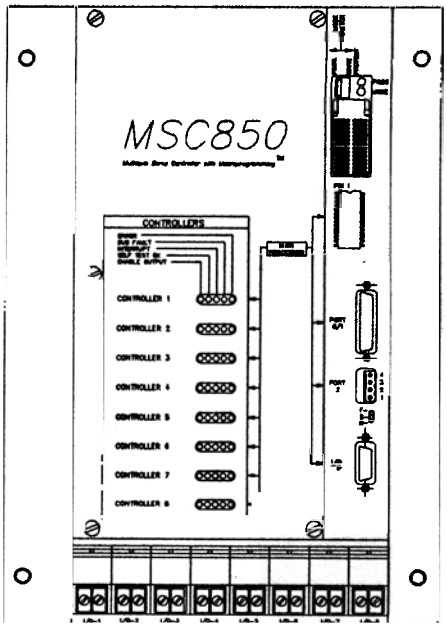
IB-11B001

MOTION CONTROL SYSTEM, MSC-SERIES DECEMBER 1991



MSC-850 SYSTEM UNIT

INSTRUCTION BOOK

INDUSTRIAL INDEXING SYSTEMS, Inc.

Revision - A

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1.0 INTRODUCTION

1.1 About this Instruction Book

This document is a part of a series of books that support Industrial Indexing Systems' MSC-850 based Motion Control System. It provides product information about the MSC-850 System Unit including; general description, product specifications, installation instructions, controls, indicators, and electrical connection diagrams.

1.2 Product Overview

An MSC-850 System Unit consists of the ENC-850 Unit Enclosure and the MAC-850 Main Processor (Figure 1-1). The MSC-850 System Unit is the heart of the Motion Control System. The System Unit houses the electronics that perform the central processing control functions and I/O functions of the Motion Control System (Figure 1-2).

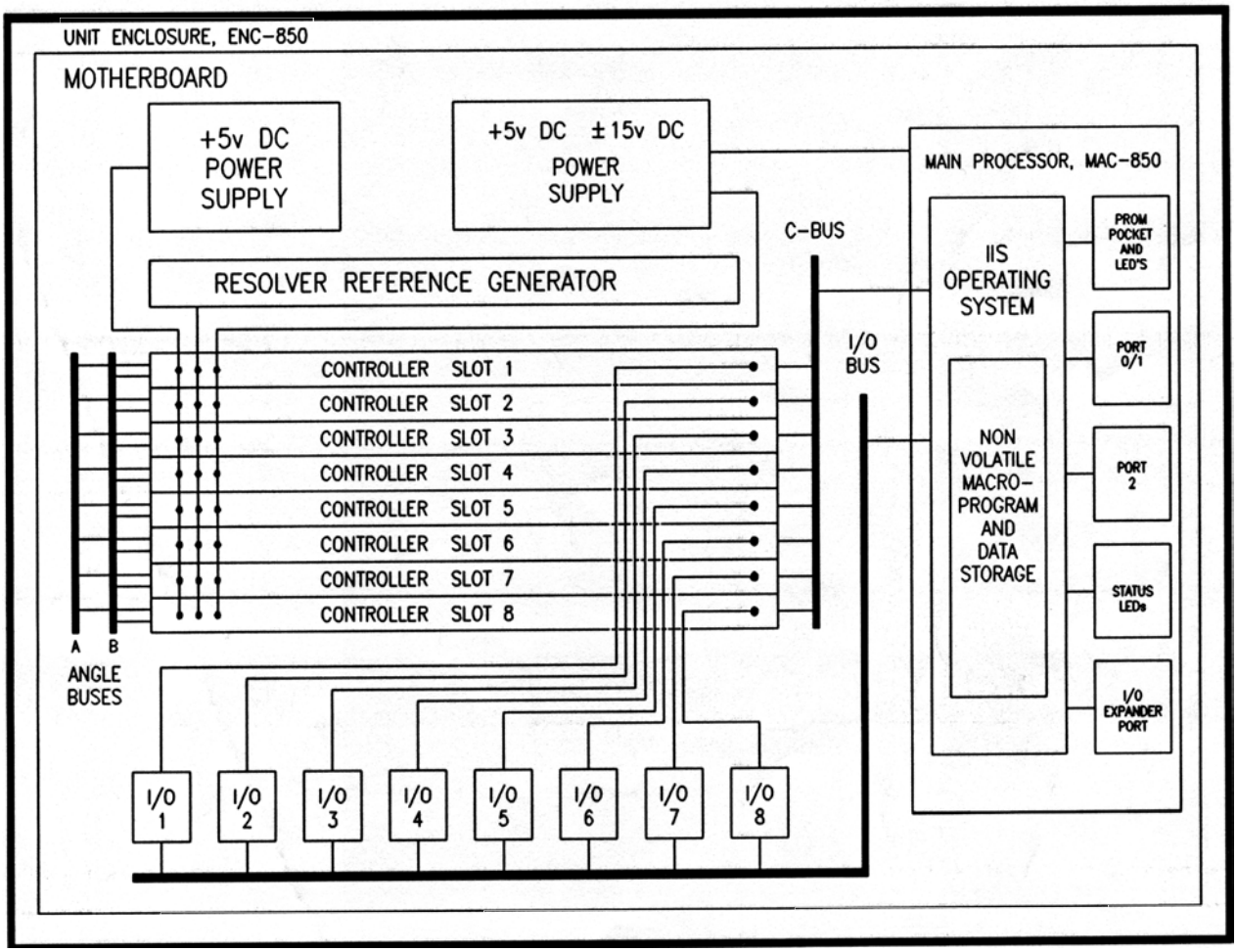


Figure 1-1 MSC-850 System Unit Internal Architecture

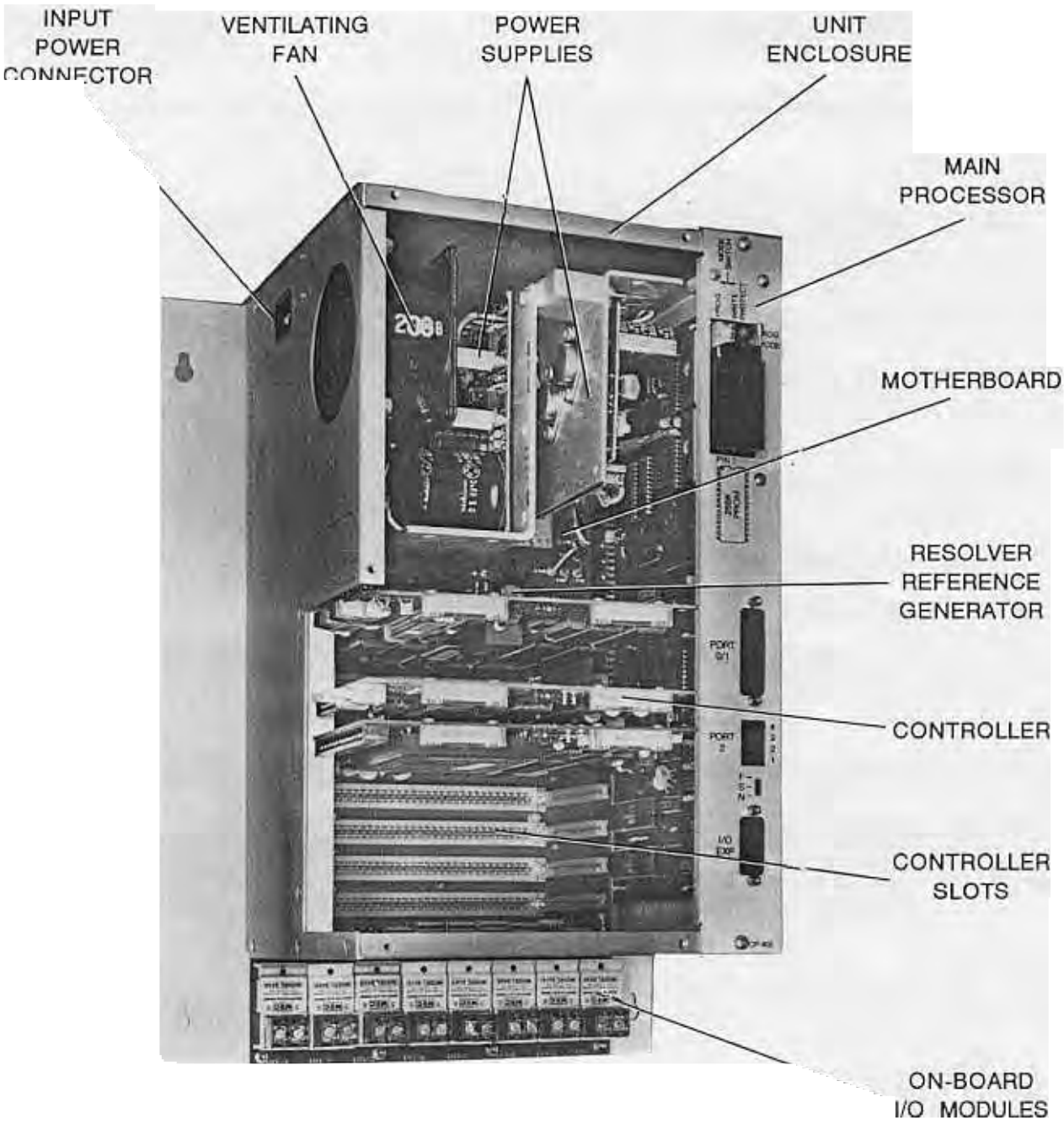


Figure 1-2 MSC-850 System Unit Internal View

2.0 DESCRIPTION

2.1 The ENC-850 Unit Enclosure

The ENC-850 Unit Enclosure (Figure 2-1) consists of a forced-air ventilated metal cabinet and a motherboard to support the functional boards of the Motion Control System.

The Unit Enclosure comprises a Command Bus (C-BUS), 8 controller slots, connections for up to 8 On-board I/O Modules, a Resolver Reference Generator, 2 Angle Buses, an I/O Bus, and 2 Power supplies.

