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GENERAL RESISTANCE INSTRUMENTS

A PRIME TECHNOLOGY COMPANY

DAS SERIES DIAL-A-SOURCE OPERATING INSTRUCTIONS

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LIMITED WARRANTY

General Resistance, Inc. warrants each instrument to be free from defects in material and workmanship for a period of one year from date of purchase.

The obligation of General Resistance, Inc. under this Warranty is limited to servicing or adjusting any failed instrument returned, shipped prepaid, to the factory for that purpose.

Units returned under this Warranty shall be examined by General Resistance, Inc. to establish that the failure resulted from defective material and/or workmanship and not as a result of misuse, neglect, or improper operation, which latter failure is not within the meaning of this Warranty.

This Warranty does not cover collateral or consequential damages of any nature.

General Resistance, Inc. reserves the right to make changes to design at any time without incurring any obligation to install same in units previously purchased.

This Warranty is expressly in lieu of all other obligations or liabilities on the part of General Resistance, Inc., express or implied, and General Resistance, Inc. neither assumes nor authorizes any person to assume for them any other liability in connection with the sale of General Resistance, Inc. products.

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GENERAL RESISTANCE INSTRUMENTS

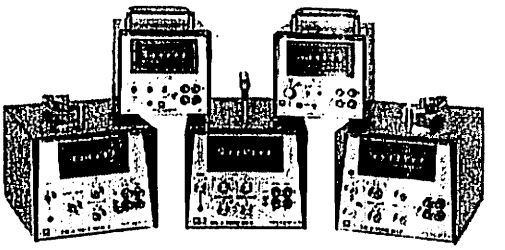
BATTERY & LINE OPERATED
DIALABLE REFERENCE/CALIBRATION SOURCES

DIAL-A-SOURCE

- Battery operated models
- Extremely stable, highly accurate, versatile power sources
- Resolutions to 0.1 uV
- Accuracies to ±0.0015% of setting
- Remote sensing
- "Zero" voltage output Z

APPLICATIONS:

Field standards (battery operated)
4-20 & 10-50 mA transmitter calibration
Reference sources
General purpose lab use
Transducer reference
Instrument calibration



SPECIFICATIONS: *(Additional information on other side)*

CONSTANT VOLTAGE & CURRENT SOURCES	DAS-56A	DAS-56AX	DAS-56AL	DAS-57AL			DAS-86
CONSTANT VOLTAGE SOURCES*	DAS-46A	DAS-46AX	DAS-46AL	DAS-47AL	DAS-66A	DAS-66AX	
Battery/line operated models available	YES; change "A" in model number suffix to "B". (For example: DAS-46A becomes DAS-46B, DAS-57AL becomes DAS-57BL, etc.)				NO	NO	NO
Output EMF, F.S., ranges, dc	±1V & 10V				±1V, 10V & 100V		±1V & 10V
Resolution, EMF, per step (LSD): 1V range	1µV			0.1µV	1µV		1µV
10V range	10µV			1µV	10µV		10µV
100V range					100µV		
Accuracy(1), EMF, %, ±	0.005	0.0025	0.0015	0.0015	0.005	0.0025	0.005
Output current, max. load, ±	50mA all battery operated models; line-only models, 30mA						1 Amp.
Resolution, as a constant current source, per step (LSD): 1V range	10nA*			1nA*			1µA*
10V range	100nA*			10nA*			10µA*
Accuracy(2), as a constant current source, %, ±	0.008*	0.0055*	0.0045*	0.0045*			0.008*
T.C., output EMF (20°C-45°C): Typ., ppm/°C, ±	2	1	0.7	0.7	2	1	2
Max., ppm/°C, ±	5	2	1.5	1.5	5	2	5
Output stability(3), EMF: ppm/24 hours, ±	10	7	5	5	10	7	10
ppm/year, ±	25	20	15	15	25	20	25
Noise & ripple(4), ppm	10	3	2	2	10	3	10
or µV peak	30	20	15	15	30	20	30
Output Z, voltage mode, typ., dc	50µΩ						
Input voltage, line operation/recharge	115 V or 230 V ±10%, 50 Hz to 440 Hz, specify voltage						
Line reg.(5), 105-125V, ppm, ±	1.0	0.5	0.5	0.5	1.0	0.5	1.0
Load reg., no load to full load	1 ppm ±1µV peak						
Isolation	Floating output. Either terminal may be grounded. Leakage 10^4 MΩ typ. @ 25°C, 50% R.H. Either terminal may be guarded up to 500V with respect to ground.						
Warm-up time(6)	30 sec. minimum (45 mins. for max. stability)						
Dimensions	See other side						
Weight(7)	10# (4.5 kg)				15# (6.8 kg)		20# (9 kg)

**Current resolution and current accuracy specifications apply to the 50 & 80 Series, and to the 40 Series when used with the appropriate Dial-An-Amp (DAA) Adaptor. (DAA constant current adaptors are also available for use with the 60 Series.) ALSO SEE OTHER SIDE.*

(1) Of actual setting, ±5µV max. possible offset, @ 25°C, nom. line voltage or battery condition, no load, after warm-up.
(2) Of actual setting, plus the effect of ±5µV max. possible offset across the integral sensing resistor, @ 25°C, nom. line voltage or battery condition, after warm-up.
(3) After 60 minute warm-up, at constant room temperature.
(4) Whichever (ppm or µV) is greater. Exclusive of random transients. Dc to 10kHz.
(5) Not applicable to battery operation.
(6) For utmost stability, these instruments should be left "on" all the time.
(7) For battery operated models, add 5# (2.3 kg) to weights shown.

All specifications subject to change without notice.

