Appendix A. Configuring LAN-attached printers

This subject was covered extensively in the *AS/400 Printing V*, SG24-2160-01 redbook. This appendix summarizes the methods, and compares and contrasts them. Ensure you are using the -01 suffix of *AS/400 Printing V*, as several changes were added to this version. Only the configuration method for the ASCII SNMP driver is given in full, as the recommendations have changed slightly since the last redbook was published.

We will cover:

- How to identify which method to use
- IPDS LAN-attached printers
- ASCII LAN-attached printers:
  - LPR/LPD
  - PJL
  - SNMP
- Other printing methods:
  - IPP
  - PC5250
- Summary of LAN attachment methods by printer

For the latest information on configuring LAN-attached printers on the iSeries, consult the Print section of the SupportLine Knowledge Base at:

`http://as400service.rochester.ibm.com`

A.1 Identifying the method to use

Firstly you must determine your printer type. We can divide LAN-attached printers into two groups:

1. IPDS LAN-attached printers
2. ASCII LAN-attached printers

A.1.1 IPDS or ASCII?

If your printer contains an IPDS feature, such as a SIMM or feature card, it will be be configured on the iSeries as a printer of type *IPDS. For LAN-attached IPDS printers the Advanced Function Printing parameter will always be AFP=*YES. The printer may be an impact printer or a non-impact printer (laser or thermal).

If your printer is capable of printing data streams such as HP-PCL, Postscript or PPDS, it is an ASCII printer. Impact printers usually use IBM PPDS or a variety of Epson. These printers will normally be configured on the iSeries as an emulated printer of type 3812 (non-impact) or 4234, 4214, 5225, etc. However this is not a guarantee that the printer is an ASCII printer - for example twinaxial SCS printers, virtual printers and printer emulation sessions use a similar convention.

Note that printers may frequently be capable of performing both roles (i.e. IPDS and ASCII support). It is perfectly possible to create multiple LAN configurations for the same printer on the same system.

A.2 IPDS LAN-attached printers

There is *only* one method to use:

- IPDS device description

This is covered in *AS/400 Printing V*, but the principal points to note are:

- IPDS port number is 5001 for IBM printers (may rarely be 9100 for some IPDS printers)
- A PSF configuration object is *optional*, unless you are sharing the printer (with another host, or another configuration on the same host) in which case it is *required*
- Host Print Transform is not used

A.3 ASCII LAN-attached printers

You have a choice of methods, in order of increasing functionality:

- Remote output queue
- PJL device description
- SNMP device description

These are covered in *AS/400 Printing V*, SG24-2160-01, but the principal points to note are:

- All three methods use Host Print Transform (which converts the native iSeries EBCDIC data stream into a suitable ASCII data stream). SCS and AFPDS conversion to ASCII is supported but IPDS conversion to ASCII is not.
- The remote output queue does not use a device description, just an output queue
- TCP/IP port numbers for PJL and SNMP are usually 2501 (IBM laser) or 9100 (most OEM printers and IBM 6400)
- PJL is for PJL-compatible printers only (no impact printer support)
- PJL support may be provided by a LAN print server (adapter), where the printer is attached to a bi-directional parallel port on the print server and the printer also supports PJL commands
- SNMP support may also be supported by a LAN print server, where the printer is attached to a parallel port on the print server

A.3.1 Remote output queue (LPR/LPD)

On the iSeries, the common TCP/IP function, Line Printer Requestor (LPR) is invoked by the SNDTCPSPLF command. This is used to send a print file to a server or device running the corresponding receiving program, Line Printer Daemon (LPD). This command can be run from the command line or built into a CL program. The LPR command is also a synonym for SNDTCPSPLF. A remote output queue is a way of automating the LPR command.

A.3.1.1 Characteristics of the remote output queue

- There is no error checking or recoverability
- The entire spooled file is sent
- Page range selection is not honoured
- There is no device description
- The writer is started using the STRRMTWTR command

- The writer can be started automatically by a spooled file arriving on the queue, if required.

