1. About this document

1.1 Function
This operating instructions manual provides all the information you need for the mounting, set-up and commissioning to ensure the safe operation and disassembly of the safety switchgear. The operating instructions must be available in a legible condition and a complete version in the vicinity of the device.

1.2 Target group: authorised qualified personnel
All operations described in this operating instructions manual must be carried out by trained specialist personnel, authorised by the plant operator only.

Please make sure that you have read and understood these operating instructions and that you know all applicable legislations regarding occupational safety and accident prevention prior to installation and putting the component into operation.

The machine builder must carefully select the harmonised standards to be complied with as well as other technical specifications for the selection, mounting and integration of the components.

1.3 Explanation of the symbols used

Information, hint, note:
This symbol is used for identifying useful additional information.

Caution:
Failure to comply with this warning notice could lead to failures or malfunctions.

Warning:
Failure to comply with this warning notice could lead to physical injury and/or damage to the machine.

1.4 Appropriate use
The products described in these operating instructions are developed to execute safety-related functions as part of an entire plant or machine. It is the responsibility of the manufacturer of a machine or plant to ensure the correct functionality of the entire machine or plant.

The safety switchgear must be exclusively used in accordance with the versions listed below or for the applications authorised by the manufacturer. Detailed information regarding the range of applications can be found in the chapter "Product description".

1.5 General safety instructions
The user must observe the safety instructions in this operating instructions manual, the country specific installation standards as well as all prevailing safety regulations and accident prevention rules.

Further technical information can be found in the Schmersal catalogues or in the online catalogue on the Internet: products.schmersal.com.

The information contained in this operating instructions manual is provided without liability and is subject to technical modifications. There are no residual risks, provided that the safety instructions as well as the instructions regarding mounting, commissioning, operation and maintenance are observed.

1.6 Warning about misuse

In case of improper use or manipulation of the safety switchgear, personal hazards or damages to machinery or plant components cannot be excluded. The relevant requirements of the standard ISO 14119 must be observed.

2. Product description

2.1 Ordering code
2.2 Special versions
2.3 Purpose
2.4 Technical data
2.5 Safety classification

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3.2 Dimensions

4. Electrical connection

4.1 General information for electrical connection
4.2 Contact variants
4.3 Wiring examples

5. Set-up and maintenance

5.1 Functional testing
5.2 Maintenance

6. Disassembly and disposal

6.1 Disassembly
6.2 Disposal

7. EU Declaration of conformity
1.7 Exclusion of liability
We shall accept no liability for damages and malfunctions resulting from
defective mounting or failure to comply with this operating instructions
manual. The manufacturer shall accept no liability for damages
resulting from the use of unauthorised spare parts or accessories.

For safety reasons, invasive work on the device as well as arbitrary
repairs, conversions and modifications to the device are strictly
forbidden; the manufacturer shall accept no liability for damages
resulting from such invasive work, arbitrary repairs, conversions and/or
modifications to the device.

2. Product description
2.1 Ordering code
This operating instructions manual applies to the following types:

<table>
<thead>
<tr>
<th>Solenoid Interlock SHGV-➀/➋/➃/➋/➋/➋/➋/➋</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
</tr>
<tr>
<td>➀</td>
</tr>
<tr>
<td>➋</td>
</tr>
<tr>
<td>➃</td>
</tr>
<tr>
<td>➋/ⷸ</td>
</tr>
</tbody>
</table>

2.2 Special versions
For special versions, which are not listed in the order code below 2.1,
these specifications apply accordingly, provided that they correspond to
the standard version.

2.3 Purpose
The trapped key system, consisting of the components SHGV..., SHGV/
ESS... and SVM..., has been designed to prevent, in conjunction with
the control part of the machine, movable safety guards from being
opened before hazardous conditions have been eliminated. If the
control part of the machine transmits a signal to the SVE... that the
hazardous situation has been eliminated, the key can be withdrawn
from the SVE..., as a result of which the movable safety guard can be
opened.
If a delay device (e.g., fail-safe delay timer SRB-E-302FWS-TS) is used to bypass the stopping time, a failure of this device must not cause the delay time to be reduced.

Please implement the necessary organisational measures to ensure that only one main key is in use for each system. The user imperatively must ensure that a key number (coding) is only used just once in every plant (factory premises).

The safety switchgears are classified according to ISO 14119 as type 2 interlocking devices.

