

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 - Available now)
- 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

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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	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	<ul style="list-style-type: none"> Contains FCC ID: 2ANPO00NRF9160 and IC ID: 24529-NRF9160 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]

Model Numbers	RANGER	RANGER LTE M1 Transmitter
	-4DPak	4 D Cell Pack
	-HCSolar	High Capacity Solar System, 9.0AH Capacity (not C1D2 certified)
	-DCDC	DC step down adapter 10-30Vdc down to 3.3Vdc. Fits in battery compartment
	-NONE	Standard I/O package 1AI, 2DI, 1Relay
	-2AI1DI	Expansion Module adding 2 Analog Input and 1 Digital Input
	-Modbus	FUTURE Expansion Module with RS485 Modbus Serial input
	-NoSIM	No SIM Card. User provides LTE CAT M1 SIM Card, No SignalFire Cloud
	-SIM/VZ	VERIZON LTE CAT M1 SIM - 1 Year Data Plan, SignalFire Cloud Connectivity

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Hazardous Location Certification

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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 matériel 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

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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

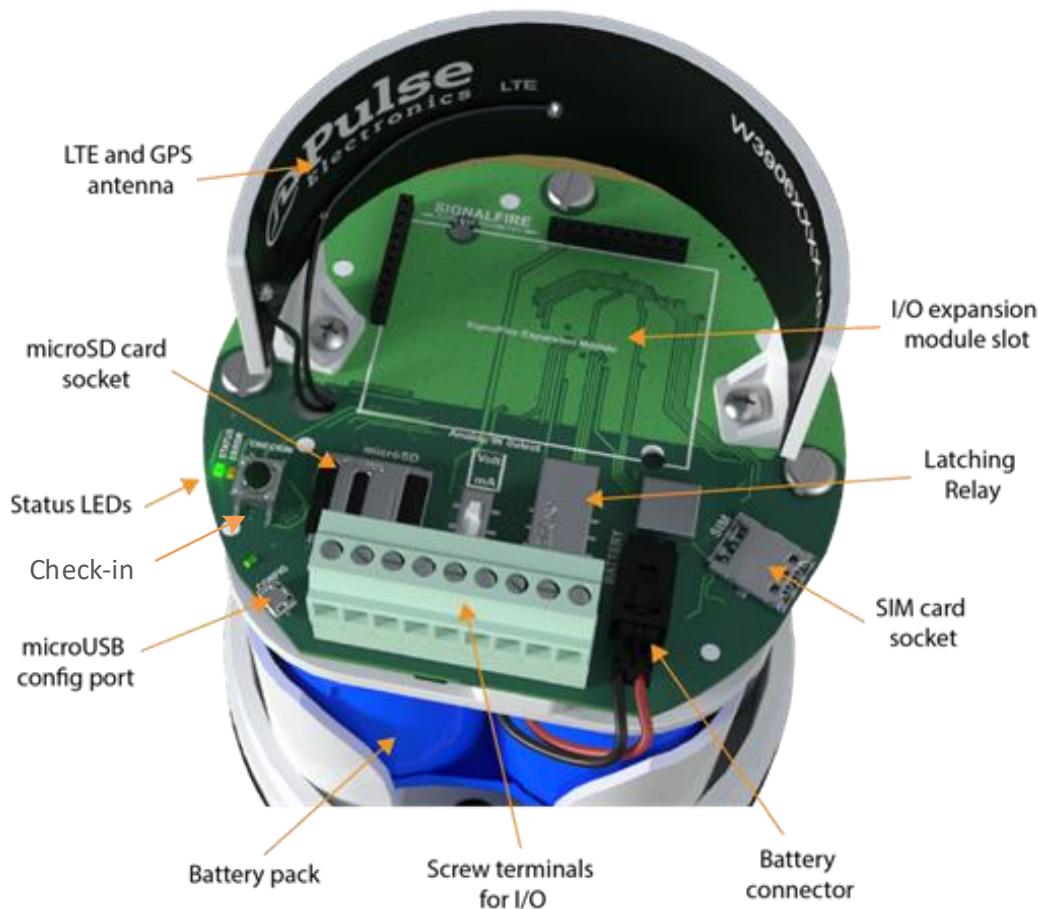
- If this button is pressed the Ranger will blink the Green or Red status LED 3 times to indicate the status of the last transmission to the server. If the Checkin button is pressed and held for more than 1 second, the Ranger will take readings from the attached sensors and send the readings to the server.

