



**TELEDYNE INSTRUMENTS**  
*Monitor Labs*  
A Teledyne Technologies Company



**LightHawk®**

MODEL 560

# OPACITY/DUST MONITOR



A DOUBLE PASS COMPLIANCE OPACITY MONITOR

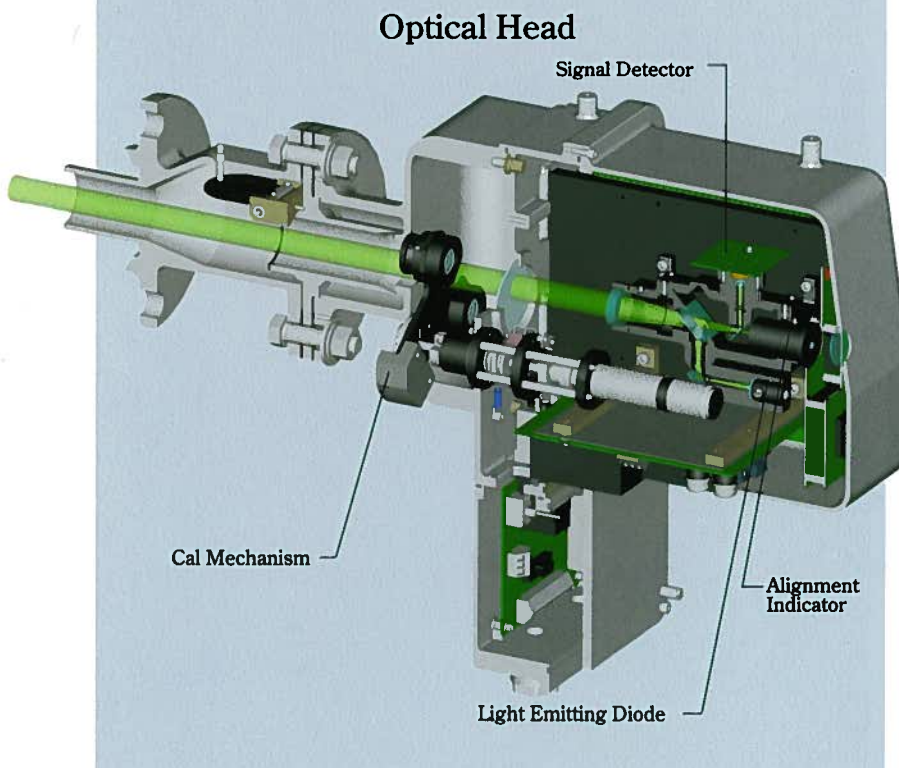
# Simplified Audit Procedures

EPA regulations require that all opacity monitors (*regardless of optical design*) be periodically set up under clear-stack conditions, the zero verified, and audit filters run. When the process is running, this requires removing the opacity monitor from the stack. The LightHawk is designed such that this can be done without the need of test stands. Furthermore, the LightHawk can capture the audit filter readings at the stack level, making it easy for one operator to perform the test without the need of reading a strip chart.

The LightHawk measures zero, upscale cal, and dust compensation using only one moving part. The LightHawk employs a single gearmotor that, unlike competitors' designs, is located safely inside the sealed optical housing, completely isolated from the potential of damage from stack gas. The gear mechanism is also brake-isolated from the effects of vibration. Finally, both the span and zero surfaces are iris-adjustable, eliminating the need to open up the optical housing to change a span filter when regulations change.

## How the LightHawk works

The heart of the Opacity/Dust Monitor is an electronically modulated (2400Hz), intensity controlled LED located in the Optical Head assembly. Light from the LED is projected from the Optical Head across the stack/duct sample area to a Retroreflector on the opposite side. The reflected light re-enters the Optical Head, where it is evaluated by a signal detector. If the stack is clear, the light transmission is 100% (*zero opacity*). When the stack passes no light, the transmission is zero (*100% opacity*). Opacity can be correlated against reference methods to calculate dust loading.



