

Interface Manual

RSD-Stick

SignalFire Number: MBS-RSD-XX



The SignalFire Remote Shutdown (RSD) Stick has the following features:

- Wide range DC power input. 6 to 36VDC
- Standard SignalFire Modbus-Stick configured in RSD mode
- Configurable check-in period and network address
- Multiple configurable failsafe timers
- DIN rail mounted RSD module with 2 relay outputs and 2 digital inputs
- Relay status monitoring with fault indicator registers
- Full time mesh node can forward messages from other SignalFire devices including sleeping nodes
- Sends data to SignalFire Modbus Gateway
- Integrated 500mW FHSS 900MHz ISM band radio and high gain antenna
- AES 128bit Encryption

Connections

2

The RSD-Stick is supplied with a 6 conductor cable. The connections are as follows:

Wire Color	Connection
RED	Positive Power (6 to 36 VDC)
BLACK	Ground
GREEN	RS-485 to RSD Module
BROWN	RS-485 to RSD Module
ORANGE	RS-232 Debug/Programming TX, 9600 Baud
YELLOW	RS-232 Debug/Programming RX, 9600 Baud

Status LED

The RSD-Stick has one LED located on stick base, in addition to a Status LED on the RSD module for field diagnostics.

LED	Description
Slow Flash (3 second pause)	System is running and in communication with radio network
Fast Flash (0.5 second pause)	System is running but no network found
Solid On	System Fault, needs service

System Components

Relay Outputs

Each relay output connector has a common, normally open, and normally closed connection. Note that the “normal” state is the non-energized condition. This is also called the “safe” state.

The relays are rated for 2A at 30VDC, 0.5A at 125VAC, and 0.25A at 250VAC.

Digital Inputs

Each digital input register will report 1 for contact closure.

Status LEDs

LEDs display the relay states and the wireless communication status.

The three RSSI LEDs will all blink quickly if the RSD Stick has no connection to the wireless network. Once the RSD Stick has established network connectivity, one of the three “signal strength” LEDs will blink to indicate the wireless signal strength. Green=strong, yellow=good, red=weak.

The LEDs labeled Relay 1 and Relay 2 will be illuminated when the corresponding relay is in the energized state.

Relay Fault Monitoring

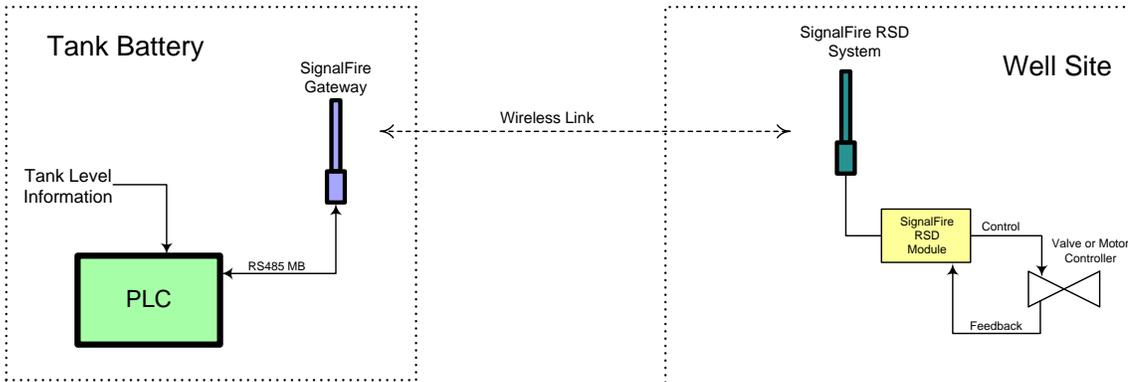
The RSD Module monitors the current flowing through the relay coil. If it senses too little current (open coil or relay driver) or too much current (shorted coil) the relay fault register will be reported as 1 to the gateway.

