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Digital Data Acquisition - Envidas Ultimate

National Air Quality Conference – Commercial Data Systems Training Session

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Overview

- Review the term Digital Data Acquisition & discuss benefits
- Discuss the benefits of Remote Access
- Discuss use of TCPIP (broadband internet) to communicate with station loggers
- Present Envidas Ultimate (Station Logger)
  - Provide examples of setup/programing/operation
- Envidas ComCenter (Central Server)
- Envidas ARM (Data Review Client)
  - Provide examples of capabilities

What is digital data acquisition?

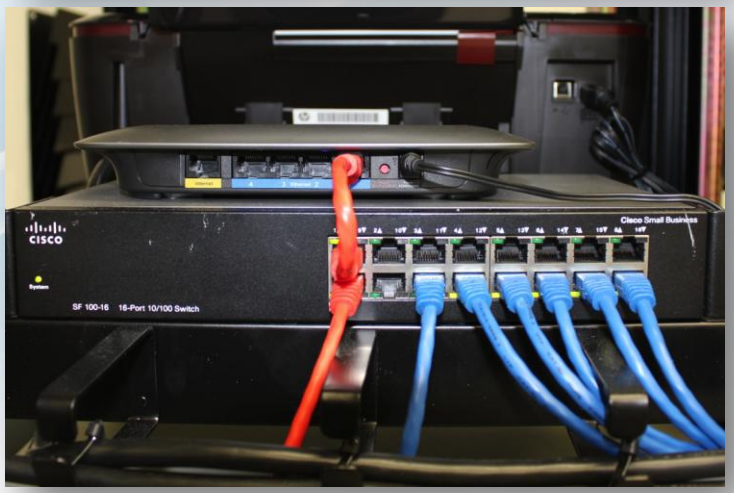
- Collection of the native digital measurement values from the instrument using either an Ethernet or Serial interface *(or both)*.
- Collection of digital instrument status “flags”
- Additional collection of instrument diagnostics parameters.

Advantages of the Digital Interface

- Recorded values are exactly what the instrument reads. There are no D/A and A/D circuits to be a source of error or points of failure.
- Instrument cost can be lowered by omitting the analog output option.
- Calibrators can be controlled digitally over a single Serial or Ethernet cable, reducing station wiring.

Digital Connections (from station logger to analyzers)

- Digital communications can be setup using RS232 (Serial) connections or via TCPIP (Ethernet) - *Faster*
- Both types of connections can be used to provide redundant access
- For TCPIP coms, some understanding of networking is required



Digital Connections (from station logger to analyzers)

- Keys to Establishing Serial Communications
  - Serial coms are almost always std. on most analyzers (but, be sure to ask)
  - Make sure you have the latest firmware
  - Check cables (null or straight through) – DCE DTE
  - Check com port assignment in device manager
    - Make a serial port list if using multiple ports
    - Embossed Moxa cable numbers are not com port numbers
  - Need to set device manager, envidas and analyzer to the same baud rate
  - Check instrument ID in analyzer settings
  - Test connections with manufacturer software first

Digital Connections (from station logger to analyzers)

- Keys to Establishing TCPIP Communications
  - Ethernet coms are frequently an option, so be sure to ask. To future proof new analyzers, order it.
  - Make sure you have the latest firmware
  - Check IP address and port in analyzer settings
  - Check IP address and port in Envidas and Iport/APICom
  - Check network configuration (modem, router, switch)
  - Test connections with manufacturer software first

Digital Connections (to the station)

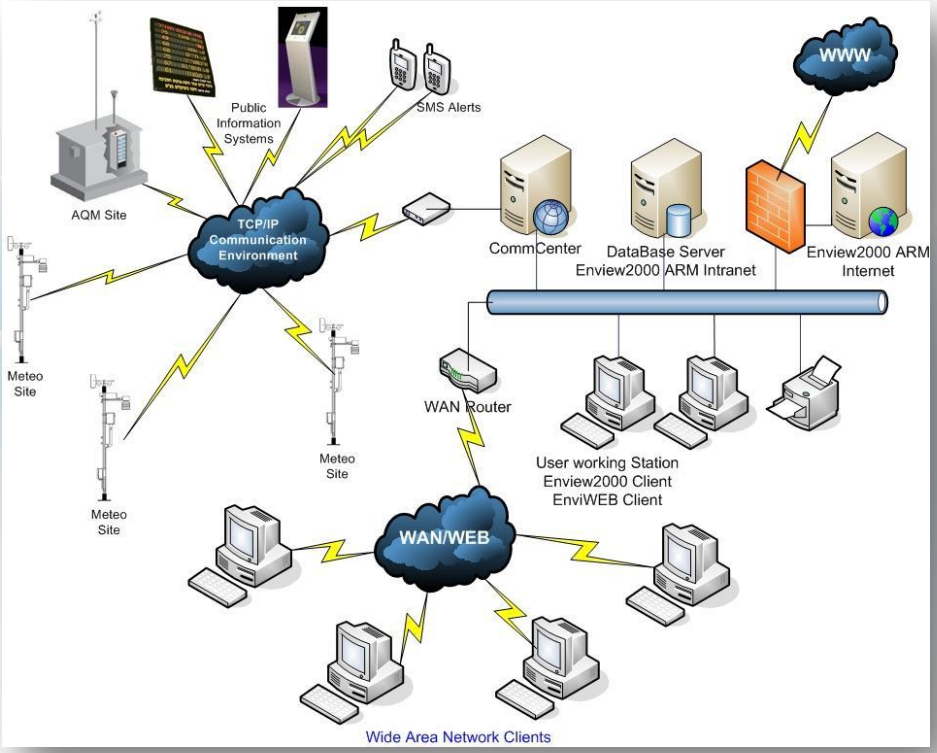
- To fully utilize the features and capabilities of Ultimate, TCPIP communication (internet access) is required.
- This can be accomplished in a variety of ways:
  - DSL or Cable ISP (Qwest, Comcast etc.)
  - Satellite (Hughesnet)
  - Cellular Modems (AT&T, Verizon, etc.)

Challenges with TCPIP communications (Central Server to Station)

- Obtaining Static IP Addresses
  - Getting statics can be challenging especially with cellular providers
  - Business plans are often needed and initial account setup can be costly
  - Dynamic DNS services can be a work around
  - Virtual Private Network (VPN) tunnels can assign your remote computer an IP address that your computer can reach.

Challenges with IP communications (Central Server to Station)

- Networking
  - It is not just a phone call anymore



Products that Support Digital Data Acquisition

- Most modern DAS products support some amount of Digital Data Acquisition
  - Some are better/easier to configure/use than others
- Many products are hosted on “PC” platforms
  - Many hardware options (solid state, rack mount etc.)
  - Flexibility to match the hardware to the monitoring requirement:
    - Environmental conditions (Temp, moisture, vibration, dust)
    - Power requirements
    - Space constraints

Advantages of the PC Platform

- Off the shelf hardware, readily available. Low cost.
- The platform can host other software such as APIcom or Iport remote interface software.
- Technical manuals, schematics, spare parts lists can be stored on the datalogger PC.
- Remote access to the PC and instruments is supported over broadband. Full control of the logger and instruments is then available.
- Electronic Station Logbooks!

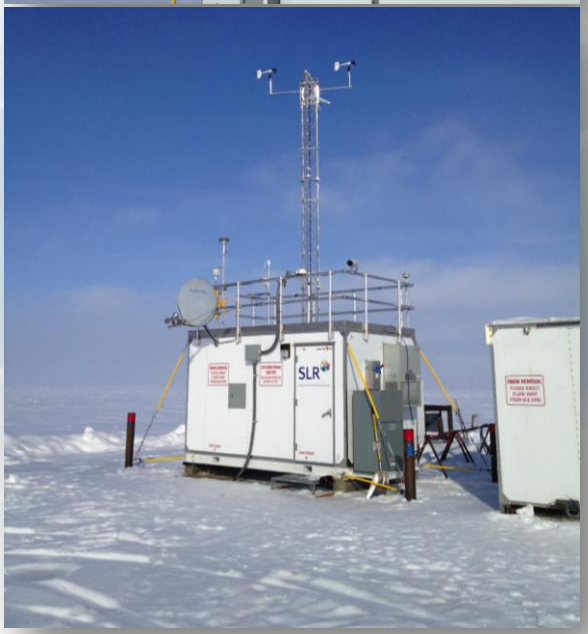
Disadvantages of the PC Platform

- It's a PC!

  - Software updates, hangs and bugs can disable logging.
    - DRAC cards and IP addressable UPS power supplies can allow remote reboot of frozen PC's.

  - Hardware failures can shut down an entire station
    - Onboard data acquisition in gas analyzers and redundant data from a/d met loggers (Campbell) can allow data to be recovered.
    - Easy backup and replacement

Remote Access



Almost all data acquisition systems transmit data out of the station, but the latest generation of advanced digital systems allow users access into the station to trigger manual calibrations, make analyzer calibration adjustments and actively track diagnostic parameters during remote troubleshooting.

