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KAM® ATD AUTOMATIC TANK DEWATERING

User Manual
ATDMANUAL-0512

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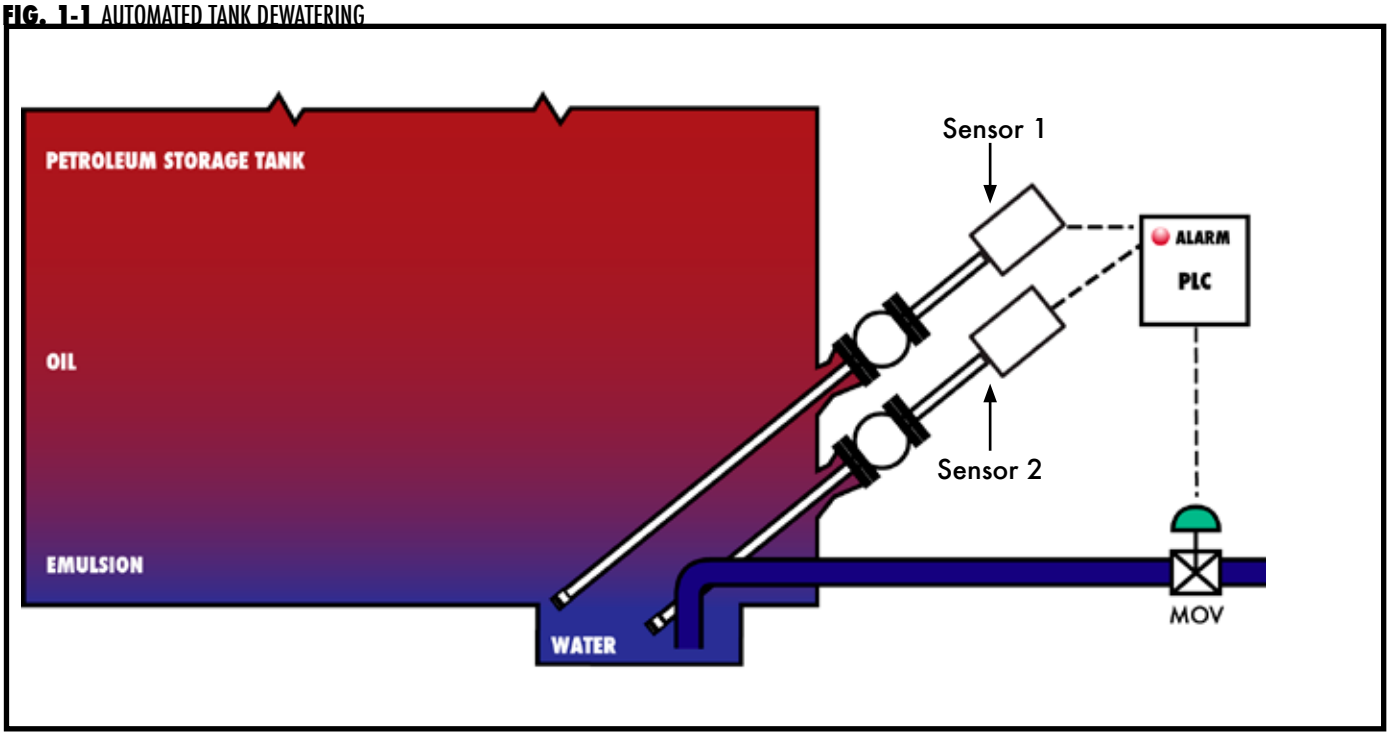
CAUTION:

When installing the ATD sensor in tanks 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.

