Installation and Operating Instructions

CM6 Cut Monitor
with HART® Protocol

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CM6 Cut Monitor
with HART® Protocol
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Section 1
Section 1: Introduction

1.1 System Description

The instructions in this manual are for the AMETEK Drexelbrook CM6 series Cut Monitor for measurement of the percentage of water in oil. Each AMETEK Drexelbrook CM6 series system consists of a two-wire, 4-20 mA electronic unit and a 700 series sensing element. Communication with the device is done by either an onboard keypad or with a laptop via HART® protocol.

AMETEK Drexelbrook has been measuring water cut with capacitive technology for over 40 years. Using capacitance to measure water cut is widely successful because of the large difference between the dielectric constants of oil (k≈2.3) and water (k≈80). The sensing element and the pipe wall form the necessary two plates 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 can then compute the relationship between capacitance change and water cut. It is termed a two-wire transmitter because the same two wires that are used to power the unit also indicate the change in Cut (4-20 mA).

1.2 Unpacking

Carefully remove the contents of the carton and check each item against the packing list before destroying any packing material. If there is any shortage or damage, report it immediately to the factory.
1.3 Model Numbering

- **Technology**
  - RCT-161 CM6 Cut Monitor

- **Calibration**
  - 0 No Pre-Calibration
  - A 0 to 1% Light Oil
  - B 0 to 5% Light Oil
  - C 0 to 10% Light Oil
  - D 0 to 30% Light Oil
  - E 0 to 50% Light Oil
  - F 0 to 1% Heavy Oil
  - G 0 to 5% Heavy Oil
  - H 0 to 10% Heavy Oil
  - I 0 to 30% Heavy Oil
  - J 0 to 50% Heavy Oil
  - K 0 to 80% Heavy Oil

- **Approvals**
  - C CSA Intrinsically Safe Approval
  - D CSA Explosion Proof with IS Barriers
  - F FM Intrinsically Safe Approval
  - G FM Explosion Proof with IS barriers

- **Filters**
  - 0 No Filters
  - 1 RFI Filter
  - 4 Loop Surge Filter
  - 7 Loop Filter and Surge Filter

- **Mounting**
  - 0 Integral
  - 1 Remote - no cable
  - 2 Remote - 10 feet cable GP
  - 3 Remote - 25 feet cable GP
  - 4 Remote - 50 feet cable GP
  - 5 Remote - 75 feet cable GP
  - 6 Remote - 75 feet cable GP
  - 7 Remote - 100 feet cable GP
  - 8 Remote (25 feet) tri-ax cable
  - 9 Remote (50 feet) tri-ax cable
  - A Remote (75 feet) tri-ax cable
  - B Remote (100 feet) tri-ax cable
  - C Remote (10 feet) high temp cable
  - D Remote (25 feet) high temp cable
  - E Remote (35 feet) high temp cable
  - F Remote (50 feet) high temp cable
  - G Remote (75 feet) high temp cable
  - H Remote (100 feet) high temp cable

- **Sensing Element**
  - 0 700-1202-001
  - 4 700-1202-041
  - 5 700-1202-081 (M0303)
  - A 700-1202-061
  - B 700-1202-081
  - 6 700-1202-081

- **Pipe Size**
  - 1 1" Pipe
  - 2 2" Pipe
  - 3 3" Pipe
  - 4 4" Pipe
  - 5 6" Pipe
  - 8 8" or Larger Pipe
  - T In Tank Sensor

- **Cote-Shield Length**
  - 0 2.0 2" CSL
  - 0 3.5 3.5" CSL
  - 0 10.0 10" CSL

- **Insertion Length**
  - X XXXXX Determined By Factory

- **Mounting**
  - AO .75" 316 SS NPT
  - BA 1" 150# RF CS
  - BB 1" 150# RF 316/316L SS
  - CB 1" 300# 316/316L SS
  - DA 1.5" 150# RF CS
  - DB 1.5" 150# RF 316/316L SS
  - EA 1.5" 300# CS
  - EB 1.5" 300# RF 316/316L SS
  - FA 2" 150# RF CS
  - FB 2" 150# RF 316/316L SS
  - GA 2" 300# RF CS
  - GB 2" 300# RF 316/316L SS
  - IA 3" 150# RF CS
  - IB 3" 150# RF 316/316L SS
  - KB 4" 150# RF 316/316L SS
  - LA 4" 300# RF CS
  - LB 4" 300# RF 316/316L SS
  - MA 6" 150# RF CS
  - MB 6" 150# RF 316/316L SS
  - NA 6" 300# RF CS
  - NB 6" 300# RF 316/316L SS
  - XX Mounting Not Listed
Section 2: Installation

2.1 Installation Guide

Use the following mounting and installation instructions so that the sensing element will operate properly and accurately:

- The sensing element should be mounted in a section of pipe as close to the center and as parallel to the pipe as possible. Factory calibration assumes mounting on the pipe centerline and in the correct size pipe.

- Vertical mounting, with the tip down, is preferred, but not essential.

- Gas bubbles must be excluded from the active area by maintaining pressure and, if necessary, a degasser upstream from the sensing element. Gas bubbles (whether from natural gas, air or steam) decrease the accuracy of the measurement.

- Do not take the sensing element apart or loosen the packing glands.

- For in-tank mounting installations, the standard length of the cote shield section is eight inches. If the nozzle is longer than six inches, a non-standard cote shield length should be used.

- In large pipe installations (greater than eight inches), the length of the cote shield section must be long enough (i.e. length of nozzle short enough) that the cutout in the concentric tube is in the actual flow of oil.

- For large pipes with no bends (18 inch and larger), it is possible to mount the sensing element at a 45 degree angle to provide sufficient flow through the shield of the sensing element.
2.1 Installation Guide (Continued)

Installation in a Pipe 8 inches or larger

Installation in a Pipe 18 inches or larger
2.2 Installation Considerations

The sensing element must be mounted at an existing or created, 90 degree bend in the pipe. It can be installed through a tee or a weld-o-let to a 90 degree elbow. The vertically downward mounting attitude is preferred for ease of inspection or cleaning, since draining of the pipe is not required. Regardless, the probe will function in any attitude, as long as the pipe is completely full in the active probe area. See the figure below for ideal installation orientation.

The probe is active from its tip to the end of the Cote-Shield element. In the area of the Cote-Shield, it is completely inactive.

In all cases, the presence of gas bubbles, whether from air, petroleum vapor, steam, or natural gas, will reduce accuracy, producing lower readings. One of the most common causes of gas bubbles is abrupt pressure drops in high temperature streams, which can allow water and light ends to flash.

An in-line mixer just upstream of the Cut Monitor is highly recommended for streams which go above 10%. Accuracy is based on uniform, oil-continuous emulsion, so any unplanned separation will cause avoidable errors.

All instruments are factory calibrated. If calibration trimming is required, it may be done through the Keypad or with AMETEK Drexelbrook PC software. The proprietary software allows one shot calibration trimming with one reading and sample. The Real-time View window is useful for observing transmitter function and troubleshooting.
## 2.3 Probe Insertion and Active Lengths

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<th>Pipe ID</th>
<th>Probe Diameter</th>
<th>Cote Shield Length</th>
<th>Active Length</th>
<th>Insertion Length</th>
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<td>0.375</td>
<td>10</td>
<td>31.04</td>
<td>41.04</td>
</tr>
</tbody>
</table>

**NOTICE**

Probe Diameter for Peek is 3/8”

8” and larger pipes require a concentric
2.4 Mounting the Electronic Unit

The integral electronic unit is mounted with the sensing element. The remote electronic unit is designed for field mounting, but it should be mounted in a location as free as possible from vibration, corrosive atmospheres, and any possibility of mechanical damage. For convenience at start-up, mount the instrument in a reasonably accessible location. Ambient temperatures should be between -40°F and 185°F (-40°C and 85°C).

When installing conduit to the electronic unit, be sure that vertical conduit runs will not cause water to enter the electronic unit housing, as shown in Figure Below.

Recommended Conduit Connections
2.5 Wiring the Electronic Unit

**CAUTION:**
Before using Intrinsic Safety Barriers, read the manufacturer's instruction for barrier operation.

**CAUTION:**
If welding anywhere on the piping or connected tanks, physically remove all connections from the electronic unit and remove the unit from its housing.

Integral units are prewired at the factory. The Figure Below shows the wiring of the integral unit.

![CM6 Wiring Connections (Integral Mounting)](image)

Always Install per Control Drawings
For remote units, the signal connections are made to the terminal block on the front of the chassis. Due to the low power consumption of the instrument, the wiring need only be light gauge (e.g. 20AWG). Twisted, shielded-pair cables are required.

The cable from the sensing element is connected to the four-terminal group on the back side of the instrument chassis. The cable connections are Probe (Center Wire), Ground (Gnd), and Shield (Shd). See Figure Below

1. All devices must be wired in series. Voltage driven devices require a series voltage dropping resistor.

2. Signal Terminals + & - can operate with minimum of 12.0 VDC with 20mA flowing.

3. If the field wiring is to be in hazardous areas, then suitable safety barriers are required between the power supply and the field to provide for intrinsically safe wiring.

CM6 Wiring Connections (Remote Mounting)
2.6 Wiring the Sensing Element (Remote Electronic Units)

Only coaxial cables supplied by AMETEK Drexelbrook should be used to connect the transmitter to the sensing element. Use of other cables can result in unstable calibration.

To prevent problems with radio frequency interference the cable should be run in metallic conduit if walkie-talkies or variable speed drives are located within 25 feet of the electronic unit.

The cable connections to the sensing element are shown in Figure Below

Do not connect the cable to the sensing element until after the sensing element has been installed and the condulet housing has been secured.

