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Installation and Operating Instructions

Series 504-3200
Ultrasonic VeriGAP II™ Switch
using 404-3200 Electronics

*(215) 674-1234 Outside North America
1-800-527-6297 US and Canada
<http://www.drexelbrook.com>
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Series 504-3200 Ultrasonic VeriGAP II™ Switch using 404-3200 Electronics

"When the measurement matters"

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DREXELBROOK

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Table of Contents

SECTION 1 INTRODUCTION	1
1.1 General Description.....	1
1.1.1 Verify Circuit (see also 3.6)	2
1.2 Model Numbering	3
SECTION 2 INSTALLATION	4
2.1 Unpacking	4
2.2 Mounting the Instrument	4
2.3 Wiring the Instrument.....	7
SECTION 3 OPERATION	10
3.1 Failsafe Jumper.....	10
3.2 Mode Selection Switch	11
3.3 Time Delay	12
3.3.1 Forward or Reverse Acting Time Delay	12
3.4 Output Current Window	13
3.5 Fault Output Selection.....	13
3.6 Verify Test Feature	14
3.6.1 AutoVerify™	15
3.6.2 Manual Certify Test	15
SECTION 4 TROUBLESHOOTING	16
SECTION 5 SERVICE	17
5.1 Factory Service Assistance	17
5.2 Equipment Return	17
5.3 Field Service	18
5.4 Customer Training.....	18
SECTION 6 SPECIFICATIONS	19
6.1 Electronics	19
6.2 Sensor	19

SECTION 1 INTRODUCTION

The instructions in this manual are for the Drexelbrook 504-3200 Series point level, two-wire ultrasonic VeriGAP II™ switch.

1.1 General Description

The 504-3200 Series VeriGAP II™ switch is an integral assembly that senses liquid presence by ultrasonic techniques. The switch can be used to indicate and/or control the liquid at a predetermined level.

The 504-3200 switch is a two-wire device. It draws current from a remote power supply over a pair of signal wires. This current is both the output signal and the operating power for the point level transmitter.

- It provides an 8 mA output (optional 16 mA) when the material being measured reaches the sensing element point in a vessel.
- It provides a 16 mA output (optional 8 mA) when the sensing element is uncovered.

Figure 1-1 shows a typical system configuration.

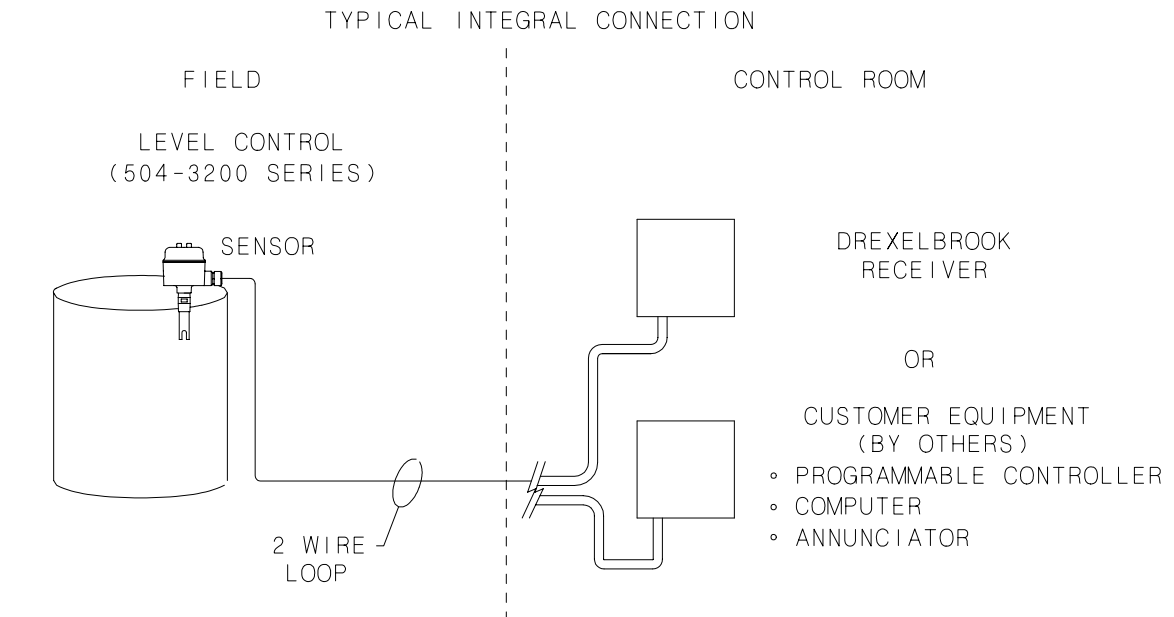


Figure 1-1
Typical System Configuration

1.1 General Description (continued)

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 1-2. When a signal is received, an electronic circuit produces a relay output.

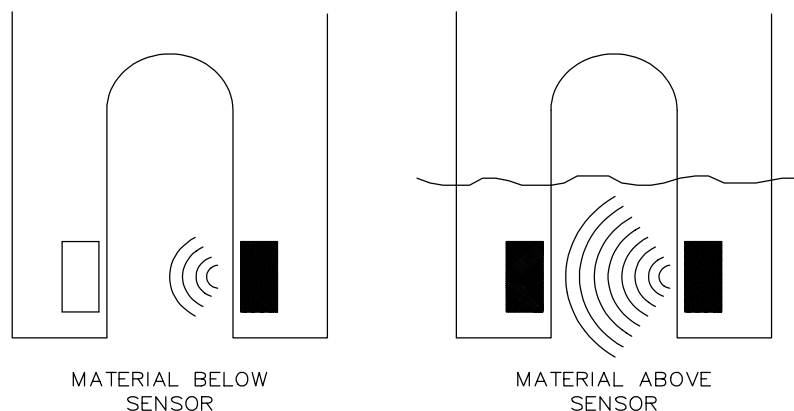


Figure 1-2
Gap Switch Operation

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 504-3200 VeriGAP II switch a very reliable and economical solution to industrial liquid level control operations.

