What is Teletext?

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WHAT IS TELETEXT?

Teletext is a system that was developed in the late '70s to deliver public information to television viewers in the comfort of their home. Since it's creation, Teletext has undergone several enhancements to improve it's flexibility, and yet maintain a low overall cost to the customer. In the 80's, new extensions were added to Teletext handle independent data services, and the format continues to expand to this day.

Multimedia computing is now discovering the benefits of having Teletext reception as another value added feature. With the ever increasing quest for more information on the desktop,applications can range from stock trading, electronic news, E–Mail, downloadable software,education, and customer service just to name a few.

Even though Teletext format has been enhanced quite a lot since it's original inception, the basic functionality is still very much the same. Here are a few examples of this:

Basic Teletext system overview

- Teletext is a format to transmit data within a video signal
- Can be multiplexed with the video, or not
- Data rate is a few MBit/s
- Accepted global standard (WST)
- Secure delivery data channel
- Data error checking
- Low cost
- Uni-directional
- Page format: 24 rows × 40 columns

HOW IS IT ENCODED IN A VIDEO SIGNAL?

There are two common methods for encoding the Teletext data into a video stream. The most common is to use the Vertical Blanking Interval or VBI**.** This is a generally unused space located between the vertical sync pulse and the actual active video picture. Because of the limited number of available lines in the VBI, the actual amount of data that can be transmitted is limited to about 17.76Kbits/sec times the number of transmitted lines. So, if we were to transmit 3 lines of Teletext data per field, that would work out to:

One horizontal line (525) of data = 37 Bytes or = 296 bits per line/field

296	
× 60	(fields per second)
17,760	bits/sec per line data rate
× 3	lines/sec
53,280	bits/sec

So, a three line/field transmission has an effective data rate close to ISDN rates!

If, however, the broadcaster has a dedicated channel (cable, MDS, satellite, video LAN,etc.), it is then possible to put Teletext data on *every* line. In this case, the data through–output would increase to almost half of Ethernet rates!

One horizontal line (525) of data = 37 Bytes or = 296 bits per line/field

296	
× 60	(fields per second)
17,760	bits/sec per line data rate
× 251	(usable lines/field)
4,457,760	bits/sec data rate

Now the data rate has been increased to over 4.5Mbits/sec, half Ethernet speed!

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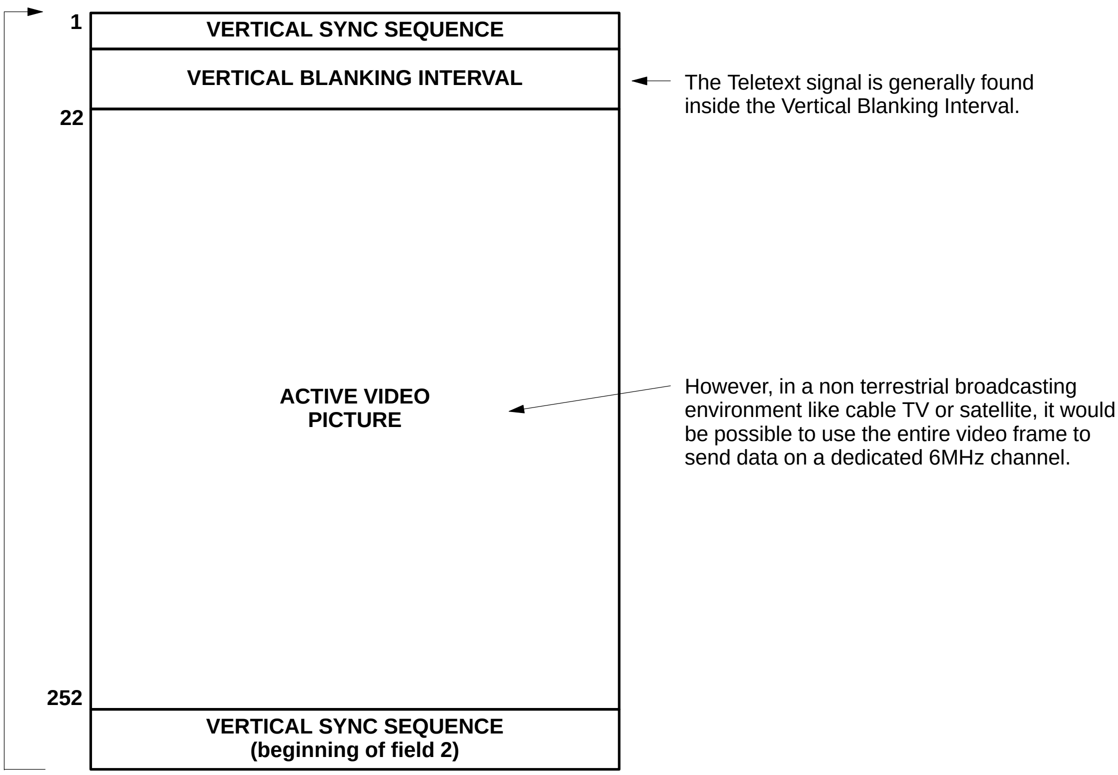
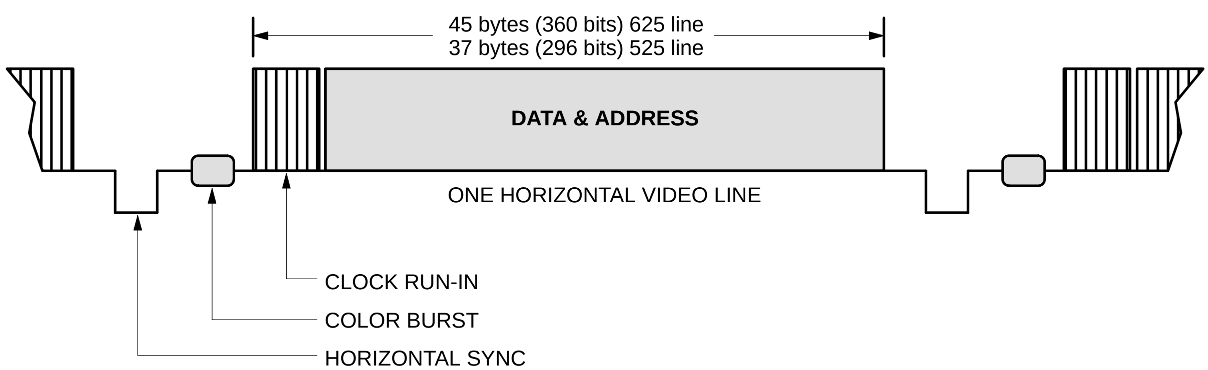
WHERE CAN TELETEXT DATA RESIDE IN A VIDEO SIGNAL?



