KONICA MINOLTA

outward

Network Scanning Basics v1

On completion of this module you will have developed a solid understanding of the scanning functions of MFPs and how to use and to troubleshoot them.

The specific areas and applications covered are:

The properties of image files and how they are determined by image size, color depth and file format

The working method of MFP scanning functions regarding the use of network connections and network servers

Parameters to be considered when using MFP scanning functions

Network troubleshooting for MFP scanning functions

Parameters to be considered when scanning images to be printed

Module Training Overview

Target audience will be:

All employees and co-workers of Konica Minolta and our partners obtaining the Outward certification level

Professional.

Attainment Targets:

- To know how image size, color depth and image file format determine the size and quality of image files.
- To know which network connections and network servers are used by MFP scanning functions.
- To understand how target applications of scanned images and the selection of an MFP scanning functions have to be considered when making initial scanning settings.
- To know how network-related problems with MFP scanning functions can be troubleshooted.

Contents

1 Introduction

This module describes the conditions of scanning when using the scanning functions of an MFP or when scanning images for printing.

First of all, scanning results in an image file that has certain properties. You will learn how the size of an image and its color depth as well as the selected image file format determine the image file size and quality.

Images are scanned for a certain purpose and target application. For example, they can be scanned to be printed or to be published on a website. Images can also be scanned with different scanning methods which use different types of communication lines such as LAN or Internet connections in order to send image files to storage locations. You will learn how to consider this framework by selecting appropriate scanning settings such as scanning resolution and image file format in order to get satisfying results.

You will also learn how to troubleshoot scanning functions of MFPs with regard to network settings and network connections.

2 Properties of digital images

2.1 Color depth

Each pixel of a digital image represents a certain color. How many different colors can be represented in an image depends on the color depth of the image.

The color depth of digital images is specified in **bits**. A bit is the basic digital unit and can represent two conditions such as “0” or “1”, “yes” or “no”, or in terms of color e.g. “black” and “white”.

For example, if the color depth of an image is 1 bit, a pixel of that image can either be black or white. If the color depth is 2 bit, a pixel can represent 4 (2^2) different colors, e.g. white, 33% grey, 66% grey, and black. The higher the color depth is, the more colors can be represented in a digital image.

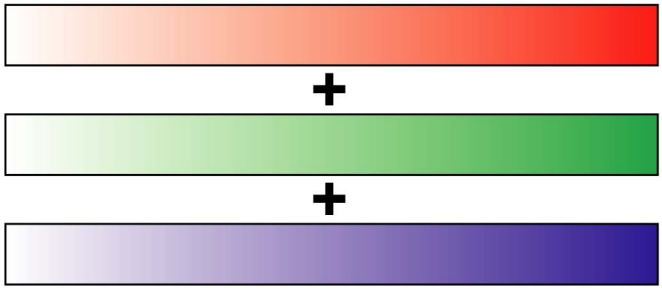
A common color depth for greyscale images is 8 bit. 8 bits can represent 256 different colors ($2^8 = 256$). A variation of color from white to black in 256 steps will be perceived as a continuous gradation, the difference between two neighboring colors is so small, that it will not catch the eye.

Picture 1: 1-bit color depth, 2-bit color depth, 8-bit color depth

Because color depth is measured in bits, it is also referred to as **bit depth**.

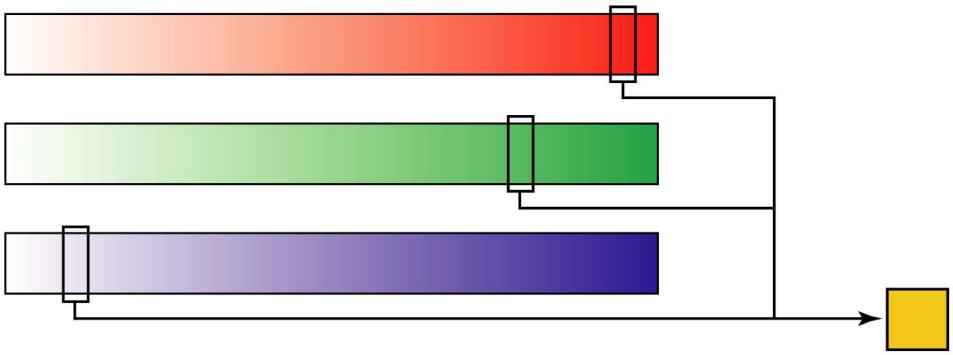
Color images need a higher color depth than greyscale images. Digital colors are usually specified according to a **color model** such as RGB (Red – Green – Blue) or CMYK (Cyan – Magenta – Yellow – Keycolor (Black)). The idea of color models is that any color can by created by mixing the three primary colors red, green, and blue or cyan, magenta, and yellow.

For example, a digital image that describes colors according to the RGB model needs a **24-bit color depth**. The color of a pixel is a mixture of a red shade, a green shade, and a blue shade. Each shade is specified by an 8-bit value.



Picture 2: 24-bit color depth

One 8-bit value specifies a red level between white and 100% red, the other two values specify the green level and the blue level. The color of each pixel is specified by three 8-bit values, so the color depth is 3 x 8 bit = 24 bit.



Picture 3: Composition of a 24-bit color from three 8-bit RGB levels

An image with colors according to the CMYK model needs a color depth of 32 bit because four 8-bit values are necessary to specify the cyan, magenta, yellow, and black levels of a color.

2.2 Image size or file size

The term *image size* often refers not to the physical image size in terms of pixels by pixels but to the size of the image's digital file in terms of bits and bytes. The size of an image file basically depends on two things:

- The physical image size (dimensions) in pixels by pixels
- The color depth of the image

The first factor that determines the file size is the **physical image size** or the number of pixels contained by the image. For example, an image is 600 pixels wide and 300 pixels high. The physical image size is 600 x 300 pixels = 180,000 pixels.

The second factor is the **color depth** of the image. For example, the image is an 8-bit greyscale image. Each of the 180,000 pixels is specified by an 8-bit value.

The size of the entire image is 8 bit x 180,000 = 1,440,000 bits (or roughly 1.37 MB).

2.3 File types

Office scanners and MFPs generate pixel images and provide corresponding image file formats for storing image data. There are many file formats available to store pixel based images.

These are some popular file formats which are also used by many scanners and MFPs:

- **TIFF** (Tagged Image File Format, .tif .tiff): TIFF images can store RGB as well as CMYK images and provide lossless (LZW) as well as lossy compression methods. TIFF files may contain color profiles.
- **BMP** (Windows BitMaP, .bmp): BMP is the Windows image file format, but it is also supported by other operating systems such Mac OS X and professional image processing applications such as Photoshop. BMP images are uncompressed.
- **JPEG** (Joint Photographic Experts Group, .jpg .jpeg): JPEG images in most cases use lossy compression methods even if the image quality is set to high. The compression methods are designed for natural images such as photos and deliver good quality. JPEG is not suited for images with distinct contours such as drawings or text. JPEG compression results in considerably small file sizes.
- **PNG** (Portable Network Graphics, .png): PNG images use lossless compression and provide smaller file sizes than uncompressed TIFF or BMP files.
- **PDF** (Portable Document Format, .pdf): If images are stored as PDF files, image data is embedded in the PDF file. PDF provides lossless and lossy compression methods as well as color management settings (color conversion and profiles).

The following sample image has been saved in different formats using different options:

Image properties:

- Size: 2400 x 1800 pixels
- Color model: RGB
- Color depth: 8 bit/channel (24 bit)
- Expected file size: 2400 x 1800 x 24 bit = 12.4 MB

The resulting file sizes are:

File format	Option	File size
TIFF	–	12.50 MB
	including color profile*	12.50 MB
	by using compression method (LZW)	7.50 MB
BMP	–	12.50 MB
JPEG	High quality	3.50 MB
	Middle quality	0.72 MB
	Low quality	0.35 MB
PNG	–	6.80 MB
PDF	Print quality	15.40 MB
	Smallest file size	0.48 MB

* Included color profile increases file size, but only by 4 KB in this case

2.4 Review questions

- How is the color of digital images specified? What does the term *color depth* mean?

- What is the relationship between the file size of a digital image and its characteristics?

- Name popular image file formats and their characteristics.

3 Working method of MFP scanning functions

3.1 Scan to eMail / Me

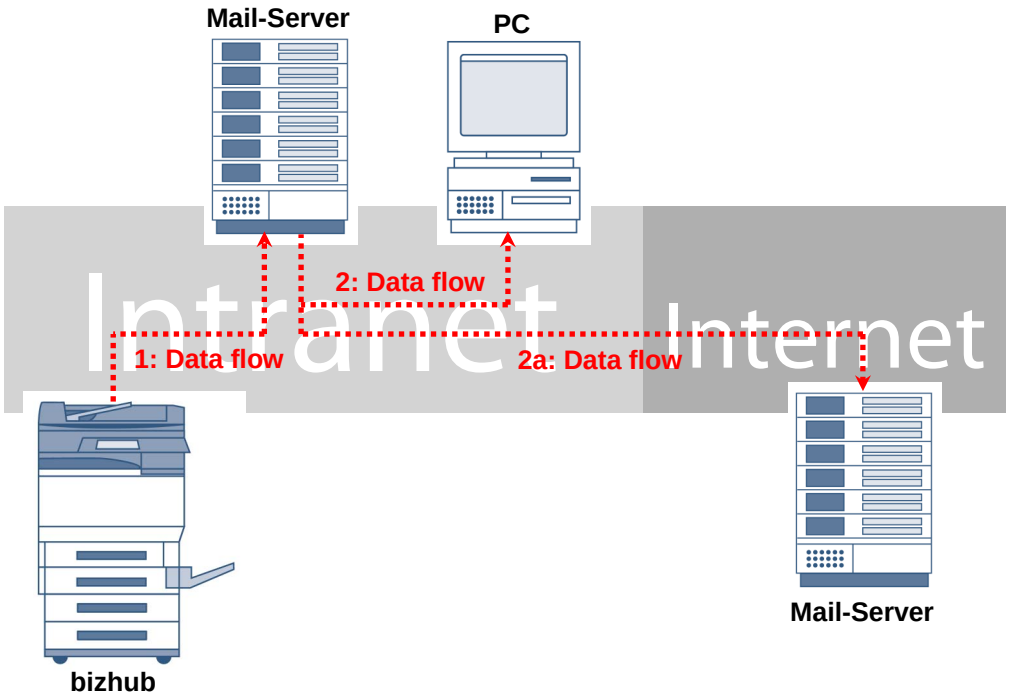


Fig.: Working method Scan-to-eMail

Scan-to-eMail means to scan the documents and then transfer them directly to the inhouse Mail-Server (1 in the fig.). During this process, the scanned data is transferred as an email attachment in TIFF or PDF format, depending on the sender's settings.

If the sender wants to send the documents to an external address via email, the mail is transferred automatically to the corresponding server for external mails (2a).

In internal transfer, the email remains on the mail server until the addressee connects his PC to the mail server. When the client PC contacts the mail server, the email is downloaded automatically on the hard disk of the client PC (2). The sender receives an email notification.

