INSTALLATION AND OPERATING INSTRUCTIONS
for the
401-500 Series Receiver
4-20mA Loop Transmitter Power Supply and Control Package

For factory service,
call toll-free 1-800-527-6297
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SECTION 1 - INTRODUCTION

1.1 Preface

This manual describes the installation and operation of the 401-500 Series Power Supply/Receiver used with Drexelbrook continuous level control systems. Section 1 includes a system description. Section 2 outlines the product specifications. Section 3 details the installation and wiring. Section 4 provides operating instructions and Section 5 gives the maintenance and troubleshooting tips. Customer service information is provided in Section 6.

1.2 Physical Description

The 401-500 Series Power Supply/Receiver is contained in either a Nema 4X or an explosionproof housing. The Nema 4X housing has a clear polycarbonate top and the explosionproof housing has an optional viewport. Relay output connections are included in the housing. The 401-500 Series relay contact receiver provides SPDT relay output for any 4-20 mA transmitter loop.

![Typical System Configurations Diagram](image)

Figure 1-1. 401-500 Single Channel Receiver
1.3 System Description

The Drexelbrook level measurement and control system is a precision RF (radio frequency) two-wire transmitter that consists of two parts: a level transmitter and a separate receiver with power supply and relay contacts. The transmitter provides a change in signal current as the material being measured changes level. The output current is monitored by a receiver that provides relay contact closure. The receiver circuitry can also provide a self-checking status monitor for loop-fault alarms.

The Drexelbrook 401-500 Series Power Supply/Receiver interfaces with the 4-20 mA output from the level controller. The Receiver converts current signals from the level control into relay contact closure for customer-supplied control devices (alarms, pump starters, valves, etc.).

**Receiver 1** Model 401-500-1 is operates as a Power Supply/Receiver with self-checking status monitor for loop fault alarms. The Receiver provides a DPDT contact for any loop fault (Loop current <3.28 mA or > 21.2 mA). The relay will de-energize while simultaneously, a yellow LED indicator will light for any loop fault condition.

**Receiver 2** Model 401-501-1 also operates as a Power Supply/Receiver with self-checking status monitor for loop fault alarms. This receiver provides a SPDT contact for any loop fault (Loop current <3.28 mA or > 21.2 mA). The relay will de-energize while simultaneously, a yellow LED indicator will light for any loop fault condition.

In addition, this Receiver has an adjustable high level alarm setpoint with an associated SPDT contact. Its alarm setpoint is adjustable over a 4-20 mA (0-100%) range with the relay operating in a high level alarm mode (relay de-energized if loop current is greater than the setpoint). The alarm setpoint also has a associated green LED indicator that lights during a normal condition.

**Receiver 3** Model 401-502-1 operates as a Power Supply/Receiver with two adjustable alarm setpoints, each with an associated SPDT contact. One setpoint will be in the high level alarm mode while the other will be in the low level alarm mode (relay de-energized if loop current is less than setpoint). Both alarm points setpoints are adjustable over a 4-20 mA (0-100%) range. Both alarm setpoints have associated green LED indicators that light during a normal condition.

**Receiver 4** Model 401-503-1 operates as a Power Supply/Receiver with one adjustable high level alarm setpoint with an associated DPDT contact. Its alarm setpoint is adjustable over a 4-20 mA (0-100%) range with the relay operating in the high level alarm mode (relay de-energized if loop current is greater than the setpoint). The alarm setpoint has an associ-
1.4 **Model Numbering**

The following receiver models are available:

- 401-500-007 120Vac Power, DPDT Fault
- 401-500-008-1 120Vac Power, DPDT Fault with Digital Loop Meter
- 401-501-007 120Vac Power, SPDT Fault and SPDT Alarm
- 401-501-008-1 120Vac Power, SPDT Fault and SPDT Alarm with Digital Loop Meter
- 401-502-007 120Vac Power, (2) SPDT Alarms
- 401-502-008-1 120Vac Power, (2) SPDT Alarms with Digital Loop Meter
- 401-503-007 120Vac Power, DPDT Alarm
- 401-503-008-1 120Vac Power, DPDT Alarm with Digital Loop Meter

**Standard Features:**

- LED indication of relay conditions.