Integrated Failsafe Timers

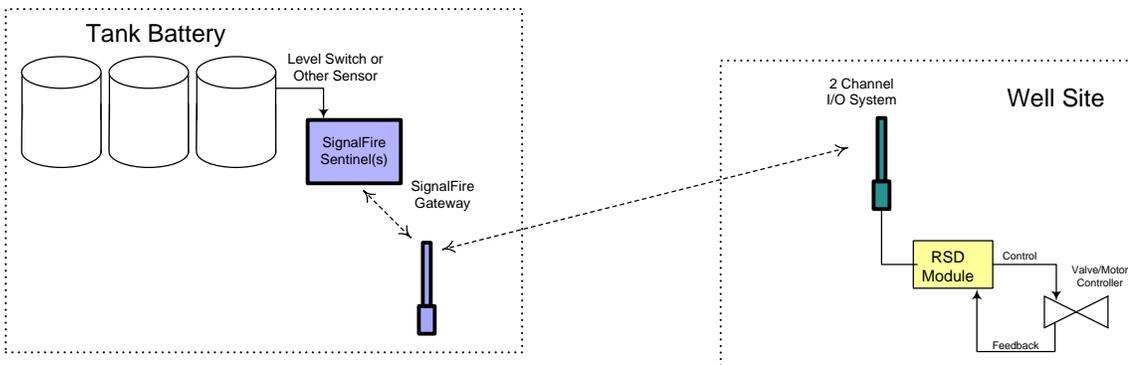
The RSD Module continuously monitors communications with the RSD Stick. In the event of no communications from the RSD Stick for 5 minutes the RSD Module will automatically de-energize both of the relays.

System Overview

In the SignalFire RSD system, there may be a local PLC at the tank battery that makes the decision to shut down the remote well sites. The tank battery information can also be monitored by remote SignalFire nodes and read from the Gateway. This type of system is shown in the following diagram (note that there are usually multiple "Well Sites" for each "Tank Battery" Gateway). The PLC will issue Modbus Coil Write commands to the Gateway for the RSD Slave ID to control the state of the relays.



Optionally the RSD control logic can be controlled entirely from the SignalFire Gateway using the "Remote Shutdown Settings" options in the Gateway. In this case, the logic or decision-making is configured in the Gateway and the PLC is optional. Refer to the manual for the SignalFire Gateway for more information. Note that there are usually multiple "Well Sites" for each "Tank Battery" Gateway).



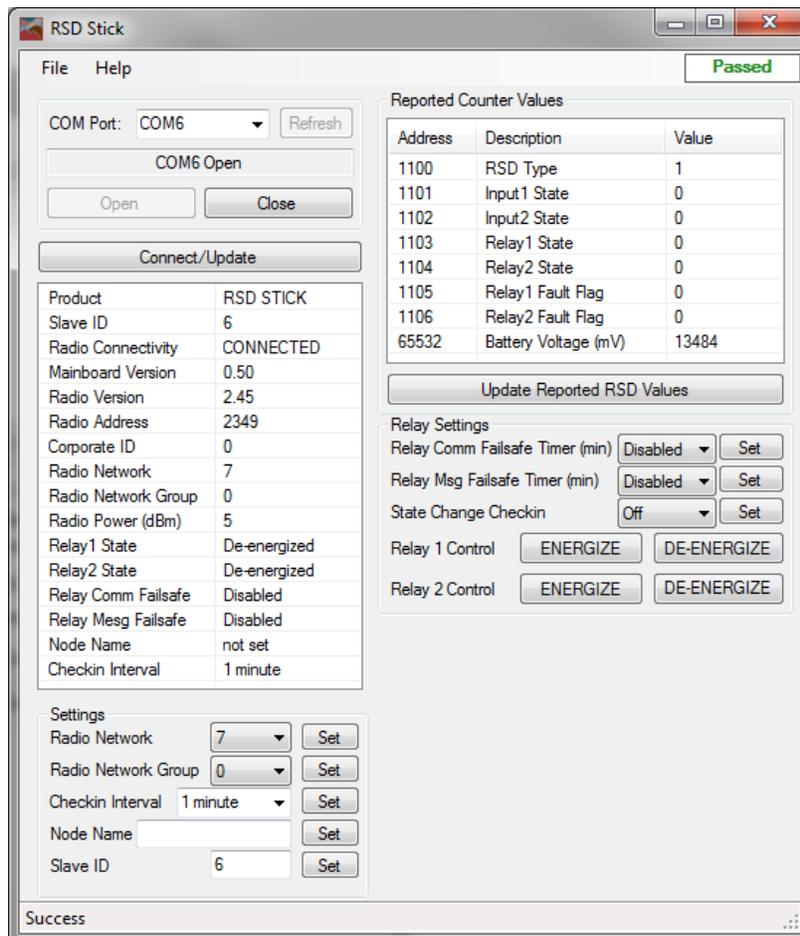
The RSD-Stick requires initial configuration over the debug port. This is done using the SignalFire Toolkit PC application to configure the device over a serial port.

