

Utilizing Broadband Service for Air Quality Data Acquisition and Remote Site Access

Santa Barbara County Air Pollution
Control District

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Goals

Increased Efficiency:

- Improve Access to Site Information
- Reduce Cost
- Increase Speed
- Reduce Trips and Downtime
- Simplify
- Increase Data Quality

A Little History

Connections

- Dialup Modems
 - one or two per site
- Leased Lines for Data polling
 - 3002 data line
 - 1200 Baud, 202T Modems
 - Costly
- Motorola “Brick” cell phone (paired with dialup modem)
 - Slow, Costly
 - lost connections



A Little History

Serial Cables

- We still have them... but a lot less



Ethernet 10/100 Mbs
switch

Broadband

Methods of Site Connectivity

- Broadband Services (Currently in Use)
 - DSL
 - Fixed WIFI
 - Cellular Wireless
 - Others
 - Cable (primary internet access at the main office)
 - Satellite

DSL Broadband

- Installed at 3 Sites
- Available in Most Urban Areas
- Inexpensive
- Requires Telephone “land line” (POTS)
- Not Generally Available in Rural Areas
- ADSL – Asynchronous
- Faster Download (Inbound)/Slower Upload (Outbound)

Fixed WIFI

- Installed at 2 Sites
- More Expensive than DSL and Cellular
- Uses Radio Frequency (2.4 and 5.8 Ghz)
- Fast
- Requires "line of sight" between site and base station
- Requires Antenna
- Does Not Require "land line"

Fixed WIFI Panel and Dish Antennas



1' X 1'



3' Diameter

Fixed WIFI Connection



Inside the site enclosure: a simple Ethernet jack.

Cellular Wireless

- Works on CDMA 1x networks at slower speeds
- Will work on EV-DO network at higher speeds (available now in bigger metropolitan areas. It is expected to be expanded to our area soon)
- Portable from one site to another
- Able to install external antenna (directional, high gain)
- Does not require land line
- Currently installed at one (1) site
- Modem more expensive. Monthly rates about the same as DSL



Cellular Modem

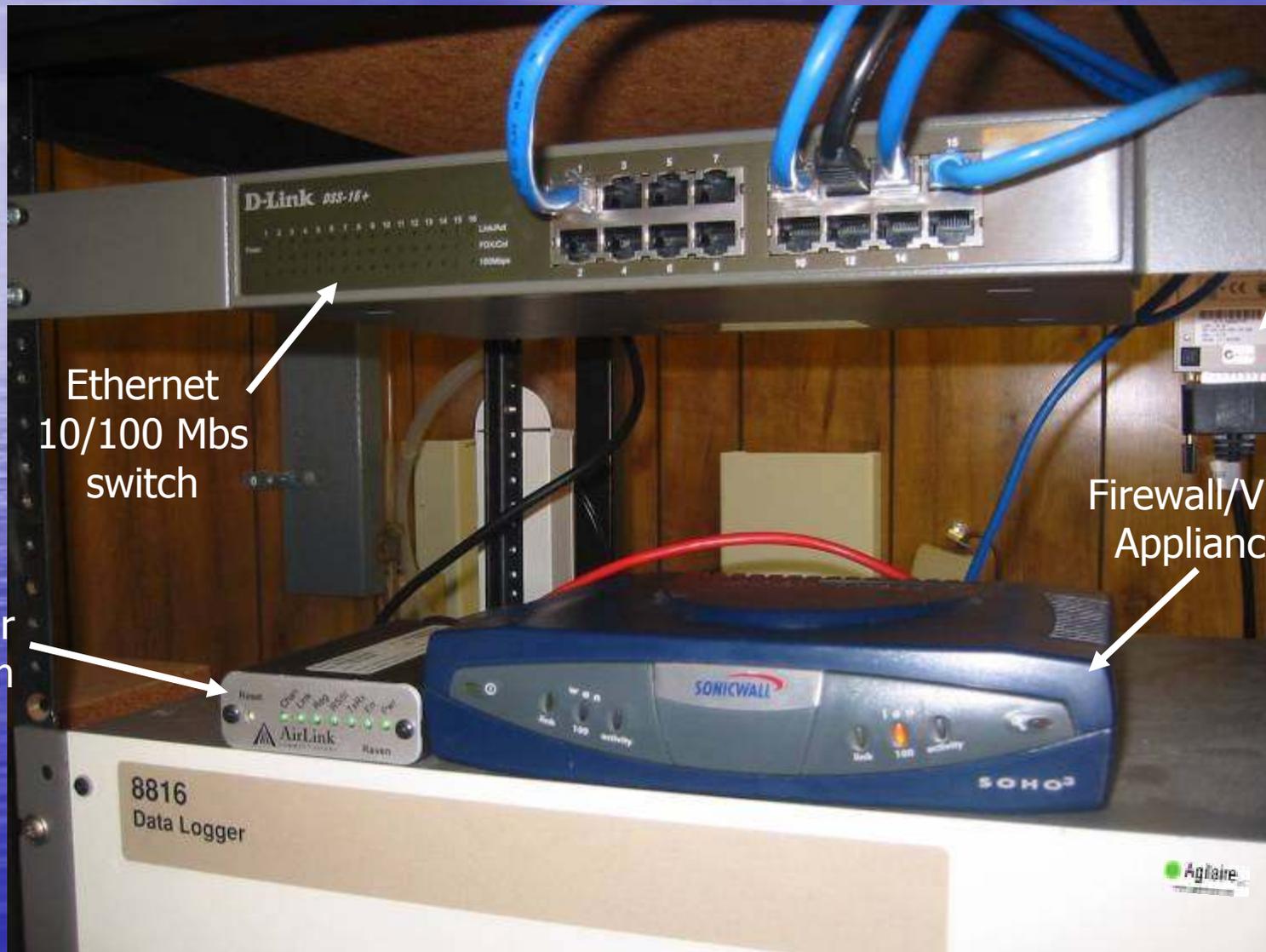


Cellular WIFI Antenna



Omni-Directional
(Directional and
Gain antennas are
available)

