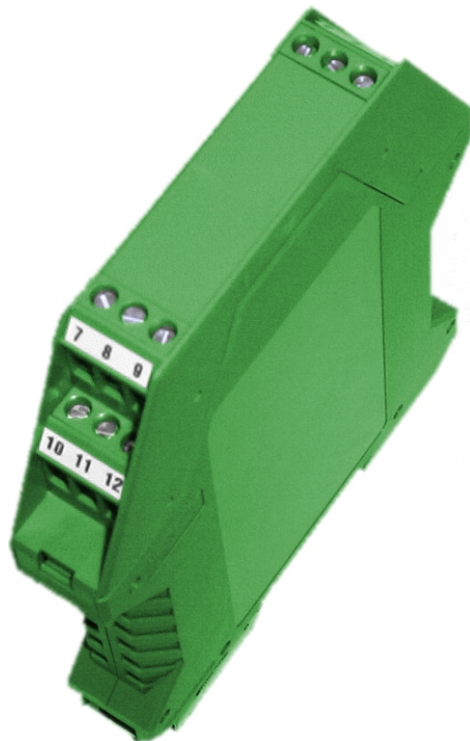# FA 9002
Frequency to Analogue Converter

Instruction Manual

ERMA

Electronic GmbH

Warranty

For delivered products our "Allgemeine Lieferungs- und Zahlungsbedingungen" are effective. In no event we or our suppliers shall be liable for any other damages whatsoever (including, without limitation, damages for loss of business profits, business interruption or other pecuniary loss) arising out of or inability to use this product.

All our products 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, the sender is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit. The warranty does not apply to defects resulting from action of the buyer, such as mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorized modification.

Trademarks
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CONTENTS

1.   Description

The converter **FA 9002** is a frequency to analog converter designed to generate a output voltaget 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 cuircuitry.
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 is adjustable to 5 V, 12 V or 24 V.

Figure 1

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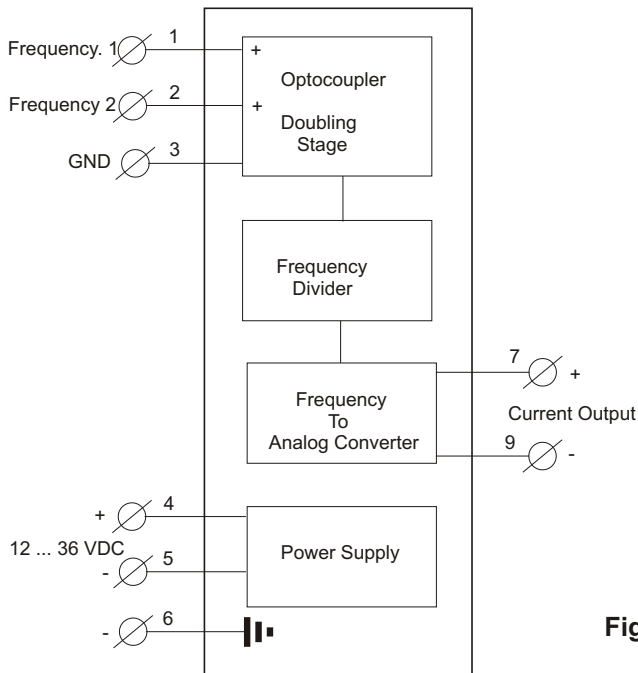
2. *Safety instructions*