*Three-Terminal Cable Connections to Three-Terminal Sensing Element*
Optional surge protection is sometimes supplied with transmitters that are expected to be exposed to surges or lightning on the two-wire loop. A Drexelbrook model 377-4-18 Surge Voltage Protector provides protection to the transmitter but is not absolute in its protection against a very close lightning strike. Refer to Figure Below to properly connect the Surge Voltage Protector. In addition to surge voltage protection, connect the transmitter housing to a good ground.

![Surge Voltage Protection Diagram]

2.8 RFI (Radio Frequency Interference)

When installing the CM6 transmitter, follow these recommendations to avoid problems with Radio Frequency Intereference (RFI).

- Choose a location to mount the electronic unit at least 6 feet away (2M) from a walkway where personnel using walkie-talkies may pass.

- For remote electronic units, connect the sensing element to the electronic unit by placing the coaxial cable in grounded metal conduit. (Integrally mounted electronic unit connections are already shielded.)

- Use twisted, shielded-pair wiring for all loop wiring connections. Loop connection wiring should also be in grounded metallic conduit.
2.8 RFI (Radio Frequency Interference) (continued)

- Do not run power wiring in the same conduit with signal cables

- Ground the electronic unit and housing with a minimum of 14 gauge wire to a good earth ground. Make sure that conduits entering and leaving the housing have a good electrical ground connection to the housing.

The RFI recommendations listed above provide a degree of protection that is usually sufficient to protect against walkie-talkies used 3 feet (1M) or more from a typical electronic unit.
Section 3: Configuration & Calibration w/ Drexelbrook Software

This section instructs the user how to use the Drexelbrook 401-700-20/40 Series PC calibrator software to configure and calibrate the CM6 (RF Admittance) Transmitter.

3.1 General Description

The 401-700-20/40 software package allows the use of any Windows® 9X/NT/2000/XP-based personal, laptop, or notebook computer to calibrate the HART® Protocol transmitter.

The CM6 requires HARTWin™ Software version 2.5 or greater.

3.2 Model Number

4 0 1 - 0 7 0 0 - 0 2 X / 4 X
2X=21 PC Software Package includes: RS232 Modem Assembly 401-0700-004 (Figure 3.1).

2X=22 PC Software Package includes: Contents in 401-0700-021 and HARTWin™ version 2.1 or greater on a CD-ROM.

4X=41 PC Software Package includes: USB Modem Assembly 401-0700-007(Figure 3.1a).

4X=42 PC Software Package includes: Contents in 401-0700-41, Utilities and Drivers on a CD-ROM, and HARTWin™ on a CD-ROM.

4 0 1 - 0 7 0 0 - 0 3 1
HARTWin™ on a CD-ROM.

3.3 System Requirements

PC Requirements
Windows® 95, 98, ME, 2000, XP.
The USB modem is not compatible with Windows® 95, 98 First Edition, or NT. It is recommended that the software be installed on a hard drive with 20 megabytes or more of space available.

Input to Modem
RS232 or USB Port, from one of the COM serial ports (COM1, COM2, etc.). The PC provides operating power for the modem but not for the transmitter.

Output (to Transmitter being Calibrated)
4-20 mA in HART® Protocol.
3.4 Installing The HART® Modem

3.4.1 Installing The RS232 Modem

Refer to Figure 3-1 for a connection diagram and use the following procedure to install the hardware that is necessary to run the PC software.

A. Connect the RS232 Drexelbrook Modem 401-700-004 to one of the COM serial ports (COM1, COM2, etc.) of the computer.

B. Connect the Modem's 4-20 loop connectors to the transmitter loop.

C. Turn on the computer.

---

NOTICE

It is necessary to put a 250 Ohm resistor in series to provide minimum loop resistance for HART communications.

---

Figure 3-1

RS232 Modem Assembly & Loop Connection
3.4.2 Installing The USB Modem

Refer to Figure 3-1a for a connection diagram and use the following procedure to install the hardware that is necessary to run the PC software.

A. Turn on the computer

B. Install Modem Software:

- It is highly recommended the USB drivers be installed BEFORE you plug in the modem.
- Install the USB Drivers by inserting the Modem Installation Disk into CD Drive of the computer.
- If program does not "Auto-Run", select "D:\setup" (where D is the letter representing the CD Drive)
- Be Sure to Select the USB interface in the setup prompt.
- Follow any "On-Screen" Instructions.

C. Connect the Drexelbrook Modem 401-700-007 to a USB port on the computer. With the USB drivers already installed, the computer will detect the modem and assign a COM PORT number.

D. Connect the Modem's 4-20 loop connectors to the transmitter loop.

![Figure 3-1a](Image)

**Figure 3-1a**

**USB Modem Assembly & Loop Connection**

---

**Notes:**

1. Modem will operate from 32°F to 122°F (0°C to 50°C). It can be stored from -40°F to +185°F (-40°C to +85°C). 0% to 95% relative humidity - non condensing.

2. Service Department 1-800-527-6297 or 1-215-674-1234

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**NOTICE**

It is necessary to put a 250 Ohm resistor in series to provide minimum loop resistance for HART communications.
3.5 Installing HARTWin Software

A. Place the 401-700-031 CD into the CD drive (usually drive D:).

B. If program does not "Auto-Run", select "D:\setup" (where D is the letter representing the CD Drive).

C. Follow "On-Screen" instructions in Setup to create program file.

D. Once loaded, double click "HARTWin" icon and the program should run under its own window.

E. Select communication port [Com 1, Com 2, etc.] and then click “OK.”

F. If you are not sure which communication port you are using (such as when first using a USB modem), select “Search Ports,” then OK. The software automatically will seek out the correct one. In either case the software begins to communicate with the HART® protocol transmitter and returns with a view (below) containing “name plate data,” Tag ID and all default or existing configuration information. This is the same as if you clicked on the Read Transmitter function button.

G. The next view, appears automatically, displaying current transmitter database for calibration set-up for your selected Tag ID. The Scratch Pad will automatically show the last message (last user, last calibration, etc.) up to 32 characters. If this is a new transmitter, the Tag ID is user-defined. Serial number, transmitter software version, range, etc. is automatically entered from the “name plate data” embedded in the transmitter:

3.6 Description of Function Keys

The following paragraphs describe the function buttons. The data fields are described in Section 3.7 Configuration.

Read Transmitter [F3 on keyboard]
Reads all pertinent data from the transmitter and displays it on the screen. The Read function also updates the real time window. Keep in mind that it takes several seconds to load the information from the transmitter. When the load is complete, the screen shows the database parameters, except any user-defined strapping table information. This command is also used when connecting to another transmitter.
3.6 Description of Function Keys (Continued)

**Write to Transmitter [F5 on keyboard]**
Sends new or edited configuration data to the transmitter. Data fields that have been edited but not sent to the transmitter are displayed in red.

**Real Time View [F4 on keyboard]**
Displays the real time values of water percentage, capacity, loop current, and status.

**D/A Trim**
Allows a field reference meter to be connected to the transmitter for adjusting transmitter output current. See Section 3.9.

**Strapping Table**
Displays the values of the input (pF) vs. output (% water) in a table of up to 21-points. Allows points to be adjusted when actual data deviated from the theoretical input/output curve. See Section 3.8.4

**Configure Meter**
Configures the Digital Integral Meter (440-44-3) used for local indication. See Section 3.10

**Cut Monitor Calibration (One-Shot®)**
Used to adjust calibration to specific oil and temperature that the transmitter monitors. See Section 3.8.1

![HARTWin Tool Bar](image)
3.7 Configuration

Configuration involves downloading information to the HART protocol transmitter that is specific to the application that is being measured.

Calibration requires that application information and two points of level and/or capacitance be supplied to the transmitter from the calibration software.

A. Begin configuration by using **Tag ID** (8 characters) to identify the unit or vessel. Use the **Scratchpad** (32 characters) to record the date of calibration or other similar notes. Press Tab or Enter on your keyboard.

B. Edit **Damping Time** from 0-90 seconds, if desired.

C. Click on **Write to Transmitter**.
3.8 Calibration

All Drexelbrook CM6 Series Cut Monitor instruments are calibrated at the factory according to:

- size of pipe, and
- density of oil

Specific factors could cause the factory calibration to be less accurate than is required. For example,

a. Pipe I.D. is smaller than nominal size (Sched. 80, 160, or extra heavy pipe)

b. Sensing element is not centered (parallel to axis) in pipe. This condition causes higher (never lower) readings.

c. Oil may be heavier (higher readings) or lighter (lower readings) than expected.

d. Major temperature deviations.

Do not change the factory calibration without obtaining data that indicates a calibration change is necessary. If the output reading is low because of gas, steam, or air in the stream, then no amount of calibration will produce satisfactory performance. Consult the factory at 1-800-527-6297.

Once the gas is gone, an accurate calibration check can be made. The following equipment is required to check the calibration of a cut monitor application and record sample data:

- A centrifuge (or other API-approved standard) to sample water content.

- If the stream temperature is greater than 150°F (65°C), a sampling bomb with a minimum capacity of 500 ml.

