FOXBORO®

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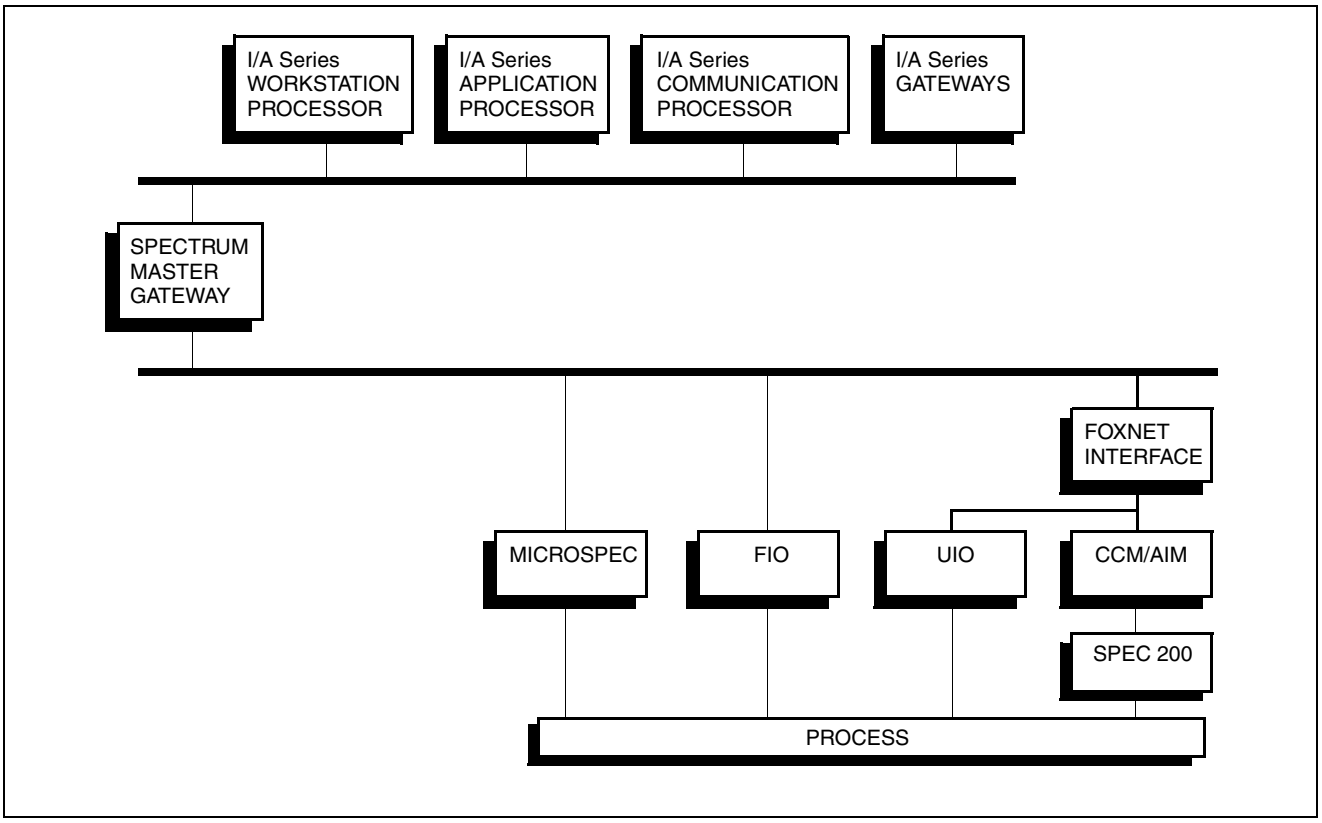
I/A Series® Hardware
SPECTRUM Master Gateway



Use Gateway for Information Management only. User must adhere to Product Specifications.

The SPECTRUM Master Gateway (SMG) is a configurable intelligent interface that allows I/A Series stations to:

- Access (read and write) SPECTRUM station data and file information,
- Control the operation of SPECTRUM stations and tasks.

Supporting optionally redundant configurations, the SMG permits the integration of SPECTRUM systems and I/A Series systems, with the I/A Series system as the master supporting the following functions:

- Plant operations
- Data acquisition
- Process monitoring

The SMG converts SPECTRUM scan-based data to exception-based data, permitting I/A Series stations to access SPECTRUM data using standard naming conventions and access methods.

