Inter-Office Memorandum

To Distribution

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From Tom Clark

Location Palo Alto

Subject Full Page & 1/4 Page Displays

Organization SDD/SD/DS

XEROX

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This memo summarizes what I think the diagnostic features are for the Janus Full Page & 1/4 Page Displays. My information sources are draft specifications obtained from Dallas design personnel, the specifications bearing neither author nor date. This type of summary is important if the diagnostic capabilities of the displays, and the limitations of system-resident, diagnostic software are to be bounded.

From the information presented here, it appears that additional information should be obtained or made available so that the functioning of the stated diagnostic features can be better understood (Note: microdiagnostics and Mesa-level software will be attempting to diagnose the displays using these features).

It is also important that the fault isolation capability, and FRU sparing required, be established. It again appears that this will be non-trivial. Consider the case where a 20-bit data word is not successfully returned, indicating that the horizontal sync logic is possibly malfunctioning. Here the fact that the 20-bit data word was not successfully returned leads nowhere.

Some questions have been identified and included in this memo. Additional questions you might develop would be helpful.

The following figures have been attached to help in understanding the contents of this memo, and to present a simple approach to testing the displays.

Figure	Heading
1	Full Page and 1/4 Page Display Interface
2	Approach to Testing

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1.0 Signal Definition

The Full Page Display will be connected to the ESS by a 15-pin cable, implemented as two wire differential input/output interface signals. The specification obtained for the 1/4 Page Display adopts the same interface. It appears as though both devices will be interfaced directly to the ESS.

The pin number and signal names as listed below:

Pin Number	Signal Name
1	DATA-IN-3
2	NDATA-IN-3
3	DATA-IN-2
4	NDATA-IN-2
5	DATA-IN-1
6	NDATA-IN-1
7	DATA-IN-0
8	NDATA-IN-0
9	CLOCK-A
10	NCLOCK-A
11	CLOCK-B
12	NCLOCK-B
13	DATA-OUT
14	NDATA-OUT
15	SIGNAL-GND (Shield)

The above signals have been defined as:

I. DATA-IN-0 - DATA-IN-3:

A four bit parallel input bus that supplies video, sync signals, and diagnostic control information to the display. How these signals are interpreted depends upon the state of CLOCK-B at the rising edge of CLOCK-A. During video transmission, these clocks are transmitted in quadrature so that all switching edges can be converted to clock pulses at four times the CLOCK-A and CLOCK-B rates.

If CLOCK-B is TRUE at the rising edge of CLOCK-A, the four bit data bus is interpreted as a serial video bit stream with the LSB appearing first.

If CLOCK-B is FALSE at the rising edge of CLOCK-A, the four bit data bus is interpreted as follows (synchronization and diagnostic control):

DATA-IN-0 = TRUE = Pointer Diagnostics

DATA-IN-1 = TRUE = Keyboard Diagnostics

DATA-IN-2 = TRUE = Horizontal Sync

DATA-IN-3 = TRUE = Vertical Sync

II. CLOCK-A and CLOCK-B:

When the pointer diagnostic command is received, the display will initiate a transmission of fourteen (14) 20-bit data words. Successful transmission of this sequence will indicate proper operation of the pointer decoding circuitry. The fourteen (14) 20-bit data words are currently undefined.

2.2 Keyboard

When the keyboard diagnostic command is received, the display will transmit a continuous stream of 20-bit data words. Excluding the first data word transmitted after receipt of the command, the keyboard portion will be as follows:

Bit	Value
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0

Successful transmission of this data will indicate that the return data bus is operational.

When this command is deactivated (=FALSE), the display will output two additional 20-bit data words.

Note: The description provided as to what these data words are is vague. It is assumed that these codes are the D1 & D2 (diagnostic) codes.

Successful transmission of this data will indicate that the keyboard assembly is connected and operational.

2.3 Diagnostic Data

Diagnostic data is returned in bits 16 through 19 of the 20-bit serial data word. Changes in these bits will be transmitted only when changes in keyboard or pointer data occur. The four bits are defined as follows:

Bit	Signal
16	Vertical Sync
17	Video

Input signals that provide synchronization and control for the input data bus. These clocks are transmitted in quadrature at 1/4 the video rate.

III. DATA-OUT:

A 20 bit serial output word that specifies an 8-bit keyboard word, a 7-bit pointer word, and a 4-bit Diagnostic Status word. The first bit of each 20-bit word delineates the word. The assignment of bits is as follows:

Bits	Function
0	FLAG (LSB)
1-7	Pointer Data (7 bits)
8-15	Keyboard Data (8 bits)
16-19	Diagnostic Data (4 bits)

1.1 Protocol

The displays will return data to the ESS by outputting 20-bit, serial data words whenever any of the data word bits change state, excluding the 4 diagnostic data bits. This means that when there is some change in the keyboard or pointer data, the display will generate a 20-bit data word. Data words can also be initiated by the diagnostic commands (keyboard and pointer).