MicroSD Card Slot

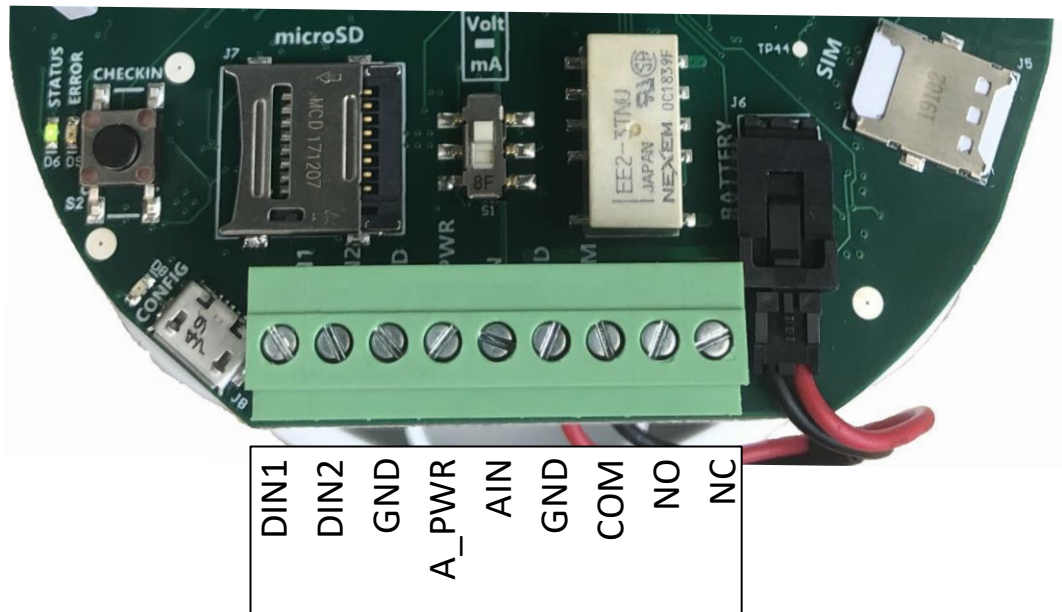
- The MicroSD card is for future use, it is not yet implemented and should not be installed

SignalFire Expansion Module

- The SignalFire Expansion Module slot will be used for future sensor support. Additional 2AI/1DI module is available now.