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Product Specifications

Features of the SMG include:

- Electrical isolation between I/A Series equipment and SPECTRUM equipment.
- Optional redundant configuration, in which no single hardware fault can cause the gateway to fail.
- The SMG performs all necessary conversion of SPECTRUM data to I/A Series system data and vice versa (except for file transfer support where the user must provide for conversions). The SMG appears as a SPECTRUM station from the SPECTRUM side of the interface and as an I/A Series station from the I/A Series side.
- The SMG databases contain I/A Series blocks with their own default displays.
- The SMG periodically scans SPECTRUM stations to refresh its data and converts this scanned data into I/A Series exception updates.
- The SMG allows I/A Series stations to read or write data to SPECTRUM Masters. Also, tasks in SPECTRUM master stations can be started or stopped upon request from I/A Series stations.

In addition, the SMG supports SPECTRUM network management functions including:

- Building and updating of MICROSPEC Unit Control Module (UCM) and Field Input-Output (FIO) Subsystem databases.
- Startup or restart of UCM and FIO stations.
- FOXNET management functions, error reporting, selecting transfer of main/backup, status, etc.

SMG OVERVIEW

The SMG provides a configurable interface between SPECTRUM and I/A Series systems. It scans SPECTRUM slave stations, detects data value changes, stores changes in its database, and generates messages to the appropriate I/A Series stations.

SPECTRUM process alarms are routed to I/A Series stations. I/A Series stations access SPECTRUM data (input and output) via the standard Inter-Process Communications (IPC) Object Manager (OM) functions (i.e., get/set or change driven). File data transfer and run/stop task requests from I/A Series stations to SPECTRUM Multistation (SMS) and FOX 1/A (Version E and F) are supported.

The SMG supports up to two independent, redundant SPECTRUM networks and can be configured as a set of redundant partners. The SMG monitors its own health and the health of the SPECTRUM networks and stations connected to it. In case of failure of SPECTRUM devices, alarm messages are reported to configured alarm devices on the I/A Series network.

SMG Configuration

The SMG consists of both SPECTRUM and I/A Series components. The SPECTRUM Database Processor (SDP) on the SPECTRUM side of the interface is a SPECTRUM master station that is connected to FOXNET via a linkport. The I/A Series side of the SMG consists of up to four (depending on capacity requirements) I/A Series SPECTRUM Interface Processors (SIP) interfaced to the SDP via dedicated links and connected to the same or separate I/A Series Nodebuses.

System configurations may contain one or two independent (redundant or nonredundant) SPECTRUM networks connected to any combination of stations at the SPECTRUM side.

Database configuration is a two step process:

1. DP scan block configuration and network configuration are done with an off-line configurator on a Personal Computer (on-line modifications to scan data from a Personal Computer are also supported). SPECTRUM UCM and FIO configuration is supported via the same Personal Computer.
2. The associated SIP(s) are configured via the I/A Series Integrated Control Configurator (ICC).

System Configurations

Following are the supported SPECTRUM configurations:

1. *Nonredundant SMG (one or two nonredundant networks)*

   The minimum configuration (Figure 1) contains a single SDP connected to one or two nonredundant SPECTRUM networks interfaced to up to four SIPs connected to Nodebus.

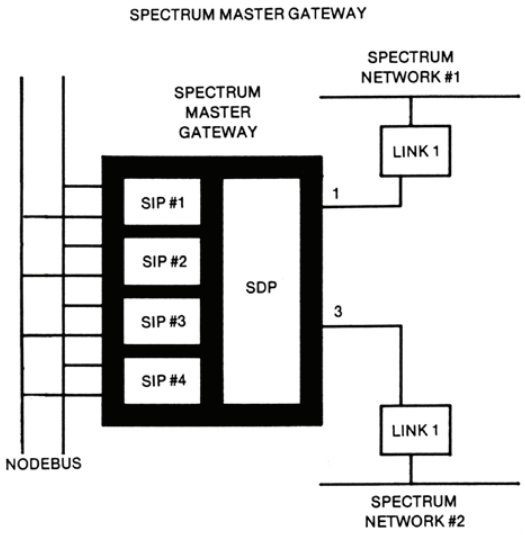


Figure 1.

2. *Nonredundant SMG (one or two redundant networks)*

   Figure 2 shows an SMG with an SDP interface up to four SIPs. The SDP can be connected to one or two fully redundant SPECTRUM networks.

