$H_2S$  $SO_2$  COS  $CS_2$

gray = optional analyte



## The world's safest tail gas analyzer.

The TLG-837 continuously measures the chemical concentrations of $H_2S$, $SO_2$, COS, and $CS_2$ in the Claus process tail gas stream. Using the patented in situ DEMISTER sampling probe and a full-spectrum UV-Vis spectrophotometer, this system provides extremely fast, accurate response for tight process control.

## Features

» Continuously measures concentrations of $H_2S$ and $SO_2$ and outputs Air Demand signal (user-defined formula)

» Patented DEMISTER sampling probe with internal sulfur vapor removal

» Totally solid state with no moving parts, sample lines, or heat tracing — modern design for low maintenance

» Ultra-safe fiber optic design — no toxic/explosive sample gas in analyzer enclosure

» Superior Off-Ratio range ( 100:1 < $H_2S/SO_2$ ratio < 1:20 )

# TLG-837 Tail Gas / Air Demand Analyzer

Applied Analytics Data Sheet No. DS-004A

**The Claus Process Analysis Need**

The sulfur recovery unit (SRU) of a refinery is dedicated to processing the $H_2S$ stripped from the hydrocarbon fuel through a series of operations that convert it into water and harmless elemental sulfur, which can be sold and repurposed.

The Claus process is the industry standard for treating the $H_2S$-rich "sour" gas . In the reaction furnace, $H_2S$ is combusted:

$$3H_2S + ^3/_2O_2 \longrightarrow SO_2 + H_2O + 2H_2S$$

A catalytic converter reacts the products of the combustion to create elemental sulfur in it various crystalline forms:

$$2H_2S + SO_2 \longrightarrow 2H_2O + ^3/_xS_x$$

As can be deduced from the 2nd reaction above, the typical Claus reaction runs most efficiently when the stoichiometric ratio of $H_2S$ to $SO_2$ is controlled at 2:1. The reactions above demonstrates that this ratio is controlled by adjusting available oxygen.

