Time-Del. Emergency Stop Safety Relay SR4C

ZANDER AACHEN

Operating Instructions

English translation

Errors and technical changes reserved

Correct Use

EN ISO 13849-1

EN IEC 62061

SR4C is an emergency stop safety relay combination that combines non-time-delayed and time-delayed contacts in a very compact housing. This permits dangerous components of a system to be switched off quickly and safely in an emergency situation. At the same time, other circuits can continue to be supplied with voltage for up to 30 seconds to allow a tool to be moved to its idle position or to brake following parts, for example.

Product Safety Functional Safety

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- *4 positively driven safety relays contacts.*
- *Continuously adjustable time delay (1 to 30s) or fixed delay times*
- *Connection of:*
  - *Emergency stop buttons*
  - *Safety switches*
  - *Non-contacts safety switches*
  - *OSSD-Outputs*
- *1- or 2-channel activation possible*
- *Feedback loop for monitoring downstream contactors or expansion modules*
- *Cyclical monitoring of the output contacts*
- *Indication of the switching state via LED*
- *2 start behaviors possible:*
  - *manual start*
  - *automatic start*
- *Short circuit and earth fault monitoring*
- *Up to PL e, SIL 3, category 4*

Function

The moving parts of a machine or system can be quickly and safely stopped in case of danger with the non-time-delayed contacts of the SR4C Safety contacts with time-delay switch-off are also integrated into the SR4C. They are used whenever it is safer to keep supplying voltage to parts of a machine after the emergency stop switch is operated. It is ensured that a single fault or malfunction does not lead to a loss of the safety function and that every fault is detected by cyclical self-monitoring no later than when the system is switched off and switched on again.

The time-delay contacts are activated at the same time as the non-time-delay contacts; however, when the emergency stop button is pressed, the contacts are only deactivated after the time set on the potentiometer (e.g. 1 … 30s).

During timeout, no power-loss is accepted.

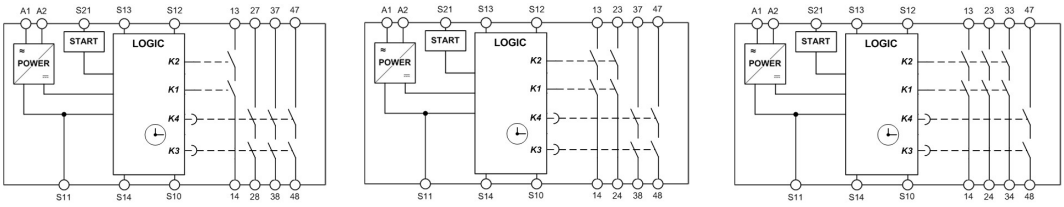


Fig. 1 Block diagram: SR4C (1nd/3d); SR4C (2nd/2d); SR4C (3nd/1d)

Installation

As per EN 60204-1, the device is intended for installation in control cabinets with a minimum degree of protection of IP54. The following should be noted:

- Mounting on 35 mm rail according to EN 60715
- Ensure sufficient heat dissipation in the control cabinet
- Minimum distance to adjacent devices depending on max. cumulative current (see Techn. Data)
- **Note:** Spacer from ZANDER AACHEN (Art. No. 472596) for defined distances - See section Accessories.

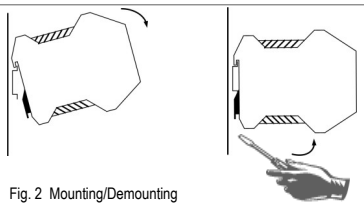


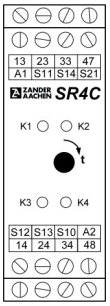
Fig. 2 Mounting/Demounting

Safety Precautions

- Installation and commissioning of the device must be performed **only by authorized personnel**.
- Observe the country-specific regulations when installing the device.
- The electrical connection of the device is only allowed to be made with the device isolated.
- The wiring of the device must comply with the instructions in this user information, otherwise there is a risk that the safety function will be lost.
- It is not allowed to open the device, tamper with the device or bypass the safety devices.
- All relevant safety regulations and standards are to be observed.
- The overall concept of the control system in which the device is incorporated must be validated by the user.
- Failure to observe the safety regulations can result in death, serious injury and serious damage.
- Note down the version of the product (see label “Ver: x”) and check it prior to every commissioning of a new device. If the version has changed, the overall concept of the control system in which the device is incorporated must be validated again by the user.
- The year of manufacture can be found on the type label on the device. It is located at the end of the line of the voltage specification, below the ID number.

