Teletext the Philips Way

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AN ARTICLE on the Rank teletext receiver in the May 1979 *Television* featured the well established Texas Instruments' Tifax teletext decoder. This proven unit comes as a package to which the setmaker (or enthusiast for that matter) needs only to connect supplies and interface it to the set. For this reason no details of the internal workings of the unit were given nor, for that matter, are they needed.

From the Mullard/Philips stable comes a group of special-purpose i.c.s designed for teletext decoder use. These give greater flexibility, enabling setmakers to build up their own panels to meet their own needs. As well as layout variation, this group of i.c.s permits the optional inclusion of a number of novel features which are described below. Naturally setmakers are not left entirely to their own initiative: Mullard/Philips provide detailed application information and layouts, one such being used in the current range of Pye/Philips teletext receivers. These use the G11 chassis as a foundation. The way in which the interfacing is done will be better understood once a description of the decoder itself has been given.

Features

A good teletext decoder should not only be capable of presenting the required page without errors and in colour: it should also have the essential facilities for newsflashes, timed pages and for revealing the answers to the puzzle pages. The Mullard/Philips package does all this, as well as character rounding, background colour and, in the interface stages, provides for superimposition of a full coloured page of text on top of the analogue signal (mixed mode).

The extra features available are: "Status", which provides a boxed programme identification at the top left of the screen for ten seconds whenever the channel is changed. "Time", which permits the teletext clock, normally seen to the right of the page header, to appear for ten seconds, boxed and double height, to the right of the analogue signal (the picture to old fogeys like me). The page header changes colour when hunting for a new page, reverting to white when the page is found. While waiting for the selected page to appear, you can watch the picture: when the wanted page has gone into the memory and is ready for display, the page header appears at the top of the picture for ten seconds – as an invitation to change back to text. Page 100 is automatically read into the memory at switch on or after a channel change – so you don't have to call up the index every time you want to go to text. The "time" facility previously mentioned means that some page or other must always be written into the memory, and this kills two birds with one stone. Most versions have a "local" double-height facility, so that a page can be split into its top and bottom halves and each half displayed double height for greater legibility. 22in. teletext sets really do need this in an average room. Incidentally, the characters in a double-height display appear to be thicker as well, but if you measure them you'll find that this isn't so.

A viewdata (Prestel) version of the chassis is also in production: the extra electronics are currently mounted in a plinth beneath the console floor. It's not intended that teletext only sets should be convertible for viewdata use.

The Decoder Chips

The teletext decoder itself is based on four special-purpose i.c.s known as the VIP, TIC, TAC and TROM chips. Two remote control chips complete a sextet.

The VIP – Video Input Processor, type SAA5030 – accepts a positive-going video signal straight from the vision detector (see Fig. 1). It ignores the analogue (picture) information, removing the data signal by means of an adaptive slicing technique. This looks at the data exactly halfway between zero and one, regardless of amplitude and baseline variations. The result is optimum teletext eyeheight, in turn providing better legibility (if you want to know more about eyeheight, see the January 1978 issue).

There are two clock signal generators in the VIP. One produces an output at 6·9375MHz, the bit rate of the incoming data, the other operating at 6MHz. The 6·9375MHz clock is derived from the clock run-in at the start of a received data row. This causes a high-Q tuned circuit to ring, and is kept in step with the incoming data by means of a control loop circuit. The 6MHz generator is crystal controlled and locked to the incoming picture sync pulses: its output goes to the TIC chip, where line and field pulses are generated for the control of the data raster.

The VIP's outputs go two ways then: the 6MHz clock to the TIC, and the data and 6·9MHz (for short) clock to the TAC.

The TAC – Teletext Data Acquisition and Control, type SAA5040 – receives the data and 6·9MHz clock signals from the VIP and also instructions from the user via the remote control receiver decoder (which has its own, much slower, clock pulses). The TAC's purpose is to select the required page and pass it to the decoder's memory – it does this via a seven-bit data bus. Also passed on, via a five-bit data bus, is the row address instruction. Part of the TAC's function therefore is to convert the incoming serial data stream into two outgoing parallel data streams.

