VSXXX-CA/CB

Peripheral Repeater

Technical Manual

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This equipment generates, uses, and may emit radio frequency energy. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such radio frequency interference. Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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The Peripheral Repeater

The VSXXX-CA/CB Peripheral Repeater, also called the PR Box, is a concentrator and multiplexer between a graphics subsystem control processor and up to seven interactive devices such as a keyboard, mouse, tablet, or other devices used with graphics workstations.

Note

The peripheral repeater was designed to be part of the graphics subsystem in a VAXstation 8000. The control processor for that subsystem is a DIGITAL KA800 processor (sometimes called the ACP, an in-house acronym). It is the KA800 that is connected to the host port on the peripheral repeater.

The VAXstation 8000 also includes a host subsystem. The processor for that subsystem is a DIGITAL KA825, and it is usually called the host. The KA825 has no direct connection to the peripheral repeater.

Throughout this manual, KA800 refers to the processor connected to the peripheral repeater, and host refers to the host subsystem processor.

Purpose of This Manual

This manual describes the functional operation and maintenance of the VSXXX-CA/CB Peripheral Repeater.

Intended Audience

This manual is written for:

- o Engineers and programmers concerned with interfaces to the peripheral repeater.

- o DIGITAL field service engineers and manufacturing repair technicians concerned with repairing the peripheral repeater.

Note

Normally, the peripheral repeater is not repaired in the field; instead, the internal assembly is replaced.

Associated Documents

The following table lists the manuals and guides associated with the peripheral repeater.

Order Number	Title
EK-VS800-SM	VAXstation 8000 System Manual
EK-VS800-IG	VAXstation 8000 Installation Guide
EK-VSXDA-TM	VSXXX-DA Dial Array Technical Manual
EK-VR290-IN	VR290 Color Video Monitor Installation/Owner's Guide

Conventions

The notational conventions used in this manual are described in the following table.

Convention	Meaning
<mm:nn>	Read as "mm through nn." This use of angle brackets and the colon indicates a bit field, or a set of lines or signals. For example, A<17:00> is the mnemonic for address lines "A17 through A00."
Addresses	Unless otherwise noted, all addresses are given in hexadecimal notation.
k, M	Abbreviations for kilo, Mega. Unless otherwise noted, k and M represent the full decimal value of quantities. For example: 8 kbytes 8192 bytes/ 8000 bytes 32 kwords 32768 words/ 32000 words 512 kbits 524288 bits / 512000 bits 4 Mbytes 4194304 bytes/4000000 bytes
<KEYNAME>	Represents nonprinting keyboard keys, such as <Ctrl> , <F11> , or <Return> .
<Ctrl/n>	Represents the keys needed to enter a control sequence. A control sequence is entered by pressing <Ctrl> and typing at the same time.
^n	Terminal echo for control sequence <Ctrl/n> .
Abbreviations	Abbreviations are in accordance with DEC STD 015.

Chapter 1

Physical Description

This chapter introduces and gives a physical description of the VSXXX-CA/CB Peripheral Repeater, or PR Box.

1.1 Introduction

The peripheral repeater is used in a graphics workstation, such as the VAXstation 8000, and is located beneath the graphics monitor, as shown in Figure 1-1. The peripheral repeater is primarily a concentrator and multiplexer for the workstation peripherals, or interactive devices. It has the following features and functions:

- o Provides a common connection point for the workstation interactive devices.
- o Provides power to the interactive devices.
- o Assembles/disassembles communications packets to and from the system.
- o Converts the RS232C and RS423 signals used by the interactive devices to/from RS232C signals used by the system.

- Includes:

  ROM-based self-tests for its internal logic.

  A self-test loopback mode for each interactive device port.

  A manufacturing test mode.

  A power supply status monitoring and reporting function.

  A switched receptacle to provide ac power to the monitor.

Figure 1–1: VAXstation 8000

To be photo? Check w/ Ray Laurencelle

The peripherals, or interactive devices, supported by the peripheral repeater include:

- o LK201 Keyboard
- o VSXXX-AA Mouse
- o VSXXX-AB Graphics Tablet
- o VSXXX-DA Dial Array
- o Other RS423/RS232C-compatible devices

Appendix A lists the typical interactive devices and their operational parameters.

Figure 1-2 is a block diagram showing the relationship of the peripheral repeater to other major components of a graphics workstation.

Figure 1-2: VAXstation 8000 Block Diagram

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1.2 Physical Description

The peripheral repeater is shown in Figure 1-3. The two major components are the enclosure and the internal assembly.

The plastic enclosure is open on the bottom and rear. It is designed to be placed beneath a VR290 color monitor. With the internal assembly installed or removed, the enclosure will support the weight of the monitor; therefore, the monitor need not be moved to service the peripheral repeater. The power switch and power LED indicator are mounted on the internal assembly and project through holes in the front of the enclosure.

Figure 1-3: Peripheral Repeater

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With the exception of the plastic enclosure, all of the peripheral repeater components are mounted on or in the internal assembly. The internal assembly is basically a 6-sided metal box.

The top of the box is extended on the left and right edges to form flanges which ride in tracks on the plastic enclosure. The rear edge of the top is turned down to form a handle for removing the internal assembly from the enclosure.

The major components contained within the internal assembly are shown in Figure 1-4, and include:

- o Peripheral repeater printed circuit board
- o Power supply printed circuit board
- o Cooling fans (3)
- o AC wiring harness

- o Power switch
- o Power LED indicator
- o Back panel components

Figure 1–4: Peripheral Repeater Component Locations

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The back panel components, identified in Figure 1–5, are mounted on the peripheral repeater printed circuit board and project through holes in the back panel of the internal assembly chassis. These components include the interactive device connectors, Function LED, and diagnostic LEDs. The ac power connectors, which also project through the back panel, are not mounted on the peripheral repeater printed circuit board.

Figure 1–5: Peripheral Repeater Back Panel

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1.2.1 Jumpers

There are two jumpers in the peripheral repeater and both are factory set.

1. Power Supply Jumper. The jumper on the power supply board selects either 120 Vac (labeled 115V on the board) or 240 Vac (labeled 230V on the board) operation.

2. External Address Jumper. The jumper on the peripheral repeater board is the external address jumper for the 8031 microprocessor. This jumper must be in place.

1.2.2 Connectors

Table 1-1 describes the various connectors and connections in the peripheral repeater.

Table 1-1: Peripheral Repeater Board Connectors

Connector	Pins	Signal	Fuse	RS232/RS423
J1 Spare	1	GND		RS232
	2	SP1 XMT		
	3	SP1 RCV		
	4:6	nc		
	7	GND		
	8:25	nc		
J2 KA800	1	GND		RS232
	2	ACP [1] XMT		
	3	ACP [1] RCV		
	4:6	nc		
	7	GND		
	8:11	nc		
	12	GND		
	13:18	nc		
		ST LOOP		
	19	nc		
	20:25			

[1] The KA800 in a VAXstation 8000.

Table 1-1 (Continued): Peripheral Repeater Board Connectors

Connector	Pins	Signal	Fuse	RS232/RS423
J3 Dial	1	+12V	F11	RS423
Array	2	-12V	0.125	
	3:4	nc	A	
	5	+5V	F12	
	6	+5V	0.125 A	
	7	nc		
	8	KNB PRESENT		
	9:10	GND	F3	
	11	KNOBS RCV	3.000	
	12	KNOBS XMT	A [2]	
	13:18	ESD GROUND [3]	F6	
			3.000	
			A [2]	
J4 Button	1	+5V	F10	RS232
Array	2	+12V	0.750	
	3	GND	A	
	4	-12V	F14	
	5	BTNS PRESENT	0.125 A	
	6	BTNS RCV		
	7	nc		
	8	BTNS XMT	F15	
	9:12	ESD GROUND [3]	0.125 A	
J5 LK201	1	KBD XMT		RS423
Keyboard	2	GND		
	3	+12V	F1	
	4	KBD RCV	0.375 A	
J6 Fan 1	1	GND		
	2	+12V		

[2] These pins and fuses are connected in parallel.
[3] Fingers on connector shell connected to ground.

Table 1-1 (Continued): Peripheral Repeater Board Connectors

Connector	Pins	Signal	Fuse	RS232/RS423
J7 Tablet	1	GND		RS232
	2	TAB RCV		
	3	TAB XMT		
	4	-12V	F7	
	5	+5V	0.125	
	6	+12V	A	
	7	TAB PRESENT	F5	
	8:9	ESD GROUND [3]	0.250	
			A	
			F4	
			0.375 A	
J8 Mouse	1	GND		RS232
	2	MOUSE RCV		
	3	MOUSE XMT		
	4	-12V	F8	
	5	+5V	0.125	
	6	+12V	A	
	7	MSE PRESENT	F9	
	8:9	ESD GROUND [3]	0.250	
			A	
			F2	
			0.375 A	
J9 Manufacturing		RESET		
	1			
Test	2	EOP		
J10 Fan 3	1	GND		
	2	+12V		

[3] Fingers on connector shell connected to ground.

Table 1-1 (Continued): Peripheral Repeater Board Connectors

Connector	Pins	Signal	Fuse	RS232/RS423
J11 DC Power	1:4	+5V		
	5:8	GND		
	9	+12V		
	10	GND		
	11	-12V		
	12	GND		
J12 Fan 2	1	GND		
	2	+12V		
J13 Power LED	1	Green Cathode		
	2	nc		
	3	Red Cathode		
J14 Keyboard	1	KBD PRESENT		RS232
	2	SP2 RCV		
	3	SP2 XMT		
	4	GND		
	5	+5V	F13	
	6:7	ESD GROUND [3]	0.750 A	

[3] Fingers on connector shell connected to ground.

1.2.3 Part Numbers

Table 1-2 lists the part numbers for the peripheral repeater's major components, subassemblies, and cables.

