

Stack Check System Manual

MSC Version

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Section 1 Warranty

Seller expressly warrants to Buyer (a) that the equipment will comply with the description set forth herein; (b) that the components and parts fabricated by Seller will be free from detrimental defects in workmanship and materials.

If it appears within one year from date of shipment by Seller that the equipment does not meet these express warranties and Buyer gives Seller prompt and reasonable notice, Seller shall, at its option, either repair or replace at its expense, F.O.B. Seller's works, but not dismantle or reinstall, the defective parts provided, upon request such parts are shipped freight prepaid to Seller's works.

These warranties shall not apply if equipment is subjected to other than normal and proper storage, handling, installation, operation and maintenance or to unauthorized repairs or alterations. Equipment, components and accessories made by other manufacturers are warranted only to the extent of the original manufacturer's warranties to Seller. The foregoing warranty obligation of the seller shall constitute the sole and exclusive remedy of the buyer and the sole liability of the seller, except as set forth herein and except as to the title it is expressly agreed (a) that there is no warranty of merchantability of any other warranty, express, implied or statutory, nor any affirmation of fact or promises by Seller with respect to the equipment or parts or otherwise which extend beyond the specifications mutually agreed upon in writing by Seller and Buyer, and (b) that the Buyer acknowledges that it is purchasing the equipment solely on the basis of the commitments of Seller expressly set forth herein, in no event shall Seller be liable for special, indirect, or consequential damages including, without limitation, anticipated profits.

Contact Information

During installation, operation, or for any reason you need to contact us, there are several methods.

Robert H. Wager Co., Inc.
570 Montroyal Road
Rural Hall, NC 27045

Phone : 336-969-6909
Fax : 336-969-6375
Email : info@wagerusa.com

General Description

The WAGER Stack Check system provides an accurate means of detecting and measuring the opacity of smoke being emitted from an onboard stack. The measurement of the opacity of the exhaust gas is accomplished by passing a beam of light thought the exhaust flow. The system knows how much light is being emitted, and how much light is received. The difference is the amount of light that is absorbed and is displayed in percent (%) opacity, with 0% being no blockage of light and 100% being total blockage of light.

The electronic control unit operates using 120vac and may be located at any convenient distance up to several hundred feet from the optical heads.

The system consists of a Transmitter unit, which emits the beam of light; a Receiving unit, which receives the light; a Control unit, which contains the display meter; a main cable, and a sensor cable.

The control unit has a single set point relay to activate an alarm or horn and a retransmission 4 – 20 ma for remote signal monitoring.

Also, the control unit has an internal switch to operate the light unit of your previous installation visual smoke system.

Component Description

Light Unit - P/N 197-0029

The light unit consists of three anodized aluminum castings, the first of which is the threaded lamp housing connection directly mates to the 4" pipe penetration nipple extending from the stack.

This casting is equipped with two quick release latches which hold the main housing in place and also has ports for purge air.

The main housing contains the optical lens, light source, LED switch board, and the main transmitter logic board. There are various physical adjustment points and several electronic test points contained in this housing. The front of the housing contains a Pyrex window, which seals the lens and electronics from the exhaust gases.

The LED switch board contains a red LED, green LED, a slide switch, and a push button switch. These components are electrically equivalent to the LED / switches that are located in the control unit. This duplication of the LED / switches is best used during initial calibration of the unit and enables the installer to operate the system and observe the LED from either the control unit location or the transmitter location.

The third casting is a weather resistant cover. This cover is mounted using the 6 hole bolt pattern and is removed for the beam adjustment procedure.

Receiving Unit - P/N 197-0028

The receiving unit also consists of three castings, i.e. connection, housing and cover.

StackCheck

The main housing contains the optical lens, light detector, and the main receiver logic board. There are various physical adjustment points and several electronic test points contained in this housing. The front of the housing contains a Pyrex window, which seals the lens and electronics from the exhaust gases.

The third casting is a weather resistant cover. This cover is mounted using the 6 hole bolt pattern and is removed for the beam adjustment procedure.

Control Unit - P/N 197-0030

The Stack Check control unit is a steel powder-coated enclosure. It contains all of the electronics and controls necessary to operate and calibrate the system and operates off 120vac.

The multi-color display is a Veeder-Root Brand S628 B DC Volts/Amps process meter and has a single set point relay. Green characters are shown when the reading is below the set point and red characters are shown when the reading is above the set point.

Three outputs are supplied with the unit, Alarm output (Normally Open, Common, and Normally Closed Contacts), a 4-20 mA retransmission output, and Lamp Connections (For control of existing visual lamp unit).

Main Cable – P/N 197-0025

This cable provides connection between the control unit and the transmitter and is a shielded heat resistant cable with standard length at 250 ft.

Sensor Cable – P/N 197-0026

This cable provides connection between the transmitter and receiver and is a shielded heat resistant cable with standard length at 50 ft.

