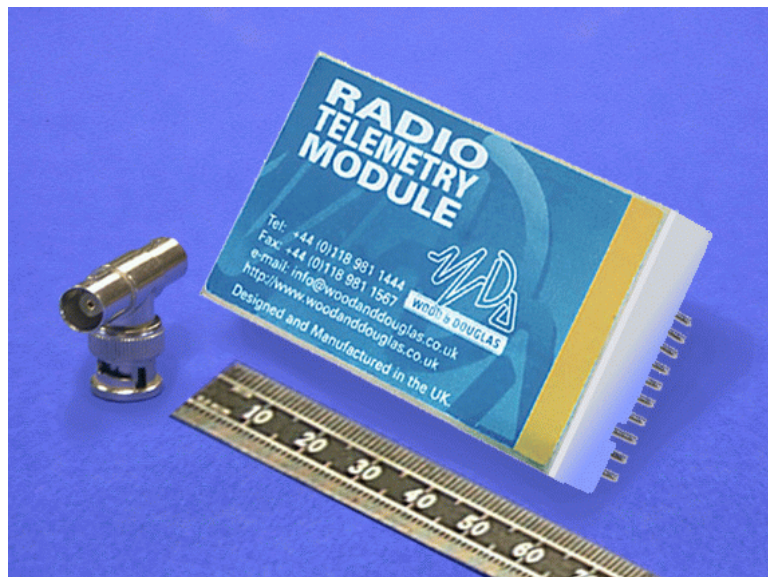**WOOD & DOUGLAS**

> **SR500 RECEIVER**
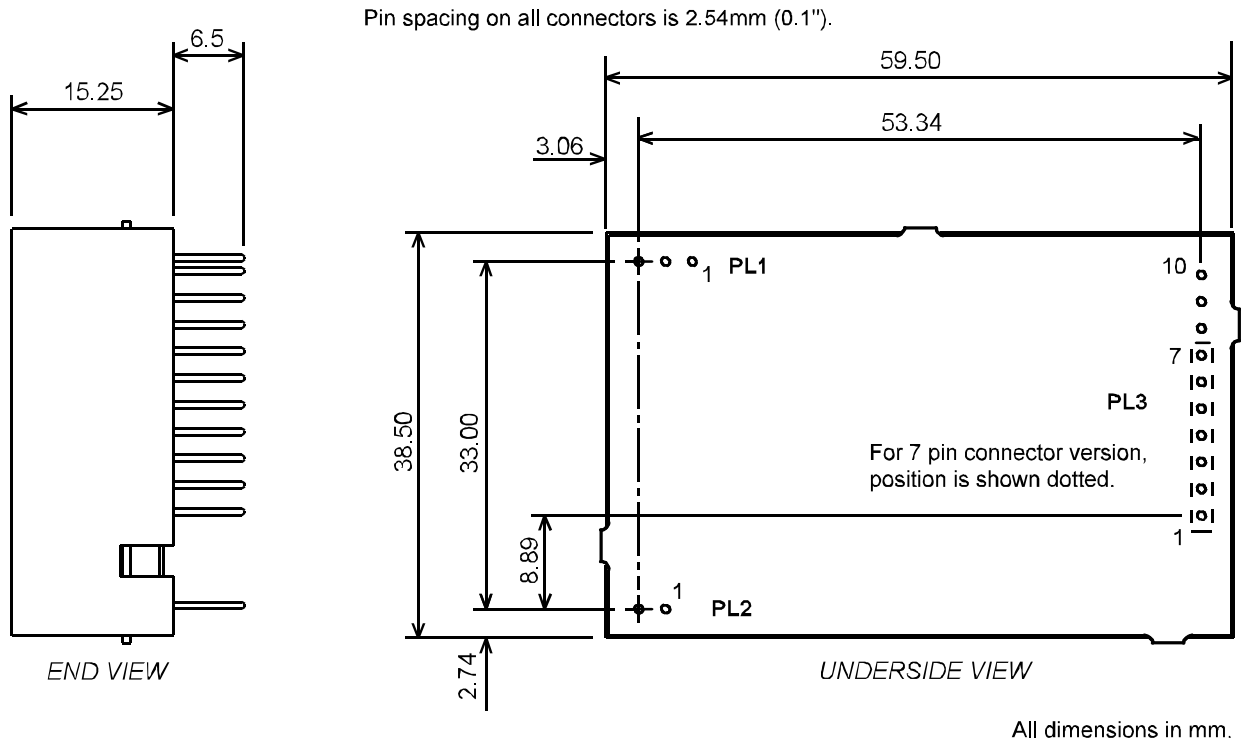> **OPERATING INSTRUCTIONS**
> 1892 1211

