For details, see page 2

First IF 51.3 MHz

Second IF 5.3 MHz

V201 5670 RF AMP

V202 5654 MIXER

V203 5654 1st IF AMP

V301 5725 OSC/MIXER

V302 5654

V303 5654

V304 5654

V305 5654

5.3 MHz

Antenna 329-335 MHz

51.3 MHz

J2 J1

1n

1M

18k 75p 18k 75p 18k 75p 18k 75p

2p7 2p7 2p7 2p7 2p7

470k

10k

120

470k

100k

82 1k 680k 22k 47k 180 12k 47k 47k 56k 24k 180p

100k 100k 120k 120 33k 470 33k 33k 56k 270

1k 1k 1k 100k 100k 100k 56k a

220 4k7 220 4k7 220 4k7 6k8 6k8

82 45.9 MC 46.2 MC

K1

780

+146 V

700

650

+190 V

300 series

V204 5670 OSC/ DOUBLER

100

L8 Jx

1M

100

18k

220 100p 390 470

V205 OB2

279.9 MHz 280.5 281.1 281.7 282.3 282.9 283.5 278.1 278.7 279.3

+107 V

10 Xtals, solenoid selected

200 series

J3 AGC

680k 680k

1M5 0.22uF

0.33uF

680k

a

680k

680k 82k

0.22uF

39k

120k

680k 39k

0.33uF D-SENS

0.33uF

100k

0.33uF C-SOFT

AGC

V401 5670

173 V

180k 56k 47k

0.33uF

60V

0.25uF

1M

120k 25uF 560

560 0.1uF

100k

90 Hz

150 Hz

5k bal

FLAG

1k8 1k

16

15

1k8

4

1k8

3

400 series

80 mA

B

+241V

90 Ω

Stepper solenoid

K2

10 Ω

300 Ω

300 Ω

K3

300 Ω

K1

F1/F2 ON

50

2x 2uF

J

F

250 Ω

C

2x 10uF

115V~ 400Hz (84V~ standby)

6.3V~ 2.28A

PSA-8A AC POWER SUPPLY

H

P

D

L

A

IF

V2 V3

V3

V4 V1

V5 V1

V2

V4

RF

filaments

DC/DC converter

B

3Ω

18Ω

H

P

A

J

DC POWER SUPPLY Alternative for ac supply

5 6 7 8 9 10 11 12 13 14 17 18 2 1 19 20

LOC / GLS CHANNEL SELECT

28V dc 115V~

Pin on main connector

Pin on sub module

+27V

6 5 4 3 2 1

10 9 8 7

14 13 12 11

22

115V~ ON F1/2 Flag
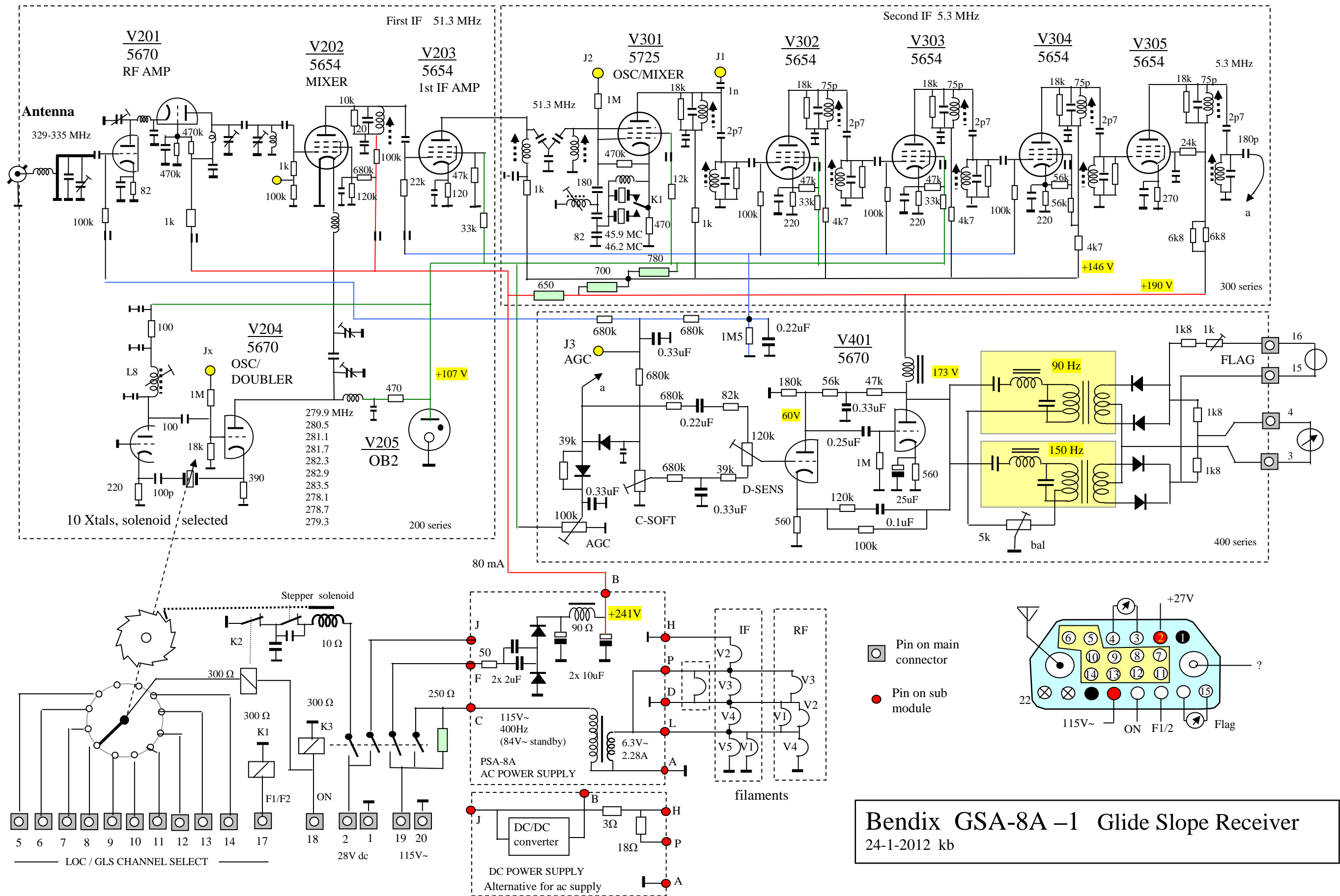
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Bendix GSA-8A –1   Glide Slope Receiver 24-1-2012 kb