Damper Units - P/N 110-A

Damper units may be provided with any smoke opacity system to allow the operator to have a means of closing off the 4" pipe nipples located in the stack during maintenance of the units mounted there.

These Damper units may be used on positive ducts to prevent the furnace gases from escaping or on negative ducts to prevent an excessive inrush of ambient air during repair or replacement of other units.

Damper units are individual, independent castings, which are located on the 4" nipples between the stack and the transmitter and receiving units.

The dampers have a manually operated gate, which when closed provides a temporary seal against gas or air leakage during maintenance operations.

The units are so designed that the damper gate is locked in either the open or closed position and will not change even if subjected to shock or vibration.

Quick Reference Data

Manufacturer:	Robert H. Wager Co., Inc. 570 Montroyal Road Rural Hall, NC 27045
Type:	Smoke Opacity Meter
Model	Stack Check
Power Requirements	110VAC – 60Hz – 2 Amp

Performance Specifications:

Range	0 - 100% Opacity
Warm-up Time	10 seconds
Meter Response time	<2.0 seconds, 0 – 100% opacity
Resolution	2% from 0 - 100% Opacity
Linearity	2% from 0 - 100% Opacity
Zero Stability (Drift)	< 1% in 24 hours
Operating Distance	6' (minimum) 30' (maximum)

Electrical Specifications

Light Source	Light emitting diode, Red Ga AL As, 660 nm
Light Detector	Silicon Photo Diode
Connecting Cables	Length as desired
Meter	Digital DC Volts/Amps Meter
Meter Accuracy	2% Full Scale

Cable Specifications

Main Cable	8 conductor shielded rubber covered 20 AWG Belden #8418
Sensor Cable	6 conductor shielded rubber covered 20 AWG Belden #8426

Section 2 INSTALLATION OF 4" PIPE NIPPLES

Note: **4" standard schedule 40 pipe nipples must be installed by customer in appropriate location in duct or stack.**

Site Selection

The best location for the stack or duct mounted units is in a straight section of vertical pipe with the pipe nipple being parallel to the ground.

The location should be chosen for easy access, to assure regular maintenance. Sufficient gratings or ladders are recommended, to make this task as easy as possible.

In choosing a site, the following should be considered:

- Monitoring required
- Straightness of gas path
- Accessibility to units
- Negative or positive pressure
- Restrictions of space

Note: The mounting of the 4" IPS pipe nipples in the duct or stack is the most important part of the installation of the system.

Misalignment of these nipples will result in no signal from the LED.

The surest way to get proper alignment is to start with a single piece of 4", schedule 40 pipe, long enough to go across the duct or stack in question and to protrude on either side approximately 6".

Installation should be made as follows:

- Cut 4" IPS Schedule 40 steel pipe to proper overall length.
- Thread both ends of pipe with 4" pipe thread.
- Burn or cut holes to accommodate this pipe on opposite sides of duct or stack so that pipe will be level and perpendicular to gas flow. A location in the approximate center of the duct should be chosen and both holes should be equidistant from the top or bottom of the duct.
- Insert pipe through holes across duct or stack.
- Seal weld pipe to duct, both inside and outside if possible. First tacking the pipe in several places around the circumference.
- Burn or cut out center section of pipe inside duct or stack 2" from the inner walls on either side.

Note: Make cut as square as possible.

Installation Of Stack Units — Positive Pressure

With nipples properly installed, proceed with the installation of the stack units as follows:

Damper Unit - P/N 110-A - Optional

If this unit is supplied, it should be mounted first, directly to the 4" pipe nipples protruding from both sides of the duct or stack. If the stack pressure is positive, the dampers should be mounted with the handle side toward the duct, so that pressure will tend to push the damper gate toward its seat, when the gate is in the closed position. A lock nut (P/N 45 supplied with unit) should be installed on the nipple first.

Position the damper units so that the housing is at top to prevent soot from collecting in this area. Tighten lock nut. Check operation of handle to be sure that there is sufficient clearance to open and close gate. Thread on additional 6" length of threaded pipe to each side to mate to the housing connections.

Light Unit - P/N 197-0029

Thread the transmitter unit onto the threaded pipe nipple. Note the orientation of the connector. During maintenance if the transmitter is removed, ensure that it is re-installed in the same orientation. If not, the beam adjustment will be incorrect. Use the 4" lock nut to fasten securely the transmitter into position.

Receiving Unit - P/N 197-0028

Thread the receiver unit onto the threaded pipe nipple. Note the orientation of the connector. During maintenance if the receiver is removed, ensure that it is re-installed in the same orientation. If not, the beam adjustment will be incorrect. Use the 4" lock nut to fasten securely the receiver into position.

Purge Air Piping - Compressed Air

The use of purge air on a positive pressure installation is imperative to the successful operation of any smoke opacity monitoring system. The compressed air piping for this system should be run as follows:

Note: The compressed air supply should be taken from the plant air system. There is no need to use instrument air.

Install a 3/4" airline from the plant air source to a location midway between the light and receiving units mounted on the stack.