The efficiency of sulfur recovery therefore hinges on the "Air Demand" signal which informs the oxygen adjustment in the DCS. The Air Demand is calculated by multiplying the expression $(2[SO_2] - H_2S)$ by a scaling factor. Obtaining the real-time Air Demand value requires continuous, reliable measurement of the $H_2S$ and $SO_2$ concentrations in the Claus tail gas. Additionally, COS and $CS_2$ levels in the tail gas can be indicators of reduced efficiency or potential catalyst issues.
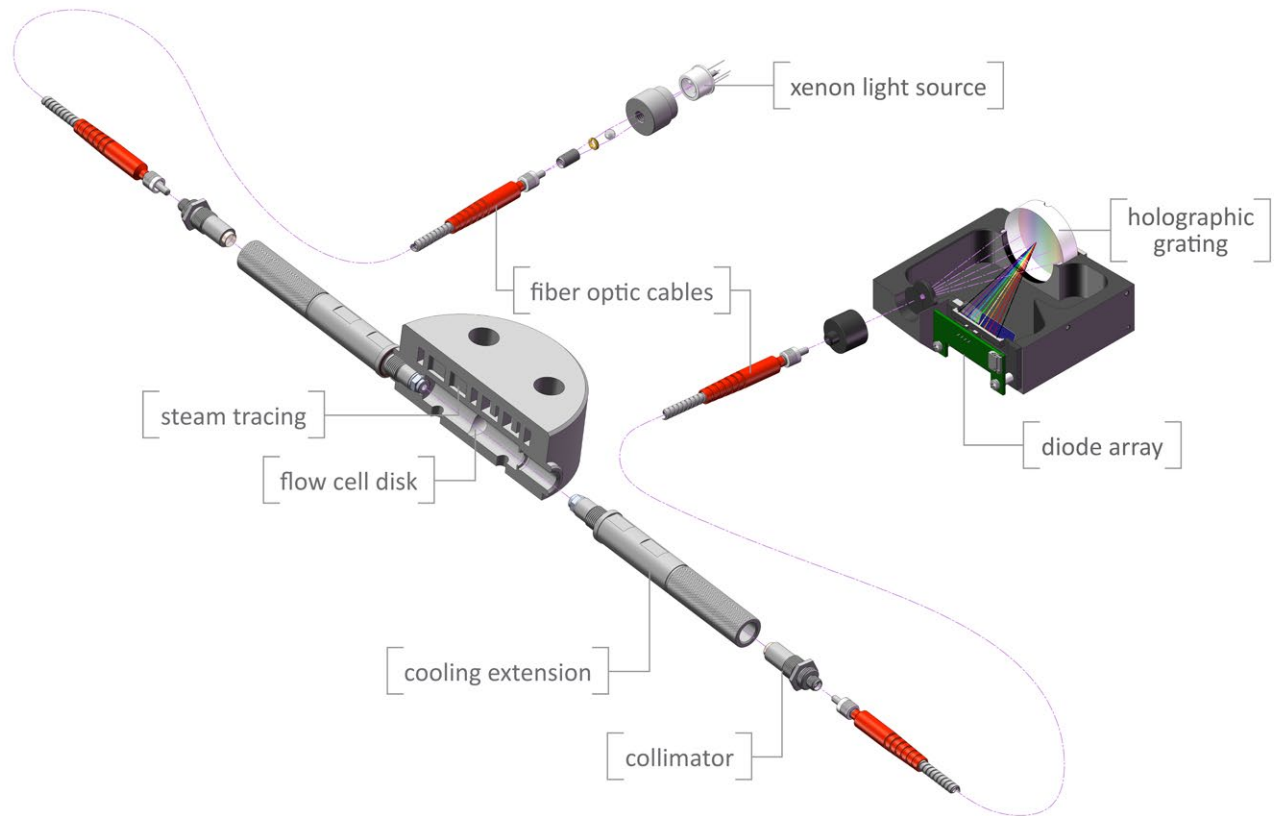
In this diagram, the tail gas analysis point is identified by **AT6**.
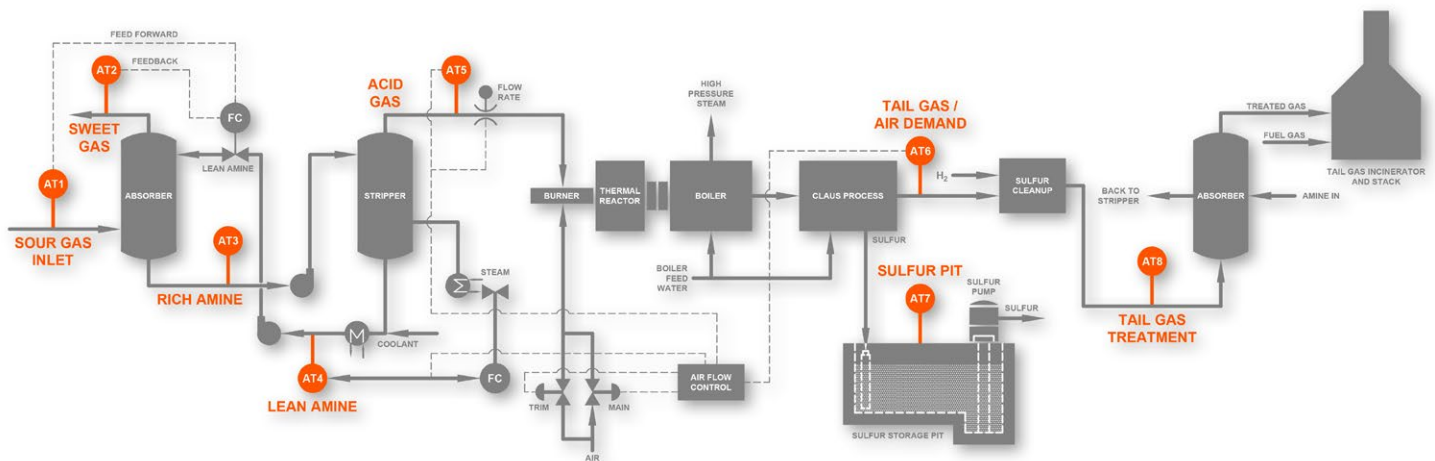
**TLG-837 Principle of Operation**



The TLG-837 measurement cycle is instantaneous, but it can be helpful to visualize it in stages:

(1) The white light signal originates in the pulsed Xe lamp that functions as the light source.

