FCC Statement

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 or more of the following measures:

- Reorient or relocate the receiving antenna

- Increase the separation between the equipment and the 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 equipment has been verified to comply with the limits for a class B computing device, pursuant to FCC rules. Operation with non-approved equipment is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of the manufacturer could void the user's authority to operate this equipment.

WARNING – READ BEFORE USE!

Congratulations on choosing the *RanchMaster* system for your business. We believe that *RanchMaster* is the most advanced technology available today for agricultural irrigation and climate control.

However, it is important to emphasize that this system is still only a tool, and cannot be expected to function error-free, 100% of the time.

The following are just some of the risks and limitations that you need to plan for:

- Control and Data information is communicated via cellular networks, such as Cingular. These network experience outages, which in turn will prevent the *RanchMaster* system from working

- Sensors occasionally report erroneous values, so ultimately no data value can ever be assumed to be 100% true. Sensor data is a **proxy** for real conditions in the field, but ultimately you should never take drastic actions before double-checking specific conditions.

- Electrically operated valves may malfunction, so for example, the *RanchMaster* system may report a valve as open when in fact the valve itself is still closed. Correlating to water flow and soil moisture sensors are good ways to detect such problems.

- No piece of software is error-free, despite thorough testing. This means that *RanchMaster* system may perform incorrect and unexpected actions, such as opening a valve without explicit instructions. The user must be vigilant in monitoring such anomalies to avoid loss or damage. *RanchMaster* sensors can themselves help implement such "closed loop" verification, but it ultimately remains the ranch owner responsibility.

Limited Warranty

Ranch Systems does not warrant that the RanchMaster solution will operate uninterrupted or error free. Ranch Systems will use commercially reasonable efforts to correct any RanchMaster Solution problems in a timely manner upon identification of issue or receipt of notice. If a customer is dissatisfied with the equipment and service within the first 90 days of equipment installation and activation, they may terminate service.

Limited Liability

Ranch Systems shall not be liable for direct, indirect, incidental or consequential damages including without limitation damages for harm to business, lost profits or lost revenues (however arising, including negligence), whether or not Ranch Systems has been advised of the possibility of such damages. Ranch Systems shall not be liable for any damage that may arise out of use, or inability to use, the services or products provided hereunder.

RanchMaster System

Manual
Version 2.1

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Chapter 1 – Getting Started

1.1   Introduction

This manual describes the use of the *RanchMaster* system, including base station, wireless sensor nodes, and corresponding web software.

1.2   Features of this manual

This manual contains 7 chapters intended to explain the features and functions of Ranch Systems equipment.

Chapter 1 – Getting Started
   A preview of the manual

Chapter 2 – About Your System
   Overview of *RanchMaster* system components and technical specifications

Chapter 3 – Installation
   Itemizes your *RanchMaster* system components and explains the proper methods for setup of each component

Chapter 4 – **Base Station Software**
   Instructions for the setup and navigation of the *RanchMaster* base station

Chapter 5 – Internet Software

   Instructions for the setup and navigation of the Ranch Systems website and how to use it in conjunction with the base station

Chapter 6 – Trouble Shooting
   An explanation of error messages, hardware issues and FAQs

Chapter 7 – Customer Service
   A list of contact information to get in touch with Ranch Systems personnel
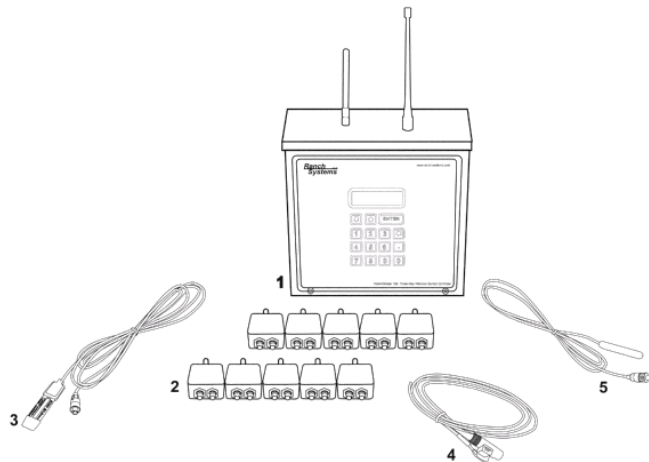
Glossary
   Definitions of frequently used terms

Chapter 2 – The *RanchMaster* System

This chapter introduces you to the specification and operational principles of the *RanchMaster* system.

2.1 *RanchMaster* System Overview

RanchMaster is a powerful, easy-to-use, system for wireless climate and irrigation control, optimized for use in agriculture. Typical hardware components of a *RanchMaster* system are shown in the picture above:

1. Wireless base station (typically one, but possibly multiple per system)

2. Wireless sensor nodes (typically 4-100 per system)

3. Soil moisture sensors

4. Flow sensors

5. Temperature sensors

Other sensors supported but not pictured include:

1. Relative humidity sensors

2. Wind speed sensors (anemometer)

3. Rain gauges (tipping bucket style)

4. Water level and pressure sensors

5. Electric valves

6. Leaf wetness sensors

2.2 Sensor Nodes

Wireless sensor nodes are small, completely self-contained units encapsulated in a rugged, water-tight metal enclosure. Each node has two input ports to which various sensors can be attached. Nodes come pre-programmed to accept a particular set of sensors on their ports, so there is absolutely no field programming required. They also come already powered up, and their built-in battery will keep them running for 2-3 years depending on sensor types attached. The types of sensors attached to sensor nodes include: soil moisture sensors, water flow sensors, wind speed gauges, and relative humidity sensors. Additionally, all sensor nodes have a built-in temperature

sensor.

Sensor nodes are **not** data collection devices – they are **sensor monitoring** devices. This distinction is important to understand the functioning of a RanchMaster system: whereas a data collection device periodically reads data from a sensor and transmits or stores this data, sensor monitors only report exceptional conditions. The important fact about the RanchMaster system is that using sensor monitoring it is possible to establish a **virtual** data series of sensor data using complex approximation and projection techniques. The result is better data at dramatically lowered battery use due to minimal wireless data transmission in the field.

Ranch Systems sensor nodes accomplish this by being programmed to understand the specific meaning of attached sensors and only transmit to the base station when a significant event occurs, which is typically a major change in the conditions. For example, in the case of a sudden temperature drop, the sensor node will realize that this needs to be reported and some action may need to be taken. It will transmit the new value to the base station with instruction to connect to the back-end server and rules engine. The rules engine will determine the necessary response and transmit back to the base station. The original signal from the node will also contain instruction to the base station to show the new value in the display as an alert and possibly take direct action locally (even without contacting the server).

More specifically, this event-based scheme works as follows: the sensor node continuously monitors the attached sensors and their latest values. It compares this to the past pattern of values and determines when the value of the sensor represents an abnormal situation, in which case a control signal is transmitted to the base station reporting this change and instructing the base station to take further action as described above. Note that the sensor node and base station maintain a mutual

"contract" as to the normal sensor value pattern, so transmission need not occur just because a sensor value changes – only if the value change is "abnormal" will transmission occur.

