How to complete the LaserHawk360 Installation Checklist

1. CUSTOMER Contact Information:

Fill out your name, phone number, email address and other information. The Stack Identification should be the name of the stack or duct that the monitor will be on. Some sites may have a name such as “Boiler1” others may have names such as “West Stack” or a more descriptive name of the process.

2. MOUNTING FLANGES (Not typically provided)

The Standard mounting flanges are 4" 150lb ANSI flanges and are to be supplied by the customer. The flanges are welded or screwed onto 4" Sch. 40 pipe that is also customer supplied. The length of this pipe should be kept to a minimum and the factory should be consulted if it exceeds 8 inches in length (see drawing 1810-0013).

If you are adapting to an EXISTING flange or using mounting pipes other than 4" Schedule 40, select Other and provide the flange size, bolt circle diameter, and orientation of holes consult the TML factory if help is needed. Adapter Plates are available.

3. MOUNTING TUBE LENGTH

The typical length of the mounting tube is between 2 inches and 8 inches in length including the flanges and adapters (refer to drawing 1810-0013). If the process to be measured is 500 °F (260^{o}C) or above, we recommend using a Mounting Tube length of 6 inches.

4. STACK DIAMETER OR DUCT WIDTH

Record this distance in English or Metric units. This distance is to be measured from the inside of the stack or duct walls with an accuracy of +\-1% of the distance. If the inside diameter of the stack or duct walls are less than 6.5 feet (1.98 m), then the light from the laser could reflect back from the far wall. This may cause the monitor to read higher values than it should and a Light Trap may need to be installed (consult drawings 1810-0014 and 1810-0015).

Small diameter stacks may require an optional ***LIGHT TRAP***, which is a device that prevents laser energy reflecting off the far stack wall opposite the Optical Head from being reflected into the viewing optics. *A **LIGHT TRAP** is generally required only for stack diameters less than 6.5 feet (2 meters), but may be necessary at great diameters based on mounting tube length, particulate mass range and other factors.*

5. TEMPERATURE OF PROCESS TO BE MEASURED

- Report the maximum and minimum process temperature Range including upset conditions.
- Report the Typical process temperature under normal operating conditions.
- Record the temperature in English or Metric units

This information is necessary to ensure that the hardware configuration chosen is adequate for the user's application (high temperature seals, stainless steel nozzles and a heat shield may be required when the temperature exceeds 500 ºF (260^{o}C)).

6. PROCESS STATIC PRESSURE

Record the process static pressure range in ***INCHES of WATER COLUMN*** at the monitor installation location. This is the difference in pressure between the process and ambient conditions.

This information is necessary to ensure that the hardware configuration chosen is adequate for the user's application (high positive pressure >5" H2O may require options)

7. MOUNTING CLEARANCES

Review the proposed installation locations and reference the TML drawings. Make the appropriate checkmark if sufficient clearances are available. Mark Other and consult the factory if alternative installation configurations are required.

- Stack Equipment: Be certain that there is sufficient clearance between the stack mounted equipment and any potential obstructions (i.e.: distance to floor, horizontal distance to catwalk rail). Weatherhood is…20" W x 22 ¼" L x 33" H (51 W x 56 L x 84 H cm). (See drawing 1810-0015).

8. DATA CABLE LENGTH

DATA CABLE LENGTH Direct Interface Configuration

The cost of the cables from the Optical Head to the output or display device has not been included in the base price. TML will provide the cable at additional cost to the customer.

The user must determine the length of the data cable measured from the Optical Head to their DAS/PLC or other output device. Minimum recommended conduit size is 1/2". A Direct Interface configuration requires two cables; a non-shielded 4-conductor/20 AWG (Alpha 66-44) and a 6-shielded pair 24 AWG (Alpha 6386/Belden 9991). Consult the TML factory for current price and delivery of data cable.

DATA CABLE LENGTH with Enhanced Remote Configuration

The cost of the cable from the Optical Head to the output or display device has not been included in the base price. TML can provide the cable at additional cost to the customer.

