N Series Gas Instruments

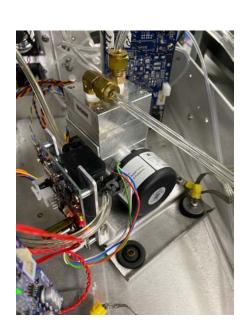*Designed for today, prepared for tomorrow*

Who we are

- Kirk Lovewell – VP of Engineering
  - 31 years with TAPI, developing AQMS analyser and calibrator products, leading engineering teams

- France Meder – VP of Global Sales and Marketing
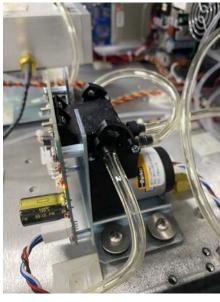 - 10 years with TAPI, product management, service management

T-Series to N-Series Transition

- All common CEMS models now available in N-Series.

- T-Series will remain in full-production likely through 2026.

- Support for T-Series (spare part sales and in-house repairs) will extend for 10 years after last production (subject to material availability).

N Series Highlights

- Smart Internal Hardware Modules
  - Easy field replacement with pre-calibrated and tested modules

- CAN Bus Communications Architecture
  - Simplified, common cabling increases reliability

- 24VDC Internal Power
  - Lower power consumption and unified power requirement
  - Ability to easily operate from alternative power source
  - No AC voltage switch – only external pumps are voltage dependent

- Split Fold-down Rear Panel
  - Access to pneumatic connections inside bulkhead

- NumaView™ Software Interface
  - Familiar, mature, and customizable with real-time graphing, diagnostic alerts, and preventative maintenance capabilities

N Series Front Panel

- Standard 19" rack mountable chassis
- Optional ears, handles, and/or slides
- Capacitive, color touch-screen display
- 2 front-panel USB ports
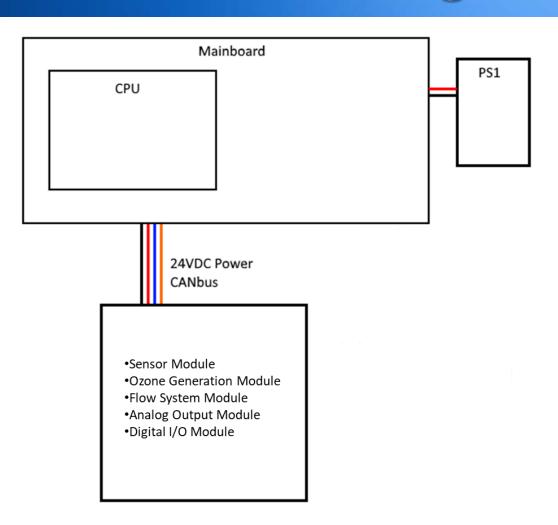- Soft power switch, allows for more reliable shut-down of system.
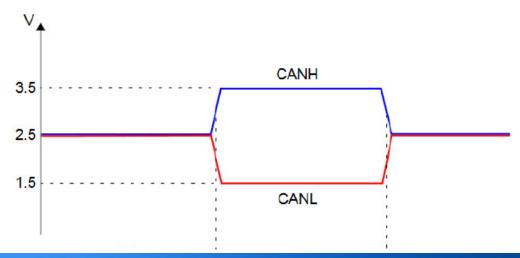
N Series Rear Panel

- Split fold-down rear panel
- Robust pneumatic bulkhead fittings

- Ethernet and serial communications with Modbus protocol
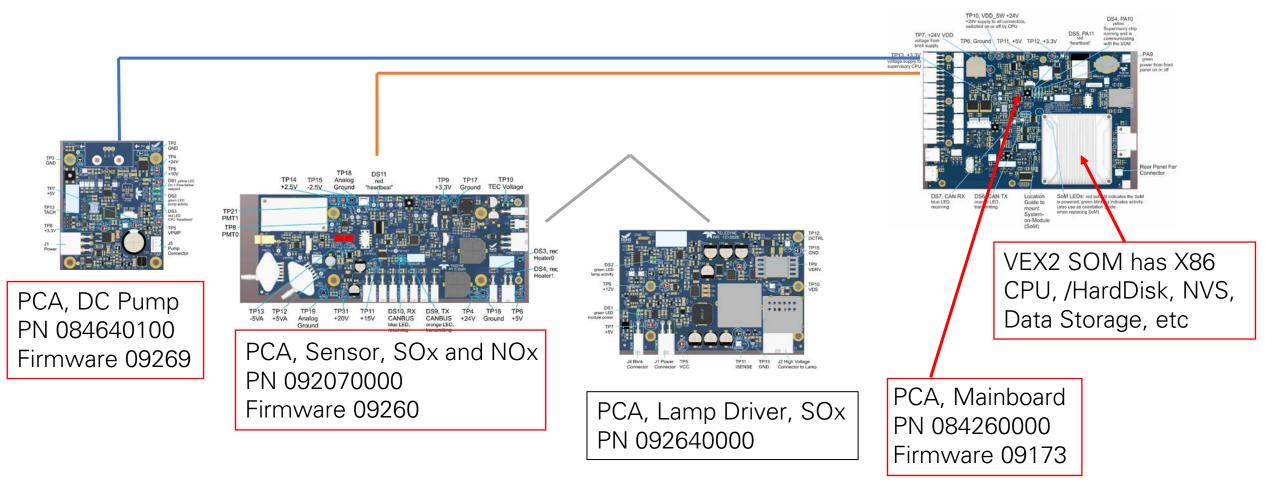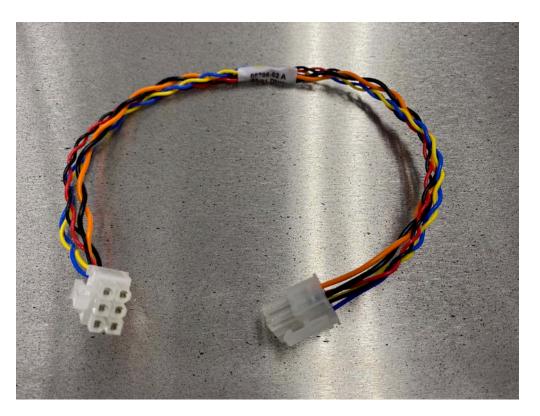- Analog output and Digital expansion cards (optional)

N Series Wiring Architecture

- Single, universal power supply
- Power and data provided in a single cable set
- All CAN Bus cables and connectors are common
- CAN bus is a robust multidrop, half-duplex, differential, industrial protocol.

