Ranger Manual

The Ranger is a self-contained, device that provides sensor readings over an LTE-M1 cellular network.

- Powers attached analog (4-20mA / 1-5V) sensor and cellular modem with internal battery
- Dual digital inputs report state, total counts and input frequency. K-Factor configurable for Flow Totalizing
- SPDT Latching relay for local on/off control
- Configurable from the SignalFire Cloud website signal-fire.cloud
- SignalFire Cloud allows for data visualization, trending and alarming
- Supports MQTT Sparkplug B communication protocol for connection to other servers
- Compact and simple to install and maintain
- Local configuration and diagnostics available using the micro-USB port and the SignalFire Ranger ToolKit PC software
- Expansion modules for additional I/O (2AI/1DI, Modbus, HART, SDI-12)
- Internal backlog of a minimum of 200 datapoints in the event of loss of signal. Backlog will be automatically sent when the Ranger reconnects
- Class 1 Division 2 certified

Specifications

Enclosure Size	7.1″ tall × 4.6″ diameter
Power Source	Internal Lithium battery pack (SignalFire Part Number: 4DPak) Optional solar or external DC power options also available
Temperature Rating	-40°C to +85°C
Enclosure	IP64 rated. Polycarbonate, ½″ NPT fitting
SIM Slot	4FF Nano SIM card (LTE Cat M SIM and data plan required)
Local config port	Standard micro-USB connector
Analog Input	Provides 13/18V (selectable) to attached 4-20mA / 1-5V sensor. One analog input built-in. Up to three with additional 2AI/1DI module
Digital Inputs	Two digital inputs. Three with additional 2AI/1DI module. Dry Contact or 30 Volts Max (push-pull), 2kHz max. Capable of reporting on state change
Relay Output	Latching Relay. 2A @ 30VDC, 0.3A @ 110VDC, 0.5A @ 125VAC
Sensor Power Output	Selectable 13V/18V. 60mA max power output
Compliance	• Contains FCC ID: 2ANPO00NRF9160 and IC ID: 24529-NRF9160 • PTCRB and Verizon Network Certified • Certified for use in Class I, Division 2, Groups A, B, C, D areas. Temperature Code T5 EXi [EXi] • [UL 121201:2017 Ed.9+R:26Aug2019], [CSA C22.2#213:2017 Ed.3+U1;U2] • IEC 62638-1:2014 (2nd Ed), EN 62368-1:2014+A11:2017

Model Numbers

RANGER			RANGER LTE M1 Transmitter
	-4DPak/IntAnt		4 D Cell Pack, Internal LTE Antenna
	-HCSolar/IntAnt		High Capacity Solar System, 9.0AH Capacity, Internal LTE Antenna
	-DCDC/IntAnt		DC step down adapter 10-30Vdc to 3.3Vdc. Fits in battery compartment,Internal Ant.
	-4DPak/ExtAnt		4 D Cell Pack, External LTE SMA Antenna connection. No Antenna provided
	-HCSolar/ExtAnt		High Capacity Solar System, 9.0AH Capacity. External LTE SMA Connection. No antenna
	-DCDC/ExtAnt		DC step down adapter 10-30Vdc to 3.3Vdc. Fits in battery compartment. External Ant.
		-NONE	Standard I/O package 1AI, 2DI, 1Relay
		-2AI1DI	Expansion Module. Adds 2 Analog Input and 1 Digital Input for a total of 3AI 3DI
		-Modbus	Expansion Module with RS485 Modbus Serial port
		-HART	Expansion Module with HART protocol interface. Supports 15 multidrop devices
		-SDI12	Expansion Module with SDI protocol interface. Supports 8 multidrop devices
			-NoSIM No SIM Card. No SignalFire Cloud. User provides LTE CAT M1 SIM Card
			-SIM/VZ VERIZON LTE CAT M1 SIM - 1 Year Data Plan, SignalFire Cloud Connectivity
			-SFCloud No SIM Card. 1 year SignalFire Cloud. User provides LTE CAT M1 SIM Card

Table of Contents

Hazardous Location Certification

The Ranger is rated Class 1 Division 2 non-incendive when powered by its internal battery pack or its internal DC-DC converter. The HCSolar unit is not C1D2 certified so it is for general purpose areas only.

WARNING: EXPLOSION HAZARD. DO NOT REMOVE OR REPLACE COMPONENTS UNLESS POWER HAS BEEN DISCONNECTED OR THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.
AVERTISSEMENT : RISQUE D'EXPLOSION . NE PAS RETIRER OU REMPLACER LES COMPOSANTS QUE L'ALIMENTATION EST DÉBRANCHÉ OU ZONE EST LIBRE DE CONCENTRATIONS IGNITIBLE.

WARNING – EXPLOSION HAZARD Substitution of components may impair suitability for Class I, Division 2
AVERTISSEMENT - RISQUE D'EXPLOSION. La substitution de composants peut rendre ce materiel inacceptable pour les emplacements de classe I, division 2

WARNING – EXPLOSION HAZARD Do not disconnect while circuit is live unless area is known to be nonhazardous
AVERTISSEMENT - RISQUE D'EXPLOSION. Ne débranchez pas lorsque le circuit est en direct , sauf si la zone est connue pour être nonhazardous

WARNING – All wiring methods must be in accordance with the NEC
AVERTISSEMENT - Toutes les méthodes de Essorez doivent être en conformité avec la NEC

WARNING - EXPLOSION HAZARD. Do no remove or replace while circuit is live unless the area is free of ignitable concentrations.
AVERTISSEMENT - RISQUE D'EXPLOSION. Ne pas enlever ou remplacer pendant que le circuit est vivant à moins que la zone soit exempt de concentrations ignitibles.

WARNING – EXPLOSION HAZARD. Do not remove or replace lamps, fuses or plug-in modules (as applicable) unless power has been disconnected or the area is free of ignitable concentrations.
AVERTISSEMENT - RISQUE D'EXPLOSION. Ne retirez ni ne remplacez les lampes, les fusibles ou les modules enfichables (le cas échéant) à moins que l'alimentation ait été coupée ou que la zone soit exempte de concentrations inflammables.

Connections and Components

STATUS LED

- The STATUS LED (green) will flash 3 times on a successful data transmission to the server

ERROR LED

- The ERROR LED (red) will blink 3 times to indicate that an attempted data transmission failed

Check-in Button

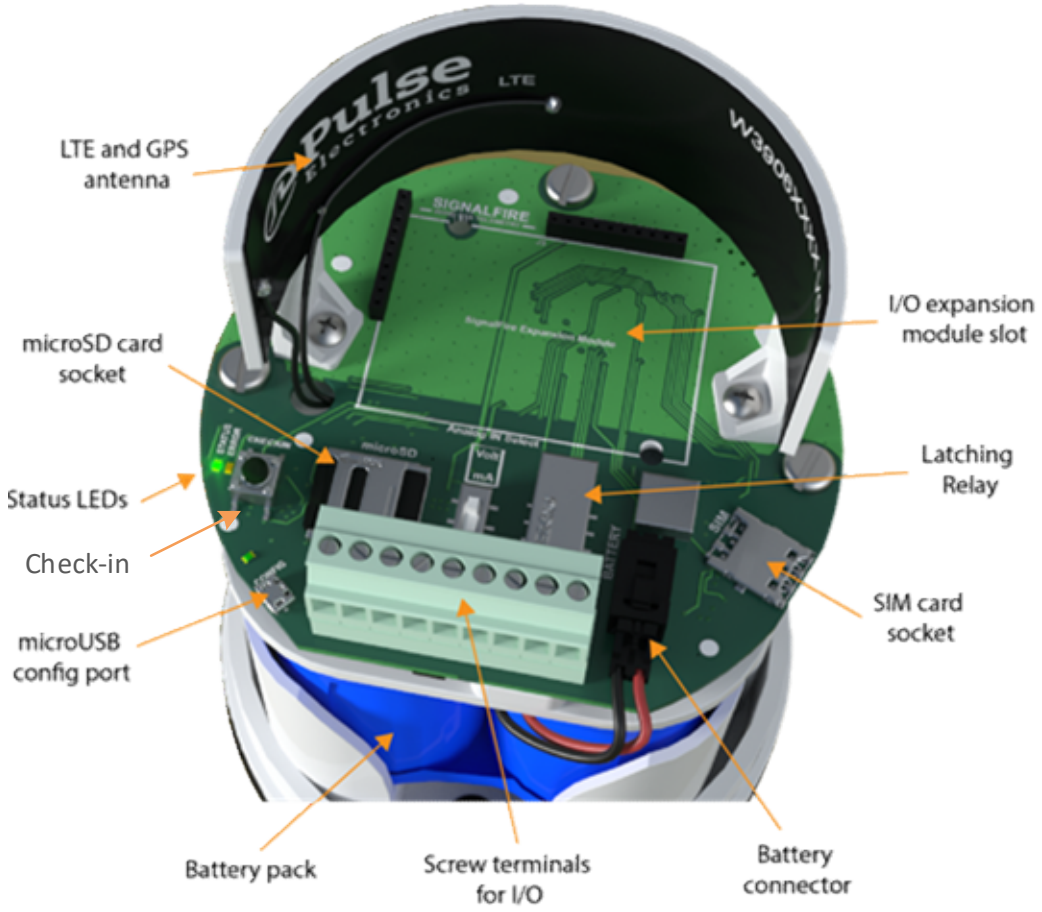
- If this button is pressed the Ranger will blink the Green or Red status LED 3 times to indicate the status of the last transmission to the server. If the Checkin button is pressed and held for more than 1 second, the Ranger will take readings from the attached sensors and send the readings to the server.

MicroSD Card Slot

- The MicroSD card is for future use, it is not yet implemented and should not be installed

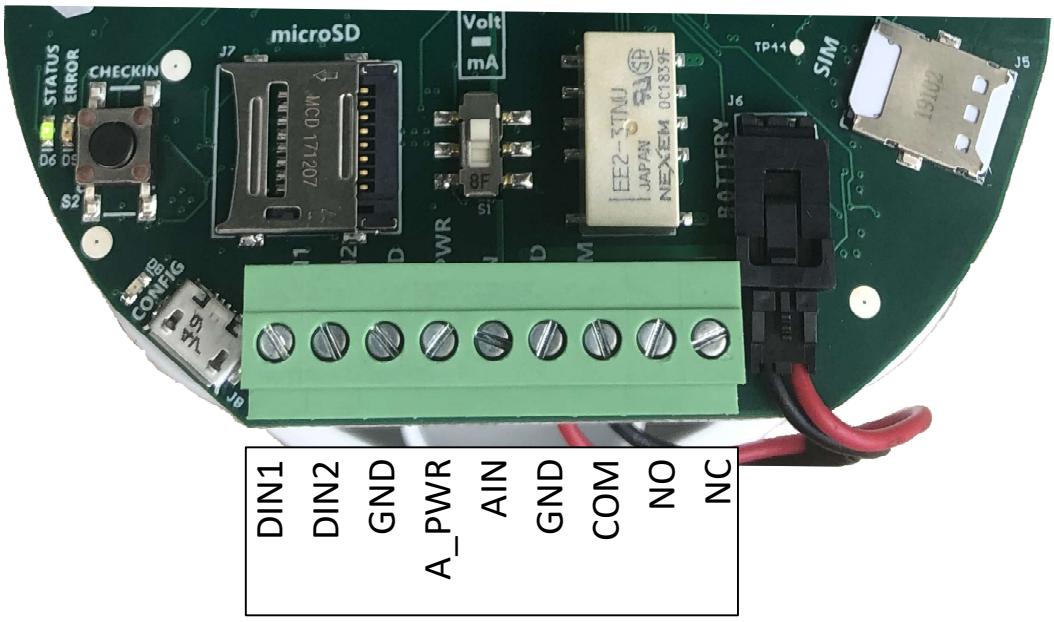
SignalFire Expansion Module

- The SignalFire Expansion Module slot is used for additional sensor support. Available expansion cards are 2AI/1DI, Modbus, and HART.



