Universal IV™ CM Model
2-Wire, 4-20mA, Water Cut Monitor

Applications
- Automatic Well Testing (AWT)
- Lease Automatic Custody Transfer (LACT)
- Basic Sediment and Water (BS&W)
- Separation Vessels
- Pipeline Slug Detection
- Truck Unloading
- Pump Protection
- Dielectric Analysis
- Machinery Lube Oil Monitoring

Use the Best
For over 50 years, Drexelbrook has established itself as the world's leader in capacitive based water cut measurements. We have done this by providing reliable and accurate products at a reasonable cost. We offer the highest pressure and temperature ratings in the industry. Our probes can handle pressures up to 1500 PSI and temperatures up to 450°F.

Easy Configuration - Now with Built-in LCD Display and Keypad
All Universal IV CM comes from the factory pre-calibrated and requires only one point validation. Field configuration can be done from anywhere along the two-wire loop with our HRTWin PC Software. You can also configure via local display / keypad without the need for laptop or handheld communicators.

Worldwide Approvals
The Universal IV CM Model has been approved for Class I, Div1, and Zone 0 hazardous locations. FM, FMc, ATEX, as well as IECEx approvals are available.

Durability
Our Perm-A-Seal sensing element does not require epoxy coatings that wear out and require expensive servicing. There are no gaskets that require servicing and the sensing element is robust in well fluids that include large amounts of sand.

Eliminate Routine Maintenance
The Universal IV CM (Cut Monitor) is built upon the Drexelbrook expertise in RF Admittance that allows the electronics to ignore paraffin and other coatings that buildup on the probe. No need to take apart spool pieces and tie-off large pipelines. The Universal IV CM can be configured for NPT or flanged mountings and can be installed in common pipe diameters.

0-50% in Light Oil & 0-80% in Heavy Oil
The Universal IV CM comes factory pre-calibrated to one of 11 pre-set ranges, for Light Oil (API Gravity > 25) and Heavy Oil (API Gravity < 25)

Cote Shield™
The proven Cote-Shield is designed into the Universal IV CM series and enables the instrument to ignore a pre-determined length of the sensing element. The ability to ignore a pre-determined length allows the sensing element to extend into the fluid beyond the nozzle mounting, and possible pipe elbows, which can affect the measurement. The Cote-Shield™ puts the sensing area of the insertion probe directly into the process stream and guarantees a more representative sample of the emulsion.
**Operating Principle**

The method of using RF Admittance to measure water cut is widely successful because of the large difference between the dielectric constants of oil \( k \approx 2.3 \) and water \( k \approx 80 \). The sensing element and the pipe wall form the necessary two surfaces of the concentric capacitor. The system electronics transmit a radio frequency voltage to the sensing element that measures changes in capacitance. As the amount of water in the flowing oil increases, the net dielectric of the fluid increases which causes the capacitance to increase. The onboard electronics will compute the relationship between capacitance change and water cut. Straightforward, Reliable, Proven.

**Typical Arrangement**

\[
\text{Capacitance} = \frac{\text{Dielectric (Area)}}{\text{Distance}} = \frac{KA}{D}
\]

**Capacitance Change with Water Content**

![Graph showing capacitance change with water content]

**Drexelbrook Sampling Advantage**

The Drexelbrook insertion probe design enables it to analyze a large representative sample of the fluid that other manufacturers can not. The Universal IV CM utilizes a sensing element that is unique in its ability to be installed directly into the process without requiring spool pieces, side-arms or slipstreams. The sensing element shown will extend directly into the main process line for a minimum of 15 inches. The advantage of this is the capacitance of the fluid is taken over the entire length of the probe to create an averaging effect. The measurement is now taking a better sample of the fluid over a larger range to produce a smoother, more accurate, response.
## Sensing Element Selection

The Universal IV™ Cut Monitor sensing element is selected based on pipe size, wetted parts, NACE requirement and pressure/temperature. Pipe sizes of 8" or larger in tank installations require a concentric shield as well. Below is a selection guide of the standard sensing elements with 3-terminal connection and Cote-Shield™.

