Before installing, operating or maintaining the device, read and understand this manual.

**DANGER**

Dangerous tension.
Danger to life or serious injury.
Disconnect the system and device from the power before starting work.

**ATTENTION**

A secure device function is only guaranteed with certified components!

**Hints**

The products described here are designed to perform safety-related functions as part of an overall plant or machine. A complete safety-related system usually contains sensors, evaluation units, signaling devices and concepts for safe shutdowns. It is the responsibility of the manufacturer of a system or machine to ensure the correct overall function. Tapeswitch is unable to guarantee all the features of a complete system or machine that was not designed by Tapeswitch. The overall concept of the controller in which the device is integrated must be validated by the user. Tapeswitch also assumes no liability for recommendations that are given or implied by the following description. Due to the following description, no new warranty, warranty or liability claims beyond the general tapeswitch delivery conditions can be derived.

**Safety Regulations**

- The device may only be installed and commissioned by knowledgeable persons who are familiar with this operating manual and with the applicable regulations on occupational safety and accident prevention.
- Observe the VDE and local regulations, especially with regard to protective measures.
- Opening the case or unauthorized modifications will invalidate any warranty.
- Mount the device in a control cabinet with degree of protection IP 54 or better; Dust and moisture can otherwise lead to impairments of the functions.
- Provide sufficient protective wiring at all output contacts for capacitive and inductive loads.
- The safety function must be triggered during commissioning.

**Intended Use**

If used as directed and in accordance with this manual, no residual risks are known. Failure to do so may result in personal injury and property damage.

The PRSU / M2SI is used for the safety-related release and interruption of a safety circuit. It can be used to protect people and machinery in applications with emergency stop pushbuttons, safety gates, self-test (type 4) photocells in accordance with IEC / EN 61 496-1, two-hand switches for metalworking presses, and other working machines with dangerous closing movements (Type III C according to EN 574) and for safety-related safety mats, safety edges and band switches.

**Device Properties**

**Your advantages**

- two independent safety functions adjustable out:
  - Safety mat / strip, band switch
  - Photocell
  - Emergency stop switch
  - Safety gate
  - Two-hand control
  - Antivalent switch
- only one device type, two safety functions at the same time
- manual or automatic start

**Characteristics**

- Performance Level (PL) e and Category 4 according to EN ISO 13849-1: 2008
- SIL claim limit (SIL CL) 3 according to IEC / EN 62061
- Safety Integrity Level (SIL) 3 according to IEC / EN 61508 and IEC / EN 61511
- according to EN 50156-1 for combustion plants
- Line fault detection on the ON button
- Activation via on-button or automatic on-function
- with or without cross-circuit detection
- 2-channel design
- positively driven output contacts
- Output: 2 NO contacts per safety function
- 1 semiconductor output per safety function
- LED indicators operating voltage, safety function 1, 2 and error
- Device connections: pluggable terminal blocks with screw terminals

**Safety Instructions**

**ATTENTION - AUTOMATIC START!**

According to IEC / EN 60 204-1 point 9.2.5.4.2, no automatic start must be made after stopping in an emergency. Therefore, in the modes with automatic start, a higher-level control must prevent an automatic start after an emergency stop.

**Terminals**

<table>
<thead>
<tr>
<th>Terminal Designation</th>
<th>Signalbeschreibung</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 +</td>
<td>DC24V</td>
</tr>
<tr>
<td>A2</td>
<td>0V</td>
</tr>
<tr>
<td>13, 14, 23, 24, 43, 44, 53, 54</td>
<td>Normally open for release circuit</td>
</tr>
<tr>
<td>38, 68</td>
<td>Semiconductor monitoring output</td>
</tr>
<tr>
<td>GND</td>
<td>Reference potential for semiconductor signal outputs</td>
</tr>
<tr>
<td>S11, S21, S31, S41</td>
<td>control outputs</td>
</tr>
<tr>
<td>S12, S22, S32, S42, ST1, ST2, RES</td>
<td>control outputs</td>
</tr>
</tbody>
</table>
Before installing, operating or maintaining this device, these instructions must be carefully read and understood.

**DANGER**

Dangerous voltage.
Electric shock will result in death or serious injury.
Disconnect all power supplies before servicing equipment.

**CAUTION**

Safe operation of the device is only guaranteed when using certified components!

