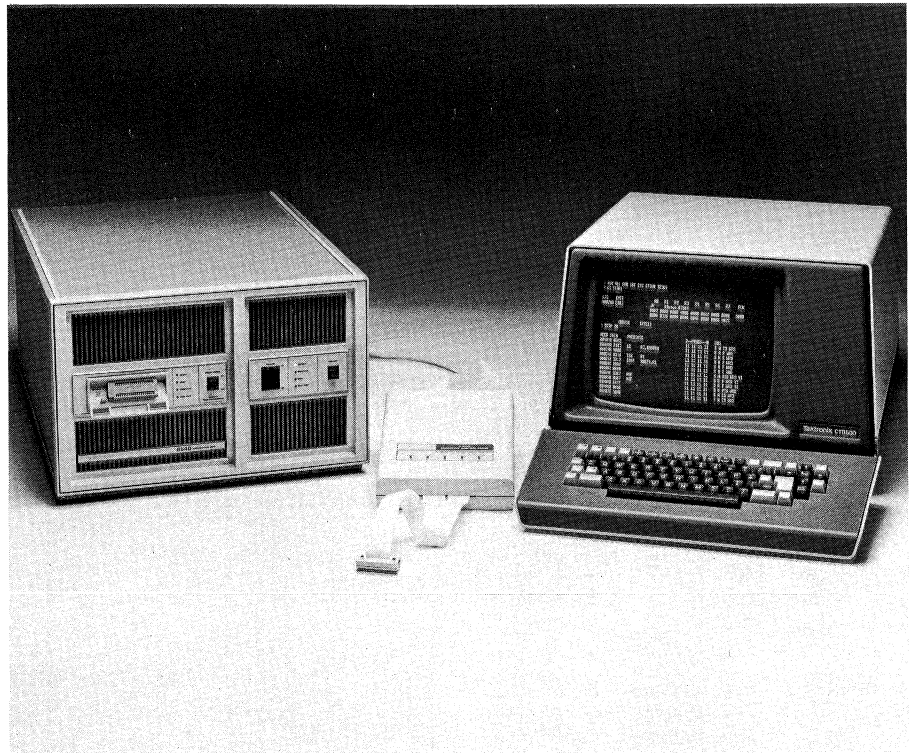# TEK 8540

8- and 16-bit emulators

Flexible host communications package

Compatible with Tektronix 8560 Multi-user Software Development Unit

Symbolic references

INTEGRATION UNIT

The Tektronix 8540 Integration Unit is used with a 8560 Multiuser Software Development Unit or a general host computer, to integrate, test and debug microprocessor based software. The 8540 supports the hardware and software integration phase of a microprocessor/micro-computer based design. The Tektronix 8560 or other host computer supports the software development task.

Application

8540 support is employed when the software has been developed to the object code level and is ready to be tested with the hardware. The object code binary program is downloaded to the 8540 and stored in its resident program memory or, if available, in the prototype's own memory. If the prototype hardware is not available, the software can be executed on the 8540 emulator processor using Mode 0 emulation.

A wide variety of emulators are available for in-circuit testing and debugging. For in-circuit testing, the emulator probe replaces the microprocessor chip in the prototype. In emulation mode 1 or mode 2, the software can interact directly with the prototype hardware.

