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Test Report

REPORT NO. QTR 82-002

DATE March 1982

NUCLEAR ENVIRONMENTAL QUALIFICATION OF THE REMOTE MULTIPLEXER UNIT MODELS MC170AD-Q2 and MC370AD-Q2 AND ASSOCIATED PC BOARDS AND PLUG-IN MODULES

Revision B October, 1982

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CORRECTION SHEET

for

QUALIFICATION TEST REPORT NO. QTR82-002

The items shown herein are corrections for errors and omissions in the original issue of QTR82-002 dated March 1982.

SECTION	DESCRIPTION	DATE	APPR
Non-Conform Summary, Post Aging, Pages 4 and 5 of 11	Replace "(Q2800-666)" with "(Q6003-8090)"	1/83	
2.5.3	Delete "and 2.5.2.2"	1/83	
2.7.3	Delete "and 2.7.2.2"	1/83	
2.10.2.1	Add to Table VI: "Note: Temperature coefficients shown above are deviations from room temperature."	1/83	
2.5.2.1 2.5.2.2 2.6.2.1 2.7.2.1 2.7.2.2 2.8.2.1	Add: Note 1, and Note 2 Note 1: Mounted on Bracket P/N 9429-Q2, S/N 5325. Note 2: Mounted on Bracket P/N 10151-Q2, S/N 571380	1/83	

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LETTER	DATE	DESCRIPTION OF CHANGE	BY
A	July 1982	Added Addendum I - Extreme Temperature and Humidity Test; and Addendum II - Qualification of Models DI325-XXX-Q2 and DI338-XXX-Q2; moved Section 2.11 to Appendix B	RHC
B	Oct. 1982	Corrected PT174-Q2 Serial Numbers Q9702-5-1 to read Q9702-1 and Q9702-5-2 to read Q9702-2	WAT

1.0 SCOPE AND OBJECTIVES

This Report covers the Environmental Qualification Test program for the Validyne Models MC170AD-Q2 and MC370AD-Q2 Remote Multiplexer/Module Cases and associated plug-in signal conditioning modules. This equipment comprises a part of the Model HD310 High Speed Data Acquisition System.

The test program included Irradiation, Thermal Aging, Seismic and Extreme Environment tests. The objective of the program was to demonstrate the adequacy of the equipment for use in nuclear power generating stations in IEEE Class 1E safety related applications.

1.1 SUMMARY

The test report is divided into two major sections; one covering the environmental tests performed by Wyle Laboratories (Wyle Report number 58666) and the other covering the pre- and post-environment functional tests performed by Validyne personnel and witnessed by Wyle Laboratories Quality Assurance personnel (reference Validyne Report number QTR 82-002).

1.2 SUPPLEMENTAL TESTS

Included in this Report are Addendum I and Addendum II covering supplemental temperature and humidity testing of plug-in modules for the MC170AD-Q2 and MC370AD-Q2; and, qualification of the Models DI325-XXX-Q2 and DI338-XXX-Q2, respectively.

2.0 TEST PROCEDURES AND RESULTS

2.1 GENERAL

2.1.1 Functional Test

Functional Tests were performed prior to and subsequent to the following events: radiation test, aging test, seismic test and extreme temperature and humidity test, and also during the seismic test and extreme temperature and humidity test. A copy of each functional test procedure is contained in Section 2.11.

Each functional test was performed by VEC personnel and witnessed by Wyle Laboratories Quality Assurance and VEC Quality Control personnel.

2.1.2 Results

The test results for each event are summarized and only typical examples are contained herein because the complete data package is too extensive to present in this report. However, the complete data package is on file at VEC Northridge facility.

2.2. BASE LINE FUNCTIONAL TEST

2.2.1 Test Procedure

Each test specimen was tested to the corresponding Acceptance Test Procedure listed in Attachment A of Validyne Doc. #9834 contained in Section 2.11.

2.2.2 Test Results

2.2.2.1 Test Results Summary

Model #	S/N	ATP#	Passed, No Deviation	Passed After Deviation Corrected	Passed with Deviation Noted
AB295-Q2	QS981-1	445	x		
	QS981-2	445	x		
AD296-Q2	QS982-1	447	x		
	QS982-2	447	x		
PT174-Q2	Q9702-1	444	x		
	Q9702-2	444	x		
	QE507-1	444	x		
	QE426-143	444	x		
TC292-Q2	QE425-1	453	x		
	QE425-2	453	x		
	QE506-1	453	x		
	QE506-2	453	x		
DI325-Q2	QE424-1	452	x		
	QE424-2	452	x		
	QE424-3	452	x		
	QE424-4	452	x		
	QE424-5	452	x		
PS294-Q2	Q9702-1	451	x		
	Q9702-2	451	x		
PC202-Q2	QE427-1	449	x		
	QE427-2	449	x		
	QE427-100	449	x		
BA332-Q2	QE419-1	450	x		
	QE419-2	450	x		
	QE419-341	450	x		
JC177-Q2	QE429-1	446	x		
	QE429-2	446	x		
PS171-Q2	QE543-56287	454	x		
	QE543-56288	454			x
CD173-Q2	QE538-1	443	x		
	QE538-2	443	x		
	QE428-21	443	x		
	QE428-22	443	x		
CM249-Q2	55420	440	x		
	55421	440	x		
	55422	440	x		
	55423	440	x		
PS324-Q2	56460	455	x		
	56461	455	x		
MC170AD-Q2	54278	442	x		
	54279	442	x		

QC VERIFICATION F. Kameeman

2.2.3 Non-Conformance Summary

This section summarizes and describes the deviations noted in Section 2.2.2.1.

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NON-CONFORMANCE SUMMARY

Event: Base Line Function

Unit: PS171-Q2

S/N: 56288

1st ATP: NCR 67 6/19/81

ATP # 454 Deviation Paragraph: 5.2.5

Deviation:

Line regulation does not meet ATP spec.

Δ Vdc = 14 mv.

Analysis:

Deviation does not exceed system performance spec. found in Addendum 1 of Remote Multiplexer Instruction Manual. (PS171-Q2 line regulation = .1%)

Rework:

Use as is.

2nd ATP:

Engineering Review: R. C. Bell

QC Approval: F. Kamerman

2.2.4 Configuration Summary

Results of baseline functional test had no impact on the configuration of the test specimens.

2.3 POST RADIATION FUNCTIONAL TEST

2.3.1 Test Procedure

Each test specimen was tested to the corresponding Acceptance Test Procedure listed in Attachment A of Validyne Doc. #9834 contained in Section 2.11.

2.3.2 Test Results

2.3.2.1 Test Results Summary

Model #	S/N	ATP#	Passed, No Deviation	Passed After Deviation Corrected	Passed with Deviation Noted
AB295-Q2	QS981-1	445		x	
	QS981-2	445		x	
AD296-Q2	QS982-1	447		x	
	QS982-2	447		x	
PT174-Q2	Q9702-1	444		x	
	Q9702-2	444		x	
	QE507-1	444		x	
	QE426-143	444		x	
TC292-Q2	QE425-1	453	x		
	QE425-2	453	x		
	QE506-1	453		x	
	QE506-2	453		x	
DI325-Q2	QE424-1	452			x
	QE424-2	452			x
	QE424-3	452			x
	QE424-4	452			x
	QE424-5	452			x
PS294-Q2	Q9702-1	451	x		
	Q9702-2	451	x		
PC202-Q2	QE427-1	449		x	
	QE427-2	449		x	
	QE427-100	449		x	
BA332-Q2	QE419-1	450		x	
	QE419-2	450		x	
	QE419-341	450		x	
JC177-Q2	QE429-1	446	x		
	QE429-2	446	x		
PS171-Q2	QE543-56287	454	x		
	QE543-56288	454		x	
CD173-Q2	QE538-1	443	x		
	QE538-2	443		x	
	QE428-21	443		x	
	QE428-22	443	x		
CM249-Q2	55420	440	x		
	55421	440	x		
	55422	440	x		
	55423	440	x		
PS324-Q2	56460	455	x		
	56461	455	x		
MC170AD-Q2	54278	442	x		
	54279	442	x		

QC VERIFICATION L. Kamiman

2.3.3 Non-Conformance Summary

This section summarizes and describes the deviations noted in Section 2.3.2.1.

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: AB295-Q2

S/N: QS981-2

1st ATP: NCR 84 - 7/1/81

ATP # 455 Deviation Paragraph: 5.5.1

Deviation: Multiplexer input to output differential voltage was excessive.

Analysis: Determined U1 and U2 were defective. Also during troubleshooting, U2 dip socket was broken. See Section 2.9, Table XI, Item 2 for component analysis.

Rework: Replaced U2 dip socket with 10^6 rad. part. Replaced U1 (2504-5016, MUX-16) with $2X10^5$ rad. part and U2 (Q2504-5016, MUX-16) with new (non-radiated) part. See Section 2.9, Table XII, Item 1 for U2 replacement justification.

2nd ATP: Passed - no deviations

Engineering Review: R E Black

QC Approval: L Kamerman

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: AB295-Q2

S/N: QS981-1

1st ATP: NCR 84 - 7/1/81

ATP #445 Deviation Paragraph: 5.5.1

Deviation: Multiplexer input to output differential voltage was excessive.

Analysis: Determined U1 and U2 were defective. See Section 2.9, Table XI, Item 2 for component analysis.

Rework: Replaced U1 and U2 (Q2504-5016, MUX-16) using $2X10^5$ rad part.

2nd ATP: Passed -- no deviations

Engineering Review: R. Blake 10/21/1

QC Approval: L. Kamerman 10/29/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: CD173-Q2

S/N: QE538-2

1st ATP: NCR 83 - 7/1/81

ATP #443 Deviation Paragraph: 5.1.3

Deviation: Would not adj. to zero at output.

Analysis: Determined U4 to be defective. See Section 2.9, Table XI, Item 12 for component analysis.

Rework: Replaced U4 (Q2500-1262, TL062CP) with 10^6 rad part.

2nd ATP: Passed -- no deviations

Engineering Review: [illegible] 10/21/1

QC Approval: L Kamerman 10/24/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: DI325-Q2

S/N: QE424-3

1st ATP: NCR 78 - 7/1/81

ATP #452 Deviation Paragraph: 5.2, 6.10, 6.12, 8.3.13, 8.4.2

Deviation: DC & AC trip thresholds are out of ATP spec.

¶ 5.2	0.160	Vdc
¶ 6.10	8.25	mA DC
¶ 6.12	8.19	mA DC
¶ 8.3.13	10.29	mA AC
¶ 8.4.2	0.143	m Vdc

Analysis: Para. 6.10, 6.12 deviations are still within system performance requirements of 10.0 mA input current per DI325 Instruction Manual.

Para. 8.3.13 deviation was determined to be a degraded U5 (Q2512-6000, Opto-Isolator). See Section 2.9, Table XI, Item 4 for component analysis.

Para. 5.2 and 8.4.2 deviations are not large enough offsets to affect the functioning of the unit because the trip point for each bit is .625 VDC and therefore an offset would have to be greater than .625 VDC before this is a problem with bit resolution.

Rework: Replaced U5 (Q2512-6000, Opto-Isolator) with 10^6 rad. part. Use as is on all other deviations.

2nd ATP: Passed Para. 8.3.13; deviations same as above. No new deviations.

Engineering Review: RBE

QC Approval: L Kamerman

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: DI325-Q2

S/N: QE424-5

1st ATP: NCR 78 - 7/1/81

ATP #452 Deviation Paragraph: 5.2, 6.24, 6.26, 8.3.10, 8.3.15, 8.3.17, 8.4.2

Deviation: DC & AC trip thresholds are out of ATP spec.

¶	5.2	0.148 Vdc	¶	8.3.17	10.11 mA AC
¶	6.24	7.80 mA DC	¶	8.4.2	0.157 Vdc
¶	6.26	7.74 mA DC			
¶	8.3.10	10.09 mA AC			
¶	8.3.15	10.01 mA AC			

Analysis: Para. 6.24, 6.26 deviations are still within system performance requirements of 10.0 mA input current per DI325 Instruction Manual.

Para. 8.3.10, 8.3.15, 8.3.17 deviations were determined to be degraded U4, U6, U7 (Q2512-6000, Opto-Isolator). See Section 2.9, Table XI, Item 4 for component analysis.

Para. 5.2 and 8.4.2 deviations are not large enough offsets to affect the functioning of the unit because the trip point for each bit is .625 Vdc, and therefore an offset would have to be greater than .625 Vdc before there is a problem with bit resolution.

Rework: Use as is.

2nd ATP: None

Engineering Review: R. [illegible]

QC Approval: L Kasmerman

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: DI325-Q2

S/N: QE424-4

1st ATP: NCR 78 - 7/1/81

ATP #452 Deviation Paragraph: 5.2, 6.17, 6.19, 6.24, 6.26, 8.3.10, 8.3.13, 8.3.15, 8.3.17, 8.4.2

Deviation: AC & DC trip thresholds out of ATP spec.

¶ 5.2	0.160 Vdc		¶ 8.3.10	10.11 mA AC
¶ 6.17	8 mA DC		¶ 8.3.13	10.80 mA AC
¶ 6.19	7.92 mA DC		¶ 8.3.15	11.17 mA AC
¶ 6.24	7.90 mA DC		¶ 8.3.17	10.76 mA AC
¶ 6.26	7.73 mA DC		¶ 8.4.2	0.163 m Vdc

Analysis: Para. 6.17, 6.19, 6.24, 6.26 deviations are still within system performance requirement of 10.0 mA input current per DI325 Instruction Manual.

Para. 8.3.10, 8.3.13, 8.3.15, 8.3.17 deviations were determined to be degraded U4, U5, U6, U7 (Q2512-6000, Opto-Isolator) and U1 (Q2502-0000, LM339). See Section 2.9, Table XI, Item 7, for U1 component analysis and Section 2.9, Table XI, Item 4 for U4, U5, U6, and U7.

Para. 5.2 and 8.4.2 deviations are not large enough offsets to affect the functioning of the unit because the trip point for each bit is .625 Vdc and therefore an offset would have to exceed .625 Vdc to be a problem with bit resolution.

Rework: Replace U1 (Q2502-0000, LM339) with non-rad. part, and U4, U5, U6, and U7 (Q2512-6000, Opto-Isolator) with 10^6 rad. part. Use as is on other deviations. See Section 2.9, Table XII, Item 3 for U1 replacement justification.

2nd ATP: Passed Para's. 8.3.10, 8.3.13, 8.3.15, 8.3.17. Other deviations are the same as first ATP.

Engineering Review: D. Ebner

QC Approval: L Kanerman

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: DI325-Q2

S/N: QE424-2

1st ATP: NCR 79 - 7/1/81

ATP #452 Deviation Paragraph: 8.4.2

Deviation: Zero output out of ATP spec.

¶ 8.4.2 0.131 Vdc

Analysis: Para. 8.4.2 deviation is not a large enough offset to affect the functioning of the unit because the trip point for each bit is .625 VDC and therefore an offset would have to be greater than .625 VDC before there is a problem with bit resolution.

Rework: Use as is

2nd ATP: None

Engineering Review: R Klar R

QC Approval: L Kamerman

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: DI325-Q2

S/N: QE424-1

1st ATP: NCR 80 - 7/1/81

ATP # 452 **Deviation Paragraph:** 8.3.15

Deviation: AC input threshold out of spec.

¶ 8.3.15 10.04 mA AC

Analysis: Para. 8.3.15 deviation determined to be a degraded U6 (Q2512-6000, Opto-Isolator). See Section 2.9, Table XI, Item 4 for component analysis.

Rework: Use as is

2nd ATP: None

Engineering Review: R. H. Beck

QC Approval: L. Kamerman

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: PS171-Q2

S/N: 56288

1st ATP: NCR 75- 7/1/81

ATP #454 Deviation Paragraph: 5.4

Deviation: Failed short circuit test ±15 VDC, carrier . .

Analysis: Determined U3 defective. See Section 2.9, Table XI, Item 7 for component analysis.

Rework: Replaced U3 (Q2502-0000, LM339J) with 10^6 rad. part.

2nd ATP: Passed -- no deviations

Engineering Review: [illegible] 10/21/1

QC Approval: L Kamminian 10/24/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: TC292-Q2

S/N: QE506-1, QE506-2

1st ATP: NCR 86 - 7/1/81

ATP #453 Deviation Paragraph: 5.2

Deviation: Linearity out of spec.

