Digital Switching Accelerator

DIGI*SPEED*-DS2

for higher performance
Version 3+4 / Standard

Digitronic Automationsanlagen GmbH

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Notification

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The instruction booklet has been constructed exercising maximum care, but mistakes are not exactly out of the question. We are grateful for any hints concerning possible mistakes in the booklet.

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PROTECTION

Note: Digispeed is a registered trademark of the company Firma Digitronic Automationsanlagen GmbH.

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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-DS2 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-DS2 accelerates the break down of the magnetic field through a freewheel circuit of -56V DC and causes a reduction of the deactivation time.
After selecting a switching device, it needs only very little current to remain active. DIGISPEED-DS2 enables you to lower this current by up to 60%; this reduces the heating, power wastage and the deactivation time of the switching units.

Result: Through time interval controlled overload amplifiers, the lowering of the current of active outputs (holding current) and the regulation of the freewheel voltage to -56V DC, the DIGISPEED-DS2 lets switching devices that can be magnetically influenced switch up to ten times faster.

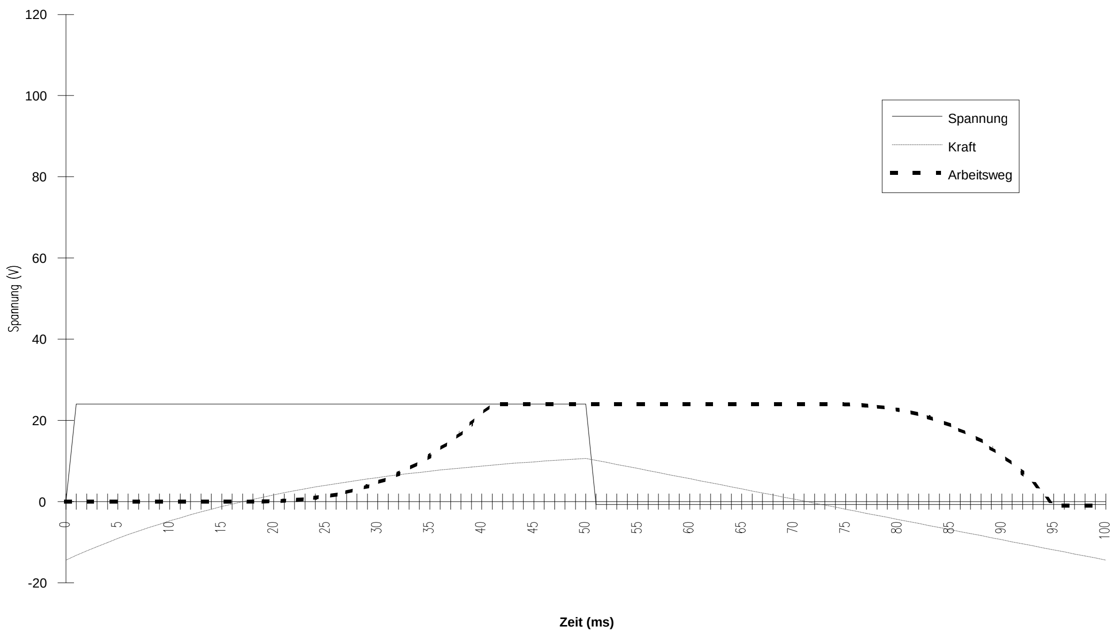
2. Features

* microprocessor controlled performance electronics for an exact reproduceable switching operation
* dual - channel version
* separate parameterization of the surge impulses for every channel per DIP switch
* separate parameterization of the holding current for every channel per DIP switchgetrennte Parametrierung des Haltestroms für jeden Kanal über DIP-Schalter
* reduction of the holding current without wastage through chopping
* short recovery time for the surge impulse
* high overload amplification voltage of 100V DC for fast activation
* high freewheel voltage of -56V DC for fast deactivation
* microprocessor controlled freewheel voltage
* galvanic separation of the inputs
* proper for switching devices up to 2 x 60 watt (2 x 2.5 ampere permanent current)
* 24V DC ±20% voltage supply without additional separat voltage
* automatic discharge of the 100V DC circuit at deactivation
* encasement with convenient clip - on assembly
* several encasements can be put in line easily
* Short-circuit and overload protection (only version 3+4)