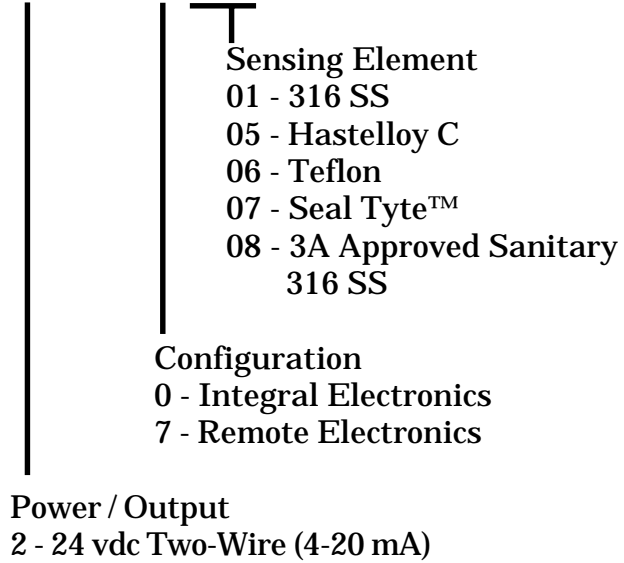
1.1.1 Verify™ Circuit

The Verify™ circuit is used in the VeriGAP II for verification that the entire control system is functioning properly by simulating a level at the sensing element. **This test may also be used for ISO 9000 validation of your level alarms and spill prevention systems.**

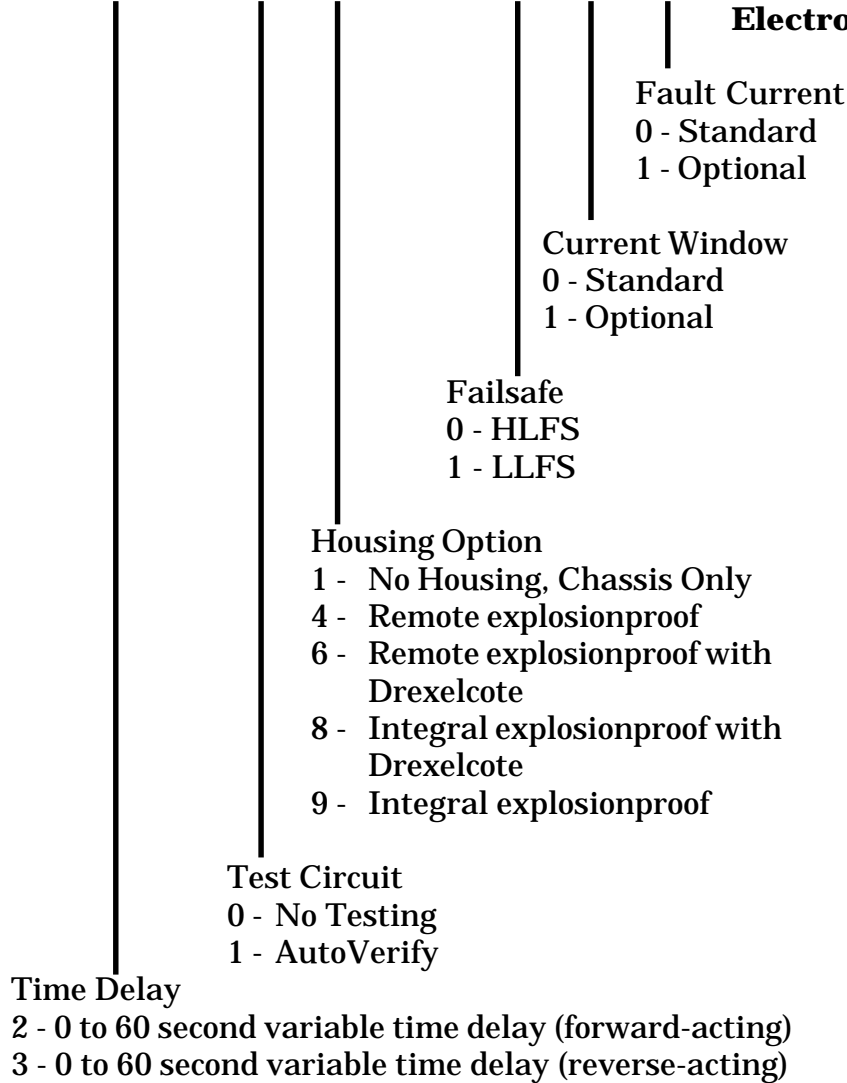
An optional Drexelbrook Point Level Receiver provides power to the VeriGAP II and monitors its current draw. Relays are activated on change of level states.

