205
SERVICE MANUAL

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CONTENTS

1 ABOUT THIS MANUAL

1.1 Layout of manual

This manual consists of chapter sections, which each begin on a new page. Pages are numbered by the product code, followed by the chapter number, followed by the page number sequence.

From time to time re-issues or modifications may be sent out, in which cases either:

- an additional page is indicated by a further digit code, or
- a replacement page carries the original number, but a later date.

The footer on each page shows the date of issue.

Examples

205 Page 3-7 is chapter 3, page 7.

205 Page 3-7-1 is a new additional page to follow page 7

205 Page 3-7 is a new page 7. Discard the older page 7.

1.2 Conventions of manual

The following conventions are used in the manual.

1.2.1 Conventions in text

Inside text a **Bold** word refers to a specific exterior part of the 205; e.g.

- Measure on **Loudspeaker** terminals. This refers to the main output terminals of the amplifier.

PCBs are referred to by short names, MN for the main audio PCB, PS for the power supply PCB. Italic form is used for trademarks, and for labelling circuit nets in text; e.g. measure *FEEDBACK*, refers to the net connection FEEDBACK.

Words appearing in the text in all upper case usually refer to the state of the 205; e.g. 'in STANDBY', refers to the state after the music-sensing circuits have closed the amplifier into the standby condition, and the light shows green at the front. 'In PLAY Mode' would mean light shows red and the amplifier is out of STANDBY.

1.2.2 PCB numbering

Both PCBs are numbered:

Board name	Number
MN	1
PS	2

1.2.3 Component numbering

Component numbering consists of 1 letter followed by 3 numbers. The letter determines the component type. The first number is the board number to which the component belongs. The last two digits are the number of that type of component on that PCB.

1.2.4 Net labelling

The circuit diagrams make use of **Net** labelling. This helps clarity, and gives meaning to the connections that are functionally important.

In the text nets are referred to in italics, e.g. *FEEDBACK*. On the relevant circuit diagram the net is labelled in all upper case directly above the connection to which it refers.

By definition all nets with the same name are connected together, whether or not they seem to be joined to the same bus. All nets with the same name on different PCBs are also connected together by the looms. All nets have unique names in this product.

1.3 Updates and modifications

This manual can be updated with bulletins sent from *Meridian*. Ensure that new sheets are filed in the correct position.

Always refer to section 10 of the manual which describes running changes that have been made to the product during production. In some cases we ask you to incorporate these changes or correct errors in units received for repair.

2 SPECIFICATIONS

Output	100W in 8 ohms 170W in 4 ohms
Input	0dBm(775mV) (for rated output)
Input Impedance	12k
Power consumption	5-230VA
Distortion	<0.1% 20Hz-20kHz typically <0.01% at 1 kHz
Noise	Better than 90dB CCIR

3 SERVICING HINTS

3.1 General

In order to prevent loose metal objects or grit from entering the 205, it is important to have a clean repair station, preferably with an antistatic rubber grid mat that allows parts to fall below the work level.

Do not loosen any screws other than those specified in these instructions.

3.2 Static electricity

All ICs and some other semiconductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can seriously reduce the life expectancy of the components and servicing operations should be carried out with the utmost care.

When repairing, make sure of the following.

- The floor around your workbench should not be static-generating. Ideally a conductive mat should be used, which is connected to the bench and to ground.
- You should not wear static-generating clothing. In general man-made fibres can lead to very high voltages being generated, even in temperate climates. If in doubt, wear a cotton coverall to shield you from the equipment.
- Keep components, aids and soldering iron all at the same potential.
- Always bring yourself to the potential of the item under repair by first touching the chassis, case, or for PCBs by touching first areas which are clearly connected to the power supply common.

In general the static susceptibility of the unit is much less when it is cased, and damage is hard to sustain.

3.3 Safety

3.3.1 Service technician

You are of course responsible for your own safety.

Please note that there is exposed lethal AC voltage on the tags of the transformer inside the unit and on the power-input socket.

3.3.2 Customer

You are also responsible for ensuring that the apparatus is repaired to its original safe condition.

Safety regulations require that the apparatus be restored to its original condition, and that parts which are identical with those specified be used.

3.4 Service aids

The following service aids may be required and may be purchased from *Meridian*.

- *Pozidrive* #1 screwdriver
- *Pozidrive* #2 screwdriver
- Hex wrench 2mm
- Nut-spinner 5mm M2.5
- Nut-spinner 7mm

3.5 Adjustments

There are no adjustments to be made to the 205.

3.6 Current-limited power supply

It can prove extremely difficult to diagnose certain faults in a direct-coupled power amplifier, particularly those which tend to turn on the output stage to an undesirable level of current.

In these circumstances we recommend that you use a current-limited supply that can give between ±30V and ±55V at ±100mA.

If such a supply is not available, we recommend that one is made using the circuit shown on page 11-29.

The two current sources are interposed between the raw ±55V supplies of the 205, and the MN PCB under test.

4 FAULT-FINDING METHOD

Normally a 205 which is being serviced has some form of fault. It should be noted however that with a product of this complexity, the unit may in fact be functioning correctly and the customer may have different expectations of its function.

