REV NO. O

P3K-AL-0649-A01

CONT ON SHEET 2 SH NO. 1

TITLE
TEST INSTRUCTIONS
CV 4 POSITION CONTROL/MOTORING 1F1-B8
CIRCUIT BOARD ASSEMBLY 148D2602
FIRST MADE FOR EHC MARK II

REVISIONS

A. BOARD CONTENTS

1. 2 regulated power supplies.
2. Input amplifier (IC1).
3. Summing amplifier (IC2).
4. Meter amplifier (IC3).

B. POWER SUPPLIES

1. $V_{TP1} = 15.7 \pm 1$ VDC.
2. $V_{TP2} = -15.7 \pm 1$ VDC.
3. I Pin 37 = 63 ± 15 ma DC.
4. I Pin 41 = 62 ± 15 ma DC.

C. INPUT AMPLIFIER (IC1)

1. Voltage Ranges

$1.45 < V_{TP50} < 1.9$ VDC (VR8 CW)

$-7.5 < V_{TP50} < -6.2$ VDC (VR8 CCW)

OK

2. Amplifier Gains

a. Adjust VR8 so that $V_{TP50} = 0$ VDC.

Ground Pin 33.

Adjust V pin 35 with variable voltage source so that

$|V_{TP7}| \leq 5$ mv DC. THEN:

OK

$-1.02 < V_{TP7}/V_{TP50} < -.975$ (VR9 CCW), ($|V_{TP50}| \leq 5$ VDC)

Read IN

273-2
273-12
273-71
273-138
273-22
273-22
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C. INPUT AMPLIFIER (IC1) (continued)

2. Amplifier Gains (continued)

b. Ground pins 33 and 35. OK

Adjust VR8 so that $|V_{TP7}| \leq 5$ mv DC. OK

Remove ground from pin 35. THEN: OK

Apply +10VDC to Pin 36 (TP9) Read TP7

$-0.512 < V_{TP7}/V_{TP9} < -0.485$ (VR9 CCW), $(0 < V_{TP9} < 10$ VDC)

$-11.7 < V_{TP7}/V_{TP9} < -9.4$ (VR9 CW), $(0 < V_{TP9} < 1$ VDC)

Remove ground at Pin 33 Repeat set b

c. Applying appropriate conditions similar to step b:

$-0.512 < V_{TP7}/V_{TP8} < -0.485$ (VR9 CCW), $(0 < V_{TP8} < 10$ VDC)

d. Jumper pins 31 and 34. THEN:

$-1.18 < V_{TP6} < -1.13$ VDC OK

WITH: $V_{TP50} = V_{TP8} = 0$ and VR9 CCW OK

Apply $V_{TP9} = +10.00$ VDC

THEN: $+.54 < V_{TP7} < +1.01$ Read ≈ +.867 VDC

Remove jumper and voltage biases.

3. Transient States

a. Ground pins 33 and 35.

Adjust VR8 for $|V_{TP7}| \leq 5$ mv DC.

VR9 CCW

Remove pin 35 ground

Apply a +1.0 VDC step input to pin 35. THEN:

$-3.35 < V_{TP7} < -3.0$ VDC @ t = 1 ms = -5.00 VDC

Remove pin 33 ground

b. Repeat for +1.0 VDC step input to pin 33. = -5.00 VDC

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D. METER AMPLIFIER (IC3)

1. V_{TP53} = -22 VDC, (VR10 CW)

$-6.85 < V_{TP53} < -5.8$ VDC (VR10 CCW)

2. Attach milliameter from pin 24 to ground.
Ground TP5 and null IC3.
Insure that VR50 runs V_{TP4} through zero.

3. V_{TP4} / V_{TP5} = 1.00 ($-10 \leq V_{TP5} \leq 0$ VDC)

4. Apply -10 VDC to TP5. THEN:

$1.5 < I_{meter} < 1.6$ ma DC (VR5 CW)

$0.82 < I_{meter} < 0.92$ ma DC (VR5 CCW)

E. SUMMING AMPLIFIER (IC2) - Steady State

1. Voltage Ranges

a. V_{TP60} = 0 VDC, (VR4 CCW)

$-6.0 < V_{TP60} < -5.0$ VDC, (VR4 CW)

b. V_{TP10} = 0 VDC, (VR7 CCW)

