

# F3S-TGR-KHL1/-KHL3/-KHL3R

The F3S-TGR-KHL3 safety-door switch keeps medium to large guard doors closed until hazards have been removed. It has a stainless steel body and is designed to cope with the rigorous applications of the food processing and chemical industries



- Safety-door switch with electromagnetic lock and unlock mechanism (mechanical lock/solenoid unlock)
- Models with 6 built-in contacts
- Strong key holding force: KHL-1 1600 N or KHL-3 2000N. (F1Max.)
- LED for diagnosis
- IP69K suitable for SIP and CIP processes
- Positive break contacts to IEC 60947-5-1

## Model Number Structure

### Switch

F3S-TGR-KHL□□  
1 2

1. Housing Material:
  - 1: key holding force: 1600 N (F1 Max)
  - 3: key holding force: 2000 N (F1 Max)
2. Rear push button manual release::
  - : Not Available
  - R: Available




### Operation Key

F39-TGR-K□  
1

1. Operation Key Type
  - AM: Standard key for metal head
  - F: Flat key for horizontal mounting
  - HF: Flexible key with die cast body
  - HFH: Flexible key with stainless steel body





## Ordering Information

### Switches

Type	Housing	Conduit	Contacts	Order code
	Full stainless steel body	M20	2NC/1NO+2NC/1NO 4NC safety contacts (2 door monitoring, 2 lock monitoring) 2NO Auxiliary contact (guard open, lock status)*1	F3S-TGR-KHL1
	Full stainless steel body			F3S-TGR-KHL3
	Full stainless steel body			F3S-TGR-KHL3R

\*1.1NO lock status if LED2 Lock Status Indicator not used

**Keys (order separately)**

Type	Material	Order code
for metal head 	Stainless steel 316	F39-TGR-KAM
Horizontal mounting 	Stainless steel 316 (Plastic cover: Polyester)	F39-TGR-KF
heavy flexible 	Stainless steel 316 (Die-Cast metal housing)	F39-TGR-KHF
hygienic flexible 	Stainless steel 316	F39-TGR-KHFH

**Accessories**

Item	Remarks	Order code
M20 Gland	Stainless steel 316	F39-TGR-M20
Key	Manual release key	F39-TGR-MRK

## Specifications

Item	F3S-TGR-KHL1	F3S-TGR-KHL3	F3S-TGR-KHL3R
<b>Standards</b>	ISO 14119, IEC 60947-5-1, EN 60204-1, UL508, EN ISO 13849-1: up to PLe*1 EN 62061: up to SIL3*1		
<b>Mechanical reliability B10d</b>	2.5 × 10 <sup>6</sup> operations at 100mA load		
<b>PFHd</b>	3.44 × 10 <sup>-8</sup>		
<b>Proof test interval (Life)</b>	35 years*2		
<b>B10d</b>	2500000 operations at 100 mA load		
<b>MTTFd</b>	356 years (8 cycles per-24 hours per day-365 days per year)		
<b>Holding Force</b>	1600 N (F1 Max) 1230 N (Fzh)	2000 N (F1 Max) 1538 N (Fzh)	
<b>Lock principle</b>	Mechanical lock/solenoid unlock		
<b>Indicator LEDs</b>	LED1: Status of solenoid LED2: Lock status indication		
<b>Utilization category</b>	AC15 A300 3 A		
<b>Thermal current (Ith)</b>	5 A		
<b>Rated insulation/Withstand voltages</b>	600 VAC/2,500 VAC		
<b>Rated travel for positive opening</b>	10 mm		
<b>Actuator entry minimum radius</b>	175 mm standard, 100 mm heavy duty		
<b>Maximum approach/Withdrawal speed</b>	600 mm/s		
<b>Body dimensions (W × H × D)</b>	63 × 143 × 41.5 mm	48 × 177 × 47 mm	
<b>Fixing</b>	2 × M5, 40 mm distance	4 × M5, 40 mm distance	
<b>Conduit entry</b>	M20		
<b>Material</b>	Stainless steel 316		
<b>Enclosure Protection</b>	IP69K/IP67	IP69K	
<b>Temperature Range</b>	-25 to 40°C		
<b>Vibration</b>	IEC 68-2-6, 10-55 Hz +1 Hz, Excursion: 0.35 mm, 1 octave/min		