<table>
<thead>
<tr>
<th>Probe Model #</th>
<th>Probe 3-Digit Code</th>
<th>Probe Description</th>
<th>Wetted Parts</th>
<th>Nace Available</th>
<th>Pipe Size</th>
<th>Retrofit IS / Xproof</th>
<th>Pressure / Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>700-1202-001</td>
<td>101</td>
<td>3/8&quot; OD active section - Length determined by pipe size With tab connection for remote installations &amp; dual seal</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>Less than 8&quot;</td>
<td>R02 / R12</td>
<td>200 psi at 450F</td>
</tr>
<tr>
<td>700-1202-015</td>
<td>104</td>
<td>3/8&quot; OD active section with 1.66&quot; OD Perforated Concentric shield With tab connection for remote installations &amp; dual seal</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>In tank</td>
<td>R02 / R12</td>
<td>200 psi at 450F</td>
</tr>
<tr>
<td>700-1202-016</td>
<td>251</td>
<td>3/8&quot; OD active section with 1.66&quot; OD Perforated Concentric shield (Integral only)</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>In tank</td>
<td>N/A</td>
<td>200 psi at 450F</td>
</tr>
<tr>
<td>700-1202-021</td>
<td>253</td>
<td>3/8&quot; OD active section - Length determined by pipe size (Integral only)</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>Less than 8&quot;</td>
<td>N/A</td>
<td>200 psi at 450F</td>
</tr>
<tr>
<td>700-1202-041</td>
<td>106</td>
<td>3/8&quot; OD active section - Length determined by pipe size With tab connection for remote installations &amp; dual seal</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>Less than 8&quot;</td>
<td>R02 / R12</td>
<td>1000 psi at 250F 300 psi at 450F</td>
</tr>
<tr>
<td>700-1202-042</td>
<td>256</td>
<td>3/8&quot; OD active section - Length determined by pipe size (Integral only)</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>Less than 8&quot;</td>
<td>N/A</td>
<td>1000 psi at 250F 300 psi at 450F</td>
</tr>
<tr>
<td>700-1202-045</td>
<td>107</td>
<td>3/8&quot; OD active section with 1.66&quot; OD Perforated Concentric shield With tab connection for remote installations &amp; dual seal</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>In tank</td>
<td>R02 / R12</td>
<td>1000 psi at 250F 300 psi at 450F</td>
</tr>
<tr>
<td>700-1202-046</td>
<td>257</td>
<td>3/8&quot; OD active section with 1.66&quot; OD Perforated Concentric shield (Integral only)</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>In tank</td>
<td>N/A</td>
<td>1000 psi at 250F 300 psi at 450F</td>
</tr>
<tr>
<td>700-1202-051</td>
<td>108</td>
<td>3/8&quot; OD active section with Center Rod Stop - Length determined by pipe size. With tab connection for remote installations &amp; dual seal</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>Less than 8&quot;</td>
<td>R02 / R12</td>
<td>1500 psi at 250F 500 psi at 450F</td>
</tr>
<tr>
<td>700-1202-052</td>
<td>258</td>
<td>3/8&quot; OD active section with Center Rod Stop - Length determined by pipe size (Integral only)</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>Less than 8&quot;</td>
<td>N/A</td>
<td>1500 psi at 250F 500 psi at 450F</td>
</tr>
<tr>
<td>700-1202-055</td>
<td>109</td>
<td>3/8&quot; OD active section with Center Rod Stop - Length determined by pipe size. Perforated Concentric shield. With tab connection for remote installations &amp; dual seal</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>In tank</td>
<td>R02 / R12</td>
<td>1500 psi at 250F 500 psi at 450F</td>
</tr>
<tr>
<td>700-1202-061</td>
<td>110</td>
<td>3/8&quot; OD active section with 1.6&quot; OD slotted concentric shield. With tab connection for remote installations &amp; dual seal</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>8&quot; and larger</td>
