Product Manual

Nomad

Automation Products Group, Inc.
Doc # 9006719 Rev B
12/2023

APG®

TABLE OF CONTENTS

INTRODUCTION

Thank you for purchasing a Nomad Remote Monitor from us! We appreciate your business and your trust. Please take a moment to familiarize yourself with the product and this manual before installation. If you have any questions, please don't hesitate to call us at 888-525-7300.

The Nomad Remote Monitor is capable of monitoring RS485 Modbus-RTU sensors almost anywhere on earth via satellite. It has Wi-Fi configurability and a very accurate GPS. It has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

Reading Your Label

Every APG instrument comes with a label that includes the instrument's model number, part number, serial number, and a wiring pinout table. Please ensure that the part number and pinout table on your label match your order.

WARRANTY

This product is covered by APG's warranty to be free from defects in material and workmanship under normal use and service of the product for 24 months. For a full explanation of our Warranty, please visit https://www.apgsensors.com/resources/warranty-certifications/warranty-returns/. Contact Technical Support to receive a Return Material Authorization before shipping your product back.

INSIDE THE BOX

- 1/4" wave antenna
- Nomad controller
- Solar panel with ground plate
- 4 hose clamps

INSTALLATION

Location

For proper installation of Nomad, it is recommended to place it outdoors in an area with an unobstructed view of the sky. If mounting the device against a wall is necessary, it is advisable to install it as high as possible to ensure that the building does not obstruct more than half of the sky.

Please install Nomad at least 3 feet from the ground.

To optimize shading during peak sunlight hours, it is recommended to install the box directly beneath the solar panel. This allows the solar panel to provide shade to the box when the sun is at its highest point. The LEDs on the Nomad box should be facing down. Any other orientation of the box would void the FCC testing and certification.

Mounting

The solar panel comes with a mounting system which can be secured to a pole using a hose clamp, or can be attached to a wall. APG offers several mounting accessory options, see the data sheet for details.

Step 1: Once the mounting system is securely attached, adjust the solar panel to an angle approximately between 30 and 45 degrees.

The direction in which a solar panel should be facing depends on the location of the panel. In general, solar panels should be facing south (in the northern hemisphere) or north (in the southern hemisphere) to capture the most sunlight over the course of a day. This orientation maximizes the amount of energy the panel can generate, especially during peak daylight hours.

However, there may be other factors to consider, such as shading from nearby trees or buildings, the angle of the sun at different times of the year, and local climate conditions. In some cases, it may be beneficial to angle the panels slightly to the east or west to capture more morning or evening sunlight.

The optimum tilt angle is calculated by adding 15 degrees to your latitude during winter and subtracting 15 degrees from your latitude during summer. For instance, if your latitude is 34°, the optimum tilt angle for your solar panels during winter will be 34 + 15 = 49°. The summer optimum tilt angle, on the other hand, will be 34 – 15 = 19°. If adjusting the solar panel based on the time of year is not an option, please tilt it based on your latitude for best performance.

Step 2: Connect the ¼" wave antenna to the top of the solar panel.

Step 3: Connect the antenna extension cable to the Nomad Box.

Step 4: To connect your sensor(s) and verify the connection, use the sensor input line, which has two available connectors and will be powered individually. If your sensors are connected in a daisy chain configuration, ensure that the power requirement of each sensor line does not exceed 120mA.

Step 5: To connect the power cable from the solar panel to the Nomad box, thread the cable into the designated connector. After plugging in the connector, use its head to fasten it securely to the Nomad box. Avoid twisting the power cable by ensuring that the connector does not turn.

Once the connector is properly inserted, Nomad will turn on a yellow LED and a blinking red LED. The yellow LED signifies that the Wi-Fi is active, and the blinking red LED indicates that the system is operational. The blue LED indicates that the sensors are powered. If all 3 LEDs are blinking fast, please contact APG.

Configuration

Step 1: To connect to the Nomad's Wi-Fi network, you can use a phone, tablet, computer, or any device with Wi-Fi capability. The box has a QR code that can be scanned using a smart device to automatically establish a connection. If the QR code is not easily accessible, you can manually connect to the Wi-Fi network named "Nomad_Fxxxxx", with "xxxxx" being the serial number of the Nomad. The password for the network is **9876543210**.