The TAC has its own small inbuilt memory, in which is stored the control data necessary to select the required page/time, depending on the instruction code passed on from the remote control receiver. The same memory also contains the programme to store page 100 in the absence of any other instruction, and to display the previously mentioned status and time boxes on the screen when required. The programme for top or bottom half of the page at double height is also stored here.

The TIC – Timing Chain, type SAA5020 – uses the 6MHz clock signal from the VIP to produce all the timing pulses required to generate a page of text. Since each text character is a microsecond long, and each dot of the character occupies a sixth of the character's width, you can see the reason for a 6MHz clock – it's running at the dot rate.

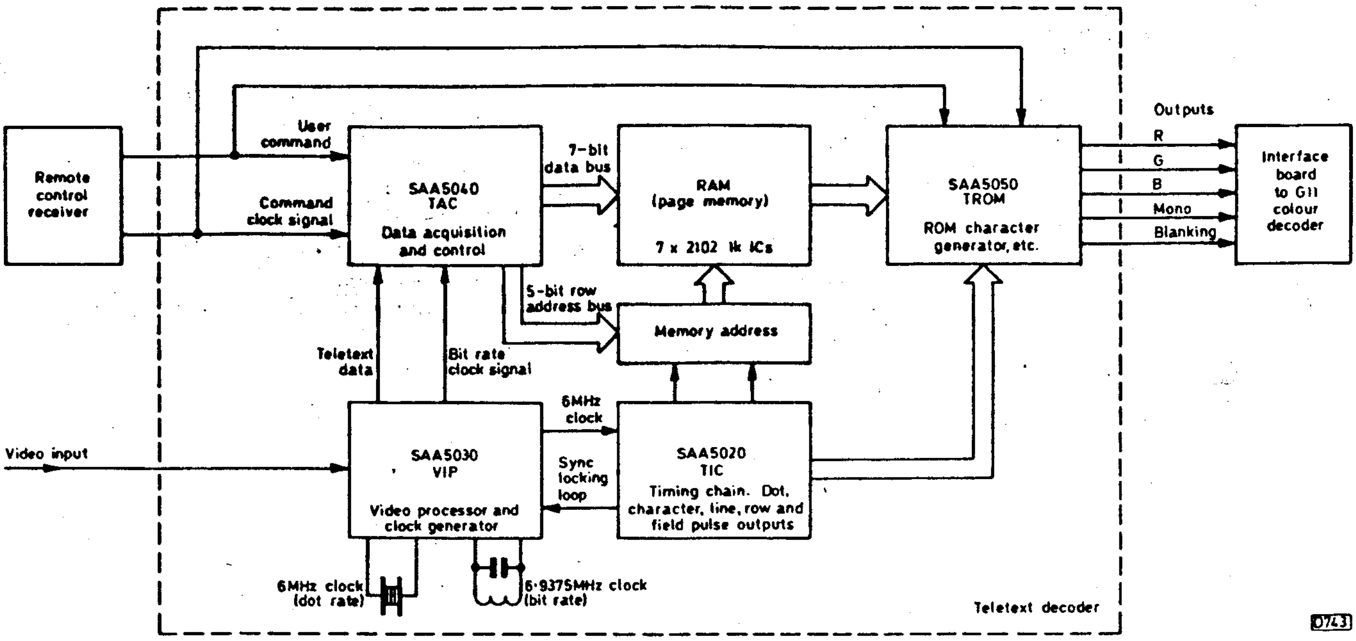

Fig. 1: Block diagram of the teletext decoder used in Pye/Philips teletext receivers.

The TIC divides the dot rate by six to get a 1MHz clock signal (character rate), then by 64 to obtain line-frequency pulses, and again by 625 to get down to the field rate. The line-rate pulses are further divided to produce the rows, and are also fed back to the VIP to lock the clock to the incoming signal.

As an optional facility, a stored page can be read after TV hours by allowing this timing chain to free run.

