INVALCO

WCM 7400 Retrofit Kit

Conversion of the CX-645 / WCM 7300 to a Model WCM 7400 Water Cut Monitor

Installation / Operation / Maintenance Manual

Bulletin MNIN001 ‖ Issue/Rev 0.0 (10/16)

FMC Technologies

Important

All information and technical specifications in this documentation have been carefully checked and compiled by the author. However, we cannot completely exclude the possibility of errors. FMC Technologies is always grateful to be informed of any errors.

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1 – Introduction

1.1. Scope

The purpose of this operating and maintenance manual is to aid in the installation of the INVALCO Watercut Monitor Conversion Kit for CX-645/WCM-7300 to the WCM 7400 Water Cut Monitor with temperature and density compensated output.

1.2. General

INVALCO Watercut Monitor Conversion kits add density compensation to the capacitance and temperature compensation. This added ability decreases how often the unit needs to be recalibrated.

Note: Make sure that you read through the complete specification prior to performing the conversion to make sure that you have an understanding of what will be required to perform this conversion and that the correct personal and tools are present prior to starting this procedure.

1.3. Required Tools

1. Multi-meter - Voltage, and 4-20mA current readings will need to be taken
2. Small 18" pipe wrench with 3 1/4" min opening
3. Adjustable wrench able to open to 1.25" (12" or longer)
4. 9/16" socket with extension
5. 3/8-5/8" chisel and hammer
6. #2 flat head screw driver
7. 3/32" flat head screw driver for making electrical connections
8. Chain wrench or breaker bar to remove conduit cover

1.4. Warning and Safety Instructions

Note: This assembly requires knowledge of the system to determine if the unit is in a non-energized state (both electrically and process fluids), ability to take multi-meter readings and make trace wiring within the system to determine source/signals required.

CAUTION: Prior to disassembly of existing CX-645/WCM-7300 make sure that all pressure in removed, the probe is empty of fluids, and the power to the electronics and source of pressure is locked out. Failure to do so can cause bodily injury including death along with causing unit to not function after assembly is complete.

If the inner electrode is removed, the probe will have to be pressure tested, checked for leaks and place back into service.

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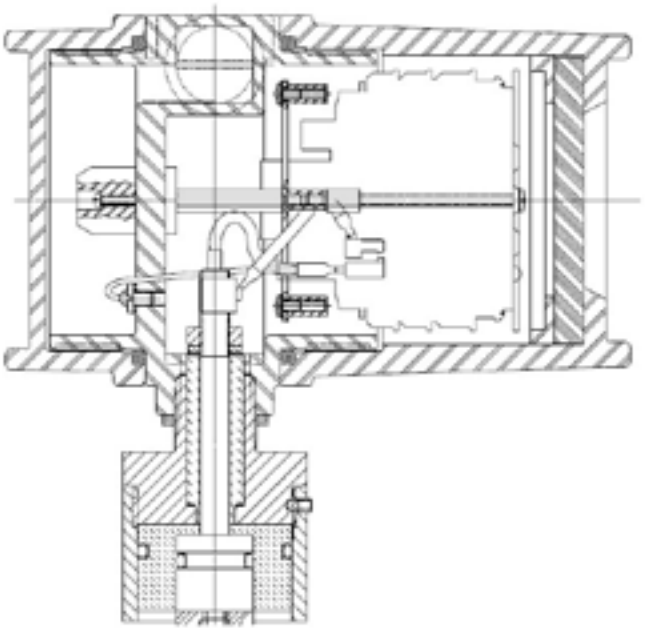
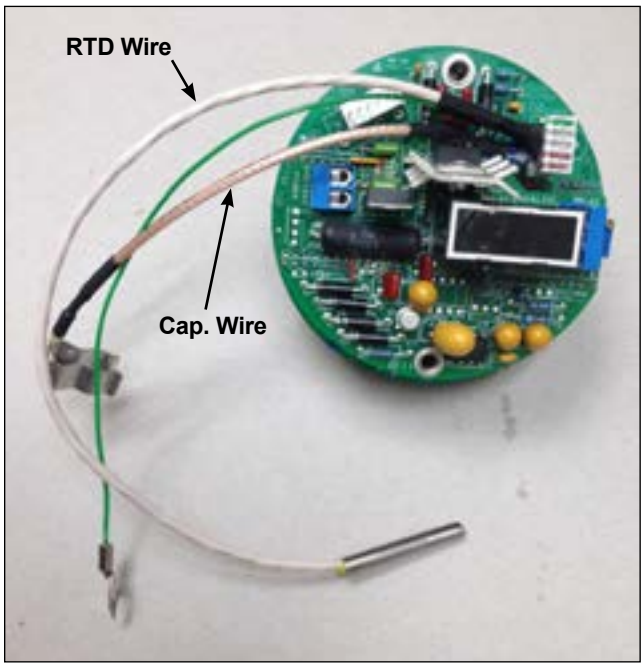
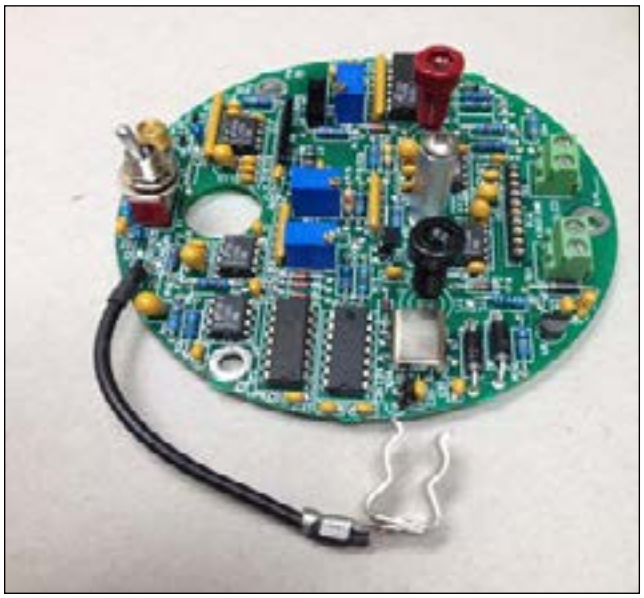
2 – Assembly Procedures

1. Start with making sure that the area is secure and that no combustible/flammable gases, dust or liquids are present (Non-zone area).
2. Open existing CX-645/WCM-7300 enclosure to access electrical connections.
3. Remove electrical connections making sure to identify all wires according to function and polarity.
4. Once all wires are removed, remove conduit connections to the CX-645/WCM-7300 conduit connection ports. Pull wires free from conduit and moved far enough away to allow the conduit to be rotated about the process connection NPT to the probe assembly.
5. Open the front cover to the CX-645/WCM-7300 to gain access to the capacitance wire.

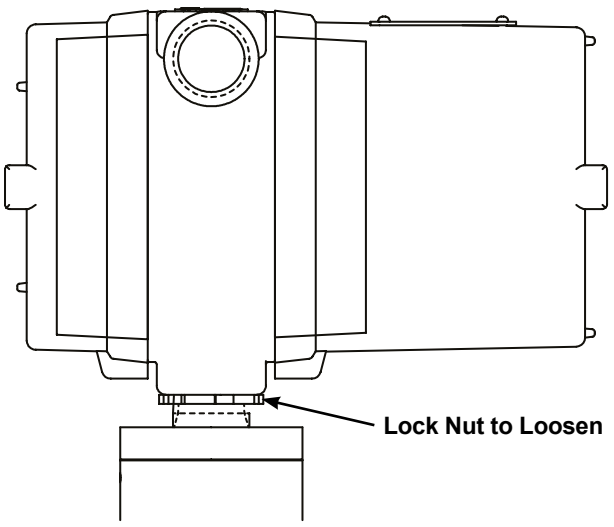


6. Remove two mounting screw (Chassis/PCB stack hold-down screws)
7. Remove capacitance wire clip from stud.
8. Remove RTD connect from PCB (white wires) (WCM-7300 only)
9. Remove ground screw from housing