4.1 General checkpoints

Before commencing any detailed diagnosis check the following overall conditions.

- Check that the unit is adjusted for the correct voltage.
- Make the initial power checks described in 4.2.

If reading this chapter does not help to identify the fault refer to section 5 on common faults before going on to any more detailed diagnosis. If this does not show the cause of the fault then check the following before going on to section 8.

- Check that all relevant DC supply voltages are present and correct.
- Examine looms for loose or broken connections.

4.2 Initial power checks

Connect AC power to the 205, and switch on at the back of unit. The front light should show red.

If this is not the case proceed as follows:

- Check switch adjacent to mains inlet is in the on (marked 1) position.
- Check that the circuit-breaker is not tripped. Switch off and press the reset button on the rear panel. Has the breaker tripped? You will hear a click as it resets.

Yes Repeat this section.
No Proceed as below.

- Check fuse in plug (where applicable).
- Remove the internal chassis from the case as described in 7.
- The power fuse is mounted on the rear of the 205 chassis.
- Check this fuse. A blown fuse may indicate a fault in the unit, but occasionally due to abuse, excessive tripping of the breaker circuit or through fatigue a fuse may blow.
- Check that the voltage setting of the transformer is correct for the local supply voltage before replacing fuse. See section 8.2.
- If the fuse blows again you will need to establish whether the fault is in the primary circuit, or whether the protection is firing. See section 8.3.
- If the light key shows green, apply an audio signal to see if the light changes to red. If it does not go red suspect the music-sensing circuit. See section 9.8.
- If the light key shows red, then continue to section 8.

5 COMMON FAULTS AND LIKELY CAUSES

The following section lists likely causes of common problems. For each fault proceed through the relevant section unless directed otherwise.

5.1 Unit 'does not work'

- Is power applied of the correct voltage?
- Is the unit switched on at the back?
- Is the light red or green? If not go to section 4.2. Perform DC checks. If this does not show a fault go to section 9.

5.2 Circuit-breaker trips frequently

If the amplifier operates correctly between tripping, a likely cause is DC fed into the amplifier. Before going any further:

- Check the integrity of the source.
- Remove signal and see if the problem occurs in STANDBY.
- If possible determine if the tripping is due to overheating or DC at the output. In any case go to section 9 having read 6.4.

If the amplifier does not operate normally between tripping then it is probable that there is a component failure. Go to section 8.

5.3 Unit comes out of standby when not playing

This is probably normal behaviour.

The music-sensing circuits provided are very sensitive, and need to be, to catch the start of quiet pieces.

This leaves the 205 vulnerable to interference, clicks or stray radio interference switching the unit out of STANDBY.

To check this circuit see 9.8.

5.4 Intermittent problem

The 205 uses through-hole-plated printed circuits, which may under some conditions give intermittent connections between the sides of a board. Trace any suspected signal line through component legs, and particularly vias.

Look for broken tracks.

5.5 No audio output

Check section 5.1.

Perform the following checks.

- Does the light show red?

Yes Go to 9. Suspect the following:

- Q101 failed
- Missing -15V supply
- Failed component on MN PCB

No Does the light show green?

No Make DC tests on MN PCB as described in 9.2.

Yes The unit is stuck in STANDBY. Go to 9.2 and then 9.8.

5.6 Crackling or noise

Go to section 9.11.

5.7 Hum

Go to section 9.12.

5.8 205 oscillates at high frequency

Go to section 9.10

5.9 Problem after some minutes

Some semiconductors in the 205 could show a fault after taking a few minutes to warm up. Typical times would be 5—20 minutes depending on the ambient temperature.

In principle this type of fault can occur in any component.

In the event of such a fault, use the fault-finding method to isolate the area, and then if possible isolate the component by force heating and cooling.

6 PRINCIPLE OF OPERATION

There are two main functional sections to the 205, the power supply and the main PCB which carries the electronics.

6.1 Power supplies

WARNING THE PROTECTION SYSTEM IS DESIGNED FOR INTERMITTENT USE ONLY. DO NOT CAUSE THE PROTECTION TO OPERATE REPETITIVELY.

Refer to the circuit diagram on page 11-27.

Power is supplied by a single transformer. There is one secondary which is used to produce the main supply of ±55V nominal.

A crowbar protection system is fitted which, when triggered by the electronic protection circuits, short-circuits the DC supply. This causes the primary circuit-breaker to trip and in some circumstances may also lead to the primary fuse blowing.

6.2 Audio power amplifier

Refer to the circuit diagram on page 11-25.

The amplifier is a discrete complimentary and symmetrical design with a non-switching class AA bipolar output stage.

D102, D103, D106 and D107 provide bias voltages for the complimentary input amplifiers Q102 and Q103. Q128 is used by the music-sensing and protection circuits to set the amplifier into STANDBY by reducing these bias voltages to ±0.6V.

The second amplifier stage comprises the cascodes of Q104 + Q106 and Q105 + Q107. Note that these operate on the regulated ±15V supplies.

