

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

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Enclosure Size	7.1" tall × 4.6" d	iamet	er		2
Power Source	Internal Lithium b Optional solar or	oattery exterr	y pack (SignalFire Part Number: 4DPak) nal DC power options also available		
Temperature Rating	-40°C to +85°C				
Enclosure	IP64 rated. Polyc	arbon	ate, ½" NPT fitting		
SIM Slot	4FF Nano SIM car	rd (LTE	Cat M SIM and data plan required)		
Local config port	Standard micro-L	JSB co	nnector		
Analog Input	Provides 13/18V in. Up to three wi	(select th adc	able) to attached 4-20mA / 1-5V sensor. One analo litional 2AI/1DI module	g input built-	
Digital Inputs	Two digital inputs (push-pull), 2kHz	s. Thre max.	e with additional 2AI/1DI module. Dry Contact or 30 Capable of reporting on state change) Volts Max	
Relay Output	Latching Relay. 2	A @ 3	0VDC, 0.3A @ 110VDC, 0.5A @ 125VAC		
Sensor Power Output	Selectable 13V/18	3V. 60)mA max power output		
Compliance	 Contains F PTCRB and Certified f T5 EXi [EX [UL 12120) IEC 62638 	FCC ID d Veriz or use i] 01:201 -1:201	2: 2ANPO00NRF9160 and IC ID: 24529-NRF9160 2on Network Certified 9 in Class I, Division 2, Groups A, B, C, D areas. Temp 7 Ed.9+R:26Aug2019], [CSA C22.2#213:2017 Ed.3+U 14 (2 nd Ed), EN 62368-1:2014+A11:2017	perature Code J1;U2]	
Model Numbers	RANGER -4DPak/IntAnt -HCSolar/IntAnt -DCDC/IntAnt -4DPak/ExtAnt -HCSolar/ExtAnt -HCSolar/ExtAnt -DCDC/ExtAnt -DCDC/ExtAnt -NONE -2AI1DI -Modbus -HART -SDI12	-NoSIM -SIM/VZ -SFCloud	RANGER LTE M1 Transmitter 4 D Cell Pack, Internal LTE Antenna High Capacity Solar System, 9.0AH Capacity, Internal LTE Antenna DC step down adapter 10-30Vdc to 3.3Vdc. Fits in battery compartment,Internal Ant. 4 D Cell Pack, External LTE SMA Antenna connection. No Antenna provided High Capacity Solar System, 9.0AH Capacity. External LTE SMA Connection. No antenna DC step down adapter 10-30Vdc to 3.3Vdc. Fits in battery compartment. External Ant. Standard I/O package 1AI, 2DI, 1Relay Expansion Module. Adds 2 Analog Input and 1 Digital Input for a total of 3AI 3DI Expansion Module with RS485 Modbus Serial port Expansion Module with HART protocol interface. Supports 15 multidrop devices Expansion Module with BDI protocol interface. Supports 8 multidrop devices No SIM Card. No SignalFire Cloud. User provides LTE CAT M1 SIM Card VERIZON LTE CAT M1 SIM - 1 Year Data Plan, SignalFire Cloud Connectivity No SIM Card. 1 year SignalFire Cloud. User provides LTE CAT M1 SIM Card		

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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.



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 acard 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 (<u>signal-fire.cloud</u>). Fill out the request form here: <u>https://signal-fire.com/lte-m1-cellular-products/cloudregister/</u> 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

Rev 1.8

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				SF TANK-EH3 Configuration
ONLINE		CONFIGURE NODE		General Alarms Release
((***))	20	FAST R	LEPORTING	Current Settings on Node
-102 dBm		HIDE /	SHOW TILES	Node Name SE TANK-EH3
Reports every 5 m	inútes	Forc	REPORT	Sensor Options
	SF TAN	K-EH3		Voltage (V) Low (13 V)
Battery	3.53 V	Temp.	72 °F	On Time (seconds)
Uptime	5 minutes 24 s	seconds		Reporting Interval
Last Report	2021-05-25	09:35:28 AN	A	in seconds 300
Online Since	Online Since 2021-05-25 09:33:49 AM		A	Flow Measurement
Carrier Info	VzW (3B02)	SW Ver.	v0.1.14-hart	
Expiration	NONE			APPLY

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.