Table 1-2: Part Numbers

Part Description	Part Number
Internal Assembly	
Peripheral Repeater Internal Assembly (without cover):	70-24065-01
AC Power Harness	70-24063-01
Fan Assembly	70-24061-01
Peripheral Repeater Printed Circuit Board	54-17157-01
Power LED Assembly	70-24052-01
Power Switch	12-22355-10
Power Supply Printed Circuit Board, 120V	H7820-A
Power Supply Printed Circuit Board, 240V	H7820-B
Signal Cables	
Peripheral Repeater to Dial Array Signal Cable	17-01416-01
Peripheral Repeater to Pedestal Signal Cable	17-01354-01

Table 1-2 (Continued): Part Numbers Part Description	Part Number
Peripheral Repeater Power Cords	

Table 1-2 (Continued): Part Numbers

Part Description		Part Number
Africa	2.5 m (100 in)	1700456-05
Australia	2.5 m (100 in)	1700198-04
Austria	2.5 m (100 in)	1700199-07
Belgium	2.5 m (100 in)	1700199-07
Canada	2.4 m (96 in), 110V	1700083-43
	2.4 m (96 in), 220V	1700083-44
Denmark	2.5 m (100 in)	1700310-07
Finland	2.5 m (100 in)	1700199-07
France	2.5 m (100 in)	1700199-07
Germany	2.5 m (100 in)	1700199-07
India	2.5 m (100 in)	1700456-05
Ireland	2.5 m (100 in)	1700209-04
Israel	2.5 m (100 in)	1700457-05
Italy	2.5 m (100 in)	1700364-05
Japan	2.4 m (96 in), 110V	1700083-43
	2.4 m (96 in), 220V	1700083-44
Mexico	2.4 m (96 in), 110V	1700083-43
	2.4 m (96 in), 220V	1700083-44
Netherlands	2.5 m (100 in)	1700199-07
New Zealand	2.5 m (100 in)	1700198-04
Norway	2.5 m (100 in)	1700199-07
Portugal	2.5 m (100 in)	1700199-07
Spain	2.5 m (100 in)	1700199-07
Sweden	2.5 m (100 in)	1700199-07
Switzerland	2.5 m (100 in)	1700210-04
United Kingdom	2.5 m (100 in)	1700209-04
United States	2.4 m (96 in)	1700083-44

Table 1-2 (Continued): Part Numbers Part Description	Part Number

Table 1-2 (Continued): Part Numbers

Part Description		Part Number
Peripheral Repeater to Monitor Power Cords		
United States	0.9 m (36.00 in)	17-00442-15
Other countries	1.0 m (39.37 in)	17-00365-19

1.3 Specifications

Table 1-3 through Table 1-5 list the physical, electrical, and environmental specifications for the peripheral repeater.

Table 1-3: Physical Specifications

Parameter	Specifications
Height	8.3 cm (3.25 in)
Width	39.6 cm (15.59 in)
Depth	39.6 cm (15.59 in)
Weight	5.4 kg (12.00 lb)

Table 1-4: Electrical Specifications

Parameter	Specifications		
	Typical	Minimum	Maximum
Frequency	60 Hz	47 Hz	63 Hz
Power consumption	200 W		330 W [1]
Voltage	115 Vac 230 Vac	88 Vac 176 Vac	132 Vac [2] 264 Vac [3]
Current	2.40 A (steady state) [2] 1.30 A (steady state) [3]		
AC power output			1.50 A [2] 0.75 A [3]
DC power output			102.00 W
+5 Vdc		3.00 A	10.00 A
+12 Vdc		0.50 A	4.00 A
−12 Vdc		0.00 A	0.25 A

[1] Including ac and dc output loads.
[2] VSXXX-CA
[3] VSXXX-CB

Table 1-5: Environmental Specifications

Parameter	Specification	
Operating		
Temperature	10° to 40° C (50° to 104° F) [1]	
Altitude	2.4 km (8000 ft) maximum	
Relative humidity	10% to 90% (noncondensing)	
Maximum wet-bulb temperature	28° C (82.4° F)	
Minimum dew-point temperature	2° C (36° F)	
Nonoperating		
Temperature	-40° to 66° C (-40° to 151° F)	
Altitude	4.9 km (16000 ft) typical	
Relative humidity	10% to 95% (noncondensing)	
Storage		
Temperature	5° to 50° C (41° to 122° F)	
Relative humidity	10% to 95% (noncondensing)	
Maximum wet-bulb temperature	32° C (90° F)	
Air flow	0.009 m^3/s (18 ft^3/min)	
Heat dissipation	Minimium	Maximum
	29 W	85 W
	99 Btu/h	290 Btu/h

[1] De-rate maximum operating temperature 1.82° C/km (1.0° F/1000 ft) above sea level.

Table 1-5 (Continued): Environmental Specifications

Parameter	Specification	
Acoustics	LPNE	LPA
	4.8 B	42 dBa

Chapter 2

Functional Description

This chapter gives a functional and architectural description of the peripheral repeater.

2.1 Introduction

The peripheral repeater is a self-contained subsystem based on an 8-bit 8031 microprocessor. It processes and controls the flow of information between the KA800 and the interactive devices.

Note

The peripheral repeater was designed to be part of the graphics subsystem in a VAXstation 8000. The control processor for that subsystem is a a DIGITAL KA800 processor (sometimes called the ACP, an in-house acronym). It is the KA800 that is connected to the host port on the peripheral repeater.

The VAXstation 8000 also includes a host subsystem. The processor for that subsystem is a DIGITAL KA825, and it is usually called the host. The KA825 has no direct connection to the peripheral repeater.

Throughout this manual, KA800 refers to the processor connected to the peripheral repeater, and host refers to the host subsystem processor.

The peripheral repeater is a free-running subsystem. It performs self-test at power up to check its internal status. Following successful completion of self-test, the peripheral repeater initializes itself and starts a continuous scan for activity from the KA800 or interactive devices.

The functional hardware components of the peripheral repeater are contained on the peripheral repeater printed-circuit board, or PRB, and the H7820 power supply printed-circuit board. The operational and diagnostic firmware are contained in 8 kbytes of ROM (read-only memory) on the PRB.

2.2 Peripheral Repeater Board

Figure 2-1 is a block diagram of the peripheral repeater printed-circuit board. The blocks are described in the following subsections.

2.2.1 8031 Microprocessor

The 8031 microprocessor (Figure 2-2) is an 8-bit microprocessor that includes the following features:

- o 32 I/O lines (four 8-bit ports)
- o 128-byte internal data memory
- o 64-kbyte external data memory address space
- o 64-kbyte external program memory address space (no internal program memory.)
- o Two 16-bit timer/counters
- o A 5-source/2-level interrupt structure

The peripheral repeater program memory and external data memory occupy only the lowest 24 kbytes of the 128-kbyte external memory address space. Program memory is contained in an 8-kbyte ROM (read-only memory). External data memory is contained in two 8-kbyte SRAMs (static random-access memories).

Figure 2-1: Peripheral Repeater Board Block Diagram

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Figure 2-2: 8031 Microprocessor Block Diagram

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Table 2-1 describes the 8031 microprocessor input and output signals.

Table 2-1: 8031 Microprocessor Signals

Signal	Port	Pin Name	Description
ADDR 15:08	2	A 15:8	Eight high-order address bits.
ADDR 07:00 DATA 07:00	0	AD 7:0	Eight multiplexed data or low-order address bits.
ST LOOP	1	P17	Self-Test Loop. This signal is for manufacturing test. The cable between the KA800 and peripheral repeater J2 is NOT wired for this signal.
EOP	1	P16	End Of Pass. This signal is for manufacturing test.
INT 0	3	P32	Interrupt 0. Interrupt line from the OCTALART (DC349).
RD	3	P37	Read. Source of the read signals for external data memory (SRAM), Function Register (FUNC REG), and Diagnostic Register (DIAG REG), and the data strobe signal for the OCTALART (DC349) registers.

Table 2-1 (Continued): 8031 Microprocessor Signals

Signal	Port	Pin Name	Description
WR	3	P36	Write. Source of the write signals for external data memory (SRAM), Function Register (FUNC REG), and Diagnostic Register (DIAG REG), and the data strobe signal for the OCTALART (DC349) registers.
ALE		ALE	Address Latch Enable. Latches the eight low-order bits of address in the address latch (ADDR LTCH).
PSEN		PSEN	Program Store Enable. Source of the read signal for program memory (ROM).
XTAL2		XTAL2	Crystal. External crystal oscillator input. The 8031 divides the input frequency by 2.
PWR UP		RST	Power-up Reset. Initializes the 8031 when power is turned on.
EA		EA	External Access. Tied to ground on an 8031 to enable access to external program memory.

2.2.2 Address Space

The 8031 microprocessor has separate address spaces for program memory and data memory. Program memory is entirely external to the 8031, while data memory comprises both external memory and on-chip, or internal, memory. The 16-bit address allows both program memory and external data memory to occupy up to 64 kbytes of address space. The appropriate address space is selected by using PSEN as the read strobe for program memory, and RD and WR as the data strobes for external data memory. Note that the peripheral repeater uses only 32 kbytes of address space and that program and external data memory occupy uniquely addressed segments. See Table 2-2.

Table 2-2: Peripheral Repeater Memory Map

Address Range	Size	Description
FFFF-E000	8 kbytes	External Data Memory (I/O Registers)
DFFF-6000	32 kbytes	Not used
5FFF-4000	8 kbytes	External Data memory (SRAM 1)
3FFF-2000	8 kbytes	External Data memory (SRAM 0)
1FFF-0000	8 kbytes	External Program Memory--Operating System and Power Up Self-test (ROM). Note that the first 256 bytes, 00FF-0000, are the 8031 internal data memory.

2.2.2.1 I/O Registers

The I/O Registers space, also called the I/O Page or Bank 7, is part of external data memory and is allocated as shown in Table 2-3. This space is selected when ADDR 15:13 are asserted, causing signal SEL BNK 7 (Figure 2-4 and Table 2-6) to be asserted. When SEL BNK 7 is asserted, note that:

- o ADDR 12 is asserted, ADDR 11 is deasserted, and ADDR <10:00> are ignored when the Diagnostic Register is addressed.

- o ADDR 12 is deasserted, ADDR 11 is asserted, and ADDR <10:00> are ignored when the Diagnostic Register is addressed.

- o ADDR <11:12> are deasserted and ADDR <10:08> and ADDR 06 are ignored when the DC349 registers are addressed.

  In addition, if ADDR 02 is set, ADDR <05:03> (the channel number bits) are also ignored and either the DC349 Interrupt Summary Register or DC349 Data Set Change Summary Register is addressed.

- o ADDR 07 is deasserted to write the writable DC349 registers. Therefore, addresses in the range E0BD_16through E080_16are read addresses, and addresses in the range E03B_16through E000_16are write addresses. Read/modify/write instructions should not be used to access these registers.

- o DC349 Mode Registers 1 and 2 have the same address and are accessed by sequential operations (read/read, read/write, write/read, or write/write) to that address. The first operation accesses Mode Register 1, the next Mode Register 2, the next Mode Register 1, and so on. Reading the Command Register resets the sequential counter to point to Mode Register 1.