<td>R02 / R12</td>
<td>1000 psi at 250F 300 psi at 450F</td>
</tr>
<tr>
<td>700-1202-062</td>
<td>260</td>
<td>3/8&quot; OD active section with 1.66&quot; OD slotted concentric shield (Integral only)</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>8&quot; and larger</td>
<td>N/A</td>
<td>1000 psi at 250F 300 psi at 450F</td>
</tr>
<tr>
<td>700-1202-081</td>
<td>111</td>
<td>3/8&quot; OD active section with Center Rod Stop - Length determined by pipe size. With 1.66 OD slotted concentric shield. With tab connection for remote installations &amp; dual seal</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>8&quot; and larger</td>
<td>R02 / R12</td>
<td>1500 psi at 250F 300 psi at 450F</td>
</tr>
<tr>
<td>700-1202-082</td>
<td>261</td>
<td>3/8&quot; OD active section with Center Rod Stop - Length determined by pipe size. With 1.6 OD slotted concentric shield (Integral only)</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>8&quot; and larger</td>
<td>N/A</td>
<td>1500 psi at 250F 500 psi at 450F</td>
</tr>
<tr>
<td>700-1202-0XX</td>
<td>112</td>
<td>1&quot; NPT, 3/8&quot; OD active section - Length determined by pipe size Applies to any 700-1202 series. Reduces all lengths by 1.5&quot;. With tab connection for remote installations &amp; dual seal</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>Less than 8&quot;</td>
<td>R02 / R12</td>
<td>1500 psi at 250F 500 psi at 450F</td>
</tr>
<tr>
<td>700-1202-0XX</td>
<td>262</td>
<td>1&quot; NPT, 3/8&quot; OD active section - Length determined by pipe size. Applies to any 700-1202 series. Reduces all lengths by 1.5&quot;. (Integral only)</td>
<td>316/316L SS and PEEK*</td>
<td>Yes</td>
<td>Less than 8&quot;</td>
<td>N/A</td>
<td>1500 psi at 250F 500 psi at 450F</td>
</tr>
<tr>
<td>700-2001-051</td>
<td>328</td>
<td>1/4&quot; OD active section - Length 18.7&quot; fixed by pipe size</td>
<td>316/316L SS and Teflon</td>
<td>Yes</td>
<td>1&quot;</td>
<td>R02</td>
<td>1000 psi at 100F 200 psi at 450F</td>
</tr>
<tr>
<td>700-2001-052</td>
<td>329</td>
<td>1/4&quot; OD active section - Length 28.1&quot; fixed by pipe size</td>
<td>316/316L SS and Teflon</td>
<td>Yes</td>
<td>2&quot;</td>
<td>R02</td>
<td>1000 psi at 100F 200 psi at 450F</td>
</tr>
<tr>
<td>700-2001-058</td>
<td>330</td>
<td>1/4&quot; OD active section - Length 37&quot; fixed by pipe size. With 1.66&quot; OD slotted concentric shield</td>
<td>316/316L SS and Teflon</td>
<td>Yes</td>
<td>8&quot; and larger</td>
<td>R02</td>
<td>1000 psi at 100F 200 psi at 450F</td>
</tr>
<tr>
<td>700-2001-059</td>
<td>331</td>
<td>1/4&quot; OD active section - Length 27&quot; fixed by pipe size. With 1.66&quot; OD Perforated concentric shield</td>
<td>316/316L SS and Teflon</td>
<td>Yes</td>
<td>In tank</td>
<td>R02</td>
<td>1000 psi at 100F 200 psi at 450F</td>
</tr>
<tr>
<td>700-2002-053</td>
<td>332</td>
<td>1/2&quot; OD active section - Length 29&quot; fixed by pipe size</td>
<td>316/316L SS and Teflon</td>
<td>Yes</td>
<td>3&quot;</td>
<td>R04</td>
<td>1000 psi at 100F 200 psi at 450F</td>
</tr>
<tr>
<td>700-2002-054</td>
<td>333</td>
<td>1/2&quot; OD active section - Length 32.1&quot; fixed by pipe size</td>
<td>316/316L SS and Teflon</td>
<td>Yes</td>
<td>4&quot;</td>
<td>R04</td>
<td>1000 psi at 100F 200 psi at 450F</td>
</tr>
<tr>
<td>700-2002-056</td>
<td>334</td>
<td>1/2&quot; OD active section - Length 38.4&quot; fixed by pipe size</td>
<td>316/316L SS and Teflon</td>
<td>Yes</td>
<td>6&quot;</td>
<td>R04</td>
<td>1000 psi at 100F 200 psi at 450F</td>
</tr>
</tbody>
</table>