Ranger Internal components

Sensor Connections

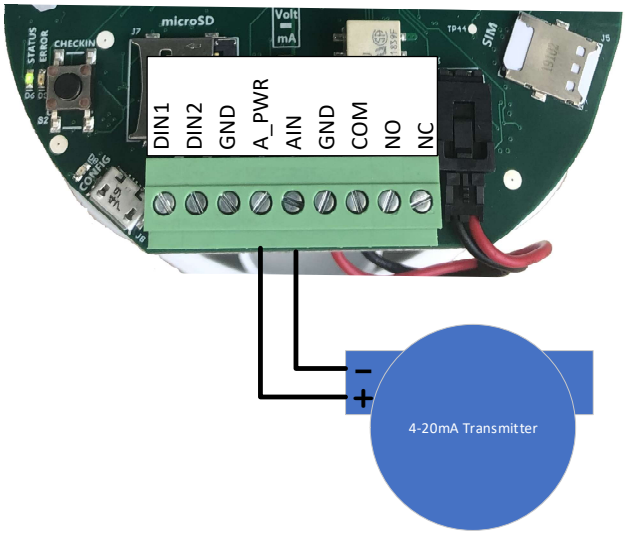


Screw Terminal Connections

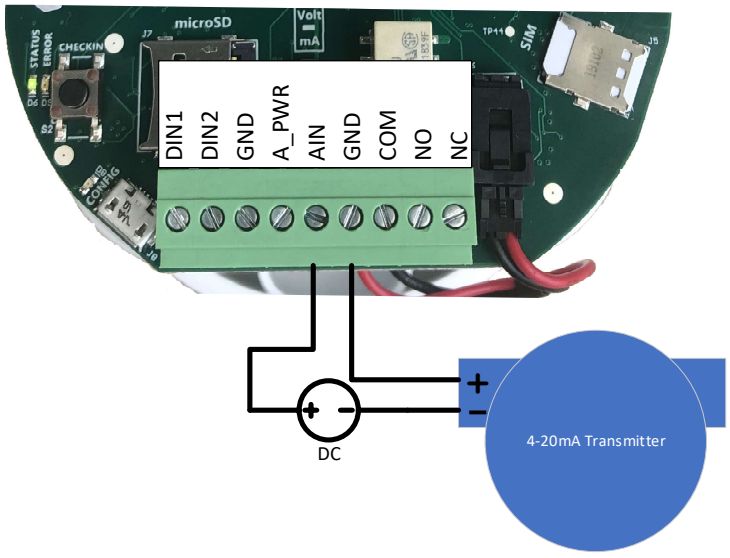
Analog Input

The analog input provides 13V/18V (selectable in software, see page 11) to the attached sensor. The analog input can operate in either current (4-20mA), or voltage (1-5V). The input mode must be set by the slide switch. Slide the switch up to **Volts** for a voltage input, or down to **mA** for a current input.

4-20mA Wiring Diagram

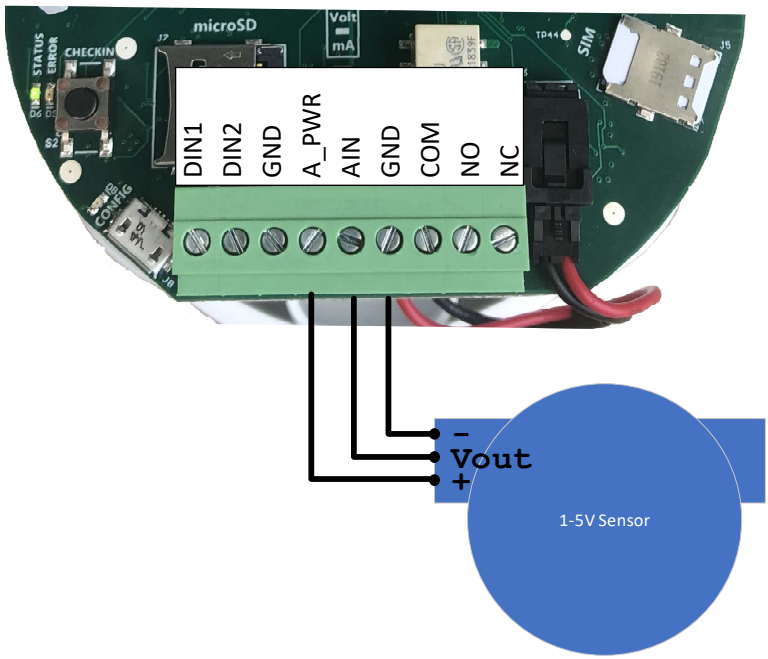


Sensor powered by Ranger



Sensor powered by external source

1-5V Wiring Diagram



Digital Inputs

The digital inputs (2 total) can be dry contact or voltage (must be push-pull, 30 Volts max). Be sure to connect the ground bus from the module to either the ground of the voltage pulse device or the dry contact.

Relay Output

The Ranger has a single latching SPDT relay which may be controlled remotely from the server.

Expansion Cards

The Ranger has the option of being ordered with daughter cards to expand the I/O capabilities. Currently, four expansion cards are offered: the 2AI/1DI, Modbus, HART and SDI-12cards. If the expansion cards are installed separately after first purchasing the Ranger without them, the expansion cards must be enabled using the Ranger ToolKit. See the Ranger ToolKit manual for more details.

Ranger with a 2AI/1DI installed

2AI/1DI

The 2AI/1DI card provides the Ranger with two (2) additional analog inputs, and one (1) additional digital input.

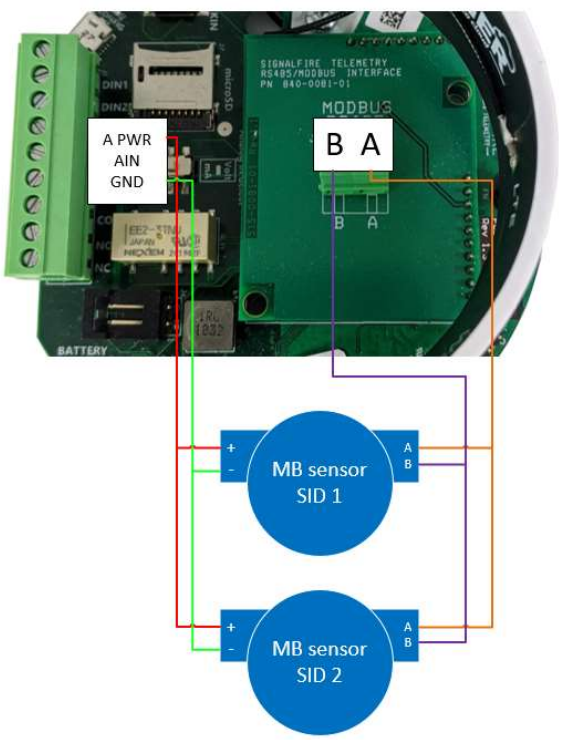
These inputs operate the same as the analog and digital inputs of the base model. The analog inputs can be set to 4-20mA mode or 1-5V mode via onboard switches. When installed, additional input configuration tiles will become available on the unit's SignalFire Cloud configuration page. An optional junction box provides for easy wiring to multiple sensors.

Modbus RS-485

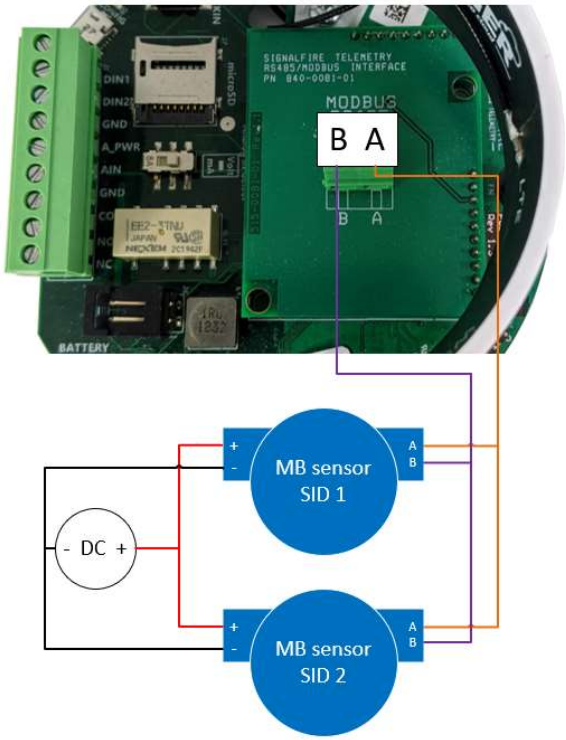
The Modbus card provides the Ranger with the ability to read a Modbus sensor over two-wire RS-485. Follow the diagram below for wiring the Modbus expansion card to a sensor. Sensors can be powered off the Ranger's onboard analog sensor power output. Like the analog sensor, its voltage is set in the Ranger configuration tile (see page 11). The Ranger can provide up to a total of 60mA at 18V for all attached sensors. If more power is needed, or to conserve battery life, it is recommended the sensors be powered with an external DC source. Follow the wiring diagram below for integrated and externally powered options.

The attached sensors need to each have a unique Modbus ID.

RS-485 Wiring Diagram



Sensor powered by Ranger



Sensor powered by external source

HART

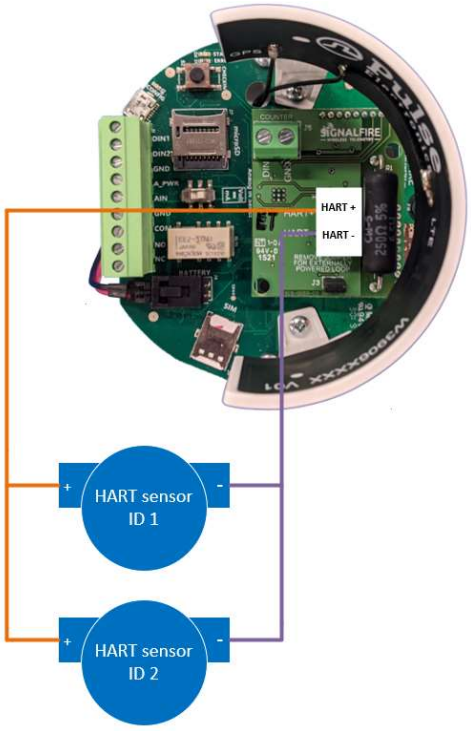
The HART card provides the Ranger with the ability to power a HART transmitter and read its variables. The HART sensor should be wired to the Ranger's HART terminals as shown below. Note that the HART card also has 1 digital input available.

The system can supply up to 18V to the sensors and then read the HART data from each sensor. Due to the 250Ω series resistance, every additional sensor will draw 4mA in multi-drop mode, dropping the output voltage by 1V. For example, if 4 HART devices are connected the total loop current will be 16mA, resulting in 4V being dropped across the 250Ω load resistor in the SignalFire node. If the Ranger is configured to output 18V, this leaves 14V available to power the sensors.