The output of the second stage is processed in the 2:1 current-mirror circuits formed from Q108 + Q110 + Q112 on the positive half, and a similar circuit on the negative half.

The current outputs of the mirror sections generate the drive voltage for the output stage across the parallel combination of R131, R132, C115 and C116.

The output stage takes the form of a cascaded triple follower, with parallel output devices.

A local feedback circuit assures the non-switching characteristic, and maintains a true zero output impedance. This feedback circuit operates via Q114 and Q115.

Q116, Q117 and associated circuits form a two-slope delayed VI limiter. Instantaneous pure current-limiting is provided by D114 and D115.

6.3 Music-sensing

A music-sense circuit is provided. This switches the amplifier to standby approximately 8 minutes after the last signal was received at the input, K103, and restarts the amplifier when a signal is applied.

The input signal is fed through the series combination of U101:A and U101:B. These form a high-gain bandpass filter with feedback-limiting performed by D116. The output of this section is taken across C124 as the envelope of the music and it is used to trigger the timer U105.

When the input ceases the timer is enabled. It then counts one full cycle at which time, if no music signal has re-triggered the timer, output Q14 of U105 will go high. This output is used to stop the timing oscillator which only runs in the absence of a musical signal.

The output Q14 of U105 is applied to one of the inputs of U106:B.

Normally when the amplifier is running, and the output Q14 is low, the *CONTROL* is at -15V. This causes Q101, Q130 and Q120 to be switched off. When Q14 goes high in the STANDBY condition, the following happen:

- Q101 turns on, inhibiting the audio input to the amplifier.
- ~~Q128~~ Q128 turns on, removing the bias from all stages of the amplifier.
- Q130 shorts the servo circuit to prevent drift.

6.4 Protection

Three types of protection are provided in the 205.

- **Thermal.** A thermistor TH1 is mounted on the side of the heatplate to which the output devices are attached. The resistance of this device falls with increasing temperature, and at around 75°C this causes the voltage on pins 5 and 6 of U106 to fall below the reference set by R170, R171 and R173 (approx 5V). This causes the *CONTROL* to go high, and the amplifier to revert to STANDBY. When the amplifier has cooled sufficiently for *CONTROL* to switch back to -15V, normal operation will recommence.
- **Thermal.** The comparator U106:A compares the resistance of TH1 to a lower voltage reference that corresponds to a heat-sink temperature of around 90°C. In the event that this fires, the crowbar trip is operated via Q129. This circuit is provided to protect against internal fatal faults in the amplifier that do not allow the STANDBY condition to cool the unit.
- **DC** offset, i.e. load protection is provided. The mean amplifier output DC level is sensed across ~~C168~~ C130, and this is compared to the ±0.6V references on U106 pins 8 and 11. If the mean output DC exceeds ±7V the crowbar protection is fired via Q129.
- **VI** Refer to section 6.2.

7 DISASSEMBLY OF 205

WARNING LIVE PARTS ACCESSIBLE WHEN COVER IS REMOVED

Refer to assembly diagram on page 7-14.

7.1 Access to chassis

Access is gained by unscrewing the centre screw on the back panel (A) marked **FIX**. With this screw removed the outer casing can be slid off.

Reassembly is the reverse process.

7.2 MN audio PCB

To remove:

- Remove screw (B) (if fitted) adjacent to phono socket.
- Remove two screws marked (C) on assembly drawing.
- Flex the sides of the chassis at the front to unclip the heatsink.
- The MN PCB may now be removed after unsoldering the speaker, power supply and protection wires.