Install an air filter with a minimum capacity of 60 cubic foot per minute at 80 - 100 psi on the end of this line.

Install a 3/4 x 1/2 x 1/2 tee in outlet side of filter and run 1/2" OD copper tubing to vicinity of light and receiving units.

Remove one of the 3/8" pipe plugs from each of the aspirating flange assemblies.

Install a 3/8 pipe x 1/2" tubing fitting in the flanges.

In a location convenient to the operator, install two assemblies consisting of a 0-60 psi gauge mounted in a brass tee and a 3/8" globe valve.

Run 1/2" OD tubing from the light and receiving units to the gauge tees.

Connect the 1/2" OD tubing from the filter to the inlet side of the 3/8" globe valve.

Before boiler comes on the line, turn on main air supply and adjust globe valves until gauges indicate a pressure of 2-3 psi.

Note: If it is possible to do so, run ID and FD fans to represent maximum boiler load conditions before light off. With a manometer, check the stack pressure.

To determine the amount of compressed air pressure required to counter balance the duct pressure, remove either the light or receiver unit casting from its connection housing; positive pressure will blow out the pipe. Slowly open the compressed air globe valve on the aspirating flange until you feel suction instead of pressure at the end of the open pipe. This is the amount needed to overcome the duct pressure.

For example, pressure of 7 - 10 psi is required to overcome 1" of water pressure in the duct when working with an open pipe.

With the light and receiving units tightly in place, a pressure of 1 - 2 psi is sufficient to keep the dirt away from the lenses. However, over a period of months some dust will tend to settle in the 4" pipe nipples. These nipples should be periodically blown out with full air pressure.

Once the constant air pressure required to keep the lenses clean has been established, a regulator can be substituted for the globe valve. However, a by-pass around the regulator should be maintained so that full pressure can be utilized to clean out the pipes.

Installation of Cables

After choosing a desirable location for the control unit, connect the sensor cable into the transmitter and receiving units and connect the main cable into the transmitter and the terminal strip in the control unit and connect power to the system.

The interconnecting cables are fitted with MIL Spec. connectors. The insert arrangement of pins and socket types cannot be connected improperly.

Since connecting cables are rubber-covered, be sure that they are properly tied down so that they cannot touch the hot stack or be subjected to undo strain so that they could be pulled out of the connectors.

The system is now ready for calibration and operation.

Section 3 CALIBRATION AND OPERATION

Initial Calibration

- Step 1* Remove the 6 bolts / nuts and remove the cover from both the transmitter and receiving units and switch the LED slide switch to the on position that is located in the transmitter.
- Ensure that the system is in clear stack conditions. If there is any smoke present during calibration, the system will see it, think the smoke is the normal dust in the air and call it zero. This will cause you to have inaccurate measurement
- Step 2* Power the system on using the on switch located in the control unit. Both green LED in the control unit and led switch board should be flashing and the transmitter should illuminate solid.
- Step 3* Unlatch the receiver unit from the housing connection, and place a white sheet of paper over the hole. A full moon light pattern should be formed on the paper. If you have a crescent moon light pattern, then the transmitter is not sending the light beam straight across the exhaust stack. Adjust the 3 beam adjustment screws located in the transmitter until a full moon light pattern is formed. Then re-latch the receiver onto the housing connection.
- Step 4* Place a voltmeter on TP2 and TP1 of the receiving unit and adjust the 3 beam adjustment screws on the receiver to increase the DC voltage reading for the highest value. This will cause the receiver to look directly into the beam.
- Step 5* Move voltmeter to TP7 and TP5 on the transmitter and unit and adjust the 3 beam adjustment screws on the transmitter to increase the DC voltage reading for the highest value. This will cause the transmitter to shoot the beam directly into the receiver.
- Step 6* Repeat steps 4 – 5 until maximum values have been achieved on both sets of test points. NOTE : TP7 / TP5 are electrically equivalent to TP2 / TP1. This gives the installer multiple test points to measure the same signal.

Note: If the value of the test points exceed 4 volts, this means the optics are too close together and the light beam needs to be partially obstructed to reduce the voltage level.

- Step 7* Once the optimal voltage has been achieved, press the calibrate button in either the control unit or on the led switch board. The green led on the control unit and the green led on the switch board should begin to flash.

Step 8 Now the unit is sampling opacity and will continue to sample until the system. Finally, reattach the housing covers using the 6 bolts.

Note: Calibration should take approximately 5 seconds.

Step 9 Power the system off.

Step 10 Power the system on, wait 5 seconds, and then press the CALIBRATE button.

Step 11 The system should again be in the operation mode and should be displaying 0.0 on the display.

- Note: If at any time you have any question or problems, please contact customer service at 800-562-7024.

Operation

There are no particular steps to follow for operation. Once the system has been calibrated, the system will self-monitor the stack, running unattended with continuous live readings on the display. The retransmission of the signal is also continuous with live data. Please note that the lenses must be kept clean, to assure accuracy.

