Installation and Operating Instructions

Series 508-45-X37
CheckWell D8™
Level Monitor System
using 408-8200 Electronics

(Use this manual in conjunction with 408-8200-LM)
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CheckWell D8™
Level Monitor System
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Section 2 - Installation

2.1 Unpacking

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

**CAUTION**
Protect the insulation from cuts and abrasions during the installation process. A cut in the insulation may cause inaccurate readings or possible system failure.

2.2 Types of Well Gage Installations

The flexible sensing element may be installed in a space between the column (string, drop pipe) and the casing or it may be installed in a plastic or metal gage sounding tube (stilling well). For monitoring wells, the sensing element may be installed in the well or in a gage tube. Refer to Figure 2-1.

A gage tube makes it easier to insert or remove a sensing element when the well is not straight or the insertion area is limited. (Sensing Element rarely needs to be removed.)

Paragraph 2.2.1 describes installing the sensing element between column and casing. Paragraph 2.2.2 describes installing sensing element in a monitoring well. Paragraph 2.2.3 describes installing sensing element in a gage tube and gage tube details.

Additional grounding may be required. See Paragraph 2.3.

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2.2.1 Sensing Element Mounted "Free-Hanging" Between Casing Column and Casing

To install the sensing element "free-hanging," a minimum clearance of 3/4" is required between the casing and the column. If the casing and column are not straight, more clearance may be required. If a well is very deep, adequate clearance is critical to the installation. Refer to Figure 2-2 for installation details.

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**Figure 2-2**
"Free-Hanging" Sensing Element Mounted in a Pumped Well

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**Figure 2-1**
Types of Well Gage Installations
2.2.2 Sensing Element Mounted in Monitoring Well

A sensing element that is mounted in a monitoring well is installed as “free-hanging”, described in paragraph 2.2.1. See Figure 2-3.

Figure 2-3
Level Sensor Mounted “Free-Hanging” in a Monitoring Well

2.2.3 Sensing Element Mounted in a Gage Sounding Tube

If well is not straight and/or sensor clearance is tight, sensing element installation is easier with a gage tube. Standard sensing element requires a 3/4” or larger I.D. pipe tubing.

NOTE
A separate gage tube or access should be available for sounding the well.

2.2.3.1 Sensing Element Mounted in a Plastic Gage Sounding Tube

Plastic gage tubes may be made from rigid pipe or flexible tubing. Tube couplings should be used to insure coupling I.D. is not less than the tube I.D.

For ease of installation, the plastic gage tube should be installed at the same time as the pump column. Try to assemble and attach the tube so that its joints fall just below the couplings on the discharge line. Tape or strap tubing to column. See Figure 2-4.

Figure 2-4
Level Sensor Mounted in a Gage Tube

CAUTION
Gage tube should always extend below sensing element weight.

A pin may be used at bottom of tube to prevent sensor from falling through tube. See Figure 2-5.

Figure 2-5
Gage Tube Bottom Stop

The bottom of the gage tube should be located above or below the intake zone so that water can not be sucked out of the tube.
If end of gage tube is in intake zone, plug end of tube and add 1/2" holes every 6" in this zone. See Figure 2-6.

Figure 2-6
Gage Tube Ending in Intake Zone (Not Recommended)

If the gage tube is installed with the column in place, put a tapered end cap on the bottom section. Using this method, the chamber can slide by the couplings on the discharge line as it is lowered into the well. See Figure 2-7. This is not recommended for deep wells or when clearance is tight.

Figure 2-7
Installing a Gage Tube with Columns in Place

Top of gage tube may be bent underneath gage tube opening in head or brought through head. A 3/4" NPT coupling should be put on top of gage tube, and vent holes added if top of gage tube is brought through. Vent holes should be underneath head for artesian wells. See Figures 2-8 and 2-9.

Figure 2-8
Positioning Gage Tube Brought Through Head

Note: Entire tube may require perforation. See Paragraph 2.3, Grounding.