The time it takes to connect may vary depending on the smart device being used. Some devices may verify internet connectivity before connecting to a Wi-Fi network, which could result in a brief delay. If a warning message appears indicating that there is no internet connectivity while attempting to connect to the Nomad's Wi-Fi network, please acknowledge it and proceed with the connection.

The Wi-Fi will turn off, to save power, after 30 minutes of inactivity. The LEDs will also turn off. You can also turn off the Wi-Fi manually from the info tab when you are done configuring the controller. Wi-Fi connectivity is only necessary for setup, and doesn't need to be continually active.

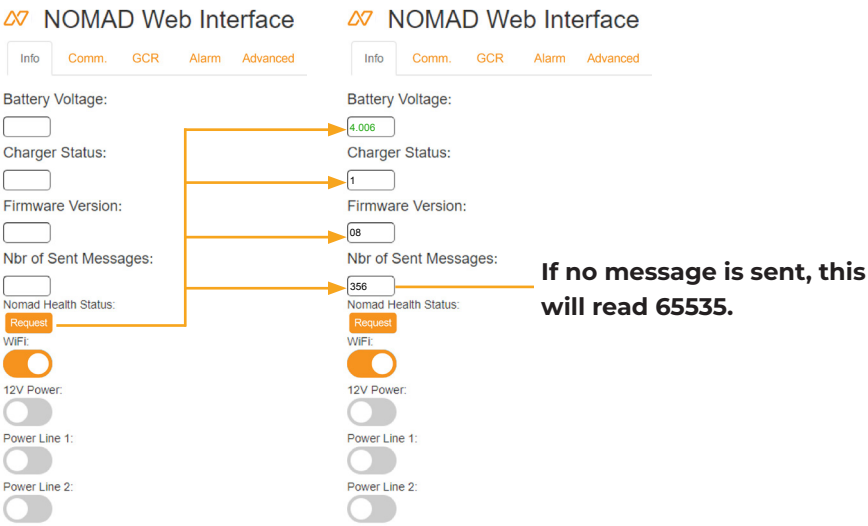
Step 2: After establishing the connection, open a web browser and enter “192.168.4.1” in the address bar. The time it takes for the page to load may vary depending on the device being used.

Step 3: Once loaded, you should see a page that resembles the info tab (found on the next page). If the page does not appear, please try reloading until it does. To ensure that everything is functioning properly, click on the “REQUEST" button on the home page, which will display information such as battery charge, firmware version, and the number of messages sent during the current month on the front page.

SOFTWARE TAB NAVIGATION

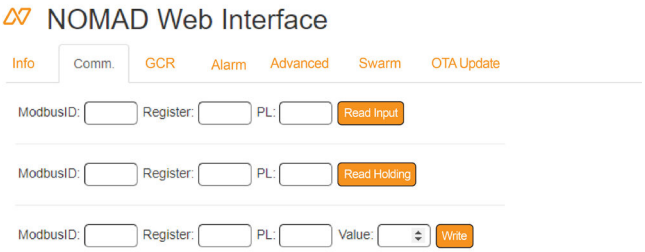
Info

Displays vital information on the device. The boxes will display information after clicking on “**Request**”



Communication (Comm.)

Use this section to check communication with Nomad.



Before you begin connecting your sensors to Nomad, you must ensure it is communicating at the same rate as Nomad. Standard Nomad communication is *9600 Baud, 8 bits, 1 Stop bit, No parity.* Information for your specific sensor can be found in your sensors' user manual.

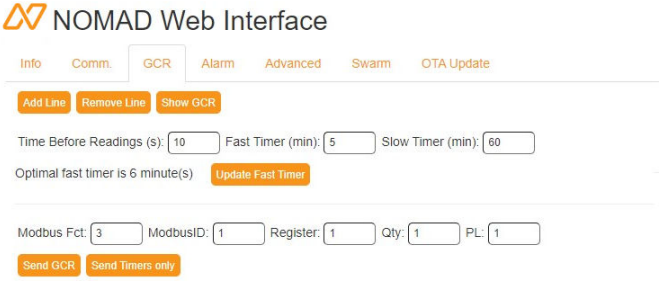
Three lines are available. Line 1 reads input register. Line 2 reads holding register. Line 3 writes holding register.