THEORY OF OPERATION

FIG. 1-1 AUTOMATED TANK DEWATERING



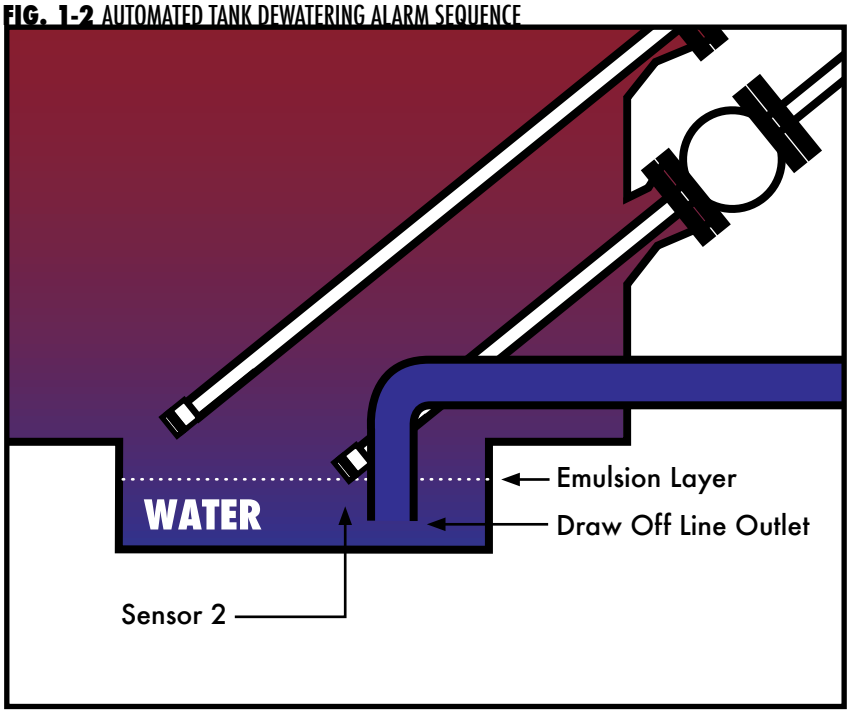
KAM ATD Automated Tank Dewatering incorporates 2 microwave sensors. The first monitors the descending emulsion layer and triggers the closing of the MOV on the draw off line when the percentage of water falls to a predetermined level. With the MOV closed, water concentrations increase in the bottom of the tank eventually triggering the reopening of the MOV.

The second ATD sensor is an alarm sensor. Should Sensor 1 fail for any reason, Sensor 2 detects decreasing water concentrations and triggers both auditory and visual alarms as well as the closing of the MOV.

Because Sensor 2 detects the descending emulsion layer well before it reaches the draw off line outlet, no oil ever enters the draw off line. FIG. 1-2

KAM ATD probes are designed with a solid tubular surface to prevent the accumulation of parrafins or any other substance from accumulating on the probe and affecting measurement.

FIG. 1-2 AUTOMATED TANK DEWATERING ALARM SEQUENCE



SPECIFICATIONS

Media:	Crude oil, refined products and chemicals
Material:	Wetted parts - 316 stainless steel
Fluid temperature:	To 600°F (315°C) *
Power requirements:	24 VDC/1 amp at 24 watts
Accuracy:	±5%
Repeatability:	±0.01%
Resolution:	±0.01%
Outputs:	Selectable 4–20 mA with adjustable range or 0–5 VDC Alarm relay RS232/RS485
Mounting:	2" MNPT seal housing 2", 3", or 4" flanged seal housing
Pressure ratings:	ANSI 150, 300, 600, 900, 1500, 2500
Sensor dimensions:	Ø1.5" x 1.5" (38mmh x 38mm)
EX enclosures:	Sensor electronics - 3" x 6" x 3" (76mm x 152mm x 76mm)
Shaft length:	Per user specification up to 16 feet
Weight:	from 20 lbs. (9kg)

INSTALLATION

PRIOR TO INSTALLATION

Remove all the protective packaging materials, and ensure that the ATD sensors were not damaged during transit.

INSTALLATION

A full-opening ball valve is used to isolate the ATD sensors from the tank during installation or removal. The seal housing of the ATD sensor allows the probe to be inserted and removed from the pipe under pressure conditions. It is the user's responsibility to ensure that the ATD sensor be placed at the optimum depth in the tank to prevent hydrocarbons from entering the water draw off line.

1. Prior to mounting verify that the tip of the sensor is all the way inside the seal housing. FIGS. 3-1,3-2.

2. If sensor is not fully enclosed inside the seal housing, pull the 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 ATD shaft from sliding and the probe from getting damaged during mounting.