Analysis: Determined U3 defective. See Section 2.9, Table XI, Item 11 for component analysis.

Rework: Replaced U3 (Q2500-1820, LM308) with 10^6 rad. part.

2nd ATP: Passed -- no deviations

Engineering Review: RKBaer 10/21/1

QC Approval: L. Kaminman 10/29/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: CD173-Q2

S/N: QE428-21

1st ATP: NCR 82 - 7/1/81

ATP # 443 Deviation Paragraph: 5.1.3

Deviation: Excessive zero shift at output

Analysis: Determined U1 defective. See Section 2.9, Table XI, Item 13 for component analysis.

Rework: Replaced U1 with 10^6 rad. part. (Q2500-1264) TL064 CN

2nd ATP: Passed -- no deviations

Engineering Review: R. Blair 10/21/81

QC Approval: L. Kameroman 10/29/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: AD296-Q2

S/N: QS982-2

1st ATP: NCR 76 - 7/1/81

ATP #447 Deviation Paragraph: 4.2.1

Deviation: Zero adj. insufficient

Analysis: Determined U25 defective (Datel, A/D). See Section 2.9, Table XI, Item 3 for component analysis.

Rework: Replaced U25 (Q2515-0120, ADC-HZ12BMC) with Micro A/D at $2X10^5$ rad.

2nd ATP: Passed -- no deviations

Engineering Review: RKBeck 10/21/1

QC Approval: L. Karamian 11/24/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: AD296-Q2

S/N: QS982-1

1st ATP: NCR 76 - 7/1/81

ATP # 477 **Deviation Paragraph:** 4.4.2

Deviation: Span adj. insufficient

Analysis: Determined U25 defective. See Section 2.9, Table XI, Item 3 for component analysis.

(Micronetworks A/D)

Rework: Replaced U25 (Q2515-0120, ADC-HZ12BMC) with Datel A/D at 2×10^5 rad.

2nd ATP: Passed - no deviations

Engineering Review: R G B Cc R

QC Approval: L Kamerman

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: PT174-Q2

S/N: Q9702-1, Q9702-2, QE426-143, QE507-1

1st ATP: NCR 77 - 7/1/81

ATP # 444 Deviation Paragraph: 5.5

Deviation: Zero drifts

Analysis: Determined U6 defective because of excessive radiation exposure. See Section 2.9, Table XI, Item 1 for component analysis. A failure at any radiation level does not affect the input signal.

Rework: Replace U6 (Q2504-5024) using 1.0×10^4 rad. part.

2nd ATP: Passed -- no deviations

Engineering Review: R.K. Bleier 10/21/1

QC Approval: L. Kameerman 10/29/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: BA332-Q2

S/N: QE419-341

1st ATP: NCR 90 - 7/1/81

ATP #450 Deviation Paragraph: 5.2

Deviation: Insufficient common mode adj.

Analysis: Determined U1 defective because of excessive radiation exposure. See Section 2.9, Table XI, Item 1 for component analysis. A failure at any radiation level does not affect the input signal.

Rework: Replace U1 (Q2504-5024, MUX-24) with 1.0 X 10^4 rad. part.

2nd ATP: Passed -- no deviations

Engineering Review: [illegible] 10/21/

QC Approval: L. Kamerman 10/29/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: BA332-Q2

S/N: QE419-1 & 2

1st ATP: NCR 89 - 7/1/81

ATP #450 Deviation Paragraph: 5.2

Deviation: Insufficient common mode adj.

Analysis: Determined U1 defective because of excessive radiation exposure. See Section 2.9, Table XI, Item 1 for component analysis. A failure at any radiation level does not affect the input signal.

Rework: Replace U1 (Q2504-5024, MUX-24) with 1.0×10^4 rad. part.

2nd ATP: Passed -- no deviations

Engineering Review: R K Blair 10/21/

QC Approval: L. Kamerman 10/29/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: PC202-Q2

S/N: QE427-1

1st ATP: NCR 87 - 7/1/81

ATP #499 Deviation Paragraph: 5.2

Deviation: Insufficient common mode adjustment

Analysis: Determined U1 defective because of excessive radiation exposure. See Section 2.9, Table XI, Item 1 for component analysis. A failure at any radiation level does not affect the input signal.

Rework: Replace U1 (Q2504-5024, MUX-24) with 1.0×10^4 rad. part.

2nd ATP: Passed -- no deviations

Engineering Review: R.T. Black 10/21/1

QC Approval: L. Kammann 10/29/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: PC202-Q2

S/N: QE427-2

1st ATP: NCR 85 - 7/1/81

ATP #499 Deviation Paragraph: 5.7.4

Deviation: Calibration output out of spec.

Analysis: Determined U1 defective because of excessive radiation exposure. See Section 2.9, Table XI, Item 1 for component analysis. A failure at any radiation level does not affect the input signal.

Rework: Replace U1 (Q2504-5024, MUX-24) with 1.0 X 10^4 rad. part.

2nd ATP: Passed -- no deviations

Engineering Review: RKBlake 10/21/

QC Approval: L. Kamerman 10/29/81

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NON-CONFORMANCE SUMMARY

Event: Post Radiation

Unit: PC202-Q2

S/N: QE427-100

1st ATP: NCR 88 - 7/1/81

ATP # 449 Deviation Paragraph: 5.2, 5.9.6.2

Deviation: Insufficient common mode adj.
100 Hz filter check bad

Analysis: Determined U1 and S2 defective because of excessive radiation exposure. See Section 2.9, Table XI, Item 1 for component analysis. A failure at any radiation level does not affect the input signal.

Rework: Replace U1 (Q2504-5024, MUX-24) with 1.0×10^4 rad. part. (Q6003-8090) with 10^6 rad. part.

2nd ATP: Passed -- no deviations

Engineering Review: [illegible] 10/21/1

QC Approval: [illegible] 10/29/81

2.3.4 Configuration Summary

Results of the Radiation Test made it necessary to alter the test level of some components in the test specimens. These components are listed in the Status Summary.

2.3.4.1 Status Summary

Table 1 defines the status changes from baseline status on test specimens that had a component replaced with other than the current test level part.

TABLE 1

UNIT	S/N	REF. DESIG.	VEC PART #	TYPE	STATUS CHANGES*
AB295-Q2	QS981-2	U1 U2	Q2504-5016 Q2504-5016	MUX MUX	$2X10^5$ RAD LEVEL Non-Radiated
AB295-Q2	QS981-1	U1, U2	Q2504-5016	MUX	$2X10^5$ RAD LEVEL
DI325-Q2	QE424-4	U1	Q2502-0000	OP AMP	Non-Radiated
AD296-Q2	QS982-1 QS982-2	U25	Q2515-0120	A/D	$2X10^5$ RAD LEVEL
PT174-Q2	Q9702-1 Q9702-2 QE426-143 QE507-1	U6	Q2504-5024	MUX	10^4 RAD LEVEL
BA332-Q2	QE419-341 QE419-1 QE419-2	U1	Q2504-5024	MUX	10^4 RAD LEVEL
PC202-Q2	QE427-1 QE427-2 QE427-100	U1	Q2504-5024	MUX	10^4 RAD LEVEL

*NOTE - This status is cumulative from baseline status.

2.4. POST AGING FUNCTIONAL TEST

2.4.1 Test Procedure

Each test specimen was tested to the corresponding Acceptance Test Procedure listed in Attachment A of Validyne Doc. #9834 contained in Section 2.11.

2.4.2 TEST RESULTS

2.4.2.1 Test Results Summary

Model #	S/N	ATP#	Passed, No Deviation	Passed After Deviation Corrected	Passed with Deviation Noted
AB295-Q2	QS981-1	445	x		
	QS981-2	445	x		
AD296-Q2	QS982-1	447	x		
	QS982-2	447	x		
PT174-Q2	Q9702-1	444	x		
	Q9702-2	444	x		
	QE507-1	444	x		
	QE426-143	444	x		
TC292-Q2	QE425-1	453	x		
	QE425-2	453	x		
	QE506-1	453		x	
	QE506-2	453	x		
DI325-Q2	QE424-1	452	x		
	QE424-2	452	x		
	QE424-3	452		x	
	QE424-4	452		x	
	QE424-5	452		x	
PS294-Q2	Q9702-1	451	x		
	Q9702-2	451	x		
PC202-Q2	QE427-1	449	x		
	QE427-2	449		x	
	QE427-100	449		x	
BA332-Q2	QE419-1	450		x	
	QE419-2	450	x		
	QE419-341	450	x		
JC177-Q2	QE429-1	446	x		
	QE429-2	446	x		
PS171-Q2	QE543-56287	454	x		
	QE543-56288	454	x		
CD173-Q2	QE538-1	443	x		
	QE538-2	443	x		
	QE428-21	443	x		
	QE428-22	443	x		
CM249-Q2	55420	440			x
	55421	440			x
	55422	440	x		
	55423	440			x
PS324-Q2	56460	455	x		
	56461	455	x		
MC170AD-Q2	54278	442		x	
*MC370AD-Q2	54279	442	x		

*Note: See Section 2.4.4

QC VERIFICATION E. Kanelman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: DI325-Q2

S/N: QE424-4

1st ATP: NCR 116 - 8/21/81

ATP # 452 Deviation Paragraph: Visual Inspection, Para. 6.0

Deviation: S1 and S2 rocker arm switches not operating properly.

For Para. 6.0, threshold voltage inadequate.

Analysis: For S1 and S2, determined lubricant had hardened causing contacts to operate intermittently. For Para. 6.0, determined U4 defective. See Section 2.9, Table XI, Item 4 for component analysis.

Note: Switches functioned normally as long as their contact position was not altered. Once this was done, they became intermittent.

Rework: Cleaned S1 (Q6007-0004) and S2 (Q6002-0004) using Validyne Procedure PS122.

Replaced U4 (Q2512-6000, Opto-Isolator) with aged and 10^6 rad. part.

2nd ATP: Passed - no deviations

Engineering Review: R.F.B.Cal

QC Approval: J. Kameerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: DI325-Q2

S/N: QE424-3, QE424-5

1st ATP: NCR 121, 115 - 8/21/81

ATP # 452 Deviation Paragraph: Visual Inspection

Deviation: S1 and S2 rocker arm switches not operating properly

Analysis: Determined lubricant had hardened causing contacts to operate intermittently.

Note: Switches functioned normally as long as their contact position was not altered. Once this was done, they became intermittent.

Rework: Cleaned S1 (Q6007-0004) and S2 (Q6007-0004) using Validyne Procedure #PS122.

2nd ATP: Passed - no deviations

Engineering Review: [illegible]

QC Approval: L Kamirman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: PC202-Q2

S/N: QE427-2

1st ATP: NCR 119 - 8/24/81

ATP # 449 Deviation Paragraph: Visual inspection

Deviation: S1 rocker arm switch not operating properly

Analysis: Determined lubricant had hardened causing contacts to operate intermittently.

Note: Switches functioned normally as long as their contact position was not altered. Once this was done, they became intermittent.

Rework: Cleaned S1 (Q6007-0103) using Validyne Procedure PS122.

2nd ATP: Passed - no deviations

Engineering Review: R Blair

QC Approval: E Kammerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: BA332-Q2

S/N: QE419-1

1st ATP: NCR 117 - 8/24/81

ATP # 450 **Deviation Paragraph:** 5.9.5.2

Deviation: Filter frequency out of spec.

Analysis: Determined S2 defective. See Section 2.9, Table XI, Item 6 for component analysis.

Rework: Replaced S2 (Q6003-8090) with 10^6 RAD and aged part.

2nd ATP: Passed - no deviations

Engineering Review: [illegible]

QC Approval: [illegible]

Validyne ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: PC202-Q2

S/N: QE427-100

1st ATP: NCR 120 - 8/24/81

ATP # 449 Deviation Paragraph: 5.9.5.2

Deviation: Filter frequency out of spec.

Analysis: Determined S2 defective. See Section 2.9, Table XI, Item 6 for componet analysis.

Rework: Replaced S2 (Q6003-8090) with 10^6 RAD and aged part.

2nd ATP: Passed - no deviations

Engineering Review: R L Black

QC Approval: Rodney Marshall

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: TC292-Q2

S/N: QE506-1

1st ATP: NCR 122 - 8/21/81

ATP #453 Deviation Paragraph: 4.15

Deviation: Suppression adjustment erratic

Analysis: Determined R35 (Pot) defective. See Section 2.9, Table XI, Item 10, for component analysis.

Rework: Replaced R35 (Q2953-7503, 89PR50K) with aged and 10^6 Rad. part.

2nd ATP: Passed - no deviations

Engineering Review: [illegible]

QC Approval: [illegible]

Validyne ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: CM249-Q2

S/N: 55420, 55421, 55423

1st ATP: NCR 126, 127, 128 - 8/25/81

ATP # 440 Deviation Paragraph: 5.5.2

Deviation: Carrier excitation current out of ATP spec.

55420 7.71 mA

55421 5.26 mA

55423 9.99 mA

Analysis: The measured excessive current draw does not exceed the system power supply (PS171-Q2) capability of 44 mA/channel. The excessive current drawn by the CM249-Q2 is being consumed by the transformer alone and only a small percentage of this additional excitation current results in heat loss. This heat loss represents less than a 2°C temperature rise in the transformer. Due to the transformer high insulation thermal rating and mass, this temperature rise has no impact on the operation of the CM249-Q2.

Rework: Use as is

2nd ATP: None

Engineering Review: [illegible]

QC Approval: L Kamerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: MC170AD-Q2

S/N: 54278

1st ATP: NCR 131 - 9/10/81

ATP # 442 **Deviation Paragraph:** 4.1.1

Deviation: Isolation resistance below spec.

Two bottom card guides were broken during test.

Analysis: Determined isolation resistance on input connectors for Channels 6, 7, 12, 13, 17, 18 and 22 degraded due to excessive aging of 400 years. Unit was aged in two phases. During the first phase, unit was aged for 47 days at 221°F. This aged the connectors to an equivalent 80 year life. The unit was tested at this point and passed the ATP. (See attached Test Report.) The second phase of aging added an additional 320 years to the connectors and this caused the above deviations.

Rework: Replaced connectors (Q1270-1208) on Channels 6, 7, 12, 13, 17, 18 and 22 with non-radiated and non-aged parts. See Section 2.9, Table XII, Item 4 for connector replacement justification.

Replaced bottom card guides with non-radiated and non-aged card guides (P/N Q2337-2000). See Section 2.9, Table XII, Item 6 for card guide replacement justification.

2nd ATP: Passed - no deviations.

Engineering Review: R. R. Cook

QC Approval: L. Kaufman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: PS171-Q2, PS294-Q2

S/N: 56287, Q9702-2

1st ATP: N/A

ATP # N/A **Deviation Paragraph:** N/A

Deviation: Tie-wraps removed from all areas.

Analysis: Tie-wraps were removed to show they do not provide necessary functional support during seismic and, therefore, would be considered a non-functional part.

Rework: None

2nd ATP: Passed - no deviations

Engineering Review: R Cascade

QC Approval: Kimerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: MC370AD-Q2

S/N: 54279

1st ATP: NCR 134 - 9/24/81

ATP #N/A **Deviation Paragraph:** N/A

Deviation: Tie-wraps removed from all wire bundles and support bar locations, and from other areas.

Analysis: Tie-wraps were removed to show they do not provide necessary functional support during seismic and, therefore, would be considered a non-functional part.

Rework: None

2nd ATP: Passed - no deviations

Engineering Review: R C Black

QC Approval: L Kamerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Aging

Unit: EMI Filter

S/N: Part No. Q2200-5031

1st ATP: N/A 3/26/81

ATP # N/A **Deviation Paragraph:** N/A

Deviation: During Wyle inspection, it was found that a slight amount of the internal potting material had leaked out of the filter case during the aging process.

Analysis: The following parameters were measured and compared to new units out of stock. Input pin continuity was identical for new and aged unit. For line to line 1000V isolation, new unit worst case was 7.8 MΩ, while aged unit was 7.0 MΩ at 600 Vdc. Comparing weight, the aged unit lost 9 grams. An insertion loss test showed the aged and new unit results to be identical. Aged unit in all areas except isolation resistance performed the same as a new unit. Under normal service conditions, the input voltage is under 200 V; therefore, isolation resistance is adequate.

Rework: Unit was reinstalled in MC170AD-Q2, S/N 54278.

