

SKF TKRS 41



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Table of contents

Safety recommendations	2
EC Declaration of conformity	3
1. Complete overview of connections, controls and settings	4
2. Technical data.....	5
3. About these operating instructions.....	6
3.1 Conventional representation in this document	6
3.1.1 Presentation of work instructions.....	6
4. Scope of delivery	7
5. Getting started	7
5.1 Connectors (→ fig. 1)	7
5.2 Brief description of set-up steps.....	7
5.3 Connect trigger	8
6. Operation	9
6.1 Controls (→ fig. 1).....	9
6.2 Display	9
6.2.1 Overview of adjustable parameters.....	9
6.2.2 Standard mode (→ fig. 2)	10
6.2.3 Pro mode (→ fig. 2)	13
6.2.4 Laser modes	16
6.2.5 Operating mode	17
6.3 Factory reset	17
7. Determining the actual rotational speed of an object.....	18
8. Spare parts	20



Safety recommendations

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.
- The device may not be used in potentially explosive areas.
- Stroboscopic light can trigger epileptic seizures in persons at risk.
- Never direct the LED beam at people or animals and do not stare directly at the beam.
- **⚠ Laser class 2**

The SKF Stroboscope TKRS 41 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 SKF Stroboscope TKRS 41 is fitted with 118 LEDs.

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.

Warranty void!

- Do not expose the equipment to rough handling or heavy impacts.
- Always read and follow the operating instructions.
- Opening the housing of the instrument may result in hazardous mishandling and voids warranty.
- The equipment should not be used in areas where there is a risk for explosion.
- Do not expose the equipment to high humidity or direct contact with water.
- All repair work should be performed by an SKF repair shop.

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.

EC Declaration of conformity

We, SKF Maintenance Products, Kelvinbaan 16, 3439 MT Nieuwegein, The Netherlands herewith declare that the products described in these instructions for use, are in accordance with the conditions of the following directive: EMC DIRECTIVE 2014/30/EU and are in conformity with the following standards:

DIN EN 61326-1:

Electrical equipment for measurement, control and laboratory use.
EMC requirements.

DIN EN 61010-1:

Safety requirements for electrical equipment for measurement, control and laboratory use.

DIN EN 60825-1:

Safety of laser products

DIN EN 62471:

Photobiological safety of lamps and lamp systems

EUROPEAN ROHS DIRECTIVE 2011/65/EU
The laser is classified in accordance with the EN 60825-1:2007