WHAT DOES THE DATA LOOK LIKE?

Each Video line use to convey the Teletext data is called a Teletext Data Line.



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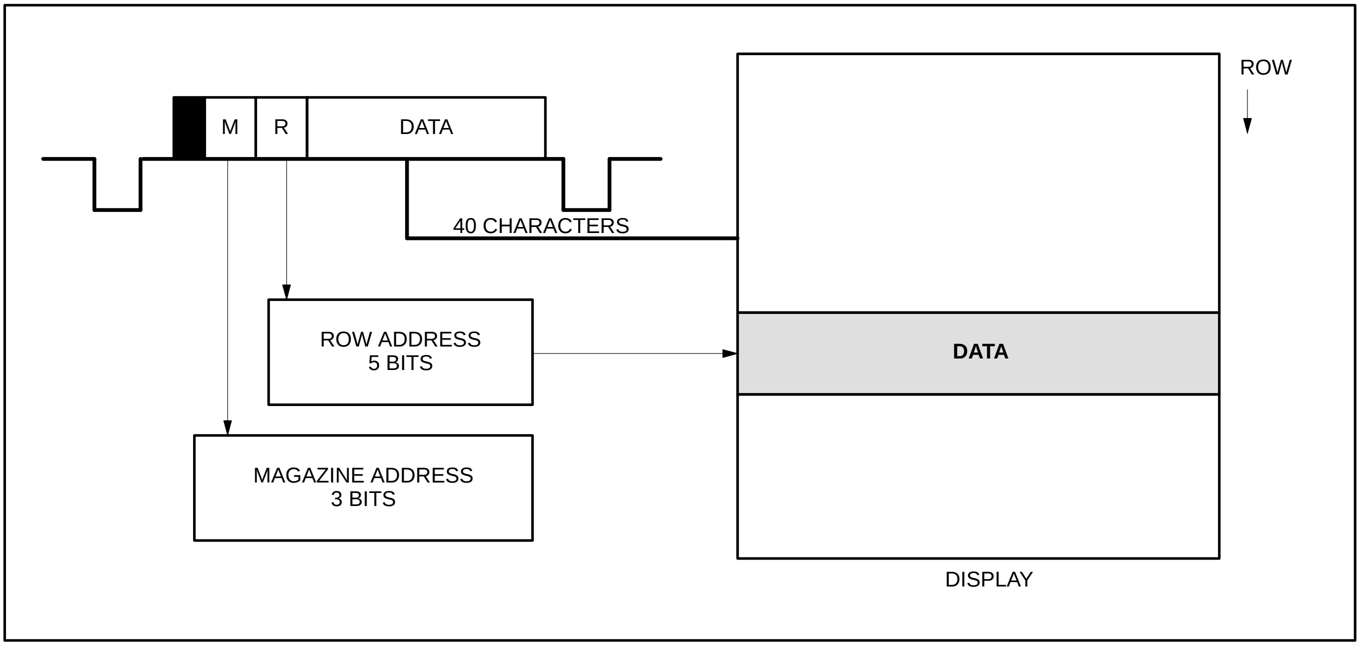
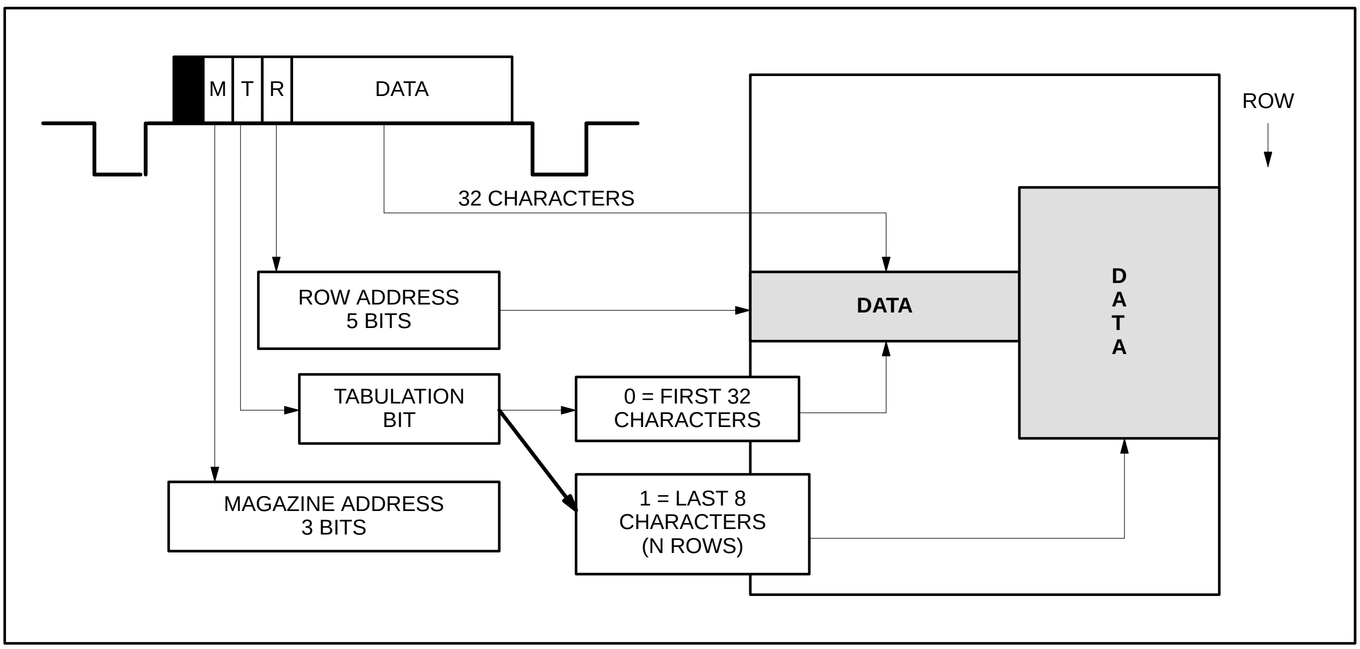
625 LINE WST TELETEXT TRANSMISSION



525 LINE WST TELETEXT TRANSMISSION



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HOW IS IT BROADCAST TO CUSTOMERS?

The most common way for Teletext to reach a large customer base is to send it using normal over-the-air broadcast television transmissions. Although this is the common approach, it is not the only method. Cable companies can distribute the data on a dedicated channel or add it to the VBI of an existing channel. Multi–point Distribution System operators (MMDS or wireless cable) can provide Teletext data via direct microwave transmissions to the customer. Satellite broadcasters can use the same approach as well. Figure 3 is an example.

And signal distribution isn't required to general off-air distribution. Teletext can also be used over a video local area network (VLAN) for supporting anything from printing devices, data servers, and even individual workstations. A simple way to provide secure data delivery in a growing multi-media environment and at a low cost.