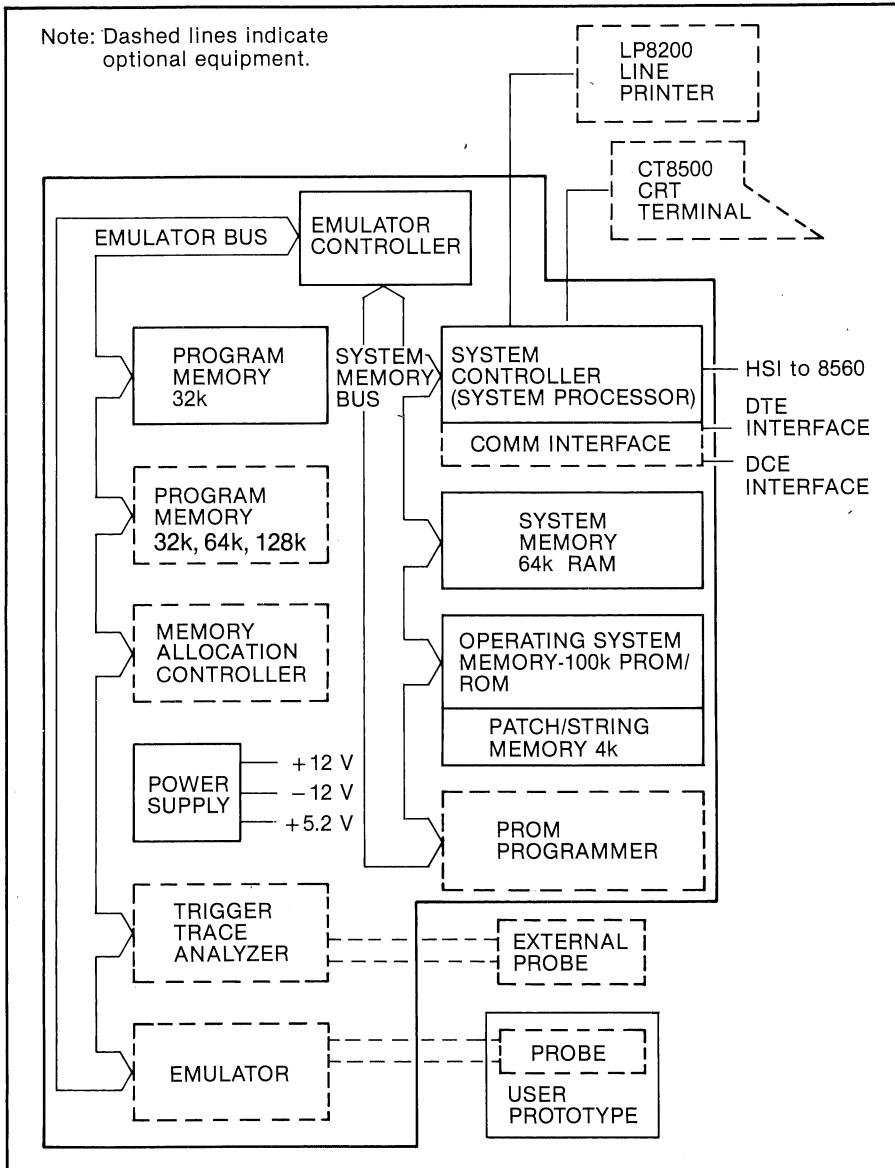The designer controls and monitors the testing process via a CRT Terminal like the Tektronix CT8500.

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Note: Dashed lines indicate optional equipment.

Figure 1. 8540 Block Diagram

Block Diagram

As shown in figure 1, a block diagram of the 8540, the complete operating system is contained in 100k byte PROM/ROM memory. The operating system is loaded and executed in the 64k-byte system memory. User symbol table information is also stored in system memory.

Part of the 8540 memory system also contains a non-volatile EEPROM buffer to store command strings and firmware update information. Complex and repeated command sequences can be permanently stored and then recalled by employing one user-definable string name. The EEPROM is also used to store update information for firmware maintenance.

The 8540 also includes 32k bytes of static program memory for use by the emulator processor. The static program memory can be expanded to 128k bytes and with the optional Memory Allocation Controller, segments of this memory can be mapped anywhere in the emulator processor's address range.

8540/8560 System Configuration

Local Interface Configuration. The 8540 Integration Unit connects to the 8560 Multi-user Software Development Unit via a high speed serial interface. Interconnecting cable lengths of up to 2,000 feet can be accomodated without performance degradation. A specialized interface protocol is used between the 8540 and the 8560 to eliminate any errors that might occur in the transmission process.

Remote Interface Configuration. For remote configurations (greater than 2,000 feet), the 8540 can be connected to the 8560 via RS-232 compatible data sets. Typical intermediate range data sets can be used over dedicated lines for distances of approximately 8 kilometers (5 miles) at data rates up to 9600 baud. For longer distances, data sets can also be used in conjunction with dial-up phone lines.

Operating Modes. The Tektronix CT8500 CRT Terminal (or a user supplied RS-232 terminal) is the user's interface with the 8540/8560 system. Command and setup information is entered from the Terminal's keyboard and processed by the the 8560. Appropriate responses are routed to the CT8500 display. Any 8540 commands are first routed to the 8560 and then sent to the 8540. A local mode is also available so the user can communicate directly with the 8540. (The 8540 can be configured to operate through a separate 8560 port with no terminal attached.)

