Operating instructions

Stroboscope RT STROBE qbLED
Stroboscope RT STROBE qbLEDs*
Stroboscope RT STROBE super qbLED

* Stationary version without integrated battery and without handle

1. Complete overview of connections, controls and settings

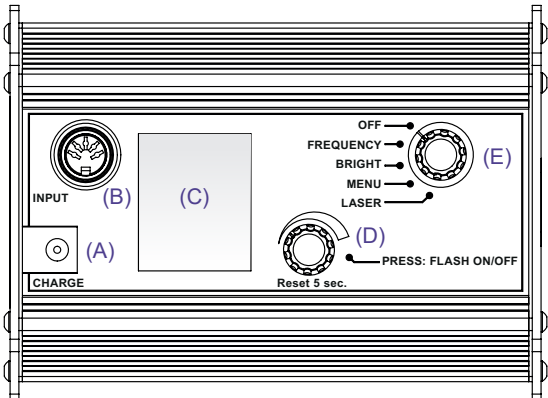|	
(A)	CHARGE = charging socket
(B)	INPUT = input for external trigger / 24 V power supply for sensors
(C)	Display
(D)	Rotary/push knob
(E)	Selector switch: OFF, FREQUENCY, BRIGHT, MENU, LASER

Fig. 1: Stroboscope RT STROBE super qbLED

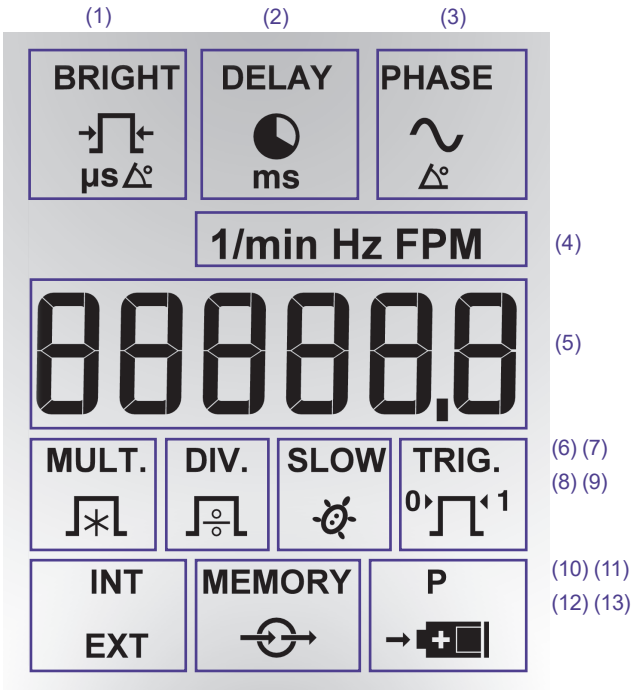|	
(1)	Brightness in µs and/or degrees (BRIGHT)
(2)	Delay in ms and/or degrees (DELAY)
(3)	Phase shift (PHASE)
(4)	Unit of frequency in rpm, Hz and/or FPM
(5)	Value
(6)	Multiplier (MULT.)
(7)	Trigger divider (DIV.)
(8)	Slow motion (SLOW)
(9)	Trigger signal edge (TRIG.)
(10)	Internal/external trigger (INT / EXT)
(11)	Store / read parameters (MEMORY IN / MEMORY OUT)
(12)	Pro mode (P)
(13)	Battery status – full, half full or low

Fig. 2: Display

Contents

2. Technical data

General parameters	qbLEDs	qbLED	super qbLED
Number of LEDs	40	40	118
Frequency range	30 - 300,000 flashes per minute		
Display	LCD, multiline		
Accuracy	±0.02 % (±1 digit / ±0.025 µs)		
Resolution	± 0.1 (30.0 ... 999.9 FPM) ± 1 (1,000 ... 9,999 FPM) ± 10 (10,000 ... 300,000 FPM)		
External trigger input	3 - 30 V / max. 5 mA (isolated optocoupler) DIN 41524 5-pin standard connector Uout = 24 VDC, 60 mA		
Certifications	EMV / EMC 2004/108/EG; 2006/95 EG; DIN EN 61010-1:2011; DIN EN 62471:2009; CE; DIN EN 60825-1:2008 (Version super qbLED)		