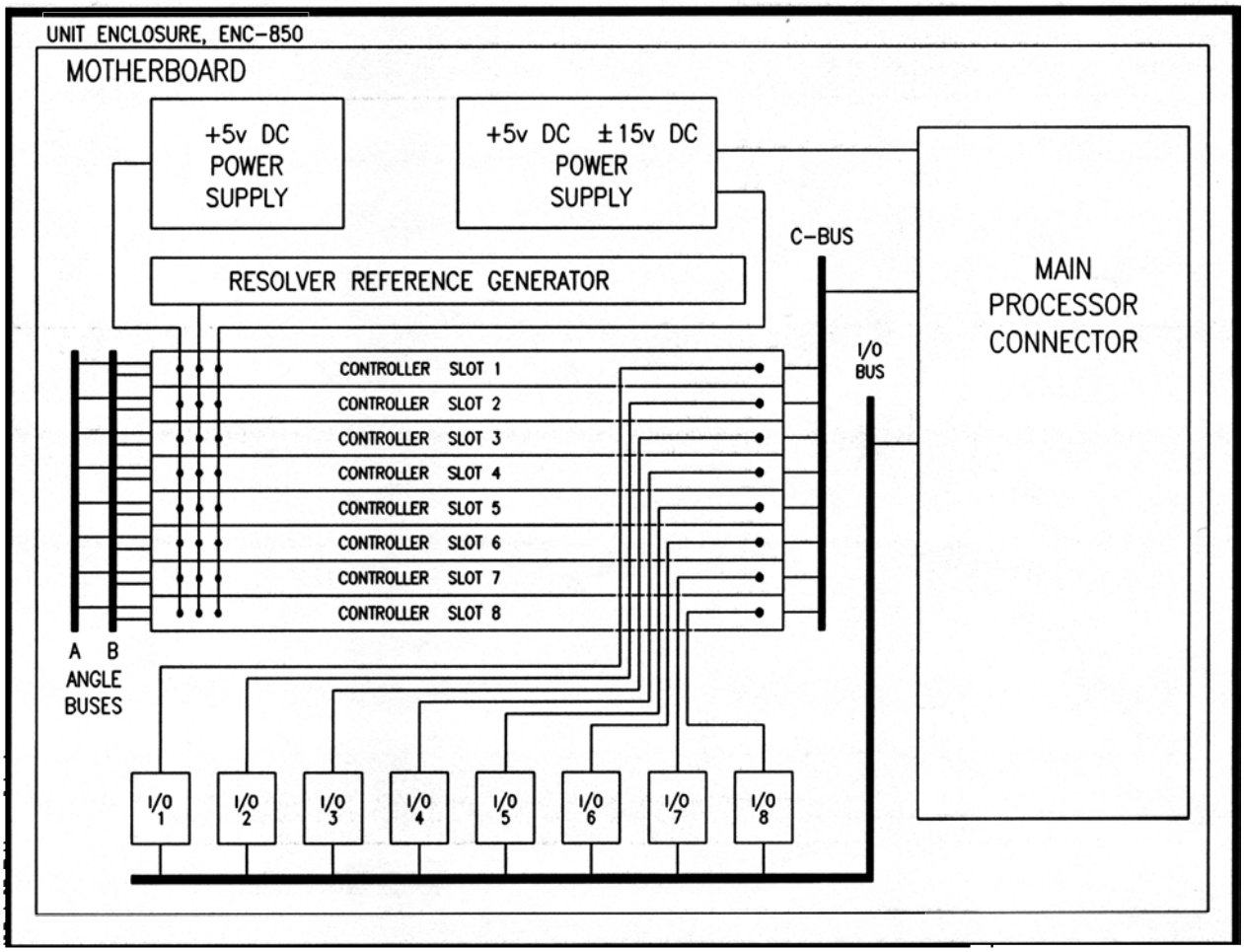


Figure 2-1 The ENC-850 Unit Enclosure

2.1.1 Command Bus

The Command Bus (C-BUS) (Figure 2-2) is a parallel digital communications bus connecting the Main Processor to the controllers. The C-BUS runs under a protocol established by a unique Industrial Indexing Systems' operating system and is accessed by the user's Macroprogram.

The C-BUS allows Macroprogram commands to be sent from the Main Processor to the controllers. It also allows data to be exchanged between the Main Processor and the controllers.

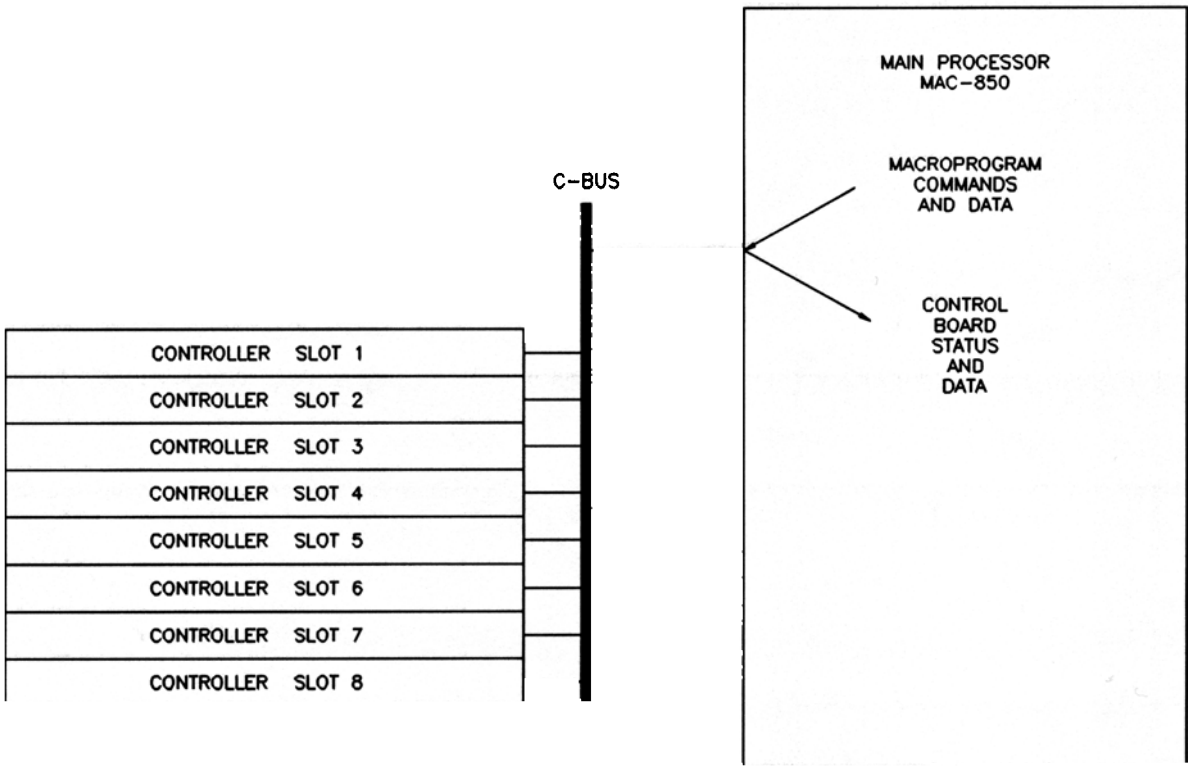


Figure 2-2 The Command Bus

2.1.2 Controller Slots

The 8 controller slots (Figure 2-3) accept any controller in any combination. The controllers are; ACR-850 Resolver Axis Controller, ACE-850 Encoder Axis Controller, MCF-850 Multifunction Controller, HPL-850 High Performance Limit Switch Controller, or ACM-850 Analog Controller.

The controller slots are connected to 2 Angle Buses, On-board Input Modules, and the C-BUS. Power is supplied to the controllers through the controller slots. A 2.6KHz Resolver Reference signal is supplied through the controller slots to the ACR-850 Resolver Axis Controllers and the ACR-850 Encoder Axis Controllers.

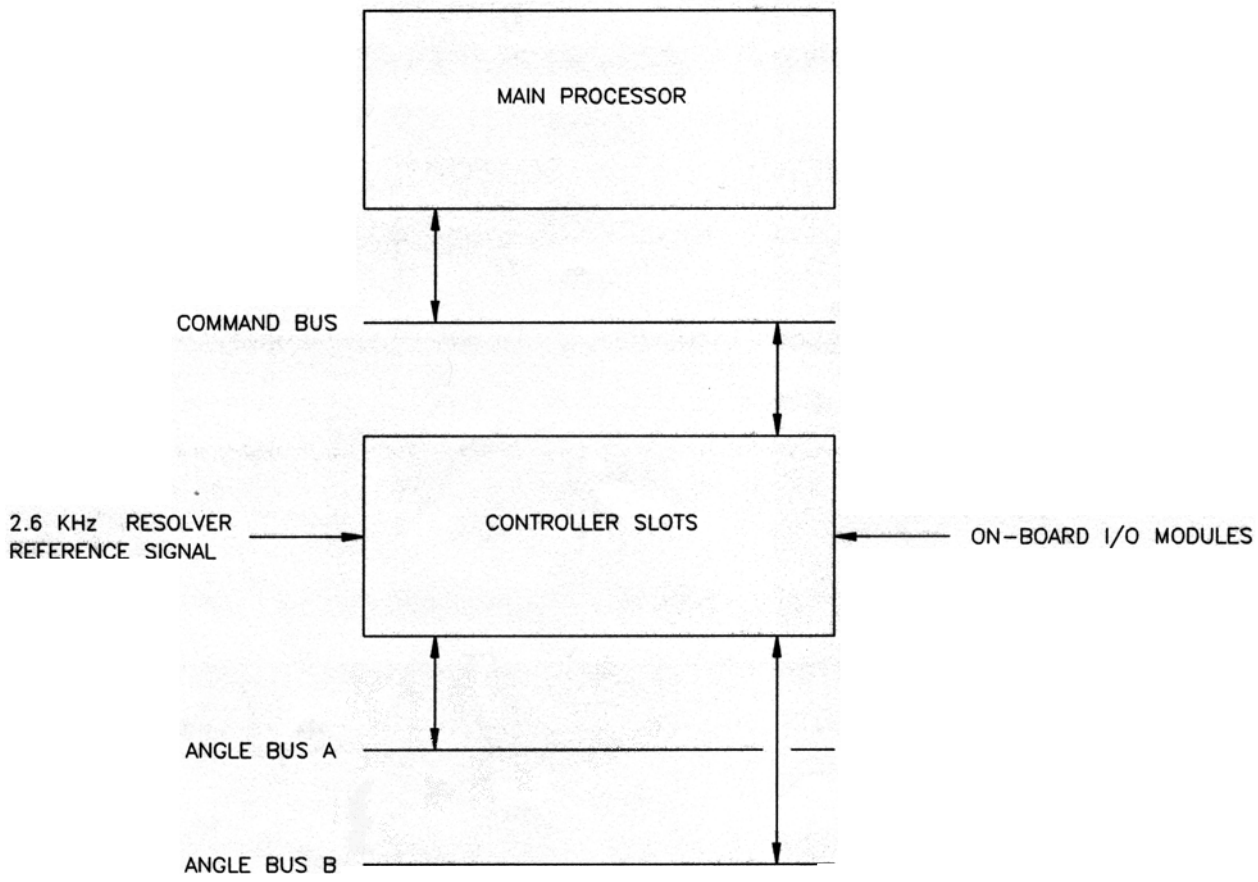


Figure 2-3 The Controller Slots

2.1.3 On-Board I/O Modules

The connections for the eight On-board I/O modules (Figure 2-4) allow process inputs to be connected directly to the controllers. They also connect process inputs and outputs to the Main Processor by way of the I/O Bus. The input and output modules can be either AC or DC. The IIS part numbers for the six different plug-in modules are listed in Table 2-1 below.