FIG. 3-1

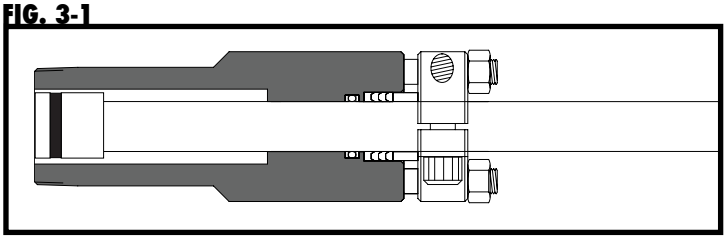
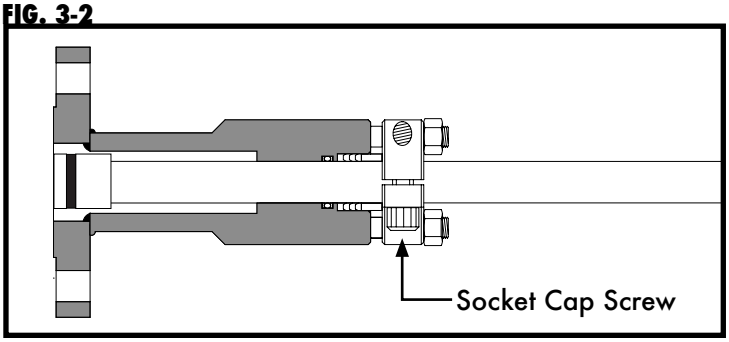
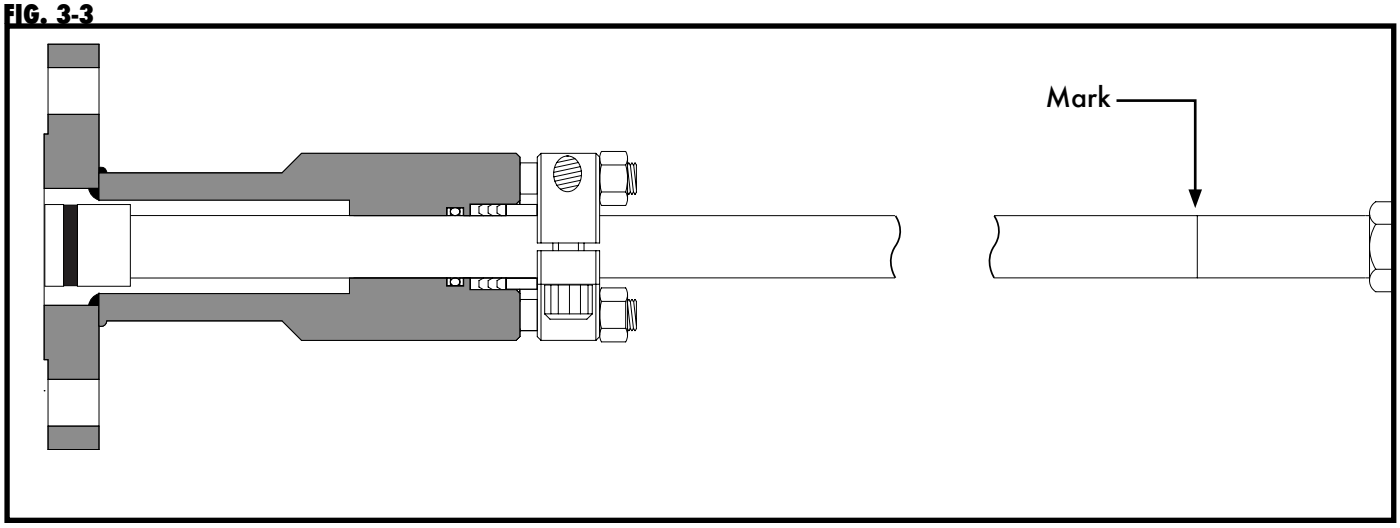


FIG. 3-2



3. Mark the ATD shaft at the predetermined insertion distance. FIG. 3-3.

FIG. 3-3



4. Bolt or screw the ATD sensor to the valve or designated installation location. (KAM CONTROLS recommends using thread sealant and not Teflon tape for the threaded ATD).