2.2.3.2 Sensing Element in a Metal Gage Tube

Sensing element may be installed in a metal gage tube. Standard sensing elements fit into 3/4" or larger tubes. Special sensing elements are required for 1/2" gage tubes. See Figure 2-4.

This eliminates the need for additional grounding (Paragraph 2.3). If metal gage tube ends in intake zone, see Figure 2.6.
2.2.3.3 Sensing Element in a PVC Coated Galvanized Gage Tube

The sensing element can be installed in a grounded 3/4" I.D. or larger flexible PVC-coated galvanized gage tube. This type of tube can only be used if water will not attack a galvanized surface.

2.2.3.4 Well with Column Positioning Ring.

If well has a positioning ring, this makes it difficult to install level gage. A gage tube is recommended for entire length of sensor. If a partial gage tube is used, the bottom of the tube must be flared to allow removal of sensing element. See Figure 2-10.

![Figure 2-10 Well with Positioning Ring and Partial Gage Tube](image)

2.3 Grounding the Sensing Element

A Check Well system requires a good ground. If the sensing element is "free-hanging", directly facing a metal casing or column, or is installed in a metal or PVC coated galvanized gage tube, further grounding is not required.

However, when the sensing element is installed in a plastic gage tube, or when the casing or column is plastic or plastic-lined, additional grounding is required.

There are two methods available to obtain an adequate ground in a plastic gage tube:

a) a ground wire, Paragraph 2.3.1
b) perforating the entire plastic gage tube, Paragraph 2.3.2

See Paragraph 2.3.3 for special grounding situations.

**NOTE**

When sensing element is in a plastic gage tube, a ground connection to motor is not adequate.

2.3.1 Installing a Ground Wire

A ground wire can be hung parallel to the entire sensing element. For 3/4" gage tubes the ground wire should be bare 1/8" OD, flexible twisted wire, 302, 304, 316 SS or Monel, as required. For larger than 3/4" OD gage tubes, 1/8" or larger ground wire should be used. For 1/2" gage tubes a smaller sensing element and special ground wire is required.

2.3.1.1 Ground Wire in Plastic Gage Tube

Wire must have method of positioning bottom so it will not wrap around sensing element. Drexelbrook furnishes an assembly consisting of a wire, weight and "anchor clip". If this ground wire is not received with equipment, order part #722-538-40. See Figure 2-11.

A union with vent holes is recommended to get ground wire from well to ground connection on the sensing element. See Paragraph 2.4.1.

![Figure 2-11 Ground Wire in Plastic Gage Tube](image)
2.3.1.2 Ground Wire in Plastic/Plastic Lined Monitoring Well

Ground wire with a weight may be used. Wire must be mounted through separate opening in opposite side of well from sensing element. See Figure 2-12.

2.3.2 Perforating the Plastic Gage Tube

An alternate to using a ground wire would be to perforate the entire length of the plastic gage tube with 1/2" holes every 6 inches. See Figure 2-13.

2.3.3 Special Grounding Requirements

There are installation conditions in metal cased wells where the sensing element mounting is not electrically grounded to the water.

1. Sensing element mounted on plastic coupling
2. Sensing element mounted on plastic head.

In either case it is necessary to run a jumper wire from some metal that is in contact with water -- the metal head, the metal column or the metal casing. See Figures 2-14 and 2-15.
2.4 Mounting Options

The sensing element may be mounted using a:

a) 3/4" NPT (standard)
b) union (recommended option) Figure 2-16.
c) flange (option)
d) swivel union (option) Figure 2-17.

Figure 2-18 shows a standard NPT and optional flange mount.

2.4.1 Union Mounting

A union or flange mount eliminates the need to turn the sensing element and spacers as the mounting thread is being screwed on or off. Hence, a union makes sensing element installation and removal much easier. A union must be used when sensing element is installed in a plastic tube with a ground wire.