This instrument is produced in accordance with Class II of IEC 348 and VDE 0411. When delivered the intrument 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 liablity, 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 shure 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
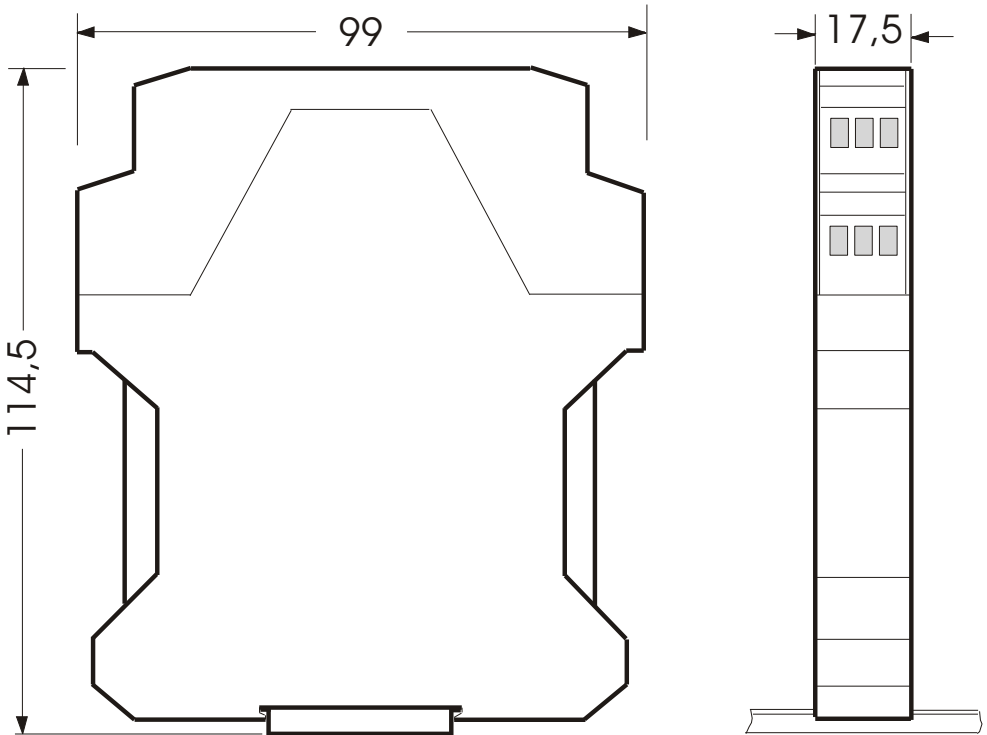
Tip: Useful hints for **better operation**

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).

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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 groung (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 Voltage 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 voltage of 20 mA, the frequency divider must be programmed with the value 100.

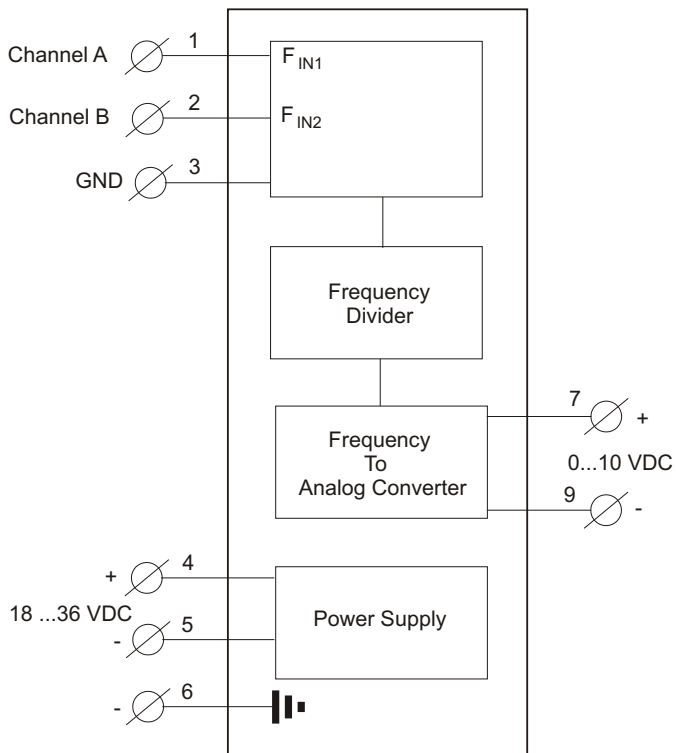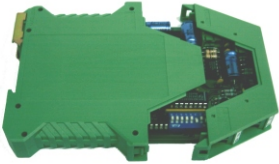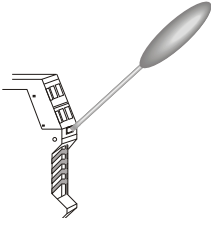The output voltage is isolated from the input channels as well as from the power supply.

Figure 2

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6. *Jumper and 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. To open the Housing of the FA9002 only a small screwdriver is needed. With the screwdriver the two little flat links between the top and the base of the housing have to be pressed inwardly on both sides. When the flat links were pressed, the top can be separated from the base. Now, the PCB can be pulled out together with the top of the housing. Look for the possible DIP switch settings in the illustration on the bottom of this page. To put the housing together again just push the top with the PCB inside the base until the flat links snap in on both sides.
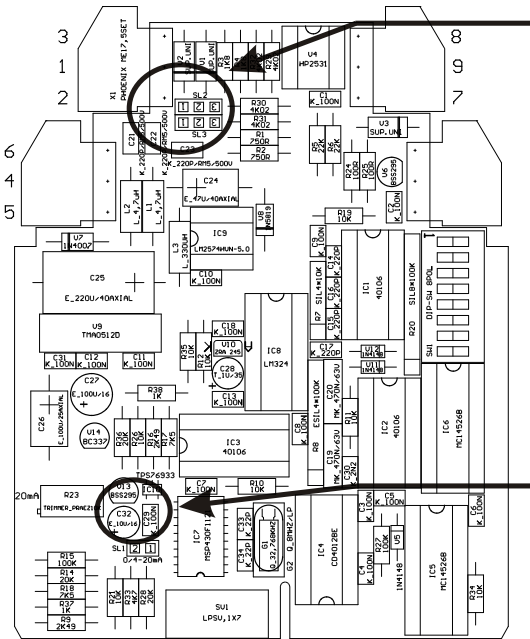
Jumper Input voltage level (SL2 un SL3)
No jumper (default): 24 V Input level

