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Volume IV

FIELD MEASUREMENTS AND INTERPRETATION OF TMI-2 INSTRUMENTATION: CF-2-LT4

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Section 1

INTRODUCTION

During and following the TMI-2 accident, a number of instruments failed or were suspected of providing erroneous readings. Because of this problem, industry concerns were focused upon the behavior of instrumentation under adverse conditions. To better understand failure mechanisms, the Technical Integration Office (TIO) contracted Technology for Energy Corporation (TEC) to perform field measurements on a set of selected TMI-2 instruments to determine in-situ operating characteristics. For some instruments, these measurements were to be performed prior to removal (and replacement with new instruments) in order to have a cross reference with post removal observations. For other instruments, an indication of the condition of the instrument (i. e., fully operational or failed) was desired.

This report describes the measurements and results of the Core Flood Tank 1B level monitor CF-2-LT4. This instrument consists of a Bailey Type BY Process Computer Transmitter connected to a readout module by approximately 500 feet of cable through a penetration junction and an instrument mounting junction. The status of this instrument is uncertain, but it was producing a reasonable output reading which implied it had not failed. As a result, measurements on this instrument were designed to determine if it was properly functioning.

Section 2

INSTRUMENT LOCATION, CABLING, AND TERMINATIONS

A review of appropriate drawings from Bailey Meter Company and Burns & Roe (itemized in the Appendix in the measurement procedure, pages A-5 and A-6) resulted in the composite electrical diagram shown in Figure 2-1. From this information, Table 2-1 gives a list of the appropriate termination points for performing measurements in Control Cabinet 156. Also noted in Figure 2-1 are the cable lengths pulled during instrument installation and lengths after trimming between each termination and/or junction point.

The level sensing assembly is a Bailey Type BY which consists of a differential pressure LVDT, temperature compensation, and calibration adjustment for conversion of pressure difference to level. This instrument has a normal range of 0-14 feet, producing an output of -10 to +10 volts. The functional diagram of the unit is shown in Figure 2-2.

Since measurements were being made in Control Cabinet 156, the effect of the readout meter (attached to the signal line) was present on the observed instrument response. However, since this readout was located outside containment, it did not experience severe operating environments, and thus was not considered to have failed.

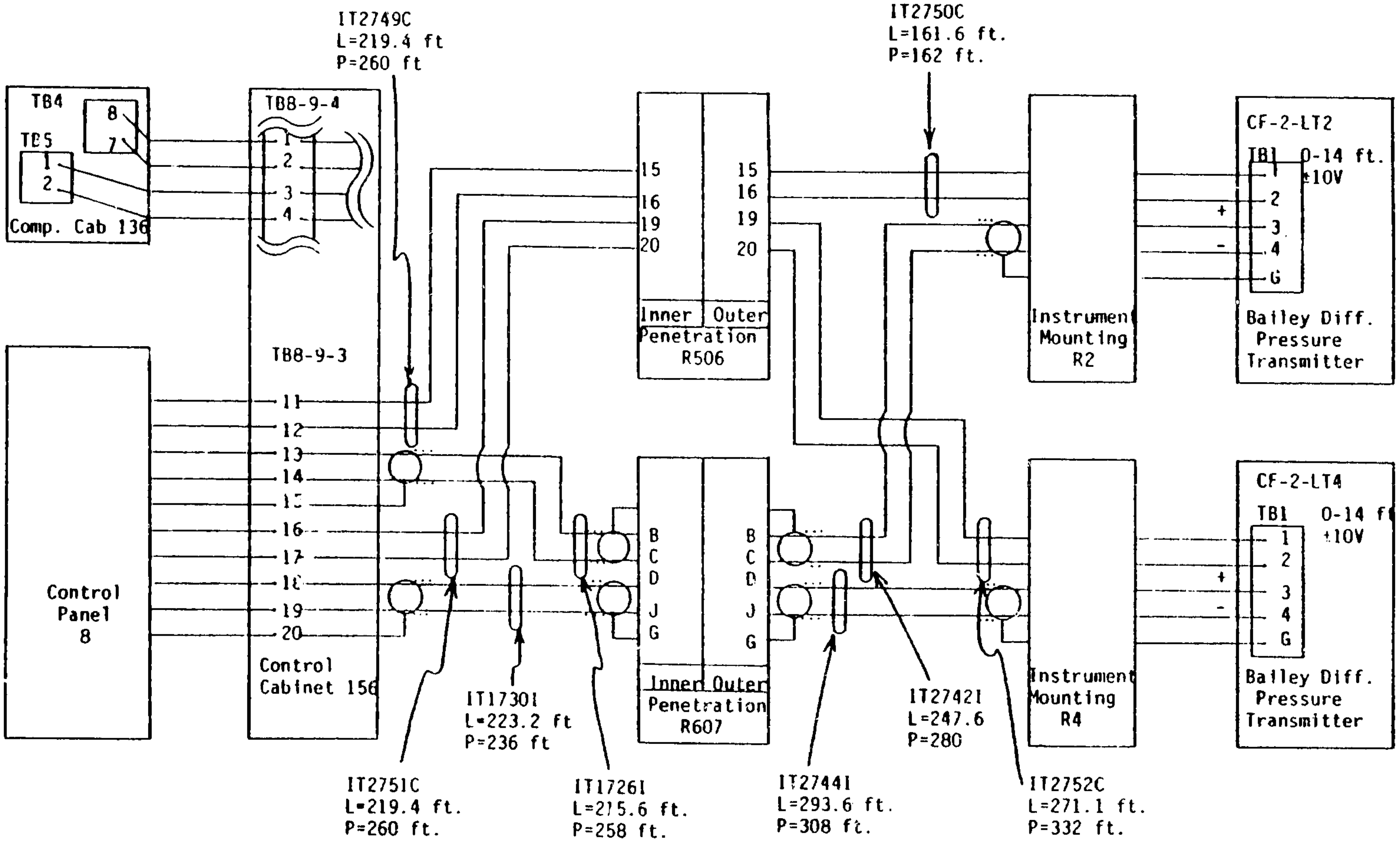

Figure 2-1. Composite Electrical Diagram for Core Flood Tank Level Transmitters CF-2-LT2 and CF-2-LT4.

Table 2-1

TERMINATION POINTS FOR CF-2-LT4 MEASUREMENTS

Signal	Cabinet 156 Identification*
+Signal	TB8-9-3/19
-Signal	TB8-9-3/18
Shield	TB8-9-3/20
118 VAC (H)	TB8-9-3/16
118 VAC (L)	TB8-9-3/17

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*From cables IT1730I (signal lines) and IT2751C (118 VAC).