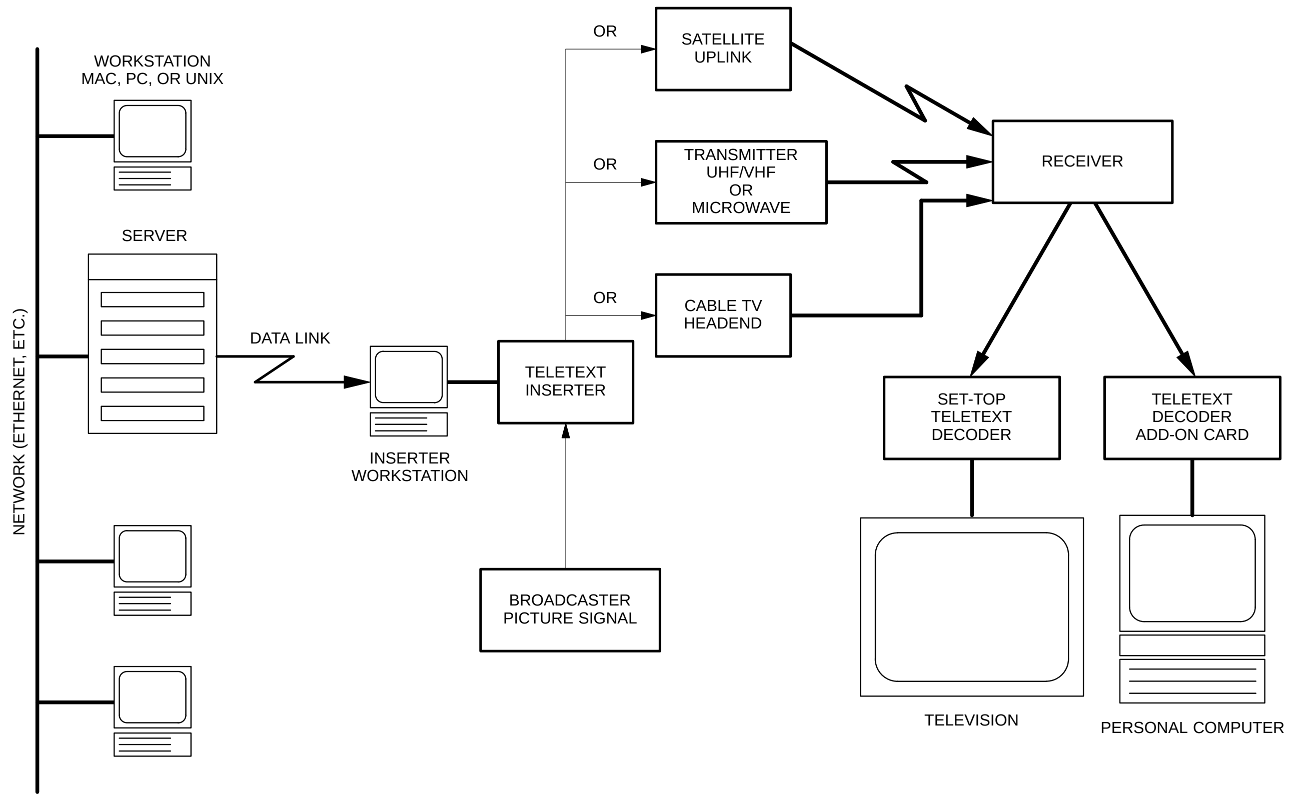

Figure 3. A Broadcast transmission example

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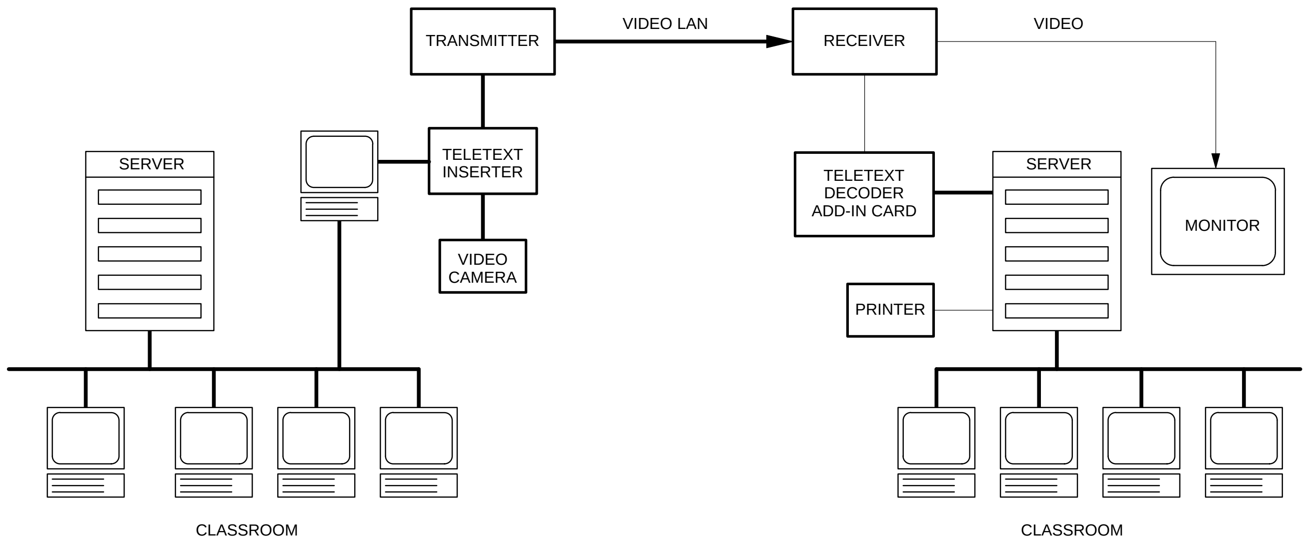

Figure 4. An example of remote corporate training

In Figure 4, an instructor at a corporate headquarters could be teaching a class locally while also delivering the same information to students at multiple remote sites. In addition to the normal video and audio transmissions, the instructor could send data specifically to individual students at the remote site (or sites) on demand over the same video link. Teletext offers a new way to add addition information to video training without affecting the current video distribution network.

