



## **ADVANCED TUNABLE DIODE LASER PROCESS ANALYZER TRAINING**

### **Day One**

- 1) Theory of TDL and How TDL Theory Relates to Normal Operation**
  - a) Beer-Lambert Law**
  - b) Near-Infrared Spectroscopy**
  - c) Two Ways to “Tune” a Tunable Diode Laser**
    - i) Temperature**
    - ii) Current**
  - d) 2f Wavelength Modulation Spectroscopy (2f WMS)**
  - e) DC Spectra**
  - f) AC (2f) Spectra**
- 2) Curve Fitting – Converting a Spectrum to a Measurement**
  - a) Non-differential Spectroscopy**
  - b) Reference Spectra**
- 3) Differential Spectroscopy (Spectral Subtraction)**
  - a) Scrubbers**
  - b) Curve Fitting in Differential Spectroscopy**
- 4) Analyzer Operation (Hands-on)**
  - a) Keyboard**
  - b) Modes 1, 3, 4, 5, 7, 8 & 9**
  - c) Parameters - #2**
    - i) Passwords**
      - (1) 3142 User**
      - (2) 1688 Service**
- 5) Diagnostic Downloads (Hands-On)**
  - a) Parameters**
  - b) Mode 1 Measurement and Diagnostic Data**
  - c) Mode 6 Spectra**



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### **Day 2**

- 1) Restarts (Differential Only)**
  - a) T delta
  - b) P delta
  - c) DC delta
  - d) R2
  - e) R3
  - f) Peak Tracking
  - g) Fitting
  - h) Wet Per Cycle
- 2) Scrubber Cycle Timing (Differential Only – Hands on)**
  - a) Dry Time
  - b) Dry Spectrum Average
  - c) Wait Time
  - d) # Spectrum Average
  - e) Wet Per Cycle
  - f) Logger Rate
- 3) Fitting Parameters**
  - a) Delta Fit Tolerance
  - b) Fit to Zero
  - c) Fit Warning Limit
- 4) Peak Tracking**
  - a) Static
  - b) Dynamic
  - c) Cross Correlation
- 5) Alarms and Alarm Codes**
  - a) DO's and Relays
  - b) Configuring the Assignable Relay
  - c) High/Low Laser DC
  - d) High/Low Laser Current
  - e) High/Low Temperature
  - f) High/Low Pressure
- 6) Start-up (Hands on)**
  - a) Power
  - b) Signal
  - c) Sample and Val Gas Flow
  - d) Temperature Stabilization
  - e) Peak Tracking ON



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### Day 3

- 1) Validation (Hands on)
  - a) Low/High Standards
  - b) Background Gas
  - c) Zero Gas
  - d) Permeation Validation
  - e) Automatic Validation Parameters
  - f) AutoDumpSpectra
- 2) Preventative Maintenance – (Hands on)
  - a) Spectra - #6
  - b) #1
  - c) Parameters
  - d) [\AAAFF](#) and [\AAAFFNNNN](#) Commands
  - e) Modbus
  - f) AMS
- 3) Spectral Interpretation
  - a) Wet/Dry DC and DC Reference Spectra
  - b) Wet/Dry 2f and Wet/Dry 2f Reference Spectra
  - c) 2f and Ref 1
  - d) Ref 2, 3, etc.
  - e) Dry & Dry -1 Spectra
  - f) Val Ref
  - g) Val Ref Dry/Wet
  - h) Process Flag
- 4) Repair/Upgrades (Hands on)
  - a) Cell Cleaning – Low DC Power
  - b) Parts
    - i) Power Supplies
    - ii) Cell
    - iii) Controller Stack – PRE and 2f Pots
    - iv) Hytek board
    - v) AO Board
    - vi) Daughter (DO) Board
    - vii) Relays
    - viii) Solenoids & Valves
    - ix) Filters, Regulators, Rotameters
    - x) Scrubber Replacement
  - c) Firmware Upgrades