X96SI/R Radiometric Transmitter

For Level Measurement in Process Environments

Instructions and Operation Manual

RONAN
ENGINEERING COMPANY
MEASUREMENTS DIVISION

Ronan Measurements Division – 8050 Production Drive Florence, KY 41042 – USA
(859) 324-8500 – www.ronanmeasure.com – ronan@ronanmeasure.com
Service Emergency: (859) 282-4721 – fieldservice@ronanmeasure.com

Revisions
11/11/18
8/14/20

Table of Contents

Chapter 1	Introduction
Chapter 2	System Configuration and Components
Chapter 3	Quick Start
Chapter 4	Installing the Level Gauge
Chapter 5	Configuring the Level Gauge
Chapter 6	Contact Information

RONAN
ENGINEERING COMPANY
MEASUREMENTS DIVISION

Chapter 1
Introduction

X96SI/R Radiometric Transmitter

The X96SI/R is a family of measurement products that replaces the current X96S product families. These products offer:

- Support for all features of the current X96S products
- Newer measurement techniques
- Integral mounting with detector, or may be mounted remotely
- Patented optical coupling which enables compatibility with a the Ronan Flex or rigid crystal Scintillation Detector
- Full Ethernet capability to enable configuration, software updates and data logging to be completed easily through the user's PC
- Menu-driven operation for simple programming
- Support for up to 15 scintillation detectors

State-of-the-art transmitter-based electronics provide precision gauging. Built-in intelligence provides a range of features including:

- Automatically compensates for vapor density changes, foam or gasses, process build-up
- Automatic source decay compensation
- Auto calibrates at multiple points
- Radiation discrimination protection against x-rays
- State of the art dynamic tracking of process fluctuations
- Data logging and event recording
- Adjustable time constant

Ronan Transmitters provide an array of outputs including:

- Ethernet
- USB port
- 4-20 mA or 0 – 10 v.d.c.
- HART
Å Transistor type
- Relay(s) output

X96SI/R Advantages Versus Previous Systems:

The new X96SI/R includes several advances:

- New communication capabilities including: Ethernet with web browser support
- Custom configuration of display
- Field mountable with the processor being integrated with the detector or installed remotely
- System configuration from a web browser
- Data logging support through a removable SD memory storage device or a serial EE flash; data gets recorded in a CSV file which can be read by a spreadsheet or a text editor

Radiometric Systems

A Radiometric Measurement System consists of a gamma source and holder, detector and transmitter. The gamma source is mounted externally to the vessel and emits energy through the vessel walls, directed towards the detector, also mounted externally, on the opposite side of the vessel. The gamma energy reaches the detector in an inversely proportional relationship to the level of material in the vessel. The detector measures the amount of energy and sends a signal to the transmitter, which interprets the signal into a measurement, and displays the information in user-specified units. The detector signal is displayed on the Live Data screen of the web interface and on the LCD of the transmitter.

On applications where varying process densities can affect the level measurement, an additional detector is added to the system to compensate for the density changes (Figure 1). The same detector that is used for the compensation can also be used to make a density measurement. The gauge can also compensate for non-linear responses due to unique vessel shapes, varying wall thickness, and obstructions in the vessel.

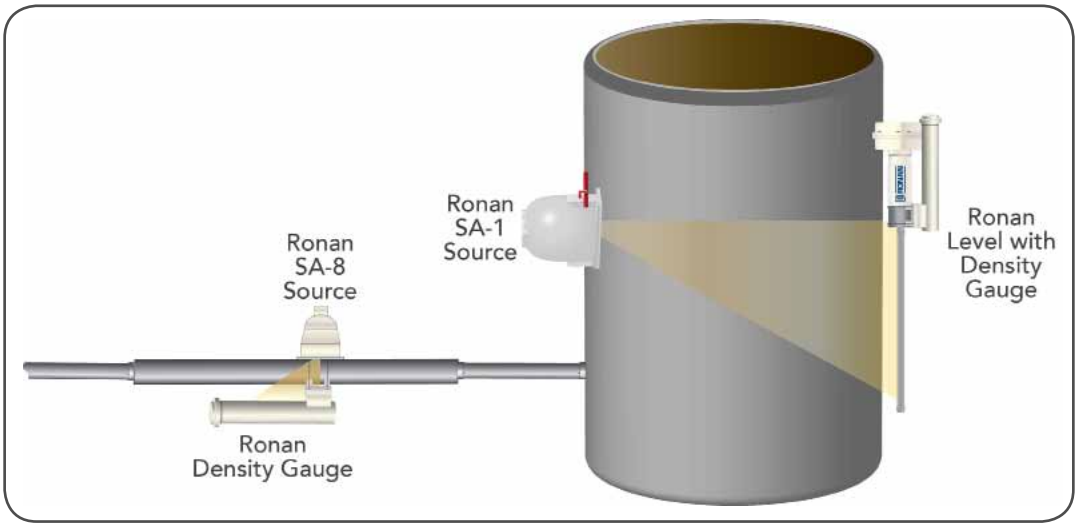


Figure 1

Because the entire system mounts externally to the vessel or pipe, it can be easily installed and maintained while the process is running without downtime, vessel modifications, risk of accidental release, or the need for specialty construction materials.

Other benefits:

- Components do not disturb flow profile
- Interference and noise in measurement readings are eliminated because system components do not come into contact with the process material
- Component wear and maintenance are reduced because the system does not come into contact with the conveyor and process material
- System is easy to calibrate

System Configuration

While users' applications vary based on needs and requirements, a typical configuration can include the following interfaces:

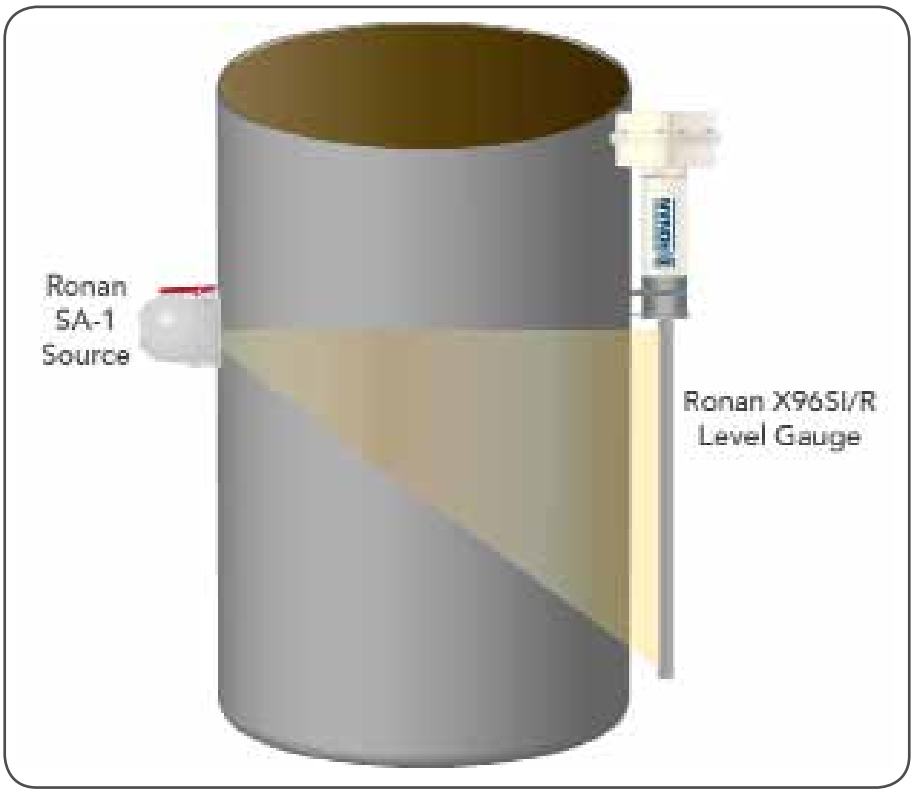
Integral Mount	Remote Mount
The Transmitter is attached to the primary detector	The Transmitter is mounted remotely, detached from the primary detector
Optional: 2 additional Scintillation Detectors	Up to 3 Scintillation Detectors
1 Digital Output (Relay or Open Collector) 2 Relays and 2 TTL Or 1 Relay and 3 TTL (Jumper selectable)	1 Digital Output (Relay or Open Collector) 2 Relays and 2 TTL Or 1 Relay and 3 TTL (Jumper selectable)
2 Digital Inputs Or 3 Digital Inputs if Scintillation is not used	2 Digital Inputs Or 3 Digital Inputs if Scintillation is not used
Analog Inputs • 1 RTD type input • 1 Analog input • 1 Head temperature	Analog Inputs • 1 RTD type input • 1 Analog input • 1 Head temperature
Analog Outputs 1 standard 4-20mA or 0 to 10 volts with an optional HART daughter board 4-20mA	Analog Outputs 1 standard 4-20mA Option of a 2nd 4-20mA
Communication Options Ethernet (Telnet or web browser) Optional daughter card can provide HART,	**Communication Options** Ethernet (Telnet or Web browser) Optional daughter card can provide HART,

For applications that require more detectors and outputs, the X96SI/R system can be expanded by adding additional X96SI units (4) configured as slave modules. The master/slave X96SI/R can be configured to a maximum number of inputs and outputs as shown:

- 15 Scintillation type Detectors (Using additional X96SI configured as slave modules)
- 8 Digital Inputs that can be Connected to Point Detectors (acting as slaves)
- 4 Relay Outputs
- 4 Open Collector Outputs
- 3 4-20mA Current Loop Interface, one of which can support Factory Communications Protocols
- 1 USB Interface
- 1 LAN Interface
- 1 Interface to Optional Display or Local Configuration Device

Typical Radiometric Measurement System Set-up

The following diagram shows a typical set-up of a Ronan Radiometric Measurement system which includes a Source Holder and a Continuous Level Gauge with the integrated X96SI/R Radiometric Transmitter.



System Components

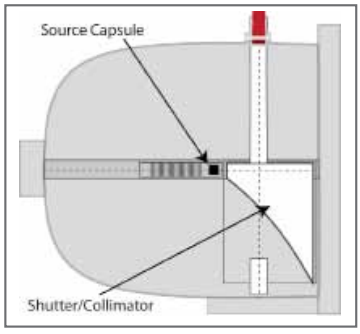
A typical Level system is made up of 3 basic components. The first component is a source and source holder to transmit the gamma ray over the measurement range. The second component is a detector to sense the gamma ray intensity, and the third component is a transmitter to convert the detector signal into a measurement. In some configurations, as with the X96SI/R Integral mount, the transmitter is directly attached to the detector. While the user's application determines the system configuration requirements, the following components (listed below) are included in the basic configurations of the X96SI/R systems.

Source Holder with Enclosed Source Capsule

A description of the source holder and source capsule is listed below.

<u>Source Capsule</u>

A radioactive cesium (Cs-137) source or (C060) is sized to fit the needs of each application. The source material is encapsulated inside a welded stainless steel cylinder and shielded by a lead-filled source holder. Cesium emits gamma radiation which has several advantages. Gamma radiation by Ronan products does not make the process material radioactive, nor does it change or affect the material as it is attenuated.



Source Holder

Ronan offers a wide variety of source holders, including the point source holder which is mounted to the external surface of the process vessel. A small slot in the lead shielding of the source holder focuses an active radiation beam through a collimated opening, into the process vessel, and toward the detector which is mounted on the opposite side of the vessel.

To ensure a safe way of closing off the active radiation beam during shipping, installation and servicing, a handle with a rotating shutter is provided.

Ronan SA-1
Source Holder

Source Holder ON/OFF Mechanism

All source holders, with the exception of the RLL Low Level Source Holder, provide a means of shielding the radiation beam. This can be either a rotating shutter in front of the capsule, or by moving the source capsule away from the opening of the lead shield, or by retracting the source rod back into the source shipping container.

When OFF, or closed, the shutter rotates in place to cover the small opening and shield the radiation beam. The ON, or open, position removes the shielding from the small opening.

Detectors

The Ronan detectors are enclosed in protective housings. When radiation from the source strikes the “active” length of the detector, a signal is generated. The active length of the elongated detector corresponds to the full measurement range of interest, and is designated by bands of tape at the top and bottom of the detector housing. Typically, the density measurement uses a smaller active length scintillation than the continuous level measurement.

Scintillation detectors use a phototube that senses the light produced by the detector crystal, which is converted into an electrical pulse, amplified, and sent to the transmitter.

X96SI/R Transmitter

Ronan's X96SI/R Transmitter converts the signal from the detector into the desired measurement and displays the results in a useful format. Through its liquid crystal display screen, and pre-programmed menus, the process level is continuously monitored with minimal operator effort. For those monitoring the system through the web interface, live data is available at the click of a mouse.

The X96SI/R uses the CPU module X96-3001-1 for scintillation detectors.

X96SI-R Transmitter
Top View

All CPU/IO module types are capable of plugging into the same slot in the X96SI/R motherboard.

Three types of optional daughter boards are available:

- HART
-
- Analog Input
- Analog Output

Interconnect Cable

The interconnect cables provide a signal from each detector to the X96SI/R Transmitter. The cables are supplied with a pre-wired MS connector.

Communications

The Ronan X96SI/R Level Gauge provides 4-20mA current loop and HART, and Ethernet communications.

Analog Output 4-20 mA

The X96SI/R provides a minimum of 1 primary 4 - 20mA analog output which is configured to 0 - 20 or 0 - 10v via the jumper selection on the CPU board. HART daughter board provides an additional 4 - 20mA output.

HART®

HART rides upon the 4-20mA output to enhance communication with Smart field instruments. HART preserves the 4-20mA signal and enables two-way digital communications to occur without disturbing the integrity of the 4-20mA signal. The HART protocol permits the process variables to be transmitted on the 4-20mA analog signal, and additional information such as variables, parameters, device configuration, calibration, and device diagnostics can be attained for use by central control or other monitoring systems. Thus, a wealth of additional information related to plant operation is available to central control or monitoring systems through HART communications.

Ethernet – TCP/IP

The X96SI/R includes an Ethernet LAN Interface which is used to:

- Interconnect multiple X96SI CPU/IO modules in large systems configurations.
- Configure the system through web-based menus.
- Collect data from the system.
- Read log files in the file system.
- Access the debugging interface (e.g. to download updated code)

Optional and Special Features

Ronan's Density Compensated Level Monitor Systems offer a number of options and special features. Among the features available are:

- Radiological Discrimination
- Alarms
- Auto-Cal
- Auto-Cal Validate

Radiological Discrimination

If there is a chance that on-site radiography devices will interfere with measurement output from the Level with Density Compensation Gauge, the radiological discrimination feature can be enabled. This feature protects the gauge from interruptions caused by external energy sources.

Alarms

The X96SI/R can provide up to 8 user configurable alarms. You can assign a level, the density, detector counts, detector head temperature, and other analog type signals to any of the eight alarms. The alarms allow the user to determine if it will trip on a high set point or a Low set point, or within a range. Once the alarms have been configured, you can then assign these alarms to a specific X96SI/R Digital Output (Relay or transistor output).

Besides the alarms, there are built in alarms such as system failure, detector fault, AutoCal in progress, Auto Cal Failed to Calibrate, Shutter Test, Wipe Test and others that can be assigned to the Digital outputs. These alarms can be preconfigured in your system based on the needs of your application. Various alarms are set to trigger when certain events occur, such as when the process level gets too high or too low, or the head temperature reaches a certain level. Alarms can be assigned to specific digital outputs as well as relay or transistor outputs. To view the alarms that have been configured for your system, refer to the system variable worksheet in your documentation packet or go to the *Diagnostics: Alarms menu*. To reconfigure the alarm settings, go to the *Operation Config menu* and select *"Alarm Config"*.

Auto Cal

The X96SI can provide the user the ability to do automatic calibration with the one or more additional point detectors.

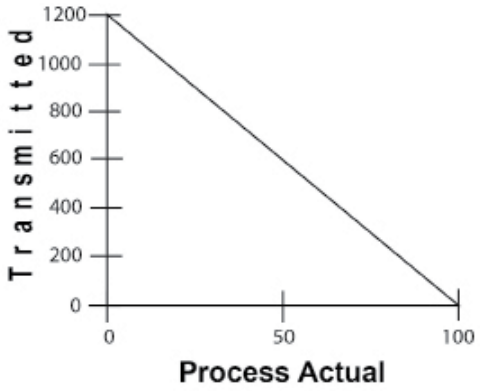
On certain applications, wall build-up can become excessive causing inaccuracy in the level measurement. By installing one or more optional point detectors along the measurement, the X96SI/R can perform a calibration feature to correct the level measurement as the process moves past each of these point detectors.

If interior walls of the vessel are prone to normal process build-up, the automatic calibration feature can be included. Auto Cal will maintain the accuracy and repeatability of the measurement with little or no effort on the part of the operator. This feature requires installation of one or more additional point detectors.

Theory of Radiation Gauging

Gamma radiation gauges operate on the principle of absorption and transmission. A source holder directs the radiation beam through the vessel and its process material onto the surface of the detector. As the process material raises inside the vessel, the gamma radiation is attenuated by the process causing the detector signal to decrease. Therefore, an increase in process level results in a decrease of transmitted radiation.

The detector's output signal, described as counts, varies inversely to the process level (or mass). Shown here is a typical response curve for a continuous level application.



Fairly simple conditions exist when only one process density is involved. In that case, the variation in mass of material can only be caused by a variation in level of the process. In these cases, we can be assured that a change in the detector counts is a result of a change in the process level.

When the process level is full (or high) the process material "shields" the detector which prevents radiation from reaching the detector, producing a low output of counts. When the process level is absent (or low) the detector is exposed to a maximum amount of radiation which produces a high output of counts. (Figure 1)

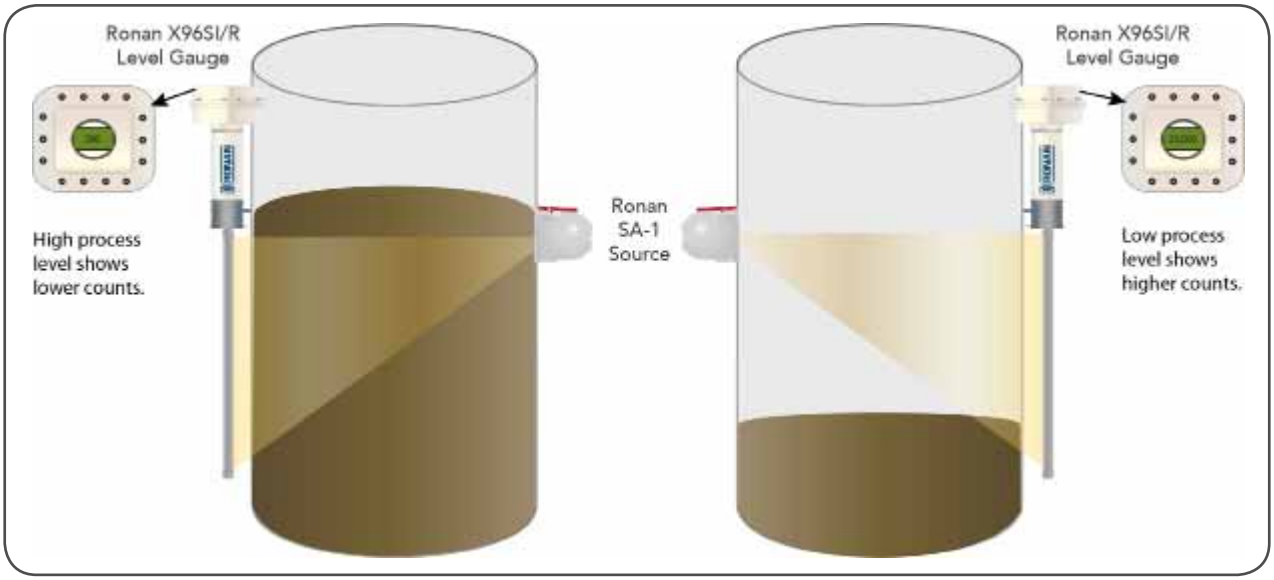


Figure 1

Additional Signal Processing

This signal of the X96SI/R is correlated to a level measurement, corrected by the density measurement, and output at the transmitter in the user's pre-selected units of measure. Some of the more significant stages of signal processing include:

- Units Conversion – conversion of counts into user-selected level units
- Measurement Range – 4-20 mAoutput defined by the user-selected range in user-selected units
- Digital Filtering – signal smoothing to reduce statistical radiation noise
- Dynamic Tracking – quick Gauge response to sudden process changes
- Source Decay Compensation – automatic compensation for the radioisotope decay
- Calibration (Referencing) – calibration of Gauge to user process

Units Conversion

The X96SI/R allows the user to select their preferred units of measurement such as inches, feet, millimeters, centimeters or meters for level.

Measurement Range

The X96SI/R allows the user to scale the analog output. The level measurement can be made up to the active length of the elongated detector, dependant upon the type of source holder and type of detector.

Digital Filtering

Reduction of the signal noise due to radiation statistics and process noise is handled through digital filtering. Digital filtering is a form of statistical averaging used to smooth, or dampen, random radiation as well as process-related noise. Increasing the digital filter's "time constant" results in decreased signal noise.

Dynamic Tracking

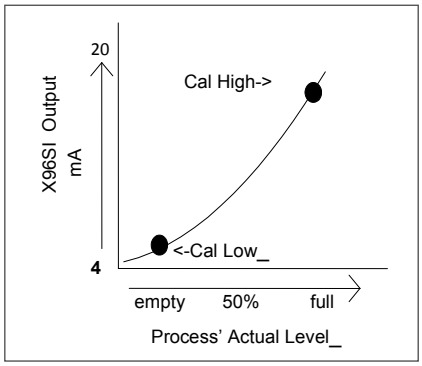
Dynamic tracking provides a 3-stage RC-type filter .

Source Decay Compensation

Software also compensates for the decay of the radioactive source activity. On-going adjustments are made automatically for the rate of decay, or source half-life.

Calibration

Calibration correlates detector signal (in counts) to numeric values that accurately represent the actual process level. The calibration procedure establishes reference points of known conditions against which the system can make ongoing comparisons. It requires at least two known points of reference: a low value and a high value. For best calibration results, the two reference points should cover as much of the full measurement range as possible.



As this example response curve shows, the calibration procedure also reverses the relationship between detector counts and actual process level. Now, a direct relationship exists, so that as the process level moves from empty to full, the X96SI/R's display screen indicates an increase in user units from minimum to maximum. (For example: 0 feet to 80 feet.).The transmitter output signal also increases from minimum to maximum (usually 4 to 20 mA).

The level algorithm used by the X96SI/R software is a simple transfer function. That is, the relationship between the detector output and the process level is mathematically expressed as:

$$Level = L_0 + \left(\left(\frac{I - I_0}{I_{f-} I_0} \right) \times \left(L_{f-} L_0 \right) \right)$$

Where:

I_f = detector signal with calibrate (full) level (Lf) in vessel

I_o = detector signal with reference (low) level (L0) in vessel

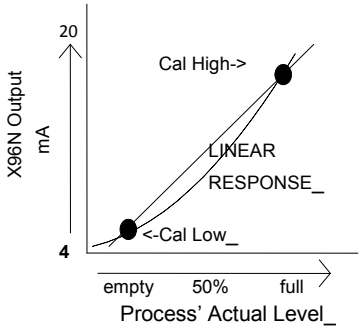
I = current detector signal

L_0 = level @ reference (low level)

L_f = level @ calibration (high level)

Curve Calibration

Level measurement non-linearity can be caused by an irregular distribution of the radiation field over the full length of the detector. Vessel size and geometry, vessel wall construction, cross paths from multiple source fields, and other system configurations are among the potential causes of an irregular field distribution. Because a linear output is desired, the adjustment is accomplished through another stage of software signal processing, curve correction. The nature and form of the curve correction required for each application depends on a number of variables such as system configurations, detector geometry, process conditions, etc. Shown here is a typical response curve with curve correction applied.



Chapter 2
Quick Start

Quick Start

This section provides a high level overview of the installation process for the X96SI/R system. Detailed directions are provided in Chapter 3: *Installing the Level with Density Compensation Gauge*.

1. Unpack and Mount the Equipment

Refer to Chapter 3 for details on inspecting and unpacking the equipment. Refer to the Configuration Drawings in Chapter 6 for detailed instructions on mounting the equipment.

2. Wire the Microprocessor and Detector

Refer to Chapter 6 for details on wiring the microprocessor and detector.

3. Power up the System

Apply power to the X96SI/R unit. You should see the following LCD screens as the system boots up.

4. Log onto the System and Access Menus

Connect your configurator to the X96SI/R (HART tp 4-20mA signal, FieldBus, or Profibus PA to the Comm line) or connect to the Ethernet via a web browser.

From the Web Interface

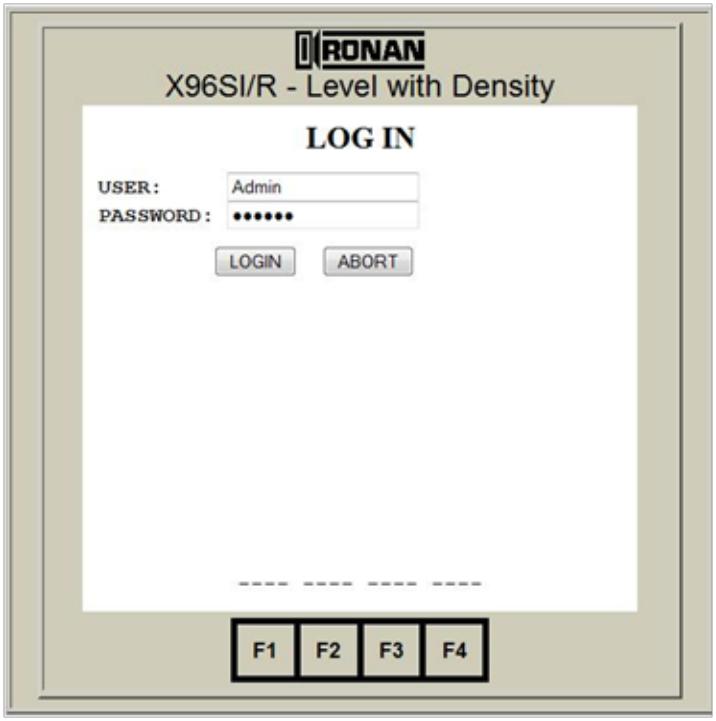
Follow these steps to log onto the system using a web browser such as Internet Explorer or Mozilla's Firefox:

4a. Enter the IP address (**http://160.100.0.234**) for the X96SI/R in the browser's address field. The Login screen will appear.

4b. Enter the Username: *Admin.*

4c. Enter the Password: *Secret* or *Ronan.*
Note: Use *Secret* to edit all fields. Use *Ronan* for read-only access.

4d. Click **Login**. The main menu will appear.

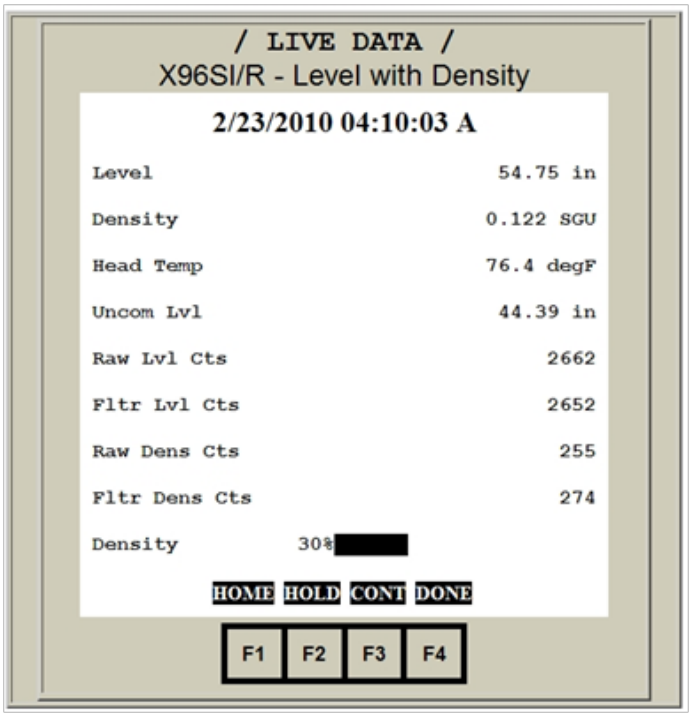


5. Document the X96SI/R Response Under an Empty Vessel Condition:

Record the following detector counts when the vessel is empty. Click the **Data** button from the Main menu to get the counts. The following screen will appear:

Record these results is in the space provided below.

- Level counts
- Vessel condition



- The above may not match your display for your specific application

Date/Time	Type of Detector Count	Condition of Vessel
	Level	

6. Perform a Level Calibration – Measures Level and Density

Calibration correlates the detector output (in counts) to numeric values that accurately represent the process level. The calibration procedure calibrates for two reference points, one low point and one high point, of known conditions against which the system can make ongoing comparisons. For best calibration results, the two reference points should cover as much of the full measurement range as possible.

Perform the following steps to complete the level calibration.

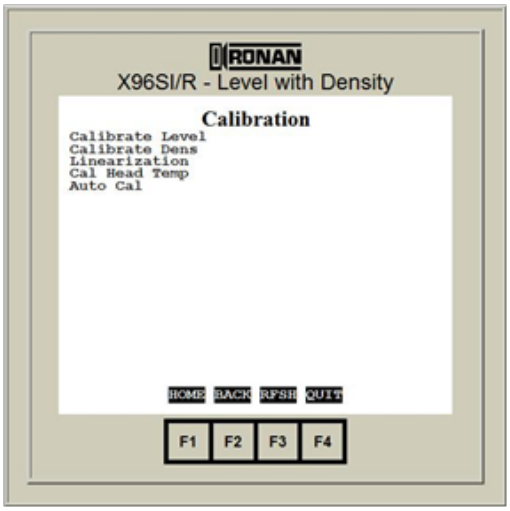
Perform the Low Level Calibration

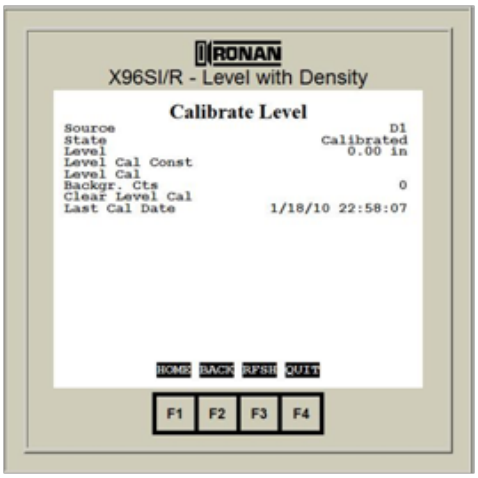
With the process level empty or at its lowest level, perform the following steps:

6a. Begin with an empty vessel or when the vessel contains the lowest possible level, and under normal operating conditions (at correct temperature and pressure).

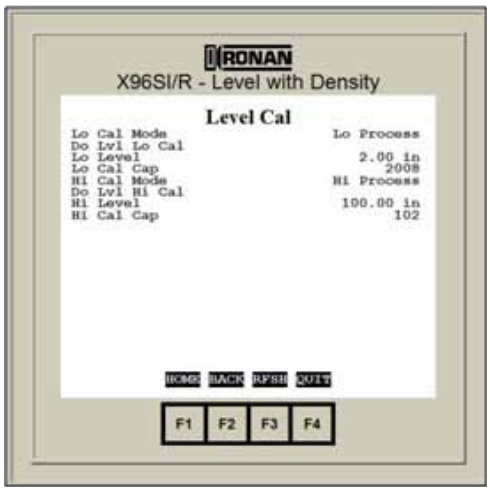
6b. Select **Calibration** from the Main menu. The Calibration menu appears:

6c. Select Calibrate Level. The following menu will appear.





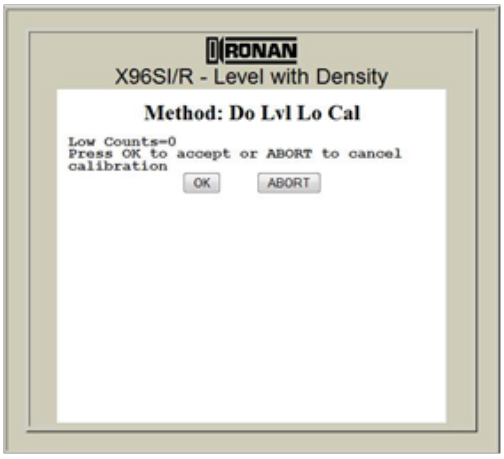
6d. Select **Level Cal**.



6e. Selece the **Low Level variable** and enter in the correct level value. For example, if the vessel is empty, enter "**0**".

6f. Select **Do Lvl Lo Cal**. The system will warn you that the previous values for the low level calibration will be replaced. Click **OK**.

6g. The system will warn you that this will remove the loop from automatic control. Click **OK**.



6h. The system will remind you to verify that the source is on and the vessel is at a low level. Click **OK**. The next screen shows you that the system is calibrating the low level.

6i. The system will display the counts for the new low level. Click **OK** to accept or **ABORT** to cancel. Record the new value.

6j. The system will confirm the low level calibration was successful.

Perform the High Level Calibration

Before calibrating the high level, fill the vessel above the full range of measurement. Then, follow these steps to perform the calibration:

NOTE:

It is ideal to perform the high level calibration when the vessel is full. If that is not feasible, the other options can be considered:

- If the typical vessel is greater than 36” in diameter, you can close the shutter (in the off position) before doing the calibration which typically represents a full vessel.
- Fill the vessel to at least 75% or greater before doing the calibration.

6a. Select **Hi Lvl** and enter the high level value.

6b. Select **Do Lvl Hi Cal**. The system will warn you that the previous values for the high level calibration will be replaced. Click **OK**.

6b. The system will warn you that this will remove the loop from automatic control. Click **OK**.

6c. The system will remind you to verify that the source is on and the vessel is at a high level. Click **OK**. The following screen appears, showing you that the system is calibrating the high level.

6d. The system will display the counts for the new high level. Click **OK** to accept or **ABORT** to cancel. Record the new value.

6e. The above screen will appear, confirming the high level calibration was successful.

Repeat the reference and calibration if the X96SI/R does not indicate zero when the vessel is emptied, or if the system does not indicate full with the process covering the complete measurement range.

Chapter 3
Installing the Level Gauge

This section covers the information that will help you prepare for installing the components of the Level with Density Compensation Gauge. Be sure to read this chapter and the Radiation Safety Manual before you begin to unpack and install the equipment.

Specific and detailed installation instructions are provided in the Drawings section of the Reference chapter.

Caution

Ronan's Measurement Systems use a sealed radioactive cesium (Cs-137) or cobalt (CO-60) source which is safe if handled properly.

Specific License (SA or GS Series)

If your gauge is equipped with the SA or GS series source holder, you are required to obtain a specific license. Your company's specific license will name a Radiation Safety Officer (RSO) or Radiation Protection Officer (RPO). The RSO for your company must be notified immediately upon receipt of the gauge. DO NOT proceed with unpacking, storage, or installation without the RSO's authorization.

General License (RLL Source Holder)

If your gauge is equipped with the RLL series source holder, you are not required to obtain a specific license. Your company should assign a responsible party to maintain records and supervise the installation and commission of the source holder.

Ronan's field service personnel are available for assistance by calling: (859) 342-8500.

Unpacking

All equipment manufactured by Ronan is carefully packaged to prevent shipping damage. Be sure to unpack the equipment in a clean, dry area. Examine the contents and compare them to the packing list. Immediately report any discrepancy or damage to Ronan, the company's RSO, and the carrier. File a claim with the carrier.

Storage

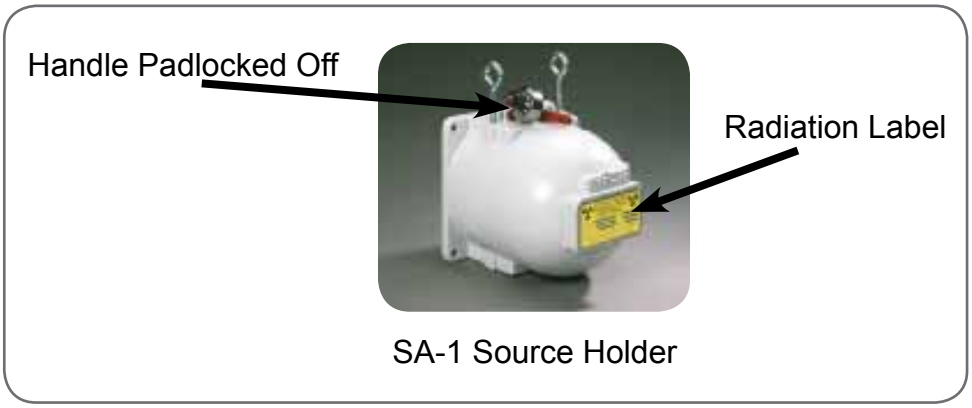
If it is necessary to store this equipment before mounting, the RSO or responsible party will assign a safe and secure location with no personnel access.

During storage, avoid temperatures below freezing, and areas with excessive humidity, moisture, or dirt.

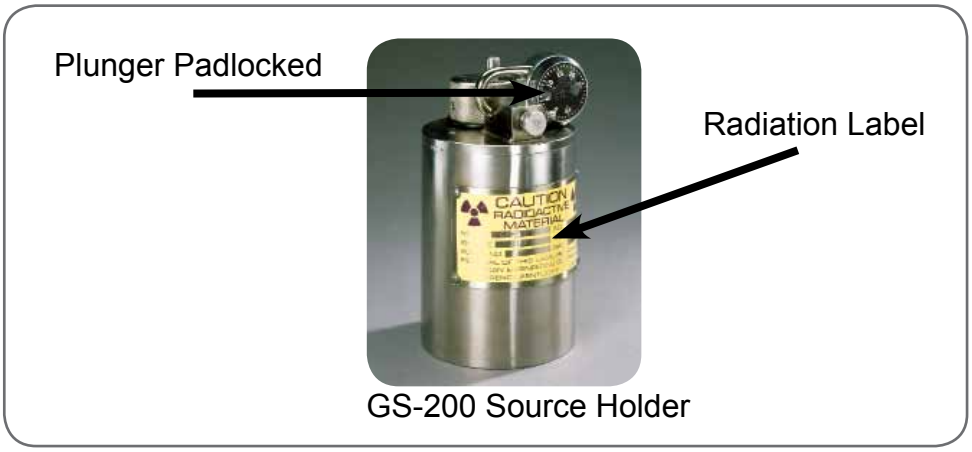
Inspection

The source holder is equipped with an ON/OFF Mechanism. During shipment and storage the mechanism MUST BE SECURED in the OFF position with a padlock.

