**SX150A
TRANSCEIVER
OPERATING INSTRUCTIONS
1892 1213**

These operating instructions are intended to provide the user with sufficient information to install and operate the module correctly.

The Wood and Douglas SX150A is a synthesized VHF transceiver for use in radio telemetry applications. The transceiver provides a maximum power output of 500mW and is designed to meet European standards ETS 300 220, ETS300 086 and ETS300 339. The unit also complies with MPT1328 and as such does not require an operating licence in the UK.

INSTALLATION

The SX150A is intended to fit easily and with minimum space requirements into the user's own equipment housing
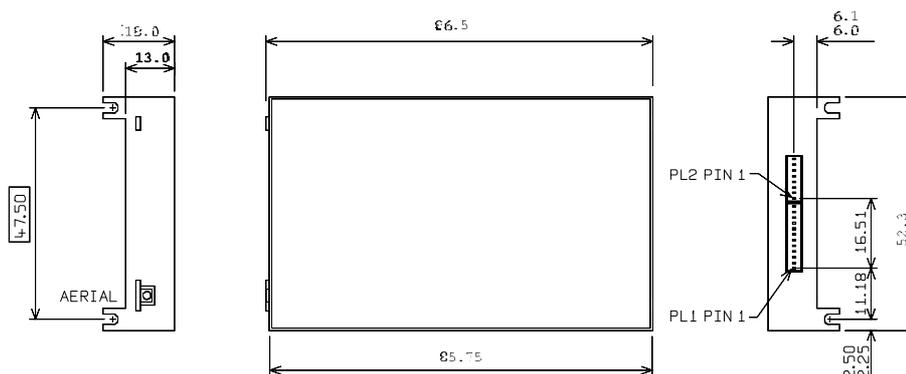

Figure 1 SX150A fixing detail

NOTE: The four corner tabs of the enclosure can be folded out to provide alternative mounting of the unit, with fixing centres of 93.00 x 47.5. using four M2 screws.

CONNECTIONS

The radio antenna connects via an MMCX 50 Ω socket. All other connections to the SX150A transceiver are made via a 12-way connector PL1 and an 8-way connector PL2. These are single-in-line plugs for use with the free-issued connectors with flying leads.

PIN	NAME	FUNCTION	REMARKS
PL1-1	0V	0 volts	common ground
PL1-2	STBY	standby input	LOW (<+0.6V) = transceiver enabled HIGH (>+2.0V) = standby mode (internal pull-up, 100kΩ)
PL1-3	HI/LO	TX RF power select input	>+2.1V = high power <+0.8V = low power (internal pull-down, 10kΩ to 0V)
PL1-4	+Vin	positive supply input	+5.5 to +9.0 V input (-ve earth)
PL1-5	TXE	transmit enable input	HIGH (>+1.7V) = receiver enabled LOW (<+0.4V) = transmitter enabled (internal pull-up, 10kΩ to +5.3V)
PL1-6	TXD/MS	TXD - serial data input MS - mode select, ie channel selection by serial or parallel data input	Serial data input = single 8-bit RS232 format control word, ie logic 1 = -V, logic 0 = +V (Maximum voltage level is ±12V; inverted TTL acceptable). If not used, leave not connected, or connect to ground. Mode selected depends on the logic state at power-up: HIGH (>+3.0V) = parallel data input LOW (<+0.5V) = serial data input (internal pull-up, 10kΩ to +5.3V)
PL1-7	CS0/DT	CS0 - channel select input (LSB) DT - synthesizer serial data input*	Channel select inputs use inverted 5V logic levels; HIGH (>+1.6V) = logic 0, LOW (<+0.4V) = logic 1 CS0 to CS5 are used for channel selection by 6-bit parallel data (Internal pull-ups 20k typical to +5V) (* DT/CK/EN inputs are used for direct control of the synthesizer, this is a separate version of the SX150.)
PL1-8	CS1/CK	CS1 - channel select input CK - synthesizer programme clock *	
PL1-9	CS2/EN	CS2 - channel select input EN - synthesizer enable strobe input*	
PL1-10	CS3	channel select input	
PL1-11	CS4	channel select input	
PL1-12	CS5	channel select input (MSB)	

