
FA 9001

Frequency to Analogue Converter

Instruction Manual



ERMA

Electronic GmbH

Warranty

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All products from ERMA-Electronic are warranted against defective material and workmanship for a period of two (2) years from date of delivery. If it is necessary to return the product to ERMA, the sender is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit. ERMA's warranty does not apply to defects resulting from action of the buyer, such mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorized modification.

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CONTENTS

1. Description	3
2. Safty instructions	4
2.1. Symbol explanation	4
3. Mounting	5
3.1. Place of operation	5
3.2. Mounting of signal converter	5
4. Electrical connections	6
4.1. General instructions	6
4.2. Hints against noisy environment	6
5. Function	7
6. DIP-switch configuration	8
7. Connection and pin assignment	10
7.1. Connection of an encoder	10
7.2. Conection of power supply	10
7.3. Pin assignment of the analogue output	11
8. Startup Procedure	11
9. Handling of misfunctions	11
10. Technical Datas	12
10.1. Elektrical Datas	12
10.2. Mechanical Datas	12
10.3. Environmental Conditions	12
11. Ordering information	13
12. Notices	13

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1. Description

1. Description

The converter **FA 9001** is a frequency to analog converter designed to generate a output current proportional to an input frequency. When using incremental encoders it is possible to obtain an output signal proportional to a velocity or revolutions per minute.

Applications

- Measurement of velocity
- Measurement of r.p.m.

The functional structure of the converter is shown in figure 1. There are two input channels provided. These input channels are optically isolated from the internal circuitry.

The inputs channels are supplied with resistor networks. These network can be used as voltage divider. By this way different input voltage levels can be realized. In addition a high noise immunity will be reached. The input voltage range may be in the range from 5 V to 48 V. When ordering the desired input voltage value must be specified.