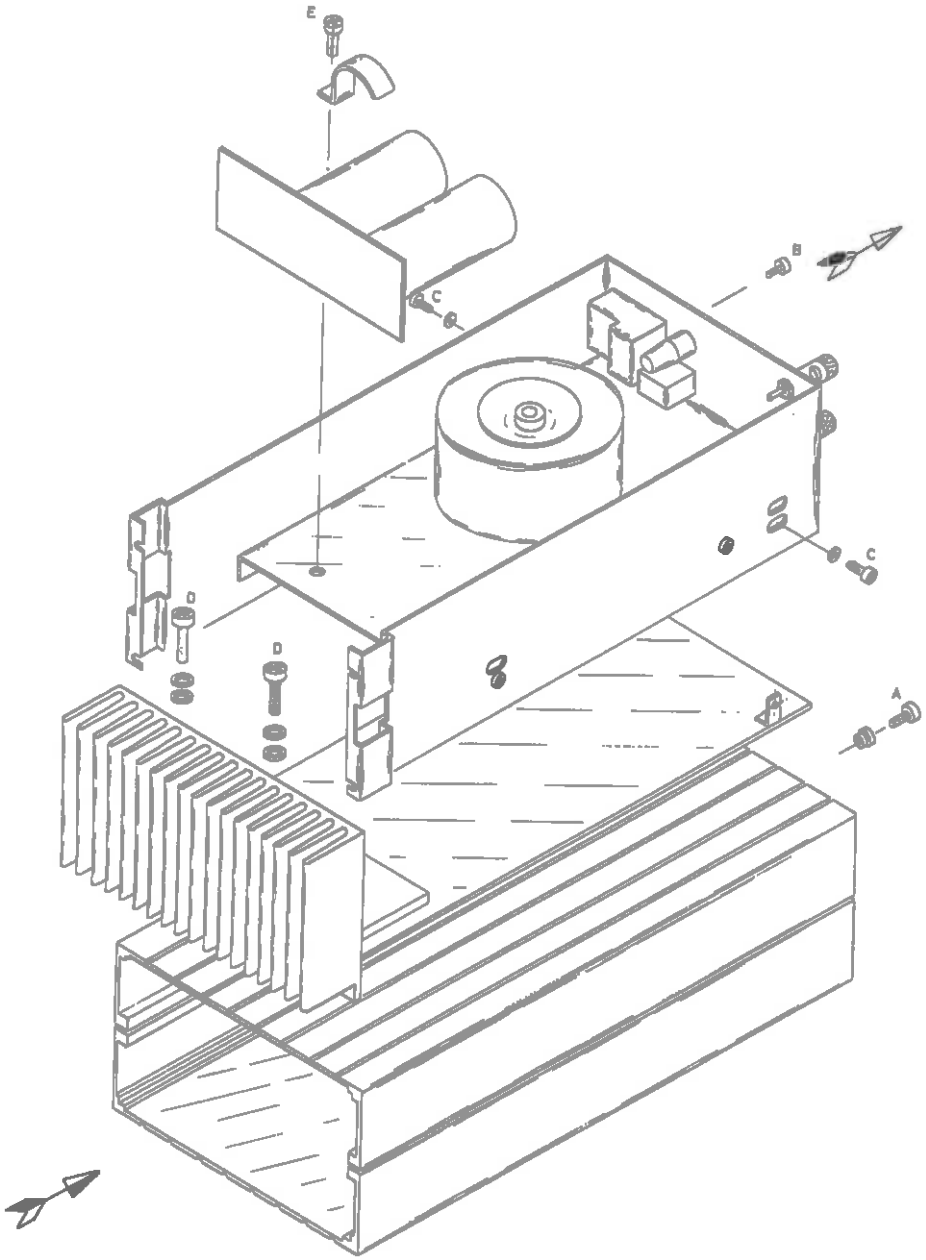
Two screws (D) fasten the MN PCB and heat-plate assembly to the block on the back of the heatsink. It will not normally be necessary to remove the PCB from the front heatsink.

To reassemble:

- Reverse the process. Ensure that the heatsink, block, and plate contact areas are adequately covered with a thermally conductive compound before reassembly.

7.3 PS PCB

- Open the case as described in 7.1.
- The PS PCB can be seen in the top section of the 205. It is held in place by the screw (E). Normally it will not be necessary to remove this PCB even to repair it.


E
B
C
C
D
D
A

8 SERVICING THE ELECTRONICS

WARNING: ALL PCBs CONTAIN STATIC-SENSITIVE COMPONENTS. ENSURE THAT FULL PRECAUTIONS ARE TAKEN.

8.1 Hints

8.1.1 Measurements on op-amps

Op-amps have been used extensively as amplifiers and buffers. Where feedback has been applied, the voltage difference at the differential inputs converges to zero. This applies to both AC and DC signals and means that in many circuits it is impossible to measure any signal or bias on an input. For this reason you are normally referred to output voltages.

8.1.2 Measurements with an oscilloscope.

To reduce the effect of input capacitance on the measured points, it is recommended that a 1:10 test probe is used.

8.1.3 Selection of ground potential

It is very important to select a ground point that is as close as possible to the test point.

8.1.4 Conditions for signal injection

- Injection of levels or signals from an external source should never take place if the related circuit has no supply voltage.
- The injected levels should never be greater than the related supply voltage of the related circuit.

8.2 Changing the transformer connections

The transformer primary wiring can be adjusted to allow the 205 to be used on a supply that deviates from its original setting.

WARNING: In some circumstances this will produce an operating unit, but not necessarily one which complies with the safety regulations of the relevant territory.

WARNING: If the adjusted tappings are changed, make sure that this is clearly marked on the back face the unit, where the normal voltage annotation is made.

WARNING: When changing between primary tappings, it is sometimes necessary to change the primary fuse value.

The primary AC connections are numbers 1—6 counting clockwise when viewed from the top, and with pin 1 being nearest to the yellow spot. Refer to the diagram of the transformer on page 11-23.

The table below shows the tappings. Connect the AC input wires Live (brown) and Neutral (blue) to the tags listed. One or two link wires will be needed as below.

Supply	Live	Neutral	Link1	Link2
240V	1	6	2-5	
220V	1	6	4-5	
120V	1	6	1-2	5-6
100V	3	6	3-4	5-6

Be sure that you make good mechanically sound and well soldered connections.

Fuse values are slow-blow:

- 3.15A for 220V or 240V
- 6.3A for 100V or 120V

8.3 Power supply faults

Refer first to section 4.2 on initial power checks.

Refer to the circuit diagrams on pages 11-27 and 11-25.