On all 3 lines, the **ModbusID** box is the ModbusID of the sensor you are trying to communicate with. By default, all sensors come with an ID of 1. If you are connecting multiple sensors, its critical that you change the ModbusID to something other than 1, so additional sensors can be recognized. **Register** is the register you want to read or write. You can find the list of registers in your sensors' user manual, typically found in the Modbus Programming section of your manual. ***PL*** is the Power Line, telling Nomad which connector the sensor is connected to. This label is found on the front of your Nomad device.

Read Input will send a Modbus function 4 to the sensor, which is a Read Input Register function. Input registers are read-only, and are meant to give you static information and raw data specific to your sensor. The **Read Holding** button will send a Modbus function 3 to the sensor, which is a Read Holding Register function. Holding registers are both Read/Write. You can check current values for a holding registers using the **Read Holding**. For **Write**, a ***Value*** needs to be entered, as this sends a Modbus function 6 "Write Single Holding Register" function to the sensor. This is what you use to change holding register values, such as Device Address, Units, etc.

Gateway Control Reading (GCR)

This tab is used to setup Nomad and control what should be read and when.



Time Before Readings (s) is used to tell Nomad how many second(s) a reading will be accessible on the slowest sensor connected to it. For example, if the slowest sensor takes 10s to transmit a correct reading after powered up, please enter at least 10 in this box.

Fast Timer (min) is used to wake up Nomad every X minute(s) to execute a Gateway Control Reading (GCR). When Nomad wakes up, it reads the sensors, check for alarms, and saves data. If no alarm is detected, the sensor readings data is saved and sent in the next satellite communication (see Slow Timer). If an alarm is detected, Nomad will initiate an asynchronous communication to transmit the alarm. You will receive an alert via email or text message (depending on how Nomad Explorer has been configured). By default, everybody who has read access to the sensor on Nomad Explorer will receive an email. Increasing the frequency of the fast timer will increase power usage.

Nomad efficiently manages data transmission with consideration for communication length (see Communication Length). The Nomad Web Interface automatically calculates and suggests the optimal frequency for the Fast Timer based on the GCR and Slow Timer settings. If the Fast Timer is not set to optimal when you click "Send GCR" or "Send Timers Only", a popup will appear to ask if you want to change the setting to optimal. Setting the frequency to higher than the optimal allows the user to check for alarms more frequently, but only the initial readings will be transmitted.

Slow Timer (min) is used to communicate with the satellite. For example, if this box is populated with 60 minutes, Nomad will wake up every 60 minutes, read the sensors (as explained below), check for alarm, and send the saved readings since the previous communication to the satellite even if no alarm is detected. As of now, you have access to 750 messages per month with Nomad, which is approximately 1 message an hour. If alarms are set, asynchronous messages will be sent during the month and the number of scheduled and unscheduled messages may exceed 750. **Nomad will stop sending messages after 750 per month.** Please fill this box carefully to not exceed this amount.

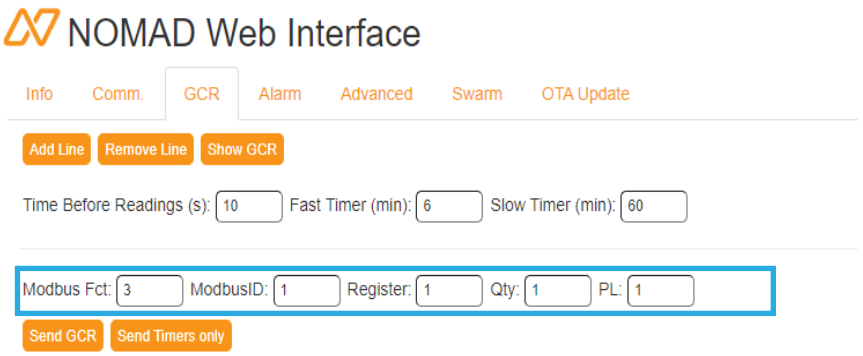
Communication Length

The optimal frequency is calculated for you by the software, no manual calculations are necessary.

