



MOUNTING AND SYSTEM DESCRIPTION

FOR SSZ-SAFETY-MATS

TYPE SSZ-SSP



MADE IN GERMANY

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This operating manual refers to the safety mat

- Type: SSZ-SSP
- The safety category depends on the control unit used
- KAT2, Plc: with control unit SSZ-CVS/N/2 24/230,
- KAT3, Pld with the control units SSZ-CVS/N/3 24/230, SSZ-RZ3 or SSZ-SMC
- Response time <20 ms
- Reset function - selectively: automatic / manual

The safety mat is a pressure sensitive safety device for implementing an emergency stop function and, when stepped on, typically independently stops an endangering movement. An automatic restart is blocked as long as someone is standing on the mat. (Presence detection)

The identification and specification of the mat (dimensions, cable outputs, name of the machine or customer) is via the serial number visible in the hologram. This hologram is usually located on the rear side of the mat.



To make identification easier later, please note the serial number separately!

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This manual forms part of the product.

This manual contains basic information that must be followed when installing the system. It is important that personnel are familiar with this manual before assembly and commissioning. In addition to this manual, the following documents of the receiving company are valid:

- Drawings of the equipment (optional)
- The cable plans (optional)

INFORMATION ABOUT THE OPERATING MANUAL

This operating manual is a part of the product. The company SSZ GmbH does not assume any liability for damages that are created or result from use of the product that deviates from the manual. Before using the product, one must be very familiar with the operating manual. The operating manual must be kept at a generally accessible location for the entire lifetime of the product.

The manual should be transferred to subsequent owners / users of the product. All updates received from the manufacturer must be made public. The operating manual is only valid for the named product. The target group of this operating manual is the user of the product and correspondingly trained personnel authorised to use this product. The connection of the system mat + control unit to the machine must be done by an appropriately trained technical personnel. To ensure proper function of the pressure-sensitive safety device and its installation according to the specification EN ISO 13856-1:2013, the technical personnel must have knowledge of the assembly technologies and the function of systems and safety systems.

In addition to the operating manual, the following must still be observed:

- The construction plan at the customer-site machine or system (optional)
- The cable plan
- The assembly plan of the equipment that contains and uses the SSZ sensor



Before installation and commissioning, one must be familiar with the entire operating manual and with the operating manual of individual control units:

Operating manual SSZ-CVS/N/2

Operating manual SSZ-CVS/N/3

Operating manual SSZ-RZ3

REMARKS

- Series switching is exclusively permitted for safety devices. Parallel connections may result in any system errors or activation of individual signal transducers not being detected.
- Parallel connections are NOT permitted for technical safety!
- Proper function of the system must be checked by the operator at least once per day.
- The operator is obliged to comply with the valid safety rules of accident prevention regulations.
- The safety equipment may only be used in circuits that have at least the same safety level.
- To guarantee seamless function, the safety equipment must be kept in a clean condition.

IMPORTANT

The SSZ safety system forms part of the entire safety system of the machine or system only. During design, planning and construction of the safety concept, one must comply with the corresponding conditions of the machinery standards and directives.

Contact loads of relay outputs may not be exceeded in any case.

All supply lines must have tension-relief and be placed in a way that protects them from damage.

All electrical connections must be tightened and checked. The electrical connections must be checked regularly.

Opening the control unit housing can lead to loss of safety. Under

no circumstances may the housing be opened. In case of damage to the hologram, all guarantee claims are void.

In case of a defect, the system must be returned to SSZ GmbH for repair / damage determination. In the case of a defect the machine / system (without safety) may not be operated. Independent of the conditions, the rules of work safety must always be followed and all regulations complied with.



The machine may not be operated if danger threatens!

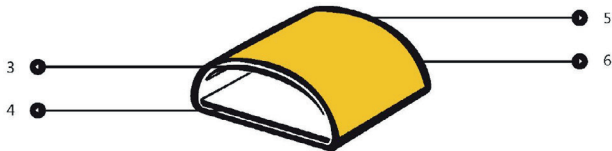
Non-compliance with these remarks can endanger health and life.

The EU declaration of conformity immediately loses its validity if other (non-SSZ) components, transducers or control units are connected within the system.

THE SYSTEM

The sensor which is used for all pressure-sensitive SSZ safety equipment is made out of a co-extruded plastic of high elasticity. For proper verification of changes occurring in the sensor, the SSZ signal transducer must be connected to an SSZ control unit.

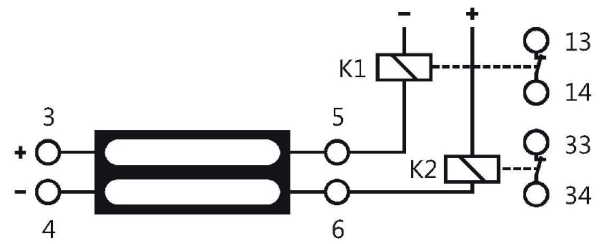
FIGURE 1 SENSOR ELEMENT



The internal electrically conductive layers of the sensor element are separated from each other and kept at a distance, as shown in figure 1 in a dark colour, they can be considered as a non-insulating resistors.

These resistors have connection lines at the start and end of the sensor element. The connection lines are (selectively) placed via a 4-strand wire or two 2-strand wires to the control unit. The "input" of the sensor element is, as shown in figure 2, connected to the control unit by terminals 3 and 4.

FIGURE 2 INACTIVE SENSOR ELEMENT



The "output" of the sensor element is connected to the control unit by terminals 5 and 6. For this, one should check for the proper cable placement. Tracks 3 and 5 and 4 and 6 each form a signal path.

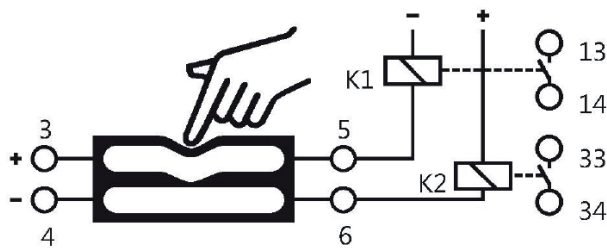


In a case of improper or incorrect wiring, proper function of the system is not guaranteed!

If the sensor element is not actuated, current flows from connection 3 to connection 5 and from connection 4 to connection 6, which means that relays K1 and K2 close their contacts and the outputs are activated. To ensure a safe output signal is received, the contacts of relays K1 and K2 are switched in series.

If the sensor element is actuated, the voltages to inputs 5 and 6 of the control unit change.

FIGURE 3 THE ACTIVATED SENSOR ELEMENT



These changes impact the drop-off of both output relays and thereby opening of the output contacts.