A union part #242-7-66 purchased from Drexelbrook provides two vent holes. One hole is for venting when the sensing element is mounted directly on the gage tube. The second hole may be used to bring out the ground wire. See Figure 2-16.
2.4.3 Mounting a Unit with a Digital Loop Meter

If the electronic unit is furnished with an integral meter and digital indicator, the meter must be pulled out and mounted on the outer stud. The furnished jumper should be connected to the center pin. Refer to DLM4000 Instruction Manual for detailed installation instructions.

2.5 Installing the Sensing Element in the Well

**CAUTION**

Protect the insulation from cuts and abrasions during the installation process. A cut in the insulation may cause inaccurate readings or possible system failure.

See Figure 2-18 for a description of the sensing element.

The bottom of the active section must be at or below lowest measuring point. Zero point can be adjusted above bottom of active section. Bottom weight is inactive.

If sensing element is not in a gage tube (pumped wells) weight should not be in the intake zone. It can be above or below intake zone. See paragraph 2.2.3.1.

Determine if sensing element is the correct length. If not see paragraph 2.6, Field Shortening.

If union is to be used, install union on sensing element as shown in Figure 2-19.

**Note:** If electronic unit is furnished with integral meter with display, the unit housing is slightly larger. The swing radius is 5 inches.

**Figure 2-19**

Installing Union with Vent Holes

Install spacers every 4 feet by snapping on the flexible cable. See Figure 2-20. Set spacer on a firm surface with the cavities facing up. Push wire into cavity. If ground wire is to be used, align spacers so that cavities are in a line, as described in Paragraph 2.5.4 and Figure 2-22.

**Figure 2-18**

700-5-34 Sensing Element
2.5.1 Installing "Free-Hanging" Sensing Element Between Casing and Column.

a. Insert weight into opening and allow to drop. If weight catches, raise sensing element slightly and allow weight to drop until cable is fully extended. Do not "push" wire down the well.

b. Tighten NPT, union or flange.

c. Sensing element is now installed.

2.5.2 Installing Sensing Element in Metal or Fully Perforated Plastic Gage Tube.

Follow instructions in 2.5.1.

2.5.3 Installing Sensing Element in PVC-Covered, Flexible Metal (Galvanized) Gage Tube.
(See Figure 2-21.)

a. Remove well cover.

b. Cut one end of conduit square.

c. Attach PVC coupling (A) on bottom of flexible tube (B). Use PVC primer on mating parts, then affix with PVC cement.

d. Insert flexible conduit in well.

e. Insert Seal-Tyte fitting (C) near top of tube. Position just under well head cover.

f. Feed tube through bottom of well head cover. Tighten Seal-Tyte fitting and reset cover.

g. Slip mounting plate (D) over conduit.

h. Mount lower 2 part of union (E) on to Seal-Tyte fitting.

i. Mount upper part of union to sensing element.
j. Attach (push) spacers to sensing element (1 every 4 feet.)

k. Feed sensing element into tube.

l. Tighten union.

m. Add conduit and shorten sensing element cable per instructions in paragraph 2.6, if required.

NOTE
Hardware kit part #285-1-92 includes parts A, C, D and E.

User must verify that galvanized metal is chemically compatible with specific well water.

2.5.4 Installing Sensing Element in PVC (not fully perforated) Gage Tube
(a ground wire and a union or flange mounting are required).

a. Check ground wire length and confirm it is longer than the sensing element and has excess wire to reach the ground connection on the sensing element mounting.

b. Install union if used.

c. Align spacer cavities in a row. See Figure 2-22.

d. If gage tube is 1" or less, feed both sensing element and ground wire through same opening. Insert top of ground wire through hole in union. The wire must be carefully fed down with the sensing element so that it sits in spacer cavity. See Figure 2-22.

e. Tighten union or flange. Connect top of ground wire to sensing element ground connection.

f. If Drexelbrook ground wire 722-538-40 (for 3/4" and 1" gage tubes) is used, it has a weight and anchor clip. The weight will pull wire down the well. The anchor clip will hold ground wire in place. If wire needs to be removed, additional force will cause clip to spring, allowing for easy removal.

g. If gage tube is greater than 1", ground wire may be fed into tube before installing sensing element.