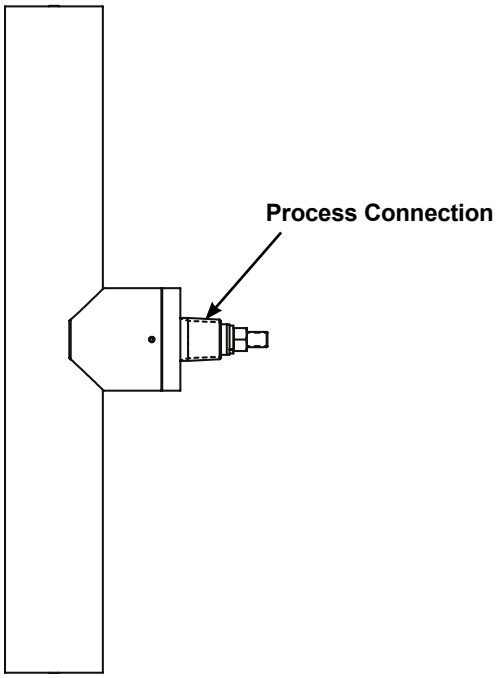




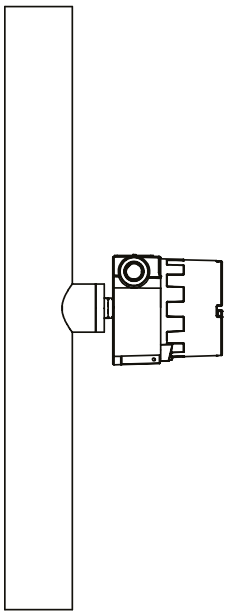
10. Remove RTD from center of stud. Use caution not to pull too hard, multiple attempts need to be made to guide the RTD out of the stepped hole. Make sure to rotate the wire as slight tension is placed on the RTD cable to remove. White electrolytic grease (thermal grease) is used to aid in connectivity of RTD. Wipe RTD clean and set aside. (WCM-7300 only).
11. Loosen the locking screw on the bottom process connection of the conduit to probe. A tap from a chisel and hammer will loosen this easily. Loosen Allen Head set screw on WCM-7300.



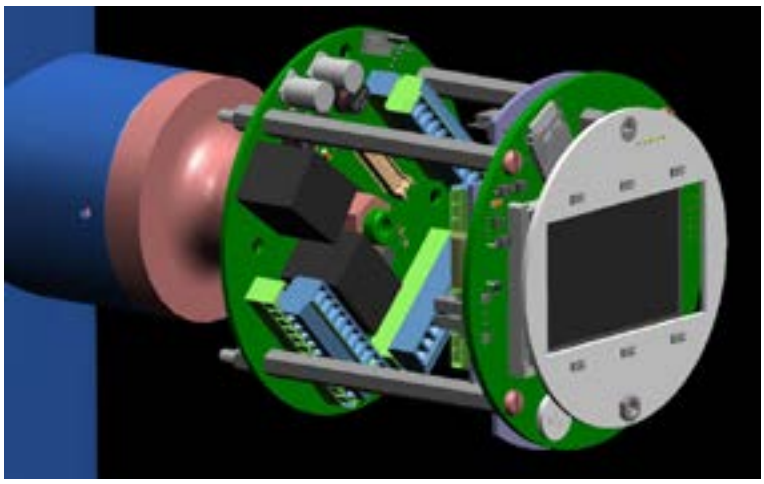
12. Slowly rotate the conduit counterclockwise about the process connection
13. Set CX-645/WCM-7300 aside



14. Remove the WCM 7400 electronic unit from shipping box. Attach the process connection on the bottom of the conduit of the WCM 7400 to the process connection of the probe.

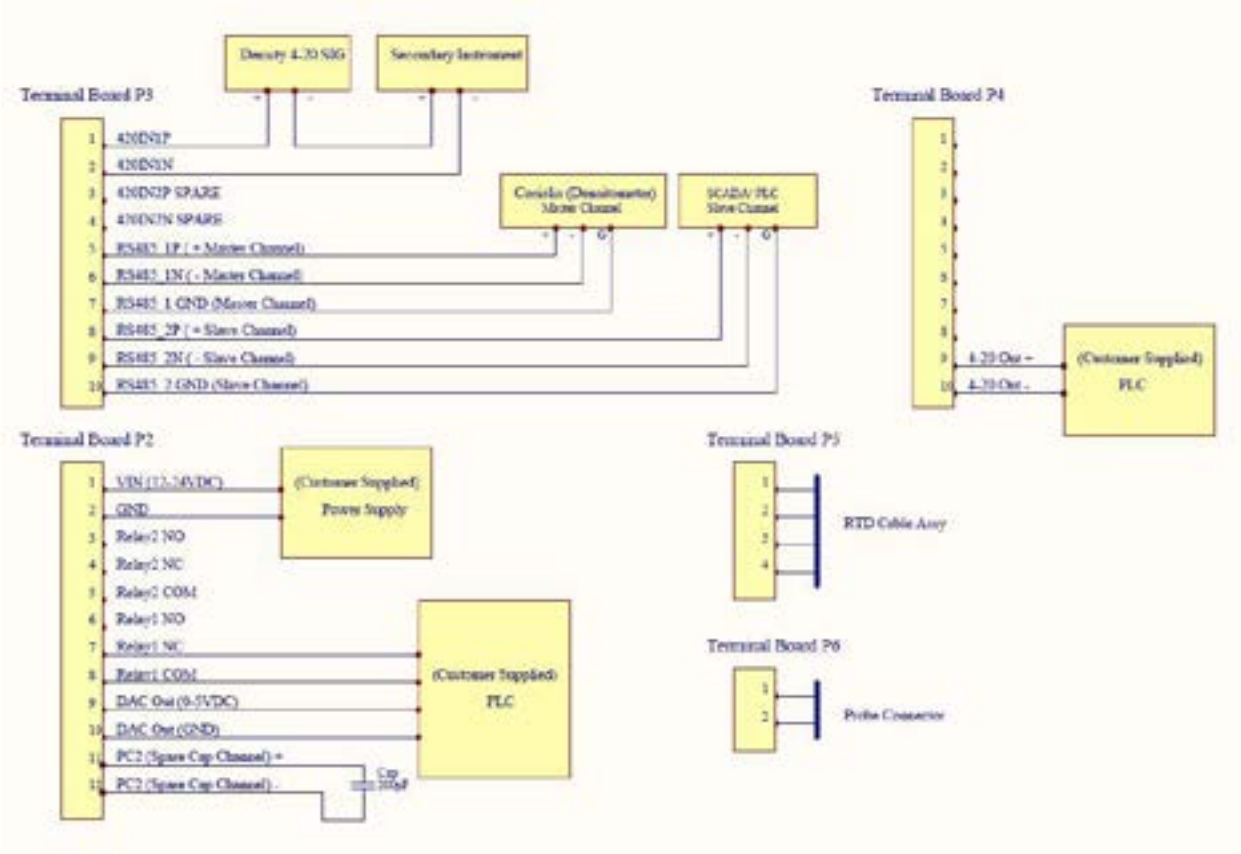


15. Tighten it down and lock the conduit to make process connection correctly (minimum turns per ASME NPT needs to be met). Retighten the locking nut using a chisel and hammer.
16. Open up the WCM 7400 conduit and remove the front PCB board by removing the two screws at top and bottom of PCB LED screen.
17. Unplug the wiring harness and set PCB on clean soft surface (make sure to not damage PCB board).
18. Using 9/16" socket wrench with extension reach down and remove 9/16 nut from process connection (set aside, this will be reused).
19. Install ring-lug of capacitance cable to stud and reinstall 9/16" nut to process connection (snug).
20. Connect capacitance cable to PCB.



21. Coat RTD with white grease and install through center hole of stud (WCM 7300 only - CX-645 conversion does not use the temperature compensation - consult factory if temperature compensation is required P/N 49021439)
22. Make RTD connection to PCB.