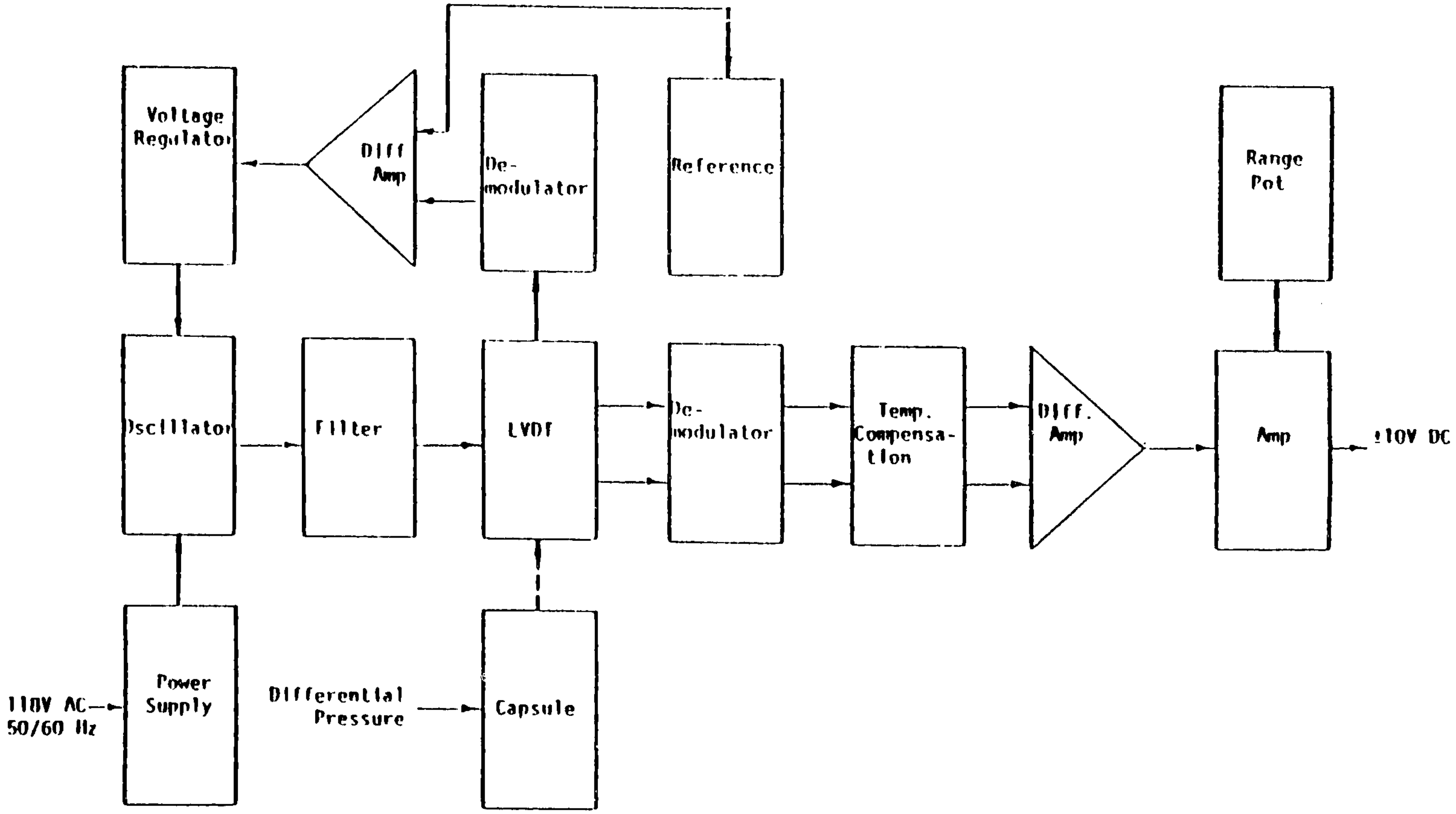


Figure 2-2. Functional Diagram of Bailey Type BY Differential Pressure Transmitter.

Section 3

PREPARATION OF MEASUREMENT PROCEDURES

As a result of generating the composite electrical diagram and from a review of the Bailey Meter Product Instruction E21-17 Manual, the major types of measurements to be performed were identified as:

1. Determine as-found condition of level indication and record signal output.
2. Perform passive measurements (i.e., passively monitor signals) on each electrical connection consisting of time domain waveforms, very-high frequency spectrum analysis (i.e., MHz region), and frequency spectra below 100 kHz.
3. Perform resistance, capacitance, impedance, and Time Domain Reflectometry (TDR) active measurements (i.e., actively introducing a test signal).

These measurements were designed to verify the operation of the Readout Module and the power supplies, but the focus of the measurement was on the level measurement assembly, cabling, and terminations/connections to the assembly. The Appendix contains the detailed procedure which was followed during the measurement program, and a summary of measurements is presented in the next section.

Section 4

MEASUREMENTS

Since the output of CF-2-LT4 was designed to cover the range of -10 to +10 volts, the signal could be directly measured without amplification. Before performing measurements, the readout of CF-2-LT4 indicated 11 feet for the core flood tank level. The level indication signal was then recorded for approximately 10 minutes on an FM recorder and the voltage outputs measured (with a DVM). The output of the level signal was 5.72 VDC, and the power supply was 116 VAC.

The next measurements consisted of photographing the output waveforms of the level signal and line voltage from a storage oscilloscope. Figures 4-1 and 4-2 show the results of these time trace measurements. Along with the time traces, both high and low frequency spectra (frequency domain) were taken of the level signal. Figure 4-3 shows the measured spectra over both a 6 MHz and 500 kHz bandwidth, while Figure 4-4 shows spectra over both a 100 kHz and 1 kHz range.

Following the frequency spectra measurements, electrical calibration was performed on the CF-2-LT4 readout module by a TMI technician. No significant adjustments were noted during this calibration. After electrical calibration, power was removed from CF-2-LT4. The test fixture was removed and all signal lines from cables IT1730I and IT2751IC to cabinet 156 were disconnected.

A series of active measurements (i.e., actively introducing a test signal into the circuit) was then performed. Table 4-1 shows the

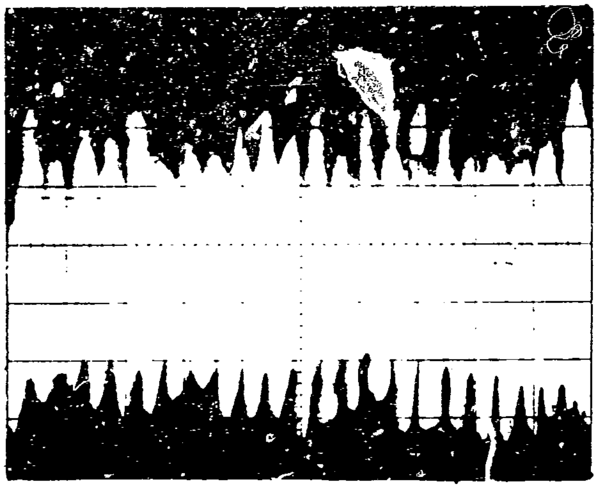


Photo 109-1

Time - 2msec/div

Gain - 10 mV/div

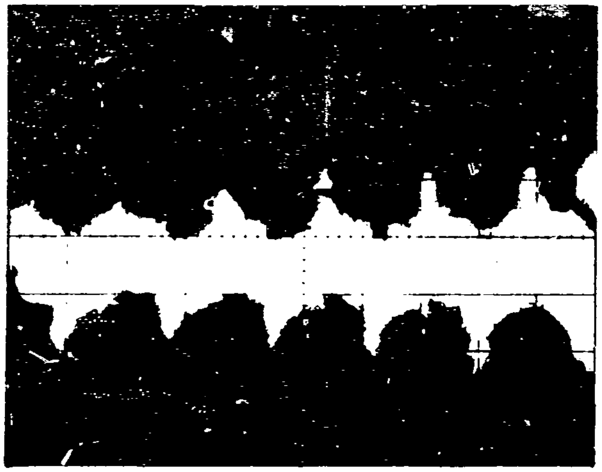


Photo 109-2

Time - 0.5msec/div

Gain - 20 mV/div

Figure 4-1. Oscilloscope Traces of Level Signal.