GENERAL RESISTANCE, INC.
Twin Lakes Road
North Branford CT 06471
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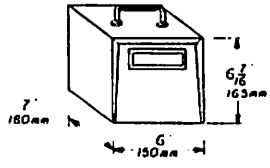
DIAL-A-SOURCE BATTERY & LINE OPERATED DIALABLE REFERENCE/CALIBRATION SOURCES

FEATURE HIGHLIGHTS: (✓ = Standard, Opt. = Optional)	40's	50's	60's	80's
Constant voltage sources: 0 to ±1 & 10 Vdc F.S.	✓	✓		✓
0 to ±1, 10 & 100 Vdc F.S.			✓	
Constant current source	Opt.	✓	Opt.	✓
One ampere output current capability				✓
Battery operated models available (50 mA output)	✓	✓		
Current limit control			✓	✓
Voltage output switch: Zero/KVD setting/F.S.	✓	✓	✓	✓
Remote sensing & Output short-circuit protection	✓	✓	✓	✓

DIMENSIONS:

CASE STYLE I:

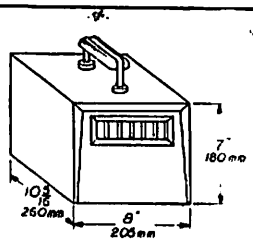
All non-battery DAS-40's & 50's



Case Style I uses RMA-40 rack adaptor

CASE STYLE II:

All other models



Case Style II uses RMA-60 rack adaptor

CONSTANT CURRENT OPERATION:

MODEL	ADAPTOR	SCALE FACTOR	SENSING RESISTOR	REMARKS
DAS-80's	BUILT-IN DAA-40	1A/V 10mA/V	1Ω 100Ω	DAS-80's have built-in constant current capability with a range of 1μA to 1 Amp. If low output levels are required (30 mA or less), accuracy can be improved by using an external DAA-40 (with DAS in constant voltage mode). This reduces by a factor of 100 the error contributed by offset (±5μV max.) thus extending the useable range by 2 decades at the low end. For example, if a 500μA output is desired, the accuracy of the output from the built-in adaptor could be ±1%; the use of the DAA-40 would provide an accuracy no worse than ±0.01%
DAS-60's	DAA-60	1mA/V	1kΩ	Resolution, per step (LSD): 1 nA on 1V range, 10nA on 10V range, 100nA on 100V range Accuracy: DAS-66A, ±0.01% of setting; DAS-66AX, ±0.0075% of setting; each plus the effect of a possible ±5μV offset across the sensing resistor
DAS-50's	BUILT-IN	10mA/V	100Ω	Constant current versions of corresponding DAS-40 models
DAS-40's	DAA-40	10mA/V	100Ω	Provides same performance as corresponding DAS-50 model

LOW NOISE ATTENUATION (Constant voltage operation):

At outputs of 1V or less, the inaccuracy contributed by a possible ±5μV offset may become the determining element of output voltage accuracy. Where output current is not a consideration, the use of the appropriate LNA Low Noise Attenuator will reduce the offset by a factor of 100 or 1000 (see below) to the nanovolt level. The accuracy of LNA's is ±0.005%. LNA's are available for all DAS models.

MODEL	ATTENUATOR	RATIO	OUTPUT Z	REMARKS
DAS-60's	LNA-600	1000/1	100Ω	Attenuates dialed output voltage and offset by a factor of 1000
All others	LNA-100	100/1	10Ω	Attenuates dialed output voltage and offset by a factor of 100

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I. OPERATION

A). GENERAL

Controls, modes, functions, capabilities

1). POWER OFF/ON switch and neon indicator : All models.

Unit will be operable within 30 seconds of turn-on; allow 45 minutes "warm-up" for rated accuracy and stability. (Recommendation : Leave these instruments "on" at all times.)

2). KVD (Kelvin-Varley divider) thumbwheel switches:

6 decades on all models except DAS-47AL, 57AL, 47BL & 57BL which have 7 decades.

The thumbwheel switches are used to set desired output. The position of the decimal point is color-coded to the RANGE selected.

3). RANGE switch 1V/10V : All models except DAS-66A/AX & 86.
1V/10V/100V: Models DAS-66A/AX.
1V/10V & .1A/1A: Model DAS-86.

4). OUPUT NORMAL/REVERSE switch : All models except DAS-66A/AX.

In constant current operation, the NORMAL position provides current flow from + terminal to - terminal.

On Models DAS-66A/AX, reverse output leads to change polarity.

5). OUTPUT CONTROL, Zero/KVD setting/Full Scale: All models.

Useful in many applications, including rapid check of meters, etc. at zero, a preset value, and full scale.

6). CONSTANT VOLTAGE/CURRENT STANDBY/CONSTANT CURRENT mode switch: Entire DAS-50 Series & Model DAS-86.

See CONSTANT CURRENT OPERATION, Section I.B. below.

7). CURRENT LIMITING control: Models DAS-66A/AX & 86.

Allows maximum load current to be preset to, or just beyond, the value necessary. Usable on DAS-86 in both voltage and current modes.

8). LOW BATTERY indicator (all battery/line operated models): Models DAS-46B/BX/BL, 47BL, 56B/BX/BL, 57BL.

Blinks when battery needs recharging or replacement.

9). Shorting links: All models.

Used to connect +OUTPUT & +SENSE terminals and -OUTPUT & -SENSE terminals (except when using a DAA adaptor for constant current operation, or when remote sensing. Also used to tie either + or -OUTPUT to case ground.

NOTE: Should the Dial-A-Source behave in an unusual or unexpected way, make sure the links are securely in place between +OUTPUT/+SENSE and -OUTPUT/-SENSE.

10). Constant current capability: Built-in on DAS-50 Series and Model Das-86; available on all others by using the appropriate DAA adaptor. See specifications, page 5.

B). CONSTANT CURRENT OPERATION

Be sure to read the section on this topic in specifications, page 5.

