



Installation & Maintenance Instructions

504-1000 Series VeriGAP™

Ultrasonic Level Switch using:
404-1000 and 404-1060 Series Electronics

DREXELBROOK®

A Leader In Level Measurement Solutions

AMETEK®

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EDO# 09-07-102
504-1000-000-LM
Issue #7

504-1000 Series VeriGAP™

Ultrasonic Level Switch

using:

404-1000 and 404-1060
Series Electronics

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Introduction

Section 1: Introduction

1.1 General Description

The 504-1000 Series ultrasonic VeriGAP™ switch is an integral assembly which senses liquid presence by ultrasonic techniques and energizes a relay which can be utilized to indicate and/or control the liquid at a predetermined level.

A high frequency acoustic signal is transmitted through the sensor gap when liquid is present. When liquid is not present, no signal transmission occurs. See Figure 1-1. When a signal is received, an electronic circuit produces a relay output. The ultrasonic sensor does not contain moving components. It is not affected by electrical or physical parameters of the process material and will operate over a wide temperature range. These characteristics make the 504-1000 a very reliable and economical solution to industrial liquid level control operations.

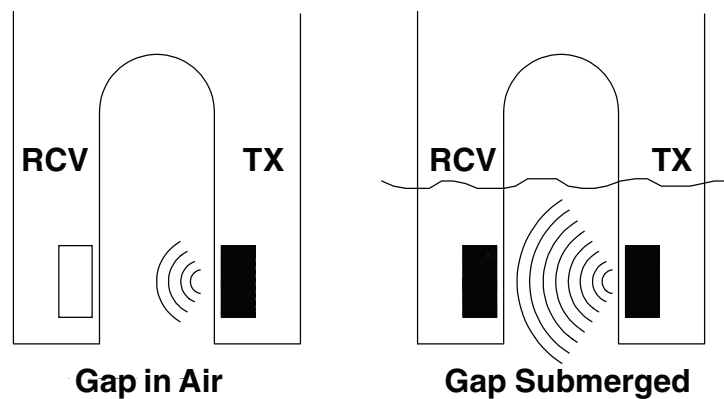
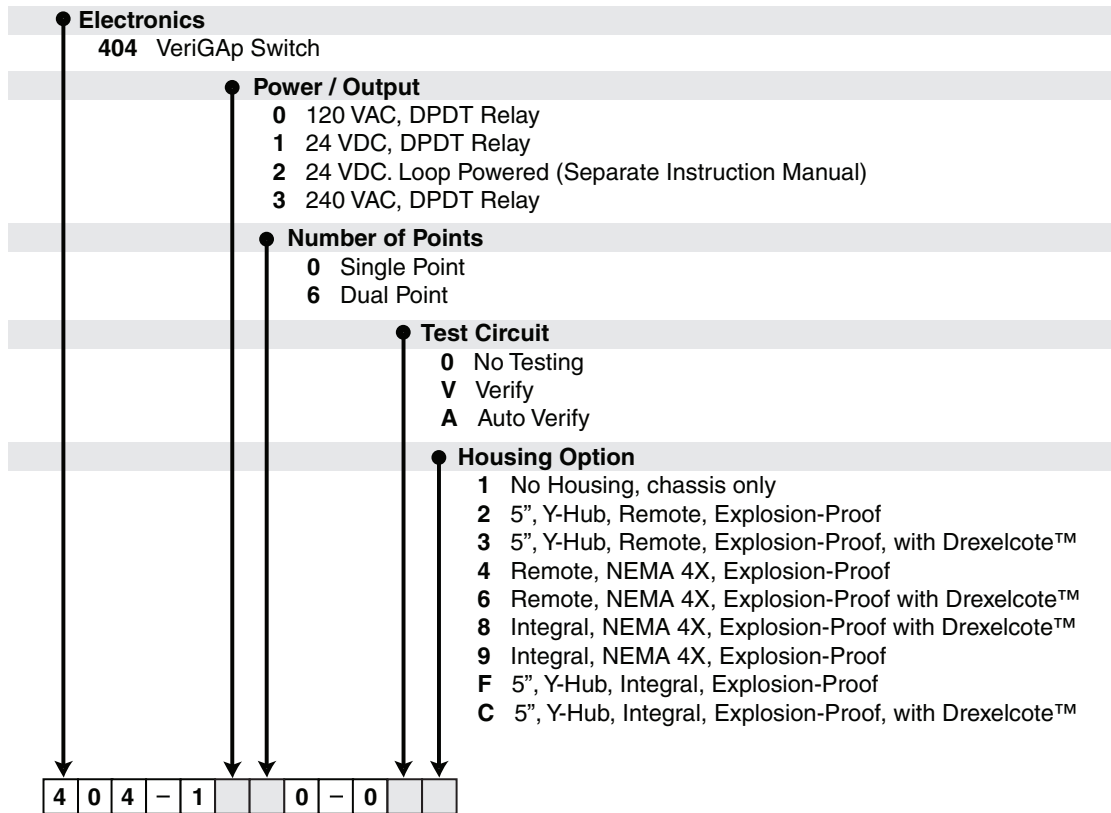
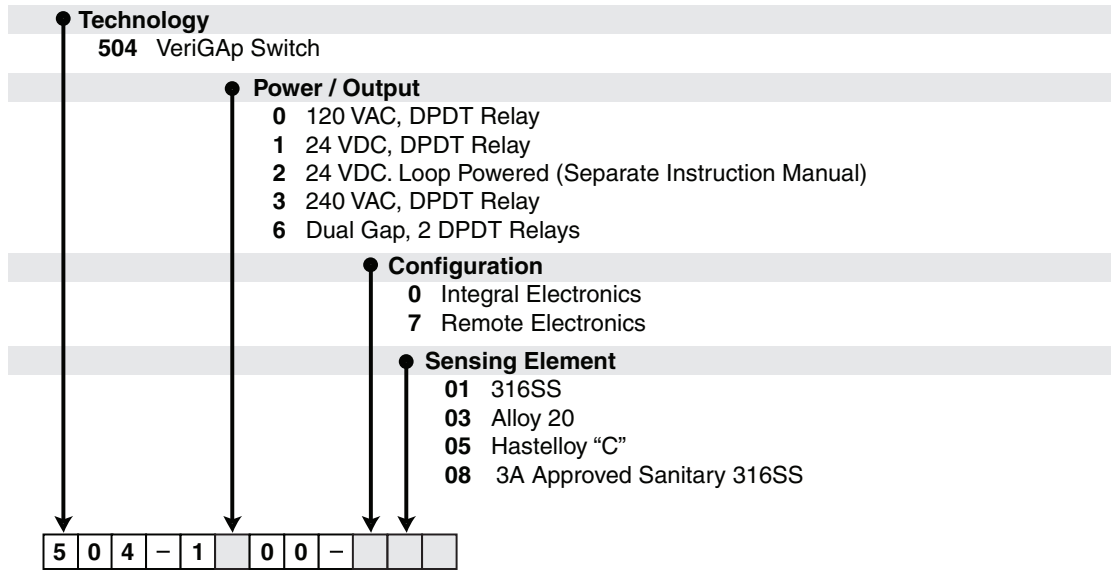


Figure 1-1
Gap Switch Operation

1.2 Verify™ Circuit

As an option, the ultrasonic two-wire Verify™ circuit is used in conjunction with the VeriGAP for pushbutton verification that the entire control system is functioning properly. This option is used with High Level Fail-safe devices only. It simulates a high level at the sensing element to meet spill prevention regulations and recommended practices. This test may also be used for ISO 9000 validation of your high level alarms and spill prevention systems.

1.3 Model Numbering



Section 2: Installation

2.1 Unpacking

Carefully remove the contents of the shipping carton and check each item against the packing list before destroying any packing material. If there is any shortage or damage, report it immediately to the factory (1-800-527-6297).

2.2 Mounting The Instrument

The 504-1000 electronic unit 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, place the instrument in a reasonably accessible location. Ambient temperatures should be between -40°F and 160°F (-40°C to 70°C).



VeriGAP switches can be mounted in any orientation vertically. If the unit is mounted horizontally, rotate the sensor so that the electrical hub is down and the sensor slot is vertical. This allows any product buildup on the sensor to fall free. Note orientation of wrench flats relative to the gap.

