2.2 T858/859 With RF Power Modules

Refer to Section 5 where the parts lists, grid reference index and diagrams will provide detailed information on identifying and locating components. Refer also to Figure 3.5 and Figure 3.7 which show the location of the main adjustment controls.

Note: Where the same component has different circuit references in the T858 and T859, in this and following sections the T858 circuit reference is given first, followed by the T859 circuit reference in brackets, e.g. Q137 [Q128].

2.2.1 Introduction

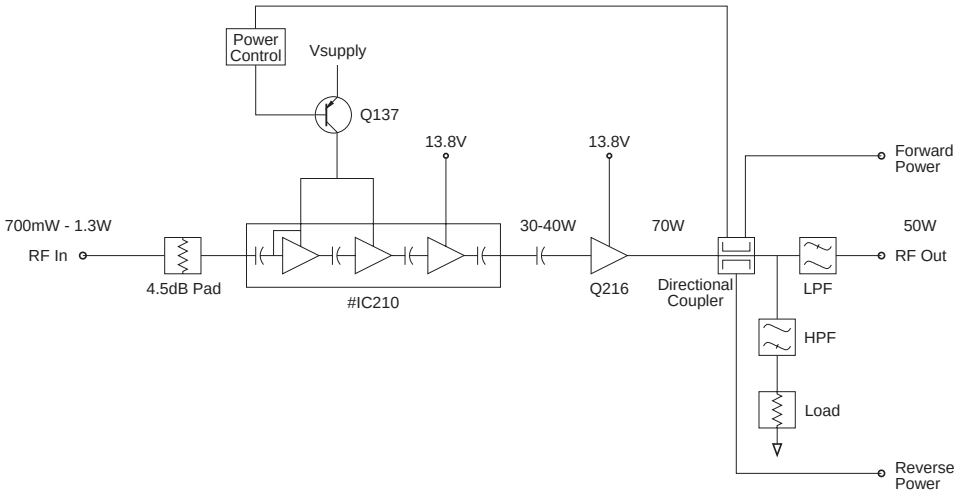

Figure 2.6 T858 High Level Block Diagram

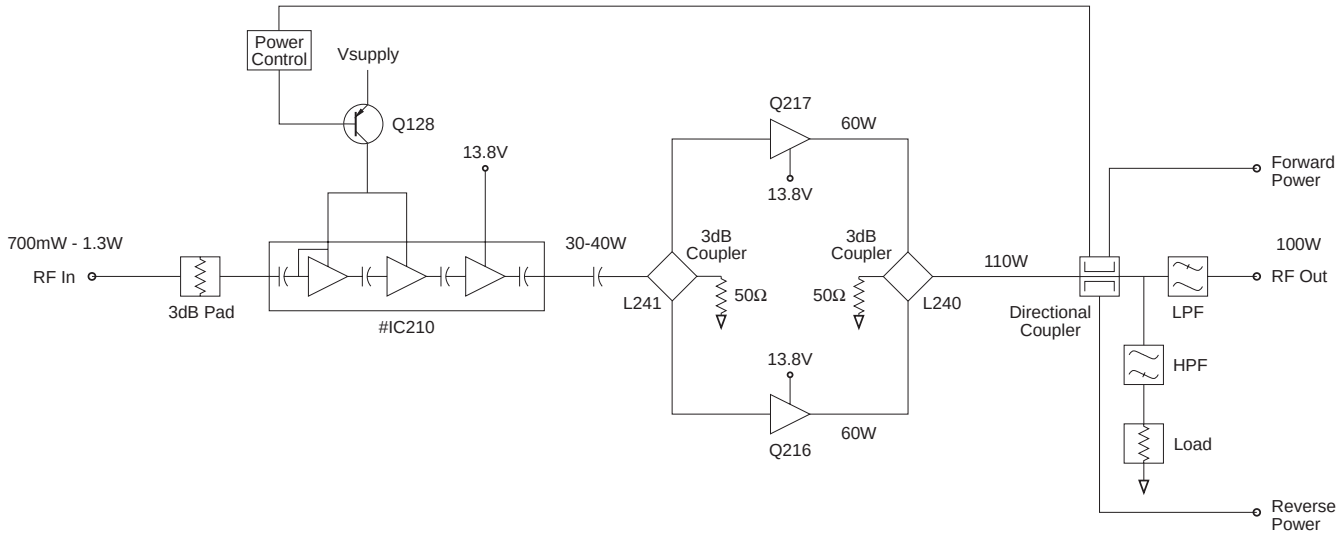

Figure 2.7 T859 High Level Block Diagram

The T858 and T859 comprise a two-stage RF power amplifier with extensive control circuitry:

- the input stage consists of a single, three-stage RF power module which increases the drive level to approx. 30W (40W typical);

- the final stage in the T858 is composed of a single transistor (Q216) which provides the rated output power; the final stage in the T859 is composed of two transistors (Q216, Q217) whose outputs are combined to provide the rated output power.