The same response results from the cross-fault / short circuit in the connection line of the transducer.

If wires or a conductive section of the sensor element is interrupted, at least one relay is switched off.

As the relay contacts of K1 and K2 are connected in series the connected power circuit is switched off.

SSZ switch element connections contain wire labels and are colour-coded. The following table details which colours belong to which individual connections.

4-STRAND WIRE

Label	Safety switch bar safety bumper	Safety mats
3	GREEN	BLUE
4	BROWN	BROWN
5	YELLOW	BLACK
6	WHITE	WHITE

TWO 2-STRAND WIRES

Label	Colours
3	BROWN
4	WHITE
5	BROWN
6	WHITE

SAFETY MATS, TYPE: SSZ-SSP

SSZ safety mats are pressure-sensitive safety devices with a proximity function that is used to secure endangering movements or hazardous areas of machines or other hazardous zones. They are used anywhere for personnel safety, where crushing and shear points, pull-in points or other endangering movements of force-activated working materials or systems are present. The complete SSZ system consists of the SSZ safety mat that is manufactured to customer wishes, the connection cable (LIYY 4x0.35 mm²) and the SSZ control unit, whose PL determines the required safety level.

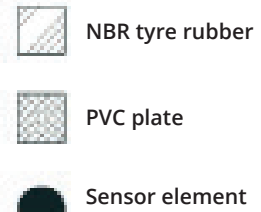
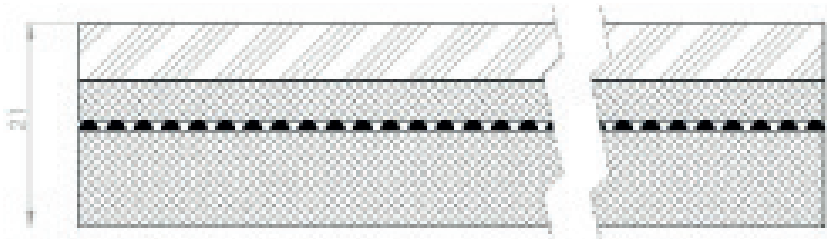
The SSZ safety mat stops the endangering movement as soon as a person steps on it. The control command, typically a stop signal, remains on while a person is standing on the mat. If desired, the control unit can also be used with a manual reset. (Step back protection\). For this function, the stop / off remains active until a manual restart is done using the reset button. This reset command is also designed for safety so that it can only be done on a falling edge, meaning the reset button is also monitored for bridging. Remark: The reset button must be placed in such a position so the operator can look over the entire hazardous area. Acknowledging may only be done after the operator is convinced that there are no longer any people standing in the hazardous area.

The SSZ safety mat is fastened to the floor using screws or special aluminium profiles that simultaneously provide tripping protection. The mats must cover the entire hazardous area.

The construction of the SSZ safety mat consists of two welded PVC sandwich structures with internally placed SSZ sensor elements. An oil-resistant rubber cover provides an anti-slip surface. If a person steps onto the SSZ safety mat, the internal SSZ transducer is compromised, the conductive surfaces touch each other and trigger a control command in the SSZ control unit. Opening the output contact in the SSZ control unit stops the endangering movement. A restart of the machine is only possible once the person has stepped off of the SSZ safety mat and for a manual restart the acknowledge button must be pushed.



PRINCIPLE SET UP OF THE SAFETY MAT, TYPE SSZ-SSP



The height of the entire structure is approx. 21 mm including an approx. 6 cm thick oil-resistant and anti-slip NBR rubber covering.

SSZ safety mat can be produced up to a maximum format of 1500 mm x 3000 mm in any shape according to customer wishes. Rounding's and cut-outs are easily possible, however the aluminium profile cannot be bent. A practical solution is to use multiple angles rather than a rounded shape.

Larger areas can be implemented using several SSZ safety mats side-by-side.

Please be aware that a maximum of 4.5 sq.m. may be connected to one single SSZ control unit.

For series switching of several SSZ safety mats please observe the following:



All mats should, if possible, have the same shape and dimensions. This makes storage and exchanging in case of a breakdown and ordering replacement parts easier.

USE

The SSZ safety mats are used to secure hazardous areas on machines and installations.

The SSZ safety mats are always implemented if mechanical barriers or optical safety systems cannot be used practically, are insufficient, or require an addition of a safety mat; for example a hazardous area of machines that are directly accessible, but require the use of safety systems.

The application comprises:

- The work area of industrial robots
- Pipe bending machines
- Box folding or gluing machines
- Injection moulding machines
- Protecting entranceways and through paths

IMPROPER USE OF SAFETY MATS

- To protect children and persons under 40 kg.
- To secure moving platforms, stairs, e.g. in amusement parks
- For presence detection of people using walking aids, e.g. walking sticks, wheelchairs, (hospitals, care homes)
- Outdoor areas

The SSZ safety mat is designed for heavy loads. It can be driven over by vehicles with a max. total weight of 5000 kg. Acceleration, braking and turning vehicles on the mat can lead to surface damage. To exclude damage, the surfaces of the mat (the rubber coating) should be checked daily and replaced if required.

SELECTION CRITERIA FOR SSZ SAFETY MAT TYPE: SSZ-SSP

The selection of an SSZ safety mat depends on its use and on the body parts potentially exposed to injury. The safety mats are used to protect the whole body, from limb amputations and / or from general, severe injuries that could occur from dangerous machine movements.

Further criteria are:

- Safety category according to standard EN ISO 13849-1 (PL SIL category and PFHd or B10d value)
- Performance Level
- Temperature range
- Protection according to IEC 60529 (higher safety levels must be individually checked)
- Ambient conditions: Chemical influences, oil, coolants, atmospheric influences, radiation

ENVIRONMENTAL CONDITIONS

During the use of SSZ safety mats, environmental influences that could impact the function of the system must be considered, e.g.:

- Damage due to cold, heat or another form of radiation
- The machine does a movement that could push or damage the safety mat or its elements
- Heavy vehicles that drive over the SSZ safety mats
- Continuous or repeated contact with water or other fluids
- Danger due to falling heavy or sharp objects
- Contamination from hot and / or hardening media
- Contamination from aggressive chemical compounds

SYSTEM INTEGRATION INTO THE MACHINE

The machine controls must fulfil the following conditions:

- Hazardous movement of the machine must be electrically controlled
- The response time / time to stop the machine and the distance from hazardous points must be sufficiently long, or large enough
- Hazardous movement of the machine must stop the machine at any time
- The control system must be planned so that an estimation of the hazard is possible (Section "Safety analysis" in this manual)

RISK ASSESSMENT

Persons that are responsible for selecting the safety device must be aware of the following:

- The degree of possible injury
- The frequency of the risk occurrence
- The options to reduce risk
- The SSZ safety mats are intended for areas with a low to medium risk, where the following conditions are fulfilled:
- The degree of any injuries is found to be low or
- The possible injury risk is found to be serious, however does not occur often and can additionally be limited by using other corresponding means.

