

Image Scanner Driver for Linux User's Guide

For the following driver:

Linux driver for SP Series scanner

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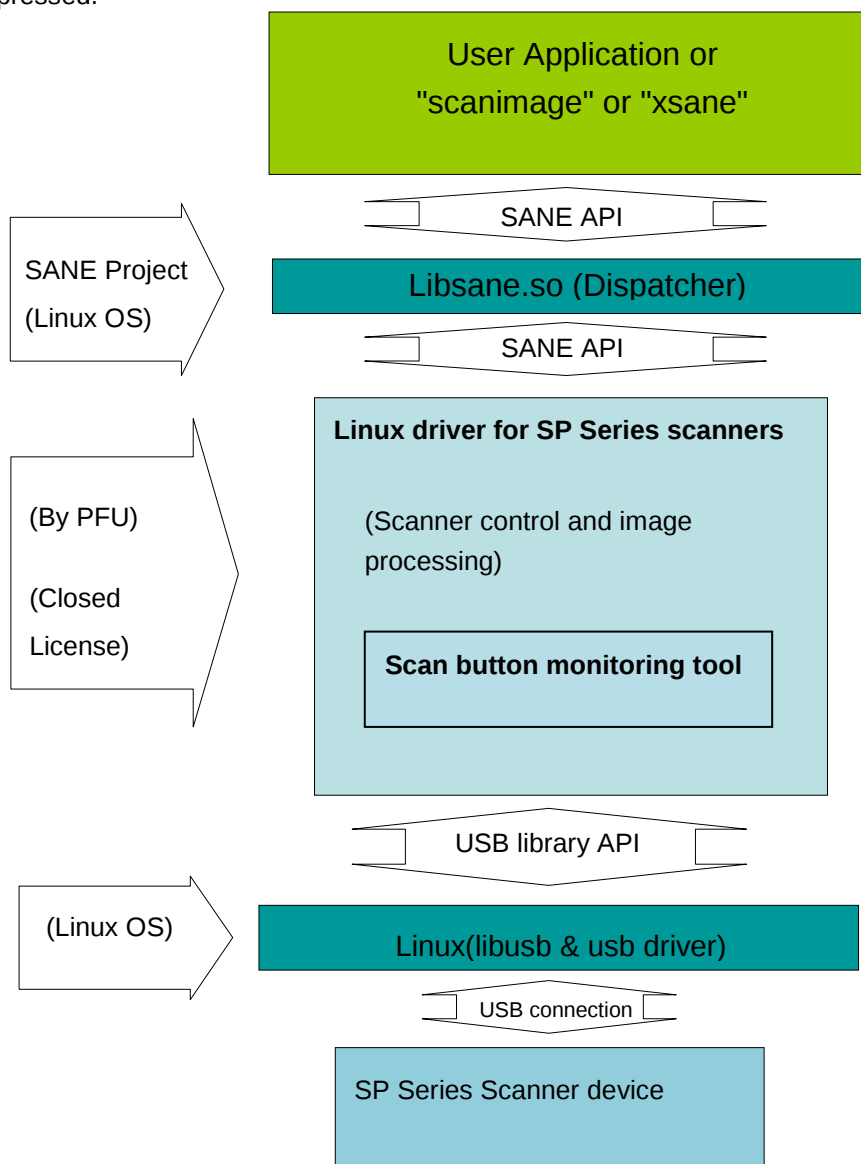
Linux Driver Product Specifications

The Linux driver product specifications are described below.

1. Linux Driver Overview

This product is a library program for controlling SP Series scanners in Linux systems. It provides an application interface based on SANE API. For this reason, it can be called from user applications ("scanimage", "xsane", etc.) that support SANE API installed in typical Linux systems.

It also provides a [Scan] button monitoring tool for performing scanning whenever the [Scan] button is pressed.



*Note: In Linux systems, the term "driver" refers to a module that is installed in the Linux kernel and operates in privilege mode for the CPU. Previously, scanner drivers had been installed in the Linux kernel for operation. Currently, drivers are installed as a library based on SANE API outside the kernel and operate by dynamically linking from applications. Although it is actually a library, PFU and other scanner manufacturers call it a "driver".

2. Supported Devices

The devices supported by this product are shown below.

SP Series scanners

No	Device	Notes
1	SP-1120/SP-1125/SP-1130	

3. Provided Product Units

This product is provided in two packages (installers). The supported devices and OS version for each package are shown below.

No	Supported device	OS version	Package (installer) filename	Package format
1	SP Series scanners	Ubuntu 32-bit	pfusp-ubuntu14.04_2.0.0_i386.deb	DEB
2		Ubuntu 64-bit	pfusp-ubuntu14.04_2.0.0_amd64.deb	DEB

The filenames have the meanings shown below.

Ubuntu14.04: OS Version. This is the Linux distribution name supported by this package.

