

DREXELBROOK  
Engineering Company

# RF Level and Flow Controls

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## **Installation and Operating Instructions**

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**for**

**303-100-122**

**Car Loading On/Off Control System**

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## 1.0 INTRODUCTION

### 1.1 Purpose and Use

The instructions in this manual apply to the Drexelbrook 303-100-122 On/Off Car Loading Level Control System.

Basically, this instrument is a precision electronic capacitance to relay operation transducer that normally is not affected by build up or coating of material on the sensing probe. The instrument will provide relay operation when the material within the tank reaches a pre-set point on the probe. The DPDT relay uses one set of contacts to activate the annunciator; the second set of controls is available for customer use.

The required change of input capacitance is provided through the probe which is mounted in or near the material being measured. Drexelbrook 380 series cable transmits the change of capacitance signal from the probe to the electronic unit. The Car Loading System seen in the Figure 1 consists of :

1. On/Off Electronic Unit 406-6000-E
2. Junction Box/Variable Setter and Push to Test

The Push to Test unit provides a self-test function. Pushing the test button places a test condition on the probe. This condition simulates at the probe the effect of the material. For an operating system, pushing the test button causes the system to trip to its alarm state. For a properly calibrated system this test will operate satisfactorily only when the probe is connected. The test thus shows a probe fault as well as inoperative electronics.

The variable Setter mounted in the Junction Box allows the option of moving the System Trip Point up and down the length of the Sensor by rotating the Setter Dial in conjunction with the range switch setting.

The On/Off electronic unit contains the relay, power supply and the electronics sensitive to the probe signal.

## 1.2 Electrical Specifications

All On/Off electronic units are housed in explosion proof housings. The Junction Box assembly and the Push to Test are associated with the intrinsically safe probe circuitry and are housed in weatherproof enclosures.

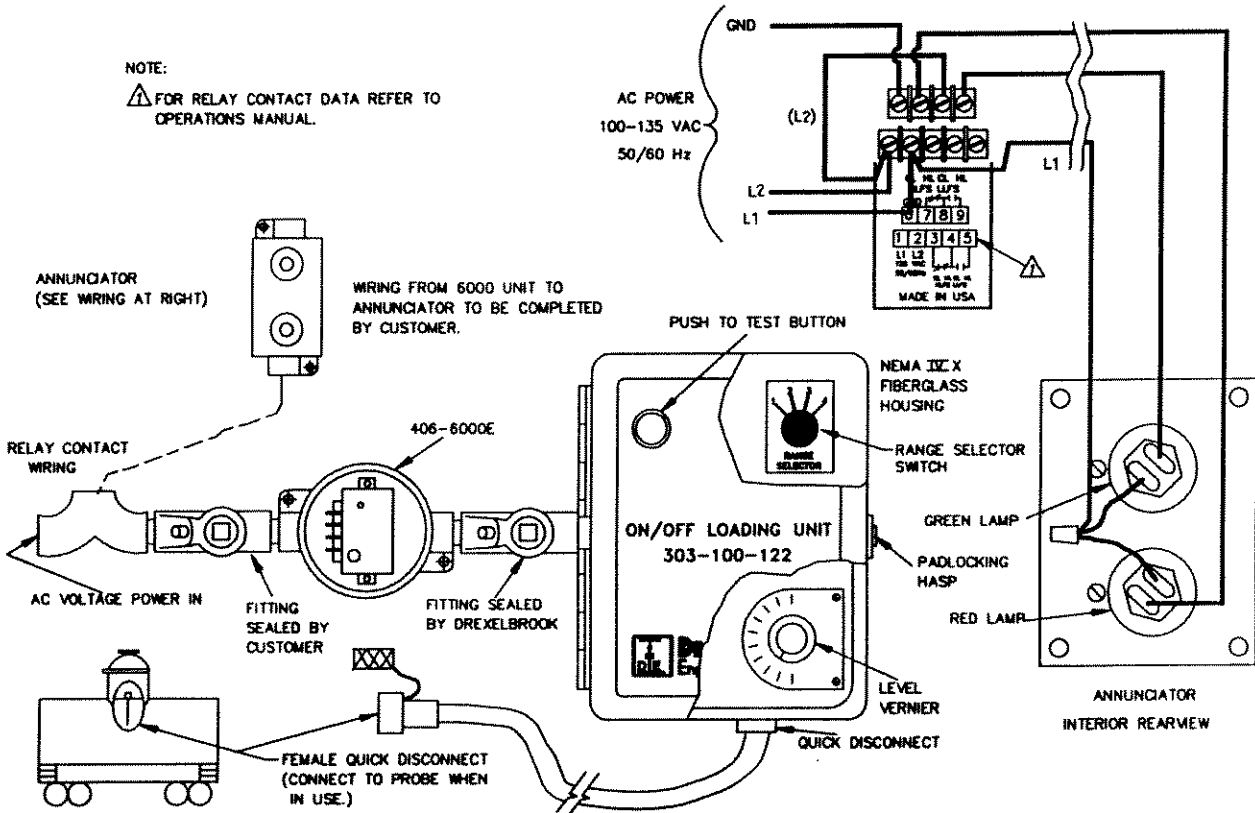
- Power requirement -  
120 VAC  $\pm$  20 VAC 50/60 Hz (6 watts)
- Ambient Temperature -  
-40°F to +140°F recommended. The system will operate above 140°F with reduced component life.
- Sensitivity -  
0.1 pF
- Stability -  
.15 pF/30°F Operating Point  
.05 pF/30°F Sensitivity
- Output -  
Relay contact, SPDT 5A 120 VAC non-inductive, 3A inductive  
Annunciator - Green/Red Lamps
- Operating Time -  
Approximately .02 seconds
- Fail Safe -  
Field switchable, either Low Level Fail Safe (LLFS) or High Level Fail Safe (HLFS).
- Measure Cable -  
Environmentally protected cable with 10 pin quick disconnect connectors at each end. Standard length is 32 feet including a self recoil section.

