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CAUTION:

When installing the OOD™ sensor in a pipeline containing petroleum products, petro-chemicals, waste waters with the presence of pressure & temperature, and high-pressure steam refer to the Pipeline Operators’ “Health, Safety and Environmental Policy Procedures” to ensure safe installation.

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1. INTRODUCTION

AVAILABLE MODELS and MOUNTING OPTIONS

The ideal solution for oil-in-water detection, the KAM OOD Optical Oil Detector offers unmatched simplicity and pin-point accuracy in an in-line meter. The OOD allows operators to monitor produced water, leak detection and wastewater streams for the presence of hydrocarbons in a variety of applications, providing continuous, real-time data with a variable range up to 0-5000 ppm. Fiber optics within the optical probe respond to the fluorescence and absorption in the fluid to detect the presence and quantity of hydrocarbons in water. The combined data is translated as voltage on a 4-20 mA output or RS485.

The simplicity of design and quality of engineering employed in the KAM® OOD™ mean there are no moving parts. Using long-lasting LED light sources ensures long-term, stable performance with limited maintenance and power requirements. In addition, locating the electronics within an explosion-proof enclosure directly on the atmospheric end of the optical probe creates a complete and compact unit with maximum installation flexibility.

Measurement is completely automatic without the need for operator intervention or supervision, and the output signal can be sent to the SCADA, PLC’s, or to a Central Control Room for logging or display on chart recorders or monitors.
## 2. SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Range:</td>
<td>0-50*</td>
</tr>
<tr>
<td>Maximum Range:</td>
<td>0-5000 ppm*</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>0-100 ppm and higher ± 1% of full range</td>
</tr>
<tr>
<td></td>
<td>Below 0-100 ppm, minimum resolution of 1 ppm</td>
</tr>
<tr>
<td>Material:</td>
<td>Wetted parts–316 stainless steel, other materials available</td>
</tr>
<tr>
<td>Power:</td>
<td>12–24 VDC 15 Watts max, 110/220 AC available with adapter</td>
</tr>
<tr>
<td>Output:</td>
<td>4-20 mA</td>
</tr>
<tr>
<td></td>
<td>RS 485</td>
</tr>
<tr>
<td></td>
<td>(2) high-current outputs</td>
</tr>
<tr>
<td>Fluid temperature:</td>
<td>-40° to 160°F (-40° to 71°C)</td>
</tr>
<tr>
<td>Electronics temp.:</td>
<td>-40° to 160°F (-40° to 71°C)</td>
</tr>
<tr>
<td>Pressure ratings:</td>
<td>ANSI 150, 300, 600, 900</td>
</tr>
<tr>
<td></td>
<td>Threaded models (3/4&quot;, 1&quot; MNPT) designed maximum working pressure of 3000 psig</td>
</tr>
<tr>
<td>Mounting:</td>
<td>2&quot; MNPT seal housing</td>
</tr>
<tr>
<td></td>
<td>2&quot;, 3&quot;, or 4&quot; flanged seal housing</td>
</tr>
<tr>
<td></td>
<td>3/4&quot;, 1&quot; MNPT for analyzer loops</td>
</tr>
<tr>
<td>EX enclosure:</td>
<td>4&quot; x 6&quot; x 4&quot; (102 mm x 152 mm x 102 mm)</td>
</tr>
<tr>
<td>Protection:</td>
<td>NEMA 4X</td>
</tr>
<tr>
<td>Shaft length:</td>
<td>12&quot; to 60&quot;</td>
</tr>
<tr>
<td>Pipe size:</td>
<td>3/4&quot; to 48&quot;</td>
</tr>
<tr>
<td>Weight:</td>
<td>from 13 lbs. (5.9 kg)</td>
</tr>
</tbody>
</table>

* Range and accuracy are hydrocarbon dependant. Some specified ranges and accuracies may require lab samples for testing in order to determine allowable range and accuracy.
3. INSTALLATION

The KAM OOD must be installed with a minimum of 6” distance between the sensor tip and the opposing internal pipe wall. Fig. 3-1.

