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# Installation and Operating Instructions

Series 401-3100  
Line Fail-Safe Receiver  
for  
LCT™ Two-Wire Level Control Systems

*(215) 674-1234 Outside North America*

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EDO # 7-87-249  
401-3100-LM

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Line Fail-Safe Receiver  
for  
LCT™ Two-Wire Level Control Systems

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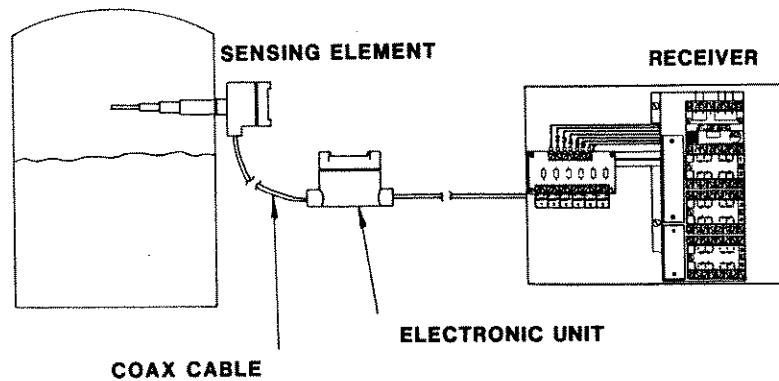
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**Fig. 1-1**  
**Typical System**

## 1.0 Introduction

The instructions in this manual are for the installation and operation of Drexelbrook Series 401-3100 Receivers, to be used with the LCT™ Series two-wire point level transmitters.

### 1.1 System Description

The LCT Series two-wire point level transmitters are precision, RF (radio frequency) operated level instruments. They provide a step change in current output when the material being measured reaches a preset point in the vessel. The transmitters output (3-11 mA in the alarm state and 14-26 mA in the normal state) can be used with the Drexelbrook 401-3100 Series receivers. See Figure 1-1.

### 1.2 Models Available

The following receivers can be used with either the LCT 506-6200 Series or the 506-6200 (91-30) Series Magi-Cal transmitters.

The 401-3100 Series relay contact receivers provide a DPDT relay output for the LCT Level Control Transmitter system. Every package includes a specified number of level channels (points) (up to 72 in groups of 6) with relay output and a power supply. See Figure 1-2.

The following receiver models are line fail-safe for opens or shorts.

401-3110-X12\*: 120/230 Vac or 24 Vdc, 12 X 14 Nema 12 housing.

401-3111-X12\*: 120/230 Vac or 24 Vdc, 12 X 14 Nema 12 housing, Intrinsically safe with barriers for C,D,E,F,G.

401-3104-X12\*: 120 Vac only, 12 X 14 Nema 12 housing, Intrinsically safe without barriers for C,D,E,F,G.

401-3310-X11\*: 120/230 Vac or 24 Vdc 19-inch EIA relay rack.

401-3311-X11\*: 120/230 Vac or 24 Vdc in, 19-inch EIA relay rack, Intrinsically safe with barriers for Groups C,D,E,F,G.

\*X Indicates number of channels, 1 through 6.

#### Additional Options

385-1-128 6-channel time delay module.

385-1-129 LED display module for 6-channel output relay conditions.

#### Other package Options

401-3XXX-XXX (modif. 91-16): Hermetically sealed relays

401-34XXX-XXX: Up to 24 points in a 24" X 24" Nema 12 housing.

401-35XX-XXX: Up to 36 points in a 72" X 24" Nema 12 cabinet.

401-36XX-XXX: Up to 72 points in a 72" X 24" Nema 12 cabinet.