1). DAS-50 SERIES & MODEL DAS-86

a). Set the mode switch to CURRENT STANDBY.

b). Connect the load between the +&- OUPUT terminals.

c). Set the output current desired using the thumbwheel switches.

d). Set the polarity desired using the NORMAL/REVERSE switch.

e). Set the mode switch to CONSTANT CURRENT.

2). DAS-40 & 60 SERIES

a). Disconnect the shorting links between the OUTPUT & SENSE terminals.

b). Insert the appropriate DAA adaptor into those terminals, making sure the switch on the DAA is set to WARMUP.

c). Connect the load between the +&- output terminals on the DAA.

d). Set the output current desired using the thumbwheel switches.

e). Set the polarity desired on the DAS-40 Series by use of the NORMAL/REVERSE switch. On the DAS-60 Series, reverse the leads to the load, if necessary.

f). Set DAA switch to OPERATE.

C). REMOTE SENSING (CONSTANT VOLTAGE OPERATION)

If the load is to be connected through an appreciable resistance, such as a long cable, and compensation is desired, disconnect the shorting links between both OUTPUT and SENSE terminals and connect the two "+" terminals to the "+" end of the load and the two "-" terminals to the "-" end, using 4 separate leads. The dialed voltage will then appear across the load.

The loop resistance must not exceed 1Ω on the DAS-86, or 20Ω on any of the other models, or full output may not be attained. The sense leads may require shielding to prevent hum pickup on the output leads.

CAUTION: When you are using the 100V range of the DAS-60 Series, disconnecting the shorting links with the unit in operation may result in a swing of output voltage to full scale regardless of the thumbwheel switch setting. Make connections on a lower range, and then switch to the 100V range.

D). LOW NOISE ATTENUATION (CONSTANT VOLTAGE OPERATION)

See section on this topic in specifications, page 5.

E). LOAD IMPEDANCE LIMITS

To maintain proper operating conditions for the amplifier, the OUTPUT terminals should not be directly loaded with more than 1μF of capacitance. Shorting the output will not injure the Dial-A-Source, but 60 seconds may be required for it to return to normal operation after the short is removed.

F). IF YOU HAVE A PROBLEM

1). Reread this manual, and study the specifications, pages 4&5.

2). If not remote sensing or operating with a DAA adaptor, make sure that the shorting links are securely in place between +OUTPUT & + SENSE and the -OUTPUT & -SENSE terminals.

3). Perform checkout of calibration (See Section II).

4). Do NOT make any other internal adjustments. These are for factory use only, and changing them will only aggravate the problem.

5). Determine the symptoms of the malfunction, and write them down.

6). Call the factory; we may be able to help you over the phone.

7). As a last resort, return the instrument to the factory, and include an Analysis Report (see pages 9&10). Be sure to give us any other information that will help us to locate and remedy the problem.

II. CALIBRATION

NOTE: Shorting links MUST be in place between +OUTPUT/+SENSE and -OUTPUT/-SENSE terminals. For the greatest accuracy, all connections should be made to the SENSE terminals.

A). AMPLIFIER ZERO SET (Periodic; check at least annually)

1). Set the KVD thumbwheel switches to "0", RANGE switch to 1V, OUTPUT NORMAL/REVERSE switch to NORMAL, and allow 45 minutes warm-up". Measure the output voltage at the SENSE terminals with a Keithley Model 155 micro-voltmeter, or equivalent, set to the 10-0-10μV range. If the reading exceeds ±5μV, adjust the amplifier zero set potentiometer.

2). The amplifier zero set is reached through an access hole in the side of the case (see page 11). Adjust with a screwdriver until the output is within ±5μV.

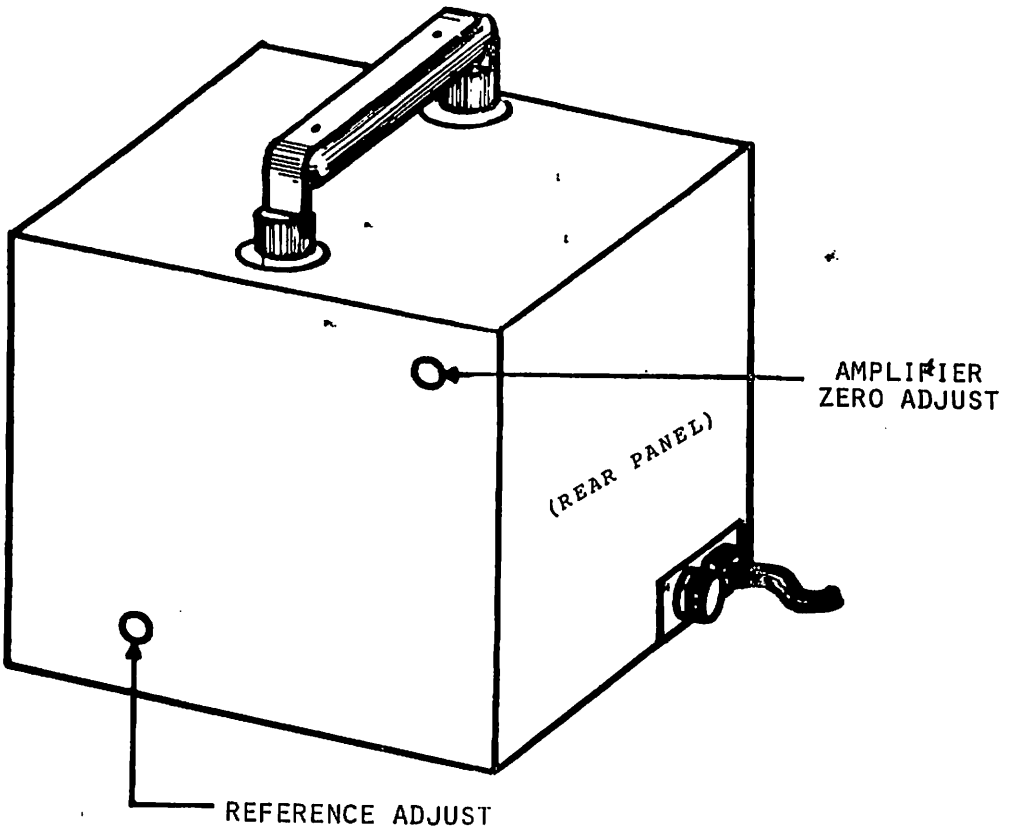
B). REFERENCE VOLTAGE ADJUST (Periodic; check at least annually)

1). Zero set as above.