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

The Wood & Douglas SR500 UHF synthesized receiver is intended to fulfil numerous OEM applications by virtue of its highly flexible synthesized design approach, miniature size and cost-effective performance. The unit complies with MPT1329 and as such does not require an operating licence in the UK. It is also approved to various EC specifications.

DIMENSIONS AND FIXING

The unit is intended for PCB mounting within the customer's equipment.

Pin spacing on all connectors is 2.54mm (0.1").

END VIEW

UNDERSIDE VIEW

All dimensions in mm.

For 7 pin connector version, position is shown dotted.

Figure 1 - SR unit dimensions and connectors

CONNECTION

Connection to the unit 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.

PIN	NAME	FUNCTION	REMARKS
1	0V	0 volts	common ground
2	RF I/P	RF input	50Ω input
3	0V	0 volts	common ground

Connector PL1 pin detail

PIN	NAME	FUNCTION	REMARKS
1	+VIN	positive supply	+6.0V to +14.0V
2	0V	0 volts	common ground

Connector PL2 pin detail

PIN	NAME	FUNCTION	REMARKS
1	RSSI	S meter output	0.5 - 2V signal strength indicator, 60dB range
2	SQF	Squelch flag	open collector output, ON (low) = no signal (15V max)
3	AUDIO	AF output	250mV p-p ±20% into 10kΩ **Note:** The output audio is inverted with respect to the ST500 (or similar Wood & Douglas product) audio input.
4	DATA	Data output	open collector, no pull-up (14V max) **Note:** The data output is inverted with respect to the ST500 (or similar Wood & Douglas product) data input.
5	+5V	+5 volt supply output	50mA maximum permissible current drain
6	0V	0 volts	common ground
7	RS232 I/P	serial programming input	RS232 programming input **Note:** inverted TTL level data can also be used. If not used, leave not connected, or connect to 0V
8	RB1	parallel frequency select	internal pull-up to +5V, active low low < 0.8V high > 4.0V
9	RB2		
10	RB3		

Connector PL3 pin detail

OPERATING FREQUENCIES

Each radio is made to order to cover a band (the switching bandwidth) of 5MHz within the range 400 - 470 MHz. Each radio is also manufactured to work within a particular channel width of 12.5kHz, 20kHz or 25kHz. Within the switching bandwidth, the unit can operate on any frequency provided it is a multiple of the channel width, and up to 128 frequencies can be stored as numbered channels. Before the unit leaves the factory, each of the 128 channels is allocated to a frequency, but you can reprogram them if you wish.

The first 16 channels can be individually programmed, and the remaining 112 are sequentially programmed by entering a starting frequency and a step size. The programming is done using Wood & Douglas software (STSRn00.exe) which runs on a PC under Windows. The PC and the unit communicate via an asynchronous RS232 serial link.

In order to reprogram the unit, an adaptor must be used to connect the unit to the serial port of the PC and a power supply. This also inverts the readback output of the unit and converts from TTL to RS232 levels for the PC. See the Appendix on page 13 for a suitable adaptor.