CALCULATION OF THE SAFETY MAT AREA

DETERMINATION OF THE HAZARDOUS AREA DIMENSIONS

The dimensions of the hazardous zone depend on the specific application. For this, the following constants must be considered:

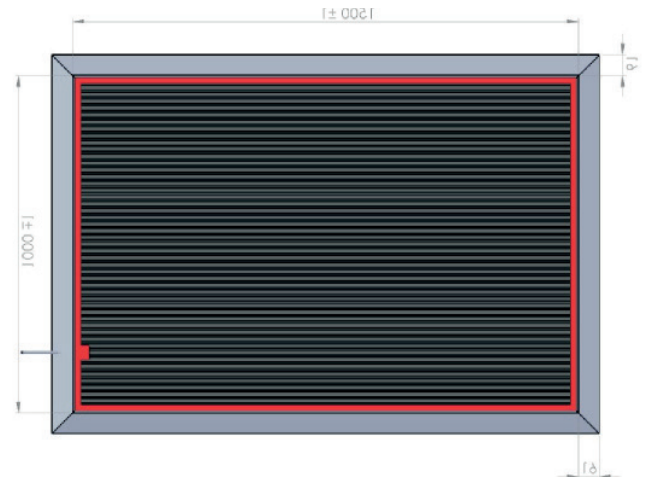
- The step speed and the gripping speed (value 1.6 m / s)
- Arm reach distance (value 0.85 m)
- Step width (value 0.70 m)
- Response time of the total system
- Inactive areas
- The time for complete stop of the system (response time of the complete system)



The safety mats of type SSZ-SSP have an inactive zone lengthwise along the outer circumferential edges. This zone is 25 mm wide and it impacts the dimensions of the active, effective area of the safety mat. The active surface is therefore 50 mm smaller than the outer dimensions. This fact must be considered during calculation of the effective area.

The SSZ safety mat can be used in the following manner:

- Detection device - the SSZ safety mat is placed so that it is activated by the person in the hazardous area
- The combined function consisting of an independently controlled stop of the machine and blocking its start up due to presence detection. (Acknowledgement obligation / manual reset)
- Warning device - an SSZ safety mat that is stepped on triggers an optical and acoustic signal that informs of the presence of a person in the hazardous area

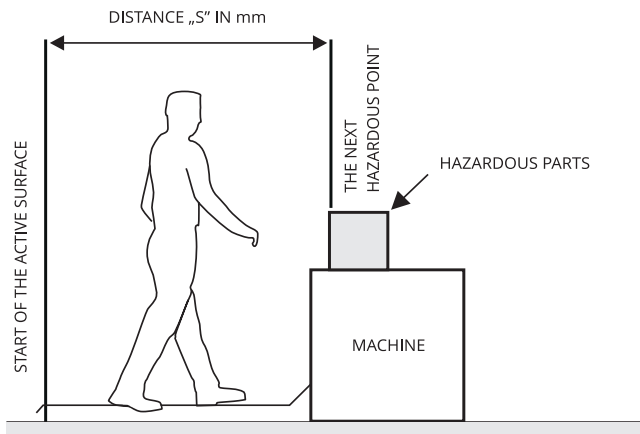


The edge areas of the safety mats are inactive (25 mm on all sides). Stepping onto inactive areas does not trigger a switch command!

After triggering the stop signal, the machine continues to move until it reaches a complete standstill (overtravel)

The dimensions of the SSZ safety mat must be selected so that the position of the endangering movement can only be reached after it has stopped. It must consider and calculate for the response time for the total system including the overtravel of the machine.

In the drawing below the "worst case" is shown, in which a person is already standing inside the hazardous area before the trigger to stop signal has been started. The distance between the edge of the safety mat and the hazardous point of the machine must be large enough that the person only reaches the hazardous area after the stop.



To calculate the length of the safety mat, the response time of the system and the total system must be known. The total response time of the system "T" is the time from which the moment the foot of the entering person touches the surface of the safety mat, until the moment in which the hazardous machine movement has stopped.

$$T = t1 + t2$$

t1 = The maximum response time of the safety mat from the moment it is stepped on by the person up to introduction of the stop signal = 30ms

t2 = The reaction time of the system between when the stop signal is made and the time for a complete stop of the hazardous movement.

According to EN ISO 13856-1 the required switch mat size is calculated referring to the hazardous area according to the following formula.

$$S = (K \times T) + C$$

K = 1600 mm/s

$$T = t1 + t2$$

$$C = 1200 \text{ mm} - 0.4 H$$

S = The minimum distance between the hazardous area and the farthest edge of the safety mat

K = Step / gripping speed

T = The response time of the total system

t1 = The response time of the safety mat

t2 = The time to stop of the endangering movement. (Reaction time plus over travel time).

C = The safety factor

H = The level height

For floor installation $H = 0$ then:

$$S = (1600 \text{ mm/s} \times T) + 1200 \text{ mm}$$

This formula is not used if the safety mat is used as an additional safety, e.g. in connection with other safety devices (scanners etc.) Independently of this, the safety devices must be designed so that the endangering movement must be stopped before reaching the person.

SSZ SAFETY MATS - ACCESSORIES

CONNECTION CABLE

The SSZ safety mat is connected to SSZ control unit. This is done either using a permanently fixed connection cable or selectively using an M8 screw plug connector, female, 4-pin with a wire of 4x0.38 mm².

The plug connections can be supplied in a straight or angled design at 90°. The Male is permanently integrated into the safety mat, for that reason determine the position of the angle direction for the angled plug in advance.

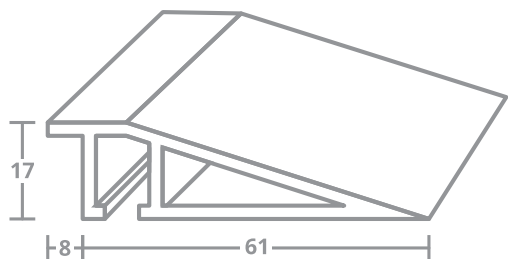
Cable length according to customer specification.



We recommend a fixed cable connection for severe environmental conditions, a large degree of contamination, dust, humidity or when driving over with vehicles, and also for smaller SSZ safety mats up to 1 sq.m.

Wiring, including series switching of several mats, can be done either with fixed cable connections or pluggable lines as well.

