

KÜPPERS

Analog frequency evaluation system

HMA 21

The HMA 21 series of equipment is for converting signals, which exist as frequencies, generated for example by turbine- gear- or other types of volume counters or by inductive or optical speed pick ups. Modules of the HMA 21 series can have the following functions:

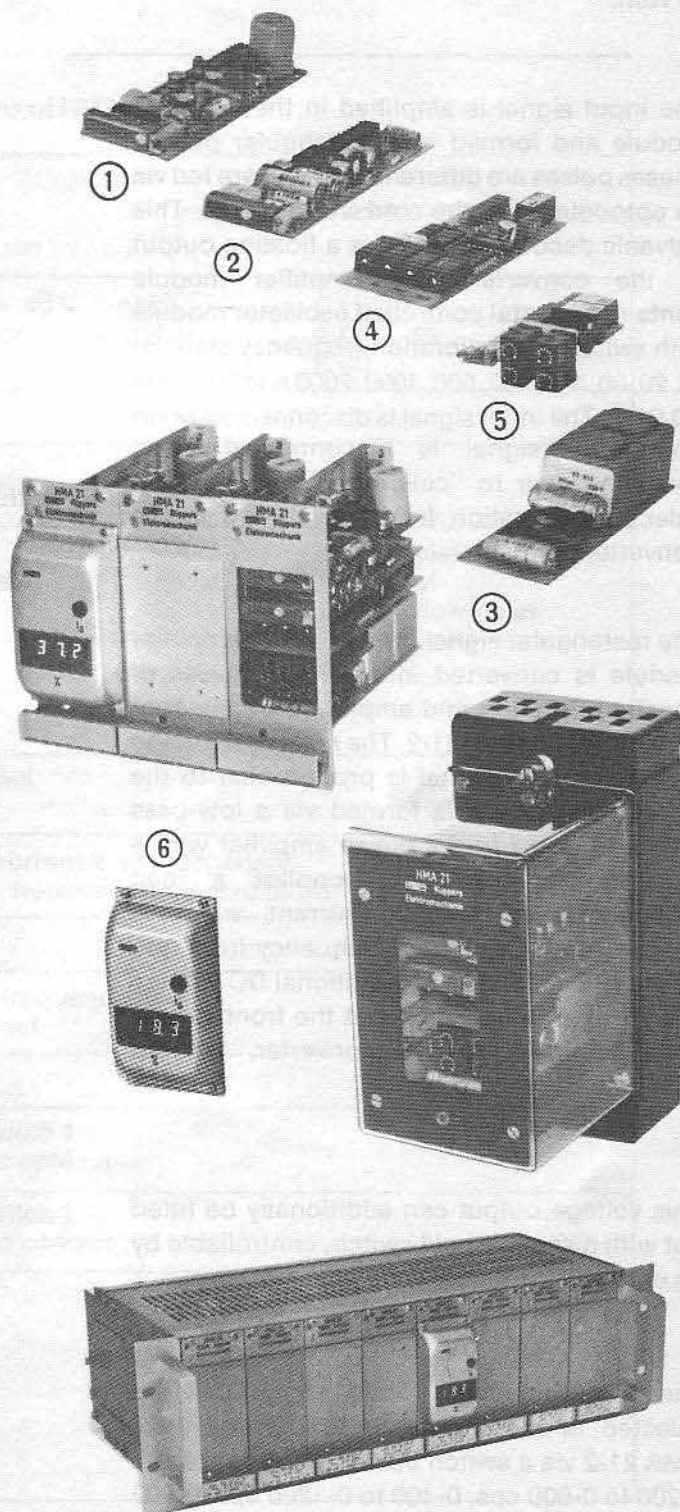
- * instantaneous value indication in the form of load independent DC current, is proportional to the input frequency.
- * signalling of limit value with adjustable switching points for maximum and minimum values.
- * counting quantity or displacement via 4-digit adjustable electronic pulse divider modules.

A very good price to yield ratio is also attained due to the plug-in card design. The system can be easily recalibrated where it is installed, without exchanging components or using other devices, and is easy to maintain.

The HMA 21 system consists of the following modules:

- pulse amplifier with referenze oscillator HMA 21-1 N (fig. 1)
- frequency to DC converter HMA 21-2 (fig. 2)
- digital display DVM 1 (fig. 6)
- alarm circuit HMA 21-5 (fig. 5)
- adjustable frequency divider HMA 21-4 (fig. 4)
- power supply unit HMA 21-3 (fig. 3)

The HMA 21 slide-in system is available either as a 19" module (HMA 21 R) or for wall-mounting (HMA 21 G) contained in a plastic housing.