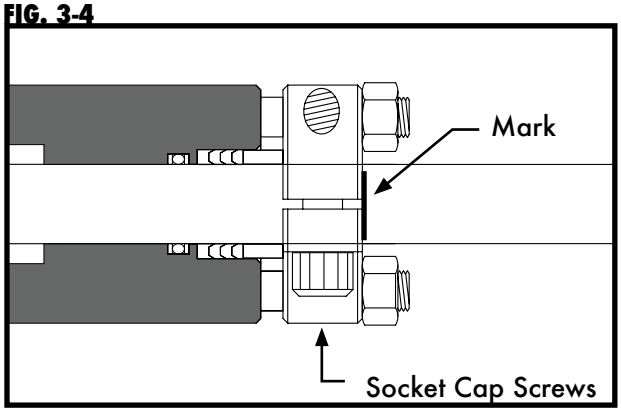
5. Open full opening valve.

6. Loosen Socket Cap Screws on the locking collar. FIG. 3-4

7. Push ATD sensor in until the mark is at the top edge of the locking collar. FIG. 3-4.

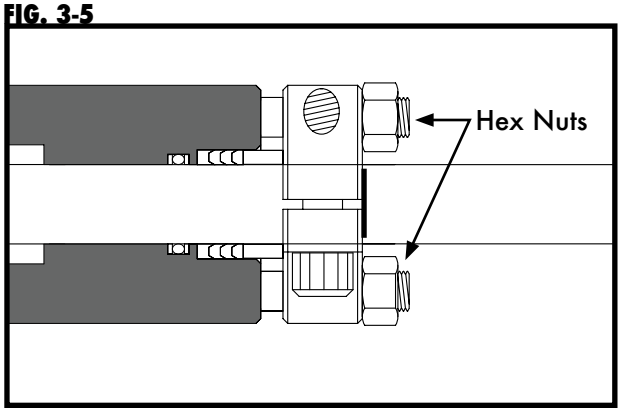
8. Re-tighten the Socket Cap Screws.

FIG. 3-4



9. Tighten the hex nuts holding down the Locking Collar one half turn. (Fig. 3-5) These 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.