2.0.0: Driver version number

i386/amd64: Supported CPU architecture

deb: Package format

4. Provided Components and Supported Languages

The provided components and supported languages in this product are shown in the table below.
(Yes: Supported, No: Not supported)

No.	Component	Japanese	English	German	French	Italian	Spanish	Chinese (traditional)	Chinese (simplified)	Russian	Portuguese	Korean	Arabic	Turkish
1	Driver file	No	Yes	No	No	No	No	No	No	No	No	No	No	No
2	Scan button monitoring tool	No	Yes	No	No	No	No	No	No	No	No	No	No	No
3	readme	No	Yes	No	No	No	No	No	No	No	No	No	No	No
4	EULA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*The No. 4 EULA is included in the package. This is also displayed on the download screen when downloading the package for this product from the release site.

The components below are not included in the package.

- SOP (Software Operation Panel)
- Emulation tools
- Manual
- help
- Firmware update tool
- ERG (Error Recovery Guide)
- SCA (ScannerCentralAdmin Agent)

Also, the scanner device options below are not supported.

- Carrier sheet
- Imprinter

5. System Requirements

The system requirements for this product are shown below.

5.1 OS Environment

The relationship between this product and the OS environment (Linux distribution) is shown below.

	Target OS	Supported OS	Installer available?	Scanner operation available?	Notes
1	Ubuntu Desktop 14.04 /16.04 LTS (32-bit/64-bit)	Yes	Yes	Yes	
2	- Debian7/8 (32-bit/64-bit) - Ubuntu12.04 LTS (32-bit/64-bit)	No	Yes	Yes	
3	- OpenSUSE42 .1 (32-bit/64-bit) - Red Hat Enterprise Linux Server release 7.x (32-bit/64-bit) - CentOS 7.x (32-bit/64-bit)	No	No	Yes	Settings must be changed manually

5.2. CPU Architecture

Intel x86 architecture (32-bit/64-bit)

5.3. Disk Space Required

1MB

5.4. Recommended Computer Specifications

CPU: Intel(R) Core i5 2400S @ 2.5GHz

Memory: 4.0 GB

5.5. Operation Verification Tools

Many versions of Linux can use the scanning applications "scanimage" and "xsane". This product can also use these as operation verification tools, but an operation with other applications that support SANE API has not been verified.

Application name	Application description
scanimage	Command line based scanning application. Command line options can be used to specify detailed settings for scanning. Because this is included in the distributions for Ubuntu 14 and 16 from the start, it can be used immediately after Ubuntu is installed.

xsane	Scanning application for a GUI environment. Detailed settings can be specified when scanning in a GUI screen. Because this is not included in the distributions for Ubuntu 14 and 16, it cannot be used immediately after Ubuntu is installed. To use "xsane", the package must be downloaded from the Ubuntu distributor. To download and install the package, follow the procedure below. Preparation: Establish an Internet connection on a computer. Download Procedure: Use the following procedure to download the files. (1) Open the terminal software. (2) Execute the "sudo" command, enter the password for the superuser (root user) to become a root user. sudo su - (3) Use the command below to connect to the Ubuntu server and check the latest package information, and then download it. apt-get update apt-get install xsane *In environments using a proxy server to connect to the Internet, settings may be required for the system. Make the settings based on the specific proxy server environment.
-------	--

6. Installation and Uninstallation Procedures

An example is shown below for installation and uninstallation of the SP Series driver (Ubuntu 64-bit).

Obtaining this product

This product can be downloaded from the vendor website. For more information, ask the vendor.

Preparation

- Copy the package that was downloaded from the website to the installation target computer.
- Turn off the scanner power, and remove the USB cable connected to the computer.

(1) Installation procedure

Use the procedure below to install the package.

- ① After starting Ubuntu and logging in, open the terminal software.
- ② Execute the "sudo" command, enter the password for the superuser (root user) to set to become a root user.
- ③ Execute the "uname -m" command, and check that the Ubuntu OS type is the target 64-bit version.
- ④ Use the "cd" command to move to the folder where the "pfusp-ubuntu14.04_2.0.0_amd64.deb" package is located.

- ⑤ Execute "dpkg -i pfusp-ubuntu14.04_2.0.0_amd64.deb" to install the package.
- ⑥ Execute "dpkg -l pfusp", and check that the package was installed correctly. If the package name pfusp appears, installation was successful.
- ⑦ Connect the scanner, and turn on the power.
- ⑧ Start "scanimage", "xsane", or other operation verification tools, and check the scanning operation.

(2) Uninstallation procedure

Use the procedure below to uninstall the package.

- ① Turn off the scanner power.
- ② Open the terminal software.
- ③ Execute the "sudo" command, enter the password for the superuser (root user) to become a root user.
- ④ Execute "dpkg -r pfusp" to uninstall the package.
- ⑤ Execute "dpkg --purge pfusp" to delete the package information.
- ⑥ Execute "dpkg -l pfusp", and check that the package was uninstalled correctly. If the "pfusp" package information is not displayed, the package was uninstalled successfully.

*Note

- Uninstalling this product does not delete any scanned image data.
- To find out the OS type, use the "uname" command. The result of the "unamej -m" shows you the type of the OS.

No.	Display result	OS type
1	i386	32-bit
2	x86_64	64-bit

7. Driver Function Overview

A function overview of this driver and specifications comparison with drivers by other companies and drivers for the other operating system are shown in the table below.

