



Simple Precision™



KAM® OID™ OPTICAL INTERFACE DETECTOR

User Manual
OIDMANUAL-0614



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CAUTION:

When installing the OID™ 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.

KAM CONTROLS, INC. reserves the right to make changes to this document without notice.

INTRODUCTION

AVAILABLE MODELS and MOUNTING OPTIONS

FIG.

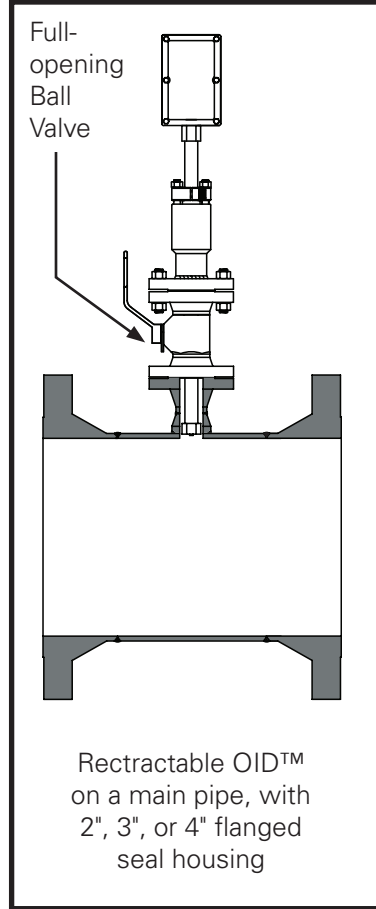


FIG.

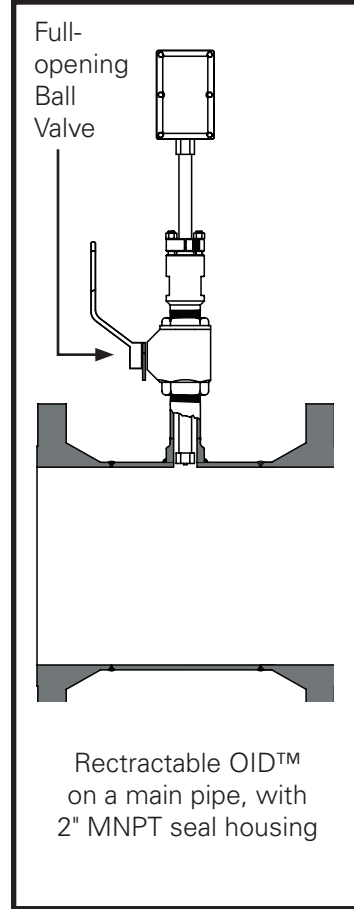
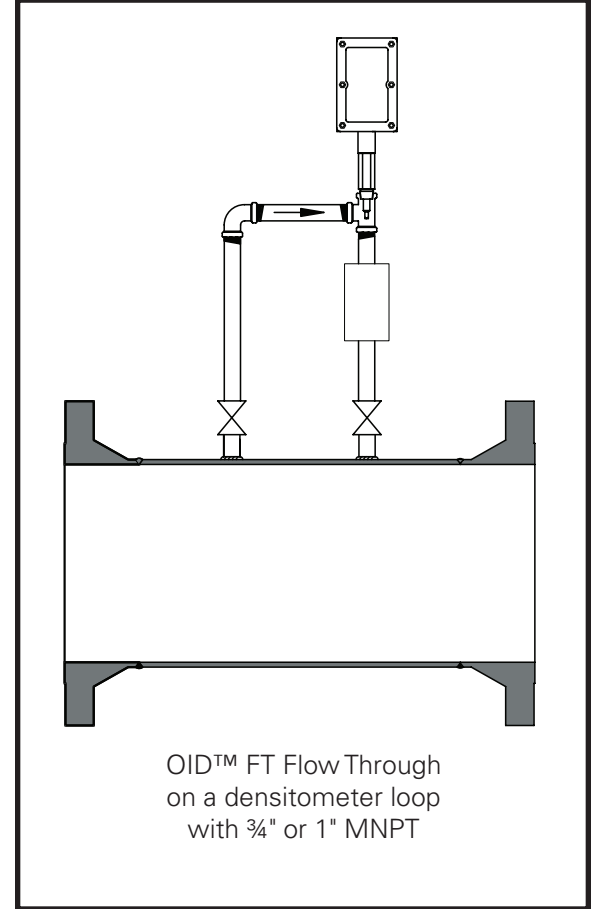


FIG.



THEORY OF OPERATION

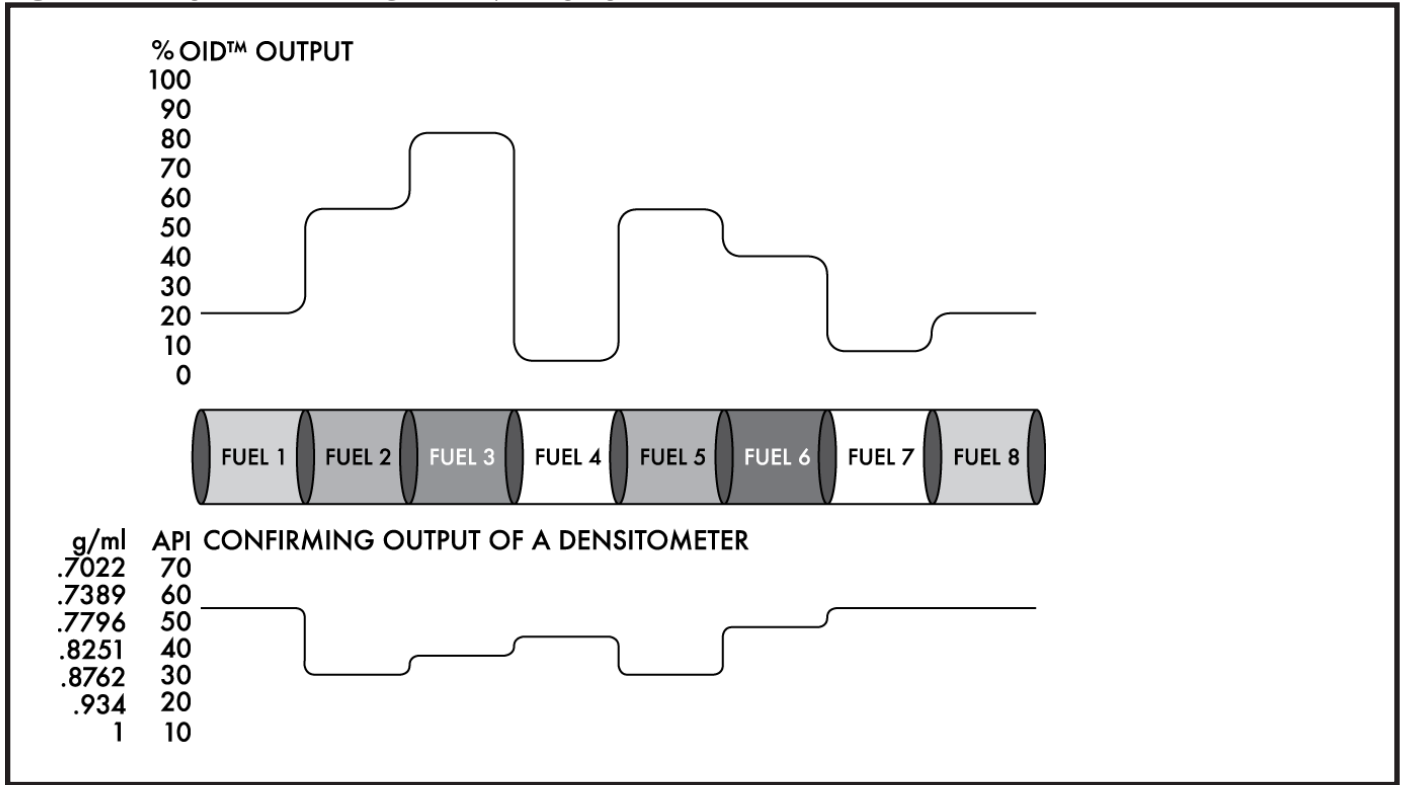
The KAM® OID™ Optical Interface Detector has been the preferred sensor for interface detection between refined products since its inception in 1995. Literally like eyes in the pipe, it provides **accurate, real-time data on product interface and quality**. That data allows operators to monitor interface in real time, making the most advantageous cut and significantly reducing product downgrade and/or transmix.