### Important Notes

The product hereby described was developed to perform safety functions as a part of a whole installation or machine. A complete safety system normally includes sensors, evaluation units, signals and logical modules for safe disconnections. The manufacturer of the installation or machine is responsible for ensuring proper functioning of the whole system. Tapeswitch cannot guarantee all the specifications of an installation or machine that was not designed by Tapeswitch. The total concept of the control system into which the device is integrated must be validated by the user. Tapeswitch also takes over no liability for recommendations which are given or implied in the following description. The following description implies no modification of the general Tapeswitch terms of delivery, warranty or liability claims.

### Safety Regulations

- This device must be installed and operated by trained staff who are familiar with these instructions and with the current regulations for safety at work and accident prevention.
- Pay attention to applicable local regulations, especially regarding safety measures.
- Opening the device or implementing unauthorized changes voids any warranty
- The unit should be panel mounted in an enclosure rated at IP 54 or superior. Dust and dampness may lead to malfunction.
- Adequate fuse protection must be provided on all output contacts with capacitive and inductive loads.
- The safety function must be triggered during commissioning

### Designated Use

When used in accordance with its intended purpose and following these operating instructions, this device presents no known residual risks. Non-observance may lead to personal injuries and damages to property.

The PRSU/M2SI is used to enable and interrupt a safety circuit in a safe way. It can be used to protect people and machines in applications with e-stop buttons, safety gates, light curtains with selftesting (Type 4) acc. to IEC/EN 61 496-1, 2-hand controls for presses as well as other production machinery with dangerous closing action (Type III C to EN 574) and for safety mats, safety edges and tape switches.

### Main Features

#### Your Advantage
- 2 independent, separately adjustable safety functions:
  - Safety mat / Safety edge / Tapeswitch
  - Light curtain
  - E-Stop
  - Safety gate
  - Two-hand control
  - Exclusive or contacts
- Only one device, two safety functions at the same time
- Manual or auto start

#### Features
- According to
  - Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008
  - SIL Claimed Level (SIL CL) 3 to IEC/EN 62061
  - Safety Integrity Level (SIL) 3 to IEC/EN 61508 and IEC/EN 61511
- Acc. to EN 50156-1 for furnaces
- Line fault detection on On-button:
  - Manual restart or automatic restart
  - With or without cross fault monitoring
- 2-channel
- Forcibly guided output contacts
- Output: 2 NO contacts per safety function
- 1 semiconductor output per safety function
- LED indicator for operation, safety function 1, 2 and failure
- Removable terminal strips: plug in screw terminals

### Connection Terminals

<table>
<thead>
<tr>
<th>Terminal designation</th>
<th>Signal designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 +</td>
<td>DC 24 V</td>
</tr>
<tr>
<td>A2</td>
<td>0 V</td>
</tr>
<tr>
<td>13, 14, 23, 24, 43, 44, 53, 54</td>
<td>Forcibly guided NO contacts for release circuit</td>
</tr>
<tr>
<td>38, 68</td>
<td>Semiconductor monitoring output</td>
</tr>
<tr>
<td>GND</td>
<td>Reference potential for Semiconductor monitoring output</td>
</tr>
<tr>
<td>S11, S21, S31, S41</td>
<td>control output</td>
</tr>
<tr>
<td>S12, S22, S32, S42, ST1, ST2, RES</td>
<td>control input</td>
</tr>
</tbody>
</table>
Practical Notes

Operation mode
With the potentiometer on the front plate the operation mode can be adjustet. The adjustment must be required before energized. Adjustment during energization is not allowed.

Only an automatic start at safety function two-hand control (3) is possible.

<table>
<thead>
<tr>
<th>Start</th>
<th>Fkt. 1</th>
<th>Fkt. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MANUAL</td>
<td>MANUAL</td>
</tr>
<tr>
<td>2</td>
<td>MANUAL</td>
<td>AUTO</td>
</tr>
<tr>
<td>3</td>
<td>AUTO</td>
<td>HAND</td>
</tr>
<tr>
<td>4</td>
<td>AUTO</td>
<td>AUTO</td>
</tr>
<tr>
<td>5</td>
<td>MANUAL with common button</td>
<td></td>
</tr>
</tbody>
</table>

Line fault detection e.g. monitoring of ON-button
If the On-button pressed more than 3 s the adequate output contacts of the safety function can't be switch. The output contacts can be energized when the On-button pressed again (0.1 s < t<sub>ON</sub> < 3 s).
A line fault is detected if the On-button more than 10 s is actuated. The output contacts can only be energized with a reset or re-start with on an off switching of power supply.