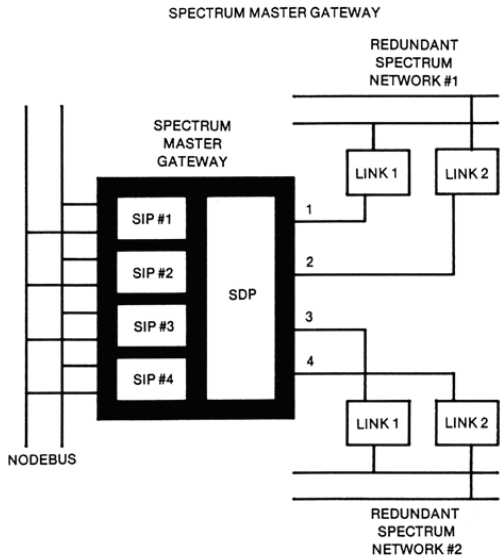


Figure 2.

3. *Red*undant SMG (one or two redundant networks)

   A fully redundant SMG configuration (Figure 3) consists of two SDPs, each connected to one or two fully redundant SPECTRUM networks. Each SDP is connected to its own set of SIPs (up to four).

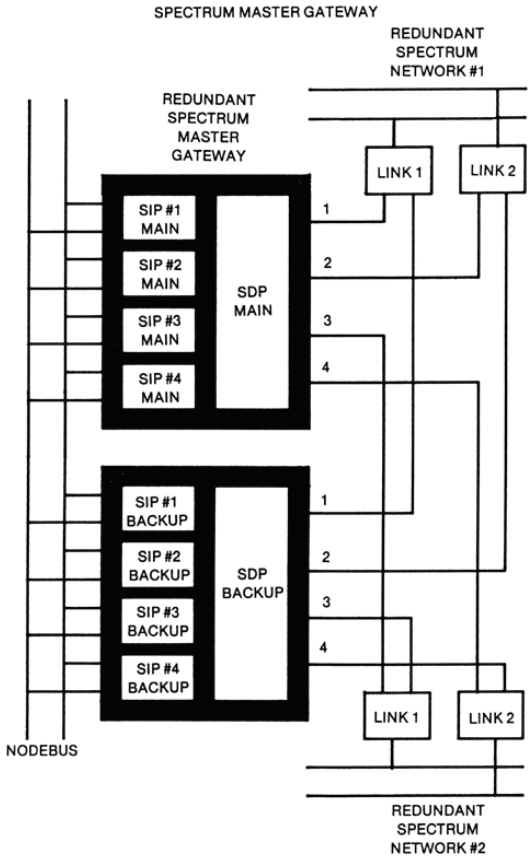


Figure 3.

In each of these cases, the SDP may be configured with two or four megabytes of memory and one or two CPUs, depending on the number of SPECTRUM blocks interface and the required processing rate (the dual CPU configuration requires four megabytes of memory).