Electrical Connection

- Consider the information in the section "Techn. data"
- A safe transformer according to EN 61558-2-6 or a power supply unit with electrical isolation from the mains must be connected
- External fusing of the safety contacts must be provided
- If the device does not function after commissioning, it must be returned to the manufacturer unopened. Opening the device will void the warranty
- Use adequate protective circuit for inductive loads (e.g. free-wheeling diode)



A1:	*Power supply*
A2 :	*Power supply*
S11:	*DC 24 V control voltage*
S10:	*Control line*
S12:	*Control line*
S13:	*Control line*
S14:	*Control line*
S21:	*Start control line*
13-14:	*Safety contact 1 (nd)*
23-24/27-28:	*Safety contact 2 (d / nd)*
33-34/37-38:	*Safety contact 3 (d / nd)*
47-48:	*Safety contact 4 (d)*

Fig. 3 Connections nd = non-time delayed; d = time-delayed

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Applications

Depending on the application or the result of the risk assessment according to EN ISO 13849-1, the device must be wired as shown in Fig. 4 to Fig. 14. Non-time delayed contacts can be used up to category 4, PL e, time-delayed safety contacts up to category 3, PL e.

Emergency Stop Circuit

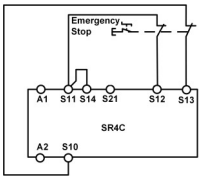


Fig. 4:
Two-channel emergency stop circuit with short circuit and earth fault monitoring.
(up to category 4, PL e, SIL 3)

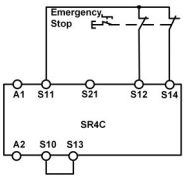


Fig. 5:
Two-channel emergency stop circuit with earth fault monitoring.
(up to category 3, PL d, SIL 2)

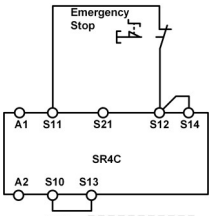


Fig. 6:
Single-channel emergency stop circuit with earth fault monitoring.
(up to category 1, PL c, SIL 1)

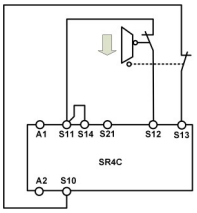


Fig. 7:
Two-channel sliding guard monitoring with short circuit and earth fault monitoring.
(up to category 4, PL e, SIL 3)

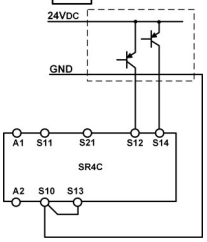


Fig. 8:
Two-channel emergency stop with pnp-outputs/OSSD-outputs ***with*** *short circuit monitoring.*
(up to category 4, PL e, SIL 3)

Notice:

- In order to activate earth fault monitoring, the PE must be connected only to the power supply unit in accordance with EN 60204-1
- For proper operation, all safety contacts must have returned to idle state before restarting the device
- It must be ensured that any switch-on pulses (light test) sent by the signal generator do not lead to a short activation of the safety relay and should therefore basically be deactivated
- For the applications according Fig. 8, make sure that the reference potential of the signal generator and the SR4C is the same

Starting Behavior

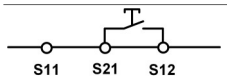
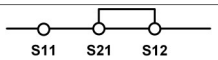


Fig. 9:
Manual start.



Warning:
Safety contacts switch when the power supply is connected.

Fig. 10:
Automatic start (e.g. for application with a safety door).
Max perm. delay during closing of the safety switches on S12 and S13:
S12 before S13: 300 ms;
S13 before S12: any

Feedback Loop

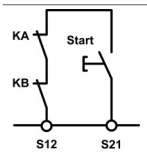


Fig. 11:
Feedback loop for manual start:
The feedback loop monitors contactors or the expansion modules.