FIG. 3-5



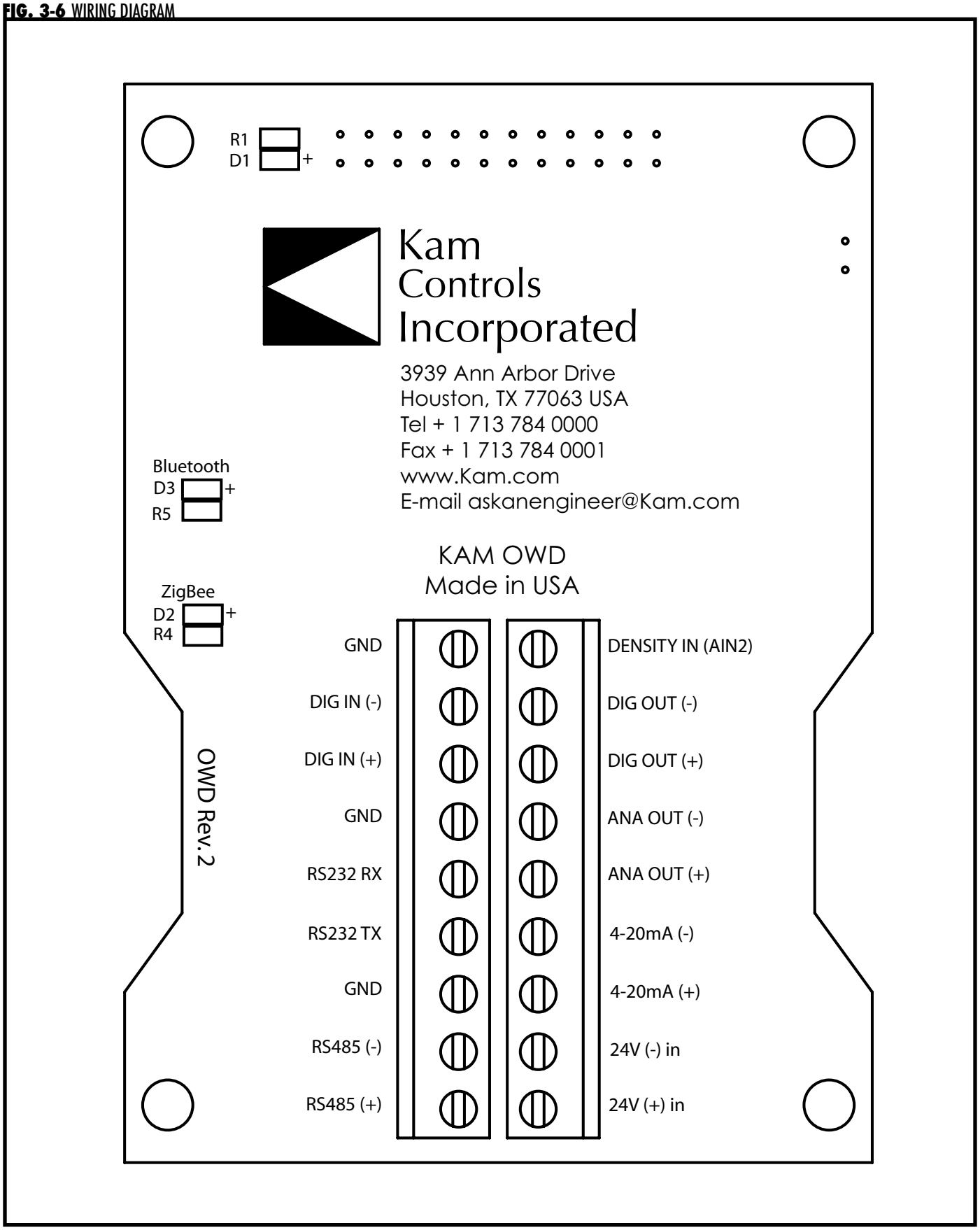
REMOVING THE ATD SENSOR

To remove the ATD sensor, first disconnect all electrical connections to the ATD enclosure. Then, loosen the Socket Cap Screw on the Lock Down Collar. Slide the ATD sensor upward until the probe rests inside the seal housing. Next, close the Full-opening Ball Valve tightly. The ATD sensor may now be unbolted from the system.

Note: If pressure exceeds 100 psi, use a KAM® IT Insertion Tool when installing/removing the KAM® ATD sensor.

WIRING

FIG. 3-6 WIRING DIAGRAM



INSTALLATION CONTINUED

INPUTS

24V (–) IN	GND
24V (+) IN	Power
DIG IN (–)	Pulse input, discrete input for different modes of operation (0 or 5 volt)
DIG IN (+)	
DENSITY IN	

OUTPUTS

4-20 mA (–)	Current output, source powered
4-20 mA (+)	
AN OUT (–)	Can be 4-20 mA or analog voltage
AN OUT (+)	
DIG OUT (–)	Alarm or relay (digital contact closure)
DIG OUT (+)	

INPUT/OUTPUT

RS232	Consol port – communication interface for calibration, connection to PLC
RS485	Modbus interface

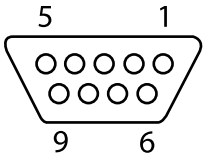
LED INDICATORS

D1	Power
D2	ZigBee wireless for communication interface
D3	Bluetooth wireless for communication interface

SERIAL PORT CONNECTIONS

DB9 (female)

5	GND
3	RS232RX
2	RS232TX



KAM ATD OPERATION

PLEASE NOTE: the KAM ATD has been calibrated in the laboratory. Typically there is no need to calibrate the ATD once in the field unless process conditions have changed. If process conditions have changed or if following the test procedures outlined below under "How to Test the KAM ATD," the user determines that the ATD requires recalibration or fine-tuning, the user may follow the steps outlined on page 9 of this manual under "How to Calibrate the KAM ATD."

HYPERTERMINAL SOFTWARE

1. Connect computer via RS232, or Bluetooth or ZigBee wireless*. To launch Hyperterminal, click on OWD icon. When Hyperterminal loads, hit ENTER/RETURN. The "OWD Optimizer" prompt menu will appear in window.

2. Optimizer options are as follows:

   "L" to Calibrate
   "Z" to display Raw Voltage
   "R" to enter Range
   "M" to change Modbus Address

3. After entering any OWD Optimizer prompt, hitting ENTER/RETURN will return you to the main OWD Optimizer entry field.

   *Bluetooth and ZigBee are hardware options when ordering ATD. If included, corresponding LED lights on ATD panel in EX Enclosure will indicate. See WIRING page 6.