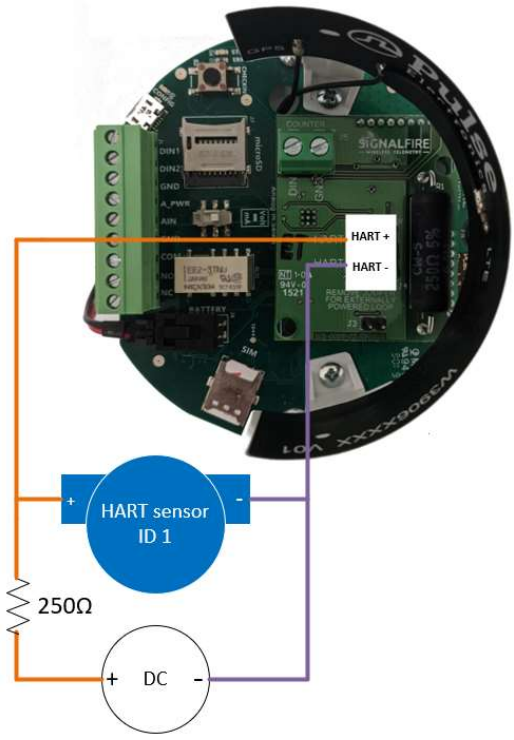
If using an external power source, remove the jumper from the HART card. It is recommended to place a 250Ω resistor in series with the source unless the supply already has a series resistor, to ensure proper HART communication across the bus. It is up to the operator to ensure that the resulting voltage of the source minus the drop across the series resistor meets the minimum voltage requirements of all attached sensors.

The attached sensors need to each have a unique HART ID. If their ID's have not been set up before connecting, they can be set up through the Ranger ToolKit.

HART Wiring Diagram



Sensor powered by Ranger. Jumper is on.



Sensor powered by external source. Jumper is off.

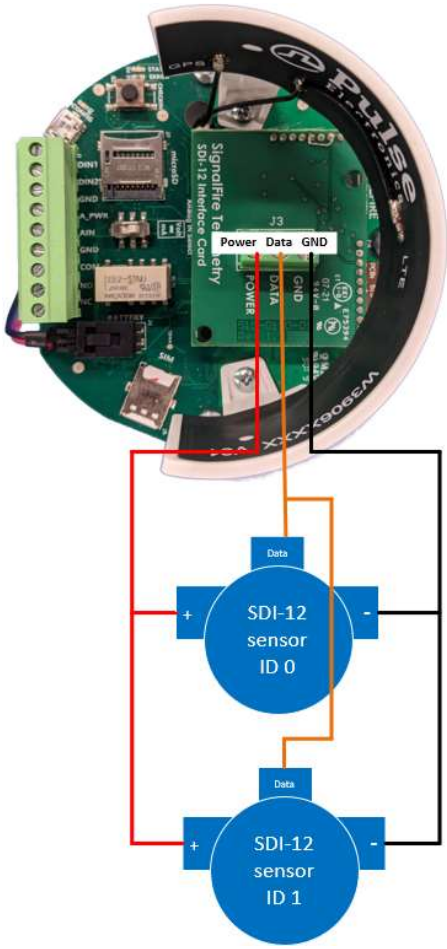
SDI-12

The SDI-12 card provides the Ranger with the ability to read from SDI-12 sensors. The SDI-12 bus contains three lines, Power (12V), Data, and GND. Across multiple sensors, these three lines must be connected in parallel, such that all the Power lines are connected together, the Data lines are all connected together, and GND lines are connected together.

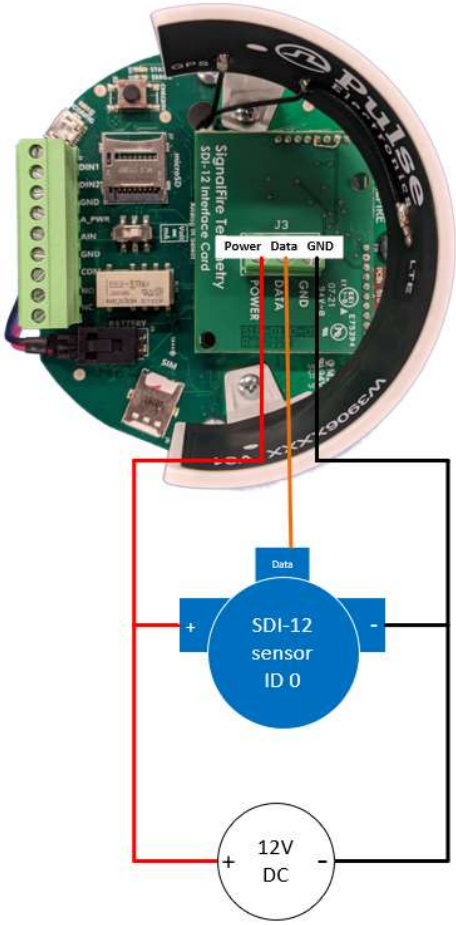
If the Ranger is powering the sensors, it can provide up to 60mA at 12V for all attached sensors. It is up to the operator to ensure this limit is not exceeded. If the sensors are powered externally, the Power terminal of the SDI-12 card must still be connected to the positive power terminal of each sensor and the external voltage source.

The attached sensors need to each have their own unique SDI-12 ID's. If their ID's have not been set up before connecting, they can be set up through the Ranger ToolKit.

SDI-12 Wiring Diagram



Sensor powered by Ranger



Sensor powered by external power supply. Positive terminals connected

Power Options

Lithium Battery Pack (4DPak)

The internal lithium battery pack is the default power source for the ranger, simply plug the battery pack into the Ranger PCB battery connector to power the Ranger on.

DC-DC converter

In situations where DC power is available, the Ranger can be ordered with an internal DC-DC converter that accepts 9-36VDC from an external source. The DC-DC converter is installed in the battery compartment of the Ranger and has a pigtail cable to connect to the Ranger PCB. Simply connect your DC power source to the "GND" and "Vin" screw terminals on the converter to power on the system.

HC-Solar System

SignalFire offers a solar system that consists of a bracket containing a solar panel and integrated battery and solar charger assembly. The solar system is connected to the Ranger PCB using the battery connector.

Setup

Devices purchased with the SignalFire Cloud service come with a pre-installed SIM card. Customers will require a login to access the SignalFire Cloud server (signal-fire.cloud). Fill out the request form here: https://signal-fire.com/lte-m1-cellular-products/cloudregister/ to setup your company site.

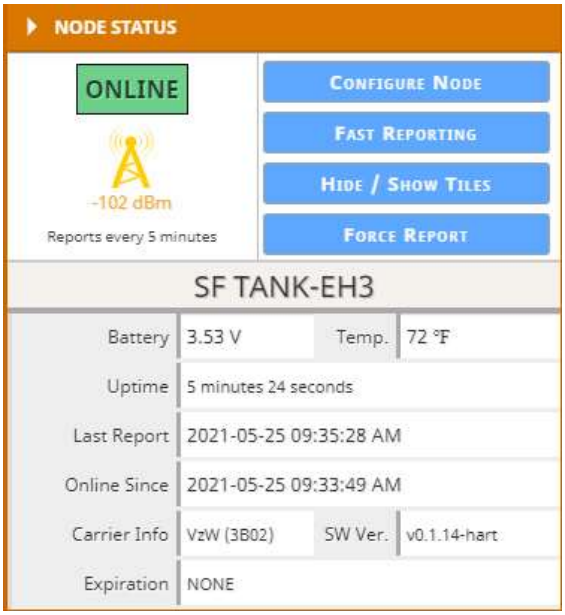
Provisioning

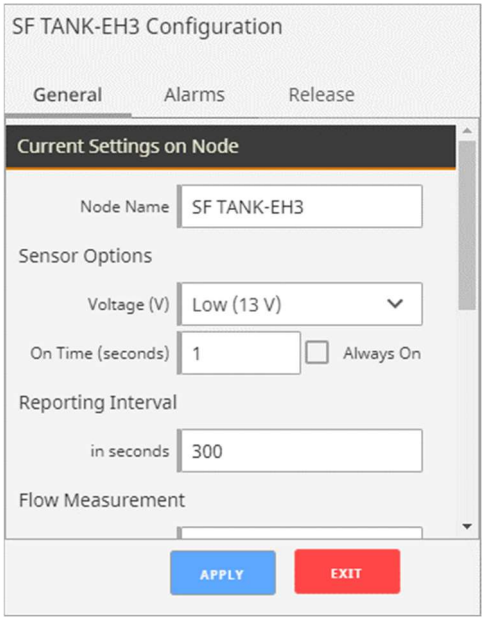
1. Plug in the battery so the Ranger can connect to the cellular network
2. Login to the SignalFire Could with the account login/password provided
3. From the Home page click "Add Device"
4. Enter either the Ranger serial number or IMEI number and click "Send Request". The serial number is located on the bottom of the Ranger with a format of "RA" followed by 6 numbers. The IMEI is located on a label inside the Ranger on the back of the antenna bracket.
5. A message will be sent to the Ranger to "claim" it to the customer site, and a wait screen with appear.
6. Within approximately one minute the device will connect to your account and you will be automatically redirected to the device status page

Ranger Settings

Select a Ranger from the list on the Home tab to see the device status, sensor readings and settings. The detail display is organized as a "tile" view with each tile representing a specific input or function. Each tile with configurable settings has a "Configure" button that will bring up the related settings.

Node Status Tile





The Node status tile contains general information about the ranger and allows setting the Ranger system parameters.

Force Report

Causes the Ranger to take a new sensor reading and send the data to the server on its next "ping" interval. This can take up to 40 seconds.

Node Name

The Node name is a user configurable string used to easily identify the Ranger.

Report Interval

The setting controls the interval at which the Ranger will apply power to the attached sensor and forward the sensor readings to the Cloud. Clicking on "Settings" will open up the Fast Reporting Interval window.

The Ranger can be configured such that if certain inputs cross a threshold, the Ranger will temporarily update at an increased rate. Fast Reporting can trigger when one or all conditions are met, and can stay on for the entire time the input(s) are above the threshold, or a set time. In the above example, if Analog Input 1 goes above 8mA, the Ranger would begin reporting its sensor values every 60 seconds, for 3,600 seconds (1 hour).

Sensor Voltage

Sets the output voltage applied to the analog sensor output. It is user configurable to 13V or 18V.

Sensor on Time

Configures the amount of time the Sensor Voltage is applied to the sensor prior to taking the reading. This needs to be long enough for the attached sensor to power on and stabilize, but should be minimized to optimize battery life. **If the Ranger is not powering a sensor or if the sensor is powered externally, set this value to 0.**

Flow Measurement

By default, the two digital inputs report input state (open/closed) and input frequency. Optionally one or both digital inputs can be configured for Flow Measurement Mode. This is used for connection to a flow meter with a pulse output and allows the user to configure a pulse k-factor and see the flow rate and total in volume units.

The analog input can also be used for flow measurement, where a current/voltage corresponds to a flow rate. The Ranger can do a rough approximation of a flow total by assuming that the flow rate stays constant between report samples.

The Alarm Group ID

This defines which alarm group will receive alarms from this device. Each user configured in the Users tab can be assigned an alarm group number. Any users with a matching alarm group will receive alarms from this

Ranger. Multiple alarm groups may be entered separated by commas and all groups entered will receive alarms.