Since the RSD Stick is a Modbus stick running in RSD mode it is possible to change a Modbus stick to/from a RSD stick using the SignalFire Toolkit.

Note that when the Modbus stick is operating is “RSD Mode” it cannot also operate as a standard Modbus stick at the same time. Also the Modbus Stick must be a standard RS485 Modbus Stick, not a RS232 Modbus version.

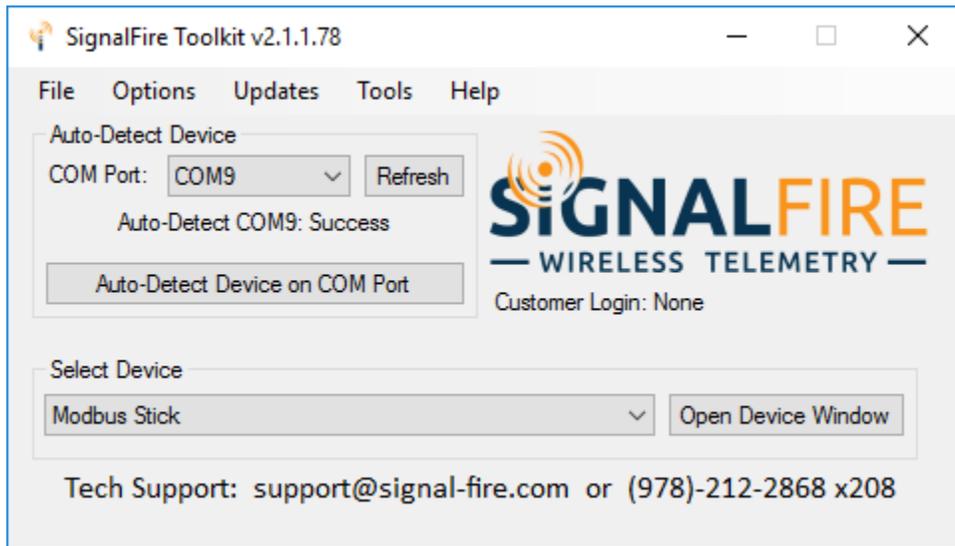
The following items must be configured:

- Enable RSD operation mode
- Network Selection / encryption settings
- Check-in Period Selection
- Modbus Slave ID
- Failsafe Timers (optional)



Configuration

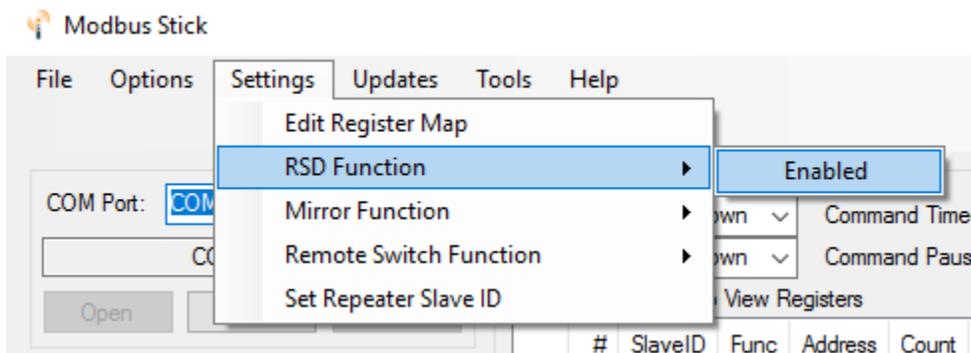
To begin configuration, open the SignalFire Toolkit. The SignalFire Toolkit application can be downloaded at www.signal-fire.com/customer. After installation, launch the software and the main toolkit window will open:



Select the COM port associated with the RSD-Stick and click "Auto-Detect Device on COM Port." This will open the device configuration window, where all device settings can be configured.