OBTAINING AND RUNNING THE PROGRAMMING SOFTWARE

1.   Download the latest version of the programming software from the Wood & Douglas site on the internet. The URL (address) is:

http://www.woodanddouglas.co.uk/products/software/stsrn00.exe

In case of difficulty, contact Sales at Wood & Douglas.

- Note that you must have software version 1.00.21 or greater to program units labelled "13MHz TCXO"

2.   Connect the unit to a suitable supply and to the PC using the programming adaptor (see page 13).

3.   Run the STSRn00.exe program. It will run in a full-screen character session.

- Please note that mouse operation is not supported with this program.

4.   You are prompted to enter the serial port number of the PC which is used to communicate with the unit. Type 1 or 2 and press the <enter> key.

5.   In the same way, follow the prompt to select transmitter or receiver: 1: STn00
                                                                              2: SRn00

6.   Finally, select the frequency range: 1 : ST/SR100 (125 - 180MHz)
                                                    2 : ST/SR500 (400 - 500MHz)
                                                    3 : ST/SR800 (860 - 880MHz)

At this stage, the main menu screen is displayed as shown in **Figure 2**. The screen shows the default settings which are displayed whenever the STSRn00 software is run.

```
    STSRn00 Programmer v.1.0.21

    Chan   0     458.5        MHz <<     Comparison freq.    12.5 kHz
    Chan   1     458.5125     MHz        Ref. (TCXO) freq. 12.8 MHz
    Chan   2     458.525      MHz        Parallel channel select
    Chan   3     458.5375     MHz
    Chan   4     458.55       MHz
    Chan   5     458.5625     MHz
    Chan   6     458.575      MHz     ┌────────────────────────────────┐
    Chan   7     458.5875     MHz     │COMMANDS:                        │
    Chan   8     458.6        MHz     │                                 │
    Chan   9     458.6125     MHz     │F2  :copy Ch 16-31 to Ch 0-15    │
    Chan  10     458.625      MHz     │F3  :change comparison frequency │
    Chan  11     458.6375     MHz     │F4  :set parallel ch. mode       │
    Chan  12     458.65       MHZ     │F5  :read from unit              │
    Chan  13     458.6625     MHz     │F6  :program unit                │
    Chan  14     458.675      MHz     │F7  :program serial channel      │
    Chan  15     458.6875     MHz     │F12:QUIT                         │
                                      └────────────────────────────────┘
    Start table 458.7        MHz
    Max. Freq.  458.95       MHz        Sequential frequencies, Chan. 16 to 127
    Table step 1 x 12.5      kHz
```

Figure 2 - Programming screen

Note: Comparison and Ref (TCXO) frequencies are display-only, and cannot be
programmed by the user.

PROGRAMMING THE UNIT

Three steps are necessary:

- Upload values from the unit
- Edit the values
- Download values to the unit

Uploading Current Unit Settings (F5)

First, you must read into the computer what is in the unit's memory at present. To do this, press F5. The data replaces the default on the screen.

- The program insists that you do this before allowing you to reprogram the unit to make it less likely that inappropriate values be entered.

- However, once you have uploaded during a session, you may edit and download the data to as many units as you wish.

  *Caution: If you do this, you must ensure that the units are all of the same type. Check that all units are of the 13MHz TCXO type ("13MHz TCXO" label affixed opposite serial number label) or the 12.8MHz TCXO type (no such label). If you change unit type, you **must** use F5 again.*

Programming Individual Channels (0-15)

To set the frequency of one of the first 16 channels (0-15), which can be individually set, use the arrow keys to move the highlight over that channel and type in a frequency in MHz.

- The entered value must be an integer multiple of the Comparison Frequency shown at the top right of the screen, otherwise an 'invalid' message is displayed.

- Make sure that the value is within the switching bandwidth of your unit, as the software cannot prevent you from inserting an inappropriate value.

Press the <enter> key to complete.

