Chapter 2. Specifications

Contents

Introduction

This chapter provides the specifications of the IBM 7537 Industrial Computer configured as a Motion Controller.

The information contained in this chapter includes:

- component descriptions
- component dimensions
- component operating specifications

Note: All descriptions, specifications, and dimensions are subject to change without notice.

IBM 7537 Motion Controller

The IBM 7537 Motion Controller is a specially configured version of the IBM 7537 Industrial Computer that can be used as the processor module for the IBM 7575 and 7576 Manufacturing Systems and also can be used with a variety of equipment provided by non-IBM vendors. The 7537 Industrial Computer is based on the high performance Intel 80386SX microprocessor which incorporates 24-bit addressing, 32-bit internal data path, and 16-bit external data path. The Motion Controller requires an Intel 80387SX Math Co-processor or one that is 100% compatible with the Intel unit. Also, a minimum of 2MB of random-access memory (RAM) is installed on the processor board.

There are five feature slots in the IBM 7537 Industrial Computer, all of which support either 16-bit or 8-bit option cards.

The 7537 Motion Controller is typically configured with the following:

- 3.5-inch 1.44Mb High-Capacity Diskette Drive ("A" Drive)
- Axis Control Card for manipulator joints 1 and 2
- Axis Control Card for manipulator joints 3 and 4
- DI/DO Card
- 4-Port RS232 Asynchronous Communications Adapter Card

In addition, the Motion Controller uses two Axis Control Card Cables, a DI/DO cable, and a RS232 Cable for interfacing to the Servo Power Module's pendant interface. A keyboard is not required. The Motion Controller supports a variety of optional features, such as additional diskette drives, fixed disks, DI/DO cards, and communications adapters.

The IBM 7537 Industrial Computer is designed for installation inside a standard 19-inch rack. It requires 4 U of rack height (U = 1.75 inches, the basic unit of rack measure) without the keyboard. The standard 19-inch rack must comply with EIA RS-310B (ANSI C83.9-1972) dimensional specifications and use the universal mounting rail hole pattern. For ease of servicing, optional rack mounting slides are also available.

Dimensions and Operating Specifications

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7537 Motion Controller Dimensions and Operating Specifications
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• Height - 177 mm (7.0 in.)
• Width - 438 mm (17.3 in.)
• Depth - 450.7 mm (17.7 in.)

• Weight - 15.9 kg (35 lb)

• Maximum electrical consumption
     100 - 125 Vac nominal   or   220 - 240 Vac nominal
     Single phase
     50 - 60 Hz ±3 Hz
     5 Amperes maximum at 115 Vac
     2.5 Amperes maximum at 230 Vac
     500 Watts
     0.50 KVA

• Maximum heat output - 300 Watts (1033 BTU/hr)
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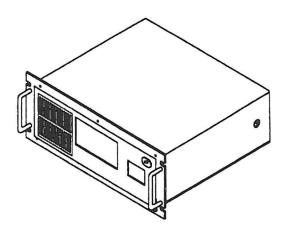
Figure   2-1. 7537 Industrial Computer

Motion Control Specifications

Performance specifications such as straight line accuracy, repeatability, and others depend upon the type of manipulator hardware attached to the controller, thus you must refer to the specifications of the manipulator in order to get this information.