For example: let say a sensor node is measuring soil moisture. When the soil is irrigation the soil moisture will increase rapidly, and this sudden event will be reported to the base station. However, after irrigating, the soil moisture will decrease slowly following logarithmic function. Because the sensor node and base station understands this function, no further transmission need occur until next abnormal event (start of rain, or irrigation).

The effect of this scheme is that at times when sudden events lead to rapid fluctuations in sensors value (like start of irrigation changing soil moisture), the nodes will transmit often to signal these abnormal conditions, while at other times when no particular events are occurring, no data will be transmitted for long periods of time.

The sensor nodes have a mechanism to prevent frequent transmission and associated battery drainage in the unlikely situation that a sensor changes value rapidly and randomly (e.g. a malfunctioning sensor). This is accomplished in three complementary ways: 1) by ensuring that at least 2 minutes pass between any to transmission cycles, even in the most extreme case, 2) by randomizing the interval of time between any two transmissions, and 3) by a "lock-out" rule that disables a sensor that has reported a dramatic change more than a certain number of times per hour.

2.3 Base Stations

Wireless base stations are rugged, self-contained wireless units placed centrally in the general areas where sensor nodes are deployed - typically on a

pole. The range around the base station for reliable deployment of sensor nodes should not exceed 1/2 mile under line-of-site conditions. Base stations are powered by a small solar panel and are contains four electrical relays capable of switching a variety of electric valves. In general, base stations perform a number of distinct functions:

- they act as real-time conrol data companions for sensor nodes, maintaining "normal data pattern" contracts with each sensor node and forwarding control and data information back and forth to the backend server

- they act on commands issued from the Internet server, such as opening and closing of electric valves

- they act on text messages (aka SMS) sent to them by users in request of latest sensor status information or with commands to open or close valves

- they can monitor sensor data from attached sensors, in much the same way as sensor nodes

Base stations constantly approximate real-time data conditions in the local network based on exception signals and data received from the sensor nodes. When exceptional changes in data occurs, transmission link is immediately established to the back-end server via the cellular network.

Base stations process

commands received via text messaging (aka SMS). These commands can either be issued by an end-user using a cellular phone, via the Internet software as a response to users selecting control options, or by the triggering of advanced rules programmed by the end-user. Commands fall in three broad categories:

- Informational commands, such as requesting information about the latest value of a particular sensor

- Control oriented commands, such as requesting the opening of a particular valve

- System-level command, such as updating the base station system configuration.

Base stations also have the ability to monitor sensors connected directly. This is especially useful for sensors that require more power than can be derived from the small battery in sensor nodes, or sensors that need constant excitation. There are five sensor ports: 1 digital port, 2 analogue ports, and 2 digital counter ports.

Finally, the four on-board relays themselves are also sensors enabling the positive confirmation that a command to open a valve has in fact been executed.

2.4 Technical Specifications

Wireless Sensor Node – RS100

- Wireless connectivity to RM100 stations (up to 1/2 mile) via Ranch Systems VHF Ranch Area Network ('RAN') protocol

- One 2.5V excitation analog input port

- One 5V excitation analog input port

- Built-in temperature sensor

- Powered by 3.6V lithium cell (~2-3 years life)

- Self-monitoring battery status to Internet software

- Rugged, watertight aluminum enclosure

Cellular Base Station – RM100C

- Receiver for Ranch Systems VHF 'Ranch Area Network' (RAN)

- Transceiver for GSM cellular packet data to Ranch Systems network operating center (NOC)

- Transceiver for SMS text messaging protocol of GSM network

- 4 built-in relays for driving valves or other equipment

- 2 analog input ports (5 or 12V excitation)

- 1 digital input ports (0-5V)

- 2 digital counter ports (0-5V)

- Built-in temperature sensor

- 4 line LCD display with backlighting

- 15 key waterproof keypad

- Battery and 12V solar charge controller

- Wall charger for 120 VAC

- Enclosure of 14 gauge steel, NEMA 3R rated

WiFi Base Station – RM100W

Identical to RM100C except:

- No cellular modem

- Built-in 802.11b card for connectivity via WiFi access point.

Hosted Software Suite

- Automatic communication with RM100 stations and RS100 nodes

- Incorporates customer-specific clickable map photo to show overview of Ranch Area Network ('RAN")

- Configurable 'dashboard' with latest values for all sensors and direct access to pop-up graphing

- Reporting module with PDF-quality, detailed reports

- Control-zone grouping of sensor into natural irrigation and management zones

- Rules engine allowing simple or complex rules and triggers

- Unlimited central database storage

- Cellular phone interface using text messaging (SMS) for controls and alarms

- 100% accessible from any Internet browser

- Secured by SSL encryption

- Database and application hosted in two separate high-security data centers with nightly backups and diesel generator power backups.

Chapter 3 - Installation

3.1 What You Have Received

Your *RanchMaster* system comes equipped with a base station, at least four wireless sensor nodes, a solar panel, a wall charger, and associated sensors. There are a myriad of alternate sensors that can also be used in conjunction with the base station. Your selected components are itemized on the inventory sheet shipped with your system.

Our Ranch Systems technicians have pre-packaged the base station and sensor node units with their associated sensors for your convenience. This typically includes a refitting of sensors with Ranch Systems bayonet style connectors for increased field reliability. Please refer to the unit labels to unsure sensor connection to the appropriate ports on the nodes.

Each node is identified by and serial number printed on the front of the node, e.g. "1014". The left plug on the node is referred to as "port 1" and the right plug is "port 2". In the software you refer to sensors using the serial number + the port number separated by colon. So a sensor in port 2 on node 1014 would be referred as: "1014:2".

Once installed, all of these components can be reviewed and managed using the Ranch Systems website (www.ranchsystems.com), for which you will receive a username and password separately.

3.2 Base Station Installation

The first and most important component to set up is the base station. It is imperative that the base station be set up in a central environment, out of the way of machinery and casual tampering, with a good cellular connection (refer to Chapter 4 for additional detail about testing cellular signal strength), and accessible to technicians for support if required.

The maximum range from the base station to the sensor nodes is approximately half a mile, line-of-sight. Nodes outside that range will have problems transmitting data, which will compromise the functionality of the *RanchMaster* system. Ideally, the base station should be placed in an area that has "line of sight" to all of the nodes that it controls, however there is some flexibility based on distance from the base station and site-specific conditions. Please contact a Ranch Systems technician if you have any questions about base station placement.

Note: if your site has complex topology, it may be necessary to order a *RanchMaster* base station with an external antenna, which can be separately mounted on a mast.

The base station is shipped with the main fuse disconnected (located separately in your packaging), so to start operation this fuse must first be inserted. To accomplish this, remove the two screws along the lower front edge of the unit and carefully slide the front-plate down and up. BE CAREFUL NOT TO PULL THE KEYBOARD CABLE OUT OF ITS SOCKET. You will then see a small socket in the lower left corner of the circuit board into which the supplied fuse will fit. As soon as you insert the fuse, the station should start up, and you can immediately replace the cover.