Remote Access - Benefits

- In some cases, whole site visit trips can be eliminated (eg. Span adj)
- Diagnostic info better prepares field staff
- Remote access allows technicians to multitask

Where would you rather do your work?

Here?

Or here?

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Envidas Ultimate

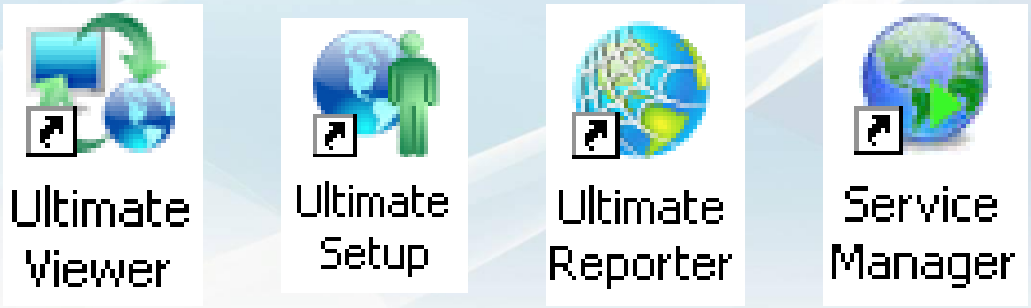
- Envidas Ultimate is the latest version of the Envidas digital data acquisition software developed by Envitech Ltd. and distributed in the U.S. by Andy Montz at DRDAS
- Many locations are still using the previous EnvidasFW product which was good, but don't be afraid to upgrade to Ultimate. It is MUCH better and the learning curve is steep if you know FW.

Envidas Ultimate Features

- Supports 256 data channels, DI and DO
- Multiple calibrators can be interfaced digitally
- Hosts its own web site and can send alerts independent of the central software
- Full support of Campbell Scientific CR1000 dataloggers (used for a/d conversion of met sensors and any legacy equipment that might be used)
- More refined and easier to use programing interface than EnvidasFW. Switching com modes of an analyzer from Serial to TCPIP is a simple drag and drop.
- Webcam images can be acquired and saved locally by the Ultimate product.

Envidas Ultimate - Station Logger Software

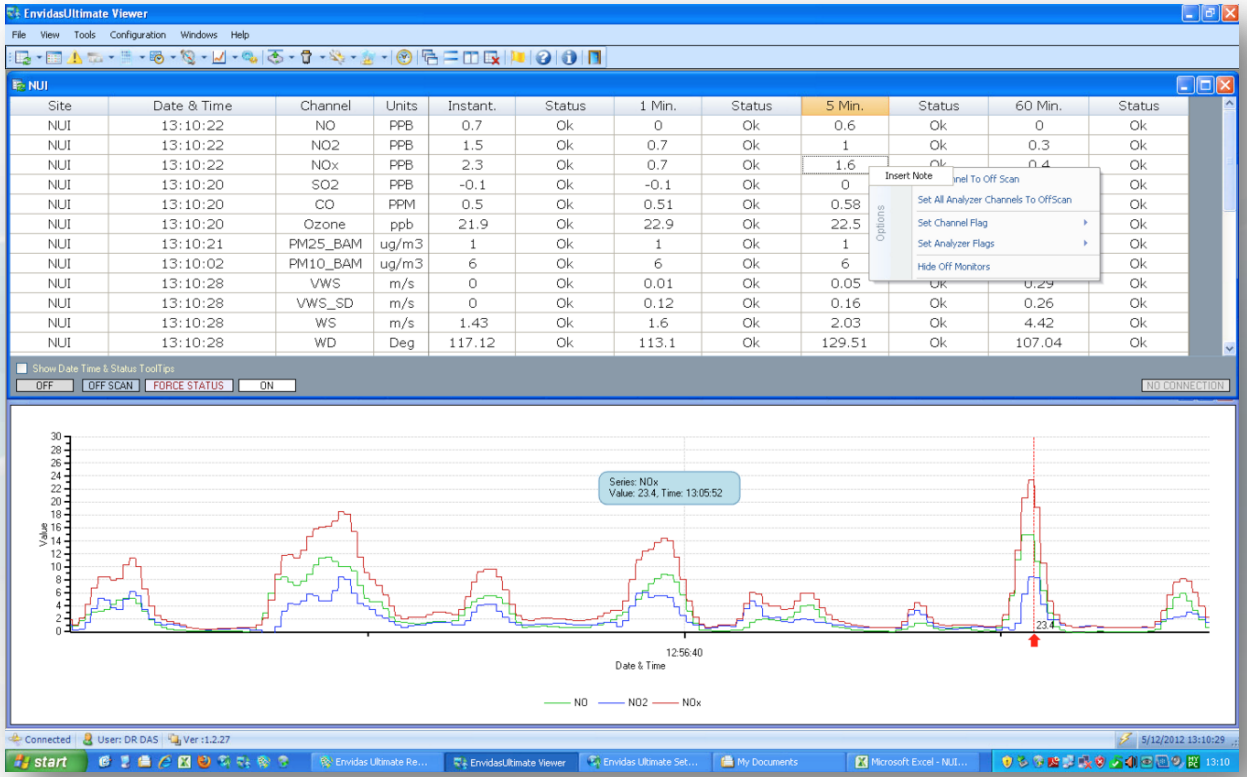
- <u>Ultimate has four main components:</u>
  - Viewer
  - Setup
  - Reporter
  - Service Manager



Envidas Ultimate - Station Logger Software

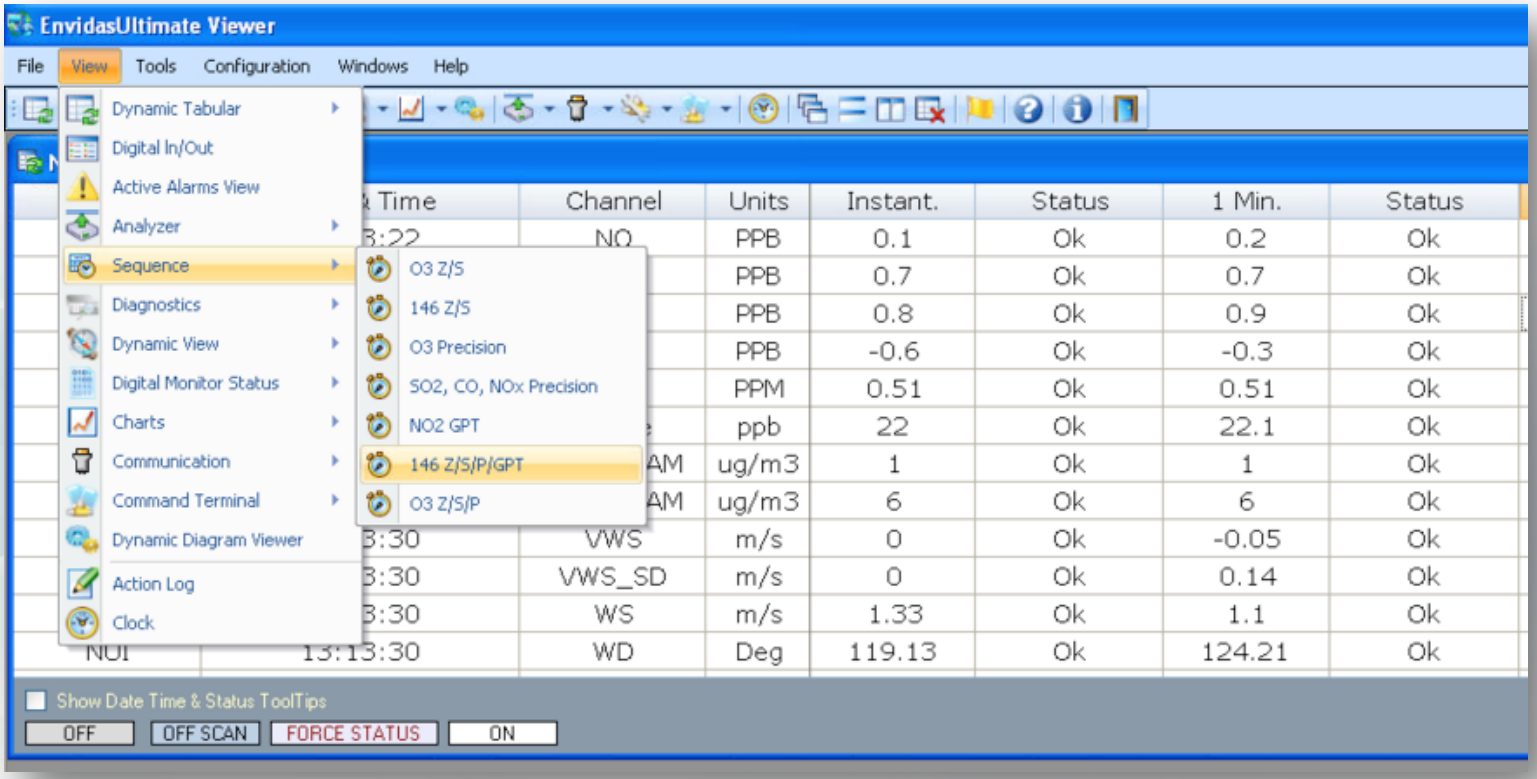
- Ultimate Viewer 

  - Used to view real-time data and initiate calibrations
  - Flag down channels for maintenance



