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Installation and Operating Instructions

RCT 10,11, 12 & 13 Series Transmitter with HART® Protocol using 409-T Electronics

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Issue #6

RCT Series Transmitter with HART® Protocol using 409-T Electronics



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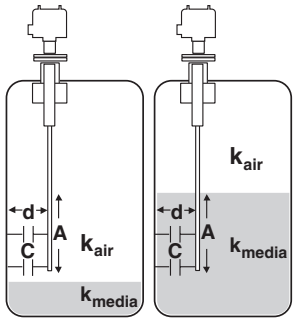
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SECTION 1

SECTION 1: INTRODUCTION

1.1 System Description



$$C = \frac{k\,A}{d} \qquad C\uparrow = \frac{k\uparrow A}{d}$$

Figure 1-1 Capacitance Sensing Element

The instructions in this manual are for the AMETEK Drexelbrook RCT Series RCT Series for level measurement in liquids, slurries, interfaces, and granulars.

Each AMETEK Drexelbrook RCT Series system consists of a RCT Series two-wire, 4-20 mA electronic unit and a 700 series sensing element. A 380 series connecting cable is also supplied for connection of the sensing element to the electronic unit.

The RCT Series system is an admittance-to-current transducer. A change in level produces a change in admittance which results in a change of current. It is termed a two-wire transmitter because the same two wires that are used to power the unit also indicate the change in level (4-20 mA).

1.2 Technology

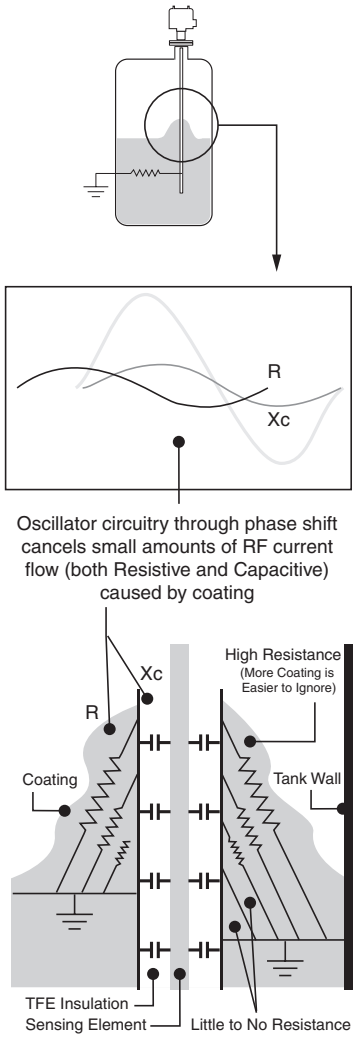


Figure 1-2 RF Admittance Sensing Element with Cote-Shield

In a simple capacitance sensing element, when the level rises and material covers the sensing element, the capacitance within the circuit between the sensing element and the medium (conductive applications) or the sensing element and the vessel wall (insulating applications) increases. This is due to the dielectric constant (k) of the material which causes a bridge misbalance. The signal is demodulated (rectified), amplified, and the output is increased. There are drawbacks, however, especially when there is coating of the sensing element.

An RF Admittance level transmitter is the next generation. Although similar to the capacitance concept, RCT Series employs a radio frequency signal and adds the Cote-Shield™ circuitry within the Electronics Unit.

Built-in oscillator buffer and chopper drive circuits permit separate measurement of resistance and capacitance. Since the resistance and the capacitance of any coating are of equal magnitude (by physical laws), the error generated by a coating can be measured and subtracted from the total output.

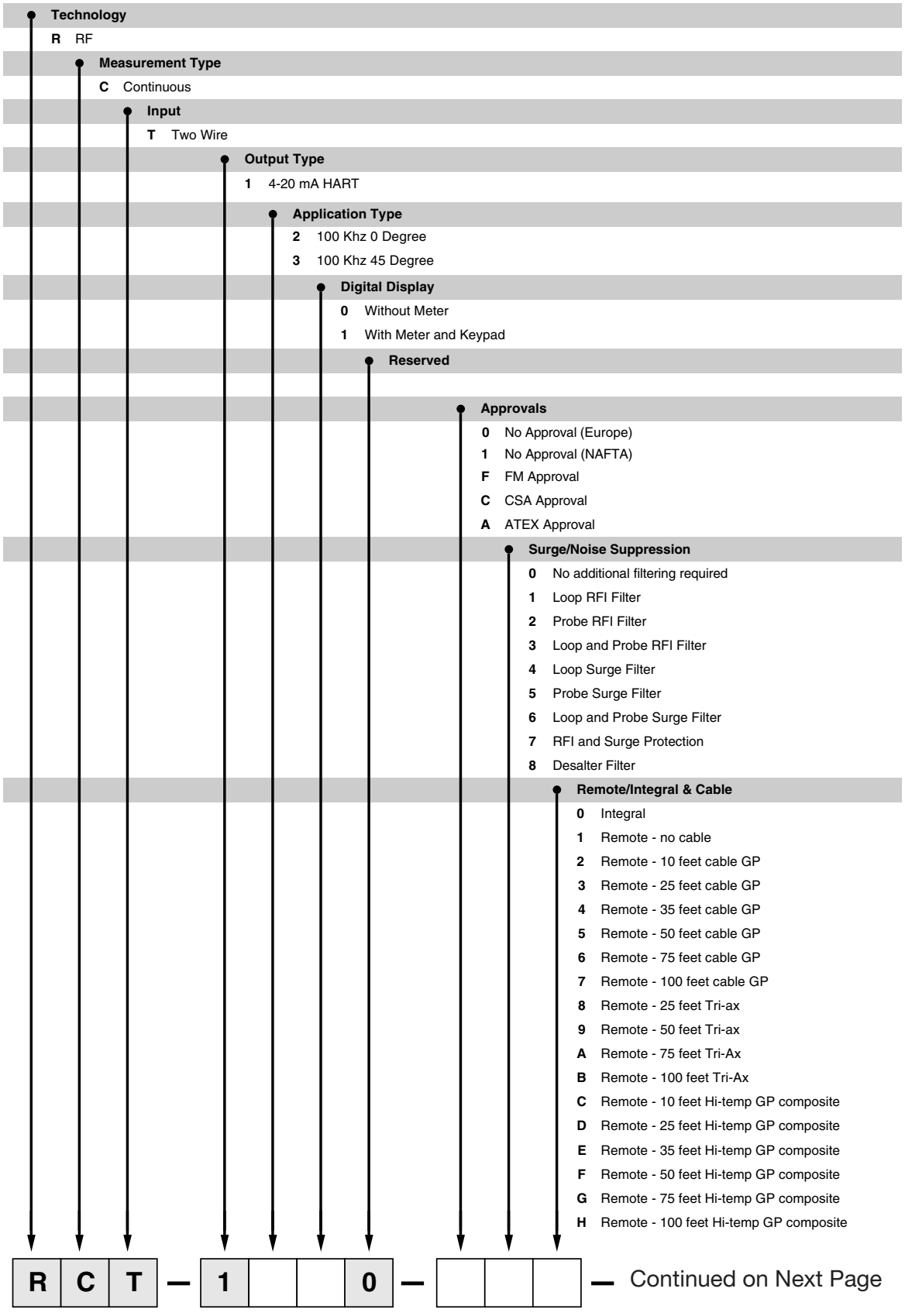
This patented Cote-Shield™ circuitry is designed into the RCT Series and enables the instrument to ignore the effect of buildup or material coating on the sensing element. The sensing element is mounted in the vessel and provides a change in RF admittance indicating presence of material.

The Cote-Shield™ circuitry prevents the transmission of RF current through the coating on the sensing element. The only path to ground available for the RF current is through the material being measured.

The result is an accurate measurement regardless of the amount of coating on the sensing element. By far the most versatile technology available it works with all types of materials in a vast array of conditions, from cryogenics to high temperature, from vacuum to 10,000psi pressure.

1.3 Models Available

RCT RF Series



Continued on Next Page

1.3 Models Available (Continued)

Sensing Element

0 0	700-1202-001
0 1	700-1202-012
0 2	700-1202-014
0 3	700-1202-018
0 4	700-1202-041
0 5	700-1202-041 (91-303)
0 6	700-1202-031
0 7	700-1202-010
0 8	700-1202-041 w/conc
0 9	700-1202-033
1 0	700-0001-018
1 1	700-0201-005
1 2	700-0201-005 Hast. C
1 3	700-0201-036
1 4	700-0202-002
1 5	700-0202-043
1 6	700-0002-360
1 7	700-0202-036
1 8	700-0001-022
1 9	700-0001-016
1 A	700-0001-024 Hast. C
1 B	700-0001-026 CS
1 C	700-0001-026 316SS
1 D	700-0001-074 CS
1 E	700-0001-074 316SS
1 F	700-0001-074 Hast. C
1 G	700-0001-344
1 H	700-0001-344 91-175
2 0	700-0209-002
2 1	700-209-002 91-112
2 2	700-0209-024
2 3	700-0002-023
2 4	700-0002-024 316SS
2 5	700-0002-024 Hast C
2 6	700-0002-027
2 7	700-0002-027 91-220
2 8	700-0002-028
2 9	700-0002-036
2 A	700-0002-037
2 B	700-0002-056
2 C	700-0002-057
2 D	700-0002-057 91-120
2 E	700-0002-224 316SS
2 F	700-0002-224 Hast C
2 G	700-0002-227
2 H	700-0002-321
2 I	700-0002-363

Sensing Element

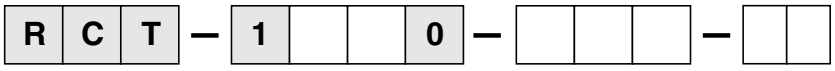
3 0	
3 1	700-0029-001
3 2	700-0029-002
3 3	700-0029-003
3 4	700-0029-004
3 5	700-0029-005
3 6	700-0029-021
3 7	700-0029-022
3 8	700-0029-023
3 9	700-0029-024
3 A	700-0029-025
3 B	700-0029-066
3 C	700-0029-102
3 D	700-0029-103
3 E	700-0029-104
3 F	700-0029-105
3 G	700-0029-106
4 0	700-0005-018
4 1	700-0005-018 91-13
4 2	700-0005-019
4 3	700-0005-028
4 4	700-0005-029
4 5	700-0005-035
4 6	700-0005-035 91-130
4 7	700-0005-048
4 8	700-0005-054
4 9	700-0005-085
4 A	700-0005-085 Hast C
4 B	700-0005-096
4 C	700-0005-348
4 D	700-0005-354
4 E	700-0205-078
5 0	700-0207-001
5 1	700-0207-002
5 2	700-0207-003
5 3	700-0207-004
5 5	700-0207-006
5 6	700-0201-025
5 7	700-0201-026
5 8	700-0201-027
5 9	700-0201-051
5 A	700-0201-052
5 B	700-0201-058
5 C	700-0201-059
5 D	700-0202-053
5 E	700-0202-054
5 F	700-0202-056

Sensing Element

6 0	700-0204-038
6 1	700-0204-002
6 2	700-0204-048
6 3	700-0204-022
6 4	700-0204-024
6 5	700-0204-049
6 A	700-0005-009
6 B	700-0005-036
6 C	700-0005-045
6 D	700-0005-095
6 E	700-0005-285
6 F	700-0005-385
6 G	700-0205-002
6 H	700-0205-005
6 I	700-0205-015
6 J	700-0205-018
6 K	700-0205-020
6 L	700-0205-075
6 M	700-0205-079
7 0	700-0008-122
7 1	700-0008-124 Hast C
7 2	700-0008-126 CS
7 3	700-0008-126 316SS
7 4	700-0008-134
7 5	700-0008-136
7 6	700-0008-144
7 7	700-0008-144 91-77
7 8	700-0008-144 91-299
7 9	700-0008-174 CS
7 A	700-0008-174 316SS
7 B	700-0008-174 Hast C
7 C	700-0008-222
7 D	700-0008-222 91-269
7 E	700-0008-242
7 F	700-0018-122
7 G	700-0018-124 Hast C
7 H	700-0018-126 CS
7 I	700-0018-126 316SS
7 J	700-0018-134
7 K	700-0018-136
7 L	700-0008-144
7 M	700-0018-144 91-77
7 N	700-0018-144 91-299
7 O	700-0018-174 CS
7 P	700-0018-174 316SS
7 Q	700-0018-174 Hast C
7 R	700-0018-222
7 S	700-0018-222 91-269

Sensing Element

8 0	700-0001-051
8 1	700-0001-052
8 2	700-0001-053
8 3	700-0001-054
8 4	700-0001-061
8 5	700-0001-062
8 6	700-0001-063
8 7	700-0001-064
8 8	700-0002-041
8 9	700-0002-042
8 A	700-0002-043
8 B	700-0002-044
8 C	700-0002-051
8 D	700-0002-052
8 E	700-0002-053
8 F	700-0002-054
8 G	700-0002-061
8 H	700-0002-062
8 I	700-0002-063
8 J	700-0002-064
9 0	700-0001-034
9 1	700-0001-040
9 2	700-0001-044
9 3	700-0001-045
9 4	700-0001-324
9 5	700-0002-027 90-635
9 6	700-0002-029
9 7	700-0002-033
9 8	700-0002-040
9 9	700-0002-057 90-523
9 A	700-0002-057 91-006
9 B	700-0002-057 91-232
9 C	700-0002-059
9 D	700-0002-321 90-674
9 E	700-0003-009
9 F	700-0004-031
9 G	700-0004-050
9 H	700-0005-018 91-26
9 I	700-0005-018 91-195
9 J	700-0005-348 91-59
9 K	700-0009-002
9 L	700-0009-024
9 M	700-0009-057
9 N	700-0011-001
9 O	700-0011-003
9 P	700-0011-004
9 Q	700-0011-015
9 R	700-0021-001
9 S	700-0021-002
9 T	700-0021-003
9 U	700-0021-007
9 V	700-9000-494
N N	System without Sensing Element



1.4 Sensing Element Model Numbering

System Reference Number	Typical Application Type	Sensing Element Model	Standard Material of Construction	OD and Standard Mounting	Temperature Pressure Limits
18	Water-like conductive liquids	700-1-22	TFE-covered rod	Rod 3/8" OD 3/4" NPT	100°F @ 1000 PSI 300°F @ 500 PSI
1C	Concentric water-like insulating liquids	700-1-26	TFE-covered rod with carbon steel concentric shield	Concentric Shield 1.66" OD 1 1/2" NPT	100°F @ 1000 PSI 300°F @ 500 PSI
24	Low viscosity conducting liquids	700-2-24	TFE-covered rod	Rod 3/4" OD 3/4" NPT	100°F @ 1000 PSI 450°F @ 500 PSI
26	Interface of liquids containing ketones and esters	700-2-27	FEP-covered rod	Rod .56" OD 3/4" NPT	100°F @ 1000 PSI 300°F @ 500 PSI
2A	Thick conducting liquids	700-2-37	"X"*-covered rod	Rod .54" OD 3/4" NPT	100°F @ 1000 PSI 250°F @ 500 PSI
2C	Conducting liquids and interfaces	700-2-57	"X"*-covered rod	Rod .84" OD 1" NPT	100°F @ 1000 PSI 250°F @ 500 PSI
40	Agitated conducting liquids and granulars	700-5-18	"X"*-covered cable	Cable 5/16" OD 3/4" NPT	100°F @ 1000 PSI 250°F @ 500 PSI
42	Heavy-duty for abrasive granulars	700-5-19	Urethane-covered cable	Cable 3/4" OD 2" NPT	150°F @ 5 PSI
48	Long lengths of conducting liquids	700-5-54	PFA-covered cable	Cable .093" OD 3/4" NPT	100°F @ 1000 PSI 300°F @ 500 PSI
4E	Insulating liquids and granulars	700-205-78	"X"* covered cable	Cable 5/16" OD 1" NPT	250°F @ 5 PSI

*"X" is a fluorocarbon-type insulation

1.5 Area Classifications

The standard electronic unit mounted in the durable housing (RCTXXX1, 2) is dual-rated and meets the following conditions:

- Type NEMA 4X Waterproof / Corrosion Resistant
- IP 65

See Section 1.4 for detailed specifications of sensing elements that are most often recommended with a RCT Series system. Contact the factory or your local representative if additional information is required.

The electronic unit and sensing element are connected by a three-terminal coaxial cable. Drexelbrook cables are available in ***See Section 7.2 for Specifications***:

- General Purpose:
- Triax:
- Composite: (first 10 feet high temperature)

SECTION 2: INSTALLATION

2.1 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.

2.2 Hazardous Location Installations

Installation in hazardous areas must comply with the control drawings ***See Appendix A***. Always install to the NEC and/ or local requirements/ codes/ directives as mandated by the authority having jurisdiction. The cable fittings supplied are weather resistant only. Before using Intrinsic Safety Barriers, read manufacturer's instruction for barrier operation. The electronic unit is rated T4 and may not be used with materials with an auto ignition temperature of less than 135C°. Substitution of components may impair intrinsic safety. To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.



When installing the transmitter in an enclosure not supplied by AMETEK Drexelbrook, the enclosure must be certified for the area in which it is to be installed.

2.3 Mounting the Electronic Unit

The RCT (409-T) Series system was 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 167°F (-40˚C and 75˚C).
See section 7.4 for customer supplied enclosure requirements for 409 Series.

2.3 Mounting the Electronic Unit (Continued)

Figure 2-1 shows the recommended conduit installation.

Figure 2-2 shows the dimensions when installing conduit to the electronic unit.

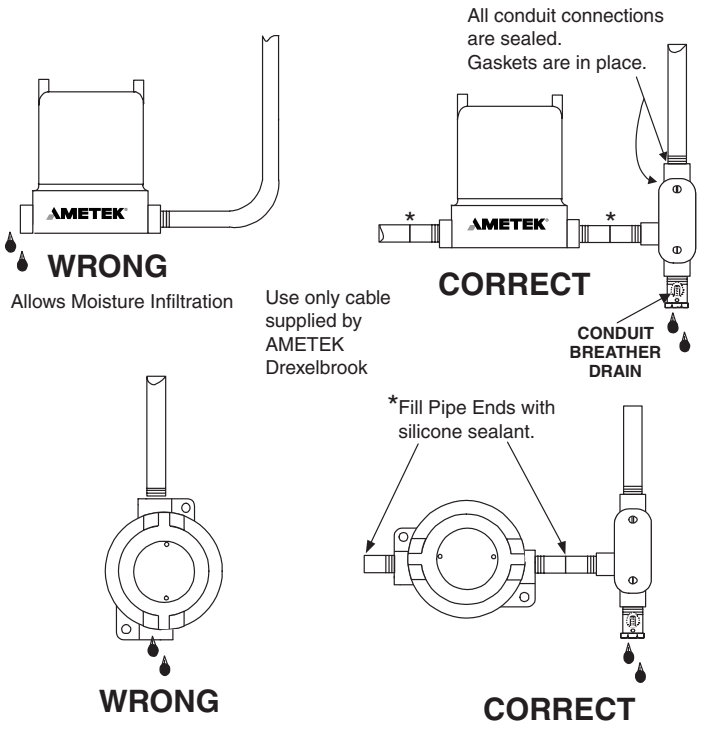


Figure 2-1
Recommended Conduit Connection

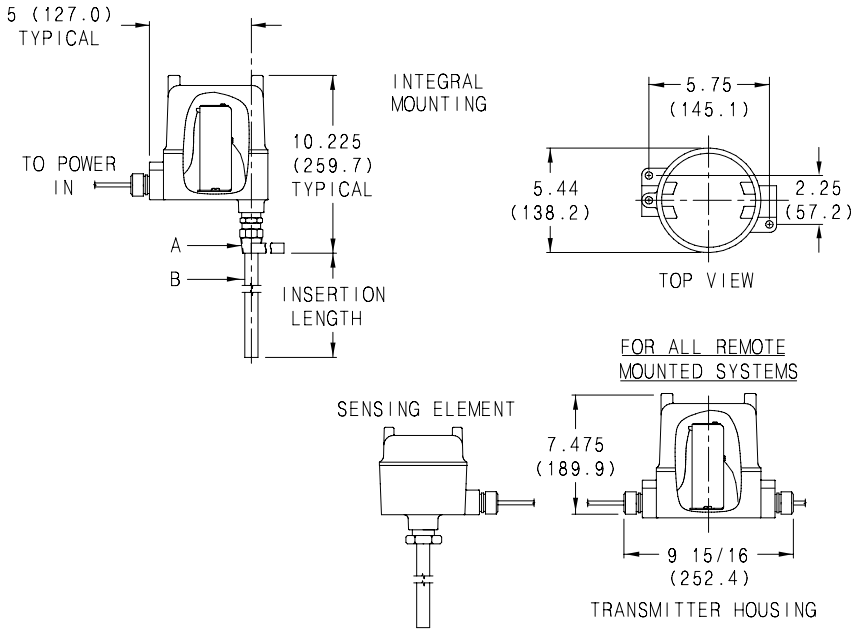


Figure 2-2
Mounting Dimensions Inches (mm)

2.3 Mounting the Electronic Unit (Continued)

The mounting location for the sensing element is often determined by whether there is a suitable location inside a vessel. An external side arm or stilling well can be considered.

The following sensing element mounting and installation instructions should be followed so that the equipment will operate properly and accurately:

A. In applications requiring an insulated sensing element, use particular care during installation. There is always the danger of puncturing the insulation, especially with the thin-walled sensing elements.

B. Sensing elements should be mounted in such a manner that they are not in the direct stream of a filling nozzle or chute. If this is not possible, a deflecting baffle should be installed between the sensing element and the fill.

C. Do not take the sensing element apart or loosen the packing glands. Follow instructions in ***Figure 2-3***.

D. Avoid installing the sensing element with any of the common mistakes shown in ***Figure 2-4.***

E. If a stilling well is used, ensure that "vent" holes are large enough to allow free passage of both air and process material. Holes should be 5/8" or larger, 120° apart, every 2-3 feet along the length of the stilling well.

F. Sensing elements that are mounted in agitated vessels usually require brackets and supports to control the position of the sensing element during agitation. See ***Figure 2-5.***

G. For non-metallic vessels without Drexelbrook self-grounding sensing elements, choose one of the grounding recommendations shown in ***Figure 2-6.***

2.3 Mounting the Electronic Unit (Continued)

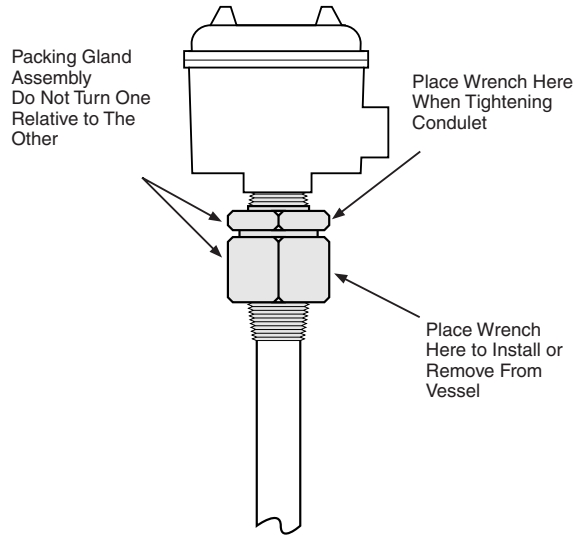


Figure 2-3
Installing Sensing Element

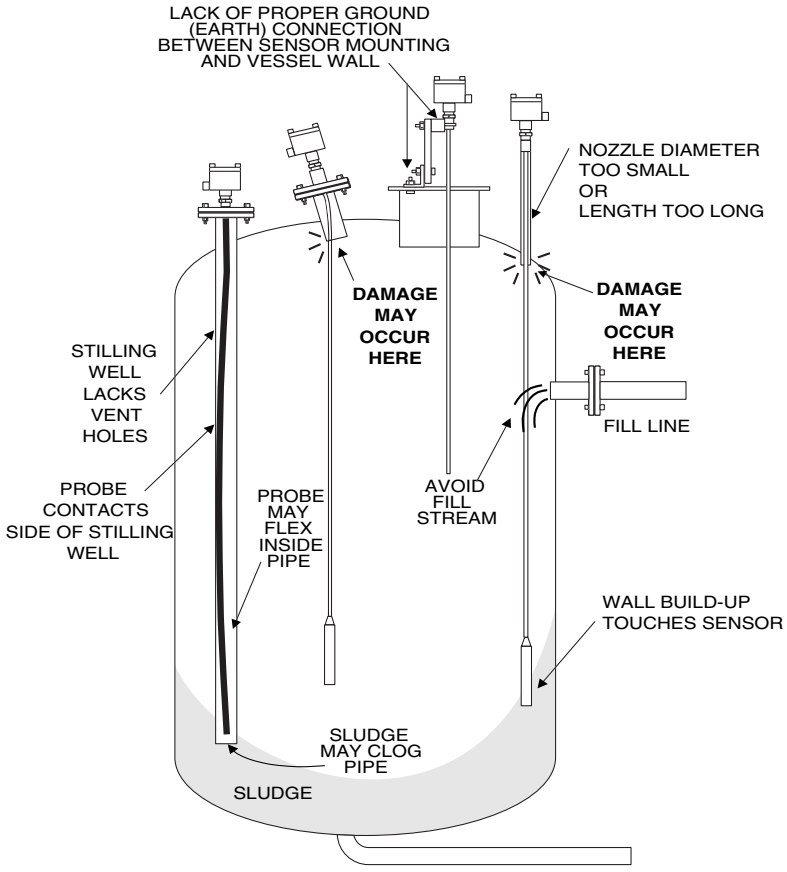


Figure 2-4
Common Installation Mistakes

2.3 Mounting the Electronic Unit (Continued)

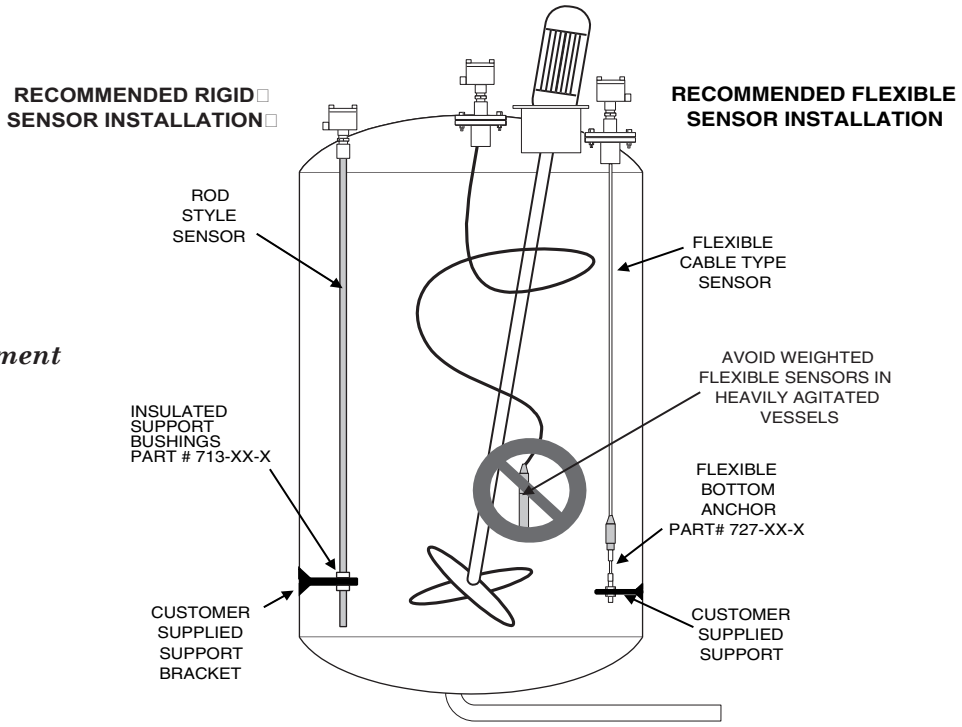
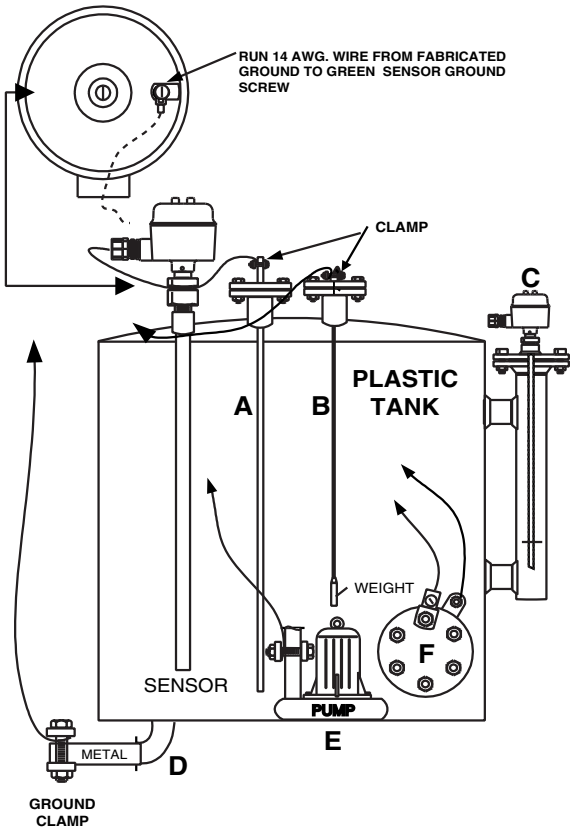


Figure 2-5 Installing Sensing Element in Agitated Vessel

- If the vessel is non metallic see grounding sketch below. sensors with factory supplied concentric shield or ground rod do not need additional grounding.
- Measure ground continuity from housing ground screw to metal wall of vessel. A good ground will measure less than 5 ohms.



A
GROUND ROD
A ground rod can be fabricated out of any metal compatible with the process. Use material that is at least 3/8inch dia. such as pipe, All-Thread, or tubing. The ground rod must be parallel and relatively close to the sensor.

B
GROUND WIRE
1/4 inch or larger dia. stainless steel rope that is anchored or weighted can be used.

C
MOUNT SENSOR IN METAL PIPE
Mounting the level sensor inside a metal pipe provides an excellent ground reference.

D
METAL PIPING
Metal piping that connects to the tank bottom can be used as a ground reference. *Use only if the process material is greter than 1000 uMHOS/cm such as acids and caustic.*

E
SUBMERGED METAL STRUCTURE
Use any constantly submerged metal object such as: pumps, agitators, or thermowells. *Use only if the process material is greter than 1000 uMHOS/cm such as acids and caustic.*

F
METAL FLANGE
A submerged metal flange or orifice plate can be used.
Use only if the process material is greater thatn 1000 uMHOS/Cm. such as acids and caustic.

Figure 2-6 Providing Ground Reference* *This is a sensing element ground reference and possibly different from an electrical power ground.

2.4 Wiring the Electronic Unit

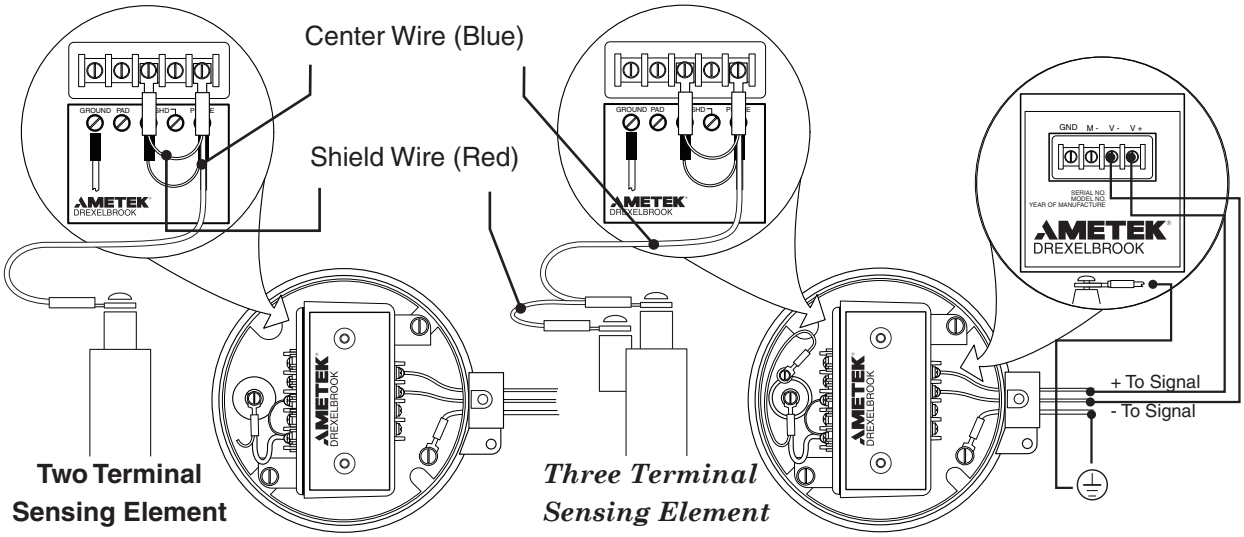
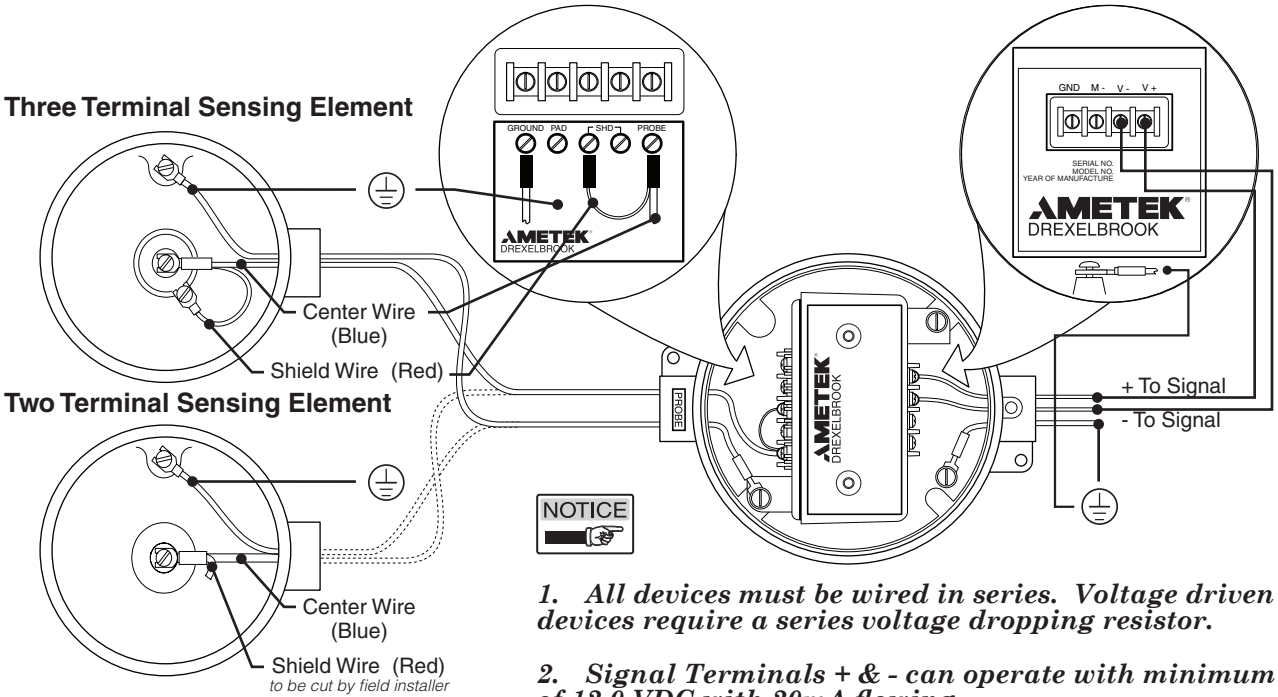


Figure 2-7
RCT Series Wiring Connections Integral Mounting



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.

4. Clipped Shield Wire must NOT touch housing!

Figure 2-8
RCT Series Wiring Connections, Remote Mounting

2.4 Wiring the Electronic Unit (Continued)

Integral units are pre-wired at the factory. ***Figure 2-7*** shows the wiring of the integral unit.

For remote units, the signal connections are made to the four-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. 20 AWG). Twisted shielded pair cables are recommended for lengths over 200 feet.

The cable from the sensing element is connected to the five-terminal strip on the back side of the instrument chassis. The cable connections are probe (PRB) or center wire (CW), ground (GND), and shield (SHD). See ***Figure 2-8*** for wiring connections of the remote unit.

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

2.5 Wiring the Sensing Element



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

The 409-T has a built-in current limiter which holds the signal current to a maximum of 28 mA.

The cable connections to the sensing element are shown in ***Figure 2-8***

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

- If the sensing element does not have a shield connection, (the most common condition for a 2-terminal sensing element) be sure to **clip and /or tape the shield wire at the sensing element end of the cable only.** See ***Figure 2-8.***

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

2.6 Spark (Static Electricity) Protection

Spark Protection for Integral Sensing Elements

If spark protection is supplied for an integral sensing element, use the following instructions for installing the spark protection.

A. Attach the mounting link on the spark protector to the sensing element center connection screw.
B. Connect the green wire from the spark protector to the housing/chassis mounting screw.
C. Connect the center wire connector (Blue) of the spark protector to the "probe" connection on the transmitter.
D. Connect the shield connector (Red) of the spark protector to the shield (SH) connector on the transmitter.

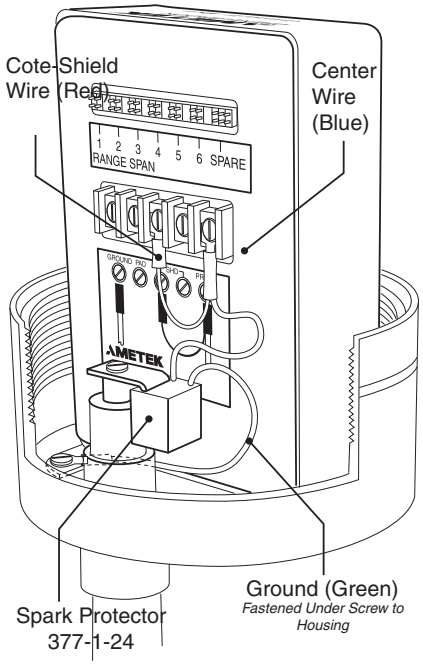


Figure 2-9
Spark Protection for Integral Sensing Elements

Spark Protection for Remote Sensing Elements

If spark protection is supplied for a remote sensing element, use the following instructions for installing the spark protection.

A. Attach the mounting link on the spark protector to the sensing element center connection screw.

B. Connect the green wire from the spark protector to the ground screw.

C. Feed the coax cable into the condulet.

2.6 Spark (Static Electricity) Protection (Continued)

D. Connect the coax cable center wire (**CW**) to the spark protector and the ground wire (**GND**) to the ground screw as shown in ***Figure 2-10.***

E. Connect the shield wire to the Cote-Shield terminal (**SH**).*

* For sensing elements that do not have shield connections, clip the shield wire as shown in ***Figure 2-8.***

NOTICE

Make sure the transmitter has a ground attached either on sensing element side or loop side of the unit.

Unless the assembly is attached to a metallic vessel, chassis of transmitter is not grounded.

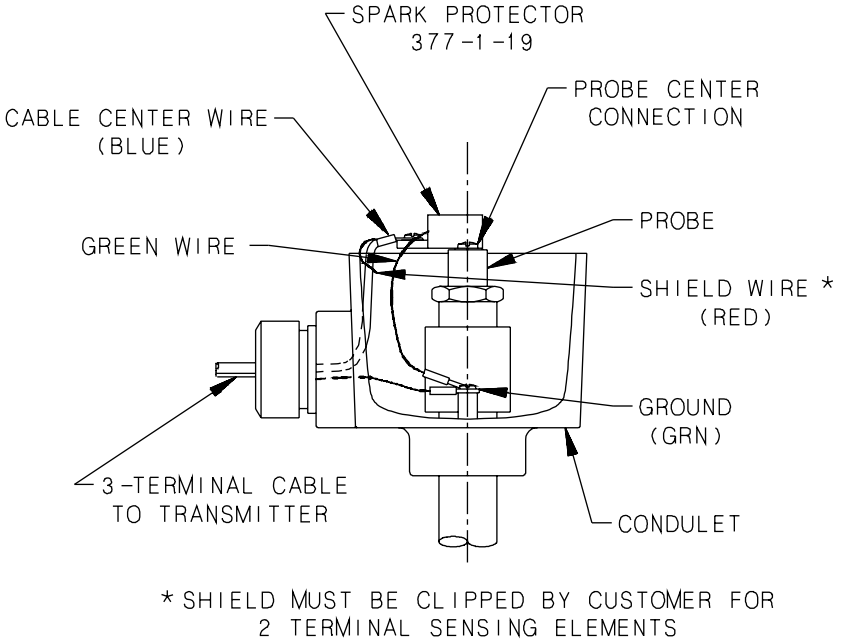


Figure 2-10
Spark Protection for Remote Sensing Elements

2.7 Surge Voltage (Lightning) Protection

Optional surge protection is sometimes supplied with transmitters that are expected to be exposed to surge voltages or surges due to lightning near the two-wire loop. A Drexelbrook Model 377-4-12 Surge Voltage Protection affords a great deal of protection to the transmitter but is not absolute in its protection against a very close lightning strike. Refer to ***Figure 2-11*** to properly connect the Surge Voltage Protection. Be sure that the transmitter housing is well connected to a good ground.

2.7 Surge Voltage (Lightning) Protection (Continued)

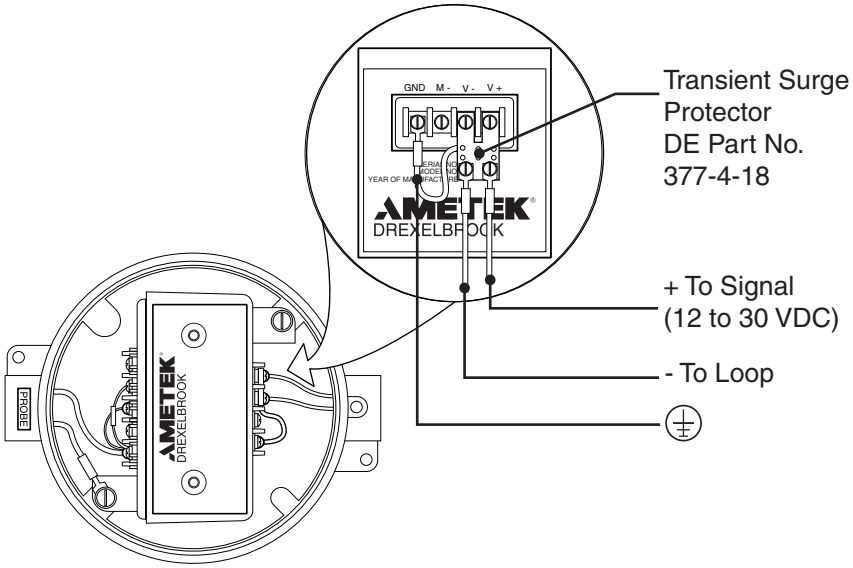


Figure 2-11
Surge Voltage Protection

2.8 RFI (Radio Frequency Interference) Filters

When installing the RCT Series transmitter, follow these recommendations to avoid problems with Radio Frequency Interference (RFI).

- Choose a location to mount the electronic unit at least 6 feet (2M) from a walkway where personnel using walkie talkies may pass.
- If the vessel is non-metallic, select, if possible, a shielded (concentric) sensor. If unsure about suitability, contact the Drexelbrook Applications department for a recommendation.
- For remotely-mounted electronic units connect the sensor to the electronic unit by placing the coaxial cable in grounded metal conduit. Integrally mounted electronic unit sensor connections are already shielded.
- Use Twisted Shielded Pair wiring for all loop wiring connections. Loop connection wiring should also be in grounded metallic conduit.
- Where possible, use of cast aluminum housings without windowed openings for the electronic unit is recommended. If local close-coupled indicators are used, install a loop filter between the indicator and the electronic unit.

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

2.7 RFI Filters (Continued)

If the recommendations listed are followed, it is usually not necessary to add RFI filtering to protect against signal strengths of 10 Volts/ Meter or less. This degree of protection is usually sufficient to protect against walkie talkies that are used 3 feet (1M) or more from a typical electronic unit. If greater protection is required, or filters have already been provided, install RFI filters as shown in ***Figure 2-12***.

CE Mark Certification:

3-Terminal Coaxial Cable - Systems with remote mounted electronics require the use of a Probe RFI filter (only) if the sensing element is connected with 3-terminal coaxial cable, installed in accordance with figure 2-14, to maintain CE Mark certification.

Triaxial Cable - Systems with remote mounted electronics that connect to the sensing element via a triaxial cable do not need a Probe RFI filter to maintain CE Mark certification.

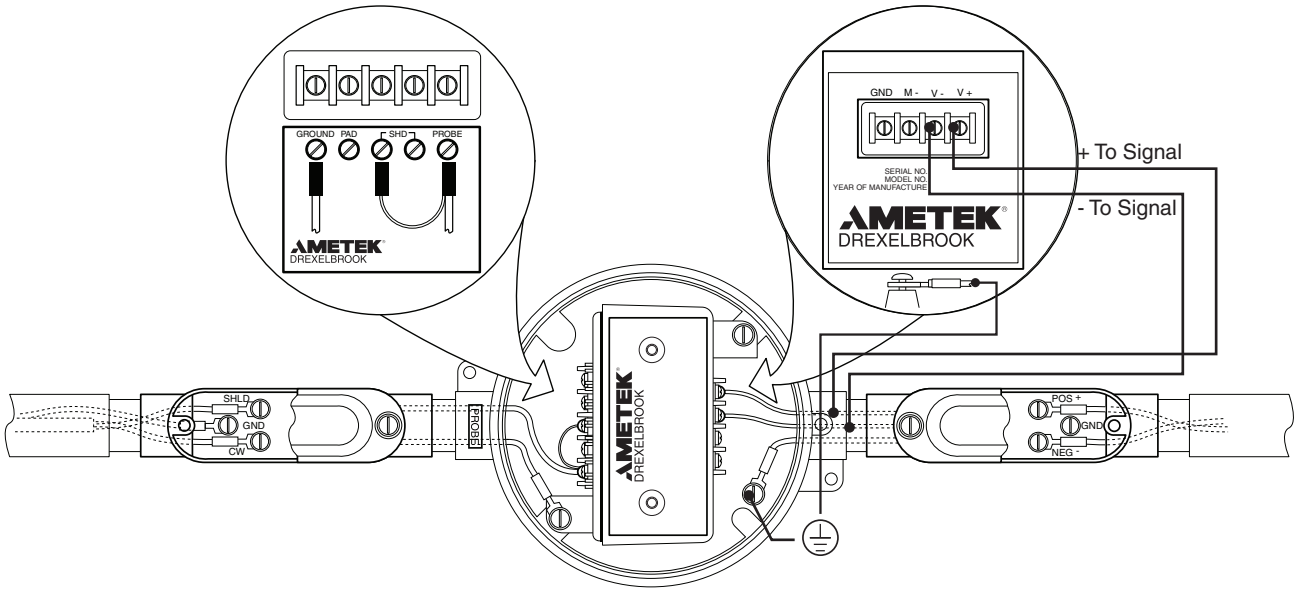


Figure 2-12
Radio Frequency Interference (RFI) Filters

2.9 Electrostatic Filters

In applications such as desalters or treaters and other coalescers with electrostatic grids, it is customary for Drexelbrook to supply a special filter on the sensing element. The purpose of the filter is to remove voltage that may be imposed in the sensor from the high voltage grids. Some earlier applications have the filter located at the transmitter instead of the sensing element; either is acceptable.