After the base station is installed you must verify that it is functioning. Once the system is turned on, it should instantly begin to synchronize with the server. Give it a few minutes to get connectivity and synchronize before starting to troubleshoot. This is a good time to get familiar with the Base Station display:

```
*** RanchMaster *** 6
    APR 10 03:23:49    6
      97:13:   77.1 F
Hit  ENTER  for  menu    *
```
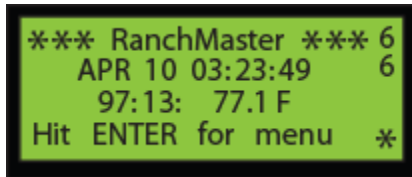
The number in the upper right hand corner of the screen marks the cellular signal strength. The number 9 marks the highest signal strength possible, whereas a zero would mark no signal being received. Typically a signal of 3 is sufficient, although 4 or 5 are preferable.

The number directly below this one on the screen indicates the connection status of the base station. The meaning of this number is as follows:

1-3   No connection, typically when there is insufficient cellular coverage. If this is the problem, either relocate the station to a place with better strength, or contact Ranch Systems, as a high-gain cellular antenna can be fitted to improve signal performance.

4   Idle state – base station is connected to the cellular network, but not communicating with Ranch Systems server

5   Not used

6   Base station is in process of connecting with the Ranch Systems server (Network Operating Center).

7   Data and control information is being synchronized with the server.

When you first initialize the base station, the cellular signal strength will appear as a dash (-) and the station connection will likely be a 2. The time and date will likely be inaccurate as well. As the system begins to boot up, the cellular signal strength will show up as a number, and the station connectivity should jump from 2 to 4 to 6 and eventually briefly 7. If the time of the unit is not correct the system will discover this at this point and time will be adjusted and unit reset automatically.

At this point the base station is running and receiving sensor information from nodes, and there is typically no more field programming to perform. All the programming of functionality is done in the Internet software.

3.3 Solar Panel Installation

The solar panel is needed to charge the battery of the base station. It should be mounted as high as possible, however such that it is accessible for maintenance if needed. The solar panel should be placed facing the sky southward, at an angle. The optimal angle depends on the latitude of your location, however a 45 degree angle should work for most locations.

3.4 Sensor Node Installation

Depending on the number of sensors attached to each node, and the variability of the data sensed, as many as 100 sensor nodes may be set up for each base station. These sensor nodes process the information from the sensors you have selected, and transmit exceptional changes back to the base station based on a complex monitoring and control scheme outlined in the introduction. Nodes should be placed around the

property in the locations where you desire to monitor sensor data.

The sensor nodes need to be placed upright, with the antenna facing vertically toward the sky. The higher up the node is placed, the better it will transmit to the base station. A typical installation will place the node on a stake just above an irrigation line, with any sensor cables that run to the ground routed downward through a PVC pipe. Please note that it is important to ensure that the sensor cables remain relatively straight at their connection as severe bends can damage both nodes and sensors.

The sensor node can be attached in the desired position using the flanges located on either side of the metal shell. It is important to make sure that the sensor node is secure and will not be removed by violent weather or machinery.

Please note that sensor nodes come pre-configured for specific sensors, which is printed on the front plate of the nodes. This means that you have no programming or configuration hassle during installation, but it also means that you must order the correct nodes for your sensors.

3.5 Sensor Installation

The *RanchMaster* system works with a range of sensors such as temperature, soil moisture, water flow, water level, humidity, and wind speed. If your current configuration does not include your preferred sensors, or if you would like to interface with an existing sensor, please speak with one of our Ranch Systems technicians.

Each sensor has its own specific method for installation. Please review the manual for the specific sensors that

you are using, or contact the manufacturer for instructions on how to install your sensors. The Ranch Systems staff is also available to give advice.

Chapter 4 – Base Station Usage

4.1 Introduction to manual base station usage

The majority of the time users will simply review and control the base station and overall *RanchMaster* system, via the Internet, which provides both ease of use and advanced functionality. Users can also control and adjust the system directly, however, using the base station keypad and LCD.

Common direct uses of the base station keypad and LCD include monitoring the most recent values of sensors to check that the system is working and all nodes are communicating as expected, manually controlling any connected valves, and reviewing various system functions (mostly intended for service personnel).

4.2 Base station keypad overview

The top row of the keypad contains the following three buttons which you will use for most of the navigating. The up and down arrow keys that will move your cursor location, and the "ENTER" key that selects prompts and engages processes.

The arrow key which faces leftward is used to go back to the previous screen, and is also used as a delete key when entering in numeric values.

The numeric keys are used to enter values. The period key (located directly under the leftward arrow/back key) is used to enter decimals into numeric entries. It also serves as the refresh button when a menu or list is shown. The base station does not automatically update the screen display, so it is generally necessary to refresh the screen to see that an operation has been performed or some anticipated sensor condition changed.
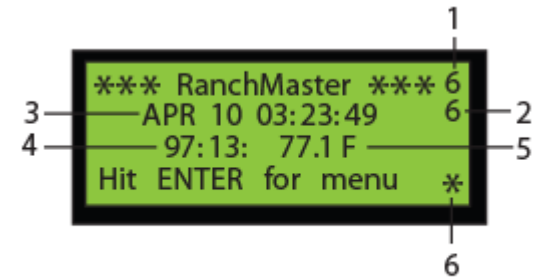
The primary screen, which is displayed initially when the base station is first turned on, provides information about the time, the attached sensors, and the cellular signal strength:

1. The number in the upper right hand corner of the screen marks the cellular signal strength, where the number 9 is the strongest signal and 0 indicates no signal.

2. The number directly below this one on the screen indicates the connection status of the base station. The base station synchronizes changes in sensor data with the central server on a real-time basis. When this number is a 4, that means that there is a connection, however nothing is currently being exchanged. When the base station is attempting to sync with the server, this number will change to a 6. When the base station is finalizing the

synchronization (this occurs briefly), this number will change to a 7 and then return to a 4. Any number below a 4 indicates that there is a connection problem. For a more detailed look at the cellular signal strength and the connection of the station please view chapter 3.

3. Directly underneath the "RanchMaster" Title, the date and time are displayed.

4. Below this line is a scrolling display of the various sensors associated with the base station either directly or through a sensor node. The number on the left identifies the sensor using the RSUID:port code that corresponds to the base station or sensor node unit and the port to which that specific sensor is attached. This same number will be notated on the Ranch Systems Website as the "Sensor ID" and is used to identify any sensor. Note: RSUID stands for Ranch System Unit ID, and is essentially the serial number of the node or base station.

5. The value to the right of the RSUID:port code corresponds to the most recent measurement or status of the sensor indicated by that code. Valves will be marked as "OPEN" or "CLOSED", wind speed will be displayed in terms of "m.p.h.", batteries will be displayed in terms of voltage, temperature will be displayed in terms of degrees Fahrenheit, etc… The values will change every couple of seconds, allowing the system to scroll through all of the active sensors.