Site Local Area Network (LAN)



Ethernet
10/100 Mbs
switch

Cellular
Modem

Device
Server

Firewall/VPN
Appliance

8816
Data Logger

Aglair

External Device Server

Serial to Ethernet (Lantronix UDS-10, UDS-1100)

- Provides data accessibility and remote management to legacy equipment not currently network enabled
- Uses existing software to take advantage of Ethernet networking (i.e., Comport Redirector)
- Any equipment with a serial port can be added to the network



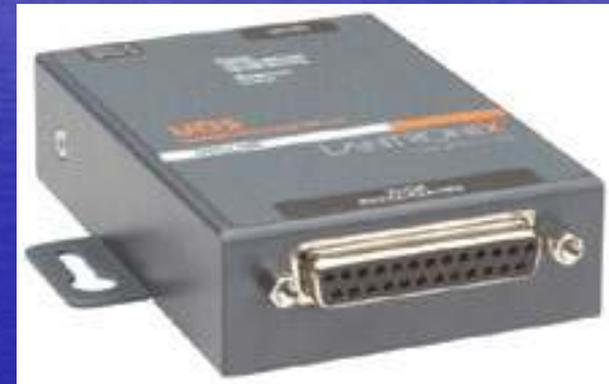
External Device Server



Ethernet cable

Lantronix UDS-10
ethernet to serial
port device

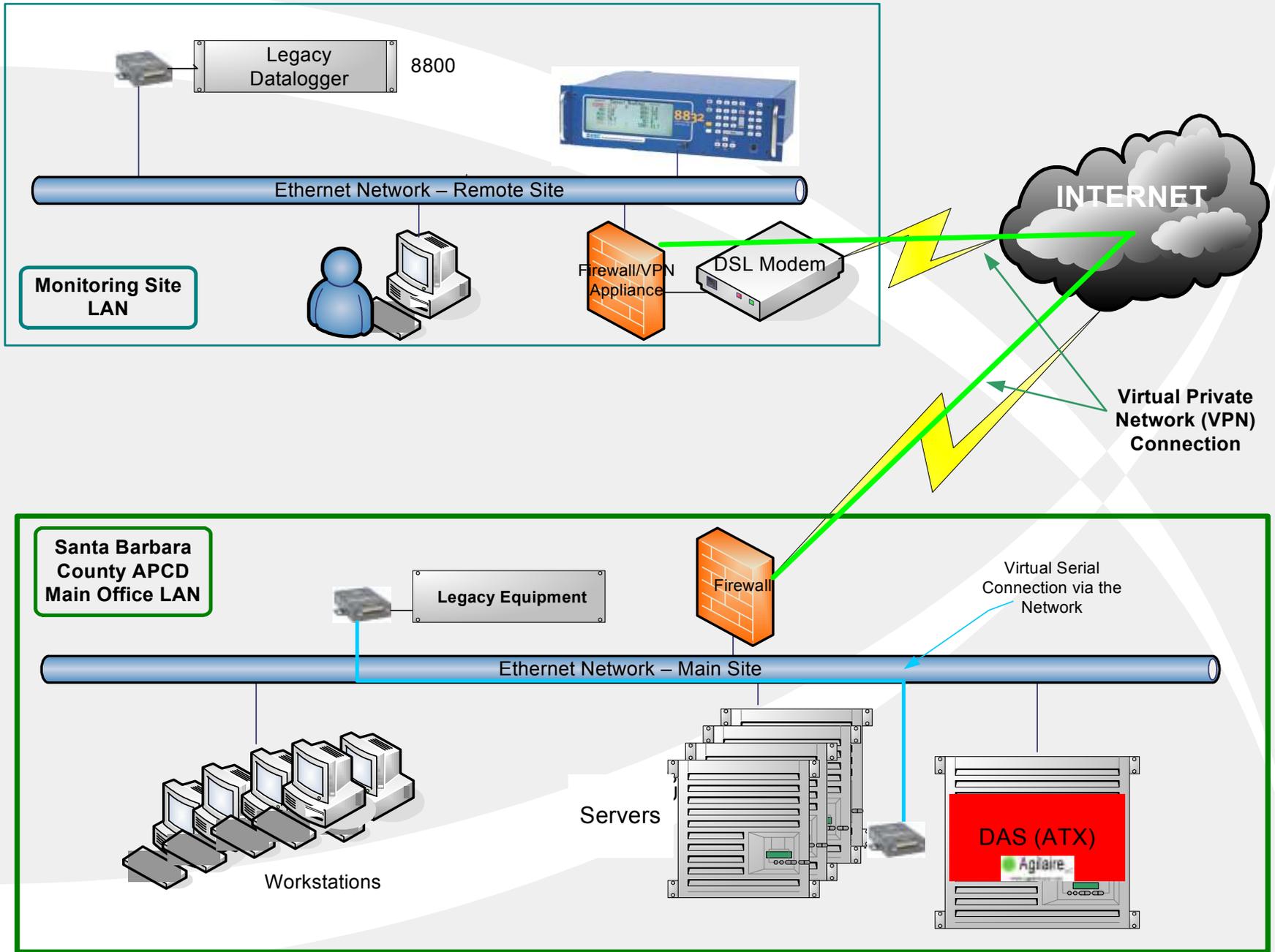
Serial cable



Lantronix UDS-1100
ethernet to serial
port device (newer)