### Training

An Operation and Maintenance Manual is provided with the LightHawk Monitor. In addition, periodic hands-on training classes are offered at both the Colorado and Pittsburgh facilities. Training classes may also be scheduled at the customer's facility.



### User Support

TML maintains a user support line that may be accessed for assistance during normal working hours. A special 24-hour phone line is also available.



### Commitment

TML has over 30 years experience in providing state-of-the-art Continuous Emissions Monitoring products to a wide variety of industrial markets. TML is dedicated to working in partnership with its customers to solve any application needs.



# Specifications

<b>PHYSICAL DIMENSIONS</b>	Optical Head (w/o purge shutter)	17"(L) x 9-1/4"(W) x 15"(H) (43.2 x 23.5 x 38.1 cm)
	Optical Head (with purge shutter)	22"(L) x 9-1/4"(W) x 15"(H) (55.9 x 23.5 x 38.1 cm)
	Retro Assembly (w/o purge shutter)	10"(L) x 7" (Diameter) (25.4 x 17.8 cm)
	Retro Assembly (with purge shutter)	15"(L) x 7" (Diameter) (38.1 x 17.8 cm)
	Single Purge Blower Assembly	22-1/4"(L) x 20"(W) x 33"(H) (56.5 x 50.8 x 83.8 cm)
	Dual Purge Blower Assembly	2 assemblies with Single Purge Blower dimensions
Enhanced Remote Panel**	3U 19" Rack Mount 5-1/4"(H) x 9" Depth 48.3(W) x 13.3(H) x 22.9(D) cm	
<b>OPTICAL CHARACTERISTICS</b>	Optical Measurement Technique	Double Pass Extinction
	Angle of View	Less than 4 degrees
	Angle of Projection	Less than 4 degrees
	Spectral Response	Peak: 500 to 600 nm Mean: 500 to 600 nm 94% of energy: 500 to 600 nm
<b>SYSTEM MEASUREMENT CHARACTERISTICS**</b>	Response Time (To 95% of Value)	Less than 10 seconds
	Calibration Zero Operation	On Command
	Upscale Calibration Operation	On Command
	Calibration Error (Mean Error + Confidence Coefficient)	2.0% Opacity Maximum
	Long Term (60 day) Drift	Zero: 0.5% Opacity Maximum Span: 0.5% Opacity Maximum
	Stability Over Operating Temperature Range	± 2.0% Opacity Maximum per 40°F (22.2°C) change in temperature (as per ASTM D6216)
Stability Over Operating Mains Voltage Range	± 1.0% Opacity Maximum (as per ASTM D6216)	
<b>POWER REQUIREMENTS</b>	Optical Head	85-245 VAC, 47-63 Hz, Single Phase, 30 VA Maximum
	Single Purge Blower System***	115 VAC/230 VAC, 60/50 Hz, Single Phase, 414 VA Maximum
	Dual Purge Blower System**	Two circuits, each with same requirements as Single Purge Blower
	Enhanced Remote Panel	85-245 VAC, 47-63 Hz, Single Phase, 30 VA Maximum
<b>AMBIENT OPERATING CONDITIONS</b>	Optical Head	Temperature Range: -4 to +140°F (-20 to +60°C) (startup) -25 to +140°F (-32 to +60°C) (operating)
	Enhanced Remote Panel	Relative Humidity Range: 0 to 100% condensing Temperature Range: +32 to +104°F (0 to +40°C) Relative Humidity Range: 0 to 95% noncondensing
	Static Pressure Range***	Single Purge Blower: -15.0 to +5.0 inches H <sub>2</sub> O Gauge Dual Purge Blower: -15.0 to +15.0 inches H <sub>2</sub> O Gauge >+15 inches H <sub>2</sub> O consult factory
	Gas Composition Humidity Maximum Temperature***	not critical must be noncondensing for valid measurement +500°F (260°C) (without High Temperature option) +1500°F (816°C) (with High Temperature option) Consult factory for higher temperature operation
<b>OPTICAL HEAD HMI CHARACTERISTICS</b>	Display Type	Six 7 segment LED's
	Indicating LED's	Fault, Set, In Cal, Power
	User Input Controls	10-key keypad
<b>ENHANCED REMOTE PANEL HMI CHARACTERISTICS</b>	Display Type	Graphics mode liquid crystal with LED backlight
	Display Resolution	240 x 128
	Indicating LED's	Fault, Alarm, Power
	User Input Controls	20-key keypad, security keyswitch
<b>MULTI I/O BOARD CHARACTERISTICS**</b>	Analog Outputs	Number Isolation Type
	Digital Inputs	Number Modes
	Relay Outputs	Number & Type