PIN	NAME	FUNCTION	REMARKS
PL2-1	RF DET	TX RF present flag output	HIGH (+5V, internal 10kΩ pull-up) = TX RF present LOW (0V) = no TX RF
PL2-2	AF O/P	receiver audio output	500mV p.p. nom. into 10kΩ AC-coupled; Rout = 1kΩ. **Note:** The audio output is inverted with respect to the SX150 (or similar Wood & Douglas product) audio input.
PL2-3	SQO	squelch flag output	NPN open collector via 1kΩ ON = no signal, OFF = signal present. (NOTE: OFF when transceiver in standby mode)
PL2-4	OOL	out-of-lock output	NPN open collector via 1k; ON = out of lock (NOTE: OFF when transceiver in standby mode)
PL2-5	DMOD	digital modulation i/p **	+3V to +12V square wave, DC-coupled
PL2-6	AMOD	analogue modulation input **	750mV p-p., AC-coupled (pre-settable 200mV to 3V p-p.) ** DMOD and AMOD may not be used simultaneously. Leave unused input unconnected.
PL2-7	RSSI	'S' meter output	0V to +3V output, rising with received signal level (typ. 50dB range)
PL2-8	SQOR	squelch override input	HIGH (>+3.0V) enables AF O/P regardless of squelch state (RX only) LOW (<+0.5V or o/c) = normal operation (internal pull-down, 20k to 0V)

CHANNEL SELECTION

The SX150A offers one of 64 channels in parallel mode selection and one of 80 random channels, or 256 sequential, in serial mode selection. Mode selection is determined by the state of the input (MS) on PL1-6 at power-up.

When MS = HIGH (>+3.0V), the unit will look at the parallel data inputs.
When MS = LOW (<+0.5V) the unit will use the last serial channel selected.

Parallel Mode

In parallel mode one of 64 channels is selected using parallel control lines via the user interface connector (Figure 2). The six channel select inputs are a binary representation of the channel number.
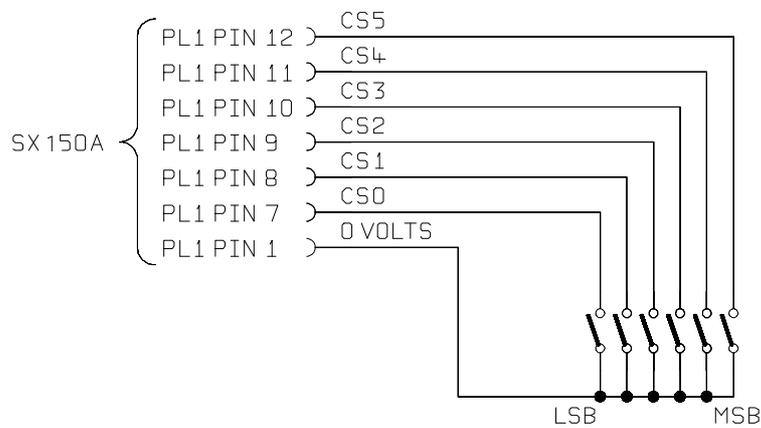

Figure 2

Serial Mode

In serial mode channel selection, one of 80 random channels, or 256 sequential, is programmed using a serial input word.

The data format is:

Input level	RS232 or TTL level
	Both levels have the same sense ie logic 1 = -V and logic 0 = +V
	(Maximum voltage level is ±12V)
Baud rate	9600 baud
Data format	1 start bit, 8 data bits, 1 stop bit.
	The eight data bits are a binary representation of the channel number.

Serial mode programming software is available for the SX150A transceiver, for further details contact the Wood and Douglas sales office.

Note: When using the serial frequency programming option the last selected frequency is held in memory when the unit is powered off.

RANGE INFORMATION

The following table gives an indication of the typical ranges to be expected between a transmitter and receiver that have simple end-fed dipole antennas.