Table 2-1 On-Board I/O Modules

FUNCTION	PART #
DC Input, high speed	HSI-850
DC Input	S410
DC Output	S430
AC Input, low voltage	S420
AC Input, high voltage	S421
AC Output	S440

Each On-Board I/O Module Connects to both the Main Processor and a corresponding controller (e.g. I/O Module 1 connects to the controller in slot 1, I/O Module 2 connects to the controller in slot 2, etc..).

The Main Processor can read inputs and set outputs. Inputs are used by the control programs to monitor the status of external devices. Outputs allow the control programs to affect the status of external devices.

The controllers can read inputs from On-Board Input Modules. These inputs are used with control program functions to provide fast hardware interrupts, typically used to initiate a motion or motion related event.

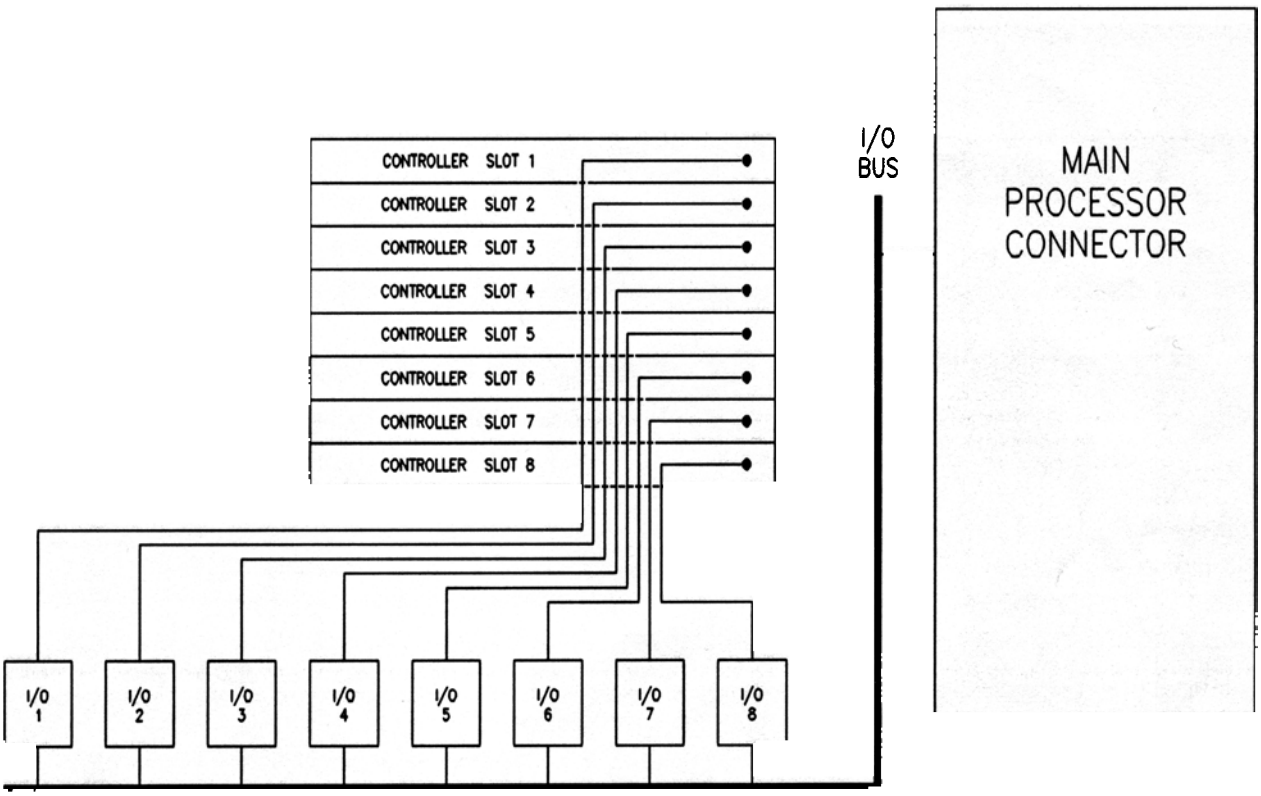


Figure 2-4 The On-Board I/O Module Connectors

2.1.4 Angle Buses

The 2 Angle Buses (Figure 2-5) are serial digital communication buses that interconnect the controllers through their controller slots.

These buses allow each of two master axis controllers per System Unit to transmit its absolute master angle position on one of the master angle buses.

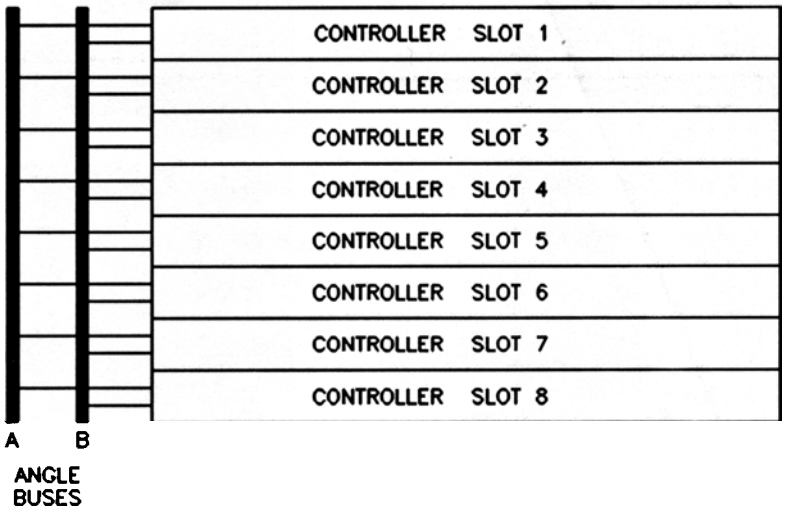


Figure 2-5 The Two Angle Buses

2.1.5

System Unit Power Distribution (Figure 2-6) provides power for the Main Processor, controllers, and Resolver Reference Generator. A +5v DC Power Supply and a +5v DC, ±15v DC Power Supply convert the 110v AC line voltage into the required voltages for the controllers and the Main Processor.

Power is supplied to the controllers through the controller slots and the Main Processor through the Main Processor connector. Both power supplies are of the linear type. This feature provides extensive incoming line noise filtering and high capacity voltage storage to produce a stable supply of power with very high fault tolerance.

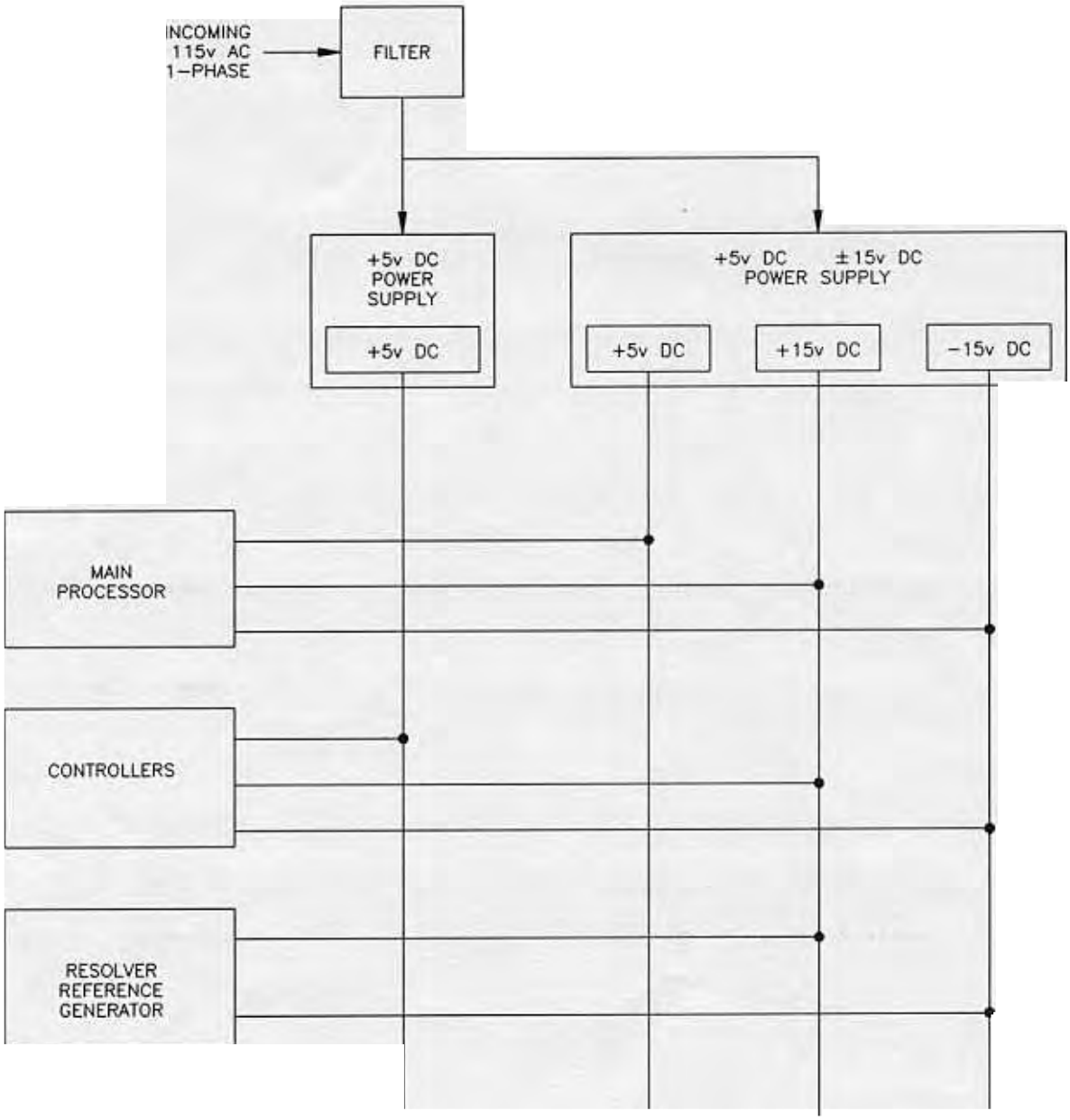


Figure 2-6 System Unit Distribution

2.1.6 Resolver Reference Generator

The Resolver Reference Generator (Figure 2-7) consists of a reference oscillator and amplifier. The reference oscillator generates a 2.6KHz Sine wave signal. The reference signal is amplified by a linear power amplifier which produces an 8v AC output capable of driving 8 resolvers. The amplifier's output is hard-wired to all of the controller slots.

The 2.6KHz Sine wave signal is used by the resolver-to-digital (R/D) converter as a reference signal. Resolver Axis Controllers also provide the reference signal to drive resolvers through their interface connectors.

The ACE-850 Encoder Axis Controller can provide the reference signal to any servo drive requiring a 2.6KHz signal.