In applications where the main pipeline is less that 6”, the OOD can be installed on the run of a “T” or analyzer loop. Fig. 3-2.
INSTALLATION CONTINUED

PRIOR TO INSTALLATION

Remove all the protective packaging materials, and ensure that the OOD™ sensor was not damaged during transit.

PLEASE NOTE: The KAM OOD Optical Oil Detector is factory calibrated to the end-user specified range. It does not require further field calibration.

MAIN LINE INSTALLATION

The KAM® OOD™ sensor should be installed according to FIG. 3-3. KAM CONTROLS recommends installing the OOD™ sensor at a 2 or 10 o’clock position to ensure the tip of the probe remains in the fluid. A full opening ball valve is used to isolate the OOD™ sensor from the pipeline during installation or removal. The seal housing of the OOD™ sensor allows the optical probe to be inserted and removed from the pipe under pressure and flow conditions. It is the user’s responsibility to ensure that the OOD™ sensor is placed at the most representative point within the flow profile. The OOD™ sensor should be inserted so that the tip of the probe is located 1/4” above the inner wall of the pipeline. This ensures that the probe is not damaged when pigging the pipeline.

NOTE 1: a KAM SMP Static Mixing Plate should be installed prior to the OOD to ensure homogeneity

NOTE 2: If line pressure exceeds 100 psi, use a KAM® IT Insertion Tool when installing/removing the KAM® OOD™ sensor.

Prior to mounting the OOD™ sensor on the Full-opening Ball Valve, you must determine the insertion length required.

1. Lay the OOD™ sensor on the ground or a table.

2. Loosen Socket Cap Screws on the locking collar. This will allow the OOD™ shaft to slide through the seal housing.

3. Push the OOD™ shaft though the seal housing until the OOD™ probe sits flush or slightly inside of the end of the seal housing or seal housing flange. FIG. 3-4 and 3-5. (Remove red protection cap on the tip of the probe if it has not been removed.)

4. Place a mark with a sharpie or a permanent marker on the shaft at the edge of the locking collar. (Do not use anything sharp to mark the shaft as this will create grooves that will damage the O-rings in the seal housing.)
5. Pull shaft back until the probe is all the way in the seal housing and tighten the socket cap screws on the locking collar. This will prevent the OOD™ shaft from sliding and the probe from getting damaged during mounting.

6. Measure the distance (D1) from the outside diameter of main pipe to the end of the connection where the OOD™ sensor is going to be installed. FIG. 3-6.

7. Calculate the insertion distance for **Flanged Seal Housing** (If you have a MNPT Seal Housing, proceed to step 9):

   Total Insertion Distance (TID) = D1 + Pipe Wall Thickness + Seal Thickness - 1/4"

   Example for D1 = 19", Pipe WT=3/8", and Seal Thickness is 1/8"

   TID = 19 + 3/8 + 1/8 - 1/4 or TID = 19 + .375 + .125 - .25

   TID = 19 1/4" or 19.25"

8. Use the calculated TID and mark a second line on the shaft, measuring from first mark. FIG. 3-7.

9. Bolt or screw the OOD™ sensor to the valve or designated installation location. (KAM CONTROLS recommends using thread sealant and not Teflon tape for the threaded OOD™). Skip to Step 12 (OOD with Flanged Seal Housing only).
10. Calculate the Insertion distance for 2” MNPT Seal Housing:

TID cannot be calculated until the Seal Housing is screwed into place. If you have not already done so, please screw your OOD™ sensor into place now.

You must then measure the Threaded Depth (TD) into the Valve or connection in order to calculate TID. You can do this by measuring the distance from the edge of the Valve or female connection to the top of the Seal Housing body and subtracting that distance from 5.25”. FIG. 3-8.

For example:

If the measured distance from the top of the valve to the top of the seal housing body is 4.75”, you would calculate the threaded depth (TD) by subtracting 4.65” from 5.25”. (5.25 – 4.65=0.6) In this case the threaded depth TD would be .6”.

