

IDENTIFICATION

PRODUCT CODE: MAINDEC-12-DØGA-A
PRODUCT NAME: PDP-12 TAPE QUICKIE
DATE CREATED: APRIL 21, 197Ø
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: WALTER MANTER

1. ABSTRACT

The Tape Quickie Diagnostic is designed to provide a test of major register information flow through use of the tape maintenance instructions. Also included is an addition test (Tape Buffer Added to Tape Accumulator) and a test of the shifting of the tape Read-Write Buffer. The Left and Right Switches are used to Test Data.

2. REQUIREMENTS

2.1 EQUIPMENT

- A) A standard basic PDP-12
- B) A TC-12, PDP-12 line-tape controller.
- C) A ASR-33 Teletype or equivalent.

2.2 PRELIMINARY PROGRAMS

All PDP-8 and 12 mode basic instruction diagnostics and exercisers must have been successfully run prior to running the program. (The processor should be solid)

3. LOADING PROCEDURE

3.1 METHOD

This program must be loaded with the rim loader.

- A) With the RIM loader program in memory, place the perforated tape which must be in RIM format in the perforated-tape reader.
- B) Make sure that the ARS-33 is on line.
- C) Place the starting address 7756 in the left switch register.
- D) Set the right switches to 0000₈.
- E) Set the mode switch to 8 mode.
- F) Depress I/O Reset.
- G) Press the Start Left Switches.
- H) Move the reader control switch to START.
- I) Stop the Reader at the end of the Tape.

4. STARTING PROCEDURE

The setting of the left, right and sense switches is not critical to the starting procedure.

- A) Set the mode switch to Linc Mode
- B) Depress I/O preset.
- C) Depress START 2Ø

The program is running; consult the listing for test descriptions

5. CONTROL SWITCH SETTINGS

There are 4 optional modes of operation which are determined by the sense switches Ø-2. They are:

- SNSØ-2 = Ø loop through program
- SNSØ = 1 loop major register tests
- SNS1 = 1 loop addition (TB TO TAC) test
- SNS2 = 1 loop shift read-write buffer test

Right switches = Data all tests.

Left switches = Data for TB TAC Test

If more than one sense switch is depressed at any time, the program will loop in the portion of the program affected by the first sense switch depressed until such time it is reset. The operator can change the setting of the left and right switches from 1s to Øs and back while the program is running.

6. MAINTENANCE INSTRUCTION SET USED

CODE	MODE	OPERATION
6151	PDP-8	Load maintenance register

The contents of the processor ACCUMULATOR bits Ø, 1, 2, 3, are loaded as a command into the maintenance instruction register. The command will be executed if and only if the transfer IOT 6154 is generated.

6152	PDP-8	Tape register clock
6154	PDP-8	Transfer

If you are not familiar with the maintenance instruction IOT's, the above list of them and the various functions are included in Appendix A.

7. ERROR HALTS

In the event an error occurs, the program will halt with the information received from the tape controller in the accumulator. This should be compared with the index register/registers containing a copy of the bit pattern transferred to the tape controller and associated with the particular test to determine what bit/bits were dropped or picked up.

8. ADDITIONAL INFORMATION

A copy of the RIM loader program is included in Appendix B for those not familiar with it.

APPENDIX A

TAPE IOT INSTRUCTIONS

MSC 3 TAC TO AC
 MSC I 3 AC TO TMA SETUP

IOT 6151	
AC BIT	FUNCTION
0	To Maint Inst Reg
1	To Maint Inst Reg
2	To Maint Inst:Reg
3	To Maint Inst Reg
4	Clear Tape Done
5	Skip on Tape Done
6	Generate TT0
7	Generate TT3
8	Simulate Mark Input
9	Simulate Data 1 Input
10	Simulate Data 2 Input
11	Simulate Data 3 Input

IOT 6152	
AC BIT	FUNCTION
0	Tape Preset
1	Shift RWB
2	TB to RWB
3	TB + TAC to TAC
4	0 to Tape Word FF
5	Set 8 Tape
6	Set Unit 1
7	Set BKWRD
8	Set Write SYNC
9	Set 8 Tape MOTN
10	Set 8 Write
11	