1.2 Model Numbering

5 0 4 - 3 2 0 0 - X X X VeriGAP II™ Switch



4 0 4 - 3 2 0 X - 0 X X - 0 - X X X VeriGAP II™ Electronic Unit



**SECTION 2
INSTALLATION**

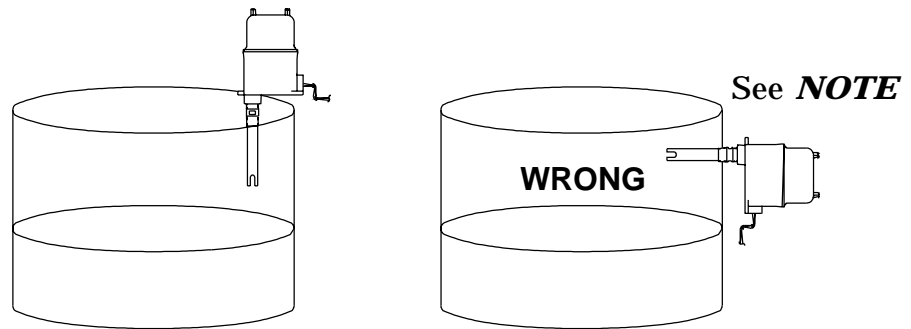
2.1 Unpacking

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

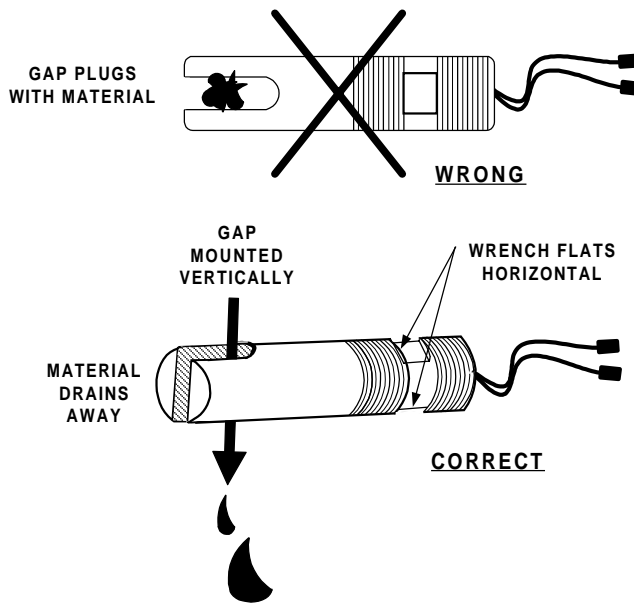
The 504-3200 electronic unit was designed for field mounting, but it should be mounted in a location as free as possible from vibration, corrosive atmospheres, and any possibility of mechanical damage. For convenience at start-up, place the instrument in a reasonably accessible location. Ambient temperatures should be between -40°F and 160°F (-40°C to 70°C).

The 504-3200 VeriGAP II™ switch can be mounted in any orientation vertically.

