Laser Self-Diagnosis Software

Laser Diagnosis Manual

Applicable model

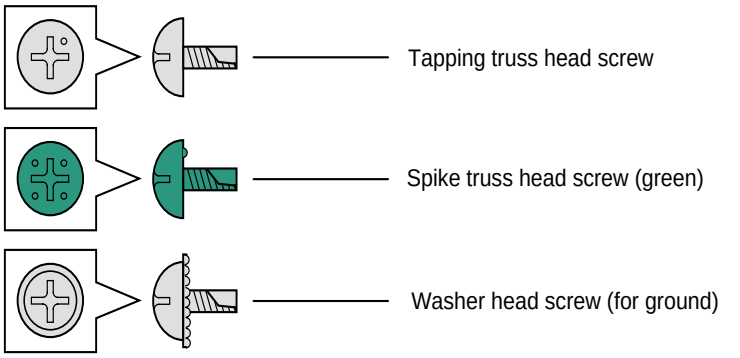
- QSS-32 series
- QSS-33 series
- QSS-34 series
- QSS-35 series
- LPS-24PRO

Issued in September, 2006

Notes to service personnel

Be sure to read this manual carefully to gain a thorough understanding of the correct procedures before servicing the system.

The printer processor uses both tapping truss head screws and spike truss head screws. When attaching the screws once removed, make sure they are on their original positions. These screws are used for the place where grounding is required.



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- The contents of this manual are subject to change without notice.
- Illustrations in this manual may vary depending on the model or manufacturing lot.

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Explanation of manual

About the chapters

Table of Contents of Laser Diagnosis Manual

Laser Diagnosis Manual is to help solve laser problems using the laser self-diagnosis software.

- 1. Cautions for work
  Contains information on how to achieve safety in service operations. Be sure to read precautions thoroughly and carefully.
- 2. Outline of Laser Self-Diagnosis Software
  Explains outline of the laser self-diagnosis software.
- 3. Using Laser Self-Diagnosis Software
  Explains how to start the laser self-diagnosis software, screens and diagnosis procedures.
- 4. Diagnosis Examples
  Gives examples of diagnoses and explains situations in which this software can and cannot be used.

Symbols used in this manual

Definitions of the marks and symbols used in this manual are as follows:

⚠ This is called the alert symbol mark. Text following this mark contains particularly important information concerning safety. Be sure to heed this information. This mark is used in conjunction with the words **DANGER**, **WARNING** and **CAUTION**, according to the extent of influence (injury) on persons or damage to physical property.
IMPORTANT The Important symbol indicates operations or procedures requiring caution, instructions and supplementary explanations that need to be followed.
☞ The pointing finger symbol indicates the manual or section where you can find additional information.
NOTE The Note symbol indicates functions or instructions which are convenient if you know.

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4. Examples of diagnoses

5. Appendix

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1. Cautions for Work

1.1 Description of warning (signal words)

- Signal words identify the level of injuries that can potentially occur.
- The signal words used in this manual and found on labels, **DANGER**, **WARNING** and **CAUTION**, are assigned according to the level of potential risk.
- Warning labels are located at or near the part of the system that pose the indicated danger. If ignored, death or serious injury occurs, or the system breaks down. Be sure to follow the indications in the manuals and on the warning labels.
- The warnings include a signal word, the type and extent of the danger, and information to avoid danger.
- Carefully read and follow the warnings included in this manual and on the warning labels before operating the system.

⚠DANGER

This indicates situations that if not immediately avoided could result in serious injury or death.

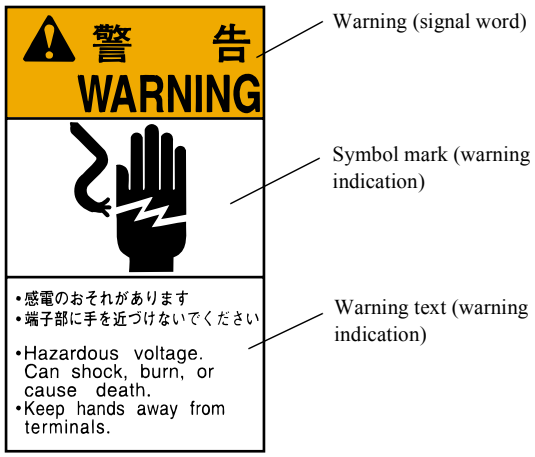
⚠WARNING

This indicates situations that if not avoided could result in serious injury or death.

⚠CAUTION

This indicates situations that if not avoided could result in non-life threatening injury. It is also used to indicate situations which may cause damage to physical property.

Example of warning label



SIGNALWORD

1.2 For safe operation

1.2.1 General precautions

⚠WARNING

- Prior to any part replacement or mechanical adjustment, be sure the main power supply is turned off.
- Since the work which uses key operations cannot turn off the circuit breaker, mechanical operation check during it requires particular attention.

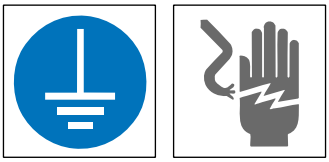
IMPORTANT

- Ground wires (green and yellow) are connected to the covers and units of the system.
  For reassembly, be sure to connect the ground wires as they were.
- Be sure to perform an operation check after replacing or adjusting any parts (or units).

1.2.2 Precautions against electric shock

⚠WARNING

- If any case you have to take care of wiring for the power such as moving the system, ask a qualified professional electrician for work. Do not forget to ground the system.
- Pay attention to avoid shocks when performing troubleshooting, wiring checking, or voltage/current measurement.
- When replacing a fuse or PCB, be sure to turn off the circuit breaker and the main power supply. Wait for 10 seconds or more before replacement.



1.3 Prevention of static electricity when replacing and maintaining electronic parts

Static electricity from your body may damage electronic components such as PCBs, if you touch them when charged.
When handling electronic parts, be sure to use static-dissipative tools as below to prevent parts from being damaged by static electricity.
In addition, use the static-dissipative tools for maintenance of the digital units or engines.

Static-dissipative tools

Description	Remarks
Portable Static-Dissipative Field Service Kit	Use this kit when replacing or installing/removing electronic parts from the system. This kit consists of four items: Static-Dissipative Work Mat, Wrist Strap, Ground Cord, and Alligator Clips.
Static-Dissipative conductive gloves	Use these to prevent oil from your hands adhering when you touch a PCB.
Wrist strap	Use this when checking electronic parts.

⚠CAUTION

- When using the static-dissipative tools, be sure to turn off the circuit breaker of the system and main power supply, and wait ten seconds or more before carrying out the operation.

2

2. Outline of Laser Self-Diagnosis Software

2.1 Outline of Laser Self-Diagnosis Software

2.1.1 Before using

The analysis of laser problems of the QSS-32 and QSS-33 shows that the signal processor and laser unit failures account for 98% of the cause.
Therefore, most of the problems can be solved if which of the signal processor or laser unit is found to be the cause.
Then, we have created the laser self-diagnosis software as a useful tool to judge the normality of the laser unit and signal processor.

NOTE

- Causes of the laser problems are the following.
  - Laser unit
  - Signal processor
  - Peripheral PCBs (B/G laser driver, laser control PCB and laser I/O PCB)
  - Power supply to each laser unit, signal processor and PCB
- Analyzed data
  - Data: Field Trouble Reports within Japan (including only the ones that failure is recognized)
  - Period: From January, 2005 to June, 2006
  - See ☞ 5.1.1 Analysis of laser problems.

2.1.2 Symptoms for which the laser self-diagnosis software is effective

Although various symptoms appear in laser troubles, this laser self-diagnosis software is not effective for all the symptoms.
Symptoms for which the laser self-diagnosis software is effective are the following.