The user must determine the length of the data cable measured from the Optical Head to the Enhanced Remote Panel. Minimum recommended conduit size is 1/2". The Enhanced Remote Panel configuration requires only a single twisted pair, which is 16 AWG PLTC with shield (Alpha 5610B1601). Consult the TML factory for current price and delivery of data cable.

9. STACK HEAD POWER CIRCUIT CAPACITY (OPTICAL HEAD)

Enter the supply voltage and current capacity of the customer supplied circuits for the STACK equipment. Circuits must meet the following minimum requirements.
Stack Equipment: Maximum power draw is:

- 14VA single phase for the Optical Head
- 414VA single phase for the Purge Blower

A minimum of one 115VAC single phase, 10A circuit is required. The customer is to hardwire 115VAC into the purge motor junction box of the Optical Head (See drawing 1810-0012).

Customers who choose Option B, Enhanced Remote, must also fill in the Volt and Amp settings for their Remote.

10. CORRECTION TO STANDARD CONDITIONS

Some sites may wish to correct the Particulate measurement to Standard Conditions by measuring the process temperature and pressure. The LaserHawk 360 can mathematically correct for temperature and pressure if they are supplied as inputs to the monitor. If you want this option, also let us know where you want to locate the input module.

If you can provide the Elevation above Sea Level, we can calculate a reasonable range of Barometric Pressure readings. Please note that this is different from the Elevation from ground level at your facility.

The scaling of the Barometric Pressure transducer is based off of your everyday readings. Higher elevations have lower Barometric Pressure readings. We do not want the range of readings to be corrected to Sea Level.

If you plan on using your own RTD, let us know if you are going to use a 1000 ohm or a 100 ohm RTD.

11. MAXIMUM PARTICULATE LIMIT

The Integration Period is simply how often the monitor will update its average value. It is usually either a value of One minute or Six minutes.

The user's operating permit includes a limit they must operate within (e.g. <95mg/Am^3). We can configure this as an alarm set point in the monitor. This value also helps us determine if the full scale value and sensitivity is calibrated accurately.

12. SPECIFY FULL SCALE

The user's operating permit may require a specific full scale based on the classification of the emission source.

- Many different Units can be used. The form lists some of the more common units.
- Particulate Mass is the actual numerical value used for full scale of the monitor.
- Let us know if you have a particulate control device. If so, also let us know if the monitor will be Before or After the particulate control device.
- If we know what kind of particulate control device you have it can help us estimate the sensitivity you will need for your monitor. The two most common are an Electrostatic Precipitator (EP) or a Baghouse.
- Examples of Fuel Constants are: Bituminous Coal = 1800, Lignite = 1910, Oil = 1420 and Natural Gas = 1040.
- Examples of Fuel Types are Coal, Oil, Natural Gas, Wood, and Municipal Waste.
- We are asking for the typical CO2 value you have when your process is running under normal operating conditions. The CO2 value will be ether a WET or a DRY measurement depending if you are getting this value from an Extractive, In-Situ or Dilution system.

13. USE AUTO CAL SEQUENCE

Check YES if the Auto Cal sequence is to be used to collect calibration data. Check NO if the user will be exclusively using External Mode control.

Auto Cal Sequence - The real time clock in the Optical Head determines the start and duration of each phase of the calibration data.

14. USE EXTERNAL MODE CONTROL

Select YES if the External Mode control sequence is to be used to collect calibration data. Check NO if the user will be exclusively using Auto Cal.

External Mode Control - The user's DAHS, PLC or Data Logger circuits control the start time of a predetermined sequence or manually control individual output modes.

15. SPECIFY CAL CYCLE OUTPUT TIMES:

Calibration information is usually provided on Channel 2. The standard auto cal reporting cycle is 120-seconds for: ZERO, UPSCALE (240-Sec total). Check YES to accept the Standard 120-seconds per calibration phase. If NO is selected, please specify on the checklist each phase duration you want. Each is independently programmable.

Dust Comp is a value which can help determine if regular maintenance (cleaning of the external optics) may be required.