2nd ATP:

Engineering Review: R. Black

QC Approval: L. Kamerman

Validyne
ENGINEERING CORPORATION

POST-AGING

TEST DATA SHEET

UNIT UNDER TEST: MC170AD-02

UNIT SERIAL NO. 54278

TESTED BY C. Ingram DATE 4-24-81

Para.

3.1 Visual inspection completed and Module Case traveler signed off (Ready for Functional Test) N/A

Model I.D & S/N label installed 54278 MC170AD-02

4.1.1 Insulation resistance at 500 VDC:
(Greater than 100 Megohms)
with respect to chassis -

a) TB101-1 >100M
-2 >100M
-3 >100M
-4 >100M
-5 >100M
-6 >100M
-7 >100M

b) Power Line HI (J101-A) >100M

c) Power Line LO (J101-B) >100M

d) Each input CH. connector, Pins A thru G

CH-1	>100M	CH-11	>100M	CH-21	>100M
-2	>100M	-12	>100M	-22	>100M
-3	>100M	-13	>100M	-23	>100M
-4	>100M	-14	>100M	-24	>100M
-5	>100M	-15	>100M	-25	>100M
-6	>100M	-16	>100M		
-7	>100M	-17	>100M		
-8	>100M	-18	>100M		
-9	>100M	-19	>100M		
-10	>100M	-20	>100M		

e) J102-A >100M
-B >100M
-C >100M

QA C. Hayden 4-28-81

Validyne
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TEST DATA SHEET

MC170AD-Q2 (WITHOUT PLUG-INS)

UNIT SERIAL NO. 54278

TESTED BY C Hyper DATE 54278

Para.

4.1.2 Continuity = 1.0 Ohms Maximum

a) J101-C to Chassis <1.0Ω.

b) Each Input Channel Connector:

CH. NO.	PIN F TO TB101-3	PIN G TO TB101-5
CH. 1	<1.0Ω	<1.0Ω
2	<1.0Ω	<1.0Ω
3	<1.0Ω	<1.0Ω
4	<1.0Ω	<1.0Ω
5	<1.0Ω	<1.0Ω
6	<1.0Ω	<1.0Ω
7	<1.0Ω	<1.0Ω
8	<1.0Ω	<1.0Ω
9	<1.0Ω	<1.0Ω
10	<1.0Ω	<1.0Ω
11	<1.0Ω	<1.0Ω
12	<1.0Ω	<1.0Ω
13	<1.0Ω	<1.0Ω
14	<1.0Ω	<1.0Ω
15	<1.0Ω	<1.0Ω
16	<1.0Ω	<1.0Ω
17	<1.0Ω	<1.0Ω
18	<1.0Ω	<1.0Ω
19	<1.0Ω	<1.0Ω
20	<1.0Ω	<1.0Ω
21	<1.0Ω	<1.0Ω
22	<1.0Ω	<1.0Ω
23	<1.0Ω	<1.0Ω
24	<1.0Ω	<1.0Ω
25	<1.0Ω	<1.0Ω

4.1.3 Fan rotation satisfactory Yes.

C. Hayden
4-28-81

Validyne
ENGINEERING CORPORATION

TEST DATA SHEET

MC170AD-02 UNIT SERIAL NO. 5V278

TESTED BY C. Nyson DATE 4-28-81

Para. 4.1.4 CH. NO.	AB295: LO Pass Filter Test Point	Voltage (Within ±.03 VDC of CD173 Output		-1 VDC Deviation In CAL Mode
1,26	A1-A, A7-B	9.003	—	—
2,27	A1-B, A7-C	—	—	—
3,28	A1-C, A7-D	—	—	—
4,29	A1-D, A8-A	—	—	—
5,30	A2-A, A8-B	—	—	—
6,31	A2-B, A8-C	—	—	—
7,32	A2-C, A8-D	—	—	—
8	A2-D	—		—
9	A3-A	—		—
10	A3-B	—		—
11	A3-C	—		—
12	A3-D	—		—
13	A4-A	—		—
14	A4-B	—		—
15	A4-C	—		—
16	A4-D	—		—
17	A5-A	—		—
18	A5-B	—		—
19	A5-C	—		—
20	A5-D	—		—
21	A6-A	—		—
22	A6-B	—		—
23	A6-C	—		—
24	A6-D	—		—
25	A7-A	—		—

Green LED at DB296 illuminated YES.

4.1.5 Continuity ≤1.0 Ohms

J102	4.1.5.1 Mother Board		4.1.5.2 (Alternate)	
A (RED) ---→	HI		AD296-4	<1Ω
B (BRN) ---→	LO		AD296-3	<1.0Ω
C (BLK) ---→	D GND		AD296-5	<1.0Ω
D (GRN) ---→	C GND		Chassis	<1.0Ω

✓ DENOTES ACCEPTABLE

C. Zkupch 4-28-81

00 8 7M

ATP 442
Rev. B

2.4.3 Non-Conformance Summary

This section summarizes and describes the deviations noted in Section 2.4.2.1.

2.4.4 Configuration Summary

The results of the aging process caused minimal impact upon the configuration of the test specimens. Some of the changes listed in the Status Summary are due to over-aging of some components, and other changes were made to prepare the test specimens for the Seismic Test to substantiate the non-functionality of specific components. Also, it should be noted that the MC170AD-Q2 (SN 54279) was modified to an MC370AD-Q2 by the installation of aged contact housings and Tefzel wire. The major functional impact of this change is to complete the connection between spare pins on the input connector and plug-in card edge connector. There is no involvement with any of the other units that go in the Module Case.

2.4.4.1 Status Summary

Table II defines the status changes from baseline status on test specimens that had a component replaced with other than the current test level part.

TABLE II

UNIT	S/N	REF DESIG.	VEC PART #	TYPE	STATUS CHANGES*
AB295-Q2	QS981-2	U1 U2	Q2504-5016 Q2504-5016	MUX MUX	$2X10^5$ RAD LEVEL NON-RADIATED
AB295-Q2	QS981-1	U1, U2	Q2504-5016	MUX	$2X10^5$ RAD LEVEL
DI325-Q2	QE424-4	U1	Q2502-0000	OP AMP	NON-RADIATED
AD296-Q2	QS982-1 QS982-2	U25	Q2515-0120	A/D	$2X10^5$ RAD LEVEL
PT174-Q2	Q9702-1 Q9702-2 QE426-143 QE507-1	U6	Q2504-5024	MUX	10^4 RAD LEVEL
BA332-Q2	QE419-341 QE419-1 QE419-2	U1	Q2504-5024	MUX	10^4 RAD LEVEL
PC202-Q2	QE427-1 QE427-2 QE427-100	U1	Q2504-5024	MUX	10^4 RAD LEVEL
MC170AD-Q2	54278	Input Connector Channels 6,7,12, 13,17,18,&22	Q1270-1208	Connector	NON-RADIATED NON-AGED
		Channels 2,3 Bottom Slot	Q2337-2000	Card Guides	NON-RADIATED NON-AGED
MC370AD-Q2	54279	Wiring Bundles, Wiring Dress	QW100-0400	Tie Wraps	REMOVED FROM USE
PS171-Q2	56287	All Positions	QW100-0400 QW100-0500	Tie Wraps	REMOVED FROM USE
PS294-Q2	Q9702-2	All Positions	QW100-0500	Tie Wraps	REMOVED FROM USE

*NOTE - This status is cumulative from baseline status.

2.5 SEISMIC FUNCTIONAL TEST

2.5.1 Test Procedure

The integrated Remote Multiplexer System was tested according to Validyne Test Procedure #466 contained in Section 2.11. The system inputs and monitoring used to detect any discrepancies due to deviations in the system is shown in Figure III, Section 2.11.

2.5.2 Test Results

For the previous tests, i.e., Baseline Functional, Post Radiation Functional and Post Aging Functional Tests, the Remote Multiplexer Module Cases and plug-in Signal Conditioning Cards were tested separately. For the Seismic Functional Test, the signal conditioning cards were installed in the module cases and tested as a system.

The CM249-Q2 Remote Carrier Modulator units were attached to mounting brackets, part numbers Q9429 and Q10151 (2 per bracket), as shown in Wyle Report #58666, page 5-49, and electrically connected to CD173-Q2 cards via the input connectors on the backplane of the Remote Multiplexer Module Cases.

The results of the Seismic Functional Test on the system for functionality and failsafe operation are evaluated against the requirements described in ATP #466.

The summarized results are shown in Section 2.5.2.1 and 2.5.2.2 for both system outputs and inputs. Representative sample data is shown in Section 2.5.2.3, Figure II. Also, the mechanical integrity of the system and its components was successfully passed and the inspection reports can be found in Section 2.11.

2.5.2.1 Test Results Summary

System Outputs

Model #	S/N	ATP#	Passed, No Deviation	Passed After Deviation Corrected	Passed with Deviation Noted
AB295-Q2	QS981-1	466	x		
	QS981-2	466	x		
AD296-Q2	QS982-1	466	x		
	QS982-2	466	x		
PT174-Q2	Q9702-1	466	x		
	Q9702-2	466	x		
	QE507-1	466	x		
	QE426-143	466	x		
TC292-Q2	QE425-1	466	x		
	QE425-2	466	x		
	QE506-1	466	x		
	QE506-2	466	x		
DI325-Q2	QE424-1	466	x		
	QE424-2	466	x		
	QE424-3	466	x		
	QE424-4	466	x		
	QE424-5	466	x		
PS294-Q2	Q9702-1	466	x		
	Q9702-2	466	x		
PC202-Q2	QE427-1	466	x		
	QE427-2	466	x		
	QE427-100	466	x		
BA332-Q2	QE419-1	466	x		
	QE419-2	466	x		
	QE419-341	466	x		
JC177-Q2	QE429-1	466	x		
	QE429-2	466	x		
PS171-Q2	QE543-56287	466	x		
	QE543-56288	466	x		
CD173-Q2	QE538-1	466	x		
	QE538-2	466	x		
	QE428-21	466	x		
	QE428-22	466			x
CM249-Q2	55420 } NOTE 1	466	x		
	55421 } NOTE 1	466	x		
	55422 } NOTE 2	466			x
	55423 } NOTE 2	466	x		
PS324-Q2	55460	466	x		
	55461	466	x		
MC170AD-Q2	54278	466	x		
MC370AD-Q2	54279	466	x		

NOTE 1: Mounted on Bracket P/N 9429-Q2, S/N 5325.

NOTE 2: Mounted on Bracket P/N 10151-Q2, S/N 571380.

QC VERIFICATION

2.5.2.2 Test Results Summary

System Inputs

Model #	S/N	ATP#	Passed, No Deviation	Passed After Deviation Corrected	Passed with Deviation Noted
PT174-Q2	Q9702-1	466	x		
	Q9702-2	466	x		
	QE507-1	466	x		
	QE426-143	466	x		
TC292-Q2	QE425-1	466	x		
	QE425-2	466	x		
	QE506-1	466	x		
	QE506-2	466	x		
DI325-Q2	QE424-1	466	x		
	QE424-2	466	x		
	QE424-3	466	x		
	QE424-4	466	x		
	QE424-5	466	x		
PC202-Q2	QE427-1	466	x		
	QE427-2	466	x		
	QE427-100	466	x		
BA332-Q2	QE419-1	466	x		
	QE419-2	466	x		
	QE419-341	466	x		
JC177-Q2	QE429-1	466	x		
	QE429-2	466	x		
CD173-Q2	QE538-1	466	x		
	QE538-2	466	x		
	QE428-21	466	x		
	QE428-22	466	x		
CM249-Q2	55420 } NOTE 1	466	x		
	55421 } NOTE 1	466	x		
	55422 } NOTE 2	466	x		
	55423 } NOTE 2	466	x		

NOTE 1: Mounted on Bracket P/N 9429-Q2, S/N 5325.

NOTE 2: Mounted on Bracket P/N 10151-Q2, S/N 571380.