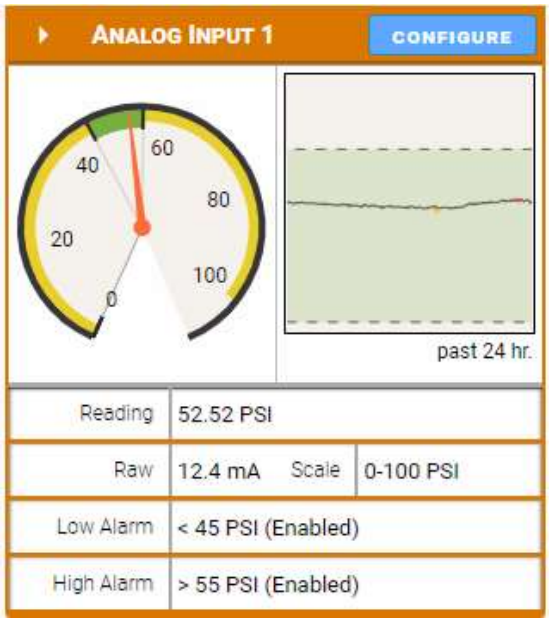
Offline Alarm

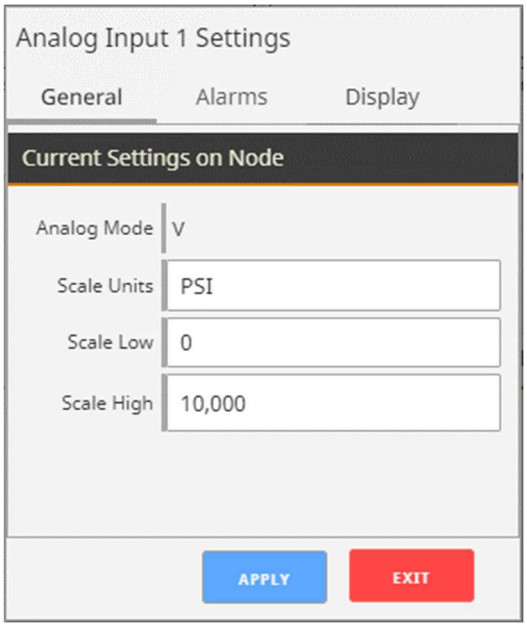
The Ranger will send an alarm if the device is offline for more the then configured 'Offline Threshold" setting.

Release

If the Ranger has been added to the wrong group and needs to be claimed under a different group, the Ranger can be released through the Release tab of the "Configure Node" window.

Analog Input Tile





The Analog input tile displays the details for the analog input, including scaling and alarms. If the 2AI/1DI expansion card is installed, "Sensor A" and "Sensor B" on the card will appear as their own Analog Input 2 and Analog Input 3 tiles, respectively.

Analog Mode

This will display the input mode (4-20mA of 1-5V) that is set by the slide switch on the Ranger.

Scale Units

This is a user definable string to identify the engineering units.

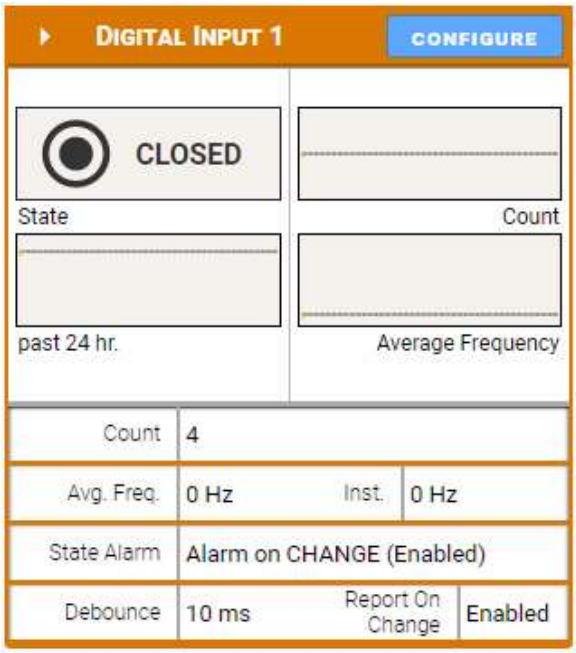
Scale Low / Scale High

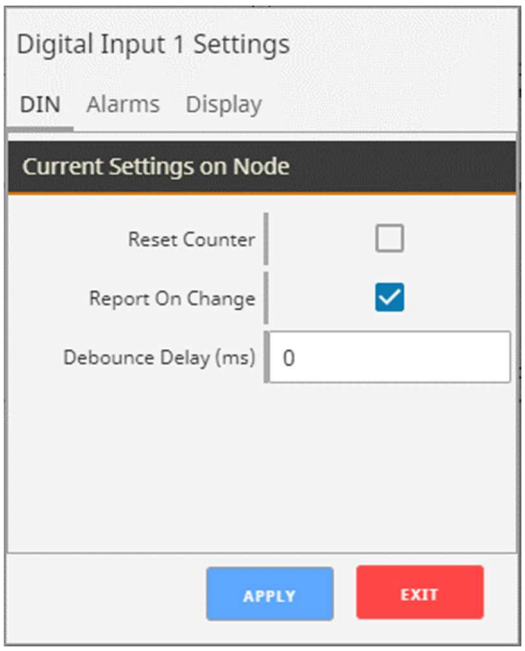
The scaling allows the user to span the analog sensor. The Scale low is the sensor value at 4mA/1V and the Scale High is the sensor value at 20mA/5V.

Alarm Thresholds

The analog input supports a high and/or low alarm threshold. This threshold is configured using the scaled engineering units. If the configured threshold is crossed and the alarm is enabled, a SMS and/or email message will be sent to each user in the alarm group of the Ranger.

Digital Input Tile





There is a Digital Input tile for each of the two digital inputs, unless they are configured for Flow Mode. If the 2AI/1DI expansion card is installed, it will appear as its own Digital Input 3 tile.

Reset Counter

Selecting this check box and click apply will zero the input cycle count.

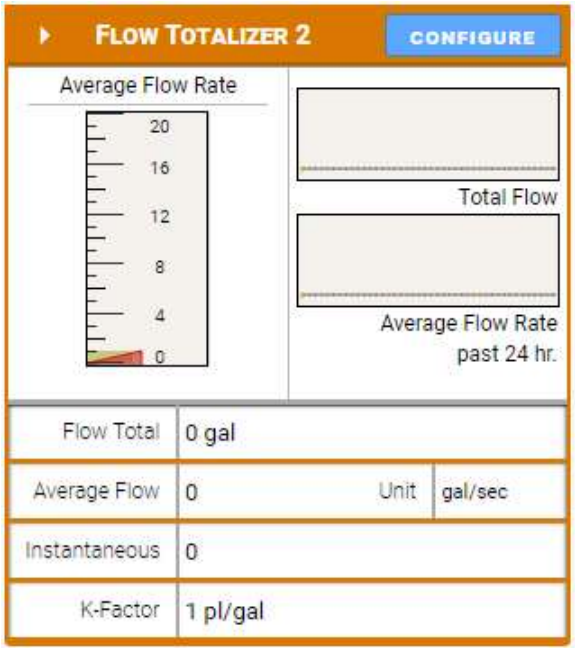
Report on Change

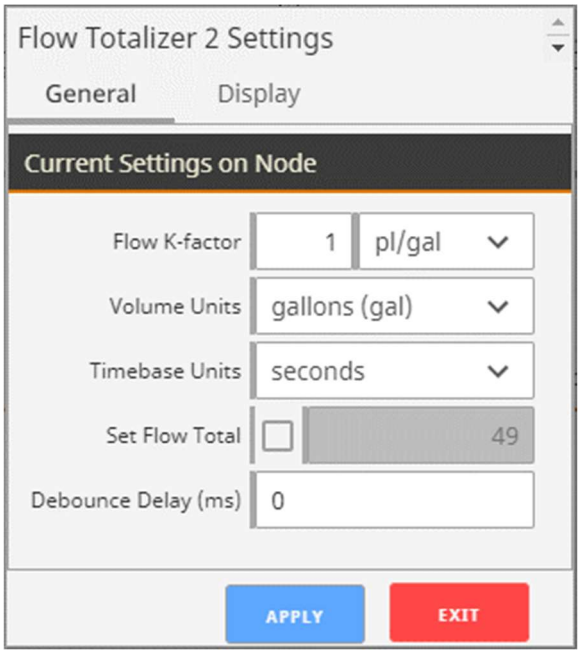
If selected, the Ranger will report any changes on state of the input to the Cloud within 2-seconds rather than waiting until its next scheduled report

DIN Alarm

The Ranger can send an alarm when the DIN opens, closes or on any change.

Flow Totalizer Tile





If a digital input is configured for Flow Mode, the flow totalizer tile will replace the default Digital Input tile. When in flow mode the Ranger will display the flow rate and total flow volume. The Average Flow is the average flow rate over the configured Ranger Report Interval, while the Instantaneous Flow rate is the flow rate calculated over the 2 seconds immediately before the report.

Flow K-Factor

Enter the number of pulses per unit volume that the flow meter outputs. The volume pulse units can be selected

Volume Units

The Volume Units is used to select the volume units to use to for the flow rate and total volume calculations

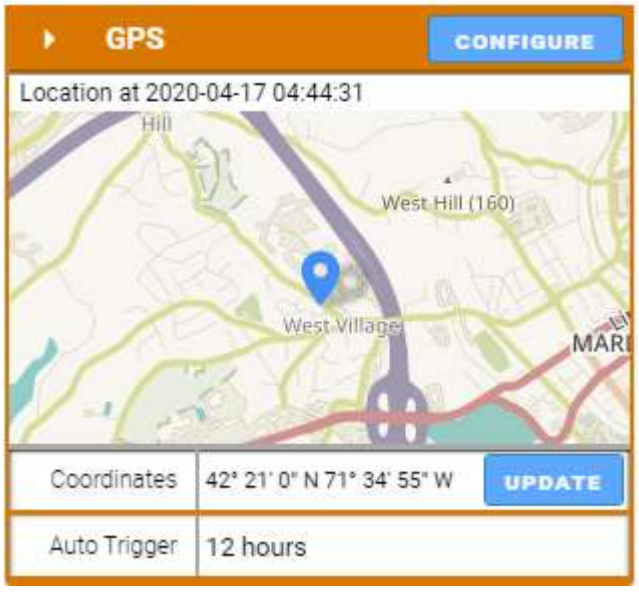
Timebase Units

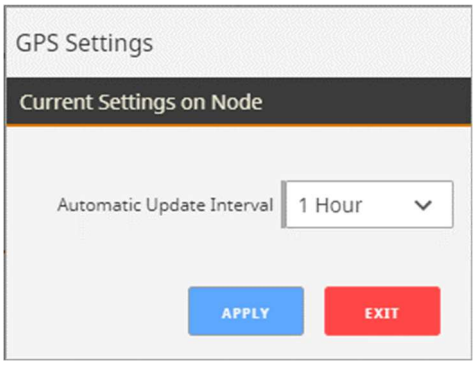
The Time base units select the time units for the flow rate calculations

Set Flow Total

The allows the user to set or reset the total volume measured. Click the checkbox then enter the volume

GPS Tile



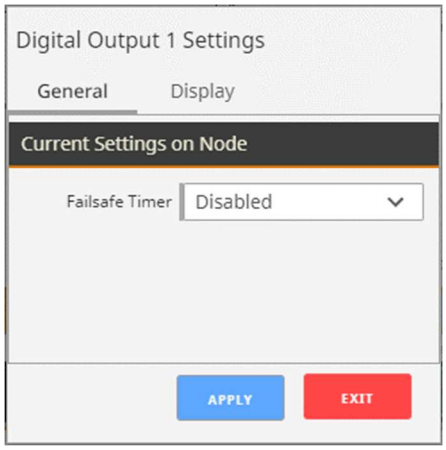


The Ranger has an internal GPS receiver/antenna to provide location data to the server. The Ranger requires a clear view of the sky for the GPS functionally. GPS will often not work inside even if the Ranger is near a window.

A GPS update may be triggered on demand, or an automatic location update interval between 1 and 12 hours can be configured. For an on-demand location update, click the "UPDATE" button. Note that an initial "cold" GPS fix may take up to 5 minutes.