Programming Sequential (Table or Block) Channels (16-127)

To set the frequency of channels 16-127, which can only be allocated as a block, use the arrows to highlight Start Table and type in the lowest frequency (channel 16).

- The entered value must be an integer multiple of the Comparison Frequency shown at the top right of the screen, otherwise an 'invalid' message is displayed.

Press <enter> then move the highlight to Table Step and type in the spacing between channels in multiples of the Comparison Frequency shown at the top right. For example, if the Comparison Frequency is 12.5kHz, enter 2 for a spacing of 25kHz.

- Make sure that the Start and Maximum frequencies are within the switching bandwidth of your unit, as the software cannot prevent you from programming inappropriate values.

Press <enter>.

All channels from 16 to 127 are automatically programmed according to the Table (start) Frequency and Table Step (channel spacing), and the Maximum Frequency is calculated and displayed.

- There is no way of viewing or editing the frequency of one particular channel, although it can be calculated from Table Start, Table Step and Maximum frequencies.

Setting a Maximum Frequency

When the Table Step is edited, the Maximum Frequency is recalculated and displayed. However, you can override this such that any higher values are replaced with this value. Thus all higher-numbered channels are programmed with this same frequency.

To do this, use the arrow keys to move the highlight over Maximum Frequency, type in a maximum frequency, and press <enter>.

- The entered value must be an integer multiple of the Comparison Frequency shown at the top right of the screen, otherwise an 'invalid' message is displayed.

Copying Values to the Individual Channels (F2)

To make programming easier, the first 16 channels of the sequential table (16-31) can be copied in one step to the individual channels (0-15) by pressing the F2 button, and then edited as described above.

Downloading New Settings to Unit (F6)

As yet, the settings have only been edited in the STSRn00 program. To download them to the unit, press F6.

- This is only permitted if F5 was previously used to upload settings at some point during the session.

Channel Selection Mode (F7 and F4)

Having programmed frequencies into the channels, you can specify which channel to use (channels 0-127) or that the channel will be selected by parallel logic levels (channels 0-7 only).

The unit defaults to serial channel selection whenever it has serial communications, which includes whenever the STSRn00.exe software communicates with it.

To select serial control, and a channel from 0-127 (which will be used until further commands are received), press F7. Type the new serial channel number and press <enter>

- The channel is displayed in 'Serial channel selected'.

- The channel command is sent to the unit immediately and becomes operative.

To enable parallel channel selection mode press F4 (Parallel channel mode).

- 'Parallel channel selected' is displayed. The channel number is unknown, because it depends on the logic levels applied to three inputs as described on page 4.

Parallel channel mode select (F4) must be the last action before disconnecting the unit: any further serial communication will reset it to serial mode.

Completing Programming

This completes programming and the unit may be disconnected. It is not necessary to switch off power or stop the program first.

Programming Further Units

Further units may be programmed by disconnecting one unit and connecting the next, which may be done without switching the power off.

- If you want to use the channel frequency settings from the previous unit, either as they are or as a basis for editing, do not stop the program, because it does not save settings between sessions.

- Note the caution on page 6 regarding mixed unit types

Proceed as above, using F6 to program the unit when all the channel parameters are correct, and selecting a channel number (F7) or parallel selection (F4) before disconnecting the unit.

CHANNEL SELECTION DURING OPERATION

There are three ways to select a channel during operation:

- In hardware, using three logic lines to select channels 0-7
- Using the STSRn00.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

- The unit must have been left in parallel mode when it was programmed (F4).

- Only channels 0 - 7 are available in this mode

The channel in use depends on the logic levels supplied to pins 8 to 10, as set out in the table below. If no connections are made, the unit defaults to channel 0.

CHANNEL SELECTION			
PIN 10 (RB3)	**PIN 9** (RB2)	**PIN 8** (RB1)	**CHANNEL**
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

Serial Channel Selection (using STSRn00.exe)

If the unit was programmed for serial channel selection (F7), it will operate on the channel nominated at that time. This setting is remembered during power off.