HOW TO TEST THE KAM® ATD

1. Make all wiring connections according to FIG. 3-6.

2. Let the ATD sensor warm up for 20 minutes.

3. Insert the ATD sensor into a bucket or a jar filled with a sample of oil. In order to accurately test the ATD sensor, you must use oil that does not have any water in it or which has a known, low percentage of water. The water percentage reading in the Hyperterminal should show 0% or reflect the known water percentage. If you inserted the ATD sensor in oil with no water and it does not show 0%, you can adjust the calibration using the steps outlined below.

4. Remove the ATD sensor from the oil and clean it. NOTE: Sensor must be completely free of oil. Oil left on the sensor could affect the accuracy of brine test.

5. Insert the sensor in a bucket with brine. It should show 100% water in the Hyperterminal. As all water in crude oil has salt, the ATD sensor has already been calibrated for salt water. You will not get an accurate reading if you use fresh water for testing. It should also show 20mA if the mA range is calibrated for 0-100% which you can measure at the output terminal.

HOW TO CALIBRATE THE KAM® ATD

PLEASE NOTE: The KAM ATD has been calibrated in the laboratory. Users should only follow the steps outlined below if process conditions have changed affecting performance or if, after following the steps on page 23 under "How to Test the KAM ATD," it is determined that the ATD's performance needs slight adjustments.

1. Connect PC to the ATD sensor via serial port. If you do not have a serial port, use a USB to Serial Port converter. Launch Hyperterminal and hit RETURN/ENTER.

2. Take an accurate (fully homogenous) sample from the pipeline close to the sensor, and at the same time type "L" for calibration in the Hyperterminal. A "Water %" prompt will appear.

3. Determine water percentage in sample using a KAM Karl Fischer Moisture Analyzer.

4. Enter the determined sample water percentage from Karl Fischer analysis into Hyperterminal prompt and hit ENTER/RETURN.

5. Type "S", then hit ENTER/RETURN to save.

   The KAM® ATD is now calibrated.

   This process can be repeated if the sample taken was a bad sample or the percent of water obtained from the sample taken was not accurate.

SETTING UP A MODBUS INTERFACE

1. To set Modbus variables, type "M" and hit ENTER/RETURN.

2. The prompt is for an ID for the slave device. This ID MUST BE UNIQUE from any other Modbus device connected and a value between 1-255.

   SYSTEM SETTINGS:

   Modbus Baudrate: 9600.

   Protocol is RTU Modbus.

   See APPENDIX A for designated MODBUS Registers.

APPENDIX A: MODBUS INTERFACE REGISTERS

MODBUS FUNCTION	USE	REGISTERS
01 Discrete Coil Status	Reads output coil status, digital outputs	0x00001–0x00016: Digital outputs 0–15
02 Discrete Input Status	Reads state of individual digital inputs	0x10001–0x10024: Digital inputs 0–23
03 Holding Register	Reads and writes to the DAC channels (0-3). Takes a converted float value (from 2 unsigned int values) and updates the DAC output values (in Volts 0-10VDC).	0x40001–0x40002: Float value for DAC 0 0x40003–0x40004: Float value for DAC 1 0x40005–0x40006: Float value for DAC 2 0x40007–0x40008: Float value for DAC 0 40100–40999: 16–bit values 41000–41999: 32–bit values 42000–44999: Float values 45000–47299: Modbus registers 40100: Alarm setpoint 40101: Alarm setpoint prior to change 40102: On or off alarm report 40103: On or off alarm report 40104: On or off alarm report 40105: True when value over alarm value for dead-band time. Reset when value below alarm value for dead-band time. 40106: Signal to reset transaction 40107: Water content integer 40108: AD0 raw value 40109: AD1 raw value 40110: Low-end output at 4ma prior to change 40111: Low-end output at 4ma 40112: High-end output at 20ma 40113: High-end output at 20ma prior to change 40114: Number of user block saves (Limit to 50,000) 41000: Sample period in seconds 41001: Sample period in seconds prior to change 41002: Alarm dead–band inter-value timer 41003: Alarm dead–band start time 41004: Alarm dead–band current time 41005: Alarm inter-value timer 41006: Alarm start time 41007: Alarm current time 41008: Array of time of alarms 41009: Array of time of alarms 41010: Array of time of alarms 41011: Value at time of alarm 41012: Value at time of alarm 41013: Value at time of alarm. Reset when value below alarm value for dead-band time. 41014: Amount of measured material 41015: Material less water 41016: Average water 41017: Transaction intervalue timer 41018: Transaction start time 41019: Sample period in second