Scan-to-eMail does not require manual intervention. The scanned data is transferred directly to every desired PC. Via internet, you can furthermore send scans to addresses which are located outside the company's network. The only disadvantage of this option is the file size: Because of the underlying transfer protocol, there is often a limit of 5 MB. Thus, this scan mode is mainly used for data with a low resolution or for documents with only a few original pages.

Scan-to-Me is a special application of Scan-to-eMail. If user authentication is active on the bizhub and you are a logged in, you can send scanned data directly to your own email address

by choosing the “Me” button (the “Me” button is automatically available as destination, if the email address of the logged in user is registered). If Active Directory or LDAP is used for user authentication, your email address is determined via LDAP. If NDS or NTLM is used for user authentication or if your authentication data is set up on the bizhub itself (MFP Authentication), the email address specified in the user registration is used.

3.2 Scan to FTP / WebDAV

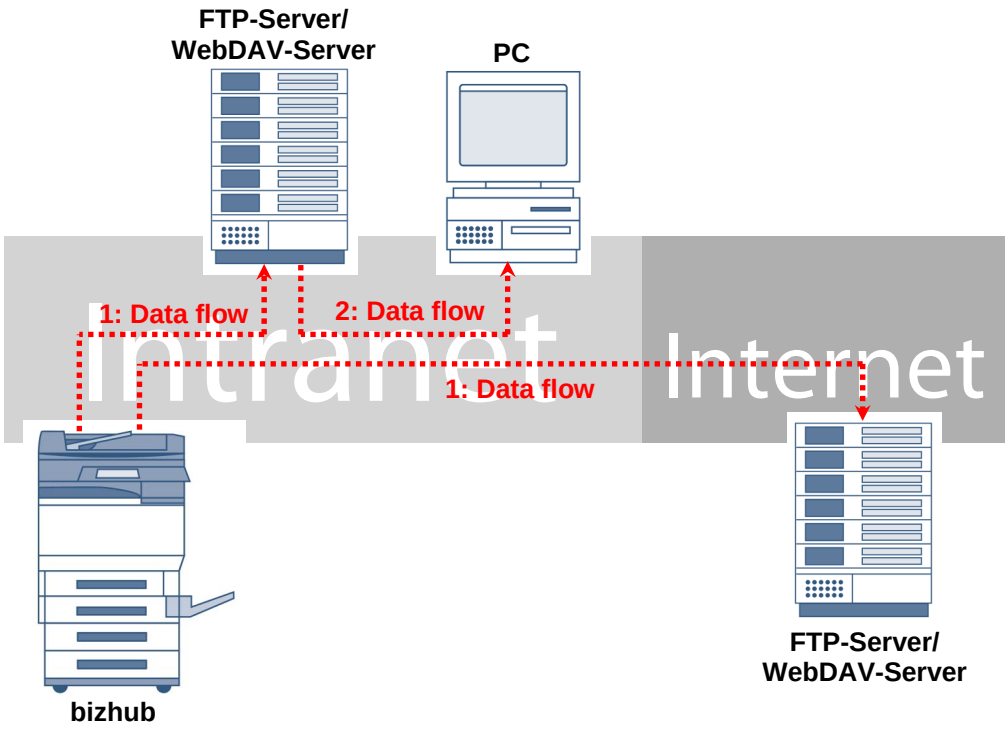


Fig.: Working method Scan-to-FTP/WebDAV

In Scan-to-FTP/WebDAV, the originals are scanned and then saved in a specific directory on an external server or on the in-house FTP-Server or WebDAV-Server (1 in the fig.). For this process, either the file transfer protocol (FTP) or HTTP with WebDAV protocol extensions are used, both or them being TCP/IP-based protocols for the transfer of files. Afterwards, the data can be retrieved by the user’s PC with the help of an FTP or WebDAV client software where they can be processed further (2). If the FTP server saves the scan data in an unblocked directory, i.e. a directory with common access, one of the usual file administration programs like Microsoft Windows-Explorer is sufficient for file access.

Scan-to-FTP/WebDAV is the functional counterpart of Scan-to-eMail. The size of the files which are transferred via FTP or WebDAV is practically unlimited. Therefore, this mode is especially suitable for the archiving of scanned documents with larger files sizes.

3.3 Scan to PC / SMB

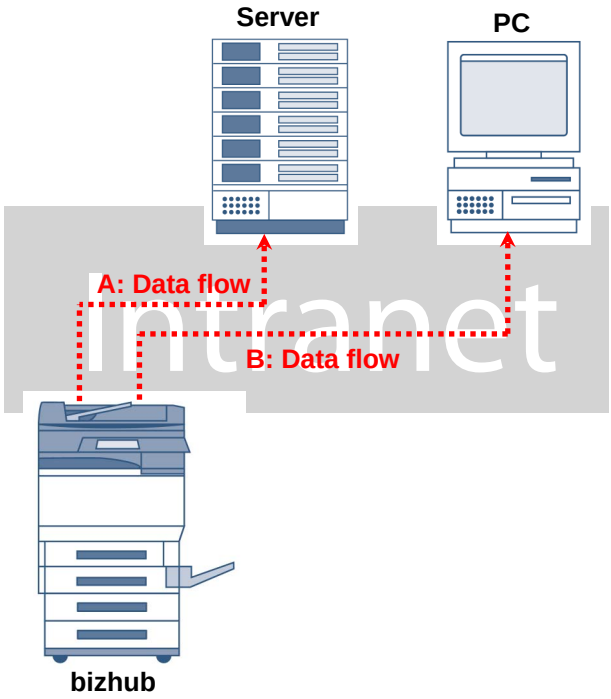


Fig.: Working method Scan-to-SMB

SMB (Server Message Block) is a network protocol providing several network services and it is mainly used in Windows networks, but also e.g. in UNIX networks. Among other things, SMB makes it possible to access shared directories and their files and to store files to these directories.

Using SMB, the bizhub may store scanned data in network directories, e.g. on a file server (A in the fig.) but also directly in shared directories of any network PC (B).

Thus, Scan-to-SMB works similar to Scan-to-FTP. But it has the advantage that files do not need to be placed on a special FTP server but can be placed on any shared storage locations of the network. Besides, Scan-to-SMB is considered to be more secure than Scan-to-FTP because SMB works with password encryption and passwords cannot be stolen in the network.

3.4 Scan to Home

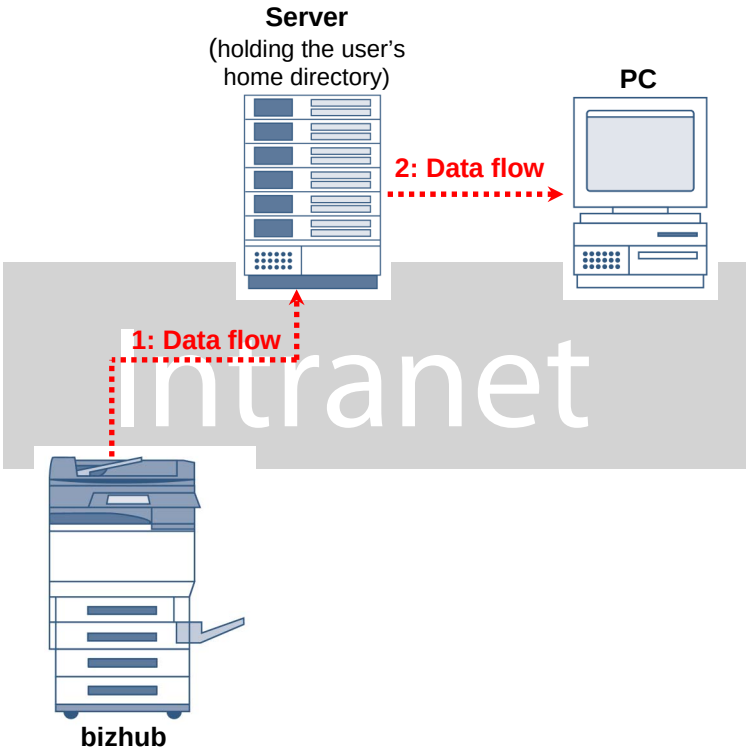


Fig.: Working method of Scan-to-Home

With Scan-to-Home you can send scanned data directly to your Active Directory home directory (1 in the fig.). Then you can access the data e.g. from your workstation (2).

The Scan-to-Home function is available, if user authentication via Active Directory is active on the bizhub and there is a home directory set up for you in Active Directory.

3.5 Twain / Web Service Scanning

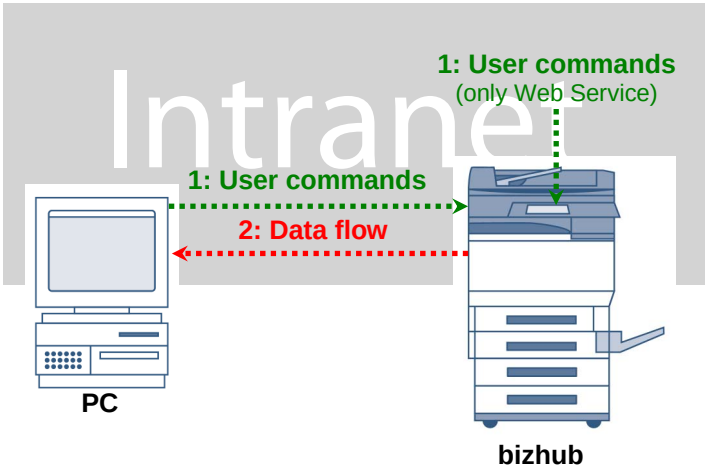


Fig.: Working method of Twain scanning

3.5.1 Twain

Twain is the name of an industry standard that determines how scanners transfer digitized data to a software application. The acronym Twain stands for *Technology Without Any Interesting Name*. Due to the conformity to Twain, a software is compatible with an image-digitizing device without knowing functional details of the hardware. The Twain driver that is installed on the client PC controls the scanner.

When scanning in Twain mode, you put the originals in the feed or onto the original glass and scan them as usual. You can start the scan process from every work place with a Twain-compatible application like Adobe Photoshop, DMS, etc. After scanning, you can remove the originals from the scanner again.

The main advantage of the Twain scan is that you can scan documents to all applications that are Twain-compatible – this is considerably time-saving.

3.5.2 Web Service

Web Service is a service provided by Windows Vista computers that helps to identify and locate devices such as scanners and printers via network. Device Profiles for Web Service (DPWS) allow appropriate interaction with devices from a Windows Vista computer.

From a Windows Vista computer you can find network devices supporting Web Service and install them on the Windows Vista computer. Once the MFP is installed on the Windows Vista computer as a scanner, the computer is also registered on the MFP. This allows two ways of scanning:

- From the computer: Open an application capable of scanning (e.g. Windows Photo Gallery) and select “Import from Camera or Scanner”. In the following dialog select the desired device (e.g. the MFP) and specify the desired scan settings (such as resolution and file format for the scanned image data). Be sure to place the original on the MFP before you finally start scanning.
- From the MFP: In the control panel of the MFP select the scan command, then select the desired computer for which the image data should be sent to, and start the scan.

3.6 Review questions

- Compare the different Scan-to-... functions. What are their differences?

