

EIP-TR013

TEST REPORT FOR
EI's Eight Channel
Digital Isolator

P/N: 01026-13

S/N: 0225

SCOPE

This report contains the following series of subtests:

- EIP TR013 A - INPUT FAULT TEST AC
- EIP TR013 B - INPUT FAULT TEST DC
- EIP TR013 C - OUTPUT FAULT TEST

REPORT #EIP-TRO13

FAULT TEST RESULTS
FOR EI'S EIGHT CHANNEL DIGITAL ISOLATOR

CUSTOMER:

BECHTEL/HL&P (STP)

SUMMARY

(1) Type of device: EIGHT CHANNEL DIGITAL ISOLATOR

(2) Part Number: 01026-13 Serial Number: 0225

Brief Test Discussion

The input to channel one of the isolator card was subjected to a fault voltage of 120 VAC RMS and then 150 VDC from a source with a minimum continuous capability of 20 amps. The outputs were monitored during the tests. All channels were tested for isolation capability and channel one was checked for functionality after application of each of the faults.

Tests were then run subjecting the outputs of the isolators to a fault voltage of 120 VAC RMS (destructive test) from the same source as above while monitoring the inputs and then again while monitoring the power supply inputs to the card.

The device (x)passed, ()failed the Input and Output Fault tests.

Other comments:

There were no component failures during the first portion of the tests. The Opto-isolators used for these tests were manufacturers seconds as far as functionality, thus they could not produce adequate voltages for normal production functional purposes but were fully capable as isolators. The voltage they were capable of was noted and checked after application of the fault for equivalence.

The output portion of the test resulted in component failures at the board level on the channel subjected to the fault. The isolation capability of the entire card was unaffected.

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PURPOSE

The purpose of these fault tests is to verify that during and after the application of a fault to the inputs or outputs of an isolator channel that the isolator maintains its isolation capabilities and does not propagate the fault to the opposite side or through the power inputs with sufficient energy to continue on through the system.

REFERENCE DOCUMENTS

1. Energy Incorporated Work Activity Package WAP-STP-029 which uses EIP-37; Integrated Functional Test Procedure for the Analog and Digital Isolation System, Including Design Basis System Fault Testing and EIP-24; Test Procedure for Performance and Isolation Testing of 1E Analog and Digital Isolators. See the Test Summary for WAP-STP-029 for clarification of the test procedures used.

TEST REPORT A: 120 VAC FAULT AT INPUT

1. Test Subject: 1E Digital Isolators

Part Number 01026-13

Serial Number 0225

Reference Figure #1 Isolator Schematic

2. Test Configuration

Fault Test (120 VAC RMS at INPUTS) monitoring isolator outputs
Reference Figure #2

Isolation Test (3000 VDC and 1500 VAC RMS)
Reference Figure #4

3. Pretest Data

The isolator was tested for complete isolation capability and for its functional capabilities per EIP-24 (Sections 8.1, 8.3, and 8.4) prior to application of the 120 VAC RMS fault. The isolator passed the isolation test and the functional values were recorded.

4. Interim Test Data (Fault applied)

The outputs were monitored with a digital storage oscilloscope and a digital strip chart recorder for short and longer term effects of the fault (see Figure 2). The fault immediately reached a steady state where the output was roughly following the input fault waveform but at the voltage levels normally found at the output. The fault was applied for about one minute with no detrimental effects.

Reference Appendix A for the pen trace and storage scope plot obtained during the fault test.

5. Post-Test Data

The isolator was once again checked for isolation and operation with virtually identical results to the pretest data. The isolator suffered no damage and function was not impaired.

6. Failed Component/s

None.

7. Comments/Test Conclusion

The isolator passed the fault test with no damage and no propagation of the fault to the outputs. The signal produced by the fault waveform was transmitted to the output as expected, within the normal levels of operation of the isolator.

TEST REPORT B: 150 VDC FAULT AT INPUT

1. Test Subject: 1E Digital Isolators

Part Number 01026-13 Serial Number 0225

Reference Figure #1 Isolator Schematic

2. Test Configuration

Fault Test (150 VDC PEAK at INPUTS)* monitoring isolator outputs
Reference Figure #2

Isolation Test (3000 VDC and 1500 VAC RMS)
Reference Figure #4

3. Pretest Data

The post-test data for the AC fault serves as the pretest data for the DC fault test. The isolator is deemed to be functional and of full isolation capability.

4. Interim Test Data (Fault applied)

During the application of the 150 VDC fault the outputs were again recorded using the oscilloscope and the strip chart recorder (see Figure 2). The system again immediately achieved steady state with the output attempting to replicate a portion of the applied fault waveform within the limits of the voltages normally found at the outputs.

Reference Appendix A for the pen trace and storage scope plot obtained for this test.

*NOTE: The fault source used provided full wave rectified, unfiltered DC.

5. Post-Test Data

The isolator was again tested for functionality and isolation capability with virtually identical results as its first pretest.

6. Failed Component/s

None.

7. Comments/Test Conclusion

The isolator passed the 150 VDC fault test with no damage and did not propagate the fault to the outputs other than by replicating the input waveform within its normal operating limits at the output.

TEST REPORT C: 120 VAC FAULT AT OUTPUT

1. Test Subject: 1E Digital Isolators

Part Number 01026-13

Serial Number 0225

Reference Figure #1 Isolator Schematic

2. Test Configuration

Fault Test (120 VAC RMS at OUTPUTS) monitoring the inputs and the power supply inputs to the card

Reference Figure #3

Isolation Test

Reference Figure #4

3. Pretest Data

The functional and isolation data from the 150 VDC fault test serve as the pretest data for these tests. This test was repeated several times on different channels to allow for the monitoring of different points and repeats due to test equipment failures.