Ranger Internal components

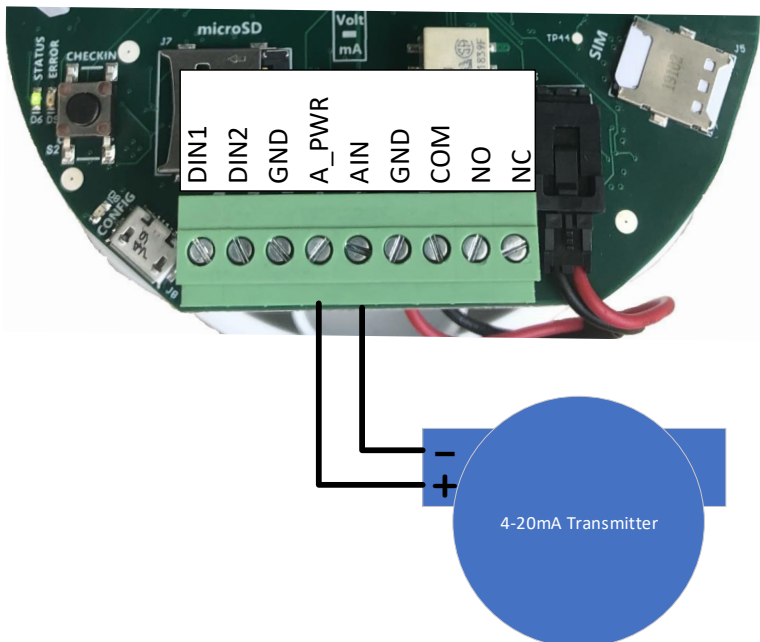


Screw Terminal Connections

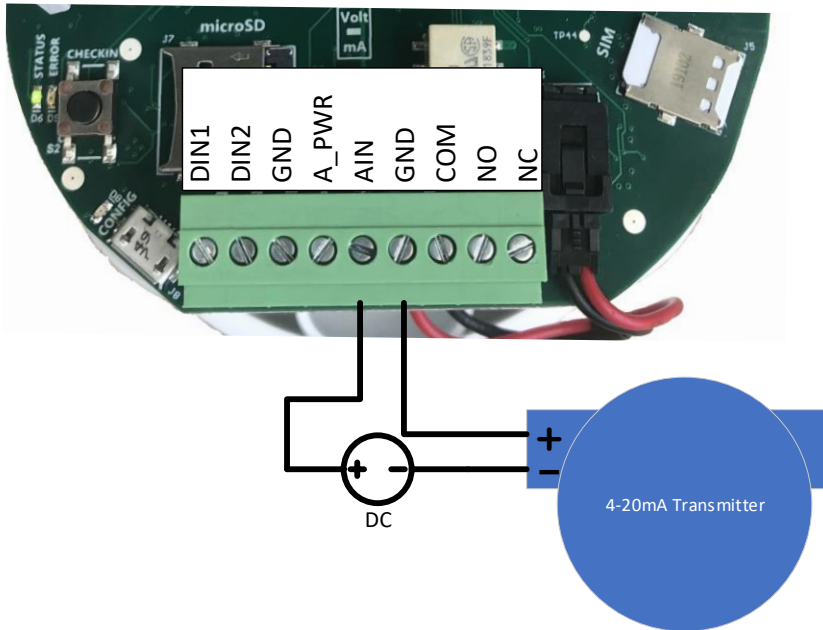
Analog Input

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.

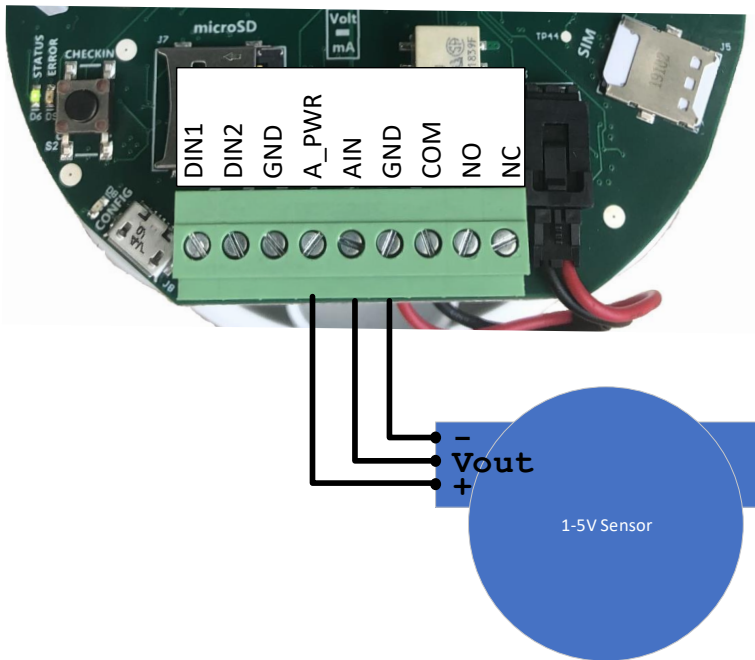
4-20mA Wiring Diagram – Ranger powered sensor



