AN APPLICATION NOTE DESCRIBING A LOW POWER RS232 LIKE INTERFACE

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Introduction

Radio Amateurs are beginning to make use **of low-power (LP) micro-processor systems for controllers and now have need for** a **LP serial interface to connect them to other LP terminals or computers. This application note describes a LP serial interface that is compatible with conventional RS232 terminals plus the new "lap" computers that have only a "sort-of" RS232 serial interface.**

Problem Statement

The "loose" global functional requirements of RS232 are that a MARK or INACTIVE signal will be transmitted as a voltage more negative than -5 volts from a low impedance source and a SPACE or ACTIVE signal will be transmitted as a voltage more positive than +5 volts from a low impedance source. A received signal into an impedance of more than 1 Kohm that is more negative than -3 volts will be considered MARKING or INACTIVE and a signal more positive than +3 volts will be considered SPACING or ACTIVE.

Most implementations of a RS232 **interface for amateur radio have used the 1488 driver and 7489 receiver.** Both **these devices provide an interface compatible with RS232 specifications but neither part can be considered "low-power." An alternate interface implementation is required for a LP system.**

An additional problem to overcome is that posed by some of the new lap computers, the Radio Shack Model 100 being a notable example. Some of these lap computers are using non-inverting, 0-3 volt buffers, for their "RS232" interface drivers and as a result, they will properly receive signals from RS232 compatible equipment but may not properly drive RS232 compatible equipment.

The goal of this application note is to provide an interface that will function well with both these standard and sub-standard interfaces.

Implementation

A simple and low cost driver and receiver can be formed with LM324 operational amplifiers. The power supply current drive for one package of four op-amps is less than 1 mA under no-load conditions. Two packages are required, one for receivers and one for drivers. This can be reduced to one package if some output voltage limiting is provided for the receivers. For the receivers, the power for the op-amp should be taken from a +5 and ground voltage source. Power for the drivers can be most anything as long as it is bipolar. The positive supply of the driver op-amps should be taken from a +5 to +15 volt supply. The negative supply of the op-amp can be taken from a -5 to -15 volt source. If the micro-processor system doesn't use a negative voltage supply one can be developed using the Siliconix 7661 configured as a voltage inverter. The voltage range of the driver's output is from the positive supply, less 1.5 volts, to the minus supply (i.e., for +/- 5 volt supply the output range of the driver would be +3.5 to -5 volts).

A reference signal is developed for a slicing/limiting point for use by the drivers and receivers. Figure 1 shows how the reference is generated by R1, D1, D2, and an op-amp. The output of this op-amp will rest at about 1.4 volts above ground with a low impedance.

Figure 2 shows how the output drivers are configured. They function simply as an inverter and bipolar driver. The output will swing from the positive supply (less 1.5 volts) to the negative supply. R1 provides current limiting.

Figure 3 shows how the input receivers are configured. Note that receivers, unlike the drivers, have their power leads connected to +5 volts and ground. The slicing/limiting point is the reference derived in Figure 1. If this point was ground, instead of 1.4 volts, the interface may not work **with those terminals using** 0-3 volt **output drivers. Diodes D1 and D2 provide voltage limiting causing the inverting input to be constrained to voltages between 0.7 and 2.1 volts. R1 provides the input impedance control and current limiting while R2 provides default signal conditioning for leads that are often unterminated (i.e., DSR, DTR, RTS, CTS, etc.). R3 and R4 provides hysteresis while R5 pulls up the receiver's output to +5 volts to ensure compatibility with CMOS circuitry.**

Conclusion

Using a serial RS232 interface such as this, the idling current should be less than 3 mA, depending on load. The interface is simple to construct and IS compatible with RS232 drivers/receivers as well as TTL/CMOS level (0-3 volts) drivers often found in the new low-power "lap" computers. Additionally, default conditions can be **set for unterminated receiver inputs.**

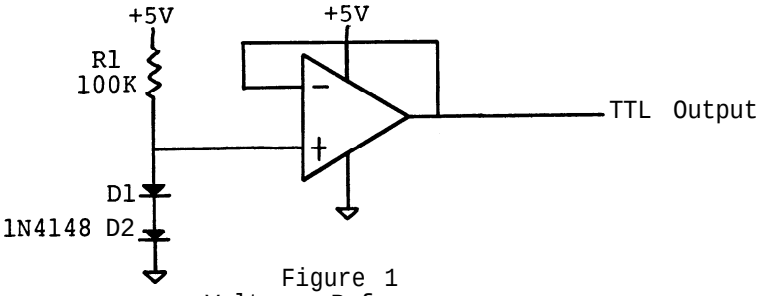

Figure 1
Voltage Reference

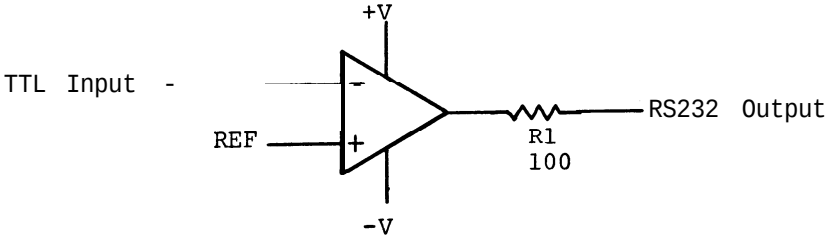

Figure 2
Driver

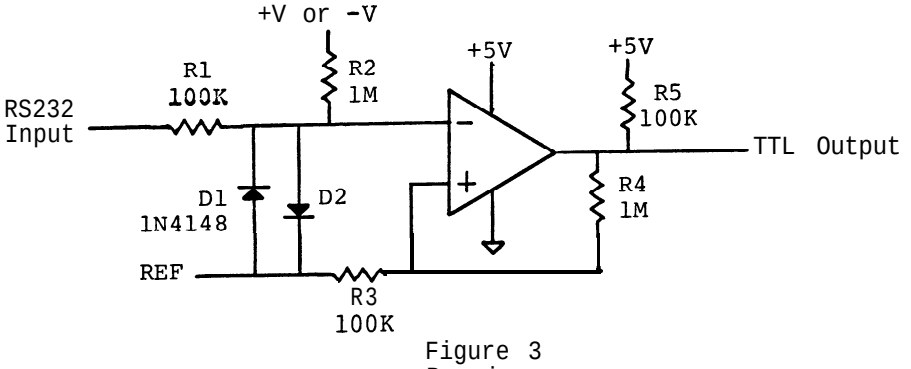

Figure 3
Receiver