MODBUS FUNCTION USE	REGISTERS
03 Holding Register continued	41020: Sample start time 41021: Sample current time 41022: Mode: oil continuous/water continuous 41023: Modify table: 0=oil continuous 1=water continuous 41024: Set to 1 to signal table modification ready. Reset to –1 to indicate not ready. 41025: Set to 1 to signal write UB 41026: Modify sensor1 TempCorf: 1 Modify sensor2 TempCorf: 2 41027: Set to 0–19 to indicate temperature curve modification ready. Reset to –1 to indicate not ready. 41028: Temperature value input by user 41029 41030 – 41049: Temperature table temperatures 42000: Trend 0 42001: Trend 1 42002: Trend 2 42003: Trend 3 42004: Trend 4 42005: Trend 5 42006: Trend 6 42007: Trend 7 42008: Trend 8 42009: Trend 9 42010: Trend 10 42011: Trend 11 42012: Trend 12 42013: Trend 13 42014: Trend 14 42015: Trend 15 42016: Trend 16 42017: Trend 17 42018: Trend 18 42019: Trend 19 42020: AD0 input 42021: AD1 input 42022: AD2 oil/water continuous input 42023: DA0 output 42024: Water content oil continuous sensor 1 42025: Water content oil continuous sensor 2 42026: Water content water continuous sensor 1 42027: Water content water continuous sensor 2 42028: Water content float 42029: Sensor 1 offset input by user 42030: Sensor 1 offset input by user 42031: Sensor 2 offset input by user 42032: Sensor 2 offset input by user 42033: Storage register for Modbus table index water value 42034 Storage register for Modbus table sensor 1 value 42035 Storage register for Modbus table sensor 2 value 42036: AD3 temperature voltage input 42037: Temperature value input

MODBUS FUNCTION USE	REGISTERS
03 Holding Register continued	42038: Temperature input low voltage 42039: Temperature input low value 42040: Temperature input high voltage 42041: Temperature input high value 42042: Sensor 1 temperature correction 42043: Sensor 2 temperature correction 42044: Water factor 0.00 – 9.99 42045: Sensor 1 temperature correction 0–10v 42046: Sensor 1 temperature correction 10v 42047: Sensor 1 temperature correction 0–10v 42048: Sensor 1 temperature correction 10v 42049: Sensor 1 temperature correction 0–10v 42050: Sensor 1 temperature correction 10v 42051: Sensor 1 temperature correction 0–10v 42052: Sensor 1 temperature correction 10v 42053: Sensor 1 temperature correction 0–10v 42054: Sensor 1 temperature correction 10v 42055: Sensor 1 temperature correction 0–10v 42056: Sensor 1 temperature correction 10v 42057: Sensor 1 temperature correction 0–10v 42058: Sensor 1 temperature correction 10v 42059: Sensor 1 temperature correction 0–10v 42060: Sensor 1 temperature correction 10v 42061: Sensor 1 temperature correction 0–10v 42062: Sensor 1 temperature correction 10v 42063: Sensor 1 temperature correction 0–10v 42064: Sensor 1 temperature correction 10v 42065 42066 42067 42068 42069 42070 42071 42072 42073 42074 42075: Sensor 1 temperature correction 0–10v 42076: Sensor 1 temperature correction 10v 42077: Sensor 1 temperature correction 0–10v 42078: Sensor 1 temperature correction 10v 42079: Sensor 1 temperature correction 0–10v 42080: Sensor 1 temperature correction 10v 42081: Sensor 1 temperature correction 0–10v 42082: Sensor 1 temperature correction 10v 42083: Sensor 1 temperature correction 0–10v 42084: Sensor 1 temperature correction 10v 42085: Sensor 1 temperature correction 0–10v 42086: Sensor 1 temperature correction 10v 42087: Sensor 1 temperature correction 0–10v 42088: Sensor 1 temperature correction 10v 42089: Sensor 1 temperature correction 0–10v 42090: Sensor 1 temperature correction 10v 42091: Sensor 1 temperature correction 0–10v 42092: Sensor 1 temperature correction 10v