6. In the bottom right hand corner of the screen there is a flashing asterisk. This is the "heart beat" of the base station, which indicates simply that it is on and working.

4.2 Menu Options

In order to access the Menu from the primary screen, press the "ENTER" key. This will take you to the main menu screen, which is divided into nine subdivisions:

1. Sensor Status
This menu lists all of the active units by their RSUID codes with the most recent known status.

Using the arrow keys to move the cursor through the list, a specific unit can be selected by clicking "ENTER" when the cursor is on the desired row. This next level of detail lists out all of the ports associated with the unit, what sensor type is present on that port, and the latest sensor value. This information is displayed as follows:
- "Prt" - The Port #
- "Tp" – The Type of Sensor
  - FL = Water Flow
  - HM = Humidity
  - SM = Soil Moisture
  - TP = Temperature
  - WS = Wind Speed
  - 3V = Internal Lithium Battery (ranges from 3-3.5V)
  - 5V = Sensor Voltage Generator (should be at ~5V)
  - CF = Configuration (diagnostic information used by the NOC to monitor unit performance)
- "Mn" – Minutes since the last read
- "Value" – The most recent reading of the sensor

In order to get a more in-depth display, simply press the "ENTER" button on the port/sensor you wish to view. This will display a menu with RSUID and port #, the type reference number and type description, the last known time, and for base station sensors only, the sampling rate. Use the arrow key to scroll down to see additional information that does not fit on the screen

2. Valve Control

This menu lists the various active valves that are linked to your base station. It displays the "RSUID" which shows the RSUID:port codes of your valves, the "Type", and the "Stat" or Status. Valves can be one of two type categories: Type "LATC" represents a valve with latching DC solenoids, and Type "N.O." represents "Normally Open", i.e. a valve that simply gets switched through a normal relay function, such as standard 24VAC valves. The type of valve is determined by jumpers on the circuit board and should be set by qualified service personnel to fit the particular valves connected to the *RanchMaster* relays. Both of the valve types can be open or closed on command. "Stat" or Status displays whether or not the valve is on or off. In order to turn a valve on or off, simply move the cursor next to the RSUID:port code of the valve you wish to change and hit enter. A new screen will show titled "Select and ENTER" in which you can choose whether the valve should remain on or off by selecting the prompt and pressing "ENTER". After you have made your selection and pressed "ENTER", use the back arrow to return to the previous menu(s).

Note:
Valves relays are assigned port number 10 through 13, where relay 1 (from left on circuit board) is on port 10, relay 2 on port 11 and so forth.

3. Memory Status
This menu lists the sensor ("data recs") and message ("msg") reads and what percentage of memory they are using (%). The last upload records the last time that this menu was updated.
- Data: Data records currently buffered in the base station. These are control records with information about exceptional sensor conditions.
- Sensors: Number of unique sensor known to this base station
- RSUIDs: Number of unique nodes known to this base station (including the base station itself)

- Sync: Last time base station synchronized with Ranch Systems Network Operations Center (NOC)
- Log: Number of system log entries currently buffered in base station
- UserNames: Internal field for system use only
- Tsynch: Time of last synchronization of base station's real time clock from the Ranch Systems Network Operations Center (NOC)

4. Synchronize
This selection causes the base station to synchronize with the server immediately. When selected, the base station will pre-empt its normal synchronization schedule and immediately synchronize with the Ranch Systems data center. This function is not normally required, and the system automatically maintains real-time consistency.

5. Configure
This menu lists the various system-level settings that are typically only used by Ranch Systems Technicians.

The following is a list of the abbreviations, their meanings, and a brief definition:
- **RSUID** – The identification number of the base station
- **IP** – This number shown is the IP address specific to the Ranch Systems server to which the base station will synchronize.
- **IP2** – This is the address for the back up server. The base station will connect to this server if the first one cannot be reached.
- **GSM** – This is the GSM phone number of this base station. This is the number to which you can send SMS commands and messages. The base station will automatically update this field based on the specific SIM card inserted.
- **AGSM** – This stands for administrative GSM. In the case of an emergency, the base station will

send an SMS message to the Ranch Systems administrator.

- **APN** – This is the access point for the GPRS network
- **APNUN** – The Username for the APN server
- **APNPW** – The password to access the APN server
- **Servertime** – This field allows you to choose how often the base station should update its real-time clock from the servers' time and date. In order to change this setting, press "ENTER" on the "Servertime" prompt. The value entered here is the number of minutes between server time synchronization.
- **Lcddatarate** – This is number of seconds between updates in the main screen. In order to change this value, simply press "ENTER" on the "Lcddatarate" prompt. Then using the key pad, type in the new value and press enter.
- **Wifion** – NOTE: Applies to model RM100W only, and enables the formation of ad-hoc networks of multiple base stations over larger(multiple miles) distances. Do not change.
- **Cellon** – Cellular on: This is the most common mode of communication between base stations and the Ranch Systems server. In order for the base station to synchronize it needs to send and receive cellular signals, so this signal should not be changed.
- **Msgmode** – This is the messaging mode. This determines to what degree the system messages are uploaded. A value of "0" denotes that none of the system messages will be uploaded. A value of "1" lets only critical messages upload. A value of "2" allows for all of the messages to upload. In order to change this value, simply press "ENTER" on the "Msgmode" prompt. Then using the key pad, type in the new value and press "ENTER".

- **Syncrate** – This menu lets you set the interval of time that the base station synchronizes with the server. Not normally necessary as the base station will automatically synchronize as needed.
- **Rdvrate** – This refers to the Rendezvous rate; or how often the multiple base stations synchronize. This is only relevant if you are operating with two or more base stations. An average suggested Rdvrate is 5 minutes.
- **Rdvsecs** – This refers to the length of time in seconds that the base stations will utilize during a rendezvous. An average suggested rate is 60 seconds.
- **Rxshow** – This refers to the "S" text icon shown in the lower right hand of the LCD display. An "S" will occur when sensor data is being received. A value of "1" in this category means that this icon will be displayed on the main LCD screen. A value of "0" will hide it.
- **SMSon** – This menu commands the base station to check for inbound SMS commands. A value of "1" allows SMS messages to be received. A value of "0" causes the base station to ignore these SMS messages. **NOTE:** turning SMS off, will also disable the control of valves from the Internet software.

6. **System**

This menu is designed for maintenance and repair. It is intended for use by Ranch Systems Technicians only.

- **System Log** – This is system event information regarding the base station.
- **RSRF Track** – This selection allows you to type in the RSUID from a single specific node, and see a real-time log of signal received from that node.
- **RSRF Scan** – This selection is used only by authorized service personnel during site analysis

and installation, allowing advanced wireless signal diagnostics and troubleshooting.

- **RSRF Status** – This menu provides advanced system information regarding the RSRF (Ranch Systems Radio Frequency) subsystem.
- **Switch Servers** – This menu allows the base station to switch its synchronization to the alternate server.
- **Recycle board IO** – This is an administrative function to reset the base station IO chips.
- **Device status** – This provides a status check of certain peripheral devices on the base station
- **Reset (soft)** – This menu resets and resynchronizes the base station.
- **Reset (w/erase)** – This menu resets, resynchronizes, and erases the memory of the base station.