(2) The signal travels via fiber optic cable to the flow cell. A collimator narrows the light beam.

(3) The signal travels directly across the flow cell, interacting with the continuously drawn process sample.

(4) The signal exits the flow cell through a collimator, now containing the distinct absorbance imprint of the current chemical composition of the sample.

(5) The signal travels via fiber optic cable to the nova II.

(6) The signal is dispersed by the holographic grating. Each differentiated wavelength is focused onto a designated photodiode within the diode array. The nova II provides this rich data to the HMI for real-time visualization of the absorbance spectrum.

## Analyzer Internal Components
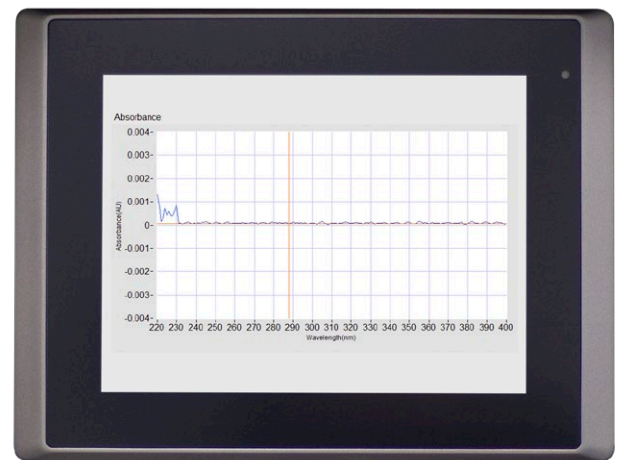
HMI

communication
electronics
(behind HMI)

nova ii™
spectrophotometer

## ECLIPSE™ Software User Interface

Normal Runtime: Real-time concentration data is displayed on the home screen.

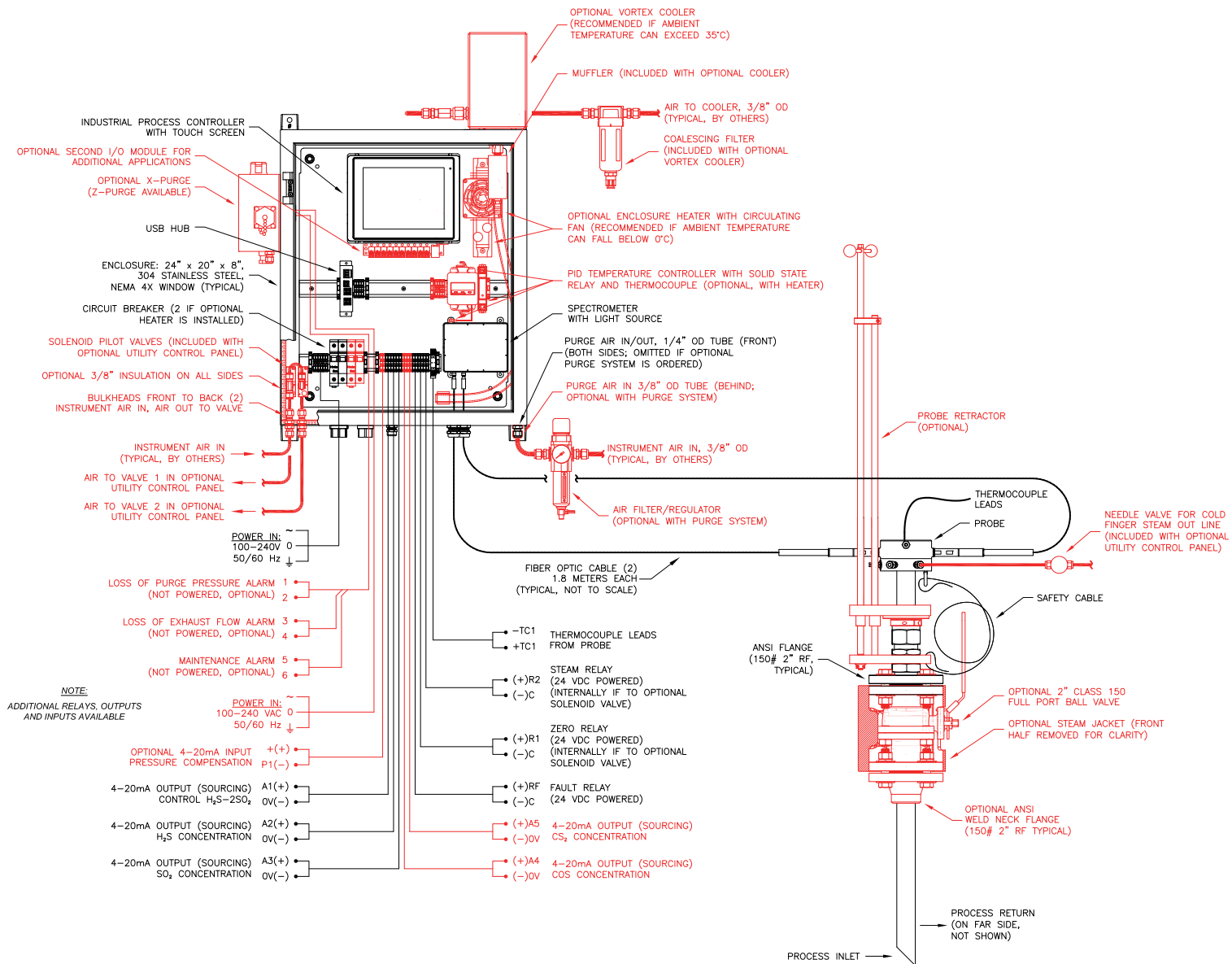Auto Zero: Runs on custom schedule to normalize the spectrophotometer readings on zero-absorbance fluid.

