

IDENTIFICATION

Product Code:

MAINDEC-08-D6GB-D-(D)

Product Name:

A/D CALIBRATION CHECK

Date Created:

NOV 17 1967

Maintainer:

Diagnostic Group

Author:

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1. ABSTRACT

The A/D Calibration check for the converters is to be used to ascertain the accuracy of converter adjustments. This tape is to be used with an adjustable voltage source/ The converted value will be displayed in the AC, and the switch register will be used to select multiplexer channels. (Passing of these checks do not guarantee 100% monotonicity, steady state accuracy, since all of the 4096 possible conditions are not checked).

2. REQUIREMENTS

2.1 Equipment

PDP-8 or 8/S Standard Computer
A/D Converter
Adjustable Voltage Source (0.01% or better, $Z_{out} < 1.0 \text{ ohm}$)

2.2 Storage

2.2.1 Program storage - the routine users memory from address 1000 to 6500 and location 0 and 1.

3. LOADING PROCEDURE

3.1 Methods

Procedure for normal binary tape should be followed.

4. STARTING PROCEDURE

4.1 For normal operation all switches should be down.

4.2 Starting address is: (A) 100 for AFOIA
(B) 101 for ADO8A
(C) 102 for ADC1

4.3 Program and/or Operator Action

Connect voltage source to input connector.
Load the program into memory.
Set switch register to Starting Address
Load Address.
Select multiplexer channel using switch register 6 to 11 - 1 (AFOI only)
Press Start

5. OPERATING PROCEDURE

Set the voltage source to the voltage desired, inspect the AC for the correct converted value.

For Starting Address 101, 102 SR = Conversion Display Time
 SA 103 Routine for Setting Muxtiplexer SR = Channel
 SA 104 Routine for Incrementing Muxtiplexer SR = Channel except for overflow which should = zero

6. If alignment errors are severe the converter should be recalibrated. See maintenance section in A-D Converter manual.

6.1 Error Halts

6.1.1 Halt (PC)

<u>AFOI</u>	<u>ADO8-A</u>	<u>ADCI</u>	<u>Function Being Checked</u>
203	403	407	Flag cleared by Start Key
207	---	413	Buffer initialized by Start Key
215	421	421	Convert Instruction sets the flag
221	425	425	Read Buffer Instruction clears the flag
230	---	---	Clear Muxtiplexer, sets the flag
240	---	---	Set Muxtiplexer, sets the flag
250	---	---	Index Muxtiplexer, sets the flag
263	445	445	Interrupt Up
271	434	434	Interrupt Down

For more information see listing.

7. RESTRICTIONS

None

8. MISCELLANEOUS

9. PROGRAM DESCRIPTION

This routine checks both the interrupt and conversion done flags. Uses the switch register, Bits 6 to 11 as the desired muxtiplexer channel, converts the voltage on the selected channel. Displays it in the AC. After a delay checks to see if a new muxtiplexer channel is selected, converts, displays in the AC.

Word Length (No. of Bits)	Max. Switching Point Error * Of INPUT Voltage Range
6	± 1.6%
7	± 0.8%
8	± 0.4%
9	± 0.2%
10	± 0.1%
11	± 0.5%
12	± 0.025%

* ± 1/2 LSB for quantizing error.

/PDP-8 A/D CALIBRATION
/
/A/D CONVERTER ENTRANCE ADDRESS
HALT=7402

0100	777	JMP	NOR	/AF01A ENTRANCE
0101	776	JMP	AD08	/AD08-A ENTRANCE
0102	775	JMP	ADC1	/ADC1 ENTRANCE
0103	774	JMP	SMUX	/SET TEST FOR MUX, MUX=SR
0104	773	JMP	IMUX	/INC. TEST FOR MUX, MUX=SR
0105	772	JMP	CONVER	/SR EQUAL CONVERSION TIME
0106	771	JMP	INST	/GENERATE IOT 565XX, XX=SR