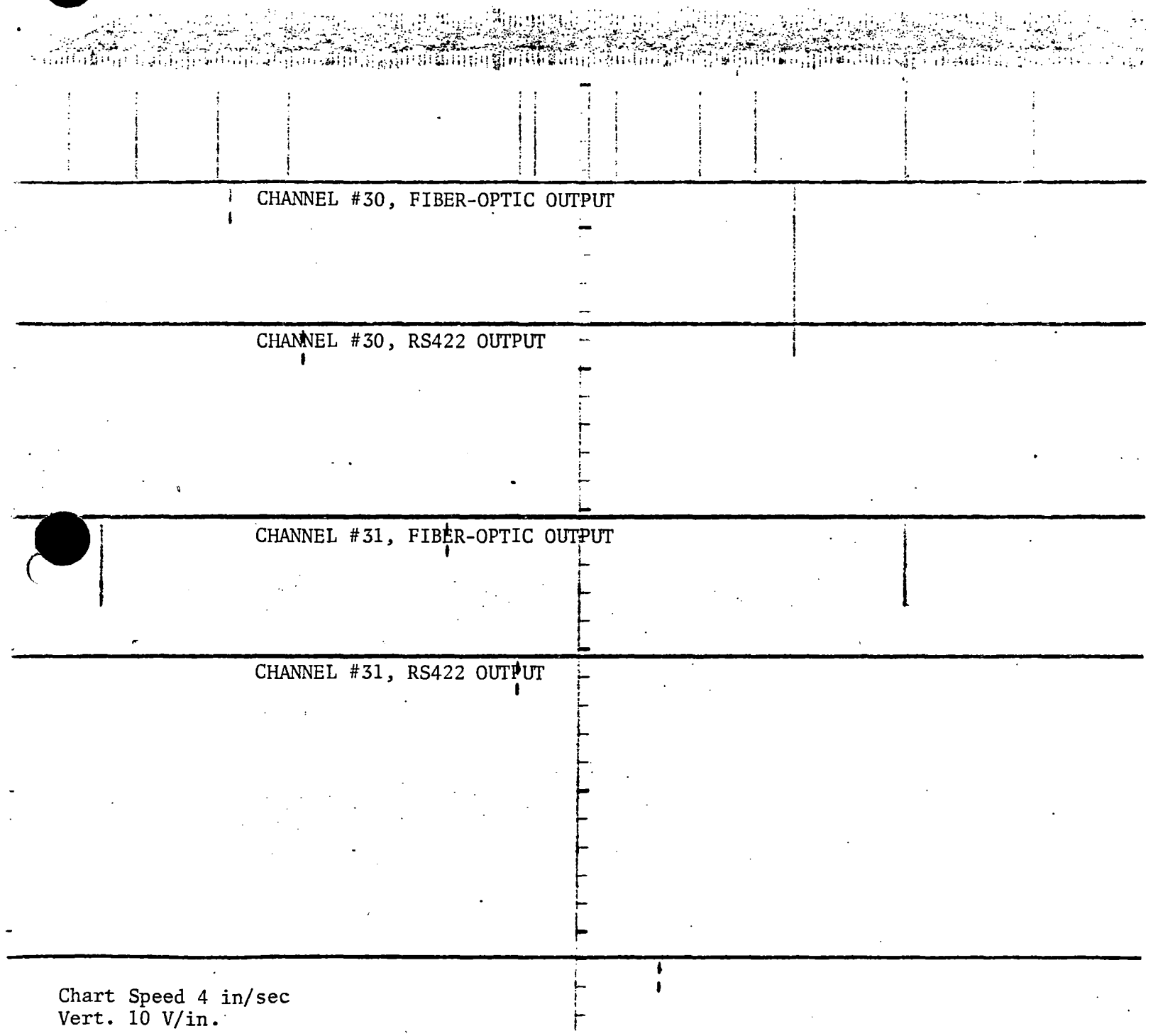
QC VERIFICATION

SECTION 2.5.2.3

FIG II A

TEST DATA SAMPLE

NT: SSE SECOND BIAXIAL PLANE



annel # is referenced
Procedure #466, Data Sheet 1

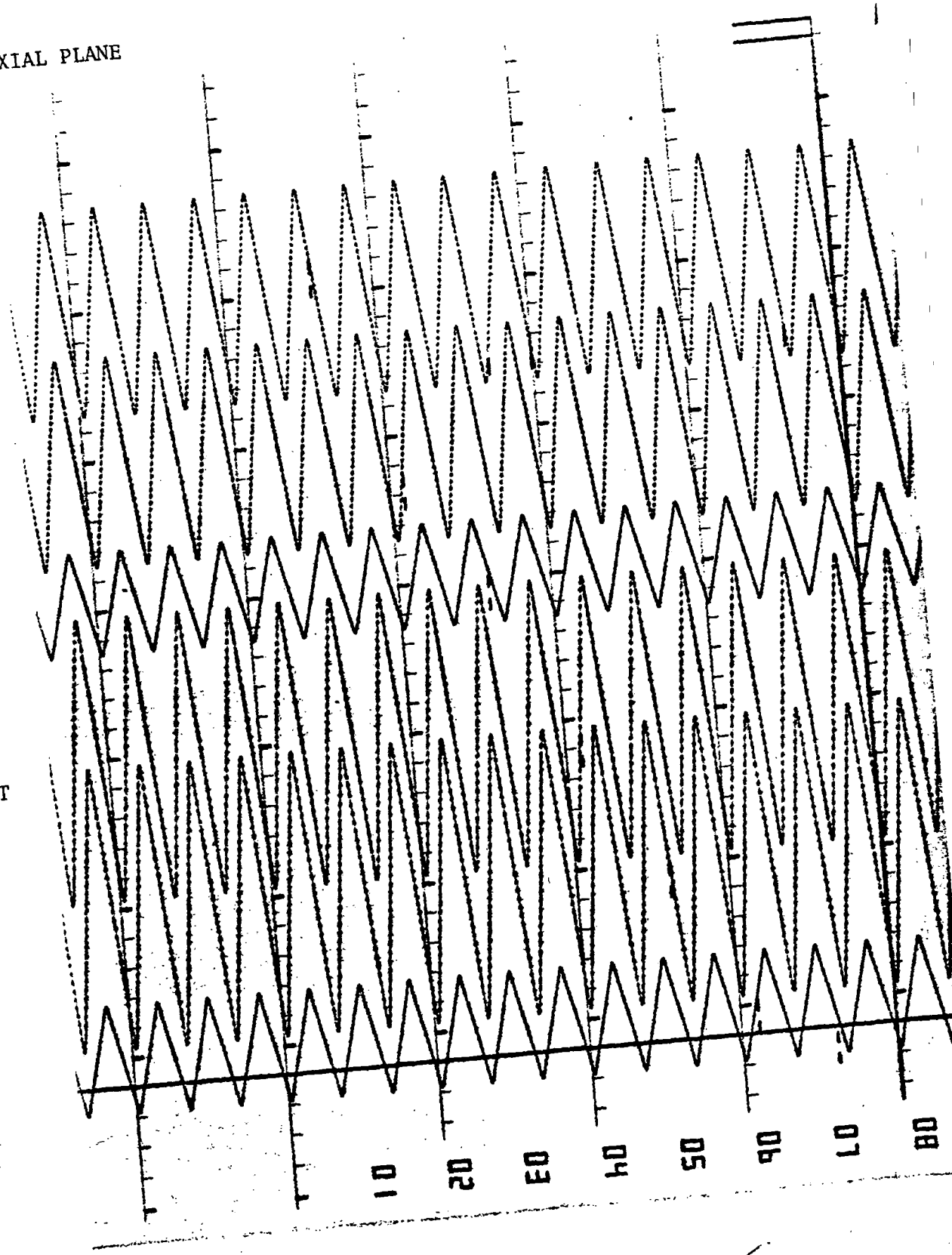
ENGRG. VERIFICATION R C Bl

QC VERIFICATION L Kamerman

FIG II B

TEST DATA SAMPLE

NT: SSE SECOND BIAXIAL PLANE



Vert. 10 V/in.