Each Nomad communication contains 384 characters, and can contain multiple messages. Each message starts with an 18 character header with time and date stamp information, followed by sensor data. Each sensor has a 10 character header, followed by a 4-character register value. If a sensor has more than one register, each register will contribute a 4-character register value.

For example, if you have one Modbus sensor with two registers, each message will contain 36 characters (18 char header + 10 char sensor header + 4 char per register x2). With this configuration, you could send 10 messages per communication, once every 6 minutes (60 minute Slow Timer).

If you have two Modbus sensors each with one register, each message will contain 46 characters (18 char header + 10 char first sensor header + 4 char register + 10 char second sensor header + 4 char register). With this configuration, you could send 8 messages per communication, once every 7 minutes (60 minute Slow Timer).



The line inside the blue box controls what Nomad does on a regular basis. Each command is on a separate line. Additional lines can be added by clicking on the **Add Line** button.

IMPORTANT: *All the lines must be filled with information. If GCR lines are empty, please use the* **Remove Line** *button.*

Modbus Fct: This is the Modbus function that Nomad will execute; 2 values are acceptable:

3: Modbus function 3; Read Holding Register
4: Modbus function 4; Read Input Register
(Please refer to your sensor to see if the register you want to read is a holding or an input register.)

ModbusID: Specify the Modbus ID of the sensor you want to read

Register: Specify the register you want to read

Qty: Number of registers you want to read, starting at the register entered. If the registers are not in numeric order, make a new line for each register (see Example 2 on page 11).

PL: Power Line. Specify what power line you are using. This is based on the connector you used to connect your sensor(s). 2 Values are acceptable:

1: The sensor you want to read is connected on the PL 1
2: The sensor you want to read is connected on the PL 2

Once the GCR is filled correctly, select **Send GCR**. This will configure Nomad with the command specified. After sending, the boxes will empty. To repopulate with the current active values, select **Show GCR**. Selecting **Send GCR** will send an asynchronous message to let Nomad Explorer know the new values.

The button **Send Timer Only** will only send the 3 boxes for the timers and will not change the command to execute.

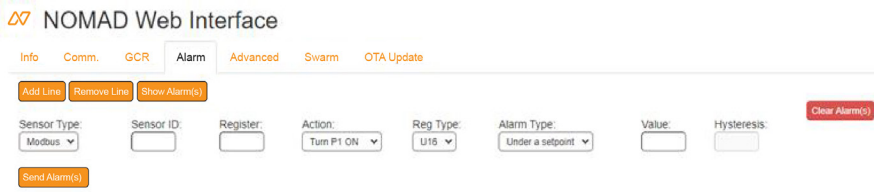
Example 1:

You have connected a sensor, with a Modbus ID 1 to the power line 1. You want to read the register 0 and register 1. Both registers are holding registers.

Example 2:
You have connected 2 sensors, with a Modbus ID 2 and 3 to the power line 1. You want to read registers 299, 300, 301 and 303 on Modbus ID 2 and register 399 on Modbus ID 3. Register 299, 300, 301 and 303 are input register, while 399 is a holding register. You will need to have 3 lines for this.

One line to read input register, on Modbus ID2, starting at 299, quantity of 3 (299, 300 and 301), PL1. One line to read input register, on Modbus ID2, starting at 303, quantity of 1 (303), PL1. One line to read holding register, on Modbus ID3, starting at 399, quantity of 1 (399), PL1

Alarm



Alarms are configured on this tab.

Sensor Type: An alarm can be triggered on a Modbus reading or using the digital input of Nomad.

Sensor ID: In case of a Modbus sensor, this is the Modbus ID of the sensor you want to check.

Register: The register you want to read and check for values. This register needs to be in the GCR. If Nomad does not read this register, the alarm will never trigger.

Action: Nomad can turn on or off a digital output (P1 or P2) based on the alarm. If this is not needed, please select “nothing.”

Register Type: This depends on the sensor you are reading. Some sensors could report negative values. For example, a temperature sensor will have a temperature reading register of I16, meaning that it is a signed register so we can display negative value. 2 types are available:

I16*:* Signed 16 bit register: The sensor can send negative values and will go from -32768 to +32767

U16: Unsigned 16 bit register: The sensor will only send positive values and will go from 0 to 65535.