- *Simplified cabling and connections = improved reliability!!*

N Series PCBAs and Firmware

PCA, DC Pump
PN 084640100
Firmware 09269

PCA, Sensor, SOx and NOx
PN 092070000
Firmware 09260

PCA, Lamp Driver, SOx
PN 092640000

VEX2 SOM has X86 CPU, /HardDisk, NVS, Data Storage, etc

PCA, Mainboard
PN 084260000
Firmware 09173
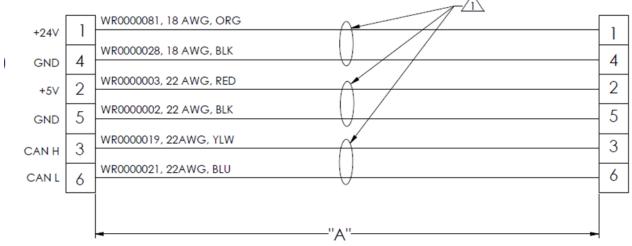
N Series CANBUS Cable
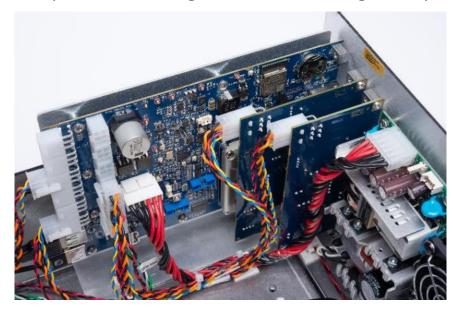
CN53
PHYSICAL PINOUT
WIRE SIDE VIEW

6	5	4
3	2	1

+24V	1	WR0000081, 18 AWG, ORG
GND	4	WR0000028, 18 AWG, BLK
+5V	2	WR0000003, 22 AWG, RED
GND	5	WR0000002, 22 AWG, BLK
CAN H	3	WR0000019, 22AWG, YLW
CAN L	6	WR0000021, 22AWG, BLU

"A"

Common Smart Modules

- Mainboard Module
    - Serves as the "carrier board" for the CPU
    - Provides the core set of user-accessible I/O, including Ethernet and Serial ports
    - DC power distribution and CAN bus hub
    - Provides all power management including soft power switch
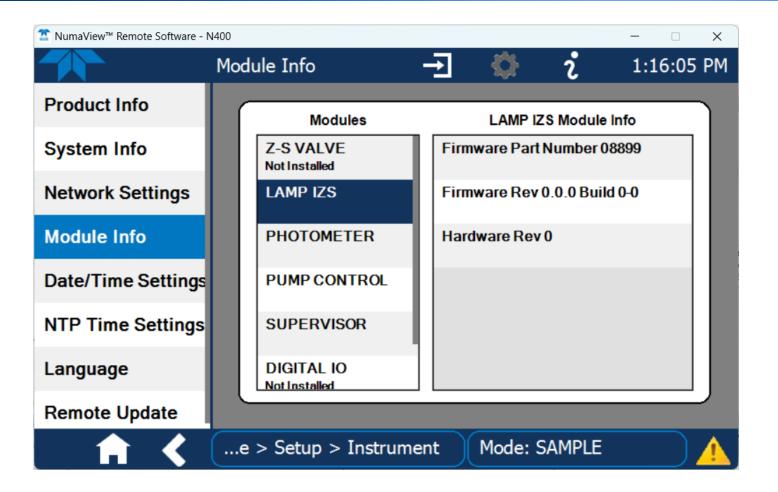
- Communication Modules
    - Digital I/O expansion
        - Status out, control in, alarm relays
    - Analog outputs
        - 3 x current (4-20 mA)
        - 4 x voltage (5 or 10V)

Firmware updates
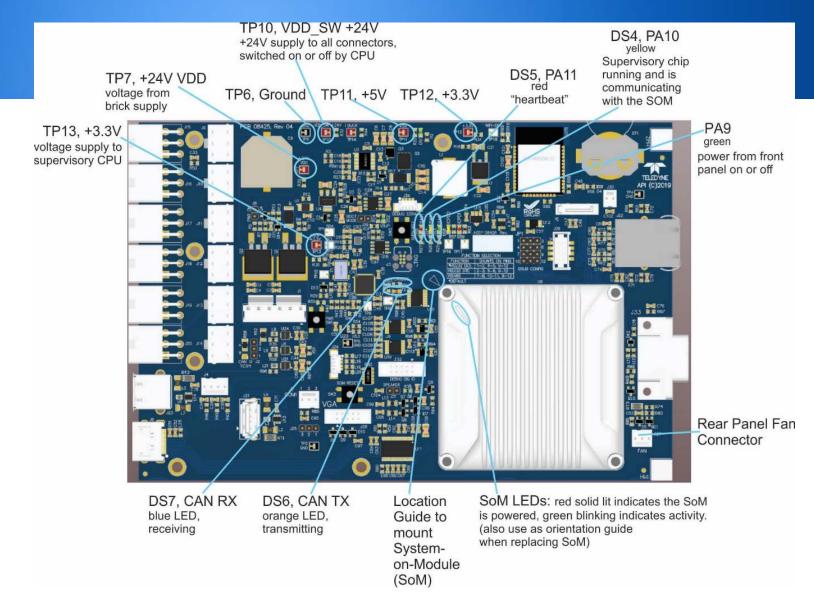
- N Series firmware updates both the NVS and the PCBAs
- The PCBA firmware is embedded in the NVS update

1. Encrypted NVS firmware is copied into the /Upgrade folder on the /Hard Disk
2. Instrument is rebooted. NVS upgrade file is unpacked. NVS firmware is updated.
3. Tags get merged as needed.
4. Instrument boots to new NVS version.
5. Instrument checks PCBA firmware version against /Hard Disk/Firmware. If /Hard Disk is newer than board firmware, the CPU "bootloads" the PCBA. This occurs one at a time for each board present. The updated can't "downgrade" PCBA firmware.