Figure 2.6 and Figure 2.7 show the configuration of each of the main circuit blocks on a functional level, while fold-outs Figure 1.3 and Figure 1.5 show their location on the PCB.

2.2.2 RF Circuitry

(Refer to Figure 2.6, Figure 2.7 and the RF section circuit diagrams in Section 5.)

The driver stage of the T858 consists of a three-stage RF power module (#IC210) which delivers 30-40W to the final amplifier (Q216). The output from the final is passed to the antenna socket via the harmonic filter.

The driver stage of the T859 consists of a three-stage RF power module (#IC210) which delivers 30-40W to the final transistors. The signal is split via a 3dB quadrature hybrid (L241) and used to drive the two final amplifiers (Q216, Q217). The outputs from these final stages are recombined by L240 and passed to the antenna socket via the harmonic filter.

The diplexer presents the final amplifiers with a good load at harmonic frequencies, which helps to achieve the expected harmonic attenuation in the output filter.

The directional coupler senses forward and reflected power, which is rectified (D205 & D206) and passed to the control circuitry for metering, alarm and power control purposes.

Power control is via a series pass transistor (Q137 [Q128]), which controls the supply voltage on the first two-stage of #IC210.

2.2.3 Control Circuitry

(Refer to the control section circuit diagrams in Section 5.)