Envidas Ultimate - Station Logger Software

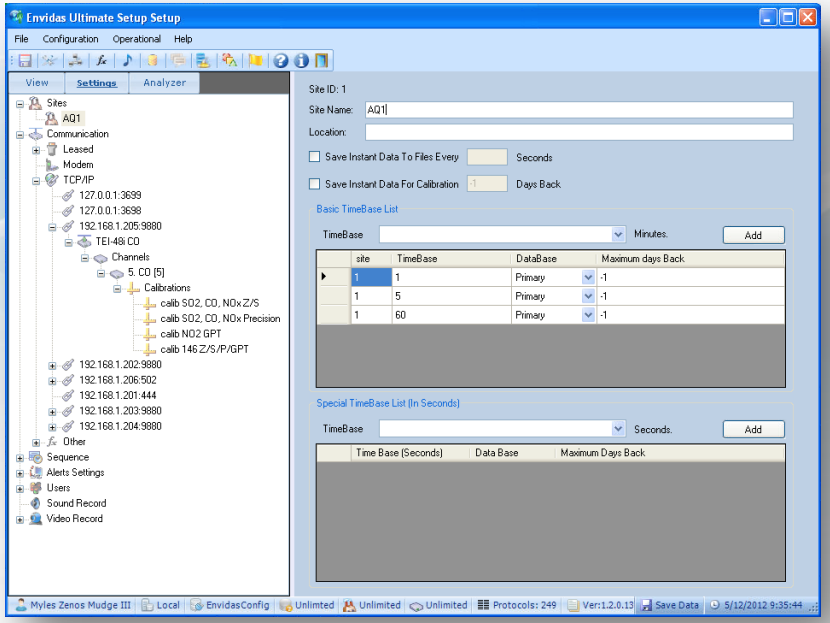
- Initiating a calibration sequence (Viewer)



Envidas Ultimate - Station Logger Software

- Ultimate Setup 

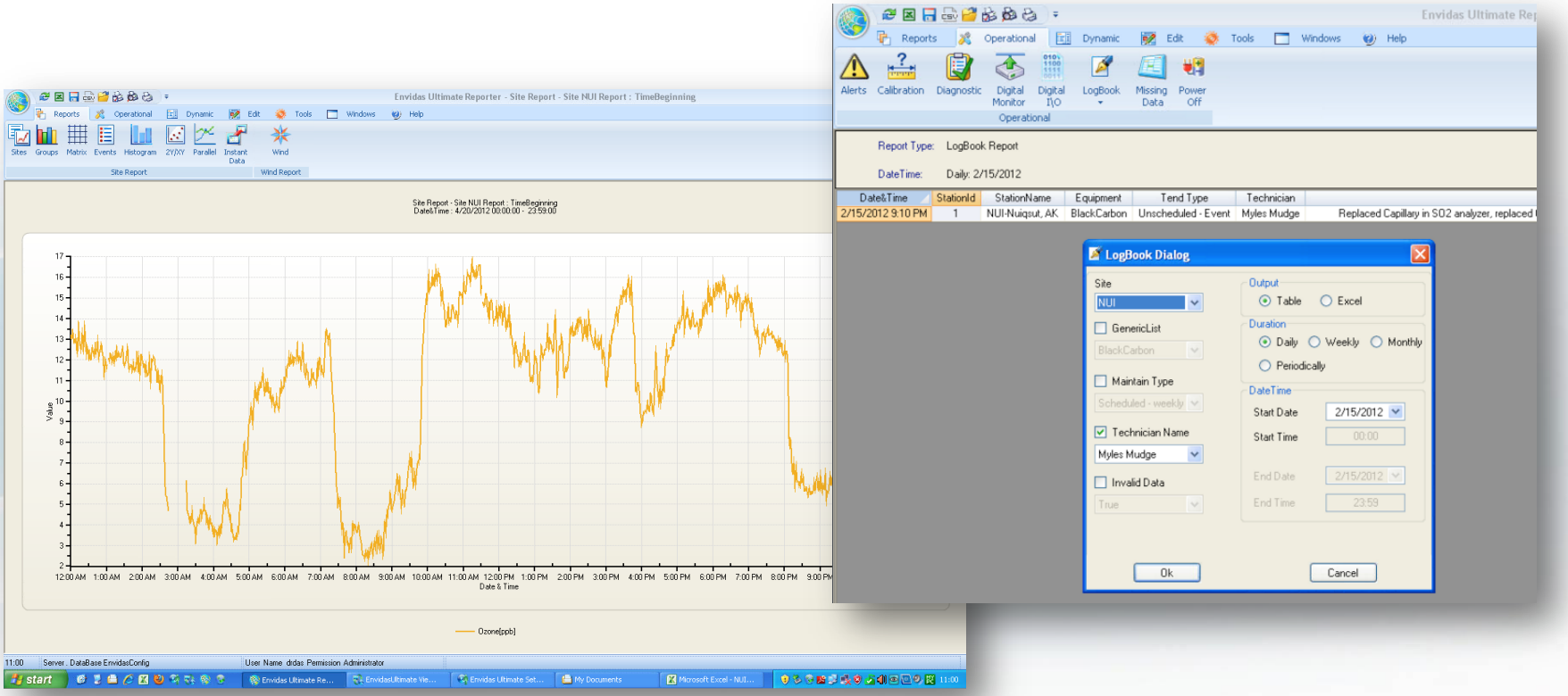
  - Configure analyzers & Calibrators
  - Setup calibration sequences
  - Configure onsite alerts (also available in ComCenter)
  - Configure webcam image capture



Envidas Ultimate - Station Logger Software

- Ultimate Reporter 

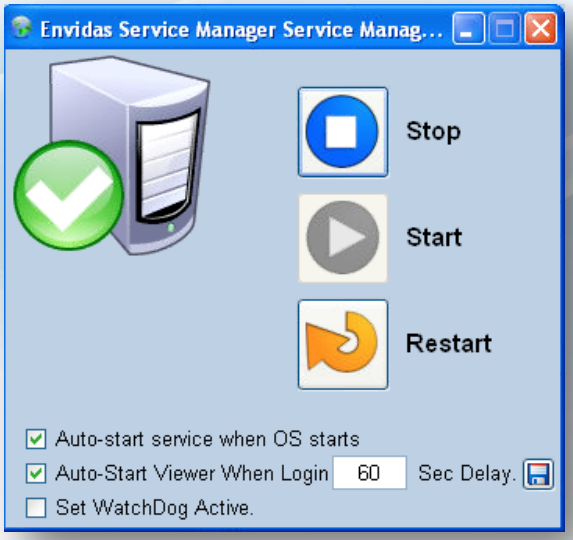
  - Used to view historic data
  - Enter and review electronic logbook entries



Envidas Ultimate - Station Logger Software

- Service Manager 

  - Used to monitor, restart and stop polling service
  - Service automatically restarts when computer boots
  - Note: Might need to stop polling service to access some analyzers for maintenance, but there are usually ways around this (serial and TCPIP coms).