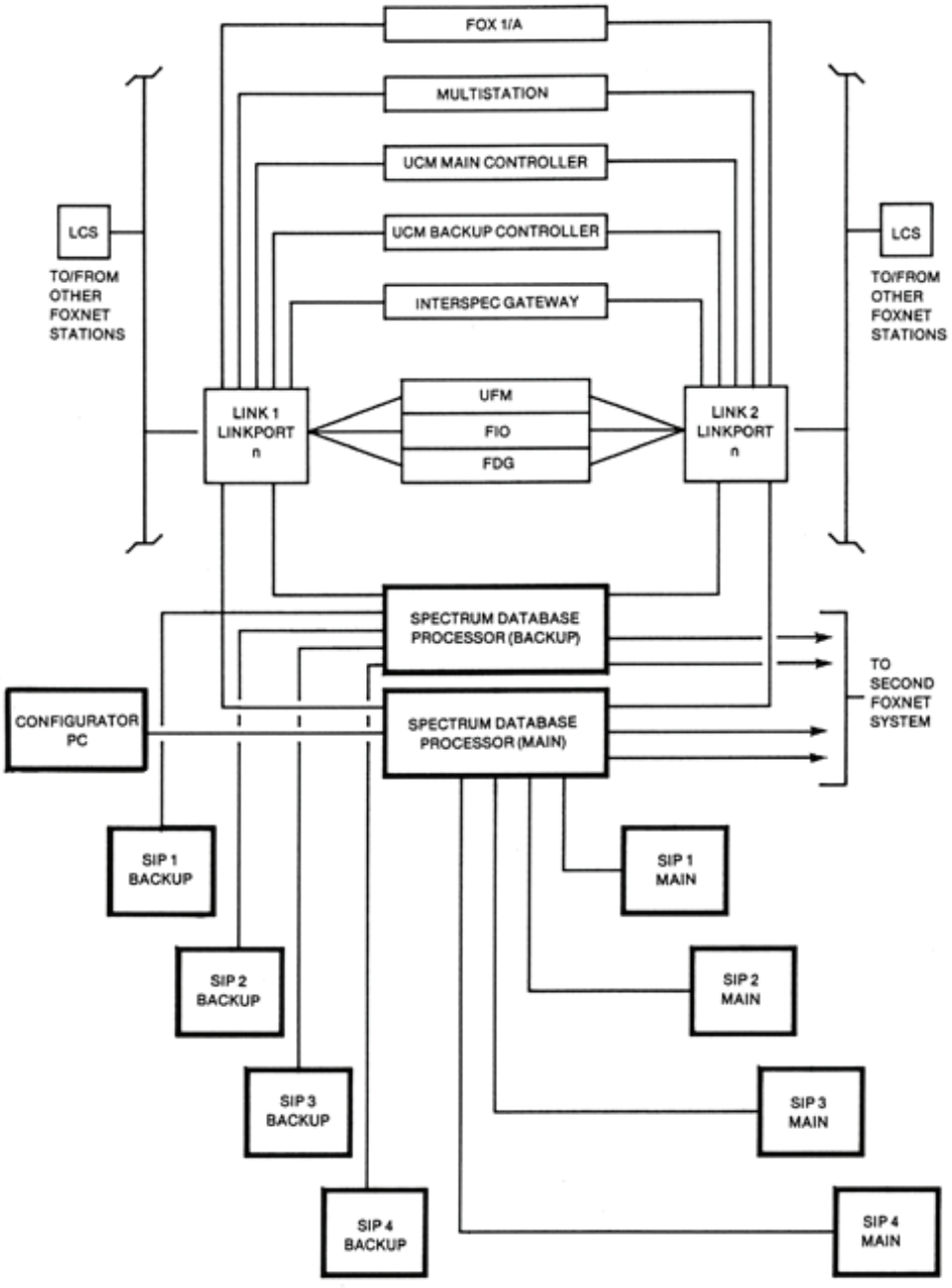
Figure 4 shows a fully redundant SMG configuration with a representative set of SPECTRUM station types. The following slave stations are supported by the SMG: UCM1, UCM2, UCM2C, UCM3, UCM4, NCM, FIO, FDG, FPCI, UIO, UFM, AIM, and CCM. The SMG also supports FDG, SMS, FOX 1/A (Version E and F), FOX 3, FOX 300, SDP, and DBU, and the INTERSPEC Gateway as configured as a Linkport Extender (all SPECTRUM station types are supported for system management functions).

The I/A Series System Configurator supports configuration of the SIPs as I/A Series station types. SIPs appear as the only network connection on the I/A Series side. The SPECTRUM stations are configured via the SDP configurator using a dedicated Personal Computer.

SMG Scan Blocks

The SMG has new I/A Series blocks associated with the SIP. These block types map into SDP scan blocks and have their own unique default displays. Table 1 shows how these block types map through to SPECTRUM. The mapping of signals (measurement, set point, ratio, total, etc.) between the SDP and SIP blocks is one-for-one for these blocks. Statuses are not mapped one-for-one since many SPECTRUM statuses have no direct equivalent in the SIP (I/A Series) blocks.

The SDP scan blocks can be configured as "standard" or "nonstandard" connections. "Standard" connections are mapped to preselected block variables as in Table 1, and alarm detection is performed in the SPECTRUM slave station. "Nonstandard" connection blocks are SDP blocks where block variables can be mapped onto most parameters or values, and alarm detection is done by the SDP (all blocks except the Totalizer block can have "nonstandard" connections). SDIO blocks can be connected to any bit in a parameter or value from SPECTRUM.



REDUNDANT SPECTRUM MASTER GATEWAY

SUPPORTED SPECTRUM STATIONS		
UCM 1	SMS	FPCI
UCM 2	FOX 1/A (VERS. E & F)	UIO
UCM 2C	FCG	UFM
UCM 3	FOX 3	DBU
UCM 4	FIO	AIM (THROUGH INTERSPEC GATEWAY OR PIT)
NCM	FDG	CCM (THROUGH INTERSPEC GATEWAY OR PIT)
FOX 300	SDP	INTERSPEC GATEWAY (CONFIG. AS LINKPORT EXTENDER)

NOTE: ALL SPECTRUM STATIONS ARE SUPPORTED FOR SYSTEM MGT. FUNCTIONS

Figure 4.