The 0% calibration should be checked whenever a clear stack is available. The 100% calibration should not vary, but can be checked at any time by blocking the light path. The 100 % check can be used by closing one of the damper units.

Note: The amount of purge air needed to keep the lenses clean is dependent on stack pressure and will be different for each installation.

Theory Of Operation

The Stack Check is a solid-state microprocessor-based opacity system, with dual location on-off switches and indicators. This gives the installer / operator local and remote locations to operate the system. The process meter with display contains two relays with set points. Normally open / closed terminals are present and additional 4-20 m amp retransmission is available.

Section 4 PARTS LIST

Parts List

Control Unit –P/N 197-0000-MSC

Process Meter with Display	643-0026
Inner Panel Assembly	197-0022
Amplifier Board Assembly	197-0021
Power Supply	197-0009
Fuse Holder	636-0001
Fuse 1A	635-0001
Fuse 250mA	635-0004
Error Indicator (Red)	197-0006
Calibrate Indicator (Green)	197-0007
Power Switch	676-0003
Lamp Switch	676-0003
Calibrate Switch	676-0009
Relay	197-0040
Charger	197-0043

Light Unit - P/N 197-0029

Transmitter PCB Assembly w Insulator	197-0023
Led/Switch Assembly	197-0044
Power Switch	197-0034
Calibrate Switch	197-0035
Error Indicator (Red)	197-0032
Calibrate Indicator (Green)	197-0033
Main Receptacle (8 pin)	627-0002
Sensor Receptacle (6 pin)	627-0049
Vision Glass	36-A
Optical Lens	543-A0001

StackCheck

Receiving Unit - P/N 197-0028

Receiver PCB Assembly w Insulator	197-0024
Sensor Receptacle (6 pin)	627-0049
Vision Glass	36-A
Optical Lens	543-A0001

Cables (Custom Lengths)

Main Cable Assembly	197-0025
Sensor Cable Assembly	197-0026

Damper Unit

Damper Unit	110-A
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Section 5 Normal System Operation and Use

Power Up and Calibration – Daily Usage

Power Up and Calibration for daily usage should only be performed when the lenses are clean and clear of any obstructions. It is recommended that this process be done when the boiler is not in operation.

- Step 1* Power the control unit on, by opening the control cabinet door, and toggling the POWER Switch to the ON position.

The Calibration Lamp on the control cabinet door should flash, indicating a calibration is required.

- Step 2* Toggle and hold the CALIBRATE Switch for 2 seconds, then release.

The Calibration Lamp on the control cabinet door should be ON, and should remain ON, for up to 30 seconds. The Calibration Lamp will finally turn OFF and the system will continue to acquiring data and displaying opacity on the digital process meter.

Process Meter Usage

The Stack Check system uses a Veederoor Digital Process meter to perform several functions. The main function of the meter is to display the measured opacity (0 to 100%). The meter also may be connected to an audible or visual signaling device in order to provide an “Alarm” in the event the opacity exceeds a user configurable set-point. If the opacity reading of the exhaust exceeds the set-point, this will trip the relay and associated NO/NC contacts. The process meter is pre-programmed at the factory. If you need to change any of the setting, then please contacts tech support.

This set-point is factory configured for 40%

The meter is also configured to display measurements in GREEN when below this set-point, and RED when greater than or equal to the set-point.

How to Change the set point for Alarm 1

Step 1 Press the PGM button on the process meter, until AL 1 is displayed.

Step 2 Press the > button once to view the current set-point.

Example 40.00 (The most significant digit will flash, indicating that it may be changed).

Step 3 Press the > button to select the digit you wish to change.

Step 4 Press the V button to decrement the digit until the desired value is shown.

Step 5 Press the PGM button twice to enter the new set-point.

The display will show AL 1, and will revert to the opacity display within 3 seconds.

Note: Some systems depending on usage, may require this process to be repeated for AL 2. It is recommended that the same set-point value be used for both AL 1, and AL 2.

Routine Lens Maintenance

The Stack Check system accuracy is completely dependent on the cleanliness of the protective lenses of the light and receiving units on the exhaust stack. A positive pressured exhaust stack may require the use of purge air routed to the transmitter and receiver housings in order to increase the duration of run time between manual cleanings.

A few items which may indicate a manual cleaning is required are as follows.

Gradual increase in opacity display over a relatively short period of time.

Consistently high opacity display for a long duration of time.

ERROR indication upon power-up and calibration sequence.

Although not a requirement, damper units are detailed in the cleaning steps listed below.

StackCheck

Step 1 Close the damper unit located between the lens assembly and the exhaust stack.

(This will prevent exhaust gases from escaping through the lens sight tube.)

Step 2 Remove the lens assembly, using the two quick release latches.

Step 3 Clean the protective lens with a soft cloth and window cleaning solution if needed.

