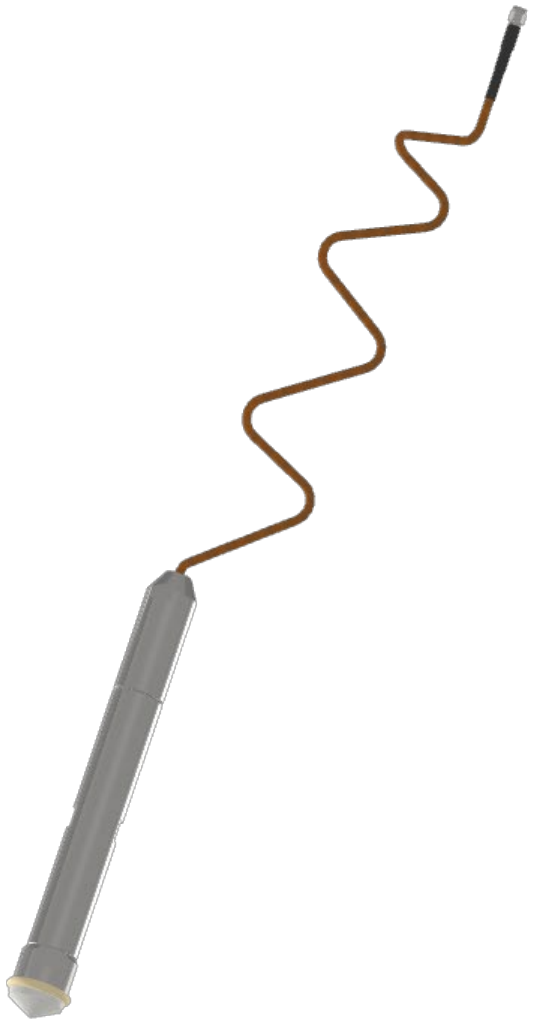
Simple Precision™



KAM® ATD-C™
AUTOMATIC TANK DEWATERING

IECEx CML 26.0018X
CML 26ATEX1071X
Ex db IIB T6 Gb

User Manual
ATD-C-MAN-0626

TEL +1 713 784 0000
FAX +1 713 784 0001
Email Sales@Kam.com
KAM CONTROLS, INC.
3939 Ann Arbor Drive
Houston, Texas 77063 USA
www.KAM.com

An ISO 9001:2015 certified company

TABLE OF CONTENTS

CAUTION:

When installing the ATD-C™ 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.

SPECIFICATIONS

Media:	Crude oil, refined products and water
Material:	Wetted parts– 316 stainless steel, PEEK Electronics enclosure– Copper-free aluminum
Fluid temperature:	-40ºC to 200ºC (32ºF to 392ºF)
Ambient temperature:	-40ºC to 60ºC (-40ºF to 140ºF)
Power requirements:	24 VDC/0.15 amp at 4 watts
Accuracy:	±5%
Repeatability:	±0.1%
Resolution:	±0.1%
Hazardous area:	IECEx CML 26.0018X CML 26ATEX1071X Ex db IIB T6 Gb
Outputs:	4–20 mA Alarm relay RS232 RS485 Modbus or HART
Mounting:	1.25" NPT seal housing for tank mounted models 2", 3", or 4" flanged seal housing for tank mounted models
Pressure ratings:	ANSI 150, 300
Sensor dimensions:	Ø1.5" x 10" (38.1 mm x 254 mm)
EX enclosures:	Sensor electronics – 5.25" x 5.65" x 4.8" (133 mm x 144 mm x 122 mm)
Cable length:	Per user specification
Weight:	from 5 lbs. (2.3kg)

INSTALLATION

PRIOR TO INSTALLATION

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

The following items are provided with the KAM® ATD-C™ sensor:

One (1) RS232 communication cable for connecting your PC to the ATD-C™
One (1) USB-to-serial converter, in case your computer does not have an RS232 serial port

Please ensure you have received these items and store them properly. They will be used for initial startup and

NOTE: Although the ATD-C™ has been calibrated in the factory, it should be calibrated offline prior to installation. Follow instructions on pages 24–25 of this manual for off-line calibration.

WARNING
:
• Do not open when energized.
• A seal shall be installed within 100 mm of the enclosure.

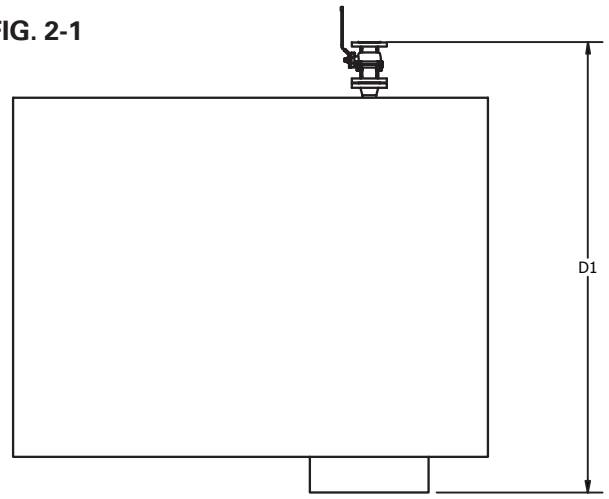
CONDITION OF SAFE USE

The equipment enclosure includes flameproof joints that have dimensions that differ from the requirements of EN 60079-1:2014 / IEC 60079-1:2014 Ed. 7 Table 2/Table 3. As such, the flameproof joints are not intended to be repaired by anyone other than the manufacturer.

CABLE LENGTH CALCULATIONS

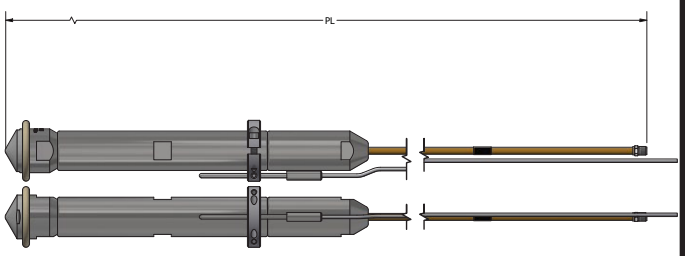
1. The distance (D1) from the mounting valve to the level where the ATD-C™ sensor needs to be calculated by the customer depending on the tank.

FIG. 2-1



2. The Probe will be provided with an exact length per customer requirements.

FIG. 2-2



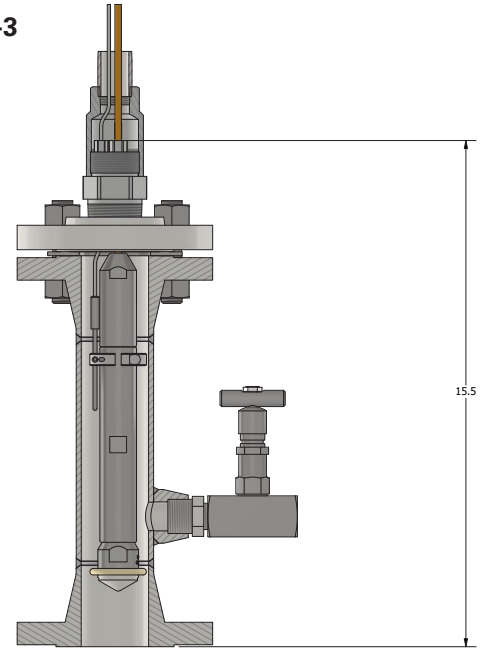
3. Calculate how much cable should remain on the exterior of the seal housing, using the following formula:

RC= PL-D1-16.2
RC= Remaining cable
PL= Probe length
D1= Calculated insertion depth

16.1 = The length of the spacer and flange that is mounted on top of the isolation valve.

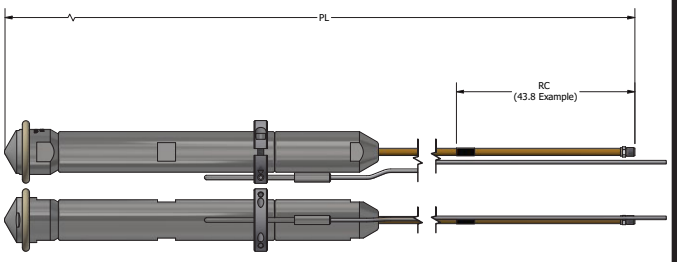
Example: Probe length = 220 inches
D1= 160
RC= 220-160-16.2
RC= 43.8"

FIG. 2-3



4. Install a piece of heat shrink or electrical tape on the probe cable at the calculated remaining cable distance, measuring from the probe's SMA connector.

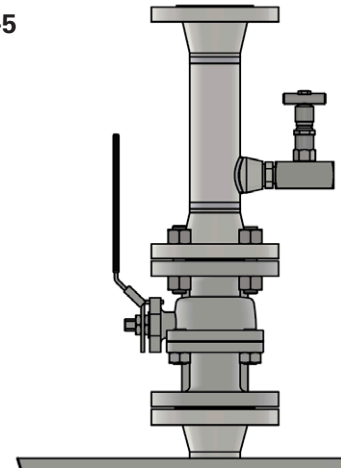
FIG. 2-4



INSTALLATION

1. Mount ATD-C™ Spacer onto valve using the proper gasket, nuts and bolts.

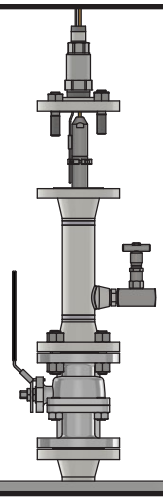
FIG. 2-5



2. Mount Probe & Seal housing assembly on spacer using proper gasket, bolts and nuts.

3. Open the isolation valve.

FIG. 2-6



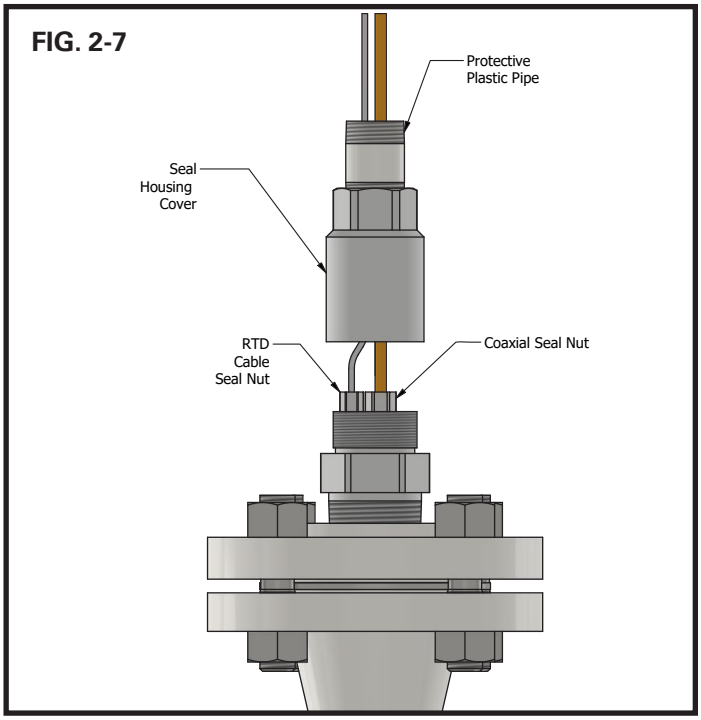
CABLE LENGTH CALCULATIONS CONTINUED

4. Unscrew the Seal Housing Cover using a 1-3/8 Wrench to have access the coaxial and RTD cable seal nuts. Do not remove the pro-tective plastic pipe

5. Losen the RTD cable seal nut by turning it 4 full turns counter-clockwise using a 3/8 wrench. Loosening the nut relieves the pres-sure on the seal around the cable to allow it to slide in and out.

6. Losen the Coaxial Seal Nut using a ½ wrench, by turning it 4 full turns.

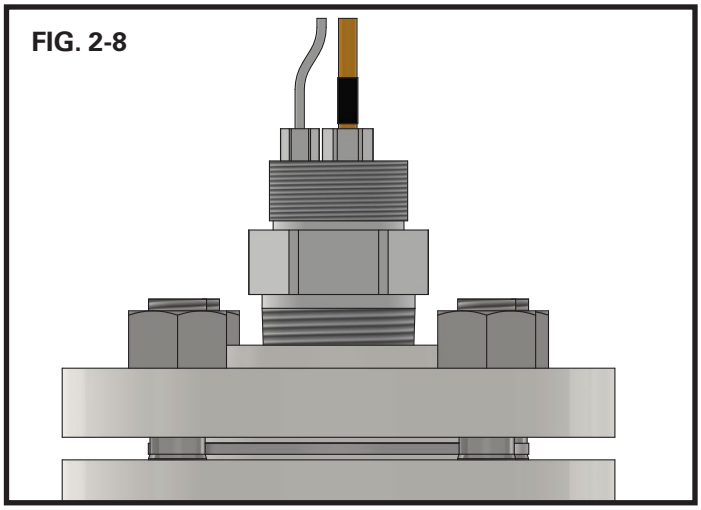
FIG. 2-7



7. Slide the coaxial cable into the Seal Housing until the marker reaches the coaxial Seal nut Fig. 2-8

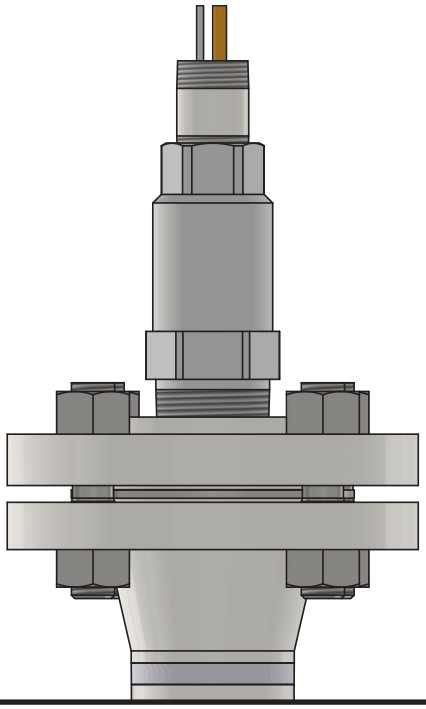
8. Tighten the coaxial and RTD cable seal nuts all the way down on to the Seal Housing.