23. Continue wiring using below for guidance.



24. Tighten all conduit connections and make sure they are compliant to specification and zone requirements for the environment that the product resides in. If further instructions to requirements are needed consult a qualified site electrician for assistance.
25. Once all wiring connections are made, reinstall the wiring harness to the WCM 7400 LCD/PCB board, being careful not to damage the board or the connectors.
26. Reinstall the four screws that hold down WCM 7400 LCD/PCB board to the main chassis assembly. Use caution not to touch the through glass buttons on the WCM 7400 LCD/PCB board. Snug the four Chassis hold down screws.
27. Reinstall the Conduit cover and snug tight. Make sure to tighten the anti-rotation screw to secure the cap to the main housing.
28. Turn on power to initiate WCM 7400 Watercut Monitor setup.

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3 – Setup of WCM 7400 Watercut Monitor

3.1. WCM 7400 Watercut Monitor Overview

- Accurately measures trace amounts of water in flowing hydrocarbon streams.
- Optional compensation for reading changes caused by temperature variation of the flowing fluid.
- Optional input signal from densitometer or Coriolis meter allows for density compensation.
- Display the calculated water cut on the LCD readout.
- Provide an adjustable timed relay closure for control purposes
- 4-20 mA, 0-5 VDC analog output, RS485 Modbus Communications.

The WCM 7400 Watercut Monitor is able to measure trace amounts of contamination displayed as % water by monitoring changes in the dielectric constant (Dk) of the process fluid. The probe functions as a large capacitor in the process stream with an inner pipe electrode forming one plate of the capacitor and the outer pipe (ground) forming the other plate of the capacitor (see below). Since the dielectric constant of oil and water are dissimilar, it is possible to associate water contamination with a change in the probe capacitance. Advanced I/O capabilities now allow for water cut calculations to be compensated for differences in density of the oil.

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4 – Specifications

4.1. Temperature Range

Electronics: -40°F to 140°F (-40°C to 60°C)

- LCD heater is active below 32° F

Standard Process Fluid: 24°F to 160°F (-4°C to 71°C)

High Temperature Process Fluid (optional): 24°F to 375°F (-4°C to 190°C)

4.2. Power

- 12 to 28 Vdc at 500 mA maximum for UL.

4.3. Hardware Accuracy

Accuracy is defined as the amount of variance observed between the WCM 7400 Watercut Monitor's output readings and the true water grind-out measurement of the oil flowing through the probe. These values are true for oil of the same chemical makeup; additional variances can be experienced above these values for changes in chemical composition; however the normal variances are:

- ± .05 ..... From 0 to 5% water cut.
- ± .10 ..... From 5 to 10% water cut.
- ± .15 ..... From 10 to 25% water cut.

4.4. Inputs

- 4-20 mA (Density)
- Modbus RS485: RTU

4.5. Outputs

- Relay: 1 (Single Pole Double Throw) rated 8 Amps, 24 VDC
- 4-20 mA: (Water Cut)
- 0-5 Vdc (Water Cut)
- Modbus RS485: RTU
- Multi-colored LED's for special alerts

4.6. Enclosure

- NEMA 7 explosion-proof, Class1, Div 1, Groups C and D.
- CSA Class 1 Div 1.

4.7. Process Connections

- ASME B16.5 Flanged, Raised face or RTJ, Class 150 - 1500
- Victualic grooved, 2", 3", and 4" only
- Threaded MNPT, 2" and 3" only

4.8. Definitions

Cut (Water Cut) - A term commonly used to describe the % water by volume in the product stream.

Grind-out - A test performed on an oil sample to determine % water by volume. This is normally performed using a centrifuge, but may be done by other methods.

Dielectric Constant (Dk) - The ratio of the permittivity of a substance to the permittivity of free space. Essentially it is the ability of the plates of a capacitor to hold a charge. In this case it is the permittivity of the oil/water in the probe compared to an empty probe. As the Dk increases from water contamination the ability to hold a charge decreases and the capacitance increase.

API Gravity - This is the measure of the density of petroleum liquids compared to water. API gravity greater than 10 means it is lighter than water, less than 10 means it is heavier than water.

4.9 Display Definitions

There are many messages used to communicate information on data entry. The messages are summarized in the following:

Delay = Sec - Related to the setpoint, this value establishes the number of seconds of delay between a bad oil condition (red LED flashing) and release of the relay to bypass (solid red LED).

Density Comp - This feature allows the water cut reading to be compensated via an external densitometer or Coriolis meter.

Density C-rate - The C-rate scales the density compensation. Typical density compensation rate would be 1% water cut delta per 20 API degrees.

Density In - Density measurements can be input via 4-20 input or Serial communications (RS485)

Modbus Setup

Enter Cut X.XX% - Enter cut or grind-out value for calibration.

4.10. Modbus Setup

Enter Cut X.XX% - Enter cut or grind-out value for calibration.

Modbus Mode: RTU

Modbus Slave ID: 0-247

Baud rate: 115,200

Parity: None, Odd or Even

4.11. Error Messages

The INVALCO Model WCM 7400 Watercut Monitor continuously calculates a water cut based on a variety of control parameters. If any of these parameters are out of range or are inconsistent with known fluid Dk properties, advisory messages will result. These messages and their meanings are stated below.

Probe Empty/Low DK - The probe value is below the range established for the dielectric constant (Dk) and/or the range of the instrument. A standard Probe unit has a Dk tuning range of 1.0 to 20.0 which encompasses a wide range of crude oils and refined products. If the probe value is low due to a low Dk, gas breakout in the oil, probe not completely full, etc., the Low Dk message will result.

Below Cal Zero - This is a message that will be displayed if the value of the probe goes below the calibrated zero point.

Over Range - This message will appear if the probe is shorted, full of water, the insulators are coated with a conductive material, or anything occurs that might produce a low resistance reading from the probe center inner electrode stud to ground or outer casing.

Check Probe Wire - This message advises that the cable from the electronics to the probe is disconnected.

4.12. Product Temperature and Density Compensation

The base Dk of oils can vary with changes in temperature resulting in water cut reading error when in fact it is a Dk shift due to temperature. For example, a 10°F change a typical crude oil may show a reading shift of as much as 0.1% which would be interpreted as water. The WCM 7400 can measure product temperature and compensates the water cut reading accordingly, thus providing an accurate water cut over a wide range of temperatures.

Oil density compensation is also available with the WCM 7400 which allows the water cut reading to be adjusted automatically depending on the flowing streams density. In order to enable this feature a Coriolis meter or densitometer must be connected via a Modbus connection or the 4 – 20 mA analog input. When configuring Modbus the WCM 7400 would be the Master and Coriolis meter the Slave.

The density compensation feature is factory calibrated to compensate water cut reading as follows. For every decrease of 10 degrees API gravity the water cut will increase by 0.5%. This factory calibration can be easily changed in the controller setup screens if the compensation rate is not accurate for the oil being processed. To change the compensation rate perform the following procedure:

1. Enter setup mode by pressing the "Enter" button and enter the password and follow the instructions on the screen, press the button labeled "Setup".
2. Next follow the menu to change the "Density Compensation Rate".
3. The change in API degrees will equal the change in %. Increasing this number will decrease the compensation rate and decreasing this number will increase the compensation rate.
4. Save the changes and press "Escape" button to get out of the setup and programming mode.

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5 – Human Machine Interface (HMI)

Through Glass Buttons (TGBs) are used to operate the WCM 7400 Controller. These TGBs allow the user to operate the controller without opening up the Explosion Proof enclosure. In order to operate the buttons simply hold your finger flat against the glass and wait until the LED on the top right hand side turns on. When your finger has been sensed this Green "LED 3" will turn on. When your finger is removed it will turn off. Button descriptions are below.

a. "◄": Moves curser Left

b. "▲": Moves curser Up or increases values when editing various fields.

c. "▼": Moves curser Down or decreases values when editing various fields.

d. "F1": Programmed for various functions when navigating HMI

e. "Enter": Programmed for various functions when navigating HMI

f. "F2": Programmed for various functions when navigating HMI

g. "LED 4": Power indicator LED. This LED will be illuminated when controller is turned on.

h. "LED 1": Programmed for various alert functions such as:

   1. Water cut OK and within "Setpoint"
   2. Water cut has exceeded the "Setpoint"
   3. Below Cal Zero: Meaning the Water Cut % has gone below the "Zero Calibration Level".

i. "LED 2": Programmed for various alert functions such as:

i. API Gravity below minimum

ii. API Gravity above maximum

j. LED 3": Green LED illuminates when one of the 6 buttons is activated.