Table 1

SMG BLOCK CONNECTIONS

SIP (I/A SERIES) BLOCKS	SDP (SPECTRUM) BLOCKS	STANDARD UCM CONNECTIONS
SAIN____	AIN____	AIN (*1)
SAIO____	AIO____	PID, INT, AMB
SDIN____	DIN____	DIN (*2, *4)
SDIO____	DIO____	DOUT, SEQ (*4)
SCTLR____	CTLR____	PID (+TUNE)(*3), INT, DGAP
SBIAS____	BIAS____	AMB
SRATIO____	RTIO____	RTIO
STOT____	TOT____	ACUM (*2)

NOTES:
*1. Either MEAS1 or MEAS2 in a UCM3 or UCM4 AIN can be connected.
*2. Valid only for UCM2, UCM3, or UCM4.
*3. Valid only for UCM4.
*4. Block associated with 8 contact logic values in the same SPECTRUM Slave Station

Block Processing

At initialization, the SDP scans all its blocks to gather the latest process data. Each block is then scanned at its configured scan period (1, 2, 3, 4, 5, 10, 30, or 60 seconds). Analog data is updated only when a per block configured exception deadband is exceeded. This applies to measurement, (remote) set point, output, (remote) ratio, and (remote) bias. Any change in digital data or changes in alarm status or block status in a "standard" block connection are processed.

The SDP can signal condition process measurements and set points of "nonstandard" blocks per Table 2.

Table 2.

SIGNAL CONDITIONING

1. LINEAR	;0-4000 COUNTS
2. LINEAR	;800-4000 COUNTS
3. SQUARE ROOT	;0-4000 COUNTS
4. SQUARE ROOT	;800-4000 COUNTS
5. SQUARE ROOT	0-4000 COUNTS (CUTOFF BELOW 30 NORM. COUNTS)
6. SQUARE ROOT	;800-4000 COUNTS (CUTOFF BELOW 830 NORM. COUNTS)
7. BINARY CODED DECIMAL	
8. POLYNOMIAL CONV.	;0-4000 COUNTS (MEAS. ONLY)
9. POLYNOMIAL CONV.	;800-4000 COUNTS (MEAS. ONLY)

Scan Block Changes and Process Data Changes

SPECTRUM variables and statuses can be changed from an I/A Series application or display.

Set Point Control

The SMG supports Peer-to-Peer connections for loosely coupled (low frequency) set point control functions initiated at an I/A Series control station (CP). The SMG limits these actions to ensure that the normal SPECTRUM data processing of the SMG is not impacted.

Alarm Handling

The SMG translates SPECTRUM alarms into the appropriate I/A Series alarms (destination per the configuration of the associated compound in the SIP). The following SPECTRUM alarm types are supported:

- Out-of-Range Alarm
- Absolute Alarm
- Deviation Alarm
- Output Alarm
- Target and Pretarget Alarm on totalizer totals
- Pattern Alarms on digital inputs

The destination of System Alarms (SPECTRUM station failures or SPECTRUM station status changes) is also configurable.

SPECTRUM Master Communication

The SMG supports file data transfer (read/write) and run/stop task requests from I/A Series stations to SMS, FOX 1/A, and FCG. Data formatting is an application responsibility.

Redundancy

A redundant SMG consists of two SDPs each with up to four associated SIPs. A pair of SDP units can be packaged together in the same cabinet with separate power supplies. The SDPs communicate with each other using FOXNET messages.

A failure in either an SDP or an SIP causes a switchover to the tracking unit (SDP and SIP[s] combination). The initial scan time of the new control unit is a function of the size of the database (site dependent). The connected points are then updated with the freshly scanned values. The duration of these updates is a function of the number of connected points.

Startup and Initialization

During powerup, the SDP Operating System is loaded into memory from the Winchester disk and initializes automatically. Initial Link Monitoring and Station Monitoring are performed before scan blocks are initialized. SIPs are downloaded from an I/A Series Application Processor and are self-initialized.