Lantronix UDS-10/1100 Device Server

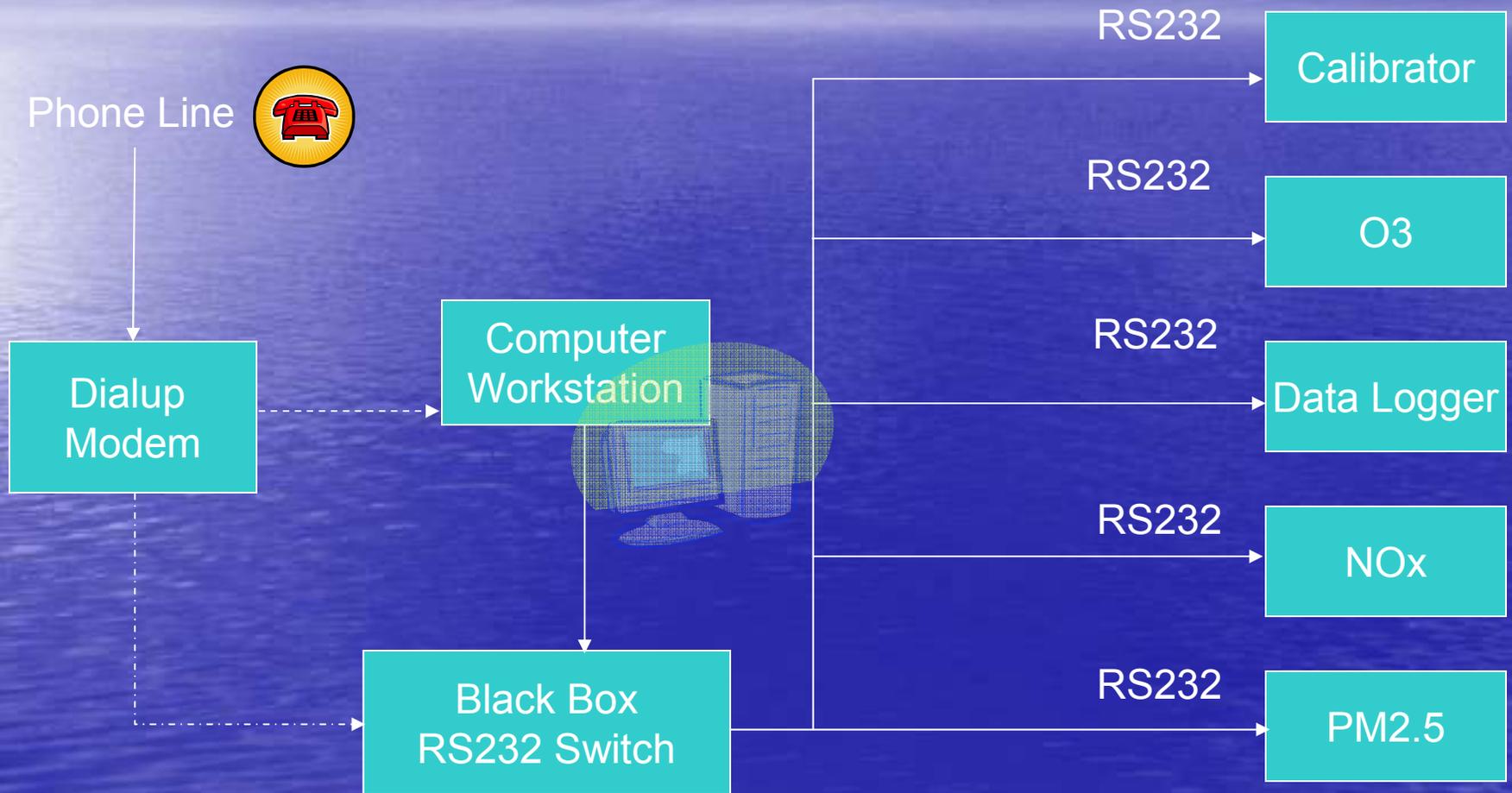
- Serial Tunneling
 - Encapsulates serial data into packets and transports it over Ethernet
- Virtual serial connection
 - Virtual serial connections can be extended across a local network or around the world over the Internet



