

# Digital Panel Meters Controller for Pulse Signals Type MDM40



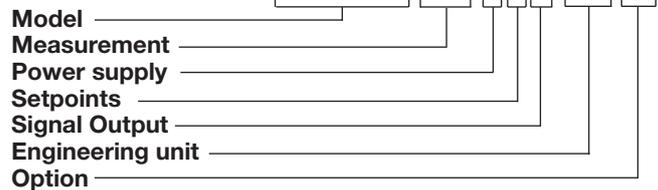
- 4-dgt multi-range  $\mu$ P-based controller
- 2 measuring channels
- For rate, speed, frequency and period measurements
- Ranges from 0.001Hz to 50kHz/20 $\mu$ s to 1000s
- Programmable time base from 0.1 to 999.9s
- Programmable pre-scaler from 9999 x 10<sup>-9</sup> to 9999 x 10<sup>9</sup>
- Special calculation functions
- NPN, PNP, NAMUR, TTL, Pick-up, free of voltage contacts and AC signal inputs
- 2 independent alarm setpoints
- Alarm for over-range, up-alarm, down-alarm, down alarm with disabling at power-on, up/down-alarm with latch
- Degree of protection: IP 65
- Optional analogue output (20 mA/10 VDC)
- Optional serial RS 485 output
- MODBUS, JBUS protocol.

## Product Description

4-dgt multi-range  $\mu$ P-based controller for rate, speed, frequency and period measurements. Scaling and setpoints are fully programmable by user-friendly key-pad.

The MDM40 includes peak/valley function and password protection. The housing is easy to mount and ensures a degree of protection of IP 65.

## Ordering Key **MDM40TF1D2A XXIX**



## Type Selection

Measurements	Power supply	Signal output	Options
<b>TF1:</b> 0.001Hz to 500Hz 0.1Hz to 50kHz for DC signals: PNP, NPN NAMUR, TTL, free of voltage contacts, voltages up to 30VDC	<b>A:</b> 24 VAC, -15% +10%, 50/60 Hz <b>B:</b> 48 VAC, -15% +10%, 50/60 Hz <b>C:</b> 115 VAC, -15% +10%, 50/60 Hz <b>D:</b> 230 VAC, -15% +10%, 50/60 Hz (standard)	<b>X:</b> None <b>A:</b> Analogue: from 0 to 20 mA /from 0 to 10 V <b>S:</b> Serial: RS 485 port <b>Y:</b> Analogue (A) + serial port (S)	<b>IX:</b> Degree of protection IP 65 (standard) <b>XT:</b> Tropicalization + IP 65
<b>TF2:</b> 0.001Hz to 500Hz 0.1Hz to 50kHz for AC signals: pick-up, voltages up to 500VAC	<b>3:</b> 9 to 32 VDC with galvanic insulation <b>6:</b> 40 to 150 VDC with galvanic insulation		

## Input Specifications

<b>Number of inputs</b>	2 measuring channels	DC AC	Max. 9999 min. -1999 Max. 9999 min. 0
<b>Rated input</b>		<b>Type of input</b>	
Frequency	0.001Hz to 500Hz (ON signal min. time duration: 500 $\mu$ s) 0.1Hz to 50kHz (ON signal min. time duration: 9 $\mu$ s)	NPN (DC)	Signal level: ON < 2VDC, OFF open collector (leakage current $\leq$ 1mA)
Period	20 $\mu$ s to 10s (ON signal min. time duration: 9 $\mu$ s) 2ms to 1000s (ON signal min. time duration: 500 $\mu$ s)	PNP (DC)	Signal level: ON >10VDC, OFF open collector (leakage current $\leq$ 1mA)
<b>Accuracy (@18 to 23°C)</b>		NAMUR (DC)	Signal level: ON $\leq$ 1mADC, OFF $\geq$ 2.2 mADC
Frequency measurement	$\pm$ 0.001%rdg $\pm$ 3dgt	TTL (DC)	Signal level: ON >4VDC, OFF $\leq$ 2VDC
<b>Temperature drift</b>	$\pm$ 100ppm/°C	Free of voltage Contact (DC)	Input load: ON <1k $\Omega$ , OFF >20k $\Omega$
<b>Time base</b>	Programmable from 0.1 to 999.9s	Pick-up (AC)	Signal level: ON > 2VAC (5.62Vpp)
<b>Response time</b>	Time base + $\leq$ 200ms	Voltage (AC)	Up to 100VAC, signal level:
<b>Display</b>	7-segment LED, h 14.2mm		
<b>Max. and min. indication</b>			