The channel can be changed by selecting a channel (press F7, type the channel number, press <enter>) whenever the PC is connected to the unit.

By making up a special adaptor, the PC could be connected to the unit in situ while it is operating.

Serial Channel Selection (own equipment)

If you want to select a channel using serial mode from your own equipment rather than using the supplied software, then you must use this protocol:

   1200 baud, RS232 levels, 1 start bit - 8 bit data - no parity - 1 stop bit

and send the following data sequence to the RS232 input, allowing at least 5ms between the characters in the data stream:

   x40 (decimal 64) synchronising code
   Channel number in hex (decimal 0 to 127) (in bits 0-6, msb = 0)
   x95 (decimal 149) confirmation byte

Any channel between 0 and 127 can be selected.

   • Any serial communication with the unit disables parallel selection.

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)
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

|		
Frequency range	:	400 - 430 MHz, 430 - 470 MHz
Switching bandwidth	:	5MHz
Frequency stability	:	±2ppm
Number of RF channels	:	up to 128, frequencies programmable within switching bandwidth (16 individually, 112 sequential table) using supplied software
RF channel selection	:	1 of 128 serial select (1200 baud RS232)
		1 of 8 3-wire parallel select
Channel switching delay	:	<50ms across switching bandwidth
Channel spacing	:	12.5kHz/20kHz/25kHz available
Modulation type	:	F1D/F2D/F3D
Spurious emissions (conducted & radiated)	:	in accordance with R&TTE directive
Supply voltage	:	6-14V DC, negative earth
Supply current at 7.2V	:	<40mA
Interface connections	:	2 + 10 pin 0.1" header
RF connection	:	3 pin 0.1" header
Operating temperature	:	-20°C to +55°C
Storage temperature	:	-30°C to +70°C
Weight	:	35g
Size	:	60 x 39 x 15mm (2.36 x 1.53 x 0.59 inches)
Type approval	:	MPT1329
Sensitivity	:	<-115 dBm for 12dB SINAD (12.5 kHz)
		<-117 dBm for 12dB SINAD (25 kHz)
		(Measured with a flat audio response)
Image/spurii	:	>60dB
Intermodulation response rejection	:	>60dB
Blocking	:	>75dB
Intermediate frequencies	:	45 MHz and 455kHz
Adjacent chan. selectivity	:	>60dB for 12.5kHz channel spacing
		>70dB for 25kHz channel spacing
Audio response	:	9Hz to 6kHz at -3dB (25kHz channels)
Recovered audio level	:	>250mV p-p (±20%) into 10kΩ
Squelch type	:	Noise-operated open collector output
General facilities	:	RSSI output (0.5 to +2V nominal)
		+5V output
		Independent data output