## 2.0 INSTALLATION

### 2.1 Unpacking

Normally the instrument and cable are packed in the same shipping carton; the probe is packed separately.

Carefully remove the contents of the carton and check each item against the packing list before destroying any packing materials. If there is any shortage or damage, report it immediately to the **DREXELBROOK ENGINEERING COMPANY**.



SYSTEM DIMENSIONS

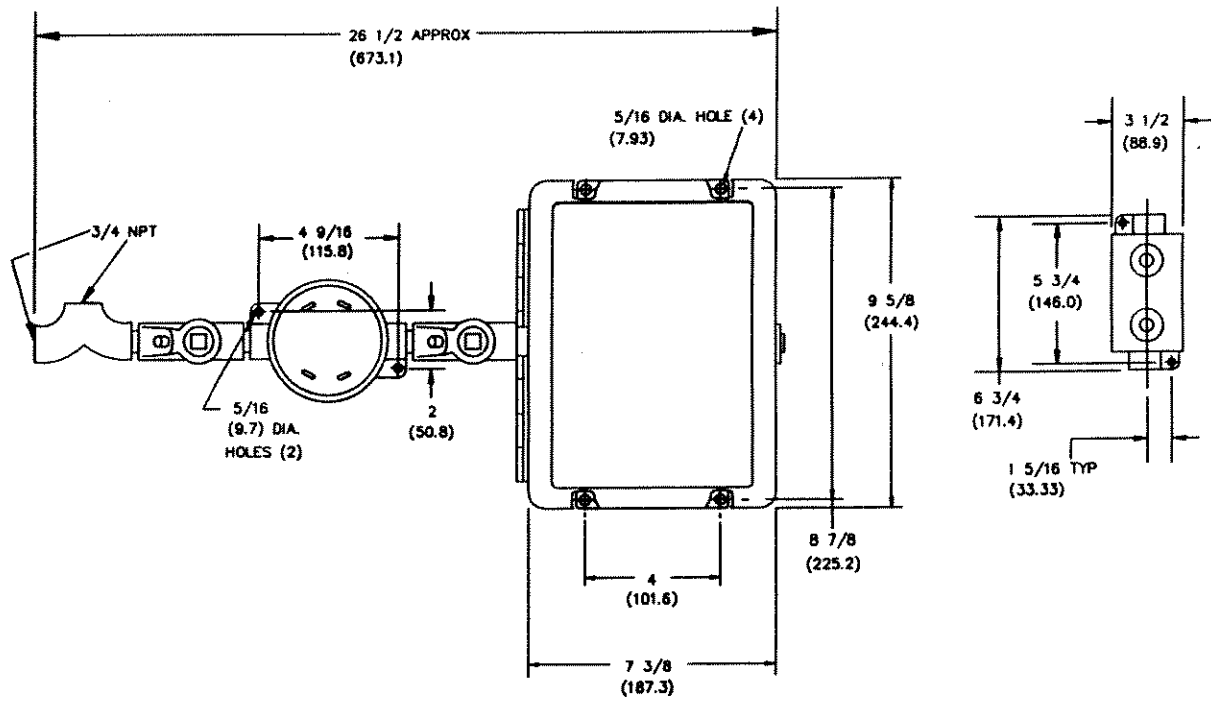


Figure 1  
 Car Loading On/Off System

## 2.2 Location

The instrument is designed for field mounting. For long life and reliable operation it is advantageous that it be mounted in a location as free as possible from vibration, corrosive atmosphere, and any possibility of mechanical damage. Ambient temperatures should be between -40°F and 140°F. For convenience of operation and calibration, it is important to locate the instrument at an easily accessed location.

## 2.3 Mounting

The electronic system may be mounted on any flat surface either vertically or horizontally. The unit sizes are shown on Figure 1.

## 2.4 Wiring

All customer connections are made to the barrier strip located on the side surface of the 406-6000 On/Off unit. See Figure 1. The barrier strip is accessed by unscrewing the conduit cover of the 406-6000 unit. All wires to the unit should be led through the seal fitting to the barrier strips. When the wiring has been completed, the seal fitting should be sealed by the customer with Chico X, or an equivalent sealing compound.

## 2.5 Cables

The radio frequency signal is carried from the Junction Box to the probe through a Quick-Disconnect coaxial cable. Only coaxial cables supplied by the **DREXELBROOK ENGINEERING COMPANY** should be used.

Care should be taken to avoid twisting the cable relative to the quick disconnect connectors. Only the collars on the connectors should be turned to make or break the cable connection.

## 3.0 OPERATION

### 3.1 General

This section contains the calibration and operating information for On/Off Car Loading Level Control Systems of the 303-100-122 System.