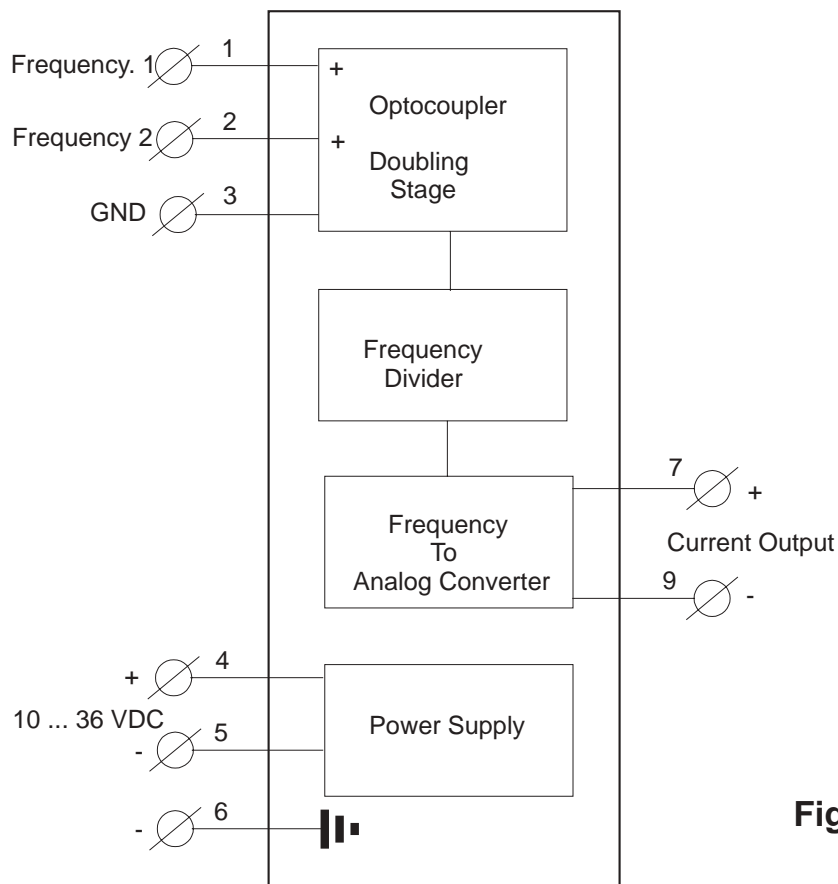


Figure 1

2. Safety instructions

This instrument is produced in accordance with Class II of IEC 348 and VDE 0411. When delivered the instrument has been tested to meet all functions described. Before installing the instrument please read the mounting and servicing instructions. We have no liability or responsibility to customer or any other person or entity with respect to any liability, loss or damage caused or alleged to be caused directly or indirectly by equipment or software sold or furnished by us. Read the installation instruction carefully. No liability will be assumed for any damage caused by improper installation. Inspect the instrument module carton for obvious damage. Be sure there are no shipping and handling damages on the module before processing. Do not apply power to the instrument if it has damaged.

ERMA's warranty does not apply to defects resulting from action of buyer, such as mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorized modifications.

2.1. Symbol explanation



Caution



Attention



Instruction



Tip

Caution: Will be used at **dangerous for life and health !**.