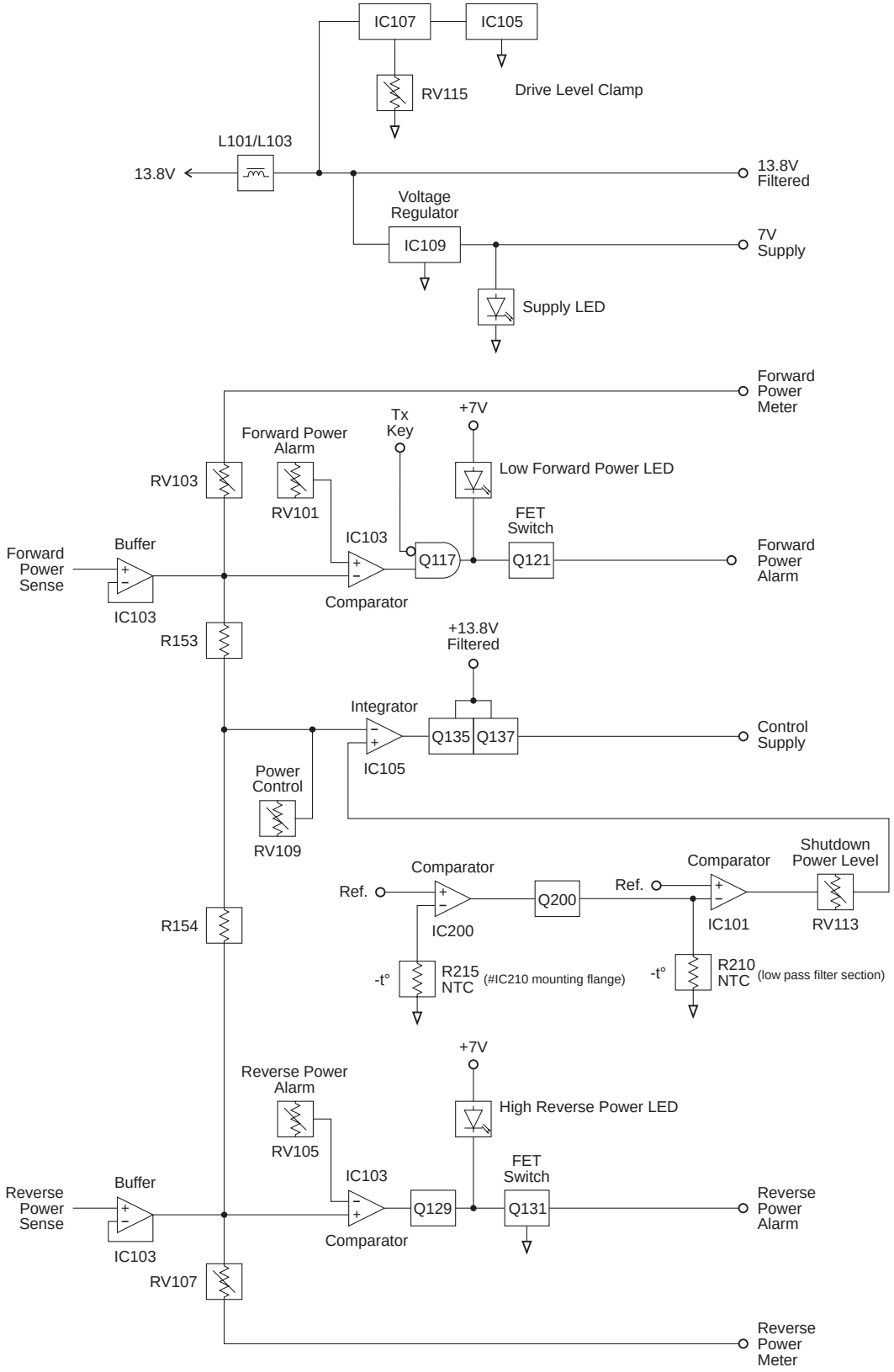

Figure 2.8 T858 Control Circuitry Block Diagram

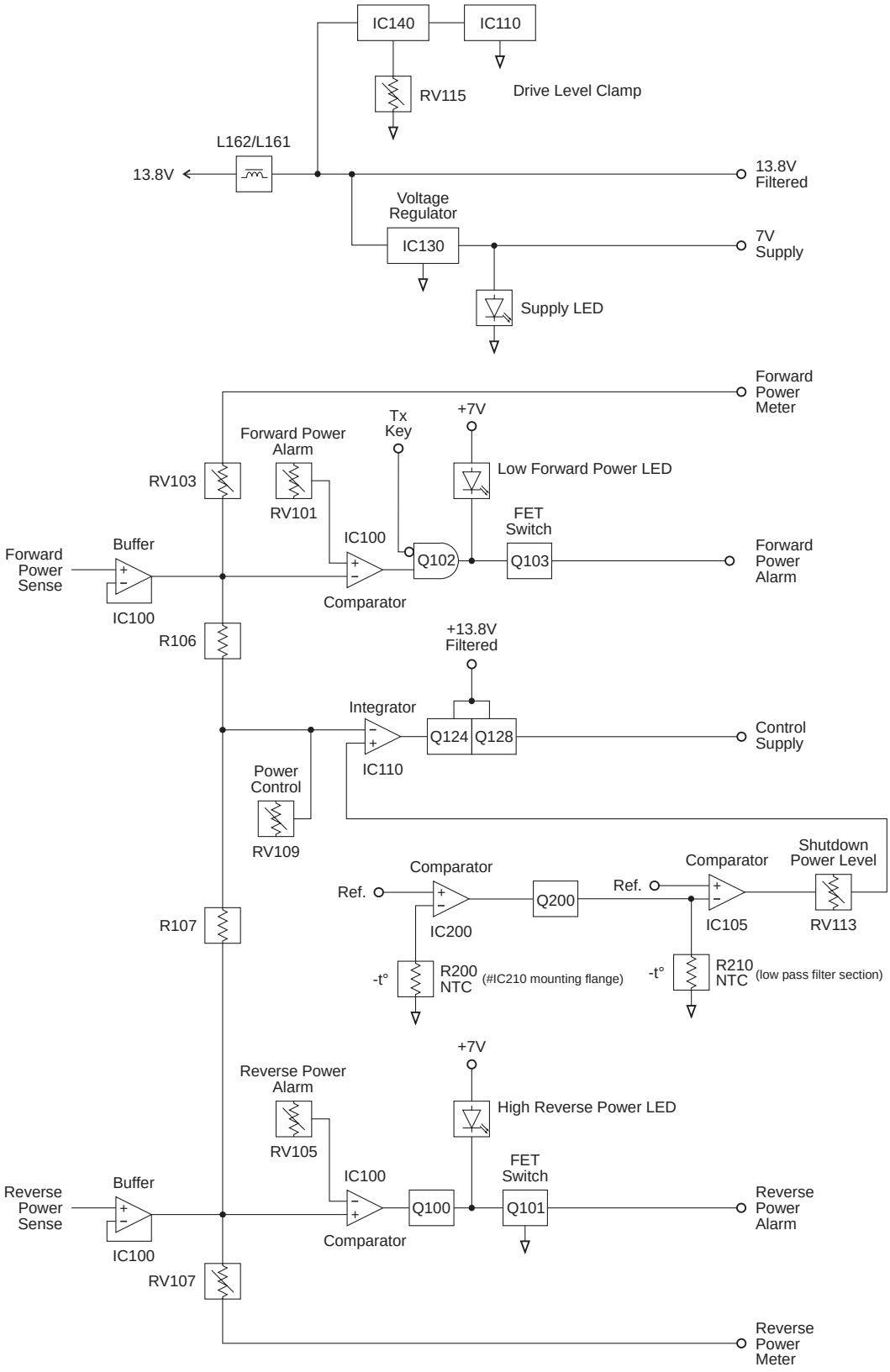

Figure 2.9 T859 Control Circuitry Block Diagram

2.2.3.1 Power Control

The DC voltages from the directional coupler representing forward and reflected power are buffered by the two voltage followers, IC103 [IC100] pins 1, 2 & 3 and pins 12, 13 & 14. Their outputs are summed at an integrator (IC105 [IC110] pins 1, 2 & 3), which drives the series pass control elements (Q135 & Q137 [Q124 & Q128]).

Forward and reflected power are summed so that, under high output VSWR, the power control turns the PA down. This is because the control loop adjusts for the same DC voltage from the directional coupler that would have been present if there were no reflected power.

2.2.3.2 Driver Power Level

The maximum output power of the T858/859 can be limited by placing a ceiling on the driver output power level using RV115 (accessible through the side cover). For example, if RV115 is set for a maximum output power of 50W, the range of adjustment using RV109 (front panel power adjust) will be 20 to 50W.

Caution: **The driver power level clamp (RV115) is factory set to give a maximum power output at room temperature of 60W for the T858 and 110W for the T859. The unit may be damaged if this level is increased.**

2.2.3.3 Thermal Protection

At excessively high temperatures, the output power will automatically reduce to a preset level (set by RV113), thus preventing the PA from overheating.

