Tactical Electronics Corporation

SX450 G TRANSCEIVER
OPERATING INSTRUCTIONS

13 December 2006

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

The SX450 G is a high-performance synthesized UHF transceiver for use in radio telemetry applications. The transceiver provides a maximum power output of 500mW and is designed to meet European standards EN 300 220, EN300 086 and EN300 389. The unit also complies with USA FCC and Industry Canada standards.

Two versions are available, the SX450 GA and the SX450 GC. They differ only in connections, and are functionally identical.

DIMENSIONS AND FIXING

The SX450 G is intended to fit easily and with minimum space requirements into the user's own equipment housing.

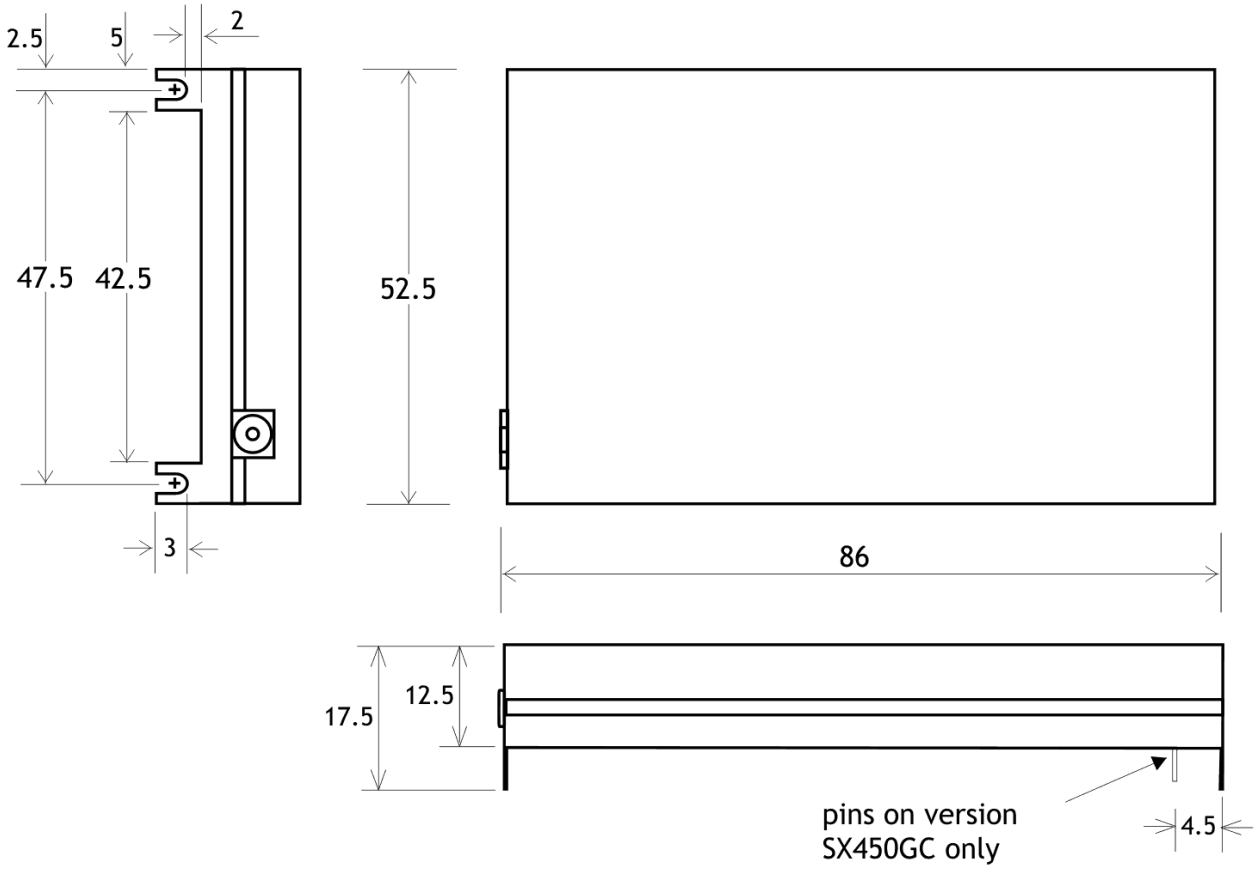

Figure 1 SX450 G fixing detail

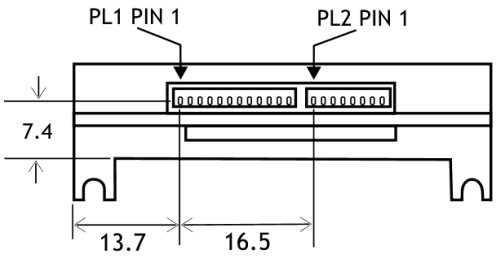

Figure 2 - SX450 GA connectors

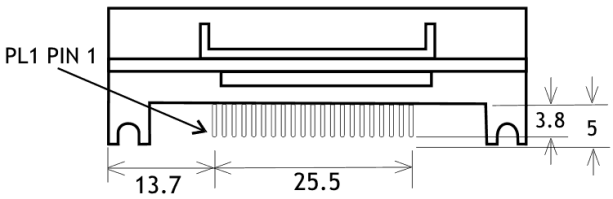

Figure 3 - SX450 GC connector

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 47.5mm using four M2 screws.

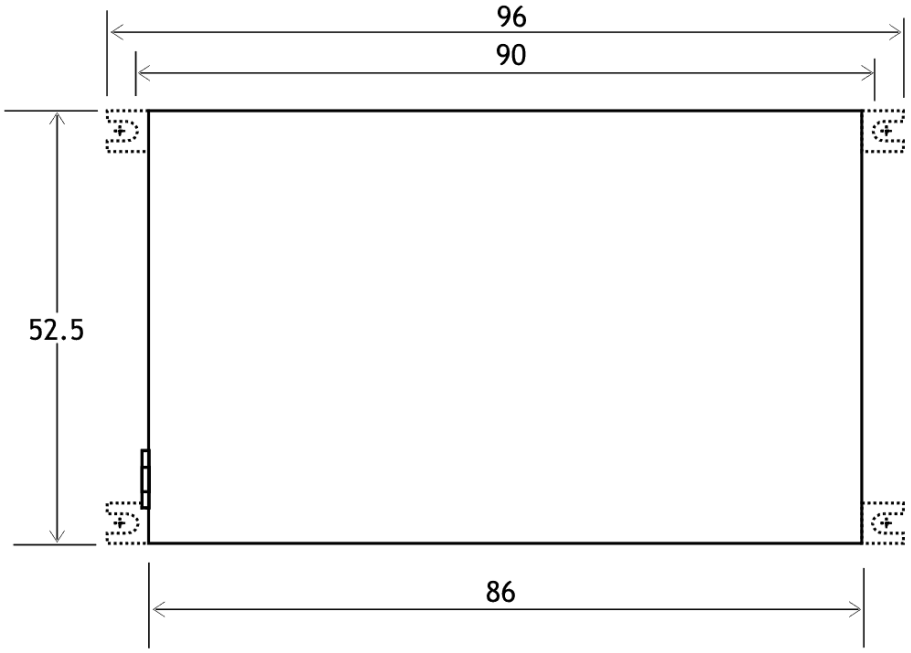

Figure 4 - Alternative mounting dimensions

CONNECTIONS

The radio antenna connects via an MMCX 50Ω socket.

All other connections to the SX450 GA 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.

All other connections to the SX450 GC transceiver are made via a 21-way SIL PCB connector, PL1.