Alarm Type: 5 acceptable entries, listed below:

- **Under a setpoint**: This will trigger an alarm if the sensor reading is under the setpoint entered in the **value** box. The alarm will be clear if the reading is over the setpoint.
- **Over a setpoint**: This will trigger an alarm if the sensor reading is over the setpoint entered in the **value** box. The alarm will be cleared if the reading is under the setpoint.
- **Abrupt change**: This will trigger an alarm if the difference between the previous reading and the current reading is greater than **value**.
- **Hysteresis near**: This will trigger an alarm if the **value** of the sensor, for the specified register, is over the setpoint. To turn off the alarm, the **value** of the sensor needs to be out of the hysteresis window.
- **Hysteresis far**: This will trigger an alarm if the **value** of the sensor, for the specified register, is under the setpoint. To turn off the alarm, the **value** of the sensor needs to be out of the hysteresis window.

Value: The value of the setpoint. The setpoint will be compared to the sensor reading; please refer to the datasheet of the sensor to see what reading is output.

Hysteresis: Needs to be entered if the alarm is of type “hysteresis.”

Multiple alarms can be entered by clicking on **Add Line**. All the lines must be filled before sending the alarm. Use **Remove line** to remove any empty line. Once the alarm(s) are configured, hit **Send Alarm**. After sending, the boxes will empty. To repopulate the fields with current values, hit **Show Alarms** and verify displayed information.

When **Send Alarm** is pressed, any existing alarm in Nomad will be removed and only the displayed alarm will be set. So, when adding an additional alarm, select **Show Alarm** first and add another line for your new alarm.

Advanced

This tab is only used for debugging.

Swarm

This tab is used for 2 functions.

Function 1: Request the RSSI for Swarm. The RSSI is the signal to noise ratio. After installation and during configuration, please hit “Request” in front of “RSSI 1s” to display the signal to noise ratio. The value will be displayed at the bottom of the screen.

Interpreting RSSI:
RSSI > -75: The signal to noise ratio is severe. Communication with the satellite is unlikely. Try adjusting the power cable from the solar panel to the box, avoid crossing the antenna cable and the power cable. If this doesn't help, try moving Nomad to a different location.
-75 < RSSI < -85: Bad signal to noise ratio.
-85 < RSSI < -95: Good signal to noise ratio
-95 < RSSI < -110: Perfect signal to noise
RSSI =< -113: The antenna is not connected. Please verify connection.

IMPORTANT: *When finished checking the RSSI, hit* **Request** *in front of RSSI 0s to stop the request.*

Function 2: Request the number of unsent messages. By clicking on **Request** in front of "Number of messages in queue", you will see how many messages are in the queue. This means that Nomad tried to send message(s) to the satellite, but due to no satellite on site or due to a bad signal to noise ratio, the messages weren't sent. This shouldn't be bigger than 10. If it is, please check the signal to noise ratio and ensure you didn't exceed the number of messages per month (Info tab).

Over The Air Update (OTA Update)

This tab is used to update Nomad Firmware Over the Air, via Wi-Fi. This procedure should not be attempted without APG consent, and only with a firmware specifically made for it.

Please contact APG if a firmware update is needed or available.

MAINTENANCE

The frequency at which a solar panel should be cleaned depends on various factors, such as: the location of the panel, the amount of dust, debris, and pollution in the air, and the local climate. In general, solar panels should be cleaned at least once or twice a year to maintain their efficiency.

However, in areas with high levels of pollution or dust, panels may require more frequent cleaning. If you live in a dry and dusty area or an area prone to high winds or frequent rain, you may need to clean your solar panels more often. Similarly, if you live in a humid and damp climate, you may need to clean your solar panels more frequently to prevent the growth of mold or algae.

It's also a good idea to clean your solar panels after a significant weather event, such as a dust storm or heavy rain, as these can leave a layer of dust or debris on the panel's surface.

APG recommends the following steps for cleaning the solar panel:

Step 1: Turn off the solar panel: Before you start cleaning, turn off the solar panel to avoid the risk of electric shock. Verify that the connectors are still connected to the box in order to avoid any water intrusion.