\* Measurement based on single pass response with a PLCF of 1.00

\*\* Does not apply to Direct Interface version

# A Complete Quality System . . .

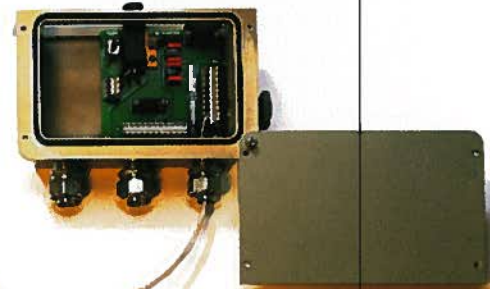
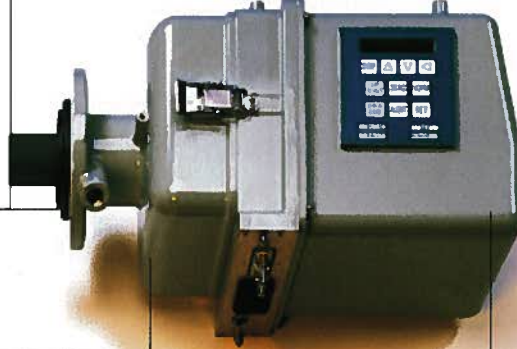
## Purge System

A purge air system is furnished with each LightHawk. The system supplies purge air to the Optical Head and the Retro-reflector, protecting the instruments from stack gases and significantly reducing maintenance intervals. Purge air sensing switches and optional aluminum fail-safe shutters are provided in case of power loss or interruption. Purge fail/power fail alarms are standard.



## LightHawk Optical Head and Retroreflector Assemblies

The Optical Head and Retroreflector Assemblies are housed in rugged aluminum castings. The Optical Head contains the active electronics necessary to project a light beam across the stack/duct to the Retroreflector assembly and to detect reflected light. The sealed Optical Head subassembly is designed for simple cover removal, allowing complete access to the electronics.



## Remote Display Panel

Uses a large, back-lit, LCD graphics display with English-language, menu-driven screens, providing ready access to all information needed for full use of the system. In addition, the user can graph up to the most recent 100 values of a selected parameter, such as:

- Opacity, Optical Density, or Particulate Concentration (averaged or instantaneous)
- Calibration Values (Zero, Upscale, or Dust [compensation])

The keypad, a rugged 20-button ensemble inlaid under a tough, hard coated, scratch and chemical-resistant coating, can be used to:

- Display Opacity, Optical Density, or Particulate Concentration
- Identify the Cause of an Alarm or Malfunction
- Configure the Relay Outputs
- Configure the Analog Outputs
- Edit Parameters such as Path Length Correction Factor
- Set Alarm Values for Opacity, Cal Zero and Upscale Cal
- Load Linearization Curves for Correlation to Particulate Concentration

Standard with the LightHawk Remote Panel is a security keylock for protection of important calibration parameters. System elements communicate over a single twisted pair (FTT) using a commercial network communication protocol. Bright LED indicator lights are used to indicate faults and alarms. The four optically-isolated analog outputs, normally packaged within the Remote Panel can also be offered in a separate housing for convenient installation.

## Ethernet Interface

The LightHawk Enhanced Remote Panel now features a 10/100 Based Ethernet interface as standard equipment. This capability provides a multilevel password protected user interface to TCP/IP networks such as LAN's or the Internet. Client side user interface access is via standard web browsers. Simultaneous Modbus TCP access to instrument parameters and emission data is also supported.