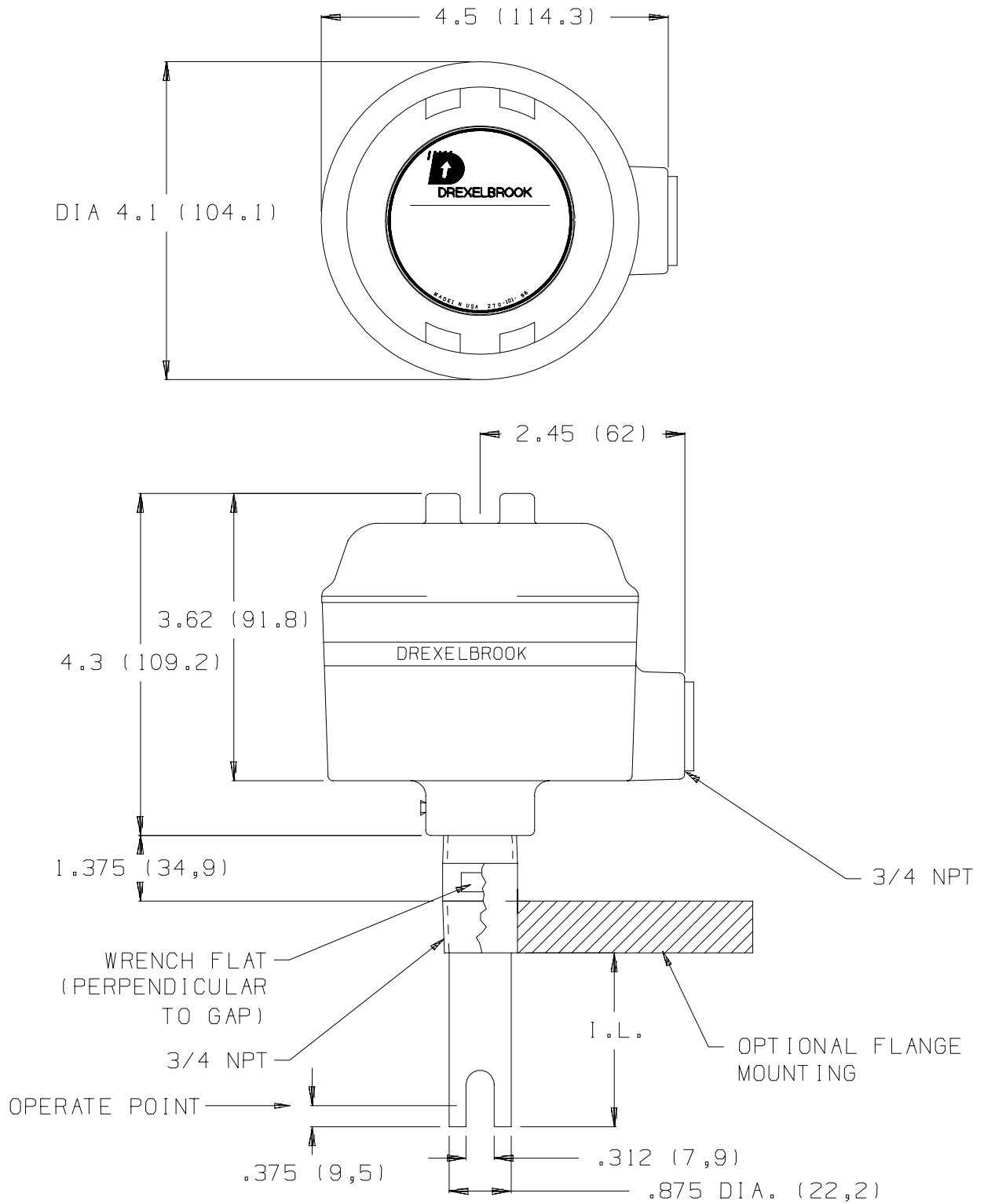


NOTE

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.

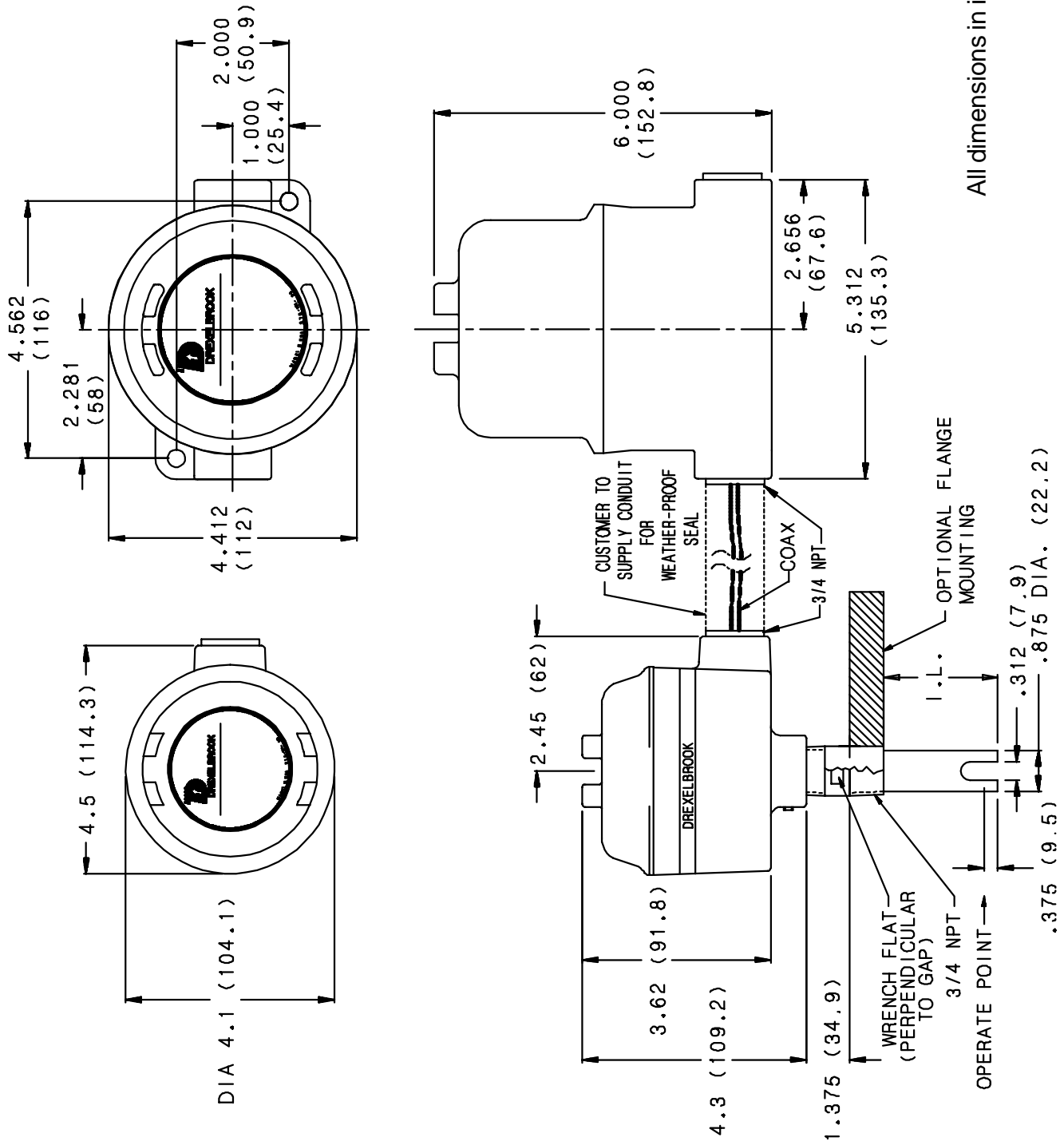


**Figure 2-1
Mounting Orientation**



All dimensions in inches (mm)

Figure 2-2
Mounting Dimensions, Integral Unit



All dimensions in inches (mm)

Figure 2-3
Mounting Dimensions, Remote Mounting

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 instrument 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 unless an intrinsically safe power supply is used.