Enable RSD Operation Mode

If the Stick is running in Modbus mode, it must be changed to RSD Function using the ToolKit. Go to the Settings menu, RSD Function, and select Enabled.



The network address can be used to create separate networks using multiple gateways (that are in close proximity with one another). The network is set using the SignalFire Toolkit. The Network Group setting is used when more than 8 networks are needed. Both the network and network group must match those of the gateway to communicate.



Radio Network: 1 Set
Radio Network Group: 0 Set

Encryption

Starting with Modbus-Stick version r72, it is possible to encrypt over-the-air transmissions to prevent tampering. Encryption keys replace the Corporate ID system, so it is important that all devices connected to a Gateway have the same encryption key as well as network and network group number.

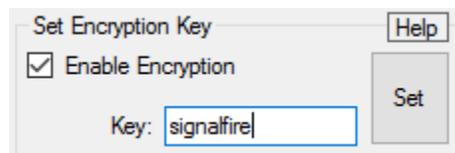
To set up a RSD-Stick to use encryption, click the checkbox labeled **Enable Encryption** inside the **Set Corporate ID** box:



Set Corporate ID Help
 Enable Encryption Set
Corporate ID: 7

The encryption key box. For more details, click the Help button.

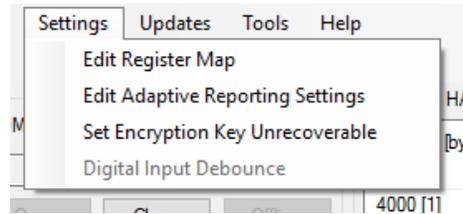
The box will then change into a **Set Encryption Key** box, and it will prompt instead for the encryption key you would like to use. Note that keys may not contain spaces or angle brackets. Enter it and then press **Set**. This will cause the RSD-Stick to drop its network, and only attempt to join networks that use the same encryption key. If you are setting up a new network, you will need to set the encryption key on all of your devices. If you are adding a RSD-Stick to a legacy network, you can simply set the Corporate ID without clicking the Enable Encryption box, and it will remain compatible with the older system.



Set Encryption Key Help
 Enable Encryption Set
Key: signalfire

Setting the encryption key.

It is also possible to hide your encryption key so it cannot be read. This is the most secure option, but if you forget your key, there is no way to recover it – you have to reset the key on every device on its network. To enable this option, select **Set Encryption Key Unrecoverable** under the **Settings** menu.



Setting the encryption key to be unrecoverable.

System Check-In Period

This setting controls how often the RSD-Stick will forward its register data to the gateway.

Node Name

Checkin Interval

The node name may be set to identify the node. The node name is visible at the Gateway and via NodeChecker

Check-in On State Change

The RSD Stick will check-in once a minute to the gateway. In addition, it will check-in any time the state of one of the relays changes. The check-in on state change will also cause a check-in to occur when the state of either of the digital inputs changes.

Modbus Slave ID

The SignalFire RSD Stick must be configured to have a unique Modbus ID within a configured network.

Relay Failsafe Settings

The RSD Stick can be configured so that both relays go to the non-energized (safe) state in the event of loss of communication. There are two options for the failsafe timer.

The “Relay Comm Failsafe Timer” If the RSD Stick loses its wireless communications link to the gateway for greater than this time, the relay outputs will be put into a non-energized state. Note that the RSD Stick will not know the wireless link has been lost until it performs its next scheduled checkin to the gateway. The relays will remain in this “safe” state until a Modbus command is sent to the gateway to energize the coil.

The “Relay Msg Failsafe Timer” is similar to the previous timer, but this indicates the time since a valid Modbus coil write message has been sent from the Modbus master through the SignalFire Gateway (or from the Gateway itself if operating in RSD Mode). If used this must be set higher than the Modbus coil write frequency of the Modbus master device.

Relay Control Buttons

The SignalFire ToolKit RSD Window also allows for the relays to be manually energized or de-energized. This is useful for testing the relay function.