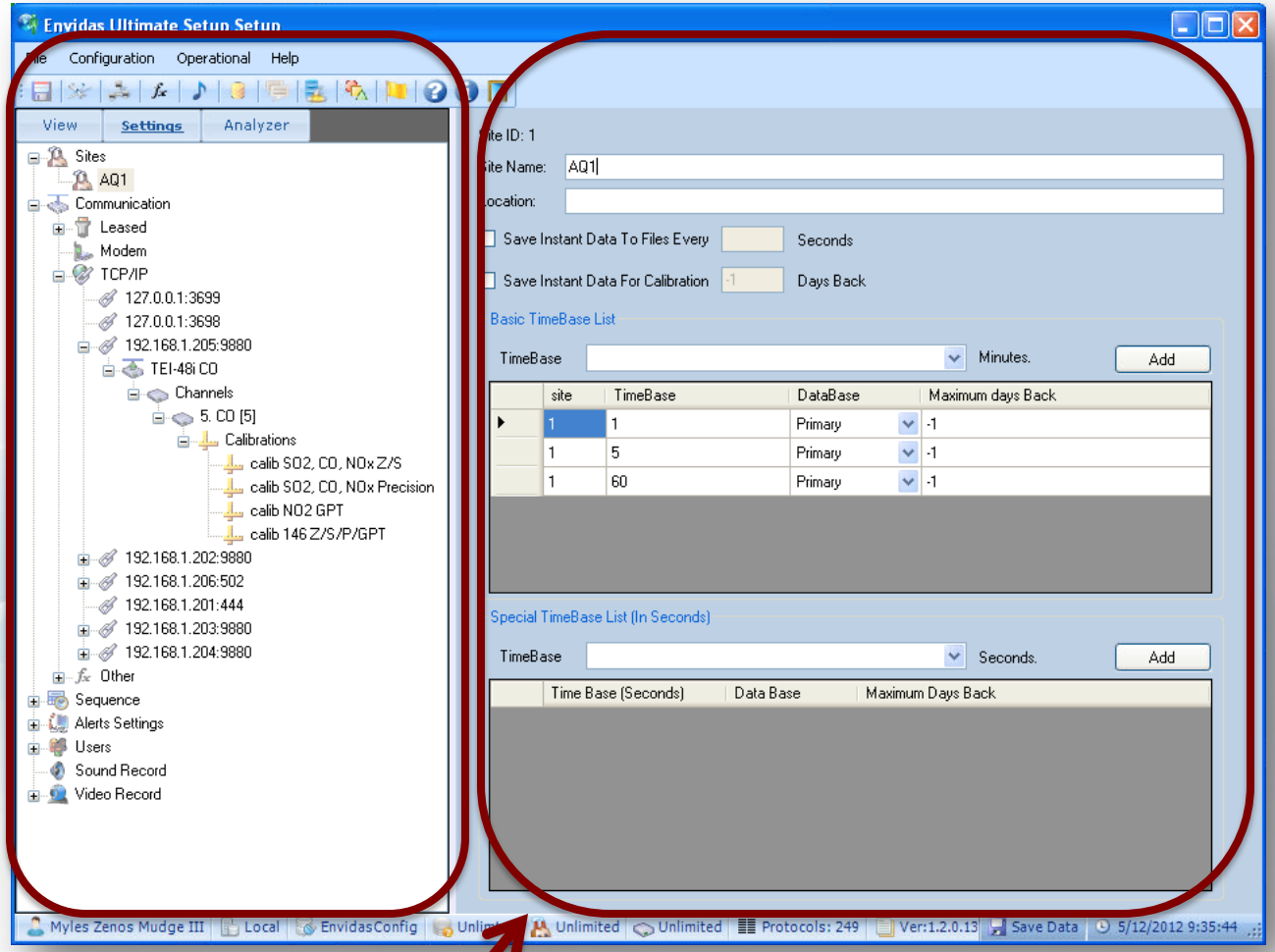


Envidas Ultimate Setup Programing

- GUI Setup and programming (no special programing skills needed)
  - All common analyzers can be simply selected from a drop-down list.
  - Most analyzers have diagnostic parameter lists preconfigured in Ultimate Setup.
  - Calibration sequences have a visual display to depict the phase length and which portion is used for calib. calculation.
  - Whole configurations can be copied from one computer to another for easy site duplication.

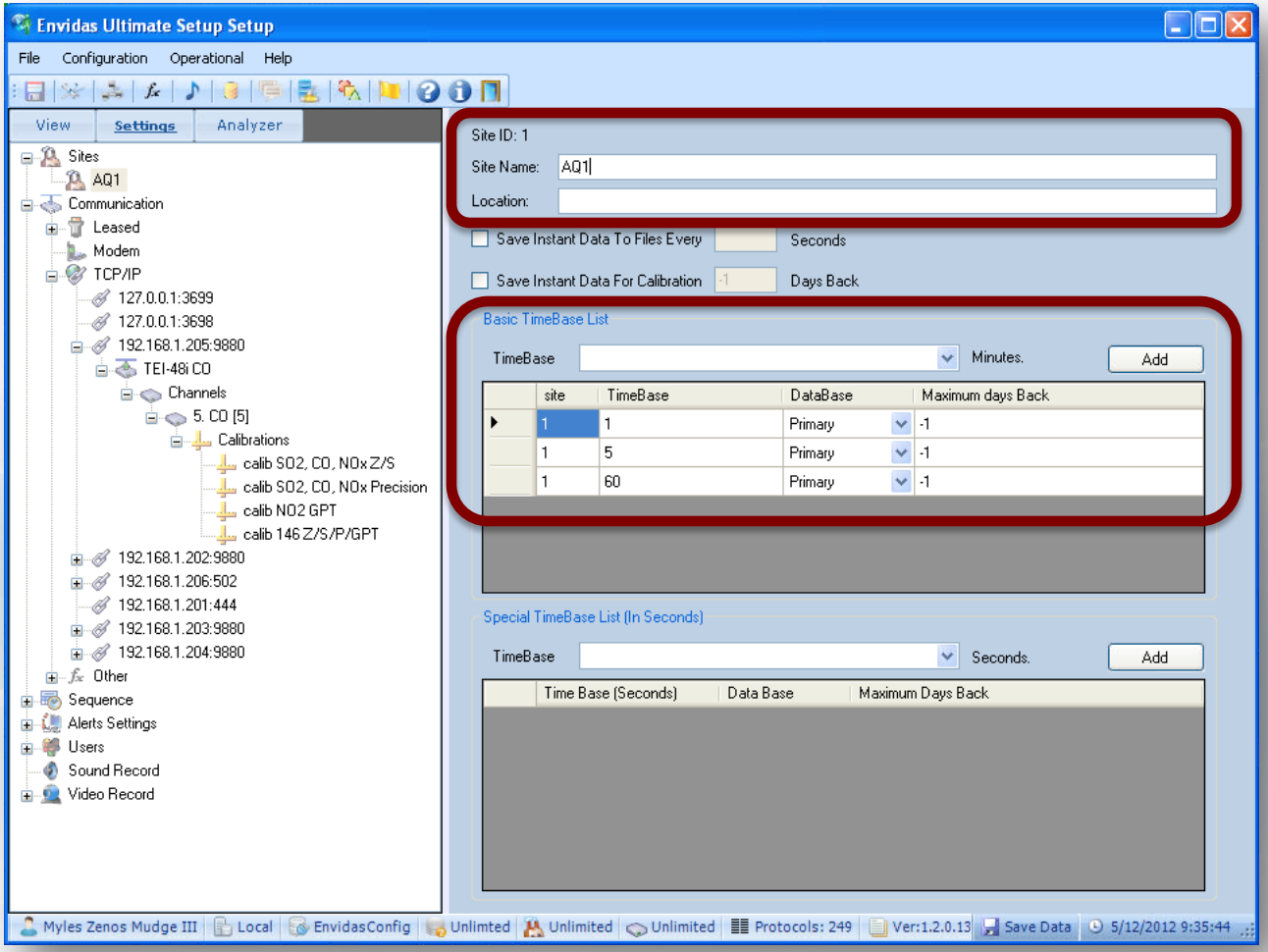
Basic Layout (Setup)