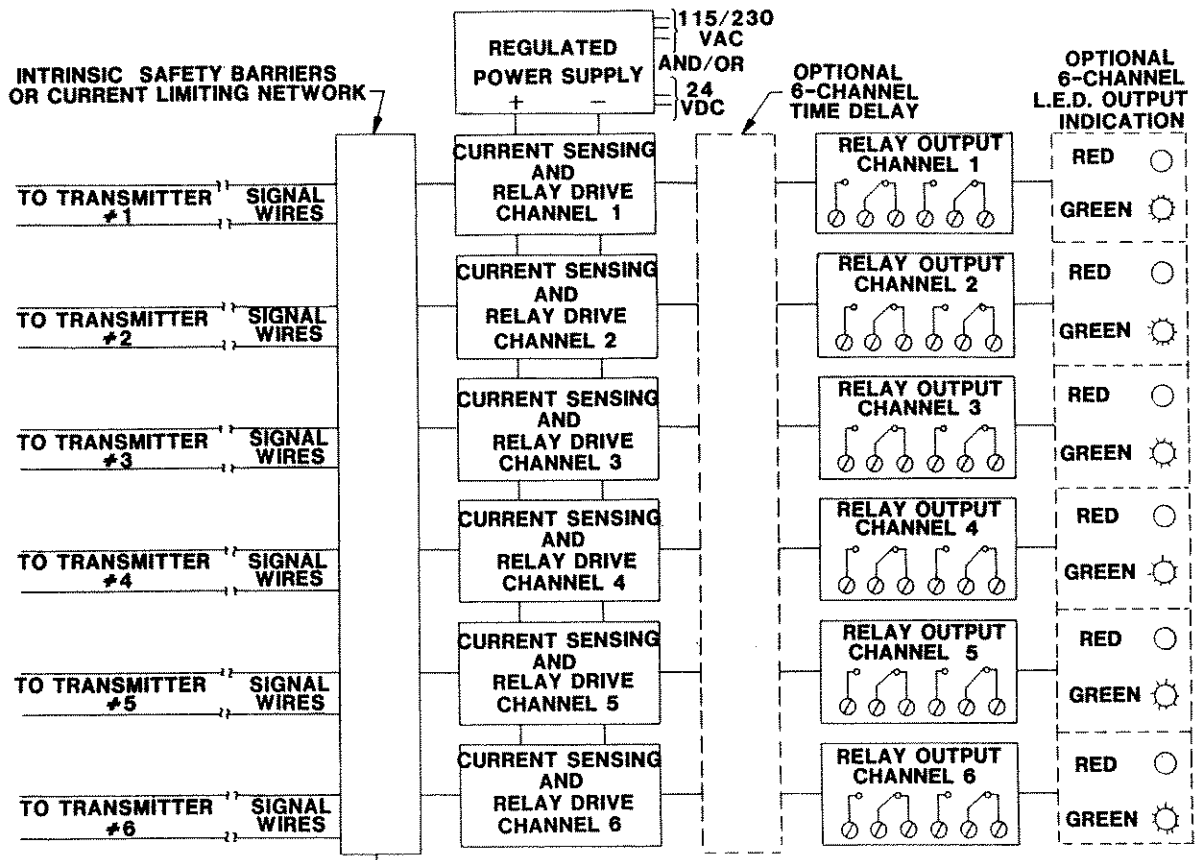


Fig. 1-2  
 Typical 401-3100 Series Receiver

## 2.0 Specifications

### A. Power Requirement -

115/230 Vac 50/60 Hz and/or 24-50 Vdc.  
18 watts max. (typical). (See Section 1.2  
for specific power combinations.)

Two sets of power input terminals may  
be provided:

D.C. Input (negative ground), 24-50 Vdc  
@ 1/2 amp. (Not available with model  
401-3104 Series.)

A.C. Input 95-145 Vac or 190-290 Vac,  
50/60 Hz.

Power input backup may be  
accomplished by providing both an A.C.  
supply and a D.C. supply. See Section  
3.3.1.

### B. Operating Temperature -

-40°F to 140°F recommended. Receiver  
will operate above 140°F, but with  
reduced component life.

### C. Level Output (DPDT Relay) - Standard:

120 Vac: 5A non-inductive,  
3A inductive

240 Vac: 5A non-inductive,  
2A inductive

24 Vdc: 5A non-inductive, 1 amp  
inductive for inductances up  
to 300 mH.

#### Optional Sealed Relay:

120 Vac: 3A non-inductive,  
2A inductive

240 Vac: 3A non-inductive,  
2A inductive

24 Vac: 1 amp for loads with induc-  
tance of 300 mH or less.

### D. Internal Power Supply -

24 Vdc supplies up to 6 channels.

### E. Intrinsic Safety

Reference 420-1-587 and 588.

