RAE Systems

MeshGuard System Introduction

Mesh Networking Product System Operation

October 30, 2009

Agenda

- **System Overview and Setup Flexibility**
  - Overview of system options
  - Mesh function

- **FMC 2000 Controller**
  - Display overview
  - Obtaining data from the monitors
  - Setting minimum number of detectors
  - Set up and testing of alarm relays
  - Setting up PAN ID
  - Data Log file
  - Connecting the FA-200 Alarm Bar
  - 3rd party interface

Agenda

- **MeshGuard Router**
  - Functions as a signal strength indicator
  - Router operation

- **MeshGuard**
  - Calibration
  - Searching for a new network
  - Changing PAN ID and USER mode
  - Service
  - Power Options

Agenda

- **MeshReader**
  - Function with ProRAE.NET
  - Function with FMC 2000 as Router
- **ProRAE.NET Software**
  - Screen overview

Product Options

Outdoor Reader

Indoor Reader

Controller

Power

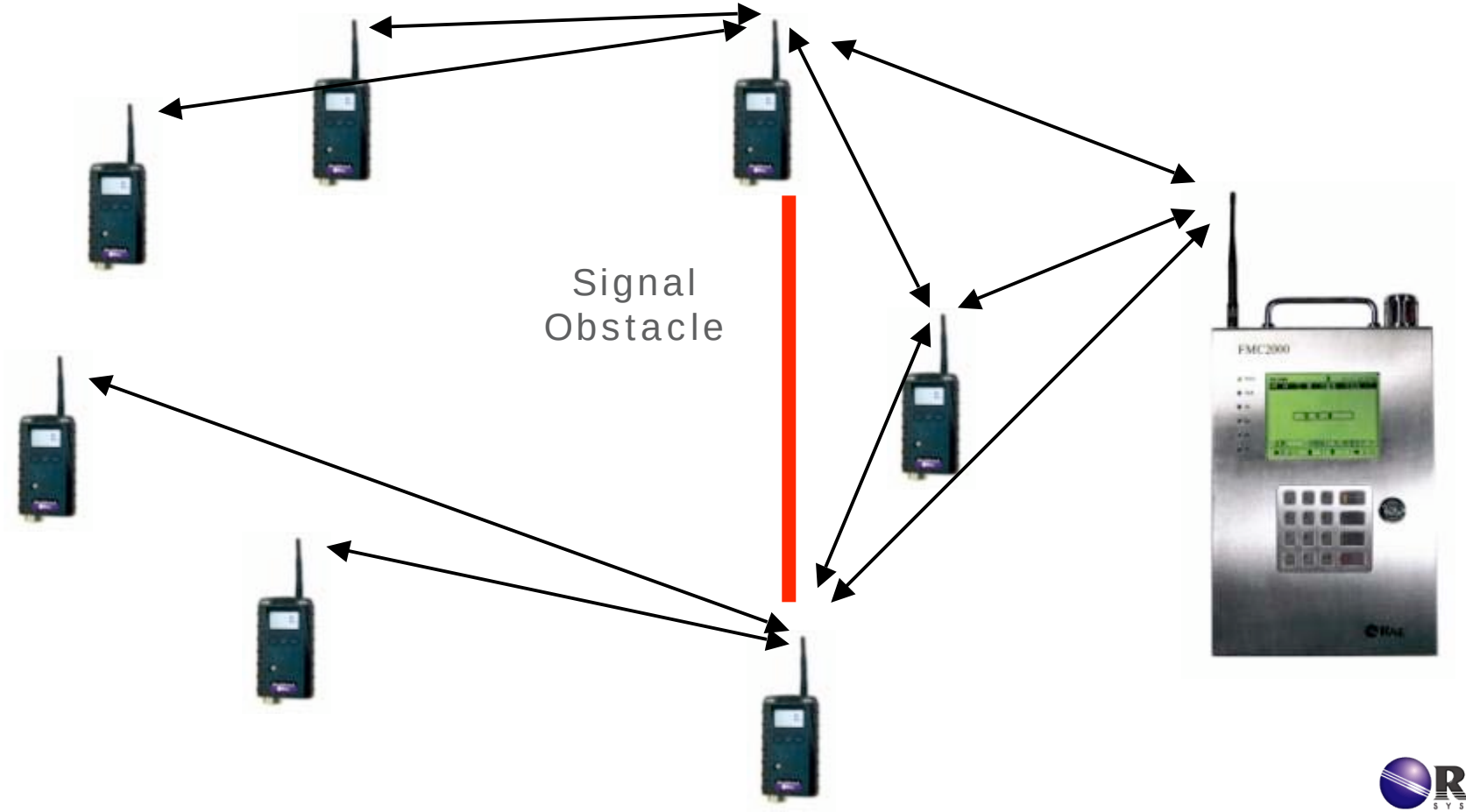
Software

Detectors

MeshGuard System Overview

Mesh Routing Function

- Forwards signal from other monitors
- Used to bypass obstacles



MeshGuard System Overview

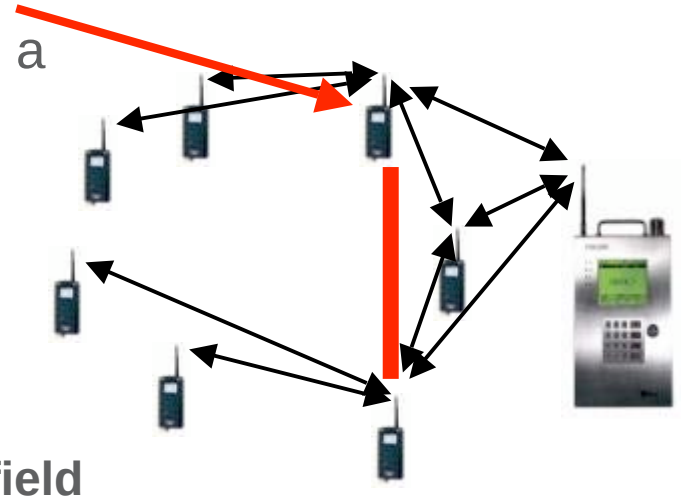
The MeshGuard Radio has 2 operation modes:

-RFD (Reduced Function Device) mode transmits a signal every 30 seconds or on alarm

-Battery operation time: Up to 6 months

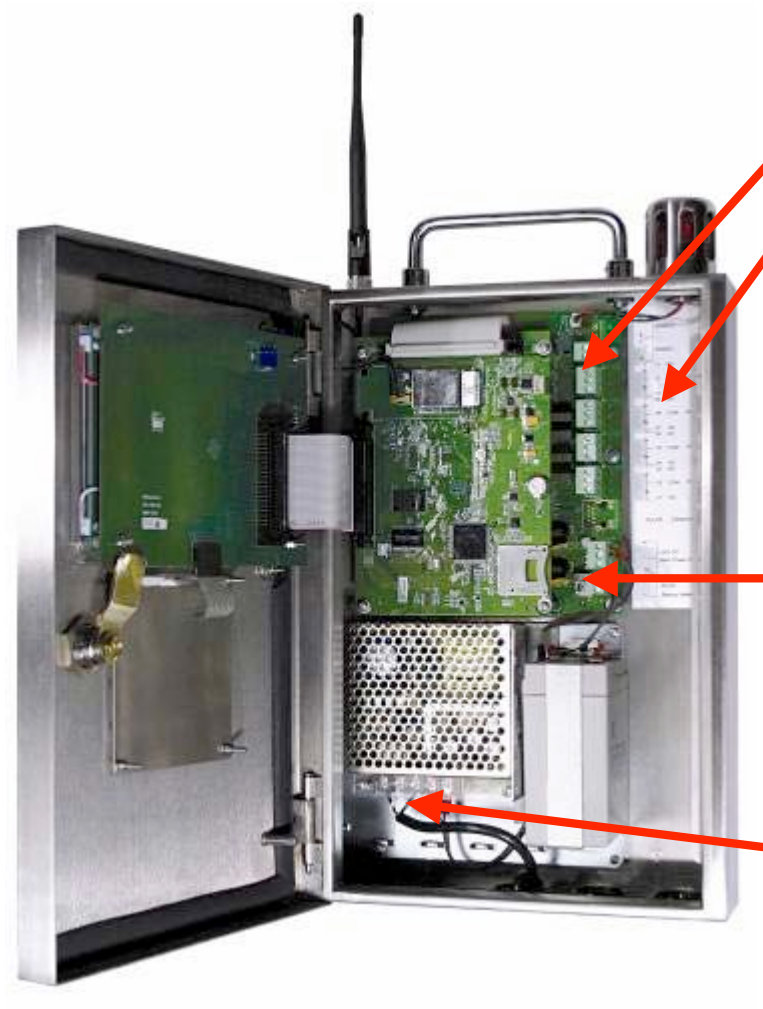
-FFD (Full Function Device) mode can forward other monitors' data and redirect data if there is a change in the network