A remote output queue may be used to send spooled files to other print servers, such as Infoprint Manager for AIX or Windows NT/2000, with or without conversion (i.e. Host Print Transform). You can include the LPR / SNDTCPSPLF command in a CL program to customize how the file is to be sent. It is possible to set Destination Options (DESTOPT) that are specific to the target server. For an example of using SNTCPSPLF in this manner see Appendix H, AS/400 to AIX printing in the Redbook *IBM AS/400 Printing V*, SG24-2160-01.

Remote output queues may also be used over an SNA network. The Send Network Spooled File (SNDNETSPLF) is used.

The configuration of remote output queues is described in a number of publications, including:

- *AS/400 Printer Device Programming*, SC41-5713
- *AS/400 Printing IV* redbook, GG24-4389
- *AS/400 Printing V* redbook, SG24-2160

At a minimum you need the IP address of the remote system or server (the printer itself often performs this role) and the queue name that already exists on that remote system. If the remote system is a printer, then most printer LPDs have built-in internal print queue names that *must* be used. A sample table of common print queue names is listed in the *AS/400 Printing V* redbook or a more extensive and up-to-date list is to be found on the SupportLine Knowledge Base web site.

A.3.2 PJL Driver

Most recent ASCII laser printers support Printer Job Language. Since Version 3.0 Release 7.0, OS/400 has included PJL drivers to use when connecting to those printers. This allows you to create a device description for the device as opposed to just a remote output queue. More enhanced control is offered to the user with this attachment method. There is better error recovery and improved operator messages. One key advantage is the ability to select page ranges of a spooled file, instead of printing it in its entirety.

You can use the PJL Driver any time you have a TCP/IP LAN-attached PCL or PostScript printer that supports PJL. This includes the following printers from IBM:

- Network Printers 12, 17 and 24
- Infoprint 20, 32, and 40

Note that impact printers do *not* support PJL.

For detailed information on the PJL Driver, including the step-by-step configuration method, see "Configuring LAN-attached ASCII printers using PJL drivers" in Chapter 11 of *IBM AS/400 Printing V* redbook, SG24-2160-01.

A.3.3 SNMP Driver

The Simple Network Management Protocol (SNMP) ASCII printer driver is a relatively new printer driver for TCP/IP LAN-attached ASCII printers. Provided as standard with OS/400 V4R5 (and available with PTFs at V4R3 and V4R4) this

printer driver provides a similar level of function to be found in the PJL printer driver. However this method also offers some support for impact printers. At the present time, the only supported IBM impact printer for use with this method is the IBM 6400 with internal Ethernet card. This printer driver is also the recommended configuration method for ASCII models of the IBM Infoprint 21, not the PJL method.

To determine whether this method can be used with a particular non-IBM printer, the following requirements may be of use. If the printer attaches via a separate LAN adapter, these requirements apply to both the printer and adapter:

- The printer must support the industry standard Host Resource MIB (Management Information Base), RFC 1514. It is also recommended that the printer also support the Printer MIB, RFC 1759.
- If an external LAN adapter is used, the printer should connect to the first parallel port and be the only SNMP device on that adapter.
- The printer must have a minimum of read-only access to the "public" SNMP community name. This is usually a default setting.

A.3.3.1 Printer hardware settings

The LAN-attached printer will use either an internal or external LAN adapter to connect to the LAN. These may be referred to by several names, for example:

- NIC - network interface card
- MIO - modular input/output
- "print server"

Branded examples of these include the IBM Network Print Server feature, HP JetDirect print server and Lexmark MarkVision range.

With any print server it is recommended to set the hardware timeout appropriately, such that the device can service other hosts, interfaces, etc, should the current print job fail for any reason (for example timeout over a slow connection). This hardware timeout may be accessed from the printer control panel, sometimes from a manufacturer's printer management utility, and usually via a direct method such as Telnet. Unfortunately there are at least two types of timeouts, those concerning the host connection (usually found in the print server configuration) and those concerning the internal print process within the print engine itself. You need to be sure you are changing the correct one!

Print Server Timeouts

This may be referred to by various names, such as **IO Timeout** or **Port Timeout**. A value of 0 will usually disable it while a value of 300 seconds is usually the appropriate (and maximum) value. However a value of 0 will not disable the setting on HP JetDirect print servers, and this value cannot be set (cannot be disabled) on the IBM Network Printers and earlier Infoprint workgroup printers. Be aware that if the timeout is disabled, no other host or print process will be able to acquire that printer until the original job releases hold of the printer. Sometimes individual timeouts may also apply to the separate data streams or protocols on the print server, for example IPDS or NetBIOS. This is seen on the IBM Infoprint 21.