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

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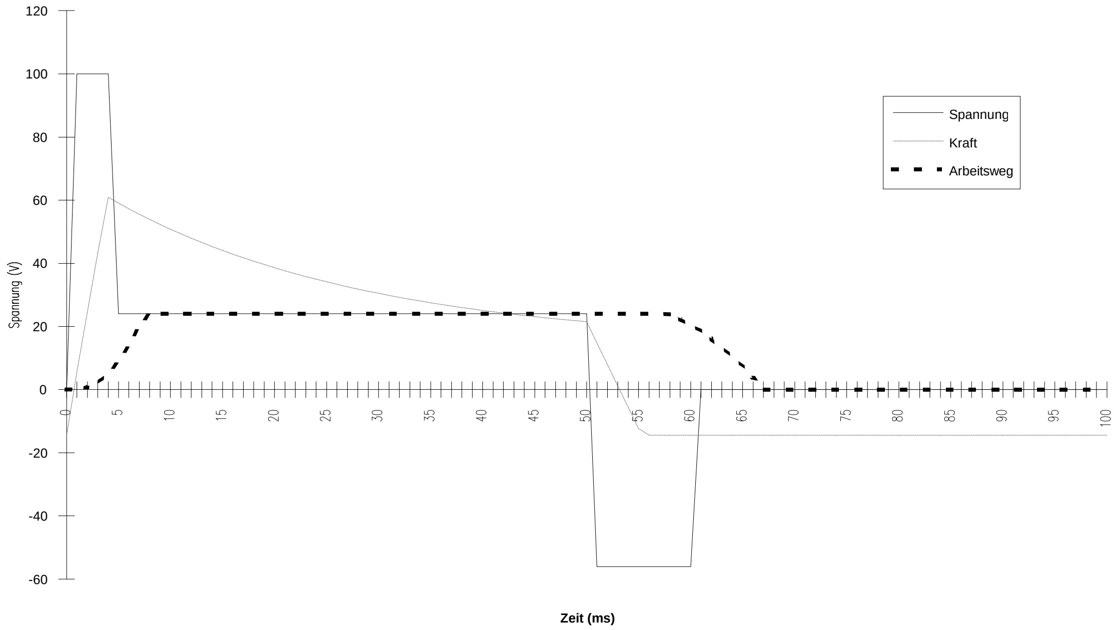
3.2. Activation and deactivation behavior of switching units with DIGISPEED-DS2

3.2.1. Overload amplifier and freewheel circuit

At the activation DIGISPEED-DS2 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-DS2 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.



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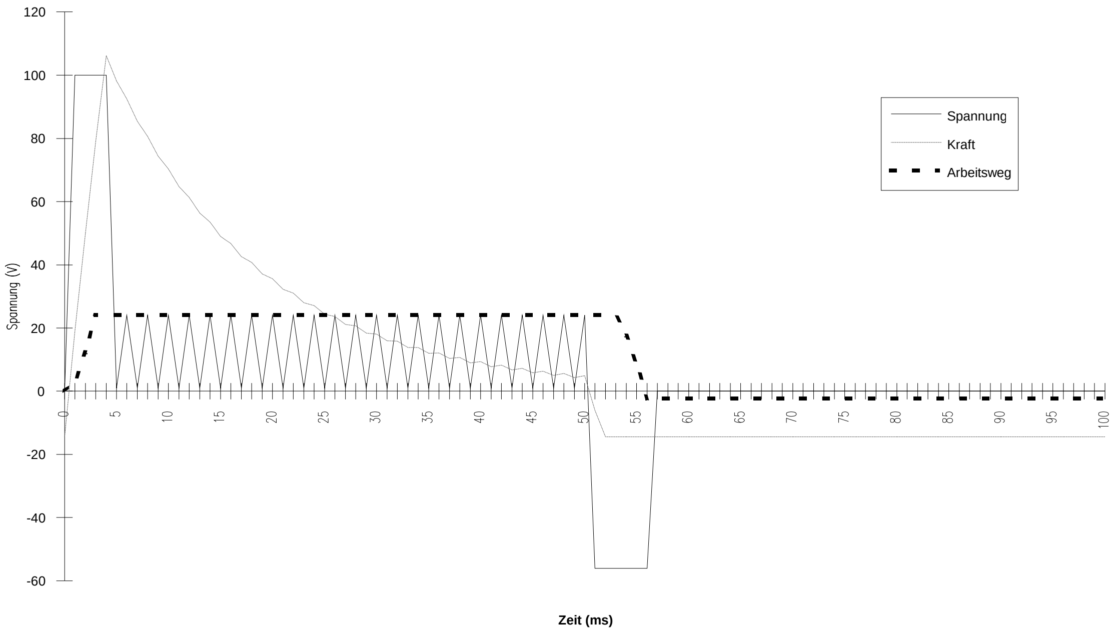
3.2.2. Reduction of the holding current

