SX500 TRANSCEIVER
OPERATOR NOTE
1892 1236

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

The Wood & Douglas SX500 UHF transceiver is intended to fulfil numerous OEM applications by virtue of its highly flexible synthesized design approach, miniature size and cost-effective performance. The transceiver can accept analogue and digital data input and provides an RF output power of 100mW (adjustable down to 10mW, refer to Sales Office for details). The unit complies with both MPT1329 and MPT1361 for license exempt use in the UK, as well as being approved to the EN 300 220 specification for use throughout Europe. The module is also approved to the EMC specification ETS 300 683.

The equipment approvals restrict the use of the equipment in the following manner:

Module use	Mobile and Portable
Power Supply	5.5 - 15V DC (but not approved for use with a vehicular power supply)

The following paragraphs detail the restriction of use against these specifications.

MPT1329 & MPT1361 Restrictions of Use

This transceiver is approved for license exempt use in the UK on specific frequencies as shown in Table 1. The maximum Effective Radiated Power (ERP) for MPT1329 is 500mW and for MPT1361 is 100mW. This means that an antenna with ≤0dB gain must be used when the equipment is operating on MPT1361 frequencies.

A label must be applied to the outside of the equipment containing the following details:

Module designation:	SX500
Radio Regulatory marking:	as per table 1 for each frequency
CE text	*This product contains CE marked module SX500"*

EN 300 220 Restrictions of Use

When used in the band 433.050 - 434.790MHz the unit output power must be set to ≤10mW with an antenna gain of ≤0dB.

The duty cycle of the equipment is limited when used in the 433.050 - 434.790MHz frequency band.

Note: the duty cycle of a module is defined as the ratio of the total on-time of the "message" to the total off time in any one hour period.

The transmit/receive duty cycle must be < 10% in operation. The end user equipment must include this control to conform to the license exempt operation in this band.

Frequency (MHz)	Restrictions	Equipment Marking
458.5000	Band Edge	
458.5125		SRD SI 1993/1591-15-GB
458.5250		SRD SI 1993/1591-15-GB
458.5375		SRD SI 1993/1591-15-GB
458.5500		SRD SI 1993/1591-15-GB
458.5625		SRD SI 1993/1591-15-GB
458.5750		SRD SI 1993/1591-15-GB
458.5875		SRD SI 1993/1591-15-GB
458.6000		SRD SI 1993/1591-15-GB
458.6125		SRD SI 1993/1591-15-GB
458.6250		SRD SI 1993/1591-15-GB
458.6375		SRD SI 1993/1591-15-GB
458.6500		SRD SI 1993/1591-15-GB
458.6625		SRD SI 1993/1591-15-GB
458.6750		SRD SI 1993/1591-15-GB
458.6875		SRD SI 1993/1591-15-GB
458.7000		SRD SI 1993/1591-15-GB
458.7125		SRD SI 1993/1591-15-GB
458.7250		SRD SI 1993/1591-15-GB
458.7375		SRD SI 1993/1591-15-GB
458.7500		SRD SI 1993/1591-15-GB
458.7625		SRD SI 1993/1591-15-GB
458.7750		SRD SI 1993/1591-15-GB
458.7875		SRD SI 1993/1591-15-GB
458.8000		SRD SI 1993/1591-15-GB
458.8125		SRD SI 1993/1591-15-GB
458.8250	MPT1361 Only	SRD SI 1993/1591-4-GB
458.8375	MPT1361 Only	SRD SI 1993/1591-9-GB
458.8500		SRD SI 1993/1591-15-GB
458.8625		SRD SI 1993/1591-15-GB
458.8750		SRD SI 1993/1591-15-GB
458.8875		SRD SI 1993/1591-15-GB
458.9000	MPT1361 Only	SRD SI 1993/1591-11-GB
458.9125		SRD SI 1993/1591-15-GB
458.9250		SRD SI 1993/1591-15-GB
458.9375		SRD SI 1993/1591-15-GB
458.9500	Band Edge	