## 3.2 Controls

### 3.2.1 Zero Adjustment

Piston capacitor located within the 406-6000 On/Off unit. This control is accessed through the top of the unit. It is rotated using the red insulated hex nut tuning wrench supplied with the system. Turning the adjustment clockwise will raise the trip level and counterclockwise will lower the level relative to the probe tip.

### 3.2.2 Push To Test

The Push to Test push button switch is mounted to Junction Box. Depressing the switch has the effect of simulating material on the probe. When the system is calibrated, if the probe is connected, pushing the switch causes the relay to switch; indicated by a change in the annunciator lights. If the probe is disconnected, the Push to Test Switch will not cause the relay to switch. The system can be checked in the absence of a probe by simulating the probe zero capacitance with a reference capacitor of 25 pF.

### 3.2.3 Level Range Switch

The Level Range Switch, seen in Figure 1, is located in the junction box. It provides the coarse control for setting the relay set point relative to the car mounted sensor. The switch provides 4 overlapping control ranges. Position 4 represents the range of maximum outage providing a switching range (for the specified material) nearest the tip of the sensor. Similarly, position 1 represents the range of minimum outage providing a switching range nearest the top of the car and the sensor mounting.

### 3.2.4 Level Vernier Control

The Level Vernier Control, seen in Figure 1, is located in the Junction Box. It provides a fine vernier adjustment of the relay set point within the range set by the Range Switch (ref. 3.2.3). The Vernier Control is continuous providing essentially infinite resolution over its range. The vernier dial is marked in arbitrary units useful primarily

as points of reference for resetting the vernier.

### 3.2.5 Fail Safe Switch (Ref. Sec. 3.4)

The Fail Safe Switch determines whether the On/Off unit operates in the HL (High Level) or LL (Low Level) fail safe mode. The switch may be changed through its access hole located on the side of the 406-6000 unit as seen in Figure 2. Unless otherwise specified, the unit is shipped with the switch in its up High-Level Fail-Safe mode.