APPENDIX A cont

IOT 6154		
CONTENTS MAIT INST REG		ACTION
000	0	AC TO TB
000	1	AC TO TBN
001	0	AC TO TAC
001	1	AC TO TMA
010	0	TMA SETUP TO AC
010	1	TBN TO AC
011	0	TB TO AC
011	1	RWB TO AC
100	0	MARK WINDOW TO AC
100	1	STATES TO AC
101	0	UNITS + MIN TO AC
101	1	TINST TO AC
110	0	MISC STATUS 1 TO AC
110	1	MICS STATUS 2 TO AC
111	0	TMA TO AC
111	1	NOT USED

APPENDIX B

PROGRAM - RIM LOADER

Program Listing

<u>Abs. Addr.</u>	<u>Octal Contents</u>	<u>Tag</u>	<u>Instruction IZ</u>	<u>Comments</u>
7756	6032	BEG,	KCC	/clear AC and flag
7757	6031		KSF	/skip if flag = 1
7760	5357		JMP .-1	/looking for char
7761	6036		KRB	/read huffer
7762	7106		CLL RTL	
7763	7006		RTL	/ch8 in ACO
7764	7510		SPA	/checking for leader
7765	5357		JMP BEG+1	/found leader
7766	7006		RTL	/OK, ch7 in link
7767	6031		KSF	
7770	5367		JMP .-1	
7771	6034		KRS	/read, do not clear
7772	7420		SNL	/checking for address
7773	3776		DCA I TEMP	/store contents
7774	3376		DCA TEMP	/store address
7775	5356		JMP BEG	/next word
7776	0	TEMP	0	/temp storage
7777	JMP start of bin loader		0	

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0000      *20
0001      /TPTS - TAPE QUICKIE MAINDEC 12-D0GA-A
0002      /AUTHOR - WALTER MANTER
0003      /MAINTAINER - DIAGNOSTIC GROOP
0004      /COPYRIGHT 1970, DIGITAL EQUIPMENT CORP., MAYNARD, MASS.
0005      /TESTS MAJOR REGISTER INFORMATION FLOW
0006      /THROUGH USE OF THE MAINTENANCE INST
0007      /REGISTERS TESTED IN ORDER ARE:
0010      /TAC
0011      /TB
0012      /RWB
0013      /TBN
0014      /TMA
0015      /TMA SETUP
0016      /ALSO ADDITION TB+TAC TO TAC
0017      /ALSO SHIFT OF RWB
0020      /SENSE SWITCHES 0-2 CONTROL THE MODE OF OPERATION DESIRED
0021      /SNS 0-2 = 0 LOOP ENTIRE PROGRAM
0022      /SNS 0   = 1 LOOP REGISTER TRANSFER TESTS
0023      /SNS 1   = 1 LOOP ADDITION TEST (TBTAC)
0024      /SNS 2   = 1 LOOP SHIFT RWB TEST (SHRWB)
0025
0026      EJECT
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LMODE
*23

/TTAC TEST - TRANSFER CONTENTS OF THE
/PROCESSOR AC TO THE TAPE ACCUMULATOR
/READ IT BACK AND TEST FOR DISCREPANCY
/THE BIT PATTERN IS DETERMINED BY THE
/LEFT SWITCHES
/PROCEED TO NEXT TEST IF NO ERROR

0020	0011	TTAC,	CLR	/CLEAR THE AC
0021	1020		LDA I	/LOAD THE AC
0022	1000		1200	/BIT 2 SET
0023	0500		IOB	/EXECUTE IN 8 MODE
0024	6151		6151	/TRANSFER OF AC TO TAPE MAINTENANCE REGISTER
0025	0517		LSW	/SELECT BIT PATTERN DESIRED WITH LEFT SWITCHES
0026	1040		STA	/STORE A COPY OF THE BIT PATTERN
0027	0010		10	/IN INDEX REG 10
0030	0500		IOB	/EXECUTE IN 8 MODE
0031	6154		6154	/TRANSFER OF AC TO TAC
0032	0011		CLR	/CLEAR THE AC
0033	0003		TAC	/TRANSFER THE TAC TO THE AC
0034	1440		SAE	/COMPARE THE BIT PATTERN IN THE AC
0035	0010		10	/WITH THE COPY IN IR 10
0036	0000		HLT	/ERROR - THE CONTENTS OF THE AC NOT EQUAL TO IR 10
0037	0016		NOP	/CAN INSERT JMP COMMAND TO LOOP TEST