FIG. 2-8



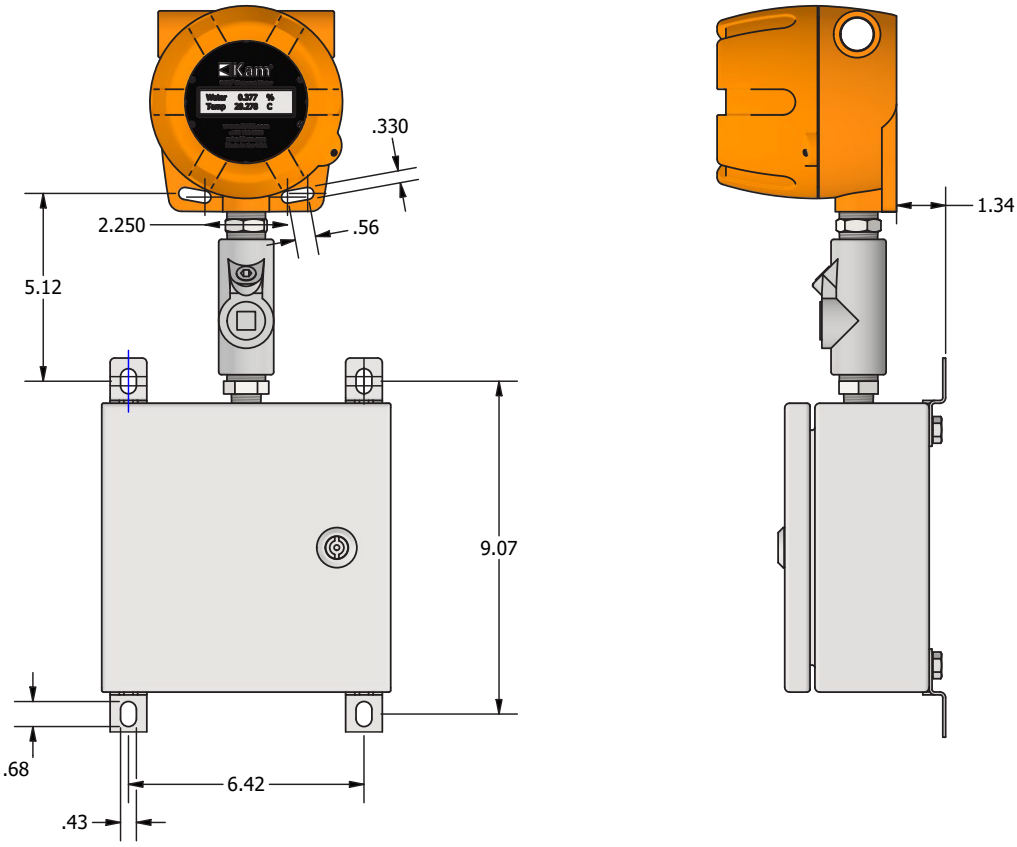
9. Screw the seal housing cover back onto the seal housing

FIG. 2-9



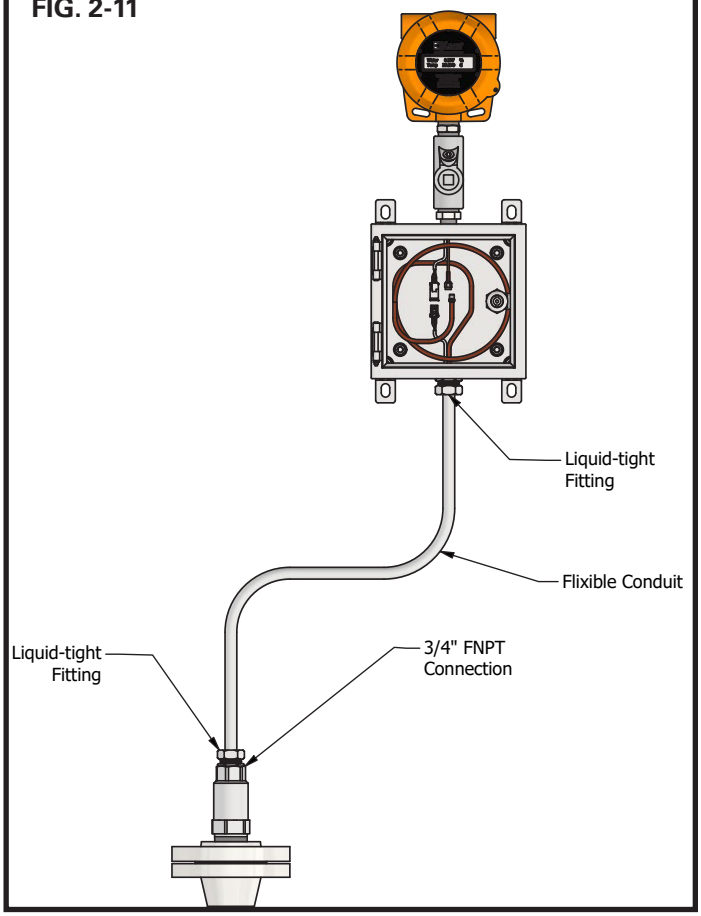
10. Mount the ATD-C electronics and junction enclosure withing the reach of the remaining cable.

FIG. 2-10



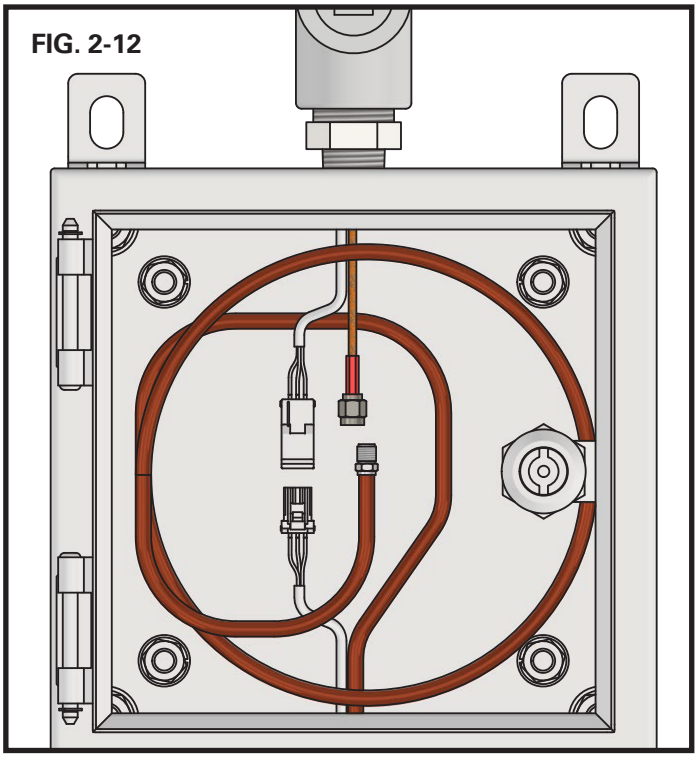
11. Remove the plastic pipe from the seal housing and Install flexible conduit from the seal housing to the junction box using proper conduit and fittings(Not supplied)

FIG. 2-11



10. Inside the junction box coil the extra cable neatly and connect the coaxial cable to the coaxial cable and the

FIG. 2-12



WIRING

Any components attached or installed (e.g. terminal compartments, bushings, explosion-proof cable entries, connectors) shall be of a technical standard that complies with the specifications on the cover sheet as a minimum and for which a separate examination certificate has been issued. The operating conditions set forth in the relevant component certificates must by all means be complied with.

The temperature of the process fluid must not exceed +200 °C.

All wiring and maintenance on the KAM ATD-C must be done in accordance with regional electrical and classifica-tion requirements. It is the user's responsibility to understand these requirements.

It is also recommended that the ATD-C be wired with flexible wiring/conduit with additional slack/length in the wire to accommodate insertion, removal, and testing.

Operator's should take all possible precautions to avoid any moisture from entering the electronics enclosure. The enclosure should not be left open in inclement weather or for long periods of time, especially during operation as condensation will accumulate. Lid should be tightly screwed shut, all conduits should be sealed and secured in accordance with regional and classification requirements, and unused 3/4" NPT openings should be sealed in accordance with regional and classification requirements. Do not power wash the unit.

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 Oil Water Detector KAM ATD-C shall be connected by means of suitable cable entries or conduit systems, which meet the requirements of IEC 60079-1, sections 13.1 and 13.2, and for which a separate examination certificate has been issued.

Cable entries (conduit threads) and sealing plugs of simple designs must not be used.

Should the Oil Water Detector KAM ATD-C be connected by means of a conduit entry which has been approved for this purpose, the appertaining sealing device shall be installed within 4 inches (100 mm) of the instrument enclosure.

Openings not used shall be sealed in compliance with IEC 60079-1, section 11.8. or using suitable plugs that meet the requirements for the local area classification.

The connecting wire of the Oil Water Detector KAM ATD-C shall be installed to provide for permanent wiring and adequate protection against mechanical damage.

If the temperature at entry fittings should exceed 70 °C, the connecting cables used have to be of the temperature resistant type.

The Oil Water Detector KAM ATD-C has to be included into the local equipotential bonding.

The connecting wire of the Oil Water Detector KAM ATD-C has to be installed in an enclosure which complies with the requirements of an accepted type of protection acc. to IEC 60079-0, section 1, if the connection takes place in an aera with potentially explosive atmosphere.

The Oil Water Detector KAM ATD-C must be connected to a suitable ground electrode per the local instal-lation codes as applicable. The resistance of the ground path must be less than 1 ohm.

INSTALLATION CONTINUED

The following relate to the installation and/or safe use of the equipment/component:

If the equipment is used in a manner not specified by Kam Controls, the protection provided by the equipment may be impaired.

WARNING: Do not open the instrument when energized

I. The equipment enclosure include flameproof joints that have dimensions that differ from the requirements of EN 60079-1:2014 / IEC 60079-1:2014 Ed. 7 Table 2/Table 3. As such, the flameproof joints are not intended to be repaired by anyone other than the manufacturer.

II. The models have the following ambient temperature ranges:

Models	Enclosure	Ambient Temperature Range	Maximum Process Temperature
ATD	EX500	-40°C to +60°C	+200°C

INPUTS

24 VDC –	GND
24 VDC +	24-30 VDC

OUTPUTS

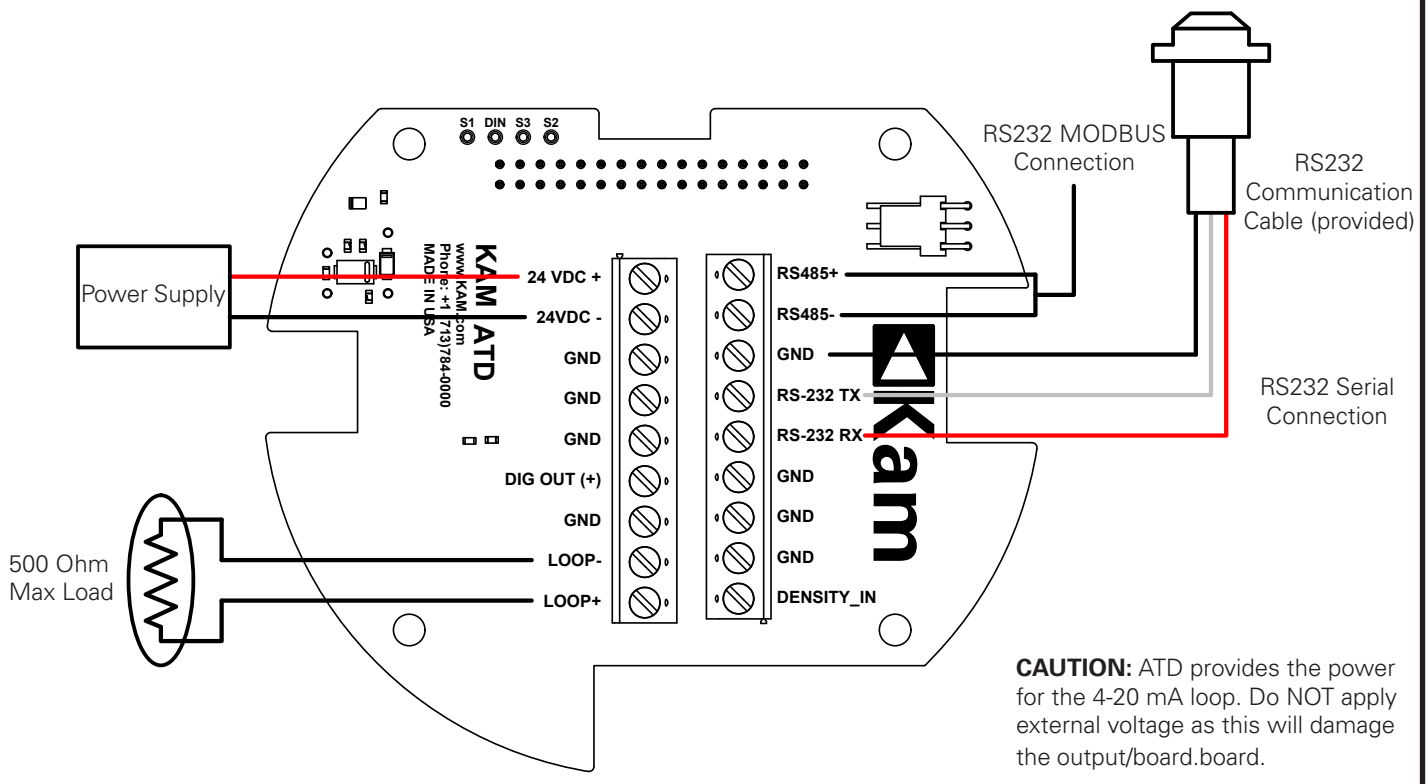
4-20 mA –	Current output, source powered.
4-20 mA +	Set to requisite percent water at factory.
Dig Out (+)	Alarm or relay (digital contact closure)
RS-485 –	Modbus interface
RS-485 +	