- Which Scan-to-... functions may use Internet connections?

- What is the difference between Twain scan and the Scan-to-... functions?

4 Using MFP scanning functions

4.1 Introduction

MFP scanning functions allow you to scan images and send them to a destination instantly. This destination can be your workstation in the same network the MFP is connected to, the e-mail account of another person or a remote storage location (e.g. on an Internet server).

MFP scanning functions provide several options for scanning images such as specifying the scanning resolution and selecting a file format. You may use these options in order to produce the optimal result.

If you scan an image you can select several **options**:

- First of all, there is the scanning function. Do you select *Scan to e-mail* to send the image directly to a colleague or do you want to use Twain scanning because you first want to edit the image in Photoshop?
- Then you have to select a file format. Is it better to store the image as TIFF file or should you select PDF?
- You can also select a compression degree. Is it better to compress the image data or do you need uncompressed data?

The following sections give you an overview of what is possible with Konica Minolta systems and they also give you advice and some background information about available options and their applications.

4.2 Scanning functions of Konica Minolta systems

Konica Minolta systems provide a range of scanning functions which enable the user to directly send scanned images to particular storage locations or addresses:

- *Scan to e-mail* enables you to send an image to an e-mail address.
- *Scan to FTP* enables you send an image to an FTP server.
- *Scan to SMB* enables you to send an image to a shared directory within a network.
- *Scan to WebDAV* enables you send an image to a *WebDAV* server.
- *Scan to box* or *Scan to HDD* enables you to store an image on the hard disk drive of the controller, from where you can access the image later.

- *IFax* enables you to send an image to another IFax device. IFax provides the user with familiar fax-like functions (like e.g. group-dialing), but works by using e-mail communication standards in the background.
- *Twain* scanning enables you to access and control the scanner across a network from a Twain-capable application on your PC. For example, you may access the scanner from Adobe Photoshop and get the scanned image directly back in Photoshop where it is ready to be edited.
- *Web Service* scanning enables you to access and control the scanner across a network from a scanning-capable application on your Windows Vista PC.

All these functions work by transferring data across data lines. These data lines provide different **data transfer rates**. Accordingly the transfer of scanned image data requires more or less time.

For the most scanning functions which are used via network, there are two types of data lines (or network connections) used for the functions named above:

- **LAN** connections (e.g. Ethernet): Today most of the Ethernet LANs are equipped with at least Fast Ethernet (e.g. 100Base-T) which provides a transfer rate of 100 Mbit/s (roughly 12.5 MB/s). Some LANs may also be equipped with Gigabit Ethernet (e.g. 1000Base-T, 1 Gbit/s or 125 MB/s) or even the brand new 10 Gigabit Ethernet (e.g. 10GBase-T, 10 Gbit/s or 1.3 GB/s).
- **Internet** connections: The data transfer rates of Internet connections may vary considerably. For example, a conventional Internet connection across an analog modem provides a maximum transfer rate of roughly 56 Kbit/s (7 KB/s or 0.007 MB/s). An ADSL connection usually provides around 1 MB/s for downloads. Some companies may also use a dedicated line towards Internet with much higher transfer rates.

If you use a particular scanning function you should have the corresponding transfer rate in mind:

- Scan to e-mail: The transfer rate for this function depends on the location of the addressee. The e-mail may be sent to a colleague in the same building across the LAN of your company (e.g. 12.5 MB/s). The addressee may also use an analog modem to download their e-mails (max. 0.007 MB/s).
- Scan to FTP/WebDAV: The FTP/WebDAV server may be part of your company's LAN. It may also be a remote server somewhere in the Internet.

- Scan to box/ HDD: Usually the image data is downloaded from the controller's hard disk drive across a LAN.
- IFax: IFax uses a fax standard, so you are not able to apply any compression rate or to select a particular file format.
- Twain/Web Service: You use this function across a LAN (but in the case of Twain also locally e.g. via USB).

4.3 Use of image file formats

When you are scanning, you can select the file format for the image file that contains the scanned data. The following **file formats** are available:

- TIFF
- JPEG
- PDF

You can select the file format that best meets your demands. The file formats have the following **general characteristics**:

- **TIFF** (Tagged Image File Format): TIFF files are able to store accurate image information as 16-bit RGB data. With uncompressed TIFF the scanned images are stored in the best possible quality. Thus, TIFF is the choice for high quality image data that may be further processed, e.g. with an image processing software like Adobe Photoshop.
- **JPEG** (Joints Photographic Expert Group): JPEG was developed as a file format with small file sizes to be used in the WWW. JPEG uses lossy and non-lossy compression methods to reduce the file size (Lossy compression reduces the image quality!). JPEG files of the highest quality already have a considerably reduced file size and do virtually not differ from e.g. TIFF files in their image quality. But with increasing compression rates, the image quality decreases accordingly. You can view JPEG files with any image processing program but also with your web browser. Thus, JPEG is the choice for image files which are just viewed but which are not further processed. Additionally, small JPEG files can be sent quickly across slow data lines.
- **PDF** (Portable Document Format): PDF was developed as file format for document interchange across different computer platforms and is able to depict complete documents including text, graphics, fonts, and layouts. But it can also be used to contain just a single image. PDF uses JPEG compression methods and produces

roughly the same results concerning file sizes and image quality. The big advantage of PDF images is that you can use Acrobat Reader or any other PDF viewer to view them.

The following table gives you a view over the **amount of data** for different **color depths** and **resolutions** required to represent one DIN A4 page.

Color depth	Scanning resolution (pixels)			
	300 x 300	400 x 400	600 x 600	4800 x 4800
1-bit*	1 MB	1.8 MB	4.2 MB	259.2 MB
8-bit*	8.3 MB	14.8 MB	33.2 MB	2073.6 MB
24-bit*	24.9 MB	44.3 MB	99.6 MB	6220.8 MB

* 1-bit: B/W image/ 8-bit: greyscale image/ 24-bit: color image (RGB)

The values in the table above show how much data is required to store a DIN-A4 page at a given resolution and color depth. The values in the table roughly correspond to the file size of a TIFF file (The file size of a TIFF image is a little bit higher because the file does not only contain image information but also some additional information e.g. the file header.).

The same image stored as JPEG or PDF file results in smaller file sizes:

	TIFF	JPEG	PDF
600 x 600, 24-bit	99.6 MB	8.1 MB	9.4 MB

The copier also handles **RAW data**. In some systems, this format is automatically used if the *Scan to box/ HDD* option is selected (with other systems you may select RAW, TIFF, JPEG, or PDF). RAW data corresponds to the data which is produced by the scanner and which are not stored in a particular file format.

4.4 Use of compression options

When you are scanning, some scan functions provide the use of data compression. By data compression, you can reduce the amount of scanned image data. For example, this is useful if you want to send image data across slow data lines (e.g. if you use *Scan to e-mail* and the addressee accesses the Internet via an analog modem).

You should keep in mind that data compression also means loss of quality (and thus loss of image information). The available **compression degrees** are:

- High Quality (no/low data compression)
- Normal Quality
- High Compression (low quality)

The following table shows you how strong the file size of a DIN A4 image (resolution: 600 x 600 ppi, color depth: 24-bit) is reduced by applying compression rates (the following values were determined by using Adobe Photoshop):

	JPEG	PDF
No compression	8.1 MB	9.4 MB
Medium compression	1.5 MB	1.6 MB
High compression	0.8 MB	0.9 MB

By default, the user is able to select a particular compression degree that meets his demands. Though, a **key user** (e.g. the system administrator) may also **pre-select** a particular compression. This compression degree is then applied to all scans and single users are not able to select another degree.

4.5 Overview

In the following table we give you some recommendations on how to use different file formats and compression degrees with different scanning functions:

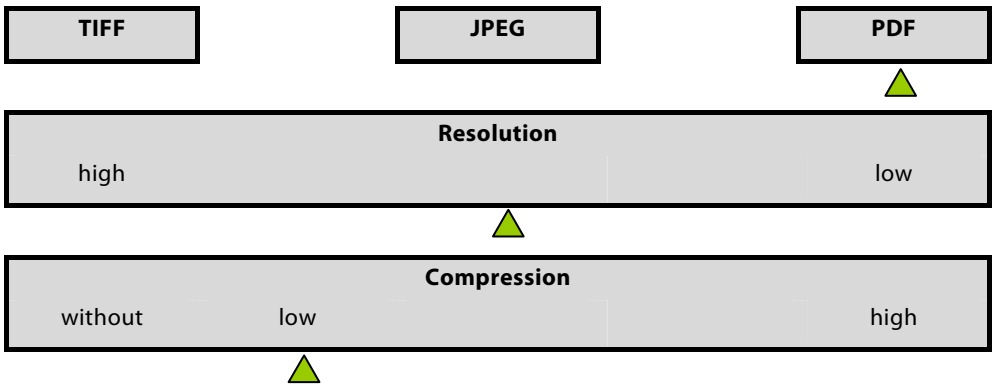
Scanning function	File format / compression
Scan to e-mail	Use a low scanning resolution, JPEG or PDF, and a higher compression degree if the addressee uses a very slow Internet connection. For faster Internet connections use a higher resolution and/ or do without compression. You may use TIFF if the addressee uses a high-speed Internet connection and/or the image should be further processed.
Scan to FTP/WebDAV	Use TIFF if you work within a LAN or if the remote FTP/WebDAV server can be accessed via high-speed Internet connections. Otherwise use JPEG or PDF (and compression if necessary). If the image is not to be further processed, use a low or medium scanning resolution.
Scan to SMB	See *Scan to FTP/WebDAV*.
Scan to box/ HDD	All options as you can select the use of the image later.
IFax	No options
Twain/Web Service scanning	By using Twain/Web Service scanning, you import uncompressed raw data. You can select the file format that best fits the later use.

Here are some examples of settings for different applications:

High quality, fast data connection
Possible further processing/ editing

Very slow data connection
No further processing/ editing

No further processing/ editing
For viewing only



4.6 Review questions

- Which scanning functions exist? Which types of data lines (LAN, Internet) correspond to these functions and do they provide small or large data transfer rates?

- Which file formats can you select for scanned image data? Which advantages and disadvantages do these file formats have?

- Which data compression rates can you select?

5 Network troubleshooting for MFP scanning functions

MFP scanning functions use the services of other devices via network connections. These functions can only work correctly if the following conditions are met:

- The MFP is connected to the network (this includes the physical connection via network connector as well as the MFP's correct network settings).
- The MFP's target devices in the network (such as eMail servers) are available (i.e. they are connected to the network).
- The target device provides the desired service (i.e. that a server that e.g. is supposed to be a WebDAV server actually provides the WebDAV service).
- The MFP uses the correct settings in order to address the target devices.

