Digital Switching Accelerator

DIGI*SPEED* DS1

Digitronic Automationsanlagen GmbH

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Notification

This handbook corresponds with the unit version of 16.11.1992. The company Digitronic Automationsanlagen GmbH reserves the right to implement changes that result in an improvement of the quality and the functions of the device at any time and without any announcements.
This instructions manual was created with a maximum of care, but mistakes are not out of the question. We are thankful for any comments, regarding possible mistakes in the instruction manual.

UP-date
You can also obtain this instruction manual on the Internet at **http://www.digitronic.com** in the latest version as PDF file.

Qualified personal only
Commissioning and operation of the device may only be carried out by qualified personal. Qualified personal are persons, authorized with commissioning, grounding and labeling devices, systems and electrical circuits according to the applicable standards of security

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Note: The products of Digitronic are so well constructed that they will not be effected by the millenium.

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1. Introduction

All switching devices that can be magnetically influenced, e.g. magnetic valves or relays, are subject to a switching delay. This switching delay consits of several factors:

1. the time needed to build up the magnetic field
2. the time needed to overcome the mechanical inertia
3. the time it takes for the magnetic field to break down at deactivation

To accelerate the building up of the magnetic field and so reducing the reaction time of a switching device during the activation procedure, the DIGISPEED-DS1 sends a surge impulse of up to 100 Volt to the coil of the switching device for a variable amount of time. The magnetic field of the coil is ampliefied through this overload amplifier. This causes the mechanical inertia to be overcome faster. Freewheeling diodes delay the break down of the magnetic field during the deactivation process, but because the diodes protect the device from faults and disturbances, they cannot be done without. This increases the deactivation time effectively. DIGISPEED-DS1 accelerates the break down of the magnetic field through a freewheel circuit of -56V DC and causes a reduction of the deactivation time.

Result: Through time interval controlled overload amplifiers in connection with the regulation of the freewheel voltage to -56V DC, the DIGISPEED-DS1 lets switching devices that can be magnetically influenced switch up to ten times faster.

2. Features

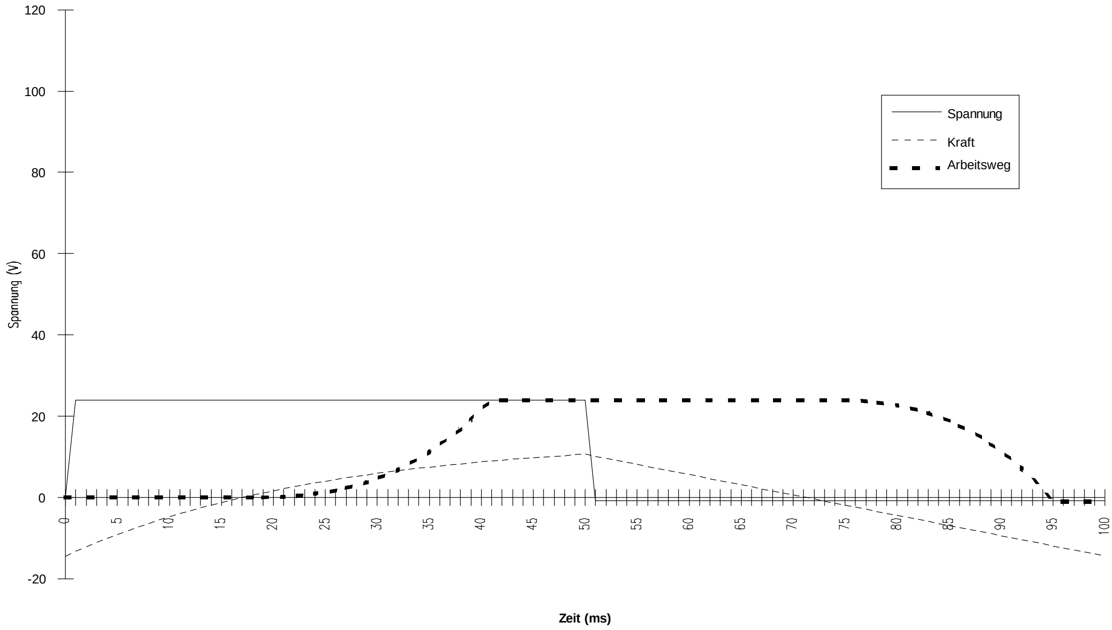
* microprocessor controlled performance electronics for an exact reproduceable switching operation
* dual - channel version
* two addiitional inputs for the parameterization of the surge impulse
* short recovery time for the surge impulse
* high overload amplification voltage of up to 100V DC for fast activation
* high freewheel voltage of -56V DC for fast deactivation
* galvanic separation of the inputs
* proper for switching devices up to 2 x 24 watt (2 x 1 ampere permanent current)
* 24V DC ±20% voltage supply without additional separat voltage
* 30mm narrow encasement made out of Thermoplast - plastic
* encasement with convenient clip - on assembly
* several encasements can be put in line easily

3. Principle of function

.