Last Relay State Change Reason Status

The RSD stick provides a status register (1108) containing the reason code for the last relay state change. This is updated when the state changes on either relay channel.

Reason Code	Description
1	Power up. Set on initial RSD stick power up
2	Message Failsafe – Set if message failsafe timer is exceeded
3	Communication Failsafe – Set if communication failsafe timer is exceeded
4	Command Run – Set when an un-energized relay is commanded to be energized via a Modbus coil write
5	Command Shutdown – Set when an energized relay is commanded to be de-energized via a Modbus coil write
6	Module Communication restored – Set when the RS485 communications between the RSD stick and the RSD module are restored from a communication failure
7	Module Communication failed – Set when the RS485 communications between the RSD stick and the RSD module has failed

Modbus Write Register Instructions – Relay Control

The Modbus Master device will issue a standard Modbus protocol command in RTU format to the SignalFire Gateway. The register write command will be automatically forwarded over the air to the RSD Stick.

The RSD Stick supports single write coil and single write register Modbus commands:

0x05 MODBUS_WRITE_BOOLEAN (1-bit coil)

For example, if a Modbus master connected to the Gateway wants to control a relay on a RSD-Stick, it would issue a Modbus Coil Write command to the Gateway using the Modbus Slave ID and register address of the RSD-Stick.

Remote Modbus Register Mapping

11

The RSD Stick sends data to a SignalFire Gateway. The data that is sent to the Gateway shows up at the Gateway in registers.

Every check-in period, the RSD Stick registers are sent to the Gateway.

Register Number	Register Address (offset)	Description
41101	1100	RSD Type code. Will return 1
41102	1101	Input 1 State. 0 = Open, 1 = Closed
41103	1102	Input 2 State. 0 = Open, 1 = Closed
41104	1103	Relay 1 State. 0 = De-Energized, 1 = Energized
41105	1104	Relay 2 State. 0 = De-Energized, 1 = Energized
41106	1105	Relay 1 Fault. 0 = OK, 1 = Relay 1 Fault
41107	1106	Relay 2 Fault. 0 = OK, 1 = Relay 2 Fault
41108	1107	RSD Module Communication Fault. 0 = OK, 1 = Comm Fail.
41109	1108	Last Shutdown Reason (1 to 7, see page 9)
<i>The registers below are common to all SignalFire Nodes</i>		
49988	9987 or 65524	Major revision number for the main board
49989	9988 or 65525	Minor revision number for the main board
49990	9989 or 65526	Major revision number for the radio
49991	9990 or 65527	Minor revision number for the radio
49992	9991 or 65528	High 16 bits of SFTS node address
49993	9992 or 65529	Low 16 bits of SFTS node address (the radio ID)
49994	9993 or 65530	Slave ID read back
49995	9994 or 65531	Received signal strength of last packet from the slave
49996	9995 or 65532	Battery voltage of the RSD-Stick, in millivolts
49997	9996 or 65533	Minutes until this slave will time out, unless new data is received
49998	9997 or 65534	Number of registers cached for this slave device
49999	9998 or 65535	Remote device type (18 for RSD Stick)

The registers below are used to control the state of the relays by a Modbus write command issued to the SignalFire Gateway.

Register Number	Register Address (offset)	Description
00102	101	Output 1. 0x00FF = energize, 0x0000 = De-energize
00103	102	Output 2. 0x00FF = energize, 0x0000 = de-energized

Revision	Date	Changes/Updates
1.5	8/25/16	Updated Design. Added encryption and additional details

APPENDIX - FCC and IC Statements

Changes or modifications not expressly approved by SignalFire Telemetry, Inc could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device has been designed to operate with only the permanently attached internal antenna, having a maximum gain of 5 dB. No other antenna may be used.

WARNING!

FCC and IC Radiation Exposure Statement:

This equipment complies with FCC's and IC's RF radiation exposure limits set forth for an uncontrolled environment under the following conditions:

1. This equipment should be installed and operated such that a minimum separation distance of 20cm is maintained between the radiator (antenna) & user's/nearby person's body at all times.
2. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a maximum (or lesser) gain approved for this transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.r.i.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.