EJECT

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0064
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0074      0040  0011  TB,      CLR      /CLEAR THE AC
0075      0041  0500          IOB      /EXECUTE IN 8 MODE
0076      0042  6151          6151     /TRANSFER OF CLEARED AC TO MAINTENANCE REGISTER
0077      0043  0517          LSW      /SELECT BIT PATTERN DESIRED WITH LEFT SWITCHES
0100      0044  1040          STA      /STORE A COPY OF BIT PATTERN
0101      0045  0010          10       /IN IR 10
0102      0046  0500          IOB      /EXECUTE IN 8 MODE
0103      0047  6154          6154     /TRANSFER OF AC TO TB
0104      0050  1020          LDA I   /LOAD THE AC
0105      0051  3000          3000     /BITS 1 AND 2 SET
0106      0052  0500          IOB      /EXECUTE IN 8 MODE
0107      0053  6151          6151     /TRANSFER OF AC TO MAINTENANCE REGISTER
0110      0054  0011          CLR      /CLEAR THE AC
0111      0055  0500          IOB      /EXECUTE IN 8 MODE
0112      0056  6154          6154     /TRANSFER OF TB TO AC
0113      0057- 1440          SAE      /COMPARE THE BIT PATTERN IN THE AC
0114      0060  0010          10       /WITH THE ORIGINAL BIT PATTERN IN IR 10
0115      0061  0000          HLT      /ERROR - CONTENTS OF AC NOT EQUAL TO IR 10
0116      0062  0016          NOP      /CAN INSERT JMP COMMAND TO LOOP TEST
0117
0120      EJECT

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0121					
0122			/RWB - TRANSFER CONTENTS OF PROCESSOR		
0123			/AC TO TAPE BUFFER		
0124			/TRANSFER TAPE BUFFER TO		
0125			/TAPE READ WRITE BUFFER		
0126			/TRANSFER TAPE READ WRITE BUFFER TO		
0127			/PROCESSOR AC		
0130			/TEST BIT PATTERN RECEIVED FOR DISCREPANCY		
0131			/THE BIT PATTERN IS DETERMINED BY THE		
0132			/LEFT SWITCHES		
0133			/IF NO ERRORS CONTINUE TO NEXT TEST		
0134					
0135	0263	0011	RWB, CLR		/CLEAR THE AC
0136	0264	0500	IOB		/EXECUTE IN 8 MODE
0137	0265	6151	6151		/TRANSFER OF CLEARED AC TO MAINTENANCE REGISTER
0140	0266	0517	LSW		/SELECT BIT PATTERN DESIRED WITH LEFT SWITCHES
0141	0267	1040	STA		/STORE A COPY OF BIT PATTERN
0142	0270	0010	10		/IN IR 10
0143	0271	0500	IOB		/EXECUTE IN 8 MODE
0144	0272	6154	6154		/TRANSFER OF AC TO TAPE BUFFER
0145	0273	1020	LDA I		/LOAD THE AC
0146	0274	1000	1000		/BIT 2 SET
0147	0275	0500	IOB		/EXECUTE IN 8 MODE
0150	0276	6152	6152		/TRANSFER OF TB TO RWB
0151	0277	1020	LDA I		/LOAD THE AC
0152	0100	3400	3400		/BITS 1, 2 AND 3 SET
0153	0101	0500	IOB		/EXECUTE IN 8 MODE
0154	0102	6151	6151		/TRANSFER OF AC TO TAPE MAINTENANCE REGISTER
0155	0103	0011	CLR		/CLEAR THE AC
0156	0104	0500	IOB		/EXECUTE IN 8 MODE
0157	0105	6154	6154		/TRANSFER OF RWB TO AC
0160	0106	1440	SAE		/COMPARE THE BIT PATTERN IN THE AC
0161	0107	0010	10		/WITH THE ORIGINAL BIT PATTERN IN IR 10
0162	0110	0000	HLT		/ERROR - CONTENTS OF AC NOT EQUAL TO IR 10
0163	0111	0016	NOP		/CAN INSERT JMP COMMAND TO LOOP TEST
0164					
0165			EJECT		