Config. Menu Tree

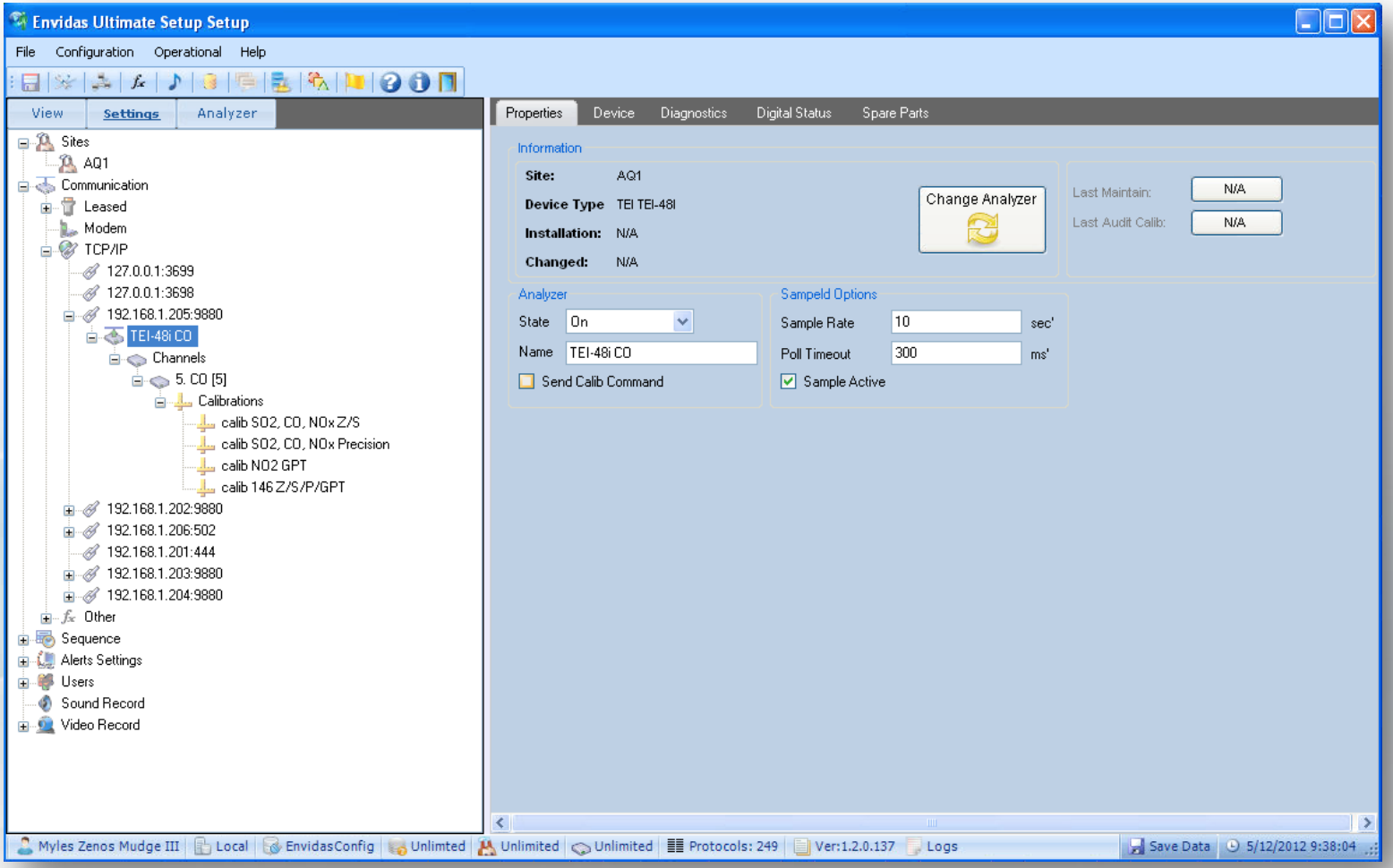


Parameter Details Configuration

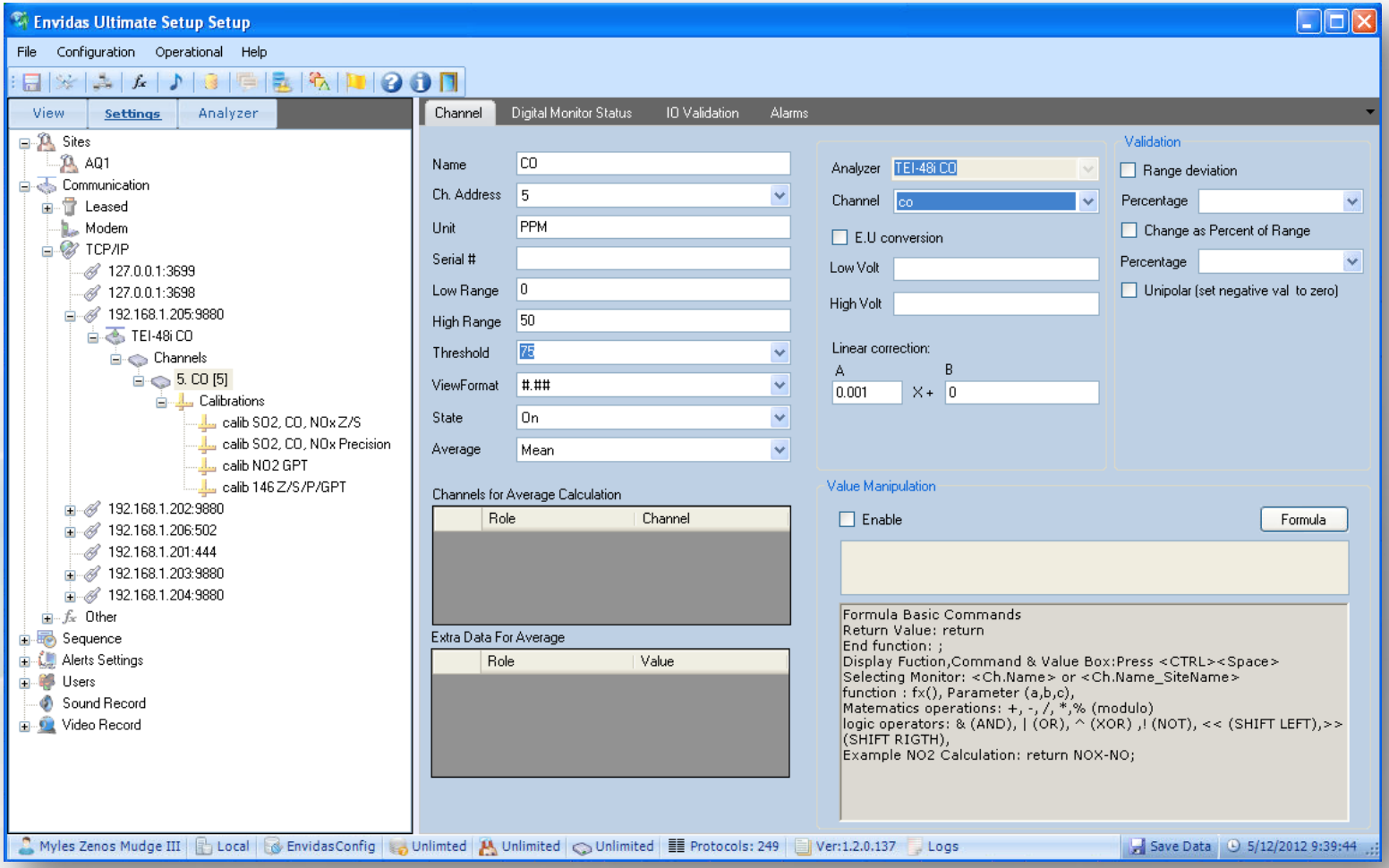
Setting Up a Site (Setup)



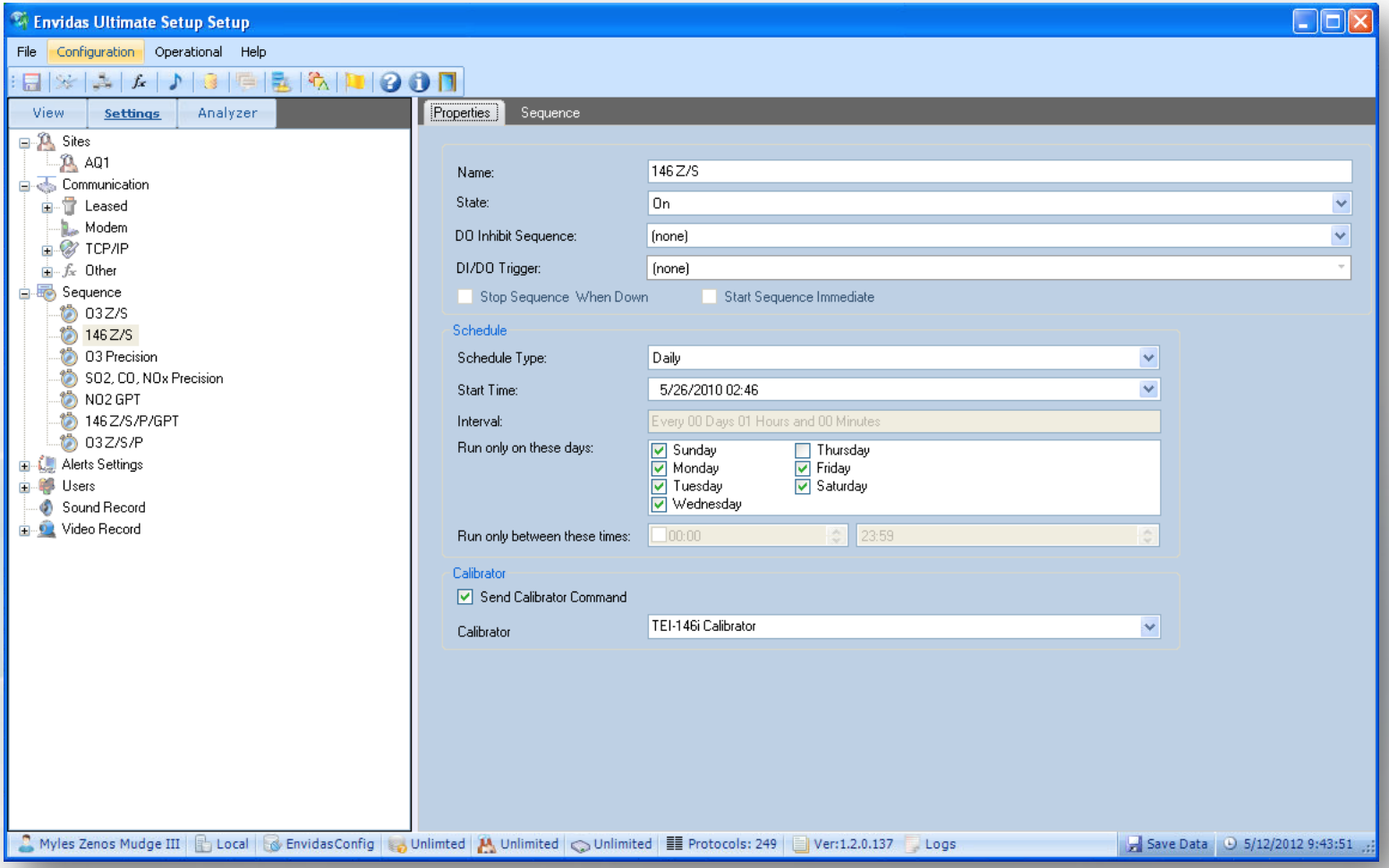
Adding a Gas Analyzer (Setup)



