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1. INTRODUCTION

1.1 Overview

The purpose of this Nomad Explorer User Manual is to provide users with guidance on how to use the features of Nomad Explorer. Key features include:

- Sensor data delivery to user
- Sensor alarm notifications
- Two-way communication between user and sensors
- User controlled sensor and gateway configuration

This introductory section will instruct users on how to register, log in/out, and basic navigation of the website.

The “Using Nomad Explorer” section will cover the main features of Nomad Explorer and show step-by-step instructions on how to use them.

If a user is having trouble or receiving error messages, the “Troubleshooting and Support” section will instruct users on how to best resolve their issues.
1.2 Registration

To use Nomad Explorer a user must be registered. To get to the Registration page, click on the “Sign Up” icon in the top right of the Login page.

Fill in the requested information and click the “Sign Up” button. A verification email will be sent to the provided email address, and once the verification has been completed the user will be registered.

1.3 Log In

Users will need to input their username and password to log into Nomad Explorer. If a user has forgotten their password, they can click the “Forgot Password” button to create a new password.
1.4 Organization & Navigation

The Home page has three displays: most recent communications, monthly communications, and a map of active gateways. It is designed to give users a brief overview of their gateways.

- The most recent communications displays the five most recent communications from the current gateways.
- The monthly communications display keeps track of uplink and downlink communications for the current month for each of the current user’s gateways.
- The map of active gateways shows where the gateways are located based on telemetry data. This will only show if the current user has access to the gateways’ GPS telemetry.
1.4.2 My View

The My View page is the principal page for viewing details and changing configurations on the current user’s gateways and sensors. Displayed from left to right, My Sensors, Overview, and the tabbed layout.

![My View Page](image)

**My Sensors**
Controls which information is displayed, and which configurations are to be changed. This is a tree structure with the trunk being groups and leaves are sensors: Group >> Gateway >> Sensor.

**Overview**
Displays Gateway and Sensor information on device health, telemetry, and current configurations.

**Tabbed Layout**
The details of each tab will be covered in Section 3 of this manual.

1.5 Log Out

Clicking on the Log Out icon will immediately log out the current user and direct the current user to the Log In page.

![Log Out](image)
2. USING NOMAD EXPLORER

The following sub-sections provide detailed, step-by-step instructions on how to use the various functions or features of Nomad Explorer.

2.1 Invitations & Phantom Users

Invitations can be sent to email addresses from the Profile page.

Once an invitation has been sent, a “Phantom” user is created with the inviter’s current configuration and access attributes. These Phantom users can then be added to groups and have access attributes modified. When the invitee registers, the Phantom user becomes a regular user.

2.1.1 How to Invite Other Users

1. Click the Profile Button
2. Click the Invite Button

Invitations & Phantom Users
2.2 Gateways

Gateways are the piece of the Nomad system that communicates between the sensors and the website. All users can control the communication frequencies as well as the request register readings from the “Gateway Control” tab:

**Step 1**  Click "My View"

**Step 2**  Select the group the gateway is a member of.

**Step 3**  Input the invitee's email address, click "Invite".

---

fig. 10. Invite Input

fig. 11. My View Button

fig. 12. Gateway Group
2.2.1 Gateway Reading Control (GRC)

Gateway Reading Control allows the user to determine how a Nomad device communicates with its sensors.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Modbus Sensor ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address To Read</td>
<td>The register address to read</td>
</tr>
<tr>
<td>Length</td>
<td>The length of the read starting at &quot;Address To Read&quot; Value</td>
</tr>
<tr>
<td>Power Line</td>
<td>The power line associated with the selected sensor</td>
</tr>
<tr>
<td>Function</td>
<td>The function to apply to the read</td>
</tr>
<tr>
<td>Fct. Desc.</td>
<td>Description of the selected function</td>
</tr>
</tbody>
</table>
2.2.2 How to Create a New Gateway Reading Control

**Step 1**  Click "Add"

![fig. 15. GRC Add Button](image1)

**Step 2**  Click "Update Queue"

![fig. 16. GRC Update Queue Button](image2)
2.2.3 How to Delete a Gateway Reading Control

**Step 1**  Click "X"

![Fig. 17. GRC X Button](image)

**Step 2**  Click "Update Queue"

![Fig. 18. GRC Update Queue Button](image)
2.2.4 Gateway Communication & Reading Settings

Users can adjust gateway sensor reading and communication settings according to their needs. See Section 2.2.1 for a description of the configuration settings.