While the GPS receiver is active commands sent to the Ranger my take up to 80 seconds to be delivered.

Digital Output Tile



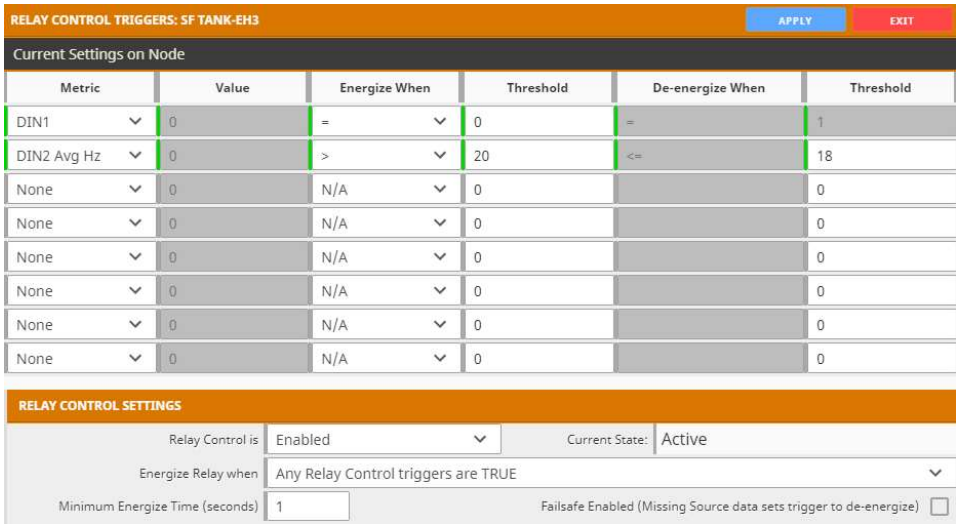
The relay output can be toggled by setting the Toggle State switch. The command will reach the Ranger on its next "ping" interval which can take up to 40 seconds. The Toggle State switch will change to blue and the OPEN/CLOSED indicator will change once the message has reached the Ranger.

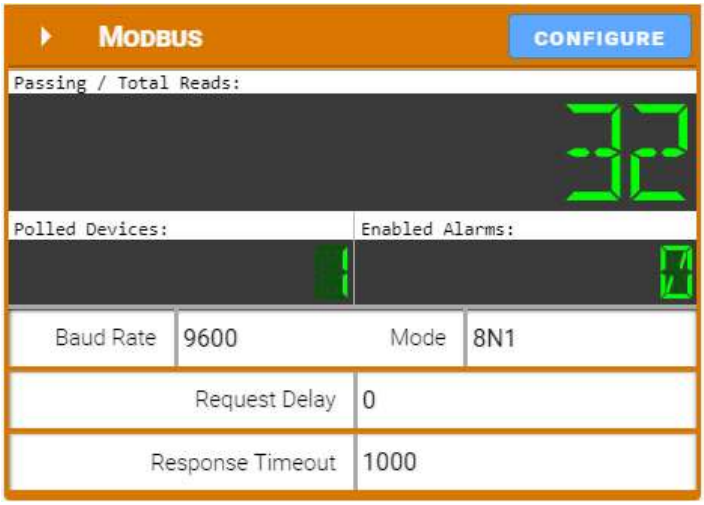
The relay output also has an optional failsafe timer. If this is configured, the relay will go to the open (failsafe) state if the Ranger loses connection to the server for the configured time.

Relay Control

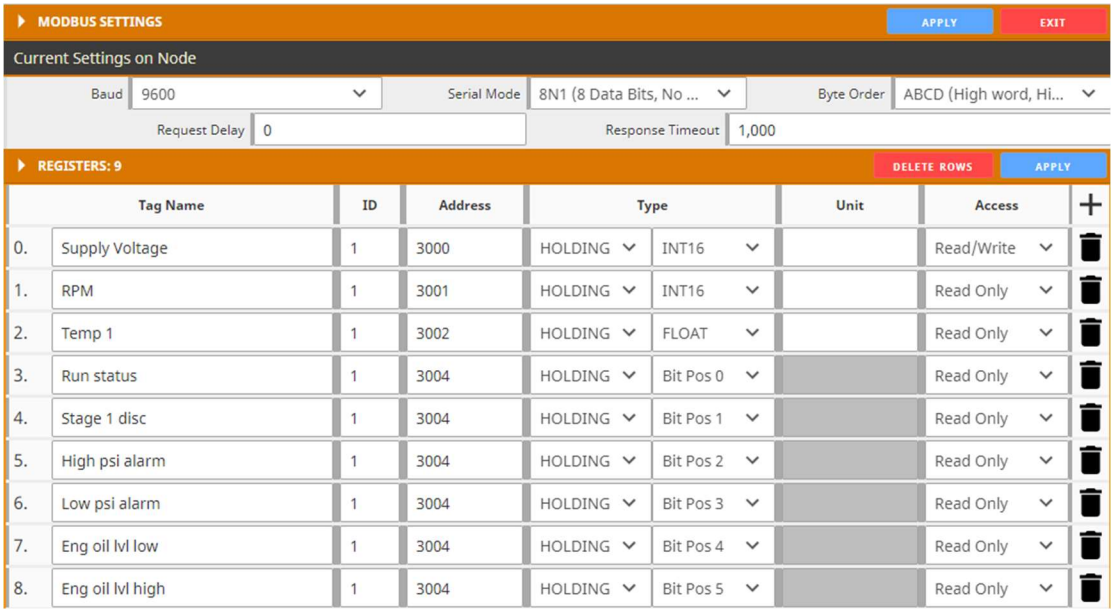
The digital output on the Ranger can be configured to energize and de-energize based on its other inputs. This control logic is run locally in the Ranger and does not depend on cellular connectivity. First, the "Relay Control is" field should be Enabled. The trigger logic can be entered by specifying which input to control the relay off of, and then specifying which values of that input energize and de-energize the relay.

If the relay is being triggered off of multiple inputs, the user can select whether all the triggers need to be true (Boolean AND), or any of the triggers need to be true (Boolean OR). The Minimum Energize Time field determines the amount of time the relay, once energized, will stay on even if the de-energize condition becomes true.





If the Ranger has the Modbus expansion card installed, users can configure the Ranger to read Modbus registers from any attached sensors. To set the RS-485 communication parameters and configure Modbus reads, click on the "Configure" button on the Modbus tile.



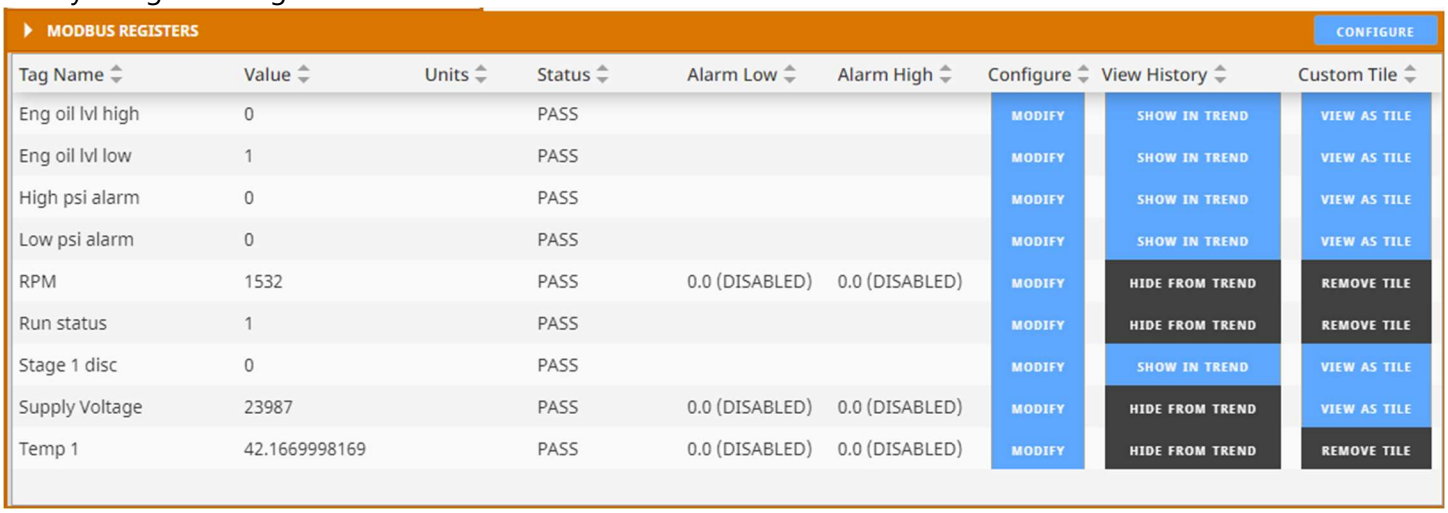
Use the top portion of the menu to configure communication parameters. These settings must match all the sensors on the RS-485 multidrop network. The default configuration is shown in the figure above.

The Ranger can read up to 32 datapoints from up to 8 connected devices. To add a new register read, click on the '+' button. Each line needs to be specified with a Tag Name, and point to a Modbus Slave ID, register address, register data type (INT16, UINT16, INT32, UINT32, INT64, UINT64, FLOAT, DOUBLE, or BIT), and read/write access. The register can also be tagged with units if needed. Click Apply to send the changes to the Ranger.

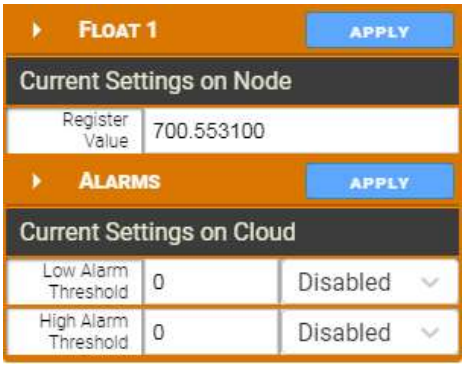
The Ranger can read individual bits of a 16-bit register (must have at least firmware version v0.1.15). This can be useful for bitmask registers where each bit position represents a flag/status alarm. To select the bit, change the Type to "Bit Pos" and then the bit position number. Bit Pos 0 reads the Least Significant Bit, and Bit Pos 15 reads the Most Significant Bit of a 16-bit register.

To select lines for deletion, click on the trash can icon at the end of each line, and then click on the "Delete Rows" button to delete all the rows selected.

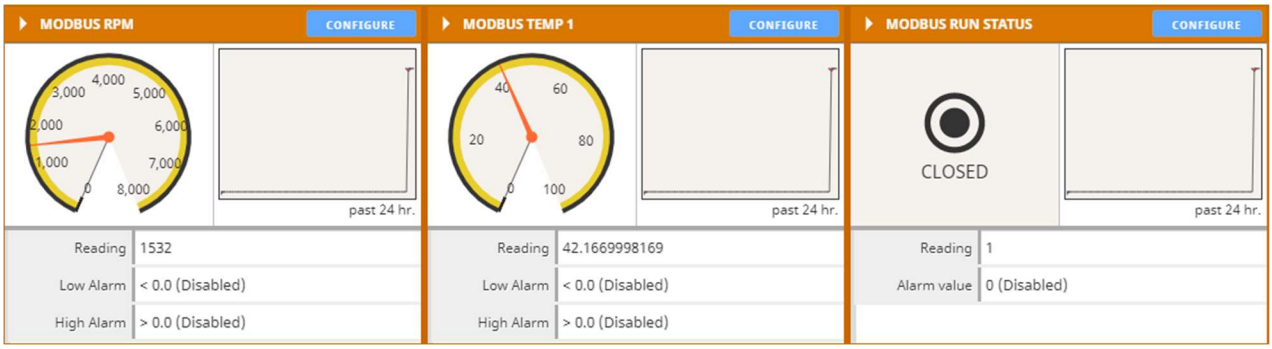
Once the registers have been set up as desired and applied, click "Exit" to return to the Ranger's main page. The registers and their values will appear in a table below, where they can be organized in ascending or descending order by clicking on each header. The Modbus register configuration can also be done locally using the Ranger ToolKit.