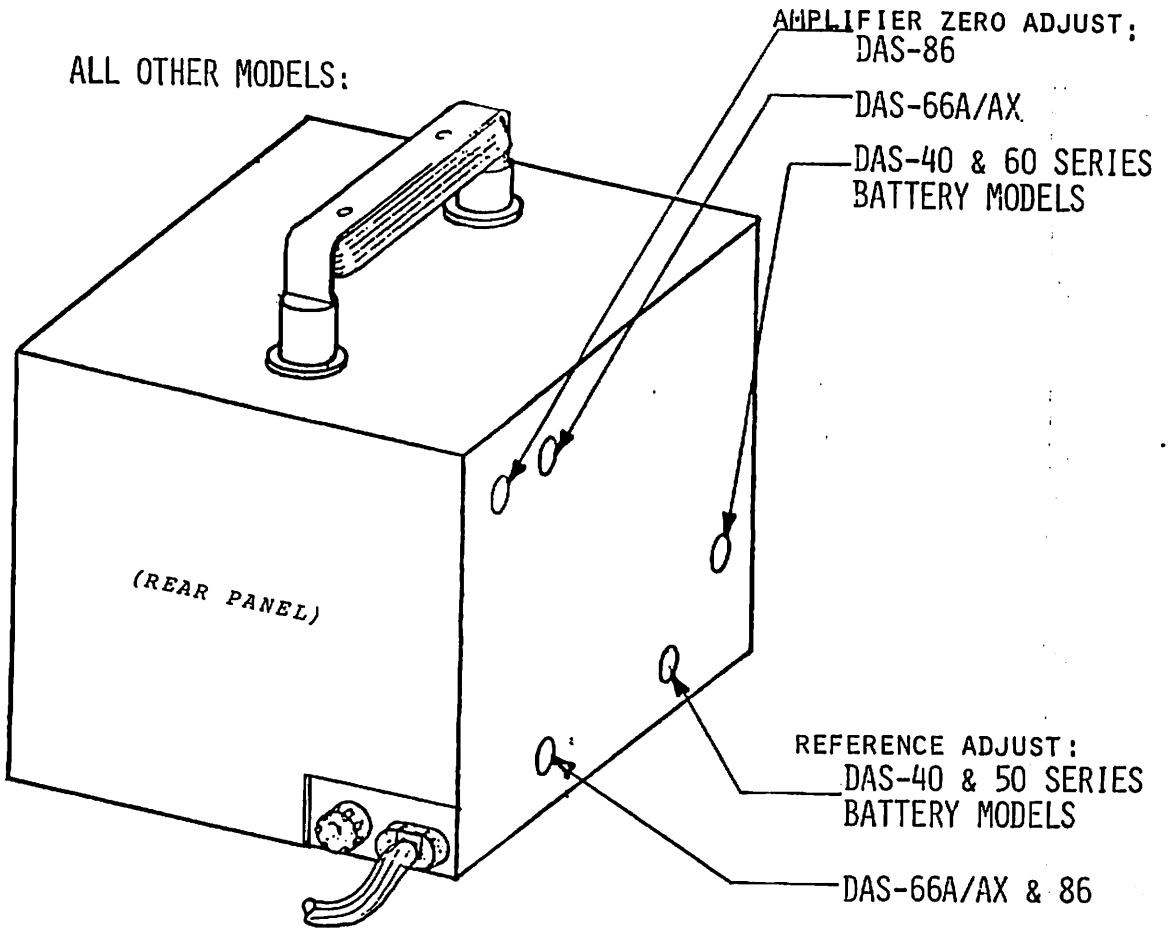
2). Set the KVD thumbwheel switches to the value of your standard cell, RANGE switch to 10V, NORMAL/ REVERSE switch to NORMAL. Connect the DAS, standard cell, and micro-voltmeter in a series configuration ("+" to "-", "+" to "-", "+" to "-"). The μV meter should read 0±25μV. If the reading exceeds that band, a 10-step reference adjust switch is located through an access hole in the side of the case (see page 11). Using a screwdriver, adjust the switch to obtain a reading within ±25μV of 0.

