

Power Systems

IBM i service functions

IBM

Power Systems

IBM i service functions

IBM

Note

Before using this information and the product it supports, read the information in “Safety notices” on page ix, “Notices” on page 203, the *IBM Systems Safety Notices* manual, G229-9054, and the *IBM Environmental Notices and User Guide*, Z125-5823.

This edition applies to IBM Power Systems™ servers that contain the POWER8® processor and to all associated models.

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Safety notices

Safety notices may be printed throughout this guide:

- **DANGER** notices call attention to a situation that is potentially lethal or extremely hazardous to people.
- **CAUTION** notices call attention to a situation that is potentially hazardous to people because of some existing condition.
- **Attention** notices call attention to the possibility of damage to a program, device, system, or data.

World Trade safety information

Several countries require the safety information contained in product publications to be presented in their national languages. If this requirement applies to your country, safety information documentation is included in the publications package (such as in printed documentation, on DVD, or as part of the product) shipped with the product. The documentation contains the safety information in your national language with references to the U.S. English source. Before using a U.S. English publication to install, operate, or service this product, you must first become familiar with the related safety information documentation. You should also refer to the safety information documentation any time you do not clearly understand any safety information in the U.S. English publications.

Replacement or additional copies of safety information documentation can be obtained by calling the IBM Hotline at 1-800-300-8751.

German safety information

Das Produkt ist nicht für den Einsatz an Bildschirmarbeitsplätzen im Sinne § 2 der Bildschirmarbeitsverordnung geeignet.

Laser safety information

IBM® servers can use I/O cards or features that are fiber-optic based and that utilize lasers or LEDs.

Laser compliance

IBM servers may be installed inside or outside of an IT equipment rack.

DANGER: When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard:

- If IBM supplied the power cord(s), connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product.
- Do not open or service any power supply assembly.
- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords.
 - For AC power, disconnect all power cords from their AC power source.
 - For racks with a DC power distribution panel (PDP), disconnect the customer's DC power source to the PDP.
- When connecting power to the product ensure all power cables are properly connected.

- For racks with AC power, connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- For racks with a DC power distribution panel (PDP), connect the customer's DC power source to the PDP. Ensure that the proper polarity is used when attaching the DC power and DC power return wiring.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Do not attempt to switch on power to the machine until all possible unsafe conditions are corrected.
- Assume that an electrical safety hazard is present. Perform all continuity, grounding, and power checks specified during the subsystem installation procedures to ensure that the machine meets safety requirements.
- Do not continue with the inspection if any unsafe conditions are present.
- Before you open the device covers, unless instructed otherwise in the installation and configuration procedures: Disconnect the attached AC power cords, turn off the applicable circuit breakers located in the rack power distribution panel (PDP), and disconnect any telecommunications systems, networks, and modems.

DANGER:

- Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.

To Disconnect:

1. Turn off everything (unless instructed otherwise).
2. For AC power, remove the power cords from the outlets.
3. For racks with a DC power distribution panel (PDP), turn off the circuit breakers located in the PDP and remove the power from the Customer's DC power source.
4. Remove the signal cables from the connectors.
5. Remove all cables from the devices.

To Connect:

1. Turn off everything (unless instructed otherwise).
2. Attach all cables to the devices.
3. Attach the signal cables to the connectors.
4. For AC power, attach the power cords to the outlets.
5. For racks with a DC power distribution panel (PDP), restore the power from the Customer's DC power source and turn on the circuit breakers located in the PDP.
6. Turn on the devices.

Sharp edges, corners and joints may be present in and around the system. Use care when handling equipment to avoid cuts, scrapes and pinching. (D005)

(R001 part 1 of 2):

DANGER: Observe the following precautions when working on or around your IT rack system:

- Heavy equipment—personal injury or equipment damage might result if mishandled.
- Always lower the leveling pads on the rack cabinet.
- Always install stabilizer brackets on the rack cabinet.
- To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.
- Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices. In addition, do not lean on rack mounted devices and do not use them to stabilize your body position (for example, when working from a ladder).



- Each rack cabinet might have more than one power cord.
 - For AC powered racks, be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.
 - For racks with a DC power distribution panel (PDP), turn off the circuit breaker that controls the power to the system unit(s), or disconnect the customer's DC power source, when directed to disconnect power during servicing.
- Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.
- An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.

(R001 part 2 of 2):

CAUTION:

- Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.
- Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.
- Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.
- *(For sliding drawers.)* Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack. Do not pull out more than one drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.



- *(For fixed drawers.)* This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack might cause the rack to become unstable or cause the drawer to fall out of the rack.

CAUTION:

Removing components from the upper positions in the rack cabinet improves rack stability during relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building.

- Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must observe the following precautions:
 - Remove all devices in the 32U position (compliance ID RACK-001 or 22U (compliance ID RR001) and above.
 - Ensure that the heaviest devices are installed in the bottom of the rack cabinet.
 - Ensure that there are little-to-no empty U-levels between devices installed in the rack cabinet below the 32U (compliance ID RACK-001 or 22U (compliance ID RR001) level, unless the received configuration specifically allowed it.
- If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.
- If the rack cabinet you are relocating was supplied with removable outriggers they must be reinstalled before the cabinet is relocated.
- Inspect the route that you plan to take to eliminate potential hazards.
- Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that comes with your rack cabinet for the weight of a loaded rack cabinet.
- Verify that all door openings are at least 760 x 230 mm (30 x 80 in.).
- Ensure that all devices, shelves, drawers, doors, and cables are secure.
- Ensure that the four leveling pads are raised to their highest position.
- Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.
- Do not use a ramp inclined at more than 10 degrees.
- When the rack cabinet is in the new location, complete the following steps:
 - Lower the four leveling pads.
 - Install stabilizer brackets on the rack cabinet.
 - If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.
- If a long-distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also lower the leveling pads to raise the casters off of the pallet and bolt the rack cabinet to the pallet.

(R002)

(L001)



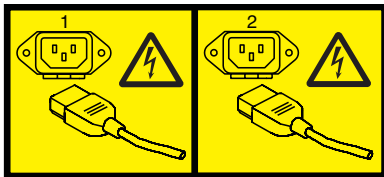
DANGER: Hazardous voltage, current, or energy levels are present inside any component that has this label attached. Do not open any cover or barrier that contains this label. (L001)

(L002)

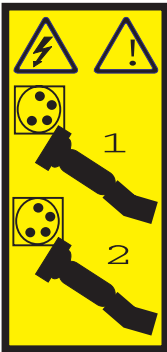


DANGER: Rack-mounted devices are not to be used as shelves or work spaces. (L002)

(L003)



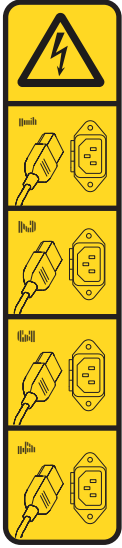
or



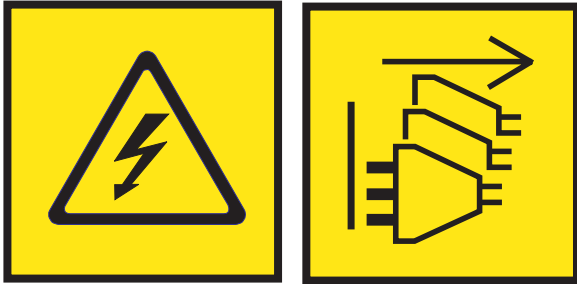
or



or



or



DANGER: Multiple power cords. The product might be equipped with multiple AC power cords or multiple DC power cables. To remove all hazardous voltages, disconnect all power cords and power cables. (L003)

(L007)



CAUTION: A hot surface nearby. (L007)

(L008)



CAUTION: Hazardous moving parts nearby. (L008)

All lasers are certified in the U.S. to conform to the requirements of DHHS 21 CFR Subchapter J for class 1 laser products. Outside the U.S., they are certified to be in compliance with IEC 60825 as a class 1 laser product. Consult the label on each part for laser certification numbers and approval information.

CAUTION:

This product might contain one or more of the following devices: CD-ROM drive, DVD-ROM drive, DVD-RAM drive, or laser module, which are Class 1 laser products. Note the following information:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of the controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

(C026)

CAUTION:

Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. Although shining light into one end and looking into the other end of a disconnected optical fiber to verify the continuity of optic fibers may not injure the eye, this procedure is potentially dangerous. Therefore, verifying the continuity of optical fibers by shining light into one end and looking at the other end is not recommended. To verify continuity of a fiber optic cable, use an optical light source and power meter. (C027)

CAUTION:

This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)

CAUTION:

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following information: laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam. (C030)

CAUTION:

The battery contains lithium. To avoid possible explosion, do not burn or charge the battery.

Do Not:

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C003)

CAUTION:

Regarding IBM provided VENDOR LIFT TOOL:

- Operation of LIFT TOOL by authorized personnel only.
- LIFT TOOL intended for use to assist, lift, install, remove units (load) up into rack elevations. It is not to be used loaded transporting over major ramps nor as a replacement for such designated tools like pallet jacks, walkies, fork trucks and such related relocation practices. When this is not practicable, specially trained persons or services must be used (for instance, riggers or movers).
- Read and completely understand the contents of LIFT TOOL operator's manual before using. Failure to read, understand, obey safety rules, and follow instructions may result in property damage and/or personal injury. If there are questions, contact the vendor's service and support. Local paper manual must remain with machine in provided storage sleeve area. Latest revision manual available on vendor's web site.
- Test verify stabilizer brake function before each use. Do not over-force moving or rolling the LIFT TOOL with stabilizer brake engaged.
- Do not move LIFT TOOL while platform is raised, except for minor positioning.
- Do not exceed rated load capacity. See LOAD CAPACITY CHART regarding maximum loads at center versus edge of extended platform.
- Only raise load if properly centered on platform. Do not place more than 200 lb (91 kg) on edge of sliding platform shelf also considering the load's center of mass/gravity (CoG).
- Do not corner load the platform tilt riser accessory option. Secure platform riser tilt option to main shelf in all four (4x) locations with provided hardware only, prior to use. Load objects are designed to slide on/off smooth platforms without appreciable force, so take care not to push or lean. Keep riser tilt option flat at all times except for final minor adjustment when needed.
- Do not stand under overhanging load.
- Do not use on uneven surface, incline or decline (major ramps).
- Do not stack loads.
- Do not operate while under the influence of drugs or alcohol.
- Do not support ladder against LIFT TOOL.
- Tipping hazard. Do not push or lean against load with raised platform.
- Do not use as a personnel lifting platform or step. No riders.
- Do not stand on any part of lift. Not a step.
- Do not climb on mast.
- Do not operate a damaged or malfunctioning LIFT TOOL machine.
- Crush and pinch point hazard below platform. Only lower load in areas clear of personnel and obstructions. Keep hands and feet clear during operation.
- No Forks. Never lift or move bare LIFT TOOL MACHINE with pallet truck, jack or fork lift.
- Mast extends higher than platform. Be aware of ceiling height, cable trays, sprinklers, lights, and other overhead objects.
- Do not leave LIFT TOOL machine unattended with an elevated load.
- Watch and keep hands, fingers, and clothing clear when equipment is in motion.
- Turn Winch with hand power only. If winch handle cannot be cranked easily with one hand, it is probably over-loaded. Do not continue to turn winch past top or bottom of platform travel. Excessive unwinding will detach handle and damage cable. Always hold handle when lowering, unwinding. Always assure self that winch is holding load before releasing winch handle.
- A winch accident could cause serious injury. Not for moving humans. Make certain clicking sound is heard as the equipment is being raised. Be sure winch is locked in position before releasing handle. Read instruction page before operating this winch. Never allow winch to unwind freely. Freewheeling will cause uneven cable wrapping around winch drum, damage cable, and may cause serious injury. (C048)

Power and cabling information for NEBS (Network Equipment-Building System) GR-1089-CORE

The following comments apply to the IBM servers that have been designated as conforming to NEBS (Network Equipment-Building System) GR-1089-CORE:

The equipment is suitable for installation in the following:

- Network telecommunications facilities
- Locations where the NEC (National Electrical Code) applies

The intrabuilding ports of this equipment are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of this equipment *must not* be metalically connected to the interfaces that connect to the OSP (outside plant) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection to connect these interfaces metalically to OSP wiring.

Note: All Ethernet cables must be shielded and grounded at both ends.

The ac-powered system does not require the use of an external surge protection device (SPD).

The dc-powered system employs an isolated DC return (DC-I) design. The DC battery return terminal *shall not* be connected to the chassis or frame ground.

The dc-powered system is intended to be installed in a common bonding network (CBN) as described in GR-1089-CORE.

IBM i service functions

The service functions provide details for the service provider to gather information about hardware problems while under the direction of the next level of support.

Before using this information, you should know how to service this particular hardware model. You must also know how to safely work with electrical components.

Attention: Misuse of service tools or using them with inappropriate security safeguards might result in loss of data, programs, or other objects on the system.

Dedicated service tools

Use dedicated service tools (DST) to work with Licensed Internal Code, disk units, configuration and resources, and to verify devices and communications. You can also use DST to display logs on the system.

DST operates in stand-alone, limited, and full paging environments. The DST tools and functions vary depending on the paging environment and the release level of the operating system. For more information, see “System paging environments.”

System service tools (SST) provide a way to access a subset of the service tools that DST offers without requiring access to DST. SST is available when IBM i is operational, and can be accessed using the STRSST CL command.

Dedicated service tools requirements

Note: It is a requirement to change the password the first time anyone signs on to DST or SST. The authorized service provider must provide the new (changed) password to the customer or have the customer change the password.

To use DST, you must have the following items:

- The disk that contains the Licensed Internal Code (the load-source disk).

Note: When you perform an alternate initial program load (IPL) to DST, you do not need the load-source disk.

- Access to the system partition using an attached workstation.
- A valid service tools user ID and password to sign on to DST. IBM supplies service tools user IDs that have different levels of privileges. For more information, see “Work with service tools user IDs” on page 27.

To make a printout, attach the printer to the workstation I/O processor or storage media unit that is performing the service function. The printer that is used with DST for service tool output must be an SCS-type data stream printer.

System paging environments

The amount of assistance that software provides for service depends on how you perform the system IPL. The service tools and functions that are available depend on how you access DST and which operating system is in use.

Stand-alone paging (nonpaging)

You can access dedicated service tools (DST) while the system is in the stand-alone paging environment, but not all DST options are available. In this environment, there is no operating system available, and only some functions of Licensed Internal Code are operational.

You can use this environment only by performing an alternate IPL to DST. For details, see *Performing an alternate IPL to DST (type D IPL)*.

The following options are available in the stand-alone environment.

- Install Licensed Internal Code
- Work with disk units
- Work with DST environment
- Start a service tool
- Work with remote service support

For a description of each option, see “DST options” on page 7.

Limited paging

The limited paging environment is the first servicing environment you access when you begin to start the system in Manual mode. This environment contains all the functions of the Licensed Internal Code, including storage management.

You can use this environment by performing an IPL to DST. For details, see *Performing an IPL to dedicated service tools*.

You can access DST while the system is in the limited paging environment. This environment accesses the temporary files that are needed and the Licensed Internal Code on the load-source disk. The operating system is not available.

The following options are available in the limited paging environment:

- Perform an IPL
- Install the operating system
- Work with Licensed Internal Code
- Work with disk units
- Work with DST environment
- Start a service tool
- Work with remote service support
- Work with system security

Note: The following options are operating system-dependent. For a list of the options available for your operating system, see “Dedicated service tools in IBM i limited paging environment” on page 174.

- Perform automatic installation of the operating system
- Save Licensed Internal Code
- Select DST console mode
- Work with save storage and restore storage

For a description of each option, see “DST options” on page 7.

Full paging

The full paging environment is used during normal system operation. The DST options vary depending on the release level of the operating system.

You remain in the full paging environment when you perform one of the following:

- Function 21 on the control panel or Work with Partition Status screen to access DST. For details, see *Selecting function 21 from the control panel*.
- System Request key procedure. For details, see *“Using the System Request Key”* on page 4.
- Access system service tools (SST) on a system that uses IBM i. For details, see *“Accessing system service tools”* on page 175.

All disk units, the Licensed Internal Code, and the operating system are available.

The following options are available in the full paging environment:

- Work with Licensed Internal Code
- Work with disk units
- Work with DST environment
- Start a service tool
- Work with remote service support
- Work with system partitions
- Work with system security

Note: The following options are operating system-dependent. For a list of the options available for your operating system, see *“Dedicated service tools in IBM i full paging environment”* on page 174.

- Select DST console mode
- Resume operating system display
- Perform automatic installation of the operating system
- Save Licensed Internal Code

For a description of each option, see *“DST options”* on page 7.

Accessing dedicated service tools

You can access dedicated service tools (DST) in several ways, including by performing an IPL to DST, using the System Request Key, and selecting Function 21 while the system is operational.

Note: You can also use the function key F16, which is not displayed, while in DST debug mode during a step-mode IPL.

Performing an IPL to dedicated service tools

Use this procedure to perform an initial program load (IPL) to dedicated service tools (DST).

This procedure is for the entire system, or if logical partitions are installed, for the primary partition.

Perform the following steps:

1. Select a type B IPL in manual mode.
 - Attention:** For systems with logical partitions, you must power down the secondary partitions normally before performing an IPL on the primary partition to avoid possible data loss.
2. Perform one of the following options:
 - **If there is a problem log entry after powering on the system**, perform a delayed power-off. (This is the data for problem analysis.) When the system is off, press the Power button on the control panel to perform an IPL. Select Function 03 if the delayed power-off takes longer than 40 minutes to complete.
 - Attention:** Performing function 03 might cause damage to objects, and it might also cause data loss.

- **If there is an attention light after powering on the system**, use the increment (↑) or decrement (↓) button to select control panel function 03. Press Enter on the control panel to perform an IPL.
 - **When the system is powered off**, press the Power button on the control panel to perform an IPL. The IPL or Install the System display is shown on the primary console.
3. Select the Use Dedicated Service Tools option. The DST Sign On display is shown. For more information on how to identify the primary console, see Primary consoles.
 4. Sign on to DST with a valid user ID and password.

Remember: Enter a valid user ID and get the password from the customer. If the customer has changed the full DST authority, user ID, or password, ask the customer for the correct values.

Notes:

- If prompted to change the password, be sure to provide the new (changed) password to the customer.
- You are limited to three sign-on attempts to DST. After three unsuccessful attempts, the service tools user ID is disabled. A user ID with a service tool security privilege must reset the ID.

The Use Dedicated Service Tools (DST) display is shown.

Restriction: The system is in the limited paging environment.

This ends the procedure.

Using the System Request Key

You can access DST by using the System Request Key only when the system is in debug mode.

Debug mode is an environment to test programs. You can select a function key and access DST during the IPL process. For details, see “Perform an IPL” on page 8.

From the console, perform the following steps:

1. Press the System Request Key.
2. Type DST on the system request line.

Note: Commands are case-sensitive.

3. Sign on to DST.

Type QSRV as the valid user ID and get the password from the customer. If the customer has changed the full DST authority user ID or password, ask the customer for the correct values. The Use Dedicated Service Tools (DST) display appears.

Notes:

- If prompted to change the password, be sure to provide the new (changed) password to the customer.
- You are limited to three sign-on attempts to DST. After three unsuccessful attempts, the service tools user ID will be disabled. A user ID with a service tool security privilege must reset the ID.

For details about the DST options, see “DST options” on page 7. **This ends the procedure.**

Selecting function 21 from the control panel

Use this information to learn about the detailed instructions for selecting function 21 while the system is operational.

Perform the following steps:

1. Select control panel function 21 (Make DST available).

Select manual mode, and then push the increment (↑) or decrement (↓) button on the control panel until 21 is shown in the Function/Data display. Press the Enter button on the control panel.

2. Sign on to DST.

Type QSRV as the valid user ID and get the password from the customer. If the customer has changed the full DST authority user ID or password, ask the customer for the correct values.

Notes:

- If prompted to change the password, be sure to provide the new or changed password to the customer.
- Since V5R1 of the operating system, you are limited to three sign-on attempts to DST. After three unsuccessful attempts, the service tools user ID is disabled. The system administrator with QSECOFR authority needs to reset the ID.

The Use Dedicated Service Tools (DST) display is shown. The system is in the full paging environment. **This ends the procedure.**

Performing an alternate IPL to DST (type D IPL)

You can use this procedure to perform a type D initial program load (IPL).

An alternate IPL to DST is called a type D IPL or a stand-alone IPL by service representatives.

To perform a type D IPL, complete the following steps:

1. To use an alternate installation device, select the DST option Work with alternate installation device. This option is available in DST from control panel function 21 or a type D IPL.
2. Determine the removable media unit or units for an alternate IPL. Power on the removable media units.
3. Place the media that contains the Licensed Internal Code (first tape of the customer's system save, the SAVLIC, ISMD tapes, or optical device) in the removable media units. Load the media and make the media units ready. See the device information for instructions on loading the removable media.
4. Power off the system. If the system is running, end all jobs and perform the power-down procedure.
5. Select a type D IPL in manual mode.
For information on how to select IPL options, see IPL type, mode, and speed options.
6. Power on the console.
For more information on how to identify the primary console, see Primary consoles.
7. Load the media and make the media unit ready.
8. Press the Power button to power on the system.

Notes:

- a. Some types of removable media units automatically reset. In this condition, SRC A100 1933 (Media device not ready) might be displayed.
 - b. If the installation device is an optical device, you might need to start the system again. This action will make the unit ready.

```
pwrdownsys restart(*yes) IPL(D)
```
 - c. If the installation device is a tape unit, system reference code (SRC) A1001933 is displayed until the device automatically makes itself ready.
 - d. The removable media becomes active. There is a delay while the system loads information from the load source. While running a process, the system continuously updates SRCs on the control panel that show the status.
9. Wait for the Install Licensed Internal Code display to shown on the console. The wait varies depending on the speed of the removable media unit and the processor speed for the specific system model.

Notes:

- a. If SRC A600 500x is displayed on the control panel, the system was not able to locate the console.

Ensure that the console is powered on (repair if necessary). Select F21 (function 21) on the control panel (see Selecting function 21 from the control panel) to make DST available.

- b. If an SRC other than A600 500x is displayed on the control panel, go to “Starting Point for All Problems” in the problem analysis information for your system.

The Install Licensed Internal Code display appears on the console.

- If you want to access DST, select the Work with Dedicated Service Tools (DST) option and continue to the next step of this procedure.
- If you want to install or restore Licensed Internal Code, select the Install Licensed Internal Code option and continue with the installation or restore instructions.
- If you want to define the device from which the system Licensed Internal Code should be installed, select the Define alternate installation device option. This option also enables or disables the alternate installation device.

10. Sign on to DST as QSRV.

Type QSRV as the valid user ID and get the password from the customer. If the customer has changed the full DST authority user ID or password, ask the customer for the correct values.

Note:

- a. If prompted to change the password, be sure to provide the new (changed) password to the customer.
- b. You are limited to three sign-on attempts to DST. After three unsuccessful attempts, the service tools user ID is disabled. The system administrator with QSECOFR authority needs to reset the ID.

The Use Dedicated Service Tools (DST) display is shown. Options are limited because the system is in the stand-alone environment. **This ends the procedure.**

Changing user IDs

You can change a service tools user ID or reset the QSECOFR service tools ID.

Changing a service tools user ID

You can use the dedicated service tools (DST) to change a service tools user ID.

Use this procedure to change a service tools user ID:

1. Sign on to DST.
2. Select option 5 on the Use Dedicated Service Tools (DST) screen to work with the DST environment.
3. Select option 3 on the Work with DST Environment screen to work with service tools user IDs. **This ends the procedure.**

Resetting QSECOFR service tools user ID

Use this procedure to recover from a disabled QSECOFR service tools user ID.

1. Sign on to the operating system with the QSECOFR user ID.
2. Use the XPF CL command CHGDSTPWD with the *DEFAULT parameter value. This command enables the profile (if disabled), resets the profile's password to QSECOFR, and sets the password to expired.
3. After using the CHGDSTPWD command, you can change the password of the QSECOFR service tools user ID by signing on to SST or DST.

Note: If the system security is set to prevent a service tools user ID with a default and expired password from changing its own password, then you will not be able to sign on to SST until you first sign on to DST and change your password there. You can start DST by using function 21 from the system control panel.

Using function keys in dedicated service tools

The F3, F12, F16, and System Request function keys allow navigation through DST.

The F3 function key

Returns you to the primary menu of the service tool you are using.

The F12 function key

Returns you to the previous DST display.

The F16 function key

Returns you to the Use Dedicated Service Tools (DST) display from the service function you are in. The active service function is not canceled. To display the service function again, select the *Work with DST environment* option.

The System Request function key

Returns you to the Use Dedicated Service Tools (DST) display (on the console). You must type the following on the system request line:

DST

The active user job is not canceled.

Exiting dedicated service tools

You can exit dedicated service tools (DST) and end all DST functions, or you can allow the DST functions to remain active.

To exit DST and end all DST functions, perform the following steps:

1. Press F3 (Exit) on the Use Dedicated Service Tools (DST) display. The Exit Dedicated Service Tools display appears with the following options:
 - Exit dedicated service tools (DST)
 - Resume dedicated service tools
2. Select *Exit dedicated service tools (DST)* to exit and end all DST functions.

To exit DST and allow the DST functions to remain active, perform the following steps:

1. Ensure that the system is operating in debug mode.
2. See *Selecting the DST debug console mode* option on the Use Dedicated Service Tools (DST) display. For more information on the DST console mode, see “Select DST console mode” on page 29.
 - In IBM i 7.1 select the **Select DST console mode** to exit DST.
 - In IBM i 7.2 select the **Select Resume operating system display** to exit DST.

DST options

DST options vary depending on the paging environment and how you access DST.

For a list of specific options available in each paging environment, see Table 1. For more information on the system paging environment options, see “System paging environments” on page 1.

For details about accessing DST, see “Accessing dedicated service tools” on page 3.

Table 1. DST options that are available for each paging environment (D-IPL (nonpaging), Limited, and Full)

DST options	Paging environment		
	D-IPL (nonpaging)	Limited	Full
Install Licensed Internal Code	Yes	No	No
Install the operating system	No	Yes	No
Perform an IPL	No	Yes	No

Table 1. DST options that are available for each paging environment (D-IPL (nonpaging), Limited, and Full) (continued)

DST options	Paging environment		
	D-IPL (nonpaging)	Limited	Full
Perform automatic installation of the operating system	No	Yes ¹	No
Save Licensed Internal Code	No	Yes ¹	No
Resume operating system display	No	Yes ¹	Yes ¹
Select DST console mode	No	Yes ¹	Yes ¹
Start a service tool	Yes	Yes	Yes
Work with disk units	Yes	Yes	Yes
Work with DST environment	Yes	Yes	Yes
Work with Licensed Internal Code	No	Yes	Yes
Work with remote service support	Yes	Yes	Yes
Work with save storage and restore storage	No	Yes ¹	No
Work with system partitions	No	Yes ¹	Yes ¹
Work with system security	No	Yes	Yes
End batch restricted state	No	No	Yes ¹
Note: ¹ This option is operating system-dependent. It is available only under certain operating systems (see “IBM i operating system” on page 173).			

Installing Licensed Internal Code

You can install or restore Licensed Internal Code.

If your system is a stand-alone environment, refer to “Utilities to install and restore IBM i Licensed Internal Code” on page 133.

Attention: If you have logical partitions, you should not use the utilities to install and restore IBM i Licensed Internal Code. It can cause damage to the logical partitions and loss of data.

Installing the operating system

Select the *Install the operating system* option from the Use Dedicated Service (DST) Tools display.

This option installs the operating system from removable media (for example, tape). The present operating system (if any) is replaced. Use this option to install a new release of the presently installed operating system or to install the operating system after a failure. You must run this option from the primary console.

This option is not available under basic DST authority. For more information about authority, see “Work with service tools user IDs” on page 27.

For more information, see Installing, upgrading, or deleting IBM i and related software (http://www.ibm.com/support/knowledgecenter/ssw_ibm_i_72/rzahc/rzahc1.htm).

Perform an IPL

Select the **Perform an IPL** option from the Use Dedicated Service Tools (DST) display.

This option allows you to install and start the operating system from the disk. If you have installed the Licensed Internal Code and there is no operating system installed, install and start the operating system from the same removable media device as the Licensed Internal Code.

Work with Licensed Internal Code

This option applies PTFs, removes PTFs, or makes PTFs permanent to the system Licensed Internal Code from removable media when the operating system is not available.

It also allows you to rebuild the Licensed Internal Code, display the Licensed Internal Code information and PTFs, and display free space. Select this option from the Use Dedicated Service Tools (DST) display. For more information on Licensed Internal Code fixes and PTFs, see “Fixes and cumulative PTF packages” on page 132 and the system operation information.

Licensed Internal Code general information

There can be two versions of some Licensed Internal Code modules on the load-source disk unit. The IPL type (A or B) determines which version of the modules your system uses. When the system is running on a type A IPL, it uses the original, permanent version. When a Licensed Internal Code fix, or program temporary fix (PTF) is temporarily applied, the system creates a second version of the module. The system uses this second version when it is running on a type B IPL.

When the PTF is permanently applied, the side B of the Licensed Internal Code replaces the original side A version of the Licensed Internal Code module. The system will then use the PTF version of the Licensed Internal Code module (which is now permanent) when running on a type A IPL.

For PTFs to be activated on each partition, they must be separately applied to each partition.

To apply a PTF that currently has an earlier version applied temporarily on the system, perform an IPL of the system from the B side (type B IPL). Then load and apply the PTF. The existing temporarily applied PTF automatically becomes permanent as the new PTF is loaded. If you do not want the existing temporarily applied PTF to become permanent, remove it manually.

If you perform the IPL on the B side when you apply PTFs to Licensed Internal Code, the system applies the PTFs to the active copy of the Licensed Internal Code.

To run the system with the PTFs, you must perform an IPL. For normal operations, use type B IPL. Use type A IPL when the B side is not available or when you want to remove a PTF.

Note: During an installation or upgrade, a type A IPL will also be used.

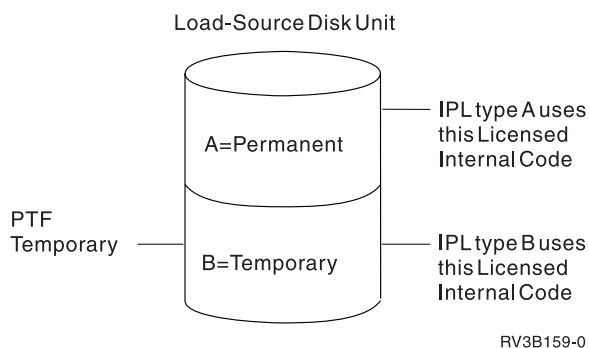


Figure 1. Copies of load-source Licensed Internal Code

Options and function keys

- Apply fixes

This option places the fixes into the Licensed Internal Code from removable media. These PTFs are placed in the inactive (change) copy of the Licensed Internal Code.

Note: There are two copies of some Licensed Internal Code on the load-source disk unit. It is the IPL type (A or B) that selects the Licensed Internal Code level with which your system will run.

- Rebuild Licensed Internal Code

This option allows you to rebuild the Licensed Internal Code.

- Display Licensed Internal Code

This option allows you to display the following:

- Replaceable unit information (code or object modules)
- Fix information
- Product information

The *Fix information* option allows you to display the status of the Licensed Internal Code fix (if it is permanently or temporarily applied). For more information on displaying fixes, see “Displaying Licensed Internal Code fixes” on page 132.

- Work with free space

This option displays the space available for storing new modules on the system and allows you to combine the space that is used.

- Remove fixes

To remove Licensed Internal Code fixes, if the PTF is a delayed PTF, the system must be running on the copy without the changes (type A IPL). Removing these changes causes the system to load the primary copy over the changes in the changed copy of Licensed Internal Code.

Immediate Licensed Internal Code PTFs can be removed while running a type B IPL.

- Make fixes permanent

To make Licensed Internal Code fixes permanent, the system must be running on the copy with the changes. When these changes are made permanent, they are loaded into the primary copy of the Licensed Internal Code.

- Display status (F6)

Press the F6 function key on the Work with Licensed Internal Code display to view the history log.

For more information on PTFs, see “Displaying Licensed Internal Code fixes” on page 132 and the system operation information.

Work with disk units

Create and update the disk configuration, and display the logical structure information.

Use this option to perform the following actions from the partition from which DST was entered:

- Work with disk configuration.
 - Create and update the disk configuration.
 - Display the logical structure (disk unit and auxiliary storage pool (ASP) information).
- Work with disk unit recovery.

Options on the Work with Disk Units display

Options and menu flow for the **Work with disk units** options vary, depending on the system paging environment. For details, see “System paging environments” on page 1. Use the following information as a reference during problem analysis and system repair.

Select the **Work with disk units** option on the Use Dedicated Service Tools display.

Work with disk unit options

Stand-alone paging environment

1. Save load-source disk unit data

2. Copy load-source disk unit data
3. Display/change page data
4. Analyze disk unit surface
5. Initialize and format disk unit
6. Reclaim IOA cache storage
7. Stop device parity protection
8. Update system Vital Product Data

Limited paging environment

- Work with disk configuration
- Display disk configuration
 - Display disk configuration status
 - Display disk configuration capacity
 - Display disk configuration protection
 - Display non-configured disk units
 - Display device parity status
 - Display disk hardware status
 - Display disk compression status
 - Display hot spare disk unit status
 - Display disk path status
 - Display encryption status
 - Display protection for multiple connection disk units
 - Display status of remove operation
- Work with ASP threshold
- Work with ASP configuration
 - Display disk configuration capacity
 - Delete user ASP
 - Display disk configuration capacity
 - Delete user ASP
 - Add units to ASP
 - Delete ASP data
 - Change ASP storage threshold
 - Move units from one ASP to another
 - Work with removing disk units from configuration
 - Add units to the ASP and balance data
- “Work with mirrored protection” on page 16
 - Start mirrored protection
 - Stop mirrored protection
 - Enable remote load source mirroring
 - Disable remote load source mirroring
 - Display disk configuration
 - Select delay for unit synchronization
- Work with device parity protection
 - Display device parity status
 - Start device parity protection
 - Stop device parity protection

- Include unit in device parity protection
- Exclude unit in device parity protection
- Select parity optimization
- Work with disk compression
 - Display disk compression status
 - Start compression on disk units
 - Stop compression of disk units
- Work with hot spare
 - Display hot spare status
 - Start hot spare
 - Stop hot spare
- Display disk configuration
 - Display encryption status
 - Create encrypted ASPs
 - Add units to encrypted ASP
 - Start encryption on ASPs
 - Stop encryption on ASPs
 - Change data encryption key for basic ASPs
 - Change data encryption key for Independent ASPs
- Work with disk unit recovery
 - Display disk configuration
 - Start mirrored protection
 - Stop mirrored protection
 - Enable remote load source mirroring
 - Disable remote load source mirroring
 - Select delay for unit synchronization
 - Disk unit problem recovery procedures
 - Initialize and format disk units
 - Display/change page data
 - Analyze disk unit surface
 - Suspend mirrored protection
 - Resume mirrored protection
 - Copy disk unit data
 - Delete disk unit data
 - Upgrade load-source utility
 - Rebuild disk unit data
 - Reclaim IOA cache storage
 - Correct device parity protection mismatch
 - Recover unknown load source
 - Recover mirrored load source
 - Recover from start compression failure
 - Migrate load-source disk unit data

Full paging environment

1. Display disk configuration
 - Display disk configuration status

- Display disk configuration capacity
 - Display disk configuration protection
 - Display non-configured disk units
 - Display device parity status
 - Display device parity status
 - Display disk hardware status
 - Display disk compression status
 - Display hot spare disk unit status
 - Display disk path status
 - Display encryption status
 - Display protection for multiple connection disk units
 - Display status of remove operation
2. “Work with disk configuration” on page 14
- Display disk configuration
 - Add units to ASPs
 - Work with ASP threshold
 - Add units to ASPs and balance data
 - Enable remote load source mirroring
 - Disable remote load source mirroring
 - Start compression on non-configured disk units
 - Start hot spare
 - Stop hot spare
 - Work with device parity protection
 - Include unit in device parity protection
 - Start device parity protection - RAID 5
 - Start device parity protection - RAID 6
 - Start device parity protection - RAID 10
 - Start device parity protection - RAID 5 with hot spare
 - Start device parity protection - RAID 6 with hot spare
 - Start device parity protection - RAID 10 with hot spare
 - Select parity optimization
 - “Work with encryption” on page 18
 - Create encrypted ASPs
 - Add units to encrypted ASPs
 - Start encryption on ASPs
 - Stop encryption on ASPs
 - Change data encryption key for basic ASPs
 - Work with removing disk units from configuration
 - Display status of remove operation
 - Remove units from configuration
 - Pause the remove operation
 - Resume the remove operation
 - Cancel the remove operation
 - Cancel the remove operation and balance data in the ASP
 - “Work with disk unit recovery” on page 18

- Replace configured unit
- Disk unit problem recovery procedures
 - Initialize and format disk units
 - Display/change page data
 - Analyze disk unit surface
 - Suspend mirrored protection
 - Resume mirrored protection
 - Delete disk unit data
 - Rebuild disk unit data
 - Rebuild IOA cache storage

Work with disk configuration:

This topic provides options and menu flow information for the *Work with disk configuration* option.

Options and menu flow for the *Work with disk configuration* option vary depending on the system paging environment. See “System paging environments” on page 1. Options are:

Display disk configuration

For details about this option, see “Display disk configuration.”

Add units to ASPs

For details about this option, see “Work with ASP configuration” on page 15.

Add units to ASPs and balance data

For details about this option, see “Work with ASP configuration” on page 15.

Work with ASPs threshold

For details about this option, see “Work with ASP threshold” on page 15.

Include unit in device parity protection

Select this option to add an unprotected disk unit to an existing parity set.

Start compression on non-configured disk units

Select this option to increase the effective disk unit capacity of non-configured disk units.

Display disk configuration:

Information about displaying the disk units that are attached to the auxiliary storage pool (ASP). The topic also describes the status and capacity of the system auxiliary storage pool.

You can select the *Display disk configuration* option from the main service tools display or the *Work with disk configuration* display according to the paging environment. From this option, you can display the disk units that are attached to the ASP and the status and capacity of the system auxiliary storage pool.

Display disk configuration status

Display the status of all ASPs and the disk units that are configured on the system.

Display disk configuration capacity

Display the following for each ASP and the assigned disk units within each ASP:

- Threshold values
- Overflow values
- Protected storage values
- Unprotected storage values

Display disk configuration protection

Display the type of protection for each ASP and the assigned disk units within each ASP.

Display non-configured units

Display the status of all the disk units that are not configured.

Display device parity status

Display the status of the disk unit subsystems that have device parity protection on the system. For more information on device parity, see “Work with device parity protection” on page 16.

Display disk compression status

Display the compression status of compressed disk units.

Display disk hardware status

Display the hardware status of the disk units. Some of the disk status are operational, not operational, read-write protected, RAID/active, RAID/failed, and RAID/rebuilding.

Display hot spare disk unit status

Display the hot-spare disk units, showing the IOA that each of the hot-spare disk units is under, along with the capacity of the hot-spare disk units.

Display encryption status

Display each ASP and the encryption status of the ASP.

Display protection for multiple connection disk units

Display the level of protection that exists for each disk unit with multiple connections.

Display status of remove operation

Display which disk units are being removed from the configuration.

Work with ASP threshold:

This topic provides information about working with the system auxiliary storage pool (ASP) threshold.

Select this option to display or change the threshold for the system ASP. The system issues a notice when it reaches the threshold value.

Note: The user ASPs are not supported.

Work with ASP configuration:

Use the Work with ASP configuration to manage disk configuration capacity, to delete a user auxiliary storage pool (ASP), and to add units to an ASP.

The following options are displayed on **Work with ASP Configuration**:

Display disk configuration capacity

Display the threshold and overflow values of the ASP and the assigned disk units. This display is also available under the *Display disk configuration* option. For details, see “Display disk configuration” on page 14.

Delete user ASP

Delete a user-defined ASP (ASPs 2 through 16).

Add units to ASPs

Add non-configured units to an existing ASP. The non-configured units increase the amount of storage that is assigned to the system ASP (ASP 1).

Add units to ASPs and balance data

Add disk units to an existing ASP or to create an ASP and add non-configured disk units to that ASP.

First, the disk units are initialized and configured. Next, the data on the other disk units is moved to balance the capacity of all the disk units in the ASP equally.

Delete ASP data

Delete the data in the ASP.

Change ASP storage threshold

Display or change the threshold for the system auxiliary storage pool (user ASPs are not supported). The system notifies you when the threshold value is reached.

Move units from one ASP to another

Change the assignment of a disk unit to another ASP.

Remove units from configuration

Remove a disk unit from the ASP configuration. If the unit being removed has data and there is space in the ASP, the system copies the data to other units in the ASP. The unit that is removed becomes non-configured.

Pause the remove operation

This function stops the remove operation from running. You can resume the remove operation at a later time.

Resume the remove operation

This function starts the remove operation that was paused.

Cancel the remove operation

This function stops the remove operation. You cannot resume the remove operation at a later time.

Cancel the remove operation and balance data in the ASP

This function stops the remove operation. You cannot resume the remove operation at a later time. The data on the disk units in the ASP are balanced so that each unit in the ASP has approximately the same percent used.

Work with mirrored protection:

This topic provides information about working with mirrored protection.

Select this option to display the disk configuration, or to change the mirror configuration of the disk units.

Display disk configuration

For details about this option, see "Display disk configuration" on page 14.

Start mirrored protection

Use this option to start mirrored protection on the selected ASP.

Stop mirrored protection

Use this option to stop mirrored protection on the selected ASP.

Enable remote loadsource mirroring

Use this option to permit the load source mirror pair to reside under any IOA in the partition.

Disable remote load source mirroring

This option permits the load source mirror pair to be under only an IOA from which the service processor can IPL the partition.

Work with device parity protection:

Learn about how to work with device parity protection. Device parity protection is a data redundancy feature that is available on some storage media units.

Select this option to perform the system functions that handle device parity protection on the system. It is maintained across all the units that are within the parity set. If a disk unit fails, the units within the set

handle the functions for the failed unit. This type of protection can improve system availability and reduce the possibility of data loss. The following options are available:

Display device parity status

Select this option to show the status of disk unit subsystems that have device parity protection.

Start device parity protection

Use this option to begin the process of protecting data on the system. This option includes the following options:

- Work with device parity protection
- Include unit in device parity protection
- Start device parity protection - RAID 5
- Start device parity protection - RAID 6
- Start device parity protection - RAID 10*
- Start device parity protection - RAID 5 with hot spare
- Start device parity protection - RAID 6 with hot spare
- Start device parity protection - RAID 10 with hot spare*
- Select parity optimization
- Start hot spare
- Stop hot spare

*RAID 10 is supported on IBM i Version 7.2 or later.

Stop device parity protection

Use this option to end device parity protection.

Include unit in device parity protection

Use this option to add an unprotected disk unit to an existing parity set.

Exclude unit in device parity protection

Use this option to remove a disk unit from a parity set.

Select parity optimization

Use this option to optimize parity.

Work with disk compression:

Select this option to display disk compression status, or select this option to start or stop disk compression.

The following options are available:

Display disk compression

Select this option to display the status of compressed disks.

Start compression on disk units

Select this option to start compression on disk units. This will increase the effective size of the disk unit.

Stop compression on disk units

Select this option to stop compression on disk units.

Work with hot-spare protection:

Work with hot-spare disk units that come with device parity protection.

Hot-spare disk units with device parity protection are spare disk units that are stored on a system to replace failed disks in case a disk failure occurs.

A hot-spare disk unit is stored on the system as a non-configured disk. When a disk failure occurs, the system exchanges the hot-spare disk unit with the failed disk unit. For the exchange to occur, the disk units must be under the same I/O adapter (IOA). The hot-spare disk unit must be of the correct capacity for the failed parity-protected disk unit.

- For SCSI IOAs, the hot-spare disk unit must be the same capacity as the failed parity-protected disk unit.
- For SAS IOAs, the hot-spare disk unit must be same or larger capacity as the failed parity-protected disk unit.

After the exchange occurs, the system rebuilds the data on the new disk unit.

The following options are available under **Work with Hot Spare Protection**:

Display hot spare disk status

Shows the status of hot-spare disks.

Start hot spare

Manually start and configure hot-spare protection. You can also start and configure hot-spare protection automatically. For details, see “Work with device parity protection” on page 16.

Stop hot spare

Stop hot-spare protection.

Work with encryption:

Select this option to display encryption status, or select this option to start or stop disk encryption on the auxiliary storage pools (ASPs).

Options

The following options are available for encryption.

Display encryption status

Select this option to display the status of encrypted ASPs.

Start encryption on ASPs

Select this option to start encryption on the disk units in ASPs. It could take a significant amount of time to encrypt all of the data in the ASP.

Stop encryption on ASPs

Select this option to stop encryption on the disk units in ASPs. It could take a significant amount of time to decrypt all of the data in the ASP.

Change data encryption key for basic ASPs

Select this option to change the encryption key for all of the basic ASPs.

Change data encryption key for independent ASPs

Select this option to change the encryption key for the independent ASP. Each independent ASP has its own encryption key.

Work with disk unit recovery:

Options are available to save and restore disk units, find and assign disk units that are missing from the configuration, replace disk units, reclaim IOA cache storage, and recover the system configuration if it is lost, destroyed, or changed.

Select the Work with Disk Unit Recovery display from the *Work with disk units* option on the Use Dedicated Service Tools (DST) display.

Save disk unit data

Run this option when the disk unit reference code (URC) indicates that a disk enclosure should be exchanged.

Before removing the disk enclosure and installing a new disk enclosure, save the data from the disk units in the disk enclosure to removable media.

When the system has saved all of the disk unit data to removable media, a menu appears on the display with the status information.

Notes:

- This procedure does not save the Licensed Internal Code on the load-source disk unit.
- The option is not available for disk units that have device parity protection or mirror protection (with both units in an active state).

Restore disk unit data

This option reads the data (recorded using the **Save disk unit** option) from the removable medium and writes the data on the disk unit. The data can be restored to a disk unit of the same type or to a different type of disk unit that has the same or larger storage capacity. When all data is restored to the disk unit, a menu appears on the display with the status information. If the replaced disk is load source, the system will perform an IPL to DST from the new disk. For the others, the system will not perform a re-IPL.

For systems with multiple partitions, the partition configuration will have to be restored first.

Replace disk unit

This option is part of the disk unit recovery procedure. The recovery procedure consists in exchanging a configured disk unit for a non-configured unit. Use the *Delete ASP data* option to clear the system ASP before replacing the disk unit only if the disk is not under mirror or device parity protection. You can make the protection active again after replacing the failed disk by following the Disk Unit Recovery Procedure.

Assign missing units

This option reports any missing units (units that were part of the system during the last IPL that have been disconnected accidentally or configured differently). When you select to assign a unit, the system attempts to find one or more valid non-configured disk units. If no valid non-configured disk units are found, use the *Replace disk unit* function.

Recover disk configuration

This option recovers the correct system configuration in cases where the load source was damaged and the device configuration table on the installation device was lost.

Disk unit problem recovery procedures

For details about this option, see the main heading "Disk unit problem recovery procedures" on page 20.

Suspend mirrored protection

Select this option when you want to stop mirrored protection for a unit in a mirrored auxiliary storage pool.

Resume mirrored protection

Select this option when you want to restart mirrored protection for a unit in a mirrored auxiliary storage pool.

Copy disk unit data

Copy all the data from a configured disk to a non-configured disk unit. This action can take the place of *save disk unit data to tape* and a *restore disk unit data*. After the operation is complete, the target disk unit (the one copied to) takes the place of the original disk unit in the system configuration. The original disk cannot be used in the system configuration without data loss.

Delete disk unit data

Deletes all the data from a non-configured disk unit.

Note: This option is only permitted for non-configured disk units.

Upgrade load-source utility

Migrates the disk unit configuration to a system with new hardware.

Rebuild disk unit data

When a failed disk unit is repaired, use this option to rebuild the data. Use the redundancy feature of device parity protection to rebuild data to a disk unit.

Attention: If there are several disk unit incompatibilities, make certain that the correct units are installed.

Reclaim IOA cache storage

When the IOA cache memory fails and needs to be replaced, you can remove and destroy the damaged data in the IOA cache.

Data can remain in the IOA cache when failures occur. Occasionally, a situation is so severe that the system perceives missing units. This prevents the system from performing an IPL. At other times, a reduction in the amount of usable cache storage occurs. This situation presents itself only as a warning during a manual mode IPL.

Correct device parity protection mismatch

You can accept the situation where configured disk units are expected to have device parity protection enabled but currently have device-parity protection disabled. The configuration no longer expects these disk units to be device parity protected.

Recover unknown load source

You can recover from an unknown load-source error where the mate of the load source in the mirrored pair is missing and the system does not currently recognize the load source.

Recover from start compression failure

Use this option in a recovery from a start compression operation that failed.

Migrate load-source disk unit data

During migration, this option copies data from an original load-source disk unit onto the load-source disk unit of a new system.

Disk unit problem recovery procedures:

Disk unit problem recovery procedures help you to select functions that lead you to isolate problems and identify repair actions.

Note: Only the disk units that are available for a specific function are displayed.

Initialize and format disk units

Use this option when the disk unit reference code indicates that reallocations have failed because no other space is available. All the ID fields on the disk unit are written again. Running this option erases all the data from the disk unit. This option is only available for non-configured disk units. Ensure that the partition does not have any disk units missing from the configuration before you run the Initialize and format disk units function.