SSZ RAMP PROFILE WITH CORNER CONNECTOR



Use	The inactive SSZ aluminium frame profile is used for tripping protection (height of the mat above 4 mm) and at the same time to fasten the mat. Interior placed empty spaces can also be used for cable conduits. Assembly without aluminium frame profile should be equally grounded, so done in a prepared floor recess. (for more information see the "Installation" section).
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Material	Anodised aluminium EV-1
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Colours	Silver
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Length	max. 6,000 mm
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Height	17 mm
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Load bearing capacity	Can be driven up to 5000 kg total weight
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Weight	0.8 kg/m.
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To calculate the complete outer dimensions including the frame profile, 61 mm must be added to the corresponding dimension of each side of the safety mat.

For example:

Safety mat 1000 mm x 500 mm, plus circumferential frame profile.

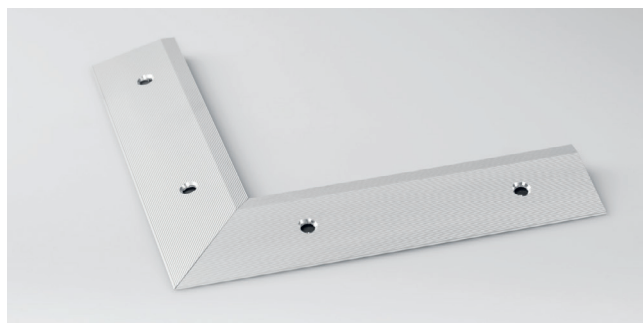
For the length:

1000 mm mat + 61 mm for the left profile + 61 mm for the right profile = 1122 mm.

For the width:

500 mm mat + 61 mm for the upper profile + 61 mm for the lower profile = 622 mm.

This completes the entire outer dimensions: 1122 mm x 622 mm



TECHNICAL DATA

SSZ SAFETY MAT, TYPE SSZ SSP

Width	1500 mm max.
Length	3000 mm max.
Height	21 mm
Edge	25 mm inactive
Material	Hard PVC bound to NBR rubber
Surface	Black oil-resistant NBR rubber Other surfaces available upon customer request
Response path	4 mm
Switch cycles	3x10 ⁶
Protection class to IEC EN 60529:2003	IP:65
Use Temperature	+0°C - +40°C
Max. static load	2000 N for a test structure diameter 80 mm / 8 h
Actuation forces	Diameter of the test structure 11 mm <300 N Diameter of the test structure 80 mm <300 N Diameter of the test structure 200 mm <600N
Fastening	Aluminium profile in a ramp shape to prevent a tripping hazard
Assembly position	Horizontal
Reset	Selectively with SSZ control unit
Electrical connections	1x4 wire, 0.38 mm ² , or M8 plug. The selection depends on the customer specifications.
Max. length of the cable from the mat to the control unit	50 m
Max. length of the cable between the mats	5 m
Weight of the mat	24 kg/m ²
Weight of the control unit	180g
Max. number of mats that can be connected to one control unit	Depends on the size of the mats, however no more than a total of 4.5m ²
Limitations of use	The standard design may be used in enclosed spaces only. Exclusively for industrial use. Only series switching is permitted. No deformations have been determined as a result of use over a longer time. The mat is not intended to detect people under 40 kg. The SSZ safety mat is not a suitable safety device for persons who require walking sticks or supports to move.
Specifics	The high load-bearing capacity safety mat can be driven over by vehicles with air-filled tyres with a total weight up to 5000 kg.

INFORMATION ABOUT THE RESISTANCE OF THE SAFETY MAT TYPE SSZ-SSP AGAINST CHEMICAL OR ENVIRONMENTAL INFLUENCES.

The safety mat is provided with an anti-slip 6 mm thick coating made of NBR rubber.

Water	+	1	1	1
Discharges	+/-	2	2	2
Ozone	+/-			
Acids	+/-	3	4	4
Acetone	-	4	5	6
Ammonia	+/-	4	5	6
Oils	+			
Smoke	+/-			
Vapour	+			
Petrol	+	1	1	2
Brake fluid	+			
Spirit (ethyl alcohol)	+			

Explanation:

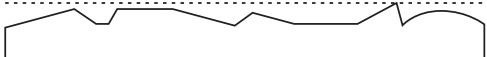
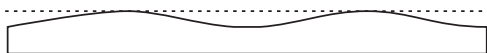
+ = Resistant
 +/- = Medium resistance
 - = Not resistant
 1 = No reaction
 2 = Small reaction
 3 = Very large reaction
 4 = Noticeable reaction
 5 = Strong reaction
 6 = Very strong reaction

The m. a. data is a results of the tests procedures followed i Laboratory. The customer is adviced to test the SSZ-equipment in his environment.

ASSEMBLY INDICATIONS

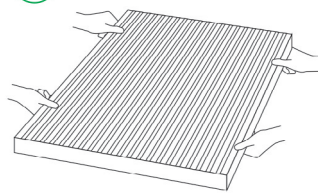
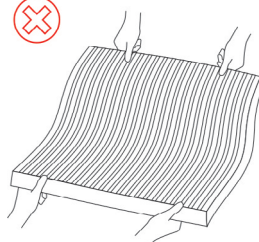
Fastening the SSZ safety mat on the floor is done using aluminium frame profile using corner connectors. The assembly of the SSZ control units are done in the control cabinet of the machine or in a separate, suitable housing.

It must be ensured that the surface for fastening is clean, leveled and dry.

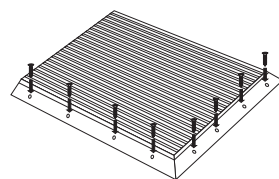
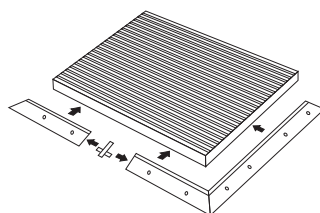


All mats should, if possible, have the same shape and dimensions. This makes storage, exchanging in case of a breakdown and ordering replacement parts easier.

The mats must be carried carefully for assembly.



When preparing the assembly area for the mats (dimensions), one must think about the additional dimensions for the aluminium profile (plus 61 mm) (see "Accessories" section for the safety mats).



The mat is already prepared for installation of the aluminium frame profile, meaning appropriate cut-outs are available in the rubber cover, also the fastening level holes 10 / 6 mm.

INSTALLATION OF THE SSZ SAFETY MAT WITHOUT ALUMINIUM FRAME PROFILE

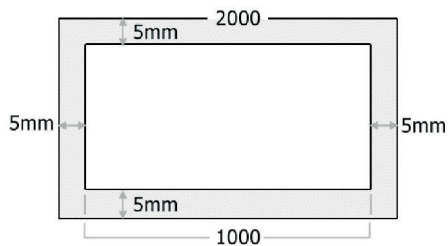
To prevent a tripping hazard the SSZ safety mat must be "worked into the floor".