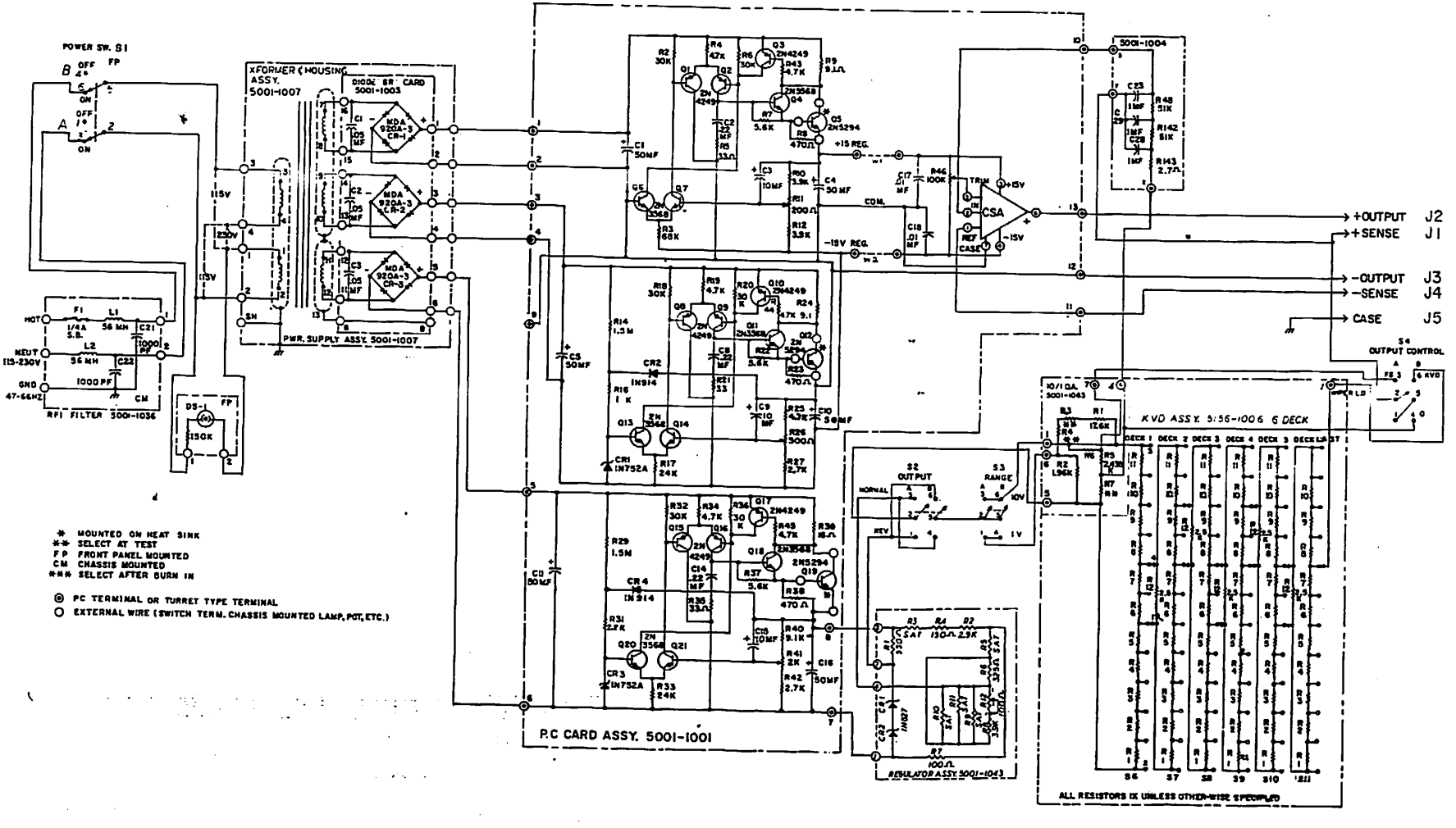
C). ADJUSTMENT LOCATIONS

DAS-40 & 50 SERIES LINE-ONLY MODELS:



ALL OTHER MODELS:

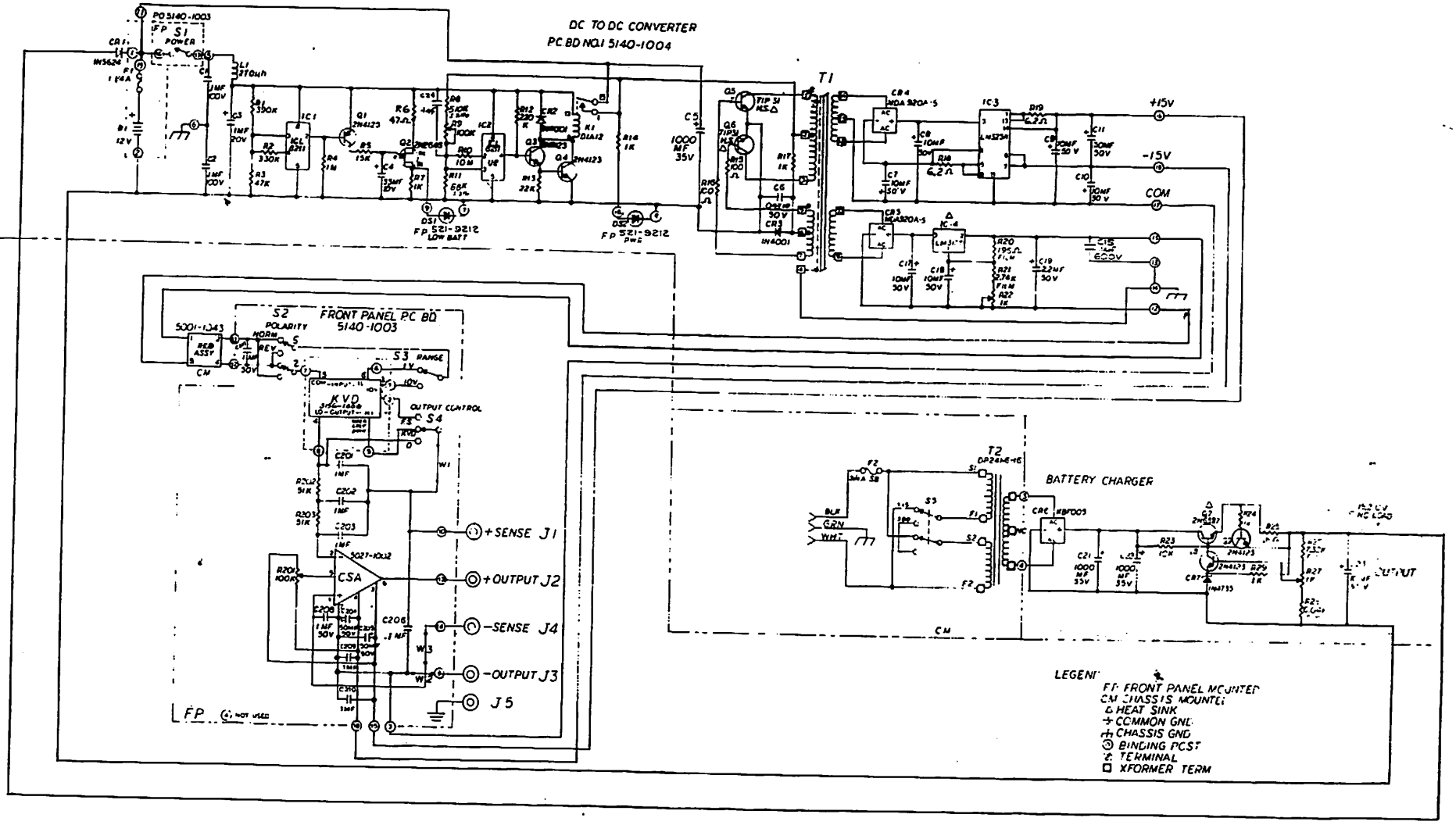




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DAS-40 SERIES

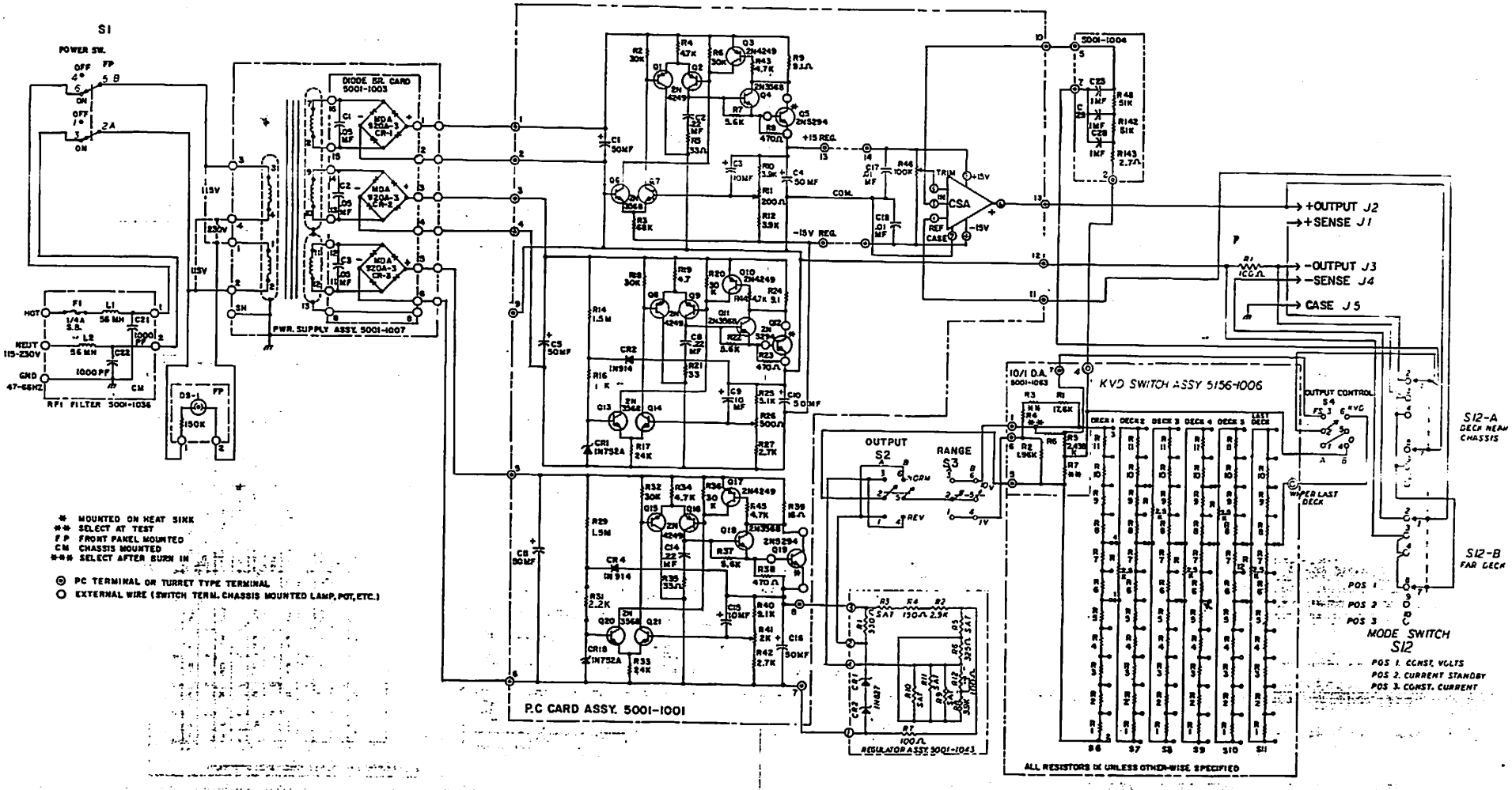
NOTE: On Model DAS-47AL, there is an additional KVD deck, 5B, same as, and following, deck 5.