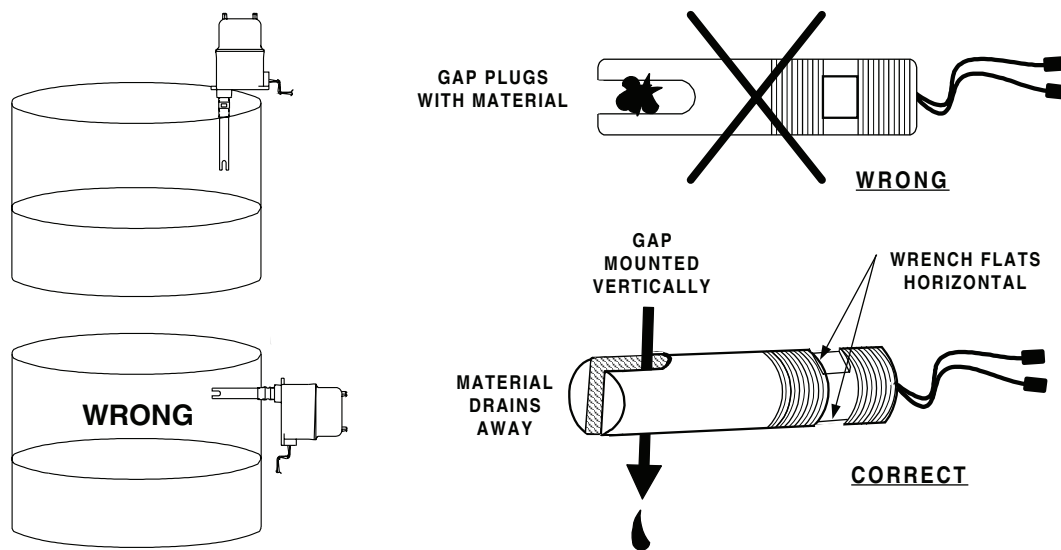


Figure 2-1
Mounting Orientation

504-1000 Series Ultrasonic VeriGAP™

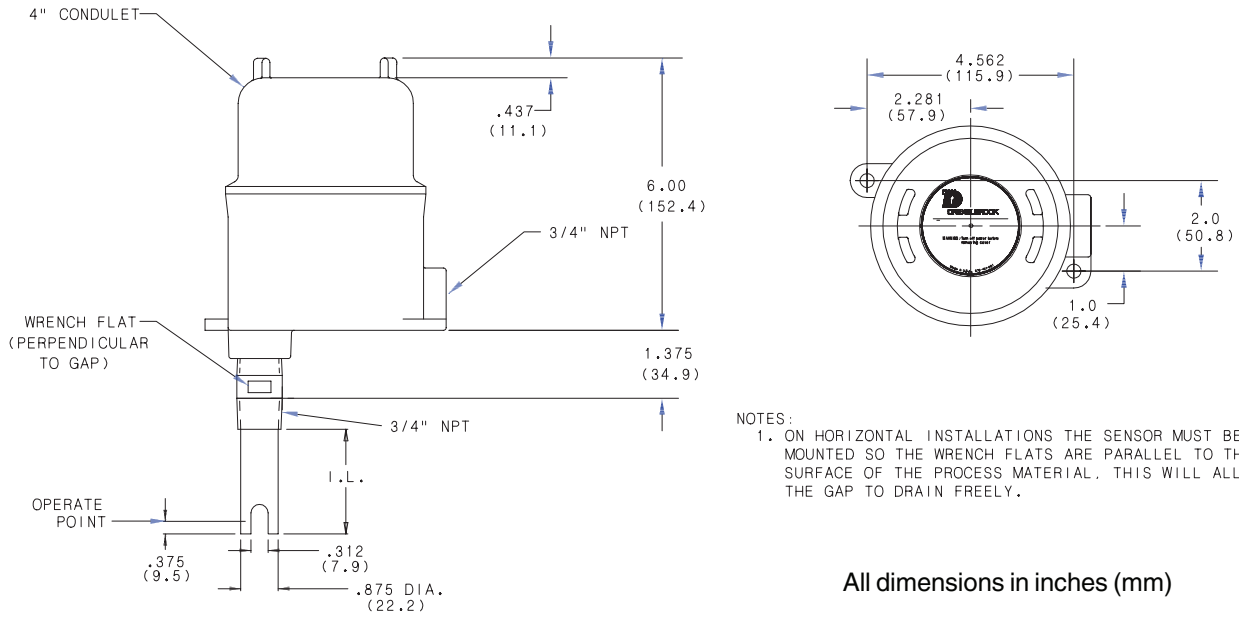


Figure 2-2
Mounting Dimensions, Integral Unit

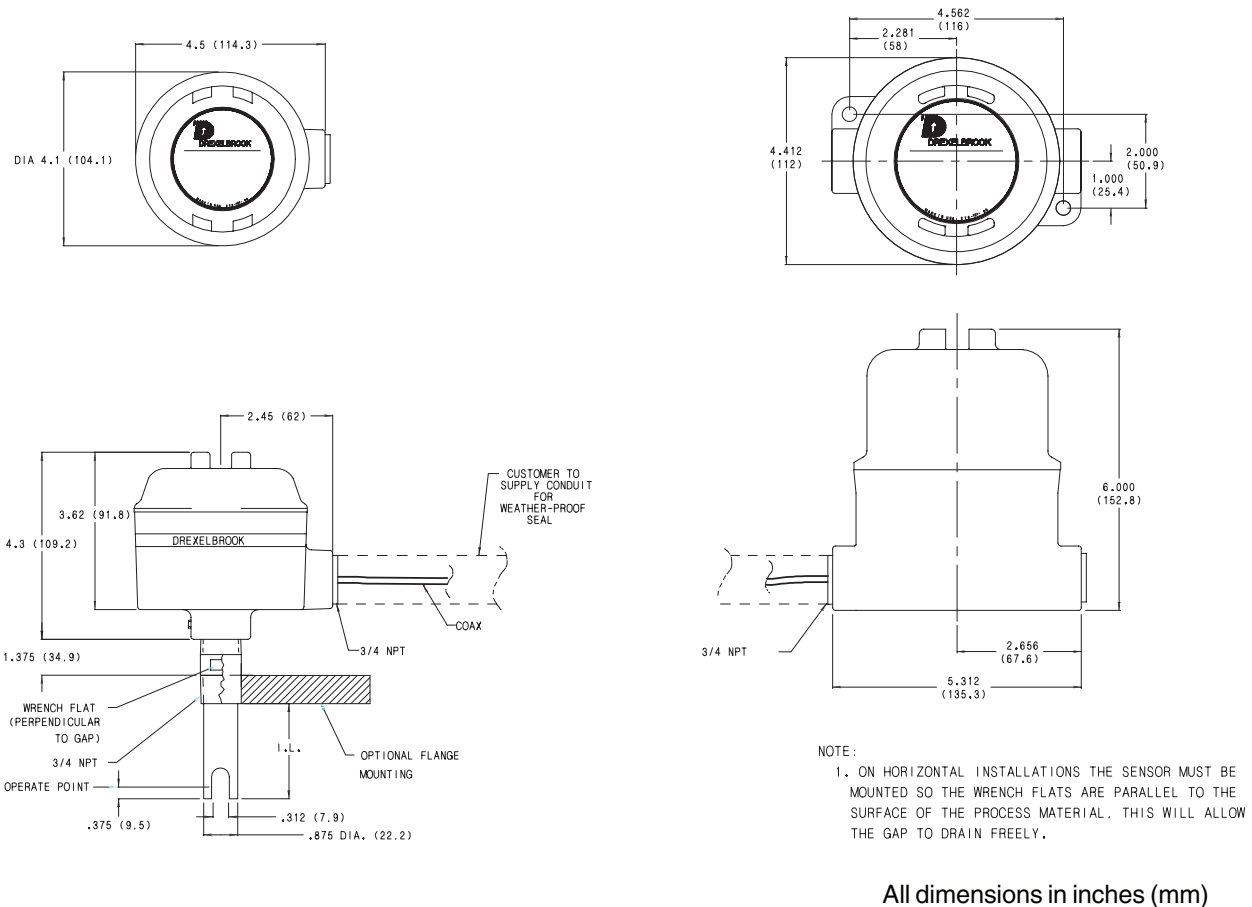
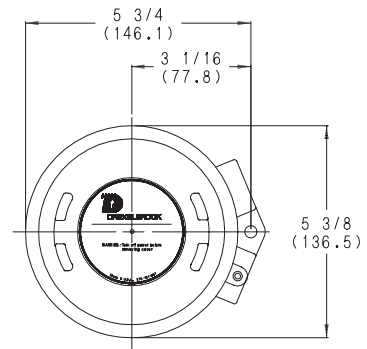
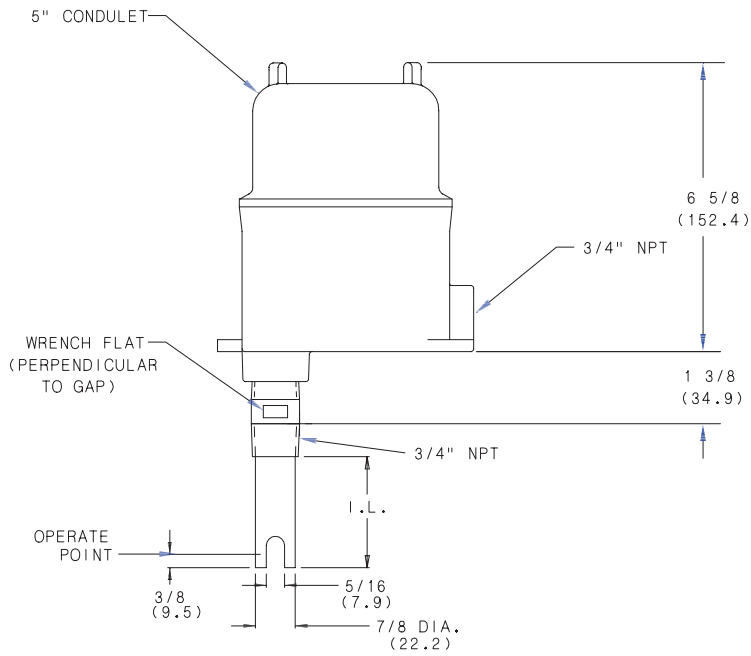
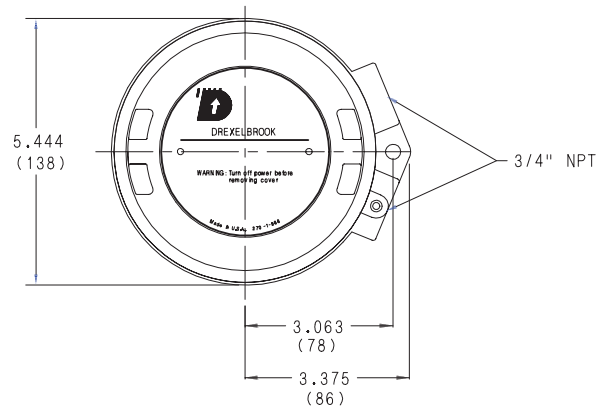
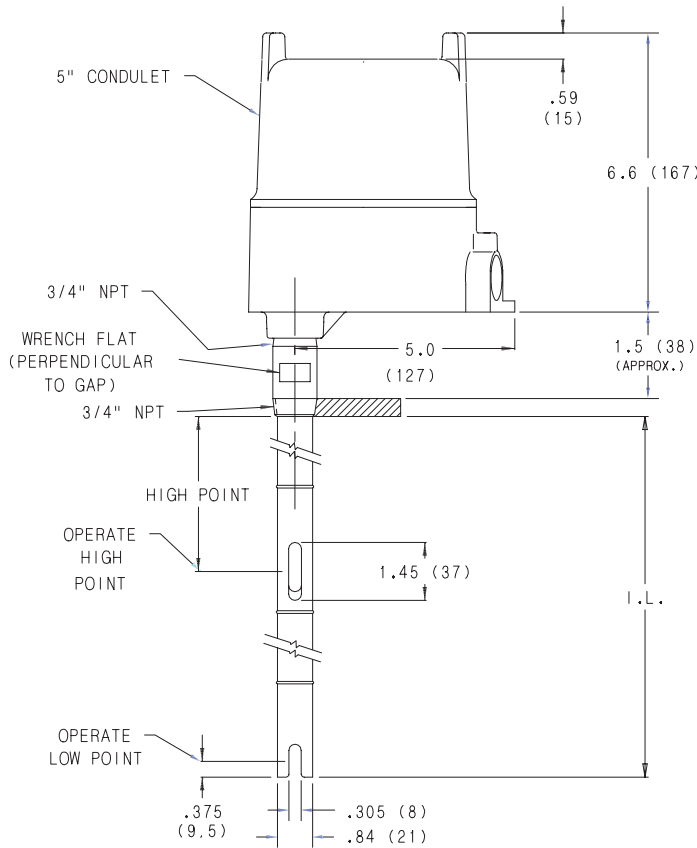


Figure 2-3
Mounting Dimensions, Remote Mounting



NOTES:
 1. ON HORIZONTAL INSTALLATIONS THE SENSOR MUST BE MOUNTED SO THE WRENCH FLATS ARE PARALLEL TO THE SURFACE OF THE PROCESS MATERIAL. THIS WILL ALLOW THE GAP TO DRAIN FREELY.