Flash parameters	qbLEDs	qbLED	super qbLED
Light duration	Adjustable		
Light intensity	ca. 1.750 Lux @ 1° / 300 mm (12 inch)	ca. 1.750 Lux @ 1° / 300 mm (12 inch)	ca. 8.000 Lux @ 1° / 300 mm (12 inch)
Flash colour	approx. 5,000 - 8,000 K		

Power supply	qbLEDs	qbLED	super qbLED
Power supply	via mains connection	Integrated lithium-ion batteries	
Continuous use time	-	approx. 7:00 h @ 0.500° (~875 Lux) approx. 4:00 h @ 2,000 Lux (1.140°)	approx. 2:30 h @ 0.500° (~4,000 Lux) approx. 5:00 h @ 2,000 Lux (0.250°)

Housing	qbLEDs	qbLED	super qbLED
Material	Aluminium		
Dimensions	150 x 130 x 112 mm / 6.0 x 5.1 x 4.4 inch		
Weight	approx. 850 g	approx. 1,050 g	approx. 1,150 g

Ambient conditions	qbLEDs	qbLED	super qbLED
Temperature	0 - 40 °C / 32 - 104 °F		
Type of protection	IP30		

3. About these operating instructions

These operating instructions are an integral part of the device. They must be stored in an easily accessible location and passed on to subsequent users. Ask your supplier if there is something you do not understand.

> ⚠ *Read the operating instructions thoroughly and follow the instructions provided. These operating instructions contain important information about installing, starting up and operating the stroboscope. Pay particular attention to the safety information and warnings to prevent injuries and product damage.*

The manufacturer reserves the right to continue to develop this device without documenting all developments. Your supplier will be pleased to inform you as to whether these operating instructions are current.

3.1 Conventional representation in this document

3.1.1 Presentation of work instructions
Work instructions are shown in numbered steps and must be carried out in the order stated.

1. Step
    → An arrow is used to show stroboscope reactions to a step.
2. Step
3. Step

The end of a work instruction is shown as follows:
    ☑ End of work instruction

A work instruction that only consists of one single step will appear as follows:
    ► Step

4. Intended use

This device is used for inspecting the movement of rotating and vibrating objects. It may only be used in accordance with these instructions. The device must not be opened. Modifications to the device are not permitted. The manufacturer shall not be liable for damage resulting from incorrect use or use contrary to the intended use. Warranty claims will also be invalidated in this event.

> ⚠ **Warning**
> *Risk of injury!*
> *Moving objects appear still or in slow motion in stroboscopic light. Do not touch such objects under any circumstance.*

> ⚠ **Warning**
> *Risk of injury!*
> *The device may not be used in potentially explosive areas.*

> ⚠ **Warning**
> *Risk of injury!*
> *Stroboscopic light can trigger epileptic seizures in persons at risk.*

> ⚠ **Warning**
> *Risk of injury!*
> Never direct the LED beam at people or animals and do not stare directly at the beam.

> ⚠ **Warning**
> *Risk of injury!*
> ☀ Laser class 2
>
> *The stroboscope super qbLED is fitted with a class 2 laser. This is located at the front of the device. The laser beam can damage eyes. For this reason, do not stare directly at the laser beam and never direct it at people or animals. Wavelength: 650 nm, output: 1 mW*

> ⚠ **Caution**
> *Flashing lights can cause retina damage!*
> ☀ The stroboscope qbLED and super qbLED versions are fitted with 40/118 LEDs respectively. These produce potentially dangerous optical radiation, which can cause retina damage. Do not stare directly at the light and never direct it at people or animals.

> ⚠ **Caution**
> *Warranty void!*
> The device may only be repaired by the manufacturer or the supplier.

> ⚠ **Caution**
> *Correct disposal!*
> The electronic components in the device contain environmentally harmful substances. They must be disposed of in accordance with the environmental regulations in the country of use.

> △ **Note**
> Suitable for use in residential, commercial and industrial area.