8540 (With Option 1 Comm Interface) Host Computer Configuration

The 8540 Integration Unit is interfaced to a host computer via an RS-232 serial port. Data bytes are ASCII encoded and transmitted asynchronously at speeds up to 9600 baud between the 8540 and the host computer. For local interface configurations (up to 50 feet), the 8540 can be hardwired directly to the host computer using a standard RS-232 cable. For remote
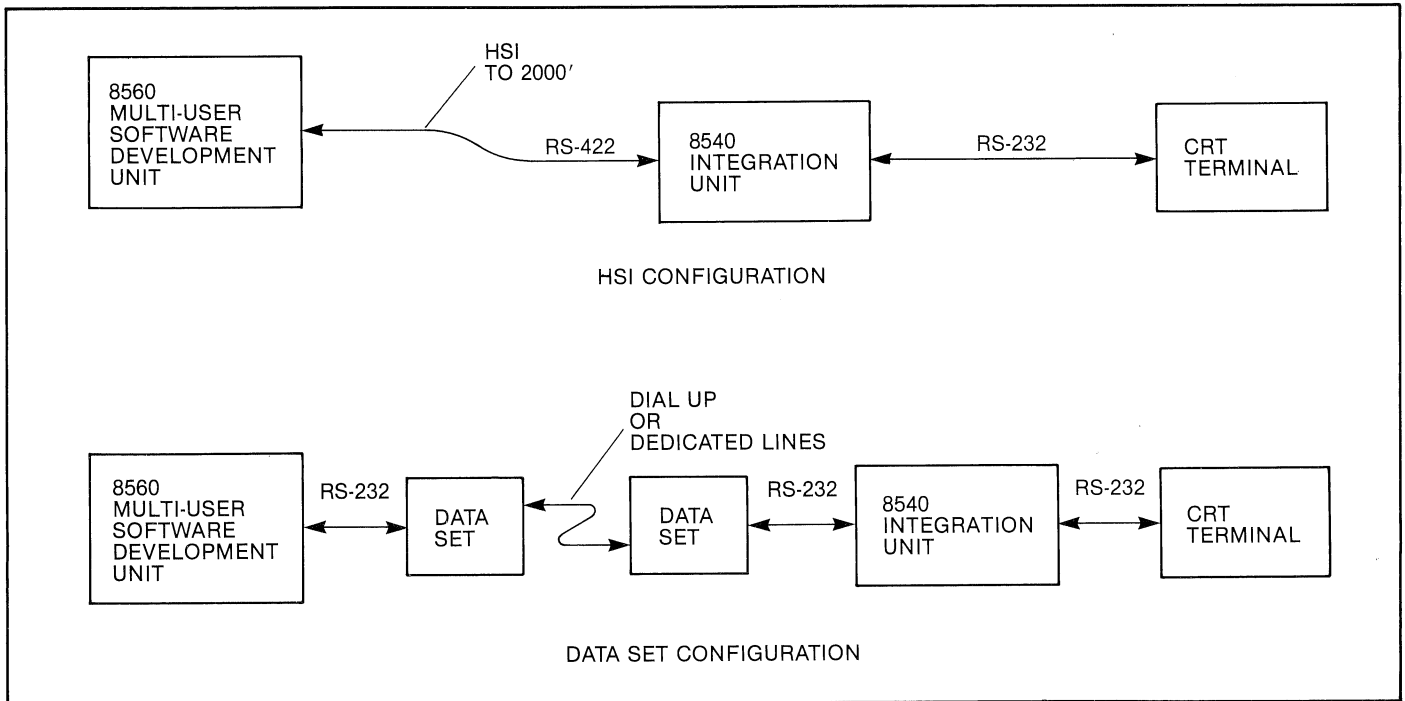
HSI CONFIGURATION

```
8560                    HSI
MULTI-USER              TO 2000'
SOFTWARE          RS-422        8540                  CRT
DEVELOPMENT                     INTEGRATION   RS-232  TERMINAL
UNIT                            UNIT
```

HSI CONFIGURATION

DATA SET CONFIGURATION

```
8560                                DIAL UP
MULTI-USER                          OR
SOFTWARE    RS-232  DATA    DEDICATED LINES  DATA   RS-232  8540          RS-232  CRT
DEVELOPMENT         SET                      SET            INTEGRATION           TERMINAL
UNIT                                                        UNIT
```

DATA SET CONFIGURATION

Figure 2. 8540/8560 System configuration.