The simplicity of design and quality of engineering employed in the OID™ sensor mean there are no moving parts. The OID™ is comprised of an optical probe inserted into the fluid/flow and connected via fiber optic cable to the related transmit and receive electronics which are housed within an explosion-proof enclosure on the atmospheric end of the sensor. During operation, light from the light source in the explosion-proof enclosure travels via the fiber optics cable to the process fluid. Unabsorbed light returns via the fiber optics cable to a photodetector in the explosion-proof enclosure. The resulting information regarding the absorption, fluorescence, and refractive properties of the fluid is then turned into an analog signal or "optical signature." Measurement is fully automatic without the need for operator intervention or supervision. The output signal can be sent to a SCADA, PLCs, or to a Central Control Room for logging or display on chart recorders or monitors.

The KAM® OID™ sensor can be installed in an analyzer loop or in the main line. Because main-line models are mounted through a full-opening ball valve, you can insert or retract the probe without having to ever drain the pipe.

INTRODUCTION CONTINUED

FIG. 1-4 KAM® OID™ AND API GRAVITY/DENSITOMETER



FEA-

- Detects the interface of specialty fuels such as ULSD
- No moving parts
- Measurement is fully automatic
- Lens cleans in place
- Insertable/retractable and flow-through models available
- Output signal can be sent to a SCADA, PLC's, or to a Central Control Room
- Insertable model installs without having to drain the pipe

APPLICATIONS

- Batching
- Interface detection
- Product transmix management
- Product downgrade management
- Pipeline automation
- Chemicals interface
- Clear oil interface
- Quality control

SPECIFICATIONS

Media:	Refined products
Material:	Wetted parts–316 stainless steel
Power:	12–24 VDC 15 Watts max (Max current is 1275 mA @ 12V and 637 mA @ 24V)
Output:	4-20 mA
Communication Port:	RS485 (factory use only)
Fluid temperature:	-40° to 160° F (-40° to 70° C)
Electronics temp.:	-40° to 160° F (-40° to 70° C)
Pressure ratings:	ANSI 150, 300, 600, 900
Mounting:	3/4" and 1" MNPT 2" MNPT Seal Housing 2", 3", or 4" Flanged Seal Housing
EX enclosure:	3" x 6" x 3" (76 mm x 152 mm x 76 mm)
Shaft length:	12" to 60" – Off-the-shelf lengths are 24", 30", 36", 48", and 60" (610 mm to 1524 mm) (Off-the-shelf 610 mm, 762 mm, 914.4 mm, 1219 mm, 1524 mm)
Pipe size:	3/4" to 48" (20 mm to 1200 mm)
Weight:	from 10 lbs. (4.5 kg)

SPECIFICATIONS CONTINUED

DIMENSIONAL DRAWINGS

FIG. 2-10ID™ SENSOR with FLANGED

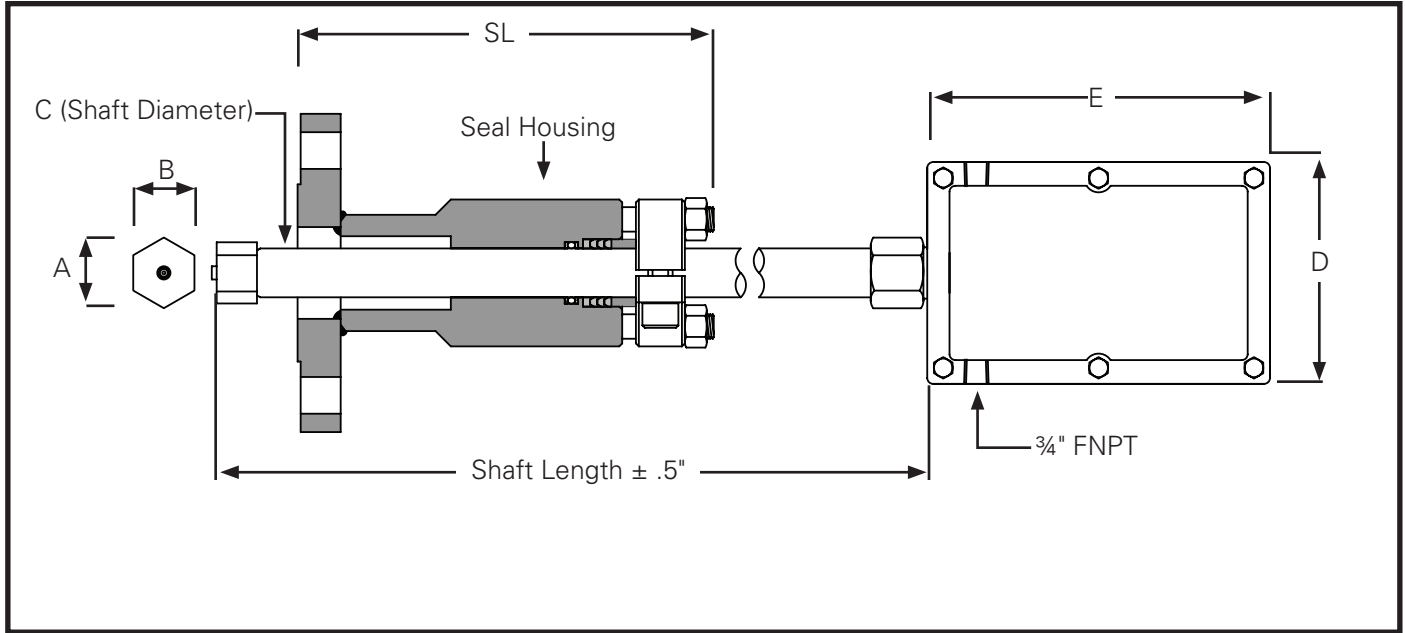


TABLE 2-2 FLANGE SIZE AND CLASS (SL)

"	150		300		600		900	
	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM
2	8.40	213	8.50	216	8.90	226	9.40	240
3	8.60	218	8.75	222	9.15	232	9.40	240
4	8.60	218	8.90	226	9.40	240	9.65	245

TABLE 2-3 DIMENSIONS

	INCHES	MM	Shaft Lengths are available in .5" (12.7 mm) increments. Standard sizes are 24", 30", 36", 48", and 60". (610 mm, 762 mm, 914.4 mm, 1219 mm, 1524 mm)
A	1.443	37	
B	1.25	32	
C	1	25	
D	4.53	115	
E	7	178	