## Input Specifications (cont.)

	ON > 2VAC (5.62Vpp) Up to 500VAC, signal level: ON > 9VAC (24.5Vpp)		20ms to 255ms
<b>Auxiliary commands</b>	Available on the back screw terminal  One input selectable as: display HOLD command or key-pad disabling	<b>Key-pad</b>	4 keys: one for menu selection; two for value programming/ function selection; one for special functions.
Activation time	Programmable from		

## Output Specifications

<b>Alarms</b>			
Number of setpoints	2 independent (standard)	Accuracy	output; it allows the management of all values from 0 to 20 mA/ from 0 to 10 V $\pm 0.3\%$ f.s.
Alarm types	Over-range, up alarm, down alarm, down alarm with disabling at power-on, up alarm with latch, down alarm with latch	Response time (@ 25°C)	$\leq 500$ ms
Setpoint adjustment	0 to 100% of the displayed range	Temperature drift	$\pm 200$ ppm/°C
Limits of setpoint adjustment	Programmable minimum and maximum values	Load: 20 mA output	$\leq 500 \Omega$
Hysteresis	0 to 100% of the displayed range	10 V output	$\geq 10$ k $\Omega$
On-time delay	0 to 255 s	Insulation	By means of optocouplers, see the relevant table
Off-time delay	0 to 255 s	<b>Serial output</b>	
Relay status	Programmable normally energized/de-energized	Type	RS 485
Output type		Multidrop	Bidirectional
Contact	2 x SPST	Connections	4 wires, max. distance 1200 m, termination and/or line biasing directly on the instrument
Rating	5 A, 250 VAC/VDC, 40 W / 1200 VA, 130.000 cycles	Addresses/protocol	255, selectable by key-pad/ MODBUS, JBUS
Min. response time	$\leq 400$ ms, filter excluded, setpoint on-time delay: "0"	Data	
Insulation	See the relevant table	Dynamic (reading only)	Measurement, data hold of minimum value, data hold of maximum value, alarm status
<b>Excitation output</b>		Static (reading/writing)	All programming data, min./max. data hold reset, reset of alarm set-points with latch
Voltage	15 VDC non-stabilized/40 mA max. (60mA@12VDC)	Data format	1-start bit, 8-data bit, no parity, 1 stop bit
Insulation	100 V <sub>rms</sub> output to measuring input 4000 V <sub>rms</sub> output to AC supply input 500 V <sub>rms</sub> output to DC supply input	Baud-rate	1200, 2400, 4800 and 9600 bauds selectable
<b>Analogue output</b>		Insulation	By means of optocouplers, see the relevant table
Range	0 to 20 mADC, 0 to 10 VDC		
Scaling factor	Programmable within the whole range of the signal		

## Insulation Table

	AC Supply	DC Supply	Meas. Input	RL1 output	RL2 output	Anal. output	RS-485
<b>AC Supply</b>	---	---	4kV	4kV	4kV	4kV	4kV
<b>Input</b>	4kV	2kV	---	2kV	2kV	500V	500V
<b>RL1 output</b>	4kV	2kV	2kV	---	2kV	2kV	2kV
<b>RL2 output</b>	4kV	2kV	2kV	2kV	---	2kV	2kV
<b>Analogue output</b>	4kV	2kV	500V	2kV	2kV	---	500V
<b>DC Supply</b>	---	---	2kV	2kV	2kV	2kV	2kV
<b>RS-485</b>	4kV	2kV	500V	2kV	2kV	500V	---

