Honeywell

HPV-2 HONEYWELL PROCESS VIDEO SUBSYSTEM (HIGH PERFORMANCE)

APVB-J-M
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TABLE OF CONTENTS

HPV-2 HONEYWELL PROCESS VIDEO SUBSYSTEM (HIGH PERFORMANCE)

1. INTRODUCTION

This publication provides installation, preventive maintenance, adjustment, repair, and troubleshooting information for the HPV-2, Honeywell Process (High Performance) Video Subsystem. This subsystem may be used with any 4500 Honeywell Process Computer System that utilizes the GENIE* Bus. The subsystem consists of a Video Interface Controller (and modems if remote), Display Generator, from one to four Display Monitors, and from one to four Display Editors (keyboards).

2. PRECAUTIONS

The 115 VAC primary power supplied to the subsystem components presents an electrical shock hazard, therefore, the subsystem should be serviced by qualified personnel only.

The VIC contains logic level voltages only, but to avoid damage to the VIC, power must always be removed prior to removal or replacement of the VIC board and/or its edge connectors.

The Display Generator contains voltages up to 115 VAC, therefore, maintenance personnel should observe and adhere to the WARNINGs and CAUTIONs in the maintenance section of the Display Generator vendor's manual.

Several hazardous voltages exist in the Display Monitors. Power supply voltages in the range of 110 V to 600 VDC are common. The cathode ray tube anode voltage may be as high as 25,000 VDC. The covers should only be removed from Display Monitors by personnel experienced in servicing high voltage equipment. The case containing the CRT anode voltage rectifier should be opened only after power has been disconnected for at least one-half hour. When power is applied, do not allow any part of your body or any materials in contact with your body to be within three inches of the anode lead to the CRT. The CRT anode and attached components may retain a charge after power is removed. The anode lead should be grounded by inserting a grounded screwdriver, with a solid ground connection to the chassis.

Extra care must be exercised in handling the cathode ray tube or using tools in its vicinity, as it has a very high internal vacuum, and may implode if broken. If it becomes necessary to remove the CRT, do not handle it by the neck. Safety glasses and protective clothing should be worn when handling the CRT. Refer to the Display Monitor vendor's manual for additional information on CRT handling and replacement.

Voltages up to 115 VAC are used within the optional Display Editor (keyboard), so maintenance personnel should observe and adhere to the WARNINGs and CAUTIONs in the maintenance section of the Display Editor vendor's manual.

The optional Light Pen contains no hazardous voltages.

3. OPTIONS

Fig. 3.1 is a simplified block diagram of the overall display subsystem.

The basic subsystem consists of the following: A VIC (located in a MEPS (I/O) chassis and connected to the GENIE Bus), a Display Generator (containing a single port interface, common logic, and one channel set), and a Display Monitor. A fully implemented subsystem consists of the basic subsystem plus up to three additional channel sets in the Display Generator, their associated Display Monitors, and a Display Editor with optional Light Pen for each of the four monitors.

3.1 Video Interface Controller

The APVB11 VIC (board type PVICW or PVIC4) provides parallel communications between the GENIE Bus and HPV-2. This consists of character transfers, 8-data bits plus parity bit, at up to a maximum rate of 600K characters per second. The total cable length between the VIC and the DG must not exceed 6.4 m (21').

The APVB12 VIC (board part no. 51301149-100) provides serial asynchronous communications between the GENIE Bus and HPV-2. This consists of character transfers, 8-data bits plus parity bit, at a rate of 9600 baud. The asynchronous VIC must be located within 15.2 m (50') cable-feet of the modem.

3.2 Display Generator

The Display Generator used in the HPV-2 Subsystem is AYDIN Controls' Model 5215C. The Display Generator consists of a 19" rack mountable chassis which contains the interface logic required to communicate with the VIC,

*Trademark

the common logic which controls the flow of data within the DG and produces the timing required for the composite video signals sent to the Display Monitor, and from one to four channel sets. The channel sets may be either alphanumeric (character-graphic) or trend, but each trend channel set requires an alphanumeric channel set to produce the alphanumeric characters and graphic symbols used for the trend displays. Each channel set contains the memory and video generation logic necessary to produce the composite color video signals for one Display Monitor. Each channel set is capable of receiving information from either the computer or from an associated Display Editor.

The Display Generator uses external DC power which is supplied by either the power page or from power supplies mounted on a swing out panel which is normally located behind the Display Generator.

NOTE: A maximum of four channel sets may be used in the Display Generator and each Trend Channel Set must be used with an Alphanumeric Channel Set.

Other options described in the AYDIN Controls' manuals may be obtained by rewiring, but they are not supported as part of the Honeywell subsystem.

3.3 Display Monitors

The Display Monitors used in the HPV-2 Subsystem are high resolution, highly stable color monitors with excellent linearity. These monitors are the CONRAC 5100/5200 Series 19- and 25-inch monitors.

The maximum length of the coaxial cables between the Display Generator and the Display Monitor (3 cables for each color channel set) is 91 m (300'). It is possible to connect more than one display monitor in the video output lines and thereby repeat a display, provided the total cable length does not exceed 91 m (300') and the 75 ohm terminators are connected on the last monitor on the lines. Cabling and termination information is provided on Fig. 3.1.

NOTES FOR FIG. 3.1

1. **Only one VIC will be used per subsystem, parallel for local or serial for remote operation.**

2. **115 VAC power is supplied to DC Power Supply Panel, Display Generator (fans), Display Monitor, and Display Editor via power cables which are approximately six feet in length.**

3. **Maximum Distances:**

   VIC Board (parallel) to DG I/O Board - 25 cable feet
   VIC Board (serial) to modem - 50 cable feet
   Modem to DG I/O Board - 50 cable feet
   DG (Red, Grn, Blu) to Display Monitor - 300 cable feet
   DG to Display Editor - 300 cable feet

   - **Implementation of Light Pen Option**
     DG (Blu) to Display Editor - 290 cable feet
     Display Editor to Display Monitor - 10 cable feet

4. **Light Pen Option**

   This option requires that the Blue video signal be routed from the DG through the Display Editor to the Display Monitor.