- Temperature stabilization bath.
3.8.1 One Shot ® Calibration Trim Using HARTWin Software

a. With a PC connected to the signal loop, click on the Real Time View button to open the “Real Time View” Screen.

b. Take a sample of the fluid from as close to the probe as possible. Use a sampling bomb if the stream temperature is greater than 150°F. Stabilize at 150°F before determining water content.

c. Read and record water percentage from the “Real Time View” as the sample is being taken.

d. After determining the actual water percentage in the sample, close the “Real Time View” window and open the “Calibration Screen” by clicking on the Cut Monitor Calibration button.

e. Enter the % water reading, recorded at the time of sampling in the “Indicated Water” box. Enter the result of the sample test in the “Sampled Water” box and click on the Calibrate button.

f. Click on the Write To Transmitter button to install the revised calibration in the transmitter.

g. Depending on the range, if the original calibration and the measured sample differed by more than 2.5% water, another iteration will probably be required. Unless there is an overwhelming discrepancy, it is best to monitor the performance with this new calibration for a few days before making a second change.
3.8.2 Use of Sample Bomb

In order to get accurate sample readings on the lines running hotter than 150°F, it is necessary to prevent water from flashing off as steam. This requires a sampling “bomb” to capture the sample under pressure, followed by cooling to 150°F.

a. Connect the sampling bomb to the sample tap

b. Open top and bottom valves on the bomb

c. Open the sample tap with a catch basin under the bomb

d. Allow the liquid to run through the bomb for at least 60 seconds

e. Close the bottom valve on the bomb and allow it to fill

f. Close top bomb valve and sample tap

g. Remove bomb and place in 150°F stabilizing bath

h. Once temp is stabilized at 150°F, proceed with normal determination of water
3.8.3 Range Change

It is always possible to reduce the span of an existing calibration simply by lowering the % water URV on the “Menu Screen”. If the reduction in span is greater than 20 or 30% of range, better accuracy can be usually achieved by changing the input/output curve to a lower range.

When changing ranges on the CM6 it is important to understand that the shape of the input/output curve may require revision, as well as the 100% point. The simplest way to re-range an instrument is to select a different input curve. Be sure to set the correct “Range Jumper” position indicated by the curve selected. This procedure can be performed on an installed instrument or in the shop, with the electronic unit itself.

Captures from Main Screen

3.8.4 Strapping Table

If none of the available input/output curves are adequate for the application, a user defined table may have to be created. This is accomplished by editing the strapping table.

a. With a PC connected to the signal loop (as in section 3.4) click on the strapping table button.

b. Click on Write Strapping Table button to re-range the transmitter to the new values.

c. Click on the Exit to return to the “Menu Screen” It may be necessary to do a “One Shot” calibration on the installed instrument.

For user defined tables it will be necessary to adjust the URV (920 mA) point to the desired range (see section 3.8.3) and adjust the local indicator so that the maximum value is equal to the maximum % water in viewing % water is desired. It may also be necessary to adjust the jumpers to put the unit in the correct pF range.
### 3.8.4 Strapping Table (Continued)

<table>
<thead>
<tr>
<th>A - 0-1% LIGHT OIL RANGE 1</th>
<th>B - 0-5% LIGHT OIL RANGE 1</th>
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<tr>
<td>INPUT</td>
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<td>INPUT</td>
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<td>% WATER</td>
<td>pF</td>
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### 3.8.4 Strapping Table (Continued)

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<td><strong>INPUT</strong></td>
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<th>M- 0-80% HEAVY OIL RANGE 4</th>
<th>P- 0-50% HEAVY OIL RANGE 3</th>
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<td><strong>INPUT</strong></td>
<td><strong>OUTPUT</strong></td>
<td><strong>INPUT</strong></td>
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<td></td>
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</tbody>
</table>
3.8.5 Linearity Correction

On high water ranges (greater than 10%) the shape of the % Water/Capacitance curve will typically vary somewhat from one field to another. If it is determined that the output is accurate at high and low water levels, but incorrect at some intermediate area, it is possible to manipulate the break points in the strapping table to improve accuracy.

A step-by-step procedure is beyond the scope of this publication. Several AWT users have successfully trimmed the theoretical curve and in one case determined their own curve to satisfy particular conditions in their installation.

When attempting to optimize the input/output curve there are 3 precautions to keep in mind:

a. Try to err on the side of under compensation for perceived deviations

b. The top three points are designed to clip the output at 20 mA and should not be disturbed. They have no significant effect on the curve below 20 mA.

c. Before beginning, be sure have a record of the starting curve, in case it becomes necessary to start over.

3.9 Set D/A Trim

D/A Trim is NOT a calibration! This is a pre calibrated alignment to precision factory settings and is rarely in need of change. The procedure is intended only as a slight "meter" adjustment to a known external reference.

The Digital to Analog (D/A) Trim adjusts the transmitter mA (current) output. Since the smart transmitter performs a digital to analog conversion, there may be a discrepancy in the 4-20 mA output loop as measured with a reliable external milliampere meter.

For example: perhaps after calibration you observe that the tank is empty and a hand-held mA meter reads only 3.94 mA, while the Real Time View in the PC Menu shows 4.00 mA. By adjusting the D/A trim, you may digitally manipulate the output current to equal 4.00. You may also wish to adjust the high end to 20.00 mA.

To make these adjustments, click on D/A Trim on the PC software Menu Screen and follow the pop-up window instructions.
3.10 Digital Integral Meter Configuration

The Digital Integral Meter (DIM)(401-44-3) is used for local display. It can be viewed through a glass viewport in the transmitter housing cover.

The meter can be configured to read any engineering units, e.g. 4-20 mA, % Range, % Water, etc. Status messages are also displayed on the meter.

By default, the meter is scaled to % water. Whenever the URV or the input/output curve is changed, the CM6 will automatically rescale the meter to the % water. If another reading, such as 4-20mA is desired; the user must rescale the meter. This must be done after the URV/LRV or the curve has been changed. Otherwise the CM6 will automatically rescale to indicate % water.

To configure the meter, "Click" on Configure Meter in menu screen for the pop-up;

**The meter is configured by:**
- setting the minimum value equal to the value to be displayed at the LRV and,
- setting the maximum value equal to the value to be displayed at the URV.

**Factory default settings are:**
Minimum Value = 0.00
Maximum Value = 80.00 (for 80% water)

**To set the meter display range equal to calibration range:**
Minimum Value = LRV
Maximum Value = URV

**To set the meter display range equal to percent of range:**
Minimum Value = 0
Maximum Value = 100

When a smart transmitter is powered down or the ribbon cable is disconnected, there is a 1 minute delay before the DIM begins to display upon return of power.

**If the display becomes distorted:**
- Remove power from the smart transmitter,
- Wait one minute,
- Reapply power to restart the meter.
3.11 Save/Print Entries

In addition to your own convenience, many regulatory agencies are requiring a record of the values being used during certain processes. All of the values developed in this configuration and calibration procedure may be saved to be reloaded into another (or replacement) transmitter. All of the values may likewise be printed out as hard copy, including the Serial Number, Transmitter Software Version, Tag ID, Scratch Pad, Instrument Calibration, all of the Real Time View numbers, and all of the Strapping Table entries.

Pop-up screens come from selections in the **FILE** pull down at the top left of the PC menu Screen.

Copies are saved in both .CM6 file and .txt files.

The .CM6 file will download into a transmitter through the **OPEN** command. The text file may be printed out, or reformatted.

**PRINT** command provides a pre-formatted hard copy.
3.12 Calibration & Configuration via 401-44-3 Display/Keypad

CFg.d (Configure Display)

See?

Edit

Min Value

Max Value

Return

Lrng (Lower Range Value)

See?

View LRV

Edit 0 - 99900

Enter

Urng (Upper Range Value)

See?

View URV

Edit 0 - 99900

Enter

diAg (Diagnostic Menu)

donE (Leave Menu)

Exit Main Menu

Continued on Next Page
3.12 Calibration & Configuration via 401-44-3 Display/Keypad (Continued)
Section 4
Section 4: Specifications

Electronics - Two Wire Transmitter

Power Requirement
17 to 30 vdc (12 vdc @ 20 mA)

Output
4-20 mA

Measurement Range - Heavy and Light Oils
0-1% water 0-5% water
0-10% water 0-30% water
0-50% water 0-80% water

Housing Rating
NEMA 4X

Ambient Temperature
-40°F to 158°F
-40°C to 70°C

Accuracy
±0.1% water for 1% and 5% ranges,
±5% of span for 10, 30, 50, and 80% ranges
(at standard conditions)

Step Response
Less than 1 second to 90% of final
value when damping = 0 sec.

Damping Time Constant
0 to 90 seconds, 1 second steps.

Repeatability
±0.5% of span

Resolution
0.2% span

Hysteresis
0.2% span

Ambient Temp Error
±0.01% span/°F

Process Temperature Error
±0.02% Water/°F (uncompensated)

Spark Protection (4-20 mA output)
10 Amperes

Spark Protection (Sensor)
10 Amperes
(Center Wire to Shield or Shield to ground)

Communications
HART® Protocol

Communications Load Resistance
250 - 750 Ohms 30 vdc

Max. Load Resistance
750 Ohms 30 vdc

Sensing Element

Class
Perm-A-Seal

Model Number
700-1202-001

Pressure
1500 PSI @ 250°F
500 PSI @ 450°F

Cote Shield Lengths (CSL)
2”, 3.5”, 10”

Insertion Length (IL)
Variable

Mountings
¾” NPT Standard
ANSI and DIN flange, Tri-Clamp mountings available

Wetted Parts
316 S.S. and PEEK (Poly Ether Ether Keytone)*

* 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 addition-
al material compatibility.

Hazard Classification and Approval

The CM6 has been approved for the followings
installations, integral and remote, when powered
from Intrinsically Safe power supply.