5.1. Passcode Setup

The WCM 7400 Watercut Monitor has a factory passcode; however, it must be entered as follows if customer would like to turn passcode on:

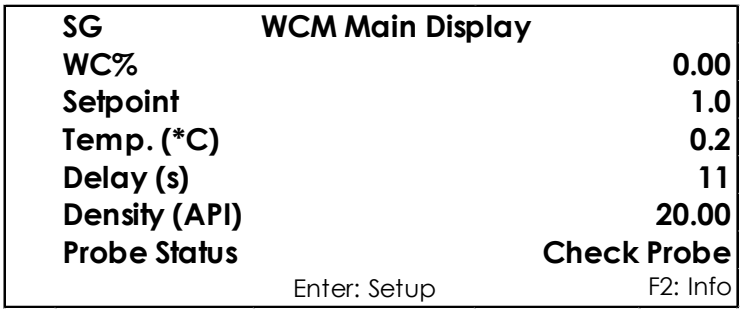
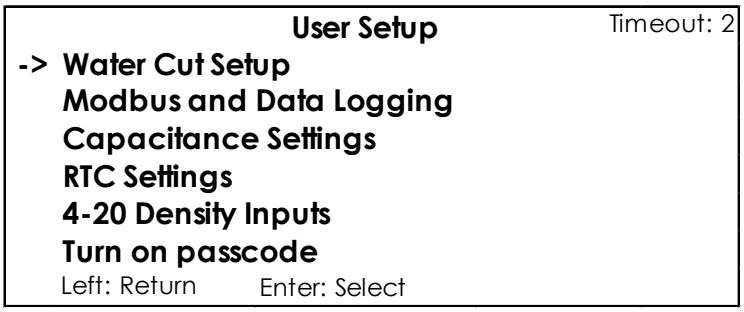


Figure 1

On the WCM Display Screen, press "Enter: Setup" to start the passcode process.



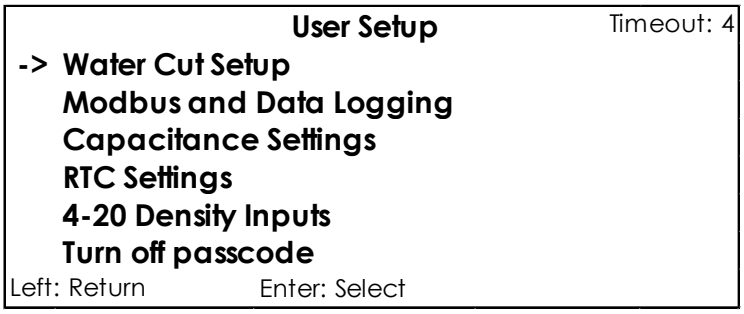


Figure 2

1. Once you select "Enter Setup" from Figure 1 then scroll down to “Turn on/off passcode”.
2. If passcode is decided the unit for the unit the then scroll down and turn off passcode and this will prompt the passcode screen. Please consult the factory if passcode is forgotten.

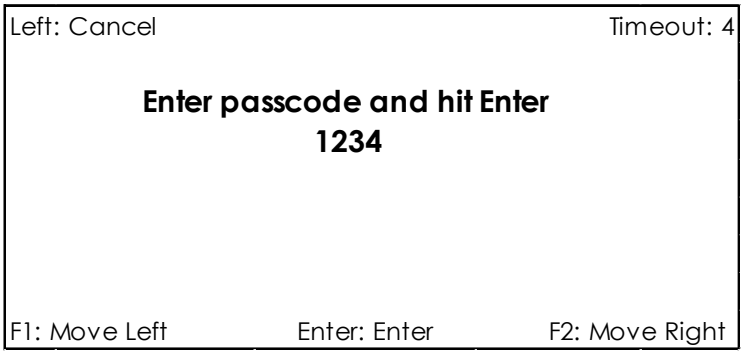


Figure 3

3. Select the arrow keys to input passcode.
4. Once passcode is entered, press "Enter" to access the setup screen. See Figure 3.

Note: The monitor only allows 10 secs to input passcode before it goes back to WCM Main display screen. See Figure 1.

If "Left Return" is selected after you enter the passcode it will go back to the WCM Main display screen. If that happens then the passcode would have to be re-entered. If "Left Return" is selected and you don't have the passcode turn on the it will go back to the User Setup screen.

5.2. Changing Density Unit of Measure

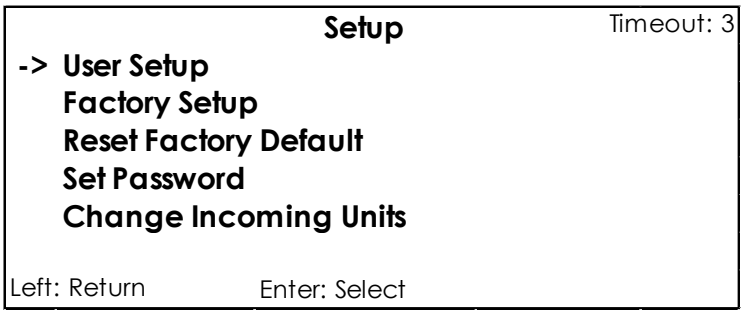


Figure 4

In Figure 4 "Setup" screen, scroll down to "Change Incoming Units" and press "Enter: Select".

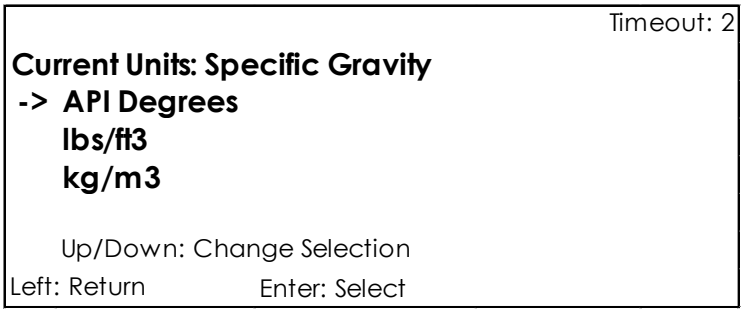


Figure 5

Use up and down arrows to make the selection of unit of measure. Press "F1 Left Return" and it will go back to the WCM Main Display screen. See Figure 1.

5.3. Field Calibration

The WCM 7400 Watercut Monitor has been factory programmed, however, it must be field calibrated as follows:

1. Bring system into operation with normal flow through the probe. Allow the temperature to stabilize.

> **Note:** Since the unit is not yet field calibrated, Error advisory messages may flash on the display. Ignore these until after calibration is complete.

2. Take a grindout for water in the oil. For calibration purposes, the oil should preferably have less than 1% water in it.
3. Press the "Enter" button then press the "Left Exit" button to bring up the "User Setup" screen.

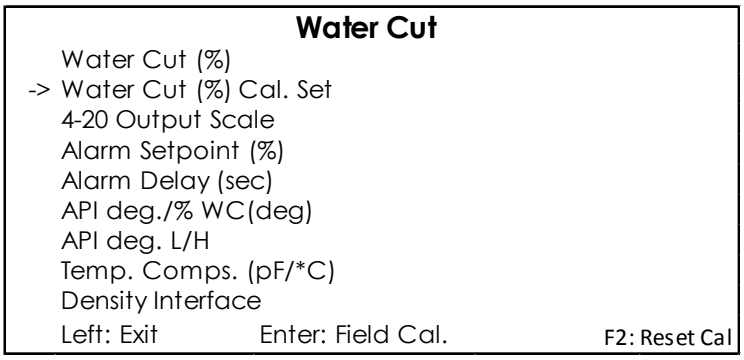


Figure 6

4. With the ">" symbol pointing to the "Water Cut Setup" menu item press "Enter" to adjust "Water Cut (%) Cal. Set" field. This is the water cut of the oil being measured. When you press the Enter button the value to be changed will be shaded and the "▲" or "▼" button can be pressed to adjust the value. Press the "Enter" button again to move the cursor to the next decimal place. Once the Water cut % has been entered press the "Enter" button to save. The Water Cut % will now be updated with the value entered in the Cal. Set field.
5. The same procedure can be used to adjust the other values on the screen. See below for additional field definitions:
   a) 4-20 Output Scale 4 mA: This is the value that will set the zero and span of this output channel. For instance, with the values set like Figure 5, 4mA is output at 0% water cut and 20 mA at 1%.
   b) Alarm Setpoint (%): This is the value that sets the trip point for the main relay K1. Once this value is exceeded a timer starts and after the next setting "Alarm Delay (sec)" expires, Relay K1 turns on.
   c) Alarm Delay (sec): Delay for tripping relay K1 once the "Water Cut (%)" has been exceeded.
   d) API deg/% WC: Compensation factor for density compensation. If set as in Figure 5, every 20 degrees of API gravity change will change the WC% by 1.0%.
   e) API deg L/H: This adjusts to what API is being seen and should match the Coriolis Meter that is putting out the 4-20mA signal.
   f) Temp Comp (pF/ *C): Compensation factor for temperature compensation. If set as in Figure 5, every .065 degrees C change will change the capacitance reading by 1 pF.
   g) Interface: The interface options available for the Density Compensation. Options are 4-20, Modbus or Not Installed.