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WHAT ABOUT ERROR CORRECTION?

The WST standard provides for two basic layers of error correction for page format Teletext, Hamming code is used for addressing, and parity for character data. The Hamming correction can catch both single and double bit errors, while the parity checking can resolve single bit errors. For Packet 31 transmissions, there is the addition of a 16 bit CRC check added to the end of the data packet, although this is optional. Both page format Teletext and Packet 31 could be encoded with 8 bit data allowing any third party protection format to be used.

WHAT ARE TELETEXT PACKETS?

Packets are the actual data information with an assigned address. There are three basic types of packet in the WST standard, page headers, normal rows, and extension packets. Each has a specific assigned purpose and bit format:

PAGE HEADERS – Packet Address 0

This packet contains page number and control information, plus 32 display characters including ‘TIME’. It appears at the top of the display.

NORMAL ROWS – Packet Address 1 – 23

These contain 32 bytes (40 bytes 625 line) of data defining a row of 32 (40) characters on the display. The address defines the vertical position of the row.

EXTENSION PACKETS – Packet Address 24 – 31

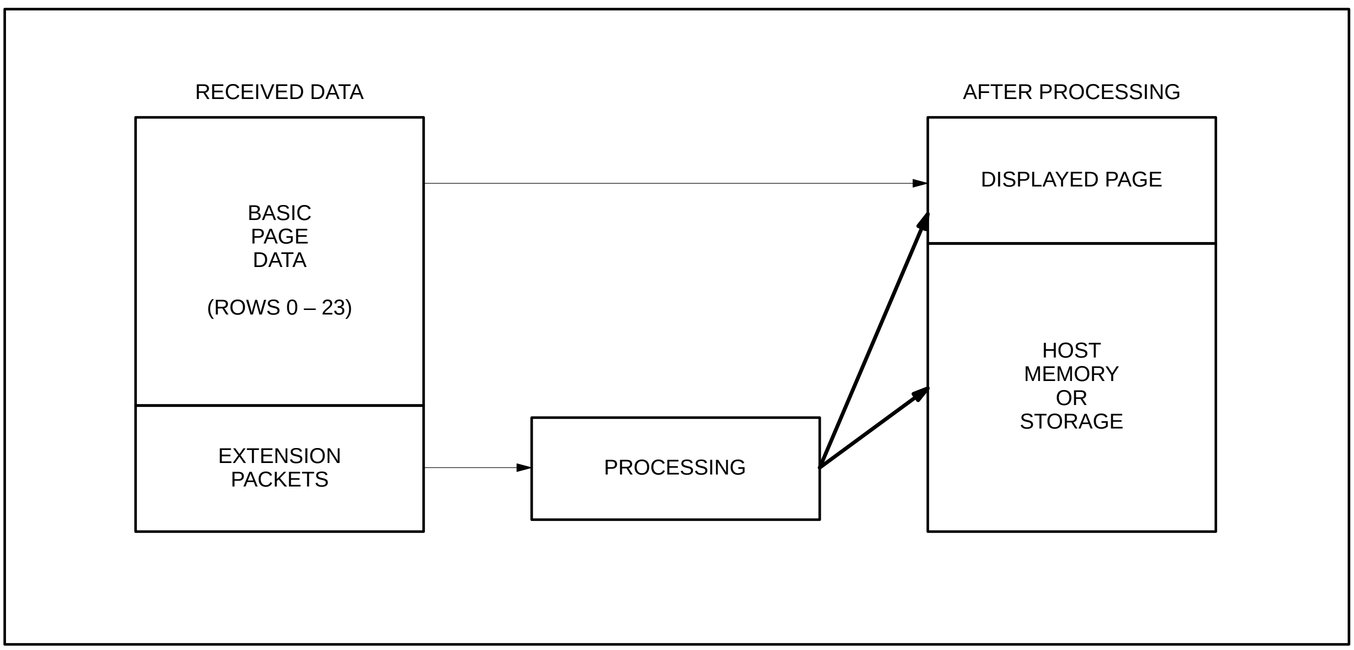
Typically each has its own special function and is not directly displayed. They are used to enhance the performance of the more advanced decoders or to provide special data services.