Connect the electrostatic filter Drexelbrook Part Number 385-0028-004 as shown in ***Figure 2-13.***

Typical Mounting For Typical Sensing Element

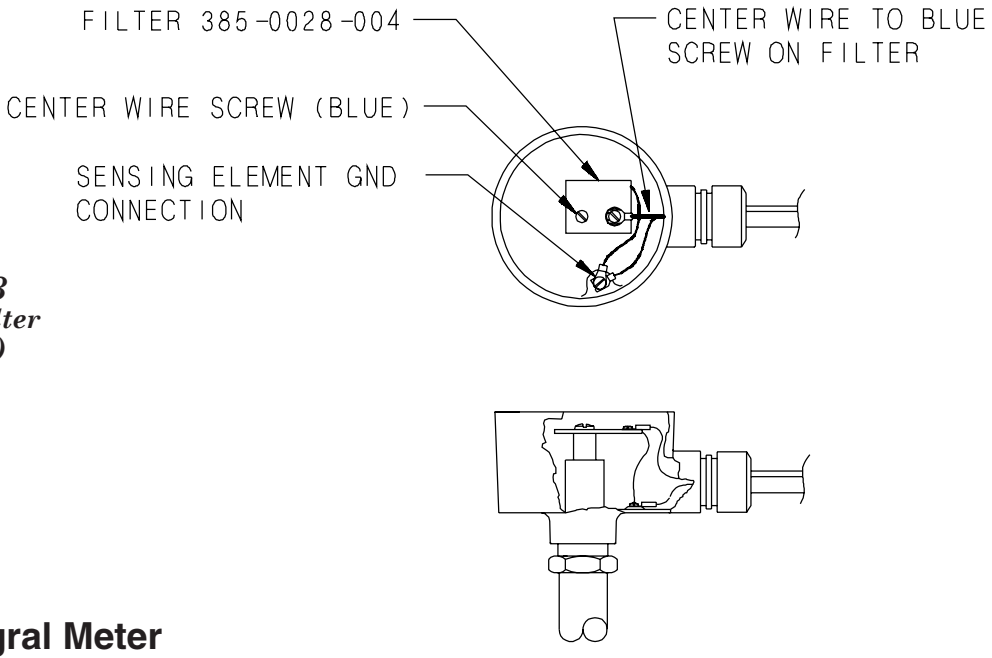


Figure 2-13
Electrostatic Filter (385-0028-004)

2.10 Digital Integral Meter

An optional digital integral meter (DIM) (401-44-3) can be used with the RCT Series electronic unit for local digital loop indication. When purchased with the RCT Series instrument, a housing with viewport is supplied. The meter display is visible through the viewport. If the meter is added as a retrofit to an existing installation, a new housing dome with viewport (260-2-222) is required and supplied as part of the retrofit package.

To install the meter:

- Remove the "perforated knockouts" from the top label of the transmitter to expose two threaded holes and ribbon cable socket
- plug the mini ribbon cable into the socket
- secure meter to top of electronic unit with screws

2.10 Digital Integral Meter (Continued)

Integral meter can be rotated 90° to allow for proper viewing orientation:

- remove hold-down screws
- remove black cover screws
- move cover screws to original hold-down screw location
- remount meter in new orientation

The meter is not inserted into the 4-20 mA loop. It receives power and data directly from the Drexelbrook smart transmitter via attached mini ribbon cable. See ***Figure 2-14.***

If the Ribbon Cable is attached while the transmitter is Powered Up, the transmitter may have to be restarted before the DIM will display correctly.

The meter can be configured using the Drexelbrook PC software, the Model 275 Calibrator, or from the DIM itself.

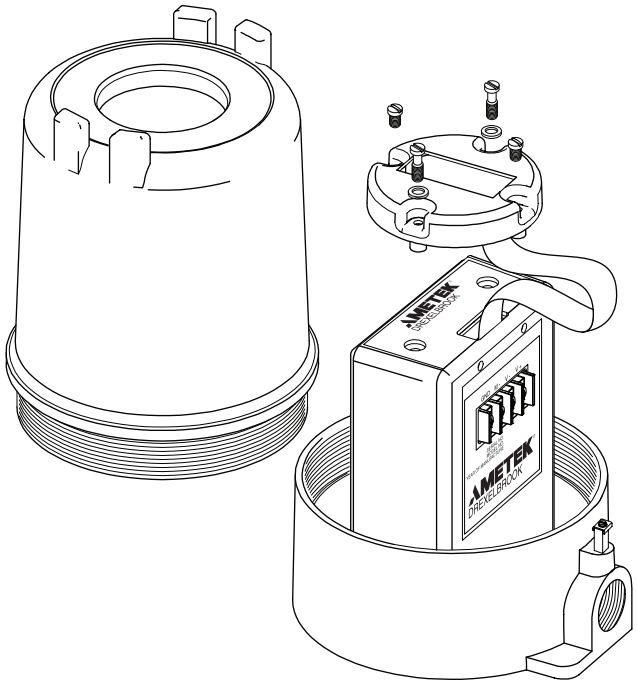


Figure 2-14
Digital Meter in Housing with Viewport

SECTION 3

SECTION 3: CONFIGURATION AND CALIBRATION WITH DREXELBROOK PC SOFTWARE

This section instructs the user how to use the Drexelbrook 401-700-20/40 Series PC calibrator software to configure and calibrate the RCT Series(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 PC software can be used in place of the Rosemount® 268 or 275 handheld calibrators used for multi-Process Variable (PV) transmitters.

3.2 Model Number

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

2X=2 PC Software Package includes:
Contents in 401-0700-021, HART® 6.0 *(DOS version)* on a 3½" Floppy Disk, and HARTWin™ version 2.1 or greater on a CD-ROM.

4X=1 PC Software Package includes:
USB Modem Assembly 401-0700-007*(Figure 3.1a)*.

4X=2 PC Software Package includes:
Contents in 401-0700-41, Utilities and Drivers on a CD-ROM, and HARTWin™ version 2.3 or greater on a CD-ROM.

4 0 1 - 0 7 0 0 - 0 0 6
HART® 6.0 *(DOS version)* on a 3½" Floppy Disk

4 0 1 - 0 7 0 0 - 0 3 1
HARTWin™ version 2.X 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 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.

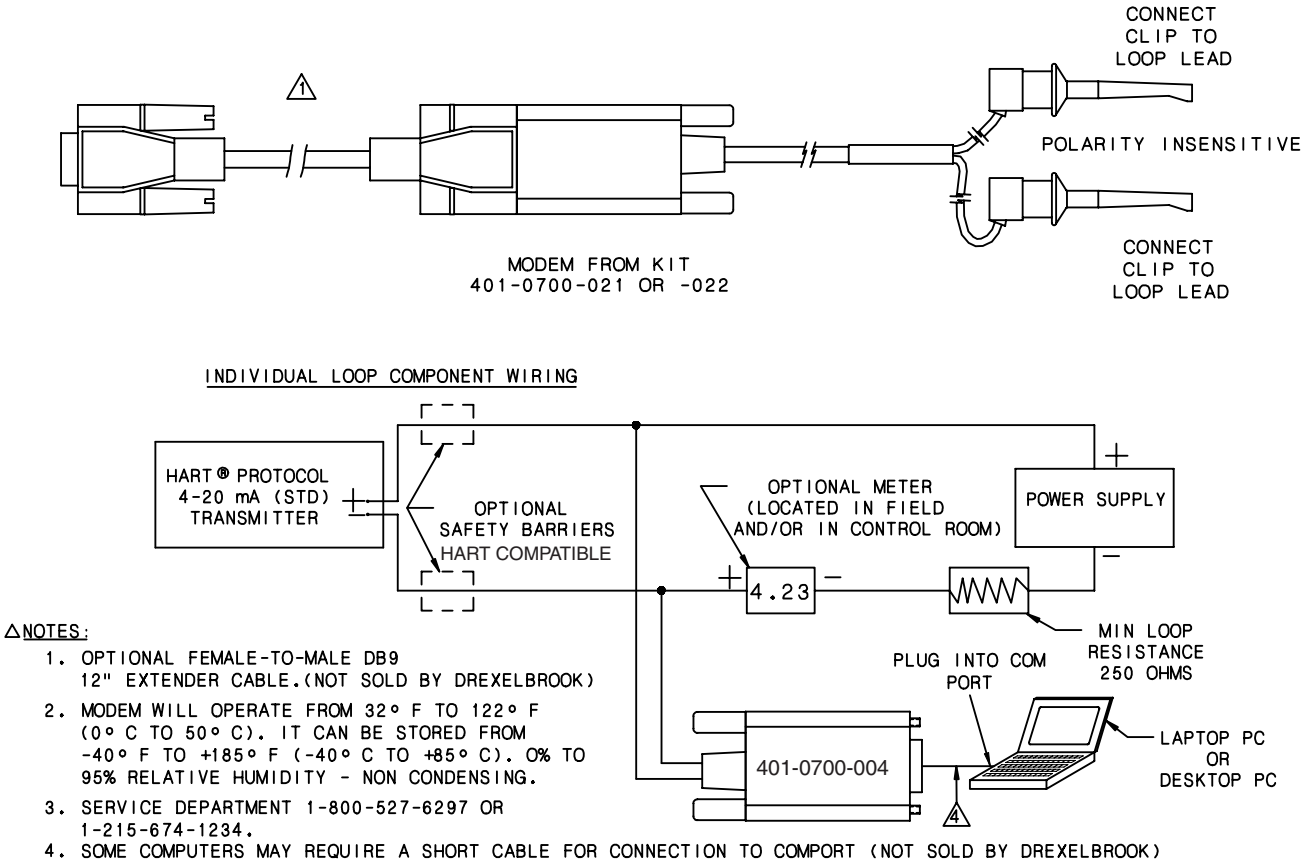


Figure 3-1
RS232 Modem Assembly & Loop Connection

3.4.1 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.

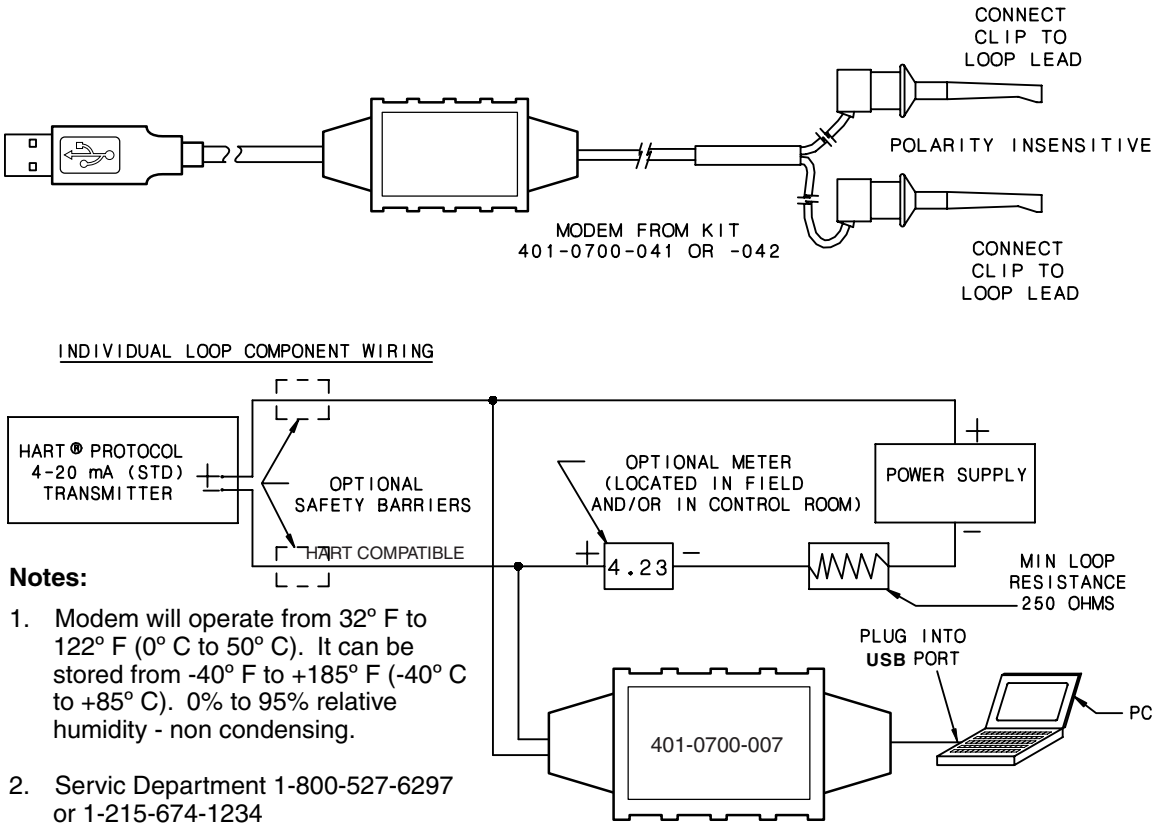


Figure 3-1a
USB Modem Assembly & Loop Connection

3.5 Install the Windows Version HARTWin 2.1 Software on Hard Drive

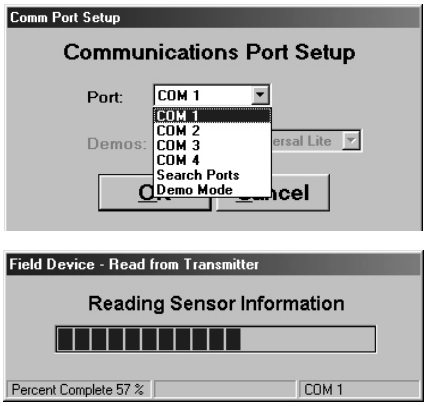


Figure 3-2
Selecting COM ports during software installation

Installation is quite simple.

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**." See ***Figure 3-2***

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, shown in ***Figure 3-3***, 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

Figure 3-3 shows a PC calibration software menu screen. 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 level, capacity, distance, temperature, loop current, percentage, and status.

Point Calibration [F6 on keyboard]
Calibrates the HART® protocol transmitter using Point calibration. See Section 3.8 Calibration. Enter the low point and high point of level for an accurate calibration.

D/A Trim
Allows a field reference meter to be connected to the transmitter for adjusting transmitter output current. See Section 3.10.

Strapping Table
Displays the values of the input to level and output to volume in percent in a 21-point table. Allows points to be changed to accommodate irregularly shaped vessels. See Section 3.11.

Configure Meter
Configures the optional Digital Integral Meter (440-44-3) used for local indication. See Section 3.12.

True Level Calibration (grayed out)
This button is inactive for the RCT Series Transmitter. It is for the extra features that come with the True Level model transmitter.

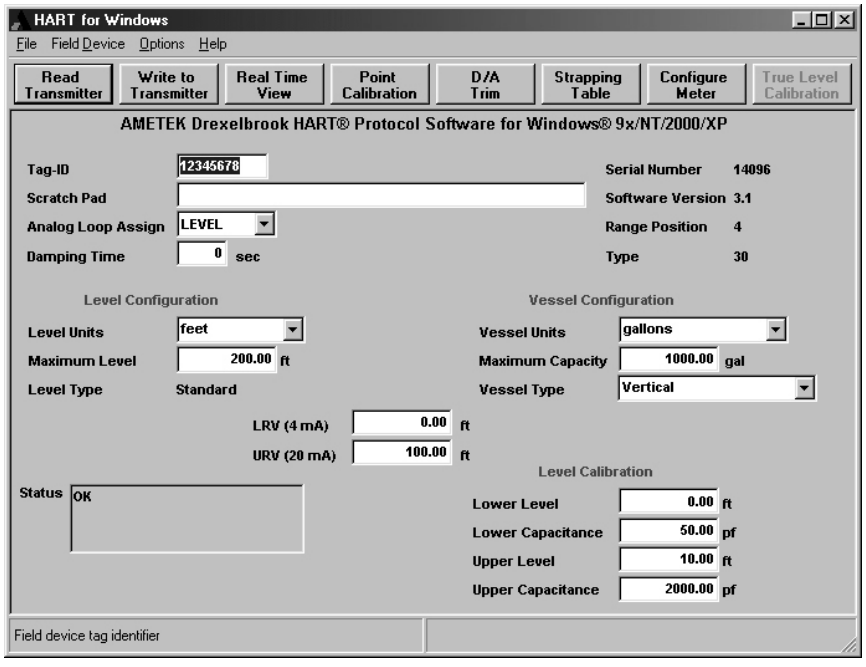


Figure 3-3
PC Software Menu Screen automatically communicates all "name plate data" from transmitter

3.7 Configuration

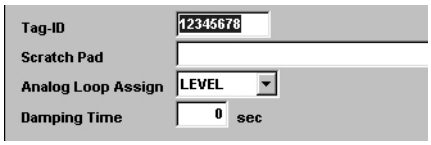


Figure 3-4
Configure Transmitter from Menu screen

Refer to ***Figure 3-3*** PC Software Menu Screen.

Configuration involves downloading information to the HART protocol transmitter that is specific to the application and vessel 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. Select **Level** or **Vessel** in the **Analog Loop Assign** selection box. Press Tab or Enter on your keyboard.

- **Level configuration** sets the output to follow the level of the material being measured.

- **Vessel configuration** sets the output to follow the strapped volume or weight in the vessel. For example, gallons in a horizontal vessel.

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

D. Click on **Write to Transmitter**.

E. Move to **Level Configuration** section of menu.

3.7.1 Level Configuration

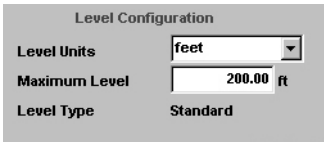


Figure 3-5
Level Configuration from Menu screen

A. Select **Level Units**. The default is feet. Choose the units that correspond to the level measurement.

B. Edit the **Maximum Level** to agree with the actual tank height (not the length of the sensing element).

C. Click on **Write to Transmitter** and move to the **Vessel Configuration** section of the menu.

3.7.2 Vessel Configuration

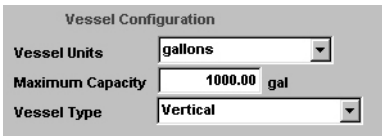


Figure 3-6
Vessel Configuration from Menu screen

A. Select **Vessel Units**. The default is gallons. Press Enter and choose the units that correspond to the vessel measurement. The units include both weight and volume outputs. Press Tab or Enter on your key board to continue.

B. Edit the **Maximum Capacity** of the vessel. Enter the corresponding value of weight or volume equal to the **Maximum Level**. Enter 100 for percent if the weight or volume units are not known or needed. Press Tab or Enter on your keyboard to continue.

C. Select **Vessel Type**. Available options include:

- Vertical Tank (**VERTICAL**)
- Horizontal cylinder with flat ends (**HRZCY/FL**)
- Horizontal cylinder with dished ends (**HRZCY/DS**)
- Horizontal cylinder with hemispherical ends (**HRZCY/HM**)
- Spherical (**SPHERE**)
- The default is **Vertical**. Press Enter and choose the type of vessel.

D. Click on **Write to Transmitter**.

E. Move on to Range Values (**URV** & **LRV**) section of menu.

3.7.3 Lower and Upper Range Values (LRV and URV)

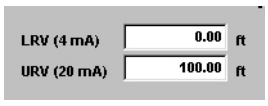


Figure 3-7
LRV & URV Configuration from Menu screen

Enter the **LRV** and **URV** to set the current (mA) window of the vessel.

A. Edit **LRV** (Lower Range Value) to display the output you want to see when the transmitter generates 4 mA current. The default **LRV** is 0 feet.

B. Edit **URV** (Upper Range Value) to display the output you want to see when the transmitter generates 20 mA current. The default **URV** is 100 feet for the RCT Series.

C. Click on **Write to Transmitter**. *Configuration is now complete.*

3.8 Calibration

There are two methods for calibrating the transmitter using the PC software:

Point Calibration (menu button selection):

Uses the two known level points in the vessel for calibration. The further apart the two points are for the calibration the better the accuracy of the overall measurement. Always initiate the point calibration process by selecting the **Point Calibration** button on the PC menu screen and following the prompts in the pop-up window.

Level Calibration (lower right of window):
See Figure 3-3

Uses capacitance values obtained from the AMETEK Drexelbrook Service department (or a previous calibration or identical application) for the zero and span calibration data. Call 1-800-527-6297. Please provide your DE purchase order number, transmitter serial number, vessel and application data to the Service Engineer. Level calibration is done using the **Level Calibration** data fields on the PC menu screen.

NOTICE

May use both Point & Level Calibrations

It is permissible or sometimes even recommended that both methods be used in order to establish a calibration standard. For example, if the vessel was already filled before the calibration was attempted and it is difficult or impossible to lower the level to establish the second point, it would be best to use a calculated zero capacitance for the low point and actual level for the high point. While this wouldn't be as accurate as two known level points, it will be reasonably accurate until an actual low point calibration can be established. The Service department will help in calculating high or low capacitance values.

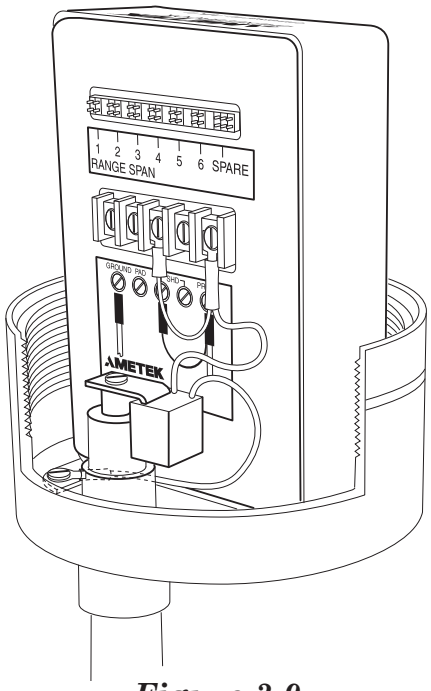


Figure 3-9
Range Span Jumpers

Because calibration involves determining two known points of capacitance, a span (or range) jumper provides an adjustment for the change in capacitance required to produce full scale current.

- The **Range Span Jumper** is located on the back of the transmitter chassis. ***See Fig. 3-9***.
- Each **Range Span** position on the RCT Series advances the range in inches or feet to approximately five times the previous setting. ***See Table 3-1***

RCT Series Span Range Setting Chart
Sensing Element Length Vs. Span Position Number / Maximum pf

Jumper Position =	1	2	3	4	5	6
Maximum pF =	20	100	450	2000	10000	40000
System #	**Maximum Sensing Element Length In Feet**					
Conducting Liquids:						
RCTX3XXXXX18	N/A	N/A	5.4	20	N/A	N/A
RCTX3XXXXX74	N/A	N/A	9.2	40	200	920
RCTX3XXXXX45	N/A	N/A	1.2	5.3	20	N/A
RCTX3XXXXX70	N/A	N/A	1.4	6.25	31	140
RCTX3XXXXX40	N/A	N/A	7.8	20	N/A	N/A
RCTX3XXXXX47	N/A	N/A	N/A	N/A	4.1	14
RCTX3XXXXX22	N/A	N/A	5.4	20	N/A	N/A
RCTX3XXXXX65	N/A	N/A	5.4	20	N/A	N/A
RCTX3XXXXX72	N/A	N/A	N/A	4.2	21	95
Interface Application:						
RCTX2XXXXX45	N/A	N/A	1.2	5.3	20	N/A
RCTX2XXXXX43	N/A	N/A	1.0	4.8	20	N/A
RCTX2XXXXX47	N/A	N/A	N/A	N/A	4.0	14
Insulating K = 1.5-5:						
RCTX2XXXXX22	N/A	2.7	12.5	20	N/A	N/A
RCTX2XXXXX18	N/A	8.3	20	N/A	N/A	N/A
RCTX2XXXXX74	N/A	8.0	37.5	166	N/A	N/A
RCTX2XXXXX45	N/A	3.6	16.2	20	N/A	N/A
RCTX2XXXXX70	N/A	3.8	17.1	76	N/A	N/A
RCTX2XXXXX40	N/A	6.0	20	N/A	N/A	N/A
RCTX2XXXXX43	N/A	5.0	20	N/A	N/A	N/A
RCTX2XXXXX47	N/A	5.0	14	N/A	N/A	N/A

Table 3-1
Span Range Position for a number of common Sensing Elements

3.8.1 Point Calibration

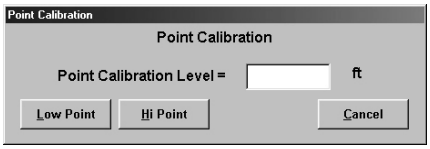


Figure 3-10
Point Calibration from Menu screen

The Point to Point method of calibration is the most accurate way to calibrate the transmitter with two level points. The high or low level must be known and should be held steady for accurate calibration. They may be any two points at more than 10% apart, and need not be the 4mA or 20 mA points.

The **Point Calibration** pop-up window is accessed by clicking on the menu "button" Point Calibration. Either a high point or a low point can be entered first.

A. Type in current value as the high point of the two point calibration.
B. Click on **Hi Point** or press *Enter* (or *Tab*) on the

3.8.1 Point Calibration (Continued)

keyboard. *High point calibration is now complete.*

C. Move level in vessel a minimum of 10%.
D. Type in that value for **Low Point** of the two point calibration.
E. Click on **Low Point** or press *Enter* (or *Tab*) on keyboard. *Low point calibration is now complete.*

3.8.2 Level Calibration

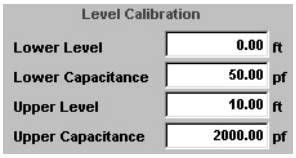


Figure 3-11
Level Calibration area of Menu screen

Level calibration uses zero and span capacitance values as the calibration data . These values can be obtained from the AMETEK Drexelbrook Service department (or from a previous calibration or identical application). Please be prepared when you call (1-800-527-6297) with the purchase order number and the serial number of the transmitter.

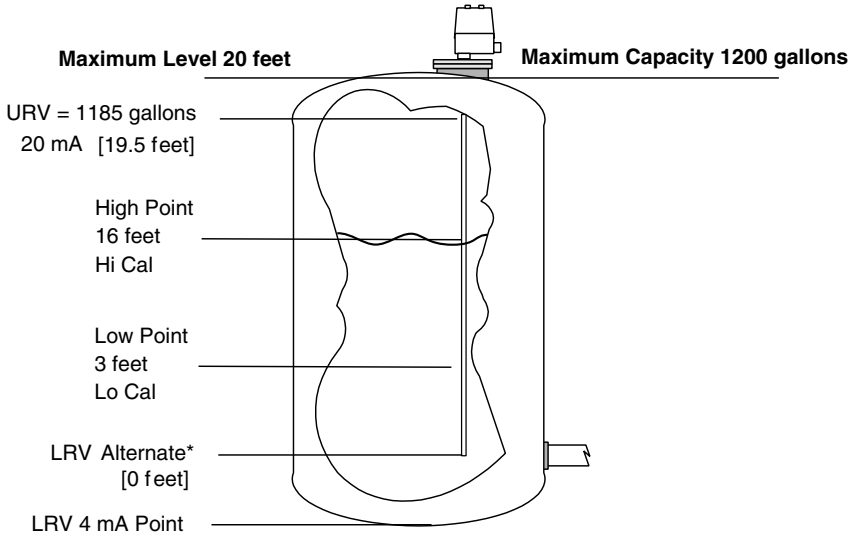
A. Go to **Level Calibration** area of the menu.
B. Enter **Lower Level** value. Press *Tab* or *Enter*.
C. Enter **Lower Capacitance** value. Press *Tab* or *Enter*.
D. Enter **Upper Level** value. Press *Tab* or *Enter*.
E. Enter **Upper Capacitance** value. Press *Tab* or *Enter*.
F. Click on **Write to Transmitter**.

3.8.3 Application Example

Example of an application using the PC software. (Application Data)

- Vertical Tank
- No Damping
- Caustic or Acid Material in Tank Sensing Element: 700-5-54, Model Code: 74 (***See Section 1.3***)
- Span Range Switch factory set to 4
- Maximum Capacity of Vessel = 1200 gallons
- Maximum Size of Vessel = 20 feet
- 4 mA (LRV) = 0 gallons
- 20 mA (URV) = 1185 gallons [19.5 feet]
- Point Cal was done using two known level points:
- Lo Cal = 3 feet [selected level]
- Hi Cal = 16 feet [current level]

3.8.3 Application Example (Continued)



*LRV may either reference the bottom of the vessel, bottom of the sensor, or an elevated point on the sensor.

Figure 3-12
Application Example Diagram

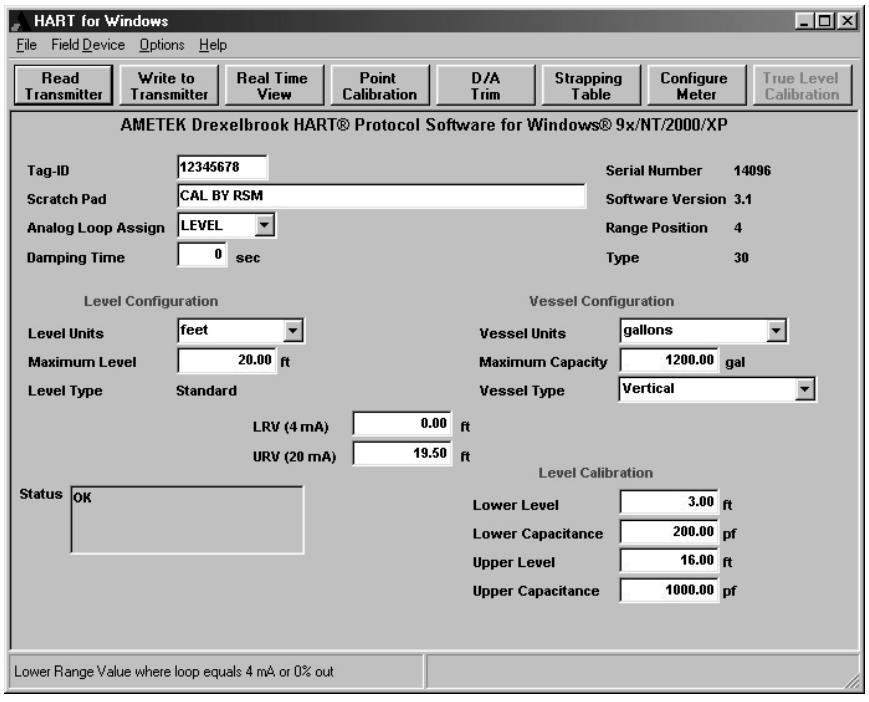


Figure 3-13
PC Software Menu Screen View of Application Example

3.9 PC Status Messages



Figure 3-13a
PC Software Menu Screen
View of Main Menu

Status Message: SPAN TOO SMALL
Difference between URV and LRV is less than 10% of range.
Example: For 0 to 10 foot calibration points: LRV=3.0 feet and URV=3.8 feet. When calibration points are too close together, overall accuracy of calibration is adversely affected.
Action: The calibration points should be farther apart.

Calibration Status Message: RAISE SPAN JUMPER
Based on LRV, URV, and capacitance calibration data, the estimated 100% capacitance exceeds selected range by greater than 10%.
Example: A unit in Range 4 (2000 pF) projects maximum capacitance equal to 2500 pF. Error message is displayed.
Action: Raise Range jumper (Section 3.8, Table 3-1) to position 5 for this example.

Calibration Status Message: LOWER SPAN JUMPER
Based on LRV, URV, and capacitance calibration data, the estimated 100% capacitance value is less than 10% of the maximum pF for the range below the selected range.
Example: A unit in Range Span 4 (2000 pF) projects maximum capacitance equal to 400 pF.
Action: Lower Range jumper (Section 3.8, Table 3-1) to position 3 (Max. pF of 450 pF) for this example.

Real-time Status Message: UNDERRANGE
Present capacitance/milliampere value is less than -5% of range.
Examples: Center wire connection is broken. Sensing element is not operating. An elevated Zero is used and actual level is below 4mA point. Vessel has lost its RF ground reference.
Action: Check connections and ground. Recalibrate if this level is in operational range of process.

Real-time Status Message: OVERRANGE
Present capacitance/ milliamp value over 105% of system span.
Examples: Actual level exceeds span point on sensing element. Cut in sensing element insulation or shorted coax.
Action: Check sensing element and coax. Re-calibrate if this level is in operational range of process.

3.10 Set D/A Trim

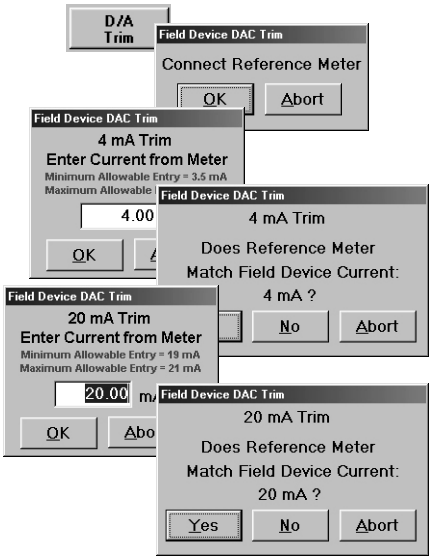


Figure 3-14
Setting D/A Trim Menu Screen "Pop-Ups"

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:

3.11 Strapping Table

The strapping table is a 2-point to 21-point table used by the RCT Series to cause the output current to follow a specified relationship to the level. There are certain strapping tables that are already built in to the transmitter software. These are: Linear (vertical tank); Horizontal Tank with flat ends; Horizontal Tank with dished ends; Horizontal Tank with hemispherical ends; and Spherical Tank. These predefined tables are automatically created by selections made with Vessel Configuration assignments during Configuration procedure in Section 3.7.2, and viewed by clicking the **Strapping Table** "button" on the Main menu.

If the output-to-level relationship is not defined by one of these tables, you may create a table in the Strapping Table program. To create a non-linear relationship, you will need at least 3 points and may use as many as 21 points. A 21-point table will define the relationship with more accuracy. A common example for a simple table would be a Cone Bottom Vertical tank which would require 3 points—the bottom, straight-side break point, and the top. On the other hand, an open channel flow application could benefit from using all 21 available points.

3.11 Strapping Table (Continued)

A. Plan your table by filling out table 3-2. You may use the first column which lists every 5% between 0 and 100%, or you may fill in your own values in column 2.

B. Fill out column 3 with output values corresponding to those listed in column 1 or 2.

C. "Click" on **Strapping Table** button to access table:

D. Enter the values you calculated into the screen view presented.

E. "Click" on **Write Strapping Table**.

F. "Click" on **Exit** when completed.

Table 3-2
RCT Series
Strapping Table

Point Number	Level Standard Preset Values % Level	Level Optional Values % Level	Output Value In Selected Units
1.	0		
2.	5		
3.	10		
4.	15		
5.	20		
6.	25		
7.	30		
8.	35		
9.	40		
10.	45		
11.	50		
12.	55		
13.	60		
14.	65		
15.	70		
16.	75		
17.	80		
18.	85		
19.	90		
20.	95		
21.	100		

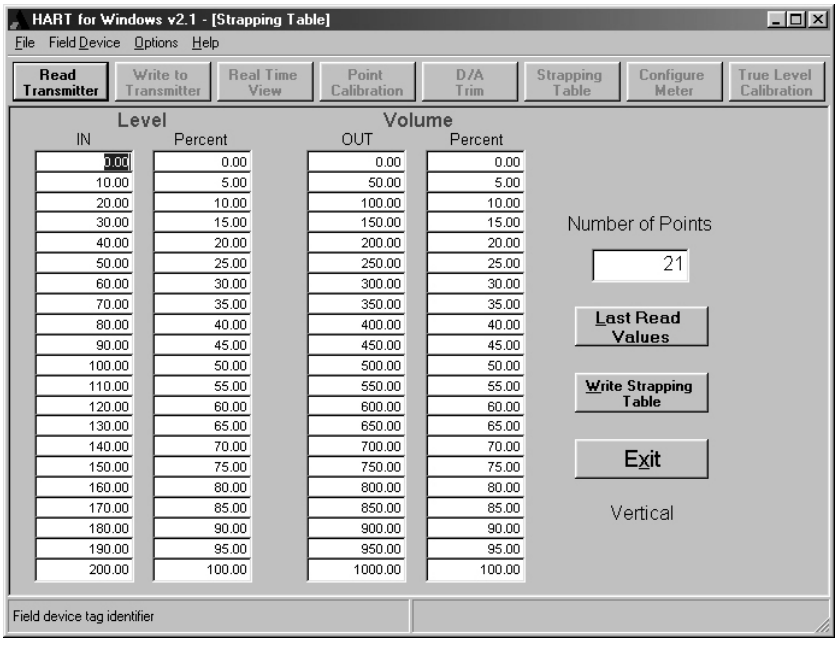


Figure 3-15
Menu Screen Transforms to Strapping Table

NOTICE

*By clicking on **Last Read Values**, this view may also be used to review existing strapping tables previously entered.*

3.12 Digital Integral Meter Configuration

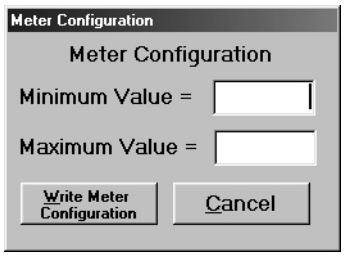


Figure 3-16
Configure Meter Pop-up from Menu Screen; values relate to LRV & URV

The optional 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. ***See Figure 2-16***

The meter can be configured to read any engineering units, e.g. 4-20 mA, gallons, inches, feet, etc. Status messages are also displayed on the meter. Refer to Section 2.9 for meter installation.

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 = 100.00

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 level:
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.

3.13 Save/Print Entries

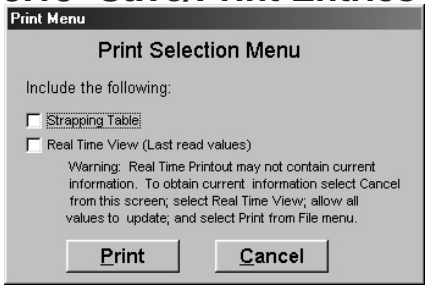


Figure 3-17
Print Pop-up from Menu

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, Level and Vessel Configurations, Level Calibration, all of the Real Time View numbers, and all of the Strapping Table entries.

3.13 Save/Print Entries (Continued)

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 .slt file and .txt files.

The .slt 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.

3.14 Validation

More and more industries are requiring formal validation of their processes for their customers as well as for various government regulatory agencies. The RCT Series Transmitter has this capability built in.

3.14.1 Validation Design Concept

Smart RF Continuous Level systems derive their input information from a sensing element that provides a capacitance value to the RF Transmitter. The RF Transmitter output signal is derived from this capacitance value, based on the capacitance span of the transmitter during initial calibration.

If the RF Transmitter's minimum and maximum capacitance values are known, and remain unchanged, the effects of a specific capacitance value within this range can be accurately predicted. If a known capacitance (which can be NIST-traceable) within this range produces repeatable results and the minimum and maximum values remain unchanged the RF Level system can be assumed to be operating correctly.

With a known capacitance input, the output signal would not be repeatable if the calibration information is altered, or if the RF transmitter was not operating within specifications. Repeatable calibration information can be maintained through the use of the Save/Print capability built into the RCT Series Transmitter.

3.14.2 Validation Procedures

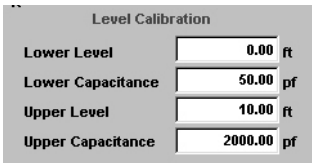


Figure 3-18
Capacitance on Menu Screen

A. Drexelbrook Laptop software must be used. Connect the laptop to the smart level transmitter signal loop to be validated and start the software according to the instructions provided at the beginning of this *Section 3*.

B. At the Main configuration screen observe the **Level Calibration, Lower Capacitance,** and **Upper Capacitance** values and the **Lower**

3.14.2 Validation Procedures (Continued)

Level and **Upper Level** values. Select an NPO Capacitor (which can be NIST traceable, if desired or required) that falls somewhere mid-range. **Example:** ***See Fig. 3-18.*** If Lower Capacitance is 50pF and Upper Capacitance is 2000pF, that corresponds to a Lower Level and Upper Level of 0-10 feet. Select an NPO Capacitor of approximately 1000pF. [Drexelbrook 401-6-8 Capacitor Substitute Box may also be used; it is traceable to NIST].

C. Connect the NPO capacitor selected from the last step to the **Probe** and **Ground** connections at the transmitter (with coaxial cable from sensing element disconnected).

D. Select **Real Time View** on the PC software Menu Screen (F4 on your keyboard) ***See Fig. 3-19***. The display should show the Capacitance as the value of the NPO Capacitor (within the capacitors tolerance), and the **LEVEL** should display close to the mid-range of the Lower and Upper Level from the **Level Calibration** field. The **Loop Current** and the **Percentage** will also reflect the values that are generated by the NPO Capacitor. Add to the scratch pad of the Menu Screen the value of the NPO capacitor that you used. If desired, this information can be printed out for file or record purposes. Mark or Tag this capacitor***** to correspond to this specific transmitter. Put the capacitor in a safe location for use in subsequent testing and validation.

E. By placing the same exact capacitor***** on the RF transmitter's **Probe** and **Ground** terminals and observing the signal output generated by this capacitor, it can be verified that the transmitter is operating properly and that the calibration information is the same as during the initial set up.

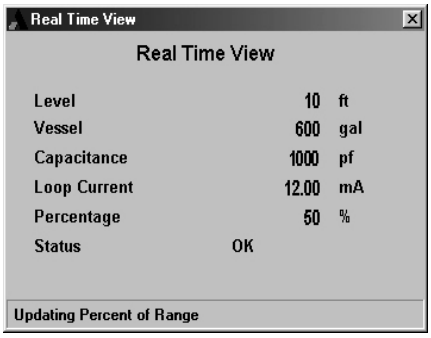


Figure 3-19
Real Time View Pop-up from Menu Screen

NOTICE

* Every capacitor manufactured will generate a slightly different capacitance value within its specified tolerance. By marking the capacitor and using only this capacitor for testing and validating the AMETEK Drexelbrook RCT Series Transmitter, the system should produce repeatable results within transmitter specifications.

3.14.3 Validation Results

See Fig. 3-20.
If the information that is shown (or printed) matches the initial readings within system specifications, then it can be verified that the calibration and configuration is as originally set. It can also be verified that the transmitter's response falls within acceptable tolerances. The system has passed validation tests. Using the Save/Print feature built into the transmitter allows the ability to comply with the record-keeping needed for many processes by regulatory agencies.

AMETEK Drexelbrook
205 Keith Valley Road
Horsham, PA 19044
Telephone: 215-674-1234
FAX: 215-674-2731
Service: 800-527-6297

Tag-ID:	LT 101	Serial Number:	1172
Scratch PAD:	1000 pf NPO validation capacitor	Software Version:	3.1
Analog Loop Assign:	LEVEL	Range Position:	4
Damping Time:	0 sec.	Type:	30

Level Configuration		Vessel Configuration		Level Calibration	
Level Units:	feet	Vessel Units:	gallons	Lower Level:	0 ft
Maximum Level:	10.00 ft	Maximum Capacity:	1200.00 gal	Upper Level:	10 ft
Level Type:	Standard	Vessel Type:	Vertical	Lower Capacitance:	50 pf
				Upper Capacitance:	2000 pf
		LRV (4mA):	0.00 ft		
		URV (20 mA):	10.00ft		

Real Time View

Level:	10 ft
Vessel:	600 gal
Capacitance:	1000 pF
Loop Current:	12.00 mA
Percentage:	50 %
Status:	OK

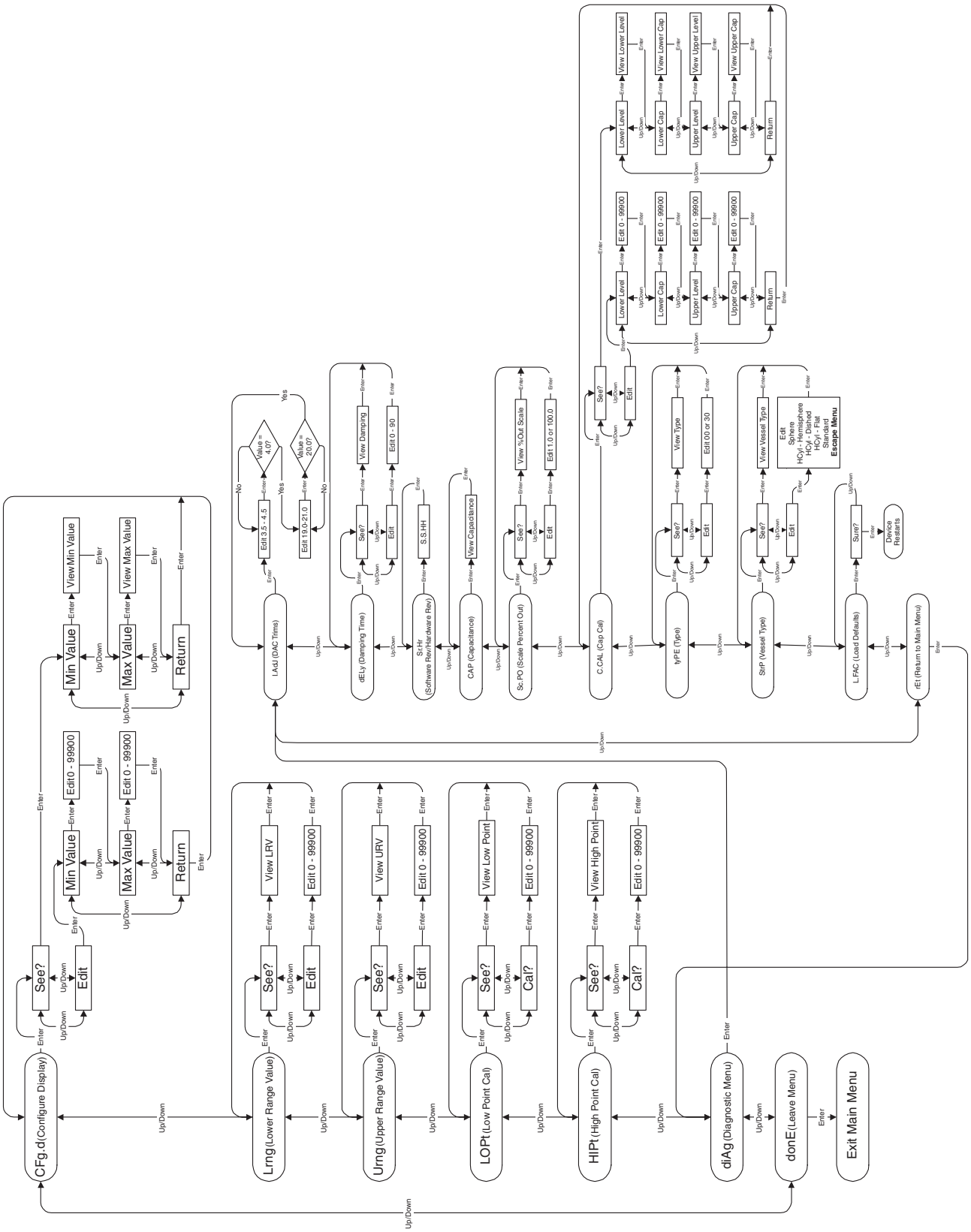
Strapping Table

Vessel Type: Vertical
Number of Points: 21

Level		Volume	
In	Percent	Out	Percent
0.00	0.00	o.oo	0.00
1.00	5.00	60.00	5.00
2.00	10.00	120.00	10.00
3.00	15.00	180.00	15.00
4.00	20.00	240.00	20.00
5.00	25.00	300.00	25.00
6.00	30.00	360.00	30.00
7.00	35.00	420.00	35.00
8.00	40.00	480.00	40.00
9.00	45.00	540.00	45.00
10.00	50.00	600.00	50.00
11.00	55.00	660.00	55.00
12.00	60.00	720.00	60.00
13.00	65.00	780.00	65.00
14.00	70.00	840.00	70.00
15.00	75.00	900.00	75.00
16.00	80.00	960.00	80.00
17.00	85.00	1020.00	85.00
18.00	90.00	1080.00	90.00
19.00	95.00	1140.00	95.00
20.00	100.00	1200.00	100.00

Figure 3-20
Typical Printout of Transmitter Data

3.15 Calibration & Configuration via 401-44-3 Display/Keypad



SECTION 4

SECTION 4: CONFIGURATION AND CALIBRATION WITH MODEL 275 WITH DREXELBROOK DEVICE DESCRIPTION

4.1 Drexelbrook Device Description

The Drexelbrook Device Description for the Rosemount 275 handheld calibrator makes it easy to calibrate a RCT Series. The device description software is stored in the memory module (located in the back portion) of the calibrator.