\*1. Depending upon system architecture

\*2. The safety functions and mechanics must be tested regularly. For applications where infrequent guard access is foreseeable, the system must have a manual function test to detect possible accumulation of faults. At least once per month for PLe Cat3/4 or once per year for PLd Cat3 (EN ISO 13849-1). Where possible it is recommended that the control system of the machine demands and monitors these tests and stops or prevents the machine from starting if the test is not done. (see ISO 14119)

## Contact Form

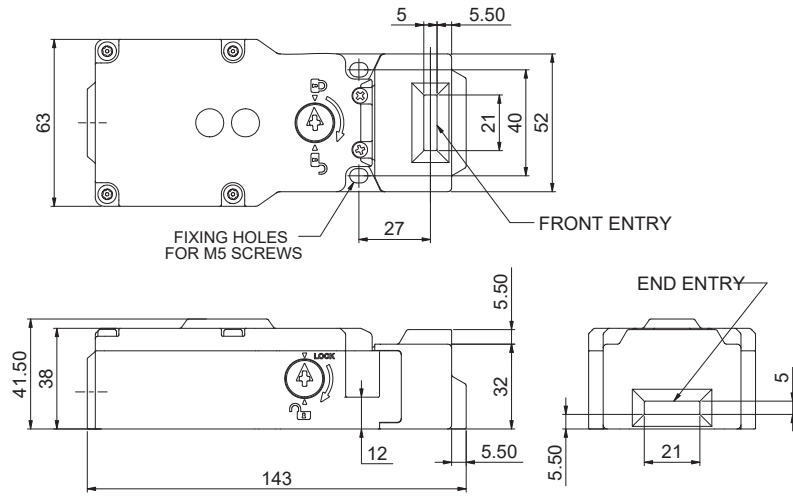
Model	Contact	Contact form	Operating pattern												
F3S-TGR-KHL1	2NC/1NO+2NC/1NO	<p>Door open/closed detection: 12, 22, 44 to 32, 42, 43; 31, 41, 34 to 11, 21, 33. Lock monitor: 11, 21, 33.</p>	<p>2NC 2NO 6.0 5.0 0 mm</p> <table border="1"> <tr> <td>11/12</td> <td>Open</td> <td></td> </tr> <tr> <td>21/22</td> <td>Open</td> <td></td> </tr> <tr> <td>33/34</td> <td></td> <td>Open</td> </tr> <tr> <td>43/44</td> <td></td> <td>Open</td> </tr> </table>	11/12	Open		21/22	Open		33/34		Open	43/44		Open
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21/22	Open														
33/34		Open													
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F3S-TGR-KHL3	2NC/1NO+2NC/1NO	<p>Door open/closed detection: 12, 22, 44 to 32, 42, 41; 31, 41, 34 to 11, 21, 33. Lock monitor: 11, 21, 33.</p>	<p>2NC 2NO 6.0 5.0 0 mm</p> <table border="1"> <tr> <td>11/12</td> <td>Open</td> <td></td> </tr> <tr> <td>21/22</td> <td>Open</td> <td></td> </tr> <tr> <td>33/34</td> <td></td> <td>Open</td> </tr> <tr> <td>43/44</td> <td></td> <td>Open</td> </tr> </table>	11/12	Open		21/22	Open		33/34		Open	43/44		Open
11/12	Open														
21/22	Open														
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F3S-TGR-KHL3R	2NC/1NO+2NC/1NO	<p>Door open/closed detection: 12, 22, 44 to 32, 42, 41; 31, 41, 34 to 11, 21, 33. Lock monitor: 11, 21, 33.</p>	<p>2NC 2NO 6.0 5.0 0 mm</p> <table border="1"> <tr> <td>11/12</td> <td>Open</td> <td></td> </tr> <tr> <td>21/22</td> <td>Open</td> <td></td> </tr> <tr> <td>33/34</td> <td></td> <td>Open</td> </tr> <tr> <td>43/44</td> <td></td> <td>Open</td> </tr> </table>	11/12	Open		21/22	Open		33/34		Open	43/44		Open
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## Dimensions

