

## Theory Of Operation - SaviReader 410R, Model SR-410R-001

The SaviReader 410R (Reader) is normally in an on state.

**Collection - The following details the theory of operation of the tag collection process;**

1. **Wake-Up** -In order to initiate communications with a tag, the reader (interrogator) will send a wake-up signal with a duration of 2.5-5 seconds to all tags within its range. After the wake-up command is recognized by the tag, it will begin processing any incoming data.
2. **Hello** - After wake-up, the Reader generates a hello command which consists of an FM pulse of less than 10 mS. This command requests that all the tags within the radius of the reader send their unique identification code along with their respective status.
3. **Response** - After the hello command is received by each tag, it sends its identification code. The response of the tag is not more than 6 ms in duration and is made only once in a given 10 second interval.
4. **Acknowledgment and Sleep** - After the reader receives the response from the tag, it transmits an acknowledgment/go to sleep command to the tag using its unique identification code. This command is a 10 ms FM pulse. After the tag receives this command, it then goes to sleep.
5. **Find Tag** - In cases where the tag ID is not received by the reader, the reader activates an alarm condition and initiates a Find Tag command. This 10 ms FM pulse requests the status of only those tags that have failed to respond to the earlier hello command.

NOTE: All transmissions during the collection are control signals as defined in FCC Part 15.231(a).

Savi Technology  
FCC ID: KL7-410R-V1  
Theory of Operation

**Functional Description Of SaviReader 410R, Model SR-410R-001**  
**(see block diagram)**

**1. Power Supply**

The power supply provides 5 volts DC and powers all devices. It accepts inputs of:

AC Source: 92-125 or 185-250 VAC, 50/60 Hz, 1 watt

DC Source: 6-15 VDC, 100 mA average (internally regulated)

**2. RF Module**

Receiver: Superhetrodyne receiver converts 433.92 MHz FSK signals from tags to base band digital data for Digital Module processing. A SAW controlled local oscillator operates at 423.22 MHz to down convert the incoming signal to a 10.7 MHz IF frequency.

Transmitter: The transmitter converts digital data from the Digital Module into a 433.92 MHz FSK signal which is then transmitted via the antenna to the tag. The transmitter consists of a SAW controlled oscillator, single transistor buffer stage and a discrete component output filter.

**3. Digital Module**

The Digital Module controls all functions of the Reader. The microcontroller is Motorola MC68HC11F1 running at 16 MHz. The 16 MHz clock is divided by 4 in order to provide the clock for the Field Programmable Gate Array. The Field programmable Gate Array is responsible for symbol encoding, decoding, and buffering during radio communication. A 32 Kbytes EPROM contains the firmware. 128 Kbytes of static RAM is used for all the collection data from the tag.

**4. Network Interface Unit**

The Network Interface Unit transfers information between the Reader and the central computer, using an RS232 or RS485 interface. A crystal resonator at 3.684 MHz is divided by 2 and provides the clock for the microprocessor.

**5. LonWorks Module**

The function of this module is to receive a packet from the host and transfer to the Digital Module and then return appropriate status information to the host. This module allows implementation of Tag/Reader initiated communication. A 10 MHz crystal provides the clock.

**6. Antenna**

Two loop elements mounted perpendicular to each other on a circular metal plate. It has a gain of 0dBd and is omnidirectional in two orthogonal polarizations.

## Savi Product List

### SaviTag 410, Models:

| Product Family | Model Number | Description                               |
|----------------|--------------|---|
| SaviTag 410    | ST-410-003   | 2KB, no beeper, no directional wakeup     |
| SaviTag 410    | ST-410-004   | 8KB, no beeper, no directional wakeup     |
| SaviTag 410    | ST-410-013   | 2KB, no beeper, with directional wakeup   |
| SaviTag 410    | ST-410-018   | 128KB, no beeper, with directional wakeup |
| SaviTag 410    | ST-410-108   | 128KB, beeper, no directional wakeup      |
| SaviTag 410    | ST-410-113   | 2KB, beeper, with directional wakeup      |
| SaviTag 410    | ST-410-118   | 128KB, beeper, with directional wakeup    |

Model ST-410-108 was tested. Differences between the model tested and all other models are:

1. Memory size.
2. Models described as having no beeper have no beeper installed.
3. Models described as having directional wakeup have the directional wakeup activated. This involves enabling the processor to acknowledge signals received by the directional wakeup receiver. The directional wakeup receiver circuitry is installed and energized on all models, however, the processor on models with no directional wakeup are programed to ignore this signal.

Model ST-410-108 that was tested has all options installed.

### SaviReader 410R, Models:

| Product Family  | Model Number  | Description                                 |
|-----------------|---------------|---|
| SaviReader 410R | SR-410R-T-001 | RS-232, RS-485, no LED, no LonWorks         |
| SaviReader 410R | SR-410R-001   | RS-232, RS-485, no LED, no LonWorks         |
| SaviReader 410R | SR-410R-002   | no RS-232, no RS-485, no LED, with LonWorks |
| SaviReader 410R | SR-410R-003   | no RS-232, no RS-485, with LED, LonWorks    |
| SaviReader 410R | SR-410R-004   | no RS-232, RS-485, no LED, with LonWorks    |
| SaviReader 410R | SR-410R-005   | no RS-232, with RS-485, LED, LonWorks       |
| SaviReader 410R | SR-410R-006   | RS-232, RS-485, LED, LonWorks               |

Model SR-410R-006 was tested. Differences between the model tested and all other models are described above. Model SR-410R-006 that was tested has all options installed.

### Savi GateReader 410R, Models:

| Product Family       | Model Number | Description                               |
|----------------------|--------------|---|
| Savi GateReader 410R | SR-410GR-021 | 2 Transmitters (2.4 GHz)/antennas, cables |
| Savi GateReader 410R | SR-410GR-041 | 4 Transmitters(2.4 GHz)/antennas, cables  |

Model SR-410GR-041 was tested. Differences between the model tested and all other models are described above. Model SR-410GR-041 that was tested has all options installed.