*PEEK is a high temperature thermoplastic with characteristics similar to TFE but with far better abrasion resistance. PEEK is compatible with the same materials as 316 SS; except for sulfuric acid, methyl ethyl ketone, concentrated phenol, or nitric acid. Consult the factory for questions on additional material compatibility.*
Sensing Element Sizing

The Cut Monitor sensing element varies with pipe size. The larger the pipe diameter size, the longer the sensing element active length must be. The Cote-Shield length is sized so the sensing element is fully extended into the fluid beyond nozzles and elbows. Below are some standard look up tables.

<table>
<thead>
<tr>
<th>700-1202-0XX Series Sensing Elements</th>
<th>Pipe Size</th>
<th>Cote-Shield Length</th>
<th>Insertion Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1½”</td>
<td>3.5”</td>
<td>18.25”</td>
<td></td>
</tr>
<tr>
<td>1½”</td>
<td>6”</td>
<td>20.75”</td>
<td></td>
</tr>
<tr>
<td>1½”</td>
<td>10”</td>
<td>24.75”</td>
<td></td>
</tr>
<tr>
<td>2”</td>
<td>3.5”</td>
<td>21.25”</td>
<td></td>
</tr>
<tr>
<td>2”</td>
<td>6”</td>
<td>23.75”</td>
<td></td>
</tr>
<tr>
<td>2”</td>
<td>10”</td>
<td>27.75”</td>
<td></td>
</tr>
<tr>
<td>3”</td>
<td>3.5”</td>
<td>25.5”</td>
<td></td>
</tr>
<tr>
<td>3”</td>
<td>6”</td>
<td>28”</td>
<td></td>
</tr>
<tr>
<td>3”</td>
<td>10”</td>
<td>32”</td>
<td></td>
</tr>
<tr>
<td>4”</td>
<td>6”</td>
<td>31.125”</td>
<td></td>
</tr>
<tr>
<td>4”</td>
<td>10”</td>
<td>35.125”</td>
<td></td>
</tr>
<tr>
<td>6”</td>
<td>6”</td>
<td>35.375”</td>
<td></td>
</tr>
<tr>
<td>6”</td>
<td>10”</td>
<td>39.375”</td>
<td></td>
</tr>
<tr>
<td>8” and &gt;</td>
<td>10”</td>
<td>25.5”</td>
<td></td>
</tr>
<tr>
<td>In Tank</td>
<td>3.5”</td>
<td>19”</td>
<td></td>
</tr>
<tr>
<td>In Tank</td>
<td>6”</td>
<td>21.5”</td>
<td></td>
</tr>
<tr>
<td>In Tank</td>
<td>10”</td>
<td>25.5”</td>
<td></td>
</tr>
</tbody>
</table>

Sensing Element Dimensions
Integral Mounting / Dimensions - inches (mm)

- CABLE ENTRIES (2) 3/4 NPT or M20 x 1.5
- SENSING ELEMENT DEPENDENT
- INSERTION LENGTH (I.L.)

Remote Mounting / Dimensions - inches (mm)

- CABLE ENTRIES (2) 3/4 NPT or M20 x 1.5
- SENSING ELEMENT DEPENDENT
- INSERTION LENGTH (I.L.)
Specifications

Technology
RF Admittance / Capacitance

Supply Voltage
13-30VDC, 2-wire loop powered

Output/Digital Protocol
4-20mA, HART
Compatible with HART®

Accuracy and Resolution

<table>
<thead>
<tr>
<th>Water Cut Range</th>
<th>Nominal Water Cut Variance*</th>
<th>Water Cut Resolution**</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 1%</td>
<td>+/- 0.03</td>
<td>0.0002</td>
</tr>
<tr>
<td>0 to 5%</td>
<td>+/- 0.04</td>
<td>0.0009</td>
</tr>
<tr>
<td>0 to 10%</td>
<td>+/- 0.04</td>
<td>0.0009</td>
</tr>
<tr>
<td>0 to 30%</td>
<td>+/- 0.12</td>
<td>0.0030</td>
</tr>
<tr>
<td>0 to 50%</td>
<td>+/- 0.35</td>
<td>0.0080</td>
</tr>
<tr>
<td>0 to 80% (Heavy Oil)</td>
<td>+/- 0.25</td>
<td>0.0035</td>
</tr>
</tbody>
</table>

* The measurement accuracy of an inline, dynamic water cut measurement is dependent upon many process variables including: oil dielectric consistency, fluid velocity at the sample point, mounting geometry and homogeneity of the oil/water emulsion. The values above represent nominal water cut measurement variances for a properly installed sensor under consistent measurement point conditions.