- Laser asynchronous detection occurs.
- **No.6105:B Laser light source status error.** or **No.6106:G Laser light source status error.** occurs.

2.1.2.1 Symptoms of laser asynchronous detection

The symptoms of the QSS-32 and QSS-33 laser asynchrouns detection are the following.

(1) Prints with off-center yellow are output.

If the light intensity of the B laser gets lower and asynchronous detection occurs, the B laser misses the exposure timing.
However, the symptom appears only when the B laser emits light regardless of the light intensity.

NOTE

- For the example image, see ☞ 4.1.1.1 Example (1).
- This symptom appears in the QSS-32, QSS-33, QSS-34 and QSS-35 that one detection sensor detects all the R/G/B laser. (This symptom does not appear in the LPS-24PRO that has three detection sensors.)

(2) Green prints are output.

If the light intensity of the G laser gets lower or no light is emitted, the asynchronous detection occurs. Then, the laser heads cannot be controlled correctly, and B and G lasers emits light continuously.
Therefore, green prints are output.

NOTE

- For the example image, see ☞ 4.1.1.4 Example (4).
- This symptom appears in the QSS-32, QSS-33, QSS-34 and QSS-35 that one detection sensor detects all the R/G/B laser. (This symptom does not appear in the LPS-24PRO that has three detection sensors.)

(3) Prints with yellow stripes are output.

If the light intensity of the R laser gets lower or no light is emitted, the asynchronous detection occurs. Then, the laser heads cannot be controlled correctly, and B laser emits light at regular intervals.
Therefore, prints with yellow stripes are output.

NOTE

- For the example image, see ☞ 4.1.1.3 Example (3).
- This symptom appears in the QSS-32 and QSS-34.

(4) **No.6073: Synchronous Sensor error.** occurs.

The error occurrence condition differs according to each model.

Model	Condition
QSS-32, QSS-34	When the R laser is not synchronized for a given length of time
QSS-33, QSS-35	When all the R/G/B lasers are not synchronized for a given length of time
LPS-24PRO	When any of the R/G/B lasers is not synchronized for a given length of time

NOTE

- In ☞ 5.1.1 Analysis of laser problems, all the cases of this symptom are R signal processor failure of the QSS-32.

(5) Unexposed prints are output.

If short circuit occurs inside the signal processor, overcurrent is applied when the printing operation starts. Then, the protection circuit of the laser power supply functions, and power supply to the signal processor stops.
Therefore, unexposed prints are output.

(6) **No.6076-0002: Polygon Mirror control error.** occurs.

This error occurs when the polygon mirror frequency is out of the specified range.
That shows that the synchronization of the R/G/B lasers is unstable.
The polygon mirror frequency is the number that the synchronous sensor detects each R/G/B laser in one second. The number differs according to each model.

Model	Polygon mirror frequency
QSS-32, QSS-33, QSS-35	1380±7
QSS-34 (LP-2300)	1720±7
QSS-34 (LP-2500)	2043±7
LPS-24PRO	600±7

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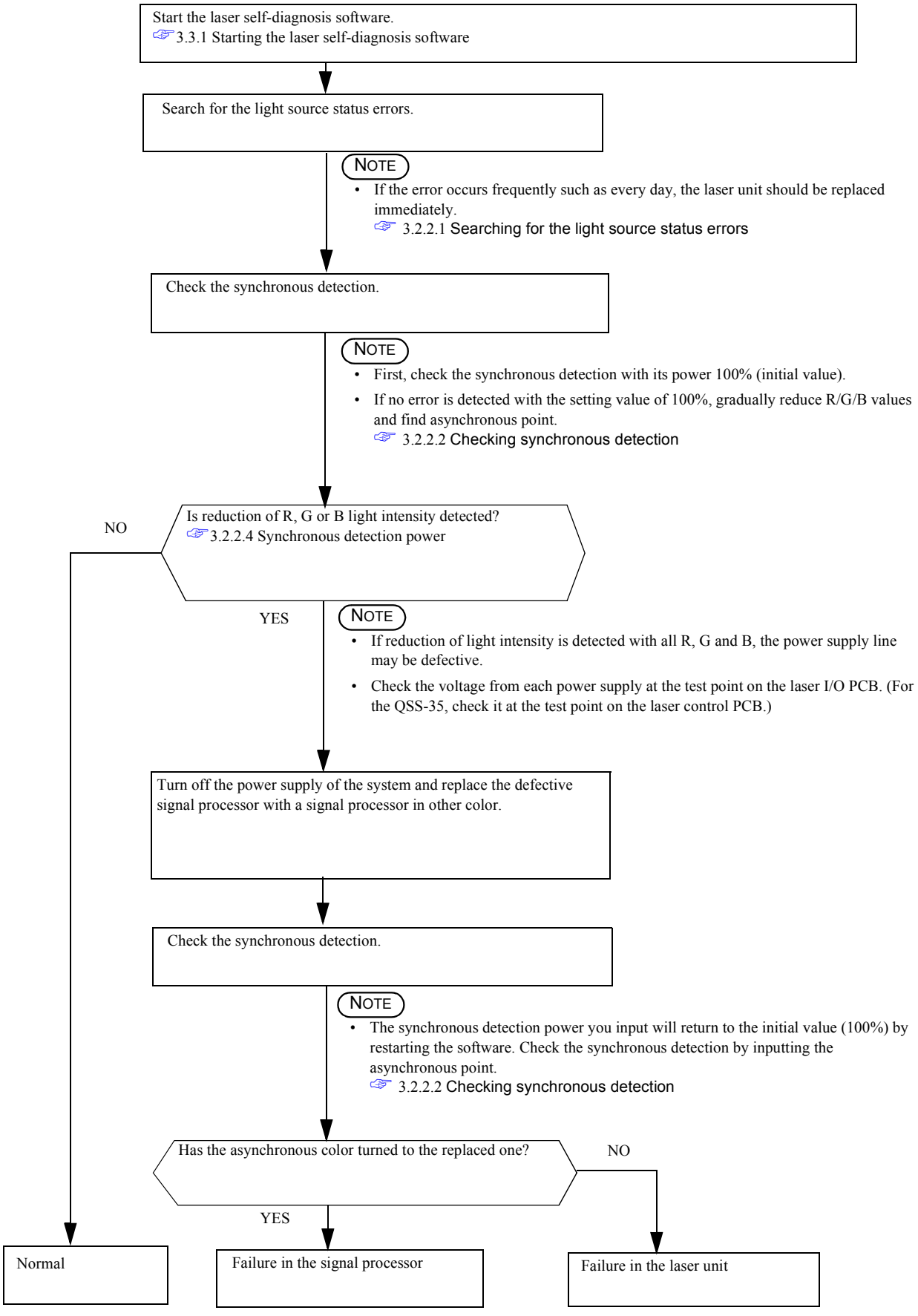
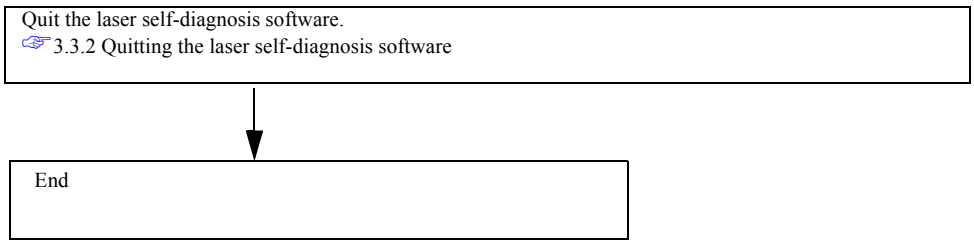
3. Using Laser Self-Diagnosis Software

