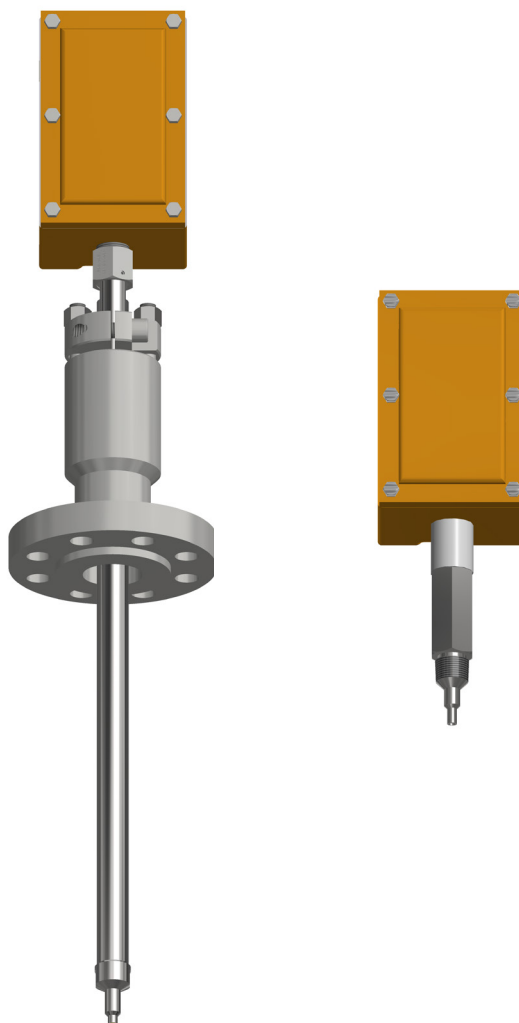




Simple Precision™



# KAM® OID™ OPTICAL INTERFACE DETECTOR

User Manual  
OIDMANUAL 0723



PTB 04 ATEX 1027  
II 2G Ex db IIB T6 Gb  
IECEX PTB 21.0012  
Ex db IIB T6 Gb

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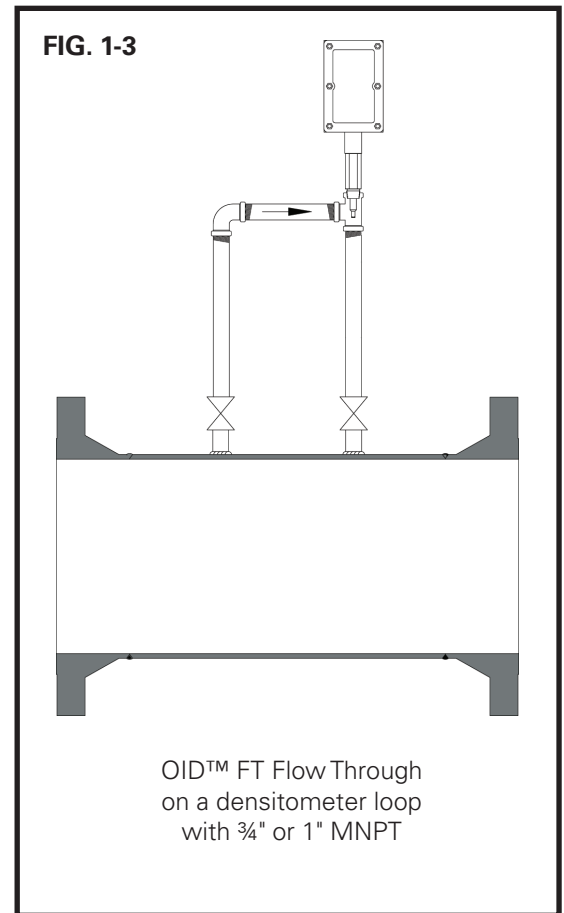
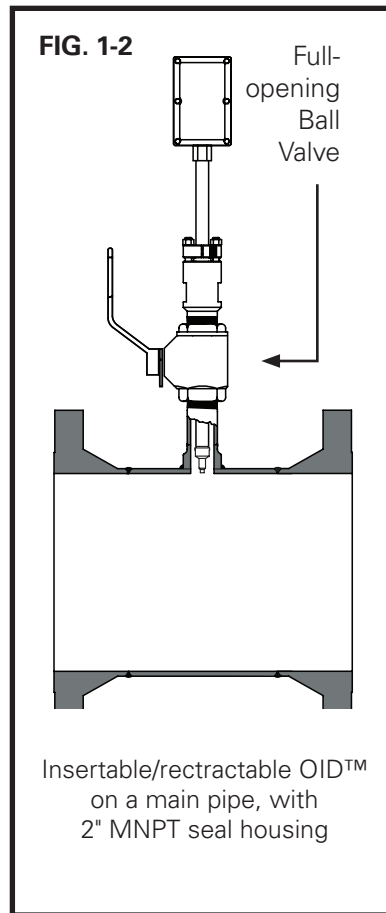
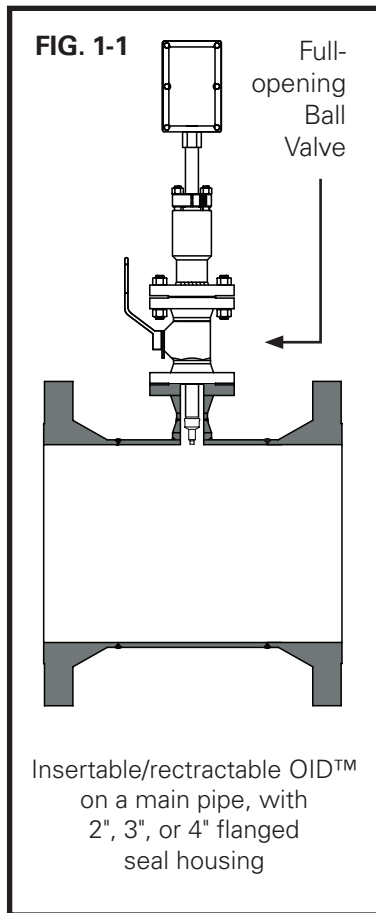
## CAUTION:

When installing the OID™ sensor in a pipeline containing petroleum products, petrochemicals, 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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# INTRODUCTION

## AVAILABLE MODELS and MOUNTING OPTIONS



## THEORY OF OPERATION

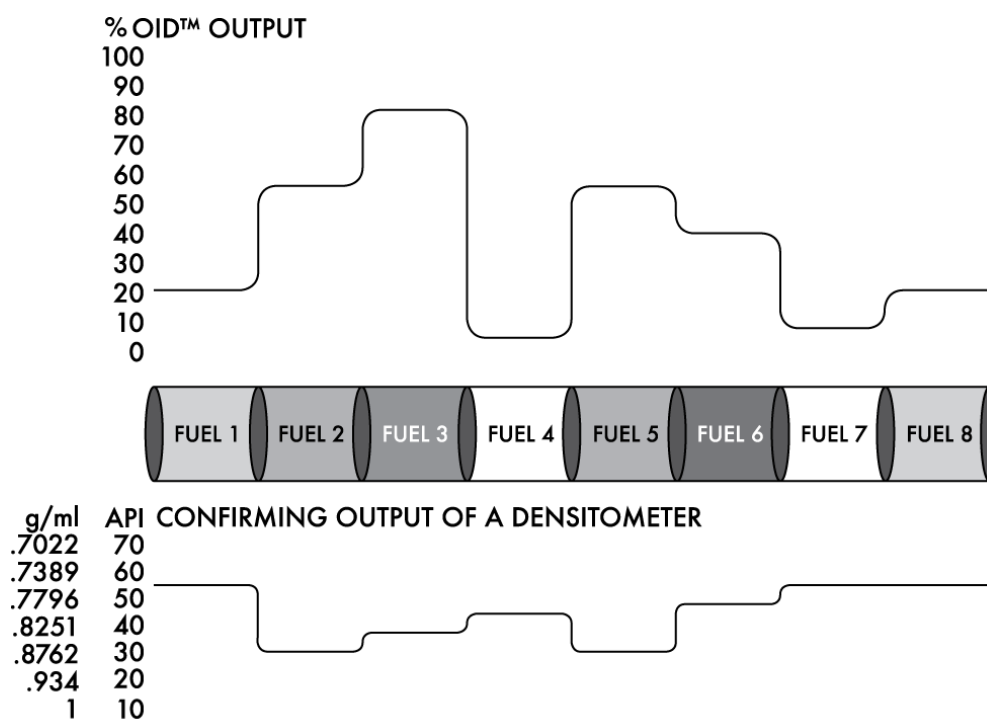
The KAM® OID™ Optical Interface Detector has been the preferred sensor for interface detection between refined products since its inception in 2000. Literally like eyes in the pipe, it provides **accurate, real-time data on product interface and quality**. That data allows operators to monitor interface 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 photo detector 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**



### FEATURES

- 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* Electronics enclosure–Copper-free aluminum
Power:	12–24 VDC 2 Watts
Output:	4–20 mA
Communication Port:	RS232 (diagnostics), RS485 (Modbus RTU)
Fluid temperature:	-40° to 176° F (-40° to 80° C)
Ambient temperature:	-4° to 140° F (-20° to 60° C)
Pressure ratings:	ANSI 150, 300, 600, 900
Hazardous area:	PTB 04 ATEX 1027 II 2 G Ex db IIB T6 IECEX PTB 21.0012 Ex db IIB T6 Gb
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)

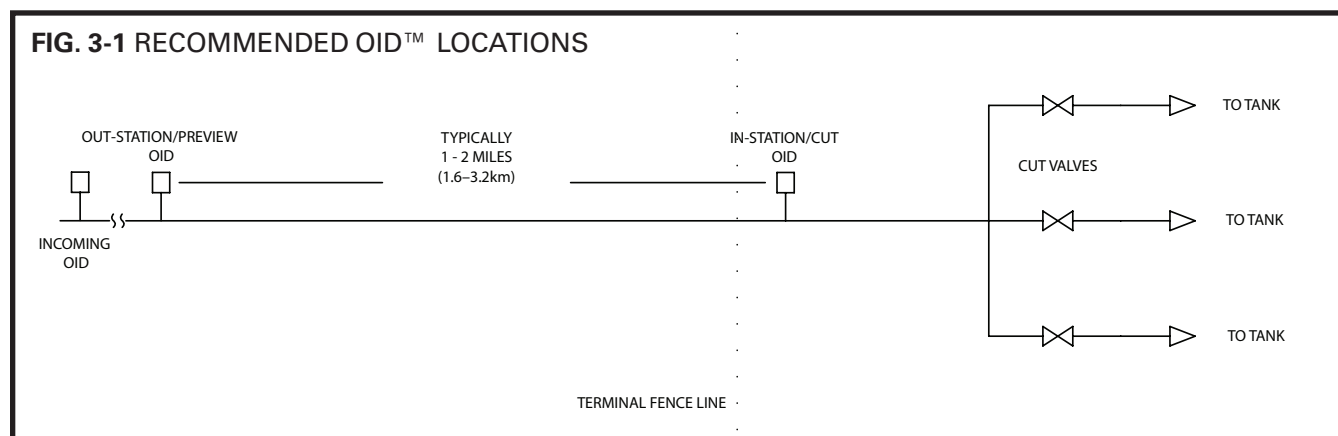
\* Seal Housing for 2" MNPT Models are Carbon Steel.

