Order this document
as AN448/D

Freescale Semiconductor

AN448

"FLOF" Teletext using M6805 Microcontrollers

By Peter Topping
MCU Applications
Motorola Ltd, East Kilbride

1. INTRODUCTION

The "T" members of the MC68HC05 family of MCUs provide a convenient and cost effective method of adding on-screen-display (OSD) to TVs and VCRs. As well as the 64-character OSD capability, they include 8 Kbytes of ROM (adequate for Teletext, frequency-synthesis, stereo and OSD), 320 bytes of RAM, a 16-bit timer and 8 pulse-width-modulated D/A converters. The MC68HC05T7 also includes IIC hardware and, by using a 56-pin package, 4 ports of I/O independent of the OSD, serial and D/A outputs. It is thus suitable for large full-feature chassis. The MC68HC05T1 is in the middle of the price/performance range and includes most of the features of the MC68HC05T7 but in a 40-pin package. This is achieved by sharing I/O with the other pin functions (SPI, OSD, D/A). Even if all these features are used, there is sufficient I/O for most applications.

The MC68HC05T2 is a 16K upgrade of the MC68HC05T1 and the MC68HC05T3 a 24K version with increased RAM (512 bytes) and enhanced OSD (112 characters and 2 rows of OSD buffer). The low cost MC68HC05T4 has 5 Kbytes of ROM and 96 bytes of RAM making it suitable in simpler (eg mono, non-Teletext) applications. The T4 and T7 also include a 14-bit D/A converter to facilitate voltage synthesis tuning. There are EPROM (and OTP) versions of the T3 (including T1 and T2 emulation), T4 and T7.

This application note describes an example of Teletext control software written for the MC68HC05T7 which directly controls Teletext chips of the type 5243. Spanish FLOF Teletext (level 1.5) is handled using packet X/26. If no CCT teletext chip is present on the IIC bus (as indicated by the lack of an acknowledge), all Teletext functions are disabled in software. About 3Kbytes of ROM are used allowing the code to fit into the 7.9K bytes available in an MC68HC05T7 along with tuning, OSD and stereo functions.

The software in the included listing has been written for the MC68HC05T7 but could, with a little modification, be implemented on other M6805 microcontrollers. A microcontroller without IIC hardware can be used as long as additional software is included to facilitate the IIC bus using I/O pins. An example of IIC master I/O driven software can be found in application note AN446.

2. "FLOF" TELETEXT FEATURES

Full Level One Feature (FLOF) Teletext utilises "ghost" packets to provide features in addition to those available with the original CCT Teletext. The primary enhancement is the provision of a menu with a choice of four linked pages selectable by the user with a single press of one of four coloured buttons on the remote control. The menu itself is sent in the ghost page using packet 24 while the linked page numbers are contained in packet 27. In addition to linked pages, packets 26 and 30 are used. Packet 26 allows for the substitution of selected characters in the display by special characters specific to a particular country. This example application includes the Spanish implementation of packet 26. The broadcast service data packet (8/30) is used to get the initial (index) page for each channel and to display station identification information.

"Ghost" packets handled

X/24 :

The FLOF menu information contained in this page extension packet is transferred by the microcomputer to row 24 of the display chapter. When links are disabled because there is no packet 27 (destination code 0) or when bit 4 of byte 43 is 0, row 24 is blank.

X/26 :

Optional handling of modes 1xxxx, 01111 and 00010 in accordance with the Spanish Teletext specification. All the additional characters which are available in the 5243 CCT chip are handled. The feature can be disabled with a hardware link on an I/O pin (see figure 1) so that the software can be used at level 1.0 in non-Spanish countries also using packet 26.

X/27 :

This packet contains the linked page numbers for the red, green yellow, blue and index (black) keys. Bit 4 on the link control byte (byte 43) is used to determine if these links are enabled (1) or disabled (0). When enabled, the Spanish specification requires that bits 1, 2 and 3 be used to enable the green, yellow and blue links respectively. This use of these bits is not defined in the World Teletext Specification. For this reason their use is selectable by a hardware link (see figure 1). If these bits are not used, all links (if enabled by bit 4) will be taken from packet 27 but will be automatically disabled if the broadcast links are default (FF3F7F) or invalid.

8/30 :

The broadcast service packet is used to supply the index page number on exit from standby and (if teletext is not stopped) after a channel change. Bytes 10-30 of this packet are displayed for 5 seconds on exit from standby and (if teletext is not stopped) after a channel change.

3. IMPLEMENTATION

The software listing is in two parts. The first part contains the "idle" loop and IIC routines from the main TV control part of the MC68HC05T7 application. The idle loop controls the timing of everything performed by the microprocessor, scans the local keyboard, checks whether or not an IR command has been received, etc. It also monitors the relevant flags in the Teletext chip and performs the tasks (eg fetching linked pages) which have to be performed independently of requests for the user.

The second and main listing is the Teletext module itself. It contains all the subroutines required to carry out automatic and user requested Teletext activity. Both modules use the same RAM allocation file (RAMT8.S05) which is included in the listing of the Teletext module. This listing also includes a symbol cross-reference table.

Figure 1 shows a simplified circuit diagram of the application. Most of the MC68HC05T7's I/O is used for purposes other that Teletext and is not shown in detail. Communication with the 5243 Teletext chip is via an IIC bus in which the T7 is always the master. The function of the three I/O pins used for Teletext is described under "Ghost packets handled" and "Inputs and Outputs".

A version of this Teletext software has been implemented on an MC68HC05C4 for use in a TV where the other control functions were handled by a separate microcontroller. The signal from the IR pre-amp was fed into the C4 which used Teletext commands to control a 5243 via a software IIC bus. Non-Teletext commands were re-generated by the C4 and sent to the other microcontroller. This arrangement allows Teletext to be added to a chassis which was originally designed without considering Teletext.

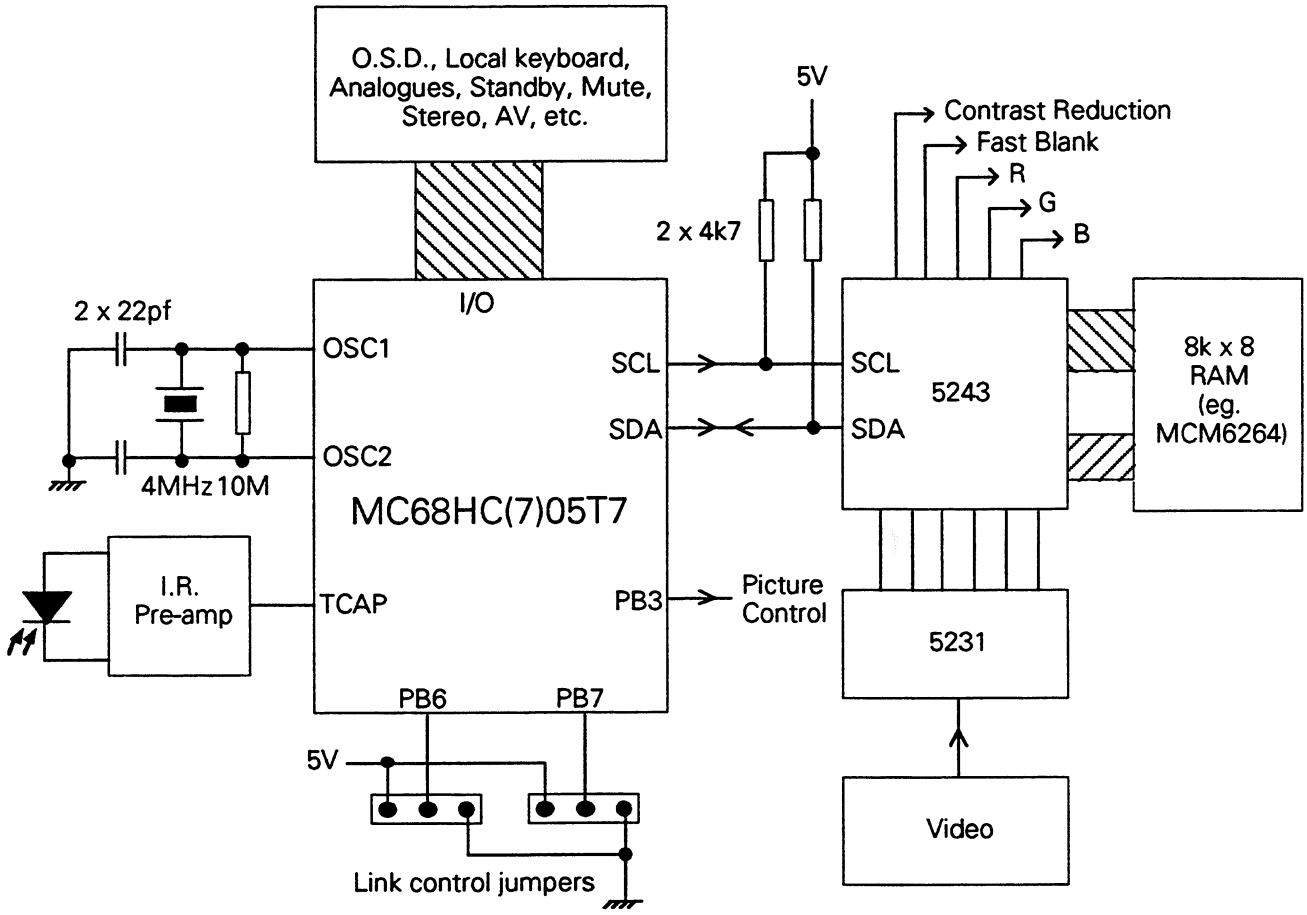

Figure 1. MC68HC(7)05T7 – Teletext application circuit

4. IDLE LOOP

In the example application the idle loop code is in the main TV control software module rather than in the teletext module. Listing 1 shows the relevant parts of this module. The loop time is 12.8mS and it is at this rate that the timing counters used by Teletext (CNT1 and CNT4) are incremented. The standby condition is checked first; if the TV set is in standby then there is no IIC activity and hence no reading from, or writing to, the 5243. If the TV has just exited from standby, as indicated by the flag 3,STAT2, then Teletext is initialised using the sub-routine RESTRT. This sub-routine writes to the 5243's control and mode registers (R5, R6 and R7) and checks that the IIC acknowledge is present. If there was no acknowledge, as indicated by flag 6,STAT7, then no further Teletext activity is attempted.

If an acknowledge is present, Teletext polling goes ahead, although it is suspended if there is a mute or time display. A mute indicates that the channel has just been changed, or no channel is tuned. During time display, all other Teletext activity is suspended. Re-initialisation using sub-routine START2 is performed if flag 7,STAT5 is set by a change of the tuned frequency.

Counter CNT4 is used to delay the transfer of packets 24 (page extension – FLOF menu), 27 (links), 26 (enhanced display characters) and the control bits from row 25 (display page) after the initial arrival of a page. When row 24 is read the 5243 FOUND flag is set to indicate that the arrival has been acted upon. If UPDATE is on then an update indicator appears if the update control bit (C9) is set or if the sub-page has changed or if it is the first arrival of the page. The update display is performed by the sub-routine ARRVD which clears the transient flags and enables the required display, i.e. page no. in normal mode and the whole of row 0 in sub-page mode. Any boxed information (eg sub-titles or newsflash) in the current page is also displayed. The last Teletext function performed by the idle loop is the checking of the FOUND flag in the 5243. This is accessed via the IIC bus; it is on the last (not displayed) row of the display page along with the current page and sup-page numbers and the control bits.

If there is a current Teletext transient (time, row 0 box or packet 8/30), the transient control branch from the idle loop is executed. This routine checks to see if it is time to end the transient. If it is, the subroutine OSDLE is executed. It resets transients for both the OSD generated by the MC68HC05T7 and Teletext. The sub-routine RSTMD2 performs this function for Teletext. It is called from within the sub-routine OSDLE (not listed).

5. REMOTE CONTROL FUNCTIONS

TV/TXT

Toggle between TV & Teletext mode.

0-9

Number keys for entry of page and sub-page numbers

Red, Green, Yellow, Blue

Linked page access keys. The decoder stores four pages of text. These are the display page and the three pages corresponding to the red, green and yellow links. The blue linked page is not acquired in advance. In the absence of FLOF data or if the links are disabled by the control bit in packet 27, the red key is page+1 and the green key page-1. Under these circumstances the requested page and the next three pages are acquired.

PC+/-

These keys always select page+1/page-1 regardless of the availability of FLOF information. As with the red, green and yellow keys, the page is displayed immediately if it is already in RAM.

INDEX

This key operates as an additional link with the difference that if the link is invalid the initial page from packet 8/30 is selected.

SUB-PAGE/TIME

Text mode: Enter sub-page mode, (max. 3979). TV mode: Display time in top-right-hand corner for 5 seconds. Pressing this key during a station identification display (packet 8/30 bytes 10-30) can be used to extend this display beyond the five seconds it appears for, after a channel change.

STOP

Halt acquisition, "STOP" is displayed instead of page number. Press again to restart. If acquisition has been stopped by partially entering a new page number then this key can be used to return to the original page.

MIX/NO-MIX

Toggle between Teletext and mixed display. Use of this key causes the display of the top status row for 5 seconds if it is not being displayed because the current page is a newsflash or a sub-title. 5243 contrast reduction is enabled in mixed mode.

FULL/TOP/BOT

Selects one of the three display formats, normal, top half enlarged, bottom half enlarged.

REVEAL

Reveal hidden text, toggle action.

UPDATE

Return to picture until a new version of the requested page arrives. When it arrives, its page no. is displayed in the top-right-hand corner, the key operates in both TV and Teletext mode, set is put into TV mode. Any boxed information (alarm clock, newsflash or sub-title) will be displayed. In sub-page mode the complete header is displayed so that both page & sub-page numbers can be seen. Cancel update by entering Teletext mode and then going back to TV mode by pressing the TV/Text key twice.

6. TELETEXT SUBROUTINES

6a. Subroutines: TVTX, UPDATE, DIGIT0 and GETIT

The Teletext module (listing 2) comprises various sub-routines which are used both by the idle loop and to perform any Teletext actions initiated by commands from the IR remote control. They are described in the order in which they appear in the listing.

TVTX is executed when the TV/TEXT button is pressed. Its function is to toggle between TV mode and Teletext mode. The flag 0,STAT indicates the current mode. This flag routes the microprocessor to execute either TXTOFF or TXTON according to the current mode. TXTON checks that Teletext hardware is present and does nothing if there has been no IIC acknowledge. If, however, a 5243 is present in the TV, it clears all transients (OSDLE) and sets up the Teletext mode. It initialises the control registers (R5 and R6) to display text and background both in and out of boxes. For newsflashes the set-up is text and background within boxes and picture outside. TXTOFF also resets transients but forces TV mode and sync. Polling and updating continue as a background activity.

When the UPDATE key is pressed the update flag 4,STAT2 is set and TXTOFF executed so the TV is forced to TV mode. If there is a current transient hold (eg time), the hold is cleared before TXTOFF is executed.

The number entry sub-routine DIGIT0 branches to DIGITS in sub-page mode but otherwise accepts any number key as a page number input. Three digits are required, the pointer PDP holding the current position (0, 1 or 2 for hundreds, tens or units). During entry the flag 2,STAT is set to stop Teletext activity. The numbers have to be written to the top-left-hand corner of the display page as well as saved in RAM. Once all three digits have been entered the page is requested and page acquisition restarted.

The code at label GETIT makes this request after first checking whether or not the selected page has already been requested (it could be the current display page or an already requested linked page). If it has, then a switch is made to the chapter associated with the appropriate acquisition circuit and no new request is generated. If not, the new request is made and the FOUND flag set.

6b. Subroutines: Colours, INDEX, NPAGE and PPAGE

The four colour keys (Red, Green, Yellow and Blue) are primarily intended for selecting Teletext linked pages. When pressed the chapter which corresponds to the appropriate acquisition circuit is selected for display. If links are disabled (by the link control bit or because there is no packet 27), then the RED and GREEN keys select current page +1 and -1 respectively. This choice is taken according to the state of flag 3,STAT3 which reflects the condition of the link control bit in packet 27. The code executed by RED, if links are not in use, is the same as that executed by the "+" function (NPAGE) which always selects the next page. Similarly the alternative GREEN function (PPAGE) is the same as for the "-" key. The YELLOW and BLUE keys do nothing under these circumstances. In Spanish Teletext the GREEN, YELLOW and BLUE links can be individually inhibited, but the RED link is only inhibited if all links are off.

The chapter associated with the selected page is displayed immediately if it has already been requested. This will normally be the case if a linked page (red, green or yellow) has been selected. The code at label LPT is executed if the page has already been requested. If not, a jump to CLRPD is performed. CLRPD is a label within DIGIT0; the code at CLRPD requests a new page just as if the page number had been entered manually. If the required acquisition circuit is the one already current, then the "unstop" code is executed. This causes the green page-being-looked-for header to roll as though the page number had just been entered. This means that something can be seen to happen in the case where the linked page differs only from the current page in its sub-page number. Linked sub-pages are not fully supported in this implementation as they are rarely used by broadcasters and would significantly increase the size of the software. When the chapter is changed the Teletext PBLF (page being looked for) flag is checked. If it is low the FOUND flag is cleared. This forces the fetching of the links associated with the new display page. If the page is not already in, this will automatically happen when it arrives so the FOUND flag does not need to be cleared.

The BLUE (or cyan) key is different in that its page will not normally be immediately available (the four pages: display, red, green and yellow occupy the four acquisition circuits and RAM chapters).

The INDEX (or black link) function is similar to BLUE except that if its link is not valid it defaults to the initial (index) page number supplied by packet 8/30 (see sub-routine GIP).

6c. Subroutines: LINK, GLP1, GLP2, SRCH, CHCK1 and NOTOKx

The sub-routine LINK allocates the three linked pages (RED, YELLOW and GREEN) to the three free acquisition circuits (not in use by the display page). To do this it checks the page numbers in turn to see if they have already been requested. If so they are left in their current acquisition circuit. If they have not already been requested the page number is put into a LIFO. Only 0-9 are regarded as acceptable digits for page numbers; this is consistent with the Spanish specification although the additional HEX numbers (A-F) may be used experimentally or by Teletext page generators. Within this first loop the sub-routine GLP1 is used to get the linked page numbers from packet 27, perform a decode of the Hamming encoded data and calculate the new magazine number (page hundreds) if different from that of the display page. GLP1 uses sub-routine SRCH to check if the page has already been requested. If there are no links, or if links are disabled, then displayed page +1, +2 and +3 are requested.

The second loop in LINK allocates new page numbers to the remaining unused acquisition circuits. It uses GLP2 to clear the relevant chapters in the Teletext memory and make the new requests. Subroutine CHCK1 is used to check whether or not an acquisition circuit is in use before it is loaded with a new page number from the LIFO.

This method of organising new page requests prevents unnecessary requests being made for pages already requested. This is particularly important when links are disabled and pages are being requested using the "+" or "-" functions. Under these circumstances when the page number is incremented (or decremented) only one new page has to be requested (new display page+3), while page, page+1 and page+2 do not need to change and can be left in their current acquisition circuits.