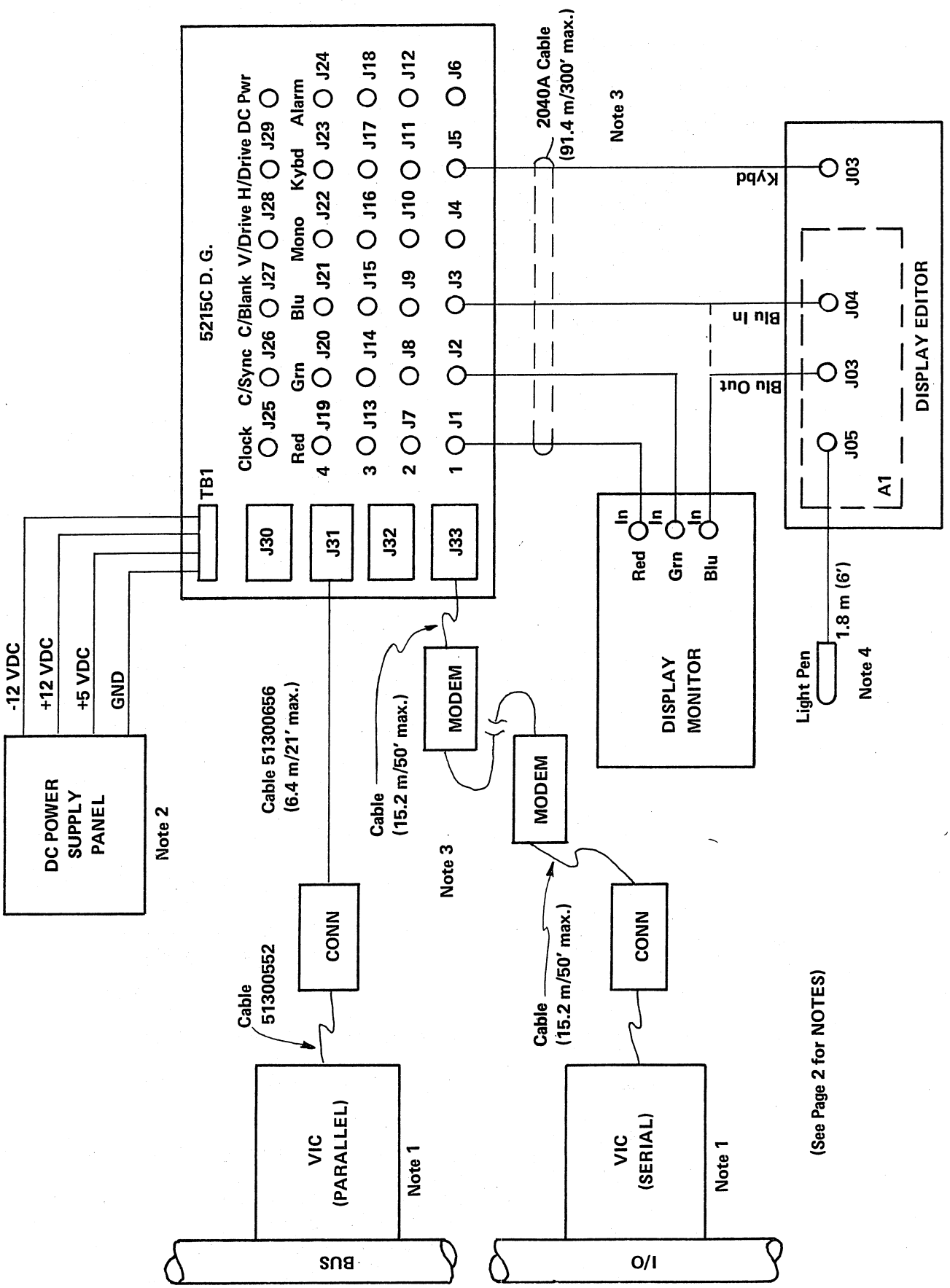


Fig. 3.1 HPV-2 Subsystem

3.4 Display Editors (Keyboards)

Each of the four possible display channels in a Display Generator may be served by a Display Editor (keyboard). The keyboard used in the HPV-2 Subsystem is the AYDIN Controls' Model 5115 Display Editor. The basic keyboard contains the alphanumeric keys, punctuation keys, cursor control keys, color switch keys, edit function keys, attribute keys, partial and full page transmit keys, and a 10-numeral keypad. In addition to the basic keyboard keys, optional 45-function code keys are available. The 45-function code keys cause a function code message, containing a function code identifier, the function code representing the key that was pushed, and the text from the first line on the display, to be transmitted to the computer. The computer software recognizes the function code as specifying that a predetermined function is requested by the operator.

3.5 Light Pen

A light pen may be implemented as an accessory to a keyboard to provide quick control over the position of the displayed cursor. When the pen is touched at a character position on the display screen, with a small amount of pressure needed to close a pair of contacts, the cursor moves to that position almost immediately. When the operator pushes a button on the body of the Light Pen, a cursor coordinate message is transmitted to the computer via the keyboard. The Light Pen's electronics are contained on a board which is mounted in the keyboard.

3.6 Pin And Switch Options

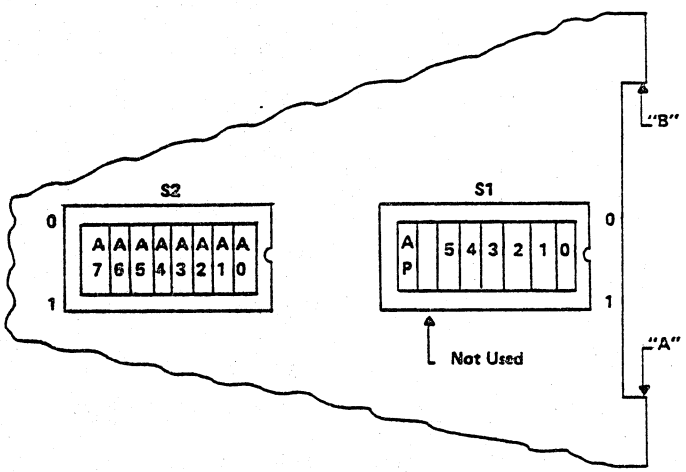
Mini-switches S1 and S2, near the rear of each of the VIC PWAs (PVIC4, PVICW, or 51101149-100) select the device address, DDS'D, and the interrupt priority. The address and priority to be selected are specified on the system documentation, typically System Spec. Section 5. The address is selected by switches A7 thru A0 and AP. These are set to a binary number 400_8 less than the DDD address (leaving out the S' bits). AP is set to one or zero to maintain odd parity. For example, to select 5402_8 (542_8), the address switches are set as follows:

Switches	A7	A6	A5	A4	A3	A2	A1	A0	AP
Value	0	1	1	0	0	0	1	0	0

The interrupt priority is selected by switches 5 thru 0, as follows:

Priority	Switch Setting (8)
Highest 1	33
2	35
3	36
4	37
5	53
6	55
7	56
8	57
9	63
10	65
11	66
12	67
13	73
14	75
15	76
Lowest 16	77

S1 and S2 are positioned and marked as indicated in this sketch:



On the serial VIC (51301149-100), a jumper pin is located at coordinates A - 17. For normal asynchronous operation, the jumper must be connected between pins 1 and 2. The jumper is placed between pins 1 and 4 for synchronous operation in a special (non-standard) application.

4. REFERENCES

4.1 Overall Subsystem

Theory publication number APVB-J-T describes the operation of the overall HPV-2 Subsystem. The Operation section of that publication provides a detailed description of the character definitions, displays, and display functions. The Theory of Operation section provides a block diagram level discussion of the operation of each major component of the subsystem. The Theory is intended to provide sufficient knowledge of the overall function of the sub-

system, so that the detailed descriptions in the AYDIN Controls' manuals, CONRAC manual, Video Interface Controller theory and the HPV-2 Communications manual will be more meaningful.

4.2 System Interface

- Parallel Video Interface Controller, Theory of Operation - publication number APVB-11.

