

Radio-to-Computer Data Interface

In this day and age of radio-computer interfaces that offer automated, hands-off monitoring, we can easily lose sight of the more exotic signals to be monitored. This article offers a simple decoder interface for non-voice signals that can be processed and displayed by a computer. Such signals include Morse Code, FAX, RTTY, packet, MDT, and probably many others.

The cool thing is that this simple interface circuit can convert most of these signals into the necessary digital bits required by the computer. While you can get sophisticated and spend a lot of money on specialized interfaces for each kind of non-voice signal, this one covers most with mediocre to excellent results, depending on the software and computer that reads and processes the decoded data.

This "analog-to-digital" interface really doesn't have a name and I'm not going to give it one, because it's old hat around computerized monitoring circles. My objective is to simplify its construction and to enhance its operation beyond the bare-bones versions that are widely circulated. Let's just call it the data interface (DI) for the remainder of this article.

Data Signals

Think about it: radio frequency (RF) is an analog function. This means that "modulation," (the intelligence that's superimposed on a radio frequency), regardless of its type, pretty much has to be analog, too. It is not possible by any conventional means to directly modulate a radio frequency with a digital signal, though Morse Code comes close in the sense that the RF carrier is either on or off. The pattern of on-off conveys intelligence. Other types of signals, including FAX and RTTY, use an analog pattern of tones to modulate the RF.

This data interface converts most analog (and Morse) signals into a digital bitstream for the computer and software. Plain old receiver audio goes into the input and digital data appears at the output. Software and the computer do the rest. Your job is to read the output on your monitor!

The Computer

Most of the freeware and shareware de-

coder software with which I am familiar requires an AT/286 class or better computer, and frankly, the faster the computer, the better. Our DI is not strictly limited to the IBM/PC world; it will work with Amiga, Macintosh, and perhaps others, depending on available software. I am familiar only with the IBM/PC environment, though, so you're on your own if you use something else.

The Software

Here it gets sticky: I've used only two decoder programs, JVFX and HAMCOMM. The latest versions are:

JVFX71A.EXE 503611 12/07/1995 07:07
 HAMCOM31.EXE 443250 06/10/1996 07:36
 Other contenders include:
 MSCAN211.ZIP 437636 11/21/1996 19:21
 PKTMON12.ZIP 22030 12/30/1992 00:23

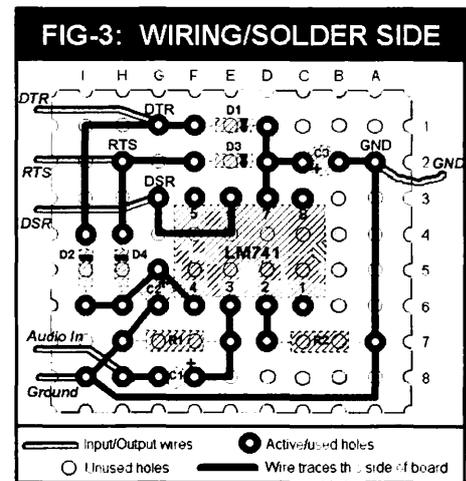
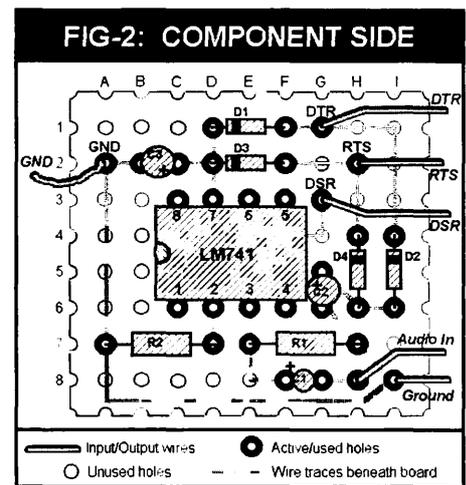
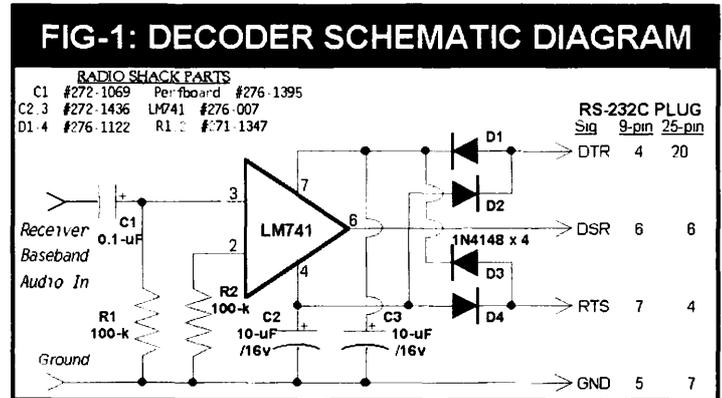
There may be more. You can look around the archives of the Internet and BBS communities for the latest and the greatest. The above four (or more) decoder programs are available on my BBS and FTP sites if you strike out elsewhere. The key thing here is that most decoder software runs fine with the DI!

The Circuit

This consists of ten common parts and a piece of perfboard, as depicted in Figs 1-3. The schematic is shown in Fig-1 and layout/construction details are shown in Figs 2-3. The circuit uses an op-amp in a comparator arrangement to convert audio sine waves to square waves. Little else needs to be said about it.

Finished Product

Unless you have different needs, it is suggested you build the DI inside a DB-25 or DB-9 female connector shell (see Fig-4) to facilitate direct connection to a serial (COM) port on your computer. PC serial ports are DB-25



or DB-9 male jacks (typically DB-9). Printer (LPT) ports are female DB-25's, so there is no mistaking the COM ports. If you want to build

yours into a DB-9 connector shell, you will probably have to do it "dead bug" style without a perfboard.