You are now ready to calculate TID.

\[
TID = (D1) + (\text{Pipe Wall Thickness}) - (TD) - (0.25"
\]

Example for D1=19”, Pipe WT=3/8”, and TD=.6”
TID=(19)+(.375)-(.6)-(.25)
TID=18.525”

11. Use the calculated TID and mark a second line on the shaft, measuring from first mark. FIG. 3-9.
INSTALLATION CONTINUED

12. If you have an OOD™ with a Flanged Seal Housing, you may now attach it to the valve on the pipeline.

13. Slowly open Full-opening Ball Valve and check for leaks.


15. Push the OOD™ in until the Second Mark is at the top edge of the Locking Collar. FIG. 3-10.

16. Re-tighten the Socket Cap Screws.

17. Tighten the Hex Nuts on the top of the Locking Collar one half turn. These nuts should never be over tightened. Their major function is to apply light pressure on the chevron packing to ensure a seal between the seal housing body and the insertion shaft.

REMOVING THE OOD™ SENSOR

1. To remove the OOD™ sensor, first disconnect all electrical connections to the OOD™ enclosure.

2. Make sure that the line pressure is below 100 psi. Then, slowly and with caution loosen the Socket Cap Screws on the Lock Down Collar.

   NOTE: Once the Socket Cap Screws have been loosened, the OOD™ shaft may push out from the line. If pressure in the line is above 100 psi, it may do so with enough force to cause bodily injury or damage to the instrument.

3. Slide the OOD™ sensor upward until it stops and the probe rests inside the seal housing. FIG. 3-11.

4. Next, close the Full-opening Ball Valve tightly. The OOD™ sensor may now be unbolted from the system.

   NOTE: If line pressure exceeds 100 psi, use a KAM® IT Insertion Tool when installing/removing the KAM® OOD™ sensor.
INSTALLATION CONTINUED

ANALYZER LOOP INSTALLATION

KAM CONTROLS recommends this installation for 3/4" & 1" MNPT OOD™ sensors.

We recommend using thread sealant and not teflon tape for the OOD™ sensor threads.

CAUTION: DO NOT USE THE ENCLOSURE TO TIGHTEN OR LOOSEN THE OOD. THIS CAN CAUSE THE PROBE TO COME UNDONE AND THE FIBER CABLE TO BREAK. Please refer to “Do’s and Don’ts” on pages 11-12.

KAM 3/4" and 1" MNPT OOD™ sensors should be installed according to FIG. 3-12. The OOD™ sensor should be installed in an analyzer loop in such a fashion that the flow sweeps across the probe lens rather than rushing directly at the probe. The reason for this is to:

1) obtain a credible reading of the product pipeline interface
2) keep the lens of the probe clean and abrasion free. If the OOD™ is installed with the product rushing directly at the probe, particles in the pipeline can scratch the lens causing abrasions and resulting in a non-credible reading.

You do not need to measure for insertion distance on the fast loop models.

FIG. 3-12
DO NOT install the fast loop OOD™ sensor in a straight portion of pipe. It needs to be mounted off the bend opposite the pump.

DO NOT install the OOD™ sensor with the lens facing directly into the flow. If the product has particulate matter in the fluid, like sand, this will sandblast the lens and could cause premature failure.

DO NOT attempt to screw the OOD™ sensor either in or out by hand. Always use a 1 1/4” or 1 3/8” wrench on the wrench flat below the electronics enclosure.
INSTALLATION CONTINUED

INSTALLATION DO’S AND DON’TS

DO NOT use teflon tape on the OOD™ sensor threads. DO use liquid thread sealant.

DO install the OOD™ sensor with a minimum of 6” or 200mm between the lens and the nearest flat surface.

DO install the OOD™ sensor with a sun shade if the electronics are directly exposed to sunlight.
CAUTION: When electronics enclosure is open, be extremely careful to avoid any contact with interior fiber optic connections. Failure to do so could result in the OOD malfunctioning.