To determine if your Model 275 Handheld calibrator has the Drexelbrook Device Description loaded, do the following steps:

- Turn on the calibrator.
- From the top screen, push ***1. Offline***.
- Push ***1. New Configuration***
- A ***Table of Contents*** is shown that lists all the Manufacturers in alphabetical order.
- Drexelbrook is third on the list in the current release.
- Select the Manufacturer (**Drexelbrook**) and a list of supported devices is displayed (RCT Series).
- Return to top screen, by backing up from arrow keys.

The Memory Module with the device description can be purchased as a direct replacement either from Drexelbrook (401-700-25) or from the local Fisher-Rosemount Service Center.

Appendix A describes configuration of the RCT Series transmitter with a Rosemount 275 handheld calibrator without a device description.

4.2 Start-up

After the RCT Series transmitter is installed and loop power is applied, per Section 2, do the following:

1. Connect the Rosemount Model 275 as shown in ***Figure 4-1.***
2. Turn on the Calibrator and look for the ONLINE screen to appear. ONLINE means that the 275 Calibrator has recognized the RCT Series and is ready for Configuration and Calibration.
3. You must start the process by doing the Configuration first-- followed by Calibration. There are also instructions for configuring the Strapping Tables and for doing a D/A Trim to make the loop output agree with a calibration standard for loop current.

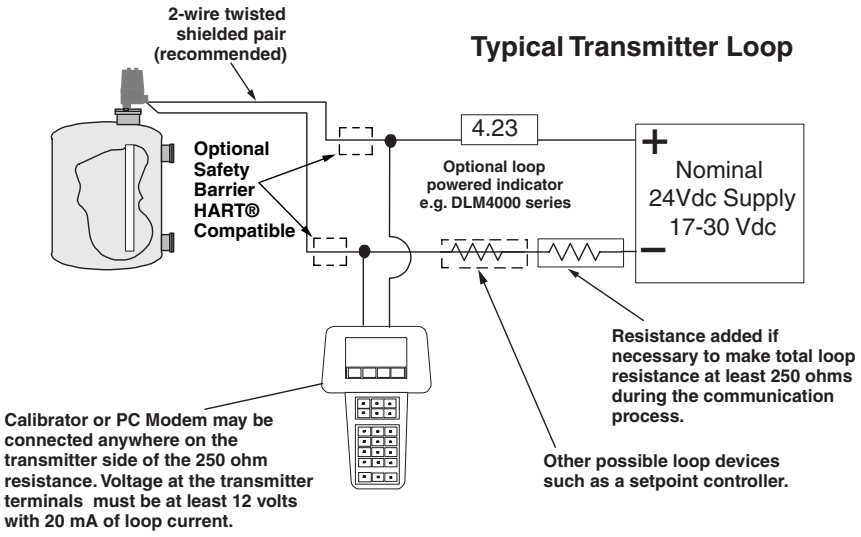
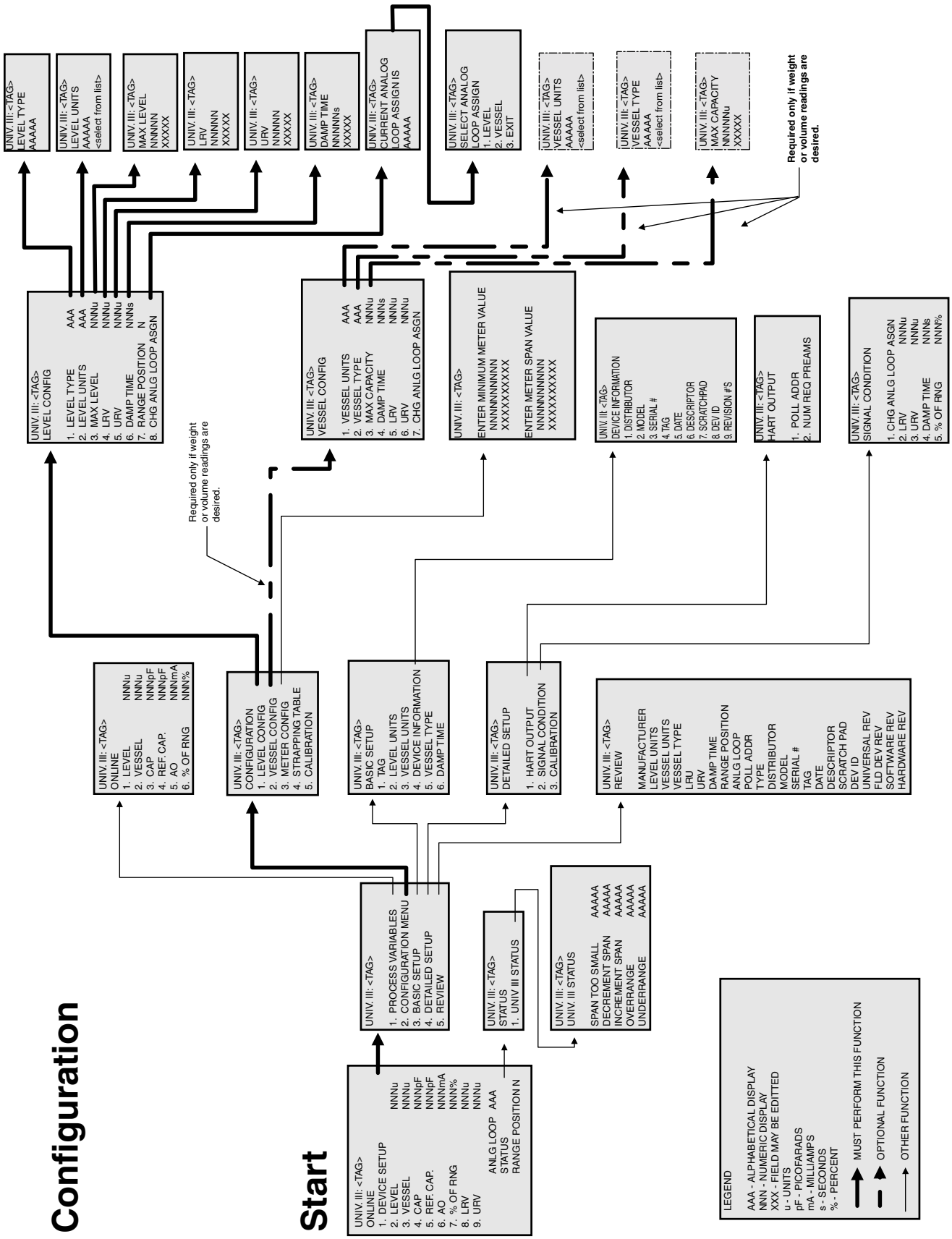


Figure 4-1
Typical Transmitter Loop

4.3 Configuration



4.3 Configuration (Continued)

Following is the keystroke sequence for Configuration using the Model 275 Calibrator.

Select **Device Setup**.
Select **Configuration Menu**.
Select **Level Config**.

Select **Level Type**—edit Level Type—return to Level Config screen.

Select **Level Units**—edit Level Units—return to Level Config screen.

Select **Max Level**—edit Max Level—return to Level Config screen.

Select **LRV**—edit LRV—return to Level Config screen.

Select **URV**—edit URV—return to Level Config screen.

Select **Damp Time**—edit Damp Time—return to Level Config screen.

Select **Chg Anlg Loop Assign**—edit Current Loop Assign. If current loop assign is Level and is correct, go to next screen and select Exit. Proceed to 4.3 Calibration.

If Vessel configuration is to be selected, choose Vessel, go back to Config screen and select **Vessel Config**. Edit all values as done for Level Config. Select **Exit** and proceed to 4.4 Calibration.

4.4 Calibration

There are two methods of calibrating the RCT Series transmitter: **Point Calibration** or **Capacitance Calibration**.

Point calibration uses the actual level in your vessel for calibration. The further apart the two points are for the calibration, then the better the accuracy of the overall measurement.



Capacitance calibration uses values obtained from the Drexelbrook Service department (or a previous calibration or identical application) for the zero and span calibration data. Call 1-800-527-6297 for assistance. Please provide the purchase order number, transmitter serial number and application information to the Service Engineer.

It is permissible or sometimes even recommended that both methods be used in order to establish a calibration standard. For example, if the vessel was already filled before the calibration was attempted and it is difficult or impossible to lower the level to establish the second point,

4.4 Calibration (Continued)

it would be best to use a calculated zero capacitance for the low point and actual level for the high point. While this wouldn't be as accurate as two known level points, it will be reasonably accurate until an actual low point can be established. The Service department will help in calculating high or low capacitance values.

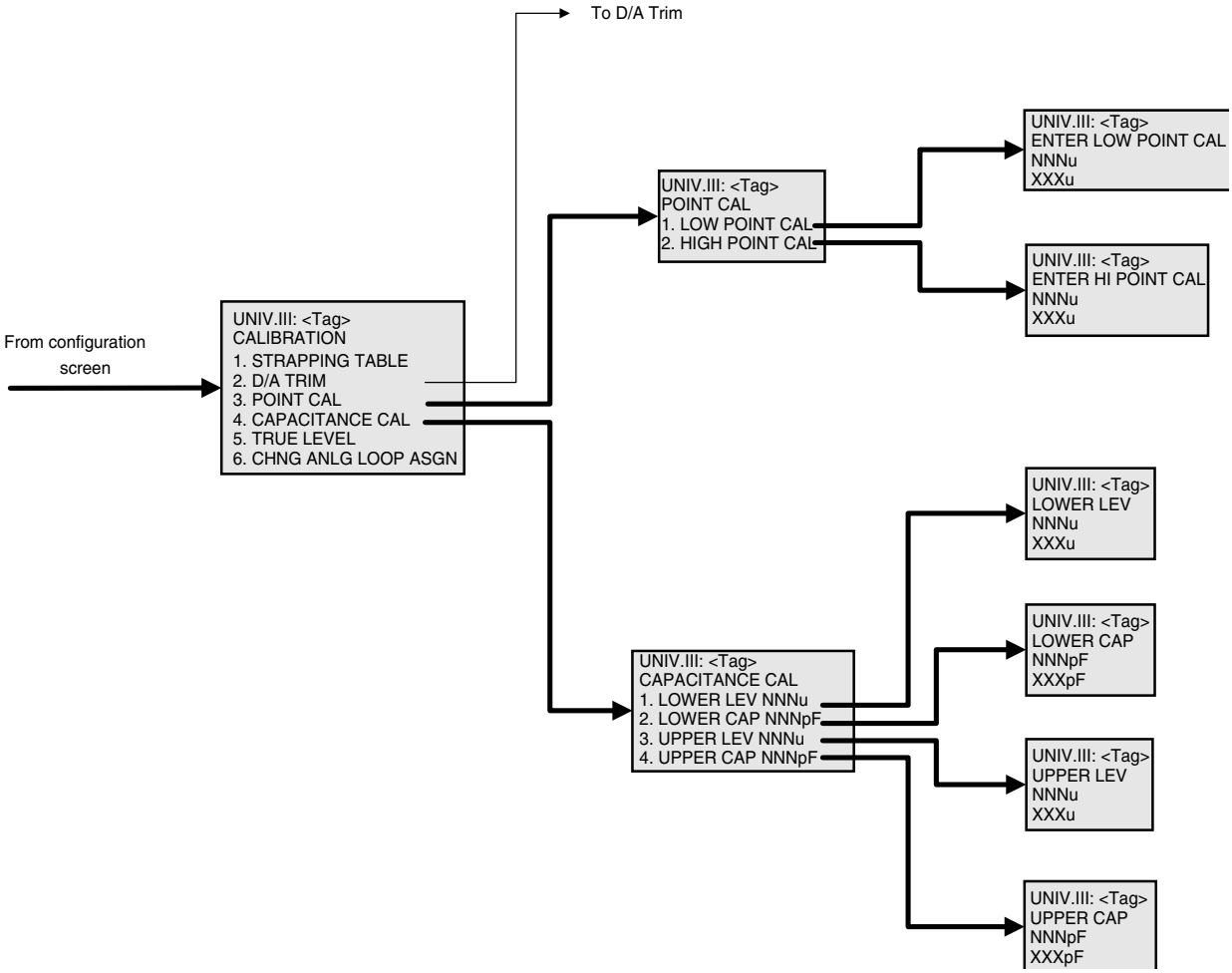
4.4.1 Point Calibration

Following is the keystroke sequence for Point Calibration using the Model 275 Calibrator.

Select **Device Setup**.
Select **Configuration Menu**.
Select **Calibration**.

Select **Point Cal**—select either **Low Point Cal** or **High Point Cal** depending on whether you plan to raise or lower the level for your second point—edit value to agree with the present actual level and return to Point Cal screen.

Exit—Calibration is complete.



4.4.2 Capacitance Calibration



Capacitance calibration uses zero and span capacitance values as the calibration data. These values can be obtained from the Drexelbrook Service department (or a previous calibration or identical application). Call 1-800-527-6297 for assistance. Please provide your DE purchase order number, transmitter serial number, and application information to the Service Engineer.

Following is the keystroke sequence for Capacitance Calibration using the Model 275 Calibrator.

Select **Device Setup.**
Select **Configuration Menu.**
Select **Calibration.**

Select **Capacitance Cal**—select either **Lower Level** or **Upper Level** depending on whether the next value will be higher or lower for the second point—edit capacitance value and level as a pair—return to Capacitance Cal screen.

Exit—Calibration is complete.

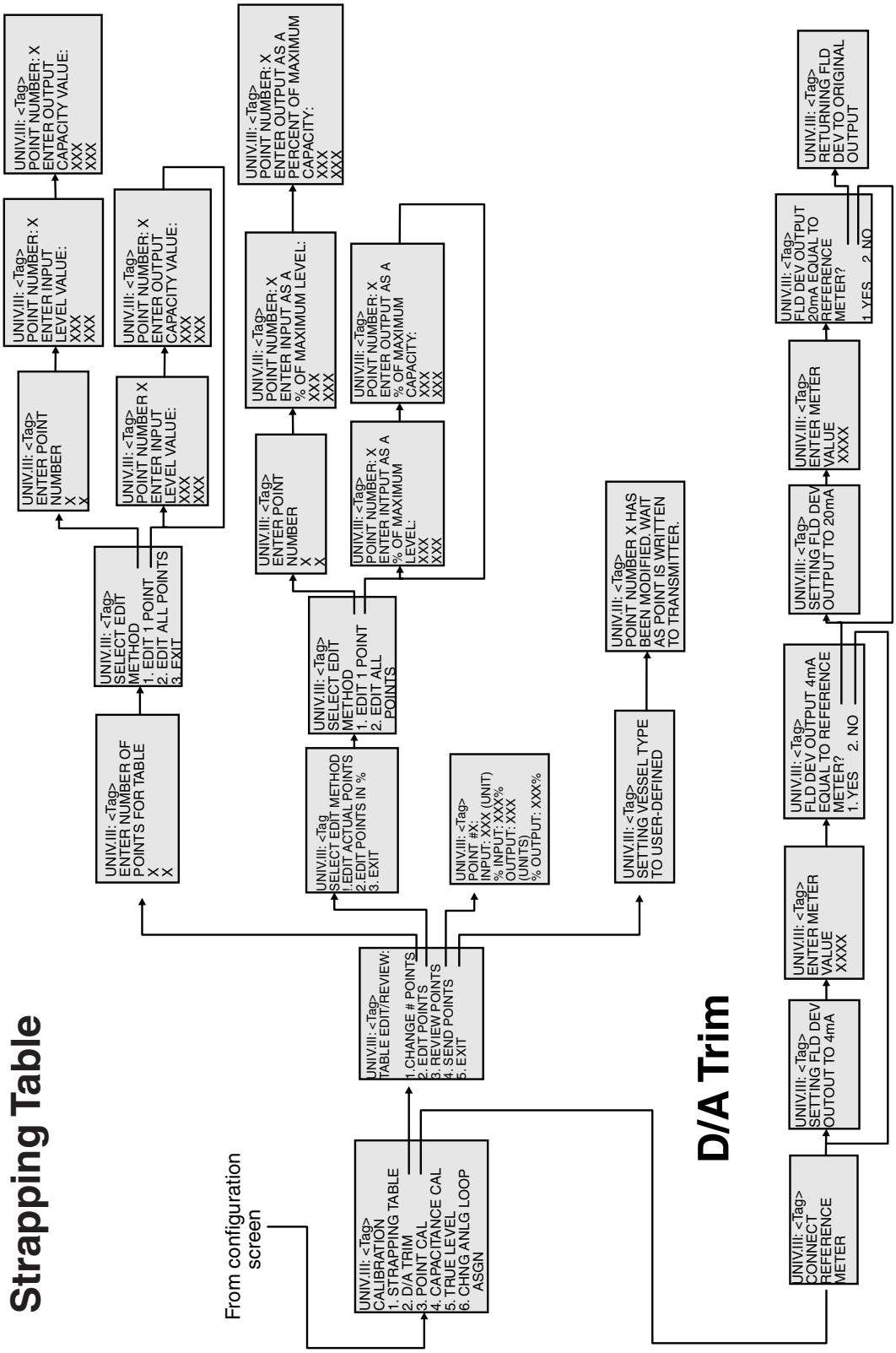
4.4.3 D/A Trim

Refer to the D/A Trim diagram for the D/A Trim sequence and Strapping Table configuration.

D/A Trim Diagram

NOTICE

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.



4.4.4 Strapping Table

The strapping table is a 2-point to 21-point table used by the RCT Series to cause output current to follow specified relationship to level. There are certain strapping tables that are already built in to the transmitter software. These are: Linear (vertical tank); Horizontal Tank with flat ends; Horizontal Tank with dished ends; Horizontal Tank with hemispherical ends; and Spherical Tank. These predefined tables are automatically created by selections made with Vessel Config assignment during Configuration procedure in Section 4.3.

If output-to-level relationship is not defined by one of these tables, you may create a table in Strapping Table program. To create a non-linear relationship, you will need at least 3 points and may use as many as 21 points. A 21-point table will define relationship to about a 0.1% accuracy. Common example for a simple table would be Cone Bottom Vertical tank which would require 3 points—bottom, straight-side break point, and top. Open channel flow application, however, could benefit from using all 21 available points.

- Plan your table by filling out form below. You may use first column which lists every 5% between 0 and 100%, or you may fill in your own values in column 2.
- Fill out column 3 with output values corresponding to those listed in column 1 or 2.

Point Number	Level Standard Preset Values % Level	Level Optional Values % Level	Output Value In Selected Units
1.	0		
2.	5		
3.	10		
4.	15		
5.	20		
6.	25		
7.	30		
8.	35		
9.	40		
10.	45		
11.	50		
12.	55		
13.	60		
14.	65		
15.	70		
16.	75		
17.	80		
18.	85		
19.	90		
20.	95		
21.	100		

SECTION 5: Configuration & Calibration of RCT Series with Model 275 Communicator without a Device Description

The Model 275 Communicator can be used to enter and download configuration/ calibration values to the RCT Series transmitter.

5.1 Range/Span Control

Definitions:

- **LRV** - Lower Range Value of control loop.
- **LSL** - Lower Sensor Limit corresponding to minimum level point.
- **PV** - Process Variable; level value from transmitter.
- **SV** - Secondary Variable; could be volume or weight-based on PV.
- **URV** - Upper Range Value of control loop.
- **USL** - Upper Sensor Limit corresponding to maximum level point.

The first step in configuration is to identify the span range position of the instrument. There is a jumper on the back of the electronics chassis: Range Span ***See Fig. 3-9***. The Range Span provides continuous adjustment of the change in capacitance required to produce full scale current. Each Range Span position advances the range in inches or feet to approximately five times the previous setting. Table A-1 gives the range span position for a number of common sensing elements and range of measurement.

Table 5-1 Range/Span Setting Chart

Probe Length Vs. Span Position Number / Maximum Pf

Jumper Position:	1	2	3	4	5	6
Max Pf	20	100	450	2000	10000	40000
System	**Maximum Probe Length In Feet**					
Conducting Liquids						
RCTX3XXXXX18	N/A	N/A	5.4	20	N/A	N/A
RCTX3XXXXX74	N/A	N/A	9.2	40	200	920
RCTX3XXXXX45	N/A	N/A	1.2	5.3	20	N/A
RCTX3XXXXX70	N/A	N/A	1.4	6.25	31	140
RCTX3XXXXX40	N/A	N/A	7.8	20	N/A	N/A
RCTX3XXXXX47	N/A	N/A	N/A	N/A	4.1	14
RCTX3XXXXX22	N/A	N/A	5.4	20	N/A	N/A
RCTX3XXXXX65	N/A	N/A	5.4	20	N/A	N/A
RCTX3XXXXX72	N/A	N/A	N/A	4.2	21	95
Interface Application						
RCTX2XXXXX45	N/A	N/A	1.2	5.3	20	N/A
RCTX2XXXXX43	N/A	N/A	1.0	4.8	20	N/A
RCTX2XXXXX47	N/A	N/A	N/A	N/A	4.0	14
Insulating K=1.5-5						
RCTX2XXXXX22	N/A	2.7	12.5	20	N/A	N/A
RCTX2XXXXX18	N/A	8.3	20	N/A	N/A	N/A
RCTX2XXXXX74	N/A	8.0	37.5	16	N/A	N/A
RCTX2XXXXX45	N/A	3.6	16.2	20	N/A	N/A
RCTX2XXXXX70	N/A	3.8	17.1	76	N/A	N/A
RCTX2XXXXX40	N/A	6.0	20	N/A	N/A	N/A
RCTX2XXXXX43	N/A	5.0	20	N/A	N/A	N/A
RCTX2XXXXX47	N/A	5.0	14	N/A	N/A	N/A

5.2 Basic Rules & Conventions of HART Configuration Software (Model 275)

To become familiar with the operation of the Model 275 Communicator, it is best to review the Operating Manual that comes with the unit. This paragraph reviews some of the basic characteristics of the Model 275 configuration/ calibration software. The following pages show the decision tree menus.

Arrow Keys: Use the arrow keys to move through the software menus. An arrow at the beginning of the menu item indicates the next progressive step.

Alphanumeric Keys: Use the alphanumeric keys to enter data. Data fields are characterized by a blinking cursor.

Function Keys: The function keys, F1 through F4, indicate the specific actions that are available to complete the software function. The action words that appear above each key change as you move through the menus and select the software task.

Heart Symbol: When a ♥ appears in the upper right corner of the screen, communication is occurring between the communicator and the transmitter.

5.3 Tag ID

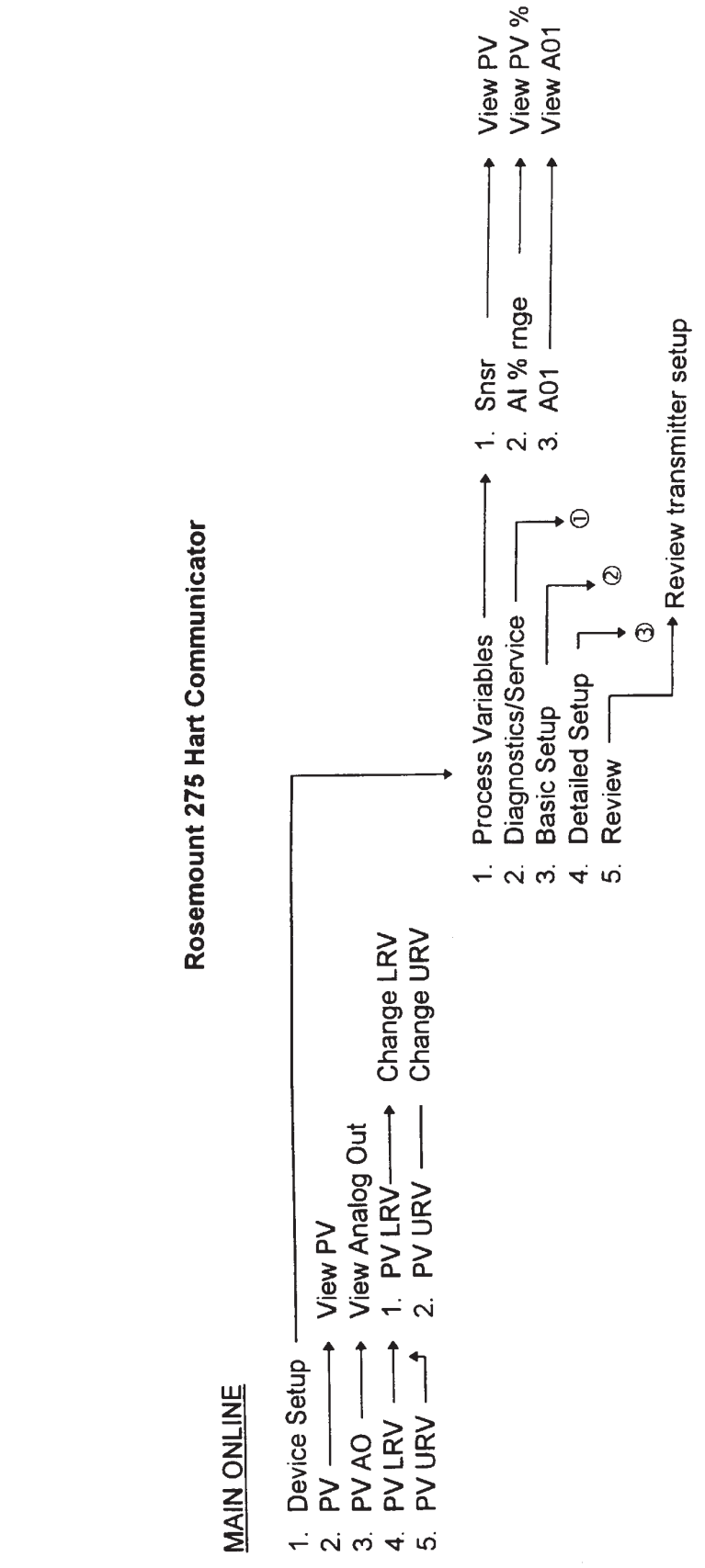
To name or identify the transmitter, use the 8-character Tag ID. The Tag ID is entered or changed in the following menus.

a) select the ONLINE MAIN menu
b) ⇒1 DEVICE SETUP ⇒ ⇓ ⇓
c) ⇒3 BASIC SETUP ⇒
d) ⇒1 TAG ⇒
e) change (use alphanumeric keys) Tag ID
f) F4 ENTER
g) F2 SEND
h) F4 OK
i) F4 OK

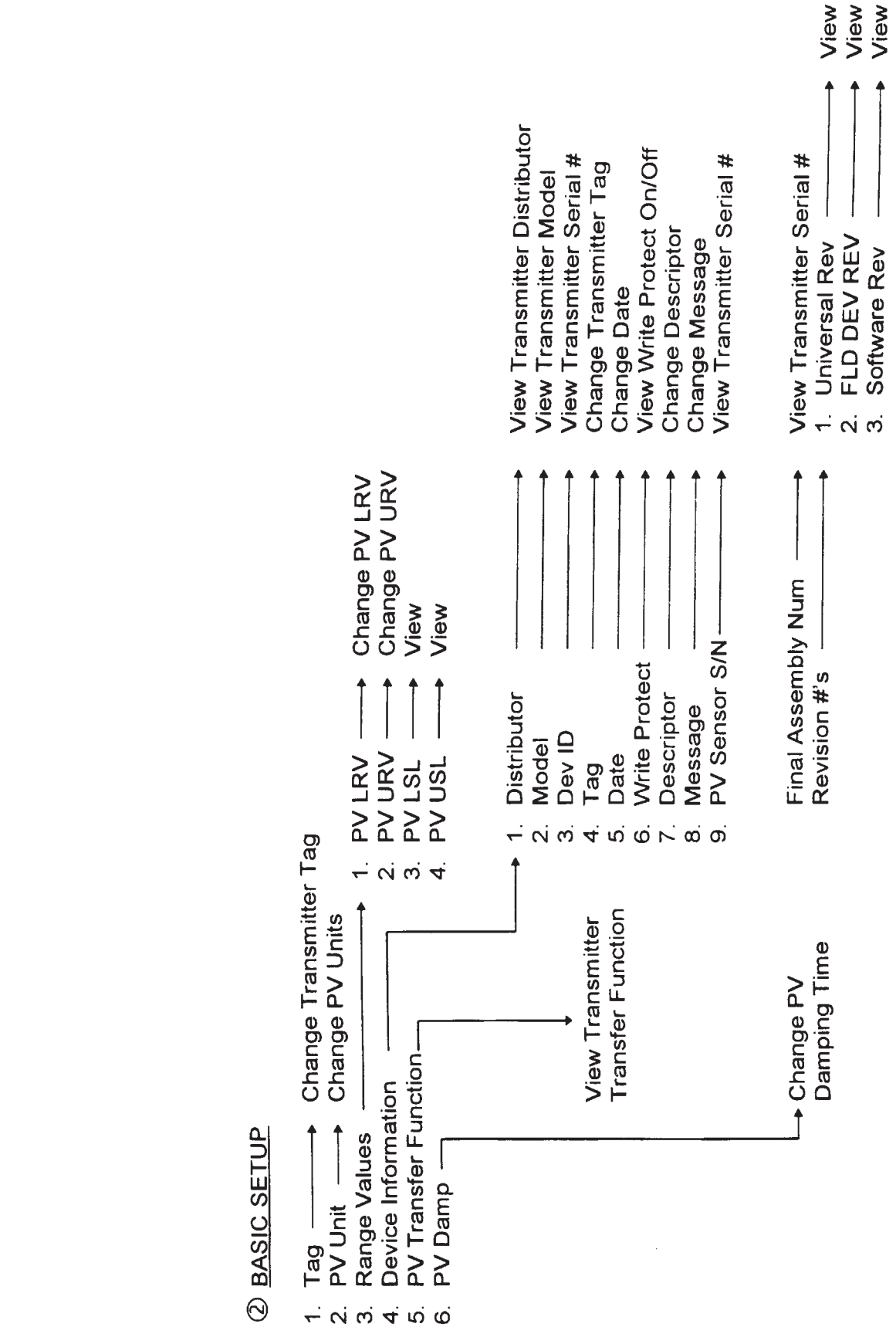
or:

a) select the ONLINE MAIN menu
b) ⇒1 DEVICE SETUP⇒ ⇓ ⇓
c) ⇒3 BASIC SETUP⇒ ⇓ ⇓ ⇓
d) ⇒4 DEVICE INFORMATION⇒ ⇓ ⇓ ⇓
e) ⇒4 TAG⇒
f) change (use alphanumeric keys) Tag ID
g) F4 ENTER
h) F2 SEND
i) F4 OK
j) F4 OK
k) F3 HOME

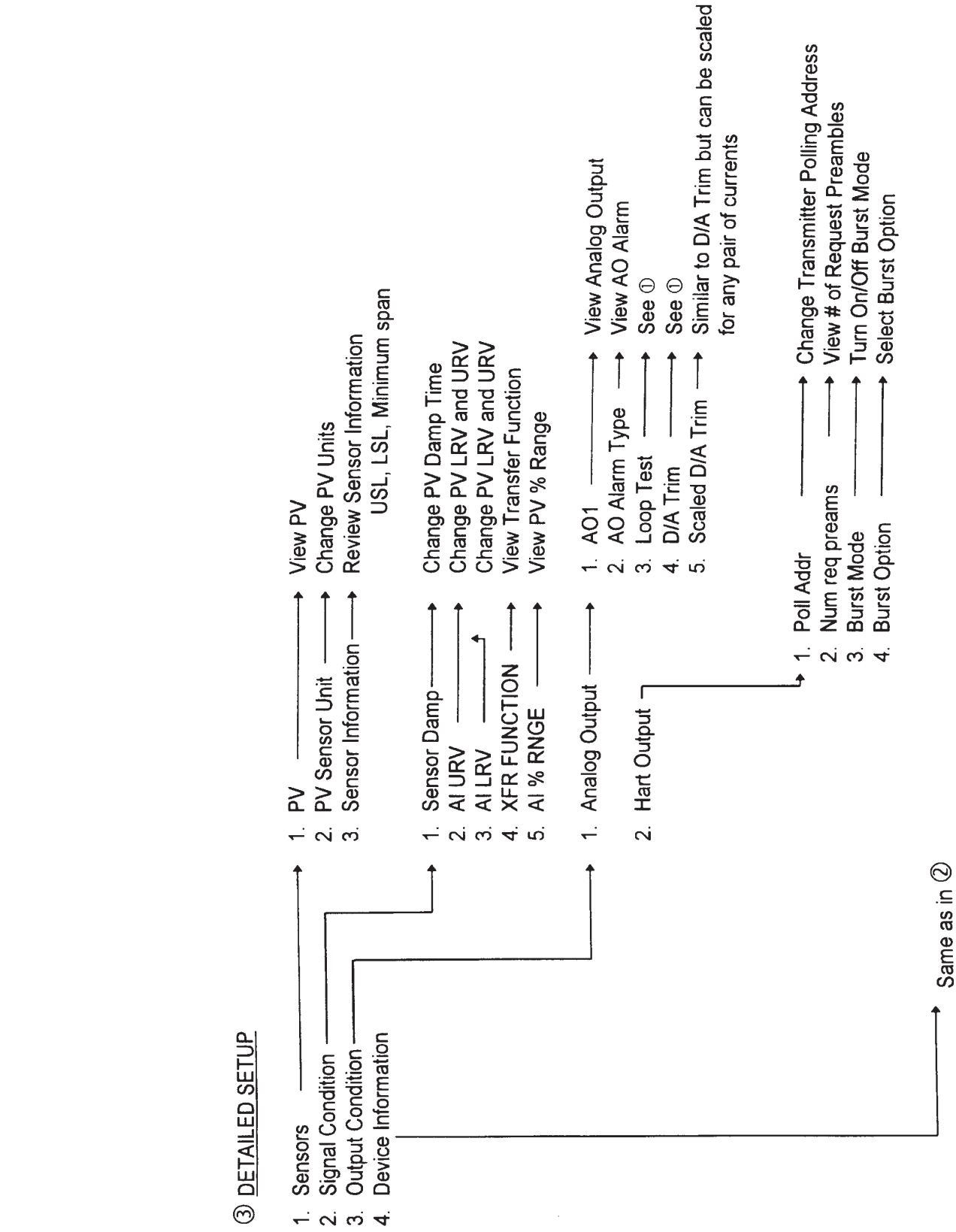
5.4 Set Up Procedures



5.4 Set Up Procedures (Continued)



5.4 Set Up Procedures (Continued)



5.5 Reading Input and Output

Within the Model 275 configuration, there are several different menus that allow you to view the Process Variable (PV) and the Analog Output (AO1).

View PV Input:

a) select the ONLINE MAIN menu ⇓
b) ⇒1 DEVICE SETUP ⇒ ⇓⇓⇓
c) ⇒4 DETAILED SETUP ⇒
d) ⇒1 SENSORS ⇒
e) ⇒1 PV ⇒
f) view Process Variable ❤
g) EXIT F4
h) HOME F3

or:

a) select the ONLINE MAIN menu ⇓
b) ⇒2 PV ⇒
c) view Process Variable ❤
d) F4 EXIT
e) ⇒2 PV ⇓
f) ⇒3 PV AO
g) view Analog Output ❤
h) F4 EXIT

or:

a) select the ONLINE MAIN menu
b) ⇒1 DEVICE SETUP
c) ⇒1 PROCESS VARIABLES
d) ⇒1 SNSR ⇒
e) view Process Varible ❤
f) F4 EXIT
g) ⇒1 SNSR ⇓
h) ⇒2 AI % RANGE ⇒
i) view PV% ❤
j) F4 EXIT
k) ⇒2 AI % RANGE ⇓
l) ⇒3 AO1 ⇒
m) view Analog Output ❤
n) EXIT F4
o) HOME F3

5.6 Calibration Using Actual Tank Level

When calibrating using a handheld without a device description, tank level must be moved. Calibration is a two-step process. A low point calibration and high point calibration are required. Calibration points do not have to be an empty tank or a full tank. (example: low point performed at 20% and high point performed at 80 % will work). You also may perform high point cal before low point cal.

From main screen go to:
1 Device setup
2 Diag/Service
3 Calibration
4 Enter values

You now have four choices:
1 PV LRV
2 PV URV
3 PV USL
4 PV LSL

Choose **PV LRV** if your vessel currently has a low level.
Choose **PV URV** if your vessel currently has a high level.

Edit the displayed value to equal the actual tank level, then:

ENTER
SEND
OK
OK
⇐
1 Apply values
OK

You now have two choices:
1 4mA
2 20 mA

Choose **20mA** if performing a high point calibration.
Choose **4mA** if performing a low point calibration.

Continue: OK
ENTER
3 EXIT
OK
HOME

Observe on the home screen that your PV URV or PV LRV value has been changed by the calibration procedure. You must manually change these values back. Re-enter your desired PV URV and PV LRV at this time.

This completes the first calibration point of the two-step process. For the second point, change the level in your tank and repeat the entire above procedure.

5.7 Bench Calibration (if needed)

When performing a bench calibration tank level will be simulated using a Drexelbrook 401-6-8 C-box. Calibration is a two-step process. A low point calibration and high point calibration are required

Hook up a Drexelbrook c-Box in place of the sensing element. Dial up the capacitance value that corresponds to an empty tank. For specific information on how to wire and use the C-box calibrator see the instructions that came with the calibrator.

From main screen go to:

1 Device setup
2 Diag/Service
3 Calibration
4 Enter values

You now have four choices

1 PV LRV
2 PV URV
3 PV USL
4 PV LSL

Choose **PV LRV** if performing a low point calibration.
Choose **PV URV** if performing a high point calibration.

Edit the displayed value to equal the actual tank level,then:

ENTER
SEND
OK
OK
⇐
1 Apply values
OK

You now have two choices:

1 4mA
2 20mA

Choose **20mA** if performing a high point calibration.
Choose **4 mA** if performing a low point calibration.

Continue: OK
ENTER
3 EXIT
OK
HOME

Observe on the home screen that your PV URV or PV LRV value has been changed by the calibration procedure. You must manually change these values back. Re-enter your desired PV URV and PV LRV at this time.

This completes the first calibration point of the two-step process. Change the value on the C-box to correspond to the Picofarads of a full tank and repeat the entire above procedure for a high point calibration.

5.7.1 Bench Calibration Information Sheet

Company _____

City _____ State _____

Customer P.O. Number _____ Item _____ DE# _____ Tag No. _____

Filled out by: _____ Date _____ Phone _____ Fax _____

Material being Measured - Fill out any known information

Name of Material: _____ ☐ Level Measurement ☐ Interface Measurement

Dielectric Constant: (K) _____

Conductivity: (g) _____ Vessel Shape ☐ Vertical Cylinder

Other: _____ ☐ Horizontal Cylinder

☐ Other _____

Installation Details

☐ NPT Thread Mount

☐ Flange Mount- if flange mount

B = _____ inches

E = _____

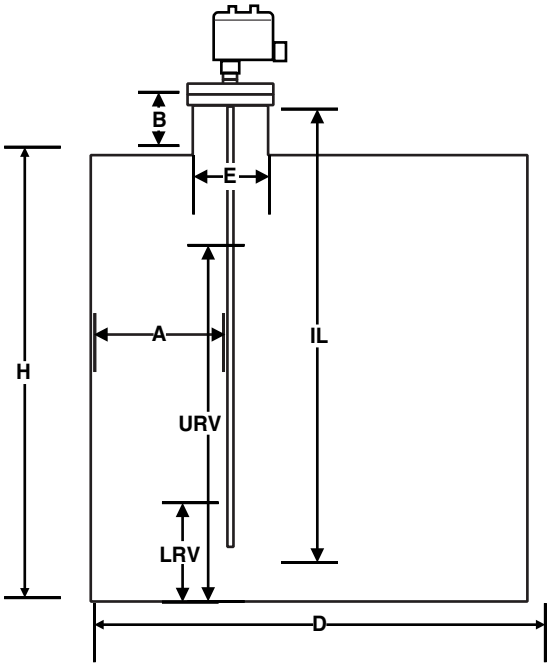
A = _____ inches

H = _____ inches

D = _____ inches

H = _____ inches

IL = _____ inches



Unless specified otherwise, calibration values of zero and span capacitances will be based on 4-20 mA being over the entire range of 'H'. If other values are desired specify LRV and URV in inches.

LRV = _____ inches

URV = _____ inches

Calculations by Drexelbrook

LRV _____ Calculated Zero Capacitance _____ pF

URV _____ Calculated Span Capacitance _____ pF

Calculated by: _____ Date _____

Phone 800-527-6297

Fax 215-443-5117

Appx-A-smh.pmd
Page 0 of 1 Created 07/31/1997 by ELS
Revised 08/07/2002 12:21 PM

5.8 Point Calibration

Equipment Required:
- RCT Series HART® Smart Transmitter
- Model 275 HART® Calibrator
- 24V Power source
- Approximately 250 ohm total loop resistance
- Two known process levels applied to the probe

This procedure uses an example of a point calibration for full-scale (20mA) = 35 ft. and zero (4mA) = 1.5 ft.

5.8.1 Fine Tuning Calibration

NOTICE

The procedure SET UP ZERO AND FULL SCALE LIMITS must be performed to set up the vessel zero and full-scale limits sometime prior to performing a point calibration. This informs the RCT Series of the tank level limits and only needs to be performed once for a given installation.

When a known level is available that is closer to an endpoint than a previous calibration point, it may be used as a new calibration point to increase accuracy. This is done in the following steps:

ENTER THE UPPER CALIBRATION POINT and/ or ENTER THE LOWER CALIBRATION POINT with the new known level applied.

The order of execution between the upper and lower calibration procedures does not matter. They can be done at different times.

5.8.2 Selecting Engineering Units

The examples in this procedure use the default units of feet. For other units, use the following procedure:

A. Connect the handheld communicator to the 4-20 mA loop per Figure 4-1.

B. Power the loop and proceed with following steps.

Do	See	Function	Comments
1/0	Online (Generic)		Power On
1	Device Setup	Select Device Setup	
3	Basic Setup	Select Basic Setup	
4	PV Snsr unit	Select PV Units	
⇑ and ⇓	Available Units	Use the arrow keys to scroll through the available units and press [ENTER] when the desired unit is displayed.	
[ENTER]	Basic Setup	Select highlighted unit	

Home Online (Generic) Desired units are now selected.

5.9 Handheld Calibrator Error Messages

Error Message: **Applied Process Too High**

The applied process at 100% exceeds the capacitance range setting by at least 5% of span.

Example: URV = 10 ft., Applied Process = 12 ft. will generate this error.

Action: The Span Select Jumper Must Be Raised. This allows the process output at 100% to be within the range of the span range capacitance.

Error Message: **Span Too Small**

The difference between the URV and LRV is less than 10% of the range.

Example: For 0 to 10 ft. calibration points: LRV = 3.0 ft., URV = 3.8 ft. will generate this error.

Action: The Calibration Points Should Be Farther Apart. When the calibration points are too close together, the overall accuracy of the calibration is adversely affected.

Error Message: **Upper Range Value Too High**

The process capacitance at 100% exceeds the present capacitance range jumper setting.

Example: For 0 to 10 ft. calibration: span select jumper = 100 pF, point cal. LRV = 0 ft. @ 10 pF, URV = 7 ft. @ 90 pF generates this error because the process would be 124 pF @ 10 ft.

Action: The Span Select Jumper Must Be Raised. This allows the process output at 100% to be within the range of the span range capacitance.

NOTE: Respond to the prompt which is displayed immediately after the error message that reads "Restore Device Value?" with <N>.

Error Message: **Upper Range Value Too Low**

The Full scale projected from the entered URV and LRV is less than 5% of the present capacitance range jumper setting.

Example: For 0 to 50 ft. calibration: span select jumper = 1000 pF, LRV = 0 ft. @ 10 pF, URV = 40 ft. @ 80 pF generates this error.

Action: The Span Select Jumper Must Be Lowered. This allows the URV-LRV span to be greater than 5% of the capacitance range jumper setting.

NOTE: Respond to the prompt which is displayed immediately after the error message that reads "Restore Device Value?" with <N>.

SECTION 6

SECTION 6: TROUBLESHOOTING

Problem/Symptom	Tests in order of probability	Reference Section(s)	Comments
Rosemount 268 or 275 Calibrator gives error message that no device was found	Check calibrator connections Check for 250Ω resistance (min.) Check voltage at transmitter Check transmitter	6.2 and 6.3 6.6	Often a result of loop connection problems
Rosemount 275 Calibrator gives error message that device could not be identified	Check calibrator connections Check for 250Ω resistance (min.) Check voltage at transmitter Check transmitter	6.2 and 6.3 6.6	Often a result of loop connection problems
Can't communicate with transmitter using Drexelbrook PC Software	Check calibrator connections Check for 250Ω resistance (min.) Check voltage at transmitter Check transmitter Try another modem	6.2 and 6.5 6.6	Often a result of loop connection problems
0 mA output all the time (no measurable output current at any time)	Check voltage at transmitter Check polarity of loop Test Transmitter	6.2 (6.3, 6.4, or 6.5) 6.6	Probable loop problem Faulty connection in loop
More than 20 mA output all the time (output current always exceeds 20 mA)	Check for moisture in head of sensor Test Sensing Element Test Transmitter Check Calibration	 6.7 6.6 Section(s) 3, 4, and 5	
Output drifts (output accuracy varies slowly over time…e.g. hours or days)	Test transmitter without sensing element (drift test) Verify proper sensing element ground reference	6.6 Fig. 2-6	
Output erratic - (output jumps around noticeably in terms of seconds or minutes)	Test Transmitter Check process level Check for Static Discharge Check for radio interference	6.6 6.9 6.10	Erratic readings often show actual process conditions. Look for bubbles or stratification, etc.
Output intermittent (output jumps quickly usually between >0mA and some "on scale" value	Check Signal Loop Connections	6.7 6.8	Intermittent Loop Connection
Inaccurate readings (Level readings are incorrect compared to actual known level)	Check calibration Test transmitter Check method of comparison	Section(s) 3, 4, and 5 6.6	Have you verified actual level? (At times even sight gauges can be misleading.)
Reading does not change with level	Check cables Check sensing element Test Transmitter	6.8 6.7 6.6	Be sure that level is really changing. Possible plugged or unvented stilling well.
Output goes in opposite direction from level change	Check calibration	Section(s) 3, 4, and 5	Probable high point cal/low point cal reversal or inverted interface application.
Application-related Problems	**Comments**		
Product Bridging	When process material fills what was originally airspace between the sensor and a nozzle or the vessel, it no longer behaves like a coating. It measures like actual level. Contact Drexelbrook.		
Corrosion of metal parts	TFE and stainless steel in the sensor's pressure seal have widely different coefficients of expansion that sometimes permit pressure leaks to occur. Re-torqueing the packing assembly can usually fix the problem. Contact the Service department for the proper torque values and procedure.		