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0176      0112  0011  TBN,   CLR           /CLEAR THE AC
0177      0113  1020          LDA I       /LOAD THE AC
0200      0114  0400          400         /BIT 3 SET
0201      0115  0500          IOB         /EXECUTE TAPE MAINTENANCE INSTRUCTION IN 8 MODE
0202      0116  6151          6151        /TRANSFER OF AC TO TAPE MAINTENANCE REGISTER
0203      0117  3517          LSW         /SELECT BIT PATTERN DESIRED WITH LEFT SWITCHES
0204      0120  1040          STA         /STORE A COPY OF BIT PATTERN
0205      0121  0010          10          /SELECTED IN IR 10
0206      0122  0500          IOB         /EXECUTE TAPE MAINTENANCE INSTRUCTION IN 8 MODE
0207      0123  6154          6154        /TRANSFER OF AC TO TBN
0210      0124  1020          LDA I       /LOAD THE AC
0211      0125  2400          2400        /BITS 1 AND 3 SET
0212      0126  0500          IOB         /EXECUTE IN 8 MODE
0213      0127  6151          6151        /TRANSFER OF AC TO TAPE MAINTENANCE REGISTER
0214      0130  0011          CLR         /CLEAR THE AC
0215      0131  0500          IOB         /EXECUTE IN 8 MOINTENANCE INSTRUCTION IN 8 MODE
0216      0132  6154          6154        /TRANSFER OF TBN TO AC
0217      0133  1440          SAE         /COMPARE THE BIT PATTERN IN THE AC
0220      0134  0010          10          /WITH THE ORIGIONAL BIT PATTERN IN IR 10
0221      0135  0000          HLT        /ERROR - AC NOT EQUAL TO IR 10
0222      0136  0016          NOP         /CAN INSERT JMP COMMAND TO LOOP TEST
0223
0224      EJECT

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0245
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0247
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0255
0256
0257
0260
0261
0262
0263

/TTMA - TRANSFER CONTENTS OF PROCESSOR
/AC TO TAPE MEMORY ADDRESS REGISTER (TMA)
/READ IT BACK AND TEST FOR DISCREPANCY
/THE BIT PATTERN IS DETERMINED BY THE
/LEFT SWITCHES
/PROCEED TO NEXT TEST IF NO ERRORS

0137	0011	TTMA,	CLR	/CLEAR THE AC
0140	1020		LDA I	/LOAD THE AC
0141	1400		1400	/BITS 1 AND 3 SET
0142	0500		IOB	/EXECUTE IN 8 MODE
0143	6151		6151	/TRANSFER OF AC TO TAPE MAINTENANCE REGISTER
0144	0517		LSW	/SELECT BIT PATTERN DESIRED WITH LEFT SWITCHES
0145	1040		STA	/STORE A COPY OF THE BIT PATTERN
0146	0010		10	/SELECTED IN IR 10
0147	0500		IOB	/EXECUTE IN 8 MODE
0150	6154		6154	/TRANSFER OF AC TO TMA
0151	1020		LDA I	/LOAD THE AC
0152	7000		7000	/BITS 0, 1 AND 2 SET
0153	0500		IOB	/EXECUTE IN 8 MODE
0154	6151		6151	/TRANSFER OF AC TO TAPE MAINTENANCE REGISTER
0155	0011		CLR	/CLEAR THE AC
0156	0500		IOB	/EXECUTE IN 8 MODE
0157	6154		6154	/TRANSFER OF TMA TO AC
0160	1440		SAE	/COMPARE THE BIT PATTERN IN THE AC
0161	0010		10	/WITH THE ORIGINAL BIT PATTERN IN IR 10
0162	0000		HLT	/ERROR - AC NOT EQUAL TO IR 10
0163	0016		NOP	/CAN INSERT JMP COMMAND TO LOOP TEST