SPECIFICATIONS CONTINUED

FIG. 2-4 FLOWTHROUGH OID™ for ANA-LYZER LOOP

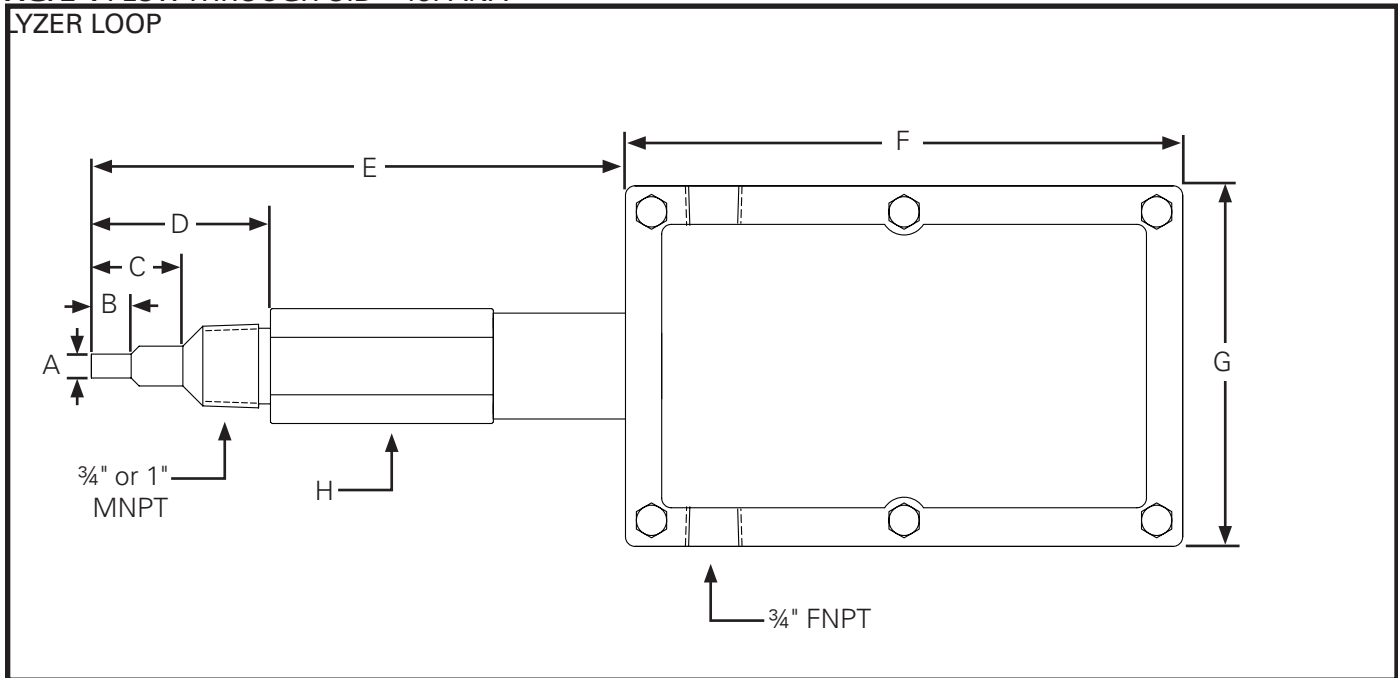


TABLE 2-5 3/4" MNPT DIMEN-

	INCHES	MM
A	.3	8
B	.5	13
C	1.4	36
D	2.25	57
E	6.75	171
F	7	178
G	4.53	115
H	1.2	30

TABLE 2-6 1" MNPT DIMEN-

	INCHES	MM
A	.3	8
B	.5	13
C	1.45	37
D	2.4	61
E	6.75	171
F	7	178
G	4.53	115
H	1.3	33

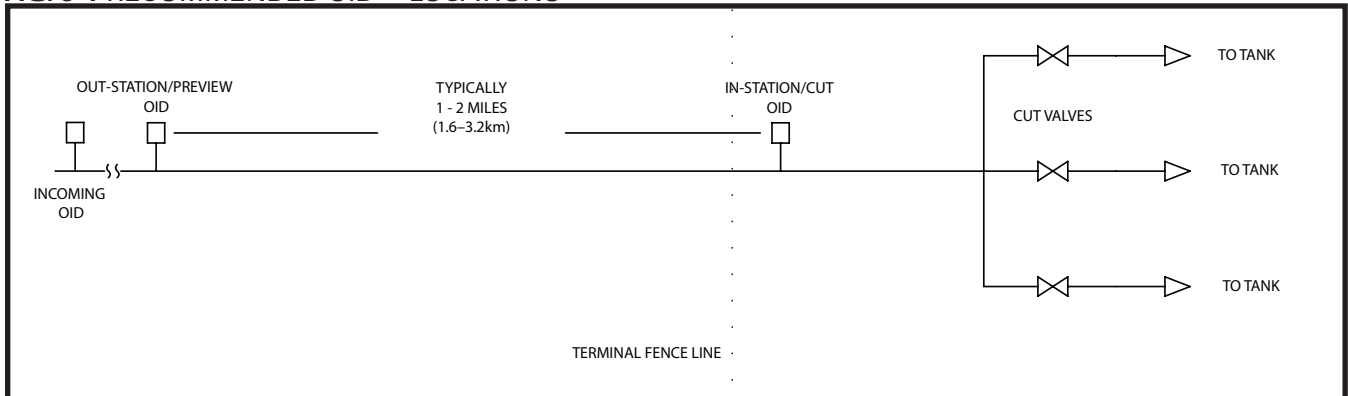
INSTALLATION

LOCATION

For optimal batch detection, KAM CONTROLS recommends that you install the in-station OID™ sensor at the first accessible pipeline location inside the terminal fence-line — upstream of the interface cut valve(s). This allows the operator ample time to open/close the cut valves prior to the arrival of the product interface.

KAM CONTROLS also strongly recommends that you utilize a preview (or out-station) OID™ sensor. This lets the operator decide how to optimize each batch cut prior to actually making the batch cut at the in-station and gives the operator more confidence in their decisions as well as the time to identify and resolve any issues that may arise during a critical interface.

FIG. 3-1 RECOMMENDED OID™ LOCATIONS



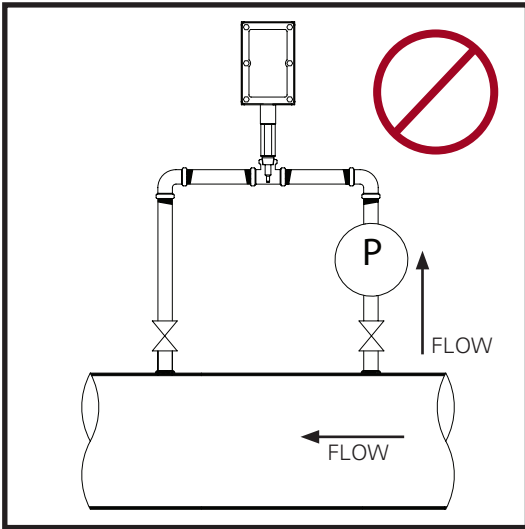
PRIOR TO INSTALLATION

Remove all the protective packaging materials including the red cap placed at the tip of the sensor probe. Ensure that the OID™ sensor was not damaged during transit.

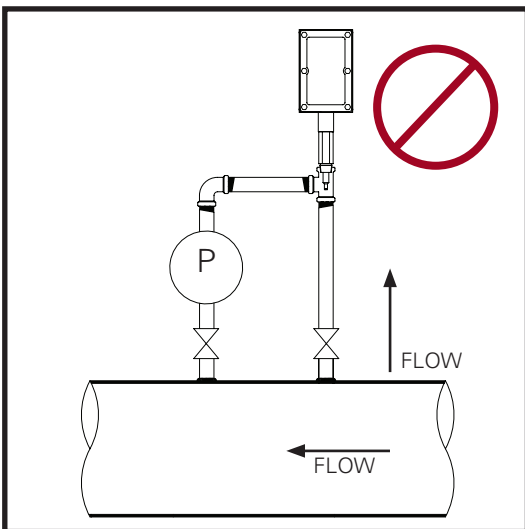
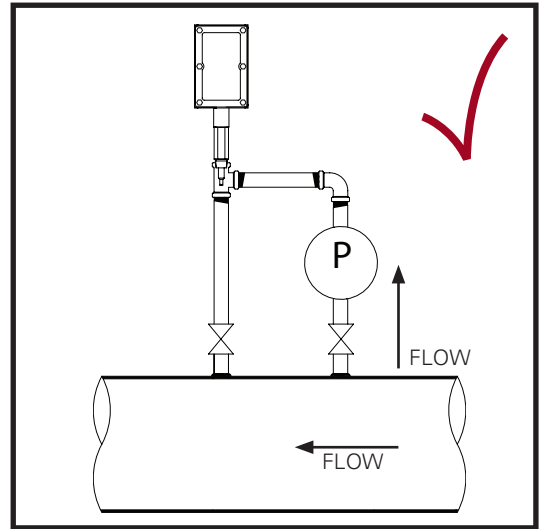
CAUTION: Do not stand the OID™ sensor on the probe end or allow the probe to hit the ground or any hard surface under any circumstances. This will damage the lens, and the OID™ sensor will not work properly.

INSTALLATION CONTINUED

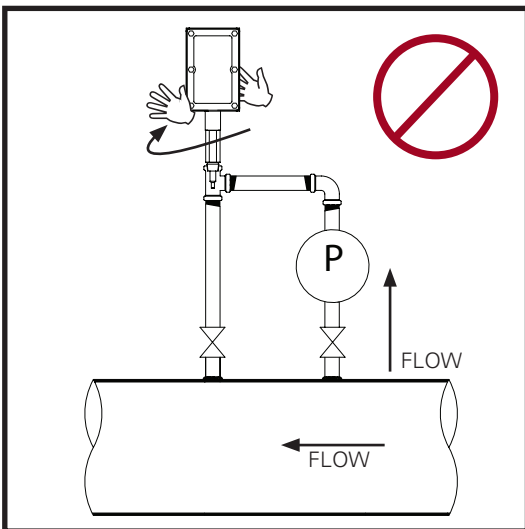
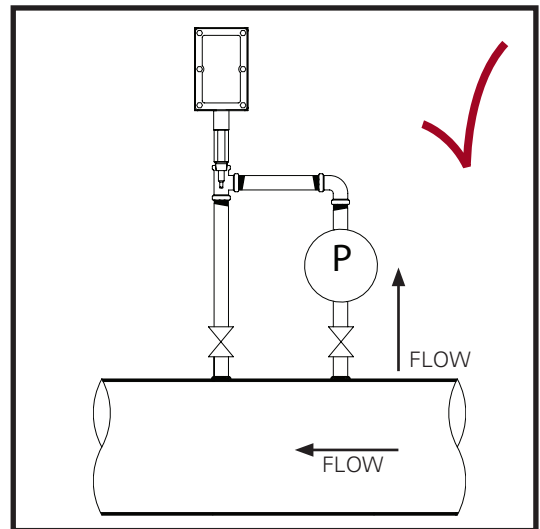
INSTALLATION DO'S AND



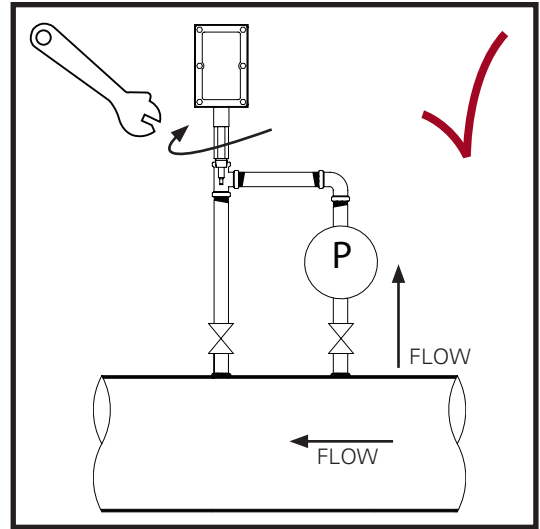
DO NOT install the fast loop OID™ sensor in a straight portion of pipe. It needs to be mounted off the bend opposite the pump.



