4. High accuracy voltage followers

The F18 employs a pair of high accuracy voltage followers (HAVF) [1], each consisting of a three-stage high gain block [2]. The input voltages are from the reference resistor via the voltage sensing leads (R_S (V)). The outputs drive the energising windings of the ratio transformer.

Caution: Each HAVF has its own "floating" power supply (FPSU). This is a slight misnomer as the circuit "drives" the PSU to follow the input voltage.

Do not connect the "0V" of an HAVF supply to earth (e.g. via a 'scope probe)

The output of each follower is thus the "0V" of the floating PSU. The circuit is quite subtle, best understood by following the path of currents during a positive half cycle. In the case of energising winding EW1 the current flows via a simulated large capacitor (Sim Cap) and the main PSU 0V connection [3]. The currents divide at PN5 and then recombine at TP10: -

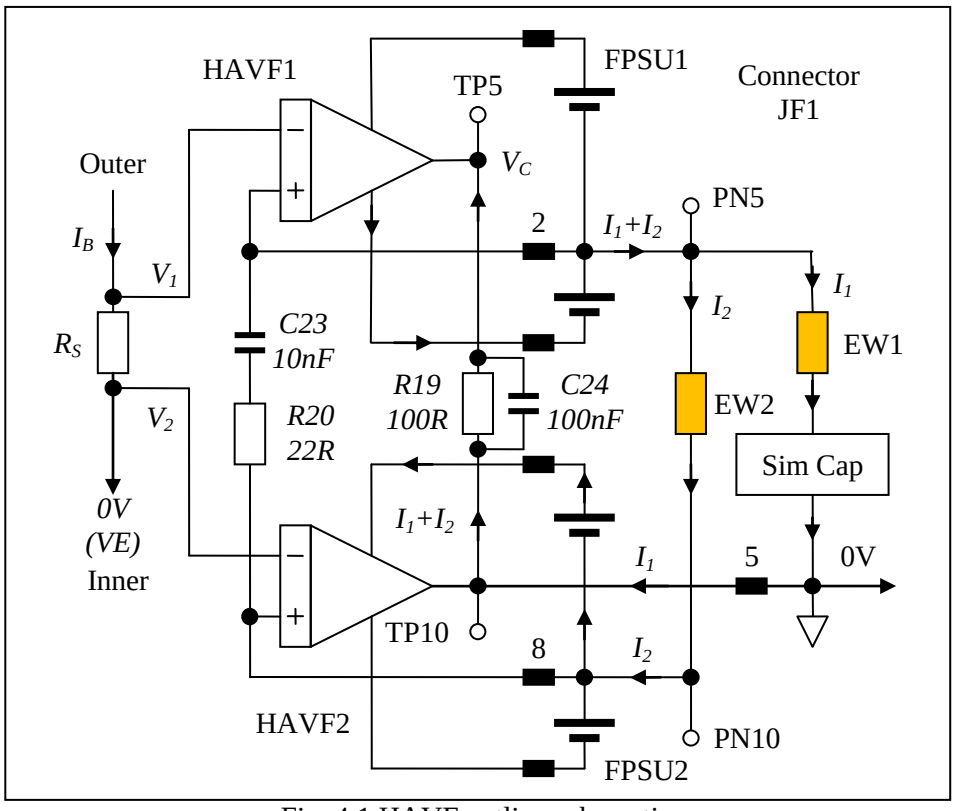

Fig. 4.1 HAVF outline schematic

The followers also produce a signal, V_C, at test point TP5, proportional to the total current through the transformer primaries. The result is a signal at the output of HGB1 which is normally connected to 0V. Fortunately there is sufficient open loop gain, within the HGB, so that the difference at the inputs remains negligible. Test points 5 and 10 (main PSU 0V) provide convenient points for connecting a 'scope probe for monitoring the current (AC and DC components). The floating PSU connections, via connector JF1, are: -

HAVF1			HAVF2		
+15V	0V	-15V	+15V	0V	-15V
1	2	3	7	8	9

1. Part 4, monograph 2: "High accuracy voltage followers".
2. Part 4, monograph 1: "High gain blocks".
3. See section 6.

The high gain blocks are third order [1] with a low noise front end (see fig. 4.3): -

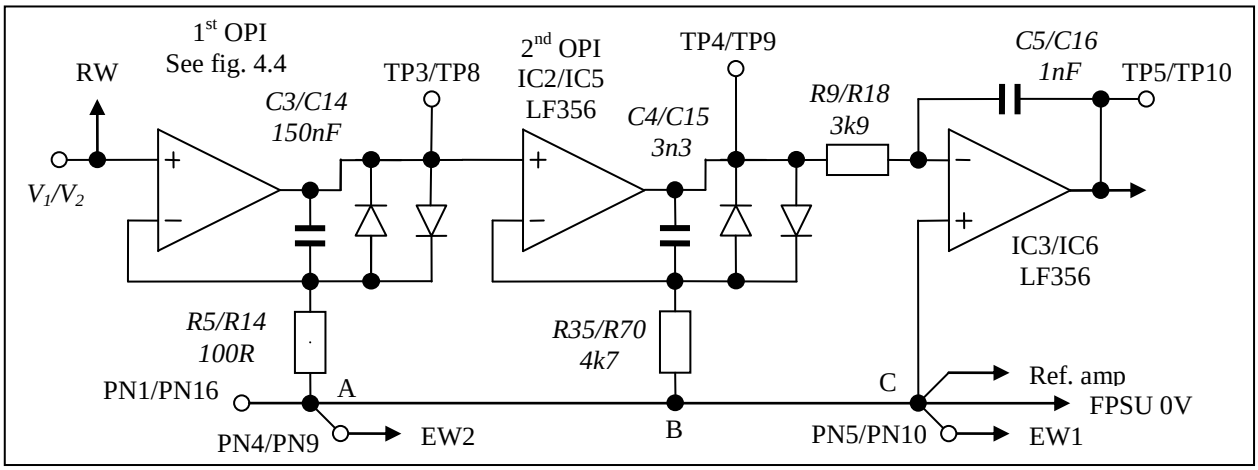

Fig. 4.2 Outline schematic of HGB for each HAVF

The first component reference applies to HAVF1, the second to HAVF2.