Table 6-1 Problem / Symptom Chart

6.1 Identifying a Problem/Symptom



Use ***Table 6-1*** as a guide to find and correct a problem when it occurs. Most problems are not related to transmitter failure. It is important to be methodical when tracking down a problem. If you experience a problem that you cannot solve using this guide, call the Drexelbrook 24-hour Service Hot line at 1-800-527-6297 or 215-674-1234. You may also E-mail us at the Internet address: drexelbrook.service@ametek.com. Further service information may be found at our World Wide Web address www.drexelbrook.com.

When you contact us, be prepared to give the service person as much information as you can about the model numbers, application requirements, and the materials being measured. At the end of this section, a form is available to organize the information that will help us resolve the problem. Prior to your call, a copy of the completed form can be faxed directly to the Service department at (215) 443-5117.

6.1.2 RCT Integral Digital Meter Display (401-0044-003) Error Codes

Error Message	Description	Probable Cause	Corrective Action
Err 1	EEPROM Failure / Checksum Error	Transmitter Failure	Restore Factory Defaults See Section 3.15
Err 2	Not Used		
Err 3	Analog to Digital Converter Response Failure	Transmitter Error	Contact Factory Service 1-800-527-6297
Err4	Probe Value too High	Probe Resistance to Ground too Low	Check for Electrical Short See Section 6.7 & 6.8

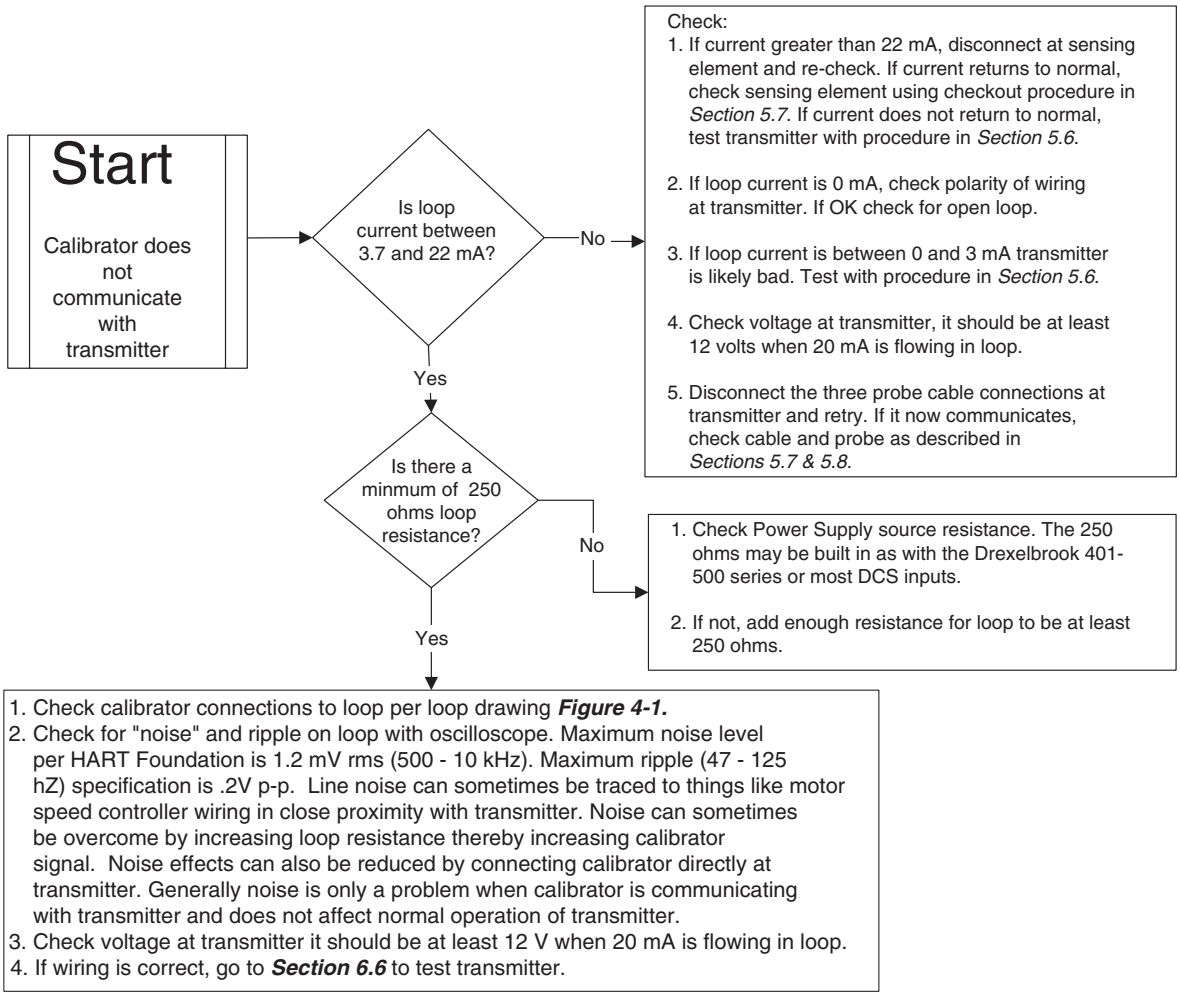
6.2 Troubleshooting Loop Connection

Specific transmitter loop connections will vary from installation to installation but in general will be connected in a similar manner to typical transmitter loop in ***Figure 4-1***. When troubleshooting the loop connection, verify the following items.

- Loop devices are wired in series.
- There is at least 250 ohms total loop resistance.
- There is at least 12 Vdc available for the transmitter when a loop current of 20 mA is flowing.

6.3 Rosemount Model 268 or 275 Calibrator cannot identify or find device

If the Rosemount 268 or 275 calibrator (generic) gives error message that no device description was found, use the following flowchart to troubleshoot.



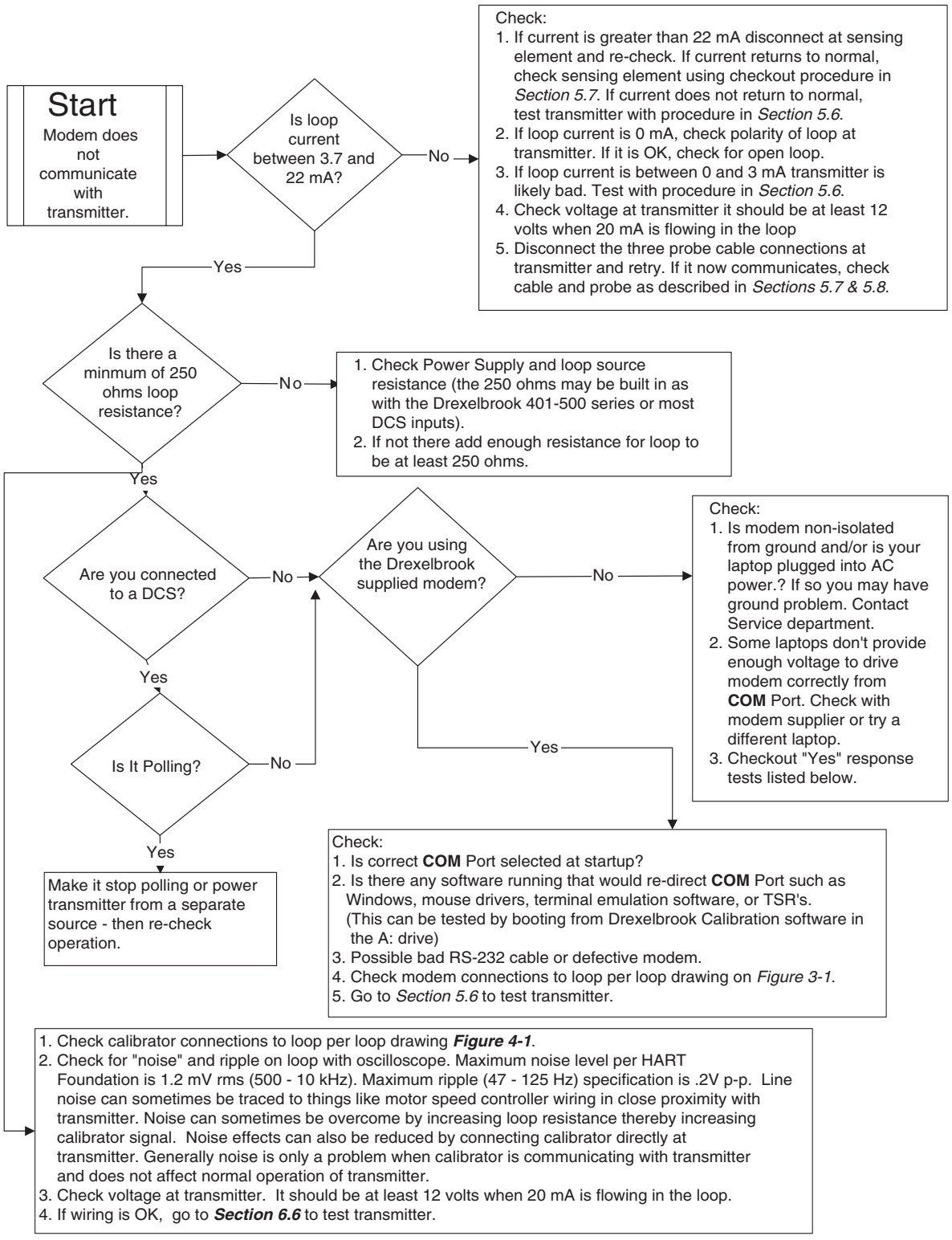
6.4 Rosemount Model 275 Calibrator with device description cannot identify or find device

This condition may be the result of trying to calibrate a transmitter with software less than version 3.0 (transmitters shipped prior to approximately January 1997). There are two options you can use to identify the device and delete the error message.

Option 1 - Configure the transmitter as a "generic" device per the instructions in this manual.

Option 2 - Contact the Drexelbrook Service department (1-800-527-6297) about upgrading your transmitter to the latest software.

6.5 RCT Series transmitter does not communicate with Drexelbrook PC software



6.6 Troubleshooting Transmitter

Always Install to Local Codes / Requirements / Directives as Mandated by the Authority Having Jurisdiction

Install Per 420-0004-203-ID

WARNING: Substitution of Components May Impair Intrinsic Safety.

WARNING: To Prevent Ignition of Flammable or Combustible Atmospheres, disconnect Power Before Servicing.

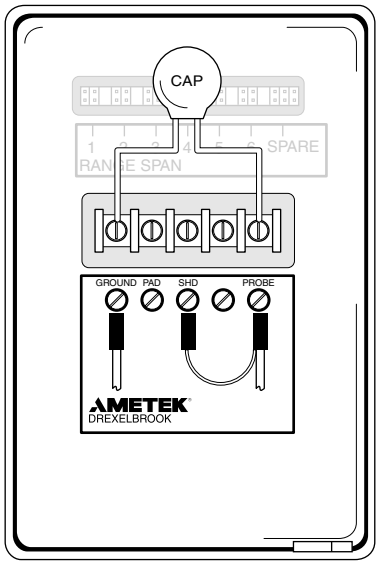


Figure 6-1

To troubleshoot the transmitter, use one of the following tests, depending on the device used with your calibration.

Some of the following tests require the use of high quality fixed capacitors in the picofarad ranges or a Drexelbrook calibrator box (C-box 401-6-81). Contact the Drexelbrook Service department if you need a C-box. Fixed temperature stable capacitors (NPO types) can often be found at many electronic supply houses.

TRANSMITTER TEST - Using a PC or 275 Handheld with device Description

1. Determine the span range currently selected on the electronic unit. ***See*** **Figure 3-9**

2. Using the MAX pF values listed in **Figure 6-3**, select a capacitance value near the midpoint of the MAX pF range. For example, position #4 has a MAX pF range of 2000 pF. Select a 1000 pF capacitance for this test.

3. Remove all three connections of the coaxial cable at the transmitter's probe terminals.

4. Place capacitor on transmitter from **PROBE** to **GND** (ground) terminals See **Figure 6-1**.

5a. Using a **PC** - Using the real-time view (F4), verify that the displayed capacitance value is within the value and tolerance printed on the test capacitor. If using a Drexelbrook C-box, be sure to add the standing capacitance of the box (10pF low range, 20 pF normal range).

5b. Using a **Rosemount 275 handheld** with device description - Viewing the **HOME** screen, verify that the displayed capacitance value is within the value and tolerance printed on the test capacitor. If using a Drexelbrook C-box, be sure to add the standing capacitance of the box (10pF low range, 20pF normal range).

6. If the displayed capacitance value is within the stated tolerance, the unit is working. If the displayed capacitance value is not accurate, call 1-800-527-6297.

6.6 Troubleshooting Transmitter (Continued)

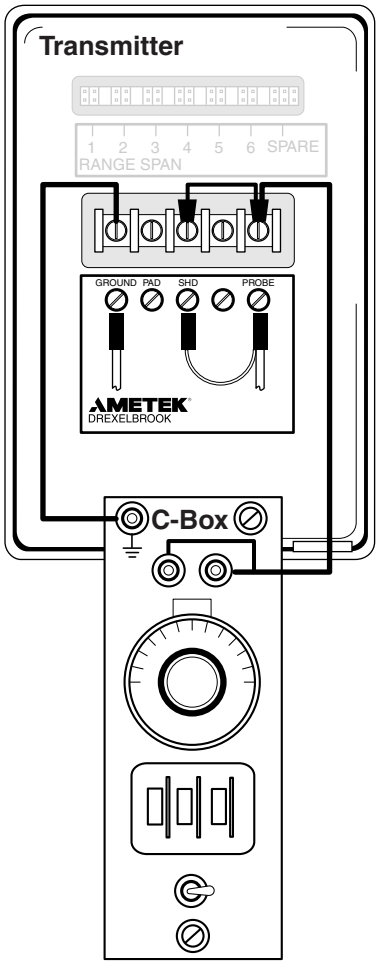


Figure 6-2

TRANSMITTER TEST - Using a 268 or 275 Handheld WITHOUT a Device Description (Generic Mode)

1. Visually verify the span range of the electronic unit.
2. Using the C-box, adjust the capacitance until 4 mA is achieved. **Record value**. ***See Figure 6-2***
3. Adjust C-box capacitance until 20 mA is achieved. Record value.
4. Using ***Figure 6-3***, verify that the capacitance value recorded at 20 mA is less than the MAX pF value for the Span Range Position of the electronic unit.
5. Verify that the loop configuration is Level Config (signal output linear to level vs. Vessel Config).
6. Subtract pF value recorded for 4 mA from the pF value recorded for 20 mA. Divide this number in half.

   Example: 4 mA = 120 pF
   20 mA = 800 pF
   800 pF – 120 pF = 680 pF
   680 pF ÷ 2 = 340 pF
7. Adjust the capacitance box (C-box) to the number figured in step 6. The signal should read approximately 50%.
8. If the display reads 50%, the unit is working properly. If the display is not accurate, contact the Service department at 1-800-527-6297 for further assistance.

SPAN RANGE	JUMPER POSITION 1	2	3	4	5	6
MAX pF	20	100	450	2000	10000	40000

Figure 6-3
Span Range Capacitance Values

6.6.1 Transmitter Drift Test

If symptoms point toward calibration drift, it is important to determine if the apparent drift is coming from the transmitter, the sensing element, or the application of the equipment. The following test determines if the transmitter is stable. In most cases, no drift will be found in the transmitter.

6.6.1 Transmitter Drift Test (Continued)

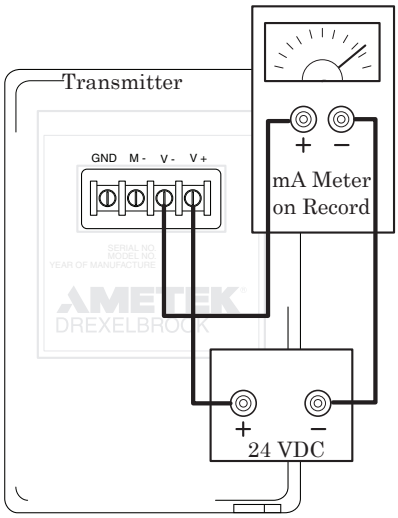


Figure 6-4

1. Remove coaxial cable from the transmitter terminals.

2. Without changing any data stored in the transmitter, connect a Drexelbrook capacitance substitution box (401-6-8) or an NPO test capacitor from the probe terminal to the GND terminal on the transmitter. (Select a capacitance value that produces between 4 and 20 mA of loop current.)

3. Observe the loop current over a 12-hour period to confirm the stability of the unit. If the readings remain stable for this period, then the problem is not in the transmitter. If the loop current has changed more than 1% during the test period, then the unit is defective. Please contact the Service department for further instructions regarding repair or replacement.

6.7 Troubleshooting Sensing Element

Troubleshooting sensing element requires use of an analog ohmmeter. Digital meters do not properly measure resistance for the purpose of this test. An analog ohmmeter typically provides more current when measuring resistance, which is required to detect a pinhole or crack in the sensing element insulation. In addition, digital meters frequently give erroneous results due to a battery-like effect when dissimilar metals contact conductive liquids.



CAUTION: Sensing element is intrinsically safe. Therefore, when using this product, it is recommended that all service activity comply with appropriate guidelines.



Remove sensing element from vessel to a safe area. Test outlined in steps 1 and 2 can be performed in a metal test vessel filled with high conductivity water. Depending on locality, tap water may not be suitable. If not, a spoonful of table salt may work.

In the following tests, if it is not possible to raise or lower level in vessel, sensing element may be suspended in a metal pipe or other container that is filled with conductive water (see above note) and connected to grounded sensing element condulet. If container is not metallic, then a ground wire or rod is needed to be placed into the water and referenced to sensing element condulet or mounting devices.

6.7 Troubleshooting Sensing Element (Continued)

Testing the Sensing Element - Step 1 (Figure 6-5)
With the material below the sensor, and the coaxial cable disconnected at the sensing element, measure the resistance from the sensing element center connector to ground connector (or condulet). The ohmmeter should be set to R x 10000 scale. The reading should be infinite (open circuit). Readings of less than one meg-ohm indicate excessive electrical leakage, probably due to product leakage or condensation in the packing seal or condulet. Contact the Service department for recommended repairs.

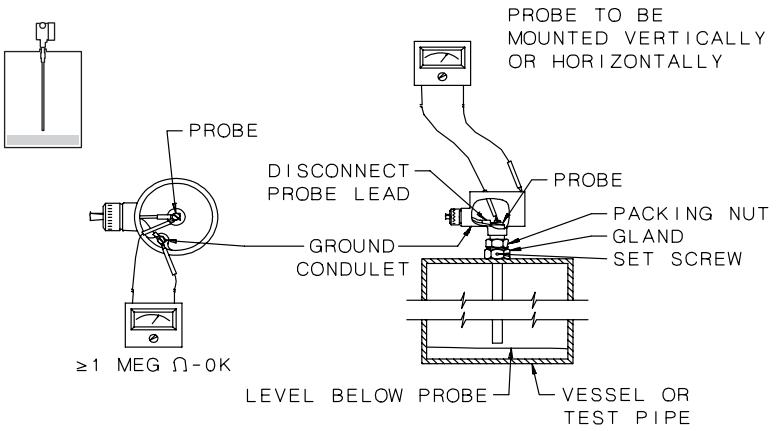


Figure 6-5
Sensing Element Testing, Material Below the Sensing Element

Testing the Sensing Element - Step 2 (Figure 6-6)
Raise the level in the vessel to cover as much of the sensor as possible. Repeat the measurement made in step 1. Readings of 1 meg-ohm or less indicate a pinhole or crack in the sensing element insulation. Failed insulation is not field repairable. Consult the Service department for further assistance.

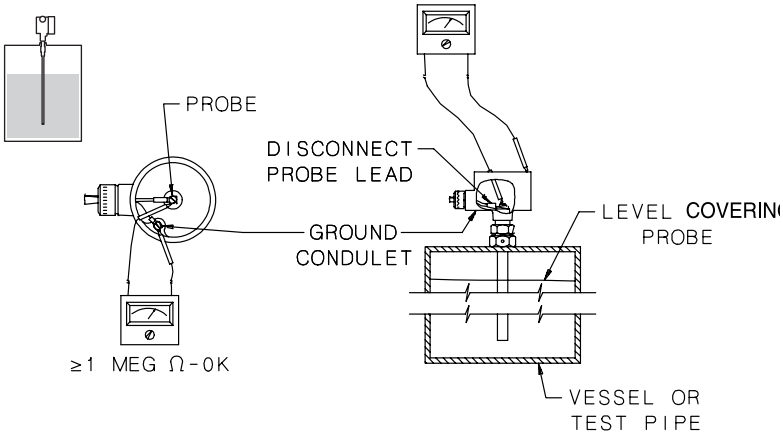


Figure 6-6
Sensing Element Testing, Material Covering the Sensing Element

6.8 Troubleshooting Coaxial Cable

NOTICE

If there is water or other conductive material in the conduit it can change the electrical properties of the coax cable and cause the system to perform poorly. Moisture in the conduit may not be detected by the following test.

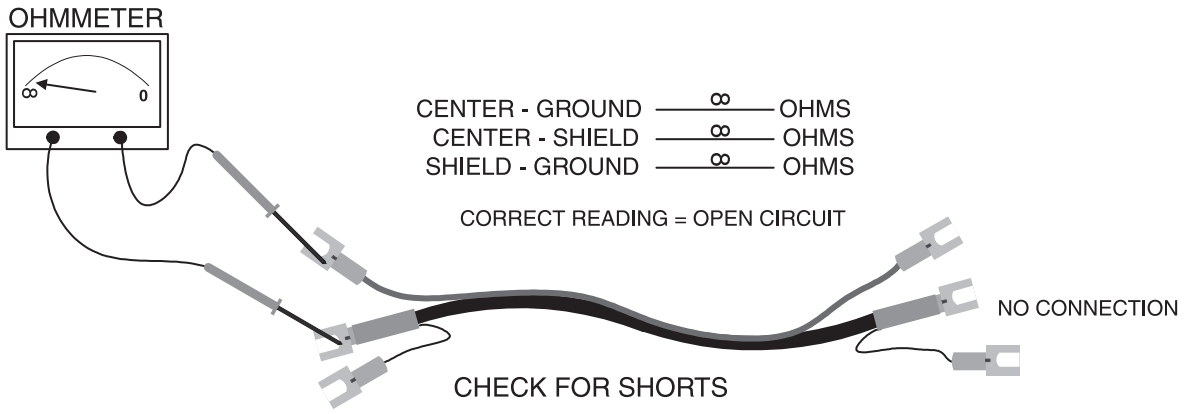
6.8 Troubleshooting Coaxial Cable (Continued)

The only sure way is to inspect the coax and associated conduit for trapped water.

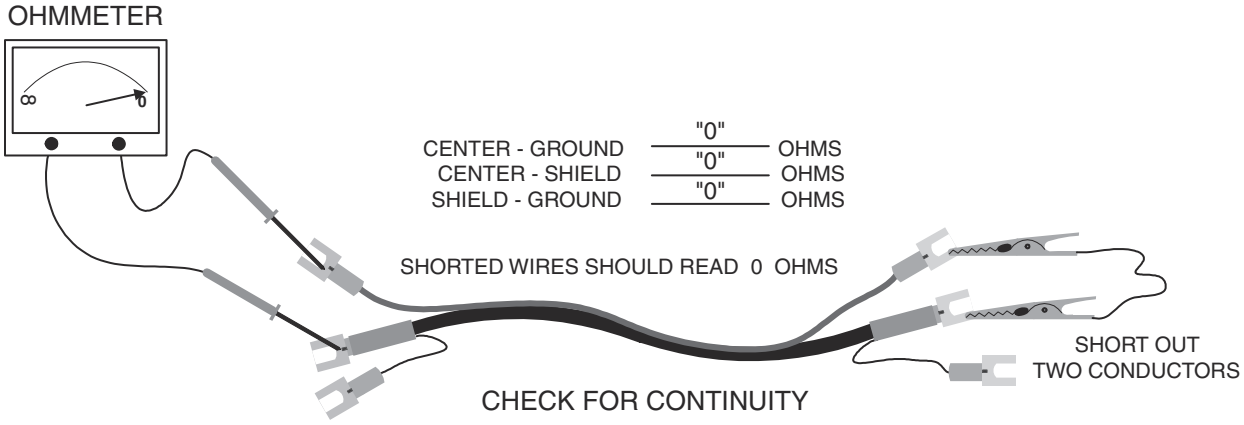
1. Disconnect all three wires of the coaxial cable at the electronic unit.

2. Disconnect all wires at the sensing element end of the coax.

3. Using an ohmmeter, measure between two of the coaxial cable conductors. Note any reading. Repeat for all three conductors. All readings should show an open circuit, (infinite resistance).



4. Check for continuity of each conductor. Short out two of the coaxial cable conductors and measure these two conductors at the other end. A reading close to 0 ohms should be shown.



6.9 Static Electricity

Static electricity can cause the 4-20 mA output to appear to jump around in an erratic fashion with a time period of few seconds. Applications that are prone to static electricity include insulating liquids that may be agitated or pumped and granulars that may be air-conveyed at high rates of speed. Conductive liquids and conductive granulars tend not to generate static electricity. In addition to causing erratic readings, static electricity can cause instrument failure. If you ever get a static shock from a sensing element, you need spark protection. (See section 2.5)

Drexelbrook normally supplies static electricity discharge devices (spark protectors) with its sensing elements that are going to be used in these types of applications. If you need a spark protector, contact the Drexelbrook Service department.

6.10 Radio Frequency Interference

All Drexelbrook transmitters have a significant amount of RFI protection built in. There are situations, however, where the standard protection is inadequate. RFI filters are available to provide additional protection for both the sensor and the 4-20 mA loop from unusually difficult sources of interference. Proper grounding and careful attention to installation practices can usually make them unnecessary. Some recommended installation practices include:

1. Use twisted shielded cable for the 4-20 mA loop.
2. Use grounded metal conduit for all entrances to the transmitter housing.
3. Ground the transmitter housing to a good earth ground.
4. Use concentric shield sensors in non-metallic vessels.

If RFI continues to be a problem, contact the Drexelbrook service department for the proper filters and assistance.

6.11 Factory Assistance



AMETEK Drexelbrook can answer any questions about your level measurement system.

For Technical Support: 1-800-527-6297

All other inquiries: Call Customer Service at 1-800-553-9092 (US and Canada) , or + 215-674-1234 (International).

If you require assistance and attempts to locate the problem have failed:

6.11 Factory Assistance (Continued)

- Contact your local Drexelbrook representative,
- For Technical Assistance call toll-free:
  1-800-527-6297 (US and Canada)
  or + 215-674-1234 (International),
- FAX: + 215-443-5117,
- E-mail: drexelbrook.service@ametek.com

Please provide the following information:

- Instrument Model Number
- Sensing Element Model Number and Length
- Original Purchase Order
- Material being measured
  - Temperature
  - Pressure
  - Agitation
- Brief description of the problem
- Checkout procedures that have failed

6.12 Field Service

Trained field servicemen are available on a time-plus-expense basis to assist in start-ups, diagnosing difficult application problems, or in-plant training of personnel. Contact the service department for further details.

6.13 Customer Training

Periodically, AMETEK Drexelbrook instrument training seminars for customers are held at the factory. These sessions are guided by Drexelbrook engineers and specialists, and provide detailed information on all aspects of level measurement, including theory and practice of instrument operation. For more information about these valuable workshops, write to AMETEK Drexelbrook, attention: Communications/ Training Group, or call direct + 215-674-1234.

6.14 Return Equipment

Any equipment being returned for repair or credit must be pre-approved by the factory.

In many applications, sensing elements are exposed to hazardous materials.

6.14 Return Equipment (Continued)

- OSHA mandates that our employees be informed and protected from hazardous chemicals.

- Material Safety Data Sheets (MSDS) listing the hazardous materials to which the sensing element has been exposed MUST accompany any repair.

- It is your responsibility to fully disclose all chemicals and decontaminate the sensing element.

To obtain a return authorization (RA#), contact the Service department at 1-800-527-6297 (US and Canada) or + 215-674-1234 (International).

Please provide the following information:

- Model Number of Return Equipment
- Serial Number
- Original Purchase Order Number
- Process Materials to which equipment has been exposed
- MSDS sheets for any hazardous materials
- Billing Address
- Shipping Address
- Purchase Order No. for Repairs

  Please include a purchase order even if the repair is under warranty. If repair is covered under warranty, you will not be charged.

Ship equipment freight prepaid to:
AMETEK Drexelbrook
205 Keith Valley Road
Horsham, PA 19044-1499

COD shipments will not be accepted.

6.15 RCT Series Troubleshooting Guide

AMETEK Drexelbrook
RCT Series Troubleshooting Guide
Service Department (800) 527-6297 FAX (215) 443-5117

Service Dept. Contact_____

Customer Name_____ Company_____ City/State_____
Phone #_____ Fax #_____
Purchase Order #_____ DE #_____
Electronic Unit Model #_____ Serial #_____ Range Jumper Position_____
Sensing Element Model #_____ Serial #_____ Insertion Length_____ Mounting_____
Process Material_____ Temp._____ Press._____ Other_____

Provide as much of the following information as possible. **All** of the information is available from the Drexelbrook Calibration Software, or from a Rosemount Model 275 with Drexelbrook Device Description (DD) installed. Information with an asterisk is available from a Rosemount 268 or 275 in the Generic mode.

AMETEK Drexelbrook HART® Protocol Software Version _____

*Tag ID_____ *Serial Number_____
*Scratch Pad_____ Software Version_____
Analog Loop Assign_____ Range Position_____
*Damping Time_____ Type (00/30)_____

Level Configuration

Level Units_____
Maximum Level_____
Level Type_____

Vessel Configuration

Vessel Units_____
Maximum Capacity_____
Vessel Type_____

*LRV (4mA)_____
*URV (20mA)_____

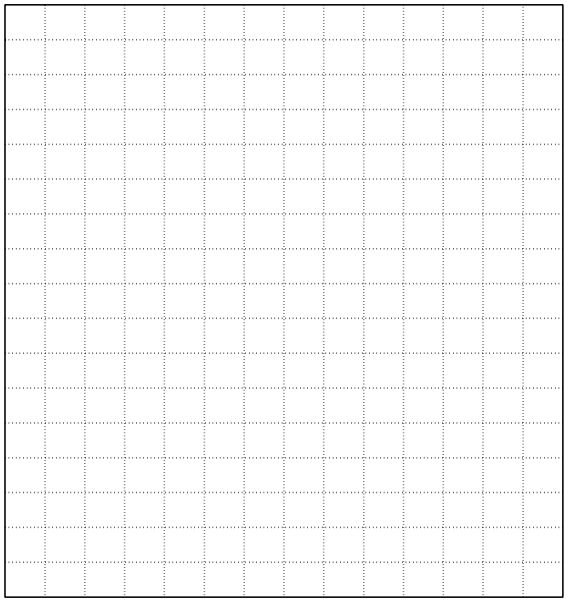
True Level Reference

Lower Reference Cap._____
Upper Reference Cap._____
Status:_____

Capacitance Calibration

Lower Level_____
Lower Capacitance_____
Upper Level_____
Upper Capacitance_____

Vessel Sketch



Show principal tank dimensions, including vessel construction, mounting location, nozzle, LRV, URV, present level, etc.

Press F4 For Real-Time View

Level_____
Vessel_____
Capacitance_____
Reference_____
Loop Current_____
Percentage_____
Status_____

Detailed description of problem:_____

SECTION 7

SECTION 7: SPECIFICATIONS

7.1 Transmitter Specifications

Power Requirement
- 12 to 30 VDC
- Minimum of 12 VDC at 20 mA

Input Range
- 409-T: 1.0 to 40,000 pF

Output Range
- 4-20 mA

Accuracy
- ± 0.25% of range. Accuracy includes the combined effects of linearity, hysteresis, and repeatability. It refers to the transmitter only and is measured at reference conditions of 25 degrees C ±1°, 10-55% R.H. and 24 ±1.2 Vdc, using an admittance standard (applied to the transmitter sensor terminals) in place of the sensor.

Load Resistance
- Maximum Load Resistance = 750 ohms
- Minimum Load Resistance
  With HART® Communications = 250 ohms
  Without HART® Communications = 0 ohms

Temperature Effect
- ±1% of range per 50°F (30°C).

Supply Voltage Effect
- < 0.1% from 12 to 30 VDC.

Effect of Load Resistance
- < 0.1% for full resistance range at 24 VDC supply.

Response to Step Change
- < 1 second standard (to 90% of final value); 0-90 seconds available with delay.

Fail-Safe
- Low-Level Fail-Safe (LLFS) standard.
  Also called direct-acting because current increases as the level increases.
- High-level Fail-Safe (HLFS).
  Also called reverse-acting because current decreases as level increases.



There Are No Devices That Are Absolutely “Fail-Safe".
Fail-safe means that in the event of the most probable failures, the instruments will fail safely. Probable failures include things such as loss of power and transistor and component failures. If your application needs absolute fail-safe, a back-up instrument should be installed.

Ambient Temperature
- -40°F to +167°F (-40°C to 75°C)

7.1 Transmitter Specifications (Continued)

Calibration Adjustments
- Range Span, 6 positions (back panel)

Lowest Permitted Resistance
(bare sensing element to ground) causing 5% error in each model:
- 600 ohms - 409-TX0, 2
- 100K ohms - 409-TX1, 3

Intrinsic Safety
- Sensing element and cable: Designed to be intrinsically safe for Class I Groups A, B, C and D; *Class II Groups E, F, and G, Class III, Div. 1. Electronics and signal wires: Intrinsically safe for Class I Groups A, B, C, and D, Class II Groups E, F and G Div. 1 when powered by an intrinsically safe power supply. EEx ia Zone 0.
  **** When provided in the aluminum enclosure (RCT Series)***

Nonincendive Equipment
- Class I Div. 2, Groups A, B, C, and D; Class II, Div 2, Groups E, F, and G, Class III Div 2

Sensing Element Cable Length
- 100 feet maximum.

7.2 Coaxial Cable Specifications

General Purpose 380-XXX-12
- .51" (13mm) OD at largest point, 160°F (70°C) temperature limit.

Composite Cable 380-XXX-18
(first 10 feet high temperature)
- .62" (16mm) OD at largest point, 450°F (230°C) temperature limit for first 10 feet.
- 160°F (70°C) temperature limit for remainder.

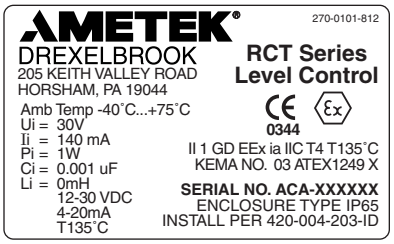
CE Mark Triaxial Cable 380-XXX-520
- .62" (16mm) OD at largest point, -55°F to 176°F (-55°C to 80°C) temperature limit.

7.3 Enclosure Specifications

- The RCT transmitter and remote sensor enclosures are constructed of aluminum and are rated both NEMA 4X and IP65. Conduit entries are 3/4 NPT with M20 adapters available The enclosures are powder coated to provide additional corrosion resistance.

7.4 Approvals Available

7.4.1 ATEX Approvals - Install Per 420-0004-203-ID



Integral Systems

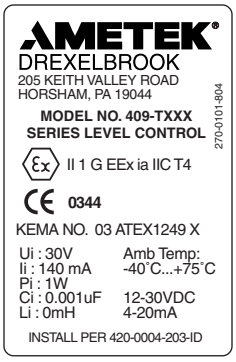
II 1 GD EEx ia IIC T4

0344 **IP65**

Remote Systems

II 1 GD EEx ia IIC T4

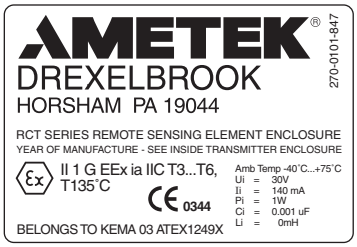
0344 **IP65**



Temperature Class	Process Temperature
T6	85° C
T5	100° C
T4	135° C
T3	200° C

Chassis Only

II 1 G EEx ia IIC T4



Remote Sensor

For indoor locations enclosure must be minimum IP20 rated.

For outdoor locations enclosure must be minimum IP44 rated.

A higher degree may be required for harsh environments. See Note 1

Note 1: *Always Install to Local Codes / Requirements / Directives as Mandated by the Authority Having Jurisdiction*

Note 2: *For applications in explosive atmospheres caused by air / dust mixtures, a degree of ingress protection of ot least IP 60 according to EN 60529 will only be achieved when certified cable and conduit entries are used providing a degree of ingress protection of at least IP65 according to EN60529*

Note 3: *The aluminum enclosure must be protected from mechanical friction and impact that could cause ignition capable sparks.*

WARNING: *Substitution of Components May Impair Intrinsic Safety.*

WARNING: *To Prevent Ignition of Flammable or Combustible Atmospheres, disconnect Power Before Servicing*

7.4.2 CSA Approvals - Install Per 420-0004-225-CD

Intrinsically Safe

Class I, Div. 1, Groups A, B, C and D;
Class II, Div. 1, Group E, F and G; Class III
Class I, Zone 0: Ex ia IIC

Class I, Div. 2, Groups A, B, C and D;
Class II, Div. 2, Group E, F and G; Class III
Class I, Zone 2: Ex na IIC

For Ambient temperatures above 70° C, use wiring rated 75° C or higher.

7.4.3 FM Approvals - Install Per 420-0004-224-CD

Intrinsically Safe:Class I, II, III, Div. 1, Groups A, B, C, D, E, F, G
Nonincendive: Class I, Div. 2, Groups A, B, C, D
Special Protection: Class II, Div. 2 , Groups F, G
Dust-Ingnitionproof: Class I, II, Div. 1, Groups E, F, G

SECTION 8: NORMAL MAINTENANCE

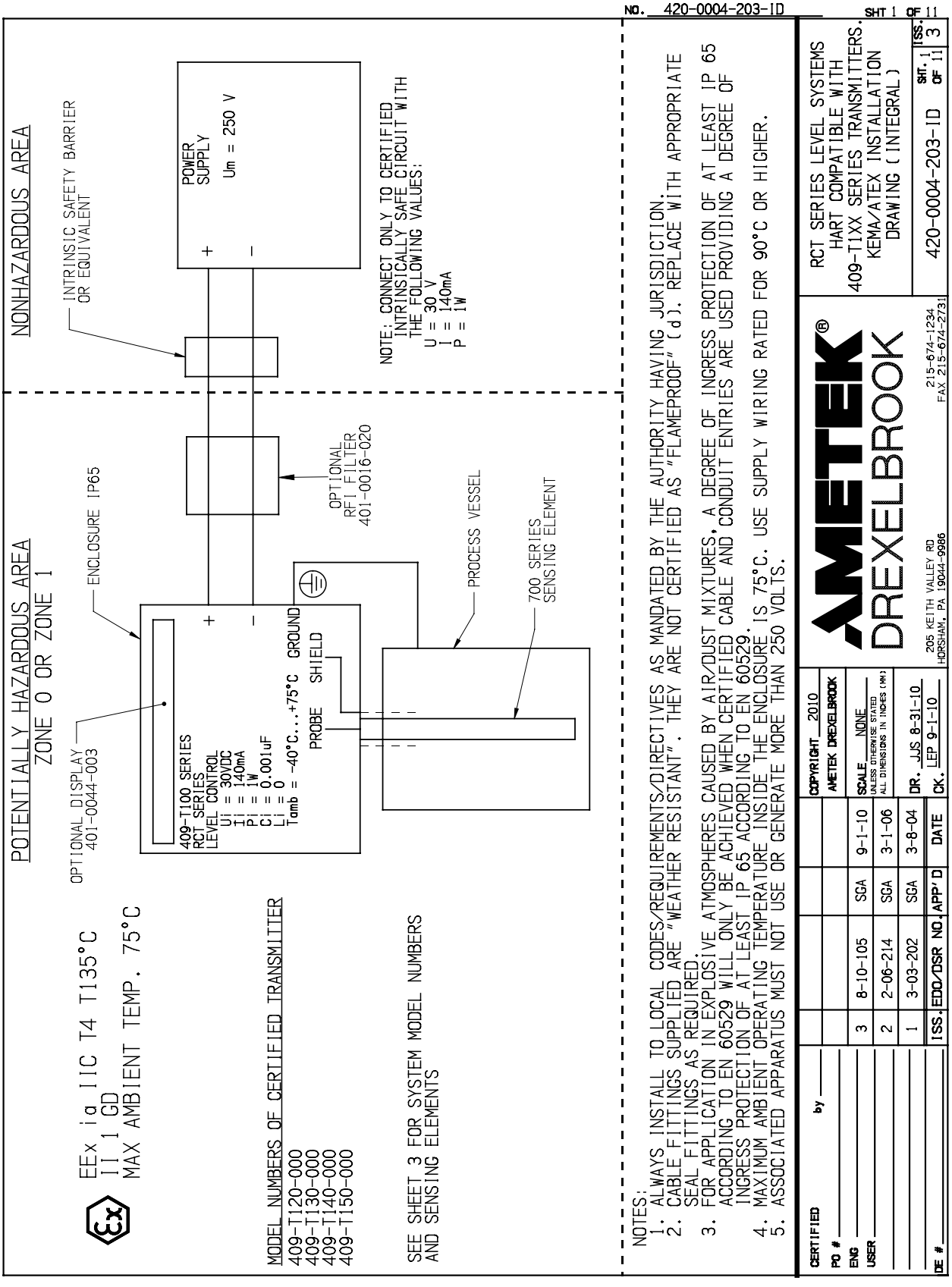
8.1 Viewport Cleaning

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.

