

MILITARY SPECIFICATION

MICROCIRCUITS, LINEAR, INTERNALLY TRIMMED
ANALOG MULTIPLIER, HYBRID AND MONOLITHIC SILICON

This amendment forms a part of MIL-M-38510/139B dated 24 March 1986, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 10

TABLE I, delete and substitute the following:

Input offset current	I_{IO}	$T_A = -55^\circ C$	-400.0	400.0	nA
		$25^\circ C \leq T_A \leq 125^\circ C$	-200.0	200.0	"

TABLE I, delete and substitute the following:

Supply current (+)	I_{CC}	$R_L = \infty$	$-55^\circ C \leq T_A \leq 25^\circ C$	6.0	mA
			$T_A = 125^\circ C$	8.0	"
Supply current (-)	I_{EE}	$R_L = \infty$	$-55^\circ C \leq T_A \leq 25^\circ C$	-6.0	"
			$T_A = 125^\circ C$	-8.0	"

The attached insertable replacement pages listed below are replacements for stipulated pages. When the new pages have been entered in the document, insert the amendment as the cover sheet to the specification.

Replacement page

Page replaced

15	Reprinted without change
16	16
17	Reprinted without change
18	18

PAGE 11

* TABLE I, delete and substitute the following:

Power supply rejection ratio (-)	P_{SRR1}	$+13.5 \text{ V} \leq V_S \leq +15 \text{ V}$ $V_y = +10 \text{ V}, V_x = +5 \text{ V}$	$25^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$	-50.0	50.0	$\frac{\text{mV}}{\text{V}}$
			$T_A = -55^\circ\text{C}$	-100.0	100.0	"

TABLE I, settling time (+ and -), maximum limits column: Delete "2.0" and substitute "2.5".

* TABLE I, delete as substituted in amendment 1 and substitute the following:

Slew rate (+)	SR(+)	$T_A = 125^\circ\text{C}$	12		$\text{V}/\mu\text{s}$
		$-55^\circ\text{C} \leq T_A \leq 25^\circ\text{C}$	18		"
Slew rate (-)	SR(-)	$T_A = 125^\circ\text{C}$	12		"
		$-55^\circ\text{C} \leq T_A \leq 25^\circ\text{C}$	18		"

TABLE I, nonlinearity (X), limits columns: Delete " ± 0.6 " and substitute " ± 0.8 ".

TABLE I, nonlinearity (Y), limits columns: Delete " ± 0.4 " and substitute " ± 1.0 ".

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* TABLE III, test numbers 35, 36, and 37, 38, equations column: Delete "1.5" and "3" and substitute "3" and "6", respectively.

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* TABLE III, test numbers 86, 87, and 88, 89, equations column: Delete "1.3" and "3" and substitute "3" and "6", respectively.

* TABLE III, test numbers 88, 89, unit column: Delete "mV" and substitute "".

* TABLE III, test numbers 90, 91, unit column: Delete "" and substitute "mV".

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* TABLE III, test numbers 137, 138, and 139, 140, equations column: Delete "1.5" (two places) and substitute "3" and "6", respectively.

* TABLE III, test numbers 139, 140, unit column: Delete "mV" and substitute "".

* TABLE III, test numbers 141, 142, unit column: Delete "" and substitute "mV".

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* TABLE III, test numbers 37, 38, equations column: Delete "1.5" and substitute "3".

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* TABLE III, test numbers 39, 40, equations column: Delete "3.0" and substitute "6".

TABLE III, test numbers 49 through 52, 55, and 56, limits column: Delete " ± 0.4 " and substitute " ± 1.0 ".

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TABLE III, test numbers 75 through 76, limits column: Delete " ± 400.0 " and substitute " ± 200.0 ".

TABLE III, test number 79, maximum limits column: Delete "6.0" and substitute "8.0".

TABLE III, test number 80, minimum limits column: Delete "-6.0" and substitute "-8.0".

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* TABLE III, test numbers 97, 98, equations column: Delete "1.5" and substitute "3".

* TABLE III, test numbers 99, 100, equations column: Delete "3" and substitute "6".

TABLE III, test numbers 105 through 108, 113, 114, limits column: Delete " ± 0.6 " and substitute " ± 0.8 ".