## Software Functions

<b>Scaling parameters</b>		1st level	Password "0", no protection. Password from 1 to 127, all data are protected Password for 128 to 255, all data protected except for the setpoints
Pulses per revolution	Programmable and independent per channel from 1 to 9999	2nd level	
Prescaler	Programmable and independent per channel from $9999 \times 10^{-9}$ to $9999 \times 10^9$	3rd level	
<b>Management of the input signals</b>	Channel A: $F_a \cdot PS1$ Pu1 Channel B: $F_b \cdot PS2$ Pu2 Where: $F_a$ and $F_b$ are the frequency signals Pu1 and Pu2 are the pulses per revolution PS1 and PS2 are the prescalers	<b>Range selection</b>	r 1: 0.001 to 500Hz r 2: 0.1Hz to 50kHz
<b>Operating mode</b>	Rate-meter Tacho-meter Frequency-meter Period-meter A 1/A Dual channel $A-B, (A-B) \cdot 100; [(A-B)/B] \cdot 100$ $A/B, A/B \cdot 100; [B/(A+B)] \cdot 100$ "A" with rotation sensing on channel B (max. 10kHz, duty-cycle 50%)	<b>Display parameters</b> Operating mode and Decimal point position	The position of the decimal point can be selected according to the needed read-out. The low and high limits of the scale are programmable and may be connected to the over-range alarms and, if available, to the part of the scale that has to be retransmitted by means of an analogue output. Programmable within the whole displaying range
<b>Peak and valley values</b>	Automatic storage (RAM only) of the min. and max. value measured from the last reset	Displayed scale	
<b>Password</b>	Numeric code of max. 3 digits; 3 protection levels of the programming data	<b>Diagnostics</b>	The display flashes when the limits of the displayed range are exceeded, the data are updated up to the maximum read-out EEE (AC) - EE (DC)
		Over range Under range	
		<b>Filter</b> Filter operating range Filtering coefficient	From 0 to 9999 From 1 to 255

## Supply Specifications

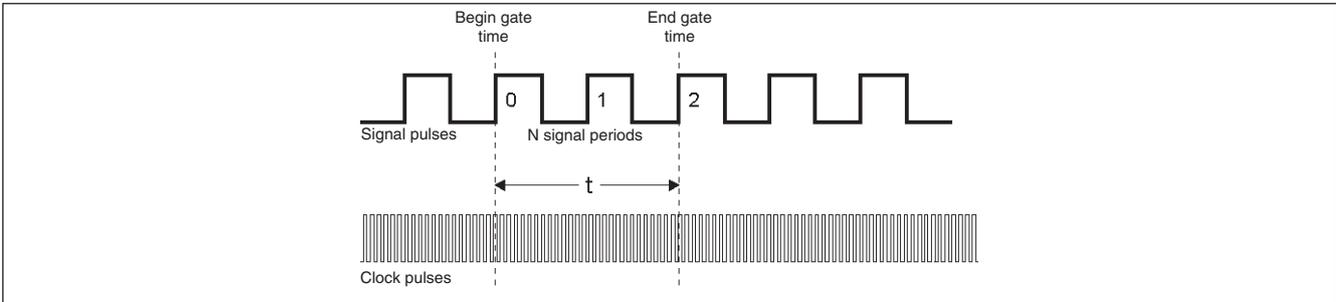
<b>AC supply</b>	230 VAC, -15%+10%, 50/60 Hz 24 VAC, 48 VAC, 115 VAC, -15%+10%, 50/60 Hz See the relevant table
Insulation	
<b>DC supply</b>	9 to 32 VDC, galvanic insulation, max. inrush current: $\leq 1.2 A/200 ms$ (on request) 40 to 150 VDC, galvanic insulation, max. inrush current: $\leq 0.6 A/200 ms$ (on request) see the relevant table
Insulation	
<b>Power consumption</b>	5 VA (basic instrument), 8 VA max. with signal output

## General Specifications

<b>Operating temperature</b>	0° to 50°C (32 to 122°F) (R.H. < 90% non-condensing)
<b>Storage temperature</b>	-10° to 60°C (14 to 140°F) (R.H. < 90% non-condensing)
<b>Insulation reference voltage</b>	300 $V_{rms}$ to ground, cat. III
<b>Dielectric strength</b>	4000 $V_{rms}$ for 1 minute
<b>EMC</b>	EN61000-6-2, IEC61000-6-2 EN61000-6-3, IEC61000-6-3
<b>Safety standards</b>	EN 61010-1, IEC 1010-1, VDE 0411
<b>Connector</b>	Screw-type, detachable
<b>Housing</b> Dimensions Material	1/8 DIN, 48 x 96 x 124 mm ABS, self-extinguishing: UL 94 V-0
<b>Degree of protection</b>	IP 65 (standard)
<b>Weight</b>	Approx 520 g (Signal output and packing included)
<b>Approvals</b>	CE, UR, CSA