4. Interim Test Data (Fault applied)

The inputs were monitored using the scope and the strip chart recorder during the application of the fault to one channel while the power supply inputs to the card were monitored on the subsequent applications of the fault (see Figure 3). A small voltage was detected at the inputs upon application of the fault but this was probably due to capacitive or inductive effects transmitted to the high impedance probes of the measuring apparatus. This rise was on the order of 2.5 volts and lasted only about 10 milliseconds while the inputs are nominally 48 volts therefore this effect was negligible.

The power supply inputs did experience momentary effects upon application of the fault, as expected, since one line is common between the output (where one fault was applied) and the power supply input. The maximum voltage observed was 22 volts peak with a total duration time of about 100 milliseconds. The isolator always experienced a single trace failure and the failure of the capacitor in the output circuit. The trace involved was the output lead and it would fuse open near the point that it met the card edge connector.

Reference Appendix A for the pen and storage scope plots obtained for these tests.

5. Post-Test Data

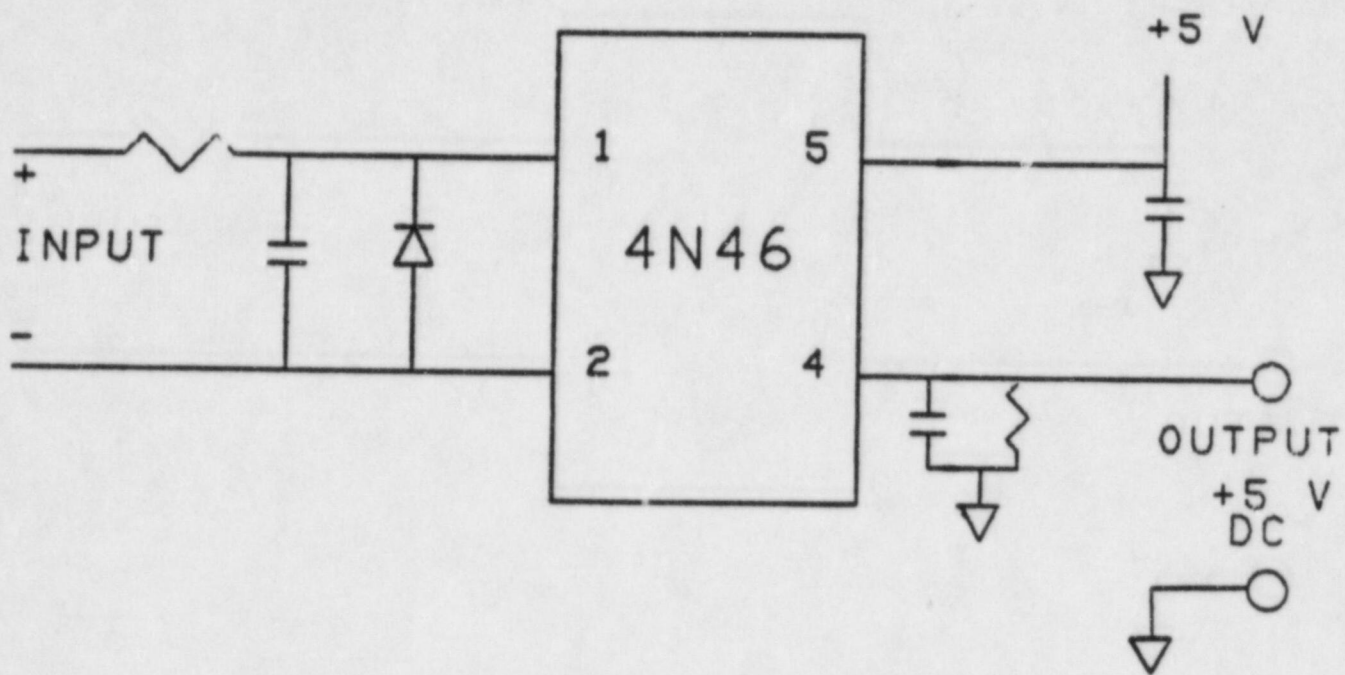
The isolator was checked for isolation (all channels) and passed completely. The remaining undamaged channels were functional. The output traces on the tested channels were open as were the output capacitors.