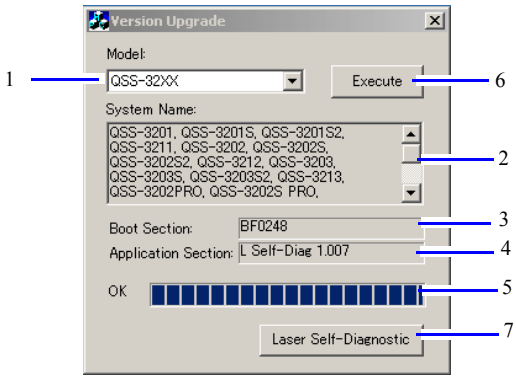
3.1 Diagnosis Flow Chart





3.2 Explanation of the Laser Self-Diagnosis Software Display

3.2.1 Version Upgrade Display



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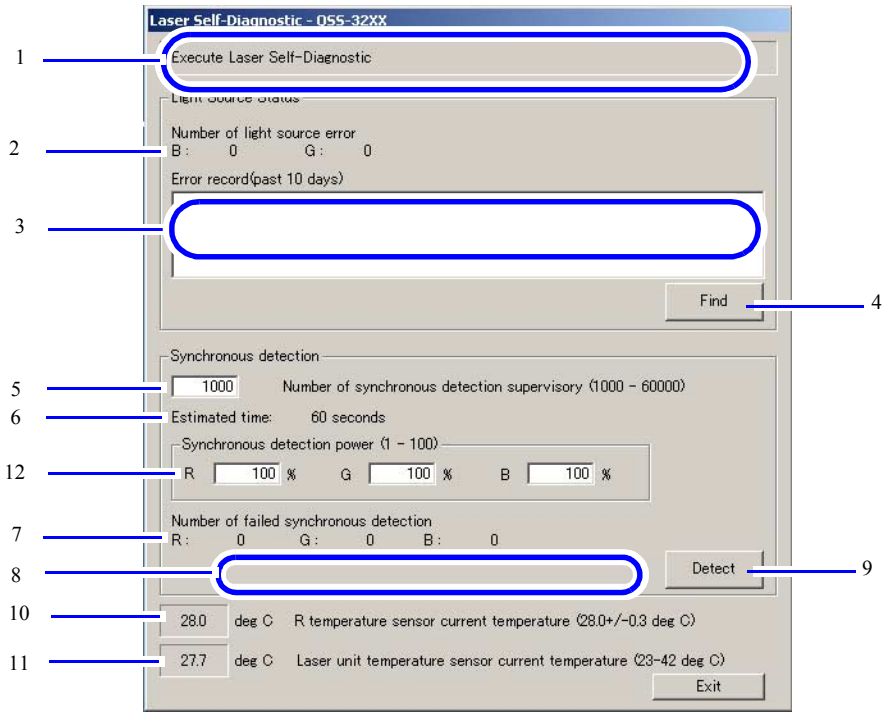
The numbers in the table below correspond to each number in the screen above.

No.	Item	Explanation
1	Model	Select the model to be upgraded.
2	System Names	Shows the system names to be upgraded.
3	Boot Section*1	Shows the version of PCB Boot section.
4	Application Section*1	Shows the version of PCB application section.
5	Upgrading status	Shows the upgrading status with a progress bar.
6	**Execute** button	Starts upgrading the selected PCB.
7	**Laser Self-Diagnostic** button	Displays the Laser Self-Diagnostic display. (This button is activated only when the PCB is self-diagnostic version.)

*1. Not displayed when the QSS is running.

3.2.2 Laser Self-Diagnostic display



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The numbers in the table below correspond to each number in the screen above.

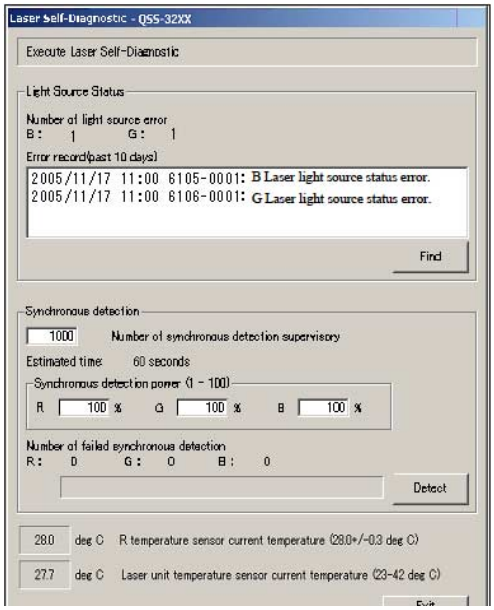
No.	Item	Explanation
1	Laser Self-Diagnosis software status	Shows the status of the Laser Self-Diagnosis software.
2	Number of light source error	Shows the number of occurrences of the errors **No.6105:B Laser light source status error.** and **No.6106:G Laser light source status error.** • For details, see ☞3.2.2.1 Searching for the light source status errors.
3	Error record	Shows the record of the errors **No.6105:B Laser light source status error.** and **No.6106:G Laser light source status error.**
4	**Find** button	Searches the number of occurrences of the errors **No.6105:B Laser light source status error.** and **No.6106:G Laser light source status error.** from the QSS error record (BkData0100.dat) within the last 10 days.
5	Number of synchronous detection supervisory	Configure how many times synchronous detection observation is performed for each of R, G and B. • See ☞3.2.2.3 Number of synchronous detection supervisory for details.
6	Estimated time	The estimated time (sec.) for synchronous detection observation is automatically calculated by entering the number of synchronous detection observation.
7	Number of failed synchronous detection	Shows the number of failed synchronous detection for each R, G and B. The number of failed synchronous detection will be updated when completing the synchronous detection.
8	Synchronous detection progress bar	Shows the time passage of the estimated time.

No.	Item	Explanation
9	**Detect** button	Starts the R, G and B synchronous detection. While detecting, the **Stop** button appears. Clicking this button stops the synchronous detection. **IMPORTANT** • Synchronous detection cannot be performed while adjusting the laser temperature.
10	R temperature sensor current temperature	Shows current temperature detected by R temperature sensor.
11	Laser unit temperature sensor current temperature	Shows current temperature detected by the laser unit temperature sensor.
12	Synchronous detection power	Configures each laser power for checking synchronous detection. Using this function, check how much leeway is available in the synchronous detection level. • See ☞ 3.2.2.4 Synchronous detection power for details.

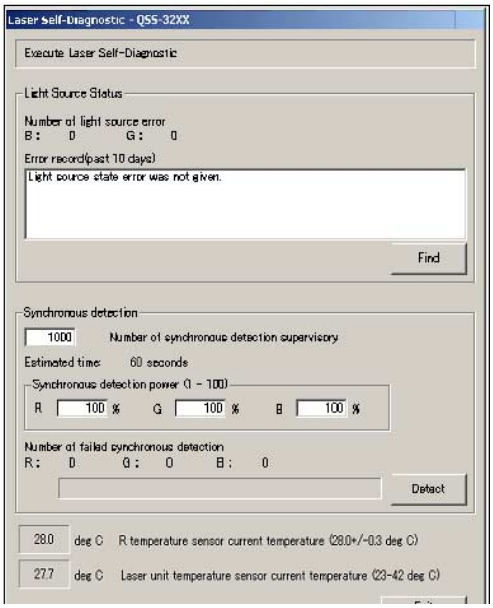
3.2.2.1 Searching for the light source status errors

Click **Find** to search for error record within the last 10 days. If **No. 6105: B Laser light source status error.** or **No. 6106: G Laser light source status error.** is found, the number of each error occurrences is shown and the error record content is displayed on the list.