**ATTENTION - AUTOMATIC START!**
According to IEC/EN 60 204-1 part 9.2.5.4.2 and 10.8.3 it is not allowed to restart automatically after emergency stop.
Therefore the machine control has to disable the automatic start after emergency stop.

Reset and external failures:
The reset input is used to reset external failures (application failures or removable external failures as e.g. a line fault on reset button). If the reset signal is connected to the input for more than 3 sec the unit unit makes a reset. A new reset is only possible when the reset signal had been switched off temporarily.
If an external failure occurs because both input channels of a safety function did not switch on or off within the simultanious time, a reset is only possible if both channels are switched to off state after removing failure cause.
If an external failure occurs in only one safety function, only this function will be disconnected. The second safety function still continues to work.

Function setting
The variants with selectable safety functions have 2 potentiometers Fkt.1 and Fkt.2 to select the required function. The following functions are possible:

<table>
<thead>
<tr>
<th>Fct. 1 / Fct. 2</th>
<th>Safety function</th>
<th>cross fault detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E-Stop</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Safety gate</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Two-hand control</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Safety mat / Safety edge</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Exclusive or contacts</td>
<td>without cross fault detection</td>
</tr>
<tr>
<td>6</td>
<td>E-Stop</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Safety gate</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Light curtain</td>
<td></td>
</tr>
</tbody>
</table>

Indicators
- green LED ON: on, when supply connected
- red LED ERR: on, at internal error flashes at external error
- green LED K1/K2: on, when relay K1 and K2 energized (safety function 1) flashes at external errors of safety function 1
- green LED K3/K4: on, when relay K3 and K4 energized (safety function 2) flashes at external errors of safety function 2

Fault Indication by Flashing Code
- Potentiometer or adjustment failure
- line fault across start button
- Cross fault or wiring fault
- simultaneity error
Function diagram

Technical Data

Input

Nominal voltage $U_n$: DC 24 V
Voltage range: 0.8 ... 1.1 $U_n$
Nominal consumption: typ. 3.2 W
Short-circuit protection: Internal PTC
Overvoltage protection: Internal VDR
Duty-cycle ON button: $0.1 \text{s} < t_{On} < 3 \text{s}$
Duty-cycle Reset button: > 3 s
Safety function
- Safety mat / safety edge / Tapeswitch (4)
  - max. permitted safety edge contact resistance: 1000 Ω
  - switching current at short circuit: typ. 15 mA at $U_n$
- Light curtains (8)
  - control current via S12, S22: typ. 8 mA at $U_n$
  - Min. voltage on terminals S12, S22 e.g. S32, S42: DC 10 V

Output

Contacts: 2 NO contacts per safety function
The NO contacts can be used for safe braking.
Thermal current Strom $I_n$: max. 8 A

Safety function
- E-Stop (1) (6), Safety gate (2) (7), Exclusive or contacts (5)
  - Start up at $U_n$: < 65 ms
  - Release delay at $U_n$ and disconnecting the supply: < 40 ms
  - Release delay at $U_n$ and disconnecting S12, S22 or S32, S42: < 60 ms
- Two-hand control (3)
  - Start up at $U_n$: < 110 ms
  - Release delay at $U_n$ and disconnecting the supply: < 40 ms
  - Release delay at $U_n$ and disconnecting S12, S22 or S32, S42: < 60 ms
- Light curtains (8)
  - Start up at $U_n$: < 65 ms
  - Release delay at $U_n$ and disconnecting the supply: < 40 ms
  - Release delay at $U_n$ and disconnecting S12, S22 or S32, S42: < 60 ms
- Safety mat (4) / Safety Edge / Tapeswitch
  - Start up at $U_n$: < 65 ms
  - Release delay at $U_n$ and disconnecting the supply: < 40 ms
  - Release delay at $U_n$ and disconnecting S12, S22 or S32, S42: < 60 ms
  - other times on request

$t_{diff}$: max. time delay for simultaneity demand dependent on selected safety function
- Safety mat, Sensing Edge, Tapeswitch, E-Stop, Safety Gate $t_{diff} =$ max. 3 s
- Light curtain $t_{diff} =$ max. 1 s
- Two-hand control $t_{diff} =$ max. 0.5 s
- other times on request