INPUT/OUTPUT

RS-232 RX	Console port – communication interface
RS-232 TX	for calibration

WIRING CONTINUED

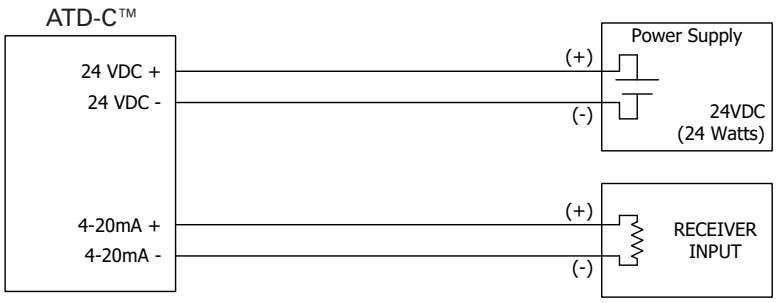
FIG. 2-13 WIRING DIAGRAM



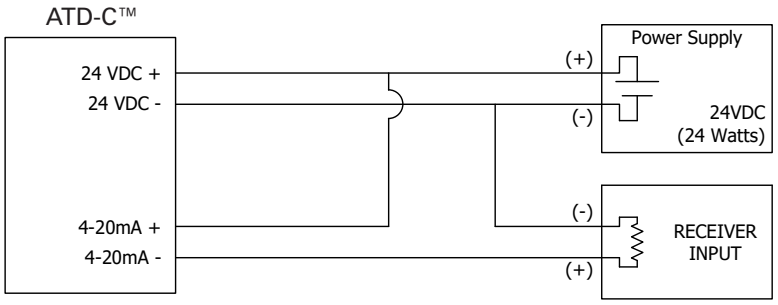
WIRING CONTINUED

TYPICAL POWER AND LOOP WIRING CONFIGURATION

FIG. 2-14



TYPICAL WIRING



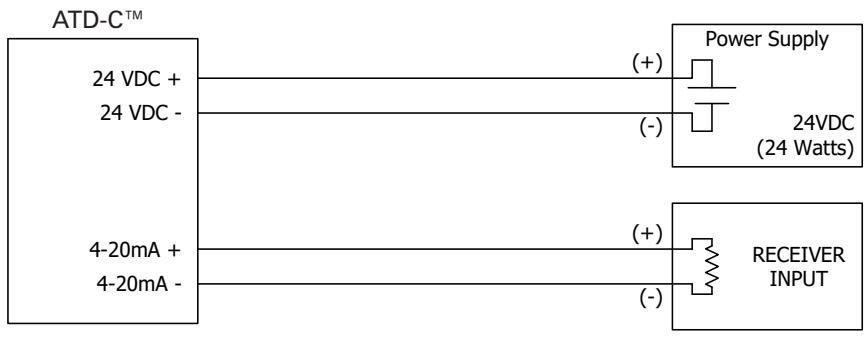
WRONG WIRING

The ATD-C™ provides power for the 4-20 mA loop. Adding external power can damage the output and/or

WIRING CONTINUED

POWER SUPPLY AND OUTPUT WIRING WITH LOOP POWERED ISOLATOR (RECOMMENDED)

FIG. 2-15



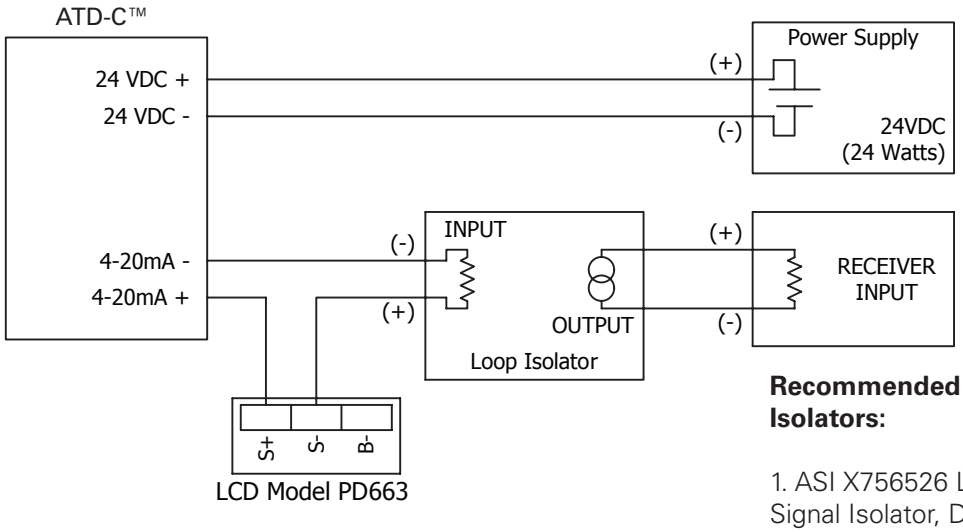
Recommended 4-20 mA Loop Isolators:

1. ASI X756526 Loop Powered Analog Signal Isolator, DIN Rail, Slim Line Single Channel

2. ASI 451129 4-20 mA Loop Powered Analog Signal Isolator, Single Channel, DIN Rail

POWER SUPPLY AND OUTPUT WIRING WITH LCD AND LOOP POWERED ISOLATOR (RECOMMENDED)

FIG. 2-16



Recommended 4-20 mA Loop Isolators:

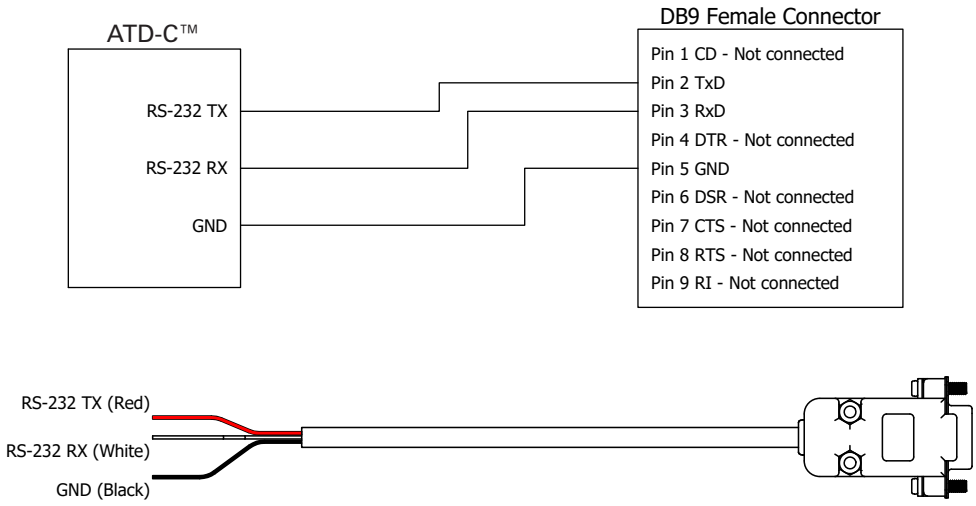
1. ASI X756526 Loop Powered Analog Signal Isolator, DIN Rail, Slim Line Single Channel

2. ASI 451129 4-20 mA Loop Powered Analog Signal Isolator, Single Channel, DIN Rail

WIRING CONTINUED

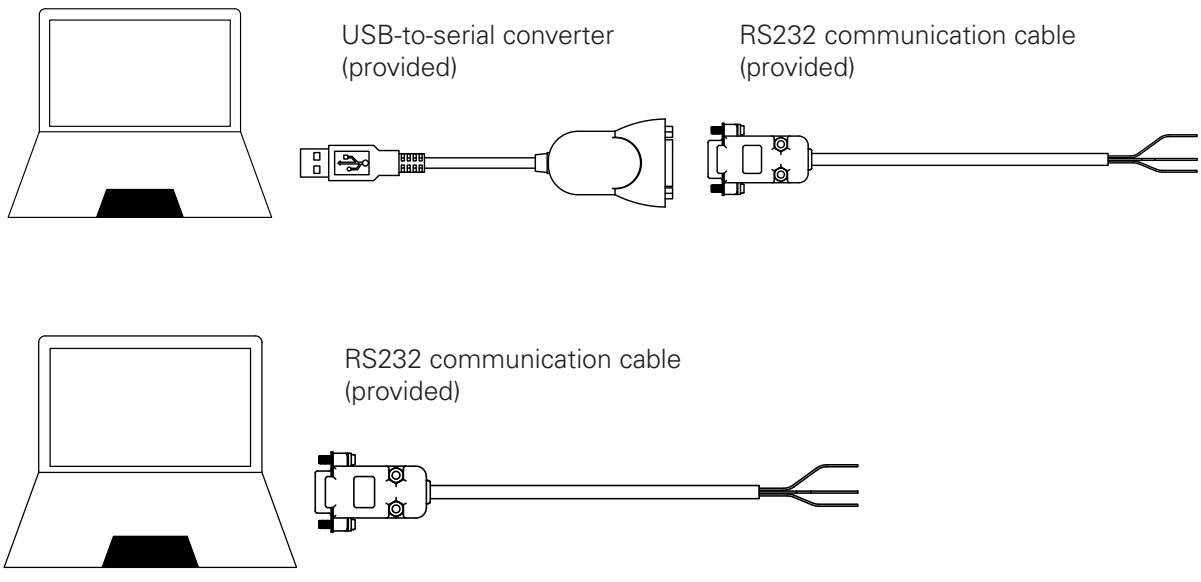
RS232 WIRING DIAGRAM

FIG. 2-17



NOTE: To avoid repeatedly opening electronics enclosure during diagnostics, it is recommended operators permanently wire an RS232 connection to the instrument with corresponding 9-pin connection at junction box for PC connection.