TELEDYNE API
Everywhere**you**look™

PCBA Bootloading

Mainboard

PMT Board

TP14 +2.5V
TP15 -2.5V
TP18 Analog Ground
DS11 red "heartbeat"
TP9 +3.3V
TP17 Ground
TP10 TEC Voltage

TP21 PMT1
TP8 PMT0

DS3, red Heater0
DS4, red Heater1

Sample Pressure

Rcell Pressure

TP13 -5VA
TP12 +5VA
TP19 Analog Ground
TP31 +20V
TP11 +15V
DS10, RX CANBUS blue LED, receiving
DS9, TX CANBUS orange LED, transmitting
TP4 +24V
TP16 Ground
TP6 +5V
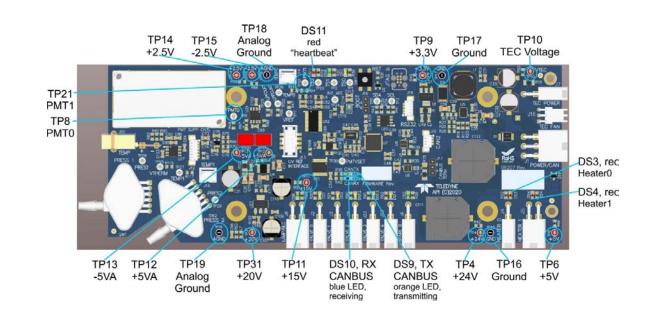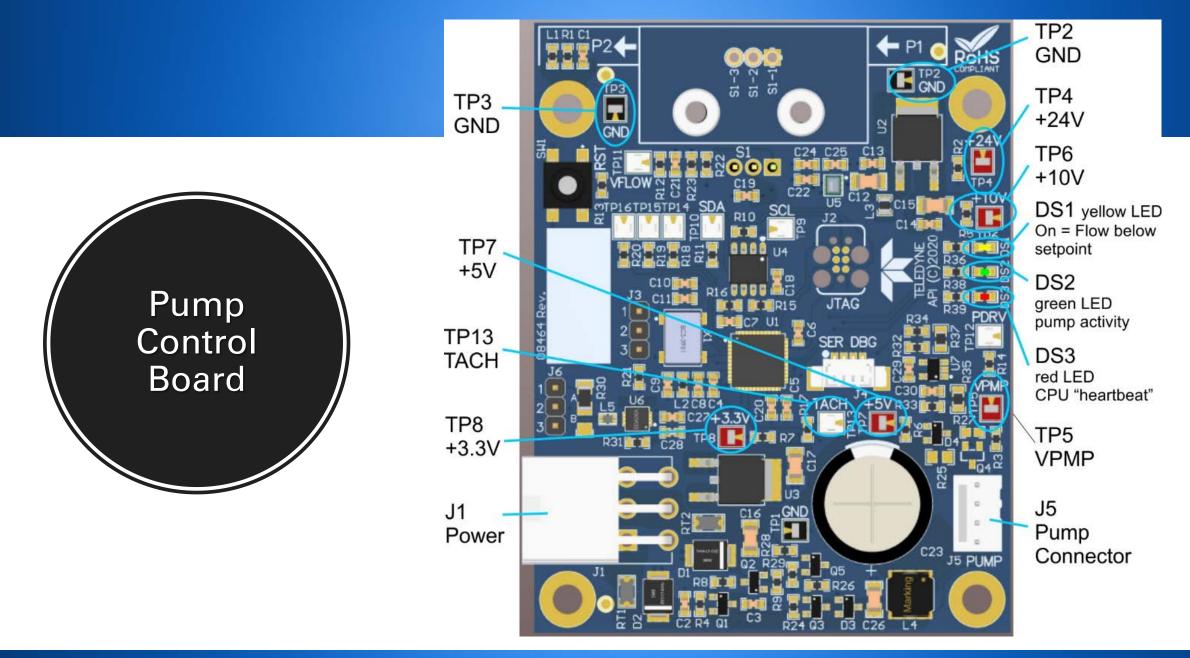
Measurement and Control

- All measurement and control occurs at the module
- Temperature measurement and control
- PMT HVPS and measurement
- Valve drivers
- Pressure measurements
- "Finished Data" is sent over 2-wire CAN BUS to Mainboard and CPU/SOM

Pump Control Board

Tags – What are they?

- NumaView uses "Tags" to store data
- Tags can be constants or changing values
- Tags can be read-only or read-write
- Some diagnostic tags can be displayed on the Dashboard or as meters
- Provide insight into the operation of the machine
- Located in /Hard Disk/Configuration as tags_A.xml and tags_B.xml

Reading Tags – REST Protocol

- **http://10.0.1.149:8180/api/taglist** will dump all tags and values to a text file (with no extension).