NOTOK3 and NOTOK2 handle the RED and GREEN functions when links are disabled. They are disabled if the link control bit (packet 27 bit 3, byte 43) is zero or if there is no packet 27. These subroutines respectively increment and decrement the current page number (units and tens). The current magazine number (page hundreds) is not affected.

6d. Subroutines: ROW24, W2B, R2B, GCYI, CLINK and DECODE

ROW24 is used to transfer ghost row 20 (packet 24) into the display chapter. This has to be done via the IIC bus. The loop reads two bytes via the IIC (sub-routine R2B) bus from the ghost page and writes it to the display page (sub-routine W2B). The FOUND flag is then set to indicate that the arrival of the page has been recognised and acted upon. This sub-routine is only called by the idle loop and is used along with the other sub-routines which get information from the ghost page (CLINK, LINK and GET25).

R2B and W2B use IIC routines READ and SEND which are outwith the Teletext module. These subroutines will differ according to the microprocessor in use. An MC68HC05C8 implementation would need to use I/O lines (see reference for suitable software) while the MC68HC05T7 can use its IIC hardware. The routines used in this example are included in the listing extract from the TV control software module (listing 1).

The sub-routine GCYI is used by LINK to store the data associated with the BLUE an INDEX links. As explained above, these pages will not be acquired in advance, the page number only being sent to an acquisition circuit if requested by an IR command.

CLINK fetches the link control byte from packet 27 if the destination code is OK and, after decoding the Hamming encoded data, transfers the bits to STAT3.

The Hamming decode sub-routine DECODE corrects for single bit errors. This is done with in-line code using the table HAM (at the end of listing 2) as this uses less ROM than an algorithmic method.

6e. Subroutines: MIX, TRANx, TXTx, HOLD, and NOHOLD

The mixed display capability of the Teletext chip (5243) is toggled using an IR key which calls the sub-routine MIX. When mixed mode is entered, interlaced broadcast sync. (312/313) is selected because the non-interlaced sync. used for teletext is not suitable if a TV picture is present on the screen. This is set up via the 5243 mode register R1. The control registers R5 and R6 are updated to provide the mixed display.

When returning to a non-mixed display, the code at NOMIX is used to re-configure the control registers and to set up a Teletext only 312/312 non-interlaced sync. This sync. reduces adjacent line flicker in a pure Teletext display.

The subroutine TRAN2 sets up a transient which retains a black background on the top row so that the page number, time etc. can be seen clearly. This type of transient is also started if the page number or sub-page number is being entered in mixed mode. Sub-routines TRAN1, TRAN2 and TRAN3 are used to initialise the various transient displays. These displays are cancelled as discussed above by actions taken within the idle loop controlled by the free-running timer within the MC68HC05T7.

The TXTx sub-routines are used in conjunction with the IIC SEND routine to write to various sub-sets of the registers within the 5243.

If the Teletext STOP function is requested by an IR command the routine HOLD is executed. This is a toggled function when requested in this way. HOLD displays the word "STOP" in place of the page number and stops the display acquisition circuit by clearing the 5243 HOLD flag accessed via its page request register R3.

NOHOLD is executed to restart the display acquisition circuit. It returns the page number to the top-left-hand corner. If a new page number has been partially entered, a press of STOP (executing an UNHOLD) will allow a return to the most recent page request. This takes only a single press as the start of the entry of a new page number cause a HOLD. The completion of a page number entry (3 digits) causes a NOHOLD.

6f. Subroutines: REVEAL, EXPTB and TIME

The REVEAL function causes any hidden display information to appear. It is controlled by a bit in the display mode register (R7). The software example leaves any revealed information permanently displayed. If, however, it is required that such information disappear when the page is updated (this may be better for a quiz page), then the two commented out lines (80 and 81) in the idle loop should be enabled.

The display expand facility is controlled by another two bits in R7. The EXPTB sub-routine cycles through normal, top-half double height and bottom-half double height.

The example application uses a single IR key (subroutine TIME) for both the display of the Teletext clock and the entry into sub-page mode. IF the set is in TV mode then the time is displayed for 5 seconds. If the TV is in Text mode then sub-page mode is selected. Sub-page number entry is described in the following section. When the Teletext clock is requested it appears (boxed) at the top-right-hand corner. It is removed by the idle loop 5 seconds after the last press of the time button. When the time is being displayed all other Teletext activity is stopped using UCHOLD.

6g. Subroutines: DIGITS, SUBPG, GET25 and GET26

DIGITS is the sub-page version of DIGIT0 and uses similar code. More checks on the input data are required as the four digits of the sub-page number have different maximum values. These maximums are 3 for thousands, 7 for the tens and 9 for the hundreds and units. These values reflect the sub-page number's original use as a time (24hr format). For tens and thousands a keyed 8 becomes a 0 and a 9 becomes a 1; for thousands only 4, 5, 6 and 7 become 0, 1, 2 and 3 respectively.

The code at the label SETIT is the sub-page equivalent of GETIT, described above. It requests the new sub-page and sets the FOUND flag.

The sub-routine SUBPG is called when the TIME (or clock) key is pressed (TV in Teletext mode). It toggles between normal mode and sub-page mode. When sub-page mode is entered the page number display (P—) is replaced with **** to indicate the mode change and to prompt for the entry of a sub-page number. Once all four digits have been entered the new sub-page is requested by SETIT. The code at the label RSTR is used to exit from this mode back to the normal (page number) mode, restoring the page number display to the top-left-hand corner.

GET25 is used by the idle loop to get the information stored in row 25 of the display chapter. This row is not displayed but contains various information used by the control microprocessor. The current page number, magazine number, sub-page number, Teletext control bits and the FOUND and PBLF flags are available. GET25 gets the required information and stores it in the RAM of the MC68HC05T7.

At the end of this sub-routine the I/O line 7,portB is checked. If it is low, packet 26 is handled. If it is high, this packet is disabled. This would be required if this application were to be used in a country other than Spain which used packet 26. It would require to be switched off as the enhanced display feature uses different characters depending on the country. In countries which do not use packet 26 (eg the UK) it does not matter whether or not packet 26 is enabled.

If packet 26 is enabled, GET26 processes all packet 26 data present in the ghost page. The tables G2TAB, G3TAB and CTAB contain the characters used to replace the character at the display location defined by each packet.

6h. Subroutines: GIP, R24T and SR24T

The sub-routine GIP gets the initial (index) page from packet 8/30. It will be doing this as the set is brought out of standby or just after a channel change. It may thus initially get a poor signal (or there may be no Teletext) so it tries repeatedly until it finds a valid packet 8/30 format 1. If this is not found after 96 tries it gives up and sets the flag 6,STAT2 to indicate that there is no packet 8/30 (or no Teletext). In this circumstance it defaults to an index page number of 100.

R24T transfers bytes 10-30 of the broadcasting service data packet (8/30) into the display chapter. It is called once a second for five seconds after power-on or a channel change. The data is transferred to row 0 of the display page which can be displayed either at the bottom or, as in this example, the top of the screen. This transient display is setup using the sub-routine SR24T if Teletext is present. If the flag 6,STAT2 has been set by GIP as described above then SR24T does nothing. The transient display is terminated by code executed at the appropriate time from within the idle loop.

7. INPUT AND OUTPUTS

Apart from the IIC bus, only three pins on the controlling microprocessor are relevant to Teletext. Two inputs select the usage of packets 26 and 27 and one output can be used to control any hardware which requires to be changed according to whether or not there is a TV picture currently being displayed. In many applications some or all of these functions will not be required and could be eliminated from the software thus freeing up the pins for other uses.

PB3)

This pin is active (high) during a pure (no-mixed, no-boxed) teletext display, otherwise it is low.

PB6)

When this pin is low, Spanish use of link control bits 1, 2 and 3 is enabled. When it is high, these bits are ignored.

PB7)

Packet 26 control. When low, packet 26 is enabled and handles all the Spanish alternate characters which are available in the 5243. When PB7 is high, packet 26 is ignored.

8. REFERENCES

Application note AN446, MCM2814 Gang-programmer using an MC68HC05B6.

LISTING 1

```
                                ********************************************************
                                *                                                      *
                                *       Idle loop.                                     *
                                *                                                      *
                                ********************************************************

00000000  0d13fd    ILP     BRCLR   6,TSR,*         OUTPUT COMPARE FLAG
00000003 >3c00              INC     CNT1            TELETEXT TRANSIENT
00000005 >3c00              INC     CNT4            ROW 24 DELAY
00000007 >3c00              INC     CNT5            MUTE TRANSIENT
00000009 >cd0000            JSR     KBD             KEYBOARD & TIMERS
0000000c  030104            BRCLR   1,PORTB,FON     STANDBY ?
0000000f >1600              BSET    3,STAT2         MAKE SURE FLAG AGREES
00000011  205f              BRA     F1              AND IDLE WITH NO IIC ACTIVITY
00000013 >070009    FON     BRCLR   3,STAT2,ALRON   NO, JUST ON ?
00000016 >1700              BCLR    3,STAT2         YES, RESTART
00000018 >1500              BCLR    2,STAT2         CLEAR THIS FLAG ALSO ?
0000001a >1f00              BCLR    7,STAT5         RE-INITIALISATION NOT NECESSARY
0000001c >cd0000            JSR     RESTRT
0000001f >cd0000    ALRON   JSR     VCRPOLL         POLL SCART LINES
00000022 >02004d            BRSET   1,STAT2,F1      REMOTE REPEATING ?
00000025 >02004a            BRSET   1,STAT4,F1      LOCAL REPEATING ?
00000028 >0c0047            BRSET   6,STAT7,F1      TELETEXT CHIP ON BUS ?
0000002b >040044            BRSET   2,STAT2,F1      SEARCH/STANDBY ?
0000002e >0a0041            BRSET   5,STAT,F1       TIME DISPLAY HOLD
00000031 >06003e            BRSET   3,STAT4,F1      TRANSIENT MUTE ?
00000034 >0c003b            BRSET   6,STAT4,F1      COINCIDENCE MUTE ?
00000037 >0f0005            BRCLR   7,STAT5,DNTRS   TO BE RE-ITIALISED ?
0000003a >1f00              BCLR    7,STAT5         YES, CLEAR FLAG &
0000003c >cd0000            JSR     START2          RE-INITIALISE TELETEXT
0000003f >01001c    DNTRS   BRCLR   0,STAT2,NO24
00000042 >b600              LDA     CNT4            PAUSE WHILE PACKET 24
00000044  a130              CMP     #48             (PAGE EXT.) ARRIVES
00000046  252a              BLO     F1
00000048 >cd0000            JSR     CLINK           CHECK LINK CONTROL BYTE
0000004b >cd0000            JSR     LINK            FETCH LINKS
0000004e >cd0000            JSR     ROW24           FETCH ROW 24 AND SET FOUNDB
00000051 >cd0000            JSR     GET25           GET ROW 25 & PACKET 26
00000054 >090005            BRCLR   4,STAT2,NOUP    UPDATE ENABLED ?
00000057 >0b0002            BRCLR   5,STAT2,NOUP    DIFFERENCES ?
0000005a  ad6e              BSR     ARRVD
0000005c >1100      NOUP    BCLR    0,STAT2
0000005e >b600      NO24    LDA     ACC
00000060 >b700              STA     R8
00000062  a608              LDA     #8              COLUMN 8 (FOUNDB & PBLF)
00000064 >b700              STA     R10
00000066  a619              LDA     #25             ROW
00000068 >cd0000            JSR     R2B
0000006b >080104            BRSET   4,IOBUF+1,F1    FOUNDB FLAG SET ?
0000006e >1000              BSET    0,STAT2         NO, SO FETCH GHOST ROWS
                    *       BCLR    5,R7            KILL REVEAL
                    *       JSR     TXT2
00000070 >3f00              CLR     CNT4
00000072 >04008b    F1      BRSET   2,STAT2,ILP     SEARCHING ?
00000075 >060088            BRSET   3,STAT2,ILP     STANDBY ?
00000078 >090085            BRCLR   4,STAT,ILP      TRANSIENT ?

                                ********************************************************
                                *                                                      *
                                *       Transient control.                             *
                                *                                                      *
                                ********************************************************

0000007b >b600              LDA     CNT1            YES
0000007d  a150              CMP     #80
0000007f  2403              BHS     NILP
00000081 >cc0000            JMP     ILP             1S TIMER
00000084 >b600      NILP    LDA     R4
00000086  a104              CMP     #4
00000088  2603              BNE     NOTE            IF PAGE 4 THEN IT'S
0000008a >cd0000            JSR     R24T            THE 8/30 TRANSIENT
0000008d >3f00      NOTE    CLR     CNT1            CLEAR 1S TIMER
0000008f >3a00              DEC     TMR             DECREMENT SECONDS COUNTER
00000091  2703              BEQ     DNILP           TRANSIENT FINISHED ?
00000093 >cc0000            JMP     ILP             NO

00000096 >cd0000    DNILP   JSR     OSDLE           OSD TIMEOUT (INC RSTMD)
00000099 >cc0000            JMP     ILP

                                ********************************************************
                                *                                                      *
                                *       End Teletext transients.                       *
                                *                                                      *
                                *       Clear mode bits (channel mode, 2-digit         *
                                *       prog. no. entry etc.)                          *
                                *                                                      *
                                ********************************************************

0000009c >010003    RSTMD   BRCLR   0,STAT5,SOS2    2-DIGIT Pr. No. ENTRY ?
0000009f >cd0000            JSR     RES             YES, RESTORE DISP
000000a2 >1500      SOS2    BCLR    2,STAT4         MAKE SURE ITS PROGRAM MODE

000000a4 >1900      RSTMD2  BCLR    4,STAT4         RESET OSD TRANSIENT FLAG
000000a6 >1900      RSTMD3  BCLR    4,STAT          RESET MAIN TRANSIENT FLAG
000000a8 >0b0011            BRCLR   5,STAT,TXTR1    TIME HOLD ?
000000ab >1b00              BCLR    5,STAT          YES, CLEAR IT
000000ad  a603              LDA     #$03
000000af >b700              STA     R5
000000b1 >b700              STA     R6
000000b3 >cd0000            JSR     TXT2            STOP TIME EXIT FLASH
000000b6 >040003            BRSET   2,STAT,TXTR1    OTHER HOLD ?
000000b9 >cd0000            JSR     NOTTH           NO, SO CLEAR HOLD
000000bc >1100      TXTR1   BCLR    0,R7            BOX OFF ROW 0
000000be >000006            BRSET   0,STAT,TXTR2    TELETEXT ?
000000c1 >b600              LDA     ACC
000000c3 >b700              STA     R4
000000c5 >3f00              CLR     R7              NO, ALL BOXES OFF
000000c7 >cc0000    TXTR2   JMP     TXT2            YES
```

```
                                ********************************************************
                                *                                                      *
                                *       Updated page has arrived.                      *
                                *                                                      *
                                ********************************************************

000000ca >b600                  ARRVD   LDA     ACC
000000cc >b700                          STA     R4
000000ce >1900                          BCLR    4,STAT          KILL TRANSIENTS
000000d0 >1b00                          BCLR    5,STAT
000000d2  4f                            CLRA
000000d3 >cd0000                        JSR     BOX0ON
000000d6 >0c0005                        BRSET   6,STAT,SPMD     SUB-PAGE MODE ?
000000d9  a606                          LDA     #6              NO, SMALL BOX
000000db >cd0000                        JSR     BOX0OF
000000de  a646                  SPMD    LDA     #$46
000000e0 >b700                          STA     R5
000000e2 >b700                          STA     R6
000000e4  a603                          LDA     #$03
000000e6 >050002                        BRCLR   2,C3,NNF        NEWSFLASH ?
000000e9  a602                          LDA     #$02            YES, NO ROW 0
000000eb >b700                  NNF     STA     R7
000000ed >cc0000                        JMP     TXT2


000000f0  a610                  RESTRT  LDA     #$10            BROADCAST SYNC.
000000f2 >b700                          STA     R1
000000f4  a606                          LDA     #6
000000f6 >b700                          STA     R5
000000f8 >b700                          STA     R6
000000fa >3f00                          CLR     R7
000000fc >cd0000                        JSR     TXT2            SWITCH PICTURE ON

000000ff  013c03                        BRCLR   0,MSR,ACKOK     ACKNOWLEDGE ?
00000102 >1c00                          BSET    6,STAT7         NO, SET FLAG
00000104  81                            RTS

00000105 >cc0000                ACKOK   JMP     INITXT


00000108 >b600                  RES     LDA     PROG            YES, RESTORE PROG. NO.
0000010a >b700                          STA     DISP
0000010c >1100                          BCLR    0,STAT5
0000010e  81                    ABS     RTS

                                ********************************************************
                                *                                                      *
                                *       IIC write.                                     *
                                *                                                      *
                                ********************************************************

0000010f  ad23                  SEND    BSR     IICSU

00000111 >bf00                          STX     DPNT            SAVE X
00000113 >1100                          BCLR    0,ADDR          SET-UP TO WRITE
00000115 >b600                          LDA     ADDR
00000117  ad25                          BSR     SHIFT           SEND CHIP ADDRESS

00000119 >b600                  WRBU    LDA     ADDR
0000011b  a180                          CMP     #$80            STEREOTONE ?
0000011d  2606                          BNE     WRB
0000011f >b600                          LDA     SUBADR          YES, SO ENABLE AUTO
00000121  ad1b                          BSR     SHIFT           SUB-ADDRESS INCREMENTING
00000123 >3c00                          INC     SUBADR

00000125 >be00                  WRB     LDX     DPNT            DATA BUFFER POINTER
00000127  f6                            LDA     0,X
00000128  ad14                          BSR     SHIFT           SEND DATA
0000012a >3c00                          INC     DPNT
0000012c >3a00                          DEC     W1
0000012e  26e9                          BNE     WRBU            DONE ?

00000130  1b3b                          BCLR    5,MCR           STOP
00000132  9a                            CLI
00000133  81                            RTS

00000134  9b                    IICSU   SEI
00000135  3f3c                          CLR     MSR             IIC SET-UP
00000137  3f3a                          CLR     FDR             90 KHz
00000139  a6b0                          LDA     #$B0            ENABLE IIC AS MASTER
0000013b  b73b                          STA     MCR             TRANSMITTER & START
0000013d  81                            RTS

0000013e  b73d                  SHIFT   STA     MDR
00000140  0f3cfd                        BRCLR   7,MSR,*
00000143  81                            RTS

00000144  adc9                  WRITE   BSR     SEND
00000146  a602                          LDA     #2
00000148 >cd0000                        JSR     TPAU            WAIT 10mS (EEPROM WRITE)
```

```
230                                 ********************************************************
231                                 *                                                      *
232                                 *       IIC read.                                      *
233                                 *                                                      *
234                                 ********************************************************
235
236 0000014b  ad0c               READ    BSR     READ1           GET FIRST BYTE
237 0000014d >b600                      LDA     IOBUF
238 0000014f >b701                      STA     IOBUF+1         MOVE IT UP
239 00000151 >b600                      LDA     ADDR
240 00000153  a1a1                      CMP     #$A1            NVM ?
241 00000155  2602                      BNE     READ1
242 00000157 >3c00                      INC     SUBADR          YES, NEXT SUB-ADDRESS
243
244 00000159  add9               READ1   BSR     IICSU
245 0000015b >1100                      BCLR    0,ADDR          RW = 0 ALWAYS WRITE (SUB-ADDRESS)
246 0000015d >b600                      LDA     ADDR
247 0000015f  addd                      BSR     SHIFT           SEND CHIP-ADDRESS
248 00000161 >b600                      LDA     SUBADR
249 00000163  add9                      BSR     SHIFT           SEND SUB-ADDRESS
250 00000165  1b3b                      BCLR    5,MCR           NO STOP BUT
251
252 00000167  1a3b                      BSET    5,MCR           A RESTART
253 00000169 >1000                      BSET    0,ADDR          SET BIT 0 FOR READ
254 0000016b >b600                      LDA     ADDR
255 0000016d  adcf                      BSR     SHIFT           RE-SEND CHIP ADDRESS
256 0000016f  193b                      BCLR    4,MCR           CHANGE TO RECEIVER
257 00000171  163b                      BSET    3,MCR           SWITCH OFF ACK.
258 00000173  b63d                      LDA     MDR             INITIATE RECEPTION
259
260                                 *       BRCLR   7,MSR,*         WAIT FOR IT
261                                 *       BSET    3,MCR           SECOND LAST SO SWITCH OFF ACK.
262                                 *       LDA     MDR             GET FIRST BYTE
263                                 *       STA     IOBUF+1         AND SAVE IT
264
265 00000175  0f3cfd                     BRCLR   7,MSR,*         WAIT FOR IT
266 00000178  1b3b                      BCLR    5,MCR           LAST BYTE SO STOP
267 0000017a  b63d                      LDA     MDR             GET BYTE
268 0000017c >b700                      STA     IOBUF           AND SAVE IT
269 0000017e  9a                        CLI
270 0000017f  81                        RTS
271
272                                 ********************************************************
273                                 *                                                      *
274                                 *       IIC interrupt.                                 *
275                                 *                                                      *
276                                 ********************************************************
277
278 00000180  3f3c               MBINT   CLR     MSR
279 00000182  80                 RETURN  RTI
```

