

# Autonomous Fire Detectors

## Project Update

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October 7, 2002



# Goals of Project

- Rapid development of a prototype board that can be adapted to many applications
- Development of embedded software to operate onboard devices
- Development of PC side software to extract collected data from boards
- Develop mechanical enclosures for boards for field applications

# Applications

- Handheld Thermistor Logger
- Thermocouple Fire logger
- Fire Sentry
- Fire Sentry/Data Acquisition
- Lake Drifter
- Pond Monitor
- Automated Ground Truth Logger
- Air born ATV/APRS
- Lake Depth feature logger
- 1 – Wire Weather Station Logger

# First Application: Handheld Logger

- Acquire precision temperature and location data
- 64 K memory = 1771 sample storage space
- Uses standard GPS unit
- PC application places data directly into Excel



# Handheld Logger

- Precision Thermistor module: self contained unit accurate to 0.01C
- Interfaces with any GPS capable of NMEA 0183 output.
- Minimal number of components on board necessary for operation
- “Off the shelf” components minimizes development time

# Visual Basic Based Application

DIRS Data Logging System

## DIRS Data Logging System

GPS

Thermistor

A/D  # of Channels

Select Communications port

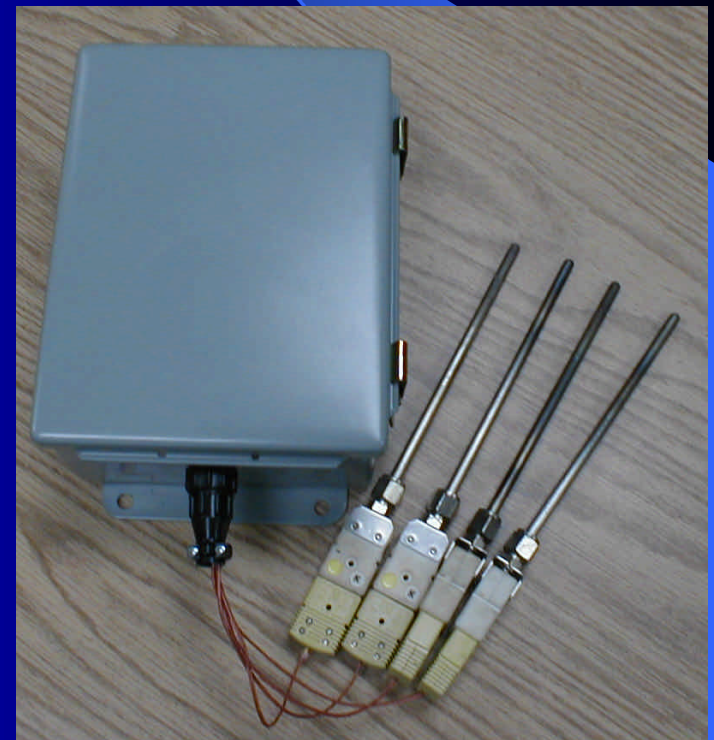
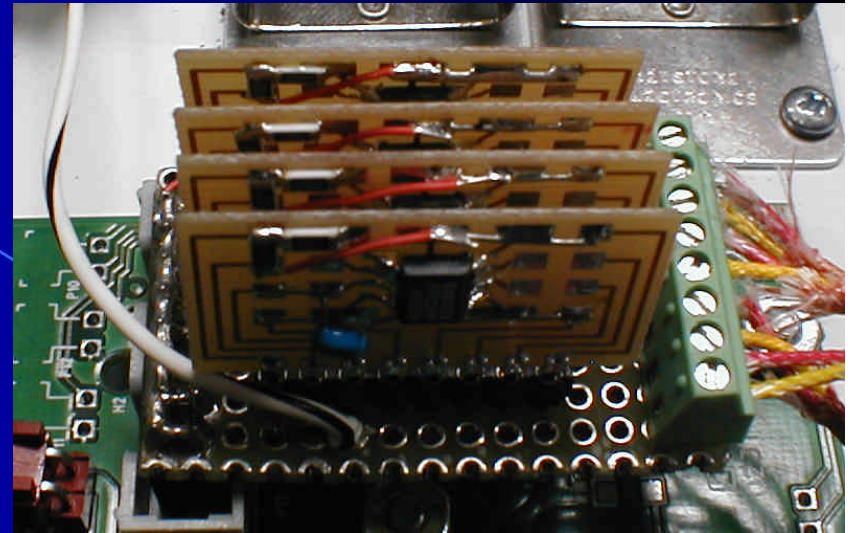
Choose an Option