6. Failed Component/s

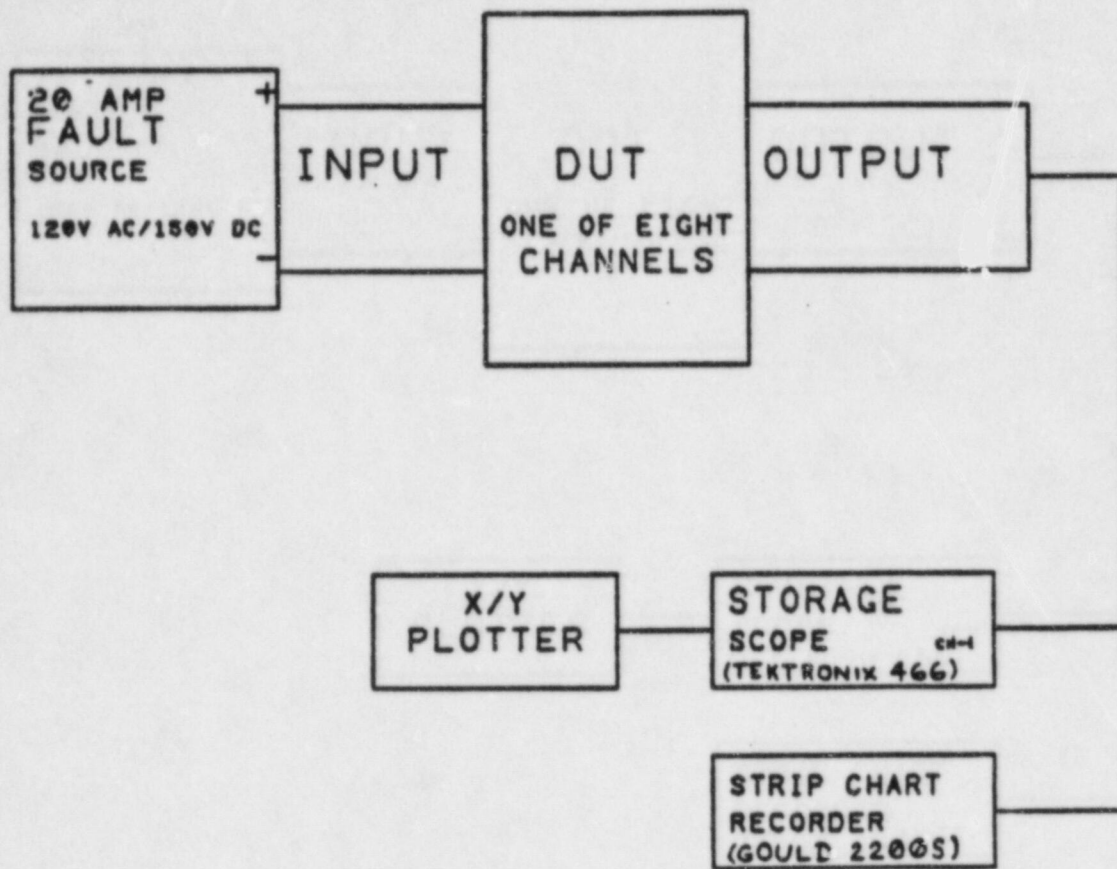
Output trace was open and capacitor in the output circuit was open on all channels to which the fault had been applied.

7. Comments/Test Conclusion

The isolator maintained isolation with minimal damage (to the affected channel only) upon application of the fault. There was no significant propagation of the fault to the inputs of the isolator. The propagation to the power supply inputs was minimal and would have been suppressed at the power supply. This propagation was insufficient to affect other isolation channels on the same board.