DO NOT install the OID™ 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.

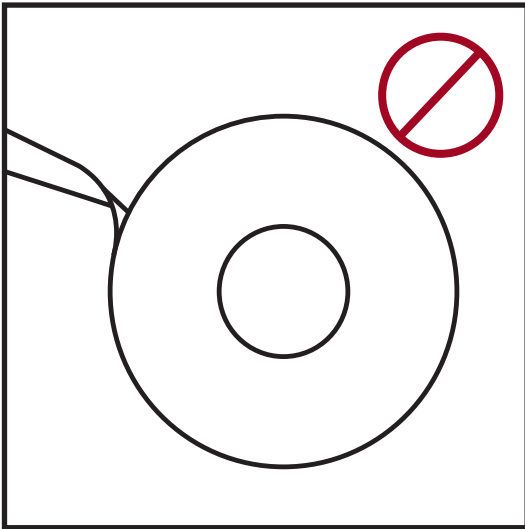


DO NOT attempt to screw the OID™ sensor either in or out by hand. Always use a 1 1/4" or 1 3/8" wrench on the wrench flat below the electronics enclosure.

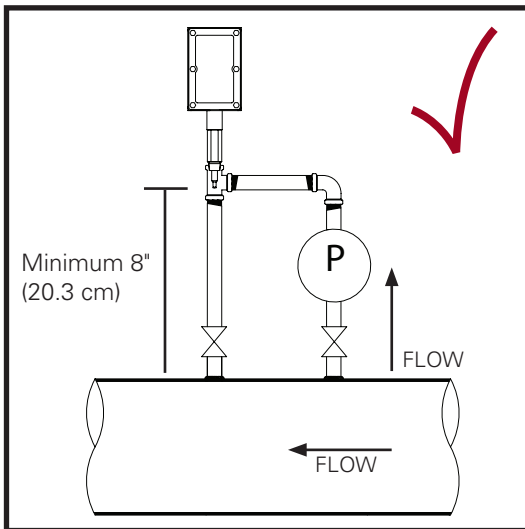
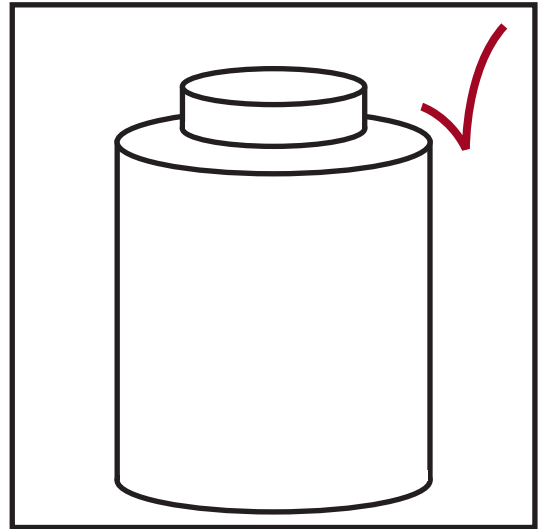


INSTALLATION CONTINUED

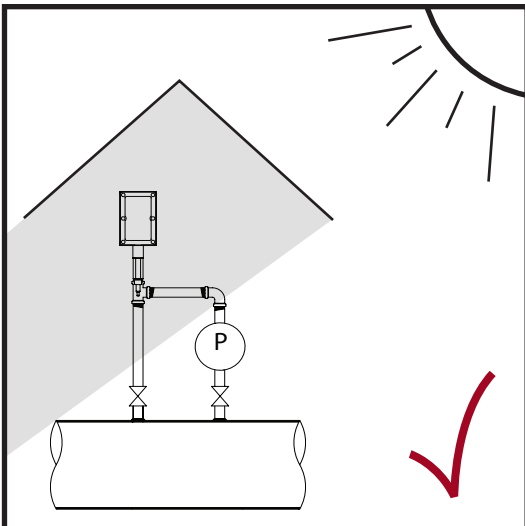
INSTALLATION DO'S AND



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



DO install the OID™ sensor with a minimum of 8" or 200mm between the lens and the nearest flat surface.



DO install the OID™ sensor with a sun shade if the electronics are directly exposed to sunlight.

INSTALLATION CONTINUED

PRIOR TO INSTALLATION

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

MAIN LINE INSTALLATION

The KAM® OID™ sensor should be installed according to FIG. 3-2. KAM CONTROLS recommends installing the OID™ 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 OID™ sensor from the pipeline during installation or removal. The seal housing of the OID™ 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 OID™ sensor is placed at the most representative point within the flow profile. The OID™ 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: If line pressure exceeds 100 psi, use a KAM® IT Insertion Tool when installing/removing the KAM® OID™ sensor.

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

1. Lay the OID™ sensor on the ground or a table.
2. Loosen Socket Cap Screws on the locking collar. This will allow the OID™ shaft to slide through the seal housing.
3. Push the OID™ shaft through the seal housing until the OID™ probe sits flush with the end of the seal housing or seal housing flange. FIG. 3-3 and 3-4. (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.)

FIG. 3-2 KAM® OID™ INSTALLED ON A MAIN PIPE

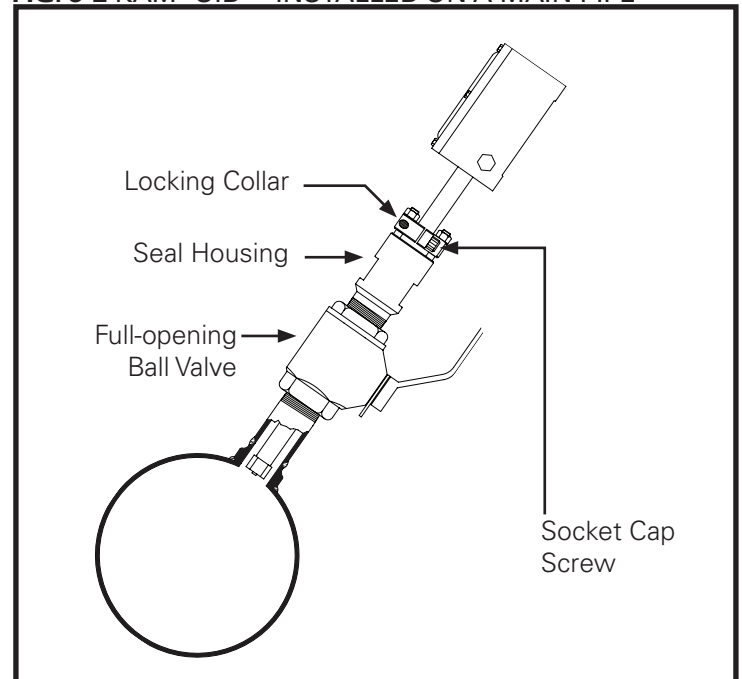


FIG. 3-3

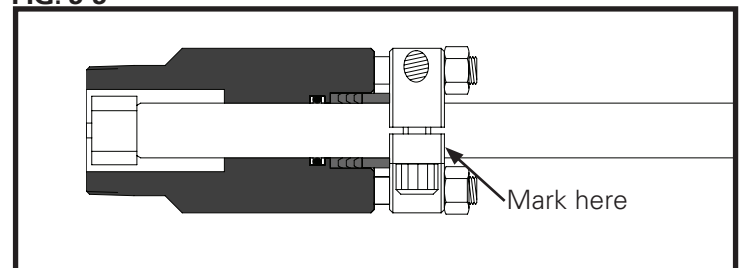
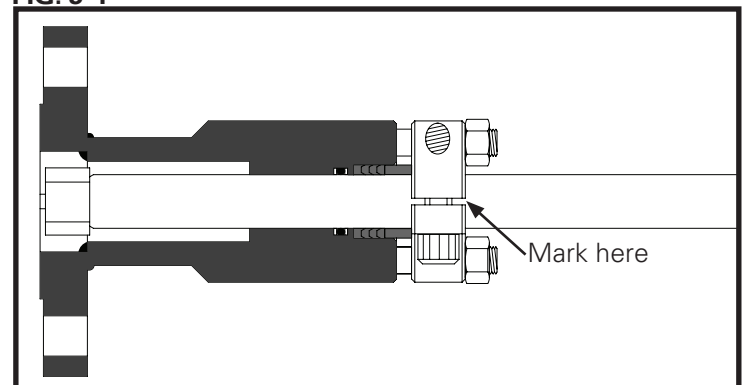