WIRING FOR RELAYS
INSTALLATION CONTINUED

RECOMMENDED CONNECTIONS FOR THE RS485

1. Make sure the jumpers J9 and J10 are installed. Fig. 3-13.

2. Set any jumpers on the RS485 converter to use 2-wire mode.

3. Hook up RS 485 TX+ terminal on the OOD to TX+ line on the converter.

4. Hook up the RS485 TX– terminal on the OOD to the TX– line on the converter.

5. Connect the converter to the computer and switch on the OOD.

6. Make sure the activity lines on the converter blink as data is transferred or read by the MODBUS master reader software.

7. Set the appropriate COM port in the MODBUS software. This setting varies with the system and whether the connection to the converter is connected to the serial communications port or on the USB ports. You may need to connect external power to the converter.

8. Check the baud rate (9600) and protocol (MODBUS RTU) options in the MODBUS software.

9. Make sure that the correct registers are being read and that the registers are set to 32 bit float to read the percentage of oil in the water.

RS485 4-WIRE CONNECTION

1. Make sure jumpers J9 and J10 are REMOVED.

2. Follow steps for 2-wire with the addition of RS485RX– and RS485+ connections.

SETTING THE ALARM SETPOINTS:

1. Connect a PC to the instrument via RS232 and open Hyperterminal.

2. Enter the password by typing “n5d444Oj” into a new line (case sensitive). There will be a return message: “System has entered Superuser mode!”

3. To set low level alarm (D OUT1), enter the following command: =proc,ALMLO,<value>
   for example: =proc,ALMLO,200 (200 is the ppm level where the alarm will activate)

4. To set High level alarm (D OUT2), enter the password by typing “n5d444Oj” into a new line (case sensitive).
   There will be a return message: “System has entered Superuser mode!”

5. Enter the following command =proc,ALMHI,<value>
   for example =proc,ALMHI,500
MAINTENANCE and TROUBLESHOOTING

CLEANING

Properly installed and under normal operation, the KAM OOD should not require cleaning, as the perpendicular flow should keep the lens free of any build up.

However, in some cases it may be necessary to clean the lens of any residue. To do so, use a clean cloth with oil solvent or part washer. Preferred solvents include, any petroleum solvent such as mineral spirits, xylene, toluene, gasoline, or diesel. Do not use WD40 or other chemicals.

If you have a question regarding cleaning solvents, please contact KAM CONTROLS directly at +1 713 784-0000, or email: AskAnEngineer@Kam.com

OVERALL SYSTEM CHECK

When powered up, a functional device will toggle its LED light source. This can be viewed at the end of the probe. CAUTION: DO NOT STARE DIRECTLY INTO THE LIGHT. LOW POWER UV RADIATION IS EMITTED. Instead, hold a piece of paper close to the probe and make sure the light is visibly blinking on the paper. The light should be a violet in color. Clean the bottom part of the probe with a soft cloth if necessary.

If the light source is not working, remove the screws connecting the top board, check all connections as follows:

1. The voltage has to be checked with a volt meter by measuring from GND (TP4) to the positive terminal of the LED.

2. Check the inter board connections on the pins sticking out at the bottom of the digital board (The top board)

3. Check the connector on the underside of the top board. On the top left side there is a connector with 5 twisted wires going to the LED board below. Make sure the wires are good and the connections are sound on both ends.

LOOP TROUBLESHOOTING

1. The OOD supplies power for the loop. Make sure the device that receives data from the OOD does not have a power source of its own switched on. Also, the LOOP+ and LOOP- are isolated inputs from the chassis/earth. Do not connect either to a common ground. Use an isolator if necessary.

2. Check the voltage across the LOOP+ and LOOP- terminals. It should read close to 12V.

3. To make sure the loop is working, it is possible to check the current running through it with an ammeter without a load. It should change as the reading changes.
The OOD digital card has LEDs to indicate the status of the input power and on board voltages of the OOD.