A persistently tripping circuit-breaker or blowing fuse indicates either a fault in the power supply circuits, or a fault on the MN PCB causing the thyristor crowbar D201 to be fired. To isolate the problem proceed as follows:

- Open the case as described in section 7.1.
- Disconnect the ±55V supplies to the MN PCB. These are carried in the red and black wires soldered directly to tags on the output devices.
- Disconnect the loom between K105 on the MN PCB and K201 on the PS PCB.
- Ensure that the ±55V supply wires are insulated.
- Apply AC power and switch on. Does the circuit-breaker trip or the fuse blow?

No The fault is in the MN PCB. First check that Q129 has not failed, then proceed to section 9.

Yes The fault is in the power-supply circuit. Do the following.

- A likely cause of short-circuit is failure of the thyristor D201.
- Discharge the supplies through a suitable resistor.
- Disconnect one end of R202.
- Check with an ohm-meter the resistance of the thyristor. Is this low?

Yes Change the thyristor.

No Check for shorts in the bridge rectifier and smoothing capacitors.

9 FAULT-FINDING MN AUDIO PCB

WARNING: ALL PCBs CONTAIN STATIC-SENSITIVE COMPONENTS. ENSURE THAT FULL PRECAUTIONS ARE TAKEN.

Refer to the circuit diagram on page 11-25.

9.1 General

This PCB houses the audio electronics, DC servo, music-sensing and protection circuits.

9.2 DC checks

NOTE: Always begin by testing the DC supplies and offsets below.

- ±55V raw input
- ±20V input to regulators U102, U103
- ±15V regulated

DC offsets 0V ±20mV on the following:

- *OUTPUT*
- Input socket

DC offset 0V ±1V on:

- U104 pin 6 (output servo)

9.3 Other DC conditions

In a correctly working amplifier the following voltages should pertain. Note some of these are difference voltages that are not referred to common.

- +4V5 on VB
- -4V5 on VC
- 300mV across R115 and across R112

500mV across each of the following:

- R126
- R128
- R130
- R125
- R127
- R129

1.7V between the following:

- BD+ and *OUTPUT*
- *OUTPUT* and BD-

1.1V between the following:

- Q118 emitter and *OUTPUT*
- *OUTPUT* and Q118 emitter

0.6V across the base—emitter or emitter—base junctions of all bipolar transistors in the circuit except:

- 200mV on Q116 and Q117
- 0V on Q129

9.4 Fault-finding DC-coupled circuits

Faults in discrete direct-coupled circuits can be puzzling to diagnose unless a rigorous approach is taken.

The main principle to be applied, is to some way get the amplifier connected to a power supply which is either standard or current-limited as described in section 3.6.

The failures in a power amplifier will be generally of a semiconductor, and these tend to fail open or short-circuit.

If a faulty component exists it will be apparent from the performance of the amplifier. Typical faults would be:

- DC offset
- Distortion
- Lack of any audio output
- Excessive power-supply drain
- Self-sustaining oscillation

It is extremely unlikely that a fault will exist with the amplifier that cannot be diagnosed from basic DC measurements, so this should always be checked first.

Wherever a component has failed, the action of the negative-feedback will be to try and reverse the fault. Thus:

- If a component has failed open-circuit in one half of the amplifier, the feedback will try to turn on that half and to close-down the other half of the amplifier.
- If a component has failed short-circuit then the feedback will try to turn off the offending side and to turn on the other half of the amplifier to restore the balance.

Note: The latter fault is usually harder to deal with since it tends to produce conditions that may over-dissipate good parts, or to produce massive power-supply drain. In this circumstance resort to the current-limited supply, and investigate the DC conditions referred to in section 9.3.

Note: In some circumstances the diagnostic process can be eased by disabling the DC servo. This can be accomplished by shorting across C105 (link pins 2 and 6 on U104).

The correct fault-finding procedure is as follows.

- Discover by checking the fundamental bias conditions whether the fault is open or short-circuit driven. See section 9.3.
- Measure throughout the circuit looking for a discrepancy between input and output of each device.

Note: If a transistor has failed C—E short, then you should find a reverse bias on the base.

Note: If a transistor has failed open then its output will be missing despite heavy forward bias introduced by the feedback.

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DC offset 0V ±1V on:

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Note: If a transistor has failed C–E short, then you should find a reverse bias on the base.

Note: If a transistor has failed open then its output will be missing despite heavy forward bias introduced by the feedback.

- One mirror half-working. Perform DC tests of 9.3.
- Fault in bias circuit. Check Q114, Q115 and associated components. Check section 9.3.

9.10 Oscillation

Under certain conditions a power amplifier may burst into ultrasonic or RF oscillation. Often this can be rapidly destructive, and should not be allowed to run unless the unit is on a current-limited supply. See section 3.6.

Make the following checks.

- Ensure that there is not a ground loop between output and input.
- Ensure that the output has been connected correctly, with common being the lower connector.
- Check that the oscillation does not originate from a regulator or the quad comparator U106.

Check all the timing components listed below.