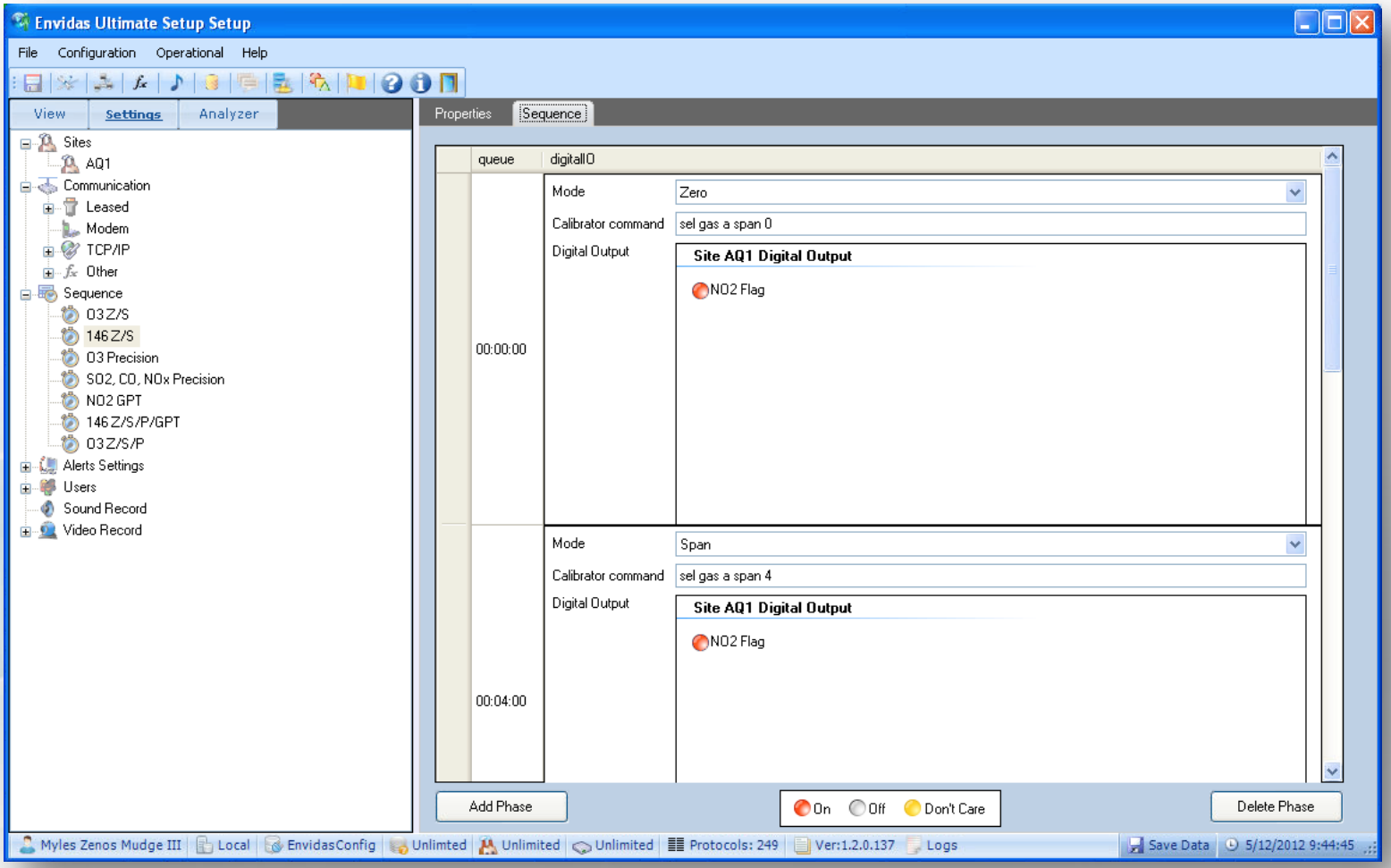
Adding Channels to an Analyzer (Setup)



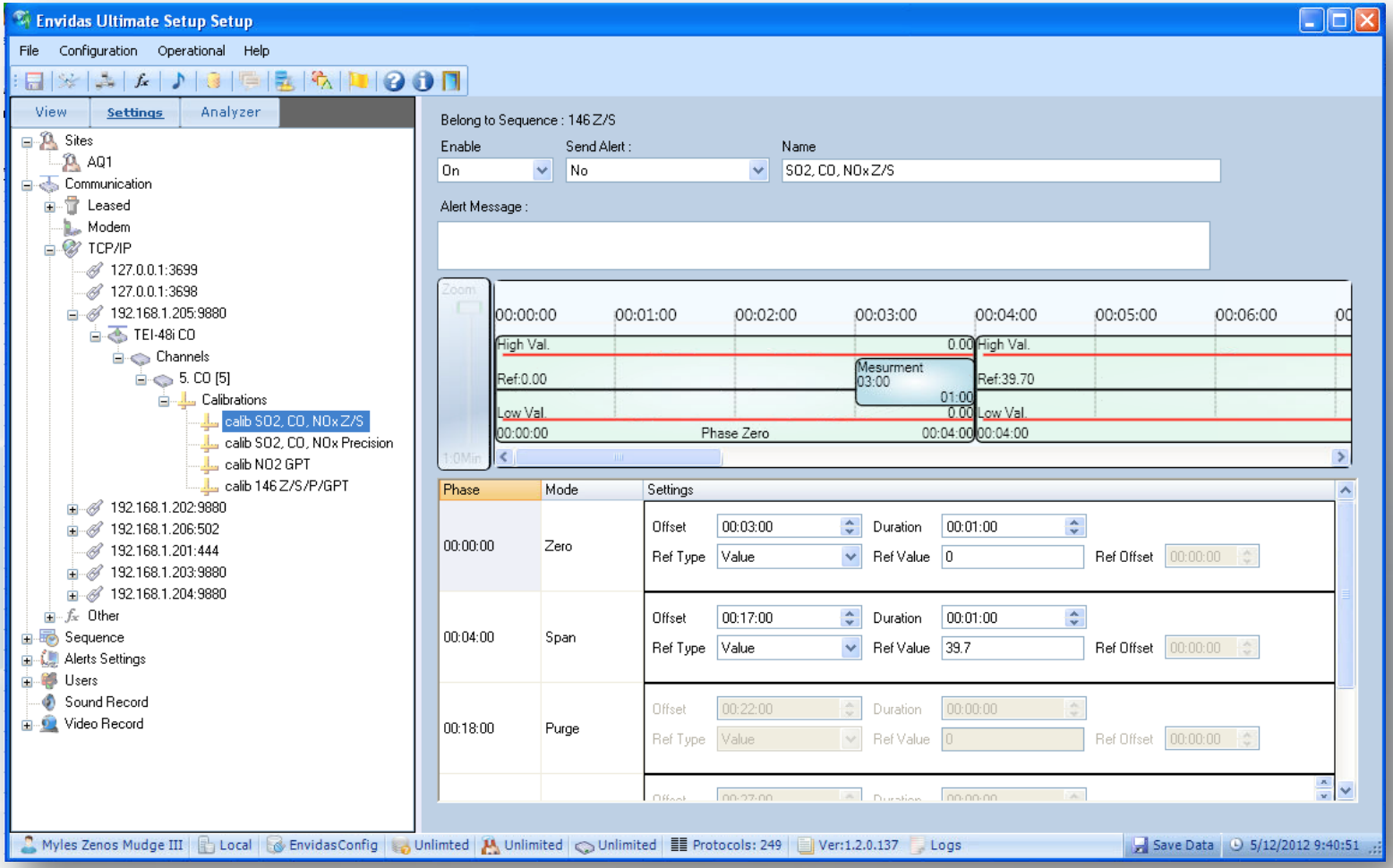
Configuring Cal Sequences – 1 (Setup)



Configuring Cal Sequences – 2 (Setup)



Adding a Calibration to a Channel (Setup)