4-20mA Wiring Diagram – Externally powered sensor



1-5V Wiring Diagram



Digital Inputs

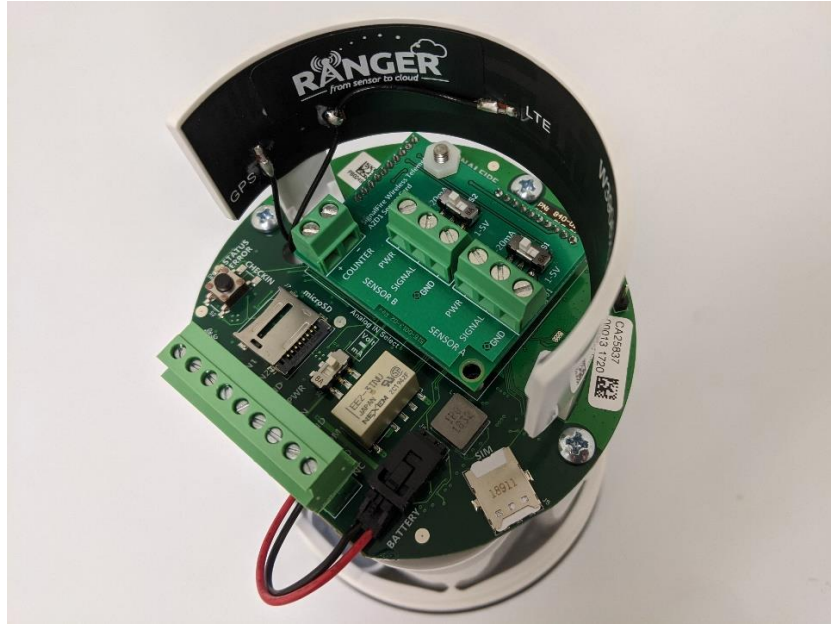
The digital inputs (2 total) can be dry contact or voltage (must be push-pull, 30 Volts max). Be sure to connect the ground bus from the module to either the ground of the voltage pulse device or the dry contact.

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, two expansion cards are offered: the 2AI/1DI and the Modbus cards. If the expansion cards are installed separately after first purchasing the Ranger without them, the expansion cards must be enabled using the Ranger ToolKit.



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.

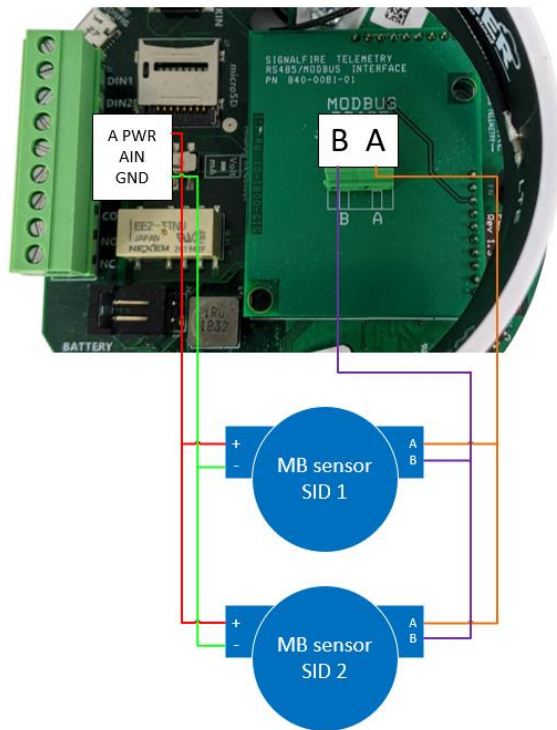
These inputs operate the same as the analog and digital inputs of the base model. The analog inputs can be set to 4-20mA mode or 1-5V mode via onboard switches. When installed, additional input configuration tiles will become available on the unit's SignalFire Cloud configuration page. An optional junction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