- C101
- C103 + R105
- C104 + R106
- C115 and C116
- C138
- C134 + R154
- C120 + R153
- C121 + R155
- L101

In the case of capacitors it will be acceptable to connect an identical component in parallel to check it. Resistors should be checked with an ohm-meter.

9.11 Noise

If a 205 shows unusual output noise, the likely cause will be a failing device or component.

The most likely offenders will be:

- Q102 or Q103
- Q101
- U104

9.12 Hum

Hum can arise if there is a ground-loop in the installation.

Hum may arise in the 205 if there is a problem with a power supply or regulator. These should all be checked with an oscilloscope.

10 CHANGES TO DETAIL

This section describes running changes to the product. There are two types of change listed:

- Due to errors in manufacture. You are asked to update each unit you handle. See section 10.1.
- Detail changes, for information only. See section 10.2.

Note: s/n means serial number.

10.1 Errors of manufacture

10.1.1 DC offset protection

Some units had D122 or D123 fitted the wrong way round, leading to loss of DC offset protection on one polarity.

- Check and correct if necessary.

10.1.2 Premature protection limiting

Some units had D113 fitted the wrong way round, leading to reduced capability into severe loads.

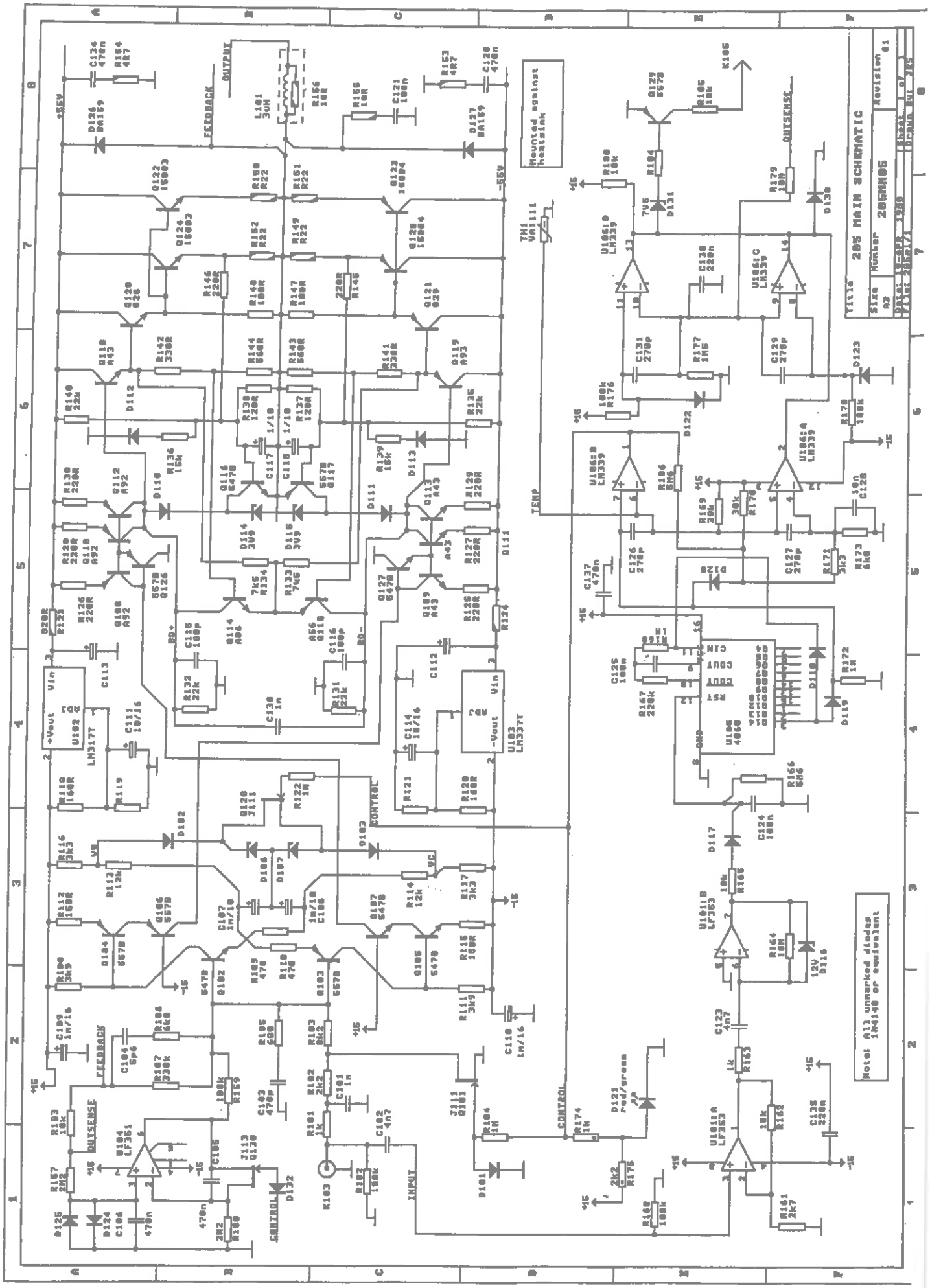
- Check and correct if necessary.