SX450 GA	SX450 GC	NAME	FUNCTION	REMARKS
PL1-1	PL1-1	0V	0 volts	common ground
PL1-2	PL1-2	STBY	standby input	LOW (<+0.6V) = transceiver enabled HIGH (>+2.0V) = standby mode (internal pull-up, 40K to +4V max)
PL1-3	PL1-3	HI/LO	TX RF power select input	>+2.0V = high power, <+0.8V = low power (internal pull-down, 10K to 0V)
PL1-4	PL1-4	+Vin	positive supply input	+5.5 to +9.0 V input (-ve earth)
PL1-5	PL1-5	$\overline{\text{TXE}}$	transmit enable input	HIGH (>+2.0V) = receiver enabled LOW (<+0.8V) = transmitter enabled (internal pull-up, 100K to +5V)
PL1-6	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). Mode selected depends on the logic state: HIGH > 1ms (>+2.0V) = parallel data input LOW (<+0.8V) = serial data input (internal pull-up, 50K to +3V)
PL1-7	PL1-7	CS0/DT	CS0 - channel select input (LSB) DT - synthesizer serial data input*	Channel select inputs use inverted 5V logic levels; HIGH (>+2.0V) = logic 0, LOW (<+0.8V) = logic 1 CS0 to CS5 are used for channel selection by 6-bit parallel data (Internal pull-ups 100K to +5V) (* DT/CK/EN inputs are used for direct control of the synthesizer, this is a separate version of the SX450.)
PL1-8	PL1-8	CS1/CK	CS1 - channel select input CK - synthesizer programme clock *	
PL1-9	PL1-9	CS2/EN	CS2 - channel select input EN - synthesizer enable strobe input*	
PL1-10	PL1-10	CS3	channel select input	
PL1-11	PL1-11	CS4	channel select input	