Modbus RS-485

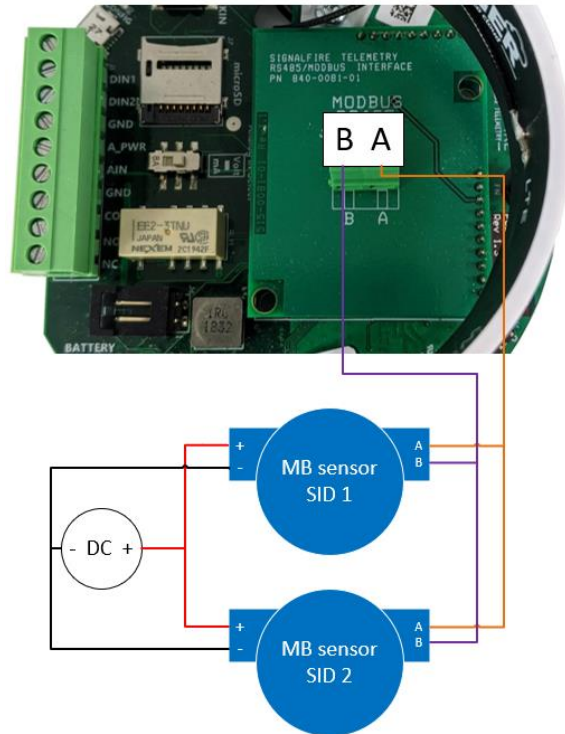
The Modbus card provides the Ranger with the ability to read a Modbus sensor over two-wire RS-485. Follow the diagram below for wiring the Modbus expansion card to a sensor. Sensors can be powered off the Ranger's onboard analog sensor power output. Like the analog sensor, its voltage is set in the Ranger 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.

RS-485 Wiring Diagram

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Sensor powered by Ranger



Sensor powered by external source

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 supplied 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

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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). Please 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 Cloud 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 will 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.

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Node Status Tile

▶ **NODE STATUS**

CONFIGURE


-88 dBm
Reports every 5 minutes

ONLINE
FORCE REPORT

Ranger Demo

Battery	3.58 V	Temp.	52 °F
Uptime	10 hours 1 minute 19 seconds		
Last Report	2020-04-17 01:57:54 PM		
Online Since	2020-04-17 03:59:22 AM		
Carrier Info	VzW (3B02)	SW Ver.	v0.1.6

▶ **RANGER SETTINGS**

APPLY

Current Settings

Node Name	Ranger Demo		
Report Interval (seconds)	300		
Sensor Voltage (V)	Low (13 V) ▼		
Sensor On Time (seconds)	2		
DIN1 Flow Measurement	Disable ▼		
DIN2 Flow Measurement	Enable ▼		

▶ **ALARMS**

APPLY

Current Settings

Alarm Group ID	1		
Offline Alarm (sec)	300	Disabled ▼	

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.

Sensor Voltage

Sets the output voltage applied to the analog sensor output

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. Configure the sensor on time to 0 when the analog input is not used or the sensor is powered externally