Explosion Proof / Class I, Div 1, Groups A, B, C, D (Integral)
Intrinsically Safe / Class I, II, III, Div 1, Groups A, B, C, D, E, F, G
Non-Incendive / Class I, Div 2, Groups A, B, C, D, IP66, Type 4X
Dust Ignition Proof / Class II, III, Div 1, Groups E, F, G

Class I, Zone 2: Ex nA IIC
Class I, Div 2, Groups A, B, C, & D;
Class II, Div 2, Groups E, F, & G; Class III
Class I, Zone 0: Ex ia IIC
Class I, Div 1, Groups A, B, C, and D;
Class II, Div 1, Groups E, F, & G; Class III
Section 5
Section 5: Normal Maintenance

5.1 Viewport Cleaning

The viewport (if supplied) is made of Borosilicate glass and can be cleaned with any common glass cleaning product (e.g.: Windex™, Isopropyl alcohol, etc.) that is suitable for the Class and Division rating of the specific system installation.
Section 6
Section 6: Drawings

6.1 Mounting & Dimensional Drawings

1" through 6" Pipe
Integral Electronics
6.1 Mounting & Dimensional Drawings (Continued)

Greater than 8" Pipe
Integral Electronics
6.1 Mounting & Dimensional Drawings (Continued)

1" through 6" Pipe
Remote Electronics
6.1 Mounting & Dimensional Drawings (Continued)

Greater than 8" Pipe
Remote Electronics
6.2 FM Control Drawings

HAZARDOUS AREA

NONHAZARDOUS AREA

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T120-000
409-T130-000
409-T140-000
409-T150-000

SEE SHEET 3 FOR SYSTEM MODEL NUMBERS
AND SENSING ELEMENTS

SEE SHEETS 12-17 FOR
409-T160 (CM6) RCT 16 SERIES
APPROVED MODEL NUMBERS

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.
CM6™ Cut Monitor

4.2x4X, T4 MAX AMBIENT TEMP. 75°C

HAZARDOUS AREA

IS CL I, II, III, ... DIV I, ... GR A-G; IP66, 4X, T4 MAX AMBIENT TEMP. 75°C

NONHAZARDOUS AREA

FM APPROVED INTRINSICALLY SAFE CIRCUIT OR EQUIVALENT

POWER SUPPLY

Um = 250 V

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T120-000 SEE SHEETS 12-17 FOR 409-T130-000 409-T140-000 409-T150-000 APPROVED MODEL NUMBERS

NOTE: CONNECT ONLY TO CERTIFIED INTRINSICALLY SAFE CIRCUIT WITH THE FOLLOWING VALUES:

U = 30 V
I = 140mA
P = 1W

SEE SHEET 4 FOR SYSTEM MODEL NUMBERS AND SENSING ELEMENTS

MODEL NUMBERS OF 380 SERIES CABLES (REMOTE ONLY) MAX CABLE LENGTH 150' (48m)
380-0XXX-abc
XXX = LENGTH IN FEET
da = 0, 5 OR BLANK
b = 1, 2
cc = 0, 2, 8

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.
6.2 FM Control Drawings (Continued)

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(Drawings)

[Image of a page with text and diagrams related to FM control drawings.]
### 6.2 FM Control Drawings (Continued)

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**Drawings**

**Copyright 2005 AMETEK DREXELBROOK**

**FM APPROVED RCT SERIES MODEL NUMBERING SYSTEM (REMOTE)**

205 Keith Valley Rd Horsham, PA 19044-3606 215-674-1294 FAX 215-674-2739

**ISS. ODD/DSR NO. APP'D DATE**

420-0004-224-CD REV. 5 ISSUE 17 4
6.2 FM Control Drawings (Continued)
6.2 FM Control Drawings (Continued)

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**FM APPROVED RCT SERIES MODEL NUMBERING SYSTEM (REMOTE)**

**AMETEK DREXELBROOK**

205 Keil Valley Rd.
Horsham, PA 19044-2966

215-674-1234
FAX 215-674-2733

*Copyright 2005 Ametek Drexelbrook*

**SCALE: NONE**

**NOTE:** ALL DIMENSIONS ARE IN INCHES (IN).
IS 1.0 DIV I...GR A-G.
T4 MAX AMBIENT TEMP. 75°C

FOR INDOOR LOCATIONS ENCLOSURE MUST
BE MINIMUM IP20 RATED, TYPE 2.

FOR CLASS II, III INSTALLATIONS ENCLOSURE
MUST BE DUST-IGNITIONPROOF.

FOR OUTDOOR LOCATIONS ENCLOSURE MUST
BE MINIMUM IP44 RATED, TYPE 4X.

A HIGHER DEGREE MAY BE REQUIRED FOR HARSH
ENVIRONMENTS. SEE NOTE 1.

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T120-000 SEE SHEETS 12-17 FOR
409-T130-000 409-T160 (CM6) RCT 16 SERIES
409-T140-000 APPROVED MODEL NUMBERS
409-T150-000

MODEL NUMBERS OF CERTIFIED INTRINSICALLY SAFE SENSING ELEMENTS
700-mnp-qr-s+t LEVEL PROBE

m = FAMILY NO. O THROUGH 9, BLANK
n = FAMILY NO. O THROUGH 9, BLANK
o = O THROUGH 9, BLANK
p = O THROUGH 9
q = FAMILY NO. O THROUGH 9, BLANK
r = FAMILY NO. O THROUGH 9, BLANK
s = FAMILY NO. O THROUGH 9
f = 14 CHARACTER EXPANDED NUMBERING SYSTEM,
   DOES NOT AFFECT SAFETY

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.

AMETEK
DREXELBROOK

RCT SERIES LEVEL SYSTEMS
HART COMPATIBLE WITH
409-TXXX SERIES TRANSMITTERS.
FM INSTALLATION DRAWING (INTEGRAL),
CUSTOMER SUPPLIED ENCLOSURE.

CERTIFIED PO #
ENG USER

11-05-219 5/6/02
8-3-05
7-5-05
7-5-05
5-21-04
11-18-05
155/EDD/CSR NO. APP’D DATE OK.
NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.
DIVISION 2, NO BARRIER

HAZARDOUS AREA, DIVISION 2

NI CL 1...DIV 2...GR A-D;
SUITABLE CL I, II, III...DIV 2...GR F, G;
DIP DIV 1...CL II, III...GR E, F, G; IP66, 4X
T4 MAX AMBIENT TEMP. 75°C

ENCLOSURE IP66
NEMA 4X

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T120-000
409-T130-000
409-T140-000
409-T150-000

SEE SHEET 3 FOR SYSTEM MODEL NUMBERS
AND SENSING ELEMENTS

SEE SHEETS 12-17 FOR
409-T160 (CM6) RCT 16 SERIES
APPROVED MODEL NUMBERS

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.

48
6.2 FM Control Drawings (Continued)

DIVISION 2, NO BARRIER

HAZARDOUS AREA, DIVISION 2

NI CL 1...DIV 2...GR A-D;
SUITABLE CL 1, II, III...DIV 2...GR F, G;
DIP DIV 1...CL 1, II, III...GR E, F, G; IP66, 4X
T4 MAX AMBIENT TEMP. 75°C

NONHAZARDOUS AREA

ENCLOSURE IP66
NEMA 4X

POWER
SUPPLY
+ Um ≤ 250 V
12-30 VDC

NOTEs:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 Volts.

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T120-000 SEE SHEETS 12-17 FOR
409-T130-000 409-T160 (CM6) RCT 16 SERIES;
409-T140-000 APPROVED MODEL NUMBERS
409-T150-000

MODEL NUMBERS OF 380 SERIES CABLES
(REMOTE ONLY) MAX CABLE LENGTH 150' (45m)
380-0XXX-a-b-c
XXX = LENGTH IN FEET
a = 0, 5 OR BLANK
b = 1, 2
C = 0, 2, 8

PROBE ENCLOSURE IP66
NEMA 4X (CONDUIT)
380 SERIES CABLE

PROCESS VESSEL

700 SERIES SENSING ELEMENT

409-T100 SERIES
RCT SERIES
V+
V-

PROBE SHIELD
IS ENTITY INSTALLATIONS

HAZARDOUS AREA

IS CL I, II, III...DIV 1...GR A-G;
1P66, 4X, T4 MAX AMBIENT TEMP. 75°C

OPTIONAL DISPLAY
401-0044-003

ENCLOSURE IP66

FM APPROVED INTRINSIC SAFETY BARRIER OR EQUIVALENT

POWER SUPPLY
Um = 250 V

RCT 16 abCoOde
a: DISPLAY = 0, 1
b: SOFTWARE = 0, A-J, M

c: SENSOR PROTECTION = 0, 4

d: SENSOR = 00, 04, 05, 0A, 0B

e: 14 CHARACTER EXPANDED NUMBER SYSTEM,
DOES NOT AFFECT SAFETY

700 SERIES SENSING ELEMENT

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.

