be equal to the configured supply voltage when it is awake and for the duration of its settling time.

VBat provides the current battery voltage.

+3.0 Volt should measure 3.0 volts when the VoBo is awake. Many of the components on the board function at 3.0 volts.

V_MTDOT is the reference voltage from the microprocessor, it is 3 volts.

FIELD INSTALLATION

Refer to the VoBo GP-1 or HL-1 Installation Manual for instructions. Supplemental information to the Installation Manuals may be found below.

Current Sensors/Transmitters

- Two-wire loop powered sensor/transmitter:
 - Connect the jumpers as indicated in the installation manual for 4-20 mA sensors.
 - Connect the VDC supply wire (typically red) in the AI+ and the signal wire (typically black) in AI- of the analog input terminal block. The Bare or shield wire goes into the Shield terminal.
- Three wire current sensor/transmitter, powered by the VoBo:
 - Connect the jumpers as indicated in the installation manual for 4-20 mA sensors.
 - Connect the VDC supply wire to AI+, the signal wire to AI-, and the common wire to the Shield terminal.
 - Close jumper JP4 (located adjacent to the AI3 terminal block). This connects the shield to ground.
- Externally powered current transmitter:
 - Only close X8, X11, and/or X18 (for the AI1, AI2, and/or AI3 respectively).
 - Connect the signal wire to AI- and the common (or supply -) to the Shield.
 - Close jumper JP4 (located adjacent to the AI3 terminal block). This connects the shield to ground.

REGULATORY

47 CFR Part 15 Regulation Class B Devices

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. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Notice

Per FCC 15.19(a)(3) and (a)(4) 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.
2. This device must accept any interference received, including interference that may cause undesired operation.

FCC Grant

FCC Part 15	
FCC Identifier:	AU792U13A16857
Equipment Class:	Digital Transmission System
Notes:	MTDOT-915
FCC Rule Parts:	15C
Approval:	Single Modular
Frequency Range:	902.3-914.9
Output Watts:	0.0772

Output power is conducted. This transmitter is a hybrid per FCC 15.247(f) and FCC KDB 453039. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter within a host device, except in accordance with FCC multi-transmitter product procedures.

Industry Canada Class B Notice

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement Canadien sur le matériel brouilleur.

This device complies with Industry Canada license-exempt RSS standard(s). The operation is permitted for the following two conditions:

1. The device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. *L'appareil ne doit pas produire de brouillage*
2. *L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

Industry Canada

Specification/ Cahier des Charges	Issue/ Édition	From Frequency/ De Fréquences	To Frequency/ À Fréquences	Emmission Designation/ Designation D'émission	Minimum Power	Maximum Power
RSS247	1.0	902.3 MHz	914.9 MHz	GDXX	77.2 mW	77.2 mW

Certification Number/No. de Certification	125A-0054
Type of Radio Equipment/Genre de Matériel	Spread Spectrum/Digital Device (902-928MHz)/ Modular Approval/Approbation modulaire
Model/Modèle	MTDOT-915

Certification of equipment means only that the equipment has met the requirements of the above noted specification. License applications, where applicable to use certified equipment, are acted on accordingly by the Industry Canada issuing office and will depend on the existing radio environment, service and location of operation. This certificate is issued on condition that the holder complies and will continue to comply with the requirements and procedures issued by Industry Canada. The equipment for which this certificate is issued shall not be manufactured, imported distributed, leased, offered for sale or sold unless the equipment complies with the applicable technical specifications and procedures issued by Industry Canada.

La certification du matériel signifie seulement que le matériel a satisfait aux exigences de la norme indiquée ci-dessus. Les demandes de licences nécessaires pour l'utilisation du matériel certifié sont traitées en conséquence par le bureau de délivrance d'Industrie Canada et dépendent des conditions

radio ambiantes, du service et de l'emplacement d'exploitation. Le présent certificat est délivré à la condition que le titulaire satisfasse et continue de satisfaire aux exigences et aux procédures d'Industrie Canada. Le matériel à l'égard duquel le présent certificat est délivré ne doit pas être fabriqué, importé, distribué, loué, mis en vente ou vendu à moins d'être conforme aux procédures et aux spécifications techniques applicable publiées par Industrie Canada.

REVISION HISTORY

Revision Date	Section	Revision
2021.05.14		Original Issue of DCM-0002 Rev A5
2021.06.28	Connecting the VoBo	Revised explanation of the Join Process
2021.06.28	Configuration	Added Stop Bits and Parity to Modbus Configuration
2021.06.28	Throughout	Corrected minor typos and prose.
2021.08.16	Analog Channels	Corrected error in 4-20 mA conversion
2021.08.16	Connect the VoBo to the Gateway	Added a caution regarding use of Adaptive Data Rate (ADR)
2021.09.17	Connect the VoBo to the Gateway	Corrected the operation of the LED during the join process
2021.12.10	Field Installation	Added supplemental information regarding current transmitters

CONTACT

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