The TROM – Teletext Read Only Memory, type SAA5050 – converts the stored page held in the RAM (Random Access Memory – a group of i.c.s we've not yet mentioned) into the dot matrix pattern of characters comprising the text we see on the screen. The input is in parallel form, but the video output signals must be in serial form. The TROM also carries out character rounding, and the graphics blocks that take the place of text characters on pages such as the weather map are also generated in this chip. There are five outputs from the TROM to the set's video stages – RGB as you'd expect, plus monochrome and blanking. The monochrome signal has a variety of uses other than to provide a signal for black-and-white sets: it can be used to complete the matrix in the unlikely event of the decoder meeting up with a TV chassis employing colour-difference tube drive, and in the Pye/Philips teletext sets it's used to "punch holes" in the analogue signal when the mixed mode is used – so that the coloured text is presented on the screen when the set is used in this picture-plus-text mode. The blanking output provides boxes into which the time, status or newsflash text is inserted.

Page Memory

In addition to the four special-purpose i.c.s we've just mentioned, ten other i.c.s provide a memory in which a whole page of teletext data is stored. This consists of a matrix of seven 1k memory i.c.s, type 2102, though later on special 8k memory i.c.s may replace them.

The teletext format consists of 24 rows of 40, seven-bit characters, but as the 1k RAM i.c.s are organised on a 32 × 32 basis some re-arrangement is required to store a selected page. Three i.c.s (a 74LS83A and two 74LS161s) perform this operation. The memory stores the appropriate page until told not to do so. Three situations will do this, clearing the memory for the next page: a command from the user's handset; receipt of a newly selected teletext page; and receipt of the clear page command from the broadcaster (as given with a rotating page). The clear page operation is put into effect by arranging for the TAC's data output to consist of the character code for a space: unless followed by further instructions, the TAC will then automatically call up page 100 as previously mentioned.

By now you'll probably be wondering what about switching – how does the memory know when to accept data and when to issue it? In effect, little switching is needed since teletext is basically organised so that the data is coming in at a different time from when it appears on the screen. The data entry window (time when the incoming data is present) is during the field blanking interval, anywhere between lines 6 and 22, though at the moment only lines 17 and 18 are used. The display starts a little way down from the top of the raster, on line 48, and continues to line 288, allowing a clear space of 26 lines between the data's entry time and its display. During this time, on line 40 to be exact, control information from another part of the TAC chip is sent to the page memory, where it's written in to control such functions as channel indication, time, selected page ready and so forth. Some more capital letters: this line is called EDIL (Encoded Data Insertion Line), and is unique to the system being described.

Ancillary Circuits

When you look in the back of the set, you'll notice that the teletext decoder board is but one of the extra boards not found in an ordinary G11 chassis. The boards adjacent to the teletext decoder board are the remote control receiver plus its own decoder. These bear a superficial resemblance to the system used in the non-teletext G11, but the ultrasonic receiver is the only common feature.

The remote control handset is capable of transmitting 32 different commands, each consisting of a 24-bit signal – typically of 200msec duration. The 24-bit signal is divided into two halves, the first twelve bits being the complement of the second. The idea is that each half must match up before the receiver's decoder accepts the command. Of a 12-bit sequence, the first seven bits are the start code, which is