Ambient temperature within the PA is measured by a thermistor controlled voltage divider (R168 [R177], R210) which applies a voltage to a comparator with hysteresis (IC101 [IC105] pins 8, 9 & 10). This thermistor is located on the PCB in the low pass filter cavity.

Thermal protection is also provided for the RF power module to prevent the module itself from overheating. This protection consists of a thermistor controlled voltage divider (R203, R215 [R200]) which sets a voltage on a comparator with hysteresis (IC200 pins 1, 2 & 3). The thermistor is located on the module flange.

The output current from all comparators is summed into the power control network via RV113 so that the power level to which the PA must turn down may be set.

2.2.3.4 Forward And Reverse Power Alarms

If forward power drops below, or reverse power rises above, presettable limits, alarms may be triggered.

The alarm outputs are open drain configuration and are low under normal conditions (i.e. forward and reverse power levels are normal).

IC103 [IC100] pins 5, 6 & 7 and pins 8, 9 & 10 form comparators with thresholds

adjusted via RV101 (forward power) and RV105 (reverse power) respectively. The inputs are from the forward and reverse power signals from the directional coupler, buffered by IC103 [IC100] pins 1, 2 & 3 and pins 12, 13 & 14. Thus, the power levels at which the forward and reverse power alarms are triggered are defined by RV101 and RV105 respectively.

2.2.3.5 Forward And Reverse Power Metering

Forward and reverse power signals from the two IC103 [IC100] buffers are available for metering purposes. The output currents are adjustable via RV103 (forward power) and RV107 (reverse power).