Use the following procedure to wire the 504-3200 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 2-4 (Integral) or Figure 2-5 (Remote). Use 14-gauge or smaller wiring (stranded wiring is preferred). All connections are made on the terminal strip.
4. If shielded wire is used, only ground one end. The other end is left floating. This wiring practice prevents ground loop problems.
5. The PC board mounting screws can be removed to allow movement of the PC board during wiring.
6. After connections are secured and dressed, re-insert the electronic unit 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.

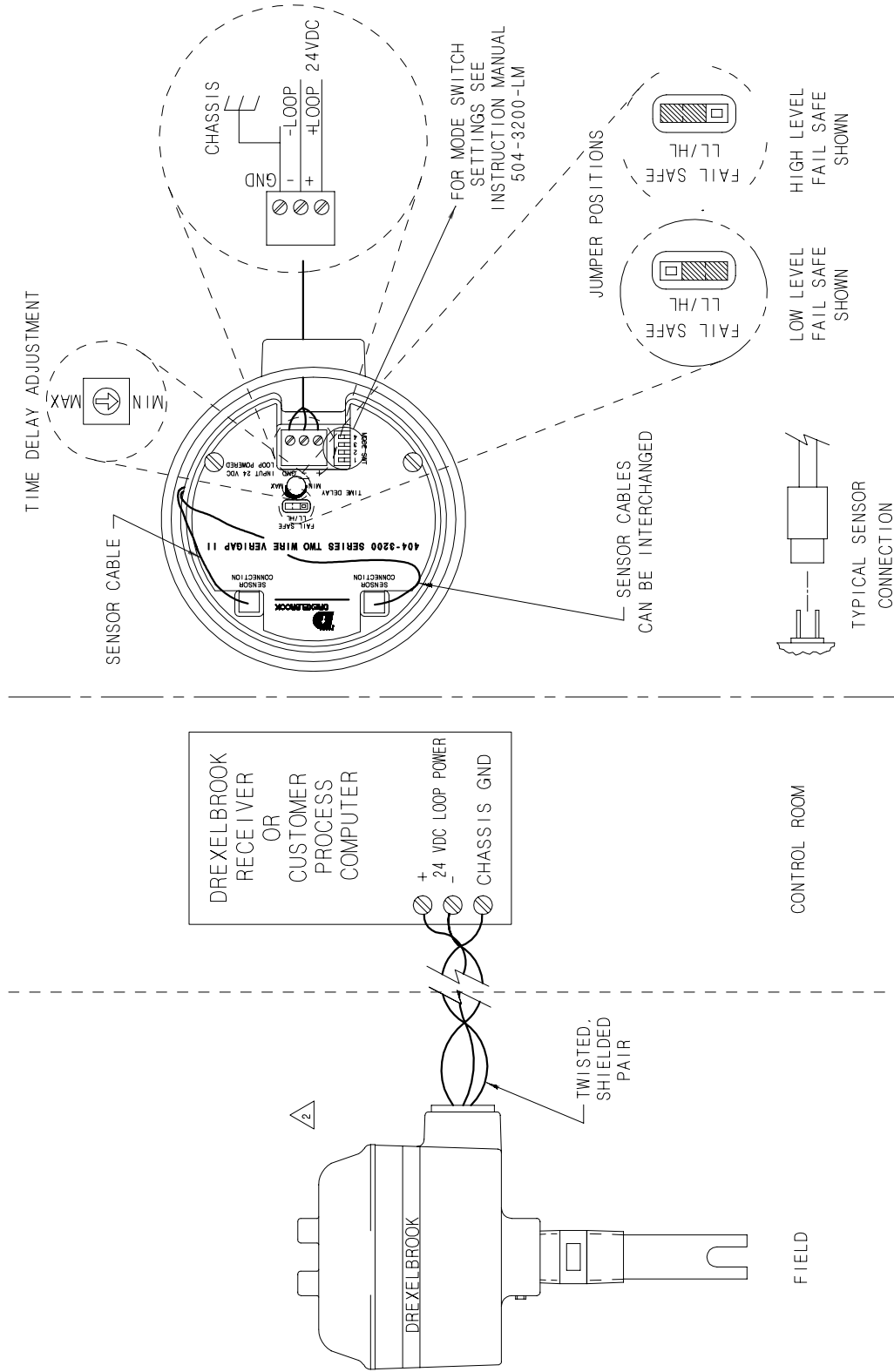


Figure 2-4
Wiring Diagram
Integral VeriGap II Level Switch

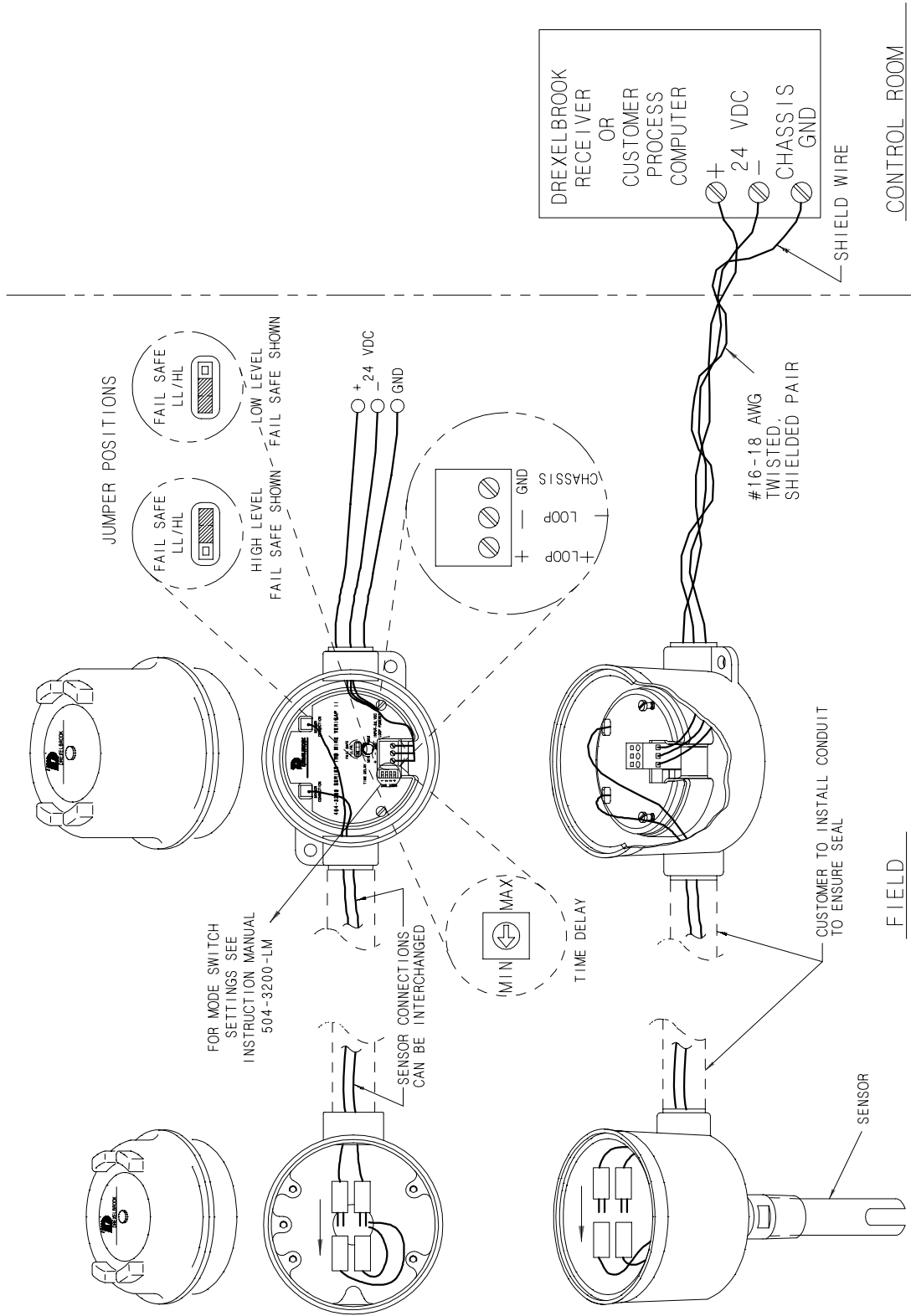


Figure 2-5
Wiring Diagram
Remote VeriGap II Level Switch

SECTION 3 OPERATION

This section outlines the switch and jumper settings necessary to customize the VeriGAP II switch for the application. See Figure 3-1.

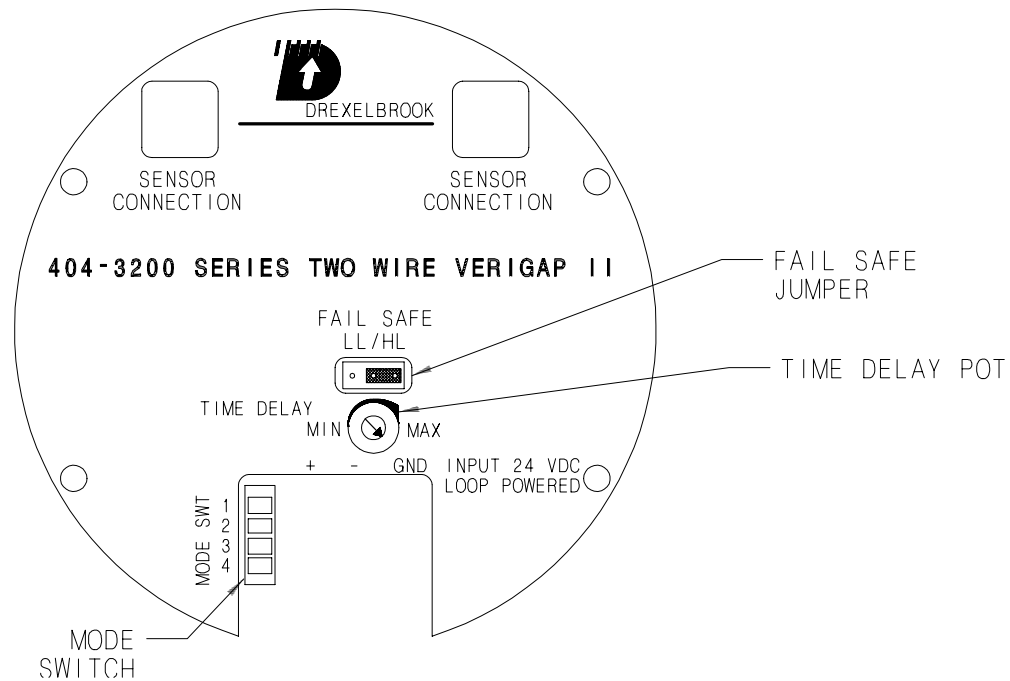


Figure 3-1
504-3200 VeriGAP II
Failsafe Jumper, Time Delay Adjustment
and Mode Switch

3.1 Failsafe Jumper

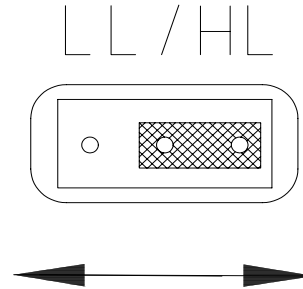
There is one operating jumper on the instrument for failsafe selection. See Figure 3-1.