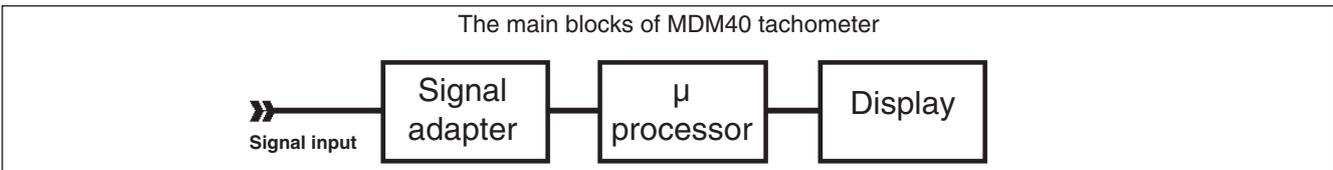
## The working principle

MDM40 measures a frequency by counting a number of clock pulses during an actual gate time "t", which corresponds to an integer number of signal periods N.



This signal is managed directly (by means of a proper firmware) by the microprocessor avoiding the usage of the two converters F/V and A/D and therefore allowing to have high-accuracy also for low-frequency measurements.

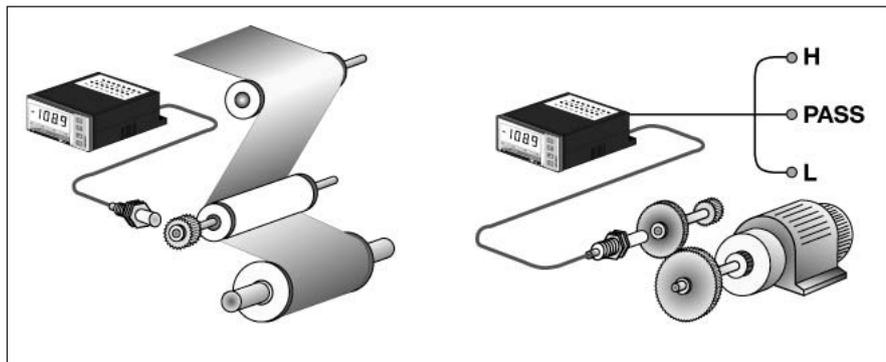
Frequency is calculated from  $N/t$ , period from  $t/N$ . This method allows to improve the accuracy of the instrument but still with a limit of approximately 5Hz to the minimum measurable frequency. To figure out this latter problem MDM40 uses a special measurement algorithm (using a dynamic gate time that eliminates any partial signal period) that allows to reduce the minimum frequency to 0.001Hz solving the problems derived from the very slow speed measurement and also the problem of the high number of pulses (e.g. hundreds of pulses/revolution, generated often by an encoder and therefore increasing the application costs) that are requested in this case to increase the minimum generated frequency signal.



## The measurements connected to the applications

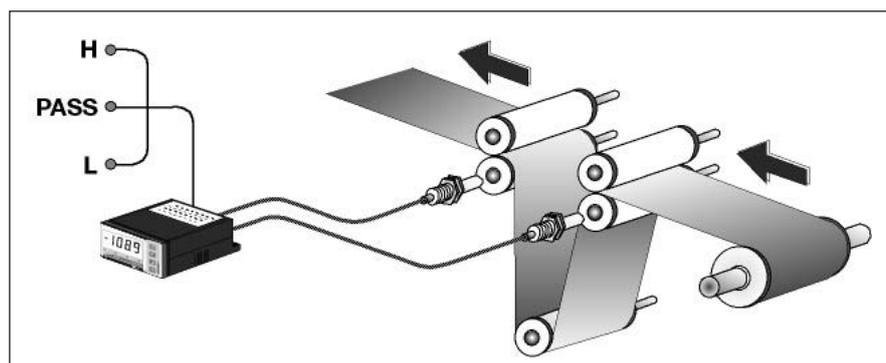
### Frequency, tachometer, rate mode:

MDM40 with a 4-digit resolution from 0.001Hz to 50kHz signal measurement allows to display frequency in Hz and kHz; as tachometer mode: the display of RPM and as rate meter it allows the display of l/s, l/min, l/h, m<sup>3</sup>/s, m<sup>3</sup>/min, m<sup>3</sup>/h, kg/s; finally as speed meter it allows also the display of speed (m/s, mm/min, m/min, mm/h, m/h).