- Chrome works well for grabbing the full taglist using the URL above

- Rename the file taglistXX.txt and open with a text editor

- Individual tags can be read with

- **http://10.0.1.149:8180/api/tag/SV_O3_SLOPE**

- {"name":"SV_O3_SLOPE","type":"float","value":"0.981924295425415","properties":"{\"Precision\":3,\"RawMin\":0.85,\"RawMax\":1.15,\"EuMin\":0.85,\"EuMax\":1.15,\"EuTag\":\"\",\"Default\":1.0,\"Name\":\"SV_O3_SLOPE\",\"HmiLabel\":\"Photo Slope\",\"Description\":\"O3 Photometer Calibration Slope\",\"Group\":\"CFG,LOG\",\"Units\":\"\",\"IsValueValid\":true,\"IsReadOnly\":false,\"IsNetwork\":true,\"IsVisible\":true,\"IsNonVolatile\":true,\"IsDashboard\":true,\"CanDashboard\":true}"}

Internal Layout (N200M)

Optional integrated paramagnetic O2 sensor
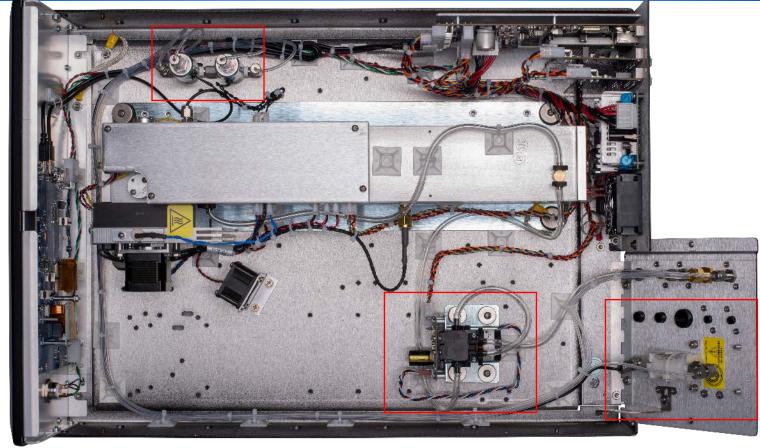
Ozone generator smart module

Split fold-down rear panel

Sensor smart module

Common electronics with a single 24VDC power supply

Internal Layout (N300)
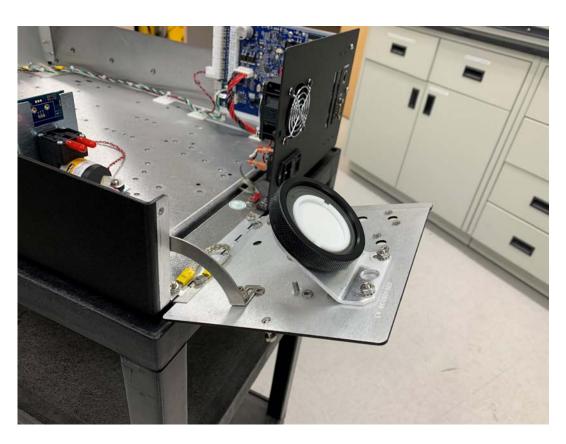
Internal Zero/Span Valve Assy*

Flow system smart module with Pulse-width modulated (PWM) control

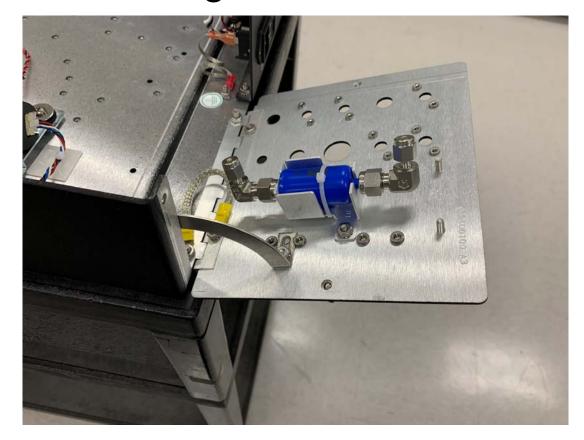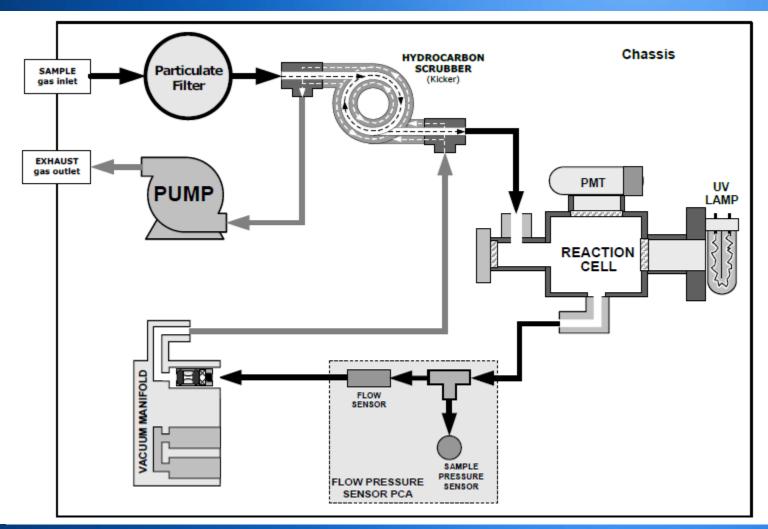Long-life or 47mm sample filter holders*