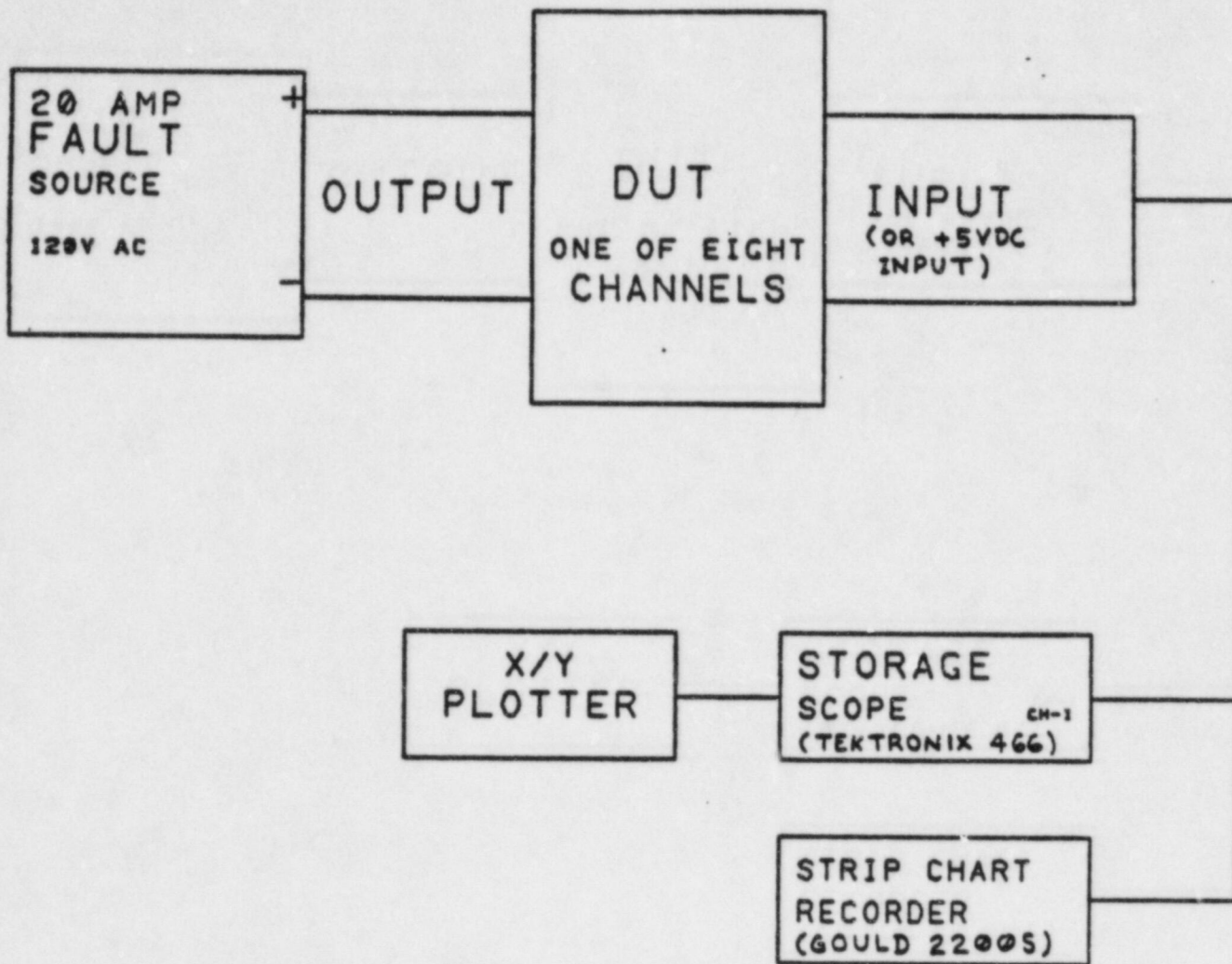


1E DIGITAL ISOLATOR
 DUT
 (DEVICE UNDER TEST)
 01026-13 (ONE CHANNEL SHOWN)
 FIGURE 1



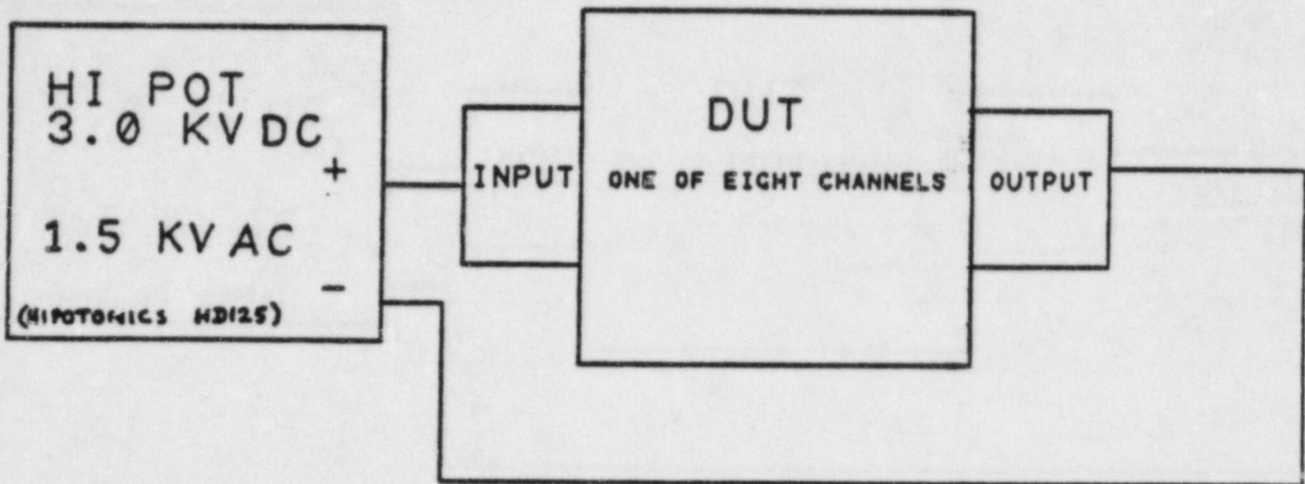
INPUT FAULT TEST 120V AC AND 150V DC

FIGURE 2



OUTPUT FAULT TEST 120V AC

FIGURE 3



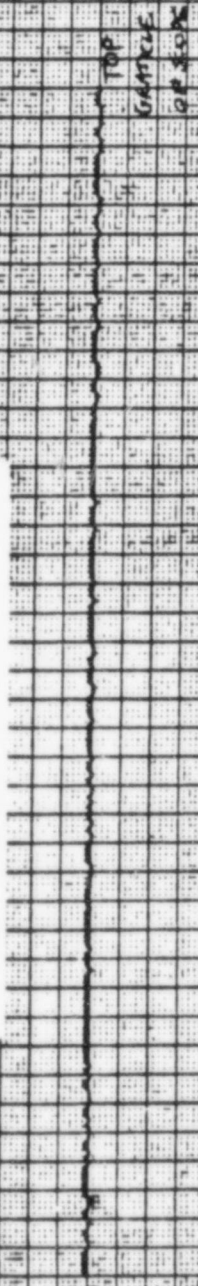
ISOLATION TEST (HI-POTENTIAL TEST)

FIGURE 4

APPENDIX A

STRIP CHART RECORDER AND OSCILLOSCOPE PLOTS

DIGITAL OSCILLOSCOPE
TO PLOTTER CALIBRATION



SCOPE SET AT 1 VOLT / DIV 1/2 VOLT / DIV IN GATE
 10 DIV / DIV 5 DIV / DIV 10 DIV / DIV
 10 DIV / DIV 5 DIV / DIV 10 DIV / DIV