2.2.3.6 T859 Fan Control Circuitry

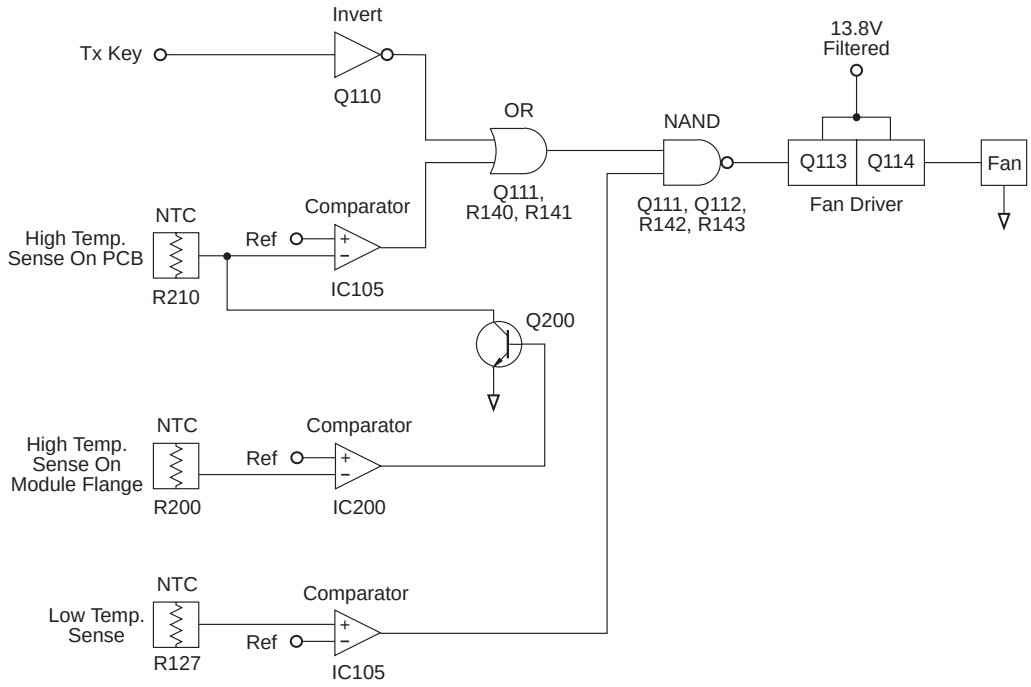

Figure 2.10 T859 Fan Control Logic Diagram

Comparator IC105 pins 12, 13 & 14 are set to switch at heatsink temperatures greater than +90°C or RF power module flange temperatures greater than +110°C, and pins 1, 2 & 3 at temperatures less than -10°C.

A logic AND function is applied to the comparator outputs by Q111 and Q112, thereby turning on the fan unconditionally (via Q113 and Q114) if the heatsink temperature exceeds +90°C or the module flange temperatures exceed +110°C.

A logic OR function is applied to comparator IC105 pins 12, 13 & 14 and Tx KEY signals, thereby turning on the fan when the transmitter is keyed and the temperature is between -10°C and +90°C (or +110°C for the module flanges).

If the temperature drops below -10°C, Q112 is turned off, preventing Q111 from activating the fan.

2.2.4 Power Supply & Regulator Circuits

(Refer to the control section circuit diagram in Section 5.)

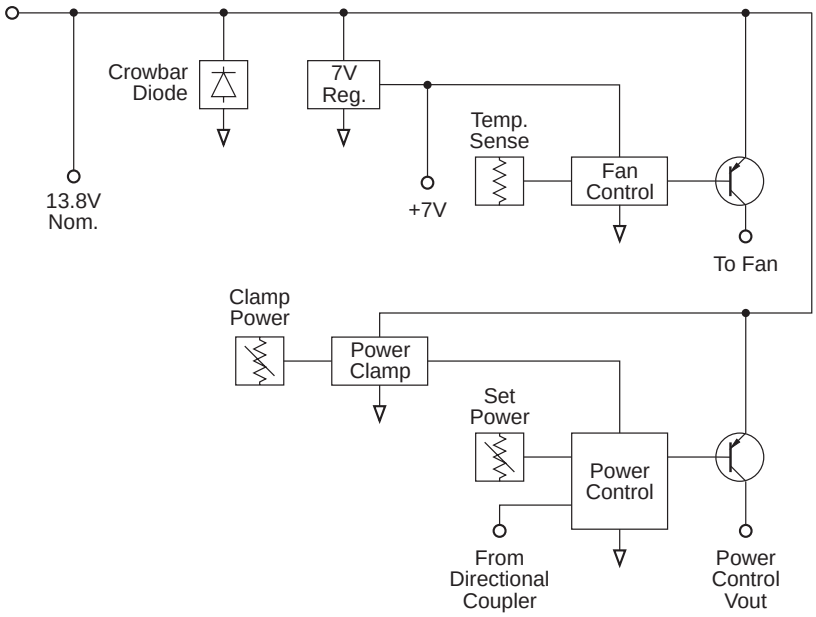

Figure 2.11 T858/859 Power Supply & Regulator Circuitry Block Diagram

The T858/859 are designed to operate off a 10.8-16V DC supply (13.8V nominal). A 7V supply runs directly off the 13.8V rail, driving the fan control, power control and alarm circuitry.

A crowbar diode is fitted for protection against connection to a power supply of incorrect polarity. It also provides transient overvoltage protection.

Note: A fuse must be fitted in the power supply line for the diode to provide effective protection.