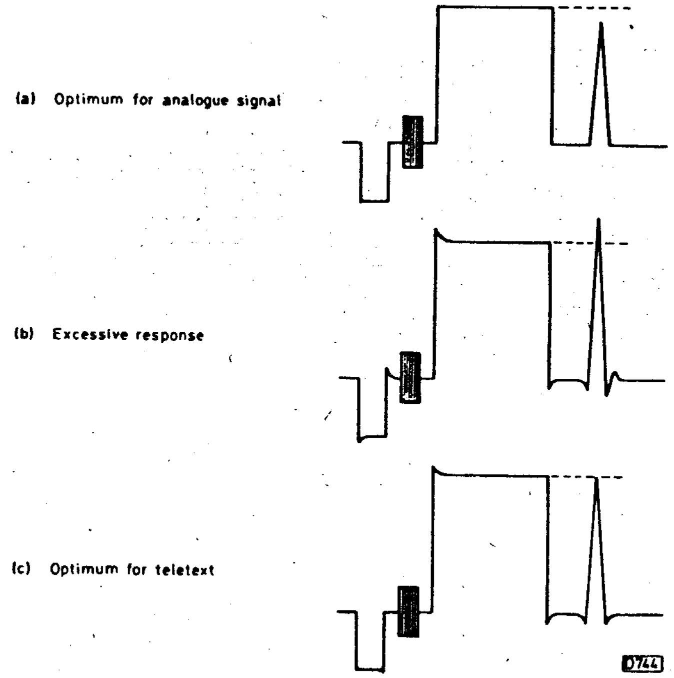

Fig. 2: Use of a pulse and bar signal to achieve optimum data capture: best conditions for teletext reception are when the amplitudes of the bar and the 2T pulse are the same and the lobes at either side of the pulse are symmetrically disposed below the datum line (black level).

identical for every command, and the last five bits the command itself. This arrangement ensures that the set doesn't respond to corrupted or spurious signals. To give the user added confidence, an occulting "message received" lamp at the foot of the cabinet glows while the message is being passed. The same lamp, operating in a steady mode, is used to indicate that the set is in the stand-by condition, i.e. with the TV side switched off but the remote control receiver still in operation.

One of the 32 commands is "mode", which permits the majority of the other commands to have a dual function. For example, the buttons for page 123 in the teletext mode will select BBC-1, BBC-2 and ITV respectively in the TV mode, using the same 24-bit words.

Power from the battery in the remote control handset is always drawn by its i.c. even when no command is being made. When not being used to transmit a command however the current drawn by the i.c. is as small as that drawn by a digital watch, so there's little wastage. The i.c.

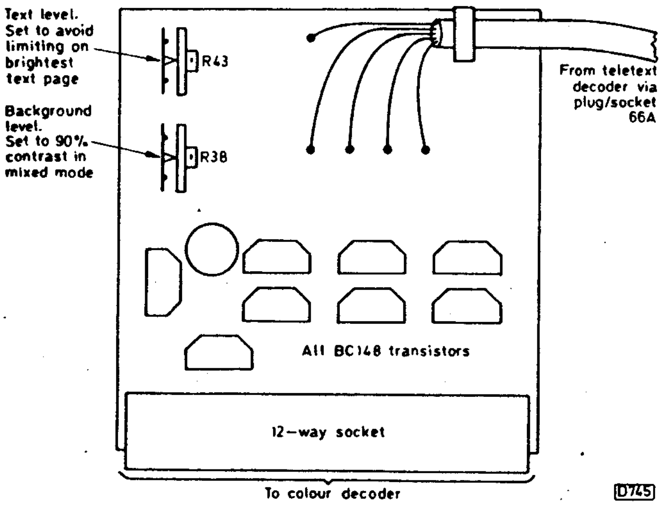

Fig. 3: Layout of the small teletext interface panel used in Pye/Philips teletext receivers (modified G11 chassis).

begins to transmit the command as soon as a button is pressed, continuing until the command has been completed, even if the user's finger has left the button.

There's no provision in the Pye/Philips sets for either a wired-in handset or for selecting text at the cabinet itself.

Power Supplies

The various supplies for the boards are provided by a unit in the base of the cabinet. This uses a chopper circuit. Later versions derive the power required from the line output stage.

Interfacing

The teletext decoder's signal input is taken from a standard G11 i.f. strip – at the inverted sync outlet. To ensure best performance, the eyeheight is optimised by using a pulse and bar i.f. signal to adjust the synchronous demodulator precisely. Optimum data capture usually occurs when the lobes (see Fig. 2) at either side of the 2T pulse are symmetrically disposed below the datum line: this condition sets the vision carrier a little below 6dB from peak (the latter is its usual place for analogue reception). Because the i.f. strip's sync outlet is used, the signal is inverted at the input to the teletext decoder. At the same time, the 6MHz intercarrier sound signal is filtered out.

The RGB outputs from the teletext decoder enter the G11 chassis proper at the back end of the chroma/luminance board. The board is modified so that the path of the TV signals is interrupted and at this point a small interface unit is plugged in (see Fig. 3).