# Installation

## 3.0 Installation

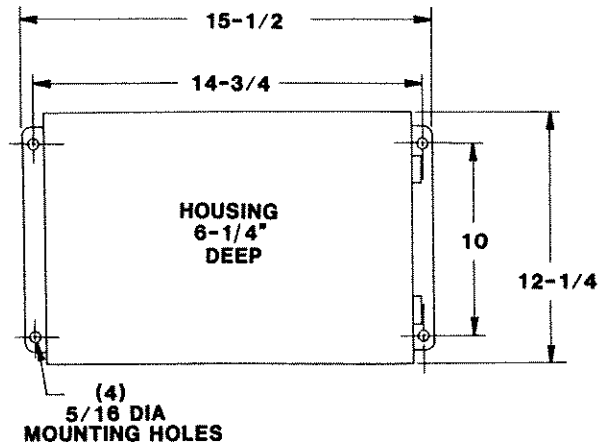
### 3.1 Unpacking

Carefully remove the contents of the shipping 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 factory.

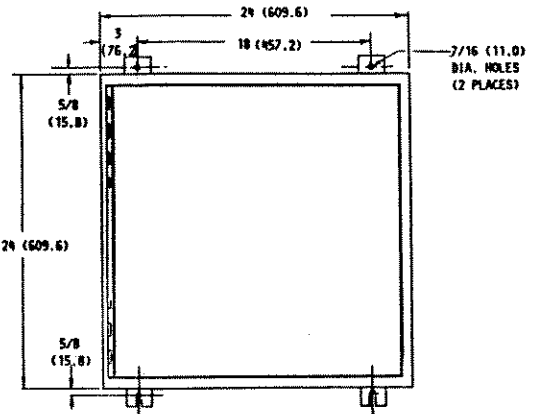
### 3.2 Mounting the Receiver Package

All Drexelbrook receiver packages are designed for mounting in the control room, particularly the rack mounted models and larger relay cabinets. However, the 12" x 14" package in a weatherproof housing and the 24" x 24" package in a Nema 4 housing may be field mounted. We recommend that they be mounted in a location as free as possible from vibration, corrosive atmospheres, and the possibility of mechanical damage.

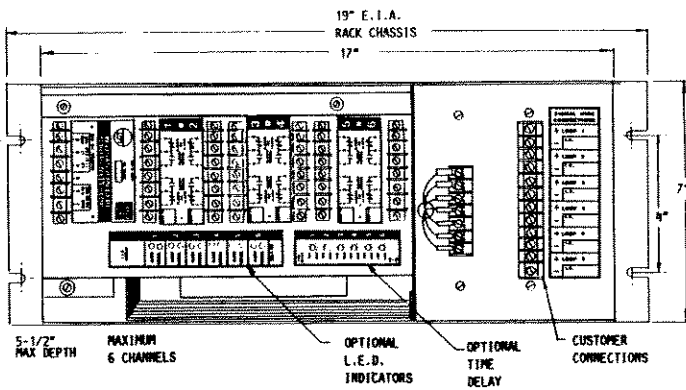
For convenience at start-up, it is best to mount the receiver package in an easily accessible location. See Figures 3-1, 3-2, 3-3, 3-4.



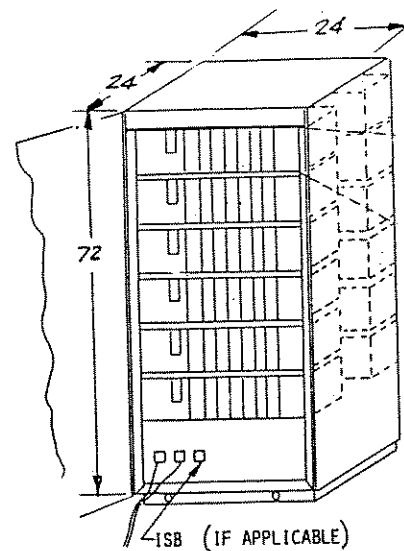
**Fig. 3-2**  
Mounting Dimensions of 401-3100 Series Receiver in 12"x14" Housing