AMETEK DREXELBROOK

Copyright 2005

RCT 16 SERIES LEVEL SYSTEMS CM6
HART COMPATIBLE WITH
409-T160 SERIES TRANSMITTERS.
FM IS ENTITY INSTALLATION
DRAWING (INTEGRAL)
6.2 FM Control Drawings (Continued)

HAZARDOUS AREA

IS CL I, II, III...DIV 1...GR A-G;
IP66, 4X, T4 MAX AMBIENT TEMP. 75°C

IN CONSTRUCTION

FM APPROVED INTRINSICALLY SAFE BARRIER OR EQUIVALENT

NOTE: CONNECT ONLY TO CERTIFIED INTRINSICALLY SAFE CIRCUIT WITH THE FOLLOWING VALUES:
U ≤ 30 V
I ≤ 140mA
P ≤ 1W

NONHAZARDOUS AREA

POWER SUPPLY
Um = 250 V

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.
DIVISION 2, NO BARRIER

HAZARDOUS AREA, DIVISION 2

NI CL I, II, III, ...DIV 2...GR A-D;
SUITE CL I, II, III...DIV 2...GR F, G;
DIP DIV 1...CL II, III...GR E, F, G; IP66, 4X
T4 MAX AMBIENT TEMP. 75°C

ENCLOSURE IP66
NEMA 4X

409-T160 SERIES
RCT 16 SERIES

V+
V-

PROBE
SHIELD

PROCESS VESSEL

700 SERIES SENSING ELEMENT

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.
HAZARDOUS AREA, DIVISION 2

NI CL 2...DIV2...GR A-D;
SUITABLE CL 1, II, III...DIV2...GR F, G;
DIP DIV 1...CL 1, II, III...GR E, F, G; IP66, 4X
14 MAX AMBIENT TEMP. 75°C

NONHAZARDOUS AREA

POWER
SUPPLY
+

- Um ≤ 250 V
12-30 VDC

6.2 FM Control Drawings (Continued)

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.
EXPLOSIONPROOF INSTALLATIONS

HAZARDOUS AREA

XP CL l...DIV 1...GR A-D;
IS CL I, II, III...DIV 1...GR A-G;
NI CL l...DIV 2...GR A-D; IP66, 4X
DIP DIV 1 CL II, III GR E,F,G
T4 MAX AMBIENT TEMP. 75°C

NON-HAZARDOUS AREA

NOTE: CONNECT ONLY TO CERTIFIED INTRINSICALLY SAFE CIRCUIT WITH THE FOLLOWING VALUES:
U = 30 V
I = 140mA
P = 1W

RCT 16 abGcCode
a: DISPLAY = 0, 1
b: SOFTWARE = 0, A-J, M
c: SURGE PROTECTION = 0, 4
d: SENSOR = 00, 04, 05, 0A, 0B
e: 14 CHARACTER EXPANDED NUMBER SYSTEM, DOES NOT AFFECT SAFETY

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANSI/ISA RP 12.06.01.
2. MAXIMUM AMBIENT OPERATING TEMPERATURE INSIDE THE ENCLOSURE IS 75°C. USE SUPPLY WIRING RATED FOR 90°C OR HIGHER.
3. ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.
6.2 FM Control Drawings (Continued)

Hazardous Area

IS CL I, II, III...DIV 1...GR A-G;
NI CL I, II, III...DIV 2...GR A-D; IP66, 4X
T4 MAX AMBIENT TEMP. 75°C

Nonhazardous Area

FM APPROVED INTRINSIC SAFETY BARRIER OR EQUIVALENT

Power Supply

Um = 250 V

Model Numbers of Certified Systems

RCT 16 abGdEf
a: DISPLAY = 0, 1
b: SOFTWARE = 0, A-J, M
c: SURGE PROTECTION = 0, 4
d: CABLE = 1-G, A-H

MAX CABLE LENGTH 150' (48m)
e: SENSING ELEMENT = 00, 04, 05, 0A, 0B
f: 14 CHARACTER EXPANDED NUMBER SYSTEM,
DOES NOT AFFECT SAFETY

Notes:
1. The installation must be in accordance with the National Electrical Code and ANSI/ISA RP.12.06.01.
2. Maximum ambient operating temperature inside the enclosure is 75°C. Use supply wiring rated for 90°C or higher.
3. Associated apparatus must not JSE or generate more than 250 volts.
HAZARDOUS (CLASSIFIED) AREA

CL I, OR A,B,C&D; INTRINSICALLY SAFE; Ex ia
CL II, OR E,F&G; CL III
MAX. AMB. 75°C T4
CLASS I, ZONE 0, 1I (Ex ia)

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T120-000
409-T130-000
409-T140-000
409-T150-000

SEE SHEET 3 FOR SYSTEM MODEL NUMBERS AND SENSING ELEMENTS

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1, APPENDIX F.
2. CABLE FITTINGS SUPPLIED ARE "WEATHER RESISTANT". THEY ARE NOT CERTIFIED AS "EXPLOSIONPROOF" (XP) OR "FLAMEPROOF" (d) UNLESS THEY ARE MARKED. REPLACE WITH APPROPRIATE SEAL FITTINGS AS REQUIRED.
3. FOR AMBIENT TEMPERATURE ABOVE 70°C USE WIRING RATED 75°C OR HIGHER.
4. USE COPPER WIRING ONLY.
5. NO REVISIONS TO THIS DRAWING WITHOUT CSA APPROVAL.
6. UNUSED OPENINGS MUST BE PROPERLY SEALED TO MAINTAIN ENCLOSURE ENVIRONMENTAL AND/OR HAZARDOUS LOCATION RATINGS.
7. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

NONHAZARDOUS AREA

ANY CSA CERTIFIED I.S. BARRIER WITH ENTITY PARAMETERS
- Voc OR Uo < 30 V,
- Isc OR Io < 140 mA
- AND Po < 1W.

ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS WITH ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS SYSTEM WHEN Ca > Ci = Ccable AND Lo > Li = Lcable IN ADDITION TO
- Voc OR Uo < Uc, Isc OR Io < Ic AND Po < Pc.

AMETEK
DREXELBROOK
RCT SERIES LEVEL SYSTEMS
HART COMPATIBLE WITH
409-TIXX SERIES TRANSMITTERS.
CSA INSTALLATION DRAWING (INTEGRAL)

CERTIFIED by 3-26-2014 2F 3-26 COPYRIGHT 2006
AMETEK DREXELBROOK
205 KEITH VALLEY RD
HERSHEY, PA 17033-9686
215-674-1234 215-674-2723
420-0004-225-CD 5/17
HAZARDOUS (CLASSIFIED) AREA

CL I, II A, B, C, D; INTRINSICALLY SAFE; Ex ia
CL II, III A, E, F, G, I
MAX. AMB. 75°C T4
CLASS I, ZONE O, I, C (Ex ia)

NONHAZARDOUS AREA

ANY CSA CERTIFIED I.S. BARRIER
WITH ENTITY PARAMETERS
Vac Or Uo < 30 V,
Isc Or Io < 140 mA
AND Po < Iw.

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T120-000 409-T140-000
409-T130-000 409-T150-000

MODEL NUMBERS OF 380 SERIES CABLES
(Remote Only) Max Cable Length 150 (48 m)
380-0XXX-abc
XXX = Length in Feet
a = 0.5 OR Blank
b = 1.2
C = 0.2 8

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART I, APPENDIX F.
2. CABLE FITTINGS SUPPLIED ARE "WEATHER RESISTANT". THEY ARE NOT CERTIFIED AS "EXPLOSIONPROOF" (XP1) OR "FLAMMEOOF" (d)
3. FOR AMBIENT TEMPERATURE ABOVE 70°C USE WIRING RATED 75°C OR HIGHER.
4. USE COPPER WIRING ONLY.
5. NO REVISIONS TO THIS DRAWING WITHOUT CSA APPROVAL.
6. UNPUSED OPENINGS MUST BE PROPERLY SEALED TO MAINTAIN ENCLOSURE ENVIRONMENTAL AND/OR HAZARDOUS LOCATION RATING.
7. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANT PEU COMPROMETTE LA SECURITE INTRINSIQUE.

CERTIFIED by
AMETEK DREXELBROOK
RCT SERIES LEVEL SYSTEMS
HART COMPATIBLE WITH
409-T1XX SERIES TRANSMITTERS.
CSA INSTALLATION DRAWING (REMOTE)
6.3 CSA Control Drawings (Continued)
### 6.3 CSA Control Drawings (Continued)

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<th>Columns 15 and up do not affect safety</th>
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SPECIAL... SEE BELOW FOR ADDITIONAL 700 SERIES MODEL NUMBERS

MODEL NUMBERS OF APPROVED INTRINSICALLY SAFE SENSING ELEMENTS

700-ns-001 LEVEL PROBE

n = FAMILY NO. 0 THROUGH 9, BLANK
p = 0 THROUGH 9, BLANK
q = FAMILY NO. 0 THROUGH 9, BLANK
r = FAMILY NO. 0 THROUGH 9, BLANK
s = FAMILY NO. 0 THROUGH 9

A = 14 CHARACTER EXPANDED NUMBERING SYSTEM, DOES NOT AFFECT SAFETY

INSERTION LENGTH/FOOTPRINT LENGTH

A = 2-1/4" 1-1/4"
B = 2-1/4" 1-1/4"
C = 2-1/4" 1-1/4"
D = 2-1/4" 1-1/4"
E = 2-1/4" 1-1/4"
F = 2-1/4" 1-1/4"
G = 2-1/4" 1-1/4"
H = 2-1/4" 1-1/4"
I = 2-1/4" 1-1/4"
J = 2-1/4" 1-1/4"
K = 2-1/4" 1-1/4"

CERTIFIED by

AMETEK DREXELBROOK

CSA APPROVED RCT SERIES
MODEL NUMBERING SYSTEM (INTEGRAL)
### 6.3 CSA Control Drawings (Continued)

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<th>3-1-06</th>
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<td>11-17-05</td>
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<td>7-05-217</td>
<td>TP</td>
<td>8-3-05</td>
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<td>SGA</td>
<td>5-23-05</td>
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</table>

**AMETEK DREXELBROOK**

**CSA APPROVED**

**RCT SERIES**

**MODEL NUMBERING SYSTEM**

**REMOTE**

**DATE**

**AMETEK DREXELBROOK**

205 Keith Valley Rd
Horsham, PA 19044-9986

215-674-1234
Fax 215-674-2734

420-0004-225-CD

**Copyright 2006 AMETEK DREXELBROOK**

**Scale None**

**All Dimensions in Inches**

**Certified by**

**Date**
6.3 CSA Control Drawings (Continued)
### 6.3 CSA Control Drawings (Continued)

<table>
<thead>
<tr>
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<th>C</th>
<th>D</th>
<th>E</th>
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**CM6™ Cut Monitor**