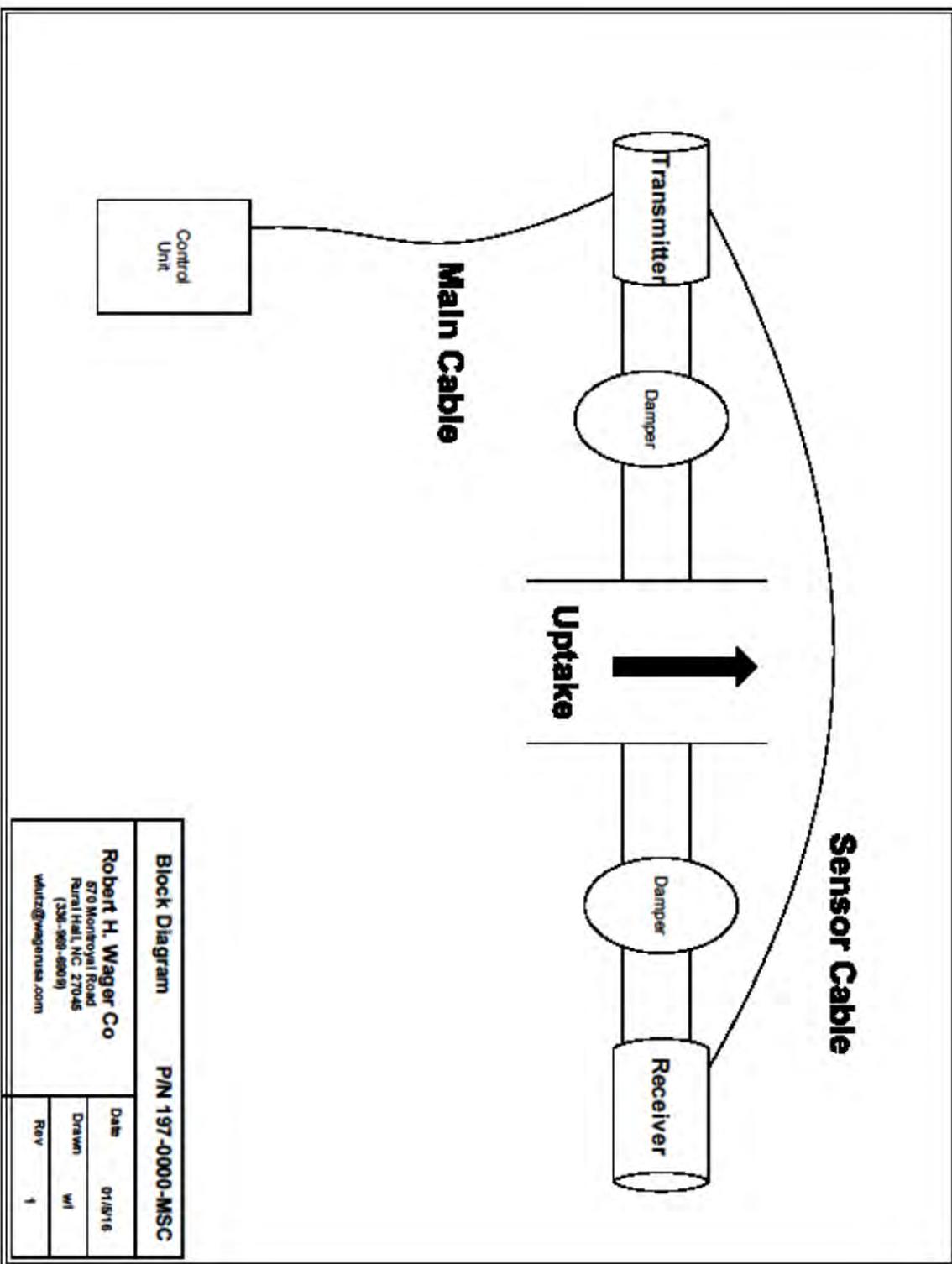
Step 4 Reattach the lens assembly in the same orientation that it was removed.

Step 5 Open the damper unit.