Attention: Will cause **damage**

Instruction: If not noticed, **trouble** may occur

Tip: Useful hints for **better operation**

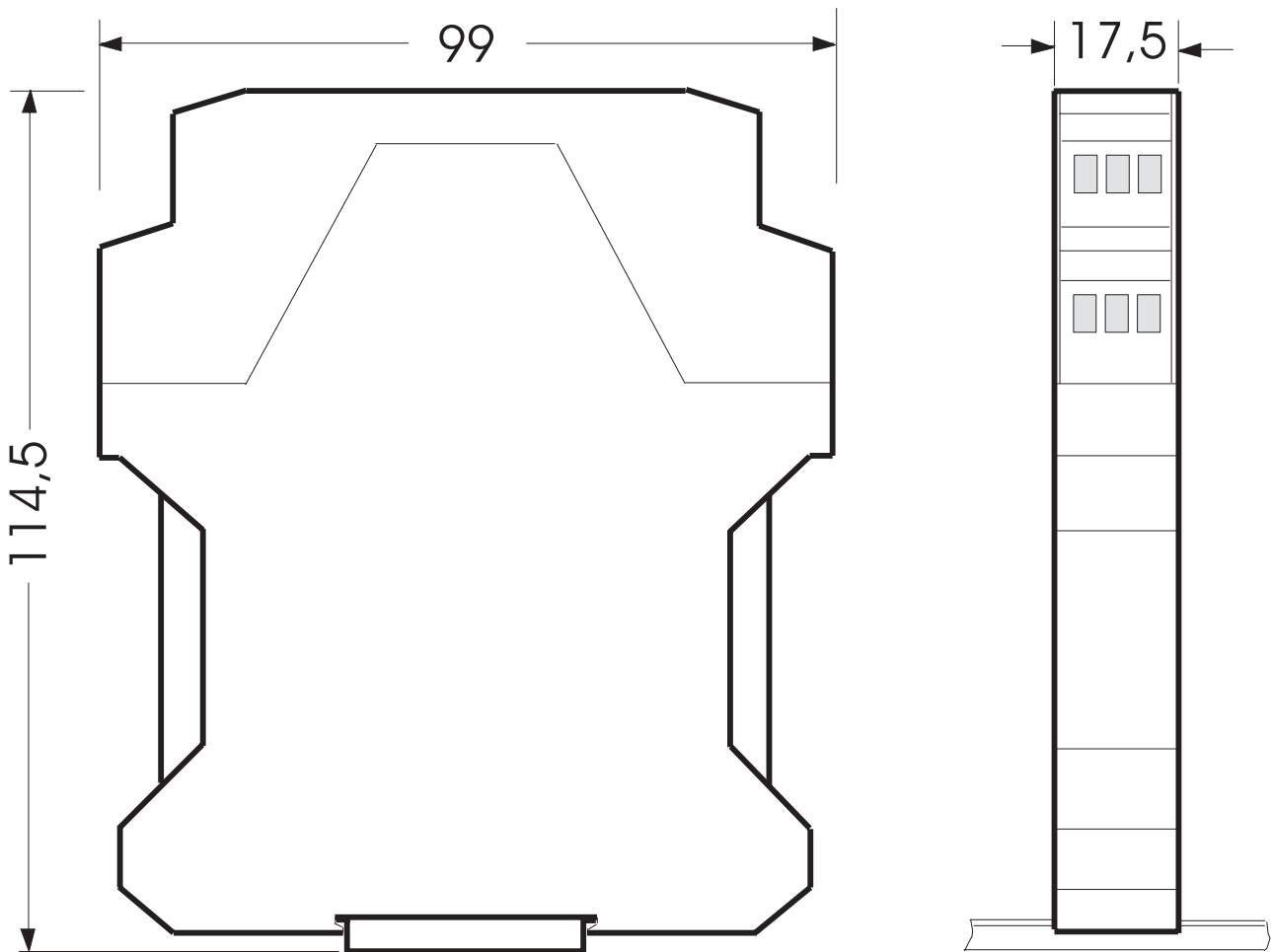
3. Mounting

3.1. Place of operation

Attention must be paid to the protection against humidity, dust and high temperatures at the place of operation.

3.2. Mounting of signal converter

- Through simple snap up at 35 mm rail (DIN EN 50022).



4. **Electrical connections**

4.1. **General instructions**



- It is forbidden to plug or unplug terminals with voltage applied.
- Attach input and output wires to terminals only without voltages applied.
- Cords must be provided with sleeves.
- Attention must be paid that the power supply voltage applied will agree with the voltage noticed at the name plate.
- The instrument has no power-on switch, so it will be in operation as soon as the power is connected.

4.2. **Hints against noisy environment**

All inputs and outputs are protected against noisy environment and high voltage spikes. Nevertheless the location should be selected to ensure that no capacitive or inductive interference can have an effect on the instrument or connection lines.

It is advisable:

- To use shielded cables.
- The wiring of shields and ground (0V) should be star-shaped.
- The distance to interference sources should be as far as possible. If necessary, protective screen or metal enclosures must be provided.
- Coils of relays must be supplied with filters.
- Parallel wiring of input signals and AC power lines should be avoided.
- The parallel output lines must be as short as possible.
- It is necessary to use shielded twisted pair cable for the RS422-lines as well as for the SSI signal lines.



5. Function

The functional structure of the converter is shown in figure 2. There are two input channels provided. The input frequencies come to a doubling stage. Attention must be paid, that the pulse width high to low is about 50% (180° or 1/2 cycle). If both input channels are used the second input pulse must have 90° degrees out of phase.

When input frequencies have passed the doubling stages the output frequencies of the doubling stages are added. By this way input frequencies can be quadrupled. The quadrupled frequency comes to a frequency divider. The frequency divider is programmable. Programming is done by an internal 8-pole DIP-switch. With the aid of the DIP-switch input frequency can be divided by values from 1 to 255. The output pulses of the frequency divider gets to the frequency to analog converter. The frequency to analog converter generates a voltage which is proportional to the output frequency of the frequency divider. The output voltage of the frequency to analog converter is controlling a voltage to current converter.

The frequency to analog converter is configured in this way that an input frequency of 500 Hz is generating an output current of 20 mA. If the input frequencies at both input channels are 25 kHz (=100 kHz at the input of the converter) and the user wants an output current of 20 mA, the frequency divider must be programmed with the value 100.

The range of the output current can be chosen between 0...20 mA or 4...20 mA. When ordering the desired output current range must be specified. The output current is isolated from the input channels as well as from the power supply. The max. current load resistor is 1 k Ohm.