**Step 1** Click "Gateway Control"

**Step 2** Adjust communications settings
**Step 3** Select "Update Queue"

![Gateway Control Update Queue](image)

**Table 1. Gateway Configuration**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Frequency Read (minutes)</td>
<td>How often the gateway will read sensor values without sending (used for alarm detection)</td>
<td>10</td>
</tr>
<tr>
<td>Send Comm. Every (minutes)</td>
<td>How often the gateway will read and send sensor values</td>
<td>60</td>
</tr>
<tr>
<td>Bootup Timeout (seconds)</td>
<td>The time between gateway bootup and sensor reading</td>
<td>10</td>
</tr>
</tbody>
</table>
2.2.5 Gateway Location

If a user has access to GPS data, then they will see a “Gateway Location” tab in “My View” that shows the gateway’s recorded location. This feature requires gateway telemetry data that may not always be available.

![Gateway Location](image1)

2.3 Alarms

Alarms are handled at the gateway level but are defined at the sensor level. When a user selects the “Alarm” tab in “My View” they will see all sensors’ set alarms and alarm history for the gateway.

![My View Alarms](image2)
2.3.1 Alarm Types

Table 2. Alarm Types

<table>
<thead>
<tr>
<th>Type ID</th>
<th>Type</th>
<th>When the Alarm will trigger.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Under</td>
<td>Sensor reading goes below the set value</td>
</tr>
<tr>
<td>2</td>
<td>Over</td>
<td>Sensor reading goes above the set value</td>
</tr>
<tr>
<td>3</td>
<td>Abrupt</td>
<td>The absolute difference between two consecutive sensor readings is larger than the set value.</td>
</tr>
<tr>
<td>4</td>
<td>Hysteresis Near</td>
<td>If the value of the sensor, for the specified register, is under the setpoint, turn on the alarm. To turn off the alarm, the value of the sensor needs to be out of the hysteresis window.</td>
</tr>
<tr>
<td>5</td>
<td>Hysteresis Far</td>
<td>If the value of the sensor, for the specified register, is over the setpoint, turn on the alarm. To turn off the alarm, the value of the sensor needs to be out of the hysteresis window.</td>
</tr>
</tbody>
</table>

2.3.2 Alarm Actions

Table 3. Alarm Actions

<table>
<thead>
<tr>
<th>Action ID</th>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Turn P1 ON</td>
<td>Gateway will turn Digital Output 1 ON</td>
</tr>
<tr>
<td>2</td>
<td>Turn P1 OFF</td>
<td>Gateway will turn Digital Output 1 OFF</td>
</tr>
<tr>
<td>3</td>
<td>Turn P2 ON</td>
<td>Gateway will turn Digital Output 2 ON</td>
</tr>
<tr>
<td>4</td>
<td>Turn P2 OFF</td>
<td>Gateway will turn Digital Output 2 OFF</td>
</tr>
<tr>
<td>5</td>
<td>Nothing</td>
<td>Gateway will do nothing (Alarm notifications will still be sent out)</td>
</tr>
</tbody>
</table>
2.3.3 How to Add an Alarm

**Step 1** Select Sensor

![Sensor Selection](image1.png)

**Step 2** Click "Alarms"

![Alarm Menu Option](image2.png)

**Step 3** Click "Add Alarm"

![Add Alarm](image3.png)
Step 4  Set the Alarm configuration

Step 5  Click "Save & Update Queue"

2.3.4 How to Edit an Alarm

Step 1  Configure Alarm Type
**Step 2** Configure Alarm Notification

![Alarm Notification Select](image1)

**Step 3** Click "Save & Update Queue"

![Notification Selection](image2)

![Alarm Edit Save and Update Queue Button](image3)
2.3.5 How to Delete An Alarm

Step 1  Click "X"

![Alarm Delete Button](fig. 34. Alarm Delete Button)

Step 2  Click "Save & Update Queue"

![Alarm Save and Update Queue](fig. 35. Alarm Save and Update Queue)

2.3.6 Alarm History

The “Alarm History” table will show all previously triggered alarms as well as all actively triggered alarms. Nomad will clear its own alarms if the sensor value returns to a ‘safe’ reading.