The synchronization and clocking for the data transmission will be provided by the horizontal sync signal from the ESS. The time required to transmit a 20-bit data word will be 1069.6 microseconds (9 microsecond pulse with a 53.48 microsecond repetition rate). Valid data will appear within 1.0 microsecond after receipt of the leading edge of the sync pulse.

Should additional data changes occur during a transmission, the next 20-bit data word will follow immediately after the current data word, and one horizontal sync period (53.48 microseconds). During the gap, DATA-OUT will be FALSE.

2.0 Diagnostic Commands and Data

When either the keyboard or pointer diagnostic command is sent from the ESS to the display, the display will initiate the transmission of diagnostic signals.

Note: It is unclear how combinations of the diagnostic commands will affect operation, e.g., sending a pointer diagnostic command followed a short time later by a keyboard diagnostic command.

2.1 Pointer

18 K/B Reqst
19 Spare

2.3.1 Vertical Sync

This bit will be TRUE only during the time in which a vertical sync pulse is being received from the ESS. Proper retransmission back to the ESS will indicate that the vertical sync signal has been received and properly decoded.

Note 1: Successful transmission of the 20-bit word shall indicate that the horizontal sync has been properly received and decoded.

Note 2: The 20-bit data words are sent to the ESS only when changes occur in the pointer and keyboard data, or a diagnostic command is received from the ESS.

2.3.2 Video

This signal will assume the logic state of the last received transmission of video on the DATA-IN-2 line. Proper retransmission will ensure that video signals are correctly being received and decoded.

2.3.3 K/B Reqst

This signal will be TRUE whenever a change in the keyboard data has been commanded.

3.0 Questions

* What happens when both diagnostic commands are issued simultaneously?

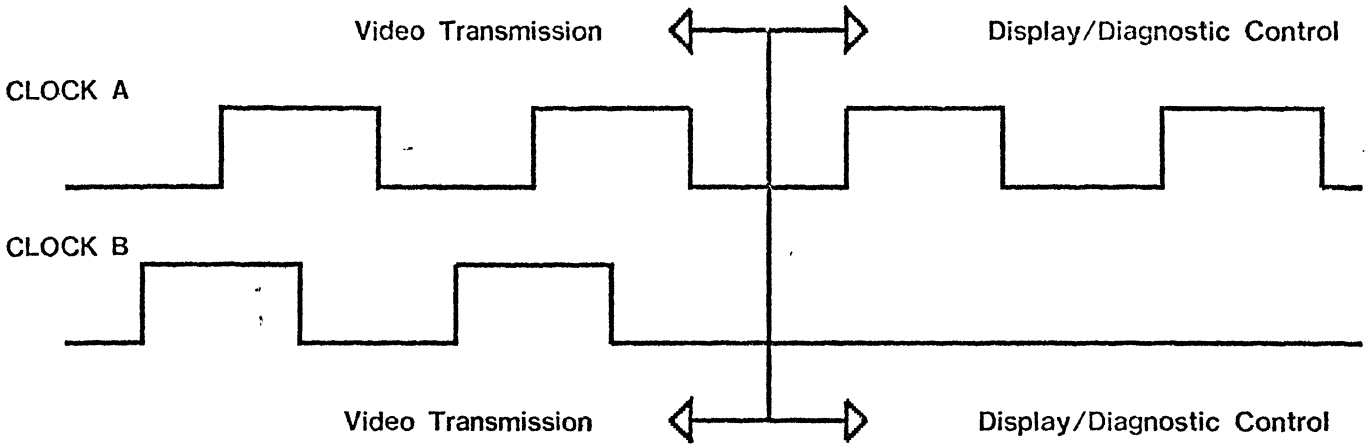
* It appears that successful transmission and certification of the fourteen (14) 20-bit data words transmitted after a pointer diagnostic command has been initiated are required to complete verification of the Pointer decoding circuitry.

* If only a pointer or a keyboard diagnostic command is issued, what data is returned in the 20-bit data words for those functions not commanded?

* How do we tell that an optional pointer is or is not present? How do we tell if a keypad is present (assuming that there is such a thing)?

* What happens to this interface in the event that data is not returned? Or, in other words, what does a Send-Receive protocol that includes exception processing look like?

* What does the electronics in the ESS look like? Is there 'turn-around' capability, etc.? How about inside the display?



Video Transmission	Display/Diagnostic Control
DATA-IN-0, DATA-IN-1, DATA-IN-2, and DATA-IN-3 represent a four bit parallel input word that is transferred into a serial video bit stream with the LSB appearing first.	DATA-IN-0 = TRUE = Printer Diagnostics DATA-IN-1 = TRUE = Keyboard Diagnostics DATA-IN-2 = TRUE = Horizontal Sync DATA-IN-3 = TRUE = Vertical Sync
20-bit data words can be sent to the ESS whenever changes occur in the Pointer and Keyboard data.	When either of the diagnostic control commands are activated, transmission of the 20-bit data words will commence.