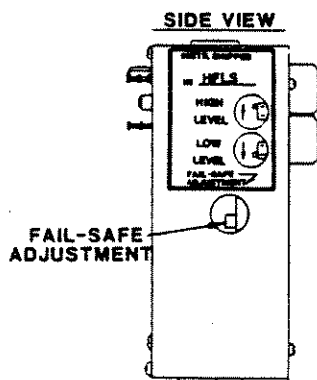


Figure 2  
Fail-Safe Adjustment

### 3.3 Start Up

Before applying power to the instrument, be sure that the input power will be 115 VAC 50/60 Hz. Check all wiring connections.

**WARNING -- EXPLOSION PROOF UNITS IN HAZARDOUS AREAS.**

Before the explosion proof housing cover is removed to calibrate the unit, the area must be checked and known to be nonhazardous.

When calibration is complete, the cover must be replaced.

Each lead from the explosion proof case must be sealed through an approved seal fitting.

### 3.4 Fail Safe

Fail Safe describes the condition under which the relay is de-energized.

High-Level Fail-Safe means the relay will de-energize under high level conditions or upon loss of power.

Low-Level Fail-Safe means the relay will de-energize under low level conditions or upon loss of power.

### 3.5 Calibration

For proper calibration, this procedure must be followed exactly; use the Insulated Tool supplied with the 406-6000 On/Off unit as shown in Figure 3.

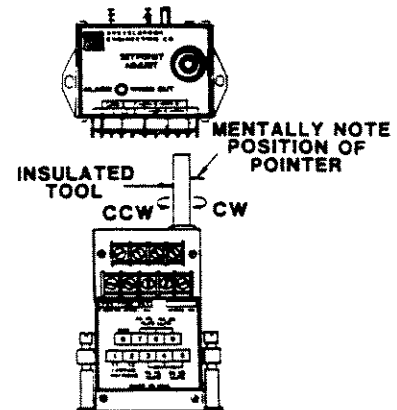


Figure 3  
Insulated Tool for Setpoint Adjustments

#### 3.5.1 Preparation

- Installation including wiring complete and probe connected.
- Variable Setter Push to Test (Junction Box) housing open.
- AREA NON-HAZARDOUS -- REMOVE CONDULET COVER FROM ON/OFF UNIT
- Material level well below probe tip, i.e., probe in air.

- e. Turn on 115 VAC power to instrument.

### 3.5.2 Adjustment

#### 3.5.2.1 Zero Calibration

If an empty car (material below the sensor tip) with mounted sensor is available, connect the sensor cable to the sensor.

- a. Set variable setter vernier dial to zero.

Set range switch to maximum outage -- position 4.

Using the Insulated Tool supplied with the 406-6000, turn the tuning adjustment to the full counterclockwise (CCW) position; refer to Figure 3. Do not force. In this position the relay should be off and the green indicator on the 406-6000 chassis should be unlit (off).

- b. Turn the tuning adjustment slowly clockwise (CW) until the green chassis indicator just lights (and the relay changes state). Turn the tuning adjustment an additional 1/4 turn clockwise (CW). The zero point is now calibrated. If setpoint is to be calibrated using actual input conditions, replace the explosion proof cover on the 406-6000 unit.

The zero may be set in the absence of a probe using a reference C-box such as Drexelbrook 401-6-81.

- a. Connect the C-box cable to the sensor cable terminals of the 406-6000. (These connections should be in parallel with the connections normally on the 406-6000 as used in the 303-100-122 loading system.)

- b. Set the C-box to a reading of 8 pF. (18 pF standing capacity plus 8 pF equals the required zero capacity of 26 pF.) (Note: This setting will be higher when using two terminal sensors.)

- c. From the fully counterclockwise setting, rotate clockwise (CW) the tuning adjustment of the 406-6000 unit until the green chassis indicator just turns on. Rotate an additional 1/4 turn clockwise (CW) from this point, the Zero point is now calibrated.

Disconnect the C-Box at this time unless it is to be also used to set the level setpoint in the absence of material. (See Section 3.5.2.2).

#### 3.5.2.2 Set Point Calibration

Calibration with Loaded Car (following zero calibration).

- a. Connect sensor cable to the sensor on a car loaded to the desired outage.
- b. With vernier dial set at zero, advance outage range switch from position 4, the position of maximum outage, toward position 1. Advance the range switch step by step until the electronic unit relay changes state. At this point, back up the range switch one step. Now move the vernier dial from zero towards 23. Stop at the position where the relay switches. Calibration is now complete.
- c. It is recommended that a record be made showing materials, outage, and instrument settings of range position and vernier position. It is also desirable to record the

corresponding capacitance obtained by a C-box substitution to produce the relay change at the calibrated setting. Refer to Sec. 3.8.2.