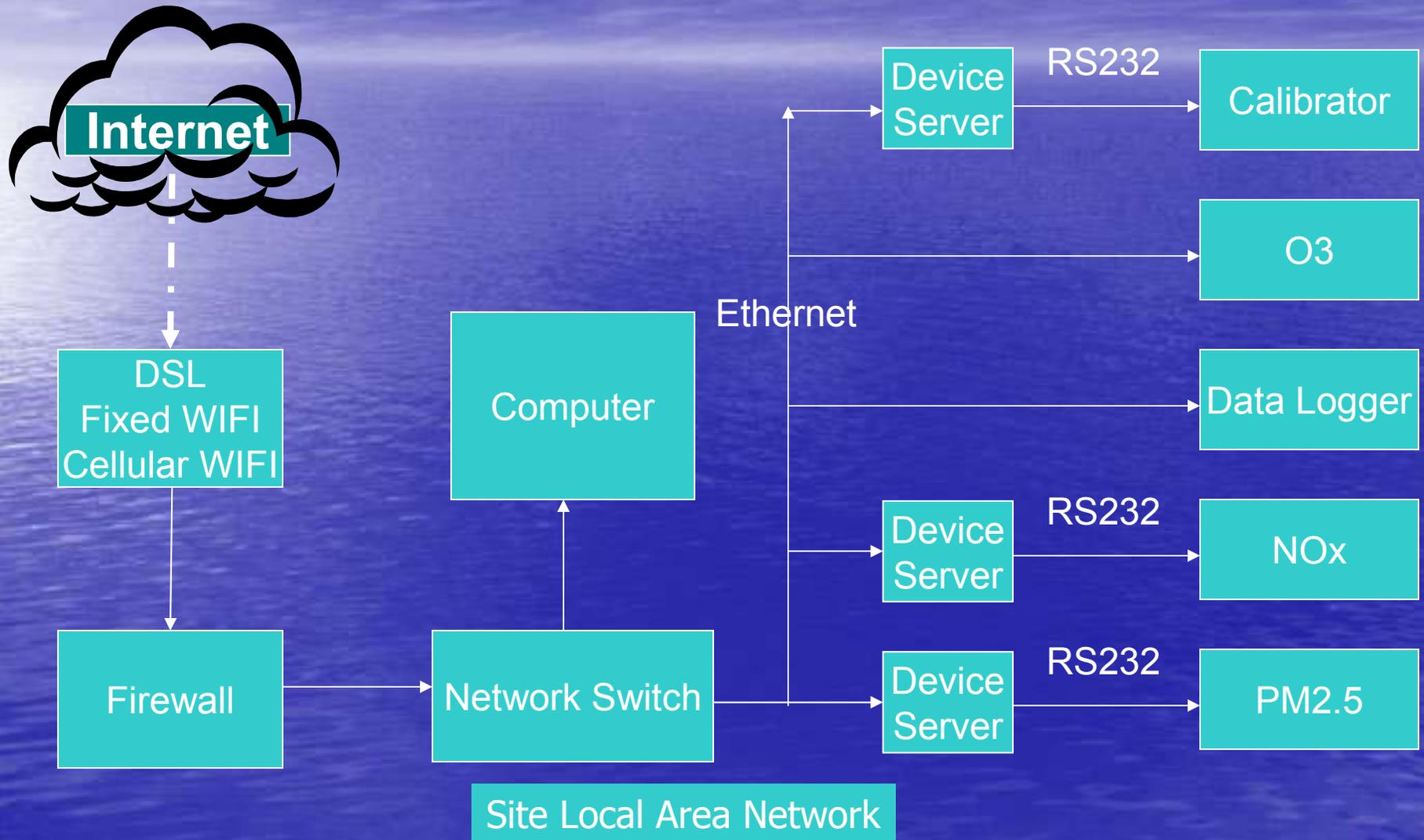
Remote Site Networking

- Digital information available at the sites
 - Analyzers have serial ports and data storage
 - Newer analyzers have Ethernet port
 - Computer workstations at the site
 - Electronic strip chart
 - Electronic record keeping
- Can connect to office LAN
 - Check email
 - Check records and documents

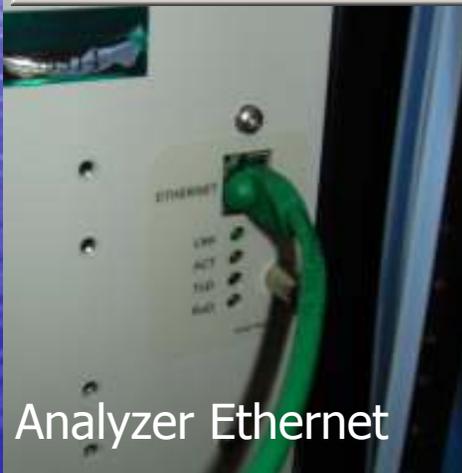
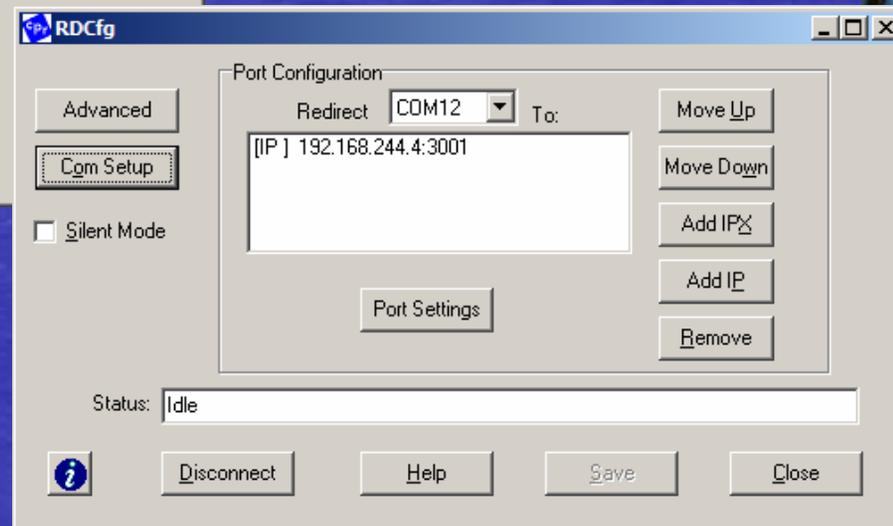
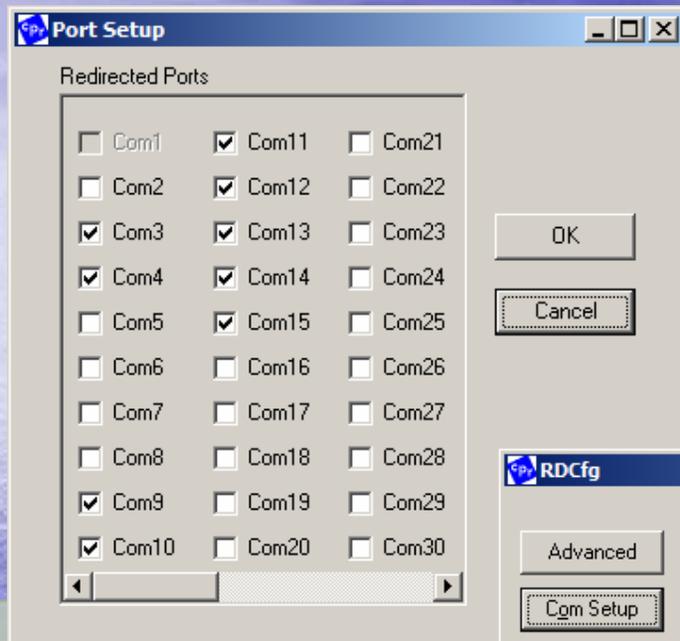
Site Network Using Phone Line