Ensure that all the circuits of the OOD are powered up with the correct voltages. LEDs indicate power, not proper voltage.

LED1 Indicates voltage presence at the input voltage terminals
LED 2 Indicates voltage presence at the 5V supply
LED 3 indicates voltage presence at the 5V supply

If LED1 does not light up:

1. Input power is not connected correctly. Check the VIN + and VIN – terminals. Confirm that the voltage across the two terminals is between 12-30V (24 V is recommended). Confirm that the polarity is correct.
   **NOTE:** The OOD has built-in protection to avoid incorrectly polarized voltages from damaging the instrument.

2. Confirm the voltage on the side of the LED towards the green terminals (near the text “RS485TX+”). It should show the input voltage (12-30V). If it does and the LED1 does not light up, it indicates a bad LED which can be replaced. This will not affect the operation of the instrument.

3. If the voltage reads zero, input fuse F1 may be blown. Remove the top board by unscrewing the 4 screws and disconnecting the LED power cable. Turn the board over. The fuse F1 is located at the bottom edge of the board near the middle. The board can be returned to the factory for repair or this fuse can be replaced as well. Use a 2 Ampere, size 1206 fuse.

4. If the fuse goes out again (use procedure above to diagnose), this could indicate that either the lighting protection on the board has been activated or that harmful voltages have reached the instrument electronics. Replace the digital board and return this board to factory for repair.

If LED1 lights up but LED 2 does not light up, then the 5V power supply is nonfunctional. Replace the topboard or return the board to the factory for repair.

If LED1 and LED2 light up but LED 3 does not, then the 3.3V power supply is nonfunctional. Return the board to factory for repair.
MAINTENANCE and TROUBLESHOOTING CONTINUED

RS232 TROUBLESHOOTING

1. Once connected to a computer, the voltages on the RS232 lines should measure as follows:

   RS232 RXD (OOD data input line) to GND terminal: should be between -5 and -12V
   RS232 TXD (OOD data output line) to GND terminal: should be between -5 and -12V

2. If one of the voltages shows 0 and the connections are good, try reversing the TXD and RXD wires.

3. In the OOD PC software or on the RS232 terminal software such as hyper terminal, make sure to use the specified baud rate and other communication settings.

4. Set the correct communications port which varies with the system used.

5. Ensure the port is opened in the terminal software.

RS485 TROUBLESHOOTING

1. If the RS485 is a 2-wire line, make sure the jumpers J9 and J10 are installed.

2. Connect wires only to the RS485TX+ and RS485TX- lines. If there is a ground terminal on the RS485 connector, hook it up as well.

3. RS485 is intended for MODBUS reading output. The lines can be checked by observing the activity LEDs on any RS485 converter connected to these terminals. They are differential voltages across the RS485+ and RS485- lines in two wire mode. The bias is provided by the master device.

4. If the RS485 is a 4-wire line, ensure that jumpers from J9 and J10 have been removed.

5. Wires should be connected to RS485TX+, RS485TX-, RS485RX+ and RS485RX-.

DEBUGGING THROUGH SOFTWARE

1. If the software is running and the port is open, you should be able to see readings come in. If not the digital board is bad. Replace it and send this digital board to the factory for repair.

2. If the readings coming in are unexpected, it is likely there is an issue with the photodiode circuit. Make sure the LED background and LED ON readings are different at a particular instant of time. The background is usually less than 50 counts and ON is between 400-1024 counts. This verifies the functionality of the LED circuit.

3. On Channel 2, make sure the background and On readings are different as well. These readings change as per the reading from the test liquid. If the probe is in open air, the difference will be low. If the light at the end of the probe is blocked the reading goes up to a maximum of 65535 counts. This verifies the functionality of the photodiode circuit.

4. Please contact KAM Technical Support (+1 713 784 0000) or askanengineer@kam.com for further trouble shooting in case the above readings are incorrect.