## Optical Head Keyboard/Display

Uses a 10 button keypad & 6 digit readout to display and/or enter:

- Instantaneous Opacity
- Average Opacity
- Upscale Calibration
- Calibration Zero
- Dust Compensation
- Path Length Correction Factor
- Status Codes
- Diagnostic Data about the Analog Signals Inside the Optical Head (no need to open the Optical Head)
- Particulate Concentration Curves
- Optical Gains
- Alarm Settings

With optional Six Point I/O board, LightHawk meets all PS-1 and ASTM D6216 requirements without a Remote Display Panel



## Calibration Kit

The calibration kit, standard with the LightHawk, is used as an additional check of the unit's proper operation and calibration. The cal fixture attaches to the front face of the optical head and has been preset to return the same amount of light as the retroreflector when the stack or duct is clear.





# LightHawk<sup>®</sup> Opacity/Dust Monitor - Model 560

The most stable (*under all operating conditions*), accurate, and maintenance free EPA-compliant opacity monitor available!



### Exceeds EPA and ASTM standards

The LightHawk was developed to comply with 40CFR60 Appendix B., PS-1 and ASTM D6216-03 "Standard Practice for Opacity Manufacturers to Certify Conformance with Design and Performance Specifications."



### Rugged construction holds up under toughest conditions

The Optical Head and Retroreflector are built of heavy gauge aluminum parts and finished with acid-resistant enamel paint. All exposed hardware is stainless steel. The rugged design and extremely low heat generation allows operation over a wide range of ambient temperatures. It is built to withstand the typical hostile environment associated with outdoor industrial applications, including substantial shock and vibration.

### Ideal for Retrofit Applications

*The LightHawk is more compact than its predecessors, so that it can easily fit inside most existing weather covers. It only requires a 2" mounting pipe; adapters are available for most previously installed opacity monitors.*

*With an optional I/O module, the Optical Head meets all PS-1 and ASTM requirements without the need of a Remote Panel, making it ideal for OEM applications.*



### Labor saving on-stack controls

All of the hardware and software needed for system setup, control and maintenance are packaged within a single optical housing. Via a membrane-sealed keypad and digital display, the user can perform clear-stack zeroing, span/zero setup, reset window dirt calculation following maintenance, input dust load correlation data, and access the full set of diagnostic parameters.



### Ideal for OEM Applications

The LightHawk is easy to calibrate. Just match the standard Optical Head with the appropriate Retroreflector and calibration mechanism filters, focus for distance and use the onboard keypad to set-up energy levels for the clear path condition. No potentiometer adjustments or resistor changes are required. In addition, linearized opacity, optical density or particulate concentration data from the transceiver can be transmitted directly to a DAS or datalogger via network or, if the optional Six Point I/O module is used, via optically isolated analog signals.



### Advanced optical design for consistent operation

Some opacity monitors don't operate well in heat, high noon conditions or when stack or duct walls shift slightly due to temperature, wind, etc. Not the LightHawk. Its electronically modulated intensity-controlled solid state LED (*light emitting diode*) ensures unusually stable operation, without interference from sunlight or room lights. The uniform LED beam provides accuracy even with small shifts in alignment. Alignment is always visible on the built-in indicator. The LED is guaranteed for many years, minimizing your replacement problems.