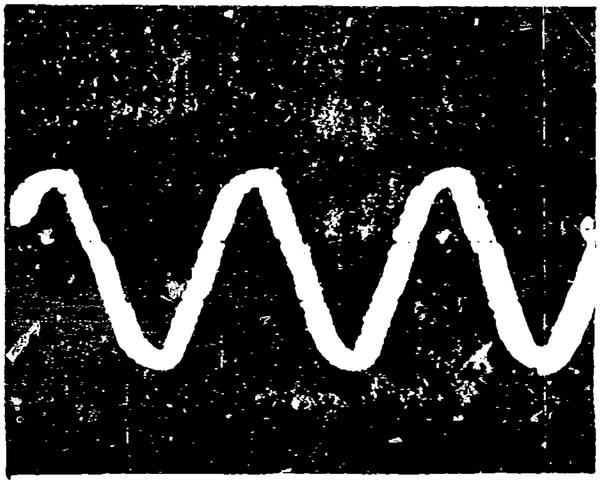


Photo 109-3

Time - 0.5msec/div

Gain - 10 V/div

Figure 4-2. Oscilloscope Trace of 118 VAC Supply.

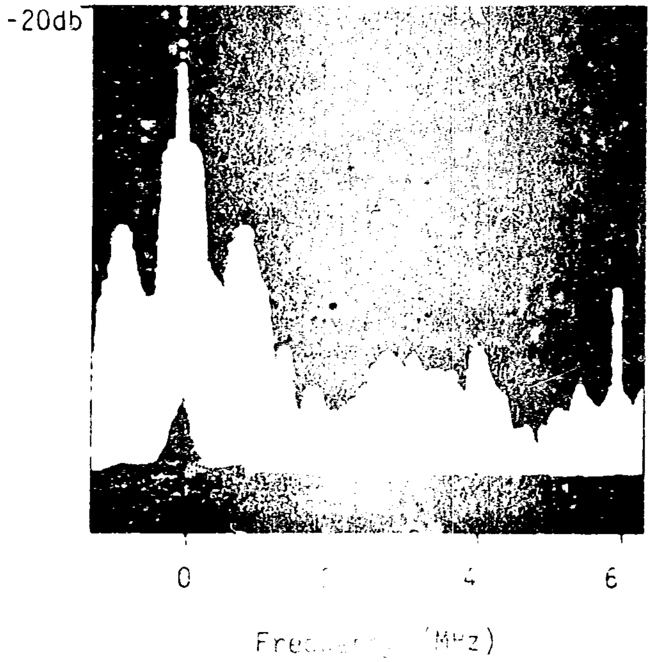


Photo 109-4

BW - 3 KHz

Scan width - 1 MHz/div

Scan time - 1 sec/div

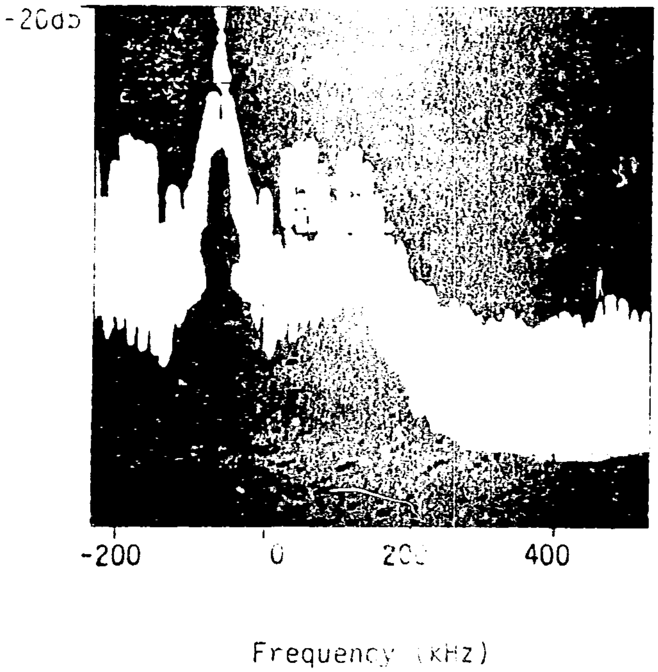


Photo 109-5

BW - 3 KHz

Scan width - 100 KHz/div

Scan time - 1 sec/div

Figure 4-3. High Frequency Spectra of Level Signal.

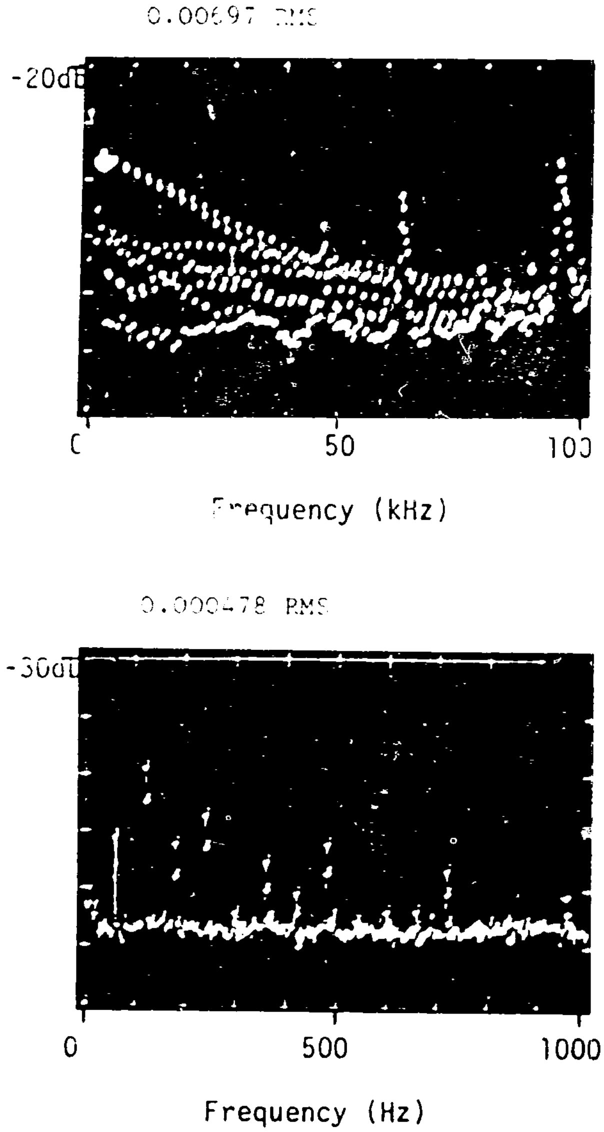


Photo - 109-6

100 KHz Range

Photo 10

1 KHz Range

Figure 4-4. Low Frequency Spectra of Level Signal.