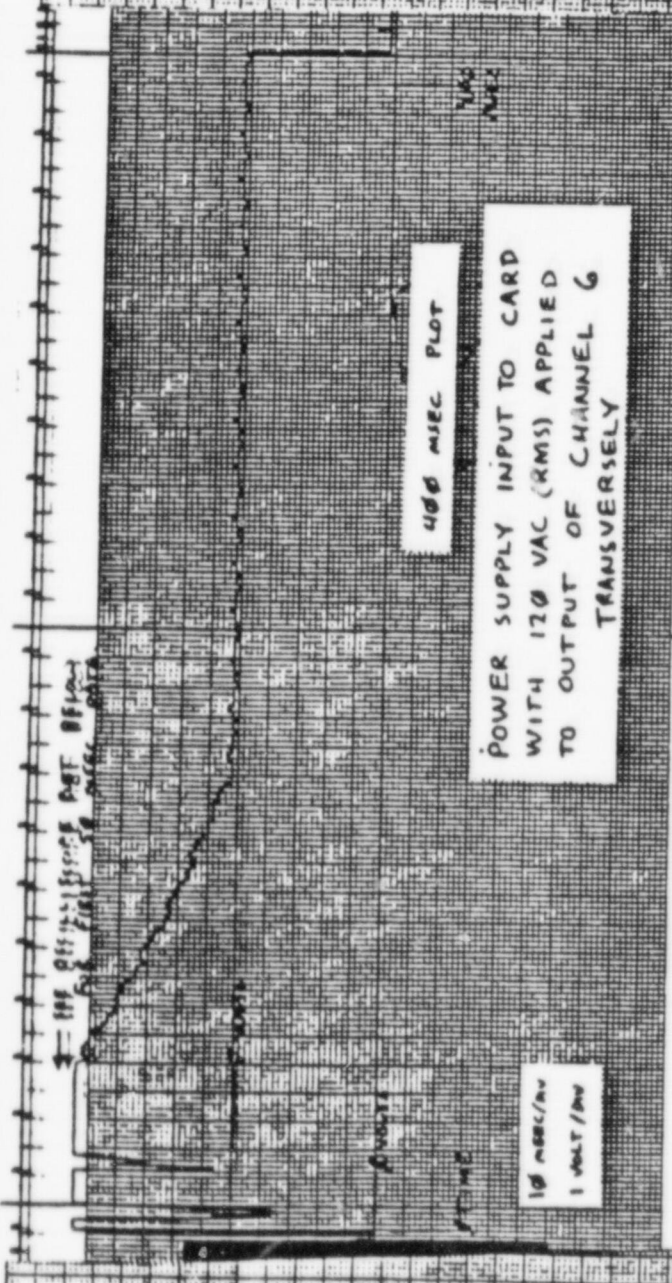
CALIBRATION RUN FOR TEST X

NOTE: SPECIFIC VOLTAGES NOT SHOWN HERE. THIS REPRESENTS THE LEFT, RIGHT, TOP AND BOTTOM LIMITS OF THE SCOPE DISPLAY AS DRAWN BY THE PLOTTER, REGARDLESS OF THE ACTUAL SWITCH SETTINGS USED TO STORE THE DISPLAY.

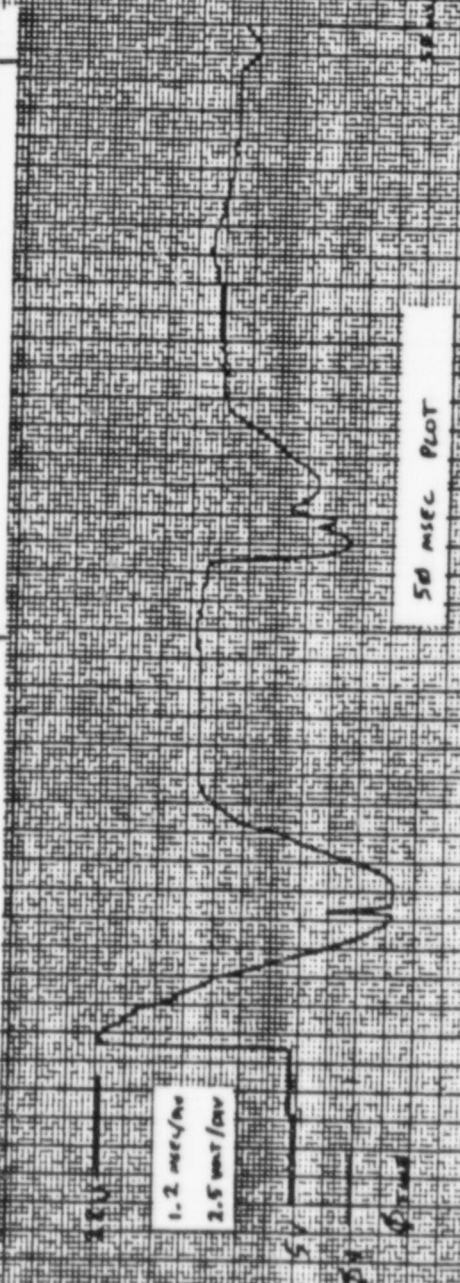


WAP STP 029

0 TIME



Waco Electronics Cleveland, Ohio Printed in U.S.A.