**Fig. 3-3**  
Mounting Dimensions of 401-3100 Series Receiver in 24"x24" Housing



**Fig. 3-1**  
Mounting Dimensions of 401-3100 Receiver in 19-inch Relay Rack



**Fig. 3-4**  
Mounting Dimensions of 24"x70" Relay Cabinet

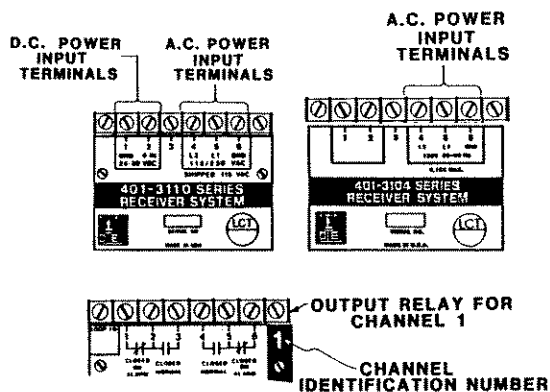


## 3.3 Wiring the 401-3100 Series Receivers

Customer wiring connections to the 401-3100 Series receivers typically include 115/230 Vac or 24-50 Vdc power wiring, signal loop wiring, and relay output wiring.

### 3.3.1 Power Wiring

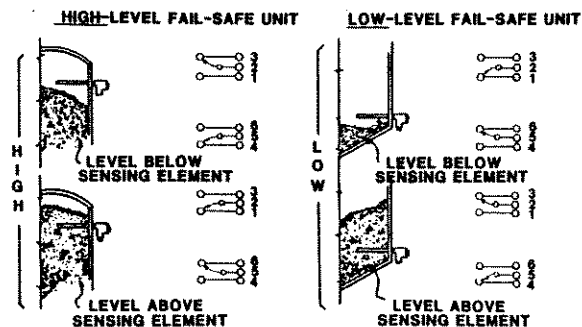
Power connections are made to the power input terminal strip, as shown in Figure 3-5. On some models connections for both "ac" and "dc" power are provided. By connecting both the 'ac' and 'dc' power source, the receiver will continue to operate with the loss of either power source. (See Section 1.2 for specific input power combinations.)



**Fig. 3-5**  
Wiring Connections Power & Relay

### 3.3.2 Relay Contact Wiring

The relays used in Drexelbrook receivers have double-pole double-throw (DPDT) contact closure. All relay connections are made to the individual terminal strips provided. See Figure 3-5. For proper contact wiring, the fail safe of the relay's transmitter must be known. See Figure 3-6 for appropriate contact closures.



**Fig. 3-6**  
Fail-Safe Relay Contact Operation

### 3.3.3 Signal Loop Wiring

The signal loops from each of the field transmitters are connected to a terminal strip at the receiver that is labeled for each of the loops provided. Each signal loop number corresponds to the same number on the appropriate relay. See Figure 3-7A&B.

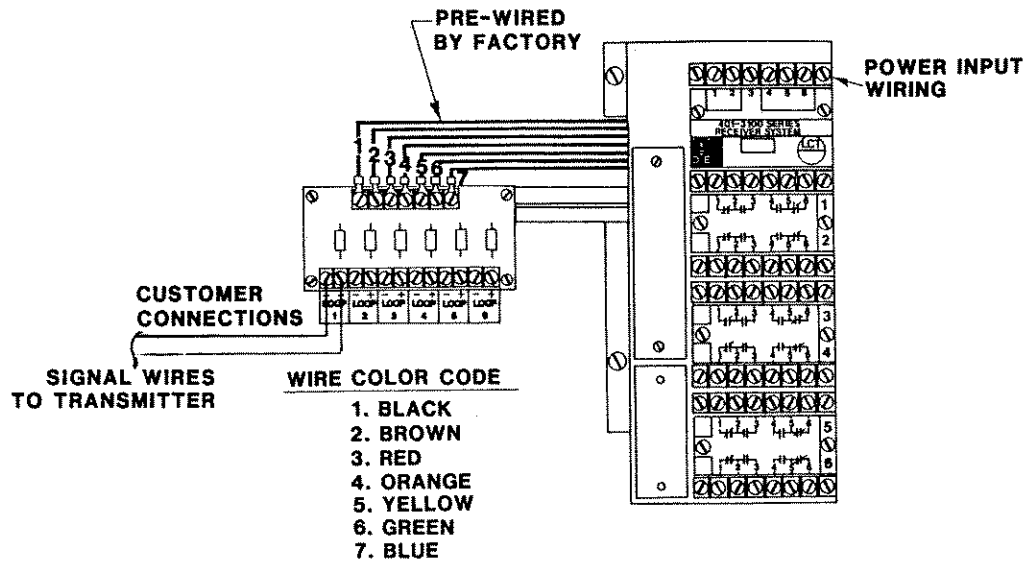
**Note:** For signal wiring and transmitters to be intrinsically safe, intrinsically safe wiring practices must be followed.