art Speed 10 in/sec

nitor # is referenced
to Table IX Section 2.11

Channel # is referenced
to Procedure #466, Data Sheet 1

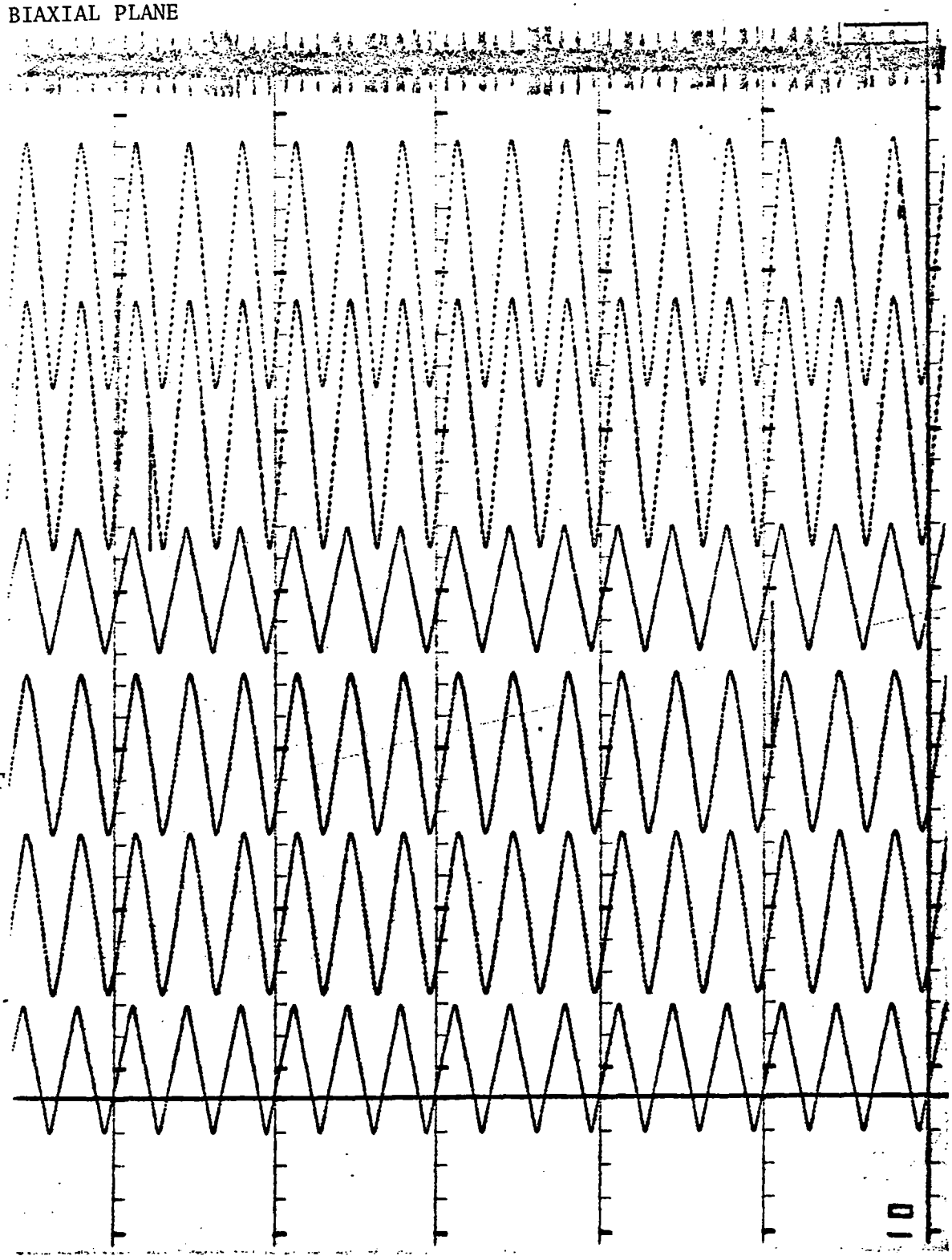
ENGRG. VERIFICATION R H Beeks

QC VERIFICATION L Kanzmann

FIG II C

TEST DATA SAMPLE

EVENT: SSE SECOND BIAXIAL PLANE



Vert. 10 V/in.
Chart Speed 10 in/sec

Monitor # is referenced to Table IX Section 2.11

Channel # is referenced to Procedure #466, Data Sheet 1

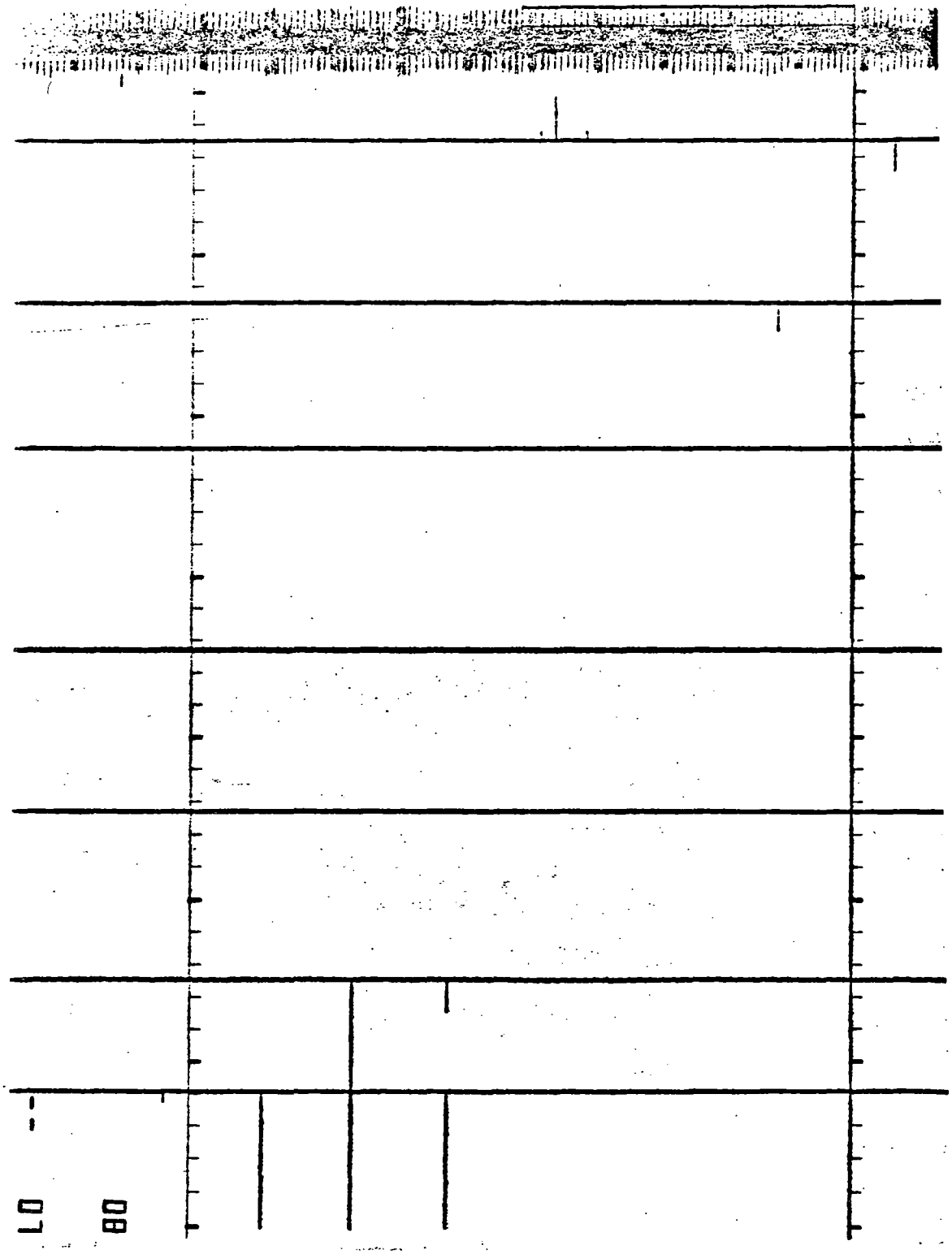
ENGRG. VERIFICATION R F Blake

QC VERIFICATION L Kameerman

FIG II D

TEST DATA SAMPLE

EVENT: SSE SECOND BIAXIAL PLANE



Vert. 10 V/in.
Chart Speed 4 in/sec

Monitor # is referenced in Table IX Section 2.11

Channel # is referenced to Procedure #466, Data Sheet 1

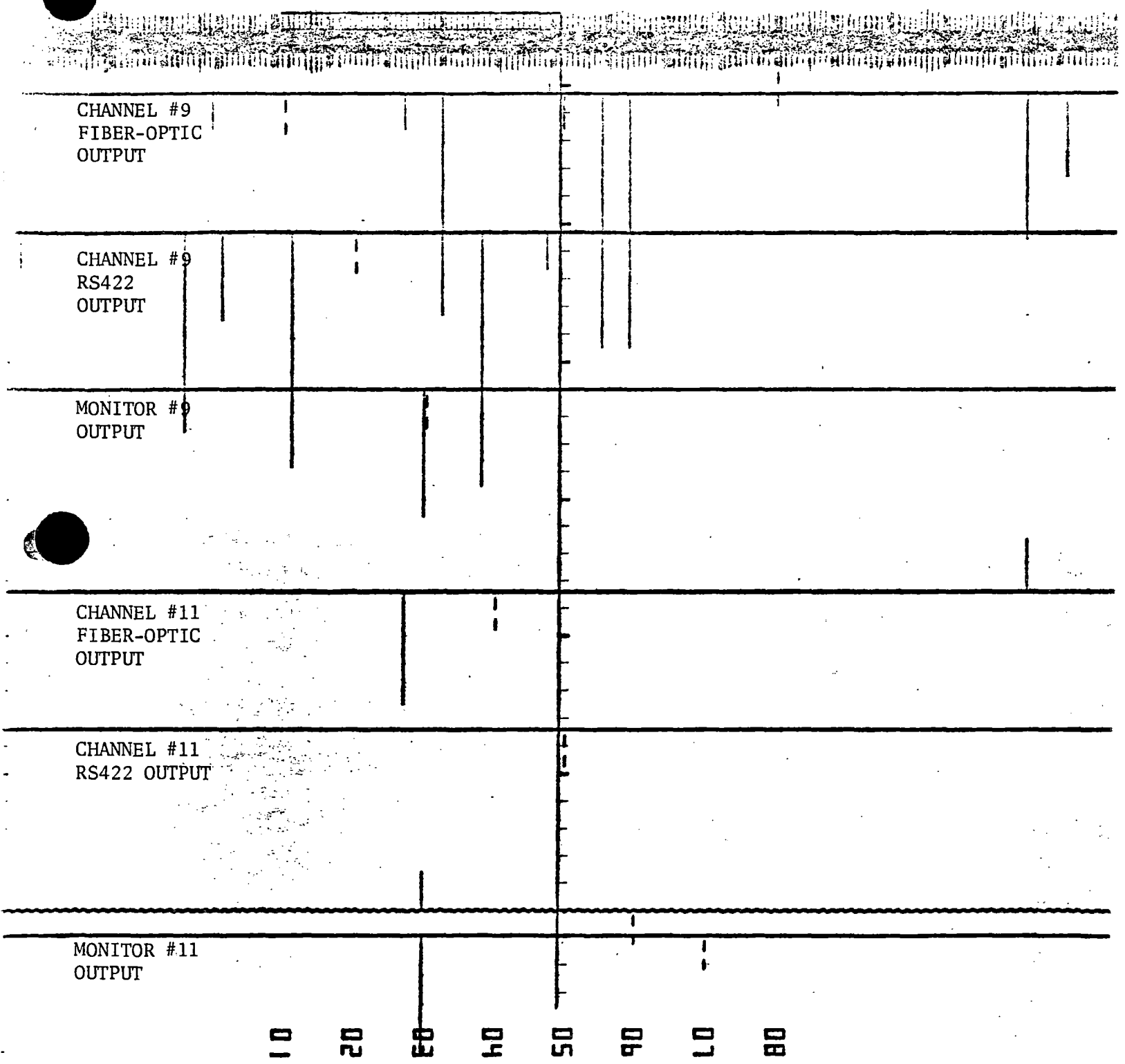
ENGRG. VERIFICATION R. Clark

QC VERIFICATION L. Kamerman

FIG II E

TEST DATA SAMPLE

EVENT: SSE SECOND BIAXIAL PLANE



Vert. 10 V/in.
Chart Speed 4 in/sec

Monitor # is referenced
to Table IX Section 2.11

Channel # is referenced
to Procedure #466, Data Sheet 1

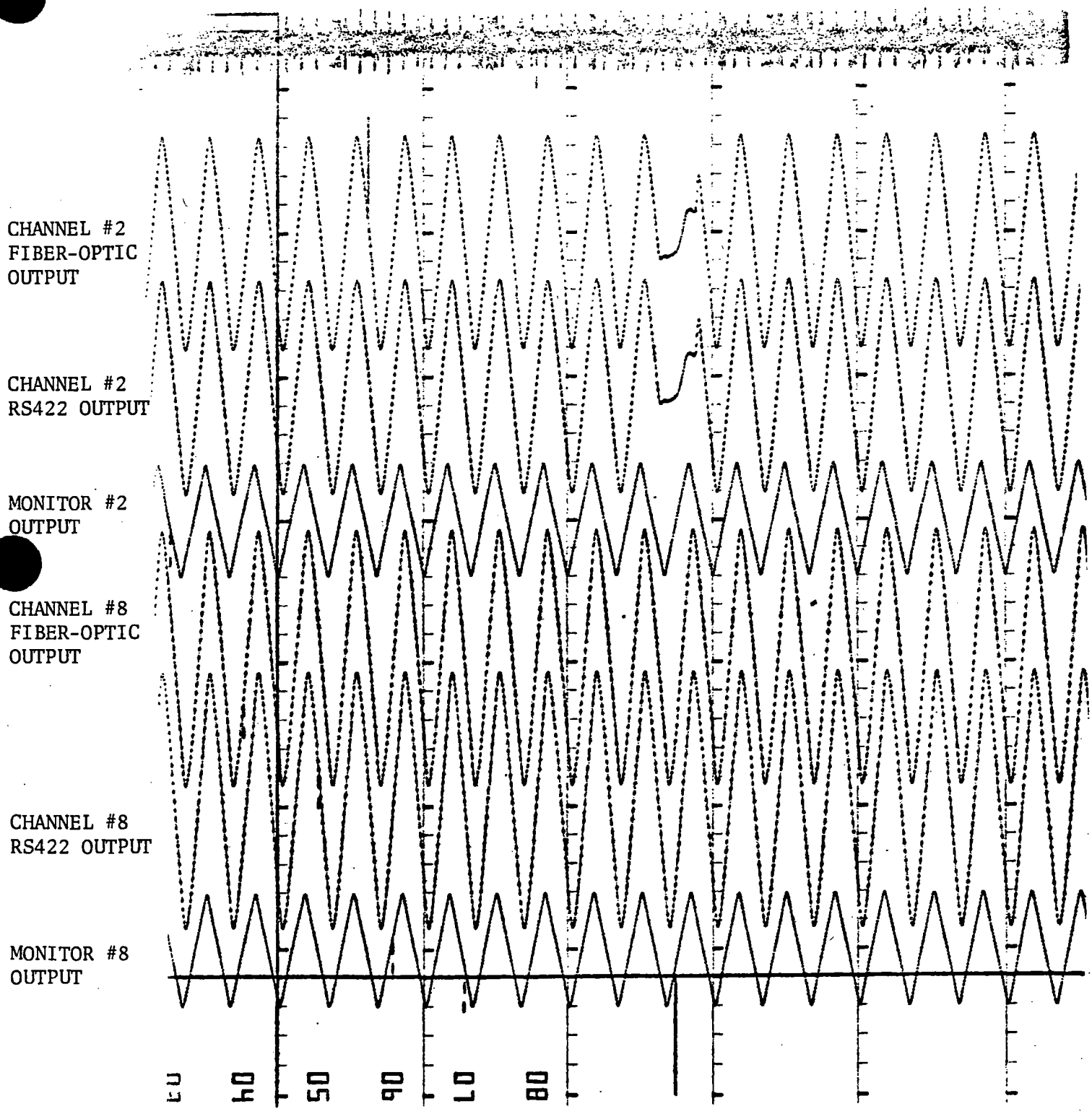
ENGRG. VERIFICATION R. Fodor

QC VERIFICATION L. Kammerman

FIG II F

TEST DATA SAMPLE

EVENT: SSE1 SECOND BIAXIAL PLANE



Vert. 10 V/in.
Chart Speed 10 in/sec

Monitor # is referenced
in Table IX Section 2.11

Channel # is referenced
to Procedure #466, Data Sheet 1

ENGRG. VERIFICATION R. Kofler

QC VERIFICATION G. Thompson

2.5.3. Non-Conformance Summary

This section summarizes and describes the deviations noted in Sections 2.5.2.1.

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Seismic Functional Test

Unit: CD173-Q2, CM249-Q2

S/N: QE428-22, 55422

1st ATP: N/A

ATP # 466 Deviation Paragraph: Section 2.B.6

Deviation: During SSE #1, F.O. and RS422 output of Channel 2 (ref. Section 2.5.2.3, Fig. IIF) was distorted for approximately .027 seconds of the 30 Hz triangle wave being reconstructed.

Analysis: Signal was lost only on this specific channel. It was determined to be an unrepeatable random deviation lasting for a period of time inadequate to affect system performance.

Rework: Use as is.

2nd ATP:

Engineering Review: R. Elder

QC Approval: L. Kaminsman

2.5.4 Configuration Summary

Results of Seismic Functional Test had no impact on the configuration of the system under test.

2.6 POST SEISMIC FUNCTIONAL TEST

2.6.1 Test Procedure

Each test specimen was tested to the corresponding Acceptance Test Procedure listed in Attachment A of Validyne Doc. #9834 contained in Section 2.11.

2.6.2 Test Results

2.6.2.1 Test Results Summary

Model #	S/N	ATP#	Passed, No Deviation	Passed After Deviation Corrected	Passed with Deviation Noted
AB295-Q2	QS981-1	445	x		
	QS981-2	445	x		
AD296-Q2	QS982-1	447	x		
	QS982-2	447	x		
PT174-Q2	Q9702-1	444	x		
	Q9702-2	444	x		
	QE507-1	444	x		
	QE426-143	444	x		
TC292-Q2	QE425-1	453	x		
	QE425-2	453	x		
	QE506-1	453		x	
	QE506-2	453	x		
DI325-Q2	QE424-1	452	x		
	QE424-2	452		x	
	QE424-3	452	x		
	QE424-4	452	x		
	QE424-5	452	x		
PS294-Q2	Q9702-1	451	x		
	Q9702-2	451	x		
PC202-Q2	QE427-1	449	x		
	QE427-2	449	x		
	QE427-100	449	x		
BA332-Q2	QE419-1	450	x		
	QE419-2	450	x		
	QE419-341	450	x		
JC177-Q2	QE429-1	446	x		
	QE429-2	446	x		
PS171-Q2	QE543-56287	454	x		
	QE543-56288	454	x		
CD173-Q2	QE538-1	443	x		
	QE538-2	443	x		
	QE428-21	443	x		
	QE428-22	443	x		
CM249-Q2	55420 } NOTE 1	440	x		
	55421 } NOTE 1	440	x		
	55422 } NOTE 2	440	x		
	55423 } NOTE 2	440	x		
PS324-Q2	55460	455	x		
	55461	455	x		
MC170AD-Q2	54278	442			x
MC370AD-Q2	54279	442	x		

NOTE 1: Mounted on Bracket P/N 9429-Q2, S/N 5325.

NOTE 2: Mounted on Bracket P/N 10151-Q2, S/N 571380.

QC VERIFICATION [signature]

2.6.3 Non-Conformance Summary

This section summarizes and describes the deviations noted in Section 2.6.2.1.

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Seismic

Unit: MC170AD-Q2

S/N: 54278

1st ATP: NCR 136 - 10/5/81

ATP # 442 **Deviation Paragraph:** 4.1.1(d)

Deviation: Insulation resistance below ATP spec. on channel one input connector.

Pins A thru G measured $\geq$ 60 MΩ.

Analysis: Insulation resistance does not compromise system functionality for future testing.

NOTE: Connector insulation degraded due to previously stated overaging of 400 years.
Reference Post-Aging, Non-Conformance Summary, Page 8 for NCR 131, dated 9/10/81.

Rework: Use as is.

2nd ATP:

Engineering Review: R. Dell

QC Approval: L. Kamerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Seismic

Unit: TC292-Q2

S/N: QE506-1

1st ATP: NCR 137 - 10/5/81

ATP #453 Deviation Paragraph: 4.15

Deviation: Adjustment unstable

Analysis: Determined R35 pot defective. See Section 2.9, Table XI, Item 10 for component analysis.

Rework: Replaced R35 (Q2953-7503) with new part. See Section 2.9, Table XII, Item 5 for component replacement justification.

2nd ATP: Passed - no deviation

Engineering Review: R Reed

QC Approval: L. Kammerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Seismic

Unit: DI325-Q2

S/N: QE424-2

1st ATP: NCR 135 - 10/5/81

ATP #452 Deviation Paragraph: 6.3, 8.3.10

Deviation: Trip point too high

Analysis: Determined U4 defective. See Section 2.9, Table XI, Item 4 for component analysis.

Rework: Replaced U4 (Q2512-6000, Opto-Isolator) with new part. See Section 2.9, Table XII, Item 2, for component replacement justification.

2nd ATP: Passed - no deviations

Engineering Review: R K [illegible]

QC Approval: L Kamerman

2.6.4 Configuration Summary

The results of the Post Seismic Functional Test indicated that no electrical deviations were found due to the presence of visual or non-visual mechanical defects. However, some components were changed due to out of ATP specifications, but these deviations were not sufficient to affect the results of the Seismic Test.

2.6.4.1 Status Summary

Table III defines the status changes from baseline status on test specimens that had a component replaced with other than the current test level part.

TABLE III

UNIT	S/N	REF. DESIG.	VEC PART #	TYPE	STATUS CHANGES*
AB295-Q2	QS981-2	U1 U2	Q2504-5016 Q2504-5016	MUX MUX	$2X10^5$ RAD LEVEL NON-RADIATED
AB295-Q2	QS981-1	U1, U2	Q2504-5016	MUX	$2X10^5$ RAD LEVEL
DI325-Q2	QE424-4 QE424-2	U1 U4	Q2502-0000 Q2512-6000	OP AMP OPTO ISOLATOR	NON-RADIATED NON-RADIATED NON-AGED
AD296-Q2	QS982-1 QS982-2	U25	Q2515-0120	A/D	$2X10^5$ RAD LEVEL
PT174-Q2	Q9702-1 Q9702-2 QE426-143 QE507-1	U6	Q2504-5024	MUX	10^4 RAD LEVEL
BA332-Q2	QE419-341 QE419-1 QE419-2	U1	Q2504-5024	MUX	10^4 RAD LEVEL
PC202-Q2	QE427-1 QE427-2 QE427-100	U1	Q2504-5024	MUX	10^4 RAD LEVEL
MC170AD-Q2	54278	Input Connector Channels 6,7,12, 13,17,18,&22	Q1270-1208	Connector	NON-RADIATED NON-AGED
		Channels 2,3 Bottom Slot	Q2337-2000	Card Guides	NON-RADIATED NON-AGED
MC370AD-Q2	54279	Wiring Bundles, Wiring Dress	QW100-0400	Tie Wraps	REMOVED FROM USE
PS171-Q2	56287	All Positions	QW100-0400 QW100-0500	Tie Wraps	REMOVED FROM USE
PS294-Q2	Q9702-2	All Positions	QW100-0500	Tie Wraps	REMOVED FROM USE
TC292-Q2	QE506-1	R35	Q2953-7503	POT	NON-RADIATED NON-AGED

*NOTE - This status is cumulative from baseline status.

2.7 EXTREME TEMPERATURE AND HUMIDITY FUNCTIONAL TESTS

2.7.1 Test Procedure

The assembled Remote Multiplexer System was tested according to Validyne Test Procedure #466 contained in Section 2.11. The system inputs and monitoring used to detect any discrepancies due to deviations in the system are shown in Figure III, Section 2.11.

2.7.2 Test Results

The results of the Extreme Temperature and Humidity Functional Test on the system for functionality and failsafe operation are evaluated against the requirements described in ATP #466.

The summarized results are shown in Section 2.7.2.1 and 2.7.2.2 for both system outputs and inputs. The test data is shown in Table IV. The digital outputs, RS422 and fiber optic, maintained their integrity during the periods monitored. The physical integrity of the system components was successfully demonstrated. The Inspection Reports can be found in Section 2.11.

2.7.2.1 Test Results Summary

System Outputs

Model #	S/N	ATP#	Passed, No Deviation	Passed After Deviation Corrected	Passed with Deviation Noted
AB295-Q2	QS981-1	445	x		
	QS981-2	445	x		
AD296-Q2	QS982-1	447	x		
	QS982-2	447	x		
PT174-Q2	Q9702-1	444			x
	Q9702-2	444	x		
	QE507-1	444	x		
	QE426-143	444			x
TC292-Q2	QE425-1	453			x
	QE425-2	453			x
	QE506-1	453			x
	QE506-2	453			x
DI325-Q2	QE424-1	452			x
	QE424-2	452	x		
	QE424-3	452			x
	QE424-4	452	x		
	QE424-5	452	x		
PS294-Q2	Q9702-1	451	x		
	Q9702-2	451	x		
PC202-Q2	QE427-1	449			x
	QE427-2	449			x
	QE427-100	449	x		
BA332-Q2	QE419-1	450			x
	QE419-2	450	x		
	QE419-341	450			x
JC177-Q2	QE429-1	446	x		
	QE429-2	446	x		
PS171-Q2	QE543-56287	454	x		
	QE543-56288	454	x		
CD173-Q2	QE538-1	443			*
	QE538-2	443			x
	QE428-21	443			x
	QE428-22	443			x
CM249-Q2	55420 } NOTE 1	440			x
	55421 } NOTE 1	440			x
	55422 } NOTE 2	440			x
	55423 } NOTE 2	440			*
PS324-Q2	55460	455	x		
	55461	455	x		
MC170AD-Q2	54278	442	x		
MC370AD-Q2	54279	442	x		

NOTE 1: Mounted on Bracket P/N 9429-Q2, S/N 5325.

NOTE 2: Mounted on Bracket P/N 10151-Q2, S/N 571380.

*See Non-Conformance Summary, Section 2.7.3.

QC VERIFICATION

2.7.2.2 Test Results Summary

System Inputs

Model #	S/N	ATP#	Passed, No Deviation	Passed After Deviation Corrected	Passed with Deviation Noted
PT174-Q2	Q9702-1	466	x		
	Q9702-2	466	x		
	QE507-1	466	x		
	QE426-143	466	x		
TC292-Q2	QE425-1	466	x		
	QE425-2	466	x		
	QE506-1	466	x		
	QE506-2	466	x		
DI325-Q2	QE424-1	466	x		
	QE424-2	466	x		
	QE424-3	466	x		
	QE424-4	466	x		
	QE424-5	466	x		
PC202-Q2	QE427-1	466	x		
	QE427-2	466	x		
	QE427-100	466	x		
BA332-Q2	QE419-1	466	x		
	QE419-2	466	x		
	QE419-341	466	x		
JC177-Q2	QE429-1	466	x		
	QE429-2	466	x		
CD173-Q2	QE538-1	466	x		
	QE538-2	466	x		
	QE428-21	466	x		
	QE428-22	466	x		
CM249-Q2	55420 } NOTE 1	466	x		
	55421 } NOTE 1	466	x		
	55422 } NOTE 2	466	x		
	55423 } NOTE 2	466	x		

NOTE 1: Mounted on Bracket P/N 9429-Q2, S/N 5325.

NOTE 2: Mounted on Bracket P/N 10151-Q2, S/N 571380.

QC VERIFICATION R. Marshall

FIGURE IV

Test Data

MODEL #	S/N	%/°F OUTPUT SHIFT*
PT174-Q2	Q9702-1	.006
	Q9702-2	.004
	QE507-1	.003
	QE426-143	.011
DI325-Q2	QE424-1	.034
	QE424-2	.022
	QE424-3	.035
	QE424-4	.029
	QE424-5	.019
TC292-Q2	QE425-1	.019
	QE425-2	.036
	QE506-1	.038
	QE506-2	.008
PC202-Q2	QE427-1	.024
	QE427-2	.012
	QE427-100	.004
BA332-Q2	QE419-1	.022
	QE419-2	.004
	QE419-341	.034
JC177-Q2	QE429-1	.001
	QE429-2	.001
CM249-Q2/CD173-Q2	55422/QE428-22	.040
	55423/QE538-1	---
	55420/QE538-2	.031
	55421/QE428-21	.007

ENGRG APPROVAL: R A Blake

QC APPROVAL: L Kamerman

*This value includes both Zero and Span shifts.

2.7.3 Non-Conformance Summary

This section summarizes and describes the deviations noted in Sections 2.7.2.1.

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Extreme Temperature & Humidity

Unit: CM249-Q2/CD173-Q2

S/N: 55422/QE428-22,55420/QE538-2,55421/QE428-21

1st ATP: 10/8/81

ATP #466 Deviation Paragraph: 3.B.8

Deviation: Output shift exceeds functional spec.