-Battery operation time: Up to 10 days



The operation mode can be changed in the field
NOTE: FMC 2000 and MeshGuards must be on the same PAN ID number

MeshGuard System Overview



Relay connections

Connection diagram

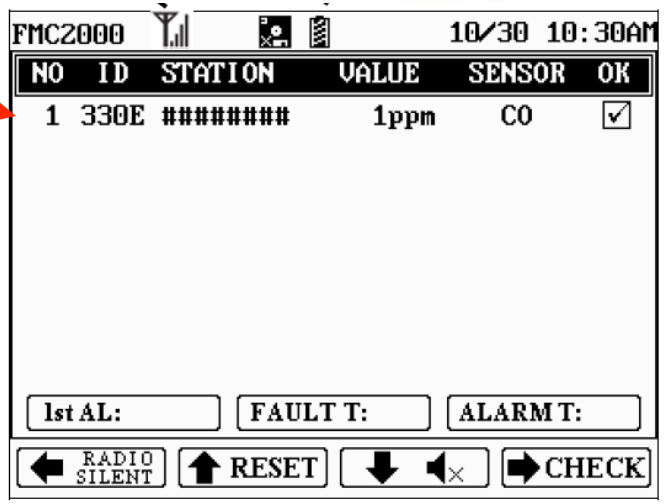
SD Card location

Power switch

Power connection

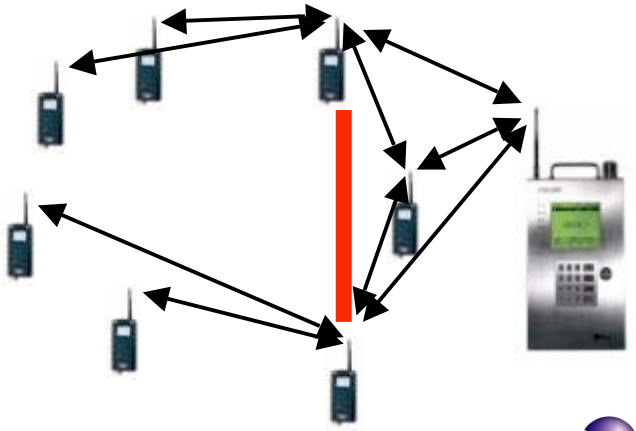
MeshGuard System Start Up

- Connect alarm devices to the FMC 2000
- Connect power to the FMC 2000
  - Switch on the FMC 2000
- Power on the MeshGuard: Press the [MODE] key
- Confirm communication
- Bump test the MeshGuard
- Deploy MeshGuard
- Deploy Routers as needed



MeshGuard System Overview

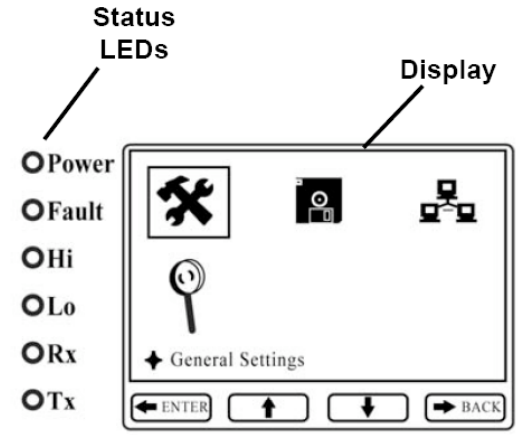
- System Start-up Survey
  - Before installing a system, conduct a site survey and estimate if routers are needed
  - The low-power modems are short-range devices: do not expect long-distance transmission
  - The system is scalable and can handle adding of Routers as needed to stabilize signal from all monitors
  - Use mains powered Readers in safe areas as needed

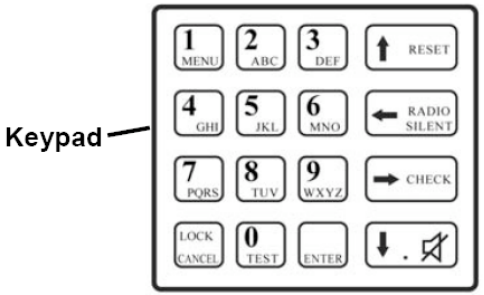


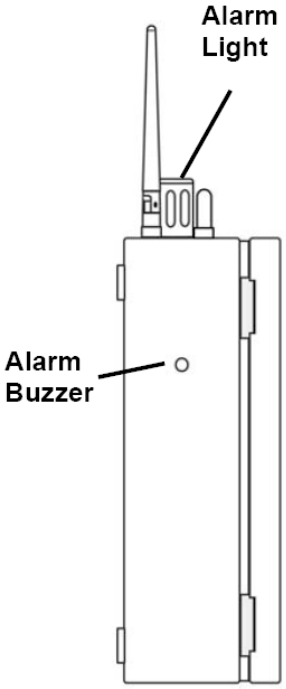
FMC 2000 Controller

- FMC 2000 Controller
  - Overview
  - Display
  - Keypad
  - Obtaining data from MeshGuard monitors
  - Set up and testing of alarm relays
  - Setting up the PAN ID
  - Data Log file