Table 4-1

CAPACITANCE, IMPEDANCE, AND RESISTANCE MEASUREMENTS

	Capacitance (nF)[*]			Impedance (ohms)			
Signal	100Hz	1kHz	100kHz	100Hz	1kHz	100kHz	Resistance (ohms)[**]
+Signal -Signal	23	18	12	4.4K	3.2K	124	7.1K (8.8K)
+Signal Shield	50	42	34	OF[†]	3.6K	48	OF
-Signal Shield	50	44	37	OF	3.5K	44	OF
118 VAC (H) 118 VAC (L)	-120	17	52	12K	9K	30	105 (105)
118 VAC (H) -Signal	--	.2	8.7	OF	OF	109	OF
118 VAC (H) Shield	--	.2	28	OF	OF	66	OF

---

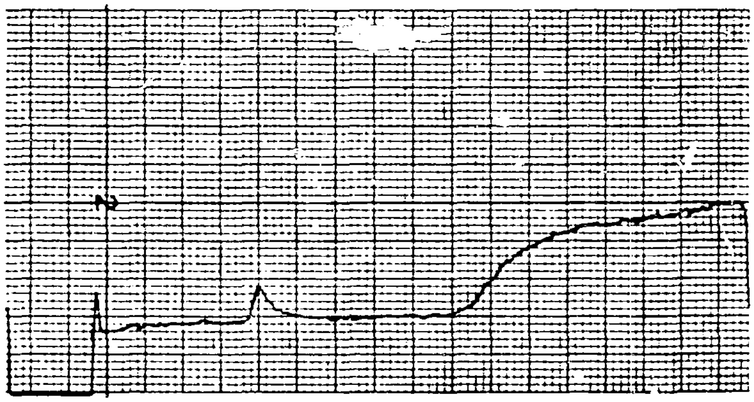
[*] nF = Nano-farads.

[**] Values in parentheses are reverse polarity values.

[†] OF indicates overflow condition.

results of capacitance, impedance, and DC resistance measurements on some of the field cable lines (see Appendix page A-12 for a complete set). A set of TDR measurements were taken on the signal lines to determine possible cable defects. These TDR traces are shown in Figures 4-5 to 4-8.