When the errors are found:



When the errors are not found:



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IMPORTANT

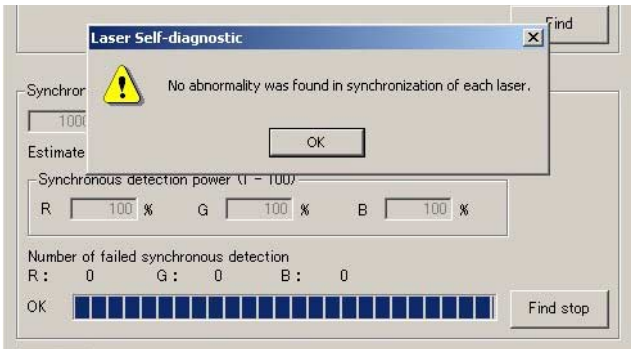
- The errors listed above mean that the LDs (laser diode) built in the B and G laser heads are deteriorated.
- If either of the errors above occur, past experience has shown that there is a high probability that the laser unit is the cause.
  If the error occurs every day although it used to occur at a few days intervals at first and comes to occur with more increased frequency so that it cannot be released, the laser unit must be replaced urgently.
- The progression of LD deterioration lowers the laser light intensity. By the asynchronous point explained in the following, also check the level of the laser light intensity lowering and use it as a judgment item for replacement timing.

3.2.2.2 Checking synchronous detection

Based on the setting values of number of synchronous detection supervisory and synchronous detection power, the system observes the synchronous detection.
As the observation result, the number of the failed synchronous detection is displayed separately for R/G/B with the message below.

If detection of R, G or B fails even once, it is judged as abnormal.

Message displayed if finished normally



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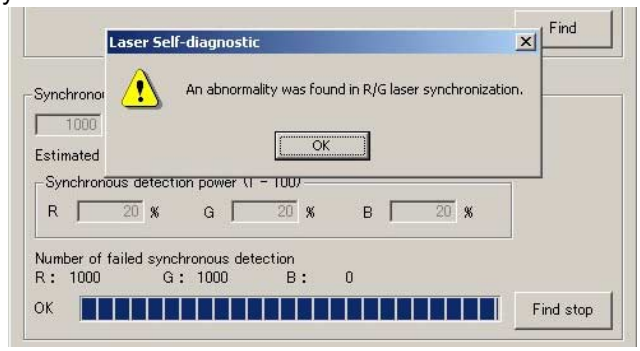
Message displayed if not finished normally

Example: When synchronous detection failed in R/G lasers



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3.2.2.3 Number of synchronous detection supervisory

Enter how many times synchronous detection observation is performed.

- Input range: 1000 to 60000 (initial value: 1000)
- Time required: 60 seconds to 60 minutes (For the LPS-24PRO: 70 seconds to 70 minutes)

IMPORTANT

- Inputting larger value increases the number of synchronous detections. Therefore, the observation time becomes longer.
  For example, for cases with low occurrence frequency, change the value if you want to observe for longer time.
  When the symptom is occurring currently, 1000 times is sufficient for observation.

3.2.2.4 Synchronous detection power

You can set the laser power (light intensity) for synchronous detection.

- Input range: 100 to 1 (initial value: 100)

First, enter 100 for checking.
If no abnormal condition is detected with the laser power of 100%, gradually reduce the R, G and B values to detect abnormal condition.

IMPORTANT

- With the usual synchronous detection such as that when printing, the detection is performed with the power of 100%. Decreasing this value reduces the light intensity, and no laser light is output with the lowest value, 1%.
  Therefore, the point at which the synchronous detection cannot be performed (asynchronous point) must exist between 100 to 1%. Asynchronous point tends to become larger with less light intensity and smaller with more light intensity.
  For example, asynchronous point is at 100% for a system with little laser light and high occurrence frequency of asynchronous detection, 70% for a system with low laser light and low occurrence frequency of asynchronous detection, 30% for a system with appropriate laser light intensity.

- As the standards for judgment of the laser unit or signal processor status at the asynchronous point, use the following values.
  For the QSS-32, QSS-33, QSS-34 and QSS-35

R/G	B	Judgment
15 to 39%	45 to 69%	Light intensity has not deteriorate (adequate light intensity)
40 to 59%	70 to 84%	Light intensity tends to deteriorate (Even though the urgency is not high, enough attention should be paid.)
60 to 100%	85 to 100%	Light intensity has deteriorated (the closer to 100%, the greater urgency)

- Not all the symptoms does not apply to the values above.
  Regarding the symptoms below, light intensity degradation cannot be found even if confirming the asynchronous point.
  - Color of prints shifts by two or three keys because of the signal processor failure. ☞4.1.2.2
  - Prints with noise are output. ☞4.1.2.1
- To find the asynchronous point at short times, narrow down the point by reducing the value as below.
  - Reduce the value of the color(s) that asynchronization was not detected with the value 100% by half, and check the synchronous detection again. (100%→50%)
  - If asynchronization is detected with the value 50%, increase the value by $^1/_4$, and check the synchronous detection again. (50%→75%)
    If asynchronization is not detected with the value 50%, reduce the value by $^1/_4$, and check the synchronous detection again. (50%→25%)

NOTE

- The values in the table above are the experience values obtained by accumulating the values when analyzing the failures of the QSS-32 and QSS-33 laser unit or signal processor.
  The values of the asynchronous point differs according to the model or laser unit individual variability. Therefore, use them only as a guide.
  Checking the value of the asynchronous point in advance enables you to compare it with the one when a problems occur. Comparing the values makes it easier to judge how much the light intensity degrades.
- The following is the reasons why two kinds of values for R/G laser and B laser are shown in the table above.
  - Regarding the B laser, low-light intensity can expose paper. Therefore, the light intensity is lower than the R/G laser.
  - Only one synchronous sensor detects the R/G/B laser that light intensity and wavelength differ. Therefore, the detection ability differs between each laser.

  However, the LPS-24 PRO uses three synchronous sensors. Therefore, such tendency is not shown.

3.3 Starting/Quitting Laser Self-Diagnosis Software

3.3.1 Starting the laser self-diagnosis software

IMPORTANT

- This laser self-diagnosis software cannot be used when the QSS software is running. Be sure to finish the QSS software before using it.
- To start the self-diagnosis software when the system has already been upgraded to the self-diagnosis version, go to Step 4. (for example, to diagnose again after connecting the signal processors to another laser head)

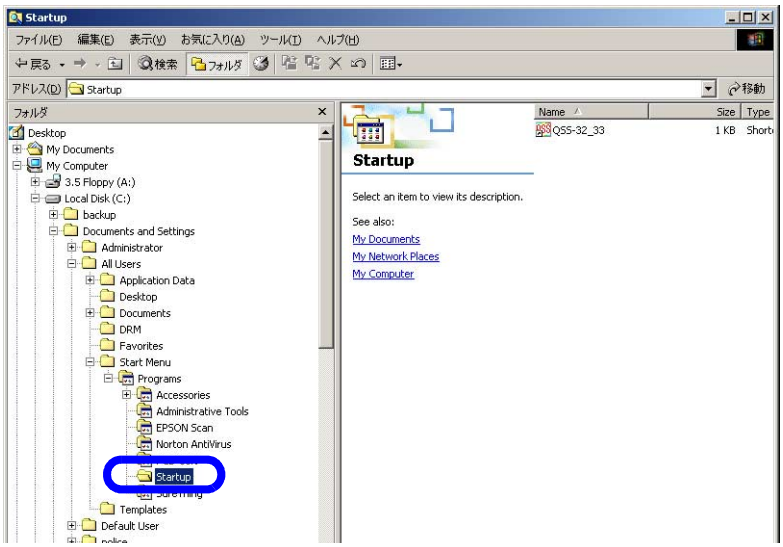
1. Save the laser self-diagnosis software to a readable and writable storage media.