FIG. 2-18



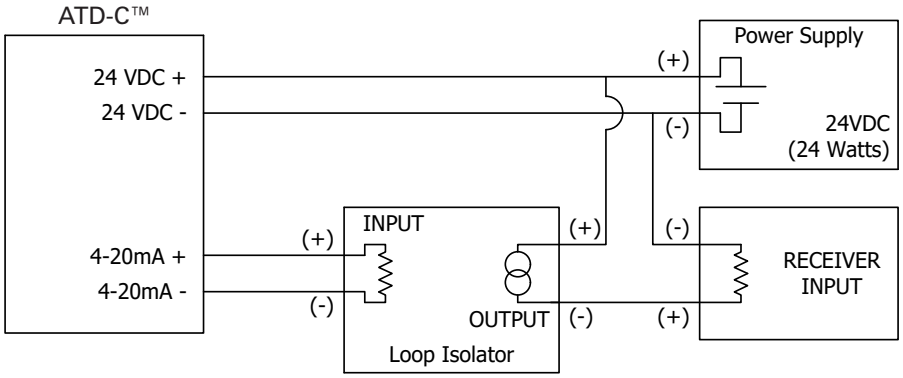
WIRING CONTINUED

RS485 WIRING DIAGRAM

FIG. 2-19

POWER SUPPLY AND OUTPUT WIRING WITH EXTERNAL POWER ISOLATOR

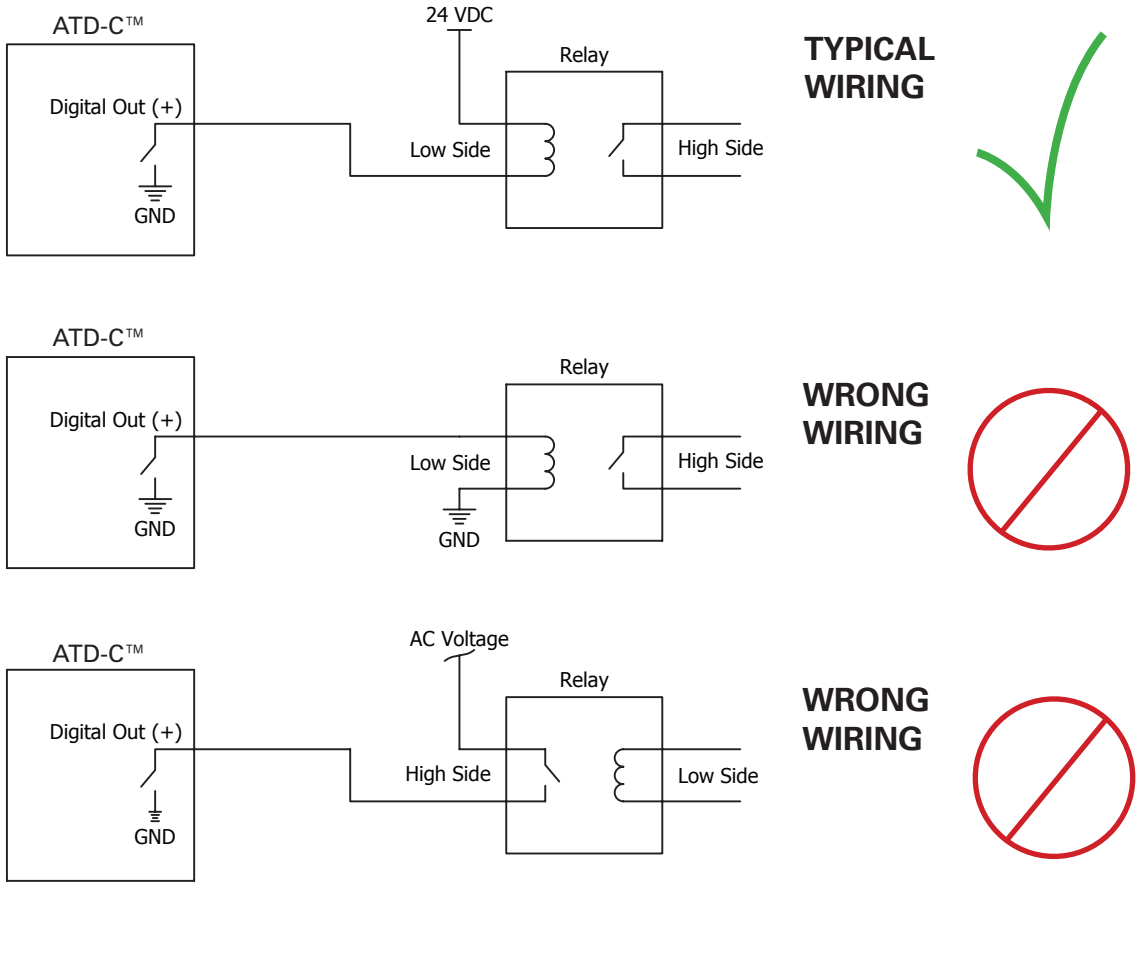
FIG. 2-20



WIRING CONTINUED

DIGITAL RELAY CONFIGURATION

FIG. 2-21



OPERATION REALTERM

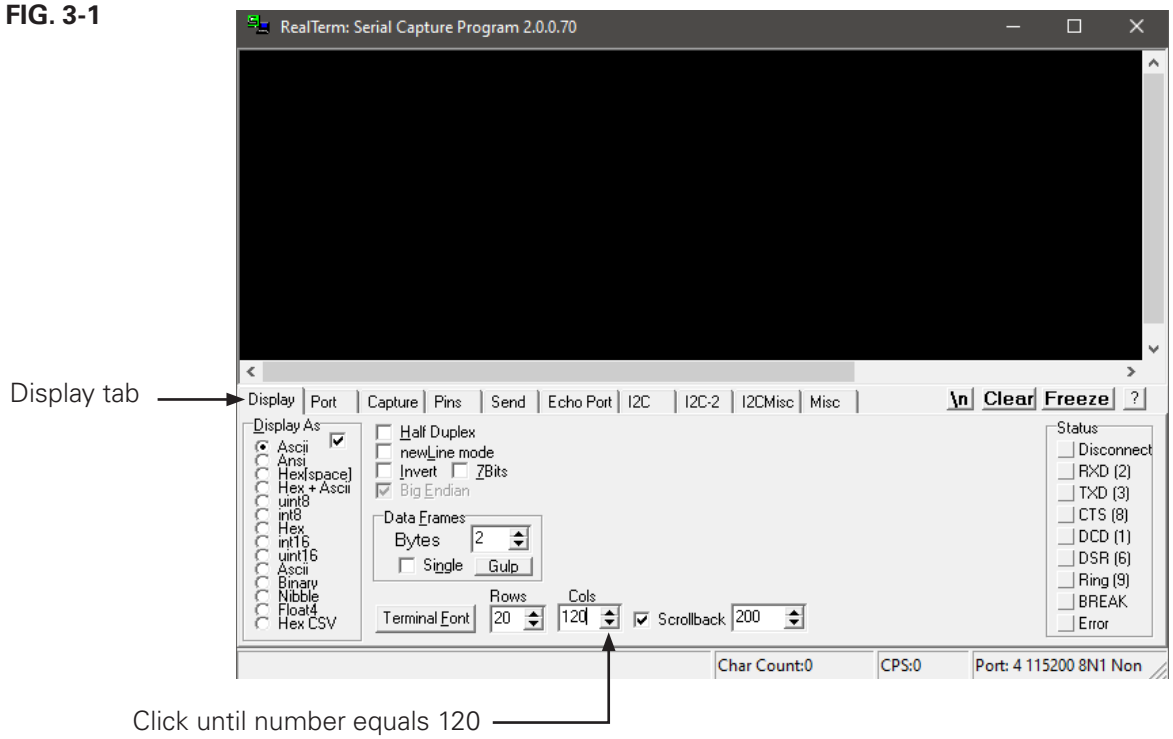
REALTERM SOFTWARE CONFIGURATION

RealTerm software is used for calibration, debugging and configuration of the ATD-C™. To download RealTerm, go to https://www.kam.com/documentation/ and download the file "Realterm Software" from the "Software" section. Once downloaded, unzip the file, double-click on the executable file (.exe) and follow on-screen instructions to install.

1. Open RealTerm software. A window will open as shown in FIG. 3-1.

2. The window will automatically default to the "Display" tab. Click on the up arrow underneath of the "Cols" window until the number reaches 120. Do not attempt to type the number in as this will result in an error message. If you receive the error message, you must close RealTerm and reopen.

FIG. 3-1



3. Click on the "Port" tab (FIG. 3-2) and change the Port settings as follows:

Baud: 9600
Parity: None
Data Bits: 8
Stop Bits: 1
Hardware Flow Control: 1
Port: Select port number assigned to your serial port or USB port connected to the converter. You can find this information in the Device Manager of your PC under "Ports." FIG. 3-3.

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

FIG. 3-2

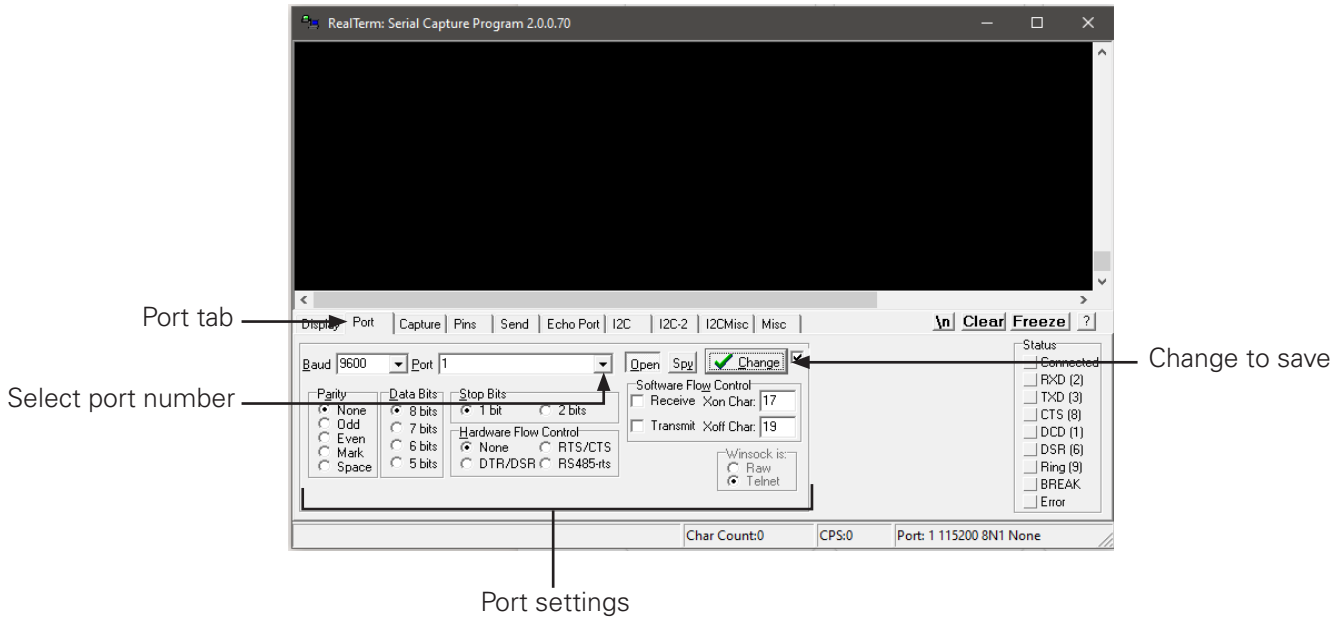
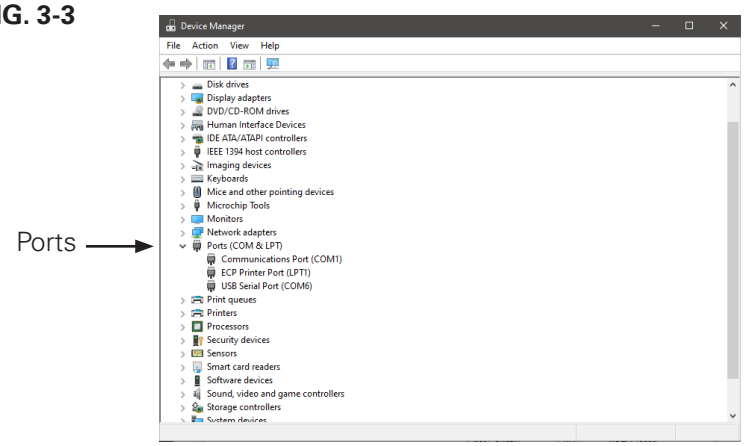


FIG. 3-3

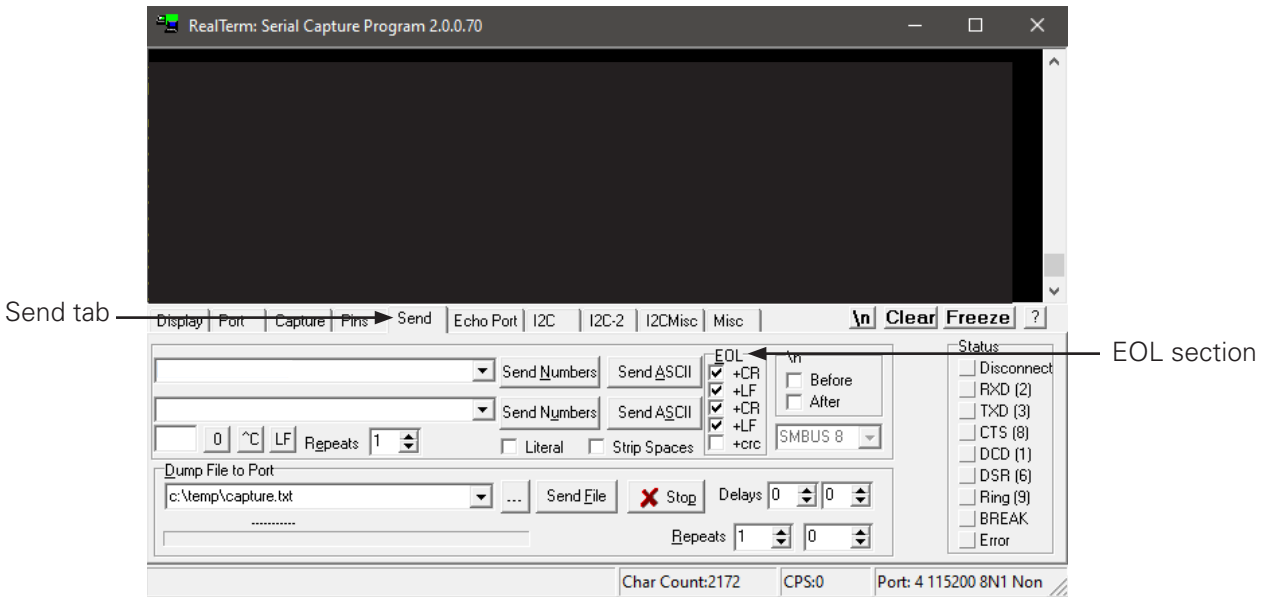


5. Click on the "Send" tab. FIG. 3-4.

6. Check the first 4 boxes in the "EOL" section. FIG. 3-4.

7. The RealTerm software configuration is complete.

FIG. 3-4



OUTPUT DATA

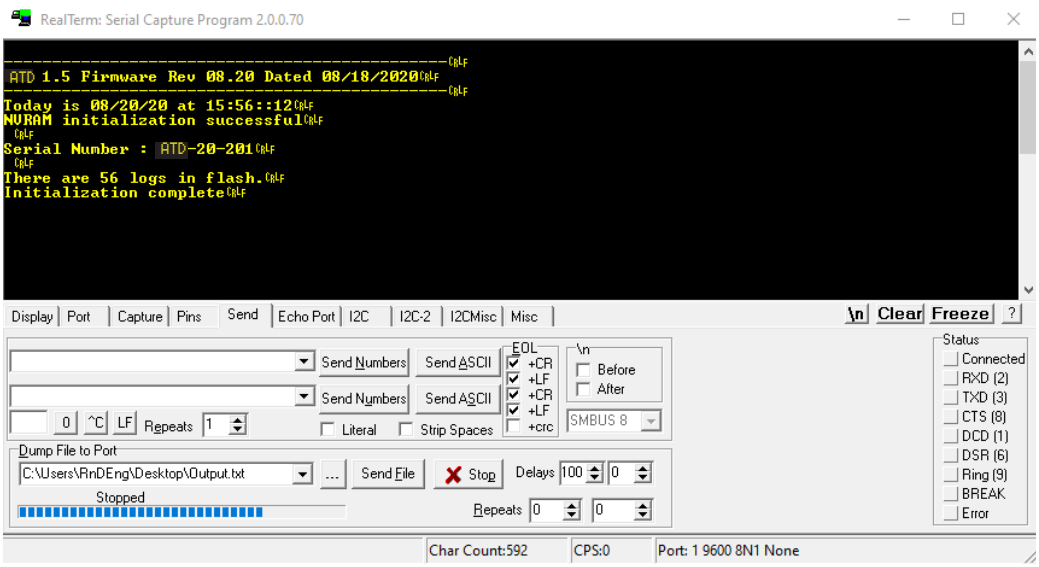
An RS232 cable for connecting your PC to the ATD-C™ has been supplied with the ATD-C™ along with a USB-to-serial converter in case your computer does not have an RS232 serial port. Go to https://www.kam.com/documentation/ and download the file "RS232 Driver" from the "Software" section. Once downloaded, unzip the file, double-click on the executable file (.exe) and follow on-screen instructions to install.

Before proceeding, install and configure RealTerm as per instructions on pages 17-19 of this manual. Ensure your PC is connected to the ATD-C™ sensor via the supplied RS232 serial cable and USB-to-serial converter as per wiring diagram on page 11. To access the boards, use a 7/16" wrench to remove the (6) hex screws on the Explosion Proof electronics enclosure and remove the cover.