STRIP CHART 109-1



Setting - 500μρ/div

Range - 52.6 ft/div

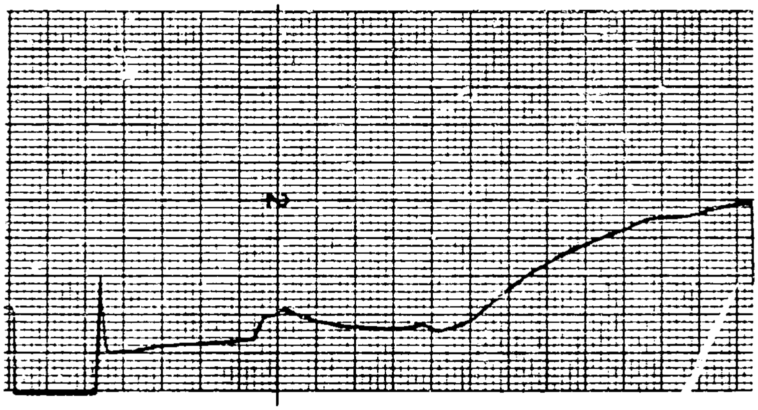
Sensitivity - 0.25

Filter - 5 Hz

Cable dielectric - other

Figure 4-5. TDR Trace of Level Signal Lines

STRIP CHART 109-2



Setting - 500μρ/div

Range - 52.6 ft/div

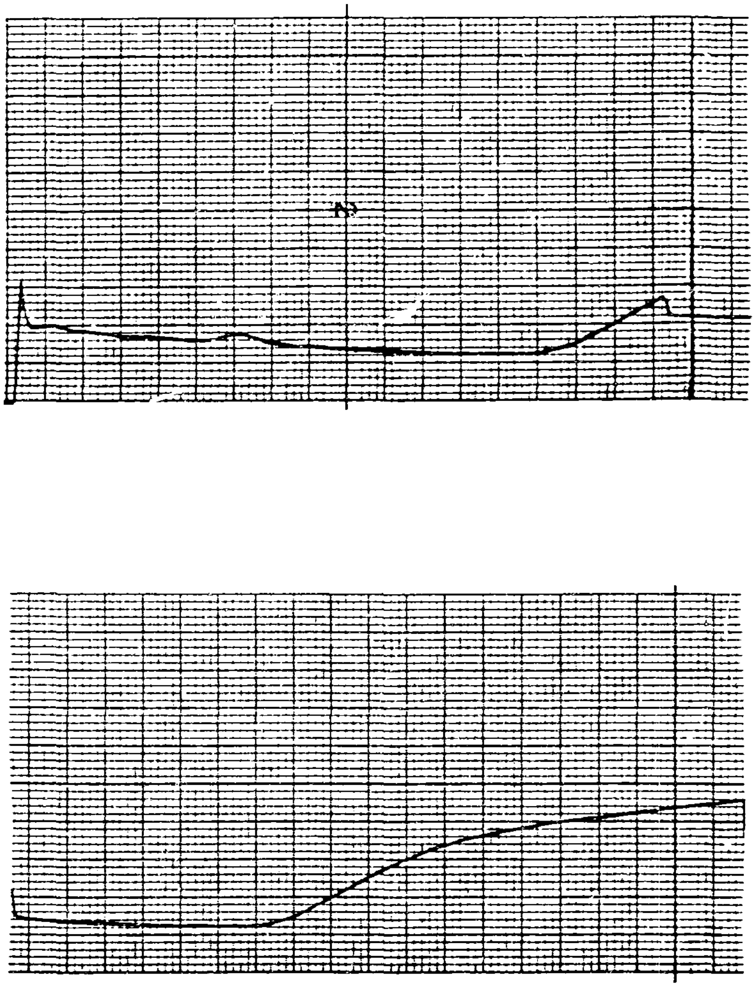
Sensitivity - 0.25

Filter - 5 Hz

Cable dielectric - other

Figure 4-6. TDR Trace of (+) Signal to Shield

STRIP CHART 109-3 & 4



Setting - 500μρ/div

Range - 52.6 ft/div

Sensitivity - 0.25

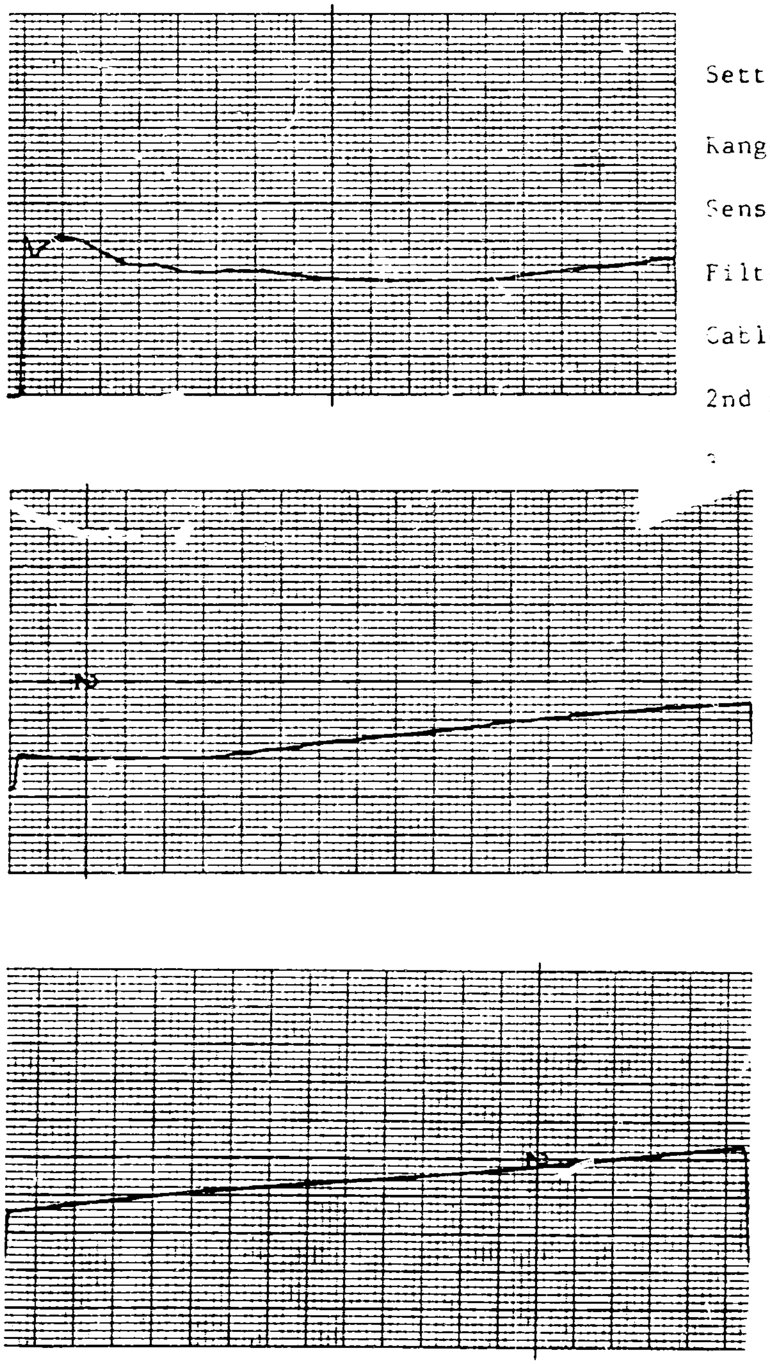
Filter - 5 nz

Cable dielectric - other

2nd plot begins @500 ft

Figure 4-7. TDR Trace of 118 VAC Lines

STRIP CHART 109-5,6, & 7



Setting - 500µp/div

Range - 52.6 ft/div

Sensitivity - 0.25

Filter - 5 Hz

Cable dielectric - other

2nd plot begins @500 ft

3rd plot begins @1000 ft

Figure 4-8. TDR Trace of 118 VAC (H) to Shield

Section 5

INTERPRETATION OF MEASUREMENTS

This section presents a summary of the interpretation of the measurements taken on CF-2-PT4. This interpretation is intended to indicate the condition of the device based on observed data.

Since this device varies from -10 to +10 volts for a 0 to 14 foot level range, the observation of 11 foot level readout indicates that the voltage should be 5.71 volts. The measured value of 5.72 volts matches within 1% of this expected value, which indicates the readout meter is correctly calibrated. The 116 VAC value on the power supply line is also well within a normal operating range.

The time traces and frequency spectra do not indicate any serious contamination which would affect the DC readout. Table 5-1 lists the low level AC components present on the level signal. Note that even though up to 60 mV P-P fluctuations are present, readout devices normally respond at low frequencies. As a result, the worst-case effect of these AC variations is likely to be less than the 0.5 mV RMS value given for the 60 Hz components.

One feature of the frequency spectrum of the level signal gives an indication that the differential pressure LVDT (see Figure 2-2) is operating. Since the LVDT AC output is "demodulated" by a full-wave rectifier and Resistance-Capacitance (RC) smoothing, a low level ripple must be present at the frequency of the internal oscillator. The oscillator for this type device operates at 1000 hertz and the component

Table 5-1

MAJOR AC COMPONENTS ON THE LEVEL SIGNAL

Frequency	Amplitude
60 Hz and harmonics	0.5 mV RMS
1 kHz and harmonics	6 mV RMS
48 kHz	<1 mV RMS
64 kHz	<1 mV RMS
96 kHz	1 mV RMS
150 kHz (broadband)	<1 mV RMS
Total Spectrum	60 mV P-P

values of the RC smoothing circuit (R = 100k ohms, C = 0.68 μF) would produce a ripple factor (fraction of AC RMS fluctuations) of 0.001. With the device producing a five volt output (15 volts above base output of -10V), the expected RMS ripple would be approximately 5 mV (15 mV). From Table 5-1, this AC ripple value was measured to be 6 mV, which is in close agreement. Also, the reduction in amplitude of the higher harmonics (see Figure 4-4) is consistent with the expected attenuation of a rectified signal.

The capacitance, impedance, and resistance data given in Table 4-1 is difficult to quantitatively interpret, but qualitative results are possible. Most of the data indicates very low effective capacitance values, which would be expected from the amplifier section of the transmitter. However, the 118 VAC (H) to 118 VAC (L) measurement passes through the primary of a transformer. This creates an inductance which appears as negative capacitance at the 100 hertz measurement.

The presence of a 10,000 ohm resistor in the transmitter amplifier and the absence of other direct electrical paths indicates that a resistance measurement near this value should be obtained. The measured values for the level signal were 7100 and 8800 ohms for two polarities. The variation would be caused by active electrical components, and the values are of the magnitudes expected. Since the expected responses are present, there is no obvious indication of instrumentation degradation from these measurements.

The results of TDR measurements performed on the cable (shown in Figures 4-5 to 4-7) are summarized in Table 5-2. Note that the lengths identified in the table are only approximate, since no calibration of the cable resistance and material composition was performed on the TDR instrument. Some junction points were not identified by these measurements, but no indication of cabling problems is present in this data.