EJECT

0264				
0265			/TMA - TRANSFER CONTENTS OF PROCESSOR	
0266			/AC TO TMA SETUP REGISTER (TMA)	
0267			/READ IT BACK AND TEST FOR DISCREPANCY	
0270			/THE BIT PATTERN IS DETERMINED BY THE	
0271			/LEFT SWITCHES	
0272			/PROCEED TO NEXT TEST IF NO ERRORS	
0273				
0274	0164	0011	TMA, CLR	/CLEAR THE AC
0275	0165	0517	LSW	/SELECT BIT PATTERN DESIRED WITH LEFT SWITCHES
0276	0166	1040	STA	/STORE A COPY OF THE BIT PATTERN
0277	0167	0010	10	/SELECTED IN INDEX REGISTER 10
0300	0170	0023	TMA	/TRANSFER AC TO TMA SETUP REGISTER
0301	0171	1020	LDA I	/LOAD THE AC
0302	0172	2000	2000	/BIT 1 SET
0303	0173	0500	IOB	/EXECUTE IN 8 MODE
0304	0174	6151	6151	/TRANSFER OF AC TO TAPE MAINTENANCE REGISTER
0305	0175	0011	CLR	/CLEAR THE AC
0306	0176	0500	IOB	/EXECUTE IN 8 MODE
0307	0177	6154	6154	/TRANSFER OF TMA SETUP REGISTER TO AC
0310	0200	1440	SAE	/COMPARE THE BIT PATTERN IN THE AC
0311	0201	0010	10	/WITH THE COPY IN INDEX REGISTER 10
0312	0202	0000	HLT	/ERROR - THE CONTENTS OF THE AC NOT EQUAL TO IR 10
0313	0203	0460	SNS I 0	/IS SENSE SWITCH 0 SET
0314	0204	6020	JMP TTAC	/NO LOOP THROUGH ALL PREVIOUS TESTS AGAIN
0315				
0316			EJECT	

0317				/TBTAC - ENTER TEST IF SENSE SWITCH
0320				/0 IS NOT DEPRESSED
0321				/TRANSFER CONTENTS OF PROCESSOR AC
0322				/AS DETERMINED BY THE LEFT SWITCHES
0323				/TO THE TAPE BUFFER (TB)
0324				/THEN TRANSFER CONTENTS OF PROCESSOR AC
0325				/AS DETERMINED BY THE RIGHT SWITCHES
0326				/TO THE TAPE ACCUMULATOR (TAC)
0327				/NOW ADDITION OF TB TO TAC IS DONE
0330				/THE SUM IS READ BACK AND TESTED FOR
0331				/DISCREPANCY AGAINST A COMPUTED SUM
0332				/STORED IN INDEX REGISTER 12
0333				/IF THERE ARE ANY ERRORS THE PROGRAM
0334				/WILL HALT
0335				/IF SENSE SWITCH 1 IS DEPRESSED
0336				/THE PROGRAM WILL LOOP ON THIS TEST
0337				/OTHERWISE IT WILL CONTINUE WITH THE
0340				/NEXT TEST
0341				
0342				
0343	0205	0011	TBTAC,	CLR
0344	0206	0500		IOB
0345	0207	6151		6151
0346	0210	0517		LSW
0347	0211	1040		STA
0350	0212	0010		10
0351	0213	0500		IOB
0352	0214	6154		6154
0353	0215	1020		LDA I
0354	0216	1000		1000
0355	0217	0500		IOB
0356	0220	6151		6151
0357	0221	0516		RSW
0360	0222	1040		STA
0361	0223	0011		11
0362	0224	0500		IOB
0363	0225	6154		6154
0364	0226	1200		LAM
0365	0227	0010		10
0366	0230	1040		STA
0367	0231	0012		12
0370	0232	1020		LDA I
0371	0233	0400		400
0372	0234	0500		IOB
0373	0235	6152		6152
0374	0236	0011		CLR
0375	0237	0003		TAC
0376	0240	1440		SAE
0377	0241	0012		12
0400	0242	0000		HLT
0401	0243	0461		SWS I 1
0402	0244	6205		JMP TBTAC
2403				
2404				
				EJECT