- Serial Video Interface Controller, Theory of Operation - publication number APVB-12.

4.3 HPV-2 Display Generator

- HPV-2 (5215C) Display Generator Operation and Maintenance Manual - publication number AR94-V-0&M.

- HPV-2 Standard 5215 Engineering Drawings - publication number AR94-V-EDWG.

4.4 HPV-2 Display Monitor

- CONRAC, Installation and Operating Instructions - Color Television Monitor - Model 5111 or 5211.

4.5 HPV-2 Display Editor (Keyboard)

- AYDIN Controls, 5115 Display Editor Operation and Maintenance Manual - Document AR54-V-0&M.

- AYDIN Controls, 5115 Display Editor Engineering Drawings - Document AR54-V-EDWG.

5. COMPONENT LOCATIONS

The interconnections between the major components of the HPV-2 Subsystem are shown on Fig. 3.1. The Display Generator is rack mounted in a 19" standard Video Cabinet. The Display Generator cannot be more than 6.4 m (21') cable length from the Parallel Video Interface Controller in the computer. For serial operation, the modem cannot be more than 15.2 m (50') cable length from the Display Generator, and the computer site modem cannot be more than 15.2 m (50') cable length from the Serial VIC.

Keyboards are table mounted or mounted in a special console that typically mounts the associated Display Monitor(s). The keyboards cannot be more than 300 cable feet from the Display Generator. Display Monitors are either table mounted or mounted in a console and cannot be more than 300 cable feet from the Display Monitor. If repeater monitors are used, the total cable length from the Display Generator to the last monitor on the video output lines cannot be more than 300 cable feet from the Display Generator.

The optional Light Pen electronics is mounted in the keyboard. The small cable connecting the Light Pen to the keyboard is 1.8 m (6') long.

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6. TEST EQUIPMENT AND MATERIALS

Oscilloscope, dual trace, DC to/50 MHz, 0.1 V/div. sensitivity (variable delay and time base expansion are desirable).

Multimeter, Simpson Model 260, Triplet Model 630, or equivalent.

Miscellaneous jumpers and test leads.

A coaxial tee adapter is useful for observing waveforms on the coaxial cables used by the display equipment, keyboards, and accessories. JAN type UG-274 is a suitable BNC adapter for use with most of the connectors. JAN type M-358 can be used on the Display Monitor connectors.

The board extender for the Display Generator is AYDIN Controls part number 460-0893 (with two 86-pin connectors).

The board extender for the VIC is Honeywell model number 4400AM121.

For adjustments to the Display Monitor, other than those listed in section 10, special test equipment is required. See the Test Procedures and Equipment Requirements in the CONRAC Installation and Operating Instructions.

7. PREVENTIVE MAINTENANCE

The following preventive maintenance schedule is provided for guidance. It may be modified locally, by authorized personnel, according to local experience and conditions. If the display subsystem appears to be operating normally, unnecessary testing and adjustments should be avoided because more troubles may be introduced than prevented. This does not preclude running of the test program and operating various operator controls when time is available.

Each month or 500 hours:

- Clean and inspect the HPV-2 Subsystem Equipment per the following:

  Video Interface Controller - None required.
  Display Generator - Section 6.3 in the Display Generator Manual.
  Display Editor - Section 5.3 in the Display Editor Manual.
  Display Monitor - Clean external cabinet and screen.
  Check input and output cables and connections for wear and tightness.

CAUTION

Power should be de-energized when cleaning and inspecting the units. No liquid is to enter the units since operation failures may occur due to electrical shorts. Removing of connections for ordinary inspection is not recommended, since progressive deterioration may occur.

- Check video amplitude and balance per paragraph 10.1 of this publication. Do not move the adjustments unless they need to be corrected.

- Check the Display Monitor adjustments per paragraph 10.2 in this publication.

- Check external power supply voltages per vendor documentation. Do not move the adjustments unless they need to be corrected.

All of these checks are to be performed as a part of the system installation or the installation of this subsystem as an expansion to an existing system. The performance tests per subsection 8 of this publication are also to be performed as part of the installation of this subsystem.

8. PERFORMANCE TESTS

The performance of the overall HPV-2 Subsystem is evaluated by testing the self-contained functions of the video display equipment that can be checked by operating various controls and observing the effect, and then testing the ability of the subsystem to communicate with the computer via the Video Interface Controller, and to respond correctly to computer initiated commands via the Subsystem Test Program.

8.1 HPV-2 Subsystem Functions

The proper operation of most of the Display Generator logic, Display Monitors, Keyboards, and accessories is self-evident and easy to evalutate. The following steps serve as a check list to assure that nothing is overlooked. The steps that pertain to equipment not present, of course, can be ignored.

1. Check that all cables and terminators are installed correctly.

2. Plug the power cords, on all units having one, into the socket that is to supply power to each unit. Check that necessary circuit breakers are closed.

3. Verify that the DC power indicator is ON. Verify that the two fans on the side panel are drawing air into the unit.

4. After a few minutes warm-up time, check each of the Display Monitors for a stable, synchronized display. A single blinking cursor should appear on each display. If no cursor is present, check that a keyboard or a terminator is connected to the keyboard connector for each implemented channel. If the TV raster lines are visible, or if a display is not synchronized horizontally and/or vertically, adjust per 10.2 and continue with step 5 when the displays are adjusted correctly and the cursor appears as it should.

5. If one or more keyboards are connected to the Display Generator, refer to section 3 of the Model 5115 Display Editor (keyboard) manual, and check that the operation of the keys and controls is as described. Note that if any key is pushed that requests the transmission of a message to the computer, the keyboard should then be locked out and further entries should have no effect until the transmission is complete (not possible unless the cables are connected and a program is running which will accept the message), or until the Display Generator is initialized by reset button inside its front panel.

   See the HPV-2 Subsystem Theory Manual or the HPV-2 Communications Manual for the codes generated by each key.

8.2 Test Program

The HPV-2 Subsystem test program is described by drawing number 51191033. The program may be loaded from cards or paper tape. The program requires a working 4500 computer system, a GENIE Bus and Bus Controller, Output Typer, a HPV-2 Subsystem, and at least 24K of Memory.

The test program provides a comprehensive test of all the subsystems features. The following tests are performed without manual intervention:

- Test 0 - Pre-Test
  This test is used to check GEN 2 command response and verify initial communication capability with the DG.

- Test 1 - Memory Test
  This test is used to verify that every bit of every memory location in each channel set can be set and reset. This test will check Line and Page wrap-around and the DG's ability to address every cursor coordinate, plus the clear screen and send page commands.

- Test 2 - Fill Screen with Random Data
  Checks the DG's ability to handle random data. The Send Line command is also tested.

- Test 3 - Repeat Modes
  Checks the Linear, Horizontal, Vertical and Random Repeat mode commands. It also tests the Transmit Compressed Picture and Transmit Compressed Picture Cursor commands.

- Test 4 - Display of all Characters and Graphics (portions require manual intervention)
  Tests the DG's ability to generate and display all normal and large characters to include their attributes (Color, Normal/Reduced Intensity, Normal/Reversed Background, and Blink-On/Blink-Off). Also checks the DG's ability to Load Channel Status Mask, Load XMIT Status Mask and Send Page Cursor Commands.