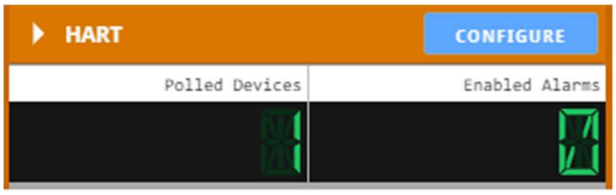


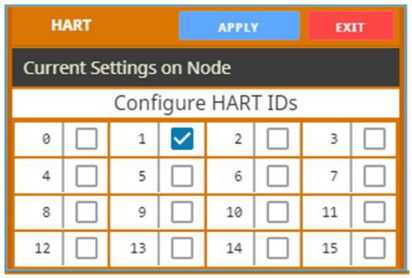
Clicking on "Show In Trend" will add that register to the historical data view at the bottom of the page. Clicking on "Modify" will bring a pop-up to configure alarms, or to do a register write to set a Modbus value in a register. Every register can be individually set up with Low and High alarm thresholds. Click "Apply" to save alarm settings for each register.



Clicking on "View As Tile" will make that metric viewable as a tile similar to the analog and digital inputs.



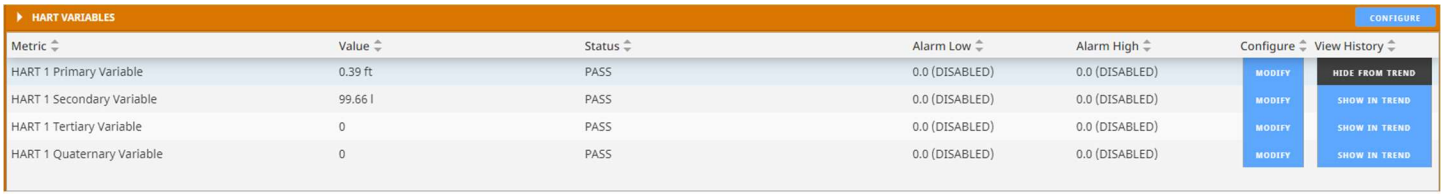




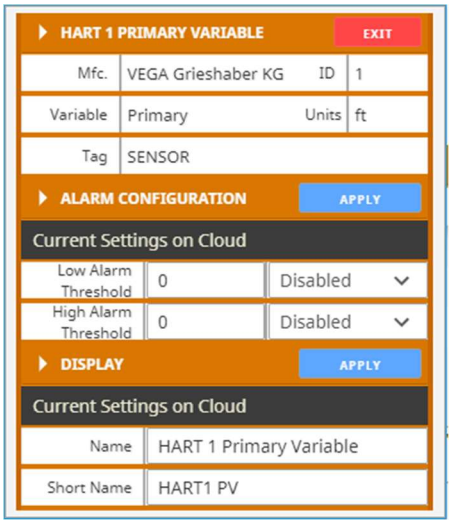
If the Ranger is configured with a HART expansion card, the HART tile will show up on its Cloud page. Clicking "Configure" on the HART tile will open a window that allows you to choose which devices the Ranger will read from by HART ID.

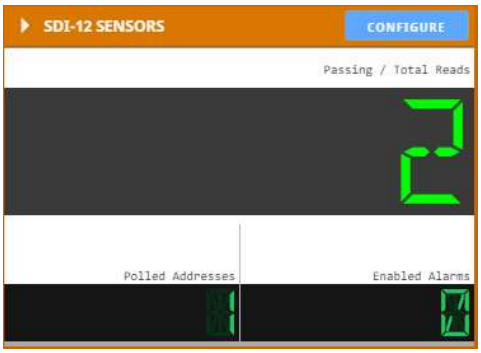
As per HART protocol, the Ranger can read one device at HART ID 0, or up to 15 devices in multi-drop mode addressed 1 through 15. Note that if the Ranger is supplying power, each sensor requires an additional 4mA, and will drop the output voltage by 1V. The Ranger cannot supply more than 60mA total to all connected sensors (including 4-20mA/1-5V analog).

Once the Ranger is set up to read HART transmitters, their variables will appear above the trend graph as shown below.



Clicking on "Show In Trend" for a variable will add that variable to the trend graph. Clicking on "Modify" will create a pop up that allows the user to set a custom name, and trigger alarms from that variable.



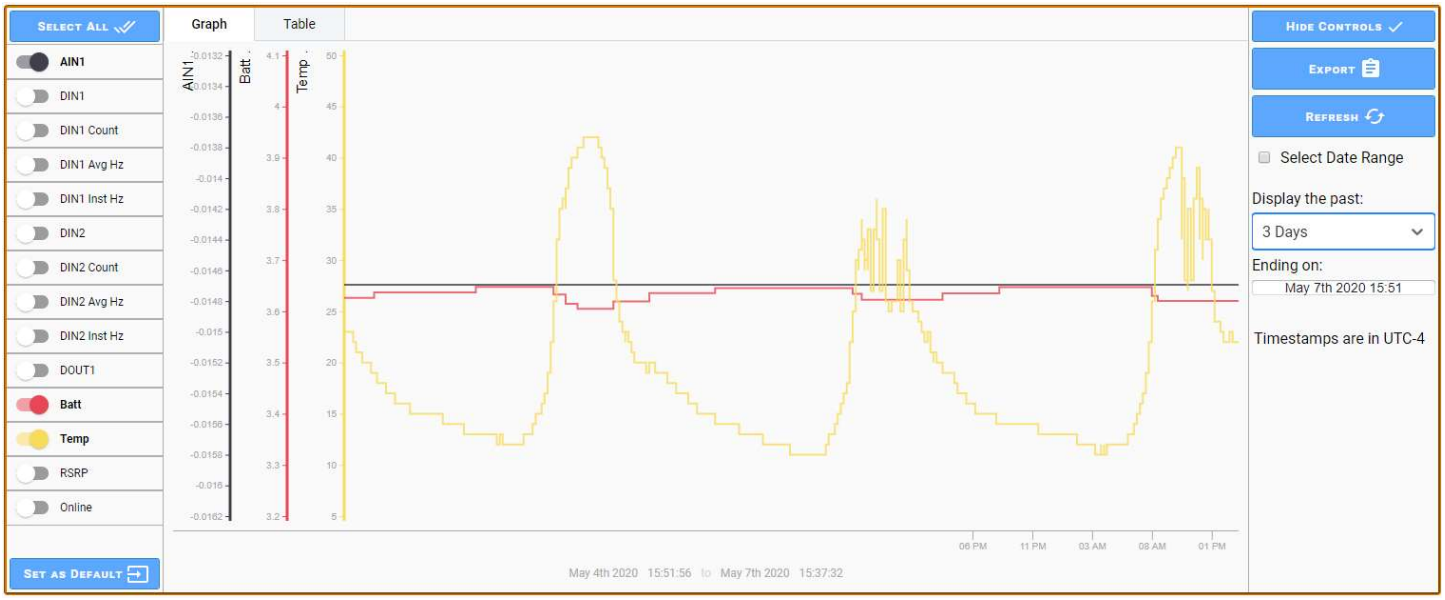


If the Ranger is configured with the SDI-12 expansion card, the SDI-12 tile will appear on its Cloud page. Click on "Configure" to set up the values for the Ranger to read. To add a line, click on the "+" button, and specify the value name, sensor address, SDI-12 request, and which position of the response to read in. To remove a line, click on the trash can icon. Hit Apply to set the lines, and the Ranger will begin reading the values specified in the table.

Once the Ranger begins reading, the values will appear on the Ranger's page, below the tiles and above the historical trend view. Click on the "Modify" button to set up High and Low Alarms. Click on "Show In Trend" to have the value show up in the graph below and any exported CSV's from the graph.

Historical Data View

The server maintains a database containing the historical data view of all reported readings. The data may be viewed as a graph or a table view. Select which data values to display and the time range to view. The selected data for the configured time interval may be exported to a .csv file by clicking the "Export" button.



Default View

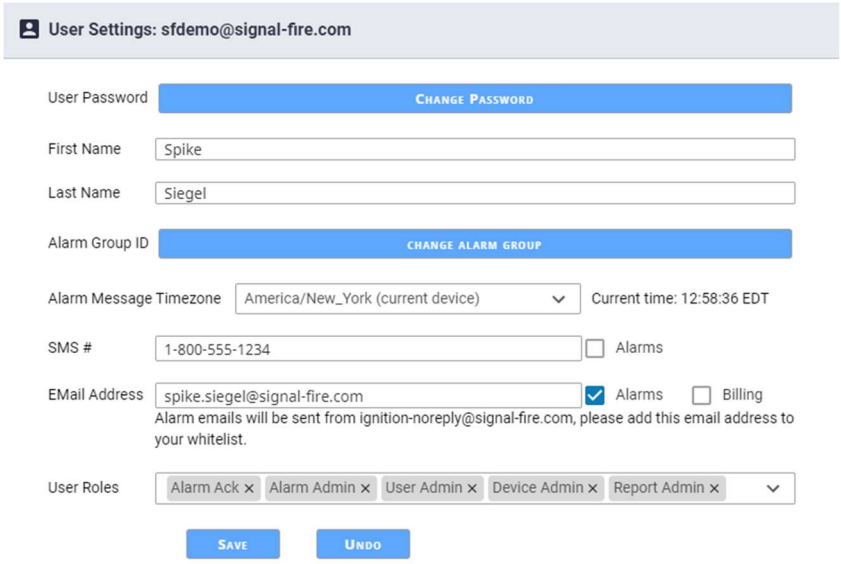
A user can configure the default trend view they which to see when they open the view for a Ranger. Simply configure the desired data to display and the desired default time display and click the "Set as Default" button. This view will be saved and be the default view for your account for that Ranger device.

Users

To have access to your company's Rangers, you will need a SignalFire Cloud account user login. Contact your company's Cloud user admin to set up your account. If your company does not have an account and you are performing first time setup, complete the form at https://signal-fire.com/lte-m1-cellular-products/cloudregister/ to request a new user account group.

User Settings

Once logged in, select your username in the upper right to change your user settings. Enter your contact phone number and/or email address and enable Alarms to have alarm notifications sent to you. Enable billing to receive reports on which Rangers are about to expire and need to have their Cloud subscription renewed. After making changes (highlighted in yellow), click Save or Undo to apply or revert the changes made.



User Roles

All users in the group can view any Ranger, but their ability to change settings can be restricted by their user roles. There are five user roles: User Admin, Device Admin, Alarm Admin, Alarm Ack, and Report Admin.

User Admin – Can add, edit, and remove users in the user group, including changing other users' permissions. The User Admin cannot view anyone's password, but they may reset the password for a user who forgets theirs. It is recommended to restrict the number of users with this permission to as few people as possible.

Device Admin – Can add, edit, and remove Rangers in the user group and toggle the relay output. Note that device admins can change any settings in any Ranger without restriction.