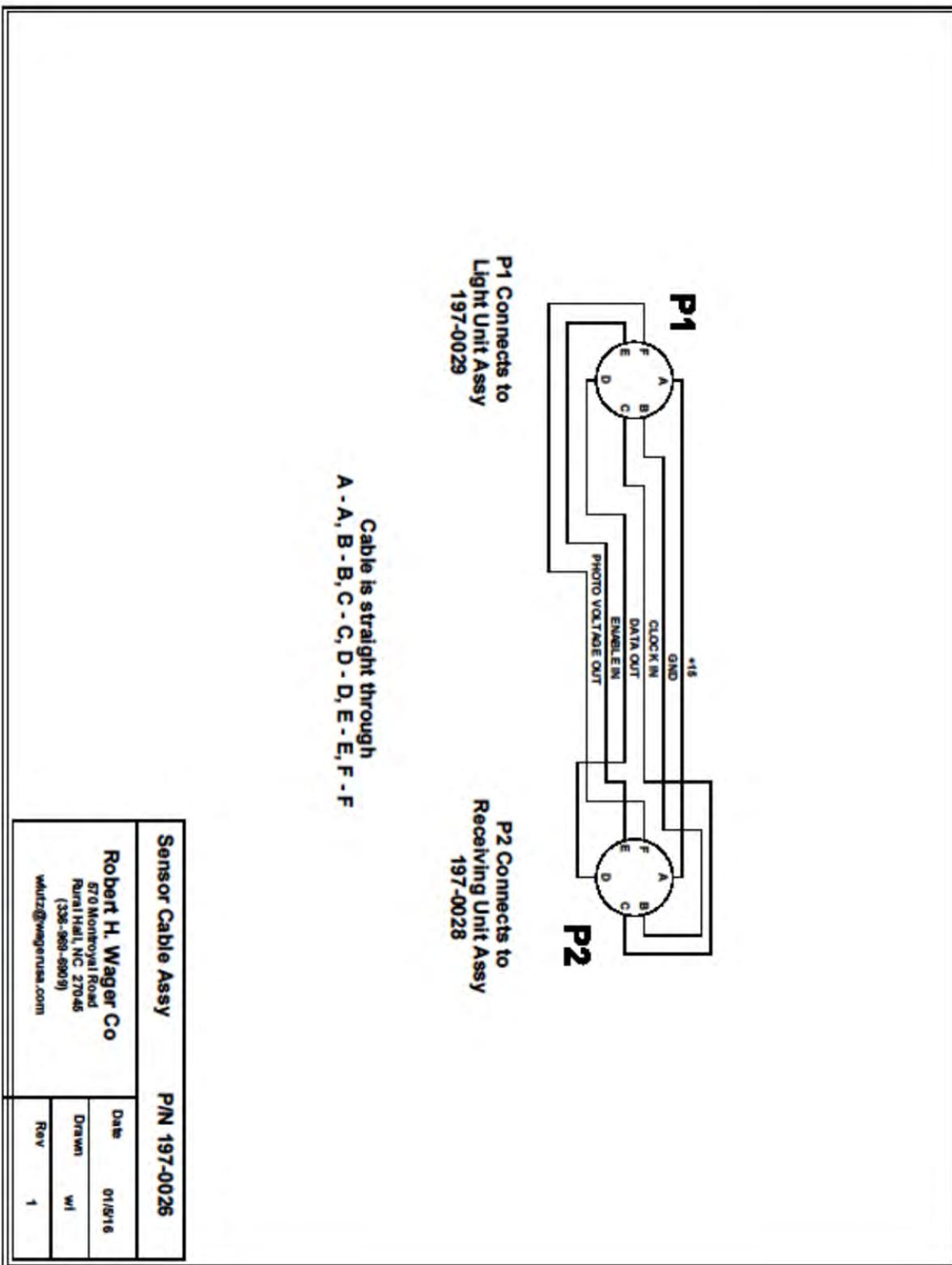
Step 6 Repeat steps 1 through 5 for the lens assembly on the opposite side of the exhaust stack.

When manually cleaning the lenses, it may also be convenient to inspect the air purge supply, to assure the air flow is sufficient. If lens cleaning is frequent, an increase in the source air provided may be required.