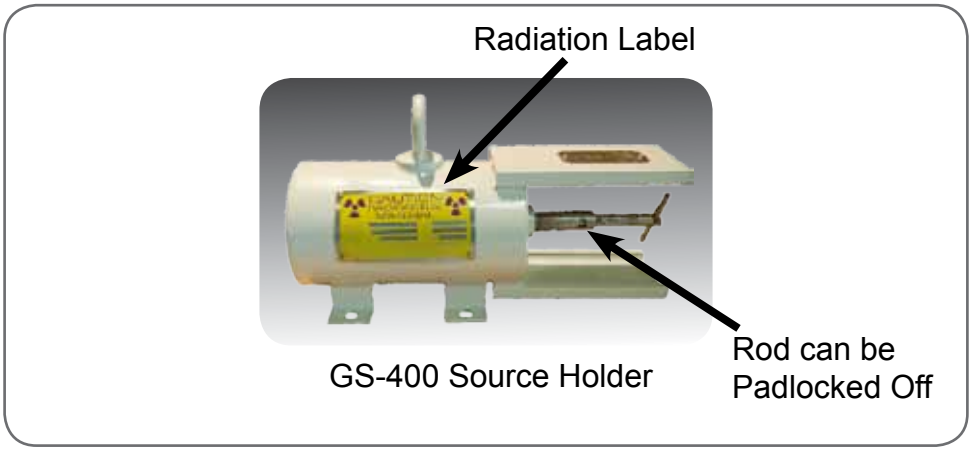
If the padlock is damaged, broken, or missing, contact the RSO immediately.



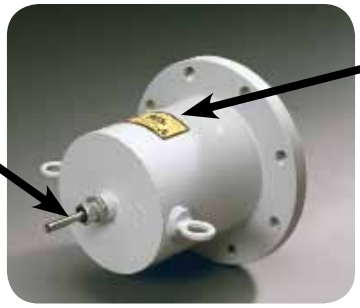
SA-1 Source Holder



GS-200 Source Holder

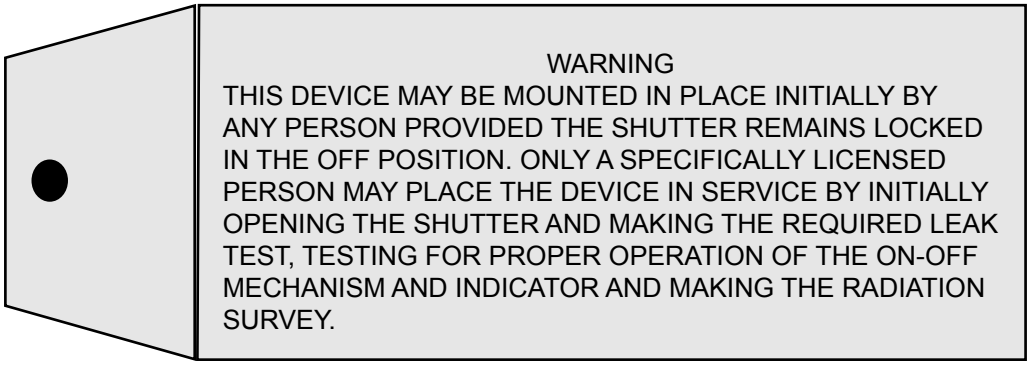


GS-400 Source Holder



SA-10 Source Holder

RLL Source Hold-



Lock Tag (does not apply to RLL devices)

Safety Precautions

During installation, the RSO will provide guidelines to assure safety. Consider the information presented in the Radiation Safety Manual and the following general guidelines:

- The source holder must remain padlocked in the OFF position until installation is complete.
- Take all necessary precautions to assure that the source holder is not dropped or damaged.
- A specifically licensed individual MUST inspect the installation prior to placing the source holder in the ON position.
- Always turn the source holder to the OFF position when working around it, the detector, or the area between these two components which is referred to as the “measuring gap.”
- When the source holder is placed in the ON position, avoid the “active beam”.

Mounting the Equipment

Before mounting the equipment, you should have carefully considered where and how the system will be mounted to the vessel. You should also carefully review the configuration and dimensional drawings which are included in the Reference section of this manual before getting started.

When mounting the sensor and detector, consider the following general guidelines:

- Avoid internal vessel obstructions such as baffles, agitators, manways, heater/cooler tubes, etc. which could interfere with the transmission through the vessel of the radiation’s “active beam.”
- The source and detector must be rigidly mounted so they do not move with respect to each other. Such movement will destroy the system’s calibration and/or its measurement.
- Insulation must be used at the point of installation **if:**
  - The temperature of the vessel at that spot exceeds 120°F (50°C), or
  - The voltage transmission through the vessel could interfere with the signal transmission from the source to the detector.

Installing the Interconnect Wiring

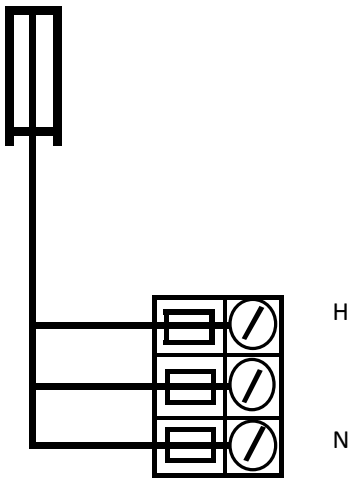
Be sure to read over the following section before installing the interconnect wiring. Wire the equipment according to the detailed interconnect drawing which is included in the Drawing section of the Reference chapter.

Consider the following guidelines before making any electrical connections:

- DO NOT APPLY POWER until wiring is carefully checked.
- Follow local and national electrical codes for all interconnections.
- Use continuous conduit runs and protect housing junction boxes from dripping of condensed moisture off of conduit.
- Plug unused conduit holes to prevent entry of dirt and moisture.
- Run the interconnect cable in a separate conduit. Feed the cable through the conduit starting at the detector end and terminate at the microprocessor end.
- DO NOT run AC power cable in the same conduit with any of the low-level cables (signal, mV, mA, etc.)
- Maintain transient-free AC power sources between 105-130 VAC for the microprocessor. DO NOT use a line that is connected to a large motor, welding equipment, solenoids, etc.

With the Power Off:

1. Connect the cable pre-wired MS connector to the detector. Verify the plug is seated. Turn locking ring until it clicks.
2. Immediately replace lid of detector housing to keep out water and dirt.
3. Check the connections at the microprocessor chassis terminals.
4. Verify that all wires are fully inserted in terminal sockets and the screws are firmly tightened.



Verifying the Microprocessor

Follow these instructions to verify the Ronan transmitter.

1. Remove the computer front cover by opening the screws on the front.

2. Check each board to see if they are fully seated into the mother board.

Note: These boards are not interchangeable in the frame's slots.

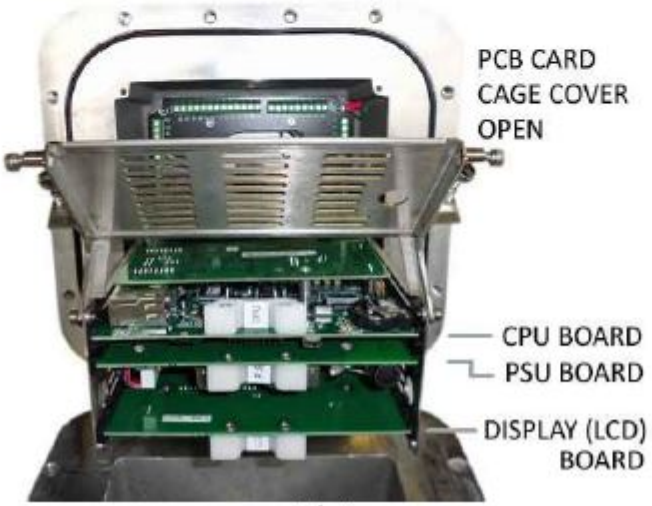
3. Identify the CPU and other major boards from the drawing below. Optional configurations are possible.

Note: The Ronan X96SI/R microprocessor can be programmed for a variety of applications and configurations. The specific application supplied with each system is determined by the combination of software and the unique hardware configuration used to support the software.

Detay 1

Detay 2

Detay 3



Detay 4

Powering Up the System

After verifying the wiring as documented in the interconnect drawing supplied in the Reference chapter and ensuring all boards are fully seated in frame's slots, follow the steps below:

Upon powering up the X96SI/R processor, the system runs a self-diagnostic program and displays the following information:

Ronan X96SI/R

S/N: 00001000

Starting Gauge

Finding INI File

The following information is displayed on the LCD:

X96SI Dens 0.7.0

160.100.0.224

00:50:C2:9C:E0:13

DB: None

System Name and Software Version

The system name and software version displays first.

IP Address

The IP address displays in the second line. The IP address (a numerical label that is assigned to devices participating in a computer network that uses the Internet Protocol for communication between its nodes) is shipped with a default value. This can be changed in the customer configuration file which is located on the SD card. A computer with a SD card reader can assign a new value.

Media Access Control Address

The Media Access Control address displays on the third line. Assigned by the factory, this address is a unique identifier that gets assigned to most network adapters or network interface (NIC) cards by the manufacturer for identification and is used in the Media Access Control protocol sub-layer.

Database

The system displays information about the database if present.
Shortly after, the system displays the following information:

Level: 0.00 in

Raw Lvl Cts: 0

Fltr Lvl Cts: 0

Det: Error F2

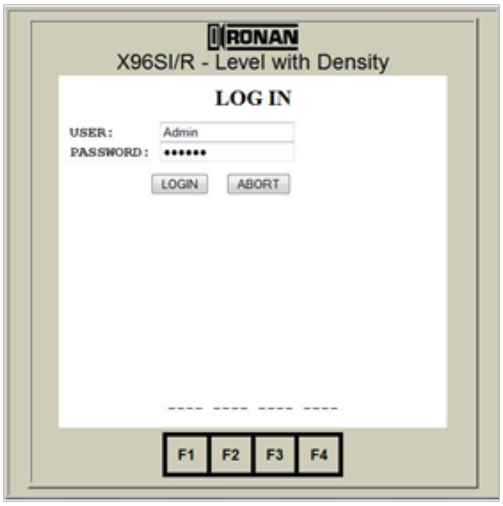
Once the system is configured and calibrated, the values for Level, Density, and Filter Level will change to reflect the current state. You can now log onto the system via the web.

Logging Onto the System

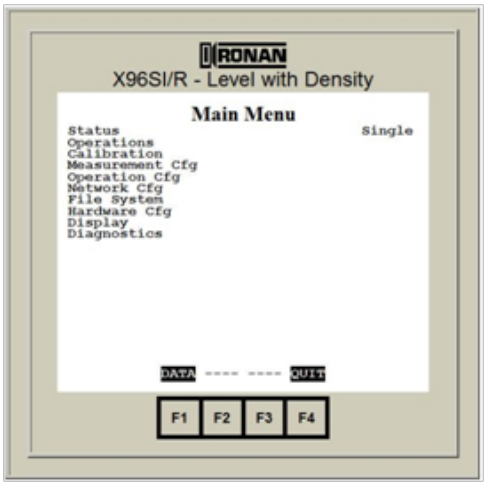
From the Web Interface

Follow these steps to log on to the system using a web browser such as Mozilla's Firefox or Internet Explorer:

1. Enter the IP address for the X96SI/R in the browser's address field. If you need to change
2. the IP address, you can change it in the customer configuration file which is located on the SD card. The Login screen appears.



3. Enter the Username: **Admin**
4. Enter the Password: **Secret** or **Ronan**.
5. Note: Use **Secret** to edit all fields. Use **Ronan** for read-only access.
6. Click **Login**. The main menu appears.



Chapter 4
Configuring the Level Gauge

Overview

Ronan ships the Level Gauge with factory-default software settings
which are listed in your document packet. Those settings are responsible for the information that initially appears on the status displays.

After installation at your site, you may need to reconfigure the system to fit your application. The goal is to correlate the X96SI/R output with your actual level readings. The list below summarizes the activities that are detailed in the remainder of this chapter:

- Review factory defaults (a worksheet is included with your document packet) to ensure they match the needs of your environment. If not, make necessary changes and keep this information for future reference.
- Perform a low density calibration on a cold and empty vessel. In most cases, this will be a single point calibration.
- Perform a Level Calibration to correlate the X96SI/R's output to the actual process level.
- Document detector output counts at calibrated values to assist in troubleshooting.
- Configure the Density Compensation feature.
- Use the Curve Correction procedure to further refine the output, producing a more accurate measurement, if required.
- If your system includes an Auto Cal detector, enable the Auto Cal optional feature and set up working parameters.

Configuring the System

Once the components of the Ronan system are installed, you will follow these steps to configure the system:

Step	Action
1	Record the following detector counts when the vessel is empty: • Level counts • • Vessel condition
2	Review factory defaults (a worksheet is included with your document packet) to ensure they match the needs of your environment. If not, make necessary changes and keep this information for future reference.
3	Perform a Low Density Calibration on a cold and empty vessel. In most cases, this will be a single point calibration.
4	Perform a Low and High Level Calibration. • Conduct a low level calibration at low range. Ensure it is below the measurement range and under normal operations. Record the level and density/density compensation detector counts. • Conduct a high level calibration with a full vessel. Record the level and density/density compensation detector counts.
5	Configure the Density Compensation feature.
6	Use the Curve Correction procedure to further refine the output, producing a more accurate measurement if required.
7	If your system includes an Auto Cal detector, enable the Auto Cal optional feature and set up working parameters.

1. Record the Detector Counts When the Vessel is Empty:

Record detector counts when the vessel is empty; write results in the chart below.

- Level counts
- Vessel condition

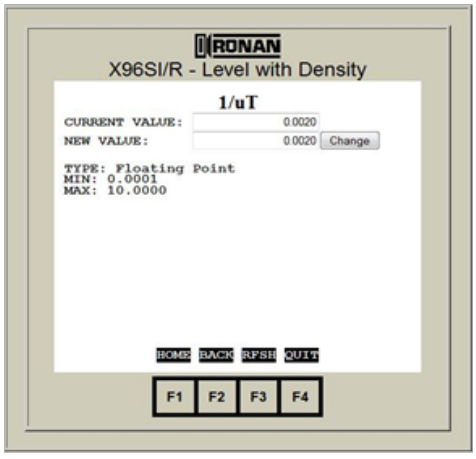
Date/Time	Type of Detector Count	Condition of Vessel
	Level	

2. Review the Factory-Default Settings and Make and Document Any Necessary Changes

The X96SI/R has been tested by Ronan factory personnel, using settings, limits, and parameters that closely match your configuration and system needs. These custom settings are included in your document packet. Be sure to review them and keep them in a safe place. If changes are necessary, see the section on the system menus later in this chapter. Be sure to update all parameter changes on the parameter worksheet.

For future reference, document the following items:

- All conditions that are present during the calibration and curve correct procedures. That is, any information that will be needed to reproduce these exact circumstances the next time a calibration is performed. For example, note if agitators are running, vessel is at normal operating temperature, process is flowing from top of vessel through “active radiation beam,” etc.
- All changes made to factory-default settings such as time constant, calibration constants, gain, etc.
- The Level and Density Reference Counts as they appear on the Status Display at the time of the initial calibration.
- The Linearizer Curve entries made during the Curve Correction procedure.



4. Perform a Level Calibration – Measures Level and Density

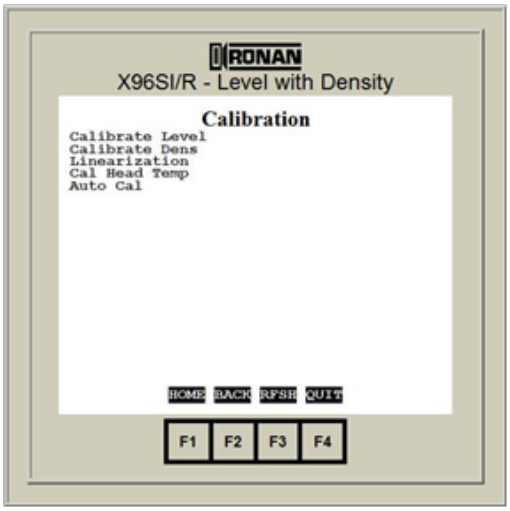
Calibration correlates detector output (in counts) to numeric values that accurately represent the actual process level. The calibration procedure establishes reference points of known conditions against which the system can make ongoing comparisons. It requires at least two known points of reference: a low value and a high value. For best calibration results, the two reference points should cover as much of the full measurement range as possible.

Perform the following steps to complete the level calibration. Begin with the empty vessel or when at lowest process level and under normal operating conditions (at correct temperature and pressure).

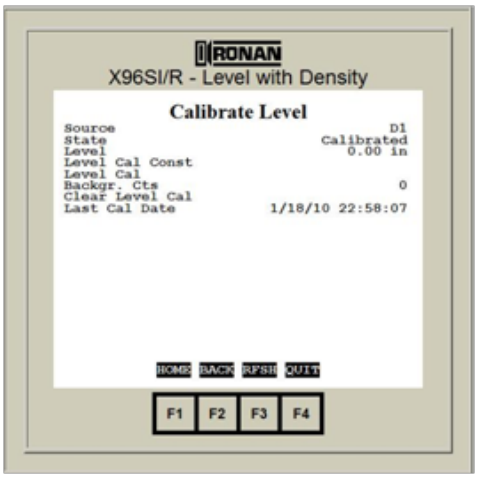
Perform the Low Level Calibration

With the process level empty, perform the following steps to complete the Low Level calibration:

1. Begin with an empty vessel with the shutter on.
2. Select **Calibration** from the Main menu. The Calibration menu appears:



3. Select **Calibrate Level**. The following menu appears.



4. Select **Level Cal**.
5. Select **Do Lvl Lo Cal**. The system warns you that the previous values for the low level calibration will be replaced. Click **OK**.
6. The system warns you that this will remove the loop from automatic control. Click **OK**.

7. The system reminds you to verify that the source is on and the vessel is at a low level. Click **OK**.
8. The next screen shows you that the system is calibrating the low level.
9. The system displays the counts for the new low level. Click **OK** to accept, **ABORT** to cancel.
10. Record the new value.
11. The system confirms the low level calibration was successful.

Perform the High Level Calibration

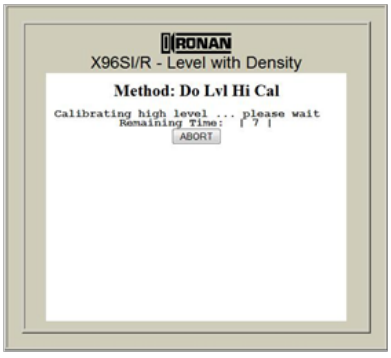
Before calibrating the high level, fill the vessel above the full range of measurement. Then, follow these steps to perform the calibration:

NOTE:

It is ideal to perform the high level calibration when the vessel is full. If that is not feasible, the other options can be considered:

- If the typical vessel is greater than 36” in diameter, you can close the shutter (in the off position) before doing the calibration which typically represents a full vessel.
- Fill the vessel to at least 75% or greater before doing the calibration.

1. Select **Do Lvl Hi Cal**. The system warns you that the previous values for the high level calibration will be replaced. Click **OK**.
2. The system warns you that this will remove the loop from automatic control. Click **OK**.
3. The system reminds you to verify that the source is on and the vessel is at a high level. Click **OK**. The following screen appears, showing you that the system is calibrating the high level.



4. The system displays the counts for the new high level. Click **OK** to accept or **ABORT** to cancel. Record the new value.
5. The above screen appears, confirming the high level calibration was successful. Repeat the reference and calibration if the X96SI/R does not indicate zero when the vessel is emptied, or if the system does not indicate full with the process covering the complete measurement range.

	Source shutter off	Cold vessel source shutter on	Vessel at normal pressure and temperature source shutter on
Level	50 cts	10,000	9,500
Density	23 cts	100	90
Process Conditions			
Auto Cal			

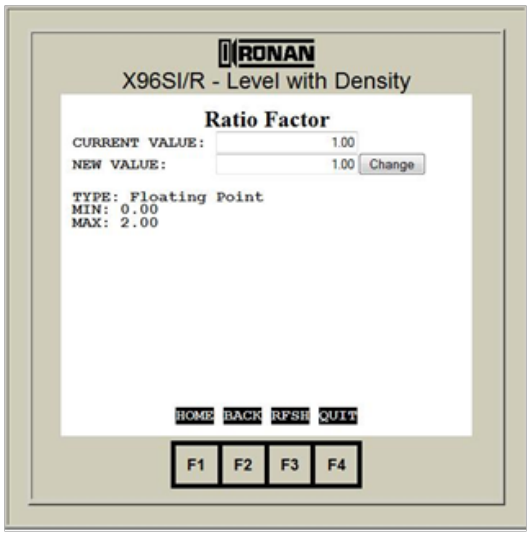
1. Complete the following calculation before entering the value in the Measurement Configuration menu:

$$\text{Ratio Factor} = \frac{1 - (\text{Level Cts. Operating Cond}/\text{Level Cold Cts})}{1 - (\text{Density Cts. Operating Cond}/\text{Density Cts. Cold}}$$

Example:

$$\text{Ratio Factor} = \frac{1 - (9500/10000)}{1 - (90/100) = 0.500}$$

2. Select **Measurement Cfg** from the main menu.
3. Select **Density Comp**.
4. Make sure High Phase is enabled.
5. Select **Ratio Factor** and choose **Edit Variable**. The following screen appears:
6. Enter the new value and click **Change**.



The following table describes the fields on the Density Comp menu.

Item	Description
Enabled	Show the current state of Density Compensation (Yes/No). Enables or Disables the Density Compensation function.
Comp Type	Show the current type of Compensation being used. (Low Phase/ High Phase)
Min Factor	Min Factor is a safeguard to limit the amount of correction the Density Compensation can provide to the indicated level.
Max Factor	Max Factor is a safeguard to limit the amount of correction the Density Compensation can provide to the indicated level.
Ratio Factor	Ratio Factor is used to linearize the change in density compensation signal with the change in level signal.

6. Apply a Curve Correction

The calibration procedure enabled the system to recognize two known points – an actual low level and an actual high level. The intermediate levels were computed based on a linear (straight line) relationship between the two actual points. This linear relationship assumes the radiation field is distributed evenly over the entire range of the vessel.

Unfortunately, however, the system's configuration does not always produce an evenly distributed radiation field. That is to say, things like the size and shape of the vessel, the dynamics of process movement, the geometry and placement of the system components can all interact to produce an uneven distribution of radiation which, in turn, produces a non-linear response. By applying a curve correction through software, a linear relationship can be achieved.

The curve correction procedure entails giving the system a number of additional intermediate points of actual process levels vs. the indicated values from the X96SI/R.

The X96SI/R software permits entry of up to 32 additional intermediate points. This procedure involves varying the process level to cover as much of the full range as possible.

You must first collect the data by observing the status displays for each increment to see the X96SI/R's reading, and compare it to what you know to be the actual level at that increment. It is recommended that you record the detector counts at each interval.

As you observe the X96SI/R reading, record the results in the table below. The first increment (#00) and the last increment (#32) MUST match the values you entered as "zero" and "full" span in the RANGE module.

Number	Actual Level	Indicated Value	Detector Cts
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			

7. Configuring the Auto Cal Feature (Optional)

With a point detector installed, this feature enables the system to automatically perform a calibration each time the process reaches the preassigned level. The Auto Cal feature maintains the accuracy and repeatability of your measurement with little or no effort on the part of the operator.

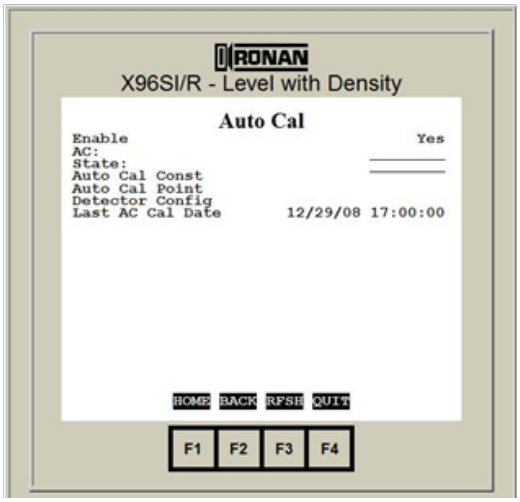
If interior walls of the vessel are prone to abnormal process build-up, enabling the Auto Cal feature is recommended.

To configure the Auto Cal feature, complete the following steps:

1. Map the hardware for each individual detector. See the Hardware Configuration menu to view the mapping. You will need to determine which terminal input is connected to which detector.
2. Decide what elevation each Auto Cal detector is going to represent
3. Decide where the minimum and maximum counts will be for each Auto Cal detector.
4. Determine the Level Detector count window for that Auto Cal point, including Lvl Lo Cts. and Lvl Hi Cts.

Auto Cal Menu

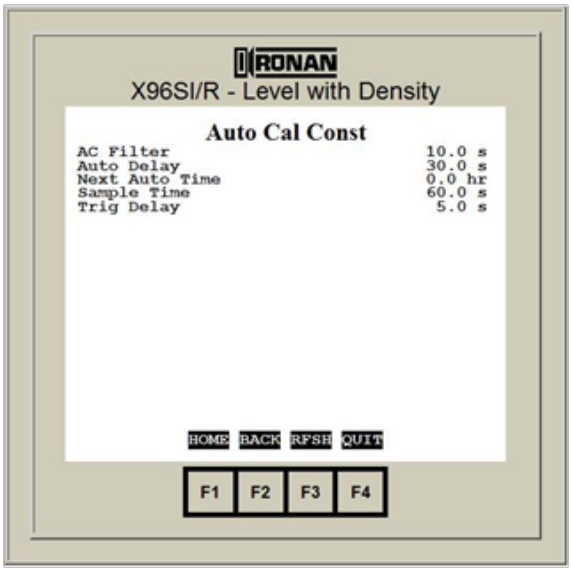
The Auto Cal menu includes the following items:



Auto Cal	Min.	Max.	Default	Description
Enable				Turns the Auto Cal feature on and off.
AC:			____	Summary of auto cal points. Will appear with a _ if is not configured. I if digital Input D if Detector.
State:			____	Summary of auto cal point state. Will appear with a _ if is not configured. N if Normal T if Triggered E if Error
Auto Cal Const				Menu
Auto Cal Point				Menu
Detector Config				Menu

Auto Cal – Auto Cal Const

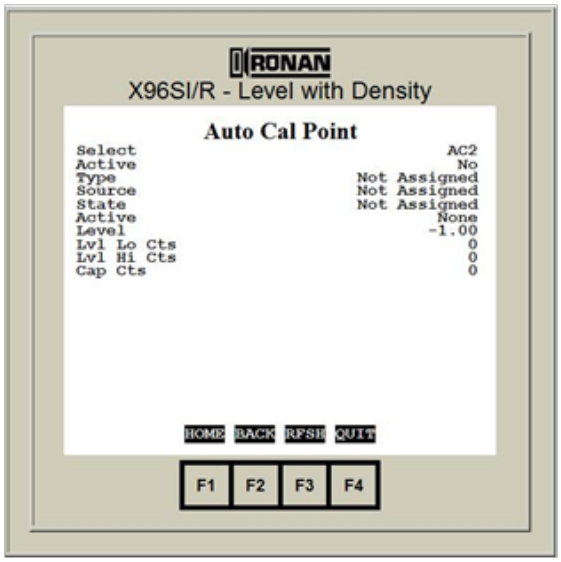
The Auto Cal Const menu includes the following options:



Auto Cal Const	Min.	Max.	Default	Description
AC Filter	0.0	240.0	10.0 s	Time to average auto cal data.
Auto Delay	0.0	120.0	30.0 s	Minimum time between recalibrating at two different auto cal points.
Next Auto Time	0.0	200.0	24.0 hr	Minimum time between recalibrating at the same auto cal point.
Sample Time	0.0	120.0	60.0 s	Amount of time to collect an auto cal sample.
Trig Delay	0.0	120.0	5.0 s	Amount of time to wait to assure that an auto cal point is stable and valid..

Auto Cal – Auto Cal Point

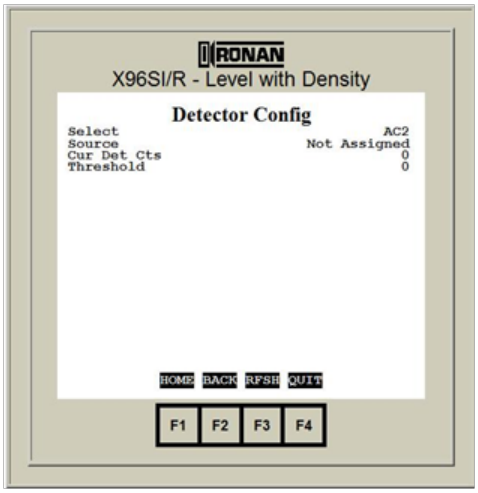
The Auto Cal Point menu includes the following options:



Auto Cal Point	Min.	Max.	Default	Description
Select			AC1	
Active			No	
Type			Digital In	
Source			Not Assigned	
State			Disabled	Current state of Auto Cal point
Error			None	Last error condition.
Level	-999.999	999.999		
Level	-999.99	999.99	0.00	
Lvl Lo Cts	0	5228280	0	Minimum level counts where correction from this Auto Cal point can be applied
Lvl Hi Cts	0	5228280	5228280	Maximum level counts where correction from this Auto Cal point can be applied
Cap Cts	0	5228280	dynamic	Level counts saved when this Auto Cal point was last triggered.
Last AC Cal Date			dynamic	

Auto Cal – Detector Config

The Detector Config menu includes the following options:

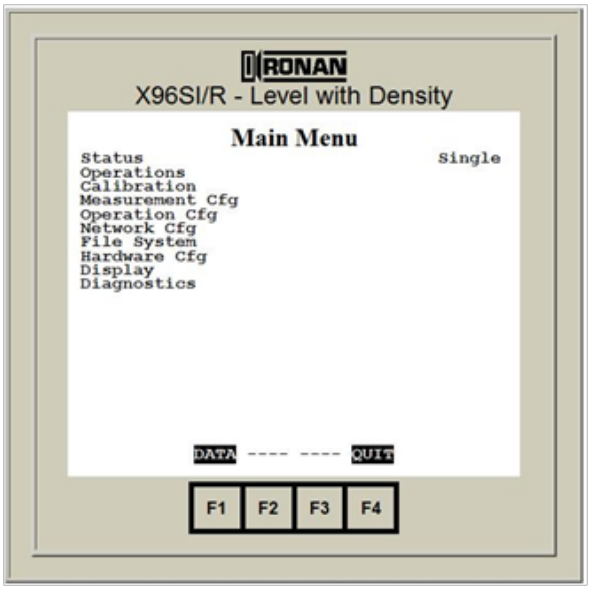


Detector Config	Min.	Max.	Default	Description
Select			AC1	
Source			Not Assigned	The source of the detector.
Cur Det Cts	0	65535	dynamic	
Threshold	0	65535	5000	

Navigating Menus

The system menus allow you to reconfigure the measurement output to meet your own specific process conditions and customized measurement needs. Menus are easily accessible via a web page where menu choices are selected with a click of a mouse and the back and forward buttons move you through the choices. Function keys (F1-F4) perform various navigation functions.

The main menu appears below:



A description of the various navigation buttons is listed below.

Web Browser Buttons

The buttons on your web browser (Internet Explorer, Firefox, etc.) allow you to back up to the previous menu or move forward to the next menu.

F1: Takes you to the Live Data Screen from the Main Menu.

F2: Not active from the Main Menu. Allows you to go back to the Main Menu from the Live Data screen.

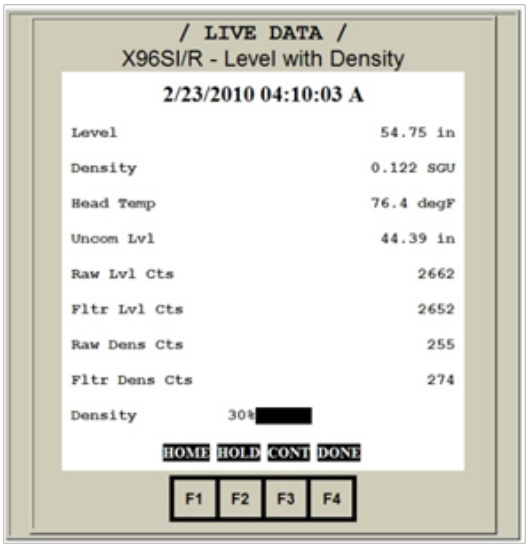
F3: Not active from the Main Menu. From the Live Data screen, allows you to Refresh the counts and information.

F4: Quits the application and closes the menu.

DATA: Takes you to the Live Data Screen.

QUIT: Closes down the application.

The Live Data Screen



The following buttons allow you to navigate from the Live Data Screen which shows current counts and gives you the current status of the system.

HOME (F1): Allows you to go back to the Main Menu from the Live Data screen.

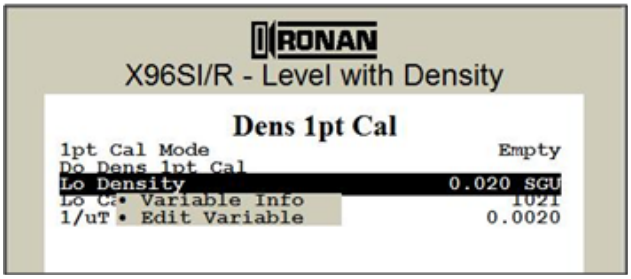
BACK (F2): Takes you back to the Main Menu from the Live Data screen.

RFSH (F3): Refreshes the counts and other information on the Live Data screen.

DONE (F4): Takes you back to the Main Menu from the Live Data screen.

Editing Menu Variables

Numerous menus allow you to view and edit the variables on the menus by accessing sub menus that appear when you highlight that menu option. Choose Variable Info to display read-only information and Edit Variable when you want to change the variable.



Descriptions of the various menus and fields follow:

Status	Description
Single	Normal status for device that has no slaves
Master	Normal status for master device that has slaves
Slave 1	Normal status for first slave device
Slave 2	Normal status for second slave device
Slave 3	Normal status for third slave device
Slave 4	Normal status for fourth slave device
Hardware Error	Contact Ronan service for assistance
Software Error	Contact Ronan service for assistance
Watchdog Timer	Watchdog timer expired
Cycle Time Err	Processing exceeded cycle time
Appl Checksum	Memory checksum on application area is wrong
Mon1 Checksum	Memory checksum on monitor area 1 is wrong
Mon2 Checksum	Memory checksum on monitor area 2 is wrong
IOP Fail	I/O processor is not communicating
IOP Error	I/O processor reports an error
IOP Checksum	I/O processor memory checksum error
Cntr Error	Counter processor reports an error
Cntr Checksum	Counter processor memory checksum error
DB Error	Daughter board error
Not Connected	Network configured as required but not connected
No IP Addr	IP address not unique on the network
Dup IP Addr	IP address not configured
No DHCP	Unable to get IP address from DHCP server
No Name	Network name not configured.
Dup Name	Network name not unique on the network
No IP Addr	Unable to get IP address from DHCP server
No Master	Unable to connect to master
Master Reject	Connection attempt rejected by master
No Slave 1	Unable to connect to slave 1
No Slave 2	Unable to connect to slave 2
No Slave 3	Unable to connect to slave 3
No Slave 4	Unable to connect to slave 4

Descriptions of the various menus and fields follow (Cont'd):

Status	Description
Dup Slave 1	More than 1 device attempting to connect as slave 1
Dup Slave 2	More than 1 device attempting to connect as slave 2
Dup Slave 3	More than 1 device attempting to connect as slave 3
Dup Slave 4	More than 1 device attempting to connect as slave 4
Slave 1 No Cfg	Slave 1 is not configured but attempting to connect
Slave 2 No Cfg	Slave 2 is not configured but attempting to connect
Slave 3 No Cfg	Slave 3 is not configured but attempting to connect
Slave 4 No Cfg	Slave 4 is not configured but attempting to connect
Det 1 Fail	Detector 1 failed
Det 2 Fail	Detector 2 failed
Det 3 Fail	Detector 3 failed
Det 4 Fail	Detector 4 failed
Det 5 Fail	Detector 5 failed
Det 6 Fail	Detector 6 failed
Det 7 Fail	Detector 7 failed
Det 8 Fail	Detector 8 failed
Det 9 Fail	Detector 9 failed
Det 10 Fail	Detector 10 failed
Det 11 Fail	Detector 11 failed
Det 12 Fail	Detector 12 failed
Det 13 Fail	Detector 13 failed
Det 14 Fail	Detector 14 failed
Det 15 Fail	Detector 15 failed
Rad Disc	Radiation Disc triggered
Empty Clamp	Empty Clamp triggered
File Sys Err	File system error
No File Sys	File System configured as required but no memory card
Battery Low	RTC battery needs to be replaced
Under Temp	Electronics temperature too low
Over Temp	Electronics temperature too high
Cfg Bad	Configuration is invalid. Contact Ronan service for assistance.
Cfg Incomplete	Configuration is not sufficient for gauge operation. Contact Ronan service for assistance.
Missing Cal	A configured device (detector, etc.) is not calibrated

Operations Menu

The Operations menu controls the processing of the level data. It contains the following items and additional menus:

Operations	Min.	Max.	Default	Description
Filtering				Configures the parameters associated with the weight measurement.
Variable Ranges				Configures the ranges for numerous variables.
Scan Time	200	6000	400 ms	Time for a cycle (input, calc, and output).

Filtering Menu

The Filtering menu (shown below) is used to configure the parameters associated with either the Level or Density measurement. There are two types of filtering: RC Filter and Walking Avg.

RC Filter

The RC is a low pass filtering algorithm that combines a fraction of the current measurement with a fraction of the previous measurement to remove random (high frequency) noise.

Walking Average Filter

The Walking Average filter algorithm is a type of digital low pass filter. The filter works by:

- Keeping a list of the last N measurements.
- Each cycle, the oldest measurement is discarded and the new measurement is added to the list.
- All the values in the list are added together and divided by N (the number of items in the list) to form the average.

If Dynamic Tracking is enabled, the Slow Ctr, the Medium TC, the Fast Ctr., and the Fast TC will be used as part of the First Order Filter. It then works as a 3-stage filter. If the detector count variation exceeds the Sigma value, the next level of filtering is activated. For example, a detector with stable counts uses a Slow Filter. If the detector counts become unstable, the Medium Filter is used. If the detector counts remain unstable, a Fast Filter is used.

Filtering	Min.	Max.	Default	Description
Filter			Level	Selects variable for filter configuration: Level or Density.
Type			RC 1st Order	Shows the type of filtering averaging the system is using (RC, 1st order, Walking avg).
Dyn Track			Disable	Shows the current state of the dynamic tracking filter (enabled or disabled) and allows the user to change the state. If disabled the filter uses only the Slow Time Constant.
Sigma	0.00	20.00	3.00	Shows the (sigma) multiplier used to determine maximum number of raw counts variation (for scintillation) that the input can vary from the current filtered counts before changing to the dynamic filter. Sigma is the square root of the current filtered counts. The user is able to change this number. Note: Increasing the value decreases the sensitivity to the signal variation.
Fast TC	0	210	1	Fast Time Constant value to be used when the Fast Counter reaches zero.
Fast Ctr	0	20	3	Shows the fast count down counter value. If gauge has been in dynamic tracking long enough to be using Medium filter and the raw counts continued to exceed the sigma value, the fast counter value is decreased each consecutive scan. The Fast counter value resets and returns back to the original value if the raw counts do not continue to exceed the sigma value. Once the Fast TC is triggered, it will continue to be used until the counts are within the sigma value for the Fast counter number of times consecutively. Also allows user to change this number.
Medium TC	0	210	3	Medium Time Constant value to be used when the Slow Counter reaches zero.
Slow TC	0	210	5	Slow Time Constant value to be used if the Slow Counter has not reached zero. Used under two conditions: If Dynamic Tracking is disabled or the detector variations are less than the Sigma value.
Slow TC	0	600		Slow Time Constant value to be used if the Slow Counter has not reached zero.