Figure 2-22
Aligning Spacers
(when ground wire is used inside plastic gage tube)

2.5.5 Installing Sensing Element in a Monitoring Well without Ground Wire (Metal Casing).

a. Install as described in paragraph 2.5.1

2.5.6 Installing Sensing Element in a Monitoring Well with Ground Wire (Plastic Casing)

a. Install sensing element as described in paragraph 2.5.1
b. Install ground wire with weight on opposite side of well from sensing element. See Figure 2-23.

**NOTE**

Sensing element must hang free. Allow weight to pull it down; do not push cable down the well.

---

**Figure 2-23**

Installing Level Sensor and Ground Wire in Plastic/Plastic-Lined Monitoring Well

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### 2.6 Adjusting the Length of the Sensing Element

The sensing element can be shortened in the field using the following procedure. Refer to Figure 2-24. A field shortening kit (389-1-22) is furnished with each sensing element.

**a.** Install Sensing Element in Vessel

The lowest point of the active section must be at or below lowest measuring point. Zero point can be adjusted above bottom of active section.

If sensing element is not in a gage tube, weight should not be in the pump intake. Weight can be above or below intake zone.

---

**b.** Determine Desired Length as Follows:

1. Loosen two set screws in clamping block \(\bigcirc\) and remove.
2. Loosen nuts and set screws in gland \(\bigcirc\).
3. Unscrew compression plug \(\bigcirc\) from gland \(\bigcirc\) (approximately two turns).
4. Carefully pull cable \(\bigcirc\) and adjust to desired length.

**c.** Tighten compression plug \(\bigcirc\) and gland \(\bigcirc\) to 75 in. lbs.

**d.** Remove swage \(\bigcirc\) and cut cable 4" above washer/support \(\bigcirc\) \(\bigcirc\). Strip cable.

**e.** Slide new swage kit \(\bigcirc\) into position, and crimp on cable using crimping tool or pliers.

**f.** Slide clamping block back into position and tighten set screws.

**g.** Tighten set screw in gland \(\bigcirc\) and replace nuts.

**h.** Cut off excess cable above clamping block.
Calibration Procedure for CheckWell Deep Wells

Use with:
• 408-820X Electronic Unit 1-800-527-6297
• 385-1-513 Variable Padding Capacitor Board
• 401-6-8 or 401-6-81 Capacitance Substitution Box (C-Box)

Factory Service EDO# 5-00-246 Assistance

1.0 Setup

Before starting calibration, record the factors required to calculate calibration values.

a. model number of sensing element 700-5-34 or 700-5-35
b. insertion length of sensing element _______________ feet
c. length of weight assembly _______________ inches
d. depth of well _______________ feet
e. diameter of gauge tube _______________ inches
f. material of construction of gauge tube _______________
g. ground wire installed? ____________ yes or no
h. well level for 4 mA output (0% level) _______________ feet
i. well level for 20 mA output (100% level) _______________ feet

2.0 Padding

The zero controls of the 408-82XX electronic unit can tune out 420 pF. In the following applications, the zero ability is exceeded.

• Sensing element is over 80 feet.
• Zero point is not at the tip of the sensing element.

In these applications, the Variable Padding Capacitor Board (385-1-513) is added to the 408-82XX electronic unit to increase the zero tuning range of the unit. If the Variable Padding Capacitor Board or a padding capacitor is used, the Zero calibration value must be calculated mathematically. Refer to paragraph 4.0.

3.0 Methods of Calibration

The preferred method of calibrating is to pump the well down to the 0% level and then allow the well to partially recover. Using actual levels to calibrate the measurement is the most accurate method. See paragraph 3.1 Calibration when Level can be Changed.

When the level in the well cannot be changed, or if padding capacitance is used, the zero calibration value is derived from mathematical calculations. See paragraph 4.0.

