SPECIFYING A PCMCIA IRIG-106 (Ch. 4) DECOMMUTATOR

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ABSTRACT

There are many applications where an ultra-compact PC (palm-top) is required for quick analysis of PCM data. There are many design issues associated with the design of a PC-Card (PCMCIA) decommutator.

- Is it possible to connect a 20Mbps PCM stream?
- What outputs are required from such a card?
- How many cards can be used?
- Which mode to use (memory or I/O)
- How to program such a card
- How to develop third-party software for analysis of data

This paper discusses some of these issues and the applications for such a card.

KEY WORDS

PCMCIA, PCM Decom, Quick-look

INTRODUCTION

The PC-Card (PCMCIA) has been around for about 15 years. Originally a specification for adding memory to portable computers, it has become a de facto standard for the addition of all kinds of peripherals to portables, hand-helds and even desktops (with the addition of an adaptor).

Its common use in compact computers raises the interesting possibility of creating a small, portable, flexible ground-station for in-flight use, or for flight-line testing of an FTI system. Recognizing this, in 1995, ACRA CONTROL produced the world's first PCMCIA format IRIG-106 decom, the SAM/DEC/005. This successful product has since been used in many applications.

With the launch of the SAM/DEC/007, ACRA CONTROL continues and enhances this product. At this point it is worthwhile to step back and look at the kind of features a PC-Card format decoder should have, focusing on its flexibility and power as a flight-line system test tool, and as an in-flight monitoring tool. This paper takes a bottom-up view of the key features required from such a device.

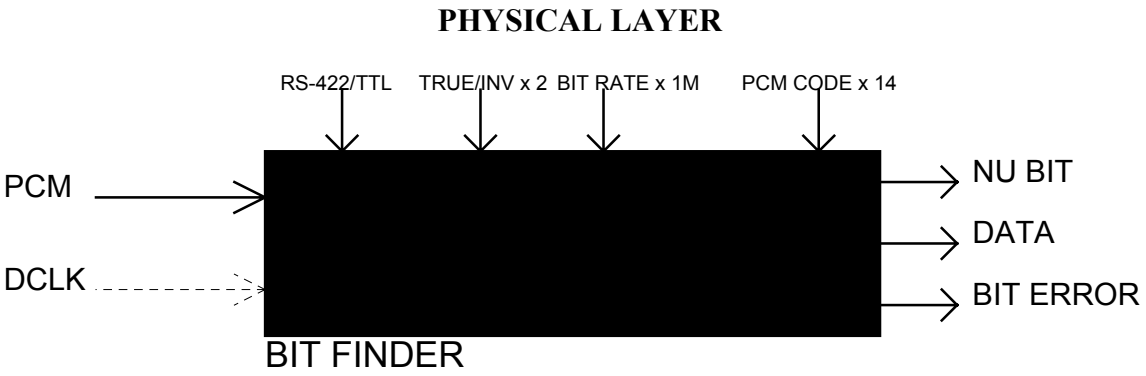

Figure 1 – Bit finder

Bit Rate

In today's FTI systems there are often multiple streams, intended for multiple destinations, with different bit-rates, frame characteristics and so on. If the decom is to be a useful flight-line test tool it must handle a broad range of bit-rates, from 1kBit right up to 20Mbit/s. This kind of range is possible with careful design, although faster bit-rates (>10Mbit/s) may require a separate clock (such as provided in standard NRZ-L).

At the extreme end of the scale, the bottleneck in data transfer and logging is not the decom, but the physical interconnection of PC-Card interface and disk. Few portables have the power to manage 20Mbit/s incoming and stream it to disk. An extremely useful way of overcoming this limitation is to allow the decom to be configured to store only a subset of the incoming parameters. The non-store parameters are ignored, reducing the effective bit rate to a manageable level. This is often all that is required for test or quick-look applications, and eliminates the need for a separate "test & debug" PCM stream at lower rates.

PCM Codes

The Flight Test Engineer wants to ensure that the system he is looking at is the system that will fly. So he must be able to work with the PCM codes that are preferred by the ground-station personnel. This means that the PC-Card decommutator must be able to handle a wide range of codes. As an example, the SAM/DEC/007 can handle RZ, NRZ-L/S/M, BIØ-L/S/M, DM-M/S, and
RNRZ-L x 4.

PROTOCOL LAYER

Frame Layout

The decom must be able to handle a wide range of frames – from quick & dirty debug frames to large, fully loaded test frames. Further, it must not be limited by requirements like equal-width sub-frames, as many of today's systems use multiple-width sub-frames to optimize bandwidth.

Often, the software available on a portable is not as powerful as that available on a ground-station. For example, the ability to extract a sub-set of a PCM word and display it as a distinct parameter may not be present. The decom can overcome this by permitting the frame to be defined on a word-by-word basis with differing parity, bits-per-word, word order and so on. In addition, a syncword of up to 64 bits (with 64-bit mask) allows a huge range of frames to be handled.