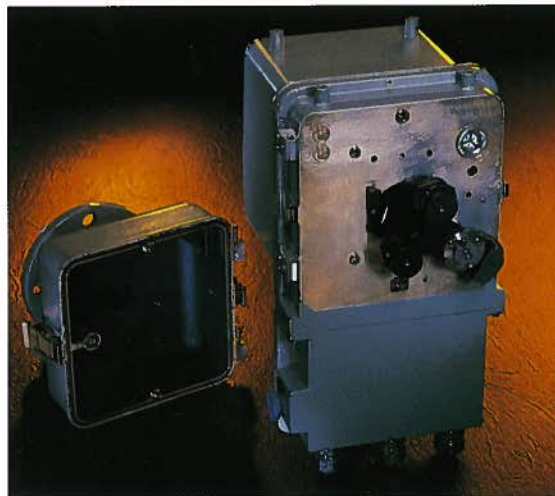


### Flexible trouble-free operation

The various components of the LightHawk are interconnected via a commercial network protocol, using transformer isolated data lines which nearly eliminate the potential effects of electro static discharge. This approach provides great flexibility in choices of options and interconnect topology. One twisted pair is required for each system interconnection. The Optical Head and Remote Panel provide all parameters needed for maintenance and diagnostics. It is easily configured for any plant or DCS/SCADA configuration.

### Optional equipment

Optional equipment with the LightHawk includes: non-corroding aluminum purge air shutters, dual blower system, dual weather covers, optional flange nozzle materials, high-temperature hardware, adapter flanges and serial data links. Consult factory for application criteria and options.

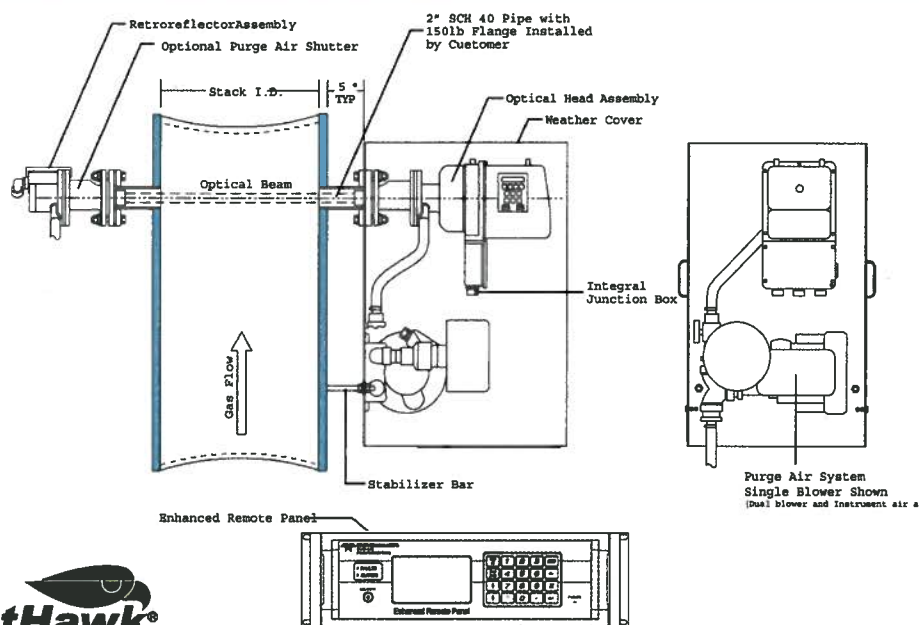


# Teledyne Monitor Labs

## Leading the Way in Emissions Monitoring

Teledyne Monitor Labs offers state-of-the-art CEM technologies to CEM users. The TML line of opacity/dust monitors were the first to use a patented Light Emitting Diode (LED) as the source, and the ULTRAFLOW 150 has proven to be the most reliable, drift-free way to monitor stack flow for mass emission based monitoring. Teledyne Monitor Labs Windows based RegPerfect Data Acquisition represents a quantum leap in flexible, configurable systems for satisfying a wide range of reporting requirements. Together with TML's CEM systems for NO<sub>x</sub>, SO<sub>2</sub>, CO and NH<sub>3</sub> and the largest, most broadly trained service organization of its kind, TML is your one-stop center for total systems solutions.

## LightHawk System Assembly



Teledyne Monitor Labs reserves the right to make changes in construction, design, specifications, and/or prices without prior notice.



**TELEDYNE INSTRUMENTS**  
**Monitor Labs**  
A Teledyne Technologies Company

35 Inverness Drive East / Englewood, CO 80112  
303-792-3300 / Fax 303-799-4853  
<http://www.teledyne-ml.com>

ISO 9001 Certified

Printed in the USA

PL/LH/9/07