Note: If 4-20mA is used all shared equipment on loop must be setup with same span values.

6. Once settings have been set, press the "Left: Return" arrow button to go back to the previous screen, "User Setup".

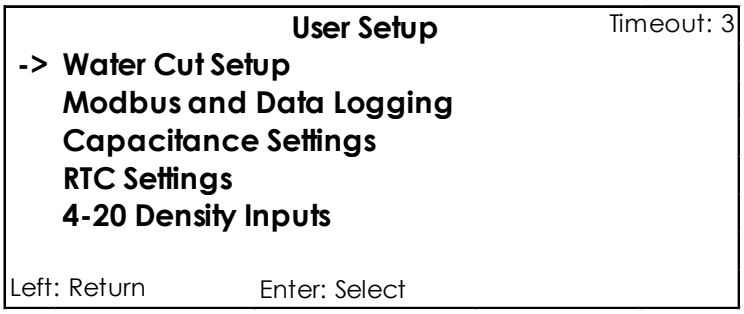


Figure 7

7. Press the "▼" button to move the ">" down to the next line.
8. "Modbus and Data Logging"
9. "Capacitance Settings" is used to configure the items shown in Figure 7.
10. "RTC Settings" is used for date and year setting. This is when data logging begins shown in Figure 10.
11. "4-20ma Density Inputs" is used to change metric or SI unit values. Shown in Figure 8. Please note there is 30 secs before the screen times out.

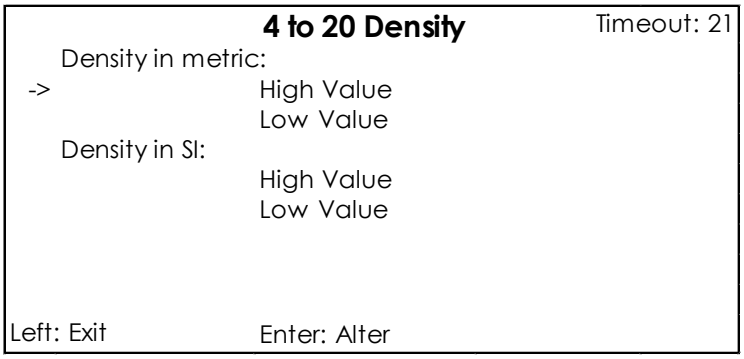


Figure 8

Note: For kg/m3 and lbs/ft3 the high value will be the lower end of the API gravity and the low value will be the higher end of the API gravity.

For Example:

High Value kg/m3 900=25 API

Low Value kg/m3 720=65 API

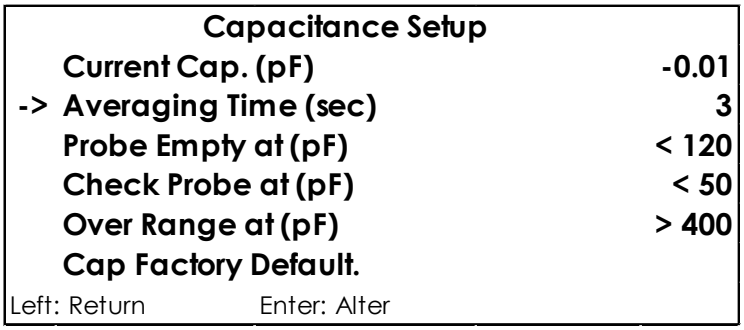


Figure 9

12. See below for information on the menu items on the Capacitance Setup screen:
    a) Current Cap (pF): The current capacitance reading of the probe.
    b) Averaging Time (sec): This setting will set the averaging time of the capacitance readings which in turn average the WC %.
    c) Probe Empty at (pF): Set as seen in Figure 9 will make the "Probe Status" value on the WCM Main Display screen display "Probe Empty" when the capacitance drops below 130 pF. This essentially means the probe is empty so very low capacitance.
    d) Probe Low dK at (pF): When the probe capacitance goes below this value the Probe Status will display "Low dK".
    e) Over Range at (pF): When the probe capacitance goes above this value the Probe Status will display "Over Range".
    f) Press the "Left: Return" button to go back to the "User Setup" screen.

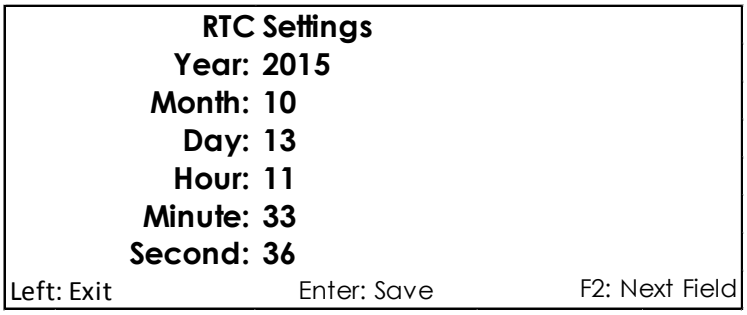


Figure 10

13. Once on the RTC Settings Screen adjust the fields by pressing the "▲" or "▼". To go to the next field press the "F2: Next Field" button and continue until all fields are adjusted. Press the "Enter: Save" button then the "Left: Exit" to Navigate away from this screen.
14. To view information regarding the status of the WCM 7400 Controller Navigate to the "Information Screen". This screen allows the user to view all important sensor activity on the WCM 7400 controller.

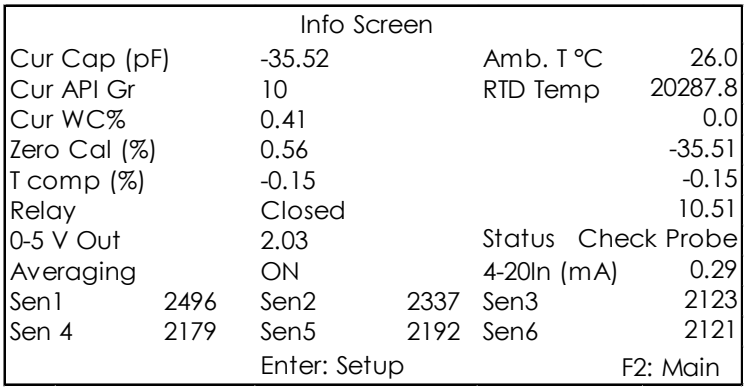


Figure 11

15. Press the "Left: Return" button to navigate away from this screen. The Information Screen does not have any fields that can be edited.

5.4. Normal Operation

The WCM 7400 is now displaying water cut in % water and will also display the oil temperature, density reading (if enabled) and other information as configured.

5.5. Bypass Relay and Indicator Lights

As stated above, the setpoint entry establishes the point at which a cut value becomes a bad oil reading. The programmed delay sets the delay, in seconds, between a bad oil condition and relay release. The indicator LED is green when the cut is below the setpoint, and red when at or above the setpoint. When the LED flashes red, the setpoint is exceeded, but the delay time has not expired. When the relay goes to bypass (delay is over), the LED will go to solid red. The same applies when going from bypass to good oil, with the LED flashing green and then going to solid green.