- Test 5 - Cursor Positioning
  Checks cursor movement and the Send Cursor Coordinate command.

- Test 6 - Edit Commands
  Verifies that the Edit Commands function properly when initiated by the computer.

- Test 7 - Quick Tab and Character String
  Checks the Quick Tab, Store, and Recall Character String command.

- Test 8 - Zone Write and Zone Read
  Verifies that the Zone Write and Zone Read commands are functioning properly.

- Test 9 - Partial Page Input
  Checks the Partial Page Command.

The following tests require manual intervention:

- Test 10 - Keyboard and Light Pen
  Verifies that the XMIT Page, XMIT Partial Page, XMIT Line, XMIT Cursor, and XMIT Function Code Keys are operating properly. The XMIT Cursor may also be initiated from the Light Pen.

- Test 11 - Protected Field
  Checks the Protected Field attribute using Keyboard entries.

- Test 12 - Trend Channel Set
  Exercises the Trend Channel Set by displaying a series of recognizable patterns for operator visual verification.

- Test 13 - Maintenance Aid - Video Adjustment
  Provides a series of Display Test Patterns for adjustment of the Display Monitor.

- Test 14 - Maintenance Aid - XMIT/RECV
  Provides a routine to Output, Read Back, and Print a data pattern specified by hand-loaded parameters.

- Test 15 - Maintenance Aid - XMIT Only
  Outputs a character stream without status checks.

9. ASSEMBLY AND DISASSEMBLY

Assembly and disassembly of the HPV-2 Subsystem consists only of the removal of and reinsertion of PWB's and cable connectors, and the removal of various panels and covers to gain access to the interior of the major assemblies. Always remove power prior to removing or replacing PWB's or cables, except for the coaxial cables, which may be connected and reconnected freely.

10. ADJUSTMENTS

The adjustments in the HPV-2 Subsystem should not require frequent attention and, normally, should not be changed unless evidence is found that an adjustment is incorrect. Most frequently needed adjustments are those in the Display Monitors, and the least frequently needed adjustments are in the Display Generator. There are no adjustments required in the Display Editor (keyboard) or the Video Interface Controllers.

10.1 Display Generator Adjustments

The Display Generator produces the composite color video signals used by the Display Monitor to form a picture on the screen. These signals, Red, Green, and Blue, are produced by each channel set's video output board and require amplitude adjustment for video balance. As with all adjustments, no adjustment should be changed unless it is necessary to verify it or it is determined that readjustment is necessary. The Display Generator adjustments are stable and should seldom require readjustment.

If a display channel is producing a satisfactory display with clear, crisp characters, no character edge fading, and equal horizontal and vertical character components, such as in the letter "T", the check of these adjustments is not necessary. An acceptable range when testing is from 0.35 volt to 2.0 volt peak-to-peak as long as all three signals are balanced within 5% of each other.

The adjustments are accomplished per the following, potentiometer - color, for the Alphanumeric Video Output board, TVD-190, and the Trend Video Ouput board, TVD-196.

TVD-190	TVD-196	COLOR
R28	R32	MONO (Not Used)
R38	R48	BLUE
R48	R40	RED
R58	R24	GREEN

Potentiometers are accessible from the front of the unit, and are located on the open card edges of the associated boards.

This test/adjustment must be performed prior to adjusting the Display Monitor.

10.2 Display Monitor Adjustments

The Display Monitors are conventional television monitors that use all of the circuits typically used in home entertainment sets except for the receiver. The brightness, contrast, horizontal sync, horizontal linearity, vertical sync, and vertical linearity adjustments are typical of these sets and should be recognized by anyone familiar with conventional TV sets. The color monitors also have several adjustments that may not be recognized by the ordinary user of a home entertainment set, but should be familiar to a technician competent to service color TV's. These include convergence, color temperature, and purity adjustments.

Several other internal, preliminary, adjustments are made to the monitors at the factory and should seldom, if ever, need readjustment.

In any case, the vendor manuals provide complete directions for adjustment of the monitors. In general, the monitor adjustments are facilitated by having the majority of the display area filled with characters. These can be entered from a keyboard, or by the applicable test program.

The brightness, contrast, and focus adjustments should be made to provide bright clear characters on a dark background. If contrast or brightness are turned up enough to smear the characters, some "burning" of the TV screen, especially in the most used areas, may occur.

Misadjustment of the horizontal hold and/or vertical hold controls can make it appear that there is some fault in the controller, because the TV raster in the background is not normally visible as it is on home entertainment sets. To check this, turn the contrast adjustment CCW to reduce the video pulse intensity and bring the brightness up so that the raster can be seen. If the Display Generator is supplying video and sync pulses, it is then fairly simple to make the horizontal and vertical hold adjustments.

One of the more important factors in the use of color monitors is the proper convergence of the three CRT electron beams used to produce multi-color displays. If the three colors are not converged, the characters on the display, especially white, have an outline of the wrong color, which is at least annoying, and can produce operator fatigue. Another factor is the adjustment of color temperature so that the seven colors produced by this subsystem can be readily discerned. These adjustments are described in general terms in paragraphs 10.2.1 and 10.2.2, which contain references to the specific instructions in the vendor manuals for the standard color monitors.

The color monitors have an internal degaussing unit, which operates when the DEGAUSS button on the front panel is pushed for five seconds. The monitors should be degaussed before the convergence and color temperature adjustments are made. If a monitor is moved to a new location, it is best to degauss the unit with an external unit, before using the internal unit. The procedure is under the "Installation" heading in the CONRAC manual. "Degaussing" neutralizes magnetic fields which can build up within the unit, and adversely affect color purity, temperature, and convergence.

10.2.1 Convergence

A color television monitor must be adjusted so that the electron beams from all three electron guns converge on the same points at the same time. A color monitor with poor convergence will display characters whose picture elements do not land exactly on top of one another. This is especially apparent when the characters are displayed in white because all three electron beams are illuminating the color dots on the screen. If convergence is correctly adjusted in the beginning and then begins to deteriorate, it generally becomes apparent in the corners and outer edges of the screen first.

Convergence is relatively easy to adjust if a cross-hatch pattern is on the entire screen. This pattern may be entered via test 13 of the 51191033 test program. It is necessary to verify the code that produces a cross-hatch character on each specific Display Generator. Refer to the HPV-2 Subsystem Theory manual to determine the code that produces such a character. If a crosshatch is not available, any character with a horizontal line and a vertical line may be used.

The Convergence Test under the Test Procedure heading in the CONRAC manual should correct the convergence problems.

10.2.2 Color Temperature

If the relative intensity of the video produced on the screen by each electron gun is correct, a reasonably pure white should appear when video is applied to the red, green, and blue inputs to the monitor. When the color temperature (gain) adjustments are correct, the six non-white colors should also be easily discerned. If the color temperature adjustments are off, it may be difficult to tell yellow from cyan, magenta from red, or yellow from green.