Site Network Using Broadband



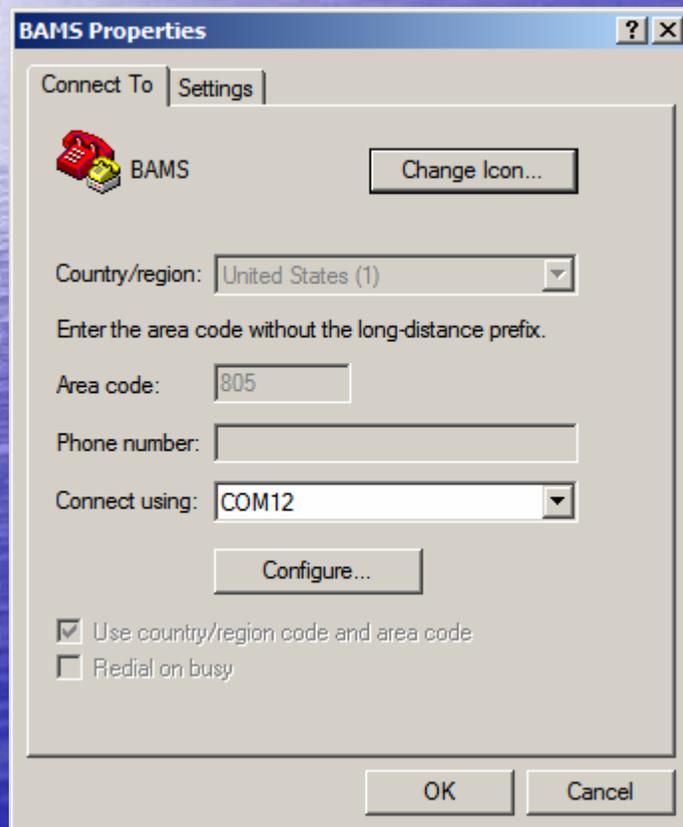
Virtual Serial Com Port



Analyzer Ethernet

Remote Analyzer Connection Using HyperTerminal

Virtual Com Port



The screenshot shows the 'BAMS Properties' dialog box with the 'Settings' tab selected. It features a 'Connect To' section with a telephone icon and a 'Change Icon...' button. Below this, there are fields for 'Country/region' (set to 'United States (1)'), 'Area code' (set to '805'), and 'Phone number'. A 'Connect using' dropdown menu is set to 'COM12'. There is a 'Configure...' button and two checkboxes: 'Use country/region code and area code' (checked) and 'Redial on busy' (unchecked). 'OK' and 'Cancel' buttons are at the bottom.

BAMS Properties [?] [X]

Connect To | Settings

 BAMS Change Icon...

Country/region:

Enter the area code without the long-distance prefix.

Area code:

Phone number:

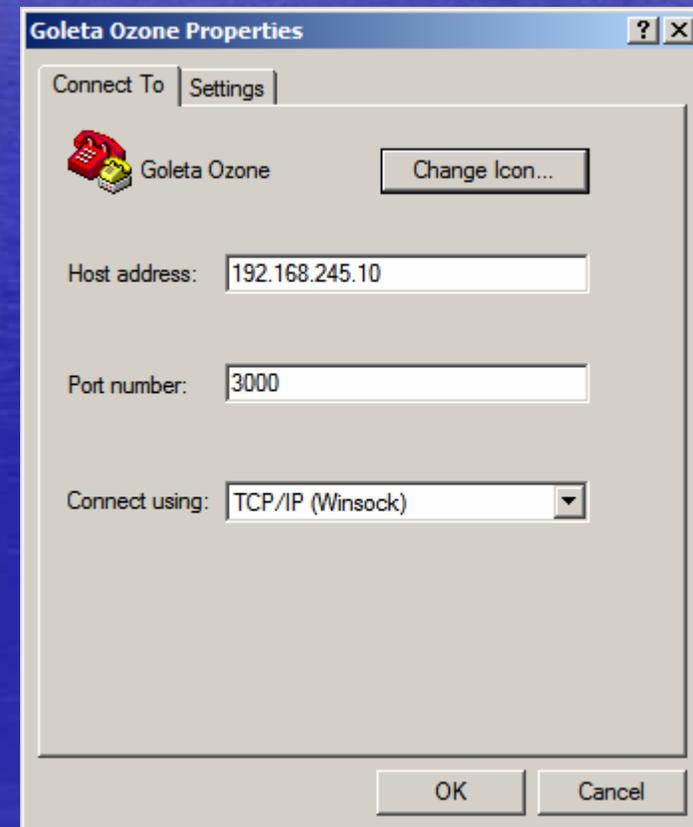
Connect using:

Configure...

Use country/region code and area code
 Redial on busy

OK Cancel

TCP/IP



The screenshot shows the 'Goleta Ozone Properties' dialog box with the 'Settings' tab selected. It features a 'Connect To' section with a telephone icon and a 'Change Icon...' button. Below this, there are fields for 'Host address' (set to '192.168.245.10') and 'Port number' (set to '3000'). A 'Connect using' dropdown menu is set to 'TCP/IP (Winsock)'. 'OK' and 'Cancel' buttons are at the bottom.

Goleta Ozone Properties [?] [X]

Connect To | Settings

 Goleta Ozone Change Icon...