Installation sequence:

- The mat must be installed horizontally!
- Mark the area to be cut out for the mat. Do not forget the cut-outs for the connection wires. Please only use suitable empty piping for the connection cable.



Please design the cut-outs for the safety switching mats 5mm larger around the circumference. In this way the space for any "movement" of the mat is ensured for any influences of higher or lower temperatures (expansion or contraction of the material) For example: For a mat size of 1000 mm x 2000 mm, the floor cut-out must be at least 1010 mm x 2010 mm. The depth of the cut-out should correspond to the height of the mat, meaning 21 mm. The empty pipe for the connection lines must be located at the height of the mat to prevent damage. Please do not kink or significantly bend the connection cable.



- Tools required for the cut-out: Bubble scale, measuring tape, pencil. Tools required for the cut-out should be selected based on the type of floor. Cut-outs should be done by an appropriately trained person.
- After the cut-out is done, the installation area should be thoroughly cleaned of any dust and debris, e.g. using an industrial vacuum cleaner. Otherwise concrete dust or debris can collect under the mat and impact its function.
- After cleaning the installation area, the mat can be placed in the cut-out space and the connection cable attached.
- After completing the connection work, the gap between the mat and the floor area must be sealed off with sealant (silicone or similar, depending on production conditions).



Before selecting the sealant, clarify whether there is a ban on the use of silicone on the corresponding production site (e.g. paint shops) or the use of other chemical binders that may be present in sealants.



During installation work, protection and ergonomic regulations must be observed.

After completing installation, a functional test must be done according to the description in the "Function test" section in this operating manual.

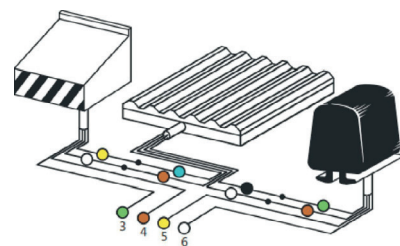
The connection line wires are labelled by colour and are also numbered. Wire numbers 3,4,5,6 must be correspondingly connected to connection terminals 3,4,5,6 on the control unit. Mixing up the wire numbers does not lead to damage however the system will not function.



A mat area of a maximum of 4.5 sq.m. can be connected to one SSZ control unit. This means a completely installed mat with a maximum size of 3000 mm x 1500 mm or an arbitrary number of smaller, series mats whose area does not exceed 4.5 sq.m.

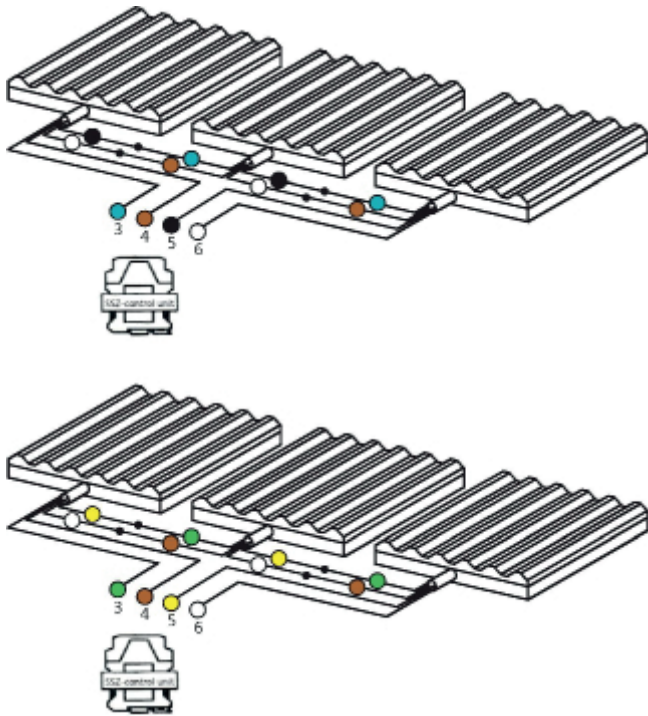


Other SSZ products can be connected to an SSZ control unit and the SSZ safety mat, e.g. SSZ safety bumpers or SSZ safety rails. However, the following applies: only series switching is permitted! Parallel switching is FORBIDDEN! Connection examples for different SSZ products



Wiring example for different SSZ products

CONNECTION IN SERIES OF MORE MATS



In the case of disassembling and renewed installation of SSZ safety mats, care must be taken to ensure the parts (e.g. snaps, clamps, the housing, fastenings, the cables) are aligned the same as before disassembly. If the instructions above are not followed, the system will not function properly



The terminals are not in chronological order! (3-5; 3-6) NOT 3-4, 5-6. If the system is functioning properly, the following switch on after connecting the SSZ transducer:

LED

● POWER
● OK 3/5
● OK 4/6



CHECK AND ACCEPTANCE OF THE SSZ SAFETY SYSTEM

- Check the correct assembly of the SSZ safety mat according to the regulations part of the "Installation" section of this manual.
- Check for proper placement of the SSZ safety mat also considering the inactive edge zones.
- Check the resistance of the SSZ safety mat according to the "Function test" section of this manual.
- Check for proper wiring including the line connection between the SSZ safety mat and the SSZ control unit according to the "Connection to the control unit" section.
- Check the safety function for which the SSZ safety mat and the connected control unit are intended for - using the safety documents.
- Do a measurement of the response time of the total system until the endangering movement has completely stopped. Check for a blocking of start up that is caused by activation of the safety mat. Compare the result generated with the required value according to the documents.



Be absolutely familiar with the "Operating manual" of the corresponding control unit.



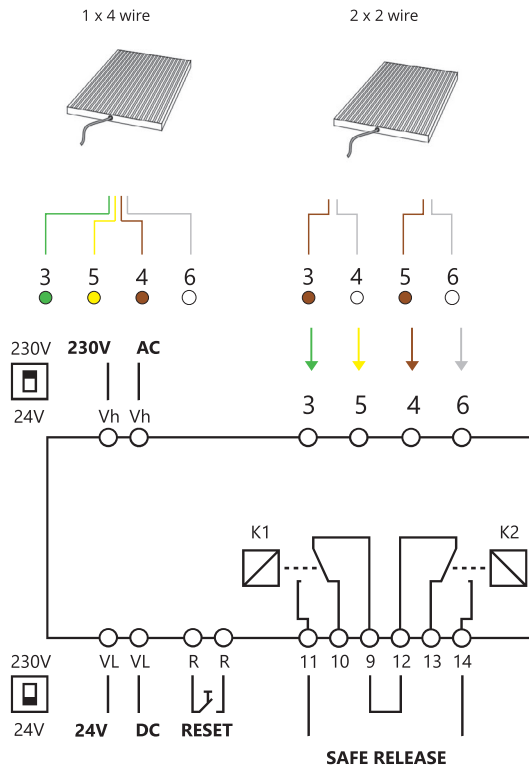
The same sequence applies in the case of an exchange of individual sub-groups.