Display/change page data

Use this option as follows:

- The results of the *Analyze disk unit surface* option (under the *Work with disk unit recovery* option) show which pages have data check conditions. Use the *Display/change page data* option to assign those sectors to new locations on the disk.
- To inspect and change the 64 bytes of page header, if necessary.

- To inspect and change the 4096 bytes of page data, if necessary.

The *Display/change page data* option has the following functions:

- Reading data from a selected page.
- Displaying the data in hexadecimal and EBCDIC formats.
- Converting and redisplaying the hexadecimal data.
- Displaying the 64-byte page header in formatted form.
- Converting the 64-byte page header and written to the sector again.
- Permitting the sector to be assigned to a new location on the disk.
- Displaying the disk unit reference code after each operation.

Analyze disk unit surface

This option performs a read/verify operation on the selected units. Pages that report disk URCs indicating data check errors can be assigned to new locations on the disk using the *Display/change data* option. The results of the analysis can be displayed on the console.

Using hot spare device parity protection:

This topic provides information about using hot spare device parity protection.

Concepts for using device parity protection with hot-spare disk units:

Device-parity-protection hot-spare disk units are spare disk units that are stored on a system to replace failed disks in case a disk failure occurs.

A hot-spare disk unit is stored on the system as a non-configured disk. When a disk failure occurs, the system exchanges the hot-spare disk unit with the failed disk unit. The disk units must be under the same IOA in order for the exchange to occur. The hot-spare disk unit must also be of the correct capacity for the failed parity-protected disk unit.

- For SCSI IOAs, the hot-spare disk unit must be the same capacity as the failed parity-protected disk unit.
- For SAS IOAs, the hot-spare disk unit must be same or larger capacity as the failed parity-protected disk unit.

After the exchange occurs, the system rebuilds the data on the new disk unit.

Include hot-spare disk units in your partition:

There are two ways to include the hot-spare disk units in your partition.

1. You can configure the hot-spare disk unit when you initially start device parity protection. For details about how to include hot-spare disk units when you start device parity protection, see “Starting device parity protection with hot-spare protection” on page 22. When you select this option, the system automatically performs the following tasks:
 - The system determines whether one or two hot-spare disk units are required.
 - The system determines which available disk units are selected based on the total number and capacity of disk units that are attached to the I/O adapter (IOA).

Note: When you start device parity protection with hot-spare disk units, the disk units are not designated to any particular parity set. The hot-spare disk unit protects the first failed disk unit that meets the following criteria:

- The failed disk unit has parity protection.
- The hot-spare disk unit has sufficient capacity to protect the failed disk unit.
- The failed disk unit and the hot-spare disk unit are under the same IOA.

2. You can create a hot-spare disk unit from non-configured disk units on your system. For details about how to include hot-spare disk units to your system, see “Starting hot spare protection” on page 23. When you select this option, determine whether one or two hot-spare disk units are required and which available units become hot-spare disk units. Determine which available units become hot-spare disk units based on the total number of disk units that are attached to the IOA and their capacity.

Costs and limitations of device parity protection with hot-spare disk units:

There are costs and limitations to consider when you use device parity protection with hot-spare disk units.

- Hot-spare disk units protect only parity sets with the same capacity disk units for SCSI IOAs. Hot-spare disk units protect only parity sets with the same or smaller capacity disk units for SAS IOAs.
- To create a new RAID 6 parity set with hot-spare disk units, a minimum of five disk units is needed. If there are not at least five disk units, then the system prompts you to create a RAID 5 parity set with hot spare instead.
- To create a new RAID 10 parity set with hot-spare disk units, at least three disk units are required. In the minimum configuration, two disk units are used for the RAID 10 parity set, and one disk unit is used as the hot-spare disk unit. In automatic hot-spare configuration, one disk unit is reserved as the hot-spare disk unit for the first 20 disk units that are attached to the adapter. For example, if you attach 20 disk units to an adapter, 18 disk units are used for the RAID 10 parity sets. One of the 20 disk units is an unprotected disk unit. One of the 20 disk units is used as the hot-spare disk unit for the other 18 disk units. A second hot-spare disk unit is reserved when you attach more than 20 disk units to an adapter.

Planning for hot-spare device-parity-protected disk units:

Successfully plan how to create hot-spare disk units.

To use hot-spare protection for your parity-protected disk units, the following requirements must be met:

- The disk units must be parity-protected disk units.
- The hot-spare disk unit must be under the same I/O adapter (IOA) as the disk units that you want protected.
- The hot-spare disk unit must be of the correct capacity for the failed parity-protected disk unit.
 - For SCSI IOAs, the hot-spare disk unit must be the same capacity as the failed parity-protected disk unit.
 - For SAS IOAs, the hot-spare disk unit must be same or larger capacity as the failed parity-protected disk unit.
- When an IOA controls the load source disk unit, the hot-spare disk unit must be in a valid load source location. This fact might require extra planning when you use a SCSI IOA. The valid load source locations are typically a subset of the possible disk unit locations within the enclosure. The system does not allow the **Start device parity protection with Hot Spare** to occur if this requirement is not met.
- The hot-spare disk unit must be a non-configured and unprotected disk unit.

Setting up hot spare device parity protected disk units:

You can use the system service tools (SST) to set up hot spare device parity protected disk units.

Starting device parity protection with hot-spare protection:

You can start device parity protection with hot-spare protection by using the system service tools (SST).

1. Start system service tools (STRSST), and specify the user name and password.
2. On the System Service Tools (SST) display, select **Work with disk units**.

3. On the Work with Disk Units display, select **Work with disk configuration**.
4. On the Work with Disk Configuration display, select **Work with device parity protection**.
5. On the Work with device parity protection display, select one of the following options:
 - **Start device parity protection - RAID 5 with hot spare**
 - **Start device parity protection - RAID 6 with hot spare**
 - **Start device parity protection – RAID 10 with hot spare**

Note: If there are enough hot-spare disk units already available, the system does not create any additional hot-spare disk units.

Starting hot spare protection:

You can start hot spare protection using the system service tools (SST).

To start hot spare protection with SST, follow these steps:

1. Start system service tools (STRSST), and specify the user name and password.
2. On the System Service Tools (SST) display, select **Work with disk units**.
3. On the Work with Disk Units display, select **Work with disk configuration**.
4. On the Work with Disk Configuration display, select **Start hot spare**.

Managing hot spare device parity protected disk units:

You can use the system service tools (SST) to manage your hot spare device parity protected disk units.

Stopping hot spare protection:

You can stop hot spare protection using the system service tools (SST).

To stop hot spare protection, follow these steps.

1. Start system service tools (STRSST), and specify the user name and password.
2. On the System Service Tools (SST) display, select **Work with disk units**.
3. On the Work with Disk Units display, select **Work with disk configuration**.
4. On the Work with Disk Configuration display, select **Stop hot spare**.

Determining which parity sets are hot spare protected:

You can determine which parity sets are hot spare protected using the system service tools (SST).

To determine which parity sets are hot spare protected, follow these steps:

1. Start system service tools (STRSST), and specify the user name and password.
2. On the System Service Tools (SST) display, select **Work with disk units**.
3. On the Work with Disk Units display, select **Work with disk configuration**.
4. On the Work with Disk Configuration display, select **Work with device parity protection**.
5. On the Device parity protection display, select **Display disk configuration**.
6. On the Display disk configuration display, select **Display Device Parity Status**.

Displaying hot spare status:

You can use the system service tools (SST) to display hot spare status.

To display hot spare status using SST, follow these steps:

1. Start system service tools (STRSST), and specify the user name and password.
2. On the System Service Tools (SST) display, select **Work with disk units**.
3. On the Work with Disk Units display, select **Work with disk configuration**.
4. On the Work with Disk Configuration display, select **Display disk configuration**.
5. On the Display disk configuration display, select **Display hot spare disk unit status**.

Troubleshooting hot-spare device parity protection:

Identify some common conditions that are associated with hot-spare device parity protection and failed drives.

If you cannot start hot-spare protection or device parity protection with hot-spare protection

Ensure that the following requirements are met:

- The I/O adapter (IOA) has enough disk units that can become hot-spare disk units.
- The disk units to become hot-spare disk units are in **Non-configured** status (not part of a disk pool).
- The disk units to become hot-spare disk units are of appropriate size to protect the disk units in the parity sets under the IOA.
- If the wanted IOA is the load source IOA, the disk units to become hot-spare disk units must be installed in a valid load source location for the specific enclosure.

Notes:

- A non-configured disk unit might not be shown as capable of becoming a hot-spare disk unit if you move the disk unit to a valid load source location. In this case, you might need to initialize or format the disk unit in its new location for the disk unit to become a hot-spare disk unit.
- If the option to start device parity protection with hot-spare protection is selected and the requirements are not met, the wanted IOA is not shown as capable of starting device parity protection.
- If the option to start hot-spare protection is selected and the requirements are not met, the wanted disk units is not shown as capable of becoming hot-spare disk units.

To identify a failed disk unit that was automatically replaced by a hot-spare disk unit

When a device parity protected disk unit fails and the automatic rebuild to the hot-spare disk unit is started or completed, the failed disk has a status of **Not operational** or **Read/Write protected**. Follow normal disk unit service and recovery procedures for replacement of the failed disk unit.

To identify a failed hot-spare disk unit

When a hot-spare disk unit fails, the failed disk has a status of **Not operational** or **Read/Write protected**. Follow normal disk unit service and recovery procedures for replacement of the failed disk unit.

Work with dedicated service tools environment

Use this option to work with active service functions and system devices while you are in dedicated service tools (DST). If you are logged on with service tools security authority, you can also change service tools user IDs and work with some system values.

The Work with Dedicated Service Tools Environment display includes the following options:

- Active service tools
- System devices
 - Printers
 - Select output printer
 - Cancel printer output

- Cancel printer output and deallocate printer
- Tape devices
 - Select tape
 - Cancel tape operation and deallocate tape
- Optical devices
 - Select optical device
 - Cancel optical device operation and deallocate optical device
- Alternate installation device
- Select console
- Configure service tools LAN adapter
- Service tools user IDs
 - Create
 - Change password
 - Delete
 - Display
 - Enable
 - Disable
 - Change privileges
 - Revoke
 - Grant
 - Change description
 - Link/Remove link
- Service tools device IDs
 - Create
 - Reset password
 - Delete
 - Display
 - Enable
 - Disable
 - Change attributes
 - Revoke
 - Grant
 - Change description
- Service tools security data
 - Reset operating system default password
 - Change operating system install security
 - Work with service tools security log
 - Restore service tools security data
 - Save service tools security data
 - Password level
 - Work with lock for device IDs from SST
 - Password expiration interval in days
 - Maximum sign-on attempts allowed
 - Duplicate password control
 - Autocreate service tools device IDs

- RCP privilege on autocreated device IDs
- Display console status screen
- Console F18 take over
- Change service tools language

Work with active service tools:

This option shows the status of the active service functions. Service functions can be started and left active while you start another service function.

Select this option from the *Work with Dedicated Service Tools Environment* display.

Note: The *Work with active service tools* option is also available from the *System Service Tools (SST)* display.

Use this option to work with a service function you left active. The status of a service tool can be active, ending, or no. A no status indicates that there are no displays pending.

The following options appear on the *Work with Active Service Tools* display:

Display

This option allows you to work with an active service tool. You can select only one active service tool.

End service tool

This option ends an active service function. A service function in the process of ending cannot be selected.

Option

Type the desired option number in this field next to the active service tool name you are displaying or ending.

Work with system devices:

Use this option to select the output printer, tape, or optical device and the console type.

Before you select an option on the *Work with System Devices* display, ensure the following is true:

- If you have a printer available, ensure that it is connected and configured to the same I/O processor or storage media unit as the workstation.
- If you have a tape or optical device storage unit available, ensure that it is installed, connected to the system, and configured correctly.

Selecting an output printer, tape, or optical device

On the *Select Output Printer* display, the *Select Tape* display, or the *Select Optical Device* display, the system completes the following fields:

Resource Name

A name that is assigned by the system to identify a specific device, I/O processor, or communications device.

Type A number that is assigned by the manufacturer to identify the specifics of a printer, tape, or optical device unit.

Model The model number of the printer, tape, or optical device unit.

Serial A number that is assigned by the manufacturer to identify a specific printer, tape, or optical device unit.

If no printer is available for this workstation I/O processor, you must select a different output device (such as a tape unit) for the service tool to use.

If the device you selected is already being used by a job, do one the following:

- Press Enter to cancel the job and use the device for the service tool.
- Press F12 (Cancel) to cancel this device selection and then select a different device.

Selecting console type

This option allows you to choose from the following console types when the system is not managed by an HMC:

Note: These changes will take effect only after performing an unattended IPL.

- 1 = Twinaxial console
- 2 = Operations Console (Direct)
- 3 = Operations Console (LAN)
- 4 = Hardware Management Console (HMC)

Work with service tools user IDs:

Service tools user IDs control access to DST functions, system service tools (STRSST command), and Licensed Internal Code service functions. When a Service tools user ID is changed, the old ID is replaced with the new one.

Note: When you type the new password, it is not displayed.

Table 2. Service tools user IDs

Privilege Description	QSECOFR	QSRV	"22222222" (full)	"11111111" (basic)	default
Logical partitioning operator	x	x	x		
Logical partitioning administrator	x	x	x		
DASD management operator	x	x	x		
DASD management administrator	x	x	x		
Disk unit — read only	x		x		x
Trace	x	x	x	x	
SLIC security administrator	x				
Display, alter, dump	x		x		
Licensed Internal Code log	x	x	x		x
Hardware resources manager	x	x	x		
Product activity log	x	x	x	x	
Main storage dump	x	x	x	x	x
Install	x	x	x		
Performance data collector	x	x	x	x	x
Initial program load (IPL)	x	x	x	x	
Work with License Internal Code	x	x	x	x	x
DST environment	x	x	x	x	
Debug	x	x	x		
Save and restore storage	x	x	x		

Table 2. Service tools user IDs (continued)

Privilege Description	QSECOFR	QSRV	"22222222" (full)	"11111111" (basic)	default
Remote service support	x	x	x		
Operator panel key	x	x	x	x	
Operator panel	x	x	x	x	
System capacity – operations	x				
System capacity – administration	x				
System security lock down	x				
Start Service Tools	x	x	x		
Take over console	x				

Note: The default column is for reference in the event a user creates a new service tools user ID without changing any of the privileges.

Work with service tools device IDs

Table 3. Device ID

Privilege Description	QCONSOLE	default
Operations Console (LAN)	x	x
Partition remote panel	x	x
Remote console	x	x

Notes:

- The default column is for reference in the event a user creates a new service tools user ID without changing any of the attributes.
- Remote console is for Linux partitions and is not applicable for IBM i partitions.

How to work with system values:

You can work with system values using the Hardware Management Console (HMC) or the Advanced System Management Interface.

Attention: If the system has logical partitions, contact your next level of support before changing the system serial number. The logical partition configuration information will be impacted.

Work with alternate installation device:

An alternate installation IPL is a special kind of type D IPL.

Two pieces of media are involved in such an installation: the alternate IPL load source (usually an optical device) and the alternate installation medium. The alternate installation medium contains the Licensed Internal Code that will be installed or restored on the system. The alternate installation medium is placed on any bus.

To enable an alternate installation IPL, select the DST option *Work with alternate installation device*. This option is available in DST from control panel function 21 or a type D manual IPL.

Notes:

1. When an alternate bus load source is defined, the Licensed Internal Code also performs an IPL on this bus and IOP for main storage dump IPLs and as a possible dump device.
2. If no alternate load source is defined for the alternate installation, the Licensed Internal Code performs an IPL only on the IOPs on bus 1 and uses the IPL load source.

Resume operating system display

Selecting the **Resume operating system display** option while you are in the full paging environment causes the operating system display to be restored. Any active service functions remain active, and any device that was allocated to the service tool remains allocated.

Select DST console mode

This option causes the operating system to share the console workstation with DST during an IPL of the operating system.

Notes:

1. For the IBM i operating system, this option requires the Install privilege. For more information on authority, see “Work with service tools user IDs” on page 27.
2. When your system is in the full or limited paging environment, the appearance of the **Select DST console mode** option varies depending on the operating system. For more information, see “System paging environments” on page 1 and “IBM i operating system” on page 173.

Operating system displays remain, until either of the following occurs:

- You enter Function 21 (start DST) from the control panel.
- You make a system request by pressing the System Request key while holding down the Shift key, then typing DST and pressing the Enter key.
- The program debug service function encounters a breakpoint.

Options on the DST Console Mode display

The DST Console Mode display includes options to exit DST and to start DST in debug mode.

Exit Dedicated Service Tools (DST) on IPL

Service functions will not interrupt the console display unless you have already set debug mode. Sign-on is necessary to access DST. All active service functions end.

Start DST in debug mode on IPL

Service functions can interrupt the normal operating system process to display debug information. When an operating display appears, you can enter DST by performing the System Request Key procedure. This allows the **Use Dedicated Service Tools (DST)** display to appear without requiring you to sign on to DST. For more information on the System Request Key procedure, see “Using the System Request Key” on page 4.

Start a service tool

The service tools include options to manage dumps, view logs, activate traces, collect performance data, and to activate the hardware service manager.

Select the *Start a service tool* option from the Use Dedicated Service Tools (DST) display.

Note: The *Start a service tool* option is also available from the System Service Tools (SST) display.

Display/Alter/Dump:

This topic provides information about displaying or changing virtual storage data.

Select this option from the Start a Service Tool display.

Note: The **Display/Alter/Dump** option is also available under system service tools (SST).

Use this option to display or change virtual storage data, as well as to dump the data to removable media (tape or optical) or a printer.

You can then use an output device to perform the following tasks:

- To view the data from storage on the screen:
 - Select the **Display/alter storage** option to display *unformatted* data and to change the contents of storage. Use the keyboard to scroll forward or backward to view the storage information.
 - Select the **Display/alter storage** option to generate a *formatted* dump of the contents in storage. The screen is inhibited while the format function is running. When the formatting process is complete, use the keyboard to search, scroll (forward or backward), or shift (left or right) the output.
- To generate a formatted dump of the data in storage to an output device.
 - Select one of the following:
 - **Dump to printer**
 - **Dump to media**

When the output device is a printer or media, the actual dump task runs independently of the Display/Alter/Dump control functions. That is, while a dump is completing on a printer or media, you can operate the display/alter function (output device is the display), or you can make other dump requests for a printer or media. The system saves dump requests in a first-in-first-out queue and processes them one at a time. To display the status of the Display/Alter/Dump dump task, select the **Display dump status** option on the Display/Alter/Dump Output Device display.

- To generate a printout from media that contains data from the Display/Alter/Dump function or from other Licensed Internal Code service functions, select the **Print media dump file** option on the Display/Alter/Dump Output Device display.

The Display/Alter/Dump function is controlled by selecting display options and by responding to prompts. Use each Display/Alter/Dump function option to request specific data. The following are examples of data types:

- Machine Interface (MI) object
- Licensed Internal Code data
- Licensed Internal Code module
- Tasks and processes
- Starting address

Note: When you exit the Display/Alter/Dump function, the dump request that is running is ended (even if it has not completed). Unprocessed dump requests are lost.

Licensed Internal Code log:

Select this option from the Start a Service Tool display.

Note: The *Licensed Internal Code log* option is also available under system service tools (SST).

This option allows you to work with Licensed Internal Code log information. Use this option to perform the following:

- Select specific log entries
- Dump selected Licensed Internal Code log entries to a printer or removable media (tape or optical)
- Change the following Licensed Internal Code log attributes:
 - The maximum number of entries
 - The size of the note log area and the size of the dump log area

- The maximum size for dump entries
- Toggle filtering
- Re-enable filtering at IPL
- Clear the Licensed Internal Code log
- Display the status of the Licensed Internal Code log dumps that are not complete

The dump tasks (one for printer and one for media) run independently of the control functions for this tool. Requests are saved in a first-in-first-out queue, and there is no practical limit to the number of requests you can have waiting to be processed. When you exit the Licensed Internal Code Log display, all the dumps that are running end. To determine the dump status, use the *Display the status of the Licensed Internal Code* option.

Licensed Internal Code trace:

Select this option from the Start a Service Tool display.

Note: The *Licensed Internal Code trace* option is also available under system service tools (SST).

This option allows you to activate (resume) or deactivate (suspend) a trace of the Licensed Internal Code so that you can gather information on the internal operation of Licensed Internal Code. Trace data can be collected by:

- Component
- Machine interface
- Multi-programming level (MPL)
- Transaction
- Task and thread performance data

The trace is placed in a trace table. Information in the table can be displayed or dumped to a printer. This command also allows you to create, allocate (size), clear, or delete a table.

Hardware service manager:

Select this option from the Start a Service Tool display.

Note: The *Hardware service manager* option is also available under system service tools (SST).

This option allows you to display, work with, and print the stored hardware resources information. For more information on the hardware service manager function, see “Hardware service manager” on page 41.

Main storage dump manager:

Select this option from the Start a Service Tool display.

Notes:

- The **Main storage dump (MSD) manager** option is also available under system service tools (SST).
- The Main Storage Dump Manager display is available when you press Enter on the Main Storage Dump Occurred display.

The main storage dump manager manages and processes main storage dumps. It allows you to copy main storage dump information and work with the current main storage dump. The current main storage dump is the latest dump on the system. It is stored on the load-source disk.

Attention: If you do not copy the dump data on the load-source disk to removable media or the Main storage dump (MSD) library, it will be replaced by the next main storage dump and lost at the next IPL. An MSD library is available to access copies of main storage dumps are stored in auxiliary storage. The dumps that are held in the library can be from the system on which you are working or from another system.

The *Main storage dump manager* option allows you to:

- Display or print a current main storage dump
- Display or print a copy of a main storage dump
- Copy a current main storage dump to removable media
- Copy a current main storage dump to the MSD library
- Copy a main storage dump from the MSD library to removable media
- Copy a main storage dump from removable media to the MSD library

An MSD library is available to access copies of main storage dumps. The contents of the library are stored in auxiliary storage. The dumps that are held in the library can be from the system on which you are working or from another system.

When entered from the Main Storage Dump Occurred display, the Main Storage Dump Manager may also allow you to:

- Activate the remote service support communication line. For more information, see “Activating remote service support” on page 39.
- Work with system partitions. For more information, see “Work with system partitions” on page 40.
- Dump all partitions.

You can display a current MSD or an MSD that has been copied to the MSD library. The Display Main Storage Dump display allows you to display or print:

- MSD summary
- System data
- Processor data
- Hardware data
- Licensed Internal Code module data
- MSD by address
- MSD by data

To ensure that the current MSD information is available for problem analysis, you must copy the dump. For details about how to use the copy options under the main storage dump manager function, see “Copying a main storage dump” on page 169.

Program temporary fixes (PTF) repair problems that appear to be hardware problems. Your next level of support can assist you in determining whether you need to copy a dump or if a PTF is available for your problem.

For more information on main storage dumps, see “Working with storage dumps” on page 168.

Product activity log:

Select this option from the Start a Service Tool display.

Note: The *Product activity log* option is also available under system service tools (SST).

This option allows you to display or print data (system, Licensed Internal Code, software components, subsystem, and I/O device data) that has been logged. It also provides data summaries, allows data to be

sorted, and allows you to work with removable media statistics. For more information on the functions of the product activity log, see “Product activity log” on page 72.

Operator panel functions:

Select this option from the Start a Service Tool display.

This option allows you to do the following tasks:

- Change the IPL attributes
- Set the IPL attributes and restart the system
- Set the IPL attributes and power off the system

Performance data collector:

Select this option from the Start a Service Tool display.

This option allows you to gather detailed information about system performance. Select **Performance data collector** only if directed by your next level of support.

To create the trace, you must specify the following:

- Collector mode
- Jobs or tasks from which to collect the data
- Events to collect

After you select the **Start** option, the collector data is placed in temporary storage. When the collector is stopped, you can copy the data to tape by selecting the **Get data** option on the Work with Performance Data Collections display. To delete the data from storage, select the **Delete** option on the Work with Performance Data Collections display. The data is automatically erased at the next IPL.

Work with communications trace:

The **Work with communications trace** option is only available under system service tools (SST). Select this option from the Start a Service Tool display.

This option allows you to start or stop a communications line trace on a configuration object.

After you run the trace, the data can be formatted. You can view the formatted data by printing it.

Use communications trace for the following situations:

- To isolate errors that you cannot isolate using the communications verification procedure
- To collect more data when the problem analysis procedures do not provide enough information on the problem
- If you suspect a communications protocol violation problem or some other line problem
- If you suspect line noise
- When the error messages indicate that there is an SNA BIND problem

Running and interpreting the communications trace requires detailed knowledge of communications protocols. To obtain the most accurate sample of your line status, whenever possible, start the communications trace before varying on the lines.

Note: Online help from the Work with Communications Trace display allows you to view a list of protocols.

Options and function keys

The Work with Communications Traces display has the following options and function keys:

Start trace (F6)

This function key allows you to start tracing the data on a communications configuration object. The *Start Trace* display appears after you press this function key. For more information, see “Starting a trace” on page 36.

Stop trace (option 2)

This option appears only on the Work with Communications Traces display. It allows you to end the trace and stop collecting data. A trace must be stopped before you can format, print, or delete the data. To ensure that the trace is stopped, press the Refresh function key and check the trace status field.

Delete trace (option 4)

The trace must be stopped (option 2) before you can use this option. Select this option to delete the trace information when you no longer need the data. Traces are not automatically deleted when you leave a communications trace function. *Delete trace* releases system space so that you can start other traces without having to increase the maximum amount of storage provided for the communications trace. Traces that are not deleted are listed on the Work with Communications Traces display.

Format and print trace (option 6)

Use this option to format and print the trace. For more information on the *Format and print trace* option, see page “Format and print trace” on page 35.

Display message (option 7)

Use this option to view a message that indicates the status of the trace that stopped because of an error.

Restart trace (option 8)

Use this option to start a trace that has been stopped.

Change size (F10)

Use this function key to change the amount of storage that all traces use. You might want to increase the amount of storage, if your system has many active traces or traces that will be active for a long time.

Display buffer size or display trace status (F11)

This function key allows you to select and alternate between buffer size and trace status.

Refresh (F5)

This function key updates the data on the display.

Status conditions

After the **Work with communications trace** option is selected from the Start a Service Tool display, the Work with Communications Traces display appears.

Details of the trace, including status, are displayed. The trace status can be one of the following:

Condition description

Waiting

The trace is waiting for the configuration object to be varied on (not collecting data).

Active The trace data is being collected.

Stopping

The trace is stopping.

Stopped

The trace has stopped (not collecting data).

Error An error occurred on the configuration object while the trace was collecting data. The data might or might not be collected. The trace stopped.

Starting

The trace is being started by another user. You cannot stop or delete this trace.

Formatting

Trace is being formatted.

Format and print trace

You must select the *Stop Trace* option before you format or print the trace. The *Format and print trace* option allows you to select various formatting options and prepare the trace data for printing. The options vary for each protocol. The following is an example of the Format Trace Data display:

Notes:

1. To view all the data associated with the trace, press Enter without changing the defaults on the Format a Trace Data display. The information is not in any special format.
2. Select the option to format and print only the data that you want to see.
3. All options available for formatting depend on the protocol of the line that is being traced.
4. Not all combinations of options are valid for all protocols.
5. For more information about these options, use online help.

When the format of the trace data is complete, the output can be printed on the console printer (the printer that is attached to the same I/O processor as the console). Only SCS-type data streams are supported. If IBM i is available, the trace might be in the job spooled files.

The structure of the trace data is:

- An introduction page that contains, for example, configuration object, type, protocol, start and stop dates and times, trace options, and formatting options.
- A help page, to assist in understanding the output. Help information for a specific protocol is given because the trace data differs for each communications protocol.
- The formatted trace data appears as follows:

The width of the file is 132 characters. The data is in hexadecimal representation and either American National Standard Code for Information Interchange (ASCII) or EBCDIC character representation. The columns of the trace output common to all protocols are:

Record number

The number of the trace record. Shows if the record type is sent (S) or received (R).

Notes:

1. The letter C in this column indicates that an X.21 short hold mode connection was cleared.
2. The letter M in this column indicates a modem change has occurred.

Data length

The amount of data, in decimal, that the record contains.

Record status

The protocol-dependent return code for the trace record. 00000000 is successful; no errors were found. Other return codes are listed in the functional specification for the protocol that is running or the port manager.

Record timer

The time that each event occurs. Depending on the communications hardware that is being used, the record timer will be either:

1. A time of day value, HH:MM:SS.NNNNN (where H=hours, M=minutes, S=seconds, and N=subseconds), based on the system time when the trace was stopped.
2. A relative time in decimal seconds. This timer value provides the relative time between events.

Data type

Shows whether the traced data is printed in ASCII or EBCDIC character representation. If the character representation of the data is mostly periods, you might want to format the data again using the other option for data representation.

Controller name/number

Indicates which controller originated the frame or record. In some conditions, this data is not available, and the column remains blank.

Note: The formatted trace output is not security protected.

Starting a trace:

The Work with Communications Traces display has a **Start Trace** function key that allows you to select options for tracing data.

On the Start Trace display, enter the name of a communications configuration object description at the Configuration object prompt:

- For IBM i operating systems:

If you do not know the name of the configuration object, the work with configuration status (WRKCFGSTS) command allows you to view a list. You can view line, controller, or network information by entering the *LIN, *CTL, *NWI, or *NWS parameter.

You can also use this command to vary off a line and all the I/O processors and devices under it.

Describe the trace in the **Trace description** field. This field can help you identify the trace.

You can select a buffer size to hold the communications data that the trace collects. The default buffer size is 1=128K bytes. Base the size of the buffer on the speed of the communications line and on the amount of time necessary to trace the data. For high-speed lines or long periods of tracing, use a larger buffer size.

If you specify Yes in the **Stop on buffer full** field, the trace stops when the buffer is full. This option is useful for viewing the initial data that is coming across a line. If you specify No, the trace continues until you stop it. In this case, the data in the buffer will be written over each time the buffer is full.

You can select the direction of data to be traced by specifying one of the three selections in the **Data direction** field:

- Only data that the system is sending (option 1)
- Only data that the system is receiving (option 2)
- Both the data sent and received by the system (option 3)

Note: If you specify option 1 (Sent) for lines that are in SDLC short hold mode, the trace does not include controller names.

You can select how much data is traced in a frame of data. The value that is entered is the amount that is saved as part of the trace. The minimum value that is allowed for both the beginning and the end value

is 36 bytes. Those 36-byte minimum values include the protocol header. The configuration object you are tracing determines the maximum value that is allowed.

Notes:

1. The BSC protocol ignores the beginning and ending byte values.
2. The SDLC, high-level data link control (HDLC), X.25, frame relay, Ethernet, distributed data interface (DDI), ATM, and token-ring protocols ignore the ending byte value.
3. The minimum value that is allowed for the beginning byte value for local area network (LAN) protocols (including frame relay protocols and ATM protocols) is 72 bytes.

When all required options are complete, press Enter. The Work with Communications Trace display appears.

If the communications object being traced is in varied off status when you start the trace, the trace remains in waiting status until you vary the communications object on. If the object is varied on, the trace will immediately go to the active state, and the system will begin to collect trace data.

The trace remains active until one of the following occurs:

- You select the option to stop the trace on the Work with Communications Traces display.
- You vary off the configuration object being traced.
- The configuration object being traced has an error.
- The trace buffer is full, and the option to stop when the buffer was full was selected.

Note: While the trace is active, you can exit the communications trace function to do other work.

Traces are not automatically deleted when you exit a communications trace function. To return to the communications trace:

1. Select the **Start a service tool** option from the service tools (SST or DST) display.
2. Select the **Work with communications traces** option.
3. From the Work with Communications Traces display, you can check the status of the trace or select to stop the trace.

Communications trace limitations:

Only two communications traces can run concurrently on one communications controller. Only one trace can exist for the same configuration object at the same time. If IBM i is available, access SST to trace more lines.

Although a communications trace can start before or after the configuration object is varied on, if it is important to see the starting information coming across the configuration object, you must start the trace *before* varying on the configuration object.

Two or more users can select the same trace to format and print. When multiple users attempt to use the same resources (trace data), one user must wait for the other user to finish before beginning to process the data.

SDLC communications trace considerations:

When the system is configured as an SDLC secondary station on a multipoint configuration object, the communications controller traces all records or frames.

The records or frames sent to the system include those records and frames intended for other stations. When you use the communications trace service tool to format the data for this configuration, the resulting report might show received records that were intended for other stations.

On a single point-to-point line, where only one secondary station is configured, SDLC traces all frames received before it gets the frames intended for other station addresses. It is not until the secondary SDLC receives the other station addresses that it knows which single-station address the communications equipment uses.

LAN communications trace considerations:

Trace options are provided for some of the LAN protocols that allow you to select, at trace start time, which data to trace.

For example, you can start a trace to collect data for only a specific remote controller. Selecting one of these trace options when starting a trace will result in less trace data and reduce the need for a large trace buffer.

Trace-filtering options are not available for all LAN communications adapters. If the adapter does not support filtering, all data will be traced, and the following informational message will appear in the prologue of the formatted trace: Trace Options not supported. All data was traced (no filtering).

Perform automatic installation of the operating system

This option allows you to install the operating system from a tape, optical media, network, or virtual optical image.

This option allows you to install the operating system. Selecting from the following devices to install the operating system:

- Tape
- Optical media
- Virtual optical - preselected image catalog
- Current alternate selected device
- Network device
- Optical Container

Note: When your system is in the limited paging environment (see “System paging environments” on page 1), the appearance of the *Perform an automatic installation of the operating system* option varies depending on the operating system. For more information, see “IBM i operating system” on page 173.

Save Licensed Internal Code

This option allows you to save the Licensed Internal Code to tape or optical device, with all currently applied PTFs.

You can use the tape or optical device to restore the Licensed Internal Code after a failure.

Note: When your system is in the limited paging environment (see “System paging environments” on page 1), the appearance of the *Save Licensed Internal Code* option varies depending on the operating system. For more information, see “IBM i operating system” on page 173.

Work with save storage and restore storage

This option allows you to perform tasks such as resuming a restore storage process that was interrupted.

The **Work with save storage and restore storage** option allows you to perform the following:

- Restore all system auxiliary storage (except Licensed Internal Code)
- Resume a restore storage process that was interrupted
- Force the end of an interrupted restore storage process
- Resume a save storage process that was interrupted

Note: When your system is in the limited paging environment, the appearance of the **Work with save storage and restore storage** option varies depending on the operating system. For details about system paging environments, see “System paging environments” on page 1. For more information, see “Dedicated service tools in IBM i limited paging environment” on page 174.

Work with remote service support

This option provides a variety of functions such as testing remote service communications.

The **Work with remote service support** option allows you to:

- Test remote service communications
- Activate and deactivate remote service support communication line
- Work with the security log (shows remote service activity)
- Change service attributes

Through remote service support, DST functions that would typically be available only at the local system console can be accessed from a remote site. Remote service support requires the following:

- An electronic customer support communications line.
- The system at the local site must be at DST (that is, perform an IPL to DST), or past DST.
- Remote service support must be enabled and activated at the local site. For details, see “Allowing access for remote service support” and “Activating remote service support.”

Allowing access for remote service support:

Before you begin a session, remote service support must be allowed access by the system.

Perform the following to allow access for remote service support:

1. Select the *Work with remote service support option* on the Use Dedicated Service Tools (DST) display.
2. Select the *Change service attributes* option.
Set the *Allow remote access* field to 1 (yes).

Note: The system is shipped with remote service access disabled (not allowed). After remote access is set to 1 the first time, it remains set until you select 2 (not allowed) or the system is restored. The system operates normally with remote access in either state (allowed or not allowed).

3. The system now allows a remote service support session. To activate a remote service support session, see “Activating remote service support.”

This ends the procedure.

Activating remote service support:

Remote service support enables you to securely give the service and support organization access to your server to enable problem analysis and determination.

Before you can activate a session, you must allow access for remote service support. For details, see “Allowing access for remote service support.” After you have allowed access for remote service support, you can activate remote service in one of the following ways:

- Perform Function 66 (Activate Remote Service) on the control panel. For details, see “Function 66: Activate remote service” on page 118.
- Select the *Activate remote service support communication line* option on the Work with Remote Service display by performing the following procedure:

Note: Electronic customer support is not available while DST remote service is active. For more information on electronic customer support, see the system operation information.

1. Select the *Work with remote service support option* on the Use Dedicated Service Tools (DST) display.
2. Make a note of the current mode setting on the modem. Then select the *Activate remote service support communication line* option from the Work with Remote Service Support display. This activates the communications line and sets the modem to asynchronous mode.
3. When the service provider ends the remote service session, the console is available for normal DST operations.

Note: If the console is input-inhibited after the service provider ends the remote service session, select Function 21 to make DST available again.

4. Select the *Work with remote service support* option from the Use dedicated service tools (DST) display.
5. Select the *Deactivate remote service support communication line* option from the Work with Remote Service Support display to release the communications line.

Note: Releasing the line does not reset the modem mode. Remote service uses asynchronous mode. If the modem was originally set to a mode other than asynchronous, you must manually select the mode again.

This ends the procedure.

Work with system partitions

Working with system partitions topic index.

You can use the Hardware Management Console (HMC) when working with system partitions. However, in some environments the service tool Virtual Partition Manager provides a limited set of partition management functions that does not require an HMC.

For information on servicing logical partitions, see “Logical partitions” on page 106.

Work with system security

There are three settings that can be changed on the Work with System Security display.

Select **Work with system security** from the Use Dedicated Service Tools (DST) display or the System Service Tools (SST) display to manage system security options. There are three settings that can be changed on the Work with System Security display:

Allow system value security changes

This option controls whether CHGYSVAL can be used to change security-related system values (see the onscreen help for a list of these values).

Allow new digital certificates

This option controls whether the Add Verifier (QYDOADDV) API can add digital certificates and also whether passwords for digital certificate stores can be reset.

Allow a service tools user ID with a default and expired password to change its own password

This option controls whether service tools user IDs with a default or expired password can change their password during SST sign-on or with the QSYCHGDS API. When set to 'No,' the password can only be changed from DST or by using the QSYCHGDS API with a requesting user that has the necessary authority.

End batch restricted state

How to stop the batch job.

Select **End batch restricted state** to end the batch job running in restricted state and start the controlling subsystem. This option has no effect if the system is not in batch restricted state.

Hardware service manager

The hardware service manager allows you to display and work with system hardware (logical or packaging) and debug input-output processors (IOP) and devices.

You can select the **Hardware service manager** option from the Start a Service Tool display. It allows you to display and work with system hardware (logical or packaging) and debug input-output processors (IOP) and devices.

Note: The system power control network (SPCN) option appears only on systems with SPCN.

The Hardware Service Manager display provides the following information:

- System type, model, and serial number
- Licensed Internal Code and operating system release information

Note: For details about how to interpret the Release field, see “Determining the dominant operating system” on page 103.

- A list of the hardware service manager options

Note: The options available vary depending on the system type and paging environment. For details, see “Hardware service manager options.”

- Function keys

Note: The function keys vary depending on the display that is shown. For information on how to use them to collect information, see “Collecting information and performing functions from the hardware service manager displays” on page 49.

For more information on the system configuration and resources, see “System architecture and configuration” on page 136 and “Resource names” on page 141.

Hardware service manager options

Options on the Hardware Service Manager display vary according to the paging environment. In the nonpaging (stand-alone) environment (type D IPL), the Hardware Service Manager display shows a subset of the options that are allowed when the operating system is available.

For more information on paging environments, see “System paging environments” on page 1.

Table 4. Paging environments and hardware service manager options

Paging environment	Hardware service manager options
Type D initial program load (IPL) (Nonpaging or Stand-alone)	<ul style="list-style-type: none">• Logical hardware resources<ul style="list-style-type: none">– System bus resources– Processor resources– Main storage resources– High-speed link resources

Table 4. Paging environments and hardware service manager options (continued)

Paging environment	Hardware service manager options
Limited and full paging	<ul style="list-style-type: none"> • Packaging hardware resources <ul style="list-style-type: none"> – Change detail – Concurrent maintenance – Remove – Display detail – Associated logical resources – Hardware contained within package • Logical hardware resources <ul style="list-style-type: none"> – Bus – Change detail – Remove – Display detail – I/O debug – Verify – Associated packaging resources – Resources associated with IOP • Locate resource by resource name • Failed and non-reporting hardware resources • System power control network (SPCN) * / Battery Power Unit Information • Work with service action log • Display label location work sheet • Device concurrent maintenance • Work with resources containing cache battery packs

Packaging hardware resources

The **Packaging hardware resources (systems, frames, cards,...)** option appears on the Hardware Service Manager display when the system is in the full or limited paging environment.

This option allows you to display and work with packaging resources. Packaging hardware resources are the physical resources of the system. The display lists them by their physical location within the system. Some packaging hardware resources contain other packaging hardware resources within them. For example, a frame might contain a card enclosure, and the card enclosure might contain cards. To display these resources, select the **Hardware contained within package** option on the Packaging Hardware Resources display.

The Packaging Hardware Resources display shows packaging hardware resources in levels that begin with the system resource. The Packaging Hardware Resource display shows all associated first level hardware resources. To see the resources contained within a packaging hardware resource, select the *Hardware contained within package* option on the packaging resource that has a “+” symbol next to it. For more information on symbols, see “Symbols on the hardware service manager displays” on page 69.

Note: The **Hardware contained within package** option will not be valid for a remote system unit since no packages for hardware within them will be created. This is because HRI will not see VPD from any resources within a remote system unit or remote expansion unit.

Selecting the **Display SPCN system information** function key will cause the following display to appear. This display lists the System Power Control Network (SPCN) type and serial number. The SPCN type and serial number is the type and serial number of the system that controls the power for this resource.

For more information on how to collect information and perform specific functions by using the options and function keys from the Packaging Hardware Resources display, see “Collecting information and performing functions from the hardware service manager displays” on page 49.

Logical hardware resources

Use the Hardware Service Manager display, Logical Hardware Resources on System Bus display, Display Processor Information display, Display Main Storage Information display, or the Work with High Speed Link (HSL) Resources display to show hardware resources.

The **Logical hardware resources (buses, IOPs, controllers,...)** option appears on the Hardware Service Manager display. This option allows you to display and work with logical resources. Logical hardware resources are the functional resources of the system used by the operating system.

From the Logical Hardware Resources on System Bus display, Display Processor Information display, Display Main Storage Information display, or the Work with High Speed Link (HSL) Resources display, you can perform the following:

- Display or change logical hardware resource information
- Display associated packaging hardware resources
- Display logical hardware resource status

Note: The **System bus resources** option also allows you to perform I/O debug functions and run verification procedures. For more information on this option, see “Display system bus resources” on page 61.

The High-speed link resources display also allows you to enable and disable HSL Opticonnect and to display port information.

For more information on collecting information and performing specific functions using the options and function keys from the Logical Hardware Resources display, see “Collecting information and performing functions from the hardware service manager displays” on page 49.

For details about the symbols that appear next to the resource description field, see “Symbols on the hardware service manager displays” on page 69.

Locate resource by name

Use the hardware service manager to locate the resource by name.

The **Locate resource by resource name** option appears on the Hardware Service Manager display when the system is in the full or limited paging environment. It allows you to enter a resource name on the Locate Resource by Resource Name display:

The system responds by displaying one of the following messages:

Resource is not found

The system displays the following message:

```
x does not exist as a current resource
name.
```

(Where x is the resource name that the user specified.)

Resource is found but is a reserved resource name

A reserved resource name is created when an IBM i command (CRTDEVx) supplies an unassigned resource name. The following message displays:

```
x exists as a reserved resource name.
Resource does not exist.
```

(Where x is the resource name that the user specified.)

Resource is found

If the resource name represents a logical hardware resource, the Logical Hardware Resources display appears. It allows you to work with the logical hardware resource.

You can also use the Locate Resource By Resource Name display to find a packaging resource. When the system finds the packaging resource name, the Packaging Hardware Resources display appears.

For more information on collecting information and performing specific functions by using the options and function keys from the Logical Hardware Resources display, see “Collecting information and performing functions from the hardware service manager displays” on page 49.

Failed and non-reporting resources

View location information and display a list of the packaging hardware resources that either failed or did not report at the last IPL.

The **Failed and non-reporting hardware resources** option appears on the Hardware Service Manager display when the system is in the full or limited paging environment. It allows you to display a list of the logical hardware resources that either failed or did not report to the system at the last IPL.

Note: To view location information and display a list of the packaging hardware resources that either failed or did not report at the last IPL, select the **Associated packaging resource(s)** option on the Failed and Non-Reporting Logical Hardware Resources display.

A failed resource that reports to the system at the time of the IPL might have a problem with its operation. On the Failed and Non-Reporting Logical Hardware Resources display, *Failed* appears in the Status column to indicate a failed resource. The failed resources appear at the top of the list.

A non-reporting resource does not report to the system at the time of the IPL. On the Failed and Non-Reporting Logical Hardware Resources display, a question mark symbol (?) appears next to the resource description field to indicate a non-reporting resource. The status of a non-reporting resource is Unknown.

Note: For more information on symbols, see “Symbols on the hardware service manager displays” on page 69.

A failed or non-reporting resource indicates that one of the following has occurred:

- The resource was removed from the system (non-reporting only).
- The resource was powered off at the time of the IPL.
- There is a problem in the signal path between the system and the device.
- There is a resource failure.

Selecting the **Failed and non-reporting hardware resources** option is a quick way to display failed and non-reporting resources on the system. For information on other ways to display failed and non-reporting resources, see “Display failed resources” on page 54 or “Display non-reporting resources” on page 55.

If no failed resources or non-reporting resources exist, the following informational message appears:

No failed or non-reporting logical hardware resources were found.

If the system finds only non-reporting resources and no failed resources, the Failed and Non-Reporting Logical Hardware Resources display appears with the list of non-reporting resources and the following message:

No failed logical hardware resources were found.

If the system finds only failed resources and no non-reporting resources, the Failed and Non-Reporting Logical Hardware Resources display appears with the list of failed resources and the following message:

No non-reporting logical hardware resources were found.

The options on the failed or non-reporting displays are the same options that are available for logical resources:

- Change detail
- Remove
- Display detail
- I/O debug
- Verify
- Associated packaging resource

For more information on these options, see “Collecting information and performing functions from the hardware service manager displays” on page 49.

System Power Control Network

This option appears on the Hardware Service Manager display when the system is in the full or limited paging environment.

The *System Power Control Network (SPCN)* option appears on the Hardware Service Manager display when the system is in the full or limited paging environment. This option is not available on all systems.

Problems that the SPCN reports to the operating system are logged. Select the *System Power Control Network (SPCN)* option to work with the network structure for SPCN. See the service action log to display and work with the log information. For more information on SPCN features and use of this option, see “System power control network” on page 136.

Work with service action log

The **Work with service action log** option appears on the Hardware Service Manager display when the system is in the full or limited paging environment.

When you select this option, the system displays a log of hardware errors that require action from a service representative. A service representative uses the log as a starting point for hardware problem analysis. It provides information on how many times a system reference code appears for a specific resource and shows description and location information for the possible failing items.

The service action log prompts you for a specific time range and allows you to select to view only entries with NEW status. The Service Actions Log Report display shows the following fields for the log entries that require service action for the time that you specify:

- Option
- Status
- Date
- Time
- SRC
- Resource
- Isolated
- Count

Notes:

1. The special value *PLATFORM displays for the resource name when the log has come from the platform Licensed Internal Code.
2. The F6 key allows you to deactivate the partition's Virtual System Attention Indicator (VSA). This key is shown only if the VSA is activated.

Option field

Use the Option field to perform the following functions:

- Display the failing item information
This option displays the possible failing items along with part action, description, location, and SRC word information. Choose the Help function key for more information about each of these fields.
- Close a *NEW* entry
After a problem has been fixed, select this option to change the status to *CLOSED*.
This option allows you to mark service action log entries with the appropriate status of the repair. For more information on status, see Status field.
- Delete a *CLOSED* entry
Select this option to remove a *CLOSED* problem from the service action log. A deleted entry will not appear the next time you view the service action log.

Status field

This field indicates the status of the entry as one of the following:

- *NEW*
This indicates that no action has been taken. The entry has not been closed or deleted.
- *CLOSED*
This indicates that a *NEW* entry has been fixed and closed.
- *DELETED*
This indicates that the entry will not appear the next time you view the service action log.
To remove a *CLOSED* problem from the service action log, select the *Delete a CLOSED entry* option from the Service Actions Log Report display.

Date and time fields

These fields display the time and date of the *first* occurrence of a system reference code (SRC) for a resource during the time range specified.

SRC field

This field shows the system reference code (SRC) that was logged against the resource.

Resource field

This field displays the resource against which the problem was logged.

Count field

This field indicates the number of SRC occurrences for the resource that is indicated in the Resource field.

Display label location work sheet

The *Display label location work sheet* option appears on the Hardware Service Manager display when the system is in the full or limited paging environment.

The *Display label location work sheet* option allows you to display current configuration location information. You can also print a worksheet that shows location information by selecting the print function on the Label Location Work Sheet display. The work sheet printout contains a field in which you can enter label information.

The system uses description labels to identify hardware. It is the customer's responsibility to configure and assign labels in the system for cables and devices. The system label must match the (physical) label on the hardware. Prior to a system upgrade procedure, you can select this option to print the label location work sheet. Use the work sheet to list the hardware labels and to verify that the system labels match the hardware labels after the upgrade.