3.1 Calibration when Level can be Changed

a. Pump well down to the zero percent level. If the zero percent level is the end of the sensor, it is acceptable to draw down below the zero percent level. It is not acceptable to partially or completely remove the sensor in lieu of changing the water level.
3.1 Calibration when Level can be Changed (cont.)

b. Sensing element must remain in well at all times.

c. Use step zero and fine zero controls on the 408-8202 chassis to produce 4 mA. Refer to 408-8200-LM.

d. Let well recover.

e. Manually measure level of well.

f. Adjust step span and fine span on the 408-8202 chassis until loop current agrees with actual level. Refer to 408-8200-LM.

g. Record calibration values using 401-6-81 Capacitance Substitution Box (C-box) for future use. See Figure 1.

3.2 Calibration when Level cannot be Changed

It is necessary to mathematically calculate the zero (0%) capacitance value if:

- it is not possible to lower the level to the 0% point. See paragraph 4.0.
- it is necessary to pad the electronic unit. See paragraph 5.0.

Figure 1
Variable Padding Capacitor Board
4.0 Calculating the Zero Capacitance Value (if level cannot be changed or padding is required)

When the level in the well cannot be changed, or if padding capacitance is used, the 0% 100% Level calibration values are derived using the mathematical calculation on Worksheet 1.

<table>
<thead>
<tr>
<th>Installation</th>
<th>Air Capacitance (700-5-34)*</th>
<th>Maximum Sensor Length without Padding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free hanging with spacers</td>
<td>5.0 pF/foot</td>
<td>80 feet</td>
</tr>
<tr>
<td>¾- inch Plastic Gauge Tube with Ground Wire</td>
<td>9.5 pF/foot</td>
<td>42 feet</td>
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<tr>
<td>¾-inch Perforated Plastic Gauge Tube</td>
<td>8.0 pF/foot</td>
<td>50 feet</td>
</tr>
<tr>
<td>¾-inch Metal Gauge Tube</td>
<td>12 pF/foot</td>
<td>33 feet</td>
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<tr>
<td>1-inch Metal Gauge Tube</td>
<td>9.0 pF/foot</td>
<td>45 feet</td>
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<tr>
<td>1¼-inch Metal Gauge Tube</td>
<td>8.4 pF/foot</td>
<td>48 feet</td>
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Table 1
Air Capacitance Values

<table>
<thead>
<tr>
<th>Model Number of Sensing Element</th>
<th>Gland Capacitance</th>
<th>Saturation Capacitance</th>
</tr>
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<tbody>
<tr>
<td>700-5-34</td>
<td>9.5 pF</td>
<td>41.9 pF/foot</td>
</tr>
<tr>
<td>700-5-35</td>
<td>5 pF</td>
<td>48 pF/foot</td>
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</tbody>
</table>

Table 2
Gland and Saturation Capacitances

*Contact Factory Service Department for air capacitance values of the 700-5-35 sensing element.
Calibration Information (refer to Figure 2)

A. Insertion Length ______feet

B. Weight Assembly ______feet

C. Active length of sensing element (insertion length minus weight) ______feet

D. Gland Capacitance from Table 2 ______pF

E. Air Capacitance from Table 1 ______pF/foot

F. Saturation Capacitance from Table 2 ______pF/foot

G. Zero Offset ______feet

H. Span ______feet

0% Level Capacitance Calculation

1. (Active IL — Zero Offset) x Air Capacitance (C — G) x E __________pF

2. Zero Offset x Saturation Capacitance G x F __________pF

3. Step 1 + Step 2 + Gland Capacitance step 1 + step 2 + D __________pF 0% level capacitance

100% Level Capacitance Calculation

1. (Zero Offset + Span) x Saturation Capacitance (G + H) x F __________pF

2. (Active Length — Zero Offset — Span) x Air Capacitance (C — G — H) x E __________pF

3. Step 1 + Step 2 + Gland Capacitance step 1 + step 2 + D __________pF 100% level capacitance
5.0 Calculating Pad Capacitance Value

Calculate the required pad capacitance value using the following equation.

\[
\frac{C_{\text{ZERO}} - 200}{4.33} = \text{Pad Capacitance Value}
\]

Refer to Table 3 and select the value closest to required pad capacitance value. If no values are within 44 pF of the calculated value, contact the Drexelbrook Service Department. Set the COARSE and FINE rotary switches on the Variable Padding Capacitor Board using the value from Table 3.