Table 2-3: I/O Registers Memory Map

Address	Access	Register
F000	Read Write	Mode Register
E800	Read Write	Diagnostic Register
E0BD	Read	DC349 Data Set Change Summary Register
E0BC	Read	DC349 Interrupt Summary Register
E0BB	Read	DC349 Channel 7 Command Register
E0BA	Read	DC349 Channel 7 Mode Registers 1 and 2
E0B9	Read	DC349 Channel 7 Status Register
E0B8	Read	DC349 Channel 7 Receiver Buffer Register
E0B3	Read	DC349 Channel 6 Command Register
E0B2	Read	DC349 Channel 6 Mode Registers 1 and 2
E0B1	Read	DC349 Channel 6 Status Register
E0B0	Read	DC349 Channel 6 Receiver Buffer Register
E0AB	Read	DC349 Channel 5 Command Register
E0AA	Read	DC349 Channel 5 Mode Registers 1 and 2
E0A9	Read	DC349 Channel 5 Status Register
E0A8	Read	DC349 Channel 5 Receiver Buffer Register

Table 2-3 (Continued): I/O Registers Memory Map

Address	Access	Register
E0A3	Read	DC349 Channel 4 Command Register
E0A2	Read	DC349 Channel 4 Mode Registers 1 and 2
E0A1	Read	DC349 Channel 4 Status Register
E0A0	Read	DC349 Channel 4 Receiver Buffer Register
E09B	Read	DC349 Channel 3 Command Register
E09A	Read	DC349 Channel 3 Mode Registers 1 and 2
E099	Read	DC349 Channel 3 Status Register
E098	Read	DC349 Channel 3 Receiver Buffer Register
E093	Read	DC349 Channel 2 Command Register
E092	Read	DC349 Channel 2 Mode Registers 1 and 2
E091	Read	DC349 Channel 2 Status Register
E090	Read	DC349 Channel 2 Receiver Buffer Register
E08B	Read	DC349 Channel 1 Command Register
E08A	Read	DC349 Channel 1 Mode Registers 1 and 2
E089	Read	DC349 Channel 1 Status Register
E088	Read	DC349 Channel 1 Receiver Buffer Register
E083	Read	DC349 Channel 0 Command Register
E082	Read	DC349 Channel 0 Mode Registers 1 and 2
E081	Read	DC349 Channel 0 Status Register
E080	Read	DC349 Channel 0 Receiver Buffer Register

Table 2-3 (Continued): I/O Registers Memory Map

Address	Access	Register
E03B	Write	DC349 Channel 7 Command Register
E03A	Write	DC349 Channel 7 Mode Registers 1 and 2
E038	Write	DC349 Channel 7 Transmitter Holding Register
E033	Write	DC349 Channel 6 Command Register
E032	Write	DC349 Channel 6 Mode Registers 1 and 2
E030	Write	DC349 Channel 6 Transmitter Holding Register
E02B	Write	DC349 Channel 5 Command Register
E02A	Write	DC349 Channel 5 Mode Registers 1 and 2
E028	Write	DC349 Channel 5 Transmitter Holding Register
E023	Write	DC349 Channel 4 Command Register
E022	Write	DC349 Channel 4 Mode Registers 1 and 2
E020	Write	DC349 Channel 4 Transmitter Holding Register
E01B	Write	DC349 Channel 3 Command Register
E01A	Write	DC349 Channel 3 Mode Registers 1 and 2
E018	Write	DC349 Channel 3 Transmitter Holding Register
E013	Write	DC349 Channel 2 Command Register
E012	Write	DC349 Channel 2 Mode Registers 1 and 2
E010	Write	DC349 Channel 2 Transmitter Holding Register

Table 2-3 (Continued): I/O Registers Memory Map

Address	Access	Register
E00B	Write	DC349 Channel 1 Command Register
E00A	Write	DC349 Channel 1 Mode Registers 1 and 2
E008	Write	DC349 Channel 1 Transmitter Holding Register
E003	Write	DC349 Channel 0 Command Register
E002	Write	DC349 Channel 0 Mode Registers 1 and 2
E000	Write	DC349 Channel 0 Transmitter Holding Register

2.2.2.2 Internal Data Memory

Internal data memory comprises 256 bytes, allocated as shown in Table 2-4. Access to this memory is controlled by the 8031 instruction addressing mode.

Table 2-4: 8031 Internal Data Memory Map

Address Range	Size	Description
00FF-0080	128 bytes	Special Function Registers
007F-0030	80 bytes	Scratch Pad Area
002F-0020	16 bytes	Bit-addressable Segment
001F-0018	8 bytes	Register Bank 3
0010-0017	8 bytes	Register Bank 2
000F-0008	8 bytes	Register Bank 1--Default Stack Area
0007-0000	8 bytes	Register Bank 0--Default Register Bank

2.2.3 Address Latch

The lowest eight bits of address and data are multiplexed on lines AD<7:0>, as shown in Figure 2-1. When an address is on these lines, signal ALE is asserted by the 8031, and the address is latched in the ADDR LTCH (Address Latch). The output of the ADDR LTCH is ADDR<7:0>.

2.2.4 Data Transceivers

The DATA XCVR (Data Transceivers), Figure 2–1, determine the direction of data transferred between the DATA<7:0> lines and the multiplexed address and data AD<7:0> lines. When the 8031 asserts BUS READ through the CTRL BFFR DCDR, data is transferred to the 8031; when BUS READ is not asserted, data is transferred from the 8031.

2.2.5 Control Buffer/Decoder

The CTRL BFFR DCDR (control buffer/decoder) is shown in Figure 2–3. Its input and output signals are described in Table 2–5.

Figure 2-3: Control Buffer/Decoder Block Diagram

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Table 2-5: Control Buffer/Decoder Signals

Signal	Description
WR	Source of the WRITE signal and one source for the UART STB signal.
RD	Source of the READ signal and one source for the UART STB signal.
PSEN	Source of the BPSEN signal.
WRITE	The write enable signal for data memory (SRAM) and the Function and Diagnostic registers (FUNC REG and DIAG REG).
READ	The read enable signal for data memory (SRAM) and the Function and Diagnostic registers (FUNC REG and DIAG REG). READ is also one source for the BUS READ signal.
BPSEN	Buffered Program Store Enable. The read enable signal for program memory (ROM). BPSEN is also one source for the BUS READ signal.
BUS READ	This signal controls the direction of the data transfer through the bus transceiver (DATA XCVR). See Figure 2-1. When BUS READ is asserted, data is input to the 8031; when not asserted, data is output from the 8031.
UART STB	UART Strobe. This signal is the data strobe (data valid) signal for read and write data transfers between the DATA XCVR and the DC349 OCTALART.

2.2.6 Address Decoder

The ADDR DCDR (address decoder) generates the signals which select ROM, either SRAM, or the I/O registers (the DC349 registers, Diagnostic Register, and Function Register). It is shown in Figure 2–4 and it’s input and output signals are described in Table 2–6.

Figure 2–4: Address Decoder Block Diagram

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Table 2-6: Address Decoder Signal Derivation

ADDR 15:11 [1]	Address Range	Output	Description
HHHxx	FFFF-E000	SEL BNK 7	Select Bank 7 selects the top 8-kbyte bank of memory address space which contains the I/O Registers; that is, the Function, Diagnostic, and OCTALART registers.
HHHHL	FFFF-F000	SEL MODE REG	Select Mode Register. Selects the Function Register. The Function Register default address is F000.
HHHLH	EFFF-E800	SEL DIAG REG	Select Diagnostic Register. The Diagnostic Register default address is E800.
HHHLL	E7FF-E000	SEL DC349	Select DC349. The addresses for the OCTALART registers fall into this range.

[1] x = don’t care.

Table 2-6 (Continued): Address Decoder Signal

ADDR 15:11 [1]	Address Range	Derivation Output	Description
LHLxx	5FFF-4000	SEL RAM 1	Select RAM 1. Selects the upper 8 kbytes of external data memory.
LLHxx	3FFF-2000	SEL RAM 0	Select RAM 0. Selects the lower 8 kbytes of external data memory.
LLLxx	1FFF-0000	SEL ROM 0	Select ROM 0. Selects the 8-kbyte program memory.

[1] x = don’t care.

2.2.7 ROM/SRAM

The peripheral repeater uses only 32 kbytes of the 128-kbyte external memory address space. The top 8-kbyte bank is reserved for the I/O Registers. Program memory is contained in an 8-kbyte ROM and external data memory is contained in two 8-kbyte SRAMs. The ADDR DCDR provides the chip select signals for the ROM and the two SRAMs. See Figure 2-5.

Figure 2-5: ROM/SRAM Block Diagram

ASD-1107

2.2.8 DC349 OCTALART

The DC349 OCTALART, Figure 2-6, contains eight ARTs (asynchronous receiver/transmitters) and a baud-rate generator. It performs the operations necessary for independent full-duplex operation on eight serial data lines, or channels. The DC349 input and output signals are described in Table 2-7.

Figure 2-6: DC349 OCTALART Block Diagram

ASD-1108

Table 2-7: DC349 OCTALART Signals

Signal	Pin Name	Description
SEL DC349	CS	Select DC349/Chip Select. When asserted, this signal enables data transfers on DATA <07:00> lines to or from the internal registers. Data transfer timing and direction are controlled by UART STB and ADDR 07.
ADDR 05:00	A5:A0	Address 05:00. These bits select the internal register; bits ADDR <05:03> select the channel and ADDR <02:00> select the register.
UART STB	DS2:DS1	UART Strobe/Data Strobe. During a write to the DC349, UART STB is asserted after data is placed on DATA <07:00> and deasserted before the data is removed. On a read from the DC349, UART STB is asserted before the data is placed on DATA <07:00>.
ADDR 07	WR	Address 07/-Write. When asserted, data is read from the DC349 registers. When not asserted, data is written to the DC349 registers.

Table 2-7 (Continued): DC349 OCTALART Signals

Signal	Pin Name	Description
DATA 07:00	D7:D0	Parallel input and output data lines. Data is input to the internal registers (write operation) when SEL DC349 and UART STB are asserted and ADDR 07 is deasserted. Data is output from the internal registers (read operation) when SEL DC349, UART STB, and ADDR 07 are asserted.
INT 0	IRQ	Interrupt 0/Interrupt Request. Asserted when a channel's receiver buffer is full, a change has occurred on a carrier detect (DCD) line, or a channel's transmitter holding register is empty.
	TXDn	Serial Transmit Data.
	RXDn	Serial Receive Data.
	DSRn	Data Set Ready (not used).