The user must evaluate and design the safety chain in accordance with the relevant standards and on the required safety level.

The entire concept of the control system, in which the safety component is integrated, must be validated to the relevant standards.

Interlocking device with key tumbler cylinder SHGV/L01/...; SHGV/R01/...; SHGV/B01/...
Insert the key from a SHGV/ESS/..., SVE/... or SVM/... in the key tumbler cylinder (1) and turn it into position (2). The interlocking device is unlocked, the safety guard can be opened. The key can only be returned into position (3) and withdrawn, when the safety guard is closed.

If on the basis of the risk assessment it cannot be excluded that persons are trapped inside the hazardous zone, the interlocking device with 2 lock barrels of type SHGV/LD1/... or SHGV/RD1/... must be used.

Interlocking device with two key tumbler cylinders SHGV/LD1/...; SHGV/RD1/...
Insert the key from a SHGV/ESS/..., SVE/... or SVM/... in the key tumbler cylinder (1) and turn it into position (3). The interlocking device is unlocked, the safety guard can be opened. In this position, the second key (6) can be turned from position (4) into position (5) and withdrawn. The guard door cannot be locked by means of key (1) as long as the key (6) is inserted in the key tumbler cylinder and turned into position (4). In position (4), the key (6) cannot be withdrawn. The key (1) can only be returned to position (2) and withdrawn, if the key (6) is in position (4) and the safety guard is closed.

Key-operated selector switch SHGV/ESS/...
In position (1), the key is trapped and cannot be withdrawn. The NC contact(s) is/are closed. The NO contact(s) is/are opened. By turning the key into position (2), the NC contact(s) is/are positively opened and the NO contact(s) closed. In this position, the key can be withdrawn.
Key-operated selector switch-interlocking device SHGV...

In position (1), the key(s) is/are trapped and cannot be withdrawn. The NC contacts of the key-operated selector switch are closed. The NO contacts are open. The NC contact of the magnet monitoring is closed and the NO contact is open. If the magnet is in de-energised condition, the keys cannot be turned and withdrawn. If the magnet is energised, it will unlock the key-operated selector switch. The NC contact of the magnet monitoring is opened and the NO contact closed. After the keys are turned into position (2), they can be withdrawn. In this position, the NC contacts of the key-operated selector switch are positively opened and the NO contacts closed. In this key position, the solenoid cannot switch to the "locked" position when the voltage supply is switched off.

Key distribution station SVM1...

In position (1), the primary key can be withdrawn. When the primary key is removable, the secondary keys can only be in position (3) and will be trapped (i.e. cannot be withdrawn). If the primary key is turned into position (2), the secondary keys can be turned into position (4) and be withdrawn. If one or more secondary keys are in position (4) either removed, the primary key cannot be withdrawn. The primary key is coming either from a SHGV/ESS... key-operated selector switch or a SVE... key-operated selector switch interlocking device. Multiple SHGV/... interlocking devices can be unlocked by means of the secondary keys.

Manual release (during set-up, maintenance, etc.) The manual release is realised by turning the triangular key (included in delivery) to the right (3), so that the solenoid is pulled into the release position. The normal locking function is only restored after the triangular key has been returned to its original position (4). The manual release must be sealed after being put into operation (e.g. sealant etc.).

2.4 Technical data

Interlock SHGV...:

- Standards: ISO 14119
- Enclosure / cover: Aluminium / chromated steel
- Actuator and locking bolt: Galvanised steel / zinc die-cast
- Coding level according to ISO 14119:
  - Actuator: low
  - Key: high
- Protection class: IP65
- Ambient temperature: −25 °C … +70 °C
- Actuating speed: 0.2 m/s
- Actuating frequency: max. 5 Hz
- Mechanical life: 100,000 operations
  - F_{max} = 1,250 N; SHGV/B... = 1,750 N
  - F_{min} = 950 N; SHGV/B... = 1,300 N
- Latching force: 5 N

Key-operated selector switch SHGVESS...