LISTING 2

```
                                ********************************************************************************
                                *                                                                              *
                                *              TV/Teletext/OSD/Stereo program (MC68HC05T7).                    *
                                *                                                                              *
                                *                  CCT Teletext control module (Spain).                        *
                                *                                                                              *
                                *                Used with RAMT8.S05, OST.S05 & TMT7.S05                       *
                                *                                                                              *
                                * This software was developed by Motorola Ltd. for demonstration purposes.     *
                                *  No liability can be accepted for its use in any specific application.       *
                                *       Original software copyright Motorola - all rights reserved.            *
                                *                                                                              *
                                *              P. Topping                19th October '90                    *
                                *                                                                              *
                                ********************************************************************************

                                        EXPORT  DIGIT0,RED,GREEN,YELLOW,CYAN
                                        EXPORT  NPAGE,PPAGE,REVEAL,EXPTB,UPDATE,TVTX,GIP
                                        EXPORT  TIME,MIX,INDEX,HOLD,SR24T,START2,INITXT

                                        EXPORT  CLINK,LINK,ROW24,GET25,R2B,TXT2
                                        EXPORT  R24T,NOTTH,BOX0ON,BOX0OF

                                        IMPORT  SEND,READ,OSDLE,TPAU2


                                        LIB     RAMT8.S05

                                ************************************************************
                                *                                                          *
                                *       RAM allocation for OST.S05, TMT7.S05 & TXT7.S05.   *
                                *                                                          *
                                ************************************************************

                                        SECTION.S .RAM,COMM

                                ********************************************************
                                *                                                      *
                                *       Equates.                                       *
                                *                                                      *
                                ********************************************************

27 00000000                     PORTA   EQU     $00             Port A address
27 00000001                     PORTB   EQU     $01             Port B    "
27 00000002                     PORTC   EQU     $02             Port C    "
27 00000003                     PORTD   EQU     $03             Port D    "
27 00000004                     DDRA    EQU     $04             Port A data direction reg.
27 00000005                     DDRB    EQU     $05             Port B    "       "       "
27 00000006                     DDRC    EQU     $06             Port C    "       "       "
27 00000007                     DDRD    EQU     $07             Port D    "       "       "

27 00000008                     LED1    EQU     $08             D/A 0  STEREO LED
27 00000009                     LED2    EQU     $09             D/A 1  BILINGUAL LED
27 0000000a                     LED3    EQU     $0A             D/A 2  FM -/- NICAM LED

27                              *VOLU   EQU     $0A             D/A 2        JP08 IN T1 EVB
27 0000000b                     CONT    EQU     $0B             D/A 3        JP09 IN T1 EVB
27 0000000c                     BRILL   EQU     $0C             D/A 4        JP10 IN T1 EVB
27 0000000d                     SATU    EQU     $0D             D/A 5        JP11 IN T1 EVB
27 0000000e                     VOLU    EQU     $0E             D/A 6

27 00000012                     TCR     EQU     $12             Timer control register.
27 00000013                     TSR     EQU     $13             Timer status register.
27 00000014                     ICRH    EQU     $14             Input capture register, high.
27 00000015                     ICRL    EQU     $15             Input capture register, low.
27 00000016                     OCRH    EQU     $16             Output compare register, high.
27 00000017                     OCRL    EQU     $17             Output compare register, low.
27 00000018                     TDRH    EQU     $18             Timer data register, high.
27 00000019                     TDRL    EQU     $19             Timer data register, low.
27 0000001c                     MISC    EQU     $1C             Misc. register

27 00000020                     OSD     EQU     $20             18 OSD data registers
27 00000032                     CAS     EQU     $32             Color & status register
27 00000033                     C34     EQU     $33             Color 3/4 register
27 00000034                     RAD     EQU     $34             Row address & character size
27 00000035                     WCR     EQU     $35             Window/Column register
27 00000036                     CCR     EQU     $36             Column/color register
27 00000037                     HPD     EQU     $37             Horizontal position delay

27 00000039                     MADR    EQU     $39
27 0000003a                     FDR     EQU     $3A
27 0000003b                     MCR     EQU     $3B
27 0000003c                     MSR     EQU     $3C
27 0000003d                     MDR     EQU     $3D

27 0000003e                     TR1     EQU     $3E             Test 1, OSD/Timer/PLM
27 0000003f                     TR2     EQU     $3F             Test 2, EPROM
```

```
27                              ********************************************************
27                              *                                                      *
27                              *       Teletext RAM allocation.                       *
27                              *                                                      *
27                              ********************************************************
27
27 00000000                     SUB1    RMB     1
27 00000001                     R1      RMB     1               mode register
27 00000002                     R2      RMB     1               page request address register
27 00000003                     R3      RMB     1               page req. data reg. col. 0 : mag.
27 00000004                     C1      RMB     1               "     "    "    "    "   1 : pgt.
27 00000005                     C2      RMB     1               "     "    "    "    "   2 : pgu.
27 00000006                     C3      RMB     1               "     "    "    "    "   3 : ht.
27 00000007                     C4      RMB     1               "     "    "    "    "   4 : hu.
27 00000008                     C5      RMB     1               "     "    "    "    "   5 : mt.
27 00000009                     C6      RMB     1               "     "    "    "    "   6 : mu.
27 0000000a                     SUB2    RMB     1
27 0000000b                     R4      RMB     1               display chapter register
27 0000000c                     R5      RMB     1               display control register (normal)
27 0000000d                     R6      RMB     1               display control register (news/sub)
27 0000000e                     R7      RMB     1               display mode register
27 0000000f                     SUB3    RMB     1
27 00000010                     R8      RMB     1               active chapter register
27 00000011                     R9      RMB     1               active row register
27 00000012                     R10     RMB     1               active column register
27 00000013                     R11     RMB     1               active data register
27 00000014                     PH      RMB     1               2nd     "       "
27 00000015                     PT      RMB     1               3rd     "       "
27 00000016                     PU      RMB     1               4th     "       "
27 00000017                     LIFO    RMB     9               LINKED PAGE No. LIFO BUFFER
27 00000020                     PAGE    RMB     7               PAGE No. INPUT BUFFER
27 00000027                     PAG0    RMB     3               AC0 PAGE No.
27 0000002a                     PAG1    RMB     3               AC1 PAGE No.
27 0000002d                     PAG2    RMB     3               AC2 PAGE No.
27 00000030                     PAG3    RMB     3               AC3 PAGE No.
27 00000033                     PAGC    RMB     3               CYAN PAGE No.
27 00000036                     PAGI    RMB     3               INDEX PAGE No.
27 00000039                     PDP     RMB     1               PAGE DIGIT POINTER
27 0000003a                     ACC     RMB     4               DISP, RED, GREEN, YELLOW AC. CIR.
27 0000003e                     WACC    RMB     1               WORKING ACC No.
27 0000003f                     ADDR    RMB     1               IIC ADDRESS
27 00000040                     DPNT    RMB     1               IIC DATA POINTER FOR WRITE
27 00000041                     SUBADR  RMB     1               IIC SUB-ADDRESS
27 00000042                     IOBUF   RMB     4               IIC BUFFER, +2 & +3 RSRVD FOR PLL
27 00000046                     STAT2   RMB     1               0: ROW24 FETCH FLAG
27                              *                               1: REMOTE REPEATING
27                              *                               2: SEARCH/STANDBY IIC LOCK
27                              *                               3: STANDBY STATUS
27                              *                               4: UPDATE PENDING
27                              *                               5: DIFFERENCE FOUND
27                              *                               6: NO TELETEXT TRANSMISSION
27                              *                               7: MIXED
27
27 00000047                     STAT3   RMB     1               0: CYAN   LINK ON
27                              *                               1: YELLOW LINK ON
27                              *                               2: GREEN  LINK ON
27                              *                               3: LINKS/ROW24  ON
27
27                              ********************************************************
27                              *                                                      *
27                              *       General RAM allocation.                        *
27                              *                                                      *
27                              ********************************************************
27
27 00000048                     PLLHI   RMB     1               PLL DIVIDE RATIO MSB
27 00000049                     PLLOW   RMB     1               PLL DIVIDE RATIO LSB
27 0000004a                     W1      RMB     1               WORKING
27 0000004b                     W2      RMB     1               "
27 0000004c                     W3      RMB     1               "
27 0000004d                     COUNT   RMB     1               LOOP COUNTER
27 0000004e                     KOUNT   RMB     1               LOCAL KEYBOARD COUNTER
27 0000004f                     CNT     RMB     1               12.8mS (inc, free running)
27 00000050                     CNT1    RMB     1               12.8mS (inc, reset every 1S during transient)
27 00000051                     CNT3    RMB     1               3.25 S (dec, automatic standby timeout)
27 00000052                     CNT4    RMB     1               12.8mS (cleared for row24 delay when page arrives)
27 00000053                     CNT5    RMB     1               12.8mS (inc, transient mute)
27 00000054                     TMR     RMB     1               TRANSIENT DISPLAY SECONDS COUNTER
27 00000055                     STAT    RMB     1               0: TV/TELETEXT
27                              *                               1: IIC R/W
27                              *                               2: HOLD
27                              *                               3: IR REPEAT INHIBIT
27                              *                               4: TRANSIENT DISPLAY ON
27                              *                               5: TIME HOLD
27                              *                               6: SUB-PAGE MODE
27                              *                               7: IR TASK PENDING
27 00000056                     STAT4   RMB     1               0: KEY FUNCTION PERFORMED
27                              *                               1: LOCAL REPEATING
27                              *                               2: P/C PROG : 0, CHAN : 1
27                              *                               3: MUTE (TRANSIENT)
27                              *                               4: OSD STATUS TRANSIENT
27                              *                               5: MUTE (BUTTON)
27                              *                               6: COINCIDENCE MUTE
27                              *                               7: SEARCH
27 00000057                     PWR     RMB     1               $55 AT RESET, $AA NORMALLY
27 00000058                     PROG    RMB     1               CURRENT PROGRAM NUMBER
27 00000059                     CHAN    RMB     1               CURRENT CHANNEL NUMBER
27 0000005a                     DISP    RMB     1               CURRENT DISPLAY NUMBER (PROGRAM)
27 0000005b                     DISC    RMB     1               CURRENT DISPLAY NUMBER (CHANNEL)
27 0000005c                     FTUNE   RMB     1               FINE TUNING REGISTER
27 0000005d                     AVOL    RMB     1               VOLUME LEVEL
27 0000005e                     BRIL    RMB     1               BRILLIANCE LEVEL
27 0000005f                     KEY     RMB     1               CODE OF PRESSED KEY (LOCAL)
27                              *NUM0   RMB     4               LED DISPLAY RAM
27 00000060                     IRRA1   RMB     1               IR INTERRUPT TEMP.
27 00000061                     IRRA2   RMB     1               "       "       "
27 00000062                     IRRA3   RMB     1               "       "       "
27 00000063                     IRRA4   RMB     1               "       "       "
27 00000064                     DIFFH   RMB     1               IR TIME DIFFERENCE
27 00000065                     DIFFL   RMB     1               "    "      "
27 00000066                     IRH     RMB     1               IR CODE BIT
27 00000067                     IRL     RMB     1               COLLECTION
27 00000068                     IRCODE  RMB     1
27 00000069                     IRCNT   RMB     1
27 0000006a                     IRCMCT  RMB     1
27 0000006b                     OLDIR   RMB     1
```

```
27                              ********************************************************
27                              *                                                      *
27                              *       RAM allocation for Stereoton.                  *
27                              *                                                      *
27                              ********************************************************
27
27 0000006c                     SHADMAT RMB     1               TEMPORARY MATRIX
27 0000006d                     LBAL    RMB     1               Loudspeaker balance variable
27 0000006e                     SNDMD   RMB     1               SOUND MODE 0:ST, 1:DA, 2:DB, 3:W, 4:M, 5:FM
27 0000006f                     ABAV    RMB     1               SCART SOUND MODE 0:STEREO, 1:DUAL A, 2:DUAL B
27
27 00000070                     K1      RMB     1               K1 level                                (reg 0)
27 00000071                     LVL     RMB     1               Loudspeaker left volume                 (reg 1)
27 00000072                     LVR     RMB     1               Loudspeaker right volume                (reg 2)
27 00000073                     HVL     RMB     1               Headphone volume left                   (reg 3)
27 00000074                     HVR     RMB     1               Headphone volume right                  (reg 4)
27 00000075                     TONE    RMB     1               Tone variable (Bass/Treble)             (reg 5)
27 00000076                     MATRIX  RMB     1               Current matrix                          (reg 6)
27 00000077                     K2      RMB     1               K2 level                                (reg 7)
27
27
27 00000078                     STAT5   RMB     1               0: 2-DIGIT PROGRAM ENTRY
27                              *                               1: ANY MUTE REQUIRED ?
27                              *                               2: OSD NAME TABLE
27                              *                               3: OSD DEFAULT P/C NUMBER
27                              *                               4: ANALOGUE OSD ON
27                              *                               5: NAME-TABLE STANDARD
27                              *                               6: STANDARD CHANGED
27                              *                               7: RE-INITIALISE TELETEXT
27
27 00000079                     STAT6   RMB     1               0: AV MODE BIT 0 (0:TV, 1:S-VHS)
27                              *                               1: AV MODE BIT 1 (2:SCRT1, 3:SCADT2)
27                              *                               2:
27                              *                               3:
27                              *                               4:
27                              *                               5:
27                              *                               6: SCART INPUT #1
27                              *                               7: SCART INPUT #2
27
27 0000007a                     STAT7   RMB     1               0: AV MODE CHANGE
27                              *                               1: FORCE FM SOUND
27                              *                               2: C5 : TELETEXT NEWSFLASH
27                              *                               3: C6 : TELETEXT SUBTITLES
27                              *                               4: LANGUAGE A/B (TV)
27                              *                               5: WIDE-PSEUDO
27                              *                               6: NO TELETEXT ACKNOWLEDGE
27                              *                               7: POWER UP IN STANDBY
27
27                              ********************************************************
27                              *                                                      *
27                              *       OSD RAM allocation.                            *
27                              *                                                      *
27                              ********************************************************
27
27 0000007b                     CAS1    RMB     1               ROW 1, colour 1/2 & outline enable
27 0000007c                     RAD1    RMB     1               Row address & character size
27 0000007d                     CCR1    RMB     1               Window colour & end column
27 0000007e                     CAS2    RMB     1               ROW 2, colour 1/2 & outline enable
27 0000007f                     RAD2    RMB     1               Row address & character size
27 00000080                     CCR2    RMB     1               Window colour & end column
27 00000081                     CAS3    RMB     1               ROW 3, colour 1/2 & outline enable
27 00000082                     RAD3    RMB     1               Row address & character size
27 00000083                     CCR3    RMB     1               Window colour & end column
27 00000084                     CAS4    RMB     1               ROW 4, colour 1/2 & outline enable
27 00000085                     RAD4    RMB     1               Row address & character size
27 00000086                     CCR4    RMB     1               Window colour & end column
27 00000087                     CAS5    RMB     1               ROW 5, colour 1/2 & outline enable
27 00000088                     RAD5    RMB     1               Row address & character size
27 00000089                     CCR5    RMB     1               Window colour & end column
27 0000008a                     CAS6    RMB     1               ROW 6, colour 1/2 & outline enable
27 0000008b                     RAD6    RMB     1               Row address & character size
27 0000008c                     CCR6    RMB     1               Window colour & end column
27 0000008d                     CAS7    RMB     1               ROW 7, colour 1/2 & outline enable
27 0000008e                     RAD7    RMB     1               Row address & character size
27 0000008f                     CCR7    RMB     1               Window colour & end column
27 00000090                     CAS8    RMB     1               ROW 8, colour 1/2 & outline enable
27 00000091                     RAD8    RMB     1               Row address & character size
27 00000092                     CCR8    RMB     1               Window colour & end column
27
27 00000093                     OSDL    RMB     1               CURRENT OSD ROW POINTER
27 00000094                     LIND    RMB     1               ROW TABLE INDEX
27 00000095                     BROW    RMB     1               CHARACTER FLASH ROW
27 00000096                     BCOL    RMB     1               CHATACTER FLASH COLUMNS
27 00000097                     WROW    RMB     1               WINDOW FLASH ROW
27 00000098                     ROW1    RMB     1               FIRST ROW No. (NAME TABLE)
27
27 00000099                     ANAL    RMB     1
27 0000009a                     ANAF    RMB     1
27
27 0000009b                     TMP1    RMB     1
27 0000009c                     TMP2    RMB     1
27
27 0000009d                             RMB     12              UNUSED
27
27 000000a9                     STACK   RMB     22              23 BYTES USED FOR STACK
27 000000bf                     SP      RMB     1               (1 INTERRUPT AND 9 NESTED SUBS)
27
27                                      SECTION .RAM2,COMM
27 00000000                     DRAM    RMB     128
28
29                                      SECTION .ROM2
```

```
                                ******************************************************
                                *                                                    *
                                *       Teletext/TV switching.                       *
                                *                                                    *
                                ******************************************************

00000000 >000037                TVTX    BRSET   0,STAT,TXTOFF
00000003 >0c0074                TXTON   BRSET   6,STAT7,PANIC   TELETEXT CHIP ON BUS ?
00000006 >1000                          BSET    0,STAT          TELETEXT MODE
00000008 >cd0000                        JSR     OSDLE
0000000b  a616                          LDA     #$16            CCT, 312/312 SYNC
0000000d >b700                          STA     R1              ENABLING GHOST ROWS
0000000f >1900                          BCLR    4,STAT          ABORT TRANSIENTS
00000011 >1900                          BCLR    4,STAT2         KILL UPDATES
00000013 >1f00                          BCLR    7,STAT2         NOT MIXED
00000015 >0b0008                        BRCLR   5,STAT,NOTT
00000018 >1b00                          BCLR    5,STAT
0000001a >040003                        BRSET   2,STAT,NOTT
0000001d >cd0000                        JSR     NOTTH
00000020  a6cc                  NOTT    LDA     #$CC
00000022 >b700                          STA     R5
00000024  a646                          LDA     #$46
00000026 >b700                          STA     R6
00000028 >b600                          LDA     ACC
0000002a >b700                          STA     R4
0000002c >cc0000                        JMP     TRAN2

0000002f >0c0048                UPDATE  BRSET   6,STAT7,PANIC   TELETEXT CHIP ?
00000032 >1800                          BSET    4,STAT2         UPDATE ON
00000034 >090003                        BRCLR   4,STAT,TXTOFF   TRANSIENT HOLD ?
00000037 >cd0000                        JSR     NOTTH           YES, RESTART
0000003a >1100                  TXTOFF  BCLR    0,STAT          TV MODE
0000003c >cd0000                        JSR     OSDLE
0000003f >1100                  TXTOF   BCLR    0,STAT          TV MODE
00000041  a610                          LDA     #$10            BROADCAST, 312/313 SYNC
00000043 >b700                          STA     R1              ENABLING GHOST ROWS
00000045 >1900                          BCLR    4,STAT          ABORT TRANSIENTS
00000047 >1b00                          BCLR    5,STAT          ABORT TIME TIMEOUT
00000049  a603                  RST     LDA     #$03            $06 FOR TRANSIENTS
0000004b >b700                          STA     R5
0000004d >b700                          STA     R6
0000004f >3f00                          CLR     R7
00000051 >cd0000                        JSR     TXT2
00000054  a602                          LDA     #2
00000056 >cc0000                        JMP     SPM

00000059 >e602                  TEST    LDA     PAG0+2,X
0000005b  a139                          CMP     #$39
0000005d  221b                          BHI     PANIC
0000005f  a130                          CMP     #$30
00000061  2517                          BLO     PANIC
00000063 >e601                          LDA     PAG0+1,X
00000065  a139                          CMP     #$39
00000067  2211                          BHI     PANIC
00000069  a130                          CMP     #$30
0000006b  250d                          BLO     PANIC
0000006d >e600                          LDA     PAG0,X
0000006f  a137                          CMP     #$37
00000071  2207                          BHI     PANIC
00000073  a130                          CMP     #$30
00000075  2503                          BLO     PANIC
00000077 >b700                          STA     PAGE
00000079  81                    ABO     RTS                     OK, CARRY CLEAR
0000007a  99                    PANIC   SEC                     NOT OK, CARRY SET
0000007b  81                            RTS
```

```
 97                                  ******************************************************
 98                                  *                                                    *
 99                                  *       Number entry routines.                       *
100                                  *                                                    *
101                                  ******************************************************
102
103 0000007c >0d0003                 DIGIT0  BRCLR   6,STAT,DIGIT
104 0000007f >cc0000                        JMP     DIGITS
105 00000082 >1700                  DIGIT   BCLR    3,R3            HOLD DURING
106 00000084 >b600                          LDA     ACC             ENTRY
107 00000086 >cd0000                        JSR     UP
108 00000089  a604                          LDA     #4
109 0000008b >cd0000                        JSR     SPM
110 0000008e >1400                          BSET    2,STAT          SET HOLD FLAG
111 00000090 >b600                          LDA     W2
112 00000092  a010                          SUB     #16
113 00000094 >be00                  LD0     LDX     PDP
114 00000096  2606                          BNE     NOCH            NOT HUNDREDS SO DON'T CHANGE
115 00000098  a107                          CMP     #7              YES, MORE THAN 7 ?
116 0000009a  2302                          BLS     NOCH            NO, SO DON'T CHANGE
117 0000009c  a008                          SUB     #8              YES, 8->0 & 9->1
118 0000009e  ab30                  NOCH    ADD     #$30            CONVERT TO ASCII
119 000000a0 >e700                          STA     PAGE,X
120 000000a2  a302                          CPX     #2              UNITS ?
121 000000a4  270e                          BEQ     CLRPD           YES, SO CLEAR PDP
122 000000a6  a62d                          LDA     #$2D            DASH
123 000000a8  a301                          CPX     #1              TENS ?
124 000000aa  2702                          BEQ     TEN             YES, SO LEAVE TENS
125 000000ac >b701                          STA     PAGE+1          CLEAR TENS
126 000000ae >b702                  TEN     STA     PAGE+2          CLEAR UNITS
127 000000b0 >3c00                          INC     PDP
128 000000b2  2002                          BRA     DPGN
129 000000b4 >3f00                  CLRPD   CLR     PDP
130 000000b6 >b600                  DPGN    LDA     R4
131 000000b8 >b700                          STA     R8
132 000000ba >3f00                          CLR     R9              ROW 0
133 000000bc  a602                          LDA     #2
134 000000be >b700                          STA     R10             COLUMN 2
135 000000c0  a650                          LDA     #$50            P
136 000000c2 >b700                          STA     R11
137 000000c4 >b600                          LDA     PAGE
138 000000c6 >b700                          STA     PH
139 000000c8 >b601                          LDA     PAGE+1
140 000000ca >b700                          STA     PT
141 000000cc >b602                          LDA     PAGE+2
142 000000ce >b700                          STA     PU
143 000000d0 >cd0000                        JSR     TXT38
144 000000d3 >cd0000                        JSR     TRAN1
145 000000d6 >b600                          LDA     PDP
146 000000d8  269f                          BNE     ABO
147 000000da  a606                          LDA     #6
148 000000dc >cd0000                        JSR     NOBX
149 000000df >b600                          LDA     PAGE
150 000000e1 >b700                          STA     PH
151
152                                  ******************************************************
153                                  *                                                    *
154                                  *       Get requested page.                          *
155                                  *                                                    *
156                                  ******************************************************
157
158 000000e3 >cd0000                 GETIT   JSR     SRCH            IS PAGE ALREADY IN ?
159 000000e6  2545                          BLO     LPT2            YES
160 000000e8  ad23                          BSR     INDX            DISPLAY CHAPTER
161 000000ea >b600                          LDA     PAGE            PAGE HUNDREDS
162 000000ec >e700                          STA     PAG0,X          SAVE IN RAM
163 000000ee >b601                          LDA     PAGE+1          PAGE TENS
164 000000f0 >e701                          STA     PAG0+1,X        SAVE IN RAM
165 000000f2 >b700                          STA     C1              PAGE REQUEST TENS
166 000000f4 >b602                          LDA     PAGE+2          PAGE UNITS
167 000000f6 >e702                          STA     PAG0+2,X        SAVE IN RAM
168 000000f8 >b700                          STA     C2              PAGE REQUEST UNITS
169 000000fa >b600                          LDA     PAGE            PAGE HUNDREDS
170 000000fc  a018                          SUB     #$18
171 000000fe >b700                          STA     R3              PAGE REQUEST HUNDREDS
172 00000100 >b600                          LDA     R4
173 00000102 >cd0000                        JSR     UP
174 00000105 >cd0000                        JSR     TXT1            REQUEST IT
175 00000108 >1500                          BCLR    2,STAT          RESET HOLD FLAG
176 0000010a >cc0000                        JMP     SFND            WRITE ONE TO FOUND
177
178
179 0000010d >b600                   INDX    LDA     ACC
180 0000010f  48                            LSLA                    x2
181 00000110 >bb00                          ADD     ACC             x3
182 00000112  97                            TAX
183 00000113  81                     YIP    RTS
184
185 00000114  48                     UP     LSLA
186 00000115  48                            LSLA
187 00000116  48                            LSLA
188 00000117  48                            LSLA
189 00000118 >b700                          STA     R2
190 0000011a  81                            RTS
```

```
192                                 ********************************************************
193                                 *                                                      *
194                                 *       Red, Green & Yellow keys.                      *
195                                 *                                                      *
196                                 ********************************************************
197
198 0000011b >3f00                   RED     CLR     PDP
199 0000011d >06000b                        BRSET   3,STAT3,RED2    LINKS ON ?
200
201 00000120 >cd0000                NPAGE   JSR     INDXP
202 00000123 >cd0000                        JSR     NOTOK3          NO, SO FORCE AN INCREMENT
203 00000126  252c                          BLO     LPT             ALREADY REQUESTED ?
204 00000128 >cc0000                        JMP     CLRPD           NO, GETIT
205 0000012b >b601                  RED2    LDA     ACC+1
206 0000012d  2025                  LPT2    BRA     LPT
207
208 0000012f >3f00                  GREEN   CLR     PDP
209 00000131 >06000b                        BRSET   3,STAT3,GLOK    LINKS ON ?
210
211 00000134 >cd0000                PPAGE   JSR     INDXP
212 00000137 >cd0000                        JSR     NOTOK2          NO, SO FORCE A DECREMENT
213 0000013a  2518                          BLO     LPT             ALREADY REQUESTED ?
214 0000013c >cc0000                        JMP     CLRPD           NO, GETIT
215 0000013f  0c0103                GLOK    BRSET   6,PORTB,IG0    GYC BITS ENABLED ?
216 00000142 >010061                        BRCLR   0,STAT3,ABC     GREEN LINK ON ?
217 00000145 >b602                  IG0     LDA     ACC+2
218 00000147  200b                          BRA     LPT
219
220 00000149 >07005a                YELLOW  BRCLR   3,STAT3,ABC     LINKS ON ?
221 0000014c  0c0103                        BRSET   6,PORTB,IG1     GYC BITS ENABLED ?
222 0000014f >030054                        BRCLR   1,STAT3,ABC     YELLOW LINKS ON ?
223 00000152 >b603                  IG1     LDA     ACC+3
224 00000154 >b700                  LPT     STA     W3
225 00000156  48                            LSLA                    X2
226 00000157 >bb00                          ADD     W3              X3 FOR PAGE POINTER
227 00000159  97                            TAX
228 0000015a >cd0000                        JSR     TEST            IS PAGE No. OK ?
229 0000015d  2547                          BCS     ABC             IF NOT ABORT
230 0000015f >b600                          LDA     W3              ACC No
231 00000161 >b100                          CMP     ACC             IF SAME ACC CCT
232 00000163  2604                          BNE     NTSAC           THEN FORCE UNSTOP
233 00000165 >1400                          BSET    2,STAT
234 00000167  2009                          BRA     CARO
235 00000169 >0d0003                NTSAC   BRCLR   6,STAT,SKOSP    SUB-PAGE MODE ?
236 0000016c >cd0000                        JSR     OUTSP           YES, ABANDON IT
237 0000016f >cd0000                SKOSP   JSR     RSTR            PUT PAGE No. BACK
238 00000172 >3f00                  CARO    CLR     PDP
239 00000174 >050003                COK     BRCLR   2,STAT,NOTHLD   IF OLD PAGE ON HOLD
240 00000177 >cd0000                        JSR     NOHOLD          CANCEL HOLD
241 0000017a  a60f                  NOTHLD  LDA     #$0F            CORRUPT C6 FOR UPDATE
242 0000017c >b700                          STA     C6
243 0000017e >b600                          LDA     W3
244 00000180 >b700                          STA     R4
245 00000182 >b700                          STA     ACC
246 00000184 >cd0000                        JSR     CFND            CHECK PBLF, IF HIGH DO NOTHING
247 00000187 >1500                          BCLR    2,STAT          IF LOW (PAGE FOUND) CLEAR FOUNDB
248 00000189 >cc0000                        JMP     TXT2            TO FORCE FETCHING OF LINKS.
249
250                                 ********************************************************
251                                 *                                                      *
252                                 *       Index & Cyan keys.                             *
253                                 *                                                      *
254                                 ********************************************************
255
256 0000018c  ae0f                  INDEX   LDX     #15
257 0000018e >cd0000                        JSR     TEST
258 00000191  2414                          BCC     IAC
259 00000193 >cc0000                        JMP     GIP
260
261 00000196 >07000d                CYAN    BRCLR   3,STAT3,ABC     LINKS ON ?
262 00000199  0c0103                        BRSET   6,PORTB,IG2     GYC BITS ENABLED ?
263 0000019c >050007                        BRCLR   2,STAT3,ABC     CYAN LINK ON ?
264 0000019f  ae0c                  IG2     LDX     #12
265 000001a1 >cd0000                        JSR     TEST
266 000001a4  2401                          BCC     IAC
267 000001a6  81                    ABC     RTS
268
269 000001a7 >1d00                  IAC     BCLR    6,STAT          RESET PAGE MODE
270 000001a9 >3f00                          CLR     PDP
271 000001ab >e602                          LDA     PAG0+2,X
272 000001ad >b700                          STA     PU
273 000001af >b700                          STA     C2
274 000001b1 >e601                          LDA     PAG0+1,X
275 000001b3 >b700                          STA     PT
276 000001b5 >b700                          STA     C1
277 000001b7 >e600                          LDA     PAG0,X
278 000001b9 >b700                          STA     PH
279 000001bb  a018                          SUB     #$18
280 000001bd >b700                          STA     R3
281 000001bf >cd0000                        JSR     INDX
282 000001c2 >b600                          LDA     PH
283 000001c4 >e700                          STA     PAG0,X
284 000001c6 >b600                          LDA     PT
285 000001c8 >e701                          STA     PAG0+1,X
286 000001ca >b600                          LDA     PU
287 000001cc >e702                          STA     PAG0+2,X
288 000001ce >b600                          LDA     ACC
289 000001d0 >b700                          STA     R8
290 000001d2 >cd0000                        JSR     UP
291 000001d5  a650                          LDA     #$50
292 000001d7 >b700                          STA     R11
293 000001d9 >3f00                          CLR     R9
294 000001db  a602                          LDA     #2
295 000001dd >b700                          STA     R10
296
297 000001df >1500                  CYOK    BCLR    2,STAT          RESET HOLD FLAG
298 000001e1 >cd0000                        JSR     TXT38
299 000001e4 >cd0000                        JSR     TRAN1           DISPLAY TOP ROW
300 000001e7 >cd0000                        JSR     SFND            SET FOUNDB
301 000001ea >cc0000                        JMP     TXT1
```

```
303                                 ********************************************************
304                                 *                                                      *
305                                 *       Get linked page nos & allocate to ACCs.        *
306                                 *                                                      *
307                                 ********************************************************
308
309 000001ed >b600                 LINK    LDA     ACC             CHAPTER
310 000001ef  ab04                         ADD     #4              ADD 4 FOR GHOST ROWS
311 000001f1 >b700                         STA     R8
312 000001f3 >3f00                         CLR     COUNT
313 000001f5  a601                         LDA     #1
314 000001f7 >b700                         STA     W3
315 000001f9  a6ff                         LDA     #$FF
316 000001fb >b701                         STA     ACC+1
317 000001fd >b702                         STA     ACC+2
318 000001ff >b703                         STA     ACC+3
319 00000201 >cd0000                       JSR     INDXP
320 00000204 >3c00                 LLOP    INC     COUNT           LOOP ROUND RED, GREEN & YELLOW
321 00000206 >b600                         LDA     W3
322 00000208 >b700                         STA     R10
323 0000020a  ad43                         BSR     GLP1            GET LINKED PAGE No.
324 0000020c  2406                         BHS     NOTFND          ALREADY IN RAM ?
325 0000020e >be00                         LDX     COUNT           YES, SAVE ACC No.
326 00000210 >e700                         STA     ACC,X           AGAINST COLOUR
327 00000212  2003                         BRA     NEXTC
328 00000214 >cd0000                NOTFND  JSR     PUSH            NOT IN RAM, SO SAVE
329 00000217 >b600                  NEXTC   LDA     W3              PAGE NUMBER IN LIFO
330 00000219  ab06                         ADD     #6
331 0000021b >b700                         STA     W3              NEXT LINK
332 0000021d >b600                         LDA     COUNT
333 0000021f  a103                         CMP     #3              ALL DONE ?
334 00000221  25e1                         BLO     LLOP
335
336 00000223 >cd0000                       JSR     GCYI            GET CYAN AND INDEX LINKS
337 00000226 >3f00                         CLR     WACC
338 00000228  a604                         LDA     #4
339 0000022a >b700                         STA     COUNT
340
341 0000022c >3a00                 LLOOP   DEC     COUNT
342 0000022e >be00                         LDX     COUNT
343 00000230 >e600                         LDA     ACC,X
344 00000232  a1ff                         CMP     #$FF            IF STILL AN ACC AT $FF THEN
345 00000234  2612                         BNE     ALOC            RECOVER PAGE No. FROM LIFO
346 00000236 >cd0000                       JSR     PULL
347 00000239 >b600                         LDA     WACC
348 0000023b >cd0000                       JSR     CHCK1           ALREADY USED ? IF SO INCREMENT
349 0000023e >be00                         LDX     COUNT
350 00000240 >e700                         STA     ACC,X
351 00000242 >cd0000                       JSR     UP
352 00000245 >cd0000                       JSR     GLP2
353 00000248 >b600                 ALOC    LDA     COUNT
354 0000024a  a101                         CMP     #$01
355 0000024c  22de                         BHI     LLOOP
356
357 0000024e  81                           RTS
358
359                                 ********************************************************
360                                 *                                                      *
361                                 *       Fetch linked page & magazine numbers.          *
362                                 *                                                      *
363                                 ********************************************************
364
365 0000024f >b600                 GLP1    LDA     R10
366 00000251  a113                         CMP     #19             IF INDEX IGNORE LINK CONTROL
367 00000253  2203                         BHI     COR
368 00000255 >07006c                       BRCLR   3,STAT3,NOTOK   LINKS OK ?
369 00000258  a610                 COR     LDA     #16             YES, ROW 16 FOR LINKED PAGES
370 0000025a >cd0000                       JSR     R2B             FETCH 2 LINK BYTES
371 0000025d >b601                         LDA     IOBUF+1
372 0000025f >cd0000                       JSR     DECODE          DECODE UNITS
373 00000262 >b700                         STA     W2
374 00000264 >b600                         LDA     IOBUF
375 00000266 >cd0000                       JSR     DECODE          DECODE TENS
376 00000269 >b700                         STA     PT
377 0000026b >b600                         LDA     W2
378 0000026d >b700                         STA     PU
379 0000026f >cd0000                       JSR     INDX            CHECK FOR ZERO ?
380 00000272 >e600                         LDA     PAG0,X          FETCH CURRENT MAG. NO.
381 00000274 >b700                         STA     PH              PAGE HUNDREDS
382
383 00000276 >cd0000                R2BJ1   JSR     RADIO
384 00000279 >070009                       BRCLR   3,IOBUF,OK0     MAG BIT ZERO OK ?
385 0000027c >000004                       BRSET   0,PH,H1         NO, SO TOGGLE
386 0000027f >1000                         BSET    0,PH
387 00000281  2002                         BRA     OK0
388 00000283 >1100                 H1      BCLR    0,PH
389 00000285 >cd0000                OK0     JSR     RADIO
390 00000288 >050009                       BRCLR   2,IOBUF,OK1     MAG BIT ONE OK ?
391 0000028b >020004                       BRSET   1,PH,PT1        NO, SO TOGGLE
392 0000028e >1200                         BSET    1,PH
393 00000290  2002                         BRA     OK1
394 00000292 >1300                 PT1     BCLR    1,PH
395 00000294 >070009                OK1     BRCLR   3,IOBUF,OK2     MAG BIT TWO OK ?
396 00000297 >040004                       BRSET   2,PH,PU1        NO, SO TOGGLE
397 0000029a >1400                         BSET    2,PH
398 0000029c  2002                         BRA     OK2
399 0000029e >1500                 PU1     BCLR    2,PH
400 000002a0 >cc0000                OK2     JMP     SRCH
401
402 000002a3 >cd0000                R2BJ2   JSR     R2B             FETCH 2 LINK BYTES
403 000002a6 >b601                         LDA     IOBUF+1
404 000002a8 >cd0000                       JSR     DECODE          DECODE UNITS
405 000002ab >b700                         STA     PU
406 000002ad >b600                         LDA     IOBUF
407 000002af >cd0000                       JSR     DECODE          DECODE TENS
408 000002b2 >b700                         STA     PT
409 000002b4  20c0                         BRA     R2BJ1
410
411 000002b6 >cd0000                NOTTH   JSR     REL1
412 000002b9  a018                         SUB     #$18
413 000002bb >b700                         STA     R3
414 000002bd  a604                         LDA     #4
415 000002bf >cc0000                       JMP     SPM
```

```
                                ********************************************************
                                *                                                      *
                                *       New bits for default (+1 & -1) links.          *
                                *                                                      *
                                ********************************************************

000002c2 >1d00                  NOTOK3  BCLR    6,STAT          CANCELL SUB-PAGE
000002c4 >cd0000                NOTOK   JSR     INDX
000002c7 >e600                          LDA     PAG0,X
000002c9 >b700                          STA     PH
000002cb >b602                          LDA     PAGE+2
000002cd  4c                            INCA
000002ce >b700                          STA     PU
000002d0 >b702                          STA     PAGE+2
000002d2  a139                          CMP     #$39
000002d4  2312                          BLS     NOV9
000002d6  a630                          LDA     #$30
000002d8 >b700                          STA     PU
000002da >b702                          STA     PAGE+2
000002dc >3c01                          INC     PAGE+1
000002de >b601                          LDA     PAGE+1
000002e0  a139                          CMP     #$39
000002e2  2304                          BLS     NOV9
000002e4  a630                          LDA     #$30
000002e6 >b701                  NOV9A   STA     PAGE+1
000002e8 >b601                  NOV9    LDA     PAGE+1
000002ea >b700                          STA     PT
000002ec  20b2                          BRA     OK2

000002ee >1d00                  NOTOK2  BCLR    6,STAT          CANCEL SUB-PAGE
000002f0 >e600                          LDA     PAG0,X
000002f2 >b700                          STA     PH
000002f4 >b602                          LDA     PAGE+2
000002f6  4a                            DECA
000002f7 >b700                          STA     PU
000002f9 >b702                          STA     PAGE+2
000002fb  a130                          CMP     #$30
000002fd  24e9                          BHS     NOV9
000002ff  a639                          LDA     #$39
00000301 >b700                          STA     PU
00000303 >b702                          STA     PAGE+2
00000305 >3a01                          DEC     PAGE+1
00000307 >b601                          LDA     PAGE+1
00000309  a130                          CMP     #$30
0000030b  24db                          BHS     NOV9
0000030d  a639                          LDA     #$39
0000030f  20d5                          BRA     NOV9A

                                ********************************************************
                                *                                                      *
                                *       Request new linked page.                       *
                                *                                                      *
                                ********************************************************

00000311 >b700                  GLP2    STA     R2
00000313  44                            LSRA
00000314  44                            LSRA
00000315  44                            LSRA
00000316 >b700                          STA     C2              x2
00000318  44                            LSRA
00000319 >bb00                          ADD     C2              x3
0000031b  97                            TAX                     X <- 3 x ACC No.
0000031c >b600                          LDA     PU
0000031e >b700                          STA     C2
00000320 >e702                          STA     PAG0+2,X
00000322 >b600                          LDA     PT
00000324 >b700                          STA     C1
00000326 >e701                          STA     PAG0+1,X
00000328 >b600                          LDA     PH
0000032a >e700                          STA     PAG0,X
0000032c  a018                          SUB     #$18
0000032e >b700                          STA     R3

00000330  a309                          CPX     #9
00000332  221c                          BHI     ABORT
00000334  a650                          LDA     #$50
00000336 >b700                          STA     R11
00000338 >b600                          LDA     WACC            ACC
0000033a  ab08                          ADD     #$08            CLEAR CHAPTER
0000033c >b700                          STA     R8              INTO IIC
0000033e >3f00                          CLR     R9              ROW 0
00000340  a602                          LDA     #2              COLUMN 2
00000342 >b700                          STA     R10
00000344 >b600                          LDA     C2
00000346  a139                          CMP     #$39
00000348  2206                          BHI     ABORT
0000034a >b600                          LDA     C1
0000034c  a139                          CMP     #$39
0000034e  2301                          BLS     LOK
00000350  81                    ABORT   RTS

00000351 >cd0000                LOK     JSR     TXT3            CLEAR CHAPTER
00000354  a606                          LDA     #6              WAIT
00000356 >cd0000                        JSR     TPAU2           FOR IT
00000359 >1700                          BCLR    3,R8            DON'T CLEAR THIS TIME
0000035b >cd0000                        JSR     TXT38           PUT PAGE NUMBER IN CHAPTER
0000035e >cd0000                        JSR     SFND            SET FOUND FLAG
00000361 >cc0000                        JMP     TXT1L           AND REQUEST IT

00000364  ae08                  PUSH    LDX     #8
00000366 >e600                  PSHL    LDA     PH,X
00000368 >e700                          STA     LIFO,X
0000036a  5a                            DECX
0000036b  2af9                          BPL     PSHL
0000036d  81                            RTS
```

```
                                ********************************************************
                                *                                                      *
                                *       Is page already in RAM ?                       *
                                *                                                      *
                                ********************************************************

0000036e >3f00                  SRCH    CLR     WACC
00000370 >b600                  LOOPS   LDA     WACC
00000372  48                            LSLA
00000373 >bb00                          ADD     WACC
00000375  97                            TAX
00000376 >e600                          LDA     PAG0,X
00000378 >b100                          CMP     PH
0000037a  260c                          BNE     FINI
0000037c >e601                          LDA     PAG0+1,X
0000037e >b100                          CMP     PT
00000380  2606                          BNE     FINI
00000382 >e602                          LDA     PAG0+2,X
00000384 >b100                          CMP     PU
00000386  2708                          BEQ     FND2
00000388 >3c00                  FINI    INC     WACC
0000038a >b600                          LDA     WACC
0000038c  a104                          CMP     #4
0000038e  25e0                          BLO     LOOPS

00000390 >b600                  FND2    LDA     WACC            IF MATCH THEN CHECK FOR
00000392  a104                          CMP     #4              SUB-PAGE MATCH (SHOULD
00000394  81                            RTS                     DISPLAY PAGE BE DIFFERENT)

                                ********************************************************
                                *                                                      *
                                *       Is Accquisition circuit in use ?               *
                                *                                                      *
                                ********************************************************

00000395 >3c00                  SAM     INC     WACC
00000397  5f                    CHCK1   CLRX
00000398 >b600                  CHCK2   LDA     WACC
0000039a >e100                          CMP     ACC,X
0000039c  27f7                          BEQ     SAM
0000039e  5c                            INCX
0000039f  a304                          CPX     #4
000003a1  25f5                          BLO     CHCK2
000003a3  81                            RTS

000003a4 >3c00                  RADIO   INC     R10
000003a6 >3c00                          INC     R10
000003a8 >cd0000                        JSR     R2BN9
000003ab >b600                          LDA     IOBUF
000003ad >cd0000                        JSR     DECODE
000003b0 >bf00                          STX     IOBUF
000003b2  81                    DDI     RTS

                                ********************************************************
                                *                                                      *
                                *       Transfer ghost row 20 to display row 24.       *
                                *       & set found flag.                              *
                                *                                                      *
                                ********************************************************

000003b3 >3f00                  ROW24   CLR     R10
000003b5 >b600                  MRE     LDA     ACC             CHAPTER
000003b7  ab04                          ADD     #4              ADD 4 FOR GHOST ROWS
000003b9 >b700                          STA     R8
000003bb  a614                          LDA     #20             ROW 20
000003bd  ad5a                          BSR     R2B

000003bf  a620                          LDA     #$20            SPACE
000003c1 >b700                          STA     R11
000003c3 >b700                          STA     PH
000003c5 >070008                        BRCLR   3,STAT3,BLANK   ROW24 ENABLED ?

000003c8 >b601                          LDA     IOBUF+1         YES, SO USE DATA
000003ca >b700                          STA     R11
000003cc >b600                          LDA     IOBUF
000003ce >b700                          STA     PH
000003d0 >b600                  BLANK   LDA     ACC             BACK TO
000003d2 >b700                          STA     R8              DISPLAY CHAPTER
000003d4  a618                          LDA     #24
000003d6  ad31                          BSR     W2B
000003d8  23db                          BLS     MRE

000003da >1800                  SFND    BSET    4,R11           SET FOUND FLAG
000003dc  a619                  SFND2   LDA     #25             WRITE IT
000003de >b700                          STA     R9              ROW
000003e0  a608                          LDA     #8
000003e2 >b700                          STA     R10             COLUMN