For those models that include intrinsic safety barriers, each signal loop must be connected to the field terminal of an intrinsically safe barrier (+) and at the grounded bus bar which mounts the barrier (-). The bus bar itself must be connected to a true earth ground by two conductors, each of which has one ohm or less resistance, and is wired according to intrinsically safe wiring practices. Access to the terminals is gained by unscrewing the knurled knob on the door of the barrier housing and opening the hinged door. See Figure 3-7B.

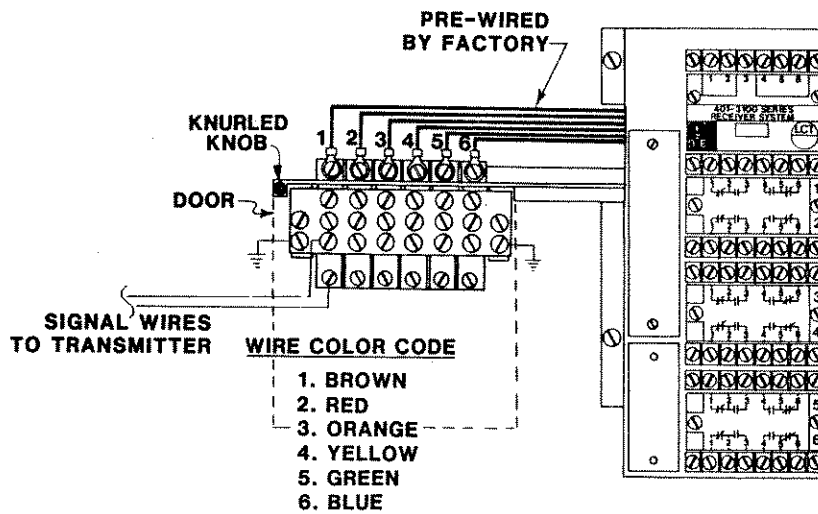
**Caution:** Before using intrinsic safety barriers, read the manufacturer's instructions for barrier operation. Barriers supplied by Drexelbrook Engineering Co., and prewired to the power supply, have already been tested for proper operation.

**Note:** Only the 401-3XX4 Series receivers are intrinsically safe without barriers. See Figure 3-7A. Although the signal wiring for this receiver is identical to other non-intrinsically safe receivers without barriers, only the 401-3XX4 Series is intrinsically safe without barriers.

# Installation



**Fig. 3-7A**  
*Signal Wiring to Unit Without Intrinsic Safety Barriers*



**Fig. 3-7B**  
*Signal Wiring to Unit With Intrinsic Safety Barriers*

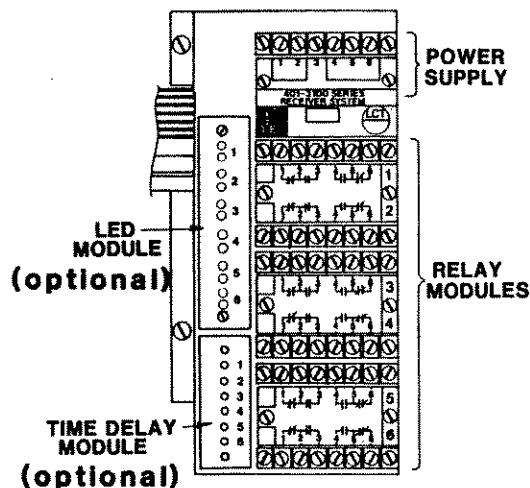
## 4.0 Operation

### 4.1 Start-up

Before applying power to the instrument, check all wiring connections. See Section 3.3.