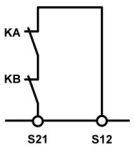


Fig. 12:
Feedback loop for automatic start:
The feedback loop monitors contactors or the expansion modules .

Power supply and Safety contacts

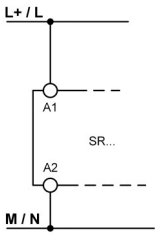


Fig. 13:
Power supply A1 and A2.
(Power supply according to techn. data)

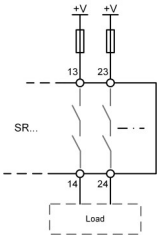


Fig. 14:
Connecting load to safety contacts.
(Figure shows example. Voltage „+V“ according to techn. Data)

Commissioning Procedure

Note: *The items listed under “Electrical connection” must be observed during commissioning.*

1. Wiring emergency stop circuit:
Wire the emergency stop circuit according to the required Performance Level determined (see Fig. 4 to Fig. 8).

2. Wiring start circuit:
Wire the start circuit according to Fig. 9 or Fig. 10 to set the starting behavior.

Warning:
If “Automatic start” is set, bear in mind that the safety contacts will switch immediately after the power supply is connected. If “Manual start” is set, the start button must be opened after wiring.

3. Wiring feedback loop:
If your application provides for external contactors or expansion modules, connect them to the device according to Fig. 11 or Fig. 12.

4. Wiring power supply:
Connect the power supply to terminals A1 and A2 (Fig. 13).

Warning: Wiring only in de-energized state.

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5. Setting the delay time

Set the desired time delay on the potentiometer (not required for the version with fixed time).

Warning:

Scale divisions should be regarding only as a setting aid. Always make shure to measure the delay time.

6. Starting the device:

Switch on the operating voltage.

Warning:

If the “Automatic start” starting behavior is set, the safety contacts will close immediately.

If the “Manual start” starting behavior is set, close the start button to close the safety contacts.

LEDs **K1**, **K2, K3** and **K4** are lit.

7. Triggering safety function:

Open the emergency stop circuit by actuating the connected safety switch. The safety contacts open immediately.

Warning: Measure the delay time.

8. Reactivation:

Close the emergency stop circuit. If “Automatic start” is selected, the safety contacts will close immediately.

If the “Manual start” starting behavior is set, close the start button to close the safety contacts.

Check and Maintenance

No maintenance is required for the device itself.

But the following checks are regularly required to ensure proper and continuous functioning:

- Check the switch function
- Check for signs of manipulation and safety function bypassing
- Check if the device is mounted and connected securely
- Check for soiling

Check if the safety device is working properly, in particular:

- Every time after initial commissioning
- Every time after replacing a component
- After every fault in the safety circuit

Irrespective of this, the safe function of the protective device should be checked at suitable intervals, e.g. as part of the system's maintenance program. Maintenance work on the device itself is not required.

What to Do in Case of a Fault?

Device does not switch on:

- Check the wiring by comparing it to the wiring diagrams.
- Check the safety switch used for correct function and adjustment.
- Check whether the emergency stop circuit is closed.
- Check whether the start button (with manual start) is closed.
- Check the operating voltage at A1 and A2.
- Is the feedback loop closed?

Device cannot be switched on again after an emergency stop:

- Check whether the emergency stop circuit was closed again.
- Is the feedback loop closed?

If the fault still exists, perform the steps listed under “Commissioning Procedure”.

If these steps do not remedy the fault either, return the device to the manufacturer for examination.

Opening the device is impermissible and will void the warranty.