FAST REPORTIN		IERS			A	PPLY	EXIT	
Current Settings	on Nod	e						
Metric	*	Value 🇘	Co	mparison	i ‡	Thre	eshold	
AIN1	~	-0.02	>		~	8		
None	~	0	N/A		~	0		
None	~	0	N/A		~	0		
None	~	0	N/A		~	0		
FAST REPORTIN	IG SETTI	NGS						
Fast Repo	rting is	Enabled	~	Current State:	Ina	ctive		
Trigger	r when	Any Fast Reporting triggers are TRUE						×
Remain Fast Rep	oorting	for Fast Report	ing Du	ration				~
Fast Reporting Du (se	uration conds)	3,600						
REPORT SETTIN	IGS USEC	WITH FAST REPO	RTING					
Report Interval (se	conds)	60		Sensor On Time (seconds)	-1		Always (Dn

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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

DIGITA	l Input 1		CON	IFIGURE	Di
O CL	OSED				DI
State		5		Count	
past 24 hr.		A	/erage	Frequency	
Count	4				
Avg. Freq.	0 Hz	Inst.	0 Hz	z	
State Alarm	Alarm on C	HANGE (Enabl	ed)	
Debounce	10 ms	Repo Ch	rt On ange	Enabled	



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

Average Flo	w Rate		ONFIGURE	General Dis	play		•
- 20 - 16				Current Settings on	Node		
12			Total Flow	Flow K-factor	1	pl/gal	~
- 4		Avera	age Flow Rate	Volume Units	gallons (g	gal)	~
0			past 24 hr.	Timebase Units	seconds		~
Flow Total	0 gal			Set Flow Total			49
Average Flow	0	Unit	gal/sec	Debounce Delay (ms)	0		
Instantaneous	0						
K-Factor	1 pl/gal				APPLY	EXI	π

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 Settings
Current Settings on Node
Automatic Update Interval 1 Hour 🗸
APPLY

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

	Digital Output 1 Settings General Display
O OPEN	Current Settings on Node
past 24 hr.	Failsafe Timer Disabled 🗸
ilsafe Timer Disabled	APPLY

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.

RELAT CONTROL	TRIGG	ERS. SP TANK-ENS						EXII
Current Setting	is on I	Node						
Metric		Value	Energiz	ze When	Thresho	ld	De-energize When	Threshold
DIN1	~	0	=	~	0	=		1
DIN2 Avg Hz	~	0	·>	~	20	<=		18
None	\sim	0	N/A	~	0			0
None	~	0	N/A	~	0			0
None	~	0	N/A	~	0			0
None	~	0	N/A	~	0			0
None	~	0	N/A	~	0			0
None	~	0	N/A	~	0			ō
RELAX CONTROL	SETT	INCS						
CONTROL		Bull Consults	Fuchled				Activo	
		Relay Control Is	Enabled		×	Current State:	Active	
Energize Relay when		Any Relay Contr	ol triggers	are TRUE			•	
Minimum	Energ	ize Time (seconds)	1		Fa	ilsafe Enabled (N	lissing Source data sets	trigger to de-energize)

Modbus Tile

•	Mode	us		CONFIGU	RE
Passing	/ Total	Reads:			
				3	2
Polled	Devices:		Enabled Al	arms:	
Bau	ud Rate	9600	Mode	8N1	
		Request Delay	0		
	Re	sponse Timeout	1000		

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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						APPLY	EXIT
Curr	rent Settings on Node							
	Baud 9600	~	Serial Mode	8N1 (8 Data Bit	s, No 🗸	Byte Order	ABCD (High w	ord, Hi
	Request Delay 0			Respon	se Timeout 1,00	0		
۱.	REGISTERS: 9						DELETE ROWS	APPLY
	Tag Name	ID	Address	Ту	pe	Unit	Acce	ss -
0.	Supply Voltage	1	3000	HOLDING 🗸	INT16 🗸		Read/Wri	te 🗸 🖠
1.	RPM	1	3001	HOLDING 🗸	INT16 🗸		Read Only	/ ~ i
2.	Temp 1	1	3002	HOLDING 🗸	FLOAT 🗸		Read Only	/ ~ i
3.	Run status	1	3004	HOLDING 🗸	Bit Pos 0 🗸		Read Only	/ ~ i
4.	Stage 1 disc	1	3004	HOLDING 🗸	Bit Pos 1 🗸		Read Only	/ ~ i
5.	High psi alarm	1	3004	HOLDING 🗸	Bit Pos 2 🗸		Read Only	/ ~ i
6.	Low psi alarm	1	3004	HOLDING 🗸	Bit Pos 3 🗸		Read Only	/ ~
7.	Eng oil Ivl low	1	3004	HOLDING 🗸	Bit Pos 4 🗸		Read Only	/ ~ i
8.	Eng oil lvl high	1	3004	HOLDING 🗸	Bit Pos 5 🗸		Read Only	/ ~ i

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.