The Bendix GSA-8 GlideSlope Receiver

This is a double conversion superhet, receiving frequencies from 329.3 to 335 MHz, on 20 channels, each 300kHz.
Build around 1958, the set uses miniature tubes like the 6AK5 and 5670.
All channels are crystal based. The first local oscillator has 10 crystals around 70MHz. The 4th harmonic is used in the first mixer to produce the first IF at 51.35 MHz. The second local oscillator is either 45.9 or 46.2 MHz to produce the second IF at 5.3 MHz.

The GlideSlope frequencies are paired with the (VHF) Localizer frequencies as in the table shown below.

Localizer MHz	GS Xtal MHz	Glideslope MHz	1 LO MHz	Turret Pos.	2 LO MHz	Pin to gnd
108.10		334.70	283.5	7	45.9	5 + 17
108.30		334.10	282.9	6	45.9	6 + 17
108.50		329.90	278.7	9	45.9	7 + 17
108.70		330.50	279.3	10	45.9	8 + 17
108.90		329.30	278.1	8	45.9	9 + 17
109.10		331.40	280.5	2	46.2	10
109.30		332.00	281.1	3	46.2	11
109.50		332.60	281.7	4	46.2	12
109.70		333.20	282.3	5	46.2	13
109.90		333.80	279.9	1	46.2	14
110.10	70.725	334.40	282.9	6	46.2	5
110.30	70.875	335.00	283.5	7	46.2	6
110.50	69.525	329.60	278.1	8	46.2	7
110.70	69.675	330.20	278.7	9	46.2	8
110.90	69.825	330.80	279.3	10	46.2	9
111.10	69.975	331.70	279.9	1	45.9	10 + 17
111.30	70.125	332.30	280.5	2	45.9	11 + 17
111.50	70.275	332.90	281.1	3	45.9	12 + 17
111.70	70.425	333.50	281.7	4	45.9	13 + 17
111.90	70.575	331.10	282.3	5	45.9	14 + 17

Due to the added damping in the second IF amplifier, the bandwidth is high (150 kHz) to handle drift in the crystals and the transmitter, and the sensitivity is quite low. A signal of -80 dBm (26uV) is needed to operate the AGC and make the amplitude of the audio signal constant.

The 10 crystals in the first local oscillator are mounted in a closed box, and selected with a stepper solenoid. This device rattles continuously, rotating the selector switch in 12 steps for a complete revolution, until stopped when the position of the feedback switch matches the position of the selector switch in the control panel for VHF-NAV.

In fact, there are two 12-position feedback switches (not shown in the diagram). The active one is chosen by an auxiliary contact of the F1/F2 relay. This is because the relation between LOC and GLS frequencies differs between the first 10 channels and the last 10 channels.
The connector pin numbers follow the VHF/LOC channel sequence.

Reverse engineering:
K.Bouwknegt.   Mail to a.k.bouwknegt –at- home.nl

AGC curve

Signal	dBm	AGC testpoint voltage
	none	- 0.01V (1Vpp noise)
	-90	- 0.1 noise and signal each 1Vpp
	-80	- 0.63 2.5Vpp signal and 10% noise
	-70	- 1.24
	-60	- 1.92
	-50	- 2.32 ,,
	-40	- 2.71
	-30	- 2.99
	-20	- 3.28
	-10	- 3.50
	0	- 3.78 2.5Vpp signal

Control panel.