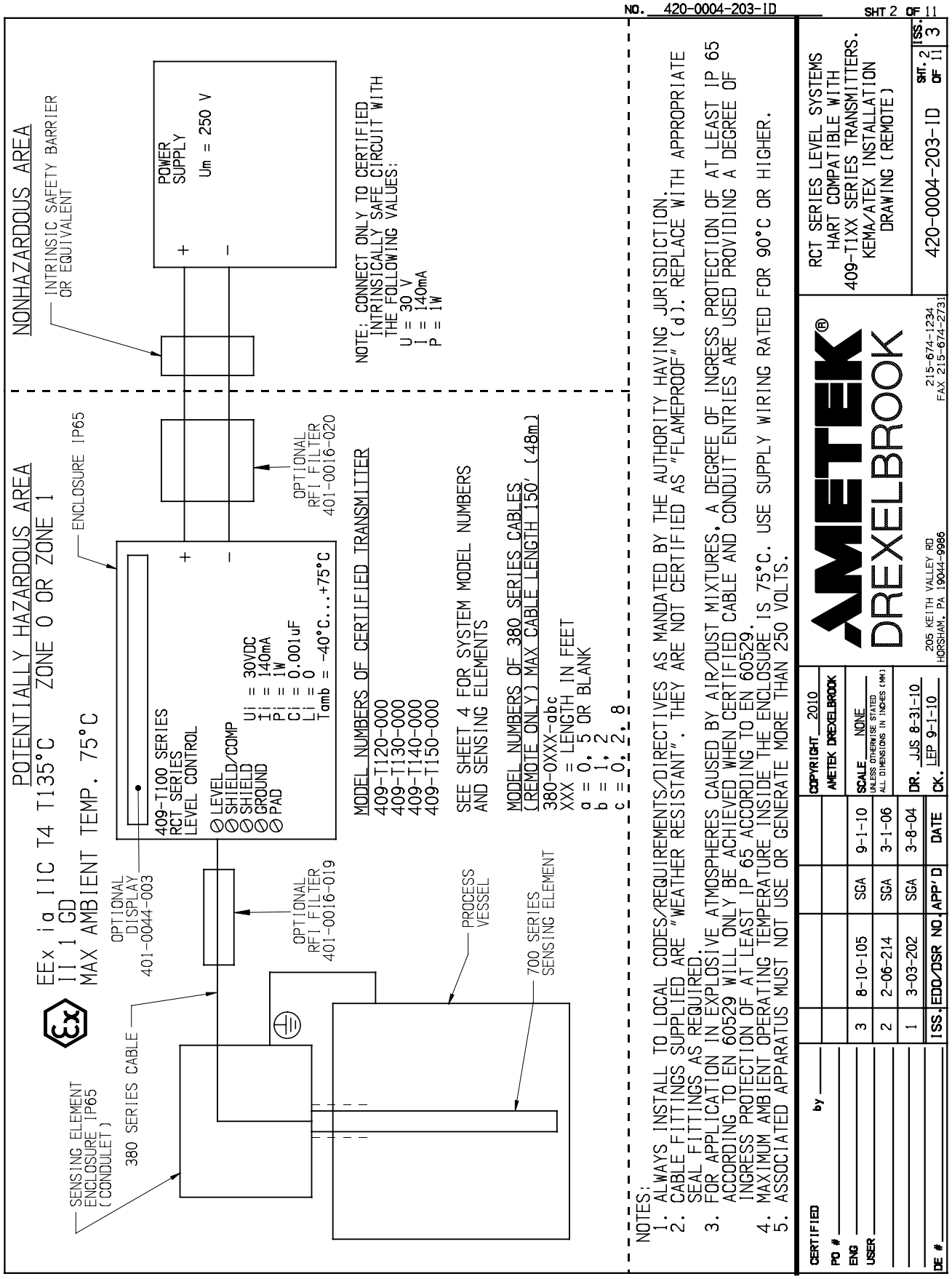
APPENDIX A

APPENDIX A: APPROVAL DRAWINGS

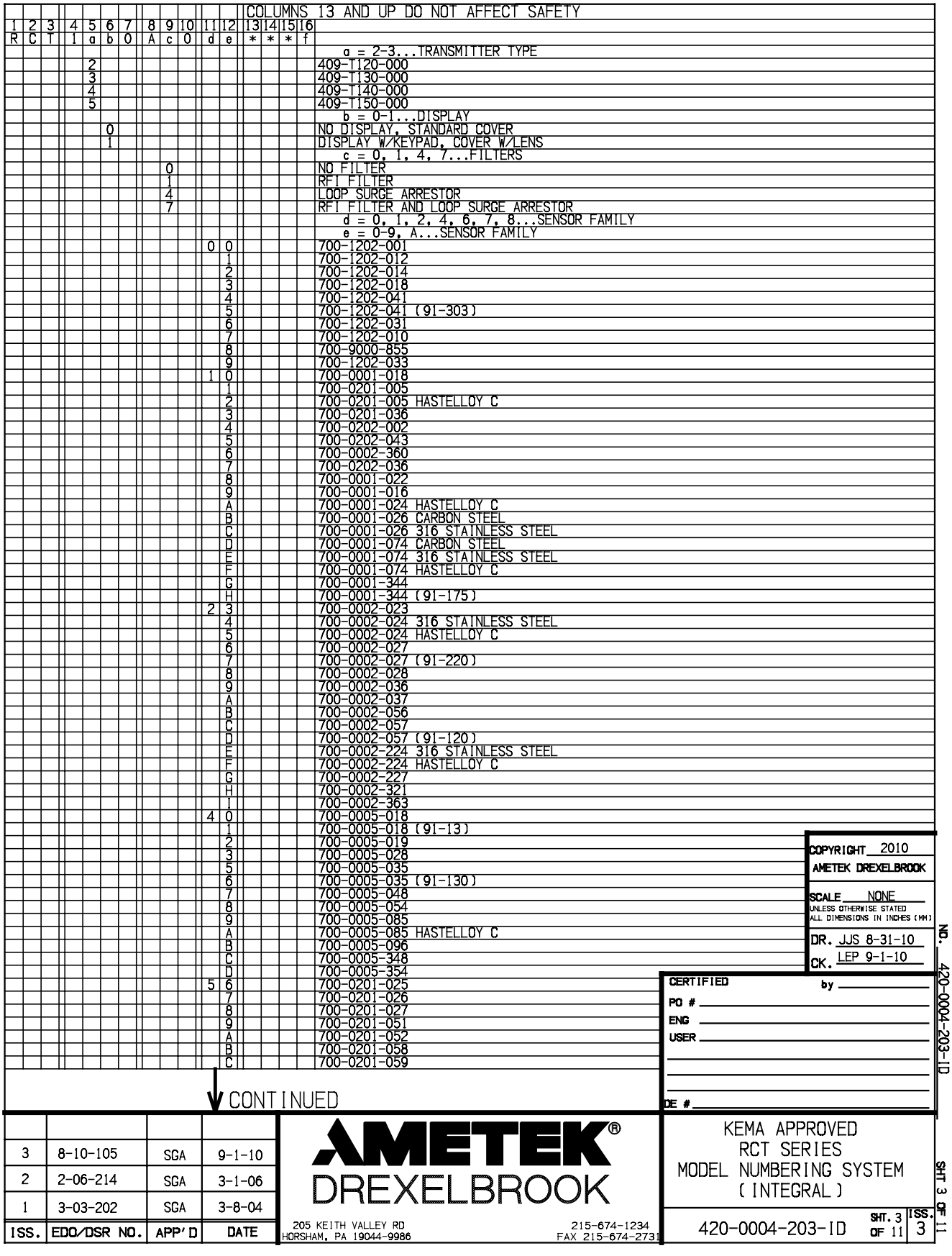
A.1 ATEX APPROVAL DRAWINGS



A.1 ATEX APPROVAL DRAWINGS (Continued)



A.1 ATEX APPROVAL DRAWINGS (Continued)



											COLUMNS 13 AND UP DO NOT AFFECT SAFETY
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
R	C	T	1	a	b	0	A	c	0	d	e	*	*	*	f	
																a = 2-3...TRANSMITTER TYPE
				2												409-T120-000
				3												409-T130-000
				4												409-T140-000
				5												409-T150-000
																b = 0-1...DISPLAY
					0											NO DISPLAY, STANDARD COVER
					1											DISPLAY W/KEYPAD, COVER W/LENS
																c = 0, 1, 4, 7...FILTERS
								0								NO FILTER
								1								RFI FILTER
								4								LOOP SURGE ARRESTOR
								7								RFI FILTER AND LOOP SURGE ARRESTOR
																d = 0, 1, 2, 4, 6, 7, 8...SENSOR FAMILY
																e = 0-9, A...SENSOR FAMILY
										0	0					700-1202-001
											1					700-1202-012
											2					700-1202-014
											3					700-1202-018
											4					700-1202-041
											5					700-1202-041 (91-303)
											6					700-1202-031
											7					700-1202-010
											8					700-9000-855
											9					700-1202-033
										1	0					700-0001-018
											1					700-0201-005
											2					700-0201-005 HASTELLOY C
											3					700-0201-036
											4					700-0202-002
											5					700-0202-043
											6					700-0002-360
											7					700-0202-036
											8					700-0001-022
											9					700-0001-016
											A					700-0001-024 HASTELLOY C
											B					700-0001-026 CARBON STEEL
											C					700-0001-026 316 STAINLESS STEEL
											D					700-0001-074 CARBON STEEL
											E					700-0001-074 316 STAINLESS STEEL
											F					700-0001-074 HASTELLOY C
											G					700-0001-344
											H					700-0001-344 (91-175)
										2	3					700-0002-023
											4					700-0002-024 316 STAINLESS STEEL
											5					700-0002-024 HASTELLOY C
											6					700-0002-027
											7					700-0002-027 (91-220)
											8					700-0002-028
											9					700-0002-036
											A					700-0002-037
											B					700-0002-056
											C					700-0002-057
											D					700-0002-057 (91-120)
											E					700-0002-224 316 STAINLESS STEEL
											F					700-0002-224 HASTELLOY C
											G					700-0002-227
											H					700-0002-321
											I					700-0002-363
										4	0					700-0005-018
											1					700-0005-018 (91-13)
											2					700-0005-019
											3					700-0005-028
											5					700-0005-035
											6					700-0005-035 (91-130)
											7					700-0005-048
											8					700-0005-054
											9					700-0005-085
											A					700-0005-085 HASTELLOY C
											B					700-0005-096
											C					700-0005-348
											D					700-0005-354
										5	6					700-0201-025
											7					700-0201-026
											8					700-0201-027
											9					700-0201-051
											A					700-0201-052
											B					700-0201-058
											C					700-0201-059

CONTINUED

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ALL DIMENSIONS IN INCHES (MM)

DR. JJS 8-31-10
CK. LEP 9-1-10

CERTIFIED by
PO #
ENG
USER
DE #

NO. 420-0004-203-ID

ISS.	EDO/DSR NO.	APP'D	DATE
3	8-10-105	SGA	9-1-10
2	2-06-214	SGA	3-1-06
1	3-03-202	SGA	3-8-04

AMETEK®
DREXELBROOK
205 KEITH VALLEY RD
HORSHAM, PA 19044-9986
215-674-1234
FAX 215-674-2731

KEMA APPROVED
RCT SERIES
MODEL NUMBERING SYSTEM
(INTEGRAL)

420-0004-203-ID SHT. 3 OF 11 ISS. 3

SHT 3 OF 11

A.1 ATEX APPROVAL DRAWINGS (Continued)

											COLUMNS 13 AND UP DO NOT AFFECT SAFETY				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
R	C	T	1	a	b	0	A	c	0	d	e	*	*	*	f	
										5	D					700-0202-053
											E					700-0202-054
											F					700-0202-056
										6	B					700-0005-036
											C					700-0005-045
											D					700-0005-095
											F					700-0005-385
										7	F					700-0018-122
											G					700-0018-124 HASTELLOY C
											H					700-0018-126 CARBON STEEL
											I					700-0018-126 316 STAINLESS STEEL
											J					700-0018-134
											K					700-0018-136
											L					700-0018-144
											M					700-0018-144 (91-77)
											N					700-0018-144 (91-299)
											O					700-0018-174 CARBON STEEL
											P					700-0018-174 316 STAINLESS STEEL
											Q					700-0018-174 HASTELLOY C
											R					700-0018-222
											S					700-0018-222 (91-269)
											T					700-0018-242
										8	0					700-0001-051
											1					700-0001-052
											2					700-0001-053
											3					700-0001-054
											4					700-0001-061
											5					700-0001-062
											6					700-0001-063
											7					700-0001-064
											8					700-0002-041
											9					700-0002-042
											A					700-0002-043
											B					700-0002-044
											C					700-0002-051
											D					700-0002-052
											E					700-0002-053
											F					700-0002-054
											G					700-0002-061
											H					700-0002-062
											I					700-0002-063
											J					700-0002-064
										9	0					700-0001-034
											1					700-0001-040
											2					700-0001-044
											4					700-0001-324
											5					700-0002-027 (90-635)
											7					700-0002-033
											8					700-0002-040
											9					700-0002-057 (90-523)
											A					700-0002-057 (91-006)
											B					700-0002-057 (91-232)
											D					700-0002-321 (90-674)
											E					700-0003-009
											F					700-0004-031
											G					700-0004-050
											H					700-0005-018 (91-26)
											I					700-0005-018 (91-195)
											J					700-0005-348 (91-59)
											V					700-9000-494
										N	1					RETROFIT 3/4" NPT, 3 TERMINAL
										N	2					RETROFIT 1", 3 TERMINAL
										N	3					RETROFIT 3/4" NPT, 2 TERMINAL
										N	4					RETROFIT 1" NPT, 2 TERMINAL
										Z	Z					SPECIAL...SEE BELOW FOR ADDITIONAL 700 SERIES MODEL NUMBERS

MODEL NUMBERS OF APPROVED INTRINSICALLY SAFE SENSING ELEMENTS

700-mnop-qrs-† LEVEL PROBE

m = FAMILY NO. 0 THROUGH 9, BLANK
n = FAMILY NO. 0 THROUGH 9, BLANK
o = 0 THROUGH 9, BLANK
p = 0 THROUGH 9
q = FAMILY NO. 0 THROUGH 9, BLANK
r = FAMILY NO. 0 THROUGH 9, BLANK
s = FAMILY NO. 0 THROUGH 9
† = 14 CHARACTER EXPANDED NUMBERING SYSTEM, DOES NOT AFFECT SAFETY

CONTINUED

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DR. JJS 8-31-10
CK. LEP 9-1-10

CERTIFIED by
PO #
ENG
USER
DE #

ISS.	EDO/DSR NO.	APP'D	DATE
3	8-10-105	SGA	9-1-10
2	2-06-214	SGA	3-1-06
1	3-03-202	SGA	3-8-04

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KEMA APPROVED
RCT SERIES
MODEL NUMBERING SYSTEM
(INTEGRAL)

420-0004-203-ID SHT. 4 OF 11 ISS. 3

NO. 420-0004-203-ID

SHT 4 OF 11

A.1 ATEX APPROVAL DRAWINGS (Continued)

												COLUMNS 13 AND UP DO NOT AFFECT SAFETY				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
R	C	T	1	a	b	0	A	c	0	d	e	*	*	*	f	
																f = A-H, J, K, L OR Z
																INSERTION LENGTH/COTE SHIELD LENGTH
															A	6″ IL, 2″ CSL (152.4mm/50.8mm)
															B	12″ IL, 2″ CSL (304.8mm/50.8mm)
															C	12″ IL, 3.5″ CSL (304.8mm/88.9mm)
															D	18″ IL, 2″ CSL (457.2mm/50.8mm)
															E	18″ IL, 3.5 CSL (457.2mm/88.9mm)
															F	18″ IL, 10″ CSL (457.2mm/254mm)
															G	18″ IL, NO CSL (700-0001-018) (457.2mm)
															H	36″ IL, 10″ CSL (914.4mm/254mm)
															J	36″ IL, NO CSL (700-0001-018) (914.4mm)
															K	48″ IL, 10″ CSL (1219.2mm/254mm)
															L	60″ IL, 10″ CSL (1524mm/254mm)
															Z	OTHER

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DR. JJS 8-31-10
CK. LEP 9-1-10

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ENG
USER
DE #

NO. 420-0004-203-ID

ISS.	EDO/DSR NO.	APP'D	DATE
3	8-10-105	SGA	9-1-10
2	2-06-214	SGA	3-1-06
1	3-03-202	SGA	3-8-04

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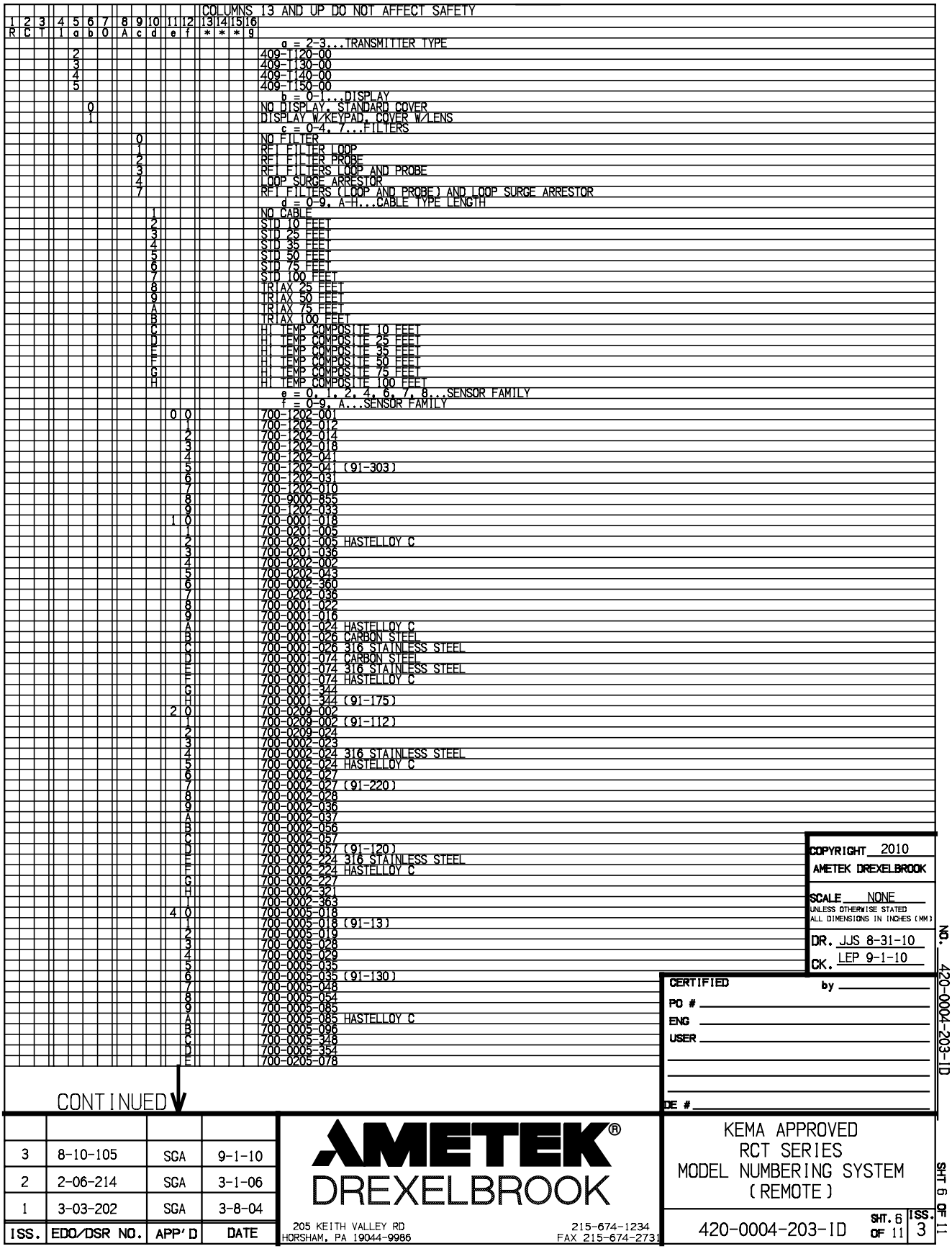
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RCT SERIES
MODEL NUMBERING SYSTEM
(INTEGRAL)

420-0004-203-ID SHT. 5 OF 11 ISS. 3

SHT 5 OF 11

A.1 ATEX APPROVAL DRAWINGS (Continued)



1	2	3	4	5	6	7	8	9	10	11	12	COLUMNS 13 AND UP DO NOT AFFECT SAFETY				
R	C	T	1	a	b	0	A	c	d	e	f	*	*	*	g	
												a = 2-3...TRANSMITTER TYPE				
				2								409-T120-00				
				3								409-T130-00				
				4								409-T140-00				
				5								409-T150-00				
												b = 0-1...DISPLAY				
					0							NO DISPLAY, STANDARD COVER				
					1							DISPLAY W/KEYPAD, COVER W/LENS				
												c = 0-4, 7...FILTERS				
								0				NO FILTER				
								1				RFI FILTER LOOP				
								2				RFI FILTER PROBE				
								3				RFI FILTERS LOOP AND PROBE				
								4				LOOP SURGE ARRESTOR				
								7				RFI FILTERS (LOOP AND PROBE) AND LOOP SURGE ARRESTOR				
												d = 0-9, A-H...CABLE TYPE LENGTH				
									1			NO CABLE				
									2			STD 10 FEET				
									3			STD 25 FEET				
									4			STD 35 FEET				
									5			STD 50 FEET				
									6			STD 75 FEET				
									7			STD 100 FEET				
									8			TRIAX 25 FEET				
									9			TRIAX 50 FEET				
									A			TRIAX 75 FEET				
									B			TRIAX 100 FEET				
									C			HI TEMP COMPOSITE 10 FEET				
									D			HI TEMP COMPOSITE 25 FEET				
									E			HI TEMP COMPOSITE 35 FEET				
									F			HI TEMP COMPOSITE 50 FEET				
									G			HI TEMP COMPOSITE 75 FEET				
									H			HI TEMP COMPOSITE 100 FEET				
												e = 0, 1, 2, 4, 6, 7, 8...SENSOR FAMILY				
												f = 0-9, A...SENSOR FAMILY				
										0	0	700-1202-001				
											1	700-1202-012				
											2	700-1202-014				
											3	700-1202-018				
											4	700-1202-041				
											5	700-1202-041 (91-303)				
											6	700-1202-031				
											7	700-1202-010				
											8	700-9000-855				
											9	700-1202-033				
										1	0	700-0001-018				
											1	700-0201-005				
											2	700-0201-005 HASTELLOY C				
											3	700-0201-036				
											4	700-0202-002				
											5	700-0202-043				
											6	700-0002-360				
											7	700-0202-036				
											8	700-0001-022				
											9	700-0001-016				
											A	700-0001-024 HASTELLOY C				
											B	700-0001-026 CARBON STEEL				
											C	700-0001-026 316 STAINLESS STEEL				
											D	700-0001-074 CARBON STEEL				
											E	700-0001-074 316 STAINLESS STEEL				
											F	700-0001-074 HASTELLOY C				
											G	700-0001-344				
											H	700-0001-344 (91-175)				
										2	0	700-0209-002				
											1	700-0209-002 (91-112)				
											2	700-0209-024				
											3	700-0002-023				
											4	700-0002-024 316 STAINLESS STEEL				
											5	700-0002-024 HASTELLOY C				
											6	700-0002-027				
											7	700-0002-027 (91-220)				
											8	700-0002-028				
											9	700-0002-036				
											A	700-0002-037				
											B	700-0002-056				
											C	700-0002-057				
											D	700-0002-057 (91-120)				
											E	700-0002-224 316 STAINLESS STEEL				
											F	700-0002-224 HASTELLOY C				
											G	700-0002-227				
											H	700-0002-321				
											I	700-0002-363				
										4	0	700-0005-018				
											1	700-0005-018 (91-13)				
											2	700-0005-019				
											3	700-0005-028				
											4	700-0005-029				
											5	700-0005-035				
											6	700-0005-035 (91-130)				
											7	700-0005-048				
											8	700-0005-054				
											9	700-0005-085				
											A	700-0005-085 HASTELLOY C				
											B	700-0005-096				
											C	700-0005-348				
											D	700-0005-354				
											E	700-0205-078				

CONTINUED

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CK. LEP 9-1-10

CERTIFIED by
PO #
ENG
USER
DE #

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1	3-03-202	SGA	3-8-04

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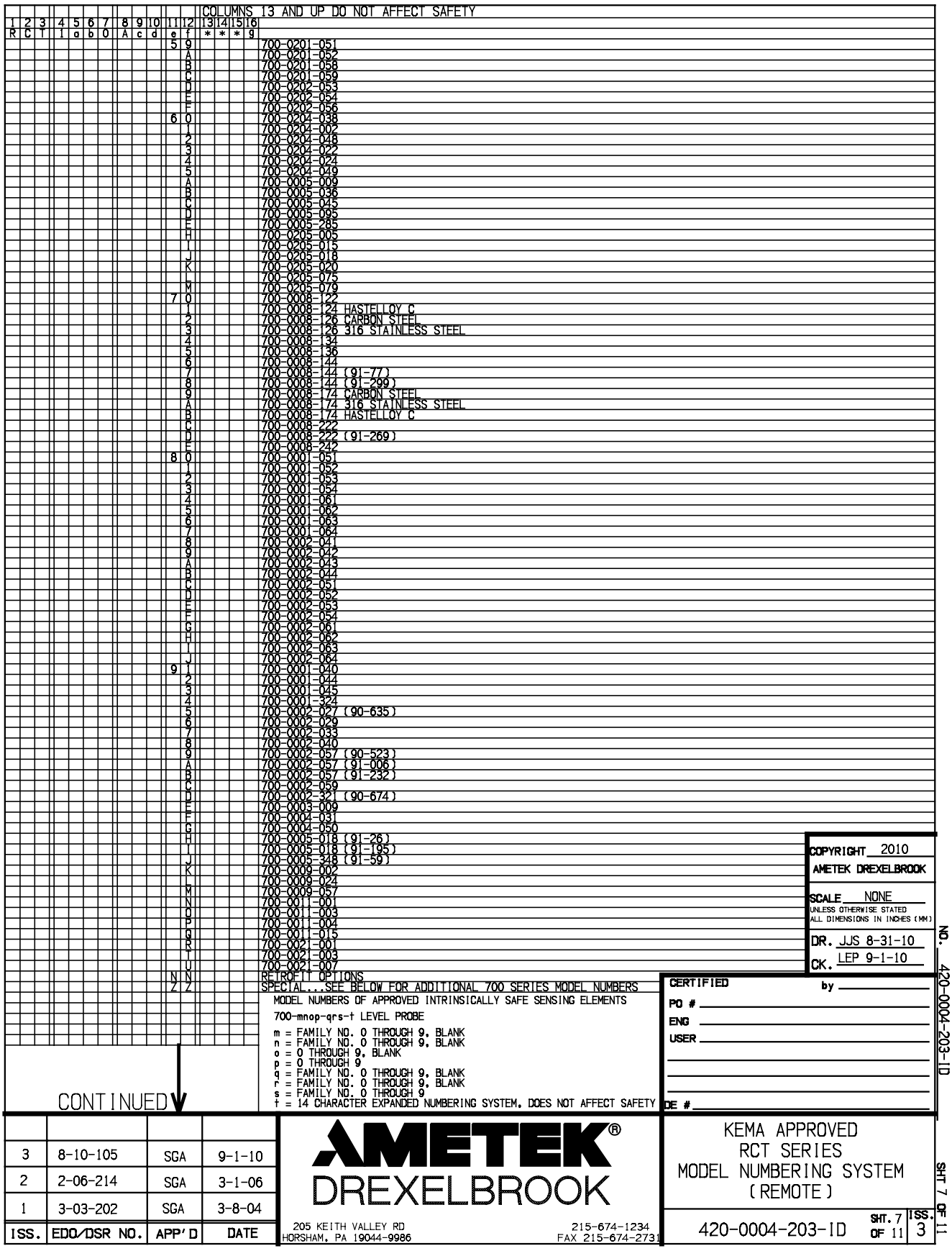
KEMA APPROVED
RCT SERIES
MODEL NUMBERING SYSTEM
(REMOTE)

420-0004-203-ID SHT. 6 OF 11 ISS. 3

NO. 420-0004-203-ID

SHT 6 OF 11

A.1 ATEX APPROVAL DRAWINGS (Continued)



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
R	C	T	1	a	b	0	A	c	d	e	f	*	*	*	g	
										5	9					700-0201-051
											A					700-0201-052
											B					700-0201-058
											C					700-0201-059
											D					700-0202-053
											E					700-0202-054
											F					700-0202-056
										6	0					700-0204-038
											1					700-0204-002
											2					700-0204-048
											3					700-0204-022
											4					700-0204-024
											5					700-0204-049
											A					700-0005-009
											B					700-0005-036
											C					700-0005-045
											D					700-0005-095
											E					700-0005-285
											H					700-0205-005
											I					700-0205-015
											J					700-0205-018
											K					700-0205-020
											L					700-0205-075
											M					700-0205-079
										7	0					700-0008-122
											1					700-0008-124 HASTELLOY C
											2					700-0008-126 CARBON STEEL
											3					700-0008-126 316 STAINLESS STEEL
											4					700-0008-134
											5					700-0008-136
											6					700-0008-144
											7					700-0008-144 (91-77)
											8					700-0008-144 (91-299)
											9					700-0008-174 CARBON STEEL
											A					700-0008-174 316 STAINLESS STEEL
											B					700-0008-174 HASTELLOY C
											C					700-0008-222
											D					700-0008-222 (91-269)
											E					700-0008-242
										8	0					700-0001-051
											1					700-0001-052
											2					700-0001-053
											3					700-0001-054
											4					700-0001-061
											5					700-0001-062
											6					700-0001-063
											7					700-0001-064
											8					700-0002-041
											9					700-0002-042
											A					700-0002-043
											B					700-0002-044
											C					700-0002-051
											D					700-0002-052
											E					700-0002-053
											F					700-0002-054
											G					700-0002-061
											H					700-0002-062
											I					700-0002-063
											J					700-0002-064
										9	1					700-0001-040
											2					700-0001-044
											3					700-0001-045
											4					700-0001-324
											5					700-0002-027 (90-635)
											6					700-0002-029
											7					700-0002-033
											8					700-0002-040
											9					700-0002-057 (90-523)
											A					700-0002-057 (91-006)
											B					700-0002-057 (91-232)
											C					700-0002-059
											D					700-0002-321 (90-674)
											E					700-0003-009
											F					700-0004-031
											G					700-0004-050
											H					700-0005-018 (91-26)
											I					700-0005-018 (91-195)
											J					700-0005-348 (91-59)
											K					700-0009-002
											L					700-0009-024
											M					700-0009-057
											N					700-0011-001
											P					700-0011-003
											Q					700-0011-004
											S					700-0011-015
											R					700-0021-001
											T					700-0021-003
											U					700-0021-007
										N	N					RETROFIT OPTIONS
										Z	Z					SPECIAL...SEE BELOW FOR ADDITIONAL 700 SERIES MODEL NUMBERS

MODEL NUMBERS OF APPROVED INTRINSICALLY SAFE SENSING ELEMENTS

700-mnop-qrs-t LEVEL PROBE

m = FAMILY NO. 0 THROUGH 9, BLANK
n = FAMILY NO. 0 THROUGH 9, BLANK
o = 0 THROUGH 9, BLANK
p = 0 THROUGH 9
q = FAMILY NO. 0 THROUGH 9, BLANK
r = FAMILY NO. 0 THROUGH 9, BLANK
s = FAMILY NO. 0 THROUGH 9
t = 14 CHARACTER EXPANDED NUMBERING SYSTEM, DOES NOT AFFECT SAFETY

CONTINUED

COLUMNS 13 AND UP DO NOT AFFECT SAFETY

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ISS.	EDO/DSR NO.	APP'D	DATE
3	8-10-105	SGA	9-1-10
2	2-06-214	SGA	3-1-06
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(REMOTE)

420-0004-203-ID SHT. 7 OF 11 ISS. 3

NO. 420-0004-203-ID

SHT 7 OF 11

A.1 ATEX APPROVAL DRAWINGS (Continued)

												COLUMNS 13 AND UP DO NOT AFFECT SAFETY				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
R	C	T	1	a	b	0	A	c	d	e	f	*	*	*	g	
																g = A-H, J, K, L OR Z
																INSERTION LENGTH/COTE SHIELD LENGTH
																A 6" IL, 2" CSL (152.4mm/50.8mm)
																B 12" IL, 2" CSL (304.8mm/50.8mm)
																C 12" IL, 3.5" CSL (304.8mm/88.9mm)
																D 18" IL, 2" CSL (457.2mm/50.8mm)
																E 18" IL, 3.5 CSL (457.2mm/88.9mm)
																F 18" IL, 10" CSL (457.2mm/254mm)
																G 18" IL, NO CSL (700-0001-018) (457.2mm)
																H 36" IL, 10" CSL (914.4mm/254mm)
																J 36" IL, NO CSL (700-0001-018) (914.4mm)
																K 48" IL, 10" CSL (1219.2mm/254mm)
																L 60" IL, 10" CSL (1524mm/254mm)
																Z OTHER

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1	3-03-202	SGA	3-8-04

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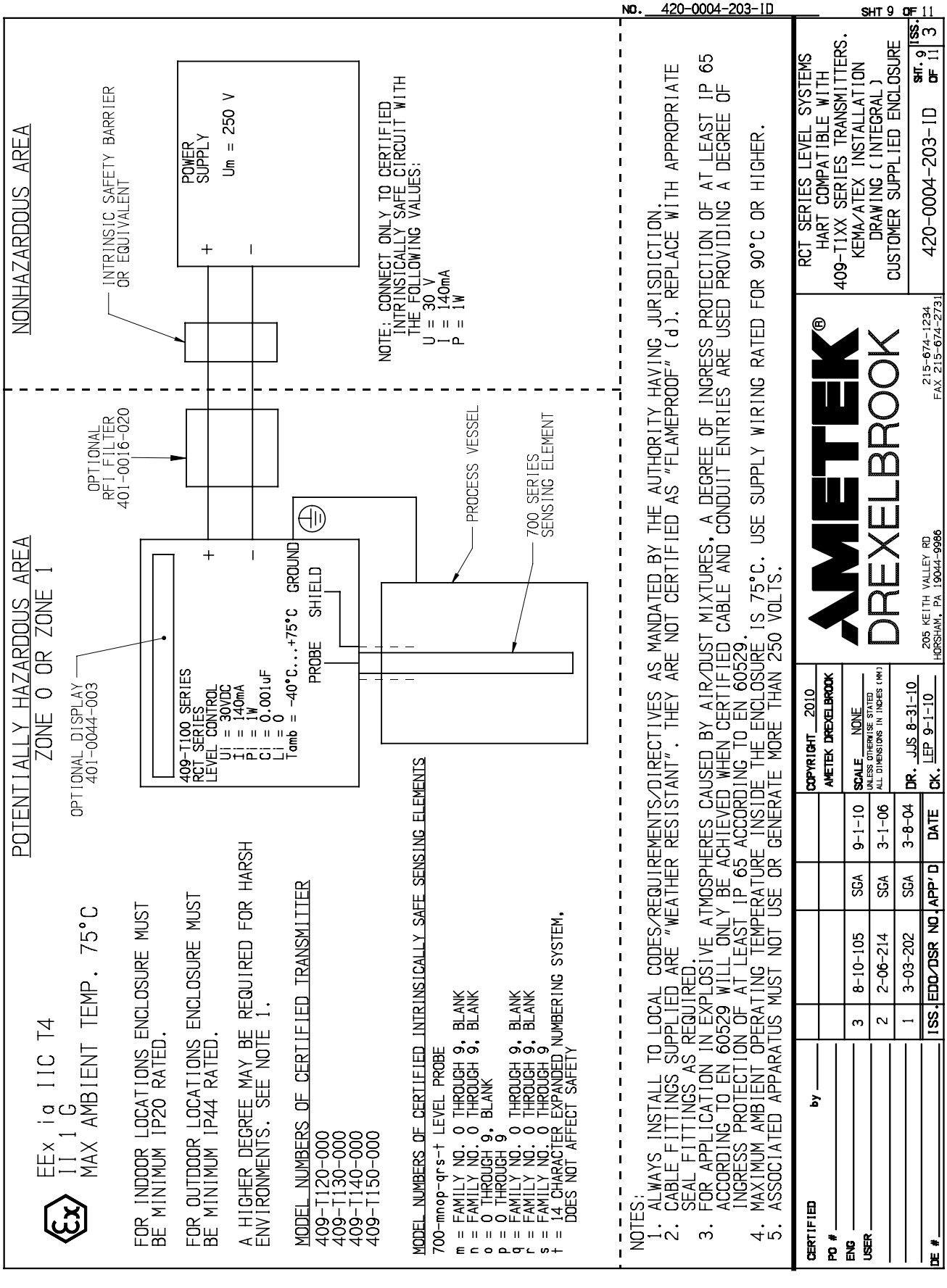
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KEMA APPROVED
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MODEL NUMBERING SYSTEM
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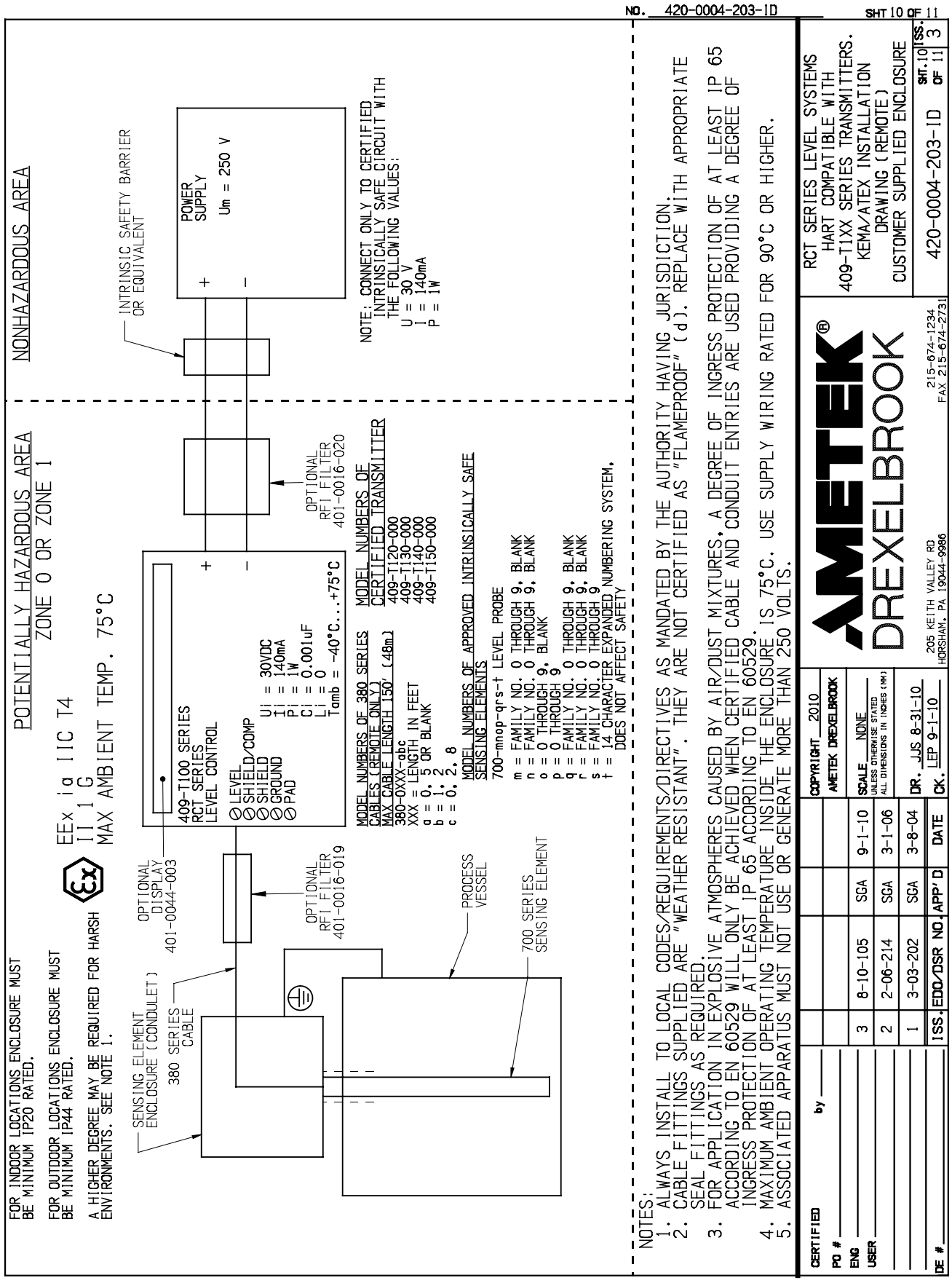
420-0004-203-ID SHT. 8 OF 11 ISS. 3

SHT 8 OF 11

A.1 ATEX APPROVAL DRAWINGS (Continued)



A.1 ATEX APPROVAL DRAWINGS (Continued)



SPECIAL CONDITIONS FOR SAFE USE

1. THE SERIES 380 CABLE SHALL BE USED FOR REMOTE CONNECTION OF THE CAPACITANCE PROBE MODEL SERIES 700, AND ITS LENGTH MAY NOT EXCEED 300 METERS.

2. FOR PROBE MODEL 700 AND FOR THE SEPARATE UNIVERSAL III LEVEL TRANSMITTER 409-T1.., BECAUSE PART OF THE ENCLOSURE IS MADE OF PLASTIC, PRECAUTIONS HAVE TO BE TAKEN TO ENSURE THAT THE ENCLOSURE CAN NOT BE CHARGED BY STATIC ELECTRICITY.

3. BECAUSE THE ENCLOSURE OF THE RCT SYSTEM LEVEL CONTROL AND PART OF THE PROBE MODEL 700 ENCLOSURE ARE MADE OF ALUMINUM ALLOY, WHEN USED IN A POTENTIALLY EXPLOSIVE ATMOSPHERE REQUIRING APPARATUS OF EQUIPMENT CATEGORY 1 G, THEY MUST BE INSTALLED SO, THAT EVEN IN THE EVENT OF RARE INCIDENTS, AND IGNITION SOURCE DUE TO IMPACT OR FRICTION BETWEEN THE ENCLOSURE AND IRON/STEEL IS EXCLUDED.

4. FOR APPLICATIONS IN EXPLOSIVE ATMOSPHERES CAUSED BY AIR/DUST MIXTURES, A DEGREE OF PROTECTION OF AT LEAST IP 65 ACCORDING TO EN 60529 WILL ONLY BE CHIEVED WHEN CERTIFIED CABLE AND CONDUIT ENTRIES ARE USED THAT PROVIDE A DEGREE OF PROTECTION OF AT LEAST IP 65 ACCORDING TO EN 60529.

CERTIFIED by _____
PO # _____
ENG _____
USER _____
_____
_____
DE # _____

ISS.	EDO/DSR NO.	APP'D	DATE
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2	2-06-214	SGA	3-1-06
1	3-03-202	SGA	3-8-04

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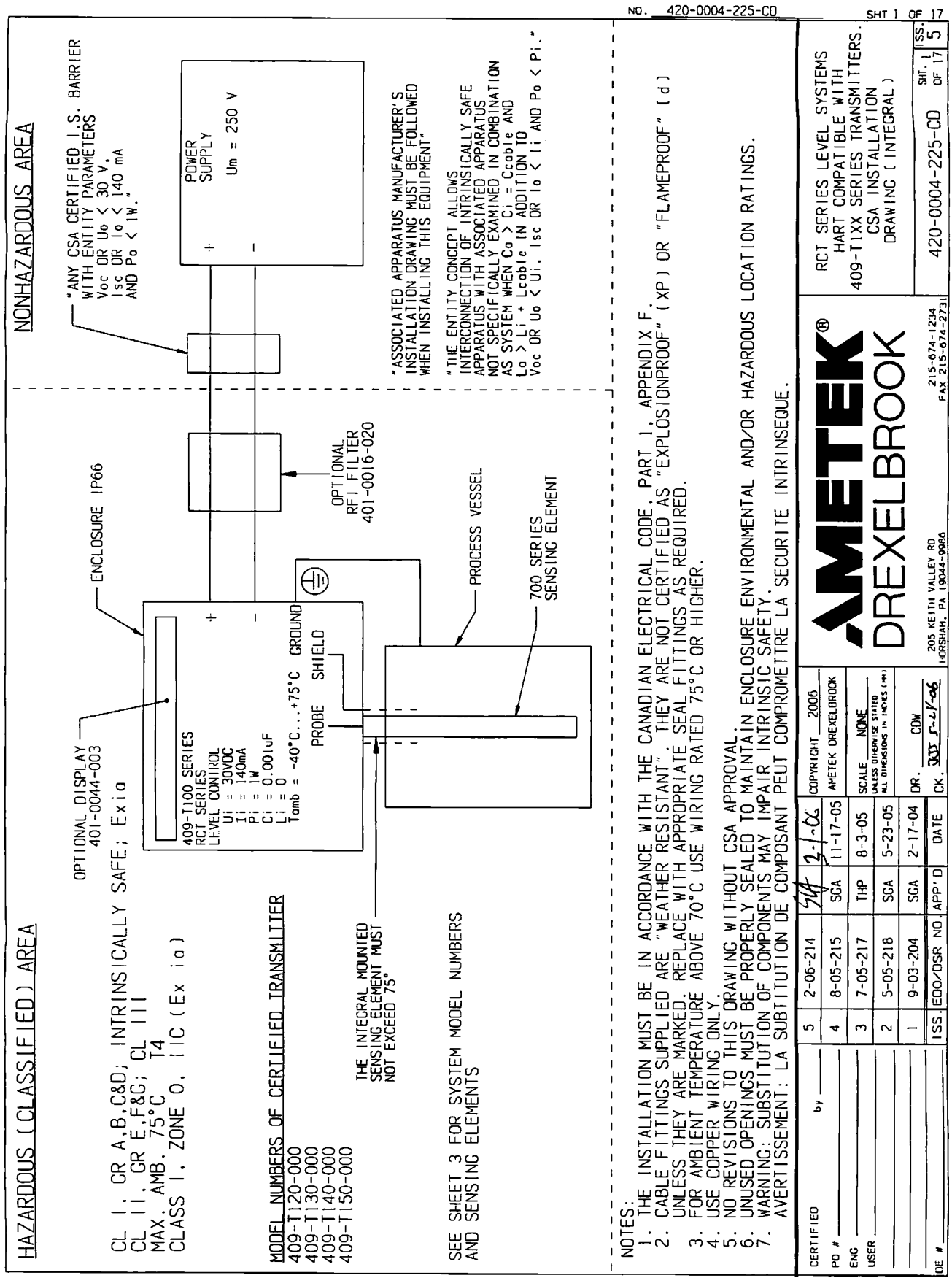
RCT SERIES LEVEL SYSTEMS
HART COMPATIBLE WITH
409-T1XX SERIES TRANSMITTERS.