7. Current Time

This menu provides you with the current date and time settings of your base station. If you want to adjust any of the settings manually regarding the date and time you can do so in this menu by lining the cursor up with either "date" or "time" and pressing "ENTER". The screen will then display the first prompt (In the case of the date it is the "year"). Simply press "ENTER" to navigate through the prompts until you find the one that you want to change. Use the left arrow to delete the current entry and enter a new one with the numeric pad. When you are finished press "ENTER". Remember that in order for your own personal date and time settings to remain, you must first change the value to 0 in the **Servertime** category of the **Configure** menu, however, generally it is preferable to let the base station automatically synchronize time from the Ranch Systems server.

8. Signal Strength

This menu displays the signal strength and the error rate. The error rate deals with the number of times that data packages are sent before actually getting received.

The cellular GSM protocol detects errors, and when this rate is high it has to resend the data. The scale is between 0 and 7, with 0 meaning that no messages are resent, and 7 meaning that messages are constantly resent, indicating either poor connection or interference from other equipment.

9. SW Version

This menu displays the specific version of software that is installed on your base station.

Chapter 5 – Internet Software

One of the unique features of the RanchMaster solution is the ability to monitor and control your entire system from anywhere in the World – at any time. All you need is access to an Internet browser. It also means that data is always kept secure in the Ranch Systems Data Center, and that system problems, such as viruses, located on your own computer systems will not affect the integrity of your RanchMaster system and data.

5.1 Logins & Security

In order to login, simply go to the Ranch Systems web site (www.ranchsystems.com) and follow the "My Account" link in the left menu bar. This will take you to a secure login screen. Your Property ID, User ID and password will be provided either by Ranch Systems or a Ranch Systems Authorized Dealer.

Property ID is a short mnemonic identifying the property you wish to log into. User ID is your personal user name on the Ranch Systems network. The same users can have accounts on multiple properties (such as an outsourced vineyard manager), and one property can have several users. If you are having problems logging in, please contact Ranch Systems technical support.

5.2 Online Features

Real-Time Map - This page displays a photographic layout of your monitored area and divides it into zones.

Within this area, your various sensors are displayed as small icons located roughly equivalent to their actual location in the field. Each sensor on the map will display its last read value next to its icon. If the last value is outside of the range set in sensor configuration, it is highlighted by a red box.
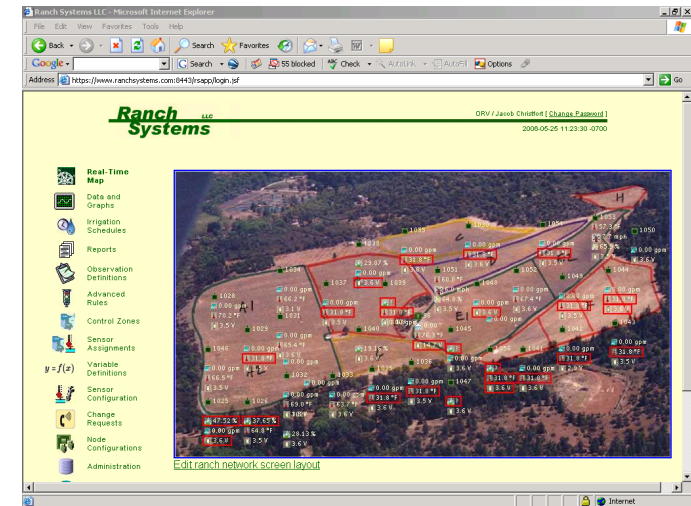
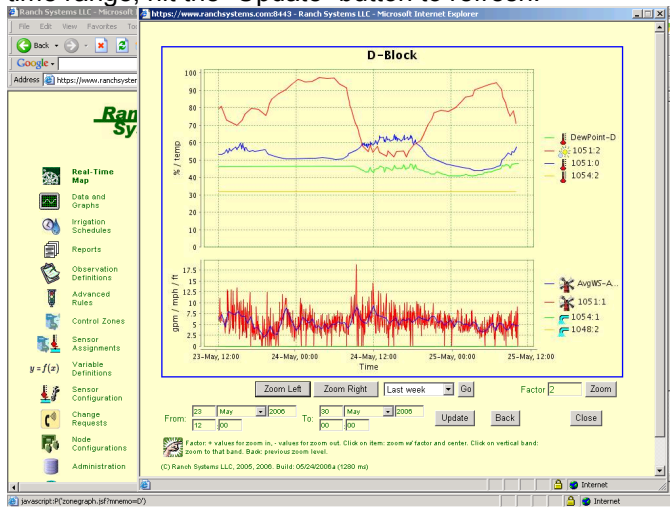
Photo courtesy of Obsidian Ridge Vineyard (www.obsidianridge.com)

For a more in-depth look at sensor data simply click on a specific sensor or anywhere within a block. This will pull up a graph portraying time series data of either a specific sensor or all the sensors in a block.

NOTE: because of the complex method used by RanchMaster to monitor sensors, the graphs don't represent simple periodic time series of data like traditional data loggers. Instead it is a result of monitoring and approximation performed between sensor nodes and base station, rather than periodic transmission. In many cases this is in fact more precise than periodic measurement. Please see introduction for more information on this method.

Once in the graph view, you can customize the chart using the pull down menu to select the amount of time you would like to graph. You can select preset values from the last hour up to the last year of stored data. You can also customize the exact date and time of the data you wish to graph by using the date/time fields and pull down menus underneath the "Zoom Left" and "Zoom Right" buttons. If you have typed in an explicit date and time range, hit the "Update" button to refresh.

Photo courtesy of Obsidian Ridge Vineyard (www.obsidianridge.com)

You can zoom into the graph either by clicking on a specific data point, or by clicking on any vertical time band on the graph. You can also use the "Zoom" function to navigate the graph. The "Zoom" function allows you to view larger or smaller amounts of data where the degree of zoom is based on a multiplier factor. A factor of "1" will keep the chart the same. A factor of "2" will zoom in (e.g. from 20 hours to 10 hours). A factor of "3" will zoom three times, etc. To zoom out, just use negative numbers. The "Zoom Left" and "Zoom Right" buttons will shift the chart to the left or the right slightly (in terms of date) with a little overlap. Finally, the graph function remembers previous zoom and time

settings, and if you hit "Back" you will pop back to the previous zoom setting.

The graphs only generate lines where data has been confirmed. If you request a graph for a period of time that has no data, the graph will display a simplified version that omits the portions without any data (for example: if I request a graph for the months of February and March, but my sensors were installed in March, the resulting graph will only display the period in March where data was received).

Data and Graphs - This page presents a more textual and comprehensive list of all sensor zones, by showing all the sensors assigned to each zone. For each sensor you will see its ID, which is composed of the node serial# (RSUID) followed by a colon and then a port number. The icon to the left of the sensor id number depicts what type of sensor is displayed. The following icons depict the following sorts of sensors:

- Soil Moisture – This icon represents any sensor that measures the amount of water moisture in soil as a percentage.

