

**TECHNICAL NOTE 10-01A**  
**WATER RESTRAINT SYSTEM (WRS)**  
**Test Procedure for the Level Gauge System**  
Dated: August 10, 2001, Revised: October 17, 2001

**Introduction**

This procedure describes how to operate and troubleshoot the WRS level gauge system. The WRS contains two level gauges; one for the water tank and one for the chemical tank. Each level gauge uses the same equipment and can be tested in the same manner.

**Description**

There are two WRS system level gauges; one, which provides the water tank level, and the other that provides the chemical tank level. Each level gauge system consists of a level sensor located in the tank, and Alfa Level electronic unit located in the Power Control Enclosure (PCC). The output of the Alfa electronic unit is connected to the microcomputer unit via a multi-conductor cable. Each level sensor consists of five stainless steel rods. The center rod is common and each of the four surrounding rods provide sensing at four different liquid levels. The level sensor circuitry senses the presence of the liquid using a small alternating voltage signal applied between the center (common) rod and the surrounding rods. As the level increases, the liquid will touch the common rod and one or more of the surrounding rods. As the liquid touches a surrounding rod the small current is detected by the circuitry contained in the Alfa Level unit. The Alfa Level unit provides an output which is a dry contact (24 VDC – relay output) which when activated provides a short-circuit to ground for the microcomputer. Power is provided to each Alfa Level Unit (24VDC) from connections inside the PCC.

The microcomputer contains two illuminated level indicators; one for the water level and one for the chemical level. Each level indicator contains 5 sets of two segments, two red at the display bottom followed by red-yellow, yellow-yellow, yellow-green, and green-green as the upper segments. Each display operates in conjunction with the sensor rods as follows:

1. If no liquid is sensed by any sensor rod indicating that the liquid level is almost at empty the microcomputer will illuminate the two bottom red display segments. In addition when the water sensor is at this level the microcomputer will also pulse the audible alarm to tell the system operator that the water level is too low to operate the system.
2. When the liquid level reaches at or above the first (longest) sensor rod the Alfa Level will sense the liquid and the microcomputer will turn off the bottom red-red and illuminate the red-yellow indicator segments.
3. In the same manner when liquid rises to the level at or above the second rod, the microcomputer illuminates, in addition, the yellow-yellow segments and so on through the third and fourth pair segments. Therefore, when the liquid touches the fourth (and shortest) sensor rod, the level indicator will read completely full (the upper four pair of segments illuminated).

The wiring and connections for each level control are as follows:

1. Each level sensor is connected to its respective Alfa Level unit via a five conductor multi-conductor cable. See Figure 1. The Black wire is common and connected to the center sensor terminal. The brown wire is the lowest (longest) sensor rod, and connected to the sensor rod that is as long as the common rod. The green wire connects to the next shortest, the blue to the next shortest, or middle rod, and the red wire to the shortest rod (clock-wise).
2. These wires are connected to the Alfa Level unit as shown in Figure 2. The output of the Alfa Level unit is connected to the microcomputer unit via a multi conductor cable. The Alfa Level unit outputs are dry contacts (from a 24 VDC relay NO) open when not activated and closed (short-circuit) corresponding to the positive indication from the level sensor. The wiring is as follows:

- Black lead – common
- White lead – Tank empty sensor (see text)
- Brown lead – lowest (longest) sensor
- Green lead – second to lowest sensor
- Blue lead – middle sensor
- Red lead – top (shortest) sensor
- Yellow lead – Pressostat (pump unit) or air pressure (chemical unit) output

## Procedures

1. Whenever a problem with a level sensor is suspected, always check for the power supply voltage and the integrity of the wiring connections before proceeding. The power is provided by the red and black leads (24 VDC) from the PCC.
2. Operation of the level sensor and Alfa Level circuitry can be tested at the level sensor terminals as follows:
  - a. Any or all of the level sensors can be tested by temporarily placing a 5-kilohm resistor between the center (common) terminal and one of the four sensor (rod) terminals.
  - b. The microcomputer will respond properly only if you temporarily connect 5 kilohm resistors in order starting with the longest sensor first (brown wire) and proceeding one at a time to the top sensor while watching the control panel indicator. Note that you will need four 5-kilohm resistors to provide a complete test.
  - c. You can test the output of the Alfa Level unit at the same time by testing for the presence of 0 or 5 VDC at the terminals when each 5-kilohm resistor is added between the common lead and Brown lead, then Green lead, then Blue lead, then Red lead.
  - d. A short circuit between the wires at the output of the ALFA LEVEL unit can check the integrity of the cable-computer-display system. (following the same order rules as the test from the electrodes). When no leads (brown, green, blue or red) are short circuited to ground, the white lead can be short circuited to ground to indicate tank empty.

- The short circuited white lead will illuminate the two red bars at the LED display bottom.
3. If a problem is encountered, check the wiring first before proceeding to replace components. There are four components that can be replaced if needed.
    - a. If temporarily installing a resistor at the sensor unit does not produce the desired indication at the microcomputer, the output of the Alfa Level unit should be tested for 0 or 5 VDC voltage at the output terminals. If the 0 or 5 volt indication is present continuously and does not go from +5 when sensor is not activated to 0 volts when the sensor is activated, replace the Alfa Level unit and retest.
    - b. If the replacement of the Alfa Level unit does not repair the problem, check the level sensor unit before proceeding. You may want to disconnect all wires from the sensor and connect the resistors to the wires. If this test provides the correct response at the microcomputer level indicator, replace the sensor unit and retest.
    - c. If the voltages appear correctly at the output of the Alfa Level unit but the microcomputer unit is still providing an incorrect indication, replace the microcomputer unit and retest.
    - d. If the replacement of the microcomputer does not solve the problem, next try replacing the control-display unit.

If you have any problems with this test procedure or need additional information, please contact our office.

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