Figure 2-4
 Mounting Dimensions, Verify™ Housing



ALL DIMENSIONS
 IN INCHES (mm)

Figure 2-5
 Mounting Dimensions, Dual Gap

2.3 Wiring The Instrument



CAUTION

Ensure that all wiring, electrical fittings and conduit connections conform to your local electrical codes for the location and environment of use. If the 504-1000 Gap Switch is located in a hazardous environment, do not open the enclosure cover or make/break any electrical connections without first disconnecting electrical power at the source.

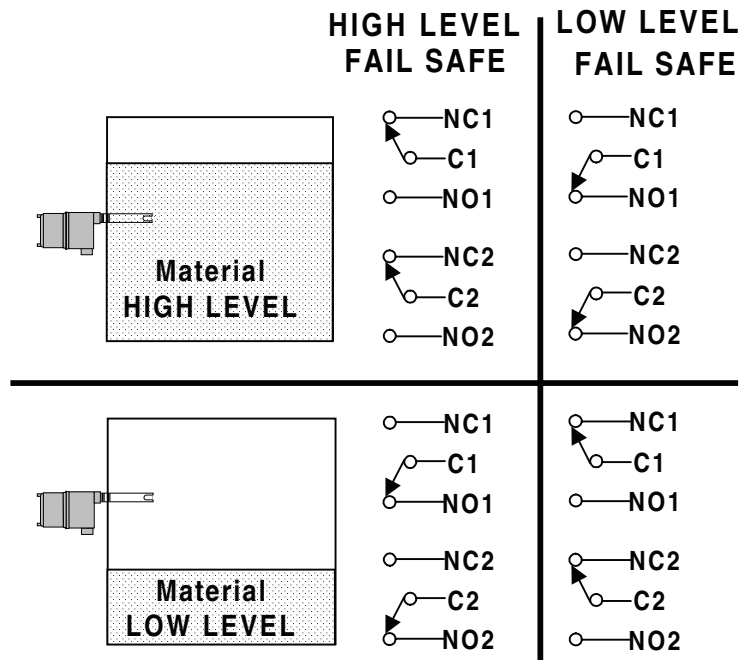
Use the following procedure to wire the 504-1000 Switch:

1. Ensure that the power is off.
2. Remove the cover.
3. Make all electrical connections to the Switch per the wiring diagram shown in Figure 2-7 through Figure 2-9. Use 14-gauge or smaller wiring. All connections are made on the terminal strip.
4. The PC board mounting screws can be removed to allow movement of the PC board during wiring.
5. After connections are secured and dressed, re-insert the PC board and close the enclosure cover.
7. Review Checklist:
 - Wiring correct?
 - Proper input voltage used?
 - Proper relay state at the receiver (relays will be in the alarm condition)?
8. Turn power on.



- Make sure that the 115 Vac supply is clean and free of noise.
- Do not supply power to the VeriGAP that originates at a variable frequency drive motor supply.
- Do not run relay wires or supply wires in same conduit as variable frequency drive wiring.

2.4 Relay Wiring



RELAY CONTACT CHART
(Power applied to instrument)