Host address:

Port number:

Connect using:

OK Cancel

Report from Remote Analyzer

Time	Flow Rate	Parameter	Value	Unit
067:16:00	0400	CONC : AVG	47.0	PPB
067:17:00	0400	CONC : AVG	47.2	PPB
065:00:00	0400	O3REF : AVG	3051.9	mV
066:00:00	0400	O3REF : AVG	3046.7	mV
067:00:00	0400	O3REF : AVG	3046.9	mV
065:00:00	0400	PNUMTC: AVG	796.9	cc/m
065:00:00	0400	PNUMTC: AVG	28.7	InHg
066:00:00	0400	PNUMTC: AVG	796.2	cc/m
066:00:00	0400	PNUMTC: AVG	28.6	InHg
067:00:00	0400	PNUMTC: AVG	796.8	cc/m
067:00:00	0400	PNUMTC: AVG	28.6	InHg
065:00:00	0400	O3GEN : AVG	0.0	mV
066:00:00	0400	O3GEN : AVG	0.0	mV
067:00:00	0400	O3GEN : AVG	0.0	mV
202:11:05	0400	CALDAT: INST	1.021	
202:11:05	0400	CALDAT: INST	-1.5	PPB
202:11:05	0400	CALDAT: INST	399.6	PPB
202:11:39	0400	CALDAT: INST	1.021	
202:11:39	0400	CALDAT: INST	-1.7	PPB
202:11:39	0400	CALDAT: INST	-0.2	PPB
202:11:57	0400	CALDAT: INST	1.021	
202:11:57	0400	CALDAT: INST	-1.7	PPB
202:11:57	0400	CALDAT: INST	399.8	PPB

Connected 0:05:39 Auto detect TCP/IP SCROLL CAPS NUM Capture Print echo

Instrument Supplied Applications

The screenshot displays a remote desktop environment with several instrument control windows and a data display window.

Goleta Calibrator at Goleta Calibrator

STANDBY PHOTO STEMP=32.6 C
<TST TST> GEN STBY SEQ SETUP

1 2 3 4 5 6 7 8

Goleta Ozone 400E at Goleta O3 400E

SAMPLE SAMP FL=800 CC/M O3= 51.4
<TST TST> CAL SETUP

1 2 3 4 5 6 7 8

Goleta NOx 200E at Goleta NOx 200E

SAMPLE SAMP=28.8 IN-HG-A NOX= 10.6
<TST TST> CAL SETUP

1 2 3 4 5 6 7 8

Goleta CO API 300 at Goleta CO API 300

SAMPLE SAMP FL=800 CC/M CO= -0.3
<TST TST> CAL SETUP

1 2 3 4 5 6 7 8

TELEDYNE - API iDAS

Thermo Electron Corporation
431- S02 Analyzer

Thermo

00.069
13:17
10-24-06
742.9
on
ure (° C)
29.5
r 45.1
s 0.00
on
) 0.494
92
t -602
it 827
on

CONCENTRATION

SO2 -1.3 PPB

13:17

PRESSURE: 742.9 mmHg

RANGE AVG DIAGS ALARM

SAVE RUN MENU ↑ ENTER

TERM HELP ← ↓ →

100

00:00
01:01 10 min

For memo: select point, press Shift and select point

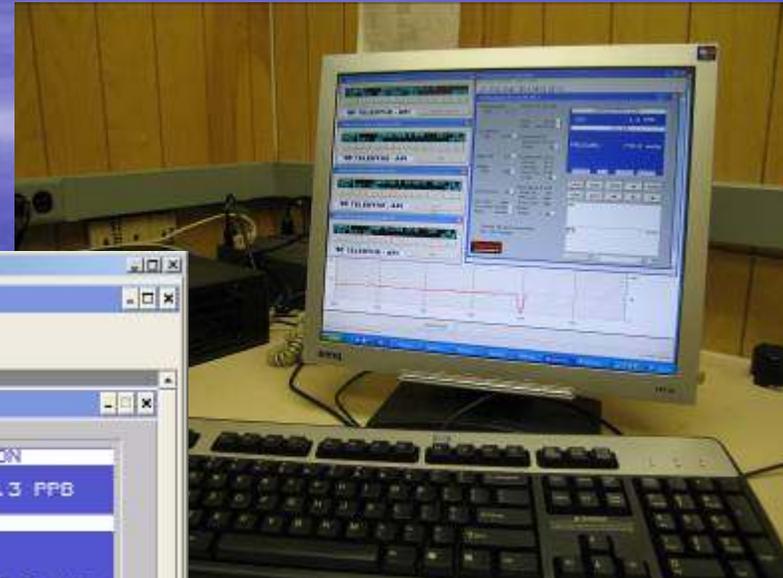
10/24/06 13:12:08

Start 5 APICOM Graphi... Thermo Electron Co... Digi-Trend Graph Di... 1:12 PM

Remote Desktop Connection



Remote Desktop



Remote Desktop session showing multiple windows for instrument control and data analysis.

Galata Calibrator at Galata Calibrator

```
STANDBY PHOTO STMP=32.6 C
<TST TST> GEN STBY SEQ SETUP
```

Galata Doser 400E at Galata D2 400E

```
SAMPLE SAMP FL=800 CC/M O3= 51.4
<TST TST> CAL SETUP
```

Galata NOx 200E at Galata NOx 200E

```
SAMPLE SAMP=28.8 IN-HG-A NOX= 10.6
<TST TST> CAL SETUP
```

Galata CO API 300 at Galata CO API 300

```
SAMPLE SAMP FL=800 CC/M CO= -0.3
<TST TST> CAL SETUP
```