For more information on label locations, see “Work with Hardware Products (WRKHDWPRD) command” on page 188.

Device concurrent maintenance

Device concurrent maintenance provides the capability to power down and remove a failed disk unit, tape unit, or optical unit. It also provides the capability to insert and power up a replacement unit or a new unit while the System i[®] system is powered on and in use.

For a configured disk unit device, this concurrent maintenance action is only permitted when the disk unit device has data storage protection. For example, if the disk unit is one member of a mirrored pair or is a member of a data parity array.

To perform concurrent maintenance on a device, specify the location of the device by providing the physical location of the device. If you do not know the location, use the following information to determine the correct location.

This field represents the position of the device within the enclosure as labelled on the frame.

Device resource name

This field shows the logical name assigned to the resource that is the target of device concurrent maintenance. An example of the resource name for a disk unit would be 'DD037'. See the information for the specific resource either in the hardware service manager displays or in the Display Disk Configuration displays.

To perform device concurrent maintenance on this unit, perform the following steps:

1. Enter the information that was gathered from the Disk Unit Hardware Resource Information Details display.
2. Press Enter.

Note: If the device is unable to report in or you are installing a device into an empty slot, use Physical Location instead of Resource Name.

Action to be performed

If removing the device, specify 1. If inserting the device, specify 2.

Time delay needed in minutes

Enter 00 in this field if you do not want any delay before the process begins. If you enter a value in this field, the device will wait that long after you press Enter to begin the operation. Typically you will enter a value if the device is at a different location and it will take you a while to get to that location. The device might be in a different room, for example.

For details about IOA or IOP concurrent maintenance, see “Concurrent maintenance” on page 49.

Work with resources containing cache battery packs

The **Work with resources containing cache battery packs** option appears on the Hardware Service Manager display when the system is in the full or limited paging environment.

The **Work with resources containing cache battery packs** option allows you to display a list of packaging hardware resources that contain a cache battery pack. It also provides the capability to force the battery pack into an error state for replacement.

For more information on collecting information and performing specific functions using the options and function keys from the Work with Resources Containing Cache Battery Packs display, see “Collecting information and performing functions from the hardware service manager displays” on page 49.

This field represents the position of the device within the enclosure as labelled on the frame.

Force battery pack into error state

The **Force battery pack into error state** option, available from the Work with resources containing cache battery packs display, allows you to force an IOA to put its cache battery pack into an error state. This IOA state requires replacement of the battery. Typically, this option is performed to ensure that write caching is stopped prior to replacing a cache battery pack (that is to prevent possible data loss) or when you are replacing a cache battery pack on one IOA, and want to replace other cache battery packs on IOAs in the same system which have not yet issued the cache battery warning or cache battery error.

Display battery information

The **Display battery information** option, only available from the Work with resources containing cache battery packs display, allows you to access information about the cache battery packs.

The following fields appear on the Battery Information display:

Resource name

This is the resource name that was either created by the system when the hardware was first detected, or was changed to a new value by the user. The packaging hardware resource name is different from the logical hardware resource name.

Serial number

This field shows the serial number of the resource as reported by the system or entered manually by the user. Only serial numbers that were initially detected as zeros can be changed by the user.

Type-model

This field shows the Type and model of the resource as reported by the system or entered manually by the user.

Frame ID

Hexadecimal identity of the frame enclosure.

Card position

The card position of the packaging hardware resource within the enclosure. This can be followed by a letter to specify the position of a second level card. This is represented by a decimal numeral.

Battery type

This field indicates the type of cache battery pack.

Battery state

This field indicates if an error condition currently exists related to the cache battery pack. See the following for possible values for this field:

- *No battery warning/error.* No warning or error condition currently exists.
- *Warning condition.* A warning condition currently exists (an entry has been placed in the PAL).

- *Error condition.* An error condition currently exists (an entry has been placed in the PAL).
- *Unknown.* Information is not available to determine whether a warning or error condition currently exists.

Power-on time (days)

This field indicates the raw power-on time, in units of days, of the cache battery pack.

Adjusted power-on time (days)

This field indicates the adjusted (prorated) power-on time, in units of days, of the cache battery pack.

Note: Some cache battery packs are negatively affected by higher temperatures and thus are prorated based on the amount of time they spend at various ambient temperatures.

Estimated time to warning (days)

This field indicates an estimated time, in units of days, until a warning is surfaced indicating that the cache battery pack replacement should be scheduled.

Collecting information and performing functions from the hardware service manager displays

This section describes how to collect information and perform specific functions by using the options and function keys from the various packaging and logical hardware resources displays.

You can select *Packaging hardware resources* and *Logical hardware resources* options from the Hardware Service Manager display (see “Packaging hardware resources” on page 42 and “Logical hardware resources” on page 43). This section describes how to collect information and perform specific functions by using the options and function keys from the various packaging and logical hardware resources displays.

Change resource details

You can change detailed information about a specific resource by selecting the Change detail option or function key.

From packaging displays

To view or change detailed information about a specific resource, select the **Change detail** option or function key. The information varies depending on the device selected.

For definitions of the fields that appear on the Change Packaging Hardware Resource Detail display, see “Display resource details” on page 56.

Note: An asterisk symbol (*) on the left and right side of the value indicates that this resource requires specific information from the user. For more information, see the section entitled “Display resources requiring attention” on page 59.

From logical displays

You can change the logical resource name of a specific resource by selecting the **Change detail** option or function key. The information varies depending on the device selected.

Concurrent maintenance

The **Concurrent Maintenance** option is available only on the packaging hardware resources displays.

From packaging displays

This option provides the capability to power off a subset of the system and perform service actions on hardware in that subset. Other parts of the system remain powered on and functional. Service actions supported include replacement, upgrade, removal, addition, and movement of hardware.

The subset of system hardware that you power off in order to shut down a particular piece of hardware is known as the *power domain* for that piece of hardware. The power domain of a piece of hardware is determined by the granularity of the power control system. For example, the power domain of an I/O processor on an SPD bus is the frame in which the SPD bus resides. This is because the power control system for SPD buses does not support powering individual I/O processor slots on and off. In contrast, the power control system for PCI buses does support powering individual I/O card slots on and off. Consequently, the power domain for an I/O card on a PCI bus is the card itself.

There are some restrictions on hardware resource concurrent maintenance which are enforced by the operating system.

Some of the more common restrictions are as follows:

- You cannot power off some expansion units without powering off the entire system.
- If you are powering off a power domain containing configured disk units that are not mirrored in a different power domain, it is likely that a disk unit attention SRC will appear in the operator panel display. Also, some or all system activity could stop until the domain is powered back on and the disk units become available again. The I/O processors and I/O adapters to which these disk units are attached may only be replaced while the domain is powered off. Any other actions on these hardware resources are unsupported and may cause failures requiring a system IPL to recover. There are no restrictions on the service actions that can be performed on other hardware resources in the power domain.
- A power domain containing hardware resources that are in use by the operating system cannot be powered off. All configuration objects using hardware resources in the power domain must be varied off before the power domain can be powered off.
- You must end all active CRGs (cluster resource groups) prior to attempting to power off a power domain using concurrent maintenance.
- The system you are using must be the SPCN (system power control network) for the selected power domain.
- A power domain containing switchable bus adapters cannot be powered off if any of the bus adapters are owned by a system other than the one you are using.

You can find more information on these restrictions by pressing F1 at the Concurrent Maintenance display.

Create frame information

Create a new packaging resource.

From packaging displays

If you change detail or reserve frame space for a frame ID that currently does not exist, the following message appears:

Containing hardware resource does not exist. Press F10 to create.

Note: For details about changing resource details, see “Change resource details” on page 49. For details on reserving frame space, see “Reserve frame space” on page 63.

To create the frame information, perform the following steps:

1. Press the **Create containing hardware resource** function key.

Note: The **Create containing hardware resource** function key is not available for all resources.

2. After you select the frame information and press Enter, the Define Frame Packaging Detail display appears. Use this display to define the following frame information:

- Resource name
- Serial number
- Location text
- Service provider
- Alternate remote telephone
- Alternate service node
- Alternate service telephone
- Owning system type
- Owning system model
- Owning system serial number

3. When you press **Enter**, the data is verified and used to create a new packaging resource. If no errors are found, you will return to the original change detail or reserve frame space display.
4. Press **Enter** from that display to complete the change and return to the previous packaging list display. You can view this newly created packaging hardware resource in the list of frames on the Packaging Hardware Resource display.

From logical displays

The **Create containing hardware resource** function key is available only on the packaging hardware resources displays. To access this function from the logical displays, select the **Associated packaging resource(s)** option. For details, see “Display associated resources” on page 53.

Debug the resource

You can access I/O debug from the packaging and logical displays.

From packaging displays

The *I/O debug* option is available only on the logical hardware resources displays. To access I/O debug from the packaging displays, you must select the *Associated logical resource(s)* option. For details, see “Display associated resources” on page 53.

From logical displays

The *I/O debug* option is available only on the logical hardware resources displays. This option helps in debugging selected resources.

Attention: Misuse of this option might cause a system software failure.

The I/O Debug display shows the following options as appropriate for the resource selected:

Read/write I/O processor data

Select this option to read or edit the I/O processor data

Dump I/O processor data

See “Performing an IOP dump” on page 173.

Reset I/O processor

Some debug functions require that the I/O processor be in a disabled state. Select this option to

disable the I/O processor. To enable the I/O processor for normal operation, you must select the *IPL I/O processor* option on the Select I/O Debug Function display or IPL the system again.

IPL I/O processor

Select this option to IPL the I/O processor. After selecting the *reset I/O processor* option, you can recover from an intermittent problem, refresh the I/O processor system information, or enable the I/O processor for normal operation. Selecting this option performs the same function as the IBM i vary command with the *reset* option. For details, see “How to reset an I/O processor while the system is running” on page 181.

Enable I/O processor trace

Select this option to enable IOP trace.

Disable I/O processor trace

Select this option to disable IOP trace.

Enable I/O processor reset

Select this function key to enable IOP reset (one IOP or all IOPs on a bus).

Attention: This function is only for System i development use and is not for use in customer installations. Using this option can disrupt system operations and lead to unrecoverable system failures.

Disable I/O processor reset

Select this function key to disable IOP reset.

Attention: This function is only for System i development use and is not for use in customer installations. Using this option can disrupt system operations and lead to unrecoverable system failures.

Enable I/O processor IPL

Select this function key to enable IOP IPL (one IOP or all IOPs on a bus).

Attention: This function is for System i development use only and is not for use in customer installations. Using this option can disrupt system operations and lead to unrecoverable system failures.

Disable I/O processor IPL

Select this function key to disable IOP IPL.

Attention: This function is for System i development use only and is not for use in customer installations. Using this option can disrupt system operations and lead to unrecoverable system failures.

Enable bus trace

Select this option to enable a bus trace.

Take/Release ownership

If this system presently owns the resource, selecting this option causes the system to release its ownership.

If this system does not presently own the resource, selecting this option causes the system to take ownership.

For more information about I/O debug, see “Performing an IOP dump” on page 173.

Reinitialize crypto source

To reinitialize the flash memory of the crypto cards, complete the following steps:

1. Select **Reinitialize Flash Memory** from the *I/O debug* option for a crypto resource.

Note: To access I/O debug from the packaging displays, you must select the *Associated logical resource(s)* option. For details, see “Display associated resources.”

2. Select **1** and press Enter.

Display address

You can display address information from packaging hardware resources and from logical resources.

From packaging displays

Each packaging hardware resource has associated address information. The address information is available only on the logical hardware resources displays. To access address information from the packaging displays, you must select the *Associated logical resource(s)* option. For details, see “Display associated resources.”

From logical displays

Select the *Display detail* option on various logical resources to view address information. For details, see “Display resource details” on page 56.

Notes:

1. The system configuration list printout shows logical address information. For more information, see *Printing the system configuration list*.
2. You can also view logical address information from the product activity log. For details, see “Product activity log” on page 72.

Display associated resources

Display the associated logical resources for a packaging communications IOP.

From packaging displays

Some packaging hardware resources have associated logical resources. Logical hardware resources represent the function of the hardware. Select **Associated logical resource(s)** to show the logical resources that are associated with the packaging resource. The packaging resource might have no associated resources or might be associated with one or more logical resources. For example, the physical hardware resources for a communications card could have three logical hardware resources associated with it: a communications I/O processor, a communications I/O adapter, and a communications port.

Note: The logical and packaging hardware resources have unique resource names. Packaging hardware resource names are used only by the system. Service representatives and customers use the logical resource names.

This display shows all the logical hardware resources that are associated with one packaging resource. The first line provides a description, type, model, and resource name of the packaging resource with which all the logical resources are associated.

The options on the Logical Resources Associated with a Packaging Resource display are the same options that are available for logical resources:

- Change detail
- Remove
- Display detail
- I/O debug
- Verify
- Associated packaging resource(s)

From logical displays

Each logical hardware resource has one or more associated packaging hardware resources. Packaging hardware resources represent the physical packaging of the system hardware. Select **Associated packaging resource(s)** to show physical locations and display the packaging resources that are associated with the logical resource. For example, the communications I/O processor is shown as the packaging hardware resource that is associated with the logical communications I/O processor.

This display shows all the packaging hardware resources that are associated with one logical resource. The first line provides a description, type, model, and resource name of the logical resource with which all packaging hardware resources are associated.

Options on the Packaging Resources Associated with a Logical Resource display are the same options that are available for packaging hardware resources:

- Change detail
- Concurrent maintenance
- Remove
- Display detail
- Associated logical resource(s)
- Hardware contained within package

Note: The logical and packaging hardware resources have unique resource names. Packaging hardware resource names are used only by the system. Service representatives and customers use the logical resource names.

Display card gap information

I/O processors must be installed in a specified logical order.

From Hardware Service Manager display

The **Display card gap information** function key appears on the Hardware Service Manager display. I/O processors must be installed in a specified logical order.

Note: SPD system busses require that no empty card positions exist between I/O processors. PCI system busses may have empty card positions.

Select this option to display the gaps in the logical card sequencing. If the cards are not installed in order, system performance might be affected, the cards might be unusable, or SRCs that provide incorrect FRU information might appear.

If the system detects gaps in the logical sequence, the Card Gap Information display appears.

The Card Position column shows the card location that is empty. One or more card positions might be empty for a single card enclosure.

If no gaps are detected, the following message displays: No card position gaps were detected in the system

Display failed resources

Detect failed hardware.

From packaging displays

The *Failed resources* function key is available only on the Logical Hardware Resources displays.

From logical displays

The *Failed resources* function is available only under the *Logical hardware resources* option. This function key displays a list of all failed logical hardware resources. A failed resource indicates that one of the following occurred:

- There is a problem in the signal path between the system and the device.
- There is a resource failure.

You can also select the *Failed and non-reporting resources* option on the Hardware Service Manager display to show failed resources (see “Failed and non-reporting resources” on page 44).

If the system contains no failed resources, the following message displays:
No failed logical hardware resources were found.

Display hardware contained within package

This option is available only on the Packaging Hardware Resources displays.

From packaging displays

The *Hardware contained within package* option is available only on the Packaging Hardware Resources displays. Use this option to view the next level of hardware for the packaging hardware resources. This option functions only when a plus sign (+) appears after the description. For more information on symbols, see “Symbols on the hardware service manager displays” on page 69.

From logical displays

The *Display hardware contained within package* option is available only on the Packaging Hardware Resources displays. To access this option from the logical displays, you must select the *Associated packaging resource(s)* option (see “Display associated resources” on page 53).

If the resource is at the lowest level of packaging (contains no other packages), the following message displays:
The selected resource cannot be expanded.

Display location

This option is available packaging and logical displays.

From packaging displays

Each packaging hardware resource has associated location information. To display specific locations, select the *Display detail* option.

From logical displays

Location information that appears on the logical displays shows the logical address. Physical location information is available only on the Packaging Hardware Resources displays. To access physical location information from the logical displays, you must select the *Associated packaging resource(s)* option (see “Display associated resources” on page 53).

Display non-reporting resources

Non-reporting resources for packaging and logical displays.

From packaging displays

The *Non-reporting resources* function key appears on the Packaging Hardware Resources display (see “Packaging hardware resources” on page 42). Use the *Non-reporting resources* function key to view a list of the hardware that was detected in the past but is not being detected by the system now. A non-reporting resource indicates that one of the following has occurred:

- The resource might have been removed from the system. (For more information on removing the resource, see “Remove non-reporting resource information” on page 63.)
- The resource might be powered off.
- There is a problem in the signal path between the system and the device.
- There is a resource failure.

You can also select the *Failed and non-reporting resources* option on the Hardware Service Manager display to view non-reporting resources (see “Failed and non-reporting resources” on page 44).

From logical displays

The *Non-reporting resources* function key appears on various Logical Hardware Resource displays. Use the *Non-reporting resources* function key to view a list of the logical resources that were detected in the past but are not being detected by the system now. A non-reporting resource indicates that one of the following occurred:

- The resource might have been removed from the system.
- The resource might be powered off.
- There is a problem in the signal path between the system and the device.
- There is a resource failure.

You can also select the *Failed and non-reporting resources* option on the Hardware Service Manager display to show non-reporting resources (see “Failed and non-reporting resources” on page 44).

If no non-reporting resources are detected, one of the following messages is displayed:

- No non-reporting logical hardware resources were found.
- No non-reporting packaging hardware resources were found.

Display resources associated with IOP

This option displays the selected IOP and lists all devices that are logically attached to it.

From packaging displays

The **Resources associated with IOP** option is available only on the Logical Hardware Resources on System Bus display. For details, see “Display system bus resources” on page 61. To access resources associated with the I/O processor, you must select the **Logical hardware resources** option on the main Hardware Service Manager display, and then select the **System bus resources** option.

From logical displays

The **Resources associated with IOP** option is available only on the Logical Hardware Resources on System Bus display. For details, see “Display system bus resources” on page 61. This option displays the selected IOP and lists all devices that are (logically) attached to it. If more than one IOP is selected, the list contains all the IOPs and their logically attached resources.

Display resource details

View additional information about a specific resource.

From packaging displays

You can select the **Display detail** option from various packaging resource displays. You can use **Display detail** to view additional information about a specific resource. Use this option to display the location information on a specified resource. The information that is displayed varies depending on the type of resource that is chosen.

The following fields appear on the detail display:

Resource name

This is the resource name that was either created by the system when the hardware was first detected, or was changed to a new value by the user. The packaging hardware resource name is different from the logical hardware resource name.

Description

This field describes the resource as reported by the system or entered manually by the user.

Type-model

This field shows the Type and model of the resource as reported by the system or entered manually by the user.

Actual type-model

This field displays the resource type and model that is shown on the hardware (physically). Entered manually by the user, this value is used to identify a hardware resource that emulates an IBM device.

Serial number

This field shows the serial number of the resource as reported by the system or entered manually by the user. Only serial numbers that were initially detected as zeros can be changed by the user.

Part number

This field shows the part number of the resource as reported by the system or entered manually by the user. Only part numbers that were initially detected as zeros can be changed by the user.

Miscellaneous text

This field displays any information that might be useful. The information is entered manually by the user. It is used only for the reserve frame space function.

Location text

This field shows the text location information that was entered manually by the user. All packages, except standalone units, display the location of the frame which contains them. The stand-alone units display the text information for themselves.

Unit ID

This field displays the value of the unit enclosure identifier in uppercase alphabetic characters and digits, usually composed of the machine type, model, and serial number of the unit.

Planar ID

This field shows the decimal value of the planar identifier within the unit.

Virtual planar ID

This shows the decimal value of the position of the virtual planar resource within the hardware package.

Card This field shows the decimal value of the position of the card within the hardware package. This can be followed by additional card location labels which identify the decimal value of additional card positions of the resource on the card.

Port This field shows the decimal value of the port location within the resource. This can be followed by additional port location labels which identify the decimal value of additional port positions of the resource on the hardware package.

Device

This field shows the decimal value of the position of the device within the hardware package. This can be followed by additional device location labels which identify the decimal value of additional device positions of the resource on the hardware package.

Electrical

This field shows the decimal value of the position of the electrical resource within the hardware package. This can be followed by additional electrical location labels which identify the decimal value of additional electrical positions of the resource on the hardware package.

Air handler

This field shows the decimal value of the position of the air handler resource within the hardware package. This can be followed by additional air handler location labels which identify the decimal value of additional air handler positions of the resource on the hardware package.

Logical path

This field shows the decimal value of the logical path of the resource within the hardware package. This can be followed by additional logical path location labels which identify the decimal value of additional logical path data of the resource on the hardware package.

Worldwide port name

This field shows the hexadecimal value of the worldwide port name of the resource within the hardware package.

Manufacturing ID

This field shows the identifier from the manufacturer. The ID of the packaging hardware resource is reported by the system or entered manually by the user.

Actual manufacturing ID

This field shows the actual manufacturing ID of the packaging hardware resource. Entered manually by the user, it is used to identify a hardware resource that emulates an IBM device.

Alternate remote telephone

This shows the telephone number of the alternate remote service machine. This field is for informational use only. It is not used by the system.

Alternate service node

This is the network node address of the alternate service provider. This field is for informational use only. It is not used by the system.

Alternate service telephone

This shows the telephone number of the alternate service provider. This field is for informational use only. It is not used by the system.

Service provider

This field defines the service provider for this resource. If IBM is not the service provider, this field should contain the service provider's name. This field is for informational use only. It is not used by the system.

Manufactured by IBM

This field contains a 1 if the resource was manufactured by IBM or a 2 if it was not.

Shared by multiple systems

This field contains a 1 if the resource is shared between multiple systems or a 2 if it is not.

From logical displays

You can select the *Display detail* option from various logical resource displays. Use Display detail to view additional information about a specific resource.

The Communication Hardware Resource Detail display shows detail for a communications port logical hardware resource.

Note: The information that is displayed varies depending on the type of resource that is chosen.

The following fields might appear on the detail display. For details about these fields, see “Display resource details” on page 56.

- Description
- Type-model
- Status

Note: For details about the Status value, see “Display resource status” on page 60.

- Serial number
- Part number
- Resource name (logical)

The information in the fields below varies depending on the type of resource that is chosen.

- SPD or PCI bus
 - System bus
 - System board
 - System card
- Communications
 - I/O bus
 - Adapter
 - Port
 - Channel

Display resources requiring attention

This function scans the system for packaging resources that need more information in order to be correctly displayed on the packaging displays.

From Hardware Service Manager display

The **Display resources requiring attention** function key appears on the Hardware Service Manager display. Most hardware resources automatically report information to the system, but some resources might require user input. This function scans the system for packaging resources that need more information in order to be correctly displayed on the packaging displays. User input might be required for the following:

- EIA location information is missing.
- Frame ID information is missing.
- The resource cannot determine if it is mounted in a frame (rack-mounted) or if it is a stand-alone unit.

If no resources currently require attention, the following message displays:

No hardware resources currently require attention.

If there are resources that need attention, the Hardware Resources That Require Attention display appears.

To update or change the resource information from the Hardware Resources That Require Attention display, select the **Change detail** option. For details, see “Change resource details” on page 49. Asterisks (*) might appear on both sides of a value that appears on the Change Packaging Hardware Resource Detail display. This shows the value that is causing the resource to need attention.

Note: If no action is taken, the following information applies:

- The resource does not appear on the packaging resource displays or printouts. On some resources displays you can press the *Unresolved locations* function key to view the unresolved locations information.
- The system operates normally. The information requested for these resources is for display purposes only.

To display detailed messages that indicate why this resource might need attention, select the **Display message(s)** option on the Hardware Resources That Require Attention display.

To update or change the resource information from the Hardware Resources That Require Attention Messages display, press Enter. For details, see “Change resource details” on page 49.

Display resource status

Describes resource status from packaging and logical displays.

From packaging displays

Resource status information is available only on the Logical Hardware Resources displays. To access status information from the Packaging displays, select the **Associated logical resource(s)** option. For details, see “Display associated resources” on page 53.

From logical displays

The status of each logical hardware resource is shown next to the description, type, and model information on various Logical Hardware Resources displays. You can also select the **Display detail** option to view the resource status. For details, see “Display resource details” on page 56. This indicates the current status of the resource as reported by the hardware.

Status values:

Unknown

Cannot determine status. The resource may be non-reporting or unable to communicate status.

Operational

Resource is functioning normally.

Failed Resource has failed and is not functional.

Errors Card or device has detected errors but may still be functional.

Not Connected

Functional connection to the card or device has been closed or has failed. For bus resources, this condition indicates that wrap plugs are installed.

Degraded

Optical bus conditions indicating that the redundant path is being used.

Powered Off

Resource has been powered off or no power is being supplied to the unit.

Disabled

Resource has been reset or suspended. This is an I/O processor status to indicate that the IOP is disabled except for bus level service or maintenance (I/O debug functions). To recover from disabled status, perform another IPL on the IOP. For details, see “Debug the resource” on page 51 or “How to reset an I/O processor while the system is running” on page 181.

Software Error

System Licensed Internal Code associated with this hardware resource has incurred a program exception.

Display serial/part numbers, logical address, and status/resource name information

Display serial and part number information on various packaging and logical hardware resources.

From packaging displays

You can display serial and part number information on various Packaging Hardware Resources displays by selecting the *Display detail* option (see “Display resource details” on page 56). To access address and status information from the Packaging Hardware Resources displays, select the *Associated logical resource(s)* option (see “Display associated resources” on page 53).

The *Display serial/part numbers*, *Display logical address*, and *Display status/resource name* function keys are available only on the Logical Hardware Resources displays.

From logical displays

The *Display serial/part numbers*, *Display logical address*, and *Display status/resource name* function key is available only on the *Logical Hardware Resources on System Bus* and *Logical Hardware Resources Associated with IOP* displays. This function key toggles the display to show serial and part number information, logical address information, or the default status and resource name.

For more information on status, see “Display resource status” on page 60.

Display system bus resources

This option is available only on the Logical Hardware Resources display.

From the Logical Hardware Resources display

The **System bus resources** option is available only on the Logical Hardware Resources display. For details, see “Logical hardware resources” on page 43. From the Logical Hardware Resources on System Bus display, you can perform the following:

- Perform the following I/O debug functions:
 - Read/write I/O processor data. For details, see “Debug the resource” on page 51.
 - Dump I/O processor data. For details, see “Performing an IOP dump” on page 173.
 - Reset I/O processor. For details, see “Debug the resource” on page 51.
 - IPL I/O processor. For details, see “Debug the resource” on page 51.
 - Enable I/O processor IPL. For details, see “Debug the resource” on page 51.
 - Disable I/O processor IPL. For details, see “Debug the resource” on page 51.
 - Enable I/O processor reset. For details, see “Debug the resource” on page 51.
 - Disable I/O processor reset. For details, see “Debug the resource” on page 51.
 - Enable bus trace. For details, see “Debug the resource” on page 51.
 - Take/Release ownership. For details, see “Debug the resource” on page 51.

Note: Not all functions are available on all models.

- Display failed and non-reporting logical hardware. For details, see “Display failed resources” on page 54 and “Display non-reporting resources” on page 55.
- Remove non-reporting logical hardware. For details, see “Remove non-reporting resource information” on page 63.
- Display serial number and part number. For details, see “Display serial/part numbers, logical address, and status/resource name information.”
- Display resource status. For details, see “Display resource status” on page 60.

- Display resource name. For details, see “Display serial/part numbers, logical address, and status/resource name information” on page 61.
- Display or change resource detail. For details, see “Display resource details” on page 56 and “Change resource details” on page 49.
- Display system information. For details, see “Display system information.”

The Logical Hardware Resources on System Bus display shows the logical hardware resources in levels, beginning with the system bus. For example, a system bus might have one or more IOPs attached, an IOP might have an associated controller, or a controller might have an associated device. All associated first level logical hardware resources are shown. Option nine allows you to see the resources that are associated with each I/O processor.

Logical hardware resources on system bus (frames with a PCI system bus)

For frames with a PCI system bus, the Logical Hardware Resources on System Bus display shows the logical hardware resources in levels, beginning with the HSL I/O bridge. As depicted in the following example, an HSL I/O bridge will have one or more bus expansion adapters. A bus expansion adapter will have one system bus. A system bus will have one or more multi-adapter bridges. A multi-adapter bridge might control one or more IOPs.

Display system information

This option is available from the Logical Hardware Resources displays.

The *Display system information* option is available from the Logical Hardware Resources displays. Use this option to view the system type and system serial number of the system that controls the SPCN (System Power Control Network) for the selected resource. You can also view the system type and system serial number of the system that is an alternate owner of the resource. If no system presently owns the selected resource, the current owner of the resource is indicated. The system that last had ownership of the resource is indicated as the owner.

Display unresolved locations

Covers packaging and logical displays.

From packaging displays

The *Unresolved locations* function key is available only on the Packaging Hardware Resources displays. This function key displays the packaging hardware resources for which the system cannot fully determine the location information. Select this function key to view the hardware resources that may require user intervention to display correctly on the Packaging Hardware Resources displays.

When you select the *Packaging hardware resources* option on the Hardware Service Manager display, the system scans the packaging resources. If location information is missing, the following message appears:
There are resources with unresolved locations. Press F13 to see list.

Select the *Unresolved locations* function key to view the Hardware with Unresolved Locations display.

To update or change the location information, select the *Change detail* option on the Hardware with Unresolved Locations display.

Note: If you take no action, the following applies:

- The resource does not appear on the packaging resource displays or print-outs. On some resource displays you can press the *Unresolved locations* function key to view the unresolved locations information.
- The system operates normally. The information that is requested for these resources is for display purposes only.

From logical displays

The *Unresolved locations* function key is available only on the Packaging Hardware Resources displays. To access unresolved location information from the logical displays, you must select the *Associated packaging resource(s)* option (see “Display associated resources” on page 53).

Print

Print from packaging and logical displays.

From packaging and logical displays

The *Print* function key produces a printout of the information displayed. You can select this option from various displays.

Select the *Print* (F6) function key from the *Hardware Service Manager* display to print the system configuration list. The system configuration list includes system information and the packaging and logical information. For more information on printing the system configuration list, see Printing the system configuration list.

Refresh the display

Refresh packaging and logical displays.

From packaging and logical displays

Select the *Refresh* function key to access the data again. Use the *Refresh* function key when a change was made from this display. For example, select this function key if power is restored to a non-reporting resource.

Remove non-reporting resource information

The *Remove* option is available on both the packaging and logical hardware resources displays.

From packaging and logical displays

This option allows you to remove non-reporting resources (hardware that has not reported to the system) and user-created frame information. Non-reporting resources are identified with a question mark (?) next to the description field (see “Symbols on the hardware service manager displays” on page 69). For more information on non-reporting resources, see “Display non-reporting resources” on page 55. Selecting this option removes this hardware resource and the associated logical or packaging resources information. Use this option after performing a hardware upgrade when hardware resources were removed.

Reserve frame space

The Reserve frame space function key appears only on the Packaging Hardware Resources display.

From packaging displays

The *Reserve frame space* function key appears only on the Packaging Hardware Resources display. Select the *Reserve frame space* function key to access the Reserve Frame Space display. The Reserve Frame Space display allows you to enter details for a section of a frame (type 9309 or 5044) that you want to reserve for future use. You can also use the *Reserve frame space* function key to keep an inventory of hardware that does not appear on the packaging hardware resources displays.

After you type the requested information, press Enter. The data is verified and used to create a new packaging resource with the new description.

If no errors are found, the new data is created, and the original Packaging Hardware Resources display appears. If you enter a Frame ID that does not currently exist, the following message appears:

Containing hardware resource does not exist. Press F10 to create.

For information on creating frame information, see “Create frame information” on page 50.

From logical displays

The *Reserve frame space* function key appears only on the Packaging Hardware Resources display.

Using high-speed link specific options

This topic provides information about using high-speed link (HSL) options.

Note: The term *high speed link (HSL)* is interchangeable with the term *remote I/O (RIO)*.

You can access options for HSL resources from the *High Speed Link resources* option on the Logical Hardware Resources display.

The Work With High Speed Link (HSL) Resources display appears when you select the **High Speed Link resources** option on the Logical Hardware Resources display.

The Work With High Speed Link (HSL) Resources display allows you to display information and perform functions that are specific to HSL.

The options below are unique for HSL:

Display detail

Select this option to display the details of the logical hardware resource. The information is device-dependent, meaning it might be different depending on the hardware resource selected.

Display port information

Select this option to display the physical cabling between resources within a given HSL loop.

Resources associated with loop

Select this option to display the selected loop and a list of all resources logically attached to it. If more than one loop is selected with this option, the list will contain all of these loops and their logically attached resources.

Display detail:

You can display detail on HSL loop resources in several ways.

Display details about an HSL loop resource

Select **Display details** on an HSL loop resource. The Display High-Speed Link (HSL) Information display will appear. This display shows the detail for an HSL loop. It also allows you to display each resource in the HSL loop. This screen is also displayed when F7 is selected and the previous resource is the beginning of the loop and when F8 is selected and the next resource is the beginning of the loop.

Display details about an HSL I/O bridge

Select **Display details** on an HSL I/O bridge resource. The Display High Speed Link (HSL) Information display will appear. This display shows the details of an HSL I/O bridge resource. This screen is also displayed when F7 is selected and the previous resource is an HSL I/O bridge or when F8 is selected and the next resource is an HSL I/O bridge.

Display details about a remote HSL NIC resource

Select **Display detail** on a remote HSL NIC resource. The Display High Speed Link (HSL) Information display will appear. This screen is also displayed when F7 is selected and the previous resource is a

remote HSL NIC or when F8 is selected and the next resource is a remote HSL NIC.

The following fields appear on the Display HSL Information displays:

HSL loop number

The HSL loop number is the numeric value of the HSL loop to which the resource belongs.

HSL resource information

The next several fields display detailed information about the resource:

Type-model

This field contains the type and model numbers as reported by the hardware.

Status This field indicates the current status of the logical resources as reported by the hardware. The list below states the possible values for this field:

Unknown

The system cannot determine status. The resource may be non-reporting or unable to communicate status.

Operational

The resource is functioning normally. For HSL loops, this also means that all links are connected and all resources are operational.

Not operational

This system does not own or control this resource.

Failed The resource has failed or been powered off for concurrent maintenance.

Serial number

This field represents the serial number of the logical hardware resource.

Part number

This field represents the part number of the logical hardware resource.

Resource name

The resource name is the symbolic name of the logical hardware resource. The resource name was either created by the system when the hardware was first sensed, or was updated to a new value by a user on a change screen. The logical hardware resource name is autonomous from the packaging hardware resource name.

HSL OptiConnect status

This field represents the status for networking. To be network capable a loop must contain at least two systems. It may also contain expansion units. There are five possible values for this field:

Not Available

The loop contains hardware which is not network capable.

Enabled

This logical partition is participating in the HSL OptiConnect system area network on this loop.

Enabling

The user selected option 1 on this resource and the system is performing the function.

Disabled

This logical partition is not participating in the HSL OptiConnect system area network on this loop.

Disabling

The user selected option 3 on this resource and the system is performing the function.

Mode

The mode field indicates whether or not the ownership of this resource can be switched to another system. The possible values are *Private* or *Switchable*. *Private* indicates that the ownership of this resource cannot be changed. *Switchable* indicates that the ownership of this resource is changeable.

Leading port to next resource

The leading port connects to the next resource in the loop. This field shows the port number to which another resource in the loop is connected. However, the loop is redundant so indicating direction is arbitrary. This field will be blank if the link is an internal link.

Trailing port from previous resource

The trailing port connects to the previous resource in the loop. This field shows the port number to which another resource in the loop is connected. However, the loop is redundant so indicating direction is arbitrary. This field will be blank if the link is an internal link.

Link status

Link status is the current status of the link as reported by the hardware. Possible values for status are as follows:

Unknown

The system cannot determine status of the resource. A resource may be non-reporting or unable to communicate its status.

Operational

The link is operating normally.

Failed The link is broken, disconnected, or does not exist. This also may mean that the resource to which the link is connected may have failed or is powered off.

Link type

This field shows the type of link to which this port connects. Possible values are optical or copper.

Type

The port may be connected to another resource through two possible connections: internal or external.

Internal

The user cannot see an internal connection. It is internal to the resource. If the connection is internal, the port number field will be blank.

External

The user can see an external connection. The port number field will contain a value.

Link Speed

This is the present speed at which the link is operating.

Display system information:

Available for an HSL I/O bridge resource.

The Display HSL System Information screen is available for an HSL I/O bridge resource.

The fields and functions that might appear, include:

Local system type and serial number

Displays the system type and serial number for this system, the system on which hardware service manager is being run.

HSL loop number

The numeric value of the High Speed Link (HSL) loop to which the resource belongs.

Serial number

This field represents the serial number of the logical hardware resource.

Part number

This field represents the part number of the logical hardware resource.

Resource name

The resource name is the symbolic name of the logical hardware resource. The resource name was either created by the system when the hardware was first sensed, or was updated to a new value by a user on a change screen. The logical hardware resource name is autonomous from the packaging hardware resource name.

Mode The mode field indicates whether or not the ownership of this resource can be switched to another system. The possible values are *Private* or *Switchable*. *Private* indicates that the ownership of this resource cannot be changed. *Switchable* indicates that the ownership of this resource is changeable.

SPCN system information

Displays the system type and system serial number for the system providing the SPCN connection for this resource.

Alternate system information

Displays the system type and system serial number for a second system (other than the SPCN system) to which this resource may be connected.

A function key is provided to return to the display HSL Information screen.

Display port information:

This display shows the connection information for an HSL loop.

This display shows the connection information for an HSL loop. For each link, the display shows information about the connection from the previous resource in the loop as well as information about the connection to the next resource in the loop.

The fields for this display are as follows:

HSL loop number

Not all functions are available on all models value of the High Speed Link (HSL) loop to which the resource belongs.

From and to information

For each link, the *From* field shows the connection from the previous resource in the loop. The *To* field shows the connection to the next resource in the loop.

Resource name

See Resource name.

Port

This field shows the port number to which another resource in the loop is connected. This field is blank if the link is an internal link.

Type

See Type.

Status

The current status of the link as reported by the hardware. Possible values for the status field are:

Unknown

Cannot determine status. A resource may be non-reporting or unable to communicate status.

Operational

The link is operating normally.

Failed The link is broken, disconnected, or does not exist. This also may mean that the resource to which the link is connected may have failed.

Resources associated with loop:

When the **Resources associated with loop** option is selected on loops 256 or 257 from the Work With High Speed Link (HSL) Resources display, the Logical Hardware Associated With HSL Loops display appears.

Use the Logical Hardware Associated With HSL Loops display to work with the High Speed Link (HSL) resources associated with an HSL loop.

For a description of the options on this display, see “Using high-speed link specific options” on page 64.

To view expansion unit information, select F11 **Display tower information** from the Logical Hardware Associated With HSL Loops display. The Logical Hardware Associated With HSL Loops display appears.

The Logical hardware associated with HSL loops display works with the HSL I/O bridge and remote HSL Network Interface Controller (HSL NIC) resources associated with a High Speed Link (HSL) Loop. For a description of the options on this display, see “Using high-speed link specific options” on page 64.

Verify resources

Verify resources from packaging and logical displays.

From packaging displays

The *Verify* option is available only on the Logical Hardware Resources displays. To access status information from the Packaging displays, you must select the *Associated logical resource(s)* option (see “Display associated resources” on page 53).

From logical displays

The *Verify* option is available on various Logical Hardware Resources displays. It is used on device-level resources (see “Display resources associated with IOP” on page 56).

Note: The *Verify* option is not available on the Logical Hardware Resources on System Bus display.

This option allows you to select hardware diagnostic tests that are defined for the selected logical hardware resource. The tests are limited to most communication ports, cartridge tape units, optical storage units, and File Server adapters. For information on how to run a verification procedure, see “Verification procedures” on page 71.

Symbols on the hardware service manager displays

Describes symbol fields.

The symbol field is next to the description field on several displays. The following list describes these indicators:

Symbol

Description

- + This symbol appears only under the *Packaging hardware resources* option. It indicates that the packaging hardware resource contains other resources that are not shown. Select the *Hardware contained within package* option to view details.
- ? Indicates a non-reporting resource that the system detected previously, but does not detect now. These resources also appear on the non-reporting packaging and logical hardware resources list. Select the *Non-reporting resource* function key to view details.
- * Indicates that this resource is the load source disk unit or the IOP to which the disk unit is attached.
- < Indicates that the resource is associated with the system console I/O processor.
- % Indicates that the resource is a potential unit that might be used for the alternate IPL. This unit might not have been used for the last IPL.
- = Indicates that the resource is the unit that is used for the alternate IPL. This unit was used for the last IPL.
- & Indicates that the resource is an original equipment manufacturer (OEM)-supplied resource.
- / Indicates that this resource is switchable.

These and other symbols may also appear on screens which are used for a specific function, for example for concurrent maintenance. See the Help text for these screens for a description of these symbols for these specific functions.

Printing the system configuration list and details of the system bus, main storage, or processor

This information describes the system configuration list and how to print the list.

The System Configuration List printout consists of the following sections (80-character width):

1. System information
 - System type, model, serial number, and release
2. Packaging hardware resource information
 - Resource name, type-model, serial number, part number, frame ID, card position, and device position

3. Logical hardware resource information
 - Resource name, type-model, serial number, and logical address
4. Legend
 - Descriptions of the indicators
 - Logical address format information

132-character width printouts consist of the following:

- Description
- Type-module
- Serial number
- Location data
 - Frame ID
 - Device position
 - Card position
- Logical resource name
- Part number
- Logical address

You can sort the printout by location or by logical address data.

Printing the system configuration list

To print the system configuration list, perform the following procedure:

1. On the Start a Service Tool display, select the Hardware service manager option.
2. Press F6 (Print) on the Hardware Service Manager display to request a printout. The Print Format Options display is shown. You can sort the information by location or logical address.

Note: The logical address sort and location sort are available only in 132-character width.

3. Look for the system configuration list printout.

Notes:

- a. If you press F6 (Print) from a display other than the Hardware Service Manager display, only the information that appears on the display will print.
- b. Use the last page of the printout (the legend) to assist in interpreting the information.
- c. The logical and packaging hardware resources have unique resource names.
- d. You can also view logical address information from the product activity log.

This ends the procedure.

To collect more details on the information that is listed on the system configuration list, press F6 (Print) from a display other than the Hardware Service Manager display.

Note: The entire system configuration list will not print. Only the information that appears on the display will print.

Printing the details of the system bus, main storage, or processor

For details (that include descriptions) of the system bus, main storage, or processor, perform the following procedure:

1. Select the Logical hardware resources option on the Hardware Service Manager display.
2. On the Logical Hardware Resources display, select one of the following options to display details:
 - System bus resources
 - Processor resources
 - Main storage resources

- High-speed link resources
3. Press F6 (Print) to print the information.
This ends the procedure.

Verification procedures

You can check communications and various hardware units and devices for correct operation by performing verification procedures.

Verification support for hardware is available under the hardware service manager Verify option, which can be run from either DST or SST. For details, see “Hardware service manager Verify option.”

Hardware service manager Verify option

Use the hardware service manager to verify communications or devices.

To verify communications or devices on any System i model using the hardware service manager *Verify* option, perform the following procedure:

Note: Before running a verification test, ensure that the customer is not using the resource you want to test and that all communication jobs on the resource to be tested are ended.

1. From the Start a Service Tool display, select the *Hardware Service Manager* option.
2. From the Hardware Service Manager display, select the *Logical hardware resources* option.
3. From the Logical Hardware Resources display, select the *System bus resources* option.
This display lists all the I/O processors.
4. Select the *Resources associated with IOP* option for the attached IOP in the list.
5. Select the *Verify* option for the communications, tape, optical storage unit, or File Server adapter that you want to test.
6. When the test completes, the system responds with either a Test is successful message or a Test failed message.

This ends the procedure.

Notes:

1. Hardware units might perform automatic self-tests when they are powered on.
2. You can test some workstations by using the *Test Request* function key while the operating system Sign On display is shown.
3. See the specific device information for possible off-line tests that you can run.

Verifying optical storage unit

This topic provides optical storage unit verify information.

You can check optical storage units for correct operation by performing the verification procedure. For details about performing the *Verify* option, see “Hardware service manager Verify option.”

Optical storage unit test descriptions

When you select the *Verify* option on an optical resource that supports a verification function, the test performs the following:

- Writes to the test media if writeable (and supported).
- Reads the test media
- Verifies that the interface between the system and the optical storage unit is valid

Verifying tape

You can check tape subsystems for correct operation by performing the verification procedure.

Tape test descriptions

When you select the *Verify* option on a tape resource that supports a verification function (for example, type 6380), the test performs the following:

- Runs a read, write, or erase function on the tape.
- Tests the interface between the system and the tape unit.
- Runs simple operations to verify that the tape unit is operating correctly.

If the test fails, the system will display a message that describes the failure. An entry might also be created in the product activity log. Use the message or the information in the product activity log to assist in problem analysis (see “Product activity log”).

For more information, see “Verification procedures” on page 71.

Verifying communications

You can check communications for correct operation by performing the verification procedure.

Communications test descriptions

When you select the hardware service manager *Verify* option (see “Hardware service manager Verify option” on page 71 for details) or run VFYCMN (see “Verify communications” on page 193) on communications, you can test the correct operation of the following hardware:

- Communications I/O adapter card
- Communications cable
- Local or remote modem
- External token ring

You can get additional problem analysis information by running more than one test.

Product activity log

The product activity log (PAL) allows you to display or print system data, Licensed Internal Code data, software components, subsystem information, and I/O device data that has been logged.

You can select the **Product activity log** option from the Start a Service Tool display.

It allows you to display or print system, Licensed Internal Code, software components, subsystem, and I/O device data that has been logged. It also provides data summaries, allows data to be sorted, displays reference code descriptions, and allows you to work with removable media statistics.

Use the options and function keys to view the log online. Function keys, such as the **Alternate view** key, allow you to page through the various log fields.

The PAL is the general use system log containing entries for informational events, thresholding incidents, dumps, and errors that need to trigger service actions. The entries are full of basic and detailed information on the event in a somewhat raw form.

This option is selected from the Start a Service Tool menu. It allows you to display or print data that has been logged for various components of the system. It also provides data summaries, allows data to be sorted, and allows you to work with removable media statistics and display reference code descriptions. It was formerly called the Error Log Utility.

Use the *Product activity log* option to:

- Analyze the log data of a specific subsystem. Some subsystem selections are:
 - All logs
 - Processor
 - Magnetic media
 - Local workstation
 - Communications (SDLC, BSC, X.25, token ring, remote workstation, IDLC, if supported by the system).
 - Power
 - Licensed program
 - Licensed Internal Code
- Analyze all log data associated with the same log ID. The user must know the log ID to use this function.
- Display summary information.
- Display information about a specific entry or a group of entries.
- Change product activity log sizes.
- Display information about volume statistics for removable media.
- Review session or lifetime counters for a specific volume or removable media type.
- Delete or print volume statistics lifetime counters.
- Display reference code descriptions

You can send output to a:

- Printer (if available)
- Console display

In the limited paging environment, you cannot change PAL area sizes, work with tape statistics, or examine session or lifetime counters for a specific volume or removable media type.

Service action log

The service action log (SAL) is a subset of the product activity log.

To access the SAL, select the following options, in order, from a DST or SST menu:

- Start a service tool
- Hardware service manager
- Work with service action log

The SAL is a utility that scans the PAL and displays entries that require service representative action. It pulls out the relevant information from those entries and formats it to the display to show service information, such as failing resource names, field replaceable unit (FRU) part numbers, and FRU locations. If FRU part numbers and locations cannot be determined, the SAL display shows symbolic FRU names and isolation procedure names, which then correspond to problem analysis procedures for the service representative. The SAL runs before the operating system is operational.

A **shadow** log is maintained by Licensed Internal Code on the load source disk. The 128 K-byte shadow log contains a duplicate of the most recent or latest product activity log entries that occurred before IPL began and those entries that were logged since the beginning of IPL. The *Product activity log* option uses the shadow log when the system is operating in limited paging environment.

If product activity log initialization is not complete, only the shadow log is accessible to this option. Also, the *Product activity log* menu offers only a few specific product activity log options. The Main menu

informs the user that log initialization has not completed, that all product activity log entries are not accessible, and to IPL the operating system to complete initialization. If initialization completes after the *Product activity log* option has been selected, the option must be selected again to make all product activity log options available for use and to generate reports that show all the log entries.

Product activity log location

The log files can be stored on any disk unit, so the system must IPL past storage management recovery to view the data.

The product activity log is maintained by the Licensed Internal Code EREP component. The log files can be stored on any disk unit, so the system must IPL past storage management recovery to view the data.

Recovering from product activity log errors while in DST

In the limited paging environment, you are limited to messages sent to the display or the SRC on the control panel.

DST uses the Licensed Internal Code; however, there is limited operating system support in the DST. Because there is limited operating system support, there is limited product activity log entry handling support. Most product activity log entries in DST are unrecoverable to the function running, however, DST should continue to function. Licensed Internal Code log entries are created only if the system is in the full paging environment. In the limited paging environment, you are limited to messages sent to the display or the SRC on the control panel. If a product activity log entry occurs while dumping information to removable media, go to “Working with removable media lifetime statistics” on page 75.

Paging environment

The product activity log is maintained by the system Licensed Internal Code.

The storage management recovery step of the IPL process must be complete to allow you to view all the data in the log. If the error log initialization (ELI) IPL step is not complete, only the shadow log is accessible. The *Product Activity Log* display under the shadow log contains a subset of the options that are allowed when the operating system is available. A message on the *Product Activity Log* display informs the user that the error log is not initialized and that all log records are not accessible. The log files can be stored on any disk unit.