10.2 Detail changes for information

None to date.

11 CIRCUIT DIAGRAMS

For conventions of the circuit diagrams please see sections 1.2.2 to 1.2.4.


205 MAIN SCHEMATIC
Size A3
Number 205MN05
Revision 01
Sheet 1 of 1
Note: All unmarked diodes 1N4148 or equivalent
Mounted against heatsink
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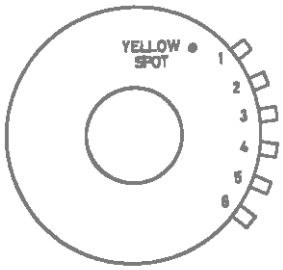
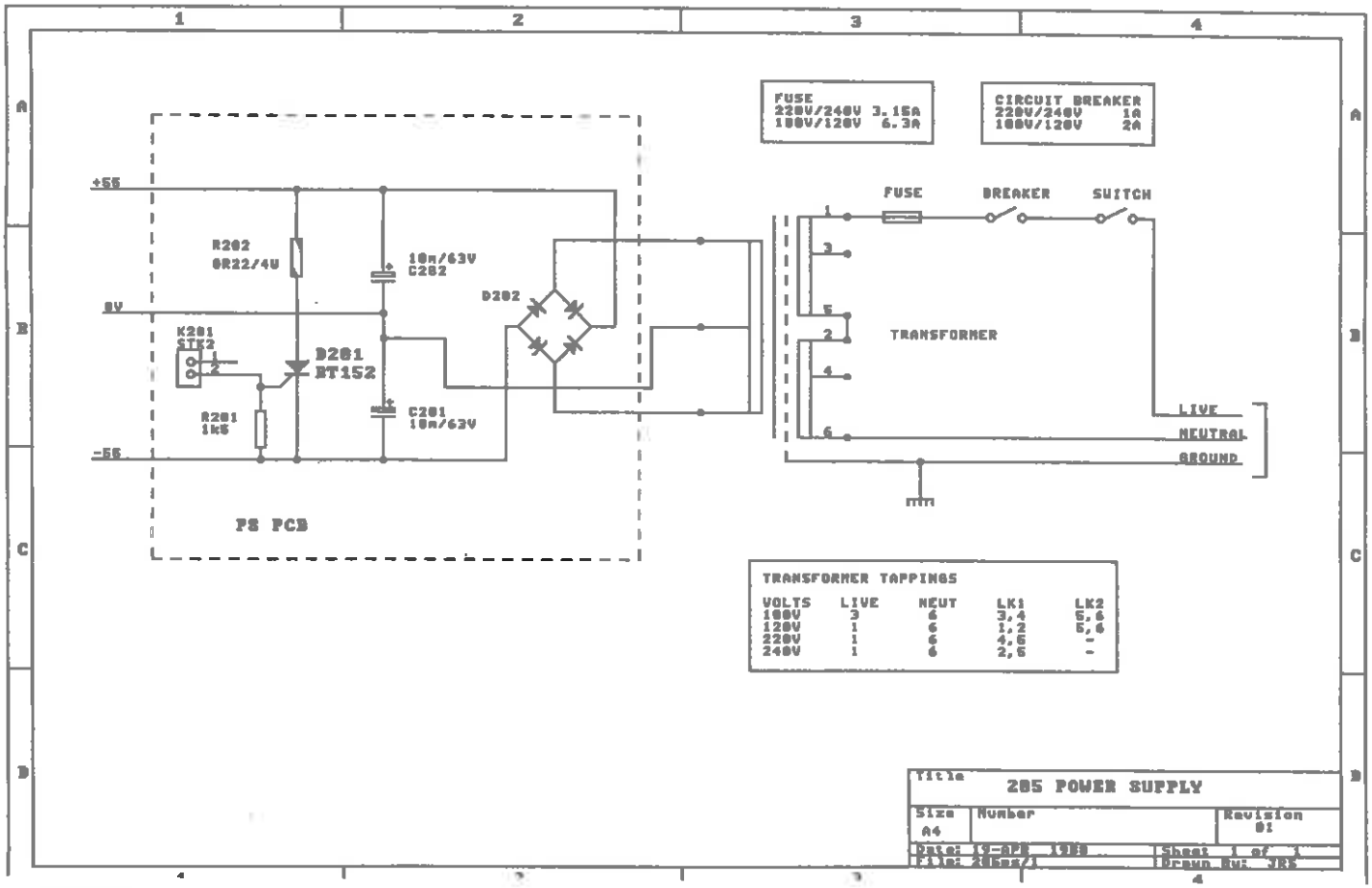
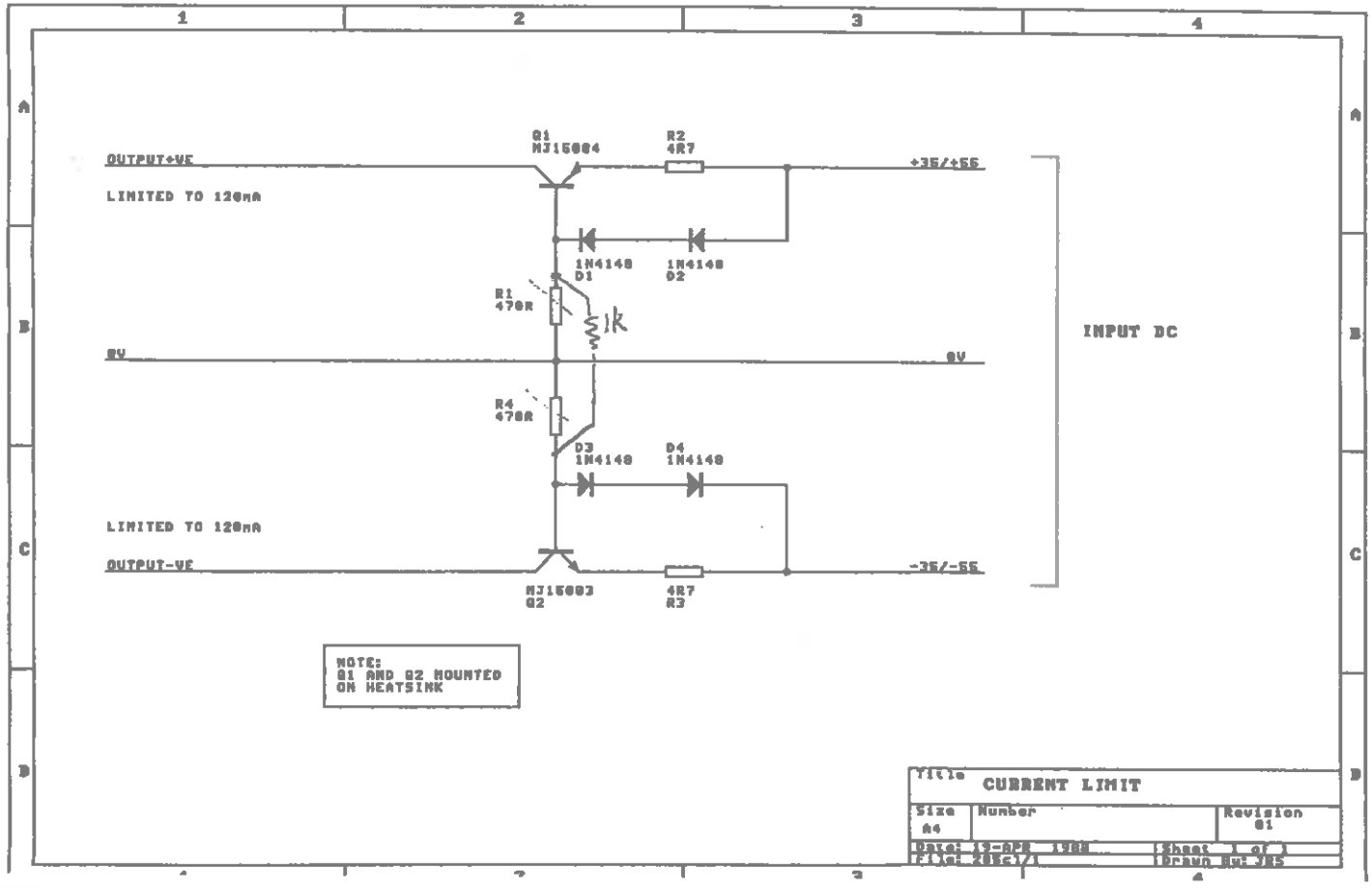
FEEDBACK
INPUT
CONTROL
TEMP
OUTSENSE
+15
-15
+5V
-5V