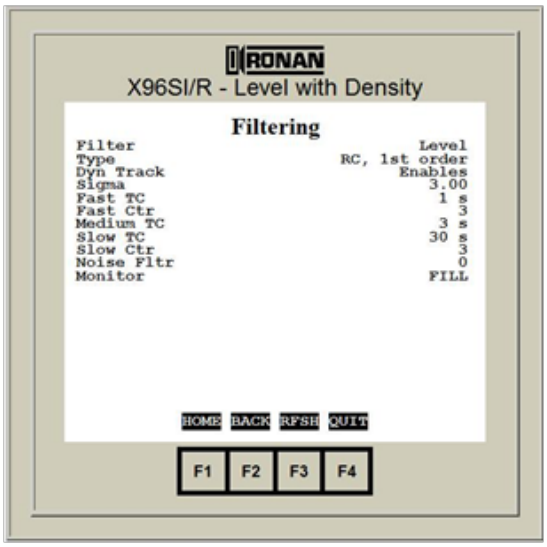
[1]The two fractions add up to 1.

[2]The typical implementation does this addition by subtracting the oldest value that is being discarded and adding the new value to the previous sum of the list.

Filtering (Cont'd)

Filtering	Min.	Max.	Default	Description
Slow Ctr	0	20	3	Shows the slow countdown counter value. If gauge is in dynamic tracking, and the raw counts continued to exceed the sigma value, the slow counter value is decreased each consecutive scan. The Slow counter value resets and returns back to the original value if the raw counts do not continue to exceed the sigma value. Also allows user to change this number.
Noise Filter	0	32	2	Shows the maximum number of potentially erroneous measurements in a row to bridge before deciding that a step change has occurred in the weight value. Also it allows user to change this number. Erroneous measurement is defined when the raw signal is 4 times the pre-selected sigma multiplier by the user.
Monitor			NOT INIT	Shows the current state of the filtering.

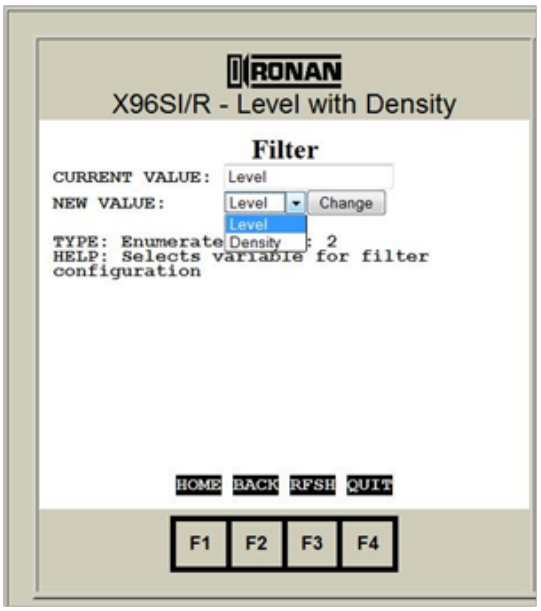
The Filter Menu



Change Filter Value

The Filter field allows you to select either Level or Density for the filtering.

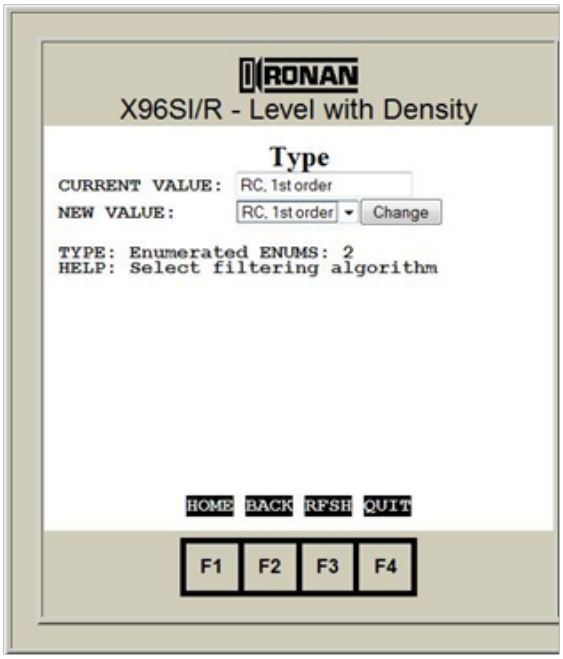
1. To change the filter from Level to Density or vice versa, highlight Filter from the Filtering menu and click Edit Variable.
2. Select Level or Density from the drop-down menu. Click Change.



Change Filter Type

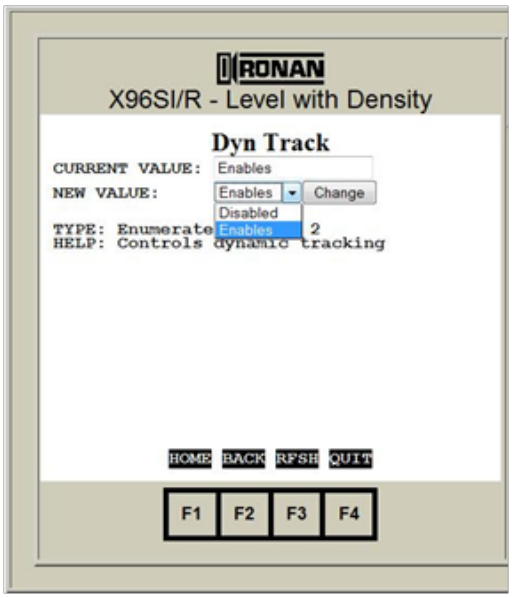
There are two types of filtering: RC Filter and Walking Average. This menu allows you to change the type of filtering to be performed.

1. To change the type of filtering averaging the system is using (RC, 1st order, Walking avg.), highlight Type from the Filter menu and click Edit Variable.
2. Select RC, 1st order or Walking Avg. from the drop-down menu. Click Change.



Enable/Disable Dynamic Tracking

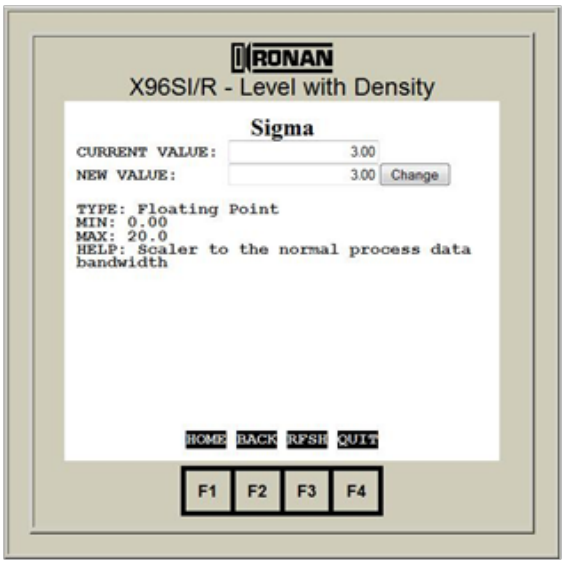
1. To enable/disable Dynamic Tracking, highlight Dyn Track from the Filter menu and click Edit Variable.
2. Choose Enable or Disabled from the drop-down menu and click Change.



Edit Value for Sigma

Sigma is the square root of the current filtered counts. Users should be aware that increasing the value decreases the sensitivity to the signal variation.

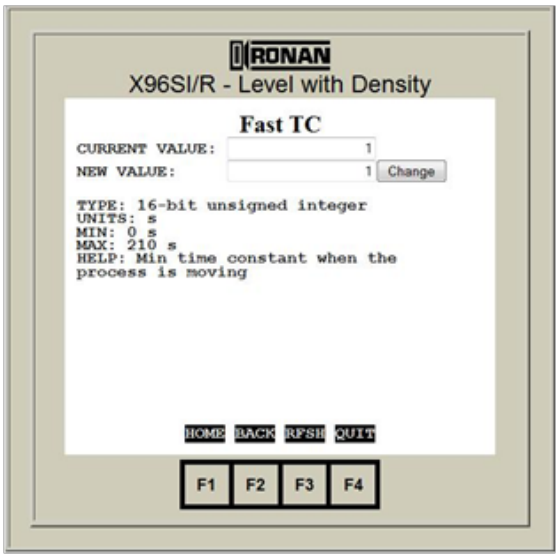
1. To change the value for Sigma, highlight Sigma from the Filter menu and click Edit Variable.
2. Type in the new value and click Change. (NOTE: The maximum value is 20.00)



Change Fast Time Constant

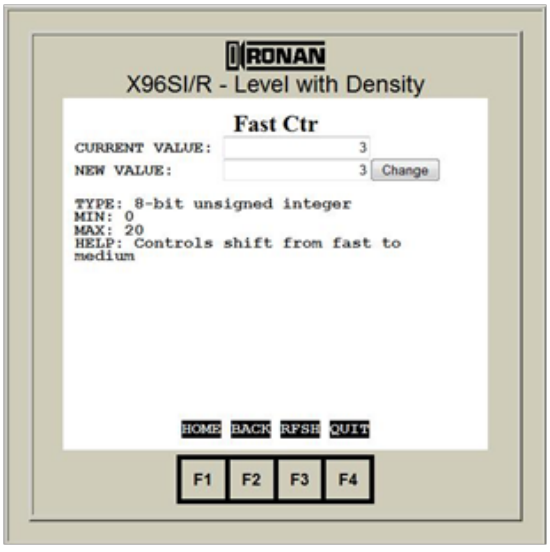
The Fast Time Constant is the value to be used when the Fast Counter reaches zero.

1. To change the value for the Fast Time Constant, highlight Fast TC from the Filter menu and click Edit Variable.
2. Type in the new value and click Change. (NOTE: The maximum time is 210)



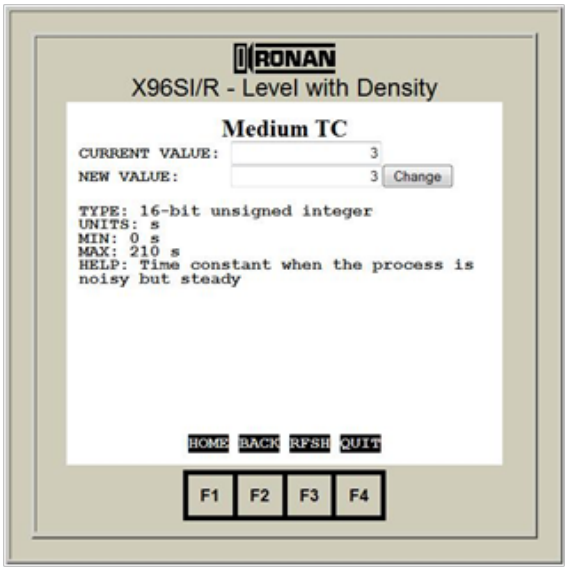
Change Fast Counter

1. To change the value for the Fast Counter, highlight Fast Ctr from the Filter menu and click Edit Variable.
2. Type in the new value and click Change. (NOTE: The maximum time is 20.)



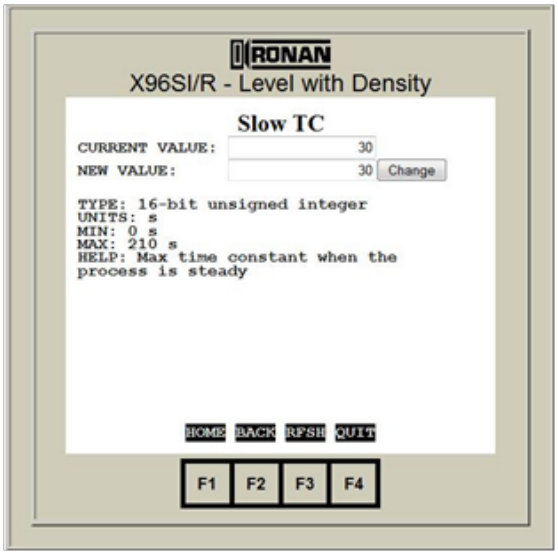
Change Medium Time Constant

1. To change the value for the Medium Time Constant, highlight Medium TC from the Filter menu and click Edit Variable.
2. Type in the new value and click Change. (NOTE: The maximum time is 210.)



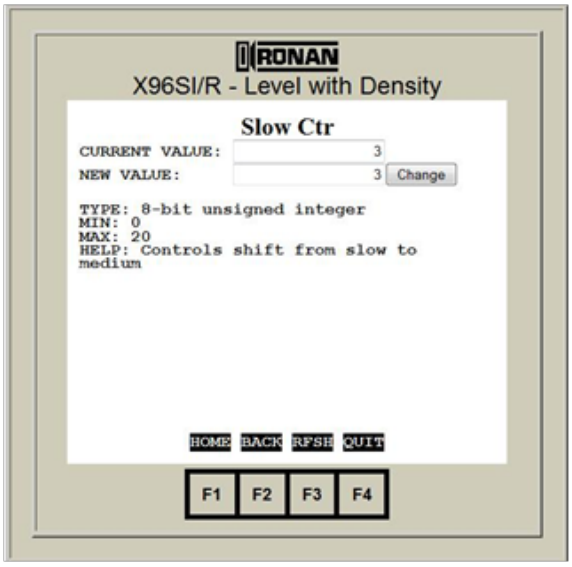
Change Slow Time Constant

1. To change the value for the Slow Time Constant, highlight Slow TC from the Filter menu and click Edit Variable.
2. Type in the new value and click Change. (NOTE: The maximum time is 600)



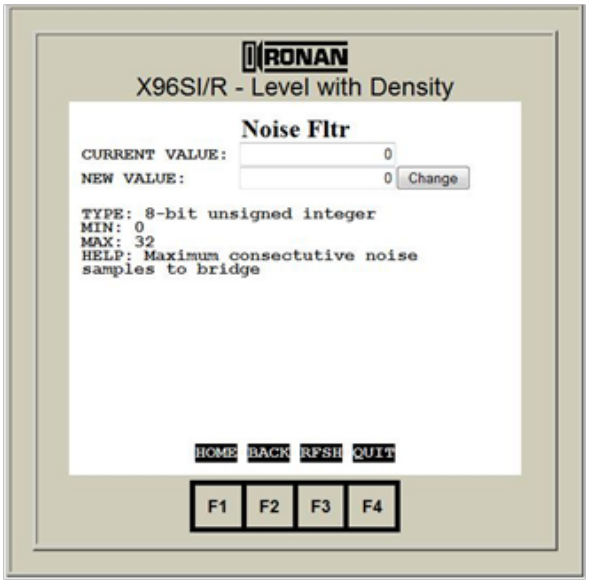
Change Slow Counter

1. To change the value for the Slow Counter, highlight Slow Ctr from the Filter menu and click Edit Variable.
2. Type in the new value and click Change. (NOTE: The maximum time is 20.)



Change Noise Filter

1. To change the value for the Noise Filter, highlight Noise Fltr from the Filter menu and click Edit Variable.
2. Type in the new value and click Change. (NOTE: The maximum value is 32.)



View Monitor

1. To view the settings for the Monitor, choose Monitor from the Filter menu.
2. View the settings.

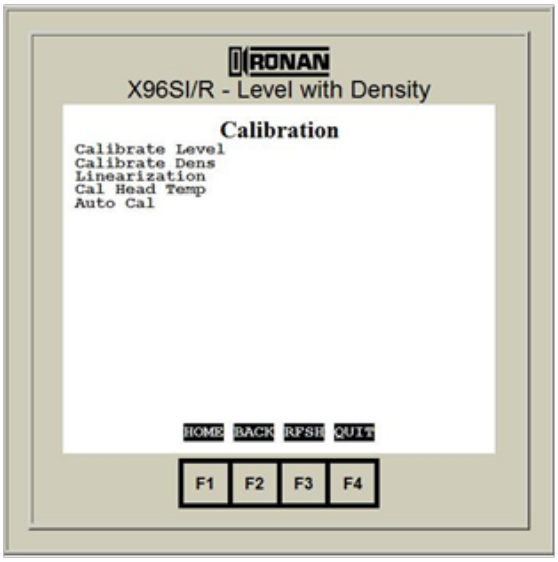
Variable Ranges Menu

The Variable Ranges menu allows you to view and change the ranges for the following items:

Variable Ranges	Description
Level Range	Shows the current ranges to be used if the Level is mapped to an analog output.
Density Range	Shows the current values of the Density ranges.
Head Temp Range	Shows the current value of the Head Temp ranges.
Counter Ranges	Shows the current value of the Counter ranges.

2.0 Calibration Menu

This menu is used to view and control the calibration of the X96SI/R Level with Density Compensation Gauge. It contains the following items:



View Monitor

1. To view the settings for the Monitor, choose Monitor from the Filter menu.
2. View the settings.

Variable Ranges Menu

The Variable Ranges menu allows you to view and change the ranges for the following items:

Calibration	Description
Calibrate Level	Takes you to the menus that allow you to perform a Level Calibration.
Calibrate Dens	Allows you to view and control the calibration of the X96SI/R Density portion of the Gauge.
Cal Head Temp	A set of menus that are used to configure and calibrate the detector's temperature. Used primarily in high-temperature applications where the temperature exceeds the electronics temperature specifications.
Linearization	These menu options are used to control the linearization mechanism. The linearization table contains thirty-two entries, numbered 1 through 32. Each entry consists of a measured value, an actual value, and a flag that indicates if the entry is used.
Auto Cal	These menu options are used to view and set up the Auto Calibration for the X96SI/R Level with Density Compensation Gauge. (Requires a point detector.)

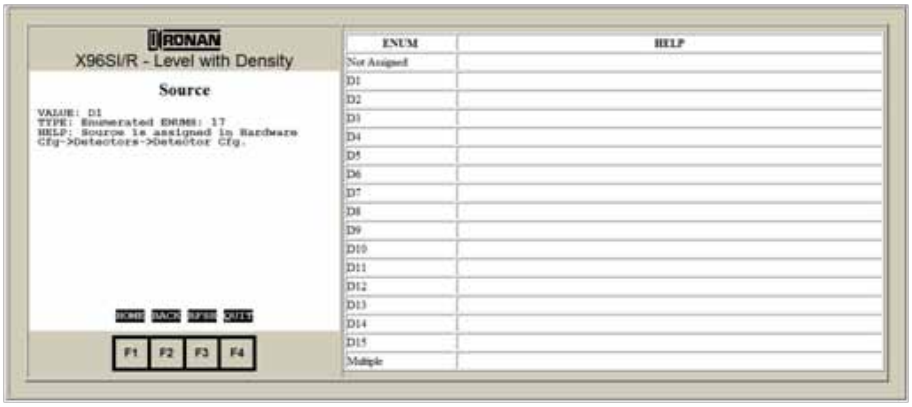
2.1 Calibrate Level

This menu is used to view and control the calibration of the X96SI/R Level portion of the Gauge.

Calibrate Level	Min.	Max.	Default	Description
Source			D1	Source is assigned in Hardware Cfg->Detectors->Detector Cfg.
State			Uncalibrated	Shows the state of the level configuration process.
Level	-1.00	999.99	dynamic	Shows and allows the user to set the calibration to the level of the process.
Level Cal Const			menu	The criteria for a valid Level Calibration
Level Cal			menu	Shows and allows the user to set the calibration to the level of the process.
Backgr. Cts	0	65535	0	Value to subtract from raw counts.
Clear Level Cal			method	This item invokes a method that clears the level low reference and high calibration. This allows the user to start over with out any stored reference or calibrated values.
Last Cal Date			dynamic	Shows the date for the last time a calibration was performed.

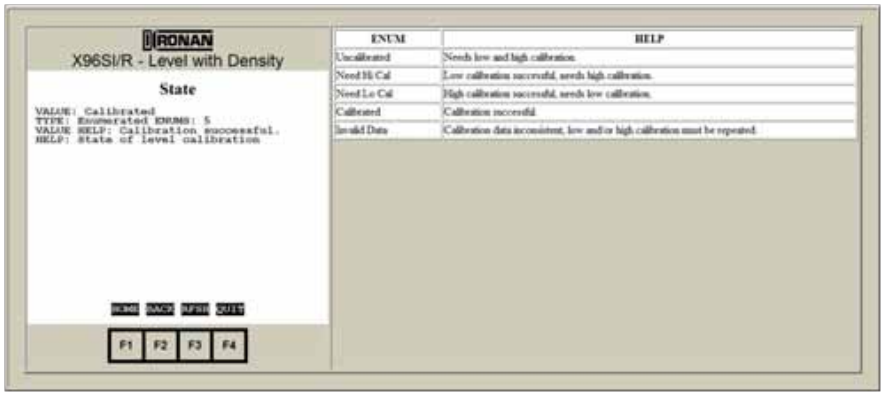
Calibrate Level – Source

The Calibrate Level – Source screen allows you to view the source of the detectors as assigned in the Hardware Cfg->Detectors->Detector Cfg menu.



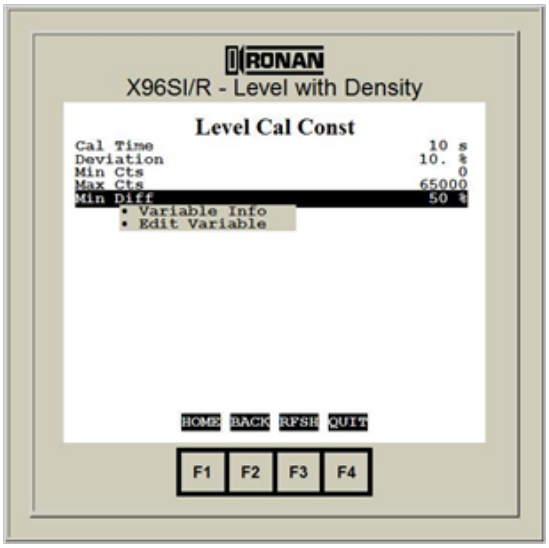
Calibrate Level – State

The Calibrate Level – State screen displays the state of the level calibration.



Calibrate Level – Level Cal Const

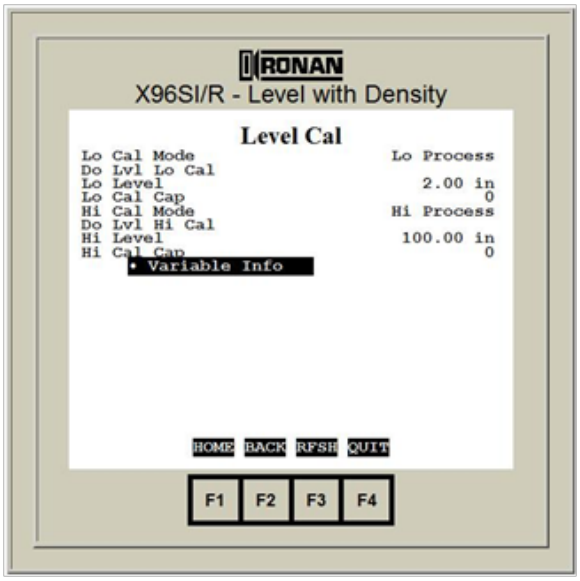
The Level Cal Const screen menu allows you to view and configure the following items:



Level Cal Const	Min.	Max.	Default	Description
Cal Time	1	9999	60s	Number of seconds of samples to accumulate to determine cal value.
Deviation	0.0	100.0	10.0	Maximum deviation that can occur during calibration without invalidating the measurement.
Min Cal Cts	0	10000	0	Minimum counts below which gauge will not calibrate.
Max Cal Cts	1000	5228280	160000	Maximum counts above which gauge will not calibrate.
Max Cal Cts	1000	65535		Maximum counts above which gauge will not calibrate.
Min Diff	10	100	50%	Minimum difference between hi and low captured counts.

Calibrate Level – Level Cal

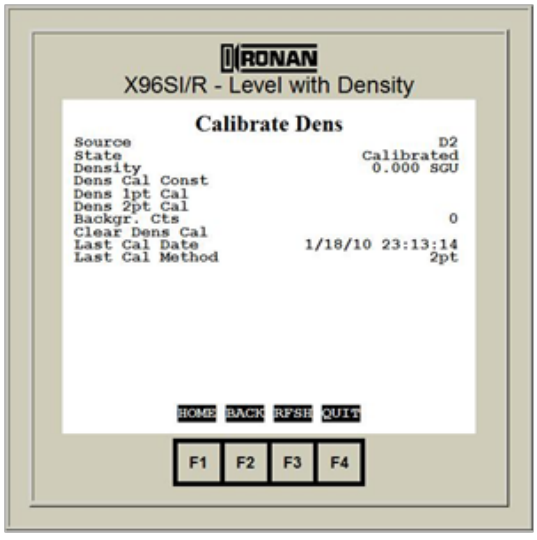
The Calibrate Level – Level Cal menu includes the following items:



Level Cal	Min.	Max.	Default	Description
Lo Cal Mode			Empty	Selects measurement condition used to establish the low calibration value.
Do Lvl Lo Cal			method	
Lo Level	-999.999	999.999		
Lo Level	-1.00	999.99	0.00	
Lo Level	-1.00	999.99		
Lo Cal Cap	0	5228280	dynamic	
Lo Cal Cap	0	65535		
Hi Cal Mode			Full	Selects measurement condition used to establish the high calibration value
Do Lvl Hi Cal			method	
Hi Value	-999.999	999.999		
Hi Value	-1.00	999.99	120.00	
Hi Value	-1.00	999.99		
Hi Cal Cap	0	5228280	dynamic	
Hi Cal Cap	0	65535		

2.2 Calibrate Density

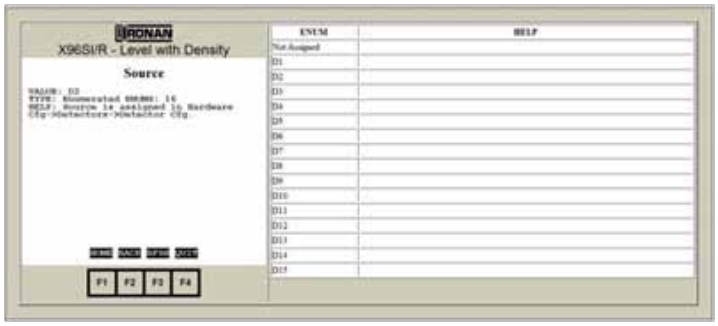
This menu is used to view and control the calibration of the X96SI/R Density portion of the Gauge. It contains the following items:



Calibrate Dens	Min.	Max.	Default	Description
Source			D2	Source is assigned in Hardware Cfg->Detectors->Detector Cfg.
State			Uncalibrated	Shows the state of the level configuration process.
Density	-1.000	999.999	dynamic	
Dens Cal Const			menu	The criteria for a valid Density Calibration.
Dens 1pt Cal			menu	Selecting this item takes the user to the Dens 1pt Cal menu.
Dens 2pt Cal			menu	Selecting this item takes the user to the Dens 2pt Cal menu.
Backgr. Cts	0	65535	0	Value to subtract from raw counts.
Clear Dens Cal			method	This item invokes a method that clears the level low reference and high calibration. This allows the user to start over without any stored reference or calibrated values.
Last Cal Date			dynamic	Displays the date for the last time a calibration was performed.
Last Cal Method			None	Displays the last calibration method used (e.g. 1 pt., 2 pt.)

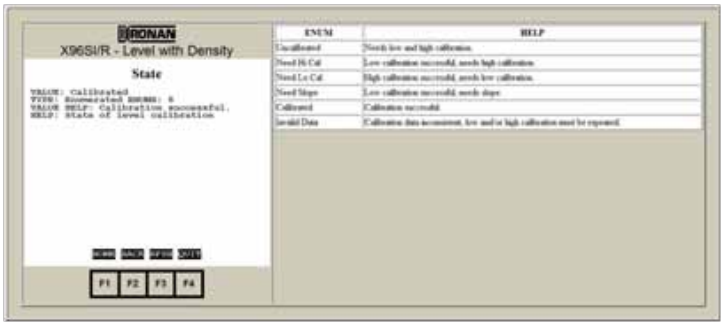
Calibrate Density – Source

The Calibrate Density – Source screen allows you to view the source of the detectors as assigned in the Hardware Cfg->Detectors->Detector Cfg menu.



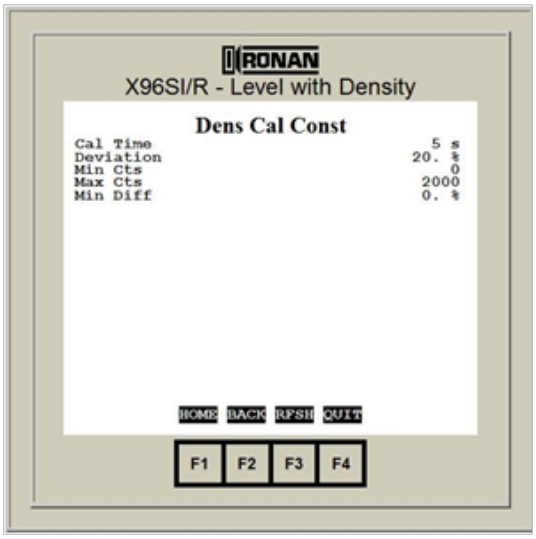
Calibrate Density – State

The Calibrate Density – State screen displays the current state of density calibration.



Calibrate Density – Dens Cal Const

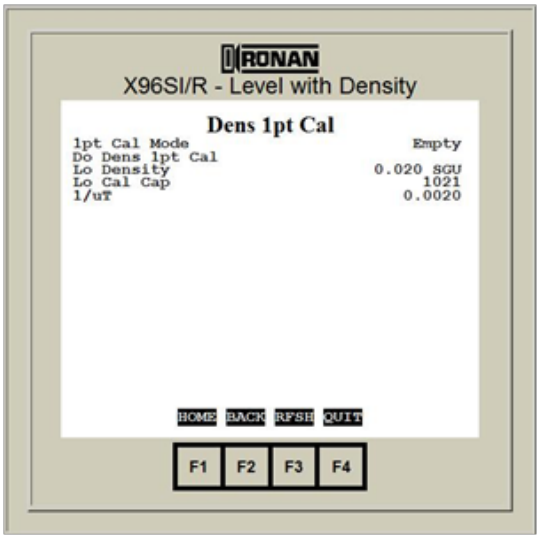
The Dens Cal Const menu includes the following items:



Dens Cal Const	Min.	Max.	Default	Description
Cal Time	1s	9999s	60s	Number of seconds of samples to accumulate to determine cal value.
Deviation	0.0	100.0	10.0	Maximum deviation that can occur during calibration without invalidating the measurement.
Min Cal Cts	0	10000	0	Minimum counts below which gauge will not calibrate.
Max Cal Cts	1000	65535	65535	Maximum counts above which gauge will not calibrate.
Min Diff	2	100	10%	Minimum difference between hi and low captured counts.

Calibrate Density – Dens 1pt Cal

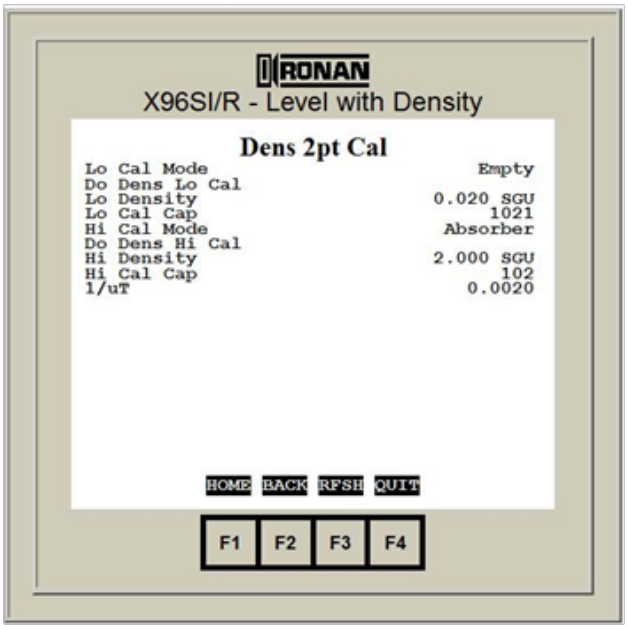
The Calibrate Density – Dens 1pt Cal menu includes the following items:



Dens 1pt Cal	Min.	Max.	Default	Description
1pt Cal Mode			Empty	Selects measurement condition used to establish the low calibration value.
Do Dens 1pt Cal			method	
Lo/1pt Value	0.000	9999.999	0.001	
Lo/1pt Cal Cap	0	65535	dynamic	
1/uT	0.0001	9.9999	0.5422	

Calibrate Density – Dens 2pt Cal

The Calibrate Density – Dens 2pt Cal menu includes the following items:



Dens 2pt Cal	Min.	Max.	Default	Description
Lo Cal Mode			Empty	Selects measurement condition used to establish the low calibration value.
Do Dens Lo Cal			method	
Lo/1pt Value	0.000	9999.999	0.001	
Lo/1pt Cal Cap	0	65535	dynamic	
Hi Cal Mode			Process	Selects measurement condition used to establish the high calibration value.
Do Dens Hi Cal			method	
Hi Value	0.0000	999.999	0.200	
Hi Cal Cap	0	65535	dynamic	
1/uT	0.0001	9.9999	0.5422	

2.3 Linearization

The X96SI/R is capable of performing a multi-point linearization of the level data when required by an application. The linearization table contains thirty-two entries, numbered 1 through 32. Each entry consists of a measured value, an actual value, and a flag that indicates if the entry is used . The Linearization menu controls the linearization mechanism and contains the following items:

Linearization	Description
Enable	Enable to permit linearization
L1-L8:	Summary of table entries 1 through 8. _ if entry not used, U if used.
L9-L16:	Summary of table entries 9 through 16. _ if entry not used, U if used.
L17-L24:	Summary of table entries 17 through 24. _ if entry not used, U if used.
L25-L32:	Summary of table entries 25 through 32. _ if not used, U if used.
Set Lin Point	Used to set the lin point.
Clear Table	Clears the table.
Sort Table	Sorts the table.

2.4 Calibrate Head Temp

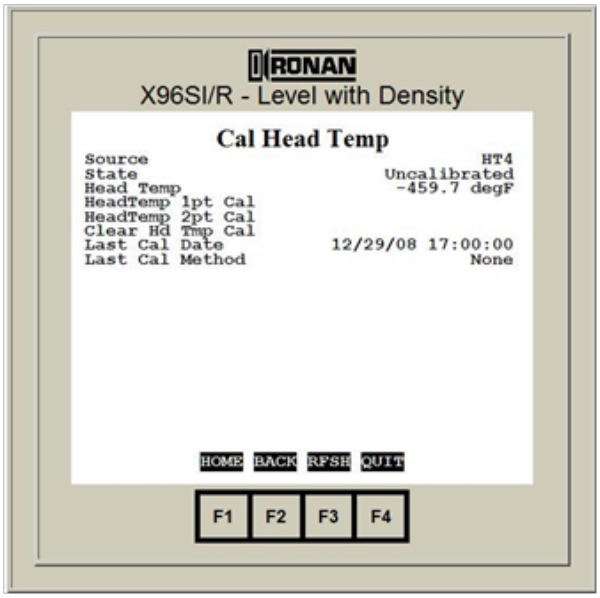
The Calibrate Head Temp menu is used to configure the parameters associated with the detector’s temperature. This function is used primarily in high-temperature applications where the temperature exceeds the electronics temperature specifications. It contains the following items.

Note:
Normally this feature will be precalibratred at the factory and further editing should not be necessary. Call Ronan Service for assistance.

2.4 Calibrate Head Temp

The Calibrate Head Temp menu is used to configure the parameters associated with the detector's temperature. This function is used primarily in high-temperature applications where the temperature exceeds the electronics temperature specifications. It contains the following items.

Note:
Normally this feature will be precalibratred at the factory and further editing should not be necessary. Call Ronan Service for assistance.



Cal Head Temp	Min.	Max.	Default	Description
Source			HT1	
State			Uncalibrated	
Head Temp	-70.0	225.0	dynamic	
Head Temp 1Pt Cal			menu	
Head Temp 2pt Cal			menu	
Clr Head Temp Cal			method	
Last Cal Date			dynamic	
Last Cal Method			None	

[3]Not all of the entries need to be used and the entries do not need to be used in any particular order.

3.0 Measurement Configuration Menu

The Measurement Configuration menu contains the following items:

Measurement Cfg	Description
Density Comp	This function will modify, or adjust, the current level based on the signal received from the density compensation detector being used to measure the density.
Head Temp Comp	The Head Temp Comp menu is used to configure the parameters associated with the detector electronics temperature measurement. This function is used primarily in high-temperature applications where the temperature exceeds the electronics temperature specifications.
Rad Disc	When the radiation level is too high, multiple pulses may occur so close together that they appear to be a single pulse. When the radiation level is extremely high, pulses may merge to such an extent as to make the pulse count be very low or even zero. This menu allows you to display and change the parameters for the Radiation Discriminator.

Configuring the Radiation Discriminator Feature (Optional)

Ronan's Radiation Discriminator feature is designed to permit normal level outputs operation during temporary periods of large, external radiation fields. It employs a separate detector outside the field of the source used for the level gauge itself.

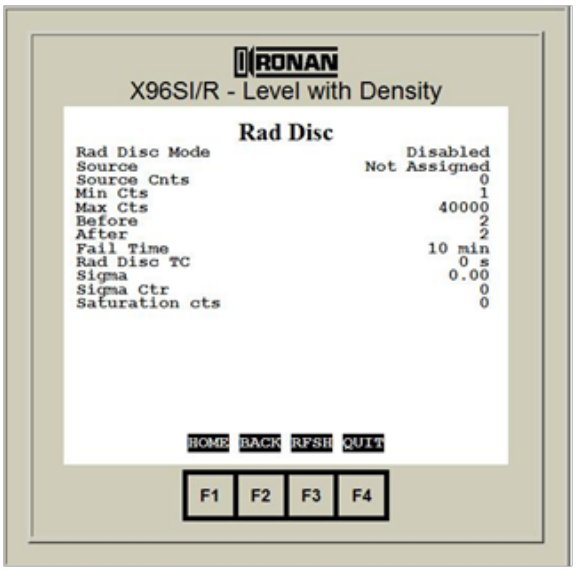
This feature will detect up to two separate conditions: radiation discriminator detector saturation, and a sigma external field. Radiation fields above the maximum for the Radiation Discriminator detector will cause the detector to go into saturation and drop its output to zero. This condition effectively disables the input to the Radiation Discriminator function and causes the system to freeze the level output until the high field is removed and the detector recovers.

When an external field is applied to the Radiation Discriminator detector (and consequently the level detector), the outputs of both will increase. When the output of the Radiation Discriminator detector increases above the calculated threshold and remains there for a number of consecutive scans, the Radiation Discriminator function will trigger. When triggered, the function will freeze the level output.

When the Radiation Discriminator detector's output drops below the sigma threshold, the alarm condition will cease.