APPENDIX: TTL TO RS232 ADAPTOR

Many PCs do not require true RS232, and will work with the simple adaptor of **Figure 3**. The transistor used must have a gain of at least 30.
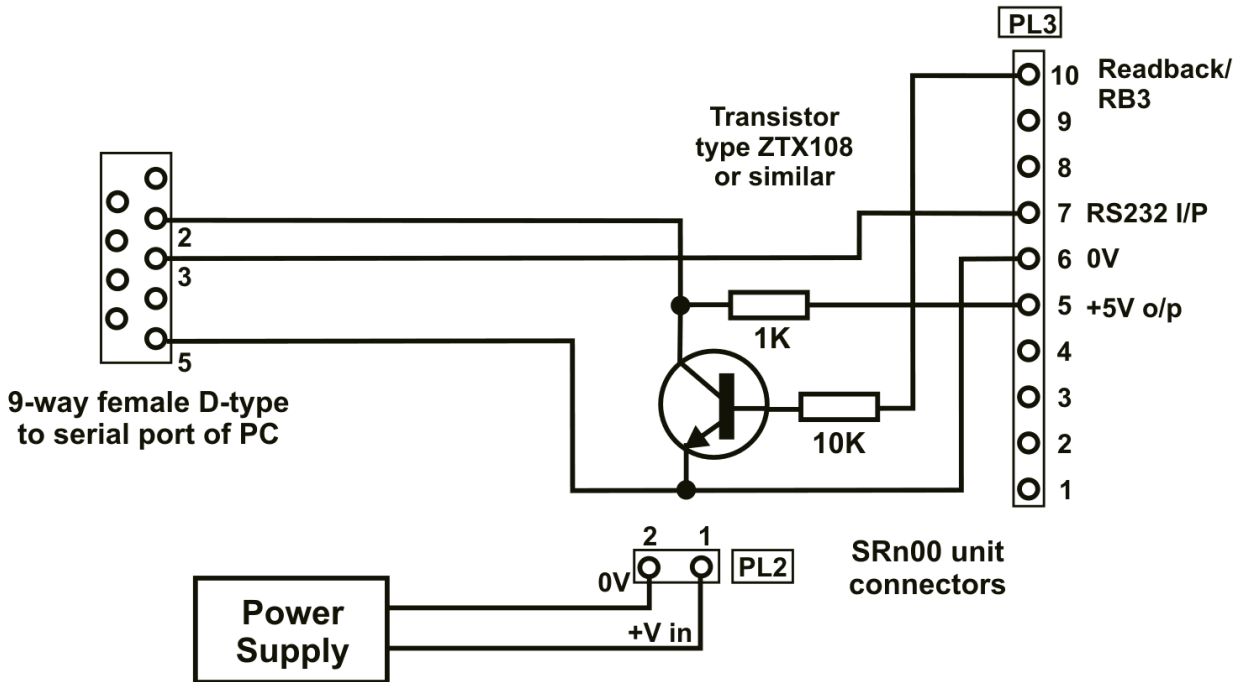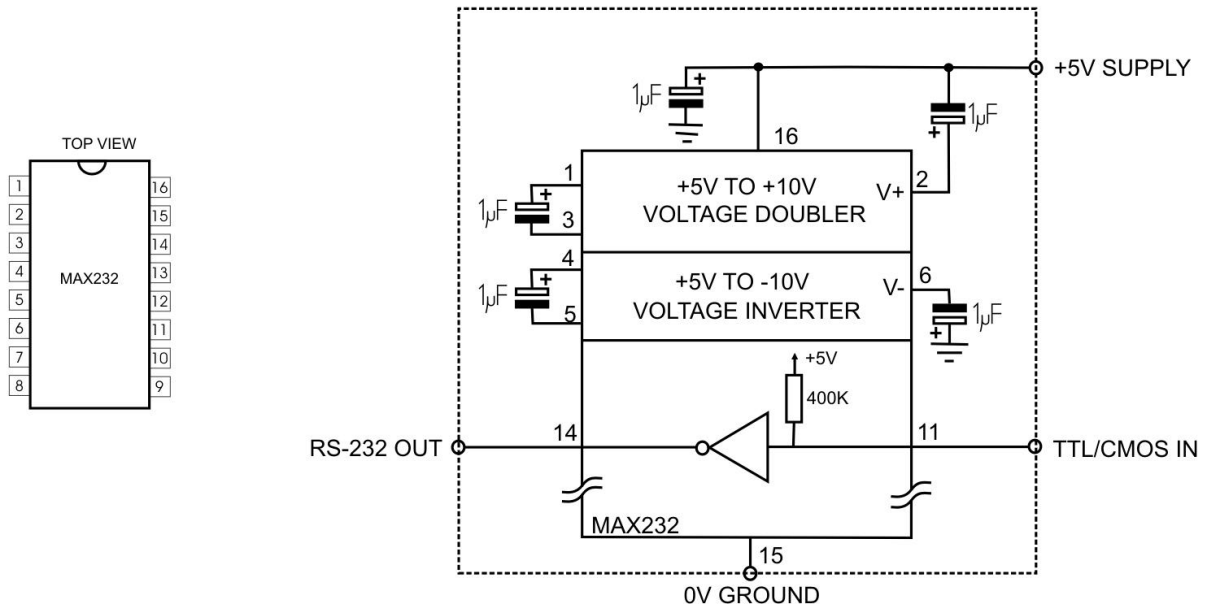