MAP STEP 009

10 mV/div
1 μsec/div

400 MSEC PLOT

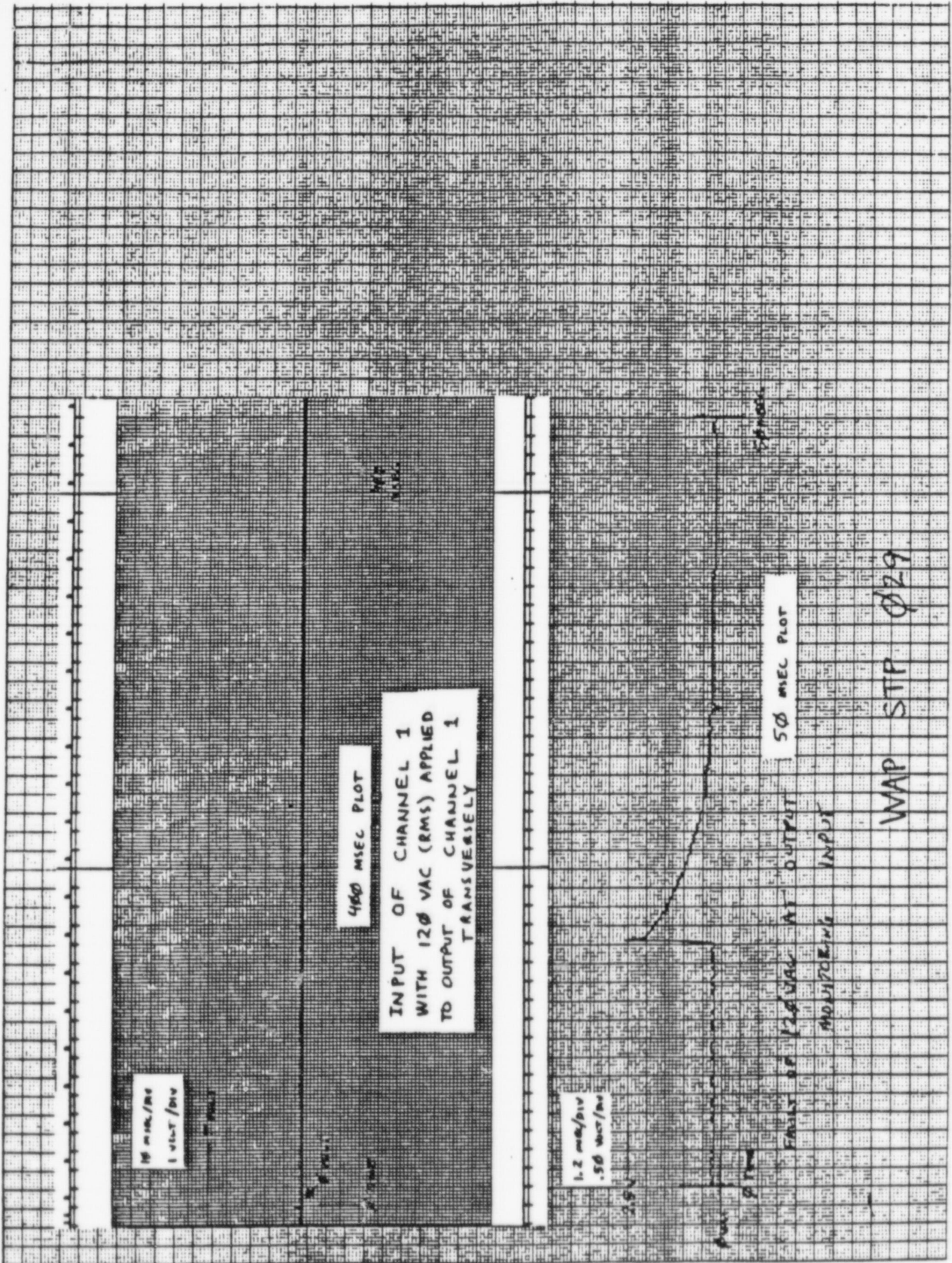
INPUT OF CHANNEL 1
WITH 120 VAC (RMS) APPLIED
TO OUTPUT OF CHANNEL 1
TRANSVERSELY

1.2 mV/div
.50 μsec/div

50 MSEC PLOT

EMITTER OF TRANSV AT OUTPUT
ADJUSTING INPUT

WAP STP Q29



100 mV/div
100 μs/div

400 msec. plot

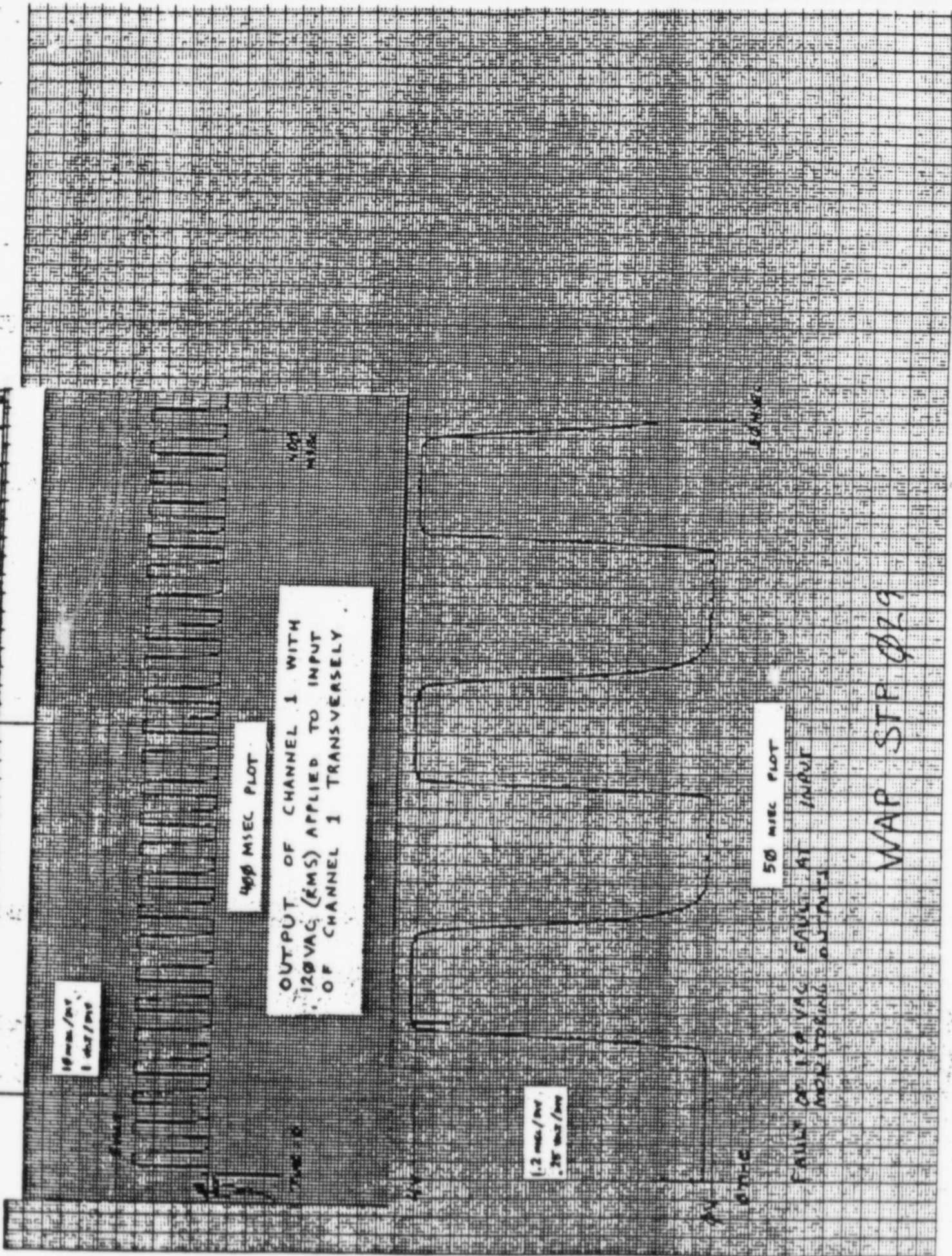
OUTPUT OF CHANNEL 1 WITH
150 VDC (PEAK) APPLIED TO INPUT
OF CHANNEL 1 TRANSVERSELY