### 3.5.2.3 Calibration Without a Loaded Car

It is possible to calibrate the system set point using a C-box such as Drexelbrook 401-6-81 to provide a capacitance input to the system in place of the sensor and material. However, it is necessary then to know or calculate the capacity corresponding to the desired level and material. Information can be calculated at the Factory when the dielectric constant (K) and the conductivity (G) of the material is known.

**CALIBRATION IS NOW COMPLETE.**

## 3.6 Calibration of Time Delay Units

When instrument is equipped with Time Delay option, see drawing below for location of Time Delay Adjustment.

- 3.6.1 Turn Time Delay adjustment to extreme counterclockwise position (i.e. minimum time delay).
- 3.6.2 Proceed with normal calibration procedure. See Section 3.5.
- 3.6.3 After the instrument is adjusted to the desired operating point, turn the time delay adjustment clockwise until the required delay is achieved. For example, half rotation of the time delay is approximately 60 seconds.

The optional time delay adjustment is located on top of the instrument, across from the setpoint adjustment. See Figure 4. It is used to help stop an oscillating relay output due to agitation or frothing in the vessel. The standard time delay is 0-90 seconds.

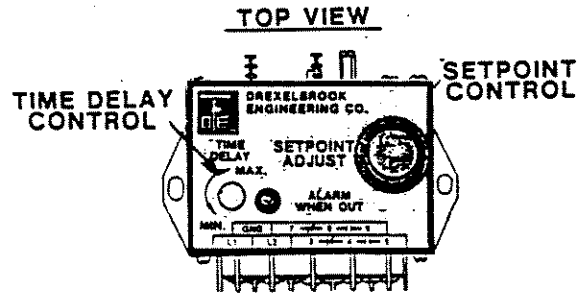


Figure 4  
Time Delay Control

The delay applies only to recovery from the alarm condition. On a High-Level Fail-Safe unit, the delay will be effective only on falling level. The output will indicate high level as long as waves continue to touch the sensing element. The unit will stop indicating high level only after the delay time has passed, with no further contact between the sensing element and the material being measured.

## 3.7 Recalibration

If initial conditions are recorded at the time of calibration, recalibration or instrument replacement is simplified. For standard systems, the Zero capacity is known and no special measurements need be made to record its value.

### 3.7.1 Zero Set Record

- a. Disconnect probe cable through quick disconnect at instrument.
- b. In place of the probe cable, connect the 401-6-81 capacitance calibration box.
- c. Adjust setting of the capacitance calibration box so that the On/Off unit just switches from low to high level. **Note:** If system contains a Variable Setter, the dial must be set at zero.



- d. Back off (reduce) setting of Capacitance Box by 1.5 pF (this is one and one half small divisions of the 401-6-8 dial).
- e. Record setting of the Capacitance Box. This value represents the zero capacitance of the system and can now be reconstituted at any time in the future for purposes of recalibration or instrument replacement.

### 3.7.2 Set Point Record

- a. Disconnect the probe cable through the Quick Disconnect connector at the instrument.
- b. Connect the 401-6-81 capacitance, calibration box to the 406-6000 unit.
- c. Adjust setting of the Capacitance calibration box so that the On/Off unit just switches from Low to High level. Note that the Setter Dial must have been previously set to its required trip level per 3.5.2.2.
- d. Record the setting of the Capacitance Box. This value represents the span on the set back of the system to provide switching at arbitrary levels along the probe. This value can be reconstituted at any time in the future for purposes of recalibration or instrument replacement.

## 3.8 Maintenance

The 406-6000 Series instruments are designed to give years of unattended service. No periodic or scheduled maintenance is required.

There are no specific spare parts that we would recommend be stocked by the user. However, if the application is critical, it is best to have a spare chassis available in the event of a component failure. In most cases, the chassis should be returned to the factory for repair.

## 4.0 BACKUP SYSTEM

### -- NOTICE --

"Drexelbrook equipment is built with great care, and subjected to rigorous quality control. Even so, failures of any equipment can and do occur. Sound engineering practice demands that, whenever equipment failure may result in more than an inconvenience, a completely independent backup system be employed such that failure of either the unit or the backup unit will not permit a hazardous condition to occur."



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