DIN 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 Alarm Group ID

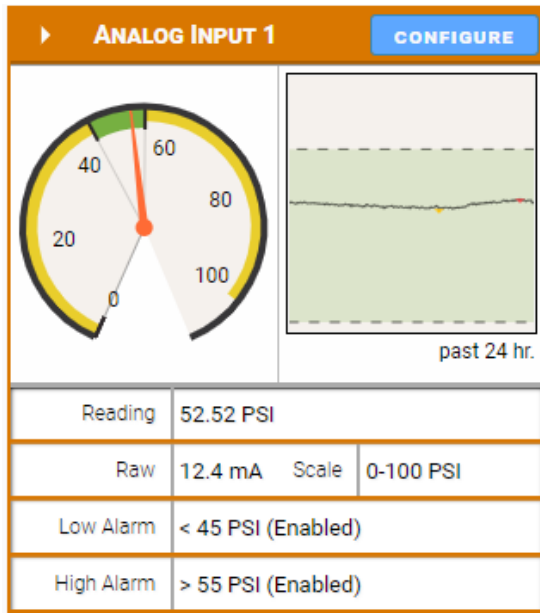
This defines which alarm group will receive alarms from this device. Each user configured in the Users tab can be assigned an alarm group number. Any users with a matching alarm group will receive alarms from this Ranger. Multiple alarm groups may be entered separated by commas and all groups entered will receive alarms.

Offline Alarm

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

Analog Input Tile

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The Analog Input 1 configuration screen shows the 'Current Settings' for the input. The settings are as follows:

Analog Mode		4-20 milliamps	▼
Scale Units		PSI	
Scale Low		0	
Scale High		100	

Below the settings is the 'ALARMS' section, which also shows 'Current Settings':

Low Alarm Threshold	45	Enabled	▼
High Alarm Threshold	55	Enabled	▼

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 or 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

DIGITAL INPUT 1
CONFIGURE


CLOSED

State

Count

past 24 hr.

Average Frequency

Count	4		
Avg. Freq.	0 Hz	Inst.	0 Hz
State Alarm	Alarm on CHANGE (Enabled)		
Debounce	10 ms	Report On Change	Enabled

DIGITAL INPUT 1
APPLY

Current Settings

Reset Counter	<input type="checkbox"/>
Report On Change	<input checked="" type="checkbox"/>
Debounce Delay (ms)	10

ALARMS
APPLY

Current Settings

State	ON CHANGE ▾	Enabled ▾
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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.

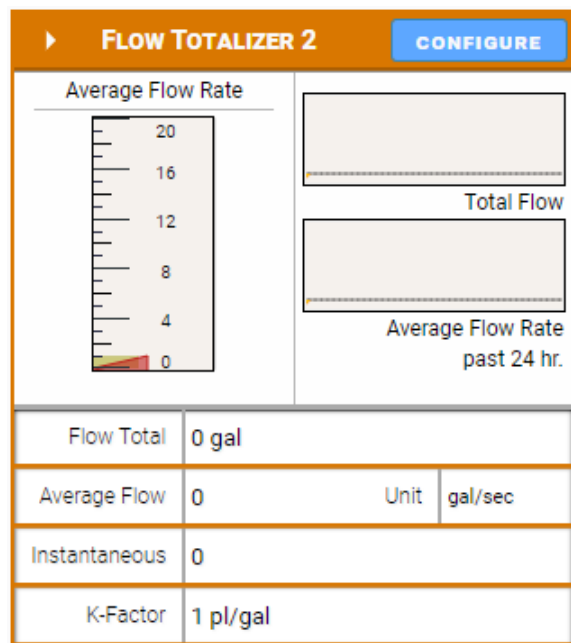
Report on Change

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



FLOW TOTALIZER 2		APPLY
Current Settings		
Flow K-factor	1	pl/gal ▼
Volume Units	gallons (gal) ▼	
Timebase Units	seconds ▼	
Set Flow Total	<input type="checkbox"/>	0

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

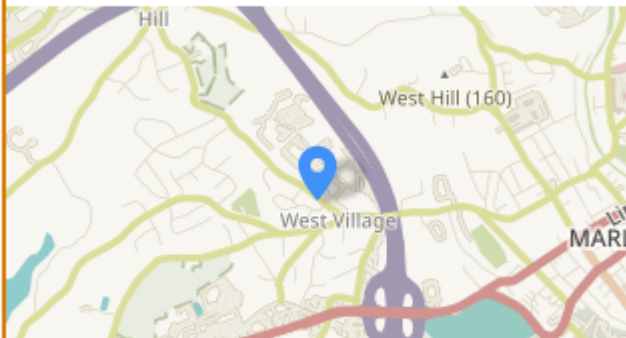
The allows the user to set or reset the total volume measured. Click the checkbox then enter the volume