CONDITIONS FOR SAFE USE

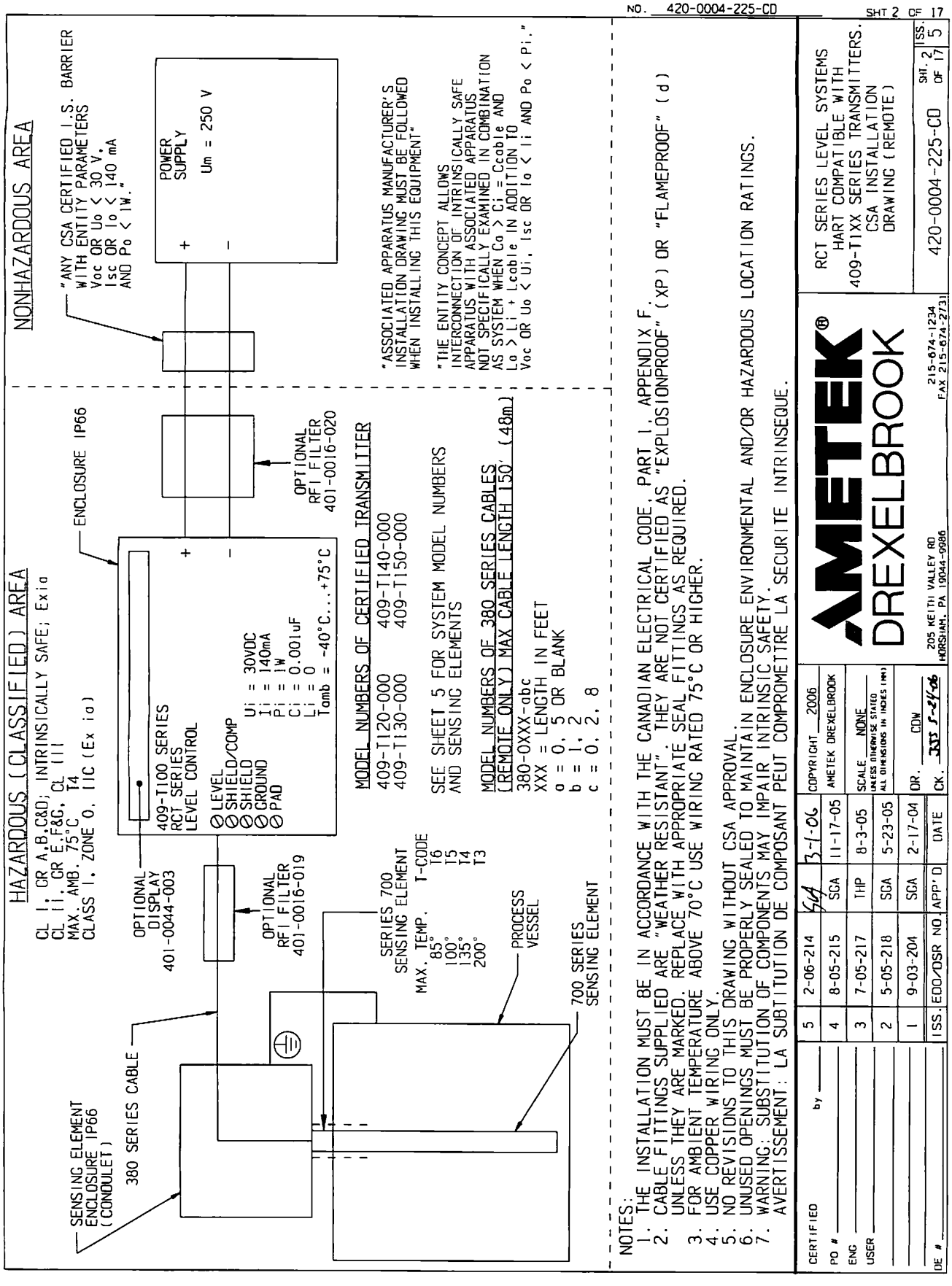
420-0004-203-ID SHT. 11 OF 11 ISS. 3

NO. 420-0004-203-ID SHT 11 OF 11

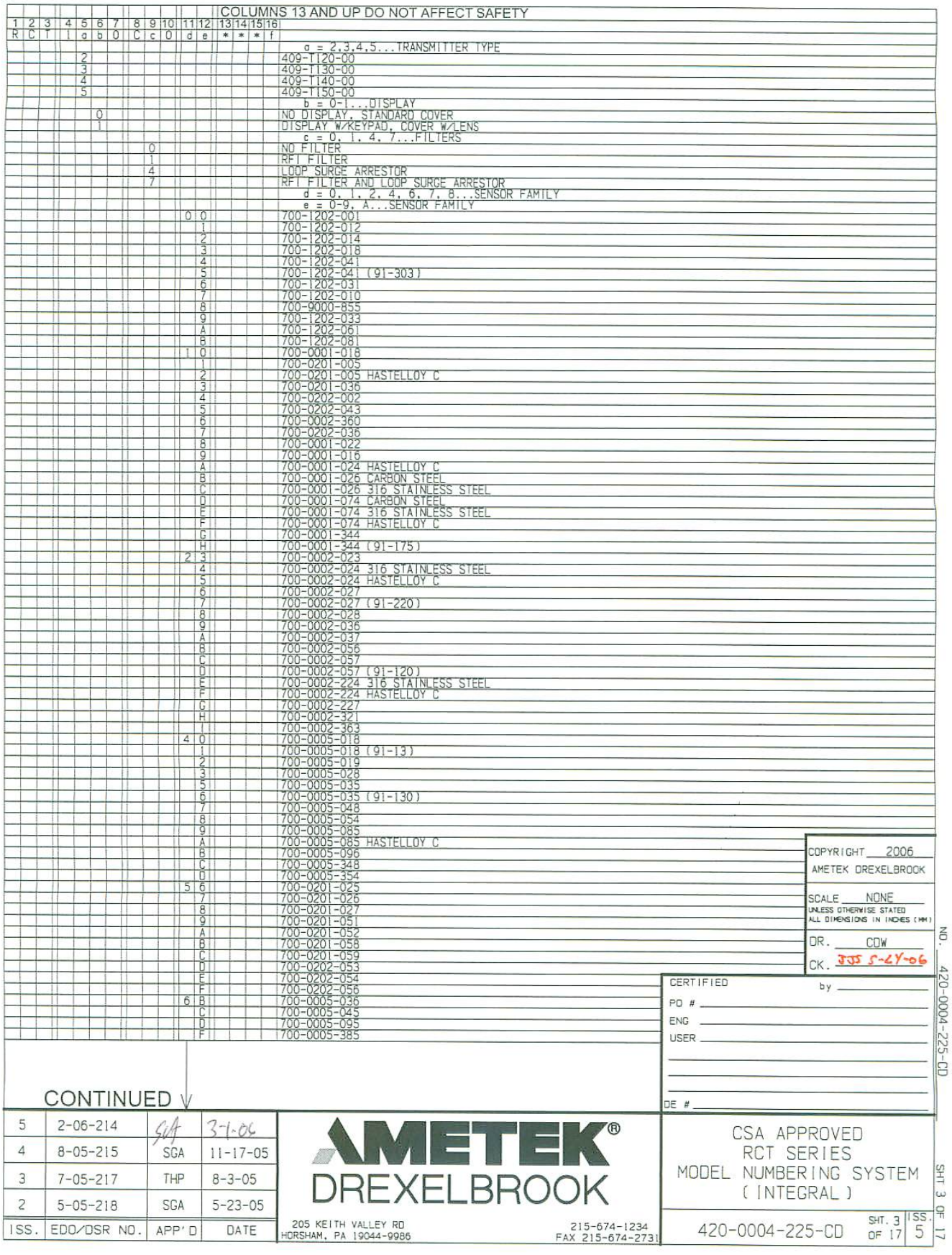
A.2 CSA APPROVAL DRAWINGS



A.2 CSA APPROVAL DRAWINGS (Continued)



A.2 CSA APPROVAL DRAWINGS (Continued)



COLUMNS 13 AND UP DO NOT AFFECT SAFETY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
R	C	T	I	a	b	0	C	c	0	d	e	*	*	*	f

a = 2,3,4,5...TRANSMITTER TYPE
2 409-T120-00
3 409-T130-00
4 409-T140-00
5 409-T150-00

b = 0-1...DISPLAY
0 NO DISPLAY, STANDARD COVER
1 DISPLAY W/KEYPAD, COVER W/LENS

c = 0, 1, 4, 7...FILTERS
0 NO FILTER
1 RFI FILTER
4 LOOP SURGE ARRESTOR
7 RFI FILTER AND LOOP SURGE ARRESTOR

d = 0, 1, 2, 4, 6, 7, 8...SENSOR FAMILY
e = 0-9, A...SENSOR FAMILY

d	e	
0	0	700-1202-001
	1	700-1202-012
	2	700-1202-014
	3	700-1202-018
	4	700-1202-041
	5	700-1202-041 (91-303)
	6	700-1202-031
	7	700-1202-010
	8	700-9000-855
	9	700-1202-033
	A	700-1202-061
	B	700-1202-081
1	0	700-0001-018
	1	700-0201-005
	2	700-0201-005 HASTELLOY C
	3	700-0201-036
	4	700-0202-002
	5	700-0202-043
	6	700-0002-360
	7	700-0202-036
	8	700-0001-022
	9	700-0001-016
	A	700-0001-024 HASTELLOY C
	B	700-0001-026 CARBON STEEL
	C	700-0001-026 316 STAINLESS STEEL
	D	700-0001-074 CARBON STEEL
	E	700-0001-074 316 STAINLESS STEEL
	F	700-0001-074 HASTELLOY C
	G	700-0001-344
	H	700-0001-344 (91-175)
2	3	700-0002-023
	4	700-0002-024 316 STAINLESS STEEL
	5	700-0002-024 HASTELLOY C
	6	700-0002-027
	7	700-0002-027 (91-220)
	8	700-0002-028
	9	700-0002-036
	A	700-0002-037
	B	700-0002-056
	C	700-0002-057
	D	700-0002-057 (91-120)
	E	700-0002-224 316 STAINLESS STEEL
	F	700-0002-224 HASTELLOY C
	G	700-0002-227
	H	700-0002-321
	I	700-0002-363
4	0	700-0005-018
	1	700-0005-018 (91-13)
	2	700-0005-019
	3	700-0005-028
	5	700-0005-035
	6	700-0005-035 (91-130)
	7	700-0005-048
	8	700-0005-054
	9	700-0005-085
	A	700-0005-085 HASTELLOY C
	B	700-0005-096
	C	700-0005-348
	D	700-0005-354
5	6	700-0201-025
	7	700-0201-026
	8	700-0201-027
	9	700-0201-051
	A	700-0201-052
	B	700-0201-058
	C	700-0201-059
	D	700-0202-053
	E	700-0202-054
	F	700-0202-056
6	B	700-0005-036
	C	700-0005-045
	D	700-0005-095
	F	700-0005-385

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SCALE NONE
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ALL DIMENSIONS IN INCHES (MM)

DR. CDW
CK. JJS 5-24-06

CERTIFIED by
PO #
ENG
USER
DE #

NO. 420-0004-225-CD

ISS.	EDO/DSR NO.	APP'D	DATE
5	2-06-214	SGA	3-1-06
4	8-05-215	SGA	11-17-05
3	7-05-217	THP	8-3-05
2	5-05-218	SGA	5-23-05

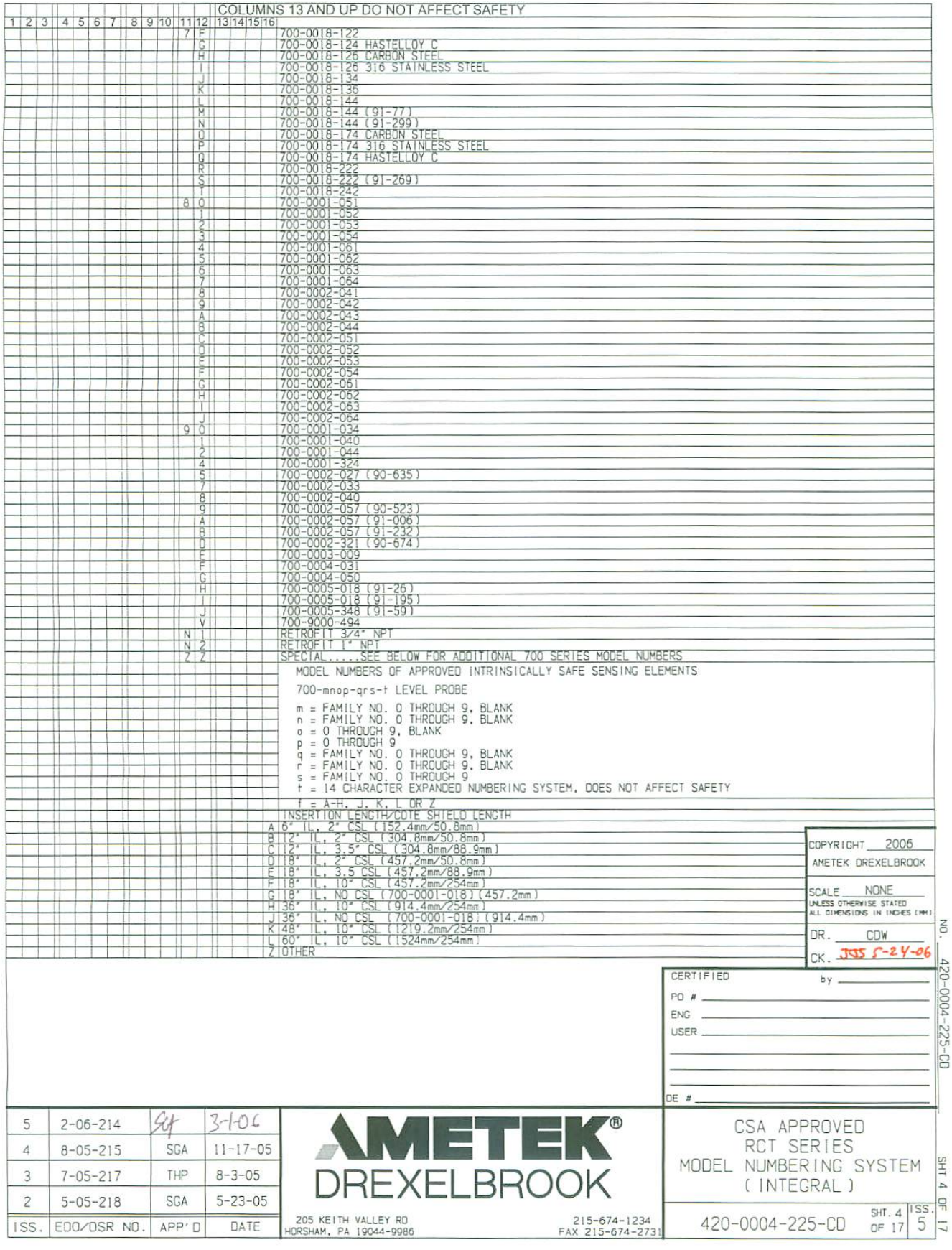
AMETEK®
DREXELBROOK
205 KEITH VALLEY RD
HORSHAM, PA 19044-9986
215-674-1234
FAX 215-674-2731

CSA APPROVED
RCT SERIES
MODEL NUMBERING SYSTEM
(INTEGRAL)

420-0004-225-CD SHT. 3 OF 17 ISS. 5

SHT 3 OF 17

A.2 CSA APPROVAL DRAWINGS (Continued)



COLUMNS 13 AND UP DO NOT AFFECT SAFETY

1 2 3 4 5 6 7 8 9 10 11 12	13 14 15 16
7 F	700-0018-122
G	700-0018-124 HASTELLOY C
H	700-0018-126 CARBON STEEL
I	700-0018-126 316 STAINLESS STEEL
J	700-0018-134
K	700-0018-136
L	700-0018-144
M	700-0018-144 (91-77)
N	700-0018-144 (91-299)
O	700-0018-174 CARBON STEEL
P	700-0018-174 316 STAINLESS STEEL
Q	700-0018-174 HASTELLOY C
R	700-0018-222
S	700-0018-222 (91-269)
T	700-0018-242
8 0	700-0001-051
1	700-0001-052
2	700-0001-053
3	700-0001-054
4	700-0001-061
5	700-0001-062
6	700-0001-063
7	700-0001-064
8	700-0002-041
9	700-0002-042
A	700-0002-043
B	700-0002-044
C	700-0002-051
D	700-0002-052
E	700-0002-053
F	700-0002-054
G	700-0002-061
H	700-0002-062
I	700-0002-063
J	700-0002-064
9 0	700-0001-034
1	700-0001-040
2	700-0001-044
4	700-0001-324
5	700-0002-027 (90-635)
7	700-0002-033
8	700-0002-040
9	700-0002-057 (90-523)
A	700-0002-057 (91-006)
B	700-0002-057 (91-232)
D	700-0002-321 (90-674)
E	700-0003-009
F	700-0004-031
G	700-0004-050
H	700-0005-018 (91-26)
I	700-0005-018 (91-195)
J	700-0005-348 (91-59)
V	700-9000-494
N 1	RETROFIT 3/4" NPT
N 2	RETROFIT 1" NPT
Z Z	SPECIAL.....SEE BELOW FOR ADDITIONAL 700 SERIES MODEL NUMBERS

MODEL NUMBERS OF APPROVED INTRINSICALLY SAFE SENSING ELEMENTS

700-mnop-qrs-t LEVEL PROBE

m = FAMILY NO. 0 THROUGH 9, BLANK
n = FAMILY NO. 0 THROUGH 9, BLANK
o = 0 THROUGH 9, BLANK
p = 0 THROUGH 9
q = FAMILY NO. 0 THROUGH 9, BLANK
r = FAMILY NO. 0 THROUGH 9, BLANK
s = FAMILY NO. 0 THROUGH 9
t = 14 CHARACTER EXPANDED NUMBERING SYSTEM, DOES NOT AFFECT SAFETY
t = A-H, J, K, L OR Z

INSERTION LENGTH/COTE SHIELD LENGTH

A	6" IL, 2" CSL (152.4mm/50.8mm)
B	12" IL, 2" CSL (304.8mm/50.8mm)
C	12" IL, 3.5" CSL (304.8mm/88.9mm)
D	18" IL, 2" CSL (457.2mm/50.8mm)
E	18" IL, 3.5" CSL (457.2mm/88.9mm)
F	18" IL, 10" CSL (457.2mm/254mm)
G	18" IL, NO CSL (700-0001-018) (457.2mm)
H	36" IL, 10" CSL (914.4mm/254mm)
J	36" IL, NO CSL (700-0001-018) (914.4mm)
K	48" IL, 10" CSL (1219.2mm/254mm)
L	60" IL, 10" CSL (1524mm/254mm)
Z	OTHER

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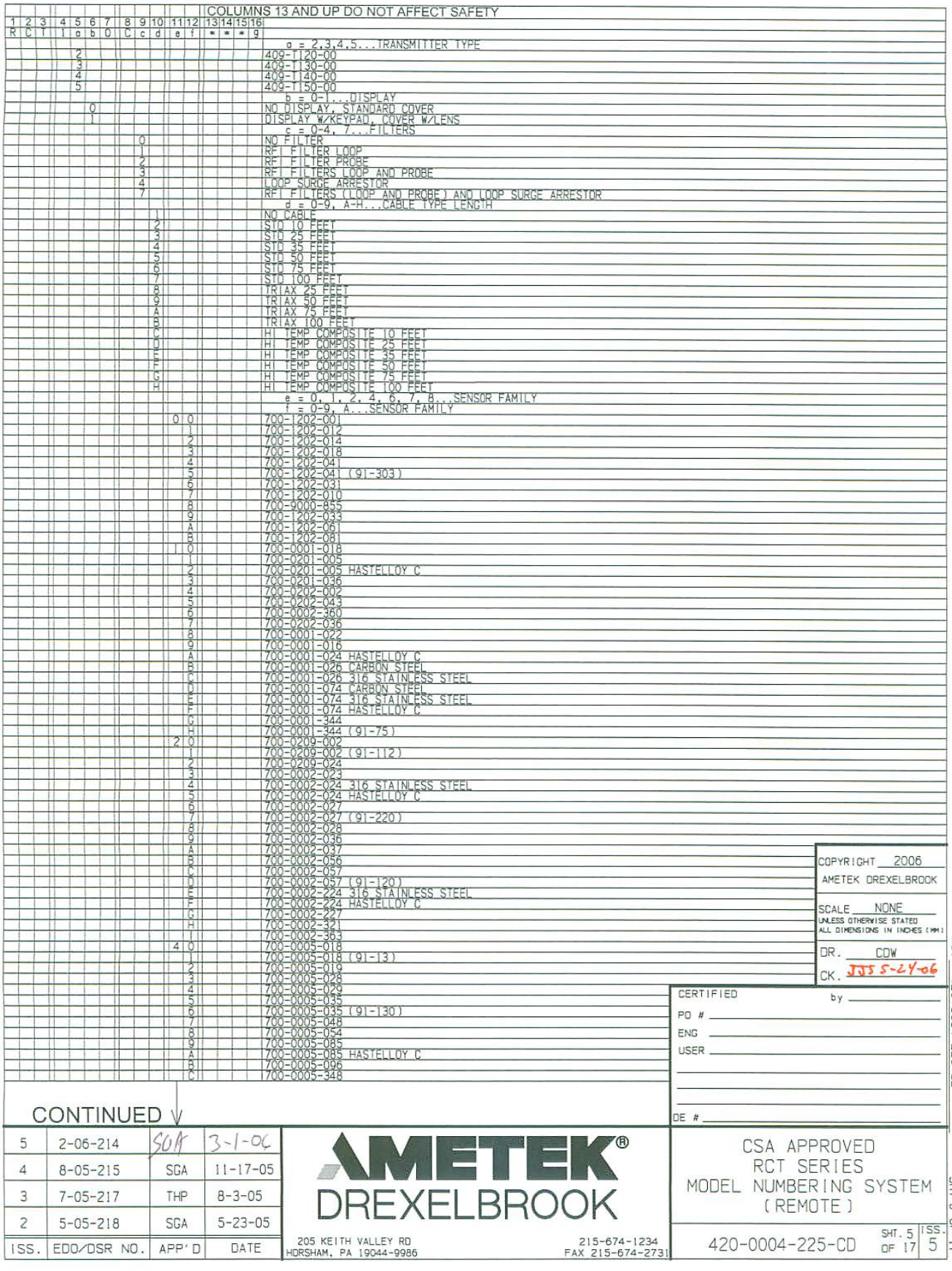
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CSA APPROVED
RCT SERIES
MODEL NUMBERING SYSTEM
(INTEGRAL)

420-0004-225-CD SHT. 4 OF 17 ISS. 5

SHT 4 OF 17

A.2 CSA APPROVAL DRAWINGS (Continued)



COLUMNS 13 AND UP DO NOT AFFECT SAFETY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
R	C	T	I	a	b	0	C	c	d	e	f	*	*	*	g	
																a = 2,3,4,5...TRANSMITTER TYPE
			2													409-T120-00
			3													409-T130-00
			4													409-T140-00
			5													409-T150-00
																b = 0-1...DISPLAY
				0												NO DISPLAY, STANDARD COVER
				1												DISPLAY W/KEYPAD, COVER W/LENS
																c = 0-4, 7...FILTERS
							0									NO FILTER
							1									RFI FILTER LOOP
							2									RFI FILTER PROBE
							3									RFI FILTERS LOOP AND PROBE
							4									LOOP SURGE ARRESTOR
							7									RFI FILTERS (LOOP AND PROBE) AND LOOP SURGE ARRESTOR
																d = 0-9, A-H...CABLE TYPE LENGTH
								1								NO CABLE
								2								STD 10 FEET
								3								STD 25 FEET
								4								STD 35 FEET
								5								STD 50 FEET
								6								STD 75 FEET
								7								STD 100 FEET
								8								TRIAX 25 FEET
								9								TRIAX 50 FEET
								A								TRIAX 75 FEET
								B								TRIAX 100 FEET
								C								HI TEMP COMPOSITE 10 FEET
								D								HI TEMP COMPOSITE 25 FEET
								E								HI TEMP COMPOSITE 35 FEET
								F								HI TEMP COMPOSITE 50 FEET
								G								HI TEMP COMPOSITE 75 FEET
								H								HI TEMP COMPOSITE 100 FEET
																e = 0, 1, 2, 4, 6, 7, 8...SENSOR FAMILY
																f = 0-9, A...SENSOR FAMILY
										0	0					700-1202-001
											1					700-1202-012
											2					700-1202-014
											3					700-1202-018
											4					700-1202-041
											5					700-1202-041 (91-303)
											6					700-1202-031
											7					700-1202-010
											8					700-9000-855
											9					700-1202-033
											A					700-1202-061
											B					700-1202-081
										1	0					700-0001-018
											1					700-0201-005
											2					700-0201-005 HASTELLOY C
											3					700-0201-036
											4					700-0202-002
											5					700-0202-043
											6					700-0002-360
											7					700-0202-036
											8					700-0001-022
											9					700-0001-016
											A					700-0001-024 HASTELLOY C
											B					700-0001-026 CARBON STEEL
											C					700-0001-026 316 STAINLESS STEEL
											D					700-0001-074 CARBON STEEL
											E					700-0001-074 316 STAINLESS STEEL
											F					700-0001-074 HASTELLOY C
											G					700-0001-344
											H					700-0001-344 (91-75)
										2	0					700-0209-002
											1					700-0209-002 (91-112)
											2					700-0209-024
											3					700-0002-023
											4					700-0002-024 316 STAINLESS STEEL
											5					700-0002-024 HASTELLOY C
											6					700-0002-027
											7					700-0002-027 (91-220)
											8					700-0002-028
											9					700-0002-036
											A					700-0002-037
											B					700-0002-056
											C					700-0002-057
											D					700-0002-057 (91-120)
											E					700-0002-224 316 STAINLESS STEEL
											F					700-0002-224 HASTELLOY C
											G					700-0002-227
											H					700-0002-321
											I					700-0002-363
										4	0					700-0005-018
											1					700-0005-018 (91-13)
											2					700-0005-019
											3					700-0005-028
											4					700-0005-029
											5					700-0005-035
											6					700-0005-035 (91-130)
											7					700-0005-048
											8					700-0005-054
											9					700-0005-085
											A					700-0005-085 HASTELLOY C
											B					700-0005-096
											C					700-0005-348

CONTINUED ↓

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DR. CDW
CK. JJS 5-24-06

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PO #
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3	7-05-217	THP	8-3-05
2	5-05-218	SGA	5-23-05

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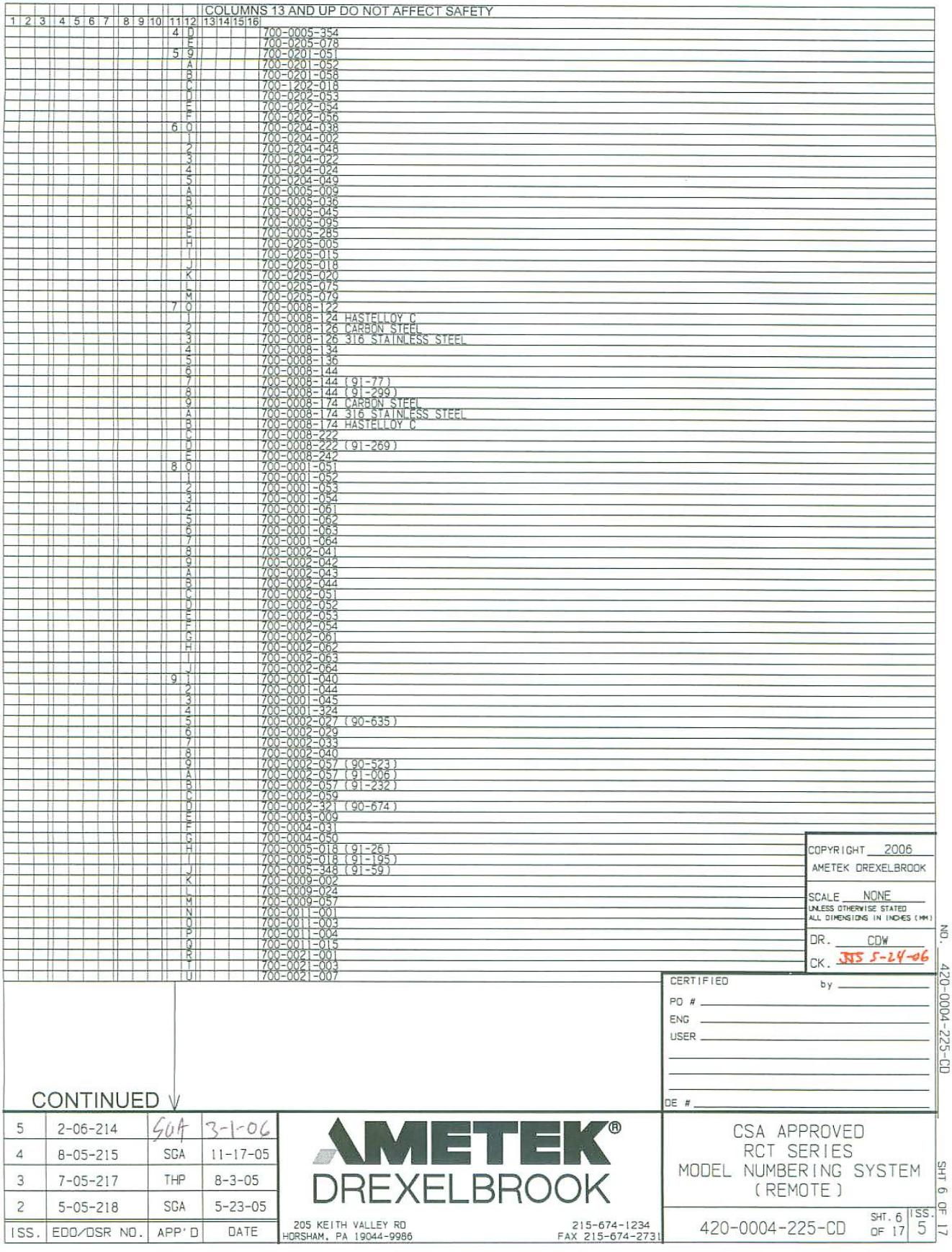
CSA APPROVED
RCT SERIES
MODEL NUMBERING SYSTEM
(REMOTE)

420-0004-225-CD SHT. 5 OF 17 ISS. 5

NO. 420-0004-225-CD

SHT 5 OF 17

A.2 CSA APPROVAL DRAWINGS (Continued)



COLUMNS 13 AND UP DO NOT AFFECT SAFETY

1 2 3 4 5 6 7 8 9 10 11 12	13 14 15 16
4 D	700-0005-354
E	700-0205-078
5 9	700-0201-051
A	700-0201-052
B	700-0201-058
C	700-1202-018
D	700-0202-053
E	700-0202-054
F	700-0202-056
6 0	700-0204-038
1	700-0204-002
2	700-0204-048
3	700-0204-022
4	700-0204-024
5	700-0204-049
A	700-0005-009
B	700-0005-036
C	700-0005-045
D	700-0005-095
E	700-0005-285
H	700-0205-005
I	700-0205-015
J	700-0205-018
K	700-0205-020
L	700-0205-075
M	700-0205-079
7 0	700-0008-122
1	700-0008-124 HASTELLOY C
2	700-0008-126 CARBON STEEL
3	700-0008-126 316 STAINLESS STEEL
4	700-0008-134
5	700-0008-136
6	700-0008-144
7	700-0008-144 (91-77)
8	700-0008-144 (91-299)
9	700-0008-174 CARBON STEEL
A	700-0008-174 316 STAINLESS STEEL
B	700-0008-174 HASTELLOY C
C	700-0008-222
D	700-0008-222 (91-269)
E	700-0008-242
8 0	700-0001-051
1	700-0001-052
2	700-0001-053
3	700-0001-054
4	700-0001-061
5	700-0001-062
6	700-0001-063
7	700-0001-064
8	700-0002-041
9	700-0002-042
A	700-0002-043
B	700-0002-044
C	700-0002-051
D	700-0002-052
E	700-0002-053
F	700-0002-054
G	700-0002-061
H	700-0002-062
I	700-0002-063
J	700-0002-064
9 1	700-0001-040
2	700-0001-044
3	700-0001-045
4	700-0001-324
5	700-0002-027 (90-635)
6	700-0002-029
7	700-0002-033
8	700-0002-040
9	700-0002-057 (90-523)
A	700-0002-057 (91-006)
B	700-0002-057 (91-232)
C	700-0002-059
D	700-0002-321 (90-674)
E	700-0003-009
F	700-0004-031
G	700-0004-050
H	700-0005-018 (91-26)
I	700-0005-018 (91-195)
J	700-0005-348 (91-59)
K	700-0009-002
L	700-0009-024
M	700-0009-057
N	700-0011-001
O	700-0011-003
P	700-0011-004
Q	700-0011-015
R	700-0021-001
T	700-0021-003
U	700-0021-007

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3	7-05-217	THP	8-3-05
2	5-05-218	SGA	5-23-05

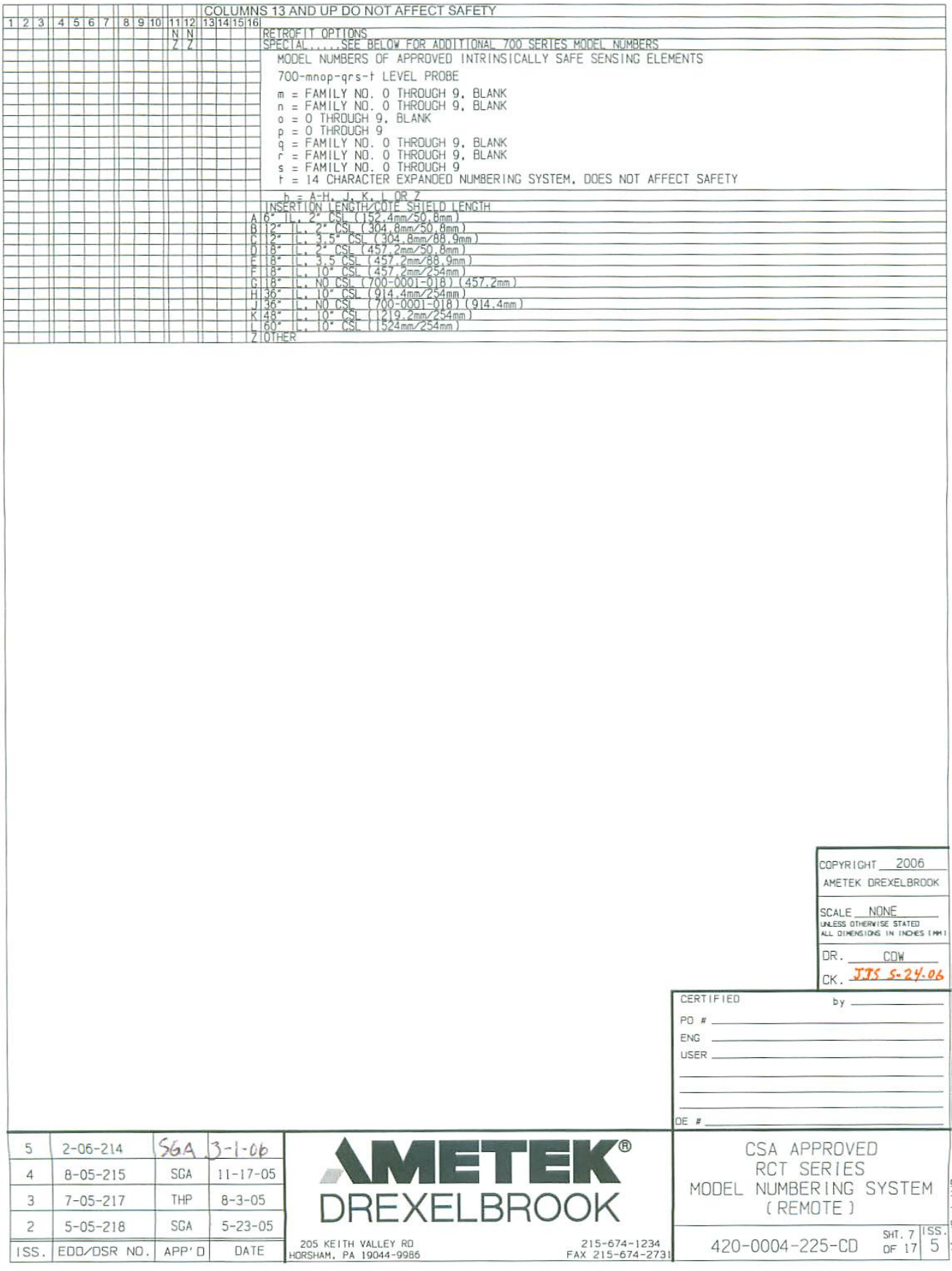
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205 KEITH VALLEY RD
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RCT SERIES
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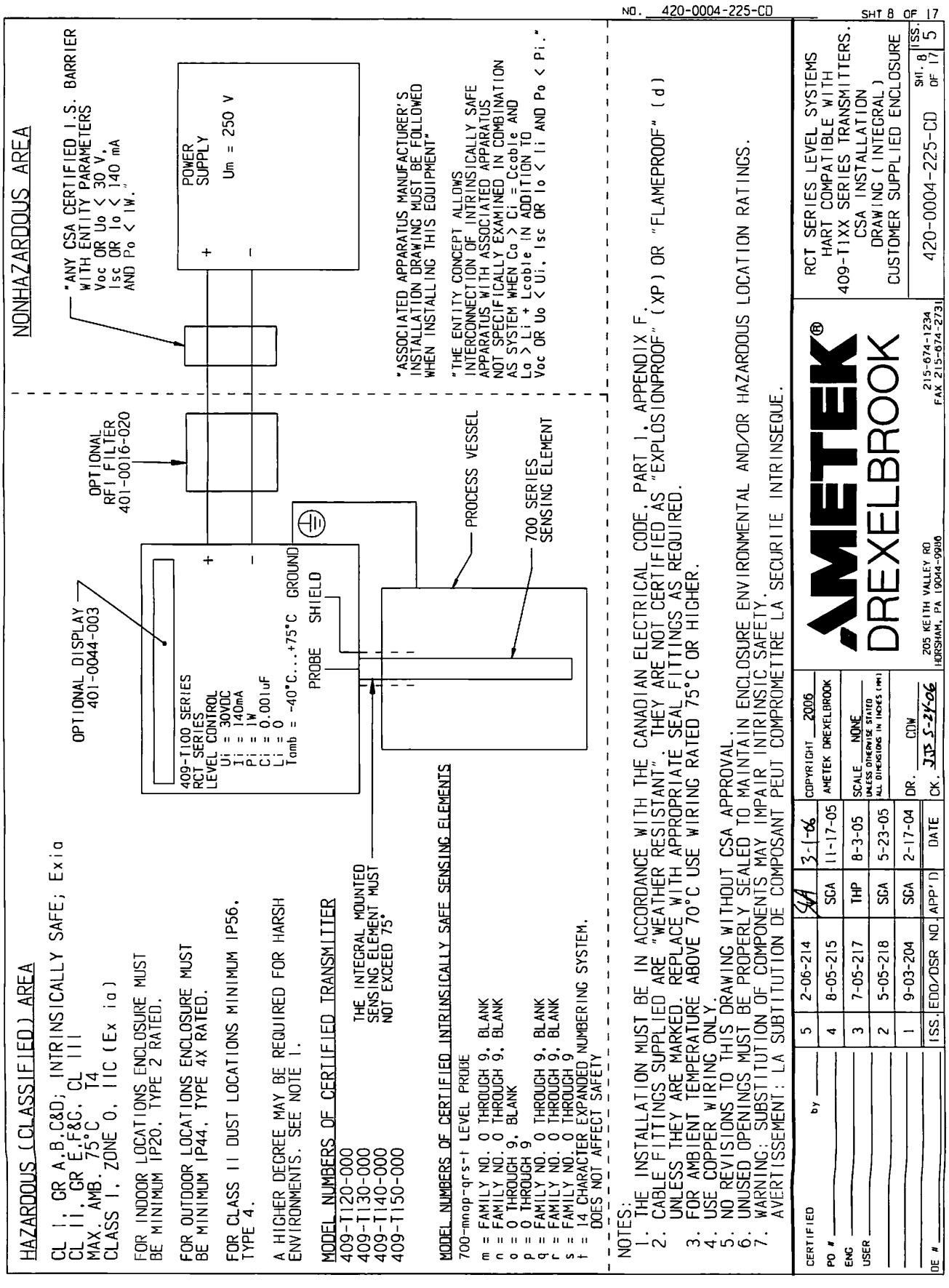
420-0004-225-CD SHT. 6 OF 17 ISS. 5

SHT 6 OF 17

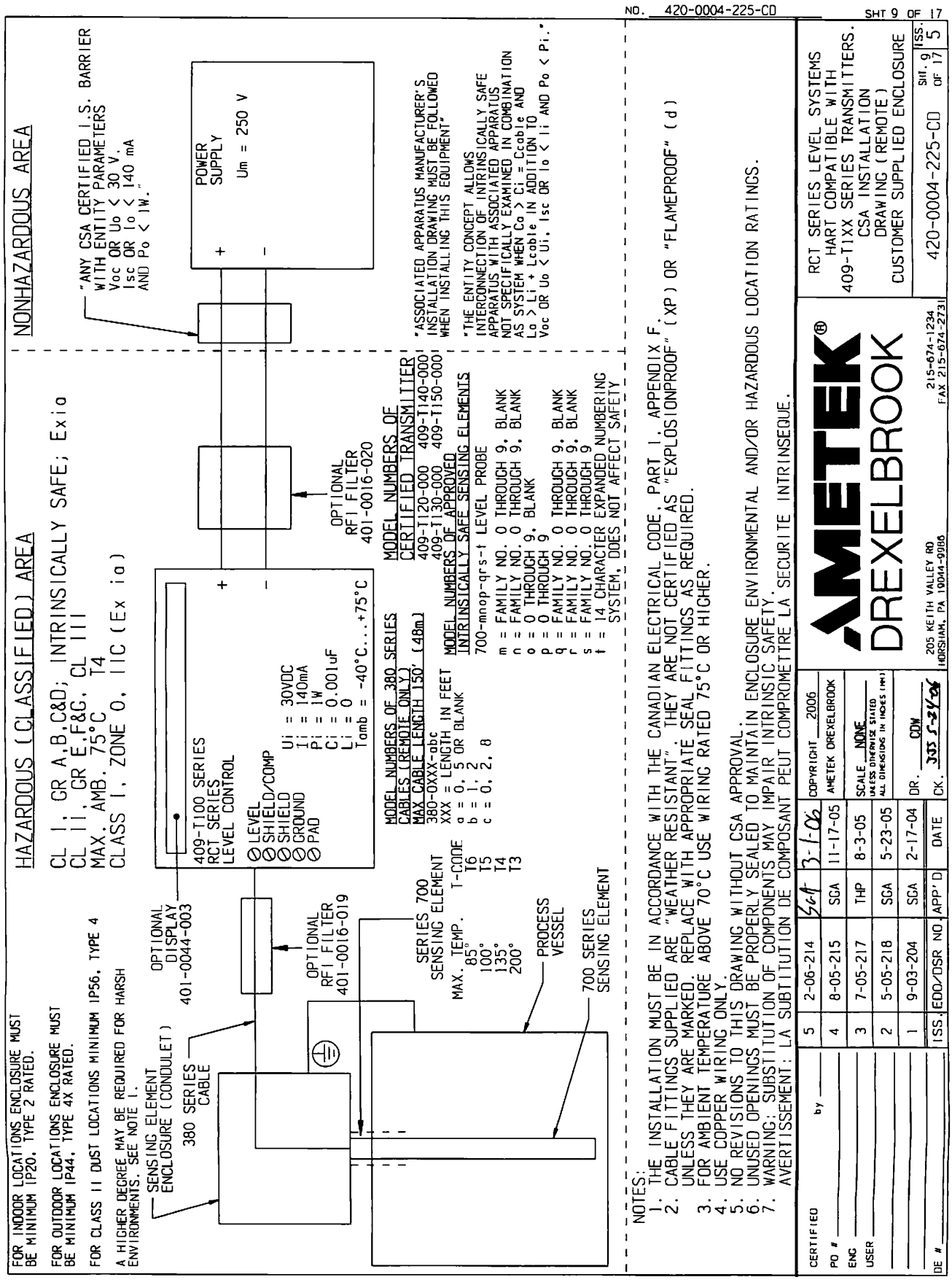
A.2 CSA APPROVAL DRAWINGS (Continued)

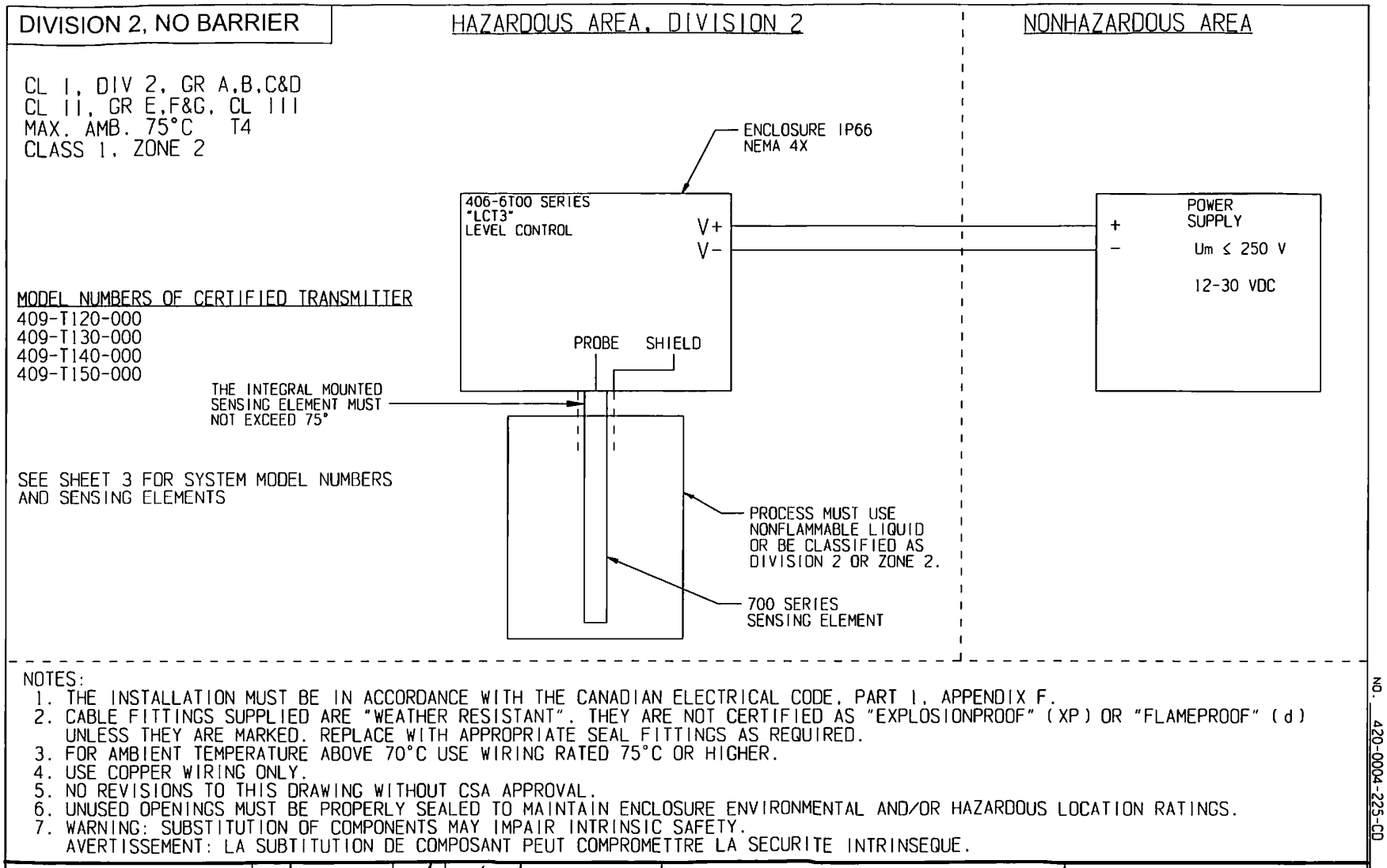


A.2 CSA APPROVAL DRAWINGS (Continued)



A.2 CSA APPROVAL DRAWINGS (Continued)





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" (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 SUBTITUTION DE COMPOSANT PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.