3.1. Activation and deactivation behavior of the switching devices with a freewheeling diode

Normally magnetic switching devices are activated by connecting a voltage source of 24V DC. In the drawing shown below, this happens at the time 0ms. Through the inductivity, the magnetic field and the field' s energy are slowly built up. At 17ms the magnetic power couteracting the spring is reached. Now the switching movement is initiated. This is finished at 41ms. The moment the time reaches 50ms, the deactivation process is begun. The installed freewheeling diode causes a freewheel voltage of -0,7V DC, so that the freewheel current breaks down the magnetic field slowly. At 71ms the spring is greater than the magnetic power, so that the deactivation movement is put into process, which is concluded at 95ms.

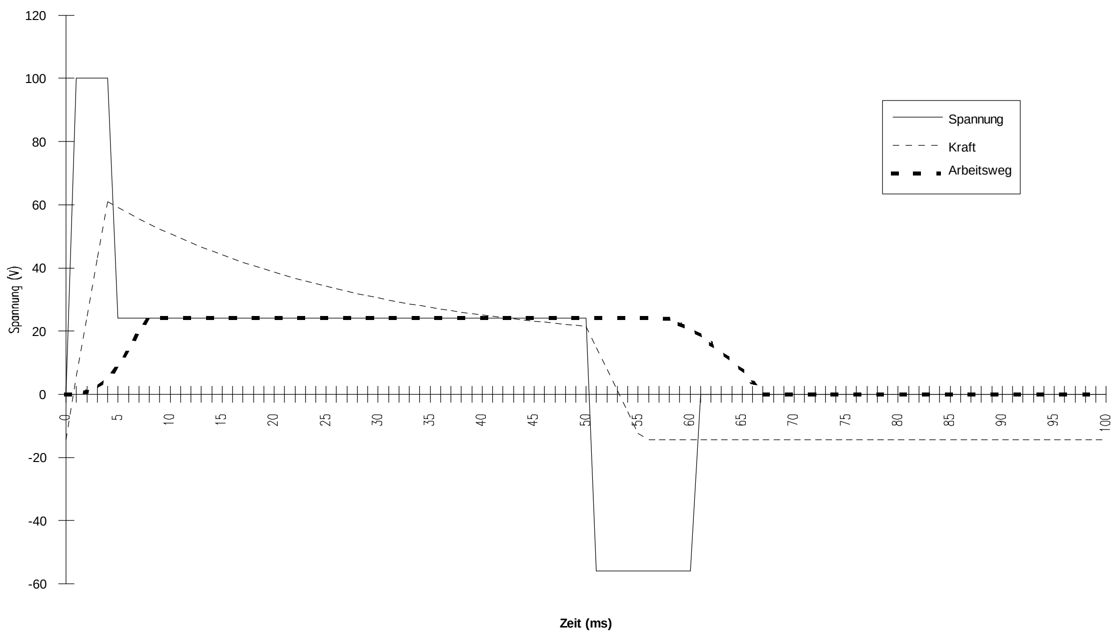


Spannung	= voltage
Zeit	= time
Kraft	= energy
Arbeitsweg	= operation route

3.2. Activation and deactivation behavior of switching devices with DIGISPEED-DS1

At the activation DIGISPEED-DS1 sends a surge impulse of up to 100V DC with a set time (here 5ms) to the coil of the switching device. Through this overload amplification the magnetic field is built up in 1/4 of the time and for a short while 4 times as high. The spring overcomes the magnetic power earlier (here at 1ms). The switching movement is completed earlier (here at 8ms), since the magnetic power is greater. To not overload the switching device, the overload amplification should stop by the completion switching movement (here at 5ms).
The deactivation process is started at 50ms. Without a freewheeling diode, DIGISPEED-DS1 regulates the freewheel voltage to -56V DC. This breakes down the magnetic power very quickly. At 53 ms the spring is already greater than the magnetic power, so that a deactivation can be initiated; the deactivation is concluded at 67ms.

Important: To be able to use the effect of the regulated freewheel circuit, you have to operate every connected relay or switching unit **without** a freewheeling diode !! The freewheel voltage is set to fixed -56V DC and cannot be changed externally. An additional increase of the freewheel voltage does not lead to better results most of the time.