Follow the steps below to view output data.

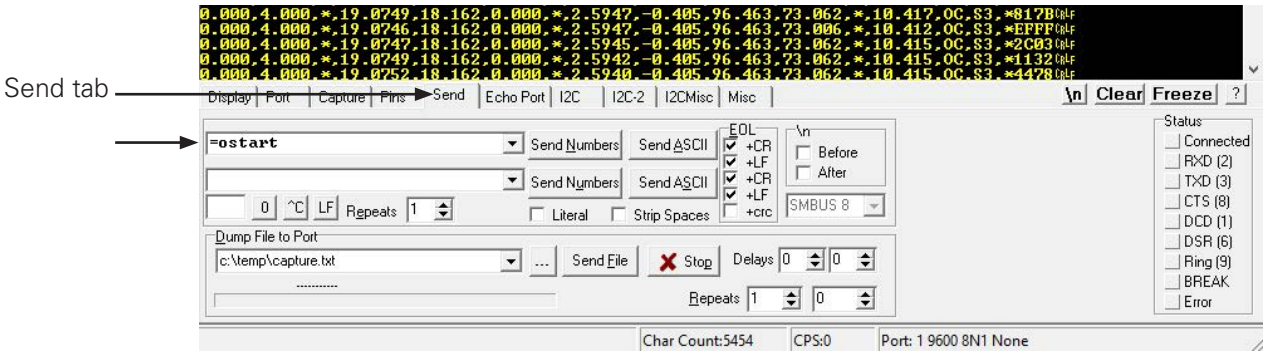
1. Launch RealTerm and turn on power to the ATD-C™. The initial message will only appear once the unit is powered up and after all the connections and configurations are made. If the ATD-C™ was already on, the message won't display. FIG. 3-5.

FIG. 3-5



2. Go to the "Send" tab, type "=ostart" on either command box for continuous data output every second, and click on the "Send ASCII" button on the same line as the text box where the command is entered to send the command. FIG. 3-6.

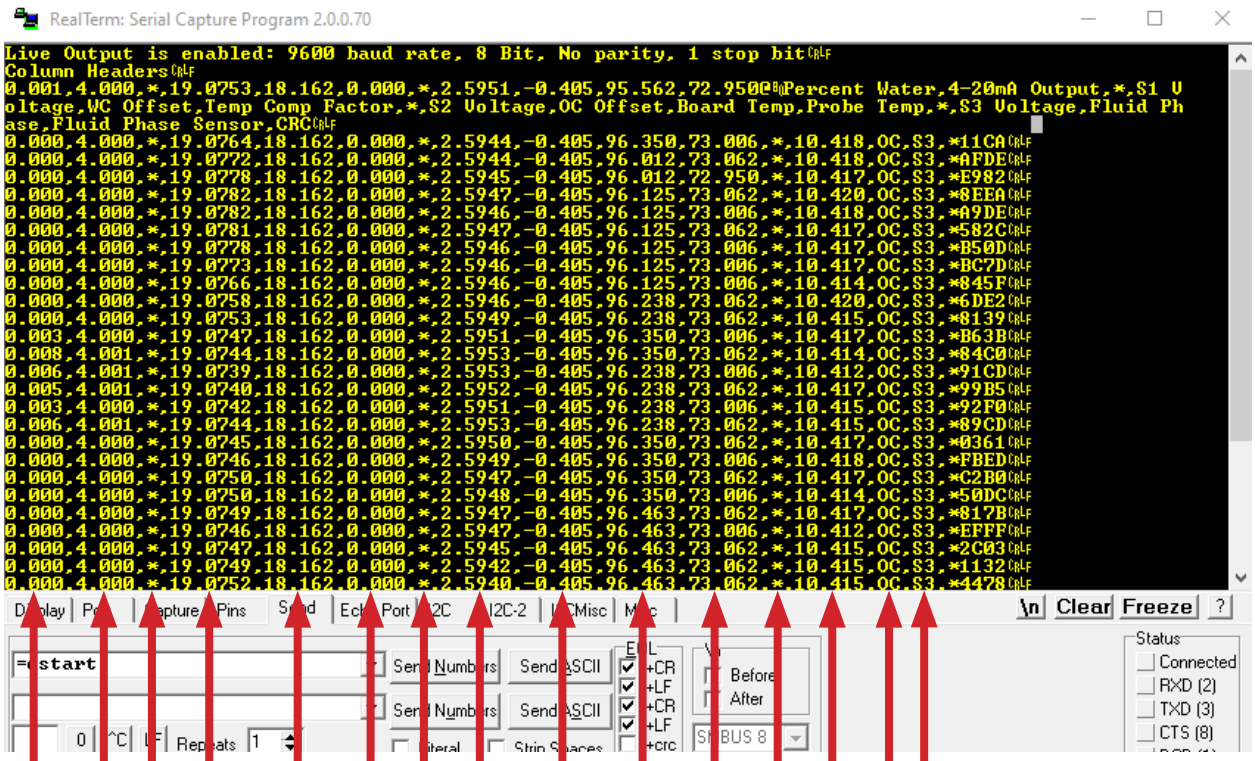
FIG. 3-6



3. The output will start automatically in CSV (comma separated values) format. See FIG. 3-7 on page 22 for output data definitions.

If the output readings do not display in the RealTerm menu, proceed to the "RS232 Communication" troubleshooting section on page 29 of this manual.

FIG. 3-7 OUTPUT DATA



Column 15: Fluid phase sensor (S1 or S3)

Column 14: Fluid phase state (OC or WC)

Column 13: Sensor 3 voltage

Column 12: Separation indicator

Column 11: Probe temperature. Range: 0 to 149 °C

Column 10: Board temperature. Range: 0 to 70 °C

Column 9: Oil continuous mode offset

Column 8: Sensor 2 voltage. Range: 0-20 volts

Column 7: Separation indicator

Column 6: Temperature compensation factor

Column 5: Water continuous mode offset.

Column 4: Sensor 1 voltage. Range:0-20 volts

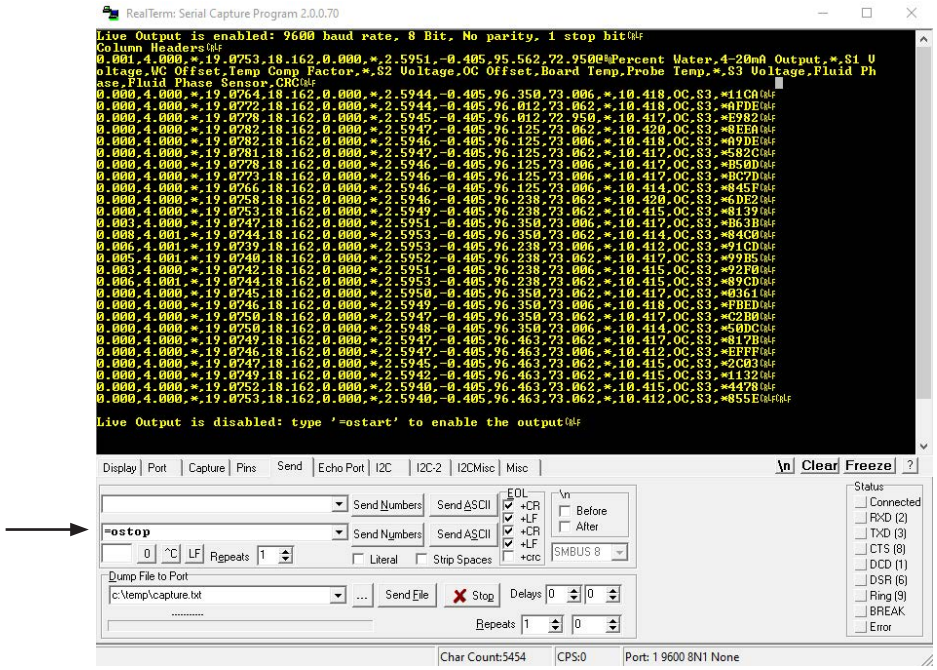
Column 3: Separation indicator

Column 2: 4-20 mA output

Column 1: Percent water output

4. Type "=ostop" and click on "Send ASCII" to stop the continuous output. **Always do this before disconnecting**. FIG. 3-8.

FIG. 3-8



OFF–LINE CALIBRATION

Although the ATD-C™ has been calibrated in the factory, it should be calibrated in process conditions prior to use. This can be done using 100% brine (produced water) and 100% dry oil in buckets as outlined below. Once installed, it will need to be adjusted per the steps in the following "In-Line Calibration and Verification" Section.

1. Connect your PC to the ATD-C™ sensor via supplied RS232 serial port or USB-to-serial converter as per the wiring diagram on page 11 of this manual.

2. Connect coaxial cables from the electronics and probe togeather

3. Apply Power to the ATD-C™

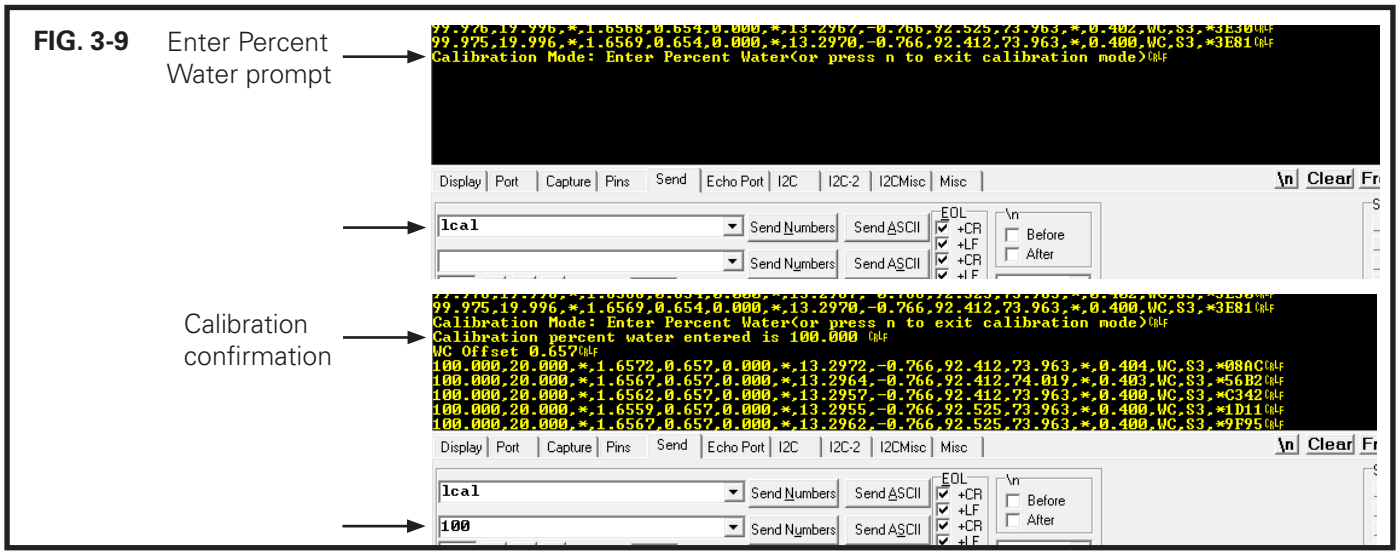
4. Launch RealTerm. Let the ATD-C™ warm up for 20 minutes. This will stabilize the electronics temperature.

5. Insert the sensor in a bucket with brine (produced water) ensuring that the sensor is at least 3" from any wall. Probe should remain in brine until a stabilized temperature is observed. Readings should show 100% water or something close to 100% (Column 1) and the water-continuous state (Column 14) in the RealTerm menu.

   NOTE: As all water in crude oil has salt, the ATD-C™ sensor has already been calibrated for salt water. You will not get an accurate reading if you use fresh water for testing. Salt water content should match stated content on approved drawings/data sheet. It should also show 20 mA if the mA range is calibrated for 0-100%, which you can measure at the output terminal. Regardless of readings, the sensor must be recalibrated.

   WARNING: If the sensor is submerged in brine and Column 14 does not display WC (Water Continuous), do not perform the calibration and contact KAM Technical Support for further assistance.

6. On RealTerm, type "lcal" (lower case L) on the first command box under the "Send" tab and click on "Send ASCII." An "Enter Percent Water" prompt will appear, you have 20 seconds to enter the water percentage. Type "100" on the second command box and click on "Send ASCII." The calibration confirmation message will display. FIG. 3-9. If the 20-second window expires, repeat the process.



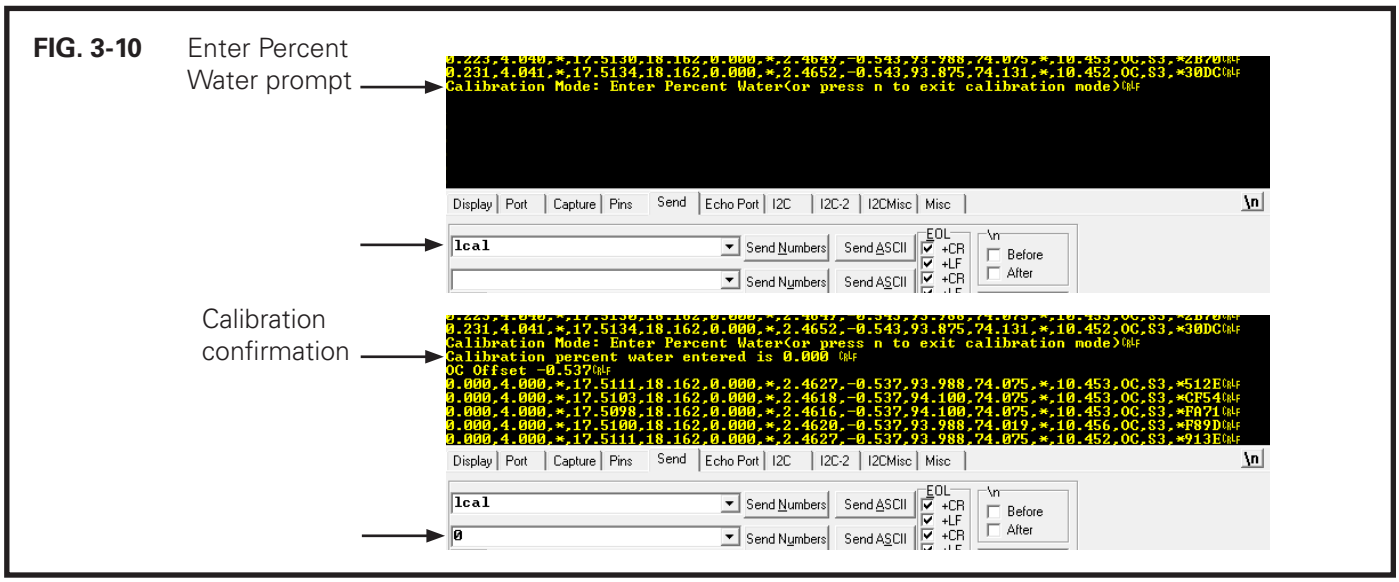
6. Remove the instrument from brine, and thoroughly clean and dry the probe.