# INSTALLATION

## LOCATION

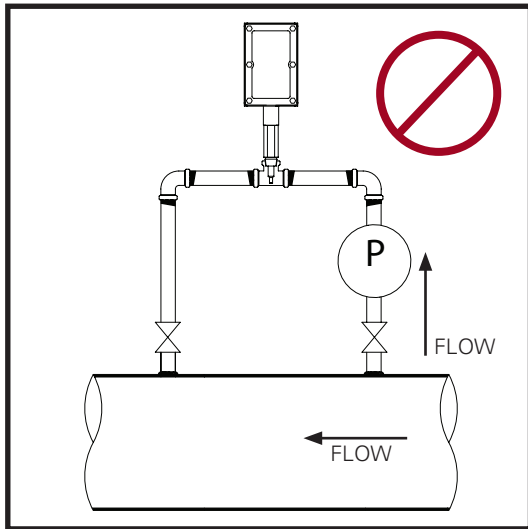
For optimal batch detection, KAM CONTROLS recommends that you install the in-station OID™ sensor at the first accessible pipeline location inside the terminal fence line – upstream of the interface cut valve(s). This allows the operator ample time to open/close the cut valves prior to the arrival of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

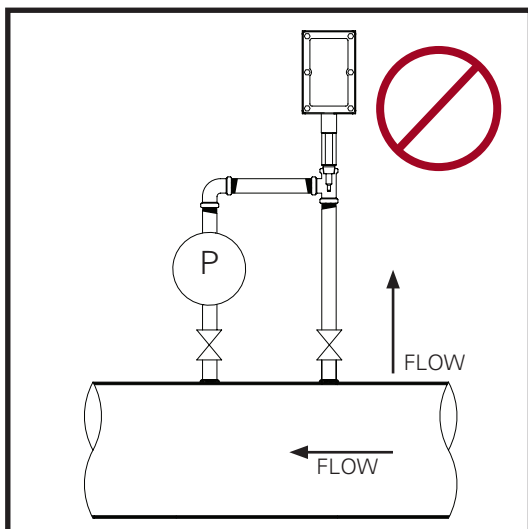
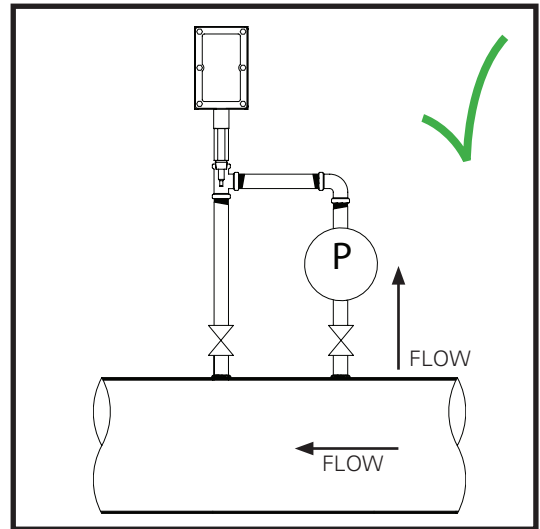


# INSTALLATION CONTINUED

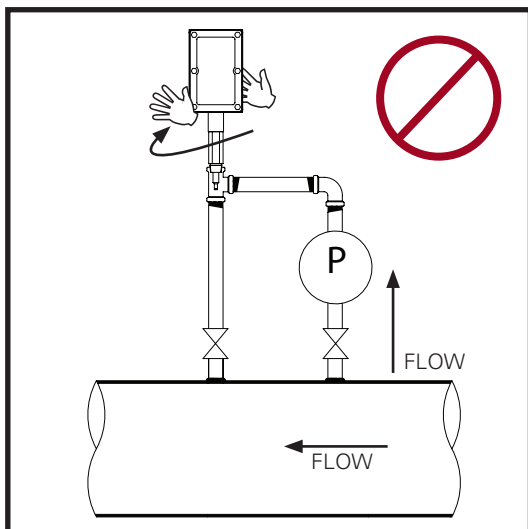
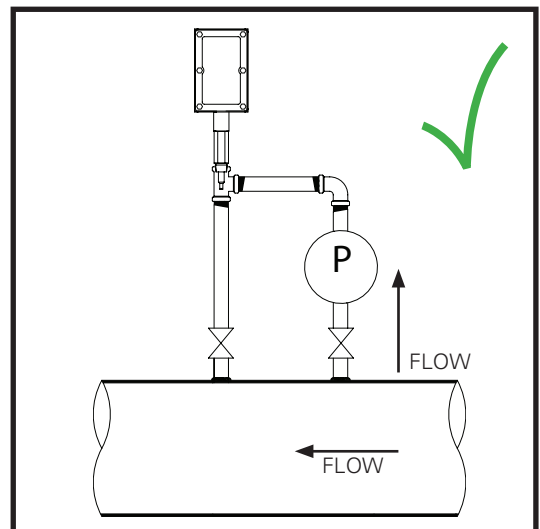
## INSTALLATION DO'S AND DON'TS



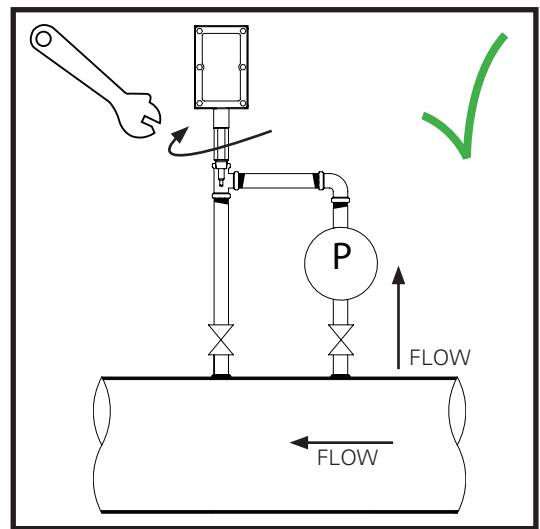
DO NOT install the fast loop OID™ sensor in a straight portion of pipe. It needs to be mounted off the bend opposite the pump.



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.

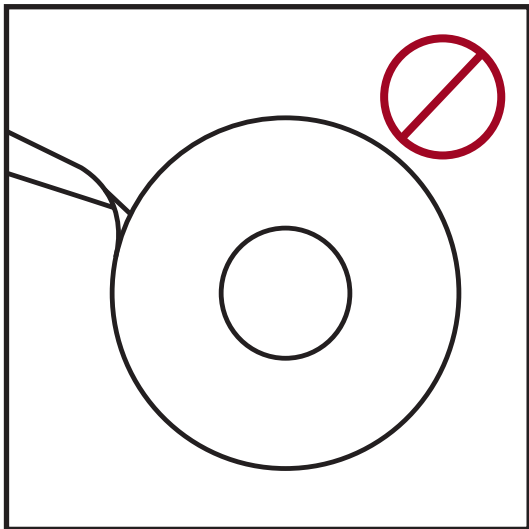


DO NOT attempt to screw the OID™ sensor either in or out by hand. Always use a 1 1/4" or 1 3/8" wrench on the wrench flat below the electronics enclosure.

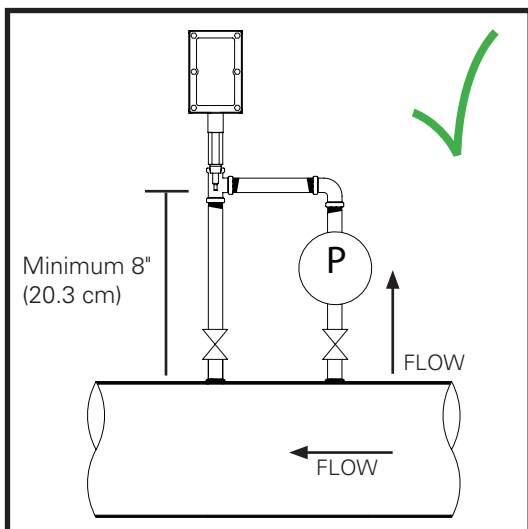
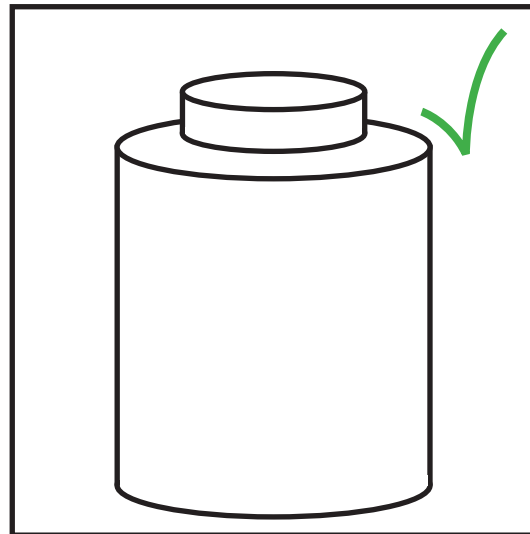


# INSTALLATION CONTINUED

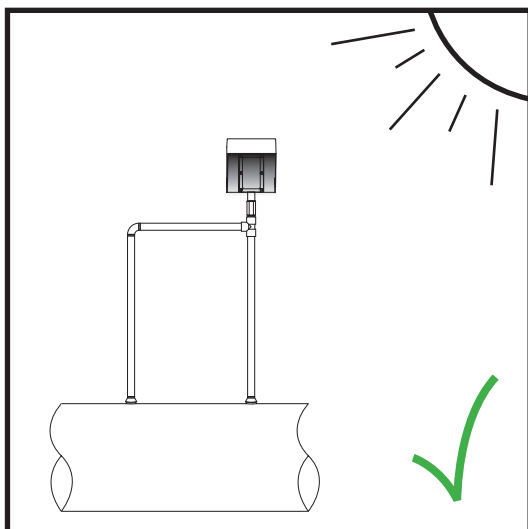
## INSTALLATION DO'S AND DON'TS



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 sunshade 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™ can be installed directly in main lines with a pipe diameter of 6" and greater.

On applications where the pipe diameter is less than 6" the instrument must be installed on a "T" or analyzer loop with a minimum distance of 6" before any bends, reducers, elbows, valves, etc.

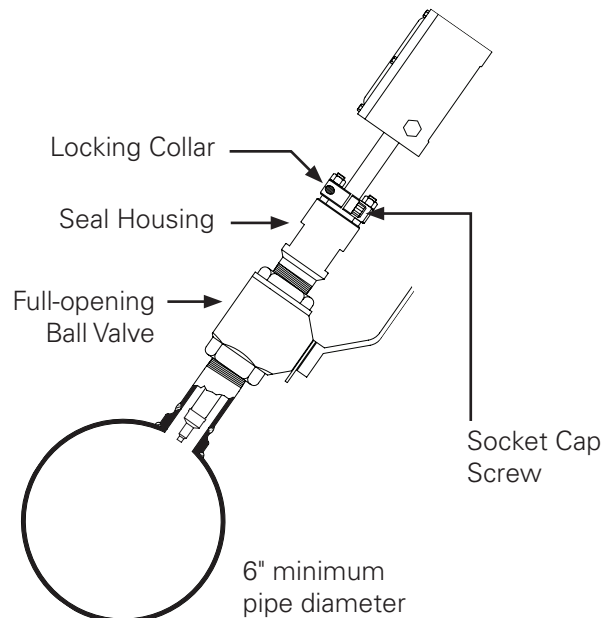
The KAM® OID™ sensor should be installed according to FIG. 3-2. KAM CONTROLS recommends installing the OID™ sensor at a 2 or 10 o'clock position to ensure the tip of the probe remains in the fluid. A full-opening ball valve is used to isolate the OID™ sensor from the pipeline during installation or removal. The seal housing of the OID™ sensor allows the optical probe to be inserted and removed from the pipe under pressure and flow conditions. 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.

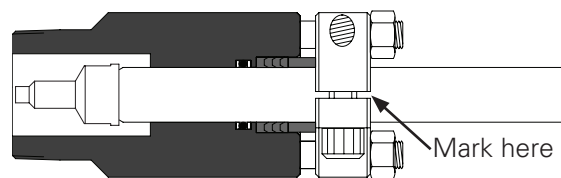
Prior to mounting the OID™ sensor on the Full-opening Ball Valve, you must determine the insertion length required.

1. Lay the OID™ sensor on the ground or a table.
2. Loosen Socket Cap Screw, using a 3/8" Allen wrench 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.)

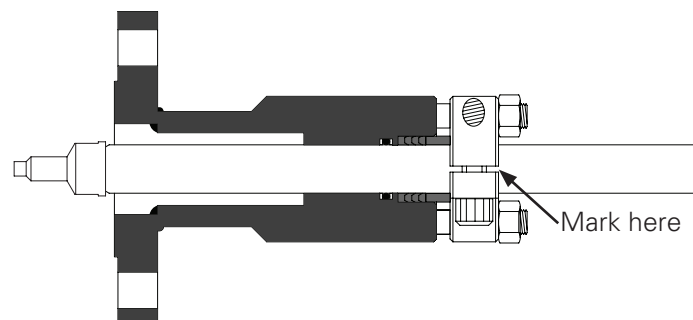
**FIG. 3-2 KAM® OID™ INSTALLED ON A MAIN PIPE**