Figure 2-6
 Relay Wiring

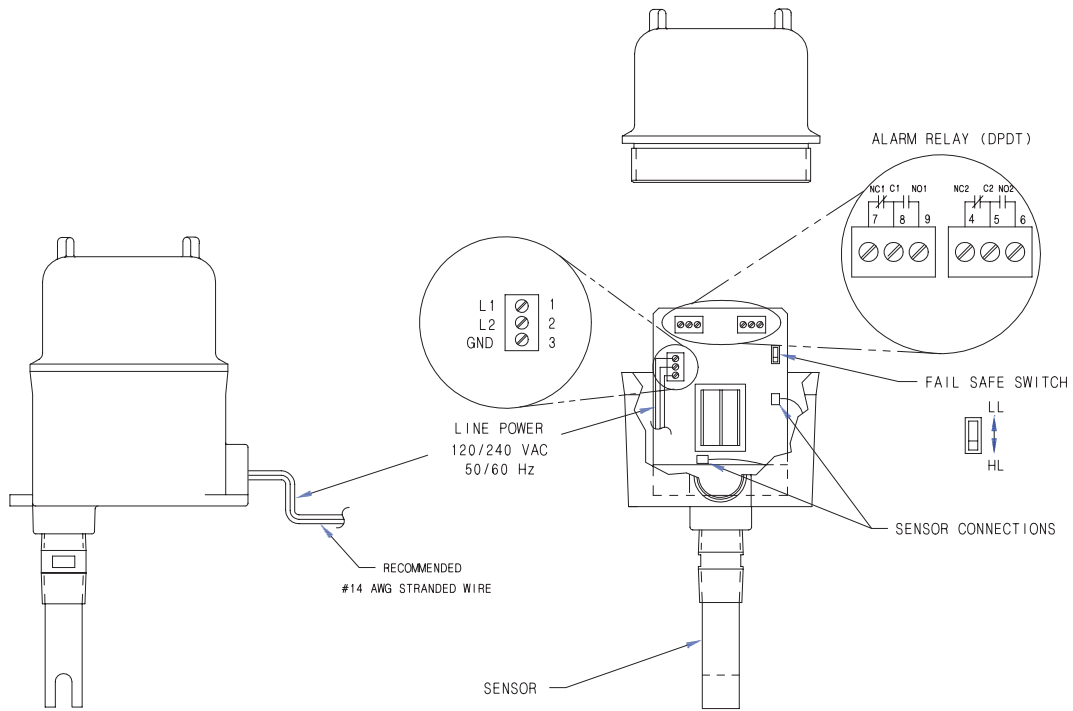


Figure 2-7
Wiring Diagram, 120 / 240 VAC, Integral Gap Switch

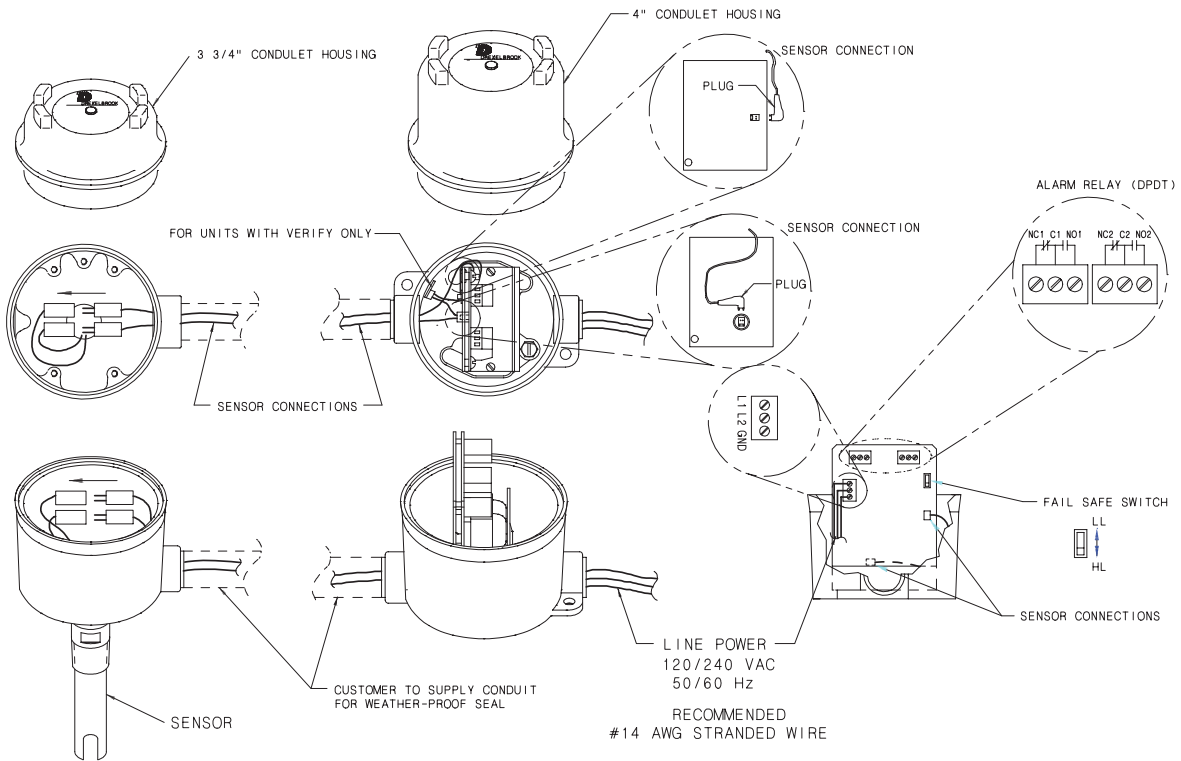


Figure 2-8
Wiring Diagram, 120 / 240 VAC, Remote Gap Switch

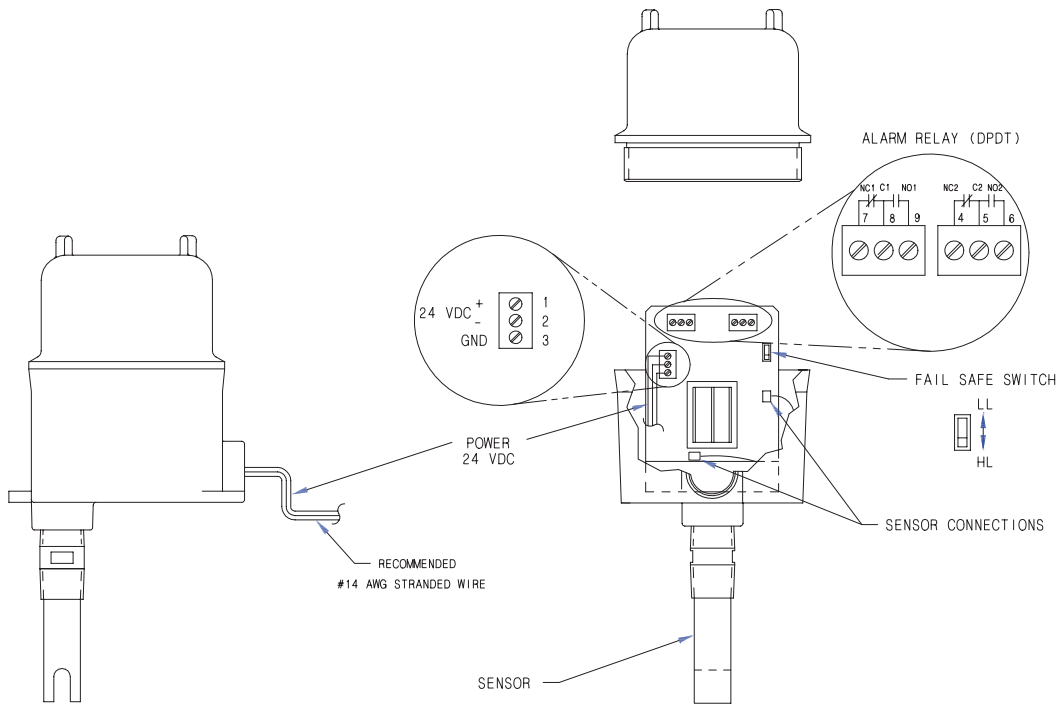


Figure 2-9
Wiring Diagram, 24 VDC, Integral Gap Switch

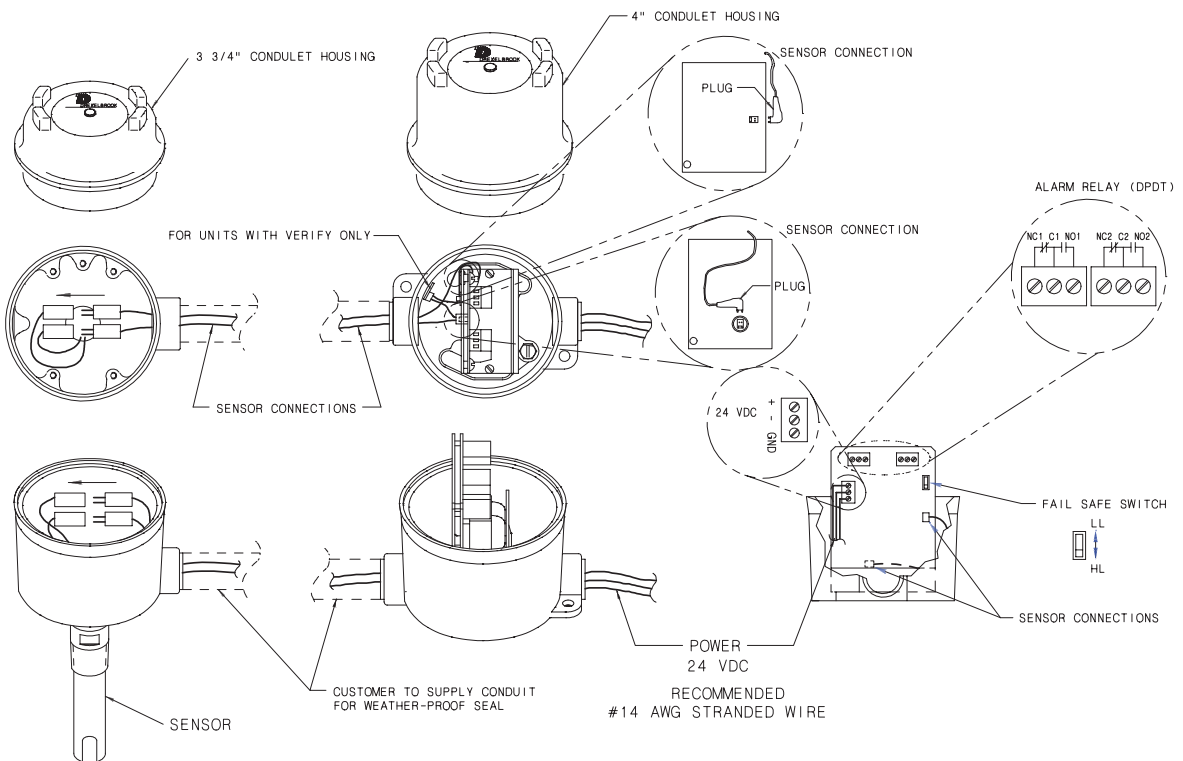


Figure 2-10
Wiring Diagram, 24 VDC, Remote Gap Switch

504-1000 Series Ultrasonic VeriGAP™

WIRING THE VERI-GAP/VERIFY ELECTRONICS, FRONT AND BACK VIEWS

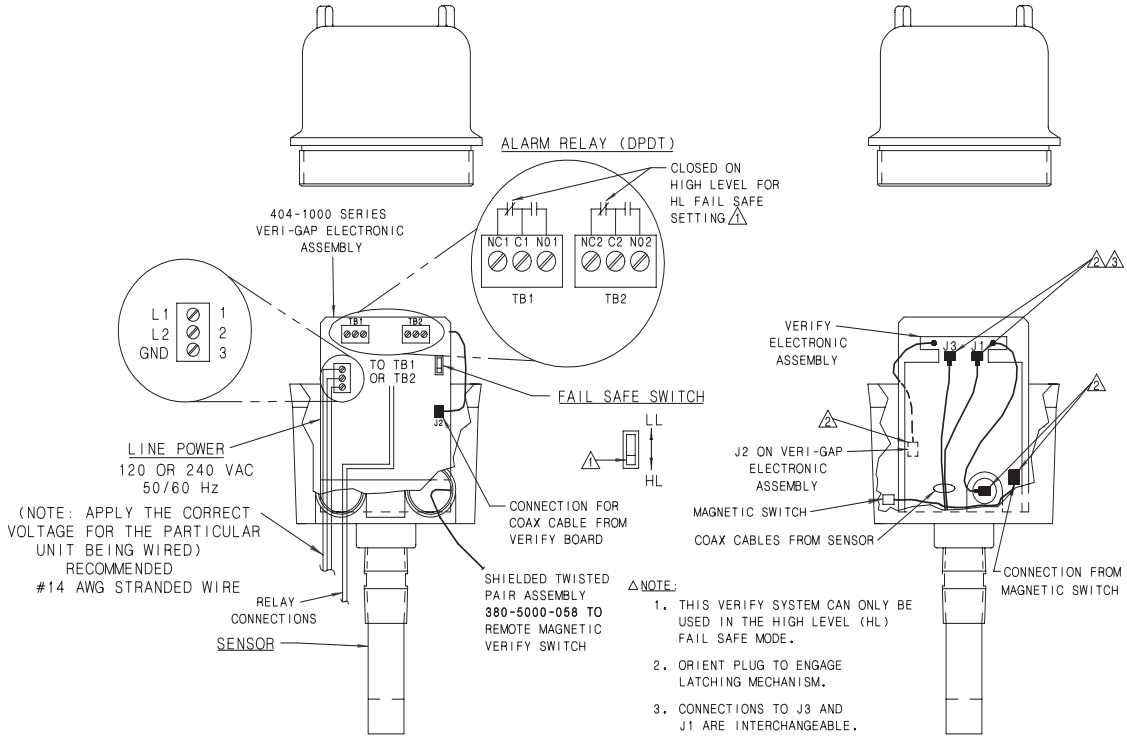


Figure 2-11 View 1
Wiring Diagram, 120 / 240 VAC, Gap Switch with Verify

WIRING THE VERI-GAP/VERIFY ELECTRONICS, TOP VIEW

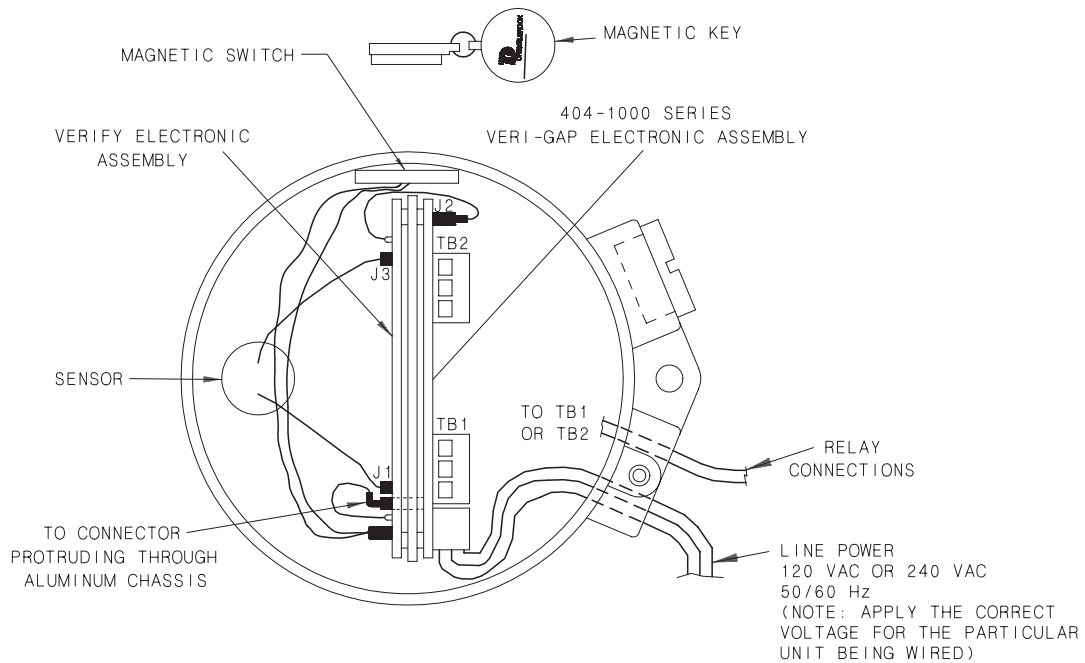