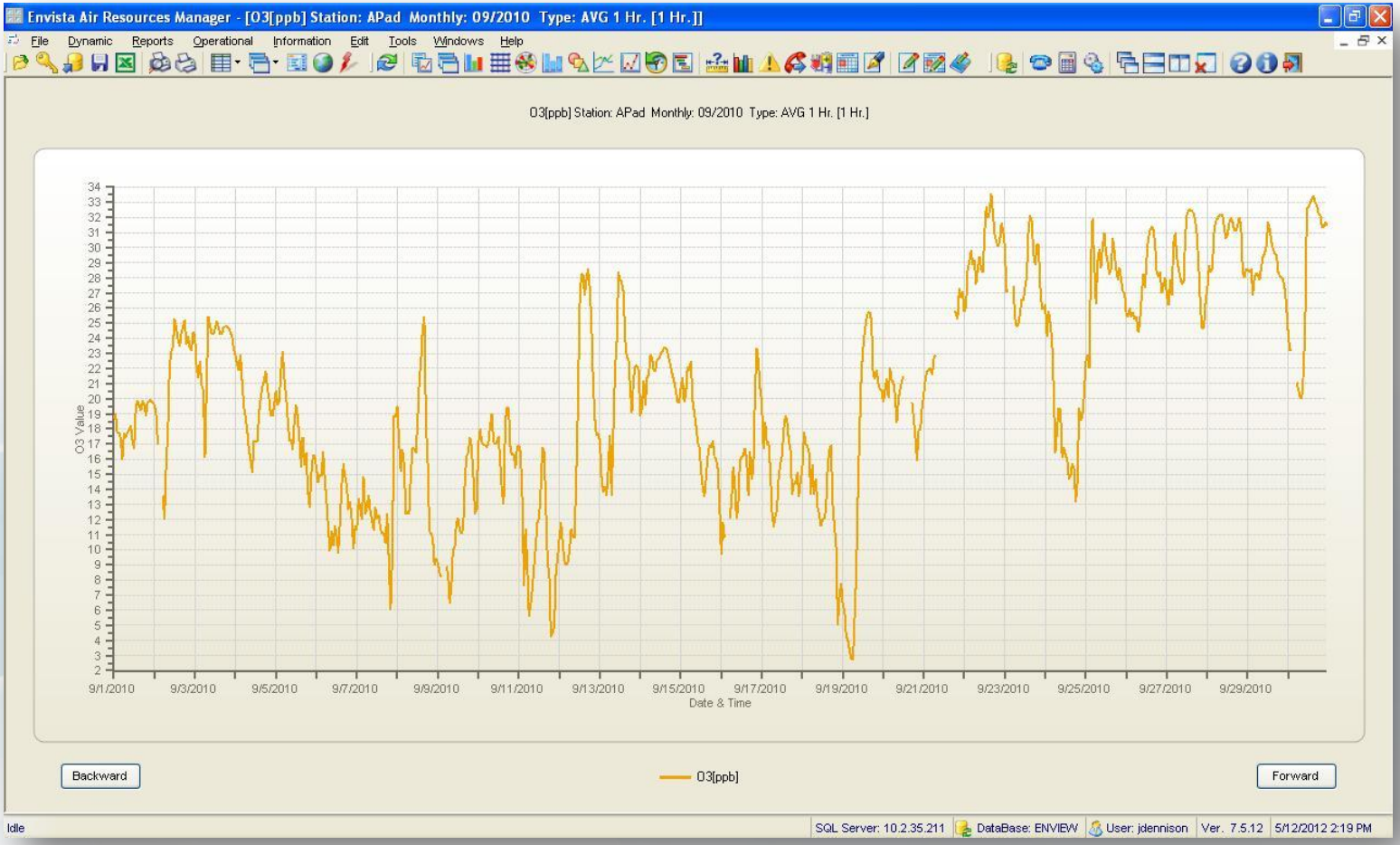
ComCenter- Central Server Software

- Site data is polled automatically via ComCenter to a MS SQL database located on a central server
  - Polls one-minute & hourly data
  - Site visit logs
  - Calibration data
  - Analyzer Flags/Alerts and diagnostic information
- SQL database provides access for remote terminals to the site data for data validation and reporting
- Routes data to AirNow and AQS

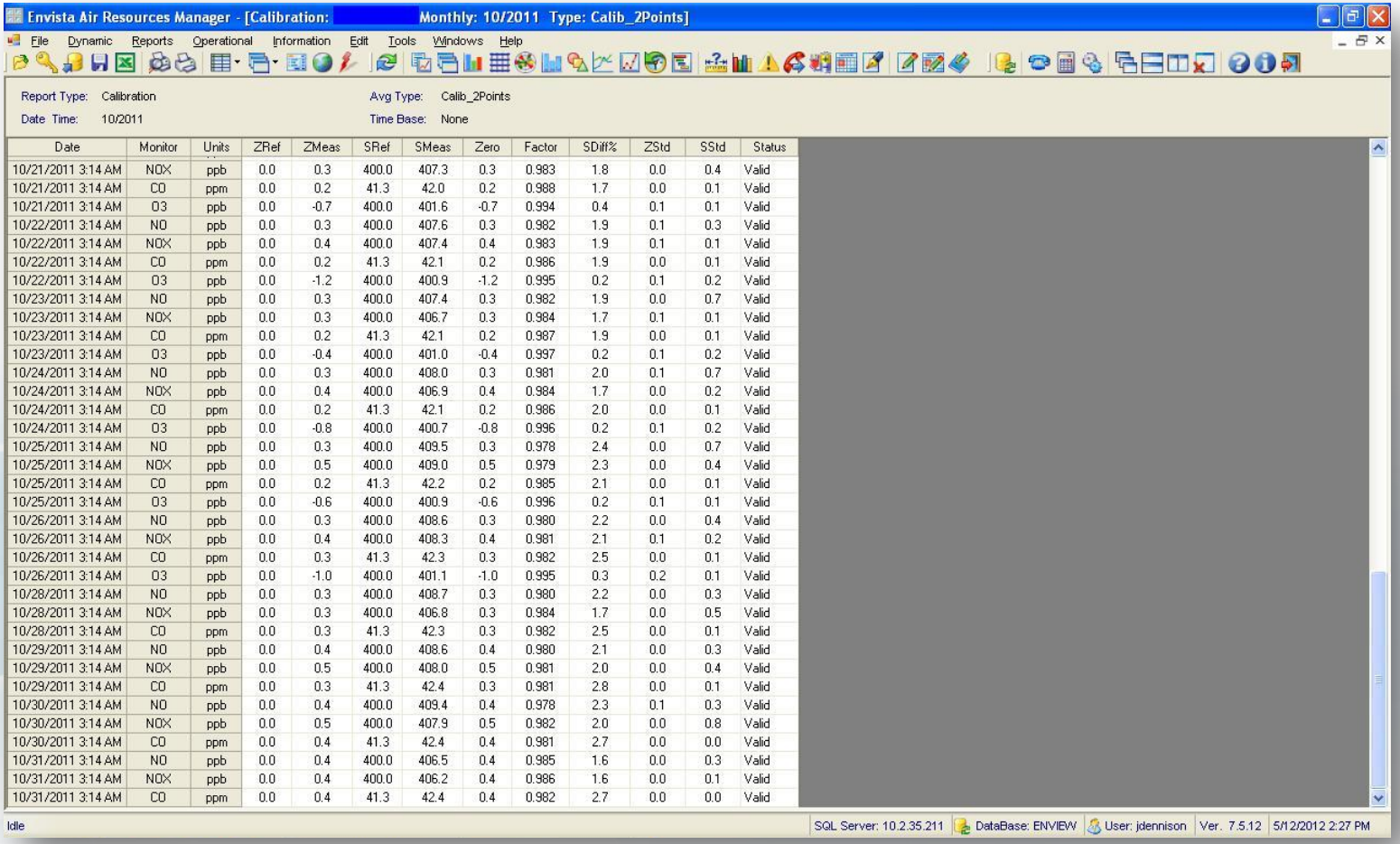
Air Resources Manager (ARM) - Laptop Client

- Provides Remote Access to:
  - Site data
  - Analyzer diagnostics
  - Logbook reports
  - Allows remote data validation
  - Allows remote report generation
  - Can be used at the office or remotely via Virtual Private Network (VPN) back to Central Server
  - Can be purchased separately and loaded onto additional workstations as usage increases.