Failsafe describes the level condition which causes the output relay to de-energize and the condition of the relay upon loss of power.

- High Level Failsafe (HLFS) means the relay will de-energize when level is high, indicating high level upon loss of power. (N.O. contacts open/N.C. contacts closed)
- Low Level Failsafe (LLFS) means the relay will de-energize when level is low, indicating low level upon loss of power. (N.O. contacts open/N.C. contacts closed)
- The instrument is supplied in the failsafe mode that is requested when the order is placed (HLFS, if not specified).

3.1 Failsafe Jumper (cont.)

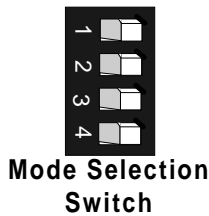
- The failsafe is field selectable by changing the jumper on the power side of the unit. See Figure 3-2.



(shown in High Level Failsafe)

**Figure 3-2
Failsafe Jumper**

3.2 Mode Selection Switch



The Mode selection switch is a set of four slide switches used to configure the following features:

- Time Delay (forward or reverse acting) *Section 3.3.*
- Output current (standard or special), *Section 3.4.*
- Fault current output selection *Section 3.5.*
- Verify (on or off) *Section 3.6.*

Feature	Switch	Factory Default Setting
Time Delay	S2	Forward acting (set to the right).
Output Current	S4	Standard factory current window (set to the right).
Verify™	S3	Verify circuit ON (set to the right).
Fault Output	S1 and S4	Standard factory current window with fault current at 21 mA (set to the right).

3.3 Time Delay

The time delay adjustment is a pot located below the High level/Low level selection jumper. See Figure 3-1.

The time delay can be adjusted to any value from 0 to 60 seconds by turning the pot.

Pot full counter clockwise = 0 delay (MIN).

Pot full clockwise = 60 second delay (MAX).

3.3.1 Forward or Reverse Acting Time Delay

The time delay can be set for forward acting or reverse acting. See *3.3 Mode Switch* for forward or reverse acting time delay. The unit is shipped from the factory in the forward acting mode.

—Forward Acting Time Delay Fast On, Slow Off

Switch goes into alarm immediately when material:

- enters the gap in HLFS mode.
- leaves the gap in LLFS mode.

The switch will stay in alarm for the delay period set, i.e. 0 to 60 seconds.

Forward acting time delay can be used to eliminate output chatter from agitated surfaces. Forward acting time delay is applicable for controlled *dumps*.

—Reverse Acting Time Delay Slow On

CAUTION

Delaying the control output of a switch (reverse acting time delay) can cause product spills. The fill rate must be known and the control point must be set to allow sufficient tank space for filling product.



Switch delays going into alarm when material:

- enters the gap in HLFS mode.
- leaves the gap in LLFS mode.

The switch will delay going into alarm for the set delay period, i.e. 0 to 60 seconds.

Reverse acting time delay allows material to continue filling (or emptying in low level) after control point has been reached.

3.4 Output Current Window

The output current window is determined by the setting of switch 4.

- Switch 4 to the right selects standard current window.
- Switch 4 to the left selects optional current window.

—Standard Factory Current Window 8mA gap covered/16mA gap uncovered

Normal Condition = 16mA (+/- 1)
Alarm Condition = 8mA (+/- 1)
Fault Current = 23mA (+/- 0.25)

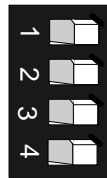
—Optional Current Window 8mA gap uncoverd/16mA covered

Normal Condition = 8mA (+/- 1)
Alarm Condition = 16mA (+/- 1)
Fault Current¹ = 5mA (+/- 1)

¹ Fault current (in the optional current window) is selectable (5mA or 19mA). See 3.5 Fault Output Selection.

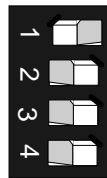
3.5 Fault Output Selection

In some control schemes, the fault output must go to high current in all cases. Switch 1 operates in conjunction with switch 4 to allow current output and fault current selection.



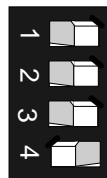
Standard Current Window

Normal Condition = 16mA (+/- 1)
Alarm Condition = 8mA (+/- 1)
Fault Current = 23mA (+/- 0.25)



Standard Current Window

Switch 1 has no affect on fault output of standard factory setting.
Fault current stays at 23mA.



Optional Current Window

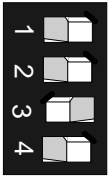
Normal Condition = 8mA (+/- 1)
Alarm Condition = 16mA (+/- 1)
Fault Current = 5mA (+/- 1)



Optional Current Window

Normal Condition = 8mA (+/- 1)
Alarm Condition = 16mA (+/- 1)
Fault Current = 19mA (+/- 1)

3.6 Verify Test Feature



Verify Test
(shown in off position)

The Verify circuit must be on for either AutoVerify™ or Manual Certify to be operational. To turn the Verify circuit on S3 should be placed to the right (factory set default). See *3.6.1 Auto Verify™* and *3.6.2 Certify Test* for descriptions of these features.