7. Insert the sensor in a bucket with sample of dry oil ensuring that the sensor is at least 3" from any wall.To accurately test the ATD-C™, you must use oil that does not have any water in it or which has a known, low percentage of water (preferably <1%). Sample water percentage can be determined by Karl Fischer, centrifuge or distillation per API Chapter 10. The water percentage reading should show 0% or reflect the known water percentage (Column 1) and the oil-continuous state (Column 14) on RealTerm.

   WARNING: If the sensor is submerged in dry oil and Column 14 does not display OC (Oil Continuous) do not perform the calibration and contact KAM Technical Support for further assistance.

8. Type "lcal" (lower case L) on the first command box under the "Send" tab and click on "Send ASCII." An "Enter Percent Water" prompt will appear, you have 20 seconds to enter the water percentage. Type "0" or the known percentage of water on the second command box and click on "Send ASCII." The calibration confirmation message will display. FIG. 3-10. If the 20-second window expires, repeat the process.

FIG. 3-10



9. The ATD-C™ has now been calibrated to process conditions and can be installed.

IN-LINE CALIBRATION AND VERIFICATION

PLEASE NOTE:

To ensure proper operation of the ATD-C™, the offsite calibration must be done prior to mechanical installation, following the instructions on page 24 of this manual.

Before final calibration can be performed, the ATD-C™ must be fully installed with the probe inserted to the final depth and all the wiring and mechanical installation complete.

At this stage, the only calibration that needs to be done is the 100% brine calibration. If it is a 2-unit configuration, both probes must be calibrated in tank, in 100% brine.

1. Launch Real Term and follow the instructions on pages 17 to 21 to see the water measured by the ATD-C™. If the off site calibration was performed with brine from the tank the ATD-C™ should be reporting a value between 90 and 100 percent when it is in 100 percent brine. If the unit is not in 100% brine (reading is well below 90%) either mechanically lower the probe into the brine until the reading is above 90% or wait until water levels have risen enough for the probe to read 90%.

2. On RealTerm, type "lcal" (lower case L) on the first command box under the "Send" tab and click on "Send ASCII." An "Enter Percent Water" prompt will appear, you have 20 seconds to enter the water percentage. Type "100" on the second command box and click on "Send ASCII." The calibration confirmation message will display. FIG. 3-9. If the 20-second window expires, repeat the process.

NOTE: The ATD-C™ might not read 100% as expected for the following reasons:

1. The offsite calibration was not performed with the brine from the tank. Please perform offline calibration first.

2. A small coating of oil may have attached to the probe when it was lowered into the tank. In this case, you would still enter the water percent for the calibration prompt as 100.

PROCESS PARAMETER VALUES

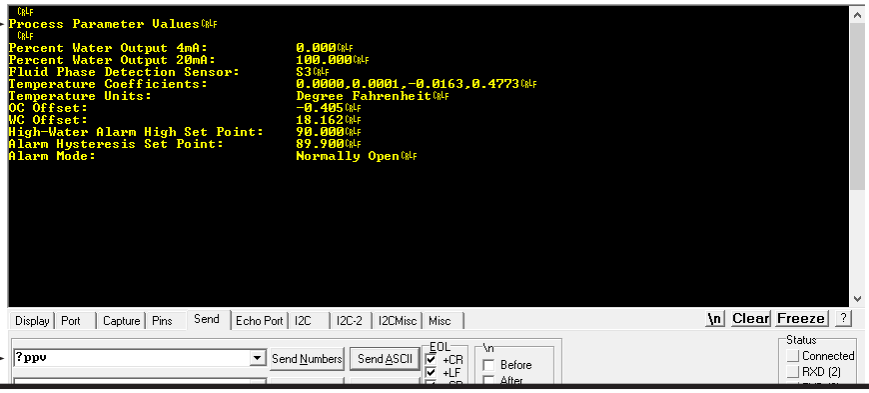
The overall configuration of the instrument is shown within the process parameter values, which include the 4-20 mA loop (water percent range), phase sensor, temperature coefficients, temperature units, OC-WC offsets, and alarm settings.

Before proceeding, install and configure RealTerm as per instructions on pages 17-19 of this manual. Ensure your PC is connected to the ATD-C™ sensor via the supplied RS232 serial cable and USB-to-serial converter as per wiring diagram on page 11. To access the boards, use a 7/16" wrench to remove the (6) hex screws on the Explosion Proof electronics enclosure and remove the cover.

To view the parameters:

1. Launch RealTerm. Type "?ppv" in the command box under the "Send" tab and click on "Send ASCII." The configured values for process parameters will be displayed. FIG. 3-11.

FIG. 3-11



SETTING THE PERCENT WATER FOR THE 20 mA OUTPUT

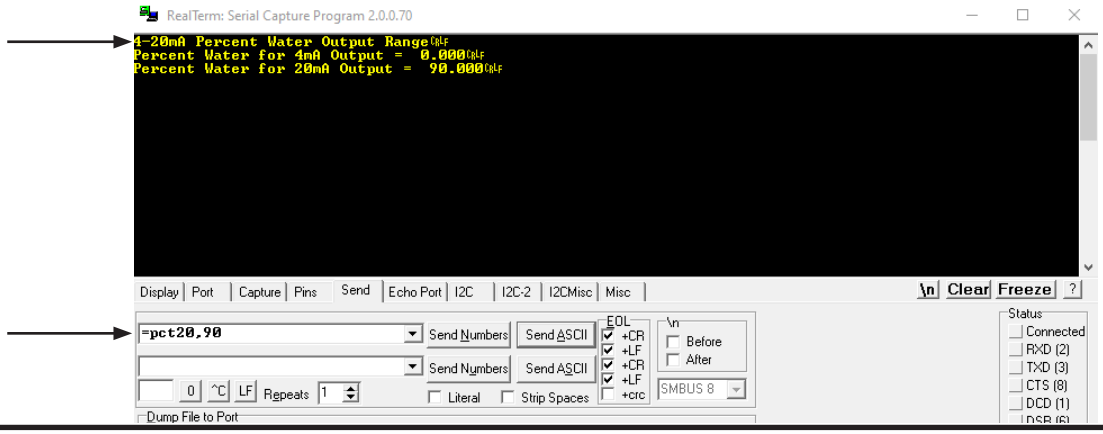
Before proceeding, install and configure RealTerm as per instructions on pages 17-19 of this manual. Ensure your PC is connected to the ATD-C™ sensor via the supplied RS232 serial cable and USB-to-serial converter as per wiring diagram on page 11. To access the boards, use a 7/16" wrench to remove the (6) hex screws on the Explosion Proof electronics enclosure and remove the cover.

The default percent water for the 20 mA output is 100%. To set a lower percent water for the 20 mA loop output:

1. Launch RealTerm. Go to the "Send" tab, type "pct20,<percent value>" on either command box and click on "Send ASCII." For example, if the water percent equivalent to the 20 mA of the output loop is 90, you would enter "=pct20,90". The change will be confirmed in the main window. FIG. 3-12.

   NOTE: Setting this value does not change the accuracy of the instrument +/- 1.0%

FIG. 3-12



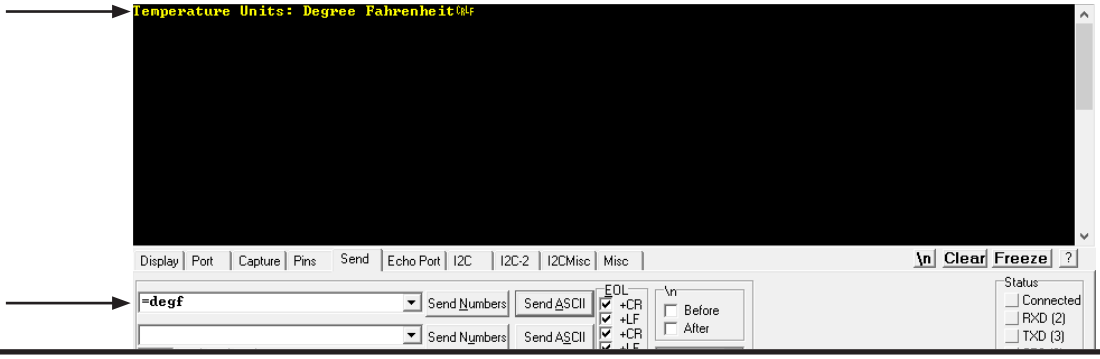
CHANGING THE TEMPERATURE UNITS

Before proceeding, install and configure RealTerm as per instructions on pages 17-19 of this manual. Ensure your PC is connected to the ATD-C™ sensor via the supplied RS232 serial cable and USB-to-serial converter as per wiring diagram on page 11. To access the boards, use a 7/16" wrench to remove the (6) hex screws on the Explosion Proof electronics enclosure and remove the cover.

To change the temperature unit (The default unit for temperature is degrees Celsius):

1. Launch RealTerm. Type "=degf" for Fahrenheit or "=degc" for Celsius on either command box under the "Send" tab and click on "Send ASCII." The change will be confirmed in the main window. FIG. 3-13.

FIG. 3-13



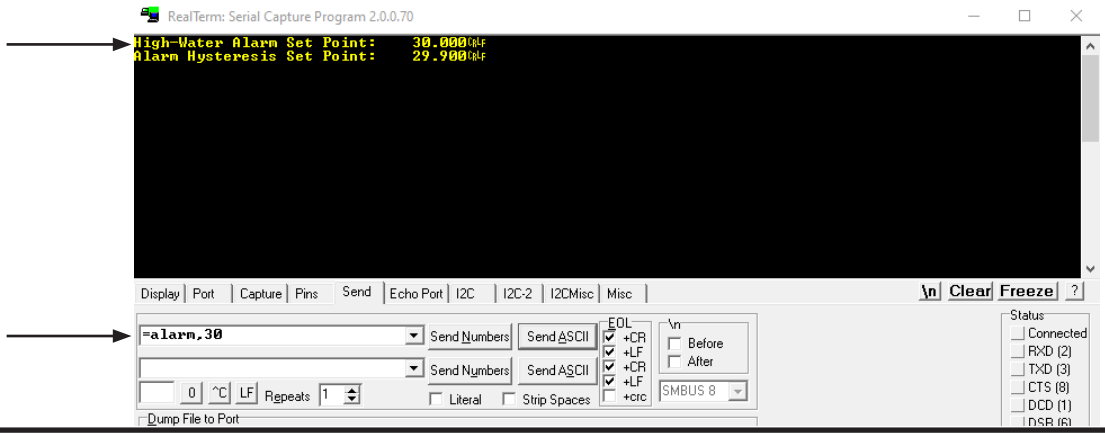
SETTING THE ALARM SETPOINTS

Ensure RealTerm is installed and configured as per instructions on pages 17-19 of this manual. Connect your PC to the ATD-C™ sensor via supplied RS232 serial cable or USB-to-serial converter as per wiring diagram on page 11. To access the boards, use a 7/16" wrench to remove the (6) hex screws on the Explosion Proof electronics enclosure and remove the cover.

To set the alarm [Digital Out (+)]:

1. Launch RealTerm, go to the "Send" tab, type "=alarm,<percent value>" on either command box and click on "Send ASCII." For example, if the percent water where the alarm will activate is 30, you would enter "=alarm,30". The configured values will be displayed. FIG. 3-15.

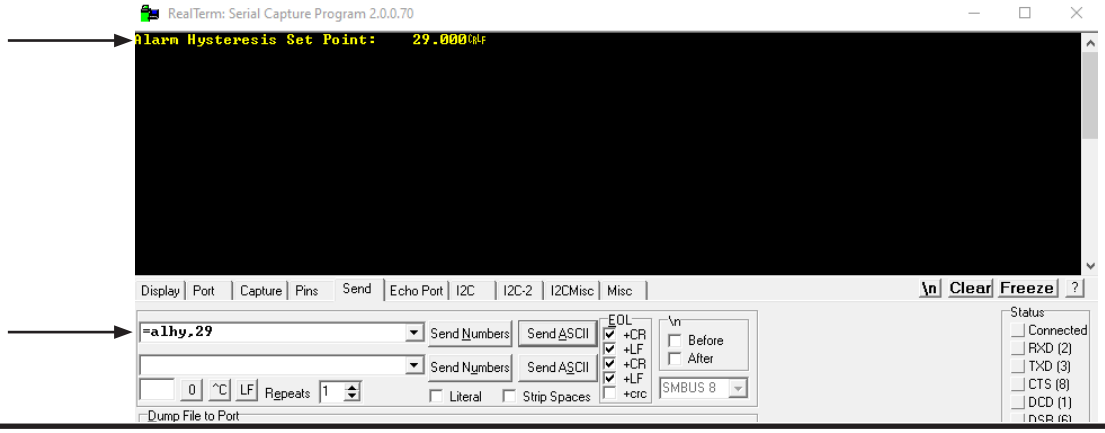
FIG. 3-15



2. The hysteresis point is adjusted automatically to 0.1% lower than the high set point.

3. To adjust the hysteresis point manually, type the command "=alhy,<hysteresis percent>" and click on "Send ASCII." The hysteresis percent must have a difference higher than 0.1% from the high set point. For example, if the water percent lower limit where the alarm will clear the high-water status and be able to reactivate is 29, you would type "=alhy,29". The new hysteresis alarm value will be displayed. FIG. 3-16.