StackCheck

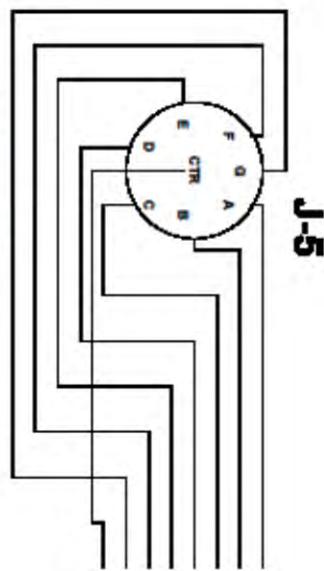


StackCheck



StackCheck

J-5 connects to
Light Unit Assy

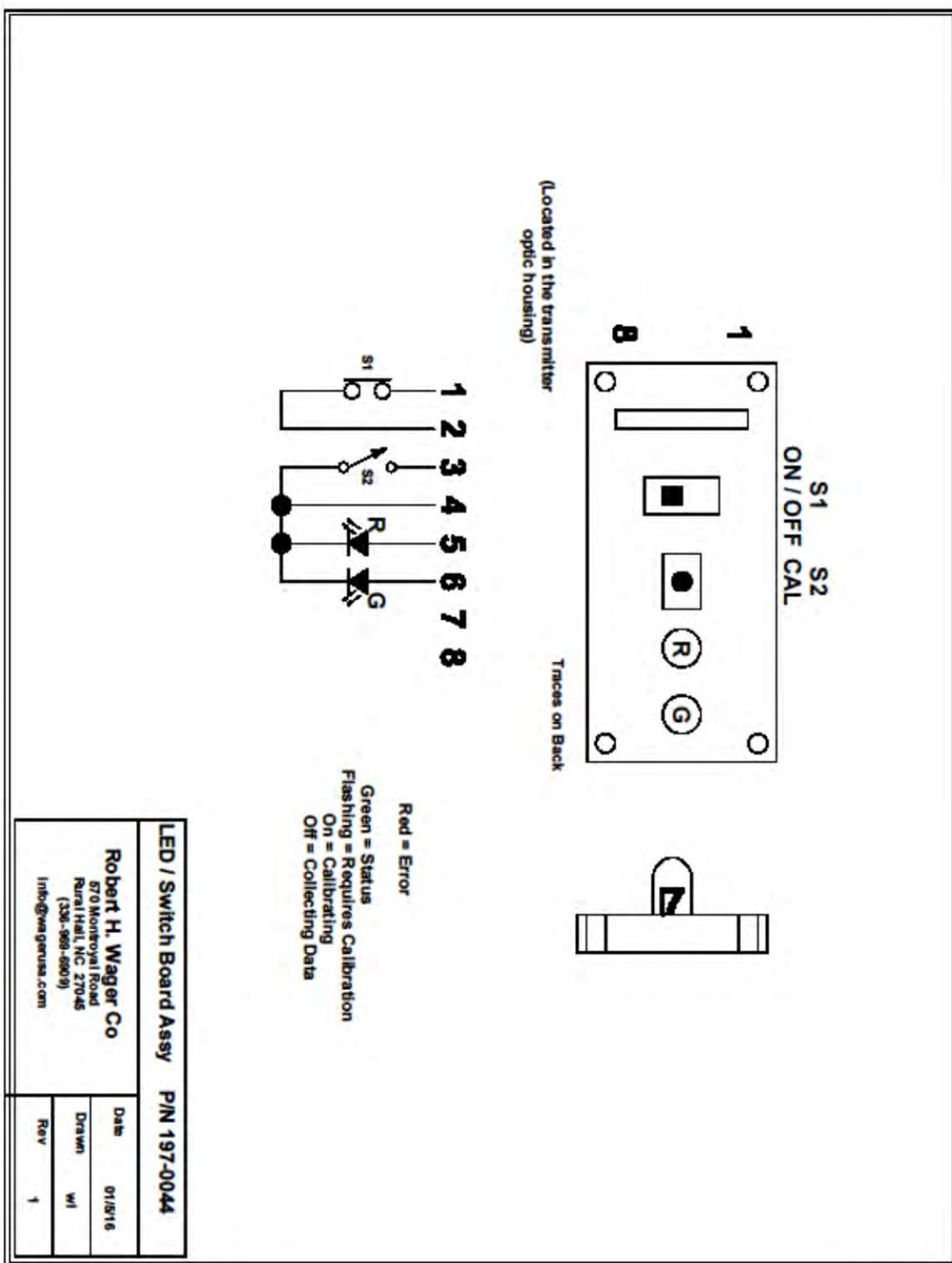


Military
Version

RED	TS-6	J3-1
YELLOW	TS-7	J3-2
ORANGE	TS-8	J3-3
BLACK	TS-9	J3-4
WHITE	TS-10	J3-5
BROWN	TS-11	J3-6
GREEN	TS-12	J3-7
BLUE	TS-13	J3-8

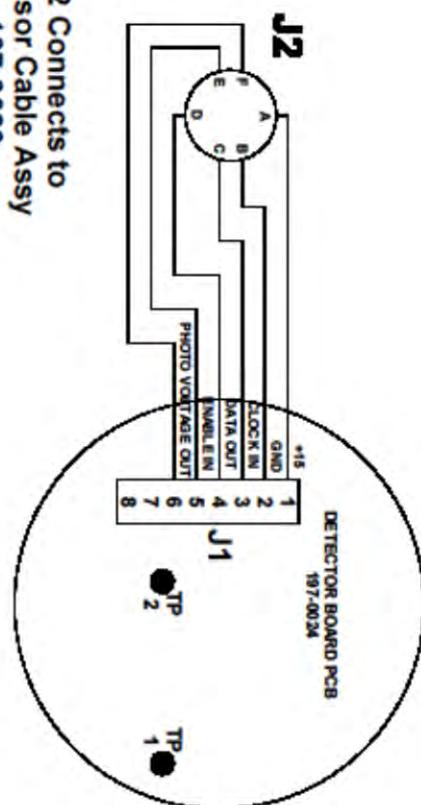
Main Cable Assy	P/N 197-0025
Robert H. Wager Co 570 Montroyal Road Rural Hall, NC 27045 (336-666-6800) Info@wagerusa.com	Date 01/01/16 Drawn WI Rev 1