$t_{On}$: max. actuation time of start button
- Standard $t_{On} =$ max. 3 s
- other times on request
**Technical Data**

**Switching capacity**
- to AC 15
  - NO contacts: 3 A / AC 230 V IEC/EN 60 947-5-1
- to DC 13
  - NO contacts: 2 A / DC 24 V IEC/EN 60 947-5-1

**Electrical life**
- at 5 A, AC 230 V cos φ = 1: > 1.5 x 10⁸ switching cycles

**Permissible operating frequency**
- 1. safety function: max. 1800 switching cycles / h
- 2. safety function: max. 360 switching cycles / h

**Short circuit strength**
- max. fuse rating: 6 A gl. IEC/EN 60 947-5-1

**Mechanical life**
- 10 x 10⁶ switching cycles

**Semiconductor monitoring output**
- (not safety):
  - max. 50 mA DC 24 V, plus switching

**General Data**

**Nominal operating mode:** continuous operation

**Temperature range**
- Operation: - 15 ... + 55 °C
- Storage: - 25 ... + 85 °C

**Altitude:** < 2.000 m

**Clearance and creepage distance**
- rated impulse voltage / pollution degree: 4 kV / 2 IEC 60 664-1

**EMC**
- Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
- HF irradiation: 10 V / m IEC/EN 61 000-4-3
- Fast transients: 2 kV IEC/EN 61 000-4-4
- Surge voltage:
  - between wires for power supply: 1 kV IEC/EN 61 000-4-5
  - between wire and ground: 2 kV IEC/EN 61 000-4-5
- HF-wire guided: 10 V EN 61 000-4-6

**Interference suppression:** Limit value class B EN 55 011

**Degree of protection**
- Housing: IP 40 IEC/EN 60 529
- Terminals: IP 20 IEC/EN 60 529
- Housing: thermoplastic with VO behaviour according to UL subj. 94
- Vibration resistance:
  - Amplitude 0,35 mm
  - Frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
- Klimate resistance:
  - Frequency 15 / 055 / 04 IEC/EN 60 068-1
- Terminal designation: EN 50 005
- Wire connection: DIN 46 228-1/-2/-3/-4
- Wire fixing: captive slotted screw
- Mounting: DIN rail IEC/EN 60 715
- Weight: approx. 275 g

**UL-Data**

The safety functions were not evaluated by UL. Listing is accomplished according to requirements of Standard UL 508, “general use applications”

**Switching capacity:**
- Ambient temperature 55°C
  - Pilot duty B300, Q300
    - 5A 250Vac Resistive or G.P.
    - 5A 24Vdc Resistive

- Ambient temperature 40°C
  - Pilot duty B300, Q300
    - 8A 250Vac Resistive or G.P.
    - 8A 24Vdc G.P.

**Wire connection:**
- 60°C / 75°C copper conductors only
- Terminal: AWG 28 - 12 Sol/Str Torque 0.5 Nm

**Troubleshooting**

<table>
<thead>
<tr>
<th>Failure</th>
<th>Potential cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED &quot;ON&quot; does not light up</td>
<td>- Power supply A1+/A2 not connected</td>
</tr>
<tr>
<td>LED &quot;ERR&quot; flashes in relation 1:1</td>
<td>- Under- or overvoltage (check power supply A1+/A2)</td>
</tr>
<tr>
<td>LED &quot;ERR&quot; flashes in relation 4:1</td>
<td>- external failure (see flashing code)</td>
</tr>
<tr>
<td>LED &quot;ERR&quot; continuously on</td>
<td>- system error (if cannot be removed after restart unit must be replaced)</td>
</tr>
</tbody>
</table>

**Maintenance and Repairs**

- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.
Application examples with safety function

Operating mode: 3 (Fkt1=AUTO ; Fkt2=MANUAL)
Safety function 1: see page 7, Auto-Start
Safety function 2: see page 7, Manual-Start

Operating mode: 5 (MANUAL with common button)
Safety function 1: see page 7, Manual-start with common button
Safety function 2: see page 7, Manual-start with common button
Application examples with safety function 1

Fct.: E-stop (1),
with cross fault detection
SIL 3, PL e, Cat. 4

Fct.: Safety gate (2),
with cross fault detection
SIL 3, PL e, Cat. 4

Fct.: Two-hand control (3),
with cross fault detection
SIL 3, PL e, Cat. 4
Type III C to EN 574