FMC 2000 Controller

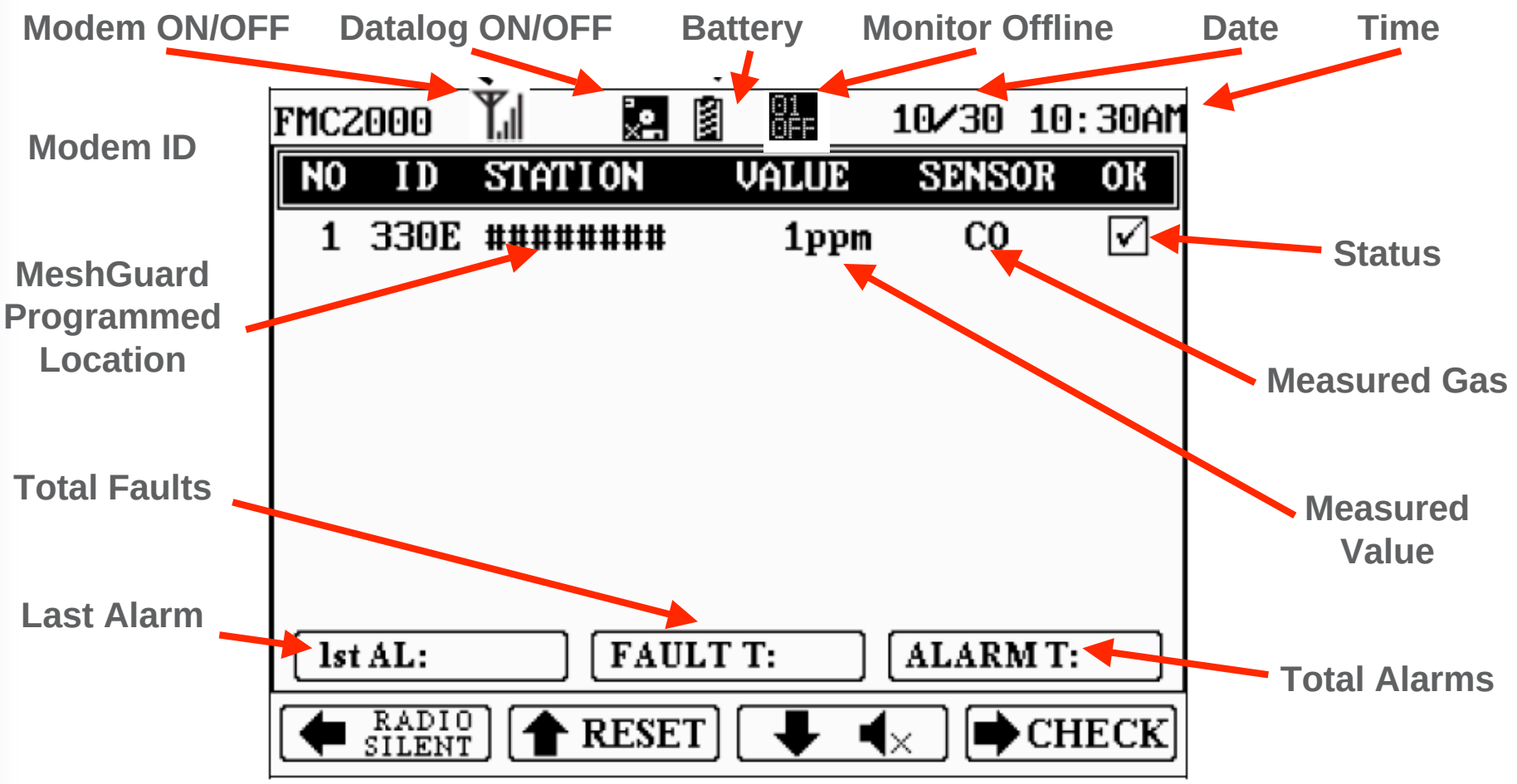






LED	Information
Power	Glows green when the FMC2000 is on
Fault	Glows orange when problem is encountered
Hi	Glows red during High Alarm
Lo	Glows red during Low Alarm
Rx	Glows green when receiving data from a remote device
Tx	Glows green when transmitting data to a remote device

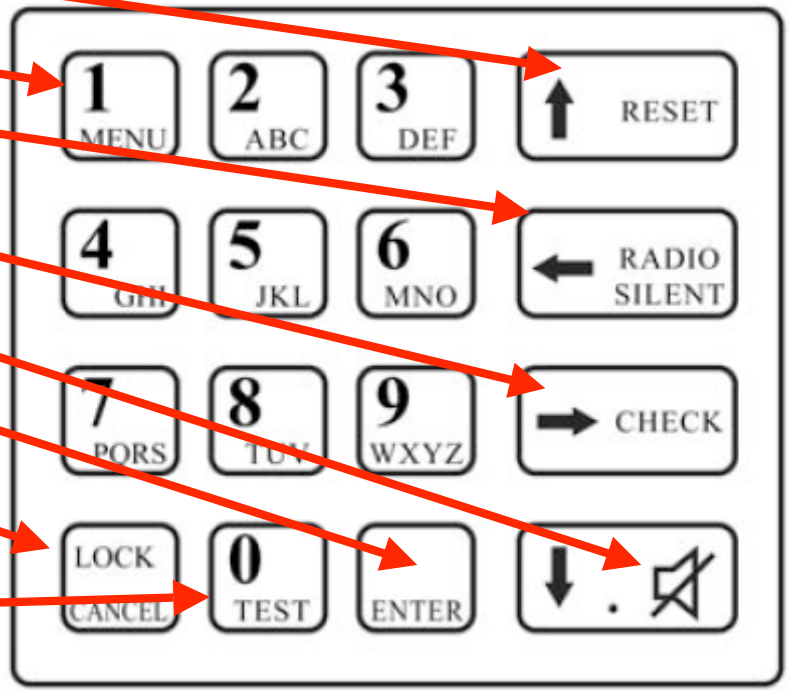
FMC 2000 Controller



Indication of the 4 large bottoms function

FMC 2000 Controller

- FMC 2000 Controller Keypad Overview
  - Reset alarm
  - Enter menu
  - Switch off modem
  - Check alarms
  - Mute local alarm
  - Enter function
  - Lock display on a MeshGuard to view status (similar to battery status)
  - Self-test function



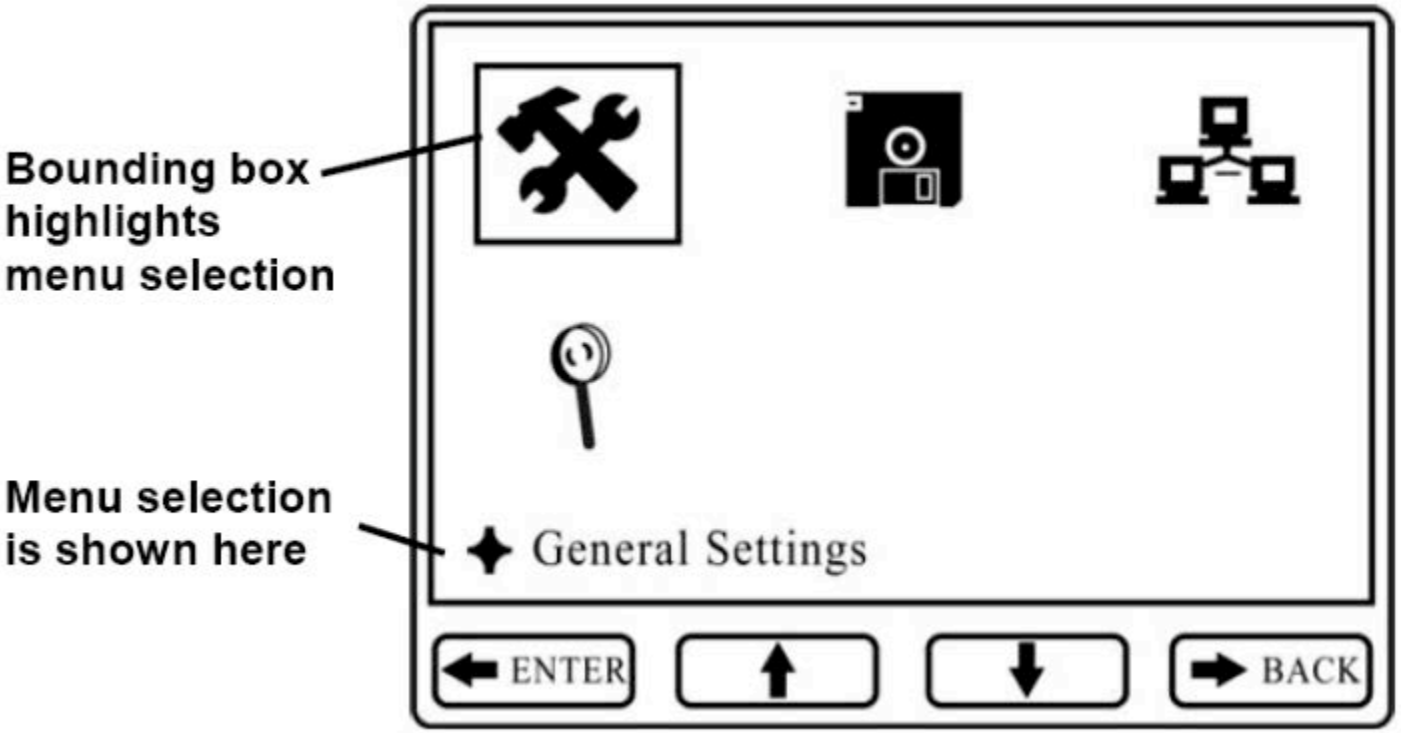
FMC 2000 Controller

- FMC 2000 Controller Configuration
  - Basic level password: 4 digits
    - Default password: 1234
  - Advanced level password: 6 digits
    - Default password: 123456
  - Type in password followed by Enter to access Menu