The DIGISPEED-DS2 grants the ability, through chopping (intermittent direct current), to reduce the holding current of the active switching device; this reduces the power wastages of the control and connected units to a minimum. It also reduces heating, performance delays and the deactivation time of the elements and switching units. Chopping means a very quick (de)activation of the supply voltage in the holding range of the switching device. This happens so fast that the connected element or relay cannot disconnect. To ensure a directed selection for every desired switching device, the input cycles (and with this the desired performance) can be set with the DIP switches. You can choose between three chopper variants: 80%, 60% and 40%. If more power is needed for greater loads, the chopping can be deactivated by setting the value to 100%.



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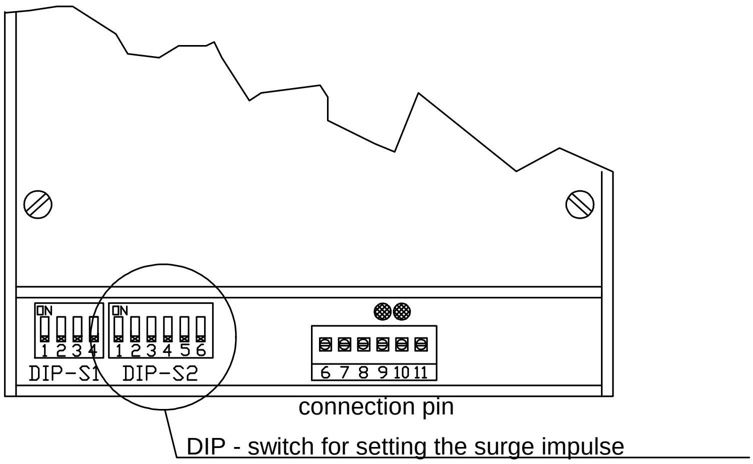
4. Setting the overload amplification time

The setting of the desired surge impulse duration is adjusted with the DIP switch with 6 poles (switch 1 to 6, see fig. below), that is situated next to the DIP switch with 4 poles on the circuit board. Both channels are set independently of one another (switch 1 - 3 ≡ chanal 1; switch 4 - 6 ≡ channel 2).



You can set up to eight different overload amplification times for each channel that are adjusted according to the following table.

O-time* (in ms)	Switch 1 (channel 1) Switch 4 (channel 2)	Switch 2 (channel 1) Switch 5 (channel 2)	Switch 3 (channel 1) Switch 6 (channel 2)
2	OFF	OFF	OFF
3	OFF	OFF	ON
5	OFF	ON	OFF
8	OFF	ON	ON
12	ON	OFF	OFF
18	ON	OFF	ON
25	ON	ON	OFF
35	ON	ON	ON

*O-time: Duration of the overload amplification impulse

Setting: Increase 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.

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5. Recovery time for the DIGISPEED-DS2