Download Clear Memory

Connect Disconnect

# Rugged Fire Logger

- Utilizes 4 ADC channels for thermocouple data
- RTC and Position via GPS
- Field controllable using a Palm Pilot
- Rugged NEMA enclosure suitable for hostile environments
- VB download application



# Rugged Fire Logger

- 12 bit, 8 Channel ADC, 1.22mV/digital count
- Single part thermocouple amplifier with a voltage divider for level conversion
- ADC will accept input from any sensor producing output levels 0V – 5V
- 16 Pin header allows for easy implementation of a sensor daughterboard if necessary

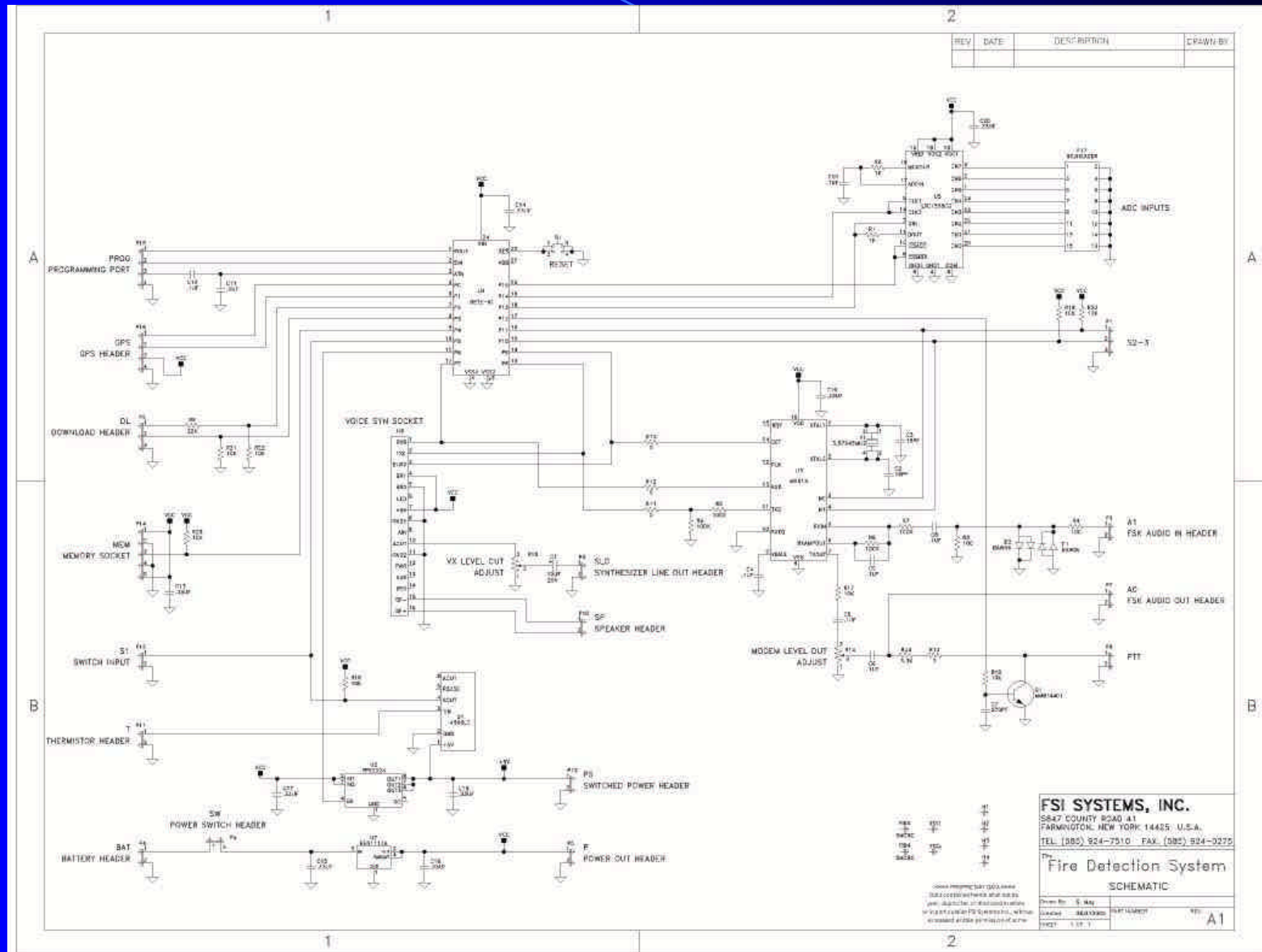
# Rugged Fire Logger

- Provides a base platform for building a fire sentry system
- Utilize other 4 ADC channels to detect other aspects of fire
- Set thresholds for alarm notification
- Add the synthesizer or modem to provide a means to alert field workers
- Utilize power management circuitry to extend battery life for longer operation