The Rad Disc menu includes the following menu items which are described below:

The Rad Disc menu includes the following menu items which are described below:



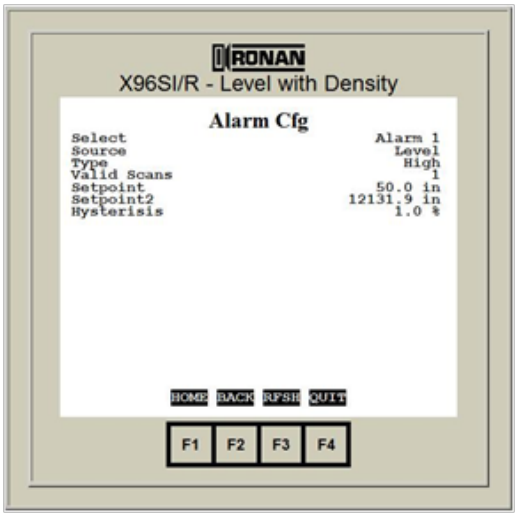
Rad Disc	Description
Rad Disc TC	The amount of RC filtering used to determine the Background average. This filter is not used on the raw detector signal.
Sigma	Multiplier used to determine the threshold to activate the Rad Disc.
Sigma Counter	The number of consecutive scans the raw counts must be above the threshold before the Rad Disc is activated.
Saturation Counts	The minimum counts the Rad Disc detector must be above. During X-raying, the detector can become saturated because of high radiation fields causing the output to appear as low counts. If the Rad Disc detector falls below this value, the Rad Disc is activated until the Rad Disc detector returns to normal.

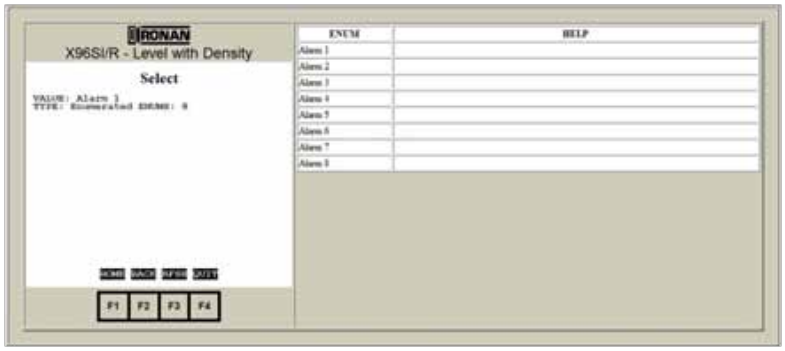
4.0 Operation Configuration Menu

The Operation Configuration menu is used to access the menus and variables that control the processing of the level data. It contains the following items:

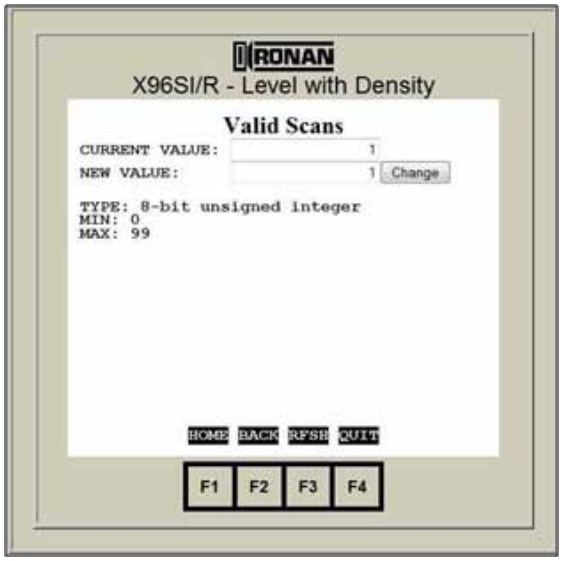
Operation Cfg	Description
Variables	Displays and allows you to configure numerous system variables.
Alarm Cfg	The Alarm Cfg menu is used to configure the parameters associated with the analog alarms 1-8 and the 4-20mA alarm.
4-20 Alarm	Allows the user to control the 4-20mA output during certain types of alarms.
Detector Fault	Provides an alarm that can be assigned to the Digital outputs if the detector counts fall outside the predetermined range based on the min. and max. values the user defines.

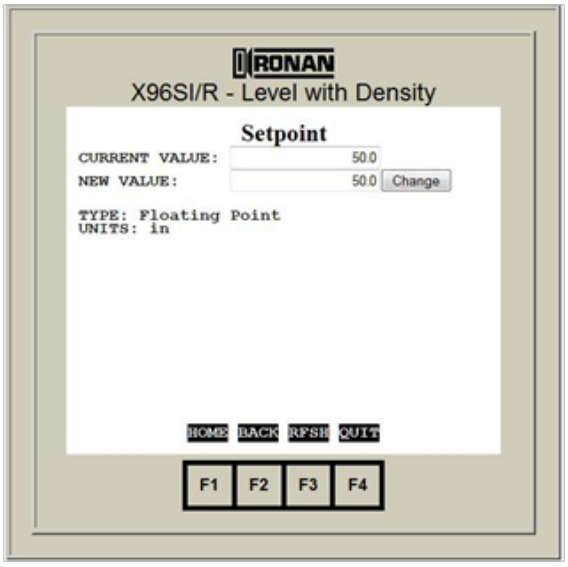
Configuring Alarms

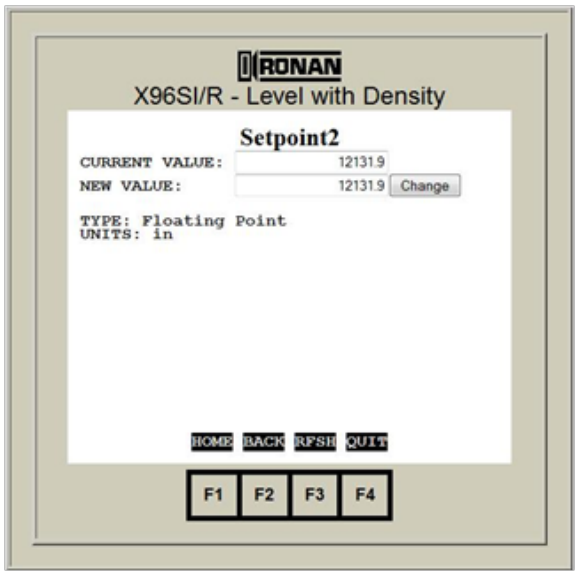




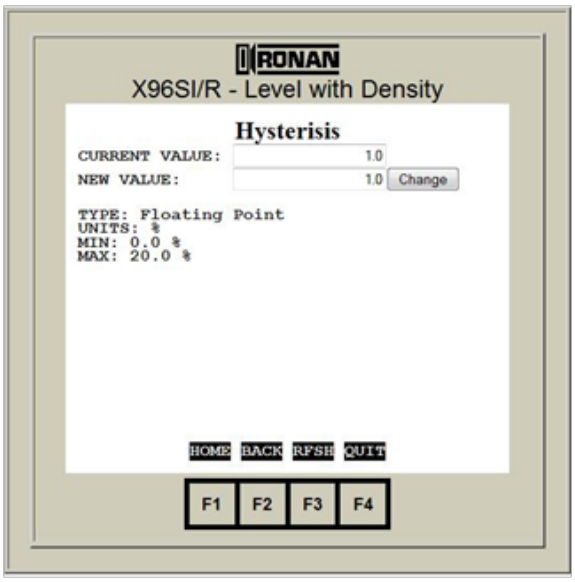
Configuring Alarms (Cont'd)





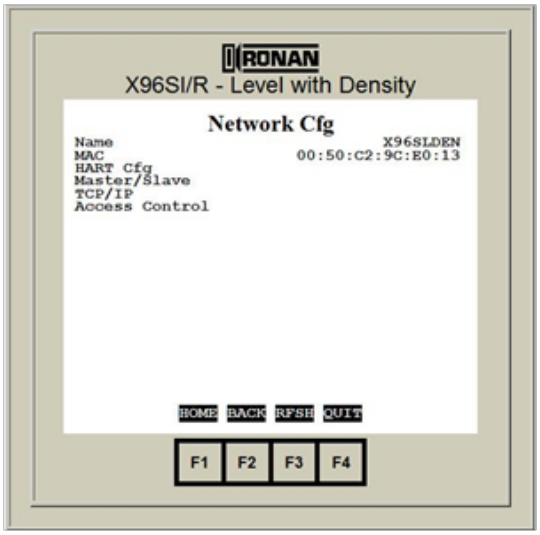


Configuring Alarms (Cont'd)

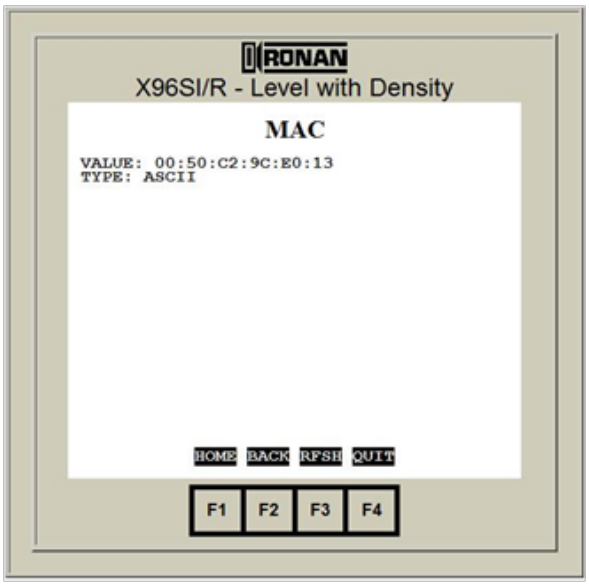


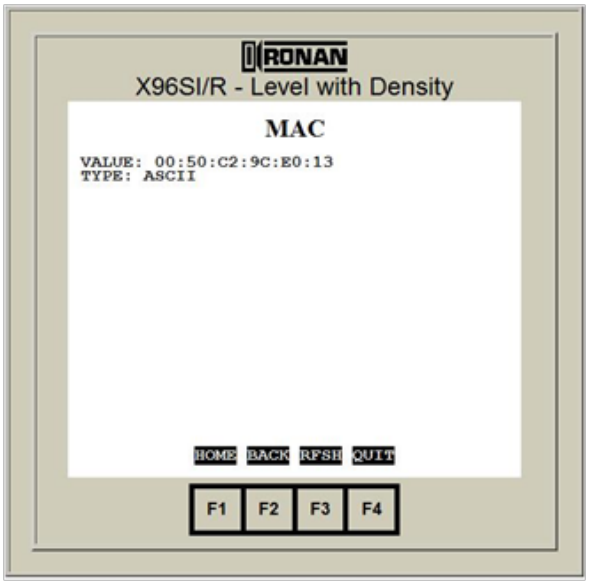
5.0 Network Configuration Menu

The Network Configuration menu allows you to configure the network options for accessing the X96SI/R system. It includes the following items:

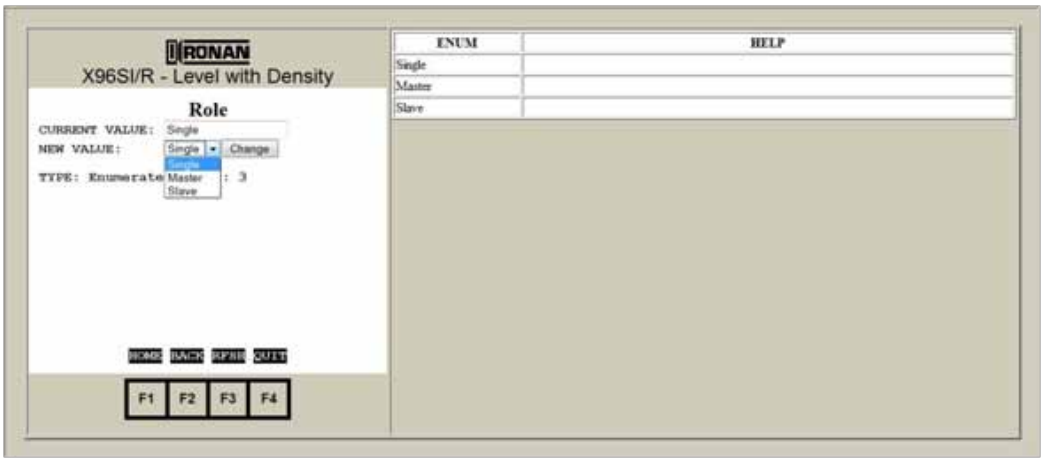


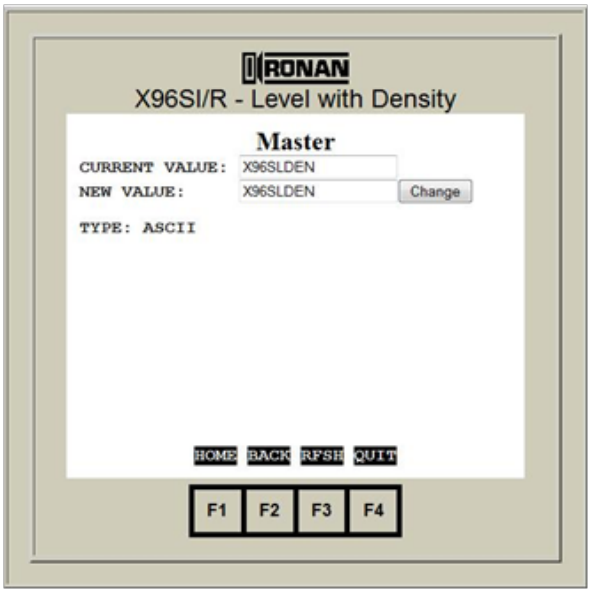
Network Cfg	Default	Description
Name	X96SLDEN	Both node name (LAN) and field bus (HART) name.
MAC		The Machine Access address.
HART CFG	menu	Used to configure the HART communication options.
Master/Slave	menu	Configures the Master/Slave options.
TCP/IP	menu	Used to configure the TCP/IP options.
Access Control	menu	Used to configure the access control options.

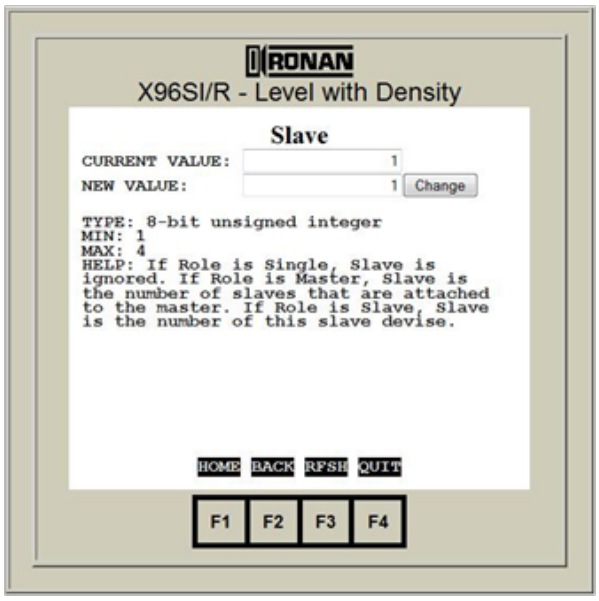

RONAN
X96SI/R - Level with Density
MAC
VALUE: 00:50:C2:9C:E0:13
TYPE: ASCII
HOME BACK RFSH QUIT
F1 F2 F3 F4

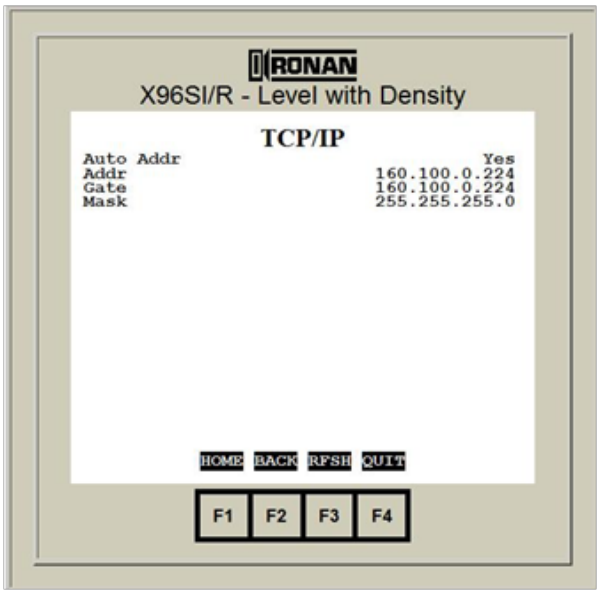

RONAN
X96SI/R - Level with Density
MAC
VALUE: 00:50:C2:9C:E0:13
TYPE: ASCII
HOME BACK RFSH QUIT
F1 F2 F3 F4

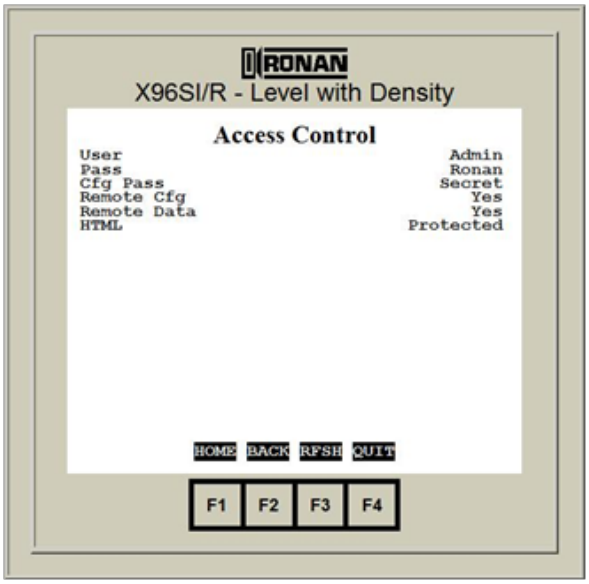
RONAN
X96SI/R - Level with Density
Master/Slave
Role
Master
Slave
Single
X96SLDEN
1
HOME BACK RFSH QUIT
F1 F2 F3 F4


RONAN
X96SI/R - Level with Density
Role
CURRENT VALUE: Single
NEW VALUE: Single Change
Single
Master
Slave
TYPE: Enumerate : 3
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM
HELP
Single
Master
Slave


RONAN
X96SI/R - Level with Density
Master
CURRENT VALUE: X96SLDEN
NEW VALUE: X96SLDEN Change
TYPE: ASCII
HOME BACK RFSH QUIT
F1 F2 F3 F4

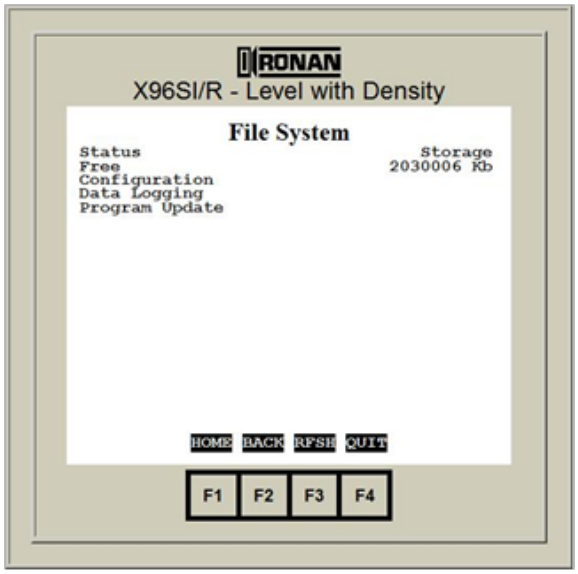

RONAN
X96SI/R - Level with Density
Slave
CURRENT VALUE: 1
NEW VALUE: 1 Change
TYPE: 8-bit unsigned integer
MIN: 1
MAX: 4
HELP: If Role is Single, Slave is ignored. If Role is Master, Slave is the number of slaves that are attached to the master. If Role is Slave, Slave is the number of this slave devise.
HOME BACK RFSH QUIT
F1 F2 F3 F4


RONAN
X96SI/R - Level with Density
TCP/IP
Auto Addr Yes
Addr 160.100.0.224
Gate 160.100.0.224
Mask 255.255.255.0
HOME BACK RFSH QUIT
F1 F2 F3 F4


RONAN
X96SI/R - Level with Density
Access Control
User Admin
Pass Ronan
Cfg Pass Secret
Remote Cfg Yes
Remote Data Yes
HTML Protected
HOME BACK RFSH QUIT
F1 F2 F3 F4

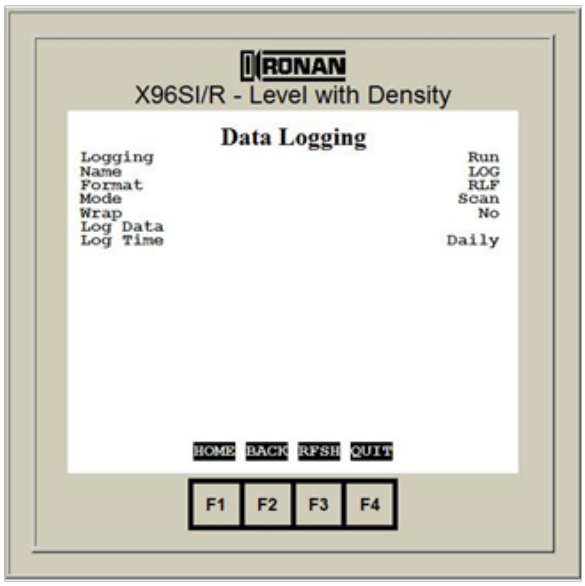
6.0 File System Menu

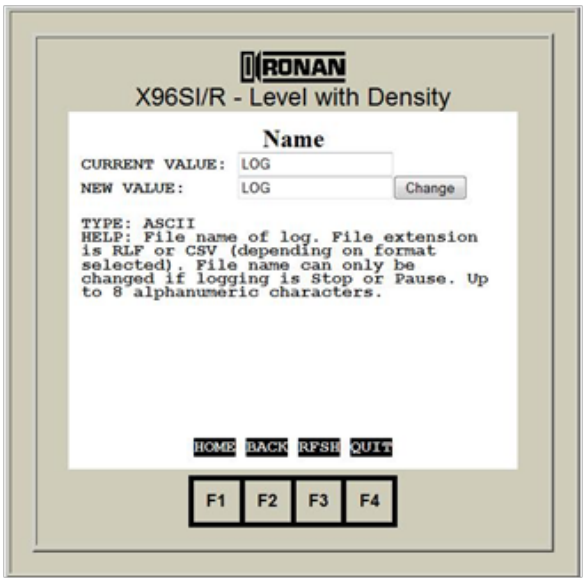
The File System menu includes the following items:

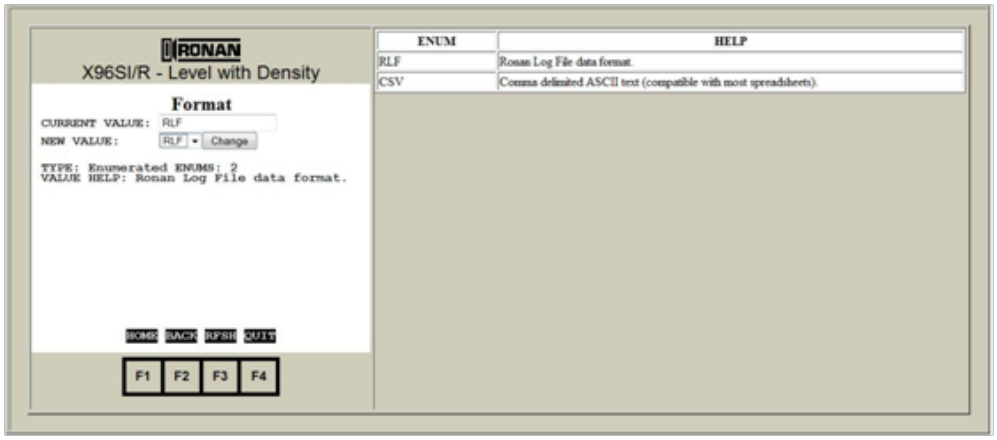


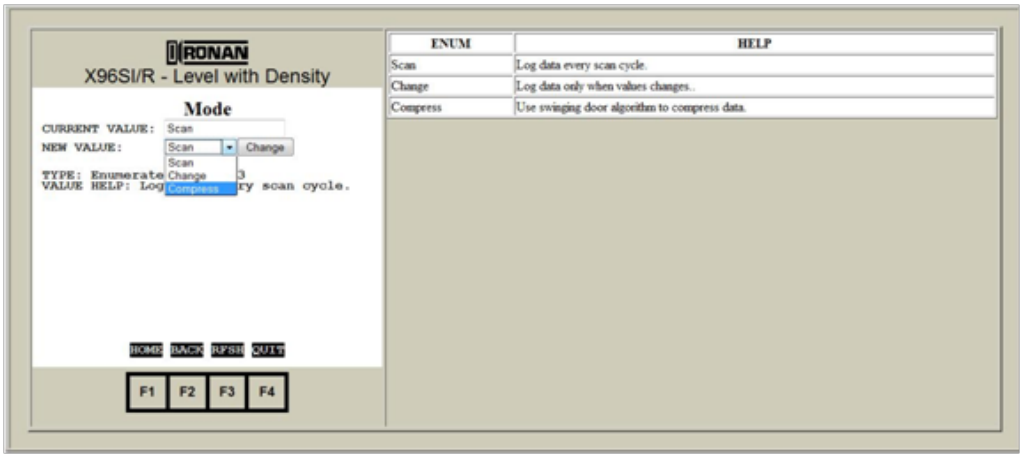
File System	Min.	Max.	Description
Status			
Free	0	1000000	Mbytes of free space on USB drive.
File System			
Data Logging			
Program Update			

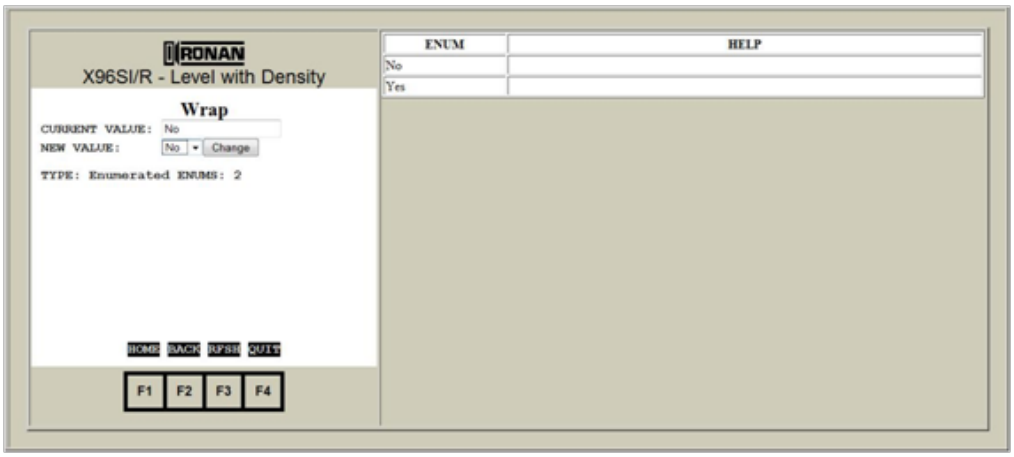
Data Logging

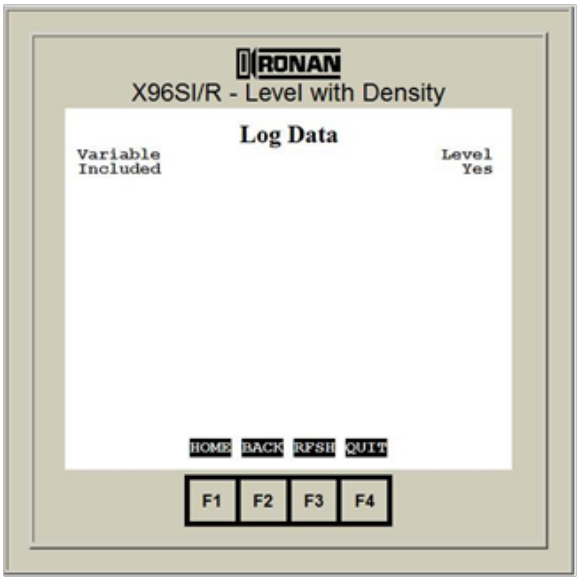


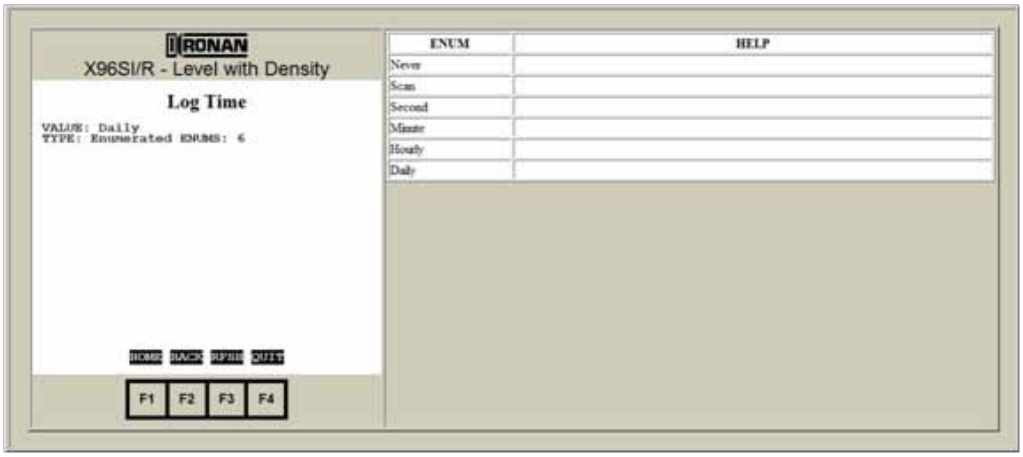

RONAN
X96SI/R - Level with Density
Name
CURRENT VALUE: LOG
NEW VALUE: LOG
Change
TYPE: ASCII
HELP: File name of log. File extension is RLF or CSV (depending on format selected). File name can only be changed if logging is Stop or Pause. Up to 8 alphanumeric characters.
HOME BACK RFSH QUIT
F1 F2 F3 F4


RONAN
X96SI/R - Level with Density
Format
CURRENT VALUE: RLF
NEW VALUE: RLF Change
TYPE: Enumerated ENUMS: 2
VALUE HELP: Ronan Log File data format.
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM
HELP
RLF
Ronan Log File data format.
CSV
Comma delimited ASCII text (compatible with most spreadsheets).

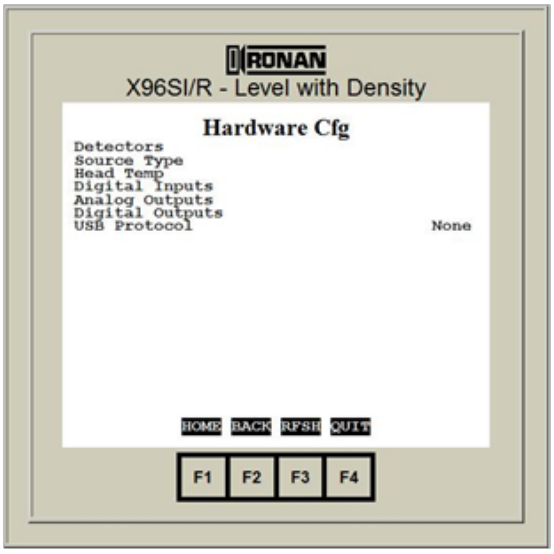

RONAN
X96SI/R - Level with Density
Mode
CURRENT VALUE: Scan
NEW VALUE: Scan Change
Scan
Change
Compress
TYPE: Enumerate 3
VALUE HELP: Log ry scan cycle.
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM
HELP
Scan
Log data every scan cycle.
Change
Log data only when values changes..
Compress
Use swinging door algorithm to compress data.


RONAN
X96SI/R - Level with Density
Wrap
CURRENT VALUE: No
NEW VALUE: No Change
TYPE: Enumerated ENUMS: 2
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM
HELP
No
Yes


RONAN
X96SI/R - Level with Density
Log Data
Variable Included
Level Yes
HOME BACK RFSH QUIT
F1 F2 F3 F4

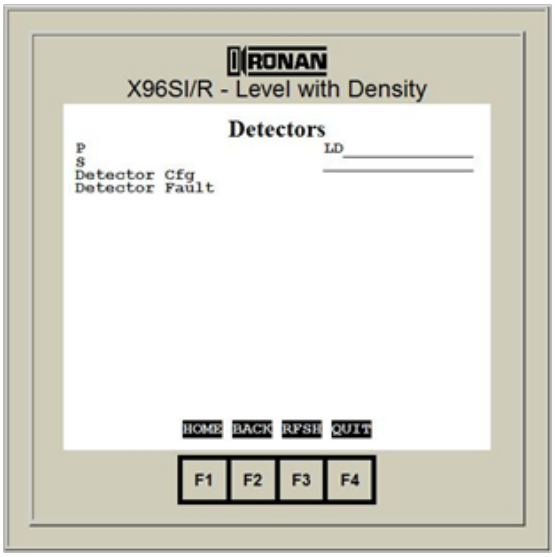

RONAN
X96SI/R - Level with Density
Log Time
VALUE: Daily
TYPE: Enumerated ENUMS: 6
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM
HELP
Never
Scan
Second
Minute
Hourly
Daily

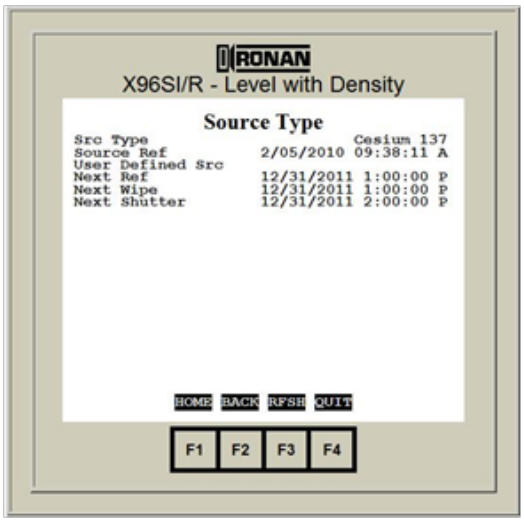
7.0 Hardware Configuration Menu

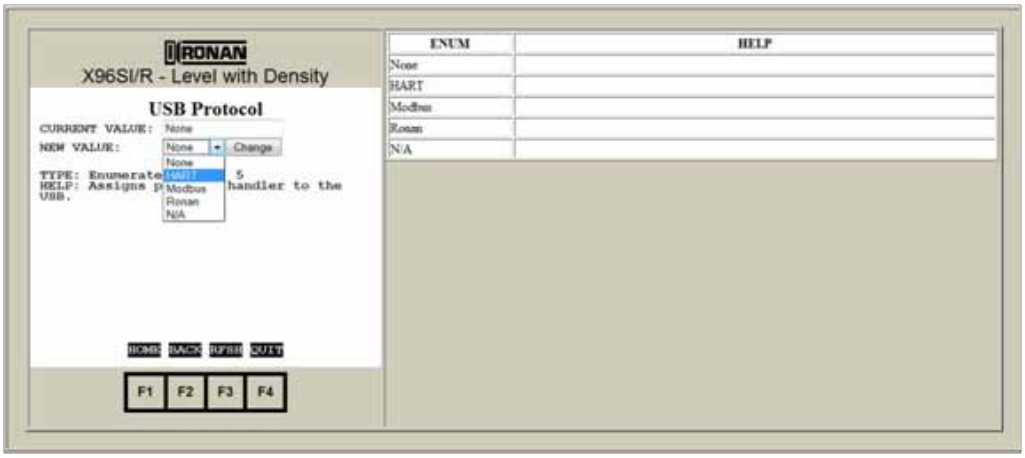


The Hardware Configuration menu includes the following options:

Hardware Cfg	Level with Density	Description
Detectors	menu	Configures the detector options.
Source Type	menu	Configures the source type options.
Counters	menu	Configures the counters options.
Frequency Out	menu	Configures the frequency out options.
Analog Inputs	menu	Configures the analog inputs.
Digital Inputs	menu	Configures the digital inputs.
Analog Outputs	menu	Configures the analog outputs.
Digital Outputs	menu	Configures the digital outputs.
USB Protocol	Ronan	Assigns protocol handler for Com1.