ARM Data Review

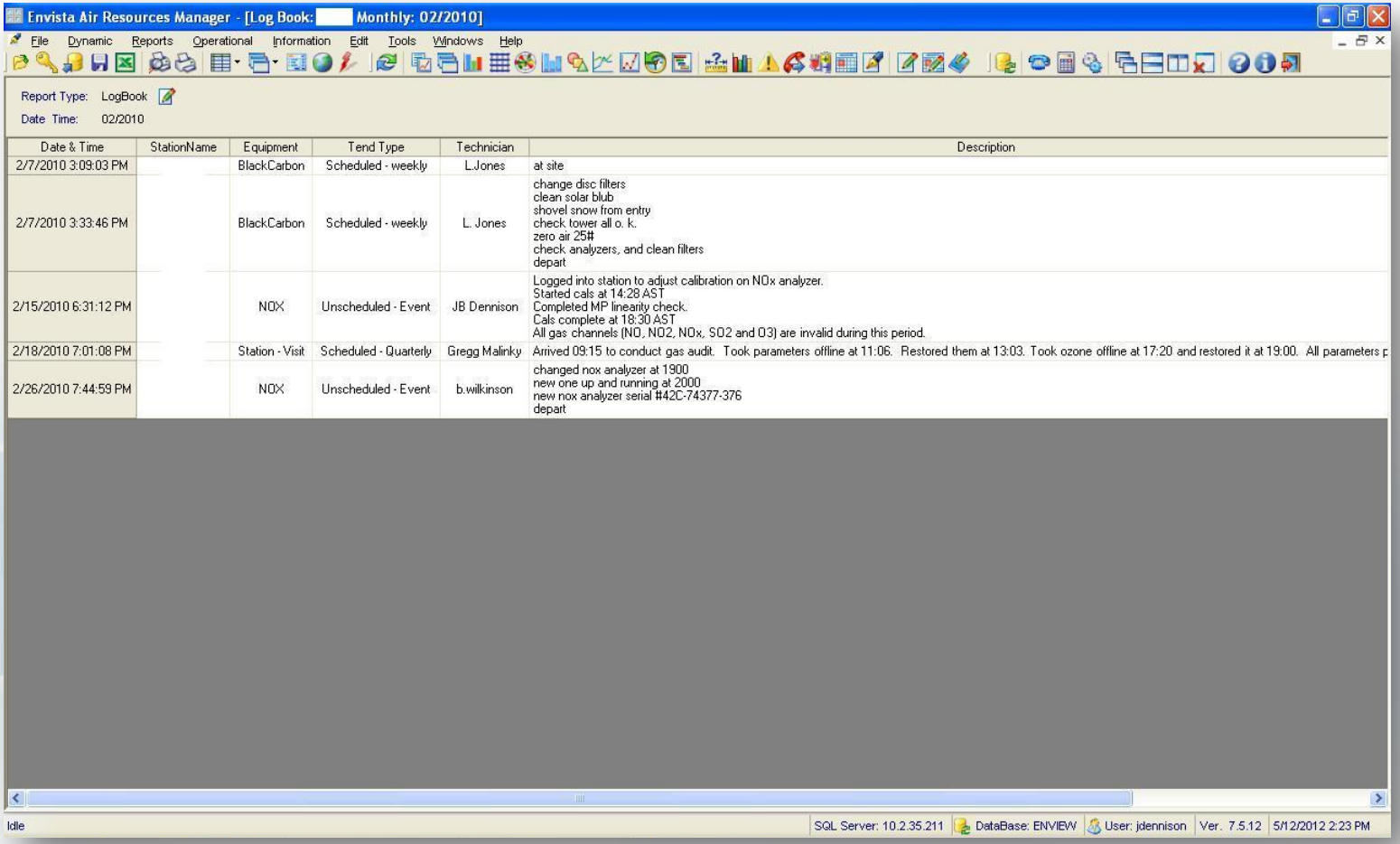


ARM Calibration Data



Date	Monitor	Units	ZRef	ZMeas	SRef	SMeas	Zero	Factor	SDiff%	ZStd	SStd	Status
10/21/2011 3:14 AM	NOX	ppb	0.0	0.3	400.0	407.3	0.3	0.983	1.8	0.0	0.4	Valid
10/21/2011 3:14 AM	CO	ppm	0.0	0.2	41.3	42.0	0.2	0.988	1.7	0.0	0.1	Valid
10/21/2011 3:14 AM	O3	ppb	0.0	-0.7	400.0	401.6	-0.7	0.994	0.4	0.1	0.1	Valid
10/22/2011 3:14 AM	NO	ppb	0.0	0.3	400.0	407.6	0.3	0.982	1.9	0.1	0.3	Valid
10/22/2011 3:14 AM	NOX	ppb	0.0	0.4	400.0	407.4	0.4	0.983	1.9	0.1	0.1	Valid
10/22/2011 3:14 AM	CO	ppm	0.0	0.2	41.3	42.1	0.2	0.986	1.9	0.0	0.1	Valid
10/22/2011 3:14 AM	O3	ppb	0.0	-1.2	400.0	400.9	-1.2	0.995	0.2	0.1	0.2	Valid
10/23/2011 3:14 AM	NO	ppb	0.0	0.3	400.0	407.4	0.3	0.982	1.9	0.0	0.7	Valid
10/23/2011 3:14 AM	NOX	ppb	0.0	0.3	400.0	406.7	0.3	0.984	1.7	0.1	0.1	Valid
10/23/2011 3:14 AM	CO	ppm	0.0	0.2	41.3	42.1	0.2	0.987	1.9	0.0	0.1	Valid
10/23/2011 3:14 AM	O3	ppb	0.0	-0.4	400.0	401.0	-0.4	0.997	0.2	0.1	0.2	Valid
10/24/2011 3:14 AM	NO	ppb	0.0	0.3	400.0	408.0	0.3	0.981	2.0	0.1	0.7	Valid
10/24/2011 3:14 AM	NOX	ppb	0.0	0.4	400.0	406.9	0.4	0.984	1.7	0.0	0.2	Valid
10/24/2011 3:14 AM	CO	ppm	0.0	0.2	41.3	42.1	0.2	0.986	2.0	0.0	0.1	Valid
10/24/2011 3:14 AM	O3	ppb	0.0	-0.8	400.0	400.7	-0.8	0.996	0.2	0.1	0.2	Valid
10/25/2011 3:14 AM	NO	ppb	0.0	0.3	400.0	409.5	0.3	0.978	2.4	0.0	0.7	Valid
10/25/2011 3:14 AM	NOX	ppb	0.0	0.5	400.0	409.0	0.5	0.979	2.3	0.0	0.4	Valid
10/25/2011 3:14 AM	CO	ppm	0.0	0.2	41.3	42.2	0.2	0.985	2.1	0.0	0.1	Valid
10/25/2011 3:14 AM	O3	ppb	0.0	-0.6	400.0	400.9	-0.6	0.996	0.2	0.1	0.1	Valid
10/26/2011 3:14 AM	NO	ppb	0.0	0.3	400.0	408.6	0.3	0.980	2.2	0.0	0.4	Valid
10/26/2011 3:14 AM	NOX	ppb	0.0	0.4	400.0	408.3	0.4	0.981	2.1	0.1	0.2	Valid
10/26/2011 3:14 AM	CO	ppm	0.0	0.3	41.3	42.3	0.3	0.982	2.5	0.0	0.1	Valid
10/26/2011 3:14 AM	O3	ppb	0.0	-1.0	400.0	401.1	-1.0	0.995	0.3	0.2	0.1	Valid
10/28/2011 3:14 AM	NO	ppb	0.0	0.3	400.0	408.7	0.3	0.980	2.2	0.0	0.3	Valid
10/28/2011 3:14 AM	NOX	ppb	0.0	0.3	400.0	406.8	0.3	0.984	1.7	0.0	0.5	Valid
10/28/2011 3:14 AM	CO	ppm	0.0	0.3	41.3	42.3	0.3	0.982	2.5	0.0	0.1	Valid
10/29/2011 3:14 AM	NO	ppb	0.0	0.4	400.0	408.6	0.4	0.980	2.1	0.0	0.3	Valid
10/29/2011 3:14 AM	NOX	ppb	0.0	0.5	400.0	408.0	0.5	0.981	2.0	0.0	0.4	Valid
10/29/2011 3:14 AM	CO	ppm	0.0	0.3	41.3	42.4	0.3	0.981	2.8	0.0	0.1	Valid
10/30/2011 3:14 AM	NO	ppb	0.0	0.4	400.0	409.4	0.4	0.978	2.3	0.1	0.3	Valid
10/30/2011 3:14 AM	NOX	ppb	0.0	0.5	400.0	407.9	0.5	0.982	2.0	0.0	0.8	Valid
10/30/2011 3:14 AM	CO	ppm	0.0	0.4	41.3	42.4	0.4	0.981	2.7	0.0	0.0	Valid
10/31/2011 3:14 AM	NO	ppb	0.0	0.4	400.0	406.5	0.4	0.985	1.6	0.0	0.3	Valid
10/31/2011 3:14 AM	NOX	ppb	0.0	0.4	400.0	406.2	0.4	0.986	1.6	0.0	0.1	Valid
10/31/2011 3:14 AM	CO	ppm	0.0	0.4	41.3	42.4	0.4	0.982	2.7	0.0	0.0	Valid

ARM Logbook Entries



Conclusions

- Digital Data Acquisition simplifies station setup and reduces the amount of wiring needed and eliminates A/D & D/A conversion issues.
- Remote Access allows site work to be done remotely saving time and money.
- Auto polling Flags/Alerts/Diagnostics provides a much richer picture of station health.
- ComCenter and ARM provides operators easy access to information making them more likely to spot a problem before data capture is jeopardized.

Questions?? Thank You!

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Special thanks:

- Lew Weinstock (USEPA OAQPS)
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- Jim Wittkopp (ShelterOne)