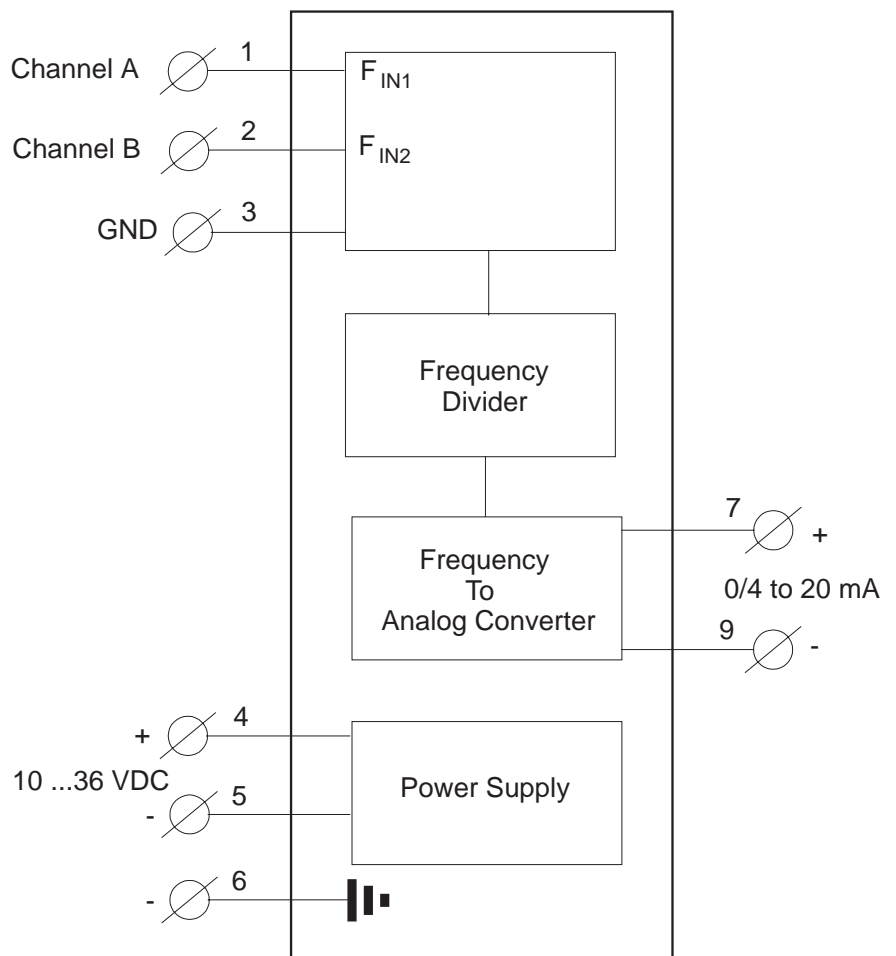


Figure 2

6. **DIP-switch configuration**

With the aid of the DIP-switch input frequency can be divided by 1 ... 255. The DIP-switch is located internal. For the configuration of the DIP-switch the device must be opened. This can be done with the aid of a screw driver by unlocking the latches on both sides (see picture 1).

The internal frequency to analog converter is optimized for an input frequency of 500 Hz. 500 Hz at the input of the internal converter means 20 mA current at the external output terminals 7 and 9.

The external applied frequencies at the terminals 1, 3 respectively 2, 3 are duplicated. If only **one** input channel is used the internal frequency is **two times** of the external applied frequency. If **both** channels are used, the internal frequency is **four times** of the external applied frequency.

For a distinct assignment between the applied frequency and the desired output current the frequency divider must be adjusted in the correct manner. The DIP-switches are binary coded as shown in table 1.



Picture 1

Programming hints

Example 1

If one input channel is used and the applied frequency range is 0 to 15 kHz and the output current at 15 kHz shall be 20 mA, the divider "D" must be adjusted as shown:

$$D = 2 \times F_{in} / 1\text{kHz} = 2 \times 15\text{kHz} / 1\text{kHz} = 30$$

Example 2

If both input channels are used and the applied frequency range is 0 to 750 Hz and the output current at 750 Hz shall be 20 mA, the divider "D" must be adjusted as shown:

$$D = 4 \times F_{in} / 1\text{kHz} = 4 \times 750 \text{ Hz} / 1\text{kHz} = 3$$

6. DIP-switch configuration

Solution of example 1

To adjust the calculated divider value several switches must be combined. The divider value of 30 can be realized by adding the values:

$$16 + 8 + 4 + 2 = 30$$

That means: in order to realize the divider value of 30 the DIP-switches 5, 4, 3, and 2 must be switched on.