Nieuwegein, The Netherlands, August 2018



Sébastien David
Manager Product Development and Quality

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

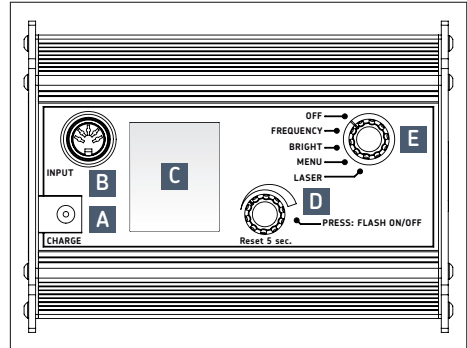


Fig.1 – Stroboscope SKF TKRS 41

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

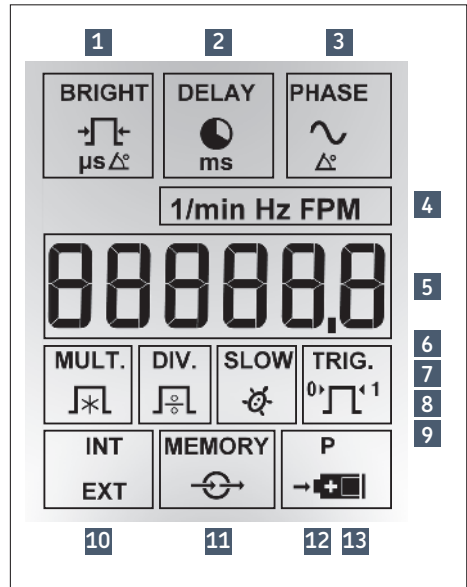


Fig.2 – Display

2. Technical data

General parameters	TKRS 41
Number of LEDs	118
Frequency range	30 to 300 000 flashes per minute (f/min)
Display	Multi-line backlight LCD
Accuracy	$\pm 0.02\%$ (± 1 digit / $\pm 0.025\ \mu\text{s}$)
Resolution	± 0.1 (30 to 999.9 f/min) ± 1.0 (1 000 to 9 999 f/min) ± 10 (10 000 to 300 000 f/min)
External trigger input	3 – 30 V / max. 5 mA (isolated optocoupler) DIN 41524 5-pin standard connector Uout = 24 VDC, 60 mA
Flash parameters	
Light duration	Adjustable, 0.025° – 3.0°
Light intensity	ca. 8 000 Lux @ 1° / 300 mm (12 in)
Flash colour	approx. 5 000 – 8 000 K
Power supply	
Power supply	Integrated lithium-ion batteries
Continuous use time	ca. 2:30 h @ 0.50° (~4 000 Lux) ca. 5:00 h @ 0.25° (~2 000 Lux)
Housing	
Material	Aluminium
Dimensions	150 × 130 × 112 mm (6.0 × 5.1 × 4.4 in)
Weight	approx. 1,15 kg (2,53 lb)
Ambient conditions	
Temperature	0 to 40 °C (32 to 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.

WARNING:

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. Scope of delivery

Check the scope of delivery.

- Stroboscope:
 - portable version TKRS 41 (= 118 LEDs, with auto-sync laser function)
- Operating instructions
- Charger with connector set
- Trigger plug
- Reflective tapes
- Handle
- Case

5. Getting started


5.1 Connectors (→ fig. 1)

No.	Marking	Term	Description
B.	INPUT	Input socket	Input for external trigger / 24 V power supply for sensor
A.	CHARGE	Charging socket	Device is charged using the charger

5.2 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 (→ fig. 1).
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 (→ section 7 – "Determining the actual rotational speed of an object").

5.3 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**.

NOTE:

The device must be manually switched between external and internal trigger signals (→ **section 6.2.2** – "Standard mode / How to select an internal / external trigger").

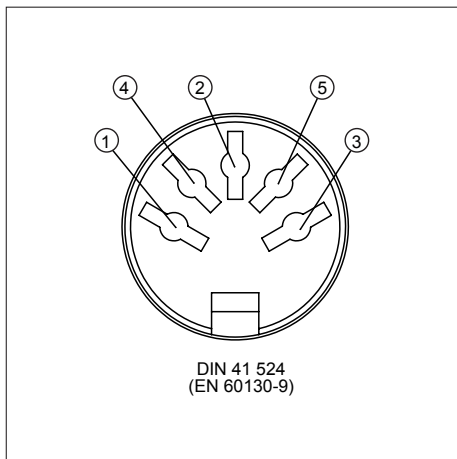


Fig.3 – Assignment of the connection socket

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

6. Operation

NOTE:

Please note that this device is available in standard and pro modes (→ section 6.2.2 – “Standard mode” and → section 6.2.3 – “Pro mode”).

6.1 Controls (→ fig. 1)

No.	Term	Description
D.	Rotary/push Knob	<ul style="list-style-type: none"> – 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” by turning the switch to the desired position.

6.2 Display

NOTE:

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


6.2.1 Overview of adjustable parameters

Position of the selector switch (E)	Display	Available with		Functions of the rotary/push knob (D)	
		Internal trigger	External trigger	Set value	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 / μ s	•	•		
	DELAY ms	•	•	•	
	DIV		•	•	
	SLOW		•	•	
	TRIG.		•		•
	MEM IN	•	•	•	
	MEM OUT	•	•	•	

6.2.2 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	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:


- 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:

			2. Select the desired frequency using the rotary/push knob (D). <input checked="" type="checkbox"/> This setting is now active.	
--	--	---	--	--

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

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


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:



→ 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.

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



→ 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).