$-14.1 < V_{TP10} < -12.0$ VDC, (VR7 CW) } (VR53 CCW)

c. $4.3 < V_{TP13} < 4.6$ VDC, (VR1 CCW)

$14.0 < V_{TP13} < 15.2$ VDC, (VR1 CW) } (VR2 CW)

d. V_{TP12} = 0 VDC, (VR3 CCW)

$-14.1 < V_{TP12} < -12.0$ VDC, (VR3 CW), (VR54 CW)

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E. SUMMING AMPLIFIER (IC2) - Steady State (continued)

2. Amplifier Gains

a. VR1 CW
VR7 CCW
TP7, TP54, TP5, TP65 grounded
TP57 - TP52 shorted
TP58 - TP59 shorted

THEN:

$-5.1 < V_{TP3} / V_{TP13} < -4.9$ (VR2 CW)
$-1.80 < V_{TP3} / V_{TP13} < -1.54$ (VR2 CCW)
} ($V_{TP13} \approx +1.0$ VDC)

b. TP7, TP54, TP [illegible], TP5, TP65 grounded
TP58 - TP59 shorted

THEN:

$-1.02 < V_{TP3} / V_{TP56} < -.98$ (VR6 CCW), ($0 < V_{TP56} < 1.5$ VDC)
$-23.3 < V_{TP3} / V_{TP56} < -18.7$ (VR6 CW), ($0 < V_{TP56} < 0.1$ VDC)

c. Series Gains

TP57 - TP52 shorted
TP66, TP63, TP13 grounded
Set $-10 < V_{TP1C} < 0$ VDC
Apply necessary $V_{TP56} > 0$ to keep amplifier from limiting

THEN when IC2 not limiting:

(1) VR51 CCW, VR53 CCW

$-2.58 < V_{TP3} / V_{TP7} < -2.42$ ($V_{TP7} > V_{TP10}$)
$-3.6 < V_{TP3} / V_{TP7} < -3.4$ ($V_{TP7} < V_{TP10}$)

PRINTS TO

E. SUMMING AMPLIFIER (IC2) - Steady State (continued)

2. (continued)

c. Series Gains (continued)

(2) VR51 CCW, VR53 CW

$-2.58 < V_{TP3}/V_{TP7} < -2.42 \quad (V_{TP7} > V_{TP10})$

$-3.12 < V_{TP3}/V_{TP7} < -2.89 \quad (V_{TP7} < V_{TP10})$

(3) VR51 CW, VR53 CW

$-.468 < V_{TP3}/V_{TP7} < -.373 \quad (V_{TP7} > V_{TP10})$

$-1.02 < V_{TP3}/V_{TP7} < -.826 \quad (V_{TP7} < V_{TP10})$

(4) VR51 CW, VR53 CCW

$-.468 < V_{TP3}/V_{TP7} < -.373 \quad (V_{TP7} > V_{TP10})$

$-1.49 < V_{TP3}/V_{TP7} < -1.34 \quad (V_{TP7} < V_{TP10})$

d. Feedback Gains

TP57 - TP52 shorted

TP7, TP54, TP grounded

Apply necessary $V_{TP56} > 0$ to keep amplifier from limiting

THEN with IC2 not limiting:

(1) VR52 CCW, VR54 CCW

$-.85 < V_{TP3}/V_{TP5} < -.7 \quad (V_{TP5} > V_{TP12})$

$-.961 < V_{TP3}/V_{TP5} < -.773 \quad (V_{TP5} < V_{TP12})$

(2) VR52 CCW, VR54 CW

$-.85 < V_{TP3}/V_{TP5} < -.7 \quad (V_{TP5} > V_{TP12})$

$-1.89 < V_{TP3}/V_{TP5} < -1.65 \quad (V_{TP5} < V_{TP12})$

E. SUMMING AMPLIFIER (IC2) - Steady State (continued)

2. (continued)

d. Feedback Gains (continued)

(3) VR52 CW, VR54 CW

$-3.4 < V_{TP3}/V_{TP5} < -3.2 \quad (V_{TP5} > V_{TP12})$

$-4.5 < V_{TP3}/V_{TP5} < -4.1 \quad (V_{TP5} < V_{TP12})$

(4) VR52 CW, VR54 CCW

$-3.4 < V_{TP3}/V_{TP5} < -3.2 \quad (V_{TP5} > V_{TP12})$

$-3.53 < V_{TP3}/V_{TP5} < -3.32 \quad (V_{TP5} < V_{TP12})$

3. Limit Circuit

a. TP58 - TP59 shorted

$V_{TP3} = \pm 2.5 \pm 0.5$ VDC (soft limit)

b. Short removed:

$V_{TP3} = 0.3 \pm 0.1$ VDC (hard limit)

4. Saturation Protection (CR10, CR11)

$|V \text{ Pin 2 IC2} - V \text{ Pin 3 IC2}| \leq 0.6$ VDC

F. SUMMING AMPLIFIER - Transient State

1. TP57 - TP52 shorted

TP7, TP54, TP66, TP13 grounded

VR52 CCW

Apply $V_{TP5} = 1.0$ step input THEN:

$-.516 < V_{TP3} < -.386$ @ t = 0.1 ms in an exponential rise.

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F. SUMMING AMPLIFIER - Transient State (continued)

1. (continued)

Remove V_{TP5}

2. TP57 - TP52 shorted

TP7, TP54, TP63, TP13 grounded

VR54 CCW

Apply V_{TP65} = 1.0 step input THEN:

$-.070 < V_{TP3} < -.057$ @ t = 0.5 ms in an exponential rise.

Remove V_{TP65}

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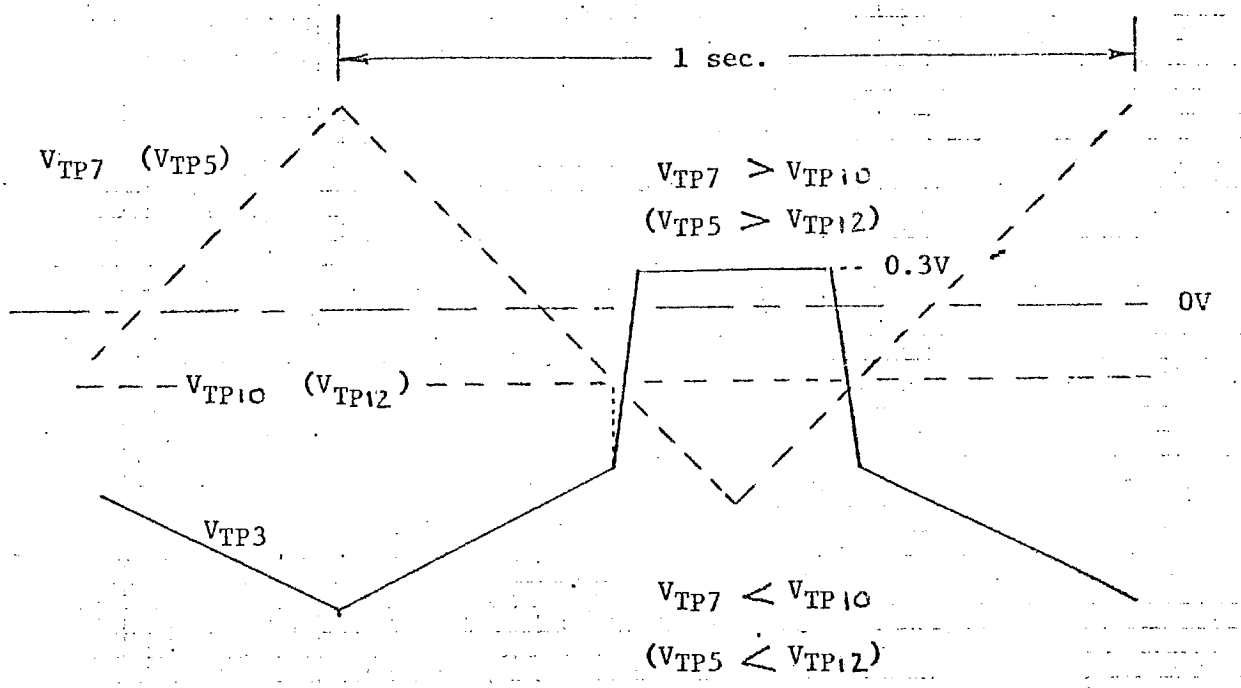

FIGURE 1: Using a 1 Hz triangle signal to check V_{TP3}/V_{TP7} (V_{TP3}/V_{TP5}) Section E.2.c (d).

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