Table 2-7 (Continued): DC349 OCTALART Signals

Signal	Pin Name	Description
	DCDn	Carrier Detect. A transition on any of these lines indicates a data set change and is one of the conditions for asserting INT 0. Through external inverters, these pins are connected to the device present signals of the devices that supply such signals.
UART CLK	CLK	Clock. Source for internal clocks and baud rates.
PWR UP A	RESET	Power Up A/Reset. Places the DC349 in a known state at power up.

There are 50 accessible DC349 registers:

- o Eight (one per channel) each:

  Receiver Buffer

  Transmitter Holding Register

  Status Register

  Mode Register 1

  Mode Register 2

  Command Register

- o Interrupt Summary Register

- o Data Set Change Summary Register

The format for the 16-bit DC349 register address is:

HHH LL XXX w X nnn rrr

The format is described in the following table.

ADDR	State	Description
15:13	HHH	SEL BNK 7--asserted to access all I/O Registers.
12:11	LL	SEL DC349--asserted to access all DC349 registers.
10:08	XXX	Don't care--not used for any DC349 register access.
07	w	Write bit, where:
	H	DC349 register read operation
	L	DC349 register write operation.
06	X	Don't care--not used for any DC349 register access.
05:03	nnn	Binary-coded channel number, where:
	LLL	channel 0
	LLH	channel 1
	LHL	channel 2
	LHH	channel 3
	HLL	channel 4
	HLH	channel 5
	HHL	channel 6
	HHH	channel 7
02:00	rrr	Register select code, where:

ADDR State	Description
LLL	Receiver Buffer (ADDR 07 = H)
LLL	Transmitter Holding Register (ADDR 07 =
LLH	L)
LHL	Status Register
LHH	Mode Registers 1 and 2 [1]
HLL	Command Register
HLH	Interrupt Summary Register
HHL	Data Set Change Summary Register
HHH	Not used
	Not used

[1] Mode Registers 1 and 2 are accessed by sequential operations (read/read, read/write, write/read, or write/write) to the same address. The first operation accesses Mode Register 1, the next Mode Register 2, the next Mode Register 1, and so on.

The register formats are described in the following subsections.

2.2.8.1 DC349 Receiver Buffer and Transmitter Holding Register

The Receiver Buffer (Figure 2-7) and Transmitter Holding Register (Figure 2-8) occupy the same address space on the chip; however, receiver (read) and transmitter (write) addresses are different because ADDR 07 controls the read/write function. The Receiver Buffer comprises a 2-entry FIFO and a character assembly register. The Transmitter Holding Register comprises a 2-entry FIFO and a serialization register. Receiver Buffer bits are described in Table 2-8, and Transmitter Holding Register bits are described in Table 2-9.

Figure 2-7: DC349 Receiver Buffer Format

ASD-1109

Table 2-8: DC349 Receiver Buffer Bit Description

Bit	Name	Access	Description
07:00	-	Read Only	Received Data

Figure 2-8: DC349 Transmitter Holding Register Format

ASD-1110

Table 2-9: DC349 Transmitter Holding Register Bit Description

Bit	Name	Access	Description
07:00	-	Write Only	Transmit Data

2.2.8.2 DC349 Status Register

The octalart Status Register is described in Figure 2-9 and Table 2-10.

Figure 2-9: DC349 Status Register Format

ASD-1111

Table 2-10: DC349 Status Register Bit Description

Bit	Name	Access	Description
07	DSR	Read Only	Data Set Ready. Indicates the inverted state of the -DSR pin. Not used in the peripheral repeater.
06	DCD	Read Only	Data Carrier Detect. Indicates the inverted state of the -DCD pin. A transition on this pin is interpreted as a device present signal.
05	FER	Read Only	Framing Error. When set, indicates the character in the Receiver Buffer was not framed by a stop bit.

Table 2-10 (Continued): DC349 Status Register Bit Description

Bit	Name	Access	Description
04	ORR	Read Only	Overrun Error. When set, indicates the character in the Receiver Buffer was not read before another character was received.
03	PER	Read Only	Parity Error. When set, indicates the character in the Receiver Buffer was received with incorrect parity.
02	TXEMT	Read Only	Transmitter Empty. When set, indicates the transmitter serialization logic has completed transmitting a character.
01	RXRDY	Read Only	Receiver Buffer Ready. When set, indicates a character has been received.
00	TXRDY	Read Only	Transmitter Holding Register Ready. When set, indicates the Transmitter Holding Register is empty and will cause an interrupt if TXIE (Command Register bit 01) is set.

2.2.8.3 DC349 Mode Register 1

Mode Register 1 and Mode Register 2 have the same address and are accessed by sequential operations (read/read, read/write, write/read, or write/write) to that address. The first operation accesses Mode Register 1, the next Mode Register 2, the next Mode Register 1, and so on. Reading the Command Register resets the sequential counter to point to Mode Register 1.

Figure 2-10: DC349 Mode Register 1 Format

ASD-1112

Table 2-11: DC349 Mode Register 1 Bit Description

Bit	Name	Access	Description
07:06	STOP	Read/Write	Stop Bits, where:
0 0			not used
0 1			1 stop bit
1 0			1-1/2 stop bits
1 1			2 stop bits

Table 2-11 (Continued): DC349 Mode Register 1 Bit Description

Bit	Name	Access	Description
05:04	PARITY	Read/Write	Parity Control, where:
0 0			parity disabled
0 1			odd parity enabled
1 0			even parity enabled
1 1			
03:02	CHARL	Read/Write	Character Length, where:
0 0			5 data bits
0 1			6 data bits
1 0			7 data bits
1 1			8 data bits
00	MCIE	Read/Write	Modem Control Interrupt Enable. When set in conjunction with RXIE (Command Register bit 05), enables DSR and DCD interrupts.
01	-	-	Not used.

2.2.8.4 DC349 Mode Register 2

Mode Register 1 and Mode Register 2 have the same address and are accessed by sequential operations (read/read, read/write, write/read, or write/write) to that address. The first operation accesses Mode Register 1, the next Mode Register 2, the next Mode Register 1, and so on. Reading the Command Register resets the sequential counter to point to Mode Register 1.

Figure 2-11: DC349 Mode Register 2 Format

ASD-1113

Table 2-12: DC349 Mode Register 2 Bit Description

Bit	Access	Description
07:04	Read/Write	Transmitter Baud Rate
03:00	Read/Write	Receiver Baud Rate, where:
0000		50.0 baud
0001		75.0 baud
0010		110.0 baud
0011		134.5 baud
0100		150.0 baud
0101		300.0 baud
0110		600.0 baud
0111		1200.0 baud
1000		1800.0 baud
1001		2000.0 baud
1010		2400.0 baud
1011		3600.0 baud
1100		4800.0 baud
1101		7200.0 baud
1110		9600.0 baud
1111		19200.0 baud

2.2.8.5 DC349 Command Register

Figure 2-12: DC349 Command Register Format

ASD-1114

Table 2-13: DC349 Command Register Bit Description

Bit	Name	Access	Description
07:06	OP MODE	Read/Write	Operating Mode, where:
0 0			normal operation
0 1			automatic echo [1]
1 0			local loopback
1 1			remote loopback [1]
05	RXIE	Read/Write	Receiver Interrupt Enable. When set, enables reception of a character to generate an interrupt.
04	RERR	Read/Write	Reset Error. Set by software to clear Status Register error flags FER, ORR, and PER.

[1] Not used in VAXstation 8000.

Table 2-13 (Continued): DC349 Command Register Bit Description

Bit	Name	Access	Description
03	TXBRK	Read/Write	Transmit Break. When set, forces a BREAK condition until this bit is reset.
02	RXEN	Read/Write	Receiver Enable. When set, enables receiver operation.
01	TXIE	Read/Write	Transmitter Interrupt Enable. When set, enables TxRDY to cause an interrupt.
00	TXEN	Read/Write	Transmitter Enable. When set, enables transmitter operation.

2.2.8.6 DC349 Interrupt Summary Register

If ADDR 02 is set when the DC349 registers are addressed, the channel number (ADDR <05:03>) is ignored and either the Interrupt Summary Register or Data Set Change Summary Register is addressed.

Figure 2-13: DC349 Interrupt Summary Register Format

ASD-1115

Table 2-14: DC349 Interrupt Summary Register Bit Description

Bit	Name	Access	Description
07	IRQ	Read Only	Interrupt Request. When set, indicates that an interrupt has occurred. The source of the interrupt is indicated by <3:0>.
06:04	–	–	Always read as zero.

Table 2-14 (Continued): DC349 Interrupt Summary Register Bit Description

Bit	Name	Access	Description
03:01	INT LN	Read Only	Interrupting Line Number, where:
000			channel 0
001			channel 1
010			channel 2
011			channel 3
100			channel 4
101			channel 5
110			channel 6
111			channel 7
00	TX/-RX	Read Only	Transmit/-Receive. Set when the interrupt source is the transmitter; clear when the interrupt source is the receiver.

2.2.8.7 DC349 Data Set Change Summary Register

If ADDR 02 is set when the DC349 registers are addressed, ADDR <05:03> (the channel number) is ignored and either the Interrupt Summary Register or Data Set Change Summary Register is addressed.

Figure 2-14: DC349 Data Set Change Register Format

ASD-1116

Table 2-15: DC349 Data Set Change Summary Register Bit Description

Bit	Name	Access	Description
07:00	DSCHNG 7:0	Read Only	Data Set Change. A set bit indicates a change in the state of either -DSR or -DCD for the corresponding channel. If MCIE (Mode Register 1 bit 00) is set, Data Set Change will cause an interrupt.

2.2.8.8 DC349 Interrupts

The IRQ output of the DC349 is controlled by an interrupt scanner, which sequentially checks channels 0 through 7 for a receiver interrupt condition, then checks channels 0 through 7 for a transmitter interrupt condition. If stopped for a receiver interrupt condition, the scanner resumes the sequential scan from the point at which it was stopped. If stopped for a transmitter interrupt condition, the scanner restarts the scan with receiver channel 0. Any interrupt must be serviced before subsequent interrupts can be posted.

Three conditions can cause an interrupt:

- A channel’s receive buffer is full and receive interrupts are enabled for that channel (RXIE is set).
- A transition occurs on a channel’s carrier detect line (DCD) and modem control interrupts are enabled for that channel (MCIE is set).
- A channel’s transmitter holding register is empty and transmit interrupts are enabled for that channel (TXIE is set).