Table 5-2

SUMMARY OF TDR MEASUREMENTS

Signal Lines	Distance (ft)*	Description**	Probable Cause
+Signal	211	Point R increase	Penetration R607
-Signal	489	Large R increase	Electronics
+Signal	200	Point R increase	Penetration R607
Shield	416	Point R small increase	Terminal block
	464	Large R increase	Electronics
118 VAC (H)	263	Point R increase	Penetration R607
118 VAC (L)	716	Large R increase	Electronics

Note: Distances are not calibrated due to lack of prior information on the cable type which prevented calibration tests.

*TDR to terminal block test cable (15 ft) not included in distance.

**R is the abbreviation for resistance.

Section 6

CONCLUSIONS

Based on the measurements, data reduction, and circuit analysis of CF-2-LT4, there is no indication of degradation of the instrument. The only significant contamination present in the pressure signal that appeared to be abnormal was the 96 kHz component. However, the amplitude of this signal was relatively low and, from other measurements performed at TMI, this low-level 96 kHz component is probably due to a widespread 16 kHz (with harmonics) signal found in various circuits. In addition to the observation of no abnormal characteristics of the instrument, the low level oscillator ripple on the level signal indicates that the LVDT is working. Therefore, it appears that CF-2-LT4 is operating correctly, but these measurements could not determine if it is calibrated.

APPENDIX

ORIGINAL FIELD PROCEDURES AND DATA SHEETS FOR CF-2-LT4

208-11

GENERATION C(NCE SYSTEM
JOB TICKET FORM (Page A-1 EE MILE ISLAND UNIT 2

COMPONENT DESIGNATION SYS	COMP TYPE	COMP ID	LOCATION/UNIT	JOB TYPE	JOB TICKET NUMBER	REQUEST DATE MO DAY YR	RECOMMENDED PRIORITY
CF	Z	0LT4	036002	CM	C5713	092280	Z

DESCRIBE MALFUNCTION OR MODIFICATION DESIRED

Perform attached procedure.

CAUSE OF MALFUNCTION (IF KNOWN)

ORIGINATOR'S EMP NO	ORIGINATOR'S SIGNATURE	DATE	SUPERVISOR'S EMP NO	SUPERVISOR'S SIGNATURE	DATE
06175	Brunner	9/22/80	06175	J Brunner	9/22/80

DOE/EG&G Project

WORK ORDER NUMBER LOCATION	SERIAL	GC CODE	ACCOUNT NUMBER X0001	PLANT CONDITION SU	OP	HC	CD	RF		HS	LP	NPRD FAILURE YR	MO	DAY	START HR	MIN
0360	0018737		7876019	/	/	/	/	/		/	/					

CHANGE MOD REQ'D		N SAFETY		REG AGENCY CODE	CHG/MOD NUMBER
0	0	0	0		

ENV CODE	OUTAGE CAUSE CODE
X	

STATUS HOLD CODE

SUPV APPROVAL COMMENCE WORK MO DAY YR
092380

	RESP LOCATION OR CONTRACTOR
2	036W

Limits and Precautions: Comply with the Provisions set forth in AP 1002 and Met Ed Safety Manual

a) Personnel

b) Equipment

c) Environment

d) Nuclear

Post Maintenance Testing required and Acceptance Criteria ENSURE WORK AREA CLEANED UP AT COMPLETION OF JOB

ORIGINATOR—SUPERVISOR—SUPERVISOR OF MAINTENANCE—MAINTENANCE FOREMAN—JOB PERFORMER—MAINTENANCE FOREMAN—SUPERVISOR OF MAINTENANCE

COPY 1

JOB QUEST)
REVIEW – CLASSIFICATION – ROUTING CONTROL FORM

JOB TICKET NUMBER C5713

1. Does work represent a change or modification to an existing system or component? If yes, an approved change modification is required per AP 1021.
C/M No. N/A Yes____ No ✓

2a. Does work requires an RWP? Yes____ No ✓

2b. Is an approved procedure required to minimize personnel exposure? Yes____ No ✓

3a. Is work on a QC component as defined in GP 1008? Yes____ No ✓

3b. If 3a is yes does work have an effect on Nuclear Safety? If 3b is yes, PORC reviewed Superintendent approved procedure must be used. Yes____ No ✓

4. Agreement that a PORC reviewed, Superintendent approved procedure is not required for this work because it has no effect on nuclear safety. (Applies only if 3a is Yes and 3b is No).

NA
UNIT SUPERINTENDENT ____ DATE

5a. Is the system on the Environmental Impact list in AP 1026? Yes____ No ✓

5b. If 5a is YES, is an approved procedure required to limit environmental impact? Yes____ No ✓

6. Agreement that 5b is No. (Required only if 5a is Yes).

NA
UNIT SUPT/SUPV OF OPERATIONS ____ DATE

7. Plant status or prerequisite conditions required for work. (Operating and/or shutdown)

8. QC Dept. review, if required in item No. 3.

NA
QC SUPERVISOR ____ DATE

9. Does work require code inspector to be notified? Yes____ No ✓

10. Supervisor of Maintenance approval to commence work:
____ Date 9/23/80

11. Maintenance Foreman Assigned: ____

12. Code Inspector Notified. Name: ____ Date ____

13. Shift Foreman's approval to commence work: Jack Garrison Date 9/24/80

____ Initial if Shift Foreman signature is not required.

TMI-154 2-80

WORK I :DURE

T[illegible]

Maintenance Procedure Format and Approval

Unit No. 2

This form outlines the format and acts as a cover sheet for a maintenance procedure. Due to the limited size of the form, additional pages may be attached as required. Work Request procedure AP 1016 Section 6 should be used as a guide in preparing the maintenance procedure.

---

1. Procedure Title & No.:
   Sensor/Cable measurements on CF-2-LT4

2. Purpose: To determine signal characteristics on CF-2-LT4.

3. Description of system or component to be worked on.
   CF-2-LT4

4. References:
   See attached

5. Special Tools, and Materials required.
   See attached

6. Detailed Procedure (attach additional pages as required
   See attached

Supervisor of Maintenance recommends approval ______ Date 9/23/80

Engineering Review Brunner Date 9/22/80

- PORC RECOMMENDS APPROVAL

Unit No. 1 Chairman ______ Date ______ Unit No. 2 Chairman ______ Date ______

- UNIT SUPERINTENDENT APPROVAL

Unit No. 1 ______ Date ______ Unit No. 2 ______ Date ______

- Standing Procedure ______ Supervisor of QC ______ Date

*Note: These approvals required only on Nuclear Safety Related/Radiation work permit jobs.

TMI-04 2-78

Technology for Energy Corporation

PROCEDURE

TITLE IN-SITU MEASUREMENTS OF CABLES AND
SIGNALS FROM CORE FLOOD TANK LEVEL
TRANSMITTER CF-2-LT4

Page A-4

NO. TP-109

REV. 0

APPROVED

M.V. Mathis, Director, Tech. Serv. Div.

DATE

PURPOSE: The purpose of these measurements is to gather baseline data and information in preparation for removal of the Core Flood Tank Level Transmitter CF-2-LT4 from the Reactor Building TMI Unit 2. The tests specified in this procedure are designed to assess the condition of the in-containment instrumentation (Level Transmitter), associated cabling, and readout devices. This assessment will require the use of Time Domain Reflectometry (TDR), Impedance (Z), Spectral Analysis (frequency domain), and general oscilloscope observations (with recording) of waveforms from/to the unit under test (UUT).