The Licensed Internal Code maintains a 128 KB shadow log on the load-source disk. The log contains a duplicate copy of the latest entries. When you perform an IPL to dedicated service tools (DST), the *Product activity log* option uses this shadow log.

Note: The shadow log is not available in the stand-alone environment (Type-D IPL). In the limited paging environment, some options are not available. For more information on paging environments, see “System paging environments” on page 1.

Options for the product activity log

Options within the product activity log include working with logs, working with removable media, and learning more about reference code descriptions.

Analyze log

Use the analyze log option to display or print log entries in a summarized form. The summary report contains a one-line entry for each requested group or subgroup of log entries and displays a count of the log entries.

Select **Analyze log** on the Product Activity Log display. The following options are available:

- Display or print a list of entries for one or all subsystems in a one-line-per-entry format.
- Analyze entries that have specific reference codes, or sort by reference codes.

- Analyze entries for specific devices, for groups of devices at the same logical address, or for groups of devices of the same type.
- Display or print the detailed reports, including the hexadecimal data, for individual entries. You can display or print the formatted report. For large reports, the print option is recommended.
- Summarize entries by using the following parameters:
 - Time and date
 - Device type
 - Resource name
 - Reference code
 - Subsystem
- Sort entries by using the following parameters:
 - Time and date
 - Time of day
 - Logical address

Note: For details, see Logical address format.

- Class
- Resource name

Note: To gather information by using the resource name, select the *Display summary* option. Then select the F9 key (Sort by...) and sort by resource name. The *Log Summary by Resource Name* display appears and shows a summary of the resources and the number of entries.

You can use an asterisk (*) to request log entries for the device and reference code selections on the Select Analysis Report Options displays. The asterisk symbol must be the rightmost character of the specified string. The string, including the asterisk symbol, cannot exceed the total number of characters that are allowed in that string. For example, a request of A00* displays all the log entries that begin with A00.

You can sort each analysis report by date, time, logical address, entry classification, or resource name. The selected sort option determines how the log entries are grouped in the summary report. For more information on the sort function, see “Sort-by function” on page 76.

Display or print by log ID

Select this option from the *Product Activity Log* display.

The system logs related events that have the same log ID, permitting you to analyze all data that is associated with that same log ID.

Note: Events that are related use the same log ID. For example, if a workstation controller has an error that causes an automatic dump, both the permanent error and the IOP dump have the same log ID.

Changing product activity log sizes

Select this option from the **Product activity log** display. Use the Product activity log to change log area sizes.

Note: To change the size of all the logs at one time, select the *Change all* function.

Working with removable media lifetime statistics

Select this option from the **Product Activity Log** display.

This option allows you to perform the following:

- Work with the removable media lifetime statistics

- Display volume statistics information
- Review lifetime counters for a specific volume
- Delete volume statistics lifetime counters
- Sort lifetime statistics by error rates or volume IDs

You can send the output of this option to a printer (if available) or to the console.

Select the **Work with removable media lifetime statistics** option to display a lifetime entry report. This report contains information about various volume IDs. The customer might want to exchange media that has a high number of read or write errors. To ensure accurate statistics, each media must have a unique volume ID.

If the following symbols appear before the volume ID on the Work with Lifetime Statistics display, perform the suggested action:

Symbol	Explanation	Action
>>	Media replacement recommended	Copy the contents to the new media and discard the old media.
>	Media approaching replacement criteria	<ul style="list-style-type: none"> • Replace the media if the format is: <ul style="list-style-type: none"> – QIC-120 – 7208 2.3GB – 6250 bpi density • If the format is anything other than above, monitor the media.

Displaying or printing removable media session statistics

Use the Product activity log to display or print session statistics for a tape unit.

Select this option from the **Product activity log** display. Use the Product activity log to:

- Display or print session statistics for a tape unit
- Select a specific media type
- Select a time range
- Select a volume ID
- Review session counters for a specific volume or removable media

You can send the output of this option to a printer (if available) or to a workstation.

Reference code description

This option allows you to view a description of the code that appears in the reference code field.

Select this option from the *Product Activity Log* display. This option allows you to view a description of the code that appears in the reference code field.

Function keys for the product activity log

Function keys allow you to gather more information about a product activity log entry. The function keys that appear at the bottom of the screen vary for each display.

Sort-by function

The sort option is used for problem analysis and preventive maintenance.

Each analysis report can be sorted by date, time, logical address, entry classification, or resource name. The selected sort option determines the order of the log entries and the type of summary report that is displayed or printed.

The sort option is used for problem analysis and preventive maintenance.

Address information function

Select **Address Information** to display configuration information about a resource. You can use the details that are shown to determine the location of the card.

For details about the logical address format as it appears on the printout, see Logical address format.

You can also display logical address information from the hardware service manager function. For details, see "Hardware service manager" on page 41.

Note: The logical address field that appears on the Display Address Information for Resource display does *not* list the address in the BBCb format.

View description function

Press the F11 function key to step through screens to view information.

Press the F11 function key to step through screens to view the following information:

- Class (entry classification)
- Library
- Logical address
- Physical location
- Component information
- Reference code description
- Resource name/type

Hexadecimal product activity log data

Use the display hexadecimal report function or follow the steps in this procedure to display hexadecimal error log dump data.

To display hexadecimal error log dump data, complete these steps:

1. Find an entry in the product activity log for the system reference code (SRC) you are using to locate the problem.
 - a. Select System Service Tools (SST).
If you cannot get to SST, select DST.

Note: Do not use an IPL of the system to get to DST.

- b. On the Service Tools display, select the Start a service tool option.
- c. Select the Product activity log option on the Start a Service Tool display.
- d. Select the Analyze log option on the Product Activity Log display.
- e. On the Select Subsystem Data display, select the option to view All Logs.

Note: If the SRC you are using occurred more than 24 hours ago, change the From and To Dates and Times from the 24-hour default.

- f. Use the defaults on the Select Analysis Report Options display by pressing the Enter key.
 - g. Find the entry in the product activity log that matches that SRC.
2. Select the Display Detail Report for Resource display. (See the following figures.)

```

Display Detail Report for Resource

Name          Type      Model    Serial      Resource
STORAGE      6512     001      10-4294009  SI05

Log ID . . . . . : 06020132 Sequence . . . . . :      2248
Date . . . . . : 05/20/95 Time . . . . . : 08:37:55
Reference code . . . . . : 3400 Secondary code . . . . . : 00000000
Table ID . . . . . : 65120001 IPL source/state . . . . . : B/7

Class . . . . . : Permanent
System Ref Code . . . . . : 65123400
I/O processor card detected device error

Press Enter to continue.

F3=Exit          F6=Hexadecimal report
F9=Address Information  F10=Previous detail report  F12=Cancel

```

Figure 2. Example of hexadecimal detail report for resource

- Press F6 to display the hexadecimal report.
The direct select address (DSA) is in the format *BBBB-Cc-bb*:
 - BBBB* means hexadecimal offsets 4C and 4D.
 - Cc* means hexadecimal offset 51.
 - bb* means hexadecimal offset 4F.

```

Display Hexadecimal Report for Resource

Name          Type      Model    Serial      Resource
STORAGE      6512     001      10-4294009  SI05

Offset      0 1 2 3 4 5 6 7 8 9 A B C D E F  EBCDIC
000000      C5D3F0F4 00000160 00E00180 77B7695E  EL04...-.....;
000010      E8A70000 000008C8 20E00602 01320000  Y.....H.....
000020      34000000 11000000 00000000 009C0000  .....
000030      F6F5F1F2 F0F0F140 F1F060F4 F2F9F4F0  6512001 10-42940
000040      F0F9F6F5 F1F20000 00000001 00060000  096512.....
000050      00020000 FFFFFFFF FFFFFFFF FFFF0000  .....
000060      00000000 00000000 00000000 F4404040  .....4
000070      40000000 00000000 00000000 00000000  .....
000080      00000000 00000000 00000000 00000000  .....
000090      00000000 00000000 00000000 00000000  .....
0000A0      00000000 00000000 00000000 00000000  .....
0000B0      00000000 00000000 40404040 40404040  .....
More...
Press Enter to continue.

F3=Exit          F12=Cancel

```

Figure 3. Example of hexadecimal report for resource

- Are offsets 170 - 173 equal to 00000000?
 - Yes:** Continue with step 5.
 - No:** Continue with step 6 on page 79.
- Page forward until you locate the offset location X'000180'.
If the rightmost hexadecimal digit of offset 000182 is 8, then the unit address is hexadecimal offset 18C - 18F.

If the rightmost hexadecimal digit of offset 000182 is 2, then the unit address is hexadecimal offset 192 - 195

Record this address information. Return to the procedure that sent you here, if one.

```

Display Hexadecimal Report for Resource

Name          Type      Model   Serial      Resource
STORAGE      6512     001     10-4294009  SI05

Offset        0 1 2 3  4 5 6 7  8 9 A B  C D E F  EBCDIC
000180      D0007800 65120001 34000620 1100FFFF }.....
000190      FFFFFFFF 31090000 00001100 03C00000 .....{..
0001A0      00000000 00000000 00000000 00000000 .....
0001B0      00000000 00000000 00000000 00000000 .....
0001C0      00000000 00000000 00000000 00000000 .....
0001D0      00000000 00000000 00000000 00000000 .....
0001E0      00000018 00000002 E00401F0 10002000 .....0...
0001F0      00000000 40000000 00000000 000002CC .....
000200      CCC00000 00000000 00800000 00000000 .....
000210      08100000 00000000 F0200040 00800000 .....0..
000220      00000000 04000000 08000040 E000E221 ..... ..S.
000230      800084F3 00000002 0000001B 110003C0 ...3.....{
More...
Press Enter to continue.

F3=Exit      F12=Cancel

```

Figure 4. Example of hexadecimal report for resource offset location (where the rightmost hexadecimal digit of offset 000182 is 8)

```

Display Hexadecimal Report for Resource

Name          Type      Model   Serial      Resource
STORAGE      571A     001     10-4294009  DC01

Offset        0 1 2 3  4 5 6 7  8 9 A B  C D E F  EBCDIC
000180      F8407200 F5F7F1C1 F0F0F0F1 3400031D 8 ..571A0001....
000190      00233104 00FFFFFF F0F0F0F0 F0F0F0F0 .....40000000
0001A0      1104E255 F0F0F0F0 F0F0F0F0 40404040 ..S.00000000
0001B0      40404000 00FF0000 04440000 A1D0038D .....}..
0001C0      0713000C 00000000 00000000 70000200 .....
More...

Press Enter to continue.

F3=Exit      F12=Cancel

```

Figure 5. Example of hexadecimal report for resource offset location (where the rightmost hexadecimal digit of offset 000182 is 2)

6. Using hexadecimal arithmetic, add the value in offsets 170 - 173, the value in offsets 174 - 177, and 00000002. For example, 000001C8 + 00000410 + 00000002 = 000005DA.

If the value of the rightmost hexadecimal digit at this offset is 8: Using hexadecimal arithmetic, add 0000000A to the offset you calculated. This will be the location of the unit address in the form abcdefgh. For example, 00005DA + 0000000A = 00005EA.

If the value of the rightmost hexadecimal digit at this offset is 2: Using hexadecimal arithmetic, add 00000010 to the offset you calculated. This will be the location of the unit address in the form abcdefgh. For example, 00005DA + 00000010 = 00005EA.

Record this address information. If you were sent here from another procedure, return to the procedure that sent you here.

This ends the procedure.

Interpreting product activity log reports

This topic provides information about product activity log reports.

Keep the following in mind while viewing product activity log reports:

- The data in the product activity log wraps.
- The newest log entries overlay the older ones.
- There is not an option to delete or clear data, but you can reduce the log sizes so that they wrap more quickly.

Considerations when interpreting product activity log reports

If you update an operating system release or apply a new operating system version to the system, the product activity log data might be cleared. (If you need the data in the product activity log, print it before you install the new operating system.)

Entries in the log might have been previously resolved (for example, machine check entries).

For more information on resource names, see “Resource name.”

If the system cannot display a character in any of the following fields, it displays an asterisk (*) instead of that character:

- *Resource*
- *Type*
- *Model*
- *Serial number*
- *Volume ID*

You can use the **Log Analysis** report to analyze problems that occur over a period of time. Look for error patterns such as multiple I/O processor errors that occur at the same time, or errors caused by the environment that occur at the same time of the day or week. As you cycle through the different views of the Log Analysis Report screens, note that F11 shows variable text: Such as **View Description**, **View Logical Address**, **View Physical Location**, **View Component Information**, and **View Resource Identification**.

Resource name

You can change the assigned resource name.

The **Name** or **Resource name** field contains a description of the resource that is associated with the entry. Server hardware and server Licensed Internal Code will have the reserved name *PLATFORM.

The system assigns a resource name, but that name might be changed to a new value by the customer. Depending on the data, the following priority scheme is used for the name field:

1. Device name
2. Controller name
3. Line name
4. Network interface name
5. A name that is created based on the data in the entry

The following names are created:

Subsystem	Possible Names
Processor	System
Storage	Storage

Subsystem	Possible Names
Workstation	LWS
Communications	COMM
Power	Power
Software	PGM

To select the **Display report** option, type 5 in the Opt (option) field for a specific resource and press Enter. A detailed report for that resource appears. If more than one entry has the same log ID, they are presented in the order of occurrence.

For more information on resource names, see “Resource names” on page 141.

Resource type, model, and location

This topic provides entry information that can assist in problem analysis.

The *Type*, *Model*, and *Physical location* fields provide entry information that can assist in problem analysis. The *Physical location* field contains the location of the resource that is most closely related to the entry. You can also use the address information function (see “Address information function” on page 77) and the logical address (see Logical address format) to gather details about the resource type, model, and location. For more information on resources, see “Hardware service manager” on page 41.

Note: When the I/O processor is not known for I/O bus entries, press the **Address Information** function key from the *Display Detail Report for Resource* display to view the configuration information. Use the configuration information to determine the card position of the I/O processor.

Class

The *Class* field describes the event that logged the entry.

Some events are related to errors that were detected, and some events are activities that normally occur. The meaning of *Class* varies depending on the system, subsystem, or device against which the entry was logged. Perform a service action only when directed by a system operator message, the directed service procedures, or your next level of support.

The events that can appear in the *Class* field are:

Data protection lost

An error occurred in hardware that has data protection (mirroring). This function continues to operate, but service is required. A second failure in this area might result in the loss of the function and the data.

Description

Explains the reference code (appears only for IBM i).

Dump A storage dump was taken.

Hardware redundancy lost

An error occurred in redundant (back-up or duplicate) hardware. This function continues to operate, but service is required. A second failure in this hardware results in a loss of the function.

Informational

Indicates that an event of importance occurred that was not an error.

LIC An error occurred due to a Licensed Internal Code problem.

Machine check

Either an error occurred that caused the system not to operate, or an SRC was present on the control panel when the system was re-IPLed (from a function 03 or a programmed IPL). These

errors are logged during the next IPL if the system was not powered off. They are logged with the data that was displayed in control panel functions 11 through 19 at the time you performed another IPL on the system.

Predictive analysis

Indicates that a system component detected a condition that might cause a problem, if it is not corrected.

Permanent

An error that could not be recovered.

Qualified

An error occurred that is described (qualified) more in the *Description* field.

Recoverable

An error occurred, and the condition was recovered either automatically or through user intervention (printer out of forms, for example).

Remote

Indicates buffered errors from remote devices or input/output processors.

Software

An error occurred due to a software problem.

Statistic

Indicates that this entry contains statistical information (for example, the number of bytes that were read or written).

Temporary

A previously detected error condition was no longer present when the operation was tried again (a successful additional attempt occurred).

Threshold

Indicates that the system reached a service action point. The occurrence of temporary errors was more than the limit specified for that type of error condition.

Vary on

Indicates that a vary-on operation occurred.

System reference code field

The system reference code field consists of a 4 character hardware or software error group, followed by a 4 character unit reference code.

The system reference code identifies a unique logging condition.

Multiple SRC entries

System Licensed Internal Code entries might appear more than once for a single problem.

System Licensed Internal Code entries might appear more than once for a single problem. This occurs when the original system reference code is permanent or temporary and additional data is logged at the same time. The additional data can be informational, temporary, an IOP dump, or any other classification. Errors with the same Log ID are generally associated with the same problem. An exception to this would be when the Log ID counter reaches the maximum value and starts over, possibly resulting in a new error being assigned a Log ID that is also used by an existing older entry. Errors that have the same Log ID, but dates that are months or years apart, are indicative of this situation.

Logical address format

Use the logical address to identify the resource entry.

To sort by logical address, select the Analyze log option on the product activity log display. Then select the F9 key (Sort by) and sort by logical address. For more information about the address, use the address information function.

The logical address format, A/B/C/D-E/F/G/H/J/K, has the following definitions:

- A** Type of I/O bus (transport)
- B** System bus number
- C** System board number (for busses that connect card enclosures)
- D** System card (bus unit) number
- Separates the bus address from the unit address
- E** Unit address type
- FGHJK** Unit address data

The values of F, G, H, J, and K vary, depending on the unit address type (E). Use the following information to determine the unit address data (FGHJK) representation.

Table 5. Unit address (E) definitions

Unit address value	Unit address definition	Unit address data				
		F	G	H	J	K
0	Reserved					
1	Communications	I/O bus	Adapter	Port	Channel	
2	Storage	I/O adapter	I/O bus	Controller	Device	
3	Workstation	I/O bus	Adapter	Port	Device	Session
4	Auxiliary processor	I/O bus	Auxiliary processor	Adapter	Port	
5	Library	I/O adapter	I/O bus	Library	Controller	Device
6	Cryptography	I/O bus	Adapter	Device		

The Logical address field contains the bus address and the unit address. The bus address describes the hardware bus, board, and card information. The unit address describes the subsystem and identifying data (see Table 5).

Note: To locate a device or card that is within the system unit, use the physical address information.

Sequence number

The sequence number increases by two each time an entry is placed in the log.

The sequence number increases by two each time an entry is placed in the log.

Secondary code

The secondary code can be the I/O adapter return code that is used for communications protocol or Licensed Internal Code problems.

The secondary code is a 4-byte hexadecimal value that provides additional detailed entry information. The secondary code can be the I/O adapter return code that is used for communications protocol or Licensed Internal Code problems. The secondary code is used for problem analysis.

Table ID

The table ID identifies a group of reference codes for the system or device.

For details about SRCs, see the management console.

IPL source/state

The IPL source indicates the IPL mode (A, B, or D) that was selected at the time the entry was logged.

The state shows the system status at the time the entry was logged. The values of the *State* field include:

0	(Not used)
1	During IPL
2	During power down
3	System in full paging
4	During diagnostic tests
5	Occurred prior to IPL
6	During DST
7	System in limited paging
8	System in pre-limited (static) paging
9	System has not entered pre-limited paging

Hexadecimal report

Press **F6** (Display hexadecimal report) to view the hexadecimal dump information.

This function is optional for this report, but it might provide additional information.

Note: If a character in the *EBCDIC* field cannot be displayed, a period (.) displays instead of that character.

To interpret the information in the hexadecimal dump, read the *Description* column in Table 6 or Table 7 on page 85 until you find the item you want (for example, reference code). Read across to the leftmost column to find the hexadecimal offset.

Table 8 on page 86 is generally reserved for engineering use. However, to get additional information for IOP product activity log entries at DST when using a D-IPL (which begins at offset hex 000180), see Examples: Obtaining additional information from hexadecimal reports.

Table 6. Hexadecimal dump byte assignments for keyed data

Hexadecimal offset	Length in bytes	Description
0000	4	Internal release level
0004	4	Length of component specific data
0008	2	Non-keyed data start @
000A	2	Component specific start @
000C	8	Time stamp
0014	4	Sequence number
0018	1	Subsystem type
0019	1	Analysis done
001A	4	System log ID
001E	2	Reserved
0020	2	Reference code
0022	2	Reserved

Table 6. Hexadecimal dump byte assignments for keyed data (continued)

Hexadecimal offset	Length in bytes	Description
0024	1	Class
0025	1	Reserved
0026	8	SRID
002E	2	Reserved
0030	4	Device type
0034	4	Model number
0038	10	Serial number
0042	4	IOP type
0046	4	I/O adapter type
004A	10	I/O processor direct select address
	2	Transport type
	2	Bus
	2	Board
	2	Card
	2	Reserved
0054	12	Unit address
0060	4	Platform log ID
0064	6	Power address
006A	2	Reserved
006C	5	Card position
0071	5	Device position
0076	10	Reserved
0080	10	Network interface name
008A	10	Line name
0094	10	Controller description
009E	10	Device description
00A8	15	Reserved
00B7	1	Overlay flag
00B8	40	Volume ID/JOB information

Table 7. Hexadecimal dump byte assignments for non-keyed data

Hexadecimal offset	Length in bytes	Description
00E0	8	Reference code translate table (RCTT) name
00E8	2	Reserved
00EA	4	Product ID
00EE	4	Component ID
00F2	8	Version/Release/Modification
00FA	50	Resource paths
012C	10	Power controlling system (PCS) name
0136	10	Power controlling system (PCS) serial number
0140	10	Resource at log time
014A	4	Frame ID
014E	2	EIA location
0150	12	Part number
015C	1	Protocol
015D	1	Format of data
015E	1	Delayed reporting
015F	1	Signal event
0160	4	Secondary code
0164	2	Flags
0166	2	State at log time
0168	4	Power controlling system (PCS) type

Table 7. Hexadecimal dump byte assignments for non-keyed data (continued)

Hexadecimal offset	Length in bytes	Description
016C	4	Power controlling system (PCS) model
0170	4	Platform Event Log offset (zero if N/A)
0174	4	Platform Event Log length
0178	2	Component record format
017A	2	Statistics offset
017C	4	Component data length

Table 8. Hexadecimal dump byte assignments for variable component specific data

Hexadecimal Offset	Length in Bytes	Description
0180		This field is different for each log entry and is intended for engineering use only. However, see Examples: Obtaining additional information from hexadecimal reports for examples of how the hexadecimal information can be interpreted for a D-IPL.

Examples: Obtaining additional information from hexadecimal reports:

You can get additional information for IOP 90xx reference code product activity log entries at DST by using a type D IPL.

Notes:

- The term I/O processor indicates an IOP or an IOA.
- Formatting is available (F4=Additional Information) for IPL from disk (type A or B IPL). Formatting is not available in DST from a type D IPL.

Use the following information and the display examples to interpret the hexadecimal dump information that begins at offset hex 000180.

If the rightmost hexadecimal digit of the offset 000182 is 8, get the format from offset 00019F, and then use the following table to determine which figure to refer to.

Table 9. Format number to figure reference

Format number	Refer to the following figures
01	Figure 6 on page 88 Figure 7 on page 89 Figure 8 on page 89
02	Figure 9 on page 90 Figure 10 on page 91 Figure 11 on page 91
03	Figure 12 on page 92 Figure 13 on page 92 Figure 14 on page 92

Table 9. Format number to figure reference (continued)

Format number	Refer to the following figures
04	Figure 15 on page 93 Figure 16 on page 94 Figure 17 on page 94

If the rightmost hexadecimal digit of offset 000182 is 2, get the format number from offset 0001B5, and then use the following table to determine which table to refer to.

Table 10. Mapping of format number to table reference

Format number	Reference the following tables
01	Table 11 on page 94
02	Table 12 on page 95
03	Table 13 on page 96
04	Table 14 on page 97
11	Table 15 on page 97
12	Table 16 on page 98
13	Table 17 on page 98
14	Table 18 on page 99
17	Table 19 on page 101
20	Table 20 on page 102

Example: Device formatting log (unformatted information)

Display Hexadecimal Report for Resource							
Name	Type	Model	Serial Number				Resource Name
STORAGE	6607	070	00-68753				
Offset	0 1 2 3	4 5 6 7	8 9 A B	C D E F	EBCDIC		
000180	F8407800	65320001	90920210	010400FF	8 .....k.....		
000190	66070000	00001306	87531400	123D0001	.....g.....	
0001A0	00000000	00000000	CA000003	00000000	.....	
0001B0	65320001	07050011	00000000	00000000	.....	
0001C0	00000004	00000003	00000000	00000000	.....	
0001D0	F6F6F0F7	13068753	010400FF	00000000	6607..g.....		
0001E0	00000000	65320001	07050011	47000001	.....	
0001F0	07069205	C0004000	00000021	00000030	..k.{.		
000200	00000000	00000000	F6F6F0F7	00071575	.....6607....	
000210	010300FF	00000000	00000000	65320001	.....	
000220	07050011	47000001	07069205	C0004000	.....k.{. .	
000230	00000000	00000000	00000000	00000000	.....	
000240	F6F6F0F7	00259DE8	010200FF	00000000	6607...Y.....		
000250	00000000	65320001	07050011	47000001	.....	
000260	07069205	C0404040	00000000	00000000	..k.{.		
000270	00000000	00000000	E2E5C3C4	D6C3E2C3	.....SVCD0CSC	
000280	D7D7F2F9	C1F800D5	00000000	00000000	PP29A8.N.....		
000290	00000000	00000000	00000000	00000000	.....	
0002A0	00000000	00000000	00000000	00000000	.....	
0002B0	00000000	00000000	00000000	00000000	.....	
0002C0	00000000	00000000	00000000	00000000	.....	
0002D0	00000000	00000000	C3D7D7F8	F9F2F9D5	.....CPP8929N	
0002E0	F6F5F3F2	F9F0F9F2	F0F0F0F0	F0F0F0F0	6532909200000000		
0002F0	F0F0F0F0	F0F1F6C3	F0F1F3F3	0000D5D5	0000016C0133..NN		
000300	00000000	00000000	00000000	00000000	.....	

Figure 6. Example of hexadecimal report, device formatting log (unformatted information)

Example: Device formatting log template

Display Hexadecimal Report for Resource				
Name	Type	Model	Serial Number	Resource Name
STORAGE	6607	070	00-68753	
Offset	0 1 2 3	4 5 6 7	8 9 A B	C D E F
000180	-----	-----	-----	-----
000190	-----	-----	-----	-----01
0001A0	-----	-----	-----	-----
0001B0	-----	-----	-----	-----
0001C0	# errors detected	# errors logged	-----	-----
0001D0	Device1 Type	Device1 Serial	Device1 UnitAddr	New Dev1 Type
0001E0	New Dev1 Serial	IOP type & model	IOP Serial	Cache Type/Mod
0001F0	Cache Serial	-----	-----	-----
000200	-----	-----	Device2 Type	Device2 Serial
000210	Device2 UnitAddr	New Dev2 Type	New Dev2 Serial	IOP type & model
000220	IOP Serial	Cache Type/Mod	Cache Serial	-----
000230	-----	-----	-----	-----
000240	Device3 Type	Device3 Serial	Device3 UnitAddr	New Dev3 Type
000250	New Dev3 Serial	IOP type & model	IOP Serial	Cache Type/Mod
000260	Cache Serial	-----	-----	-----

Figure 7. Example of hexadecimal report, device formatting log template

Example: Device formatting log (as formatted information for A or B IPL)

Display Additional Information for Resource				
Name	Type	Model	Serial Number	Resource Name
STORAGE	6607	070	00-68753	
Device Errors detected			4	
Device Errors logged			3	
Device		1	2	3
Unit Address		010400FF	010300FF	010200FF
Type		6607	6607	6607
Serial Number		13068753	00071575	00259DE8
New Device Information:				
Type		****	****	****
Serial Number		00000000	00000000	00000000
I/O Processor Information:				
Type		6532	6532	6532
Serial Number		07050011	07050011	07050011
Cache Adaptor Card Information:				
Type		4700	4700	4700
Serial Number		07069205	07069205	07069205

Figure 8. Example of hexadecimal report, device formatting (as formatted information for type A or B IPL)

Example: Array member formatting log (unformatted information)

Display Hexadecimal Report for Resource									
Name	Type	Model	Serial Number				Resource Name		
STORAGE	6532	001	00-50011						
Offset	0 1 2 3	4 5 6 7	8 9 A B	C D E F	EBCDIC				
000180	F4407800	65320001	90210210	0FFFFFFF	4	.....		
000190	00000000	00000000	00001400	12400002		.....		
0001A0	00000000	00000000	CA000003	00000000		.....		
0001B0	65320001	07050011	00000000	00000000		.....		
0001C0	F6F6F0F7	0025ED09	000200FF	000200FF	6607	.....		
0001D0	F6F6F0F7	00158135	000100FF	000100FF	6607	.a.....			
0001E0	F6F6F0F7	00259DE8	010200FF	00000000	6607	...Y.....			
0001F0	F6F6F0F7	00008326	010100FF	00000000	6607	.c.....			
000200	F6F6F0F7	00071575	010300FF	00000000	6607	.....		
000210	F6F6F0F7	13068753	010400FF	00000000	6607	.g.....			
000220	00000000	00000000	00000000	00000000		.....		
000230	00000000	00000000	00000000	00000000		.....		
000240	00000000	00000000	00000000	00000000		.....		
000250	00000000	00000000	00000000	00000000		.....		
000260	000000FF	00000004	00000000	00000000		.....		
000270	00000000	E2E5C3C4	D6C3E2C3	D7D7F2F9		...SVCDOCSCPP29			
000280	C1F800D5	00000000	00000000	00000000	A8.N	.....		
000290	00000000	00000000	00000000	00000000		.....		
0002A0	00000000	00000000	00000000	00000000		.....		
0002B0	00000000	00000000	00000000	00000000		.....		
0002C0	00000000	00000000	00000000	00000000		.....		
0002D0	00000000	C3D7D7C5	C1F0F2D5	F6F5F3F2		...CPPEA02N6532			
0002E0	F9F0F2F1	F0F0F0F0	F0F0F0F0	F0F0F0F0	9021000000000000				
0002F0	F0F0C4F4	F0F1F3F3	0000D5D5	00000000	00D40133	..NN....			
000300	00000000	00000000	00000000	00000000		.....		

Figure 9. Example of hexadecimal report, array member formatting log (unformatted information)

Example: Array member formatting log template

Display Hexadecimal Report for Resource				
Name	Type	Model	Serial Number	Resource Name
STORAGE	6532	001	00-50011	
Offset	0 1 2 3	4 5 6 7	8 9 A B	C D E F
000180	-----	-----	-----	-----
000190	-----	-----	-----	-----02
0001A0	-----	-----	-----	-----
0001B0	-----	-----	-----	-----
0001C0	Member0	Member0	Expected	Current
	Type	Serial	Address	Address
0001D0	Member1	Member1	Expected	Current
	Type	Serial	Address	Address
0001E0	Member2	Member2	Expected	Current
	Type	Serial	Address	Address
0001F0	Member3	Member3	Expected	Current
	Type	Serial	Address	Address
000200	Member4	Member4	Expected	Current
	Type	Serial	Address	Address
000210	Member5	Member5	Expected	Current
	Type	Serial	Address	Address
000220	Member6	Member6	Expected	Current
	Type	Serial	Address	Address
000230	Member7	Member7	Expected	Current
	Type	Serial	Address	Address
000240	Member8	Member8	Expected	Current
	Type	Serial	Address	Address
000250	Member9	Member9	Expected	Current
	Type	Serial	Address	Address

Figure 10. Example of hexadecimal report, array member formatting log template

Example: Array member formatting log (as formatted information for type A or B IPL)

Display Additional Information for Resource						
Name	Type	Model	Serial Number	Resource Name		
STORAGE	6532	001	00-50011			
Array Member :		0	1	2	3	4
Type :		6607	6607	6607	6607	6607
Serial Number :		0025ED09	00158135	00259DE8	00008326	00071575
Unit Address:						
Current :		000200FF	000100FF	00000000	00000000	00000000
Expected :		000200FF	000100FF	010200FF	010100FF	010300FF
Array Member :		5	6	7	8	9
Type :		6607	****	****	****	****
Serial Number :		13068753	00000000	00000000	00000000	00000000
Unit Address:						
Current :		00000000	00000000	00000000	00000000	00000000
Expected :		010400FF	00000000	00000000	00000000	00000000

Figure 11. Example of hexadecimal report, array member formatting (as formatted information for type A or B IPL)

Example: Configuration formatting log (unformatted information)

```

Display Hexadecimal Report for Resource

Name          Type      Model      Serial      Resource
STORAGE      6532     001        00-50011   Name

Offset       0 1 2 3  4 5 6 7  8 9 A B  C D E F  EBCDIC
000180      50407800 65320001 90120210 0FFFFFFF  & .....
000190      00000000 00000000 00001400 123C0003  .....
0001A0      00000000 00000000 CA000003 00000000  .....
0001B0      65320001 07050011 00000000 00000000  .....
0001C0      00000000 00000000 47000001 07069205  .....k.
0001D0      F8F6C7F8 F1F4F9C3 D7D7F8F9 F8F100D5 86G8149CPP8981.N
0001E0      00000000 00000000 00000000 00000000  .....
0001F0      00000000 00000000 00000000 00000000  .....
000200      00000000 00000000 00000000 00000000  .....
000210      00000000 00000000 00000000 00000000  .....
000220      00000000 00000000 00000000 00000000  .....
000230      C3D7D7C5 C1F0F2D5 F6F5F3F2 F9F0F1F2 CPPEA02N65329012
000240      F0F0F0F0 F0F0F0F0 F0F0F0F0 F0F0C4F4 00000000000000D4
000250      F0F1F3F4 0000E8D5 00000000 00000000 0134..YN.....
    
```

Figure 12. Example of hexadecimal report, configuration formatting log (unformatted information)

Example: Configuration formatting log template

```

Display Hexadecimal Report for Resource

Name          Type      Model      Serial      Resource
STORAGE      6532     001        00-50011   Name

Offset       0 1 2 3  4 5 6 7  8 9 A B  C D E F
000180      -----
000190      -----
0001A0      -----
0001B0      -----
0001C0      -----

Current      Current   Current   Current
IOP type IOP      Cache     Cache
& model serial type serial
Expected     Expected Expected Expected
IOP type IOP      Cache     Cache
& model serial type serial
    
```

Figure 13. Example of hexadecimal report, configuration formatting log template

Configuration formatting log (as formatted information for type A or B IPL)

```

Display Additional Information for Resource

Name          Type      Model      Serial      Resource
STORAGE      6532     001        00-50011   Name

Configuration . . . . . : Current      Expected
I/O Processor Information:
  Type . . . . . : 6532      0000
  Serial Number . . . : 07050011 00000000
Cache Adaptor Card Information:
  Type . . . . . : 0000      4700
  Serial Number . . . : 00000000 07069205
    
```

Figure 14. Example of hexadecimal report, configuration formatting log (as formatted information for type A or B IPL)

Example: Array addendum formatting log (unformatted information)

Display Hexadecimal Report for Resource						
Name	Type	Model	Serial Number	Resource Name		
STORAGE	2757	001	10-0322005	DC03		
Offset	0 1 2 3	4 5 6 7	8 9 A B	C D E F	EBCDIC	
000000	C5D3F0F5	000000A0	00E00180	82745D0F	EL05.....b.)	
000010	1FD78000	00002CE0	20100084	049F0000	.P.....d....	
000020	902F0000	11000000	00000000	00C70000	.....G..	
000030	F2F7F5F7	F0F0F140	F1F060F0	F3F2F2F0	2757001 10-03220	
000040	F0F50000	0000F2F7	F5F70002	00020000	05....2757.....	
000050	00200000	0002FFFF	FFFFFFFF	0004FFFF	.....
000060	00000000	00000000	00000000	40404040	.....
000070	40404040	40400000	00000000	00000000	.....
000080	00000000	00000000	00000000	00000000	.....
000090	00000000	00000000	00000000	00000000	.....
0000A0	00000000	00000000	00000000	00000000	.....
0000B0	00000000	00000000	40404040	40404040	.....
0000C0	40404040	40404040	40404040	40404040	.....
0000D0	40404040	40404040	40404040	40404040	.....
0000E0	F2F7F5F7	F0F0F0F1	0000E2D3	C9C3C9D6	27570001..SLICIO	
0000F0	4040E5F5	D9F2D4F0	40400000	00000000	V5R2M0	
000100	00B90000	00000000	000000C7	00000000	.....G.....	
000110	00000000	00000000	00000000	00000000	.....
000120	00000000	00000000	00000000	00000000	.....
000130	00000000	00000000	00000000	00000000	.....
000140	C4C3F0F3	40404040	40404040	40404040	DC03	
000150	D5C5C5C4	E5C1D3C9	C4D740D5	00070001	NEEDVALIDP N....	
000160	00000000	A0200007	00000000	00000000	.....
000170	00000000	00000000	0003001E	000000A0	.....
000180	A0407800	27570001	902F0200	4FFFFFFF	. ....*.....|...
000190	00000000	00000000	00001400	623E0004	.....
0001A0	F6F6F0F7	0026121D	410500FF	410500FF	6607.....	
0001B0	F6F6F0F7	00248B85	410400FF	410400FF	6607...e.....	
0001C0	F6F6F0F7	0014BE1F	410300FF	410300FF	6607.....	
0001D0	F6F6F0F7	0014C0F0	410200FF	410200FF	6607..{0.....	
0001E0	F6F6F0F7	001403C8	410100FF	410100FF	6607...H.....	
0001F0	F6F6F0F7	0014BEA4	410800FF	410800FF	6607...u.....	
000200	00000000	00000000	00000000	00000000	.....
000210	00000000	00000000	00000000	00000000	.....

Figure 15. Example of hexadecimal report, array addendum formatting log (unformatted information)

Example: Array addendum log template

```

Display Hexadecimal Report for Resource

Name          Type      Model    Serial      Resource
STORAGE      6532     001      00-50011    Name

Offset       0 1 2 3  4 5 6 7  8 9 A B  C D E F

000180      -----
000190      -----04
0001A0      Member10 Member10 Expected Current
              Type      Serial  Address  Address
0001B0      Member11 Member11 Expected Current
              Type      Serial  Address  Address
0001C0      Member12 member12 Expected Current
              Type      Serial  Address  Address
0001D0      Member13 Member13 Expected Current
              Type      Serial  Address  Address
0001E0      Member14 Member14 Expected Current
              Type      Serial  Address  Address
0001F0      Member15 Member15 Expected Current
              Type      Serial  Address  Address
000200      Member16 Member16 Expected Current
              Type      Serial  Address  Address
000210      Member17 Member17 Expected Current
              Type      Serial  Address  Address

```

Figure 16. Example of hexadecimal report, array addendum formatting log template

Example: Array addendum log (as formatted information for type A or B IPL)

```

Display Additional Information for Resource

Name          Type      Model    Serial      Resource
STORAGE      2757     001      10-0322005  Name
DC03

Array Member . . . . . :      10      11      12      13      14
  Type . . . . . :      6607      6607      6607      6607      6607
  Serial Number . . . . : 0026121D 00248B85 0014BE1F 0014C0F0 001403C8
Unit Address:
  Current . . . . . : 410500FF 410400FF 410300FF 410200FF 410100FF
  Expected . . . . . : 410500FF 410400FF 410300FF 410200FF 410100FF

Array Member . . . . . :      15      16      17
  Type . . . . . :      6607      ****      ****
  Serial Number . . . . : 0014BEA4 00000000 00000000
Unit Address:
  Current . . . . . : 410800FF 00000000 00000000
  Expected . . . . . : 410800FF 00000000 00000000

```

Figure 17. Example of hexadecimal report, array addendum formatting (as formatted information for type A or B IPL)

Table 11. Format 01

Description	Hex offset
Device errors detected	0001D6 - 0001D9
Device errors logged	0001DA - 0001DD
Device 1 type	0001E6 - 0001E9
Device 1 serial number	0001EA - 0001ED
Device 1 unit address	0001EE - 0001F1
New device 1 type	0001F2 - 0001F5

Table 11. Format 01 (continued)

Description	Hex offset
New device 1 serial number	0001F6 - 0001F9
Device 1 IOA type and model	0001FA - 0001FD
Device 1 IOA serial number	0001FE - 000201
Device 1 Cache type and model	000202 - 000205
Device 1 Cache serial number	000206 - 000209
Device 2 type	00021E - 000221
Device 2 serial number	000222 - 000225
Device 2 unit address	000226 - 000229
New device 2 type	00022A - 00022D
New device 2 serial number	00022E - 000231
Device 2 IOA type and model	000232 - 000235
Device 2 IOA serial number	000236 - 000239
Device 2 cache type and model	00023A - 00023D
Device 2 cache serial number	00023E - 000241
Device 3 type	000256 - 000259
Device 3 serial number	00025A - 00025D
Device 3 unit address	00025E - 000261
New device 3 type	000262 - 000265
New device 3 serial number	000266 - 000269
Device 3 IOA type and model	00026A - 00026D
Device 2 IOA serial number	00026E - 000271
Device 3 cache type and model	000272 - 000275
Device 3 cache serial number	000276 - 000279

Table 12. Format 02

Description	Hex offset
Array member 0 type	0001D6 - 0001D9
Array member 0 serial number	0001DA - 0001DD
Array member 0 expected unit address	0001DE - 0001E1
Array member 0 current unit address	0001E2 - 0001E5
Array member 1 type	0001E6 - 0001E9
Array member 1 serial number	0001EA - 0001ED
Array member 1 expected unit address	0001EE - 0001F1
Array member 1 current unit address	0001F2 - 0001F5
Array member 2 type	0001F6 - 0001F9
Array member 2 serial number	0001FA - 0001FD
Array member 2 expected unit address	0001FE - 000201
Array member 2 current unit address	000202 - 000205
Array member 3 type	000206 - 000209
Array member 3 serial number	00020A - 00020D

Table 12. Format 02 (continued)

Description	Hex offset
Array member 3 expected unit address	00020E - 000211
Array member 3 current unit address	000212 - 000215
Array member 4 type	000216 - 000219
Array member 4 serial number	00021A - 00021D
Array member 4 expected unit address	00021E - 000221
Array member 4 current unit address	000222 - 000225
Array member 5 type	000226 - 000229
Array member 5 serial number	00022A - 00022D
Array member 5 expected unit address	00022E - 000231
Array member 5 current unit address	000232 - 000235
Array member 6 type	000236 - 000239
Array member 6 serial number	00023A - 00023D
Array member 6 expected unit address	00023E - 000241
Array member 6 current unit address	000242 - 000245
Array member 7 type	000246 - 000249
Array member 7 serial number	00024A - 00024D
Array member 7 expected unit address	00024E - 000251
Array member 7 current unit address	000252 - 000255
Array member 8 type	000256 - 000259
Array member 8 serial number	00025A - 00025D
Array member 8 expected unit address	00025E - 000261
Array member 8 current unit address	000262 - 000265
Array member 9 type	000266 - 000269
Array member 9 serial number	00026A - 00026D
Array member 9 expected unit address	00026E - 000271
Array member 9 current unit address	000272 - 000275

Table 13. Format 03

Description	Hex offset
Current I/O card type	0001C6 - 0001C7
Current I/O card serial number	0001CA - 0001CD
Current cache type	0001CE - 0001CF
Current cache serial number	0001D2 - 0001D5
Expected I/O card type	0001D6 - 0001D7
Expected I/O card serial number	0001DA - 0001DD
Expected cache type	0001DE - 0001DF
Expected cache serial number	0001E2 - 0001E5

Table 14. Format 04

Description	Hex offset
Array member 10 type	0001B6 - 0001B9
Array member 10 serial number	0001BA - 0001BD
Array member 10 expected unit address	0001BE - 0001C1
Array member 10 current unit address	0001C2 - 0001C5
Array member 11 type	0001C6 - 0001C9
Array member 11 serial number	0001CA - 0001CD
Array member 11 expected unit address	0001CE - 0001D1
Array member 11 current unit address	0001D2 - 0001D5
Array member 12 type	0001D6 - 0001D9
Array member 12 serial number	0001DA - 0001DD
Array member 12 expected unit address	0001DE - 0001E1
Array member 12 current unit address	0001E2 - 0001E5
Array member 13 type	0001E6 - 0001E9
Array member 13 serial number	0001EA - 0001ED
Array member 13 expected unit address	0001EE - 0001F1
Array member 13 current unit address	0001F2 - 0001F5
Array member 14 type	0001F6 - 0001F9
Array member 14 serial number	0001FA - 0001FD
Array member 14 expected unit address	0001FE - 000201
Array member 14 current unit address	000202 - 000205
Array member 15 type	000206 - 000209
Array member 15 serial number	00020A - 00020D
Array member 15 expected unit address	00020E - 000211
Array member 15 current unit address	000212 - 000215
Array member 16 type	000216 - 000219
Array member 16 serial number	00021A - 00021D
Array member 16 expected unit address	00021E - 000221
Array member 16 current unit address	000222 - 000225
Array member 17 type	000226 - 000229
Array member 17 serial number	00022A - 00022D
Array member 17 expected unit address	00022E - 000231
Array member 17 current unit address	000232 - 000235

Table 15. Format 11

Description	Hex offset
SCSI sense data	0001C4 - 0001E3
Worldwide ID of device with problem	0001E4 - 001EB
Unit address of device with problem	0001EC - 0001EF
SCSI command descriptor block	0001F4 - 000203
Problem description	000204 - 000223

Table 16. Format 12

Description	Hex offset
Current I/O card type and model	0001C4 - 0001CB
Current I/O card serial number	0001CC - 0001D3
Current I/O card worldwide ID	0001D4 - 0001DB
Current cache type and model	0001DC - 0001E3
Current cache serial number	0001E4 - 0001EB
Current cache worldwide ID	0001EC - 0001F3
Previous I/O card type and model	0001FC - 000203
Previous I/O card serial number	000204 - 00020B
Previous I/O card worldwide ID	00020C - 000213
Previous cache type and model	000214 - 00021B
Previous cache serial number	00021C - 000223
Previous cache worldwide ID	000224 - 00022B

Table 17. Format 13

Description	Hex offset
Device errors detected	0001FC - 0001FF
Device errors logged	000200 - 000203
Device 1 type	000204 - 000207
Device 1 serial number	000208 - 00020F
Device 1 worldwide ID	000210 - 000217
Device 1 unit address	000218 - 00021B
New device 1 type	00021C - 00021F
New device 1 serial number	000220 - 000227
New device 1 worldwide ID	000228 - 00022F
Device 1 IOA type and model	000230 - 000237
Device 1 IOA serial number	000238 - 00023F
Device 1 IOA worldwide ID	000240 - 000247
Device 1 cache type and model	000248 - 00024F
Device 1 cache serial number	000250 - 000257
Device 1 cache worldwide ID	000258 - 00025F
Device 2 type	000260 - 000263
Device 2 serial number	000264 - 00026B
Device 2 worldwide ID	00026C - 000273
Device 2 unit address	000274 - 000277
New device 2 type	000278 - 00027B
New device 2 serial number	00027C - 000283
New device 2 worldwide ID	000284 - 00028B
Device 2 IOA type and model	00028C - 000293
Device 2 IOA serial number	000294 - 00029B
Device 2 IOA worldwide ID	00029C - 0002A3

Table 17. Format 13 (continued)

Description	Hex offset
Device 2 cache type and model	0002A4 - 0002AB
Device 2 cache serial number	0002AC - 0002B3
Device 2 cache worldwide ID	0002B4 - 0002BB
Device 3 type	0002BC - 0002BF
Device 3 serial number	0002C0 - 0002C7
Device 3 worldwide ID	0002C8 - 0002CF
Device 3 unit address	0002D0 - 0002D3
New device 3 type	0002D4 - 0002D7
New device 3 serial number	0002D8 - 0002DF
New device 3 worldwide ID	0002E0 - 0002E7
Device 3 IOA type and model	0002E8 - 0002EF
Device 3 IOA serial number	0002F0 - 0002F7
Device 3 IOA worldwide ID	0002F8 - 0002FF
Device 3 cache type and model	000300 - 000307
Device 3 cache serial number	000308 - 00030F
Device 3 cache worldwide ID	000310 - 000317

Table 18. Format 14

Description	Hex offset
RAID number	000204 - 00020B
Array member 0 type	00020C - 00020F
Array member 0 serial number	000210 - 000217
Array member 0 worldwide ID	000218 - 00021F
Array member 0 expected unit address	000220 - 000223
Array member 0 current unit address	000224 - 000227
Array member 1 type	000228 - 00022B
Array member 1 serial number	00022C - 000233
Array member 1 worldwide ID	000234 - 00023B
Array member 1 expected unit address	00023C - 00023F
Array member 1 current unit address	000240 - 000243
Array member 2 type	000244 - 000247
Array member 2 serial number	000248 - 00024F
Array member 2 worldwide ID	000250 - 000257
Array member 2 expected unit address	000258 - 00025B
Array member 2 current unit address	00025C - 00025F
Array member 3 type	000260 - 000263
Array member 3 serial number	000264 - 00026B
Array member 3 worldwide ID	00026C - 000273
Array member 3 expected unit address	000274 - 000277
Array member 3 current unit address	000278 - 00027B

Table 18. Format 14 (continued)

Description	Hex offset
Array member 4 type	00027C - 00027F
Array member 4 serial number	000280 - 000287
Array member 4 worldwide ID	000288 - 00028F
Array member 4 expected unit address	000290 - 000293
Array member 4 current unit address	000294 - 000297
Array member 5 type	000298 - 00029B
Array member 5 serial number	00029C - 0002A3
Array member 5 worldwide ID	0002A4 - 0002AB
Array member 5 expected unit address	0002AC - 0002AF
Array member 5 current unit address	0002B0 - 0002B3
Array member 6 type	0002B4 - 0002B7
Array member 6 serial number	0002B8 - 0002BF
Array member 6 worldwide ID	0002C0 - 0002C7
Array member 6 expected unit address	0002C8 - 0002CB
Array member 6 current unit address	0002CC - 0002CF
Array member 7 type	0002D0 - 0002D3
Array member 7 serial number	0002D4 - 0002DB
Array member 7 worldwide ID	0002DC - 0002E3
Array member 7 expected unit address	0002E4 - 0002E7
Array member 7 current unit address	0002E8 - 0002EB
Array member 8 type	0002EC - 0002EF
Array member 8 serial number	0002F0 - 0002F7
Array member 8 worldwide ID	0002F8 - 0002FF
Array member 8 expected unit address	000300 - 000303
Array member 8 current unit address	000304 - 000307
Array member 9 type	000308 - 00030B
Array member 9 serial number	00030C - 000313
Array member 9 worldwide ID	000314 - 00031B
Array member 9 expected unit address	00031C - 00031F
Array member 9 current unit address	000320 - 000323
Array member 10 type	000324 - 000327
Array member 10 serial number	000328 - 00032F
Array member 10 worldwide ID	000330 - 000337
Array member 10 expected unit address	000338 - 00033B
Array member 10 current unit address	00033C - 00033F
Array member 11 type	000340 - 000343
Array member 11 serial number	000344 - 00034B
Array member 11 worldwide ID	00034C - 000353
Array member 11 expected unit address	000354 - 000357
Array member 11 current unit address	000358 - 00035B

Table 18. Format 14 (continued)

Description	Hex offset
Array member 12 type	00035C - 00035F
Array member 12 serial number	000360 - 000367
Array member 12 worldwide ID	000368 - 00036F
Array member 12 expected unit address	000370 - 000373
Array member 12 current unit address	000374 - 000377
Array member 13 type	000378 - 00037B
Array member 13 serial number	00037C - 000383
Array member 13 worldwide ID	000384 - 00038B
Array member 13 expected unit address	00038C - 00038F
Array member 13 current unit address	000390 - 000393
Array member 14 type	000394 - 000397
Array member 14 serial number	000398 - 00039F
Array member 14 worldwide ID	0003A0 - 0003A7
Array member 14 expected unit address	0003A8 - 0003AB
Array member 14 current unit address	0003AC - 0003AF
Array member 15 type	0003B0 - 0003B3
Array member 15 serial number	0003B4 - 0003BB
Array member 15 worldwide ID	0003BC - 0003C3
Array member 15 expected unit address	0003C4 - 0003C7
Array member 15 current unit address	0003C8 - 0003CB
Array member 16 type	0003CC - 0003CF
Array member 16 serial number	0003D0 - 0003D7
Array member 16 worldwide ID	0003D8 - 0003DF
Array member 16 expected unit address	0003E0 - 0003E3
Array member 16 current unit address	0003E4 - 0003E7
Array member 17 type	0003E8 - 0003EB
Array member 17 serial number	0003EC - 0003F3
Array member 17 worldwide ID	0003F4 - 0003FB
Array member 17 expected unit address	0003FC - 0003FF
Array member 17 current unit address	000400 - 000403

Table 19. Format 17

Description	Hex offset
Associated IOA type and model	0001C4 - 0001CB
Associated IOA serial number	0001CC - 0001D3
Associated IOA worldwide ID	0001D4 - 0001DB
Type of adapter connection (1 = Dual storage IOA pair, 2 = Storage IOA to auxiliary cache)	0001DC - 0001DC
Problem description	0001E0 - 00021F

Table 20. Format 20

Description	Hex offset
Problem description	0001C4 - 000203
Path 1 adapter port	00020A
Path active (00 = Unknown, 01 = Yes, 10 = No, 11 = Unknown)	00020D, bit 0 - 1
Path state (0000 = Unknown, 0001 = Operational, 0010 = Degraded, 0011 = Failed)	00020D, bit 4 - 7
Node 1 port type (0000 = Empty, 0001 = Adapter, 0010 = Expander, 0011 = Device, 0100 = LUN)	000210, bit 0 - 3
Node 1 status (0000 = Operational, 0001 = Degraded, 0010 = Failed, 0011 = Suspect, 0100 = Missing, 0101 = Not valid)	000210, bit 4 - 7
Node 1 phy	000212
Node 1 information (1000 = 1.5 Gbps, 1001 = 3.0 Gbps)	000213, bit 4 - 7
Path 1 node 1 SAS address	000214 - 00021B
Additional nodes are self defining	

Service reference procedures

The service reference procedures include general tasks such as setting the system date and time, setting the system password, determining the dominant operating system, accessing the history file, and so on.