N O	Function	PFU (SP Series)			
		PSIP	WIA	Linux	
1	Supported OS Yes: Operation verified Δ: Installation possible □: Information to be provided at later date (Support for Δ and □ is limited to specific version numbers.)	Windows	Windows	Ubuntu 12	Δ
				Ubuntu 14	Yes
				Ubuntu 15	No
				Ubuntu 16	Yes
				Fedora	No
				Mandriva	No
				openSUSE	□
				Debian	Δ
				Linux Mint	No
				CentOS	□
				Redhat	□
2	Supported architecture	Intel x86 compatible		Intel x86 compatible	
3	32-bit CPU support	Yes	Yes	Yes	
4	64-bit CPU support	Yes	Yes	Yes	
5	Download from public site	Yes	No	Yes	
6	Installer format	Unique	—	Deb	
7	Installer size	100MB	-	1MB	
8	Source license	Unique	Unique	Unique	
9	Scan software	Included	—	No	
10	Profile	Yes	Yes	No	
11	Paper source	Yes	Front	Yes	
	(Front/Rear/Duplex)		/Duplex		

N o	Function	PFU (SP Series)		
		PSIP	WIA	Linux
1 2	Resolution	50 to 1200 dpi	75 to 600 dpi	50 to 600 dpi
1 3	Image type (Color/gray scale/binar y black & white)	Yes	Yes	Yes
1 4	Paper size (Custom)	Yes		Yes
1 5	Paper size (Standard sizes)	Yes (Vario us)	Yes (Vari ous)	A4,A5,A6, B5,B6, Postcard, Business card, letter, Legal, Folio
1 6	Cropping	Yes	No	Yes
1 7	Rotation (90°, 180°, 270°)	Yes	No	No
1 8	Rotation (Automatic)	Yes	No	No
1 9	Multifeed detection	Yes	No	Yes
2 0	Brightness	Yes	Yes	Yes
	Contrast	Yes	Yes	Yes
	Gamma correction	Yes	No	No
2 1	Binarizatio n function	Autom atic	No	Yes (SDTC)
		Static thresh old	Yes	Yes
		Halftone	No	No
		Error diffusi on	No	Yes
2 2	Dropout color	None/ R/G/B/ W/ Custo m	No	None/R/G/B · W
2 3	Image enhancem ent (Tone adjustment)	Yes	No	Yes
2 4	Inverted image	Yes	No	No
2 5	Automatic color/black & white detection	Yes	No	No
2 6	Blank page detection	Yes	No	Yes

N o	Function	PFU (SP Series)		
		PSIP	WIA	Linux
27	Blank page detection (sensitivity)	Yes	No	Yes
28	sRGB correction	Yes	No	No
29	Hole punch removal	Yes	No	No
30	Multi image output	Yes	No	No
31	Separation	Yes	No	No
32	Edge repair	Yes	No	No
33	Edge removal	Yes	No	No
34	Digital endorser	Yes	No	No
35	Asynchronous (pre-read)	Yes	No	Yes
36	Scan button	Yes	Yes	Yes

8. Driver Function Details

This product provides SANE API as a library for using the functions of this product from applications that support SANE API ("xsane", "scanimage", etc.).

To use this product to scan a document with a scanner, use one of the methods below.

(1) Method using a SANE API function interface

This is used to perform direct control of the scanner from a C-language application.

(2) Method using a scan application ("scanimage", "xsane", etc.) created using SANE API

This is used to configure the scan settings from the OS standard CUI or a GUI application in order to scan a document.

8.1. Method Using SANE API Function Interface

In SANE API, the SANE API function interface is preset as shown below. This product also supports the SANE API functions below.

```

sane_init()           - Initialize scanner library
sane_exit()           - Exit scanner library
sane_get_device()     - Get scanner device
sane_open()           - Open scanner device
sane_close()          - Close scanner device
sane_get_option_description() - Get option parameters
sane_control_option()  - Set option parameter values
sane_get_parameters() - Get option parameter values
sane_start()          - Start scan

```

sane_read() - Read data from scanner
sane_cancel() - Cancel scanner operation
sane_set_io_mode() - Set I/O mode
sane_get_select_fd() - Get file descriptor
sane_strstatus() - Get scanner status

For details on how to call the SANE API functions and the product functions, refer to the link below.

SANE API Specifications <http://www.sane-project.org/html/>

8.2. Method Using Scan Application Created Using SANE API

For applications that support SANE API ("scanimage", "xsane"), a list of the options that can be specified when using this product with the "scanimage" command (CUI-based) is shown in the table below.

When using this product with "xsane" (GUI-based), the setting items corresponding to the options below can be specified on the "xsane" setting screen.

Linux Driver Detailed Specifications for SP Series

pfusp: SP Series driver

Function	Option (Syntax)	Settable values of argument (Bold: Default setting)	Notes
Paper source	--source	Adf-front	
		Adf- back	
		Adf-duplex	
Image type	--mode	Lineart	
		Gray	
		Color	
Resolution	--resolution	[50 to 600] (200)	Settable in units of 1 dpi
Paper width	--page-width	[26 to 216] (210.0)	- This setting is valid only when "Custom" is specified for "paper-size" (units: mm). - This setting value may be rounded by the application.

