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IO TEST

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IO TEST is intended as a hardware testing and debugging aid for use with the PDP-6 and its associated input multiplexer (analog to digital converter) and output multiplexer (digital to analog converter). While all characters typed are echoed, only the following have any effect on the program's operation:

F	enable scope display (normal)
Y	disable scope display
W	enable teletype output (normal)
V	disable teletype output
B	enable line printer output (normal)
E	disable line printer output
D	return control to DDT (JRST 174000)
S	start sequence of tests over, beginning with TEST2
nT	try test which has just failed n times, where n is an octal number
P	proceed past test which has just failed to the next test in sequence
A	enter automatic testing mode, which is identical to to typing P each time a test fails; typing any character leaves this mode

The sequence of tests and the error message each generates upon failure is as follows. Note that recovery for TEST1 is different from that for other tests.

TEST1
IO RESET DOES NOT CLEAR FLAGS. CONI ADC=α, MPXR=β
where α and β are the data obtained by doing the appropriate CONIs. Also types two bells on teletype to alert user to the condition. Recovery: All teletype input is ignored. The user is expected to momentarily depress IO RESET, then CONTINUE, and the test will be made again. This is the only test whose failure cannot be recovered from by teletype commands.

TEST2
ADC CHANGES WITHOUT CONO. ORIG=α, NOW=β
CONIs ADC 1000 times.

TEST3
ADC CONO/CONI LOSES. CONO=α, CONI=β
Typing P proceeds to try CONOing and CONIing the next higher number.

TEST4
SELECTING DEV 6 (ADC) WITH DC CAUSED RANDOMNESS.
ADC: ORIG=0, NOW=α
DC: ORIG=4260, NOW=β
Test detects bits coming on erroneously due to sync error.

TEST5
ADC DOES NOT WAIT FOR DC SELECT. ADC=α, DC=β
Test is similar to TEST4, but CONOs ADC with clock 1.

TEST6
ADC ENTERS TEST MODE WITHOUT CONO. ADC=α, DC=β
Test detects data entering DC when ADC is DATAOed.

TEST7
DC READS IN MORE THAN 12. BITS. DC=α, WORD=β
where β is the number DATAIed from DC.

TEST8
DC DATA CLOBBERED SET. ADC=α, DC=β
Hardware in DC has detected malfunction.

TEST9
DATA SEEMS TO BE CLOBBERED. ADC=α, DC=β, DATA=γ
where γ is the number DATAIed from DC. Test is sensitive to third data word being garbled when ADC has to wait for DC to empty.

TEST10
ADC DOES NOT FILL DC. ADC=α, DC=β

TEST11
Same error message as TEST2, but this time data input has occurred between "original" and "now." Tests 7 through 11 are performed in one block of code, so the T command jumps from any one of these to TEST7, and the P command jumps from any one to TEST12.

TEST12
ADC DOES NOT STOP FILLING DC. ADC=α, DC=β

TEST13
Same error message as TEST5, but this time with "continuous" bit (10000) CONOed to ADC as well as clock 1.

TEST14
Same error message as TEST8, but this time reading in 100 words of three 12 bit bites each instead of only 3 words of one 36 bit bite each.

TEST15
CONTINUOUS MODE TAKES α (decimal) USEC/SAMPLE. ADC=β
Tolerance on α is between 15 and 25 is acceptable. Tests 14 and 15 are performed in ;one block of code, so the T command jumps from either of these to TEST14. Typing P from TEST14 proceeds to TEST15.

TEST16
CANNOT COUNT THROUGH CHANNEL α, ADC READS β
Typing P attempts to CONI next expected channel number.

TEST17
ADC WILL NOT ENTER TEST MODE. ADC=α, DC=β
DATAOs have not caused DC to be filled. Typing P will skip testing of test mode (test 17 and 18) and jump to TEST19.

TEST18
CANNOT COUNT LADDER THROUGH α, ADC READS β
Typing P will attempt to DATAI next expected number from DC.