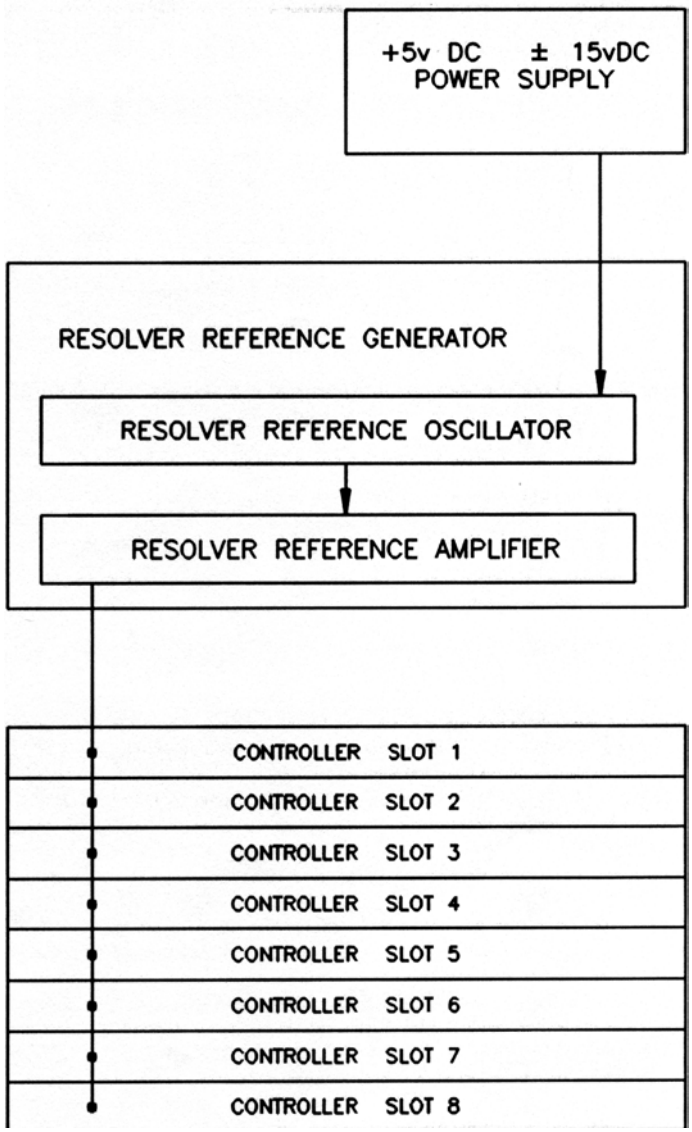


Figure 2-7 The Resolver Reference Generator

2.2 The MAC-850 Main Processor

The central processing functions of the Motion Control Systems are performed by the MAC-850 Main Processor (Figure 2-8). The Industrial Indexing System's operating system in conjunction with the user's control program utilize the central processing facilities to provide the system control functions.

The Main Processor also provides several external interface ports. The external interface ports allow the Main Processor to integrate external system components, such as, external PROMs, operator interfaces, and I/O expanders with the System Unit.

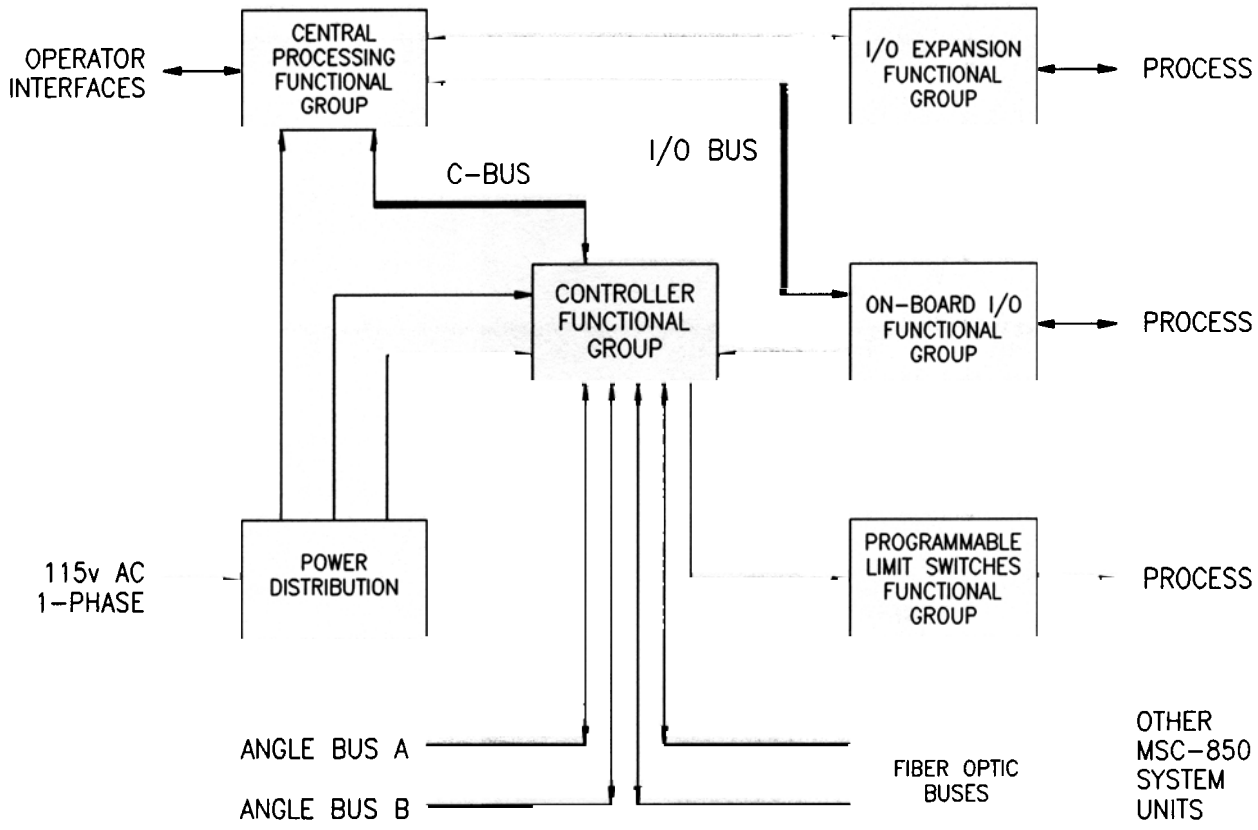


Figure 2-8 System Unit Functional Block Diagram

2.2.1 Operating System Firmware

The operating system is a 48K embedded software package residing in On-Board firmware. The operating system firmware also provides access to 16K of nonvolatile memory for Macroprogram and data storage. Figure 2-9 illustrates the internal and external exchange of information being handled by the Main Processor.

The external interface ports (Figure 2-10) provide the Main Processor with an executive port, operator interface ports, an I/O expander port and an external PROM Pocket.

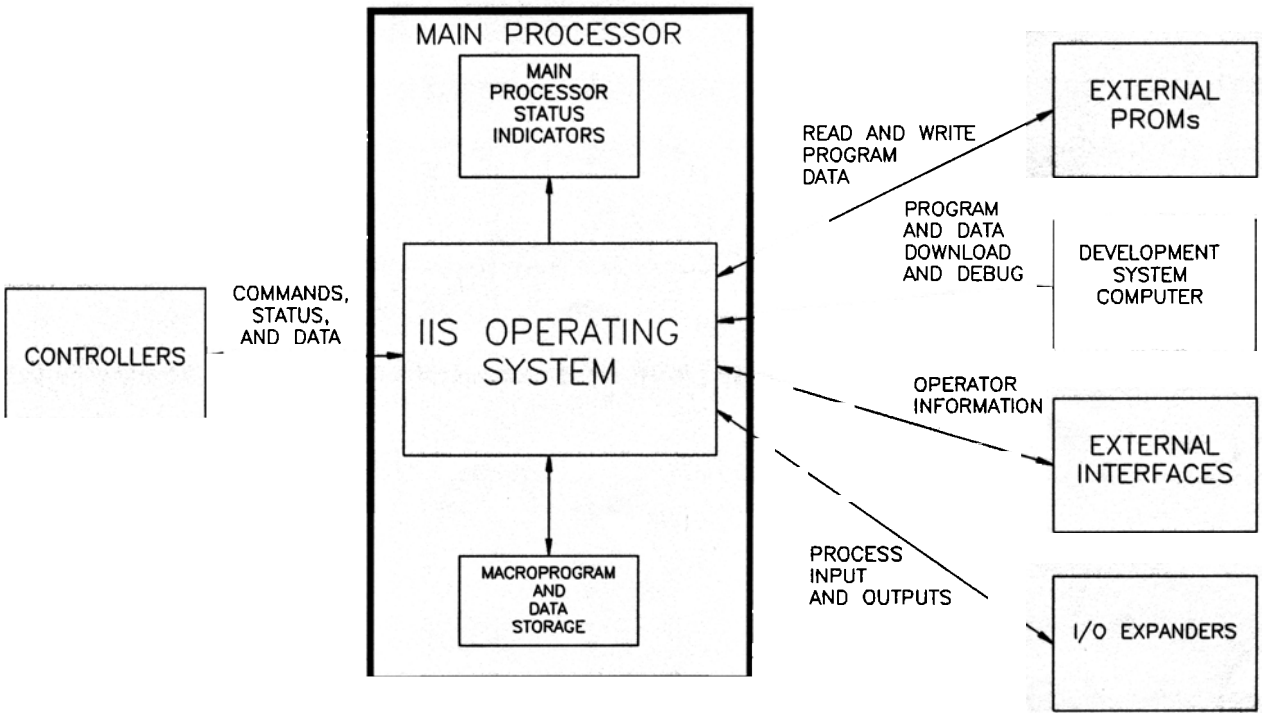


Figure 2-9 Main Processor Information Exchange

The executive port permits the downloading of user control programs (Macroprogramms) from the Macroprogram Development System to the Main Processor. It also allows the Macroprogram Development System to trace and debug Macroprograms running on the Main Processor. The executive port is an RS-232C port labeled 1 on the Main Processor's faceplate. This port supports a pocket protocol used by the Macroprogram Development System. This protocol communicates at a 9600 Baud rate with 1 stop bit, 8 data bits, and no parity.

The operator interface ports permit the macroprograms to display information and requests for input to operators and to receive operator input while the program is running. Port 0 and port 2 are 20mA ASCII current loop ports available for operator interfaces. Port 0 uses the same 25-pin connector as port 1 and is configurable to be either an active or passive current loop. Port 2 uses a 4-pin connector and is a dedicated passive current loop. These ports can be used for operator interfaces, such as, the OPI-1 Operator Interface Unit, the AC-100006 Onneline Display, or any ASCII driven terminal device.

I/O Expander Assemblies allow 64 discrete inputs or outputs to be connected to the Main Processor. The I/O expander port is a 15-pin connector dedicated to connecting an IOE-850 I/O Expander Assembly to the Main Processor. Three other IOE-850 I/O Expander Assemblies can be daisy-chain connected to the same I/O Expander port. The I/O scan time is incresed by 12msec for each I/O Expander Assemblv.

External PROMs allow for up to 32K bytes of nonvolatile program/data storage. The PROM Pocket allows an Intel 27256-1 E-PROM or compatible to be connected to the Main Processor. Programs and data can be written to and read from the PROM with the Macroprogram Development System. Macroprogram commands can save and load programs, and write and read data from the PROM. The PROM Pocket has a write-protect feature which is controlled by a mode switch on the Main Processor's face-plate. The operation of the mode switch is described in Section 5.