(Continued on next page)

Function	Option (Syntax)	Settable values of argument (Bold: Default setting)	Notes
Paper length	--page-height	[26 to 863.6] (297.0) 50 to 300 DPI is [26, 863.6]. 301 to 600 DPI is [26, 355.6].	- This setting is valid only when "Custom" is specified for "paper-size" (units: mm). - This setting value may be rounded by the application.
Scanning area (Top-leftX)	-l	[0 to page-width] (0)	- This setting is valid when "Custom" is specified for "paper-size" (units: mm). - This setting value may be rounded by the application.
Scanning area (Top-leftY)	-t	[0 to page-height] (0)	
Scanning area (Bottom-right x)	-x	[26 to page-width] (210.0)	
Scanning area (Bottom-right y)	-y	[26 to page-height] (297.0)	

Function	Option (Syntax)	Settable values of argument (Bold: Default setting)	Notes
Paper type	--paper-size	Custom	When "Custom" is selected, scanning is performed within the range of the setting values for "page-height" and "page-width". Also, if "page-auto" is enabled, this setting is ignored.
		A4	210×297mm
		A5	148×210mm
		A6	105×148mm
		B5	182×257mm
		B6	128×182mm
		Postcard	100×148mm
		Business card	90×55mm
		Letter	216×279.4mm
		Legal	216×355.6mm
		Folio	216.0mm x 330.0mm
Cropping	--page-auto	[=(yes no)]	- If this setting is enabled ("page-auto=yes"), the setting values for "page-height", "page-width", "paper-size", "Top-leftX", "Top-leftY", "Bottom-right x", and "Bottom-right y" are ignored, and the setting for "--page-auto-priority" is enabled.

(Continued on next page)

Function	Option (Syntax)	Settable values of argument (Bold: Default setting)	Notes
Binarization method	--bw-mode	SDTC	This setting is enabled when "lineart" is specified for "--mode". SDTC: Automatic Threshold: Static threshold Error-diffusion: Error diffusion
		Threshold	
		Error-diffusion	
Binarization method (Static Threshold)	--threshold	[0-255](128)	This setting is enabled when "Threshold" is specified for "--bw-mode".
Brightness	--brightness	[-127 to 127] (0)	
Contrast	--contrast	[-127 to 127] (0)	
Multifeed detection control	--multifeed-detection	Do-not-detect	
		Stop	
Detects multifeed by the overlapping of documents	--mf-overlapping	[=(yes no)]	This setting is enabled when "Stop" is specified for "--Multifeed Detection".
Dropout color	--dropoutcolor	White	This setting is enabled when "gray" or "lineart" is specified for "--mode".
		Red	
		Green	
		Blue	
		None	
		Hardware-setting	

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Function	Option (Syntax)	Settable values of argument (Bold: Default setting)	Notes
Sharpness/ Image enhancement	-- cleanup-sharpness	None	
		Smoothing	This setting is enabled when "Lineart" is specified for "--mode".
		Emphasis-level-3	This setting is enabled when "Color" or "Lineart" is specified for "--mode".
		Emphasis-level-2	
		Emphasis-level-1	
		Descreen-level-1	This setting is enabled when "Color" is specified for "--mode".
		Descreen-level-2	
		Descreen-level-3	
		Descreen-level-4	
Blank page skip	--blank-page-skip	[=(yes no)]	If yes is specified, the data for blank pages is deleted.
Blank page skip sensitivity	--blank-page-skip-sensitivity	[1 to 5] (3)	This is enabled when "yes" is specified for "--blank-page-skip". The determination sensitivity is specified. 1: Less likely to detect blank pages 3: Normal detection setting 5: More likely to detect blank pages
Binarization method (SDTC level)	--bw-sdtk-variance	Low	This setting is enabled when "SDTC" is specified for "--bw-mode".
		Mid	
		High	Specifies the SDTC level.
Continuous scan	--autofeed	[=(yes no)]	If ADF is used, a preceding scan is performed by using the cache memory in the scanner. Because all sheets that are loaded in the feeder are fed, if an application stops the scanning process along the way, the scanned images that remain in the cache memory are discarded.

*Note: The list of these options and settable values is displayed when the command below is executed as long as this product is installed and the target scanner is turned on and connected to the computer.

```
scanimage --help
```

9. Driver Operation Specifications for Errors

This describes driver operations for various types of errors when using this product to perform scanning. The display messages for various types of errors when scanning by "scanimage" are also included for reference.