There are two preset controls on the interface unit. The one nearest the socket strip is the background control and is normally set, in the mixed mode, to reduce the contrast to 90% of normal. This has been found to give the most acceptable level when pages are superimposed on a programme. The other control, farther from the socket strip – at the corner – is called "text level". It's not set too high during production, to avoid beam limiting occurring on pages with a lot of background colour. Some dealers wind it up a little however to compete with other makes – it's reassuring to know that it can be easily reset for domestic use. The eye, being used to reading black characters on white pages, is easily tired by prolonged exposure to the "negative" teletext display – particularly if there's too much contrast.

Modifications

Current production Pye/Philips teletext receivers use the Signetics "SAA" range of decoder chips, the panels bearing green labels. To dealers, this is "Phase $1\frac{1}{2}$". Earlier sets, few in number but produced to meet the demand for sets at the start of the service, use chips with preproduction "M" numbers on them. The performance is identical, but there's a degree of board non-interchangeability. "Phase 1" units carry a white label and must be used with Phase 1 handsets and remote control receivers. Phase $1\frac{1}{4}$ units carry a yellow label, and although the handset and remote control receivers are compatible with the green label Phase $1\frac{1}{2}$ ones the decoders are not directly interchangeable. The only difference is a small 6V regulator board which is plugged into the Phase $1\frac{1}{4}$ units and is not required on Phase $1\frac{1}{2}$ units.

At the start of 1980 the six-way ultrasonic remote control system was replaced by an infra-red counterpart. Also, in anticipation of the fourth TV network, the tuning system has gone eight-way – useful to viewers who can receive from two sets of transmitters. The only change in the teletext decoder is the TAC i.c., which becomes type SAA5040A and contains the extra information to display the two extra channels available. No harm will be done by using an SAA5040A to replace an SAA5040, or vice versa, but in this event the status displayed on the screen will not tie up with what's printed on the control panel.

Servicing

Unless you are good at working at 50nsec, can gate out a teletext eye, have your own "wallpaper generator" and a scope that looks at pulses, leave the decoder severely alone.

The four special chips are MOS devices and, provided you use the makers' advance replacement schemes, decoder panels will come in the correct conductive plastic bag which can be use to store them safely. Failing this, quickly wrap units in baking foil, handle them only be the edges (as you would an LP), and never handle them in a set connected to the mains or on stand-by. Wait until the replacement arrives before removing the old board, then change the units straight over.

Since the power supply is conventional, this can be safely worked on in the normal manner. When looking for lost voltages here, don't overlook the thermal fuse in the mains transformer. Three supply lines go from the power supply to the teletext units, and combinations of failures of these can produce various symptoms as follows.

No main 5V supply: Bright blank raster, flyback lines, set pulsating due to the action of the beam limiter. The message received light still winks during commands.

No main 5V and 12V supplies to the remote control receiver: No picture or sound apart from a three second burst at switch on.

No secondary 5V supply: Normal picture, weak colour, no handset action.

All teletext supplies dead: Picture present, weak colour, no sound, no remote control action.

If the set writes "scribble" in the teletext mode, either the decoder is faulty, the i.f. mistuned or there's aerial trouble (in that order).

To isolate a faulty teletext unit, unplug the white eight-way connector 66A from the decoder. The set then reverts to ordinary TV operation.

To keep the set going with faulty interfacing, remove the interface unit, join pins 5-6, 8-9, 11-12 on the chroma board, and remove plug 66A as above.

A weak battery in the handset may give a short control range or errors before packing up altogether. The type is PP3, and a plastic bag is provided to stop it ruining the handset if it leaks. Remove the battery during long idle spells, and in any event replace it once a year.

The clockcracker engineering test page is the installation engineer's yardstick for checking data capture. If you've handled both the Philips/Mullard type units and the Tifax module you'll know that clockcracker performance doesn't relate directly to page legibility. On a Tifax unit, a corrupted page of news can be seen at the same signal level as a perfect clockcracker page. On the Philips/Pye sets things work the other way round. Here the clockcracker display rows become corrupted (mostly to blank rows) towards the right-hand edge as the signal conditions get worse.

This provides a handy way to get the most out of an installation – if you're patient enough not to make more than one adjustment per clockcracker page read-in. On Pye/Philips sets, a clockcracker page that's more than three-quarters complete will almost certainly mean good legibility on any chosen text page. ■