A DB-9 shell is rather cramped inside, so if there is any doubt, build yours into a female DB-25 shell and use a 25-pin male to 9-pin female port pdapter to mate with the PC's DB-9 COMport. (Radio Shack #26-209) for maximum flexibility, since computer COMports can be one or the other. If you build your DI into a DB-9 shell, and later need to connect to a computer's DB-25 serial port, you'll need a 9-pin male to 25-pin female port adapter (Radio Shack's #26-287) to make the fit.

With the DI circuit built inside the connector shell of choice and wired to appropriate pins as in Fig-1, you'll need a cable of sufficient length to go between the radio and the back of the computer. Length is not critical, but use shielded cable, similar to RG-174/u coax or even shielded microphone cable (RS #278-512) with an appropriate phone plug on the end.



■ Radio Connection

The phone plug (typically 1/8" male, RS# 274-286) should be of the type to plug into a jack on the radio. This can be the headphone jack or perhaps even the external speaker jack; either will do for testing and startup purposes. Later, you will want to experiment with enhanced measures.

■ Enhanced Operation

Choose your decoder software and follow its instructions for decoding the various kinds of non-voice data signals. In general, marginal-to-mediocre operation can be expected from the receiver's headphone or external speaker jacks, largely because the audio at these points has been filtered for the voice band, 300-3000 Hz. Trouble is, non-voice computer data can occupy a significantly wider bandwidth of 5 kHz to 15 kHz or more.

Therefore, after you've wet your feet in data decoding, you will want to experiment with tapping the receiver's internal audio at

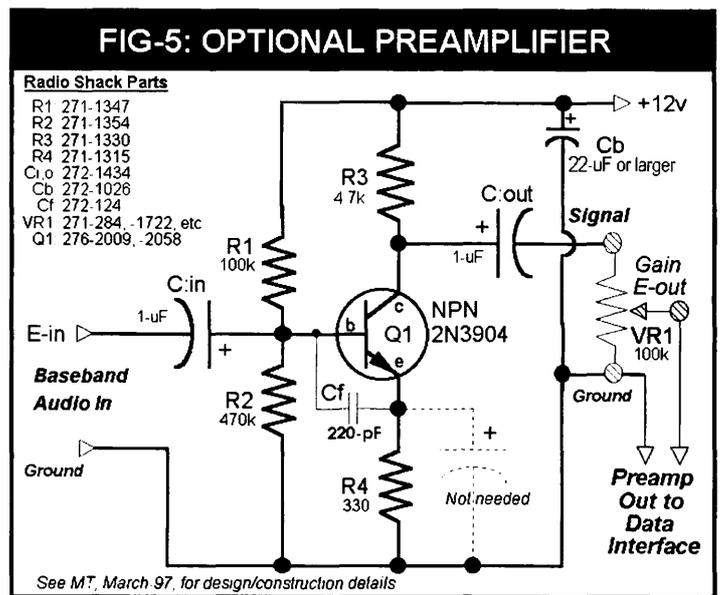
other points before any voice-band filtering takes place. The ideal pickoff point for raw, unfiltered "baseband audio" is at the output of the detector for AM signals or the discriminator for NFM signals.

World class radios usually have output jacks specifically for this purpose, so I'll not cover them here. Other radios and scanners are easily modified for baseband audio output by connecting the (+) lead of a 2.2- μ F capacitor to the detector or discriminator output, and the (-) lead to the center lug of a phone jack. The shell or outer lug of this baseband audio jack should be grounded to the receiver's chassis.

There are two primary considerations for the enhancement of the DI's capabilities, the first of which is **bandwidth**. Generally speaking, bandwidth is not a consideration (enhancement not needed) for signals below 30 MHz where there just isn't enough spectrum to afford the luxury of broadband, high-speed data. Therefore, most data signals below 30 MHz are within the receiver's voice band, and it may not be productive to go for the raw unfiltered baseband audio. Headphone or speaker audio may be adequate to decode data in the LF/MF/HF bands.

The VHF/UHF spectrum is eminently suited to broadband signals. Invariably, better performance of the DI will be achieved by taking its input signal from the receiver's discriminator or detector output. Space doesn't allow me to show a Table of the IC's and pin numbers of the baseband audio outputs for all the radios on the market, but I have a large list freely available on my BBS and FTP sites under the filename, IC-PINS.TXT. I also periodically post that list to the Usenet *rec.radio.scanner* newsgroup. I can mail a printed hard copy upon request to those who provide a business-size S.A.S.E. and an additional, loose, first class US postage stamp. (Two IRC's for foreign requests.) Mail requests to me at PO Box 262478, San Diego, CA 92196-2478.

The second consideration for decoding data is **signal-to-noise ratio**. Baseband audio



output in most radios is rather weak, so better performance might be obtained with an amplified signal before injecting it into the DI's input. Fig-5 shows an optimized preamp design (based on my March-97 column) for the DI. Too much gain is undesirable, so an adjustment is provided to set the best output level.

The face and nature of radio are undergoing monumental changes with more and more digital data signals and a lot less voice. The DI and a host of readily available decoder software are great, low-cost tools for exploring the exciting new avenues of radio for the near future. Beware of possible legal issues in monitoring data signals, however: you never can tell anymore.....

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 BBS & FAX: (619) 578-9247 5:30pm-1:30pm, PDT

Performance Upgrades

JRC NRD 525/535	AOR AR-7030
Sony ICF-2010	Yaesu FRG-100
Lowe HF-150 and AP/SP-150	RS DX-394

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