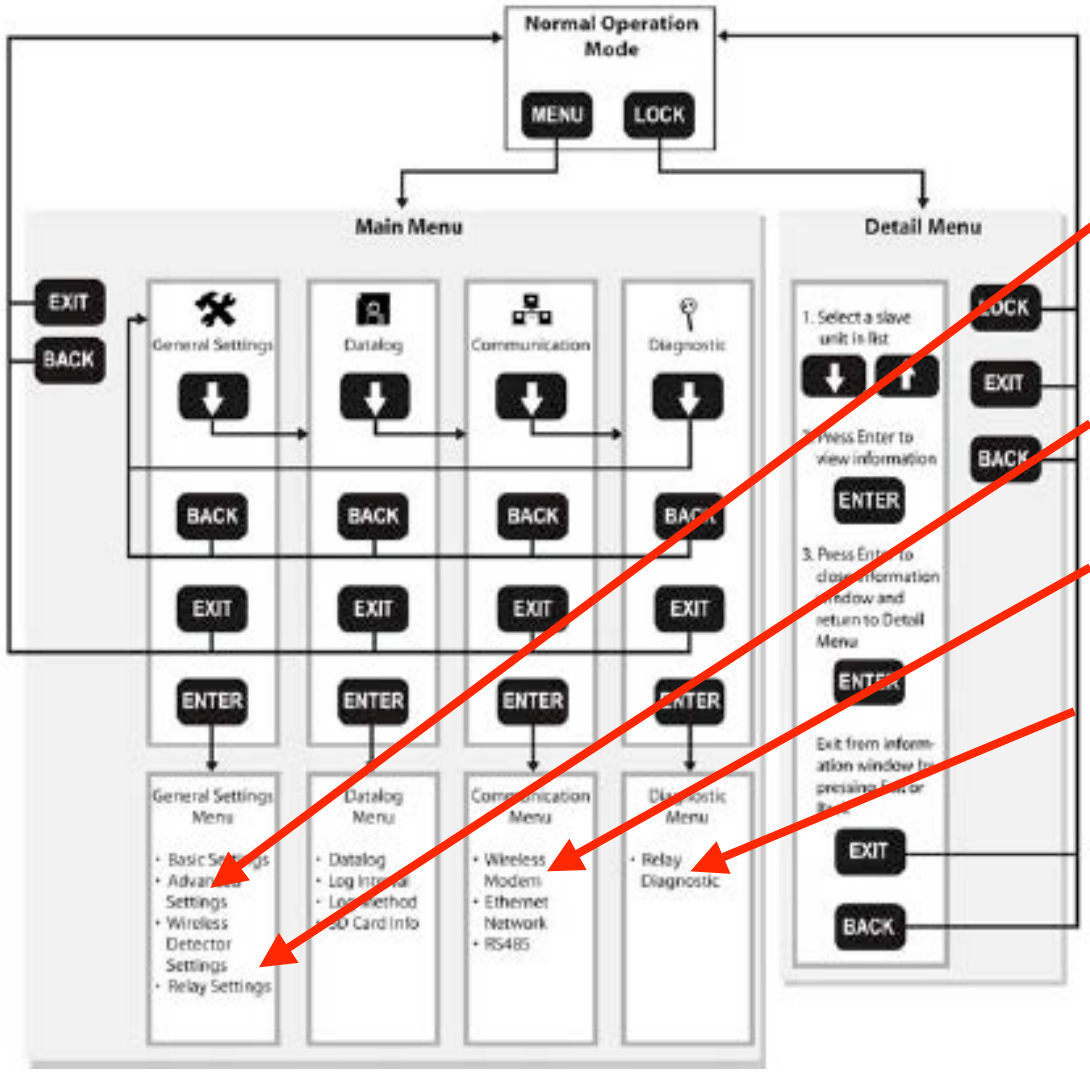
FMC 2000 Controller

Overview of Main Menu

	General Settings
	Datalog Settings
	Communications Settings
	Diagnostic Settings



FMC 2000 Controller

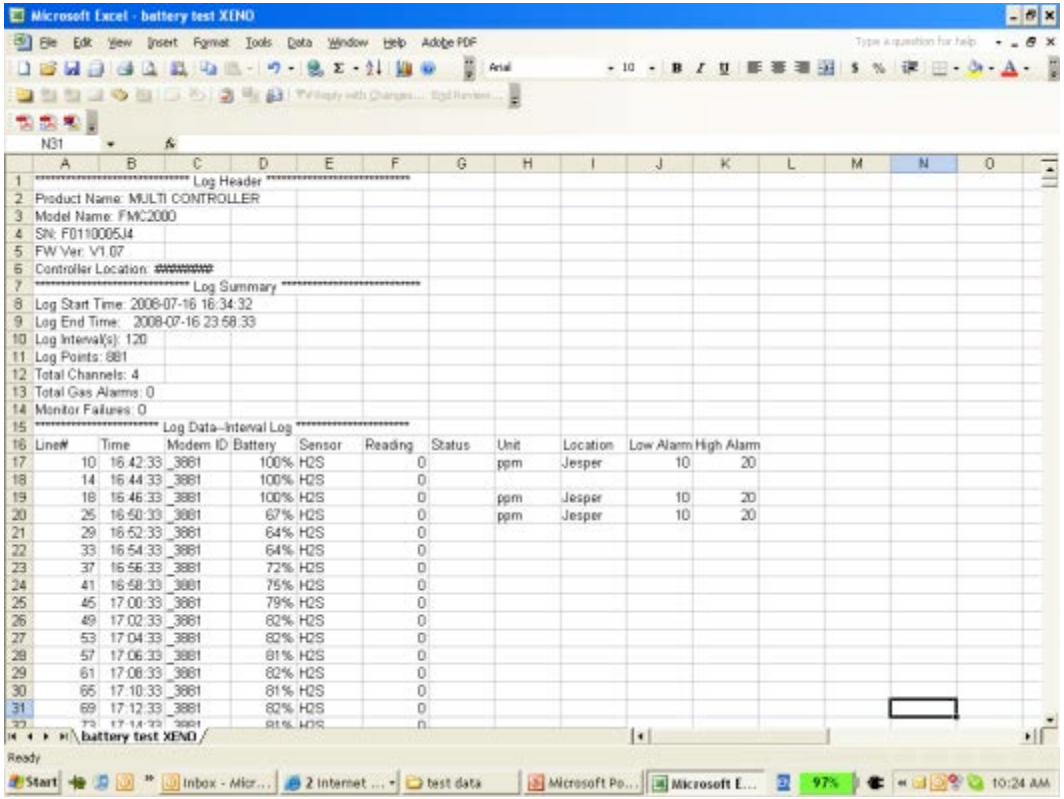


Main Settings

1. Minimum detectors on-line (advanced settings)
2. Set relay output (relay settings)
3. Set PAN ID (wireless modem settings)
4. Relay testing

FMC 2000 Controller

- FMC 2000 Controller data log file
  - Switch off the controller to avoid damage to the SD card
  - The SD card contains a Microsoft Office Excel comma separated values (CSV) file
  - This file can be opened with standard programs



FMC 2000 Controller

Connecting the FA-200 Alarm Bar

- Simply connect the Alarm bar to the FMC 2000 controller using the test the relays

FMC 2000 Controller

- **FMC 2000 Controller Output**
  - The FMC 2000 can interface with 3rd party equipment and RAE Systems software
  - Communication protocol: Modbus
  - Hardware interface options
    - RS-232
    - RS-485
    - Ethernet
  - Contact RAE Systems for more details

Router Function during operation

- **The MeshGuard Router is a powerful tool**
  - Can be used to measure signal strength at different locations
  - Extend network area coverage by routing signal from other monitors
  - Tracks changes in the network and redirects data as needed
  - Provides backup routes or alternative paths in the event of network congestion or device failure
- **The MeshGuard Router is**
  - A FFD (Full Function Device) without a gas sensor
  - It is in constant communication with the FMC 2000 controller and MeshGuard detectors in the network
  - The MeshGuard Router manages up to 12 detectors

Router Use During Site Survey & System Setup

Used to measure wireless signal strength

- Switch off all MeshGuards and use only one router
- Switch on the FMC 2000 controller
- Press the N/- key on the Router – if you have contact to the controller, The LED and audible alarm will sound and the [%] reading will be updated

Router Use During Site Survey & System Setup

If the [%] reading is 30% or higher, a MeshGuard detector deployed at this location will have strong link with controller

Checking the transmission

Location 1

Router Function during set up TRANMISSION TEST

If the [%] reading is less than 30%, the signal will need to be routed back to the controller using a Router or another MeshGuard detector in FFD mode

- Use Router to identify a nearby location which shows 30% or higher link
- Deploy a Router or a FFD MeshGuard in this nearby position
- Go back to position 1 and press N/- key on the MeshGuard detector

Location 1

Location 2

MeshGuard

- MeshGuard Daily Use and Setup
  - Main menu and display information
  - Search for new network
  - Change PAN ID and Operation Mode
  - Calibration
  - Service