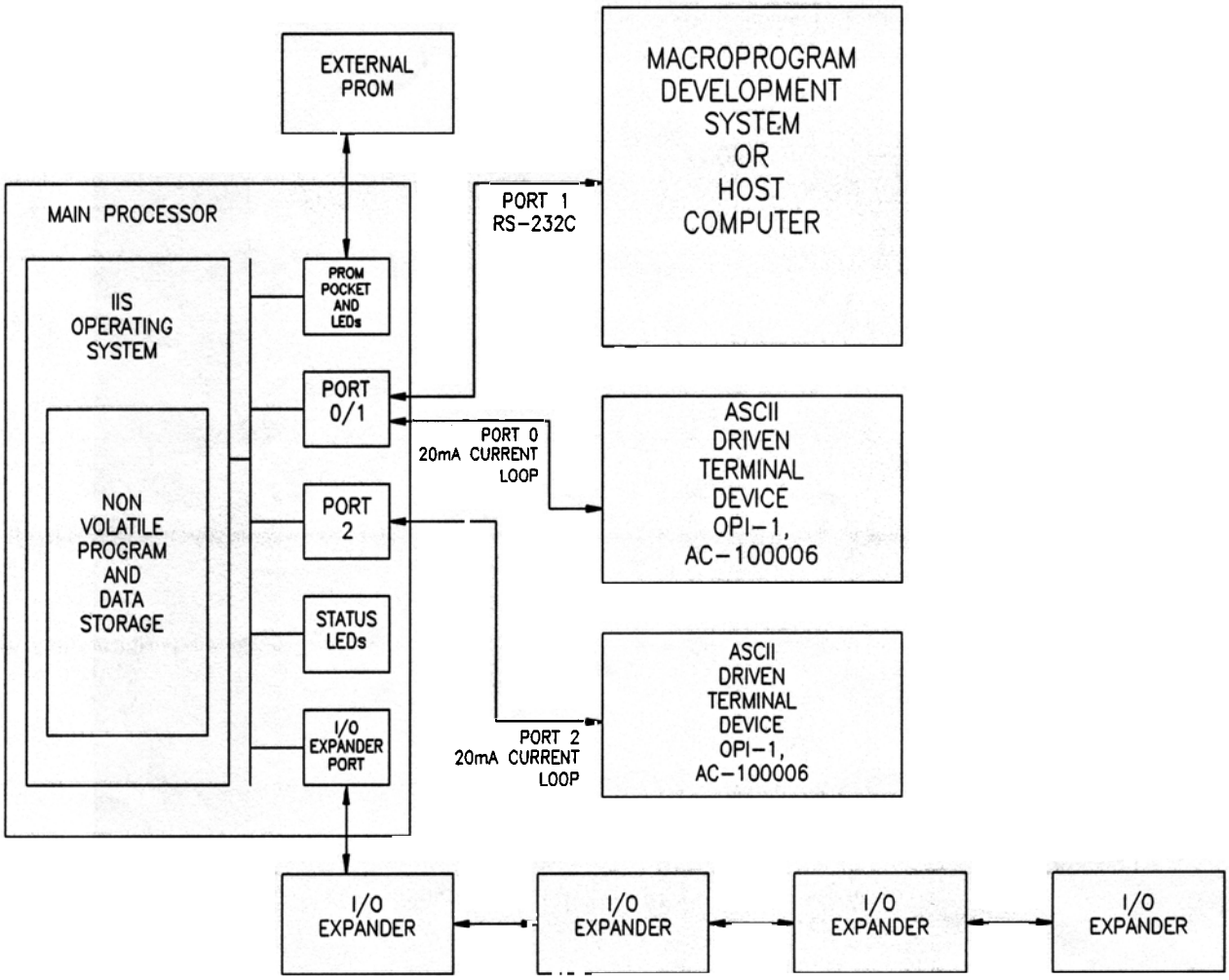


Figure 2-10 Main Processor External Interfaces

3.0 SPECIFICATIONS

3.1 Functional Characteristics

Operator Interfaces

Any ASCII Device
IBM Compatible PC
Operator Interface Unit, (OPI-1)
One-Line Display (AC-100006)

Serial Communication

Port 1	RS-232C (Packet Protocol)	9600 Baud 1 Stop Bit 8 Data Bits No Parity
Port 0, 2	20mA Current Loop	ASCII Programmable

Memory

Operating System	48K bytes
Program and Data nonvolatile RAM	16K bytes
External EPROM	32K bytes

I/O Interface

On-Board, Discrete	8 Positions
Expansion, Discrete	64 Positions

Controller Slots 8 Positions

3.2 Performance Characteristics

System Unit

Input Power

Voltage	100v to 130v AC
Frequency	48Hz to 62Hz
Current	2A Maximum

Environmental

Operating Temp.	32° to 140° F (0° to 60° C)
Operating Humidity	30 to 90% (Non-condensing)

On-Board I/O Modules

Interrupt Response Time

Hardware	less than 1msec.
Software	less than 5msec.

S410

Type	DC Input
Voltage Range	10v to 32v DC
OFF Voltage	1v DC Minimum
ON Current	25mA @ 32v DC
OFF Current	0.8mA Maximum

Type	AC Input
Voltage Range	90v to 135v AC
OFF Voltage	30v AC Minimum
On Current	15mA @ 120v AC
Input Impedence	10KΩ Nominal

Type	AC Input
Voltage Range	180v to 270v AC
OFF Voltage	60v AC Minimum
On Current	15mA @ 240v AC
Input Impedence	10KΩ Nominal

S430

Type	DC Output
Voltage Range	10v to 55v DC
ON Current	2.75A Maximum
Voltage Drop (on-state)	2v DC Maximum
OFF Current (leakage)	10mA Maximum @ 55v DC

S440

Type	AC Output
Voltage Range	30v to 140v AC
ON Current	2.75mA Maximum
Voltage Drop (on-state)	1.5v AC Maximum
OFF Current (leakage)	4mA Maximum @ 140v AC

3.3 Physical Characteristics

Dimensions	
Height	15 $^{13}/_{16}$ in. (402 mm)
Width	11 in. (279 mm)
Depth	9 in. (51 mm)
Weight	15 lbs. (6.8 Kg
Mounting	Panel
Power Cable	6 foot cord (C-800006)

4.0 SPECIFICATIONS

4.1 General

This section contains the specific information needed to properly install the MSC-850 System Unit. For maximum performance, it is recommended that the System Unit be installed in a NEMA 12 type enclosure and certain other criteria be met.

4.2 Enclosure Cabinet Requirements

Ideally, the System Unit, along with other related electronic components, should be mounted on a panel housed in a NEMA 12 enclosure. The enclosure should be mounted as far away as practical from noise generating devices, such as; SCR equipment, but should be within 100 feet (30 meters) of the drive motors being controlled.

4.3 Mounting The System Unit

The MSC-850 System Unit is designed for mounting on a grounded panel, and is secured to the panel with four #10 screws. Figure 4-1 gives the dimensions and screw hole locations.

Be sure to provide adequate space around the System Unit for ease of maintenance and proper ventilation. Typically, wire ways can be located up to 3 inches (76 mm) from the edge of the System Unit back plate. Figure 4-2 illustrates an example of the arrangement.

4.4 Cable Isolation Requirements

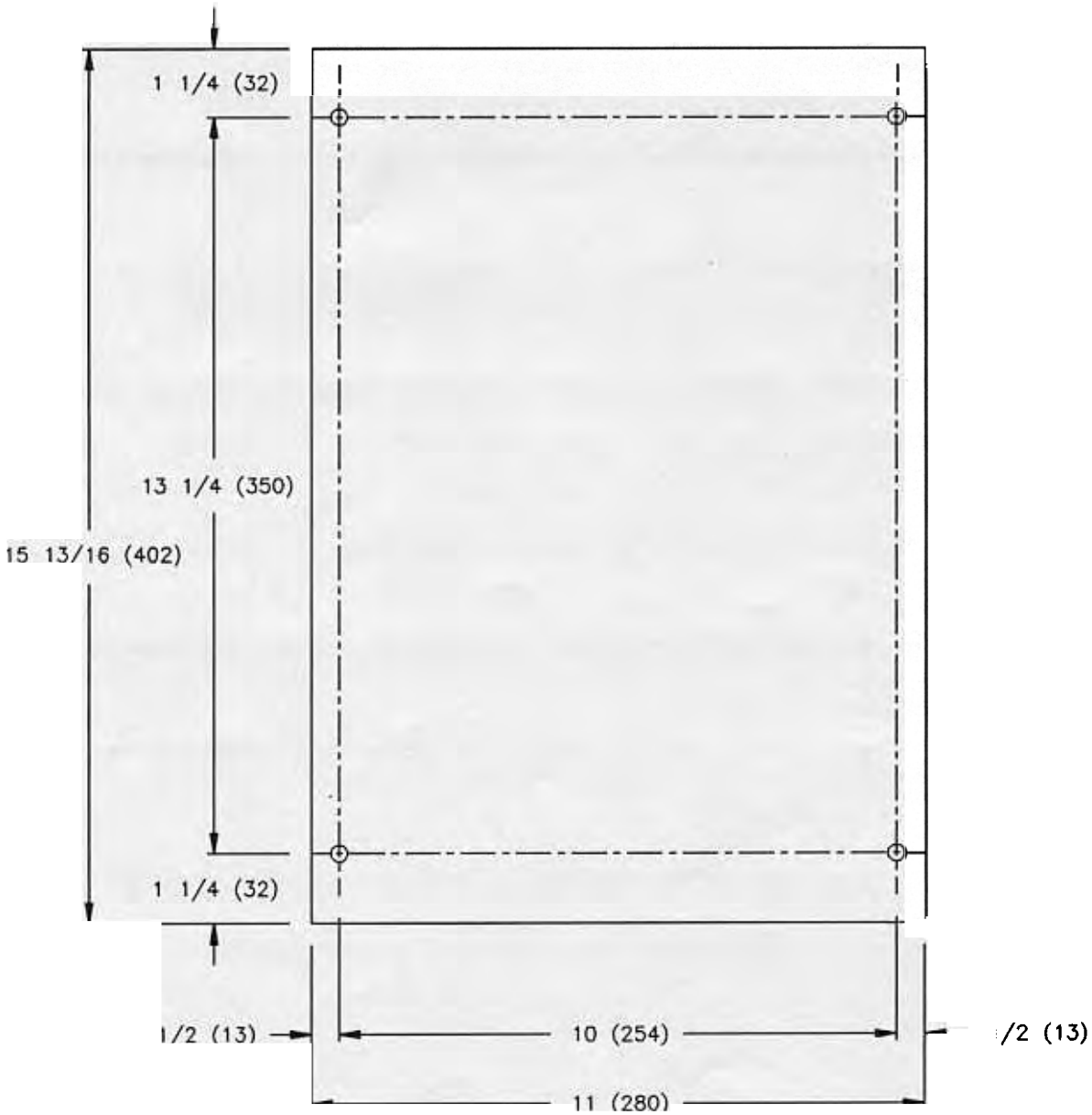
It is imperative that any low-voltage signal conductors, such as resolvers, encoders, drive commands, or communications, (15v or less) be routed in conduits or wire ways separate from high-voltage, such as motor cables, transformer lines, and I/O signal lines (100v or more). This will insure that electromagnetic fields produced by high power transmission do not corrupt the low level signals.