Protocol Tracking

Programmable matches-to-lock and misses-to-loss allows control over the sensitivity of the decom to aberrations in the incoming stream. A surprisingly useful feature is the ability to program a "matches-to-lock" of 1, which means that the decoder locks on as soon as any syncword is detected. This allows even asynchronous "bursts" of IRIG-106-like data to be stored.

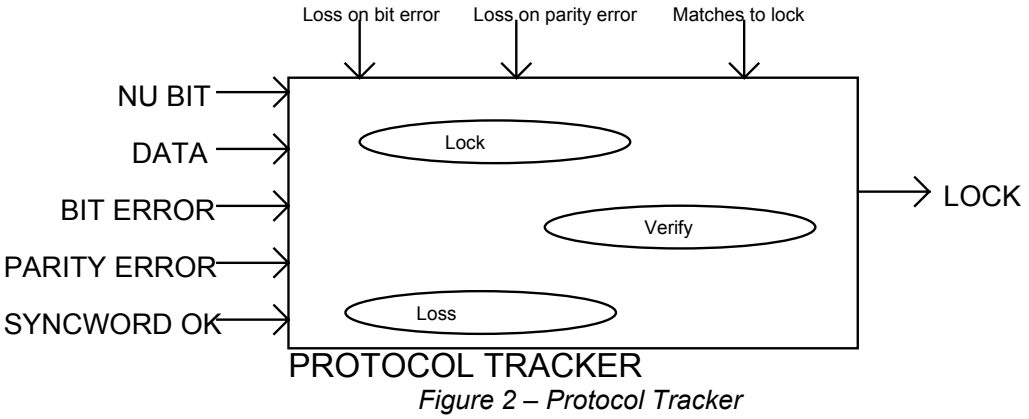

Figure 2 – Protocol Tracker

Synchronization Debug

Many people are familiar with the "it's not in lock" panic when the pressure is on. A modern decom can provide debug assistance for the engineer in this case. The SAM/DEC/007 provides a status word which indicates whether the syncword is present, whether there is a valid clock, whether the number of bits per frame is as expected and so on. Also, the sync word polarity can be set to "both" and each bit can be masked. All the above is useful in identifying where the problem lies.

DATA MANAGEMENT

Handling Embedded Data

A common element of many streams is embedded data. This could be a stream of samples from a voice or video encoder, or even an embedded PCM stream. Typically these are handled by some software to extract the embedded data, and then transmit it to an interface card that can send the data to an audio or video playback unit. However, PC-Card is all about compact size and portable systems, so there is no room for extra interface cards.

The SAM/DEC/007 takes a unique and innovative approach to solving this problem. When programming the unit, particular words in the incoming PCM stream can be marked as "embedded". These are then extracted in hardware and sent to output pins on the decom itself, from where they can be simply wired to the playback device. There is no software required, and no extra complications.

Embedded PCM can be handled just as simply, the embedded output can be looped back to a second SAM/DEC/007 in the same system where it is handled as straightforward PCM without any hardware or software complications.

PCMCIA usually has two type II slots. One of which can be used as a second decom or bit synchronizer.

Handling CVTs

Most decoms convert the incoming serial data to parallel samples stored in a current value table (CVT). Many "ping-pong" between two or more such tables to prevent data overwrite during reading. The PC-Card interface also allows this architecture.

There are two modes of operation for PC-Cards – input/output (I/O) mode with interrupt support, and memory mode. I/O mode has speed and memory space restrictions. It supports the "ping-pong" architecture (using interrupts), however, a more powerful architecture is possible using memory mode. In memory mode, there is access to a large RAM buffer. Depending on frame size, this can be configured to store multiple CVTs.

This allows a configurable amount of buffering in the decom itself, an important requirement for working with modern multi-tasking operating systems.

Persistent Storage

The format, protocol and CVT organization can all be stored in EEPROM, so that the decom becomes a stand-alone device that can be swapped between machines without the need for re-configuration.

SOFTWARE

Plug & Play

The PC-Card represented both a driving force and a challenge for the Plug 'n' play architecture which has appeared in Microsoft operating systems over the last five years. With on board Card Information Services (CIS) a PC-Card decom can configure itself as soon as it is plugged into a new PC. Installing the drivers involves following the on-screen instructions.

Simple Interface

By adopting a very straightforward approach to data recovery from the decom, it is possible to make access to the card completely open. The SAM/DEC/007 ships with DLLs and library support for Visual C++, Visual Basic, LabVIEW, MathLAB and other packages. In addition it is supported by powerful third-party data logging and analysis packages such as Magali from HTS.

CONCLUSION

A PCMCIA decom and a lap-top or palm-top PC provide an excellent compact part of today's ground support equipment (GSE). However, they must still be able to cope with some of the more daunting aspects of larger ground stations, for example, 20Mbps, multiple PCM codes and embedded PCM output.

They must also have features that allow for fast logging to disk such as store/ no-store select on data and multiple CVTs.

Finally, they must come with DLLs for third-party software packaging.

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