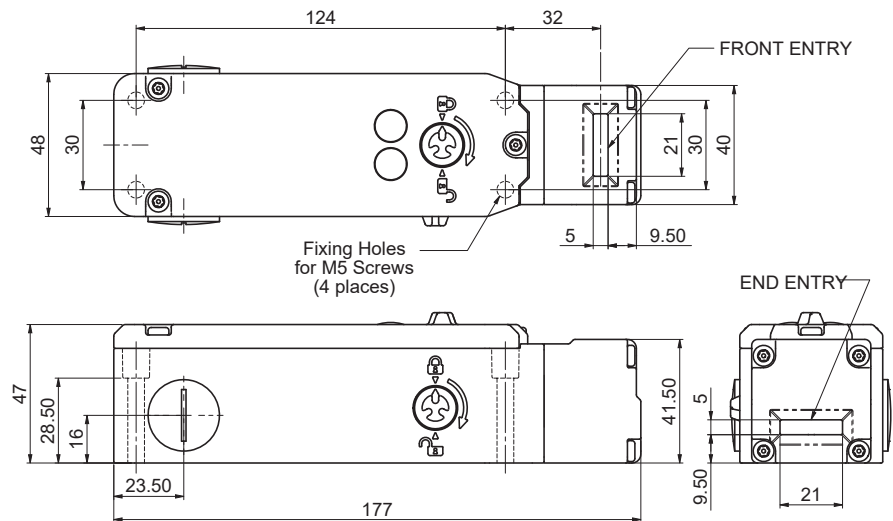
Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