MODBUS FUNCTION USE	REGISTERS
03 Holding Register continued	42093: Sensor 1 temperature correction 0–10v 42094: Sensor 1 temperature correction 10v 40100: Alarm setpoint 40101: Alarm setpoint prior to change 40102: On or off alarm report 40103: On or off alarm report 40104: On or off alarm report 40105: True when value over alarm value for dead-band time. Reset when value below alarm value for dead-band time. 40106: Signal to reset transaction 40107: Water content integer 40108: AD0 raw value 40109: AD1 raw value 40110: Low end output at 4ma prior to change 40111: Low end output at 4ma 40112: High end output at 20ma 40113: High end output at 20ma prior to change 40114: Number of user block saves (Limit to 50,000) 41000: Sample period in seconds 41001: Sample period in seconds prior to change 41002: Alarm dead-band intervalue timer 41003: Alarm dead-band start time 41004: Alarm dead-band current time 41005: Alarm intervalue timer 41006: Alarm start time 41007: Alarm current time 41008: Array of time of alarms 41009: Array of time of alarms 41010: Array of time of alarms 41011: Value at time of alarm 41012: Value at time of alarm 41013: Value at time of alarm. Reset when value below alarm value for dead band time. 41014: Amount of measured material 41015: Material less water 41016: Average water 41017: Transaction intervalue timer 41018: Transaction start time 41019: Sample period in second 41020: Sample start time 41021: Sample current time 41022: Mode: oil continuous/water continuous 41023: Modify Table: 0=oil continuous 1=water continuous 41024: Set to 1 to signal table modification ready. Reset to –1 to indicate not ready. 41025: Set to 1 to signal write UB 41026: Modify sensor 1 TempCorf: 1 Modify sensor 2 TempCorf: 2 41027: Set to 0–19 to indicate temperature curve modification ready. Reset to –1 to indicate not ready. 41028: Temperature value input by user 41030 – 41049: Temperature table temperatures 42000: Trend 0

MODBUS FUNCTION USE	REGISTERS
03 Holding Register continued	42001: Trend 1 42002: Trend 2 42003: Trend 3 42004: Trend 4 42005: Trend 5 42006: Trend 6 42007: Trend 7 42008: Trend 8 42009: Trend 9 42010: Trend 10 42011: Trend 11 42012: Trend 12 42013: Trend 13 42014: Trend 14 42015: Trend 15 42016: Trend 16 42017: Trend 17 42018: Trend 18 42019: Trend 19 42020: AD0 input 42021: AD1 input 42022: AD2 oil/water continuous input 42023: DA0 output 42024: Water content oil continuous sensor 1 42025: Water content oil continuous sensor 2 42026: Water content water continuous sensor 1 42027: Water content water continuous sensor 1 42028: Water content float 42029: Sensor 1 offset input by user 42030: Sensor 1 offset input by user 42031: Sensor 2 offset input by user 42032: Sensor 2 offset input by user 42033: Storage register for Modbus table index water value 42034 Storage register for Modbus table sensor 1 value 42035 Storage Register for Modbus table sensor 2 value 42036: Temperature voltage input 42037: Temperature value 42038: Temperature input low voltage 42039: Temperature input low value 42040: Temperature input high voltage 42041: Temperature input high value 42042: Sensor 1 temperature correction 42043: Sensor 2 temperature correction 42044: Water factor 0.00 – 9.99 41023: Modify Table: 0:oil continuous 1:water continuous 41024: Set to 1 to signal table modification ready 42031: Storage register for Modbus table index water value 42032: Storage register for Modbus table sensor 1 value 42033: Storage register for Modbus table sensor 2 value

MODBUS FUNCTION	USE	REGISTERS
04 Input Register	Reads individual calibrated values of each ADC input	0x30001–0x30002: Float value of ADC 0 0x30003–0x30004: Float value of ADC 1 0x30005–0x30006: Float value of ADC 2 0x30007–0x30008: Float value of ADC 3 0x30009–0x30010: Float value of ADC 4 0x30011–0x30012: Float value of ADC 5 0x30013–0x30014: Float value of ADC 6 0x30015–0x30016: Float value of ADC 7 0x30017–0x30018: Float value of ADC 8 0x30019–0x30020: Float value of ADC 9 0x30021–0x30022: Float value of ADC 10