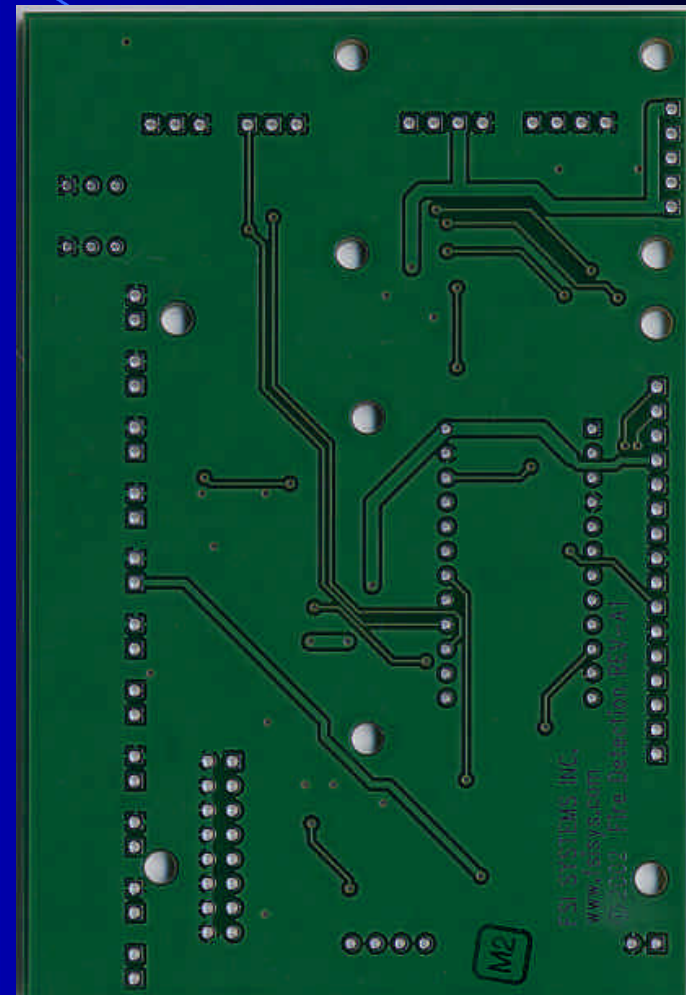
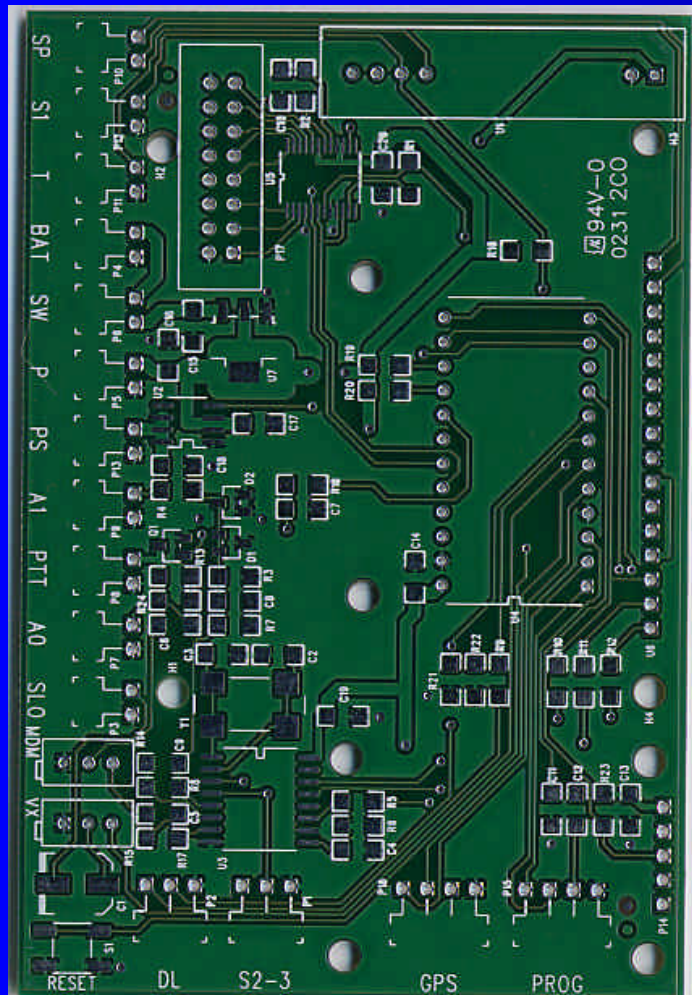
# Design Methodology