There are a total of eight extension packet functions pre-defined under the WST standard. They are:

Packet Number	Function
Packet (row) 24	Page Extension
Packet (row) 25	Telesoftware
Packet (row) 26	Schedule Information & Page Related Redefinition
Packet (row) 27	Linked Pages (FLOF/FASTEXT)
Packet (row) 28	Page Related Redefinition
Packet (row) 29	Magazine Related Redefinition
Packet (row) 30	Broadcaster Data Services
Packet (row) 31	Independent Data Services (Multi–media)

With these extensions, Teletext can support a wide variety of functional services from programming a VCR to acquiring the latest software for a home or business computer.

EXTENSION PACKET PROCESSING



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HOW DOES A DECODER FUNCTION?

There are two basic architectures to a WST decoder. The first is for standalone applications, as in a television set or a set–top decoder (Figure 5). These units are self contained and usually offer limited capabilities for extension packet handling. Generally the decoder is made up of a video input processor (VIP), the Teletext processor, some form of page memory storage for received data, a character generator to drive a CRT, and a character language font ROM for displaying the text in the native language the receiver is being used. These processors offer a simple serial interface for communicating with the televisions microcontroller. Although the actual data usually can be removed via this interface, it is generally not recommend for performance reasons.

The second method for receiving Teletext data is to use a acquisition only decoder. This type of decoder relies on a host microprocessor to determine what happens to the received data once is has been acquired and error checked. At this point, the processor must handle all of the storage and display functions remaining to present the data to the user. This is the preferred method used for teletext interacting with a personal computer. Because the host computer already has memory, disk, networking, and advanced display functions, there is no need to have these function duplicated in the Teletext receiver. (See Figure 6.)

Typically a decoder used in this method supports all of the packets described under the WST standard. The text processor is a minimal Teletext decoder only handling the error correction and acquisition functions. It is therefore quite flexible in supporting multiple packet format reception.

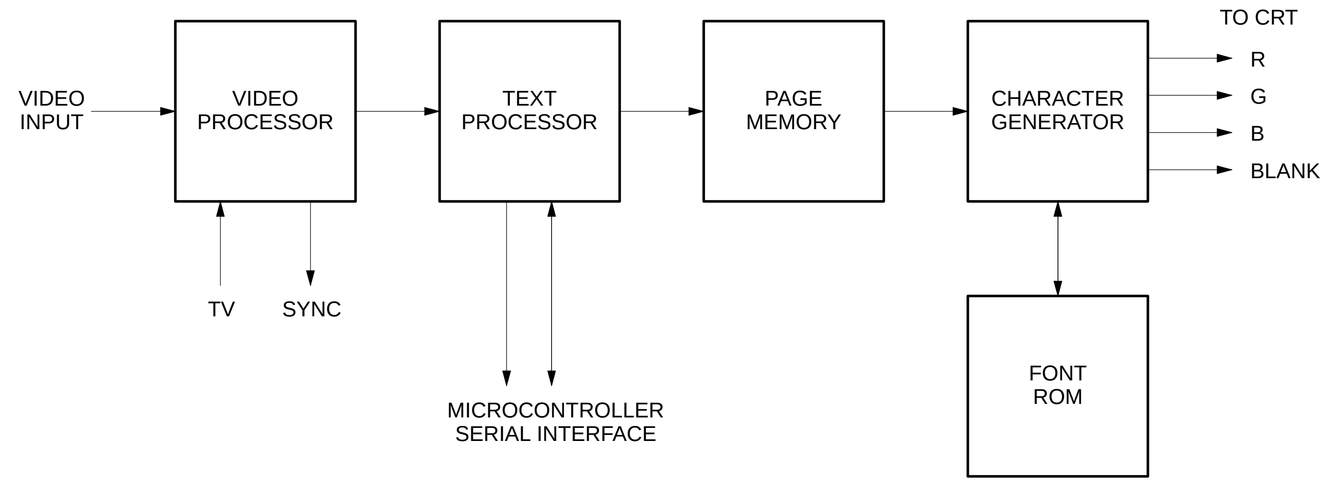

Figure 5.