STANDARD TLG-837 ANALYZER
(DOOR WITH NEMA 4X WINDOW REMOVED FOR CLARITY)

**COMMON OPTIONS SHOWN IN RED**



OPTIONAL VORTEX COOLER
(RECOMMENDED IF AMBIENT
TEMPERATURE CAN EXCEED 35°C)

MUFFLER (INCLUDED WITH OPTIONAL COOLER)

AIR TO COOLER, 3/8" OD
(TYPICAL, BY OTHERS)

COALESCING FILTER
(INCLUDED WITH OPTIONAL
VORTEX COOLER)

INDUSTRIAL PROCESS CONTROLLER
WITH TOUCH SCREEN

OPTIONAL SECOND I/O MODULE FOR
ADDITIONAL APPLICATIONS

OPTIONAL X-PURGE
(Z-PURGE AVAILABLE)

USB HUB

ENCLOSURE: 24" x 20" x 8",
304 STAINLESS STEEL,
NEMA 4X WINDOW (TYPICAL)

CIRCUIT BREAKER (2 IF OPTIONAL
HEATER IS INSTALLED)

SOLENOID PILOT VALVES (INCLUDED WITH
OPTIONAL UTILITY CONTROL PANEL)

OPTIONAL 3/8" INSULATION ON ALL SIDES

BULKHEADS FRONT TO BACK (2)
INSTRUMENT AIR IN, AIR OUT TO VALVE

INSTRUMENT AIR IN
(TYPICAL, BY OTHERS)

AIR TO VALVE 1 IN OPTIONAL
UTILITY CONTROL PANEL

AIR TO VALVE 2 IN OPTIONAL
UTILITY CONTROL PANEL

OPTIONAL ENCLOSURE HEATER WITH CIRCULATING
FAN (RECOMMENDED IF AMBIENT TEMPERATURE
CAN FALL BELOW 0°C)

PID TEMPERATURE CONTROLLER WITH SOLID STATE
RELAY AND THERMOCOUPLE (OPTIONAL, WITH HEATER)

SPECTROMETER
WITH LIGHT SOURCE

PURGE AIR IN/OUT, 1/4" OD TUBE (FRONT)
(BOTH SIDES; OMITTED IF OPTIONAL
PURGE SYSTEM IS ORDERED)

PURGE AIR IN 3/8" OD TUBE (BEHIND;
OPTIONAL WITH PURGE SYSTEM)

PROBE RETRACTOR
(OPTIONAL)

INSTRUMENT AIR IN, 3/8" OD
(TYPICAL, BY OTHERS)

AIR FILTER/REGULATOR
(OPTIONAL WITH PURGE SYSTEM)

THERMOCOUPLE
LEADS

PROBE

NEEDLE VALVE FOR COLD
FINGER STEAM OUT LINE
(INCLUDED WITH OPTIONAL
UTILITY CONTROL PANEL)