**FIG. 3-3**

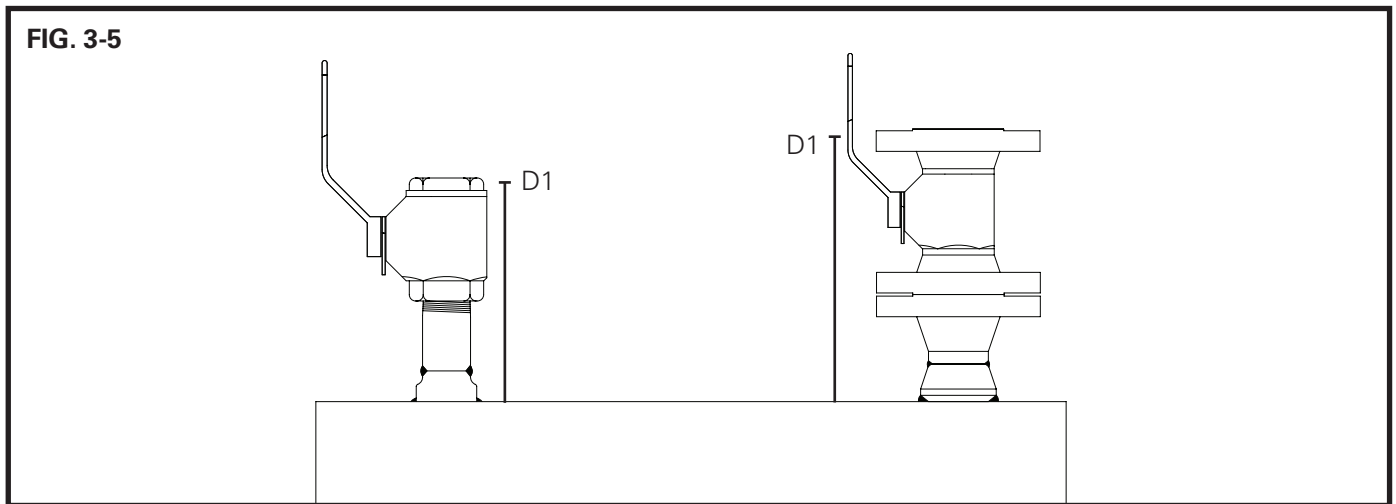


**FIG. 3-4**



## 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 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.



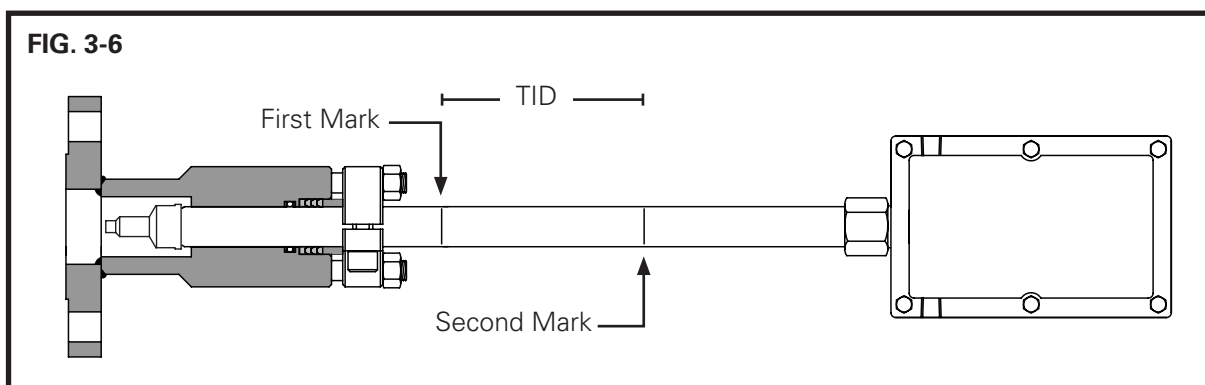
7. Calculate the insertion distance for **Flanged Seal Housing** (If you have an MNPT Seal Housing, proceed to step 10):

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

Example for  $D1=19"$ ,  $\text{Pipe WT}=3/8"$ , and Seal Thickness is  $1/8"$   
 $TID=19 + 3/8 + 1/8 - 1/4$  or  $TID=19 + 0.375 + 0.125 - 0.25$   
 $TID=19 1/4"$  or  $19.25"$

$MID=18 3/8"$

8. Use the calculated TID and mark a second line on the shaft, measuring from first mark. FIG. 3-6.



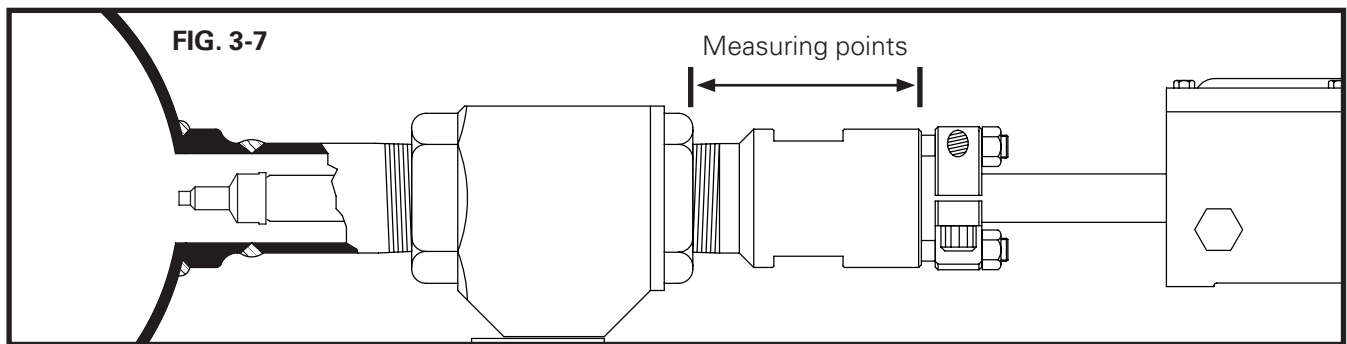
9. Bolt or screw the OID™ sensor to the valve or designated installation location. (KAM CONTROLS recommends using thread sealant and not Teflon tape for the threaded OID™). Skip to Step 12 (OID™ with Flanged Seal Housing only).

## 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.



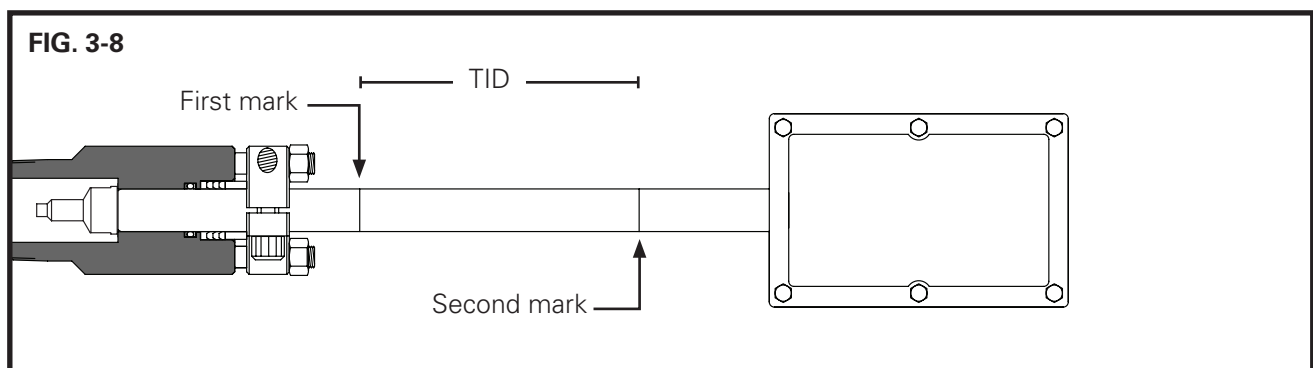
For example:

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.

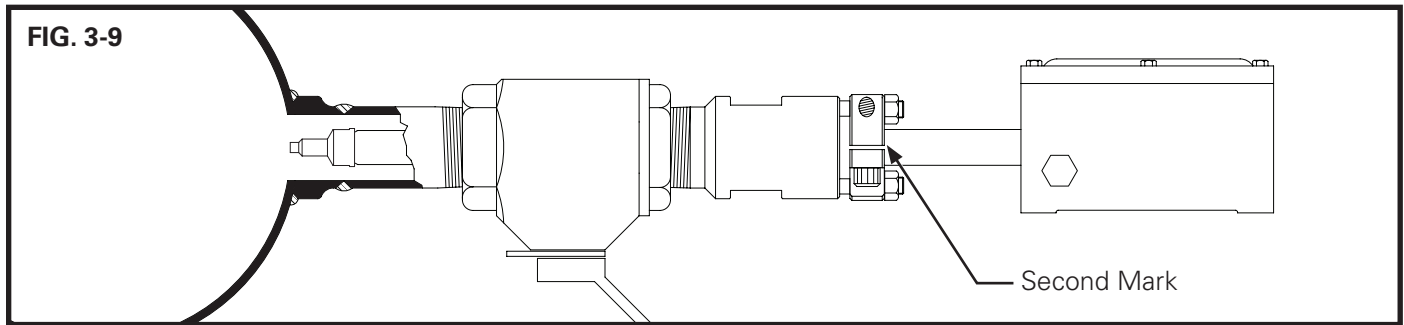
$$\begin{aligned} \text{TID} &= (\text{D1}) + (\text{Pipe Wall Thickness}) - (\text{TD}) - (.25") \\ \text{Example for D1}=19", \text{Pipe WT}=3/8", \text{ and TD}=.6" \\ \text{TID} &= (19) + (.375) - (.6) - (.25) \\ \text{TID} &= 18.525" \end{aligned}$$

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



## INSTALLATION CONTINUED

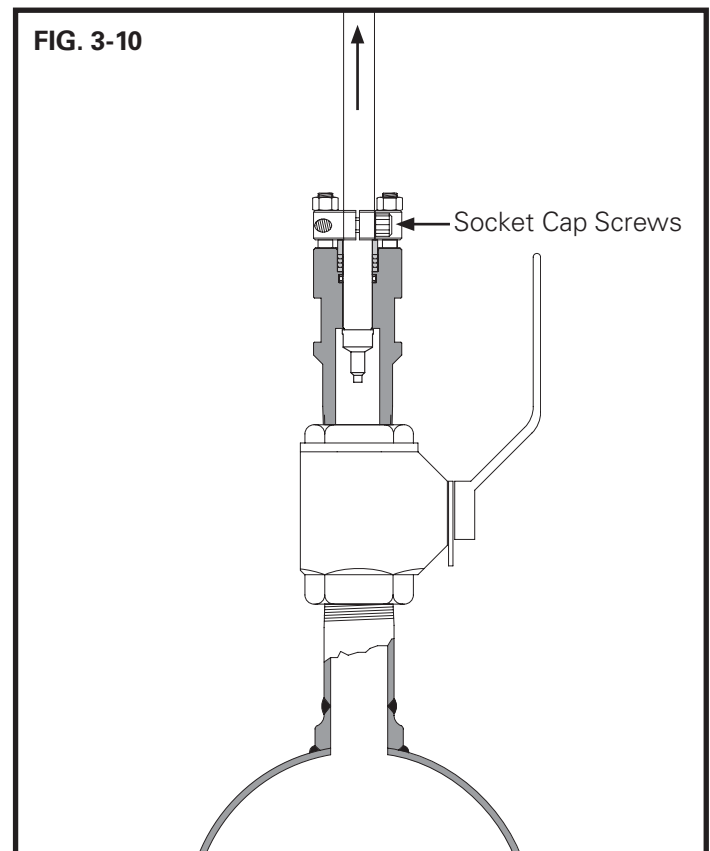
12. If you have an OID™ with a Flanged Seal Housing, you may now attach it to the valve on the pipeline.
13. Slowly open Full-opening Ball Valve and check for leaks.
14. Using a 3/8" Allen wrench, loosen Socket Cap Screw on the Locking Collar.
15. Push the OID™ in until the Second Mark is at the top edge of the Locking Collar. FIG. 3-9.



16. Re-tighten the Socket Cap Screws.
17. Tighten the Hex Nuts, using a 3/4" wrench, 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.  
  
CAUTION: 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.



# INSTALLATION CONTINUED

## ANALYZER LOOP INSTALLATION

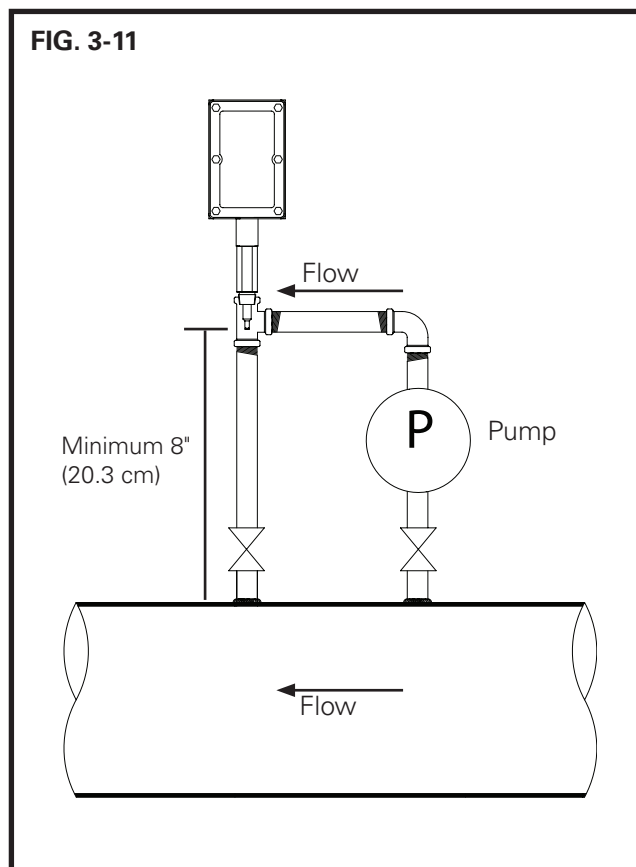
KAM CONTROLS recommends this installation for 3/4" & 1" MNPT OID™ sensors.

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 6-7.

KAM 3/4" and 1" MNPT OID™ sensors should be installed according to FIG. 3-11. 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 obtain a credible reading of the product pipeline interface and 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.