The fitter should complete a form that identifies the installed equipment. To ensure correct part identification note the serial number located on the hologram before installation.

CONNECTION TO THE SSZ CONTROLLER

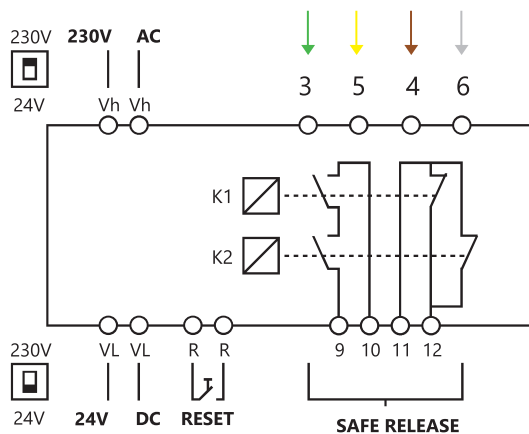
CONNECTION TO THE SSZ-CVS/N/2 24/230V CONTROLLER



To supply power with 230 V, set the voltage selector to 230V, and connect to VH (high voltage).

To supply power at 24 V, set the voltage selector to 24V, and connect to VL (low voltage).

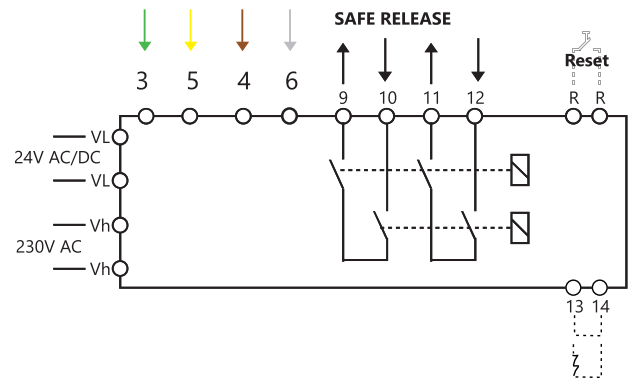
CONNECTION TO THE SSZ-CVS/N/3 24/230V CONTROLLER



To supply power with 230 V, set the voltage selector to 230V, and connect to VH (high voltage).

To supply power at 24 V, set the voltage selector to 24V, and connect to VL (low voltage).

CONNECTION TO THE SSZ-RZ3 24/230V CONTROLLER



To supply power with 230 V, set the voltage selector to 230V, and connect to VH (high voltage).

To supply power at 24 V, set the voltage selector to 24V, and connect to VL (low voltage).



The terminals are not in chronological order! (3-5; 4-6) NOT 3-4, 5-6 If the system is functioning properly, the following switch on after connecting the SSZ transducer

LED

POWER
OK 3/5
OK 4/6



The 24V versions of the SSZ-CVS/N/2, SSZ-CVS/N/3, and SSZ-RZ3 controllers do not have a voltage selector!

FUNCTIONAL TEST

Proper function of the SSZ safety mat can be checked using a universal measurement device or a resistance measurement device. For a functional test the mat must be separated from the control unit and the remaining connected safety components.

Measurement points and measurement range:

3 and 4 wires 5 and 6 open	20 MegaOhms	∞
3 and 4 wires 5 and 6 connected	400 kiloOhms	<280 kiloOhms
3 and 5	200 kiloOhms	<140 kiloOhms
4 and 6	200 kiloOhms	<140 kiloOhms

The results of measurements on wires 3/5 and wires 4/6 are not identical, but the maximum difference of 20% may not be exceeded!

To verify the function of the control unit, one must be familiar with the operating manual of it.

Description of the signal elements:

1. When the system is functioning properly, the following is switched on after the SSZ transducer is connected (using terminals 3,4,5,6):

- Red diode POWER
- Green diode OK 3/5
- Green diode OK 4/6

2. After actuating the SSZ transducer the state of the diodes are switched as shown in the following:

- Red diode POWER - switched on
- Green diode OK 3/5 - switched off
- Green diode OK 4/6 - switched off

This state describes the proper function of the SSZ transducer in terms of the SSZ control unit.

If, after return of the pressure from the SSZ transducer, the state of the diodes does not change, then a manual reset is required. To do this, the reset button located near the machine must be actuated.

3. If, despite the reset and return of the pressure, the system does not reset (or only one of the green diodes lights) then the cable connection to terminals 3,4,5,6 should be checked and then the wiring between the SSZ transducer and SSZ control unit.

4. If none of the diodes illuminate, the power supply of the SSZ control unit must be checked. If, despite proper wiring and power supply, proper function is not attained, please contact us.

5. The system does not have an automatic or periodic testing. According to the safety level PLd, the system is checked permanently by the control unit in an idle current principle.

CONNECTION OF THE SSZ SYSTEM INTO THE MACHINE CONTROLS

The emergency stop circuit is switched via both output contacts of the SSZ control unit. As long as the system does not detect an error and no-one is standing on the SSZ safety mat, the relay contacts and also thereby the emergency stop circuit is closed. If a person stands on the SSZ safety mat, the relay contacts of the SSZ control unit open and the endangering movement stops. The same is done in case of error, for example a cable break, cross-fault or defect of the SSZ safety mat.

The SSZ safety system can be operated with either an automatic or manual reset selected. The selection is done using selector switches in the SSZ control unit.

For some applications the use of a manual reset can be required, which means that the position of the reset button is located where the entire hazardous area can be viewed. Acknowledgement, meaning reset, may only be done after the operator has ensured that no-one is standing in the hazardous area. Restarting the machine, meaning the reset, is the responsibility of the operator.



The operator must itself determine, implement and comply with the safety level of the total system including the subsequent switching.