Step 2: Remove debris: Remove any debris, such as leaves or bird droppings, from the surface of the panel with a soft-bristled brush or a clean, dry cloth.

Step 3: Rinse with water: Use a garden hose or a bucket of water to rinse the panel gently.

Step 4: Use a mild detergent: If there is still dirt or grime on the panel, mix a mild detergent with water and apply it to the panel with a soft sponge or cloth. Avoid using abrasive materials or harsh chemicals that could damage the panel.

Step 5: Rinse again: Rinse the panel thoroughly with clean water.

Step 6: Dry the panel: Use a squeegee or a dry, clean cloth to remove any remaining water from the surface of the panel. Avoid letting the panel air-dry, as this can leave water spots.

WARNING!!

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.

In order to comply with FCC / ISED RF Exposure requirements, this device and antenna must be installed to provide at least 36 cm separation from the human body at all times.

This device is not intended to be installed or located where the general population has access and is only intended to be installed or located in an Occupational/Controlled Environment. If installed where access to the General Population can not be avoided, a separation distance of 75 cm must be maintained between Public Access and this device.

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

FCC Compliance

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.

AVERTISSEMENT!!

Ce dispositif est conforme à la partie 15 des règles de la FCC. Son fonctionnement est soumis aux deux conditions suivantes : (1) Ce dispositif ne doit pas causer d'interférences nuisibles, et (2) ce dispositif doit accepter toute interférence reçue, y compris une interférence pouvant provoquer un fonctionnement indésirable.

Afin de respecter les exigences d'exposition aux RF de la FCC / ISED, cet appareil et son antenne doivent être installés de manière à fournir au moins 36 cm de séparation par rapport à au corps humain en permanence.

Cet appareil n'est pas destiné à être installé ou situé là où le grand public a accès et ne doit être installé ou situé que dans un environnement professionnel/surveillé. S'il est installé là où l'accès du grand public ne peut être évité, une distance de séparation de 75 cm doit être maintenue entre l'accès du public et cet appareil.

FCC Certification

Cet équipement a été testé et jugé conforme aux limites pour un dispositif numérique de classe B, conformément à la partie 15 des règles de la FCC. Ces limites sont conçues pour offrir une raisonnable protection contre les interférences nuisibles dans une installation résidentielle. Cet équipement génère, utilise et peut émettre de l'énergie radiofréquence et, s'il n'est pas installé et utilisé conformément aux instructions, peut causer des interférences nuisibles aux communications radio. Cependant, il n'y a aucune garantie que des interférences ne se produiront pas dans une installation particulière. Si cet équipement provoque des interférences nuisibles à la réception radio ou télévision, ce qui peut être déterminé en éteignant et en rallumant l'équipement, l'utilisateur est encouragé à essayer de corriger les interférences en utilisant une ou plusieurs des mesures suivantes :
— Réorienter ou déplacer l'antenne de réception.
— Augmenter la distance entre l'équipement et le récepteur.
— Brancher l'équipement sur une prise électrique d'un circuit différent de celui auquel le récepteur est connecté.
— Consulter le revendeur ou un technicien radio/TV expérimenté pour obtenir de l'aide.
Des modifications ou des altérations non expressément approuvées par la partie responsable de la conformité pourraient annuler l'autorisation de l'utilisateur à utiliser l'équipement.

WARNING!!

ISED Compliance

1.2.1 ISED RSS-Gen Notice CAN ICES-3 (B)NMB-3(B):
This device complies with Industry Canada's license-exempt RSSs. 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.

1.2.2 IC ID:
The IC ID for the Swarm M138 Modem is 25817-M138. All manufacturers integrating the Swarm M138 Modem into their products are required to provide a physical or e-label stating "Contains IC ID: 25817-M138".

AVERTISSEMENT!!

ISED Certification

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

Automation Products Group, Inc.
Tel: 1 (888) 525-7300 or 1 (435) 753-7300

e-mail: sales@apgsensors.com
www.apgsensors.com

Automation Products Group, Inc.
1025 W. 1700 N.
Logan, UT 84321