StackCheck

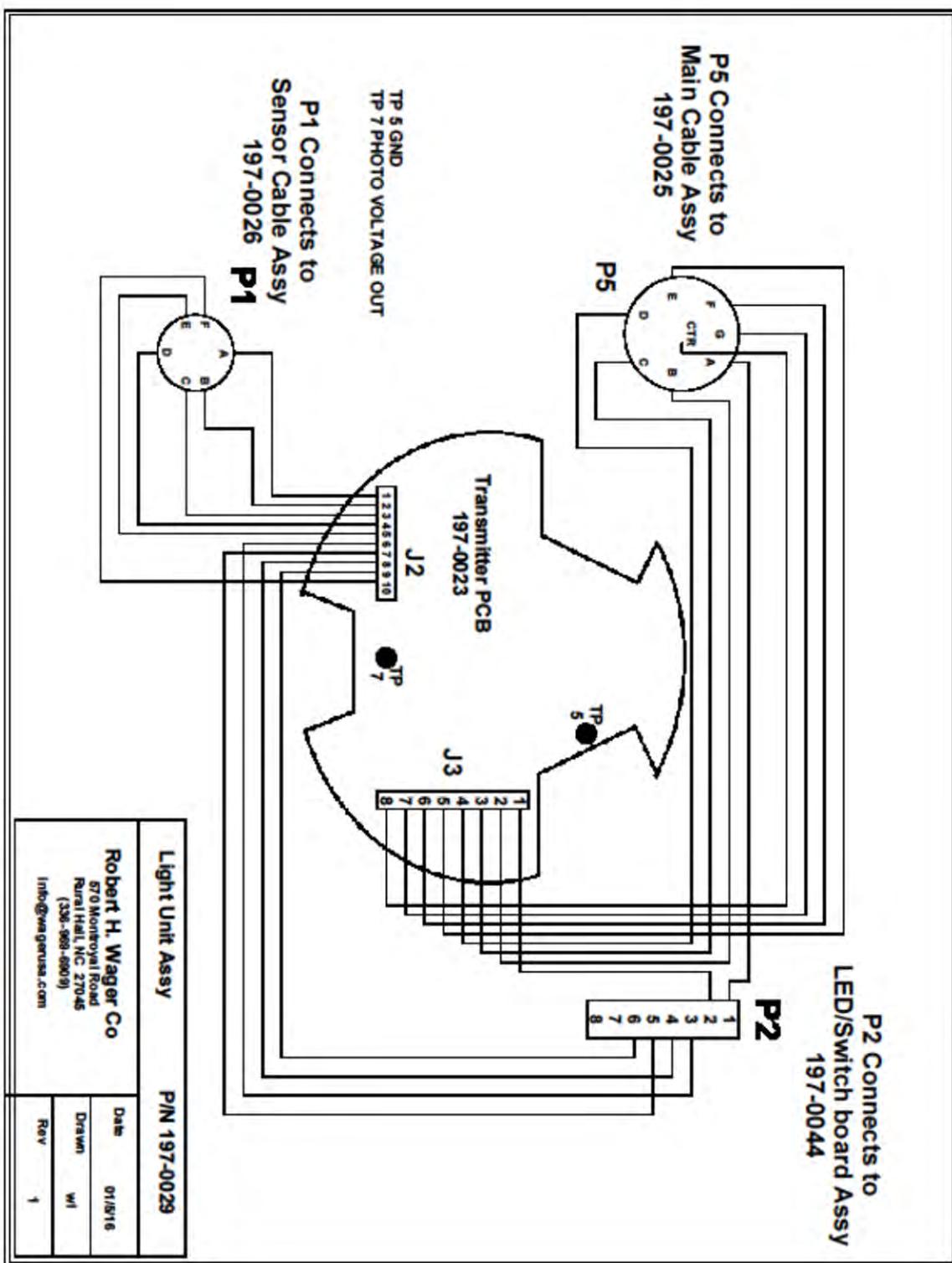


J2 Connects to
Sensor Cable Assy
197-0026

TP1 GND
TP2 PHOTO VOLTAGE OUT



Receiving Unit Assy	P/N 197-0028
Robert H. Wager Co 570 Montroyal Road Rural Hall, NC 27045 (336-661-6800) Info@wagergroup.com	Date 01/08/16
	Drawn WI
	Rev 1



Door Harness (MILITARY)

Plug 1

13	14	15	16	17	18	19	20	21
12					22			
11					23			
10					24			
9	8	7	6	5	4	3	2	1

BROWN	1	AC IN
3	2	AC IN
4	BLUE	Signal In +
5	WHITE / BROWN	Signal In -
6	WHITE / ORANGE	Relay 1 NO
7	PINK	Relay 1 C
8	GRAY	
9	WHITE / YELLOW	
10	YELLOW	
11	WHITE	
12	WHITE	Output +
13	VOLET	Output -
14	WHITE / VOLET	
15	GREEN	
16		Cal
17		Error
18		GND

STATUS LAMP G

ERROR LAMP R

Status Lamp

Flashing - Requires Calibration

On - Calibrating

OFF - Collecting Data

Output = 4 - 20 ma DC
NO = Normally Open
NC = Normally Closed
C = Common

Door Harness - MSC	
Robert H. Wager Co	Date 01/16
570 Montroyal Road	
Rural Hall, NC 27045	
(336-860-6809)	
Info@wagergroup.com	Drawn w/
	Rev 1