Setting the system date and time

The system date and time can be set with various tools.

Attention: Customer applications may be sensitive to system date and time settings. Incorrect date and time settings may cause data loss. Ensure that the customer knows the date and time that you have set.

Note: If the system is logically partitioned, then you must use the Advanced System Management Interface (ASMI) to set the system date and time.

Use one of the following methods to set the date and time:

- If the system is powered off, perform a Manual mode (attended) IPL. You can set the date and time on the IPL Options display.
- If the system is powered on, perform the following procedure:
 1. To set the correct date, enter the system command:

```
CHGSYSVAL QDATE VALUE('mmddy')
```

where:

```
mm = month
dd = day
yy = year
```

2. Press Enter.

Note: This sample uses the month, day, and year format. To determine the format for your system, enter DSPSYSVAL QDATE.

3. To set the correct time, enter the system command:

```
CHGSYSVAL
QTIME VALUE('hhmmss')
```

where:

hh = 24-hour time

mm = minutes

ss = seconds

4. Press Enter. **This ends the procedure.**

Determining the dominant operating system

How to determine the dominant operating system.

The operating system is a collection of system programs that control the overall operation of the system. IBM i is an example of such an operating system. Systems can run one or more operating systems. When there is more than one operating system, IBM i is the dominant operating system.

The hardware service manager function (under Start a Service Tool) indicates which operating system is dominant on the system. The *Release* field on the *Hardware Service Manager* display or printout shows the following values:

0 Unknown

This indicates that an alternate IPL was performed.

1 IBM i is dominant

This indicates that either IBM i is the only operating system installed, or that more than one operating system is installed (and IBM i is dominant).

For more information on the hardware service manager function, see “Hardware service manager” on page 41.

System password

If a system password is required, the Verification of System Password Failed display appears just prior to the IPL or Install the System display.

If the Verification of System Password Failed display appears after a repair action, contact your next level of support for assistance.

When customer information is known by manufacturing, the new system will be shipped with the correct system password.

The system requires a new system password each time someone enters the system serial number and at each model and processor card feature change. The new system password, which is required at the time of the first IPL, is provided by IBM if IBM knows the user. Customers who do not have the system password when they need it must contact their marketing representative to place a system password order.

If the correct system password is not entered, you can select a system password bypass period to allow time to obtain the correct system password from the marketing representative. If the bypass period expires, the system will not complete the next IPL unless the correct system password is entered. While in bypass mode, by way of control console messages, the system indicates the amount of time that remains before the bypass period expiration date.

Note: If the system password was changed at the most recent IPL, performing a fast power off (control panel function 08) might cause that new password information to be lost.

System unique identifier

The system unique identifier (SUID) is a 12-character ID that is assigned by the manufacturer.

New systems are shipped with the specific value assigned. The SUID is used by specific software support to identify that a system object model was generated.

A new SUID can be assigned for the following reasons:

- If the serial number that was entered is not the serial number that was previously assigned and stored on the system.
- If 256 Licensed Internal Code (scratch) installation were performed on the system.

The SUID is needed only to support system object model software functions. An incorrect SUID does not affect other system functions. To order a new SUID, contact the marketing representative (hardware feature code 1311).

Primary consoles

A console is a workstation that is used to view and control system operations.

If a workstation is not found, the system displays a reference code on the control panel. If the system is set for manual mode, it stops during the initial program load (IPL).

Primary console requirements

For a workstation to be the primary console, it must be operational. If the workstation is a personal computer, it must also have an active workstation emulation program.

For more information, see "Selecting console type" on page 27.

Locating the system's load source from the system console

Use this procedure to locate the system load-source and alternate load-source input/output processors (IOPs), load-source I/O adapter, and load-source disk unit.

1. From either the System Service Tool (SST) display or the Dedicated Service Tools (DST) display, select the *Start a service tool* option.
2. At the Start a Service Tool display, select the *Hardware service manager* option.
3. At the Hardware Service Manager display, select the *Logical hardware resources* option.
4. At the Logical Hardware Resources display, select the *System bus resources* option.
5. At the Logical Hardware Resources on System Bus display, search for an I/O processor, combined function I/O processor, or multifunction I/O processor that contains an asterisk (*) in the description. This special character (*) indicates that this I/O processor is the load-source I/O processor.

The special characters percent (%) and equals (=) might also appear in the description of logical hardware resources. These characters indicate that those resources are alternate IPL resources. To better understand the special characters that indicate load-source resources and alternate load-source resources, use the Help function key (F1).

6. Move the cursor to the load-source IOP. To determine the location of the load-source IOP:
 - a. Select the *Associated packaging resources* option.
 - b. At the Packaging Resources Associated with a Logical Resource display, select the *Display detail* option. Listed on the Packaging Hardware Resource Detail display is the frame ID and card position of the FRU that contains the load-source IOP.
 - c. Select the Cancel function to return to the Packaging Resources Associated with a Logical Resource display.

- d. Select the Cancel function to return to the Logical Hardware Resources on System Bus display.
7. Select the *Resources associated with IP* option for the load-source IOP.
8. Page down until you find the disk unit with the special character * in its description. This is the load-source disk unit.
9. Move the cursor to the load-source disk unit. To determine the location of the load-source disk unit:
 - a. Select the *Associated packaging resources* option.
 - b. At the Packaging Resources Associated with a Logical Resource display, select the *Display detail* option. Listed on the Packaging Hardware Resource Detail display is the frame ID and card position of the FRU that contains the load-source disk unit.
 - c. Select the Cancel function to return to the Packaging Resources Associated with a Logical Resource display.
 - d. Select the Cancel function to return to the Logical Hardware Resources on System Bus display.
10. Search for the I/O adapter that is above and closest to the load-source disk unit on the display. This is the load-source IOA.
11. Move the cursor to the load-source IOA. To determine the location of the load-source IOA:
 - a. Select the *Associated packaging resources* option.
 - b. At the Packaging Resources Associated with a Logical Resource display, select the *Display detail* option. Listed on the Packaging Hardware Resource Detail display is the frame ID and card position of the FRU that contains the load-source IOA.
 - c. Select the Cancel function to return to the Packaging Resources Associated with a Logical Resource display.
 - d. Select the Cancel function to return to the Logical Hardware Resources on System Bus display.

History file

The history file provides a high-level audit trail of the actions that are performed by the system.

The history file information can assist the system operator, the data processing manager, and the service representative.

The commands that are used to display the history file vary depending on your operating system. For information on service commands, see “Commonly used IBM i service commands” on page 182.

Data is sent to the history file when:

- Fixes are installed on the system
- Fixes are temporarily or permanently applied
- Fixes are temporarily or permanently removed

Notes:

1. The term *fix* refers to a program temporary fix (PTF) to the Licensed Internal Code, operating system, or other licensed programs.
2. You should submit a copy of the history file with every authorized program analysis report (APAR).
3. 99xx messages can contain SRC information.

Low-level debug and data collecting procedures

Use these procedures to collect data for problems with Licensed Internal Code or hardware that you have been unable to solve with other methods.

The low-level debug functions (Functions 63-70) use sub-functions. This means that these functions have a function range inside them (00-FF) where you can display or enter information.

Getting started

Before you start, ensure that Manual mode is selected.

To enable the low-level debug functions, perform the following steps:

1. At the control panel, select function 25.
2. Press Enter on the control panel.
3. Press the Increment (↑) button again. The number 26 appears in the Function/Data display.
4. Press Enter on the control panel. The low-level debug functions are now enabled.

Displaying data for functions 63 and 64

Use this procedure to collect data. Each function has a different amount of data to collect. Collect the data for the range that is listed for each function in the following table.

Table 21. Data collection ranges. Functions 63 and 64

Function	Description	Range
63	Status SRC trace	6300 to 6318
64	Diagnostic SRC trace	6400 to 6420

Record the data:

Use the following procedure and record the data as shown.

1. Press the Increment (↑) button until the function you want appears in the Function display (example: 63).
2. Press Enter on the control panel; ** appears next to the function number to indicate that you are in the sub-function mode. This is the *entry* point and *exit* point for sub-function mode).
If the data is *xx _ _ _ FF* (where *xx* = the function number), this function is not available.
3. Press the Increment (↑) button until 00 is next to the function number.
4. Press Enter on the control panel. Data appears in the display. Record the data.
5. Press the Increment (↑) button to continue to the next sub-function (example: 5401).
6. Press Enter on the control panel. Record the data.
7. Repeat steps 5 and 6, increasing the sub-function number one at a time and recording the data until all the suitable data is collected.
8. Press the Increment (↑) or Decrement (↓) buttons to move from the last sub-function back to ** (example: 633F to 63**).
9. Press Enter on the control panel. Doing this takes you out of sub-function mode, and ** no longer appears.

Repeat steps 1 through 9 for additional data that you were instructed to collect.

Call your next level of support and give them the information you collected to write a Licensed Internal Code APAR.

Logical partitions

Logical partitions are the distribution of resources within a single system to make it operate as if it were two or more independent systems.

Note: If the system has logical partitions, the terms: *console*, *IPL*, *SST*, *DST*, *load source*, *alternate load source*, *power off*, *power on*, *panel function*, *product activity log*, *service action log*, *Licensed Internal Code log*, and *operating system* refer to the logical partition that you are servicing (unless otherwise stated in a procedure, Failing Item, or Symbolic FRU).

Failed partition

Failures can be reported from the partition that experienced the problem with a resource. Attempt to service from the failed partition unless otherwise directed.

System Attention Light

For partitions, the system attention light is represented as the partition's *State*.

Powering off and on

Read and understand the power-off and power-on procedures referenced when a procedure directs you to power on or power off a system or partition.

Notes:

- To perform a main storage dump or platform dump of a partition, you must use the management console.
- When servicing a logical partition, you must use the service documentation that supports the version and release of the logical partition.

Examples: Missing or non-reporting system bus resources

On most systems with logical partitions, it is common to have one or more missing or non-reporting system bus resources under hardware service manager.

The following examples show some of the reasons why the system might show missing resources and corresponding actions to take.

- Residual resource names after a reconfiguration of resources. When resources are removed from a partition, there are two options:
 - **1=Remove** leaves the resource names (usually when switching resources across partitions temporarily. This option is used when the customer intends to switch the resources back to the original partition sometime in the future and wants to use the same resource names when the future switch occurs). If this option is selected, the resource names will show as non-reporting in the partition that they were removed from following the next IPL of that partition.
 - **2=Remove and clear hardware resource(s)** removes the resource names (when permanently moving or removing the resource).

Corrective action: Work with the customer to understand why the option to leave resource names was selected. These resources should be left as is if the customer intends to switch the resource back to the partition from which they were removed. If they are removed and the resource is switched back to that partition, a new resource name is created and the resource name is incremented. This will cause problems with the device descriptor that uses this resource; for example, TAP01 being used by multiple partitions.

- The resource has actually failed or has been removed from the system.

Corrective action: Find out why each missing or non-reporting resource exists. Follow normal problem-determination procedures including analyzing the service action log.

Accessing the control panel functions of a logical partition

Logical partitions should use the management console to access control panel functions.

Independent auxiliary storage pool and clustering

These service reference procedures include determining whether an expansion unit is switchable, and determining the power controlling and current logical system ownership of an expansion unit.

Determining whether an expansion unit is configured as switchable under OptiConnect

You can determine whether an expansion unit is configured as a switchable expansion unit under OptiConnect by performing the following procedure.

Note: To perform this procedure, you must have the resource name of the high speed link (HSL) I/O bridge resource.

1. Move to the console of the system where you know the name of the HSL I/O bridge resource in the expansion unit.
2. Sign on to the System Service Tool (SST) or Dedicated Service Tool (DST).
3. From the SST or DST, select **Start a service tool**, then **Hardware Service Manager**.
4. From the Hardware Service Manager display, select **Logical Hardware Resources**.
5. From the Logical Hardware Resources display, select **High Speed Link Resources**.
6. From the High Speed Link Resources display, select the function **Include non-reporting resources**.
7. Move the cursor to the HSL I/O bridge resource of the expansion unit and select the **Display detail** option. The Display HSL Information display appears.
8. At the Display HSL Information display, locate the **Mode** information of the resource.

Note: If you cannot locate the **Mode** information, then this HSL resource is not part of a Cluster Resource Group (CRG) and the expansion unit where this HSL I/O bridge resource is located cannot be configured as switchable under OptiConnect.

9. Is the mode listed as *Private* or is the mode not displayed for this resource?
 - **Yes** = the expansion unit where this HSL I/O bridge resource is located cannot be configured as switchable under OptiConnect. **This ends the procedure.**
 - **No** = the HSL I/O bridge resource has a mode of *switchable*. The expansion unit is configured as a switchable expansion unit under OptiConnect. Continue with the next step of this procedure.
10. Record the HSL loop number, the type-model, and the serial number of the HSL I/O bridge resource.

Note: You will need the type-model and serial number to identify the HSL I/O bridge on the other system that can own this resource.

Determining the power controlling and current logical system ownership of an expansion unit

Determine the power controlling system of an expansion unit and the current logical owning system.

1. From the Logical Hardware Resources screen, select **High-Speed Link Resources**.
2. Go to the HSL Loop with the expansion unit you wish to learn about. Select **option 5** (Display detail) and press **Enter**.
3. Press F8 (Follow Leading Port) until you reach the expansion unit you want to learn about.
4. Press F11 (Display System Information). There will be a section called SPCN System Information. That will have the system serial number for the power controlling system. The current logical owning system will be labeled as "owner."

Determining the resource name and HSL loop number of an HSL I/O bridge

Determine the resource name and HSL loop number of the HSL I/O bridge resource in the alternate system that can own a selected HSL I/O bridge resource.

1. Move to the console of the alternate system that can own the resources in the expansion unit.
2. Sign on to the System Service Tool (SST) or Dedicated Service Tool (DST).
3. Select **Start a Service Tool**.
4. Select **Hardware Service Manager**.
5. Select **Logical hardware resources**.
6. Select **High speed link resources**.
7. Select the function **Include non-reporting resources**.
8. Search for the HSL I/O bridge resource name by selecting the **Display detail** option for each HSL I/O bridge resource until you find the HSL I/O bridge resource that has the same type-model and

serial number you recorded for the HSL I/O bridge resource. For details, see “Determining the power controlling and current logical system ownership of an expansion unit” on page 108.

9. Record the **HSL loop number** and **Resource name** for the HSL I/O bridge resource from the Display HSL Information display.
10. Select the function **Display system information** from the Display HSL Information display.
11. Record the local system type and local system serial number with the HSL I/O bridge resource and the HSL loop number you recorded for this system earlier. **This ends the procedure.**

Switching ownership of an expansion unit's switchable resources

It may be necessary for the local system to take or release ownership of a switchable resource.

You can use the *Take/release ownership* option on the Select I/O Debug Function display to have the local system take ownership of a resource or to have the local system release its ownership of a resource. Ownership of a resource indicates which system controls the functions of a resource. Ownership may be released only by the system that presently owns it.

The following procedure will direct you to switch ownership of switchable resources in an expansion unit from the current owner to the alternate system that can own those resources. To perform this procedure, you must know:

- The system that currently owns the switchable resources in an expansion unit. This is the system that you are going to *release* the resources from.
- The alternate system that can *take* ownership of the switchable resources.
- The resource name of the high speed link (HSL) I/O bridge resource and the HSL loop number on the currently owning system that will *release* ownership.
- The resource name of the high speed link (HSL) I/O bridge resource and the HSL loop number on the system that will *take* ownership.

Attention: Perform this procedure only if you are not able to switch the ownership of the resource using the OptiConnect user interface. Cluster Resource Group (CRG) problems may occur as the result of using this procedure when the OptiConnect user interface is available.

1. Determine the current owner of the switchable resources in the expansion unit if you have not already done so. (See the procedure “Determining the power controlling and current logical system ownership of an expansion unit” on page 108.)
2. Move to the console of the system that is the current owner of the switchable resources in the expansion unit.
3. Sign on to System Service Tool (SST) or Dedicated Service Tool (DST).
4. Select **Start a service tool**.
5. Select **Hardware Service Manager**.
6. Select **Logical Hardware Resources**.
7. Select **High speed link resources**.
8. Select the function **Include non-reporting resources**.
9. Select **Resources associated with loop**.
10. Move the cursor to the HSL I/O bridge resource in the expansion unit. Search for the resource name that the currently owning system assigned to the HSL I/O bridge resource.
11. Select the **I/O Debug** option.
When you select the I/O debug option on an HSL I/O bridge that has the capability of being switched, the I/O Debug Function display appears.
12. From the Select I/O Debug Function display, select the **Take/release ownership** option. The Confirm Release of Resource Ownership display appears.

Note: If you select option two to release ownership of the resource and another system currently owns it, the following message appears at the bottom of the screen:

Ownership of this resource cannot be released. It is owned by another system.

13. Record the **type-model** and the **serial number** of the HSL I/O bridge resource if you have not already done so.
14. Press Enter to confirm releasing the resource.
15. Move to the console of the other system that can take ownership of the switchable resources in the expansion unit.
16. Sign on to System Service Tool (SST) or Dedicated Service Tool (DST).
17. Select **Start a service tool**.
18. Select **Hardware Service Manager**.
19. Select **Logical Hardware Resources**.
20. Select **High speed link resources**.
21. Select the function **Include non-reporting resources**.
22. Move the cursor to the HSL I/O bridge resource in the expansion unit. Search for the resource name that this system assigned to the HSL I/O bridge resource.
23. Select the **I/O Debug** option.
24. From the Select I/O Debug Function display, select the **Take/release ownership** option. The Confirm Ownership Change display will appear.
25. Press Enter to confirm the ownership change. **This ends the procedure.**

Switching the mode of an expansion unit's switchable resources

This procedure provides instructions on how to switch the mode of switchable resources in an expansion unit.

Note: To perform this procedure, the switchable resources in the expansion unit must be owned by the power controlling system for the expansion unit. For information on switching ownership of the switchable resources in an expansion unit, see the procedure "Switching ownership of an expansion unit's switchable resources" on page 109.

Attention: Perform this procedure only if you are not able to end the Cluster Resource Group (CRG) using the OptiConnect user interface. CRG problems may occur as the result of using this procedure when the OptiConnect user interface is available.

1. Move to the console of the power controlling system of the expansion unit.
2. Sign on to System Service Tool (SST) or Dedicated Service Tool (DST).
3. Select **Start a service tool**.
4. Select **Hardware Service Manager**.
5. Select **Logical hardware resources**.
6. Select **High speed link resources**.
7. Select the function **Include non-reporting resources**.
8. Move the cursor to the HSL I/O bridge resource in the expansion unit. Search for the resource name that the currently owning system assigned to the HSL I/O bridge resource.
9. Select the **I/O Debug** option.
10. From the **Select I/O Debug Function** display, select the **Change mode** option.
11. Is the present value of the expansion unit mode a value that you want to change?
 - **Yes** = proceed to the next step.
 - **No** = The power is already in the mode you want it to be in. **This ends the procedure.**
12. Press Enter to confirm changing the mode of the resource.

If you press Enter at the Confirm Mode Change display, one of the following messages will appear:

- Change mode was successful.
- Unable to change mode for this hardware resource.

This ends the procedure.

Adding expansion units to a large configuration with SPCN firmware update control

You can add expansion units to a running system with 10 or more expansion units, including those being added with SPCN firmware update control.

Important:

- Continue with this procedure only if you were directed here from another procedure.
 - This procedure must be performed by an on-site service provider. If an on-site service provider is not available, return to the procedure that sent you here and choose a different option or contact your service provider.
1. Obtain a product engineering shell (PESH) and a celogin password:
 - a. Obtain a password for the HMC **hscpe** account:
 - 1) HMC: If the user ID of **hscpe** has not been created, create this user ID with the task role of **hmcpe**.
Create the user ID by using the **mkhmcusr -u hscpe -a hmcpe --passwd <mypwd>** command, where, *<mypwd>* is the password for the account.
 - 2) If you lost or forgot the password, reset it.
HMC: Reset the password by using the **chhmcusr -u hscpe -t passwd -v <newpwd>** command, where *<newpwd>* is the new password for the account.
 - b. Open a terminal session for the **hscpe** user:
 - 1) Log off from the management console, and log in as the **hscpe** user by using your password.
 - 2) With the cursor flashing, right-click on the management console desktop to display the action box for terminals.
 - 3) Click **rshterm** to open a terminal session.

Alternate method:

If the remote command execution is enabled, use a secure shell (ssh) to log in as the **hscpe** user. At the restricted shell prompt, type the **ssh hscpe@localhost** command.

- c. Obtain a PESH password from an authorized support center:
 - 1) From the restricted shell window, run the **lshmc -v** command. The output of this command returns several fields of information. The SE field is the management console serial number. Record the serial number.
 - 2) Find the N2 field in the output from the **lshmc** command. Record the current date on the management console.
 - 3) Provide the serial number and the date from the management console to the authorized support center. The support center will generate the PESH password that is required to complete this procedure.

Note: If the serial number of the management console is not registered, you cannot create a PESH password.
- d. Obtain an ASMI celogin password from an authorized support center:
 - 1) Launch the ASMI and record the system date and serial number from the Welcome window.
 - 2) Provide the system date and system serial number to the authorized support center. The authorized support center will provide the ASMI celogin password.

- e. Run the **pesh** command in the management console:
 - 1) From the restricted shell window, enter the **pesh <serial number>** command, where *<serial number>* is the serial number recorded in step 1c1 on page 111.

Note: Type all alphabetic characters used in the serial number in uppercase characters, and do not include spaces or dashes.

- 2) When prompted for a password, enter the PESH password that is provided by the authorized support center. Ensure that the password is entered in all lowercase letters. After you log in, `role=hmcpe` (for HMC) and a command prompt is displayed.
- f. Switch to the root user on the management console:
 - 1) At the pesh prompt, type **su -** and press Enter. When prompted, type the password for the root user.

Note: If the password has been lost or forgotten, log in as **hscroot** and reset the password.

- 2) Validate that you are the root user by entering the **whoami** command on the management console.
2. Obtain access to the PHY P prompt:
 - a. Access and then record the service processor IP address by issuing the command **lssysconn -r all**. Find the entry in the `lssyscon` that shows `resource_type=sys`, `sp=primary`, and record its IP address.
 - b. Using the ASMI celogin password that was obtained in step 1d on page 111, log into ASMI as user celogin.
 - c. Under Network Services, select **Debug Virtual TTY**.
 - d. Enter 0 for both the partition ID and the session ID on the Debug Virtual TTY ASMI window.

Note: Five minutes of inactivity on a virtual TTY connection permits the debug virtual TTY connection to timeout and close.

- e. Click **Save Settings**.
- f. Access the service processor by using Telnet on port 30002 to obtain the phy p prompt.
 - 1) For the management console Telnet client, do this by issuing the command **telnet <service processor ip> 30002** where *<service processor ip>* is the name or IP address of the service processor determined in step 2a. For example, `Telnet 9.5.32.12 30002`
 - 2) After the Telnet session is established, wait for the 'phy p#' to indicate that the phy p prompt is available. This part of the procedure might take several seconds to complete.

Tip: The debug virtual TTY connection automatically closes after five minutes of inactivity. Periodically returning to this window and pressing **Enter** during this procedure permits you to avoid having to reconnect to the phy p prompt to enable SPCN firmware updates.

3. Disable SPCN firmware updates:
 - a. From the phy p prompt enter the **spcndownload -disable** command to disable SPCN firmware updates. The disable option will interrupt and disable the SPCN firmware updates.

Notes:

- This option will begin an asynchronous process to stop the SPCN firmware updates. The process usually takes less than one minute to complete. However, in extreme cases where a large number of SPCN firmware updates are in progress when the stop step is initiated, the disabled process can take up to an hour to complete.
 - Disabling the SPCN firmware updates will not continue across a platform IPL. SPCN firmware updates will be enabled following a platform IPL.
- b. Enter the **spcndownload -status** command to determine if the disable process has completed.

Attention: Do not proceed to the next step until the disable process is complete. Output from the `spcndownload -status` command informs you when the disable process is complete.

4. Remove or open the rear of the system.
5. Find the connector locations.
6. Connect the expansion units with SPCN cables.
7. Connect the ac power cables to the expansion units being added.

Tip: The power cable should be plugged into the power source prior to connecting it at the power supply of an expansion unit.

If the expansion units have power switches, ensure that they are in the on position. The expansion units power on automatically. Verify that the expansion units are powered on.

Note: For each expansion unit that you just powered on, wait for the green power indicator to light up on the expansion unit's control panel. It might take up to 10 minutes for each expansion unit's green indicator to become lit. During this time, the yellow attention indicator might become lit on the control panel of the expansion unit that just powered on.

After the green power indicators on all of the expansion units are lit, wait an additional 10 minutes for the hardware initialization to complete. and then go to step 8.

8. Verify the System Power Control Network.

Depending on various factors in the system configuration and procedures, you might see the following error logs:

- 1000 9135 informational or permanent log due to an open SPCN loop.
- 1000 9139 informational log for SPCN closed loop in system release SF240 or later.
- 1000 9137 permanent error logs because the RIO/HSL cables are not attached.

9. Connect the units with RIO/HSL cables. After connecting the RIO/HSL cables, the resources in the new expansion units are initialized. Allow up to 10 minutes for this to occur.

10. Verify that the new configuration is functioning. Depending upon various factors in the system configuration and procedures, you might see the following error logs:

- B700 6907 information logs for each new expansion unit being added that has an existing VPD from a system that the expansion unit was previously attached to.
- B700 6985 informational logs before and after the B700 6907 information logs as well as B700 6984 informational logs to indicate a broken HSL loop.

11. Enable SPCN firmware updates using the PHYP prompt.

Note: If the phyp prompt session has been inactive for more than five minutes, it might have timed out and you will need to reestablish the session using the procedure in step 2 on page 112.

- a. After the PHYP prompt has been established, enter the `spcndownload -enable` command.

Notes:

- This command enables the SPCN firmware updates.
 - The enable option will enable but not initiate SPCN firmware updates.
- b. Enter the `spcndownload -initiate` command to start the required SPCN firmware updates. The initiate option will asynchronously begin any required SPCN firmware updates.

Note: The SPCN firmware updates continue to be processed after the command has completed execution.

Attention: You might see one or more of the following firmware update informational logs. There is no need to check for these log entries.

Broadcast SPCN firmware updates:

- Informational 10009107 (download started)
- Informational 100091DD (download done)

HSL/RIO SPCN firmware updates:

- Informational 1000910A (HSL/RIO download started)
- Informational 100091DE (HSL/RIO download done)

12. If the system is logically partitioned, assign the new hardware to a partition. It is not necessary to wait for the completion of the SPCN firmware updates.

Control panel functions

Systems managed by a management console should use the management console to perform control panel functions.

Notes:

1. Some control panel functions might not be available on all system types.
2. The x can be any number 0 through 9, any letter A through F, or a blank.
3. If the user is performing the function, find out why the user selected the function and verify whether it is complete.
4. If you cannot change the *Function/Data* display or complete the selected function, contact your next level of support.

Values for IPL types, system operating modes, and speeds

Reference tables for IPL types, system operating modes, and speeds.

Table 22, Table 23 on page 115, Table 24 on page 115, and Table 25 on page 115 describe the valid IPL types, system operating modes, speeds, and firmware IPL modes that are used in control panel functions 01 and 02. Table 26 on page 115 describes whether the management console is active for the managed systems.

Notes:

1. Systems managed by the management console should use the management console to perform control panel functions.
2. OS IPL types are displayed only when the OS IPL mode has been enabled from the operating system.

Table 22. OS IPL types

IPL type	Action or description
A	IPL from disk using copy A of the system Licensed Internal Code.
B	IPL from disk using copy B of the system Licensed Internal Code.
C	Reserved for hardware service use only under the direction of Rochester development support. Attention: Severe data loss can occur with improper use of this function.
D	IPL from media other than load-source disk. Alternate IPL for code installation support.

Table 23. System operating mode values

System operating mode	Action or description
Manual (M)	Allows you to access DST and perform an attended IPL .
Normal (N)	Allows you to access the operating system and perform an unattended IPL .

Table 24. IPL speeds

IPL speed	Action or description	Details
F	Fast override for one IPL.	Fast IPL run. Some hardware diagnostics are skipped.
S	Slow override for one IPL.	Full hardware diagnostics run. Use whenever hardware is changed, for intermittent hardware failure, and on the first installation IPL. The following diagnostics are run: <ul style="list-style-type: none"> • Main storage tests. • CEC Inter-chip interface tests (wire test). • Extended Logical Built-in Self Tests.
V=F	Use system-defined speed.	Fast IPL set by system value (displayed at function 01).
V=S	Use system-defined speed.	Slow IPL set by system value (displayed at function 01).
V	Fast IPL or slow IPL set by the system value (selected at function 02).	Function 02 selection or the system default at each IPL.

Table 25. Firmware IPL types

IPL type	Action or description
P	IPL from disk using copy P of the system Licensed Internal Code.
T	IPL from disk using copy T of the system Licensed Internal Code.

Table 26. HMC indicators

HMC indicator	Action or description
HMC=1	The HMC is connected.
HMC=0	The HMC is disconnected.

Accessing the control panel functions

There are various methods to access control panel functions, including the physical control panel, an IBM i virtual control panel or remote control panel, and through the management console.

Physical control panel

For information about control panel, see Control panel LEDs.

Virtual or remote control panel

The IBM i virtual control panel and remote control panel are graphical representations of the physical control panel. The graphical control panels install through the Operations Console and you can use them to access control panel functions using a PC.

Management console

If you are managing the system with the management console, you should use the management console to perform control panel functions. The management console affects the physical control panel in the following ways:

- Except for some limited auto-platform override function, such as Auto Power On Restart and Timed Power On, the system operating mode value has no meaning.
- The OS IPL type value is disabled in functions 01 and 02.
- Functions 11–19 will not display partition SRCs. It will continue to display SRCs from the platform Licensed Internal Code.
- Functions 21, 22, 34, and 65-70 are not selectable.

Service extended control panel functions

Service functions 50 through 99 are enabled when you select Manual mode and enter function 25 (service switch 1), then function 26 (service switch 2). Sub-functions are used with Functions 51 and 57 through 64.

To enable functions 50 through 99:

1. Select function 25 and press Enter. The display reads 25 00.
2. Use the Increment button to select function 26 and press Enter. The display reads 26 00.

Functions 50 through 99 are now available.

You can disable the service functions by selecting and entering either function 25 (service switch 1) or function 26 (service switch 2).

To disable functions 50 through 99, select function 25 and press Enter. Functions 50 through 99 are then no longer available.

Using Sub-functions

Information about using sub-functions.

To work with sub-functions, do the following:

1. Use the Increment or Decrement buttons to select the appropriate function and press Enter. The function number appears with asterisks (**); for example, 57**. The two asterisks indicate that sub-functions are available.
2. Press the Increment button. The first sub-function number appears; for example, 5700.
3. As the sub-function number is displayed, press Enter. The data associated with the sub-function number is displayed.
4. Press the Increment button. The next sub-function number appears; for example, 5701.
5. As the sub-function number is displayed, press Enter. The data associated with the new sub-function number is displayed.
6. Repeat these steps to gather all the data that is associated with the sub-function.
7. Use the Increment or Decrement buttons to return to the function display with asterisks; for example 57**.
8. Press Enter to exit the sub-functions.

Functions 50 to 54—Reserved CE functions

These functions are reserved.

Function 55–Platform dump override

Use this function to view and change dump policy and override variables. This function is available in manual operating mode when activated by the FSP and when the CE functions have been enabled.

1. Select Function 55 and press Enter to display 55**.
2. Select the function you want to perform (refer to the table below). Use the Increment or Decrement button to scroll to the appropriate function. Press Enter to display 55nn, where nn is the function that you selected.

Table 27. Override of platform dump functions in Function 55

Function	Action or Description
00	View policy override settings
01	Policy: As Needed
02	Policy: Never
03	Policy: Always
04	Content Override - Maximum
05	Content Override - As Required
06	Content Override - Minimum
07	Content Override - Optimum

Functions 56 to 62–Reserved

These functions are reserved.

Low-level debug panel functions

Control panel functions 63 through 99.

You can enable these functions by selecting Manual mode and selecting Functions 25 and 26. The following is a list of all the low-level debug (LLD) panel functions and a description of each.

Function 63–System status SRC trace:

Use this function to view a copy of the first word of the last 25 system status SRCs.

Typically, these are SRCs associated with the IPL sequence or power off sequence.

1. Select Function 63 and press Enter to display 63**.
2. Enter a sub-function between 0x00 and 0x18 to view the SRCs in sequential order, 0x18 being the most recent. Press Enter to display 63nn, where nn is the function that you selected.

Function 64–Diagnostic status SRC trace:

Use this function to view a copy of the first word of the last 25 diagnostic status SRCs.

Typically, these are SRCs associated with problem analysis and main store dump.

1. Select Function 64 and press Enter to display 64**.
2. Enter a sub-function between 0x00 and 0x18 to view the SRCs in sequential order, 18 being the most recent. Use sub-functions 0x19 and 0x1A to read extended SRC data associated with SRC 00x18. Press Enter to display 64nn, where nn is the function that you selected.

Function 65: Deactivate remote service:

Use this function to deactivate a remote service session.

This function is available in manual operating mode when activated by the OS.

Function 66: Activate remote service:

Use this function to activate a remote service session.

This function is available in manual operating mode when activated by the operating system.

Function 67: Disk unit IOP reset/reload:

Use this function to initiate an I/O processor dump and a disk unit I/O reset/reload.

This function is available in manual operating mode when activated by the OS. This function is enabled only when the I/O processor of a displayed SRC supports a reset/reload function.

Function 68: Concurrent maintenance – power off:

Use this function to power off power domains to affect concurrent replacement of IOPs and IOAs.

This function is available in manual operating mode when activated by the OS.

Function 69: Concurrent maintenance – power on:

Use this function to power on power domains to change concurrent replacement of IOPs and IOAs.

This function is available in manual operating mode when activated by the OS.

Function 70: IOP dump:

Use this function to initiate IOP dumps. This function is available in manual operating mode when activated by the OS.

This function is available in manual operating mode when activated by the OS.

Functions 71 to 99–reserved:

These functions are reserved.

System reference code information

System reference codes (SRCs) are a sequence of data words (codes) that can help identify system status, describe a failure (for example, hardware, Licensed Internal Code, or software), and identify the failing unit and its location.

SRCs can display on the control panel, appear in a system console message, or appear in the product activity log. For details, see “Product activity log” on page 72. For details about how SRC information displays on the control panel, see “SRC formats” on page 119.

The system uses the following procedure to gather information about errors:

1. The system gathers information about an error as the system detects the error.
2. The product activity log (PAL) records and stores the error information.

3. An SRC encodes information used to evaluate or identify a system-detected hardware or software error, failure, or status. The failure information may include the failing condition or part (or unit) that can be exchanged or replaced and its location.
4. The SRC links to the problem determination procedure when the element detecting the failure cannot isolate the failing condition.
5. The SRC link completes the isolation process.

In summary, the SRC provides the first-failure-data-capture information. The customer or support representative uses SRCs during problem determination, repair actions, and verification. The SRC provides a link to the problem determination procedures (hardcopy or softcopy). Use the SRC and the problem determination procedures to isolate the problem.

SRC formats

SRC formats describe the SRC record structure.

The control panel automatically displays the first word of the SRC and the extended word 1 data in Function 11 when the panel shows an SRC (see “Word 1 - SRC general information” on page 120). You can select other SRC words (Functions 12 through 19) by using the control panel Increment (↑), Decrement (↓), and Enter buttons. Some portions of the SRC might not contain data. SRC records vary in length (up to 36 bytes for words 1 through 9 and there may be up to 24 bytes of extended word 1 data) and display as described in the following sections.

SRC records show with a -3 next to the function number in the Function/Data display on System Units (for example, 11-3 xxxx xxxx).

The SRC record structure provides information about the machine at the time of the failure.

The control panel can display up to four words at a time. The first word of the SRC can consist of ASCII or hexadecimal characters. The other eight words of the SRC consist of hexadecimal data. Function 11 displays the first word of the SRC, which can contain 8 to 32 characters (expanded word 1). In the product activity log (PAL) and other software displays, the SRC appears much like it does for earlier releases, except for the possibility of word 1 containing up to 32 characters. Words display as a number from 1 to 9 instead of Function 11 to 13, thus disassociating the word number from the function number. Refer to “Product activity log” on page 72 for more information on the PAL and SAL. Refer to Table 28 to see the SRC format.

Example SRC record structure

Table 28. Example SRC record structure

SRC word or FRU call-out data	Control panel function	Display characters	Format	Description
1	11	1-8	Axxx uuuu Bxxx uuuu	uuuu = unit reference code If any of these SRCs appears in a serviceable event view or in the control panel, the operator or service provider must take some action.
1	11	1-8	Cxxx uuuu Dxxx uuuu	uuuu = unit reference code Initial program load (IPL) progress codes.
1 – extended SRC information	11	9-32	text	Additional text about the failure. This text varies by SRC.

Table 28. Example SRC record structure (continued)

SRC word or FRU call-out data	Control panel function	Display characters	Format	Description
2	12	1–8	MIGVEPff	See “Hardware SRC formats” on page 124 for details.
3	12	9–16	Hexidecimal data	Varies by SRC format. See “Hardware SRC formats” on page 124 for details.
4	12	17–24		
5	12	25–32		
6	13	1–8		
7	13	9–16		
8	13	17–24		
9	13	25–32		
Replacement priority	14–19	1–2	Hexidecimal data	FRU call-out data. Displays the replacement priority, part number, part type, and location code.
Part number	14–19	3–9		
Part type	14–19	13–16		
Location code	14–19	17–32		

Note: Select Function 20 to display machine type, model number, and processor feature code.

Word 1 - SRC general information

Word 1 is the 8-digit SRC. The SRC includes a 2-byte unit reference code (URC) and variable length configuration and supporting data.

The URC is located in the second half of Word 1 of the SRC. This SRC (including the URC) is used during problem analysis. You can identify the type of SRC record by the first digit in Word 1 using Table 29 on page 121.

The type of SRC can be identified by the first digit in the function 11 data display as follows:

Function display	Description
11 0xxx xxxx to 11 9xxx xxxx	Hardware reported error.
11 Axxx xxxx	Attention or action required. The system is waiting for a user action, or the system is making the user aware of an event or condition that does not need any user action. Examples: <ol style="list-style-type: none"> 1. This type of SRC is displayed on a tape IPL if the tape unit is not ready. This requires user action. 2. This type of SRC is displayed when on demand resource allocations have timed out. This does not require user action.
11 Bxxx xxxx	Machine check or internal error detected by Licensed Internal Code. A Licensed Internal Code component detected a system error. The problem could be failing hardware or software. Follow the unit reference code tables.

Function display	Description
11 Cxxx xxxx	IPL status. Status SRCs are displayed to indicate the progression of the IPL. These values can be: <ul style="list-style-type: none"> • C1xx xxxx service processor • C2xx xxxx partition IPL • C3xx xxxx system processor • C5xx xxxx Licensed Internal Code system hardware initialization • C6xx xxxx Licensed Internal Code • C7xx xxxx Server firmware • C9xx xxxx IBM i Operating System • CAxx xxxx Partition firmware • Dxxx xxxx Diagnostic or power down status
11 Dxxx xxxx	General system status. Status SRCs are displayed to indicate the status of system functions when the console is not available. Some of these functions are main storage dump or delayed power off. Note: x = any hexadecimal number

Table 29. General SRCs

Problem	SRC	Description
Machine problems	1xxx xxxx	Problem reported by system power control network
	2xxx xxxx through 9xxx xxxx	Hardware machine check, usually IO related
	A1xx xxxx	Service processor reference (error) codes
	A2xx xxxx	Logical partition reference codes
	A6xx xxxx	Licensed Internal Code reference codes
	A7xx xxxx	Platform Licensed Internal Code reference codes
	A9xx xxxx	Reference codes
	AAxx xxxx	Partition firmware reference (attention) codes
	B001 xxxx - B002xx xxxx,	Reference codes
	B003 xxxx	Asynchronous communications reference codes
	B004 xxxx - B005 xxxx	Reference codes
	B006 xxxx	IOP common code
	B008 xxxx - B010 xxxx	Reference codes
	B013 xxxx - B015 xxxx	Reference codes
	B017 xxxx - B022 xxxx	Reference codes
	B025 xxxx - B026 xxxx	Reference codes
	B028 xxxx	Reference codes
	B030 xxxx	Reference codes
	B038 xxxx	Reference codes
	B040 xxxx	Reference codes
	B045 xxxx	Reference codes
	B070 xxxx	Reference codes
	B075 xxxx	Workstation adapter console reference codes
B1xx xxxx	Service processor	
B2xx xxxx	LPAR error conditions	
B6xx xxxx	Licensed Internal Code machine check and LPAR configuration machine check	
B7xx xxxx	Platform Licensed Internal Code reference codes	
B9xx xxxx	Operating system machine check	
BAxx xxxx	Partition firmware reference (error) codes	
Operator intervention	A1xx xxxx	Operation interruption by service processor
	A2xx xxxx	Logical partition reference codes

Table 29. General SRCs (continued)

Problem	SRC	Description
IPL status	A6xx xxxx	Operation intervention by Licensed Internal Code
	A7xx xxxx	Licensed Internal Code reference codes
	A9xx xxxx	Operation interruption by operating system
	AAxx xxxx	Partition firmware reference (attention) codes
	C1xx xxxx	IPL status for the service processor
	C2xx xxxx	General status for normal LPAR power on
	C3xx xxxx	IPL status for the system processor
	C5xx xxxx	IPL status for system hardware initialization
	C6xx xxxx	IPL status for Licensed Internal Code
	C6xx 4400	Automatic main storage dump recovery (IPL) status
	C6xx 441x	Automatic power failure recovery (IPL) status
	C6xx 4500 through 4509	DST IPL status
	C700 xxxx	Server firmware IPL status progress codes
	C9xx xxxx	IPL status for IBM i operating system program.
General status	CAxx xxxx	Partition firmware progress codes
	D1xx xxxx	General status for the service processor
	D6xx xxxx	General status for Main Storage Dump Manager, Licensed Internal Code run-time status, or Licensed Internal Code power off

Word 2 - System status information

Word 2 provides a fixed location for information common to all SRCs shown on the control panel.

Word 2 is available for all SRC formats except power and control panel. The service processor provides this information at the time the SRC is displayed to the panel.

Notes for status indicators listed below:

1. For the coding of **M**, Main storage dump indicator, see “Main Storage Dump Indicator (M).”
2. For the coding of **I**, IPL state indicator, see “IPL State Indicator (I)” on page 123.
3. For the coding of **G**, IPL type last initiated indicator, see “IPL Type Last Initiated Indicator (G)” on page 123.

Main Storage Dump Indicator (M):

This topic provides information about storage dump status.

The first hexadecimal digit that is displayed in Word 2 indicates whether the system started a main storage dump and if it was successful. The indicator has the following meanings:

M	Description
0	Dump was not initiated
1	Debug data exists, destructive data only
2	Debug data exists, main storage only
3	Debug data exists, main storage and destructive data only
4	Debug data exists, partial dump (hardware data only)
5	Debug data exists, hardware and destructive data only
6	Debug data exists, full dump (main storage and hardware data)
7	Debug data exists, extended dump (main storage, hardware data, and destructive data)

- 8 Debug data exists; dump failed after writing segment identifier (SID) 82 to disk
- 9 No debug data exists, destructive data access failed
- A No debug data exists, main storage dump failed
- B No debug data exists, destructive and main storage access failed
- C No debug data exists, partial dump failed
- D No debug data exists, hardware dump failed
- E No debug data exists, full dump failed
- F No debug data exists, extended dump failed

IPL State Indicator (I):

Indicates how far the IPL continued before the system displayed the SRC.

The second digit that is displayed in Word 2 indicates how far the IPL continued before the system displayed the SRC. The indicator has the following meanings.

Hex Digit

Hex Digit	IPL State Description
0	Service processor IPL from start-up code in progress
1	IPL from random access memory (RAM) is running
2	Service processor task initialized
3	Licensed Internal Code initialization completed
4	Operational load of Licensed Internal Code is complete
5	Bus manager initialized
6	Main Storage initialization is complete
7	Load Source DASD connection established
8	Dedicated Service Tool (DST) or limited paging available
9	Storage management directories verified
A	Authority structures verified
B	Indexes verified
C	Database verified
D	Licensed Internal Code hand-off to operating system
E	IPL is complete to sign on display
F	Power down attempted

IPL Type Last Initiated Indicator (G):

The third hexadecimal digit that Word 2 displays indicates the IPL type (IPL mode and environment) of the last IPL performed, or the IPL running at the time of the failure.

The IPL type is coded as shown in Table 30.

Table 30. IPL type indicator

	IPL Type A	IPL Type B	IPL Type C	IPL Type D
Power-on IPL	A	B	C	D

Table 30. IPL type indicator (continued)

	IPL Type A	IPL Type B	IPL Type C	IPL Type D
Programmed IPL	1	2	3	4
Function 3 IPL	5	6	7	8
MSD IPL	9	E	F	N/A
Unknown IPL type (service processor has been reset)	0	0	0	0

Power-on IPL

Includes the IPL that occurs automatically when someone turns on the main power switch or starts power after a power failure. It also includes an IPL started by the timer and a remote IPL started by a communication line.