Fct.: Safety mat / Safety edge / Tape-switch (4), with cross fault detection
SIL 3, PL e, Cat. 4

Fct.: Exclusive or contacts (5),
with cross fault detection
SIL 3, PL e, Cat. 4

Fct.: E-Stop (6),
without cross fault detection
SIL 3, PL e, Cat. 4

Fct.: Safety gate (7),
without cross fault detection
SIL 3, PL e, Cat. 4

Fct.: Light curtain (8),
without cross fault detection
SIL 3, PL e, Cat. 4

1) To achieve the stated safety classification the wiring has to be done with cross fault monitoring.
2) To achieve the stated safety classification light curtains with selftest (type 4) according to IEC/EN 61496-1 have to be used.

Application examples with safety function 2
The safety function 2 is connected as well as safety function 1, but S11 ≠ S31, S12 ≠ S32, S21 ≠ S41 and S22 ≠ S42.
Labeling and connections

Circuit diagram

DIN 5264-A; 0.6 x 3.5
0.5 Nm
5 LB. IN

Dimensions (dimensions in mm)

Mounting / disassembly of the terminal blocks
Safety related data

<table>
<thead>
<tr>
<th>EN ISO 13849-1:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category:</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>PL:</td>
</tr>
<tr>
<td>e</td>
</tr>
<tr>
<td>MTTF$_{a}$:</td>
</tr>
<tr>
<td>134,5 a (year)</td>
</tr>
<tr>
<td>DC$_{avg}$:</td>
</tr>
<tr>
<td>99,0 %</td>
</tr>
<tr>
<td>d$_{op}$:</td>
</tr>
<tr>
<td>365 d/a (days/year)</td>
</tr>
<tr>
<td>h$_{op}$:</td>
</tr>
<tr>
<td>24 h/d (hours/day)</td>
</tr>
<tr>
<td>t$_{cycle}$:</td>
</tr>
<tr>
<td>3600 s/cycle</td>
</tr>
<tr>
<td>$\equiv$ 1 /h (hour)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IEC/EN 62061 IEC/EN 61508 IEC/EN 61511:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIL CL:</td>
</tr>
<tr>
<td>3 IEC/EN 62061</td>
</tr>
<tr>
<td>SIL:</td>
</tr>
<tr>
<td>3 IEC/EN 61508 / IEC/EN 61511</td>
</tr>
<tr>
<td>HFT:</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>DC$_{avg}$:</td>
</tr>
<tr>
<td>99,0 %</td>
</tr>
<tr>
<td>SFF:</td>
</tr>
<tr>
<td>99,6 %</td>
</tr>
<tr>
<td>PFH$_{2}$:</td>
</tr>
<tr>
<td>3.89E-10 h$^{-1}$</td>
</tr>
<tr>
<td>PFD:</td>
</tr>
<tr>
<td>3.27E-05</td>
</tr>
<tr>
<td>T$_{1}$:</td>
</tr>
<tr>
<td>20 a (year)</td>
</tr>
</tbody>
</table>

$^{1}$ HFT = Hardware failure tolerance

The values stated above are valid for the standard type. Safety data for other variants are available on request.

The safety relevant data of the complete system has to be determined by the manufacturer of the system.

Approvals and Markings

<table>
<thead>
<tr>
<th>Demand to our device based on the evaluated necessary safety level of the application.</th>
<th>Intervall for cyclic test of the safety function</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN ISO 13849-1 PL e with Cat. 3 or Cat. 4</td>
<td>once per month</td>
</tr>
<tr>
<td>IEC/EN 62061, IEC/EN 61508 SIL CL 3, SIL 3 with HFT = 1</td>
<td>once per month</td>
</tr>
<tr>
<td>IEC/EN 62061, IEC/EN 61508 SIL CL 2, SIL 2 with HFT = 1</td>
<td>once per month</td>
</tr>
<tr>
<td>EN 61511, EN 50156-1 SIL 3</td>
<td>once per year</td>
</tr>
</tbody>
</table>

Tapeswitch Corporation
e-mail: sales@tapeswitch.com • web: http://www.tapeswitch.com

Phone: 631-630-0442 Toll Free: 800-234-8273

10/2015 EN