Figure 2-11 View 2
Wiring Diagram, 120 / 240 VAC, Gap Switch with Verify

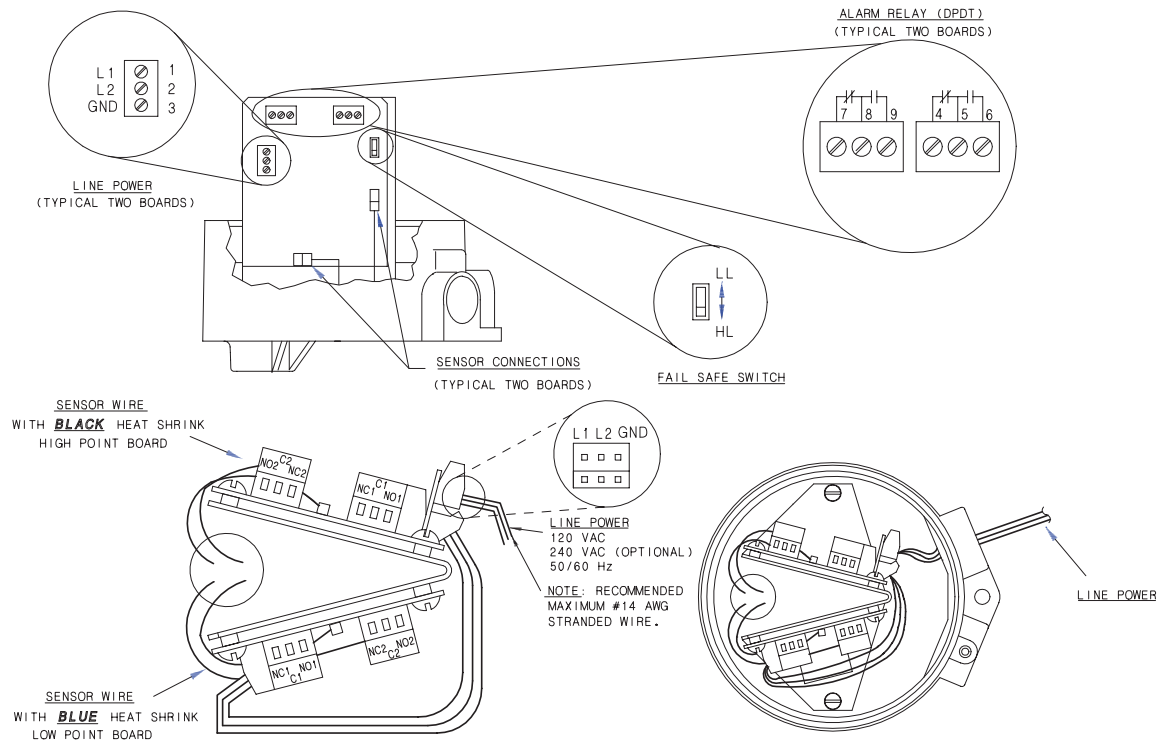


Figure 2-12
Wiring Diagram, 120 / 240 VAC, Integral, Dual, Gap Switch

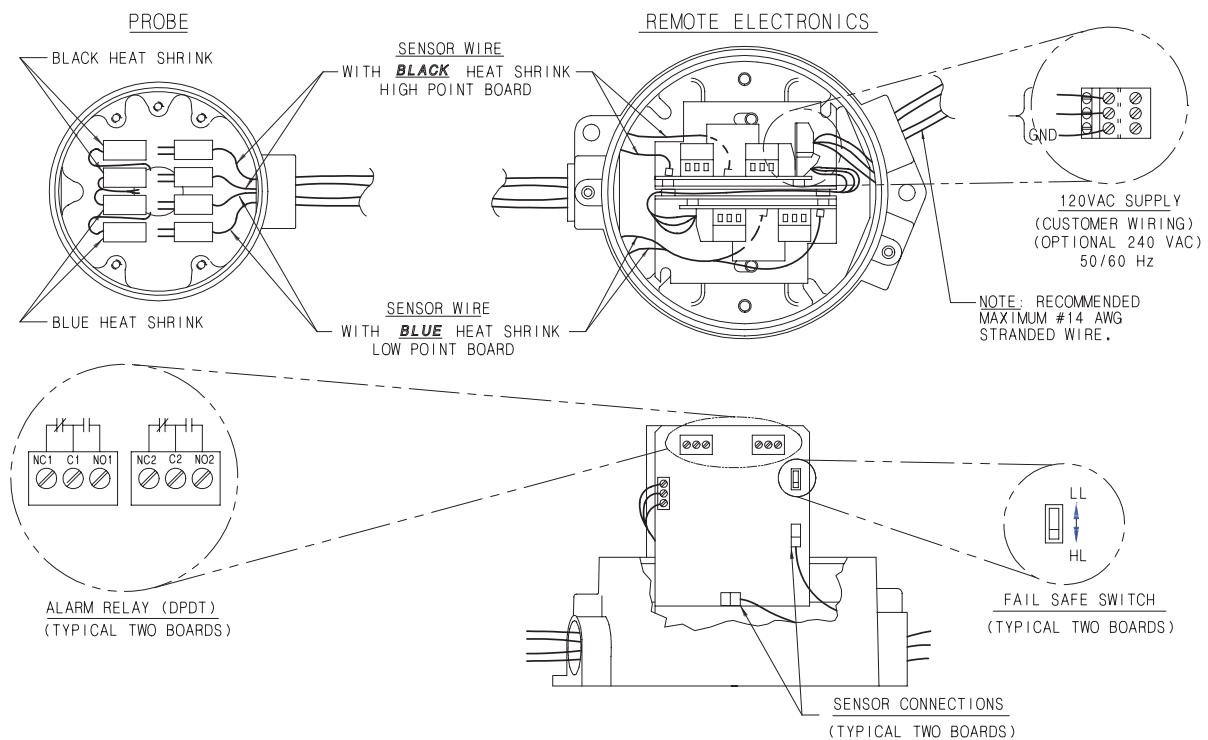


Figure 2-13
Wiring Diagram, 120 / 240 VAC, Remote, Dual, Gap Switch

504-1000 Series Ultrasonic VeriGAP™

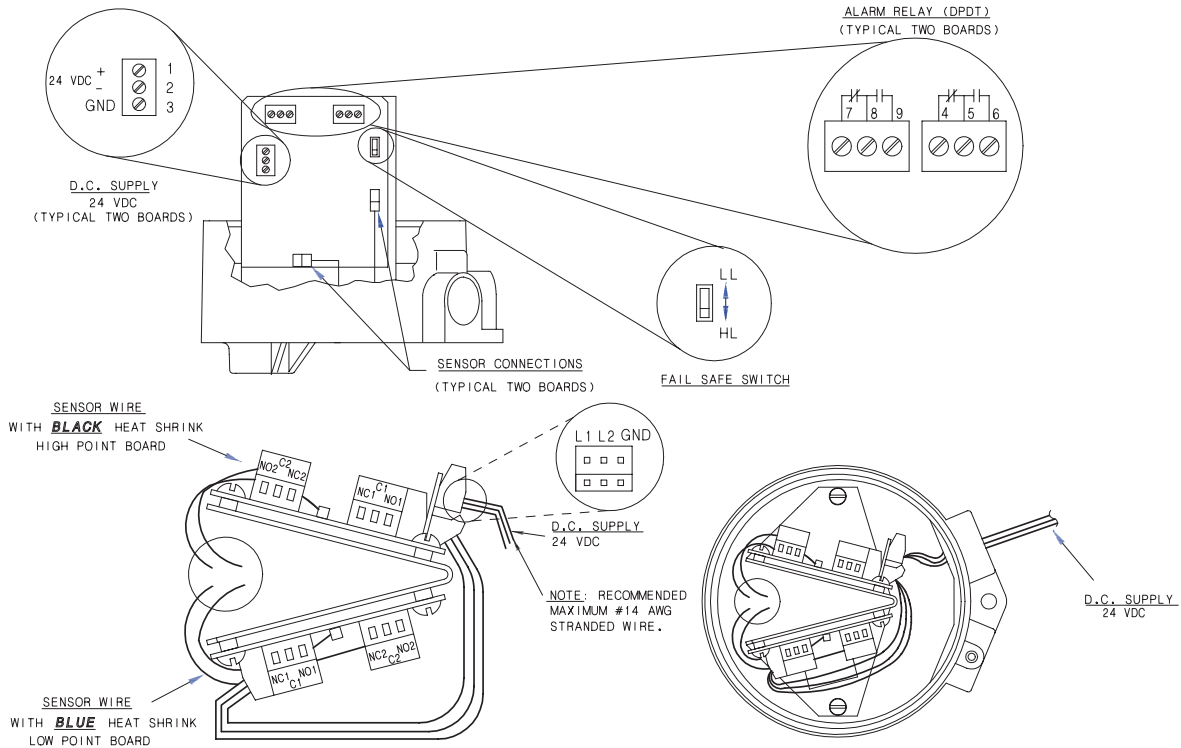


Figure 2-14
Wiring Diagram, 24 VDC, Integral, Dual, Gap Switch

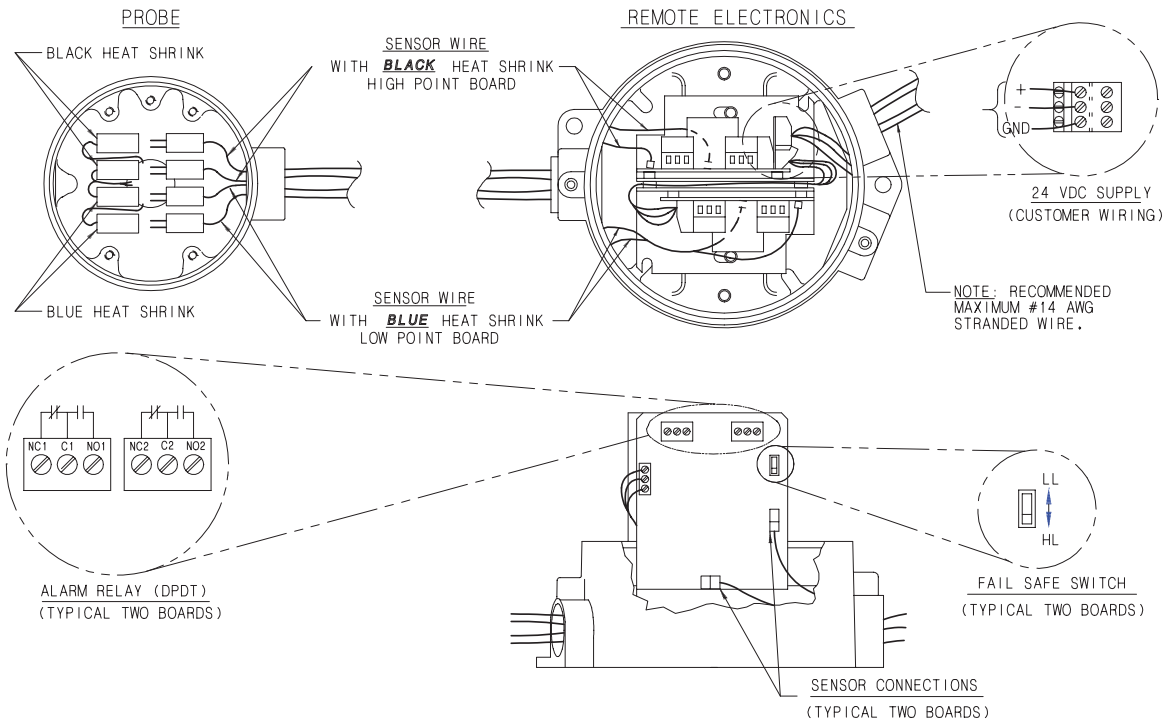


Figure 2-15
Wiring Diagram, 24 VDC, Remote, Dual, Gap Switch

Section 3: Operation

3.1 Failsafe Selector

The VeriGAP switch operates successfully upon applying power to the unit. No further calibration or adjustments are necessary.