4.5 Grounding Requirements

The site must have a suitable earth ground rod and ground bus installed. The NEMA 12 enclosure, wire ways, conduits, and machine frame must be connected directly to this ground bus. All shields and other earth grounds must be connected to the MSC Ground Strip installed on the panel (Figure 4-2).

4.6 Power Isolation

The System Unit requires 115v AC, 1-phase power and is equipped with a line filter, fuse, and transient protection device. It is recommended that an isolating transformer be installed between the main power source and the outlet servicing the input power cord to the System Unit. The isolation transformer must be dedicated to the motion control system components. Other devices, such as; switched I/O, air conditioners, fans, and lighting, even though these devices are tied to the motion control system, must be powered by a separate AC power source.



Dimensions shown in inches (millimeters)

Mounting holes should be sized for #10 screws

Figure 4-1 Panel Mounting Dimensions for the System Unit

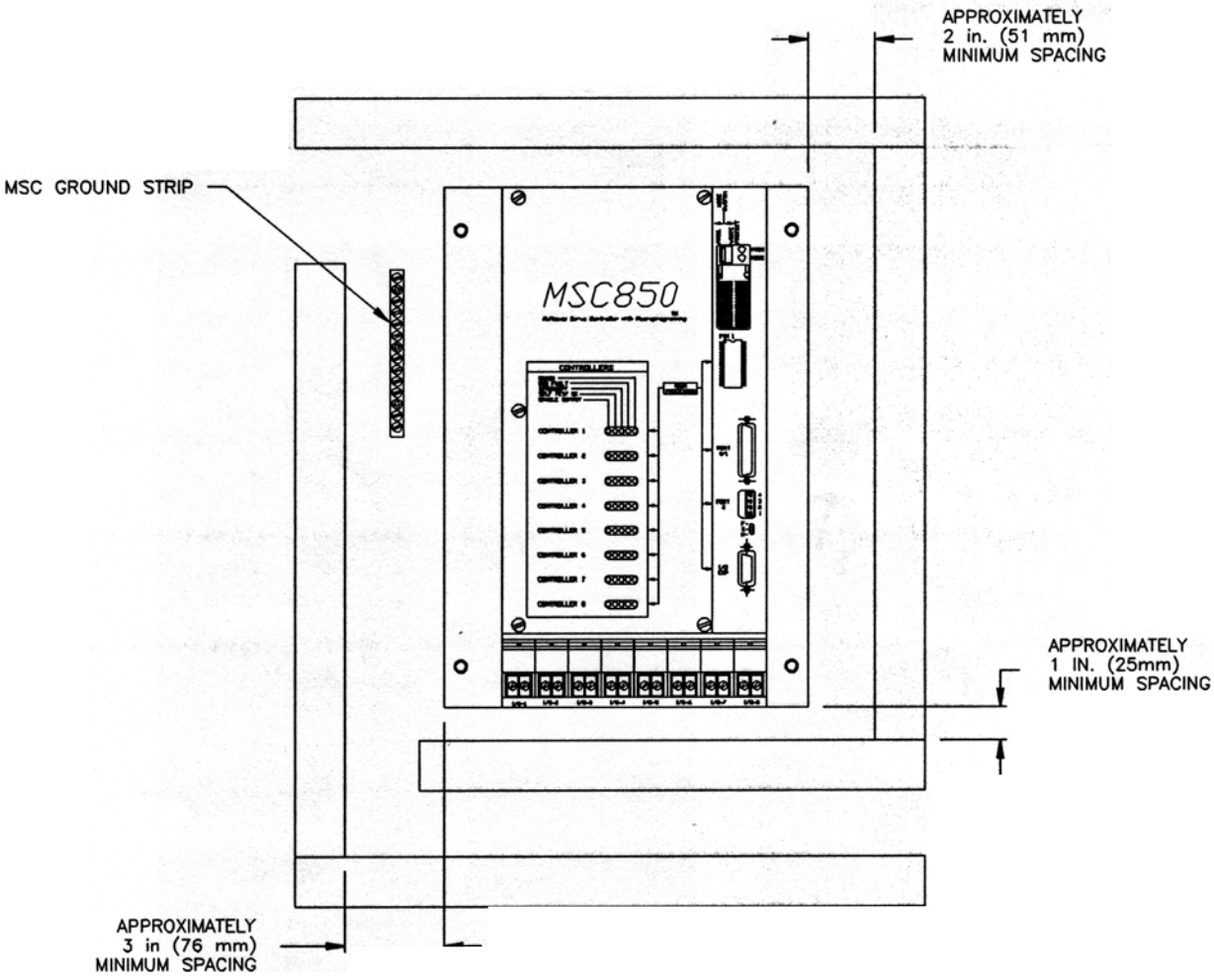


Figure 4-2 Typical Mounting of the System Unit

4.7 Installing The Face-plate

The face-plate is held on by five self-retaining screws. The face-plate is required for proper ventilation and also secures the controllers in their slots.

CAUTION

Proper installation of the face-plate is necessary for ventilating the System Unit. Be sure the face-plate has been properly installed before powering the System Unit.

To remove the face-plate, proceed as follows:

1 Hold the face-plate in place and loosen the five self-retaining screws.

2. Carefully pull the face-plate straight out from the System Unit.

To replace the face-plate, proceed as follows:

1. Set the face-plate in place and move it up and down to seat the controllers in the plastic spacers on the back of the face-plate.

2. Hand tighten the five self-retaining screws.

5.0 CONTROLS AND INDICATORS

5.1 General

The MSC-850 System Unit has status indicators and a mode switch on the face-plate of the Main Processor (Figure 5-1). The status indicators of the controllers are visible through cutouts on the face-plate of the Unit Enclosure.

5.2 Controls

Above the PROM Pocket is a two-position mode switch. The mode switch controls the Write-Protect feature for the PROM.

The mode switch positions are labeled "PROG." for program (write-protect off) and "WRITE PROTECT" for write-protect on. The position of this switch determines the indication of the red LED PROM status indicator labeled "MODE" (Table 5-1).

CAUTION

The MODE SWITCH should be in the WRITE-PROTECT position when inserting the PROM into the PROM pocket, or when powering up the System Unit.

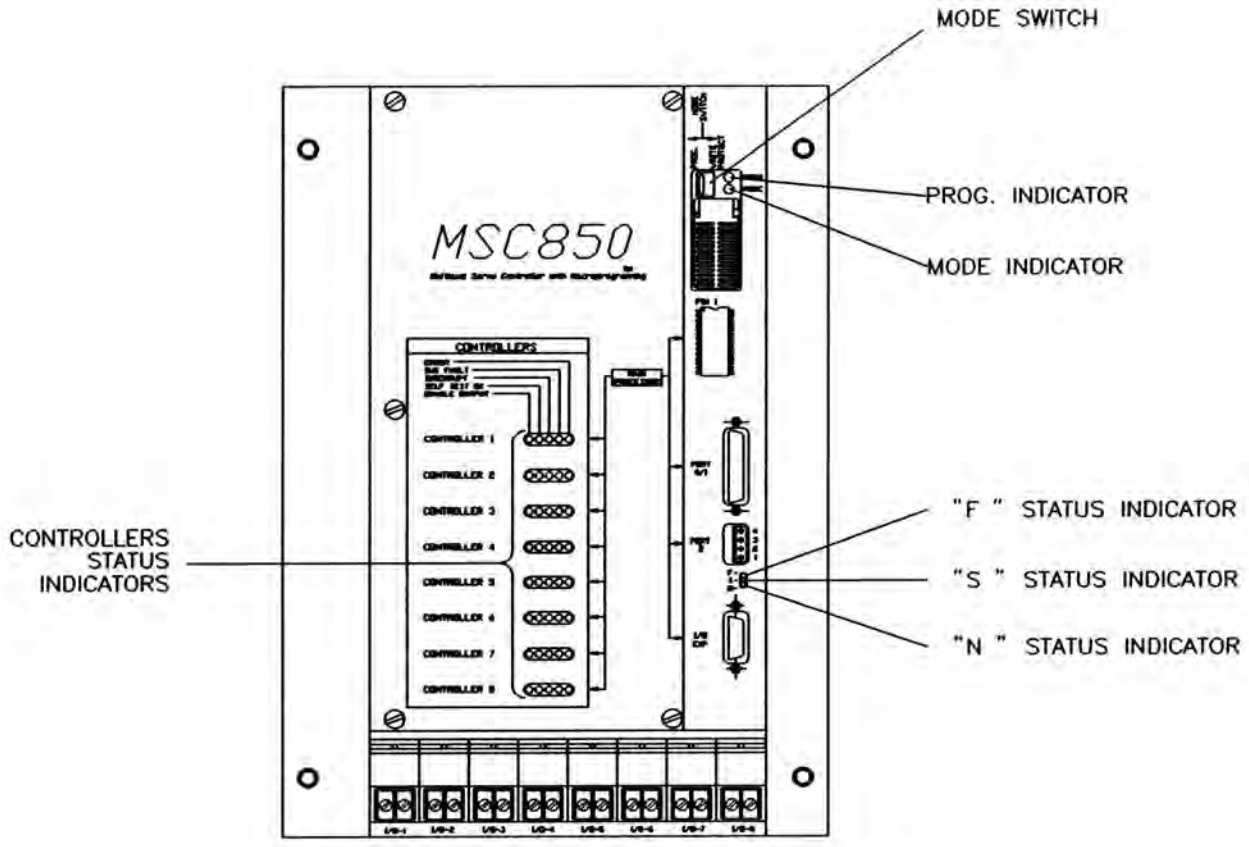


Figure 5-1 Location of Controls and Indicators

5.3 Indicators

The indicators located on the Main Processor (Table 5-2) of the System Unit provide status indication of various operating conditions. The status indicators of the controllers are desribed in the individual controller instruction books.

The indicator on an Output Type Module is illuminated when the MSC-850 System Unit turns the module on.

The indicator on an Input Type Module is illuminated when a user connected activating device turns the module on.