The Verify test feature is limited in use by combinations of sensor types and process temperature. Table 3-1 defines the sensor type and maximum process temperature that must be in place for the Verify circuit to be operational.

If the process temperature exceeds the maximum temperature listed in Table 3-1, the Verify test circuit must be turned off by moving S3 to the left position.

Table 3-1
Sensor Temperatures for Verify Circuit

Sensor Type	Sensor Model Number	Maximum Temperature for Verify Circuit	Maximum Temperature Sensor Can Withstand
316 SS (standard)	705-1-1, 705-1-601, 705-21-1, 705-31-1	250°F	250°F
316 SS (high temp.)	705-2-1, 705-2-601, 705-32-1	285°F	350°F
Hastelloy C (standard)	705-1-5	250°F	250°F
Hastelloy C (high temp.)	705-2-5	285°F	350°F
PFA	705-1-6, 705-1-306	160°F	250°F

3.6.1 AutoVerify™

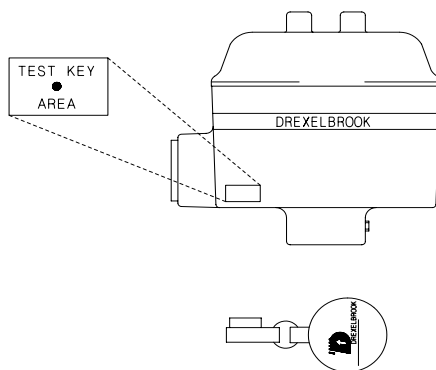
Auto Verify™

The VeriGAP II instrument is equipped with a self check circuit that tests the operational integrity of the switch every five seconds. If the switch is operating properly, the AutoVerify circuit shuts off and waits five seconds to test the switch again. If the test determines that the switch is not functioning properly, the unit goes into fault current condition (see *section 3.3 Fault Output Selection* for fault current specifications).

3.6.2 Certify Test

—Manual Certify

The VeriGAP II instrument is also equipped with a Certify test circuit. This feature allows an operator to certify that the AutoVerify™ test is being performed correctly. This will simulate an alarm and check the entire control loop (including valves, pumps, interlocks, etc.) 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 (see *section 3.3 Fault Output Selection* for fault current specifications).



Simulating a high level with the Certify 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 VeriGAP II switch operates successfully upon applying power to the unit. No further configuration or adjustments are necessary.

SECTION 4

TROUBLESHOOTING The 504-3200 Ultrasonic VeriGAP II™ Switch is a solid-state device with no moving parts. It requires no maintenance or adjustments after initial set-up. 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). Connect a milliammeter in series with the current loop and monitor the loop current. With the unit switched to high level failsafe and the sensing element in liquid, the loop current should be 8 mA (16 mA optional). If this does not occur, remove the equipment from the process for visual inspection.

- Check to see that the gap is not plugged by process material.
- Clean if required.
- Repeat the dip test.
- If no change occurs in loop current, the instrument has failed.

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.
- 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.

SECTION 5 FACTORY AND FIELD SERVICE

5.1 Factory Service Assistance

If you are experiencing difficulty with your Drexelbrook equipment and attempts to locate the problem have failed:

- contact your local Drexelbrook representative,
- call the Service department toll-free at 1-800-527-6297 (in US and Canada) or 1-215-674-1234 (International),
- fax the following information to the Service department at 1-215-674-5117.

To expedite assistance, please provide the following information:

Instrument Model Number _____

Sensing Element Model Number and Length _____

Coax Cable Length (remote systems) _____

Original Purchase Order Number _____

Material being measured _____

Temperature _____

Pressure _____

Agitation _____

Brief description of the problem _____

Checkout procedures that have failed _____

5.2 Equipment Return

In order to provide the best service, 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.

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

**5.2 Equipment
Return
(cont.)**

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

Model Number of Return Equipment _____

Serial Number _____

Original Purchase Order Number _____

Process Materials that equipment has been exposed to _____

MSDS sheets for any hazardous materials

Billing Address _____

Shipping Address _____

Purchase Order Number 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:
DREXELBROOK ENGINEERING CO.
205 KEITH VALLEY ROAD
HORSHAM, PA 19044
COD shipments will not be accepted.

**5.3 Field
Service**

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

**5.4 Customer
Training**

Instrument Training Seminars for customers are conducted at the factory. These sessions, guided by Drexelbrook engineers and specialists, provide detailed information on all aspects of level measurement, including theory and practice of instrument operation. Contact the Training Department for further information.

**SECTION 6
SPECIFICATIONS****—Power Requirements**

13-30 Vdc

6.1 Electronics**—Power Consumption**

.5 watt at 20 mA

—Ambient Temperature

-40°F to 160°F

—Repeatability

1/16 inch

—Response Time

50 microseconds

—Fail Safe

High Level or Low Level (field-selectable)

—Housing

NEMA 1 to 4X, 5 and 12

Intrinsically Safe Explosionproof

6.2 Sensor**—Insertion Lengths**

2, 6, 12, 18, or 24 inches standard (other lengths available)

—Wetted Materials

Standard 316 SS

Optional Hastelloy “C”, Teflon

—MountingMetallic Sensors: ¾-inch NPT standard,
flange mounting available.Teflon Sensors: 1-inch NPT standard,
threaded flange mounting
available.Seal Tyte™ Sensors: Flange mounting only,
1-inch minimum flange**Process Temperature**

-40°F to 250°F

Process Pressure

1000 psi maximum, metallic sensors

50 psi maximum, Teflon sensors

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