**6.3 CSA Control Drawings (Continued)**

- **Sheet 2 of 2**

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<th>Columns 13 and up do not affect safety</th>
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<td>Model numbers of approved intrinsically safe sensing elements</td>
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<td>700-nop-qr-1 level probe</td>
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<td>n = FAMILY NO. 0 THROUGH 9, BLANK</td>
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<tr>
<td>o = FAMILY NO. 0 THROUGH 9, BLANK</td>
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<tr>
<td>p = FAMILY NO. 0 THROUGH 9, BLANK</td>
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<td>q = FAMILY NO. 0 THROUGH 9, BLANK</td>
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<tr>
<td>r = FAMILY NO. 0 THROUGH 9, BLANK</td>
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<tr>
<td>s = FAMILY NO. 0 THROUGH 9, BLANK</td>
</tr>
<tr>
<td>t = 14 character expanded numbering system, does not affect safety</td>
</tr>
</tbody>
</table>

**Insertion constant/seefeld length**

- A
- B
- C
- D

- M
- N
- O
- P

- S
- T
- U
- V

**Certified by**

**Model numbering system**

**Series RCT**

- Remote

**CSA approved**
6.3 CSA Control Drawings (Continued)

HAZARDOUS (CLASSIFIED) AREA

CL I, OR A,B,C&D; INTRINSICALLY SAFE; Ex ia
CL II, OR E,F,G, CL III
MAX. Amb. 75°C T4
CLASS I, ZONE 0, 11C (Ex ia)

FOR INDOOR LOCATIONS, ENCLOSURE MUST BE MINIMUM IP20, TYPE 2 RATED.
FOR OUTDOOR LOCATIONS ENCLOSURE MUST BE MINIMUM IP44, TYPE 4X RATED.
FOR CLASS II DUST LOCATIONS, MINIMUM IP56, TYPE 4.
A HIGHER DEGREE MAY BE REQUIRED FOR HARSH ENVIRONMENTS. SEE NOTE 1.

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T120-000
409-T130-000
409-T140-000
409-T150-000

THE INTEGRAL MOUNTED SENSING ELEMENT MUST NOT EXCEED 75°C.

MODEL NUMBERS OF CERTIFIED INTRINSICALLY SAFE SENSING ELEMENTS
700-mmop-qr-t LEVEL PROBE
m = FAMILY NO. 0 THROUGH 9, BLANK
n = FAMILY NO. 0 THROUGH 9, BLANK
q = 0 THROUGH 9, BLANK
r = 0 THROUGH 9
s = FAMILY NO. 0 THROUGH 9, BLANK
t = 14 CHARACTER EXPANDED NUMBERING SYSTEM.

700 SERIES SENSING ELEMENT

NONHAZARDOUS AREA

OPTIONAL DISPLAY
401-0044-003

OPTIONAL RFI FILTER
401-0016-020

PROCESS VESSEL

ANT Friendly... CSA CERTIFIED I.S. BARRIER WITH ENTITY PARAMETERS
Voc or Ue < 30 V
Iqc or Ic < 140 mA
AND Po < 1 W.

"ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWS WHEN INSTALLING THIS EQUIPMENT."

"THE ENTITY CONCEPT ALLS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS WITH ASSOCIATED APPARATUS NOT SPECIFLY EXAMINED IN COMBINATION AS SYSTEM WHEN Co > C or Ci > C and Po > Li + Lcable IN ADDITION TO
Voc or Ue < U1, Iqc or Ic < I1 AND Po < Pi."

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART I, APPENDIX F.
2. CABLE FITTINGS SUPPLIED ARE "WEATHER RESISTANT," THEY ARE NOT CERTIFIED AS "EXPLOSION PROOF" (XP) OR "FLAME PROOF" (d)
   UNLESS THEY ARE MARKED. REPLACE WITH APPROPRIATE SEAL FITTINGS AS REQUIRED.
3. FOR AMBIENT TEMPERATURE ABOVE 70°C USE WIRING RATED 75°C OR HIGHER.
4. USE COPPER WIRING ONLY.
5. NO REVISIONS TO THIS DRAWING WITHOUT CSA APPROVAL.
6. UNUSED OPENINGS MUST BE PROPERLY SEALED TO MAINTAIN ENCLOSURE ENVIRONMENTAL AND/OR HAZARDOUS LOCATION RATINGS.
7. WARNING, SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
   AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.

CERTIFIED BY

PD #

EMG

USER

ISS (EDO/DSN NO APP) DATE

AMETEK DREXELBROOK

420-0004-225-CD

205 KEITH VALLEY RD
HERSHAM, PA 19044-9930
215-674-1234
FAX 215-674-2131

DRAWINGS

SHL 8 OF 12

DF 17
6.3 CSA Control Drawings (Continued)

DIVISION 2, NO BARRIER

HAZARDOUS AREA, DIVISION 2

NONHAZARDOUS AREA

CL 1, DIV 2, GR A, B, C&D
CL II, GR E, F & G, CL III
MAX. AMB. 75°C T4
CLASS 1, ZONE 2

ENCLOSURE IP66
NEMA 4X

406-6100 SERIES
"LCF3"
LEVEL CONTROL

+ POWER
SUPPLY

- Umax ≤ 250 V
12-30 VDC

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T120-000
409-T130-000
409-T140-000
409-T150-000

THE INTEGRAL MOUNTED
SENSING ELEMENT MUST
NOT EXCEED 75°

PROBE SHIELD

PROCESS MUST USE
NONFLAMMABLE LIQUID
OR BE CLASSIFIED AS
DIVISION 2 OR ZONE 2.

700 SERIES
SENSING ELEMENT

SEE SHEET 3 FOR SYSTEM MODEL NUMBERS
AND SENSING ELEMENTS

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1, APPENDIX F.
2. CABLE FITTINGS SUPPLIED ARE "WEATHER RESISTANT". THEY ARE NOT CERTIFIED AS "EXPLOSIONPROOF" (XP) OR "FLAMEPROOF" (d) UNLESS THEY ARE MARKED. REPLACE WITH APPROPRIATE SEAL FITTINGS AS REQUIRED.
3. FOR AMBIENT TEMPERATURE ABOVE 70°C USE WIRING RATED 75°C OR HIGHER.
4. USE COPPER WIRING ONLY.
5. NO REVISIONS TO THIS DRAWING WITHOUT CSA APPROVAL.
6. UNUSED OPENINGS MUST BE PROPERLY SEALED TO MAINTAIN ENCLOSURE ENVIRONMENTAL AND/OR HAZARDOUS LOCATION RATINGS.
7. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANT PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.

CERTIFIED

AMETEK
DREXELBROOK

NO. 420-0004-225-CD

DRAWINGS

205 KEITH VALLEY RD
HERSHEY, PA 17033-9216
215-674-1234
FAX 215-674-2733

2002
5 sections

DRAWING NO.
420-0004-225-CD
SHEET 7 OF 17

DREW

AMETEK DREXELBROOK
HAZARDOUS (CLASSIFIED) AREA

CL I, GR A.B.C&D; INTRINSICALLY SAFE; Ex ia
CL II, GR E,F&G; CL III
MAX. AMB. 75°C T4
CLASS 1, ZONE 0, T1C (Ex ia)

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T160-000

MODEL NUMBER OF CERTIFIED SYSTEMS
RCT 16 abcCode
a: DISPLAY = O, 1
b: SOFTWARE = 0, A-J, M
c: SURGE PROTECTION = 0, 1, 4, 7
d: SENSOR = 00, 04, 05, 06, 0A, 0B
e: 14 CHARACTER EXPANDED NUMBER SYSTEM.
DOES NOT AFFECT SAFETY

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1, APPENDIX F.
2. CABLE FITTINGS SUPPLIED ARE "WEATHER RESISTANT". THEY ARE NOT CERTIFIED AS "EXPLOSIONPROOF" (XP) OR "FLAMEPROOF" (d)
   UNLESS THEY ARE MARKED. REPLACE WITH APPROPRIATE SEAL FITTINGS AS REQUIRED.
3. FOR AMBIENT TEMPERATURE ABOVE 70°C USE WIRING RATED 75°C OR HIGHER.
4. USE COPPER WIRING ONLY.
5. NO REVISIONS TO THIS DRAWING WITHOUT CSA APPROVAL.
6. UNUSED OPENINGS MUST BE PROPERLY SEALED TO MAINTAIN ENCLOSURE ENVIRONMENTAL AND/OR HAZARDOUS LOCATION RATINGS.
7. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
   AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANT PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.

CERTIFIED by __________
PD # ______
ENG ______
USER ______

DE # ______
ISD: EOD/DSR NO APP: 0 DATE 04.25.13

AMETEK DREXELBROOK
205 KEITH WALLEY RD
ERIKSHAM, PA 19044-9988
215-674-1234
FAX 215-674-2733

420-0004-225-CD

6.3 CSA Control Drawings (Continued)

NONHAZARDOUS AREA

"ANY CSA CERTIFIED I.S. BARRIER WITH ENTITY PARAMETERS
Voc OR Ut < 30 V
Isc OR It < 140 mA
AND Po < 1 W."

"ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT"

"THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS WITH ASSOCIATED APPARATUS
NOT SPECIFICALLY EXAMINED IN COMBINATION AS SYSTEM WHEN Ci > Ci = Cable AND
Co > Li = Cable in ADDITION TO
Voc or Ut < Ui, Isc or It < Ii AND Po < Pi."