Table 5-1 PROM Status Indicators

PANEL MARKING	DESCRIPTION	OBSERVED INDICATION	INDICATOR FUNCTION
PROG	Green LED	OFF ON	Normal Read Condition Signal-writing to PROM
MODE	Red LED	ON OFF	Write Enabled Write Disabled

Table 5-2 Main Processor Status Indicators

PANEL MARKING	DESCRIPTION	OBSERVED INDICATION	INDICATOR FUNCTION
F	Red LED	OFF Flashes 4 times/sec Turns on for 1 sec ON	No fault. Program lost. Controller response error at start-up. Faulty controller or controller not present.
S	Yellow LED	OFF ON (flashing)	Waiting for communication. Communicating with controller.
N	Green LED	OFF ON	System fault Normal operation

6.0 CONNECTION DIAGRAMS

6.1 General

This section contains the electrical connection diagrams for wiring the On-board I/O Modules and the pin-connectors for ports 0, 1, and 2.

6.2 On-board I/O Modules

Figures 6-1 to 6-6 show the wiring of the six kinds of On-board I/O Modules.

NOTE

Some difficulty may arrise when driving high impedence input modules with solid state outputs. The OFF State leakage current of the Output device can be enough to keep the Input Moudules OFF Voltage too high. This can in result intermittent false triggers or failure to be able to turn the Input Module OFF. It is suggested that the Input Modules OFF State voltage be checked when using this configuration. These OFF State voltages should be no greater than;

- 30v AC for AC Input Modules.
- 1v DC for DC Input Modules.

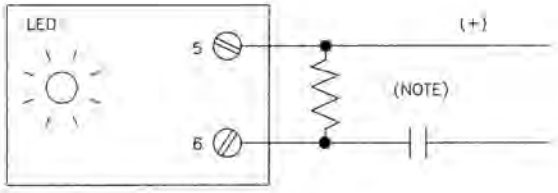


Figure 6-1 DCInput Module S410

VOLTAGE RANGE:	10v to 32v DC
OFF VOLTAGE:	1v DC Min.
ON CURRENT:	25mA @ 32v DC
OFF CURRENT:	0.8mA Max.

NOTE: Higher voltages must be shunted with a resistor. Nominal value: 1KΩ, 1 WATT.

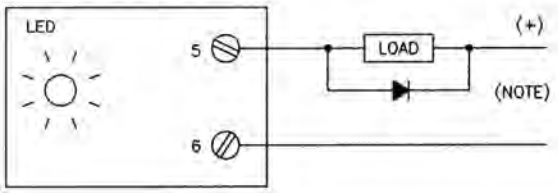


Figure 6-2 DC Output Module S430

VOLTAGE RANGE:	10v to 55v DC
ON CURRENT:	2.75A Max.
VOLTAGE DROP:	2v DC Max.
OFF CURRENT:	10mA Max.

NOTE: Diode Required for Inductive load.

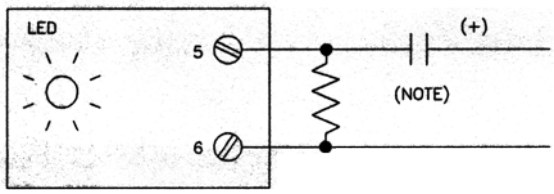


Figure 6-3 AC Input Module S420

VOLTAGE RANGE:	90v to 135v AC
OFF VOLTAGE:	30v AC Min.
ON CURRENT:	15mA
INPUT IMPEDANCE:	10KΩ Nominal

NOTE: Higher voltages must be shunted with a resistor. Nominal Value: 3KΩ, 5 WATT.

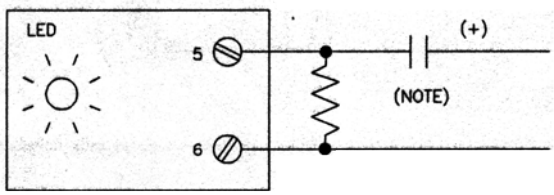


Figure 6-4 AC Input Module S421

VOLTAGE RANGE:	180v to 270v AC
OFF VOLTAGE:	60v AC Min.
ON VOLTAGE:	15mA @ 240v AC
INPUT IMPEDANCE:	10K Nominal

NOTE: Higher voltages must be shunted with a resistor. Nominal value: 6KΩ, 10 WATT.

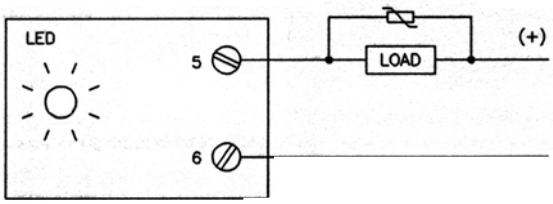
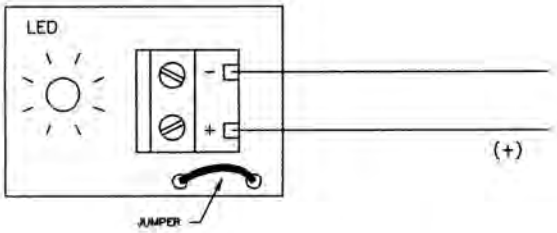


Figure 6-4 AC Output S440

VOLTAGE RANGE	30v to 140v AC
ON CURRENT:	2.75A Max.
VOLTAGE DROP:	1.5v AC Max.
OFF CURRENT:	4mA Max.

NOTE: Required (use GE Transient Suppressor V150LA20A or equivalent).



ON VOLTAGE:	12v to 24v DC Jumper installed 5v Jumpercut
OFF VOLTAGE:	2v DC Max.
INPUT CURRENT:	20mA Max.

Figure 6-6 High Speed DC Input Module HSI-850

6.3 PORT 0

Port 0 is a 20mA current loop port configurable for passive or active operation. Figures 6-7 and 6-8 show their respective connections.

6.4 PORT 1

Port 1 (Figure 6-9) is an executive port for the Macroprogram Development System or a host computer using RS-232C standard interface with Packet Protocol.

6.5 PORT 2

Port 2 (Figure 6-10) is a 20mA current loop port dedicated to passive operation.