A full screen of solid white characters alternating with spaces is useful in making the color temperature checks. This pattern may be entered via test 13 of the 51191033 test program. It is necessary to verify the code that produces a solid white character on each specific Display Generator. Refer to the HPV-2 Subsystem Theory manual to determine the code that produces such a character. If a solid white character is not available, any character with a large white area may be used.

The alternating space/solid white pattern is used to adjust the blue and green gain controls to get white. The Color Temperature adjustment procedure is under the Adjustments heading in the AYDIN Controls' manual. Grey scale tracking and exact color temperatures, as described in that procedure are not so important as the rendition of the six non-white colors generated by the Display Generator. If a good white, with no blooming, at moderate contrast and brightness can be attained, the redition of colors should be satisfactory.

10.3 Additional Power Supplies

The external power supply, supplies power to the Display Generator while the keyboards, and Display Monitors have internal power supplies, some of which are adjustable. The Light Pen electronics modules derive their power from the keyboard. The individual vendor manuals have measurement and adjustment information for these power supplies. If not specified in the vendor manuals, these supplies

generally should have DC output voltages within ±2% of nominal. For supplies that are adjustable, replacement or repair probably should not be considered unless an output is more than 5% from nominal or there is evidence that an incorrect voltage is causing improper operation.

The Display Monitors have very high CRT anode voltages that can be measured only with a high voltage meter, such as an electrostatic voltmeter, using extreme caution. These voltages can be as high as 24 KV and can cause fatal shocks. The high voltage module in the color monitors have a label that gives measurement instructions and indicates a specific voltage spec for the monitor in which it is installed. The voltage specified insures compliance with federal standards for X-ray emissions from the monitor.

11. TROUBLESHOOTING

The HPV-2 Subsystem is of such complexity that a step-by-step troubleshooting routine would be lengthy, complex, and of questionable value. With some understanding of the theory of operation of the subsystem, most troubles can be isolated without too much difficulty. This does not necessarily mean a detailed understanding, but a good understanding of the primary signal paths throughout the subsystem, the operating characteristics, message formats, and method of generating the displays is essential.

The theory of operation of the overall subsystem, including the display equipment and the video interface controller is in publication number APVB-J-T, which is in the Theory of Operation manuals supplied with each process computer system which incorporates the HPV-2 Subsystem. The Subsystem theory of operation publication contains four primary sections: Introduction, Subsystem Operation, Documentation, and Theory of Operation. The operation section describes the proper functioning of the subsystem in terms which should be meaningful to user, programming, and maintenance personnel. Once the symptoms of a trouble can be understood in those terms, and once the symptoms have been demonstrated visually or through the use of the test program, reference to the appropriate headings in the theory publication should allow suitable areas for further investigation to be identified. For detailed theory information, refer to the references described in subsection 4 of this publication.

The flow chart, Fig. 11.1, and the remaining paragraphs in this Troubleshooting subsection provide suggestions for the use of the test aids available for this subsystem, and for troubleshooting technique appropriate for the subsystem. Format and sequence of messages exchanged between the Display Generator and the Computer are discussed in both the Theory publication and the HPV-2 Communications Manual.

11.1 Troubleshooting Suggestions

Many troubles are apparent through the observation of the displays, noting that a keyboard entry causes an unexpected result, the inability to display one or more of the primary colors (red, green, and blue), noting that characters are displayed in an unexpected color, etc. Communications channel troubles may be first noted by some kind of error type-out by the on-line software. User programs which make error checks on the operation of the subsystem may also provide error type-outs.

Any symptoms provided from the above and from communication with the site personnel should be anlayzed to determine the most likely areas to investigate. The flow chart, Fig. 11.1, along with the following paragraphs describe some of the typical conditions which may confront maintenance personnel when called to solve a problem in this subsystem.

11.2 Basic Troubleshooting Checks

Visually inspect the subsystem for disconnected or loose cables. Visually check for power to the subsystem components via the "power-on" indicators on: front of display monitor, rear of DG chassis, and on keyboard. Also check the cooling fans in the DG chassis for operation. If indicators are not lit , check the subsystem's power cables, circuit breakers, fuses, and on/off switches.

11.3 No Video

Lack of a video display on the monitor can usually be attributed to one of the following:

- Monitor Failure - Failure of the monitor to produce a video display from the signals received from the Display Generator.
- Cable Failure - A break in one or more of the video transmission lines (coaxial cables). This will inhibit one or more of the color video signals from reaching the monitor.
- Display Generator Failure - Failure of the DG Video Output PWB (TVD-190) to produce the video output signals.

Check the monitor's brightness and contrast controls. If video pulses can be seen but they are moving or distorted, see the Display Quality paragraph 11.5. If there is absolutely no video on the monitor, disconnect the video input cables and, using the scope, look for a video waveform from the red, green, and blue cables. A typical waveform is illustrated in Fig. 11.3. If the video input cables have video signals on them, the trouble is in the monitor.