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4	8-05-215	SGA	11-17-05
3	7-05-217	THP	8-3-05
2	5-05-218	SGA	5-23-05
1	9-03-204	SGA	2-17-04

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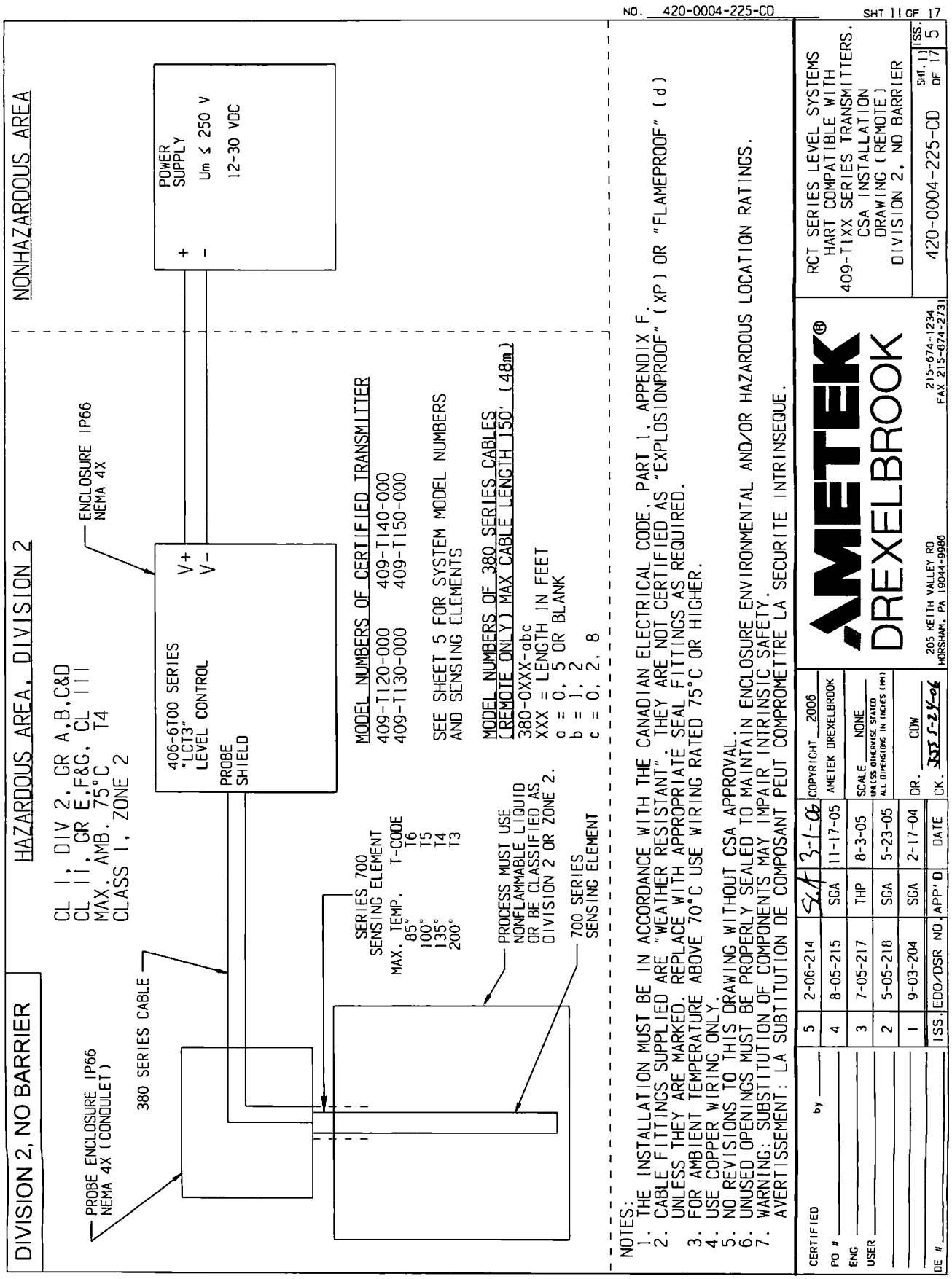
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RCT SERIES LEVEL SYSTEMS
HART COMPATIBLE WITH
409-T1XX SERIES TRANSMITTERS.
CSA INSTALLATION
DRAWING (INTEGRAL)
DIVISION 2, NO BARRIER

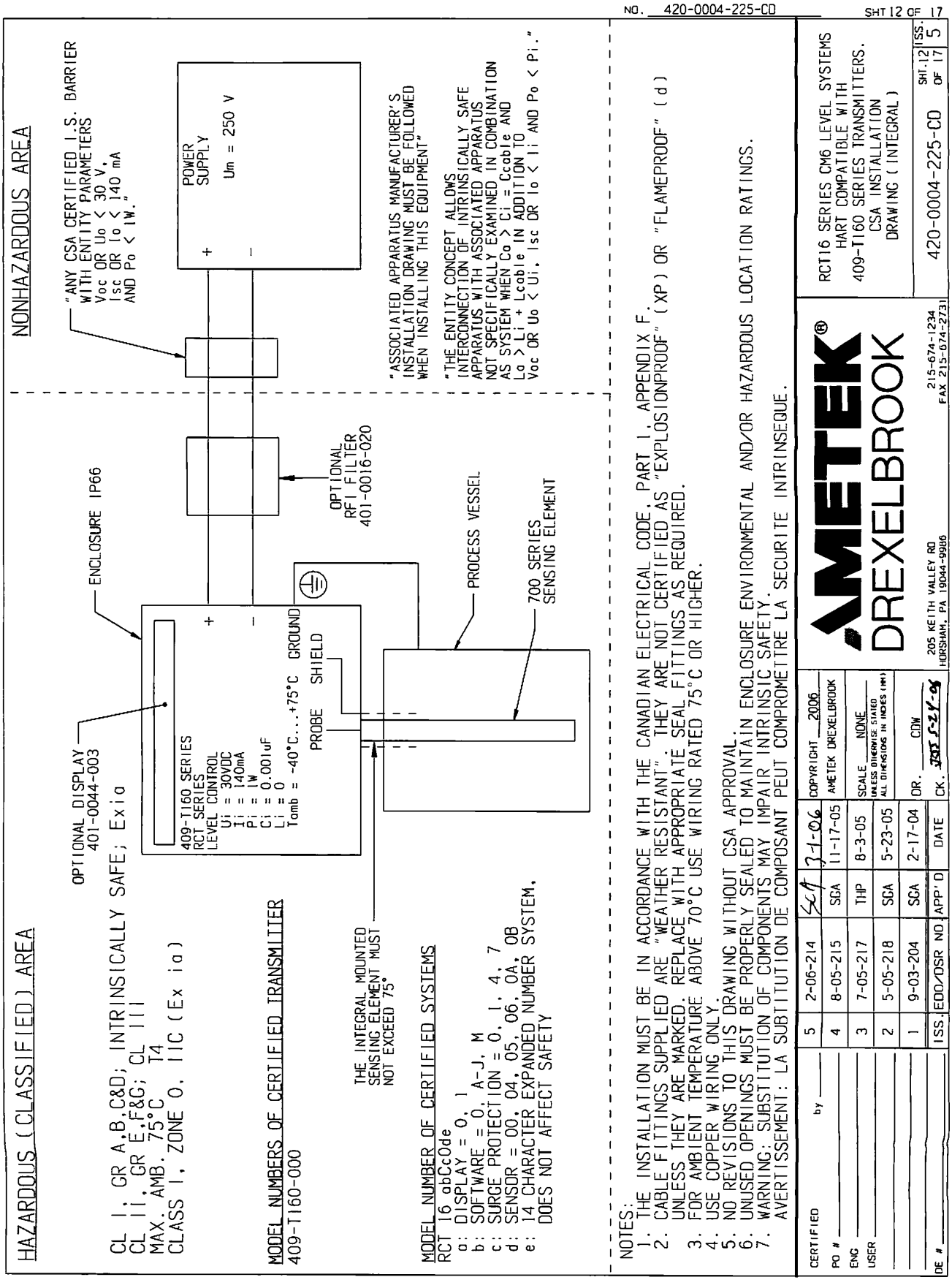
NO. 420-0004-225-CD
SHT 10 OF 17

420-0004-225-CD | SHT. 10 OF 17 | ISS. 5

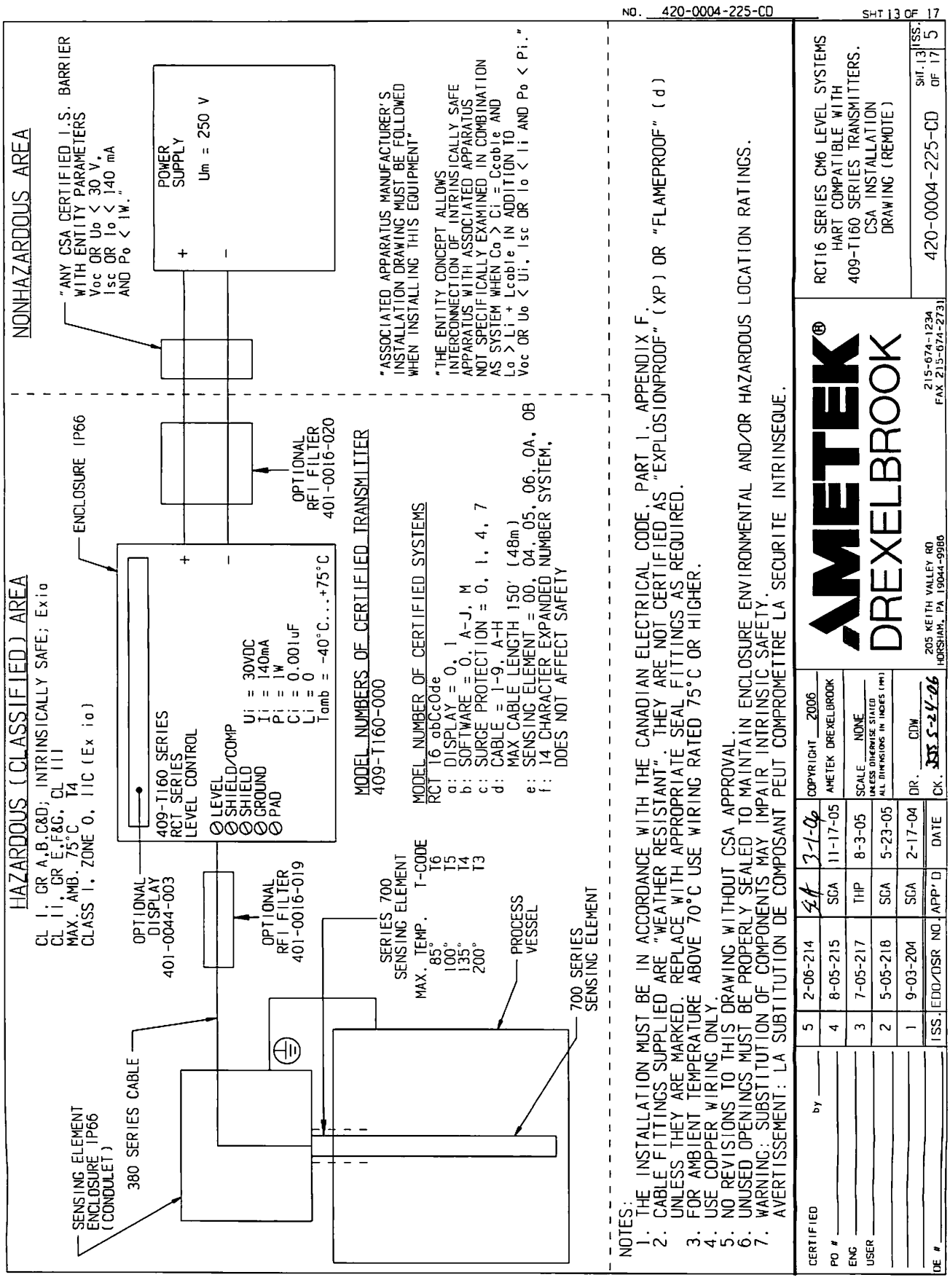
A.2 CSA APPROVAL DRAWINGS (Continued)



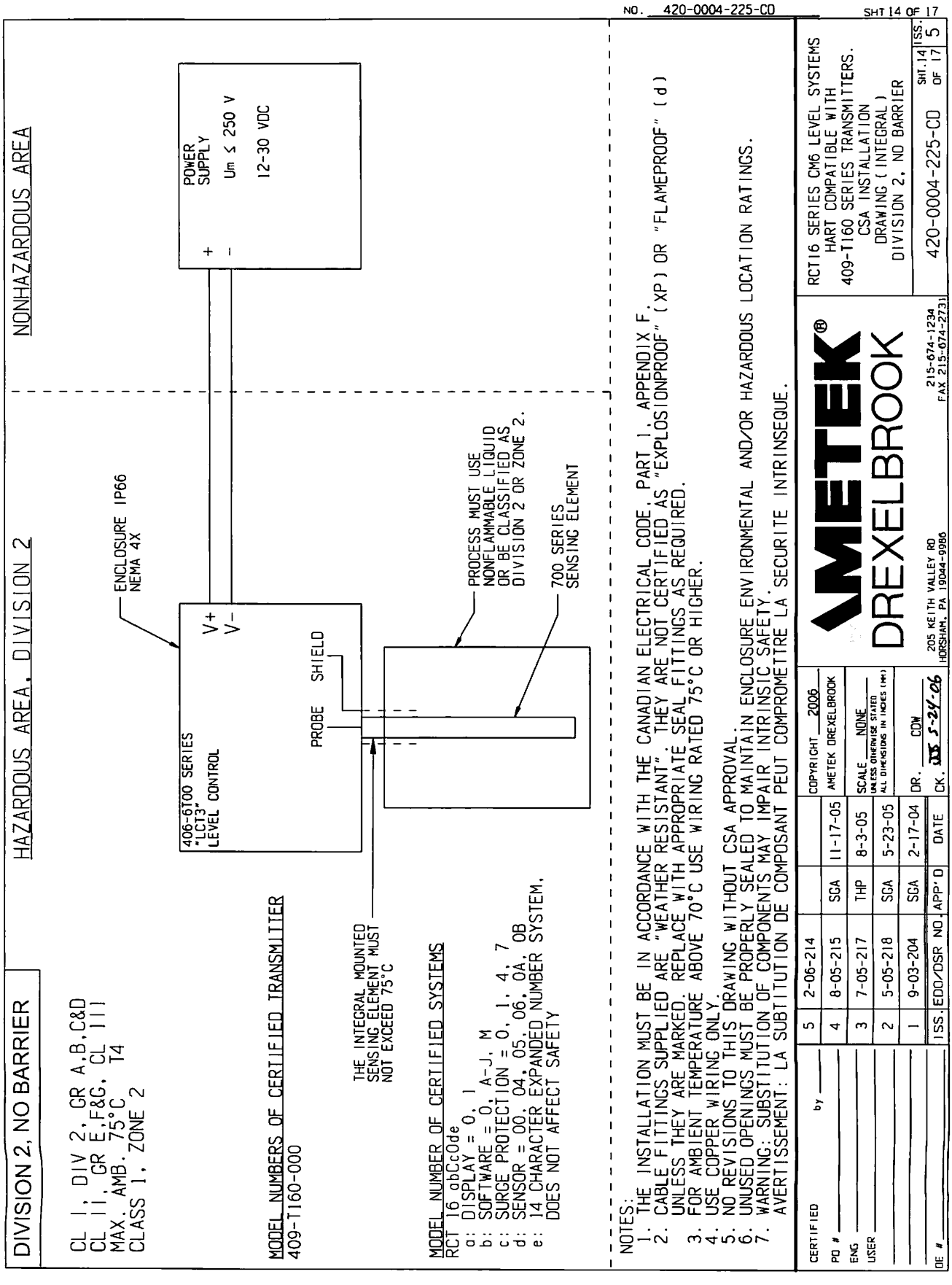
A.2 CSA APPROVAL DRAWINGS (Continued)



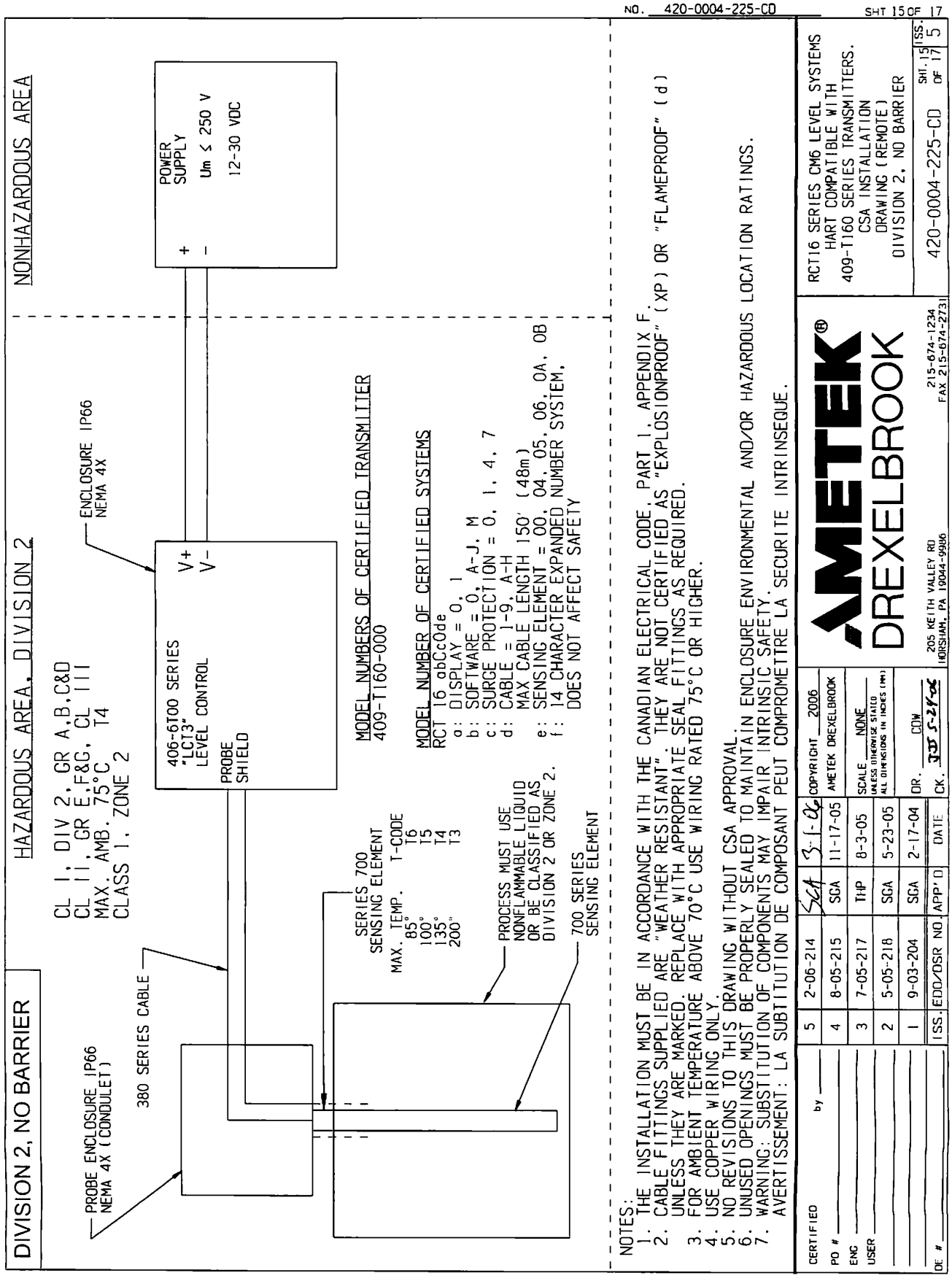
A.2 CSA APPROVAL DRAWINGS (Continued)



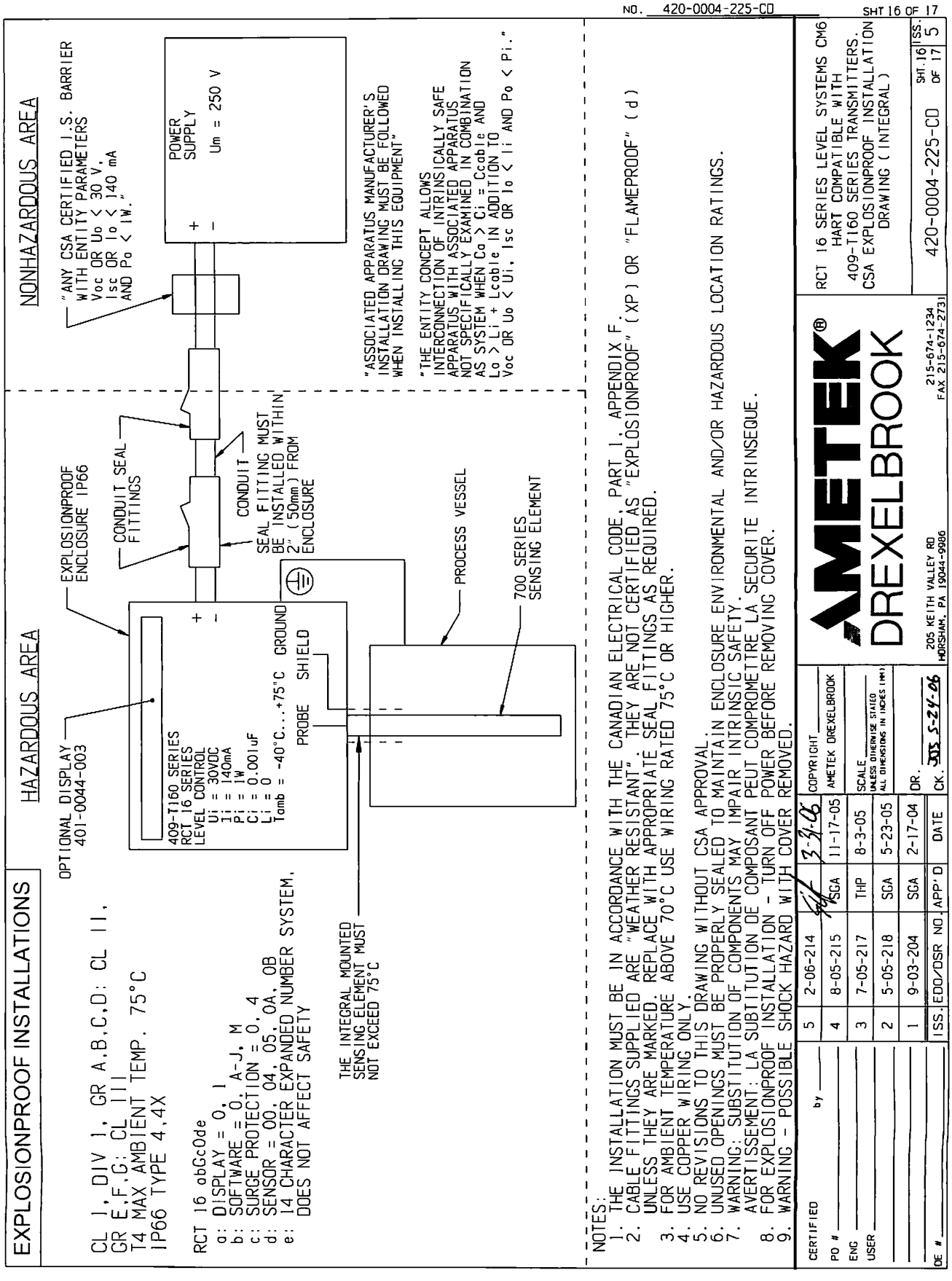
A.2 CSA APPROVAL DRAWINGS (Continued)



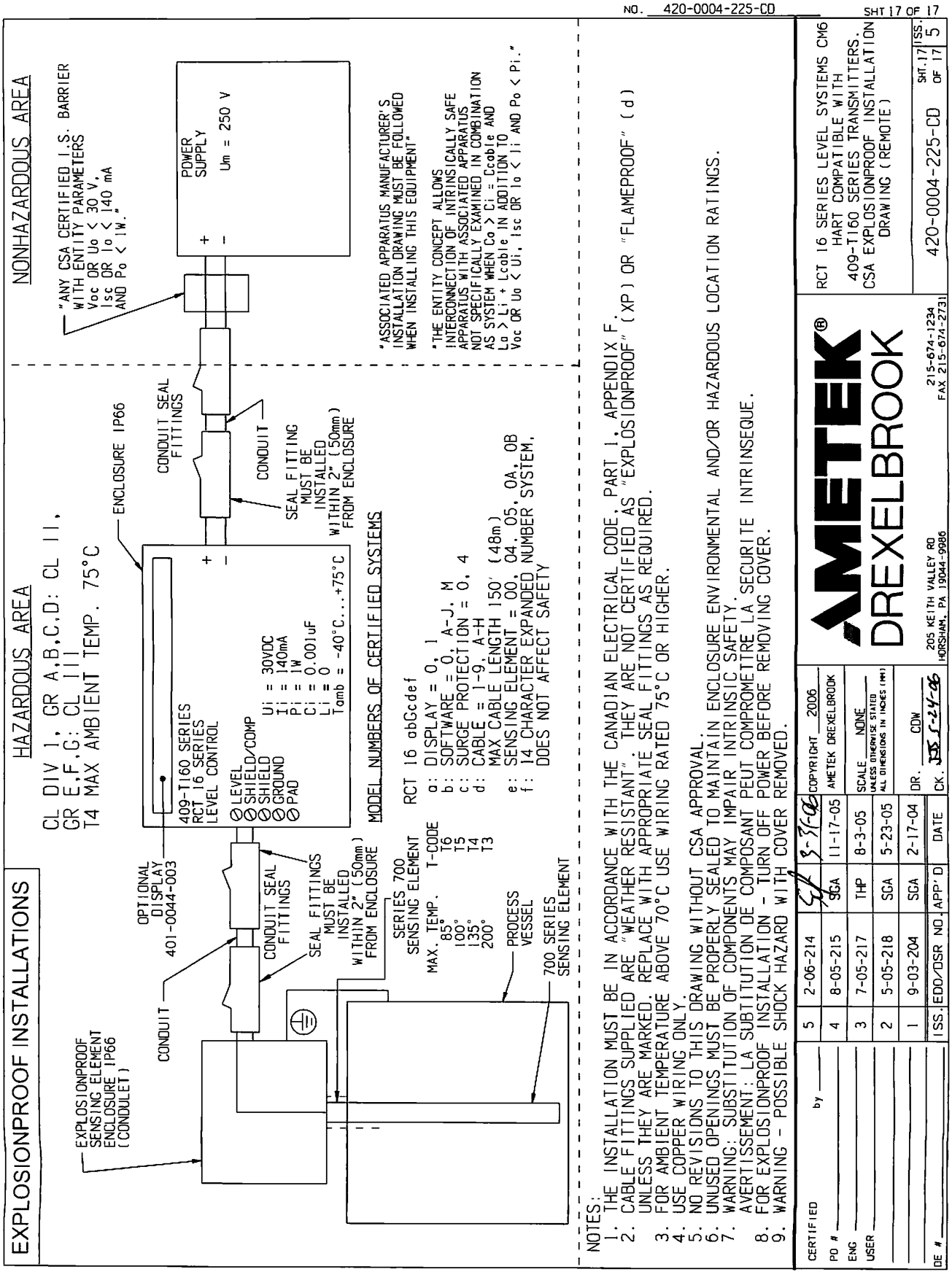
A.2 CSA APPROVAL DRAWINGS (Continued)



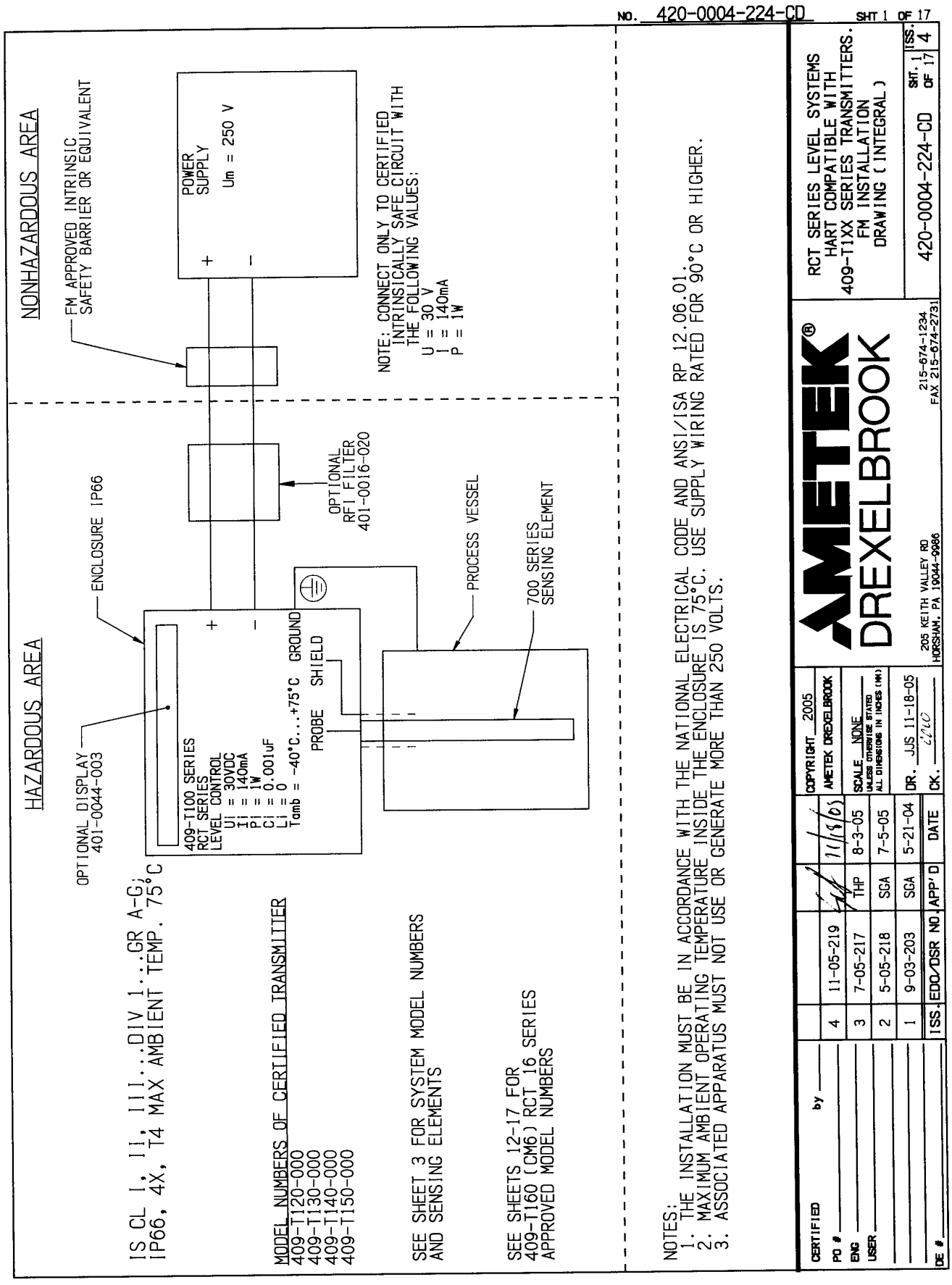
A.2 CSA APPROVAL DRAWINGS (Continued)



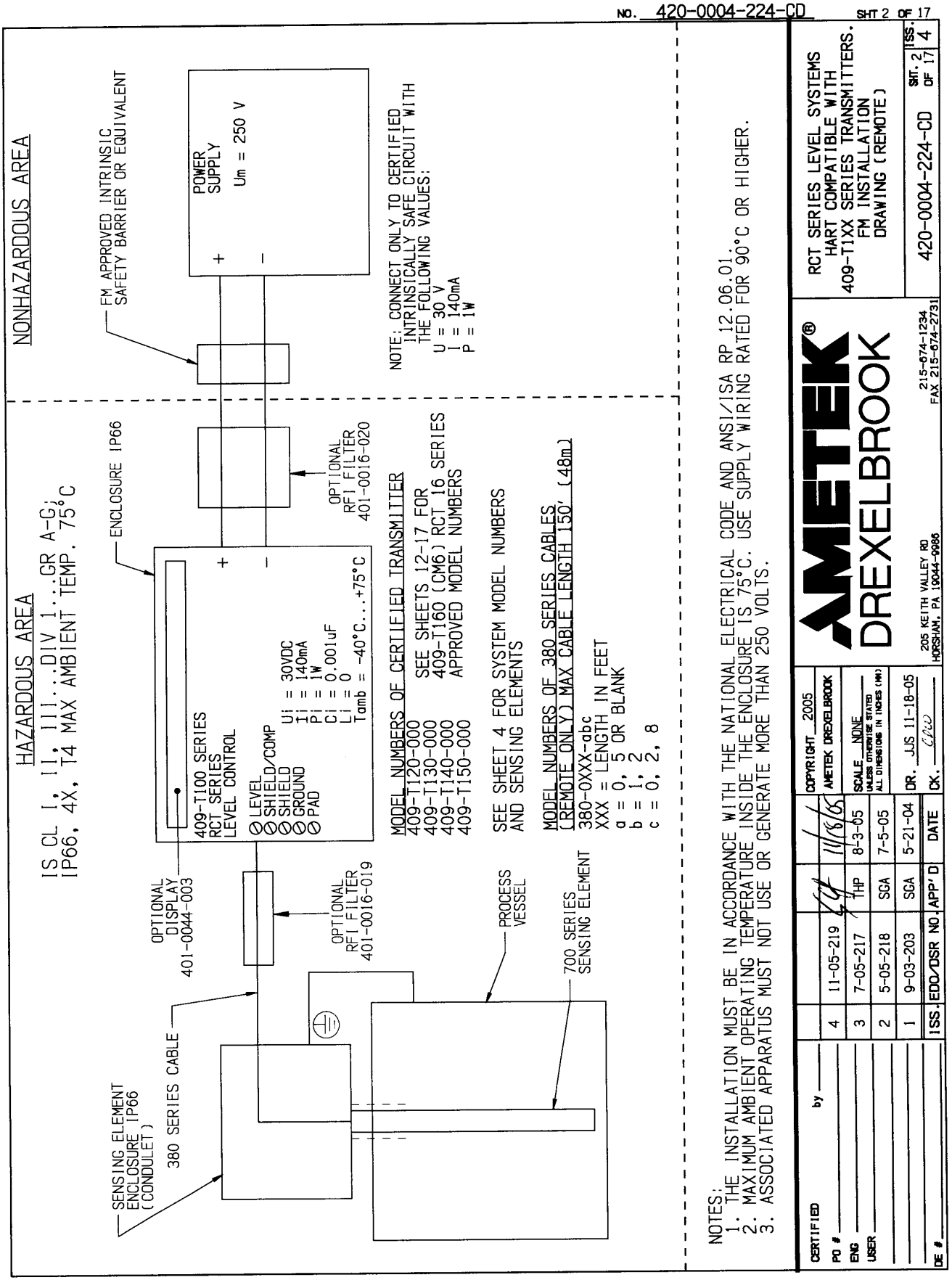
A.2 CSA APPROVAL DRAWINGS (Continued)



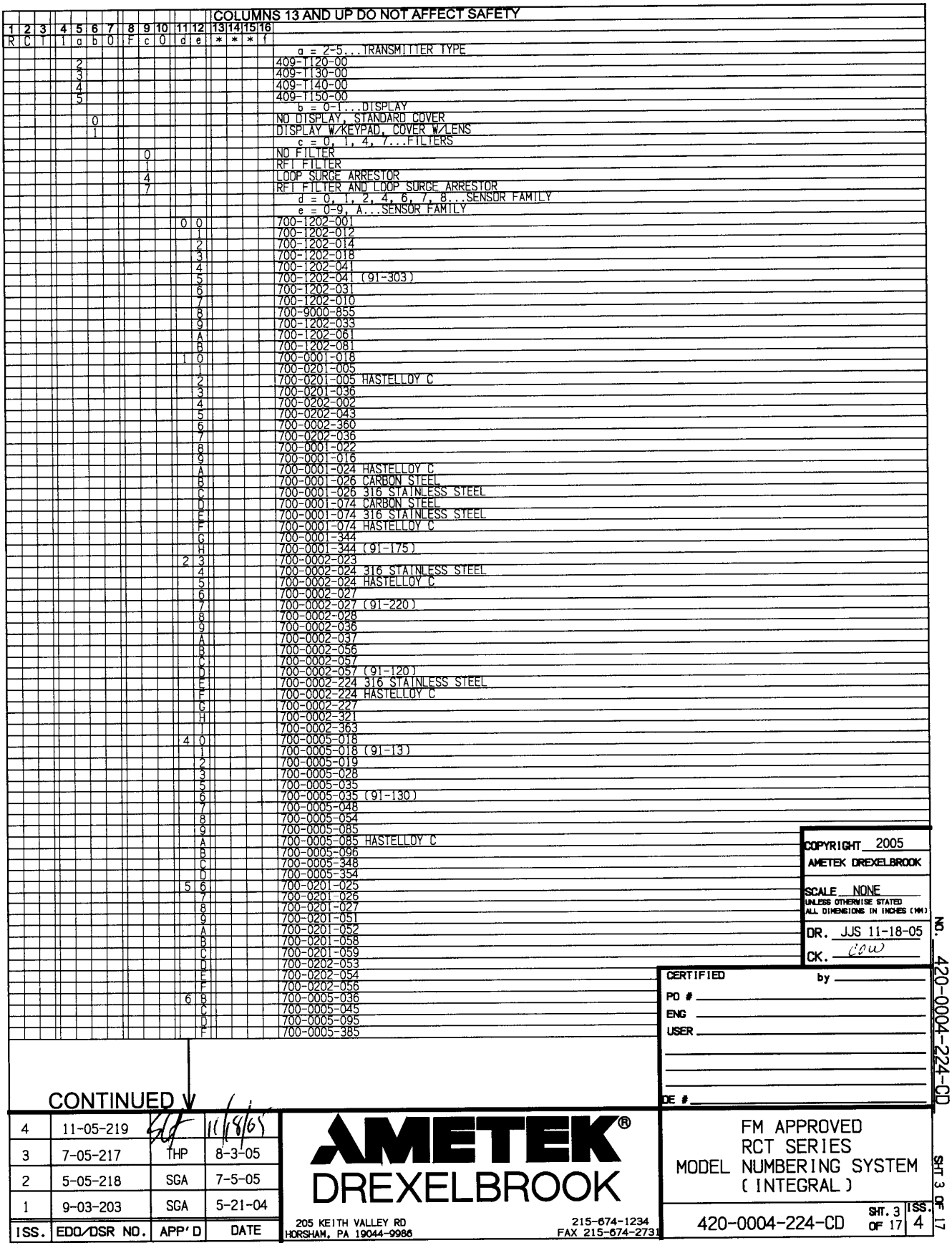
A.3 FM APPROVAL DRAWINGS (Continued)



A.3 FM APPROVAL DRAWINGS (Continued)



A.3 FM APPROVAL DRAWINGS (Continued)



COLUMNS 13 AND UP DO NOT AFFECT SAFETY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
R	C	T	I	a	b	0	F	c	0	d	e	*	*	*	f

a = 2-5...TRANSMITTER TYPE
2 409-T120-00
3 409-T130-00
4 409-T140-00
5 409-T150-00

b = 0-1...DISPLAY
0 NO DISPLAY, STANDARD COVER
1 DISPLAY W/KEYPAD, COVER W/LENS

c = 0, 1, 4, 7...FILTERS
0 NO FILTER
1 RFI FILTER
4 LOOP SURGE ARRESTOR
7 RFI FILTER AND LOOP SURGE ARRESTOR

d = 0, 1, 2, 4, 6, 7, 8...SENSOR FAMILY
e = 0-9, A...SENSOR FAMILY

d	e	
0	0	700-1202-001
	1	700-1202-012
	2	700-1202-014
	3	700-1202-018
	4	700-1202-041
	5	700-1202-041 (91-303)
	6	700-1202-031
	7	700-1202-010
	8	700-9000-855
	9	700-1202-033
	A	700-1202-061
	B	700-1202-081
1	0	700-0001-018
	1	700-0201-005
	2	700-0201-005 HASTELLOY C
	3	700-0201-036
	4	700-0202-002
	5	700-0202-043
	6	700-0002-360
	7	700-0202-036
	8	700-0001-022
	9	700-0001-016
	A	700-0001-024 HASTELLOY C
	B	700-0001-026 CARBON STEEL
	C	700-0001-026 316 STAINLESS STEEL
	D	700-0001-074 CARBON STEEL
	E	700-0001-074 316 STAINLESS STEEL
	F	700-0001-074 HASTELLOY C
	G	700-0001-344
	H	700-0001-344 (91-175)
2	3	700-0002-023
	4	700-0002-024 316 STAINLESS STEEL
	5	700-0002-024 HASTELLOY C
	6	700-0002-027
	7	700-0002-027 (91-220)
	8	700-0002-028
	9	700-0002-036
	A	700-0002-037
	B	700-0002-056
	C	700-0002-057
	D	700-0002-057 (91-120)
	E	700-0002-224 316 STAINLESS STEEL
	F	700-0002-224 HASTELLOY C
	G	700-0002-227
	H	700-0002-321
	I	700-0002-363
4	0	700-0005-018
	1	700-0005-018 (91-13)
	2	700-0005-019
	3	700-0005-028
	5	700-0005-035
	6	700-0005-035 (91-130)
	7	700-0005-048
	8	700-0005-054
	9	700-0005-085
	A	700-0005-085 HASTELLOY C
	B	700-0005-096
	C	700-0005-348
	D	700-0005-354
5	6	700-0201-025
	7	700-0201-026
	8	700-0201-027
	9	700-0201-051
	A	700-0201-052
	B	700-0201-058
	C	700-0201-059
	D	700-0202-053
	E	700-0202-054
	F	700-0202-056
6	B	700-0005-036
	C	700-0005-045
	D	700-0005-095
	F	700-0005-385

CONTINUED ▼

ISS.	EDO/DSR NO.	APP'D	DATE
4	11-05-219		11/8/05
3	7-05-217	THP	8-3-05
2	5-05-218	SGA	7-5-05
1	9-03-203	SGA	5-21-04

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FAX 215-674-2731

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SCALE NONE
UNLESS OTHERWISE STATED
ALL DIMENSIONS IN INCHES (MM)
DR. JJS 11-18-05
CK. DW

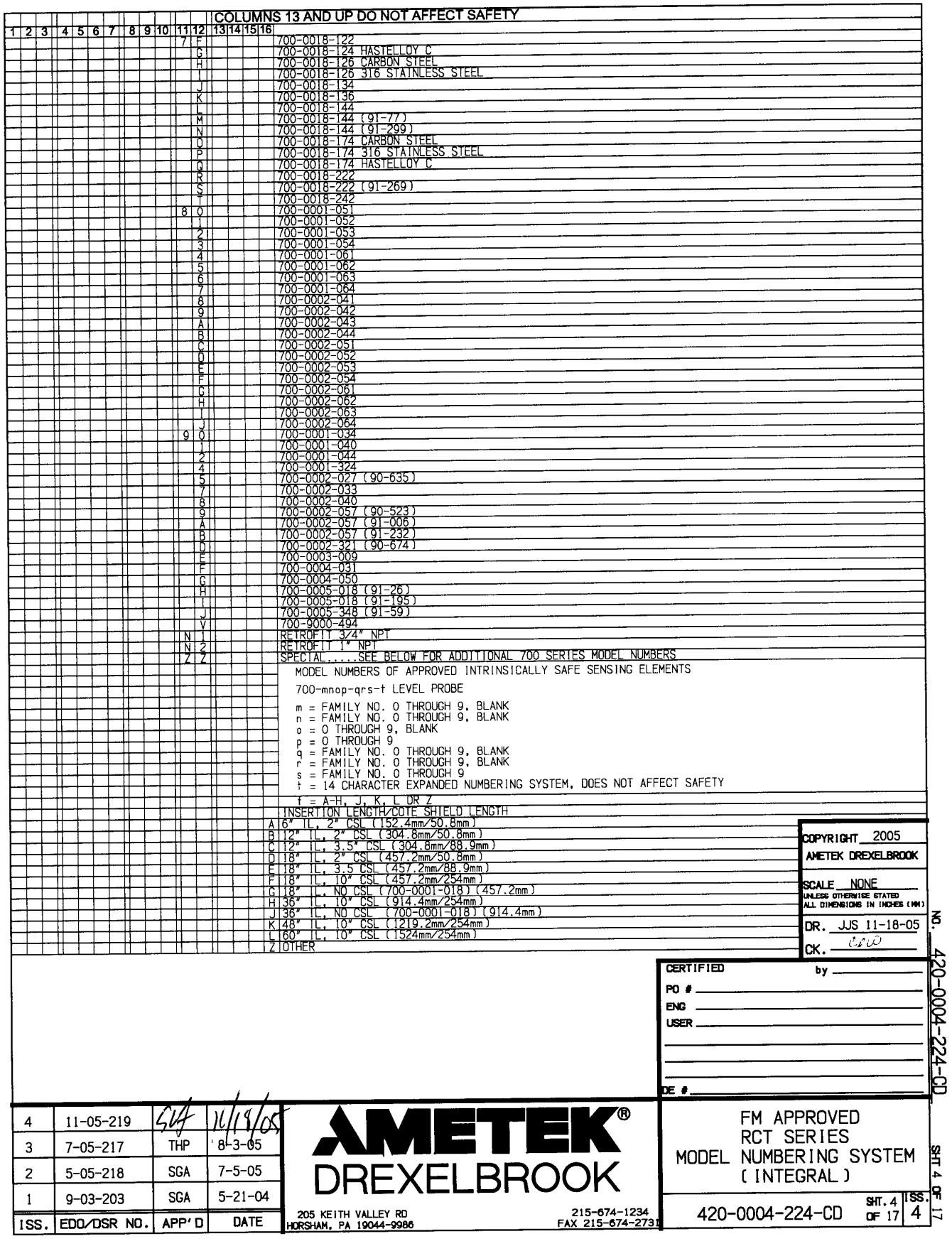
CERTIFIED by
PO #
ENG
USER
DE #

FM APPROVED
RCT SERIES
MODEL NUMBERING SYSTEM
(INTEGRAL)