000003e4  a605                          LDA     #5
000003e6 >cc0000                        JMP     TXT32

000003e9 >cd0000                CFND    JSR     CPBLF
000003ec  250f                          BCS     ABCF
000003ee >1900                          BCLR    4,R11           CLEAR FOUND FLAG
000003f0  20ea                          BRA     SFND2

000003f2 >cd0000                INDXP   JSR     INDX
000003f5 >e601                          LDA     PAG0+1,X
000003f7 >b701                          STA     PAGE+1
000003f9 >e602                          LDA     PAG0+2,X
000003fb >b702                          STA     PAGE+2
000003fd  81                    ABCF    RTS

000003fe  5f                    PULL    CLRX
000003ff >e600                  PLLL    LDA     LIFO,X
00000401 >e700                          STA     PH,X
00000403  5c                            INCX
00000404  a309                          CPX     #9
00000406  25f7                          BLO     PLLL
00000408  81                            RTS
```

```
633                                  ********************************************************
634                                  *                                                      *
635                                  *       Read and write subroutines.                    *
636                                  *                                                      *
637                                  *       Cyan & Index links & link control byte.        *
638                                  *                                                      *
639                                  ********************************************************
640
641 00000409 >b700                  W2B     STA     R9              ROW 24
642 0000040b  a606                           LDA     #6
643 0000040d >cd0000                         JSR     TXT32
644 00000410 >3c00                           INC     R10
645 00000412 >3c00                           INC     R10
646 00000414 >b600                           LDA     R10
647 00000416  a126                           CMP     #38
648 00000418  81                     V5      RTS
649
650 00000419 >b700                  R2B     STA     R9              ROW
651 0000041b  a608                  R2BN9   LDA     #8
652 0000041d >b700                          STA     SUB3
653 0000041f  a604                          LDA     #4
654 00000421 >b700                          STA     W1
655 00000423 >ae00                          LDX     #SUB3
656 00000425 >cd0000                        JSR     SEND22
657 00000428  42                            MUL                     DELAY TO SATISFY
658 00000429  42                            MUL                     IIC TIMING
659 0000042a  a60b                          LDA     #11
660 0000042c >b700                          STA     SUBADR
661 0000042e  a622                  READ22  LDA     #$22
662 00000430 >b700                          STA     ADDR
663 00000432 >cc0000                        JMP     READ
664
665 00000435  a613                  GCYI    LDA     #19             CYAN
666 00000437 >b700                          STA     R10
667 00000439 >cd0000                        JSR     GLP1
668 0000043c  a640                          LDA     #$40
669 0000043e >cd0000                        JSR     GLP2
670 00000441  a61f                          LDA     #31             INDEX
671 00000443 >b700                          STA     R10
672 00000445 >cd0000                        JSR     GLP1
673 00000448  a650                          LDA     #$50
674 0000044a >cc0000                        JMP     GLP2
675
676 0000044d >b600                  CLINK   LDA     ACC
677 0000044f  ab04                          ADD     #4
678 00000451 >b700                          STA     R8
679 00000453 >3f00                          CLR     STAT3
680 00000455 >3f00                          CLR     R10
681 00000457  a610                          LDA     #16
682 00000459 >cd0000                        JSR     R2B
683 0000045c >b601                          LDA     IOBUF+1         DESTINATION BYTE
684 0000045e  260e                          BNE     NPK27           IF NOT ZERO, NO PK27
685 00000460  a625                          LDA     #37             CHAIN CONTROL BYTE
686 00000462 >b700                          STA     R10
687 00000464  a610                          LDA     #16
688 00000466  adb1                          BSR     R2B
689 00000468 >b601                          LDA     IOBUF+1
690 0000046a  ad03                          BSR     DECODE
691 0000046c >bf00                          STX     STAT3
692 0000046e  81                    NPK27   RTS
693
694                                  ********************************************************
695                                  *                                                      *
696                                  *       Hamming decode.                                *
697                                  *                                                      *
698                                  ********************************************************
699
700 0000046f >b700                  DECODE  STA     W1
701 00000471  5f                            CLRX
702 00000472 >d60000                TRA     LDA     HAM,X
703 00000475 >b100                          CMP     W1
704 00000477  2732                          BEQ     FNDJ
705
706 00000479 >b700                  TRZE    STA     SUB2
707 0000047b >000004                        BRSET   0,SUB2,ZE1
708 0000047e >1000                          BSET    0,SUB2
709 00000480  2002                          BRA     ZE1+2
710 00000482 >1100                  ZE1     BCLR    0,SUB2
711 00000484 >cd0000                        JSR     SSUB
712 00000487  2722                          BEQ     FNDJ
713
714 00000489 >d60000                TRON    LDA     HAM,X
715 0000048c >b700                          STA     SUB2
716 0000048e >020004                        BRSET   1,SUB2,ON1
717 00000491 >1200                          BSET    1,SUB2
718 00000493  2002                          BRA     ON1+2
719 00000495 >1300                  ON1     BCLR    1,SUB2
720 00000497  ad7a                          BSR     SSUB
721 00000499  2774                          BEQ     FND
722
723 0000049b >d60000                TRTW    LDA     HAM,X
724 0000049e >b700                          STA     SUB2
725 000004a0 >040004                        BRSET   2,SUB2,TW1
726 000004a3 >1400                          BSET    2,SUB2
727 000004a5  2002                          BRA     TW1+2
728 000004a7 >1500                  TW1     BCLR    2,SUB2
729 000004a9  ad68                          BSR     SSUB
730 000004ab  2762                  FNDJ    BEQ     FND
731
732 000004ad >d60000                TRTH    LDA     HAM,X
733 000004b0 >b700                          STA     SUB2
734 000004b2 >060004                        BRSET   3,SUB2,TH1
735 000004b5 >1600                          BSET    3,SUB2
736 000004b7  2002                          BRA     TH1+2
737 000004b9 >1700                  TH1     BCLR    3,SUB2
738 000004bb  ad56                          BSR     SSUB
739 000004bd  2750                          BEQ     FND
```

```
741                                 ********************************************************
742                                 *                                                      *
743                                 *       More Hamming decode.                           *
744                                 *                                                      *
745                                 ********************************************************
746
747 000004bf >d60000             TRFO    LDA     HAM,X
748 000004c2 >b700                      STA     SUB2
749 000004c4 >080004                    BRSET   4,SUB2,FO1
750 000004c7 >1800                      BSET    4,SUB2
751 000004c9  2002                      BRA     FO1+2
752 000004cb >1900             FO1     BCLR    4,SUB2
753 000004cd  ad44                      BSR     SSUB
754 000004cf  273e                      BEQ     FND
755
756 000004d1 >d60000             TRFI    LDA     HAM,X
757 000004d4 >b700                      STA     SUB2
758 000004d6 >0a0004                    BRSET   5,SUB2,FI1
759 000004d9 >1a00                      BSET    5,SUB2
760 000004db  2002                      BRA     FI1+2
761 000004dd >1b00             FI1     BCLR    5,SUB2
762 000004df  ad32                      BSR     SSUB
763 000004e1  272c                      BEQ     FND
764
765 000004e3 >d60000             TRSI    LDA     HAM,X
766 000004e6 >b700                      STA     SUB2
767 000004e8 >0c0004                    BRSET   6,SUB2,SI1
768 000004eb >1c00                      BSET    6,SUB2
769 000004ed  2002                      BRA     SI1+2
770 000004ef >1d00             SI1     BCLR    6,SUB2
771 000004f1  ad20                      BSR     SSUB
772 000004f3  271a                      BEQ     FND
773
774 000004f5 >d60000             TRSE    LDA     HAM,X
775 000004f8 >b700                      STA     SUB2
776 000004fa >0e0004                    BRSET   7,SUB2,SE1
777 000004fd >1e00                      BSET    7,SUB2
778 000004ff  2002                      BRA     SE1+2
779 00000501 >1f00             SE1     BCLR    7,SUB2
780 00000503  ad0e                      BSR     SSUB
781 00000505  2708                      BEQ     FND
782
783 00000507  5c                        INCX
784 00000508  a30f                      CPX     #$0F
785 0000050a  2203                      BHI     FND
786 0000050c >cc0000                    JMP     TRA
787 0000050f >d60000             FND     LDA     NUM,X
788 00000512  81                        RTS
789
790 00000513 >b600               SSUB    LDA     SUB2
791 00000515 >b100                      CMP     W1
792 00000517  81                        RTS
793
794                                 ********************************************************
795                                 *                                                      *
796                                 *       Mix/nomix.                                     *
797                                 *                                                      *
798                                 ********************************************************
799
800 00000518 >0e0015             MIX     BRSET   7,STAT2,NOMIX   ALREADY MIXED ?
801 0000051b >1e00                       BSET    7,STAT2          NO, SO MIX IT
802 0000051d  a610                       LDA     #$10             BROADCAST, 312/313 SYNC
803 0000051f >b700                       STA     R1               ENABLING GHOST ROWS
804 00000521  a606                       LDA     #$06
805 00000523 >cd0000                     JSR     NOBX
806 00000526  a66e                       LDA     #$6E
807 00000528 >b700                       STA     R5
808 0000052a  a617                       LDA     #$17             $46 FOR NOMIX FLASH/SUBT.
809 0000052c >b700                       STA     R6
810 0000052e  2015                       BRA     TRAN2
811
812 00000530 >1f00               NOMIX   BCLR    7,STAT2          MIXED, SO NOMIX
813 00000532  a616                       LDA     #$16             CCT, 312/312 SYNC
814 00000534 >b700                       STA     R1               ENABLING GHOST ROWS
815 00000536  a6cc                       LDA     #$CC
816 00000538 >b700                       STA     R5
817 0000053a  a646                       LDA     #$46
818 0000053c >b700                       STA     R6
819 0000053e  2005                       BRA     TRAN2
820
821 00000540  a606               TRAN1   LDA     #6
822 00000542 >cd0000                     JSR     BOX0OF
823 00000545  a602               TRAN2   LDA     #2
824 00000547 >cd0000                     JSR     SPM              SET-UP SYNC
825 0000054a  4f                         CLRA
826 0000054b >cd0000                     JSR     BOX0ON
827 0000054e >1800               TRAN3   BSET    4,STAT
828 00000550  ad15                       BSR     FR0              FORCE HEADER DISPLAY
829 00000552  a606                       LDA     #6
830 00000554 >b700                       STA     TMR              5s TIMER
831 00000556  a607                       LDA     #$07
832 00000558 >b700                       STA     R7               ENABLE ALL BOXES
833
834 0000055a  a605               TXT2    LDA     #5               DISPLAY CONTROL
835 0000055c >b700                       STA     W1
836 0000055e  a604                       LDA     #4
837 00000560 >b700                       STA     SUB2
838 00000562 >ae00                       LDX     #SUB2
839 00000564 >cc0000                     JMP     SEND22
840
841
842 00000567  a619               FR0     LDA     #25              FORCE DISPLAY OF HEADER
843 00000569 >b700                       STA     R9
844 0000056b  a606                       LDA     #6
845 0000056d >b700                       STA     R10
846 0000056f >b600                       LDA     ACC
847 00000571 >b700                       STA     R8
848 00000573 >3f00                       CLR     R11
849 00000575  a605                       LDA     #5
850 00000577 >cc0000                     JMP     TXT32
```

```
852                                 ********************************************************
853                                 *                                                      *
854                                 *       Hold.                                          *
855                                 *                                                      *
856                                 ********************************************************
857
858 0000057a >3f00               HOLD    CLR     PDP
859 0000057c >040062                   BRSET   2,STAT,NOHOLD
860 0000057f >1400                     BSET    2,STAT
861 00000581 >b600                     LDA     ACC
862 00000583 >b700                     STA     R8
863 00000585 >cd0000                   JSR     UP
864 00000588 >3f00                     CLR     R9              ROW 0
865 0000058a >1d00                     BCLR    6,STAT          RESET SUB-PAGE MODE
866 0000058c  5f                       CLRX
867 0000058d  ad2b                     BSR     DISP8
868 0000058f >b600               UCHOLD  LDA     ACC
869 00000591 >b700                     STA     R8              DISPLAY CHAPTER
870 00000593 >cd0000                   JSR     UP
871 00000596 >3f00                     CLR     R9              ROW 0
872 00000598 >1700                     BCLR    3,R3            HOLD
873 0000059a  a604                     LDA     #4
874 0000059c  ad11                     BSR     SPM             WAS TXT1
875 0000059e  20ae                     BRA     TRAN3
876
877 000005a0 >0c000a             TXT1    BRSET   6,STAT,SPM2
878 000005a3 >3f00               TXT1L   CLR     C3
879 000005a5 >3f00                       CLR     C4
880 000005a7 >3f00                       CLR     C5
881 000005a9  a60f                       LDA     #$0F            CORRUPT C6 SO THAT NEXT
882 000005ab >b700                       STA     C6              ARRIVAL IS SEEN BY UPDATE
883 000005ad  a60a               SPM2    LDA     #10
884 000005af >b700               SPM     STA     W1
885 000005b1  a601                       LDA     #1
886 000005b3 >b700                       STA     SUB1
887 000005b5 >ae00                       LDX     #SUB1
888 000005b7 >cc0000                     JMP     SEND22
889
890 000005ba >bf00               DISP8   STX     W3
891 000005bc >3f00                       CLR     R9
892 000005be  4f                         CLRA
893 000005bf  ad07                       BSR     DISP4
894 000005c1 >b600                       LDA     W3
895 000005c3  ab04                       ADD     #4
896 000005c5  97                         TAX
897 000005c6  a604                       LDA     #4
898 000005c8 >b700               DISP4   STA     R10
899 000005ca >d60000                     LDA     LHOLD,X
900 000005cd >b700                       STA     R11
901 000005cf >d60001                     LDA     LHOLD+1,X
902 000005d2 >b700                       STA     PH
903 000005d4 >d60002                     LDA     LHOLD+2,X
904 000005d7 >b700                       STA     PT
905 000005d9 >d60003                     LDA     LHOLD+3,X
906 000005dc >b700                       STA     PU
907 000005de >cc0000                     JMP     TXT3
908
909                                 ********************************************************
910                                 *                                                      *
911                                 *       Nohold.                                        *
912                                 *                                                      *
913                                 ********************************************************
914
915 000005e1 >1500               NOHOLD  BCLR    2,STAT
916 000005e3 >b600                       LDA     ACC
917 000005e5 >b700                       STA     R8
918 000005e7 >3f00                       CLR     R9              ROW 0
919 000005e9  a602                       LDA     #2
920 000005eb >b700                       STA     R10             COLUMN 2
921 000005ed  a650                       LDA     #$50
922 000005ef >b700                       STA     R11             P
923 000005f1  ad0b                       BSR     REL1
924 000005f3  ad14                       BSR     REL2
925 000005f5 >cd0000                     JSR     TXT38
926 000005f8 >cd0000                     JSR     SFND
927 000005fb >cc0000                     JMP     TRAN2
928
929 000005fe >b600               REL1    LDA     ACC
930 00000600 >cd0000                     JSR     UP
931 00000603 >cd0000                     JSR     INDX
932 00000606 >e600                       LDA     PAG0,X
933 00000608  81                         RTS
934 00000609 >b700               REL2    STA     PH
935 0000060b  a018                       SUB     #$18
936 0000060d >b700                       STA     R3
937 0000060f >e601                       LDA     PAG0+1,X
938 00000611 >b700                       STA     PT
939 00000613 >b700                       STA     C1
940 00000615 >e602                       LDA     PAG0+2,X
941 00000617 >b700                       STA     PU
942 00000619 >b700                       STA     C2
943 0000061b >cc0000                     JMP     TXT1
944
945 0000061e >b600               CPBLF   LDA     ACC
946 00000620 >b700                       STA     R8
947 00000622  a609                       LDA     #9
948 00000624 >b700                       STA     R10
949 00000626  a619                       LDA     #25
950 00000628 >cd0000                     JSR     R2B
951 0000062b  99                         SEC
952 0000062c >0a0101                     BRSET   5,IOBUF+1,HIGH
953 0000062f  98                         CLC
954 00000630  81                 HIGH    RTS
```

```
                                ********************************************************
                                *                                                      *
                                *       Reveal,top/bottom & clock.                     *
                                *                                                      *
                                ********************************************************

00000631 >0a0004                REVEAL  BRSET   5,R7,REV
00000634 >1a00                          BSET    5,R7
00000636  2016                          BRA     OUT
00000638 >1b00                  REV     BCLR    5,R7
0000063a  2012                          BRA     OUT
0000063c >07000b                EXPTB   BRCLR   3,R7,EXP
0000063f >090004                        BRCLR   4,R7,BOT
00000642 >1700                          BCLR    3,R7            SINGLE HEIGHT
00000644  2008                          BRA     OUT
00000646 >1800                  BOT     BSET    4,R7            BOTTOM
00000648  2004                          BRA     OUT
0000064a >1600                  EXP     BSET    3,R7
0000064c >1900                          BCLR    4,R7            TOP
0000064e >cc0000                OUT     JMP     TXT2

00000651 >0c00dc                TIME    BRSET   6,STAT7,HIGH    TELETEXT CHIP ?
00000654 >010003                        BRCLR   0,STAT,CLOCK    TELETEXT MODE ?
00000657 >cc0000                        JMP     SUBPG           YES
0000065a >0a0025                CLOCK   BRSET   5,STAT,TAO      NO, TIME ALREADY ON ?
0000065d >b600                          LDA     ACC
0000065f >b700                          STA     R4
00000661 >cd0000                        JSR     UCHOLD
00000664 >1800                          BSET    4,STAT
00000666 >1a00                          BSET    5,STAT
00000668  4f                            CLRA
00000669  ad1c                        BSR     NOBX
0000066b  a61e                        LDA     #30
0000066d  ad1e                        BSR     BOX0ON
0000066f >cd0000                        JSR     FR0
00000672  a609                          LDA     #$09
00000674 >b700                          STA     R7
00000676 >cd0000                        JSR     TXT2            STOP FLASHES ON FIRST PRESS
00000679  a646                          LDA     #$46
0000067b >b700                          STA     R5
0000067d >b700                          STA     R6
0000067f >cd0000                        JSR     TXT2
00000682  a606                  TAO     LDA     #6
00000684 >b700                          STA     TMR
00000686  81                            RTS
00000687 >b700                  NOBX    STA     R10
00000689  a620                          LDA     #$20
0000068b  200a                          BRA     BOX
0000068d >b700                  BOX0ON  STA     R10
0000068f  a60b                          LDA     #$0B
00000691  2004                          BRA     BOX
00000693 >b700                  BOX0OF  STA     R10
00000695  a60a                          LDA     #$0A
00000697 >b700                  BOX     STA     R11
00000699 >b700                          STA     PH
0000069b >b600                          LDA     R4
0000069d >b700                          STA     R8
0000069f >3f00                          CLR     R9
000006a1  a606                          LDA     #6
000006a3 >cc0000                        JMP     TXT32
```

```
1017                                    ********************************************************
1018                                    *                                                      *
1019                                    *       Sub-page number entry routine.                 *
1020                                    *                                                      *
1021                                    ********************************************************
1022
1023 000006a6 >cd0000                  DIGITS  JSR     TPSTP
1024 000006a9 >b600                            LDA     W2
1025 000006ab  a010                            SUB     #16
1026 000006ad >be00                    SD0     LDX     PDP
1027 000006af  2704                            BEQ     THOU
1028 000006b1  a302                            CPX     #2
1029 000006b3  260f                            BNE     SORTD
1030 000006b5  a107                    THOU    CMP     #7              THOUSANDS OR TENS
1031 000006b7  2302                            BLS     SOCH            NO, SO DON'T CHANGE
1032 000006b9  a008                            SUB     #8              YES, 8->0 & 9->1
1033 000006bb  5d                      SOCH    TSTX                    WAS  CPX  #0
1034 000006bc  2606                            BNE     SORTD
1035 000006be  a103                            CMP     #3              MORE THAN 3 ?
1036 000006c0  2302                            BLS     SORTD           NO
1037 000006c2  a004                            SUB     #4              YES, 4->0 THRU 7->3
1038 000006c4  ab30                    SORTD   ADD     #$30            CONVERT TO ASCII
1039 000006c6 >e703                            STA     PAGE+3,X
1040 000006c8  a303                            CPX     #3              UNITS ?
1041 000006ca  2714                            BEQ     SLRPD           YES, SO CLEAR PDP
1042 000006cc  a62a                            LDA     #$2A            ASTERISK
1043 000006ce  a301                            CPX     #1              HUNDREDS ?
1044 000006d0  2706                            BEQ     HUN             YES, SO LEAVE HUNDREDS
1045 000006d2  a302                            CPX     #2              TENS ?
1046 000006d4  2704                            BEQ     SEN             YES, SO LEAVE TENS & HUNDREDS ?
1047 000006d6 >b704                            STA     PAGE+4          CLEAR HUNDREDS
1048 000006d8 >b705                    HUN     STA     PAGE+5          CLEAR TENS
1049 000006da >b706                    SEN     STA     PAGE+6          CLEAR UNITS
1050 000006dc >3c00                            INC     PDP
1051 000006de  2002                            BRA     SPGN
1052 000006e0 >3f00                    SLRPD   CLR     PDP
1053 000006e2 >b600                    SPGN    LDA     ACC
1054 000006e4 >b700                            STA     R8
1055 000006e6  4f                              CLRA
1056 000006e7 >b700                            STA     R9              ROW 0
1057 000006e9 >cd0000                          JSR     BOX0ON          COLUMN 0
1058 000006ec  a602                            LDA     #2
1059 000006ee >b700                            STA     R10             COLUMN 2
1060 000006f0 >b603                            LDA     PAGE+3
1061 000006f2 >b700                            STA     R11
1062 000006f4 >b604                            LDA     PAGE+4
1063 000006f6 >b700                            STA     PH
1064 000006f8 >b605                            LDA     PAGE+5
1065 000006fa >b700                            STA     PT
1066 000006fc >b606                            LDA     PAGE+6
1067 000006fe >b700                            STA     PU
1068 00000700 >cd0000                          JSR     TXT3
1069 00000703 >cd0000                          JSR     TRAN1
1070 00000706 >b600                            LDA     PDP
1071 00000708  2661                            BNE     SBO
1072 0000070a  a606                            LDA     #6
1073 0000070c >cd0000                          JSR     NOBX
1074 0000070f >b603                            LDA     PAGE+3
1075 00000711 >b700                            STA     R11
1076 00000713 >b604                            LDA     PAGE+4
1077 00000715 >b700                            STA     PH
1078
1079                                    ********************************************************
1080                                    *                                                      *
1081                                    *       Get requested sub-page.                        *
1082                                    *                                                      *
1083                                    ********************************************************
1084
1085 00000717 >b601                    SETIT   LDA     PAGE+1
1086 00000719 >b700                            STA     C1
1087 0000071b >b602                            LDA     PAGE+2
1088 0000071d >b700                            STA     C2
1089 0000071f >b603                            LDA     PAGE+3
1090 00000721 >b700                            STA     C3
1091 00000723 >b604                            LDA     PAGE+4
1092 00000725 >b700                            STA     C4
1093 00000727 >b605                            LDA     PAGE+5
1094 00000729 >b700                            STA     C5
1095 0000072b >b606                            LDA     PAGE+6
1096 0000072d >b700                            STA     C6
1097
1098 0000072f >b600                            LDA     PAGE            PAGE HUNDREDS
1099 00000731  a018                            SUB     #$18
1100 00000733 >b700                            STA     R3              PAGE REQUEST HUNDREDS
1101 00000735 >b600                            LDA     ACC
1102 00000737 >cd0000                          JSR     UP
1103 0000073a >cd0000                          JSR     TXT1            REQUEST IT
1104 0000073d >1500                            BCLR    2,STAT          NOHOLD
1105 0000073f >cc0000                          JMP     SFND            WRITE ONE TO FOUND
1106
1107 00000742 >b600                    TXT38   LDA     PH
1108 00000744  a130                            CMP     #$30
1109 00000746  2604                            BNE     TXT3
1110 00000748  a638                            LDA     #$38
1111 0000074a >b700                            STA     PH
1112
1113 0000074c  a608                    TXT3    LDA     #8
1114 0000074e >b700                    TXT32   STA     W1
1115 00000750  a608                            LDA     #8              WRITE CCT RAM VIA IIC
1116 00000752 >b700                            STA     SUB3
1117 00000754 >ae00                            LDX     #SUB3
1118
1119 00000756  a622                    SEND22  LDA     #$22
1120 00000758 >b700                            STA     ADDR
1121 0000075a >cc0000                          JMP     SEND
1122
1123 0000075d >b600                    TPSTP   LDA     PAGE            HOLD DURING
1124 0000075f >b700                            STA     R3              SUB-PAGE NUMBER
1125 00000761 >b600                            LDA     ACC             ENTRY
1126 00000763 >cd0000                          JSR     UP
1127 00000766  a604                            LDA     #4
1128 00000768 >cc0000                          JMP     SPM
1129 0000076b  81                      SBO     RTS
```

```
1131                                ********************************************************
1132                                *                                                      *
1133                                *       Sub (timed) pages.                             *
1134                                *                                                      *
1135                                ********************************************************
1136
1137 0000076c >0c002e               SUBPG   BRSET   6,STAT,OUTSP
1138 0000076f >1c00                        BSET    6,STAT
1139 00000771  adea                        BSR     TPSTP
1140 00000773 >3f00                        CLR     PDP
1141 00000775 >cd0000                      JSR     INDX
1142 00000778 >e600                        LDA     PAG0,X
1143 0000077a >b700                        STA     PAGE
1144 0000077c >e601                        LDA     PAG0+1,X
1145 0000077e >b701                        STA     PAGE+1
1146 00000780 >e602                        LDA     PAG0+2,X
1147 00000782 >b702                        STA     PAGE+2
1148 00000784  a62a                        LDA     #$2A            *
1149 00000786 >b700                        STA     R11
1150 00000788 >b700                        STA     PH
1151 0000078a >b700                        STA     PT
1152 0000078c >b700                        STA     PU
1153 0000078e >b600                        LDA     ACC
1154 00000790 >b700                        STA     R8
1155 00000792 >3f00                        CLR     R9
1156 00000794  a602                        LDA     #2
1157 00000796 >b700                        STA     R10
1158 00000798  adb2                        BSR     TXT3
1159 0000079a >cc0000                      JMP     TRAN1
1160
1161 0000079d  ad0d                OUTSP   BSR     RSTR
1162 0000079f >b600                        LDA     ACC
1163 000007a1 >cd0000                      JSR     UP
1164 000007a4 >1500                        BCLR    2,STAT          RESET HOLD FLAG
1165 000007a6 >cd0000                      JSR     TXT1
1166 000007a9 >cc0000                      JMP     TRAN1
1167
1168 000007ac >1d00                RSTR    BCLR    6,STAT
1169 000007ae >3f00                        CLR     PDP
1170 000007b0  a650                        LDA     #$50            P
1171 000007b2 >b700                        STA     R11
1172 000007b4 >cd0000                      JSR     INDX
1173 000007b7 >e600                        LDA     PAG0,X
1174 000007b9 >b700                        STA     PH
1175 000007bb  a018                        SUB     #$18
1176 000007bd >b700                        STA     R3
1177 000007bf >e601                        LDA     PAG0+1,X
1178 000007c1 >b700                        STA     PT
1179 000007c3 >b700                        STA     C1
1180 000007c5 >e602                        LDA     PAG0+2,X
1181 000007c7 >b700                        STA     PU
1182 000007c9 >b700                        STA     C2
1183 000007cb >3f00                        CLR     R9
1184 000007cd  a602                        LDA     #2
1185 000007cf >b700                        STA     R10
1186 000007d1 >b600                        LDA     ACC
1187 000007d3 >b700                        STA     R8
1188 000007d5 >cc0000                      JMP     TXT38
1189
1190                                ********************************************************
1191                                *                                                      *
1192                                *       Read in Row 25 information.                    *
1193                                *                                                      *
1194                                ********************************************************
1195
1196 000007d8 >b600                GET25   LDA     ACC
1197 000007da >b700                        STA     R8
1198 000007dc >1b00                        BCLR    5,STAT2         CLEAR DIFFERENCE FLAG
1199 000007de  a602                        LDA     #2              COLUMN 2 (MINUTES)
1200 000007e0 >b700                        STA     R10
1201 000007e2  a619                        LDA     #25             ROW
1202 000007e4 >cd0000                      JSR     R2B
1203 000007e7 >b601                        LDA     IOBUF+1
1204 000007e9 >b100                        CMP     C6
1205 000007eb  2704                        BEQ     SM6
1206 000007ed >1a00                        BSET    5,STAT2
1207 000007ef >b700                        STA     C6              MINUTES UNITS
1208 000007f1 >b600                SM6     LDA     IOBUF
1209 000007f3 >b700                        STA     SUB2            MINUTES TENS & CBIT 4
1210
1211 000007f5  a604                        LDA     #4              COLUMN 4 (HOURS)
1212 000007f7 >b700                        STA     R10
1213 000007f9  a619                        LDA     #25             ROW
1214 000007fb >cd0000                      JSR     R2B
1215 000007fe >b601                        LDA     IOBUF+1
1216 00000800 >b100                        CMP     C4
1217 00000802  2704                        BEQ     SM4
1218 00000804 >1a00                        BSET    5,STAT2
1219 00000806 >b700                        STA     C4              HOURS UNITS
1220 00000808 >b600                SM4     LDA     IOBUF
1221 0000080a >b100                        CMP     C3
1222 0000080c  2704                        BEQ     SM3
1223 0000080e >1a00                        BSET    5,STAT2
1224 00000810 >b700                        STA     C3              HOURS TENS & CBITS 5 & 6
1225
1226 00000812  a40c                SM3     AND     #$0C            SAVE CBITS 5 & 6 IN STAT7
1227 00000814 >1500                        BCLR    2,STAT7         CLEAR NEWSFLASH BIT
1228 00000816 >1700                        BCLR    3,STAT7         CLEAR SUBTITLE BIT
1229 00000818 >ba00                        ORA     STAT7
1230 0000081a >b700                        STA     STAT7
1231 0000081c  a606                        LDA     #6              COLUMN 6 (CONTROL BITS)
1232 0000081e >b700                        STA     R10
1233 00000820  a619                        LDA     #25             ROW
1234 00000822 >cd0000                      JSR     R2B
1235 00000825 >1700                        BCLR    3,SUB2          XFER CBIT8 (UPDATE)
1236 00000827 >030102                      BRCLR   1,IOBUF+1,TR5   TO BIT 3 OF MINUTES TENS
1237 0000082a >1600                        BSET    3,SUB2          (REPLACING CBIT4 (ERASE))
1238 0000082c >b600                TR5     LDA     SUB2
1239 0000082e >b100                        CMP     C5
1240 00000830  2704                        BEQ     CGET26
1241 00000832 >1a00                        BSET    5,STAT2
1242 00000834 >b700                        STA     C5
1243
1244 00000836  0f0101              CGET26  BRCLR   7,PORTB,GET26   PACKET 26 ENABLED ?
1245 00000839  81                          RTS
```

```
1247                            ********************************************************
1248                            *                                                      *
1249                            *       Process packet 26 info.                        *
1250                            *                                                      *
1251                            ********************************************************
1252
1253 0000083a  a6ff             GET26   LDA     #$FF
1254 0000083c >b700                     STA     LIFO
1255
1256 0000083e >3f01             LOOP26  CLR     LIFO+1          START NEW ROW
1257 00000840 >b600                     LDA     ACC
1258 00000842  ab04                     ADD     #4              GHOST CHAPTER
1259 00000844 >b700                     STA     R8
1260 00000846 >b601                     LDA     LIFO+1
1261 00000848 >b700                     STA     R10
1262 0000084a >3c00                     INC     LIFO
1263 0000084c >b600                     LDA     LIFO
1264 0000084e  a10e                     CMP     #14             STILL PACKET 26 ?
1265 00000850  2303                     BLS     OKROW
1266 00000852 >cc0000                   JMP     END26
1267 00000855 >b600             OKROW   LDA     LIFO
1268 00000857 >cd0000                   JSR     R2B
1269 0000085a >b601                     LDA     IOBUF+1
1270 0000085c >b100                     CMP     LIFO            IS BYTE ZERO OK ?
1271 0000085e  26de                     BNE     LOOP26          NO, TRY NEXT ROW
1272 00000860 >3a01                     DEC     LIFO+1
1273
1274 00000862 >b600             LOOP62  LDA     ACC
1275 00000864  ab04                     ADD     #4
1276 00000866 >b700                     STA     R8
1277 00000868 >3c01                     INC     LIFO+1
1278 0000086a >3c01                     INC     LIFO+1
1279 0000086c >b601                     LDA     LIFO+1
1280 0000086e >b700                     STA     R10
1281 00000870  a126                     CMP     #38             PAST END OF ROW ?
1282
1283
1284 00000872  230d                     BLS     NXTCH
1285 00000874 >3f00                     CLR     R10             YES, BLOW AWAY ROW
1286 00000876  a6ff                     LDA     #$FF
1287 00000878 >b700                     STA     R11             CORRUPT SEQUENCE No.
1288 0000087a >b600                     LDA     LIFO
1289 0000087c >cd0000                   JSR     W2B
1290 0000087f  20bd                     BRA     LOOP26          NEXT ROW
1291
1292 00000881 >b600             NXTCH   LDA     LIFO
1293 00000883 >cd0000                   JSR     R2B             GET 2 BYTES
1294 00000886 >b601                     LDA     IOBUF+1
1295 00000888 >b708                     STA     LIFO+8
1296 0000088a >b600                     LDA     IOBUF
1297 0000088c >b707                     STA     LIFO+7
1298 0000088e >3c01                     INC     LIFO+1
1299 00000890 >b601                     LDA     LIFO+1
1300 00000892 >b700                     STA     R10
1301 00000894 >cd0000                   JSR     R2BN9           GET THIRD BYTE
1302
1303 00000897 >b600                     LDA     IOBUF
1304 00000899 >b706                     STA     LIFO+6
1305 0000089b >b607                     LDA     LIFO+7
1306 0000089d  a47c                     AND     #$7C
1307 0000089f  44                       LSRA
1308 000008a0  44                       LSRA
1309 000008a1 >b702                     STA     LIFO+2          SAVE MODE
1310 000008a3 >cd0000                   JSR     EXAD
1311 000008a6 >b605                     LDA     LIFO+5
1312 000008a8  a128                     CMP     #40             ROW 24 ?
1313 000008aa  2706                     BEQ     RW24
1314 000008ac  250a                     BLO     NOTROW
1315
1316 000008ae  a028                     SUB     #40             SUBTRACT 40 FOR ROW
1317 000008b0  2002                     BRA     SKIP
1318 000008b2  a618             RW24    LDA     #24
1319
1320 000008b4 >b704             SKIP    STA     LIFO+4
1321 000008b6  20aa                     BRA     LOOP62
1322
1323 000008b8 >b604             NOTROW  LDA     LIFO+4
1324 000008ba >b700                     STA     R9
1325 000008bc >b600                     LDA     ACC
1326 000008be >b700                     STA     R8
1327 000008c0 >b605                     LDA     LIFO+5
1328 000008c2 >b700                     STA     R10
1329
1330 000008c4 >090241                   BRCLR   4,LIFO+2,NOTD   DIACRITICAL ?
1331 000008c7 >b602                     LDA     LIFO+2
1332 000008c9  a110                     CMP     #$10            NULL ?
1333 000008cb  2775                     BEQ     NULD            YES, JUST SEND IT (BIT7=1)
1334
1335 000008cd  5f                       CLRX
1336 000008ce >1f06                     BCLR    7,LIFO+6
1337 000008d0 >d60000           TRNCH   LDA     CTAB,X
1338 000008d3 >b106                     CMP     LIFO+6
1339 000008d5  270a                     BEQ     CHFND
1340 000008d7  9f                       TXA
1341 000008d8  ab07                     ADD     #7
1342 000008da  97                       TAX
1343 000008db  a15b                     CMP     #91
1344 000008dd  23f1                     BLS     TRNCH
1345 000008df  2063                     BRA     CHNF
1346
1347 000008e1 >b602             CHFND   LDA     LIFO+2
1348 000008e3  a40f                     AND     #$0F
1349 000008e5 >b703                     STA     LIFO+3
1350 000008e7  275b                     BEQ     CHNF            NULL DIA.
1351 000008e9  a104                     CMP     #4
1352 000008eb  2312                     BLS     GTT
1353 000008ed  a108                     CMP     #8
1354 000008ef  2604                     BNE     NOTCF
1355 000008f1  a003                     SUB     #3
1356 000008f3  2008                     BRA     UOC
```

```
1358 000008f5  a10b                NOTCF   CMP     #11
1359 000008f7  2702                        BEQ     CEDI
1360 000008f9  2049                        BRA     CHNF            ILLEGAL MODE
1361 000008fb  a005                CEDI    SUB     #5
1362 000008fd >b703                UOC     STA     LIFO+3
1363 000008ff  9f                  GTT     TXA
1364 00000900 >bb03                        ADD     LIFO+3
1365 00000902  97                          TAX
1366 00000903 >d60000                      LDA     CTAB,X
1367 00000906  203e                        BRA     GOTCH
1368
1369 00000908 >b602                NOTD    LDA     LIFO+2
1370 0000090a  a10f                        CMP     #$0F
1371 0000090c  271c                        BEQ     G2BIT
1372 0000090e  a102                        CMP     #$02
1373 00000910  263e                        BNE     END26
1374
1375 00000912 >1f06                G3BIT   BCLR    7,LIFO+6
1376 00000914  5f                          CLRX
1377 00000915 >d60000              TN32    LDA     G3TAB,X
1378 00000918  2603                        BNE     STRM
1379 0000091a >cc0000                      JMP     LOOP62
1380 0000091d >b106                STRM    CMP     LIFO+6
1381 0000091f  2704                        BEQ     G32F
1382 00000921  5c                          INCX
1383 00000922  5c                          INCX
1384 00000923  20f0                        BRA     TN32
1385 00000925 >d60001              G32F    LDA     G3TAB+1,X
1386 00000928  201c                        BRA     GOTCH
1387
1388 0000092a >1f06                G2BIT   BCLR    7,LIFO+6
1389 0000092c  5f                          CLRX
1390 0000092d >d60000              TN23    LDA     G2TAB,X
1391 00000930  2603                        BNE     STMR
1392 00000932 >cc0000                      JMP     LOOP62
1393 00000935 >b106                STMR    CMP     LIFO+6
1394 00000937  2704                        BEQ     G23F
1395 00000939  5c                          INCX
1396 0000093a  5c                          INCX
1397 0000093b  20f0                        BRA     TN23
1398 0000093d >d60001              G23F    LDA     G2TAB+1,X
1399 00000940  2004                        BRA     GOTCH
1400
1401 00000942 >1e06                NULD    BSET    7,LIFO+6
1402 00000944 >b606                CHNF    LDA     LIFO+6
1403 00000946 >b700                GOTCH   STA     R11
1404
1405 00000948  a605                        LDA     #5
1406 0000094a >cd0000                      JSR     TXT32
1407 0000094d >cc0000                      JMP     LOOP62
1408
1409 00000950  81                  END26   RTS
1410
1411                               *********************************************************
1412                               *                                                       *
1413                               *       Packet 26 character look-up table.              *
1414                               *                                                       *
1415                               *********************************************************
1416
1417 00000951  202021e02383        G2TAB   FCB     $20,$20,$21,$E0,$23,$83
1418 00000957  248426932740                FCB     $24,$84,$26,$93,$27,$40
1419 0000095d  289429a72aa2                FCB     $28,$94,$29,$A7,$2A,$A2
1420 00000963  2cbc2d5e2ebe                FCB     $2C,$BC,$2D,$5E,$2E,$BE
1421 00000969  2f7630cb37c7                FCB     $2F,$76,$30,$CB,$37,$C7
1422 0000096f  388a39a73aa2                FCB     $38,$8A,$39,$A7,$3A,$A2
1423 00000975  3c823d8c3e89                FCB     $3C,$82,$3D,$8C,$3E,$89
1424 0000097b  3fe161f963e5                FCB     $3F,$E1,$61,$F9,$63,$E5
1425 00000981  69fd6be66cfe                FCB     $69,$FD,$6B,$E6,$6C,$FE
1426 00000987  71f879fc7cff                FCB     $71,$F8,$79,$FC,$7C,$FF
1427 0000098d  7f7f00                      FCB     $7F,$7F,$00
1428
1429 00000990  51815b8d5c8b        G3TAB   FCB     $51,$81,$5B,$8D,$5C,$8B
1430 00000996  5d8e5f2000                  FCB     $5D,$8E,$5F,$20,$00
1431
1432 0000099b  61eaebd2c59261      CTAB    FCB     $61,$EA,$EB,$D2,$C5,$92,$61       a
1433 000009a2  41f1f041d59b41              FCB     $41,$F1,$F0,$41,$D5,$9B,$41       A
1434 000009a9  65e9ecdc65db65              FCB     $65,$E9,$EC,$DC,$65,$DB,$65       e
1435 000009b0  45f29045454545              FCB     $45,$F2,$90,$45,$45,$45,$45       E
1436 000009b7  6969edde69d469              FCB     $69,$69,$ED,$DE,$69,$D4,$69       i
1437 000009be  4949f34949f449              FCB     $49,$49,$F3,$49,$49,$F4,$49       I
1438 000009c5  6fc8eed8c6986f              FCB     $6F,$C8,$EE,$D8,$C6,$98,$6F       o
1439 000009cc  4ff6f5d8d69c4f              FCB     $4F,$F6,$F5,$D8,$D6,$9C,$4F       O
1440 000009d3  75c1efd975e275              FCB     $75,$C1,$EF,$D9,$75,$E2,$75       u
1441 000009da  5555f755559e55              FCB     $55,$55,$F7,$55,$55,$9E,$55       U
1442 000009e1  6e6e6e6ee86e6e              FCB     $6E,$6E,$6E,$6E,$E8,$6E,$6E       n
1443 000009e8  4e4e4e4ee74e4e              FCB     $4E,$4E,$4E,$4E,$E7,$4E,$4E       N
1444 000009ef  636363636363e3              FCB     $63,$63,$63,$63,$63,$63,$E3       c
1445 000009f6  434343434343d7              FCB     $43,$43,$43,$43,$43,$43,$D7       C
1446
1447 000009fd >3f05                EXAD    CLR     LIFO+5
1448 000009ff >030702                      BRCLR   1,LIFO+7,NO32
1449 00000a02 >1a05                        BSET    5,LIFO+5
1450 00000a04 >010702              NO32    BRCLR   0,LIFO+7,NO16
1451 00000a07 >1805                        BSET    4,LIFO+5
1452 00000a09 >0d0802              NO16    BRCLR   6,LIFO+8,NO8
1453 00000a0c >1605                        BSET    3,LIFO+5
1454 00000a0e >0b0802              NO8     BRCLR   5,LIFO+8,NO4
1455 00000a11 >1405                        BSET    2,LIFO+5
1456 00000a13 >090802              NO4     BRCLR   4,LIFO+8,NO2
1457 00000a16 >1205                        BSET    1,LIFO+5
1458 00000a18 >050802              NO2     BRCLR   2,LIFO+8,NO1
1459 00000a1b >1005                        BSET    0,LIFO+5
1460 00000a1d  81                  NO1     RTS
```

```
1462                                ********************************************************
1463                                *                                                      *
1464                                *       Fetch initial page from 8/30 format 1.         *
1465                                *                                                      *
1466                                ********************************************************
1467
1468 00000a1e >1b00                 GIP     BCLR    5,STAT          CLEAR TIME HOLD
1469 00000a20 >1d00                         BCLR    6,STAT          CLEAR SUB-PAGE MODE
1470 00000a22 >1d00                         BCLR    6,STAT2         CLEAR NO TXT FLAG
1471 00000a24 >3f00                         CLR     PDP
1472 00000a26  a602                         LDA     #2
1473 00000a28 >cd0000                       JSR     SPM             TXT1 1 BYTE ONLY
1474 00000a2b  a604                         LDA     #4
1475 00000a2d >b700                         STA     R8              CHAPTER 4 (GHOST)
1476 00000a2f  a660                         LDA     #96             96 TRYS
1477 00000a31 >b700                         STA     W3
1478 00000a33 >3a00                 TRYAG   DEC     W3
1479 00000a35  2735                         BEQ     IPNF            AGAIN ?
1480 00000a37  a601                         LDA     #1
1481 00000a39 >cd0000                       JSR     TPAU2
1482 00000a3c >3f00                         CLR     R10
1483 00000a3e  a617                         LDA     #23
1484 00000a40 >cd0000                       JSR     R2B
1485 00000a43 >b601                         LDA     IOBUF+1         8/30 FORMAT 1 FOR INITIAL PAGE
1486 00000a45  26ec                         BNE     TRYAG
1487 00000a47  a601                         LDA     #1              COLUMN 1
1488 00000a49 >b700                         STA     R10
1489 00000a4b  a630                         LDA     #$30            RESET PAGE HUNDREDS
1490 00000a4d >b700                         STA     PH
1491 00000a4f  a617                         LDA     #23             LINE 23 (PACKET 8/30)
1492 00000a51 >cd0000                       JSR     R2BJ2
1493 00000a54 >b600                 GETIND  LDA     PH              INITIALISE INDEX (BLACK)
1494 00000a56 >b700                         STA     PAGI
1495 00000a58 >b700                         STA     PAGE
1496 00000a5a >b600                         LDA     PT
1497 00000a5c >b701                         STA     PAGI+1
1498 00000a5e >b600                         LDA     PU
1499 00000a60 >b702                         STA     PAGI+2
1500 00000a62 >b600                         LDA     ACC
1501 00000a64 >b700                         STA     WACC
1502 00000a66 >cd0000                       JSR     UP
1503 00000a69 >cc0000                       JMP     GLP2
1504 00000a6c >b601                 IPNF    LDA     IOBUF+1
1505 00000a6e  a110                         CMP     #$10
1506 00000a70  2502                         BLO     P830OK
1507 00000a72 >1c00                         BSET    6,STAT2
1508 00000a74  a631                 P830OK  LDA     #$31            REQUEST
1509 00000a76 >b700                         STA     PH              PAGE 100
1510 00000a78  4a                           DECA                    IN CASE
1511 00000a79 >b700                         STA     PT              INITIAL PAGE
1512 00000a7b >b700                         STA     PU              NOT FOUND
1513 00000a7d  20d5                         BRA     GETIND
1514
1515                                ********************************************************
1516                                *                                                      *
1517                                *       Row 24 transient.                              *
1518                                *                                                      *
1519                                ********************************************************
1520
1521 00000a7f  a604                 R24T    LDA     #4
1522 00000a81 >b700                         STA     R8              CHAPTER 4
1523 00000a83  48                           LSLA
1524 00000a84 >b700                         STA     R10             BOX ON AT 8 & 9
1525 00000a86  a60b                         LDA     #$0B
1526 00000a88 >b700                         STA     R11
1527 00000a8a >b700                         STA     PH
1528 00000a8c  a618                         LDA     #24             ROW 24
1529 00000a8e >b700                         STA     R9
1530 00000a90  a606                         LDA     #6
1531 00000a92 >cd0000                       JSR     TXT32           WRITE BOX ON
1532 00000a95  a61f                         LDA     #31             BOX OFF AT 31 & 32
1533 00000a97 >b700                         STA     R10
1534 00000a99  a60a                         LDA     #$0A
1535 00000a9b >b700                         STA     R11
1536 00000a9d >b700                         STA     PH
1537 00000a9f  a606                         LDA     #6
1538 00000aa1 >cd0000                       JSR     TXT32           WRITE BOX OFF
1539 00000aa4  a614                         LDA     #20
1540 00000aa6 >b700                         STA     W3              START READING @ COLUMN 20
1541 00000aa8 >b700                 EA      STA     R10
1542 00000aaa  a617                         LDA     #23             ROW 23 - PACKET 8/30
1543 00000aac >cd0000                       JSR     R2B
1544 00000aaf >b601                         LDA     IOBUF+1
1545 00000ab1  a47f                         AND     #$7F
1546 00000ab3 >b700                         STA     R11
1547 00000ab5 >b600                         LDA     IOBUF
1548 00000ab7  a47f                         AND     #$7F
1549 00000ab9 >b700                         STA     PH
1550 00000abb >b600                         LDA     W3
1551 00000abd  a00a                         SUB     #10             START WRITING AT COLUMN 10
1552 00000abf >b700                         STA     R10
1553 00000ac1  a618                         LDA     #24             WRITE TO ROW 24
1554 00000ac3 >cd0000                       JSR     W2B
1555 00000ac6 >3c00                         INC     W3
1556 00000ac8 >3c00                         INC     W3
1557 00000aca >b600                         LDA     W3
1558 00000acc  a127                         CMP     #39             ALL DONE ?
1559 00000ace  23d8                         BLS     EA
1560 00000ad0  81                   NOTR    RTS
1561
1562 00000ad1 >cd0000               START2  JSR     TXTOF
1563 00000ad4  a614                         LDA     #20
1564 00000ad6 >cd0000               SDLY    JSR     TPAU2
1565 00000ad9  a60c                 NIICD   LDA     #$0C
1566 00000adb >b700                         STA     R8
1567 00000add >cd0000                       JSR     TXT3            CLEAR CHAPTER 4
1568 00000ae0  a606                         LDA     #6
1569 00000ae2 >cd0000                       JSR     TPAU2
1570 00000ae5 >cd0000               INITXT  JSR     GIP             GET PAGE No. FROM 8/30
```

```
1572                                    ********************************************************
1573                                    *                                                      *
1574                                    *       Set up Row 24 transient.                       *
1575                                    *                                                      *
1576                                    ********************************************************
1577
1578 00000ae8 >0c0022                  SR24T   BRSET   6,STAT2,NOTXTX
1579 00000aeb >1a00                            BSET    5,STAT          "TIME HOLD"
1580 00000aed  4f                              CLRA
1581 00000aee >cd0000                          JSR     UP              ACC 0
1582 00000af1 >1700                            BCLR    3,R3            STOP IT
1583 00000af3  a604                            LDA     #4              3 BYTES
1584 00000af5 >cd0000                          JSR     SPM
1585 00000af8  a604                            LDA     #4
1586 00000afa >b700                            STA     R4
1587 00000afc  a606                            LDA     #6
1588 00000afe >b700                            STA     R5
1589 00000b00 >b700                            STA     R6
1590 00000b02  a684                            LDA     #$84            PUT 24 AT TOP ($44 FOR CURSOR)
1591 00000b04 >b700                            STA     R7
1592 00000b06 >cd0000                          JSR     TXT2
1593 00000b09  a606                            LDA     #6
1594 00000b0b >b700                            STA     TMR
1595 00000b0d >1800                  NOTXTX  BSET    4,STAT
1596 00000b0f  81                              RTS
1597
1598
1599
1600                                    ********************************************************
1601                                    *                                                      *
1602                                    *       Tables for HEX-ASCII conversion, "STOP"        *
1603                                    *       and Hamming decode.                            *
1604                                    *                                                      *
1605                                    ********************************************************
1606
1607 00000b10  3031323334353637        NUM     FCC     "0123456789ABCDEF?"
1608 00000b21  0b0b53544f500a0a        LHOLD   FCB     $0B,$0B,$53,$54,$4F,$50,$0A,$0A
1609 00000b29  1502495e6473382f        HAM     FCB     $15,$02,$49,$5E,$64,$73,$38,$2F
1610 00000b31  d0c78c9ba1b6fdea        HAM8    FCB     $D0,$C7,$8C,$9B,$A1,$B6,$FD,$EA
1611
1612                                            END
```