Techn. Data

Corresponds to the standards	EN 60204-1, EN ISO 13849-1, EN IEC 62061
Operating voltage	AC/DC 24 V
Rated supply frequency	50 - 60 Hz
Permissible deviation	+/- 10 %
Power consumption	**DC 24 V** approx. 4.7 W **AC 24 V** approx. 5.3 VA
Control voltage at S11	DC 24 V
Control current	approx. 190 mA
Response delay after actuation of the buttons	< 20 ms
Safety contacts	4 NO contacts (3n/1d, 2n/2d, 1n/3d)
Max. switching voltage	AC 250 V
Safety contact breaking capacity (6 switching cycles/min)	AC: 250 V, 2000 VA, 8 A for ohmic load 250 V, 3 A for AC-15 DC: 40 V, 320 W, 8 A for ohmic load 24 V, 3 A for DC-13
Max. cumulative current on the safety contacts	15 A *)
Time delay	Depending on variant 1 ... 30 s, continuously adjustable or fixed delay time
Minimum contact load	5 V, 10 mA
Contact fuses	10 A gG
Max. line cross section	0.14 - 2.5 mm^2
Tightening moment (Min. / Max.)	0.5 Nm / 0.6 Nm
Typ. switch-on delay / switch-off delay for NO contacts requested via safety circuit	< 30 ms / < 30 ms + set delay time
Max. length of control line	1000 m at 0.75 mm^2
Contact material	$AgSnO_2$
Contact service life	mech. approx. 1 $x10^7$
Test voltage	2.5 kV (control voltage/contacts)
Rated impulse withstand voltage, leakage path/air gap;	4 kV (EN 60664-1)
Rated insulation voltage	250 V
Contamination / Overvoltage category	2 / 3 (EN 60664-1)
Degree of protection/	IP20
Temperature range	-15 °C ... +40 °C
Max. altitude	≤ 2000 m (above sea level)
Weight	approx. 250g
Mounting	DIN rail according to EN 60715 TH35

*) If several SR4C devices are closely spaced under load, the max. total current at the ambient temperature of T=20 °C: 9 A; at T=30 °C: 3 A; at T=40 °C =1 A. If these currents are exceeded, a spacing of 5 mm between the devices must be observed.

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Disclaimer and warranty

If the above mentioned conditions for appropriate use are not complied with or if the safety instructions are not followed or if any maintenance operations are not carried out as required, this shall lead to an exclusion of liability and loss of warranty.

ATTENTION!

We would like to point out that it is the full responsibility of the operator to ensure a plant availability. Using the SR4C, a safety emergency stop relay according to

- EN ISO 13849-1
- EN IEC 62061

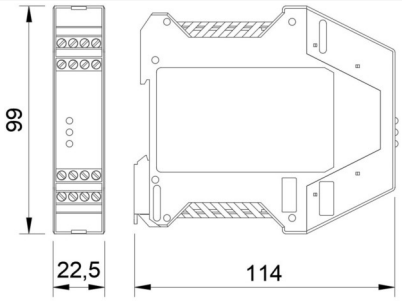
is used, which will be brought into the safe state when the safety function is requested.

This means that the connected load is switched off as soon as a request from connected sensor elements or diagnostic measures detects a dangerous state, e.g. caused by a component fault.

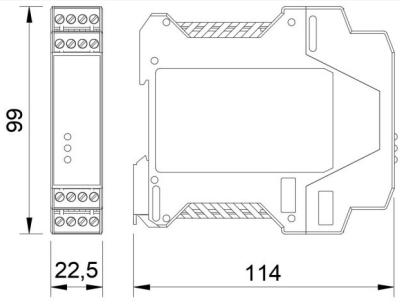
Since process-related applications in particular have high demands on availability, limited availability can also have significant consequences. It is therefore recommended to stock a second unit to avoid long downtimes in such a case. These are recommendations of the manufacturer, the evaluation of the importance of the plant availability is the sole responsibility of the operator.

Dimension Drawing

Fixed Terminals



Plug-In Terminals



Note: Actual number of front LEDs may differ from the number shown in the drawing, depending on the variant.