The following specifications are for the AML/2 3.0 or higher software and 7537 hardware:

```
• Real-Time I/O
  - Base Real-Time period              18 ms (55 Hz)
  - Real-Time tasks (IOTASKs)          16
  - I/O control based on XYZ position

• Servo Controls
  - Inverse Kinematic transform period  18 ms (55Hz)
  - Fine Interpolation period           4.5 ms (220 Hz)
  - Analog servo command period         1.5 ms (660 Hz)

• Move Types
  - Point to Point
  - Three dimensional straight lines
  - Three dimensional circles

• Move Planning Controls
  - Splining of multiple moves together
  - Asynchronous or synchronous joint accelerations
  - User speed control
  - User acceleration control
  - User rate of acceleration change control
  - Motion stop on I/O change of state
  - Guarded workspace areas

• Kinematic Types Supported
  - 1 - 6 axes of motion
  - 4 axes SCARA
  - 4 axes Cartesian
  - 5 axes SCARA (pitch 5th axis)
  - 5 axes Cartesian (pitch 5th axis)
  - expandable to other types
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IBM Adapters

The following list of features are formally supported by IBM when installed or attached to the IBM 7537 Industrial Computer when configured as a Motion Controller for manufacturing systems.

General specifications for IBM adapters can be found on the following pages.

- Mass Media Storage Devices

  Note: The IBM 7537 Motion Controller supports a maximum of two diskette drives and one fixed disk drive.

  - 1.2 Mb Diskette Drive
  - 1.44 Mb Diskette Drive
  - 2.88 Mb Diskette Drive
  - 40 Mb Fixed Disk Drive
  - 80 Mb Fixed Disk Drive

- IBM Axis Control Adapter and Cable
- IBM 48 Point DI/DO Adapter and Cable
- IBM 4-Port Communications Adapter and Cables
- IBM Multiport Model 1 Communications Adapter
- IBM Serial Parallel Adapter
- IBM Teach Pendant & Cable
- Sankyo Axis Control Adapter
- Sankyo 72 Point DI/DO Adapter

IBM Axis Control Adapter

The IBM Axis Control Adapter is used to provide the servo command signals to a servo power module that in turn, drives the servo motors on a manipulator. The adapter also contains the necessary electrical interfaces to accept the encoder position feedback from the servo motor in order to close the servo loops on the card.

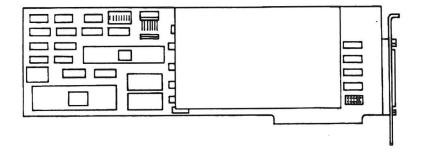|	
• Card Type	PC/XT 8 Bit
• Processor	Motorola 68000 @ 12 MHz
• RAM	Shared Static 16 KB
• Selectable IRQ levels	5
• Selectable base addresses	3
• Axes Supported	2
• Fault indicator	7 segment LED
• Watchdog timer	55ms
• Position Interface Type	Incremental three track encoder
• Position Interface Range	5 VDC differential
• Control Output Type	Analog torque or velocity
• Control Output	12 bit DAC, +/- 10 VDC
• Actual Motor Velocity Signal	generated from encoder feedback
• Miscellaneous I/O	12 DI / 12 DO

Figure 2-2. IBM Axis Control Adapter

IBM 48 Point DI/DO Adapter

The IBM 48 Point DI/DO Adapter provides the user I/O interface that can be controlled and sensed from the user application code. See Appendix E for technical specifications of interfacing to user circuits.

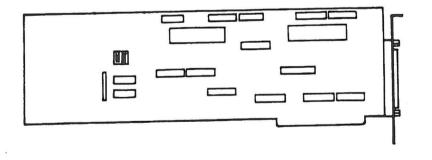|	
• Card Type	PC/XT 8 Bit
• I/O Points	48 TTL Level
• Line Drivers/Receivers	Double Buffered
• Data Direction	Selectable (groups of 8)
• Selectable Base Addresses	16 (three supported)
• I/O Controller	8255 PPI
• Interface	Cable to industry standard optical isolation rails

Figure   2-3. IBM 48 Point DI/DO Adapter

IBM 4-Port Communications Adapter

The 4-Port communications adapter provides a low-cost, medium port density per slot, interface to RS-232 devices.

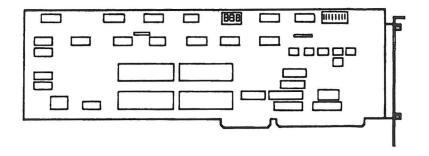|	
• Card Type	PC/XT 16 Bit
• Communications Type	RS-232-C
• Number of ports	Four
• Connectors	Four 10-pin square shell MODU
• Controller	8250 Equivalent USART
• Selectable Base Addresses	8 (two supported)
• Selectable IRQ Levels	3 (one supported)

Figure   2-4. IBM 4-Port Communications Adapter

IBM Multiport Model 1 Adapter

The Multiport Model 1 adapter provides a large number of communication ports per slot while also off-loading processor intensive communications handling from the main processor. Both RS-232 and RS-422 devices can be attached.