SAFETY CABLE

POWER IN: ~
100-240V   0
50/60 Hz   ⏚

LOSS OF PURGE PRESSURE ALARM   1
(NOT POWERED, OPTIONAL)   2

LOSS OF EXHAUST FLOW ALARM   3
(NOT POWERED, OPTIONAL)   4

MAINTENANCE ALARM   5
(NOT POWERED, OPTIONAL)   6

*NOTE:*
*ADDITIONAL RELAYS, OUTPUTS*
*AND INPUTS AVAILABLE*

POWER IN: ~
100-240 VAC   0
50/60 Hz   ⏚

OPTIONAL 4-20mA INPUT   +(+)
PRESSURE COMPENSATION   P1(-)

4-20mA OUTPUT (SOURCING)   A1(+)
CONTROL $H_2S-2SO_2$   0V(-)

4-20mA OUTPUT (SOURCING)   A2(+)
$H_2S$ CONCENTRATION   0V(-)

4-20mA OUTPUT (SOURCING)   A3(+)
$SO_2$ CONCENTRATION   0V(-)

FIBER OPTIC CABLE (2)
1.8 METERS EACH
(TYPICAL, NOT TO SCALE)

-TC1   THERMOCOUPLE LEADS
+TC1   FROM PROBE

(+)R2   STEAM RELAY
(-)C   (24 VDC POWERED)
(INTERNALLY IF TO OPTIONAL
SOLENOID VALVE)

(+)R1   ZERO RELAY
(-)C   (24 VDC POWERED)
(INTERNALLY IF TO OPTIONAL
SOLENOID VALVE)

(+)RF   FAULT RELAY
(-)C   (24 VDC POWERED)

(+)A5   4-20mA OUTPUT (SOURCING)
(-)0V   $CS_2$ CONCENTRATION

(+)A4   4-20mA OUTPUT (SOURCING)
(-)0V   COS CONCENTRATION

ANSI FLANGE
(150# 2" RF,
TYPICAL)

OPTIONAL 2" CLASS 150
FULL PORT BALL VALVE

OPTIONAL STEAM JACKET (FRONT
HALF REMOVED FOR CLARITY)

OPTIONAL ANSI
WELD NECK FLANGE
(150# 2" RF TYPICAL)

PROCESS RETURN
(ON FAR SIDE,
NOT SHOWN)

PROCESS INLET

# TLG-837 Tail Gas / Air Demand Analyzer

Applied Analytics Data Sheet No. DS-004A

All performance specifications are subject to the assumption that the sample conditioning system and unit installation are approved by Applied Analytics. For any other arrangement, please inquire directly with Sales.

<div style="writing-mode: vertical">Subject to modifications. Specified product characteristics and technical data do not serve as guarantee declarations.</div>

| Technical Data | |
|---|---|
| **General** | |
| Measurement Principle | Dispersive UV-Vis absorbance spectrophotometry |
| Detector | nova II™ Spectrophotometer<br>Data sheet: https://aai.solutions/documents/AA_DS201A_novaII.pdf |
| Spectral Range | 200-800 nm |
| Light Source | Standard: pulsed xenon lamp with average 5 year lifespan |
| Fiber Optic Cables | Standard: 600 µm core 1.8 meter fiber optic cables (qty = 2)<br>Data sheet: https://aai.solutions/documents/AA_DS206A_FiberOptics.pdf |
| Sample Introduction | DEMISTER in situ sampling probe<br>Data sheet: https://aai.solutions/documents/AA_DS004B_TLG837_Probe.pdf |
| Analyzer Calibration | Calibrated with certified calibration fluids; no re-calibration required after initial calibration; measurement normalized by Auto Zero |
| Reading Verification | Simple verification with sample gas |
| Human Machine Interface | Applied Analytics standard HMI: industrial controller with touch-screen LCD display<br>Data sheet: https://aai.solutions/documents/AA_DS202A_HMI.pdf |
| User Interface | ECLIPSE™ Runtime Software<br>Data sheet: https://aai.solutions/documents/AA_DS203A_Eclipse.pdf |
| Data Storage | Solid State Drive<br>Data sheet: https://aai.solutions/documents/AA_DS204A_SSD.pdf |
| Enclosure | Standard: wall-mounted NEMA 4X stainless steel type 304 Enclosure<br>Options in data sheet: https://aai.solutions/documents/AA_DS401X_Enclosures.pdf |
| Certifications | Standard: General Purpose<br>Available Options: ATEX, IECEx, EAC<br>*Please inquire with your sales representative for additional certifications (CSA, FM etc.).* |
| **Measuring Parameters** | |