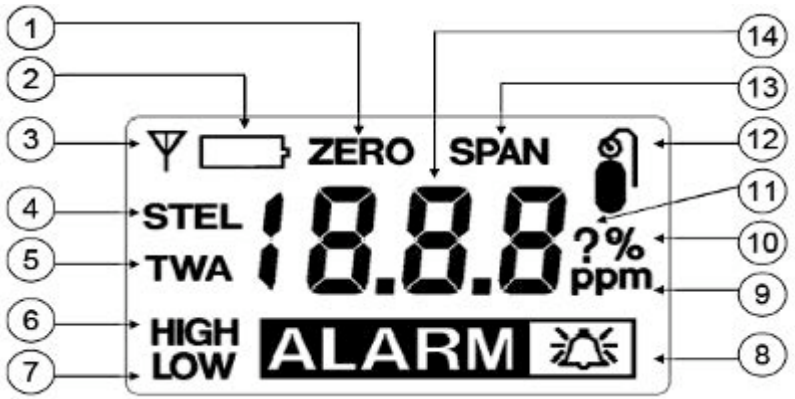
MeshGuard Main Menu and Display Information

- Overview of the MeshGuard

1	LED alarm
2	LCD
3	Buzzer alarm
4	Sensor gas inlet
5	Battery cover
6	Y/+, MODE, and N/- keys
7	Antenna
Not visible	Optional magnetic mount on rear

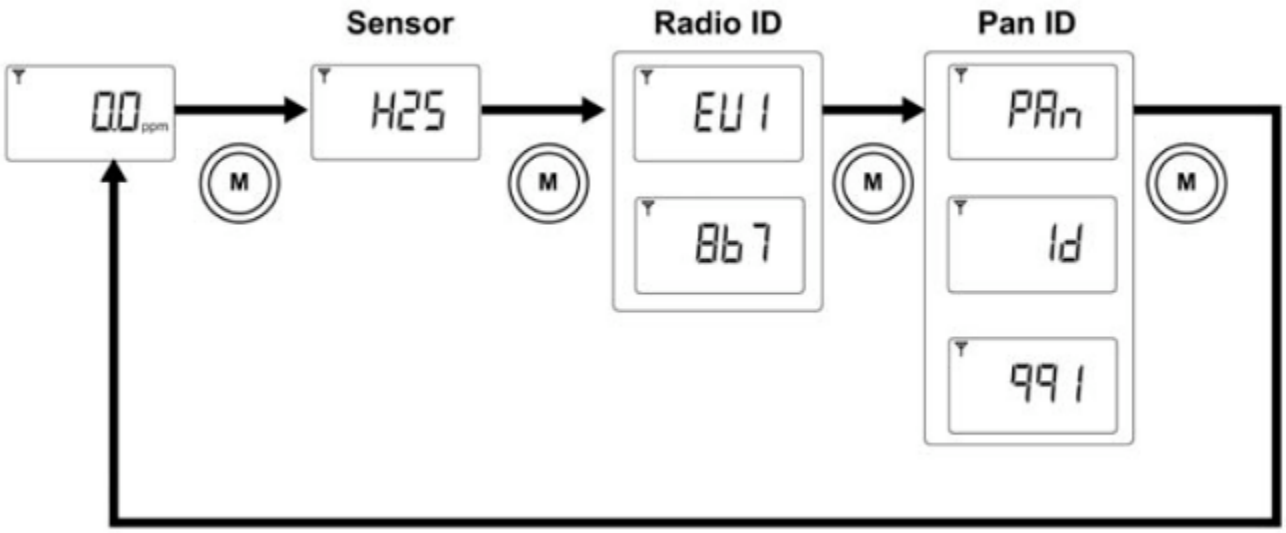
MeshGuard Main Menu and Display Information

1	Zero Calibration
2	Low Battery Indicator
3	Wireless Communication (if on, the monitor is in RDF; if blinking, the monitor is FFD)
4	Short Term Exposure Limit (STEL)
5	Time Weighted Average (TWA)
6, 8	High Alarm
7, 8	Low Alarm
9	Gas Concentration unit, ppm
10	Gas Concentration unit, %
11	Save Setting
12,13	Span Calibration
14	Reading Value
Remark:	Concentration unit is shown as either ppm (9) or % (10).



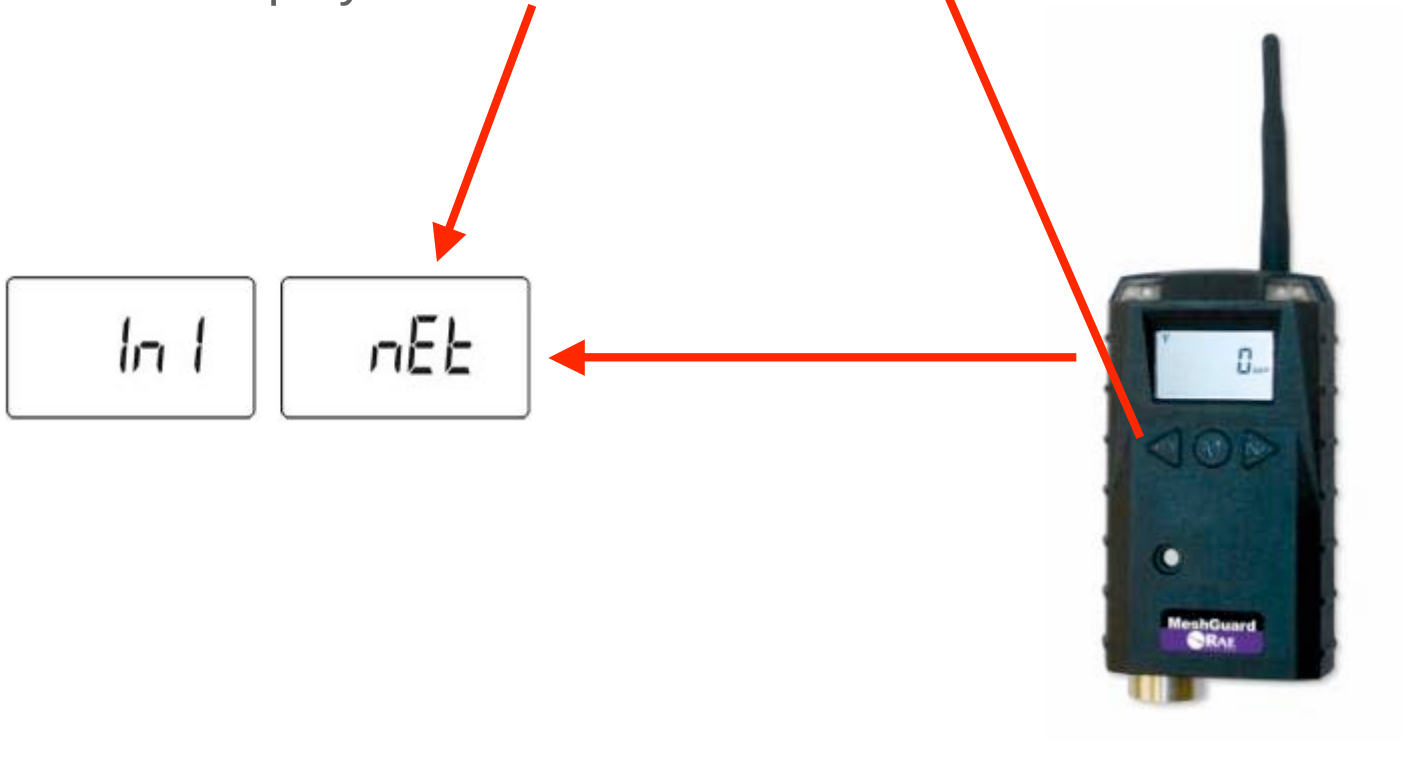
MeshGuard Main Menu Information

- Turn on the MeshGuard by pressing and holding the [M] key
  - 0.0 ppm indicates the reading
  - H2S indicates the measured gas
  - EUI indicates the last 3 digits of the modem ID (4 digits shown on the controller)
  - Pan ID indicates the network number (must be the same as the controller)