"OPTIONAL DISPLAY 401-00-003"
ENCLousure IP66

OPTIONAL RF FILTER 401-0016-020

PROBE SHIELD

409-T160 SERIES
RTC SERIES
LEVEL CONTROL
Ui = 30VDC
1 = 100A
Po = 1W
Ci = 0.001uf
Li = 0
Tamb = -40°C...+75°C GROUND

PROCесс VESSEL

700 SERIES
SENSING ELEMENT
# 6.3 CSA Control Drawings (Continued)

## Division 2, No Barrier

**HAZARDOUS AREA, DIVISION 2**

<table>
<thead>
<tr>
<th>CLASS 1, ZONE 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Amb. 75°C 14</td>
</tr>
</tbody>
</table>

**NONHAZARDOUS AREA**

**ENCLOSURE IP66 NEMA 4X**

**MODEL NUMBERS OF CERTIFIED TRANSMITTER**

| 409-T160-000 |

**MODEL NUMBER OF CERTIFIED SYSTEMS**

<table>
<thead>
<tr>
<th>RCT16 0bCCode</th>
</tr>
</thead>
<tbody>
<tr>
<td>a: DISPLAY = 0, 1</td>
</tr>
<tr>
<td>b: SOFTWARE = 0, A-J, M</td>
</tr>
<tr>
<td>c: SURGE PROTECTION = 0, 1, 4, 7</td>
</tr>
<tr>
<td>d: SENSOR = 00, 04, 05, 06, 08, 0B</td>
</tr>
<tr>
<td>e: 14 CHARACTER EXPANDED NUMBER SYSTEM, DOES NOT AFFECT SAFETY</td>
</tr>
</tbody>
</table>

**NOTES:**

1. The installation must be in accordance with the Canadian Electrical Code, Part 1, Appendix F.
2. Cable fittings supplied are "weather resistant", they are not certified as "explosionproof" (XP) or "flameproof" (d) unless they are marked. Replace with appropriate seal fittings as required.
3. For ambient temperature above 70°C use wiring rated 75°C or higher.
4. Use copper wiring only.
5. No revisions to this drawing without CSA approval.
6. Unused openings must be properly sealed to maintain enclosure environmental and/or hazardous location ratings.
7. Warning: Substitution of components may impair intrinsic safety.

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**AMETEK DREXELBROOK**

**RCT16 SERIES CM6 LEVEL SYSTEMS**

HART compatible with 409-T160 SERIES TRANSMITTERS.

CSA INSTALLATION DRAWING (INTEGRAL) DIVISION 2, NO BARRIER

205 Keith Valley Rd
Horsham, PA 19044-9965

215-674-1234
FAX 215-674-2723

420-0004-225-CD

Sht. 14 of 17
DIVISION 2, NO BARRIER

HAZARDOUS AREA, DIVISION 2

CL I, DIV 2, GR A, B, C & D
CL II, GR E, F & G, CL III
MAX. AMB. 75°C T4
CLASS 1, ZONE 2

NONHAZARDOUS AREA

POWER SUPPLY
+ - Unm ≤ 250 V
12-30 VDC

CM6™ Cut Monitor

380 SERIES CABLE

ENCLOSURE IP66 NEMA 4X (CONDULET)

SERIES 700 SENSING ELEMENT

MAX. TEMP. T-CODE
85° 16
100° 15
135° 14
200° 13

PROCESS MUST USE NONFLAMMABLE LIQUID OR BE CLASSIFIED AS DIVISION 2 OR ZONE 2.

406-6100 SERIES "LC13"
LEVEL CONTROL
PROBE SHIELD

700 SERIES SENSING ELEMENT

MODEL NUMBERS OF CERTIFIED TRANSMITTER
409-T160-000

MODEL NUMBER OF CERTIFIED SYSTEMS
RCT6 abcCde
a: DISPLAY = 0, 1
b: SOFTWARE = 0, A, J, M
c: SURGE PROTECTION = 0, 1, 4, 7
d: CABLE = 1-9, A-H
f: 14 CHARACTER EXPANDED NUMBER SYSTEM,
DOES NOT AFFECT SAFETY

NOTES:
1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1, APPENDIX F.
2. CABLE FITTINGS SUPPLIED ARE "WEATHER RESISTANT". THEY ARE NOT CERTIFIED AS "EXPLOSIONPROOF" (XP) OR "FLAMEPROOF" (d)
   UNLESS THEY ARE MARKED, REPLACE WITH APPROPRIATE SEAL FITTINGS AS REQUIRED.
3. FOR AMBIENT TEMPERATURE ABOVE 75°C USE WIRING RATED 75°C OR HIGHER.
4. USE COPPER WIRING ONLY.
5. NO REVISIONS TO THIS DRAWING WITHOUT CSA APPROVAL.
6. UNUSED OPENINGS MUST BE PROPERLY SEALED TO MAINTAIN ENCLOSURE ENVIRONMENTAL AND OR HAZARDOUS LOCATION RATINGS.
7. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
   AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.

CERTIFIED

AMETEK DREXELBROOK

RCT16 SERIES CM6 LEVEL SYSTEMS
HART COMPATIBLE WITH
409-T160 SERIES TRANSMITTERS.
CSA INSTALLATION
DRAWING (REMOTE)
DIVISION 2, NO BARRIER

420-0004-225-CD
EXPLOSIONPROOF INSTALLATIONS

CL I, DIV 1, GR A.B.C.D: CL II, 
GR E.F.G: CL III 
14 MAX AMBIENT TEMP. 75°C 
IP66 TYPE 4.4X

RCT 16 s6gGode
a: DISPLAY = 0, 1
b: SOFTWARE = 0, A-J, M
C: SURGE PROTECTION = 0, 4
d: SENSOR = 00, 04, 05, 0A, 0B
e: 14 CHARACTER EXPANDED NUMBER SYSTEM.
DOES NOT AFFECT SAFETY

THE INTEGRAL MOUNTED SENSING ELEMENT MUST
NOT EXCEED 75°C

OPTIONAL DISPLAY
401-0044-003

CL71

6.3 CSA Control Drawings (Continued)
6.3 CSA Control Drawings (Continued)

**EXPLOSIONPROOF INSTALLATIONS**

**HAZARDOUS AREA**

- CL DIV 1, OR A.B.C.D: CL II, GR E.F.G: CL III
- T4 MAX AMBIENT TEMP. 75°C

**NONHAZARDOUS AREA**

- "ANY CSA CERTIFIED I.S. BARRIER WITH ENTITY PARAMETERS
  Voc OR Uo < 30 V,
  Isc OR Io < 140 mA
  AND Po < 1 W."

**SERIES 700 SENSING ELEMENT**

- RCT 16 abGcdef
- MAX TEMP. T-CODE
  - 85°C: T6
  - 100°C: T5
  - 125°C: T4
  - 200°C: T3

**NOTES:**

1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1, APPENDIX F.
2. CABLE FITTINGS SUPPLIED ARE "WEATHER RESISTANT," THEY ARE NOT CERTIFIED AS "EXPLOSIONPROOF" (XP) OR "FLAMEPROOF" (d) UNLESS THEY ARE MARKED, REPLACE WITH APPROPRIATE SEAL FITTINGS AS REQUIRED.
3. FOR AMBIENT TEMPERATURE ABOVE 70°C USE WIRING RATED 75°C OR HIGHER.
4. USE COPPER WIRING ONLY.
5. NO REVISIONS TO THIS DRAWING WITHOUT CSA APPROVAL.
6. UNIMPLANTED OPENINGS MUST BE PROPERLY SEALED TO MAINTAIN ENCLOSURE ENVIRONMENTAL AND/OR HAZARDOUS LOCATION RATINGS.
7. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
8. FOR EXPLOSIONPROOF INSTALLATION - TURN OFF POWER BEFORE REMOVING COVER.
9. WARNING - POSSIBLE SHOCK HAZARD WITH COVER REMOVED.

**CERTIFIED by**

**PD #**

**ENG**

**USER**

**DE #**

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**AMETEK DREXELBROOK**

**RCT 16 SERIES LEVEL SYSTEMS CM6 HART COMPATIBLE WITH 409-T160 SERIES TRANSMITTERS, CSA EXPLOSIONPROOF INSTALLATION DRAWING (REMOTE).**

**205 KEITH VALLEY RD KIRKLAND, PA 19064-3805**

**215-671-1234 FAX 215-671-2731**

**420-0004-225-CD**

**OF 17**

**SS**

**SS 01-24-06**

**DO**

**ISS EDD/DSR NO APP OF DATE**

**CM6 Cut Monitor**
GENERAL: ALL ORDERS ARE SUBJECT TO THE FOLLOWING TERMS AND CONDITIONS. ANY ACCEPTANCE OF ANY OFFER OF BUYER FOR ANY GOODS OR SERVICES IS CONDITIONED UPON THESE TERMS AND CONDITIONS, AND SELLER OBJECTS TO ANY ADDITIONAL OR DIFFERENT TERMS OR CONDITIONS PROPOSED BY ANY DOCUMENT, WHICH SHALL NOT BE BINDING UPON SELLER. No salesman or other party is authorized to bind AMETEK DREXELBROOK Division of AMETEK, Inc. (hereinafter “Seller”) by any agreement, warranty, statement, promise, or understanding not herein expressed, and no modifications shall be binding on Seller unless the same are in writing, and signed by an executive officer of Seller or his or her duly authorized representative. Verbal orders shall not be executed until written notification has been received and acknowledged by Seller.

QUOTATIONS: Written quotations are valid for thirty (30) days unless otherwise stated. Verbal quotations expire the same day they are made.

PRICES: All prices and terms are subject to change without notice. Buyer-requested changes to its order (“Orders”), including those affecting the identity, scope and delivery of the goods or services, must be documented in writing and are subject to Seller’s prior approval and adjustments in price, schedule and other affected terms and conditions. Orders requiring certified test data in excess of commercial requirements, are subject to a special charge.

ORDER ACCEPTANCE: All Orders are subject to final approval and acceptance by Seller at its office located at 205 Keith Valley Road, Horsham, Pennsylvania 19044.

TERMS OF PAYMENT: Seller's standard terms of payment for Buyers who qualify for credit are not thirty (30) days from date of invoice. All invoices must be paid in United States dollars.