GPS Tile

GPS

CONFIGURE

Location at 2020-04-17 04:44:31



Coordinates	42° 21' 0" N 71° 34' 55" W	UPDATE
Auto Trigger	12 hours	

GPS

APPLY

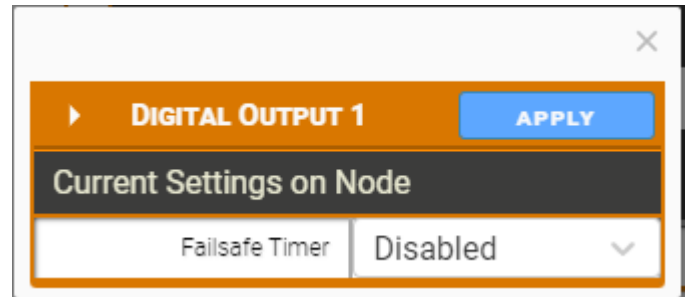
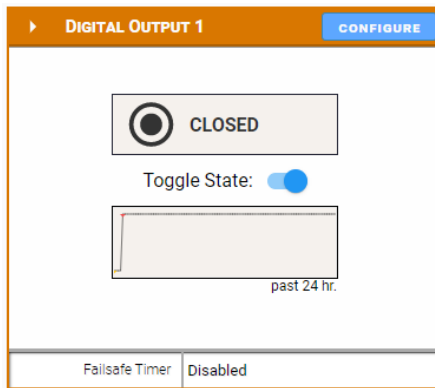
Current Settings

Automatic Update Interval	12 Hours	▼
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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 functionality. 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 may take up to 80 seconds to be delivered.



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.

MODBUS

CONFIGURE

Passing / Total Reads:

32

Polled Devices:

Enabled Alarms:

Baud Rate

9600

Mode

8N1

Request Delay

0

Response Timeout

1000

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.

MODBUS SETTINGS

EXIT

APPLY

Current Settings on Node

Baud

9600

Serial Mode

8N1 (8 Data Bits, No Parity, 1 ...

Byte Order

ABCD (High word, High byte)

Request Delay

0

Response Timeout

1,000

REGISTERS: 32

DELETE ROWS

APPLY

	Tag Name	ID	Address	Type	Unit	Access	+
0.	Float 1	1	3000	HOLDI... FLOAT	PSI	Read/W...	
1.	Float 2	1	3002	HOLDI... FLOAT		Read/W...	
2.	Float 3	1	3004	HOLDI... FLOAT		Read/W...	
3.	Float 4	1	3006	HOLDI... FLOAT		Read/W...	
4.	Float 5	1	3008	HOLDI... FLOAT		Read/W...	
5.	Float 6	1	3010	HOLDI... FLOAT		Read/W...	

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, and read/write access. The register can also be tagged with units if needed. Click Apply to send the changes to the Ranger.

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, 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.

Modbus Registers							CONFIGURE
Tag Name	Value	Units	Status	Alarm Low	Alarm High	Configure	View History
Float 1	848.948120117	PSI	PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND
Float 10	11.7683057785		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND
Float 11	10.4390907288		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND
Float 12	8.62783718109		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND
Float 13	11.6053752899		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND
Float 14	11.7515869141		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND
Float 15	11.0843963623		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND
Float 16	11.0996818542		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND
Float 17	9.52708530426		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND

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.

FLOAT 1

APPLY

Current Settings on Node

Register Value 700.553100

ALARMS

APPLY

Current Settings on Cloud

Low Alarm Threshold	0	Disabled
High Alarm Threshold	0	Disabled

Selecting your username in the upper right allows you to select your User settings. This will allow you to configure your email address and phone number for text messages.