<table>
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<th>Coarse Adjustment</th>
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<tr>
<td>D</td>
</tr>
<tr>
<td>E</td>
</tr>
<tr>
<td>F</td>
</tr>
</tbody>
</table>

Table 3
Fine and Coarse Adjustment Values
Padding Capacitor Kit
700-5-34 SENSING ELEMENT

NOTES:
1. SPACERS FURNISHED WITH SENSING ELEMENT. ONE FOR EVERY 4' OF ILL, FIELD INSTALLED. FOR INSTALLATION IN 1/2" GAGE TUBE CONSULT FACTORY.
2. WEIGHT ASSEMBLY LENGTH GUIDELINES.
   - ILL TO 500' - 28" STD.
   - ILL. 500' OR LONGER - 50" STD.
   - CONSULT FACTORY IF THERE IS A NEED TO SHORTEN WEIGHT.
3. ALL METAL WETTED PARTS 316 SST.
4. SENSING ELEMENT IS FIELD SHORTENABLE. SHORTENING KIT IS FURNISHED WITH EACH SENSING ELEMENT (P/N 389-1-22) SEE 700-5-34-CD1 FOR INSTRUCTIONS
5. SEE 700-5-34-CD2 FOR CAGE SOUNDING TUBE & GROUNDING INSTALLATION DETAILS.
6. UNION MOUNTING RECOMMENDED FOR EASE OF INSTALLATION. IF GROUND WIRE IS USED, SPECIFY UNION PART NUMBER 242-7-66. UNION IS STANDARD WITH SWIVEL MOUNTING.

DREXELBROOK Engineering Company
205 KEITH VALLEY RD
HOHNSHAM, PA 19044-9986
PHONE: 215-674-1234 FAX: 215-674-2731

Check Well™ LEVEL MONITOR
TWO WIRE
REMOTE MOUNT
508-45-737

CERTIFIED by

PO #

ENG

USER

ISS. EDO/DSR NO.

APP'D DATE

DATE

508-0045-737-CD1 01/92

Copyright 1992 DREXELBROOK ENG. CO.
COAX-CENTER (SENSING ELEMENT) WIRE (BLUE)
GROUND WIRE (GREEN)
COTE-SHIELD WIRE (RED) (TO BE CUT BY FIELD INSTALLER)
GROUND (GRN)
SHIELD (RED)

408-8202-14 LEVEL TRANSmitter
TRANSIENT (LIGHTNING/SURGE) PROTECTOR
OPTIONAL ZERO CAPACITORS (IF REQUIRED)

408-8202-11 WITH INTEGRAL DIGITAL METER. (SEE 370-4000-1-CD1 SHEETS 4-6 OR INSTRUCTION MANUAL FOR ADDITIONAL DETAILS.

NOTES:
1. MAXIMUM POWER SUPPLY VOLTAGE IS 50 VDC
2. PUT ALL 4-20 mA DEVICES IN SERIES. VOLTAGE DRIVEN DEVICES REQUIRE A SERIES RESISTANCE
3. MAXIMUM LOOP RESISTANCE (INCLUDING ANY BARRIERS) IS 625 OHMS WITH 24 VDC SUPPLY.
   FOR OTHER THAN 24 VDC USE FOLLOWING FORMULA FOR MAXIMUM LOAD RESISTANCE:

\[ R_{\text{MAX}} = \frac{V_s - 11.5}{.02} \text{ OHMS} \]

\[ V_s = \text{SUPPLY VOLTAGE} \] (SEE NOTE 1)

TYPICAL 4-20 mA LOOP CIRCUIT