5.1 Tools for troubleshooting

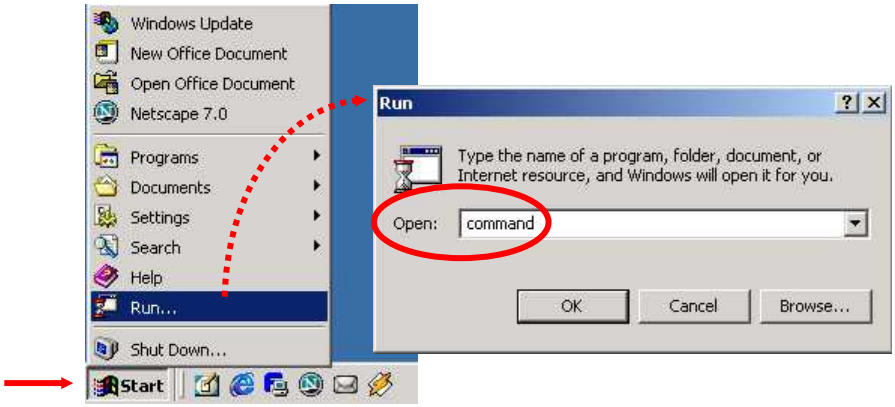
The **MS-DOS** shell is a command-line user interface that is provided by Windows operating systems. Using the MS-DOS shell you can e.g. check if a network device is available across the network with the *ping*-command.

Telnet is a protocol that can be used to communicate with another computer in a network or across the Internet. You can use telnet to check the communication with an SMTP server.

On Windows PCs (Windows 2000/XP), a telnet session is established by using the MS-DOS shell, a command line interface.

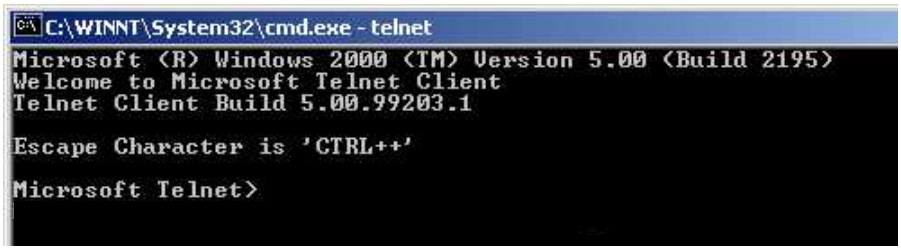
To open the MS-DOS shell and establish a telnet session:

1. open the MS-DOS shell by using **Run...** in the MS Windows Start menu and opening **command** (or just **cmd**).



2. Type the command **telnet** into the MS-DOS shell and press Enter.

The telnet client (Microsoft Telnet) is ready:



5.2 How to check the availability of network devices

5.2.1 How to check the availability of network devices from a computer connected to the network

To check the IP address or the availability of a network device, send a ping to the device (see below); use the IP address that is specified in the MFP's settings:

- If the device replies, everything is fine so far.
- If the device does not reply, either the IP address is wrong and has to be changed in the MFP's settings or the device is not available. Ask the network administrator to reconfirm the device's address and to confirm that the device is running.

If there is trouble with the network connection, e.g. when the MFP cannot be accessed across the network, the first step is to check whether the network connection has been properly configured. It is useful to carry out this check right after the MFP has been configured for TCP/IP the first time to prevent problems during later operation.

To check whether the MFP has been connected correctly to the network or not, send a ping from a PC across the network to the MFP:

> **Ping** (abbrev. for Packet InterNet Groper) is a function that is supplied by network tools in order to send data packets across a network for test purposes. When a network device is correctly connected to the network (in terms of physical wiring as well as proper configuration) and a ping is sent to that device, it responds by sending an echo that is received by the ping tool. If no echo is received, the addressed device is not correctly connected to the network by wiring or not configured with the correct TCP/IP settings.

To send a ping to the MFP:

- open the MS-DOS shell on a PC in the network (see section 5.1 *Tools for troubleshooting*, step 1),
- type in the command **ping <IP address>** and press **Enter**.

If the MFP does not respond a corresponding message is displayed by the MS-DOS shell (see fig. 1).

```
C:\>ping 222.222.222.56

Pinging 222.222.222.56 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 222.222.222.56:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum =  0ms, Average =  0ms
```

Fig. 1: MS-DOS shell, ping without reply (“Request timed out”)

When the MFP is correctly connected to the network by wiring, the TCP/IP settings of the MFP must be wrong.

First check the TCP/IP settings of the MFP. If the actual settings correspond to the parameters determined by the network administrator, you must ask the administrator for reconfirmation and inform her/him of the faulty configuration.

When you finally know the correct TCP/IP settings, configure the MFP again and send another ping to the device. If the settings are correct, the MFP sends replies that are displayed by the MS-DOS shell (see fig 2).

```
C:\>ping 222.222.222.56

Pinging 222.222.222.56 with 32 bytes of data:

Reply from 222.222.222.56: bytes=32 time=10ms TTL=128
Reply from 222.222.222.56: bytes=32 time<10ms TTL=128
Reply from 222.222.222.56: bytes=32 time<10ms TTL=128
Reply from 222.222.222.56: bytes=32 time<10ms TTL=128

Ping statistics for 222.222.222.56:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum =  10ms, Average =  2ms
```

Fig. 2: MS-DOS shell, ping with reply

In this same way you can check the availability of other network devices such as eMail servers, which are addressed by the MFP. Be sure to use the IP addresses as they are specified in the settings of the MFP. If the devices in question do not send replies, contact the network administrator and verify whether the MFP settings are incorrect or whether the addressed devices are not working.

Note:

Some MFPs may provide the option to send a ping to a specified network address, so you do not have to use a network computer. Please note that the MFP's network connection must be working in order to check other network devices. This option e.g. can be used if there are troubles with a particular scanning function while other scanning functions are working properly.

5.3 How to check the availability of network services

5.3.1 E-mail

Troubles concerning an e-mail connection can be caused for different reasons:

- The IP address of the SMTP server, which is specified in the *Scan to e-mail* settings, is invalid or the SMTP server is not running.
- The domain of the scan system is incorrectly specified or not accepted by the SMTP server.
- The e-mail account of the scan system is incorrectly specified or unknown to the SMTP server.
- The scan system is asked to download its e-mails (e-mails addressed to the scan system) before it can send any e-mails.
- The scan system is asked to give an SMTP authentication that is requested by the SMTP server before e-mail data can be transmitted from the scan system to the SMTP server.

To check the IP address or the availability of the **SMTP server**, act as described in the *TCP/IP / Troubleshooting* section and send a ping to the SMTP server; use the IP address that is specified in the controller's settings:

- If the SMTP server replies, everything is fine so far.
- If the SMTP server does not reply, either the IP address is wrong and has to be changed in the controller's settings or the SMTP server is not available. Ask the network administrator to reconfirm the SMTP server address and to confirm that the SMTP server is running.

To check for other causes for trouble, you need to establish a connection to the SMTP server via **telnet**:

1. Start telnet (as described in section 5.1 *Tools for troubleshooting*).
2. Type the command **set localecho** into the command line and press **Enter**.
3. Type in the command **open <IP address>:<port number>** and press **Enter** to establish the connection to the SMTP server. Use the IP address of the SMTP server and the port number 25, which is the port normally used for SMTP (for example: open 222.222.222.56:25).

If the SMTP server refuses the connection there could be different reasons:

- The PC you are working on is not allowed to login to the SMTP server. Ask the network administrator for a PC that is allowed to login to the SMTP server or to configure the SMTP server in order to allow your PC to login.
- The SMTP server was found but a connection across port 25 is not possible. Ask the network administrator for the port number the SMTP server uses.

When the connection to the SMTP server finally is established, you are now able to check other reasons that may cause trouble.

The e-mail server is set up to allow only connections requested from **dedicated domains**. To check whether the scan system uses a domain that is accepted by the SMTP server you can use the HELO-command, an SMTP command that is used by an e-mail client to identify itself to an e-mail server:

4. Type the command **HELO <domain>** into the command line and press **Enter** (for example: *HELO car.co.uk*).

   If the SMTP server refuses the identification, an error message occurs as it is displayed in the following picture.

```
HELO car.co.uk
550 Domain konicaminolta.com does not accept mail from car.co.uk
```

   If the identification fails please check the domain name/IP address of the scan system. If the settings of the scan system are correct, please ask the network administrator.

The scan system must be an e-mail client that is known by the e-mail/SMTP server; there must be a valid **e-mail account for the scan system** on the e-mail server. To check whether a valid e-mail account is set up on the e-mail server you can use the MAIL FROM-command, an SMTP

command that is used by the e-mail client to inform the e-mail server about a new e-mail that will be sent. The MAIL FROM-command contains the e-mail address of the client (for example: *MAIL FROM: john@konicaminolta.com*) and the e-mail address contains the name of the client's e-mail account (in this example: john). If there is no valid e-mail account, the e-mail server will not accept an e-mail from the sender.

5. Type the command **MAIL FROM: <e-mail address>** into the command line and press **Enter**.
   (for example: *MAIL FROM: john@konicaminolta.com*)

   If there is no e-mail account for the sender, an error message occurs as it is displayed in the following picture (the first two lines refer to a successful identification of the sender by using the HELO-command).

```
HELO konicaminolta.com
250 konicaminolta.com Hello konicaminolta.com, pleased to meet you
MAIL FROM:<john@konicaminolta.com>
550 <john@konicaminolta.com>, Sender unknown
```

   If the sender is unknown to the e-mail server, please check the sender name/e-mail address of the scan system. If the settings of the scan system are correct, please ask the network administrator.

   E-mail servers supply a ***POP before SMTP*** option. If this option is enabled, the e-mail client first must request e-mails addressed to the client from the server (using POP) before the client is able to send e-mails to the server (using SMTP).

   The Pi3502/5501 controller is not able to request e-mails, so this option must be disabled on the e-mail server. Other controllers support *POP before SMTP*, so the *POP before SMTP* option can remain enabled on the e-mail server.

   If the POP before SMTP option is enabled, a MAIL FROM-command will lead to an error message as it is displayed in the following picture.

```
220 konicaminolta.com ESMTP Jan 2009 14:02:56 +0100

HELO TREIBER
250 konicaminolta.com Hello TREIBER, pleased to meet you
MAIL FROM:<admin@konicaminolta.com>
550 admin@konicaminolta.com must check for new mail first
```

   If this error message occurs, ask the network administrator to disable the *POP before SMTP* option.

SMTP servers ask the e-mail client for an **SMTP authentication** when the e-mail client sends a RCPT TO-command. The RCPT TO-command is used to specify the recipient of an e-mail. The scan system is not able to give an SMTP authentication, thus the SMTP authentication must be disabled on the server. To check whether the SMTP server requests an SMTP authentication use the RCPT TO-command with the valid e-mail address of a recipient:

6. Type the command **RCPT TO: <e-mail address>** into the command line and press **Enter**.
   (for example: *RCPT TO: admin@konicaminolta.com*)

   If SMTP authentication is requested an error message occurs as it is displayed in the following picture.

```
HELO konicaminolta.com
250 konicaminolta.com Hello konicaminolta.com, pleased to meet you
MAIL FROM:<admin@konicaminolta.com>
250 <admin@konicaminolta.com>, Sender ok
RCPT TO:<admin@konicaminolta.com>
530 Authentication required
```

   If this error message occurs, ask the network administrator to disable the SMTP authentication of the e-mail account.