### A/B frequency (speed) ratio mode:

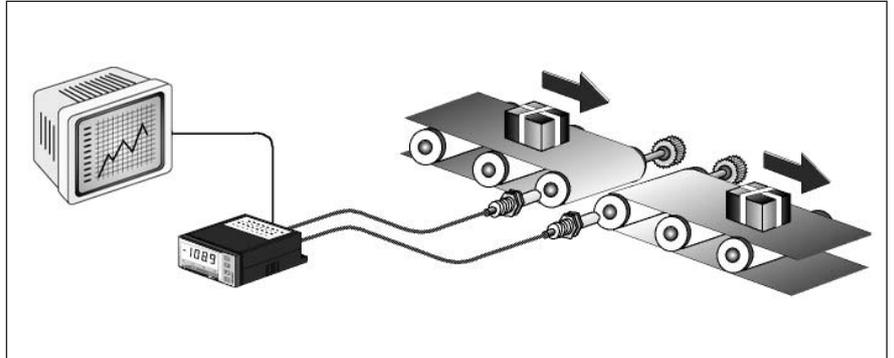
this measuring capability is ideal for monitoring the relative speed of shafts, conveyor belts, and other moving machinery.



## The measurements connected to the applications (cont.)

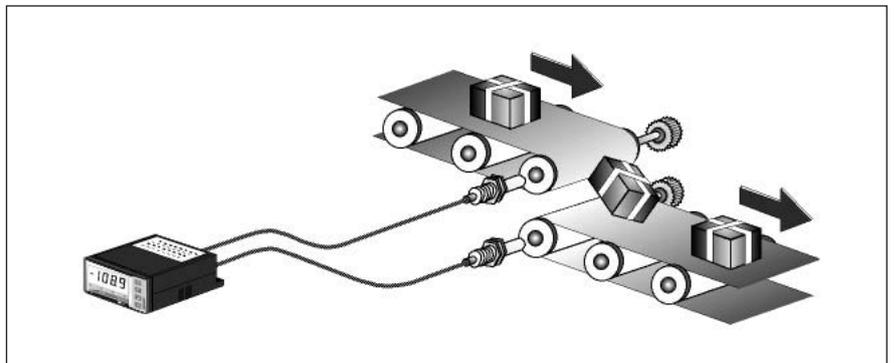
### (A-B)/B frequency (speed) error ratio:

this measuring capability is used when the speed difference between two conveyor belts has to be as low as possible (in any case within a well known value that can be controlled by the available alarm set-points) in order to avoid any transportation problem of the goods. If MDM40 is equipped with an analogue output, this signal can be used to correct the speed of the second conveyor belt



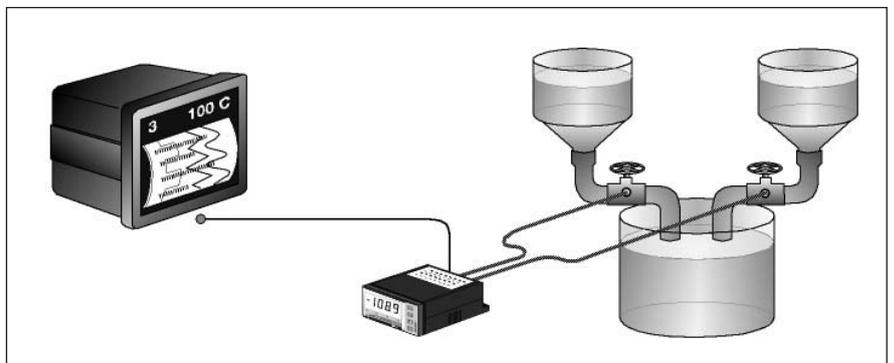
### A-B frequency (speed) difference:

this measuring capability is comparable with the previous one "(A-B)/B" with the difference that the measurement doesn't take into consideration the reference speed of the first conveyor.