- Standards: IEC 60947-5-1, ISO 14119
- Installation diameter: 22.3 mm
- Front plate thickness: 1 … 6 mm
- Mounting position: any
- Ambient temperature: −25 °C … +75 °C
- Protection class: IP65
- Front ring material: Aluminium anodised
- Mounting: with mounting flange
- Max. tightening torque for the ELM fixing screws: 0.6 Nm
- Actuating frequency: max. 5 Hz
- Mechanical life: 100,000 operations

Contact element (in combination with SHGV/ESS...):

- Contact material: Silver
- Protection class: Wiring level: IP20
  - Wiring compartment: IP40
- Contact type: Change-over contact with double break type Zb,
  - with galvanically separated contact bridges
- Switching system:
  - IEC 60947-5-1, slow action,
  - NC contact with positive break
- Connection:
  - screw terminals
- Cable type:
  - solid wire
- Cable section:
  - max. 2 × 0.5 … 2.5 mm²
- Cable type:
  - stranded wire
- Cable section:
  - max. 2 × 0.5 … 1.5 mm² with conductor ferrules
- Positive break travel: approx. 2 mm after the opening point
- Mechanical life: 10 million operations
- Ambient temperature: −25 °C … +50 °C
- Utilisation category: AC-15, DC-13
- Rated operating current/voltage I_{e}/U_{e}:
  - 8 A / 230 VAC;
  - 5 A / 24 VDC
- Rated insulation voltage U_i:
  - 400 V
-Rated impulse withstand voltage U_{imp}:
  - 4 kV
- Thermal test current I_{th}:
  - 10 A
- Max. fuse rating: 10 A gG D-fuse to IEC 60269-1

Key-operated selector switch-interlocking device SVE...

- Standards: IEC 60947-5-1, ISO 13849-1, ISO 14119
- Enclosure: glass-fibre reinforced thermoplastic, self-extinguishing
- Latching bolt: Plastic
- Protection class: IP65
- Protection class: II
- Contact type: Change-over contact with double break type Zb,
  - with galvanically separated contact bridges
- Switching system:
  - IEC 60947-5-1, slow action,
  - NC contact with positive break
- Termination:
  - Connector plug with screw terminals
- Cable type:
  - solid and stranded wire
- Cable section:
  - solid: 0.2 … 2.5 mm²
  - stranded wire: 0.2 … 2.5 mm² with conductor ferrules
Rated impulse withstand voltage $U_{imp}$: 4 kV  
Rated insulation voltage $U_i$: 250 V  
Thermal test current $I_{th}$: 4 A  
Degree of pollution: 2  
Overvoltage category: II  
Utilisation category: AC-15, DC-13  
Rated operating current/voltage $I_e/U_e$: 4 A / 230 VAC; 4 A / 24 VDC  
Max. fuse rating: 4 A gG D-fuse to EN 60269-1  
Positive break travel (unlocked): 2 x 3.5 mm  
Positive break force (unlocked): 20 N  
Duty ratio solenoid: 100%  
Rated control voltage $U_s$: 24 VDC, 110 VAC: 50 / 60 Hz; 230 VAC: 50 / 60 Hz  
Power consumption: max. 8.5 W  
Ambient temperature: 0 °C ... +50 °C  
Actuating frequency: max. 5/h  
Mechanical life: 100,000 operations

Key distribution station SVM...  
Standards: ISO 13849-1, ISO 14119  
Enclosure: Design .../A: Aluminium  
Front plate: Design .../E: Stainless steel  
Latching bolt: Brass  
Protection class: IP65 (SVM1.../A)  
Ambient temperature: -25 °C ... +50 °C  
Actuating frequency: max. 5/h  
Mechanical life: 100,000 operations

2.5 Safety classification

Classification Interlock SHGV... / Key distribution station SVM...:

<table>
<thead>
<tr>
<th>Standards</th>
<th>ISO 13849-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTTF_D</td>
<td>150 years</td>
</tr>
<tr>
<td>Category</td>
<td>applicable up to PL d</td>
</tr>
<tr>
<td>Mission time (dependent on actuation frequency):</td>
<td>20 years</td>
</tr>
</tbody>
</table>

Classification Key-operated selector switch SHGV/ESS...:

<table>
<thead>
<tr>
<th>Standards</th>
<th>ISO 13849-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_{10D}$ (NC contact):</td>
<td>100,000</td>
</tr>
<tr>
<td>$B_{10D}$ (NO contact):</td>
<td>100,000</td>
</tr>
<tr>
<td>Mission time:</td>
<td>20 years</td>
</tr>
</tbody>
</table>

Classification of SVE... interlocking device/ key-operated selector switch release circuit and auxiliary contact:

<table>
<thead>
<tr>
<th>Standards</th>
<th>ISO 13849-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_{10D}$ NC contact:</td>
<td>100,000</td>
</tr>
<tr>
<td>$B_{10D}$ NO contact at 10% ohmic contact load:</td>
<td>100,000</td>
</tr>
<tr>
<td>Mission time:</td>
<td>20 years</td>
</tr>
</tbody>
</table>

$MTTF_D = \frac{B_{10D}}{0.1 \times n_{op}} = \frac{d_{op} \times h_{op} \times 3600 \, \text{s/h}}{t_{cycle}}$

(Determined values can vary depending on the application-specific parameters $n_{op}$, $d_{op}$ and $t_{cycle}$ as well as the load.)

Classification of the guard locking function SVE... / key release:

The key release must always be classified.

The following classification of the key release is based on the application of the principle of safety energy disconnection for the solenoid connection.

A fault exclusion for the locking device of the solenoid interlock of the interlocking device can be assumed by a fail-safe energy disconnection.

In this case, the locking device of the interlocking device does not have an effect on the failure probability of the key release.

The safety level of the key release is also determined by the external safety power shutdown.

### Safety power shutdown

1. Fault exclusion with regard to wiring routing must be observed.

#### 3. Mounting

#### 3.1 General mounting instructions

Please observe the relevant requirements of the standards ISO 12100, ISO 14119 and ISO 14120.

Interlocking device

Four mounting holes are provided for fixing the interlock. Any mounting position. The mounting position must be chosen so as to avoid the penetration of dirt in the used holes. For the lock barrel, the SHGV-SK dust-proof flap (accessory) can be used as required. In case of painting activities, the components must be covered.

If another actuating direction is desired, the four screws of the actuating head must be loosened. Turn the actuating head in the desired direction and retighten the screws (tightening torque 0.5 Nm). To satisfy manipulation protection requirements, the two standard screws must be replaced with the non-removable screws supplied. The actuator must be inserted when the actuating head is turned.

The solenoid interlock must not be used as an end stop.

Key-operated selector switch SHGV/ESS...

Any mounting position. The mounting position however must be chosen so that the ingress of dirt and soiling in the lock barrel is avoided.

If necessary, use the dust protection cap SHGV-SK (accessories). Mount the key-operated selector switch in the provided mounting hole Ø 22.3 by means of the mounting flange, align and tighten. (tightening torque: 0.6 Nm). Snap the contact elements onto the mounting flange. Check for a correct and firm fixation of the elements.
Operating instructions
Trapped key system

Key-operated selector switch-interlocking device SVE...
Six mounting holes are provided for fixing the device. Any mounting position. The mounting position however must be chosen so that the ingression of dirt and soiling in the lock barrel is avoided, use the SHGV-SK dust-proof flap (accessory) if necessary. In case of painting activities, the components must be covered.

The key-operated selector switch interlocking device SVE... must be installed in a switch cabinet/enclosure with protection class IP54 at a minimum.

Key distribution station SVM...
Four mounting holes are provided for fixing the device. Any mounting position. The mounting position however must be chosen so that the ingression of dirt and soiling in the lock barrel is avoided, use the SHGV-SK dust-proof flap (accessory) if necessary. In case of painting activities, the components must be covered.

3.2 Dimensions
All measurements in mm.

Interlock SHGV...

Key-operated selector switch SHGV/ESS...

SHGV/ESS21S2/.../103

Key-operated selector switch-interlocking device SVE...

SVE......

Key distribution station SVM...

SVM1/...-6/.../E

SVM1/...-10/.../E

SHGV/R01/..., SHGV/L01/..., SHGV/B01/...

SHGV/RD1/..., SHGV/LD1/...

SHGV/R1.1/..., SHGV/L1.1/..., SHGV/B1.1/...
4. Electrical connection

4.1 General information for electrical connection

⚠️ The electrical connection may only be carried out by authorised personnel in a de-energised condition.

After wiring, the wiring compartment must be cleaned (i.e. remove excess cables etc.).

4.2 Contact variants

Key-operated selector switch SHGV/ESS...

The contacts are shown with the key-operated selector switch in a non-actuated condition and the key in unremovable condition.

SHGV/ESS21S2/…/103

4.3 Wiring examples

Key-operated selector switch-interlocking device SVE...