5.3.2 FTP

Trouble concerning FTP connections can be caused for different reasons:

- The IP address of the FTP server, which is specified in the *Scan to FTP* settings, is invalid or the FTP server is not running.
- Login name and password that are specified in the Scan to FTP settings are incorrect.
- The destination directory on the FTP server is not available.
- Files cannot be transferred to the destination directory using FTP.

To check the IP address or the availability of the **FTP server**, act as described in the *TCP/IP / Troubleshooting* section and send a ping to the FTP server; use the IP address that is specified in the controller's settings:

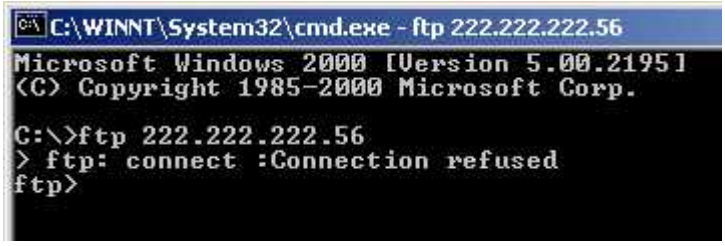
- If the FTP server replies, everything is fine so far.
- If the FTP server does not reply, either:
  - the IP address is wrong and has to be changed in the controller's settings,
  - the FTP server is not available, or
  - the FTP server is not part of the local network but behind a firewall (e.g. somewhere in the Internet).

  Ask the network administrator to
- reconfirm the FTP server address,
- confirm that the FTP server is running, and
- confirm that the firewall allows FTP connections to the outside (if not Scan to FTP must use a proxy server).

To check other causes for trouble, you need to establish an **FTP session** with the FTP server using the MS-DOS shell:

1. Open the MS-DOS shell (as described in section Tools for setup and troubleshooting / MS-DOS shell and telnet, step 1).
2. Type in the command **ftp <IP address>** and press **Enter** to establish the connection to the FTP server. Use the IP address of the FTP server (for example: ftp 222.222.222.56:21).

If the FTP server **refuses** the **connection** there could be different reasons.

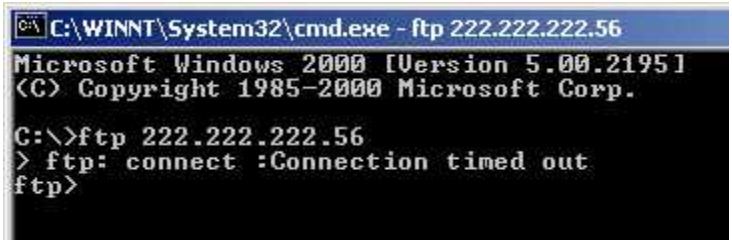


- The IP address of the FTP server was wrong.
- The FTP server is not running.

- The FTP server does not use the standard port 21.

Ask the network administrator for information.

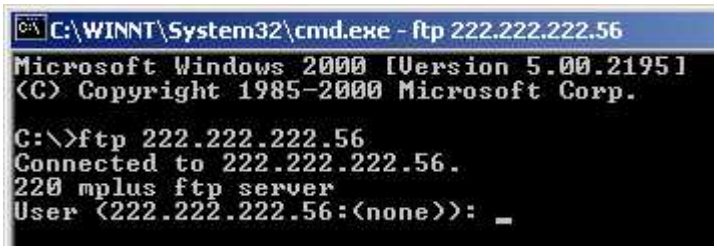
If the **connection** to the FTP server is **timed out**, the used IP address cannot be reached.



Check the following items of the scan system:

- IP address
- Subnet mask
- Gateway IP address

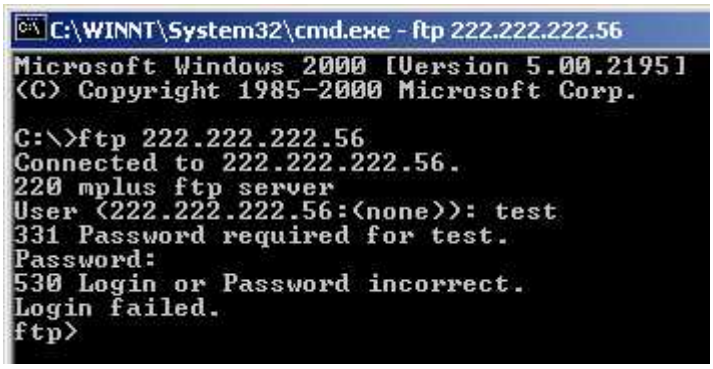
When the connection to the FTP server finally is established, you are able to check other reasons that may cause trouble.



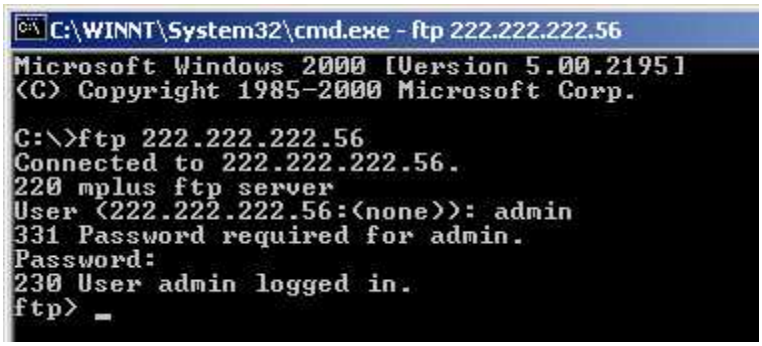
First, check the correct **login name** and **password**.

3. Type the login name into the command line and press **Enter** (for example: *test*).
4. Type the password into the command line and press **Enter**.

   If login name and/or password are incorrect, an error message occurs as it is displayed in the following picture.



   Ask the network administrator for the correct login name and password and try again. The following picture shows a correct login.



Then check whether the **destination directory** is available via FTP session:

5. Type **dir** ("directory") into the command line and press **Enter**.

   The files and directories in the user's home directory are listed. The destination directory for Scan to FTP is *inbox/2003*. If *inbox* is not listed, ask the network administrator to create the required destination directory.

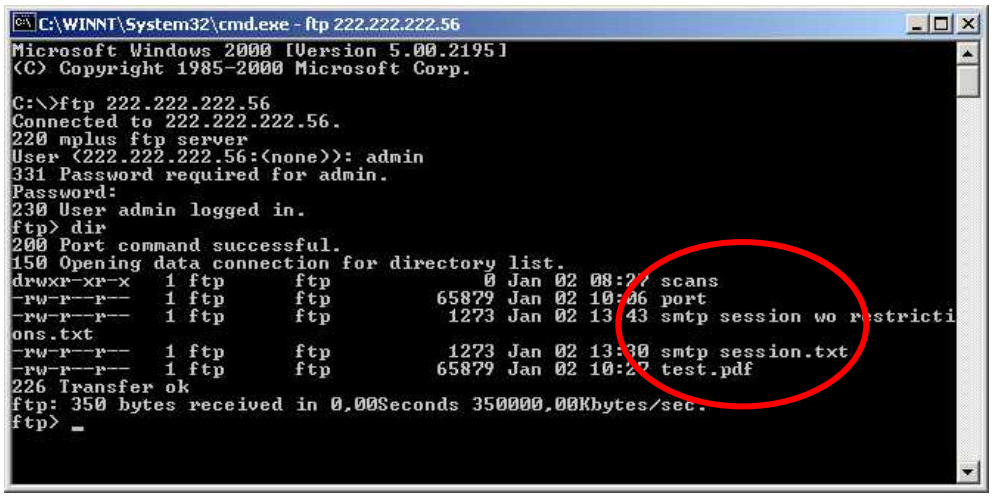


Fig. 1: Home directory of the user, *inbox* not listed

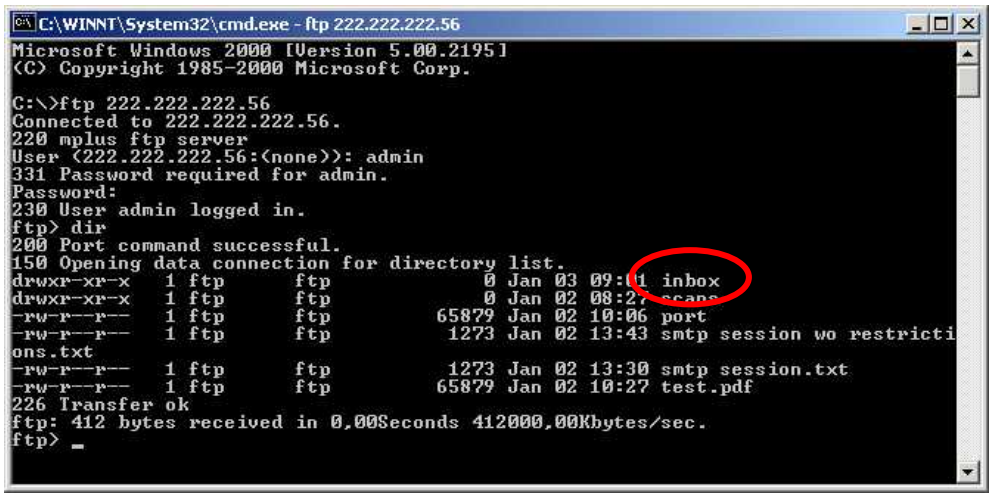


Fig. 2: Home directory of the user, *inbox* listed

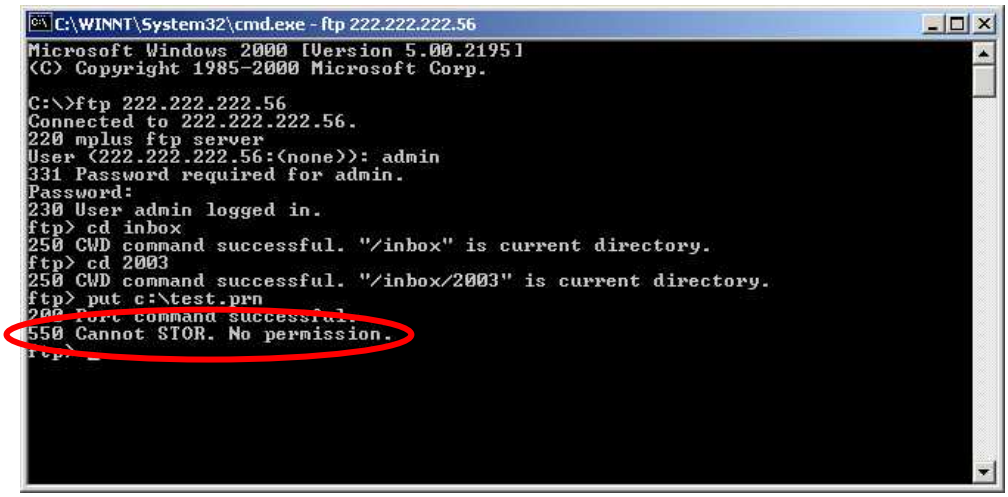
Finally, check if ***binary transfer mode*** is selected for the destination directory. *Binary transfer mode* is necessary to transfer image files to the destination directory using FTP:

6. Type **cd inbox** ("change directory to *inbox*") into the command line and press **Enter**.

7. Type **cd 2003** ("change directory to *2003*") into the command line and press **Enter**. You are now in the directory …/<user's home directory>/inbox/2003.