NOTE

- The data size of this laser self-diagnosis software is about 2.8 MB.
- You can use the laser self-diagnosis software by saving its data file to a new folder created in the drive C:\QSS.

2. If the QSS software is running, quit it. Then, display the Windows screen.

3. Move the QSS software (QSS-##) from Startup folder to desktop.



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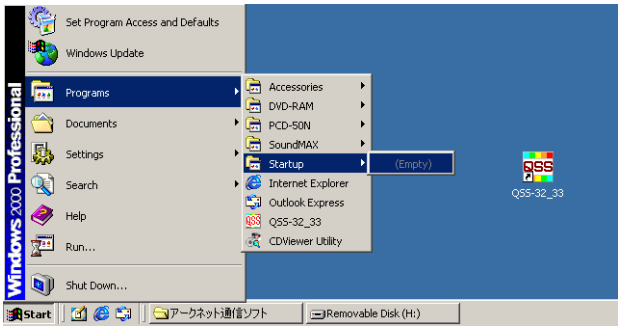
NOTE

- QSS software is moved from Startup to Desktop so that the QSS software does not start automatically after restarting the system.
- You can also access the Windows program menu from **Start→Programs→Startup**, and drag the **QSS-##** file to the desktop from there.



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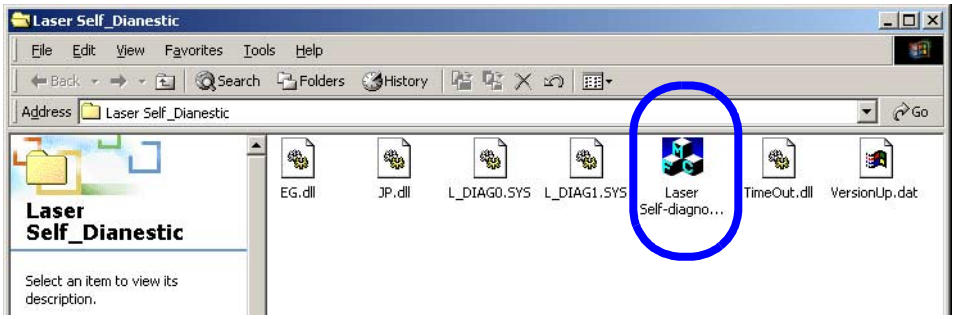
4. Insert the storage media with the laser self-diagnosis software into the drive, and double-click **Laser Self-Diagnostic.exe**.



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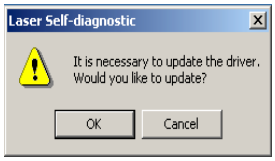
5. When the display for updating the driver is shown, click [OK].



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NOTE

- This display is shown only if the PCB driver needs to be updated.
  If it is not necessary to update the driver, the computer is not restarted and the display in Step 7 is shown.

6. After the driver is updated, the display for restarting the computer. Then, click [Restart].

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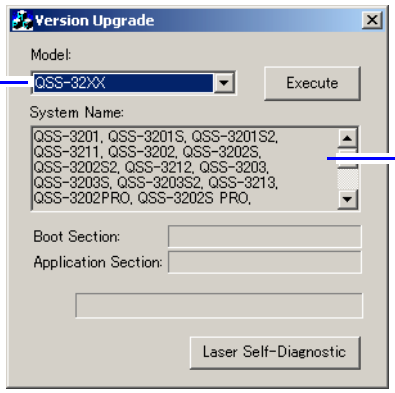
7. After the computer is restarted, double-click **Laser Self -Diagnostic.exe** . Then, the **Version Upgrade** display is shown. Select the model, and click [Execute].

Select the model (series).
QSS-32XX
QSS-33XX
QSS-3411
QSS-3412
QSS-35XX
LPS-24PRO



System names are displayed according to the selected model (series).

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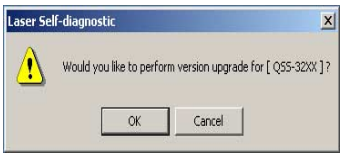
NOTE

- If selecting a wrong model and performing the version upgrade, the self-diagnosis software does not operate correctly.
  Select the correct model, and perform the version upgrade again.
- If the system has already been upgraded to the self-diagnosis version, the version upgrade is not required.
  Click **Laser Self-Diagnosis**, and go to Step 9.

8. When the message **Would you like to perform version upgrade for** [**QSS-XXXX**]**?** is shown, click **OK**. Then, the version upgrade automatically starts.



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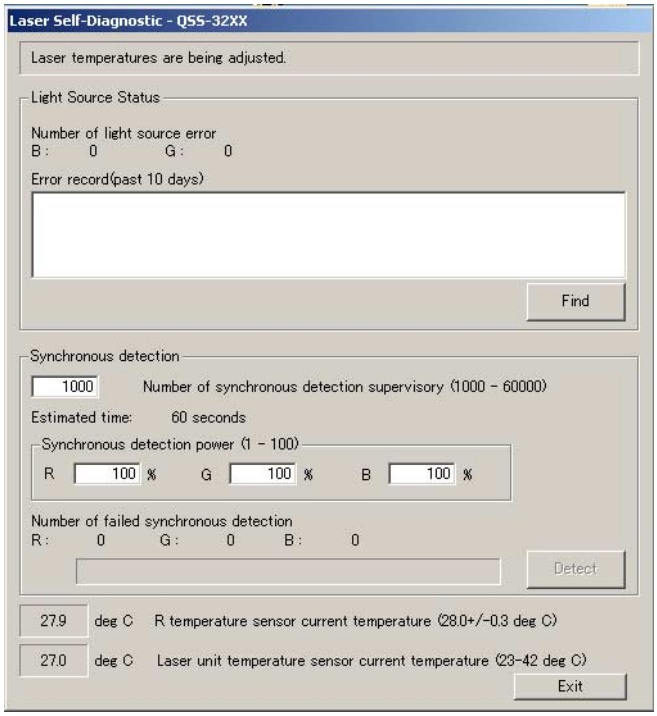
9. The **Laser Self-Diagnostic** display is automatically shown.



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NOTE

- The laser self-diagnosis software has a function to voluntarily perform the synchronous detection as well as print operation.
  To use this function, it is necessary to make the laser unit under the same condition as that to print. For this reason, it is required to finish the temperature adjustment in the laser unit.
  Replacing the laser unit and using the laser self-diagnosis software requires waiting time until the laser temperature adjustment is completed.

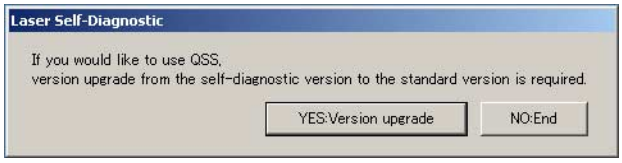
10. This completes starting the software.

3.3.2 Quitting the laser self-diagnosis software

1. Click **Exit** on the **Laser Self-Diagnostic** display.

2. Click × on the **Version UP** display.

3. When the message **If you would like to use QSS, version upgrade from the self-diagnostic version to the standard version is required.** is shown, click **YES: Version upgrade**.



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NOTE

- Clicking **YES:Version upgrade** changes the program to the standard version, then you can use the QSS software.
- To turn off the power supply in order to shift the signal processor, click **NO:End** to quit the program while remaining in the self-diagnosis version.