# INSTALLATION CONTINUED

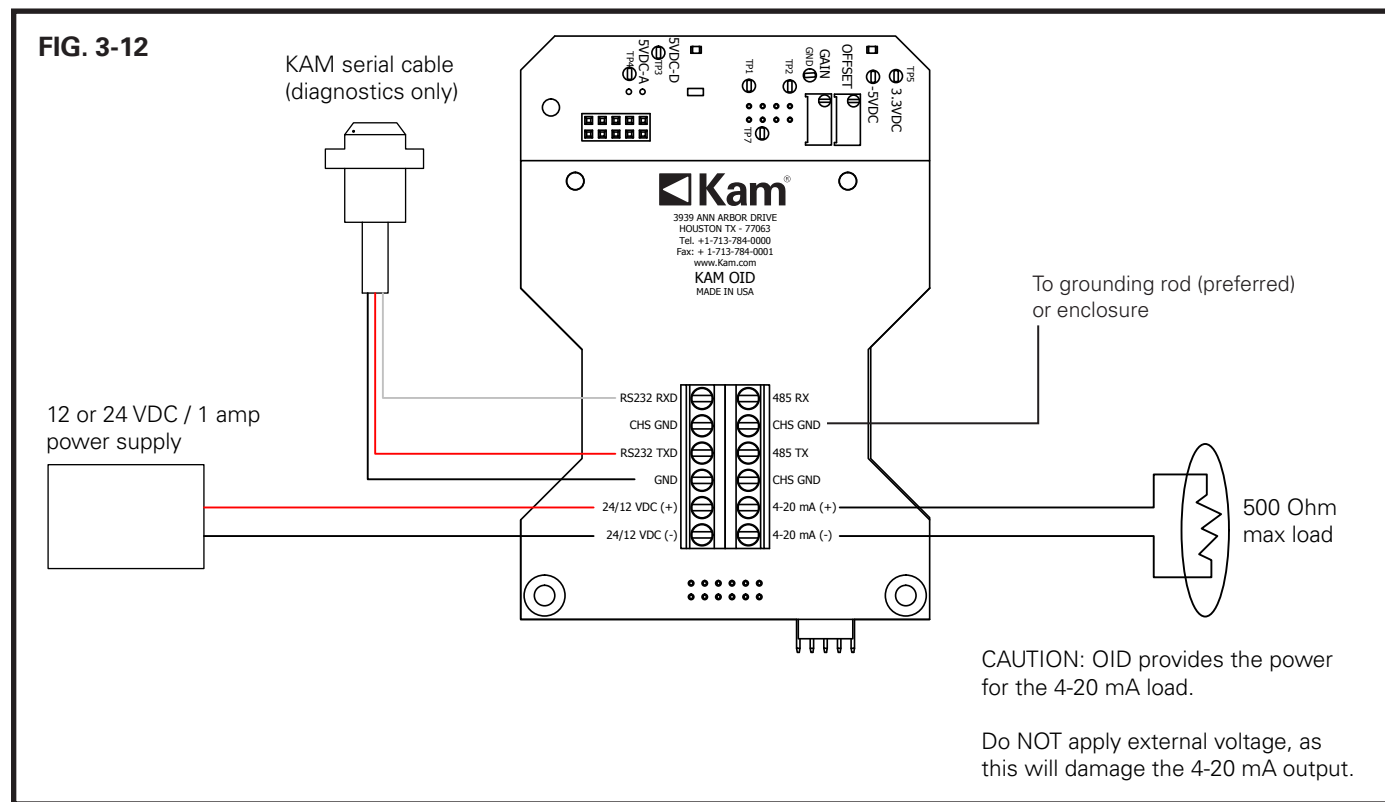
## WIRING

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.

- The installed 3/4" NPT plug is not part of the instrument installation and should be replaced by the appropriate Ex certified 3/4" NPT plug for the final installation.
- The Optical Interface Detector KAM OID resp. KAM CHA Color Haze Analyzer EX shall be connected by means of suitable cable entries, resp. conduit systems which correspond technically to the requirements at least of the standard conditions, indicated on the cover sheet of the referenced ATEX certification, and for which a separate test certificate is available. Thereby the operating conditions specified in the appropriate certificates of the components are to be considered absolutely.
- Cables entries (heavy-gauge screwed cable glands) and sealing plugs of simple construction shall not be used. For connection of the Optical Interface Detector KAM OID resp. KAM CHA Color Haze Analyzer EX by means of an approved conduit entry, the associated sealing device must be arranged directly at the enclosure.
- Non-used openings shall be sealed according to EN 60079-1, section 13.8.
- The connecting lead of the Optical Interface Detector KAM OID resp. KAM CHA Color Haze Analyzer EX shall be installed as permanent installation and as such that it is sufficiently protected against damage.

# INSTALLATION CONTINUED

## WIRING CONTINUED



### POWER

V (+)  
GND

### OUTPUTS

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

### COMMUNICATION INTERFACE

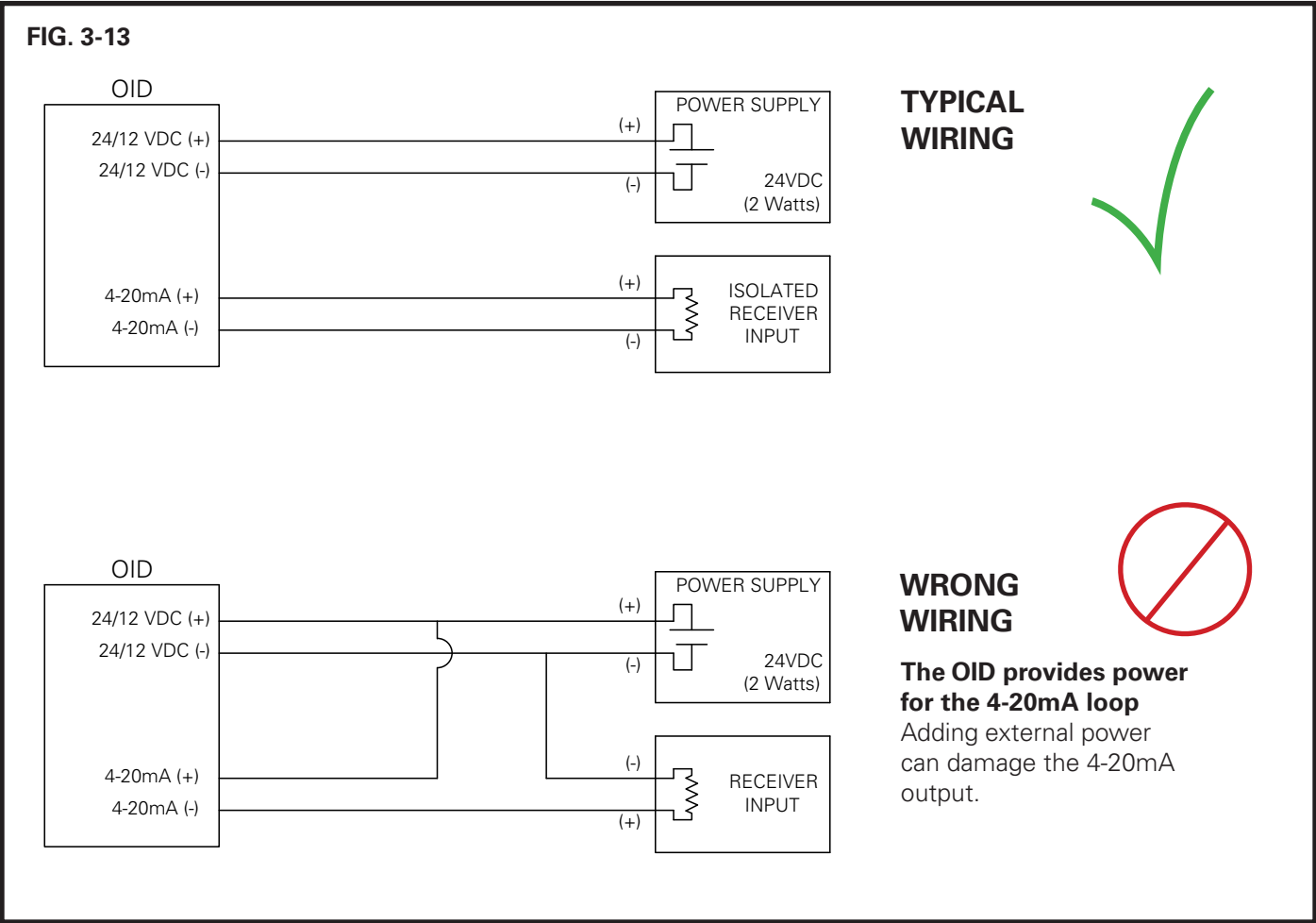
RS232 (diagnostics)  
RS485 (Modbus RTU)

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

## WIRING CONTINUED

### TYPICAL POWER AND LOOP WIRING CONFIGURATION



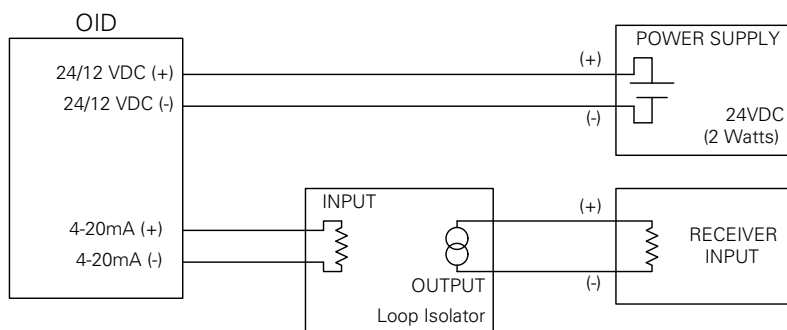


# INSTALLATION CONTINUED

## WIRING CONTINUED

### POWER SUPPLY AND OUTPUT WIRING WITH LOOP POWERED ISOLATOR (recommended)

**FIG. 3-14**



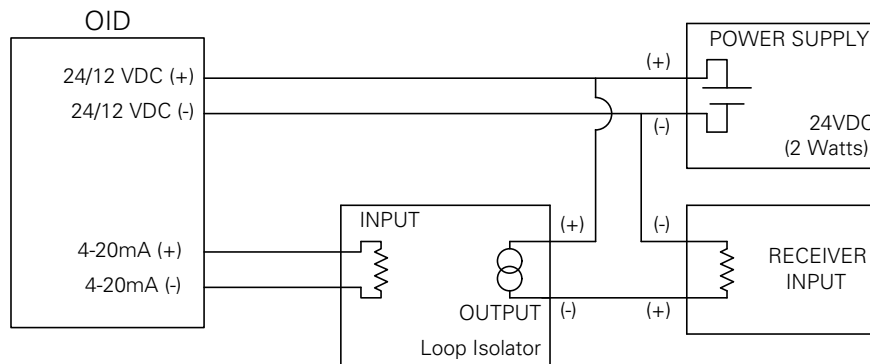
#### **Recommended 4-20 mA Loop Isolators:**

XCONPC528P DIN Rail Mount Loop Powered Isolator, 4-20mA, Galvanic, UL Listed or equivalent (V min 10 Volts)