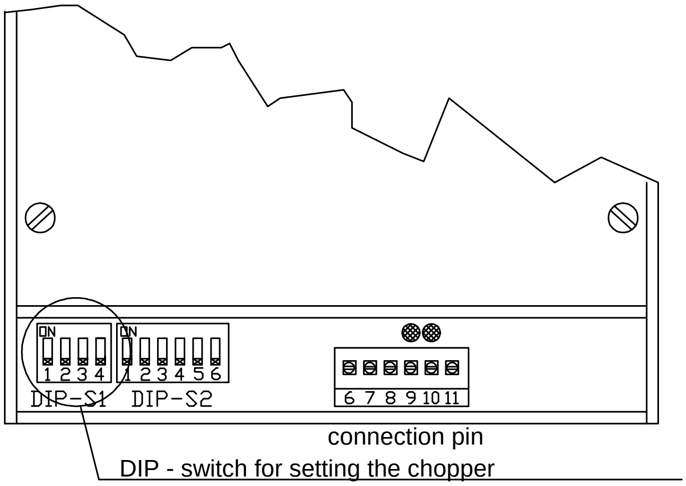
The recovery time for the DIGISPEED-DS2 is needed for the continous recharging of the condenser to create the overload amplifier impulse, since after every initiation of such a surge impulse, the condenser has to recharge itself first. This means, that between two consecutive overload amplifier impulses, you have to wait for at least the time given in the table below.

current (A)	O-time* 2ms	O-time* 3ms	O-time* 5ms	O-time* 8ms	O-time* 12ms	O-time* 18ms	O-time* 25ms	O-time* 35ms
0.250	3 ms	4 ms	7 ms	10 ms	15 ms	23 ms	32 ms	44 ms
0.500	5 ms	8 ms	13ms	20 ms	30 ms	45 ms	63 ms	88 ms
0.750	8 ms	12 ms	20 ms	30 ms	45 ms	68 ms	95 ms	132 ms
1.000	10 ms	15 ms	25 ms	40 ms	60 ms	90 ms	125 ms	175 ms
1.250	13 ms	19 ms	32 ms	50 ms	75 ms	113 ms	158 ms	219 ms
1.500	15 ms	23 ms	38 ms	60 ms	90 ms	135 ms	188 ms	263 ms
1.750	18 ms	27 ms	45 ms	70 ms	105 ms	158 ms	220 ms	307 ms
2.000	20 ms	30 ms	50 ms	80 ms	120 ms	180 ms	250 ms	350 ms
2.250	23 ms	34 ms	57 ms	90 ms	135 ms	203 ms	282 ms	394 ms
2.500	25 ms	38 ms	63 ms	100 ms	150 ms	225 ms	313 ms	438 ms

*O-time: Duration of the overload amplification impulse

6. Setting of the chopper

Both channels can be adjusted independently of one another with the DIP switch with four poles (see fig. below); the first two switches (1 and 2) adjust channel 1 and the other two switches (3 and 4) adjust channel 2.



For every channel you can set the four following switch positions.

Holding current div. by chopper in %	Switch 1 (channel 1) Switch 3 (channel 2)	Switch 2 (channel 1) Switch 4 (channel 2)
100	OFF	OFF
80	OFF	ON
60	ON	OFF
40	ON	ON

Setting: To ensure a perfect operation of the switching devices, the assemblies should at first be set to maximum performance (setting "100%") and afterwards determine the needed power by reducing the chopper value step by step. Of course this can be done during operation. If during this process one switching device deactivates, the needed power is not supplied any more. If you now set the chopper back by one step and the switching device reactivates, you have found the perfect setting. If you have followed this procedure and the switching unit does not react accordingly, you can raise the activation power by increasing the overload amplification time. In case you notice during operations, that the holding power of the switching unit is not enough, you have to set the chopper back by one step.

7. Commissioning

Connect DIGISPEED-DS2 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.