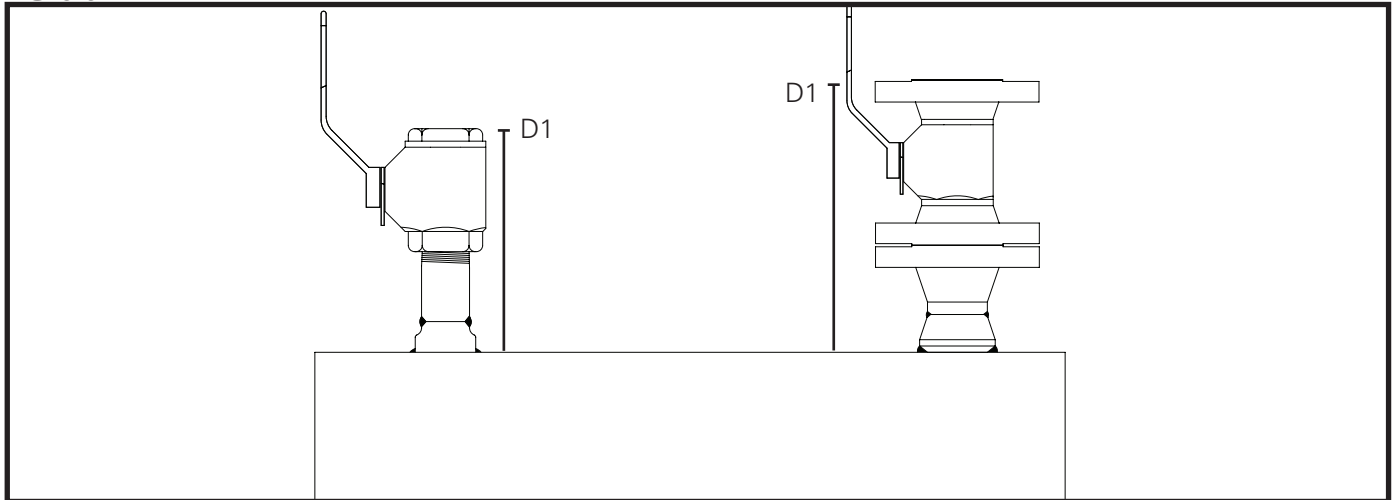
FIG. 3-4



INSTALLATION CONTINUED

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 the OID™ 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 OID™ sensor is going to be installed. FIG. 3-5.

FIG. 3-5



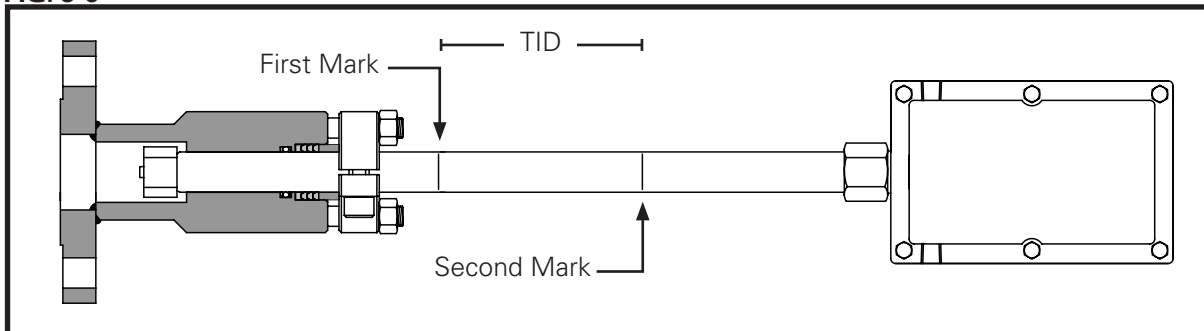
7. Calculate the insertion distance for **Flanged Seal Housing** (If you have a MNPT Seal Housing, proceed to step 9):

Total Insertion Distance (TID) = $D1 + \text{Pipe Wall Thickness} + \text{Seal Thickness} - 1/4"$

Example for $D1 = 19"$, $\text{Pipe WT} = 3/8"$, and $\text{Seal Thickness} = 1/8"$
 $TID = 19 + 3/8 + 1/8 - 1/4$ 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. 3-6.

FIG. 3-6



9. Bolt or screw the OID™ sensor to the valve or designated installation location. (KAM CONTROLS recommends using thread sealant and not Teflon tape for the threaded OID™). Skip to Step 12 (OID with Flanged Seal Housing only).

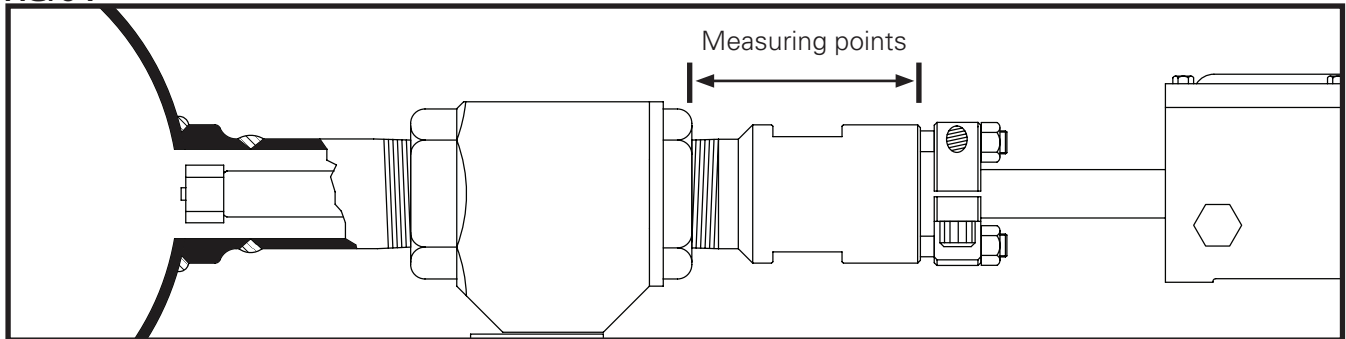
INSTALLATION CONTINUED

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 OID™ 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. 3-7.

FIG. 3-7



For example:

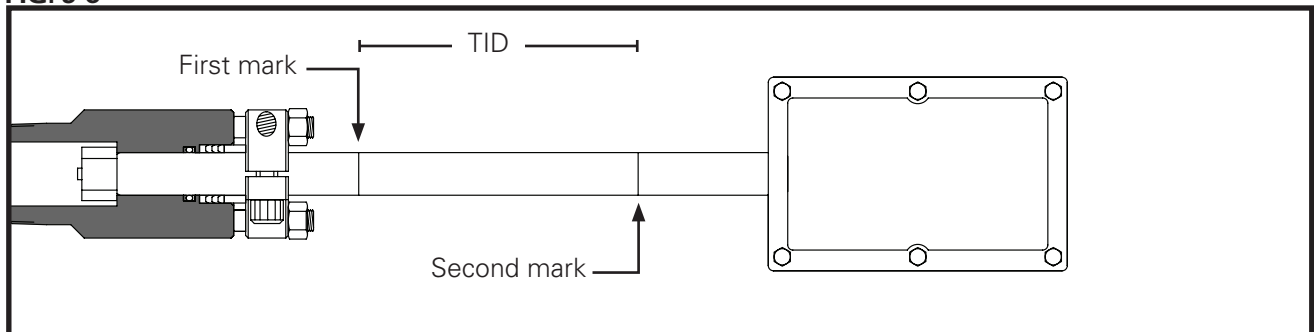
If the measured distance from the top of the valve to the top of the seal housing body is 4.75", you would calculate the threaded depth (TD) by subtracting 4.65" from 5.25". ($5.25 - 4.65 = 0.6$) In this case the threaded depth TD would be .6".