Loop Isolator Minimum Requirements:  
Voltage: 6- 30 VDC  
Input Range: 0-20 mA

### POWER SUPPLY AND OUTPUT WIRING WITH EXTERNAL POWER ISOLATOR

**FIG. 3-15**

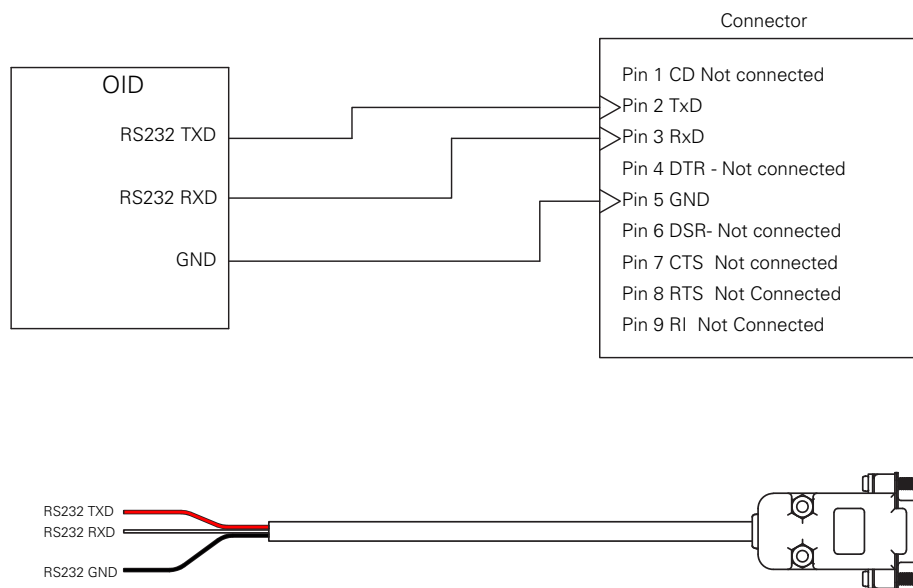


# INSTALLATION CONTINUED

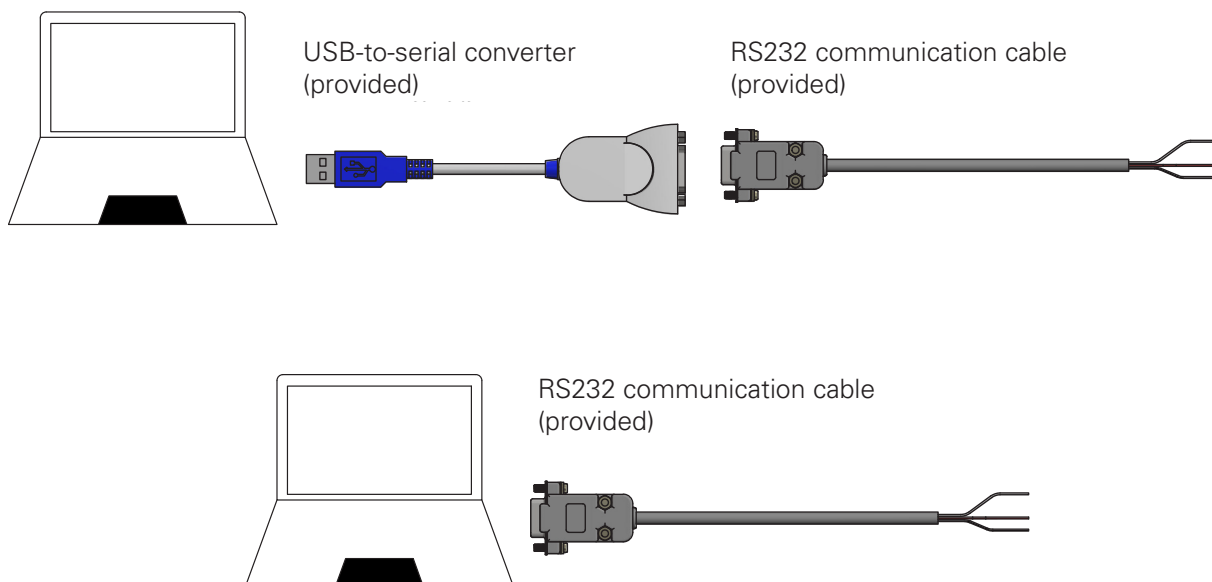
## WIRING CONTINUED

### RS232 WIRING DIAGRAM

**FIG. 3-16**



**FIG. 3-17**

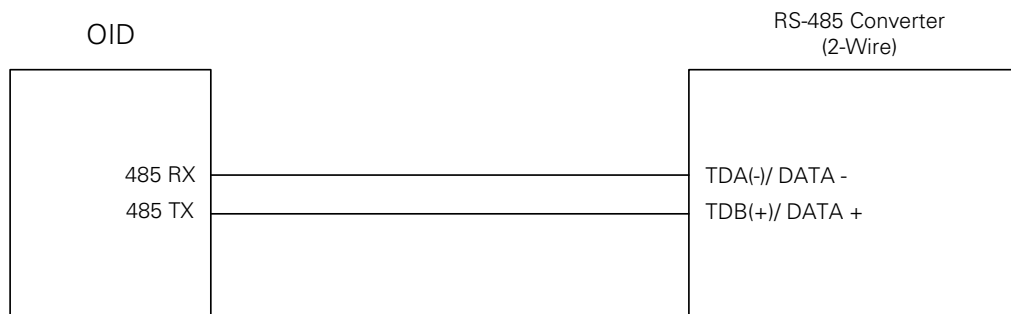


# INSTALLATION CONTINUED

## WIRING CONTINUED

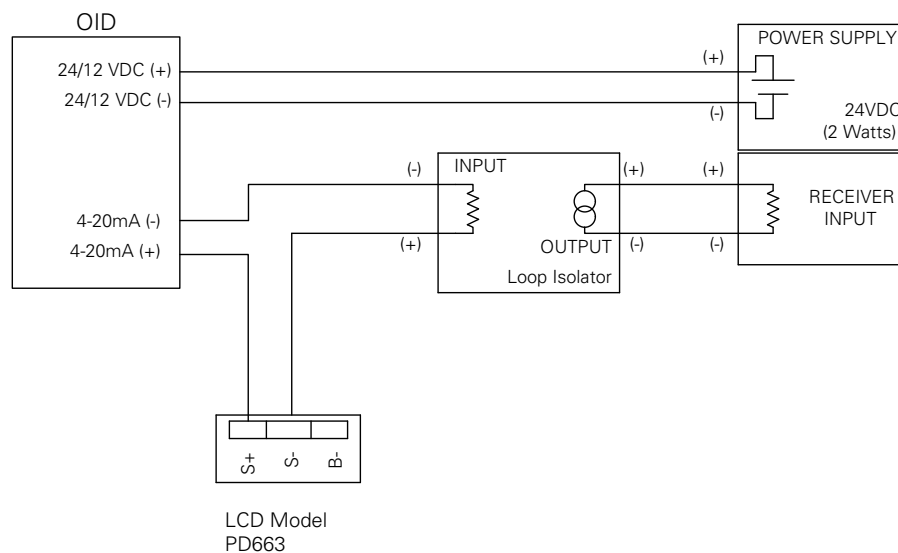
### RS485 WIRING DIAGRAM

**FIG. 3-18**



### POWER SUPPLY AND OUTPUT WIRING WITH LCD & LOOP POWERED ISOLATOR (Recommended)

**FIG. 3-19**



#### **Recommended 4-20 mA Loop Isolators:**

XCONPC528P DIN Rail Mount  
Loop Powered Isolator, 4-20mA,  
Galvanic, UL Listed or equivalent  
(V min 10 Volts)

# INSTALLATION CONTINUED

## CONNECTING THE OID

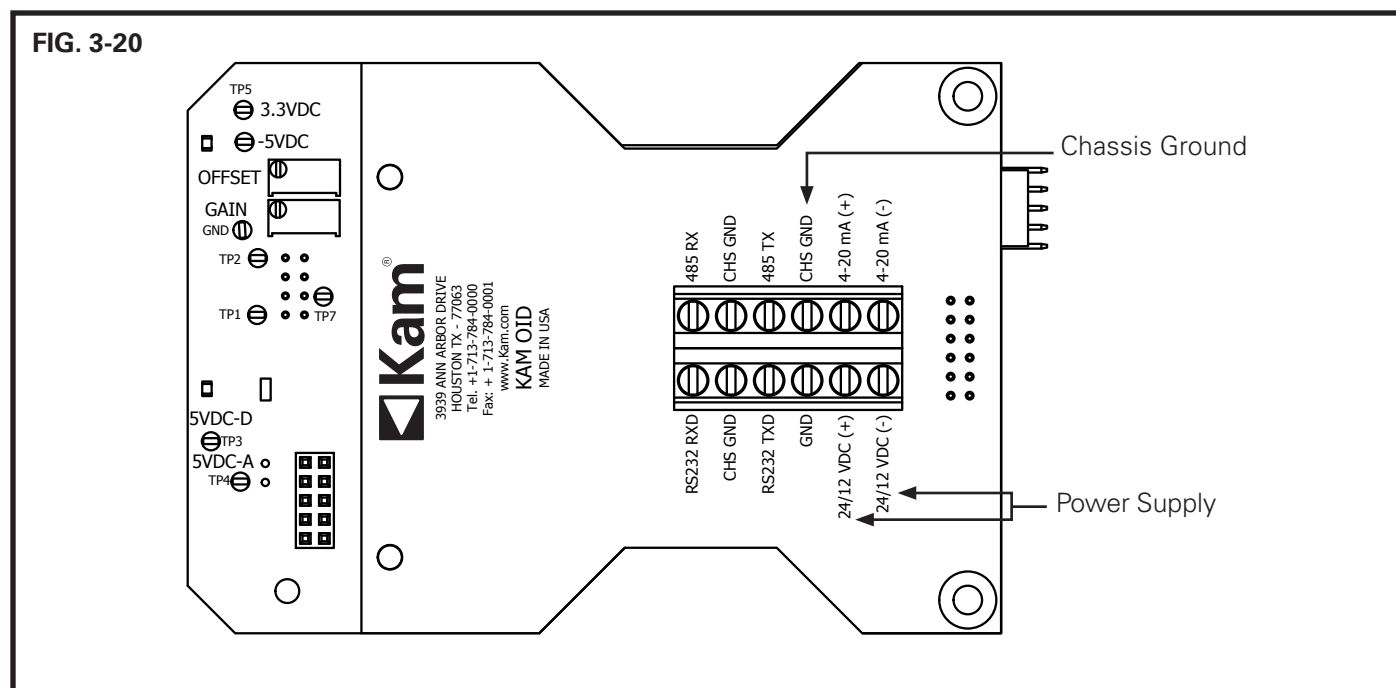
### 1. Proper Grounding of the OID™ sensor:

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 (if not already done) on the OID™ board (labeled CHS on the OID™ Terminal Block. FIG. 3-20) to the green grounding screw on the OID™ explosion-proof box using 16 AWG braided wire. Ensure 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 24/12 VDC (+). FIG. 3-20.
4. Connect negative wire to 24/12 VDC (-).\*\* FIG. 3-20
5. Check voltage and polarity at terminal block.



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 terminal board will damage the 4-20 mA output and result in failure of the unit.

# FIELD CALIBRATION

Though the KAM® OID™ sensor is factory calibrated, it should be calibrated in the field to suit specific application requirements and fuels. Increasing or decreasing the sensitivity will allow the instrument to maintain the highest resolution possible while detecting the interface of all possible fuels.

INCREASE SENSITIVITY WHEN 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 unique 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: VOLTMETER, SMALL FLAT-HEAD SCREWDRIVER

## CHANGING THE HIGH END OF OUTPUT RANGE

1. Determine which product produces the highest current output.
2. Connect a voltmeter across 4-20 mA terminals. When the highest output product is flowing, increase the gain by turning GAIN counterclockwise or decrease by turning clockwise. As you are turning, look at your voltmeter and stop when it reads 16.8 mA or 80% of scale. See FIG. 4-1 on page 21.

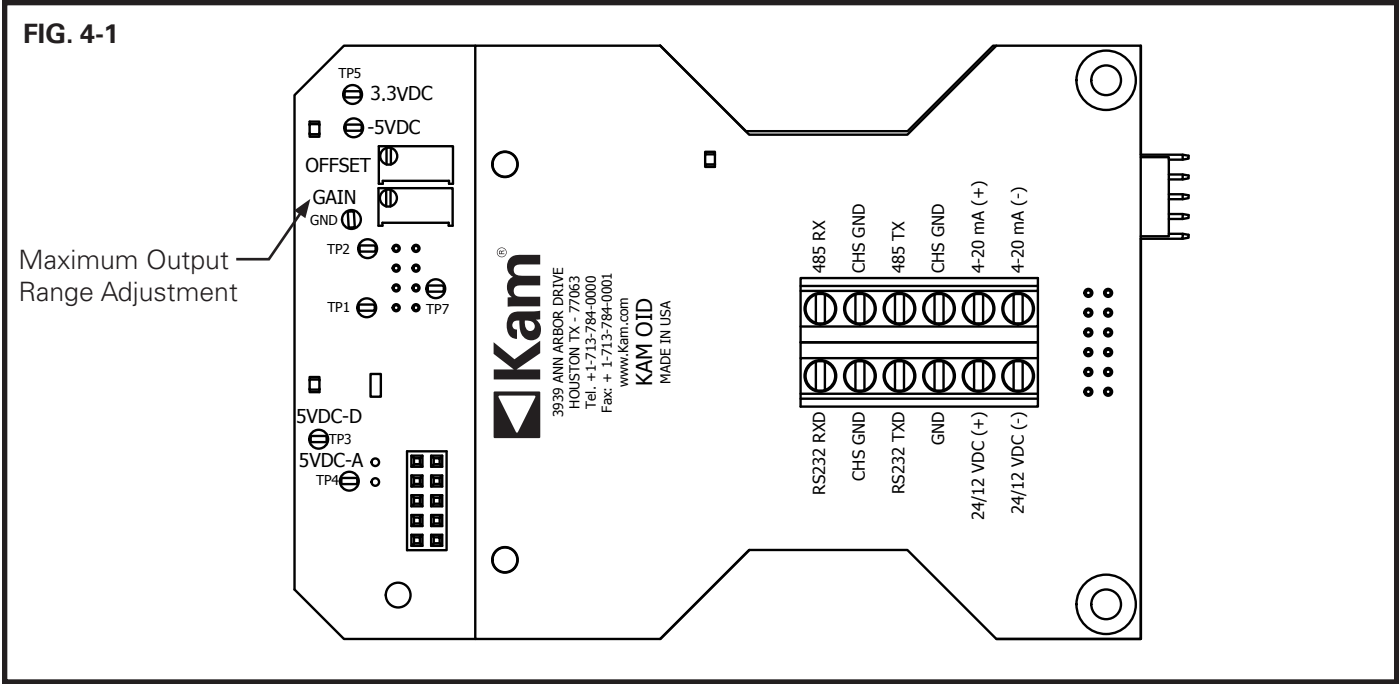
## CHANGING THE LOW END OF OUTPUT RANGE

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 all products are producing an output greater than 40%.

Should the low end of the range require adjustment, please contact the KAM factory directly at +1 713 784 0000.

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

# FIELD CALIBRATION CONTINUED



# 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, isopropyl alcohol, gasoline, or diesel. Do not use other chemicals.