Solution of example 2

The divider value of 3 can be realized by adding the values:

$$2 + 1 = 3$$

In that case the DIP-switches 2 and 1 must be switched on.

Table 1

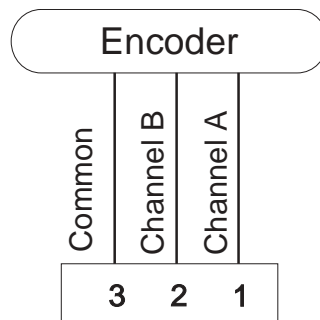
DIP-switch number	Value of the switch
1	1
2	2
3	4
4	8
5	16
6	32
7	64
8	128

7. Connection and pin assignment

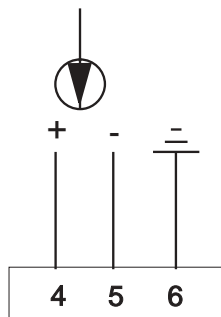
Plug-in screw terminal assignment:

1	Input Channel A	7	Output Current (+)
2	Input Channel B	8	nc
3	Input Channels GND	9	Output Current (-)
4	Power supply voltage DC (+)	10	nc
5	Power supply voltage DC (Gnd)	11	nc
6	Ground connection	12	nc

7.1. Connection of an encoder

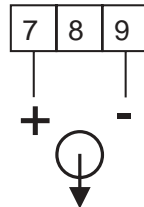


7.2. Connection of power supply



7.3. Pin assignment of the analogue output

Current 0(4) .. 20 mA



8. Startup Procedure

Attention must be paid that power supply voltage applied will agree with the voltage noticed at the name plate.

When delivered, the instrument is adjusted with a standard configuration (default value of the divider = 1). By changing the adjustment the customer can alter the standard configuration according to his measuring task.

Attention ! When the instrument is built in a machine and the customer wants to change the configuration, attention must be paid, that no damage will occur to the machine!

9. Handling of misfunctions

All devices of ERMA-Electronic GmbH are tested for perfect function during production as well as when delivered. Nevertheless it is possible that a device won't work. That is not always a reason by the new device. There are many small reasons that will result in misfunctions. If the FA 9001 won't work properly, please check the following points.

- Look for proper supply voltage
- Look for proper wiring of supply
- Look for proper configuration of the divider value
- Look if high voltage spikes are existing and have an influence to the device.

If all tests are all right, the device must be send back for controlling.

10. Technical Datas

10.1. Elektrical Datas

Input Channels

Voltage	: 5 ... 48 V DC
Current	: 5 mA
Max. Frequency	: 25 kHz
Accuracy	: better 0.2%
Span tempco	: 50 ppm/ °C max.
Isolation voltage	: 500 V

Output

Current	: 0 to 20 mA or 4 to 20 mA
Max.- Resistance	: 1 k Ohm
Isolation voltage	: 500 V

Supply Voltage DC

Power consumption	: max. 135 mA (10 V DC)
Isolation voltage	: 500 V / 1 min

10.2. Mechanical Datas

Case	: DIN rail mounting DIN EN 50022
	: 35 mm
Dimensions (W x H x D)	: 114.5 x 99 x 17.5 mm
Weight	: appr.100 g
Connection	: screw terminals

10.3. Environmental Conditions

Operating temperature	: 0 .. 50 °C
Storage temperature	: -20 .. 70 °C
Humidity	: < 80 %, not-condensing
SProtection	: class II
Field of application	: class 2
	: overvoltage protection II
CE	: in conform with 89/336/EWG
	: NSR 73/23/EWG

11. Ordering information

Ordering Guide

FA 9001 -	0		
			Current Output
		0	0...20 mA
		1	4...20 mA
			Frequency Input
		0	24 V
		1	12 V
		2	5 V
		3	48 V
			Power Supply
		0	10 ... 36 V DC

12. Notices

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