Figure 3 - Simple programming adaptor

Figure 4 shows the circuit of an adaptor providing true RS232 for readback when programming a unit.
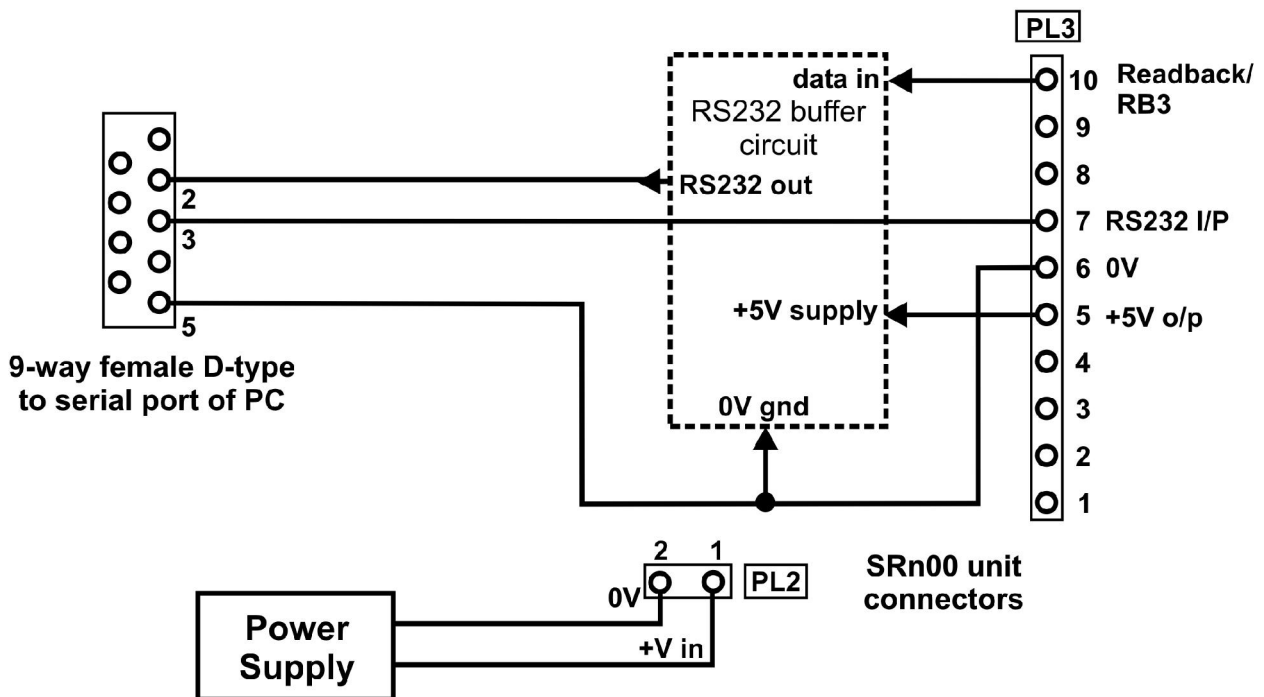
Figure 4 - Programming adaptor (True RS232)

A suitable inverting TTL to RS232 buffer circuit using the industry-standard MAX232 part is shown in **Figure 5**.

Figure 5 - Suggested RS232 buffer circuit

The MAX232 is obtainable from many component suppliers, e.g. RS Components stock no. 655-290.