Spannung	= voltage
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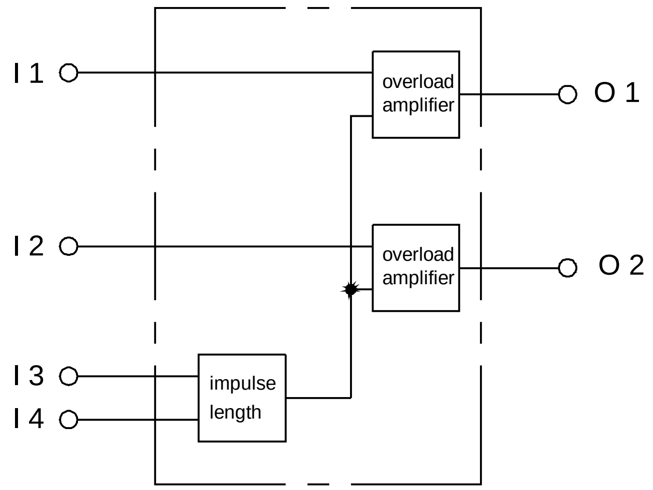
4. Switching modes in the DIGISPEED-DS1

DIGISPEED-DS1 can be programmed for four different logic behaviors. Through this the user has the possibility to carry out time critical logic functions outside a PLC stressed by cycle time.

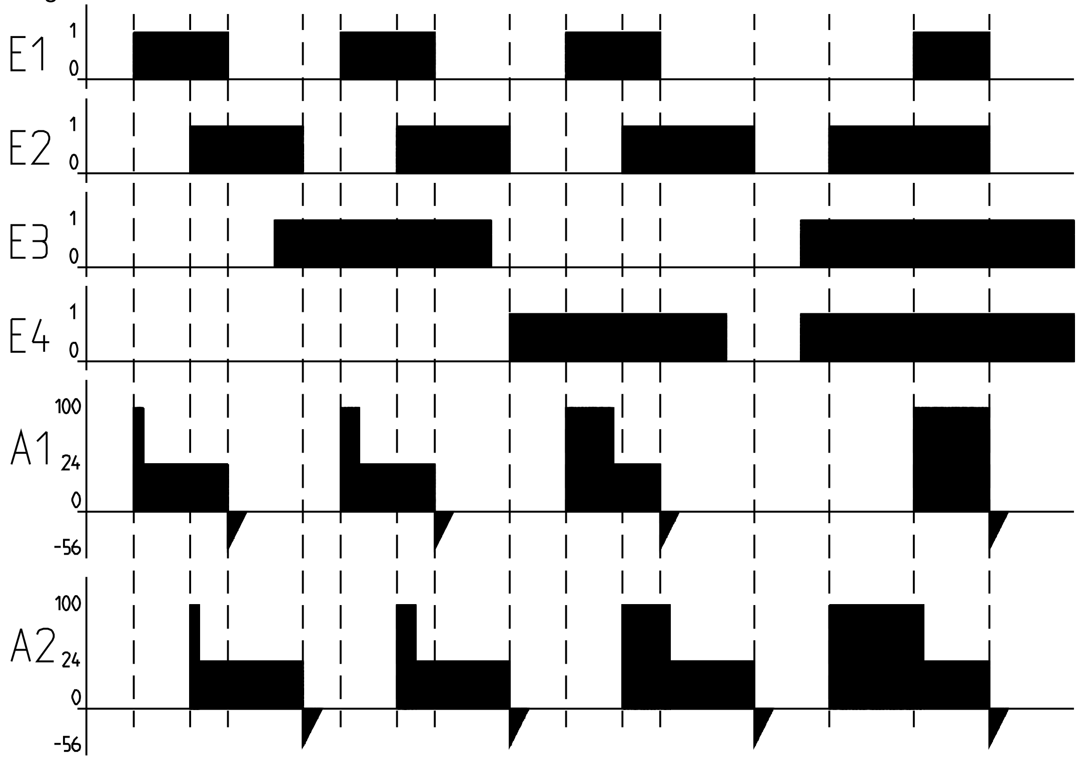
4.1. Switching mode 1

In the switching mode 1 (default) the input 1 (pin 1) is switched to output 1 (pin 7) and the input 2 (pin 2) is switched to output 2 (pin 8). The length of the impulse for the overload amplifier is set at inputs 3 and 4 (pin 3 and 4).