### B/(A+B) frequency (speed) flow ratio:

this measuring capability is used in all the applications where it is necessary to measure a mixture flow between two liquids. If MDM40 is equipped with an analogue output, this signal can be transmitted to a paper recorder to show the mixture deviation that is connected to the quality result of the mixture itself.

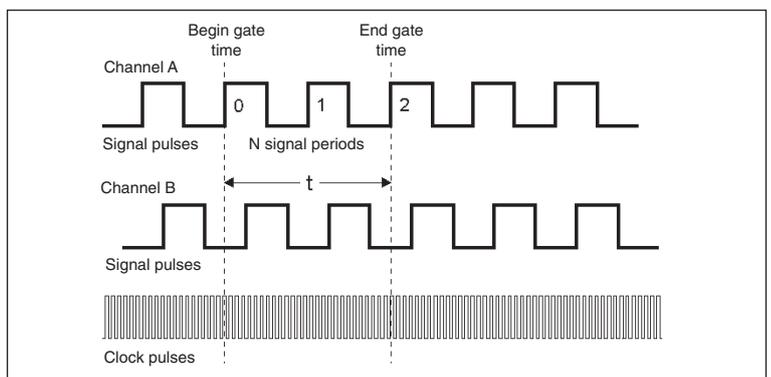


## The measurement methods

### Speed control with indication of the clockwise and counter clockwise rotation sensing mode:

this measuring capability is ideal for monitoring the relative speed of shafts, conveyor belts, and other moving machinery taking into account the rotation mode, showing the reverse speed by means of a "-" sign.

The working principle can be explained in the following way: the rotation sensing is detected by means of a phase difference, measured using the two input channels available as standard in the MDM40. If we assume that the channel A is the main channel, the channel B is used to detect if the signal arrives "after" (phase displacement) the signal of the main channel (begin gate time) meaning "clockwise" rotation or "before" meaning "counter clockwise rotation" (see figure above). Such kind of signals are normally generated by standard encoders.

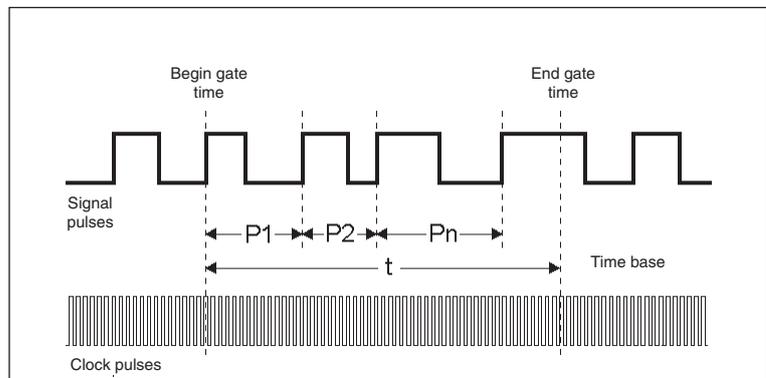
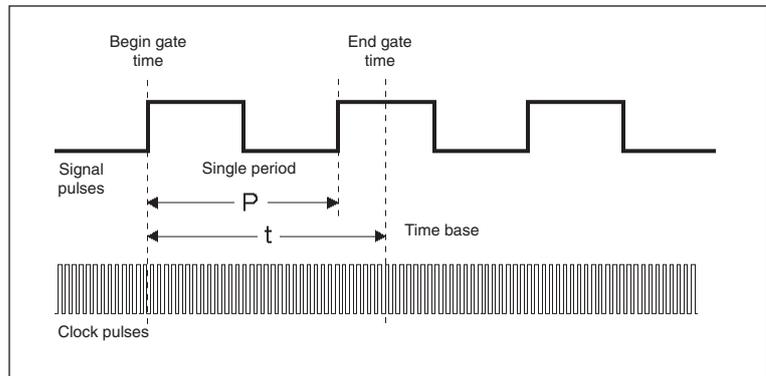