Note: The Bypass relay has both NO (Normally Open) and NC (Normally Closed) positions. For Normally Open connections the relay will open the contact to COM when the electronics are turned off or while in Bypass due to high water detection. The opposite is true for the NC terminals

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6 – Commissioning

6.1. Probe Installation

It is recommended that the probe be mounted in a vertical section of the process piping with the flow upwards through the probe. Trapped air and gases will cause dramatic changes in the reading due to the high differential of the Dk values between air (gas) and oil. This problem is greatly reduced with vertical probe orientation.

Note: Water contamination in oil can take several physical forms, such as small droplets, slug, or larger "globs" of emulsion. The WCM 7400 will provide the best indication of contamination in the process stream if the water is fully entrained.

6.2. Electrical Considerations / Installation

The WCM 7400 electronics are housed in a NEMA 7 explosion-proof enclosure and may be located in any Class I Div1 or Zone 1 environment. The unit requires 12-24 Vdc, 500 mA. It is possible to install the analog loop as isolated (using an external power supply to power the loop) or non-isolated (using the 24 Vdc on the unit to power the loop).

Note: Before opening the enclosure turn off power and perform proper Lockout/ Tagout procedures. Never perform any work with the WCM 7400 wiring with power turned on to the controller.

Also, do not open the explosion proof enclosure when precipitation or any moisture may inadvertently expose the circuit boards to moisture.

In order to terminate external connections to the WCM 7400, the "Processor Board" must be removed to access the terminal board. There are 4 screws that fasten the processor board to the standoffs below. Carefully remove the four screws and allow the processor board to hang by the attached Orange 30 pin cable.

6.3. Programming

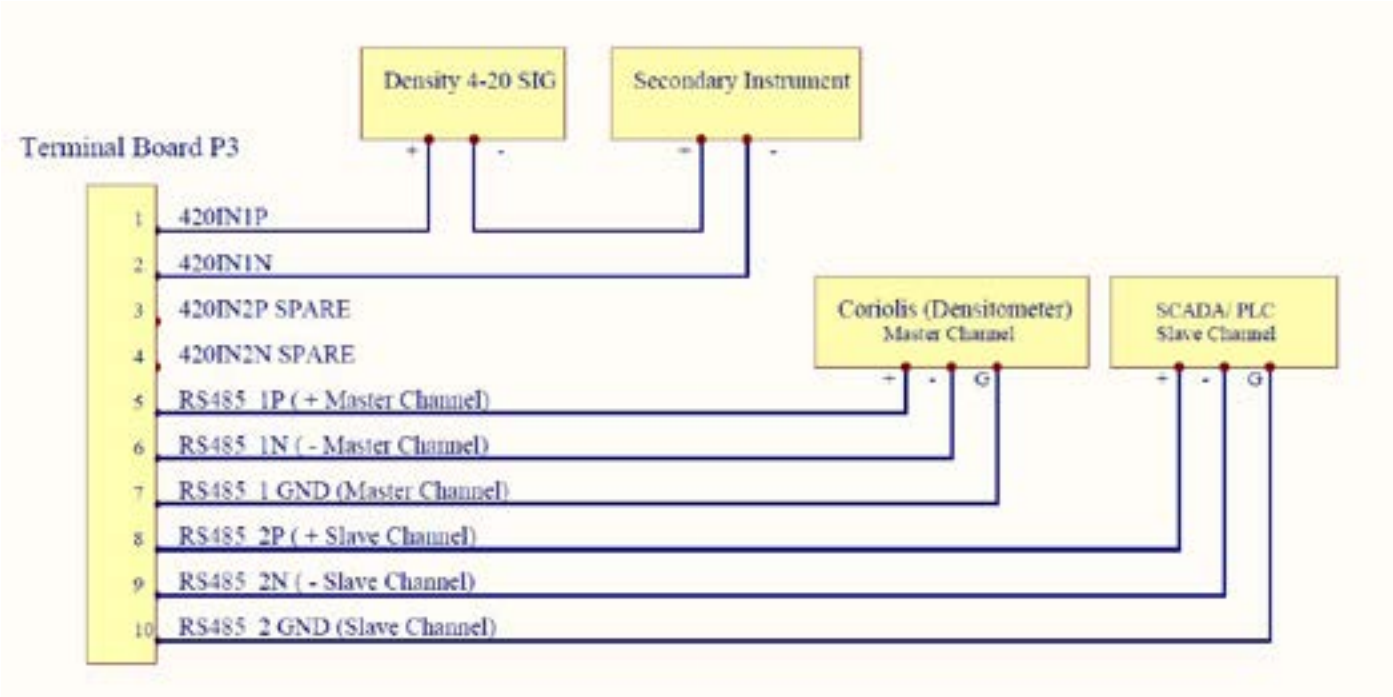
As with any microprocessor-based measuring device, certain process and control values must be entered into the memory. These values customize the unit for specific customer needs and applications. Information needed is:

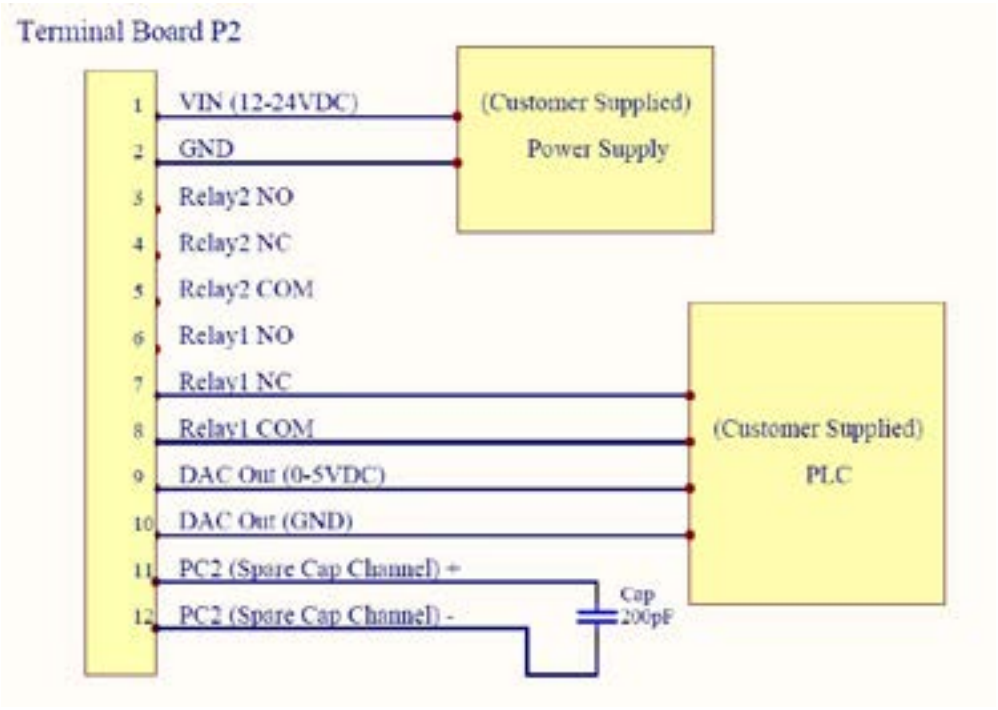
- Span of 4-20 mA
- Relay actuation setpoint
- Setpoint time delay
- Cut calibration (grind-out value)
- Modbus serial communication settings
- Density (API) Gravity compensation settings