**Note:** Using satellite communications can cause some messages to become unordered. It is possible for Nomad Explorer to receive an alarm cleared message before receiving an alarm triggered message. To better inform the user, the Alarm History table includes the “Triggered On”, “Received On”, and “Acknowledged On” timestamp columns.
2.4 Attributes

The user can configure the sensor configuration by changing the values in the Sensor Attributes list. Any change to these values will automatically be saved to the database.

Table 4. Sensor Attributes

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gateway Name</td>
<td>User defined alias for the gateway</td>
</tr>
</tbody>
</table>

2.4.1 Sensor Attributes

The user can configure the sensor configuration by changing the values in the Sensor Attributes list. Any change to these values will automatically be saved to the database.

Table 4. Sensor Attributes

<table>
<thead>
<tr>
<th>Name</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Model</td>
<td>The model of the sensor</td>
</tr>
<tr>
<td>Address To Read</td>
<td>The address of the register holding the sensor value</td>
</tr>
<tr>
<td>Sensor Name</td>
<td>User defined alias for the sensor</td>
</tr>
<tr>
<td>Power Line</td>
<td>Which power line the sensor is using</td>
</tr>
</tbody>
</table>
2.4.2 Register Attributes

The register attributes let Nomad Explorer know how to format the register values for display to the user.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register Extra Math</td>
<td>Equation used to convert this register’s values.</td>
</tr>
<tr>
<td>Register Type</td>
<td>The data type stored by this register.</td>
</tr>
<tr>
<td>Register Name</td>
<td>User defined alias for the register</td>
</tr>
<tr>
<td>Measurement Units</td>
<td>Units that will display in the chart and exported data</td>
</tr>
<tr>
<td>AI Predictions Enabled</td>
<td>Toggle. If enabled, the chart and exported data will display AI predictions for the register</td>
</tr>
</tbody>
</table>

**Note:** Nomad Explorer converts to and from the register, meaning this equation must be bijective and should be kept simple.

Currently, Register Extra Math doesn’t support equations with exponential values that are less than one.

2.5 Message Center

The “Message Center” is where outgoing messages are queued and sent to Nomad devices.
2.5.1 Sending Messages

Configuration changes to a gateway or a sensor are encoded into hexadecimal messages and assembled in the Message Center. Users will see a notification if any pending messages are waiting to be sent. To send the messages just click the “Send Message(s)” button.

![Message Center with a Queued Message](image)

2.5.2 Message History

Messages that have been sent are saved and can be viewed in the Message Center. Messages that have been received and acknowledged by the Nomad device have a “Date Received” timestamp.

![Message History](image)
2.6 Chart

The Chart tab will visualize a sensor’s register values over time.

![Sensor Value Chart](image)

2.6.1 Chart Filters

The number of readings can be changed to common choices:

- Last 30 readings
- Last 24 hours
- Last 30 days
- Last 7 days

If none of these options suffice, the user can input a custom date range to visualize.

2.6.2 Register to Read

Users can select which sensor register to visualize with the dropdown menu “Register to read”.

![Chart Register to Read](image)
2.6.3 Export Data

Users can download a CSV file that contains the current chart visualization data. The column headers of this downloaded data are:

- sensor_id
- sensor_type_id
- address
- lastupdate_ts
- last_update_user_id
- sensor_data_id
- sensor_data_value
- receive_datetime
- sensor_address

2.7 Profile

The Profile page is for users to add or change basic user information, test notifications, and invite other users.
2.7.1 User Contact Information

The user’s contact information is used almost exclusively for alarm notifications. Users should keep this information updated and use the test notifications to ensure that alarm notifications are delivered.

3. NOMAD EXPLORER API

Users that have access to the Nomad Explorer website may also retrieve information using Nomad Explorer’s API.