**Accessories:**

- Digital Loop Meter
SECTION 2 - SPECIFICATIONS

A. Power Requirement
   120 or 240 Vac 50/60 Hz

B. Power Consumption
   4 watts maximum (typical)

C. Internal Power Supply
   Provides loop power for transmitter
   Terminal voltage is 17.7-23V, depending on output (4-20mA).

D. Contact Rating
   SPDT or DPDT depending on selected options.
   120 Vac: 5A non-inductive,
      3A inductive
   230 Vac: 5A non-inductive
      2A inductive

E. LED Indication
   Green: Normal when lit.
      Alarm when out.
   Yellow: Fault/Malfunction when lit.
      (Less than 3.5mA)
      (Greater than 21mA)
   Note: LEDs are visible through standard Nema 4X housing or optional viewport
         on explosionproof housing.

F. Intrinsic Safety
   Signal wires to transmitter are intrinsically safe as follows:
   Optional package with separate entity approved barrier:
   Class I, Groups C, D, and Class II Groups E, F, G, Div. 1.

G. Housing
   Nema 4X (5" x 5")
   Nema 4X (5" x 7")
   Explosionproof for Class I Groups A, B, C, D, and Class II, Groups E, F, G,
   Division 1 or 2.
SECTION 3 - 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 to the factory immediately.

3.2 Mounting the Receiver

Drexelbrook Receiver packages are designed for mounting in the control room. However, either of the packages (Nema 4X or explosionproof) may be field-mounted. It is recommended that the receiver be mounted in a location as free as possible from vibration, corrosive atmospheres, and the possibility of mechanical damage. For start-up convenience, it is best to mount the receiver in an easily-accessible location. Figure 3-1 gives the mounting dimensions of the 401-500 Receiver.

3.3 Wiring the Receiver

Customer wiring connections to the 401-500 Receiver typically include 120 Vac or 240 Vac 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 3-2 through 3-9. Connections for the ac power source, alarm and fault relays are provided on a common 9-terminal strip.

1) Connect the hot wire (black) to terminal 1.
2) Connect the neutral wire (white) to terminal 2.
3) Connect the ground wire (green) to terminal 3.

3.3.2 Signal Loop Wiring

The field transmitter signal loop is connected to a terminal strip at the receiver. Refer to Figures 3-2 through 3-9 for signal wiring and Figure 3-10 for signal wiring with intrinsic safety barriers.
Figure 3-1. Mounting Dimensions, Explosionproof and NEMA 4X Housings
NOTES:
1. AT 20mA LOOP CURRENT, VOLTAGE DROP ACROSS DLM TERMINALS = 1.6 VOLTS.
2. FACTORY STANDARD CALIBRATION FOR DLM PROVIDES 0–100% READING FOR 4mA–20mA CURRENT.

STATUS CHART

<table>
<thead>
<tr>
<th>RECEIVER STATE</th>
<th>FAULT L.E.D. (YELLOW)</th>
<th>LOOP CURRENT (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL</td>
<td>OFF</td>
<td>3.28 ≤ I ≤ 21.20</td>
</tr>
<tr>
<td>LINE FAULT</td>
<td>ON</td>
<td>I &lt; 3.28, I &gt; 21.20</td>
</tr>
</tbody>
</table>

Figure 3-3. 401-500-008 Power, Signal, and Fault Wiring with Digital Loop Meter
Figure 3-4. 401-501-007 Power, Signal, Alarm, and Fault Wiring
401-501-008-1

RELAY CHART

ALARM RELAY
NORMAL 7 8 9
ALARM 8 9

FAULT RELAY
NORMAL 4 5 6
FAULT 5 6

TOP VIEW
POWER IN
RELAY CONNECTIONS (SEE CHART)