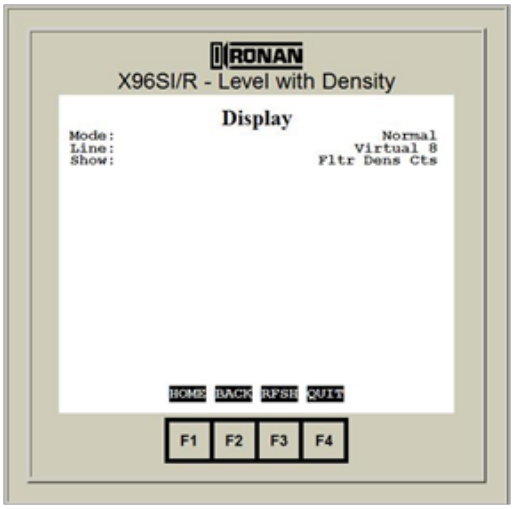


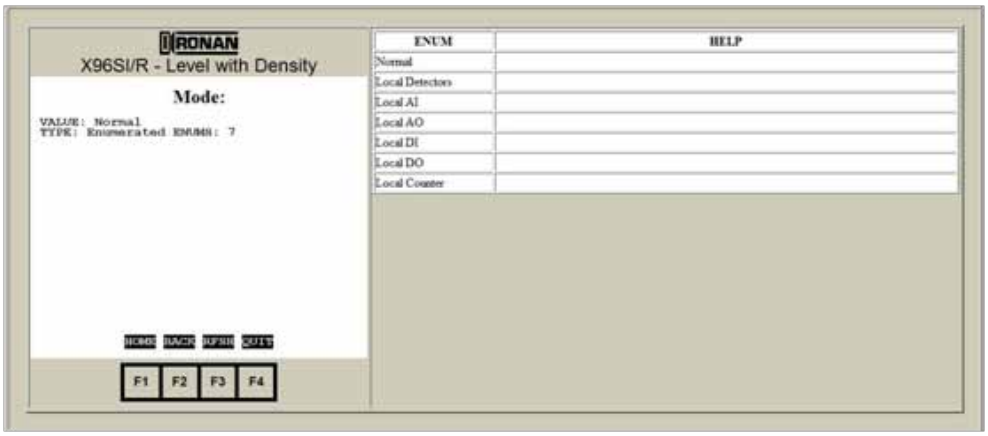


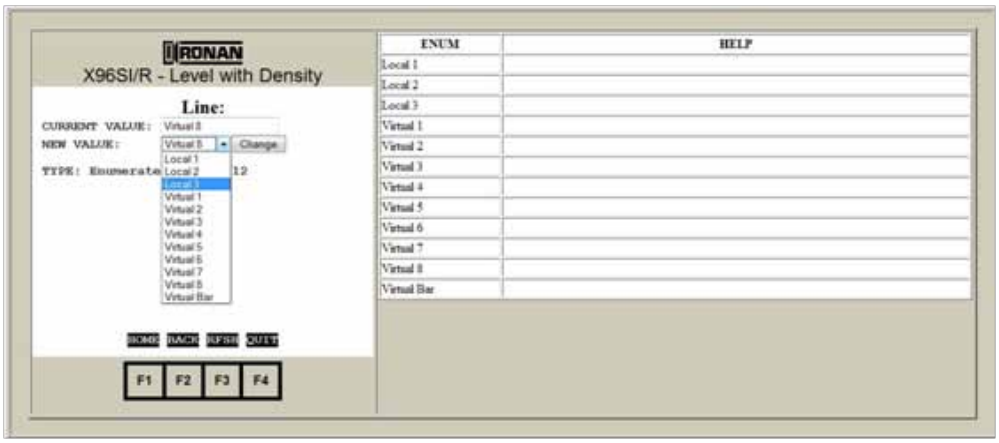


8.0 Display Menu

The Display menu includes the following options:




RONAN
X96SI/R - Level with Density
Mode:
VALUE: Normal
TYPE: Enumerated ENUMS: 7
HOME BACK REFRESH QUIT
F1 F2 F3 F4
ENUM
HELP
Normal
Local Detectors
Local AI
Local AO
Local DI
Local DO
Local Counter

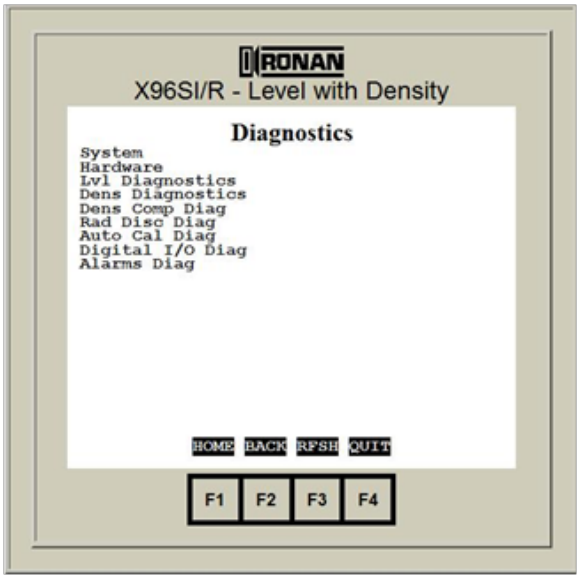

RONAN
X96SI/R - Level with Density
Line:
CURRENT VALUE: Virtual 8
NEW VALUE: Virtual 8 Change
TYPE: Enumerate 12
Local 1
Local 2
Local 3
Virtual 1
Virtual 2
Virtual 3
Virtual 4
Virtual 5
Virtual 6
Virtual 7
Virtual 8
Virtual Bar
HOME BACK REFRESH QUIT
F1 F2 F3 F4
ENUM
HELP
Local 1
Local 2
Local 3
Virtual 1
Virtual 2
Virtual 3
Virtual 4
Virtual 5
Virtual 6
Virtual 7
Virtual 8
Virtual Bar

RONAN
X96SI/R - Level with Density
Show:
CURRENT VALUE: Flt Dens Cts
NEW VALUE: Flt Dens Cts Change
TYPE: Enumerate
Not Assigned
Level
Uncomp Level
Non-Lin Level
Density
Head Temp
% Level
Raw Lvl Cts
Flt Lvl Cts
Raw Dens Cts
Flt Dens Cts
Raw Rad Comp
HOME BACK REFRESH QUIT
F1 F2 F3 F4
ENUM
HELP
Not Assigned
Level
Uncomp Level
Non-Lin Level
Density
Head Temp
% Level
Raw Lvl Cts
Flt Lvl Cts
Raw Dens Cts
Flt Dens Cts
Raw Rad Comp

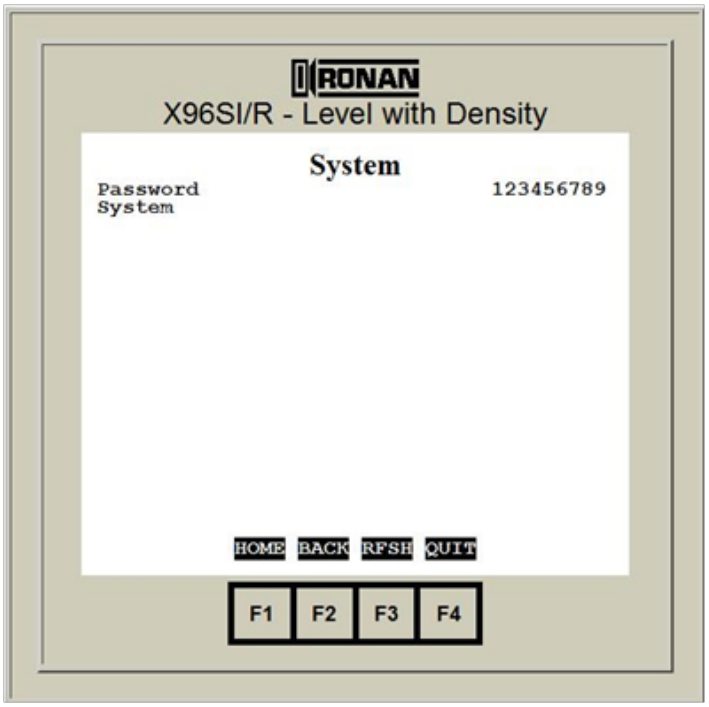
Display	Level with Density	Description
Mode		
Line	Local 1	Defines the lines that show up on the local display.
Show	Level	Defines the 8 lines you see under the Live Data screen.

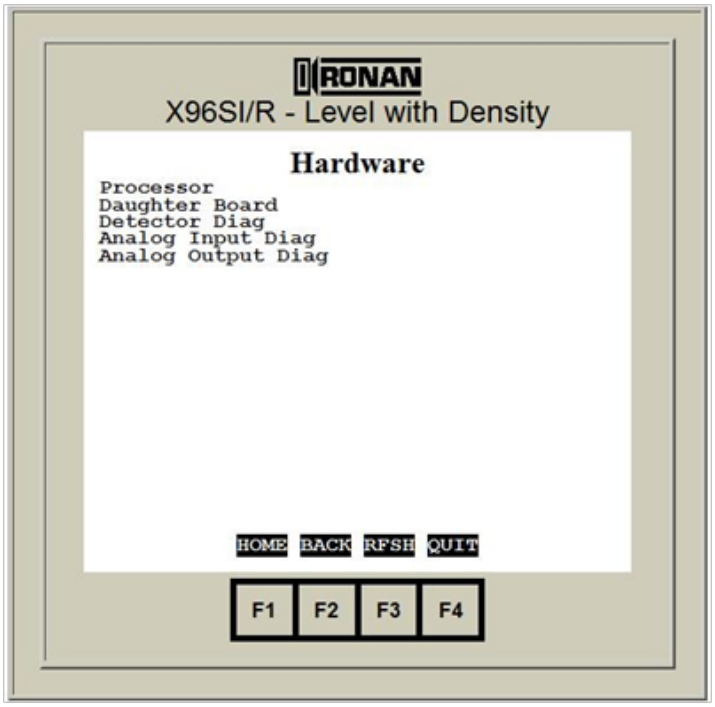
9.0 Diagnostics Menu

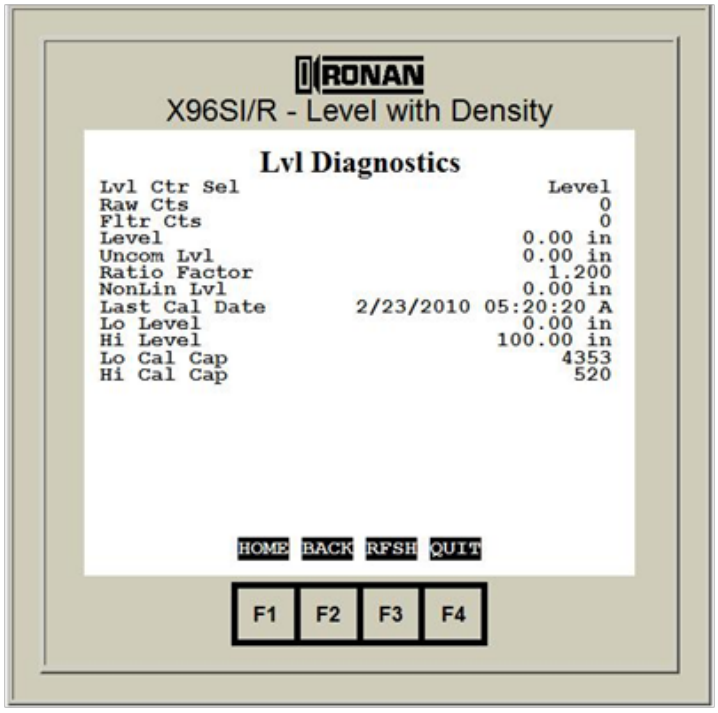
The Diagnostics menu includes the following options:

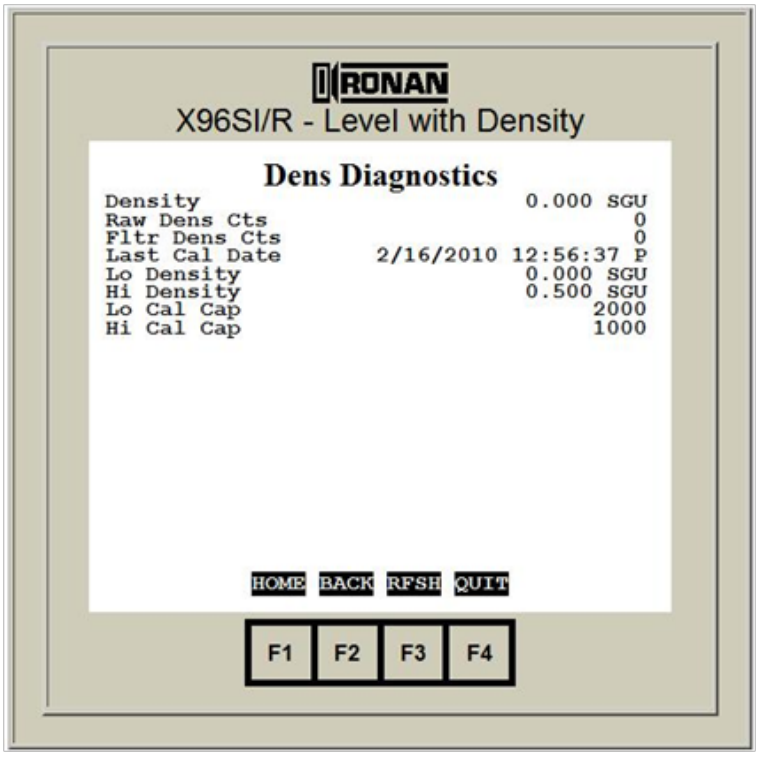


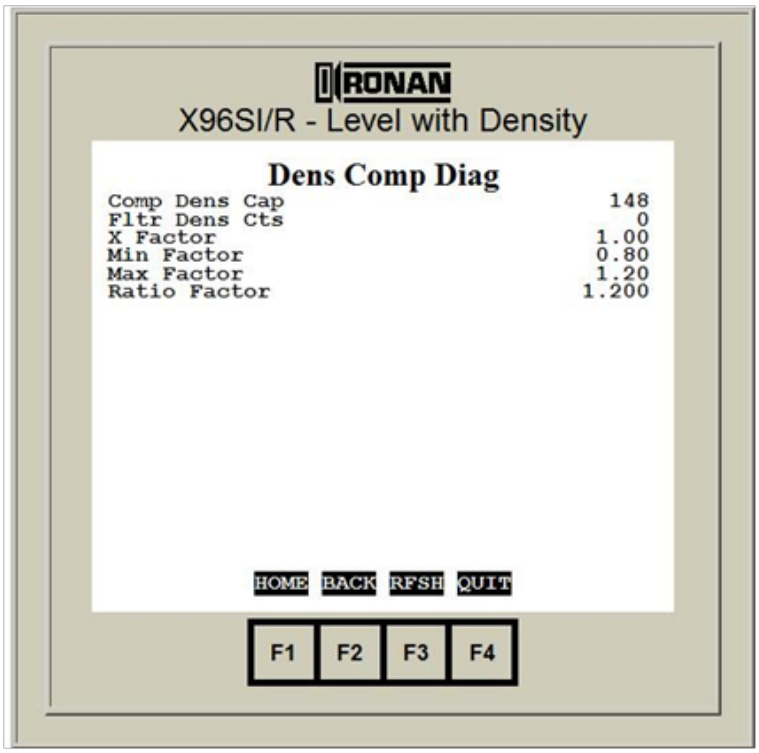
Diagnostics	Description
System	Displays password and system date and time.
Hardware	Displays information on the processor and daughter board.
Detector Diag	Displays information about the detector.
Lvl Diag	Displays information about Level configuration options.
Dens Diag	Displays information about Density configuration options.
Dens Comp Diag	Displays information about Density Compensation configuration options.
Rad Disc Diag	Displays information about Radiation Discrimination options.
Rad Comp Diag	Displays information about Radiation Compensation options.
Auto Cal Diag	Displays information about the Auto Cal options.
Digital I/O Diag	Displays information about the digital I/O options.
Alarms Diag	Displays information about the alarms options.

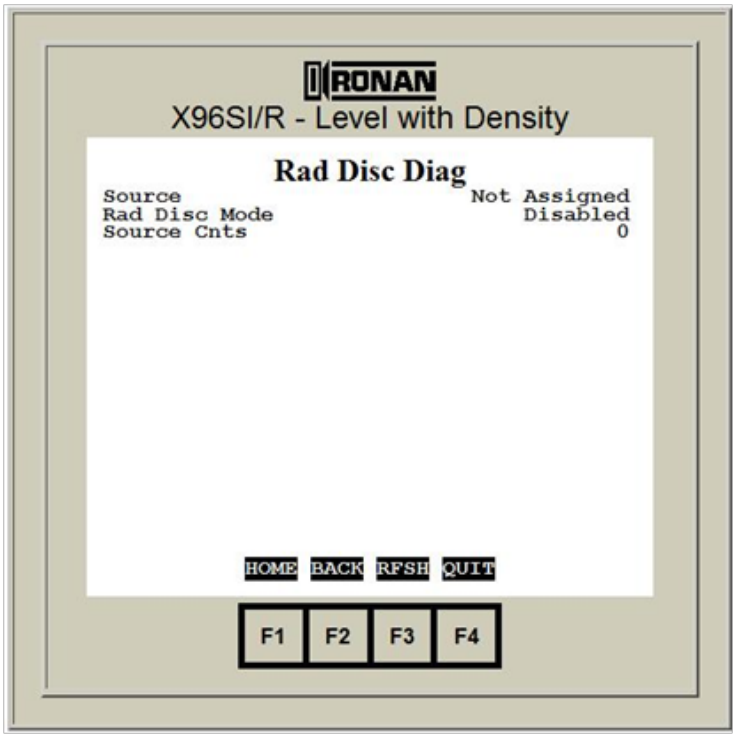

IRONAN
X96SI/R - Level with Density
System
Password 123456789
System
HOME BACK RFSH QUIT
F1 F2 F3 F4

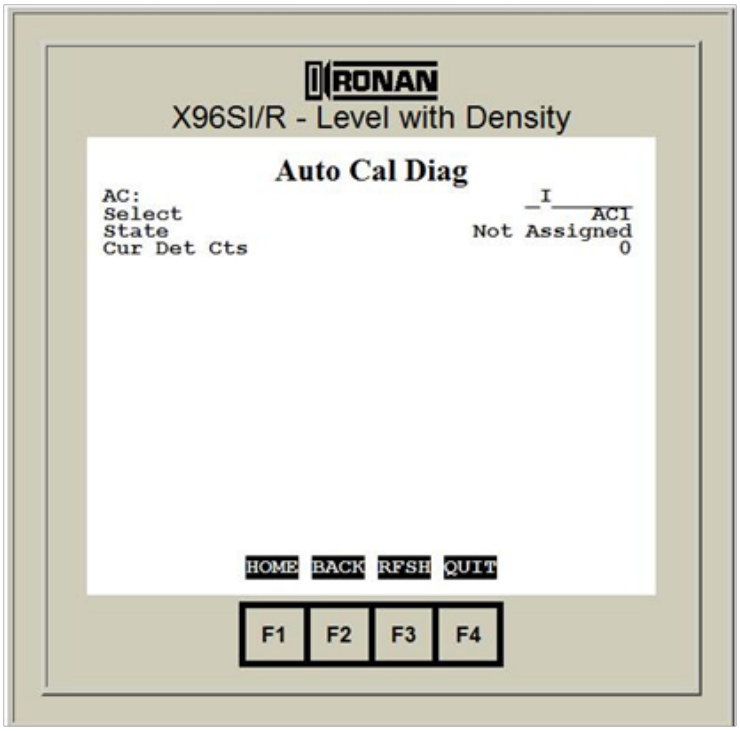

IRONAN
X96SI/R - Level with Density
Hardware
Processor
Daughter Board
Detector Diag
Analog Input Diag
Analog Output Diag
HOME BACK RFSH QUIT
F1 F2 F3 F4

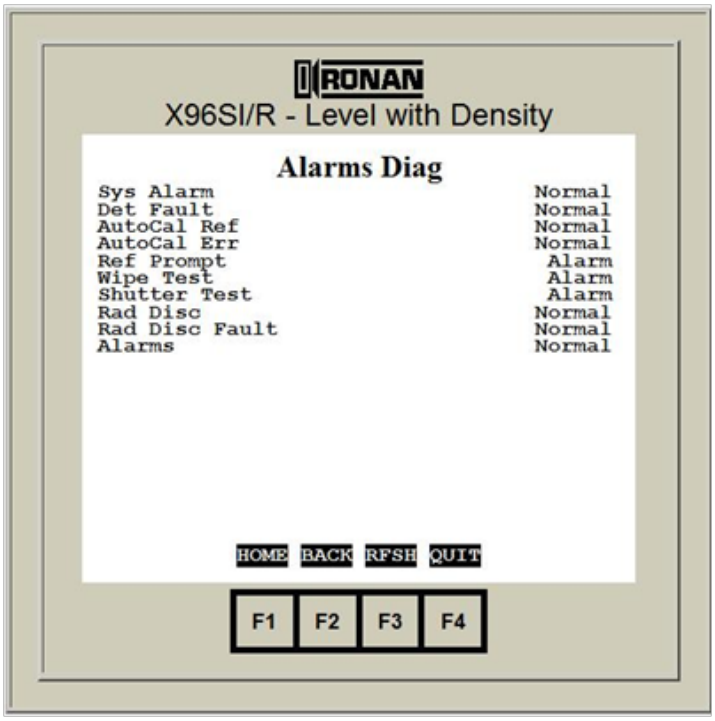

IRONAN
X96SI/R - Level with Density
Lvl Diagnostics
Lvl Ctr Sel Level
Raw Cts 0
Fltr Cts 0
Level 0.00 in
Uncom Lvl 0.00 in
Ratio Factor 1.200
NonLin Lvl 0.00 in
Last Cal Date 2/23/2010 05:20:20 A
Lo Level 0.00 in
Hi Level 100.00 in
Lo Cal Cap 4353
Hi Cal Cap 520
HOME BACK RFSH QUIT
F1 F2 F3 F4


IRONAN
X96SI/R - Level with Density
Dens Diagnostics
Density 0.000 SGU
Raw Dens Cts 0
Fltr Dens Cts 0
Last Cal Date 2/16/2010 12:56:37 P
Lo Density 0.000 SGU
Hi Density 0.500 SGU
Lo Cal Cap 2000
Hi Cal Cap 1000
HOME BACK RFSH QUIT
F1 F2 F3 F4


IRONAN
X96SI/R - Level with Density
Dens Comp Diag
Comp Dens Cap 148
Fltr Dens Cts 0
X Factor 1.00
Min Factor 0.80
Max Factor 1.20
Ratio Factor 1.200
HOME BACK RFSH QUIT
F1 F2 F3 F4


IRONAN
X96SI/R - Level with Density
Rad Disc Diag
Source Not Assigned
Rad Disc Mode Disabled
Source Cnts 0
HOME BACK RFSH QUIT
F1 F2 F3 F4


IRONAN
X96SI/R - Level with Density
Auto Cal Diag
AC:
Select
State
Cur Det Cts
I
ACI
Not Assigned
0
HOME
BACK
RFSH
QUIT
F1
F2
F3
F4


IRONAN
X96SI/R - Level with Density
Alarms Diag
Sys Alarm
Det Fault
AutoCal Ref
AutoCal Err
Ref Prompt
Wipe Test
Shutter Test
Rad Disc
Rad Disc Fault
Alarms
Normal
Normal
Normal
Normal
Alarm
Alarm
Alarm
Normal
Normal
Normal
HOME
BACK
RFSH
QUIT
F1
F2
F3
F4

Chapter 5
Troubleshooting the Level Gauge

Troubleshooting

Most operating issues that occur can be isolated to one of four causes:

- Optional accessories
- Configuration/Installation issues
- Process conditions
- Measurement equipment

Isolating the Problem

The following section offers some troubleshooting tips when attempting to isolate the problem. Whenever problems are experienced, you may contact Ronan Support at 859-282-4721.

Accessories

Begin by disconnecting potentiometers, records, and controllers from the system. Accessories, when operating properly, should have NO effect on the X96SI/R display.

Configuration/Installation

When troubleshooting, it is important to consider the “Theory and Principles of Operation” information in Chapter 2. Process measurement is possible due to the principles of radiation transmission and absorption. The total mass of material between the radiation source and the detector (i.e. “measuring gap”) will affect the final measurement. You must eliminate possible configuration/installation type of changes as the cause of your problem.

For example, consider these possibilities:

- Did the vessel insulation expand due to absorbed moisture during a wash down or absorbed process during a spill? This condition would increase the total mass of material in the “measuring gap” and would therefore indicate a higher level.
- Did something happen to compress the vessel insulation and therefore change the total mass of material?
- Could dust from process material or surrounding environment be collecting in “dead space” between the radiation source and detector? This would also indicate a higher level.
- Are changes taking place inside cooling or heating coils that carry liquid or vapor through the “active beam” of radiation?

Process Conditions

If installation, configuration, and accessory causes have been eliminated, consider the process conditions.

For example, entrained air or gas bubbles in the process material present pockets of minimum mass (i.e. low vessel conditions). If the amount of entrained gas remains constant, the system’s calibration procedure will automatically allow for its effect. However, if the amount of entrained gas increases or decreases, the system will indicate lower or higher process levels.

Measurement Equipment
After eliminating the accessories, installation/configuration, and process conditions as possible causes of the problem, you will want to consider the measurement equipment. Follow these steps to troubleshoot problems with various components of the X96SI/R.

Analog Output Board
Follow these steps to troubleshoot problems with the Analog Output Board:

1. Verify the Output Type (mA/V) meets your requirements. If not, power down the system, remove the Analog Output Board, change the switch setting, rescan the module, and try powering up the system.
2. Verify the module is not offline. If it is, press the Reset button. If it is not offline, advance to the Test Module function and press the Modify key.
3. Attach a current or voltage meter to the output of this board (depending on the switch setting on the board for current or voltage).
4. Change the output from minimum to maximum. The output should reflect your changes, and the range should match your requirements.
5. If the output range is not okay, remove field wiring and repeat the test. If the test fails, replace the module. If the test passes, the field device is most likely overloading the output.

CPU
Follow these steps to troubleshoot problems with the CPU:

1. Make sure the CPU has +5 VDC on pin 1 and pin 2 is ground.
2. Verify the voltage is greater than 4.75 VDC. If not, there is likely a problem with the power supply.
3. If the voltage is greater than 4.75 VDC, pull the CPU from the rack and ensure that the two socketed components on the top board are pressed in tightly.
4. Retry the board. If the problem persists, you should consider replacing the CPU board.

Detector Input Board
Follow these steps to troubleshoot problems with the Detector Input Board:

1. Verify the Scintillator Input is found.
2. Verify the module is not offline. If it is, press the Reset button. If it is not offline, press the Setup button, or Reset and then Setup, and then the Continue button.
3. Verify that the counts are being displayed.

If not, follow these steps:

1. Identify the Detector Input board in the rack.
2. For Scintillator Input, check for +15 VDC at pins 6 and 7.
3. Verify that the voltages(s) is okay (+/- 10%).

Detector Input Board (cont'd)

If no, follow these steps:

1. Remove all wires from the detector input board except pins 1, 2, 3, and 4.
2. Recheck the voltage:
   For scintillator input, check for +15 VDC on pins 6 and 7.
3. Check if the voltages are okay and are at +/-10%.
   – If no, replace the detector input board.
   – If yes, follow the next step:
4. Check the cable to the detector. If okay replace the detector. Otherwise, replace the cable.

If yes, follow these steps:

1. Check the input on pin 5 with a counter.
2. Verify if there are any counts.
   – If yes, try replacing the detector input borad.
   – If no, check the cable to the detector. If okay, replace the detector. Otherwise, replace the cable.

If yes (counts are displayed), follow these steps:

1. Verify if there is scintillator input.
   – If yes, then follow the next two steps.
2. Check the count period and ensure its value matches your scan rate (usually 400 mS).
3. Advance to the Prescale Divider and ensure its value is set to 1.

Power Supply Problems

Follow these steps to troubleshoot problems with the power supply:

1. Ensure that the power switch on the power supply is turned on.
2. Check the supply voltage:
   AC=85 to 265 VAC
   DC=23.8 to 25.2 VDC
3. Check the power supply fuse.
4. Make sure the power supply input connector is pushed down all the way.
5. Pull the 2 pin 5V connector from the supply.
6. Verify that the power supply LED is on.
   – If not, replace the power supply.
   – If yes, replace the 2 pin 5V connector and verify that the power supply LED is still on.

   – If yes, you are done.
   – If not, check the module voltages.

Output Problem

Follow these steps to troubleshoot output problems.

Access the Outputs Group, Output Percent for the output-in-question.

1. Is the Output Percent correct?
   – If yes, check the analog output board
   – If no, make sure the Get Output Form for this output is pointing to the menu variable you wish to use as the gauge's output.
2. Make sure the Output Low Range is the lowest value you expect (represents zero percent output).
3. Make sure the Output High Range is the highest value you expected (represents 100 percent output).
4. Is the output percent correct?
   – If no, check the analog output board.
   – If yes, you are done.

Analog Input

Follow these steps to troubleshoot problems with the Analog Inputs:

1. Access the I/O Status menus and display the address for the Analog Input module.
2. Is the Analog Input module found?
   – If no, the module was not found.
   – If yes, proceed to the next step.
3. Is the Type (mA/V) correct?
   – If no, remove the module from the rack, set the switch to the proper input (mA/V), and retry the modeul.
   – If yes, proceed to the next step.
4. Is the module offline?
   – If no, press the setup button (or reset button if failed then the setup button), and then press the continue button. Proceed to the next step.
   – If yes, press the reset button and see if the module was found.
5. Remove the wiring from pins 5 and 6, hook a voltage or current source (depending on the switch setting), to pins 5 and 6, and monitor the input value on the handheld.
6. Is the value displayed okay?
   – If no, try calibrating the analog input module. If the calibration fails or the input still does not work, replace the analog input module.
   – If yes, check the field wiring or device supplying the voltage/current.

Using the X96SI/R Status Displays to Troubleshoot

The X96SI/R continuously monitors system operation. The following Status Displays may help to uncover the cause of system malfunctions.

Begin by first ensuring the displays are operational. If all of the display screens are blank, consider these possible causes:

Problem to Rule Out	Things to Check For
Power Off	Check AC power line for fuses.
Total System Failure	Check for faulty power supply.
Faulty Display Board	Check for shorts at X96SI/R: • TB-A pins 1-2 and 2-3 • TB-B pins 1-2 and 3-4

If all display screens begin flashing:

- Radiological discrimination may have detected outside source of radiation. Check the Calibration Constant for Fault Count.
- Make sure the Density Compensation Ratio limits have not been exceeded.

The following table shows the standard display errors which can help further troubleshoot problems with the X96SI/R.

Standard Display Errors

Display	Value	Label	Help
Single	STATUS_Single	Single	Normal status for device that has no slaves
Master	STATUS_Master	Master	Normal status for master device that has slaves
Slave 1	STATUS_Slave1	Slave 1	Normal status for first slave device
Slave 2	STATUS_Slave2	Slave 2	Normal status for second slave device
Slave 3	STATUS_Slave3	Slave 3	Normal status for third slave device
Slave 4	STATUS_Slave4	Slave 4	Normal status for fourth slave device
HW Error	STATUS_HwErr	Hardware Error	Contact Ronan service
SW Error	STATUS_SwErr	Software Error	Contact Ronan service
Mem Error	STATUS_MemErr	Memory Error	Contact Ronan service
WDT Error	STATUS_WdTimer	Watchdog Timer	Watchdog timer expired
CYCLE OVR	STATUS_Cycie	Cycle Time Err	Processing exceeded cycle time

Standard Display Errors (con'td)

Display	Value	Label	Help
Boot 1 Bad	STATUS_B1Chk	Boot 1 Checksum	Memory checksum on boot area 1 is wrong
Boot 2 Bad	STATUS_B2Chk	Boot 2 Checksum	Memory checksum on boot area 2 is wrong
APPL BAD	STATUS_ApplChk	Appl Checksum	Memory checksum on application area is wrong
IOP Fail	STATUS_IopFail	IOP Fail	I/O processor is not communicating
IOP Err	STATUS_IopErr	IOP Error	I/O processor reports an error
IOP Chk	STATUS_IopChk	IOP Checksum	I/O processor memory checksum error
Cntr Err	STATUS_CntrErr	Cntr Error	Counter processor reports an error
Cntr Chk	STATUS_CntrChk	Cntr Checksum	Counter processor memory checksum error
HART BD	STATUS_DbError	DB Error	Daughter board error
FF DB			
NO LAN	STATUS_NoCon	Not Connected	Network configured as required but not connected
NO IP	STATUS_NoIp	No IP Addr	IP address not configured
NO IP	STATUS_DupIp	Dup IP Addr	IP address not unique on the network
No DHCP	STATUS_NoDHCP	No DHCP	Unable to get IP address from DHCP server
No Name	STATUS_NoName	No Name	Network name not configured
Dup Name	STATUS_DupName	Dup Name	Network name not unique on the network
No Master	STATUS_NoMstr	No Master	Unable to connect to master
Master Rej	STATUS_MstrRej	Master Reject	Connection attempt rejected by master
Slaves NC	STATUS_MissSs	Missing Slaves	Unable to connect to slave multiple slaves
Slave 1 NC	STATUS_NoS1	No Slave 1	Unable to connect to slave 1
Slave 2 NC	STATUS_NoS2	No Slave 2	Unable to connect to slave 2
Slave 3 NC	STATUS_NoS3	No Slave 3	Unable to connect to slave 3
Slave 4 NC	STATUS_NoS4	No Slave 4	Unable to connect to slave 4
Dup Slave1	STATUS_DupS1	Dup Slave 1	More than 1 device attempting to connect as slave 1
Dup Slave2	STATUS_DupS2	Dup Slave 2	More than 1 device attempting to connect as slave 2

Standard Display Errors (con'td)

Display	Value	Label	Help
Dup Slave3	STATUS_DupS3	Dup Slave 3	More than 1 device attempting to connect as slave 3
Dup Slave4	STATUS_DupS4	Dup Slave 4	More than 1 device attempting to connect as slave 4
Extra Slv1	STATUS_S1NoCfg	Slave 1 No Cfg	Slave 1 is not configured but attempting to connect
Extra Slv2	STATUS_S2NoCfg	Slave 2 No Cfg	Slave 2 is not configured but attempting to connect
Extra Slv3	STATUS_S3NoCfg	Slave 3 No Cfg	Slave 3 is not configured but attempting to connect
Extra Slv4	STATUS_S4NoCfg	Slave 4 No Cfg	Slave 4 is not configured but attempting to connect
Det 1 Fail	STATUS_D1Fail	Det 1 Fail	Detector 1 failed
Det 2 Fail	STATUS_D2Fail	Det 2 Fail	Detector 2 failed
Det 3 Fail	STATUS_D3Fail	Det 3 Fail	Detector 3 failed
Det 4 Fail	STATUS_D4Fail	Det 4 Fail	Detector 4 failed
Det 5 Fail	STATUS_D5Fail	Det 5 Fail	Detector 5 failed
Det 6 Fail	STATUS_D6Fail	Det 6 Fail	Detector 6 failed
Det 7 Fail	STATUS_D7Fail	Det 7 Fail	Detector 7 failed
Det 8 Fail	STATUS_D8Fail	Det 8 Fail	Detector 8 failed
Det 9 Fail	STATUS_D9Fail	Det 9 Fail	Detector 9 failed
Det10 Fail	STATUS_D10Fail	Det 10 Fail	Detector 10 failed
Det11 Fail	STATUS_D11Fail	Det 11 Fail	Detector 11 failed
Det12 Fail	STATUS_D12Fail	Det 12 Fail	Detector 12 failed
Det13 Fail	STATUS_D13Fail	Det 13 Fail	Detector 13 failed
Det14 Fail	STATUS_D14Fail	Det 14 Fail	Detector 14 failed
Det15 Fail	STATUS_D15Fail	Det 15 Fail	Detector 15 failed
Rad Disc	STATUS_RadDisc	Rad Disc	Radiation Disc triggered
Empty Clmp	STATUS_Empty	Empty Clamp	Empty Clamp triggered
Err Drv EE	STATUS_FileErr	File Sys Err	File system error
Err Drv SD			
No SD	STATUS_NoFile	No File Sys	File System configured as required but no memory card

Standard Display Errors (con'td)

Display	Value	Label	Help
CFG Bad	STATUS_CfgBad	Cfg Bad	Configuration is invalid
CFG Partial	STATUS_CfgPart	Cfg Incomplete	Configuration is not sufficient for gage operation
Miss Cal	STATUS_MissCal	Missing Cal	A configured device (detector etc.) is not calibrated
Bat Low	STATUS_BatLow	Battery Low	RTC battery needs to be replaced
Lo Temp	STATUS_LoTemp	Under Temp	Electronics temperature too low
Hi Temp	STATUS_HiTemp	Over Temp	Electronics temperature too high

Diagnostics Status LEDs

The X96SI/R uses LED lights to indicate the system's health and operation. The red and green LEDs are used to indicate module operational health[1]. The yellow LEDs are used for module specific status.

Red LED	Green LED	Meaning
Off	Off	Application processor not receiving power
On	Off	Application processor bad
On	On (steady)	Application processor internal self-check passes but not in communication with the I/O processor
Off	On (flashing)	Application processor operating correctly

Diagnostics Status LED Flash Codes

Flash codes are composed of the following:

- Delay between flash codes is a minimum of 1 second
- Long flash is 1 second
- Short flash is ½ second
- Delay between flashes is a minimum of ½ second

[1]A study done by a major process control company has shown that this system makes it simple for operators and technicians that have minimum product training to maintain the product. This decreases MTTR (mean time to re-pair) and increases product availability.

Boot Error Flash Codes

Check the following items when encountering these flash codes:

Flash Code	Description	Possible Resolutions
1 long	Flash checksum failed	Reprogram (JTAG) ARM processor
1 long 1 short	Instruction test failed	Replace processor
1 long 2 shorts	Memory test failed	Replace processor
1 long 3 shorts	I/O Test Failed	Check for shorts on board
1 long 4 shorts	Unable to initialize LCD	Check connection to LCD

Calibrate Dens	Min.	Max.	Default	Description
Source			D2	Source is assigned in Hardware CFG->Detectors->Detector CFG
State			Uncalibrated	Shows the state of the level configuration process
Density	-1.000	999.999	dynamic	
Dens Cal Const			menu	The criteria for a valid Density Calibration.
Dens 1 pt Cal			menu	Selecting this item takes the user to the Dens 1 pt. Cal menu
Dens 2 pt.			menu	Selecting this item takes the user to Dens 2 pt. Cal menu.
Backgr. Cts	0	65535	0	Value to subtract from raw counts.
Clear Dens Cal			method	This item invokes a method that clears the level low reference and high calibration. This allows the user to start over without any stored reference or calibrated value.

Calibrate Density- Source

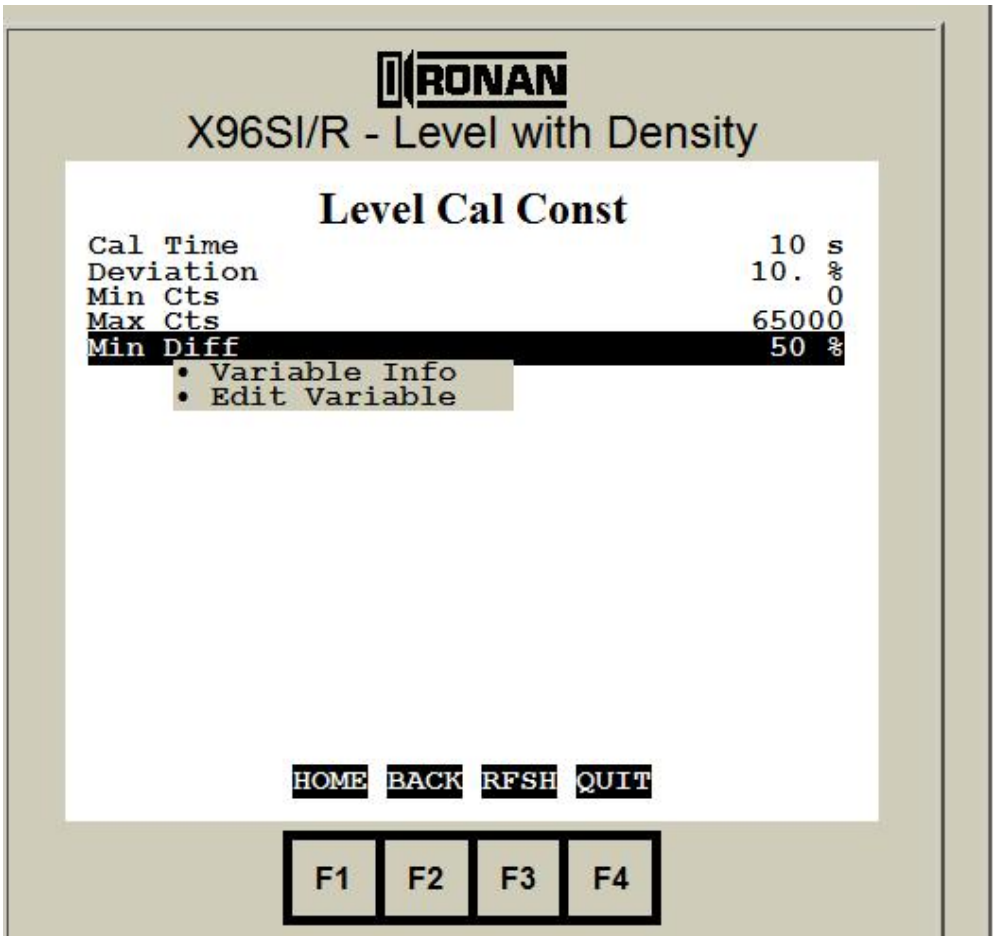
The Calibrate Density - Source screen allows you to view the source of the detectors as assigned in the Harware CFG->Detectors->Detector CFG menu.