FIG. 3-16



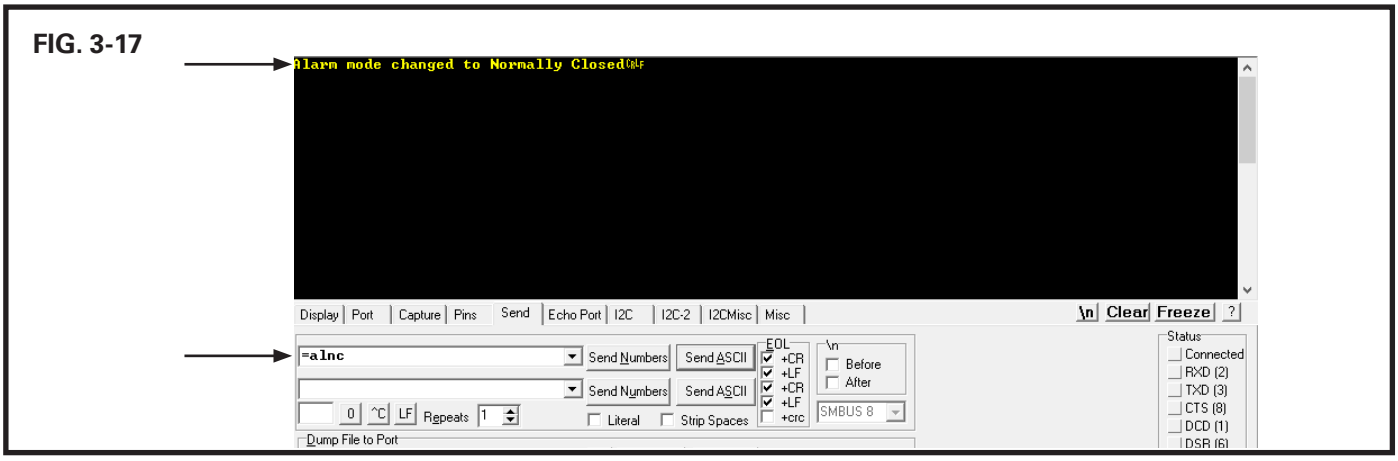
SETTING THE ALARM MODE

Before proceeding, install and configure RealTerm as per instructions on pages 17-19 of this manual. Ensure your PC is connected to the ATD-C™ sensor via the supplied RS232 serial cable and USB-to-serial converter as per wiring diagram on page 11. To access the boards, use a 7/16" wrench to remove the (6) hex screws on the Explosion Proof electronics enclosure and remove the cover.

The alarm mode is set to "Normally Open" by default, follow the steps below to change the mode to "Normally Closed."

1. To set the alarm mode, launch RealTerm and type "=alnc" on either command box under the "Send" tab. Click on "Send ASCII." The change will be confirmed in the main window. FIG. 3-17.

FIG. 3-17



2. To change the alarm mode back to "Normally Open", type the command "=alno" and click on "Send ASCII."

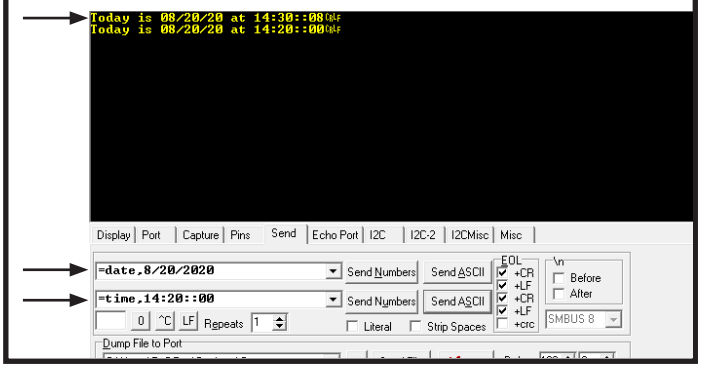
SETTING THE DATE AND TIME

Before proceeding, install and configure RealTerm as per instructions on pages 17-19 of this manual. Ensure your PC is connected to the ATD-C™ sensor via the supplied RS232 serial cable and USB-to-serial converter as per wiring diagram on page 11. To access the boards, use a 7/16" wrench to remove the (6) hex screws on the Explosion Proof electronics enclosure and remove the cover.

1. To set the date, launch RealTerm and type the command "=date,<MM>/<DD>/<YYYY>" on either command box under the "Send" tab. Click on "Send ASCII." For example, if the desired date is August 20th, 2020, you would enter "=date,08/20/2020". The change will be confirmed in the main window FIG. 3-18.

2. To set the time, type the command "=time,<HR>:<MM>::<SS>". For example, if the desired time is 14:20::00 hrs, you would enter "=time,14:20::00". The change will be confirmed in the main window. FIG. 3-18.

FIG. 3-18

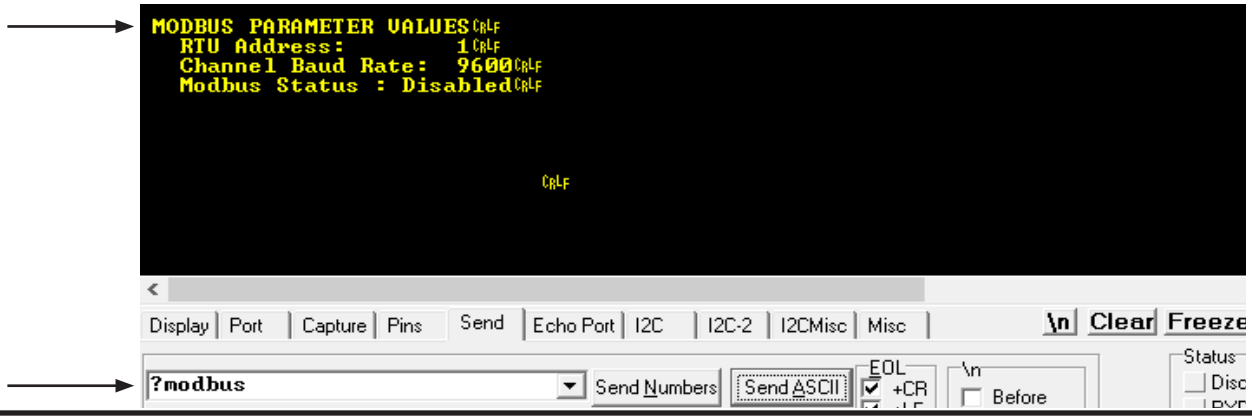


ENABLE/DISABLE MODBUS

Unless requested, Modbus is usually disabled prior to shipment from KAM. Before proceeding, install and configure RealTerm as per instructions on pages 17-19 of this manual. Ensure your PC is connected to the ATD-C™ sensor via the supplied RS232 serial cable and USB-to-serial converter as per wiring diagram on page 11.

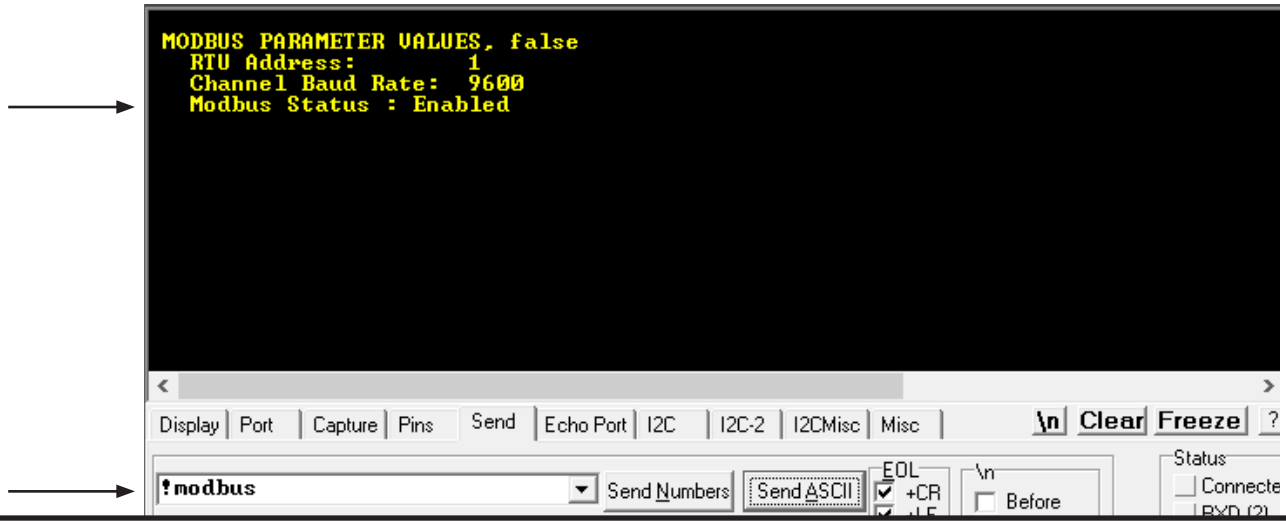
1. Launch RealTerm. Go to the "Send" tab, type "?modbus" on either command box and click on "Send ASCII" to check Modbus status. The Modbus parameters will display on the RealTerm window. FIG. 3-19.

FIG. 3-19



2. Type the command "!modbus" and click on "Send ASCII" to enable Modbus. Modbus status will change to "Enabled" confirming the change. FIG. 3-20.

FIG. 3-20



3. Power cycle (turn off and on) the ATD-C™ to start the Modbus communication.
4. To disable Modbus, use the same command "!modbus" and click on "Send ASCII." Modbus status will change to "Disabled" confirming the change.

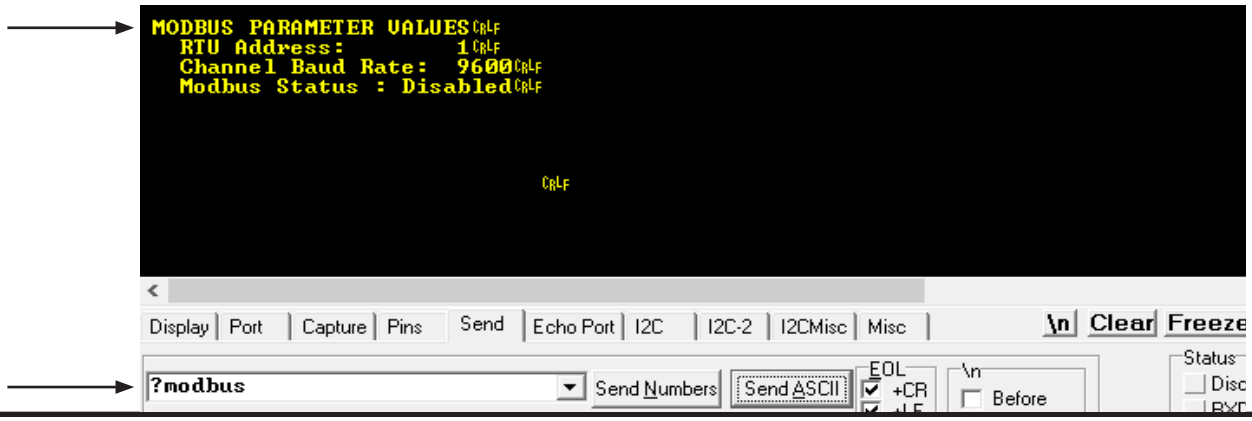
CHANGE THE MODBUS ADDRESS

The default Modbus address is 1. This address can be change to any number from 1 to 247. Follow the steps below to change the Modbus address.

Before proceeding, install and configure RealTerm as per instructions on pages 17-19 of this manual. Ensure your PC is connected to the ATD-C™ sensor via the supplied RS232 serial cable and USB-to-serial converter as per wiring diagram on page 11. To access the boards, use a 7/16" wrench to remove the (6) hex screws on the Explosion Proof electronics enclosure and remove the cover.

1. On RealTerm, go to the "Send" tab and type the command "=modbus,2,9600" on either command box. Click on "Send ASCII." FIG. 3-21. The #2 represents the new address.

FIG. 3-21



2. To complete the change, turn the ATD-C™ power off, wait two to three seconds, and turn it back on.

COMMAND LIST

Once RealTerm has been installed and configured as per the instructions on the "RealTerm Software Configuration" section, any of the commands listed in the table below can be used to view or change the various instrument's parameters.

TABLE 3-1

COMMAND	PURPOSE
^ostart	Start continuous output
output	Single line output
^ostop	Stop continuous output
lcal (lower case L)	Live calibration
^pcaloc,<value>,<value2>	Oil Continuous calibration for laboratory sample analysis
^pcalwc,<value>,<value2>	Water Continuous calibration for laboratory sample analysis
?ppv	View the process parameters values
=degc	Set the temperature units displayed to Celsius (°C)
=degf	Set the temperature units displayed to Fahrenheit (°F)
^pct20, <value>	Set the percent water for the 20 mA output
^alarm, <value>	Set high water percent alarm value
^alhy,<value>	Set alarm hysteresis (lower limit for the alarm activation band)
=alnc	Set alarm mode to normally closed
=alno	Set alarm mode to normally open
=date,<MM>/<DD>/<YYYY>	Set the current date
=time,<HR>:<MM>::<SS>	Set the current time
^modbus	View/Change Modbus parameters
?sn	View the serial number of the instrument
?version	Display the software version of the instrument
help	Display a list of commands

The command the symbol "^" can be replaced with the following options:

"*" to see the command usage details
"?" to see the current value of the parameter
"=" to change the value of the parameter

Type the command with the replaced symbol in the command box and click on "Send ASCII" to send the command.

Detailed instructions on how to use commands and examples are available in the previous sections.