- Precipitation – This icon represents a sensor that measures the amount of rainfall in inches.

- Temperature – This icon represents a sensor that measures the temperature on a Fahrenheit scale.

- Valve – This icon represents a valve that can be either open or closed. It maps to one of the four relays in a RanchMaster base station.

- Voltage – This icon represents a battery level in volts.

- Water Flow – This icon represents a sensor that measures water flow in gallons per minute.

- Water Level – This icon represents a sensor that measures the water level of a tank in feet.

- Wind Speed – This icon represents a sensor that measures the wind speed in miles per hour.

- Relative Humidity – This icon represents a sensor that measures the relative humidity as a percentage.

Your sensors must be organized into control zones (see the control zones segment later in this chapter) for viewing within the data and graphs menu. The screen below is an example of a control zone that has a temperature sensor, a water flow sensor, and a soil moisture sensor.

A1-Block (A1)			Last: 2006-03-21 10:35:22			Show graph
	Sensor ID#	Sensor Class	Latest Value	Latest Time	Notes	Indicators
	1020/0	Temperature (23)	77.6 °F	03-21 10:35:22	...	
	1020/2	Water Flow (71)	0.00 gpm	03-10 11:44:22	...	
	1020/1	Soil Moisture (50)	27.78 %	03-12 17:01:40	...	

In order to display a graph of a specific control zone, simply click the "show graph" link.

 Irrigation Schedules - Use this screen to define your irrigation schedule for each zone. This screen shows one line for each valve assigned to an irrigation zone. You use the calendar on top to select the week for which you wish to inspect or change irrigation programming.

You can only change programming for future dates, so past dates serve as a log of past irrigation.

To change irrigation programming, simply type in a combination of time (e.g. 16:30) and a number of minutes (e.g. 45) you wish the valve to be open on a particular day. Then press save, and the schedule is changed.

WARNING: As soon as changes are made to this schedule, they are automatically remember by the *RanchMaster* system and will be executed accordingly. So be careful to delete any "experimentation data" you may enter to get familiar with the system.
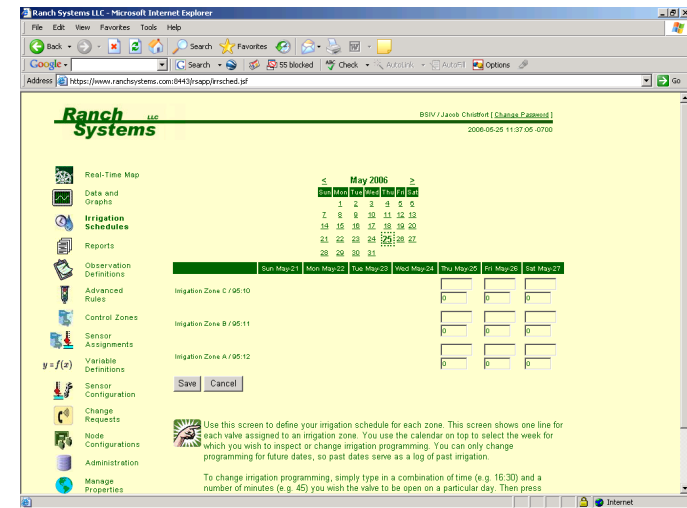
 Advanced Rules - Use this screen to define the rules you wish the *RanchMaster* system to follow for monitoring and controlling within your zones. You need to assign sensors to your zones before defining your rules (See Sensor Assignments above).

Each rule uses one or more variables (see below) to define a condition that the system will regularly evaluate. When the condition is met, the action associated with the rule will be executed automatically.

You can use the following variables to define conditions:

ATP,LTP,HTP	Average, lowest and highest temperature in zone (Fahrenheit)
ASM,LSM,HSM	Average, lowest and highest soil moisture in zone (%)
AWL,LWL,HWL	Average, lowest and highest water level in zone (feet)
AFL,LFL,HFL	Average, lowest and highest water flow in zone (GPM)
AHM,LHM,HHM	Average, lowest and highest relative air humidity in zone (%)
AVL,LVL,HVL	Average, lowest and highest valve status in zone (0=closed, 1=open)
ABV,LBV,HBV	Average, lowest and highest base station battery voltage in zone (volts)
ANV,LNV,HNV	Average, lowest and highest sensor node battery voltage in zone (volts)
TOD	Current time of day as a decimal 24 hr number. E.g. when it is 7.30pm this variable will be 19.30
DOW	Day of week as a number, 1-7. 1=Sunday
DOM	Day of month as a number, 1-31
MON	Month as a number, 1-12

Example formula: (ASM<15 and (TOD>19.30 or TOD<9.00)) or (ASM<10)

The "hours before re-arming" is the time in which the rule will be de-activated after the condition is first met and action is performed. This option controls how often the rule will be resent: if the condition is still met after this amount of time, the action will be executed again.

WARNING! As soon as you start adding rules, the *RanchMaster* system will start acting on them, so be sure the rules are really what you want. It is a good idea to watch the dashboard frequently after establishing and/or changing rules, in order to validate that everything works as you intended.

Control Zones - Use this screen to create new control zones or to delete existing zones. Control zones are the fundamental way that you group sensors and valves that are deployed in the same area. Typically a control zone will be the same as a vineyard block. After creating a new zone in this screen, use the separate icon on the left toolbar to assign sensors to the zone.

	Shortcode	Description	Soil Moisture Sensors	Temperature Sensors	Flow Sensors	Valves
☐	A1	A1-Block		1034/0 1028/0		
☐	A2	A2-Block		1033/0 1046/0 1025/0		
☐	B	B-Block		1038/0		
☐	BASE	Base Station				
☐	C	C-Block		1030/0		
☐	D	D-Block		1052/0 1051/0 ORV-V/0 1054/0		
☐	E1	E1-Block				
☐	E2	E2-Block		1050/0		
☐	F	F-Block		1044/0 1041/0 1043/0		
☐	G	G-Block		1036/0		
☐	H	H-Block				
☐	TMP	Temperatures				
☐	ZB	Batteries				

Save | Add Zone | Delete Checked

Sensor Assignments - Use this screen to assign sensors and valves to control zones. To do this correctly, you must first make note of the specific sensors placed in the zone. Each sensor is identified by two numbers: the RSUID (ie. Serial#) of the sensor node or base station (e.g. #1003), and the port number between 0 and 13 where the sensor is connected. Both of these numbers are printed on the boxes. However, it is important to note that some port numbers refer to the internal port, such as the voltage sensor sensing the internal battery level. So for instance a soil moisture sensor inserted into port 1 on node #1003 would be called "1003:1", while the internal battery sensor of the same node would be "1003:8".

A2 A2-Block | Select

		Sensor ID#	Sensor Class	Sensor Description	Notes

#1020/4: RS Node 5V Excitation Generator (auto)(271) | Add Sensor

Delete Checked

To add a sensor to a zone, you must first select the zone you wish to associate the sensor with. Using the pull down menu on the top, find your desired zone, and hit the "Select" button.