Functional description:

The basic frequency to DC converter HMA 21 consists of the following sub-assemblies:

- amplifier module HMA 21-1 N with reference frequency generator
- converter module HMA 21-2 and
- power supply unit HMA 21-3

The amplifier module has 2 different frequency inputs:

a high sensitive transformer coupled input with 1 mV sensitivity, and less sensitive input with adjustable trigger threshold (0,5 to 40 volt).

The input signal is amplified in the amplifier module and formed into rectangular pulses. These pulses are differentiated and are fed via an optocoupler to the converter module. This galvanic decoupling enables a floating output of the converter. The amplifier module contains a crystal controlled oscillator module with switchable calibration frequency steps of 10, 20, 50, 100, 200, 500, 1000, 2000 and 5000 cps $\pm 0,01\%$. The input signal is disconnected when switching over to "calibration" mode and a selected calibration frequency is fed to the converter module.

The rectangular signal formed by the amplifier module is converted into voltage pulses of constant duration and amplitude by the converter module HMA 21-2. The mean DC voltage of the resulting signal is proportional to the input frequency. It is formed via a low-pass filter and is fed into a power amplifier with a current feedback. This supplies a load independent floating DC current, which is proportional to the input frequency from 0 to 20 mA or 4 to 20 mA. An additional DC voltage (0 to 5 V) on a test socket at the front can be used to calibrate the converter, without interrupting the load circuit.

This voltage output can additionally be fitted out with a sample-hold switch, controllable by an external contact.

The following measuring ranges can be selected in the frequency to DC converter HMA 21-2 via a switch behind the front panel: 0-200 to 0-600 cps, 0-400 to 0-1200 cps, 0-900

to 0-2800 cps, and 0-2000 to 0-6000 cps. They are finely adjustable using potentiometers. Other measuring ranges up to max. 20 kHz are available on request.

A low-price plug-on 3-digit voltmeter DVM-1 is available for calibration of the converter and continuous controlling. This equipment usually supplies a display from 0 to 99,9% of the converter output span. However, in many cases, it can be calibrated in physical units per units of time. The power and measuring signal input of the digital display are supplied via 3 contact studs. The position of the decimal point of the display can be programmed in the DVM-1.

The alarm circuit module HMA 21-5 has voltage comparators, which have an input voltage 0 to 5 volt like the display DVM-1 via the emitter resistances of the power output stage. Using scaled potentiometers, which can be adjusted with a screwdriver, the switching points (in the range 5 to 100% of the final value) and the hysteresis (in the range 0,5 to 10%) can be adjusted separately for each switching level. The switching output is a potential free relay contact. The function of the contacts NC, NO can be programmed using solder jumpers.

The 4-digit pulse divider module HMA 21-4 is for the integral conversion of the input frequency. The calibration factor of the input frequency can be adapted to other physical standard units by adjusting the divider ratio in the range 1:2 to 1:9999 on 4-decade preset switches. For example if the pulse-rate of the connected turbine flow meter is 281 pulses/liter, and the units counted are 10 liters the preset value is 2810.

The 4-digit divider module HMA 21-4 basically consists of a preadjustable integrated 4-decade electronic counter. Starting from the preset value the counter moves backward (i.e. subtracts). When Zero is reached, a control pulse is generated, and the figure fed in by the code switch is set as the new counter reading. The counting cycle then starts again. The control pulse generated by the counter is fed to a monostable multivibrator which actuates the output relay for triggering an electro-mechanical counter, which is to be connected externally.

Technical data:

HMA 21-1 N Amplifier and reference frequency generator:

input sensitivity: 1. 0,5 mV to 150 mV impedance 100 ohms at sensitive input for direct connection of inductive pick-ups via 2-wire screened cable for short distances between meter and converter input. PLL (Phase locked loop) multiplier/divisor. The input frequency can be multiplied by 10 or 100 or divided by 10 or 100. The sensitive or nonsensitive input will be programmed via Shuntconnector on the HMA 21-1 N board. The frequency range is 50 Hz up to 50 kHz.

calibration frequencies: 2. Level 2 to 40 V trigger switchable 10, 20, 50, 100, 200, 500, 1000, 2000 and 5000 cps $\pm 0,01\%$

HMA 21-2 Frequency to DC converter

measuring range: selectable via switch behind front panel and finely adjustable via potentiometers from 5 Hz, 200 to 600 cps, 400 to 1200 cps, 900 to 2800 cps and 2000 to 6000 cps final value. Up to max. 50 kcps on request.