The following assumptions have been made in the calculations:

line-of-sight between antennas
0dB gain for the transmitter and receiver antennas
0dB loss for connectors and cables between the antenna and the radio connector
20dB fade and environmental margin
-100dBm received signal strength, allowing for digital and analogue signals

Range versus TX power			
Frequency (MHz)	Power (mW)	Power (dBm)	Range (km)
173	1mW	0	1.4
173	10mW	10	4.4
173	100mW	20	13.8
173	500mW	27	30.9
458.5	1mW	0	0.5
458.5	10mW	10	1.7
458.5	100mW	20	5.3
458.5	500mW	27	11.9
869	1mW	0	0.3
869	10mW	10	0.9
869	100mW	20	2.8
869	500mW	27	6.2

SPECIFICATIONS

General

Frequency ranges	:	125 - 140Mhz
		140 - 160MHz
		160 - 180MHz
		200 - 225MHz
Switching bandwidth	:	5MHz in 140 - 160MHz band
Frequency stability	:	±1.5kHz over operating temperature
Number of RF channels	:	80 random customer programmable
		Or up to 256 sequential channels
Channel switching delay	:	50mS maximum (over 5MHz switching bandwidth)
Channel selection	:	64 channels maximum using 6 bit parallel input.
		256 channel maximum sequential, 80 random using serial data word.
Channel spacing	:	12.5kHz/20kHz/25kHz available
Modulation type	:	F1D/F2D/F3D
Spurious emissions	:	(conducted & radiated) In accordance with ETSI/CEPT
Supply voltage	:	5.5-9.0V DC -ve earth
Supply current at 7.2V	:	50mA typical (receive)
		400mA typical for 500mW output (transmit)
Interface connections	:	1x8 + 1x12 way 1.27mm pitch Molex right angle plug (with mating connector + 200mm lead suppied).
		Available as a 21 pin SIL pcb connection (SX150C version)
RF connection	:	PC mounted socket, (200mm RG178 lead supplied).
Operating temperature	:	-25°C to +55°C
Storage temperature	:	-30°C to +70°C
Size overall	:	87 x 53 x 13 mm
Weight	:	70g
Type approvals	:	ETS300 220, ETS300 683 (EMC), ETS300 086

Transmitter

RF output power	:	25 - 500mW (HI) (+1, -2dB)
(into 50 ohm)		1 - 25mW (LO)
TX/RX switching time	:	<20mS
Modulation input		
analogue	:	750mV p-p, AC-coupled (pre-settable 200mV to 3V p-p)
digital	:	+3 to +12V square wave DC-coupled
Frequency response	:	9Hz to 3kHz at -3dB (analogue input) (optional extended response to 10kHz for 9600 baud GMSK)
Frequency deviation		
25kHz channel spacing	:	±3.0kHz nominal (±4.0kHz max)
20kHz channel spacing	:	±2.3kHz nominal (±3.0kHz max)
12.5kHz channel spacing	:	±1.5kHz nominal (±2.0kHz max)
Adjacent channel power	:	<200nW (-37dBm)
Facilities	:	OOL detect output (+5V = TX on) (HI power only)

Receiver

Sensitivity	:	<-115dBm for 12dB SINAD (psophometrically weighted) (25KHz cs) <-107dBm for 20dB SINAD (psophometrically weighted)
Image rejection	:	>70dB
Intermodulation rejection	:	>65dB
Blocking	:	>85dB
Spurious rejection	:	>70dB
Intermediate frequencies	:	45MHz and 455kHz
Adjacent channel Selectivity		
12.5kHz channel spacing	:	>60dB
20/25kHz channel spacing	:	>70dB
Recovered audio level	:	>500mV p-p typ into 10kΩ
Squelch type	:	Noise operated (2dB hysteresis typical @ 12dB SINAD point)
Squelch output	:	NPN open collector via 1kΩ ON = no signal, OFF = signal present
Facilities	:	RSSI output (0 to +3V nominal from 1kΩ source) OOL Squelch override input STBY input
Standby current	:	0.9mA typ for HI/LO input = 0V 1.6mA typ for HI/LO input = +Vin