SPECTRUM DATABASE PROCESSOR

The SPECTRUM Database Processor (SDP) component of the SMG is available as a rack-mounted stand-alone unit that is in either a redundant or nonredundant version. It connects to the FOXNET Process Communications Link through a Linkport (LP). Redundant LPs can be added for additional communications and system security. In a multiple LP configuration, Link Control Stations arbitrate contention for control among LPs.

Communications from the SDP component to the I/A Series component of an SMG (SIP) are supported through up to four X.25 channels.

SDP Hardware Elements

A basic SDP consists of the following hardware elements:

- One (or two, dependent on required performance) INTEL 286-10 CPU board with one 80287 math co-processor and asynchronous system terminal port.
- One (or two, dependent on number of blocks or INTEL 286-10 CPU boards) 2 megabyte RAM memory.
- A magnetic media controller for a floppy disk, Winchester disk, and streamer tape drive.
- Up to four independent FOXNET ports.
- A streamer tape drive.
- A Winchester disk drive.
- A floppy disk drive.
- Serial interface (INTEL 188) controller board for Personal Computer and SIP interface.

These hardware elements are Multibus compatible assemblies that plug into a nest in the SDP.

The Personal Computer for database configuration is supplied by the customer and must be an IBM PC or IBM XT compatible, with 640K memory and 10 megabyte disk, running MS-DOS Operating System Version 3.1 or higher.

SDP Software Elements

The SDP consists of the following software:

On-Line:

- VRTX Operating System
- SPECTRUM Database Processing Software

Off-Line:

- Concurrent PC DOS
- Utility Software
- PC Database Configuration Software

System Security

System security encompasses both hardware and software elements. The SDP performs a series of on-line diagnostic self-checks as an aid in detecting hardware faults. An optionally, fully redundant SDP provides the maximum hardware security, with an automatic switchover to the redundant unit in the event the primary unit fails. The following summarizes the security provisions of the SDP:

Power

The SDP monitors its internal voltages and supply sources. Input voltage variations of +10% or -15% can be tolerated without adversely affecting systems operation. The system can also tolerate total power interruptions of up to 30 milliseconds.

Processors

During startup, a set of internal diagnostic tests is run to determine the health of the processors. If any of these tests should fail, the SDP will not initialize.

FOXNET Ports

Whenever a FOXNET port is logically connected to the system, a series of self-tests are run to verify its proper operation. If an error occurs or the data calculations do not match, the port is failed and an appropriate error message generated at selected I/A Series workstations. Longitudinal redundancy checks are also used to verify operation of FOXNET Ports.

FOXNET Messages

All incoming messages are checked for address and data validity prior to being processed.

Serial Ports

The SDP monitors the status of each X.25 serial port, including its error counter, and can be notified automatically when this status changes.

I/A Series SPECTRUM INTERFACE PROCESSOR

The I/A Series SPECTRUM Interface Processor (SIP) component of the SMG is an I/A Series station packaged as a nonexpandable single width X-module form factor which connects to the Mounting Structure of an I/A Series enclosure and accesses the Nodebus. Peripheral connectors are made via cable connectors secured to the top or bottom of the mounting structure that houses the SIP. Communication to the SDP component of the SMG is via an X.25 interface port.

SIP Hardware Elements

The SIP processor architecture consists of the following:

- 80C86 Processor
- 896KB Dynamic RAM Memory
- Nodebus Interface
- X.25 Interface I/O Port
- 80C87 Numeric Coprocessor

SIP Software Elements

The SIP consists of the following software:

On-Line:

- VRTX Operating System
- I/A Series SPECTRUM Interface Processing Software

Access to Data

Any station on the I/A Series network has access to all data variables imported through the SDP. Additionally, I/A Series stations can initiate communication of data values to SPECTRUM stations through the SDP.

Diagnostics

The SIP uses three types of diagnostics to detect and/or isolate faults:

- Powerup Self-Checks
- Runtime and Watchdog Timer Checks
- Off-line Diagnostics

Powerup self-checks are self-initiated when power is applied to the SIP. These checks perform sequential tests on the various processor functional elements.

Red and green indicators at the front of the processor module reflect the successful (or nonsuccessful) completion of the startup sequence.

The runtime and watchdog timer checks provide continuous monitoring of processor functions during normal system operations. The operator is informed of a malfunction by printed and/or displayed system messages. Using standard I/A Series off-line diagnostics, a suspected fault in the processor can be isolated and/or confirmed.

Initialization

When the SIP powers up, it receives its code and database from an I/A Series Application Processor before beginning execution.

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