Symbol cross-reference

```
.RAM                *27
.RAM2               *27
.ROM2               *29
ABAV                *27
ABC                  216    220    222    229    261    263   *267
ABCF                 614   *623
ABO                 *93    146
ABORT                491    502   *506
ACC                 *27     54    106    179    181    205    217    223    231    245    288    309    316    317    318    326
                     343    350    561    584    599    676    846    861    868    916    929    945    981   1053   1101   1125
                    1153   1162   1186   1196   1257   1274   1325   1500
ADDR                *27    662   1120
ALOC                 345   *353
ANAF                *27
ANAL                *27
AVOL                *27
BCOL                *27
BLANK                593   *599
BOT                  968   *971
BOX                 1003   1006  *1009
BOX0OF               22     822   *1007
BOX0ON               22     826    989   *1004   1057
BRIL                *27
BROW                *27
C1                  *27     165    276    483    503    939   1086   1179
C2                  *27     168    273    475    477    480    500    942   1088   1182
C3                  *27     878   1090   1221   1224
C4                  *27     879   1092   1216   1219
C5                  *27     880   1094   1239   1242
C6                  *27     242    882   1096   1204   1207
CARO                 234   *238
CAS1                *27
CAS2                *27
CAS3                *27
CAS4                *27
CAS5                *27
CAS6                *27
CAS7                *27
CAS8                *27
CCR1                *27
CCR2                *27
CCR3                *27
CCR4                *27
CCR5                *27
CCR6                *27
CCR7                *27
CCR8                *27
CEDI                 1359  *1361
CFND                 246   *613
CGET26               1240  *1244
CHAN                *27
CHCK1                348   *559
CHCK2               *560    565
CHFND                1339  *1347
CHNF                 1345   1350   1360  *1402
CLINK                21    *676
CLOCK                978   *980
CLRPD                121   *129    204    214
CNT                 *27
```