2.2.9 Interactive Device Receivers and Transmitters

As shown in Figure 2-6, serial data is transferred between the DC349 OCTALART and the interactive devices through eight drivers (DRVR) and eight receivers (RCVR). The drivers and receivers provide the TTL signal levels required by the DC349 and the RS232/RS422 signal levels required by the interactive devices.

Each receiver and driver is connected to an ESD/EOS (electrostatic discharge and electrical overstress) protection circuit. Each of these circuits consists of a bidirectional zener diode and a resistor.

In addition, inverters (INVT) are connected between the device present lines from the applicable devices and the DC349 carrier detect pins on the following ports:

Port	1	2	3	4	6
Connector	J8	J7	J3	J4	J14

2.2.10 Function Register

The Function Register, Figure 2-15, consists of two flip-flops and drivers connected to the data lines and the tricolor Function LED on the rear panel of the peripheral repeater. This register is addressed as described in Table 2-6. The register format is described in Figure 2-16 and Table 2-16.

The Function LED glows either red, yellow, or green, as follows:

- Red

  When the peripheral repeater is in manufacturing mode, the Function LED glows red, except when the Function Register is being tested.

- Yellow

  During power-up, the Function LED glows yellow. If an error that will make the system unusable is detected during power-up, the following actions occur:

  1. The Function LED remains yellow.

  2. An error code is displayed in the Diagnostic Register.

  3. The peripheral repeater does not go into operational mode.

  Errors that prevent the peripheral repeater from entering operational mode are 8031 errors detected by the 8031 tests listed in Section 3.2.

  If there are no errors that make the peripheral repeater unusable, the Function LED will turn green.

- Green

  After the Function LED turns green, the peripheral repeater waits for the KA800 to respond to the diagnostic report with an ACK/NAK (see Section 2.3), indicating that the communications link between the KA800 and the peripheral repeater is established. If the link is not established, a KA800 error code is loaded into the Diagnostic Register and the peripheral repeater enters operational mode. If the link is later established, the error code is cleared. Table 2-18 gives a summary of the Diagnostic and Function LED indications.

Figure 2-15: Function Register Block Diagram

ASD-1117 (to be corrected)

Figure 2-16: Function Register Format

ASD-1118

Table 2-16: Function Register Bit Description

Bit	Access	Description	Function LED
07:02	-	Not used.	
01:00	Read/Write	Function Code, where:	
0 0		Self-test mode.	Yellow
0 1		Self-test mode.	Green
1 0		Operating mode.	Red
1 1		Manufacturing mode.	

2.2.11 Diagnostic Register

The Diagnostic Register, Figure 2-17, consists of eight flip-flops and drivers connected to the data lines and diagnostic LEDs. The register is addressed as described in Table 2-6. The register format is described in Figure 2-18 and Table 2-17.

Table 2-18 gives a summary of the Diagnostic and Function LED indications.

Figure 2-17: Diagnostic Register Block Diagram

ASD-1121

Figure 2-18: Diagnostic Register Format

ASD-1119

Table 2-17: Diagnostic Register Bit Description

Bit	Name	Access	Description
07	PR	Read/Write	Peripheral Repeater bit. When set, lights diagnostic LED 7. This bit is interpreted according to Table 2-18 and Table 2-19.
06	SYS	Read/Write	System bit. When set, lights diagnostic LED 6 and indicates a KA800 error. The code displayed in diagnostic LEDs 5 through 0 apply to the KA800. See Table 2-18 and Table 2-19.
05:00	-	Read/Write	Error/Test Code--These bits drive diagnostic LEDs 5 through 0 and are combined with <07:06> to make up the 2-digit hexadecimal code that indicates the failed test or error code. See Table 2-18 and Table 2-19.

Table 2-18: Diagnostic and Function LED Indication Summary

Function LED	Diagnostic LEDs [1]		Description
	76	543210	
Green	00	000000	No peripheral repeater (PR) or KA800 errors. PR is in operational mode.
Green	01	eeeeee	KA800 error, no PR error. PR is in operational mode. [2]
Green	10	eeeeee	PR error, no KA800 error. PR is attempting to enter operational mode. [3]
Yellow	10	dddddd	Self-test. PR is executing self-test.
Yellow	10	eeeeee	PR 8031 error. PR will not enter operational mode. [3]
Red	10	dddddd	Manufacturing mode. PR is in manufacturing mode.

[1] 1 = on, 0 = off, d = dynamic, e = error code.
[2] For additional information on error codes see the VAXstation 8000 System Manual.
[3] 8031 errors are the only errors which will prevent the peripheral repeater from entering operational mode.

Table 2-18 (Continued): Diagnostic and Function LED Indication Summary

Function LED	Diagnostic LEDs [1]		Description
Red	10	eeeeee	Error detected while the PR is in manufacturing mode.
Green	11	eeeeee	PR and KA800 error. Error code applies to KA800. PR is attempting to enter operational mode. [2]?[3]

[1] 1 = on, 0 = off, d = dynamic, e = error code.
[2] For additional information on error codes see the VAXstation 8000 System Manual.
[3] 8031 errors are the only errors which will prevent the peripheral repeater from entering operational mode.

Table 2-19: Diagnostic LED Code Description

Function LED	Diagnostic LEDs 76543210 [1]	Code [2]	Failed Test or Error
Green	00000000	none	No problems, system totally functional
Green	01000000	40	KA800 did not respond to a packet with ACK/NAK in the allotted time.
Red or yellow	10000001	81	8031
Red or green [3]	10000010	82	Diagnostic register
Red or green [3]	10000011	83	Function register
Red or green [3]	10000100	84	External RAM
Red or green [3]	10000101	85	ROM checksum
Red or green [3]	10000110	86	Unsolicited interrupt received

[1] 1 = on, 0 = off, nnn = channel number.
[2] Hexadecimal.
[3] The Function LED may be yellow an instant before it turns green.

Table 2-19 (Continued): Diagnostic LED Code

Function LED	Diagnostic LEDs 76543210 [1]	Description Code [2]	Failed Test or Error
Red or green [3]	10001nnn		DC349 error generating or receiving an interrupt, where:
	10001000	88	Channel 0
	10001001	89	Channel 1
	10001010	8A	Channel 2
	10001011	8B	Channel 3
	10001100	8C	Channel 4
	10001101	8D	Channel 5
	10001110	8E	Channel 6
	10001111	8F	Channel 7
Red or green [3]	10010nnn		DC349 register error, where:
	10010000	90	Channel 0
	10010001	91	Channel 1
	10010010	92	Channel 2
	10010011	93	Channel 3
	10010100	94	Channel 4
	10010101	95	Channel 5
	10010110	96	Channel 6
	10010111	97	Channel 7
Red or green [3]	10011nnn		DC349 local loopback error, where:

Table 2-19 (Continued): Diagnostic LED Code

Function LED	Diagnostic LEDs 76543210 [1]	Description Code [2]	Failed Test or Error

[1] 1 = on, 0 = off, nnn = channel number.
[2] Hexadecimal.
[3] The Function LED may be yellow an instant before it turns green.

Table 2-19 (Continued): Diagnostic LED Code

Function LED	Diagnostic LEDs 76543210 [1]	Description Code [2]	Failed Test or Error
	10011000	98	Channel 0
	10011001	99	Channel 1
	10011010	9A	Channel 2
	10011011	9B	Channel 3
	10011100	9C	Channel 4
	10011101	9D	Channel 5
	10011110	9E	Channel 6
	10011111	9F	Channel 7
Red	10100nnn		DC349 external loopback error, where: 4
	10100000	A0	Channel 0
	10100001	A1	Channel 1
	10100010	A2	Channel 2
	10100011	A3	Channel 3
	10100100	A4	Channel 4
	10100101	A5	Channel 5
	10100110	A6	Channel 6
	10100111	A7	Channel 7
Red	10101nnn		DC349 DSR or DCD error, where: 4

[1] 1 = on, 0 = off, nnn = channel number.
[2] Hexadecimal.
4 These tests are run only in manufacturing mode.

Table 2-19 (Continued): Diagnostic LED Code

Function LED	Diagnostic LEDs 76543210 [1]	Description Code [2]	Failed Test or Error
	10101000	A8	Channel 0
	10101001	A9	Channel 1
	10101010	AA	Channel 2
	10101011	AB	Channel 3
	10101100	AC	Channel 4
	10101101	AD	Channel 5
	10101110	AE	Channel 6
	10101111	AF	Channel 7

[1] 1 = on, 0 = off, nnn = channel number.
[2] Hexadecimal.

2.2.12 Power Up and Power Monitor Circuits

The Power Up and Power Monitor circuits are shown in Figure 2-19. The Power Up circuit consists of an RC circuit and several inverters. When power is turned on, the RC circuit charges up to a HIGH level at the input to the first of three Schmitt-trigger inverters (ST INVT), which provide the PWR UP A L and PWR UP B L outputs. A buffer inverter (BFFR INVT) provides the PWR UP H output.

The Power Monitor is based on four comparators which sense overvoltage and under-voltage conditions in the +12V and -12V supplies. The +2V reference input for the four comparators (two OVER and two UNDER) is provided by an operational amplifier (+2V REF), which is controlled by a 1.25V zener diode. The other input to each of the comparators is a voltage divider.

Under normal conditions, the voltage dividers (>+2V) for the overvoltage comparators provide an input level that is greater than +2V, and the voltage dividers (<+2V) for the overvoltage comparators provide an input level that is less than +2V. In this state, the output of the comparators is HIGH and the preset input to the flip-flop (F/F) is not asserted. The F/F is cleared at power up, and the Power Status LED (PWR LED) glows green.

If the comparator input from either >+2V divider is less than +2V, or the comparator input from either <+2V divider is greater than +2V, the output of the associated comparator will go LOW, asserting the preset input to the F/F and causing the PWR LED to glow red.

The monitor reacts to over and under voltage conditions in excess of +12V+15% and -12V+15%.

Figure 2-19: Power Up and Power Monitor Block Diagram

ASD-1122 (to be corrected)

2.3 Operational Firmware

The peripheral repeater operational firmware and diagnostic firmware occupy less than 4 kbytes of the 8-kbyte program memory ROM on the PRB. The diagnostic firmware is described in Chapter 3. All the firmware is run by the 8031 microprocessor.