* TABLE III, test numbers 105 through 112, equations column: Delete and substitute as follows:

<u>Test number</u>	<u>Equation</u>
105	" $+NLx(A) = E54 - [(E35-E37)/4 + (((E35+E37)/2) + E66)/2]$ "
106	" $+NLx(B) = E56 + [(E35-E37)/4 - (((E35+E37)/2) + E66)/2]$ "
107	" $-NLx(A) = E53 - [(E34-E36)/4 + (((E34+E36)/2) + E65)/2]$ "
108	" $-NLx(B) = E55 + [(E34-E36)/4 - (((E34+E36)/2) + E65)/2]$ "
109	" $+NLy(A) = E50 - [(E36-E37)/4 + (((E36+E37)/2) + E64)/2]$ "
110	" $+NLy(B) = E52 + [(E36-E37)/4 - (((E36+E37)/2) + E64)/2]$ "
111	" $-NLy(A) = E49 - [(E34-E35)/4 + (((E34+E35)/2) + E63)/2]$ "
112	" $-NLy(B) = E51 + [(E34-E35)/4 - (((E34+E35)/2) + E63)/2]$ "

TABLE III, test numbers 109 through 112, 115, and 116, limits column: Delete " ± 0.4 " and substitute " ± 1.0 ".

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TABLE III, test number 140 minimum limits column: Delete "-6.5" and substitute "-6.0".

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* TABLE III, test numbers 157, 158, equations and limits columns: Delete "1.5" and " ± 50.0 " and substitute "3" and " ± 100 ", respectively.

* TABLE III, test numbers 159, 160, equations column: Delete "3.0" and substitute "6".

TABLE III, test numbers 165 through 168, limits column: Delete " ± 0.6 " and substitute " ± 0.8 ".

* TABLE III, test numbers 165 through 170, equations column: Delete and substitute as follows:

<u>Test number</u>	<u>Equation</u>
165	" $+NLx(A) = E87 - [(E68-E70)/4 + (((E68+E70)/2) + E99)/2]$ "
166	" $+NLx(B) = E89 + [(E68-E70)/4 - (((E68+E70)/2) + E99)/2]$ "
167	" $-NLx(A) = E86 - [(E67-E69)/4 + (((E67+E69)/2) + E98)/2]$ "
168	" $-NLx(B) = E88 + [(E67-E69)/4 - (((E67+E69)/2) + E98)/2]$ "
169	" $+NLy(A) = E83 - [(E69-E70)/4 + (((E69+E70)/2) + E97)/2]$ "
170	" $+NLy(B) = E85 + [(E69-E70)/4 - (((E69+E70)/2) + E97)/2]$ "

TABLE III, test numbers 169, 170, limits column: Delete " ± 0.4 " and substitute " ± 1.0 ".

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* TABLE III, test numbers 45 through 52, equations column: Delete and substitute as follows:

<u>Test number</u>	<u>Equation</u>
45	" $+NLx(A) = E21 - [(E2-E4)/4 + (((E2+E4)/2)+E33)/2]$ "
46	" $+NLx(B) = E23 + [(E2-E4)/4 - (((E2+E4)/2)+E33)/2]$ "
47	" $-NLx(A) = E20 - [(E1-E3)/4 + (((E1+E3)/2)+E32)/2]$ "
48	" $-NLx(B) = E22 + [(E1-E3)/4 - (((E1+E3)/2)+E32)/2]$ "
49	" $+NLy(A) = E17 - [(E3-E4)/4 + (((E3+E4)/2)+E31)/2]$ "
50	" $+NLy(B) = E19 + [(E3-E4)/4 - (((E3+E4)/2)+E31)/2]$ "
51	" $-NLy(A) = E16 - [(E1-E2)/4 + (((E1+E2)/2)+E30)/2]$ "
52	" $-NLy(B) = E18 + [(E1-E2)/4 - (((E1+E2)/2)+E30)/2]$ "

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* TABLE III, test numbers 105 through 112, equations column: Delete and substitute as follows:

<u>Test number</u>	<u>Equation</u>
105	" $+NLx(A) = E54 - [(E35-E37)/4 + (((E35+E37)/2)+E66)/2]$ "
106	" $+NLx(B) = E56 + [(E35-E37)/4 - (((E35+E37)/2)+E66)/2]$ "
107	" $-NLx(A) = E53 - [(E34-E36)/4 + (((E34+E36)/2)+E65)/2]$ "
108	" $-NLx(B) = E55 + [(E34-E36)/4 - (((E34+E36)/2)+E65)/2]$ "
109	" $+NLy(A) = E50 - [(E36-E37)/4 + (((E36+E37)/2)+E64)/2]$ "
110	" $+NLy(B) = E52 + [(E36-E37)/4 - (((E36+E37)/2)+E64)/2]$ "
111	" $-NLy(A) = E49 - [(E34-E35)/4 + (((E34+E35)/2)+E63)/2]$ "
112	" $-NLy(B) = E51 + [(E34-E35)/4 - (((E34+E35)/2)+E63)/2]$ "

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* TABLE III, test numbers 165 through 172, equations column: Delete and substitute as follows:

<u>Test number</u>	<u>Equation</u>
165	" $+NLx(A) = E87 - [(E68-E70)/4 + (((E68+E70)/2)+E99)/2]$ "
166	" $+NLx(B) = E89 + [(E68-E70)/4 - (((E68+E70)/2)+E99)/2]$ "
167	" $-NLx(A) = E86 - [(E67-E69)/4 + (((E67+E69)/2)+E98)/2]$ "
168	" $-NLx(B) = E88 + [(E67-E69)/4 - (((E67+E69)/2)+E98)/2]$ "
169	" $+NLy(A) = E83 - [(E69-E70)/4 + (((E69+E70)/2)+E97)/2]$ "
170	" $+NLy(B) = E85 + [(E69-E70)/4 - (((E69+E70)/2)+E97)/2]$ "
171	" $-NLy(A) = E82 - [(E67-E68)/4 + (((E67+E68)/2)+E96)/2]$ "
172	" $-NLy(B) = E84 + [(E67-E68)/4 - (((E67+E68)/2)+E96)/2]$ "

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* TABLE III, test numbers 37, 38, equations column: Delete "1.5" and substitute "3".

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* TABLE III, test numbers 39, 40, equations column: Delete "3.0" and substitute "6".

TABLE III, test numbers 45 through 48, 53 and 54, limits column: Delete "*0.6" and substitute "*0.8".

* TABLE III, test numbers 45 through 52, equations column: Delete and substitute as follows:

<u>Test number</u>	<u>Equation</u>
45	" $+NLx(A) = E21 - [(E2-E4)/4 + (((E2+E4)/2)+E33)/2]$ "
46	" $+NLx(B) = E23 + [(E2-E4)/4 - (((E2+E4)/2)+E33)/2]$ "
47	" $-NLx(A) = E20 - [(E1-E3)/4 + (((E1+E3)/2)+E32)/2]$ "
48	" $-NLx(B) = E22 + [(E1-E3)/4 - (((E1+E3)/2)+E32)/2]$ "
49	" $+NLy(A) = E17 - [(E3-E4)/4 + (((E3+E4)/2)+E31)/2]$ "
50	" $+NLy(B) = E19 + [(E3-E4)/4 - (((E3+E4)/2)+E31)/2]$ "
51	" $-NLy(A) = E16 - [(E1-E2)/4 + (((E1+E2)/2)+E30)/2]$ "
52	" $-NLy(B) = E18 + [(E1-E2)/4 - (((E1+E2)/2)+E30)/2]$ "

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* TABLE III, test numbers 171, 172, equations column: Delete and substitute as follows:

<u>Test number</u>	<u>Equation</u>
171	"+NLy(A) = E82-[{(E67-E68)/4+(((E67+E68)/2)+E96)/2]"
172	"+NLy(B) = E84+[(E67-E68)/4-(((E67+E68)/2)+E96)/2]"

* TABLE III, test numbers 171, 172, 175, and 176, limits column: Delete "±0.4" and substitute "±1.0".

* TABLE III, test numbers 173 and 174, limits column: Delete "±0.6" and substitute "±0.8".

TABLE III, subgroup 4 column: Delete " $T_A = +5^{\circ}\text{C}$ " and substitute " $T_A = +25^{\circ}\text{C}$ ".

TABLE III, test numbers 177 through 180, minimum limits column: Delete "20.0" and substitute "18.0".

TABLE III, test numbers 183 through 186, minimum limits column: Delete "20.0" and substitute "15.0".