4. When the message, **Computer will restart** is shown, click **OK**.

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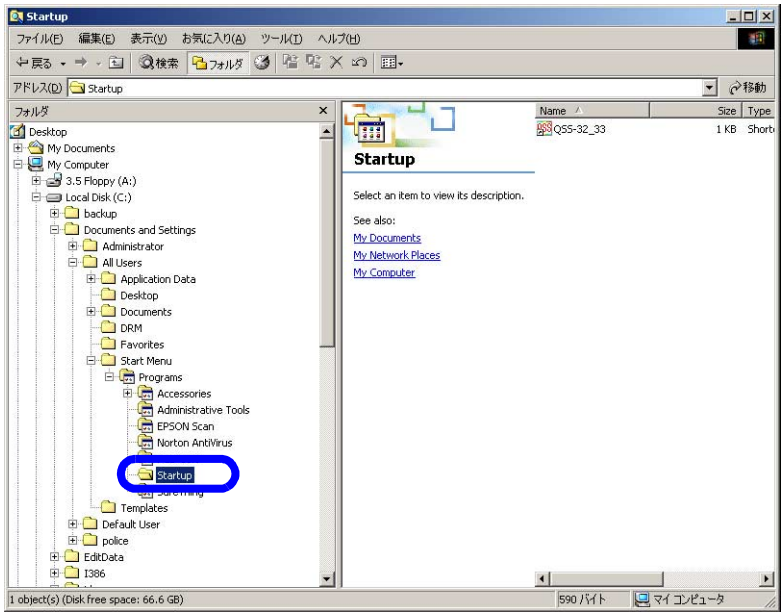
NOTE

- This display is shown only if the PCB driver was updated.

5. After the computer is restarted, move the QSS software (QSS-##) back to Startup folder.

Move the **QSS-##** file from Desktop to **Startup**.



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NOTE

- You can also move the **QSS-##** file from Desktop to **Startup** by dragging and dropping the **QSS-##** file via **Start→Programs→Startup**.

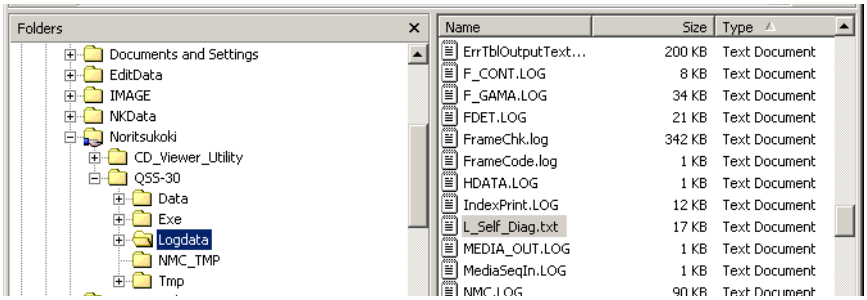
6. This completes quitting the software.

3.4 Automatic Saving of Diagnosis Result

3.4.1 Location for saving diagnosis data

This laser self-diagnosis software automatically writes the diagnosis data to the **L_Self_Diag_.txt** file in the **C:\Noritsukoki\QSS-##\Logdata** folder.

- Software upgrade information
- Result of checking the light source status
- Result of synchronous detection
- Error



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3.4.2 Information in the saved file

Following information is shown from the left with TAB intervals.

Operation date

- The start and end time of upgrading is shown.

PCB Name

- The name displayed at **PCB Name** to be upgraded is shown.

Boot

- The version of the boot section is shown.

Application

- The version of the application section is shown.

Example: Description in the saved file

```
//□□□□      □□□                              Boot                                    Aplication
2006/01/27 09:30:47     printer control PCB     BF0205 BF0206          L Self-Diag 1.000
2006/01/27 09:32:17     □□□□□□□□□ [ B:   0□ G:   0□ ]
2006/01/27 09:37:51     □□□□□□□□□[  1000□ ] □□□□□□□□[ R:100 G:100 B:100 ] □□□□□□□[ R:    0□ G:    0□ B:    0□ ]
2006/01/27 09:38:52     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 90 G: 90 B: 90 ] □□□□□□□[ R:    0□ G:    0□ B:    0□ ]
2006/01/27 09:39:35     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 80 G: 80 B: 80 ] □□□□□□□[ R:    0□ G:    0□ B:    0□ ]
2006/01/27 09:40:20     □□□□□□□□□[  1000□ ] □□□□□□□□[ R:  1 G: 80 B: 80 ] □□□□□□□[ R: 1000□ G:    0□ B:    0□ ]
2006/01/27 09:41:05     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 50 G: 80 B: 80 ] □□□□□□□[ R:    0□ G:    0□ B:    0□ ]
2006/01/27 09:41:44     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 30 G: 80 B: 80 ] □□□□□□□[ R: 1000□ G:    0□ B:    0□ ]
2006/01/27 09:42:32     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 35 G: 80 B: 80 ] □□□□□□□[ R: 1000□ G:    0□ B:    0□ ]
2006/01/27 09:43:15     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 40 G: 80 B: 80 ] □□□□□□□[ R:    0□ G:    0□ B:    0□ ]
2006/01/27 09:43:53     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 40 G: 40 B: 80 ] □□□□□□□[ R:    0□ G:    0□ B:    0□ ]
2006/01/27 09:44:31     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 40 G: 30 B: 80 ] □□□□□□□[ R:    0□ G:    0□ B:    0□ ]
2006/01/27 09:45:10     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 40 G: 20 B: 80 ] □□□□□□□[ R:    0□ G: 1000□ B:    0□ ]
2006/01/27 09:46:00     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 40 G: 30 B: 30 ] □□□□□□□[ R:    0□ G:    0□ B:    0□ ]
2006/01/27 09:46:38     □□□□□□□□□[  1000□ ] □□□□□□□□[ R: 40 G: 30 B: 20 ] □□□□□□□[ R:    0□ G:    0□ B: 1000□ ]
```

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4

4. Examples of diagnoses

4.1 Diagnosis Examples

The examples here are those diagnosed using the laser self-diagnosis software when analyzing defects.

NOTE

- The laser self-diagnosis software is used with the conditions below.
  - Number of synchronous detection supervisory: 1000
  - Start the check of synchronous detection with the power of R/G/B 100% and repeat changing each value and checking in order to find the asynchronous point.

In some cases, the laser self-diagnosis software is not effective.

When the laser self-diagnosis software is effective:

Reference	Symptom	Cause
☞ Example (1)	Prints with off-center yellow are output.	Signal processor
☞ Example (2)	**No.6105: B Laser light source status error.** occurs.	Laser unit
☞ Example (3)	**No.6073: Synchronous Sensor error.** occurs.	Signal processor
☞ Example (4)	Green prints are output.	Signal processor

When the laser self-diagnosis software is ineffective:

Reference	Symptom	Cause
☞ Example (5)	Prints with wave pattern (noise) are output.	Laser unit
☞ Example (6)	The print color suddenly changes to red or cyan by two or three keys.	Signal processor

IMPORTANT

- There are some cases such as (5) and (6) above that the asynchronous point value of failed laser units and signal processors is not low.
  The symptoms that prints with noise or off-center color(s) are output appear before light intensity degrades. Therefore, they are not symptoms of the asynchronous detection.

4.1.1 Examples that the laser self-diagnosis software is effective

4.1.1.1 Example (1)

Symptom

- Prints with off-center yellow were output several times a day.

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Corrective action

- The laser unit was replaced with a new one. However, prints with off-center yellow were still output.
  Finally, the problem was solved by replacing the signal processor of the B laser.

Analysis result

- Laser unit: Normal
- Signal processor: Element in the circuit was broken and the signal output (electric power) greatly decreased.

Diagnosis result of the laser self-diagnosis software

- Light intensity degradation was detected.
  (The following is the diagnosis result when attaching the returned signal processor to B laser.)