MODBUS REGISTERS								CONFIGURE
Tag Name 🌲	Value 🌲	Units 🚔	Status 🌲	Alarm Low 🌲	Alarm High 🌲	Configure 🌲	View History 🌲	Custom Tile 🌲
Eng oil lvl high	0		PASS			MODIFY	SHOW IN TREND	VIEW AS TILE
Eng oil Ivl low	1		PASS			MODIFY	SHOW IN TREND	VIEW AS TILE
High psi alarm	0		PASS			MODIFY	SHOW IN TREND	VIEW AS TILE
Low psi alarm	0		PASS			MODIFY	SHOW IN TREND	VIEW AS TILE
RPM	1532		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	HIDE FROM TREND	REMOVE TILE
Run status	1		PASS			MODIFY	HIDE FROM TREND	REMOVE TILE
Stage 1 disc	0		PASS			MODIFY	SHOW IN TREND	VIEW AS TILE
Supply Voltage	23987		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	HIDE FROM TREND	VIEW AS TILE
Temp 1	42.1669998169		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	HIDE FROM TREND	REMOVE TILE

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 700.553100 Value ALARMS APPLY Current Settings on Cloud Low Alarm Threshold Disabled 0 High Alarm 0 Disabled Threshold

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

MODBUS RPM	CONFIGURE	MODBUS TEM	P 1	CONFIGURE	MODBUS RUN	STATUS	CONFIGURE
3,000 4,000 2,000 1,000 0 8,0	5,000 6,000 7,000 past 24 hr.		80	past 24 hr.	CLOSE)	past 24 hr.
Reading	1532	Reading	42.1669998	3169	Reading	1	
Low Alarm	< 0.0 (Disabled)	Low Alarm	< 0.0 (Disal	bled)	Alarm value	0 (Disabled	()
High Alarm	> 0.0 (Disabled)	High Alarm	> 0.0 (Disal	bled)			

HART Tile



HART				APPL		EXIT		
Current Settings on Node								
	Configure HART IDs							
0		1	\checkmark	2		3		
4		5		6		7		
8		9		10		11		
12		13		14		15		

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.

HART VARIABLES						CONFIGURE
Metric 🗘	Value 🌲	Status 🌩	Alarm Low 🌻	Alarm High 🌲	Configure 🌲	View History 🌲
HART 1 Primary Variable	0.39 ft	PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	HIDE FROM TREND
HART 1 Secondary Variable	99.66 l	PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND
HART 1 Tertiary Variable	0	PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND
HART 1 Quaternary Variable	0	PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND

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.

HART 1 PRIMARY VARIABLE								
Mfc.	VE	GA Grieshaber H	٢G	ID	1			
Variable	Pr	imary		Units	ft			
Tag	SE	NSOR						
ALARM CONFIGURATION								
Current Se	ttir	igs on Cloud						
Low Alar Thresho	m Id	0	Di	sabled	i v			
High Alar Thresho	m Id	0	Di	sabled	i v			
DISPLAY					PPLY			
Current Se	ttir	igs on Cloud						
Nam	Name HART 1 Primary Variable							
Short Nam	ne	HART1 PV						

SDI-12 Tile



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.

•	SDI-12 SETTINGS					EXIT
•	READINGS: 2				DELETE ROWS	APPLY
	Tag Name	Sensor Address	Measurement Request	Value Position	Unit	+
0.	Water Temp	0	M! ~	1		Î
1.	Battery Voltage	0	M! ~	2		Î

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.

► SDI12 SENSOR READINGS								
Tag Name 🌲	Value 🌲	Units 🌲	Status 🌲	Alarm Low 🌲	Alarm High 🌲	Configure 🗘	View History 🌲	
Battery Voltage	1295.0		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND	
Water Temp	247.0		PASS	0.0 (DISABLED)	0.0 (DISABLED)	MODIFY	SHOW IN TREND	

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 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 <u>https://signal-fire.com/lte-m1-</u> <u>cellular-products/cloudregister/</u> 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.

sfdemo@signal-fire.com
CHANGE PASSWORD
Spike
Siegel
CHANGE ALARM GROUP
Timezone America/New_York (current device) Current time: 12:58:36 EDT
1-800-555-1234
spike.siegel@signal-fire.com I Billing Alarms Billing Alarm emails will be sent from ignition-noreply@signal-fire.com, please add this email address to your whitelist.
Alarm Ack x Alarm Admin x User Admin x Device Admin x Report Admin x

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.