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TABLE III, test numbers 187 through 190, minimum limits column: Delete "20.0" and substitute "18.0".

TABLE III, subgroup 9 column: Delete " $T_A = -25^{\circ}\text{C}$ " and substitute " $T_A = +25^{\circ}\text{C}$ ".

TABLE III, test numbers 192 through 193, maximum limits column: Delete "2.0" and substitute "2.5".

The margins of this amendment are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

CONCLUDING MATERIAL

Custodians:

Army - ER
Navy - EC
Air Force - 17
NASA - NA

Preparing activity:
Air Force - 17

Agent:
DLA - ES

Review activities:

Army - AR, MI
Navy - OS, SH
Air Force - 11, 19, 80, 85, 99
DLA - ES

(Project 5962-1127)

User activities:

Army - SM
Navy - AS, CG, MC

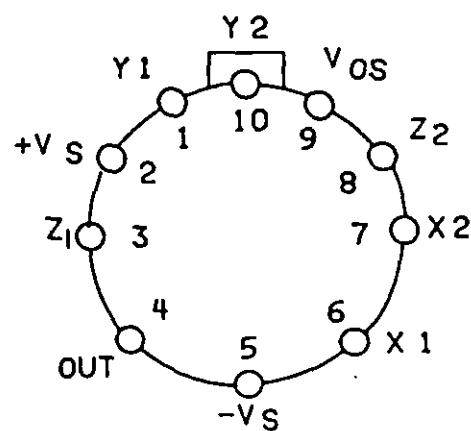
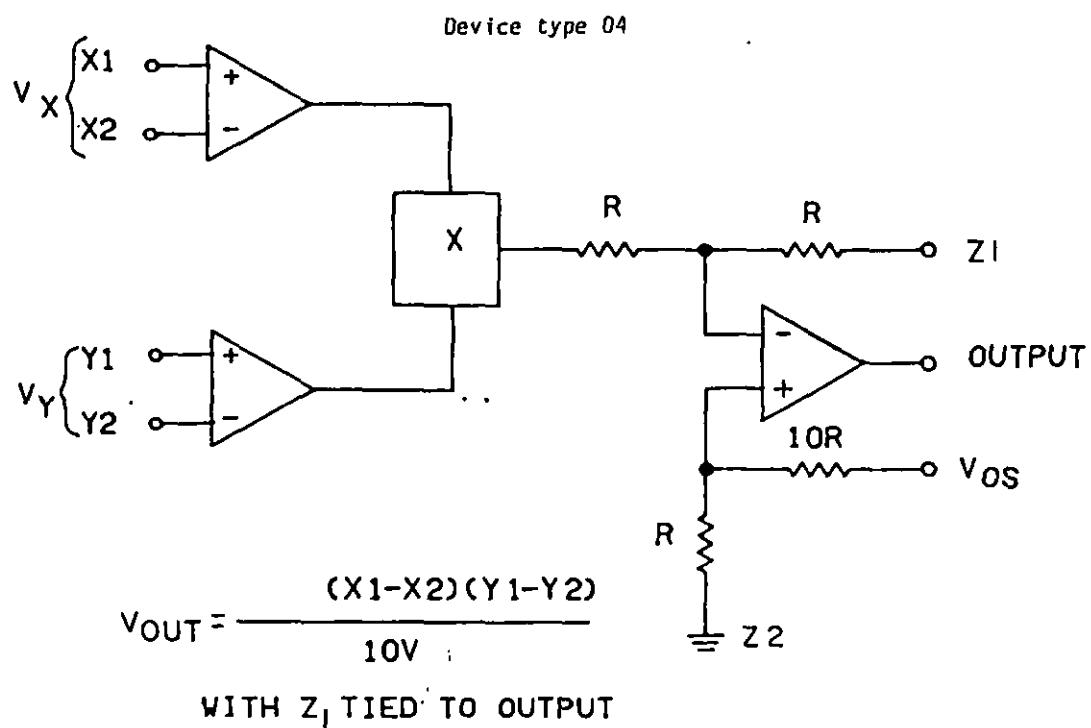
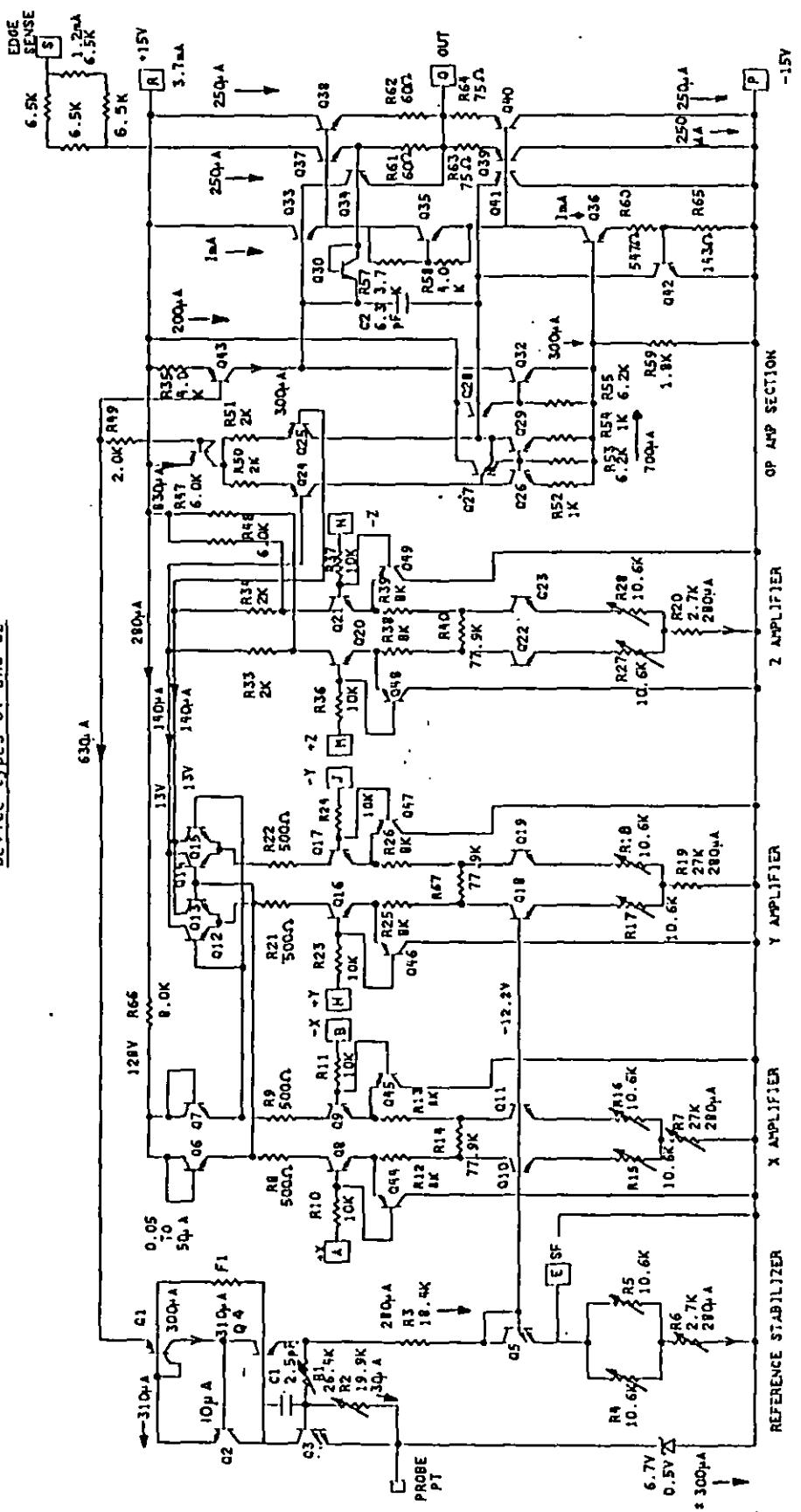


FIGURE 1. Functional block diagrams and terminal connections - Continued.

Device types 01 and 02



NOTE: All resistances are nominal and in ohms.

▲ BOOTSTRAP TO THE N° SIDE OF C2

FIGURE 2. Functional schematic circuits.