When power is turned on, the diagnostics are run. When testing is completed, the diagnostics leave the peripheral repeater in a known state:

- Data memory is initialized.
- Queues are cleared.
- The DC349 ARTs are set to the default interactive device baud rates and data formats (see Appendix A).
- The Diagnostic and Function registers are set to the appropriate values.
- A system status area containing peripheral repeater status is setup.

On completion of the self-test diagnostics, a diagnostic report is sent to the KA800, and the peripheral repeater enters operational mode. If there are no other messages to transmit, the peripheral repeater waits 10 seconds for an ACK/NAK (acknowledge/negative acknowledge) from the KA800. (Note that the ACK/NAK timeout for all other packets is 20 ms.) Reception of the ACK/NAK indicates a communications link is established between the peripheral repeater and the KA800. If the ACK/NAK is not received, an error code is loaded into the Diagnostic Register.

In either case, if the diagnostics have been completed without error, the peripheral repeater enters operational mode. When the operational firmware starts running, the DC349 ARTs are enabled, providing communications between the interactive devices and the KA800 through the peripheral repeater. In operational mode, the peripheral repeater is a communications concentrator between the interactive devices and the KA800.

A "keep-alive" timer is also enabled and is used to indicate that the link between the peripheral repeater and KA800 is active. For example, in the VAXstation 8000, the KA800 has a "watch-dog" timer with a 10-second interval. When it receives a null keep-alive message from the peripheral repeater, it resets its watch-dog timer.

2.3.1 Device Identification

The KA800 sends data to a physical port address. The address is taken from a KA800-maintained table of which device is attached to which DC349 port. This table identifies the device attached to the rear panel device connectors as follows (see Figure 2-6 and Table 2-22 for port and connector identification):

1. KA800 Port--If the KA800 is not connected, the system is inoperable.

2. LK201 Port--The KA800 ROM-based firmware checks for the LK201 keyboard. This keyboard is required as part of the host-processor system console.

3. Spare Port--If the spare port is connected, the attached device will be determined by the KA800 RAM-resident, user-supplied, operational firmware.

4. Other Ports--In its self-test report (sent at power-up or on request), the peripheral repeater reports which ports have an <u>active</u> device-present signal (any port except the KA800 port, LK201 keyboard port, or spare port).

   If the present device has the same connector configuration as another device (for example, the mouse and tablet), the KA800 determines which type of device is connected by requesting a self-test report from the device.

A device is marked as not present or unknown if:

- o It's device present signal is inactive.
- o It fails to respond to a self-test request from the KA800.

2.3.2 Communications Overview

All data received and transmitted by the peripheral repeater is handled by interrupt routines. These include routines to handle packets to and from the KA800 and various multibyte commands and reports to and from the peripheral devices. The interrupt routines assemble/disassemble packets and move the packets/data to and from transmit and receive queues.

In general, data is transferred from the KA800 receive queue (receive queue 7) to some other channel transmit queue; and from some peripheral channel receive queue to the KA800 transmit queue (transmit queue 7).

2.3.2.1 Queues and Interrupt Routines

Transmit and Receive Queues: There are eight transmit queues and eight receive queues. A background process constantly scans the transmit and receive queues to see if they are empty. If the receive queue for a particular peripheral channel is not empty, its contents are transferred to transmit queue 7 (the transmit queue to the KA800). If a transmit queue is not empty, then the transmitter for that channel is enabled.

Commands from the KA800 to the peripheral repeater are received in receive queue 7 (the KA800 receive queue) and placed in transmit queue 8, where they are interpreted by the peripheral repeater. Receive queue 8 is also special in that it is primarily used internally by the peripheral repeater.

The Timer Interrupts Routine (described below) maintains the Send Keep Alive Flag. If this flag is set, then the Keep Alive Packet is loaded into transmit queue 7 (the transmit queue to the KA800).

Receive Interrupt Routine: This routine does the following:

- o Assembles data received from a peripheral device and places it in the receive queue associated with the device port.

- o Disassembles packets received from the KA800 and places the data in receive queue 7 (the queue for the KA800 port). The data includes a peripheral device ID, which enables the background process to move the data to the transmit queue associated with the device port.

Transmit Interrupt Routine: This routine does the following:

- o Transmits data to a peripheral from the transmit queue associated with the device port.

- o Assembles data into packets and transmits the packet to the KA800 from transmit queue 7 (the transmit queue associated with the KA800 port).

- o Resets the keep-alive timer.

- o Transmits ACK/NAK.

Timer Interrupts Routine: This routine does the following:

- o Sets the Send Keep Alive Flag if time expires.

- o Includes timers for peripheral data packeting, ACK/NAK, and port off/on functions.

Reports received from the peripheral devices are considered complete if the number of characters received equals the maximum report size for that device, or a character timeout occurs. In other words, there is a maximum report size associated with each port as well as a timeout based on the baud rate for that port.

For example, Appendix A shows that the maximum report size for the VSXXX-AB Tablet is the position report at 5 bytes, while its diagnostic report is 4 bytes. Because the tablet diagnostic report does not equal the maximum report size, character timeout is used to indicate the end of the report. At 4800 baud and 11 bits per character (1 start bit, 8 data bits, 2 stop bits), each character is transmitted in approximately 2.3 ms. Therefore, the timer for the tablet port is set to 2.3 ms. After the last character of the diagnostic report is sent, this timer expires, indicating that the report is complete.

2.3.2.2 Communications Protocol

Packets are exchanged between the peripheral repeater and KA800 as follows (see Figure 2-20).

Figure 2-20: Peripheral Repeater/KA800 Packet Format

ASD-1120

The originator sends its data and waits for an ACK (acknowledge) or NAK (negative acknowledge). If NAK is returned, the originator retransmits the previous packet. The receiving device, which sent the NAK, will discard the previous packet, and respond to the retransmitted packet as a new packet.

When the KA800 sends a T or R command to the peripheral repeater, it expects either an ACK or NAK to the command packet, and it also expects to receive a packet with the Reply bit (04) set in the DEV ID byte.

If an error occurs, the System Error bit (07) is set in the DEV ID byte and the packet contains only an error byte.

The packet format is shown in Figure 2-21 and described in Table 2-20. The DEV ID byte format is shown in Figure 2-22 and described in Table 2-22. The error byte codes are listed in Table 2-21.

Figure 2-21: Packet Protocol

ASD-1132

Table 2-20: Packet Format Description

Byte	Name	Size	Value [1]	Description
1	SOH	1 byte	1	Start of Header
2	DEV ID	1 byte	–	Device ID. See Figure 2-22 and Table 2-22.
3	BYTE COUNT	1 byte	–	The number of DATA bytes.
m:n	DATA	Variable	–	Data, message, or report bytes. The number of bytes depends on the interactive device (identified in DEV ID byte).
n+1	CHECKSUM	1 byte	–	The last byte. The value is the checksum for the complete packet.

[1] Hexadecimal

Table 2-20 (Continued): Packet Format Description

ByteName	Size	Value [1]	Description
ACK/NAK	1 byte	6/15	Acknowledge/Negative Acknowledge. The 1-byte response to a packet is either an ACK (byte value = 6) if the packet was received correctly, or a NAK (byte value = 15_16) indicating that something was wrong with the reception and the packet should be retransmitted.

[1] Hexadecimal

Table 2-21: System Error Report Error Codes

Code [1]	Description
01	Bad command sent from KA800.
02	Device queue overflow.

[1] Hexadecimal

Two methods of error checking are used on packets transmitted to and from the KA800:

1. A checksum for the transmission (add with carry).

2. Odd parity for each byte.

Figure 2-22: Device ID Byte Format

ASD-1123

Table 2-22: Device ID Byte Bit Description

Bit	Name	Description
07	SE	System Error. This bit is used to send error reports to the KA800. When this bit is set, the packet contains only an error byte. This byte contains one of the error codes listed in Table 2-21.
06	DC	Device Change. When set, this bit indicates that a device with a device present signal has been either connected to or disconnected from the peripheral repeater. When this bit is set, the packet contains only a configuration byte. In this byte a bit is set for each device that has a device present line connected to the peripheral repeater.

Table 2-22 (Continued): Device ID Byte Bit Description

Bit	Name	Description
05	KA	Keep Alive. This bit is used to send null transmissions to the KA800 if there has been no other transaction within approximately 10 seconds. This bit is set only for null, keep-alive transactions, and the device ID (<02:00>) is the peripheral repeater. When the KA800 receives this bit, it ignores <04:03> and resets its watchdog timer.
04	RPL	Reply. When set, this bit indicates to the KA800 that the information in the packet data bytes is in response to a KA800 request; it is not a report or data spontaneously originated by the peripheral repeater or an attached device. The reply bit is set in response to the T and R commands (described in Section 2.3.3).
03	RE	Reception Error. When set, this bit indicates that an error has occurred and is associated with the device identified in <02:00>. This bit is set by a parity, framing, or overrun error on the DC349 channel associated with the device.
02:00	DEV ID	Device ID. A 3-bit interactive device identity code, where:

Table 2-22 (Continued): Device ID Byte Bit Description

Bit	Name	Description
000		LK201 Keyboard
001		VSXXX-AH Mouse or either tablet
010		VSXXX-AB or Evans & Sutherland Tablet or VSXXX-AH Mouse
011		VSXXX-DA Dial Array or Evans & Sutherland DIGIT Box
100		Evans & Sutherland Button Array
101		Spare Port 0
110		Evans & Sutherland Keyboard
111		Peripheral repeater including KA800 port [1]

[1] The KA800 port is considered to be part of the peripheral repeater and has the same device ID.

2.3.2.3 Device Self-Test Commands

Note that if the KA800 sends a self-test command directly to a peripheral (the device ID is not 7), the protocol is the same as it is for a command to the peripheral repeater, but the DEV ID byte of the response packet differs as follows.

- o Peripheral repeater command response:

  Reply bit: set

  Device ID: 7

- o Peripheral device command response:

  Reply bit: clear

  Device ID: 0 through 6

There are no peripheral repeater commands for testing individual peripherals.

2.3.2.4 Overrun Errors

If a device overrun error occurs, data may be lost. When the peripheral repeater gets an overrun error and continues to receive data from that device before it can empty the device's queue, the receiver for that device is turned off for 10 ms. The receiver is then turned on, and received data is assembled into a packet and placed in the KA800 transmit queue. Data transmitted by the device during the 10 ms receiver-off time is lost.

2.3.2.5 Maximum Bytes per Transmission

Device responses or reports transmitted to the peripheral repeater are limited to a maximum of six consecutive data bytes. If a peripheral device transmits more than six consecutive data bytes without a null period between bytes, the peripheral repeater assembles separate packets, each with a maximum of six data bytes.