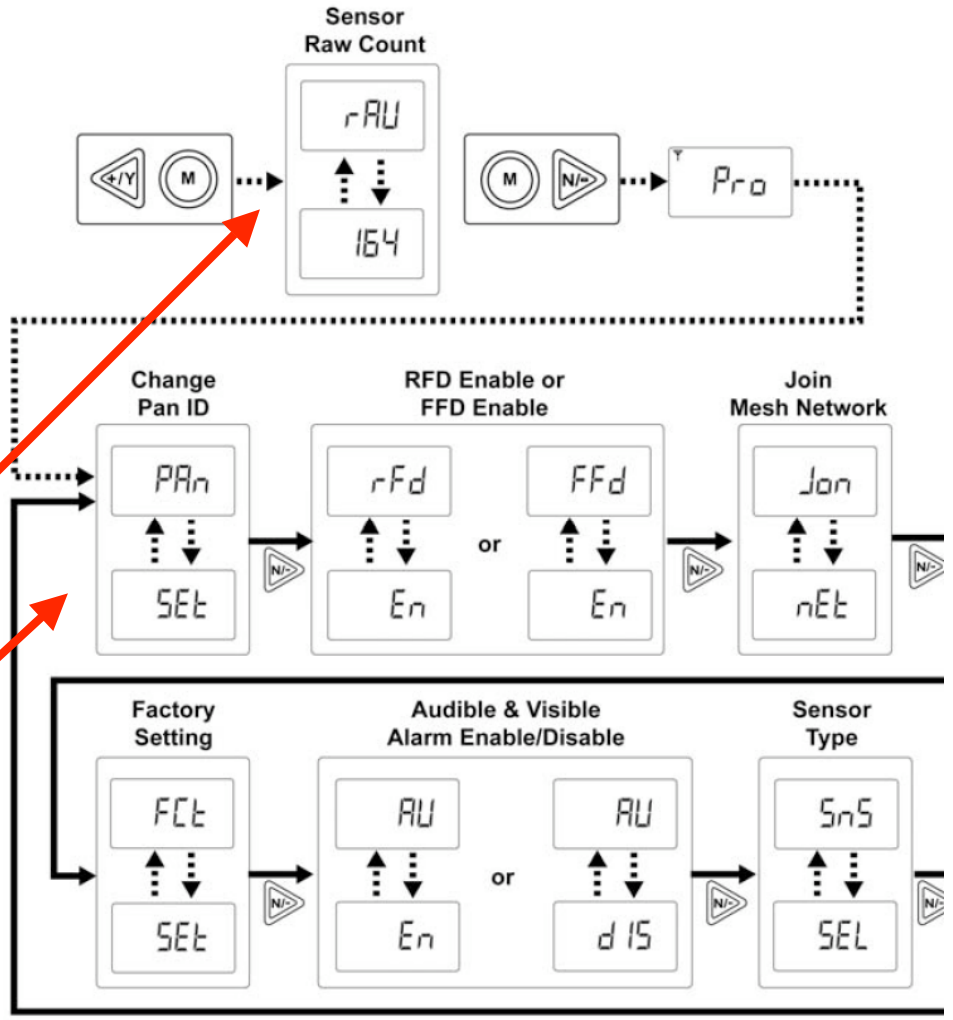
Searching for a New Network

- If the monitor operation mode is changed or a link back to the controller test is required, then press and hold the [Y/+] key. This will initiate a network search.
- The monitor will now search for a new controller faster than under normal operation and display network initiation as shown below.



PAN ID & Operation Mode (RFD/FFD)

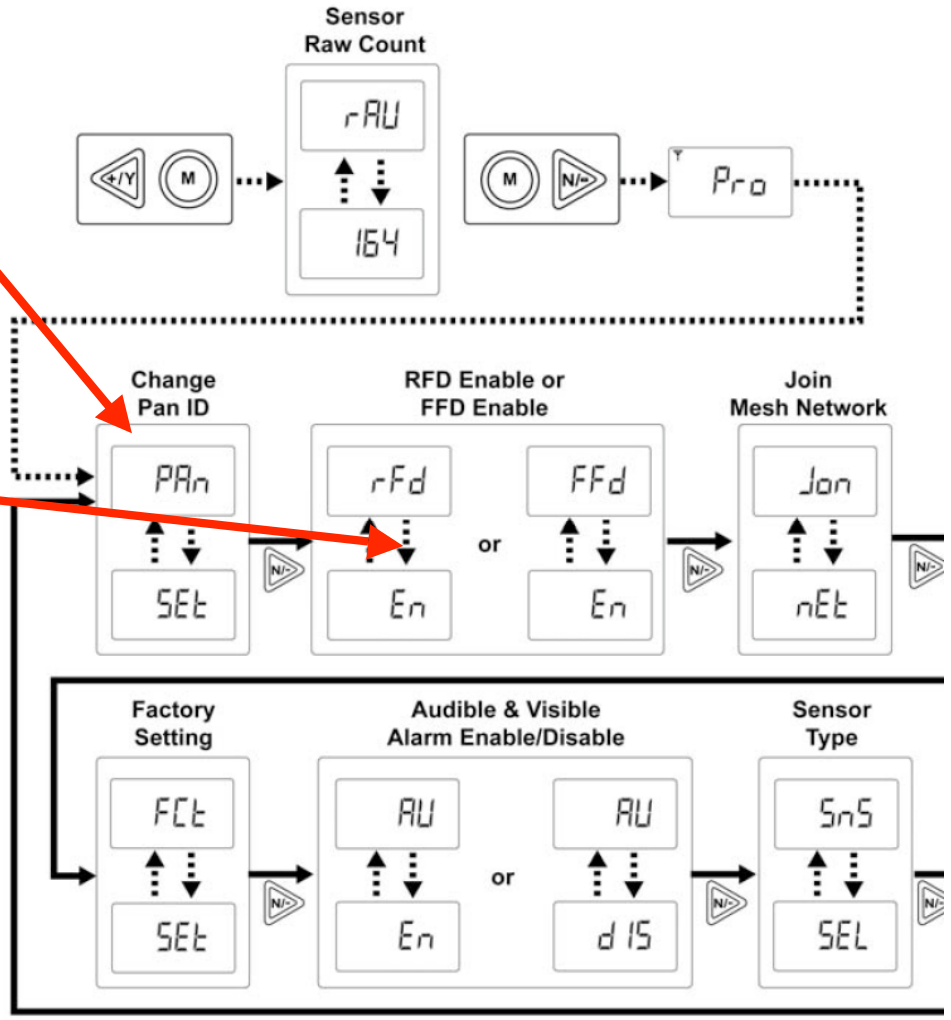
- The most important settings in daily operation are the network setting and the MeshGuard operation mode
- Press [Y/+] and [M] at the same time when the monitor is off to start the monitor in diagnostic mode
  - The monitor now indicates the sensor RAW signal
- Press [M] and [N/-] at the same time to enter the configuration mode



PAN ID & Operation Mode (RFD/FFD)

- The first setting is PAN ID
  - Make sure it matches FMC 2000 controller
- The next menu option allows changing of operation mode from RFD to FFD
- In order to return to normal operation, the monitor must be switched OFF and then ON again