Print Processor Timeouts

This is sometimes referred to as **Job Timeout, End-of-Job Timeout, Idle Timeout** or **Wait Timeout**. It controls the time in seconds the printer waits before

printing the last page of a job. This timeout only comes into effect if the printer does not receive a page eject at the end of a print job. A symptom of the latter is seen when the transmission of a following job flushes the last page of the previous job out of the printer. It should be set to a high value, the maximum value or disabled, if possible. A typical value is 300 seconds. Avoid setting the timeout too low (5 seconds), as a complex job (including transformation) combined with a slow printer could result in the timeout executing and a partial page printed. A value of 0 seconds may disable this feature on some printers.

A.3.3.2 iSeries device configuration

To create an SNMP LAN-attached device description, type the following command, followed by the F4 (Prompt) key:

```
CRTDEVPRT
```

The following display is shown (these are on an OS/400 V4R5 system, the breaks between displays may vary slightly between different OS/400 releases):

```
                    Create Device Desc (Printer) (CRTDEVPRT)

 Type choices, press Enter.

 Device description . . . . . . .   RED_SNMP      Name
 Device class . . . . . . . . . .   *LAN          *LCL, *RMT, *VRT, *SNPT, *LAN
 Device type  . . . . . . . . . .   3812          3287, 3812, 4019, 4201...
 Device model . . . . . . . . . .   1             0, 1, 2, 3, 4, 10, 13, 301...
```

Figure 1. Creating a device description for SNMP LAN-attached ASCII printer (1 of 7)

Fill in the parameter values as shown in the example. The device type is always 3812 model 1. Next press **Enter** to continue. The following display is shown:

```
                    Create Device Desc (Printer) (CRTDEVPRT)

 Type choices, press Enter.

 Device description . . . . . . . > RED_SNMP      Name
 Device class . . . . . . . . . . > *LAN          *LCL, *RMT, *VRT, *SNPT, *LAN
 Device type  . . . . . . . . . . > 3812          3287, 3812, 4019, 4201...
 Device model . . . . . . . . . . > 1             0, 1, 2, 3, 4, 10, 13, 301...
 LAN attachment . . . . . . . . .   *IP           *LEXLINK, *IP, *USRDFN
```

Figure 2. Creating a device description for SNMP LAN-attached ASCII printer (2 of 7)

Change the parameter value as shown, then press **Enter** to continue.

```
                    Create Device Desc (Printer) (CRTDEVPRT)

 Type choices, press Enter.

 Device description . . . . . . . > RED_SNMP      Name
 Device class . . . . . . . . . . > *LAN          *LCL, *RMT, *VRT, *SNPT, *LAN
 Device type  . . . . . . . . . . > 3812          3287, 3812, 4019, 4201...
 Device model . . . . . . . . . . > 1             0, 1, 2, 3, 4, 10, 13, 301...
 LAN attachment . . . . . . . . . > *IP           *LEXLINK, *IP, *USRDFN
 Port number  . . . . . . . . .   2501            0-65535
 Online at IPL  . . . . . . . .   *YES             *YES, *NO
 Font:
   Identifier . . . . . . . . .   416             3, 5, 11, 12, 13, 18, 19...
   Point size . . . . . . . . .   *NONE           000.1-999.9, *NONE
 Form feed  . . . . . . . . . .   *AUTOCUT        *TYPE, *CONT, *CONT2, *CUT...
 Separator drawer . . . . . . .   *FILE           1-255, *FILE
 Separator program  . . . . . .   *NONE           Name, *NONE
   Library  . . . . . . . . . .                   Name, *LIBL, *CURLIB
```

Figure 3. Creating a device description for SNMP LAN-attached ASCII printer (3 of 7)

An explanation of the parameters on this display is as follows:

Port number Specify 2501 for IBM Infoprint and Network Printers. Specify 9100 for all other printers, including the IBM 6400 with internal Ethernet adapter.

Font Identifier Specify 11 (Courier) normally, or if you wish, the IBM Infoprint and Network Printers' scalable version of Courier, font ID 416. The system will assign a point size.