Symbol cross-reference

```
CNT1            *27
CNT3            *27
CNT4            *27
CNT5            *27
COK             *239
COR              367   *369
COUNT           *27     312    320    325    332    339    341    342    349    353
CPBLF            613   *945
CTAB             1337   1366  *1432
CYAN             17    *261
CYOK            *297
DDI             *574
DECODE           372    375    404    407    572    690   *700
DIFFH           *27
DIFFL           *27
DIGIT            103   *105
DIGIT0           17    *103
DIGITS           104   *1023
DISC            *27
DISP            *27
DISP4            893   *898
DISP8            867   *890
DPGN             128   *130
DPNT            *27
DRAM            *27
EA              *1541   1559
END26            1266   1373  *1409
EXAD             1310  *1447
EXP              967   *973
EXPTB            18    *967
FI1              758    760   *761
FINI             536    539   *543
FND              721    730    739    754    763    772    781    785   *787
FND2             542   *548
FNDJ             704    712   *730
FO1              749    751   *752
FR0              828   *842    990
FTUNE           *27
G23F             1394  *1398
G2BIT            1371  *1388
G2TAB            1390   1398  *1417
G32F             1381  *1385
G3BIT           *1375
G3TAB            1377   1385  *1429
GCYI             336   *665
GET25            21    *1196
GET26            1244  *1253
GETIND          *1493   1513
GETIT           *158
GIP              18     259   *1468   1570
GLOK             209   *215
GLP1             323   *365    667    672
GLP2             352   *471    669    674    1503
GOTCH            1367   1386   1399  *1403
GREEN            17    *208
GTT              1352  *1363
H1               385   *388
HAM              702    714    723    732    747    756    765    774   *1609
HAM8            *1610

HIGH             952   *954    977
HOLD             19    *858
HUN              1044  *1048
HVL             *27
HVR             *27
IAC              258    266   *269
IG0              215   *217
IG1              221   *223
IG2              262   *264
INDEX            19    *256
INDX             160   *179    281    379    424    618    931    1141   1172
INDXP            201    211    319   *618
INITXT           19    *1570
IOBUF           *27     371    374    384    390    395    403    406    571    573    595    597    683    689    952    1203
                 1208   1215   1220   1236   1269   1294   1296   1303   1485   1504   1544   1547
IPNF             1479  *1504
IRCMCT          *27
IRCNT           *27
IRCODE          *27
IRH             *27
IRL             *27
IRRA1           *27
IRRA2           *27
IRRA3           *27
IRRA4           *27
K1              *27
K2              *27
KEY             *27
KOUNT           *27
LBAL            *27
LD0             *113
LHOLD            899    901    903    905   *1608
LIFO            *27     518    626   1254   1256   1260   1262   1263   1267   1270   1272   1277   1278   1279   1288   1292
                 1295   1297   1298   1299   1304   1305   1309   1311   1320   1323   1327   1330   1331   1336   1338   1347
                 1349   1362   1364   1369   1375   1380   1388   1393   1401   1402   1447   1448   1449   1450   1451   1452
                 1453   1454   1455   1456   1457   1458   1459
LIND            *27
LINK             21    *309
LLOOP           *341    355
LLOP            *320    334
LOK              505   *508
LOOP26          *1256   1271   1290
LOOP62          *1274   1321   1379   1392   1407
LOOPS           *530    546
LPT              203    206    213    218   *224
LPT2             159   *206
LVL             *27
LVR             *27
```