DIRECT RS-232 CONFIGURATION

```
HOST              DIRECT
COMPUTER          RS-232
                  TO 50'      OPT 1   8540         RS-232   CRT
                              COMM    INTEGRATION           TERMINAL
                              INTFC   UNIT
```

DIRECT RS-232 CONFIGURATION

DATA SET CONFIGURATION

```
                                    DIAL UP
                                    OR
HOST               DATA     DEDICATED LINES  DATA    RS-232  OPT 1   8540         RS-232  CRT
COMPUTER   RS-232  SET                       SET             COMM    INTEGRATION           TERMINAL
                                                             INTFC   UNIT
```
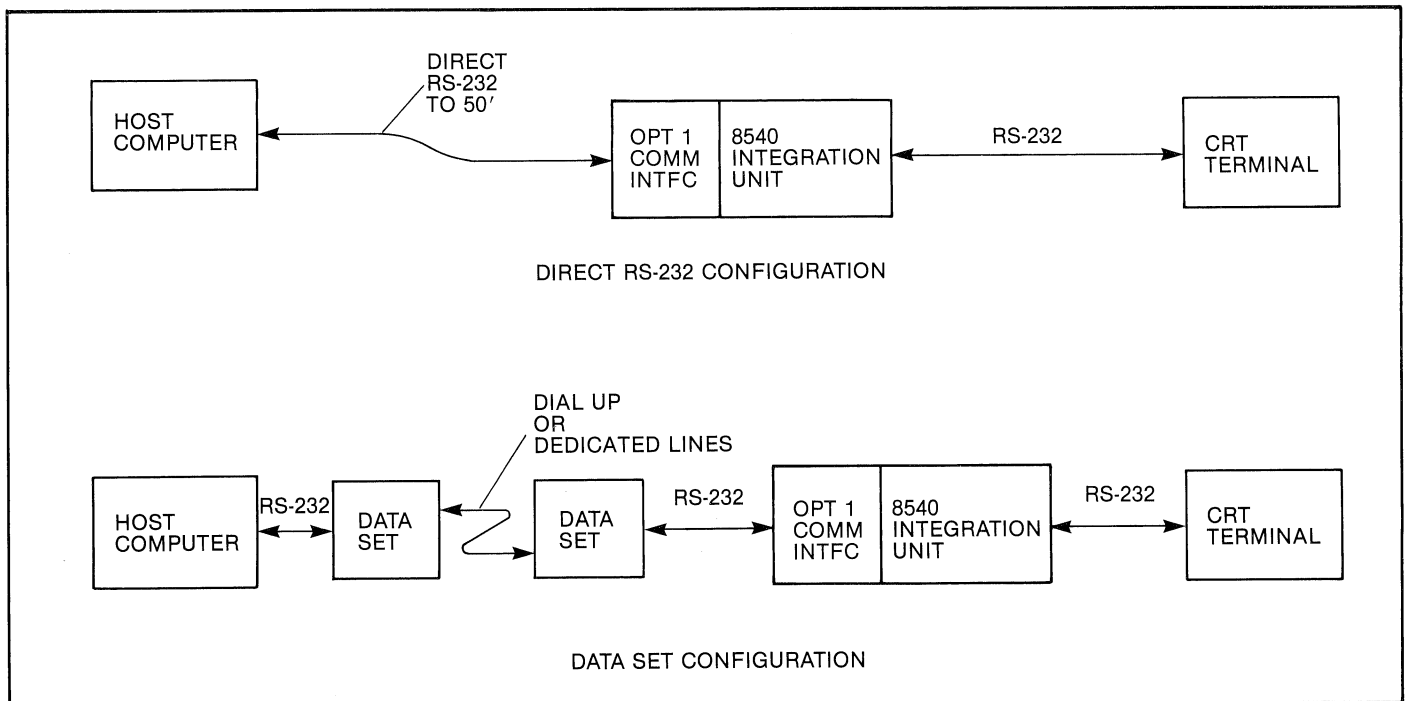
DATA SET CONFIGURATION

Figure 3. 8540/General host system configuration.

configurations (more than 50 feet) the 8540 interfaces to the host computer via a data set arrangement. Data sets can connect over moderate distances using dedicated lines or virtually unlimited distances with conventional phone lines.

The 8540 can communicate with a host computer in several modes including:

Local Mode. In this mode the terminal communicates directly with the 8540 operating system to control the emulation and debugging process.