205


FUSE
220V/240V 3.15A
100V/120V 6.3A
CIRCUIT BREAKER
220V/240V 1A
100V/120V 2A
FUSE
BREAKER
SWITCH
+5S
R202
0R22/4W
10n/63V
C202
D202
5V
K201
STK2
D201
BT152
R201
1k5
C201
10n/63V
-5S
PS PCB
TRANSFORMER
LIVE
NEUTRAL
GROUND
TRANSFORMER TAPPINGS
VOLTS LIVE NEUT LK1 LK2
100V 3 6 3,4 5,6
120V 1 6 1,2 5,6
220V 1 6 4,6 -
240V 1 6 2,6 -
Title
205 POWER SUPPLY
Size
A4
Number
Revision
01
Date: 15-APR 1988
Sheet 1 of 1
File: 205sch/1
Drawn By: JRS


1
2
3
4
A
B
C
D
OUTPUT+VE
LIMITED TO 120mA
Q1
MJ15004
R2
4R7
+35/+55
1N4148
D1
1N4148
D2
R1
470R
1k
0V
0V
INPUT DC
R4
470R
D3
1N4148
D4
1N4148
LIMITED TO 120mA
OUTPUT-VE
MJ15003
Q2
4R7
R3
-35/-55
NOTE:
Q1 AND Q2 MOUNTED
ON HEATSINK
Title
CURRENT LIMIT
Size
A4
Number
Revision
01
Date: 19-8-8 1988
Sheet 1 of 1
File: 205s1/1
Drawn By: JRS