Symbol cross-reference

```
MATRIX          *27
MIX              19    *800
MRE             *584    603
NEXTC            327   *329
NIICD           *1565
NO1              1458  *1460
NO16             1450  *1452
NO2              1456  *1458
NO32             1448  *1450
NO4              1454  *1456
NO8              1452  *1454

NOBX             148    805    987   *1001   1073
NOCH             114    116   *118
NOHOLD           240    859   *915
NOMIX            800   *812
NOTCF            1354  *1358
NOTD             1330  *1369
NOTFND           324   *328
NOTHLD           239   *241
NOTOK            368   *424
NOTOK2           212   *446
NOTOK3           202   *423
NOTR            *1560
NOTROW           1314  *1323
NOTT             46     48    *50
NOTTH            22     49     61    *411
NOTXTX           1578  *1595
NOV9             432    439   *442    454    461
NOV9A           *441    463
NPAGE            18    *201
NPK27            684   *692
NTSAC            232   *235
NULD             1333  *1401
NUM              787   *1607
NXTCH            1284  *1292
OK0              384    387   *389
OK1              390    393   *395
OK2              395    398   *400    444
OKROW            1265  *1267
OLDIR           *27
ON1              716    718   *719
OSDL            *27
OSDLE           *24     40     63
OUT              964    966    970    972   *975
OUTSP            236    1137  *1161
P830OK           1506  *1508
PAG0            *27     77     82     87    162    164    167    271    274    277    283    285    287    380    425    447
                 481    484    486    534    537    540    619    621    932    937    940    1142   1144   1146   1173   1177
                 1180
PAG1            *27
PAG2            *27
PAG3            *27
PAGC            *27
PAGE            *27     92     119    125    126    137    139    141    149    161    163    166    169    427    430    435
                 436    437    441    442    449    452    457    458    459    620    622    1039   1047   1048   1049   1060
                 1062   1064   1066   1074   1076   1085   1087   1089   1091   1093   1095   1098   1123   1143   1145   1147
                 1495
PAGI            *27     1494   1497   1499
PANIC            38     58     79     81     84     86     89     91    *94
PDP             *27     113    127    129    145    198    208    238    270    858    1026   1050   1052   1070   1140   1169
                 1471
PH              *27     138    150    278    282    381    385    386    388    391    392    394    396    397    399    426
                 448    485    517    535    592    598    627    902    934    1010   1063   1077   1107   1111   1150   1174
                 1490   1493   1509   1527   1536   1549
PLLHI           *27
PLLL            *626    630
PLLOW           *27
PPAGE            18    *211
PROG            *27
PSHL            *517    520

PT              *27     140    275    284    376    408    443    482    538    904    938    1065   1151   1178   1496   1511

PT1              391   *394
PU              *27     142    272    286    378    405    429    434    451    456    479    541    906    941    1067   1152
                 1181   1498   1512
PU1              396   *399
PULL             346   *625
PUSH             328   *516
PWR             *27
R1              *27     42     66     803    814
R10             *27     134    295    322    365    499    568    569    583    609    644    645    646    666    671    680
                 686    845    898    920    948    1001   1004   1007   1059   1157   1185   1200   1212   1232   1261   1280
                 1285   1300   1328   1482   1488   1524   1533   1541   1552
R11             *27     136    292    493    591    596    605    615    848    900    922    1009   1061   1075   1149   1171
                 1287   1403   1526   1535   1546
R2              *27     189    471
R24T             22    *1521
R2B              21     370    402    588   *650    682    688    950    1202   1214   1234   1268   1293   1484   1543
R2BJ1           *383    409
R2BJ2           *402    1492
R2BN9            570   *651   1301
R3              *27     105    171    280    413    488    872    936    1100   1124   1176   1582
R4              *27     55     130    172    244    982    1011   1586
R5              *27     51     70     807    816    995    1588
R6              *27     53     71     809    818    996    1589
R7              *27     72     832    962    963    965    967    968    969    971    973    974    992    1591
R8              *27     131    289    311    496    511    586    600    678    847    862    869    917    946    1012   1054
                 1154   1187   1197   1259   1276   1326   1475   1522   1566
R9              *27     132    293    497    607    641    650    843    864    871    891    918    1013   1056   1155   1183
                 1324   1529
RAD1            *27
RAD2            *27
RAD3            *27
RAD4            *27
RAD5            *27
RAD6            *27
RAD7            *27
RAD8            *27
RADIO            383    389   *568
```