Next you must assign the sensor to that zone. Using the pull down menu on the bottom, find the sensor that you want added to the zone and hit the "Add Sensor" button. In order to delete a sensor from a zone, select the zone, then check the box next to the sensor you wish to remove and hit the "Delete Checked" button.

$y = f(x)$ **Variable Definitions -** This page lets you create and edit user-defined variables. Variables are a series of data over time, much like sensors, but are calculated by the *RanchMaster* system at fixed minute intervals based on formulas that you specify. These variables are stored and plotted in the system next to sensor data, and can be viewed and plotted similarly. Variables can also be freely used when defining control rules.

Variable data is automatically generated by the system at certain intervals, and is specified for each variable in minutes. You can also specify the date interval to generate data, as you will often want the variables to be generated for previous data, as well.

Variable #	Variable Description	Equivalent Sensor Type	Unit of measurement	Start date	End date	Minutes between data points	Formula	
0	DewPoint-A1	Temperature sensor Aux Bus -55-125C	°F	Mar 29, 2006	Mar 31, 2006	1440	RH=LASTVALUE("1051/2")/100; TF=LASTVALUE("1051/0"); float T=(5f/9)*(TF-32f); float v = RH*6.112f*(float) java.lang.Math.exp((17.62f*T)/ (T+243.12f)); float DP=((243.12f* (float)java.lang.Math.log(v)- 440.1f)/(19.43f-(float) java.lang.Math.log(v))); return DPF=DP*9f/5+32f;	Delete
1	Rainfall last 24hrs	Rain Gauge 0.01"	"	Apr 2, 2006	Apr 4, 2006	15	SUM("94/4",68*24)	Delete
2	WS-A1-1/2hour average	Wind Speed 1.25MPH"	mph	Apr 3, 2006	Apr 4, 2007	30	AVERAGE("1051:1",30)	Delete

Add

This picture shows some examples of variable definitions. For assistance creating advanced variables, please contact Ranch Systems support.

Sensor Configuration - The screen provides an overview of all your *RanchMaster* system sensor nodes and the attached sensors.

Node	Description	port 0	port 1	port 2	port 3	port 4	port 5	port 6	port 7	port 8	port 9	port 10	port 11	port 12	port 13
96	Redeployed 4/22														
1025	A1 (row 10, vine 23)														
1028	A2 (row 13, vine 24)														
1030	C (row 35, vine 4)														
1033	A1 (row 70, vine 15)														
1034	A2 (row 70, vine 2)														
1036	G (row 28, vine 9)														
1038	B (row 57, vine 14)														
1041	F (row 8, vine 4)														
1043	F (row 108, vine 7)														
1044	F (row 145, vine 2)														
1046	A1 (400ft east from NW corner)														
1050	F (row 181, vine 9)														

Click on the sensor icon to see details for each sensor.

Sensor ID	262
RSUID of parent node	1020
Sensor Type	Temperature sensor Aux Bus -55-125C
Port on node	0
Sensor description/location	Temperature sensor Aux Bus -55-125C (auto)
Lower limit for warning	32.0
Upper limit for warning	100.0

Update   Cancel

Most of the information in the sensor field cannot be changed because it reflects the physical connection and "wiring" of the sensor. However, you can modify the description and the value limits to trigger warning emails as well as the yellow/red color coding in various screens.

Change Requests - Use this form to submit service requests to Ranch Systems support, service and development, as well as to check the status of ongoing requests, provide more information, etc. Make sure to fill out all of the fields and be as specific as possible as to the nature of your request or problem

Req#	0
Type	Enhancement
Status	Newly filed
Component	Undefined
Component (other)	
Short Request Description	
Opened	
Last Update	
Closed	2099-01-01 00:00:00
Filer Email	admin@ranch-systems.com
Owner	John Public
Priority	Medium

Request Log

Enter description of bug/request here:

Simply click the "Add" link and then fill out the necessary fields to report the problem.

Log Out – Clicking on this link will log you out of your account.

5.3 Text Messaging Control (aka SMS)

The *RanchMaster* system can be queried as well as controlled in real-time using most of the commonly available cellular phones.

Commands are sent to the base station by using SMS text messages from a cellular phone. Once received, the base station will reply to these messages. The effective result is that you will be able to 'chat' with your *RanchMaster* system.

The following is a list of SMS commands that the base station will accept, and the resulting actions produced by these commands. In order to send a command, simply enter in the command as it is listed below, and send it to the GSM phone number of your base station, which you can find in the Configuration menu. Once the base station receives the command, it will process the information requested and send an SMS message back to your phone.

Note, that while the commands are known by long names, such as **sensor** or **memory**, you will almost always want to use the shorter versions, such as **s** and **m**, because of the limited keyboards on most phones.

Commonly Used Commands

- **sensor** or **s** – sensor data – this is the command you will likely be using the most. There are several distinct format options:
    - o **s** – this queries for the nodes known to this base station, including the base station itself.
    - o **s <RSUID>** - this queries for all the sensors attached to a particular node known to the base station (Example: **s 1098).**

- o **s <type>** - this queries for all sensors of a particular type across all nodes known to this base station. The types are the same used in the sensor status menu of the base stations **(**Example: **s FL**):

    - o **FL** = Water Flow

    - o **HM** = Humidity

    - o **SM** = Soil Moisture

    - o **TP** = Temperature

    - o **WS** = Wind Speed

    - o **3V** = Internal Lithium Batter (ranges from 3-3.5V)

  - o **s <RSUID> <port#>** - queries the details of a single, specific sensor identified by node number and port (Example: **s 1098 2**).

- **batt** – Display the current battery charge level

- **relay** or **r** – Read or switch relay status. Command is followed by a number from 1 to 4 and then optionally by status ON or OFF. There are two format options:

    - o **r <#>** – query current status of relay/valve. Example: **r 1**

    - o **r <#> <on/off>** – turn relay/valve on or off (Example: **r 1 on**).

- **time** – Show current base station time

- **timeset** – Set base station system time YYYY-MM-DD HH:MM:SS. HH is 24 hours. WARNING: causes system reset

- **sync** – Request out-of-cycle sync with server

- **valve** or **v** – Synonym for **relay**

- **memory** or **m -** queries the current memory status of the base stations.

These SMS commands can only be sent one at a time. To continue sending SMS commands to the same base station, you can simply use the reply option after each SMS reply you receive. It is important to note that due to the wireless nature of SMS messaging, SMS messages may occasionally be lost, so you should not assume that the base station has received a command before you receive an explicit reply.

Chapter 6 – Troubleshooting

6.1 Trouble Shooting Overview

- **How do I change my login name and password?** Please contact Ranch Systems support.

- **What does it mean if a sensor has a red box around it on the real-time map?** A red box indicates that the current value for that sensor is outside of limits defined in sensor configurations.

- **How do I change the limits for my sensor values?** To change limits, go to the Sensor Configuration icon and click on the sensor that you wish to change. You can set minimum and maximum limit values in that field.