PROCEDURE (ADMINISTRATIVE):

A. Limitations and Precautions

1. Nuclear Safety. Core Flood Tank Level Transmitter CF-2-LT4 is part of a Redundant Level Monitoring System located at elevation 305'. The unit is part of the engineered reactor safeguards system and is nulcear safety-related.

2. Environmental Safety. Core Flood Tank Level Transmitter CF-2-LT4 can be taken out-of and restored to services without producing a hazard to the environment.

3. Personnel Safety. The test described herein produces no additional personnel safety hazards other than normally associated with performing instrument testing.

4. Equipment Protection. In the performance of each test described herein, care will be taken to insure adequate equipment protection as follows:

   a. In all cases actual test hookups to the Unit-2 instrumentation shall be made and verified by Instrumentation Personnel.

   b. All passive measurements (Spectral Analysis and Oscilloscope observations) of waveforms and signals from powered instruments shall be performed using high input impedance probes or inputs (Z = $\geq$ 1 Meg ohm) to prevent loading of signals.

   c. In all Time Domain Reflectometry and Impedance measurements, power will be removed from the unit under test and low level test signals prescribed in Table 4-1 shall be utilized to perform cable integretary measurements on the appropriate instrumentation cables by inserting test signals on appropriate conductors of Cables

IT1730I and IT2751C (Terminations shall be removed) and replaced on TB 8-9-3 of Cabinet 156).

Table 4-1 Active Measurements

Active Signal Parameter	Time Domain Reflectometry	Impedance
Voltage	225 mV nominal (into 50 ohm base)	$\leq$ 5V rms
Frequency	---	100Hz, 1kHz, 10kHz, 100kHz
Current	$\leq$ 10mA	$\leq$ 100mA
Other	225mV, 110 picosecond pulses	---

B. Prerequisites

1. The Shift Supervisor/Shift Foreman shall be notified for concurrence prior to the performance of those measurements.
2. Instrumentation personnel shall be assigned to assist in the performance of these measurements.
3. All measurements and test instrumentation shall be in current calibration (traceable to NBS).
4. The Shift Supervisor/Shift Foreman shall be notified prior to starting and upon completion of the measurements.

C. Procedure for Performing Measurements

References:

1. Bailey Meter Company Transmitter #BY-8231X-A.
2. Bailey Product Instruction E 21-17.

3. Burns & Roe Dwg. 3343, Sh. 4.
4. Burns & Roe Dwg. 3024, Sh. 20.
5. Burns & Roe Dwg. 3045, Sh. 36F.
6. Instruction Manual, Tektronix Model 1502 Time Domain Reflectometer.
7. Instruction Manual, Hewlett Packard Model 4274 Multifrequency LCR Meter.
8. Instruction Manual, Hewlett Packard Spectrum Analyzer (Model 141T, 8553B, 8552B Modules).
9. Instruction Manual, Nicolet Model 444A-26 Spectrum Analyzer.
10. Instruction Manual, Tektronix Model 335 Oscilloscope.
11. Instruction Manual, Lockheed Store-4 Recorder.
12. Instruction Manual, Tektronix SC502 Oscilloscope.
13. TEC Composite Electrical Connection Diagram, CF-2-LT4 (see attachment).

SIGNAL	CABLE	CABINET 156
+ Signal	IT1730I	TB 8-9-3/19
- Signal	IT1730I	TB 8-9-3/18
118 VAC (H)	IT2751C	TB 8-9-3/16
118 VAC (L)	IT2751C	TB 8-9-3/16
Shield (Signal)	IT1730I	TB 8-9-3/17

STEPS

1. Notify Shift Supervisor/Shift Foreman of start of test on CF-2-LT4.
2. Verify power is applied to CF-2-LT4.
3. Record present readings from CF-2-LT4 Readout Module.

SIGNAL	LEVEL
CF-2-LT4 Readout	11' FT.

3. Connect differential conditioning amplifier TEC Model #901 across TB 8-9-3/19 (+) and /18 (-). Connect output from TEC Model #901 to FM Recorder and record for 30 minutes.

4. Using a Keithley Model 177 DMM (or equivalent, Range 0-2000 V, Precision ± 1%) measure the DC Voltage or current at the following test points.

SIGNAL	CABINET 156	TEST LEAD	READING
a.	8-9-3/19 TB 8-9-3/13	(+) (-)	Signal 5.719 VDC
b.	TB 8-9-3/16 TB 8-9-3/17	(+) (-)	118 VAC 116.1 VDC

*CAUTION: 118 VAC

Signature/Date

5. Using a Tektronix Model SC502 (or equivalent) oscilloscope observe the de-coupled waveform at the following test points:

TEC	TITLE	IN-SITU MEASUREMENTS OF CABLES AND SIGNALS FROM CORE FLOOD TANK LEVEL TRANSMITTER CF-2-LT4	NO. TP-109 REV. 0

SIGNAL	CABINET 156	PARAMETER			
a.	TB 8-9-3/19 TB 8-9-3/18	(+) SIG (-) SIG	Photo 109-1 Time Base 2mS Vert Gain 10mV	Photo 109-2 Time Base .5mS Vert Gain 20mV	Photo ____ Time Base ____ Vert Gain ____
*b.	TB 8-9-3/16 TB 8-9-3/17	118 VAC Power	Photo 109-3 Time Base 5mS Vert Gain 10V	Photo ____ Time Base ____ Vert Gain ____	Photo ____ Time Base ____ Vert Gain ____

*CAUTION 118 VAC; Use X10 Probe.

Sync the oscilloscope and photograph the waveform using up to three time base and vertical gain settings. Mark the back of the photographs with the instrument tag number and parameter measured.

Signature/Date

6. Using a Hewlett-Packard Spectrum Analyzer (Models 141T, 8553B and 8552 or equivalent) perform an analysis of the following signal for spectral content:

SIGNAL†	CABINET 156	PARAMETER	PHOTO #
a.	TB 8-9-3/19 TB 8-9-3/18	(+) SIG (-) SIG	109-4 109-5

Before photographing each scope display adjust analyzer for best spectral resolution. Record critical analyzer parameters e.g., RF bandwidth, RF bandwidth and sweep speed on rear of photograph as well as parameter analyzed.

TEC	TITLE	IN-SITU MEASUREMENTS OF CABLES AND SIGNALS FROM CORE FLOOD TANK LEVEL TRANSMITTER CF-2-LT4	NO. TP-109 REV. 0

SPECTRUM IDENT FREQUENCY AMPLITUDE REMARKS

BANDWIDTH	SCAN WIDTH	INPUT ATTEN	SCAN TIMING	LOG REF 10db LOG	SENS	
3KHz	1 MEG Hz/DIV	0	1 SEC	-20 db	0	109-4
1k	100K Hz/DIV	0	"	"	"	1095

9/24/80
Signature/Date

7. Using the Nicolet Model 444 FFT Analyzer (or equivalent) perform FFT annalysis of signals for the following test point:

SIGNAL	CABINET 156	PARAMETER	PHOTO #	
a.	TB 8-9-3/19 TB 8-9-3/18	(+) SIG (-) SIG	109-6 109-7	100K RANGE 1K RANGE

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8. Inside Cabinet 156 perform usual electronic calibrations using applicable instrument shop procedures. Attach instrument shop calibration data sheet and record any significant adjustments or problems in the space below.