Symbol cross-reference

```
READ            *24     663
READ22          *661
RED              17    *198
RED2             199   *205
REL1             411    923   *929
REL2             924   *934
REV              962   *965
REVEAL           18    *962
ROW1            *27
ROW24            21    *583
RST             *69
RSTR             237    1161  *1168
RW24             1313  *1318
SAM             *558    562
SBO              1071  *1129
SD0             *1026
SDLY            *1564
SE1              776    778   *779
SEN              1046  *1049
SEND            *24     1121

SEND22           656    839    888   *1119
SETIT           *1085
SFND             176    300    513   *605    926    1105
SFND2           *606    616
SHADMAT         *27
SI1              767    769   *770
SKIP             1317  *1320
SKOSP            235   *237
SLRPD            1041  *1052
SM3              1222  *1226
SM4              1217  *1220
SM6              1205  *1208
SNDMD           *27
SOCH             1031  *1033
SORTD            1029   1034   1036  *1038
SP              *27
SPGN             1051  *1053
SPM              75     109    415    824    874   *884    1128   1473   1584
SPM2             877   *883
SR24T            19    *1578
SRCH             158    400   *529
SSUB             711    720    729    738    753    762    771    780   *790
STACK           *27
START2           19    *1562
STAT            *27     37     39     43     46     47     48     60     62     64     67     68     103    110    175    233
                 235    239    247    269    297    423    446    827    859    860    865    877    915    978    980    984
                 985    1104   1137   1138   1164   1168   1468   1469   1579   1595
STAT2           *27     44     45     59     800    801    812    1198   1206   1218   1223   1241   1470   1507   1578
STAT3           *27     199    209    216    220    222    261    263    368    593    679    691
STAT4           *27
STAT5           *27
STAT6           *27
STAT7           *27     38     58     977    1227   1228   1229   1230
STMR             1391  *1393
STRM             1378  *1380
SUB1            *27     886    887
SUB2            *27     706    707    708    710    715    716    717    719    724    725    726    728    733    734    735
                 737    748    749    750    752    757    758    759    761    766    767    768    770    775    776    777
                 779    790    837    838    1209   1235   1237   1238
SUB3            *27     652    655    1116   1117
SUBADR          *27     660
SUBPG            979   *1137
TAO              980   *998
TEN              124   *126
TEST            *77     228    257    265
TH1              734    736   *737
THOU             1027  *1030
TIME             19    *977
TMP1            *27
TMP2            *27
TMR             *27     830    999    1594
TN23            *1390   1397
TN32            *1377   1384
TONE            *27
TPAU2           *24     510    1481   1564   1569
TPSTP            1023  *1123   1139
TR5              1236  *1238
TRA             *702    786
TRAN1            144    299   *821    1069   1159   1166

TRAN2            56     810    819   *823    927
TRAN3           *827    875
TRFI            *756
TRFO            *747
TRNCH           *1337   1344
TRON            *714
TRSE            *774
TRSI            *765
TRTH            *732
TRTW            *723
TRYAG           *1478   1486
TRZE            *706
TVTX             18    *37
TW1              725    727   *728
TXT1             174    301   *877    943    1103   1165
TXT1L            514   *878
TXT2             21     73     248   *834    975    993    997    1592
TXT3             508    907    1068   1109  *1113   1158   1567
TXT32            611    643    850    1015  *1114   1406   1531   1538
TXT38            143    298    512    925   *1107   1188
TXTOF           *64     1562
TXTOFF           37     60    *62
TXTON           *38
UCHOLD          *868    983
UOC              1356  *1362
UP               107    173   *185    290    351    863    870    930    1102   1126   1163   1502   1581
UPDATE           18    *58
```

```
                    Symbol cross-reference
V5                  *648
W1                  *27     654     700     703     791     835     884     1114
W2                  *27     111     373     377     1024
W2B                  602    *641    1289    1554
W3                  *27     224     226     230     243     314     321     329     331     890     894     1477    1478    1540    1550    1555
                     1556   1557
WACC                *27     337     347     494     529     530     532     543     544     548     558     560     1501
WROW                *27
YELLOW               17    *220
YIP                 *183
ZE1                  707    709    *710
```

How to Reach Us:

Home Page:
www.freescale.com

E-mail:
support@freescale.com

USA/Europe or Locations Not Listed:
Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
+1-800-521-6274 or +1-480-768-2130
support@freescale.com

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

For Literature Requests Only:
Freescale Semiconductor Literature Distribution Center
P.O. Box 5405
Denver, Colorado 80217
1-800-441-2447 or 303-675-2140
Fax: 303-675-2150
LDCForFreescaleSemiconductor@hibbertgroup.com

Freescale Semiconductor, Inc.