Calibrate Density- State

The Calibrate Density - State screen displays the current state of the density calibation.

Calibrate Density - Dens Cal Const

The Dens Cal Const menu includes the following items:

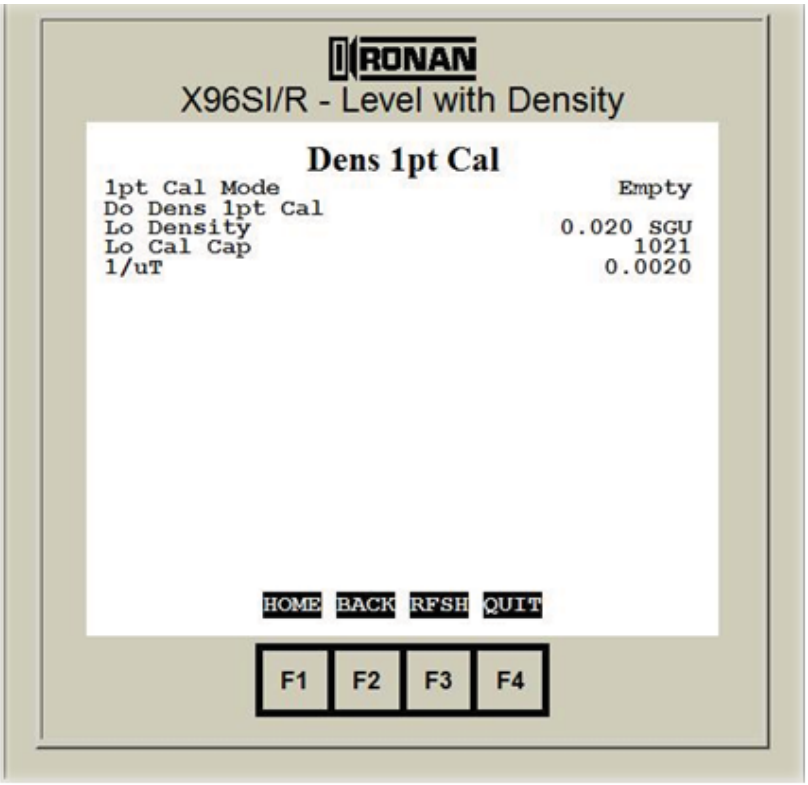


Dens Cal Const	Min.	Max.	Default	Description
Cal Time	1s	9999s	60s	Number of seconds of samples to accumulate to determine a value.
Deviation	0.0	100.0	10.0	Maximum deviation that can occur during calibration without invalidating the measurement.
Min Cal Cts	0	10000	0	Minimum count bellow which guage will not calibrate.
Max Cal	1000	65535	65535	Maximum counts above which guage will not calibrate
Min Diff	2	100	10%	Minimum difference between hi and low captured counts.

Calibrate Density - Dens 1pt. Cal

The calibrate - Dens 1 pt Cal menu includes the following items:

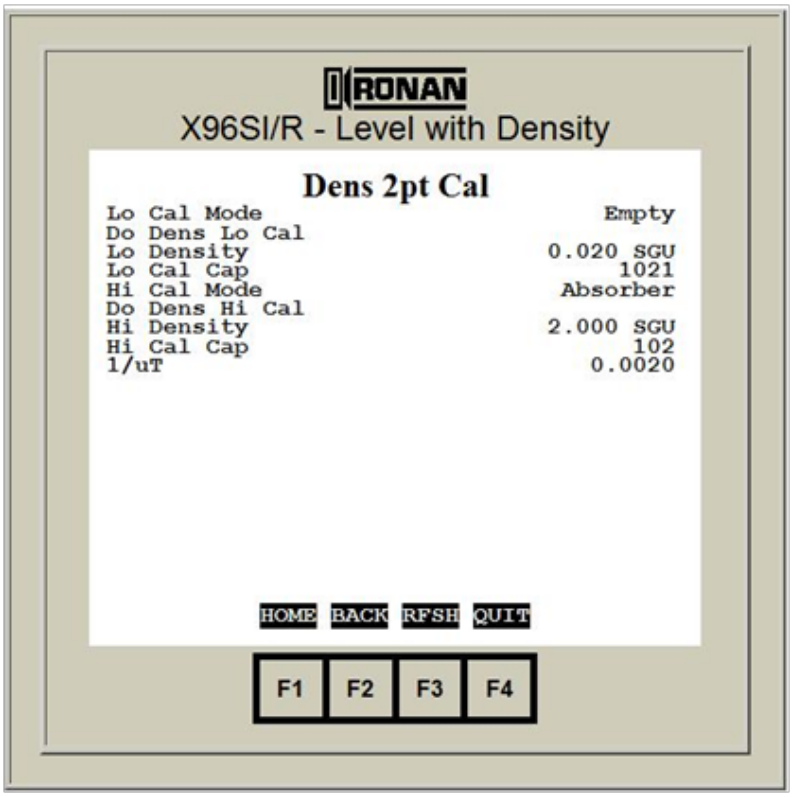
1 pt Cal Mode
Lo Dens 1 pt Cal
Lo Density
Lo Cal Cap
1/ut



Dens 1 pt Cal	Min	Max.	Default	Description
1 pt. cal			Empty	Selects measurement condition used to establish the low calibration value/
Do Dens 1 pt Cal			method	
Lo/ 1pt value	0.000	9999.999	0.001	
Lo/ 1pt Cal Cap	0	65535	dynamic	
1/ut	0.0001	9.9999	0.5422	

Calibrate Density -Dens 2 pt Cal

The Claibrate Density -Dens 2pt Cal menu iincludes the following items:



Dens 2 Pt Cal	Min	Max	Default	Description
Lo Cal Mode			Empty	Selects Measur-ment Condition used to establish the low calibration level
Lo Dens Lo Cal			method	
Lo/1pt Value	0.000	9999.999	0.001	
Lo/1pt Cal Cap	0	65535	dynamic	
Hi Cal Mode			Process	Select Measur-ment conditions used to select the high calibration level
Do Dens Hi Cal			method	
Hi Value	0.0000	999.9999	0.200	
Hi Cal Cap	0	65535	dynamic	
1/uT	0.0001	9.9999	0.5422	

2.3 Linearization

The X96SI/R is capable of performing a multi-point lineatization of the level data when required by an application. The linearization table contains thirty- two entries, numbered 1 through 32. Each entry consist of a measured value, an actual value, and a flag that indicates if the entry is used. The Linearization menu controls the linearization mechanism and contains the following items:

Linearization	Description
Enable	Enable to permit linearization
L1-L8:	Summary of table entries 1-8 ._if entry not used, U if used
L9-L16:	Summary of table entries 9-16. _ if entry not used, U if used.
L17-L24:	Summary of table entries 17-24
L25-L32:	Summary of table entries 25 through 32. _ if not used, U if used
Set Lin Point	Used to set the lin point
Clear Table	Clears the table
Sort Table	Sorts the table

2.4 Calibrate Head Temp

The Calibrate Head Temp

The Calibrate Head Temp menu is used to configure the parameters associated with the detector's temperature. This function is used primarily in high- tempature applications where the temperature exceeds the electronics temperature specification. It contains the following items.

Note:

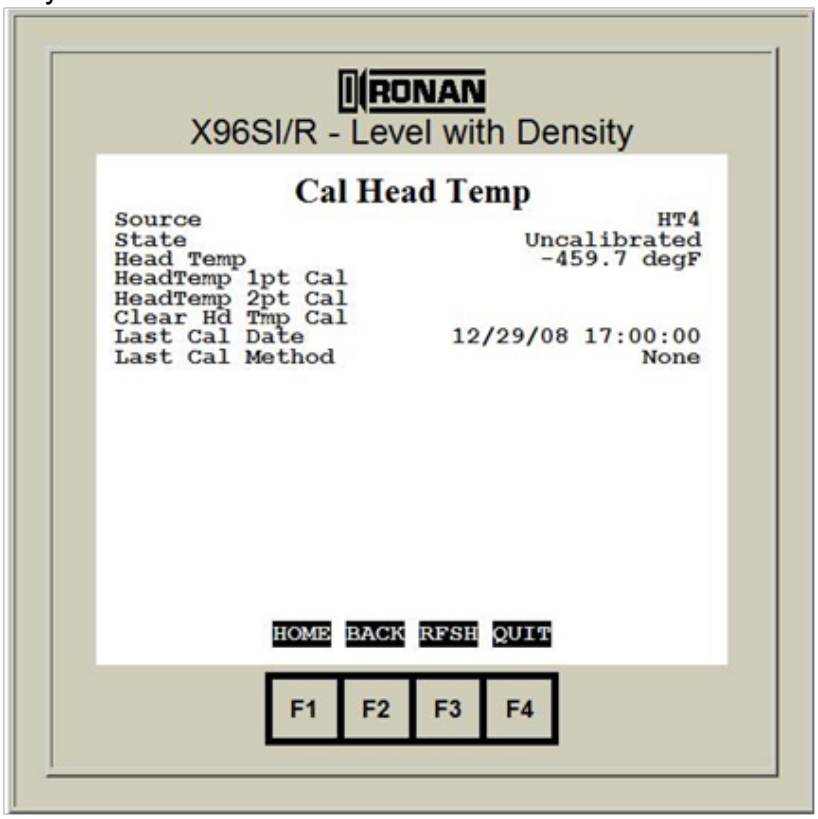
Normally this feature will be precalibrated at the factory and further editing shouuld be necessary. Call Ronan Service for assistance.

2.4 Calibrate Head Temp

The calibrate Head Temp menu is used to configure the parameters associated with the detector's tempature. The function is used primarily in high-tempature applications where the tempature exceeds the electronics tempature specifications. It contains the following items.

Note:

Normally this feature will be precalibrated at the factory and further editing should not be necessary. Call Ronan Service for assistance.



Cal Head Temp	Min	Max	Default	Description
Source			HT1	
State			uncalibrated	
Head Temp	-70.0	225.0	dynamic	
Head Temp 1 pt Cal			menu	
Head Temp 2 pt Cal			menu	
CLR Head Temp Cal			method	
Last Cal Date			dynamic	
Last Cal Meth-od			none	

[3] Not all of the entries need to be used and the entries do not need to be used in any particular order.

3.0 Measurement Configuration Menu

The Measurement Cconfiguration menu contains the following items:

Measurement Cfg	Description
Density Comp	This function will modify, or adjust, the current level based on the signal recieved from the density compensation detector being used to measure the density
Head Temp Comp	The Head Temp Comp menu is used to configure tha parameters associated with the detector electronics temperature measurement. This function is used primarily in high- tempature applications where the tempature exceeds the electronics tempature speciafications.
Rad Disc	When the radiation level is to high, multiple pulses may occur so close togather that they appear to be a single pulse. When the radiation level is extremely high, pulses may merge to such an extent as to make the pulse count be very low or even zero. This menu allows you to display and change the parameters for the Radiation Discriminator.

Configuring the Radiation Discriminator Feature (optional)

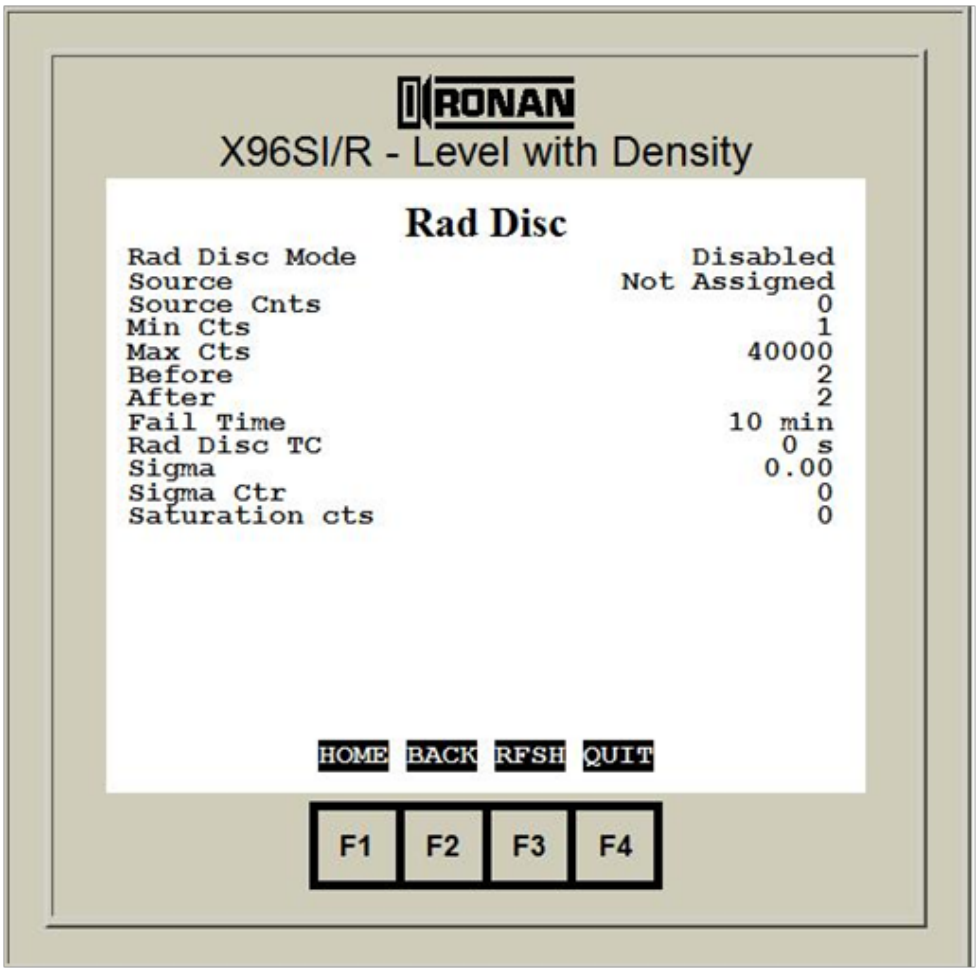
Ronan's Radiation Discriminator is designed to permit normal level outputs operation during temporary periods of large, external radiation fields. It employs a seperate detector outside the field source used for the level guage.

This feature will detect up to two conditions: radiation discriminator detector saturation, and a sigma external field. Radiation fields above the maximum for the Radiaton Discriminator detector will cause the detector to go into saturation and drop its output to zero. The condition is effectively disables the input to the Radiation Discrimintor function and causes the system to freeze the level output until the high field is removed and the detector recovers.

When an external field is applied to the Radiation Discriminator detector (and consequently the level detector), the outputs of both will increase. when the output of the Radiation Discriminator detector increase above the calculated threshold and remains there for a number of consecutive scans, the Radiation Discriminator function will trigger. When triggered, the function will freeze level output.

when the Radiation Discriminator detector's output drops below the sigma threshold, the alarm condition will cease.

The Rad Disc menu includes the following menu items which are described below:

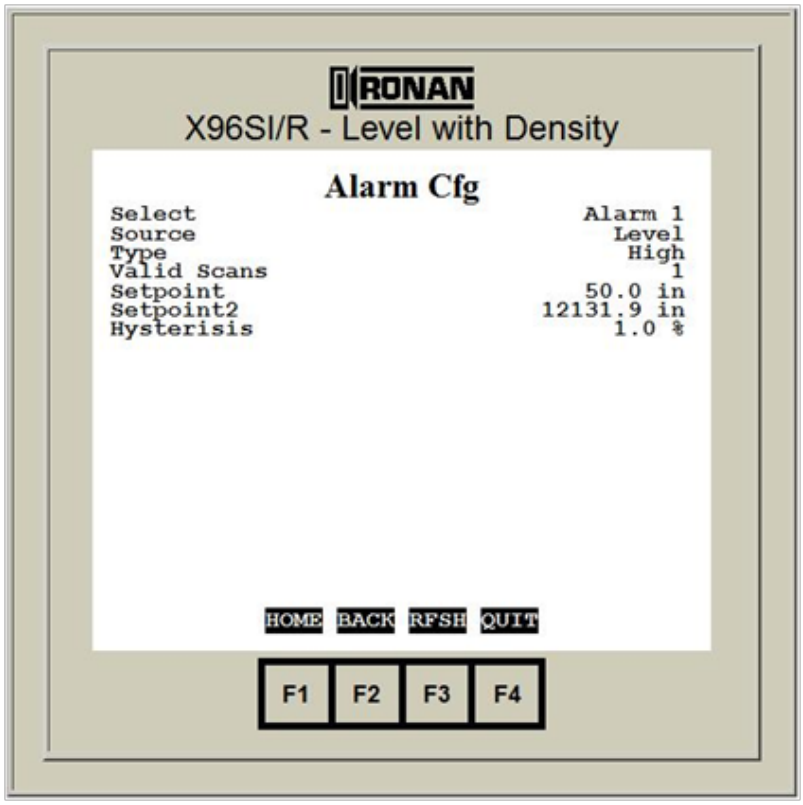


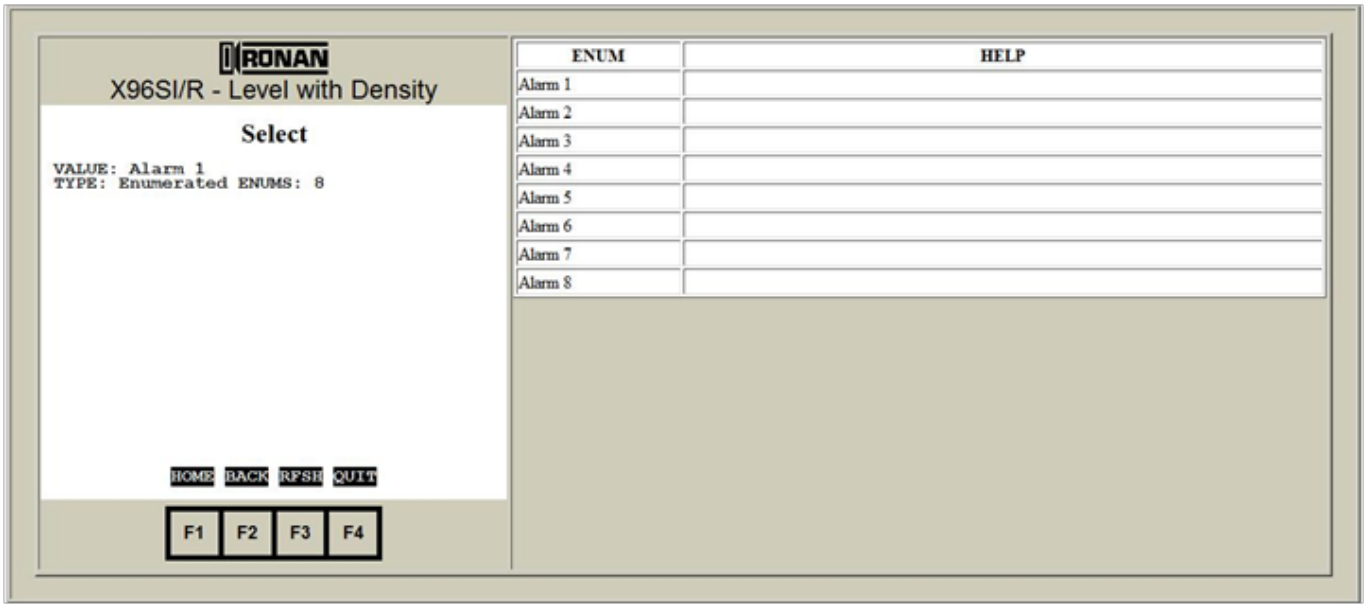
Rad Disc	Description
Rad Disc TC	The amount of RC filtering used to determine the Backgrouond average. This filter is not used on the raw detector signal.
Sigma	Multiplier used to determine the threshold to activate the Rad Disc
Sigma Counter	The number of consecutive scans the raw counts must be above the threshold before the Rad Disc is activated.
Saturation Counts	The minimum counts the Rad Disc detector must be above. During the X-Raying, the detector can become saturted because of high radiation fields causing the output to appear as low counts. If the Rad disc detector falls below this value, the Rad Disc is activated until the Rad Disc detector returns to normal.

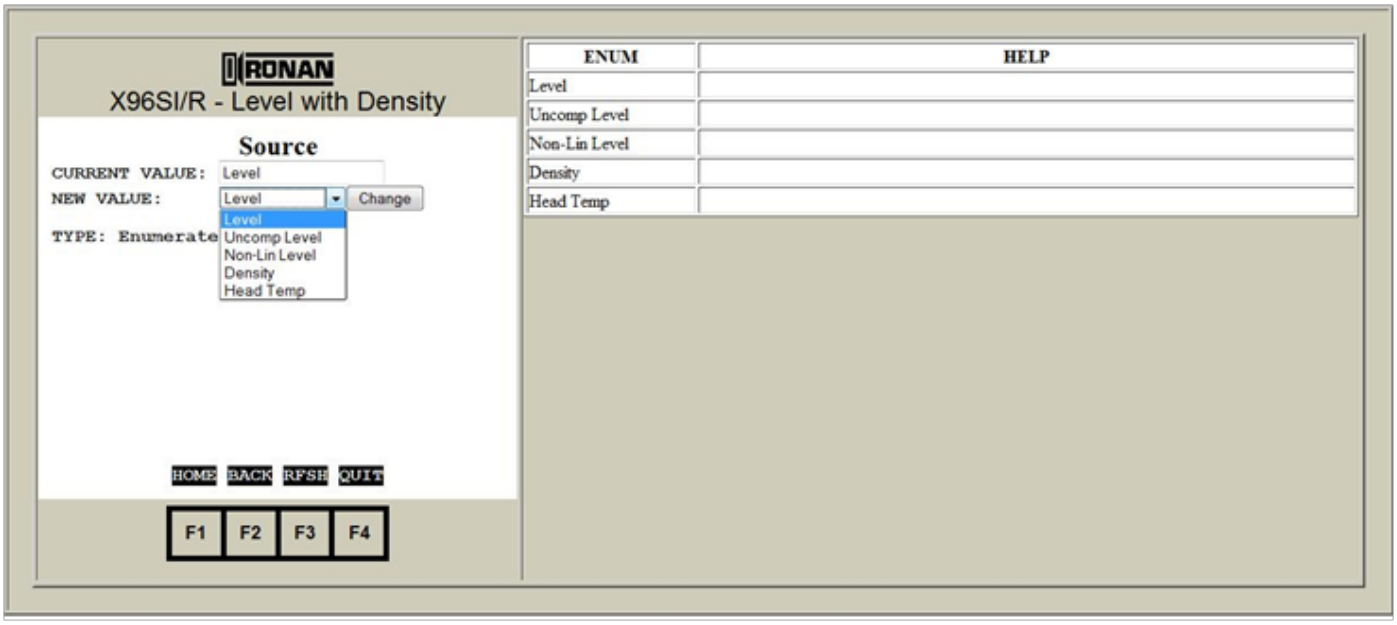
4.0 Operation Configuration Menu

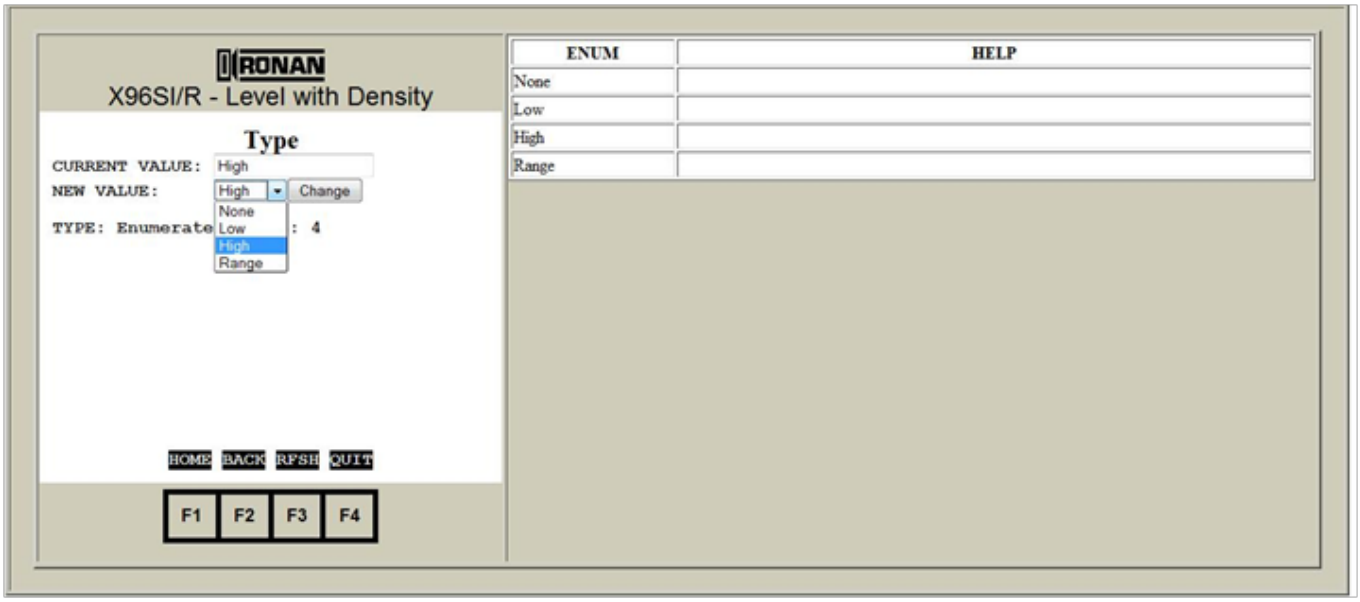
The Operation Configuration menu is used to access the menus and variables that control the processing of the level data. It contains the following items.

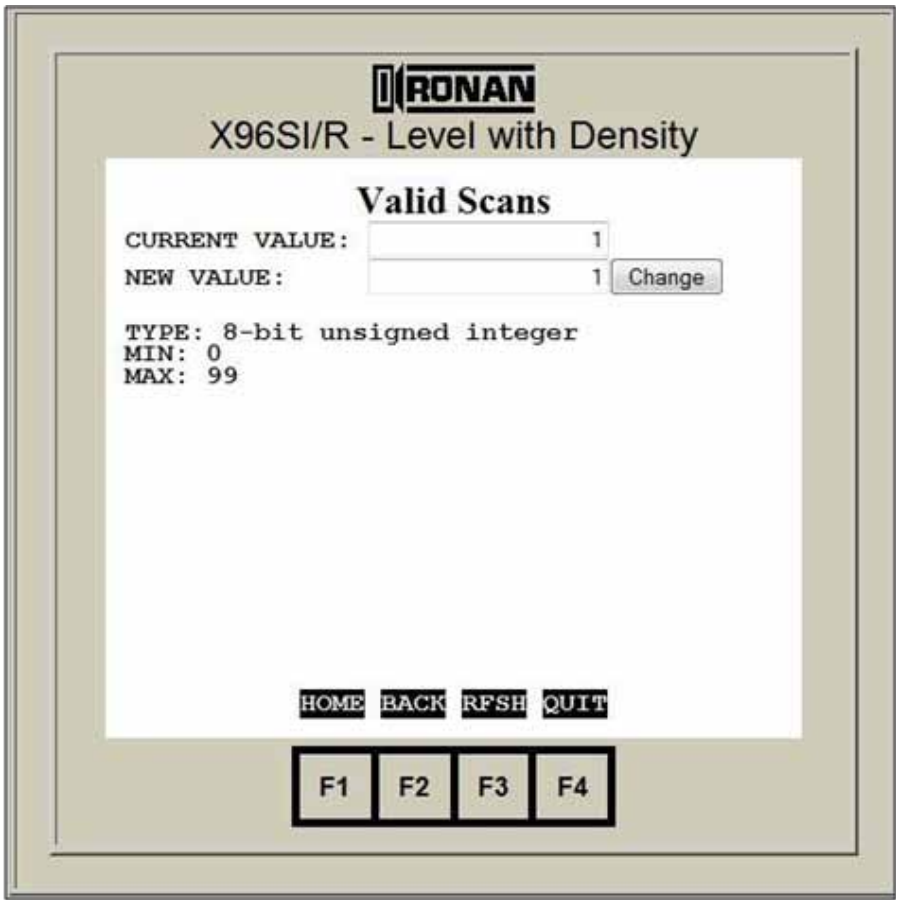
Operation CFG	Description
Variables	Displays and allows you to configure numerous system variables.
Alarm CFG	The alarm Cfg menu is used to configure the parameters associated with the analog alarms 1-8 and the 4.20mA alarm.
4-20 Alarm	Allow the user to control the 4-20mA output during certain types of alarms.
Detector Default	Provides an alarm that can be assigned to the digital outputs if the detector counts fall outside the predetermined range based on the Min. and Max. values the user defines.

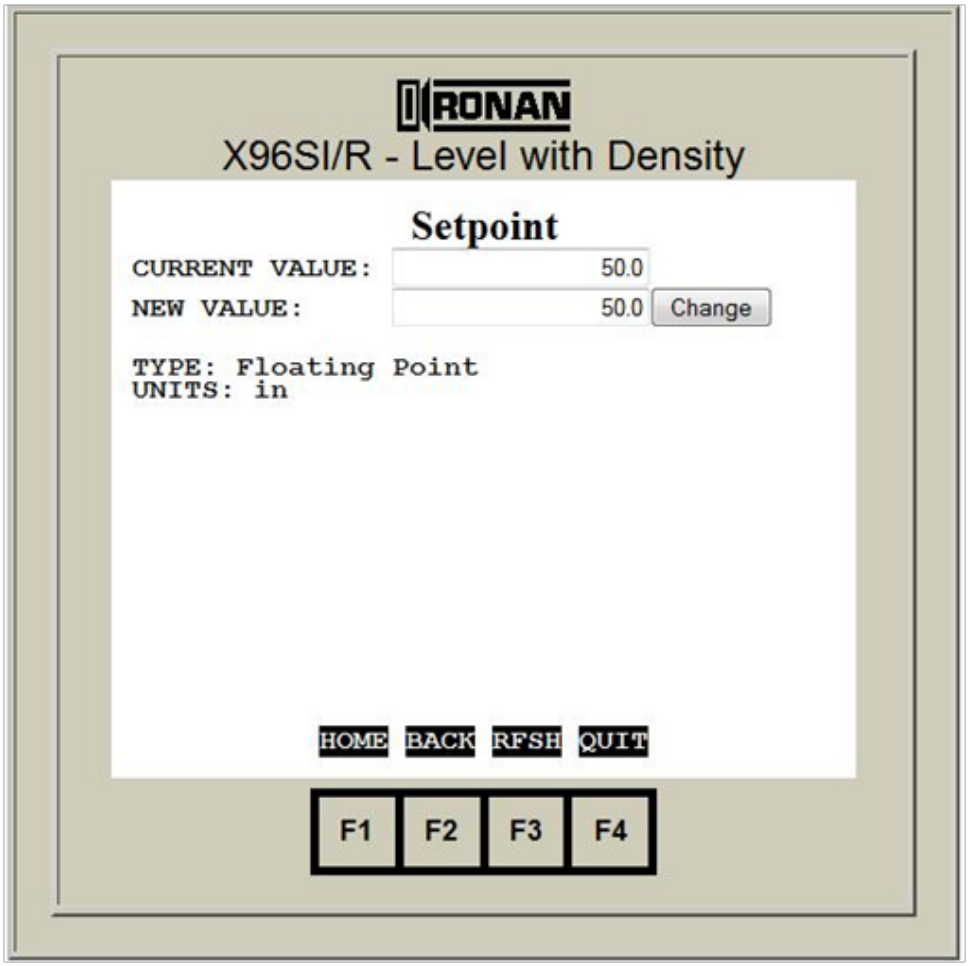

RONAN
X96SI/R - Level with Density
Alarm Cfg
Select Alarm 1
Source Level
Type High
Valid Scans 1
Setpoint 50.0 in
Setpoint2 12131.9 in
Hysterisis 1.0 %
HOME BACK RFSH QUIT
F1 F2 F3 F4

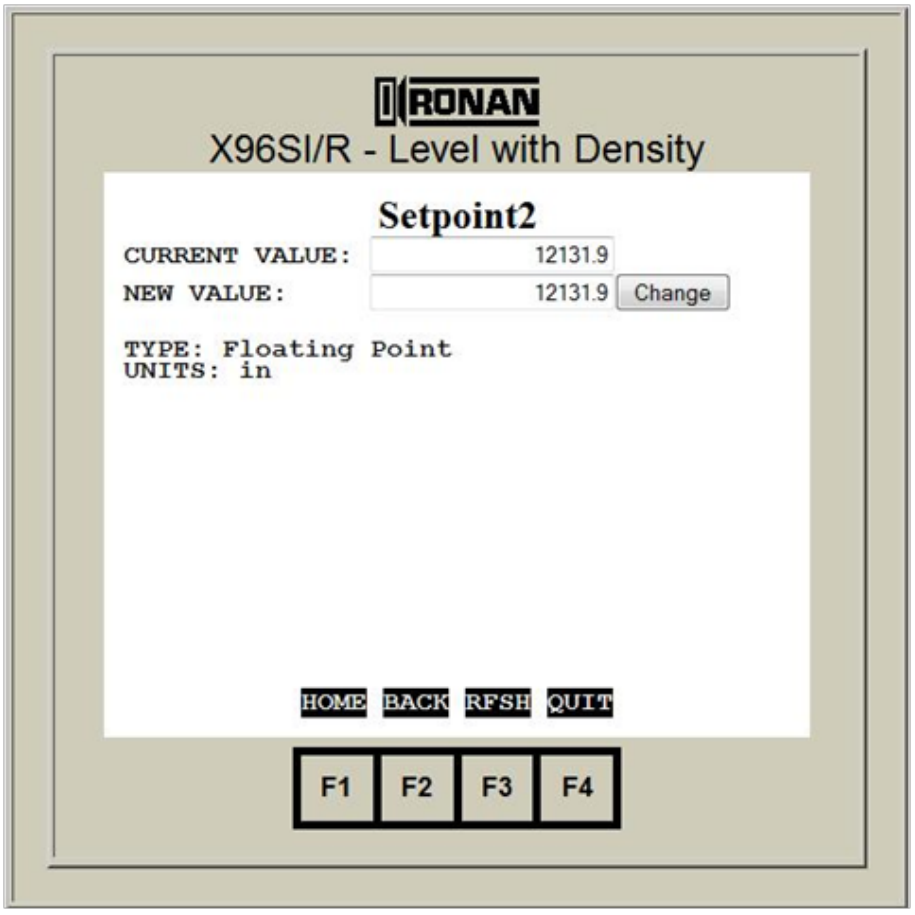

RONAN
X96SI/R - Level with Density
Select
VALUE: Alarm 1
TYPE: Enumerated ENUMS: 8
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM
HELP
Alarm 1
Alarm 2
Alarm 3
Alarm 4
Alarm 5
Alarm 6
Alarm 7
Alarm 8


RONAN
X96SI/R - Level with Density
Source
CURRENT VALUE: Level
NEW VALUE: Level Change
TYPE: Enumerate
Level
Uncomp Level
Non-Lin Level
Density
Head Temp
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM HELP
Level
Uncomp Level
Non-Lin Level
Density
Head Temp

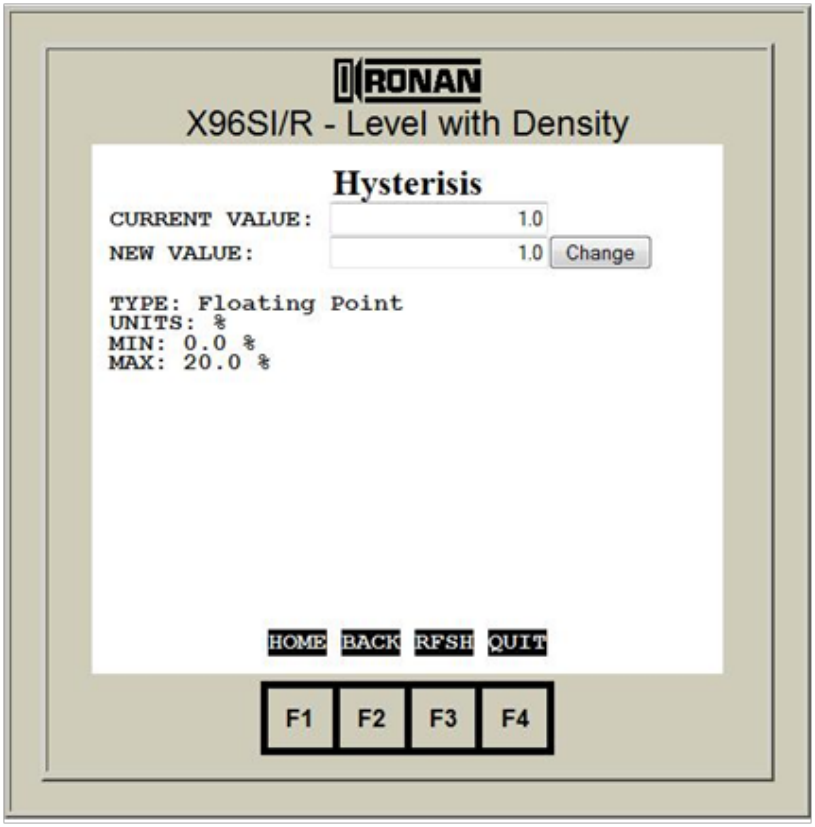

RONAN
X96SI/R - Level with Density
Type
CURRENT VALUE: High
NEW VALUE: High Change
TYPE: Enumerate : 4
None
Low
High
Range
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM HELP
None
Low
High
Range


RONAN
X96SI/R - Level with Density
Valid Scans
CURRENT VALUE: 1
NEW VALUE: 1 Change
TYPE: 8-bit unsigned integer
MIN: 0
MAX: 99
HOME BACK RFSH QUIT
F1 F2 F3 F4


RONAN
X96SI/R - Level with Density
Setpoint
CURRENT VALUE: 50.0
NEW VALUE: 50.0 Change
TYPE: Floating Point
UNITS: in
HOME BACK RFSH QUIT
F1 F2 F3 F4