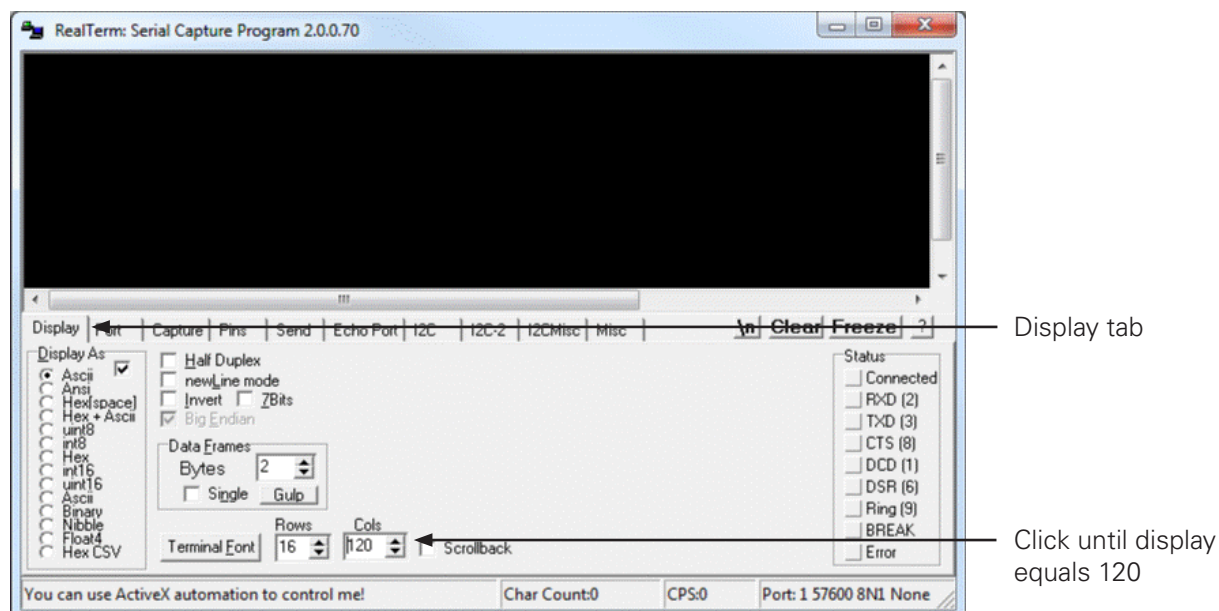
If you have a question regarding cleaning solvents, please contact KAM CONTROLS directly at +1 713 784-0000 or email: AskAnEngineer@Kam.com

## DIAGNOSTICS VIA RS232

Connecting to the RS232 Serial Port using RealTerm

1. Install RealTerm if not installed on your PC.
  - RealTerm Software can be downloaded at <http://sourceforge.net/projects/realterm/files/Realterm/2.0.0.70/>
  - Click on Realterm\_2.0.0.70.\_setup.exe to install.
2. Connect the RS232 cable to the OID™ as shown in the wiring diagram. FIG. 3-12 on page 14.
3. Connect the other end of the RS232 Cable to your computer serial port or to USB with the provided serial converter.
4. Open RealTerm. A window will open up as shown in FIG. 5-1.
5. The program will open on the "Display" tab. Click on the up arrow of the "Cols" window until it reaches 120. Do not try to type the number in the window as it will result in an error. If you do this, you must close the program and start again.

FIG. 5-1



## MAINTENANCE CONTINUED

6. Click on the "Port" tab (See FIG. 5-2), and change the settings as follows:

Baud: 115200

Parity: None

Data Bits: 8

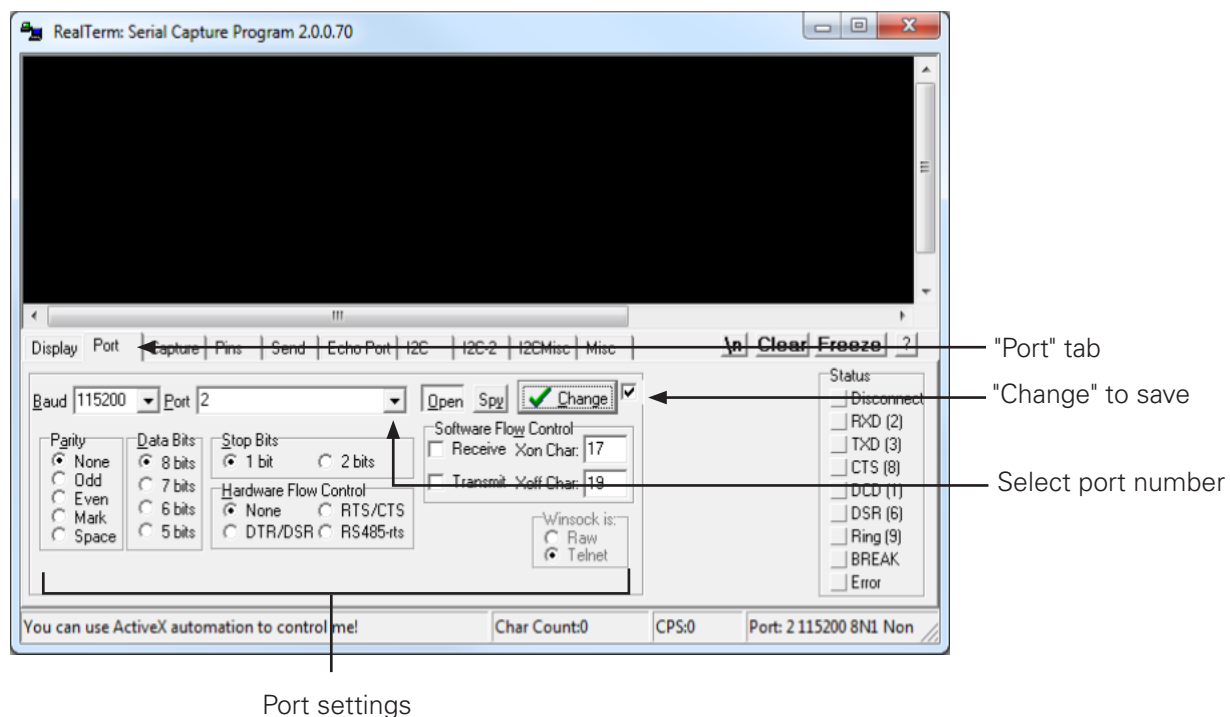
Stop Bits: 1

Hardware Flow Control: None

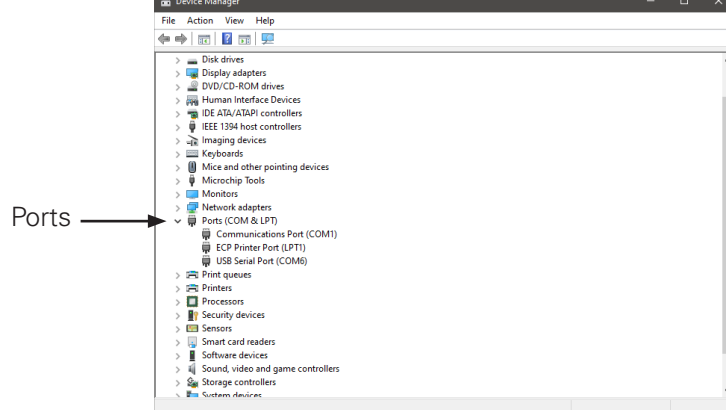
Port: Select port number assigned to your serial port or USB to serial converter. You can find this information in the Device Manager of your PC under "Ports." FIG. 5-3.

7. Click on the "Change" button to save these settings.

**FIG. 5-2**



**FIG. 5-3**

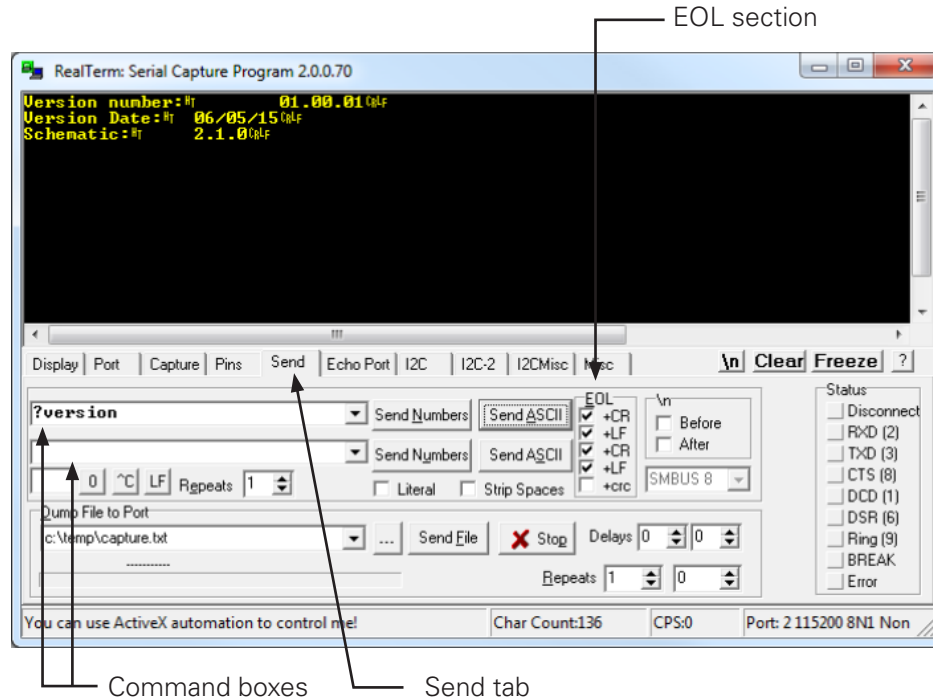




## MAINTENANCE CONTINUED

8. Click on the "Send" tab.
9. Check the first 4 boxes in the "EOL" section.
10. Type "?version" in either of the command boxes and click the "Send ASCII" button. You will see a message on the window displaying the software version number, the version date and the schematic version of the board.

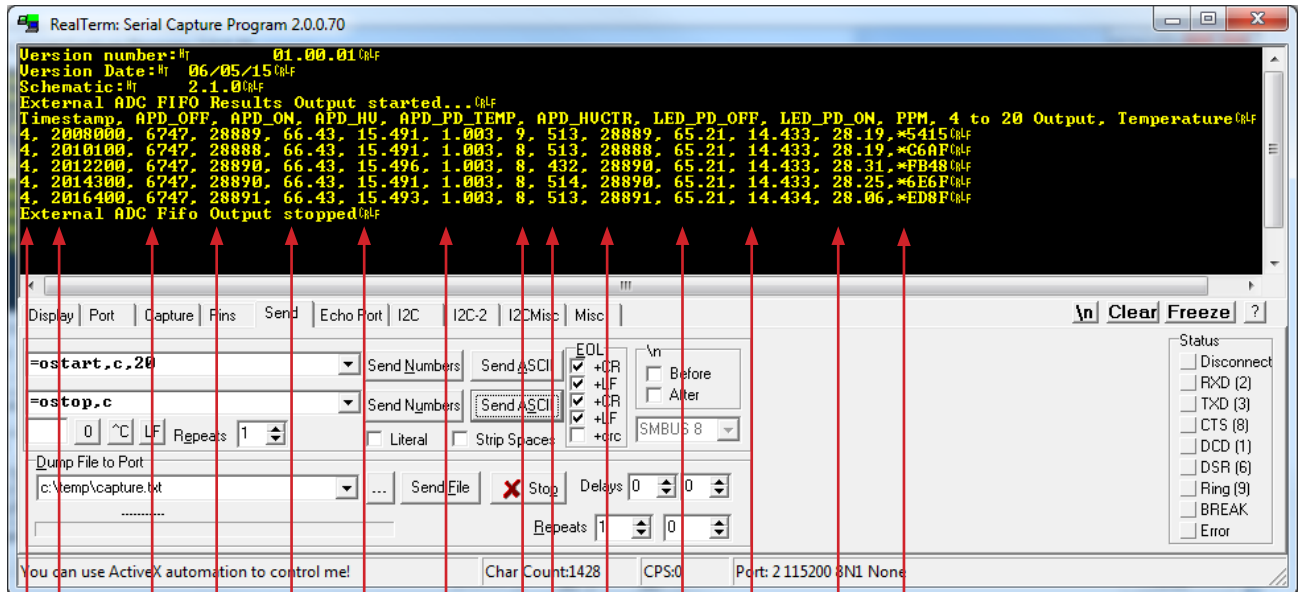
FIG. 5-4



10. To view output data, type the command "=ostart,c,20" and click on "Send ASCII." See FIGs. 5-5 and 5-6 on pages 25 and 26.
11. Type the command "=ostop,c" to stop the data. **Always do this before disconnecting.**

# MAINTENANCE CONTINUED

**FIG. 5-5** Output data OID™ models serial numbers OID-15-1045 to OID-15-1061



**Column 14** - CRC Cyclic Redundancy Check (for information only)

**Column 13** – Electronics temperature

**Column 12** – OID output on a 4-20mA range

**Column 11** – OID output on a 0-100% range

**Column 10** – Signal in counts after any compensations such as compensation for temperature.

**Column 9** – Value of the photodiode monitoring the LED when it is ON. This value is shown in counts and should be between 400 & 600. If the LED is damaged and not turning on this value will be the same as in column 8.

**Column 8** – Value of the photodiode monitoring the LED when it is OFF. This value is shown in counts and should be less than 100.

**Column 7** – Reference Voltage that controls the High Voltage supply. This value should be between .980 to 1.100 VDC

**Column 6** – MPPC Photodiode Temperature, controlled by a thermoelectric cooler inside the photodiode. The factory temperature is between 14C and 16C.