You are now ready to calculate TID.

$$\begin{aligned} \text{TID} &= (D1) + (\text{Pipe Wall Thickness}) - (\text{TD}) - (.25") \\ \text{Example for } D1 &= 19", \text{ Pipe WT} = 3/8", \text{ and TD} = .6" \\ \text{TID} &= (19) + (.375) - (.6) - (.25) \\ \text{TID} &= 18.525" \end{aligned}$$

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

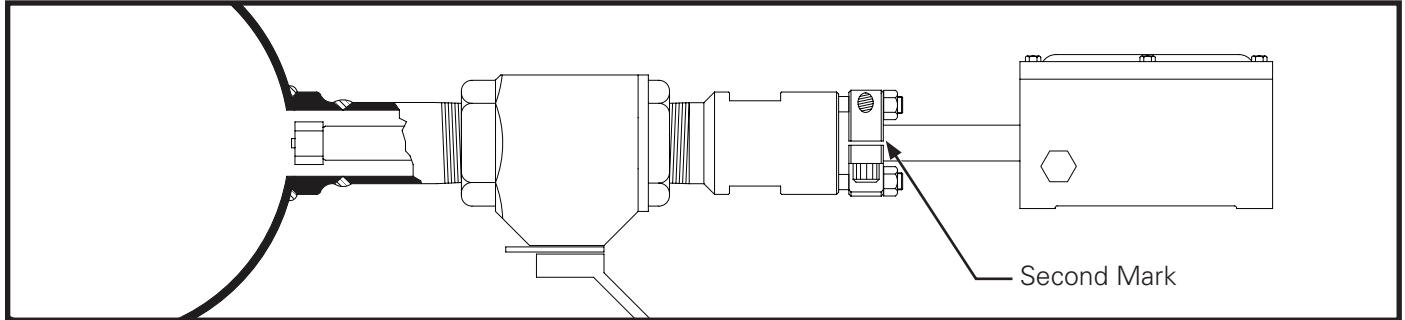
FIG. 3-8



INSTALLATION CONTINUED

12. If you have an OID™ 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.
14. Loosen Socket Head Screw on the Locking Collar.
15. Push the OID™ in until the Second Mark is at the top edge of the Locking Collar. FIG. 3-9.

FIG. 3-9



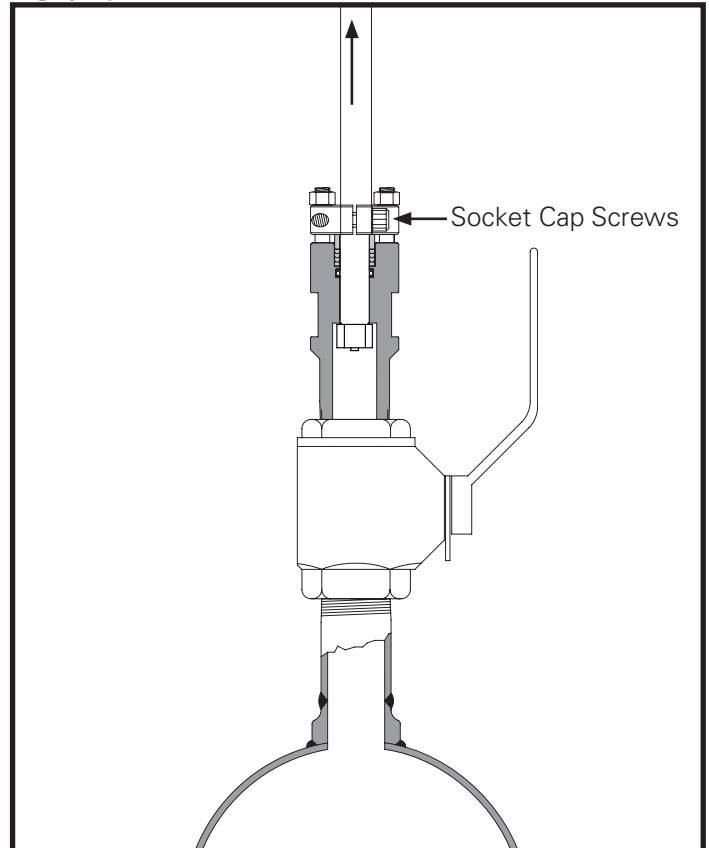
10. Re-tighten the Socket Cap Screws.
11. Tighten the Hex Nuts on the top of the Locking Collar one half turn. These nuts should never be over tightened. Their major function is to apply light pressure on the chevron packing to ensure a seal between the seal housing body and the insertion shaft.

REMOVING THE OID™ SENSOR

1. To remove the OID™ sensor, first disconnect all electrical connections to the OID™ 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 OID™ 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 OID™ sensor upward until it stops and the probe rests inside the seal housing. FIG. 3-10.
4. Next, close the Full-opening Ball Valve tightly. The OID™ sensor may now be unbolted from the system.

FIG. 3-10



INSTALLATION CONTINUED

ANALYZER LOOP INSTALLATION

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

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

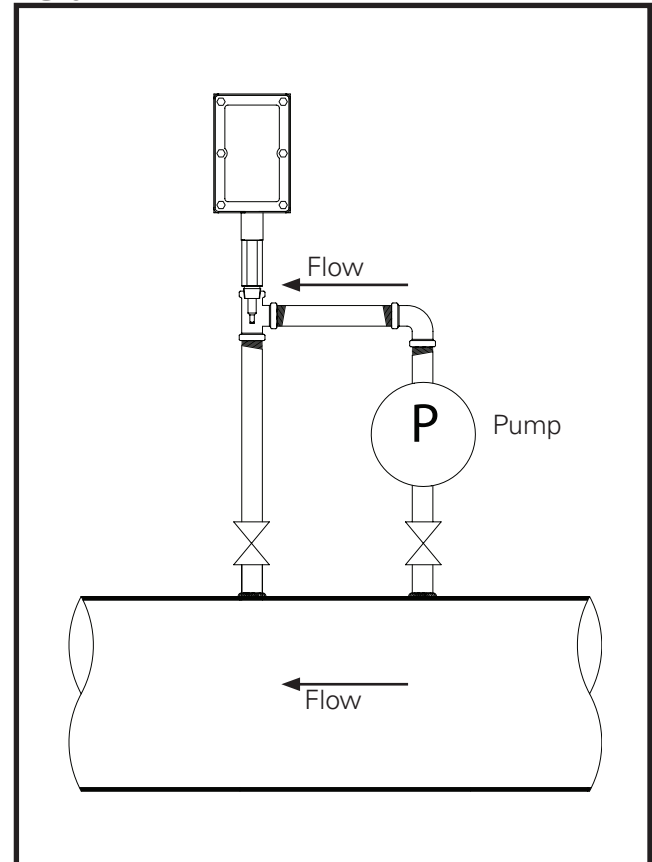
CAUTION: DO NOT USE THE ENCLOSURE TO TIGHTEN OR LOOSEN THE OID. THIS CAN CAUSE THE PROBE TO COME UNDONE AND THE FIBER CABLE TO BREAK. Please refer to "Do's and Don'ts" on pages 8-9.

KAM 3/4" and 1" MNPT OID™ sensors should be installed according to FIG. 3-10. The OID™ 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 OID™ 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.

