F1 DSC VHF Transceiver Audio and Control Module: Circuit Description

(Corresponding circuit diagram: 84-510C)

Function
The Audio and Control module provides all the user-interface, RF module interface, and DSC message formulation / encoding and decoding / display functions for the radio. It is linked to (and controls) the RF module.

Microprocessor
The 8 bit microprocessor (U4) provides a keyboard scanning interface, non-volatile RAM interface, LC display interface, RS485 data port interface, NMEA interface, synthesizer and radio state control, DSC decoding/encoding and message composition/recognition, PTT and off-hook condition handling, audio alarm generation, and LCD contrast and back-lighting control.
(The power On/Off key latching is independent of the processor.)

The processor clock frequency is 18.432MHz as this is related to a multiple of a standard serial communications baud rate. The processor control program is accessed from (internal) FLASH memory. This type of memory allows easy programming as transceiver needs only a serial connection to a PC, the appropriate interface software and the target software itself in order to change the program. The processor also contains integral ADC and DAC conversion facilities to enable DSC tone detection and generation, and alarm tone generation. Reset circuitry U1, D21, D23, C18 and 3 resistors allow processor to be forced into the reset state when supply voltage is below threshold and to guarantee an orderly start-up when power is applied.

Memory
'Non-volatile' FRAM U6 maintains radio information such as MMSI, received DSC messages, user preferences (profiles). An internal (software) real time clock is maintained while power is applied, which can be set by the operator.
** [If a GPS receiver is connected, the clock is automatically set and maintained using the GPS data. The clock is used to time stamp DSC messages and also as a means of determining that position information is too old (not updated within 4 hours).]*

U6 is protected against writing during low supply voltage conditions by U1, D22, R65 and C22.

Display contrast
LCD contrast is software adjustable via the scroll keys. The contrast adjusting voltage is derived from one of the PWM outputs of the microprocessor and delivered via Q1, Q6, Q3 mirror and level shifter. Note that the output contrast voltage is negative, a charge pump / oscillator comprising U1, D1, D2, C1, C2, C4, R1, R2. Temperature compensation (contrast bias voltage) is integral, provided by R12 and Q6.

Lighting
Backlighting for the LCD (driving the LCD module integral LEDs) is set by means of another PWM output and is again software controllable by the operator. Q13, Q14, R29-34 and R108-113 share the load.

Keypad lighting requires only an on-off state. Q2, Q4, Q5 and Q7 each drive a string of keypad LEDs.

Indicators
Status indicator LEDs D18, D19, D20 are independently driven by microprocessor port line, via Q8, Q9, Q10. Optionally these LEDs be varied in response the backlight brightness level (if Q11 fitted and R91 removed.

Keys
The keypad comprising 21 keys on a common array, is scanned using processor ports 5 and 6. The remaining key (power) is not connected to the microprocessor. Instead this key temporarily closes a circuit in the RF module, to latch the power supply on or off.

Volume and Squelch controls
R45 and R50 set the audio gain and squelch threshold respectively. Alarm tones are injected into the audio path after the volume control, as alarm is at a fixed volume.

Routing
A number of signals are routed through this board including, low level audio from the microphone, high level audio to the speaker and the on-off signal.