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Rosemount

NUCLEAR OPERATIONS GROUP

30 MONTH STABILITY SPECIFICATION FOR

ROSEMOUNT MODEL 1152, 1153 AND 1154

PRESSURE TRANSMITTERS

ROSEMOUNT REPORT D8900126

REVISION A

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REVISION STATUS SHEET

DOCUMENT NUMBER D8900126

DOCUMENT TITLE 30 Month Stability Specification for Rosemount Model 1152, 1153 and 1154 Pressure Transmitters

REVISION	CHANGE/DESCRIPTION	PAGE/PARAGRAPH	APPROVED BY	DATE
A	See following page			

REVISIO" STATUS

ROSEMOUNT)RT D8900126

30 MONTH STABILITY SPECIFICATION FOR ROSEMUUNT MODEL 1152, 1153 AND 1154 TRANSMITTERS

REV	PAGE	PARAGRAPH	CHANGE DESCRIPTION	ENG APP	ENG SUPV APP	QA APP	MKTG APP	EFFECTIVE DATE
A	1-15	All	Original Release	1/18/90	MWK 2/23/90	2/13/90	1/31/90	2/26/90

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30 MONTH STABILITY SPECIFICATION FOR

ROSEMOUNT MODEL 1152, 1153 AND 1154 PRESSURE TRANSMITTERS

ROSEMOUNT REPORT D8900126

REVISION A

1.0 SCOPE

This report documents the testing that was performed to demonstrate the new stability specification of ±0.2% URL for 30 months for Rosemount Model 1152, 1153 and 1154 transmitters. The former specification of ±0.25% URL for 6 months, including accuracy, was based on test results from the Model 1151 (Ref. 2.1). The new specification does not include accuracy.

2.0 REFERENCES

The revision level of the reference listed below were current at the time of release of this report.

2.1 Rosemount Report 78223, Revision A. "Long Term Test Results for Pressure Transmitters Rosemount Model 1151."

3.0 TEST DESCRIPTION

Test units consisted of four 1153 Series B transmitters, model number 1153GB6PA and serial numbers 402720, 402721, 402722, 402723, all calibrated 0 to 100 psig. The transmitters were powered with 34 V and output voltage of the transmitter was measured over a 500 ohm resistor. Response of the transmitter to an input pressure of 50 psi ±3 psi was recorded daily for the first week of the test, weekly for the next six months, and monthly for the duration of the test. Ambient temperature was also recorded. Calibration checks at 20% span increments were made between 0 and 100% span at the beginning and end of the test.

The test was originally scheduled to run 18 months. Input pressure was removed after 18 months and a calibration check performed. A request was made to extend the test out to 30 months so another calibration check was performed prior to pressurizing the transmitters to 50 psi again. No adjustment was made to the calibrations of the test units during the test interruption. Calibration data was recorded again after the test was over.

Transmitter output voltages measured during the first 18 months of the test are shown in Table 1 along with the output shifts. Output shifts are referenced to the output voltage measured at the beginning of the test. All of the output shifts are within the new stability specification of ±0.2% URL (±.016 V). Ambient temperatures ranged from 70 to 82°F

Results from the extension of the test to 30 months are shown in Table 2. Output shifts again are referenced to the output voltage measured at the beginning of the test. However, the shifts are adjusted for the change in output observed between the last measurement before the extension and the first measurement of the extension due to shut-down and start-up of pressure source.

For example, the output measured after 18 months for S/N 402720 was 5.990 V. After the pressure source was reapplied to the transmitter, the output was 5.996 V. The output shift referenced to the beginning of the test is +0.006 V (5.996 - 5.990 V). To determine the output shift due to drift, this value is adjusted by subtracting the 0.006 V output shift due to the change in pressure, resulting in an output drift of 0.000 V (0.006 - 0.006V).

All of the output shifts in Table 2 are within the new stability specification of ±0.2% URL (±.016 V). A graph of the output drift is shown in Figure 1. Ambient temperature ranged from 67-76°F.

The calibration checks made at the beginning of the test are shown in Table 3 and meet the accuracy specification ±0.25% span (±0.020 V). Calibration checks made after 18 months are shown in Table 4, prior to the extension to 30 months in Table 5, and after 30 months in Table 6. All meet the combined effects of accuracy (±0.25% span) and drift (±0.2% URL).

Original data is stored in Engineering Test File ETF.24.0.