NOTE: PAN ID and MeshGuard operation mode can be obtained from the main menu



MeshGuard Service

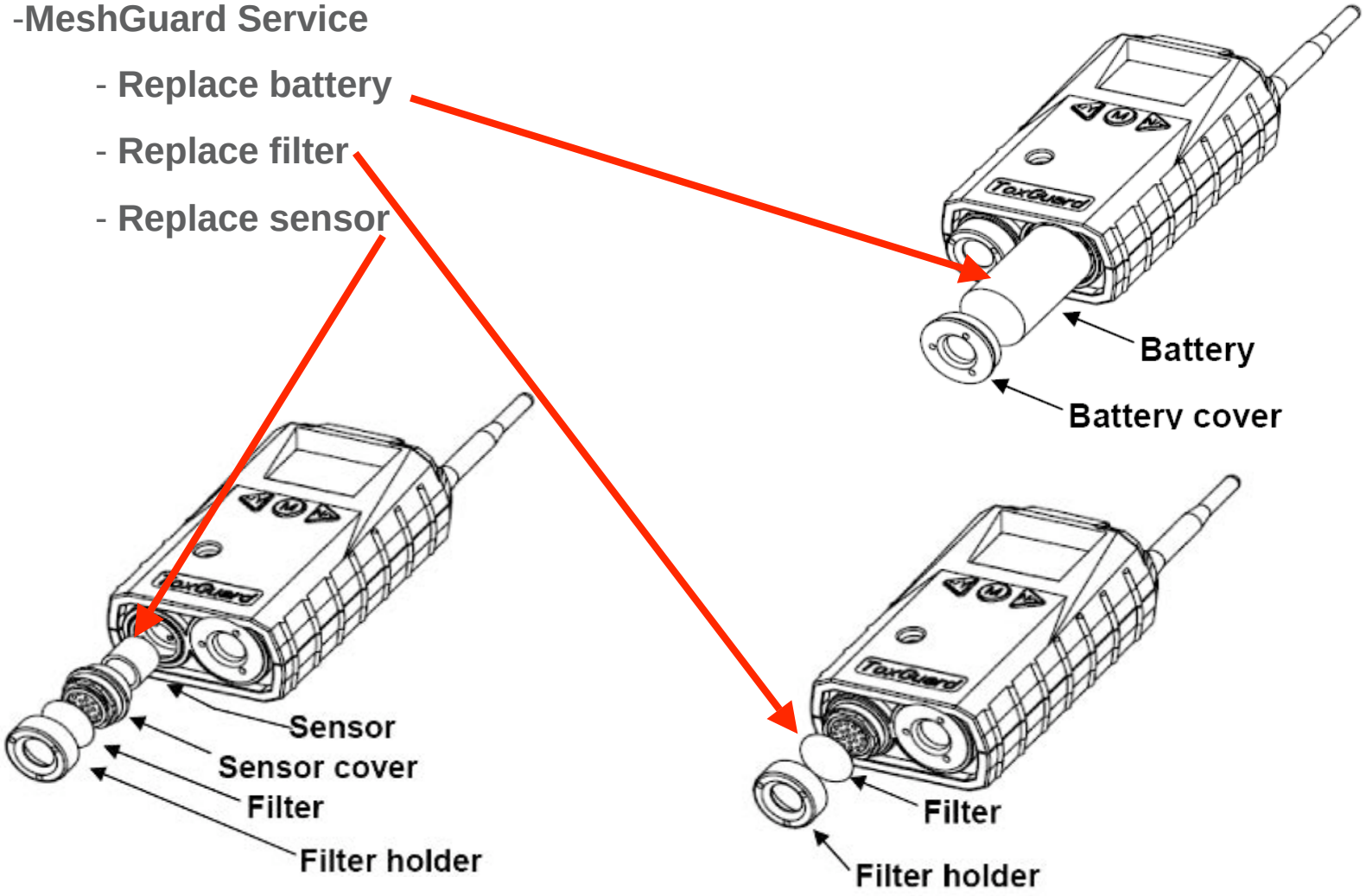
- MeshGuard is a low- maintenance product with only three consumable parts:
  - Battery
  - Filter
  - Sensor

One tool can be used to perform all service

MeshGuard

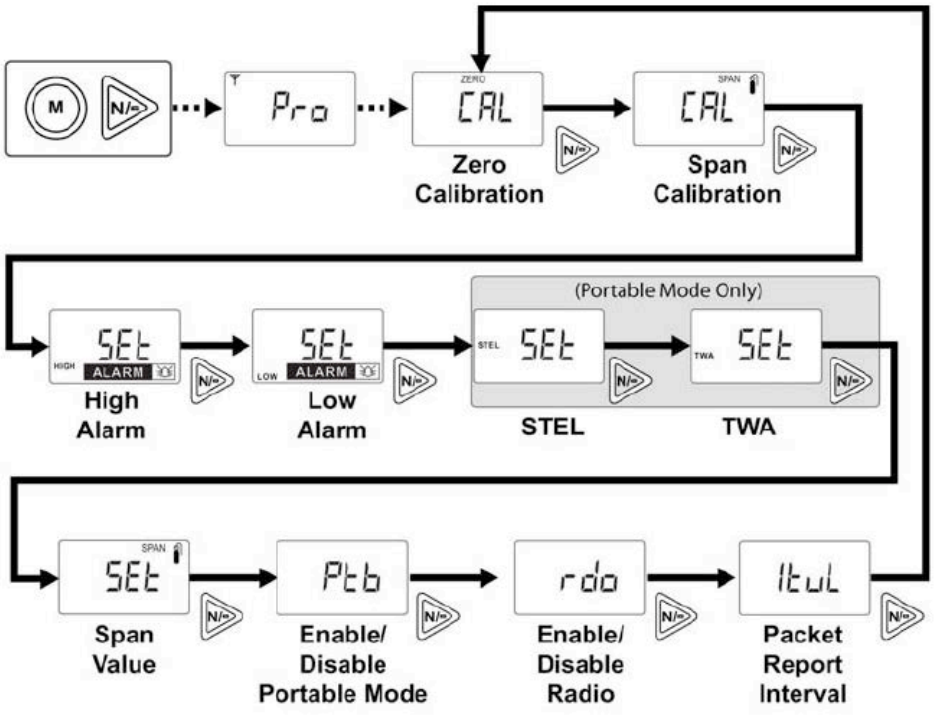
-MeshGuard Service

- Replace battery
- Replace filter
- Replace sensor



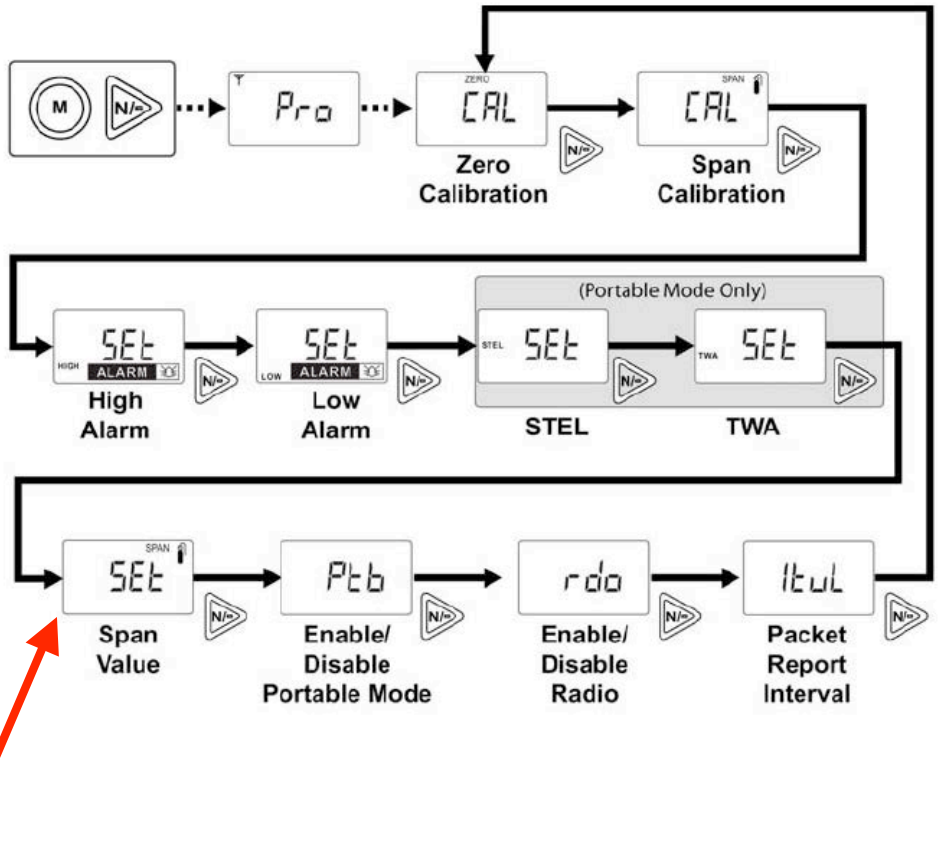
MeshGuard

- MeshGuard Zero Calibration
  - Before calibration, make sure the ambient air is clean from the target gas and check that you have the right span gas.
  - Enter the program menu by pressing [M] and [N/-] at the same time.
  - First screen is zero calibration. Press [Y/+] to zero calibrate or [N/-] to go to the next screen.