linearity: $\pm 0,2\%$ of final value

temperature error: $\pm 0,1\%$ of final value per 10°C temperature change

working temperature: -20° to $+50^\circ\text{C}$

output: load independent DC current 0 to 20 mA, 4 to 20 mA, max. load 1 K Ohm, 0 to 2,5, 0 to 5,0, 0 to 10 or 50 mA at an output impedance of 9 M ohms maximum load $\frac{20}{J_{\max}} = \dots \text{K Ohm}$

time constant: 300 m sec

DVM 1 Digital display

LCD-display: 3-digit 000 to 999 without sign

accuracy: $\pm 0,1\%$

voltage supply: 15 V from HMA 21-2, input impedance 1000 k ohms

electrical connections: via 3 contact studs

housing: length 100 mm
width 50 mm
height 25 mm

HMA 21-5 Limit switch

switch output: 2 switching relay contacts alternatively NC or NO programmable via jumpers, max 220 V 50 Watt low-induction

switching point adjustment: adjustable between 5 and 100% using scaled screw-driver potentiometers

hysteresis: adjustable between 0,5 and 10% as above

HMA 21-4 Pulse divider

dividing ratio: adjustable from 1:2 to 1:9999 via 4-decade programming switch

output: potential-free relay operating contact max 220 V, capable of carrying 50 Watt, an external spark absorber has to be provided.

HMA 21-3 Power supply unit

mains supply: 24 V or 110 V or 220 V, 50/60 +15/-10 %, 50/60 cps approx. 15 VA

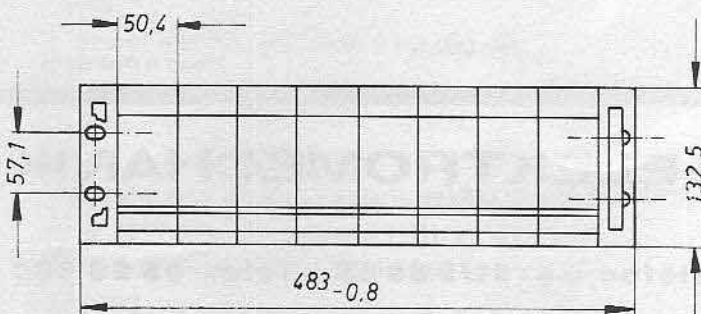
24 Volt DC

supply voltage for external amplifier: 12 V, max 10 mA

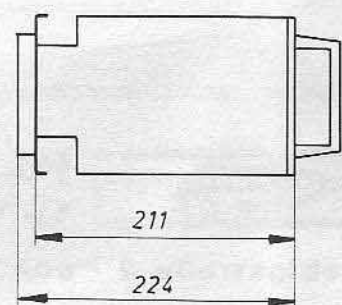
19" module rack for installation of max. eight HMA 21 R modules (Schroff Rationalpak)

electrical connections: via 20-pole numbered screw terminals to each module

dimensions: height 133 mm
depth 260 mm



HMA 21 R



4-digit divider module HMA 21-4


After removing the cover, the dividing ratio is adjusted with a screwdriver on the 4-digit switch.

The 10's powers are arranged as marked on the card from right to left from 10^0 to 10^3 . It should

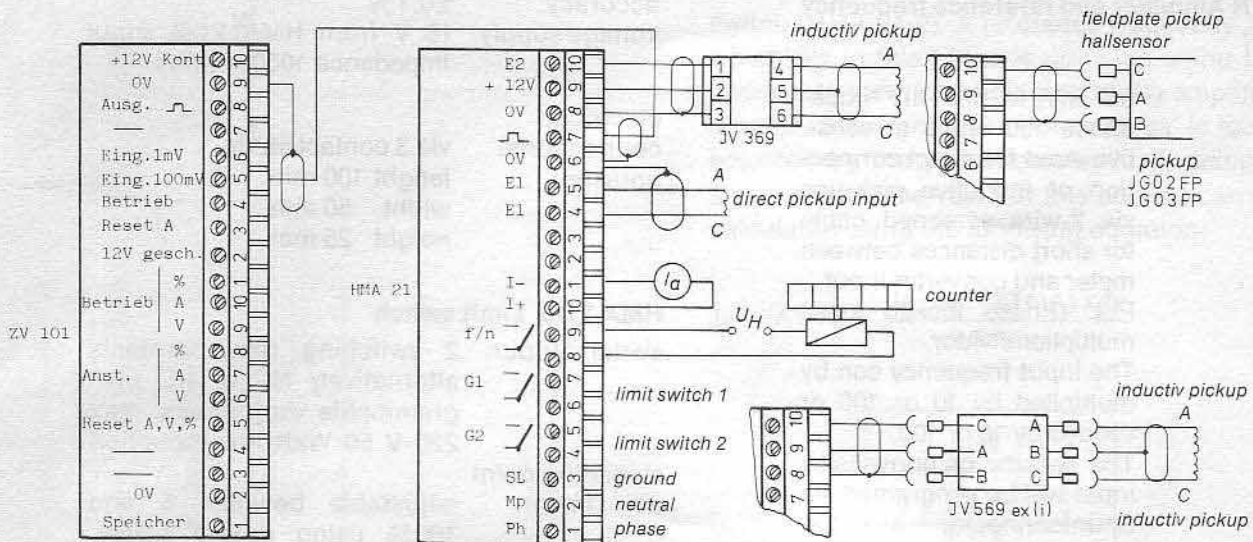
be made sure that only a potential-free contact or optocoupler is available at the output and an external auxiliary voltage corresponding to the counter data must be available. The built-in power supply cannot be used for this.