TABLE 1 - TRANSMITTER OUTPUT DRIFT 0-18 MONTHS

TIME	S/N 402720	402721	402722	402723
		OUTPUT (V) OUTPUT SHIFT (V)		
DAY 1	5.990 .000	6.000 .000	5.992 .000	5.990 .000
DAY 2	5.990 .000	6.000 .000	5.993 +.001	5.990 .000
DAY 3	5.990 .000	6.000 .000	5.993 +.001	5.991 +.001
DAY 4	5.990 .000	6.000 .000	5.993 +.001	5.991 +.001
DAY 5	5.990 .000	6.000 .000	5.993 +.001	5.989 -.001
DAY 8	5.992 +.002	6.001 +.001	5.995 +.003	5.991 +.001
WEEK 2	5.993 +.003	6.001 +.001	5.997 +.005	5.992 +.002
WEEK 3	5.991 +.001	6.001 +.001	5.996 +.004	5.991 +.001
WEEK 4	5.994 +.004	6.002 +.002	5.997 +.005	5.989 -.001
WEEK 5	5.991 +.001	5.999 -.001	5.994 +.002	5.990 .000
WEEK 6	5.992 +.002	6.000 .000	5.994 +.002	5.989 -.001
WEEK 7	5.993 +.003	6.000 .000	5.995 +.003	5.991 +.001
WEEK 8	5.994 +.004	6.001 +.001	5.997 +.005	5.992 +.002
WEEK 9	5.993 +.003	5.999 -.001	5.996 +.004	5.990 .000
WEEK 10	5.994 +.004	5.999 -.001	5.996 +.004	5.990 .000
WEEK 11	5.992 +.002	6.000 .000	5.995 +.003	5.990 .000

TABLE 1 (CONT'D) - TRANSMITTER OUTPUT DRIFT 0-18 MONTHS

TIME	S/N 402720	OUTPUT (V) OUTPUT SHIFT (V) 402721	402722	402723
WEEK 12	5.992 +.002	5.999 -.001	5.997 +.005	5.990 .000
WEEK 13	5.993 +.003	5.999 -.001	5.997 +.005	5.990 .000
WEEK 14	5.993 +.003	5.999 -.001	5.997 +.005	5.990 .000
WEEK 15	5.993 +.003	5.999 -.001	5.997 +.005	5.990 .000
WEEK 16	5.994 +.004	6.000 .000	5.998 +.006	5.991 +.001
WEEK 17	5.993 +.003	6.000 .000	5.998 +.006	5.991 +.001
WEEK 18	5.993 +.003	6.000 .000	5.997 +.005	5.990 .000
WEEK 19	5.993 +.003	6.000 .000	5.996 +.004	5.990 .000
WEEK 20	5.993 +.003	6.000 .000	5.997 +.005	5.990 .000
WEEK 21	5.993 +.003	5.999 -.001	5.997 +.005	5.990 .000
WEEK 22	5.993 +.003	5.999 -.001	5.997 +.005	5.990 .000
WEEK 23	5.993 +.003	5.999 -.001	5.997 +.005	5.989 -.001
WEEK 24	5.993 +.003	5.999 -.001	5.997 +.005	5.989 -.001
WEEK 25	5.993 +.003	5.999 -.001	5.998 +.006	5.990 .000
MONTH 7	5.992 +.002	5.998 -.002	5.997 +.005	5.989 -.001
MONTH 8	5.992 +.002	5.998 -.002	5.996 +.004	5.986 -.004

TABLE 1 (CONT'D) - TRANSMITTER OUTPUT DRIFT 0-18 MONTHS

TIME	OUTPUT (V) OUTPUT SHIFT (V) S/N 402720	402721	402722	402723
MONTH 9	NR	NR	NR	NR
MONTH 10	5.992 +.002	5.996 -.004	5.997 +.005	5.987 -.003
MONTH 11	5.993 +.003	5.997 -.003	5.998 +.006	5.988 -.002
MONTH 12	5.993 +.003	5.994 -.006	5.996 +.004	5.986 -.004
MONTH 13	5.996 +.006	5.995 -.005	5.998 +.006	5.988 -.002
MONTH 14	5.994 +.004	5.996 -.004	5.996 +.004	5.986 -.004
MONTH 15	5.992 +.002	5.996 -.004	5.996 +.004	5.986 -.004
MONTH 16	6.003 +.013	5.995 -.005	6.000 +.008	5.988 -.002
MONTH 17	NR	NR	NR	NR
MONTH 18	5.990 .000	5.994 -.006	5.999 +.007	5.986 -.004