### Switches

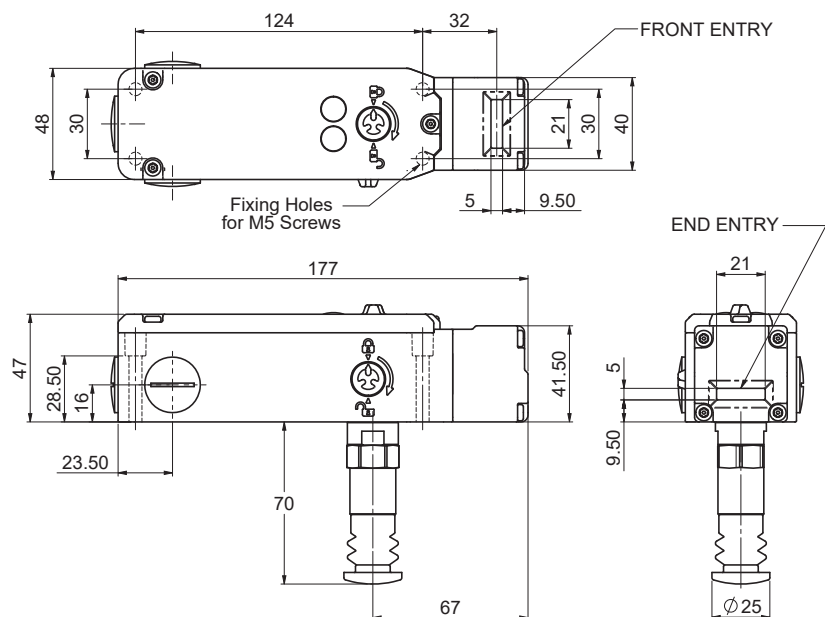
#### F3S-TGR-KHL1



#### F3S-TGR-KHL3

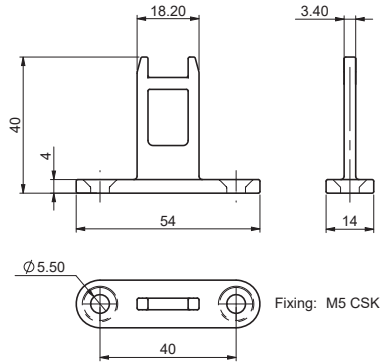


#### F3S-TGR-KHL3R

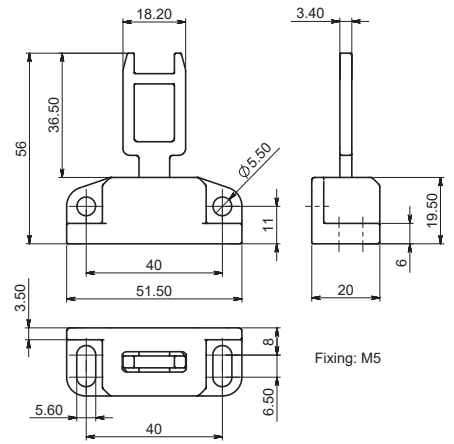


## Operation Keys

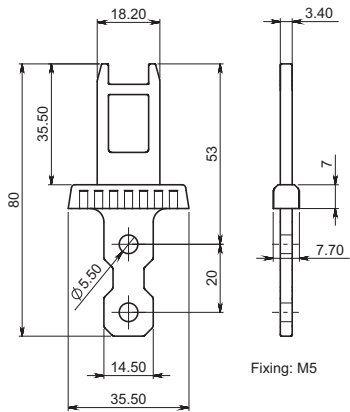
### F39-TGR-KAM



### F39-TGR-KHF F39-TGR-KHFH



### F39-TGR-KF



## Safety Precautions

<b>⚠ DANGER</b>	Indicates an imminently hazardous situation which, if not avoided, is likely to result in serious injury or may result in death. Additionally there may be severe property damage.
<b>⚠ CAUTION</b>	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.
<b>Precautions for Safe Use</b>	Supplementary comments on what to do or avoid doing, to use the product safely.
<b>Precautions for Correct Use</b>	Supplementary comments on what to do or avoid doing, to prevent failure to operate, malfunction or undesirable effect on product performance.

### ⚠ DANGER

Injury may occasionally occur. Always check to make sure that the safety functions operate correctly before using the machine. The safety functions may not operate correctly because of wiring mistakes, setting mistakes, or Switch malfunction, causing some machines to continue operating in situations where they should be stopped.

### ⚠ CAUTION

Injury may occasionally occur. When the Switch function is damaged, some machines may continue operating in situations where they should be stopped. Do not impose a force exceeding the key holding force.

Always provide a lock separate from the Switch, attach a warning seal to avoid excessive force applied to the Switch, or provide an indicator lamp to show the locked/unlocked status of the door.

### Precautions for Safe Use

- Be careful not to drop your safety door switch, or it will not fully exhibit its ability.
- Do not disassemble or remodel your safety door switch in any case, or the switch will not operate normally.
- Do not use the switch where explosive gas, ignitable gas, or any other harmful gasses may be present.
- Install operation key so that it will not hit the operator when the door is open. Injury may be caused.
- Do not use the switch with IP69K in the oil and in the water.
- Though the switch body is protected from the ingress of dust or water, avoid the ingress of foreign substance through the key hole on the head. Otherwise, wear in short time or break may be caused
- Do not put the electric power when wiring.
- Be sure to install a cover after the wiring.  
Do not put the electric power when opening a cover.
- Connect the fuse to the switch in series to prevent it from short circuit damage.  
The value of the breaking current of the fuse must be increased to cover the rated current by 150 to 200%. When using the switch with EN rating, use 10 A fuse, type gI or gG that complies with IEC 60269.
- Keep the electrical load below the rated value.
- On the switching of general loads (250VAC/3A), do not operate two circuits or more at the same time. Otherwise, insulation performance may be degraded.
- The durability of the switch is seriously affected by operating conditions.  
Evaluate the switch under actual working conditions before permanent installation.
- Please mention in machine manufacturer's Instruction. Manual that the user must not repair nor maintain the switch and must contact machine manufacturer for them.
- Do not use the switch as a stopper.  
Be sure to install a stopper as shown in the following illustration to prevent the edge of the operation key from inadvertently hitting the switch directly.
- Do not impose excessive force on the key top while the operation key is inserted into the switch body or drop the switch with the operation key inserted to avoid the deformation of the key or the breakage of the switch body.