PL1-12	PL1-12	CS5	channel select input (MSB)	
	PL1-13	-	not connected	-
PL2-1	PL1-14	RF DET	TX RF present flag output	HIGH (+5V, internal 10K pull-up) = TX RF present LOW (0V) = no TX RF NOTE: only available when high TX RF power is selected
PL2-2	PL1-15	AF O/P	receiver audio output	600mV p.p. nom. into 10K; AC-coupled; Rout = 2K3.
PL2-3	PL1-16	SQO	squelch flag output	NPN open collector via 470Ω; ON = no signal, OFF = signal present. (NOTE: OFF when transceiver in standby mode)
PL2-4	PL1-17	OOL	out-of-lock output	NPN open collector via 470Ω; ON = out of lock (NOTE: OFF when transceiver in standby mode)
PL2-5	PL1-18	DMOD	digital modulation input **	+3V to +12V square wave, DC-coupled ** DMOD and AMOD may not be used simultaneously. Leave unused input unconnected.
PL2-6	PL1-19	AMOD	analog 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	PL1-20	RSSI	'S' meter output	0V to +3V output, rising with received signal level (typ. 50dB range)
PL2-8	PL1-21	SQOR	squelch override input	HIGH (>+2.0V) enables AF O/P regardless of squelch state (RX only) LOW (+0.8V or o/c) = normal operation (internal pull-down, 70K to 0V)

OVERVIEW OF FREQUENCIES AND PROGRAMMING

Each radio is built to order to cover a band (the *switching bandwidth*) of 15 or 20MHz within the range 400 - 490MHz. Available bands are 400-415, 415-430, 430-450, 450-470, and 470-490MHz. Each radio is also manufactured to work with a particular channel width of 12.5kHz, 20kHz or 25kHz. These are fixed parameters, and cannot be changed by the user.

Within the switching bandwidth, the unit can operate on any frequency (provided it is a whole multiple of the comparison frequency - see page 9), and up to 256 frequencies can be stored as numbered channels 0 to 255.

There can also be an offset between transmit and receive frequencies, which is the same for all channels. You can set this offset, but both transmit and receive frequencies must remain within the switching bandwidth, fixed at manufacture.

During operation, a channel can be selected at any time either using logic lines or a serial data input. Logic lines can only select channels 0-63, serial commands can select any channel.

Before the unit leaves the factory, each of 256 channels is allocated to a frequency, but you can reprogram them if you wish. To do this, you need to read the existing data from the unit, edit it using a special program supplied by Wood & Douglas (SXWIN.EXE), which runs on a PC under Windows, then write the data back to the unit.

You can program the unit in one of two ways:

- 256-channel mode: All 256 channels 0-255 can be programmed, but as a block by entering a starting frequency and a step size, so that they contain uniformly spaced frequencies.

- 80-channel mode: Each of channels 0-79 can be individually programmed with any frequency, but the remaining channels 80-255 are not available for use.

One channel is then nominated as the operational channel.

CONNECTING THE UNIT TO A PC FOR PROGRAMMING

In order to program the unit, the unit and a PC (IBM-compatible personal computer) must communicate via an asynchronous RS232 serial link. The unit also requires a power supply.

The adaptor of **Figure 3** provides these connections.