TABLE 2 - TRANSMITTER OUTPUT DRIFT EXTENSION TO 30 MONTHS

TIME	S/N 402720	402721	402722	402723
		OUTPUT (V) OUTPUT SHIFT (V)		
DAY 1	5.996 .000	5.990 -.006	5.995 +.007	5.979 -.004
DAY 2	5.995 -.001	5.989 -.007	5.995 +.007	5.977 -.006
DAY 3	NR	NR	NR	NR
DAY 4	5.993 -.003	5.987 -.009	5.992 +.004	5.977 -.006
MONTH 19	5.994 -.002	5.998 +.002	5.993 +.005	5.978 -.005
MONTH 20	5.995 -.001	5.991 -.005	5.995 +.007	5.979 -.004
MONTH 21	5.994 -.002	5.997 +.001	5.998 +.010	5.982 -.001
MONTH 22	NR	NR	NR	NR
MONTH 23	5.993 -.003	5.998 +.002	6.000 +.012	5.988 +.005
MONTH 24	5.992 -.004	5.998 +.002	6.000 +.012	5.988 +.005
MONTH 25	5.988 -.008	5.995 -.001	5.996 +.008	5.985 +.002
MONTH 26	5.992 -.004	5.997 +.001	6.000 +.012	5.987 +.004
MONTH 27	NR	NR	NR	NR
MONTH 28	5.993 -.003	5.997 +.001	6.002 +.014	5.988 +.005
MONTH 29	5.984 -.012	5.992 -.004	5.994 +.006	5.981 -.002
MONTH 30	5.991 -.005	5.996 .000	5.999 +.011	5.988 +.005

TABLE 3 - INITIAL ACCURACY CHECK

INPUT, % SPAN	0%	20%	40%	60%	80%	100%
IDEAL OUTPUT (V)	2.000	3.600	5.200	6.800	8.400	10.000
S/N 402720						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.995	3.592	5.188	6.785	8.383	9.986
VOLTAGE SHIFT	-.005	-.008	-.012	-.015	-.017	-.014
DECREASING INPUT						
ACTUAL OUTPUT(V)	1.996	3.595	5.192	6.789	8.386	9.986
VOLTAGE SHIFT	-.004	-.005	-.008	-.011	-.014	-.014
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.995	3.593	5.190	6.787	8.385	9.988
VOLTAGE SHIFT	-.005	-.007	-.010	-.013	-.015	-.012
S/N 402721						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.995	3.592	5.196	6.797	8.393	9.990
VOLTAGE SHIFT	-.005	-.008	-.004	-.003	-.007	-.010
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.997	3.596	5.199	6.800	8.395	9.990
VOLTAGE SHIFT	-.003	-.004	-.001	.000	-.005	-.010
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.997	3.594	5.197	6.799	8.395	9.991
VOLTAGE SHIFT	-.003	-.006	-.003	-.001	-.005	-.009
S/N 402722						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.997	3.593	5.191	6.791	8.390	9.993
VOLTAGE SHIFT	-.003	-.007	-.009	-.009	-.010	-.007
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.998	3.596	5.194	6.794	8.391	9.993
VOLTAGE SHIFT	-.002	-.004	-.006	-.006	-.009	-.007
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.998	3.595	5.193	6.793	8.392	9.998
VOLTAGE SHIFT	-.002	-.005	-.007	-.007	-.008	-.002

TABLE 3 (CONT'D) - INITIAL ACCURACY CHECK

INPUT, % SPAN	0%	20%	40%	60%	80%	100%
IDEAL OUTPUT (V)	2.000	3.600	5.200	6.800	8.400	10.000
S/N 402723						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.996	3.592	5.189	6.786	8.386	9.992
VOLTAGE SHIFT	-.004	-.008	-.011	-.014	-.014	-.008
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.998	3.595	5.191	6.789	8.388	9.992
VOLTAGE SHIFT	-.002	-.005	-.009	-.011	-.012	-.008
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.997	3.594	5.192	6.788	8.388	9.994
VOLTAGE SHIFT	-.003	-.006	-.008	-.012	-.012	-.006