SSZ SAFETY MAT CONNECTED WITH THE SSZ CONTROL UNIT

THE SSZ SAFETY MAT WITH THE SSZ RZ3

Power supply	24V AC/DC and 230V AC
The test basics	EN ISO 13856-1, EN ISO 138491-1
Properties of switching at V=250 mm/s	
Switch cycles	$>3 \times 10^6$
Reset	Manual / automatic
B10d	2×10^6
Load-bearing capacity of the output contacts	2A
Installation of the unit in a control cabinet	Yes
Max. resistance of the 1st and 2nd channels of the mat	250k Ω
Max. resistance difference between channels	20%
Max. response time of the unit / the system	<15 ms/<20ms
Max. static load - test piece 80 mm / 8 h	2000N
Trigger force - test piece 11 mm	< 300N
The test piece 80 mm	< 300N
The test piece 200mm	< 600N
Safety category	Pld
Duration of use	20 years
MTTFd	100 (and more)
DC (Diagnostic Coverage)	90%
CCF (Common Cause Failure)	75
PFHd (e.g. IEC/EN 62061)	4.33 E-8
Nop	95040
Category acc. to IEC/EN/62061	SIL2
Performance Level EN ISO 13849-1	PLd
Protection class: Control unit/SSP	IP30/IP65

SSZ SAFETY MAT WITH SSZ-CVS/N/3

Power supply	24V AC/DC and 230V AC
The test basics	EN ISO 13856-1, EN ISO 13849-1
Properties of switching at V=250 mm/s	
Switch cycles	$>3 \times 10^6$
Reset	Manual / automatic
B10d	2×10^6
Load-bearing capacity of the output contacts	2A
Installation of the unit in a control cabinet	Yes
Max. resistance of the 1st and 2nd channels of the mat	250k Ω
Max. resistance difference between channels	20%
Max. response time of the unit / the system	<15 ms/<20ms
Max. static load - test piece 80 mm / 8 h	2000N
Trigger force - test piece 11 mm	< 300N
The test piece 80 mm	< 300N
The test piece 200mm	< 600N
Safety category	PLd
Duration of use	20 years
MTTFd	100 (and more)
DC (Diagnostic Coverage)	90%
CCF (Common Cause Failure)	80
PFHd (e.g. IEC/EN 62061)	$4,29 \times 10^{-8}$
Nop	60,000
Category according to EN ISO 13849-1	3
Performance Level EN ISO 13849-1	PLd
Protection class: Control unit/SSP	P30/IP65
Category acc. to IEC/EN 62061	SIL 2

SSZ SAFETY MAT WITH SSZ-CVS/N2

Power supply	24V AC/DC and 230V AC
The test basics	EN ISO 13856-1, EN ISO 13849-1
Properties of switching at V=250 mm/s	
Switch cycles	$>3 \times 10^6$
Reset	Manual / automatic
B10d	2×10^6
Load-bearing capacity of the output contacts	2A
Installation of the unit in a control cabinet	Yes
Max. resistance of the 1st and 2nd channels of the mat	250k Ω
Max. resistance difference between channels	20%
Max. response time of the unit / the system	<15 ms/<20ms
Max. static load - test piece 80 mm / 8 h	2000N
Trigger force - test piece 11 mm	< 300N
The test piece 80 mm	< 300N
The test piece 200mm	< 600N
Safety category	PLd
Duration of use	20 years
MTTFd	34 high
DC (Diagnostic Coverage)	90%
CCF (Common Cause Failure)	80
PFHd (e.g. IEC/EN 62061)	2.29×10^{-7}
Nop	60,000
Category according to EN ISO 13849-1	2
Performance Level EN ISO 13849-1	PLd
Protection class: Control unit/SSP	P30/IP65
Category according to IEC/EN 62061	SIL 1

SAFETY ASSESSMENT

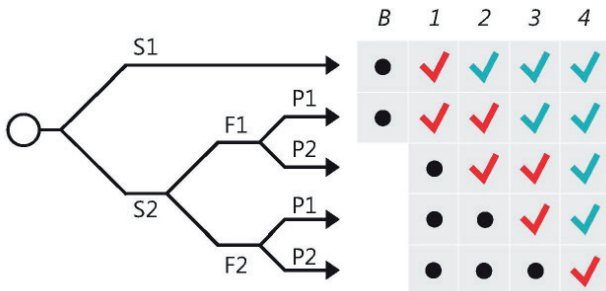
The safety analysis was done according to standard EN ISO 13849-1
From the point of view of the fact that none of the system elements can function independently or together with other existing elements currently on the market (e.g. the SSZ safety mat and the control unit of another manufacturer), the total system (mat supply lines plus control unit) is considered.



The user himself must determine the safety level for his application.



The safety category and level must at least match the risk assessment safety category and level.



Preferred category



Possible category that requires further measures



Categories that can be over-dimensioned

Severity of injury

- S1 light injury
- S2 heavy injury

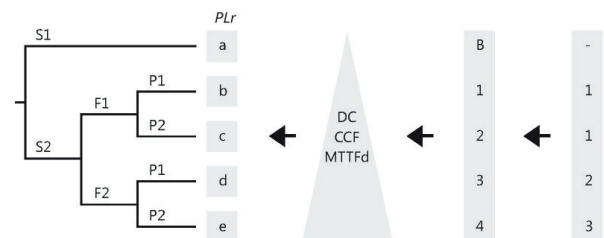
Frequency and / or duration of the danger

- F1 Seldom or more often and / or short period
- F2 Frequent to continuous and / or longer period

Possibility to prevent the hazardous occurrence

- P1 Possible under certain conditions
- P2 Hardly possible

THE RISK GRAPH, IEC 61508



Cat.	Requirement	Consequences for the system
B	Safety related parts of controls and / or their safety devices and also their components must match the corresponding standards in their design, construction, selection, and combined and assembled that they can meet the influences that are expected of them.	The occurrence of an error can lead to loss of safety function.
1	The specifications of category B must be fulfilled. Well-known components and safety principles must be used.	The occurrence of an error can lead to loss of safety function, but the probability of occurrence is lower than in category B.
2	The requirements of category B and 1 must be fulfilled. - The safety function must be checked at suitable intervals.	The occurrence of an error can lead to loss of safety function between the test periods, this will also be detected by the test.
3	The requirements of category B and 1 must be fulfilled. Safety related parts must be designed so that individual errors in these parts do not lead to a loss of safety function. Individual errors are then always detected in an appropriate way.	If individual errors occur the safety function is retained. Some, but not all, errors are detected. An accumulation of undetected errors can lead to loss of safety function.
4	The requirements of category B and 1 must be fulfilled. Safety related parts of the controls must be designed so that a single error in any of these parts does not lead to loss of safety function and individual errors or are detected before the next requirement of the safety function. Or, if this is not possible, then an accumulation of errors may not lead to a loss of safety function.	If errors occur, the safety function is retained. The errors are detected in a timely manner to prevent loss of safety function.

STORAGE AND TRANSPORT

To prevent damage to the system, the product should exclusively be transported and stored in the original packaging.