Symptom	Operation and corrective action	Error code in SANE API	Message displayed in scanimage (Reference)
When the USB cable is disconnected during the scanning process	Operation: Stops a scan and returns an error. Corrective action: Reconnect the USB cable to the computer. After that, turn the scanner off and then on so that the scanner is recognized by the computer again.	SANE_STATUS_IO_ERROR	Error during device I/O
When the power cable is disconnected during the scanning process	Operation: Stops a scan and returns an error. Corrective action: Connect the power cable properly. To disconnect and connect the power cable, an interval of 5 or more seconds is required. After reconnecting the power cable, turn the scanner on so that the scanner is recognized by the computer again. Exit the application and start it again.	SANE_STATUS_IO_ERROR	Error during device I/O
When scanning without unlocking the transport lock	Operation: Stops a scan and returns an error. Corrective action: Turn off the scanner, unlock the transport lock, and try scanning again.	SANE_STATUS_IO_ERROR	Error during device I/O
When there is no document in the ADF during the scanning process	Operation: Stops a scan and returns an error. Corrective action: Load the document on the ADF, and try scanning again.	SANE_STATUS_NO_DOCS	Document feeder out of documents
When a document jammed during the scanning process	Operation: Stops a scan and returns an error. Corrective action: Open the ADF cover, clear the jam, and then try scanning again. If paper jams occur frequently, clean the inside of the scanner.	SANE_STATUS_JAMMED	Document feeder jammed

Symptom	Operation and corrective action	Error code in SANE API	Message displayed in scanimage (Reference)
When the ADF cover is opened during the scanning process	Operation: Stops a scan and returns an error. Corrective action: Close the ADF cover, return the paper, and then try scanning again.	SANE_STATUS_COVER_OPEN	Scanner cover is open
When scanning is canceled during the scanning process	Operation: Stops a scan and returns an error. Corrective action: A document may be remaining in the scanner. Open the scanner cover and remove the document.	SANE_STATUS_CANCELLED	Operation was cancelled
When an incorrect option was specified	Operation: Does not a scan and returns an error. Corrective action: Specify the correct option, and then try scanning again.	SANE_STATUS_COVER_OPEN	unrecognized option Example: #scanimage --page-size=A4 >pfu.pnm #unrecognized option '--page-size=A4'
When a value outside the allowable range was specified	Operation: Scans a document after a value is changed to a value within the allowable range. A message appears indicating that the value was changed. Corrective action: Not needed.	The scanner operates normally.	rounded value of XX from XX to XX Example: #scanimage --contrast 128 >pfu.pnm # rounded value of contrast from 128 to 127
When there is not enough memory during the scanning process	Operation: Stops a scan and returns an error. Corrective action: Change the settings such as the resolution and the paper size to reduce the image size and scan again. In addition, some parameters tend to consume memory. Disable the cropping parameter and the blank page skip parameter and try again. If the problem persists, add memory.	SANE_STATUS_NO_MEM	Out of memory
When the STOP button was pressed to cancel scanning.	Operation: Stops a scan and returns an error. Corrective action: A document may be remaining in the scanner. Open the scanner cover and remove the document.	SANE_STATUS_CANCELLED	Operation was cancelled

10. Scan Button Monitoring Tool

This tool monitors the [Scan] button of the scanner and performs a scan by executing the "scanimage" command when it detects that the [Scan] button was pressed.

The usage procedure is described below.

(1) Monitoring tool starting and stopping procedure

The monitoring tool is not started in the state immediately after installation.

Perform the operation below in the superuser (root) to enable starting and stopping.

Start monitoring tool	/etc/init.d/pfuspscanbutton start
Stop monitoring tool	/etc/init.d/pfuspscanbutton stop

The monitoring tool must be registered to start it automatically when the system is started.

Because the system management procedure varies depending on the distribution, make the appropriate setting for your distribution.

- Deb-type system (such as Debian): The system is managed by "update-rc.d" or "nsserv2".
- Rpm system (such as CentOS): The system is managed by "chkconfig".

(2) Output location of image data

When scanning is performed by pressing the [Scan] button, a folder with a name having the current time is created under the folder below, and the scan image is stored there.

/opt/pfusp/image

The attributes of the scanned image are shown below. Also, the image is output in the format PNM by default.

Owner: root

Permissions: 644

(3) Changing the scan parameters

When the Scan button is pressed, the scan process is performed based on the configuration file below.

`/opt/pfusp/etc/pfuspscanbutton.conf`

To change the scan parameters, change the values in the configuration file with the superuser (root) in any text editor. Due to the "scanimage" specifications, images can be output in tiff or PNM format only. If necessary, use an application or another tool to convert to other image formats.

Configuration file example: A configuration file with the settings below is saved upon installation.

```
scanimage --batch --format=png --source "Adf-duplex" --mode Color --resolution 200 --autofeed=yes
```

*Note: The contents of this configuration file cannot be written as a shell script. This file can be used only as an option for the "scanimage" command.

By default, images are saved in the "/opt/pfusp/image" directory. However, you can change the save destination by using the "batch" option as follows.

```
scanimage --batch=/tmp/Image-%d.png --format=png --source "Adf-duplex" --mode Color --resolution 200  
--autofeed=yes
```

(4) Notes

- When a the scanner is in use (for example, when a scanning application is using the scanner), the monitoring tool cannot start scanning even if the [Scan] button is pressed.
On the other hand, when a scan is being performed by the monitoring tool due to the [Scan] button being pressed, other applications cannot start scanning.
- The monitoring tool can monitor only one scanner. When multiple scanners are connected to the computer, the monitoring tool does not run correctly.

Appendix: Basic Knowledge for Using Linux Drivers

1. Linux

Many different types of Linux distributions are available around the world. A Linux distribution includes a Linux kernel module that is released for free, libraries, command components, and applications. In addition, a Linux distribution is on the DVD provided or other distributable media.