Procedure Step	Remarks
See attached instrument shop procedure data sheet.	

Instrument Shop Procedure No. ________

____
Signature/Date

9. Remove all power from CF-2-LT4.

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10. Remove field wires (in table below) from Cables IT2751C and IT1730I (Cabinet 156) leaving test connections attached for direct measurements on field wire signals (from Step A.4.C).

CABINET 156	SIGNAL IDENT.
TB 8-9-3/19	(+) SIGNAL
TB 8-9-3/18	(-) SIGNAL
TB 8-9-3/16	(H) 118 VAC
TB 8-9-3/17	(L) 118 VAC
TB 8-9-3/20	SHIELD (Signal)

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11. Using the Hewlett-Packard Model 4274 (or equivalent) Impedance Bridge, measure the capacitance and impedance at the following test points:

TEST POINT	FROM	TO
a.	TB 8-9-3/19 (+) Signal	TB 8-9-3/18 (-) Signal
b.	TB 8-9-3/19 (+) Signal	TB 8-9-3/20 Shield (Signal)
c.	TB 8-9-3/18 (-) Signal	TB 8-9-3/20 Shield (Signal)
d.	TB 8-9-3/16 118 VAC (H)	TB 8-9-3/17 118 VAC (L)
e.	TB 8-9-3/16 118 VAC (H)	TB 8-9-3/19 (+) Signal
f.	TB 8-9-3/16 118 VAC (H)	TB 8-9-3/18 (-) Signal
g.	TB 8-9-3/16 118 VAC (H)	TB 8-9-3/20 Shield (Signal)

Record the data required below:

Test Point	Capacitance			Impedance		
Frequency	100 Hz	1 kHz	100 kHz	100 Hz	1 kHz	100 kHz
a. TB 8-9-3/19-18	23NF	18NF	12NF	4.4K/23°	3.2K/-21°	124Ω/-78°
b. TB 8-9-3/19-20	50NF	42NF	34NF	0F	3.6K/-76°	48Ω/-77°
c. TB 8-9-3/18-20	50NF	44NF	37NF	0F	3.5K/-78°	44Ω/-77°
d. TB 8-9-3/16-17	-120NF	17NF	52NF	12K/50°	9K/-80°	30Ω/-84°
e. TB 8-9-3/16-19	-.8NF 2NF	.2NF	8.7NF	0F	0F	109Ω/-143°
f. TB 8-9-3/16-18	-1.2NF 1.9NF	.2NF	10NF	0F	0F	101Ω/-141°
g. TB 8-9-3/16-20	-.8NF 2NF	.2NF	28NF	0F	0F	66Ω/-121°

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12. Using the Tektronix Model 1502 (or equivalent) TDR unit peform TDR measurements at the following test points.

IN-SITU MEASUREMENTS OF CABLES AND SIGNALS FROM CORE FLOOD TANK LEVEL TRANSMITTER CF-2-LT4

NO. TP-109

REV. 0

Record data below:

Test Point	Instrument Settings Ampl Range Mult	Strip Chart Number
a. TB 8-9-3/19-18 (±) Signal		109-1
b. TB 8-9-3/19-20 (+) Signal/SHLD		109-2
c. TB 8-9-3/16-17 (118 VAC)		109-3, 109-4
d. TB 8-9-3/16-20 (118 VAC/SHLD)		109-5, 109-6, 109-7

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13. Using the Keithley Model 144 (or equivalent DMM) perform resistance measurements on the test points specified and record values in the space provided.

			POLARITY From = +; To = -	POLARITY From = -; To = +
TEST POINT	FROM LINK	TO LINK	RESISTANCE	RESISTANCE
a.	TB 8-9-3/19	TB 8-9-3/18	7.1 K	8.8 K
b.	TB 8-9-3/19	TB 8-9-3/20	~	~
c.	TB 8-9-3/18	TB 8-9-3/20	~	~
d.	TB 8-9-3/16	TB 8-9-3/17	105 Ω	105 Ω
e.	TB 8-9-3/16	TB 8-9-3/19	~	~
f.	TB 8-9-3/16	TB 8-9-3/18	~	~
g.	TB 8-9-3/16	TB 8-9-3/20	~	~

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14. Connect field wires from Cables IT2751C and IT1730I at Cabinet 156 (see Step 10) and apply power.

15. Notify the Shift Supervisor/Shift Foreman of the conclusion of testing CF-2-LT4.

I hereby certify that this Test Procedure has been completed as written and that all data has been correctly entered and filed as requested.

TEC Representative ______________________
Signature/Date

Instrumentation ______________________
Signature/Date

GENERATION CORRECTIVE MAINTENANCE SYSTEM

CM STATUS ACTIVITY FORM

COMPONENT DESIGNATOR				LOCATION UNIT	JOB TYPE	WORK AUTHORIZATION NUMBER	REQUEST DATE		
SYS 5	COMP. TYPE 8	COMP ID 12	LOOP 16	17 22	23 24	28 32	MO 33	DAY	YR 38
CF	2	0LTU		036002	CM	▨ C5713	09	22	80

TXN CD 1	ACT 4	ECM NUMBER 47 - 51
804	A	

TXN CD 1	ACT 4	PRTY 66	RESP LOCATION OR CONTRACTOR 67 71	PRTY	ASSISTING CONTRACTOR	PRTY	ASSISTING CONTRACTOR
805	A	2	036N				

TXN CD 1	ACT 4	PURCHASE REQUISITION NUMBER 59 66	PURCHASE ORDER NUMBER 67 73
807	A		

TXN 1	ACT 4	STATUS HOLD CODE 39 40	STATUS HOLD START DATE 41 45	STATUS HOLD RELEASE DATE 47 52	% COMPL 53 55	S/M APPROVAL TO COMMENCE WORK MO DAY YR 56 61	FIELD WORK COMPLETION DATE MO DAY YR 62 67	
810	A	▨	▨	▨				
		01						OUTAGE HOLD
		02						PART HOLD
		03						QUALITY CONTROL PART HOLD
		04						QUALITY CONTROL PROCEDURE HOLD
		05						OPERATIONS HOLD
		06						CHANGE MODIFICATION HOLD
		07						ENGINEERING HOLD
		08						PLANNING HOLD
		50						MANPOWER NOT AVAILABLE
		51						AT PORC
		52						AT QUALITY CONTROL
		53						AT UNIT SUPERINTENDENT
		54						AT READING
		55						POST MAINTENANCE TEST HOLD
		56						AT ALARA

TMI 199 5 80