Programmed IPL

An IPL that results from the PWRDWN SYS command with Restart=Yes*FULL specified.

Function 3 IPL

Uses the selected IPL options to load the system. It is started by selecting function 03 on the control panel and pressing Enter.

Note: Selecting IPL type A or B (type C is reserved) with Function 02 causes an IPL from different areas on the load source DASD. IPL type D is from the alternative load-source device, such as a tape or optical device.

System reference codes

This topic provides information about system reference codes.

1. For information about IPL status SRCs, see “IPL status SRCs” on page 127.
2. For details about SRCs, see the management console.

Displaying system reference codes

This topic provides information about displaying system reference codes (SRCs).

Note: This information does not list all SRCs.

Table 29 on page 121 shows how SRCs are grouped. The SRC is a variable length structure.

The SRCs are displayed as a sequence of words that may be displayed by selecting different control panel functions. Function 11 is shown automatically when an SRC is shown. You may select additional functions through function 20 by using the Increment/Decrement (↑ ↓) switches and the Enter button. There is also an option to include reference code details from the Work with Partition Status display. You can also select SRC history option from the Display Partition Info menu.

System reference code format descriptions:

The format of the system reference code (SRC) depends on the system or server.

For details about SRCs, see the management console.

Hardware SRC formats:

List of SRC format examples.

Notes:

1. Other formats exist; if necessary contact your next level of support.

2. For more information on formats 60–63, see “Licensed Internal Code detected problem reference code formats” on page 126.

Table 31. SRC format examples

SRC Word Number	Panel function, digits x to y (from left to right)	IOP SRC format 13	IOP SRC format 17	Device SRC format 27	IOP detected a failure format 29	LIC ¹ SRC format 60	LIC ¹ SRC format 61	LIC ¹ SRC format 62	LIC ¹ SRC format 63	LIC ¹ SRC format 72
1	11, 1-8	TTTT RRRR	TTTT RRRR	tttt rrrr	B0XX RRRR	A6xx RRRR	B6xx RRRR	B6xx RRrr or B7xx Rrrr	A600 RRRR	B7xx RRRR
2	12, 1-8	MIGV EP13	MIGV EP17	MIGV EP27	MIGV EP29	MIGV EP60	MIGV EP61	MIGV EP62	MIGV EP63	MIGV EP72
3	12, 9-16	BBBB Ccbb	BBBB Ccbb	BBBB Ccbb	BBBB Ccbb	PPPP 0000	cccc cccc	cccc cccc	AAAA BBBB	cccc cccc
4	12, 17-24	aaaa aaaa	aaaa aaaa	aaaa aaaa	SAPP UUFF	BBBB Ccbb	pppp pppp	pppp pppp	CCCC DDDD	pppp pppp
5	12, 25-32	TTTT LMMM	TTTT LMMM	tttt lmmm	TTTT FMMV	aaaa aaaa	qqqq qqqq	qqqq qqqq	EEEE FFFF	qqqq qqqq
6	13, 1-8	uuuu uuuu	tttt lmmm	TTTT LMMM	tttt lmmm	tttt mmmm	qqqq qqqq	qqqq qqqq	GGGG HHHH	qqqq qqqq
7	13, 9-16	uuuu uuuu	ZZZZ rrrr	ZZZZ RRRR	zzzz rrrr	ssss ssss	0000 0000	BBBB Ccbb	JJJJ KKKK	dddd dddd
8	13, 17-24	uuuu uuuu	ssss ssss	ssss ssss	0sss ssss	NNNN 0000	0000 0000	TTTT MMMM	TTTT 0MMM	TTTT MMMM
9	13, 25-32	uuuu uuuu	uuuu uuuu	uuuu uuuu	uuuu uuuu	0000 0000	0000 0000	0000 0000	SSSS SSSS	0000 0000

Note:
1. Licensed Internal Code

Table 32. SRC format examples (continued)

SRC format	Description
AAAA	Type of I/O Bus (see Logical address format — field 'A').
aaaa	Unit address.
BBBB	System Bus Number (see Logical address format — field 'B').
BBBBCcbb	Bus, bus, bus, bus, card, card, and board, board address (Direct Select Address or DSA). <ul style="list-style-type: none"> For PCI system buses 0001-0003 and 0018-FFFF the Cc field is a one digit multi-adapter bridge number and a one digit multi-adapter bridge function number. For SPD system buses 0004-0017 the Cc field is a two digit card number.
CCCC	System Board Number (see Logical address format — field 'C').
cccc cccc	Component reference code. Format 62 varies by component.
DDDD	System Card Number (see Logical address format — field 'D').
dddd dddd	Dynamic reconfiguration connector (DRC) index.
EEEE	(see Logical address format — Unit Address type — field 'E').

Table 32. SRC format examples (continued) (continued)

SRC format	Description
FFFF	(see Logical address format — Unit Address type — field 'F').
GGGG	(see Logical address format — Unit Address type — field 'G').
HHHH	(see Logical address format — Unit Address type — field 'H').
JJJJ	(see Logical address format — Unit Address type — field 'J').
KKKK	(see Logical address format — Unit Address type — field 'K').
LMMM	Level indicator plus 3" digit model number (for example, 0001).
lmmm	Level indicator plus 3" digit model number of failing device.
0MMM	Model number of failing device (i.e. MMM='001').
MIGV EP	General system status.
NNNN	Number of disk device facilities that are missing.
PPPP	Cause code.
pppp pppp	Programming reference code.
qqqq qqqq	Programming reference code qualifier.
RRRR	Unit reference code (URC).
rrrr	Outboard failing unit reference code (URC).
SAPP UUFF	Unit address.
SSSSSSSS	System Reference Code — this SRC is used to determine why the primary console failed to respond.
ssss	Serial number of failing unit.
TTTT	Type number or card identification number (hex).
tttt	Outboard failing unit type number (i.e. 6607).
uuuu	Unit-specific data.
ww	SRC type.
ZZZZ	Reserved.

Licensed Internal Code detected problem reference code formats:

List of reference code formats.

Formats 60–63 in Table 1. SRC format examples represent the formats for Licensed Internal Code SRCs.

- Format 60 is used for Licensed Internal Code Attention SRCs.
- Format 61 is used when Licensed Internal Code detects a Licensed Internal Code programming problem.
- Format 62 is used when Licensed Internal Code detects an IOP Bus or IOP programming problem.

RRRR Licensed Internal Code *unit reference code* (URC).

cccc Licensed Internal Code *Component Reference Code* (CRC). Identifies the Licensed Internal Code component and subcomponent that generated the SRC.

pppp Licensed Internal Code *Program Reference Code* (PRC). Identifies the Licensed Internal Code class or component that generated the SRC and the specific error detected.

qqqq Licensed Internal Code *Program Reference Code Qualifier*. SRC words found at functions 15-3 through 19-3 or 15-3 and 16-3, depending on the format, provide additional error isolation information that is specific to the Program Reference Code. One or more of these words may be

'0000 0000'. *Format 61* has up to 5 words of PRC Qualifier, in words 5-9. The PRC determines the *number* of PRC qualifier words. The *content* of words 5-9 is dependent on the value in word 4. *Format 62* has the PRC qualifier ONLY in words 5-6; there is physical address and type information in words 7-9.

BBBB Ccbb

Bus/Card/Board identifiers of failing component (direct select address)

@@@@ Unit address

ssss Serial number of failing unit

TTTT Type number or card identification number of failing component (hex 2xxx through 9FFF). May be 0000, if system data is not available at the time the SRC is signaled.

ZZZZ Reserved

mmmm

Model number of failing component (hex 2xxx through 9FFF). May be 0000, if system data is not available at the time the SRC is signaled.

CCCC Cause code

NNNN

Number of disk device facilities missing

MIGV EP

General system status (see "System reference code information" on page 118 for more information.)

x Any hexadecimal number

Notes:

1. For information about Function 11 and 12, refer to "System reference code information" on page 118.
2. Format 60 may contain data in a format other than that shown. Format 60 is an old VLIC format, which some new Licensed Internal Code components use. It does not have the component reference code and program reference code that format 61 and 62 have (61 and 62 were specifically defined for the new Licensed Internal Code). Format 60 is mostly component-specific with no key information to indicate format (the developer has to interpret it).

IPL status SRCs

As the system performs an IPL, SRCs appear on the control panel. The SRCs indicate the status of the IPL and are often useful in problem analysis.

Initial program load information

This topic provides initial program load (IPL) information.

Note: You can also use the management console and the Advanced System Management Interface (ASMI) to perform an IPL.

IPL type, mode, and speed options

Set the IPL options from function 02 on the control panel. To permanently change the IPL speed use the CHGIPLA command.

Note: Systems managed by the management console should use the management console to perform control panel functions.

- Use function 01 to display the current IPL option, including IPL speed. This is the option and speed that the system will use at the next IPL.

- Refer to the information in Table 24 on page 115 for speed override definitions.
- Use the HDWDIAG (hardware diagnostics) parameter of the CHGIPLA command to permanently change the IPL speed. The values are: The default shipped value *MIN (minimal) for fast diagnostics and *ALL for all (full) diagnostics.

IPL speed recommendations

- Use CHGIPLA *MIN, or Function 02 F or V=F for most IPLs (to perform a fast IPL that uses minimum diagnostics).
- Use CHGIPLA *ALL, or Function 02 S or V=S, if you change hardware or suspect an intermittent hardware failure (to perform a slow IPL that uses all diagnostics).
- Use CHGIPLA *ALL, or Function 02 S or V=S during the first Install IPL. You can set this at the panel with Function 02; it affects only the one IPL because the next IPL will again pick up the value set with CHGIPLA.

For more information about:

- OS IPL types, see Table 22 on page 114.
- Firmware IPL types, see Table 25 on page 115.
- IPL modes, see Table 23 on page 115.
- IPL speeds, see Table 24 on page 115.

Methods to perform IPL

This topic provides information about methods that can be used to perform an IPL.

Table 33. Methods to perform IPL

Methods	Description
POR	<p>Power on reset IPL. The system was powered off and powered on. During the power on, all hardware runs diagnostic tests if the IPL speed is set to slow. If the IPL speed is set to fast, some diagnostic functions will be overridden. For more information on IPL speeds, see IPL type, mode, and speed options.</p> <p>You can perform this IPL from either the control panel or the management console.</p> <p>For information about the control panel, see Control panel functions.</p> <p>For information about using the HMC, see Managing the HMC.</p>
F03	<p>Attention: No system shutdown is performed before the IPL. The use of this function can cause loss of data.</p> <p>Control panel Function 03 starts a Load IPL. This differs from a POR IPL because no power off and power on sequence is done. This means a system shutdown is not performed and not all hardware diagnostics are performed during the IPL. Input-output processors (IOP) are reset using a software POR equivalent.</p> <p>You can perform this IPL from either the control panel or the management console.</p>
Programmed IPL without parameters	This IPL is started by the operating system. A PWRDWNSYS command with RESTART (*YES) will initiate this IPL.
Remote power on	An unattended IPL is started from a remote location. Normal mode must be selected, the system power must be turned off, and the user must set specific indicators (see the system operation information).
Automatic restart	An unattended IPL is started automatically after a power failure. Normal mode must be selected and the user must set specific indicators (see the system operation information).
Power on by date/time	This IPL is started by an internal clock. Normal mode must be selected and the user must set specific indicators (see the system operation information).

Alternate installation IPL

This topic provides information about how to enable an alternative installation IPL.

To enable an alternate installation IPL, select the dedicated service tool (DST) option to *Work with alternate installation device*; see “Work with dedicated service tools environment” on page 24 or “Work with alternate installation device” on page 28. This option is available in DST from control panel function 21 or a type D IPL.

Platform IPL sequence

This topic provides information about the steps for initial program load.

The IPL consists of the following steps:

1. Service processor's performing power-on tests and loading the system processor
2. Platform Licensed Internal Code initialization
3. If the system is partitioned, platform Licensed Internal Code loads the partition's SLIC code
4. Licensed Internal Code (system) initialization
5. Installing or starting the operating system program

For information on IPL status SRCs, see “IPL status SRCs” on page 127.

Service processor initialization

The service processor runs on its own power boundary and continually monitors hardware attributes and the environmental conditions within the server.

Functions performed

The service processor runs on its own power boundary and continually monitors hardware attributes and the environmental conditions within the server. The service processor is controlled by firmware and does not require an operating system to be running to perform its tasks.

When external power is applied to the system, the service processor is activated. The service processor does the following:

- Runs diagnostic routines to verify its hardware and firmware.
- Gathers vital product data (VPD) from the electronic components in the server.

When the service processor has successfully completed these tasks, it is in the standby state. The control panel displays 01. You can now power up the server.

When you power on the server using the power button on the control panel, the Advanced System Management Interface (ASMI), or the management console the service processor turns on the system power. The service processor does the following:

- Runs diagnostic routines to verify the operation of the system processor and system memory.
- Verifies that it can communicate with the environmental sensors and monitors in the system.

When the service processor completes these diagnostics, it turns control over to a system processor. Server firmware starts executing on the system processor.

Abnormal ending

The service processor ends an IPL when a condition is detected that prevents the base machine from functioning. If an IPL stops, an SRC appears on the control panel, and the system attention light goes on. The SRC indicates the failing condition.

Licensed Internal Code initialization

This topic provides information about Licensed Internal Code initialization.

Functions performed

The following list is a high-level description of the functions that are performed by Licensed Internal Code during an initial program load (IPL):

1. Licensed Internal Code sets the internal processing unit registers and arrays.
2. When the initialization is complete, Licensed Internal Code signals the service processor of the event.
3. Licensed Internal Code enters the disabled state (task dispatcher is disabled). After the service processor starts the processing unit, the earlier constructed queue is made ready. The Licensed Internal Code then does its normal work-time functions.

See "IPL status SRCs" on page 127 for information that is displayed on the control panel during an IPL.

Abnormal ending

Licensed Internal Code ends an IPL when a condition is detected that prevents the machine from doing work. The service processor sends the correct SRC to the control panel.

Conditions that cause Licensed Internal Code initialization to fail are:

- Licensed Internal Code hangs (loops or waits), causing a Licensed Internal Code initialization time-out. The processor gives control to the service processor which, in turn, ends the IPL.
- Licensed Internal Code that is not compatible with the control storage.

Some of the Licensed Internal Code is in main storage in an area that is known as the Licensed Internal Code overlay area. If this code is not compatible with resident code in control storage, the IPL might end during the Licensed Internal Code initialization phase.

- Bad data on file.

If bad data is not detected when read from the file but is detected by the Licensed Internal Code initialization routine, the IPL ends with an SRC. If bad data is on the file, use the *Main storage dump manager* option from the Start a Service Tool display under DST to save the main storage dump to removable media. You must install the Licensed Internal Code again to correct this problem. If the system does not complete an IPL after initializing the Licensed Internal Code again, the Licensed Internal Code tape is bad.

- Hardware errors.

If hardware errors occur during the Licensed Internal Code initialization step, the IPL ends. If the hardware error is associated with the file, you might need to install the Licensed Internal Code again.

At any point in the Licensed Internal Code initialization phase, errors that end machine processing during an IPL can occur. If this occurs, indicators are set to the data function. The machine check error log buffer, Licensed Internal Code log, or the product activity log contain information about the condition that caused the ending.

Initialization output

The output that is created when the Licensed Internal Code is initialized consists of the following:

- Machine status information saved in the machine initialization status record (MISR).
- Status codes for an initial program load displayed on the control panel for long-running IPL functions.
- Product activity log and Licensed Internal Code log information that service personnel need to service the machine.

Data descriptions

- Preceding stopped data
- Bad page table

Log entries:

Logging is a function of Licensed Internal Code and starts during Licensed Internal Code initialization.

Logging is a function of Licensed Internal Code and starts during Licensed Internal Code initialization. Licensed Internal Code parts (see “Licensed Internal Code” on page 132) send log records to the product activity log. Licensed Internal Code input/output managers do much of the error machine check controlling.

The IOPs also have the ability to send data into the product activity log. Log records from the IOPs are processed by the Reliability Availability Serviceability (RAS) Focal Point Common Class I/O Manager Task in Licensed Internal Code. The following are the types of log entries from the IOP:

Asynchronous log report

This is a bus-level record that is used when the I/O processor has detected a critical failure. The asynchronous log report is used when the IOP cannot communicate with Licensed Internal Code or the service processor.

Log notification record

This is a log record that is reported to the system from the IOP after the RAS connections have been set up.

Log information record

This is an information-only record that is reported to the system after the RAS connections have been set up. The information records (statistics) are logged as product activity log information.

The following list describes the attributes of the product activity log:

- Permanent errors that do not stop the system
- Machine check data when available on the next IPL (if power was not switched off before doing the next IPL)
- Any temporary errors necessary for problem analysis
- Data in multiple formats
- RAS error information and bus level asynchronous log report
- Device driver reported records
- Some dumps and trace data
- Volume information (statistics) data records

A formatted printout of the product activity log records is available by using the *Product activity log* option from the Start a Service Tool display under dedicated service tools (DST).

Status SRCs

Status system reference codes (SRCs) indicate the current state of the system for informational purposes.

Status SRCs appear on the system or partition control panel during the following processes:

- System IPL
- DST functions (local or remote)

- Dump functions
- System power-down

For more information on specific status SRCs, see “IPL status SRCs” on page 127.

Licensed Internal Code

Lists various fixes and PTF packages.

Fixes and cumulative PTF packages

Between code releases, problems that are found with the code are fixed with program temporary fixes (PTFs).

The term PTF can refer to a Licensed Internal Code, an operating system, or other IBM licensed program fix. Because some PTFs repair problems that might appear to be hardware failures, your actions with PTFs are important for both the customer and for IBM. It is often difficult to tell the difference between a hardware failure and a code problem that is fixed by a PTF.

For information on obtaining updates to your server firmware, management console machine code, and IBM i operating system, refer to the following:

- For information about server firmware fixes, see *Managing the HMC*.
- For information about updating machine code on the HMC, see *Installing and configuring the HMC*.
- For information about updating your IBM i operating system, see *Getting operating system fixes for IBM i*.

The customer is responsible for maintaining fixes to Licensed Internal Code and the operating system.

Some PTFs fix problems that might appear to be hardware failures. *Always ensure that the recommended PTFs are applied before you exchange hardware.*

Cumulative PTF packages

Cumulative PTF packages contain fixes for a given release of the IBM i operating system and associated licensed programs. You should install the entire cumulative PTF package after you first load or reload the operating system and periodically throughout the release as defined in your maintenance strategy.

PSP listings

Obtain information about preventive service planning (PSP) by contacting the customer's software service provider.

Before generating a Licensed Internal Code APAR, ask your next level of support to screen the APAR and enter the symptoms of the problem into the service support system.

Licensed programs

Licensed programs are represented by names in the form xxxxyyy, where xxxx is the base operating system software and yyy is a unique, 3-character alphanumeric identifier.

Displaying Licensed Internal Code fixes

You can use the system service tools, dedicated service tools, or the management console to determine the Licensed Internal Code fixes that are on the system.

To determine the operating system fixes that are on the system, see “Displaying IBM i PTFs” on page 180.

Use the system service tools (SST) to display Licensed Internal Code (server firmware) fixes. If it is not available, use the dedicated service tools.

Note: You can also use the management console if your system is managed by an management console.

Using SST to determine the Licensed Internal Code level

1. Type STRSST at a command line and press Enter. The Start Service Tools (SST) Sign On display is displayed.
2. Type in your user ID and password and press Enter.
3. Select **Start a Service Tool**.
4. Select **Display/Alter/Dump**.
5. Select **Display/Alter storage**.
6. Select **Licensed Internal Code (LIC) data**.
7. Scroll down and select **Advanced analysis**.
8. Scroll down and select **FLASHLEVELS**.
9. When the Specify Advanced Analysis Options screen is displayed, press Enter.
The PTFs for server firmware updates are displayed with the Licensed Internal Code product (5722999) and begin with the prefix MH. For example, MHnnnnn where nnnnn is the number associated to the specific server firmware fix.

Note: During the normal shut down of the service partition, the IBM i operating system verifies that the firmware level on the service processor is at the same level as the IBM i operating system firmware load source (PTF level). If they are different, then the firmware is updated. This process is known as LS Flash Synching (Firmware Load Source to Fsp Flash synchronization).

Using DST to determine the Licensed Internal Code level

1. Access DST. For details, see “Accessing dedicated service tools” on page 3.
2. Select the *Work with Licensed Internal Code* option from the *Use Dedicated Service Tools (DST)* display.
3. Select the *Display Licensed Internal Code* option.
4. Select the *Fix information* option.
5. Select F4 (Prompt) to display a list of Licensed Internal Code fixes. The status information is displayed (pending, or applied permanently or temporarily).
6. To display detailed information about a specific fix, use the *Select* option.

Note: To display PTF requirements, supersede information, and dependent fix information, use the function keys on the *Display Fix Information* display.

Utilities to install and restore IBM i Licensed Internal Code

Before performing problem analysis for Licensed Internal Code, ensure that the latest level of Licensed Internal Code is on your system.

To verify that the customer has the latest Licensed Internal Code fixes applied, perform one of the following:

- If the latest cumulative PTF package is applied, you can assume that the latest Licensed Internal Code fixes are on your system. To view a list of the cumulative PTF packages that are installed on your system, see “Displaying IBM i PTFs” on page 180.
- To view a list of the Licensed Internal Code fixes that are installed on your system, display the information about Licensed Internal Code fixes from DST. For more information, see “Displaying Licensed Internal Code fixes” on page 132. The first entry that is displayed is the latest.

For more information about fixes, see “Fixes and cumulative PTF packages” on page 132.

For information about fixes for the Hardware Management Console (HMC), see Installing and configuring the HMC.

For information about server firmware fixes, see Managing the HMC.

Utility to install Licensed Internal Code

Installing the Licensed Internal Code erases all information on the load-source disk unit, makes the data on the remaining disk units (including customer data) inaccessible, and copies the Licensed Internal Code from removable media to the load-source disk.

Installing the Licensed Internal Code erases **all** information on the load-source disk unit, makes the data on the remaining disk units (including customer data) inaccessible, and copies the Licensed Internal Code from removable media to the load-source disk.

The system disk units might not be accessible because data is arranged over multiple drives on the system. After you complete the install procedure, consider the customer data destroyed. The customer can install the operating system and the system data from removable media after you complete the install procedure. **To exchange the Licensed Internal Code without destroying customer data**, see “Utility to restore Licensed Internal Code” on page 135.

Use this utility to install Licensed Internal Code when one of the following occurs:

- The load-source disk has been replaced.
- The system does not contain customer data and Licensed Internal Code.
- The instructions for a new Licensed Internal Code release specify that you cannot use the restore Licensed Internal Code utility.

The system Licensed Internal Code might be on the customer's system save media, the IBM distribution IBM Software Manufacture and Delivery (ISMD) media, or the Licensed Internal Code save media.

Notes:

1. If there is a set of distribution or save media, start the installation with the first tape or optical device.
2. If the console is not powered on, SRC A600 500x is displayed. Power on the display, then select Function 21 on the control panel to make DST available.
3. The Licensed Internal Code level (with the PTFs applied) is returned to the level supported at the time the media was saved.
4. If you use Volume 1 of the IBM distribution media, you do not apply any PTFs. The operating system reflects that no Licensed Internal Code PTFs have been applied. For more information on PTF levels, see “Displaying Licensed Internal Code fixes” on page 132.

While this utility is running, the control panel displays SRCs until DST becomes active. After DST is active, the displays on the console prompt the user and show the install status.

Installing Licensed Internal Code

1. Perform steps 1 through 9 of the alternate IPL to DST procedure. For details, see Performing an alternate IPL to DST (type D IPL).
2. Select the *Install Licensed Internal Code* option on the Install Licensed Internal Code display.
Attention: The *Install Licensed Internal Code and Initialize System* option destroys all data on the system, including customer data. Select the *Install Licensed Internal Code and Initialize System* option from the Install Licensed Internal Code display.
3. When the Install Licensed Internal Code - Confirmation display appears, press F10 to continue.

Note: A series of displays appears on the console throughout the process to show the installation status. User intervention might be required.

4. The system automatically performs a disk IPL and the Install the Operating System display appears. To install the operating system, select the *Continue installing the operating system* option. See the system operation information for details about how to install the operating system.

Note: When the procedure is complete, remove the media from the removable media unit.

This ends the procedure.

Utility to restore Licensed Internal Code

Install the new Licensed Internal Code in place of the system's existing Licensed Internal Code without losing customer data already on the system.

Restoring Licensed Internal Code completely exchanges all Licensed Internal Code with a new level of code. The **Restore Licensed Internal Code** option copies all system Licensed Internal Code from media and puts it on a disk.

Select this utility to do the following:

- Install the new Licensed Internal Code in place of the system's existing Licensed Internal Code **without losing customer data** already on the system.
- Update a system's Licensed Internal Code to a new release.
- Reinstall Licensed Internal Code when DST is not operational.

The system Licensed Internal Code might be on the customer's system save media, the IBM distribution (ISMD) media, or the Licensed Internal Code save media.

Notes:

1. If there is a set of distribution or save media, start the installation with the first tape or optical device.
2. The Licensed Internal Code level (with the PTFs applied) is returned to the level supported at the time the media was saved.
3. If you use Volume 1 of the IBM distribution media, you do not apply any PTFs. The operating system reflects that no Licensed Internal Code PTFs have been applied. For more information on PTF levels, see "Displaying Licensed Internal Code fixes" on page 132.

Restoring Licensed Internal Code

1. Perform steps 1 through 8 of the alternate IPL to DST procedure (see Performing an alternate IPL to DST (type D IPL) for instructions).
2. Select **Install Licensed Internal Code** option from the Install Licensed Internal Code display.
3. The **Install Licensed Internal Code and Initialize System** option *destroys* all data on the system, including customer data. Be sure to select the **Restore Licensed Internal Code** option from the Install Licensed Internal Code display. Select the **Restore Licensed Internal Code** option from the Install Licensed Internal Code display.

Note: Displays appear on the console throughout the process to show the restore status. User intervention might be required.

The system automatically performs a disk IPL and the IPL or Install the System display appears.

4. To install the operating system, select the **Install the operating system** option. See the system operation information for details about how to install the operating system.

Note: When the procedure is complete, remove the media from the alternate IPL unit.

This ends the procedure.

Authorized program analysis report

You can submit problem analysis report.

Report problems in the system program or code to IBM. When you find a problem with the Licensed Internal Code, you can submit a Licensed Internal Code authorized program analysis report (APAR). Program problems are tracked using an APAR. An APAR is a request for the correction of a program defect. Because operating system and Licensed Internal Code fixes might solve program and Licensed Internal Code problems, perform the procedures in “IBM i or Licensed Internal Code APAR” on page 180 before submitting the report.

System architecture and configuration

Provides information about the system architecture and configuration.

System power overview

Provides information about the system power.

Power supply

This topic provides power supply descriptions.

Power is supplied by one or more power supplies. Each power supply provides all the voltages that are needed in the system. Two or more installed power supplies provide redundancy and allows power supply replacement with the system powered on.

Battery power unit

The battery power unit provides temporary auxiliary power to the expansion unit in the event of an ac power loss.

The battery power unit is available on the 5074 I/O expansion unit. It provides temporary auxiliary power to the expansion unit in the event of an ac power loss.

System power control network

Problems that are detected by the system power control network (SPCN) are reported to the operating system and logged.

The SPCN is a concept of power distribution and control for the IBM i system. Problems detected by SPCN are reported to the operating system and logged. You can work with the SPCN information by selecting **System Power Control Network (SPCN)** under the hardware service manager function. For more information on how to work with the SPCN information under the hardware service manager, see “SPCN menu flow” on page 137.

SPCN power components

Most power components in a system contain an SPCN node. The SPCN node contains a microprocessor-based controller that controls and monitors the power in that node. The SPCN node functions in the SPCN network and connects the points necessary for controlling power, sending commands, and reporting status.

There is one primary node in a system. All other nodes are secondary nodes.

Primary node

The primary node is located in the system unit and is the controlling node in the network. This node is located on a separate card that is installed in the rear of the system or is part of the backplane in the PCI cage. The primary node is programmed to issue network commands and poll for status from secondary SPCN nodes in the network.

The primary node monitors the status of the power supplies, regulators, and backup power (BBU). The primary node is powered on as long as there is ac power to the frame. It communicates with the operating system by exchanging commands and network status.

The primary node collects command responses and error status from the secondary nodes and formats them for return to the operating system.

Secondary node

The secondary node is a microprocessor-based controller located on a card, or on a backplane.

Each secondary node is programmed to collect unit power status and respond to commands from the primary node. The secondary node also controls the unit's display panel. The following information is displayed on the unit display panel:

- Normal - Type, model, serial number of the unit and type, model, serial number of the power controlling system
- Error - Type, model, serial number of the unit and power reference code

In frames with a PCI system bus, the secondary node is located on a card in the PCI cage, or on the backplane.

SPCN addressing

Each unit in the SPCN network is identified and located by a four-character frame address and a two-character unit address. A frame address is assigned by the primary node or by the operating system and will usually be 3Cxx, where xx is any hex digit. A unit address is fixed and is either 00 or 01.

SPCN menu flow

To work with the SPCN information, select the **System Power Control Network (SPCN)** option under the hardware service manager function.

Note: For more information on hardware service manager, see "Hardware service manager" on page 41.

When you select the **System power control network (SPCN)** option on the Hardware Service Manager display, the first System Power Control Network display shows advisory information. It informs you that there might be a delay before the System Power Control Network main menu display appears. You must press Enter to continue.

The second System Power Control Network display allows you to choose the frame or unit with which you want to work.

Fields on the System Power Control Network display:

The fields on the system power control network display are Opt, Frame, Unit, Type, Serial number, and Fault fields.

Opt

This field allows you to choose to work with the frame or unit components.

The following options are available for the *Opt* field: 5 (Display detail). For details on this option, see Display Detail option.

Frame

This field refers to one of the system frames. The value is the SPCN address.

Unit

The unit value is a 01, 0C, or 00; a unit value of zero indicates a system frame node.

Type

This field shows the product type of the frame or unit.

Serial number

This field shows the serial number of the frame or unit.

Fault

This field indicates whether a power fault currently exists on that frame or unit. You can find information on the fault in either a message to the system operator or a power reference code on the unit.

Display Detail option:

You can select the *Display detail* on the System Power Control Network (SPCN) display to show detailed SPCN information about a frame or unit.

Fields on the Display Detail for Frame display:

The display detail for frame option shows details for a frame, such as alert status, serial number, and so on.

If you select the **Display detail** next to the entry for a frame, the Display detail for frame display appears.

The fields in this display have the following meanings:

Frame This field shows the frame address.

Type This field shows the product type of the frame.

Model This field shows the model number of the frame.

Serial number

This field shows the serial number of the frame.

Load ID

This field shows the load identifier of the frame Licensed Internal Code.

Reference code

This field shows the error code for the frame. Starting with version 4 release 5, this field will always be 0000.

Alert status

This field shows the status of the frame SPCN node.

Extended status

This field provides additional status information for the frame.

AROS part number

This field shows the alterable read-only storage (AROS) part number.

Responding to polls

This field indicates whether the frame is responding to polling requests from the Primary SPCN node. Field values are Yes or No.

Primary frame

This field indicates whether this is the primary frame. Field values are Yes or No.

Power sequence complete

This field indicates whether the frame power sequencing completed. Field values are Yes or No.

Fault This field indicates whether a power or functional fault currently exists. Field values are Yes or No.

UEPO switch

This field indicates whether the unit emergency power-off (UEPO) switch is on or off.

Cable type for connector J15

This field indicates the presence or type of cable. Field values are None, Copper, or Optical.

Cable type for connector J16

This field indicates the presence or type of cable. Field values are None, Copper, or Optical.

Cable type for connector J18

This field indicates whether a cable for connector J18 is present. Field values are Yes or No.

Fields on the Display Detail for Unit display:

The display detail for unit option shows details for a unit, such as alert status, serial number, and so on.

If you select option 5 (Display detail) next to the entry for a unit, the following display appears with detailed information about the unit:

Note: The Display status of regulators function key (F6) on the Display Detail for Unit display is not recommended for service representative use.

The fields in this display have the following meanings:

Frame This field shows the frame address.

Unit This field shows a 1 or C.

Type This field shows the product type of the unit.

Model This field shows the model number of the unit.

Serial number

This field shows the serial number of the unit.

Load ID

This field shows the load identifier of the unit Licensed Internal Code.

Reference code

This field shows the error code for the unit. Starting with version 4 release 5, this field will always be 0000.

Alert status

This field shows the status of the unit SPCN node.

Extended status

This field provides additional status information for the unit.

AROS part number

This field shows the alterable ROS part number.

Battery present

This field indicates whether a battery is present. Field values are Yes or No. The following fields on battery information contain data when the field value is Yes:

Last battery capacity test date

This field gives the date of the last battery test in the format MM/DD/YY.

Last battery capacity test time

This field gives the time of the last battery test in the format HH:MM:SS.

Next battery capacity test date

This field gives the date of the next battery test in the format MM/DD/YY.

Next battery capacity test time

This field gives the time of the next battery test in the format HH:MM:SS.

Power sequence complete

This field indicates whether or not the power sequence is complete. Field values are Yes or No.

Fault This field indicates whether a power or functional fault currently exists. Field values are Yes or No.

High-speed link and remote I/O

High-speed link (HSL), also known as remote I/O (RIO), resources provide the connection between system I/O busses and the system processor.

HSL/RIO resources are normally configured in loops with the system unit having an HSL/RIO controller resource that handles routing of the data between the system processor and the system I/O busses. System I/O busses connect to the loop with HSL I/O adapter or RIO adapter resources. When you view the logical resources of a High Speed Link loop using hardware service manager, you will see:

- *HSL controller resources*, sometimes called local high-speed link network interface controllers (local HSL NICs).
- *HSL controller resources* of other processing units in the RIO loop, called remote high-speed link network interface controllers (remote HSL NICs).
- *HSL loop resources* under the controller listed above the loop.
- *HSL I/O adapter resources* under the loop listed above the adapters.
- The *System bus adapter resources* under the *HSL I/O adapter resources* option. From this level and below, I/O resources appear the same way as they do in the *System bus resources* option from *Display Logical Resources* in the *Hardware Service Manager* menu.

HSL/RIO links consist of these items:

- A port from either the controller or an adapter on the loop.
- An HSL/RIO connection which is either an internal connection or an external HSL/RIO cable.
- A port from either an adapter on the loop or the controller.

Loops start and end on the same port pair of an HSL/RIO controller, for example, the A0 and A1 ports.

When you view an HSL/RIO controller or adapter resource in HSM, you can select *Display detail* option to view the status and information about the links on that resource.

There are two ports on each HSL/RIO resource. The *Leading link* usually refers to the connection between the resource's 0 port to the next HSL/RIO resource on the loop. The *Trailing link* usually refers to the connection between the resource's 1 port to the next HSL/RIO resource on the loop.

In some cases a link is an internal connection in a system unit or expansion unit. In that case the link will be labeled as "internal" and there will not be port label information.

When port pairs are on a system unit they are labeled on the frame as A0 and A1; B0 and B1; and so on, or as -Tx. When port pairs are on an expansion unit they are labeled on the frame as 00 and 01, or as Tx.

Multi-adapter bridge

A multi-adapter bridge is a resource which provides the connection between PCI I/O processors and a system PCI bus under an HSL I/O or RIO adapter.

The bridge controls a set of card positions that are labeled “PCI Bridge Set” on the frames of system units and expansion units. There can be more than one multi-adapter bridge resource connected to a system bus. Each bridge resource operates independently from any other bridge on the system bus and the bridge controls only the card positions in its own PCI bridge set.

Resource names

Communications lines, I/O processors, and devices are system resources. All system resources are identified by a resource name.

To list the system resources, or display and change resource names:

- See “Hardware service manager” on page 41.
- Enter the resources command:
 - WRKHDWRSC

During an IPL, all powered-on resources that do not have a name are assigned a name. The Licensed Internal Code assigns the name according to the order in which the resource reports to the system. The resource name is used for identification (by the Licensed Internal Code) during the next IPL, on displays, in printouts, and during system configuration.

Note: Many system resources are identified by both logical and packaging resource names. The logical and packaging hardware resources have different resource names.

Use the following tables to identify the logical and packaging system resources. For more information on system resources, see “Hardware service manager” on page 41 and “Product activity log” on page 72.

Table 34. Logical resource naming formats

Name	Description	Example
A	Disk (device)	A1
BC	Bus controller	BC01
BCC	Bus controller (expansion adapter)	BCC01
BD	Bus extender driver	BD01
BR	Bus extender receiver	BR01
BUS	Bus	BUS01
CC	Communications IOP	CC01
CEC	System (logical)***	CEC01
CMB	Multiple Function IOP	CMB01
CTL	Workstation I/O adapter	CTL01
DC	Storage controller (disk, tape, optical)	DC01
ERR	Inoperative resource**	ERR01
LIN	Communications IOA	LIN01
LINE	Communications port	CMN01
MP	Main (system) processor	MP01
MS	Main storage card	MS01
OPT	Optical drive	OPT01

Table 34. Logical resource naming formats (continued)

Name	Description	Example
PN	Control panel	PN01
SI	Storage IOP	SI01
SP	Service processor	SP01
T	Tape device (external)	T1
TC	Tape device (internal)	TC
UNK	Unknown resource*	UNK0001
WS	Workstation I/O processor	WS01
See Note	Printer (device)	P1
See Note	Workstation (device)	W1
<p>Note: Names for displays and printers are defined by the user as any two characters.</p> <p>* An unknown resource (UNK) is one that is assigned to an I/O processor that is not operational, or to a device that the operating system does not recognize.</p> <p>** An inoperative resource (ERR) is one that is not operational. Full vital product data might not be provided.</p> <p>*** A system resource (CEC) is a collection of all logical resources that are attached to the processor. It also indicates the type, model, and serial number of the system.</p>		

Table 35. Packaging resource naming formats

Name	Description	Example
C	Card	C01
CE	Card enclosure (rack-mounted)	CE01
DE	Device enclosure (rack-mounted)	DE01
EE	Card enclosure (enclosure-mounted)	EE01
EMD	Device (enclosure-mounted)	EMD01
EMP	Control panel (enclosure-mounted)	EMP01
FR	Frame	FR01
SD	Stand-alone device	SD001
SYS	System (packaging)*	SYS01
<p>* A system resource (SYS) is a collection of all packaging resources that are contained within, or attached to the system unit.</p>		

Hardware configuration restrictions

Provides information about the lists of restrictions that apply for the hardware that is associated with resources.

The following restrictions apply for the hardware that is associated with resources. For more information, see "Hardware service manager" on page 41.

- If you move a workstation I/O processor (IOP), you must move the attachment cable that is connected to the IOP to the card position along with the IOP.

Note: The cable must be moved because the configuration for the IOP is tied to the resource name of the IOP, which follows the serial number of the card.

- If you move a communications I/O adapter (IOA), you must move the cables that are connected to the IOA along with the IOA.

Note: The cable must be moved because the configuration for the lines is tied to the resource name of the IOA, which is based on the serial number of the IOA card.

Communications card, cable, and wrap connector reference

A few of the communication cards, cables, and wrap connectors include: single-port communications adapter card and TPAC wrap connector, high-speed communications card and wrap connector wiring, and the advanced PCI communications console cable.

Single-port communications adapter card and TPAC wrap connector

Note: TPAC = Two-Port Adapter Cable.

Table 36. Single-port communications adapter card wrap connector. This adapter wrap connector is also used for the 25-pin D shells on the two port adapter cable.

Communications adapter card wrap connector	Connector pin	V.24-RS232 adapter card	X.21 adapter card	V.35 adapter card
1 cable ID 3	1	CID 3	CID 3	CID 3
2 to 3	2	XD	XD-A	XD-A
3 to 2	3	RD	RD-A	RD-A
4 to 5	4	RTS	XD-B	XD-B
5 to 4	5	CTS	RD-B	RD-B
6 to 20	6	DSR	IND-A	Not Used
7	7	SGND	SGND	SGND
8 to 16,18	8	CD	SET-B	RX-A
9 to 11,17	9	DCERS	Not Used	CD
10 cable ID 2	10	CID 2	CID 2	CID 2
11 to 9,17	11	STBY	DCLK-A	CTS
12 cable ID 1	12	CID 1	CID 1	CID 1
13 cable ID 0	13	CID 0	CID 0	CID 0
14 to 21,22	14	Not Used	Not Used	DX-B
15 to 23	15	TCLK	IND-B	DSR
16 to 8,18	16	Not Used	Not Used	TX-A
17 to 9,11	17	RCLK	SET-A	RTS

Table 36. Single-port communications adapter card wrap connector (continued). This adapter wrap connector is also used for the 25-pin D shells on the two port adapter cable.

Communications adapter card wrap connector	Connector pin	V.24-RS232 adapter card	X.21 adapter card	V.35 adapter card
18 to 8,16	18	WRAP	DCLK-B	DX-A
19 to 24,25	19	Not Used	Not Used	Not Used
20 to 6	20	DTR	CTL-A	Not Used
21 to 14,22	21	RLB	Not Used	RX-B
22 to 14,21	22	RI	Not Used	TX-B
23 to 15	23	RATE	CTL-B	DTR
24 to 19,25	24	DTE	Not Used	Not Used
25 to 19,24	25	TI	Not Used	Not Used

High-speed communications card and wrap connector wiring

Table 37. High-speed communications

Wrap connector pin to pin	Connector pin	Signal destination
4 to 5, 8	4	RTS A to CTS A, CD A
5 to 4	5	CTS A to RTS A
7 to 9, 43, 49, 50	7	SGND to CID 0, CID 1, CID2, CID 3
8 to 4	8	CD A to RTS A
9 to 7	9	CID 0 to SGND
10 to 12, 40	10	DTE clock A to RCLK A, TCLKA
11 to 14	11	RI to Remote loop back
12 to 10	12	RCLK A to DTE clock A
14 to 11	14	Remote loop back to RI
15 to 45	15	Local loop back to test indicator
18 to 37	18	TD A to RD A

Table 37. High-speed communications (continued)

Wrap connector pin to pin	Connector pin	Signal destination
20 to 34	20	RD B to TD B
21 to 22, 25	21	RTS B to CTS B
22 to 21	22	CTS B to RTS B
25 to 21	25	CD B to RTS B
27 to 29, 41	27	DTE clock B to RCLK B, TCLK B
28 to 47	28	RSGND to TSGND
29 to 27	29	RCLK B to DTE clock B
34 to 20	34	TD B to RD B
35 to 39	35	DTR B to DSR B
36 to 38	36	DTR A to DSR A
37 to 18	37	RD A to TD A
38 to 36	38	DSR A to DTR A
39 to 35	39	DSR B to DTR B
40 to 10	40	TCLK A to DTE clock A
41 to 27	41	TCLK B to DTE clock B
43 to 7	43	CID 1 to SGND
47 to 28	47	TSGND to RSGND
49 to 7	49	CID 2 to SGND
50 to 7	50	CI 3 to SGND

Advanced PCI communications console cable

Table 38. Advanced PCI communications console cable

Signal designation	Adapter connector pin number	DCE connector pin number
Ready for sending (CTS) to RTS	2	8
Data set ready (DSR) to DTR	4	6

Table 38. Advanced PCI communications console cable (continued)

Signal designation	Adapter connector pin number	DCE connector pin number
Transmit data to Received data	6	3
Signal Ground (SGND)	9	5
Signal Ground (SGND)	10	5
Received data to Transmit data	13	2
DTR/CD to DSR	15	1,4
Signal Ground (SGND)	27	5
Request to send (RTS) to CTS	33	7

Two-port communications adapter card and wrap connector wiring

Table 39. Two-port 232/ac dc

Wrap connector pin to pin	Connector pin	EIA 232 or V.24	EIA 366 or V.25	X.21
1 Cable ID (CID) 3	1	CID 3 P1	CID 3 P1	CID 3 P1
2 to 3	2	XD P1	Not Used	XD-A P1
3 to 2	3	RD P1	PWI P1	RD-A P1
4 to 38	4	DSR P1	Not Used	IND-A P1
5 to 6, 18	5	DCERS P1	DG RV P1	Not Used
6 to 5, 18	6	STBY P1	NB2 P1	DCLK-A P1
7 to 8, 36	7	RLB P1	NB4 P1	Not Used
8 to 7, 36	8	Not Used	Not Used	Not Used
9 to 10	9	XD P2	Not Used	XD-A P2
10 to 9	10	RD P2	PWI P2	RD-A P2
11 to 15	11	DSR P2	Not Used	IND-A P2
12 to 13, 33	12	DCERS P2	DG RV P2	Not Used
13 to 12, 33	13	STBY P2	NB2 P2	DCLK-A P2
14 to 44, 46	14	Not Used	Not Used	Not Used
15 to 11	15	DTR P2	Not Used	CTL-A P2
16 to 29, 30	16	CD P2	DSC P2	SET-B P2

Table 39. Two-port 232/ac dc (continued)

Wrap connector pin to pin	Connector pin	EIA 232 or V.24	EIA 366 or V.25	X.21
17	17	SGND P2	SGND P2	SGND P2
18 to 5, 6	18	RCLK P1	RCV1 P1	SET-A P1
19 to 20	19	RTS P1	DPR P1	XD-B P1
20 to 19	20	CTS P1	PND P1	RD-B P1
21 to 39	21	TCLK P1	RCV2 P1	IND-B P1
22 to 23, 35	22	Not Used	Not Used	Not Used
23 to 22, 35	23	WRAP P1	NB8 P1	DCLK-B P1
24 to 25, 37	24	TI P1	DLO P1	Not Used
25 to 24, 37	25	DTE P1	CRQ P1	Not Used
26 to 27	26	RTS P2	DPR P2	XD-B P2
27 to 26	27	CTS P2	PND P2	RD-B P2
28 to 32	28	TCLK P2	RCV2 P2	IND-B P2
29 to 16, 30	29	Not Used	Not Used	Not Used
30 to 16, 29	30	WRAP P2	NB8 P2	DCLK-B P2
31 to 43, 45	31	RI P2	ACR P2	Not Used
32 to 28	32	RATE P2	NB1 P2	CTL-B P2
33 to 12, 13	33	RCLK P2	RCV1 P2	SET-A P2
34	34	SGND P1	SGND P1	SGND P1
35, 22, 23	35	CD P1	DSC P1	SET-B P1
36 to 7, 8	36	RI P1	ACR P1	Not Used
37 to 24, 25	37	Not Used	Not Used	Not Used
38 to 4	38	DTR P1	Not Used	CTL-A P1

Table 39. Two-port 232/ac dc (continued)

Wrap connector pin to pin	Connector pin	EIA 232 or V.24	EIA 366 or V.25	X.21
39 to 21	39	RATE P1	NB1 P1	CTL-B P1
40	40	CID 2 P1	CID 2 P1	CID 2 P1
41	41	CID 1 P1	CID 1 P1	CID 1 P1
42	42	CID 0 P1	CID 0 P1	CID 0 P1
43 to 31, 45	43	Not Used	Not Used	Not Used
44 to 14, 46	44	DTE P2	CRQ P2	Not Used
45 to 31, 43	45	RLB P2	NB4 P2	Not Used
46 to 14, 44	46	TI P2	DLO P2	Not Used
47	47	CID 3 P2	CID 3 P2	CID 3 P2
48	48	CID 2 P2	CID 2 P2	CID 2 P2
49	49	CID 1 P2	CID 1 P2	CID 1 P2
50	50	CID 0 P2	CID 0 P2	CID 0 P2

ISDN wrap connector and connector pin

Table 40. ISDN

Wrap connector pin to pin	Connector pin	ISDN
1 Cable ID (CID) 3	1	CID 3
2 to 3	2	FLASHER TRIG
3 to 2	3	Jumper to FLASHER DISCH
4 to 38	4	OPTO OUT/DEGLITCH IN
5 to 6, 18	5	FLASHER OUT
6 to 5, 18	6	OPTO OUT/DEGLITCH IN
7 to 8, 36	7	VCC OPTO
8 to 7, 36	8	Not Used

Table 40. ISDN (continued)

Wrap connector pin to pin	Connector pin	ISDN
9 to 10	9	+XMIT TE DRIVER (+DATA IN)
10 to 9	10	+RCV TE DSHL (+DATA OUT)
11 to 15	11	RES
12 to 13, 33	12	Not Used
13 to 12, 33	13	Not Used
14 to 44, 46	14	Not Used
15 to 11	15	Not Used
16 to 29, 30	16	Not Used
17	17	SGND
18 to 5, 6	18	DEGLITCH DISCH
19 to 20	19	Not Used
20 to 19	20	Not Used
21 to 39	21	DEGLITCH BASE
22 to 23, 35	22	Not Used
23 to 22, 35	23	Not Used
24 to 25, 37	24	Not Used
25 to 24, 37	25	Not Used
26 to 27	26	-XMIT TE DSHL (-DATA IN)
27 to 26	27	-RCV TE DRIVER (-DATA OUT)
28 to 32	28	Not Used
29 to 16, 30	29	RES
30 to 16, 29	30	Not Used

Table 40. ISDN (continued)

Wrap connector pin to pin	Connector pin	ISDN
31 to 43, 45	31	RES
32 to 28	32	Not Used
33 to 12, 13	33	Not Used
34	34	SGND
35 to 22, 23	35	Not Used
36 to 7, 8	36	Not Used
37 to 24, 25	37	Not Used
38 to 4	38	JUMPER TO DEGLITCH IN
39 to 21	39	DEGLITCH RST
40	40	CID 2
41	41	CID 1
42	42	CID 0
43 to 31, 45	43	Not Used
44 to 14, 46	44	Not Used
45 to 31, 43	45	Not Used
46 to 14, 44	46	Not Used
47	47	CID 3
48	48	CID 2
49	49	CID 1
50	50	CID 0

Two-port communications adapter cable

Table 41. Two-port communications adapter cable wiring

50-pin connector	Port 1 DTE connector number	Port 2 DTE connector number
1	1	Not Used
2	2	Not Used
3	3	Not Used
4	6	Not Used
5	Not Used	Not Used
6	11	Not Used
7	21	Not Used
8	Not Used	Not Used
9	Not Used	2
10	Not Used	3
11	Not Used	6
12	Not Used	Not Used
13	Not Used	11
14	Not Used	19
15	Not Used	20
16	Not Used	8
17	Not Used	7
18	17	Not Used
19	4	Not Used
20	5	Not Used
21	15	Not Used
22	Not Used	Not Used
23	18	Not Used
24	25	Not Used
25	24	Not Used
26	Not Used	4
27	Not Used	5
28	Not Used	15
29	Not Used	Not Used
30	Not Used	18
31	Not Used	22
32	Not Used	23
33	Not Used	17
34	7	Not Used
35	8	Not Used
36	22	Not Used
37	19	Not Used
38	20	Not Used
39	23	Not Used

Table 41. Two-port communications adapter cable wiring (continued)

50-pin connector	Port 1 DTE connector number	Port 2 DTE connector number
40	10	Not Used
41	12	Not Used
42	13	Not Used
43	Not Used	Not Used
44	Not Used	24
45	Not Used	21
46	Not Used	25
47	Not Used	1
48	Not Used	10
49	Not Used	12
50	Not Used	13

RJ-45 cable wrap connector

Table 42. RJ-45 cable wrap connector

Description	Wrap connector pin to pin
+RCV_TE DRIVER (+DATA_OUT TO +XMIT_TE DSHL (+DATA_IN)	3 to 4
-XMIT_TE DSHL(-DATA_IN) TO -RCV_TE DRIVER (-DATA_OUT)	5 to 6
(Positions 1,2,7,8 not used)	

V.24 communications adapter remote power-on cable

Table 43. V.24 communications adapter remote power-on cable

Signal designation	Interchange circuit number	Adapter connector pin number	DCE connector pin number
Transmitted data	103	2	2
Received data	104	3	3
Request to send (RTS)	105	4	4
Ready for sending (CTS)	106	5	5
Data set ready (DSR)	107	6	6
Data terminal ready/connect data set to line	108/2 108/1	24	20
Received line signal (carrier) detector	109	8	8
Data signal rate selector (DTE source)	111	43	23
Transmitter signal element timing (DTE)	113	11	24
Transmitter signal element timing (DCE)	114	19	15
Receiver signal element timing (DCE)	115	21	17

Table 43. V.24 communications adapter remote power-on cable (continued)

Signal designation	Interchange circuit number	Adapter connector pin number	DCE connector pin number
Select standby ³	116	29	11
Calling indicator ⁴	125	27, E1	22
Remote loopback	140	25	21
Local loopback	141	22	18
Test indicator	142	12	25
Cable ID 1, common return	102	7,16,17,33	7
Notes:			
1. Cable ID 1, 2, 4 is connected to common return pin 7 only at the DTE connector end and is not connected at the DCE end.			
2. The V.24 cable wrap connector is used with this cable. See V.24 cable information for wiring diagram.			
3. The Select Standby signal (circuit 116) is not used on all V.24 Communication Adapter Remote Power-On cables.			
4. Adapter Connector Number E1 is needed only with Stage 1 hardware.			