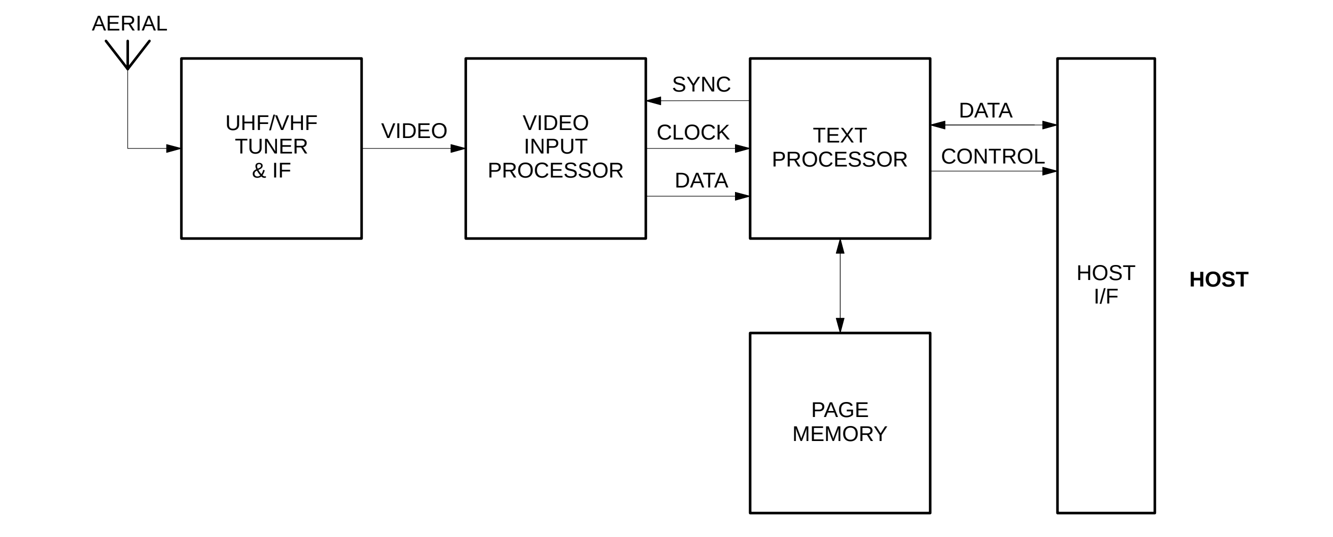

Figure 6.

WHAT ARE SOME RECOMMENDED CONFIGURATIONS?

For basic level 1 Teletext reception in the 525 line television system, the standard configuration is comprised of the SAA5191 data slicer, SAA9042 WST Teletext decoder, a DRAM for local storage, and either a microcontroller as the control host or and I2C UART to interface to an external host (i.e., a microcomputer). This solution will not decode Packet 31 transmissions but will decode all other extension packets.

Figure 7 demonstrates a standalone decoder with the acquisition and display sections of the SAA9042 timed from the incoming video signal. Although this will work quite well for set–top or computer add–in card applications, it should be noted that in the absence of any incoming composite sync signal, or if the signal is very noisy, the field sync integrator in the acquisition section will not be able to detect the start of the field. Consequently the display section will not receive a reliable vertical trigger, and thus a stable text display cannot be guaranteed under all signal conditions.

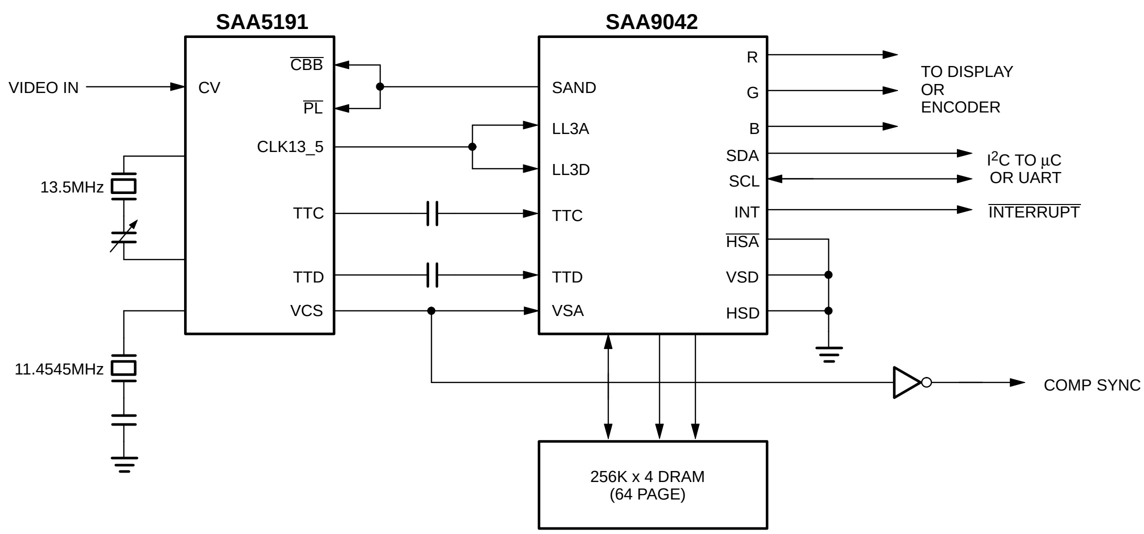

Figure 7. Standalone Example (Direct Sync Mode Shown)

What is Teletext?