TELEDYNE - API

Thermo Electron Corporation
431- S02 Analyzer

CONCENTRATION

502	-1.3 PPB
13:17	
PRESSURE:	742.9 mmHg

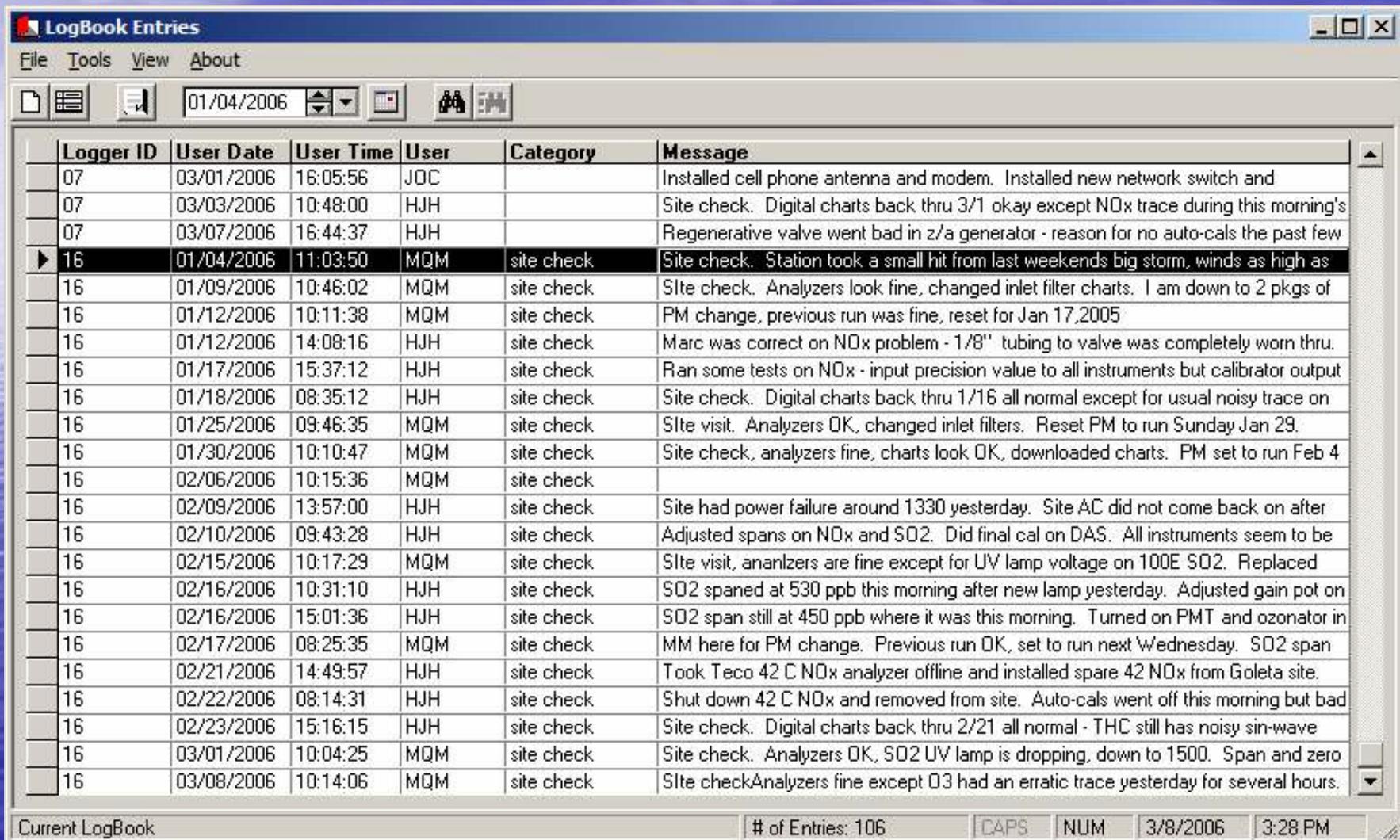
RANGE FUG DIRGS PURSH

SAVE RUN MENU ↑ ENTER
TERM HELP ← ↓ →

10/24/08 13:12:08

Start | 5 APICOM Graphi... | Thermo Electron Co... | Digi-Trend Graph Di... | 1:12 PM

Viewing Log Notes



The screenshot shows a window titled "LogBook Entries" with a menu bar (File, Tools, View, About) and a toolbar. The main area contains a table with columns: Logger ID, User Date, User Time, User, Category, and Message. The table lists various site check entries from 2006. The entry for 01/04/2006 at 11:03:50 by user MQM is highlighted. At the bottom, there is a status bar showing "Current LogBook", "# of Entries: 106", and "CAPS NUM 3/8/2006 3:28 PM".

Logger ID	User Date	User Time	User	Category	Message
07	03/01/2006	16:05:56	JOC		Installed cell phone antenna and modem. Installed new network switch and
07	03/03/2006	10:48:00	HJH		Site check. Digital charts back thru 3/1 okay except NOx trace during this morning's
07	03/07/2006	16:44:37	HJH		Regenerative valve went bad in z/a generator - reason for no auto-cals the past few
16	01/04/2006	11:03:50	MQM	site check	Site check. Station took a small hit from last weekends big storm, winds as high as
16	01/09/2006	10:46:02	MQM	site check	Site check. Analyzers look fine, changed inlet filter charts. I am down to 2 pkgs of
16	01/12/2006	10:11:38	MQM	site check	PM change, previous run was fine, reset for Jan 17,2005
16	01/12/2006	14:08:16	HJH	site check	Marc was correct on NOx problem - 1/8" tubing to valve was completely worn thru.
16	01/17/2006	15:37:12	HJH	site check	Ran some tests on NOx - input precision value to all instruments but calibrator output
16	01/18/2006	08:35:12	HJH	site check	Site check. Digital charts back thru 1/16 all normal except for usual noisy trace on
16	01/25/2006	09:46:35	MQM	site check	Site visit. Analyzers OK, changed inlet filters. Reset PM to run Sunday Jan 29.
16	01/30/2006	10:10:47	MQM	site check	Site check, analyzers fine, charts look OK, downloaded charts. PM set to run Feb 4
16	02/06/2006	10:15:36	MQM	site check	
16	02/09/2006	13:57:00	HJH	site check	Site had power failure around 1330 yesterday. Site AC did not come back on after
16	02/10/2006	09:43:28	HJH	site check	Adjusted spans on NOx and SO2. Did final cal on DAS. All instruments seem to be
16	02/15/2006	10:17:29	MQM	site check	Site visit, analzers are fine except for UV lamp voltage on 100E SO2. Replaced
16	02/16/2006	10:31:10	HJH	site check	SO2 spanned at 530 ppb this morning after new lamp yesterday. Adjusted gain pot on
16	02/16/2006	15:01:36	HJH	site check	SO2 span still at 450 ppb where it was this morning. Turned on PMT and ozonator in
16	02/17/2006	08:25:35	MQM	site check	MM here for PM change. Previous run OK, set to run next Wednesday. SO2 span
16	02/21/2006	14:49:57	HJH	site check	Took Teco 42 C NOx analyzer offline and installed spare 42 NOx from Goleta site.
16	02/22/2006	08:14:31	HJH	site check	Shut down 42 C NOx and removed from site. Auto-cals went off this morning but bad
16	02/23/2006	15:16:15	HJH	site check	Site check. Digital charts back thru 2/21 all normal - THC still has noisy sin-wave
16	03/01/2006	10:04:25	MQM	site check	Site check. Analyzers OK, SO2 UV lamp is dropping, down to 1500. Span and zero
16	03/08/2006	10:14:06	MQM	site check	Site checkAnalyzers fine except O3 had an erratic trace yesterday for several hours.