Well-known distributions are Debian, Ubuntu, Redhat, CentOS, and OpenSUSE. Each distribution has a different aspect, such as bundled applications, a GUI system, a support system, or a bug fix frequency.

- Debian: For general use.
- Ubuntu: For desktops. This is a Debian based version that is optimized for desktops.
- Redhat (Red Hat Enterprise Linux): For server systems. This is a commercial based version and is supported by Red Hat for a fee.
- CentOS: A clone of Red Hat Enterprise Linux. Trademarks are removed from this distribution so that users can use this for free.
- OpenSUSE: For general use. Novell supports the development of this distribution. This is the commercial based version (SuSE Enterprise Linux).

PFU conducted the development for the driver and support based on the Ubuntu distribution because of its market share and high versatility.

1.1. Ubuntu

Ubuntu 16.04 LTS includes the scanner driver (SANE 1.0.25) for free. At this point, the majority of fi Series scanners and ix500 scanners can use this driver.

*Note 1: Ubuntu 14.04 LTS also includes a free scanner driver, but because the driver is older (SANE 1.0.24), it does not work when the scanner is connected to the computer via the USB 3.0 controller.

*Note 2: The latest SANE 1.0.25 can be used in Ubuntu 14.04 LTS.

The following describes how to obtain Ubuntu16.04 LTS and how to install it.

(1) Obtaining an OS image

An OS Image (ISO format) can be obtained from the site below. This site is mirrored by organizations in various countries. Because the network environment varies in each country, be sure to select the most suitable site.

●Download site

[Original site]

<http://releases.ubuntu.com/16.04/>

[Example of a mirror site: Japan Advanced Institute of Science and Technology]

<http://ftp.jaist.ac.jp/pub/Linux/ubuntu-releases/16.04/>

- ISO image to be downloaded

(for 32-bit systems) [ubuntu-16.04-desktop-i386.iso](#)

(for 64-bit systems) [ubuntu-16.04-desktop-amd64.iso](#)

*Note: A screen asking for a donation may appear when attempting to download an OS image by following the URL from the original website for Ubuntu.

*If you do not know the nearest mirror site to you, search for the above ISO image file name, and find which site is the nearest to you from among the URLs of the displayed sites based on the country name.

(2) How to install Ubuntu16.04 LTS

There are three methods for installing Ubuntu16.04 LTS. Methods (a) and (b) allow you to keep your Windows computer environment as it is and use Ubuntu 16.04 LTS.

(a) Install the virtualization software such as VirtualBox and VMware on Windows.

(b) Burn the ISO image to a burnable disc such as a DVD, and then start Linux from the DVD. Linux runs in the memory without installing to the computer hard disk.

(c) Install Ubuntu 16.04 LTS on your computer from the DVD.

If you proceed with method (a), install the virtualization software in advance. For the installation method, refer to the install instructions of each software.

After you prepare the virtualization environment, proceed with the installation steps by referring to the following website:

<http://www.ubuntu.com/download/desktop/install-ubuntu-desktop>

If you proceed with method (b), refer to the following website for the installation:

<http://www.ubuntu.com/download/desktop/try-ubuntu-before-you-install>

If you proceed with method (c), refer to the following website for the installation:

<http://www.ubuntu.com/download/desktop/install-ubuntu-desktop>

2. Scanners on Linux Platform

2.1. SANE API

The APIs for scanners in Windows OS include TWAIN and ISIS, and the API for scanners in Linux OS is called SANE.

SANE API can be used to operate a scanner using one of the two methods below.

- (1) Method for using the scanner application included in Linux OS
Scanner applications ("scanimage", "xsane", "simple-scan", etc.) that support SANE API are included in the typical Linux OS. The scanner can be used from these applications.

For example, by calling the "scanimage" command from the user application, a scanned image can be output as a file. In this case, you can develop your application without any regard to SANE API.

- (2) Method of creating an application using SANE API
This driver has a function calling interface based on SANE API (14 functions including "sane_open()", "sane_start()", and "sane_read()"). These functions can be used to create a unique application in C language.

The points to take into consideration when using SANE API are shown below.

- In contrast to the scanner driver for Windows, no GUI setting screen is included, and the functions are generally limited, which results in an extremely small size. For this reason, distribution is easy, and it is ideal as an element for creating mechanisms with limited disk resources such as thin clients.
- In SANE API, the driver cannot create files. Transfer of image data to applications uses uncompressed memory transfer only. For this reason, JPEG and PDF creation functions are assigned to applications at the calling side. Generally, the Linux OS includes file format conversion tools, and so after scanning, the application calls these tools to create the target file format.

2.2. SANE API Function Interface

The driver that supports SANE API provides the functions below. By calling the following functions from the application, the scanner can be controlled.

sane_init()	- Initialize scanner library
sane_exit()	- Exit scanner library
sane_get_device()	- Get scanner device
sane_open()	- Open scanner device
sane_close()	- Close scanner device
sane_get_option_description()	- Get option parameters
sane_control_option()	- Set option parameter values
sane_get_parameters()	- Get option parameter values
sane_start()	- Start scan
sane_read()	- Read data from scanner
sane_cancel()	- Cancel scanner operation
sane_set_io_mode()	- Set I/O mode
sane_get_select_fd()	- Get file descriptor
sane_strerror()	- Get file status

For details, refer to the link below. SANE API is in a public domain, and it can be used by anyone without restrictions.