Variants

Order No. 472212	SR4C, AC/DC 24 V, 3 non-time del./ 1 time-del. contact 1-30 s	fixed screw terminals
Order No. 472222	SR4C, AC/DC 24 V, 2 non-time del./ 2 time-del. contacts 1-30 s	fixed screw terminals
Order No. 472232	SR4C, AC/DC 24 V, 1 non-time del./ 3 time-del. contacts 1-30 s	fixed screw terminals
Order No. 472235	SR4C, AC/DC 24 V, 1 non-time del./ 3 time-del. contact 1-3 s	fixed screw terminals
Order No. 472225	SR4C, AC/DC 24 V, 2 non-time del./ 2 time-del. contacts 1-3 s	fixed screw terminals
Order No. 472215	SR4C, AC/DC 24 V, 3 non-time del./ 1 time-del. contacts 1-3 s	fixed screw terminals
Order No. 474212	SR4C, AC/DC 24 V, 3 non-time del./ 1 time-del. contact 1-30 s	incl. plug-in screw terminals
Order No. 474222	SR4C, AC/DC 24 V, 2 non-time del./ 2 time-del. contacts 1-30 s	incl. plug-in screw terminals
Order No. 474232	SR4C, AC/DC 24 V, 1 non-time del./ 3 time-del. contacts 1-30 s	incl. plug-in screw terminals
Order No. 474235	SR4C, AC/DC 24 V, 1 non-time del./ 3 time-del. contact 1-3 s	incl. plug-in screw terminals
Order No. 474225	SR4C, AC/DC 24 V, 2 non-time del./ 2 time-del. contacts 1-3 s	incl. plug-in screw terminals
Order No. 474215	SR4C, AC/DC 24 V, 3 non-time del./ 1 time-del. contacts 1-3 s	incl. plug-in screw terminals
Order No. 475212	SR4C, AC/DC 24 V, 3 non-time del./ 1 time-del. contact 1-30 s	incl. push-in twin spring connector
Order No. 475222	SR4C, AC/DC 24 V, 2 non-time del./ 2 time-del. contacts 1-30 s	incl. push-in twin spring connector
Order No. 475232	SR4C, AC/DC 24 V, 1 non-time del./ 3 time-del. contacts 1-30 s	incl. push-in twin spring connector
Order No. 475235	SR4C, AC/DC 24 V, 1 non-time del./ 3 time-del. contact 1-3 s	incl. push-in twin spring connector
Order No. 475225	SR4C, AC/DC 24 V, 2 non-time del./ 2 time-del. contacts 1-3 s	incl. push-in twin spring connector
Order No. . 475215	SR4C, AC/DC 24 V, 3 non-time del./ 1 time-del. contacts 1-3 s	incl. push-in twin spring connector

Other variants with fixed times of up to 30 seconds are available on request. Please contact us with the corresponding type codes:

SR4C X/Y ABS S

X = Number of non-delayed contacts (1 to 3)
Y = Number of delayed contacts (1 to 3)
ABC = 000 bis 300 (set fixed time. E.g.: 005 = 0.5 seconds; 065 = 6.5 seconds; 200 = 20 seconds)
S = Sekunden

Accessories

Order No. 472592	EKLS4,	set of plug-in screw terminals
Order No. 472595	EKLZ4,	set of push-in twin spring connector
Order No. 472596	Spacer Electric Cabinet	rail spacer 5mm, PU = 12 pcs

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Safety Charcteristics

Safety characteristics according to EN ISO 13849-1

Load - DC-13	**≤ 0.1 A**		**≤ 1 A**		**≤ 2 A**	
Type of Safety Contact	delayed	non-delayed	delayed	non-delayed	delayed	non-delayed
Max. duration of use [Years]	20	20	20	20	20	20
Category	3	4	3	4	3	4
PL	e	e	e	e	e	e
PFHd [1/h]	8.84E-08	4.22E-08	8.84E-08	4.22E-08	8.84E-08	4.22E-08
nop [Cycles / year]	≤ 500,000	≤ 500,000	≤ 350,000	≤ 350,000	≤ 100,000	≤ 100,000

Safety characteristics according to IEC 61508 - High Demand

Conditions: Days of operation/year: 365; Hours/Day: 24; Switching-Cycle/Hour: 1; Maximum load AC-15 / DC-13		
Type of Safety Contact	delayed	non-delayed
Max. duration of use [Years]	20	20
Proof-Test-Intervall [Years]	20	20
PFH [1/h]	9.29E-10	9.69E-11
SIL	3	3

Safety characteristics for alternate 1oo1 structure for process industry - High Demand