SIDE VIEW
(+)  (+)
(-)  (-)

ALARM SETPOINT
ADJUSTMENT

ALARM LED
ALARM WHEN OUT
NORMAL WHEN LIT

SPAN ADJUSTMENT
CONTROL (DLM)

FAULT LED
NORMAL WHEN OUT
FAULT WHEN LIT

ZERO ADJUSTMENT
CONTROL (DLM)

ALARM SETPOINT ADJUSTMENT

<table>
<thead>
<tr>
<th>PERCENT</th>
<th>MILLIAMPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.0</td>
</tr>
<tr>
<td>20</td>
<td>7.2</td>
</tr>
<tr>
<td>40</td>
<td>10.4</td>
</tr>
<tr>
<td>60</td>
<td>13.6</td>
</tr>
<tr>
<td>80</td>
<td>16.8</td>
</tr>
<tr>
<td>100</td>
<td>20</td>
</tr>
</tbody>
</table>

OUTPUT CHART

<table>
<thead>
<tr>
<th>RECEIVER STATE</th>
<th>ALARM L.E.D. (GREEN)</th>
<th>FAULT L.E.D. (YELLOW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ALARM</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>LINE FAULT</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

NOTES:
1. AT 20mA LOOP CURRENT, VOLTAGE DROP ACROSS DLM TERMINALS = 1.6 VOLTS.
2. FACTORY STANDARD CALIBRATION FOR DLM PROVIDES 0–100% READING FOR 4mA–20mA CURRENT.

Figure 3-5. 401-501-008 Power, Signal, Alarm and Fault Wiring with Digital Loop Meter
Figure 3-7. 401-502-008 Power, Signal, and Alarm Wiring with Digital Loop Meter
Figure 3-8. 401-503-007 Power, Signal, and Alarm Wiring
Figure 3-9. 401-503-008 Power, Signal, and Fault Wiring with Digital Loop Meter

NOTES:
1. AT 20mA LOOP CURRENT, VOLTAGE DROP ACROSS DLM TERMINALS = 1.6 VOLTS.
2. FACTORY STANDARD CALIBRATION FOR DLM PROVIDES 0–100% READING FOR 4mA–20mA CURRENT.

ALARM SETPOINT ADJUSTMENT

<table>
<thead>
<tr>
<th>PERCENT</th>
<th>MILLAMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.0</td>
</tr>
<tr>
<td>20</td>
<td>7.2</td>
</tr>
<tr>
<td>40</td>
<td>10.4</td>
</tr>
<tr>
<td>60</td>
<td>13.6</td>
</tr>
<tr>
<td>80</td>
<td>16.8</td>
</tr>
<tr>
<td>100</td>
<td>20.0</td>
</tr>
</tbody>
</table>

OUTPUT CHART

<table>
<thead>
<tr>
<th>RECEIVER STATE</th>
<th>ALARM L.E.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL</td>
<td>ON</td>
</tr>
<tr>
<td>ALARM</td>
<td>OFF</td>
</tr>
</tbody>
</table>
Intrinsically safe wiring practices must be followed for signal wiring and transmitters to qualify as intrinsically safe.

**NOTE**

For the 401-500 models that need 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 (1) ohm or less resistance, and is wired according to intrinsically safe wiring practices.

**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.
3.3.3 Relay Contact Wiring

Relay connections are made to the terminal strip provided in each unit, as shown in Figure 3-2 through 3-9 respectively. For proper contact wiring, the fail-safe level of the transmitter should be determined. See Figure 3-2 through 3-9 for appropriate contact closures.
SECTION 4 - OPERATION

4.1 Start-Up

Before applying power to the receiver, check all wiring connections as outlined in paragraph 3.3.

4.2 Power Supply

The 401-500 Receiver contains a regulated 24 Vdc power supply that provides power for the signal loop and the processing of that signal information. The power supply’s output is controlled regardless of changes in the input voltage.