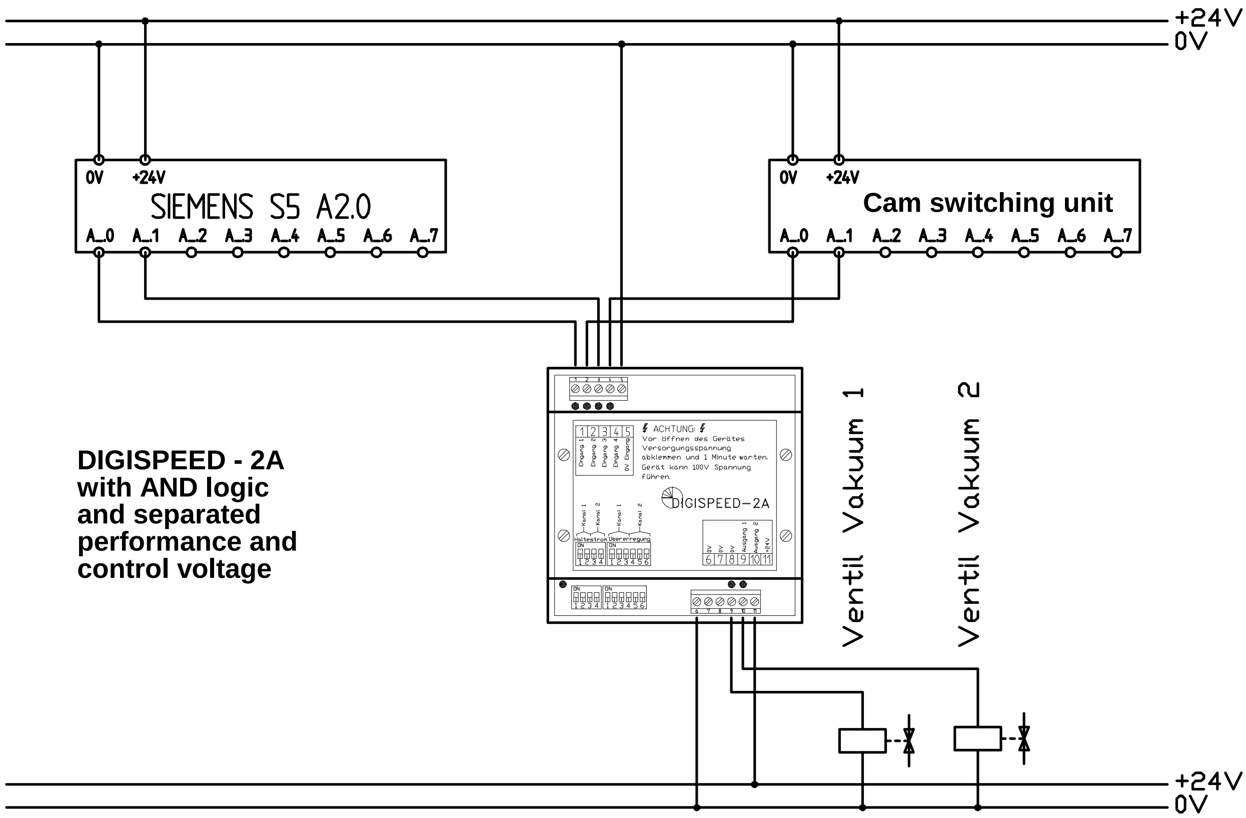
Attention: *The connection of a light bulb, a valve plug with a built in LED or zener diode, or something similar to the output of the DIGISPEED-DS2 is not allowed and can lead to the destruction of the unit !! The DIGISPEED-DS2 is not short circuit proof due to the high peak performances; please see to it at the activation, that you do not operate under voltage.*

8. 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	=	0V for output 1
Pin	8	=	0V for output 2
Pin	9	=	output 1
Pin	10	=	output 2
Pin	11	=	+24V DC ±20% / min. 10 Amp. supply voltage

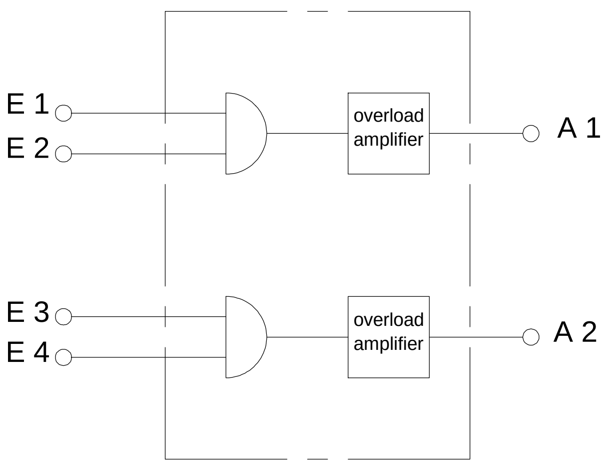
Attention: **A discharging circuit becomes active after the deactivation, that discharges those elements charged with 100V; because of this you should let 1 minute elapse before opening the cabinet. Repeated deactivations within one minute should be avoided, as this can overload the discharging circuit.**

9. Connection example



10. Switching pattern

The inputs of every channel are linked through an AND logic (see fig. below). This enables the user to perform time critical logic functions outside a PLC stressed by cycle time. If different logic types are needed (e.g. SR-logic or dual magnetic coil driving elements), you have to substitute a different microprocessor (order optionally).