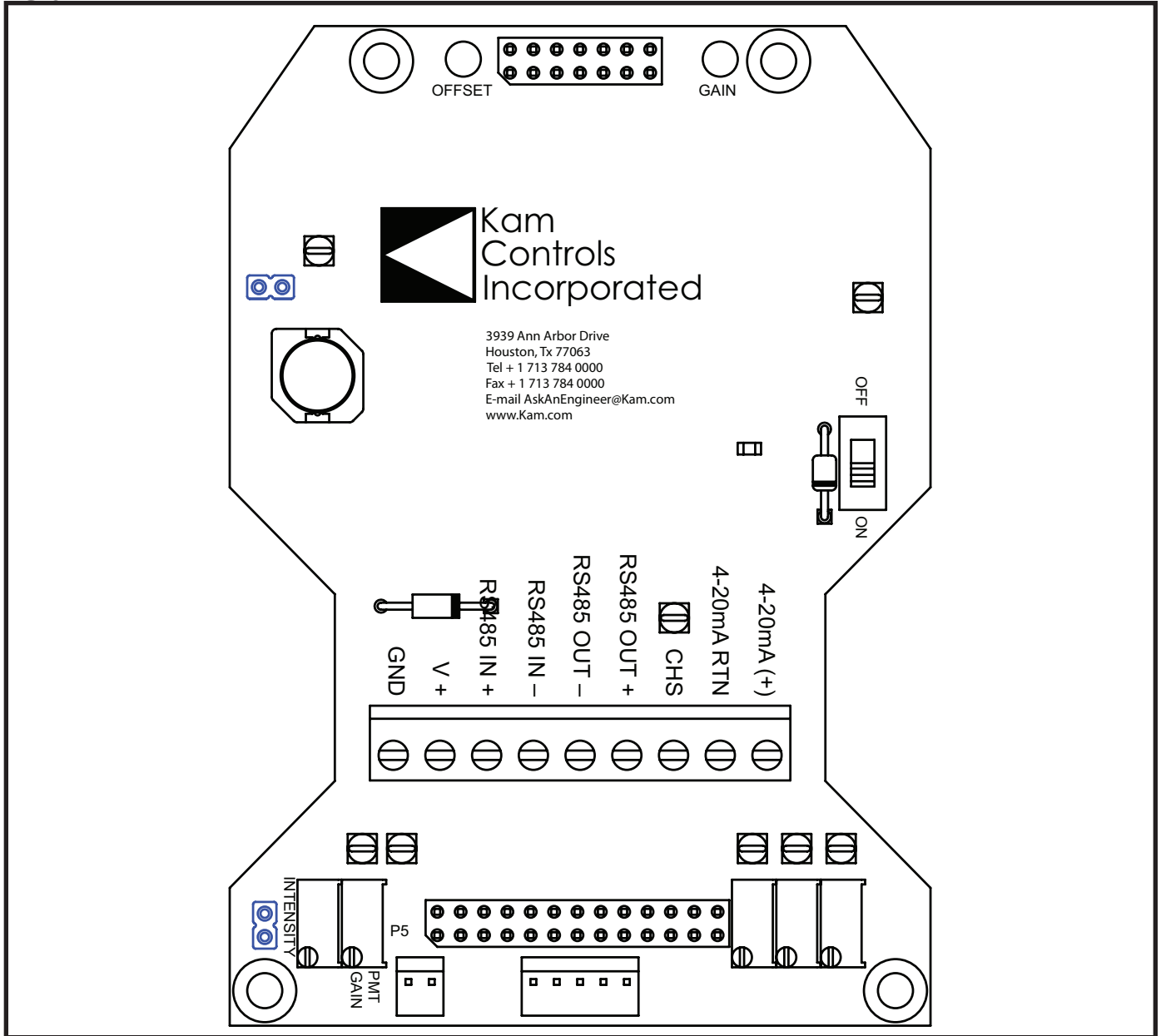
FIG. 3-11



INSTALLATION CONTINUED

WIRING

FIG. 3-12



POWER

V (+)
GND

OUT-

4-20 mA (-) Current output, source powered
4-20 mA (+)

COMMUNICATION INTERFACE (factory use only)

RS485 OUT (+) Communication port
RS485 OUT (-)
RS485 IN (-)
RS485 IN (+)

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 OID malfunctioning.

INSTALLATION CONTINUED

CONNECTING THE OID

1. Proper Grounding of the OID™ sensor.

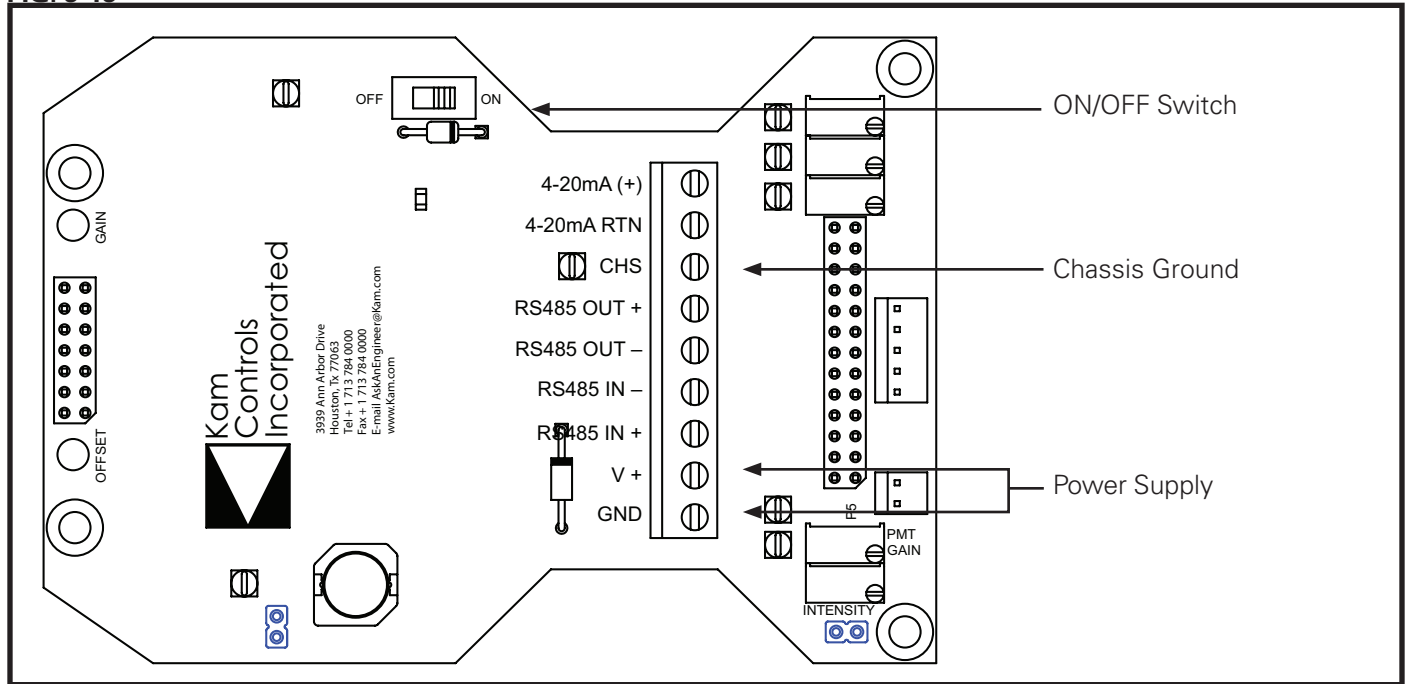
Grounding the OID™ sensor through the 4-20 mA signal out and power lines is not adequate to protect the OID™ sensor against power surges.

To ground the OID™ sensor, connect the chassis ground on the OID™ board (labeled CHS on the OID™ Terminal Block. FIG. 3-13) to the green grounding screw on the OID™ explosion-proof box using 16 AWG braided wire. Insure that the box is connected to Earth ground either through the pipeline or appropriate low-impedance buried grounding structure.

NOTE: CHS is isolated from GND. Grounding CHS to pipeline through the grounding screw will not short OID™ GND to the pipeline.

2. To connect the power for the OID™ sensor, first check both wires from the source for polarity and voltage, then label appropriately.*
3. Connect positive wire to V (+). FIG. 3-13.
4. Connect negative wire to GND on TB (Terminal Block).** FIG. 3-13.
5. Check voltage and polarity at TB, then turn OID on.

FIG. 3-13



EXTERNAL FUSES:

Power Amp slow fuse, Current loop 750 mA

MAXIMUM CURRENT LOOP RESISTANCE: 500 Ohm

*Recommended Wire: Shielded twisted pair wire is recommended for both power and signal.

**WARNING: Connecting a power source to the 4-20 mA ports on the TB will damage the OID Power Supply Board and result in failure of the unit.

FIELD CALIBRATION

PRIOR TO ANY CALIBRATION, MAKE SURE POWER SWITCH IS ON

The KAM® OID™ sensor is factory calibrated at the time of shipment for user-specific, product-interface requirements. However, field calibration may be required to fine-tune the instrument for increased or decreased sensitivity in specific applications.

INCREASE SENSITIVITY WHEN factory calibration is not sensitive enough to provide adequate resolution for interface detection, and all readings are typically falling in the lower or middle portion of the KAM® OID™ output range. Increasing sensitivity elevates the output range to provide greater interface resolution.

DECREASE SENSITIVITY WHEN some products exceed the maximum reading of the pre-calibrated settings. Products that exceed the pre-set calibration readings will produce an off-scale reading exceeding 20mA. Decreasing sensitivity lowers the output range of the KAM® OID™ sensor to allow all readings to fall within the 4-20 mA output ranges.

Caution: When multiple KAM® OID™ sensors are being used on the same system, each sensor should be calibrated equally. If special calibration is applied to one unit, its output will vary from those of other units measuring or monitoring like products.

The calibration procedure consists of increasing the gain or reducing the gain as needed to increase or reduce sensitivity.

LED light output settings are pre-set at the factory and should not be adjusted.

REQUIRED TOOLS: VOLT METER, SMALL FLAT-HEAD SCREWDRIVER

CHANGING THE HIGH END OF OUTPUT RANGE

1. Determine which product produces the highest current output.
2. Connect a volt meter across 4-20 mA terminals. When the highest output product is flowing, increase the gain by turning GAIN (FIG. 4-1) counterclockwise or decrease by turning clockwise. As you are turning, look at your volt meter and stop when it reads 18.4 mA or 80% of scale.