For acquisition only and Datacast reception (packet 31), the SAA5250 CMOS Interface for Data Acquisition and Control, or CIDAC, is a WST decoder designed for direct interfacing to a microprocessor host. Unlike the SAA9042, CIDAC only has one acquisition channel and support for only a 2K×8 static RAM for local buffering. But because CIDAC was intended to interface to a microprocessor, the need for most of the larger local storage and multiple acquisition channels are unnecessary in this application since the microcomputer host has superior storage and data transfer capabilities already.

In the circuit shown in Figure 8, the SAA5231 is used purely as a data slicer since the CIDAC doesn't require a dot clock for display the VCO section of the SAA5231 is left unused. Because the CIDAC was design as a multi-Teletext format decoder, the chip was designed primarily for full field data reception. For VBI applications, it is suggested to add a simple circuit between the SAA5231 and the CIDAC that creates a VBI 'window'.

The purpose of the VBI window generator is simple. To aid the CIDAC in the reduction of invalid data being processed, and to provide the host microprocessor with a data valid interrupt so the microprocessor will not be required to poll the CIDAC on a regular basis to determine if new data has arrived.

The TDA4820T is a adaptive sync separator which provides the PLD with vertical and composite sync. With these signals at hand, the PLD simply counts the number of horizontal lines after the vertical sync period until the desired active video line for the window to open is found. Upon finding this, the PLD then allows the data from the SAA5231 to be passed onto the CIDAC, but not before it is gated with the composite blanking signal first. This has the result of passing only valid data for a select number of horizontal lines and pre-filtering out any sync or color burst information which could be confused as valid data.

The other function the PLD generates is a simple interrupt pulse for the microprocessor. This pulse can be generated before, during, or after the window closes. The choice is up to the PLD's designer and is important for the microprocessors best performance. In addition, it is recommended that the PLD designer add a hardware select line from the PLD to the microprocessor to allow it to select full field or VBI reception for flexibility.

In conclusion, the WST Teletext format allows a system designer great flexibility while providing a low cost means to deliver secure data over a wide area network. Philips Semiconductors has been providing complete Teletext solutions since the formats early beginning and as a customer you can look forward to continued innovative and cost effective solutions from Philips Semiconductors, World wide supplier of Teletext components.

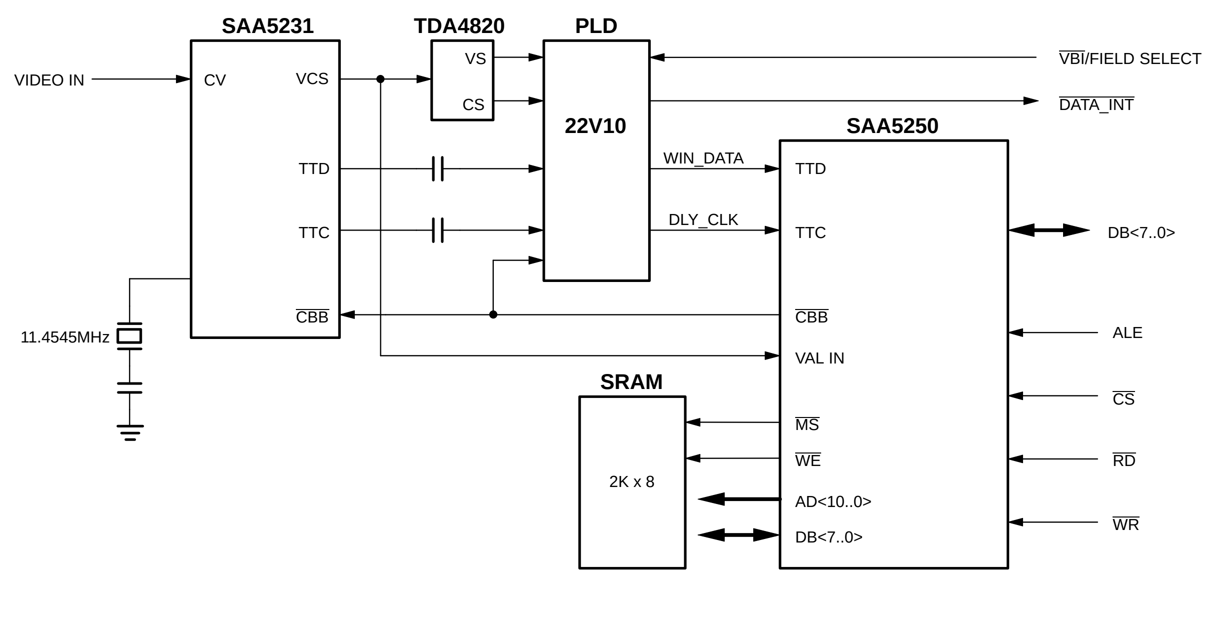

Figure 8. An Example WST Packet 31 Decoder for Multi-Media Applications