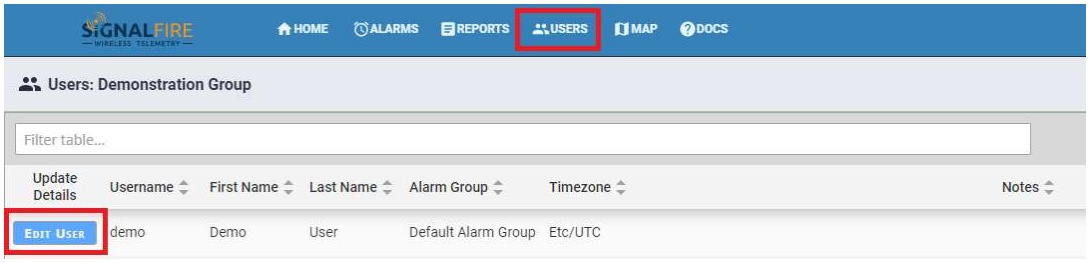
Alarm Admin – Can configure just the alarm settings for Rangers and users.

Alarm Ack – Can acknowledge active alarms.

Report Admin – Can add, edit, and remove automated reports.

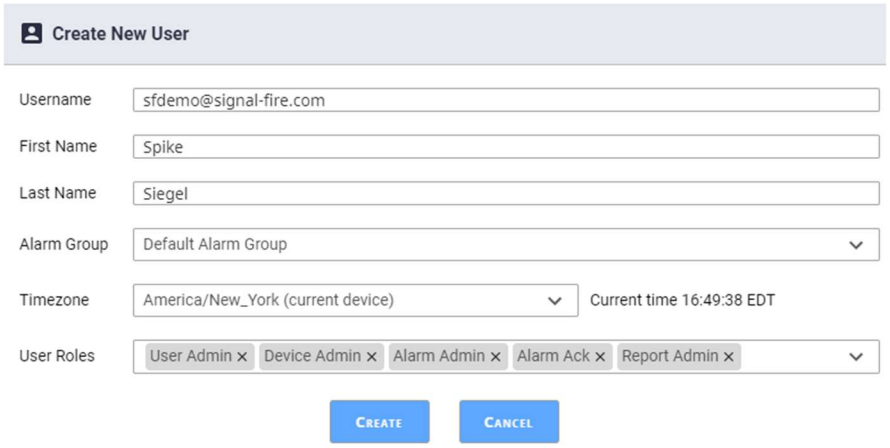
User View

A list of users in the group can be viewed by clicking on the Users icon in the top menu. User Admins will be able to edit any user by clicking on the "Edit User" button. This will bring up the same User Settings as shown above, with an additional option to delete the user.



Adding Users

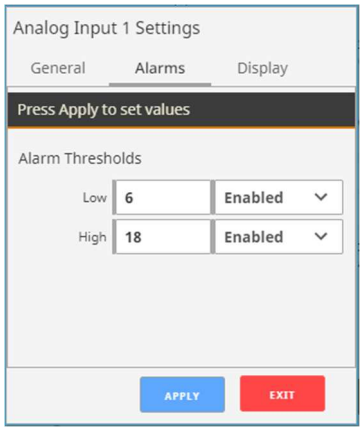
User Admins may add additional users in the User view by clicking Add User in the upper right-hand corner. Fill in the fields, configure permissions, and click "Create". A window will pop up with a temporary password for the new user once complete. It is recommended that an email address is used for the username so it is unique.



Alarms

The SignalFire Cloud provides a robust and flexible system that allows users to be notified by email and/or text when a specified metric from a Ranger enters and clears an alarm state. The alarms can be set up so only certain users get alarms for certain Rangers with the alarm group function.

To enable an alarm on an account with the Alarm Admin role, go to the Ranger, click "Configure" on the tile for the metric that you'd like to trigger an alarm on, and set its alarm threshold through the Alarms tab. The screenshot below shows the Configure window for Analog Input 1. If Analog Input 1 goes below 6mA or above 18mA, an alarm notification will go out to every user subscribed to this Ranger's alarms. A user with Alarm Ack permissions may acknowledge the alarm to signal that the alarm and/or its cause have been taken care of. Unacknowledged alarms can be seen accumulated in the upper right-hand corner of the Cloud page.



Alarms View

Clicking on the Alarms button in the top bar will open a table of all alarm trigger events. The list of events can be sorted in ascending or descending order by any of the display columns by clicking on the column name.

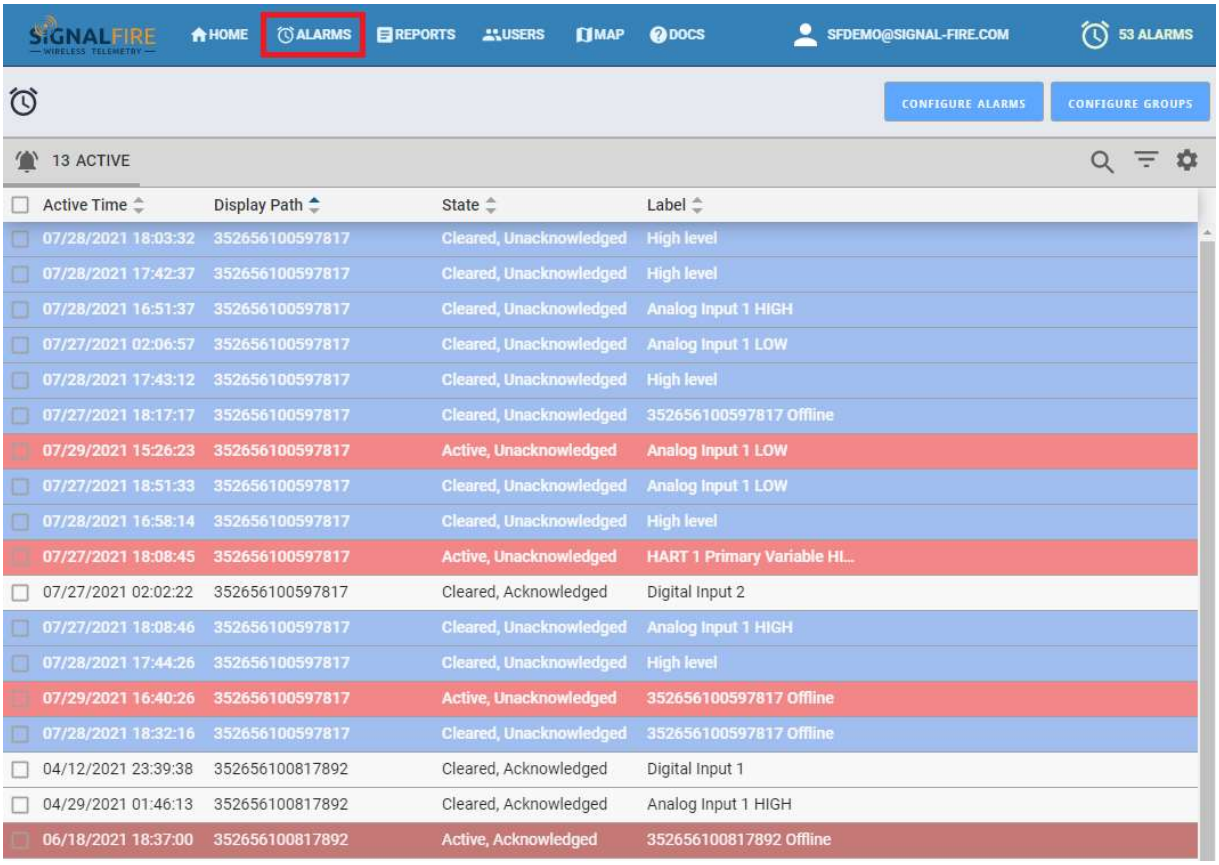
The upper-right hand corner of the table contains a gear icon, sort icon, and search icon that help filter and find alarm triggers. The gear icon is used to enable/disable the display columns used for ascending/descending sort. The sort icon is used to filter alarms by their cleared/acknowledge state. The search icon is used to search alarms by keyword in any of its enabled columns. For example, if there is a Ranger named "Tank 6R" and the name column is enabled, typing in "Tank 6R" will show all alarm events from that Ranger. Hovering the mouse over a line will show a icon. Clicking on it will reveal a detailed view for that alarm.

State

Ranger alarms, once triggered, can be in one of four states: "Active, Unacknowledged", "Active, Acknowledged", "Cleared, Unacknowledged", and "Cleared, Acknowledged". Active means that the alarm still meets the alarm trigger criteria, while Cleared means it no longer does. Unacknowledged means that the alarm has not been dismissed by someone with Alarm Ack privileges, while Acknowledged means someone has been seen.

For example, a digital input set to flow mode may have an alarm set to trigger when the average flow rate goes above 15 gallons/sec. When that threshold is first crossed, the alarm will appear in the Alarms table as “Active, Unacknowledged”. If the average flow rate goes down to 12 gallons/sec, the state will change to “Cleared, Unacknowledged”. Once an Alarm Ack user acknowledges the alarm, the state will change to “Cleared, Acknowledged”. In other words, the inputs control the Active/Clear state, while users control the Unacknowledged/Acknowledged state.

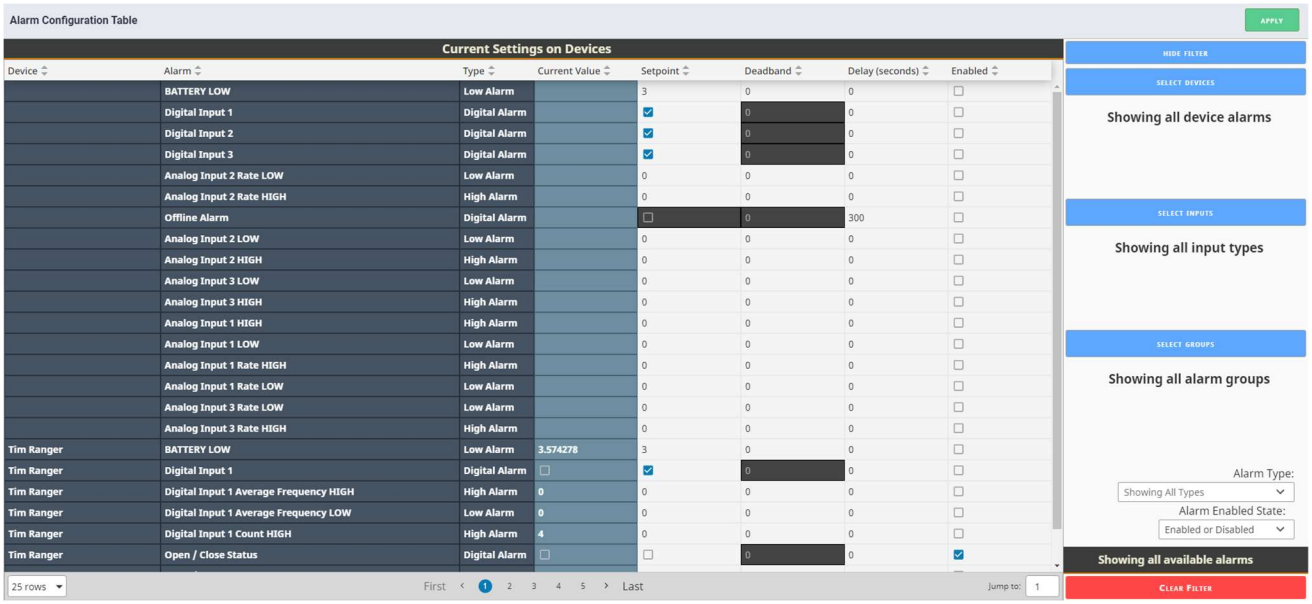
To Acknowledge an alarm, a user with the Alarm Ack user role must click on the alarm and click “Acknowledge” in the bottom right corner. A user may alternatively select “Shelve”, which prevents the alarm from triggering for a time period.