TABLE 4 - ACCURACY CHECK AFTER 18 MONTHS

INPUT, % SPAN	0%	20%	40%	60%	80%	100%
IDEAL OUTPUT (V)	2.000	3.600	5.200	6.800	8.400	10.000
S/N 402720						
INCREASING INPUT						
ACTUAL OUTPUT (V)	2.000	3.594	5.190	6.787	8.382	9.984
VOLTAGE SHIFT	.000	-.006	-.010	-.013	-.018	-.016
DECREASING INPUT						
ACTUAL OUTPUT (V)	2.001	3.599	5.194	6.789	8.385	9.984
VOLTAGE SHIFT	+.001	-.001	-.006	-.011	-.015	-.016
INCREASING INPUT						
ACTUAL OUTPUT (V)	2.001	3.597	5.192	6.787	8.383	9.984
VOLTAGE SHIFT	+.001	-.003	-.008	-.013	-.017	-.016
S/N 402721						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.997	3.592	5.194	6.794	8.387	9.983
VOLTAGE SHIFT	-.003	-.008	-.006	-.006	-.013	-.017
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.997	3.594	5.197	6.797	8.390	9.983
VOLTAGE SHIFT	-.003	-.006	-.003	-.003	-.010	-.017
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.997	3.593	5.195	6.794	8.389	9.984
VOLTAGE SHIFT	-.003	-.007	-.005	-.006	-.011	-.016
S/N 402722						
INCREASING INPUT						
ACTUAL OUTPUT (V)	2.007	02	5.197	6.795	8.390	9.992
VOLTAGE SHIFT	+.007	+.002	-.003	-.005	-.010	-.008
DECREASING INPUT						
ACTUAL OUTPUT (V)	2.007	3.603	5.199	6.797	8.393	9.992
VOLTAGE SHIFT	+.007	+.003	-.001	-.003	-.007	-.008
INCREASING INPUT						
ACTUAL OUTPUT (V)	2.007	3.602	5.198	6.795	8.391	9.992
VOLTAGE SHIFT	+.007	+.002	-.002	-.005	-.009	-.008

TABLE 4 (CONT'D) - ACCURACY CHECK AFTER 18 MONTHS

INPUT, % SPAN	0%	20%	40%	60%	80%	100%
IDEAL OUTPUT (V)	2.000	3.600	5.200	6.800	8.400	10.000
S/N 402723						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.995	3.593	5.187	6.783	8.382	9.987
VOLTAGE SHIFT	-.005	-.007	-.013	-.017	-.018	-.013
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.995	3.593	5.187	6.786	8.384	9.987
VOLTAGE SHIFT	-.005	-.007	-.013	-.014	-.016	-.013
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.995	3.592	5.187	6.784	8.383	9.987
VOLTAGE SHIFT	-.005	-.008	-.013	-.016	-.017	-.013

TABLE 5 - ACCURACY CHECK BEFORE TEST EXTENSION

INPUT, % SPAN	0%	20%	40%	60%	80%	100%
IDEAL OUTPUT (V)	2.000	3.600	5.200	6.800	8.400	10.000
S/N 402720						
INCREASING INPUT						
ACTUAL OUTPUT (V)	2.001	3.600	5.198	6.796	8.383	9.985
VOLTAGE SHIFT	+.001	.000	-.002	-.004	-.017	-.015
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.999	3.596	5.193	6.788	8.385	9.985
VOLTAGE SHIFT	-.001	-.004	-.007	-.012	-.015	-.015
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.999	3.595	5.198	6.786	8.382	9.984
VOLTAGE SHIFT	-.001	-.005	-.002	-.014	-.018	-.016
S/N 402721						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.999	3.597	5.202	6.803	8.390	9.985
VOLTAGE SHIFT	-.001	-.003	+.002	+.003	-.010	-.015
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.996	3.593	5.197	6.796	8.390	9.985
VOLTAGE SHIFT	-.004	-.007	-.003	-.004	-.010	-.015
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.996	3.592	5.195	6.793	8.388	9.984
VOLTAGE SHIFT	-.004	-.008	-.005	-.007	-.012	-.016
S/N 402722						
INCREASING INPUT						
ACTUAL OUTPUT (V)	2.008	3.605	5.203	6.802	8.390	9.991
VOLTAGE SHIFT	+.008	+.005	+.003	+.002	-.010	-.009
DECREASING INPUT						
ACTUAL OUTPUT (V)	2.006	3.601	5.198	6.795	8.391	9.991
VOLTAGE SHIFT	+.006	+.001	-.002	-.005	-.009	-.009
INCREASING INPUT						
ACTUAL OUTPUT (V)	2.006	3.600	5.196	6.792	8.398	9.990
VOLTAGE SHIFT	+.006	.000	-.004	-.008	-.002	-.010

TABLE 5 (CONT'D) - ACCURACY CHECK BEFORE TEST EXTENSION

INPUT, % SPAN	0%	20%	40%	60%	80%	100%
IDEAL OUTPUT (V)	2.000	3.600	5.200	6.800	8.400	10.000
S/N 402723						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.994	3.591	5.188	6.785	8.373	9.976
VOLTAGE SHIFT	-.006	-.009	-.012	-.015	-.027	-.024
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.991	3.588	5.182	6.777	8.374	9.976
VOLTAGE SHIFT	-.009	-.012	-.018	-.023	-.026	-.024
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.991	3.586	5.180	6.775	8.372	9.975
VOLTAGE SHIFT	-.009	-.014	-.020	-.025	-.028	-.025