3.1 Authentication

API users can receive a JSON web token by logging into the API using the “user/login” POST call with the username and password.

https://nomad.apgsensors.com:7073/user/login?username={user}&password={pass}

Example with username as ‘testUser’ and password as ‘password123’:

https://nomad.apgsensors.com:7073/user/login?username=testUser&password=password123

The web token is good for 10 hours after login, and the web token must be included in the header of every API call, otherwise the call will return a 401 code. The header property should look like:

Authorization: Bearer {token}
### 3.2 Endpoints table

<table>
<thead>
<tr>
<th>Method</th>
<th>Route</th>
<th>Description</th>
<th>Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>POST</td>
<td>user/login</td>
<td>Login</td>
<td>JSON web token</td>
</tr>
<tr>
<td>GET</td>
<td>myGroups</td>
<td>Get a list containing the user’s groups</td>
<td><code>{ Type, List, status }</code></td>
</tr>
<tr>
<td>GET</td>
<td>gateways/me</td>
<td>Get a list containing the user’s gateways</td>
<td><code>{ Type, List, status }</code></td>
</tr>
<tr>
<td>GET</td>
<td>sensors/info/:id/:rangeType/:fromDate/:toDate</td>
<td>Get extensive data from a sensor given the sensor ID, a range type*, and start/end dates**</td>
<td><code>{ Type, Info, Attributes, AttributesReg, Readings, MinMaxValues, Unresponsive UnresponsiveData, ExportData, HoldingRegisters, AlarmSet, AlarmHistory, AlarmCountActive, status }</code></td>
</tr>
<tr>
<td>Method</td>
<td>Endpoint</td>
<td>Description</td>
<td>Response Body</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
<td>-------------</td>
<td>---------------</td>
</tr>
<tr>
<td>GET</td>
<td>mySensors/gateway/:id</td>
<td>Get a list containing the sensors for the given gateway ID</td>
<td><code>{ Type, List, status }</code></td>
</tr>
<tr>
<td>GET</td>
<td>mySensors</td>
<td>Get a list containing all the user's sensors</td>
<td><code>{ Type, List, status }</code></td>
</tr>
<tr>
<td>GET</td>
<td>reading/:sensorId/:address/:fromDate/:toDate</td>
<td>Get a list of register readings given a sensor ID, register address†, and start/end dates**</td>
<td><code>{ GatewayName, GatewayID, Readings, RegisterName, Units, ExtraMath, status }</code></td>
</tr>
<tr>
<td>GET</td>
<td>sensors/:ai/:id/:address</td>
<td>Get a list of AI predictions for the next 48 hours given the sensor ID, and the register address</td>
<td><code>{ prediction, timestamps, status }</code></td>
</tr>
</tbody>
</table>
* Range Type options:
  • “30r” – The API will return the latest 30 readings. Date parameters not used.
  • “24h” – The API will return 24 hours of readings. Date parameters not used.
  • “7d” – The API will return seven days of readings. Date parameters not used.
  • “30d” – The API will return 30 days of readings. Date parameters not used.
  • “custom” – The API will use the given “fromDate” and “toDate” parameters for the number of readings to return.

** Date format is YYYY-MM-DD; Ex. October 01, 2011, 2011-10-01. Use “NA” for the date parameter to act like a wildcard.
† The asterisk wildcard (*) can be used instead of a register address integer to fetch all registers for the given sensor.
4. TROUBLESHOOTING & SUPPORT

4.1 Error Messages

The result of Nomad Explorer saving information to the database is displayed to the user using pop up notifications (examples below). These notifications will be shown at the bottom right of the website.

When data was saved successfully the user will see a green notification along with a brief description:

![Queue the alarms message!](image)

*Figure 43. Example of Successful Database Interaction*

However, whenever there is a problem saving data, the user will see a red notification:

![Unable to queue alarms message. Please try again later.](image)

*Figure 44. Example of Unsuccessful Database Interaction*

*Note: If an error message appears, any changes the user was attempting to make will not be saved until the error has been corrected.*
4.2 Troubleshooting

The most common reason for a user to run into problems with Nomad Explorer is disruption of their internet connection.

**Step 1**  The first step of troubleshooting should always be to check that the user’s device has a connection to the internet

The second most likely reason a user will experience problems is if Nomad Explorer’s website host is down. Once the user has ensured that they are connected to the internet, the second step is to wait. This will give the hosting service time to get back online.

**Step 2**  Wait one hour before resuming work on Nomad Explorer.

If a user still has problems after these two steps, please see Section 4.3 about getting support.
4.3 Support

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