CHANGING THE LOW END

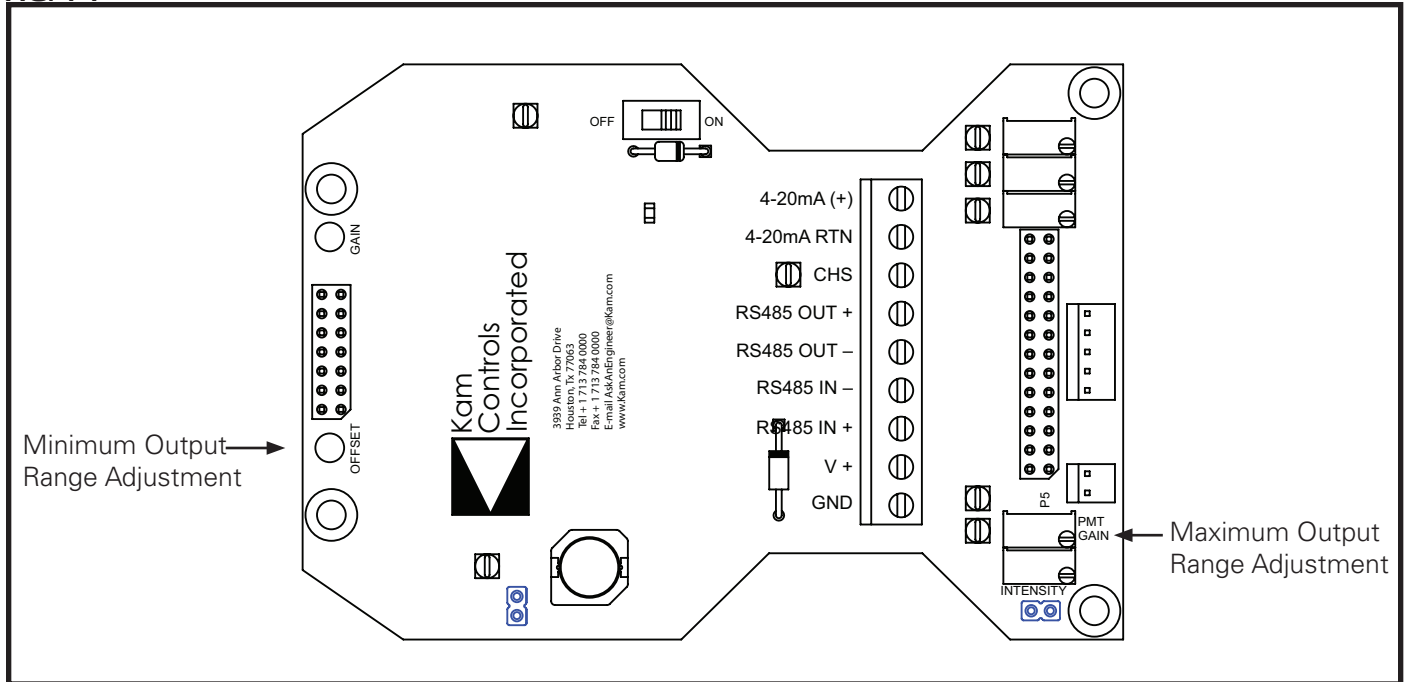
In most cases, products with the minimum current output are clear and readings will be consistent with factory calibration. Only recalibrate the low end of the range in situations when there will be no clear product in the pipeline.

1. Determine which product produces the lowest current output.
2. Connect a volt meter across 4-20 mA terminals. When the lowest output product is flowing, increase or decrease the gain by turning OFFSET. As you are turning OFFSET, look at your volt meter and stop when it reads 7.2 mA or 20% of scale. SEE FIG. 4-1. Once the low end of the output range has been reset, output sensitivity can be further refined by resetting the high end of the output range again.

FOR ALL OTHER TYPES OF ADJUSTMENTS CALL KAM CONTROLS, INC. +1 713 784 0000.

FIELD CALIBRATION CONTINUED

FIG. 4-1



MAINTENANCE

CLEANING AND INSPECTION

Under normal operation, the KAM OID should not require cleaning, unless pipeline usage is limited to a small number of products. Gasoline products or jet fuel in the pipeline will clean the OID without removal.

To remove any oil residues for visual inspection 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.

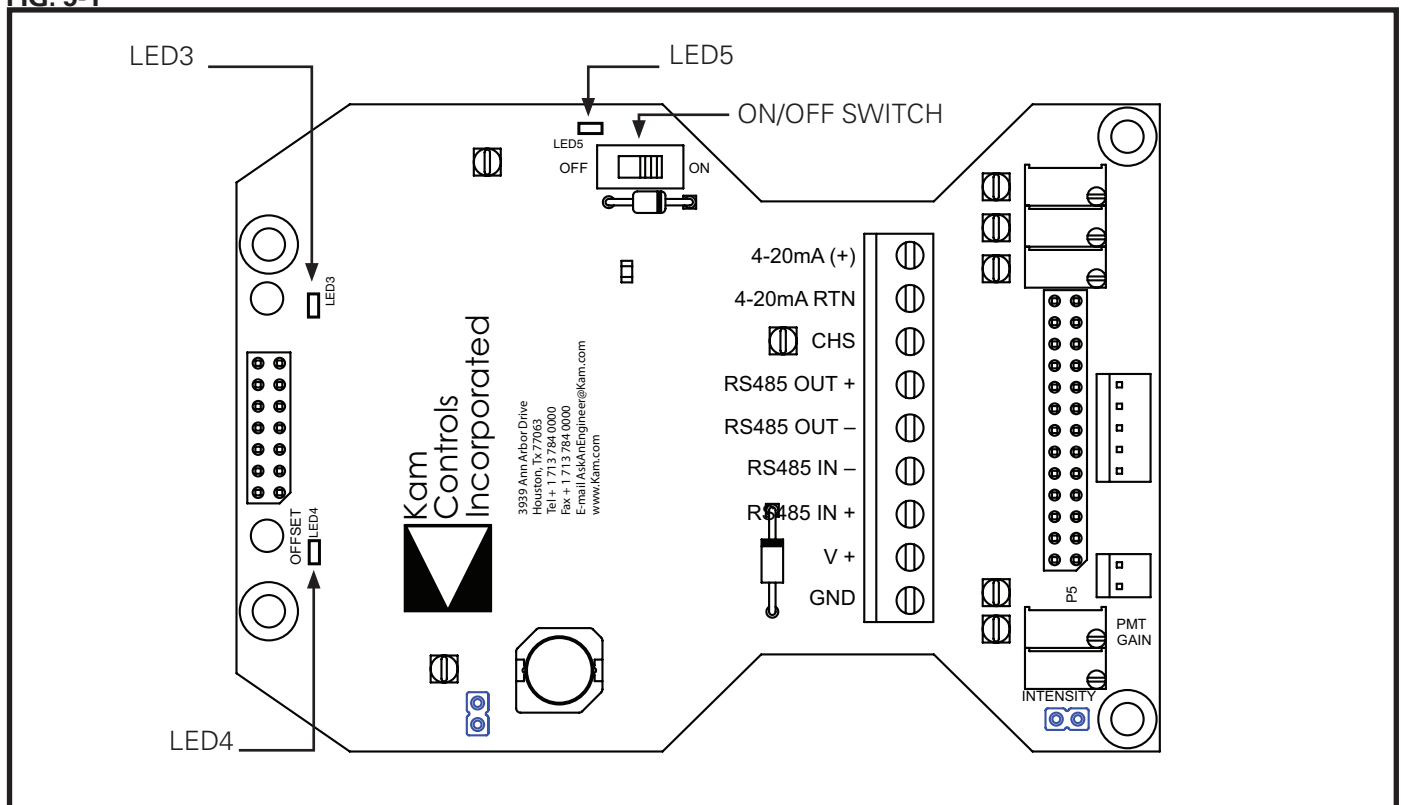
If you have a question regarding cleaning solvents, please contact KAM CONTROLS directly at +1 713 784-0000, or email: AskAnEngineer@Kam.com

TROUBLESHOOTING

If there is no **signal output** from the OID, please follow the steps below.

1. Please double check that the instrument is switched on. Fig. 5-1.

FIG. 5-1



2. If the instrument is switched on and LED5 (Fig. 5-1) is NOT illuminated, it indicates a problem with the power source: check the voltage input and polarity.

3. If LED5 is illuminated, source voltage and polarity should be correct.

MAINTENANCE CONTINUED

4. LED3 and LED4 (Fig. 5-1) should both be illuminated when the power switch on the instrument is in the ON position. If LED5 is illuminated, the power switch is ON, and either LED3 or LED4 is off, this indicates that the power supply on the OID is either damaged or there is a short in one of the circuits. In this case, the boards will have to be repaired or replaced. Please contact KAM CONTROLS at +1 713 784 0000 for spare or replacement boards and/or to arrange for repair.

5. If LED5, LED3, LED4 and the power switch are all on, and there is still no signal out, this indicates that there may be a short in the 4-20 mA circuit. In this case, the boards will have to be repaired or replaced. Please contact KAM CONTROLS at +1 713 784 0000 for spare or replacement boards and/or to arrange for repair.

For all other issues, please contact KAM CONTROLS at +1 713 784 0000.