- Utilized existing work done with Basic Stamp, rapid development environment
- Utilized existing choices for Thermistor, ADC, Memory and Voice Synthesizer
- Added components for power management, wireless digital data transfer & radio control
- Designed schematic for interfacing of all components

# Resulting Schematic

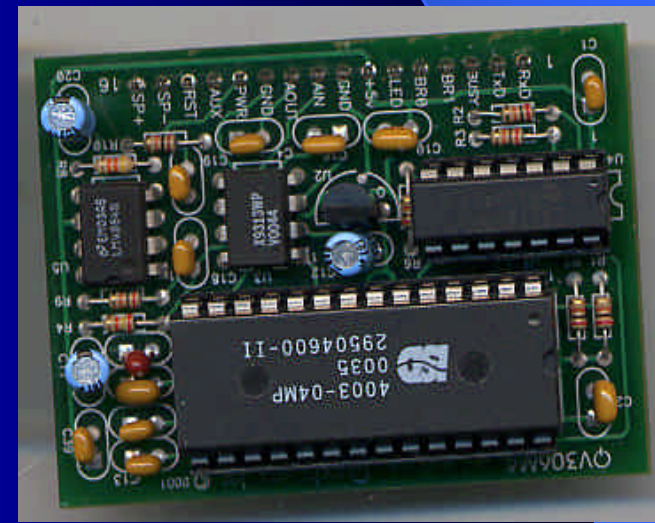
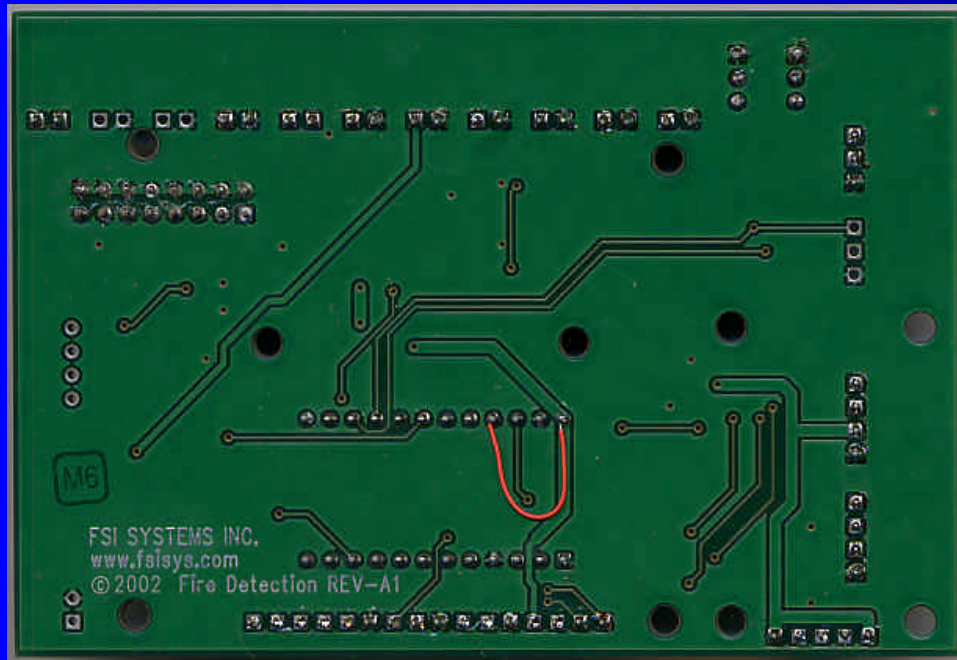
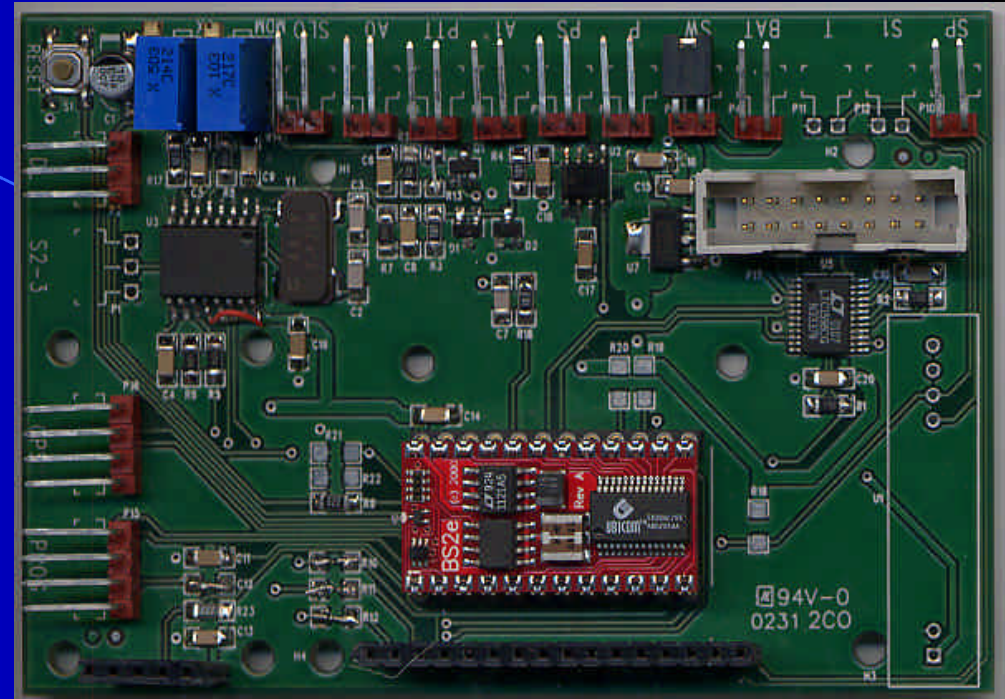
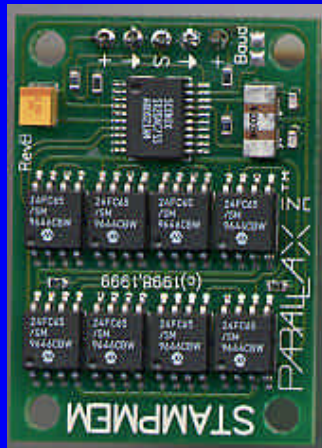