Device types 01 and 02

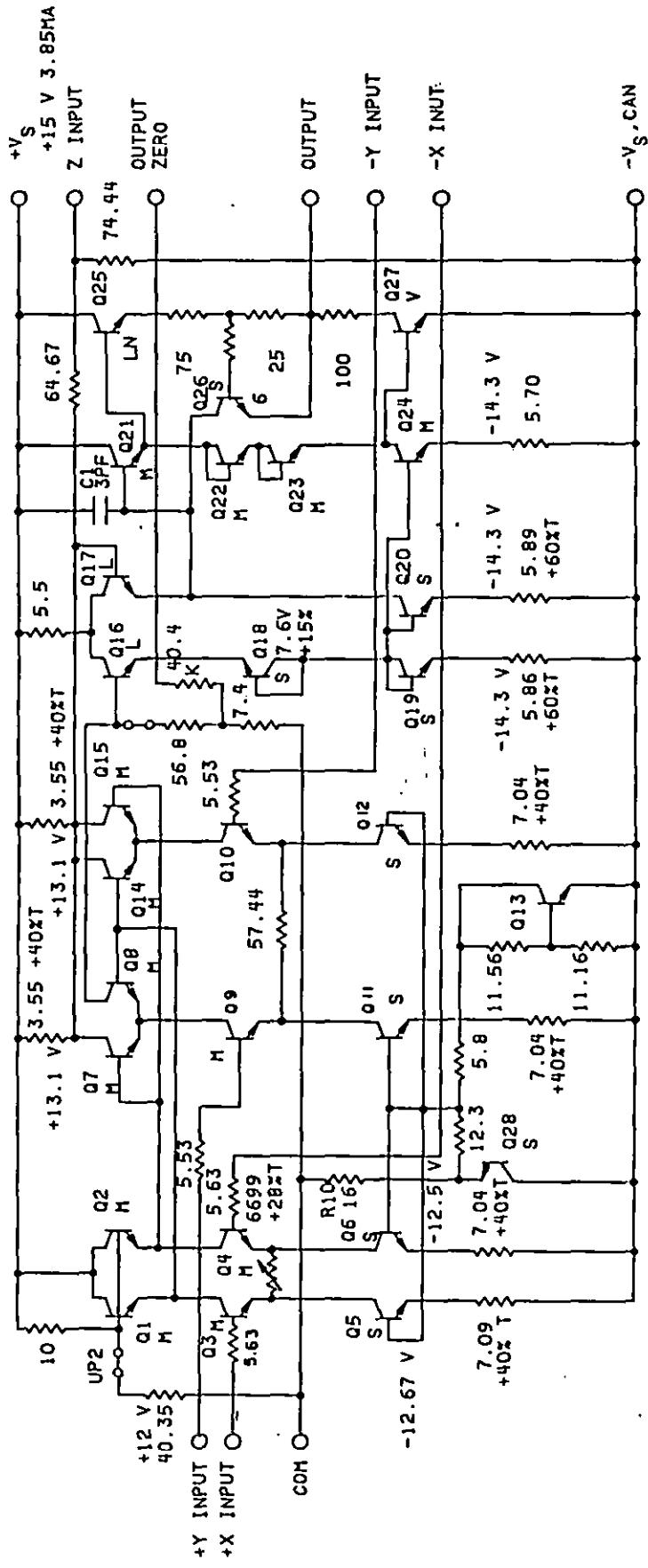
Function	Trim characteristic	R#
Gain	Decrease (coarse) Decrease (fine) Increase (coarse)	R6 R4, R5 R7, R3
Xos	-Ref. to +XIN +Ref. to +XIN	R15 R16
Yos	-Ref. to +YIN +Ref. to +YIN	R17 R18
Zos	-Ref. to +ZIN +Ref. to +ZIN	R27 R28
TC	VZ1 > 6.7 V VZ1 < 6.7 V	R1 R2

NOTES:

1. All resistors are $\pm 20\%$ tolerance and are thin film, 1 k Ω /sq. except R28, R29, and R30.
2. Pairs matched to 1 mV, minimum temperature difference, (Q1 and Q2), (Q7 and Q8), and (Q14 and Q15).
3. Resistor ratios matched to 2% (R3 and R4), (R27 and R13).
4. Q28 = Buried zener, 6.5 V ± 0.5 V at 240 μ A.
5. Resistor values are $\pm 20\%$ and are expressed in ohms, except where otherwise specified.

FIGURE 2. Functional schematic circuits - Continued.

Device type 03



NOTE: All resistances are nominal and in ohms.

FIGURE 2. Functional schematic circuits - Continued.