- **What does it mean if I get a "Zone not defined" message when I click on the Real-Time map?** In this case the zone mnemonic code which is embedded in the map is not found as a valid defined sensor zone. You can see the code embedded in the map in the bottom window bar of your browser when you move the mouse over the field. Make sure that you have defined the corresponding zones.

- **How do I zoom in and out on graphs?** You can zoom into the graph either by clicking on a specific data point, or by clicking on any vertical time band on the graph. You can also use the "Zoom" function to navigate the graph. The "Zoom" function allows you to view larger or smaller amounts of data where the degree of zoom is based on a multiplier factor. A factor of "1" will keep the chart the same. A factor of "2", will double the zoom of the graph (i.e. from 20 hours to 10 hours). A factor of "3", will triple the zoom, etc. To zoom back out, just use negative numbers. The "Zoom Left" and "Zoom Right" buttons will shift the chart to the left or the right slightly (in terms of date) with a little overlap.

- **How do I change which sensors are in which zones?** You use the sensor assignment screen. Note that the same sensor can be assigned to multiple zones, which is helpful if you want to use, say, a single humidity sensor as the proxy for humidity in a number of zones.

- **How do I know if I've used the correct syntax for Advanced Rules?** The system shows a status field in the rules list, which tells you if the conditions of the rule are currently met or not. If the rule syntax is wrong, it will display "syntax error".

- **I changed the start date for my graph to an earlier month but it's not showing up – why?** The likely reason for data not appearing in early months is that data wasn't recorded at that time. The graphs only generate lines where data has been logged. If you request a graph for a period of time that has no data, the graph will display a simplified version that omits the portions without any data (for example: if I request a graph for the months of February and March, but my sensors were installed in March, the resulting graph will only display the period in March where data was received).

- **What is the difference between the signal strength in the menu and the signal strength in the top right corner?** The number in the top right corner stands for the first digit of the actual percentage received. For example if the signal is being received at 65%, the number in the top right hand corner would be a 6.

- **In Signal Strength, how can a signal be at -3%, and what does the error rate mean?** This occurs when there is no signal and the modem is searching.

- **What reports are available to me?** If you go to the reports tab, you will see the standard reports produced every night by the server. These are produced in PDF format and will print as complete 'books' of reports and graphs. Some people find it helpful to bind these regularly as a paper reference.

- **What would I use Variable Definitions for?** Variable Definitions are useful if there is a value that you want to track, like a sensor value, that is not directly measured, and that can be derived using other known sensor values. Dew point and Gallons/Minute/Vine are two examples.

Chapter 7 – Customer Service

7.1 Customer Service

The Ranch Systems office is open Monday through Friday from 9am-5pm Pacific Standard Time. Operators and Technicians are available to help you during these times. Please consult your Ranch Systems manual before calling to help specify the problem. Remember that you can also log a problem online in the "Change Requests" menu.

7.2 Contact Information

A Ranch Systems technician can be reached by calling the Ranch Systems office at (415)-558 8044.

Glossary

Technical Terms

In this manual we will frequently use some technical terms that should be explained here in a few words:

Base Station
This is the primary sending and receiving site in a telecommunications facility network. In Ranch Systems case, base stations are three-way wireless units capable of communicating simultaneously on three networks: 1. GSM cellular networks, 2. WiFi networks following the 802.11B standard, 3. The Ranch Systems proprietary VHF radio protocol optimized for Ranch area networks

Cellular
The term cellular refers to circuit-switched voice telephone communications via radio channels. The service area is divided into many cells and in each there is a base station handling the communications in that particular cell. Ranch Systems uses cellular for base stations to communicate with the central server.

GSM
This stands for "Global System for Mobile communications", the most widely used digital mobile phone system and the de facto wireless telephone standard in Europe. It was originally defined as a pan-European open standard for a digital cellular telephone network to support voice, data, text messaging and cross-border roaming. GSM is now one of the world's main 2G digital wireless standards. Implemented on 800, 900, 1800 and 1900 MHz frequency bands. The two

components of GSM that is utilized by Ranch Systems are SMS and GPRS.

GPRS
General Packet Radio Service: a radio technology for GSM networks that adds packet-switching protocols, shorter set-up time for ISP connections, and offer the possibility to charge by amount of data sent rather than connect time. GPRS promises to support flexible data transmission rates typically up to 20 or 30 Kbps (with a theoretical maximum of 171.2 Kbps), as well as continuous connection to the network. Ranch Systems uses the GPRS for data transfer between the base station and the Ranch Systems server

IP Address
Each machine connected to the Internet has an address known as an Internet Protocol address (IP address). The IP address takes the form of four numbers separated by dots, for example: 123.45.67.890.

LCD
This stands for "Liquid Crystal Display". The screen of the base station is an LCD display.

Node
A wireless sensor monitoring device that monitors sensor data and uses sophisticated control signals to keep base station abreast of sensor status. All of the sensors in the RanchMaster system are attached to nodes, which communicates status of those sensors to a base station.

RSRF
This stands for "Ranch Systems Radio Frequency". It is a Ranch Systems proprietary wireless protocol in the UHF band, optimized for ranch applications.

RSUID
Ranch Systems Unit ID.

This is simply a number that used to identify a Ranch Systems sensor node or base station, and is equivalent to a VIN number. You will find it printed on the front of all sensor nodes.

Sensor
A device that responds to a stimulus, such as heat, humidity or wind, and generates a signal that can be measured or interpreted. Examples from the *RanchMaster* system is soil moisture sensors, flow sensors etc.

SMS
Short Message Service: available on digital GSM networks allowing text messages of up to 160 characters to be sent and received via the network operator's message center to your mobile phone, or from the Internet, using a so-called "SMS gateway" website. If the phone is powered off or out of range, messages are stored in the network and are delivered at the next opportunity. Ranch Systems uses SMS for three purposes: 1. to communicate urgent requests from the internet application to base stations and sensor nodes, 2. for users to communicate directly with the base stations, 3. to send SMS alerts to users based on rules and conditions regarding the entire system.

Valve
A device fitted to a pipeline or orifice in which the closure member is either rotated or moved transversely or longitudinally in the waterway so as to control or stop the flow. Ranch Systems supports three types of valves: 1.standard solenoid controlled irrigation valves power by AC voltage, 2. standard solenoid controlled irrigation valves switched by reverse polarity DC voltage, 3. motorized shut off ball valves which can be used for situations where there is little or no water pressure (as opposed to standard irrigation valves).

WiFi

The term WiFi, is short for 'wireless fidelity'. A term for certain types of wireless local area networks (WLAN) that use specifications conforming to IEEE 802.11b. WiFi has gained acceptance in many environments as an alternative to a wired LAN. Many airports, hotels, and other services offer public access to WiFi networks so people can log onto the Internet and receive emails on the move. Ranch Systems uses WiFi in order to synchronize multiple base stations deployed on the same property.

Zones
Groupings of sensors with a specific interdependency, for example sensors and valves deployed in the same irrigation vineyard block).

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