Switching mode 1



Time-diagramm



Input 3	Input 4	O-time*
0 VDC	0 VDC	1 ms
+24 VDC	0 VDC	2 ms
0 VDC	+24 VDC	5 ms
+24 VDC	+24 VDC	10 ms

*O-time: Duration of the overload amplification impulse

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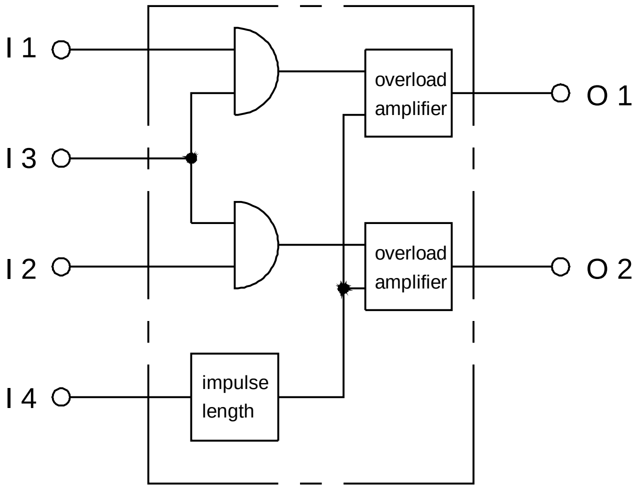
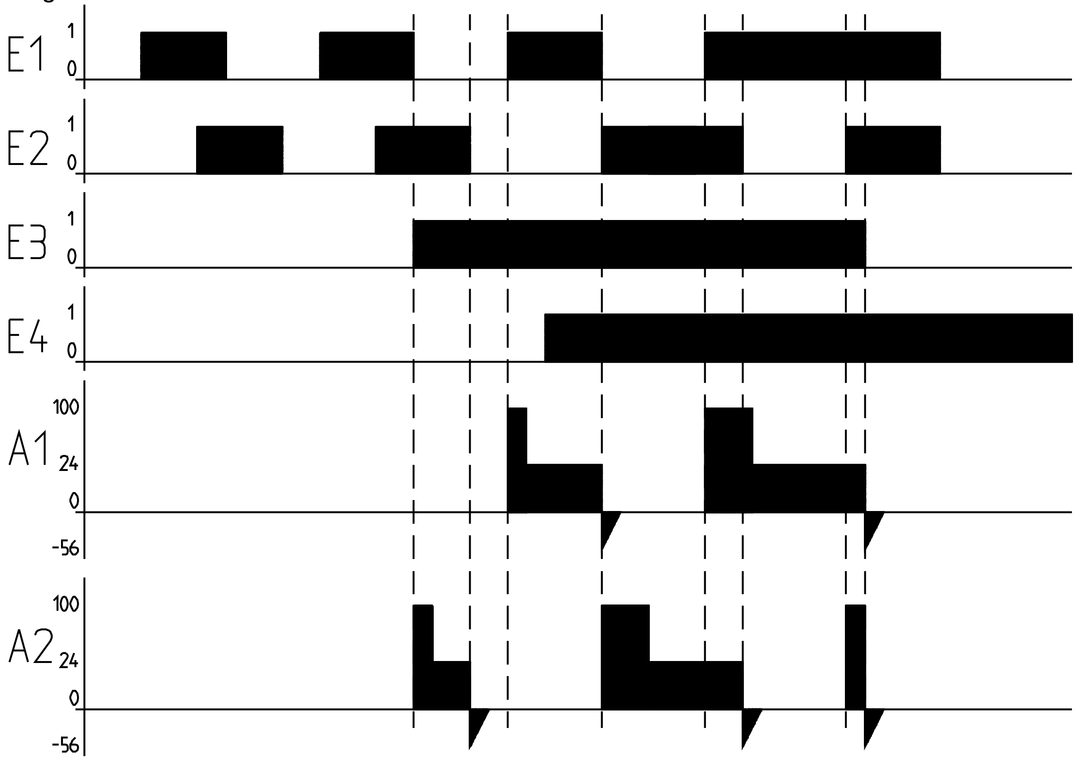
4.2. Switching mode 2

In the switching mode 2 eatures an enabling input I3 (AND - Linkage).