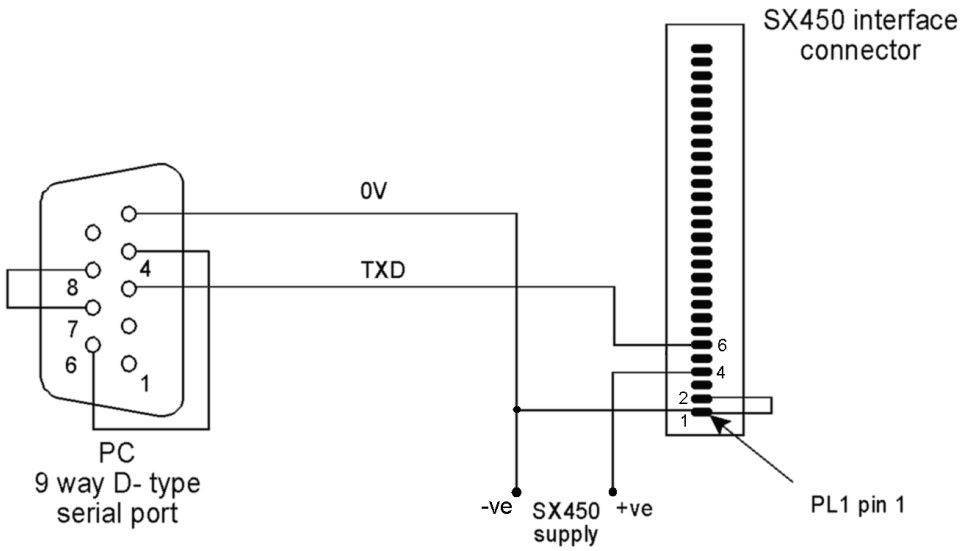

Figure 5 - Adaptor to connect a PC to an SX450 G

The power supply should source between 4.5V and 16V DC at approximately 60mA.

CHANNEL SELECTION DURING OPERATION

There are three ways to select a channel during operation:

- In hardware, using six logic lines to select channels 0-64
- Using the SXWIN.EXE software and a serial connection from a PC to the unit
- By sending a short serial data message to the unit from your own equipment.

Parallel Channel Selection

- PL1 pin 6 must be logic high (>2.0V) or high-impedance (e.g. no connection) to select parallel channel selection. This can be done at any time.

- Only channels 0 - 63 are available in this mode

The six channel select inputs are an inverse binary representation of the channel number, that is, switch ON = input LOW = logic 1. If no connections are made, the unit therefore defaults to channel 0.

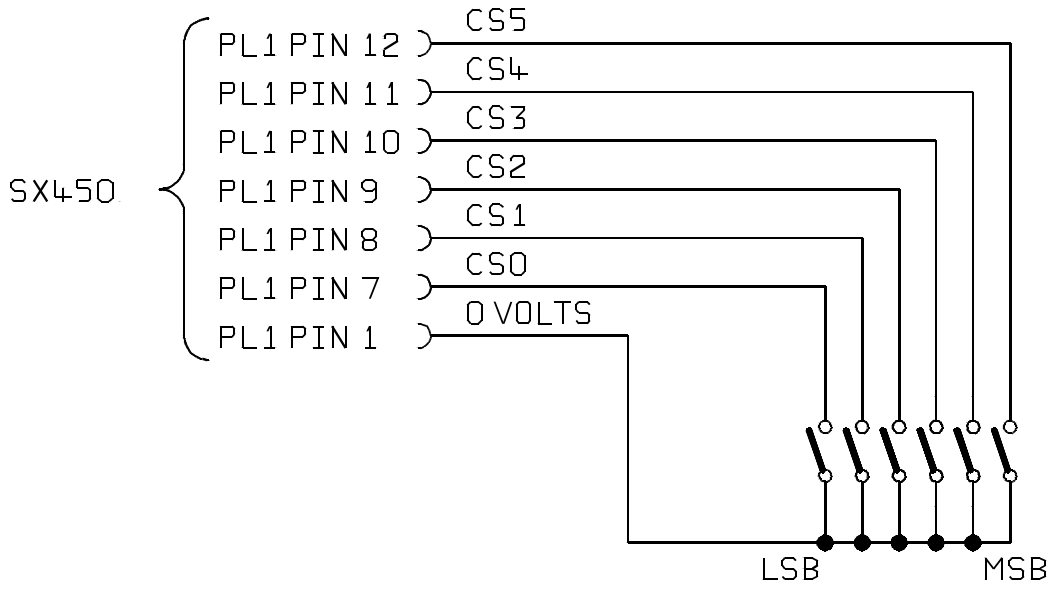

Figure 6 - Parallel channel selection

Changes are implemented immediately.

