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Bureau of Reclamation

INFORMATIONAL ROUTING

PAP-291

Memorandum
Chief, Hydraulic Structures Branch

Denver, Colorado
February 27, 1974

Chief, Hydraulics Branch WRH 2/28/74

R. A. Dodge

Summary of data obtained during the February 19th demonstration of a Miltronics, Inc. water level measuring system (your memo dated 12-26-73)

Jim Bauh
Tech Sales
Inc.
Denver, Co.

John Brown of Miltronics, Inc. brought a water level measuring system to the Hydraulics laboratory for demonstration and testing. Ray Thibault, Hydraulic Structures Branch, and Rudy Hogg, Electrical Branch, assisted in taking the data that are summarized in this memorandum.

The operation was briefly observed by several members of the Mechanical Branch. The system included an ultrasonic transducer, a transmitter-receiver (transceiver), and electronics to provide a 4- to 20-milliampere output with zero and span (measuring range adjustments). The transceiver sends a pulse to the transducer which in turn sends an ultrasonic sound wave down to the water surface. The return echo from the water surface is received by the transducer which sends the echo pulse to transceiver. The transceiver calculates the sound pulse travel time to the water surface and back to transducer. The transceiver then produces an analog output that is proportional to water surface elevation.

The ultrasonic transducer was mounted at the top end of a 20-foot-long 4-inch-diameter thin-walled aluminum tube (enclosure, right margin). The tube was provided with a manometer and white face tape of 0.01-foot graduations to measure the water level. The water level was raised by filling the tube from the city water supply and lowered by a valve drain. A digital multimeter measured the milliampere output of the system.

The output of the water level system was adjusted by Brown to read 4 milliamperes with 16 feet of water in the tubing and 20 milliamperes with 1 foot of water. The full scale calibration for 15 feet of water should produce an output ratio of 0.938 foot per milliampere.

Schuster 2/28

During the demonstration covering a period of about 4 hours, 29 data points of water surface elevation versus milliampere output were obtained (enclosure, left side). The upward pointed triangles and the squares are data points in upward moving water surface sequences, read during short pauses between water surface changes.

cohen 3-1

The downward pointed triangles and hexagons were obtained in downward sequences.

A least squares fit using the 29 data points resulted in a slope of 0.943 foot per milliampere agreeing closely with the calibration slope. Reading and evaluating the deviations of data points from the graph of water surface versus milliampere output are difficult. The least squares fit equation was used to calculate deviations from measured values. The calculated deviations are summarized in the small plot showing percent data versus deviation (enclosure, top middle). This curve indicates that 70 percent of the data obtained during the demonstration was within a $\pm$ 0.15 foot water band or $\pm$ 1 percent of full scale. All the data were within $\pm$ 0.30 foot or $\pm$ 2 percent full scale.

For a demonstration period of about 4 hours no conclusions can be made concerning long term stability or drift characteristics of the water level measuring system.

For water surfaces below the dresser coupling shown on the test arrangement schematic, the system picked up extraneous echos. The company representative thought the echos came from misalinement of the tube ends or the tubing at the coupling. However, the data plotted in the curve below the 4.6-foot water level show that the system was able to sufficiently discriminate actual water level. After the demonstration the alinement of the pipe was measured at the dresser coupling at two places 90° apart. The total angles were the same in both directions, i.e., about 1-3/4°. It was not determined during the tests how much tube misalinement, tube joint offset, or wall roughness can be tolerated by the water level measuring system.

R A Dodge

Copy to: 224
224 (Thibault)
240
243
252 (Durham)
430 (Water Systems Automation Team)
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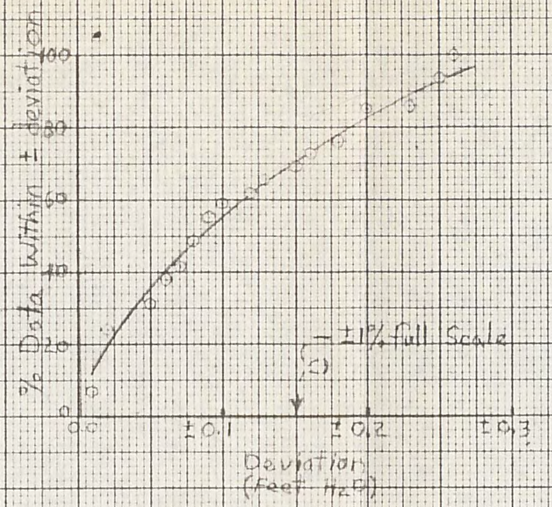
△,□ Data Taken in upward sequence
▽,○ Downward Sequence

(Feet Water)