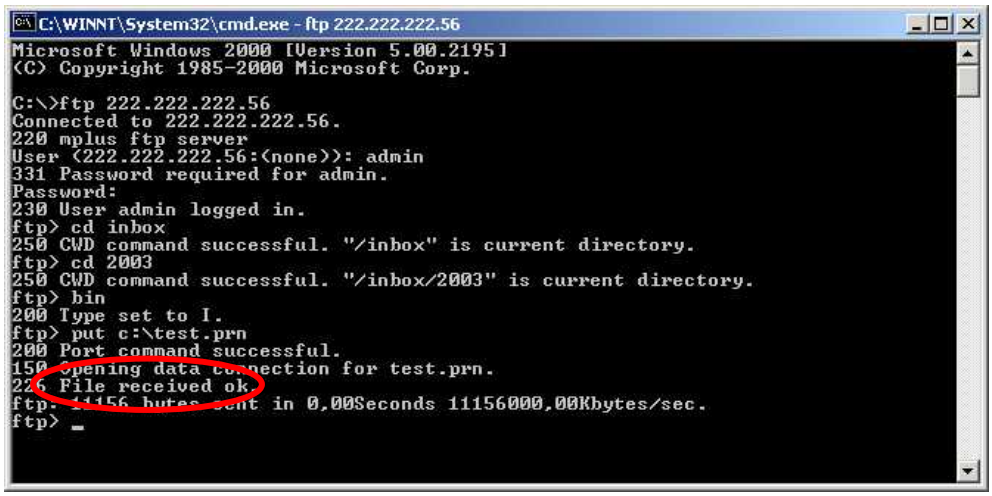
8. Type **put <path/file>** (for example, *put c:\test.prn*; "put the file *test.prn* into the directory *2003*") into the command line and press **Enter**.

   If *binary transfer mode* is not selected for the destination directory, an error message occurs, as it is displayed in the following picture.



To select *binary transfer mode* for directory 2003

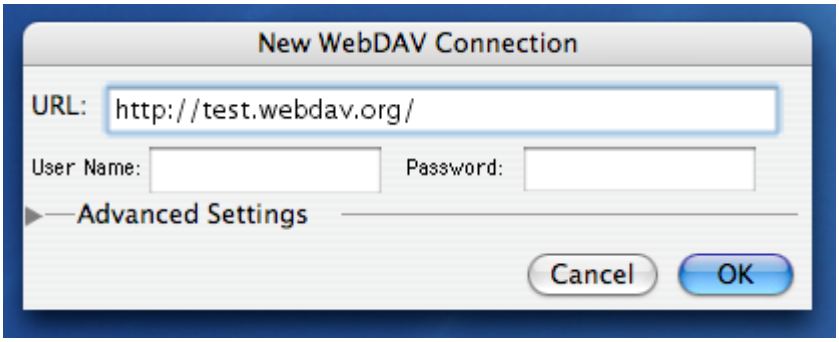
9. Type **bin** (“binary transfer mode”) into the command line and press **Enter**.
10. Try again to transfer the file into the directory 2003 using the put-command.



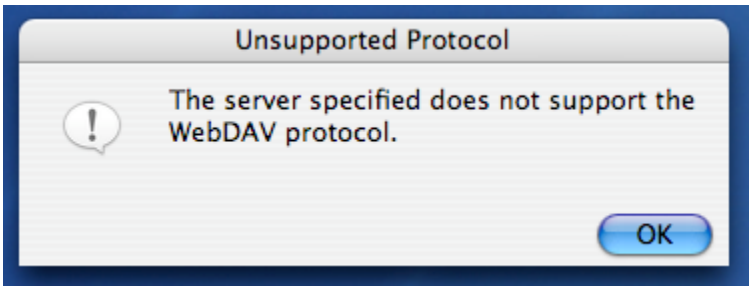
The file transfer was successful (if not, ensure that the FTP server supports **active and passive FTP mode**).

5.3.3 WebDAV

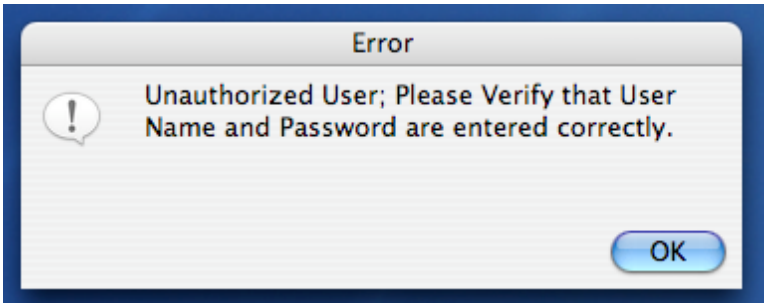
You can check the availability of the WebDAV service on a particular server by trying to access the WebDAV service with the help of a freeware WebDAV client (here: Goliath on Mac OS X):



When you try to connect to the server and the server does not provide a WebDAV service, you will get a corresponding error message:



If the server provides a WebDAV service, you will get access to the directory or at least you will get a WebDAV-related error message (e.g. when authentication is required and you used the wrong or no user name and password):



5.4 Review questions

- How do you start a telnet session on a Windows PC?

- How can you check whether a scan system is correctly connected to the network or not?

- Which reasons can lead to trouble with *Scan to e-mail*? How can you check them?

- Which SMTP commands are used to check for trouble with *Scan to e-mail*? Which task performs each command?

- Which settings on the e-mail/SMTP server may lead to trouble with *Scan to e-mail*? Why?

- How can you check if the FTP server is available?

- Which other items may have to be checked besides the FTP server's availability for *Scan to FTP*?

- Which commands do you need to know when you carry out troubleshooting for Scan to FTP in the MS-DOS shell? Which task does each command perform?

- How can you check whether a WebDAV service is available or not?

6 Scanning images to be printed

6.1 Introduction

Scanning of digital images and printing these images in an electronic environment is a process that basically consists of the following steps:

1. Scanning the original and generating a digital image.
2. Converting the digital image into digital halftones.
3. Printing the digital halftones.

The basic step between the creation of images and the reproduction of images is **halftoning**. This step is necessary because images – photographic images or digital images – are continuous tone images and printed images are not. Continuous tone images can contain thousands or millions of different colors. In contrast to this, the reproduction of images by printing works with only up to four colors (cyan, magenta, yellow, and black for full color printing) that are usually applied on white paper.

The basic task of halftoning is to convert **continuous tone images** into images that are combined from only a few print colors but that nevertheless create the illusion of a continuous tone image.

Originally halftoning was developed to reproduce photographs by printing. With the use of computers and digital images, a digital halftoning process was developed.

Scanned images are often reproduced by a printer. For example, digital copiers and fax machines combine scanning and printing in one device. There is a direct relation between the resolution of a scanned or digital image, the resolution of a halftone image, and the resolution of a printer. To achieve an optimal printout on a certain printer, the scanning already needs to be adjusted to the following halftone process and printing.

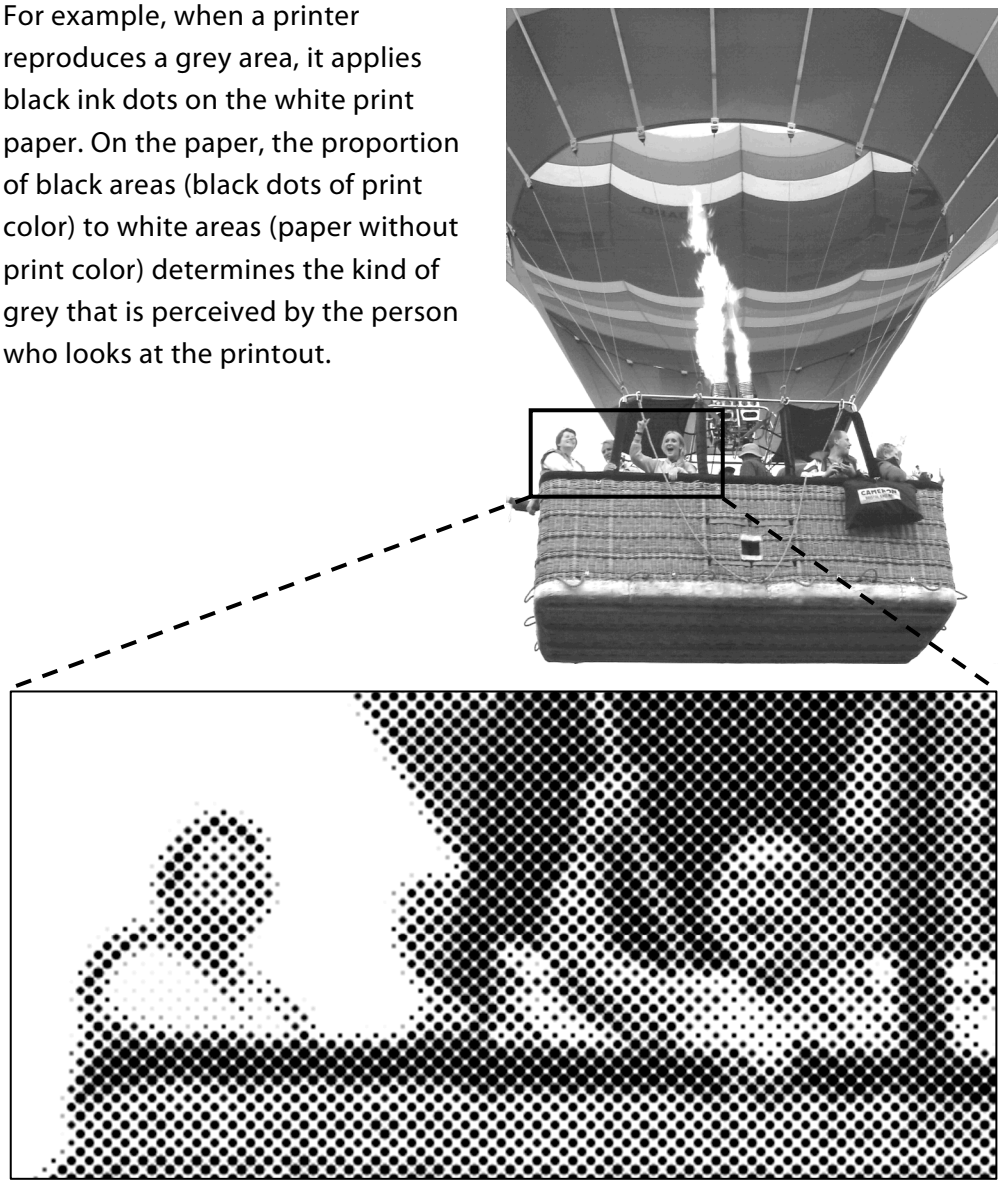
The next sections of this chapter introduce you to some basic characteristics of halftone images and to the resolution of halftone images. In the last section you will learn how to calculate the scanning resolution of an image that is to be printed on a printer with a particular output resolution.