5. Scope of delivery

Check the scope of delivery. Please note, that this device is available in different versions and that the following scope of delivery may vary.
- stroboscope:
  - stationary version qbLEDs (= 40 LEDs, without ingetrated battery and without handle)
  - portable version qbLED (= 40 LEDs)
  - portable version super qbLED (= 118 LEDs, with auto-sync laser function)
- operating instructions
- calibration certificate
- charger with connector set
- trigger plug
- reflective tapes (Version super qbLED)
- handle (portable versions)
- case (portable versions)

6. Getting started

6.1 Connectors (Fig. 1)

No.	Marking	Term	Description
(A)	CHARGE	Charging socket / Mains connection (version qbLEDs)	Device is charged using the charger / Power supply for the device (version qbLEDs)
(B)	INPUT	Input socket	Input for external trigger / 24 V power supply for sensor

6.2 Brief description of set-up steps

Please follow the steps below when setting up the device:

1. Charge the device: plug the charger into the CHARGE socket (A) to the rear of the device (see fig. 1 - only applies for portable versions).

2. Direct the device at a moving object and switch on. Turn the selector switch (E) one notch to the left to "FREQUENCY".

⚠ *The device will start to flash straightaway. For this reason, do not direct it at people or animals.*

- The device will flash at the frequency that was set most recently. The display shows the selected flash frequency in the unit that was set most recently (rpm, Hz or FPM).
- If the flash frequency coincides with the frequency of the motion, a static image appears.

△ **Note**
Static images are produced when the flash frequency is identical to, or a multiple or fraction of the frequency of the motion (see also section 9 "Determining the actual rotational speed of an object")

6.3 Connect trigger

The device has the option of being externally triggered.

⚠ **Caution**
Material damage!
Do not trigger the device with signals in excess of 300,000 FPM.

△ **Note**
Only use original material from the manufacturer to connect the trigger signal.

The trigger input is isolated. The isolated input is suitable for PNP and NPN signals. A trigger plug suitable for this input socket is included with the device.
1. Plug the trigger plug into input socket INPUT (B).
2. Screw in trigger plug.
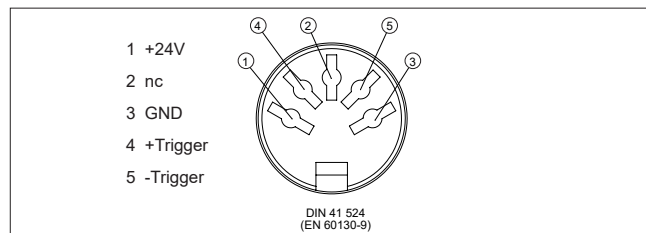3. Assign the connection socket as per fig. 3.

1 +24V
2 nc
3 GND
4 +Trigger
5 -Trigger

DIN 41 524
(EN 60130-9)

Fig. 3: Assignment of the connection socket

△ **Note**
The device must be manually switched between external and internal trigger signals (see section 7.2.2 "Standard mode / How to select an internal / external trigger").

7. Operation

△ **Note**
Please note that this device comes in two versions.
Version 1: stationary stroboscope qbLEDs (= 40 LEDs, without ingetrated battery and without handle)
Version 2: portable stroboscope qbLED (= 40 LEDs)
Version 3: portable stroboscope super qbLED (= 118 LEDs, with auto-sync laser function)

All three versions are available in standard and pro modes (see section 7.2.2 "Standard mode" and section 7.2.3 "Pro mode").

7.1 Controls (Fig. 1)

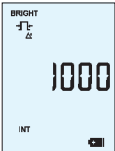| No. Term	Description
(D) Rotary/push knob	- Turn the knob to select the value and push to confirm. The adjustment increment depends on the rotational speed.
	- Turning the knob while pushing it simultaneously, the adjustment increment is effected in steps of 100.
	- The flash can be turned off by pushing the knob once and turned on again by pushing the knob once again.
(E) Selector switch	Choose between "OFF", "FREQUENCY", "BRIGHT", "MENU" and "LASER" (super qbLED version) by turning the switch to the desired position.

7.2 Display

△ **Note**
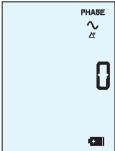*Preset values are retained in each mode (standard or pro mode)!*

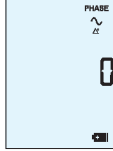### 7.2.1 Overview of adjustable parameters
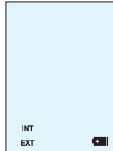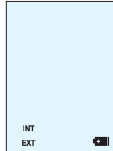
Position of the selector switch (E)	Display	Available with internal trigger	Available with external trigger	Functions of the rotary/push knob (D) Set value	Functions of the rotary/push knob (D) Select parameter
OFF	–				
FREQUENCY	FPM			•	
BRIGHT	BRIGHT deg			•	
MENU	PHASE deg	•	•	•	
	INT / EXT	•	•		•
Following functions are only available in the PRO mode:					
	1/min / Hz / FPM	•	•		•
	MULT.	•		•	
	BRIGHT deg / µs	•	•		•
	DELAY ms	•	•	•	
	DIV		•	•	
	SLOW		•	•	
	TRIG.		•		•
	MEM IN	•	•	•	
	MEM OUT	•	•	•	

7.2.2 Standard mode (Fig. 2)

△ **Note**

Not all of the settings shown in fig. 2 are available in standard mode.