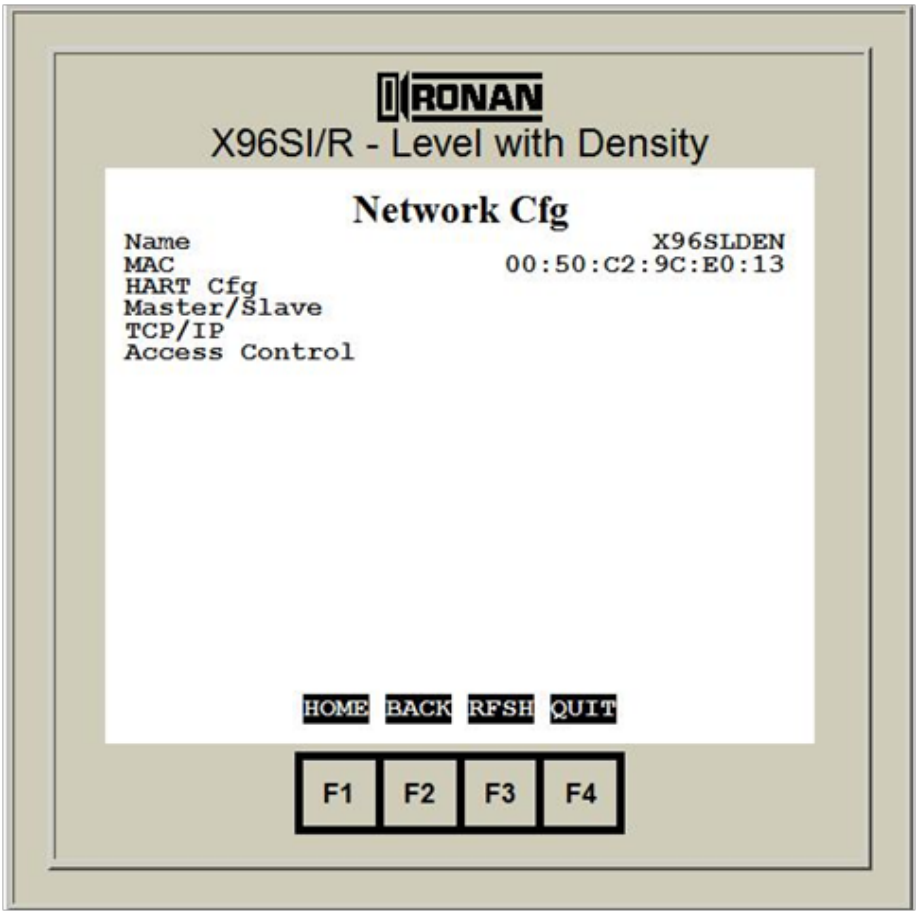

RONAN
X96SI/R - Level with Density
Setpoint2
CURRENT VALUE: 12131.9
NEW VALUE: 12131.9 Change
TYPE: Floating Point
UNITS: in
HOME BACK RFSH QUIT
F1 F2 F3 F4

Configuring Alarms (contd)

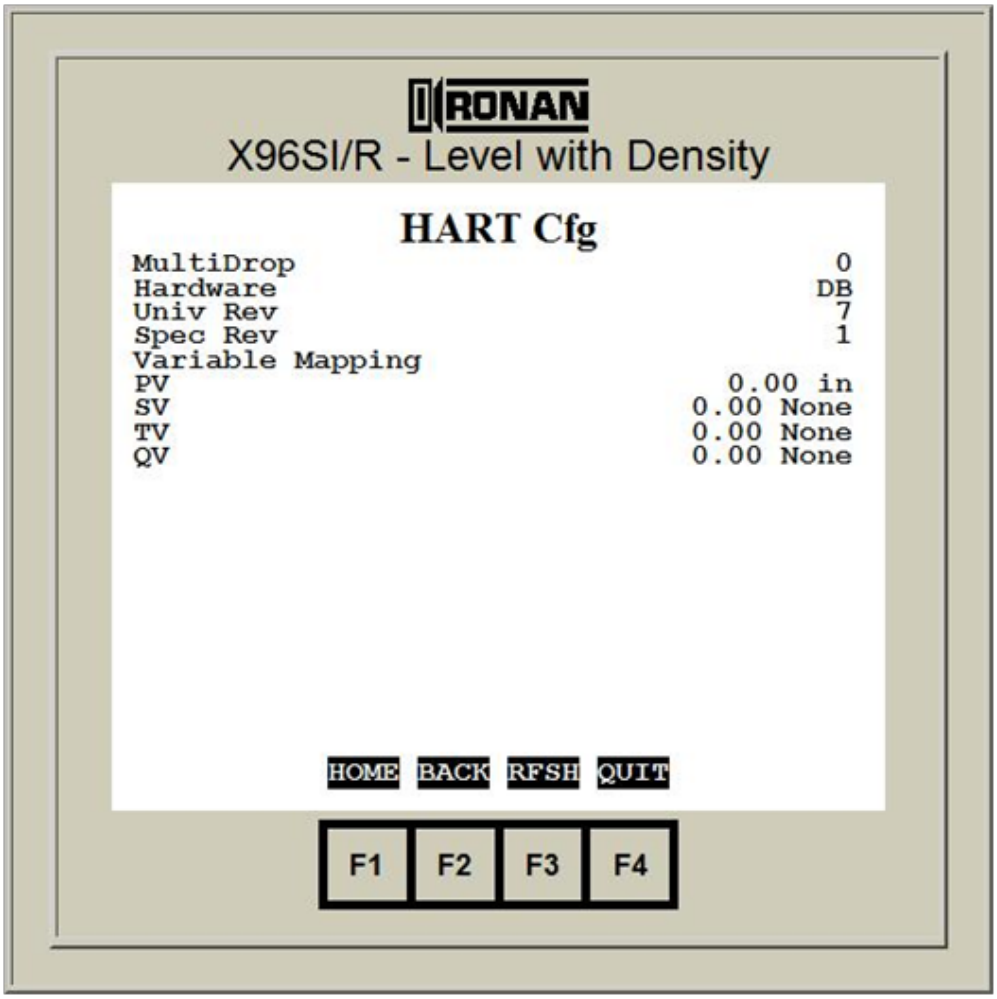


5.0 Network Configuration Menu

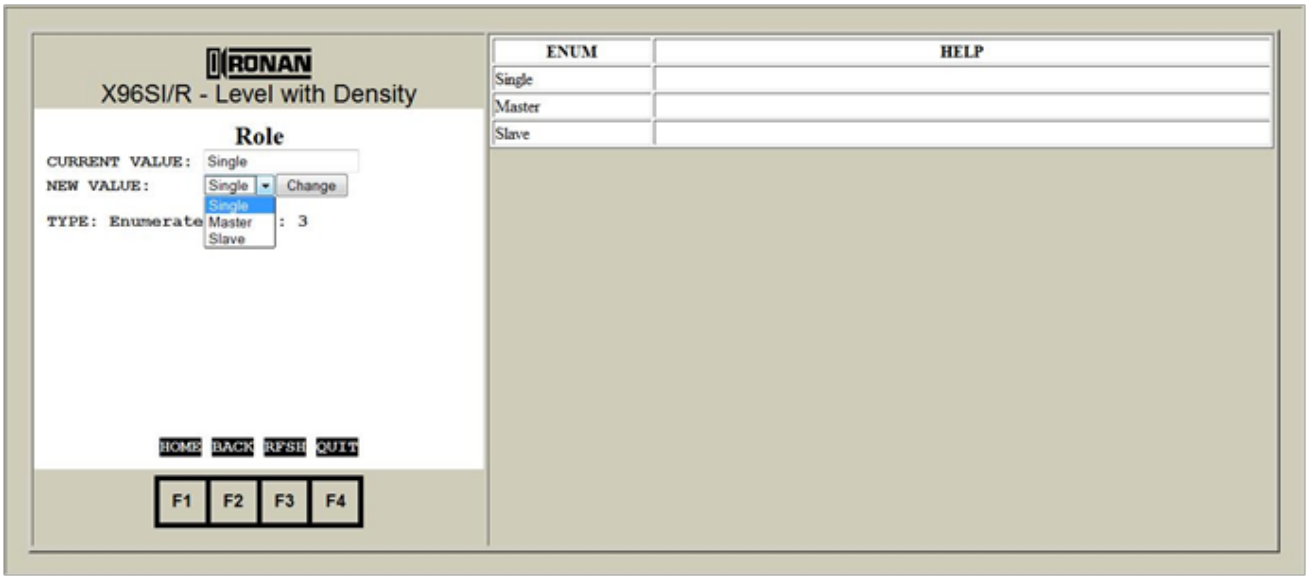
The network Configuration menu allows you to configure the network options for accessing the x96SI/R system. It includes the following items:

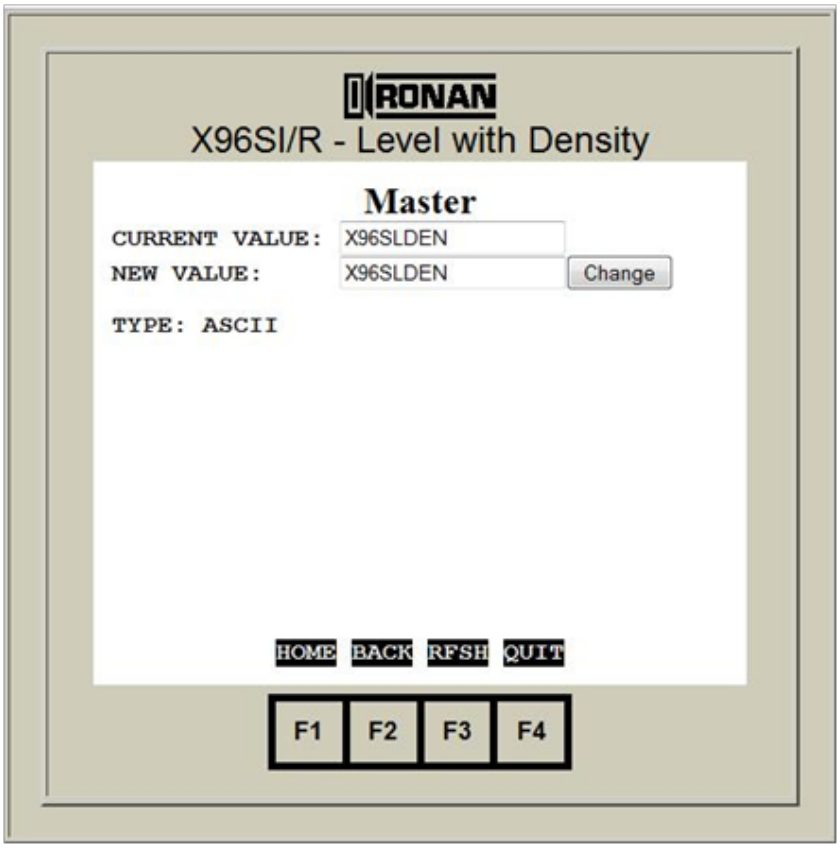


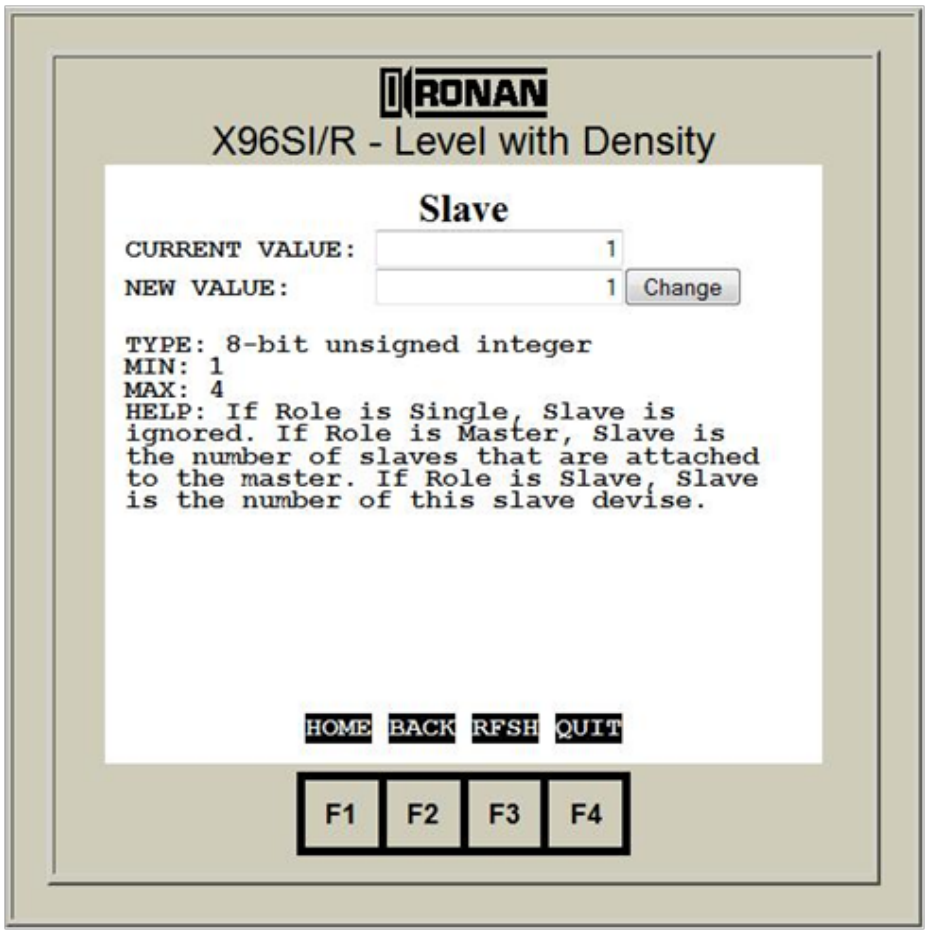
Network Cfg	Default	Description
Name	X96SLDEN	Both node name (LAN) and field bus (HART) name
Mac		The Machine Access address.
Hart CFG	menu	Used to configure the HART communication options.
Master/Slave	menu	Configures the Master/Slave options.
TCP/IP	menu	Used to configure the TCP/IP options.
Access Control	menu	Used to configure the access control options.

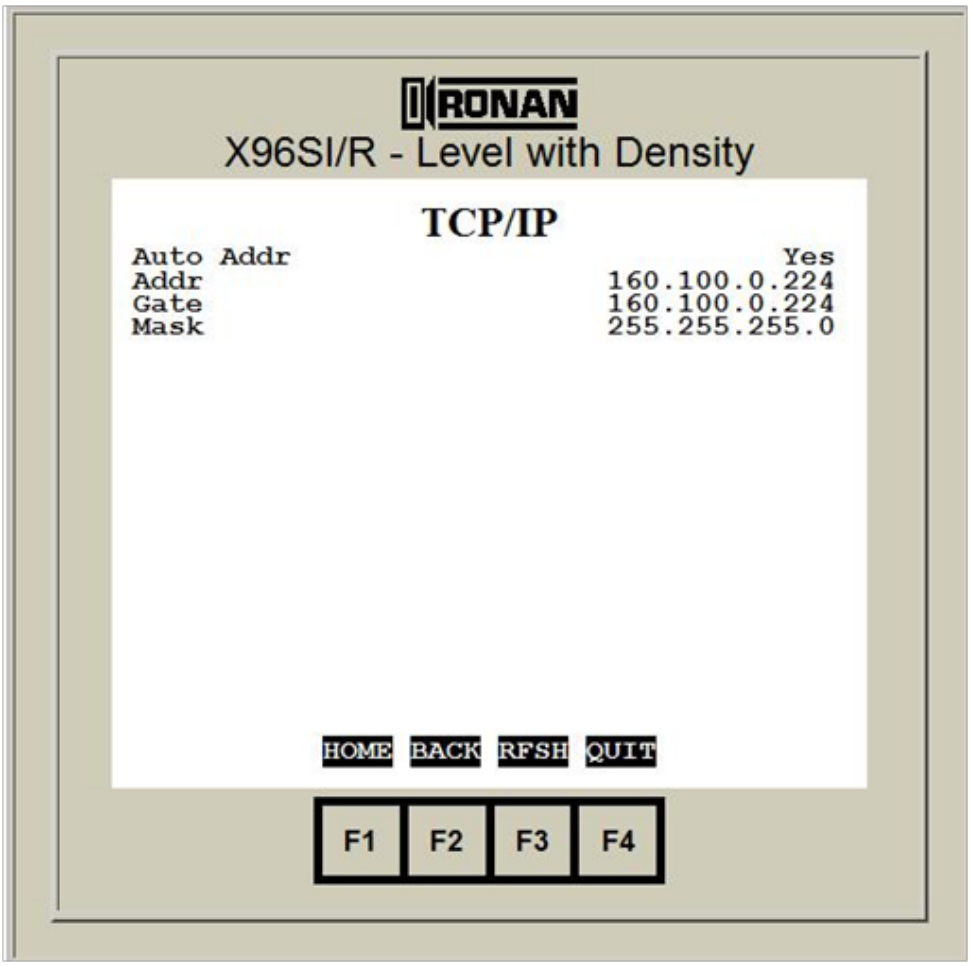

RONAN
X96SI/R - Level with Density
HART Cfg
MultiDrop 0
Hardware DB
Univ Rev 7
Spec Rev 1
Variable Mapping
PV 0.00 in
SV 0.00 None
TV 0.00 None
QV 0.00 None
HOME BACK RFSH QUIT
F1 F2 F3 F4

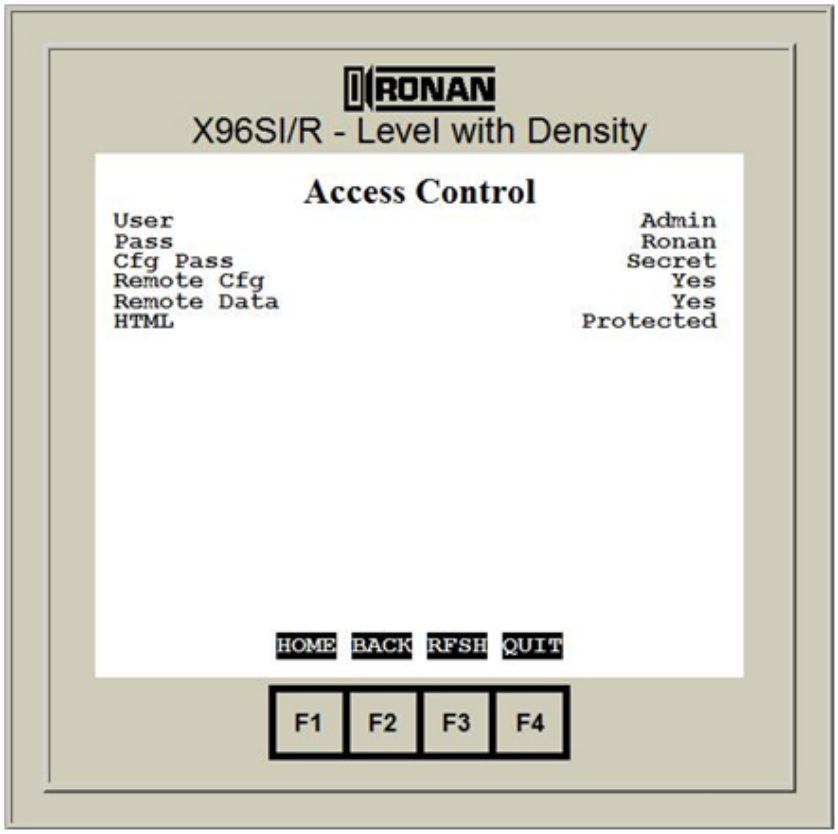
RONAN
X96SI/R - Level with Density
Master/Slave
Role Single
Master X96SLDEN
Slave 1
HOME BACK RFSH QUIT
F1 F2 F3 F4


RONAN
X96SI/R - Level with Density
Role
CURRENT VALUE: Single
NEW VALUE: Single Change
Single
Master
Slave
TYPE: Enumerate : 3
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM
HELP
Single
Master
Slave


RONAN
X96SI/R - Level with Density
Master
CURRENT VALUE: X96SLDEN
NEW VALUE: X96SLDEN Change
TYPE: ASCII
HOME BACK RFSH QUIT
F1 F2 F3 F4

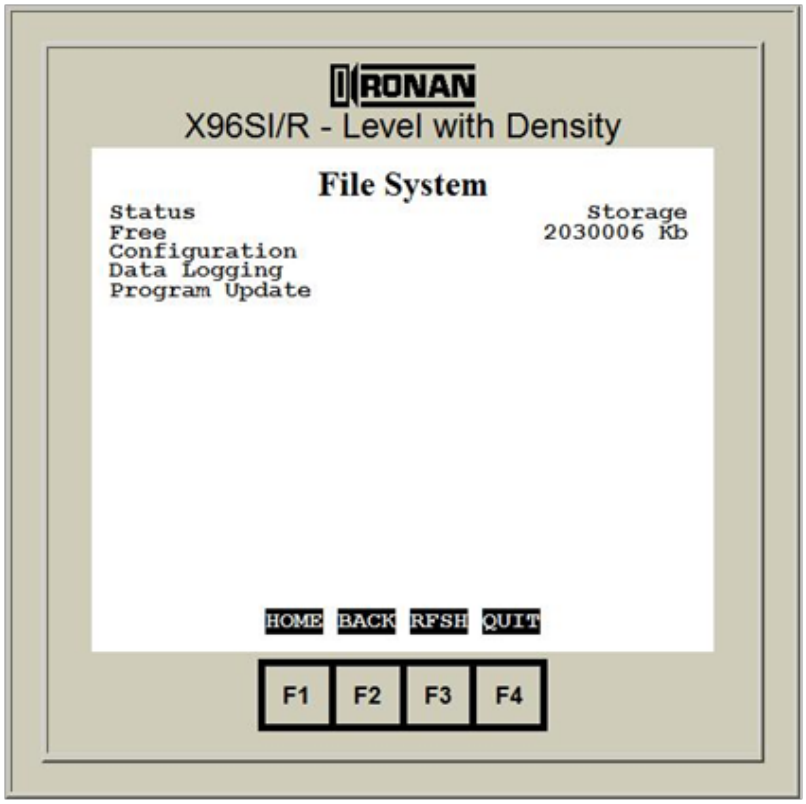

RONAN
X96SI/R - Level with Density
Slave
CURRENT VALUE: 1
NEW VALUE: 1 Change
TYPE: 8-bit unsigned integer
MIN: 1
MAX: 4
HELP: If Role is Single, Slave is ignored. If Role is Master, Slave is the number of slaves that are attached to the master. If Role is Slave, Slave is the number of this slave devise.
HOME BACK RFSH QUIT
F1 F2 F3 F4


IRONAN
X96SI/R - Level with Density
TCP/IP
Auto Addr Yes
Addr 160.100.0.224
Gate 160.100.0.224
Mask 255.255.255.0
HOME BACK RFSH QUIT
F1 F2 F3 F4



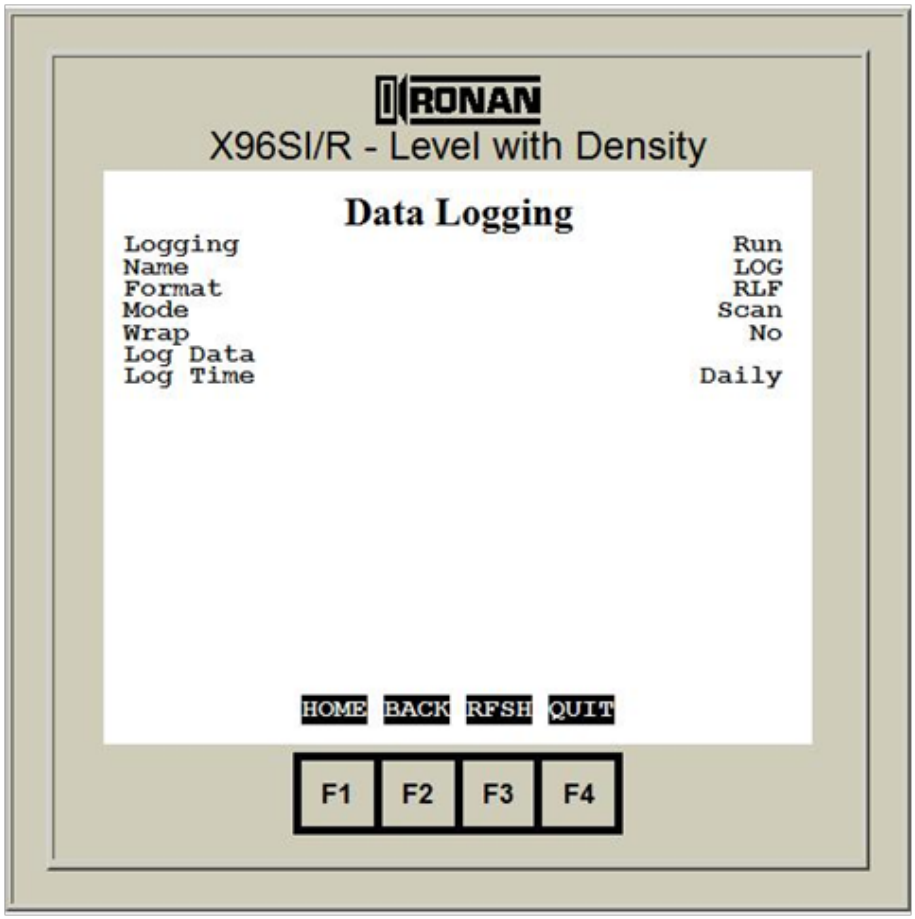
6.0 File System Menu

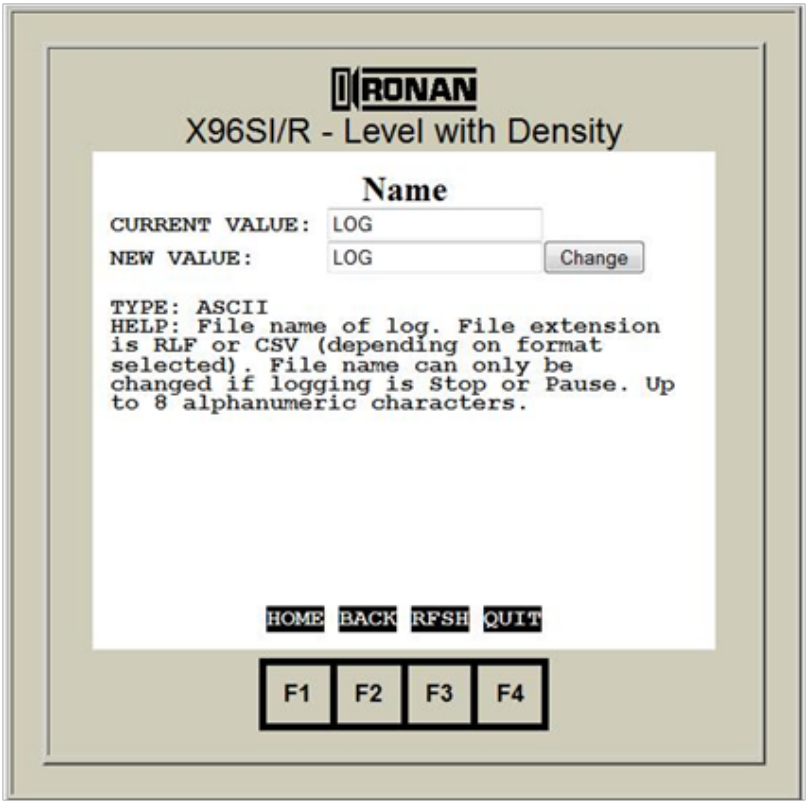
The File System menu includes the following items:

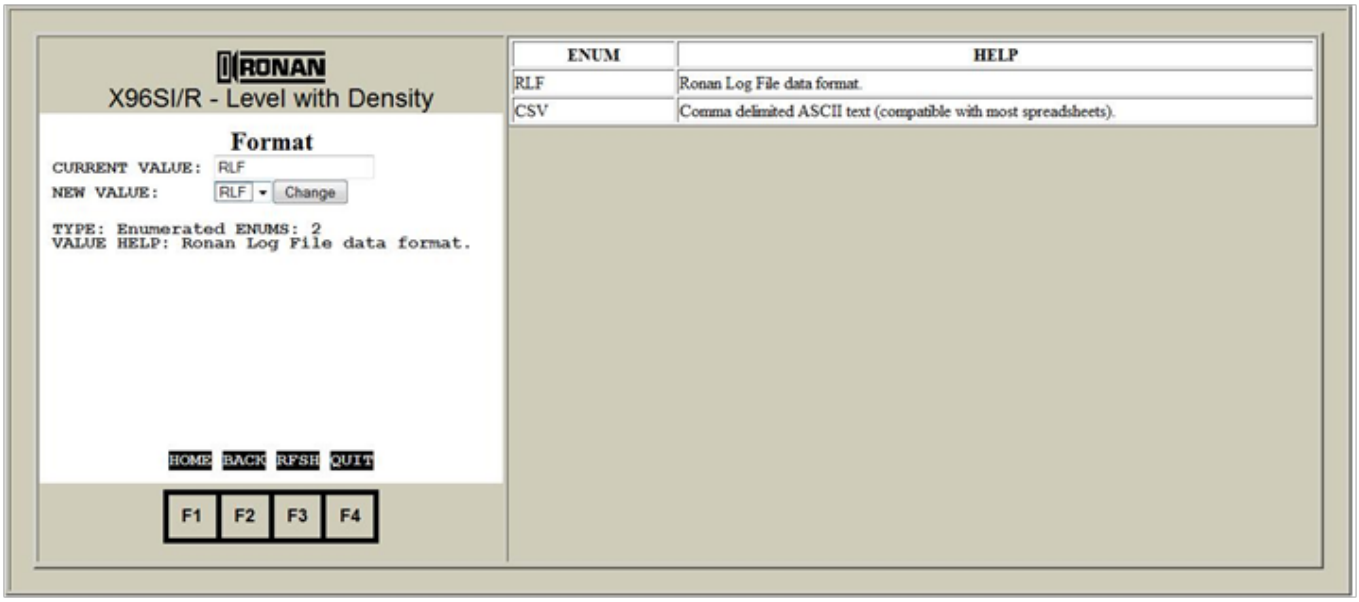


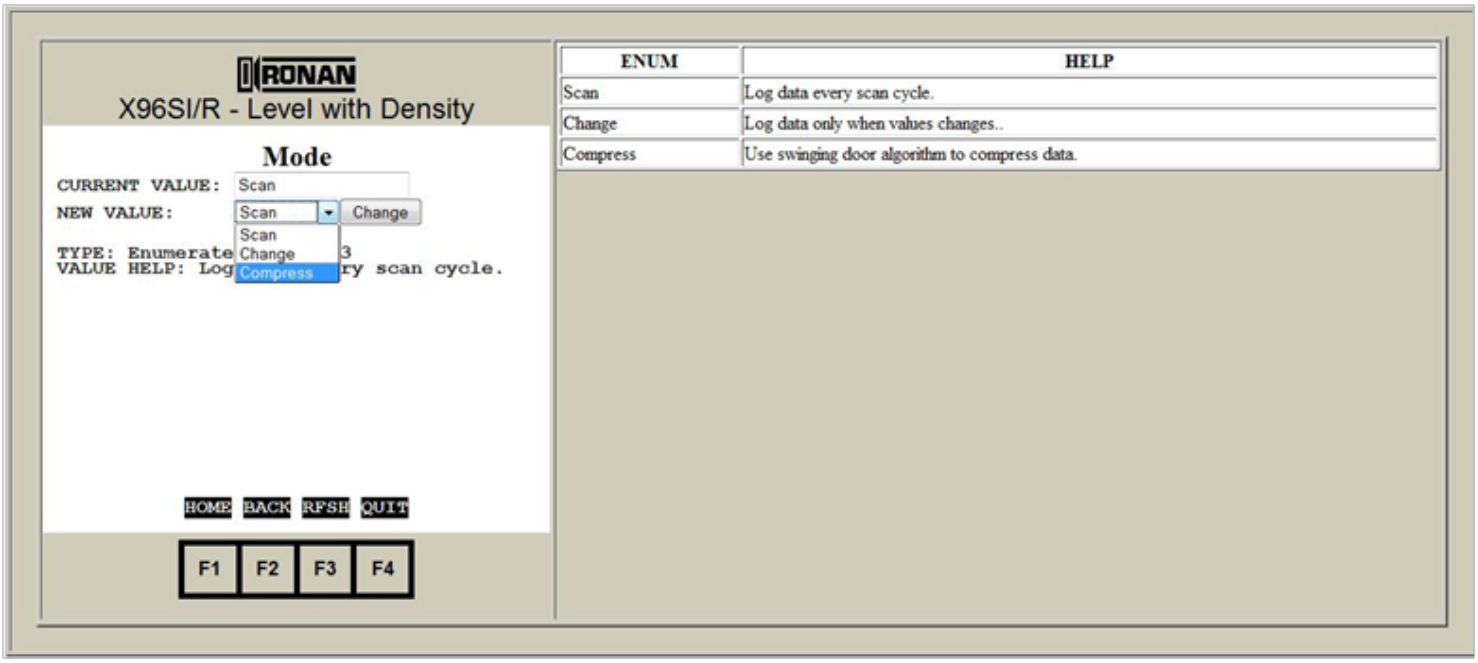
File System	Min.	Max	Description	
Status				
Free	0	1000000	Mbytes of free space on USB drive.	
File System				
Data Logging				
Program Update				

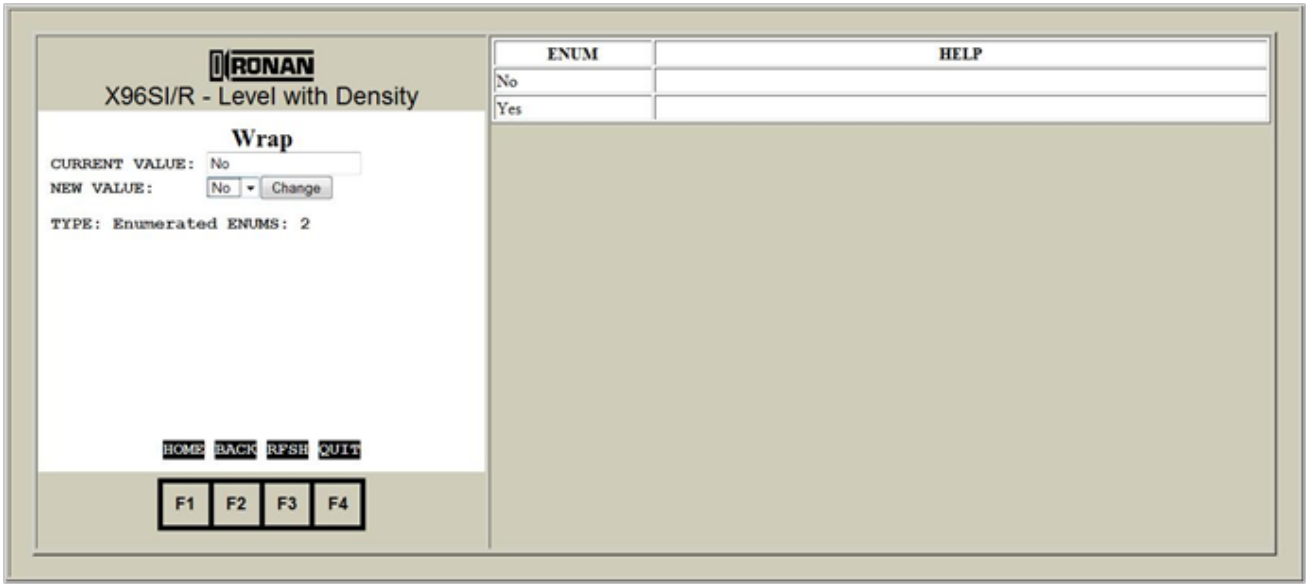
Data Logging
Needs steps documented

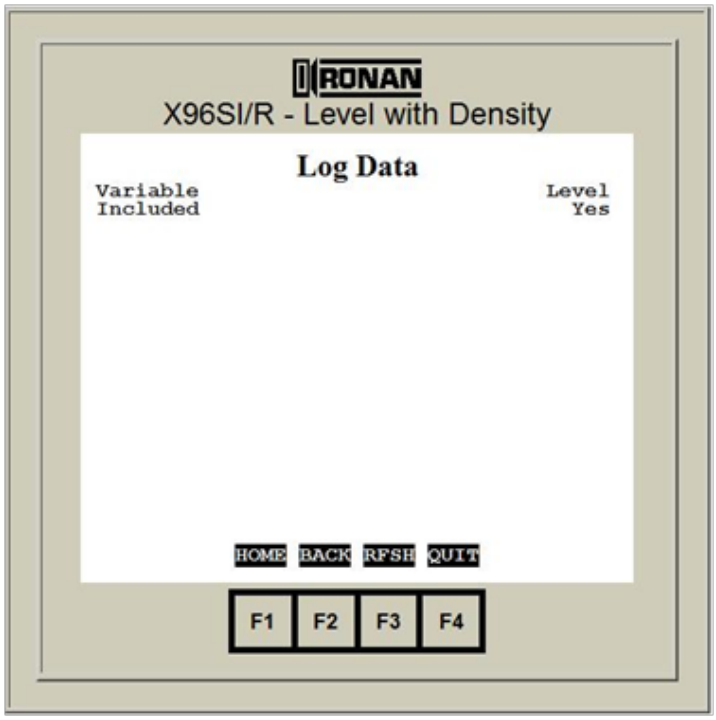


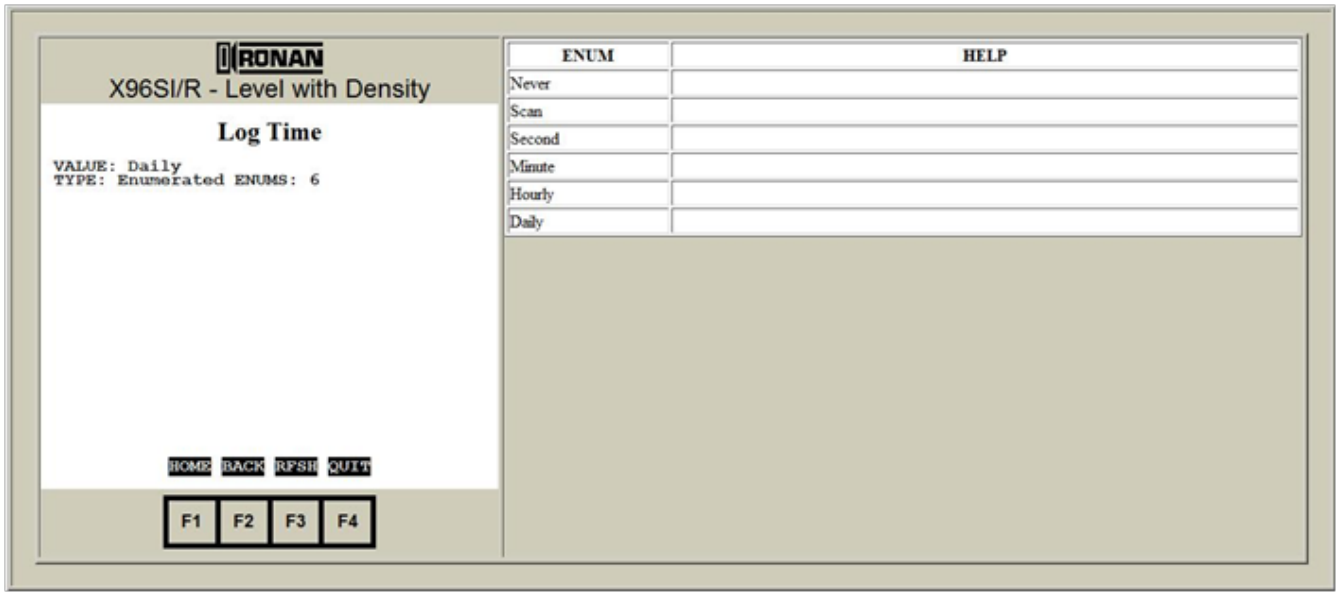

RONAN
X96SI/R - Level with Density
Name
CURRENT VALUE: LOG
NEW VALUE: LOG
Change
TYPE: ASCII
HELP: File name of log. File extension is RLF or CSV (depending on format selected). File name can only be changed if logging is Stop or Pause. Up to 8 alphanumeric characters.
HOME BACK RFSH QUIT
F1 F2 F3 F4


RONAN
X96SI/R - Level with Density
Format
CURRENT VALUE: RLF
NEW VALUE: RLF Change
TYPE: Enumerated ENUMS: 2
VALUE HELP: Ronan Log File data format.
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM
HELP
RLF
Ronan Log File data format.
CSV
Comma delimited ASCII text (compatible with most spreadsheets).