Switching mode 2



Time-diagramm



Eingang 4	O-time*
0 VDC	2 ms
+24 VDC	5 ms

*O-time: Duration of the overload amplification impulse

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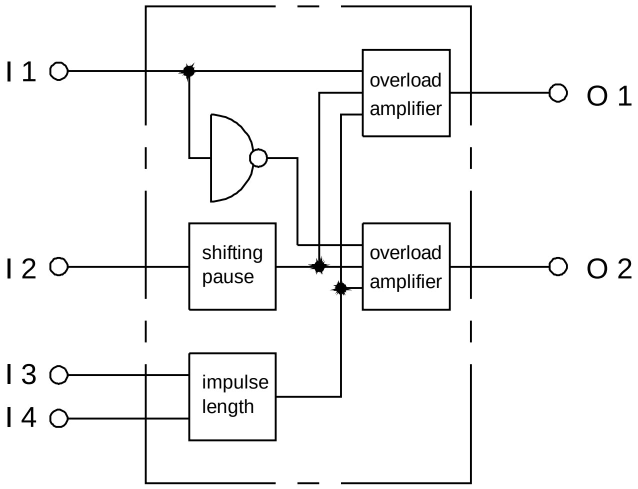
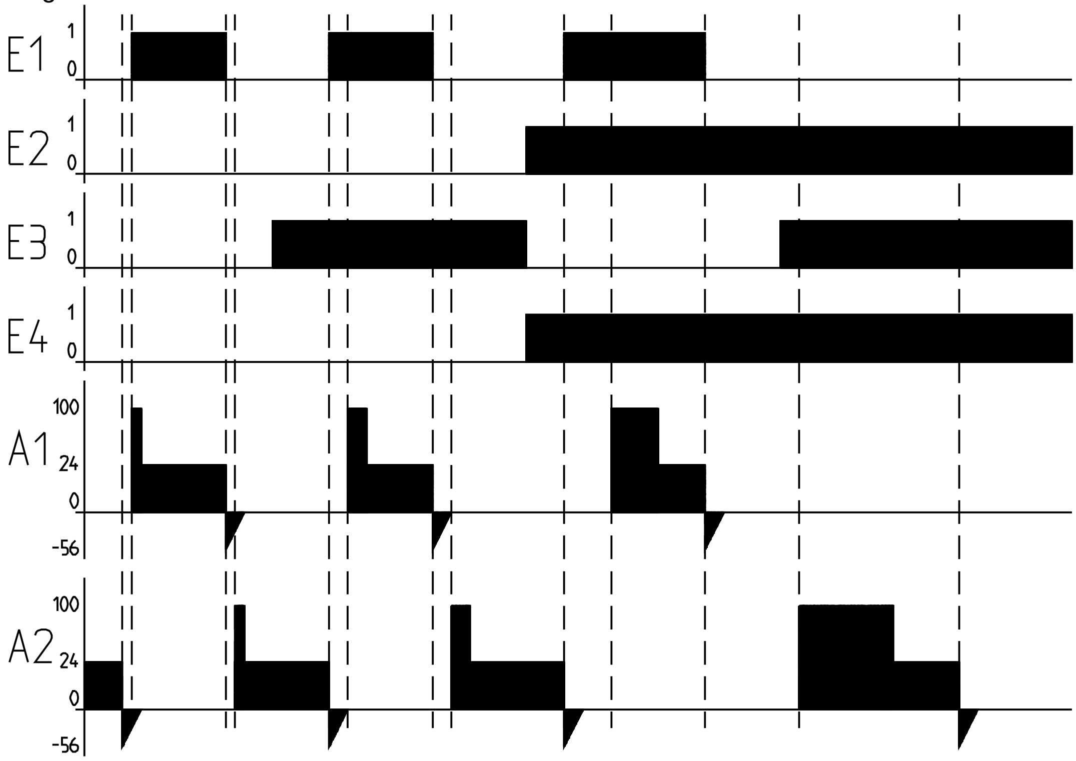
4.3. Switching mode 3

The switching mode 3 was especially develloped for double magnetic coils (driving elements).

Switching mode 3



Time-diagramm:



Input 3	Input 4	O-time*
0 VDC	0 VDC	1 ms
+24 VDC	0 VDC	2 ms
0 VDC	+24 VDC	5 ms
+24 VDC	+24 VDC	10 ms

Input 2	Pause**
0 VDC	O-time* x 2
+24 VDC	O-time* x 1

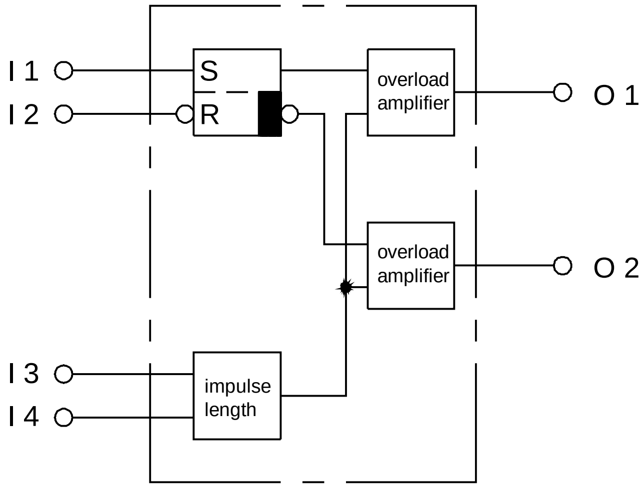
*O-time: Duration of the overload amplification impulse

**Pause: The time between the deactivation of the magnetic coil 1 and the activation of the magnetic coil 2 or reversed. It is the result of the O-time multiplied with 2 or 1.