Form feed Use *AUTOCUT for a printer with cut-sheet paper feed, or *CONT for a continuous forms printer such as the IBM 6400.

Press **Enter** once more:

```
                    Create Device Desc (Printer) (CRTDEVPRT)

 Type choices, press Enter.

 Device description . . . . . . . > RED_SNMP      Name
 Device class . . . . . . . . . . > *LAN          *LCL, *RMT, *VRT, *SNPT, *LAN
 Device type  . . . . . . . . . . > 3812          3287, 3812, 4019, 4201...
 Device model . . . . . . . . . . > 1             0, 1, 2, 3, 4, 10, 13, 301...
 LAN attachment . . . . . . . . . > *IP           *LEXLINK, *IP, *USRDFN
 Port number  . . . . . . . . . . > 2501          0-65535
 Online at IPL  . . . . . . . .   *YES           *YES, *NO
 Font:
   Identifier . . . . . . . . . . > 416           3, 5, 11, 12, 13, 18, 19...
   Point size . . . . . . . . .   *NONE           000.1-999.9, *NONE
 Form feed  . . . . . . . . . . . > *AUTOCUT      *TYPE, *CONT, *CONT2, *CUT...
 Separator drawer . . . . . . .   *FILE           1-255, *FILE
 Separator program  . . . . . .   *NONE           Name, *NONE
   Library  . . . . . . . . . .                   Name, *LIBL, *CURLIB
 Printer error message  . . . . .   *INFO         *INQ, *INFO

                                                                       More...
```

Figure 4. Creating a device description for SNMP LAN-attached ASCII printer (4 of 7)

Printer error message This defaults to *INQ, but change it to ***INFO**. This way, if a recoverable error occurs (such as paper out), the print writer will continue once the intervention has been corrected. A setting of *INQ would post a message on the printer's message queue which must be answered before printing can continue.
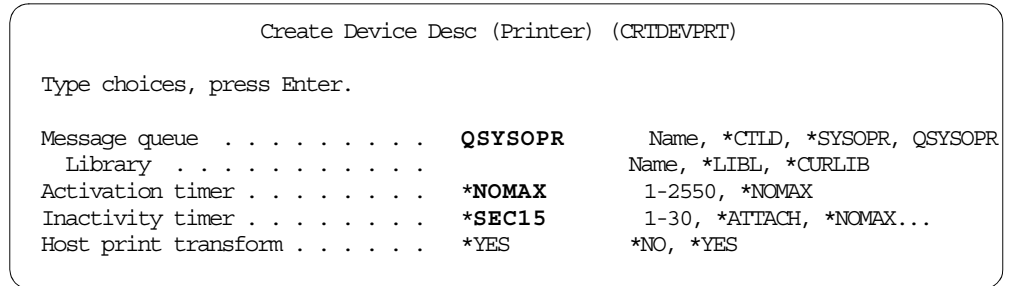
Now press the **Page Down** key:

```
              Create Device Desc (Printer) (CRTDEVPRT)

 Type choices, press Enter.

 Message queue  . . . . . . . . .   QSYSOPR       Name, *CTLD, *SYSOPR, QSYSOPR
   Library  . . . . . . . . . . .                 Name, *LIBL, *CURLIB
 Activation timer . . . . . . . .   *NOMAX        1-2550, *NOMAX
 Inactivity timer . . . . . . . .   *SEC15        1-30, *ATTACH, *NOMAX...
 Host print transform . . . . . .   *YES          *NO, *YES
```

Figure 5. Creating a device description for SNMP LAN-attached ASCII printer (5 of 7)

Message queue   This names the message queue to which operational messages for the printer are sent

Activation timer   Specifies the amount of time to wait for the printer to respond. If the printer is attached to only one iSeries, the default of 170 (seconds) may be used. If more than one system is sharing the printer, set the value to *NOMAX so that the iSeries will continually try to establish a connection.

Inactivity timer   Specifies the amount of time after which the driver program closes the connection when no files are in ready status. A value of *SEC15 (15 seconds) is usually adequate for sharing, but *SEC30 is also available. If you choose a numeric value, note that these are in minutes, not seconds. See also the setting for the User-defined options parameter later in this example.