TEST19
LADDER OR INPUT MPXR LOSING. VALUE GIVEN=0
VALUE READ=α, INPUT CHNL=β
where β is the read-back channel connected directly to the ladder (currently 153).

TEST20
SIGNAL TOO NOISY. VALUE GIVEN=4000, MEAN=α, OFFSET=β, VAR=γ, o/o >2VAR=λ, INPUT CHNL=μ
where β is the difference between the value given and the mean, γ is the variance, and λ is the percentage of samples outside of mean + or - 2 times the variance. Sample size is 250. Tolerance is variance 4 or less is acceptable.

TEST21
TOO MUCH OFFSET. VALUE etc. (same as TEST20)
Tolerance is offset 20 (octal) or less is acceptable.

TEST22
BUSY FLAG DOES NOT COME ON WITH DATAO. MPXR=α
Typing P jumps to TEST24.

TEST23
DONE FLAG DOES NOT COME ON. MPXR=α
Typing T jumps back to TEST22. Program is patient with no done flag for about 1 second, then assumes a fault exists.

TEST24
MPXR CHANGES WITHOUT CONO OR DATAO. ORIG=α, NOW=β
Similar to TEST2 but for output multiplexer instead of input multiplexer.

TEST25
MPXR CONO/CONI LOSES. CONO=α, CONI=β
Similar to TEST3 but for output multiplexer instead of input multiplexer.

TEST26
BLKO MODE TAKES α (decimal) USEC/DATAO.
Tolerance is between 50 and 150 is acceptable.

TEST27
CHANNEL α SAMPLE AND HOLD LOSING. DATAO=β, DATAI=γ
Sample and hold channel (i.e., output multiplexer channel, digital to analog converter channel) assignments are listed on last page. The ones-complement of β is DATAOed 100 times, then β is DATAOed. This is done for β = 0 and 7777 on each of the channels in use. Typing P proceeds to test the next channel in use. A difference of 20 is acceptable.

TEST28
CHANNEL α SAMPLE AND HOLD DRIFTS. DATAO=β, DATAI=γ AFTER 1 SEC.
Drift from 0 and from 7777 is tested on all channels is use. Drift of 122 or less (0.2 volts) is acceptable.

TEST29
OTHER CHANNELS DISTURB CHANNEL α SAMPLE AND HOLD. DATAO=β, DATAI=γ
The ones-complement of β is DATAOed on all channels (used or unused) except α, and then all channels are read by the ADC. Channel α is then DATAIed via the ADC and DC. This is done for β = 0 and 7777 on each of the channels in use. Typing P proceeds to test the next channel in use.

TEST30
SAMPLE AND HOLD TOO NOISY. VALUE GIVEN=4000, MEAN=α, OFFSET=β, VAR=γ, o/o>2VAR=λ, OUTPUT CHNL=μ
Same as TEST20 except a sample and hold read-back channel (200 + output channel number) is read instead of the direct ladder read-back channel. Tolerance is variance 4 or less is acceptable.

TEST31
TOO MUCH OFFSET ON SAMPLE AND HOLD. VALUE etc. (same as TEST30)
Tolerance is offset 20 (octal) or less is acceptable.

After completion of TEST31, testing automatically resumes at TEST2. Useful diagnostic data is displayed on the scope, unless scope is disabled, in which case it is line printed, unless the line printer is disabled, in which case it is typed, unless the teletype is disabled. Error messages are line printed, unless line printer is disabled, in which case they are typed, unless the teletype is disabled.

SAMPLE AND HOLD CHANNEL ASSIGNMENTS as of October 5,1967

32	iris
33	focus
34	mirror
54	shoulder
55	shoulder
56	joint J1A
57	joint J1B
60	joint J2A
61	joint J2B
62	joint J3A
63	joint J3B
64	joint J4A
65	joint J4B
66	Alles grip
67	Alles tilt
70	Alles extend
71	Alles rotate
72	AMF wrist roll
73	AMF wrist yaw
74	tdr horizontal
75	AMF horizontal
76	AMF vertical
77	AMF swing