SANE API Specifications

<http://www.sane-project.org/sane.ps>

2.3. Scanning Software

The scanning applications that can be used in Ubuntu are shown below.

Tool name	Description
scanimage	Scanning application for command line based operation. Command line options can be used to specify detailed settings for scanning.
xsane	Scanning application for a GUI environment. Detailed settings can be specified when scanning in a GUI screen.
simple-scan	Scanning application for a GUI environment. This has an extremely simple structure, and it is easy to use, but as a result, detailed options cannot be specified.

*Notes

The above-mentioned software and software described starting from the next section are all Linux freeware. PFU uses the above-mentioned "scanimage" and "xsane" to evaluate the Linux drivers, but no operation guarantee or support is provided for "scanimage" and "xsane" themselves. This document is intended to provide a description of how to use the Linux drivers only. The freeware listed starting from the next section is also unsupported. Because it is highly likely that the customer is using this software, this software is introduced here so that the readers of this manual can gain some familiarity with it.

2.4. Scanimage Usage Examples

This explanation assumes that the computer and scanner are connected by a USB cable and power is being supplied to them.

- (1) Open the terminal software.
- (2) Load paper into the hopper.
- (3) Execute the "scanimage" command. When this is executed, the scan operation is performed, and the specified file is created.

```
scanimage --format=tiff --batch=sample-image.tiff
```

Example - when scanning with the settings: resolution 300, gray, dropout red, and output file format tiff

```
scanimage --mode Gray --resolution 300 --batch=ImageFile-%d.tiff --format=tiff --dropoutcolor Red
```

Example - when scanning with the settings: resolution 100, color, contrast 30, and output file format tiff

```
scanimage --mode Color --resolution 100 --batch=ImageFile-%d.tiff --format=tiff --contrast 30
```

* The "scanimage" command is open source. Any unclear points about an operation can be checked using the source code.

The scanimage for each Linux OS can be obtained from the respective distributor. The latest version can be obtained from the site below.

<http://www.sane-project.org/>

* In addition to the options supported by the driver, the options for batch processing and other operations by the "scanimage" command itself can also be specified in "scanimage". This appears as shown below.

```
root:/home/pfu# scanimage --help
```

```
Usage: scanimage [OPTION]...
```

Start image acquisition on a scanner device and write image data to standard output.

Parameters are separated by a blank from single-character options (e.g.

-d epson) and by a "=" from multi-character options (e.g. --device-name=epson).

-d, --device-name=DEVICE use a given scanner device (e.g. hp:/dev/scanner)

--format=pnm|tiff file format of output file

-i, --icc-profile=PROFILE include this ICC profile into TIFF file

-L, --list-devices show available scanner devices

-f, --formatted-device-list=FORMAT similar to -L, but the FORMAT of the output

can be specified: %d (device name), %v (vendor),

%m (model), %t (type), %i (index number), and

%n (newline)

-b, --batch[=FORMAT] working in batch mode, FORMAT is `out%d.pnm' or
`out%d.tif' by default depending on --format

--batch-start=# page number to start naming files with

--batch-count=# how many pages to scan in batch mode

--batch-increment=# increase page number in filename by #

--batch-double increment page number by two, same as

--batch-increment=2

--batch-prompt ask for pressing a key before scanning a page

--accept-md5-only only accept authorization requests using md5

-p, --progress print progress messages

-n, --dont-scan only set options, don't actually scan

-T, --test test backend thoroughly

-h, --help display this help message and exit

-v, --verbose give even more status messages

-B, --buffer-size=# change input buffer size (in kB, default 32)