6.2 Halftoning

Printers create an image (on the printout) that differs in its structure from the digital image. The basic element of the digital image is the **pixel**. Basically, a pixel is determined by its color (except for its position inside the image). Depending on the color depth of the image, each pixel can represent one color out of a range of many different colors.

In contrast to the digital representation of colors, a printer only uses black print color (for black/white printing) or cyan, magenta, yellow and black print color (for full color printing). A particular color of a printed image needs to be simulated by combining differently **colored dots of print color**.

For example, when a printer reproduces a grey area, it applies black ink dots on the white print paper. On the paper, the proportion of black areas (black dots of print color) to white areas (paper without print color) determines the kind of grey that is perceived by the person who looks at the printout.



Picture 1: Halftones realized by dots of different size

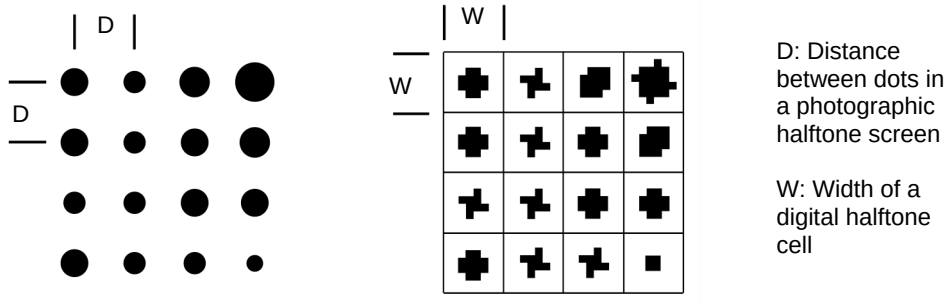
When a digital image is to be printed, first the digital image passes through a process called halftoning. Halftoning converts the digital image with its pixels into an image consisting of color dots. This image is called a **raster image** and corresponds to the image that is generated by the printer on the print paper.

6.3 Halftone cells

So-called photographic halftones are reproduced by printing dots of different sizes. The single printing dots are arranged in a right-angled raster and between the dots is certain distance (see picture 1, left). The actual halftone is realized by the size of the ink dot in relation to the distance between the dots in the screen. For example, if the dots in the screen are that big that they overlap, a dark halftone is reproduced. The distance between the printing dots is called raster frequency and determines the resolution of the halftone raster.

Photographic halftone rasters already were developed in the 19th century in order to reproduce photographs by printing. Today, computer-controlled devices like modern copiers use digital halftones. The central element of digital halftoning is the halftone cell or respectively raster cell. One halftone cell corresponds to a photographic halftone dot and its background.

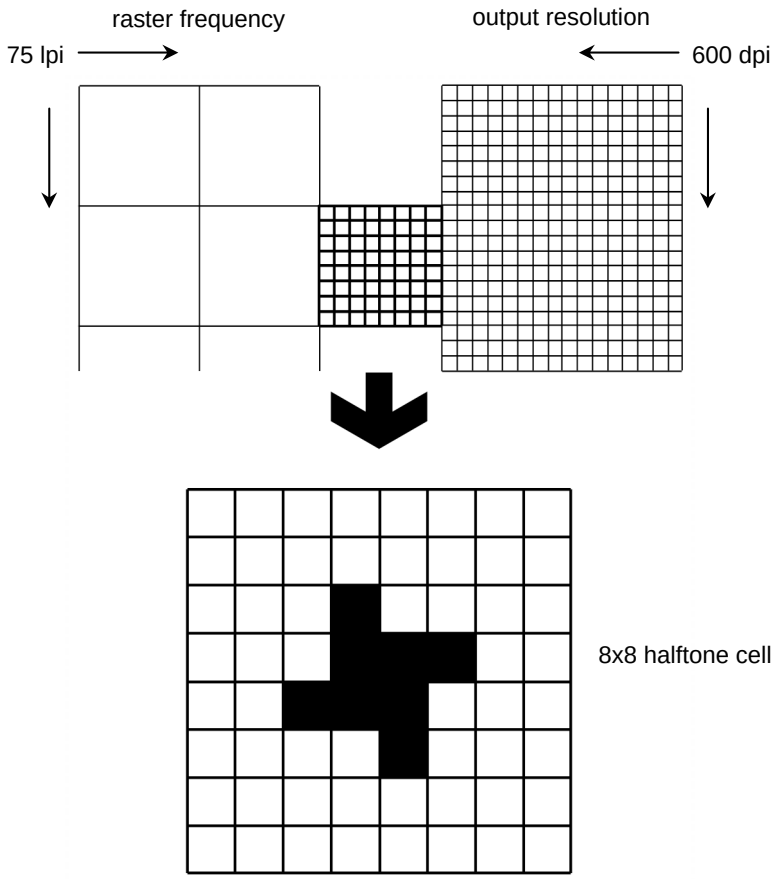
Digital halftoning uses a raster of halftone cells, each halftone cell provides space for several dots that can be either black (if printing color is applied) or white (if no printing color is applied; see picture 1, right). The relation between white and black dots determines which actual halftone is realized. When the halftone cell contains more black dots than white dots, a dark halftone is reproduced.



Picture 1: Photographic halftone screen, digital halftone screen

As photographic halftoning, digital halftoning works at a certain resolution or **raster frequency**, which is measured in lines per inch (lpi). The digital halftone resolution is strongly related to the **output resolution** of the printer that is measured in dots per inch (dpi).

The line screen consists of lines of halftone cells. A raster frequency of 75 lpi means that within an inch, 75 lines of halftone cells are arranged. Each halftone cell consists of a raster of dots, and one dot in a halftone cell corresponds to a single dot that can be printed by the printer.



Picture 2: Raster frequency, output resolution, halftone cell

Usually, halftone cells have a square shape. The size of a halftone cell can be calculated based on a given raster frequency and a given output resolution. The formula is

$$\left(\frac{\text{output resolution}}{\text{raster frequency}} \right)^2$$

For example, if the raster frequency is 75 lpi and the output resolution of the printer is 600 dpi, the size of the halftone cell is 8 by 8 (8x8). If the exact result of this calculation is a fraction the size of the halftone cell must be rounded up or down. For example, if the raster frequency is 106 lpi and the output resolution is 600 dpi, the size of the halftone cell would be roughly 5,66 by 5.66. In this case the size of the halftone cell would be rounded to 5x5 or 6x6. The actual size will be selected by the raster image processor that generates the digital halftone screen for the printer.

6.4 Screen angle

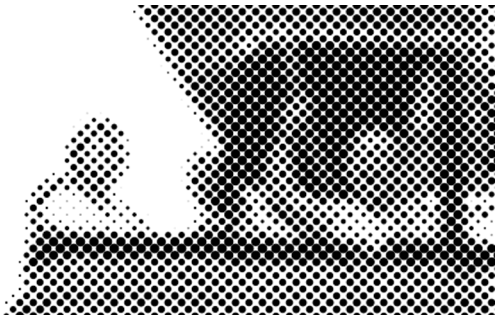
Besides the raster frequency, the screen angle determines how much a halftone image creates the illusion of a continuous tone image. Greyscale halftones are usually printed at a screen angle of 45°. The human eye best recognizes the structure or the elements of a pattern, when these elements are aligned horizontally or vertically (1).

Picture 1: Image at a screen angle of 0°

When pattern elements are not aligned horizontally or vertically, the pattern is not recognized that easily (2).

Picture 2: Image at a screen angle of 18°

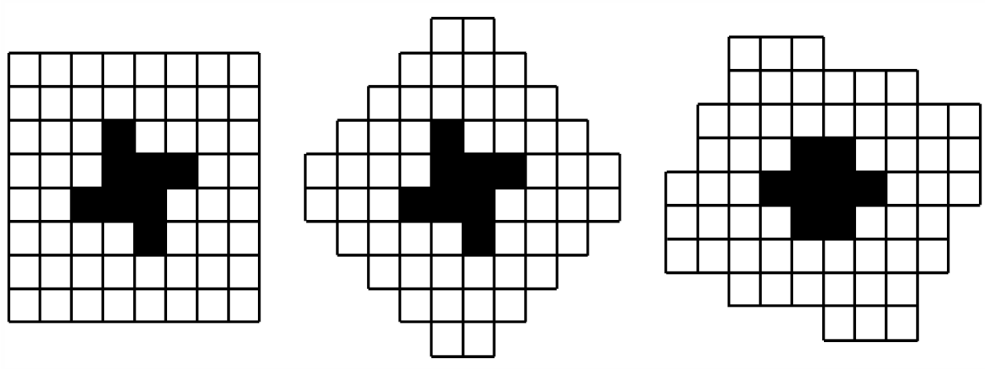
At 45° the recognition of the pattern is bad and thus a viewer tends to see the image rather than the pattern the image is built up from (3).



Picture 3: Image at a screen angle of 45°

This is why photographic halftone screens are tilted to an angle of 45° for black&white printing or to some other angles with full color printing, so are digital halftone screens.

The angles, digital screens are tilted to, differ more or less from the angles of photographic screens. The tilted halftone screen is displayed onto the dot raster of the printer that is aligned horizontally and vertically. For example, an 8x8 halftone cell can be tilted as the following picture shows.



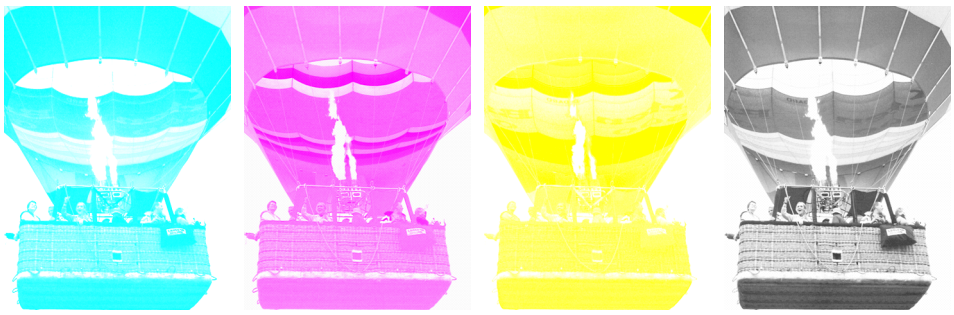
Picture 4: 8x8 halftone screens with different screen angles

Which actual angle a screen can be tilted to depends on the size of the halftone cell. The larger the halftone cell, the more angles can be realized and the smaller the deviation from the original screen angles (with full color printing: 45°, 75°, 105°; see chapter 6.5 *Color halftones*).

6.5 Color halftones

In contrast to black & white printing, full color printing uses four print colors: **cyan, magenta, yellow, and black** (CMYK). The combination of the primary colors cyan, magenta, and yellow makes the reproduction of a wide of colors possible. Additionally black – the so-called *keycolor* (K in CMYK) – is used to compensate for flaws of the CMY inks and to realize a true black in the shadows of an image. The share of each print color can be printed separately.