SL2 1 2 3
SL3 1 2 3

Jumper 2-3 SL2 }
Jumper 2-3 SL3 } 12 V Input level

SL2 1 2 3
SL3 1 2 3

Jumper 1-2 SL2 }
Jumper 2-3 SL3 } 5 V Input level

SL2 1 2 3
SL3 1 2 3

Jumper analog output (SL1)
No jumper (default): 0-10 V

SL1 2 1

Jumper 2-1 SL1:   2-10 V

SL1 2 1

6.1. *Jumper settings for input voltage level and analog output*

The FA9002 can be adjusted to the input voltage level. It is also possible to select the range of the analog output. All possible jumper settings are shown in the picture below.

6.2. *DIP-switch settings for dividing factor*

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 at the external output
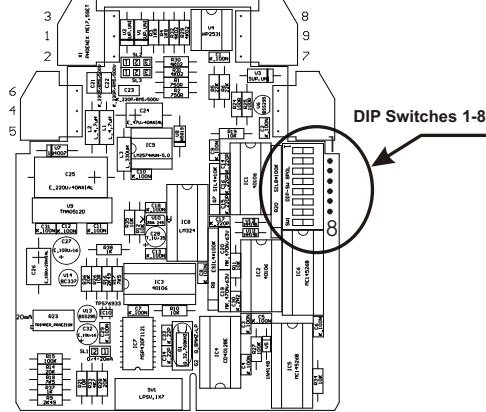
terminals 7 and 9.

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 freqency.

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

Formula to calculate the dividing factor (one input)

$$D = 2 \text{ x Fin} / 1 \text{ kHz}$$

Example 1

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

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D = 2 x Fin / 1kHz = 2 x 15kHz / 1kHz = 30

Formula to calculate the dividing factor (two inputs)

D = 4 x Fin / 1 kHz

Example 2
If both input channels are used and the applied frequency range is 0 to 750 Hz and the output voltage at 750 Hz shall be 20 mA, the divider "D" must be adjusted as shown:

D = 4 x Fin / 1kHz = 4 x 750 Hz / 1kHz = 3

DIP switch settings for 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.

DIP switch settings for 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

7.1.   Plug-in screw terminal assignment:

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

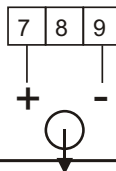### 7.2.   Connection of input signals
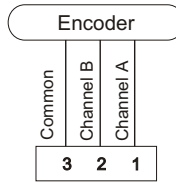
7.3.   Conection of power supply
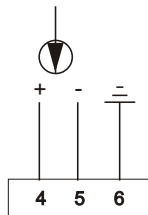
7.4.

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 intrument 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 allways a reason by the new device. There are many small reasons that will result in misfunctions. If the FA 9002/S01 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 controling.

10. *Technical Datas*

10.1. *Elektrical Datas*

Input Channels
  Voltage : 5, 12 or 24 V DC
  Current : 5 mA
  Max. Frequency : 50 kHz (Single Channel Mode)
: 25 kHz (Two Channel Mode)
  Accuracy : better 0.2%
  Span tempco : 50 ppm/ °C max.
  Isolation voltage : 500 V
Output
  Current : 0/4 to 20 mA
  Max.- Resistance
: 1 k Ohm
  Isolation voltage : 500 V
  Response time : 200 ms + period time
  Ripple : max. 20   A
Supply Voltage DC : 18 ... 36 V DC
  Power consumption : max. 40 mA (24 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 applicationt : class 2
: overvoltage protection II
  CE : in conform with 89/336/EWG
: NSR 73/23/EWG

11. *Ordering information*

Ordering Guide

FA 9002 -				
			Analog Output	
			0	500 Hz = 20 mA
			1	50 Hz = 20 mA
			2	5 Hz = 20 mA
		Max. Input Frequency		
		0	50 kHz (E1 or E2), 25 kHz (E1 and E2)	
		1	reserved	
		2	reserved	
		3	reserved	
	Power Supply			
	0	18 ... 36 V DC, (standard)		
	1	4,5 ... 9 V DC, (option)		
	2	9 ... 18 V DC, (option)		
	3	36 ... 48 V DC, (option)		

12. *Notices*

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