An external spark absorber has to be provided.

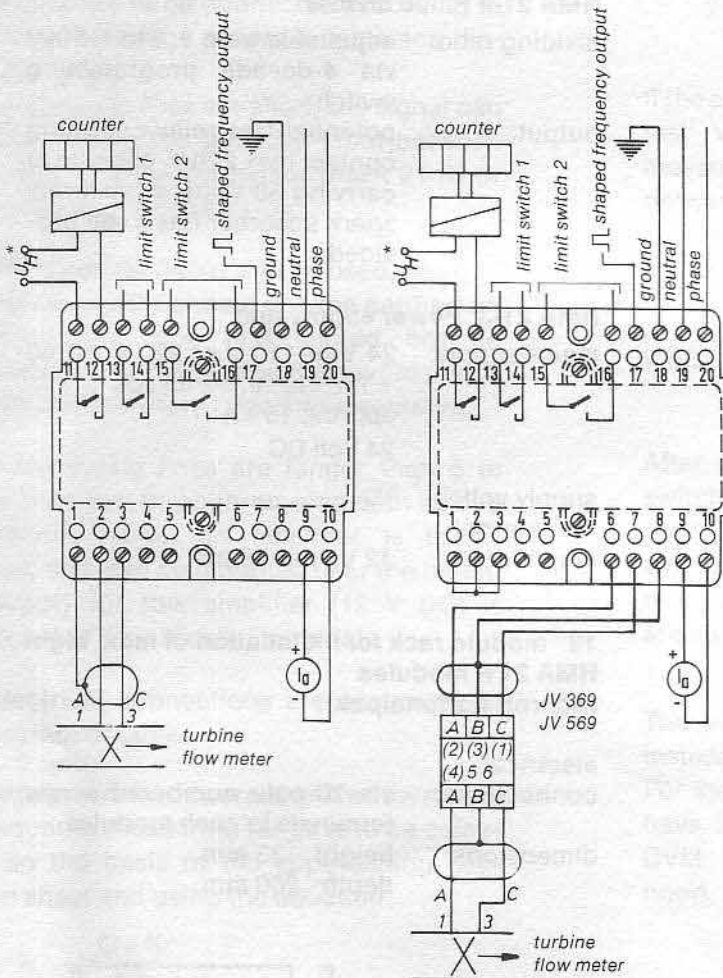
Print connector and screw terminal connections of HMA 21 system

Pin No	Input or output	Screw terminals on rack	Function	to be connected to
1 2 3	E2 +12 0V	10 9 8	{ input 2 – 40 V pos supply for ext. amplifier ground	C (1) A (2) to { JV 569 B (3) { JV 369
4	0V			
5 6	 0V	7 6	{ shaped pulse output	
7 8 9	0V E1 E1	– 5 4	{ shield sensitive input	B { pickup A { of C { flowmeter
10 11 12	0V } }			
13 14	U a– U a+		{ DC-output Voltage	
15 16	I a– I a+	1 10	{ output current load independent floating, however connected to Ua	
17	not uned	–		
18 19	+F/n +F/n	9 8	{ divided frequency output No contact	
20	not uned	–		
21 22	G1 G1	7 6	{ Limit switch 1 No or Nc contact	
23 24	G2 G2	5 4	{ Limit switch 2 No or Nc contact	
25 26 27 28 29 30 31	SL SL SL SL Mp not used Ph	{ 3 2 2 1	{ ground neutral phase	{ mains

Screw terminals of 19" rack DFVR 109/1 with HMA 21 R



HMA 21 G



* UH wiring of external supply voltage for counters