1.2 mV/div
100 μs/div

50 msec. plot

NOTE: DC APPLIED WAS FULL-WAVE RECTIFIED
BUT UNFILTERED. PEAK VALUE WAS
150 VOLTS.

WAP STP 029



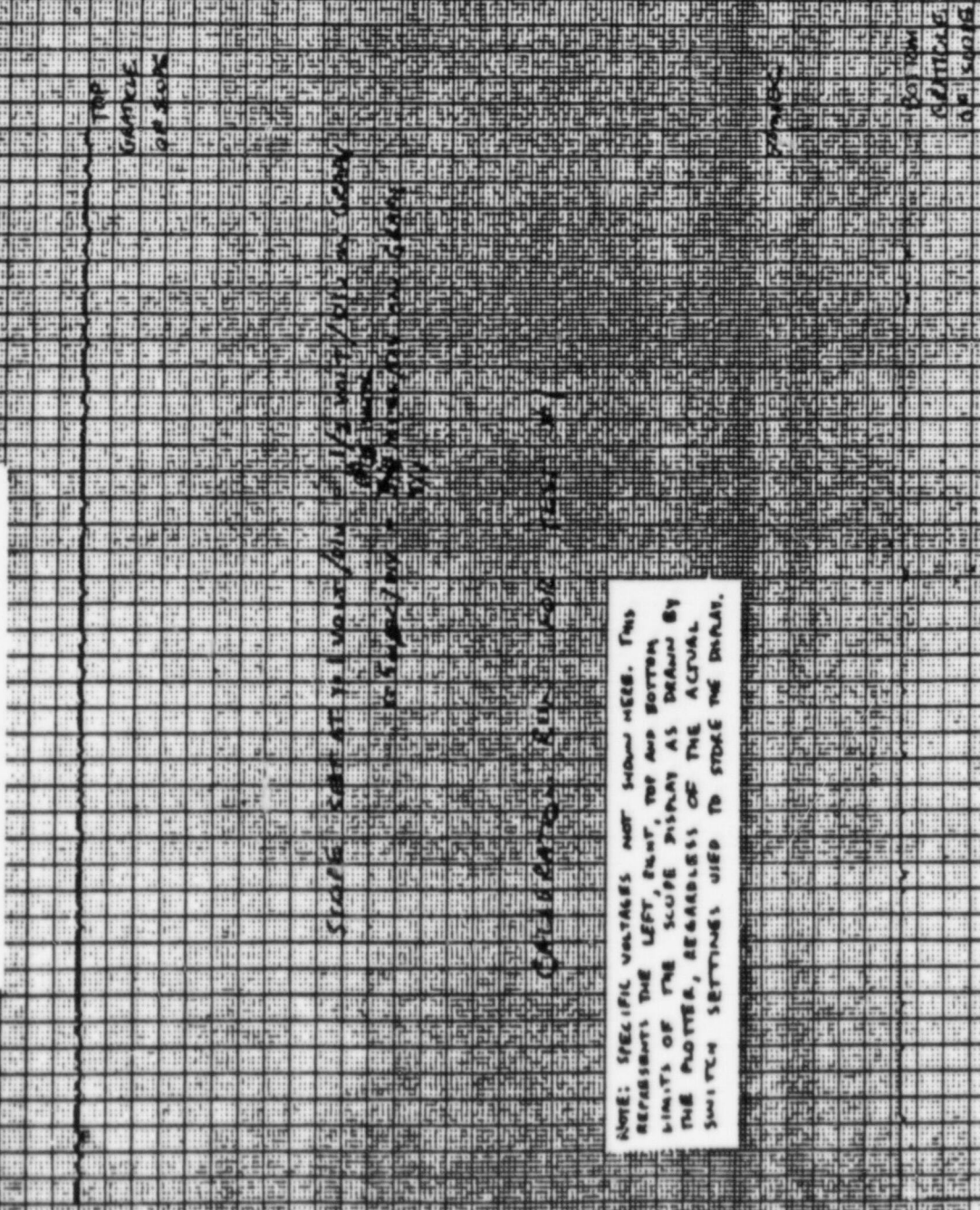
FAULT TEST FOR EI-EIGHT-CHANNEL DIGITAL ISOLATOR P/N 01028-13 S/N 0225

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CORPORATION
HOUSTON, TEXAS

OMNIGRAPHIC®

DIGITAL OSCILLOSCOPE TO PLOTTER CALIBRATION



SAWTOOTH GRAPHIC / IN 1/2 VOLT / IN 1/2 VOLT / IN 1/2 VOLT

NOTE: SPECIFIC VOLTAGES NOT SHOWN HERE. THIS REPRESENTS THE LEFT, RIGHT, TOP AND BOTTOM LIMITS OF THE SLOPE DISPLAY AS DRAWN BY THE PLOTTER, REGARDLESS OF THE ACTUAL SWITCH SETTINGS USED TO STORE THE DISPLAY.