55422/QE428-22 = 4.0% }
55420/QE538-2 = 3.7% } Total over 100°F Δ
55421/QE538-21 = .7% }

Analysis: Problem with excessive condensation at the environmental test levels used was felt to be the major contributing factor in the deviations incurred based on informal tests run with reduced condensation.
Note: Test environment calls for non-condensing humidity.

Rework: Use as is.

2nd ATP:

Engineering Review: R Fl[illegible]

QC Approval: [illegible] Kamirman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Extreme Temperature & Humidity

Unit: TC292-Q2

S/N: QE425-1, QE425-2, QE506-1, QE506-2

1st ATP: 10/8/81

ATP #466 Deviation Paragraph: 3.B.8

Deviation: Output shift exceeds functional spec.

QE425-1 = 1.9% }
QE425-2 = 3.6% } Total over 100°F Δ
QE506-1 = 3.8% }
QE506-2 = .8% }

Analysis: Problem with excessive condensation at the environmental test levels used was felt to be the major contributing factor in the deviations incurred based on informal tests run with reduced condensation.
Note: Test environment calls for non-condensing humidity.

Rework: Use as is.

2nd ATP:

Engineering Review: R F B [illegible]

QC Approval: L. Kamerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Extreme Temperature & Humidity

Unit: CM249-Q2/CD173-Q2

S/N: 55423/QE538-1

1st ATP: 10/8/81

ATP #466 Deviation Paragraph: 3.B.7 & 3.B.8

Deviation: 18 V Pk-Pk triangle wave output was clipped due to an excessive zero shift.

Analysis: Problem with excessive condensation at the environmental test levels used was felt to be the major contributing factor in the deviations incurred based on informal tests run with reduced condensation.
Note: Test environment calls for non-condensing humidity.

Rework: Use as is.

2nd ATP:

Engineering Review: R. Gaba

QC Approval: L. Kamerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Extreme Temperature & Humidity

Unit: BA332-Q2

S/N: QE419-1, QE419-341

1st ATP: 10/8/81

ATP # 466 **Deviation Paragraph:** 3.B.8

Deviation: Output shift exceeds functional spec.

QE419-1 = 2.2%
QE419-341 = 3.4% } Total over 100°F Δ

Analysis: Problem with excessive condensation at the environmental test levels used was felt to be the major contributing factor in the deviations incurred based on informal tests run with reduced condensation.
Note: Test environment calls for non-condensing humidity.

Rework: Use as is.

2nd ATP:

Engineering Review: R. B. Card

QC Approval: L. Kamerman

Validyne ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Extreme Temperature & Humidity

Unit: DI325-Q2

S/N: QE424-1,-3

1st ATP: 10/8/81

ATP # 466 Deviation Paragraph: 3.B.8

Deviation: Output shift exceeds 3.3% margin causing inaccurate decode of digital inputs.

QE424-1 = 3.4%
QE424-3 = 3.5% } Total over 100°F Δ

Analysis: Problem with excessive condensation at the environmental test levels used was felt to be the major contributing factor in the deviations incurred based on informal tests run with reduced condensation.
Note: Test environment calls for non-condensing humidity.

Rework: Use as is.

2nd ATP:

Engineering Review: R. Robar

QC Approval: L. Kameman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Extreme Temperature & Humidity

Unit: PT174-Q2

S/N: Q9702-1, QE426-143

1st ATP: 10/8/81

ATP # 466 Deviation Paragraph: 3.B.8

Deviation: Output shift exceeds functional spec.

Q9702-1 = .6%
QE426-143 = 1.1% } Total over 100°F Δ

Analysis: Problem with excessive condensation at the environmental test levels used was felt to be the major contributing factor in the deviations incurred based on informal tests run with reduced condensation.
Note: Test environment calls for non-condensing humidity.

Rework: Use as is.

2nd ATP:

Engineering Review: R T Black

QC Approval: L Kamiman

Validyne ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Extreme Temperature & Humidity

Unit: PC202-Q2

S/N: QE427-1, QE427-2

1st ATP: 10/8/81

ATP # 466 **Deviation Paragraph:** 3.B.8

Deviation: Output shift exceeds functional spec.

QE427-1 = .6%
QE427-2 = 1.2% } Total over 100°F Δ

Analysis: Problem with excessive condensation at the environmental test levels used was felt to be the major contributing factor in the deviations incurred based on informal tests run with reduced condensation.
Note: Test environment calls for non-condensing humidity.

Rework: Use as is.

2nd ATP:

Engineering Review: R. B. [illegible]

QC Approval: F. Kaufman

2.7.4 Configuration Summary

Results of the Extreme Temperature and Humidity Functional Test had no impact on the configuration of the system under test.

2.8 POST EXTREME TEMPERATURE AND HUMIDITY FUNCTIONAL TESTS

2.8.1 Test Procedure

Each test specimen was tested to the corresponding Acceptance Test Procedure listed in Attachment A of Validyne Doc. #9834 contained in Section 2.11.

2.8.2 Test Results

2.8.2.1 Test Results Summary

Model #	S/N	ATP#	Passed, No Deviation	Passed After Deviation Corrected	Passed with Deviation Noted
AB295-Q2	QS981-1	445	x		
	QS981-2	445		x	
AD296-Q2	QS982-1	447		x	
	QS982-2	447		x	
PT174-Q2	Q9702-1	444	x		
	Q9702-2	444	x		
	QE507-1	444	x		
	QE426-143	444	x		
TC292-Q2	QE425-1	453	x		
	QE425-2	453	x		
	QE506-1	453	x		
	QE506-2	453	x		
DI325-Q2	QE424-1	452	x		
	QE424-2	452	x		
	QE424-3	452	x		
	QE424-4	452	x		
	QE424-5	452	x		
PS294-Q2	Q9702-1	451	x		
	Q9702-2	451	x		
PC202-Q2	QE427-1	449	x		
	QE427-2	449	x		
	QE427-100	449	x		
BA332-Q2	QE419-1	450	x		
	QE419-2	450	x		
	QE419-341	450		x	
JC177-Q2	QE429-1	446	x		
	QE429-2	446	x		
PS171-Q2	QE543-56287	454			x
	QE543-56288	454	x		
CD173-Q2	QE538-1	443	x		
	QE538-2	443	x		
	QE428-21	443		x	
	QE428-22	443	x		
CM249-Q2	55420 } NOTE 1	440			x
	55421 } NOTE 1	440			x
	55422 } NOTE 2	440	x		
	55423 } NOTE 2	440			x
PS324-Q2	55460	455	x		
	55461	455	x		
MC170AD-Q2	54278	442	x		
MC370AD-Q2	54279	442	x		

NOTE 1: Mounted on Bracket P/N 9429-Q2, S/N 5325.

NOTE 2: Mounted on Bracket P/N 10151-Q2, S/N 571380.

QC VERIFICATION R. Marshall

2.8.3 Non-Conformance Summary

This section summarizes and describes the deviations noted in Section 2.8.2.1.

Validyne ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Extreme Temperature & Humidity

Unit: CD173-Q2

S/N: QE428-21

1st ATP: NCR 147 - 10/15/81

ATP # 443 **Deviation Paragraph:** 5.3.9

Deviation: Output gain intermittent

Analysis: Determined gain pot (R30) intermittent. See Section 2.9, Table XI, Item 10 for component analysis.

Rework: Replaced R30 (Q2953-7503, pot) with new part. See Section 2.9, Table XII, Item 5 for component replacement justification.

2nd ATP: Passed - no deviations

Engineering Review: [illegible]

QC Approval: L Kamerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Extreme Temperature & Humidity

Unit: BA332-Q2

S/N: QE419-341

1st ATP: NCR 145 - 10/15/81

ATP #450 Deviation Paragraph: 5.4.2

Deviation: Switch operation

Analysis: Determined S3 intermittent

Rework: Cleaned S3 (6001-8101, switch) using Validyne Procedure PS122.

2nd ATP: Passed - no deviations

Engineering Review: R. Clark

QC Approval: L. Kamerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Extreme Temperature & Humidity

Unit: PS171-Q2

S/N: 56287

1st ATP: NCR 144 - 10/15/81

ATP #454 Deviation Paragraph: 5.1.1

Deviation: +15 VDC regulation is .020 VDC

Analysis: Retested unit to ATP, passed Para. 5.1.1. Engineering determined initial test was deficient.

Rework: Use as is

2nd ATP:

Engineering Review: R.E. Bauer

QC Approval: L. Kamerman

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Extreme Temperature & Humidity

Unit: CM249-Q2

S/N: 55420, 55421, 55423

1st ATP: NCR 143 - 10/15/81

ATP #440 Deviation Paragraph: 5.5.2

Deviation: Carrier excitation out of ATP spec.

55420	10.5 mA
55421	8.7 mA
55423	9.99 mA

Analysis: The measured excessive current draw does not exceed the system power supply (PS171-Q2) capability of 44 mA/channel. The excessive current drawn by the CM249-Q2 is being consumed by the transformer alone and only a small percentage of this additional excitation current results in heat loss. This heat loss represents less than a 2°C temperature rise in the transformer. Due to the transformer high insulation thermal rating and mass, this temperature rise has no impact on the operation of the CM249-Q2.

Rework: Use as is

2nd ATP: None

Engineering Review: _____

Validyne
ENGINEERING CORPORATION

NON-CONFORMANCE SUMMARY

Event: Post Extreme Temperature & Humidity

Unit: AB295-Q2

S/N: QS981-2

1st ATP: NCR 142 - 10/15/81

ATP # Deviation Paragraph: 5.5.1

Deviation: Channels 5 and 19 have output fault.

Analysis: During inspection of card, residue was found overlaying PCB traces causing possible low resistance paths.

Rework: Clean PCB with alcohol

2nd ATP: Passed - no deviations

Engineering Review: R F Black

QC Approval: L. Kamiennan

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NON-CONFORMANCE SUMMARY

Event: Post Extreme Temperature & Humidity

Unit: AD296-Q2

S/N: QS982-1, QS982-2

1st ATP: NCR 141 - 10/15/81

ATP # **Deviation Paragraph:** 4.1.3.1

Deviation: Test fixture link, sublink and channel indicators are intermittent.

Analysis: S1 and S2 operate intermittently

Rework: Cleaned S1 (Q6007-1005, switch) and S2 (Q6007-1007, switch) using Validyne Procedure PS122.

2nd ATP: Passed - no deviations

Engineering Review: R K Black

QC Approval: L. Kaufman

2.8.4 FINAL CONFIGURATION SUMMARY

The results of the Post Extreme Temperature and Humidity Functional Test are included in Table V, Section 2.8.4.1. This represents the complete status with all tests complete. The items of major impact are discussed in Section 2.10.

2.8.4.1 Status Summary

Table V defines the final and complete status changes from baseline status on test specimens that had a component replaced with other than the current test level part.

TABLE V

UNIT	S/N	REF. DESIG.	VEC PART #	TYPE	STATUS CHANGES*
AB295-Q2	QS981-2	U1 U2	Q2504-5016 Q2504-5016	MUX MUX	$2X10^5$ RAD LEVEL NON-RADIATED
AB295-Q2	QS981-1	U1, U2	Q2504-5016	MUX	$2X10^5$ RAD LEVEL
DI325-Q2	QE424-4 QE424-2	U1 U4	Q2502-0000 Q2512-6000	OP AMP OPTO ISOLATOR	NON-RADIATED NON-RADIATED NON-AGED
AD296-Q2	QS982-1 QS982-2	U25	Q2515-0120	A/D	$2X10^5$ RAD LEVEL
PT174-Q2	Q9702-1 Q9702-2 QE426-143 QE507-1	U6	Q2504-5024	MUX	10^4 RAD LEVEL
BA332-Q2	QE419-341 QE419-1 QE419-2	U1	Q2504-5024	MUX	10^4 RAD LEVEL
PC202-Q2	QE427-1 QE427-2 QE427-100	U1	Q2504-5024	MUX	10^4 RAD LEVEL
MC170AD-Q2	54278	Input Connector Channels 6,7,12, 13,17,18,&22	Q1270-1208	Connector	NON-RADIATED NON-AGED
		Channels 2,3 Bottom Slot	Q2337-2000	Card Guides	NON-RADIATED NON-AGED
MC370AD-Q2	54279	Wiring Bundles, Wiring Dress	QW100-0400	Tie Wraps	REMOVED FROM USE
PS171-Q2	56287	All Positions	QW100-0400 QW100-0500	Tie Wraps	REMOVED FROM USE
PS294-Q2	Q9702-2	All Positions	QW100-0500	Tie Wraps	REMOVED FROM USE
TC292-Q2	QE506-1	R35	Q2953-7503	POT	NON-RADIATED NON-AGED
CD173-Q2	QE428-21	R30	Q2953-7503	POT	NON-RADIATED NON-AGED

*NOTE - This status is cumulative from baseline status.

2.9 COMPONENT ANALYSIS AND REPLACEMENT JUSTIFICATION

Table XI represents a statistical analysis for the components which either failed or were degraded because of the test events. The "% of Failure" column is used to determine if a component which failed or degraded has a generic problem. If this value exceeds 50%, this component is considered to have a generic problem. All of the components in this table are referenced in the Non-Conformance Summaries by item number.

The table consists of columns for Validyne Part Numbers, number of components which failed or had degraded, total number of components in the units under test plus additional components which were spares to take care of possible failures, a percentage of failure column determined by the previous two columns, and the last column which denotes the component type or commercial part number.

Looking at the "% of Failure" column, it shows that Items 1, 2 and 3 have a generic problem and were required to be replaced with components tested to a reduced level as shown on the corresponding non-conformance reports. Items 4-14 all had failure rates below the 50% tolerance and therefore are not considered to have generic problems.

Table XII represents a statistical analysis for failed components which had to be replaced with new components. In this table, the columns are similar to Table XI except for the number of components used which represents only the total count of components installed on the test units. This table is used to justify using new components in place of fully tested components. In all cases in this table the percentage of new parts are equal to or below 25% of the in use components. In all cases, the component in question is fully represented in its fully tested state on one or more units. Since each component is redundantly in use, the new parts do not affect the results of the tests.

TABLE XI

Item	Part No.	# of Failed Components	Total # of Components	% of Failure	Component Type
1	Q2504-5024	10	10	100	MUX-24-FQ
2	Q2504-5016	4	4	100	MUX-16-FT
3	Q2515-0120	2	2	100	ADC-Hz 12 BMC
4	Q2512-6000	11	27	40.7	Opto-Isolator
5	Q5000-6050	1	4	25	Dip Socket
6	Q2800-6666	2	14	14.3	Switch
7	Q2502-0000	2	10	20	LM339J
8	Q1270-1208	7	50	14.0	8 Pin Connector
9	Q6003-8090	1	11	9.0	Switch
10	Q2953-7503	3	37	8.1	50K Pot
11	Q2500-1820	2	28	7.1	LM308N
12	Q2500-1262	1	15	6.67	TL062CP
13	Q2500-1264	1	19	5.3	TL064CN
14	Q2337-2000	2	108	1.85	Card Guide

TABLE XII

Item	Part No.	New Components In Use	Total # of Components In Use	% New Components	Component Type
1	Q2504-5016	1	4	25	MUX-16-FT
2	Q2512-6000	1	20	5	Opto-Isolator
3	Q2502-0000	1	9	11	LM339J
4	Q1270-1208	7	50	14	8 Pin Connector
5	Q2953-7503	2	36	5.5	TL064CN
6	Q2337-2000	2	108	1.8	Card Guide

2.10 CONCLUSIONS AND RECOMMENDATIONS

In this section, the results of the various tests are combined to present a final statement regarding the failsafe and functional qualification of the test specimens, as well as the steps Validyne Engineering Corporation is taking and planning to take to improve upon the results of these tests.

2.10.1 Failsafe Qualification Statement

The units listed in Table VI meet the failsafe requirements as defined in Validyne ATP #466 and Wyle Qualification Plan #26344, and therefore are qualified for failsafe operation.

2.10.2 Functional Qualification Statement

Table VI defines the status of each individual model. This status represents the level to which qualification can be shown by the results of these tests. Improvements on some of these results are discussed in Section 2.10.3.