Each laser	Asynchronous point	Remarks
R	22%	Normal
G	25%	Normal
B	85%	Problem

4.1.1.2 Example (2)

Symptom

- **No.6105: B Laser light source status error.** occurred every morning.
  The error was closed by resetting the power supply and the same error did not occur within the day.
  The error used to occur every few days. However, the frequency increased and occurred every day.

Corrective action

- The problem was solved by replacing the laser unit.

Analysis result

- Laser unit: The LD (laser diode) of the B laser deteriorated.

Diagnosis result of the laser self-diagnosis software

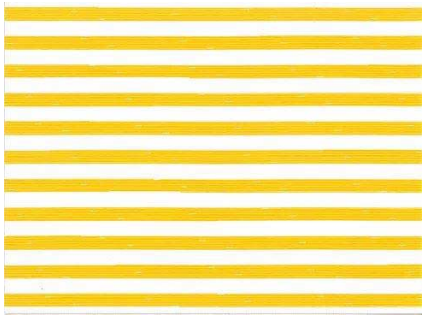
- Degradation of the B laser light intensity was detected.
  (The following is the diagnosis result when installing the returned laser unit to a system.)

Each laser	Asynchronous point	Remarks
R	21%	Normal
G	22%	Normal
B	89%	Problem

4.1.1.3 Example (3)

Symptom

- Extremely reddish prints were output.
  After resetting the power supply and starting a printing operation, **No.6073:Synchronous Sensor error.** occurred and prints with yellow stripes were output.



G084901

Corrective action

- The problem was solved by replacing all the signal processors.

Analysis result

- Signal processor (B): Normal
- Signal processor (G): Normal

- Signal processor (R): Element in the circuit was broken and the signal output (electric power) greatly decreased.

Diagnosis result of the laser self-diagnosis software

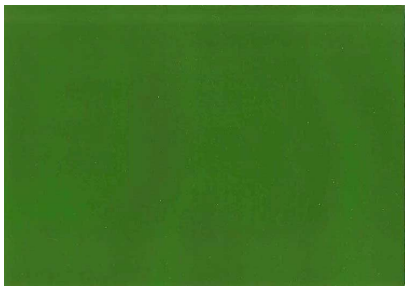
- Light intensity degradation was detected.
  (The following is the diagnosis result when attaching the returned signal processor to R laser.)

Each laser	Asynchronous point	Remarks
R	97%	Problem
G	19%	Normal
B	21%	Normal

4.1.1.4 Example (4)

Symptom

- Green prints were output.



G084902

Corrective action

- The problem was solved by replacing all the signal processors.

Analysis result

- Signal processor (B): Normal
- Signal processor (G): Normal
- Signal processor (R): Element in the circuit was broken and the signal output (electric power) was 0 mW.

Diagnosis result of the laser self-diagnosis software

- Light intensity degradation was detected.
  (The following is the diagnosis result when attaching the returned signal processor to R laser.)

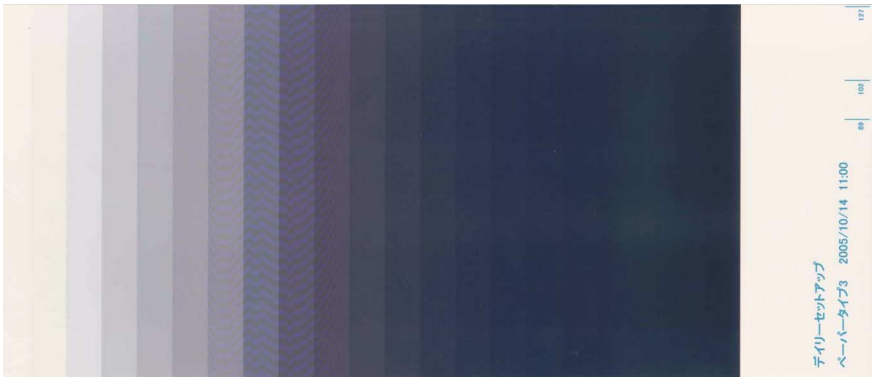
Each laser	Asynchronous point	Remarks
R	100%	Problem
G	19%	Normal
B	21%	Normal

4.1.2 Examples that the laser self-diagnosis software is not effective

4.1.2.1 Example (5)

Symptom

- Prints with yellow wave pattern (noise) are output.



G084903

Corrective action

- The problem was solved by replacing the laser unit.

Analysis result

- Laser unit: Noise occurred because foreign objects adhered to the optical parts inside the B laser head.

Diagnosis result of the laser self-diagnosis software

- No light intensity degradation was detected in all the R/G/B lasers.
  (The following is the diagnosis result when installing the returned laser unit to a system.)

Each laser	Asynchronous point	Remarks
R	18%	Normal
G	20%	Normal
B	55%	Normal

NOTE

- However noise makes laser light unstable, it does not greatly degrade light intensity.
- The print above is an example. Actually, various patterns because of noise are shown on prints.

4.1.2.2 Example (6)

Symptom

- Color of prints suddenly changed to red or cyan by two or three keys.

Corrective action

- The problem was solved by replacing the signal processor of the R laser.

Analysis result

- Signal processor: Element in the circuit was broken and the signal processor output status was unstable.

Diagnosis result of the laser self-diagnosis software

- Light intensity degradation was not detected.
  (The following is the check result by attaching the returned signal processor to R laser.)

Each laser	Asynchronous point	Remarks
R	30%	Normal
G	25%	Normal
B	52%	Normal

NOTE

- If the signal processor is broken, electrical power may not be output at all. ☞ 4.1.1.4 Example (4)
  However, in many cases, the signal output becomes unstable and gets out of the normal range as time passes.
  When diagnosing with normal signal output, light intensity degradation will not be detected. In addition, if diagnosing when the signal output slightly decreases than the normal range, the synchronous sensor is not affected very much and the asynchronous point may be within the normal range.

5

5. Appendix

5.1 Appendix

5.1.1 Analysis of laser problems

Failed part	Analysis result	Symptom	Number of cases
Signal processor*1	FET failure etc.	Color change of prints	248
		Prints with off-center yellow	11
		No. 6073 Synchronous Sensor error.	7
		Green prints	2
		Unexposed prints	2
		No.6076-0002 Polygon Mirror control error.	1
Laser unit	LD deterioration	No.6105 B Laser light source status error.	16
		No.6106 G Laser light source status error.	4
		No. 6074 B Laser control error.	1
		Prints with off-center yellow	1
		Green prints	1
		Prints with wave pattern (noise)	1
		Color change of prints	1
	Light diffuseness inside the AOM	Prints with off-center yellow	5
		Fogged prints	3
	Foreign objects inside the B/G laser head	Prints with wave pattern (noise)	6
	Temporal change of the B/G laser head	Prints with wave pattern (noise)	3
	Coaxial connector failure	Prints like banding prints	2
	Peltier failure (R laser)	Problems in the laser temperature adjustment	1
Laser control PCB	IC failure	Prints that gradation is not reproduced normally	3
		Prints with dot pattern	1
Laser I/O PCB	Transistor failure	Problems in the laser temperature adjustment	1

*1. The reason why the number of cases regarding the signal processor is extremely large is that the FET failure frequently occurred with the **24K type**.(The number of cases whose cause is not the FET failure is five.)

IMPORTANT

- The analysis above shows the following.
  - The FET failure, LD deterioration and light diffuseness inside the AOM cause several symptoms.
  - There are some cases that the same symptom appears even if the failure part is different.
    - Both the signal processor problem (FET failure) and laser unit problems (LD deterioration and light diffuseness inside the AOM) cause prints with off-center yellow.
    - Both the signal processor problem (FET failure) and laser unit problem (LD deterioration) cause green prints.