16. SYSTEM CONFIGURATION:

(Select one) Direct Interface or Enhanced Remote

The LaserHawk360 is available in two basic configurations. The Direct Interface configuration does not have the Enhanced Remote Panel. The Direct Interface requires more wires to be run from the stack or duct. The Enhanced Remote option gives the user more information down at the 'remote' location and offers more inputs and outputs than the Direct Interface. The Enhanced Remote option requires only one cable with two wires to be run from the stack or duct to the Enhanced Remote Panel's location.

This is option A, Direct Interface

SPECIFY OUTPUT UNITS:

Check the analog output units your monitor is to report in, Backscatter Energy (a raw percentage value of the energy measured by the monitor) or Particulate Mass (a correlation of the raw Backscatter Energy measurement to a particulate value representative for your emissions)

DIGITAL INPUT SELECTION

Two discrete inputs are provided to allow monitor output mode control by user supplied circuits. These optical isolators are activated by either dry contact closures or +5VDC signal from a user-supplied circuit. These signals are transmitted to the Optical Head via the Data cable.
This configuration is field selectable and may be modified at the time of instrument start up
The following definitions apply to the selection of the External Mode control digital inputs:

Force Upscale =	The instrument goes into calibration UPSCALE mode. The calibration mechanism moves to the UPSCALE position. Analog output #1 holds the last stack value read, analog output #2 follows the UPSCALE value
Force Zero =	The instrument goes into calibration ZERO mode. The calibration mechanism moves to the ZERO position. Analog output #1 holds the last stack value read analog output #2 follows the ZERO value.
Dump Dust Comp =	The calibration mechanism moves to NORMAL position. Real time stack data appears on the LED readout and on analog output #1. Analog output #2 follows the DUST COMPENSATION value.
Force Cal Cycle =	The calibration mechanism moves to ZERO, UPSCALE, DUST COMPENSATION and then back to NORMAL. It remains in each mode for a configurable period of time.

The Standard configuration for digital inputs:

ISO1 = C - FORCE CAL CYCLE
ISO2 = C - DUMP DUST COMP

RELAY OUTPUTS:

The Six Point I/O board uses 2 relays that can be configured to actuate on various output modes or monitor conditions. Select any two from the table below. These functions are set via jumper settings and can be easily modified at the site. Contacts are SPDT Form C. The two relays available can be configured as either Normally Open or Normally Closed via a jumper setting. The standard selections most commonly chosen are “Calibration Data on Analog Outputs” and “Instrument Malfunction”. The following table lists the available selections.

Calibration Data on Analog Outputs
Instrument Malfunction
Instantaneous Alarm 1 Actuated
Selectable Average Alarm 1 Actuated
UPSCALE data on Analog Outputs
ZERO data on Analog Outputs
Purge Failure
Excessive Dust Compensation

CURRENT OUTPUTS:

The Direct Interface has two analog outputs available. They are isolated from each other and circuit common.

Channel 1 is always dedicated to the Instantaneous value and does not carry calibration values. Channel 2 is always Selectable Average with calibration. If an output carries calibration values (Channel 2), the analog output will track the calibration values when it is commanded to go into calibration or when it is scheduled to go into calibration. If the output does not carry calibration values (Channel 1), the analog output will hold the last NORMAL mode value when the monitor is in a calibration mode.

Please select the output current configuration you want, **4 - 20 ma** or **0 - 20 ma**. Select only one. Standard default = 4 - 20ma

End of Option A, Direct Interface Option

This is Option B, Enhanced Remote Option

ANALOG OUTPUTS:

The Standard Configuration includes:

Channel 1		Selectable Average Particulate Mass, with cal values displayed.
Channel 2		Selectable Average Particulate Mass, without cal values displayed.
Channel 3		Zero Drift Backscatter
Channel 4		Dust Compensation

The Analog Outputs can be easily changed at a later date, through a list on the Enhanced Remote Panel. Choose the desired Analog Outputs from the following table:

Parameters for Analog Output

Parameter Name	Functional description
Instant Backscatter	Instantaneous Backscatter. Update time is 6-8 seconds.
Minute Ave. Backscatter	A one minute average of the instantaneous Backscatter reading. The period is minute to minute according to the real time clock in the Optical Head.
Selectable Ave. Backscatter	An average Backscatter reading whose time period is selectable in one-minute increments. The time selected should divide evenly into 60 minutes. 1, 2, 4, 6, 10, 12, 15, 30 and 60-minute averages are possible.
Zero Drift Backscatter	
Upscale Drift Backscatter	.
Upscale Set Value	
Instant Particulate Mass	Instantaneous Particulate Mass loading in mg/m3. Update time is 6-8 seconds. This is a mathematical correlation from the Backscatter reading by a curve that is developed through extractive testing. This is not available for output until the correlation testing is done and the results entered into the LaserHawk software.
Minute Ave Particulate Mass	A one minute average of the instantaneous Particulate Mass reading. The period is minute to minute according to the real time clock in the Optical Head. Not available for output until testing results are entered.
Select Ave Particulate Mass	An average Particulate Mass reading whose time period is selectable in one-minute increments. The time selected should divide evenly into 60 minutes. 1, 2, 4, 6, 10, 12, 15, 30, and 60-minute averages are possible. Not available for output until testing results are entered.
Dust Compensation Output	The amount of Dust Compensation build up. The Dust Compensation factor applied to the NORMAL and UPSCALE mode readings is limited to ±4% Backscatter. However, the Dust Compensation reading is unbounded.
Zero Backscatter	The calibration Zero value.

Other selections are also available to observe internal operations of the monitor.

RELAY OUTPUTS

There are eight relays (K1-K8) available on the LaserHawk360 Multi I/O Module to interface with user circuits. Each relay is SPST with one normally open contact rated 3A max. The Standard Configuration includes:

K1		Analog outputs displaying calibration ZERO
K2		Analog outputs displaying UPSCALE calibration
K3		Calibration Failure
K4		Analog outputs displaying any type of calibration data
K5		Data Valid (Failsafe)
K6		Instantaneous Particulate Mass exceeds Level 1 set-point
K7		Average Particulate Mass exceeds Level 1 set-point
K8		Purge Fail

The relays can also be easily changed at a later date, through a list on the Enhanced Remote Panel. Select options for the relay configurations from the following table:

Parameters for Relay Assignment
(Digital Output closure conditions)

Backscatter Exceedence	**Particulate Mass Exceedence**	**System Trouble**	**Calibration Control**
Inst. Backscatter Level #1	Inst. Particulate Mass Level #1	Cal Failure	Normal
Inst Backscatter Level #2	Inst. Particulate Mass Level #2	Excess Dust Compensation	Cal on A.O.
Min. Backscatter Level #1	Min. Particulate Mass Level #1	Fault	Dust Comp on A.O.
Min. Backscatter Level #2	Min. Particulate Mass Level #2	Data Valid	Invalid Selection
Ave. Backscatter Level #1	Ave. Particulate Mass Level #1	Purge Failure	Zero on A.O
Ave. Backscatter Level #2	Ave. Particulate Mass Level #2	No Selection	Upscale on A.O.

DIGITAL INPUTS

The Enhanced Remote has 6 isolated inputs available. The location and designation of each are fixed. To use any of these inputs, merely connect wires to the appropriate input. A simple jumper setting on the Multi- I/O board determines if they are activated by a dry contact or +5 VDC input. Dry contact closure is the standard configuration. More information is provided on the Installation Drawings and in the Manual.

Input #1	Force Upscale
Input #2	Force Zero
Input #3	Not Used
Input #4	Dump Dust Comp
Input #5	Force Cal Cycle
Input #6	Not Used
Input #7	Test Zero Scale
Input #8	Test Full Scale

ENHANCED REMOTE PANEL POWER CIRCUIT CAPACITY

Maximum power draw is:
25 VA single phase for the remote equipment.

The Enhanced Remote Panel normally operates on an 115VAC, 60 HZ, single phase supply. The assembly is usually shipped with a standard straight 115VAC, 3-pronged molded power cord, 15' long. (See drawing 1810-0012). Other cords such as a 230VAC, 3-pronged cord can also be provided at request. The Enhanced Remote Panel power specifications are: 85 to 265VAC, 47 to 63 Hz, Single Phase, 25 VA maximum.

End of Option B, Enhanced Remote Option