SECTION 2.10.2.1

TABLE VI

Model #	Requirements for RAD	Requirements for Seismic	Requirements for Extreme Environment
AB295-Q2	$2X10^5$ RADS	Passed	Passed
AD296-Q2	$2X10^5$ RADS	Passed	Passed
PT174-Q2	1.0×10^4 RADS	Passed	Output Shift = .013%/°F
TC292-Q2	Passed	Passed	Output Shift = .040%/°F
DI325-Q2	Passed	Passed	Ambient Temp, Humidity
PS294-Q2	Passed	Passed	Passed
PC202-Q2	1.0×10^4 RADS	Passed	Output Shift = .015%/°F
BA332-Q2	1.0×10^4 RADS	Passed	Output Shift = .035%/°F
JC177-Q2	Passed	Passed	Passed
PS171-Q2	Passed	Passed	Passed
CD173-Q2	Passed	Passed	Output Shift = .042%/°F
CM249-Q2	Passed	Passed	Passed
PS324-Q2	Passed	Passed	Passed
MC170AD-Q2	Passed	Passed	Passed
MC370AD-Q2	Passed	Passed	Passed

NOTE: Temperature coefficients shown above are deviations from room temperature.

NOTE: Passed indicates unit met the requirements per ATP #466 and Qualification Specification #9834. Other values indicate the levels to which the particular requirement was reduced.

2.10.3 Recommendations

Regarding models PC202-Q2, BA332-Q2 and PT174-Q2, the 1.0 X 10^4 RAD levels may be increased to 10^6 RADS by the removal of the component that provides the remote calibration function. This removal disables only the remote calibration function. Currently, VEC is working with the component manufacturer to bring the component back up to the 10^6 RADS level it passed in pre-testing.

The DI325-Q2 plug-in card experienced a shift in input current sensitivity after exposure to 10^6 RADS (Ref. Section 2.3.3). This shift was analyzed and the opto isolator and comparator circuit were found to have been degraded. Therefore, the input current level necessary to insure proper operation must be increased. This change requires the voltage level to be maintained at 24V RMS or higher, or a change in the input resistor scaling. VEC is planning to rescale the input resistors so that the DI325-24-Q2 units are compatible with 24 volts ±10% input range both before and after radiation exposure. The impact of this change on the qualification status is minimal due to the fact this is a resistor value change only. The resistor type has been proven out by the tests completed and, also, no other functional specification is degraded, only improved.

After aging, a particular problem was found with certain styles of the piano dip switches used on the DI325-Q2, PC202-Q2 and BA332-Q2 (Ref. Section 2.4.3). Communication with the manufacturer revealed these styles have a different lubricant than other switches of the same type used. The lubricant in the other style switch experienced relatively little hardening during the aging process. The manufacturer is scheduled to use this type lubricant in all switches of

2.10.3 Recommendations (Continued)

this type. However, at the present time, VEC recommends Process Spec. #122 contained in Section 2.11 for switches exhibiting similar problems.

The general problem experienced during extreme environment testing has been analyzed and determined to be mainly the fault of excessive condensation in the test chamber. The Test Plan calls for non-condensing humidity, but after review with Wyle Labs, it has been concluded that little can be done to eliminate the condensation at the 173°F, 95% RH level. Therefore, to improve functional operation a retest is being planned with some form of coating on units to protect against condensation.

2.10.4 Maintenance

Some periodic maintenance is required to maintain the forty year life of the equipment. In particular, the fan and EMI Filter in the MC170AD-Q2 and MC370AD-Q2 must be replaced every ten years, based on the Wyle Labs analysis Appendix A, Qualification Plan #26328, Sections 3.6.7 and 3.6.8. These are the only items that affect functionality which must be replaced. There is no other maintenance required unless the dip switches become intermittent after long term high temperature as found in the aging process. This high temperature condition, however, is not within the normal range experienced and therefore this switch problem is not likely to occur, but using the process specification outlined in Reference Section 2.11 will correct the problem if it does occur.

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SECTION 3.0

SUPPLEMENTARY REPORTS

8626 WILBUR AVENUE • P.O. BOX 9025 • NORTHRIDGE, CALIFORNIA 91328 • (213) 886-8488, (213) 886-2057 • TELEX 65-1202

ADDENDUM I
To
NUCLEAR ENVIRONMENTAL QUALIFICATION
TEST REPORT NUMBER QTR 82-002

Extreme Temperature And Humidity Test Of Signal Conditioning
Plug-in Modules For Remote Multiplexer/Module Case

1.0 PURPOSE AND SCOPE

This addendum covers supplemental testing on various signal conditioning plug-in modules to evaluate their performance under conditions of extreme temperature and humidity. The equipment tested are units that were included in the original qualification test program described in Report QTR 82-002, and are listed in Section 2.0, below.

2.0 EQUIPMENT TESTED

UNIT	S/N's
BA332-Q2	QE419-1, QE419-2, QE419-341
TC292-Q2	QE425-1, QE425-2, QE506-1, QE506-2
PT174-Q2	Q9702-1, Q9702-2, QE507-1, QE426-143
PC202-Q2	QE427-1, QE427-2, QE427-100
DI325-Q2	QE424-1, QE424-2, QE424-3, QE424-4
CM249-Q2	55420, 55421, 55422, 55423
CD173-Q2	QE538-1, QE538-2, QE428-21, QE428-22

The above modules were installed in a MC170AD-Q2 Module Case, S/N 54278, equipped with a PS171-Q2 Power Supply, S/N 56287.

3.0 TEST CONDITIONS

These tests were conducted at three temperature/humidity conditions:

A. Room temperature and humidity
B. 173°F at 60% relative humidity
C. 152°F at 95% relative humidity

Output zero and full scale readings were taken at each test condition to determine the zero and span shifts caused by test conditions B and C.

Tests were conducted in accordance with the test procedure of Section 5 of this Addendum at the facilities of National Technical Systems, Saugus, California on May 25-28, 1982. A copy of their test report is included as Section 6 of this Addendum.

4.0 SUMMARY OF TEST RESULTS

In general, the results show that high humidity at elevated temperature tends to increase the output zero and span shifts over that caused by temperature alone, as previous temperature tests at lower humidity levels have shown that the modules meet their specifications for thermal effects. The tests run at 152°F and 95% RH show greater effects than those run at 173°F and 60% RH. However, none of the test results indicate serious degradation of performance.

Results of the 152°F/95% RH tests, which showed the greatest effects, are summarized below for the various modules.

TC292:	Max Zero Shift: 0.0047% FS/°F Max Span Shift: 0.0275% FS/°F
CD173/CM249:	Max Zero Shift: 0.0063% FS/°F Max Span Shift: 0.0357% FS/°F
BA332/PC202:	Max Zero Shift: 0.0014% FS/°F* Max Span Shift: 0.0099% FS/°F*
PT174:	Max Zero Shift: 0.0032% FS/°F Max Span Shift: 0.0036% FS/°F These remained within specs for thermal effect.
DI325:	The zero and span changes remained within the requirements for input to the DD326 Decoder.

*Excludes channels 14, 15 and 16 - See "Excluded Data."

Acceptance tests run at room temperature and humidity (approximately 72°F and 50% RH) after completion of elevated temperature/humidity testing, showed all test units to be within specifications.

Excluded Data

Test data taken on the PC202-Q2 in the channel 14 position and the BA332-Q2's in channels 15 and 16 were determined to be invalid because of improper electrical connections during the operational tests at National Test System (NTS). These units were configured for single-ended input voltages and, during initial set up at Validyne, were tested with the negative terminal of the signal source connected to signal ground. When the units were tested at NTS the negative of the signal source was not tied to signal ground, producing substantial errors.

Similar units installed in channels 5, 6, and 17 were configured for differential inputs and thus were unaffected by the floating input.

The DI325-Q2 (S/N QE424-4-B) in the Channel 23 position exhibited an intermittant output at the outset of testing at NTS and was excluded from the test result. Later analysis identified the problem as Switch S2, the Forward/Reverse mode switch being intermittant.

Table 4-1 lists the Zero and Span shifts for each unit at each temperature/humidity setting. Table 4-2 is the detailed listing of actual output values for the test series used to develop the data in Table 4-1.

5.0 TEST PROCEDURE

5.1 Test Item Installation:

A. All items shall have been tested per applicable acceptance test procedure. (Reference Qualification Specification for Remote Multiplexer Units, Document No. 9834).

B. All module inputs shall be configured per Figure 5-1.

C. Equipment supply voltage shall be 115 Vac nominal, 60 Hz.

D. Module inputs and outputs shall be adjusted to the values shown in Table 5-1.

E. Equipment to be tested shall be installed for operation in a temperature/humidity environmental test chamber.

5.2 Procedure:

A. Prior to energizing the environmental chamber, record the zero and full scale per data sheet.

B. Increase temperature to 173°F and soak equipment for a minimum of two hours.

C. Record zero and full scale per data sheet.

D. Adjust humidity level to 60% RH while holding 173°F and soak equipment at combined condition for minimum of 24 hours. Ensure that condensation is not present.

E. Record zero and full scale per data sheet.

F. Decrease temperature to 152°F and allow humidity to increase to 95% RH. After one hour, record zero and full scale.

G. Soak at 152°F/95% RH for 24 hours, then record zero and full scale.

H. Remove equipment from chamber after sufficient cooling period.

I. Perform an acceptance test on all equipment under test.

TABLE 4-1. Tabulation of Test Results

	Chan. No.	Module	S/N	Zero Shift, %FS/°F 173°F/60%RH	Zero Shift, %FS/°F 152°F/95% RH	Span Shift, %FS/°F 173°F/60% RH	Span Shift, %FS/°F 152°F/95% RH
(1)	1	TC292-Q2	QE425-1-A	+0.0011	+0.0041	+0.0015	+0.0151
	4	TC292-Q2	QE425-2-A	+0.0028	+0.0045	+0.0050	+0.0134
	20	TC292-Q2	QE506-1-A	+0.0066	+0.0042	+0.0042	+0.0275
	21	TC292-Q2	QE506-2-A	-0.0069	-0.0047	+0.0026	+0.0079
	2	CD173-Q2 CM249-Q2	QE428-22-C 55420	+0.0020	+0.0061	+0.0078	+0.0214
	8	CD173-Q2 CM249-Q2	QE538-1-C 55421	+0.0008	+0.0061	+0.0206	+0.0346
	12	CD173-Q2 CM249-Q2	QE538-2-C 55422	+0.0029	+0.0056	+0.0224	+0.0357
	19	CD173-Q2 CM249-Q2	QE428-21-A 55423	+0.0015	+0.0063	+0.0035	-0.0159
	5	BA332-Q2	QE419-1-C	+0.0005	+0.0008	+0.0031	+0.0099
	6	PC202-Q2	QE427-1-C	+0.0010	+0.0014	+0.0037	+0.0089
	14	PC202-Q2	QE427-2-C	+0.0044	+0.0294	-0.0031	*
	15	BA332-Q2	QE419-2-C	+0.0048	+0.0318	-0.0046	*
	16	BA332-Q2	QE419-341-C	+0.0041	+0.0312	-0.0017	*
	17	PC202-Q2	QE427-100-C	-0.0003	-0.0002	+0.0020	+0.0019
	7	PT174-Q2	Q9702-1	+0.0023	+0.0029	+0.0004	+0.0028
	18	PT174-Q2	QE426-143-E	+0.0025	+0.0032	-0.0006	+0.0019
	22	PT174-Q2	QE507-1-E	+0.0020	+0.0027	+0.0002	+0.0035
	13	PT174-Q2	Q9702-2	+0.0021	+0.0028	-0.0001	+0.0036
(2)	9	DI325-Q2	QE424-1-B	+0.223V	+0.477V	+0.163V	-0.293V
	10	DI325-Q2	QE424-2-B	+0.161V	+0.374V	+0.172V	+0.608V
	11	DI325-Q2	QE424-3-B	+0.210V	+0.483V	+0.234V	+0.631V
	23	DI325-Q2	QE424-4-B	Unit exhibited erratic operation			

NOTES: (1) Channel No. indicates the position of the module in the MC170AD-Q2 Module Case.
(2) Output changes for the DI325-Q2 Modules are shown in Vdc, and not as %FS/°F.
*(3) Span shift data for channels 14, 15 and 16 at 152°F/95% RH invalid due to discrepancy in electrical connections.

TABLE 4-1. Tabulation of Test Results

	Chan. No.	Module	S/N	Zero Shift, %FS/°F 173°F/60%RH	Zero Shift, %FS/°F 152°F/95% RH	Span Shift, %FS/°F 173°F/60% RH	Span Shift, %FS/°F 152°F/95% RH
(1)	1	TC292-Q2	QE425-1-A	+0.0011	+0.0041	+0.0015	+0.0151
	4	TC292-Q2	QE425-2-A	+0.0028	+0.0045	+0.0050	+0.0134
	20	TC292-Q2	QE506-1-A	+0.0066	+0.0042	+0.0042	+0.0275
	21	TC292-Q2	QE506-2-A	-0.0069	-0.0047	+0.0026	+0.0079
	2	CD173-Q2 CM249-Q2	QE428-22-C 55420	+0.0020	+0.0061	+0.0078	+0.0214
	8	CD173-Q2 CM249-Q2	QE538-1-C 55421	+0.0008	+0.0061	+0.0206	+0.0346
	12	CD173-Q2 CM249-Q2	QE538-2-C 55422	+0.0029	+0.0056	+0.0224	+0.0357
	19	CD173-Q2 CM249-Q2	QE428-21-A 55423	+0.0015	+0.0063	+0.0035	-0.0159
	5	BA332-Q2	QE419-1-C	+0.0005	+0.0008	+0.0031	+0.0099
	6	PC202-Q2	QE427-1-C	+0.0010	+0.0014	+0.0037	+0.0089
	14	PC202-Q2	QE427-2-C	+0.0044	+0.0294	-0.0031	*
	15	BA332-Q2	QE419-2-C	+0.0048	+0.0318	-0.0046	*
	16	BA332-Q2	QE419-341-C	+0.0041	+0.0312	-0.0017	*
	17	PC202-Q2	QE427-100-C	-0.0003	-0.0002	+0.0020	+0.0019
	7	PT174-Q2	Q9702-1	+0.0023	+0.0029	+0.0004	+0.0028
	18	PT174-Q2	QE426-143-E	+0.0025	+0.0032	-0.0006	+0.0019
	22	PT174-Q2	QE507-1-E	+0.0020	+0.0027	+0.0002	+0.0035
	13	PT174-Q2	Q9702-2	+0.0021	+0.0028	-0.0001	+0.0036
(2)	9	DI325-Q2	QE424-1-B	+0.223V	+0.477V	+0.163V	-0.293V
	10	DI325-Q2	QE424-2-B	+0.161V	+0.374V	+0.172V	+0.608V
	11	DI325-Q2	QE424-3-B	+0.210V	+0.483V	+0.234V	+0.631V
	23	DI325-Q2	QE424-4-B	Unit exhibited erratic operation			

NOTES: (1) Channel No. indicates the position of the module in the MC170AD-Q2 Module Case.
(2) Output changes for the DI325-Q2 Modules are shown in Vdc, and not as %FS/°F.
*(3) Span shift data for channels 14, 15 and 16 at 152°F/95% RH invalid due to discrepancy in electrical connections.