CREDIT: Seller reserves the right at any time to revoke any credit extended to Buyer or otherwise modify the terms of payment. Buyer may fail to pay for any shipments when due. Seller’s opinion is that a material adverse change in Buyer’s financial condition. Seller, at its option, cancel any accepted Order if Buyer fails to pay any invoices when due.

DELIVERY: Shipments are F.O.B. place of manufacture (“Shipping Point”) and the Buyer shall pay all freight, transportation, insurance, duties, fees, taxes, storage, damage or similar charges from Shipping Point. Delivery of goods to common carrier shall constitute delivery and passing of title to the Buyer, and all risk of loss or damage in transit shall be borne by Buyer. Any claims for loss or damages for damage or destruction after such delivery shall be the responsibility of Buyer.

Seller reserves the right to make delivery in installments which shall be separately invoiced and paid for when due, without regard to subsequent deliveries. Delay in delivery of any installment shall not relieve Buyer of its obligation to accept remaining deliveries.

Acknowledged shipping dates are approximate only and based on prompt receipt of all necessary information from Buyer and Buyer’s compliance with terms of payment.

TAXES: All sales, excise and similar taxes which Seller may be required to pay or collect with respect to the goods and/or services covered by any Order, shall be for the account of the Buyer except as otherwise provided by law or unless specifically stated otherwise by Seller in writing.

TERMINATION AND HOLD ORDERS: No Order may be terminated by Buyer except upon written request by Buyer and approval by Seller, and if said request is approved by Seller, under the following conditions: (1) Buyer agrees to accept delivery of all of the units completed by Seller through the workday on which Seller receives the written termination request; (2) Buyer agrees to pay to Seller all direct costs and expenses applicable to the portion of the Order that is incomplete.

WARRANTY: A. Hardware: Seller warrants its goods against defects in materials and workmanship under normal use and service for one (1) year from the date of invoice. B. Software: Seller warrants for a period of one (1) year from date of invoice that standard software or firmware, when used with Seller specified hardware, shall perform in accordance with Seller’s published specifications. Seller makes no representation or warranty, express or implied, as to any software or firmware shall be uninterrupted or error-free, or that functions contained therein shall meet or satisfy the Buyer’s intended use or requirements. C. Services: Seller warrants that services, including engineering and custom application, whether provided on a fixed cost or time and material basis, shall be performed in accordance with generally accepted industry practices.

D. Remedies: Seller’s liability under this section is restricted to replacing, repairing, or issuing credit (at Seller’s option) for any returned goods and only under the following conditions: (1) Seller must be promptly notified, in writing, as soon as possible after the defects have been noted by the Buyer, but not later than (1) year from date of invoice from Seller; (2) The defective goods are to be returned to the place of manufacture, shipping charges prepaid by the Buyer; (3) Seller’s inspection shall disclose that its goods were defective in materials or workmanship at the time of shipment; (4) Any warranty service (consisting of time, travel and expenses related to such services) performed other than at Seller’s factory, shall be at Buyer’s expense.

E. Repaired/Reconditioned Goods: As per our warranty terms which Seller has repaired or reconditioned, Seller warrants for a period of sixty (60) days from date of invoice only new components replaced in the most recent repair/reconditioning.

F. Returns and Adjustments: No goods may be returned unless authorized in advance by Seller and then only upon such conditions to which Seller may agree. Buyer must obtain an RMA (Return Material Authorization) number from Seller prior to any return shipment and such RMA number must appear on the shipping label and packing slip. Buyer shall be responsible for the returned goods until such time as Seller receives the same at its plant and for all charges for packing, inspection, shipping, insurance, and any similar charges from Shipping Point. In the event that credit for returned goods is granted, it shall be at the lesser of the then current replacement price or original purchase price. Claims for shortage or incorrect material must be made within five (5) days after receipt of shipment.

ALL OTHER WARRANTIES, FOR ANY OF SELLER’S GOODS OR SERVICES, WHETHER ORAL, WRITTEN, EXPRESS, IMPLIED, STATUTORY OR OTHERWISE, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE ARE EXCLUDED.

INTELLECTUAL PROPERTY: Seller’s sale of goods or provision of related documentation or other materials to Buyer shall not transfer any intellectual property rights to Buyer unless Seller specifically agrees to do so in writing. Seller shall retain ownership of all applicable patents, trademarks, copyrights and other intellectual property rights. Buyer shall not use, copy or transfer any such items in violation of Seller's intellectual property rights or applicable law, or for any purposes other than that for which the items were furnished.

Seller shall defend any lawsuit brought against the Buyer based on a claim that the design or construction of the goods sold hereunder by Seller infringe any United States or Canadian Patent, Copyright or Mask Work Registration, provided that Buyer promptly notifies Seller of such claim in writing and further provided that, at Seller’s expense, (1) Buyer gives Seller the right to defend or control the defense of the suit or proceeding, including settlement, and (2) Buyer provides all necessary information and assistance for that defense. In the event of a change of infringement, Seller’s obligation under the agreement shall be fulfilled if Seller, at its option and expense, either (i) settles such claim; or (ii) procures for Buyer the right to continue using such goods; (iii) replaces or modifies goods to avoid infringement; or (iv) accepts the return of any infringing goods and refunds their purchase price; or (v) defends against such claim.

If Buyer furnishes specifications or designs to Seller, the obligations of Seller set forth above shall not apply to goods made by Seller using such specifications or designs, and Buyer shall defend, indemnify and hold Seller harmless against any third party claims for infringement which arise out of Seller’s use of specifications or designs furnished by Buyer.

SOFTWARE LICENSE: If goods purchased hereunder include software (“Software”), Buyer may use the Software only as part of the goods. Buyer may not use, copy, or transfer any of the Software, except as may be included in the price of the goods. Published weights and dimensions are estimates or approximate only and are not warranted.

FORCE MAJEURE: Seller shall not be responsible for delays in delivery or any failure to deliver due to causes beyond Seller’s control, including but not limited to the following items: acts of God, war, terrorism, riots, embargoes, domestic or foreign governmental regulations or orders, governmental priorities, port congestion, acts of the Buyer, its agents or employees, fires, floods, strikes, lockouts and other labor difficulties, shortages of or inability to obtain shipping space or transportation, inability to secure fuel, supplies or power at current prices or on account of shortages thereof, or due to limitations imposed by Seller’s normal manufacturing facilities.

If a delay excused per the above extends for more than ninety (90) days and the parties have not agreed upon a revised basis for continuing the provision or services at the end of the delay, including adjustment of the price, then Buyer, upon thirty (30) days’ prior written notice to Seller may terminate the Order with respect to the unexecuted portion of the goods or services, whereupon Buyer shall promptly pay Seller its reasonable termination charges upon submission of Seller’s invoices thereof.

LIMITATION OF LIABILITY: Seller’s liability for any claim of any kind, except infringement of intellectual property rights, shall not exceed the purchase price of any goods or services which give rise to the claim. SELLER SHALL IN NO EVENT BE LIABLE FOR BUYER’S MANUFACTURING COSTS, LOSS PROFITS, LOSS OF USE OF THE GOODS OR SERVICES, COST OF CAPITAL, COST OF SUBSTITUTE GOODS, FACILITIES, SERVICES OR REPLACEMENT POWER, DOWNTIME COSTS, CLAIMS OF BUYER’S CUSTOMERS FOR DAMAGES, OR ANY SPECIAL, PROXIMATE, INCIDENTAL, INDIRECT, EXEMPLARY OR CONSEQUENTIAL DAMAGES. Any action against Seller must be brought within eighteen (18) months after the cause of action accrues. These disclaimers and limitations of liability shall apply regardless of the form of action, whether in contract, tort or otherwise, and further shall extend to the benefit of Seller’s vendors, suppliers, distributors and other authorized representatives.

PROHIBITION FOR HAZARDOUS USE: Goods sold hereunder generally are not intended for application in and shall not be used by Buyer in the construction or operation of a nuclear installation in connection with man use of nuclear energy, or in connection with any activity or critical application, where failure of a single component could cause substantial harm to persons or property, unless the goods have been specifically approved for such use or are so designated by the seller. Seller disclaims all liability for any loss or damage resulting from such unauthorized use and Buyer shall defend, indemnify and hold harmless the Seller against any such liability, whether as a result of breach of contract, warranty, tort (regardless of the degree of fault or negligence), strict liability or otherwise.

EXPORT CONTROL: Buyer shall comply with all export control laws and regulations of the United States, and all sales hereunder are subject to those laws and regulations. Seller shall not be named as shipper or exporter of record for any goods sold hereunder unless specifically agreed to in writing by Seller. At Seller’s request, Buyer shall furnish Seller with end-use and end-user information to determine export license applicability. Buyer warrants, in accordance with U.S. Export Law, that goods sold hereunder shall not be delivered to, or used by, anyone who is a listed person, country or entity responsible for any arms, or materials or activities involving nuclear, chemical or biological weapons, or related missile delivery systems in named prohibited regions or countries.

GOVERNING LAW: Seller intends to comply with all laws applicable to its performance under any order. All matters relating to interpretation and effect of these terms and any authorized changes, modifications or amendments thereto shall be governed by the laws of the Commonwealth of Pennsylvania. No provisions of this Agreement are intended to give rights to the goods or services, this agreement, or act to bind Seller unless specifically agreed to by Seller in writing.

NO-WAIVER BY SELLER: Waiver by Seller of a breach of any of these terms and conditions shall not be construed as a waiver of any other breach. SEVERABILITY AND ENTIRE AGREEMENT: If any provision of these terms and conditions is unenforceable, the remaining terms shall nonetheless continue in full force and effect. This writing, together with any other terms and conditions Seller specifically agrees to in writing, constitutes the entire terms and conditions of sale between Buyer and Seller and supersedes any and all prior discussions, and negotiations on its subject matter.