**Column 5** – High Voltage supply going to the MPPC Photo diode. The range is from 63VDC to 69VDC.

**Column 4** – Signal value from the MPPC photodiode. This value is also in counts. It has range from  $6553 \pm 500$  to 58982 ( 0.5V to 4.5V) depending on the product that the probe is seeing.

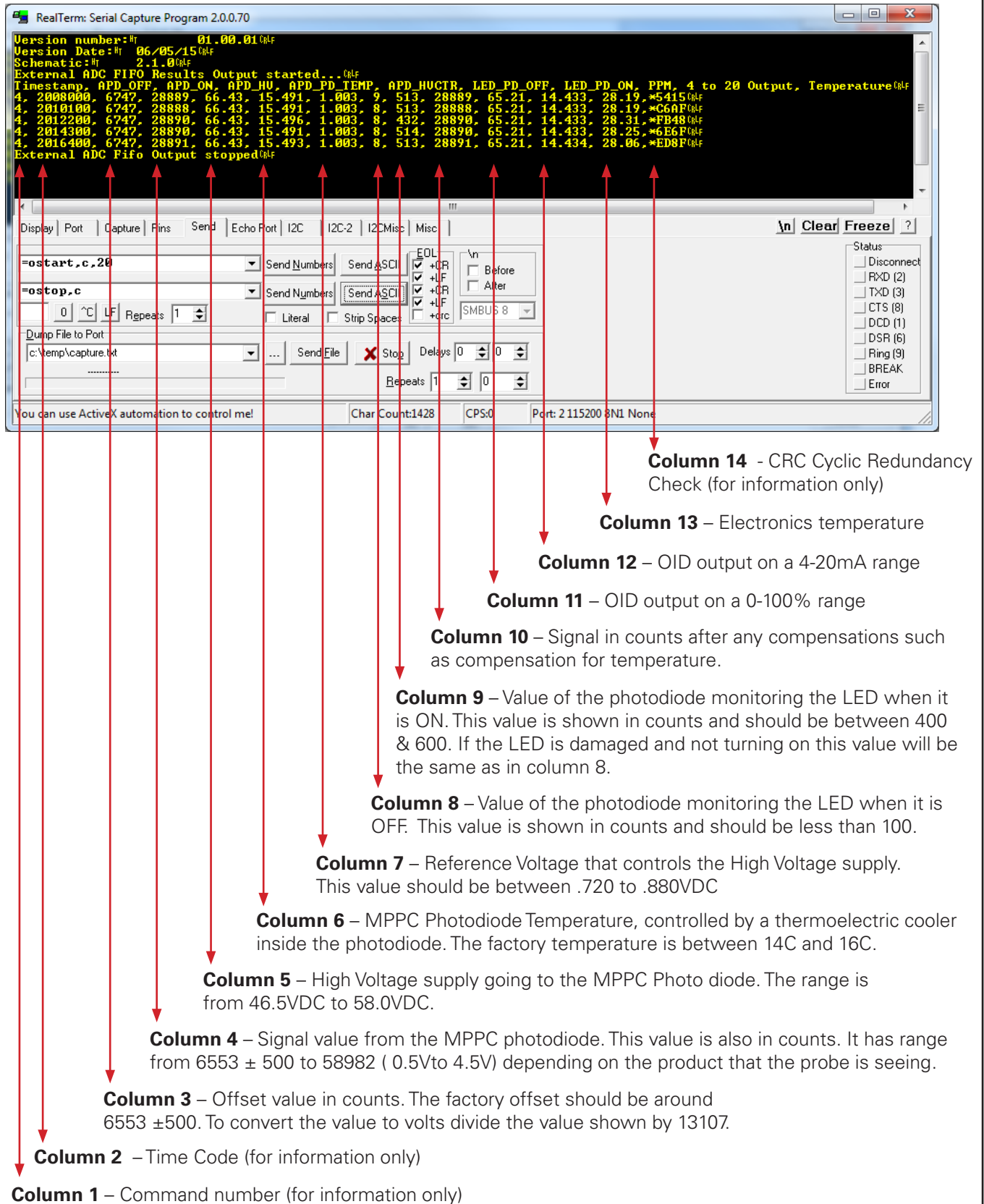
**Column 3** – Offset value in counts. The factory offset should be around  $6553 \pm 500$ . To convert the value to volts divide the value shown by 13107.

**Column 2** – Time Code (for information only)

**Column 1** – Command number (for information only)

## MAINTENANCE CONTINUED

**FIG. 5-6** Output data OLD™ models serial numbers OLD-15-1062 or higher



# TROUBLESHOOTING

If experiencing any of the issues listed below, please proceed to follow instructions on each of the following sections in their specific order, starting with the "Power Verification" section.

- Instrument is not powering on
- No 4-20 mA Output
- PLC is not reading the 4-20 mA Output
- No RS232 communication
- No RS485 communication
- Output is not changing
- Instrument does not calibrate.

To perform any of the troubleshooting procedures, you will need to access the boards. To do so, use a 7/16" wrench to remove the (6) hex screws on the electronics enclosure and remove the cover.

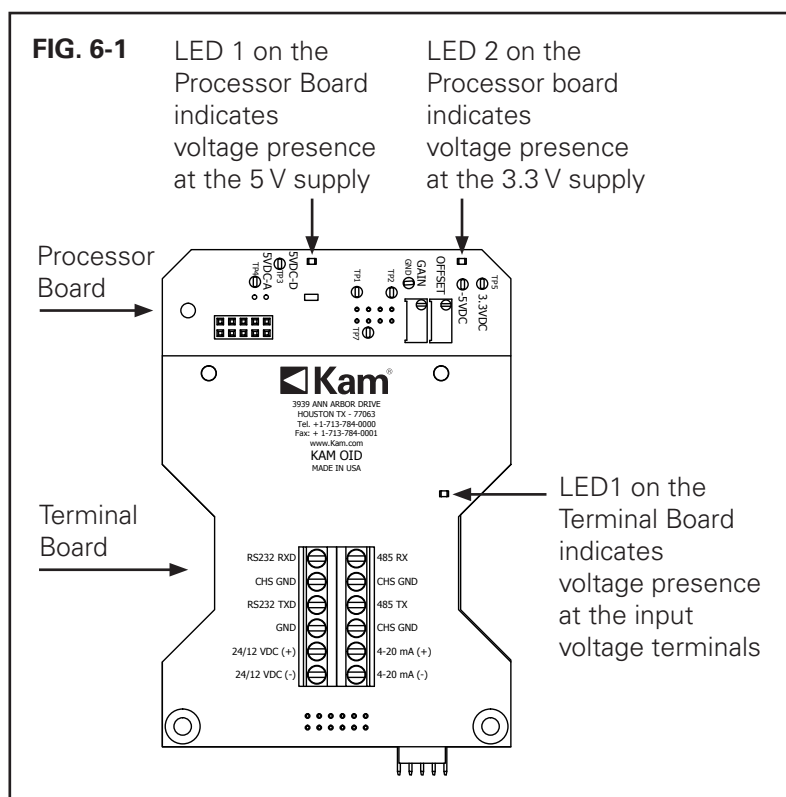
A device to measure both voltage and amperage is needed during the troubleshooting process. Please have a multimeter available before proceeding.

NOTE: Regardless of the problem being experienced, the troubleshooting steps need to be followed in order, starting from the "Power Verification" section.

## POWER VERIFICATION

There are 3 LEDs on the OID™ electronics (two on the Processor Board and one on the Terminal Board). These LEDs indicate the presence of power. When any of the LEDs are lit, it indicates that there is voltage going to the boards, but not necessarily the proper voltage. When any of the LEDs are not lit, it may indicate they are damaged. In any case, the first step is to check all power supplies. Please follow the procedure below.

1. Use a multimeter in voltmeter mode to measure the voltage across the power loop terminals 24/12 VDC (+) and 24/12 VDC (-). The voltage should be within the instrument's requirements (12 V to 24 V) and close to the power supply ratings (+/- 0.5 V). For example, a 24 V power supply could measure 23.5 V on the OID™ terminals. If the voltage is not within those requirements, verify that the power supply has a wattage capability of 5 Watts, and check for any blown fuses, faulty wiring, or a faulty power supply. If LED1 on the Terminal Board does not light up, but the voltage at the power terminals is within the appropriate range, it indicates a bad LED. The faulty LED will not affect the operation of the instrument, since it is only an indicator that a voltage is present.
2. Once voltage across power loop terminals has been verified, make sure the OID™ is wired with the correct polarity as per the wiring diagram on page 14 of this manual. If the polarity is wrong, turn off the power and rewire the OID™ with the correct polarity. Turn the power back on when done.



NOTE: The OID™ has built-in protection to avoid incorrectly polarized voltages from damaging the instrument.

## TROUBLESHOOTING CONTINUED

3. Use a multimeter in voltmeter mode to verify the voltage of the Processor Board's primary power supply by measuring across TP3 & TP GND and TP4 & TP GND. The voltage should be between +4.8 VDC and 5.1 VDC.

If the voltage is lower than 4.8 VDC, it indicates that the primary power supply of the Processor Board is not working properly or there is a short circuit on the board. The Processor Board needs to be repaired or replaced. Contact KAM Technical Support for further assistance.

NOTE: LED 1 on the Processor Board remains lit when there is voltage between TP3 & TP GND and TP4 & TP GND. If not, it indicates a faulty LED. The faulty LED will not affect the operation of the instrument, but a Processor Board repair is recommended.

4. Use a multimeter in voltmeter mode to verify the voltage of the Processor Board's primary power supply by measuring across TP6 and TP GND. The voltage should be between -4.8 VDC and -5.1 VDC.

If the voltage is lower than -4.8 VDC, it indicates that the primary power supply of the Processor Board is not working properly or there is a short circuit on the board. The Processor Board needs to be repaired or replaced. Contact KAM Technical Support for further assistance.

5. Use a multimeter in voltmeter mode to verify the voltage of the Processor Board's secondary power supply by measuring across TP5 and TP GND. It should be between +3.1 VDC and 3.4 VDC.

If you have a voltage lower than 3.1 VDC, it indicates that the secondary power supply is not working properly or there is a short circuit on the board. The Processor Board needs to be repaired or replaced. Contact KAM Technical Support for further assistance.

NOTE: LED 2 on the Processor Board remains lit when there is voltage between TP5 and TP GND. If not, it indicates a faulty LED. The faulty LED will not affect the operation of the instrument, but a Processor Board repair is recommended.

### 4-20 mA OUTPUT LOOP

Once the power supplies have been verified, proceed to verify the output loop by following the procedure below.

1. Use a small screwdriver to disconnect the wires connected to the 4-20 mA terminals from the Terminal Board.
2. Using a multimeter in voltmeter mode, measure the voltage across the two wires that were connected to the 4-20 mA+ and 4-20 mA- terminals by placing one of the voltmeter's test lead in one wire and the other test lead on the other wire. Polarity is not important. The voltage should be 0 VDC. If there is any voltage, the loop is powered up externally. Proceed to disable the power source from the connected device.
3. Use a small screwdriver to fully close the 4-20 mA+ and 4-20 mA- terminals. Using a multimeter in voltmeter mode, measure the voltage across the 4-20 mA+ and 4-20 mA- terminals. The voltage should be between 10.0 VDC to 12.8 VDC. If the voltage is within the specified range, continue to step 4. If not, contact KAM Technical Support for further assistance.
4. Using a multimeter in ammeter mode measure the amperage across the 4-20 mA+ and 4-20 mA- terminals. The electric current should be between 3.9 to 20.1 mA. If the voltage from step 3 is within the set limits but the electric current is not, check the multimeter fuse and repeat this step. If there is no change, contact KAM Technical Support for further assistance.

If the measurements are within the corresponding ranges, reconnect the 4-20 mA output loop wires to the OID™ as per the wiring diagram on FIG. 3-19, page 18. If the PLC cannot read the output, there could be a wiring issue with the loop. Please inspect the wires from the OID™ to the PLC. If the issue persists, continue to the next section, and contact KAM Technical Support for further assistance.

NOTE: The 4-20 mA terminals are isolated from the chassis/earth ground.