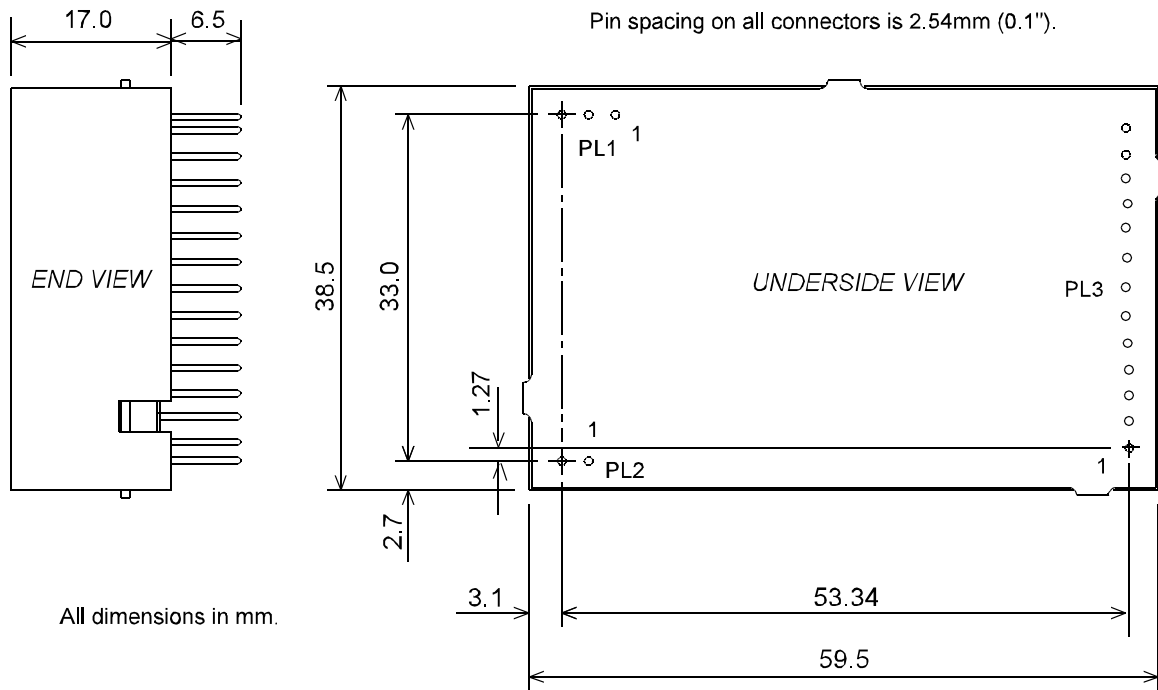Table 1   MPT1329 & MPT1361 Frequency Allocations

INSTALLATION

Figure 1   SX500 Outline Drawing

CONNECTION

Connection to the SX500 transceiver is via PL1, PL2 and PL3 which plug directly into the user's own equipment. The location of these connectors is shown in Figure 1 and detailed in the following tables.

PL1 PIN	NAME	FUNCTION	REMARKS
1	0V	0 volts	common ground
2	RF O/P	RF output	50 ohms output
3	0V	0 volts	common ground

Table 2   PL1 Pin Connections

PL2 PIN	NAME	FUNCTION	REMARKS
1	+VRAW	DC Supply Input	5.5 - 15V DC input
2	0V	0 volts	common ground

Table 3   PL2 Pin Connections

PL3 PIN	NAME	FUNCTION	REMARKS
1	$\overline{\text{TXE}}$	Transmit Enable	< 0.5V = Transmit ON (internal 20kΩ pullup)
2	DI	Data Input	Digital: DC coupled TTL compatible
3	AI	Analogue Input	Analogue : 750 mV p-p nominal
4	RSSI	Received Signal Strength Indication	RSSI: 0.5 - 2.0 V, 60dB dynamic range (<33kΩ output impedance)
5	$\overline{\text{SQ}}$	Squelch	Open drain to <0.4V with 10kΩ load. Low = No Signal
6	AF	Audio Output	250mV p-p nominal (~1kΩ output impedance) **Note** inversion of audio from TX input to RX output
7	DATA O/P	Data output	Open collector digital output **Note** inversion of data from TX input to RX output
8	+VOUT	+ 5 volt supply output	VOUT= 50mA maximum current drain
9	0V	0 volts	common ground
10	RS232 I/P	serial programming i/p	RS232 programming input **Note** inverted TTL level data can also be used. If not used, leave not connected, or connect to ground.
11	RB1	parallel frequency select	internal pull-up to +5V, active low
12	RB2		
13	RB3		

Table 3   PL3 Pin Connections

FREQUENCY PROGRAMMING

An area of the PIC memory is re-programmable and allows up to 24 channels to be set to random frequencies and 232 channels to be set to sequential frequencies. The first 8 of the random frequencies can be accessed in parallel mode using the three programming pins RB1, 2 and 3. To access the rest of the channels, the serial programming mode is required. The channel change can be controlled through this serial input.

The Windows® based software supplied with the SX500 transceiver allows both a new channel to be selected as well as the re-programming of the internal frequency information.