0405					
0406			/SHRWB - ENTER TEST IF SENSE SWITCH		
0407			/1 IS NOT DEPRESSED		
0410			/TRANSFER CONTENTS OF PROCESSOR		
0411			/AC TO TAPE BUFFER (TB)		
0412			/THEN TAPE BUFFER IS TRANSFERRED TO READ WRITE BUFFER (RWB)		
0413			/THE READ WRITE BUFFER IS NOW SHIFTED		
0414			/ONE BIT POSITION AND ITS CONTENTS READ		
0415			/BACK TO THE AC AND COMPARED WITH A		
0416			/SIMULATED SHIFT IN THE PROCESSOR		
0417			/IF AN ERROR OCCURS THE PROGRAM WILL HALT		
0420			/THE THREE BITS SHIFTED OUT FROM UNDER		
0421			/THE READ WRITE HEAD ARE MASKED OUT AS		
0422			/THEY COULD BE EITHER SET OR RESET		
0423			/IF SENS SWITCH 2 IS DEPRESSED YOU WILL		
0424			/LOOP THIS TEST OTHERWISE YOU WILL GO		
0425			/BACK TO THE BEGINNING OF THE PROGRAM		
0426			/AND START THROUGH AGAIN		
0427					
0430	0245	0011	SHRWB, CLR	/CLEAR THE AC	
0431	0246	0500	IOB	/EXECUTE IN 8 MODE	
0432	0247	6151		/AC-MAIN REG	
0433	0250	0517	LSW	/SELECT BIT PATTERN DESIRED FROM THE RIGHT SWITCHES	
0434	0251	0500	IOB	/EXECUTE IN 8 MODE	
0435	0252	6154	6154	/TRANSFER OF AC TO TB	
0436	0253	0261	ROL I 1	/ROTATE RIGHT ONE PLACE MSB LOST	
0437	0254	1560	BCL I	/CLEAR OUT BITS THAT WILL BE SHIFTED IN FROM TAPE READ HEAD	
0440	0255	0421	0421	/BITS 3, 7 AND 11	
0441	0256	1040	STA	/STORE A COPY OF THE BIT PATTERN	
0442	0257	0010	10	/IN INDEX REGISTER 10	
0443	0260	1020	LDA I	/LOAD THE AC	
0444	0261	1000	1000	/BIT 2 SET	
0445	0262	0500	IOB	/EXECUTE IN 8 MODE	
0446	0263	6152	6152	/TRANSFER OF TB TO RWB	
0447	0264	1020	LDA I	/LOAD THE AC	
0450	0265	2000	2000	/BIT 1 SET	
0451	0266	0500	IOB	/EXECUTE IN 8 MODE	
0452	0267	6152	6152	/SHIFT RWB	
0453	0270	1020	LDA I	/LOAD THE AC	
0454	0271	3400	3400	/BITS 1, 2 AND 3 SET	
0455	0272	0500	IOB	/EXECUTE IN 8 MODE	
0456	0273	6151	6151	/TRANSFER AC TO TAPE MAINTENANCE REGISTER	
0457	0274	0011	CLR	/CLEAR THE AC	
0460	0275	0500	IOB	/EXECUTE IN 8 MODE	
0461	0276	6154	6154	/TRANSFER OF RWB TO AC	
0462	0277	1560	BCL I	/CLEAR OUT BITS THAT WERE UNDER THE READ WRITE HEAD	
0463	0300	0421	0421	/BITS 3, 7 AND 11	
0464	0301	1442	SAE	/COMPARE THE BIT PATTERN IN THE AC	
0465	0302	0010	10	/WITH THE ORIGINAL BIT PATTERN STORED IN INDEX REG 10	
0466	0303	0000	HLT	/ERROR - CONTENTS OF AC NOT EQUAL TO INDEX REGISTER 10	
0467	0304	2462	SNS I 2	/IS SENSE SWITCH 2 DEPRESSED	
0470	0305	6245	JMP SHRWB	/YES LOOP THIS TEST	
2471	0306	0021	JMP TTAC	/NO LOOP BACK TO BEGINNING OF PROGRAM AGAIN	

0000 ERRORS

RWB 4053
SHRWB 4245
TB 4040
TBN 4112
TBTAC 4205
TMAS 4164
TTAC 4020