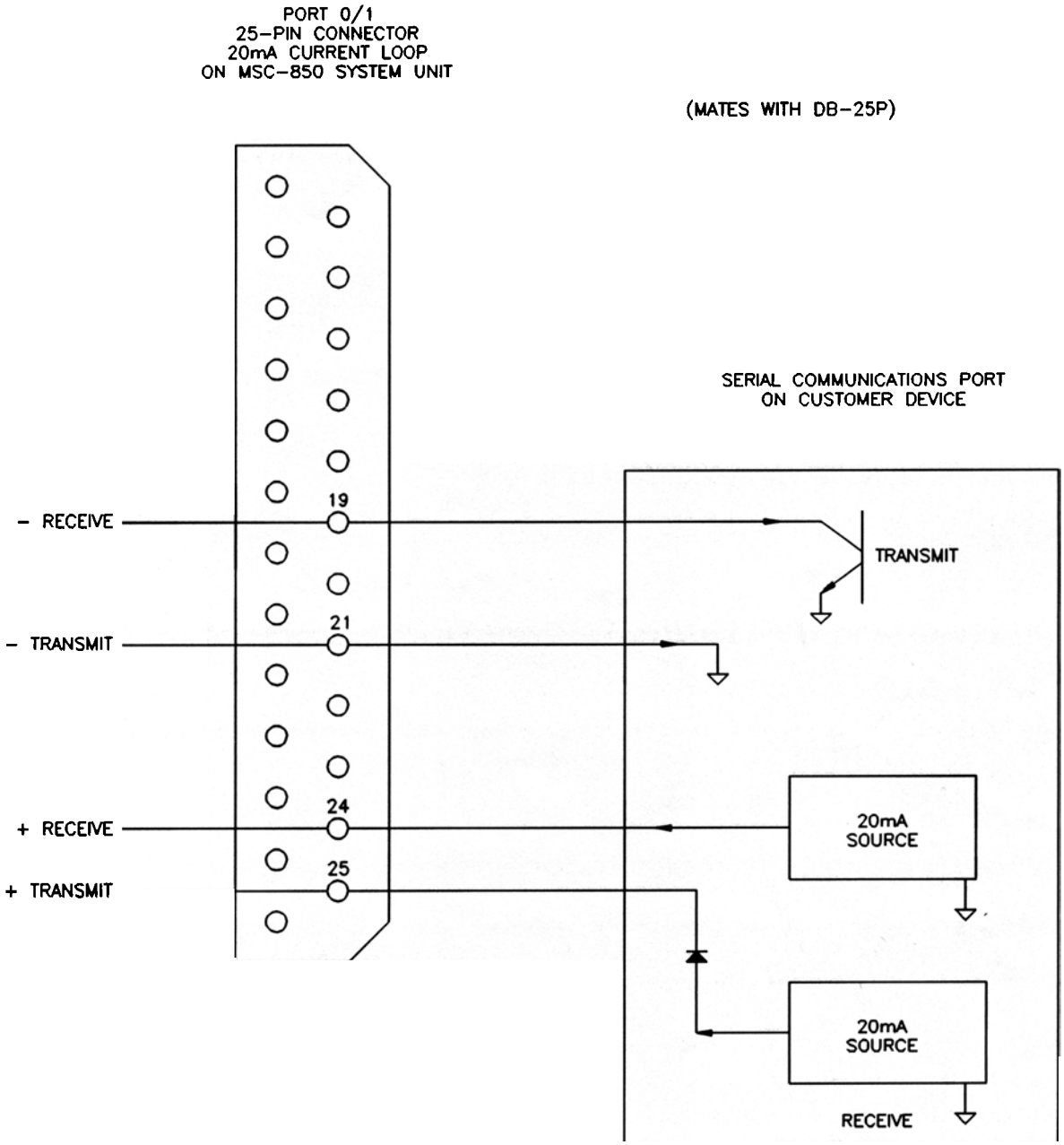


Figure 6-7 Port 0 Typical Passive Configuration

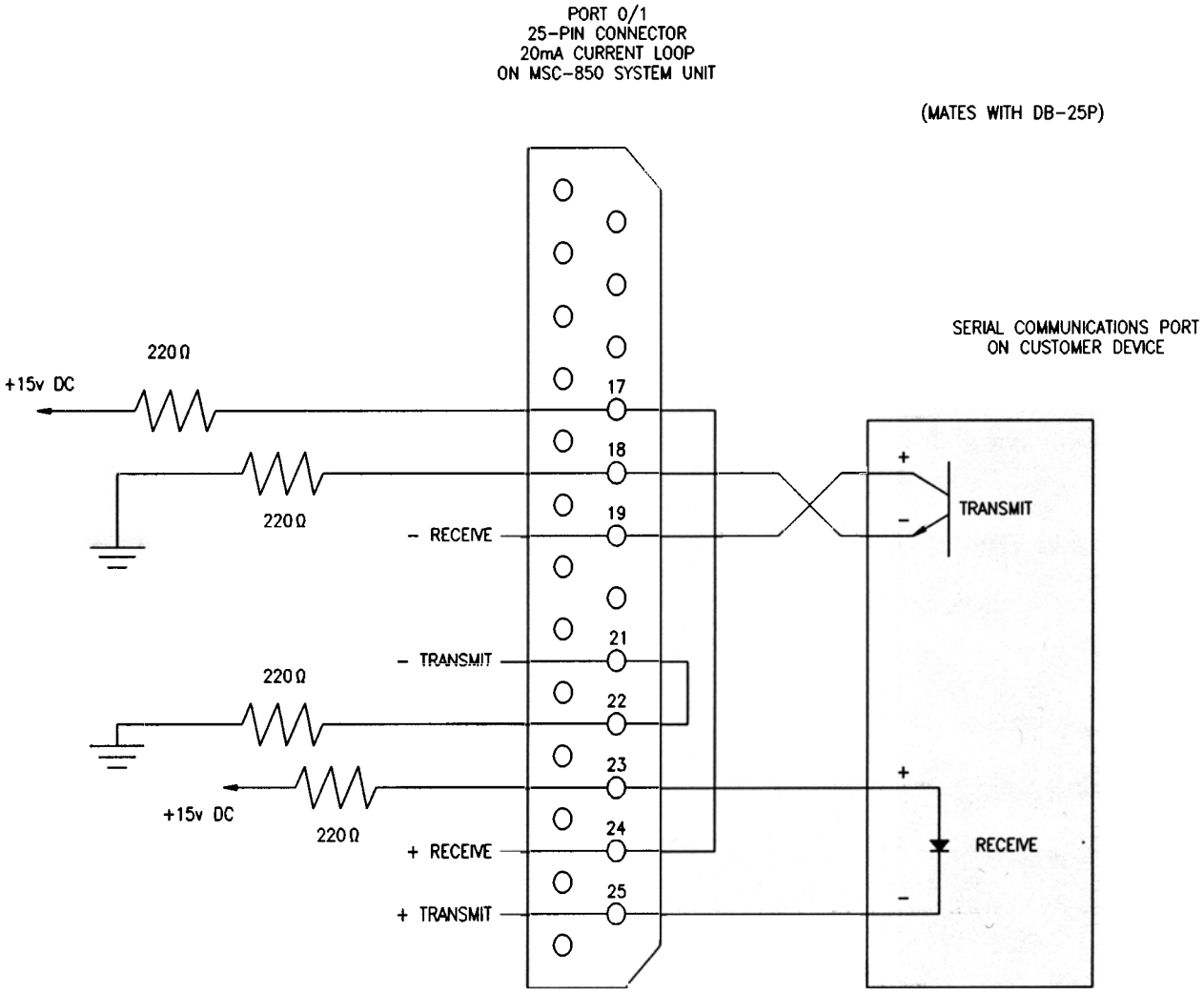


Figure 6-8 Port 0 Typical Active Configuration

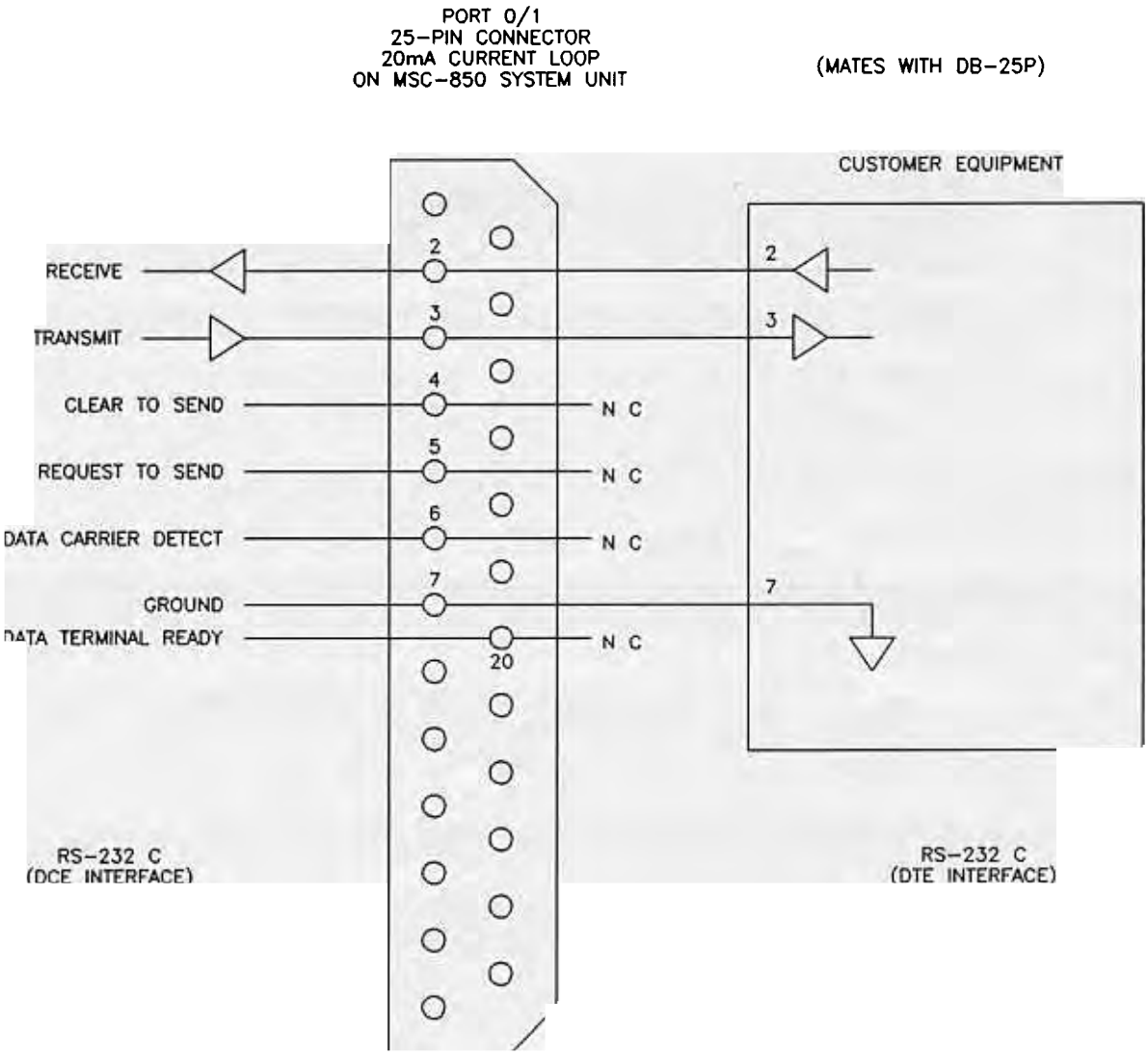


Figure 6-9 Port 1, RS-232C Host Computer Connections

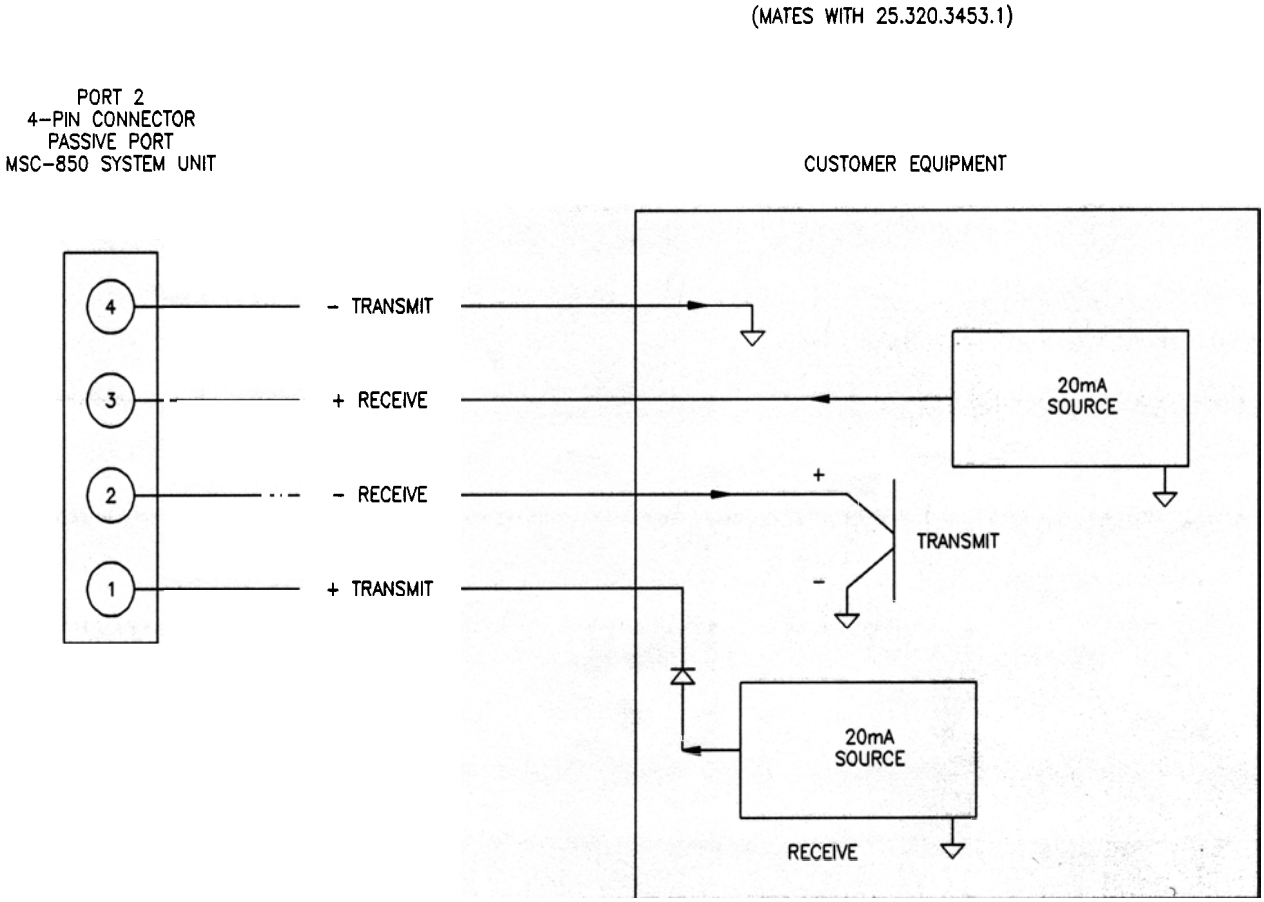


Figure 6-10 Port 2 Typical Connections

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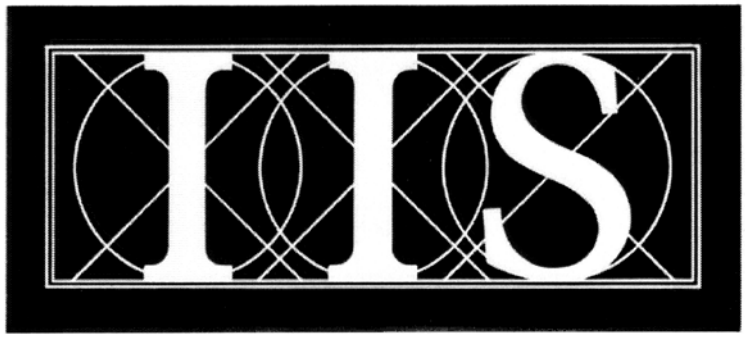

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