| Accuracy & Repeatability | Analyte | Typical Range | Accuracy | Repeatability |
|---|---|---|---|---|
| | $H_2S$ | 0-2% | ±1% of full scale | ±0.4% |
| | $SO_2$ | 0-2% | ±1% of full scale | ±0.4% |
| | Air Demand | user-defined | ±1% of full scale | ±0.4% |
| | COS | 0-2,000 ppm | ±1% of full scale (±5% under 500 ppm) | ±0.4% |
| | $CS_2$ | 0-2,000 ppm | ±1% of full scale (±5% under 500 ppm) | ±0.4% |

| | |
|---|---|
| Sensitivity | ±0.1% full scale |
| Noise | ±0.004 AU at 220 nm |
| Off-Ratio Range | 100:1 < $H_2S$:$SO_2$ <20:1 |
| Response Time | 1-5 seconds |

# TLG-837 Tail Gas / Air Demand Analyzer

Applied Analytics Data Sheet No. DS-004A

| Ambient Conditions | |
|---|---|
| Analyzer Environment | Indoor/Outdoor (no shelter required) |
| Ambient Temperature | Standard: 0 to 35 °C (32 to 95 °F)<br>With optional temperature control: -20 to 55 °C (-4 to 131 °F)<br>*To avoid radiational heating, use of a sunshade is recommended for systems installed in direct sunlight.* |
| **Physical Specifications** | |
| Dimensions | Analyzer: 24" H x 20" W x 8" D (610mm H x 508mm W x 203mm D)<br>Probe Average Dimensions: 36" length x 12" widest diameter (914mm x 305mm)<br>Optional Utility Control Panel: 24" H x 24" W x 8" D (610mm H x 610mm W x 203mm D) |
| Weight | Analyzer: 32 lbs. (15 kg)<br>Probe Average Weight: 29 lbs. (13 kg)<br>Optional Utility Control Panel: 25 lbs. (11 kg) |
| Wetted Materials | Standard: Stainless Steel 316/316L, Kalrez<br>*Various custom materials available — please inquire.* |
| Probe Material | Standard: Stainless Steel 316/316L<br>*Other materials available* |
| **Utilities** | |
| Utility Management | Optional: Utility Control Panel<br>Data sheet: https://aai.solutions/documents/AA_DS004C_TLG837_UCP.pdf |
| Electrical Requirements | 85 to 264 VAC 47 to 63 Hz |
| Power Consumption | 65 watts |
| Instrument Air | 70 psig (-40 °C dew point) |
| Steam Pressure | 70 psig for DEMISTER chamber<br>30-50 psig for probe blowback function<br>75-100 psig for optional ball valve steam jacket |
| **Outputs/Communication** | |
| Outputs | 1x galvanically isolated 4-20mA analog output per measured analyte<br>5x digital relay outputs for indication and control<br>1x K type ungrounded thermocouple input<br>Optional: Modbus TCP/IP; RS-232; RS-485; Fieldbus; Profibus; HART; more |
| I/O Electronics | Voltage/Current Interface Module (i.e. I/O Board)<br>Data sheet: https://aai.solutions/documents/AA_DS205A_VCIM.pdf |

**Further Reading**

| Subject | Location |
|---|---|
| TLG-837 DEMISTER Probe<br>Data sheet | https://aai.solutions/documents/AA_DS004B_TLG837_Probe.pdf |
| TLG-837 Utility Control Panel<br>Data sheet | https://aai.solutions/documents/AA_DS004C_TLG837_UCP.pdf |
| Advantage of Collateral Data<br>Technical Note | https://aai.solutions/documents/AA_TN-202_CollateralData.pdf |
| Multi-Component Analysis<br>Technical Note | https://aai.solutions/documents/AA_TN-203_MultiComponentAnalysis.pdf |

**APPLIED** ™
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