TABLE 6 - ACCURACY CHECK AFTER 30 MONTHS

INPUT, % SPAN	0%	20%	40%	60%	80%	100%
IDEAL OUTPUT (V)	2.000	3.600	5.200	6.800	8.400	10.000
S/N 402720						
INCREASING INPUT						
ACTUAL OUTPUT (V)	2.000	3.597	5.193	6.788	8.385	9.986
VOLTAGE SHIFT	.000	-.003	-.007	-.012	-.015	-.014
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.999	3.598	5.195	6.791	8.387	9.986
VOLTAGE SHIFT	-.001	-.002	-.005	-.009	-.013	-.014
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.999	3.597	5.193	6.788	8.386	9.987
VOLTAGE SHIFT	-.001	-.003	-.007	-.012	-.014	-.013
S/N 402721						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.995	3.592	5.195	6.798	8.391	9.986
VOLTAGE SHIFT	-.005	-.008	-.005	-.002	-.009	-.014
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.995	3.594	5.198	6.797	8.393	9.986
VOLTAGE SHIFT	-.005	-.006	-.002	-.003	-.007	-.014
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.995	3.592	5.196	6.795	8.392	9.987
VOLTAGE SHIFT	-.005	-.008	-.004	-.005	-.008	-.013
S/N 402722						
INCREASING INPUT						
ACTUAL OUTPUT (V)	2.007	3.603	5.200	6.798	8.397	9.998
VOLTAGE SHIFT	+.007	+.003	.000	-.002	-.003	-.002
DECREASING INPUT						
ACTUAL OUTPUT (V)	2.007	3.604	5.202	6.[illegible]00	8.398	9.998
VOLTAGE SHIFT	+.007	+.004	+.002	0	-.002	-.002
INCREASING INPUT						
ACTUAL OUTPUT (V)	2.007	3.603	5.200	6.798	8.397	9.999
VOLTAGE SHIFT	+.007	+.003	.000	-.002	-.003	-.001

TABLE 6 (CONT'D) - ACCURACY CHECK AFTER 30 MONTHS

INPUT, % SPAN	0%	20%	40%	60%	80%	100%
IDEAL OUTPUT (V)	2.000	3.600	5.200	6.800	8.400	10.000
S/N 402723						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.994	3.591	5.188	6.786	8.386	9.992
VOLTAGE SHIFT	-.006	-.009	-.012	-.014	-.014	-.008
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.998	3.592	5.190	6.788	8.388	9.992
VOLTAGE SHIFT	-.002	-.008	-.010	-.012	-.012	-.008
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.998	3.591	5.188	6.786	8.386	9.992
VOLTAGE SHIFT	-.002	-.009	-.012	-.014	-.014	-.008

TABLE 6 (CONT'D) - ACCURACY CHECK AFTER 30 MONTHS

INPUT, % SPAN	0%	20%	40%	60%	80%	100%
IDEAL OUTPUT (V)	2.000	3.600	5.200	6.800	8.400	10.000
S/N 402723						
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.994	3.591	5.188	6.786	8.386	9.992
VOLTAGE SHIFT	-.006	-.009	-.012	-.014	-.014	-.008
DECREASING INPUT						
ACTUAL OUTPUT (V)	1.998	3.592	5.190	6.788	8.388	9.992
VOLTAGE SHIFT	-.002	-.008	-.010	-.012	-.012	-.008
INCREASING INPUT						
ACTUAL OUTPUT (V)	1.998	3.591	5.188	6.786	8.386	9.992
VOLTAGE SHIFT	-.002	-.009	-.012	-.014	-.014	-.008

4.0 CONCLUSION

Based on the test results documented in this report and the similarity in design between the Model 1152, 1153, and 1154 transmitters, it has been demonstrated that the Rosemount Model 1152, 1153, and 1154 transmitters will meet a new stability specification of ±0.2% URL.