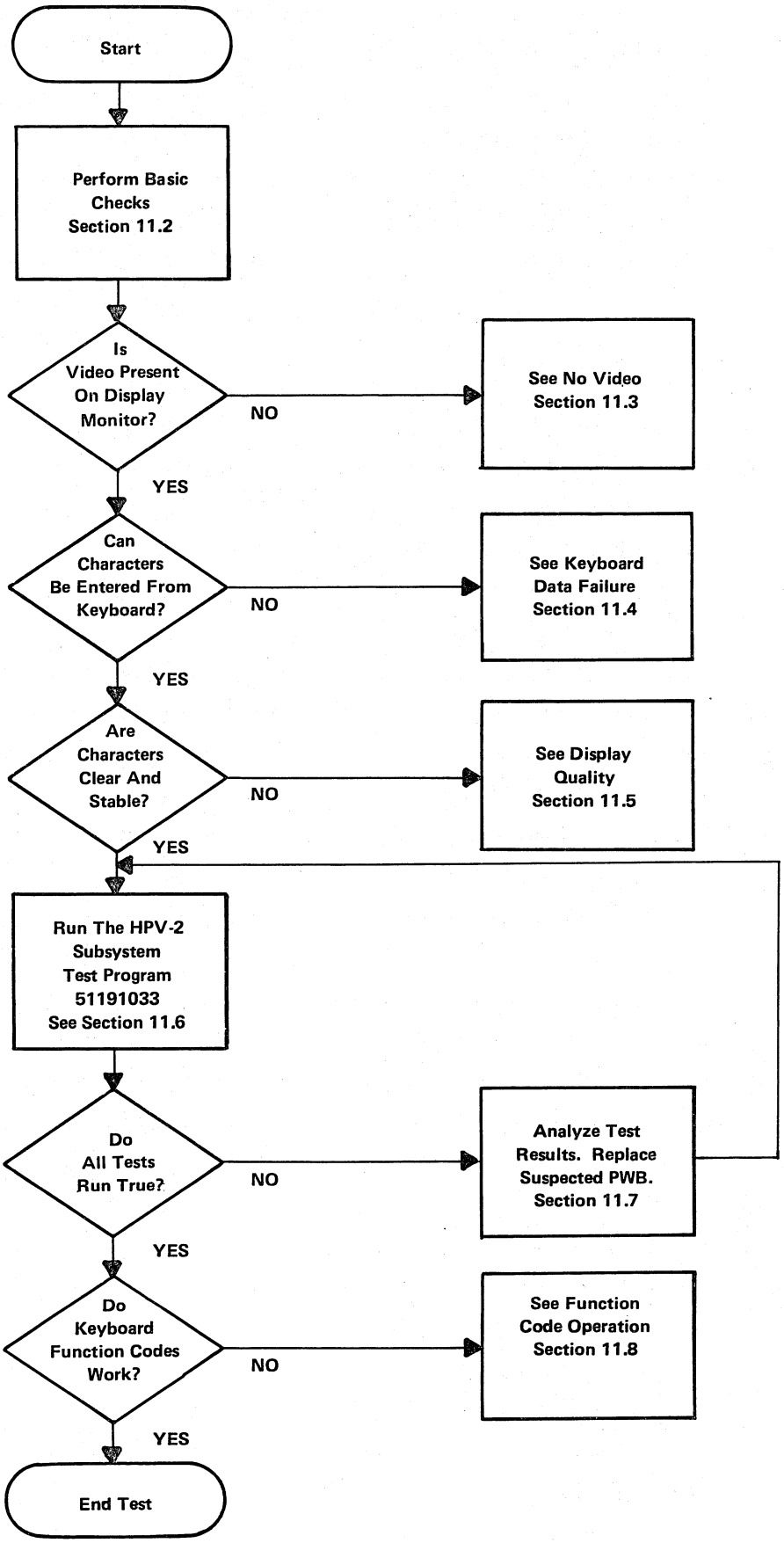
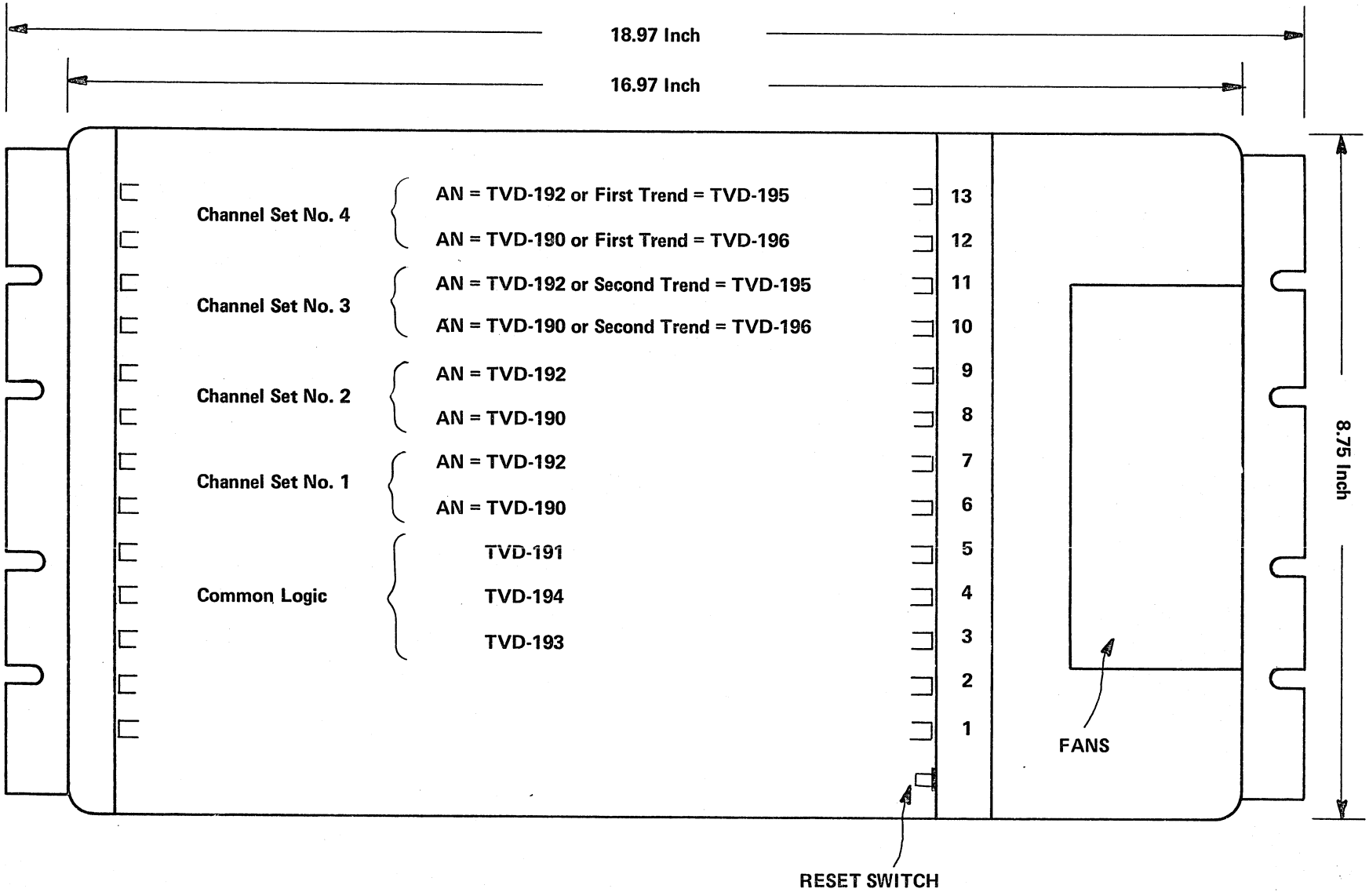


Fig. 11.1 Flow Chart for Troubleshooting the HPV-2 Subsystem



NOTE: The first and second AN channel sets are assigned to the first and second trend channel sets, respectively.

Fig. 11.2 DG PWB Locations

If no video signals are present on the cables, the trouble is in either the cables or the Display Generator. Note that the sync pulses are present whether the display channel set memory contains displayable characters or not. Also, if a keyboard or terminator is connected to the KY BD jack on the DG for that channel, at least the cursor should appear. Check the cables by disconnecting them from the DG and check for outputs from the red, blue, and green signal outputs. If video signals are present at the DG outputs but not at the monitor input cable connections, the cables are at fault. If no video signal is present at the DG outputs, the DG Video Output PWB is probably at fault. See section 11.7 for PWB exchange information.

11.4 Keyboard Data Failure

Being unable to enter and display characters on the monitor from the keyboard is usually the result of one of the following failures:

- Keyboard failure - The inability of the keyboard to generate and transmit signals to the Display Generator.
- Cable Failure - A break in the coaxial cable which inhibits the signal produced by a keystroke from reaching the Display Generator.
- DG Failure - Failure to accept and/or process the keystroke signal.

Usually when characters cannot be written on the display from the keyboard it means that pushing any key on the keyboard does absolutely nothing. Verify that the power indicator on the keyboard is on. If the power indicator is out check to see if the ac power toggle switch is on and if the fuses are good. If the power indicator is on, disconnect the coaxial cable to the Display Generator channel and check for a series of pulses on the center pin of the keyboard jack as keys are pushed. If none are observed, the keyboard may be generating codes that the Display Generator cannot recognize, or the trouble may be in the cable or the Display Generator.