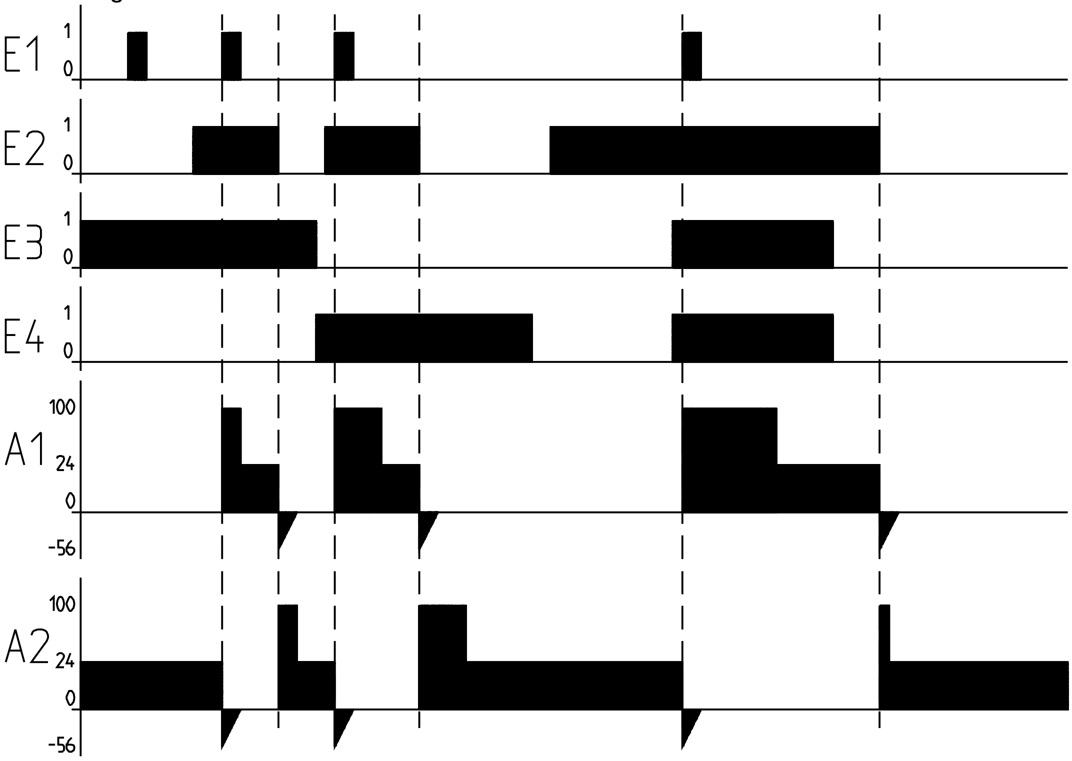
4.4. Switching mode 4

Switching mode 4 includes a SR flipflop logic (set-reset logic) with broken wire security for the reset-input.

Switching mode 4



Time-diagramm:



Input 3	Input 4	O-time*
0 VDC	0 VDC	1 ms
+24 VDC	0 VDC	2 ms
0 VDC	+24 VDC	5 ms
+24 VDC	+24 VDC	10 ms

*O-time: Duration of the overload amplification impulse

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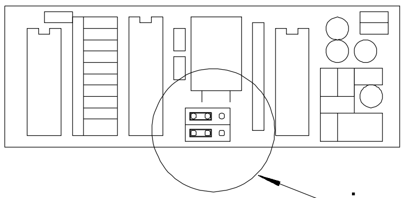
4.5. Setting of the switching modes in the DIGISPEED-DS1

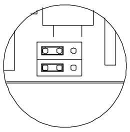
On the lower circuit board on the DIGISPEED-DS1 is a jumper field with which the four switching modes can be set. To allow the user and DIGISPEED-DS1 to go through this procedure without any risk, please heed the following:

The DIGISPEED-DS1 includes a condenser loaded with 100V overload amplifier voltage. This condenser **has to be** discharged first. To discharge the condenser, connect a resistor of 2.2kΩ to pins 6 and 10. After 10 sec. you can remove the resistor and check, if there is a voltage < 10V between pin 6 and pin 10. Now you can open the DIGISPEED-DS1 without any risk of danger.

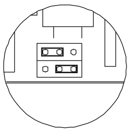
DIGISPEED-DS1 consists of two circuit boards. The lower one includes the jumper field. Both circuit boards are linked through a plug connector. After the circuit boards have been separated from another, the jumper field becomes visible at the lower board. Now you can select the desired switching mode by switching the jumpers.