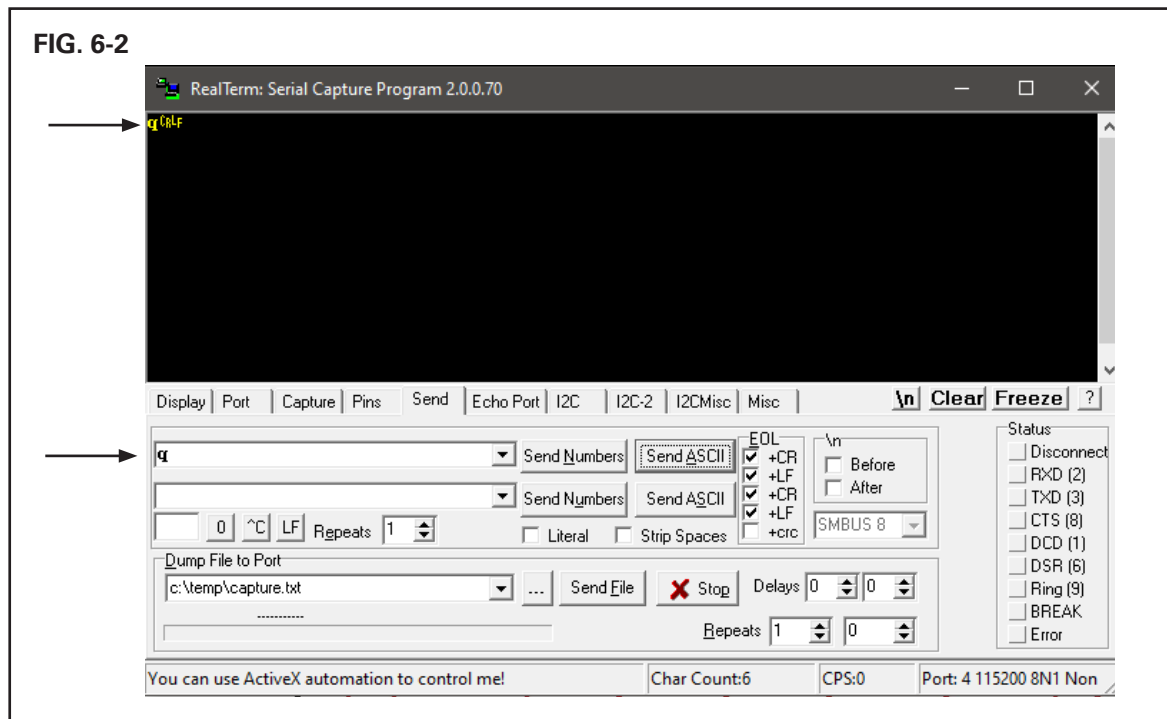
# TROUBLESHOOTING CONTINUED

## RS232 COMMUNICATION

If you have not already done so, follow the previous procedures of the Troubleshooting section to verify power supplies and check the 4-20 mA output.

Before proceeding, please ensure that RealTerm has been installed and properly configured as per instructions on pages 23-24 of this manual. Also, please verify the driver for the supplied USB to serial converter is installed on your PC.

1. Using a multimeter in voltmeter mode, measure the voltage between the terminals RS232 TXD and GND. Ensure the terminal screws on the board are fully closed. The voltage should be between -5 and -10 VDC. If the voltage is not between the stated range, then the RS232 communication circuit might be damaged. Please contact KAM Technical Support for further assistance.
2. If the voltage is within the stated range, proceed to connect the supplied RS232 serial cable and USB to serial converter to your computer and launch RealTerm.
3. The RS232 serial cable has three wires (red, white, and black). Connect the tips of the white wire (RS232 RX) and the red wire (RS232 TX) together. While these wires are connected, type any letter (e.g. "q") in any of the command boxes of the "Send" tab on RealTerm and click on "Send ASCII." If the configuration is done properly, the letter will appear in the window display. FIG. 6-2.



If there is no response, verify the RealTerm settings as per the instructions on pages 23-24 of this manual and try sending the command again.

If there is no change, use another RS232 serial cable and/or USB to serial converter and try sending the command once more.

If there is still no change, there might be a communication issue with the RS232 serial cable, the USB to serial converter, or the computer. Please contact KAM Technical Support for further assistance.

## TROUBLESHOOTING CONTINUED

- Once the letter appears on the window display, connect the RS232 serial cable to the OID™ as per the wiring diagram on page 13 of this manual.
- Using a multimeter in voltmeter mode, measure the voltage between the terminals RS232 RXD and GND. Ensure the terminal screws on the board are fully closed. The voltage should be between -5 and -10 VDC. If the voltage is not between the stated range, then the RS232 serial cable and/or the USB to serial converter might be damaged. They need to be replaced. Contact KAM Technical Support for further assistance.

If the voltage is within the specified range, please continue to the next section and follow instructions for debugging the electronics.

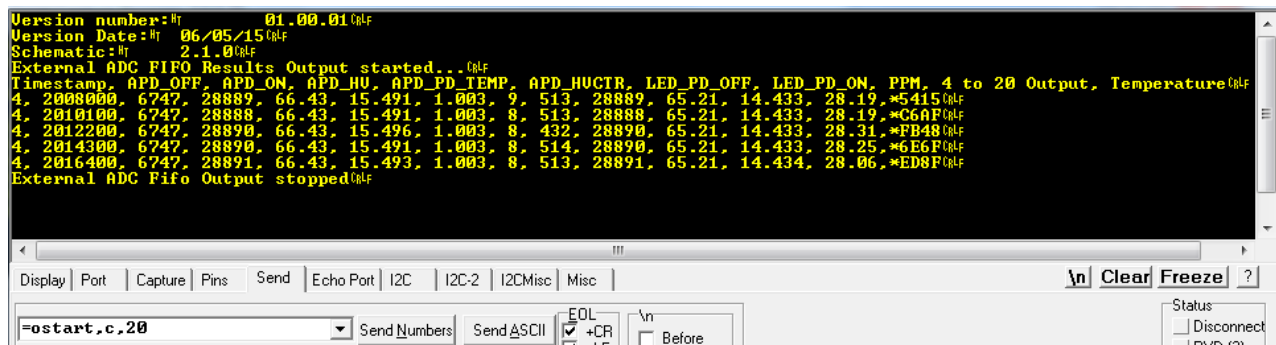
## ELECTRONICS DEBUGGING

The following procedure is to be conducted in cases where the Power Connections, 4-20 mA Output Loop and RS232 Communication sections' steps have been performed, but the output is not changing, the instrument cannot be calibrated, or it is still having issues.

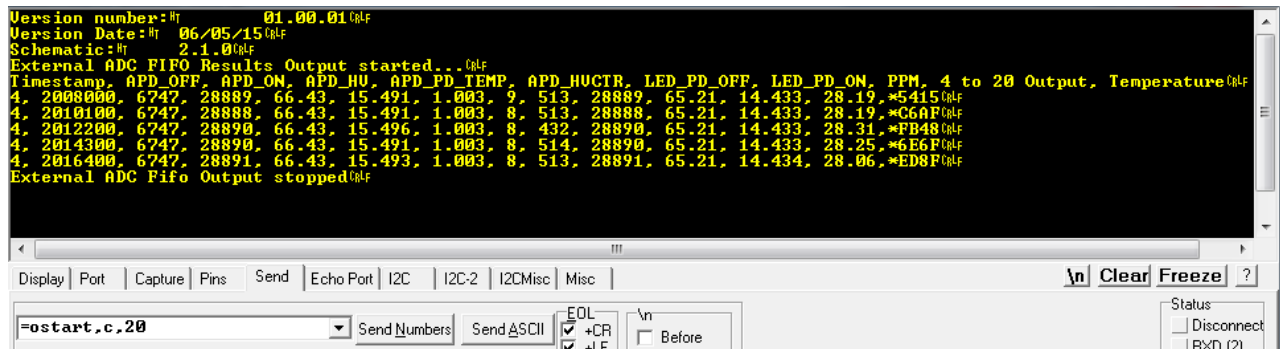
Before proceeding, please ensure that RealTerm has been installed and properly configured as per instructions on pages 23-24 of this manual. Also, please verify the driver for the supplied USB to serial converter is installed on your PC.

- Launch RealTerm and type "=ostart,c,20" in either command box on the "Send" tab and click on "Send ASCII." The instrument's data will start being displayed. If not, contact KAM Technical Support for further assistance. FIG. 6-3 and FIG. 6-4.

**FIG. 6-3** Output data OID™ models serial numbers OID-15-1045 to OID-15-1061



**FIG. 6-4** Output data OID™ models serial numbers OID-15-1062 or higher





## TROUBLESHOOTING CONTINUED

2. Verify that the value of the Offset counts (column 3) is 6553 +/- 500. If the value is within the stated limits, continue to the next step. If not, contact KAM Technical Support for further assistance.
3. Verify that the value of the LED Off signal (column 8) is between 0 and 150 and the value of the LED On signal (Column 9) is between 400 and 600. If the values of these signals are within the stated limits, continue to the next step. If not, contact KAM Technical Support for further assistance.
4. Verify the value of the PD sensor voltage as follows:  
  
For Serial Numbers OID-15-1045 to OID-15-1061: Column 5 should be between 63 and 69.  
For Serial Numbers OID-15-1062 or higher: Column 5 should be between 46.5 and 58 volts.  
  
If the voltage is within the stated limits, continue to the next step. If not, contact KAM Technical Support for further assistance.
5. Use a multimeter in ammeter mode to measure the output current loop across the 4-20 mA+ and 4-20 mA- terminals on the top board. This voltage should match the value of the 4-20 mA current output (column 12) displayed on RealTerm. If the values do not match, please contact KAM Technical Support for further assistance.

## RS485 COMMUNICATION

The following procedure is to be conducted in cases where the Power Connections, RS232 Communication and Electronics Debugging sections' steps have been performed, but there is no RS485 communication with the PLC/ computer.

1. Ensure the Modbus settings are configured according to the instructions on page 30 of this manual and verify that the RS485 converter (Not provided) is installed on your PC as per the device's user manual.
2. Connect the RS485 converter to the OID™ per the wiring diagram on page 13 of this manual.
3. Use a multimeter in voltmeter mode to measure the voltage between the 485 TX and 485 RX on the Terminal Board. The differential voltage is usually around 2 volts. Continue to the next step.

NOTE: The RS485+ and RS485- lines in two wire mode are differential, so their voltage needs to be measured with respect to each other to conform to the RS485 standards. The bias is provided by the master device.

4. Ensure the OID™ and PLC/Computer are connected properly as per the RS485 converter's user manual.
5. Check the activity LEDs on the RS485 converter connected to the RS485 terminals of the OID™. The LEDs should be blinking while data is being sent/received.
6. If there is no differential voltage or there is no activity on the LED (if available) of the RS485 converter, contact KAM Technical Support for further assistance.



## MODBUS REGISTER

OID Holding Modbus Registers		
Register No	Type	Description
42000	32bit Float	Signal Offset
42001	32bit Float	Sinal In from Photodiode
42002	32bit Float	LED OFF status
42003	32bit Float	LED ON Status
42004	32bit Float	Electronics Temperature in Celsius
42005	32bit Float	0-100 Output
42006	32bit Float	4-20mA Output

1. Connect the Serial cable to the OID per FIG. 3-15 on page 15.
2. Follow the instructions on page 19 "Diagnostics via RS232" Steps 1 to 9.
3. Type the command "OIDmaster" and click on "Send ASCII." FIG. A-1. You will get a confirmation that you have entered superuser mode.

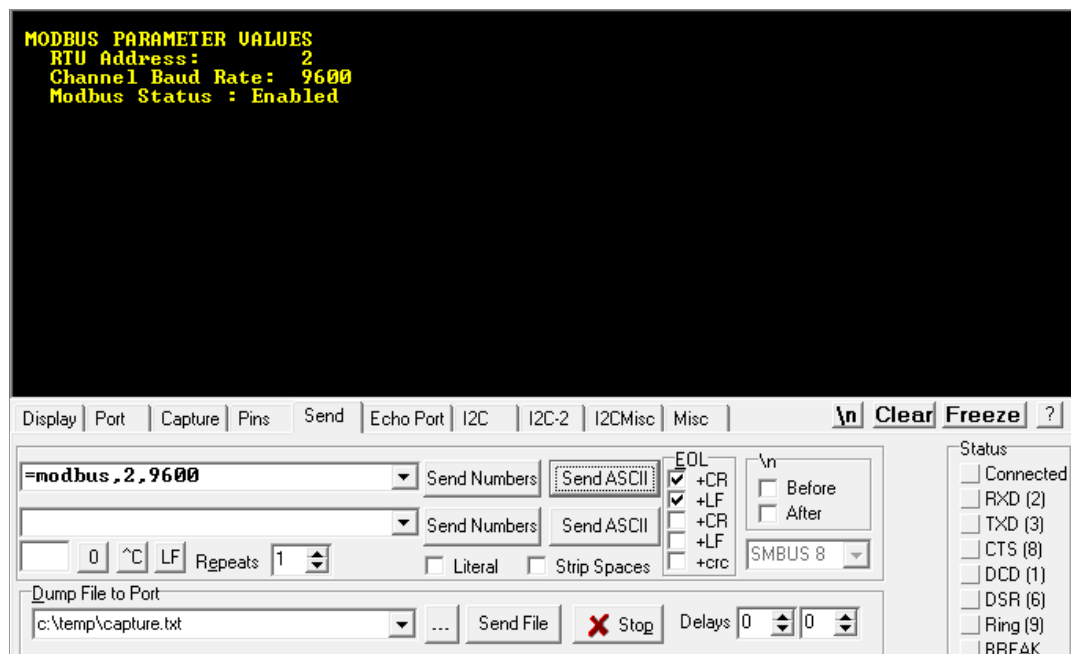


## APPENDIX A

### CHANGING THE MODBUS ADDRESS continued

4. Type the command =modbus,2,9600 and click on Send ASCII. FIG. A-2. The #2 represents the new address. That number can be any number from 1 to 247.

FIG. A-2



5. To complete the change turn the OID power off, wait a couple of seconds and turn it back on.