There is one operating switch on the instrument for failsafe selection.

Failsafe describes the level condition that causes the output signal to change states.

- High Level Failsafe (HLFS) means the output signal will change to the alarm state under high level conditions (indicating high level upon loss of power).
- Low Level Failsafe (LLFS) means the output signal will change to the alarm state under low level conditions (indicating low level upon loss of power).
- The instrument is supplied in the failsafe mode that is requested when the order is placed (HLFS, if not specified).
- The failsafe is field selectable by changing slide switch S1 on the power side of the unit. See Figure 3-1.

FAIL SAFE SWITCH

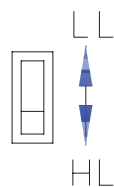


Figure 3-1
Failsafe Switch Settings

3.2 Manual Verify™ Test

As an option, the Manual Verify test feature performs a confidence test of the system by duplicating the same signal as a high-level alarm condition.

Simulating a high level with the Manual Verify test feature:

- confirms that the system is set up correctly for ISO 9000 purposes.
- checks the integrity and continuity of wiring connections.
- verifies that the sensing element is working properly.

The Manual Verify test is initiated by holding the magnetic key against the switch housing at the position indicated on the label marked test key area. If the switch is operating properly, the unit goes into alarm for approximately two seconds. If the switch is not operating properly, the unit goes into fault current condition.

3.3 Auto Verify™

As an option, the VeriGAP switch is equipped with an AutoVerify™ self-check circuit that checks the switch operation automatically every thirty seconds.

The AutoVerify test operates as follows:

- a. If the switch is operating properly, the AutoVerify circuit shuts off and waits 20 seconds to test the switch again.
- b. If the switch does not function properly, the unit goes into alarm (de-energizes the relay) and the yellow fault LED is lit. Push the blue reset button and wait for the next cycle. If fault is still indicated, refer to Section 4.

The Certify test is initiated by holding the magnetic key against the switch housing at the position indicated on the label marked test key area. The key must be held in this position until the circuit begins the AutoVerify test. This test occurs every five seconds. If the switch is operating properly, the unit goes into alarm for approximately two seconds. If the switch is not operating properly, the unit goes into fault current condition.

Section 4: Troubleshooting

The 504-1000 Ultrasonic VeriGAP Switch is a solid-state device with no moving parts. It requires no maintenance or adjustments. The units are designed to give years of unattended service.

A spare electronic chassis is recommended for every 10 units. In the event of a failed unit, this will prevent the interruption of a critical application while the unit is returned to the factory for repair.

In applications where liquids/products can coat or build up on the sensor tip over a period of time, it is recommended to use the Drexelbrook RF Admittance Point Level switches, which are not affected by coatings.

Proper operation of the gap switch can be verified by dipping the gap assembly in a small container of liquid (e.g. water). An audible click should be heard two seconds after submerging the gap assembly in liquid. If no relay click is heard, remove the equipment from the process.

- Check to see that the gap is not plugged by process material.
- Clean if required.
- Repeat the dip test.
- If no audible click is heard the instrument has failed.
- If spare parts are available find out whether the problem is caused by a defective gap assembly or by a defective electronics module. This is done by substituting a known good gap assembly or electronics module.

The gap assembly is removed by disconnecting the two coax cables from the electronics module.

Gently pull the quick disconnect connectors at the end of the coax wires out of the electronics module circuit card.

Loosen the set screw in the blue cast housing and unscrew the gap assembly from cast housing.

Section: 5

Section 5: Factory Assistance and Field Service

5.1 Telephone Assistance



If you have questions about your AMETEK Drexelbrook equipment:

- Contact your local Drexelbrook representative
- Call the Drexelbrook Service department toll-free at:
1-800-527-6297 (US and Canada) or
215-674-1234 (Outside North America)
- Fax the following information to the Service department at:
215-443-5117.

To expedite assistance, please provide the following information:

Instrument Model Number: _____

Original Purchase order number: _____

Material being measured: _____

Temperature: _____

Pressure: _____

Agitation: _____

Brief description of the problem: _____

Checkout procedures that have failed: _____

5.2 Field Service

Trained field service personnel are available on a time-plus-expense basis to assist in start-ups, diagnosing difficult application or equipment problems, or in-plant training of personnel. Preventive Maintenance and Calibration Certification service contracts are also available to maintain plant efficiency. Contact the Service department for further information.

5.3 Equipment Return / Warranty

In order to provide the best service, any equipment being returned for repair or credit must be pre-approved and have a return number issued by the factory.

In many applications, the equipment is exposed to hazardous materials.

- OSHA mandates that our employees be informed and protected from hazardous materials.
- Material Safety Data Sheets (MSDS) listing the hazardous material that the system has been exposed to must accompany any return.
- It is your responsibility to fully disclose all chemicals and decontaminate the returned items.



To obtain a return authorization number, contact the Service department:
1-800-527-6297 (US and Canada) or
215-674-1234 (Outside North America).

Please provide the following information:

Model Number of Returned Equipment: _____

Serial Number: _____

Original Purchase Order Number: _____

Process Material that the equipment has been exposed: _____

MSDS for any hazardous materials

Billing Address: _____

Shipping Address: _____

Purchase Order Number for Repairs: _____

Please include a purchase order number 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

COD shipments will not be accepted.

AMETEK Drexelbrook warrants its products free of material defects or manufacturing defects for a period of 1 year after date of shipment.

Section 6: Specifications

6.1 Electronics

Power Requirements	120 Vac \pm 50/60 Hz 240 Vac \pm 10% 50/60 Hz 18-30 Vdc
Power Consumption	120 Vac Unit 2.5 Watts 240 Vac Unit 1.5 Watts 24 Vdc Unit 2.5 Watts
Ambient Temperature	-40°F to 160°F
Repeatability	1/16 inch
Response Time	2 seconds (Time Delay standard)
Fail Safe	High Level or Low Level (field-selectable)
Relay	DPDT
Contact Rating	5A, 240 Vac, Resistive 5A, 30 Vdc, Resistive 4.9A, 240 Vac, Inductive 4.4A, 120 Vac, Inductive
Housing	NEMA 1 to 4X, 5 and 12 FM Approved Explosionproof

6.2 Sensing Element

Insertion Lengths	2, 6, 12, 18, or 24 inches standard (other lengths available)
Wetted Materials	Standard 316 SS Optional Alloy 20, Hastelloy “C” (Consult factory for other materials)
Mounting	
Metallic Sensors:	¾-inch NPT standard, flange mounting available.
Seal Tyte™ Sensors:	Flange mounting only, 1-inch minimum flange
Gap	Single gap standard (404-1000) Dual gap available (404-1600)
Process Temperature	-40°F to 250°F
Process Pressure	1000 psi maximum, metallic sensors

Section 7: Approval Control Drawings

7.1 FM and CSA Approval Control Drawings

NO. 420-0004-024-CD SHEET 1 OF 5

NO CHANGE IN PART OR VENDOR OF PART ALLOWED WITHOUT PRIOR APPROVAL OF FM.

FM & CSA CONTROL DRAWING
FOR VeriGAP™ ULTRASONIC
POINT LEVEL SENSORS

MODEL	SHEETS
404-1000 SERIES	2
1100 SERIES	2
1300 SERIES	2
404-1200 SERIES	3-5

FM SENSOR SHEET 2

705-abcd-efg-h
 a = BLANK OR 0
 b = BLANK OR 0
 c = BLANK, 0, 2 (DUAL POINT), 3 (SINGLE POINT/ADJUSTABLE),
 4 (DUAL POINT/ADJUSTABLE)
 d = 1, 2 TEMPERATURE
 e = BLANK, 6, CONSTRUCTION (6)
 f = BLANK OR 0
 g = 1, 3, 5, MATERIALS (6)
 h = 14 CHARACTER EXPANDED NUMBERING SYSTEM.
 DOES NOT AFFECT SAFETY.

****APPROVED DRAWING****
 CHANGES TO THIS DRAWING
 REQUIRE AGENCY APPROVAL
 PER 440-0015-003
 FM CSA KEMA
 420-0004-067
 420-0004-076
 420-0004-036

CERTIFIED	by _____	9-07-102	9-07-102	6	6
PO #	THP	9-01-202	9-01-202	5	5
ENG	THP	6-00-201	6-00-201	4	4
USER	DJM	6-96-212	6-96-212	3	3
ISS	EDD/DSR NO.	APP'D	DATE	ISS	EDD/DSR NO.
DE #				OF	OF