V.24/X.21bis communications adapter cable

Table 44. V.24/X.21bis communications adapter cable

Signal Designation	Interchange Circuit Number	Adapter Connector Pin Number	DCE Connector Pin Number
Transmitted data	103	2	2
Received data	104	3	3
Request to send (RTS)	105	4	4
Ready for sending (CTS)	106	5	5
Data set ready (DSR)	107	6	6
Data terminal ready/connect data set to line	108/2	20	20
Received line signal (carrier) detector	109	8	8
Data signal rate selector	111	23	23
Transmitter signal element timing (DTE)	113	24	24
Transmitter signal element timing (DCE)	114	15	15
Receiver signal element timing (DCE)	115	17	17
Select standby ²	116	11	11
Calling indicator	125	22	22
Remote loopback	140	21	21
Local loopback	141	18	18
Test indicator	142	25	25
Cable ID 0, common return	102	(7, 13)	7

Table 44. V.24/X.21bis communications adapter cable (continued)

Signal Designation	Interchange Circuit Number	Adapter Connector Pin Number	DCE Connector Pin Number
Notes:			
1. Cable ID 0 is connected to common return pin 7 only at the DTE connector end and is not connected at the DCE end.			
2. The Select Standby signal (circuit 116) is not used on all V.24 Communication Adapter cable assemblies.			

Stage 1 V.24/X.21bis cable wrap connector wiring

Table 45. V.24/X.21bis cable wrap connector wiring

Signal designation	Wrap connector pin to pin
Transmit data to receive data A	2 to 3
RTS to CTS	4 to 5
DTR to DSR	20 to 6
Data signal rate selector to carrier detector	23 to 8
DTE clock to RSET DCE, (TSET) ¹	24 to 17 (15)
Select standby to TSET ¹	11 to 15
Remote loopback to calling indicator	21 to 22
Local loopback to test indicator	18 to 25
Note:	
¹ Some cables do not contain the Select Standby to TSET wrap. In these cables, DTE Clock wraps to RSET DCE and TSET.	

V.24/X.21bis cable wrap connector wiring

Table 46. V.24/X.21bis cable wrap connector wiring

Signal designation	Wrap connector pin to pin
Transmit data to receive data A	2 to 3
RTS to CTS	4 to 5
DTR to DSR	20 to 6
Data signal rate selector to carrier detector	23 to 15 (17)
DTE clock to RSET DCE, (TSET)	24 to 25
Select standby to TSET ¹	11 to 17
Remote loopback to calling indicator	21 to 22
Local loopback to test indicator	18 to 8
Notes:	
¹ Some cables do not contain the Select Standby to TSET wrap. In these cables, DTE Clock wraps to RSET DCE and TSET.	

EIA 232 advanced PCI communications cable

Table 47. EIA 232 advanced PCI communications cable

Signal designation	Adapter connector pin number	DCE connector pin number
Transmitted data (TD)	13	2
Received data (RD)	6	3
Request to send (RTS)	2	4
Ready for sending (CTS)	33	5
Data set ready (DSR)	15	6
Signal Ground (SGND)	7,10,27	7
Received line signal (carrier) detector (CD)	20	8
Transmitter Clock (TCLK)	29	15
Receiver Clock (RCLK)	26	17
Data terminal ready (DTR)	4	20
Ring Indicate (RI)	31	22

EIA 232 advanced wrap connector wiring

Table 48. EIA 232 advanced wrap connector wiring

Signal destination	Wrap connector pin to pin
TD to RD, RI	2 to 3,22
RD to TD	3 to 2
RTS to CTS, TCLK	4 to 5,15
CTS to RTS	5 to 4
DSR to DTR	6 to 20
CD to DTR	8 to 20
TCLK to RTS	15 to 4
RCLK to DTR	17 to 20
DTR to CD, DSR, RCLK	20 to 17,8,6
RI to TD	22 to 2

Stage 1 EIA-232/X.21bis communications adapter cable

Table 49. EIA-232/X.21bis communications adapter cable

Signal designation	Interchange circuit number	Adapter connector pin number	DCE connector pin number
Transmitted data	103	2	2
Received data	104	3	3
Request to send (RTS)	105	4	4
Ready for sending (CTS)	106	5	5
Data set ready (DSR)	107	6	6
Data terminal ready/connect data set to line	108/2 108/1	24	20
Received line signal (carrier) detector	109	8	8

Table 49. EIA-232/X.21bis communications adapter cable (continued)

Signal designation	Interchange circuit number	Adapter connector pin number	DCE connector pin number
Data signal rate selector	111	43	23
Transmitter signal element timing (DTE)	113	11	24
Transmitter signal element timing (DCE)	114	19	15
Receiver signal element timing (DCE)	115	21	17
Select standby ²	116	29	11
Calling indicator	125	27	22
Cable ID 1, 4 common return	102	(17, 33, 7)	7
Notes:			
1. Cable ID 1, 4 is connected to common return pin 7 only at the DTE connector end and is not connected at the DCE end.			
2. The Select Standby signal (circuit 116) is not used on all EIA-232/X.21bis Communication Adapter cables.			

EIA-232/X.21bis communications adapter cable

Table 50. EIA-232/X.21bis communications adapter cable

Signal designation	Interchange circuit number	Adapter connector pin number	DCE connector pin number
Transmitted data	103	2	2
Received data	104	3	3
Request to send (RTS)	105	4	4
Ready for sending (CTS)	106	5	5
Data set ready (DSR)	107	6	6
Data terminal ready/connect data set to line	108/2	20	20
Received line signal (carrier) detector	109	8	8
Data signal rate selector	111	23	23
Transmitter signal element timing (DTE)	113	24	24
Transmitter signal element timing (DCE)	114	15	15
Receiver signal element timing (DCE)	115	17	17
Select standby ²	116	11	11
Calling indicator	125	22	22
Cable ID 0, 3 common return	102	(1, 7, 13)	7
Notes:			
1. Cable ID 0, 3 is connected to common return pin 7 only at the DTE connector end and is not connected at the DCE end.			
2. The Select Standby signal (circuit 116) is not used on all V-24 Communication Adapter cable assemblies.			

EIA-232/X.21bis cable wrap connector wiring

Table 51. EIA-232/X.21bis cable wrap connector wiring

Signal designation	Wrap connector pin to pin
Transmit data to receive data	2 to 3
RTS to CTS	4 to 5
DTR to DSR, calling indicator	20 to 6, 22
Data signal rate selector to carrier detector	23 to 8
DTE clock to RSET DCE, (TSET) ¹	24 to 17, (15)
Select standby to TSET ¹	11 to 15
Note: ¹ Some cables do not contain the Select Standby to TSET wrap. In these cables, DTE Clock wraps to RSET DCE and TSET.	

V.36/EIA 449 high-speed communications adapter cable

Table 52. V.36/EIA 449 high-speed communications adapter cable

Signal designation	Interchange circuit number	Adapter connector pin number	DCE connector pin number
Transmitted data A, B	103	18,34	4,22
Received data A, B	104	37,20	6,24
Request to send (RTS) A, B	105	4,21	7,25
Ready for sending (CTS) A, B	106	5,22	9,27
Data set ready (DSR) A, B	107	38,39	11,29
Data terminal ready (DTR) A, B	108	36,35	12,30
Received line signal (carrier) detector (RLSD) A, B	109	8,25	13,31
Transmitter signal element timing (DTE) A, B	113	10,27	17,35
Transmitter signal element timing (DCE) A, B	114	40,41	5,23
Receiver signal element timing A, B	115	12,29	8,26
Calling indicator (CI)	125	11	15
Local loop back (LLB)	141	15	10
Remote loop back (RLB)	140	14	14
Test indicate (TI)	142	45	18
Receive circuit ground		28	20
Send circuit ground		47	37
Note: Cable ID 0, 2, 3 is connected to common return pin 7 only at the DTE connector end and is not connected at the DCE end.			

V.36/EIA 449 high-speed communications adapter cable wrap connector wiring

Table 53. V.36/EIA 449 high-speed communications adapter cable wrap connector wiring

Signal designation	Wrap connector pin to pin
Transmit data A to receive data A	4 to 6
Transmit data B to receive data B	22 to 24

Table 53. V.36/EIA 449 high-speed communications adapter cable wrap connector wiring (continued)

Signal designation	Wrap connector pin to pin
DTR A to DSR A	12 to 11
DTR B to DSR B	30 to 29
RTS A to CTS A and RLSD A	7 to 9,13
RTS B to CTS B and RLSD B	25 to 27,31
TSET A (DTE) to TSET A (DCE) RSET A	17 to 5,8
TSET B (DTE) to TSET B (DCE) RSET B	35 to 23,26
Remote loopback to ring indicate	14 to 15
Local loopback to test indicate	10 to 18
Send circuit ground to receive circuit ground	37 to 20

Stage 1 V.35 communications adapter cable

Table 54. V.35 communications adapter cable

Signal designation	Interchange circuit number	Adapter connector pin number	DCE connector pin number
Transmitted data A, B	103	42, 26	P, S
Received data A, B	104	44, 31	R, T
Request to send (RTS)	105	4	C
Ready for sending (CTS)	106	5	D
Data set ready (DSR)	107	6	E
Received line signal (carrier) detector	109	8	F
Transmitter signal element timing (DCE) A, B	114	48, 30	Y, A (A)
Receiver signal element timing (DCE) A, B	115	13, 46	V, X
Cable ID 2, 1, common return	102	(17, 16, 7)	B
Data terminal ready	108	24	H

Note: Cable ID 2, 1 is connected to common return pin 7 only at the DTE connector end and is not connected at the DCE end.

Stage 1 V.35 cable wrap connector wiring

Table 55. V.35 cable wrap connector wiring

Signal designation	Wrap connector pin to pin
Transmit data A to receive data A, TSET A, RSET A	P to (R, Y, V)
Transmit data B to receive data B, TSET B, RSET B	S to (T, A, X)
RTS to CTS, DSR, carrier detector	C to (D, E, F)

V.24 advanced PCI communications cable

Table 56. V.24 advanced PCI communications cable

Signal designation	Adapter connector pin number	DCE connector pin number
Transmitted data (TD)	13	2

Table 56. V.24 advanced PCI communications cable (continued)

Signal designation	Adapter connector pin number	DCE connector pin number
Received data (RD)	6	3
Request to send (RTS)	2	4
Ready for sending (CTS)	33	5
Data set ready (DSR)	15	6
Signal Ground (SGND)	7,27	7
Received line signal (carrier) detector (CD)	20	8
Transmitter Clock (TCLK)	29	15
Receiver Clock (RCLK)	26	17
Local Loop Back (LLB)	21	18
Data terminal ready (DTR)	4	20
Ring Indicate (RI)	31	22
Remote Loop Back (RLB)	23	21
Test Indicate (TI)	18	25

V.24 advanced wrap connector wiring

Table 57. V.24 advanced wrap connector wiring

Signal destination	Wrap connector pin to pin
TD to RD	2 to 3
RD to TD	3 to 2
RTS to CTS, TCLK	4 to 5,15
CTS to RTS	5 to 4
DSR to DTR	6 to 20
CD to RLB	8 to 21
TCLK to RTS	15 to 4
RCLK to DTR	17 to 20
LLB to TI	18 to 25
DTR to DSR, RCLK	20 to 6,17
RLB to CD, RI	21 to 8,22
RI to RLB	22 to 21
TI to LLB	25 to 18

V.35 advanced PCI communications cable

Table 58. V.35 advanced PCI communications cable

Signal designation	Adapter connector pin number	DCE connector pin number
Transmitter Clock B (TCLK-B)	28	AA
Signal Ground (SGND)	7,8,27	B
Request to send (RTS)	2	C
Ready for sending (CTS)	33	D

Table 58. V.35 advanced PCI communications cable (continued)

Signal designation	Adapter connector pin number	DCE connector pin number
Data set ready (DSR)	15	E
Carrier detector (CD)	20	F
Data terminal ready (DTR)	4	H
Ring Indicate (RI)	31	J
Local Loop Back (LLB)	21	L
Remote Loop Back (RLB)	23	N
Test Indicate (TI)	18	NN
Transmitted Data A (TD-A)	13	P
Received data A (RD-A)	6	R
Transmitted Data B (TD-B)	12	S
Received Data B (RD-B)	5	T
DTECK A	36	U
Receiver Clock A (RCLK-A)	26	V
DTECK B	35	W
Receiver Clock B (RCLK-B)	25	X
Transmitter Clock A (TCLK-A)	29	Y

V.35 advanced wrap connector wiring

Table 59. V.35 advanced wrap connector wiring

Signal destination	Wrap connector pin to pin
TCLK-B to DTECK-B	AA to W
RTS to CTS	C to D
CTS to RTS	D to C
DSR to DTR	E to H
CD to DTR	F to H
DTR to DSR, CD	H to E,F
RI to RLB	J to N
LLB to TI	L to NN
RLB to RI	N to J
TI to LLB	NN to L
TD-A to RD-A	P to R
RD-A to TD-A	R to P
TD-B to RD-B	S to T
RD-B to TD-B	T to S
DTECK-A to RCLK-A, TCLK-A	U to V,Y
RCLK-A to DTECK-A	V to U
DTECK-B to TCLK-B, RCLK-B	W to AA,X
RCLK-B to DTECK-B	X to W
TCLK-A to DTECK-A	Y to U

V.35 communications adapter cable

Table 60. V.35 communications adapter cable

Signal designation	Interchange circuit number	Adapter connector pin number	DCE connector pin number
Transmitted data A, B	103	2, 4	P, S
Received data A, B	104	3, 5	R, T
Request to send (RTS)	105	17	C
Ready for sending (CTS)	106	11	D
Data set ready (DSR)	107	15	E
Received line signal (carrier) detector	109	9	F
Transmitter signal element timing (DCE) A, B	114	16, 22	Y, AA
Receiver signal element timing (DCE) A, B	115	8, 21	V, X
Cable ID 1, 0, common return	102	7, 12, 13	B
Data terminal ready	108	23	H

Note: Cable ID 1, 0 is connected to common return pin 7 only at the DTE connector end and is not connected at the DCE end.

V.35 cable wrap connector wiring

Table 61. V.35 cable wrap connector wiring

Signal designation	Wrap connector pin to pin
Transmit data A to receive data A, RSET A, TSET B	P to R, V, AA
Transmit data B to receive data B, RSET B, TSET A	S to T, X, Y
RTS to CTS, carrier detector	C to D, F
DSR to data terminal ready	E to H

V.35 high-speed communications adapter cable

Table 62. V.35 high-speed communications adapter cable

Signal designation	Interchange circuit number	Adapter connector pin number	DCE connector pin number
Transmitted data A, B	103	18, 34	P, S
Received data A, B	104	37, 20	R, T
Request to send (RTS)	105	4, 21	C
Ready for sending (CTS)	106	05, 22	D
Data set ready (DSR)	107	38, 39	E
Received line signal (carrier) detector	109	8, 25	F
Transmitter signal element timing (DCE) A, B	114	40, 41	Y, AA
Receiver signal element timing (DCE) A, B	115	12, 29	V, X
Cable ID 1, 0, common return	102	43, 09, 7	B
Data terminal ready	108	36, 35	H

Table 62. V.35 high-speed communications adapter cable (continued)

Signal designation	Interchange circuit number	Adapter connector pin number	DCE connector pin number
Transmitter signal element timing (DTE) A, B	113	10, 27	U, W
Ring Indicate (RI) A, B	125	11, 28	J

Note: Cable ID 1, 0 is connected to common return pin 7 only at the DTE connector end and is not connected at the DCE end.

V.35 high-speed communications adapter cable wrap connector wiring

Table 63. V.35 high-speed communications adapter cable wrap connector wiring

Signal designation	Wrap connector pin to pin
Transmit data A to receive data A	P to R
Transmit data B to receive data B	S to T
RTS to CTS, RI	C to (D,J)
DTR to DSR, RLSA	H to (E,F)
TSET A(DTR) to TSET A(DCE), RSET A	U to (V,Y)
TSET B(DTE) to TSET B(DCE), RSET B	W to (X,AA)

V.36 RS-449 advanced PCI communications cable

Table 64. V.36 RS-449 advanced PCI communications cable

Signal designation	Adapter connector pin number	DCE connector pin number
Transmitted data A (TD-A)	13	4
Transmitter clock A (TCLK-A)	29	5
Received data A (RD-A)	6	6
Request to send A (RTS-A)	2	7
Receiver clock A (RCLK-A)	26	8
Ready for sending A (CTS)	33	9
Local Loop Back (LLB)	21	10
Data set ready A (DSR-A)	15	11
Data terminal ready A (DTR-A)	4	12
Carrier detector A (DC-A)	20	13
23	14	
Ring Indicate (RI)	16	15
DTECK A	36	17
Test Indicate (TI)	17	18
Signal Ground (SGND)	7,9,10,27	19
RC Ground (SC-GND)	34	20
Transmitted data B (TD-B)	12	22
Transmitter clock B (TCLK-B)	28	23
Received data B (RD-B)	5	24
Request to send B (RTS-B)	1	25

Table 64. V.36 RS-449 advanced PCI communications cable (continued)

Signal designation	Adapter connector pin number	DCE connector pin number
Receiver clock B (RCLK-B)	25	26
Ready for sending B (CTS-B)	32	27
Data set ready B (DSR-B)	14	29
Data terminal ready B (DTR-B)	3	30
Carrier detector B (CD-B)	19	31
DTECK B	35	35
SC Ground (SC-GND)	22	37

V.36 RS-449 advanced cable wrap connector wiring

Table 65. V.36 RS-449 advanced cable wrap connector wiring

Signal destination	Wrap connector pin to pin
TD-A to RD-A	4 to 6
TC-A to RTS-A	5 to 7
RD-A to TD-A	6 to 4
RTS-A to TC-A, CTS	7 to 5,9
RC-A to DTECK-A	8 to 17
CTS to RTS-A	9 to 7
LLB to TI	10 to 18
DSR-A to DTR-A	11 to 12
DTR-A DSR-A, CD-A	12 to 11,13
CD-A to DTR-A	13 to 12
RLB to RI	14 to 15
RI to RLB	15 to 14
DTECK-A to RC-A	17 to 8
TI to LLB	18 to 10
RC-GND to SC-GND	20 to 37
TD-B to RD-B	22 to 24
TC-B to RTS-B	23 to 25
RD-B to TD-B	24 to 22
RTS-B to TC-B, CTS-B	25 to 23,27
RC-B to DTECK-B	26 to 35
CTS-B to RTS-B	27 to 25
DSR-B to DTR-B	29 to 30
DTR-B to DSR-B, CD-B	30 to 29,31
CD-B to DTR-B	31 to 30
DTECK-B to RC-B	35 to 26
SC-GND to RC-GND	37 to 20

X.21 communications adapter cable

Table 66. X.21 Communications Adapter Cable

Signal designation	Adapter connector pin number	DCE connector pin number
Transmitted data A, B	2, 4	2, 9
Received data A, B	3, 5	4, 11
Control A, B	20, 23	3, 10
Indication A, B	6, 15	5, 12
Signal element timing A, B	17, 8	6, 13
Cable ID bit 2, common return	7, 10	8

Note: Cable ID 2 is connected to common return pin 7 only at the DTE connector end and is not connected at the DCE end.

X.21 high-speed communications adapter cable

Table 67. X.21 high-speed communications adapter cable

Signal designation	Adapter connector pin number	DCE connector pin number
Transmitted data A, B	18, 34	2, 9
Received data A, B	37, 20	4, 11
Control A, B	36, 35	3, 10
Indication A, B	38, 39	5, 12
Signal element timing A, B	12, 29	6, 13
Cable ID bit 2, common return	49, 7	8

Note: Cable ID 2 is connected to common return pin 7 only at the DTE connector end and is not connected at the DCE end.

X.21 cable wrap connector wiring

Table 68. X.21 cable wrap connector wiring

Signal designation	Wrap connector pin to pin
Transmit data A to receive data A, signal timing A	2 to 4, 6
Transmit data B to receive data B, signal timing B	9 to 11, 13
Control A to indicate A	3 to 5
Control B to indicate B	10 to 12

X.21 advanced PCI communications cable

Table 69. X.21 advanced PCI communications cable

Signal designation	Adapter connector pin number	DCE connector pin number
Transmitted data A (TD-A)	13	2
CNTL-A	4	3
Received data A (RD-A)	6	4
IND-A	15	5
SET-A	29	6
Signal Ground (SGND)	27,9	8

Table 69. X.21 advanced PCI communications cable (continued)

Signal designation	Adapter connector pin number	DCE connector pin number
Transmitted data B (TD-B)	12	9
CNTL-B	3	10
Received data B (RD-B)	5	11
SET-B	28	13

X.21 advanced wrap connector wiring

Table 70. X.21 advanced wrap connector wiring

Signal destination	Wrap connector pin to pin
TD-A to RD-A, SET-A	2 to 4,6
CTL-A to IND-A	3 to 5
RD-A to TD-A	4 to 2
IND-A to CTL-A	5 to 3
SET-A to TD-A	6 to 2
TD-B to RD-B, SET-B	9 to 11,13
CTL-B to IND-B	10 to 12
RD-B to TD-B	11 to 9
IND-B to CTL-B	12 to 10
SET-B to TD-B	13 to 9

Token-ring communications adapter cable and card wrap

Table 71. Token-ring Communications Adapter Cable

Interface line name	Adapter connector pin number	ICS data connector	Wrap connector pin to pin
Transmit positive (TX+)	9	Orange dot	9 to 1
Transmit negative (TX-)	5	Black dot	5 to 6
Receive positive (RX+)	1	Red dot	1 to 9
Receive negative (RX-)	6	Green dot	6 to 5

Ethernet IEEE 802.3 transceiver adapter cable and card wrap

Table 72. Ethernet IEEE 802.3 transceiver adapter cable and card wrap

Interface line name	Adapter connector pin number	Wrap connector pin to pin (normal wrap)	Wrap connector pin to pin (collision wrap)
Data out - circuit A (DO-A)	3	3 to 5	3 to 2
Data out - circuit B (DO-B)	10	10 to 12	10 to 9
Data out - circuit shield (DO-S)	11		
Data in - circuit A (DI-A)	5	5 to 3	
Data in - circuit B (DI-B)	12	12 to 10	
Data in - circuit shield (DI-S)	4		
Control in - circuit A (CI-A)	2		2 to 3

Table 72. Ethernet IEEE 802.3 transceiver adapter cable and card wrap (continued)

Interface line name	Adapter connector pin number	Wrap connector pin to pin (normal wrap)	Wrap connector pin to pin (collision wrap)
Control in - circuit B (CI-B)	9		9 to 10
Control in - circuit shield (CI-S)	1		
Voltage common (VC)	6		6 to 13
Voltage plus (VP)	13		13 to 6
Voltage shield (VS)	14		
Protective ground (PG) (Conductive shell)	Shell		

Facsimile adapter cable wrap connector wiring

Table 73. Facsimile adapter cable wrap connector wiring

Signal designation	Wrap connector port A pin to port B pin
OH/DP to RI	11 to 13
AN1 to AN2	9 to 9
AN2 to AN2	10 to 10
RI to OH/DP	13 to 11
+5V to wrap cable logic	19
DL to country or region code	23 to 14
CLK to CLK Wrap	16 to 18
Country or region code to DL	14 to 23
CLK wrap to CLK	18 to 16
Logic ground to wrap cable logic	7

DDI transceiver adapter cable and card wrap

Table 74. DDI transceiver adapter cable and card wrap

Interface line name	Adapter connector pin number	ICS data connector	Wrap connector pin to pin
Transmit positive (TX+)	5	Red dot	5 to 1
Transmit negative (TX-)	9	Green dot	9 to 6
Receive positive (RX+)	1	Black dot	1 to 5
Receive negative (RX-)	6	Orange dot	6 to 9

PCI communications card wrap connector wiring

Table 75. PCI communications card wrap connector wiring

Signal destination	Wrap connector pin to pin
RTS-B to CTS-B	1 to 32
RTS-A to CTS-A	2 to 33
DTR-B to DSR-B, CD-B	3 to 14,19
DTR-A to DSR-A, CD-A	4 to 15,20
RD-B to TD-B	5 to 12

Table 75. PCI communications card wrap connector wiring (continued)

Signal destination	Wrap connector pin to pin
RD-A to TD-A	6 to 13
SGND to SGND	7 to 27
CID(1) to SGND	8 to 27
SGND to SGND	9 to 27
SGND to SGND	10 to 27
unused	11 to 30
TD-B to RD-B	12 to 5
TD-A to RD-A	13 to 6
DSR-B to DTR-B	14 to 3
DSR-A to DTR-A	15 to 4
RI to RLB	16 to 23
TI to DIAG_OUT-A	17 to 24
TI to LLB	18 to 21
CD-B to DTR-B	19 to 3
CD-A to DTR-A	20 to 4
LLB to TI	21 to 18
RLB to RI, RI	23 to 31,16
DIAG_OUT-A to TI	24 to 17
RCLK-B to DTECK-B	25 to 35
RCLK-A to DTECK-A	26 to 35
LGND to RGND, CID(3), CID(2), CID(1), CID(0)	27 to 34,10,9,8,7
TCLK-B to DTECK-B	28 to 35
TCLK-A to DTECK-A	29 to 36
UNUSED	30 to 11
RI to RLB	31 to 23
CTS-B to RTS-B	32 to 1
CTS-A to RTS-A	33 to 2
SGND to SGND	34 to 27
DTECK-B to RCLK-B, TCLK-B	35 to 28,25
DTECK-A to RCLK-A, TCLK-A	36 to 29,26

Communications signal voltage levels

Communications signal voltage levels for several interface types, including V.24 EIA-232 X.21bis, V.35, X21, and ISDN.

Table 76. Communications signal voltage levels

Interface type	OFF voltage level	ON voltage level
V.24 EIA-232 X.21bis	Less than -3 volts	More than +3 volts

Table 76. Communications signal voltage levels (continued)

Interface type	OFF voltage level	ON voltage level
V.35	When terminated by a 100-ohm resistive load, the differential voltage (A-B) is 0.55 volts +/- 20%. Note: See the V.35 cable to find out which pin numbers are A and B.	When terminated by a 100-ohm resistive load, the differential voltage (B-A) is 0.55 volts +/- 20%. Note: See the V.35 cable to find out which pin numbers are A and B.
X.21	The differential voltage (A-B) is less than -0.3 volts. When terminated by a 100 ohm resistive load, the differential voltage (B-A) is the larger of 2.0 volts or 50% of the open circuit voltage. The open circuit voltage is between 2.0 and 6.0 volts. Note: See X.21 cable diagram to find out which pin numbers are A and B.	The differential voltage (A-B) is more than + 0.3 volts. When terminated by a 100 ohm resistive load, the differential voltage (A-B) is the larger of 2.0 volts or 50% of the open circuit voltage. The open circuit voltage is between 2.0 and 6.0 volts. Note: See X.21 cable diagram to find out which pin numbers are A and B.
ISDN	Logic 0 The differential voltage (A-B) is less than +.75 volts and more than -.75 volts (nominal).	Logic 1 The differential voltage (A-B) is 0.0 volts (nominal).

Working with storage dumps

A main storage dump (MSD) is a process of collecting data from the system's main storage.

A main storage dump can be performed in the following ways:

- Automatically - by the service processor as the result of a system failure.
- Manually - by using control panel functions when the system waits, loops, or appears to have an operating system failure. For more information on control panel functions, see "Control panel functions" on page 114.

For more information on working with storage dumps, see the following:

Automatic main storage dump

When the system stops due to a hardware or software failure, the service processor begins the main storage dump process.

To check whether the system performed a main storage dump (MSD) or to verify that a current MSD is on the system, see "Error recovery for dumps" on page 171.

When the service processor begins the main storage dump process, the control panel displays D1xx 3xxx reference codes. When the initial stages of the MSD are complete, the service processor performs one of the following:

- Displays a reference code on the control panel (if it cannot continue).
- Begins an MSD IPL and displays C6xx 44xx SRCs along with the IPL SRCs on the control panel.

When the system completes the dump, some of the data for the current MSD is copied to the load-source disk, and the other data is held temporarily in main storage. The Main Storage Dump Manager (MSDM) function then starts.

When a failure causes the system to perform a main storage dump, the Main Storage Dump Manager SRC display will appear as soon as the last disk unit reports in.

Note: If all disk units do not report in (after about 40 minutes), the *Disk Configuration Error Report* screen will appear when the user specifies an action that requires access to auxiliary storage. Note the error that appears on the display. This can help during problem analysis. Press the F3 (Exit) key to continue to view the current MSD or copy it to removable media.

Attention: Unless the current MSD is copied to removable media or the MSD library, the dump data in main storage will be lost when the system performs an IPL at the end of the dump process. To copy the MSD, press Enter. For more details about how to copy, report, or delete a dump after you have completed a dump, see *Managing dumps*.

If you select F3/F12 to exit Main Storage Dump Manager without copying the MSD, the following message appears:

Main storage dump has not been copied for service.

Selecting F3/F12 a second time ends the main storage dump manager function, and the system performs an IPL again.

Performing a main storage dump to disk

A main storage dump (MSD) is a collection of data from the main storage of the IBM i operating system. It can be manually initiated when the system administrator suspects a system wait or loop, or automatically by the server firmware as the result of a system failure.

For more details about performing a main storage dump, refer to *Performing an IBM i main storage dump*.

Copying a main storage dump

Provides information about how to copy main storage dump data.

You can copy main storage dump data in the following ways:

- From the current main storage dump to removable media
- From the current main storage dump to the MSD library
- From the MSD library to removable media
- From removable media to the MSD library

For information on copying a dump, refer to *Managing dumps*.

Working with current main storage dump

This topic provides information about options that are available while working with the current main storage dump.

If you select the **Work with current main storage dump (MSD)** option from the Main Storage Dump Manager display, you can work with the newest MSD taken by the system. The current MSD is stored on the load-source disk. It gets replaced by the next main storage dump or is lost during the next IPL.

The work with current main storage dump display allows you to select the following options:

Displaying main storage dump

Use this option to display the current MSD. For more information on displaying the current MSD, see “Main storage dump manager” on page 31.

Copying main storage dump to media

If you select the **Copy to media** option, you must load the removable media. A series of displays appears indicating the progress. When the copy function completes, a success or a failure message appears. When you exit the Main Storage Dump Manager, the system IPLs again and can be returned to the customer.

Copying main storage dump to MSD copy

If you select the **Copy to ASP** option, you must provide a description of the dump. When you press Enter, a series of displays appears indicating the progress. When the copy function completes, a success or a failure message appears. When you exit the Main Storage Dump Manager, the system IPLs again and can be returned to the customer.

The following message indicates that the system encountered problems while trying to copy the dump to MSD library:

```
Cannot IPL to Storage Management Recovery. Copy dump to media.
```

If this message appears, you must copy the MSD to removable media.

Working with copies of main storage dumps

If you select the **Work with copies of main storage dumps** option from the Main Storage Dump Manager display, you can work with a copy of an MSD that is on removable media or in the MSD library.

For descriptions of removable media and the MSD library storage, see “Working with storage dumps” on page 168.

This option allows you to perform the following functions:

- Display an MSD in the MSD library
- Delete an MSD from the MSD library
- Rename an MSD in the MSD library
- Copy an MSD
 - From the MSD library to removable media
 - From removable media to the MSD library

Follow the on-line instructions on the displays to work with an MSD copy.

Main storage dump status

During a main storage dump (MSD), the control panel shows MSD status system reference codes (SRCs).

During a main storage dump, the control panel shows MSD status SRCs (D1xx 3xxx and C6xx 44xx).

The main storage dump ends successfully if the Main Storage Dump Occurred display appears. The main storage dump ends unsuccessfully if a terminating SRC appears at the control panel.

Terminating system reference code

A lit *System Attention* light indicates dump termination. The terminating system reference code (SRC) displays after the main storage dump completes.

- In the case of an automatic dump (system stopping, including a main storage dump), the normal terminating SRC is the one associated with the system error that started the dump.
- In the case of a manual dump (Function 22), the normal terminating SRC is a service processor completion code (A1xx 300x or B1xx xxxx):

Table 77. Functions performed by main storage dump (MSD) status

MSD status	Function performed
11 xxxx xxxx	System terminating SRC. See “Error recovery for dumps.”
11 A1xx 300x	Main storage dump successful completion. See “Copying a main storage dump” on page 169.
11 A6xx4404	
11 B1xx 4998 or 11 B1xx4698 or 11 B2xx5117	A valid main storage dump exists. Perform a complete IPL and try the MSD procedure again.
A6xx1404	A full main store dump is compressed
A6xx2404	A full main store dump is not compressed
A6xx3404	A subset main store dump is not compressed
A6xx4404	A subset main store dump is compressed

Note: *x* can be any hexadecimal character (0 through 9, A through F).

Error recovery for dumps

Provides information about how to determine whether main storage dump data was written to disk, and reporting the error.

Determining whether main storage dump data was written to disk

Perform the following steps to determine whether a main storage dump data was written to disk:

1. If the Main Storage Dump Occurred display appears on the system console, then the first part of the main storage dump data has been written to disk. Go to “Copying a main storage dump” on page 169 to save the main storage dump.
2. If the main storage dump terminated with an SRC displayed on the control panel, and the Main Storage Dump Occurred display does not appear on the system console do the following:
 - a. Check to see if function 34 is available at the control panel.
 - b. If function 34 is available, select function 34 at the control panel and press Enter at the control panel to attempt a retry of the dump IPL.
If the Main Storage Dump Occurred display appears on the system console, function 34 was successful and the main storage dump data is not lost. Go to “Copying a main storage dump” on page 169 to save the main storage dump.
 - c. If function 34 is not available or if the terminating SRC continues to be displayed at the control panel, then the main storage dump data has been lost. The only remaining data that might be available is the main storage dump residue, a service processor storage dump, and all of the System Reference Code data words. Go to “Reporting the error” to collect as much data as possible.

Reporting the error

The main storage dump failure needs to be reported with all of the data that can be collected. Collect and record or save the following data:

1. Save the SRC data words:
 - a. Set the control panel system operating mode to Manual.
 - b. Record all of the SRC data words available from function 11 through function 20
2. Save the service processor dump.
 - a. Select control panel function 43 and press Enter. See “Performing a service processor dump” on page 172.

Note: You can initiate a service processor dump on a POWER5 system only by using function 43.

3. Save the main storage dump residue.
 - a. Use SST to enter the Main Storage Dump Manager.
 - b. Use the Main Storage Dump Manager to save the current main storage dump. See “Copying a main storage dump” on page 169.

Performing a service processor dump

A service processor dump is a collection of data from a service processor either after a failure, external reset, or manual request.

Perform the following to obtain a storage dump of the service processor:

1. Select Manual system operating mode.
2. Select control panel Function 25 (service switch 1 function).
3. Press Enter on the control panel.
4. Select control panel Function 26 (service switch 2 function).
5. Press Enter on the control panel.
6. Select control panel Function 43 (service processor dump).
7. Press Enter on the control panel.
8. Wait for the status SRCs to complete (D1xx 1xxx followed by 00 status displayed).
9. The data is now saved to a non-volatile storage area.
10. Save the service processor control storage data. For details on how to copy, report, or delete a dump after you have completed a dump, see Managing dumps.

Copying the IOP storage dump to removable media

Start from the Start a Service Tool display to begin the storage dump.

1. Load the removable media that is initialized with a SID87 volume ID.

Note: If you are using a volume with a different volume name, use that name in place of SID87. Press the Enter key.

2. From the Start a Service Tool display, select the *Display/Alter/Dump* option.
3. Select the correct dump option (for the type of media that you are copying to) from the *Display/Alter/Dump Output Device* display.
4. Select the *Starting address* option.
5. Enter a starting address of 0000000087 000000 and length of 400000.
6. Type DUMP in the *File* field. Type SID87 in the *Volume ID* field. If you are using a volume with a different volume name, use that name in place of SID87. Press the Enter key.
7. The dump image is being copied from the disk to the media. Wait for the operation to complete.

Note: You might not receive a completion message.

8. Press F3 (exit) from the Specify Dump Title display. Type DUMP2 in the *File* field.
9. Press F3 to exit.
10. Remove the media.
11. Ask your next level of support for procedures to send in the IOP storage dump image (now on media) for Licensed Internal Code APAR creation.

This ends the procedure.

Performing an IOP dump

You can perform I/O processor storage dumps by using the control panel or by using the hardware service manager.

Choose from the following to perform an IOP dump:

- “Performing an IOP dump using the control panel”
- “Performing an IOP dump using the hardware service manager”

Performing an IOP dump using the control panel

Do the following to perform an IOP dump:

1. Select Manual system operating mode.
2. Select control panel Function 25 (service switch 1 function).
3. Press Enter on the control panel.
4. Select control panel Function 26 (service switch 2 function).
5. Press Enter on the control panel.
6. Select control panel Function 67 (disk unit IOP reset/reload).
7. Press Enter on the control panel.
8. Wait for one of the following completion SRCs:
 - 11xx A1XX8ABF
 - 11xx B1XX8ABF
 - 11xx D1XX8ABF
9. The data is now written to disk.
10. Save the MFIOP data for the storage dump to tape. See “Copying the IOP storage dump to removable media” on page 172.

Performing an IOP dump using the hardware service manager

You can perform I/O processor storage dumps by using the *I/O debug* option on the Logical Hardware Resources display (under hardware service manager). Use this utility under the direction of your next level of support. For more information on the hardware service manager function, see “Hardware service manager” on page 41.

The Logical Hardware Resources display (under hardware service manager) lists the logical resources that are attached to the system bus. Select the *I/O debug* option to access the IOP dump function. Use the IOP dump function to collect, display, print, and save data from the I/O processor. The dump is written to a temporary disk storage area. When you exit the hardware service manager function, the dump is lost.

IOP dump information in the product activity log

IOP storage dumps occur at the time the system detects the problem. If the IOP failure does not cause a system failure, the dump information is placed in the product activity log.

1. Search the product activity log for a class of entries that are labeled *IOP dump*. For more information on the product activity log, see “Product activity log” on page 72.
2. Display the detailed entry.

Note: Multiple entries (with the same log ID) are associated with this dump. Press Enter to display each entry. Verify the *Class* field for the IOP dump.

3. To view the entire dump, select the function to print the IOP dump.

IBM i operating system

Provides information about the list of operating systems.

Dedicated service tools in IBM i full paging environment

Dedicated service tools (DST) operates in stand-alone (nonpaging), limited, and full paging environments.

The DST tools and functions vary depending on the paging environment and operating system that is used. For details, see “System paging environments” on page 1.

The full paging environment is used during normal system operation. The following options appear on the Use Dedicated Service Tools (DST) display for the IBM i operating system:

- Resume operating system display
- Start a service tool
- Work with disk units
- Work with DST environment
- Work with Licensed Internal Code
- Work with remote service support
- Work with system partitions
- Work with system security

For details about each DST option, see “DST options” on page 7. For general information on DST, see “Dedicated service tools” on page 1.

Dedicated service tools in IBM i limited paging environment

Dedicated service tools (DST) operates in stand-alone (nonpaging), limited, and full paging environments.

The DST tools and functions vary depending on the paging environment and the operating system used. For details, see “System paging environments” on page 1.

The limited paging environment is available when you perform an IPL to DST. The following options appear on the Use Dedicated Service Tools (DST) display for the IBM i operating system:

- Install the operating system
- Perform an IPL
- Perform automatic installation of the operating system
- Select DST console mode
- Start a service tool
- Work with disk units
- Work with DST environment
- Work with Licensed Internal Code
- Work with remote service support
- Work with system partitions
- Work with save storage and restore storage
- Work with system security

For details about each DST option, see “DST options” on page 7. For general information on DST, see “Dedicated service tools” on page 1.

System service tools

The system service tools (SST) run one or more Licensed Internal Code or hardware service functions under the control of the operating system.

To determine whether the IBM i operating system is running on your system, see “Determining the dominant operating system” on page 103. SST allows you to perform service functions concurrently with the customer's application programs.

Accessing system service tools

You can access SST only when the system is in the full-paging environment. The full paging environment is used during normal system operation. All disk units, the Licensed Internal Code, and the operating system are available.

For more information, see “System paging environments” on page 1.

You can access system service tools (SST) in two ways:

Selecting SST from the problem handling option:

1. At the Main Menu, select the *Problem handling* option. The *Problem Handling* display appears.
2. Select the *System service tools* option. The *Start Service Tools (SST) Sign On* display appears.
3. Type in your user ID and password and press Enter. The *System Service Tools* display appears.

For more information on SST options, see “System service tools options.” **This ends the procedure.**

Entering the Start System Service Tools (STRSST) command:

1. Type STRSST on the command entry line at the Main Menu and press Enter. The *Start Service Tools (SST) Sign On* display appears.
2. Type in your user ID and password and press Enter. The *System Service Tools (SST)* display appears.
3. The *System Service Tools (SST)* display appears.

For more information on SST options, see “System service tools options.” **This ends the procedure.**

System service tools options

This topic provides information about system service tools (SST) options.

When you access SST (see “Accessing system service tools”), the following options are available:

Start a service tool:

This topic provides information about the start a service tool option.

Select this option from the *System Service Tools* display. It displays all of the service tools that are available under SST. This option is a subset of the functions available under dedicated service tools (DST). For information on the *Start a Service Tool* option under DST, see “Dedicated service tools” on page 1. The following options are available under SST:

- Product activity log - For details, see “Product activity log” on page 72.
- Trace Licensed Internal Code - For details, see “Licensed Internal Code trace” on page 31.
- Work with communications trace - For details, see “Work with communications trace” on page 33.
- Display/Alter/Dump - For details, see “Display/Alter/Dump” on page 29.
- Licensed Internal Code log - For details, see “Licensed Internal Code log” on page 30.
- Main storage dump manager - For details, see “Main storage dump manager” on page 31.
- Hardware service manager - For details, see “Hardware service manager” on page 41.

Work with active service tools:

Use this option to list active service tools and their status.

Select this option from the *System Service Tools* display. It lists active service tools and their status. You can start service tools and leave them active while you start another service tool. Use this function to work with a service tool you left active or to end an active service tool. The status of a service tool shows whether the service tool is active or ending. For more information, see “Work with active service tools” on page 26.

Work with disk units:

Select this option from the *System Service Tools* display.

For current information about working with disk units, see “Work with disk units” on page 10.

Work with system partitions:

Some functions are restricted to DST use only and cannot be performed from SST.

For information on the *Work with system partitions* options, see “Work with system partitions” on page 40.

Note: Some functions are restricted to DST use only and cannot be performed from SST.

Work with system security:

Some functions are restricted to DST use only and cannot be performed from SST.

For more information on the *Work with system security* option, see “Work with system security” on page 40.

Note: Some functions are restricted to DST use only and cannot be performed from SST.

Work with service tools user IDs and devices:

Some functions are restricted to DST use only and cannot be performed from SST.

For more information on the *Work with service tools user IDs* option, see “Work with service tools user IDs” on page 27.

For information on the *Service tools device IDs* option, see “Work with service tools device IDs” on page 28.

For information on the *Select console* option, see “Selecting console type” on page 27.

Configure service tools LAN adapter:

This defines the Internet Protocol (IP) for the service tools adapter used for the Service Tool Server (STS) or Operations console (LAN). This option allows input for IPv4 and IPv6 addresses, adapter speed, duplex control, the router IP and mask.

Change service tools password level

This changes the password encryption from DES (PWLVL 1) to SHA (PWLVL 2) and cannot be reversed.

Work with service tools security options:

- **Display console status screen** (yes or no)
- **Allow console device F18 take over** (yes or no)
- **Password expiration interval in days**
- **Maximum sign-on attempts allowed**
- **Duplicate password control**

SST function keys

This topic provides information about F3, F5, F10, F12, and F16 SST function keys.

Keys F3, F5, F10, F12, and F16 usually have the following functions:

- F3 key ends the SST function.
- F5 key causes the system to ignore input to the display. Use this key to see the same display with the input erased or a waiting display.
- F10 key causes the command entry display to be shown. You can then enter CL commands.
- F12 key causes a return to the previous display. You can use this key to return through the prompts to the first service tool display that has an option that can cancel the service tool.
- F16 key always returns control to the *System Service Tools (SST)* display; it does not cancel the active service tool.

IBM i online problem analysis and resolution

Problem analysis and resolution (PAR) manages system errors and gives the customer maximum system availability, effective problem analysis, and a set of software tools for analyzing, repairing, and reporting problems.

If your system is managed by a management console, use the *Manage Serviceable Events* task on the management console.

Online PAR performs the following functions:

- Displays and prompts the customer and service representative through problem analysis
- Provides problem analysis for the hardware and software parts of the devices to perform problem analysis
- Contains a problem log, which contains system problem descriptions and the status of each problem
- Contains the Service Support Facility, which reports the problems to the service and support system.

Online PAR manages system errors and gives the customer maximum system availability, effective problem analysis, and a set of software tools for analyzing, repairing, and reporting problems. It runs concurrently with other customer programs; therefore any part of the system that is not usable by the customer is also unavailable for a problem analysis task. The customer should be aware of this when deciding to run Online PAR.

Another part of PAR is the IBM i problem management functions. This provides automated problem analysis, automated problem logging and tracking, automated problem reporting, and problem correction. It quickly and accurately manages problems occurring on the system. For more information on the automated problem management functions, see “Service attributes (DPSRVA or CHGSRVA) commands” on page 185.

System failures fall into two groups: System-detected and customer-detected.

IBM i system-detected problems

System-detected problem management starts with the detection of a software or hardware error by a device that is attached to the system. When software logically detects a problem, the system collects the data and notes the error. When a device physically detects a problem, the device uses the common I/O interface to report an error message (note) to the system.

The system uses these error notes to create a problem log entry and sends a message to the QSYSOPR message queue. The problem log entry has a description of the failing device. This description allows a problem analysis procedure to be called without initial customer input.

Problem log:

The problem log contains descriptions for all messages with problem analysis routines.