RONAN
X96SI/R - Level with Density
Mode
CURRENT VALUE: Scan
NEW VALUE: Scan Change
Scan
Change
Compress
TYPE: Enumerate 3
VALUE HELP: Log ry scan cycle.
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM
HELP
Scan
Log data every scan cycle.
Change
Log data only when values changes..
Compress
Use swinging door algorithm to compress data.

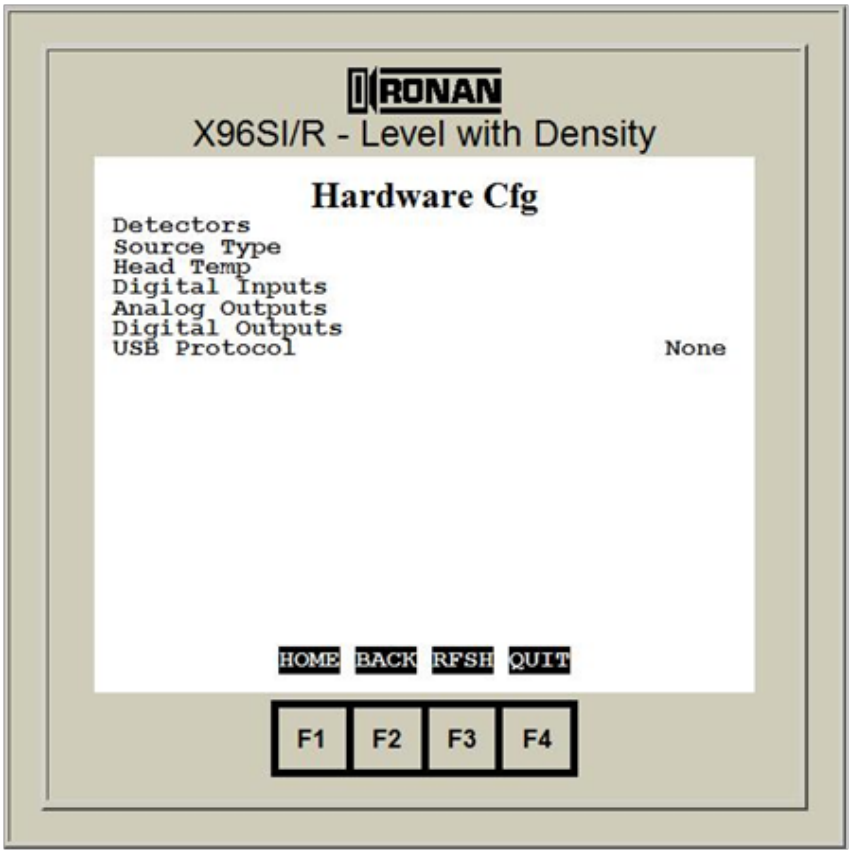

RONAN
X96SI/R - Level with Density
Wrap
CURRENT VALUE: No
NEW VALUE: No Change
TYPE: Enumerated ENUMS: 2
HOME BACK RFSH QUIT
F1 F2 F3 F4
ENUM
HELP
No
Yes



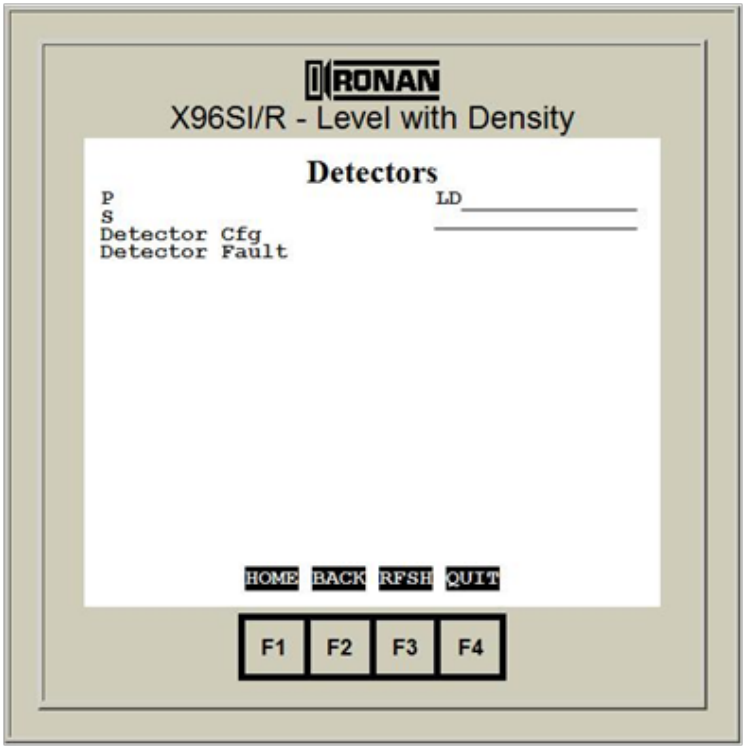


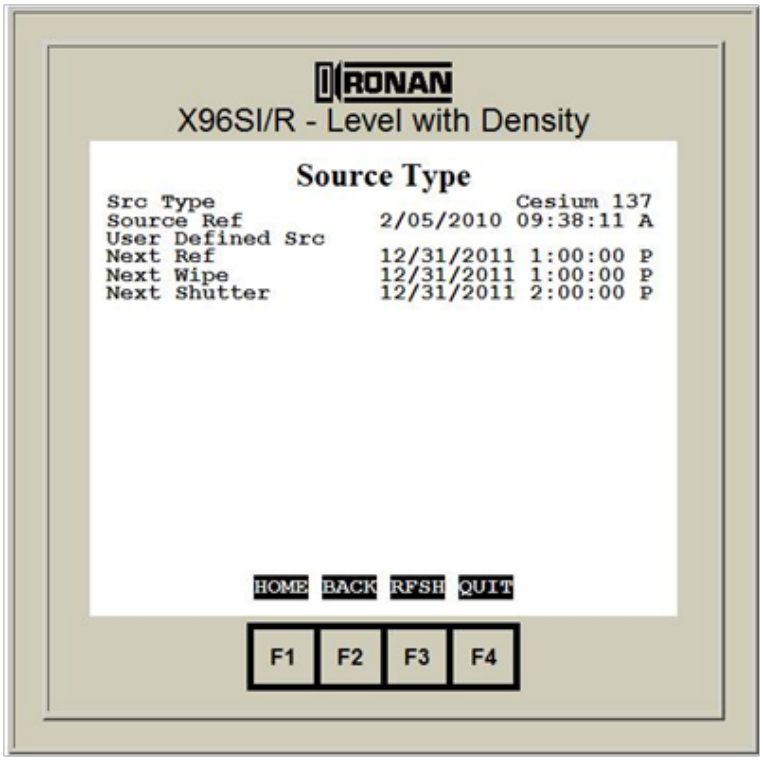
7.0 Hardware Configuration Menu

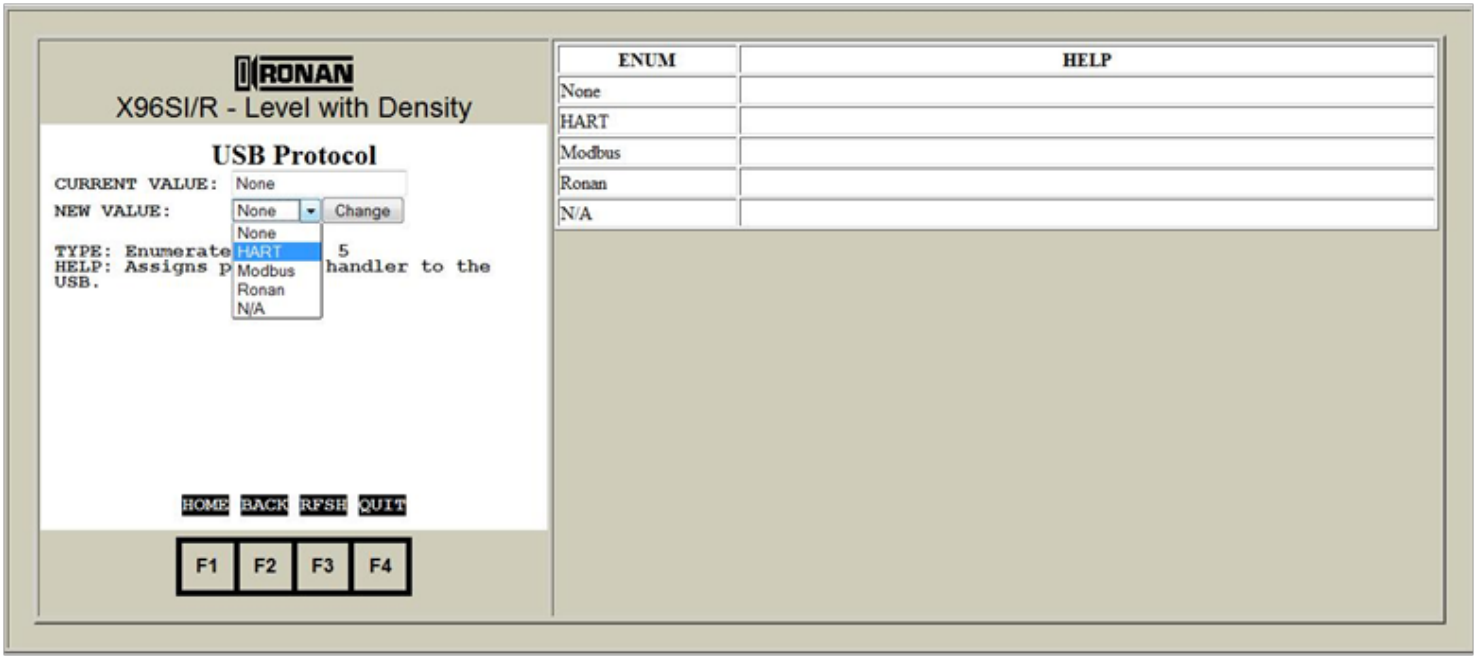
The Hardware Configuration menu includes the following options:



Hardware Cfg	Level with Density	Description
Detectors	menu	Configures the detector options
Source Type	menu	Configures the source type
Counters	menu	Configures the counter frequency
Frequency Out	menu	Configures the frequency out options
Analog Inputs	menu	Configures the Analog outputs
Digital Outputs	menu	Configures the digital output
USB Protocol	Ronan	Assigns protocol handller for Com1

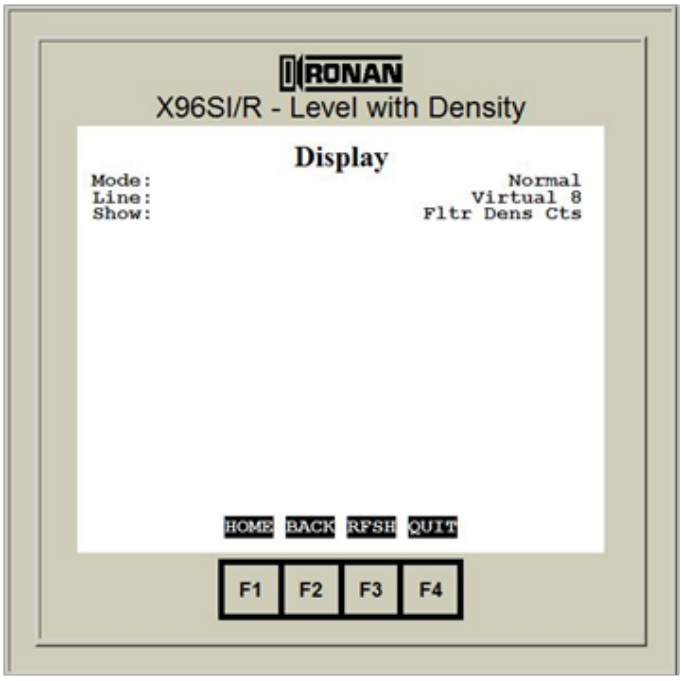

RONAN
X96SI/R - Level with Density
Detectors
P
S
LD
Detector Cfg
Detector Fault
HOME
BACK
RFSH
QUIT
F1
F2
F3
F4

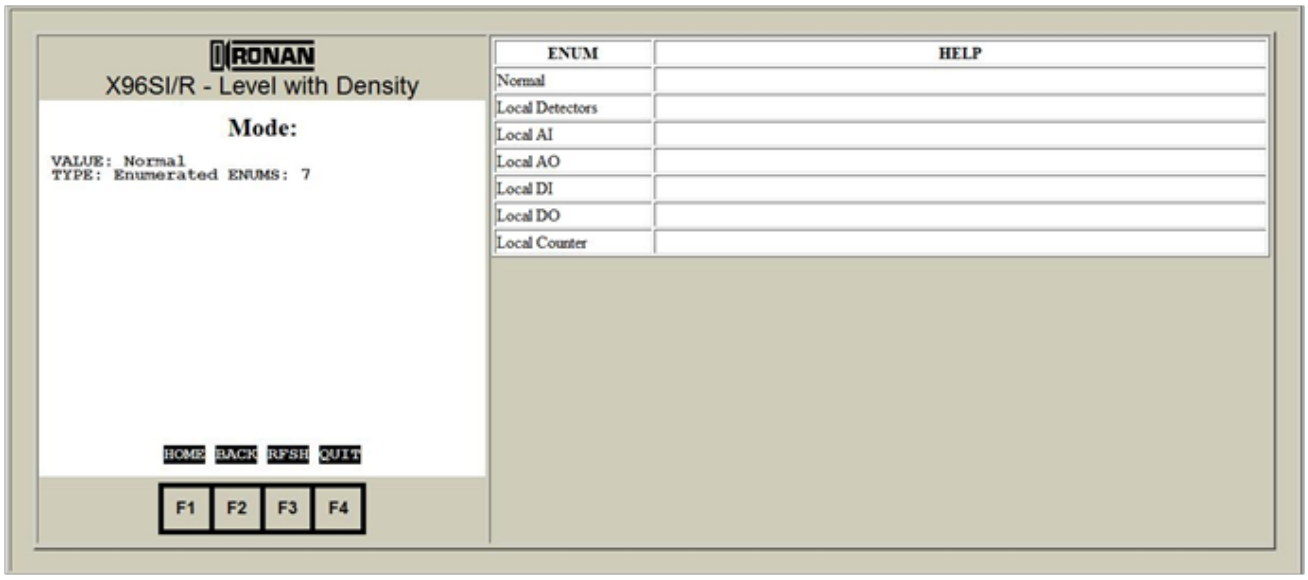


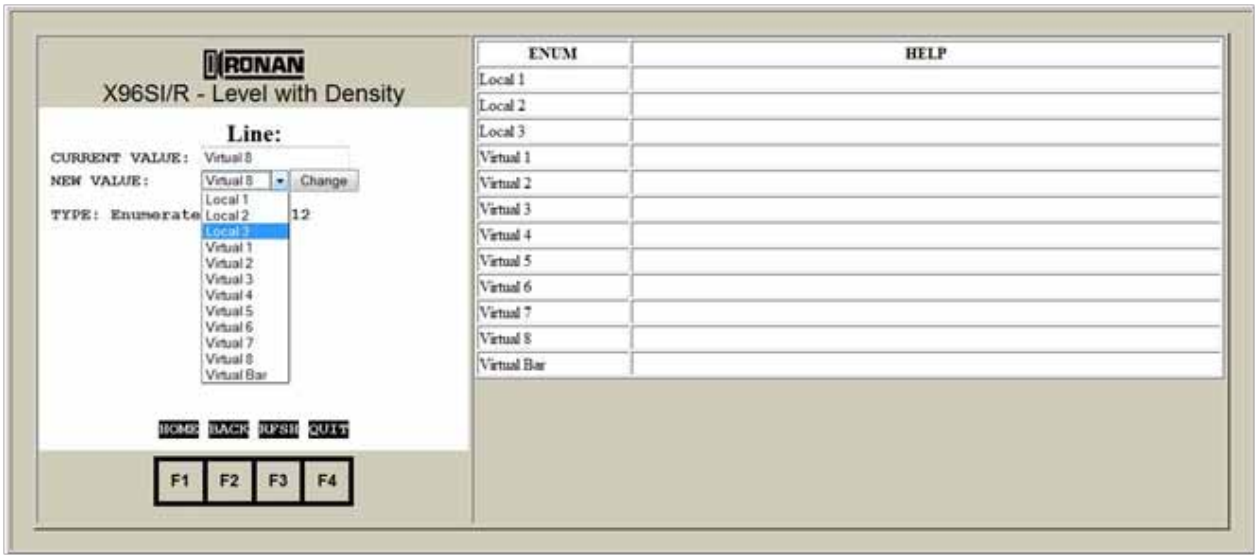


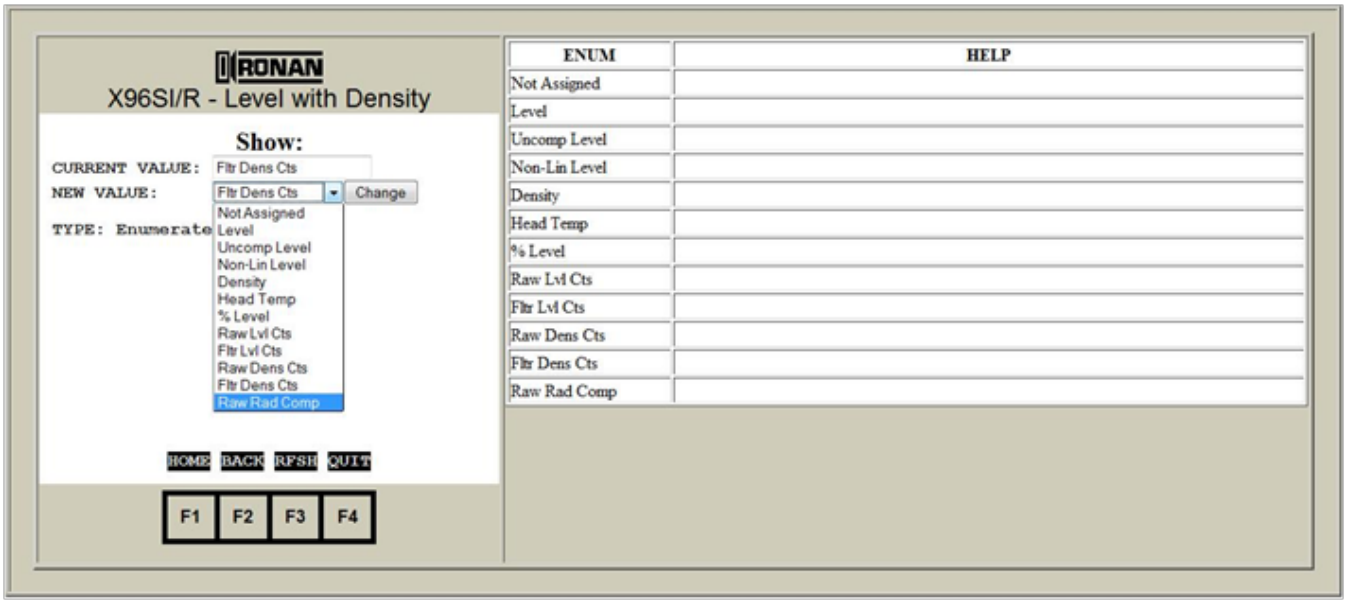
ENUM	HELP
None	
HART	
Modbus	
Ronan	
N/A	

8.0 Display Menu
The Display menu includes the following options:



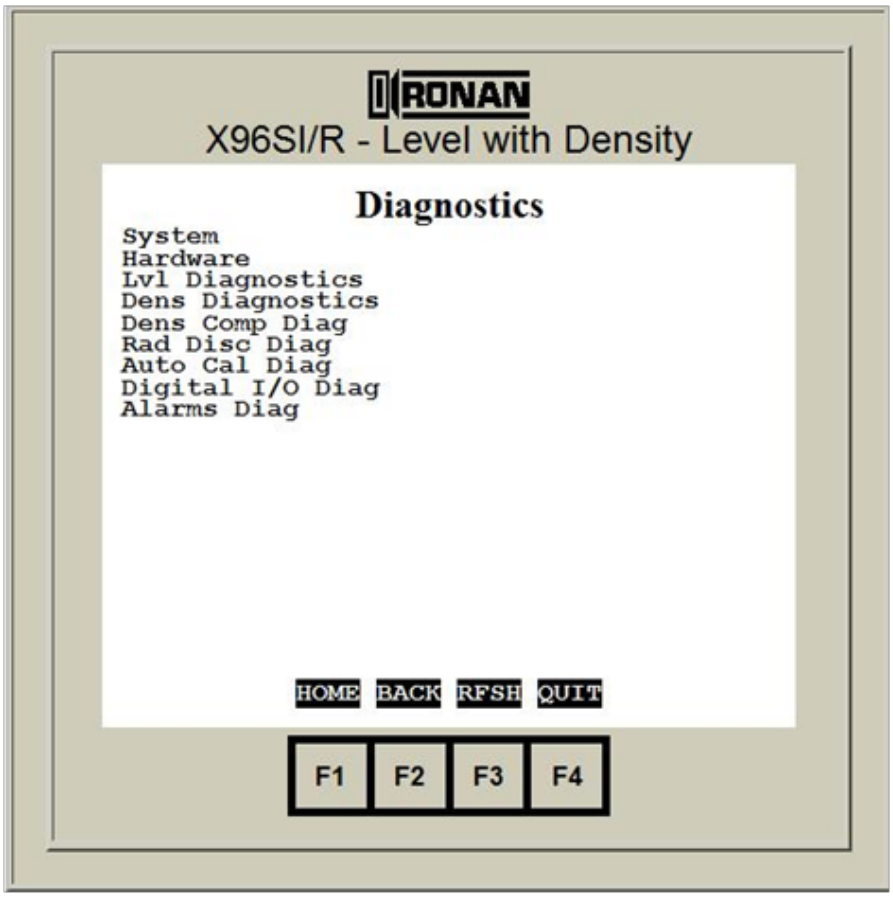




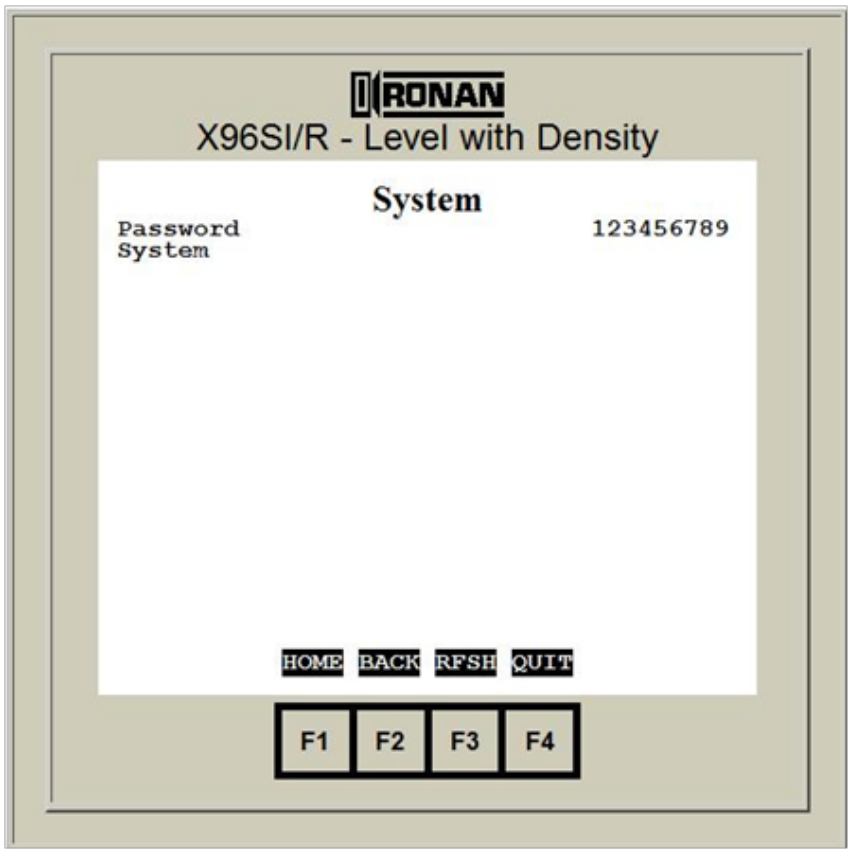


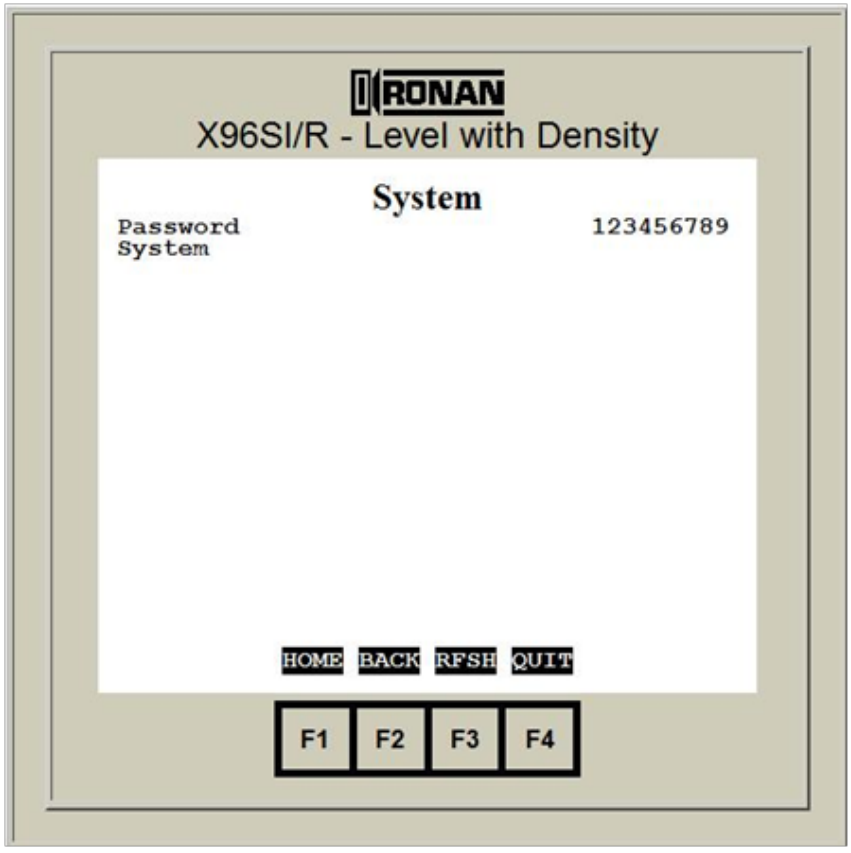
Display	Level with Density	Description
Mode		
Line	Local 1	Defines the lines that show up on the local display
Show	Level	Defines the 8 lines you see under the Live Data screen.

9.0 Diagnostics Menu
The Diagnostics menu includes the following options:

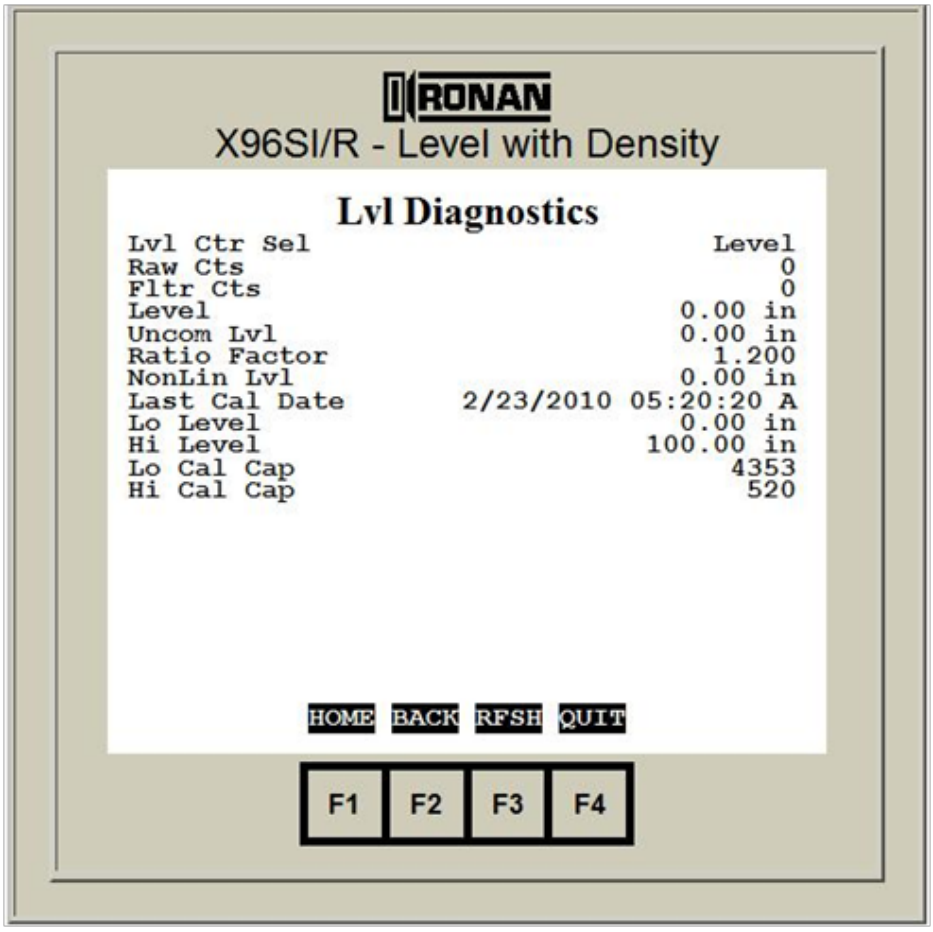


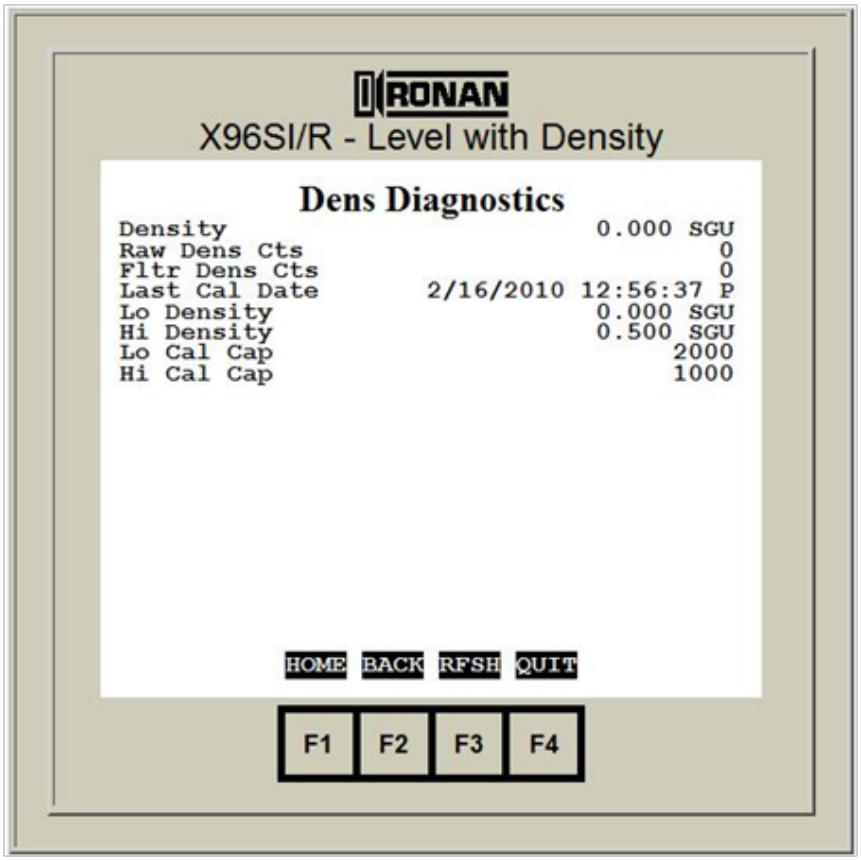
Diagnostic	Descriptions
System	Displays password and system date and time
Hardware	Displays information on the processor and daughter board
Detector Diag	Displays information about the detector
LvL Diag	Displays information about the density configuration.
Dens Diag	Displays information about density configuration options
Dens Comp diag	Displays information about Density Compensation configuration options
Rad disc Diag	Displays about Radiation Discrimination options
Rad Comp Diag	Displays information about Radiation Compensation options
Auto Cal Diag	Displays information about the Auto Cal options
Digital I/O	Displays information about the digital I/O
Alarms Diag	Displays information about the alarms option


RONAN
X96SI/R - Level with Density
System
Password
System
123456789
HOME
BACK
RFSH
QUIT
F1
F2
F3
F4

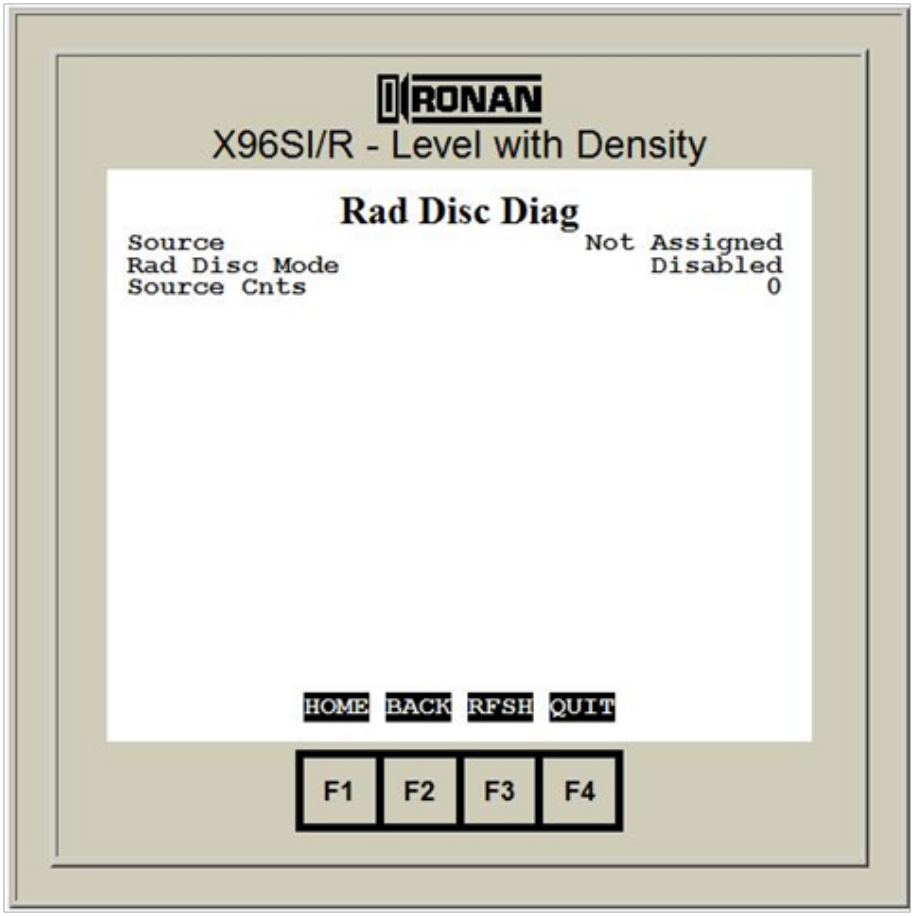

RONAN
X96SI/R - Level with Density
System
Password
System
123456789
HOME
BACK
RFSH
QUIT
F1
F2
F3
F4

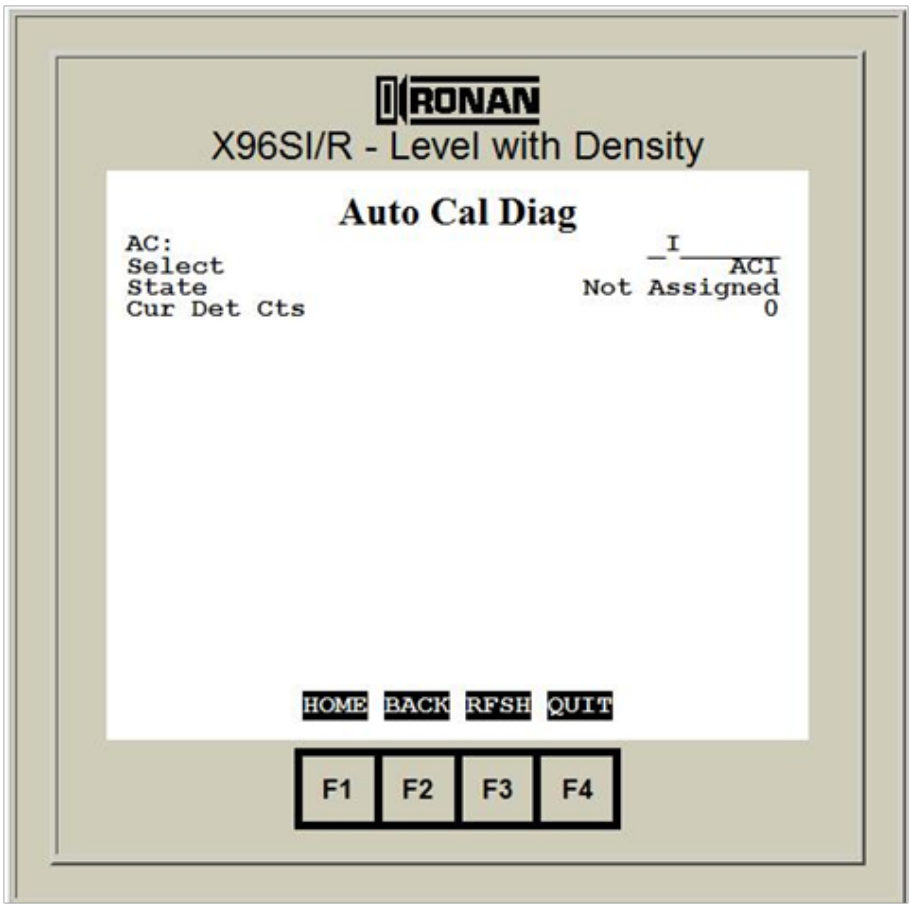
NEED DETECTOR DIAG





IRONAN
X96SI/R - Level with Density
Dens Comp Diag
Comp Dens Cap 148
Fltr Dens Cts 0
X Factor 1.00
Min Factor 0.80
Max Factor 1.20
Ratio Factor 1.200
HOME BACK RFSH QUIT
F1 F2 F3 F4


IRONAN
X96SI/R - Level with Density
Rad Disc Diag
Source Not Assigned
Rad Disc Mode Disabled
Source Cnts 0
HOME BACK RFSH QUIT
F1 F2 F3 F4


IRONAN
X96SI/R - Level with Density
Auto Cal Diag
AC:
Select
State
Cur Det Cts
_I_____
ACI
Not Assigned
0
HOME
BACK
RFSH
QUIT
F1
F2
F3
F4