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#274
/CPH CALIBRATION TEST FOR AF01A, 12 BITS
/TEST FOR NO FLAG
0200 6531 ADX, ADZF /SKIP ON FLAG
0201 7417 SKP
0202 7402 HALT /FLAG NOT CLEARED BY START KEY
/WAS BUFFER INITIALIZED TO SEVENS?
0203 6534 ADRB /READ BUFFER
0204 7040 CMA /SHOULD BE=7777
0205 7440 SZA /WORD LENGTH=12 BITS?
0206 7402 HALT /BUFFER WAS NOT 7777
/WILL CONVERT INSTRUCTION (ADCV) SFT FLAG?
0207 6532 ADCV /START CONVERT
0210 3273 DCA STALL
0211 2273 ISZ STALL
0212 5211 JMP ,-1
0213 6531 ADZF /SKIP ON FLAG
0214 7402 HALT /ADCV DID NOT SET FLAG
/WILL READ BUFFER CLEAR FLAG
0215 6534 ADRB /CLEAR FLAG
0216 6531 ADZF /SKIP ON FLAG
0217 7410 SKP
0220 7402 HALT /ADRB DID NOT CLEAR FLAG
/WILL CLEAR MULTIPLEXER SET DONE FLAG?
0221 7200 CLA /START CONVERT
0222 6541 ADCC
0223 3273 DCA STALL
0224 2273 ISZ STALL
0225 5224 JMP ,-1
0226 6531 ADZF /SKIP ON FLAG
0227 7402 HALT /ADCC DID NOT SET FLAG
0230 6534 ADRB /CLEAR FLAG
/WILL SET MULTIPLEXER, SET DONE FLAG?
0231 7200 CLA /START CONVERT
0232 6542 ADSC
0233 3273 DCA STALL
0234 2273 ISZ STALL
0235 5234 JMP ,-1
0236 6531 ADZF /SKIP ON FLAG
0237 7402 HALT /ADSC DID NOT SET DONE FLAG
0240 6534 ADRB /CLEAR FLAG

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/WILL INCREMENT MULTIPLEXER SFT DONE FLAG?
0241 7200 CLA
0242 6544 ADIC /START CONVERT
0243 3273 DCA STALL
0244 2273 ISZ STALL
0245 5244 JMP .-1
0246 6531 ADSF /SKIP DN FLAG
0247 7402 HALT /AUC DID NOT SET DONE FLAG
0250 6534 ADPB /CLEAR FLAG
0251 7200 CLA

/INTERRUPT CHECK
0252 1377 INTENT, TAD (JMP I C.+11)
0253 3001 DCA 1 /SET UP FOR INTERRUPT
0254 6532 ADCV /CONVERT
0255 6001 ION
0256 3273 DCA STALL
0257 2273 ISZ STALL /SHOULD INTERRUPT HERE
0260 4257 JMP .-1
0261 6002 IOF
0262 7402 HALT /NO INTERRUPT
0263 1376 TAD (JMP I C.+5)
0264 3001 DCA 1
0265 6534 ADPB /CLEAR DONE FLAG
0266 6001 ION
0267 7410 SKP
0270 7402 HALT /INTERRUPT ALWAYS UP
0271 6002 IOF
0272 7410 SKP
0273 6000 STALL, 0

/DISPLAY CONVERTED VALUE IN A.C.
0274 7604 IAS /LOAD SW REGISTER
0275 6542 ADSC /SET MUX CHANNEL
0276 7200 CLA
0277 6531 ADSF /WAIT FOR FLAG
0300 5277 JMP .-1
0301 6532 ADCV /CONVERT
0302 6531 ADSF /WAIT FOR FLAGS
0303 5302 JMP .-1
0304 6534 ADPB /READ BUFFER
0305 2273 ISZ STALL /WAIT 36 MILL SEC
0306 5305 JMP .-1 /DISPLAY IN AC
0307 2273 ISZ STALL
0310 5307 JMP .-1
0311 6274 JMP .-15
0312 6000 STALL, 0 /LOOP, SET MUX AND CONVERT