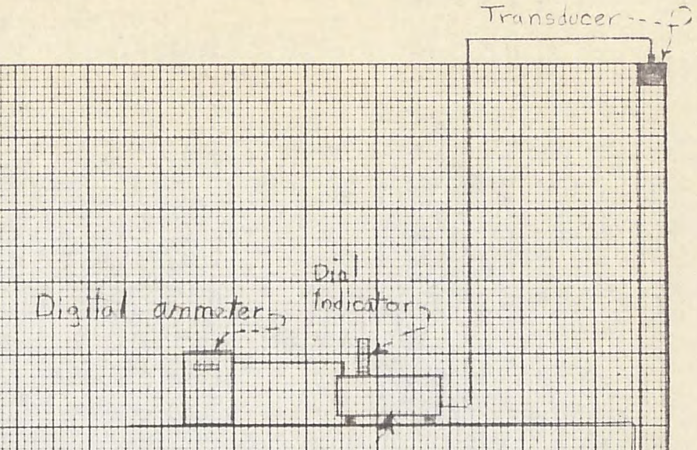
(milliamperes)

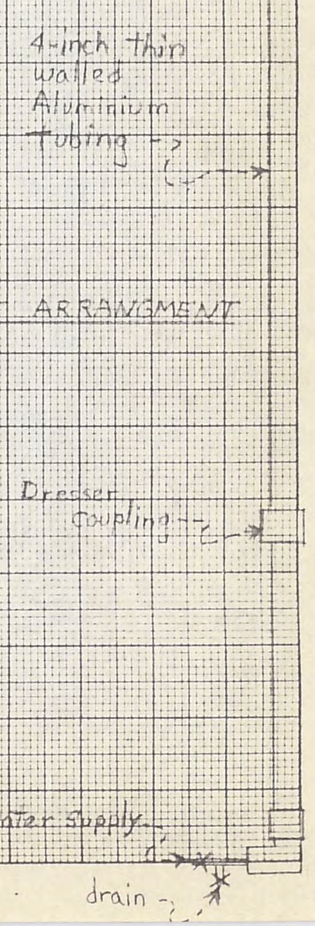
WATER SURFACE ELEVATION VS MILLIAMPERE OUTPUT
FEB 19th TEST OF
MILTRONIC'S WATER LEVEL MEASURING SYSTEM

-- Least square fit
Slope 0.943 ft/ma



PERCENT DATA VS DEVIATION





LABORATORY TEST ARRANGEMENT

KE 10 X 10 TO ½ INCH 47 1323
10 X 15 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

→ Dodge 1532

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA GEN. REG. NO. 27

(O/P 4-65) 5010-107

UNITED STATES GOVERNMENT

Memorandum

Memorandum

Denver, Colorado
DATE: December 26, 1973

TO : Chief, Hydraulics Branch

THROUGH: Chief, Division of Design 1/9/74
Director of Design and Construction
Chief, Division of General Research

ACTING

FROM : Chief, Hydraulic Structures Branch

SUBJECT: Testing of Ultrasonic water level measuring device (UWLMD)

Two UWLMD's are now being specified for use on each of four large concrete water tanks as a part of the telemetering equipment on the Altus-Snyder Aqueducts, Mountain Park Project. We believe the ultrasonic device has several advantages over the conventional float system used in the past. The Metritape water level measuring device, originally specified for the Altus-Snyder tanks, did not perform as described in advertising literature as determined by your recent tests. Therefore, the Metritape will not be used on that project.

The second UWLMD is normally required in a regulating tank for a backup in case the first device malfunctions and for emergency high and low level alarms. We are interested in possible signal interference between the two devices when operated simultaneously. (Scanner)

To provide more assurance that UWLMD's will perform as advertised, you are hereby requested to test two devices in a manner similar to that used for recent Metritape tests. In cooperation with Rudy Hogg, Code 243, Extension 3382, please investigate the possiblity of obtaining two devices on loan from one of the following companies:

Sonargage - C. W. Stevens, Inc.
Local Representative: Rod Street
Goble-Sampson Associates
Telephone 757-4971

Milltronics, Inc.
Local Representative: Glen Selch
B-F Sales Engineering Company
Telephone 893-1124

Funds for 10 man-days of test work are available from the Water Systems Automation Team, Job No. 102-0065-8802-012-12-0-0. If any additional time is needed it may be available from the Altus-Snyder Aqueduct, Job No. 210-0981-5827-210-04-0-0. Results of the tests are desired by

February 1, 1974, to verify use of the UWLMD's on Altus-Snyder Aqueduct structures. Specifications for these aqueducts are to be published in January 1974. A memorandum summary of test results will be adequate for Code 210 purposes.

If you have additional questions, please call R. E. Thibault, Code 224, Extension 3586.

R W. Beck 1/8/74

Copy to: 220
224
225
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241
243
352
430 Calhoun (2)
1500

Note 1/8
240
Bucks 1-9
212