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DAS-40B SERIES (BATTERY/LINE OPERATED MODELS)

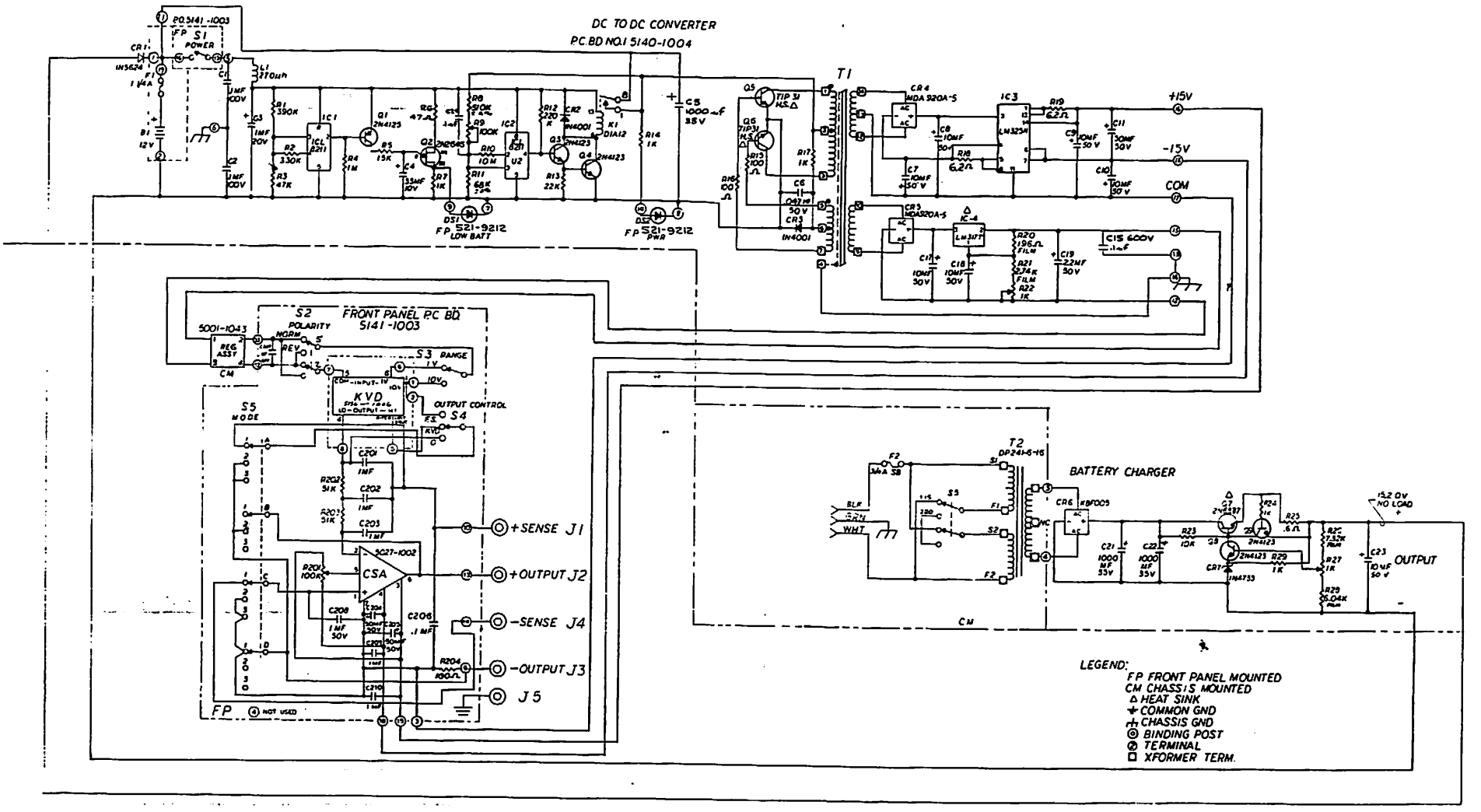
NOTES: See DAS-40 Series schematic for details of:
Regulator Assembly (5001-1043).
KVD Assembly (5156-1006).
On Model DAS-47BL, there is an additional KVD deck, 5B, same as, and following, deck 5.



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DAS-50 SERIES

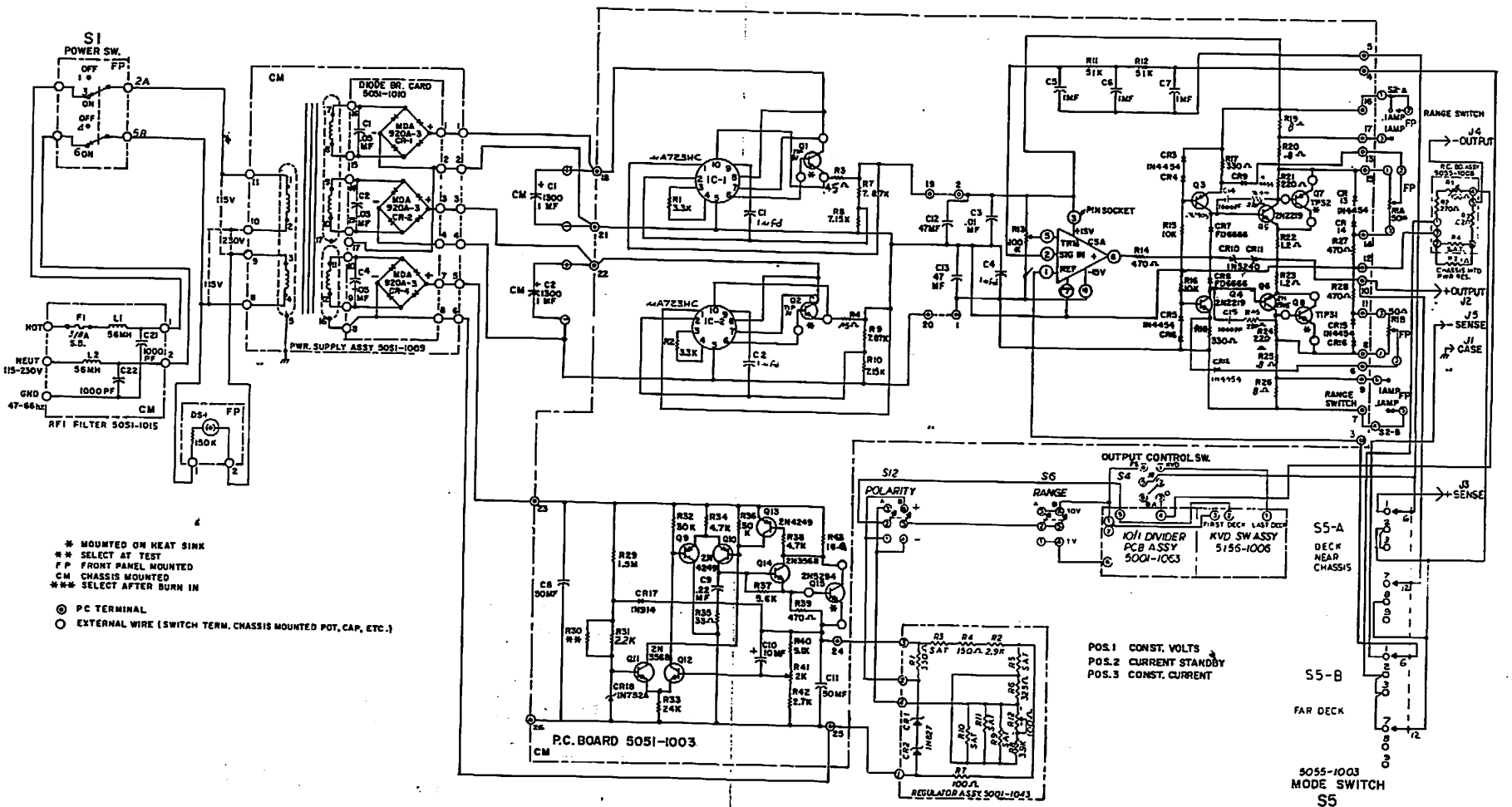
NOTE: On Model DAS-57AL, there is an additional KVD deck, 5B, same as, and following, deck 5.