If a pulse train is available, reconnect the cable to the keyboard and disconnect it from the Display Generator. Check for the pulse train on the center pin of the cable when keys are pressed. If none are observed, the cable is at fault.

If a pulse train is observed at the DG cable connector, the DG must not be accepting and/or processing the data to produce the characters. The DG accepts the data via the edit control PWB (TVD-192) and processes it via the video output PWB (TVD-190). See paragraph 11.7 for PWB exchange information.

11.5 Display Quality

The quality of the displayed image is a product of the video signal produced by the DG and the adjustment of the display monitor. Display Generator failures which affect the display are:

- Loss of Video - One or more of the video signals are suppressed. This will usually be the fault of the video output PWB (TVD-190) provided characters are being provided for display by the edit PWB (TVD-192).
- Loss of or unstable sync signals - This will cause the displayed characters to move vertically, horizontally, or diagonally on the screen.

The loss of either the red or blue video signal causes colors other than those expected to be displayed. If a light pen option is used the loss of blue will inhibit its operation. Loss of the green video signal causes unexpected colors to be displayed as well as the loss of horizontal and vertical sync. The sync pulses can be checked on the green video signal by using a coaxial tee on the green input connection on the display monitor. A typical waveform is illustrated in Fig. 11.3. See paragraph 11.7 for PWB exchange information.

If the green video waveform appears good but the characters displayed are unstable the display monitor is at fault. Usually this is caused by incorrect adjustment of the horizontal hold, vertical hold, horizontal linearity, vertical linearity, height, and width adjustments on the display monitor. See section 10.2 for adjustment procedures.

11.6 Test Program

The test program available for testing of this subsystem is 51191033. Summary descriptions of the program is provided under 8.2 in this publication. It may also be helpful to consult the ATPG Programs - How to Load Them, Run Them, and Use Them publication, ATPG-I.

The program was developed by the Automatic Test Program Generator (ATPG) program and detailed troubleshooting with this program to isolate faults below the board replacement level, requires a good understanding of the operation and theory of operation of the HPV-2 Subsystem. Where the test program error type-outs indicate output or input channel status or data comparison errors, refer to the VIC Theory publication's INTERRUPTS section for explanations of the various status error conditions. Where timing errors are indicated, time-outs, the trouble may be caused by the DG not being powered up, improper or loose cable connections, incorrect address selection of the VIC, DG, or Channel Sets, or failure of

one of the units to acknowledge receipt of data, thus hanging up the data transfer. The non-manual intervention portion of the test program will run whether or not a Display Monitor is connected to a display channel, because it checks the Display Generator's operation by sending data to its memory and then reading back the contents of the memory to verify that the correct operation took place. The manual intervention portion of the test program requires a Display Monitor for visual verification of the test results.

11.7 Troubleshooting Through PWB Exchanges

Due to the complexity of the Display Generator and the Video Interface Controller PWB, replacement or exchange is the optimum method of troubleshooting the subsystem. In systems where duplicate HPV-2 Subsystems exist, the PWBs (one at a time) can be exchanged between subsystems and if the trouble follows a PWB from one subsystem to the other, the trouble has been isolated to that PWB. See Fig. 11.2 for DG PWB locations.

If only one HPV-2 subsystem is present and it has two or more channel sets, the channel set PWBs can be exchanged for isolating the PWB at fault. Also, if spare PWBs are available they may be used for troubleshooting.

CAUTION

To avoid possible damage to the PWBs, always remove power before removing or reinstalling them.

The following provides a brief functional description of the Video Interface Controller PWB and each of the Display Generator's PWBs. For more detailed information about them, see the VIC Theory publication and the AYDIN Documentation.

- VIC - Provides the communication link between the computer's GENIE Bus and the Display Generator. It formats and controls all transfers between the computer and DG, detects interrupts from the DG and informs the computer, generates and checks parity on all information transferred, and flags the alarm conditions for interrogation by the computer.

- I/O PWB (TVD-193) - Provides the Display Generator interface to the VIC. It provides the data receivers and transmitters, control (handshaking) logic, DG address detection, DG status logic and parity checking/generation of the data transferred.

- Control PWB (TVD-194) - Provides the principal control for the processing of data/commands received from the computer and/or keyboard. It contains the micro-processor, its memory, and operating logic. The control PWB decodes instructions, performs comparisons and provides the channel address decode/selection.

- Sync Generator PWB (TVD-191) - Provides the basic timing for the subsystem. Timing for data flow, data refresh operation, control (Micro-processor), CRT scan and video sync timing is produced on this PWB.

- Edit Control PWB (TVD-192) - Provides the channel set control function. It contains the function decode/control logic, channel interrupt, RAM address and cursor control logic.

- Video PWB (TVD-190) - Provides the composite video signals to the display monitor. Contains the RAM memory refresh logic plus the video data generation and video data output and conditioning logic. This PWB and TVD-192 comprise one alphanumeric Channel Set. There may be up to four Channel Sets in a DG.

- Data Trend PWBs (TVD-195 and TVD-196) - These optional Data Trend Channel Set PWBs provide the control and storage logic to produce up to four trend charts. Contains Data point counter logic, baseline counter logic, left and right limit counter logic plus the logic used to combine the TVD-190 video signals with the trend video signals. Alphanumeric characters on the trend display are provided by a companion alphanumeric Channel Set.

11.8 Function Codes

On the standard keyboard there are 30 function keys of which 29 are normally implemented. Usually when a keyboard failure occurs (see paragraph 11.4) the function keys will not work either. The function keys can be divided into three functional groups: Edit, Characteristic, and Transmit functions.

The Edit function can easily be checked by observing the effect of the function on the data displayed. Such as the Delete Line function, this function causes the line where the cursor is located to be deleted.

The Characteristic functions can also be easily checked by observing the display while entering data on the screen with a specific characteristic selected. Such as entering the word "The" in the color red.

The Transmit functions are more difficult to check since they require interaction with the CPU. All of the function codes from the keyboard are serviced by the channel set PWBs (TVD-190 and TVD-192) connected to the keyboard.

Note that data cannot be entered from the keyboard after a transmit function is requested until that request has been serviced by the computer.

The Display Generator transmits to the computer only when the computer requests it to do so. Check that the computer is running a program that can make such requests. If the computer can write on the display in this situation, it may be that the computer's requests are not recognized by the Display Generator. If the computer cannot get the Display Generator to respond, the program should have typed some kind of error message. See the VIC Theory publication for status information. This situation may also arise if the VIC is not generating an interrupt per the Display Generator's request, or because the computer is not accepting the request, thus the computer is not polling the Display Generator.

If the on-line system software is running and characters can be entered from the keyboard but not the computer, it is usually accompanied by an error type-out such as "VIDEO OUT OF SERVICE". If a test program is running, it should provide an error message indicating that while trying to transfer information, some status error occurred. See the VIC Theory publication for status information.