# Surface Mount Board



ESI SYSTEMS, INC.  
www.esisys.com  
97-2552 1/14 Rev. 00000000000000000000

# Full Stuffed Board



# Lake Drifter

- Currently exploring packaging options with RIT ME Dept.
- Defining target sensors to be used
- Looking at pros/cons of using a moored buoy or a free-floating package
- Developing a wireless packet based protocol for remotely downloading data from the device

# Wireless Communication

- Utilizing MXComm 614 modem chip
- Generates AFSK signal from simple serial data @ 1200 baud
- AFSK passed wireless via 2 meter amateur radio, can use almost any frequency radio
- AEA PK232 modem used for base station receive, may be replaced with single chip modem
- Half duplex operation allow remote control of logger

# Wireless, contd.

## Packet Formation

SOH SOH KB2WLK ID ID CMD...

↑  
Start of header (\$01)

↑  
Call sign for legal amateur operation (6 bytes)

↑  
Unit ID

↑  
Dest. ID

↑  
Command



# Wireless, contd.

## Packet Formation

... 16 bytes of data Checksum EOT EOT

↑  
Data to be sent  
(commands, stored  
or live data)

↑  
Calculated for  
Error Correction

↑   ↑  
End of  
Transmission  
(\$04)

Checksum Poly

$$x^{16} + x^{12} + x^5 + x^0$$

# Wireless, contd.

## Command Field

Command	Purpose
A	Acknowledge Transmission
B	Dump Memory
C	End of Memory
D	clear memory
E	gets current latitude
F	gets current longitude
G	gets the current time
H	gets the current date
I	gets the value for specified AD channel in data field
J	gets the value for the thermistor
K	indicates there is data in the data field
L	resend last packet

# Wireless, contd.

- Initially, non-digipeated protocol
- All transmissions are followed by an ACK packet by receiver
- Speak when spoken to
- Room for some command set expansion, limited by code space and RAM

# Bathymetry

- Utilize DGPS and a sonar device to map the bottom of a lake
- Garmin Fishfinder 100 provides depth information via a NMEA 0183 sentence
- Very rapid development, got fish finder on Friday morning: Friday afternoon software and electronics hardware is ready to run
- Building a library of functions that can be easily adapted to most applications



Questions and Suggestion for  
other future applications