GENERAL RESISTANCE, INC.

DAS-50B SERIES (BATTERY/LINE OPERATED MODELS)

NOTES : See DAS-50 Series schematic for details of :
Regulator Assembly (5001-1043).
KVD Assembly (5156-1006).
On Model DAS-57BL, there is an additional KVD deck, 5B, same as, and following, deck 5.


S1
POWER SW.
OFF
ON
FP
2A
5A
6
RFI FILTER 5051-1015
HOT
NEUT
115-230V
GND
47-66hz
F1
3/8A
S.B.
L1
L2
56MH
C21
C22
1000 PF
DS1
150K
CM
DIODE BR. CARD
5051-1010
MDA 920A-3
PWR. SUPPLY ASSY 5051-1009
115V
230V
+C1
1300 MF
+C2
1300 MF
IC-1
IC-2
μA723HC
R1
3.3K
R2
3.3K
R3
145Ω
R4
145Ω
R7
7.87K
R8
7.15K
R9
7.87K
R10
7.15K
C1
1 mfd
C2
1 mfd
C3
MF
C4
1 mfd
C12
47MF
R13
100
R14
470Ω
PIN SOCKET
+15V
-15V
TP18
TP19
SIG IN
REF
C5A
R11
51K
R12
51K
C5
1MF
C6
1MF
C7
1MF
CR3
IN4454
CR4
CR7
FD6666
CR10
CR11
IN5240
CR8
FD6666
CR5
IN4454
CR6
CR9
IN4454
CR12
IN4454
CR13
IN4454
CR14
IN4454
Q3
Q4
Q5
2N2219
Q6
2N2219
Q7
TP32
Q8
TIP31
R15
10K
R16
10K
R17
330Ω
R18
150Ω
R19
8Ω
R20
8Ω
R21
220Ω
R22
1.2Ω
R23
1.2Ω
R24
22Ω
R25
8Ω
R26
8Ω
R27
470Ω
R28
470Ω
R29
330Ω
R30
50Ω
RANGE SWITCH
S2-A
S2-B
.1AMP
1AMP
FP
J4
OUTPUT
+OUTPUT
J2
J5
SENSE
J1
CASE
J3
+SENSE
P.C. BOARD 5051-1003
CM
C8
50MF
C9
.22 MF
C10
10MF
C11
50MF
R29
1.5M
R30
**
R31
2.2K
R32
30K
R33
24K
R34
4.7K
R35
33Ω
R36
30K
R37
5.6K
R38
4.7K
R39
470Ω
R40
5.6K
R41
2K
R42
2.7K
R43
16Ω
Q9
Q10
2N4249
Q11
Q12
2N3568
Q13
2N4249
Q14
2N3568
Q15
2N3294
CR17
IN914
CR18
IN752A
S12
POLARITY
S6
RANGE
S4
OUTPUT CONTROL SW.
10:1 DIVIDER
PCB ASSY
5001-1063
KVD SW ASSY
5156-1006
FIRST DECK
LAST DECK
S5-A
DECK
NEAR
CHASSIS
S5-B
FAR DECK
5055-1003
MODE SWITCH
S5
POS.1 CONST. VOLTS
POS.2 CURRENT STANDBY
POS.3 CONST. CURRENT
R1
330Ω
R2
2.9K
R3
150Ω
R4
330Ω
R5
330Ω
R6
330Ω
R7
100Ω
R8
330Ω
R9
330Ω
R10
330Ω
R11
330Ω
R12
330Ω
CR21
IN827
CR22
CR23
REGULATOR ASSY 5001-1043
* MOUNTED ON HEAT SINK
** SELECT AT TEST
FP FRONT PANEL MOUNTED
CM CHASSIS MOUNTED
*** SELECT AFTER BURN IN
PC TERMINAL
EXTERNAL WIRE (SWITCH TERM. CHASSIS MOUNTED POT, CAP, ETC.)

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