Data for Acoustic Monitors installed on Peach Bottom Units 2 & 3

1. results of Drift projection:

Manufacture: NDT Model No. 104DC-M1

INTERVAL (MONTHS)	OISD MEAN	SQRT SMAZ (% of SPAN)
1	-0.050000	0.076376
2	-7.100000	7.100000
11	-0.523077	0.947206
12	-1.375000	3.031392
13	-0.400000	0.741620
18	-0.225000	0.399929
24	-0.660000	1.319276
25	-0.766667	0.872417
45	0.150000	0.792149

2. Raw input data for Peach Bottom Units 2 & 3

INSTRUMENT NUMBER	TEST DATE (Yr/Month/Day)	AS-LEFT VALUE	AS-FOUND VALUE
POS-3-2-70A	85/02/20	199	199
POS-3-2-70A	86/01/30	198	198
POS-3-2-70A	89/11/08	204	185
POS-3-2-70A	90/11/04	204	204
POS-3-2-70B	85/02/20	200	200
POS-3-2-70B	86/01/30	198	198
POS-3-2-70B	89/11/08	196	196
POS-3-2-70B	90/11/03	200	200
POS-3-2-70B	90/11/17	202	170
POS-3-2-71A	85/02/20	203	203
POS-3-2-71A	86/01/30	202	202
POS-3-2-71A	89/11/16	202	176
POS-3-2-71B	85/02/20	201	201
POS-3-2-71B	86/01/30	201	201
POS-3-2-71B	89/11/16	202	198
POS-3-2-71C	85/02/20	207	207

INSTRUMENT NUMBER	TEST DATE (Yr/Month/Day)	AS-LEFT VALUE	AS-FOUND VALUE
POS-3-2-71C	86/01/30	198	207
POS-3-2-71C	89/11/07	201	201
POS-3-2-71C	90/11/03	209	141
POS-3-2-71D	85/02/20	205	205
POS-3-2-71D	86/01/30	199	204
POS-3-2-71D	89/11/07	204	204
POS-3-2-71D	90/11/03	204	130
POS-3-2-71E	85/02/20	208	208
POS-3-2-71E	86/01/30	200	195
POS-3-2-71E	89/11/08	201	201
POS-3-2-71E	90/09/06	206	206
POS-3-2-71E	90/11/04	201	135
POS-3-2-71F	85/02/20	206	206
POS-3-2-71F	86/01/30	200	192
POS-3-2-71F	89/11/08	197	197
POS-3-2-71F	90/09/06	197	197
POS-3-2-71F	90/11/04	201	126
POS-3-2-71G	85/02/20	197	197
POS-3-2-71G	86/01/30	200	178
POS-3-2-71G	89/11/10	206	177
POS-3-2-71G	90/11/04	205	205
POS-3-2-71H	85/02/20	196	196
POS-3-2-71H	86/01/30	199	177
POS-3-2-71H	89/11/10	205	176
POS-3-2-71H	90/11/04	205	166
POS-3-2-71J	85/02/20	200	200
POS-3-2-71J	86/01/30	199	199
POS-3-2-71J	89/11/08	199	199
POS-3-2-71J	90/11/04	200	200
POS-3-2-71K	85/02/20	195	195
POS-3-2-71K	86/01/30	198	198
POS-3-2-71K	89/11/08	198	198
POS-3-2-71K	90/11/04	198	93
POS-3-2-71L	85/02/20	201	201
POS-3-2-71L	86/01/30	201	201

INSTRUMENT NUMBER	TEST DATE (Yr/Month/Day)	AS-LEFT VALUE	AS-FOUND VALUE
POS-3-2-71L	89/11/08	205	185
POS-3-2-71L	90/11/04	205	188
POS-2-2-70A	83/11/30	205	205
POS-2-2-70A	85/05/23	200	202
POS-2-2-70A	87/12/14	208	208
POS-2-2-70A	89/03/01	199	199
POS-2-2-70A	90/03/17	200	200
POS-2-2-70A	91/03/08	200	200
POS-2-2-70B	83/11/30	203	203
POS-2-2-70B	85/05/23	203	203
POS-2-2-70B	89/03/01	199	199
POS-2-2-70B	90/03/17	192	180
POS-2-2-70B	91/03/08	197	197
POS-2-2-71A	83/11/30	201	201
POS-2-2-71A	85/05/23	201	204
POS-2-2-71A	89/02/22	208	208
POS-2-2-71A	90/03/11	197	197
POS-2-2-71A	91/03/08	197	197
POS-2-2-71B	83/11/30	203	203
POS-2-2-71B	85/05/23	200	206
POS-2-2-71B	89/02/22	196	196
POS-2-2-71B	90/03/11	201	201
POS-2-2-71B	91/03/08	201	201
POS-2-2-71C	83/11/30	202	202
POS-2-2-71C	85/05/23	201	200
POS-2-2-71C	89/03/01	206	206
POS-2-2-71C	90/03/17	205	205
POS-2-2-71C	91/03/04	203	203
POS-2-2-71C	91/03/08	203	203
POS-2-2-71C	91/04/15	203	203
POS-2-2-71D	83/11/30	201	201
POS-2-2-71D	85/05/23	201	199
POS-2-2-71D	89/03/01	206	206
POS-2-2-71D	90/03/17	200	200
POS-2-2-71D	91/03/04	198	198