12. PARTS

Complete parts lists for AYDIN Controls' units are provided in the vendor's manual for each unit. Replaceable parts for the Display Monitors are listed near the back of that vendor's manual, and in some cases, in the schematics in those manuals. Interconnecting cable part numbers are marked on the cables.

Table 12.1 lists the Honeywell purchase spec. part numbers for the D. G. and its contents. These are to be used in ordering replacement PWB's and subassemblies.

Video Interface Controller (VIC) board part numbers are:

- PX4000PVICW, Parallel, wire-wrapped (early production, replace with PVIC4).
- PX4000PVIC4, Parallel, etched copper.
- 51301149-100, Serial.

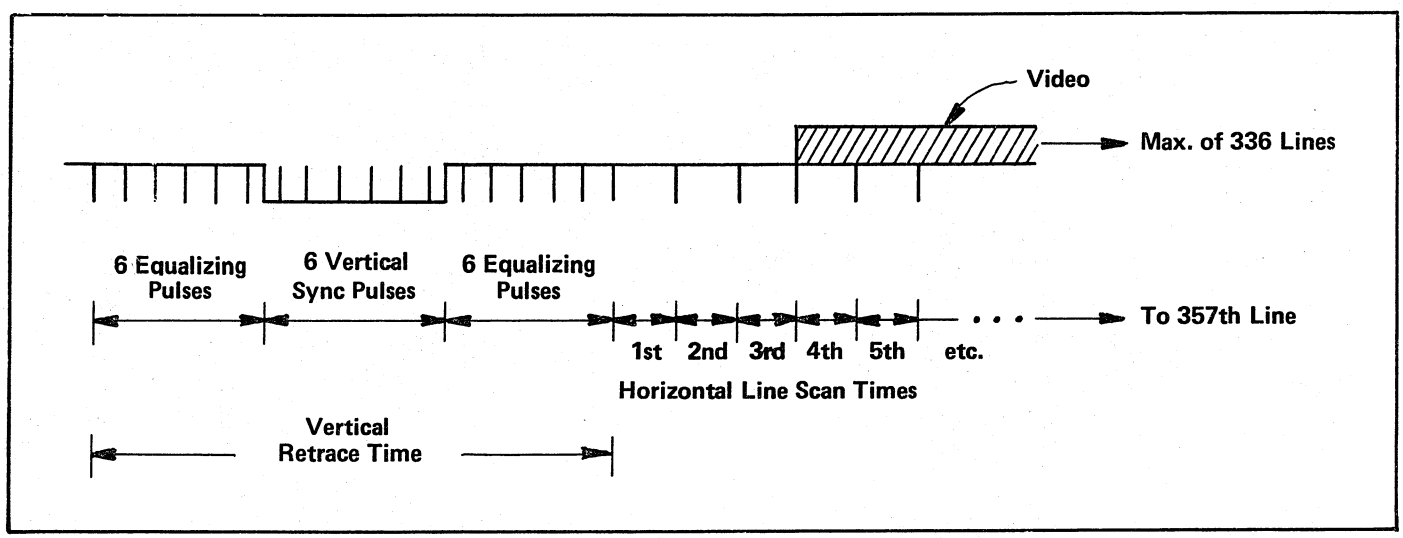


Fig. 11.3 Video Composite Signal

51101318-XYZ	
PART NUMBER	**DESCRIPTION**
51101318-XYZ-	
1YZ	Basic with single parallel interface
2YZ	Basic with dual parallel interface
4YZ	Basic with standard single asynchronous interface
SCADA or SEER channel sets	
Y=1	One A/N ch. set w/SCADA graphics
2	Two A/N ch. sets w/SCADA graphics
3	Three A/N ch. sets w/SCADA graphics
4	Four A/N ch. sets w/SCADA graphics
5	One A/N ch. set w/SEER graphics
6	Two A/N ch. sets w/SEER graphics
7	Three A/N ch. sets w/SEER graphics
8	Four A/N ch. sets w/SEER graphics
Z=0	No TREND ch. set
1	One TREND ch. set
2	Two TREND ch. sets
PM/C channel sets	
Y=1	One A/N ch. set w/PM/C graphics
2	Two A/N ch. sets w/PM/C graphics
3	Three A/N ch. sets w/PM/C graphics
4	Four A/N ch. sets w/PM/C graphics
Z=3	No TREND ch. set
4	One TREND ch. set
5	Two TREND ch. sets
5YZ	Keyboard with no cursor control
6YZ	Keyboard with Light Pen
7YZ	Keyboard with joystick
8YZ	Keyboard with trackball
Y=0	Keyboard, SCADA engraving, no case
1	Keyboard, SCADA engraving, with case
2	Keyboard, PM/C engraving, no case
3	Keyboard, SEER engraving, no case
4	Keyboard, SEER engraving, with case
5	Keyboard, PM/C engraving, with case
6	Keyboard, no graphic engraving, no case
7	Keyboard, no graphic engraving, with case
Z=0	Keyboard only
1	KBOS
2	45 Function Keys
3	45 Function Keys, lighted
4	KBOS and 45 Function Keys
5	KBOS and 45 Function Keys, lighted

Table 12.1 HPV-2 Part Numbers (continued next page)

(continued)

PART NUMBER	DESCRIPTION	
51101318-		
900	TVD-191 Sync Generator	-Note 3
901	TVD-193 Parallel/Serial Interface PWB	-Note 3
902	TVD-194 Microprocessor PWB	-Note 3
903	TVD-190 w/SCADA graphics	-Note 1
904	TVD-192 Edit	-Note 1
905	TVD-195 TREND	-Note 2
906	TVD-196 TREND	-Note 2
907	TVD-190 w/SEER graphics	-Note 1
908	TVD-190 w/PM/C graphics	-Note 1
910	One full set black keycaps for Display Editor	
911	One set SCADA keycaps for Display Editor	
912	One set SEER keycaps for Display Editor	
913	One set 45 function keycaps - gray	
914	One set 45 function keycaps - orange	
915	One set 45 function keycaps - white	
916	One set 45 function keycaps - black	
917	One Light Pen and electronics PWB	
918	One Light Pen only	
919	One set PM/C engraved keycaps for Display Editor	
920	One set of 4 PROMS for SEER character set	
921	One set of 1 ROM and 8 PROMS for PM/C character set	

Channel sets will be inserted in the designated slots as follows:

	Channel Sets	
Card Slots	Standard	Trend
6 & 7	No. 1	
8 & 9	No. 2	
10 & 11	No. 3	No. 2
12 & 13	No. 4	No. 1

Quantity of standard channel sets plus trend channel sets is ≤ 4.

Notes:

1. **TVD-190 and 192 (Channel Set) must be ordered as a set.**
2. **TVD-195 and 196 (Trend Channel Set) must be ordered as a set.**
3. **TVD-191, 193, and 194 (Common Electronics) must be ordered as a set.**

Table 12.1 HPV-2 Part Numbers

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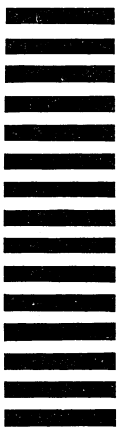

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