6.2.3 Pro mode (→ fig. 2)

NOTE:

Follow the steps below to access the pro mode:

- ▶ Turn the selector switch (E) from "OFF" to the required position whilst simultaneously holding the rotary/push knob (D) until the "Pro" notification appears in the display.





- The following will then appear in the display: "Pro" for pro mode.

NOTE:

If pro mode is activated, a "P" will be shown in the bottom right area of the display.



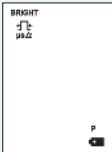


NOTE:

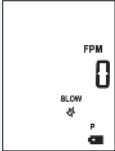
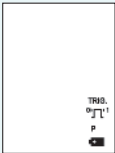


If you have selected settings in pro mode and then switch the device off, these settings will ONLY be active when the device is switched back on if pro mode is activated. Otherwise, only the standard mode settings will be active.

No.	Position of the selector switch (E)	Display	Adjustable parameters	Description
	OFF	–		Device is switched off
4.	FREQUENCY		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 deg.: 0.025° ... 3,000° BRIGHT μs: 1 ... 2,000 μs	Selection of brightness (in 1/1,000 degrees) Selection of brightness unit in degrees (displayed in 1/1,000 degrees) or in microseconds.
3.	MENU		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	Internal / external trigger

NOTE:

→ section 6.2.2 – "Standard mode" for examples and explanations regarding above mentioned display messages.

No.	Position of the selector switch (E)	Display	Adjustable parameters	Description
4.	MENU		rpm / Hz / FPM	Unit of frequency selection: – rpm: unit for measuring rotational speed – Hz: flash frequency per second – FPM: flashes per minute
6.	MENU		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 (→ section 9 – "Determining the actual rotational speed of an object").				
1.	MENU		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 ... 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 ... 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.				

No.	Position of the selector switch (E)	Display	Adjustable parameters	Description
8.	MENU		SLOW: 0 ... 600	<ul style="list-style-type: none"> – The flash frequency exceeds the trigger frequency by the value selected. – This function is only possible when the "external trigger" is selected.
<p>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.</p>				
10.	MENU		TRIG. 0 / 1	<ul style="list-style-type: none"> 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.

6.2.4 Laser modes

NOTE:

The stroboscope TKRS 41 features both a higher number of LEDs as well as a laser.

WARNING:

Risk of injury!




-  Laser class 2

The stroboscope TKRS 41 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 TKRS 41 features a laser in addition to the aforementioned settings (→ section 6.2.2 – and 6.2.3).






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 stroboscope 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		The trigger frequency is 3,000 flashes per minute, determined by the reflective laser beam.
	LASER		The trigger frequency is below the measurement range.
	LASER		The trigger frequency is above the measurement range.

6.2.5 Operating mode

The following operating modes may be displayed:

No.	Position of the selector switch (E)	Display	Description
	BATTERY STATUS		Fully charged
	BATTERY STATUS		Half charged
	BATTERY STATUS		Low (symbol will flash)
	LASER / EXT / SLOW		The trigger frequency is below the measurement range.
	LASER / EXT / SLOW		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!

6.3 Factory reset

NOTE:

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

7. 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

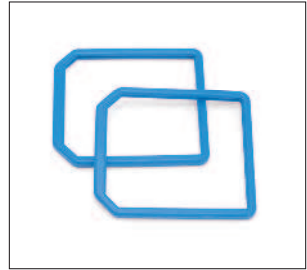
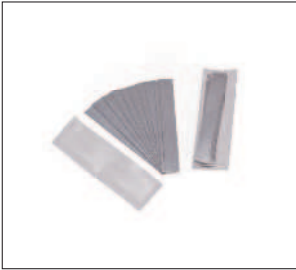
The images showing 6,000 and 4,000 rpm are double or multiple images rather than single images.

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.

8. Spare parts

Designation	Description
TKRT-RTAPE	Reflective tape for tachometers (TKRT) and stroboscopes (TKRS)
TKRS 41-CHARG	Charger and power adapter for TKRS 41 (110-230V, 50/60Hz, EU/US/UK/AUS plugs)
TKRS 41-PROT	Rubber side protectors for TKRS 41, 2 pcs.



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