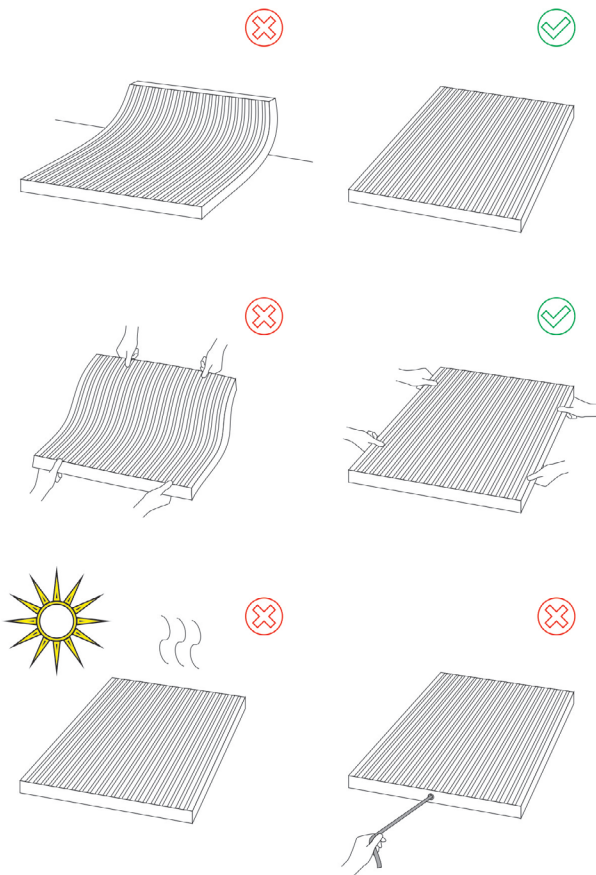
Store in a dry, closed space with humidity of maximum 80%. The maximum storage temperature: -10°C to + 60°C. Prevent direct sunlight! The control units have a safety level of IP 30.

During transport and assembly bending of safety mats is prohibited. Larger safety mat should be moved by at least two people.

The mats are packaged in wooden crates that are filled with protective material on the inside. Depending on the delivery country they are also supplied with IPPC certificates. The crates should be opened with a screwdriver. The mat must be pulled out of the crate in a horizontal position by two people.



The crate with the mats must be transported in a horizontal position. The crate should be opened carefully, a screwdriver is the best tool for this! Do not use a crowbar to open! The use of unsuitable tools or attempting to open using violence may lead to mat damage!



MAINTENANCE AND INSPECTION



This operating manual must be read before starting any kind of maintenance work.

The mat is maintenance-free, its monitoring is done by the control unit. The functional control of the total system must be manual and repeated at least once a day. An optical visual inspection must be done to check for damage occurrence. Damage to the mat surface may lead to limitations in function. For the purposes of cleanliness the mat should be wiped off with a moist cloth. Additional regulation and setting is not required.



The active area of the mat must be checked and documented at regular intervals with static load of 300 N using a test piece with smooth surface and diameter of 80 mm.

The maximum distance between the inspection is 3 months. Regular inspections should be done according to the following points (checklist). In case of technical problems contact the manufacturer or the responsible foreign representative. The current list of our foreign representatives is on our website: www.ssz-gmbh.de

Mat

- Has the surface of the mat (NBR cover) been damaged? (Is damage mechanical, environmentally related or also by chemical substances?)
- Has the mat been properly fastened (screws "loose"?). The possibility of the mat slipping must be excluded, the condition of the aluminium profile must be checked (any cracks, damage)
- Is the mat laying flat on the assembly area? Has dirt collected under the mat?
- Is the mat functioning properly? (A functional inspection must be done according to the "Function test" section of this operating manual)

Connection

- Has the cable that connects the mat to the control unit been damaged? (partially torn, bent)?
- Is the connection between the mat and the plug connection stable? The connections must not be wobbly.



During inspection of the devices, please check for a seamless connection between the mat and the control unit. Particular attention should be paid to the plug connections.

Control unit

- Has the housing been damaged?
- Has the control unit been manipulated? (It should be checked whether the SSZ hologram is sealed).

- Is the system functioning properly? (A functional test must be done according to the "Functional test" in this operating manual).
- Has the control unit been properly placed on the fastening rails on the control cabinet?
- Has the system been linked to the machine properly and according to regulations?

After determining seamless and proper function and seamless and proper installation the system can: be released for use, mat + control unit (according to the valid country standards and regulations).



The time period at which inspection tests are done depends on the user of the safety mat and must be determined by the operating company according to the legal requirements of the country.

There are no replacement parts for the above-mentioned system. In case of damage, the "fixed parts", meaning the control unit, the aluminium profile or the mat must be exchanged.

Caution: The machine or system may NOT be operated without safety devices.

In case of a safety device defect or parts of it, the MACHINE STOPS.



Only parts authorised by the manufacturer can be exchanged by the user. A modification, meaning installation of other components into the system is not permitted. Only an SSZ control unit is permitted for monitoring of the SSZ mat. The use of components, mat and / or control unit from other manufacturer, hides safety hazards that can lead to injury/ In addition the declaration of conformity is immediately void. SSZ GmbH assumes no liability as soon as any component other than SSZ is used. Sub-groups can be exchanged by the user. The exchange should be done by a correspondingly trained technical personnel who is familiar with the safety knowledge for assembly and function of the respective machine or system.



All parts (e.g. housing, snaps, terminals or fastenings) that have been removed during maintenance, must be replaced after maintenance work is complete. In a case where elements are not replaced or improperly replaced, it may result in insecure or error functions.

TROUBLESHOOTING

Error.	Cause	Solution
No LED is illuminated.	No power being supplied	Check power supply
The red diodes and one green are illuminated	Broken cable connection	Check whether the sensor is connected properly. Disconnect the sensor and measure with a universal device.
	Mixed up wiring, wires 3/4 or 5/6	Check whether the sensor is connected properly
	Short circuit in the sensor, e.g. cause by penetration of humidity	Disconnect the sensor and measure with an universal device
The red diode is illuminated. Both green diodes are off	The sensor is permanently active or there is a cable break in the supply line	Remove permanent signal of the sensor by repairing cable break
The sensor switches partially only	Exchange wires 3/5 or 4/6	Check whether the sensor is connected properly

The table below can be used for electrical measurement of the transducer! The transducer must be separated from the control unit for measurement.

The measurement device to the wires	Measurement range	Result of measurement
3 and 4 wires 5 and 6 open	20 MegaOhms	∞
3 and 4 wires 5 and 6 connected	400 kiloOhms	<280 kiloOhms
3 and 5	200 kiloOhms	<140 kiloOhms
4 and 6	200 kiloOhms	<140 kiloOhms



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