### 4.2 Power Supply

The Drexelbrook 401-3100 Series Receivers contain a regulated 24 Vdc power supply that provides power for up to six signal loops and the processing of that signal information. The power supply's output is controlled regardless of changes in the input voltage. See Figure 4-1.



**Fig. 4-1**  
**Operating Features of 401-3100 Series Receiver**

### 4.3 Relay Output

Each of the relay contact receivers can contain up to 72 points (in groups of 6) that provide DPDT contact closure output. See Section 2.0 for contact ratings.

The relay modules in receiver models 401-3110 and 401-3111 consist of a printed circuit mounted relay, a terminal strip, and connections for the relay drive signal.

Relay modules are field changeable and can be added after purchase to increase the

number of active channels. See Figure 4-1. Optional hermetically sealed relays are available for use in Division 2 areas.

### 4.4 Line Fail-Safe Operation

The amount of current flowing in each signal loop is monitored and converted electronically to generate a relay drive signal. The relay is de-energized when the loop current indicates an alarm condition. The receiver will de-energize any relay whose loop current indicates open or shorted signal wires, thus providing "line fail-safe" operation.

### 4.5 Optional LED Display

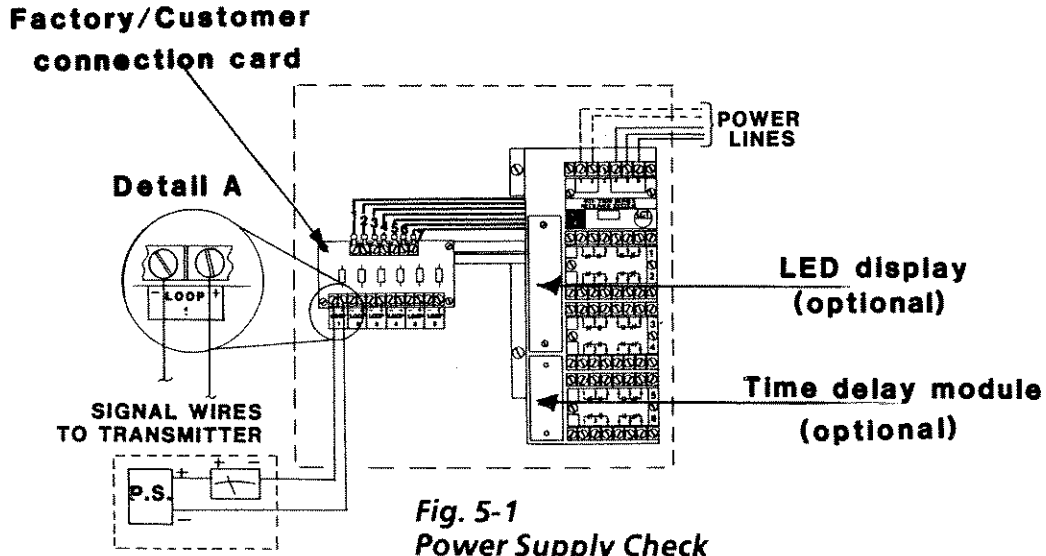
The LED output display module provides a visual indication of the "line fail-safe state" of the relays. See Figure 4-1. The standard module has both red and green LEDs for each of six channels. The green LED is lit when the relay is in the "normal" condition. The red LED is lit when the relay is in the "alarm" condition. If there are fewer than 6 channels connected to relays, the unused channels' red LEDs will be lit. The LED display module can be easily added to already installed receivers.

### 4.6 Optional Time Delay Module

The time delay module (385-1-129) provides an adjustable time delay (1 to 60 ± 10 seconds) for all of the 6 available channels. See Figure 4-1. The delay time for each channel is adjusted by using a screwdriver to turn the corresponding potentiometer. For those channels where time delay is not desired, those potentiometers should be set to the full counterclockwise position (minimum delay). Delay time is set by turning the potentiometer to the desired scale mark. If the reason for time delay is wave cycling, set the delay to the minimum value and, when cycling occurs, advance the time delay until the cycling stops.