The system operator and other authorized persons use the problem log to manage the problem records that are made by Online PAR. Functions that the problem log provides include the following options:

- Display problem records or print problem records
- Define a new problem
- Analyze an existing problem
- Report a problem
- Add notes to a problem record
- Recover from a problem
- Verify that a problem has been corrected
- Mark a problem as corrected
- Delete one or more problem records
- Query problem analysis status from a remote site

The customer has access to problem log functions in one of the following ways:

- Type the WRKPRB (Work with Problems) command and press Enter.
- On the Main Menu, select the *Problem handling* option. Then, on the Problem Handling display, select the *Work with problems* option.

The WRKPRB command has search parameters available to control the range of problems that is displayed. Pressing F4 displays the search parameters. One of these parameters is SRVID, which is the problem management report (PMR) number the remote support system returned when it reported the problem. Some other examples of search parameters are time range, type of failing hardware, and resource name of failing hardware.

Each entry in the problem list that WRKPRB displays contains a unique, ten-digit problem identification (ID). This ID appears on all displays for a specific problem and in the PMR for the problem in the remote support system. The problem list has a field that you can use to specify the problem ID that you want to go to directly.

Messages relating to hardware failures:

When the system makes an entry in the problem log for each system-detected problem, it also sends a message to the QSYSOPR message queue. Messages that are associated with system-detected problems are marked with an asterisk (*) or are highlighted.

Start problem analysis by placing the cursor anywhere on the message line that contains the asterisk and press F14. For more options, press the Help key to view the *Additional Message Information* display, then press F14 (Work with Problem) to view the *Work with Problems* display. To see available online help, press the Help key.

Note: It is possible to have highlighted or marked with an asterisk multiple system messages that are related to the same failure. For example, a 9335 A01 control unit failure would generate its own message and two more system messages (one per actuator) for each B01 unit on the A01 device function processor.

If you have additional messages that are marked with an asterisk from the original failure, you can remove them by doing the following:

1. Close the problem under "Work with problem" (WRKPRB).

2. Display system messages [(DSPMSG QSYSOPR ASTLVL(*INTERMED))]. Run problem analysis by moving the cursor to the message that is marked with an asterisk (*) or highlighted and pressing F14 to remove the * or highlighting. Then press F11 or select option 4 to remove the message.
You can use F14 multiple times on one message.

Online help is available by pressing the Help key.

You can display the QSYSOPR message queue by entering.

```
DSPMSG QSYSOPR
```

To display the message queue every time a message is logged, put the queue in *BREAK mode.

To put the queue in Break mode, enter

```
CHGMSGQ QSYSOPR *BREAK
```

Putting the QSYSOPR message queue in Break mode lets the customer know immediately when the system detects a problem. The customer can then choose to analyze the problem or delay analysis until a later time. System-detected problems can be analyzed later by displaying QSYSOPR or using the WRKPRB command.

Other messages that describe system problems can be logged in QSYSOPR although they are not associated with a specific system-detected problem.

The first three letters in the message are the message identifier and indicate the message category. The following list shows some typical message identifiers that relate to hardware:

CPA Messages that need system operator action

CPD Diagnostic messages

CPI Informational messages

MCH Machine interface

The remaining four digits indicate the sequence number of the message. If an error condition occurs, you receive an error message that identifies the error.

1. Place the cursor anywhere on the same line as the error message.
2. Press the Help key. The resulting Additional Message Information display contains the message identifier, the name of the program that is sending the message, and additional message information.
3. Read the additional message information about the error or the description of which corrective action to take; take the corrective action.

Customer-detected problems

Online PAR guides the customer through a series of panels to solve customer problems, analyze problems for a failing part, or generate a symptom string for reporting.

Customer-detected problem management is activated when the customer detects a problem that was not detected by the system.

During the definition of a customer-detected problem, to prevent errors in the procedure, the system guides the customer. System units supply a problem analysis (PDP) as the entry point from Online PAR. After the problem is analyzed to a part, Online PAR determines which general entry PDP is requested, if any. Online PAR generates a symptom string for a software error. The IBM service support system uses the symptom string to determine whether a software problem already has an available fix.

Customer-detected problem analysis can be started in one of the following ways:

- Enter the ANZPRB (Analyze Problem) command. Use the ANZPRB command to analyze a user-detected problem when no problem analysis message was generated, or when a problem is intermittent.
- Enter the WRKPRB (Work with Problem) command. Select the *Work with problem* option for any listed problem that has *Opened* in the Status field. Select the *Analyze problem* option.

Service support facility

The service support facility can be used for system-detected problems and user-detected problems.

When problem analysis is complete, online PAR gives the customer the option of reporting the problem. For many problems, analysis results are shown as a field-replaceable unit. Other analysis procedures make a symptom string to be reported with the problem.

Displaying IBM i PTFs

Between code releases, problems that are found with the code are fixed with program temporary fixes (PTFs). These PTFs can be displayed.

The term PTF can refer to a Licensed Internal Code or an operating system fix. For more information on fixes and cumulative PTFs, see “Fixes and cumulative PTF packages” on page 132.

For information on displaying the operating system PTFs that are installed on your system, see Using IBM i to view the installed server firmware PTFs.

IBM i or Licensed Internal Code APAR

This topic provides information about the tasks to perform before requesting a new APAR.

Use the system operation or the service library information to assist in performing the tasks that are listed in Table 78. This ensures that the system is current for all known problems before you create an authorized program analysis report (APAR).

Table 78. Tasks to perform before requesting a new IBM i or Licensed Internal Code APAR

Task to be performed	What to do	Location of instructions
Determine whether customer-reported symptom is a problem fixed by a program temporary fix (PTF).	Use support data: Support publications, TIPS, Exception lists, or Support Center recommendations	
Review the PTF level to see whether a cumulative PTF package needs to be installed.	DSPPTF 5722SS1 and DSPPTF 5722999. Look for PTF marker. See PTF levels on back.	System operation information
Order a cumulative PTF package	Send Program Temporary Fix Order (SNDPTFORD) SF99VRM	System operation information
Obtain a list of generally available PTFs.	SNDPTFORD SF97VRM (VRM = version, release, modification example 410).	System operation information
Determine if a PTF has been superseded	SNDPTFORD SF97VRM Find the PTF number in the PTF summary listing. The latest PTF is listed in the “replaced by” column.	System operation information
Determine whether the system has all the Licensed Internal Code HIPER fixes.	Check for HIPER marker TLYYDDD using DSPPTF 5722999 and compare with the latest PSP.	See “Displaying IBM i PTFs.”
Obtain a list of HIPER PTFs not in the latest cumulative PTF package.	SNDPTFORD SF98VRM	System operation information

Table 78. Tasks to perform before requesting a new IBM i or Licensed Internal Code APAR (continued)

Task to be performed	What to do	Location of instructions
Obtain a list of all Licensed Internal Code HIPER repairs (hardware PSP listing)	SNDPTFORD MF98VRM	System operation information
Install all HIPER PTFs from the cumulative PTF package.	Get latest cumulative PTF package and use GO PTF.	Follow the instructions in the cumulative PTF package.
Install just the HIPER Licensed Internal Code fixes from the cumulative PTF package.	Get the latest cumulative PTF package and use GO PTF.	Follow the instructions in the cumulative PTF package.
Order a PTF	SNDPTFORD PTF # (where # is the PTF number).	System operation information
Load a PTF	Load Program Temporary Fix (LODPTF)	System operation information
Apply a PTF	Apply Program Temporary Fix (APYPTF)	System operation information
Remove a PTF	Remove Program Temporary Fix (RMVPTF)	System operation information
Display a PTF	DSPPTF	System operation information
Display the release level	Enter "GO LICPGM" and select menu option 10.	System operation information
Install all Licensed Internal Code after a load source disk fails.	Use customers latest save tapes.	94xx service library
Restore all Licensed Internal Code if the IPL code is damaged.	Use customers latest save tapes.	94xx service library

How to reset an I/O processor while the system is running

This topic provides information about how to reset an I/O processor while the system is running.

Resetting an IOP restarts and reloads that IOP. Use this procedure to recover from an intermittent error condition.

Note: You can also perform an IOP reset under the hardware service manager function (see "Debug the resource" on page 51).

Note: You cannot reset the workstation IOP for the workstation at which you are working or a workstation that is the only one on the system

1. Do you want to reset the local workstation IOP?

No: Continue with the next step.

Yes: Vary off the local workstation IOP (see "Varying configuration descriptions on and off" on page 182). Then, go to step 6 on page 182 of this procedure.

2. Do you want to reset the communications IOP?

No: Continue with the next step.

Yes: Vary off all the lines on a communications IOP (see "Varying configuration descriptions on and off" on page 182). Then, go to step 6 on page 182 of this procedure.

3. Do you want to reset the cryptographic IOP?

No: Continue with the next step.

Yes: You must end cryptographic services. Enter ENDCS (End Cryptographic Services) command. To reset the cryptographic IOP, enter STRCS Press F4 to prompt parameters. Then, enter RESET *YES. **This ends the procedure.**

4. Do you want to reset a tape, optical, or disk IOP without an attached disk unit?

Yes: Continue with the next step.

No: **This ends the procedure.**

5. Vary off all the IOPs and device descriptions on the IOP (see “Varying configuration descriptions on and off”).
6. Enter the VRYCFG (Vary Configuration) command. Then, press F4 for prompting.
7. Enter STATUS *ON RESET *YES Then, press Enter. **This ends the procedure.**

Varying configuration descriptions on and off

Access all lines, devices, and IOPs and to see and change (vary on or off) the configuration status for these resources.

The *Go Hardware* display allows you to access all lines, devices, and IOPs and to see and change (vary on or off) the configuration status for these resources.

The status of all configuration descriptions can also be displayed or changed (varied on or off) using the WRKCFGSTS (*NWI | *CTL | *LIN | *NWS | *DEV) command. This command is also used for varying off a line and all the IOPs and devices under it.

Notes:

1. All active jobs must be ended before you can vary off. You might be able to enter the WRKACTJOB (Work with Active Jobs) command on the command line on the WRKCFGSTS display or use the Work with Job option to end active jobs.

Note: To end active jobs running on the facsimile IOP, use the ENDFAXSPT command.

2. If a line, IOP, device, network interface (NWI), or nonprogrammable workstation is hung up, varying its configuration description off, then on (in that sequence) provides recovery for some intermittent problems.
3. You cannot display or change cryptographic resources by using the WRKCFGSTS command. To view these resources, use the Work with Hardware Resources (WRKHWRSC) command.

Commonly used IBM i service commands

This topic provides information about commonly used service commands.

The following list provides a quick reference to commands that are commonly used in servicing the System i.

Table 79. Commonly used IBM i service commands

IBM i command	Function
APYPTF	Apply a Program Temporary Fix (PTF)
ANZPRB	Analyze a new problem
CHGMSGQ QSYSOPR *BREAK	Change message to break
CHGSRVA	Change service attributes
CHGNETA	Change network attributes
CHGSYSVAL	Change system values (see 1 on page 188)

Table 79. Commonly used IBM i service commands (continued)

IBM i command	Function
CHGXMTLVL	Change transmit level of the facsimile I/O processor (see "Change Transmit Level (CHGXMTLVL) command" on page 187)
CRTCTLBSC	Create a controller description for a BSC controller
CRTCTLLWS	Create local workstation I/O processors
CRTDEVDSP	Create a local display device
CRTDEVPRT	Create a local printer device
CRTDEVSPR	Create a device description for a remote display
CRTDEVTAP	Create a local tape device
CRTLINASC	Create a line descriptor for an asynchronous line
DLTPRB	Delete all entries in problem log over 30 days old
DSPJOB	Display a job
DSPJOBLOG	Display the job log
DSPLCLHDW	Display local hardware
DSPLOG QHST	Display the history log
DSPMSG QSYSOPR	Display messages in the system operator's message queue
DSPPFM	Display physical file member
DSPPTF	Display Program Temporary Fixes (PTFs)
DSPSFWRSC	Display software resources
DSPSYSVAL	Display system values.
ENDRMTSPT	End remote support
ENDSBS	End subsystem
GO *ALL	Lists all menus for system commands
GO CMDDSK	Go to the disk commands menu
GO CMDHDW	Go to the hardware commands menu
GO CMDHDWRSC	Go to the hardware resource commands menu
GO CMDINF	Go to the information commands menu
GO CMDPTF	Go to the PTF commands menu
GO CMDPWR	Go to the power commands menu
GO CMDSPT	Go to the support commands menu
GO CMDSRV	Go to the service commands menu
GO CMDSYS	Go to the system commands menu
GO CMDSYSVAL	Go to the system value commands menu (see "Using the configuration description label information to prepare for a system upgrade" on page 188)
GO CMDVfy	Go to the verify commands menu
GO INFO	Go to the information assistant options menu
GO LICPGM	Display Release/ Version/Modification level of the IBM i program; Display national language
GO MAIN	Go to the main menu
GO ORDER	Display the IBM market support commands

Table 79. Commonly used IBM i service commands (continued)

IBM i command	Function
GO SUPPORT	Go to the support and education menu
GO UPGRADE	Displays upgrade information
INSPTF	Install PTF
INZTAP	Initialize tape
PRTDEVADR	Print device address
PRTERLOG	Print information from the error log
PRTINTDTA	Print the Vertical Licensed Internal Code exception information
PWRDWN SYS *IMMED	Power down the system
RQSORDAST	Request (marketing) order assistance
SAVAPARDTA	Save APAR data
SAVSYS	Save system
SIGNOFF	Sign you off the system
SNDPTFORD	Send PTF order
SNDSRVRQS *TEST	Test the IBM support link
STRPRTWTR	Start printer writer
STRRMTSPT	Start remote support to give service access to the system from a remote location
STRSST	Start the system service tools (see "System service tools" on page 174)
SNDSRVRQS	Test the support link
VFYCMN	Show the Communications Verification display (see "Verify communications" on page 193)
VFYOPT	Verify optical storage unit or library
VFYPRT	Verify printer prints a pattern on the printer
VFYTAP	Verify tape unit
VRYCFG	Vary configuration (vary device, I/O processor, or communications line on or off)
WRKALR	Show the alert log
WRKCFGSTS	Display the status of all I/O processors
WRKDEV	Work with device display
WRKORDINF	Work with order information to build topology files for upgrades
WRKOUTQ	Work with output queue
WRKPRB	Show the problem log display (see "IBM i online problem analysis and resolution" on page 177)
WRKHDWPRD	Show the Work with Hardware Products display (see "Work with Hardware Products (WRKHDWPRD) command" on page 188)
WRKHDWRSC	Displays the resource names
WRKSYSSTS	Work with system status

To sign off the workstation, return to the main menu by selecting the *end* option, or by pressing the System Request key. Then, enter 90 to sign off.

Work with System Value (WRKSYSVAL) command

The system is shipped with system values that control different aspects of its operation. The Work with System Value (WRKSYSVAL) command shows a list of all system values.

If you know the name of the system value you want to display or change, you can use the Display System Value (DSPSYSVAL) or Change System Value (CHGSYSVAL) command.

To work with system values:

1. Enter WRKSYSVAL
2. From the Work with System Values display, you can request a list of all the system values or a subset of that list.
 - To list all system values, type *ALL in the *Subset by type* field.
 - To list a subset of system values, enter a type in the *Subset by type* field. (Press F4 for a list of types).
3. To change the system value, select the *Change* option.

Commonly used system values:

QDATE

QDATE is the system date. It is composed of the following system values: QYEAR, QMONTH, and QDAY. Available date formats are YMD, MDY, DMY (Y = year, M = month, D = day), or JUL (Julian format). Its value is set from the IPL Options display, and is updated when the system value QTIME reaches midnight (000000). A change that is made to this value might also change QYEAR, QMONTH, and QDAY.

QTIME

QTIME is the system value for the time of day. It is composed of the following system values: QHOUR, QMINUTE, and QSECOND. You can set its value from the IPL Options display. QTIME format is hhmmss.

hh=24 hour time clock
mm=minutes
ss=seconds

Changes to this value take effect immediately, and they might affect the system values QHOUR, QMINUTE, and QSECOND.

QAUTOCFG

The automatic configuration indicator (QAUTOCFG) controls whether the system creates device descriptions automatically for locally attached devices. The system default, 1, is to perform automatic configuration. If you do not want the system to create device descriptions, change the system value to zero (0). You can use the WRKSYSVAL command, or enter the following command:

```
CHGSYSVAL SYSVAL(QAUTOCFG) VALUE('0')
```

QRMTSRVATR

The remote service attribute (QRMTSRVATR) system value controls incoming access to remote service support through the electronic customer support line.

Note: You can also set or reset this system value by using the change service attributes command (see “Service attributes (DSPSRVA or CHGSRVA) commands”).

Service attributes (DSPSRVA or CHGSRVA) commands

The system is shipped with service attributes that assist in system operation.

You can display the service attributes by entering the Display Service Attributes (DSPSRVA) command or change the service attributes by entering the Change Service Attributes (CHGSRVA) command.

Commonly used service attributes

ANZPRBAUTO:

The automated problem analysis function enables problem analysis routines to run automatically.

Problem analysis routines are programs that attempt to isolate a problem. At the time of the failure, they run in a background batch job. This function also monitors for selected critical conditions. When it encounters one, it sends a *BREAK message to users (who are specified by the service attribute, CRITMSGUSR) to ensure that they recognize the condition.

To change the value of the automated analysis function, type:

```
CHGSRVA ANZPRBAUTO(*YES)
```

The system default (*Yes) is to run the automated problem analysis function.

If you do not want the system to perform the automated problem analysis function, change the value to *NO.

CRITMSGUSR:

When problem analysis routines run automatically, the CRITMSGUSR function specifies who is sent a *BREAK message at the time of a failure.

Use the CRITMSGUSR (critical message user) function to create an ordered list of user identifiers and user classes. When the system detects a critical condition, it notifies the first entry in the list by a *BREAK message. If the user or the user class is not signed on, the system sequentially notifies the entries in the list until a user is notified. For details about how to set up automatic problem analysis, see "ANZPRBAUTO."

To work with the critical message user function, type:

```
CHGSRVA CRITMSGUSR(*QSYSOPR)
```

The system default *QSYSOPR sends a *BREAK message to the system operator.

You can change the value and create an ordered list of user identifiers and user classes.

RPTPRBAUTO:

This service attribute allows automatic reporting of software problems.

When problem analysis routines run automatically at the time of a failure (see "ANZPRBAUTO"), the RPTPRBAUTO function specifies whether the software service provider is notified. For more information on the service provider function, see "RPTSRVPVD" on page 187. To change the value of automated reporting function, type:

```
CHGSRVA RPTPRBAUTO(*YES)
```

The system default is to run the automated problem notification (*YES). It runs in a background batch job at the time of the failure.

When problem notification is not automatic (*NO), you can report problems to the service provider from the QSYSOPR message queue, or by using the Work with Problems (WRKPRB) command.

RPTSRVPVD:

This function specifies the name of the service provider for your system.

When problems are automatically reported (see “RPTPRBAUTO” on page 186), this function specifies the name of the service provider for your system.

To work with the service providers function, type:

```
WRKSRVPVD
```

The system default (*IBMSRV) is to automatically report problems to IBM.

You can change the service provider. Use the Help key for more information on the specific options.

SNDDTAPKT:

This function sends data that was collected at the time of the failure to the specified service provider.

When problems are automatically reported (see “RPTPRBAUTO” on page 186), this function sends data that was collected at the time of the failure to the specified service provider.

To change the value of the send data packet function, type:

```
CHGSRVA SNDDTAPKT(*YES)
```

The system default (*YES) is to send up to 2000 bytes of data to the service provider.

If you do not want the system to send data, change the system value to *NO.

PTFINSTYP:

This function specifies when to apply PTFs. To apply a PTF, use the install PTF command (INSPTF) or the GO PTF command (select the *Install a program temporary fix* option from the Program Temporary Fix (PTF) display).

These commands use the PTFINSTYP service attribute automatically when you do not specify the *Type* field.

To change the value of the PTF install function, type:

```
CHGSRVA PTFINSTYP (*DLYIPL)
```

The system default (*DLYIPL) is to designate all of the PTFs for a delayed type of application, and then perform an IPL on the system.

Use the Help key for more information on the specific options.

Change Transmit Level (CHGXMTLVL) command

The CHGXMTLVL command is used to change the transmit level of the facsimile I/O processor.

The command exists in library QFAX and is accessible only to users with *SERVICE authority.

Note: Do not change the transmit level unless you have direction from your next level of support.

The command is supported in the Facsimile Support/400 Licensed Program.

The following parameters are used with the CHGXMTLVL command:

CARD

CARD specifies the facsimile description name with which you want to work. The name must be a member of file QAFFCFG in library QUSRSYS.

TELPORT

TELPORT specifies the port with which you want to work. The only choices are FAX1 or FAX2.

XMTLVL

XMTLVL specifies the new transmit level setting (XMTLVL) of the port. Country-defined transmit level ranges, and default values are contained in the internal table of the Facsimile I/O processor (for example, type 2664). The code for the Facsimile I/O processor determines the proper transmit level by detecting which country coupler is attached to the I/O processor and automatically sets the transmit level range and default. The values represent the negative dB level of the port.

Valid XMTLVL ranges, 0 through 30 (in whole number increments), and default values vary by country. For example, the US and Canada range is 0 to -15 dB, and the default is set to -9 dB.

*DFT assigns the country-specific coupler default value.

Do not change the transmit level unless you have direction from your next level of support. If you enter an XMTLVL value that is not within the valid range for your country, the I/O processor selects the closest valid transmit level. For example, if your country's valid range is -6 dB to -15dB and you set the XMTLVL to 4, the IOP selects -6 dB.

Notes:

- At each ADDFAXCRD command request, the I/O processor tables are initialized.
- There is no online help information available for the CHGXMTLVL command.

Work with Hardware Products (WRKHDWPRD) command

The Work with Hardware Products (WRKHDWPRD) command allows you to work with description labels. The system uses description labels to identify hardware.

When you run the WRKHDWPRD command, the Work with Hardware Products display appears with the following options:

1. Display description label locations

This option allows you to display or print the current configuration label location information. It is the customer's responsibility to configure and assign labels in the system for cables and devices.

Before a system upgrade procedure, the service representative uses this option to identify cables and devices that might need a (physical) label attached.

For more information on how to use this option before an upgrade, see "Using the configuration description label information to prepare for a system upgrade."

2. Change description label locations

This option allows you to display, change, or print a worksheet of the current configuration label location information. Use this option after a system upgrade to compare the system configuration description label information with the (physical) label that is attached to the cable or device. If the labels do not match, use the **Change Description Label Locations** display to change the system label.

For more details about how to use this option after an upgrade, see "Using the configuration description label information after a system upgrade" on page 190.

Using the configuration description label information to prepare for a system upgrade:

Before powering off the system for an upgrade, you must record specific system value information, verify the system configuration, and create (physical) labels to attach to the system cables and devices.

Perform the following steps before you begin the upgrade:

1. Display and note the IPL type (QIPLTYPE) system value by performing the following:

- a. On the command line of the Main Menu, type `wrksysval qipltype` and press Enter.
- b. Type 5 in the `qipltype` field to display the value. Press Enter.
- c. Note the information for later use.
2. Display and note the automatic configuration indicator (QAUTOCFG) system value by performing the following:
 - a. On the command line of the Main Menu, type `wrksysval qautocfg` and press Enter.
 - b. Type a 5 in the `qautocfg` field to display its value.
 - c. Note the information for later use.
3. On the command line of the Main Menu, type the `wrkhdwprd` command and press Enter: The Work with Hardware Products display appears.
4. Select **Display description label locations** and press Enter. The Display Description Label Locations display appears.
5. Press the F17 key to create a printout.

Note: You must press the F17 key even if a printer is not available. Pressing the F17 key places a copy of the label locations in the system print spool if a printer is not available. Pressing the F17 key causes the label locations to print at another time or at another printer location. You can continue by copying the information from the displays onto a piece of paper.

6. Use the Display Description Label Locations printout to verify that all of the system cables and devices are labelled correctly.
 - Cable information is in the *Label* column for each card position.
 - Device information is in the *Label* column for each device position.
7. Compare the label that is attached to the cable or device with the name that appears in the Label column on the printout.
 - If the label that is attached to the cable or device matches the information in the Label column, do not create a label.
 - If one of the following occurs, you must create and attach a label to the cable:
 - a. There is information in the *Label* column, but no label is attached to the cable.
 - b. The label that is attached to the cable does not match the information in the Label column.
 - c. A label is attached to the cable, and *NONE appears in the Label column.

Note: If no label is attached to the cable, *NONE indicates that it is not necessary to attach a label to the cable.

8. Find the blank labels that came with the upgrade shipment.
9. Create a label for each cable or device that you identified:
 - a. On the blank labels that were provided, write the information that appears in the Label column.
10. Use the *Card Position*, *Device Position*, *Type-Model*, and *Serial Number* columns on the printout to assist in locating the devices.

Note: If an asterisk (*) appears in the *Location* and *Serial Number* columns, the label is no longer associated with hardware in the system. You do not need to create a label.

Attach the labels to the cables and devices that you identified.

11. Keep the Display Description Label Locations printout you might want to use it during the Test Procedure portion of the upgrade.
12. Press F3 (Exit) until you reach the Main Menu.

Attention: If you replace the labeled cable or device during the hardware install of the upgrade, ensure that you transfer the label from that cable or device to the replacement cable or device. If you cannot remove the label without damaging it, copy the information onto a new label and attach it to the replacement cable or device.

13. Ask the customer to sign on as QSECOFR. Have the customer save the system configuration to a file by performing the following:
 - a. Create a file to store the system configuration data.
CRTSAVF QGPL/CFGSAVE
 - b. Save the system configuration data to the file you created.
SAVCFG DEV(*SAVF) SAVF(QGPL/CFGSAVE)
14. Go to the instructions to perform the upgrade.

After completing the upgrade, verify that labels that are attached to the cables or devices match label information in the system. For details, see "Using the configuration description label information after a system upgrade."

Using the configuration description label information after a system upgrade:

After performing a system upgrade, you must update the configuration description label information in the system to match the information that appears on the (physical) label that is attached to the cable or device.

1. Perform an attended IPL:
 - a. Select Manual mode on the control panel.
 - b. Power on the system.
 - c. When the IPL display or the Install display appears, select the **Perform an IPL** option.
2. The Sign On display appears. Ask the customer to sign on as QSECOFR.

Note: It is important that you perform the following step to correctly update the device resource names.

3. At the IPL Options display:
 - a. Set the **Start this device only** option to **Y** (Yes).
 - b. Set the **Define or change system at IPL** option to **Y** (Yes).
 - c. Select **System value commands** option.
 - d. Select **Change system values** option.
 - e. Ensure that the system value QAUTOCFG is '0'
 - f. Ensure that the system value QIPLTYPE is '2'

Press F3 twice to continue the IPL.

Note: As the IPL continues, SRC A900 2000 appears. No action is necessary at this time.

4. Have the customer sign off after the IPL is complete.
5. Sign on to the system at the console:
 - On the User line of the Sign On display, type QSRV
 - On the Password line, type the default password QSRV or ask the customer for the password and press Enter.
6. Use the following commands to verify that all devices are varied off.


```
WRKCFGSTS CFGTYPE(*CTL) CFGD(*LWS)
WRKCFGSTS CFGTYPE(*CTL) CFGD(*TAP)
WRKCFGSTS CFGTYPE(*DEV) CFGD(*TAP)
WRKCFGSTS CFGTYPE(*DEV) CFGD(*DKT)
WRKCFGSTS CFGTYPE(*LIN)
WRKCFGSTS CFGTYPE(*NWI)
WRKCFGSTS CFGTYPE(*NWS)
```
7. On the command line of the Main Menu, type the following and press Enter: wrkhdwprd The Work with Hardware Products display appears.

8. Select **Change description label locations** and press Enter. The Change Description Label Locations display appears.
9. Press the F17 key to print a worksheet. If a printer is not available, continue the procedure by noting the information from the displays onto a piece of paper.

Note: Do not use the printout from the Display Description Label Locations display.

10. Use the Change Description Label Locations display or worksheet to verify that all of the system cables and devices are labelled correctly.
11. Compare the label that is attached to the cable or device with the name that appears in the *Label* column.

- Label information *matches* if the following occurs:

- a. The name on the label that is attached to the cable or device is the same as the information in the Label column on the display.

Note: If you replace the previously labeled cable or device during the system upgrade, be sure to transfer the existing label information to the replacement cable or device.

- Label information does *not match* if the following occurs:

- a. There is information in the *Label* column, but no label is attached to the cable. (The following steps of this procedure instruct you to create a label.)
- b. The label that is attached to the cable does not match the information in the Label column. (The following steps of this procedure instruct you to change the system label.)
- c. *NONE appears in the *Label* column, and a label *is* attached to the cable. (The following steps of this procedure instruct you to change the system label.)
- d. *INCORRECT appears in the *Label* column.

This indicates that the label that is attached to the cable does not match the information in the *Label* column. (The following steps of this procedure instruct you to change the system label.)

12. Does all of the label information match?

Note: It is normal for the resource names to change during the upgrade process. Do not use the resource name information from other displays to match the labels.

No **Yes**

- ↓ The system label information is the same as the (physical) label.

Press the F17 key on the *Change Description Label* display to request a printout of the new information for your records.

Go to step 23 on page 192 of this procedure.

13. Do you need to create physical labels?

No **Yes**

- ↓ Perform the following if there is information in the *Label* column, but no label is attached to the cable:

- a. Write the information that appears in the *Label* column on a blank label (labels were provided with the upgrade).
- b. Attach the label to the cable or device.
- c. Continue to the next step of this procedure.

14. Do you need to change the description label information in the system?

Yes **No**

- ↓ The system label information is the same as the (physical) label. Go to step 20 on page 192 of this procedure.

15. On the Change Description Label Locations display, type 2 in the *Opt* column for each location that requires a label change.

Press Enter.

Note: You can make more than one selection at a time, but if More... appears on the bottom of the screen, do not press Enter. Page forward to select the remaining labels.

16. The Change Description Label display appears.

A list of possible label names is shown for the first item you selected.

To select the label name (on the display) that matches the label that is attached to that cable or device, perform the following:

- a. Type 1 in the *Opt* column for each location that you want to change.
- b. Press Enter.

Note: If you cannot find (on the display) the label that matches the label attached to that cable or device, verify that your information is correct. If it is correct, contact your next level of support for assistance.

17. If you chose to change more than one item, the Change Description Label display appears for the next label.

A message at the bottom of the display indicates whether the previous change was successful.

18. For all of the labels that require a change, repeat steps 14 on page 191 through 17.

19. After you change the last label, the Change Description Label Locations display appears with the updated information.

A message at the bottom of the display indicates whether the last change was successful.

If More... appears on the bottom of the screen, scroll forward to view more information.

20. Press the F17 key on the Change Description Label display to request a printout of the new information for your records.

21. Verify that the labels on the printout match the labels that are attached to the cables or devices.

22. If you find any errors, go to step 14 on page 191 and repeat the instructions through step 21.

Continue with the next step if all description label information is correct.

23. Sign off from the system (you are signed on as QSRV).

24. Ask the customer to sign on as QSECOFR and change the QAUTOCFG and QIPLTYPE system values to the values you noted before the upgrade. For details, see "Using the configuration description label information to prepare for a system upgrade" on page 188.

25. Select Normal mode.

Perform an immediate IPL by typing the following on the Main Menu:

```
pwrdownsys *immed restart (*Yes)
```

26. Return to the upgrade instructions that sent you here.

This ends the procedure.

Verify commands

Use the verify command to check for the correct operation of hardware and communications.

Use the verify command to check for the correct operation of hardware and communications. To display a menu of the verify commands, type.

```
GO CMDVFY
```

You can also use the hardware service manager function to verify hardware and communications. For details, see "Verification procedures" on page 71.

Commonly used verify commands

VFYCMN

Use the VFYCMN command to verify the correct operation of a communications card, line, or interface. For information on the communication tests, see “Verify communications.”

VFYOPT

Use the VFYOPT command to verify the correct operation of an optical library. For non-library optical units, use the verify option within the hardware service manager.

VFYPRT

Use the VFYPRT command to verify the correct operation of a printer.

VFYTAP

Use the VFYTAP command to verify the correct operation of a tape unit.

Verify communications

Use the VFYCMN (verify communications) command to verify correct hardware operation.

Use the VFYCMN (verify communications) command to:

- Verify the correct operation of the following hardware:
 - I/O processor and I/O adapter cards
 - Remote communications - SDLC, ISDN, frame relay, and so on
 - Local area networks - Ethernet, token-ring, wireless, LocalTalk, and so on
 - Cryptographic resources
 - Facsimile features
- Diagnose and verify communications hardware problems and cable problems.
- Send test data to the remote equipment to verify correct connection.
- Analyze problems

Note: Use the VFYCMN command to assist in isolating hardware problems that the system does not detect.

- Run concurrent Link Problem Determination Aid-2 (LPDA-2) tests. For details, see “Concurrent LPDA-2 tests” on page 199.
- Run wireless diagnostic tests.
- Monitor telephone lines and modems concurrently.
- Monitor modems interface signals.
- Verify a communications link.

For information on running a trace on a communications interface and other tests that are available, see “Communications tests” on page 198.

Performing the verify communications procedure:

You can verify communications by using the VFYCMN command or the problem handling option.

To verify communications or devices on a System i, perform the following steps:

1. Check the operating system.
2. Use one of the following methods to verify communications:
 - Use the VFYCMN (Verify Communications) command: Type the VFYCMN command and press Enter.
 - Use the *Problem handling* option:
 - a. On the Main Menu, select the *Problem handling* option.
 - b. On the Problem Handling display, select the *Network problem handling* option.

- c. Select the *Verify communications* option.
3. Select the type of connection you want to test. For details, see "Test descriptions." Use the online help information to follow the system menus. For example, select the number of times you want the test to run. The system responds with either the *Verification Successful* message or the *Errors Occurred* message.

Note: Before running the verification test (which loads a diagnostic program into the card), ensure that the customer is not using the resource that you want to test.

Test descriptions:

You can test various resources including modems, cables, I/O adapters, and Local Area Network (LAN) links.

When you run these tests, the system displays only that the test completed successfully or failed. You can get additional problem isolation information by running more than one test. For example, if the communications cable test is failing, before you can isolate positively the cable as the cause of the problem, you must also run the communications I/O adapter card test. If the communications I/O adapter card test completes successfully, the communications cable is failing. If the communications I/O adapter card test fails, the communications I/O adapter card is failing.

Remote modem test:

The remote modem test verifies that the remote modem is operating correctly.

For this test the remote modem must be compatible with LPDA-1 or LPDA-2 diagnostic tests and must be attached via a nonswitched telephone line. The MODEM parameter in the line description determines the diagnostic test to run. Because this test loads a diagnostic program into the card, you must vary off all lines from the communications I/O adapter before running the test. The diagnostic program takes the place of the programs that are used for normal operation.

If this test completes successfully, the remote modem and the telephone line are operating correctly.

If this test fails, the remote modem or the telephone line is the cause of the problem.

Local modem test:

The local modem test verifies that the local modem is operating correctly. For this test the local modem must be compatible with LPDA-1, LPDA-2, or V.54 loop 3 diagnostic tests, or support the IBM ability to wrap.

The MODEM parameter in the line description determines the diagnostic test to run. Because this test loads a diagnostic program into the card, you must vary off all lines from the communications I/O adapter before running the test. The diagnostic program takes the place of the programs that are used for normal operation.

If this test completes successfully, the local modem, the communications cable, and the communications I/O adapter card are operating correctly. However, modems that are not compatible with LPDA-1 or LPDA-2 diagnostic tests are not completely tested. It is possible that they are failing, although the local modem test completes successfully.

If this test fails, the cause of the problem is the local modem, the communications I/O adapter card, or the communications cable.

To further isolate the cause of the problem, run the communications cable test and the communications I/O adapter card test.

Communications cable test:

The communications cable test verifies that the communications cable is operating properly. Because this test loads a diagnostic program into the card, you must vary off *all* lines from the communications I/O adapter before running the test.

For this test, the cable must be an IBM cable with a wrap connector plugged in (note that IBM token-ring cables are self-wrapping; no external wrap connector is needed).

Notes:

- If this test completes successfully, the communications cable and the communications I/O adapter card are operating properly.\
- If this test fails, the cause of the problem is the communications cable or the communications I/O adapter card.
- To further isolate the cause of the problem, run the communications I/O adapter card test.

Communications I/O adapter test:

The I/O adapter test verifies correct operation of the communications I/O adapter. Because this test loads a diagnostic program into the card, you must vary off *all* lines from the communications I/O adapter before running the test.

Note the following when testing:

A communications adapter that has two ports

This is a two step test. The selected port on the two port adapter cable is tested first, then the I/O adapter card.

Test results:

- If this test completes successfully, the communications I/O adapter card is operating correctly.
- If this test fails, the I/O adapter card might be failing.

Notes:

1. Verify that the wrap connector has the correct identifier (as indicated by the display prompt) and is properly installed.
2. In some conditions, the associated I/O processor is the failing card. Select the I/O processor test option, if it is available on the display, to verify the I/O processor operation.

Communications I/O processor test:

The communications I/O processor test verifies the correct operation of the I/O processor. Because this test loads a diagnostic program into the card, you must vary off *all* lines from the communications I/O processor before running the test.

If the test completes successfully, the I/O processor is operational.

If the test fails, the I/O processor is failing.

Communications I/O processor memory test:

The communications I/O processor memory test verifies that the storage of the I/O processor is operational. Because this test loads a diagnostic program into the card, you must vary off *all* lines from the communications I/O processor before running the test.

If the test completes successfully, memory modules on the I/O processor are operational.

If the test fails, a memory module on the I/O processor is failing. If the memory modules on the card are replaceable, exchange the failing memory module. Otherwise, exchange the communications I/O processor.

Communications port A modem and coupler test:

The communications port A modem and coupler test verifies that the modem (which is built into the I/O adapter card) and the externally attached coupler are operating correctly.

The coupler is attached to the port of the I/O adapter card. Because this test loads a diagnostic program into the card, you must vary off *all* lines from the communications I/O adapter before running this test.

If these tests complete successfully, the modem and the coupler are operational.

If a modem error appears on the Results display, exchange the I/O adapter.

Note: A test is provided for both ports (A and B) on the I/O adapter card. If one port is operational, the I/O adapter card is still operational.

If a coupler error appears on the Results display, exchange the coupler.

External ring test:

The External Ring test verifies that all hardware to the network is operational.

Note: The External Ring Test is not supported on token-ring hardware for V4R5.

The External Ring test verifies that all hardware to the network is operational. It is available for token-ring networks and distributed data interfaces. To run this test, all hardware must be connected as it would be in normal operation. This test allows a signal to be sent through the network and wrapped (no wrap connectors are required).

If the test completes successfully, the adapter, cable, and access unit are operating correctly.

For further problem analysis if the test fails, run the cable and I/O adapter tests in the order in which the display lists them.

Communications or local area network link test:

Use the communications or the local area network (LAN) link test to send data to remote equipment using the Ethernet, token-ring, DDI, wireless, SDLC, X.25, or BSC protocols.

This test is useful on multipoint lines to verify that a specific terminal is operating correctly without interrupting normal operation of the other terminals.

To run this test, you must have the line varied on, and you must make a connection with the remote equipment. This is necessary because the functional communications program performs this test. If you are using the BSC protocol and the remote equipment is not a System i, a service representative is needed at the remote location to start diagnostic programs. When you run a link test against the Local Area Network, you can enter *NONE in the controller description field to test a specific remote adapter address.

If this test completes successfully, all equipment within the communications link is operating correctly.

If this test fails and all other devices on the line are operating correctly, one of the following could be the problem:

- The remote device that is being tested
- The remote modem
- The cabling at the remote site

If this test fails and all devices on the line are not operating correctly, run the cable, modem, and I/O adapter tests in the order they are listed on the display for further problem analysis.

Wireless network management utility:

This utility allows you to monitor the operation of a wireless network.

The wireless network management utility (WNMU) test allows you to monitor the operation of a wireless network. This utility collects information that assists in analyzing network problems. Before running this utility, make sure that the line and the attached descriptions are varied on, and a job is active. The following functions are available:

- Display active network topology
- Collect wireless network statistics
- Display statistics for any node on the wireless network
- Run tests between any wireless network nodes

Note:

1. Running the wireless network management utility might affect the performance of the network or decrease system performance.
2. For more information on the wireless LAN adapter indicators, see “Wireless LAN adapter card indicators” on page 198.

Wireless echo back test:

The wireless echo back test verifies the correct operation of a device on the wireless network. Because this test loads a diagnostic program into the card, ensure that all lines from the communications I/O adapter are varied off before running the test.

Note: If more than one device is *not present* in the network, the test will fail.

The system allows you to perform the echo back procedure using the following:

- RS-485 cable connection
- Radio connection (that uses the system configuration)
- Radio connection (that uses a test configuration)

The *Echo back test on RS-485 cable connection* verifies communication to any device on the RS-485 wired network. If this test completes successfully, the adapter and RS-485 wired link are working correctly. If this test fails, run the I/O adapter tests in the order they are listed on the display to further analyze the problem.

The *Echo back test on radio connection using system configuration* verifies communication to any device on the radio network by using the configuration for the line selected. If this test completes successfully, the adapter and radio link are working correctly. If this test fails, run the *Echo back test on radio connection using test configuration*.

The *Echo back test on radio connection using test configuration* verifies communication to any device by using a test configuration. The device must be within radio range of the antenna that is connected to the Wireless LAN Adapter card. If this test fails, run the I/O adapter tests in the order they are listed on the display for further problem analysis. If this test completes successfully, the adapter and radio link work

successfully with the test configuration. If you performed this test after an *Echo back test on radio connection using system configuration* test failed and this test passed, a configuration problem exists.

LocalTalk interface test:

The LocalTalk interface test verifies that the workstation I/O adapter card and the cable (connector box cable) that attaches to the workstation I/O adapter card are operating correctly.

The workstations that support LocalTalk protocol and the connecting cables are **not** tested. Because the test loads a diagnostic program into the communications I/O adapter card, you must run the test from a workstation that is not attached to the I/O adapter you are testing. To run this test, you must have more than one workstation I/O adapter on the system.

If this test completes successfully, the workstation I/O adapter card and the cable that attaches to the workstation I/O adapter card are operating correctly.

If this test fails, a display indicates the probable failure rates of the workstation I/O adapter card and the cable that attaches to the workstation I/O adapter card.

Communications tests

Communications tests include the wireless LAN adapter and indicators test, communications interface trace, and concurrent LPDA-2 tests.

Wireless LAN adapter card indicators

The wireless local area network (LAN) adapter has two indicators located above the 8-pin RS-485 connector.

The top-most indicator shows the adapter card status. The indicator closest to the RS-485 connector shows data transmission or reception.

Use Table 80 to assist in problem analysis.

Table 80. Wireless LAN adapter card indicators

Status	Data	Action
Blinking Green	Off	No action required
Solid Green	Green (momentarily)	No action required
Solid Red	Solid Amber	Run VFYCMN procedure
Solid Red	Solid Red	Run VFYCMN procedure
Solid Red	Solid Green	Run VFYCMN procedure
Off	Off	Run VFYCMN procedure
Solid Amber	Solid Amber	Verify configuration
Solid Red	Off	Verify configuration
Solid Amber	Off	Verify configuration

Communications interface trace

The communications interface trace monitors the modem interface signals and detects wrong or incompatible use of the modem interface.

To achieve the most accurate sample of the lines, start the trace before varying on the communications lines. This test monitors the following modem interface signals:

Data Terminal Ready (DTR)

Data terminal equipment (DTE) uses this signal to show the modem that the DTE is ready to transmit and receive data.

Data Set Ready (DSR)

For nonswitched telephone lines, the active DSR signal shows that the modem is powered-on and ready to transmit and receive data. For switched telephone lines, the active DSR signal shows that the modem is connected to the telephone line and is ready to transmit data.

Request To Send (RTS)

The request to send trace uses this signal to activate or deactivate the modem's modulator lines. If the DSR signal is active, the RTS signal causes the modem to activate the carrier signal.

Ready For Sending (CTS)

The modem activates this signal in response to the Request To Send signal when the modem is ready to transmit data. When the CTS signal is active, the DTE can send data on the transmitted data line.

CTS delay is the time between the RTS signal active condition and the CTS signal active condition. On most nonswitched telephone line modems, there are three CTS delay options, ranging from 0 to 250 milliseconds (ms). Switched telephone line modems, operating in half-duplex mode, are normally set for 150 to 250 ms of CTS delay.

Carrier Detect (CD)

The modem uses this signal to show the DTE that the modem is receiving an acceptable carrier signal. Because of hardware limits on taking short frame samples, the carrier detect signal might not be accurate. In this condition, an asterisk (*) takes the place of the sample data. The status is still correct.

This test displays five of the modem interface signals in a graphic format, showing the time relationship of the signals to each other.

Concurrent LPDA-2 tests

The purpose of these tests is to test the local and remote modems and get modem status information.

Test description

Use this option to run the Verify Link; it supports the LPDA-2 (VFYLNKLPDA) command. The concurrent LPDA-2 tests let you retrieve information from the data circuit-terminating equipment (DCEs). DCEs can be analog (modems) or digital (combined data service units (DSUs) and channel service units (CSUs)). You can get information from four tests:

- DCEs and line status
- DCEs and line test
- Analyze line
- Send and receive test

You can run the LPDA-2 tests on a line while applications are using the line. The tests do not interrupt communications but temporarily slow the data transfer.

The following restrictions apply to these tests:

- The DCEs must be compatible with LPDA-2.
- You can run the tests only on non-switched synchronous data link control (SDLC) lines.
- For multipoint DCEs, the DCEs and Line Status test does not interrupt normal communications. The other LPDA-2 tests might interrupt normal communications.
- You cannot run the tests on an active secondary line. A line is secondary if its data link role is either secondary or is negotiable and has negotiated to a secondary role. A line is active if a controller description under the line is varied on.

The *DCEs and line status* and *DCEs and line test* options are two modes of the same LPDA-2 request.

The DCEs and Line Status test reports parameters that the local and remote DCEs monitor during normal communications.

The DCEs and Line Test reports these parameters, runs internal tests, and reports the results. If poor line conditions are causing problems at normal speed, this test is sent over the communications line to the remote DCE at a slower transmit speed.

These two tests return the following information:

- Configuration summary
This includes DCE type and model, address, operating mode, transmit speed, network function, LPDA-2 code level, switched network backup (SNBU) status, data terminal equipment (DTE) interface connection, and installed features.
- DCEs and line parameters
These include receive level, number of received line signal detector (RLSD) losses, line quality, number of line errors, ages of remote DCE power-off and failure, ages of local DCE reinitialization and error conditions, DCE idle condition, base DCE in error, and features in error.
- Remote DCE interface status
This reports the current status and previous activity of the signals on the DTE interface lines attached to the remote DCE. The DCE monitors the following signals:
 - Request to send
 - Ready for sending
 - Transmit data
 - Receive data
 - Received line signal detector or carrier detect
 - Data signalling rate selector
 - Data terminal ready
 - DTE power loss detected
 - Test control

You can run the *Analyze line test* only on analog DCEs (modems). The test causes the modems to exchange test patterns on the line. The modems measure parameters of the analog signals. The modems report:

- Frequency shift
- Second and third harmonic distortion ratios
- Signal to noise ratio
- Phase jitter
- Receive level
- Transmit level
- Round trip delay time
- Modem type, model, address, and transmit speed
- Number of line errors and RLSD losses

The modem returns acceptable limits for some of the parameters.

The *Send and receive test* causes the DCEs to exchange several blocks of test patterns and track the errors that occur during transmission. The test reports the following:

- DCE type, model, address, and transmit speed

- Signal lost condition
- Worst line quality
- Number of line errors
- The number of blocks that are sent, received, and in error

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Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Compliance Statement

CAN ICES-3 (A)/NMB-3(A)

European Community Compliance Statement

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European Community contact:
IBM Deutschland GmbH
Technical Regulations, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 800 225 5426
email: halloibm@de.ibm.com

Warning: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

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Japan Electronics and Information Technology Industries Association Statement

This statement explains the Japan JIS C 61000-3-2 product wattage compliance.

(一社) 電子情報技術産業協会 高調波電流抑制対策実施
要領に基づく定格入力電力値 : Knowledge Centerの各製品の
仕様ページ参照

This statement explains the Japan Electronics and Information Technology Industries Association (JEITA) statement for products less than or equal to 20 A per phase.

高調波電流規格 JIS C 61000-3-2 適合品

This statement explains the JEITA statement for products greater than 20 A, single phase.

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- 回路分類 : 6 (単相、PFC回路付)
- 換算係数 : 0

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扰。在这种情况下,可能需要用
户对其干扰采取切实可行的措
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Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:
International Business Machines Corp.
New Orchard Road
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Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
IBM Deutschland GmbH
Technical Relations Europe, Abteilung M456
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Tel: +49 (0) 800 225 5426
email: HalloIBM@de.ibm.com

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- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM-authorized dealer or service representative for help.

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Japan Electronics and Information Technology Industries Association Statement

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This statement explains the Japan Electronics and Information Technology Industries Association (JEITA) statement for products less than or equal to 20 A per phase.

高調波電流規格 JIS C 61000-3-2 適合品

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Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse B EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2014/30/EU zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022/ EN 55032 Klasse B ein.

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Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

Dieses Produkt entspricht dem "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)". Dies ist die Umsetzung der EU-Richtlinie 2014/30/EU in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC Richtlinie 2014/30/EU) für Geräte der Klasse B

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

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Generelle Informationen:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022/ EN 55032 Klasse B.

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