Configure Alarms

Users may also edit alarm settings by clicking on “Configure Alarms” in the upper-right corner of the Alarms table. This view shows all possible alarm sources on all possible devices in the user group. The interface on the right side can be used to filter which devices, input types, and alarm groups show up in the table. This interface provides a much faster and more convenient way of editing a large number of alarms

For example, clicking on Select Devices will pull up a list of all devices available. Select the Rangers to filter by and click “Select” to add it to the list. Hold the Ctrl key as you click to select multiple at a time, or the Shift key to select a range. Once you have all the devices you’d like to see on the Included Devices list, click View Selected. Click “Clear Filter” to view all devices again.



To change a field, double click the field, enter the desired value, and then press the Enter key. Fields that have been edited but not set will be highlighted yellow. Clicking cancel will undo the yellow highlighted fields. Once all fields have been edited as needed, click the green Apply button in the upper-right hand corner. The yellow highlighted fields will change to green to indicate the changes have been set.

For a digital input, if the setpoint column is checked off that means the alarm will trigger when that input is Close or logic 1. For analog alarms, it sets the high or low threshold value depending on if it's a High Alarm type or Low Alarm type.

The **Deadband** column changes the Clear threshold for an analog alarm. As an example, if the high alarm level is 4,000, and the deadband is 200, after the analog input has gone above 4,000 and activated the alarm, it will have to go below 3,800 for the alarm to clear. Similarly, if the low alarm is 2,000 and the deadband is 200, the input will have to go above 2,200 to clear an active low alarm. This setting is useful to prevent multiple alarms when a reading is at the alarm threshold.

The **Delay** column adds a countdown timer to the alarm that starts once the threshold has been crossed. If the input stays past the threshold for entire duration of the Delay countdown, the alarm becomes active and alert messages are sent out. However, if the Ranger reports a reading below the threshold during that countdown, the timer is reset, and the threshold must be crossed again for the countdown to start again. **The Delay value should be greater than the Ranger's report interval** so there's at least one new reading before the countdown ends.

The Delay timer takes the Deadband value into consideration. Consider the previous example where the high alarm threshold is 4,000 and the deadband is 200, but now there is a 120 second Delay. Once the Ranger reports a reading above 4,000, a 120 second countdown begins. If the Ranger reports a reading of 3,900 before the timers hits 0, the alarm still activates because it's within the deadband. If it instead goes to 3,700, the timer is reset and the input has to go back above 4,000 for the Delay timer to count down again.

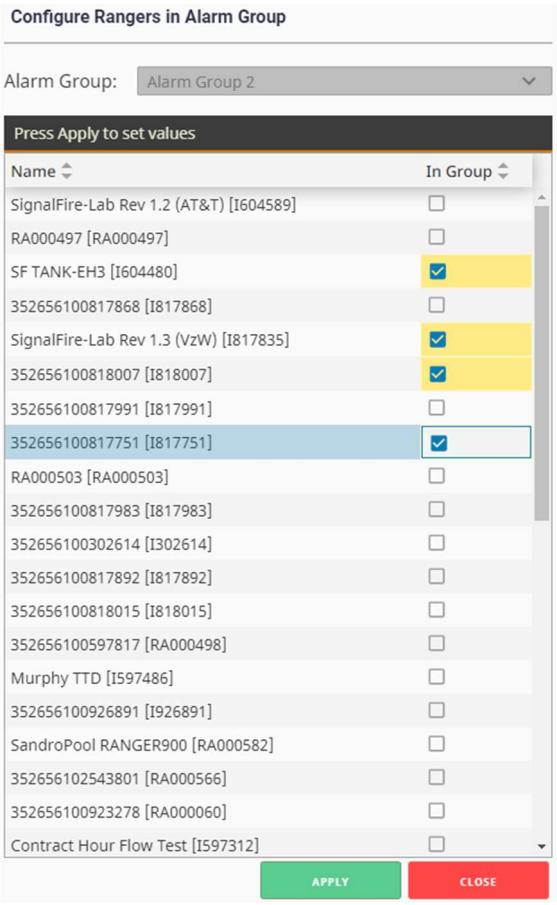
Alarm Groups

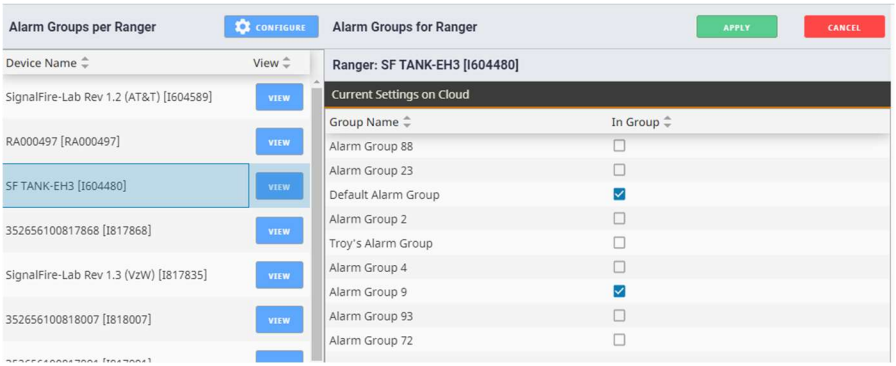
When alarms are triggered, the Cloud sends messages out to users based on alarm groups. Click on the "Configure Groups" button in the upper-right corner of the Alarms tab to edit user and Ranger alarm groups. **Only users with Alarm Admin privileges may edit settings here**.

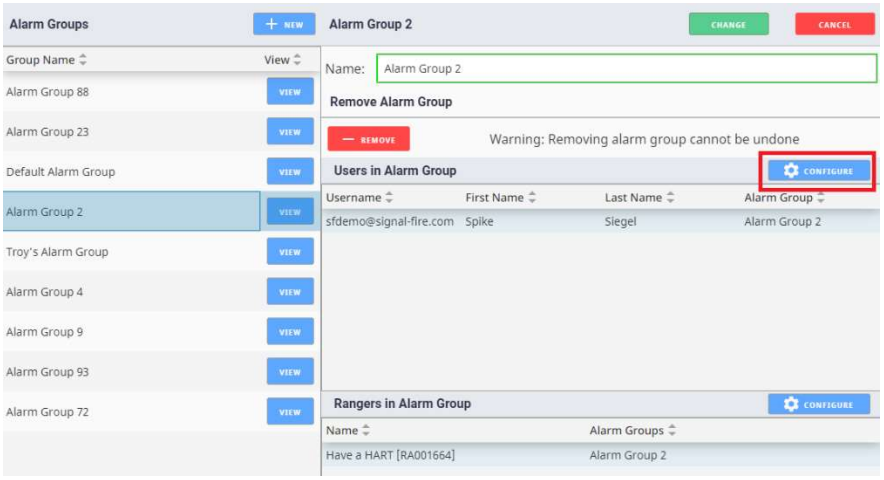
New users and newly added Rangers will be assigned to the Default Alarm Group, which cannot be removed or renamed. To add a new group, click on the "+ New" button in the Groups tab, and then rename it in the Name field. To select which Rangers you'd like to have in the group, click on the Configure button, check off the desired Rangers, and click Apply.

To add a single Ranger to multiple groups at once, go to the Rangers tab, click on the Ranger, check off the groups to add it to in the panel on the right, and click Apply. When any of that Ranger's alarms become active or clear, the Cloud will send messages to every user in the groups the Ranger is a part of.

To edit each user's group, click the Configure button to bring up a list of all users. You may then one-by-one edit which single group a user is assigned to. **Users may only be assigned to a single group**.

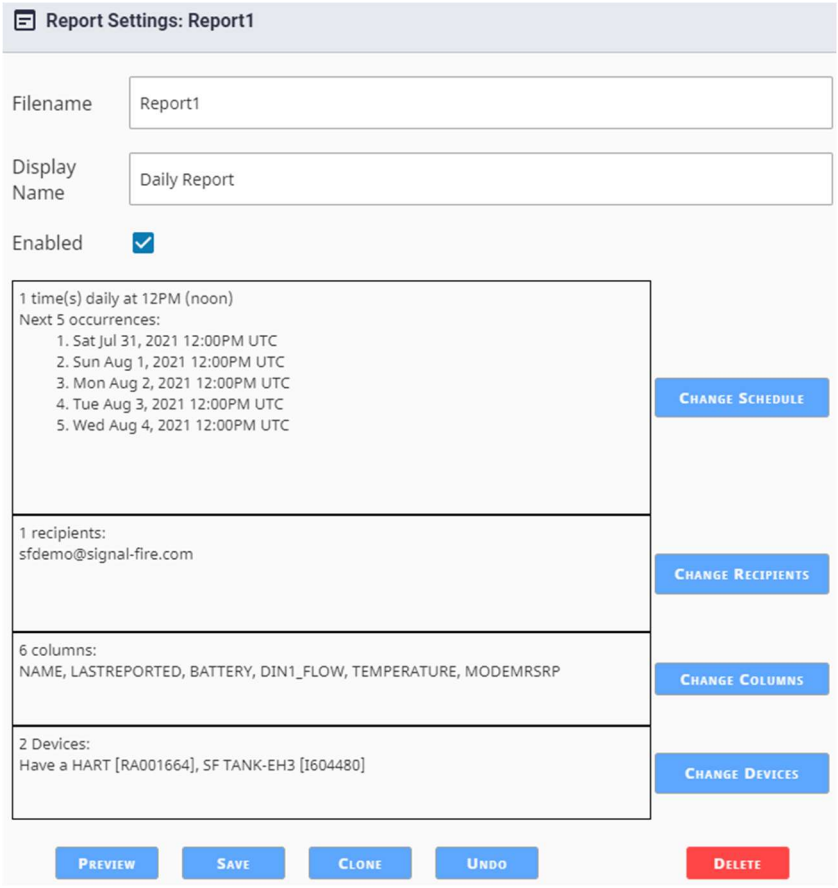






Reports

The SF Cloud has an automated reporting function that can send a snapshot of data to a group of recipients on a schedule. To create a report, go to the Reports tab and then click on the "Add Report +" button. Reports can be sent out up to 4 times a day.



Mounting and Care

The Ranger unit comes with an integrated ½" NPT fitting with leads for connection to the sensors. It is important to mount the Ranger so it is vertically oriented with the NPT fitting facing down.

Junction Box

The Ranger can also be purchased with a junction box to make wiring more convenient. Shown below are the Ranger and Junction Box assembled, as well as the interior of the junction box. The inside cover of the junction box contains a wiring color-code guide

Internal Lithium Battery Replacement

Battery Packs can be changed with the node in place.

1. Unscrew the cover from the base.
2. Unplug the battery from the PCB, by depressing the locking clip on the connector.
3. Loosen the three screws that attach the circuit board assembly to the base. **Do not remove the two screws that attach the antenna assembly**
4. Remove/replace battery
5. Re-install circuit board assembly. Do not overtighten the screws
6. Connect the battery to the main PCB battery connector.
7. Install the enclosure cover.

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Revision History

Revision	Date	Changes/Updates
1.0	11/12/19	Initial release
1.2	1/27/20	Added section on GPS
1.3	1/31/20	Added detail about linking Ranger using its serial number
1.4	4/24/20	Updated to reflect changes to the SignalFire Cloud
1.5	5/29/20	Updated to reflect changes to SF Cloud and C1D2 certification
1.6	7/21/20	Added 2AI/1DI and Modbus expansion cards
1.7	5/26/21	Added HART, SDI-12, Fast Reporting, Relay Control, Ranger junction box, updated Cloud screenshots
1.8	7/30/2021	Added support for bitmask registers, new alarm settings, reports