EXTREME ENVIRONMENT
DATA SHEET

TABLE 4-2

	DATE 5/26/32 TIME 8:15 AM		DATE 5/27/32 TIME 12 P.M.		DATE 5/28/32 TIME 6:40 P.M.	
	TEMP 67°F HUMIDITY 66% R.H.		TEMP 173°F HUMIDITY 60% R.H.		TEMP 152°F HUMIDITY 95% R.H.	
CHAN	ZERO	FULL SCALE	ZERO	FULL SCALE	ZERO	FULL SCALE
1	0.002	9.997	0.014	10.025	0.037	10.160
2	-0.004	9.998	0.017	10.102	0.048	10.232
4	0.003	9.990	0.033	10.040	0.041	10.143
5	-0.001	9.994	0.004	10.032	0.006	10.085
6	0.000	10.000	0.011	10.050	0.012	10.088
7	0.001	9.997	0.025	10.025	0.026	10.046
8	0.001	9.996	0.010	10.223	0.053	10.342
9	-9.381	9.382	-9.158	9.545	-8.904	9.680
10	-9.386	9.386	-9.225	9.558	-9.012	9.994
11	-9.375	9.368	-9.164	9.602	-8.892	9.999
12	-0.001	9.997	0.030	10.265	0.047	10.348
13	-0.002	9.999	0.020	10.020	0.022	10.054
14	-0.002	9.992	0.045	10.006	0.248	8.906
15	0.000	9.993	0.051	9.995	0.270	8.875
16	0.005	10.000	0.048	10.025	0.270	8.942
17	0.001	10.000	-0.002	10.018	-0.001	10.014
18	-0.001	10.001	0.025	10.021	0.026	10.044
19	-0.006	10.004	0.010	10.057	0.048	9.923
20	-0.006	9.999	0.064	10.114	0.030	10.269
21	-0.001	10.001	-0.074	9.956	-0.041	10.028
22	0.000	10.000	0.021	10.023	0.023	10.053
23	-9.251*	9.394*	-8.300*	9.580*	-8.571*	9.490*

* ERRATIC OPERATION

TESTED BY: [illegible]

Q.C. APPROVED: [illegible]

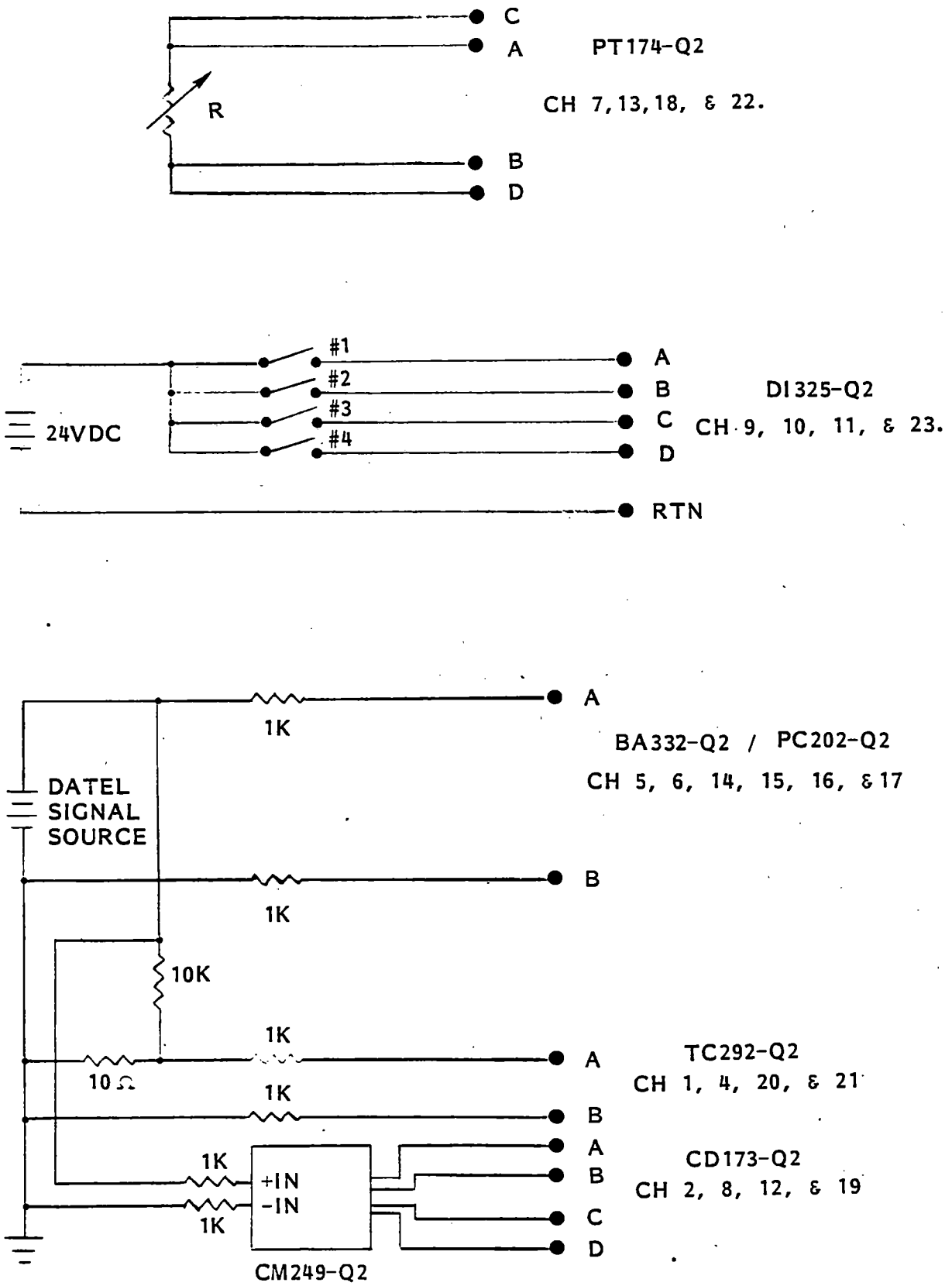
C
A
PT174-Q2
R
CH 7,13,18, & 22.
B
D
#1
#2
#3
#4
A
B
DI325-Q2
24VDC
C
CH 9, 10, 11, & 23.
D
RTN
A
1K
BA332-Q2 / PC202-Q2
CH 5, 6, 14, 15, 16, & 17
DATEL
SIGNAL
SOURCE
B
1K
10K
1K
A
TC292-Q2
10 Ω
CH 1, 4, 20, & 21
1K
B
A
1K
+IN
B
CD173-Q2
-IN
CH 2, 8, 12, & 19
C
1K
D
CM249-Q2

FIGURE 6-1

TABLE 5-1

CH. NO.	AMP TYPE	SERIAL NUMBER	INPUT	OUTPUT
1.	TC292	QE425-1	Z = 0.000 Vdc F.S. = 10.000 mV	Z = 0.000 Vdc F.S. = 10.000 Vdc
2.	CD173 CM249	QE428-22 55422	Z = 0.000 Vdc F.S. = 5.000 Vdc	Z = 0.000 Vdc F.S. = 10.000 Vdc
4.	TC292	QE425-2	Z = 0.000 Vdc F.S. = 10.000 mV	Z = 0.000 Vdc F.S. = 10.000 Vdc
5.	BA332	QE419-1	Z = 0.000 Vdc F.S. = 10.000 Vdc	Z = 0.000 Vdc F.S. - 10.000 Vdc
6.	PC202	QE427-1	Z = 0.000 Vdc F.S. = 10.000 Vdc	Z = 0.000 Vdc F.S. = 10.000 Vdc
7.	PT174	Q9702-1	Z = 92.89 Ω F.S. = 297.31 Ω	Z = 0.000 Vdc F.S. = 10.000 Vdc
8.	CD173 CM249	QE538-1 55423	Z = 0.000 Vdc F.S. = 5.000 Vdc	Z = 0.000 Vdc F.S. = 10.000 Vdc
9.	DI325	QE424-1	Z = 1,2,3,4 = 0 Vdc F.S.= 1,2,3,4 = 24 Vdc	Z = (All OFF = -9.375 Vdc) F.S. = +9.375 Vdc
10.	DI325	QE424-2	Z = 1,2,3,4 = 0 Vdc F.S.= 1,2,3,4 = 24 Vdc	Z = (All OFF = -9.375 Vdc) F.S. = +9.375 Vdc
11.	DI325	QE424-3	Z = 1,2,3,4 = 0 Vdc F.S.= 1,2,3,4 = 24 Vdc	Z = (All OFF = -9.375 Vdc) F.S. = +9.375 Vdc
12.	CD173 CM249	QE538-2 55420	Z = 0.000 Vdc F.S. = 5.000 Vdc	Z = 0.000 Vdc F.S. = 10.000 Vdc
13.	PT174	Q9702-2	Z = 92.89 Ω F.S. = 297.31 Ω	Z = 0.000 Vdc F.S. = 10.000 Vdc
14.	PC202	QE427-2	Z = 0.000 Vdc F.S. = 10.000 Vdc	Z = 0.000 Vdc F.S. = 10.000 Vdc
15.	BA332	QE419-2	Z = 0.000 Vdc F.S. = 10.000 Vdc	Z = 0.000 Vdc F.S. = 10.000 Vdc
16.	BA332	QE419-341	Z = 0.000 Vdc F.S. = 10.000 Vdc	Z = 0.000 Vdc F.S. = 10.000 Vdc
17.	PC202	QE427-100	Z = 0.000 Vdc F.S. = 10.000 Vdc	Z = 0.000 Vdc F.S. = 10.000 Vdc
18.	PT174	QE426-143	Z = 92.89 Ω F.S. = 297.31 Ω	Z = 0.000 Vdc F.S. = 10.000 Vdc
19.	CD173 CM249	QE428-21 55421	Z = 0.000 Vdc F.S. = 5.000 Vdc	Z = 0.000 Vdc F.S. = 10.000 Vdc
20.	TC292	QE506-1	Z = 0.000 mV F.S. = 10.000 mV	Z = 0.000 Vdc F.S. = 10.000 Vdc

TABLE 5-1

CH. NO.	AMP TYPE	SERIAL NUMBER	INPUT	OUTPUT
21.	TC292	QE506-2	Z = 0.000 mV F.S. = 10.000 mV	Z = 0.000 Vdc F.S. = 10.000 Vdc
22.	PT174	QE507-1	Z = 92.89 Ω F.S. = 297.31 Ω	Z = 0.000 Vdc F.S. = 10.000 Vdc
23.	DI325	QE424-4	Z = 1,2,3,4 = 0 Vdc F.S. = 1,2,3,4 = 24 Vdc	Z = (All OFF = -9.375 Vdc) F.S. = +9.375 Vdc

Report Number 525-0889

Temperature/Humidity Test
on
One Signal Conditioner Assembly

Part Number: 170AD-2CM-249

TESTED FOR:

Validyne Engineering Corporation
8626 Wilbur Avenue
Northridge, California 91324

TESTED BY:

National Technical Systems
Testing Division
20988 West Golden Triangle Road
Saugus, California 91350

National Technical Systems

Report 525-0889

APPROVALS

Written By: Glenn D. Meltzer Date: 23 June 1982
PUBLICATIONS, Glenn D. Meltzer

Approved By: Richard H Bonsante Date: 23 June 1982
PROJECT ENGINEER, Richard Bonsante

Approved By: Robert A. Ely Date: June 24, 1982
QUALITY ASSURANCE MANAGER, Robert A. Ely

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1.0 PURPOSE

1.1 The purpose of this report is to present the test procedure used and the test results obtained during a test program. The objective of the test program was to determine the conformance of one Signal Conditioner Assembly, Part Number 170AD-2CM-249, to the Temperature/Humidity requirements specified in Reference 2.1, in accordance with 2.2. The Signal Conditioner Assembly consists of the components listed Table I.

TABLE I

Quantity	Part Number	Description
3	BA332-Q2	Buffer Amplifier
4	TC292-Q2	Thermocouple Conditioner
4	PT174-Q2	RTD Signal Conditioner
3	PC202-Q2	Buffer Amplifier
4	DI325-Q2	Input Encoder
4	CM249-Q2	Carrier Modulator
4	CD173-Q2	Carrier Demodulator
1	PS171-Q2	Power Supply

2.0 REFERENCES

2.1 Verbal Instructions, Validyne Engineering Corporation.

2.2 Validyne Engineering Corporation, Purchase Order Number D31237.

3.0 SUMMARY

3.1 One Signal Conditioner Assembly, described in Paragraph 1.0 and hereafter referred to as "Specimen," has been subjected to Temperature/Humidity testing as described in this report. All results conformed to the specification requirements and no adverse effects were noted.

3.2 All results are presented for evaluation.

4.0 TEST CONDITIONS AND TEST EQUIPMENT

4.1 TEST CONDITIONS

Unless otherwise specified herein, all tests were performed at room ambient conditions defined as a temperature of 73 ±18°F (23 ±10°C), a relative humidity of 50 ±30 percent, and a barometric pressure of 28.5 +2.0, -3.0 inches of mercury absolute (725 +50, -75 mm of mercury absolute).

4.2 TEST EQUIPMENT

The test equipment presented below was calibrated, as required, in accordance with MIL-C-45662A and is traceable to the National Bureau of Standards (NBS). The NBS traceability records are maintained on file in the NTS Quality Assurance Office.

4.3 TEMPERATURE/HUMIDITY TEST EQUIPMENT

NTS Number	Manufacturer	Instrument
ENV893S	Honeywell, Inc.	Temperature Recorder
ENV913S	Honeywell, Inc.	Temperature Recorder
ENV914S	Myron Company	Conductivity Bridge

5.0 TEST PROCEDURES AND TEST RESULTS

5.1 TEMPERATURE/HUMIDITY TEST

Reference 2.1

Date Commenced: 25 May 1982
Date Completed: 28 May 1982

5.1.1 The Specimen was placed on a polyethelene coated rack and installed in a temperature/humidity test chamber. The test chamber was equipped with provisions for electrical operation of the Specimen.

5.1.2 The chamber temperature was increased to 173°F and maintained for a period of 2 hours. The humidity was not controlled during this exposure.

5.1.3 The chamber relative humidity was increased to 60 percent and the chamber temperature was maintained at 173°F. These conditions were maintained for a period of 24 hours.

5.1.4 The chamber temperature was decreased to 152°F and the chamber relative humidity was increased to 95 percent. These conditions were maintained for a period of 24 hours.

5.1.5 The Specimen was subjected to functional tests by Validyne Engineering Corporation personnel prior to the temperature/humidity test, after each temperature/humidity exposure described in Paragraphs 5.1.2 through 5.1.4, and on completion of the temperature/humidity test. No anomalies were reported by the customer and the customer retained his own data.

5.1.6 This completed testing and the Specimen was returned to Validyne Engineering Corporation.

ADDENDUM II
to
NUCLEAR ENVIRONMENTAL QUALIFICATION
TEST REPORT NUMBER QTR 82-002:

QUALIFICATION OF MODEL DI325-XXX-Q2 AND DI338-XXX-Q2

1.0 HISTORY

The Nuclear Environmental Qualification Test Program conducted on the MC170AD-Q2/MC370AD-Q2 Remote Multiplexer Module Cases and the plug-in signal conditioners used in them included the DI325-Q2 Four Input Digital Encoder plug-in module.

The DI325-Q2 units tested were designed for use with 24 Vdc input voltages. In addition, the four input circuits shared a common voltage return, reflecting the fact that the design envisioned the use of a single power supply to power all four input circuits.

Subsequently, there developed a need for two categories of modification of the DI325-Q2 design: first was the need for units with higher voltage input capabilities (48 and 125 Volt levels); and, second, the need to provide input-to-input isolation for the four circuits.

2.0 DESIGN CONSIDERATIONS

The higher input voltage requirement was satisfied by simply tabulating the required resistance values for two resistors used in each input stage -- the scaling resistor across the output of the diode bridge (R1, R12, R22 and R32 for inputs 1 through 4, respectively), and the resistor in series with the inputs ahead of the diode bridge (R48, R59, R60 and R61). The resistors are all MIL-spec types RLR32XXXX per MIL-R-39017, or RN55XXX per MIL-R-10509, ranging in nominal resistance value from 221Ω to 30kΩ. The basic part number --DI325-Q1-- was tabulated to reflect the three input levels as follows: DI325-24-Q2, DI325-48-Q2 and DI325-125-Q2. The printed circuit board remained unchanged, and is used for all three input configurations.

The second category of change -- to provide four isolated inputs -- simply involved a re-layout of the circuit board traces to eliminate the common return trace to Pin 14 and eliminate the jumper trace between Pin 19 and Pin 14. Added were individual return traces to Pins 19, 21, 15 and 17 for input circuits 1 through 4, respectively. Fuse F1 (3/8A, 125v) in series with the common return was deleted. In all other respects the printed circuit board used for the isolated input version is the same as is used for the DI325 series. This isolated input version was designated the DI338-XX-Q2 (with XX representing the same input voltage variations as are provided on the DI325 series).

3.0 QUALIFICATION STATUS

In consideration of the high degree of commonality of the 24, 48 and 125 volt variations for the DI325-series, and the isolated input version -- DI338-XX-Q2 series -- to the DI325-Q2 units included in the original Qualification tests, the DI325-24-Q2, DI325-48-Q2, DI325-125-Q2, DI338-24-Q2, DI338-48-Q2 and DI338-125-Q2 part numbers are considered to have met the qualification criteria established for the signal conditioning plug-in units used in the MC170AD-Q2 and MC370AD-Q2 Remote Multiplexer/Module Cases without further tests.

Validyne
ENGINEERING CORPORATION

APPENDIX A

WYLE LABORATORIES TEST REPORT

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