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.

# Troubleshooting



**Fig. 5-1**  
**Power Supply Check**

## 5.0 Troubleshooting

The LCT Series Receivers are designed to give years of unattended service. No periodic or scheduled maintenance is required.

If a difficulty does occur in the operation of your receiver, the troubleshooting procedures listed here should be followed. If attempts to locate the difficulty fail, notify your local factory representative or call the factory direct and ask for the service department.

### 5.1 Testing the Power Supply

To verify proper power supply operation, measure any signal loop's voltage at the receiver where the factory and customer signal wire loop connections are terminated on the factory/customer connection card.

- A. Disconnect all positive (+) field signal wires. This will ensure that a shorted signal pair will not overload the power supply.
- B. With a voltmeter, measure the DC voltage between any pair of positive and negative terminals on the factory/customer connection card. See Figure 5-1. Voltage should equal  $22 \pm 1$  Vdc. If the voltage is out of spec., please consult the factory Service Department.
- C. With the voltmeter still connected, create a short between any pair of positive and negative terminals at the factory/customer connection card. (This is to verify operation under load conditions.) Voltage should remain at  $22 \pm 1$  Vdc. If the voltage changes, please consult the factory Service Department.

### 5.2 Testing the Relay Modules

- A. Disconnect a pair of field signal wires at the customer connection card.
- B. If the receiver includes a time delay module, set all time delays to the minimum setting.
- C. One at a time, hook up resistors of  $2000\Omega$ ,  $1200\Omega$  and  $330\Omega$  to the signal connections. Observe the relay state and/or LED indication.
- D. Compare your results with those in the chart in Figure 5-2. In case of discrepancy, please consult the factory Service Department.

RESISTOR	RELAY CONTACTS		LED LIT
	CLOSED		
2000 $\Omega$	1 & 2	5 & 6	RED
1200 $\Omega$	2 & 3	4 & 5	GREEN
330 $\Omega$	1 & 2	5 & 6	RED

**Fig. 5-2**  
**Relay Contact Operation Check**

## 6.0 Factory and Field Service Assistance

### 6.1 Telephone Assistance

If you are having difficulty with your Drexelbrook equipment, and attempts to solve the problem have failed, notify your local Drexelbrook representative, or call the factory direct and ask for the Service Department. Drexelbrook Engineering Company is located at 205 Keith Valley Road, Horsham, PA 19044. The telephone number is (215) 674-1234. To help us solve your problem quickly, please have as much of the following information as possible when you call:

Instrument Model # \_\_\_\_\_  
Probe Model # \_\_\_\_\_  
P.O. # \_\_\_\_\_  
& Date \_\_\_\_\_  
Cable Length \_\_\_\_\_  
Application \_\_\_\_\_  
Material Being Measured \_\_\_\_\_  
Temperature \_\_\_\_\_  
Pressure \_\_\_\_\_  
Agitation \_\_\_\_\_  
Brief Description of the Problem \_\_\_\_\_  
\_\_\_\_\_  
Checkout Procedures that Failed \_\_\_\_\_  
\_\_\_\_\_

### 6.2 Equipment Return

Do not return equipment without first contacting the factory for a return authorization number. Any equipment being returned must include the following information in addition to that above.

Reason for Return \_\_\_\_\_  
Return Authorization # \_\_\_\_\_  
Person to Contact at Your Company \_\_\_\_\_  
"Ship-To" Address \_\_\_\_\_  
\_\_\_\_\_

If available, please include the original P.O. # an the original Drexelbrook order # also.

To keep the paperwork in order, you must include a purchase order with returned equipment, even though it may be coming back for warranty repair. You will not be charged if the equipment is covered under warranty. Please return your equipment with freight charges prepaid. We regret that we cannot accept collect shipments.

Standard electronic units are generally in factory stock. If the application is critical, a spare electronic chassis should be kept on hand.

### 6.3 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.

### 6.4 Customer Training

Periodically, 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 Drexelbrook Engineering, Attn: Communications/ Training Group, or call direct (215) 674-1234.

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