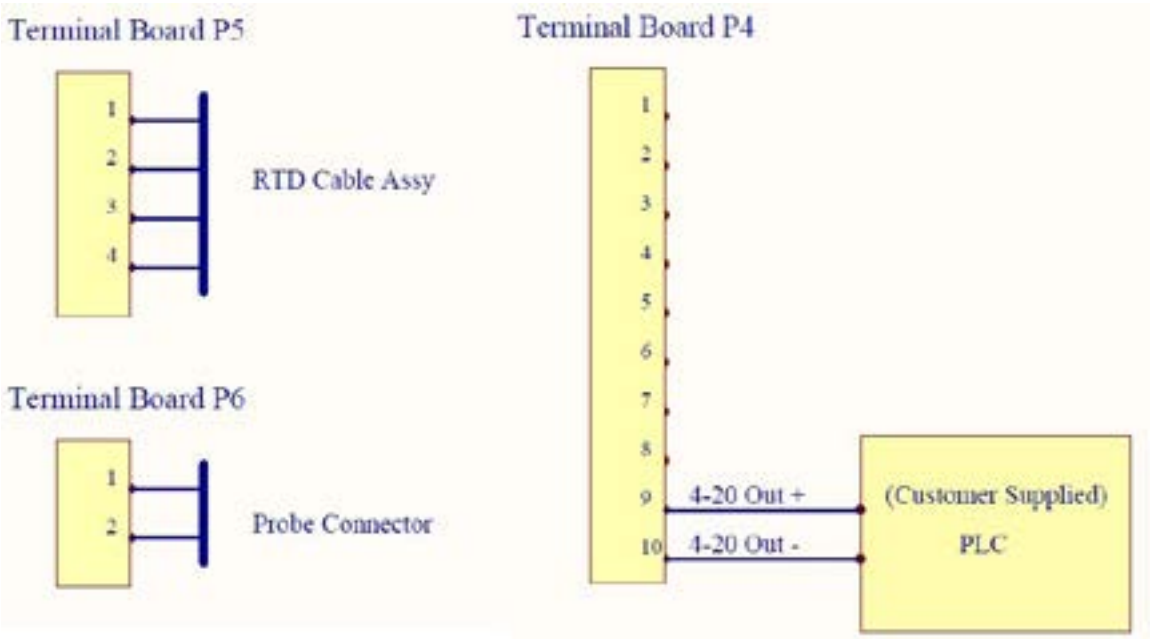
6.4. Modbus Master / Slave Parameters

- Master or Slave
- Modbus Mode: RTU
- Modbus Slave ID: 0-247
- Baud rate: 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600, and 115200
- Parity: None, Odd or Even

6.5. Electrical Connections






Terminal Board P5
1
2
3
4
RTD Cable Assy
Terminal Board P6
1
2
Probe Connector
Terminal Board P4
1
2
3
4
5
6
7
8
9
10
4-20 Out +
4-20 Out -
(Customer Supplied)
PLC

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7 – Troubleshooting and Calibration

7.1. Troubleshooting

1. The 24 volt power supply to the WCM 7400 must be good, steady, and ripple free. Half wave rectifier sources normally are not acceptable, producing unreadable displays. FMC Technologies recommends line conditioners.
2. If the RTD (Resistance Temperature Device) that measures the fluid temperature should "short" or "open", the WCM 7400 will continue to operate but will lose its temperature compensating ability.

> **Note:** If it should short, the LCD will display an error message to "Check RTD Connection".

3. If the water cut reading drifts, but the shakeouts show the cut to be constant, check the temperature and probe readings from the LED display. Stop the fluid flow through the probe to see if the reading stabilizes. If it does, then the problem is flow related, and could be caused by any of the following:
   a) If the probe value is varying, look for:
      (i) An increase in the API gravity of the oil. This will cause the value to go down. Conversely, a decrease in API gravity will cause the reading to increase. This is not a linear function, and varies from oil to oil, but generally is consistent. Oil gravity compensation will enable the effects of oil gravity changes to be minimized but drastic changes of different types of oil may require the compensation settings to be adjusted.
      (ii) A variation in the amount of solution gas in the oil.
      (iii) NEVER mount a probe downstream of the dump valve when monitoring oil from a pressure vessel, as solution gas will break out when the fluid goes from the higher vessel pressure to the lower pressure downstream of the valve. An increase in gas will make the reading become smaller. Also, since the size and volume of the gas bubbles are constantly changing with flow, the probe value can be very unstable as it attempts to follow the fluctuating gas content.
      (iv) A change in pressure on the oil as the divert value switches from "good" to "bad" oil on a LACT. For good operation a fully loaded line with sufficient backpressure to keep the gas from breaking out must be maintained. Please note that air eliminators will vent slugs of gas, but not solution gas.
4. Other things that can cause troubles are:
   a) Having a loose fitting on the suction side of the pump that is pumping the fluid through the monitor probe. The pump will draw in air causing the oil to act as if it had gas in it.
   b) Mounting the probe directly on the pump discharge. This will/may be ok as long as the pump has plenty of suction head, is not over speeding, has the proper impeller, etc. but the possibility for trouble always exists.
   c) Mounting the probe directly to a static mixer. A static mixer functions by mixing (as violently as possible) the fluid going through it. The fluid exiting the mixer is normally still full of bubbles and will cause erratic readings. If the mixer has been installed backwards, the result further decreases accuracy. Static mixers should be installed no less than ten pipe diameters upstream with a pressure drop of less than 10%.
5. All internal "wetted" parts of the probe are typically coated by a PTFE based material to minimize paraffin and other material from building up on the inside of the probe. Normally a probe will give many years of service without any problems. However, chemicals added to the process stream often will cause a conductive film to coat over the PTFE insulators and the epoxy coating causing much trouble. Often you can check for this without removing the probe from the line by doing the following:

a) Check the controller screen to see if the probe capacitance is greater than 350 pF. If it is greater and low water cut oil is present there may be some buildup on the inside of the probe that needs to be removed.

b) Remove the 24 volts power to the WCM 7400. Remove the four screws holding the electronic assembly into the XP enclosure. Gently pull the electronic assembly out. Measure the resistance from the center stud to the XP enclosure. The resistance should be infinity. Any reading less than 250,000 ohms is bad. If the resistance is low it is possible that there is water trapped inside the internal components due to degraded o-rings.

c) Using multi-meter select low range D.C. volts. Check for voltage from the center stud to ground or XP enclosure. The voltage should be zero. Any voltage higher than .25 volts indicates a poor ground which will affect the water cut readings.

d) If you observed questionable reading in any of the three above checks, the PTFE insulators are beginning to either be coated, or impregnated by chemicals or water and need to be replaced or cleaned.

7.2. Calibration Details and Tips

1. The LCD will read "Check Probe Wire" if the lead from the electronic assembly to the probe is loose, not attached, The LED will blink red for the amount of time delay set in the unit, and then go solid red. At the same time the relay will actuate.
2. If the unit is in operation and the Dk of the fluid going through the probe falls, the LCD will go to 0.00%. If the Dk continues to fall the LCD will flash "Below Cal Zero". The LED will stay green and the relay will stay in the good oil position. As the oil Dk falls the screen will display "Low dK" until the probe capacitance goes down to about 100 pF. Readings down this low mean the probe is empty in most circumstances. Often a probe will empty out between loads if there is no backpressure or check valve present or the oil is leaking by the valve thus, emptying out the WCM 7400.
3. The ground electrical connection from the probe to the WCM 7400 electronics is through the threads of the XP enclosure where it screws onto the probe. For this reason, the XP enclosure must be securely screwed onto the probe and the allen screw going through the XP enclosure hub into the probe adaptor threads must be tight. A loose XP enclosure can result in readings jumping by large values anytime the probe/XP enclosure is moved or shaken. Also, there is a pipe clamp assembly that holds the enclosure in place so assure that the pipe clamps are always tight to assure help eliminate vibration induced problems.

8 – Approvals

8.1. Agency Approval Information

1. Conduit Entries: There are four conduit entries in the explosion proof enclosure. Sizes can range from 1/2" NPT female to 1" NPT female. Unless otherwise stated the standard entry sizes are 3/4" NPT for all except the one on the bottom which is 1" NPT.
2. All cable entry devices and blanking elements shall be certified in type of explosion protection flameproof enclosure "d", suitable for the conditions of use and correctly installed.
3. Unused apertures shall be closed with suitable blanking elements.
4. US/ Canada Approvals: Class I, Div 1 Groups C & D
5. Specific Conditions of Use: Contact FMC Technologies factory for specific guidance for information on the dimensions of the flameproof joints.