Host print transform   This is necessary for the print data EBCDIC to ASCII conversion (either SCS or AFPDS to ASCII)

Press the Enter key to continue and the following display is shown:

```
                    Create Device Desc (Printer) (CRTDEVPRT)

 Type choices, press Enter.

 Message queue  . . . . . . . . . > QSYSOPR       Name, *CTLD, *SYSOPR, QSYSOPR
   Library . . . . . . . . . . .     *LIBL        Name, *LIBL, *CURLIB
 Activation timer . . . . . . . . > *NOMAX        1-2550, *NOMAX
 Inactivity timer . . . . . . . . > *SEC15        1-30, *ATTACH, *NOMAX...
 Host print transform . . . . . .   *YES          *NO, *YES
 Manufacturer type and model  . . > *IBM4322
 Paper source 1 . . . . . . . . .   *LETTER        *MFRTYPMDL, *LETTER...
 Paper source 2 . . . . . . . . .   *LETTER        *MFRTYPMDL, *LETTER...
 Envelope source  . . . . . . . .   *C5            *MFRTYPMDL, *MONARCH...
 ASCII code page 899 support  . .   *NO           *NO, *YES
 Image configuration  . . . . . .   *NONE         *NONE, *IMGA01, *IMGA02...
 Character identifier:
   Graphic character set  . . . .   *SYSVAL       1-32767, *SYSVAL
   Code page  . . . . . . . . . .                 1-32767


                                                                      More...
```

Figure 6. Creating a device description for SNMP LAN-attached ASCII printer (6 of 7)

Manufacturer type and model	Enter a value closest to your printer type. The value shown here (*IBM4322) really is for an IBM Infoprint 21!
Paper sources	Enter a value appropriate for your printer and country, for example Letter or A4

Press the **Page Down** key to continue:

```
                    Create Device Desc (Printer) (CRTDEVPRT)

 Type choices, press Enter.

 Remote location:
   Name or address  . . . . . . .   1.2.3.4



 User-defined options . . . . . .   *IBMSHRCNN    Character value, *NONE
                 + for more values
 User-defined object:
   Object . . . . . . . . . . . .   *NONE         Name, *NONE
     Library . . . . . . . . . .                  Name, *LIBL, *CURLIB
   Object type  . . . . . . . . .                 *DTAARA, *DTAQ, *FILE...
 Data transform program . . . . .   *NONE         Name, *NONE
   Library . . . . . . . . . . .                  Name, *LIBL, *CURLIB
 System driver program  . . . . .   *IBMSNMPDRV
 Text 'description' . . . . . . .   IBM Infoprint 21 via SNMP driver

                                                                      Bottom
```

Figure 7. Creating a device description for SNMP LAN-attached ASCII printer (7 of 7)

Remote location	This is the IP address of the printer, or it's equivalent host name

User-defined options The value of *IBMSHRCNN causes the printer driver to open and close the connection to the data port on the printer for every copy of every spooled file. This allows multiple writers and systems to access the printer even if there are more copies or RDY files to be processed. If this option is specified it overrides the setting of the Inactivity timer.

System driver program Use *IBMSNMPDRV

The value for the User-defined options is *required* for an IBM Infoprint 21. For other printers, including printers that are not shared with other systems, the use of this option is not required (the *IBMSNMPDRV system driver program is sufficient).

If any other parameter values are offered, take the defaults and press **Enter** to create the device description.

A.3.3.3 When to use SNMP rather than PJL
Use of the *IBMSHRCNN user-defined option provides true network sharing. This means that the network connection to the printer interface is opened and closed for every copy of every spooled file. We are therefore much less reliant on setting hardware timeouts.

Another factor is that the PJL method is more prone to driver failures caused by simple, common interventions such as "paper out" or "paper jam" occurrences. With the correct printer and software settings, including OS/400 PTFs, these can largely be avoided, but the SNMP driver has the advantage of being able to notify the print writer that operator intervention is required.

As the SNMP driver method is the preferred method for printers such as the IBM Infoprint 21 and IBM 6400 ASCII printers, we recommend you adopt this method for new LAN-attached printer installations. Existing printer configurations may be left as PJL, or migrated to an SNMP driver method.