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

Serial Channel Selection

- PL1 pin 6 must be logic low (<0.8V) to select serial channel selection. This can be done at any time.

- Channels 0 - 255 are available in this mode

When PL1 pin 6 is first taken low (or it is low at power-up), the unit operates on the channel most recently selected in serial mode. This setting is remembered during unit power off.

The channel can be changed by sending a serial channel number as an RS232 character on PL1 pin 6. The SXWIN.EXE software has the ability to do this, or you can use your own equipment. The protocol is:

9600 baud, RS232 levels, 1 start bit - 8 bit data - no parity - 1 stop bit

Single-byte, channel number in binary, LSB first (decimal 0 to 255)

As soon as the character is recognised as a valid RS232 character, the channel is changed. No confirmation is required.

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 analog signals

Range versus TX power			
Frequency (MHz)	**Power (mW)**	**Power (dBm)**	**Range (km)**
458.5	1mW	0	0.5
458.5	10mW	10	1.7
458.5	100mW	20	5.3
458.5	500mW	27	11.9

TECHNICAL SPECIFICATION

General

Frequency range	400-490MHz available. Specify 400-415, 415-430, 430-450, 450-470 or 470-490MHz when ordering.
Switching bandwidth	15 or 20MHz depending on band ordered.
Frequency stability	±2.6ppm over operating temperature
Channel switching delay	100ms maximum (over 20MHz switching bandwidth)
Channel selection	64 channels maximum using 6-bit parallel logic line input. 256 channel maximum sequential, 80 individually programmed using serial data word.
Channel spacing	12.5kHz/20kHz/25kHz available
Modulation type	F1D/F2D/F3D
Spurious emissions	(conducted & radiated) In accordance with ENI/CEPT
Supply voltage	4.5 to16V DC negative earth
Supply current at 7.2V	60mA typical (receive), 400mA typical for 500mW output (transmit)
Interface connections	21 pin SIL PCB connection (SX450 GC) 1 x 8 + 1 x 12 way 1.27mm pitch Molex plug with mating connectors + 200mm leads (SX450 GA)
RF connection	PC mounted socket
Operating temperature	-30°C to +55°C
Storage temperature	-30°C to +70°C
Size overall	85 x 55 x 12.7mm
Weight	81g
Type approvals - complies with:	EN300 220, EN300 389 (EMC), EN300 086, FCC Part 90 and Part 15

Transmitter

RF output power into 50Ω	500mW (HI) (+0/-1.5dB) 5mW (LO)
TX/RX switching time	<25ms
Modulation input analogue digital	 750mV p-p, AC-coupled +3 to +12V square wave DC-coupled
Frequency response	9Hz to 3kHz at -3dB (analog input) (optional extended response to 6kHz for 9600 baud GMSK)
Frequency deviation 25kHz channel spacing 20kHz channel spacing 12.5kHz channel spacing	 ±3.0kHz nominal (±4.0kHz max) ±2.3kHz nominal (±3.0kHz max) ±1.5kHz nominal (±2.0kHz max)
Adjacent channel power	<200nW (-37dBm)
Facilities	RF detect output (+5V = TX on) (HI power only)

Receiver

Sensitivity	<-115dBm for 12dB SINAD (Measured with flat audio response) <-107dBm for 20dB SINAD (Measured with flat audio response)
Image rejection	>70dB
Intermodulation rejection	>65dB
Blocking	>84dB
Spurious rejection	>70dB
Intermediate frequencies	45MHz and 455kHz
Adjacent channel rejection 12.5kHz channel spacing 20/25kHz channel spacing	 >60dB >70dB
Recovered audio level	600mV p-p (±20%) into 10K
Squelch type	Noise operated
Squelch output	NPN open collector via 470Ω ON = no signal, OFF = signal present
Facilities	RSSI output (0 to +3V nominal from 2K2 source) Squelch override input
STBY input Standby current	150µA typ for HI/LO input = 0V

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