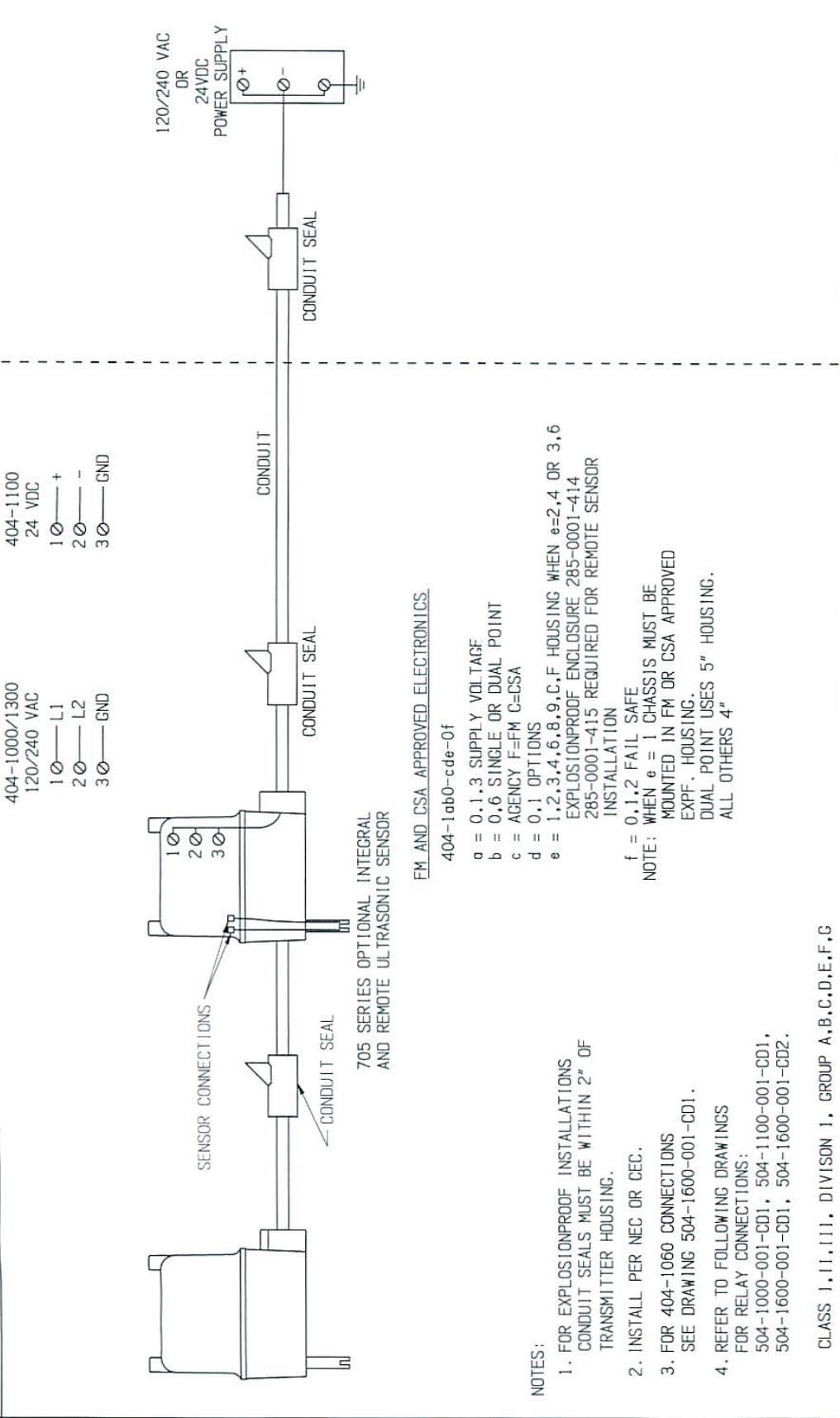
AMETEK®
DREXELBROOK
 205 KEITH VALLEY RD.
 HURSHAM, PA 19044-9886
 215-674-1234
 FAX 215-674-2731

FM & CSA CONTROL DRAWING
 FOR VeriGAP™ ULTRASONIC
 POINT LEVEL SENSORS

420-0004-024-CD

ISS: 1 OF 5
 OF 5

NO CHANGE IN PART OR VENDOR OF PART ALLOWED WITHOUT PRIOR APPROVAL OF FM.



404-1000/1300
120/240 VAC
1 1 1
2 2 2
3 3 3

404-1100
24 VDC
1 1 1
2 2 2
3 3 3

705 SERIES OPTIONAL INTEGRAL AND REMOTE ULTRASONIC SENSOR

FM AND CSA APPROVED ELECTRONICS

404-1ab0-cde-Of

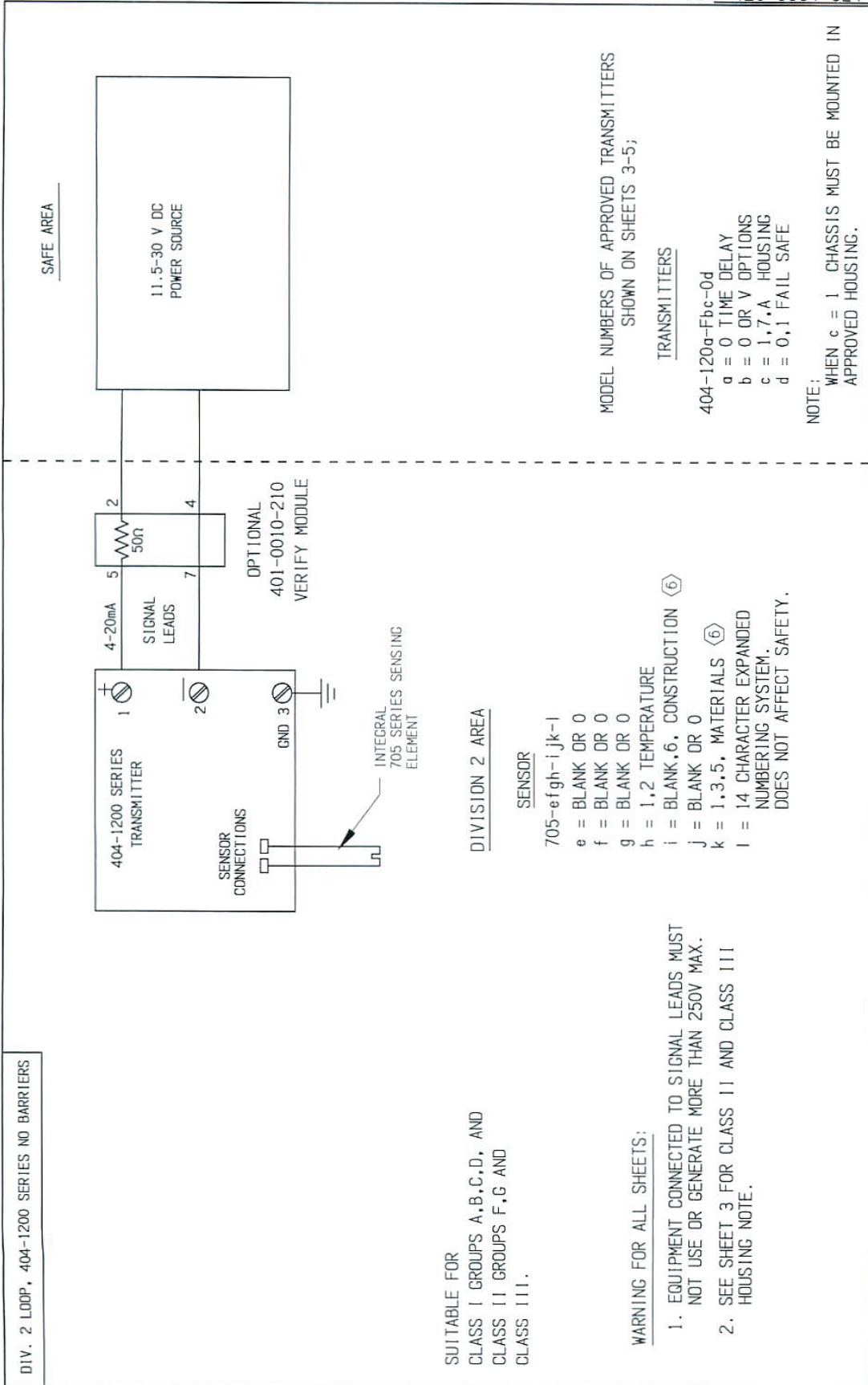
- a = 0,1,3 SUPPLY VOLTAGE
- b = 0,6 SINGLE OR DUAL POINT
- c = AGENCY F=FM C=CSA
- d = 0,1 OPTIONS
- e = 1,2,3,4,6,8,9,C,F HOUSING WHEN e=2,4 OR 3,6 EXPLOSIONPROOF ENCLOSURE 285-0001-4.14 285-0001-4.15 REQUIRED FOR REMOTE SENSOR INSTALLATION
- f = 0,1,2 FAIL SAFE

NOTE: WHEN e = 1 CHASSIS MUST BE MOUNTED IN FM OR CSA APPROVED EXP. HOUSING. DUAL POINT USES 5" HOUSING. ALL OTHERS 4"

- NOTES:
1. FOR EXPLOSIONPROOF INSTALLATIONS CONDUIT SEALS MUST BE WITHIN 2" OF TRANSMITTER HOUSING.
 2. INSTALL PER NEC OR CEC.
 3. FOR 404-1060 CONNECTIONS SEE DRAWING 504-1600-001-CD1.
 4. REFER TO FOLLOWING DRAWINGS FOR RELAY CONNECTIONS:
504-1000-001-CD1, 504-1100-001-CD1,
504-1600-001-CD1, 504-1600-001-CD2.

CLASS 1,11,111, DIVISION 1, GROUP A,B,C,D,E,F,G

<p>CERTIFIED</p> <p>PO # _____</p> <p>ENG _____</p> <p>USER _____</p> <p>DE # _____</p>	<p>by _____</p> <p>THP 1-24-02</p> <p>THP 6-23-00</p> <p>OJM 8-22-97</p>	<p>9-07-102</p> <p>9-01-202</p> <p>6-00-201</p> <p>6-96-212</p>	<p>DATE</p> <p>DATE</p> <p>DATE</p> <p>DATE</p>	<p>ISS. EDD/DSR NO. J APP'D</p> <p>DATE</p>	<p>COPYRIGHT 2007</p> <p>AMETEK DREXELBROOK</p> <p>SCALE NONE</p> <p>UNLESS OTHERWISE STATED</p> <p>ALL DIMENSIONS IN INCHES (IN)</p> <p>DR. JUS 9-10-07</p> <p>CK. <i>CD</i></p>	<p>FM & CSA CONTROL DRAWING FOR ULTRASONIC POINT LEVEL SENSOR TRANSMITTERS VeriGAP™</p> <p>215-674-1234 FAX 215-674-2731</p> <p>205 KEITH VALLEY RD HORSHAM, PA 19064-0986</p>	<p>420-0004-024-CD</p> <p>SHT. 2 OF 5</p> <p>ISS. 2 OF 6</p>
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DIV. 2 LOOP, 404-1200 SERIES NO BARRIERS

SAFE AREA

11.5-30 V DC POWER SOURCE

404-1200 SERIES TRANSMITTER

SENSOR CONNECTIONS

INTEGRAL 705 SERIES SENSING ELEMENT

OPTIONAL 401-0010-210 VERIFY MODULE

4-20mA SIGNAL LEADS

SUITABLE FOR CLASS I GROUPS A,B,C,D, AND CLASS II GROUPS F,G AND CLASS III.

WARNING FOR ALL SHEETS:

- EQUIPMENT CONNECTED TO SIGNAL LEADS MUST NOT USE OR GENERATE MORE THAN 250V MAX.
- SEE SHEET 3 FOR CLASS II AND CLASS III HOUSING NOTE.