Sample Filter Options
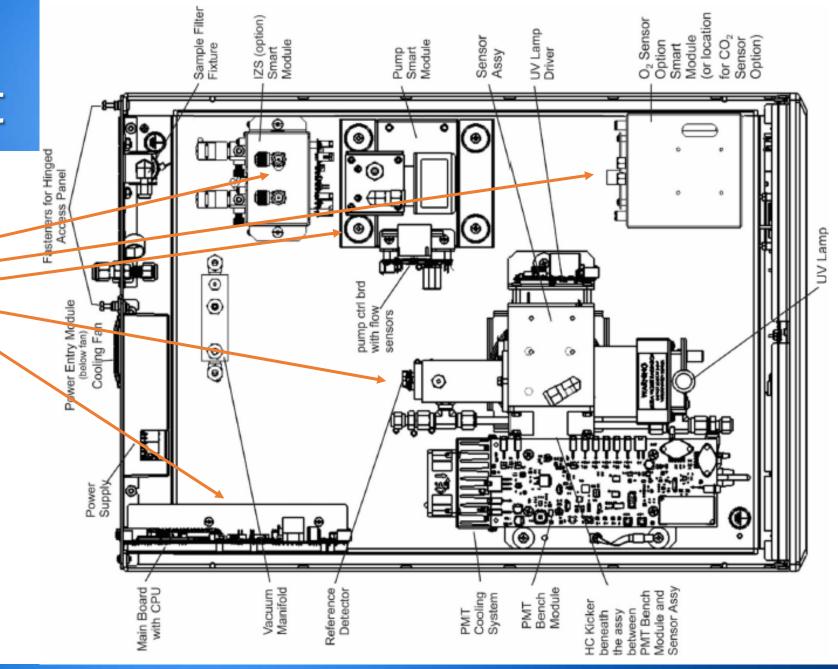
Traditional 47mm

New Long-Life Filter (DFU)

N100 Pneumatics

- Optional O2 Sensor
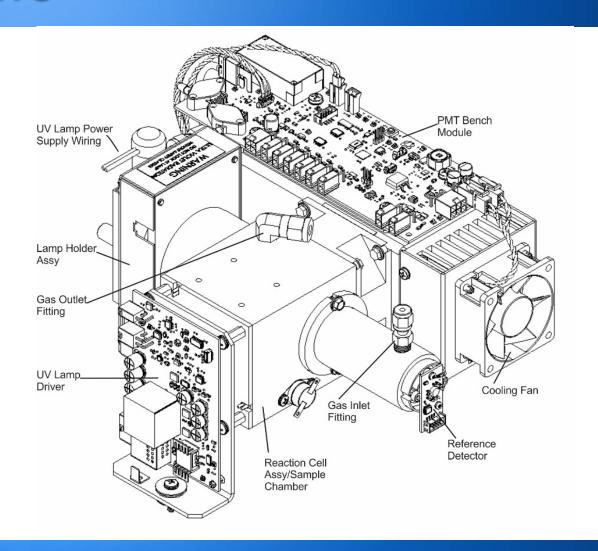- Optional Calibration Valves
- Optional permeation calibration source

N100 Layout

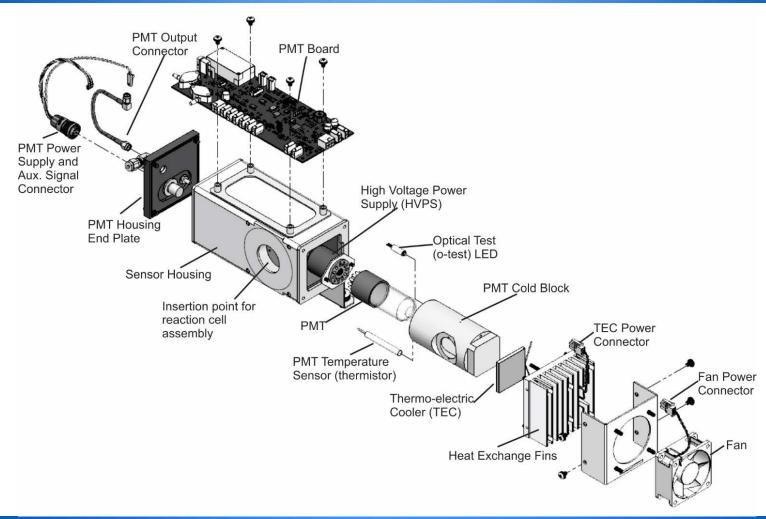Each module connects to main board via common CAN, 24V, 5VDC cable

N100 Sensor Module

- Sensor calibration stored on module
- Similar optics and spare parts as T Series (aside from PCBAs)
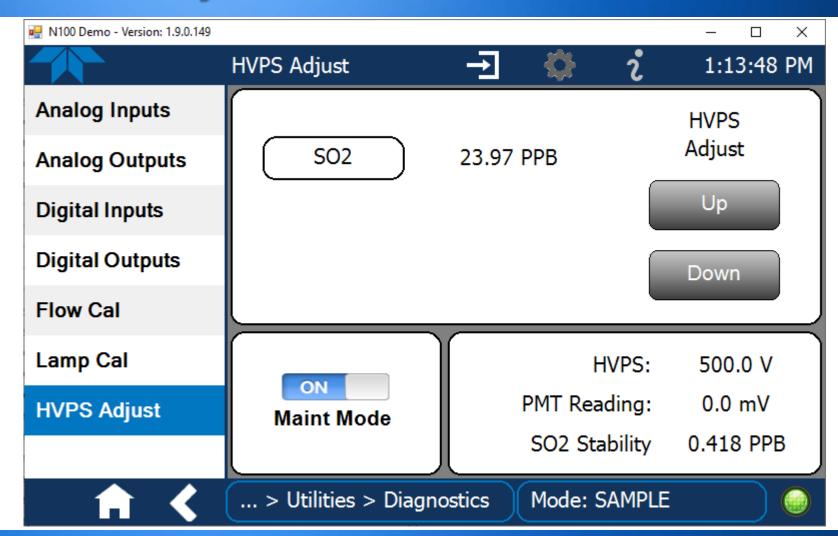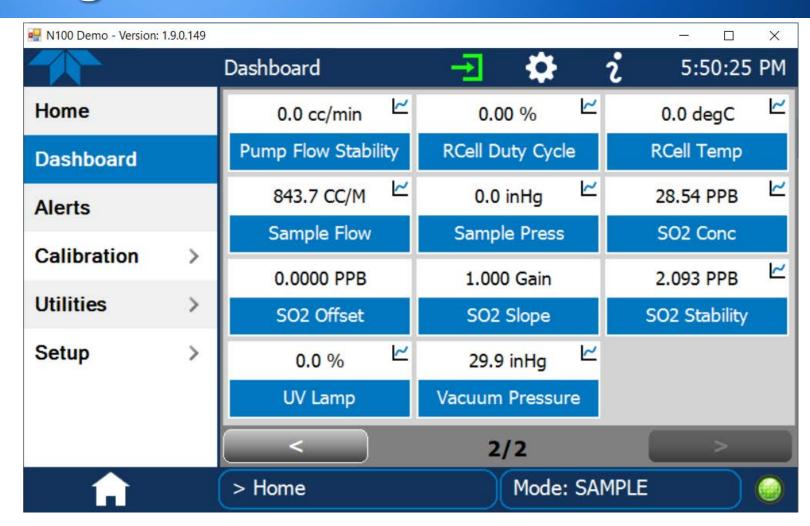- No Shutter in N Series
- No PMT potentiometers