Adding Users

If an account is configured with User Admin rights, you may add additional users by selecting the Users Menu and clicking Create New User. It is recommended that an email address is used for the Username.

User Roles

There are four user roles that control access to various features. Each role allows access to a specific feature of the SignalFire Cloud. More than one role can be assigned to a user and an administrator would typically have access to all roles.

User Admin

The role allows a user to be able to add additional users.

Device Admin

This role allows a user to configure the settings on a Ranger and to control its digital output

Alarm Admin

This role allows a user to configure the alarm settings for the Ranger

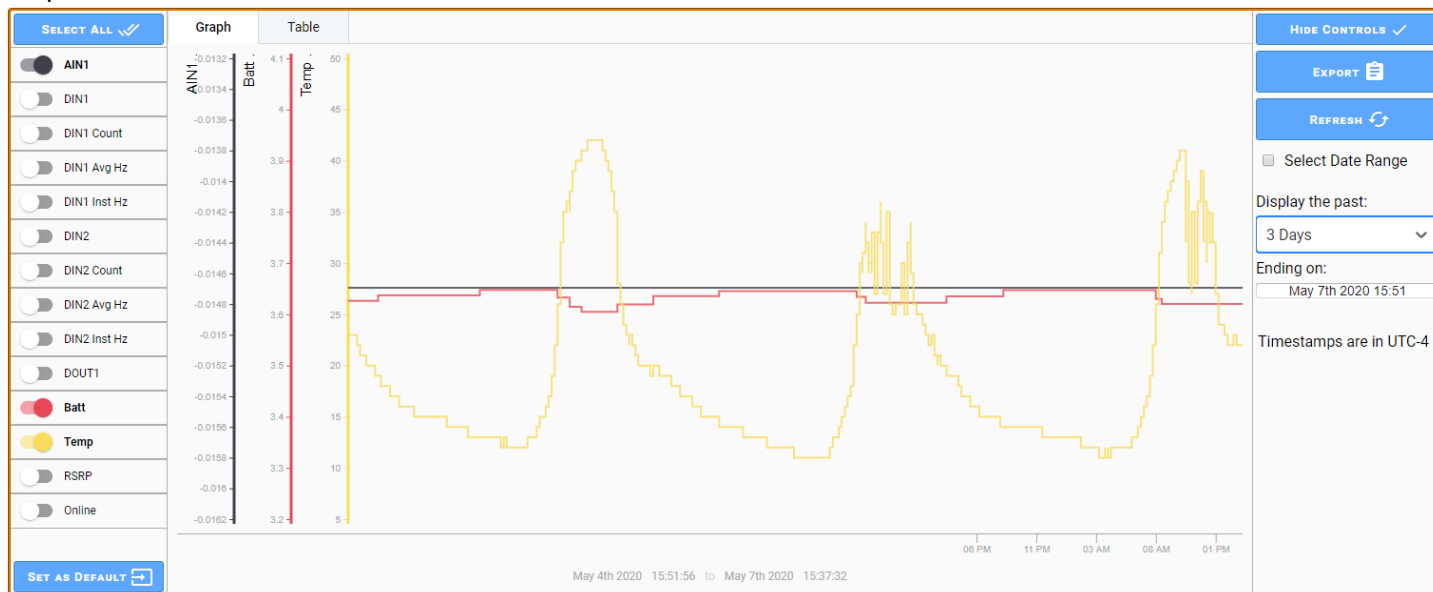
Alarm Ack

This role allows a user to acknowledge active alarms

Historical Data View

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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 wish 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.

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 orientated with the NPT fitting facing down.

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.

Technical Support and Contact Information

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140 Locke Dr., Suite B
Marlborough, MA 01749
(978) 212-2868
support@signal-fire.com

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