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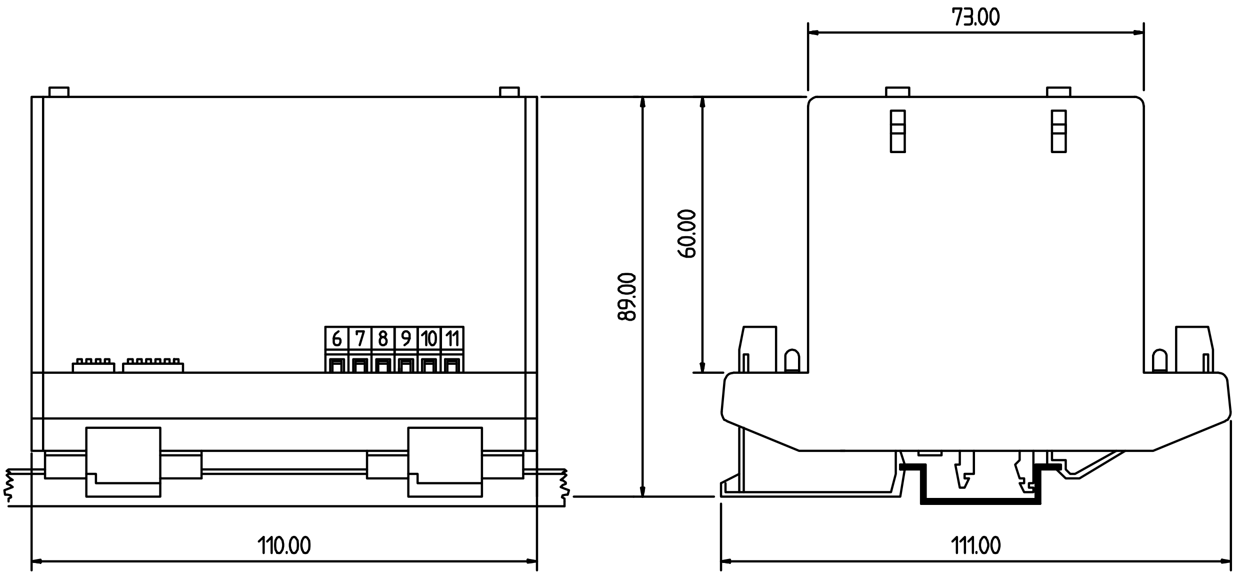
11. Dimensions



The following carrier rail can be used for the attachment of the cabinet
- carrier rail NS 35/7.5 (DIN 50022)
- carrier rail NS 35/15 (DIN 50022)
- carrier rail NS 32 (DIN 50035)

12. Technical Data

Supply voltage............................	24V DC ±20% min. 10 Amp.
Current absorbtion	up to 20A peak current by power up up to 9A peak current in the switching moment
Number of inputs	4, galvanically separated
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...	can be set from 2ms to 35ms with the DIP switch in 8 steps
Reduction of the hold. current...	through chopping of the output voltage at 8000Hz, can be set to 100%, 80%, 60% or 40% with the DIP switch
Freewheel voltage......................	about -56V DC
Output voltage............................	supply voltage minus 1V voltage loss (internal) at 2.5A (with 24V DC at least 23V DC)
Output current............................	2,5A permanent current per output
Delay time................	up to 100µs
Recovery time	see chapter 5. Recovery time for the DIGISPEED-DS2
Cabinet......................................	hardly flammable Thermoplast plastic, temperature up to 100°C
Conductor connections	five screw pins of up to 2.5mm² in the grid measure of 5.08 mm on both sides; including label
Assembly	comfortable clip-on assembly on symmetrical carrier rail by EN 50 022, can be put in line easily
Disassembly...............................	by pulling back the two clip catches
Dimensions	see chapter 11. Dimensions
Cover type..................................	cabinet corresponds with IP 20, connection pins with IP 20
Operating temperature..............	0 +55°C
Weight.......................................	about 410g

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