4.3 Relay Output

The 401-500 Receiver contains 2 relays that provide contact closure output for level alarms and a fault alarm.

4.4 Line Monitoring Operation
   (Fault/Malfunction)

The following receivers have a fault relay: 401-500-007  401-500-008  401-501-007  401-501-008

The receiver de-energizes the fault relay when the loop current indicates open or shorted signal wires, thus providing line monitoring operation.

4.5 LED Indication

LEDs provide a visual indication of the relay status. The green LED is lit when the alarm relay is in the “normal” condition. The green LED is off (not lit) when the relay is in the “alarm” condition. The yellow LED is lit when a “fault” condition exists, i.e., open or shorted signal wires.

Table 4-1 summarizes the LED states and the respective operating conditions.

<table>
<thead>
<tr>
<th>ACTIVATED LED STATE</th>
<th>OPERATING CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green ON</td>
<td>Normal</td>
</tr>
<tr>
<td>Green OFF</td>
<td>Level Alarm (some models)</td>
</tr>
<tr>
<td>Yellow</td>
<td>Fault (some models)</td>
</tr>
</tbody>
</table>

Table 4-1. LED Display States
SECTION 5 - MAINTENANCE

5.1 Troubleshooting

The 401-500 Power Supply/Receiver is 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, use the troubleshooting procedures listed below. If attempts to locate the difficulty fail, notify your local factory representative or call the factory direct at 1-800-527-6297.

5.1.1 Testing the Power Supply

To verify proper operation of the power supply, measure any signal loop's voltage at the receiver where the factory and customer signal wire loop connections are terminated on the terminal strip. Refer to Figure 5-1.

a. Disconnect the positive (+) field signal wire. This ensures that a shorted signal pair does not overload the power supply.

b. With a voltmeter, measure the dc voltage between the positive and negative terminals on the terminal strip. Voltage should be 22-25 Vdc. If the voltage is out of range, please consult the factory Service Department.

5.1.2 Testing the Relay Modules

a. Disconnect the field signal wires on the terminal strip.

b. Connect either a current sink (0-25 mA) or potentiometer with a loop meter to signal wire connections. Potentiometer should cover adjustment range from 500 to 2500 ohms.

c. Where applicable, turn setpoint adjustments on Power Supply to 50% setting.

d. Use current sink or potentiometer to adjust Power Supply output current to levels shown in column 1 of Table 5-1.

e. Use table for appropriate Power Supply model to check LED and relay contact output conditions. Any discrepancies, please consult factory.
**Figure 5-1. Power Supply Check**

<table>
<thead>
<tr>
<th></th>
<th>401-500</th>
<th>401-501</th>
<th>401-502</th>
<th>401-503</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Supply Current</strong></td>
<td>Yellow LED</td>
<td>Relay Contact Closed</td>
<td>Yellow LED</td>
<td>Green LED</td>
</tr>
<tr>
<td>2 mA</td>
<td>ON</td>
<td>4-5 7-8</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>6 mA</td>
<td>OFF</td>
<td>5-6 8-9</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>16 mA</td>
<td>OFF</td>
<td>5-6 8-9</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>22 mA</td>
<td>ON</td>
<td>4-5 7-8</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Table 5-1. Power Supply Check**
SECTION 6 - FACTORY AND FIELD SERVICE

6.1 Telephone Assistance

If you are experiencing difficulty with Drexelbrook equipment, and attempts to solve the problem have failed, notify the local Drexelbrook representative, or call the factory service department direct using the toll-free number (1-800-527-6297). Drexelbrook Engineering Company is located at 205 Keith Valley Road, Horsham, PA 19044. To help solve your problem quickly, please have the following information available:

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. # and the original Drexelbrook order # also.
To keep the paperwork in order, include a purchase order with returned equipment, even though it may be coming back for warranty repair. There will be no repair charge if the equipment is covered under warranty. Please return your equipment with freight charges prepaid. Collect shipments cannot be accepted.

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 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. 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.