The Bendix GSA-8A could be driven by the following frequency selectors. The indication is for the VHF-LOC frequency.
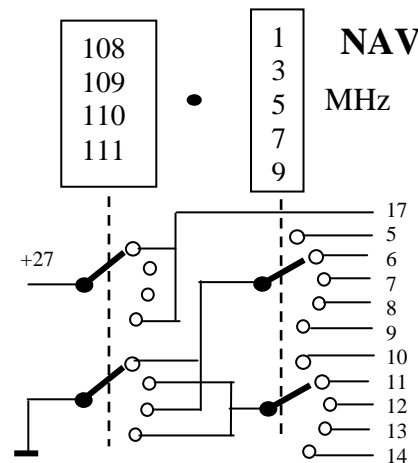

Course Softening

The receiver is capable to course softening, that is the sensitivity is reduced when a very strong signal is received, near the runway. This will widen the glidepath, as regarded necessary in 1955.
Later, the C-soft was no longer needed, and the adjustment C-SOFT can be set to zero.

Output filters

The received signal is demodulated and fed to two bandfilters, one at 90Hz, the other at 150Hz. Their outputs are rectified. The difference is connected to the glideslope needle to inform the pilot whether he is below or above the ideal glideslope.
The sum of the two is connected to the OFF flag, removing the flag when the sum is above a certain level.
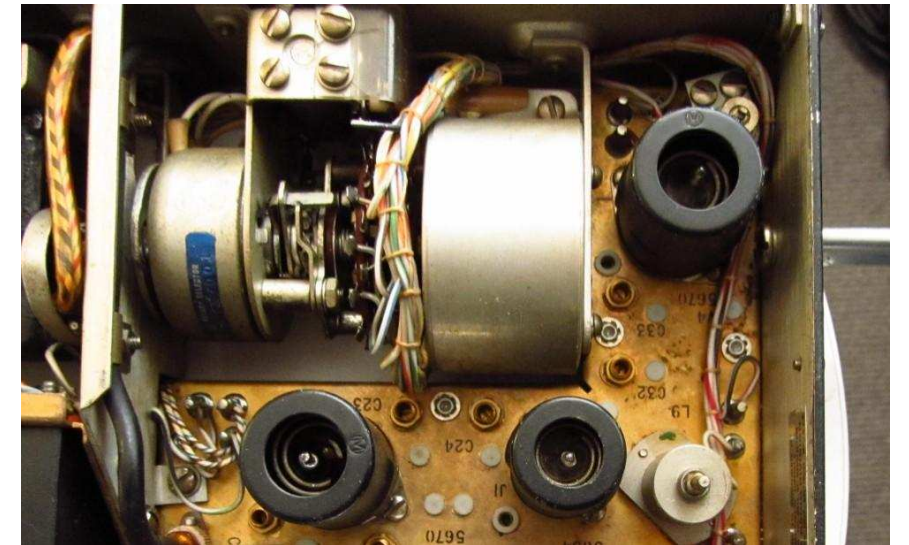
Detail of the solenoid stepper motor (left) and the turret with 10 crystals (middle) The oscilator tube 5670 is top-right.

Indicator

A course deviation indicator has a 1kΩ moving coil to drive the needle. The receiver can drive one or two indicators in parallel. The sensitivity is + /- 0.3 mA for full deviation, with 1mA allowed overdrive. The GSA-8 gives 1V at either 90Hz or 150Hz between pin 3 and 4, pin 3 is positive at 90Hz. With less than 25uV antenna input, the output drops proportionally.
The flag alarm is also a 1 kΩ moving coil instrument , requiring at least 0.3mA to make the red flag disappear.

Power supply

The GSA-8A has a DC and 115Vac (400Hz) power supply
The GSA-8B has a DC-only power supply (27V / 1A)

AC supply
The 115V ac (400Hz) is transformed to 6.3Vac to feed all filaments in parallel. The 115Vac is also fed to a voltage rectifier/doubler to provide 240Vdc high voltage.
AC Input current is 0.25A at 115Vac (30VA). The DC input is 0.2A for a few relays plus 1A when the stepper motor runs.
The filaments are pre-heated with 4.7Vac in standby mode.

DC supply
The 28Vdc is fed directly to the filaments of the tubes, series/parallel connected to minimize the use of dropper resistors.
The dc voltage is also fed to a 2-transistor inverter, to get the 240Vdc at 40mA high voltage.
Input current (at 27.5Vdc) is 0.525A (filaments) + 0.4A (inverter) + 0.2A (two relays) = 1.13A. Add short 1A pulses when the stepper motor runs.