  These cases show that both problems greatly decrease laser light intensity and cause the laser asynchronous detection.

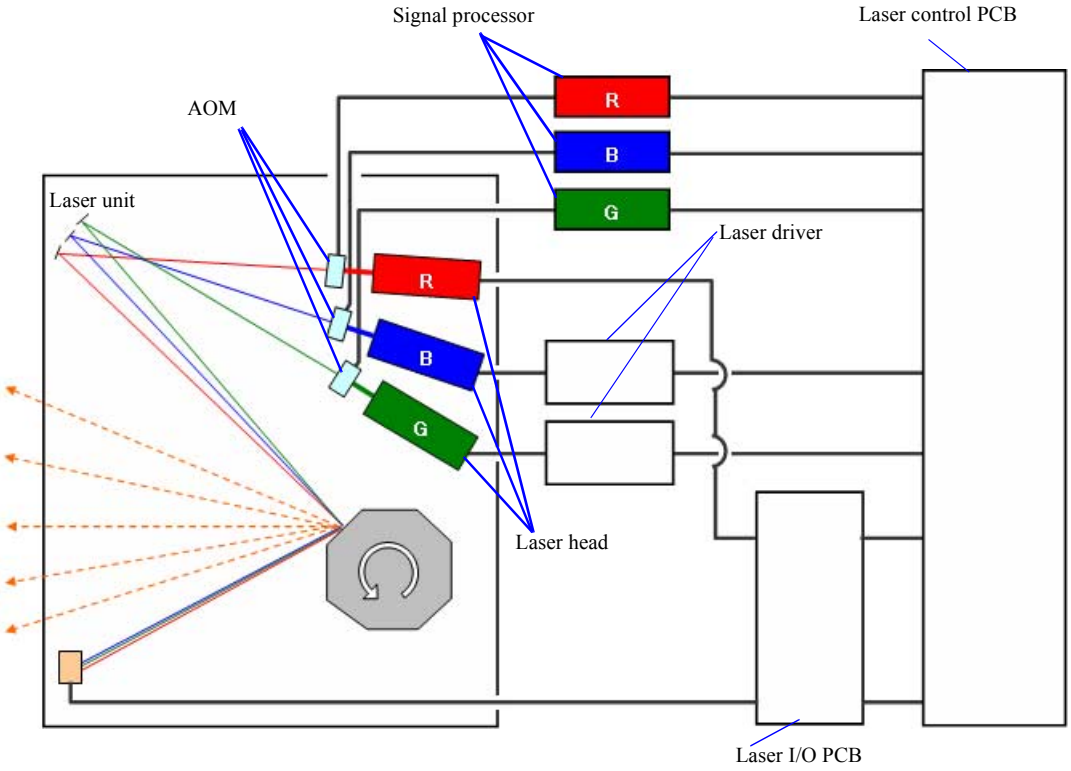
5.1.2 Glossaries

5.1.2.1 FET failure

The signal processor type was changed to **24K** around the same time that the QSS-32 was released.

The element, FET is newly used for the **24K** type signal processor. Then, the problem that the FET broke early because of overvoltage and heat frequently occurred.(Countermeasure against the problem has been taken for the **24K2** and **24L** types of signal processors.)
The signal processor controls the AOM. Therefore, if the signal processor breaks, the following symptoms appear.

- The AOM divides the light emitted from the R/G/B laser head into the 0th order light (reflected light) and 1st order light (Diffracted light) by receiving signal from the signal processor, and adjusts the light intensity. Therefore, when signal output decreases because of the signal processor failure, the 1st order light intensity of the AOM gets low.
  - When the signal processor output is unstable, print color changes.
  - When the signal processor output greatly decreases or it does not output signal, the laser asynchronous detection occurs.



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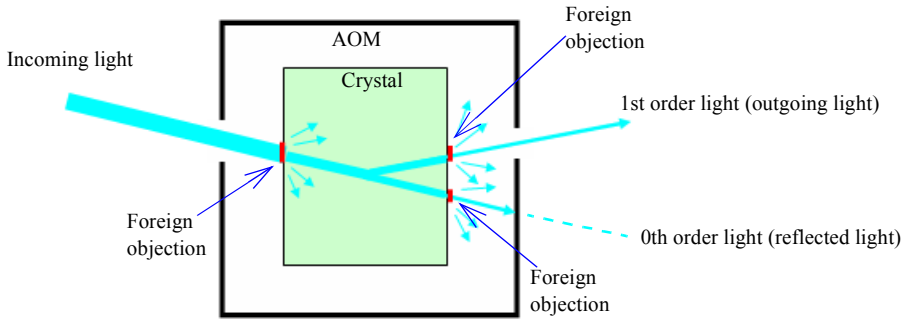
5.1.2.2 Light diffuseness inside the AOM

If foreign objects adhere to the AOM crystal, the incoming light diffuses. Then, the 1st order light intensity (outgoing light) gets low and asynchronous detection occurs. In addition, 0th order light leaks and fogged prints are output.
The foreign objects may be the AOM materials. Therefore, the materials may be changed.



Light diffuses because of foreign objects. Therefore, 1st order light intensity gets low, or 0th order light leaks.

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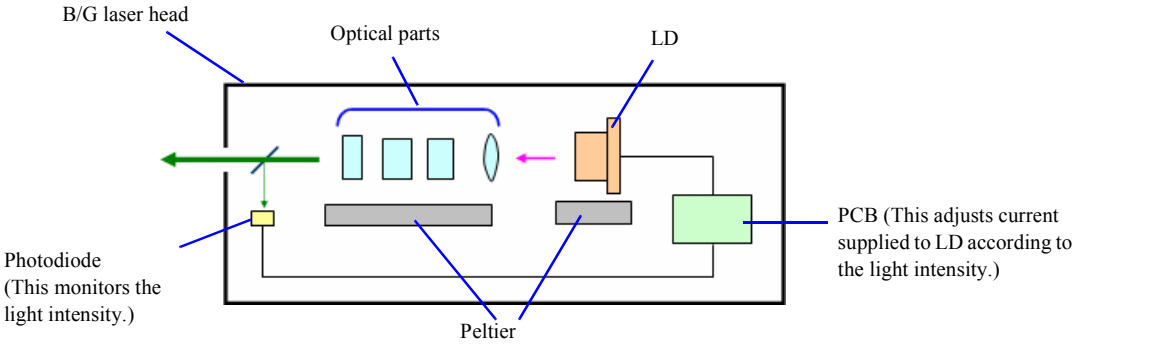
5.1.2.3 LD deterioration

The characteristics of the LD (laser diode) built into the B/G laser heads change as time passes. The characteristic changes cause the light intensity change.
The B/G laser head automatically adjusts the power current value supplied to the LD to keep the light intensity constant. There is the upper limit of the power current value.
If the current value reaches the one near the upper limit, the B/G laser driver sends the B/G laser light source status signal (LD deterioration signal) to the laser control PCB. Then **No.6105 B Laser light source status error.** or **No.6106 G Laser light source status error.** appears.
As the LD deterioration progresses, the laser head cannot emit enough light even if the maximum value of current is supplied. Eventually, the laser will not emit light at all.



5.1.2.4 Foreign objects inside the B/G laser head/ Temporal change

Some optical parts other than the LD are built into the B/G laser head. The status of the optical parts must be kept so that the laser head can emit stable laser light.
The peltiers adjust the temperature of the LD and optical parts. This is to keep the status of each part.
Noise affects laser light if foreign objects get into the laser head during manufacturing process and adhere to the optical parts, or the status of the optical parts changes even if only slightly as time passes.
Therefore, failed prints such as ones with wave pattern are output.

NOTE

- See ☞ 4.1.2.1 Example (5).