Terminal Transparent Mode. In this mode the terminal communicates with a host computer using standard protocol; keyboard data is transmitted to the host and host data is displayed on the terminal's display screen.

Formatted Upload/Download. In this mode microprocessor object code is transferred between the host computer and the 8540 program (emulation) memory. Binary data is encoded into Extended TEKHEX format and transmitted in message blocks. TEKHEX formatting, used by the 8001, is also supported. Checksum information is included in the message blocks to allow detection of communication errors.

Details of TEKHEX encoding and protocol are included in the 8540 System Users Manual.

Emulation Support

When a program is ready for testing, the object module is downloaded from the host computer (or 8560) into 8540 emulator memory. When a symbol table is included with the object module, it is also downloaded and stored in a separate portion of system memory. Program symbols can then be used to reference memory locations instead of the absolute addresses.

The object code is now executed by the emulator processor under control of the 8540 debugging system. Trace displays to the screen (or line printer) show all pertinent information including instruction mneumonics, processor status and any program symbols. The user can set breakpoints to stop in critical sections or use the trace display to show selected instructions or address ranges.

There are three progressive emulation modes available in the 8540. In the first (mode 0) the 8540 supplies all memory, clock, and interface signals to the emulator processor. No prototype hardware is required. In the second (mode 1) the clock and interface signals are provided by the

prototype hardware. The emulator processor connects to the prototype microprocessor socket via the prototype control probe. The program under test still resides in the 8540 but as debugging progresses, it can be gradually transferred (mapped) over to the prototype's memory. In the third (mode 2) all of the program is transferred to prototype memory. The 8540 still maintains control of program execution through the debugging system. For more specific emulator support information, refer to the appropriate data sheet for each (supported) emulator.

Diagnostics

The 8540 has a complex diagnostic subsystem. On each power-up cycle, diagnostic firmware checks all available 8540 memory and verifies that all boards are functional.

Trigger Trace Analyzer (Optional)

The Trigger Trace Analyzer (TTA), optional equipment for the 8540 is a powerful debugging tool. It monitors program flow in real time and allows sophisticated control and analysis of the emulator processor. The TTA stores program information in a high-speed 255-event buffer. Each event contains 63-bits of information: up to 24-bits of address, 16-bits of data, 8-bits of processor information, and 8-bits of external probe information. TTA information is displayed on the terminal in processor specific mnemonics along with all pertinent register and flag information.

PROM Programmer (Optional)

The PROM Programmer, optional equipment for the 8540 is a general purpose controller unit with plug-in adapter modules. Each module supports a range or family of programmable devices. Functions include: READ WRITE and COMPARE.

CT8500 Terminal (Optional)

The CT8500 Terminal is an optional peripheral that is recommended for use with the 8540 in system applications. It is connected to the 8540 system controller as shown in figure 1 (block diagram). The CT8500 features: a detachable typewriter keyboard with programmable function keys, split screen operation, scrolling and paging, 4k display memory, and a full duplex RS-232C interface.

Compatibility

The 8540 Integration Unit is compatible with existing 8001 Microprocessor Lab support software (8540/General host configuration). Additional support software will be required for 16-bit emulators to accomodate downloading of large address object files and symbol table information.

8540 General Specifications

Operating System (Software): DOS/50 derivative (contained in 8k PROM/ROM's) i.e., 96k bytes, command interpreter and kernel 20k bytes diagnostics; 4k bytes patch and command storage (EEPROM)

Card Slot Usage

Standard Boards:
system controller
emulator controller
system memory (64k RAM)
program memory, (32k RAM)
system memory (224k PROM/ROM)

Empty Board Slots:
system side = I slot
program side = 11 slots

Electrical Characteristics

Nominal Operating Voltage: 115 Vac and 230 Vac at 60 Hz

Power Requirements: 700 W max

Line Voltage Ranges: 90 to 132 Vac and I80 to 250 Vac.
Line Frequency Range: 48 to 66 Hz

I/O Ports

I/O Ports: J100 (8560 Interface) J101 (remote DTE male); J102 (remote DCE female) J103 (Line Printer, Aux); J104 (Terminal)

I/O Port Data Rates:
J100(HSI) = 153.6k baud
J101, J102, J103, J104 = 110/ext CLK, 150, 300, 600, 1200, 2400, 4800, 9600 baud

Reliability

MTBF: 6700 hr (calculated)
MTTR Board: 0.5 hr.
MTTR Component: 1.5 hr.