No.	Position of the selector switch (E)	Display	Adjustable parameters	Description
	OFF	–		Device is switched off
(4)	FREQUENCY	FPM 1000 INT	FPM	Frequency selection: FPM: flashes per minute - Turning the knob while pushing it simultaneously, the adjustment increment is effected in steps of 100. - The flash can be turned off by pushing the knob once and turned on again by pushing the knob once again.

How to select frequency:

1. Turn the selector switch (E) to the "FREQUENCY" position.
   → The following will then appear in the display for a few seconds:
   ▪ all settings followed by
   ▪ "S" for standard mode
   → The following will then appear in the display:

		FPM 1000 INT	2. Select the desired frequency using the rotary/push knob (D). ☑ This setting is now active.

(1)	BRIGHT	BRIGHT 1000 INT	BRIGHT deg	Selection of brightness (in 1/1,000 degrees)

Brightness (BRIGHT in deg)

Flash duration. This function allows the flash duration to be adjusted, which influences the brightness and focus of the object being viewed. In the standard mode, this setting can only be made in relative form (degrees), whereas the pro mode also features the additional setting of measuring brightness in absolute form (microseconds).

(3)	MENU	PHASE ∿ 0 INT	PHASE deg.: 0 … 359	Delay setting between the trigger signal and flash (in degrees, relative to the frequency) Position fixed; actual delay depending on current frequency.

Phase shift (PHASE in deg)

Phase shift setting (in degrees, relative to the frequency) between the trigger signal and flash. This value allows a fixed angle to be set between the trigger signal and flash.

▪ *Example without external connection: The viewing position can be extremely precisely adjusted without changing the flash frequency. You can shift the viewing position within a movement cycle.*
▪ *Example with external connection: The external trigger signal is triggered before the desired observation point (= flash position of the stroboscope). This would mean that the connected stroboscope would regularly flash too early. The PHASE deg setting adjusts the delay, altering the flash position of the stroboscope by a set angle. This setting is not affected by the current rotational speed, which means that the stroboscope will flash at the desired position even during rotational speed fluctuations or during the start-up period.*

No.	Position of the selector switch (E)	Display	Adjustable parameters	Description

How to select in the MENU:

1. Turn the selector switch (E) to the "MENU" position.
2. Select which parameter (e.g. PHASE deg) you want to change using the rotary/push knob (D).
3. Push the rotary/push knob (D) to confirm a parameter selection.

   → The following will appear in the display:

PHASE
∿
0

   → the number display will flash

4. Select the desired value using the rotary/push knob (D).
5. Confirm and exit selection by pushing the rotary/push knob (D).

   ☑ This setting is now active.

(10)	MENU	INT EXT	INT / EXT	Internal / external trigger

How to select an internal / external trigger:

1. Turn the selector switch (E) to the "MENU" position.
2. Select the INT / EXT parameter using the rotary/push knob (D).
3. Push the rotary/push knob (D) to confirm a parameter selection.

   → The display will now show the selection of INT and EXT parameters:

INT
EXT

   → the active setting will flash

4. Select the desired parameter using the rotary/push knob (D).
5. Confirm and exit selection by pushing the rotary/push knob (D).

   ☑ This setting is now active.

△ **Note**

The display and adjustable value can be changed by turning the rotary/push knob (D).