N100 PMT and TEC

N100/N200 PMT Adjust Screen

- Software driven HVPS adjustments allows for remote calibration
- Maintenance Mode can be logged in internal DAS
- Allows calibration w/o removing analyzer cover
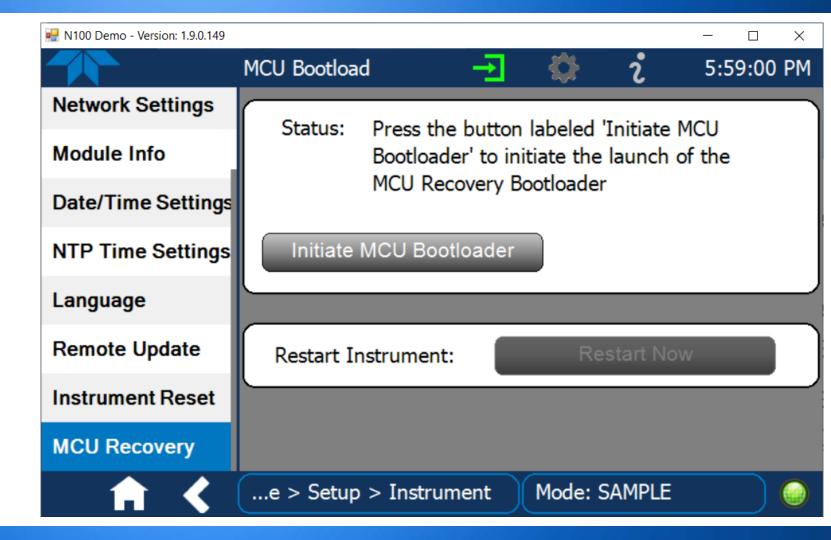- Other Utilities > Diagnostics familiar to T Series

Dashboard / Diagnostics

- Tag units may differ from E and T series
- Acceptance ranges for tags may be found in respective user's manuals
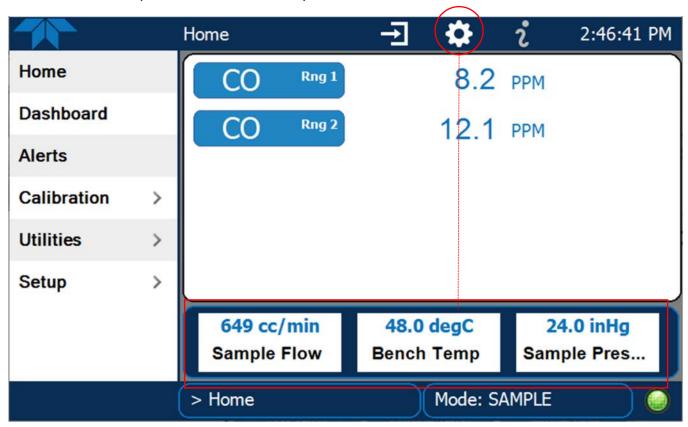- Many signal voltages no longer normalized to 5000mV scale

MCU Recovery App

- Each N Series module operates with its own firmware and communicates data over CAN Bus.

- MCU Recovery app deals with issues if firmware updates get interrupted.

- Work with TAPI technical support to use this feature

NumaView™ Software Interface

Customizable, content rich, and intuitive user interface

User-definable meter variables

NVS – Home Screen

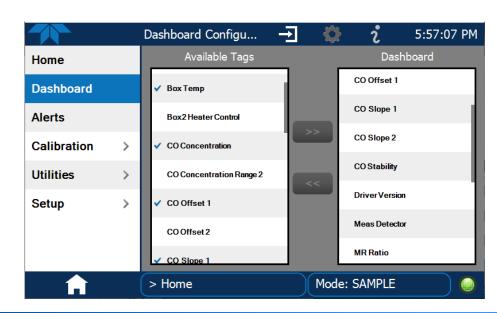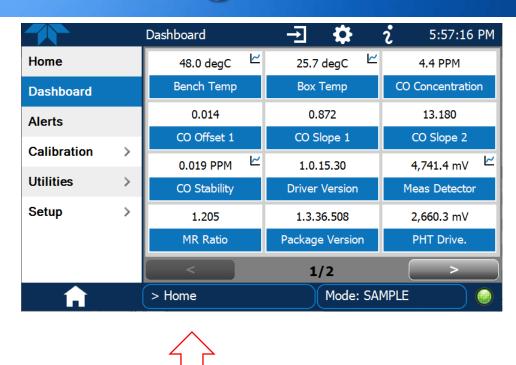Real-time graphical representation of concentration and stability