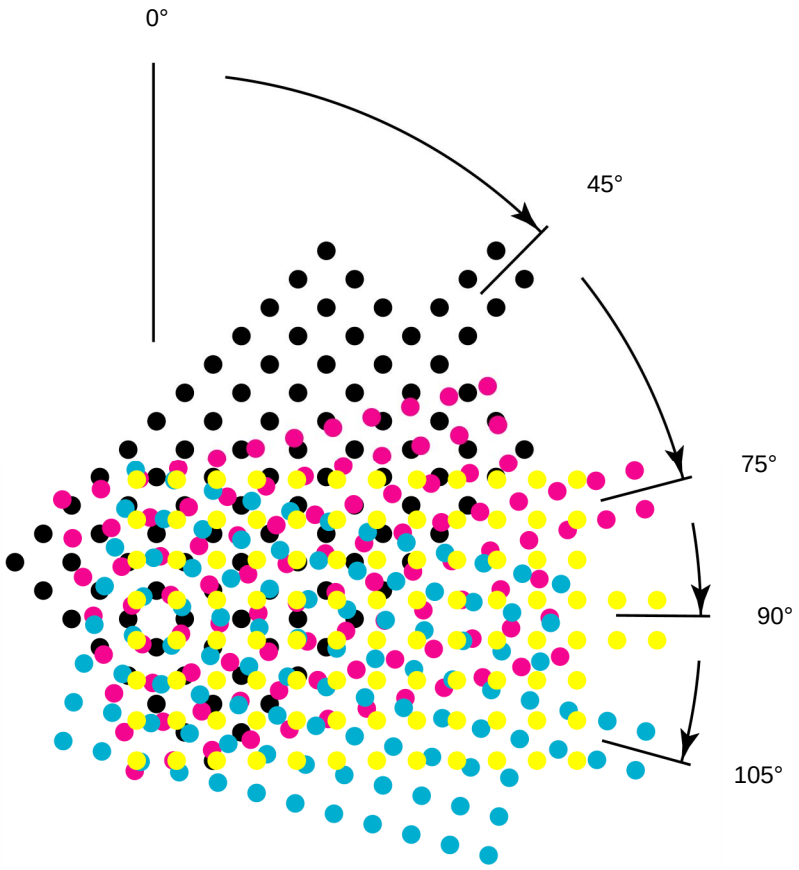
Picture 1: Full color image



Picture 2: CMYK Separation

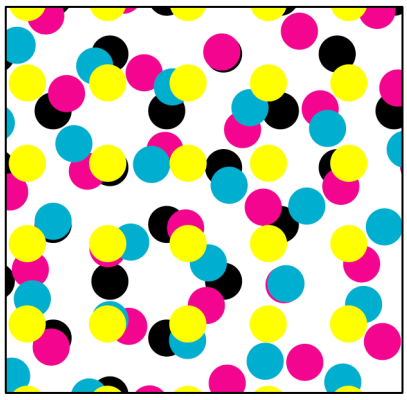
Actually, each print color is printed separately when a full color image is printed. Thus not just one halftone screen for black ink dots is used, but four screens – one screen for each color. With photographic halftones, first the four halftone screens have to be created separately. For each of the primary print colors, the process – as it is described in section *Photographic halftones* – is carried using an additional color filter that isolates the desired color cyan, magenta or yellow.

Also each **screen** is created at a **different angle**. To avoid a strong Moirè effect (the superposition of two or more patterns creates a new, undesired pattern), each screen alignment differs by 30°. Usually, black (or keycolor) is printed at 45°, magenta is printed at 75°, and cyan is printed at 105°. Following the rotation in 30°-steps, yellow would have to be printed at 135°. Then the yellow screen and the black screen would differ by exactly 90° and the square grating of black dots would cover the square grating of yellow dots. Because the light yellow color creates a Moirè effect that is hardly noticeable, the yellow screen is out of the 30° variance and is actually printed at 90°.



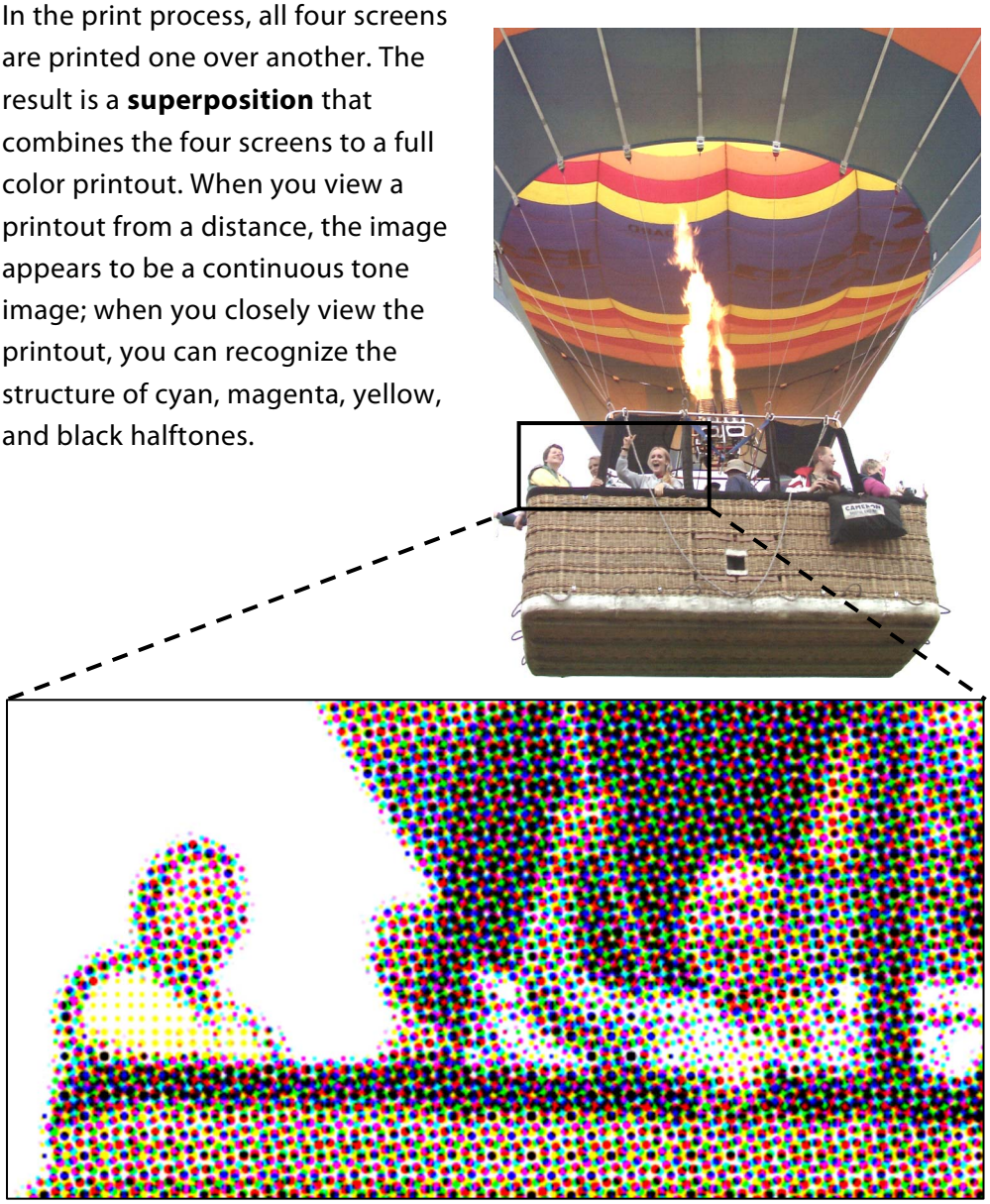
Picture 3: Superposition of CMYK screens

The superposition of CMYK screens creates so-called **rosettes**, a ring-like alignment of the cyan, magenta, yellow, and black ink dots.



Picture 4: Rosettes of a CMYK screen

In the print process, all four screens are printed one over another. The result is a **superposition** that combines the four screens to a full color printout. When you view a printout from a distance, the image appears to be a continuous tone image; when you closely view the printout, you can recognize the structure of cyan, magenta, yellow, and black halftones.



Picture 5: Full color halftone printout

6.6 Scanning to a given output device

The output of a scanned image can be optimized when the scanning resolution is selected in relation to the raster frequency of the output device or printer. Additionally, a scaling of the image can be considered.

Before you scan an image, collect the following **specifications**:

- The raster frequency of the printer
- The size of the original image
- The size of the printed image

The basic **formula** for the scanning resolution is

- for a raster frequency of 133 lpi or higher:

  raster frequency (lpi) x 2 = scanning resolution (ppi)

- for a raster frequency of less than 133 lpi:

  raster frequency (lpi) x 1.5 = scanning resolution (ppi)

The **scaling** of the image can be considered as additional factor. For example, if the printed image should be two times larger than the original, the formula is:

raster frequency (lpi) x 2 x 2 = scanning resolution (ppi)

Example:

An 8cm by 10cm original should be printed at 12cm by 15cm on a printer with a raster frequency of 150 lpi.

The image is scaled by the factor 1.5.

The formula is:

150 lpi x 2 x 1.5 = 450 ppi

450 ppi is the optimal scanning resolution.

6.7 Review questions

- Why can digital images not be printed directly?

- Describe the structure of a halftone image on a black & white printout. How are the different levels of gray realized?

- What are halftone cells?

- What does *raster frequency* mean?

- How is the perception of an image influenced if it is printed at different screen angles? Why?

- How are full color printouts realized by halftoning? How are the different color halftone screens arranged? Why?

- What is the relationship between digital raster frequency and the output resolution of a printer?

7 Review questions

- How is the color of digital images specified? What does the term *color depth* mean?
- What is the relationship between the file size of a digital image and its characteristics?
- Name popular image file formats and their characteristics.
- Compare the different Scan-to-... functions. What are their differences?
- Which Scan-to-... functions may use Internet connections?
- What is the difference between Twain scan and the Scan-to-... functions?
- Which scanning functions exist? Which types of data lines (LAN, Internet) correspond to these functions and do they provide small or large data transfer rates?
- Which file formats can you select for scanned image data? Which advantages and disadvantages do these file formats have?
- Which data compression rates can you select?
- How do you start a telnet session on a Windows PC?
- How can you check whether a scan system is correctly connected to the network or not?
- Which reasons can lead to trouble with *Scan to e-mail*? How can you check them?
- Which SMTP commands are used to check for trouble with *Scan to e-mail*? Which task performs each command?
- Which settings on the e-mail/SMTP server may lead to trouble with *Scan to e-mail*? Why?
- How can you check if the FTP server is available?
- Which other items may have to be checked besides the FTP server's availability for *Scan to FTP*?
- Which commands do you need to know when you carry out troubleshooting for Scan to FTP in the MS-DOS shell? Which task does each command perform?
- How can you check whether a WebDAV service is available or not?
- Why can digital images not be printed directly?

- Describe the structure of a halftone image on a black & white printout. How are the different levels of gray realized?
- What are halftone cells?
- What does *raster frequency* mean?
- How is the perception of an image influenced if it is printed at different screen angles? Why?
- How are full color printouts realized by halftoning? How are the different color halftone screens arranged? Why?
- What is the relationship between digital raster frequency and the output resolution of a printer?