Packets transmitted to the peripheral repeater from the KA800 are not checked for a maximum number of data bytes. However, KA800 packets should be limited to no more than nine data bytes. The peripheral repeater can safely store up to 256 packets, each having nine data bytes, and warn the KA800 if a queue overflow occurs. Alternatively, the peripheral repeater can accept larger packets less frequently; for example, it can accept 128 packets, each having 18 data bytes, with a longer null period between packets.

2.3.2.6 Timers

Device Intercharacter Timer: Timers are used to handle the assembly of device data into packets for transmission to the KA800. When the peripheral repeater receives a null period between bytes from a device, it closes the packet and places it on the KA800 transmit queue. The null period is equal to two character times, based on the baud rate of the device port.

KA800 Intercharacter Timer: By default, the null time between bytes received from the KA800 is 10 ms. If this time expires, the peripheral repeater transmits a NAK to the KA800. Note that this intercharacter timer is not the same as ACK/NAK timer described below. If the KA800's default baud rate is changed, the intercharacter timer reverts to two character times, based on the new baud rate.

ACK/NAK Timer: This is a 20 ms timer, set as soon as the last byte (checksum) in a packet is transmitted to the KA800. If this time expires before the KA800 returns an ACK or NAK, the peripheral repeater transmits the next packet in the KA800 transmit queue.

Keep-Alive Timer: If no other packets are sent to the KA800 before this 10 second timer expires, a null packet is transmitted to the KA800.

2.3.3 Peripheral Repeater Commands

The KA800 encodes the following commands in the data bytes of a packet to the peripheral repeater.

2.3.3.7 T Command (Self-Test)

In response to this command, the peripheral repeater runs self-test and returns a self-test report, including configuration information, to the KA800. This command temporarily disconnects the peripheral repeater from the KA800 for less than 10 seconds. The command packet format is shown in Figure 2-23, where bytes 1, 2, 3, and 5 are as described in Table 2-20. Byte 4 has the value 84 (54_16), the ASCII value for the letter T. The self-test report is described in Section 2.3.3.2.

Figure 2-23: T Command Packet Format

ASD-1124

2.3.3.2 Self-Test Report

The peripheral repeater transmits this report to the KA800 at the completion of self-test either at power up or in response to a self-test command, and in response to a report status command. The report packet format is shown in Figure 2-24, where bytes 1 and 8 are as described in Table 2-20. Bytes 2 through 7 are as follows:

- o Byte 2 is the device ID byte and has a value of 23 (17_16). This value indicates that the device ID (bits <03:00>) is 7 and the Reply bit (bit 04) is set.
- o Byte 3 is the number of data bytes and has a value of 4.
- o Byte 4 is a two-digit hexadecimal error code, different from byte 5 (see Table 2-19 for the error codes).

- Byte 5 is a two-digit hexadecimal error code, different from byte 4 (see Table 2-19 for the error codes).

- Byte 6 is the bit-encoded configuration, where bit n is set if a device with an active device present signal is attached to port n.

- Byte 7 is the hexadecimal value of the peripheral repeater's firmware revision.

Figure 2-24: Self-Test Report Packet Format

ASD-1125

2.3.3.3 R Command (Report Status)

The report status command requests the status of the peripheral repeater, including peripheral configuration. In response to this command the peripheral repeater returns a self-test report (described in Section 2.3.3.2). The command packet format is shown in Figure 2-25, where bytes 1, 2, 3, and 5 are as described in Table 2-20. Byte 4 has the value 82 (52_{16}), the ASCII value for the letter R.

Figure 2-25: R Command Packet Format

ASD-1126

2.3.3.4 C Command (Change Baud Rate)

The change baud rate command has two formats:

7-Byte Format: This format requests a specified baud rate on a specified port. The command packet format is shown in Figure 2-26, where bytes 1, 2, 3, and 7 are as described in Table 2-20. Bytes 4 through 7 contain the following:

- o Byte 4 has the value 67 (43_16), the ASCII value for the letter C.
- o Byte 5 is the binary-coded port number, as shown in Table 2-23.
- o Byte 6 is the hexadecimal-coded baud rate as shown in Table 2-24.

Figure 2-26: C Command Packet 7-Byte Format

ASD-1127

9-Byte Format: This format requests a specified baud rate, parity, and bits/character on the Spare port only. The command packet format is shown in Figure 2-27, where bytes 1, 2, 3, and 9 are as described in Table 2-20. Bytes 4 through 9 contain the following:

- o Byte 4 has the value 67 (43_16), the ASCII value for the letter C.

- o Byte 5 is the binary-coded port number, and always has a value of 5 (Spare port) in this packet format.)

- o Byte 6 is the hexadecimal-coded baud rate as shown in Table 2-24.

- o Byte 7 is the ASCII-coded parity, as shown in Table 2-25.

- o Byte 8 is the hexadecimal-coded number of bits per character, as shown in Table 2-26.

Figure 2-27: C Command Packet 9-Byte Format

ASD-1128

Table 2-23: Port Number Codes

Code	Port
00000000	LK201 Keyboard
00000001	Mouse
00000010	Tablet
00000011	Dial Array
00000100	Evans & Sutherland Button Array
00000101	Spare
00000110	Evans & Sutherland Keyboard
00000111	Peripheral Repeater KA800 Port

Table 2-24: Baud Rate Codes

Baud Rate	Hexadecimal Value

Table 2-24 (Continued): Baud Rate Codes

Baud Rate	Hexadecimal Value
50.0	00
75.0	01
110.0	02
134.5	03
150.0	04
300.0	05
600.0	06
1200.0	07
1800.0	08
2000.0	09
2400.0	0A
3600.0	0B
4800.0	0C
7200.0	0D
9600.0	0E
19200.0	0F

Table 2-25: Parity Codes

Parity	ASCII Code	Decimal Value	Hexadecimal Value
Even	E	69	45
None	N	78	4E
Odd	O	79	4F

Table 2-26: Bits/Character Codes

Bits/Character	Hexadecimal Value
5	05
7	06
6	07
8	08

2.3.3.5 L Command (Light LED)

The light LED command specifies a pattern to be displayed in diagnostic LEDs 6:0. Note that only LEDs 6:0 can be controlled by this command; LED 7 is controlled by the peripheral repeater and is used only for error display. The command packet format is shown in Figure 2-28, where bytes 1, 2, 3, and 6 are as described in Table 2-20. Bytes 4 and 5 are coded as follows.

- o Byte 4 has the value 76 ($4C_{16}$), the ASCII value for the letter L.
- o Byte 5 is bit pattern to light the LEDs, where:

  1 = on

  0 = off

  Bit 6 = LED 6

  Bit 0 = LED 0

Figure 2-28: L Command Packet Format

ASD-1129

2.4 H7820 Power Supply

The H7820 is a switching-mode power supply with the following specifications.

Table 2-27: H7820 Power Supply Specifications

Parameter	Specification
Input	
Power	160 W
Voltage Current	115 Vac nom (88 to 132 Vac), H7820-AA 2.4 A maximum, H7820-AA
Voltage Current	230 Vac nom (176 to 264 Vac), H7820-AB 1.3 A maximum, H7820-AB
Output	
Power	104 W
+5.1 Vdc	A+4.85 to +5.35 Vdc @ 3.0 to 10.00
+12.1 Vdc	+11.50 to +12.70 Vdc @ 0.5 to 4.00 A
-12.0 Vdc	-11.40 to -12.60 Vdc @ 0.0 to 0.25 A

The H7820 circuit board is connected to the peripheral repeater circuit board with 12 wires, terminated in connector P11. The pin assignments are listed in Table 2-28.

Table 2-28: H7820 Connector P11 Pin Assignments

Pin	Assignment
1:4	+5.1 Vdc
5:8	Ground
10	Ground
12	Ground
9	+12.1 Vdc
11	−12.0 Vdc

Chapter 3

Diagnostics

This chapter describes the peripheral repeater diagnostics and how they are used.

3.1 Introduction

The peripheral repeater firmware includes diagnostic tests that are run at power-up for self-test, on command for fault isolation, and for manufacturing tests. These are all the same diagnostics, with additional diagnostics for manufacturing mode. The diagnostics check the peripheral repeater logic. They do not test attached devices, request attached devices to run self-tests, or report the results of attached device self-tests. The operational and diagnostic firmware are resident in the 8-kbyte program memory ROM on the PRB. Operational firmware is described in Section 2.3.

At power-up, the diagnostics have control of the peripheral repeater and perform self-tests on the logic. If the appropriate loopback is connected to the KA800 port on the peripheral repeater, the diagnostics run in manufacturing mode.

In manufacturing mode the diagnostics loop continuously and do not enter operational mode. No devices are attached, and loopbacks are connected to all DC349 ports. If an error is detected in this mode, the diagnostics loop continuously on the test that detected the error.

The peripheral repeater mode is reported in the tricolor Function LED and the diagnostic status is reported in the eight diagnostic LEDs. These LEDs are driven by the Function and Diagnostic registers, described in Chapter 2, and are located on the peripheral repeater rear panel. In manufacturing mode, the Function LED is always red (except during the Function Register test).

The following is a list of some of the diagnostics' capabilities and limitations.

- The diagnostics execute the manufacturing test and power-up tests in less than 10 seconds.

- The diagnostics will isolate the peripheral repeater if it is the failing FRU (field replaceable unit).

- When possible, the diagnostics indicate which peripheral repeater component(s) failed (hardware fault isolation to the component level is not a diagnostic design goal).

- Report detected hardware failures in the diagnostic LEDs.

- Report VR290 monitor failure as a system error in the diagnostic LEDs.

3.2 Self-Test

The power-up self-test verifies peripheral repeater operation at power-up or on command.

The power-up self-test tests the peripheral repeater circuit board extensively, but does not fully test the transmitter/receiver side of the DC349 OCTALART. The power-up self-test includes:

- 8031 microprocessor tests:

  Internal RAM

  Programmable timers

  Interrupts

  Condition codes (Processor Status Word register)

  Internal I/O ports 0 and 2

  Addressing (data pointer)

- Peripheral repeater circuit board tests:

  SRAM

  ROM (pseudocyclic redundancy check)

  Diagnostic and Function registers

  DC349 registers and local loopback

  DC349 interrupts

3.2.1 Running Self-Test

Self-test is run automatically at power-up. In the VAXstation 8000, it can also be run on command as a subtest under the KA800 self-test RBD (ROM-based diagnostic). For information on running KA800 RBDs, see the VAXstation 8000 System Manual.