- Confirm that the seal rubber has no abnormality and then use it. If the seal rubber is displaced or floated, or if foreign matters adhere to the seal rubber, the seal rubber will lose its sealing capability.
- Do not use any screw other than correct one, or the sealing capability of the seal rubber will deteriorate.
- Please do a regular check in premeditation for this switch.

### Precautions for Correct Use

#### 1. Operating Environment

Do not use the Switch submersed in oil or water or in locations continuously subject to splashes of oil or water. Doing so may result in oil or water entering the Switch. (The IP67 degree of protection of the Switch specifies the amount of water penetration after the Switch is submersed in water for a certain period of time.)

#### Application

Safety Interlock Switches with Guard Locking are designed to fit to the leading edge of sliding or hinged guard doors to provide positively operated switching contacts and provide a tamper resistant key mechanism.

They are designed to provide robust position interlock detection and holding closed of moving guards.

#### Operation

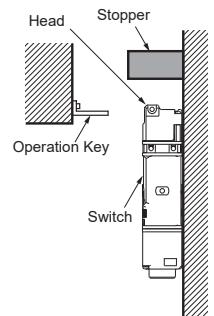
The switch is rigidly mounted to the frame of the guard or machine. The actuator is fitted to the moving part (frame) of the guard and is aligned to the switch entry aperture. The actuator profile is designed to match a cam mechanism within the switch head and provides a positively operated not easily defeatable interlock switch.

When the guard is closed and the actuator is inserted into the switch the safety contacts close, the actuator is locked and the machine start circuit can be enabled.

When the solenoid is energised the safety contacts are positively opened, the machine stop circuit is broken and the guard door can be opened.

#### 2. Installation

- Make sure the Switch is mounted securely to prevent it from falling off. Otherwise injury may result.
- Do not use a Switch as a stopper.
- Be sure to install a stopper as shown in the following illustration so that the Operation Key does not touch the head.
- Do not subject the Switch to a shock that exceeds the Switch's shock resistance of 1,000 m/s<sup>2</sup>.
- Installation of all interlock switches must be in accordance with a risk assessment for the individual application.
- Installation must only be carried out by competent personnel and in accordance with these instructions.



#### F3S-TGR-KHL1

1 -- M5 mounting bolts must be used to fix the switch and actuator, the tightening torque to ensure reliable fixing is 4.0 Nm.

Tightening torque for the lid screws, conduit entry plugs and cable glands must be 1.0 Nm to ensure IP seal.

Only use the correct size gland for the conduit entry and cable outside diameter.

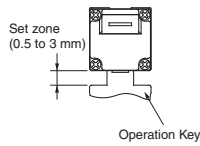
**Note:** For 1/2" NPT versions, the gland thread length must be limited to 10mm maximum.

Tightening torque for the connection terminal screws is 0.7 Nm, max conductor size is 1.0 sq.mm. The switch head position can be selected by loosening the 4 head bolts and then rotating to the position required.

Tightening torque for the head bolts is 1.5 Nm.

Always check for correct 24 V.dc polarity to LED 2 (if fitted).

2 -- Set the actuator gap to 3 mm when the guard is closed and against the stop.



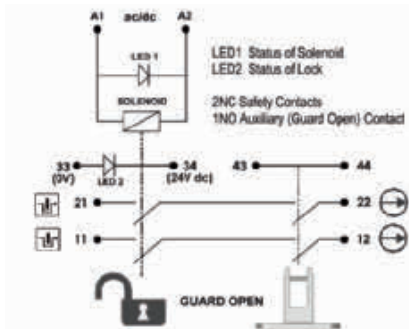
Use alignment guides to ensure that the actuator enters the switch without interfering with the sides of the aperture. Ensure access to at least one of the manual release points. Always fit the aperture plug to the unused entry aperture to prevent foreign debris entering the switch mechanism.

3 -- After installation check operation of all control circuits and the locking function.

For applications with a run down time after removing power, ensure that the correct timing allowance has been made before energising the solenoid. For hand operated guards, push to release after solenoid energisation.

LED 1 will illuminate when power is applied to A1 and A2 (solenoid feed).

LED 2 (if used) will be illuminated when the actuator is not locked. If extinguished then the switch is locked and the safety contacts are closed.