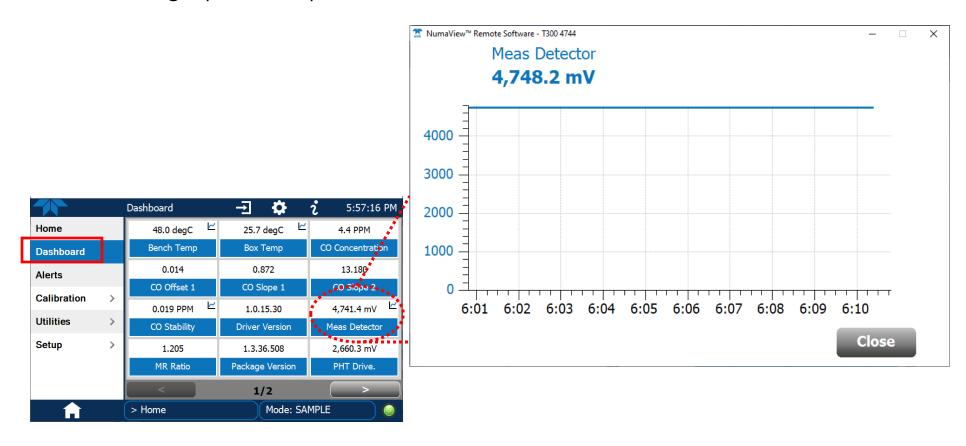# NVS – Dashboard User Config
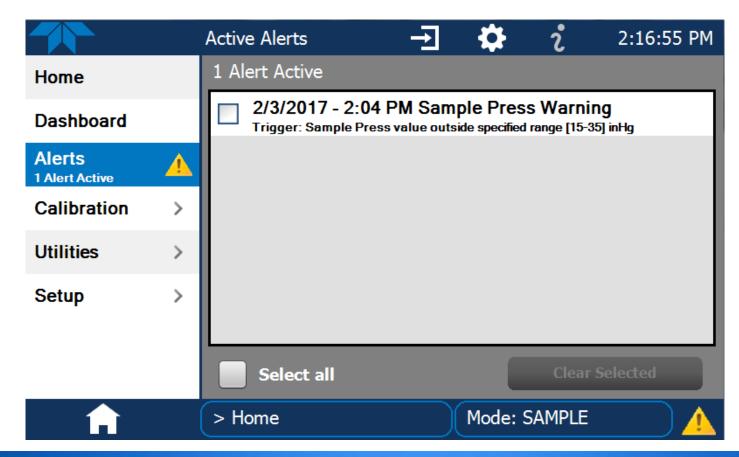
Fully configurable dashboard

NVS – Dashboard Real-Time Plots

Real-time graphical representation of test functions

NVS – Alerts
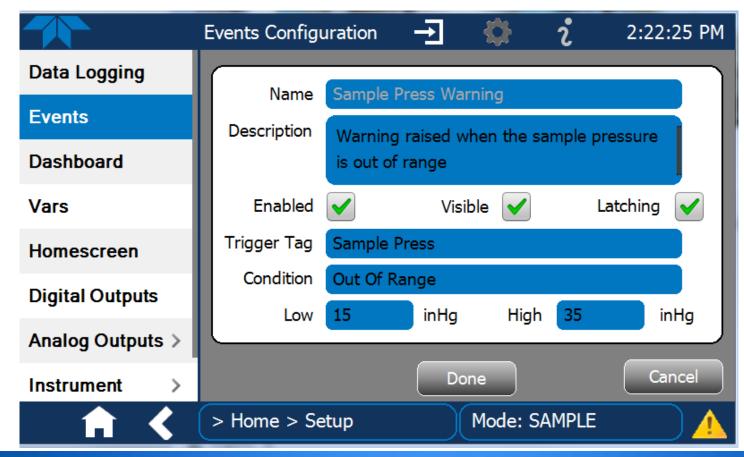
Simultaneous display of all active alerts with time stamp and cause
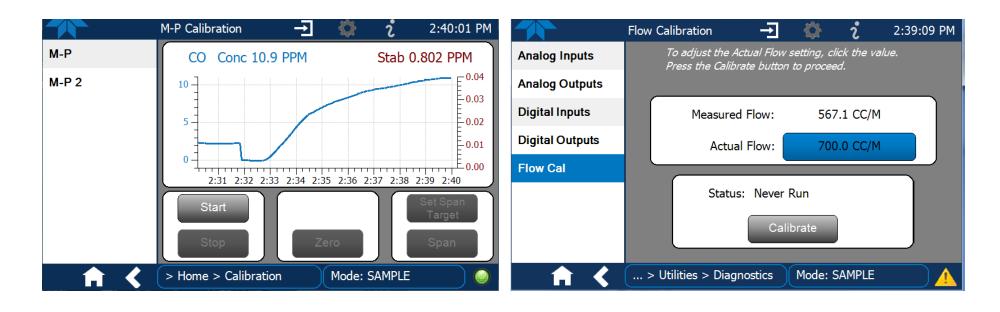
NVS – Custom Alerts and Alarms
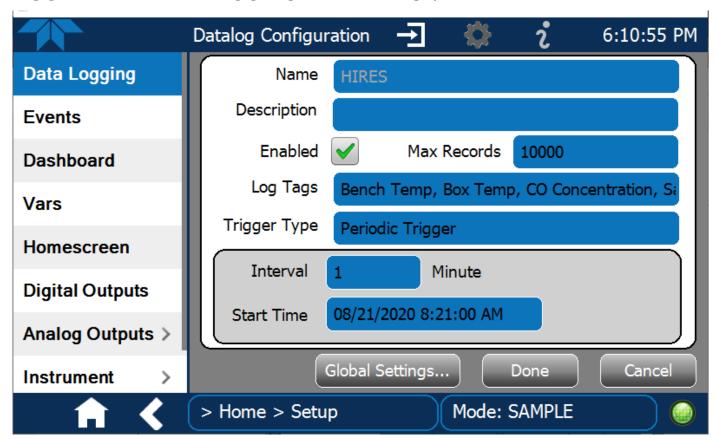
Custom events and warnings