DIVISION 2 AREA

SENSOR

- 705-efgh-ijk-l
 e = BLANK OR 0
 f = BLANK OR 0
 g = BLANK OR 0
 h = 1,2 TEMPERATURE
 i = BLANK,6, CONSTRUCTION (6)
 j = BLANK OR 0
 k = 1,3,5, MATERIALS (6)
 l = 14 CHARACTER EXPANDED NUMBERING SYSTEM.
 DOES NOT AFFECT SAFETY.

MODEL NUMBERS OF APPROVED TRANSMITTERS SHOWN ON SHEETS 3-5;

TRANSMITTERS

- 404-120a-Fbc-0d
 a = 0 TIME DELAY
 b = 0 OR V OPTIONS
 c = 1,7,A HOUSING
 d = 0,1 FAIL SAFE

NOTE: WHEN c = 1 CHASSIS MUST BE MOUNTED IN APPROVED HOUSING.

CERTIFIED	by							
PO #		6	9-07-102					
ENG		5	9-01-202	THP	1-24-02			
USER		4	6-00-201	THP	6-23-00			
		3	6-96-212	OJM	8-22-97			
ISS. #	EDD/DSR NO.	APP'D	DATE	DR.	JUS	9-10-07	OK.	COD

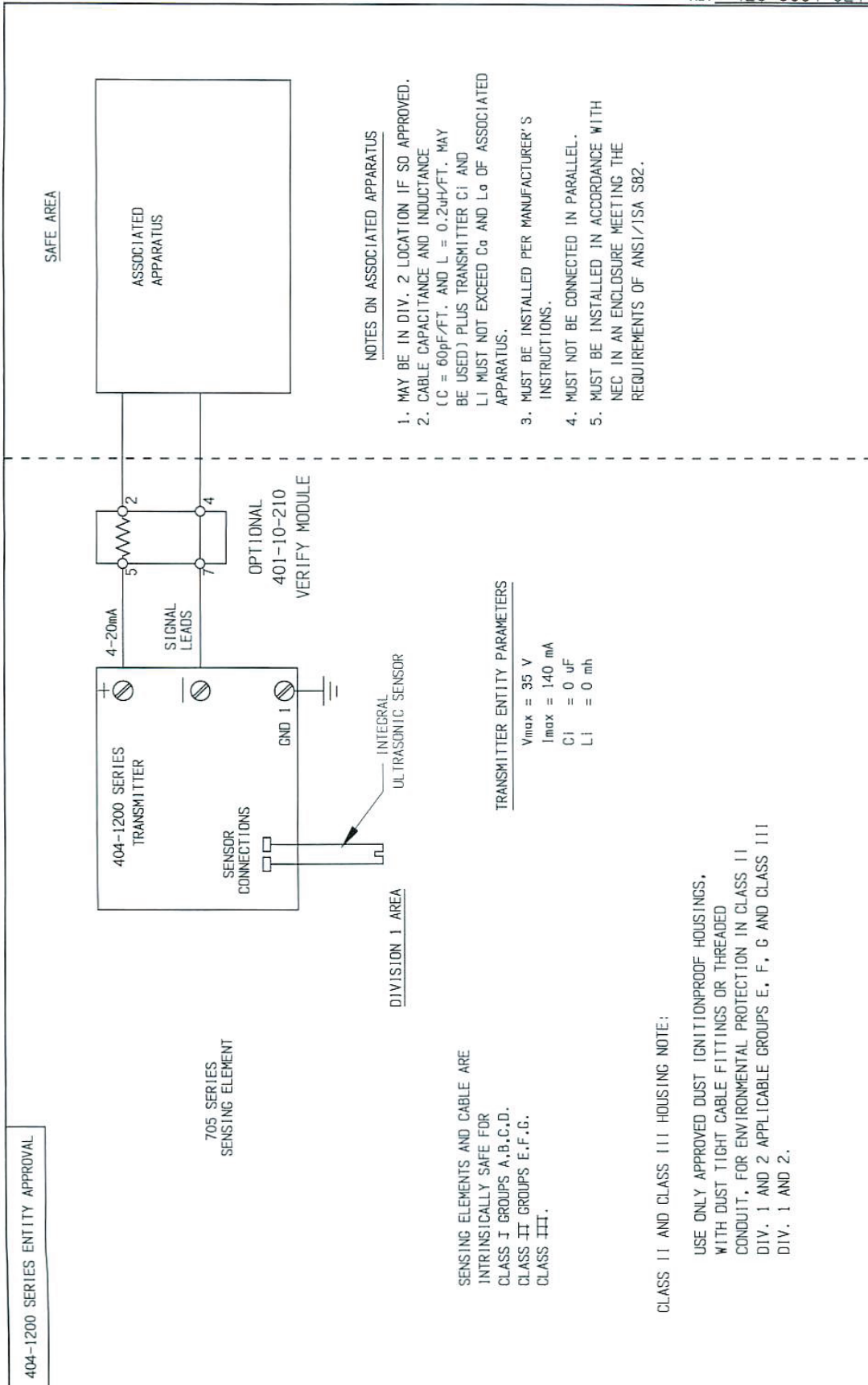


205 KEITH VALLEY RD
 HORSHAM, PA 19044-9086
 215-674-1234
 FAX 215-674-2731

FM CONTROL DRAWING FOR ULTRASONIC POINT LEVEL TRANSMITTER

420-0004-024-CD

ISS. OF 3 OF 5



CERTIFIED		by _____		COPYRIGHT 2007	
PO #	6	9-07-102	THP	10/5/02	AMETEK DREXELBROOK
ENG	5	9-01-202	THP	1-24-02	SCALE NONE
USER	4	6-00-201	THP	6-23-00	UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES (MM)
DE #	3	6-96-212	OJM	8-22-97	DR. JJS 9-10-07
ISS. EDO/DSR NO. APP'D		DATE		CK. <i>CHD</i>	
FM CONTROL DRAWING FOR ULTRASONIC POINT LEVEL TRANSMITTER		420-0004-024-CD		SHT. 4 OF 6	

AMETEK®
DREXELBROOK

205 KEITH VALLEY RD.
 HORSHAM, PA 19044-9986
 215-674-1234
 FAX 215-674-2731

404-1200 SERIES ENTITY APPROVAL

SENSING ELEMENTS AND CABLE ARE INTRINSICALLY SAFE FOR CLASS I GROUPS A, B, C, D. CLASS II GROUPS E, F, G. CLASS III.

CLASS II AND CLASS III HOUSING NOTE:

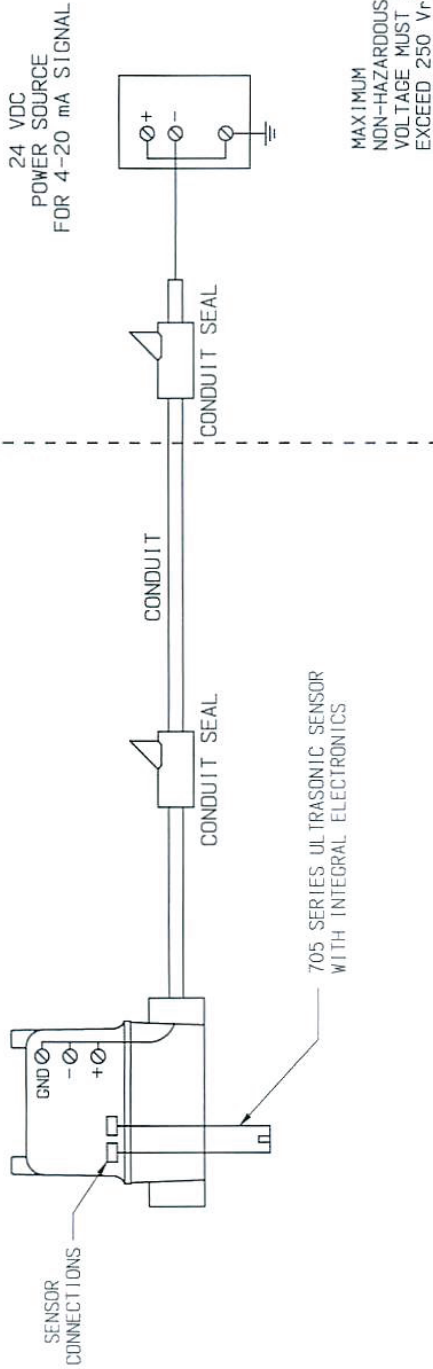
USE ONLY APPROVED DUST IGNITIONPROOF HOUSINGS, WITH DUST TIGHT CABLE FITTINGS OR THREADED CONDUIT, FOR ENVIRONMENTAL PROTECTION IN CLASS II DIV. 1 AND 2 APPLICABLE GROUPS E, F, G AND CLASS III DIV. 1 AND 2.

NO. 420-0004-024-CD

SHT 5 OF 5

EXPLOSIONPROOF 404-1200 SERIES INSTALLATION

NO CHANGE IN PART OR VENDOR OF PART ALLOWED WITHOUT PRIOR APPROVAL OF FM.



NON-HAZARDOUS AREA

FM & CSA CONTROL DRAWING FOR ULTRASONIC POINT LEVEL SENSOR TRANSMITTERS VeriGAP™

420-0004-024-CD

215-674-1234
FAX 215-674-2731



205 KEITH VALLEY RD
HORSINGHAM, PA 19044-9986

- NOTES:
1. FOR EXPLOSIONPROOF INSTALLATIONS CONDUIT SEALS MUST BE WITHIN 2 INCHES OF TRANSMITTER HOUSING.
 2. EXPLOSIONPROOF INSTALLATIONS MUST COMPLY WITH NEC.

CLASS I, II, III, DIVISION 1, GROUP A, B, C, D, E, F, G

CERTIFIED	by	THP	DATE	DR.	JJS 9-10-07
PO #	9-07-102	THP	1-24-02	APP' D	8-22-97
ENG	9-01-202	THP	6-23-00	NO	
USER	6-00-201	THP	6-23-00	ISS	5
DE #	6-96-212	OJM	8-22-97	OF	6
COPYRIGHT 2007		AMETEK DREXELBROOK		SCALE NONE	
UNLESS OTHERWISE STATED		ALL DIMENSIONS IN INCHES (IN)		DR. CK. <i>AWD</i>	



TERMS AND CONDITIONS OF SALE

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 (v) defends against such claim.

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

SOFTWARE LICENSE: If goods purchased hereunder include software ("Software"), Buyer may use the Software only as part of the goods. Buyer may not use, copy, or transfer any of the Software except as may be 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-user 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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