### F3S-TGR-KHL3-3R

1 -- M5 mounting bolts must be used to fix the switch and actuator, the tightening torque to ensure reliable fixing is 4.0 Nm. To prevent loosening of the switch after installation, always fix the M5 mounting bolts with a thread-locking compound or secure using self locking nuts.

Tightening torque for the lid screws, conduit entry plugs and cable glands must be 1.5 Nm to ensure IP seal. Only use the correct size gland for the conduit entry and cable outside diameter.

Tightening torque for the connection terminal screws is 0.7 Nm, max conductor size is 1.0 sq.mm.

The switch head position can be selected by removing the actuator, loosening the 4 head bolts and then rotating the head to the position required. Re-tighten the head bolts and then check actuator insertion and withdrawal. Tightening torque for the head bolts is 1.5 Nm.

The switch is supplied with removable conductor links fitted 41/42 and 31/32. If required by the control circuit these may be removed to offer independent monitoring of the solenoid locking function or the actuator.

2 -- Head direction: it has a 90° rotatable head to allow 8 actuator entry position.

The rotation of the switch head may be adjusted to any of the four directions by loosening the head clamping screws at the four corners of the head.

3 -- Always fit a mechanical stop to the guard to prevent damage to the front of the switch. Set the actuator gap to 3mm when the guard is closed and against the stop. Use alignment guides to ensure that the actuator enters the switch without interfering with the sides of the aperture.

Ensure access to at least one of the manual release points. Always fit the aperture plug to the unused entry aperture to prevent debris entering the switch mechanism.

4 -- After installation check operation of all control circuits and the locking function.

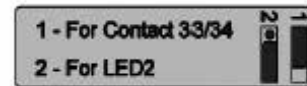
For applications with a run down time after removing power, ensure that the correct timing allowance has been before energising the solenoid.

LED 1 RED will illuminate when power is applied to A1 and A2 (solenoid feed).

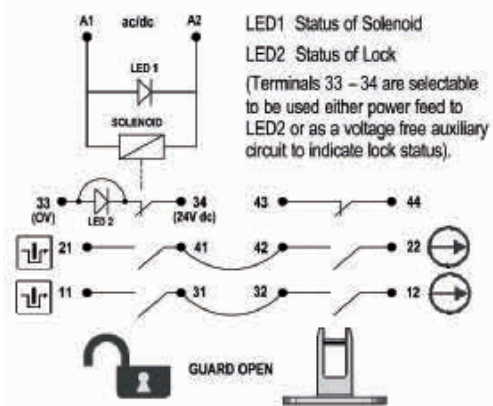
LED 2 GREEN (if used) will be illuminated when the actuator is locked.

5 -- IMPORTANT!

At installation choose the status of terminals 33 and 34 by setting the slide switch inside the switch housing



If LED2 is used always check for correct DC polarity. Terminal 33: 0 VDC Terminal 34: +24 VDC



### F3S-TGR-KHL3R - Rear Release version

Where the Risk Assessment for the application permits, a non latching emergency release version (F3S-TGR-KHL3R) enables quick release of the switch lock in case of emergency. The switch can be mounted such that access to the release button is available from inside the active guard area. Pressing and holding the release button will release the lock mechanism and open the lock monitoring contacts, whilst the guard can be pushed open.



### Release Key

- The release key is used to unlock the Switch in case of emergency or if the power supply to the Switch stops.
- If the release key setting is changed from LOCK to UNLOCK, the lock will be released and the safety door can be opened



### Maintenance:

Every Week: Check correct operation of all circuits and the Lock function. If the actuator shows signs of bending or the switch head housing displays mechanical damage then remove and replace the whole device.

OMRON will not accept responsibility for failure of the switch functions if the installation and maintenance requirements shown in this sheet are not implemented.

Never attempt to remove the internal screws or parts of the mechanism, any attempt to do so will invalidate the product warranty. Never attempt to repair any switch.

Every 6 Months: Isolate power and remove cover. Check screw terminal tightness and check for signs of moisture ingress.

THESE INSTRUCTIONS FORM PART OF THE PRODUCT WARRANTY.