WAP STP - 0229

10 mV/div
1 μsec/div

400 MSEC PLOT

INPUT OF CHANNEL 1
WITH 120 VAC (RMS) APPLIED
TO OUTPUT OF CHANNEL 1
TRANSVERSELY

1.2 mV/div
.50 μsec/div

50 MSEC PLOT

FAULT IS PLOTTED AT OUTPUT
MONITORING INPUT

WAP STIP Q29

100 mV/div
100 ns/div

400 msec. Plot

OUTPUT OF CHANNEL 1 WITH
150 VDC (PEAK) APPLIED TO INPUT
OF CHANNEL 1 TRANSVERSELY.

1.2 mV/div
100 ns/div

50 msec. Plot

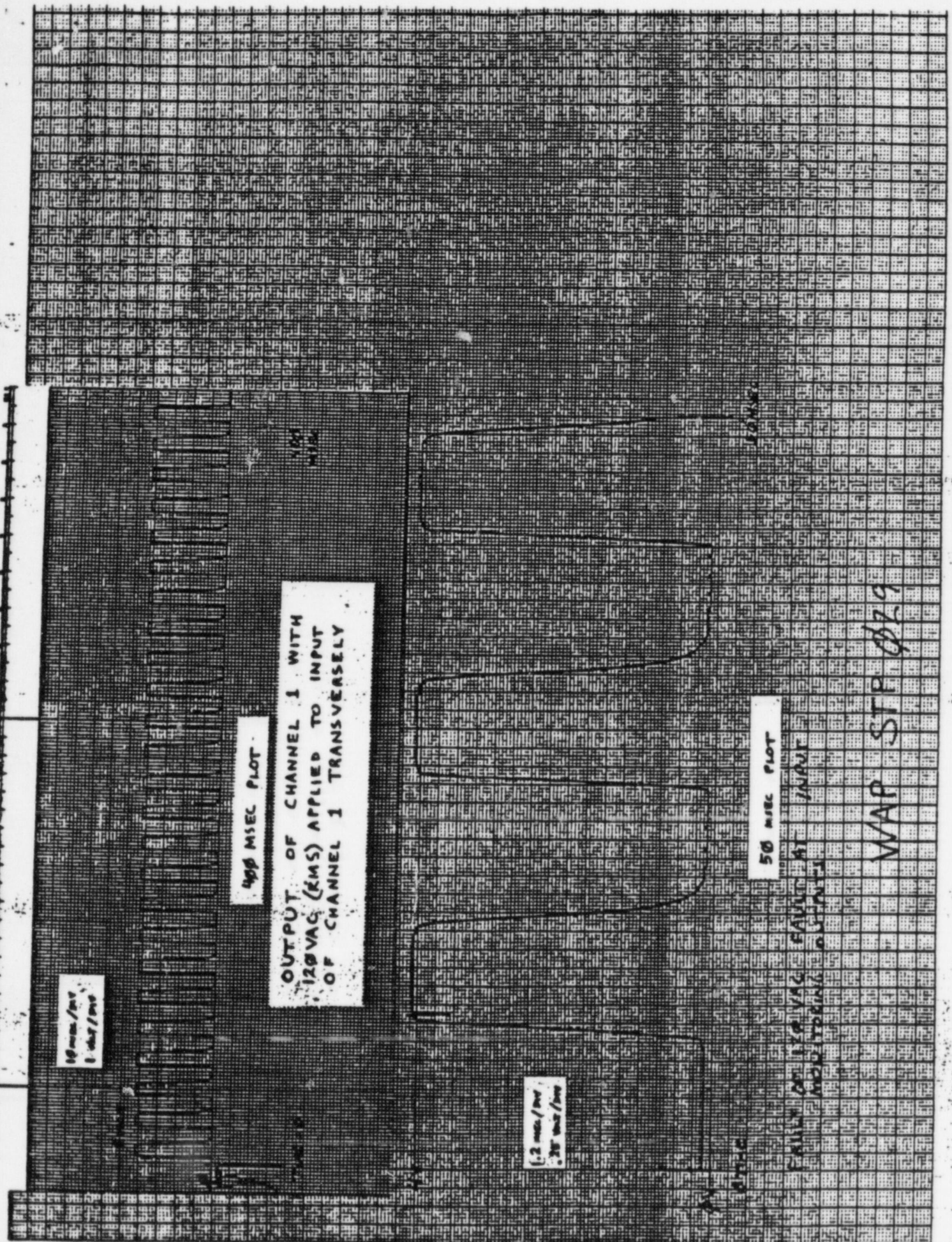
NOTE: 150 VDC APPLIED WAS FULL-WAVE RECTIFIED
BUT UNFILTERED. PEAK VALUE WAS
150 VOLTS.

WAP STP 029

FAULT TEST FOR E1 EIGHT-CHANNEL DIGITAL ISOLATOR P/N 01026-13 S/N 0225

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Attachment 5

Cooper Energy Systems Diesel Generator Isolator,
Wyle Laboratories Report No. 57719 - Electrical Test
Report on Isolation Relays and Transmitter and
Receiver for Bechtel Energy