All diodes are 1N4148

Front end (first OPI) diodes: D3 & D4/D9 & D10.

Second OPI diodes: D5 & D6/D11 & D12.

EW1 and EW2 refer to the energising windings, RW to the ratio winding.

The order of connections to the ratio transformer is important;
Despite the fact that the pins are connected by short PCB tracks.

The floating power supply (FPSU) "0V" arrives at point C from which the connection to the first energising winding (EW1) is taken. The high current required to drive the majority of flux is thus prevented from flowing through the connection to points B and A. The relatively small current to drive the second energising winding (EW2) is taken from point A. The connection, to the ratio winding (RW) primary, is taken from the inputs of the HAVFs.

The HAVF outputs also provide a low impedance source of the reference voltage, V_S, which goes to the reference amplifier (see fig. 3.5.1) for the phase reference circuit and quadrature servo.

The connections to the ratio transformer and reference amplifier must be twisted pairs.

1. Part 4, monograph 1: "High gain blocks".

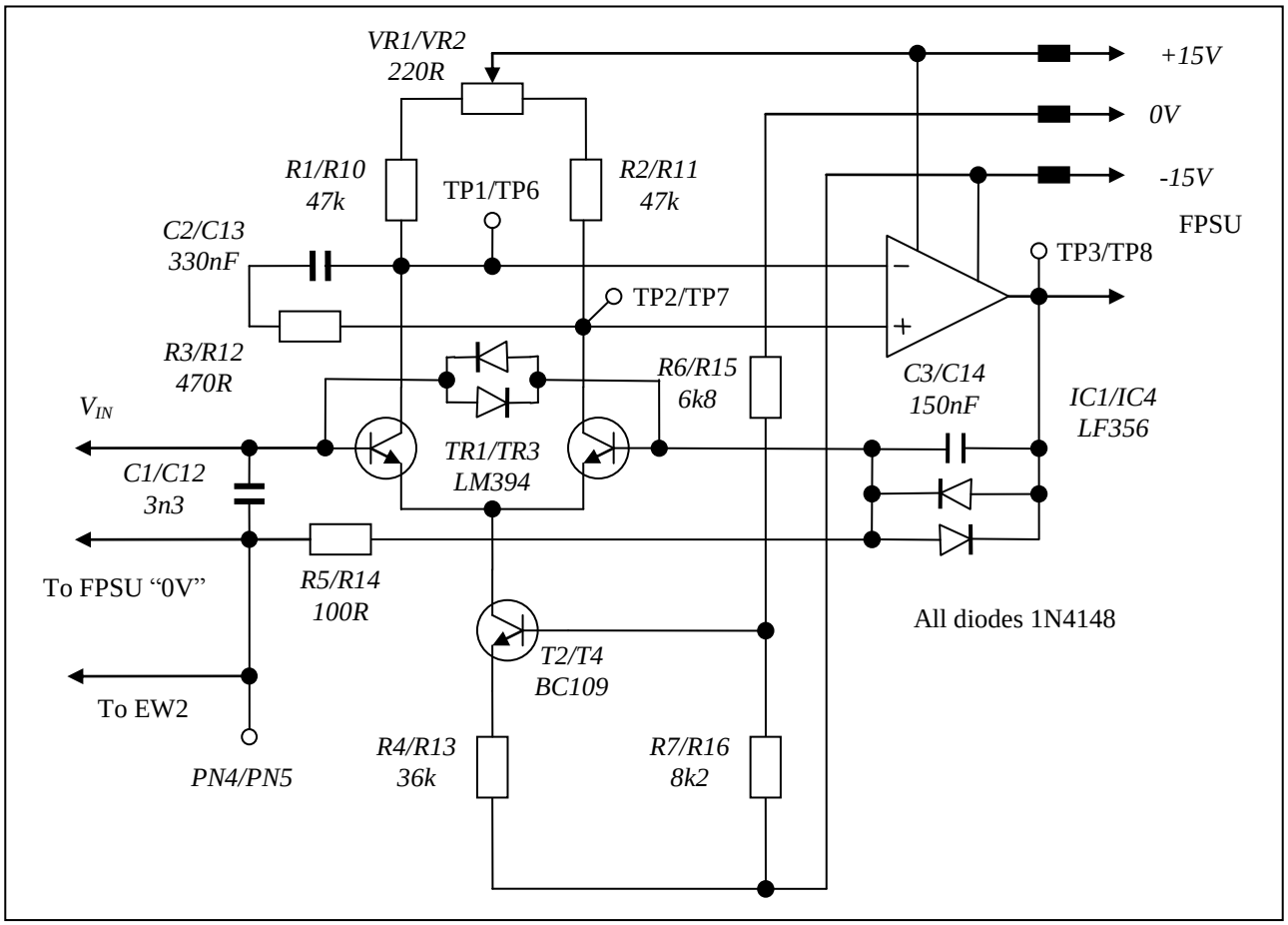

Fig. 4.3 HAVF1/HAVF2 low noise front end (one-plus-integrator)

The first component reference applies to HAVF1, the second to HAVF2.

Diodes protecting TR1/TR3: D1 & D2/D7 & D8.

Diodes in parallel with C3/C14: D3 & D4/D9 & D10

For more theory see [1].

1. Part 5, monograph 2: "Low noise BJT preamps".