MeshGuard

- MeshGuard Span Calibration
  - Connect the span gas with a flow of 500-700 cc/min
  - Press [Y/+] and confirm that the indicated gas concentration is the same as what is on the cylinder*
  - After a 60-second countdown the calibrated reading is displayed



***Span value must match calibration gas concentration**

MeshGuard Battery Runtime

Product / function	battery	Run time
MeshGuard EC / RFD	Internal	6 months
MeshGuard EC / FFD	internal	10 days
MeshGuard EC / RFD	External	N/A
MeshGuard EC / FFD	External	45 days
MeshGuard Router	Internal	10 days
MeshGuard Router	External	45 days
MeshGuard LEL / RFD	Internal	5 days
MeshGuard LEL / FFD	internal	4 days
MeshGuard LEL / RFD	External	22 days
MeshGuard LEL / FFD	External	16 days

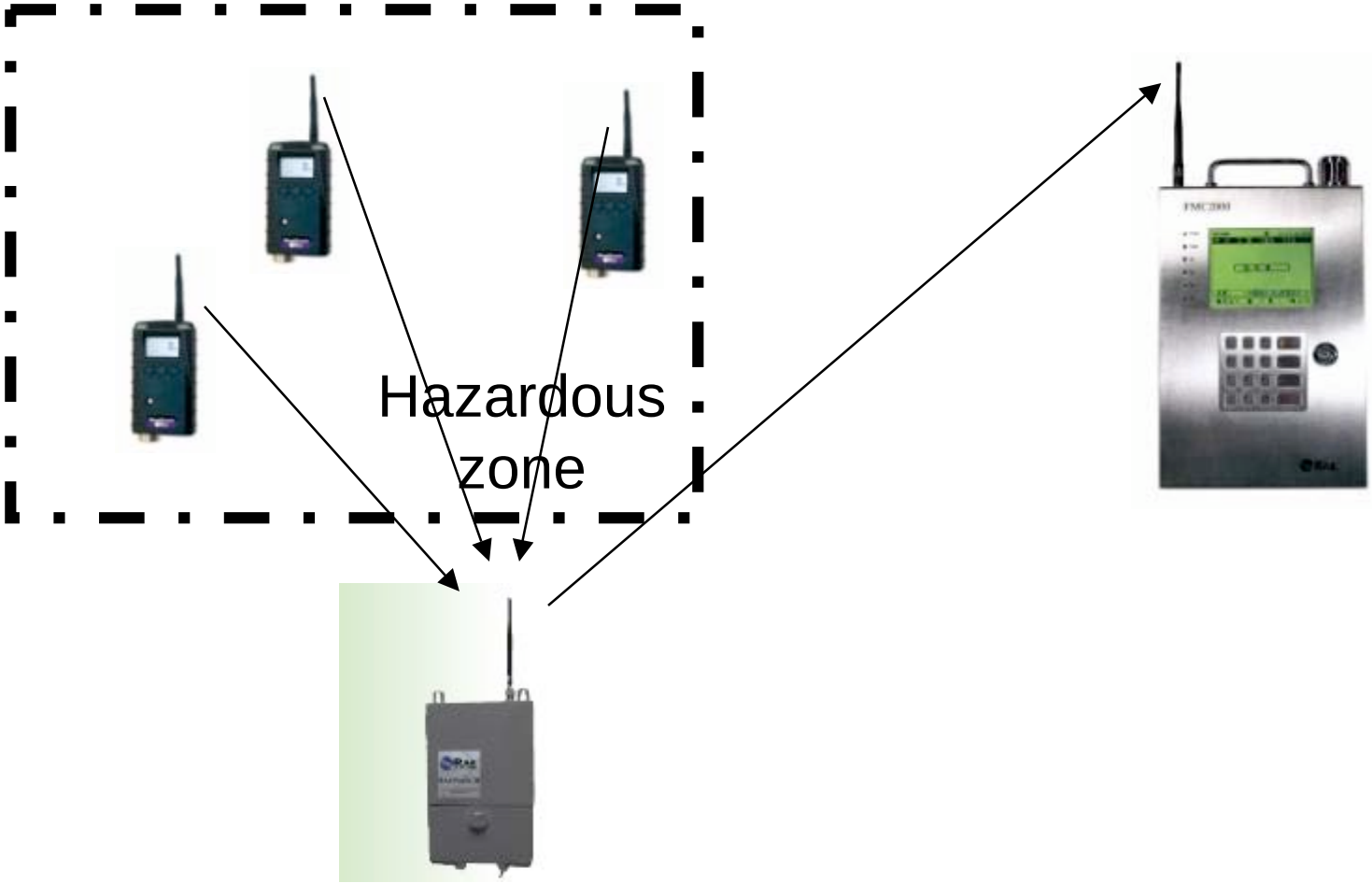
Select the battery that fits the application the best

MeshReader

- Can work as a Reader to communicate with MeshGuard detectors
- Can work as a router to route signal past obstacles

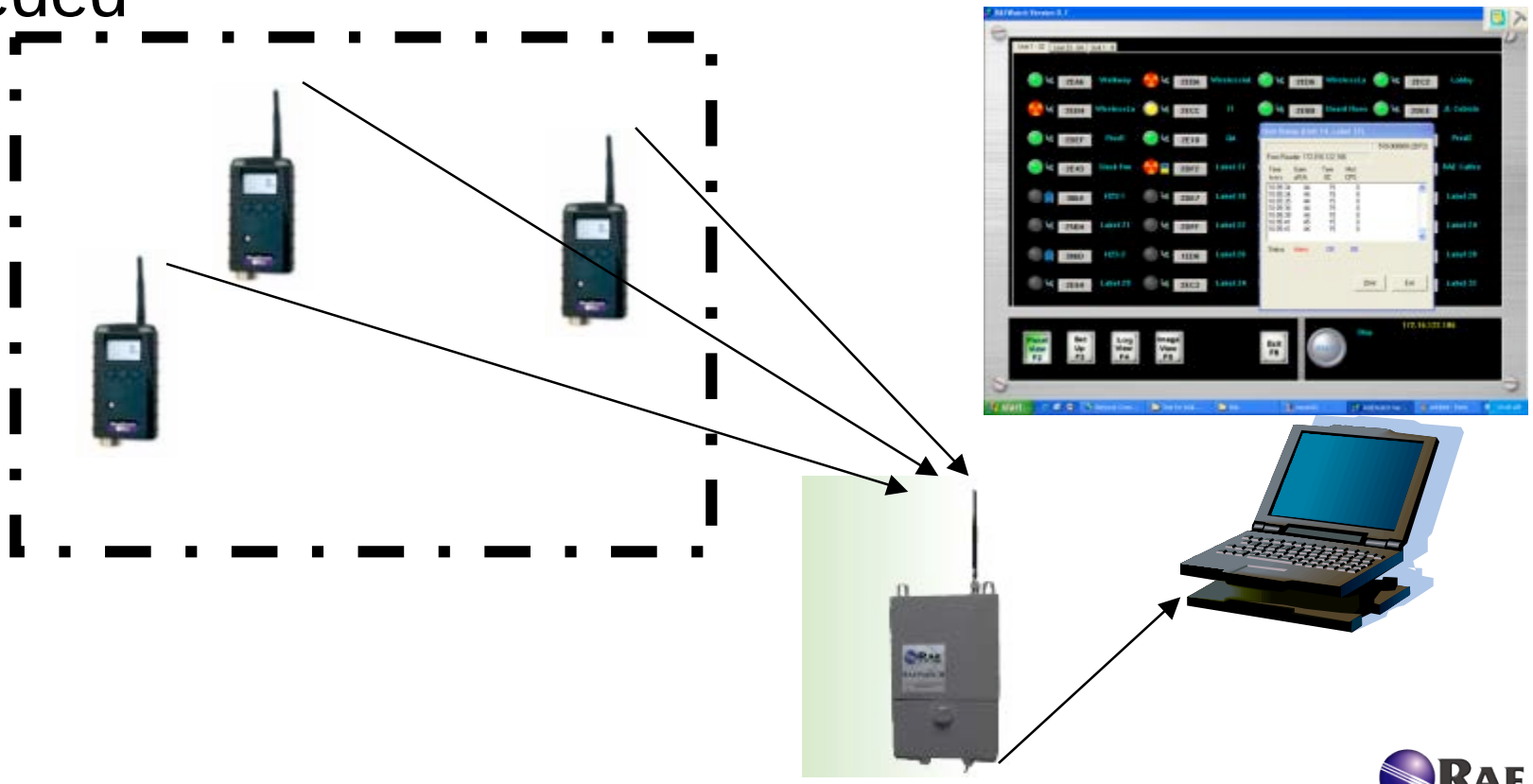
MeshReader

- Working as a Router in a Mesh System



MeshReader

- Working as a Reader for ProRAE.NET, in applications where a embedded system is not needed



ProRAE.NET

- On line data view
- Graph view
- Datalog file

Additional Support Material

This presentation is intended to help get you started.

The MeshGuard system has many detailed features not described in this presentation.

Please refer to the user manuals on the resource CD included with the product or contact your local RAE Systems service center for more information.