Standards Compliance: UL1244; CSA Bulletin 556B; IEC 348

Environmental Characteristics

Temperature Range

Operating: 0°C to 50°C (32°F to 122°F)
Storage: 55°C to 75°C (67°F to 167°F)

Altitude Range

Operating: Sea level to 4500 m (15,000 ft)
Storage: Sea level to 15000 m (50,000 ft)

Humidity: 0 to 90% non-condensing (0 to 50°C)

Physical Characteristics

Cabinet Dimensions:
  Height = 280 mm (11 in)
  Width = 430 mm (17 in)
  Depth = 585 mm (23 in)

Cabinet Weight: 26 kg (57.5 lb)
Shipping Weight: 35 kg (77.5 lb)*

Cabinet Color: 3 tone; ivory/gray, smoke tan, earth brown

*Standard configuration only, no options.

Communications Interface (Optional)

Interface signals are routed to and from the 8540 system controller board via rear panel connectors J101 (male) and J102 (female). Table 2 lists the J101/J102 pin numbers and corresponding signal names and descriptions. Baud rate on transmitted data and received data is selectable from 110 to 9600 baud. All signals are RS-232-C compatible.

Standard Accessories

Power Cord

8540 System Users manual 070-3939-00*

8540 Installation Guide 070-3921-00*

8540 System Reference Booklet 070-3992-00*

Simplifying Microcomputer Based Product Design 062-5312-00

*Orderable after Oct. 15, 1981

Ordering Information 8540 Integration Unit

Factory Configuration
Order as 8540 Option No.

System Options

8550F02	32k Memory Board	02
8540F01	Comm Interface package	01
8540F03	TTA and Control Firmware	03
8550F04	64k Program Memory	04
8550F05	128k Program Memory	05
8550F3001	PROM Controller	30
8550F31	2716/32 PROM module	31
8550F32	8748/41A/55 PROM module	32
	Rackmount version*	47
N/A	220 V, European plug	A1
N/A	240 V, UK	A2
N/A	240 V, Australian plug	A3
N/A	240 V, N. American plug	A4

Emulators

8300E0401	Z80A Emulator and Control Firmware	2C
8300E0601	8085A Emulator and Control Firmware	2E
8300E20	Z8001/2 Emulator	2M
8300E28	68xx Emulator	2Q

*for field installed rackmount version, order 040-1020-00

Table 2. Interface signals (Option 1, Comm Interface)

Signal Name	Circuit	J101 DTE	J102 DCE	Pin
GND	AA	Protective ground	Protective ground	1
Tx	BA	Out	In	2[a]
Rx	BB	In	Out	3[a]
RTS	CA	Out[b]	In[c]	4
CTS	CB	In[d]	Out[e]	5
DSR	CC	In[f]	Out	6
GND	AB	Signal ground	Signal ground	7
DCD	CF	In[g]	Out	8
DTR	CD	Out	In[h]	20

[a] Selectable, 110-9600 baud
[b] DTE 1, DTE 2 modes; goes high when data to send
[c] DCE mode; must be high before 8540 accepts data
[d] DTE 1 mode; must be high before 8540 sends data
[e] DCE mode; goes low when 8540 sends data
[f] DTE 2 mode; must be high before 8540 sends data
[g] DTE 1, DTE 2 mode; must be high before 8540 accepts data
[h] DCE mode; must be high before 8540 sends data

Probes

8300P04	Z80A Probe	3D
8300P06	8085A Probe	3F
8300P2001	Z8001 Probe and Control Firmware	3Q
8300P2201	Z8002 Probe and Control Firmware	3S
8300P2801	6809 Probe and Control Firmware	3V

Optional Accessories and Interface Cables 8540 to 8560

HSI Cable, 24.35 m
(8 ft) 012-1009-00
HSI Cable, 6.1 m
(20 ft) 012-1008-00
HSI Cable, 15.24 m
(50 ft) 012-1007-00
HSI Cable, 76.2 m
(250 ft) 012-1010-00

8540 To Host/Data Set

RS-232 Interface Cable, 6.1 m
(20 ft) 012-0757-00
(for general data set and host connection)

Peripheral Options

| CT8500 | CRT Terminal |
| LP8200 | Line Printer (220 V at 50 Hz, 4 W) |

For further information, contact:

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