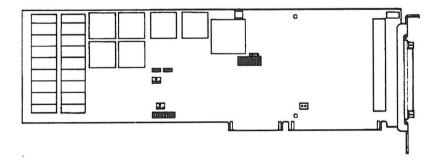|	
• Card Type	PC/XT 16 Bit
• Processor	Intel 80186 @ 7.3728 MHz
• RAM	128 or 512 Kb Dynamic RAM
• Communications Type	RS-232-C and RS-422
• Number of ports	Four RS-232-C plus options of - four RS-232-C or - four RS-422
• Connectors	Eight 25-pin D-Shell from "breakout" box cable
• I/O Controller	Zilog SCC
• Selectable Base Addresses	Two supported
• Selectable IRQ Levels	Two supported

Figure   2-5. IBM Multiport Model 1 Adapter

IBM Serial Parallel Adapter

The serial parallel adapter provides a low cost interface to one serial device and one parallel device, such as a printer.

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• Card Type                    PC/XT 8 Bit 1/2 Slot

• Interfaces                   - Serial RS-232-C
                               - parallel printer

• Connectors                   - one 9-pin D-Shell
                               - one 25-pin D-Shell

• Selectable Base Addresses    one supported

• Selectable IRQ Levels        one supported
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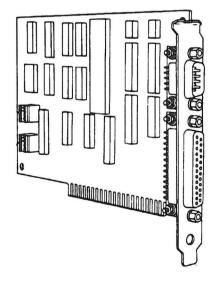

Figure 2-6. IBM Serial Parallel Adapter

Environment

This equipment is designed to operate in an area that stays within the following environmental limits.

Climate and Altitude

Acceptable climate and altitude ranges (upper and lower limits) are:

- Temperature:

    Operating — 0° C to 40° C (32° F to 104° F)

    Storage — -15° C to 60° C (5° F to 140° F)

- Relative humidity:

    Operating — 8% to 80% (non-condensing)

    Storage — 5% to 80%

- Maximum wet bulb temperature: 29.4° C (85° F)

- Altitude: Sea level to 2134 meters (7000 ft)

Note: High-precision applications can tolerate only small ambient temperature variations. To ensure machine repeatability, plan to run the application at the same temperature at which it is taught.

Atmosphere

This equipment must not be installed or operated in an explosive atmosphere or in an environment where the concentration of particulate, liquid, or gaseous atmospheric contaminants exceeds the following limits. Such environments can cause corrosion, contact failures, and electrical short circuits.

Particulate Contaminates

The following specifications represent a "P1-Extended" environment. The upper limit is expressed as arithmetic mean values in $\mu g/m^3$ (micrograms per cubic meter) or $\mu g/cm^2/30$ days (micrograms per square centimeter per 30 days).

- Suspended particles: 500 $\mu g/m^3$

- Benzene soluble organics: 30 $\mu g/m^3$

- Settleable particles: 1500 $\mu g/cm^2/30$ days.

Corrosive Gas Contaminates

The following specifications represent a "clean" industrial environment. Corrosive gas upper limit is expressed as arithmetic mean values (averaged over one year) in micrograms per cubic meter (μg/m³) and parts per billion (ppb), by volume.

- Total reactive sulfur: 3.2 μg/m³. This includes elemental sulfur vapor (S) of up to 2.1 μg/m³. Total reactive sulfur is the quantity of elemental sulfur expressed in μg/m³ in all gaseous species that react with silver to form silver sulfide (such as, S H S, CH SH, etc., but not SO). The 3.2 μg/m³ of reactive sulfur is equivalent to 3.4 μg/m³ or 2.5 ppb of H S.

- Sulfur dioxide: 100 μg/m³

- Nitrogen dioxide: 141 μg/m³ (75 ppb).

- Acidic gaseous chlorine: 3 μg/m³. Acidic gaseous chlorine is the quantity of elemental chlorine expressed in μg/m³ in chlorine containing acidic gases (such as, HCl, Cl , ClO , etc.). The 3 μg/m³ is equivalent to 2 ppb of HCl or 1 ppb of Cl .

- Ozone: 98 μg/m³ (50 ppb).

Vibration

This equipment is designed to operate within the following limits of vibration:

- 5 to 10 Hz at 0.76 mm (0.030 inch) double amplitude displacement
- 10 to 200 Hz at 0.150 G peak
- 200 to 500 Hz at 0.077 G peak

System performance can be affected by excessive vibration from other machinery or heavy moving equipment. You should try to minimize vibration in the area where your manufacturing system is to be installed.