5. **Circuit Description**

5.1 **General Features**

Figure 5.1 shows the circuit of the SP104 schematically in conjunction with the cryostat. The circuit includes a preamplifier, a high voltage supply and a filter for the high voltage.

5.2 **Preamplifier**

The preamplifier consists of a charge sensitive stage, a pole-zero compensation network, and a cable driver stage.

In the charge sensitive stage the input FET, the feedback resistor \( R_f \), the feedback capacitor \( C_f \), and test capacitor are located inside the vacuum cryostat and maintained at an optimum temperature with respect to electronically generated noise. The input FET is in the common source configuration. This together with a high gain differential amplifier acts as an operational amplifier with feedback components \( R_f \) and \( C_f \). The test capacitor \( C_t \) provides a path for injecting pulses from a test pulser to the input of the preamplifier.

The D.C. voltage at the output of the charge sensitive stage is brought to a rear panel test jack for monitoring purposes. When the detector HV is off, this voltage is normally -0.3 to -0.7 V, reflects the gate voltage of the FET. The voltage range of the charge loop output is ±18V.

The voltage signal from the charge loop with a fall time of several milliseconds is differentiated to give a fall time of 10 microseconds. A pole-zero network is included with the differentiator to remove the undershoot caused by the differentiator. Adjustment is by RV-3, and is set at the factory.

The cable driver consists of an operational amplifier with a gain of 1 or 5 set by a jumper. The jumper is factory set at A-C for a gain of 1. A 5X higher gain is available by selecting the jumper position A-B. A push-pull emitter follower output allows an output voltage swing of ±10V. Output 1 has a 93 ohm series termination, while output 2 has 50 ohms.

The test input is terminated by 93 ohms and is connected to the test capacitor \( C_t \) to allow a test signal to be injected at the input to the preamplifier.