The software can be run on a PC with the serial port connected to PL3 of the SX500 transceiver via a suitable adaptor as shown in Figure 2. If the internal stored data is to be accessed, the read-back function is desired, then PL3 pin 13 of the transceiver must be connected to pin 2 of the PC serial port via a buffer circuit. A 1k pull-up resistor to +5V must also be provided as shown.

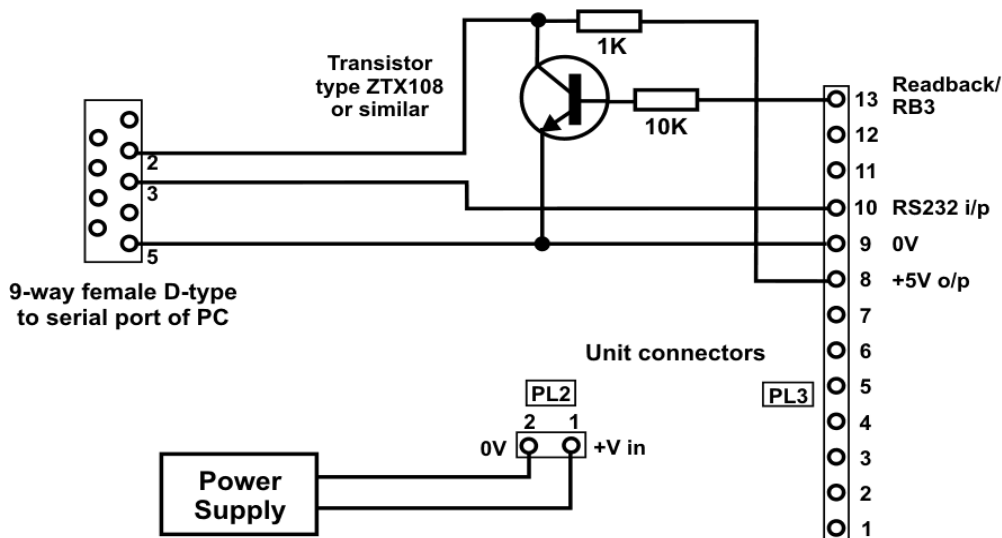### Software Installation

Figure 2   Programming Adaptor

The software is installed by following the normal procedures for installing windows based software.

Insert CD or the first floppy disk and run the "setup.exe" program. Follow the on-screen instructions and the s/w will be installed into the c:\program files\sx500 directory (WIN98) or c:\programs\sx500 (WIN95) directories. A program icon will be placed in the s/w group designated during the installation routine.

Running the Software

The s/w is accessed after installing by a single click on the SX500 icon. A screen page as shown in the following figure will be displayed. All functions are accessed through this screen.

The fields shown in colour can be accessed and modified. Those field shown in grey are fixed by the hardware of the SX500 and cannot be changed by the user.

Data is accessed by moving through the fields using the mouse or the TAB key. Where data can be modified, a short description of the data is shown at the bottom of the screen as an aide-memoir.

There are 4 main areas of the screen plus the drop-down menu buttons at the top of the screen. The default settings of the screen give the user access to the common data to be modified through these four areas:

Random Channel Table	This gives access to the first 24 channels which can be set to any random frequency.
Sequential Channel Table	This gives access to the 232 channels which can only be sequential
Current Settings	This sets up the program parameters
Unit Program Commands	This area sets up the data transfer to and from the SX500

Top Level Menu

File   *Load*   Load a pre-stored set of data.

A file list is displayed which can be selected and loaded by using the mouse, highlighting and double clicking.

Save   Save the current set of data

A set of directories are displayed. When in the correct directory, over-write the default file name displayed and click or hot <ENTER>.

Print   Print the current set of data.

The currently selected Windows default printer will be used.

Exit   Exit the program.

View *Internal EEPROM Contents*

This displays in a separate window the contents of the units EEPROM. The data displayed is for the functions and channels displayed on the main screen at that time. Data can be hand-modified by moving highlighting the data and over-writing it. THIS SHOULD ONLY BE CARRIED OUT WITH FULL KNOWLEDGE OF THE INTERNAL WORKING OF THE SX500. Note that the type of data in each field is displayed at the bottom of the window.

While this window is displayed, no access is available to the main screen. The window must be cleared down by clearing the "tick" in the View drop-down menu.

Unit Settings

PIC Code   only displayed when the Readback function has been used to download the contents of the EEPROM.

Current Settings Data

COM port	Select the correct serial port for the connection to the SX500, default COM1.
Intermediate Frequency	The Intermediate Frequency is fixed by the hardware and cannot be accessed
Fosc	The oscillator frequency is fixed by the hardware and cannot be accessed.
Comparison Freq. (Fc)	The channel step size is fixed by the hardware at 12.5 kHz. For 25kHz or other channel spacings, set the Table Step size accordingly.
Minimum Frequency	The minimum frequency is used by the software as a base-line for all other frequency information. This frequency is determined by the physical build of the unit and how it has been aligned. The s/w will not allow a frequency below this minimum to be selected. This frequency is stored in the non-volatile EEPROM in the unit.