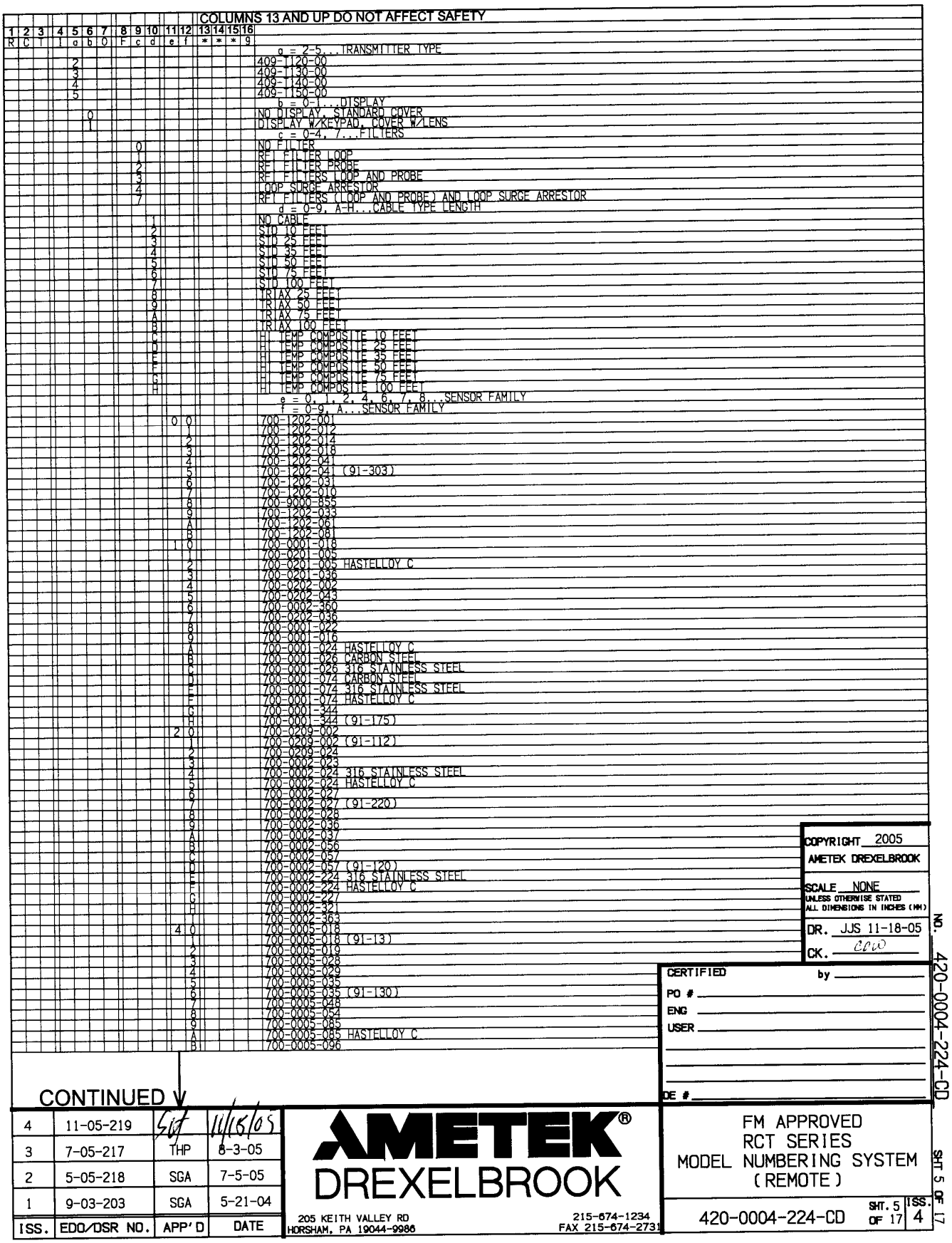
420-0004-224-CD SHT. 3 OF 17 ISS. 4

NO. 420-0004-224-CD SHT 3 OF 17

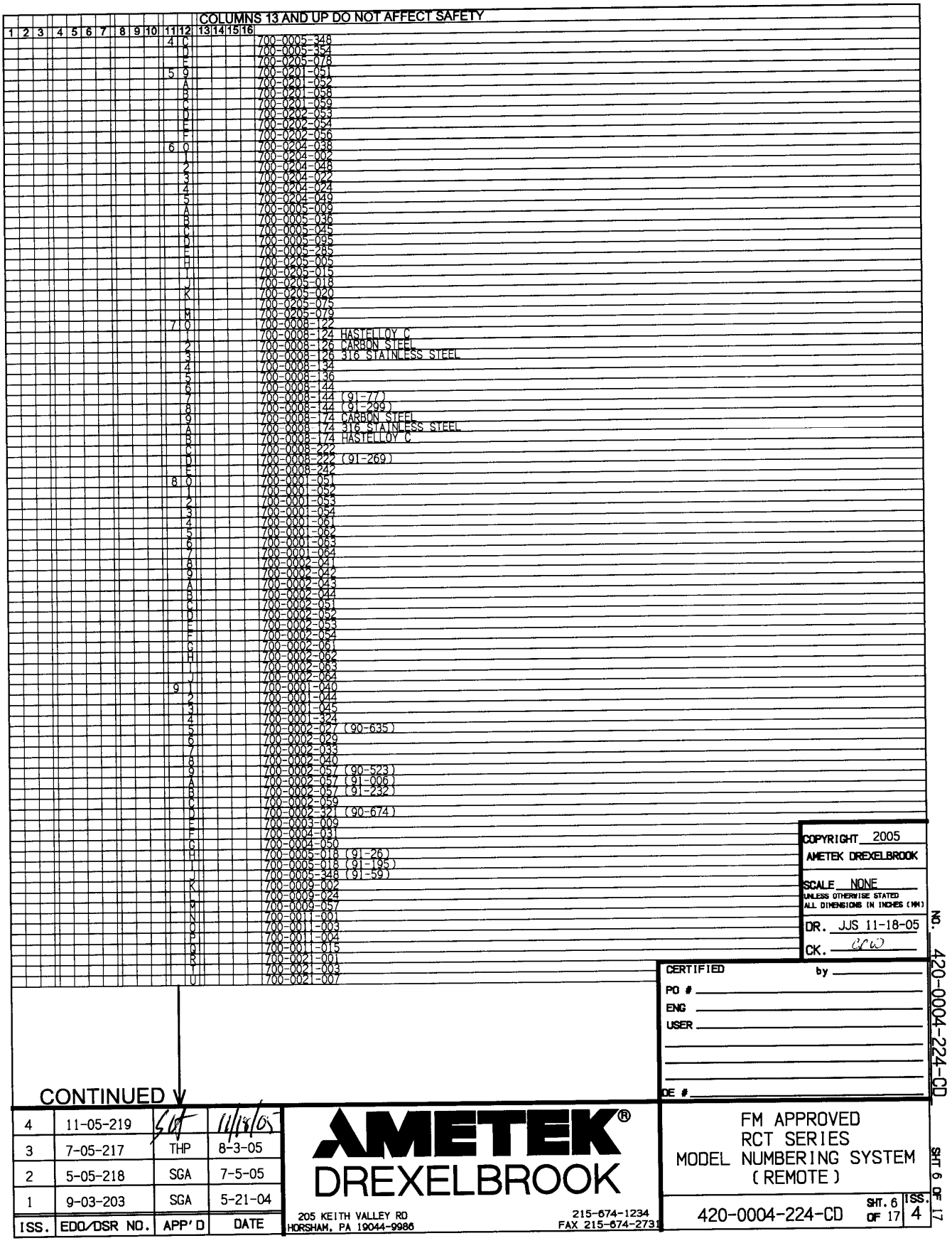
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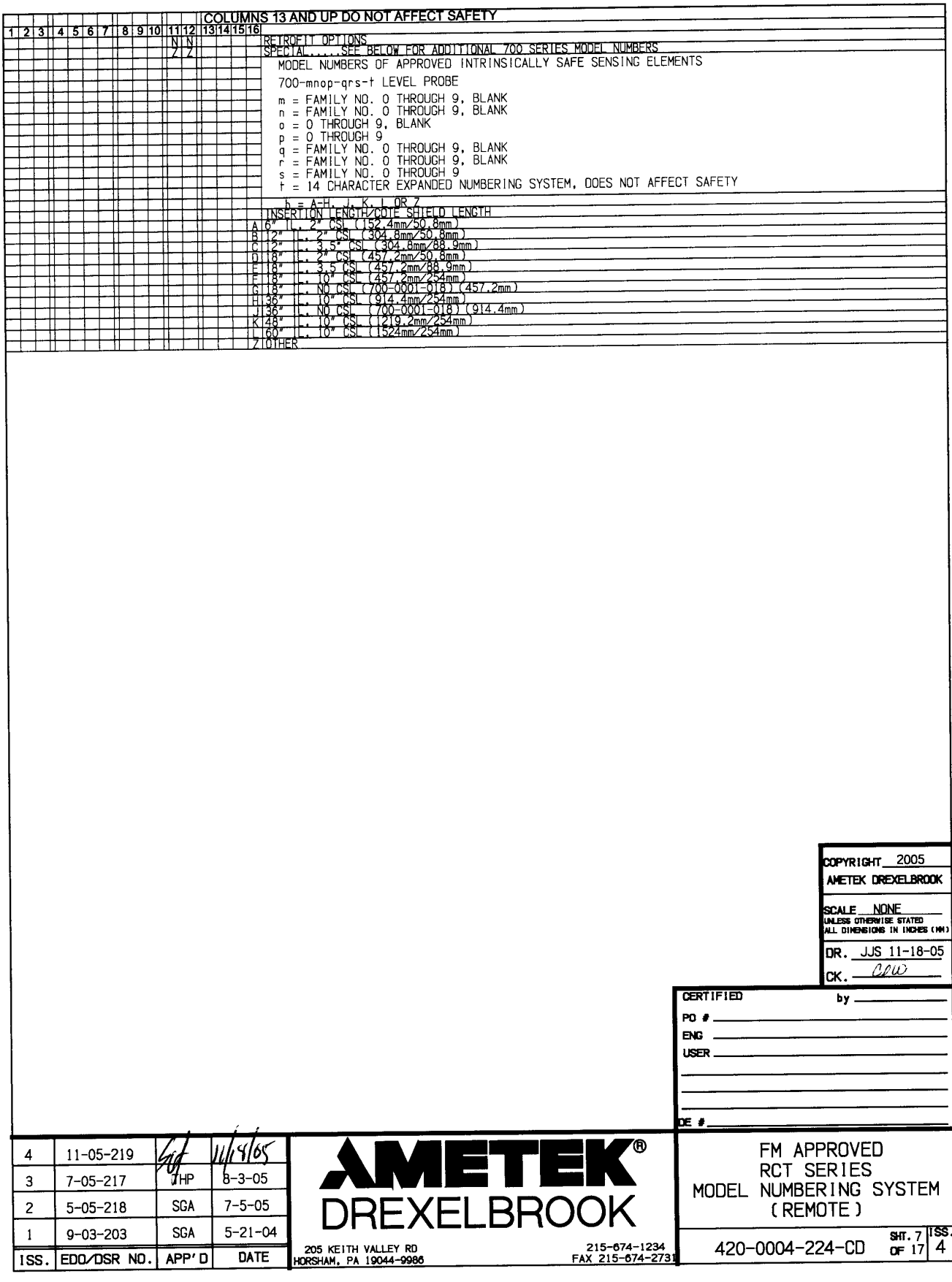
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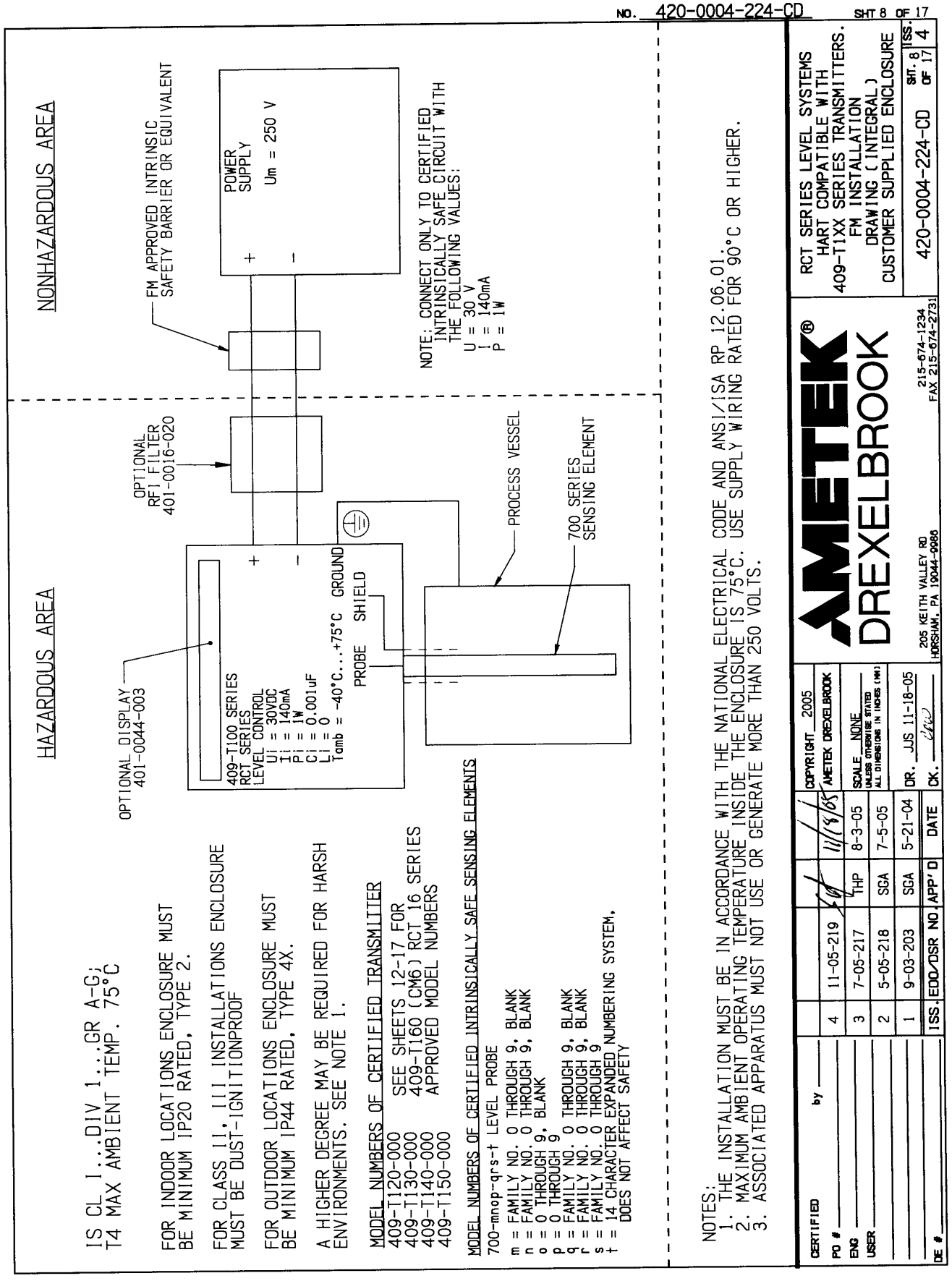
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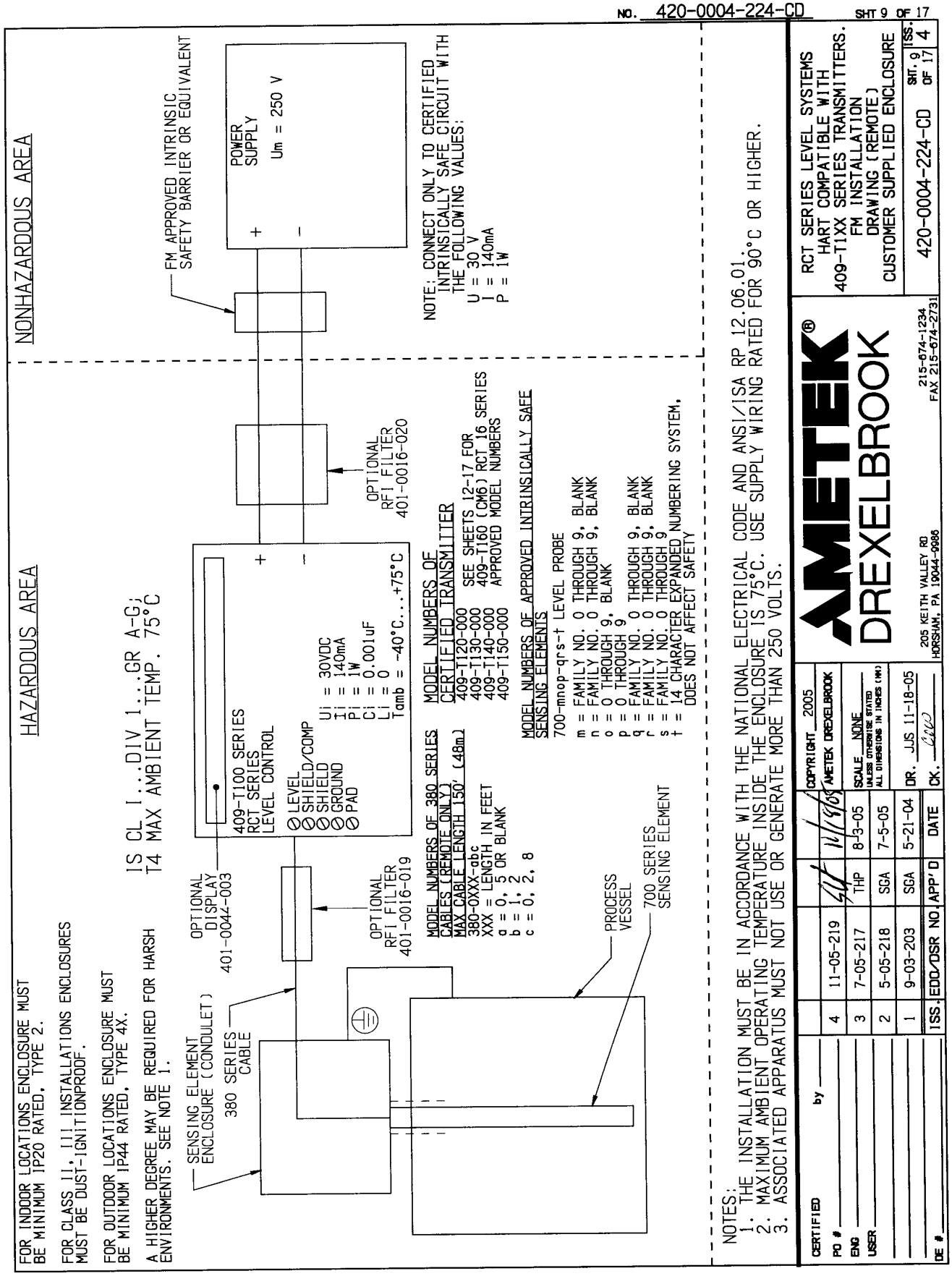
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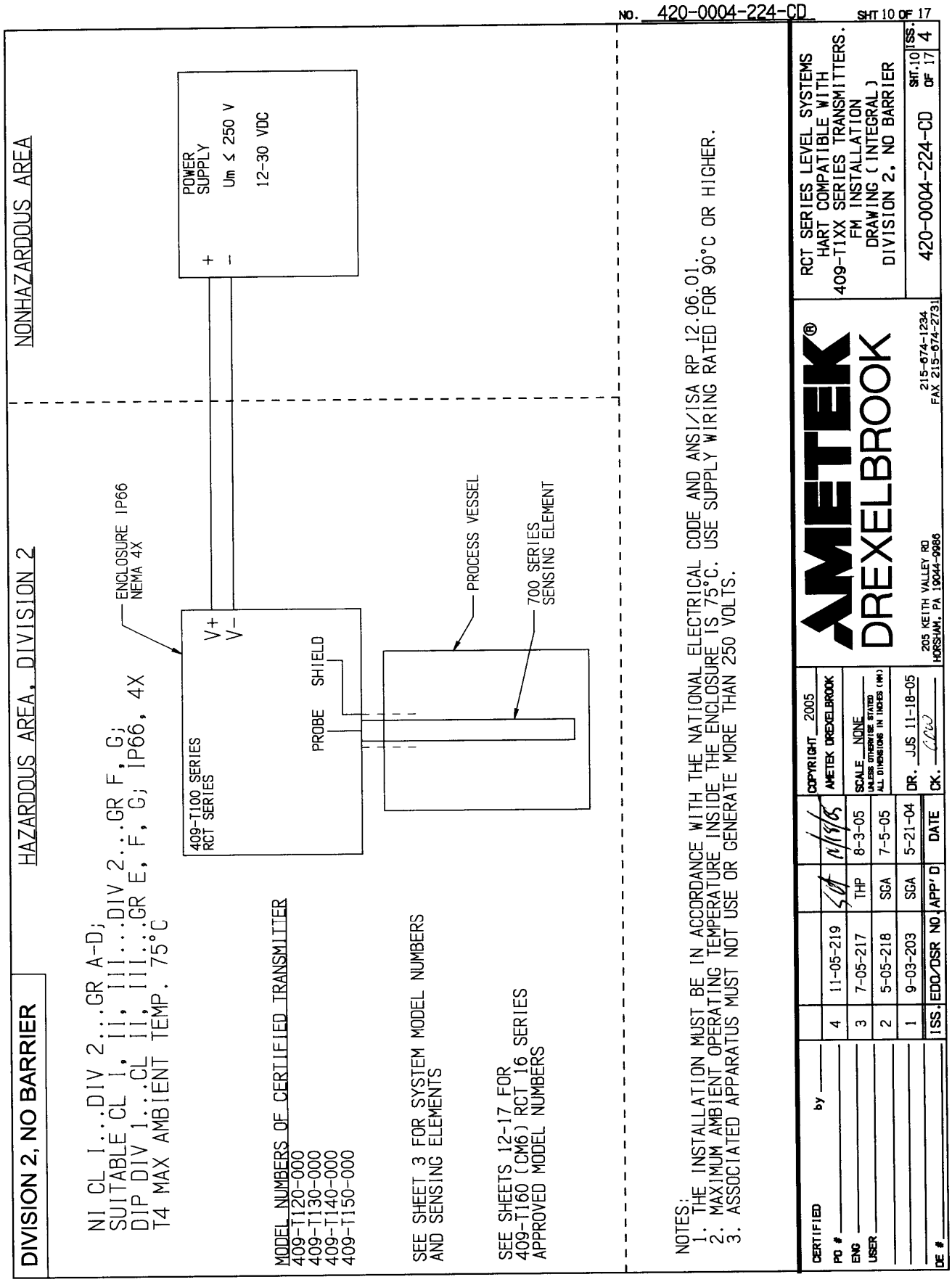
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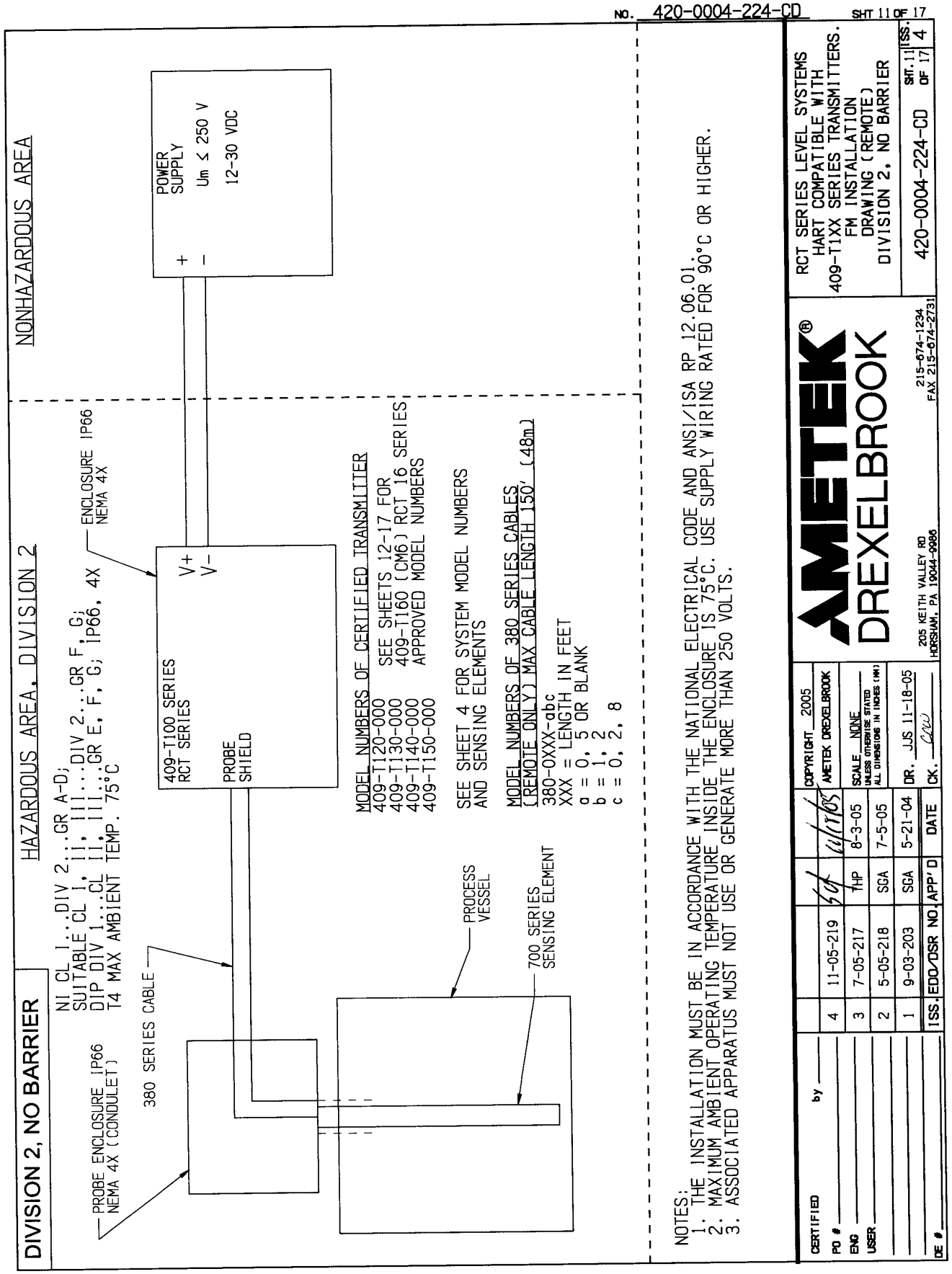
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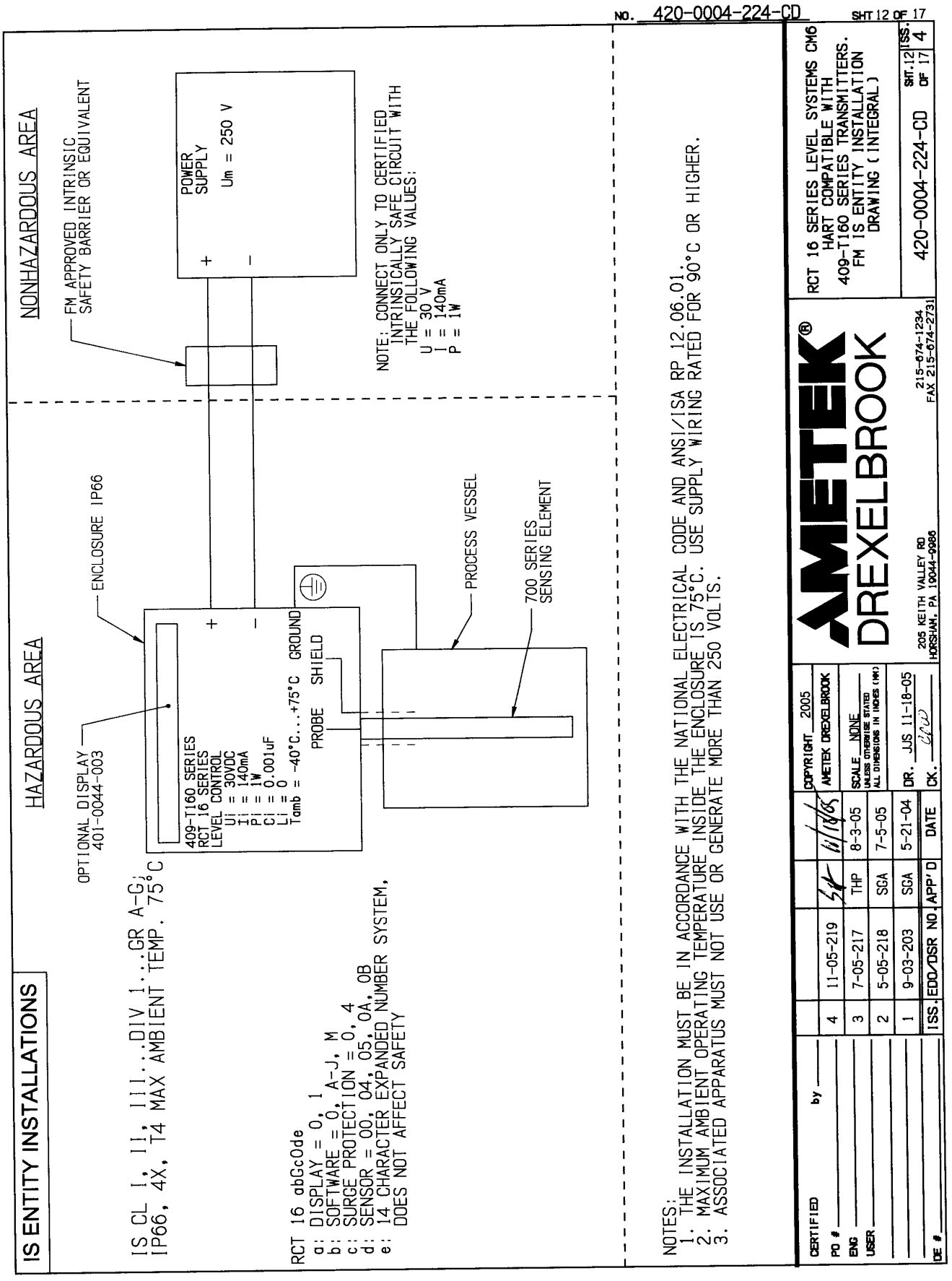
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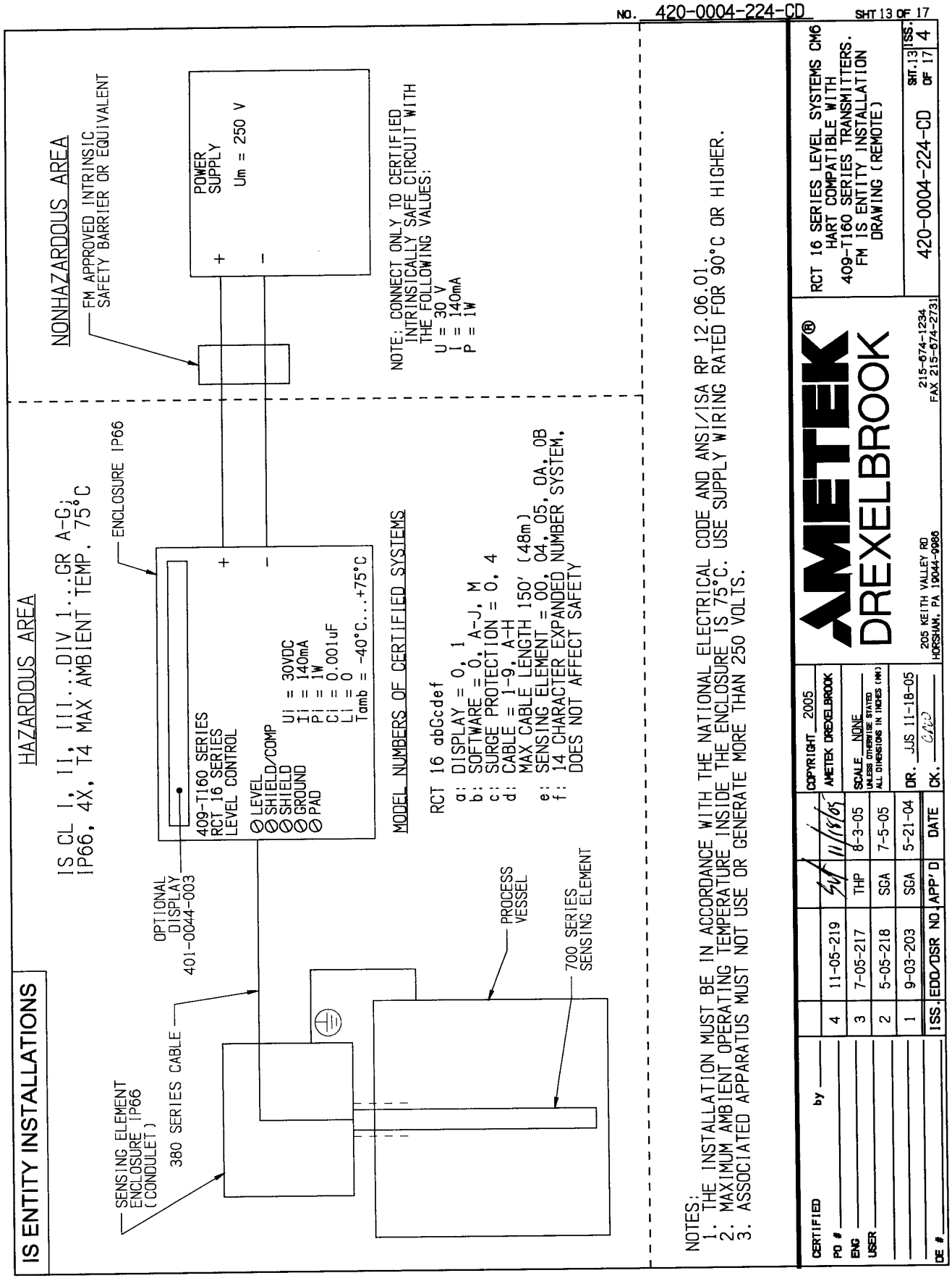
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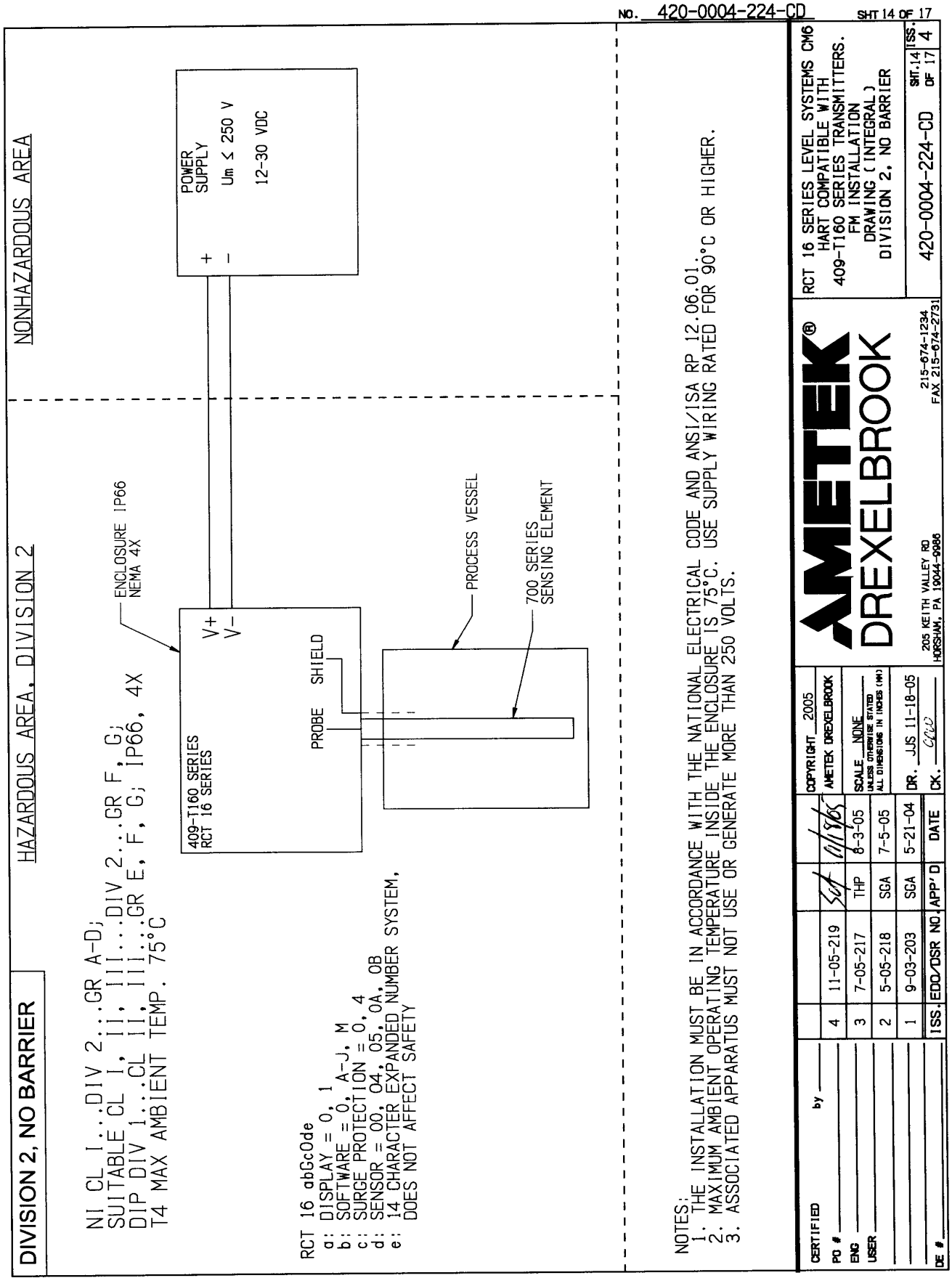
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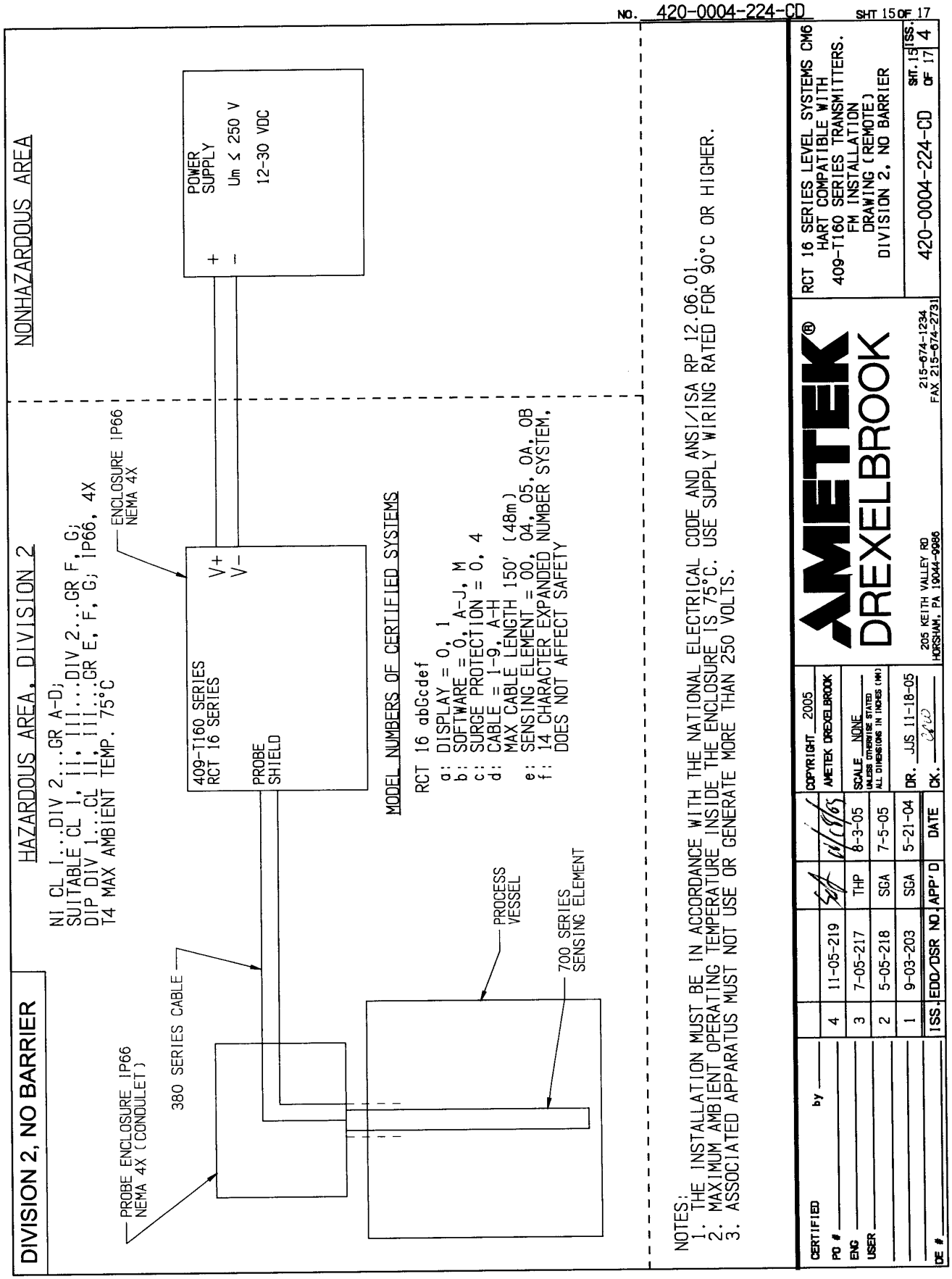
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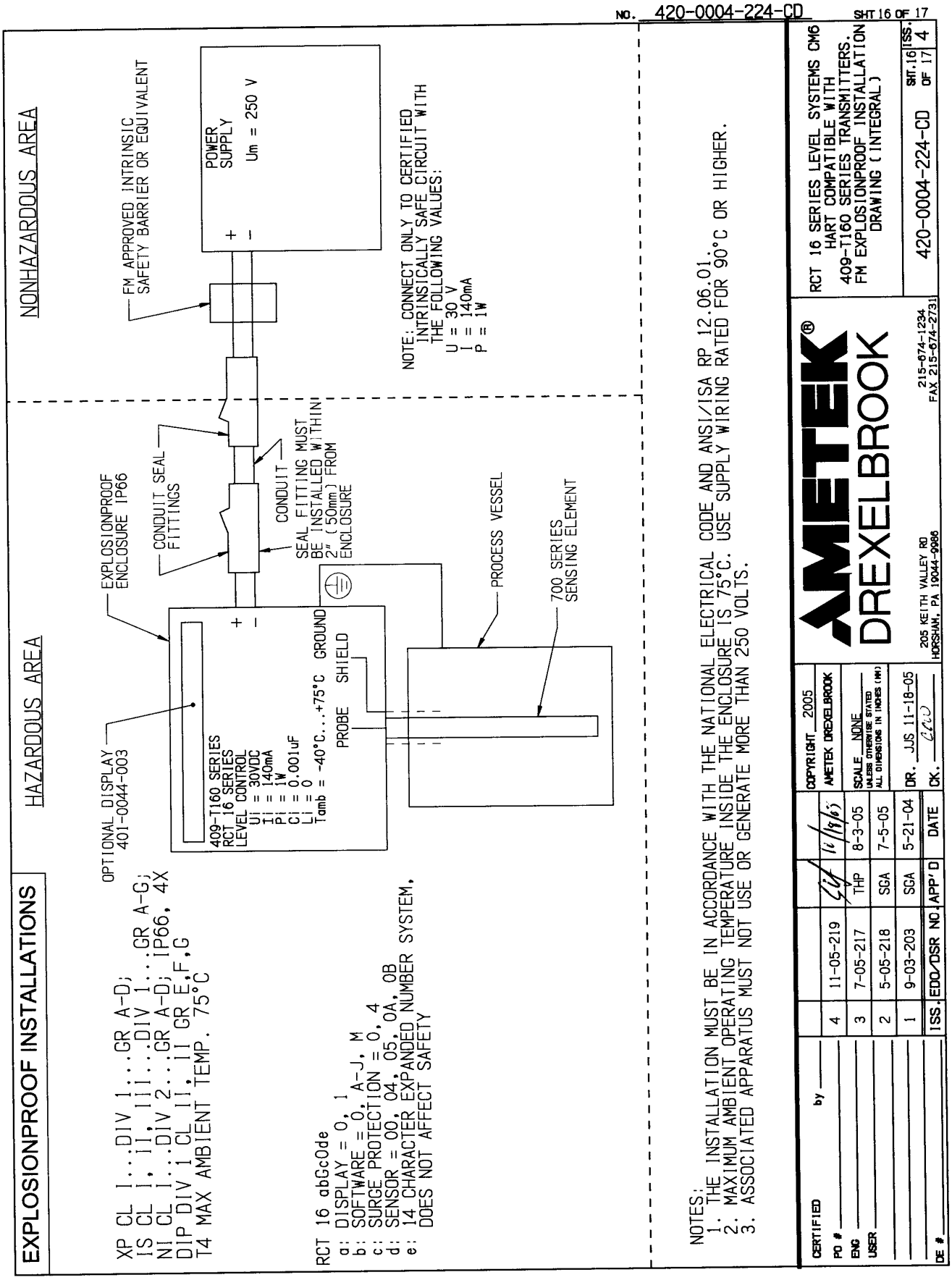
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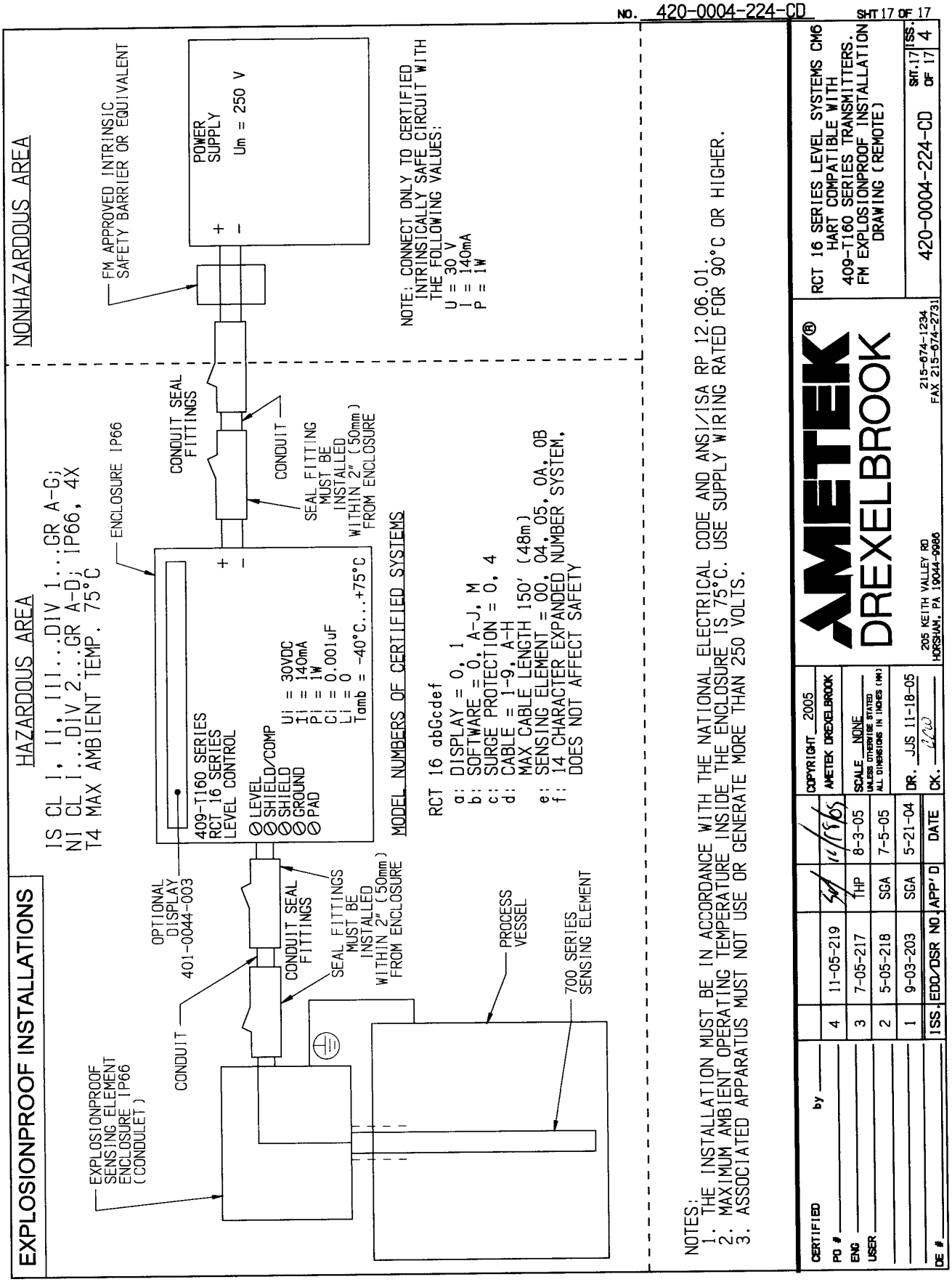
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A.3 FM APPROVAL DRAWINGS (Continued)



A.3 FM APPROVAL DRAWINGS (Continued)



TERMS AND CONDITIONS OF SALE

AMETEK DREXELBROOK

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 PROPOSED BY BUYER IN ANY DOCUMENT, WHICH SHALL NOT BE BINDING UPON SELLER.*** No salesman or other party is authorized to bind the 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 net 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 terms of payment if Buyer fails to pay for any shipments when due or if in Seller's opinion there is a material adverse change in Buyer's financial condition. Seller may, 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, shipping, duties, fees, handling, insurance, storage, demurrage, 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 or losses 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 and Firmware: Unless otherwise specified, 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, expressed or implied, that the operation of the 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 to its satisfaction that the 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 to out-of-warranty goods which Seller has repaired or reconditioned, Seller warrants for a period of sixty (60) days from date of its 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, transportation, or insurance associated with returned goods. In the event that credit for returned goods is granted, it shall be at the lesser of the then current prices or the 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 ANY 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 sole 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 charge of infringement, Seller's obligation under the agreement shall be fulfilled if Seller, at its option and expense, either (i) settles such claim; (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 (iv) 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 permitted under the applicable License Agreement provided with the goods. Buyer's right to use, copy or transfer the Software shall terminate upon termination of Buyer's right to use the goods.

PACKAGING/WEIGHTS AND DIMENSIONS: Buyer specified packing or marking may be subject to additional charges not otherwise 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, mobilization, civil commotion, 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 the extent of availability of 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 providing the goods 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, LOST 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 OTHER 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, appointed distributors and other authorized resellers as third-party beneficiaries.

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 or in connection with the use or handling of nuclear material, or for any hazardous 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 a use or application. 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 destined for facilities 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 government contract regulations or clauses shall apply to the goods or services, this agreement, or act to bind Seller unless specifically agreed to by Seller in writing.

NON-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 supercedes any and all prior discussions, and negotiations on its subject matter.

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Website: www.drexelbrook.com