General

1. 20-bit data words will be returned to the ESS when changes occur in the Keyboard or Pointer data, or when a diagnostic command is received from the ESS.

Figure 1. Full Page & 1/4 Page Display Interface

* How long does the K/B REQST signal stay TRUE after a change in keyboard data?

Appendix

A.1 Notation

LSB Least Significant Bit

Distribution:

D. Stottlemyre
P. Jarvis
E. Reber
C. Hankins
B. Kennedy
B. Bosse
D. Cahill
R. Fox

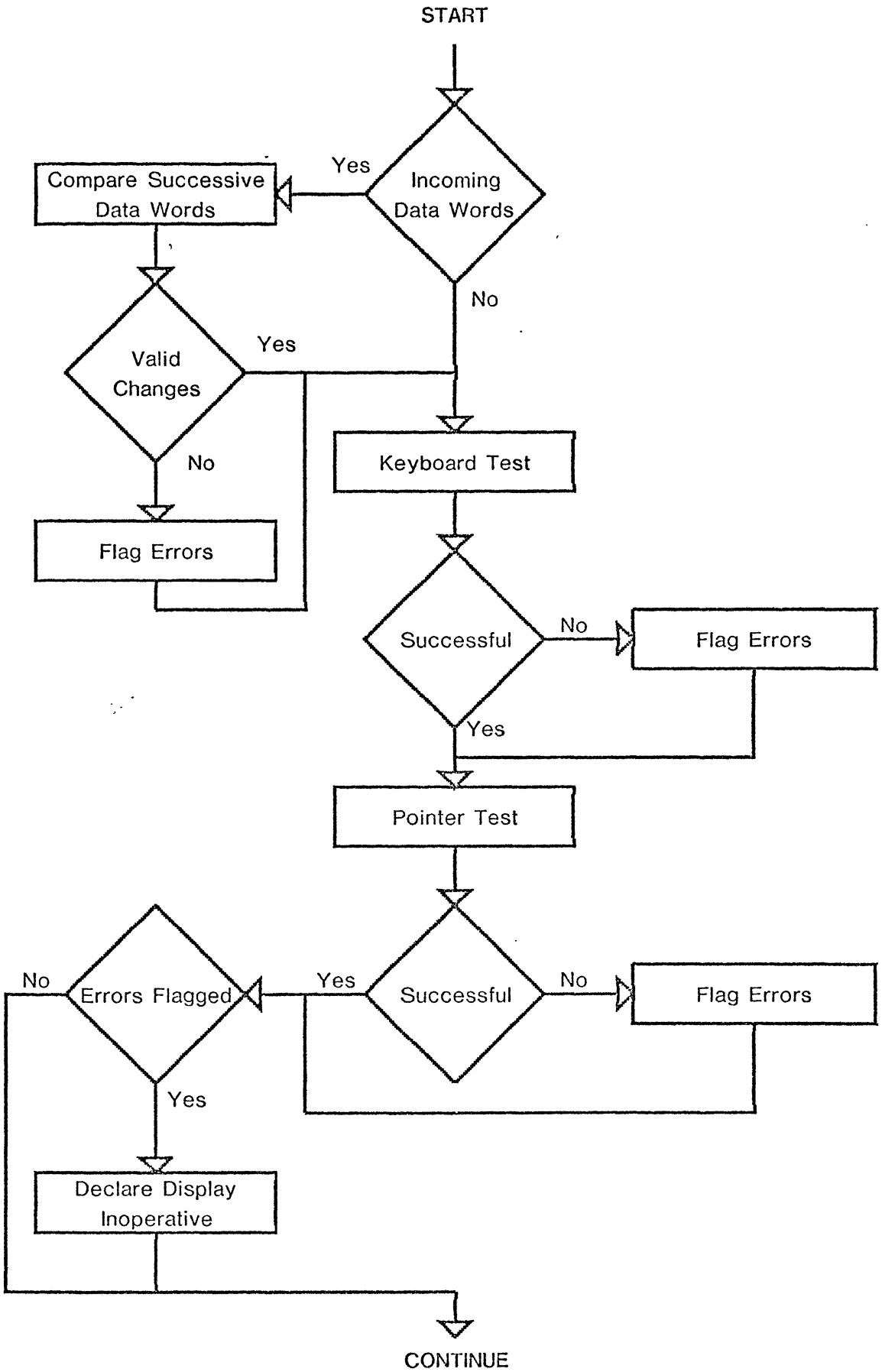


Figure 2. Approach to Testing