\$	GNALFIRE	≜ ⊧	IOME (ÖALAR	MS REPORTS	LUSERS DMAP	ODOCS
Users:	Demonstratio	n Group				
Filter table						
Update Details	Username 🌲	First Name 🌲	Last Name 🌲	Alarm Group 🛬	Timezone 🌲	Notes $_{\psi}^{\pm}$
EDIT USER	demo	Demo	User	Default Alarm Group	Etc/UTC	

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.

Create No	ew User	
Username	sfdemo@signal-fire.com	
First Name	Spike	
Last Name	Siegel	
Alarm Group	Default Alarm Group	~
Timezone	America/New_York (current device) V Current time 16:49:38 EDT	
User Roles	User Admin x Device Admin x Alarm Admin x Alarm Ack x Report Admin x	~
	CREATE CANCEL	

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.

Analog Input	t 1 Settings								
General	General Alarms Display								
Press Apply to	Press Apply to set values								
Alarm Thresh	olds								
Low	Low 6 Enabled 🗸								
High	High 18 Enabled V								
	APPLY								

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 so icon, sort right 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.

SIGNALFIRE	HOME		MAP	ODOCS	SFDEMO@SIGNAL-FIRE.COM	53 ALARMS
Ø					CONFIGURE ALARMS	CONFIGURE GROUPS
13 ACTIVE						Q \Xi 🌣
🗌 Active Time 🌲	Display Path 🌲	State 🌲		Label 🌲		
07/28/2021 18:03:32						-
07/28/2021 17:42:37		Cleared, Unack				
07/28/2021 16:51:37		Cleared, Unack				
07/27/2021 02:06:57		Cleared, Unack		Analog Input 1 LOW		
07/28/2021 17:43:12						
07/27/2021 18:17:17					Offline	
07/29/2021 15:26:23	352656100597817	Active, Unackn	owledged	Analog Input 1 LOW		
07/27/2021 18:51:33		Cleared, Unack		Analog Input 1 LOW		
07/28/2021 16:58:14		Cleared, Unack				
07/27/2021 18:08:45	352656100597817	Active, Unackn	owledged	HART 1 Primary Var	iable HI	
07/27/2021 02:02:22	352656100597817	Cleared, Acknow	wledged	Digital Input 2		
07/27/2021 18:08:46		Cleared, Unack		Analog Input 1 HIGH		
07/28/2021 17:44:26						
07/29/2021 16:40:26	352656100597817	Active, Unackn	owledged	352656100597817	Offline	
07/28/2021 18:32:16						
04/12/2021 23:39:38	352656100817892	Cleared, Acknow	wledged	Digital Input 1		
04/29/2021 01:46:13	352656100817892	Cleared, Acknow	wledged	Analog Input 1 HIGH		
06/18/2021 18:37:00	352656100817892	Active, Acknow	ledged	352656100817892	Offline	

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.

Alarm Configuration Table								
Current Settings on Devices were rearred								
Device 🌲	Alarm ≑	Type 🌲	Current Value 🌲	Setpoint 🌻	Deadband 🌻	Delay (seconds) 🌐	Enabled 🌲	
	BATTERY LOW	Low Alarm		3	0	0		SELECT DEVICES
	Digital Input 1	Digital Alarm			0	0		Showing all device alarms
	Digital Input 2	Digital Alarm			0	0		J
	Digital Input 3	Digital Alarm			0	0		
	Analog Input 2 Rate LOW	Low Alarm		0	0	0		
	Analog Input 2 Rate HIGH	High Alarm		0	0	0		
	Offline Alarm	Digital Alarm			0	300		SELECT INPUTS
	Analog Input 2 LOW	Low Alarm		0	0	0		Showing all input types
	Analog Input 2 HIGH	High Alarm		0	0	0		showing an input types
	Analog Input 3 LOW	Low Alarm		0	0	0		
	Analog Input 3 HIGH	High Alarm		0	0	0		
	Analog Input 1 HIGH	High Alarm		0	0	0		
	Analog Input 1 LOW	Low Alarm		0	0	0		SELECT GROUPS
	Analog Input 1 Rate HIGH	High Alarm		0	0	0		
	Analog Input 1 Rate LOW	Low Alarm		0	0	0		Showing all alarm groups
	Analog Input 3 Rate LOW	Low Alarm		0	0	0		
	Analog Input 3 Rate HIGH	High Alarm		0	0	0		
Tîm Ranger	BATTERY LOW	Low Alarm	3.574278	3	0	0		
Tim Ranger	Digital Input 1	Digital Alarm			0	0		Alarm Type:
Tim Ranger	Digital Input 1 Average Frequency HIGH	High Alarm	0	0	0	0		Showing All Types 🗸
Tim Ranger	Digital Input 1 Average Frequency LOW	Low Alarm	0	0	0	0		Alarm Enabled State:
Tim Ranger	Digital Input 1 Count HIGH	High Alarm	4	0	0	0		Enabled or Disabled V
Tim Ranger	Open / Close Status	Digital Alarm			0	0		Showing all available alarms
25 rows 💌	Fir	st < 🚺 2	3 4 5 > L	.ast			Jump to: 1	CLEAR FILTER