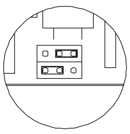
jumper area field



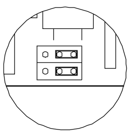
jumper areas in switching mode 1
(standard setting)



jumper areas in switching mode 2



jumper areas in switching mode 3



jumper areas in switching mode 4

Pay attention during the assembly that the two circuit boards are correctly set into the cabinet (compare pin numbers of the board and those of the cabinet). When assembling the bottom cover, the orange colored clip catch has to point in the direction of pins 6 to 10.

5. Commissioning

The device should be clamped upon an "EN"-carrier-rail in the circuit-chesrt (see chapter "9. Dimensions"on page 14). All wiring has to be done in cold state.
Connect DIGISPEED-DS1 in respect to the pin allocation at first with the lowest overload amplification time possible (operating a relay or a switching device without a freewheeling diode) and activating the machine, increasing the overload amplification time under consideration of the current recovery time, until you can make out no further improvement of the switching process and adjust the time back to the overload amplification time in which there was the last switching acceleration. It is unnecessary to increase the overload amplifier time above this point, as this only charges the switching devices and they use up faster. At an optimal adjustment of the overload amplifier time, you can generally dismiss the possibility of the devices being used up too fast.

⚠ ***Attention:*** *The connection of a light bulb, a valve plug with a built in LED or zener diode, or something similar to the output of the DIGISPEED-DS1 is not allowed and can lead to the destruction of the unit !!*
Interupting the connection between the DIGISPEED and the switching device while being under load can cause the unit's destruction! Avoid contact-switchings or connection hat could be interrupted while beeing under load absolutely!

If this is not possible, use protection switch directly at the switching device.sein.
The DIGISPEED-DS1 is not short circuit proof due to the high peak performances; please see to it at the activation, that you do not operate under voltage.

6. Recovery time for the DIGISPEED-DS1

The recovery time for the DIGISPEED-DS1 is needed for the continous recharging of the condenser to create the overload amplifier impulse, since after every initiation of such a surge impulse, the condenser has to recharge itself first. This means, that between two consecutive overload amplifier impulses, you have to wait for at least the time given in the table below.

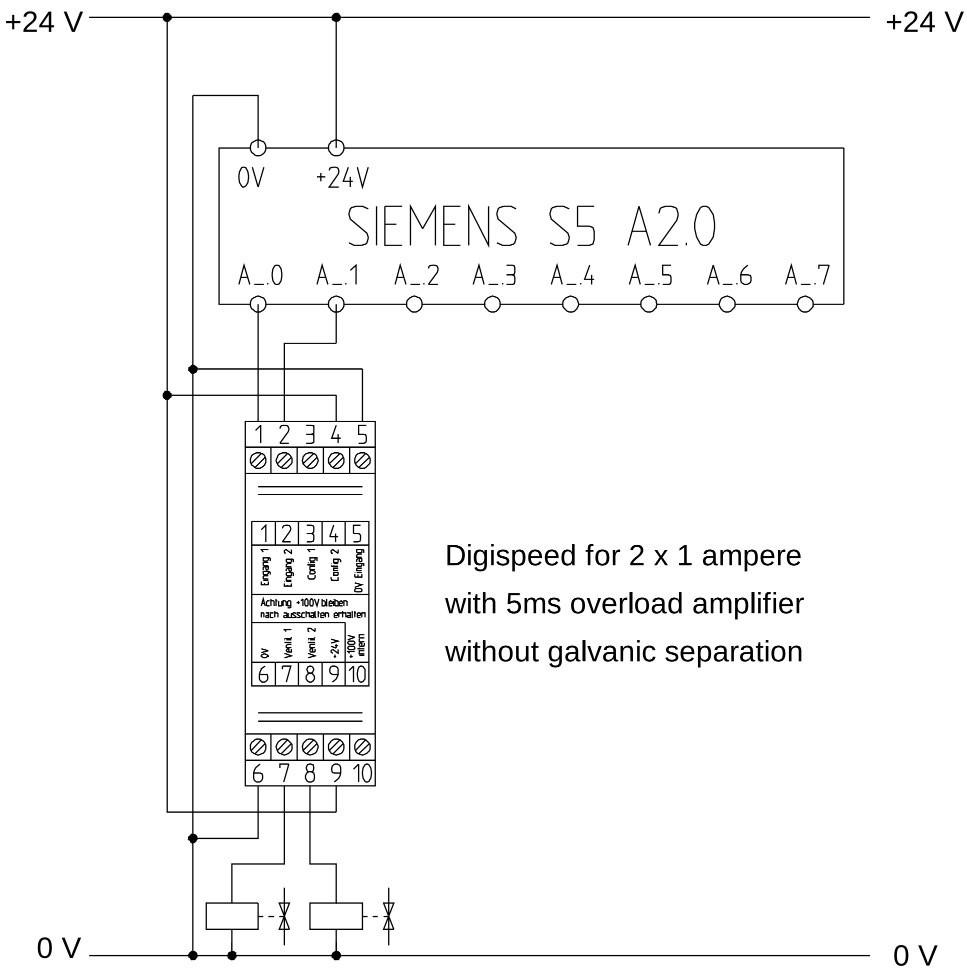
Current (mA)	O-time* 1 ms	O-time* 2 ms	O-time* 5 ms	O-time* 10 ms
100	4 ms	8 ms	20 ms	40 ms
200	8 ms	16 ms	40 ms	80 ms
300	12 ms	24 ms	60 ms	120 ms
400	16 ms	32 ms	80 ms	160 ms
500	20 ms	40 ms	100 ms	200 ms
600	24 ms	48 ms	120 ms	240 ms
700	28 ms	56 ms	140 ms	280 ms
800	32 ms	64 ms	160 ms	320 ms
900	36 ms	72 ms	180 ms	360 ms
1000	40 ms	80 ms	200 ms	400 ms