Maximum Frequency	The maximum frequency that the unit can work on is determined by the physical build of the unit and the alignment of the unit. If a frequency outside the alignment band is selected then the operation of the SX500 will no longer be to the stated specification. The maximum switching frequency over which the unit will operate is 5MHz. The software uses this 5MHz limit to calculate the maximum frequency from the minimum set and uses this for the selectable frequencies in the drop-down list displayed when selecting frequencies. This 5 MHZ band can be different for the transmit and receive frequencies.
Receiver Offset	The normal operation of the SX500 is with the transmit and receive frequency the same. If an offset is required, a fixed offset can be made between the frequencies by double-clicking to bring up a selection of offsets. If a frequency outside the alignment band is selected then the operation of the SX500 will no longer be to the stated specification
Max. Channel Number	This number will determine how many sequential channels are programmed into the table.
Serial/Parallel	To ensure the correct operation of the unit after programming set this flag accordingly. After programming the unit the serial or parallel mode will be set according to this selection.
Serial Channel No.	To change channel select a new channel number by right-clicking to bring up a list or double-clicking to select the field to modify.

Random Channel Table

The first 24 channels of the SX500 can store randomly selected channels, which are non-sequential or separated by a common gap. To change an existing frequency, double-click the particular channel. Either type in a new frequency or select from a displayed list of allowed frequencies.

Sequential Channel Table

To program these frequencies, ensure that the Max. Channel Number field in the "Current Settings" is set correctly. Under the "Sequential Channel Table" area enter the start frequency and the Table Step size to set the frequencies in the table.

Unit Programming Commands

To access these 4 functions, double-click on the text or highlight and press ENTER.   When accessed, the relevant data areas on the other three screen areas are highlighted to show which data is being transferred.

Set parallel ch. mode	Changes the SX500 from serial channel selection mode to/from parallel.
Read from the unit	Download the data from the SX500, assuming that the correct interface lead has been made.
Program unit	Send all the data displayed on the screen to the unit.
Program serial channel	Send the new serial channel number to the unit.

Parallel Channel Selection

Three inputs RB1, RB2 and RB3 applied to PL3 pins 11, 12 and 13 respectively, select the operating channel as shown in the following table:

CHANNEL SELECTION			
Most Significant Bit		Least Significant Bit	CHANNEL
PIN 13	**PIN 12**	**PIN 11**	
LOW	LOW	LOW	7
LOW	LOW	HIGH	6
LOW	HIGH	LOW	5
LOW	HIGH	HIGH	4
HIGH	LOW	LOW	3
HIGH	LOW	HIGH	2
HIGH	HIGH	LOW	1
HIGH	HIGH	HIGH	0

The logic levels are: LOW = < 0.8V,
HIGH = > 2V or floating

TECHNICAL SPECIFICATION

Transceiver (Overall)	
Frequency Range	400 - 500 MHz (banded)
Switching Bandwidth	5MHz
Channel Spacing	12.5, 20 and 25 kHz
Number of RF Channels	8 selectable with an external 3 line select 255 selectable via a serial interface 32 random and 255 sequential
Frequency Stability	±2.5ppm
Supply Voltage	5.5 - 15V DC
Supply Current Transmit Receive	<100mA at 7.2V DC < 40mA at 7.2V DC
Duty Cycle	100% max
Interface Connections	Refer to Figure 1
RF Connection	Via PCB Pins
Size	59.5 l x 38.5 w x 17.0 h mm
Weight	≈ 30g
Temperature (operating)	-25°C +55°C
Temperature (storage)	-30°C +80°C
Approvals	ETS 300 220, ETS 300 683

Transmitter	
RF Output Power	100mW +1, -2 dB adjustable down to 1mW
Receive to Transmit Switching Time	<25ms
Power-on settling time	<60ms
Modulation Input	Analogue : 750 mV p-p nominal Digital: DC coupled TTL compatible
Frequency Response	<10 - 3000 Hz flat (at -3dB)

Receiver	
Sensitivity	-115dBm/12dB SINAD at 25kHz channel spacing
AF Output	250mV p-p into 10kΩ (muted by Squelch)
RSSI Output	0.5 - 2.0V with 60dB range and 33kΩ o/p impedance
Squelch Type	Noise operated with hysteresis.
Squelch Flag	Open collector to <0.4V with 10kΩ load. Low = No Signal

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