INSTRUMENT NUMBER	TEST DATE (Yr/Month/Day)	AS-LEFT VALUE	AS-FOUND VALUE
POS-2-2-71D	91/03/08	200	200
POS-2-2-71D	91/04/15	197	197
POS-2-2-71E	83/11/30	207	207
POS-2-2-71E	85/05/23	201	199
POS-2-2-71E	89/03/01	199	199
POS-2-2-71E	90/03/11	192	176
POS-2-2-71E	91/03/06	200	190
POS-2-2-71F	83/11/30	205	205
POS-2-2-71F	85/05/23	201	201
POS-2-2-71F	89/03/01	200	200
POS-2-2-71F	90/03/11	194	175
POS-2-2-71F	91/03/06	191	191
POS-2-2-71G	83/11/30	203	203
POS-2-2-71G	85/05/23	201	202
POS-2-2-71G	89/03/01	197	197
POS-2-2-71G	90/03/17	193	196
POS-2-2-71H	83/11/30	203	203
POS-2-2-71H	85/05/23	201	201
POS-2-2-71H	89/03/01	201	201
POS-2-2-71H	90/03/17	196	133
POS-2-2-71J	83/11/30	203	203
POS-2-2-71J	85/05/23	200	200
POS-2-2-71J	89/03/09	199	199
POS-2-2-71J	90/03/19	195	195
POS-2-2-71J	91/03/08	206	206
POS-2-2-71K	83/11/30	204	204
POS-2-2-71K	85/05/23	200	198
POS-2-2-71K	89/03/09	199	199
POS-2-2-71K	90/03/19	198	198
POS-2-2-71K	91/03/08	201	201
POS-2-2-71L	83/11/30	204	204
POS-2-2-71L	85/05/23	201	199
POS-2-2-71L	89/03/01	199	199
POS-2-2-71L	90/03/17	197	197
POS-2-2-71L	91/03/08	198	198

ATTACHMENT 3

KINEMETRICS

INSTRUMENTS
SYSTEMS
SERVICES

July 15, 1992

John Carolan
Philadelphia Electric
Mail Stop 63A-1
965 Chesterbrook Blvd.
Wayne, PA 19087

Subject: Applicability of Kinemetrics' solid state instrumentation to a 30-month calibration interval.

Reference: Request by Steve Kincaid (Philadelphia Electric) on July 7, 1992 for transmittal of this information to you.

Dear Mr. Carolan,

The design of the Kinemetrics Model SSA-3 Strong Motion Accelerograph is in full accordance with USNRC Reg. Guide 1.12 (1974), ANSI ANS 2.2-1978 and ANSI ANS 2.2-1988.

This solid state accelerograph permits response spectra calculations and plotting to be performed on-site within minutes following an earthquake event. When integrated with the Kinemetrics Model SSP-1 Playback Computer, the EPRI CAV analysis, OBE analysis, response spectra calculations and printed plots with the earthquake response spectra vs. the plant design criteria all are executed automatically immediately following the recorded event; using spreadsheet parameters preprogrammed into the computer by plant engineers.

Recently (January 1992) the USNRC staff released Draft Regulatory Guide DG-1016 for public comment. Under this guide, the staff allows four (4) hours for determination of exceedance of OBE criteria for sites with the ability to provide response spectra data within that time frame. Further, EPRI's proposed cummulative absolute velocity (CAV) analysis, with minor modifications, is identified by the staff as an acceptable method for determining whether or not the earthquake energy was sufficient to cause damage. This is important at sites where the OBE is likely to be exceeded at higher frequencies (which are less damaging to civil structures).

The SSA-3 accelerograph does not use the Kinemetrics Model TS-3 (electromagnetic) Seismic Trigger. If the TS-3 Seismic Switch is required for a Level 1 OBE indicator, then the drift and secondary calibration issues addressed in my previous letter are applicable. It is my interpretation of Draft Regulatory Guide DG-1016 that plants which upgrade to the solid state instrumentation and have the ability to provide response spectra data from a sensor mounted at the containment foundation (or freefield site if there is soil interaction at the containment foundation) will be allowed four hours for determination of OBE exceedance. Thus, determination of OBE exceedance is based upon analysis of data provided by the instrumentation identified in ANSI ANS-2.2-1988 as being the most authoritative; the time history accelerograph. In such case, the seismic switch need only be operated to meet existing licensing requirements.