*O-time: Duration of the overload amplification impulse

7. Pin allocation

Pin 1	=	Input 1
Pin 2	=	Input 2
Pin 3	=	Input 3
Pin 4	=	Input 4
Pin 5	=	0V for Inputs
Pin 6	=	0V for supply voltage
Pin 7	=	Output 1
Pin 8	=	Output 2
Pin 9	=	+24V DC ±20% Supply voltage
Pin 10	=	**Do not connect !** (only for the discharging of the internal condenser)

8. Connection example



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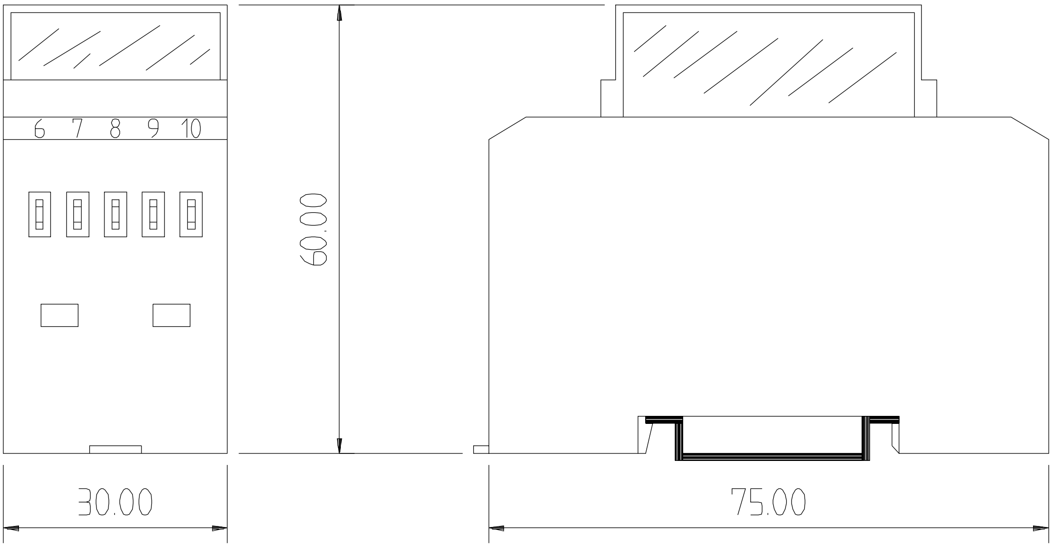
9. Dimensions



10. Technical data

Supply voltage	24V DC ±20%
Current absorbtion	up to 8A peak current in the switching moment
Number of inputs	4 programmable inputs, galvanically separated with 4 basic programs. **Example:** 2 switch inputs and 2 inputs that determine the time interval of the surge impulse
Input voltage	active 16-30V DC, passive 0-3V DC
Input resistance	2,2kΩ-2,5kΩ
Number of outputs	2
Surge impulse	80-100V DC
Duration of the surge impulse	programmable
Freewheel voltage	-56V DC
Output voltage	supply voltage -1V at 1A permanent current (with 24V DC at least 23V DC)
Output current	1A permanent current per output
Delay time	up to 100µs
Recovery time	see chapter 6. Recovery time
Cabinet	hardly flammable Thermoplast plastic; temperature up to 100°C
Conductor connections	five screw pins up to 2.5mm² in the grid measure of 5.08mm on both sides; including label
Assembly	comfortable clip-on assembly on symmetrical carrier rail by EN 50 022, leave at least 1cm space for air to circulate
Disassembly	by pulling back the orange colored clip catch
Dimesions	see chapter 9. Dimensions
Cover type	cabinet corresponds with IP 40, connection pins with IP 20
Operating temperature	0...+55°C
Weigth	about 110g