Universal IV™ CM Model with Temperature Compensation

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

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.

Eliminate Routine Maintenance
The Universal IV CM ignores 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.

Cote Shield™
Cote-Shield is designed into the Universal IV CM and enables the instrument to ignore a pre-determined length of the sensing element, allowing the sensing element to extend into the fluid beyond the nozzle mounting. The Cote-Shield puts the sensing area of the probe directly into the process stream and provides a more representative sample of the emulsion.

Temperature Compensation
The dielectric constant of crude oil can change with any changes in temperature. These changes may cause standard cut monitors to change without any variance in water content. The Universal IV Water Cut Monitor measures product temperature internally and calculates a true water cut reading at any temperature up to 160° F.

Use the Best
For over 50 years, Drexelbrook has been the world’s leader in capacitive based measurements by providing reliable and accurate products at a reasonable cost. We offer the highest pressure and temperature ratings in the industry, 1000 PSI and temperatures up to 450°F.

Easy Configuration with Built-in 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.
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 addition of temperature compensation allows the user to take into account changes in the dielectric constant of the oil producing a more accurate measurement in applications where the temperature changes. 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 vs. Water Cut](image)

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.
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</th>
<th>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>
<td></td>
</tr>
<tr>
<td>0 to 5%</td>
<td>+/- 0.04</td>
<td>0.0009</td>
<td></td>
</tr>
<tr>
<td>0 to 10%</td>
<td>+/- 0.04</td>
<td>0.0009</td>
<td></td>
</tr>
<tr>
<td>0 to 30%</td>
<td>+/- 0.12</td>
<td>0.0030</td>
<td></td>
</tr>
</tbody>
</table>

Above 30% - Consult Factory

* 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 75°C (-40°F to 167°F)

Process Temperature
Up 232°C (450°F)

Process Pressure
Up 69 bar (1,000 psi), probe dependent

Process Connection
NPT, ANSI, and more upon request

Response Time
350 msec nominal (no damping applied)
1-90 seconds programmable damping time

Supply Voltage Effect
0.2% of full scale max

Temperature Effect
(Includes Process Temperature Effect up to 160°F)
0.5% per 100°F (37.7°C) change

Start-Up Time
< 12 seconds

Configuration and Calibration
Standard LCD display and keypad are built-in
HRTWIN™ PC-based software (free download)

Emission and Surge Protection
Compliant with IEC6100-4.2, 3, 4, 6, 8
Compliant with CISPR11 Group I, Class B

Approvals
Intrinsically Safe (IS)
Explosion Proof (XP)
FM, FMc, ATEX, IECEx
CE Mark
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.

### 700-1202-4XX Series Sensing Elements

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Cote-Shield Length</th>
<th>Insertion Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td>6&quot;</td>
<td>23.75&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>10&quot;</td>
<td>27.75&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>6&quot;</td>
<td>28&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>10&quot;</td>
<td>32&quot;</td>
</tr>
<tr>
<td>4&quot;</td>
<td>6&quot;</td>
<td>31.125&quot;</td>
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<tr>
<td>4&quot;</td>
<td>10&quot;</td>
<td>35.125&quot;</td>
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<tr>
<td>6&quot;</td>
<td>6&quot;</td>
<td>35.375&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>10&quot;</td>
<td>39.375&quot;</td>
</tr>
<tr>
<td>8&quot; and &gt;</td>
<td>10&quot;</td>
<td>25.5&quot;</td>
</tr>
<tr>
<td>In Tank</td>
<td>3.5&quot;</td>
<td>19&quot;</td>
</tr>
<tr>
<td>In Tank</td>
<td>6&quot;</td>
<td>21.5&quot;</td>
</tr>
<tr>
<td>In Tank</td>
<td>10&quot;</td>
<td>25.5&quot;</td>
</tr>
</tbody>
</table>

Integral Mounting / Dimensions

**Note:** 2" Through 6" Pipe
## Model Numbering - System Electronics and Probe Model

### Technology
- **U** Universal IV

### Measurement Type / Frequency and Phasing
- **T0** Water Cut Monitor with Temperature Compensation Electronics

### Digital Protocols
- **1** HART®

### Future Use
- **0** Future Use

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

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

### Surge / Noise Suppression
- **0** No additional filtering required
- **1** Signal RFI (Integral)

### Integral / Remote options
- **0** Integral configuration

### Dual seal option
- **0** Without Dual Seal option

### Sensing Element Code
- **201** 700-1202-401 Perma-Seal™, Pipe < 8" 200 psi @ 450°F
- **202** 700-1202-402 Perma-Seal™, Pipe < 8" 1000 psi @ 250°F
- **203** 700-1202-411 Perma-Seal™, In Tank Perforated Concentric 200 psi @ 450°F
- **204** 700-1202-412 Perma-Seal™, In Tank Perforated Concentric 1000 psi @ 250°F
- **205** 700-1202-421 Perma-Seal™, Pipe 8" and > 200 psi @ 450°F
- **206** 700-1202-422 Perma-Seal™, Pipe 8" and > 1000 psi @ 250°F

### Cut Monitor Software
- **0** None
- **A** Light Oil -- 0 - 1%
- **B** Light Oil -- 0 - 5%
- **C** Light Oil -- 0 - 10%
- **D** Light Oil -- 0 - 30%
- **F** Heavy Oil -- 0 - 1%
- **G** Heavy Oil -- 0 - 5%
- **H** Heavy Oil -- 0 - 10%
- **I** Heavy Oil -- 0 - 30%

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**UT 010**
Model Numbering - Probe Dimensions and Process Connection

**Process gland wetted part (X)**

- B 316/316L SS

**Process connection (XX)**

- A0 3/4” NPT Carbon Steel
- FA 2” 150# RF Carbon Steel
- FB 2” 150# RF 316/316L Stainless Steel
- GA 2” 300# RF Carbon Steel
- GB 2” 300# RF 316/316L Stainless Steel
- IA 3” 150# RF Carbon Steel
- IB 3” 150# RF 316/316L Stainless Steel
- JA 3” 300# RF Carbon Steel
- JB 3” 300# RF 316/316L Stainless Steel
- KA 4” 150# RF Carbon Steel
- KB 4” 150# RF 316/316L Stainless Steel
- LA 4” 300# RF Carbon Steel
- LB 4” 300# RF 316/316L Stainless Steel

**How To Order**

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.