NVS - Calibrations
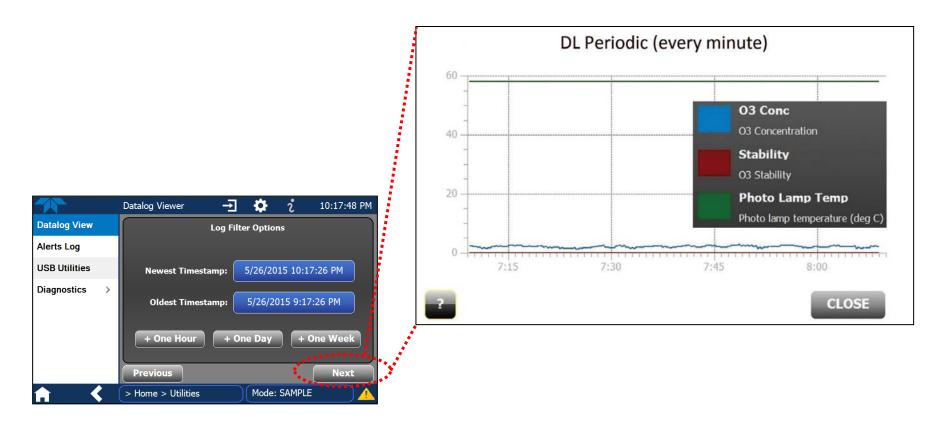
Simple Calibrations

NVS - Data Acquisition

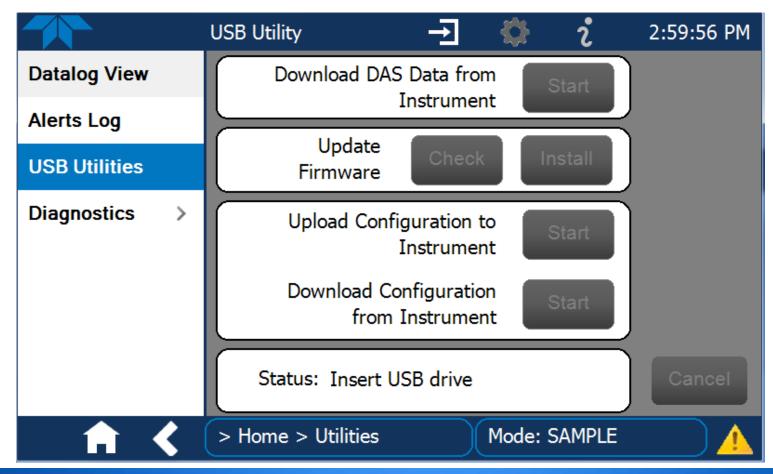Triggers for data logging, including periodic and conditional

NVS Data Viewing

Customizable datasets that can be viewed on the GUI
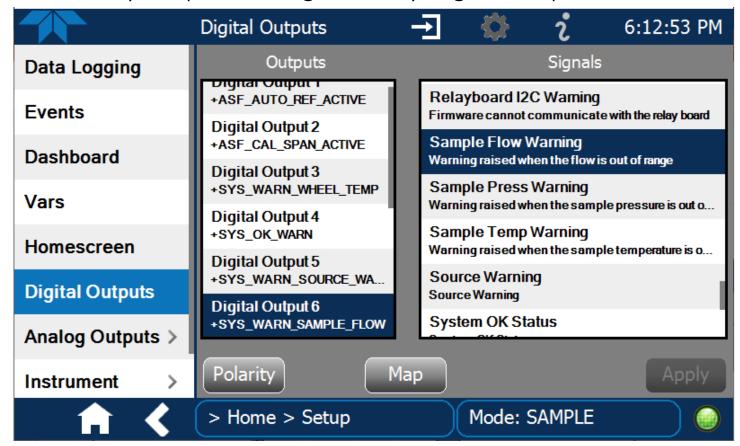
NVS - Full USB Support

Data Upload and Download

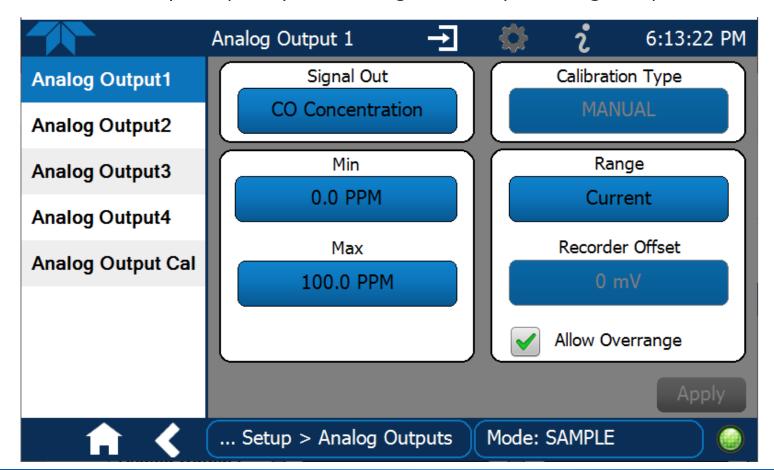# NVS - Digital Output Config

Easily map data 'tags' to any digital output channel

NVS - Analog Output Config

Easily map any data 'tags' to any analog output

Tech Support

- TAPI has a re-vamped tech support team
    - Retirement of several very experience techs, training several new hires.
    - New management structure, implementing best-practices.
- Tech Support Tips
    - For performance issues, download and send instrument DAS data (HIRES logger) when making initial contact.
    - Custom data loggers can be easily added, but please do not alter the default HIRES logger, this data is selected for tech support diagnosis.

* PWM is on internal pumps only for certain models

TELEDYNE API
Everywhere**you**look™

Teledyne API N Series Gas Analyzers

Designed for today, prepared for tomorrow

Thank you for your attention!
Questions???