-V, --version print version information

2.5. "xsane" Usage Example

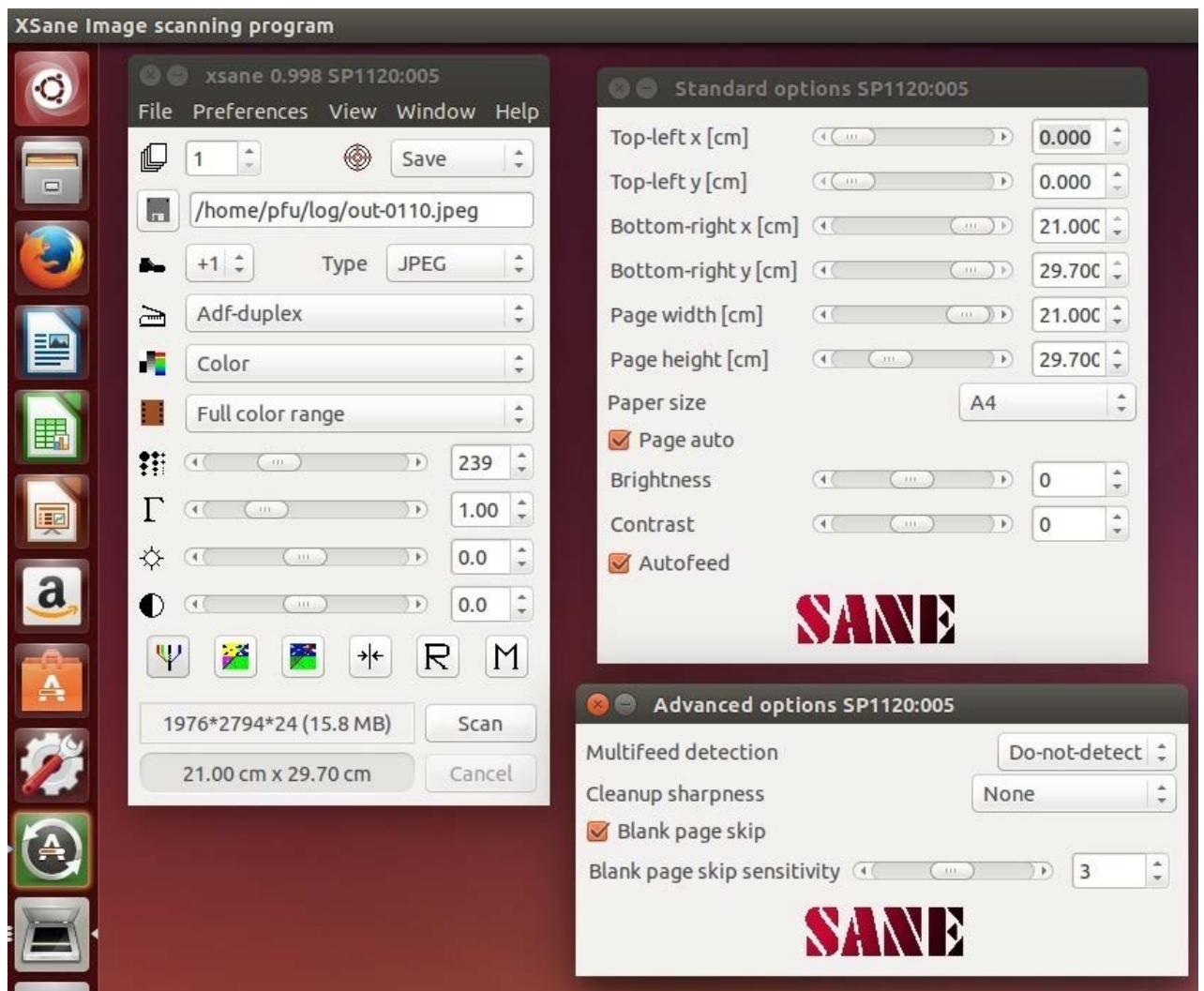
The procedure for scanning by "xsane" is shown below.

This explanation assumes that the computer and scanner are connected by a USB cable and power is being supplied to them.

- (1) Open the terminal software.
- (2) Execute the "xsane" command. When this is executed, a tool with a GUI setting screen is started.

```
xsane
```

- (3) In the GUI setting screen, check or change the resolution, scan mode, paper size, and other settings.
- (4) Load paper into the hopper.
- (5) If the [Scan] button is clicked on the GUI setting screen, the scan process is started.
- (6) Once the scan is completed, operation is performed based on the output method that was set beforehand.



*Notes

Because "xsane" is not included in the distributions for Ubuntu 14 and 16, it cannot be used immediately after Linux is installed. To use "xsane", the package must be downloaded from the Ubuntu distributor. To download and install the package, follow the procedure below.

Preparation:

Establish an Internet connection on a computer.

Download Procedure:

Use the following procedure to download the files.

- (1) Open the terminal software.
- (2) Execute the "sudo" command, enter the password for the superuser (root user) to become a root user.

sudo su -

- (3) Use the command below to connect to the Ubuntu server and check the latest package information, and then download it.

apt-get update

apt-get install xsane

- In environments using a proxy server to connect to the Internet, settings may be required for the system. Make the settings based on the specific proxy server environment.

2.6. Image Conversion of an Output Image

SANE API does not have an interface for outputting a file. As a result, the driver does not have a function to output an image data as a file. A scanning application or similar program is required to create the file. Typical Linux operating systems include tools for image conversion. Some examples are the "convert" command and "mogrify" command provided in ImageMagick (group of tools for using, editing, and viewing images). These commands can be used to convert the TIFF format file created by "scanimage" to the target format.

- Example of image conversion of a single TIFF format file to JPEG format

```
convert TIFFfilename.tiff JPEGfilename.jpeg
```

- Example of image conversion of all JPEG files in the current directory to PNG format

```
for pic in *.jpg
do
convert ${pic} `basename ${pic} .jpg`.png
done
```

- Example of image conversion of all TIFF files in the current directory to JPEG format

```
mogrify -format jpeg *.tiff
```

*ImageMagick supports more than 100 types of image file formats including GIF, JPEG, JPEG 2000, PNG, PDF, Photo CD, TIFF, and DPX. For details about the usage procedure, refer to the site below.

<http://www.imagemagick.org/>

*ImageMagick may not be installed for certain Linux OS installation methods. If this happens, perform an additional installation using the method for the respective Linux OS.

For Ubuntu, ImageMagick can be installed from the Ubuntu Software Center.