It is Kinemetrics' position that the design of the SSA-3 Seismic Monitoring System is capable of operating in a calibratable manner for an additional 12 months beyond the currently practiced 18 month calibration interval. Because the SSA-3 does not use an electromagnetic triggering device, Kinemetrics considers the SSA-3 to be superior to the SMA-3 for such applications.

Few SMA-3 systems have been sold in the last two to three years; fewer nuclear power plants going on-line and customers are opting for the newer digital instrumentation. It is therefore, inevitable that the FM cassette recording instrumentation will be obsoleted sometime in the near future. Given this condition, the following points concerning the SSA-3 will be of interest to you:

-The SSA-3 is seismically qualified to IEEE 344-1987.
- " " is designed to directly retrofit most Model SMA-3 FM cassette recording systems.
-All remote Kinemetrics FBA-3 sensor packages and the existing cabling directly mate to the newer solid state instrumentation.
-Each accelerograph record section has an internal digital trigger algorithm which directly monitors each channel out of the assigned remote accelerometer package.

Thus, use of the solid state instrumentation greatly improves the plant's post-event performance, provides higher quality data, reduces the instrumentation to be operated and, provides redundancy in the triggering operation.

I appreciate the opportunity to discuss the application of Kinemetrics' instrumentation for your project. Please let me know if any further information is required.

Sincerely,

Rod Merrill
Manager of Services

RAM:lpc

enclosures: noted

cc: John Diehl, Vice-President, Kinemetrics, Inc.
Ian Standley, Manager of Engineering, Kinemetrics, Inc.

ATTACHMENT 4

GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

6-5-92

J. Carolan
Philadelphia Electric Company
965 Chesterbrook Blvd
Wayne, PA 19087

John,

As you requested the 30 month (24 + 25%) information for the 3 NUMAC (LCRM, LRM and LDS) devices is provided. The drift values do not include contributions due to the sensors.

For the LDS (Leak Detection System) NUMAC the error in the performance specification is 0.7°F. This specified random value is for [illegible] months and is mainly due to the A-D conversions. The value for 30 months would therefore be $5^{1/2}$ (0.7°F) or 1.6°F.

For the LCRM and LRM the attached 2 pages describe the considerations for 30 month drift for the NUMACs.

Please feel free to call if you have any questions.

Thanks,

J.L. Leong
Lead Setpoint
Methodology Engr

LIMERICK TRIP PATH DRIFT RATES
FOR NUMAC LCRM 304A3701G003 AND LRM 304A3700G022

INTRODUCTION

Overall drift within either the Logarithmic Count Rate Meter (LCRM) 304A3701G003 or the Logarithmic Radiation Monitor (LRM) 304A3700G022 may be broken down into three component parts:

1. Drift occurring from signal input to digital representation of the signal within the instruments's CPU (Computer) Module. Once the signal is in digital form there is no further drift until output signals are generated. The digital representation of the measured signal may be viewed on the instrument's front panel.

   This component part is of concern since it involves the trip function and will be discussed below.

2. Drift in analog outputs (to recorders, meters, process computers) after digital to analog conversion.

   Analog outputs signals are not used for any trip or control functions and their related circuits do not add more than 0.1% of linear full scale per month to overall drift (from measured input to analog output).

3. Drift in discrete output signals (ie, trips) generated as a result of trip comparisons within the CPU Module.

   There is no drift associated with trip output circuits since they are entirely digital.

LOG COUNT RATE METER (LCRM)

Input pulses from an associated detector enter the LCRM's Discriminator Module where they discriminated by pulse height and then digitally processed. Pulse counts are sent to the CPU Module where count rates are determined. CPU timing is crystal controlled. The process just described is not known to contribute to overall instrument drift rate as it pertains to the trip function. Measurements made on similar Discriminator and CPU Modules in a NUMAC Source Range Monitor (an instrument similar to the LCRM) showed that there was no drift over a 30 day period.

LOG RAD MONITOR (LRM)

Input current from an associated detector enters the LRM's Femtoammeter Module where it is converted to a voltage proportional to the logarithm of the current. This voltage is, in turn, converted to a digital value by the LRM's Analog Module. The digital value is then read by the CPU Module where further signal processing occurs. Based on testing, the process just described contributes a drift of ± 1 percent of point per month to overall instrument drift. This converts to an 18 month value of less than ± 4.3 percent for the trip function.

TRIP POINT COMPARISONS

The following applies to both the LCRM and LRM.

Trip set points are entered numerically via the instrument's front panel keyboard and display. Entered values are immediately converted from ASCII to binary format and stored in the CPU's memory. All trip comparisons are made by the CPU using binary numbers. There are no drifts associated with the above process.