A.3.3.4 Migrating a PJL printer device description to SNMP
To do this, perform the following:

1. End the PJL printer writer
2. Vary the printer offline
3. Change the device description:
   - Add *IBMSHRCNN to the User-defined options parameter (Note: "options" not "object")
   - Change the System driver program to *IBMSNMPDRV
4. Vary the printer online
5. Start the writer and test printing with some spooled files

Note that the output queue (and any spooled files on it) is unaltered, and the printer device description uses all other configuration parameter values as before.

A.4 Other methods of printing

The following methods may also be used to submit print jobs to an iSeries printer, however they do not involve directly creating a printer device description on the

iSeries server. These are not the only other methods either, however they are the most common (or likely to become the most common).

A.4.1 Internet Printing Protocol

Starting with OS/400 V5R1, printing using the Internet Printing Protocol (IPP) is supported. This support provides an IPP server (the iSeries) which responds to print requests from IPP-enabled clients (such as Windows 2000) and sends the print file to any iSeries-attached printer. This support is not yet at the stage where remote printers on the Internet may be used by the iSeries, but a number of useful features are enabled with IPP support, such as:

- (single) page range support
- cancel / hold/ release / restart print job

Strictly speaking, the iSeries is continuing to use one of the existing print drivers (PSF, HPT, etc.) but it appears to the user as a different printer driver process. Note that the iSeries implementation is also not restricted to LAN-attached printers.

For more information, refer to

A.4.2 PC5250 printer emulation

This heading covers a wide area, including both SNA and TCP/IP connections with the Personal Communications 5250 (PC5250) product. We will briefly review the latter method of connection.

TCP/IP printer emulation support is a printer emulation session that runs alongside (or instead of) a conventional 5250 terminal emulation session. It therefore requires that the PC is up and running. Other users can also access this printer session (although they are usually created on a one printer-to-one terminal session basis). However if the PC is offline (switched off or rebooted) the printer session is of course also temporarily unavailable.

This support is available with all versions of Client Access, namely:

- Client Access/400 Enhanced for Windows 3.1
- Client Access/400 for Windows 95/NT
- Client Access Express for Windows

but PTFs will be required in some cases. Refer to either the SupportLine Knowledge Base at the URL given at the beginning of this chapter, or to the Client Access web page at:

```
http://www.ibm.com/iseries/clientaccess
```

Creation and configuration is done through the PC5250 session (**Communication** - **Configure...**). A virtual printer description (device class *VRT, and usually of type 3812 model 1) and output queue with active print writer are automatically created on the iSeries when configuration is successful. Unless you specified otherwise, the printer device name will be the same as that of your terminal session, for example QPADEV0001. Version 5 Release 1 of Client Access Express for Windows added some useful enhancements in this area, including the use of the Windows PC name for the printer session, or that of the signed on user.

Unlike the printer attachment methods we have looked at so far, the default setting for this device is not to use Host Print Transform. In other words, the EBCDIC to ASCII transform is performed by the PC5250 session, not by OS/400 itself. You will therefore get little control over how your output looks, and worse, may get different output on different printers. However there is a simple radio button setting in the PC5250 Configure menu option which enables Host Print Transform.

A.5 Summary of LAN attachment methods

Table 1, "LAN-attached ASCII printer support" on page 12 summarizes the methods by which selected IBM ASCII printers and print devices may be driven from the iSeries server

Table 1. LAN-attached ASCII printer support

Printer or print device	Supported driver methods	Notes
Infoprint Color 8	LPR, PJL, IPP	IPP refers to native IPP printer support
Infoprint 12	LPR, SNMP	
Network Printer 12, 17, 24	LPR, PJL, SNMP	
Infoprint 20, 32, 40	LPR, PJL, SNMP	
Infoprint 21, 70	LPR, PJL, IPP, SNMP	SNMP recommended. IPP refers to native IPP printer support
Network Print Server feature	LPR, PJL	For PJL, the attached printer must also support PJL
IBM 6400	LPR, SNMP	SNMP support via the integrated Ethernet adapter only

A final reminder is that referral to the above table is only needed for *ASCII* printers. If you have an IPDS version of one of these printers, such as the Infoprint 21 or 70, the primary LAN attachment method for the iSeries will be an IPDS device description.