Depiction of contacts: solenoid dead and key switch activated (key cannot be removed).

Connection to the machine control is carried out by the customer and is not shown.
Application examples:
The application examples shown are suggestions. They however do not release the user from carefully checking whether the switchgear and its set-up are suitable for the individual application.

Additional information on connection and settings can be found in the SRB-E-302FWS-TS and SRB-E-301ST operating instructions. The solenoid monitoring and key-operated selector switch release circuits must be integrated into the additional safety monitoring.

Application example 1:
Fail-safe time-delay monitoring SRB-E-302FWS-TS for solenoid control and safety evaluation SRB-E-301ST with SVE... for applications to PL d.

Key: SRB-E-302FWS-TS
F1: Fuse
S1: Additional standstill signal
S2: Reset button (deletes the warning)
S3: Start button
a) Safety inputs
d) Cyclic outputs
e) Processing unit
f) power supply

Key: SRB-E-301ST
F1, F2: Fuse
a) Safety inputs
d) Cyclic outputs
e) Processing unit
f) power supply
j) Start button
s) Feedback circuit

Key: SVE.../...
1/2: Solenoid connection
4/5: Enabling circuit solenoid monitoring
6/7: Enabling circuit key-operated selector switch
3/15: Solenoid auxiliary contact (connection to e.g. machine control)
10/22: Key-operated selector switch auxiliary contacts (connection to e.g. machine control)
11/23: Key-operated selector switch auxiliary contacts (connection to e.g. machine control)
12/24: Key-operated selector switch auxiliary contacts (connection to e.g. machine control)
SVE1, SVE2, SVE3: Key-operated selector switches 1, 2 or 3
Operating instructions
Trapped key system

Application example 2:
Safe standstill monitoring SRB-E-302FWS-TS for solenoid control and safety evaluation SRB-E-301ST with SVE... for applications to PL d.

Key: SRB-E-302FWS-TS
F1: Fuse
S2: Reset button (deletes the warning)
S3: Start button
a) Safety inputs
e) Processing unit
f) power supply

Key: SRB-E-301ST
F1, F2: Fuse
a) Safety inputs
d) Cyclic outputs
e) Processing unit
f) power supply
s) Feedback circuit

SVE1, SVE2, SVE3: Key-operated selector switches 1, 2 or 3

5. Set-up and maintenance

5.1 Functional testing
The safety function of the safety components must be tested.
The following conditions must be previously checked and met:
1. Fitting of the solenoid interlock and the actuator.
2. Check the integrity of the cable entry and connections.
3. Check the switch enclosure for damage.

5.2 Maintenance
We recommend the following checks at regular intervals:
1. Check for tight installation of the actuator and the switch.
2. Remove particles of dust and soiling.
3. Check cable entry and connections.
4. Functional test min. once annually in accordance with ISO 14119

Adequate measures must be taken to ensure protection against tampering either to prevent tampering of the safety guard, for instance by means of replacement actuators.

Damaged or defective components must be replaced.

6. Disassembly and disposal

6.1 Disassembly
The safety switchgear must be disassembled in a de-energised condition only.

6.2 Disposal
The safety switchgear must be disposed of in an appropriate manner in accordance with the national prescriptions and legislations.
EU Declaration of conformity

We hereby certify that the hereafter described components both in their basic design and construction conform to the applicable European Directives.

Name of the component: SHGV, SHGV/ESS, SVE, SVM

Type: See ordering code

Description of the component: Interlocking device with electromagnetic interlock for safety functions

Relevant Directives:
- Machinery Directive 2006/42/EC
- RoHS-Directive 2011/65/EU

Applied standards:
- IEC 60947-5-1:2016 + Cor1:2016
- ISO 14119:2014
- ISO 13849-1:2015
- ISO 13849-2:2012

Notified body for the prototype test: TÜV Rheinland Industrie Service GmbH
Am Grauen Stein, 51105 Köln
ID n°: 0035

EC-prototype test certificate: 01/205/5754.00/20

Person authorised for the compilation of the technical documentation: Oliver Wacker
Möddinghofe 30
42279 Wuppertal

Place and date of issue: Wuppertal, March 23, 2020

Authorized signature
Philip Schmersal
Managing Director

The currently valid declaration of conformity can be downloaded from the internet at products.schmersal.com.