OPERATION USING MODBUS

1. If you have not already done so, follow instructions on the "Enabling/Disabling Modbus" on page 31 of this manual to enable Modbus.

2. Ensure power to the ATD-C™ is turned off.

3. Set any jumpers on the RS485 converter to use two wire mode.

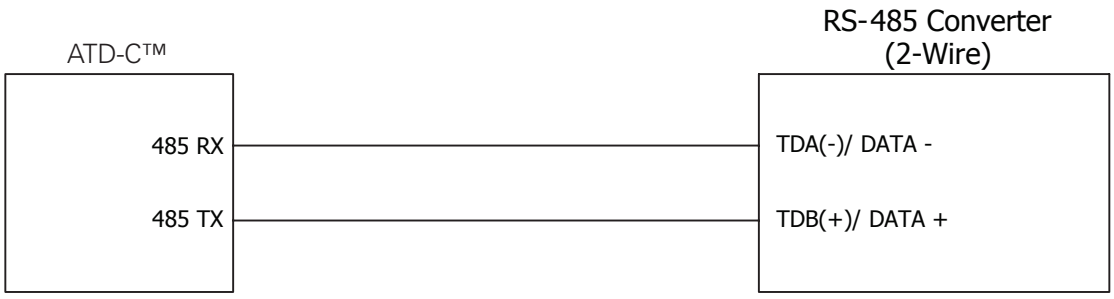
4. Set your RS485 converter for two-wire mode as per the instructions on the RS485 converter manufacturer's manual.

5. To access the boards, remove cover from the enclosure by turning it counterclockwise.

6. Connect the "RS-485 +" terminal on the ATD-C™'s Terminal Board to the Data(+) line on the RS485 converter. FIG. 4-1.

7. Connect the "RS-485 -" terminal on the ATD-C™'s Terminal Board to the Data(-) line on the RS485 converter. FIG. 4-1.

FIG. 4-1 RS485 WIRING DIAGRAM



8. Turn on power to the ATD-C™.

9. Make sure the activity indicator (when available) on the converter blinks as data is transferred or read by the Modbus master reader software.

10. Set the appropriate COM port in the Modbus software. This setting varies with the system and whether the connection to the converter is connected to the serial communications port or to the USB port. Follow converter manufacturer's recommendations for settings.

11. Use the following configuration settings in the Modbus software:

Mode: RTU
Baud Rate: 9600
Data Bits: 8
Stop Bits: 1
Parity: None
Function Code: 3
Slave ID: 1 (By default, the Slave ID or Modbus Address is set to 1. To change Modbus address see "Changing Modbus Address" section on page 32 if necessary).
Offset: 0

12. Make sure that the correct registers are being read as 32 bit float. See Table 4-1.

TABLE 4-1

ATD Modbus Registers			
Register	**Type**	**Read/Write**	**Value**
42000	Float	Read	Percent Water
42001	Float	Read	Current Output (mA)
42002	Float	Read	S1 Voltage
42003	Float	Read	S2 Voltage
42004	Float	Read	S3 (OC/WC) Voltage
42005	Float	Read	OC Offset
42006	Float	Read	WC Offset
42007	Float	Read	Board Temperature
42008	Float	Read	RTD Temperature
42009	Float	Read	OC-WC Enabled/Disabled State
42010	Float	Read	Temperature Compensation
42011	Float	Read	Phase State(OC/WC)

13. The output data of the ATD-C™ can be accessed via the Modbus registers.

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.

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 2 LEDs on the ATD-C™'s 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.

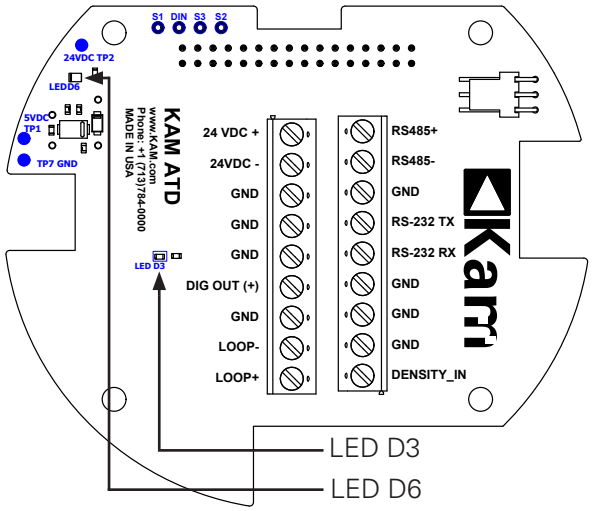
1. Use a multimeter in voltmeter mode to measure the voltage across the power loop terminals 24 VDC + and 24 VDC -. The voltage should be within the instrument's requirements (24 V) and close to the power supply ratings (+/- 0.5 V). For example, a 24 V power supply could measure 23.5 V on the ATD-C™ terminals. If the voltage is not within those requirements, verify that the power supply has a wattage capability of 24 watts, and check for any blown fuses, faulty wiring, or a faulty power supply.

   If LED D6 does not light up, but you have the adequate voltage at the power terminals, it indicates a bad LED. The faulty LED will not affect the operation of the instrument, it is only an indicator that a voltage is present.

2. Once the voltage across power loop terminals has been verified, make sure the ATD-C™ is wired with the correct polarity as per the wiring diagram on page 11 of this manual. If the polarity is wrong, turn off the power and rewire the ATD-C™ with the correct polarity. Turn the power back on when done.

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

FIG. 5-1



NOTE: LED location may vary depending on the version of board

3. Using a multimeter in voltmeter mode, verify the voltage of the primary power supply by measuring across TP1 and TP7 (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 Terminal Board is not working properly or there is a short circuit on the board. In this case, the Terminal Board needs to be fixed or replaced. Please contact KAM Technical Support for further assistance.

NOTE: LED D3 on the Terminal Board remains lit when there is voltage between TP1 and TP2. If not, it indicates a faulty LED. The faulty LED will not affect the operation of the instrument, but a Terminal Board repair is recommended.

4-20 mA OUTPUT LOOP

Once the power supplies have been verified as per instructions in the previous section ("Power Verification"), 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 V. 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 and fully close the terminals on the "4-20 mA+" and "4-20 mA-" terminals by turning the screwdriver clockwise. 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 to 12.0 volts. 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 ATD-C™ as per the wiring diagram on page 11. If the PLC cannot read the output, there could be a wiring issue with the loop. Please inspect the wires from the ATD-C™ 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.

RS232 COMMUNICATION

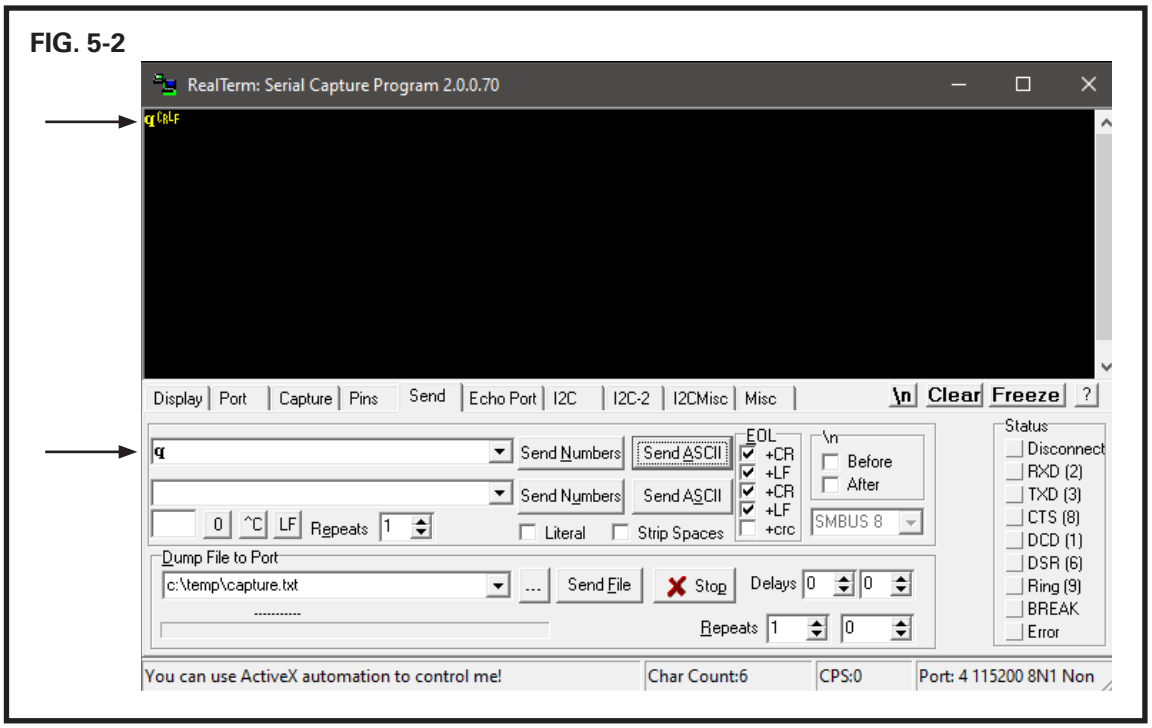
If you have not already done so, follow the previous procedures of the Troubleshooting section to verify power supplies.

Before proceeding, install and configure RealTerm as per instructions on pages 27-29 of this manual. Also, please ensure the driver for the supplied USB-to-serial converter is installed on your PC.

1. If the RS232 cable is connected to the ATD-C™, ensure all 3 wires from the ATD-C™ terminal are disconnected. Proceed to connect the supplied RS232 serial cable and USB-to-serial converter to your computer and launch RealTerm.

2. 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 the tips of these wires are connected, type any letter (i.e. "q") in either command box of the "Send" tab on RealTerm and click on "Send ASCII." If the configuration is done properly, the letter should appear in the window display. FIG. 5-2.

FIG. 5-2



If there is no change, use another RS232 serial cable and/or USB-to-serial converter and try sending the command once more. If the same letter you typed does not appear, try reinstalling the USB-to-serial converter drivers or try a different converter and repeat step 2.

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.

3. Once the letter appears on the window display, connect the RS232 serial cable to the ATD-C™ as per the wiring diagram on page 11 of this manual.

4. Turn the ATD-C™ off and back on.

5. Type the command "help" in either command box and click on "Send ASCII." A list of commands should appear in the window. If the list does not appear, proceed to the next step. If the list appears, you are now ready to perform the desired procedures, such as calibration or configuration changes by following the instructions on the corresponding sections of this manual.

6. 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 volts. If the voltage is not between the stated range, the RS232 port from the ATD-C™ may be damaged. Contact KAM Technical Support for further assistance.

If the voltage is within the specified range, but you are still not able to establish communication with the ATD-C™, please contact KAM Technical Support for further assistance.

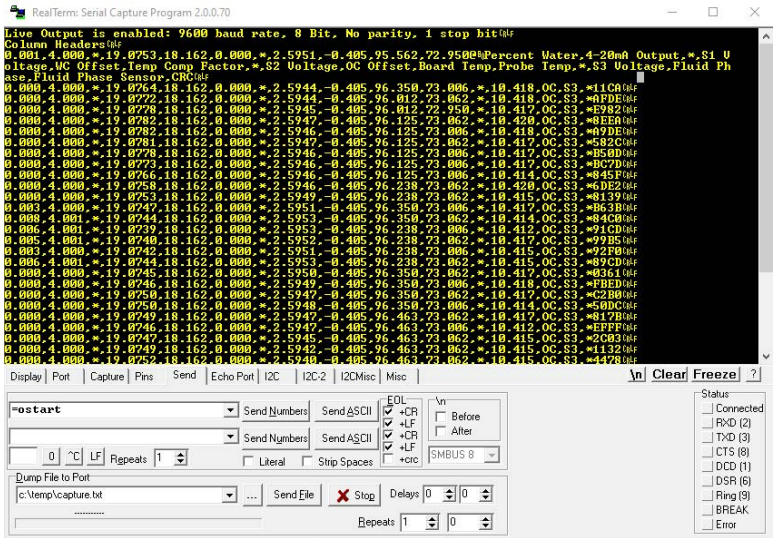
ELECTRONICS DEBUGGING

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 is still having issues.

Before proceeding, install and configure RealTerm as per instructions on pages 27-29 of this manual. Ensure your PC is connected to the ATD-C™ sensor via the supplied RS232 serial cable and USB-to-serial converter as per wiring diagram on page 11. Also, please ensure the driver for the supplied USB-to-serial converter is installed on your PC.

1. Launch RealTerm and follow the steps to view output data as per instructions on pages 17-18. The instrument's data will start being displayed. FIG. 5-3. If not, contact KAM Technical Support for further assistance.

FIG. 5-3



2. Using a multimeter in voltmeter mode, measure the voltage between the test point TP4 and TP2 (GND). Compare this voltage to the value on Column 8 (Sensor 2 voltage) of the RealTerm display. With a steady state fluid condition (i.e. constant water content and flow conditions), the values should have less than 0.2 V difference. If not, contact KAM Technical Support for further assistance.

3. Using a multimeter in voltmeter mode, measure the voltage between the test point TP5 and TP2 (GND). This test point can have two values 9.75 +/- 2 V or 0.7 +/- 1 V. This voltage and the value on Column 13 (Sensor 3 voltage) of the RealTerm display should have a difference of less than 2 V. If not, contact KAM Technical Support for further assistance.

4. Verify that the value of the 4-20 mA current output (Column 2) matches the reading of the connected device to the 4-20 mA terminals (PLC, flow computer, etc.) If the values do not match, please contact KAM Technical Support for further assistance.

If initially experiencing RS485 communication issues, continue to the next section. If any of the other issues persist after performing all the troubleshooting procedures above, 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 35 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 ATD-C™ per the wiring diagram on page 11 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 ATD-C™ 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 ATD-C™. The LEDs should be blinking while data is being sent/received.

6. If the differential voltage is not present and/or there is no activity on the LED of the RS485 converter, contact KAM Technical Support for further assistance.