Current LogBook # of Entries: 106 CAPS NUM 3/8/2006 3:28 PM

Connection to ESC 8832 using Web Browser

8832 DATA SYSTEM CONTROLLER

ESC 8832 Home Menu

- [Help Screen](#)
- [Login](#)
- [Configuration Menu](#)
- [Real-Time Display Menu](#)
- [Report Generation Menu](#)
- [Status Menu](#)
- [Log Out](#)

Real-Time Display Menu

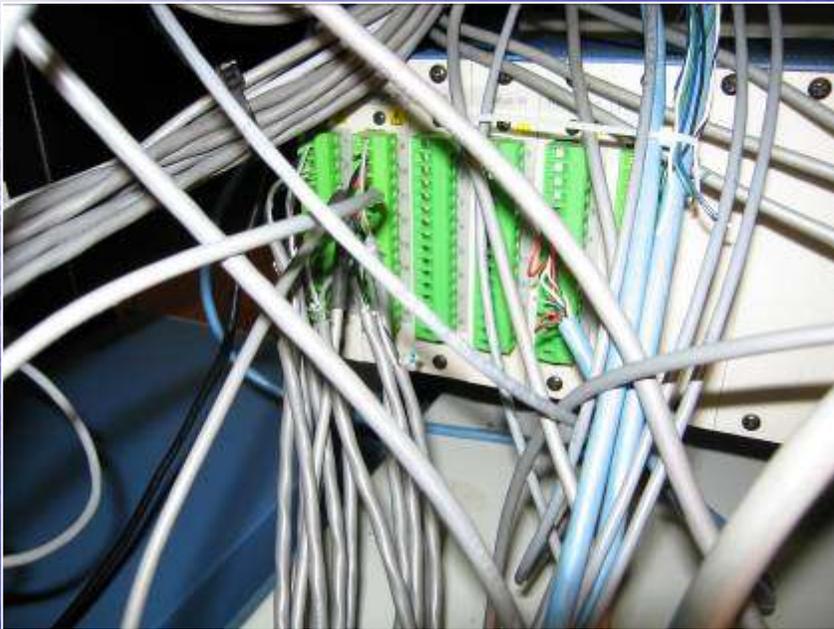
- [Display Raw Readings](#)
- [Display Readings with Units](#)
- [Display Readings with Flags](#)
- [Display Last Base Average](#)
- [Continuous Average Report](#)
- [Show LARGE TEXT Display](#)
- [Display Digital Inputs](#)
- [Display Digital Outputs](#)
- [Change Digital Output State](#)
- [Display Analog Outputs](#)

Real-Time Engineering Units

O3 =	56.59 (PPB)
NO =	1.792 (PPB)
NOX =	9.328 (PPB)
SO2 =	-0.7856 (PPB)
CO =	-0.3484 (PPM)
STM =	22.43 (DEGC)
ATM =	18.22 (DEGC)
NO2 =	7.536 (PPB)
WSA =	2.211 (MPS)
WDA =	182.1 (DEG)
O3TRF =	-0.1769 (PPB)
RH =	68.85 (%)
BP =	29.88 (INHG)
SOLAR =	550.3 (W/M2)
WSR =	2.211 (MPS)
WDR =	182.1 (DEG)
O3FLOW =	799 (cc/min)
O3PRES =	28.4 (INHG)
O3TEMP =	37.2 (DEGC)
O3REF =	2656 (MV)
NOXFLW =	509 (CC/MIN)
NOXO3FLW =	78 (CC/MIN)

Simplify Wiring

Analog



Ethernet



What We Can Do Remotely With Broadband

- Poll data loggers
- Remote desktop connection
- View remote strip chart
- View instrument data
- Run diagnostics
- Calibrate instruments
- View remote documentation

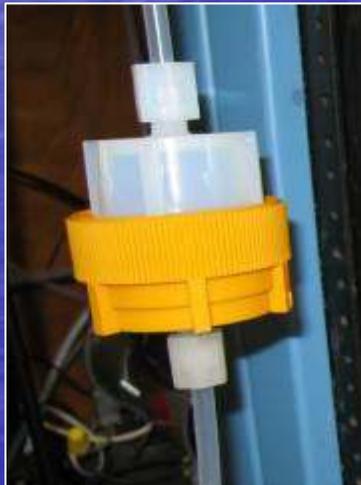
How Does it Help Us?

Reduced car trips = Less pollution
= Reduced time
= Cost savings

More data = Faster response
= Less down time
= Better data quality

What We Can't Do Remotely

- Change sample filters
- Change PM10 filters
- Climb towers



Contact Information

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