7.2.3 Pro mode (Fig. 2)
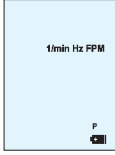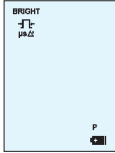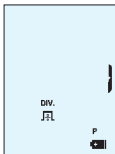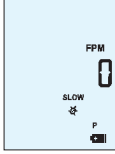
Nr.	Position of the selector switch (E)	Display	Adjustable parameters	Description
	OFF	–		Device is switched off
(4)	FREQUENCY	FPM 1000 INT	FPM	Frequency selection: FPM: flashes per minute - Turning the knob while pushing it simultaneously, the adjustment increment is effected in steps of 100. - The flash can be turned off by pushing the knob once and turned on again by pushing the knob once again.
(1)	BRIGHT	BRIGHT 1000 INT	BRIGHT deg.: 0.025° ... 3,000°	Selection of brightness unit (to 1/1,000 degrees)
			BRIGHT µs: 1 ... 2,000 µs	Selection of brightness unit in degrees (displayed in 1/1,000 degrees) or in microseconds.
(3)	MENU	PHASE 0	PHASE deg.: 0 … 359	Delay setting between the trigger signal and flash (in degrees, relative to the frequency) Position fixed; actual delay depending on current frequency.
(10)	MENU	INT EXT	INT / EXT	Internal / external trigger

⚠ **Note**

See also section 7.2.2 "Standard mode" for examples and explanations regarding above mentioned display messages.

No.	Position of the selector switch (E)	Display	Adjustable parameters	Description
(4)	MENU	1/min Hz FPM P	rpm / Hz / FPM	Unit of frequency selection: - rpm: unit for measuring rotational speed - Hz: flash frequency per second - FPM: flashes per minute
(6)	MENU	1/min 0.0 MULT. P	MULT: x 1, x 2, x 3, ... / ÷1, ÷2, ÷3, ... respectively. The selected flash frequency is immediately multiplied/ divided by 1, 2, 3...	Multiplier: - This function is only possible when the "internal trigger" is selected.

Multiplier (MULT.)

At this function the adjusted frequency can be divided or multiplied with integer values to check the harmonic multiple images (see section 9 "Determining the actual rotational speed of an object").

(1)	MENU	BRIGHT µs/Δt P	BRIGHT: PULSE deg / PULSE µs	Selection of brightness unit (in degrees or microseconds).

Brightness (BRIGHT in deg / BRIGHT in µs)

Flash duration. This function allows the flash duration to be adjusted, which influences the brightness and focus of the object being viewed. Brightness can either be measured in absolute terms (microseconds) or in relative terms (degrees).

(2)	MENU	DELAY ms 0.0 P	DELAY ms: 0.0 … 2,000	Delay time setting (in milliseconds) between the trigger signal and flash. Position fixed; actual delay depending on current frequency.
(7)	MENU	DIV. 1 P	DIV: 1 … 255	Pulse divider, max. value 255 - This function is only possible when the "external trigger" is selected.

Pulse divider (DIV)

The pulse divider can be used to set a value x, by which the external trigger signal is then divided.
Example: when scanning a cog wheel, an external trigger (e.g. rotational speed sensor) sends out a signal for each cog scanned. With a DIV value of 10, it will only flash once in every 10 signals.

(8)	MENU	FPM 0 SLOW P	SLOW: 0 … 600	- The flash frequency exceeds the trigger frequency by the value selected. - This function is only possible when the "external trigger" is selected.

SLOW (slow motion)

The "SLOW" function allows the viewer to view movement in slow motion.
The speed of the slow motion depends on the flash frequency and corresponds to the value selected.

No.	Position of the selector switch (E)	Display	Adjustable parameters	Description
(10)	MENU		TRIG. 0 / 1	Selection of trigger signal edge (increasing: 0, decreasing: 1). - This function is only possible when the "external trigger" is selected.
(11)	MENU		MEM IN: 1 … 5	Selected settings can be backed up in five separate storage locations.
(11)	MENU		MEM OUT : 1 … 5	It is possible to read backed-up settings.

7.2.4 Stroboscope super qbLED (Fig. 2)

△ **Note**

The stroboscope super qbLED features both a higher number of LEDs as well as a laser.

⚠ **Warning**

Risk of injury!

⚠ *Laser class 2*

The stroboscope super qbLED is fitted with a class 2 laser. The laser beam can damage eyes. For this reason, do not stare directly at the laser beam and never direct it at people or animals.

The stroboscope super qbLED features a laser in addition to the aforementioned settings (see sections 7.2.2 and 7.2.3).

To use the laser, you must first affix a reflective marking onto the object to be measured. Direct the stroboscope at the rotating object. The laser will recognise the marking and measure the rotations.