3.2.2 Exiting Self-Test

At the completion of self-test, the Function LED turns green and the peripheral repeater waits for the KA800 to respond to the diagnostic report with an ACK/NAK (see Section 2.3), indicating that the communications link between the KA800 and the peripheral repeater is established. If the link is not established, a KA800 error code is loaded into the Diagnostic Register and the peripheral repeater enters operational mode. If the link is later established, the error code is cleared.

3.3 Manufacturing Mode

The peripheral repeater is put into manufacturing mode by connecting the special manufacturing loopback to the KA800-port rear-panel connector, J2. This loopback connects pin 7 of 8031 microprocessor Port 1 to ground. When this loopback is connected, the tricolor Function LED glows red (except during the Function Register test). The manufacturing mode tests expect loopbacks to be attached to the rear panel connectors for all the DC349 ports with device present signals implemented:

Port	1	2	3	4	6
Connector	J8	J7	J3	J4	J14

In manufacturing mode, the same tests are executed as in power-up self-test. Two additional tests are also run:

- An external loopback test tests the transceiver/receiver side of all the DC349 ports, including the connection to the rear panel connectors.

o All DC349 port DSR (data set ready) and DCD (carrier detect) functions are tested. This verifies that:

  DSR and DCD pins not used for device present are connected to ground at the DC349. This sets the DSR and DCD bits in the channel's Status Register (see Figure 2-9 and Table 2-10).

  DCD pins which are used for device present are connected to ground at the port's rear panel connector. This clears the DCD bit in the channel's Status Register because of the intervening inverter (see Figure 2-9 and Table 2-10).

It is these two additional manufacturing tests that require external loopbacks on all DC349 port connectors.

In this mode, the diagnostics will loop continuously until either peripheral repeater power is turned off or the special manufacturing loopback is removed from the host port connector. In addition, the manufacturing test will loop continuously if a hard or intermittent error is detected, displaying the number of the failing test in the diagnostic LEDs.

Chapter 4

Troubleshooting and Repair

Normally, the peripheral repeater is not repaired in the field; the entire internal assembly is replaced. This chapter briefly describes what to check before replacing the internal assembly.

4.1 Problem Summary

Peripheral repeater failures are indicated in two ways: by the front panel Power LED and/or by the KA800 RBDs. Table 4-1 lists the symptoms, possible causes, and action to take when a peripheral repeater failure is indicated.

4.2 Repair

The peripheral repeater is repaired by removing and replacing the internal assembly.

Note

The peripheral repeater internal assembly can be removed and replaced without removing the monitor from atop the peripheral repeater.

Table 4-1: Troubleshooting

Symptom	Cause	Action
Front panel Power LED is off on both the peripheral repeater and monitor. [1]	No ac power	Make sure wall receptacle circuit breaker is on. Make sure power cord is connected. Make sure power switch is on.

[1] It is assumed that the monitor power cord is connected to the peripheral repeater ac power out receptacle.

Table 4-1 (Continued): Troubleshooting

Symptom	Cause	Action
Front panel Power LED is off on peripheral repeater; monitor power LED is on. [1]	Peripheral repeater +5V power supply failure.	Replace periph- eral re- peater in- ternal assem- bly.
Front panel Power LED is red.	Peripheral repeater +12V or −12V power supply failure.	Replace periph- eral re- peater in- ternal assem- bly.
KA800 diagnostics indicate a peripheral repeater failure and the rear panel Function and Diagnostic LEDs contain one of the codes listed in Table 2-18 and Table 2-19. [2]	See Table 2-19	Replace periph- eral re- peater in- ternal assem- bly.

[1] It is assumed that the monitor power cord is connected to the peripheral repeater ac power out receptacle.
[2] The Function LED should never glow red if the manufacturing turnaround is not connected.

4.2.1 Removal

1. Turn the peripheral repeater ac power off.

2. Disconnect the power and peripheral cables from the rear panel of the peripheral repeater. Note the position of each cable.

3. Loosen the hex-socket cap screw at the top-center of the rear panel.

4. Slide the internal assembly out of the plastic cabinet.

4.2.2 Replacement

1. Slide the internal assembly into the plastic cabinet.

2. Tighten the hex-socket cap screw at the top-center of the rear panel.

3. Connect the power and peripheral cables to the rear panel of the peripheral repeater. See Figure 4-1 and Figure 4-2.

Figure 4-1: Pedestal, Monitor, and Peripheral Repeater Cables

ASD-1102

Figure 4-2: Peripheral Device Cables

ASD-1101

Appendix A

Interactive Device Parameters

This appendix lists the following information, as applicable, for the DC349 ports and/or the attached interactive devices.

- o Interface
- o Baud Rate
- o Data Format
- o Commands
- o Reports
- o Initialization
- o Mode

A.1 LK201 Keyboard

Interface: RS423

Baud Rate: 4800

Data Format: 1 start bit, 8 data bits, 1 stop bit

Data values from 255 through 64 represent matrix positions; values from 63 through 1 are reserved for other information, such as diagnostic status, ID, and so on.

Commands:

- Reinitialize keyboard (FD_16)
- Jump to self-test (CB_16)

Reports:

- Self-test. This report consists of four bytes:

  Byte 0: Firmware ID = 01 (first release)

  Byte 1: Hardware ID = 00 (first release)

  Byte 2: 0 or error code

  Byte 3: 0 or key code (stuck key)

A.2 VSXXX-AA Mouse

Interface: RS232

Baud Rate: 4800

Data Format: 1 start bit, 8 data bits, 1 parity bit (odd), 1 stop bit

Commands:

- Self-test. This command is T (54_16).

Reports:

- Self-test. This report consist of four bytes:

  Byte 0: A0_16(first release). The contents of the three most significant bits are equal to 101_2.

  Byte 1: 0xxx00102, where:
  0xxx = manufacturing ID and
  0010 = mouse data

  Byte 2: 0 or error code, where:
  3E_16= RAM/ROM error
  3D_16= switch failure

  Byte 3: 0 or switch failure

- Position report. This report consists of three bytes. The contents of the three most significant bits of byte 0 are equal to 100_2.

Mode: Prompt mode is the power-up default.

A.3 VSXXX-AB Tablet

Interface: RS232

Baud Rate: 4800

Data Format: 1 start bit, 8 data bits, 1 parity bit (odd), 1 stop bit

Commands:

- o Self-test. This command is either of the following:

  T (54_16)

  <BREAK> (minimum of two character times)

Reports:

- o Self-test. This report consist of four bytes:

  Byte 0: A0_16(first release). The contents of the three most significant bits are equal to 101_2.

  Byte 1: 0xxx0100_2, where:
  0xxx = manufacturing ID and
  0010 = tablet data

  Byte 2: 0 or one of the following error
  codes: 11_16
  13_16
  3A_16
  3D_16
  3E_16

  Byte 3: 0 or button code

- o Position report. This report consists of five bytes. The contents of the three most significant bits of byte 0 are equal to 110_2.

Mode: Request point mode is the power-up default.

A.4 GTCO Tablet

Interface: RS232

Baud Rate: 9600

Data Format: 1 start bit, 8 data bits, 2 stop bits

Reports:

- o Self-test. This report consists of four bytes. The contents of the three most significant bits of byte 0 are equal to 101_2.
- o Position report. This report consists of five bytes.

Initialization: Five initialization bytes are sent on power up. The value of each byte is:

- o FF_{16}if the tablet is 15.24 x 15.24 cm (6 x 6 in)
- o FE_{16}if the tablet is 30.48 x 30.48 cm (12 x 12 in)

Mode: Continuous output mode (62 points/second) is the power-up default.

A.5 VSXXX-DA Dial Array

Interface: RS423

Baud Rate: 9600

Data Format: 1 start bit, 8 data bits, 1 stop bit

Commands:

- o Self-test: 13_16(CTRL/S)

- o Revision report: 05_16(CTRL/E)

Reports:

- o Self-test. This is a 1-byte report.

- o Revision report. This report consists of six bytes:

  Bytes 5:4: CD (43_16 and 44_16) for Control Dials unit.

  Bytes 3:1: the ROM revision level

  Byte 0: either of the following:

  D (44_16) if the unit includes dial

  LEDs N (4E_16) if the unit does not include dial LEDs

- o Position report. This report consists of four bytes. Byte 0 = 16_16(CTRL/V).

A.6 Evans & Sutherland Controls Dials

Interface: RS423

Baud Rate: 9600

Data Format: 1 start bit, 8 data bits, 1 stop bit

Commands:

- o Self-test: 13_16(CTRL/S)
- o Revision report: 05_16(CTRL/E)

Reports:

- o Self-test. This is a 1-byte report.
- o Revision report. This report consists of six bytes:

  Bytes 5:4: CD (43_16 and 44_16) for Control Dials unit.

  Bytes 3:1: the ROM revision level

  Byte 0: either of the following:

  D (44_16) if the unit includes dial

  LEDs N (4E_16) if the unit does not include dial LEDs

- o Position report. This report consists of four bytes. Byte 0 = 16_16(CTRL/V)

A.7 Evans & Sutherland Button Array

Interface: RS232

Baud Rate: 9600

Data Format: 1 start bit, 8 data bits, 1 stop bit

Commands:

- o Self-test: 80_16.

Reports:

- o Self-test. This report consists of four bytes:

  Byte 0: Hardware ID = 64_16(first release).

  Byte 1: Firmware ID = 00 (first release).

  Byte 2: 0 or one of the following error codes: 3D_16= key down on self-test
  3E_16= ROM or RAM failure

  Byte 3: 0 or hexadecimal stuck key code

A.8 Evans & Sutherland Keyboard

Interface: RS232

Baud Rate: 1200

Data Format: 1 start bit, 8 data bits, 1 parity bit, 1 stop bit

Commands:

- o Reset: FF_16.

Reports:

- o Reset command responses:

  AA_16= keyboard is operational

  FC_16= RAM/ROM failure

Mode: Default is autorepeat at 10 characters/s after 500 ms initial delay.

A.9 Spare Port

Interface: RS232

Baud Rate: 9600

Data Format: 1 start bit, 8 data bits, 1 parity bit (odd), 1 stop bit

A.10 Host Port

Interface: RS232

Baud Rate: 19200

Data Format: 1 start bit, 8 data bits, 1 parity bit (odd), 1 stop bit

Commands: See Chapter 2, Section 2.3.3.

Reports: See Chapter 2, Section 2.3.3.2.