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9 – Modbus Register Information

Register Name	Bits	Type	Register	R/W	Valid Values	Register Description	Notes
Reset Unit	1	Coil	1000	W	0/1	Can be written to 1 but only reads zero.	Forces Unit into a full reset
Set/Reset Alarm Relay	1	Coil	1001	R/W	0/1	0 - Alarm relay is off 1- alarm relay is on	Manually sets/resets the alarm relay.
Enable Data Logging	1	Coil	1002	R/W	0/1	0 - logging off 1 - logging on	Enable/Disable Data logging capability
Auto Calibrate	1	Coil	1003	W	0/1	1 - forces auto calibration. Will always read 0	Forces the unit into an auto calibration zero process
Calibrate to existing Settings	1	Coil	1004	W	0/1	1 - forces calibration to current readings. Will always read 0	Forces the unit to recalibrate to the most recent measurements
Check Probe Signal	1	Coil	1005	R	0/1	1 - indicates the capacitance probe is reading below expected values	Indicated a possible open probe status
Auto Temp Compensation	1	Coil	1006	R	0/1	1 - indicates that auto temp compensation is on	Shows the current auto temperature compensation status
Calculated Water Cut	32	Input Register	31000	R	NA		Outputs the Calculated Water Cut percentage in Float format
Current Capacitance	32	Input Register	31002	R	NA		Outputs the capacitance seen by the by cap sensor in xx.x pF
Emulsion Temperature	32	Input Register	31004	R	NA		Outputs the temperature of the emulsion in xx.x C
Ambient Temperature	32	Input Register	31006	R	NA		Outputs the ambient temperature in xx.x C
Emulsion Density	32	Input Register	31008	R	NA		Outputs the calculated density of the emulsion in xx.xx degree format
Probe Status	16	Input Register	31010	R	NA		Outputs current probe codes.
Prox Sensor 1 Reading	16	Input Register	31011	R	NA		Outputs the current proximity sensor 1 reading.
Prox Sensor 2 Reading	16	Input Register	31012	R	NA		Outputs the current proximity sensor 2 reading.
Prox Sensor 3 Reading	16	Input Register	31013	R	NA		Outputs the current proximity sensor 3 reading.
Prox Sensor 4 Reading	16	Input Register	31014	R	NA		Outputs the current proximity sensor 4 reading.
Prox Sensor 5 Reading	16	Input Register	31015	R	NA		Outputs the current proximity sensor 5 reading.
Prox Sensor 6 Reading	16	Input Register	31016	R	NA		Outputs the current proximity sensor 6 reading.

Register Name	Bits	Type	Register	R/W	Valid Values	Register Description	Notes
Alarm Delay	16	Holding Register	41000	R/W	0 - 255	The time in seconds before alarm sounds when the alarm set point is passed	Controls the systems Delay before alarm activation.
Alarm Set Point	16	Holding Register	41001	R/W	0 -255		Indicates the Point at which the alarm is activated
WC Zero Cal	32	Holding Register	41002	R/W	0.00 to		Indicates the WC% zero Calibration Point
4 to 20 Output High Calibration	32	Holding Register	41004	R/W	20.0 -		Controls the High range calibration of the 4_20 output
4 to 20 Input High Calibration	32	Holding Register	41006	R/W	20.0 -		Controls High range calibration of 4_20 Density Input
4 to 20 Input Low Calibration	32	Holding Register	41008	R/W	20.0 -		Controls Low range calibration of 4_20 Density Input
Probe Empty Value	16	Holding Register	41010	R/W			Controls the Capacitance value which indicates a lack of emulsion
Averager Time	16	Holding Register	41011	R/W	0 - 60		Controls the time period over which the water cut calculations are averaged.
Modbus Slave Address	16	Holding Register	41012	R/W	1 - 246		Controls the Modbus Slave address of the Monitor.
Modbus Slave Baud rate	16	Holding Register	41013	R/W	0 -		Controls the Modbus Slave baud rate of the monitor
Modbus Slave Parity	16	Holding Register	41014	R/W	0 -		Controls the Modbus Slave Parity of the monitor
Modbus Master Address	16	Holding Register	41015	R/W	1 - 246		Controls the Modbus address that the monitor links to
Modbus Master Baud rate	16	Holding Register	41016	R/W	0 -		Controls the Modbus baud rate that the monitor transmits to
Modbus Slave Parity	16	Holding Register	41014	R/W	0 -		Controls the Modbus Slave Parity of the monitor
Modbus Master Address	16	Holding Register	41015	R/W	1 - 246		Controls the Modbus address that the monitor links to
Modbus Master Baud rate	16	Holding Register	41016	R/W	0 -		Controls the Modbus baud rate that the monitor transmits to
Modbus Master Parity	16	Holding Register	41017	R/W	0 -		Controls the Modbus Parity that the monitor transmits to
Data Logging Rate	16	Holding Register	41018	R/W	0 - 60	time between data log entries in	Controls the rate at which the monitor logs data to the SD Card
Modbus Slave Parity	16	Holding Register	41014	R/W	0 -		Controls the Modbus Slave Parity of the monitor

10 – Model Code

WCM 7400 Probe/Monitor Assemblies Ordering Information

Choose one code selection from each option group to build model number.

WCM 7400	Water Cut Monitor, Digital, Temperature and Density Compensating. Ranges from 0-25% water.					
	CODE-2	**PROBE BODY SIZE**				
	2	2 INCH I.D. x 17" FACE TO FACE				
	3	3 INCH I.D. x 32" FACE TO FACE				
	4	4 INCH I.D. x 32" FACE TO FACE				
	6	6 INCH I.D. x 32" FACE TO FACE				
	8	8 INCH I.D. x 32" FACE TO FACE				
	10	10 INCH I.D. x 32" FACE TO FACE				
	12	12 INCH I.D. x 32" FACE TO FACE				
	16	16 INCH I.D. x 32" FACE TO FACE				
	18	18 INCH I.D. x 32" FACE TO FACE				
	20	20 INCH I.D. x 32" FACE TO FACE				
		CODE-3	**PROCESS CONNECTION**			
		00	SCREWED ENDS (to 3" only)			
		00	GROOVED ENDS / victaulic (to 4" only)			
		00	150 LB ANSI RAISED FACE			
		30	300 LB ANSI RAISED FACE			
		60	600 LB ANSI RAISED FACE (SCH 80)			
		90	900 LB ANSI RAISED FACE (SCH 80)			
		05	150 LB ANSI RTJ			
		35	300 LB ANSI RTJ			
		65	600 LB ANSI RTJ (SCH 80)			
		95	900 LB ANSI RTJ (SCH 80)			
		115	1500 LB ANSI RTJ (SCH 80)			
			CODE-4	**MATERIAL AND TEMPERATURE OPTIONS**		
			B	STANDARD MATERIALS, A53B CARBON STEEL, 0-160°F		
			H	STANDARD MATERIALS/HIGH TEMP, C/F		
			S	316 STAINLESS STEEL MATERIALS, 0-160°F		
			T	316 STAINLESS STEEL/HIGH TEMP, C/F		
			X	Carbon Steel NACE, 24-160°F		
			XH	Carbon Steel NACE, 24-375°F		
				CODE-5	**CONNECTION STYLE**	
				S	SCREWED CONNECTIONS, MNPT	
				G	VICTAULIC CONNECTIONS (GROOVED)	
				F	FLANGED CONNECTIONS	
					CODE-6	**OPEN**
					P	Epoxy
Example:						
WCM 7400-	**4**	**60**	**B**	**F**	**P**	**= WCM 7400 - 460 - BFP**

WCM 7400 Retrofit Kit

P559082	Includes electronics, explosion-proof housing and all necessary connectors.

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11 – Conversion Chart

70Degree API	Specific Gravity	Weight	
		(lbs/ft^3)	(kg/m^3)
8	1.014	63.19	1012
9	1.007	62.74	1005
10	1.000	60.29	998
15	0.966	60.17	964
20	0.934	58.30	932
25	0.904	56.43	902
30	0.876	54.68	874
35	0.850	53.06	848
40	0.825	51.50	823
45	0.802	50.06	800
50	0.780	48.69	778
55	0.759	47.38	757
58	0.747	46.63	745
60	0.738	46.13	738
65	0.720	44.94	720
70	0.702	43.82	702

12 – Related Publications

Title	Publication Number
WCM 7400W Watercut Monitor I/O Manual	MNIN002
WCM 7400 Specifications	SSIN063

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