** The smallest water cut step that the instrument can resolve.

Load Resistance
Maximum 550 ohms at 24 VDC
Minimum 250 ohms for HART protocol

Ambient Temperature
-40°C to 85°C (-40°F to 167°F)

Process Temperature
Up 232°C (450°F)

Retrofit Upgrade

The Universal IV CM is backward compatible with Drexelbrook’s previous Cut Monitors including CM-6 and CM-3. You can leave your probe in the pipe and upgrade your electronics. Refer to retrofit model R02, R04, and R12.

Start-Up Service

Thousands of cut monitor installations have shown us that the initial start-up of any analytical device is critical. Applications that use the cut monitor for process control and custody transfer demand the most from these devices and can not afford to sacrifice accuracy or reliability.

AMETEK Drexelbrook offers installation and start-up service on all of our cut monitor products. Factory trained service engineers can assist you with the installation, start-up, and calibration of your device.
### Model Numbering - System Electronics and Probe Model

#### Technology
- Universal IV

#### Measurement Type / Frequency and Phasing
- Water Cut Monitor Electronics

#### Digital Protocols
- 1 HART®

#### Future Use
- 0 Future Use

#### Approvals
- 0 Unapproved
- 1 FM/FMc IS
- 2 FM/FMc XP
- 3 ATEX ia
- 4 ATEX d [ia]
- 5 IECEx ia
- 6 IECEx d [ia]

#### Electrical Connection
- 0 3/4" NPT without external ground lug
- 1 M20 with external ground lug
- 2 3/4" NPT with external ground lug

#### Surge / Noise Suppression
- 0 No additional filtering required
- 1 Signal filtering RFI and Surge protection (Integral or Remote)
- 2 Probe RFI (Remote only)
- 3 Signal filtering and Probe RFI (Remote only)
- 4 Probe HDSP (Heavy Duty Spark Protector) - Remote only
- 5 Signal filtering and Probe HDSP (Remote only)
- 6 Probe RFI and Probe HDSP (Remote only)
- 7 Signal filtering and Probe RFI and Probe HDSP (Remote only)

#### Integral / Remote options
- 0 Integral configuration
- 1 Remote configuration without cable
- 2 Remote configuration with 10 ft General Purpose Cable
- 3 Remote configuration with 25 ft General Purpose Cable
- 8 Remote configuration with 10 ft Triax Cable
- 9 Remote configuration with 25 ft Triax Cable
- E Remote configuration with 10 ft Hi Temp Cable
- F Remote configuration with 25 ft Hi Temp Cable
- L Remote configuration with 10 ft Hi Temp Composite Cable
- M Remote configuration with 25 ft Hi Temp Composite Cable
- Z Remote configuration with custom cable

#### Dual seal option
- 0 Without Dual Seal option
- 1 With Dual Seal option

#### Sensing Element Code
- ### Sensing element 3-digit code (Refer to probe selection table)
- 000 Remote System without a probe
- ZZZ Special sensing element
- R## Retrofit kit upgrade with probe dependent adapters R02, R04 or R12 (Refer to table)

#### Cut Monitor Software
- 0 No Pre-Calibration
- A Light Oil — 0 - 1%
- B Light Oil — 0 - 5%
- C Light Oil — 0 - 10%
- D Light Oil — 0 - 30%
- E Light Oil — 0 - 50%
- F Heavy Oil — 0 - 1%
- G Heavy Oil — 0 - 5%
- H Heavy Oil — 0 - 10%
- I Heavy Oil — 0 - 30%
- J Heavy Oil — 0 - 50%
- M Heavy Oil — 0 - 80%
- Z Special Software - Contact Factory
To order a Universal IV CM, users must specify the following items:

1. Percentage of Water-In-Oil
2. Approvals Required
3. Integral or Remote Electronics with Cable Length
4. Pipe Size
5. Cote Shield Length
6. Probe Mounting- NPT of Flanged
7. Installation Services
8. Cut Monitor Accessories
9. Pressure & Temperature of Process
10. API Gravity

The model numbering maps show how to place your specifications into our part numbering system. There are two model maps, one for the electronics and one for the probe. Please provide both numbers when ordering.