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

Configure Rangers in Alarm Group

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**.

Alarm Group: Alarm Group 2	~
Press Apply to set values	
Name 🌲	In Group 🌲
SignalFire-Lab Rev 1.2 (AT&T) [I604589]	
RA000497 [RA000497]	
SF TANK-EH3 [I604480]	
352656100817868 [I817868]	
SignalFire-Lab Rev 1.3 (VzW) [I817835]	
352656100818007 [I818007]	
352656100817991 [I817991]	
352656100817751 [I817751]	
RA000503 [RA000503]	
352656100817983 [I817983]	
352656100302614 [I302614]	
352656100817892 [I817892]	
352656100818015 [I818015]	
352656100597817 [RA000498]	
Murphy TTD [I597486]	
352656100926891 [I926891]	
SandroPool RANGER900 [RA000582]	
352656102543801 [RA000566]	
352656100923278 [RA000060]	
Contract Hour Flow Test [I597312]	
APPLY	CLOSE

Alarm Groups per Ranger		Alarm Groups for Ran	ger		APPLY	CANCEL
Device Name 🌲	View 🌻	Ranger: SF TANK-EH3	[1604480]			
ignalFire-Lab Rev 1.2 (AT&T) [I604589]	VIEW	Current Settings on Clou	bu			
		Group Name 🌲		In Group 🌲		
A000497 [RA000497]	VIEW	Alarm Group 88				
		Alarm Group 23				
F TANK-EH3 [1604480]	VIEW	Default Alarm Group				
52656100817868 [1817868]	VIEW	Alarm Group 2				
52656166617666 [1617666]		Troy's Alarm Group				
ignalFire-Lab Rev 1.3 (VzW) [I817835]	VIEW	Alarm Group 4				
	_	Alarm Group 9				
52656100818007 [I818007]	VIEW	Alarm Group 93				
	_	Alarm Group 72				
Group Name \$	View \$	Name: Alarm Group	2		CHANGE	CANCEL
Alarm Group 23	VIEW	Remove Alarm Group	Maraia a Da		annat ha undar	
		- REMOVE	warning: kei	moving alarm group c	annot be undo	le
Default Alarm Group	VIEW	Users in Alarm Group				CONFIGURE
Alarm Group 2	VIEW	Username ‡	First Name 🌲	Last Name 🌲	Alarm G	roup 🗘
		sfdemo@signal-fire.com	Spike	Siegel	Alarm G	roup 2
Troy's Alarm Group	VIEW					
Alarm Group 4	VIEW					
Alarm Group 9	VIEW					
Alarm Group 93	VIEW					
Alarm Group 72	VIEW	Rangers in Alarm Gro	up			CONFIGURE
		Name 🏺		Alarm Groups 🌲		
		Have a HART [RA001664]		Alarm Group 2		

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.

E Report Se	ttings: Report1					
Filename	Report1					
Display Name	Daily Report					
Enabled						
1 time(s) daily a Next 5 occurren 1. Sat Jul 3 2. Sun Aug	at 12PM (noon) nces: 11, 2021 12:00PM UTC g 1, 2021 12:00PM UTC					
3. Mon Au 4. Tue Au 5. Wed Au	ig 2, 2021 12:00PM UTC g 3, 2021 12:00PM UTC g 4, 2021 12:00PM UTC	CHANGE SCHEDULE				
1 recipients:	L-fire com					
sidemo@signa	-mexon	CHANGE RECIPIENTS				
6 columns:						
NAME, LASTREI	PORTED, BATTERY, DIN1_FLOW, TEMPERATURE, MODEMRSRP	CHANGE COLUMNS				
2 Devices: Have a HART [F	ADD1664] SE TANK-EH3 [I604480]					
		CHANGE DEVICES				
PREVIE	W SAVE CLONE UNDO	DELETE				

Mounting and Care

The Ranger unit comes with an integrated 1/2" 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.

Technical Support and Contact Information

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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