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0376 6567 PAGE
0377 6570
/PDPP CALIBRATION FOR AD08-A
/TEST FOR NO FLAG
0400 6531 AD08, ADSF
0401 7410 SKP /SKIP ON FLAG
0402 7402 HALT
0403 6216 JMP BOTH /FLAG NOT CLEARED BY START KEY
/COMMON TO BOTH AD08 AND ADC-1
/PDPP 8 CALIBRATION FOR ADC1 12 BITS
/TEST FOR NO FLAG
0404 6531 ADC1, ADSF
0405 7410 SKP /SKIP ON FLAG
0406 7402 HALT
/WAS BUFFER INITIALIZED TO /FLAG NOT CLEARED
SEVENS
0407 6534 ADRB /SHOULD EQUAL 7777
0410 7040 CMA
0411 7440 SZA
0412 7402 HALT
/WILL CONVER INSTRUCTION (ADCV) SET FLAG
/BUFFER NOT INITIALIZED
0413 6532 BOTH, ADCV
0414 3777 DCA STALL
0415 2777 ISZ STALL /START CONVERT
0416 5215 JMP .-1 /STALL TIME
0417 6531 ADSF
0420 7402 HALT /SKIP ON FLAG
/WILL READ BUFFER CLEAR FLAG /((ADCV) NOT SET FLAG
0421 6534 ADRB /CLEAR FLAG
0422 6531 ADSF /SKIP ON FLAG
0423 7410 SKP /SHOULD SKIP
0424 7402 HALT /((ADRB) DID NOT CLEAR FLAG
/INTERRUPT CHECK
0425 7200 CLA
0426 1376 TAD (JMP I C.+5
0427 3001 DCA 1
0430 6534 ADRB
0431 6001 TON /CLEAR FLAG, DROP INTERRUPT
0432 7410 SKP /INTERRUPT ON
0433 7402 HALT /SHOULD NOT INTERRUPT
0434 7200 CLA /INTERRUPT ALWAYS UP
0435 1375 TAD (JMP I C.+10
0436 3001 DCA 1
0437 6532 ADCV /START CONVER
0440 777 DCA STALL
0441 777 ISZ STALL /SHOULD INTERRUPT HERE
0442 5241 JMP .-1
0443 6002 TDF
0444 7402 HALT
0445 7000 UP /NO INTERRUPT

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/DISPLAY CONVERTED VALUE IN AC
/FOR ADC-1 AND AD08
/S REGISTER EQUAL CONVERSION TIME
0446 0532 ADCV /START CONVERSION
0447 0531 ADSE /SKIP ON FLAG
0450 0247 JMP .-1
0451 7674 L4S /LOAD SWITCH
0452 7040 CMA
0453 0777 DCA STALL
0454 0534 ADPB /HEAD BUFFER TO AC
0455 0777 ISZ STALL /STALL TIME
0456 0255 JMP .-1
0457 0246 JMP .-11 /LOOP

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0575 0575 FACE
0576 0576
0577 0577

/SPECIAL TEST FOR MULTIPLEXER INCREMENTING
/SWITCH REGISTER SHOULD EQUAL MULTIPLEXER LIGHTS
0600 0600 IMUX, LAS /LOAD CHANNEL
0621 0621 TAD (-1 /MINUS ONE
0602 0602 ADSC /SET MULTIPLEXER
0603 0603 ADIC /INCREMENT MULTIPLEXER
0604 0604 ISZ STALL
0605 0605 JMP .-1 /DISPLAY TIME
0606 0606 JMP IMUX /LOOP

/SET TEST FOR MULTIPLEXER SR SHOULD EQUAL MULTIPLEXER LIGHTS
0607 0607 SMUX, LAS /LOAD CHANNEL
0610 0610 ADSC /SET MULTIPLEXER
0611 0611 ISZ STALL
0612 0612 JMP .-1 /DISPLAY TIME
0613 0613 JMP SMUX /LOOP

/SCOPE SET UP FOR CONVERSION ST=TIME
0614 0614 CONVER, ADCV /START CONVERSION
0615 0615 LAS /READ SW REGISTER
0616 0616 CMA /COMPLEMENT NUMBER
0617 0617 DCA STALL
0620 0620 ISZ STALL
0621 0621 JMP .-1 /CONVERSION TIME=
0622 0622 JMP CONVER /LOOP

/SCOPE LOOP FOR INSTRUCTIONS
/10T INSTRUCTION 65XX, XX=SR BITS 6 TO 11
0623 0623 INST, NOP
0624 0624 LAS /READ SWITCH
0625 0625 AND (0077
0626 0626 TAD (6500 /CREATE INSTRUCTION
0627 0627 DCA .+1
0630 0630 HLT
0631 0631 NOP /LOCATION OF INSTRUCTION
0632 0632 JMP INST+1 /IN CASE OF SKIP
0774 0774 $ /LOOP
0775 0775
0776 0776
0777 0777
1165 1165
1166 1166
1157 1157
1170 1170
1171 1171
1172 1172
1173 1173
1174 1174
1175 1175
1176 1176
1177 1177

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