Conditions: Days of operation/year: 365; Hours/Day: 24; Switching-Cycle/Hour: 1; Maximum load AC-15 / DC-13		
Type of Safety Contact	delayed	non-delayed
Device type	A	A
HFT	0	0
SIL	3	3
SFF [%]	99.54	99.91
λ_{SD} [FIT]	0	0
λ_{SU} [FIT]	109.72	103.25
λ_{DD} [FIT]	92.39	9.69
λ_{DU} [FIT]	0.96	0.10
PFH [1/h]	9.29E-10	9.69E-11

Safety characteristics according to IEC 61508 - Low Demand

Conditions: Maximum load AC-15 / DC-13		
Type of Safety Contact	delayed	non-delayed
Max. duration of use [Years]	20	20
Proof-Test-Intervall [Years]	6	6
$\mathbf{PFD_{AVG}}$	9.75E-05	6.14E-05
SIL	3	3

Safety characteristics for alternate 1oo1 structure for process industry - Low Demand

Conditions: Maximum load AC-15 / DC-13		
Type of Safety Contact	delayed	non-delayed
Device type	A	A
HFT	0	0
SIL	3	3
SFF [%]	86.4	97.06
λ_{SD} [FIT]	0	0
λ_{SU} [FIT]	34.59	103.13
λ_{DD} [FIT]	0	0
λ_{DU} [FIT]	5.44	3.12
$\mathbf{PFD_{avg}}$ (e.g. for T = 1 year)	2.38E-05	1.37E-05

Proof-Test

In order to check the proper function of the device, the following steps have to be carried out

- Trigger the safety function via the safety circuit. Measure the time until the time-delayed release current paths open and compare this with the set delay time. Check that all release current paths (13-14; 23-24/27-28; 33-34/37-38; 47-48) have been opened by triggering the safety function.
- Now reactivate the device by closing the safety circuit again and, if configured, triggering a start command. Check that the release current paths (13-14; 23-24/27-28; 33-34/37-38; 47-48) are closed again.

If the device does not switch back on or the measured delay time does not correspond to the set one, the proof test has failed.

ATTENTION:

If the proof-test fails, the device must be replaced. Otherwise there is a risk of loss of functional safety.

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CE Declaration

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Déclaration de conformité

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Groupe de produits:
Sicherheits-Not-Halt-Schaltgeräte
Safety emergency stop switching devices
Relais de sécurité d'arrêt d'urgence

Produkt Name Product Name Nom du produit	**Anbringung der CE-Kennzeichnung** Affixing of CE marking: Application du marque CE	**Zertifikats-Nr.** No of Certificate N° du certificat
SR4C	2020	01/205/5072.02/20

Die Produkte stimmen mit den Vorschriften folgender Europäischer Richtlinien überein:
The products conform with the essential protection requirements of the following European directives:
Les produits sont conformes aux dispositions des directives européennes suivantes:

2006/42/EG : Maschinenrichtlinie
2006/42/EG : Machinery directive
2006/42/EG : Directive <<Machines>>

2011/65/EU: RoHS Richtlinie
2011/65/EU: RoHS directive
2011/65/EU: Directive RoHS

2014/30/EU : EMV Richtlinie
2014/30/EU : EMC directive
2014/30/EU : Directive <<CEM>>

Die Übereinstimmung der bezeichneten Produkte mit den Vorschriften der o.a. Richtlinie wird, falls anwendbar, nachgewiesen durch die vollständige Einhaltung folgender Normen:
If applicable, the conformity of the designated products is proved by full compliance with the following standards:
Le strict respect des norms suivantes confirme, s´il y a lieu, que les produits désignés sont conformes aux dispositions de la directive susmentionnée:

Gemäß Zertifikat der benannten Stelle:
According to the certificate of the below mentioned organisation:
Selon de organisme notifé:

EN ISO 13849-1:2015
EN ISO 13849-2:2013-02
EN 62061:2005 + Cor.:2010 + A1:2013 + A2:2015

Benannte Stelle / Organisme notifé:
TÜV Rheinland Industrie Service GmbH
Am Grauen Stein
51105 Köln
Kenn-Nr.: 0035

Dokumentationsbeauftragte/-r: Christiane Nittschalk
Documentation manager
Autorisé à constituer le dossier technique

Aachen, den 02.11.2020

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