To enable the integrated "Auto Save" feature, direct the strobo-scope at the rotating object for at least 2 seconds. The measured frequency will be stored. After switching to the parameter "Internal trigger", the stroboscope flashes at this frequency and it can now be used for all other settings.

No	Position of the selector switch (E)	Display	Description
	LASER	3000	The trigger frequency is 3,000 flashes per minute, determined by the reflective laser beam.
	LASER	--UL--	The trigger frequency is below the measurement range.

No.	Position of the selector switch (E)	Display	Description
	LASER	--OL--	The trigger frequency is above the measurement range.

7.2.5 Operating mode

The following operating modes may be displayed:

No.	Position of the selector switch (E)	Display	Description
	Battery status	1000	Fully charged
	Battery status	1000	Half charged
	Battery status	1000	Low (symbol will flash)
	LASER / EXT / SLOW	--UL--	The trigger frequency is below the measurement range.
	LASER / EXT / SLOW	--OL--	The trigger frequency is above the measurement range.

△ **Note**
The symbol of a parameter that differs from the factory settings will flash during operation.

△ **Note**
The stroboscope will be automatically switched off after 15 minutes of running on battery power!

7.3 Factory reset

△ **Note**
To reset the factory settings, press and hold the rotary/push knob (D) for at least 5 seconds.

8. Accessories, optional

DIN plug 5-pin, edge bumpers, mounting kit for tripod or articulating arm, articulating arm including mounting kit, tripod, connection cable (1.5 m), extension cable (2.0 m), trigger sensors

9. Determining the actual rotational speed of an object

The stroboscope can be used as a digital revolution indicator to determine an object's actual rotational speed and/or the frequency of cyclical movements. The stroboscope does this by visually "freezing" the object's movement and then taking a reading of the rotational speed or frequency from the LCD display. As is the case with all stroboscopes, it is vital to ensure that this "frozen" image is not a harmonic of the object's actual rotational speed.

Useful information:

- It's helpful to have a rough idea of the object's rotational speed beforehand.

- Regular shaped objects, e.g. a fan with several vanes or a motor shaft, must be affixed with an identification marking (using colour or a reflective strip etc.) in order to be able to differentiate its orientation of movement.

- A still image always appears exactly at integer division of the speed of the object's actual rotational speed!

Example 1 (marking required):

 This example shows the importance of using identification markings. Say you want to determine the actual rotational speed of this ventilator.

The only thing you know is that its rotational speed is less than 3,500 rpm. The following "frozen" images will appear if you reduce the flashing rate based on 3,500 FPM (flashes per minute):

Image No.	1	2	3	4
Flashing rate	3,300	2,200	1,650	1,320

Image No.	5	6	7	8
Flashing rate	1,100	825	733.3	550

What is the actual rotational speed of the fan? Images 1, 3, 5, 6 and 8 correspond to the original one, which means the rotational speed could be 3,300, 1,650, 1,100, 825 or 550 rpm.

Which is correct?

 To determine the fan's actual rotational speed, one of the ventilator vanes is attached with a marking and the test is repeated.

Image No.	1	2	3	4
Flashing rate	3,300	2,200	1,650	1,320

Image No.	5	6	7	8
Flashing rate	1,100	825	733.3	550

The orientation marking confirms that the images at 3,300, 1,650 and 825 rpm are harmonic multiple images. Three identification marks appear in each of these images.

Still images appear at 1,100 rpm and again 550 rpm, each displaying just one mark. Remember that a still image always appears exactly at integer division of the speed of the actual rotational speed of an object. 550 is half of 1,100. This means that the rotational speed of the ventilator must be 1,100 rpm.

Example 2 (no marking required):

This example shows how the actual rotational speed of an object can be determined without using an orientation marking. This is only possible for suitably shaped objects.

 Let's assume the only thing we know about this cam is that it rotates at less than 7,000 rpm. Its clear shape eliminates the need for an orientation marking. The following "frozen" images will appear if the flashing rate of 7,000 is reduced:

Image No.	1	2	3	4
Flashing rate	6,000	4,000	3,000	1,500

The images showing 6,000 and 4,000 rpm are double or multiple images rather than single images. Still images appear at 3,000 and again at 1,500 rpm. 1,500 is half of 3,000. This means that the actual rotational speed is 3,000 rpm.

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