## The measurement methods (cont.)

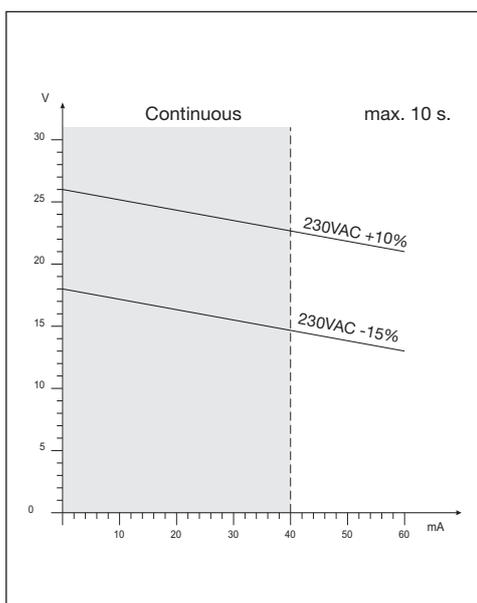
### Period / average period mode:

MDM40 can be used also to measure a time period in two different ways: with direct indication of the period or with average indication of some measured periods. The time period measurement is directly connected to the time base that has been programmed in the MDM40 (for low frequencies / long time periods):

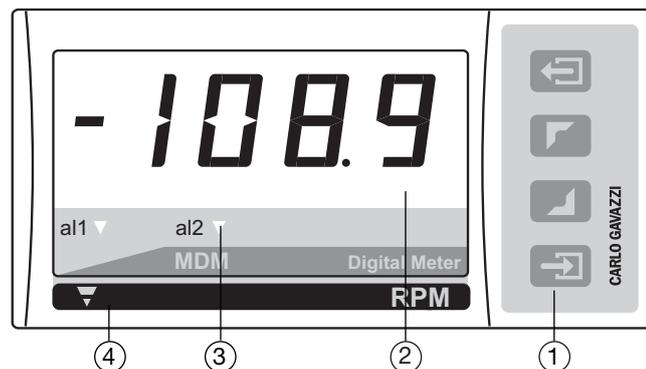
- if the time base is in the range of the period being measured (see figure), the updating of the display is as fast as possible and any period changing is updated immediately on the display;
- if the time base is for instance three times the period being measured (see figure), the updating of the display is made at the end of the time base (end gate time) as average calculation of the measured periods  $P = (P1 + P2 + Pn) / N$ .



## Excitation output



## Front panel description



**1. Key-pad.** The programming of the configuration parameters and the display may be easily controlled by means of the 4 function keys.

 : to enter the programming phase and to confirm the password.

  : to program values; to select functions; to scroll display pages.

 : for special functions.

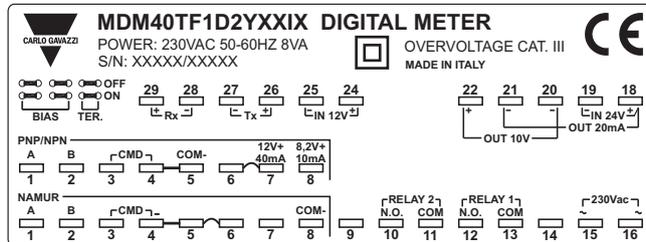
**2. Display.** Instantaneous measurements: 4 digit (max display 9999). Alphanumeric indications by means of LED display for: display of configuration parameters and of the measured variable.

**3. Alarm status LED:** "1" and "2" LED indications for alarm conditions.

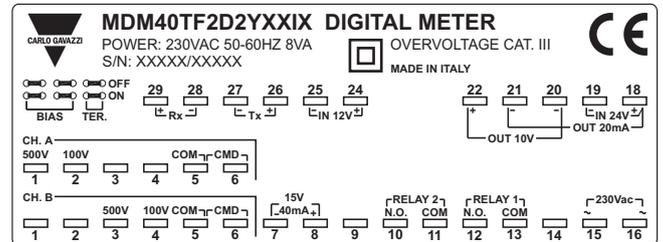
**4. Engineering unit:** the instrument is supplied with a complete set of self-sticking labels with the main engineering units.

## Terminal Board and dimension

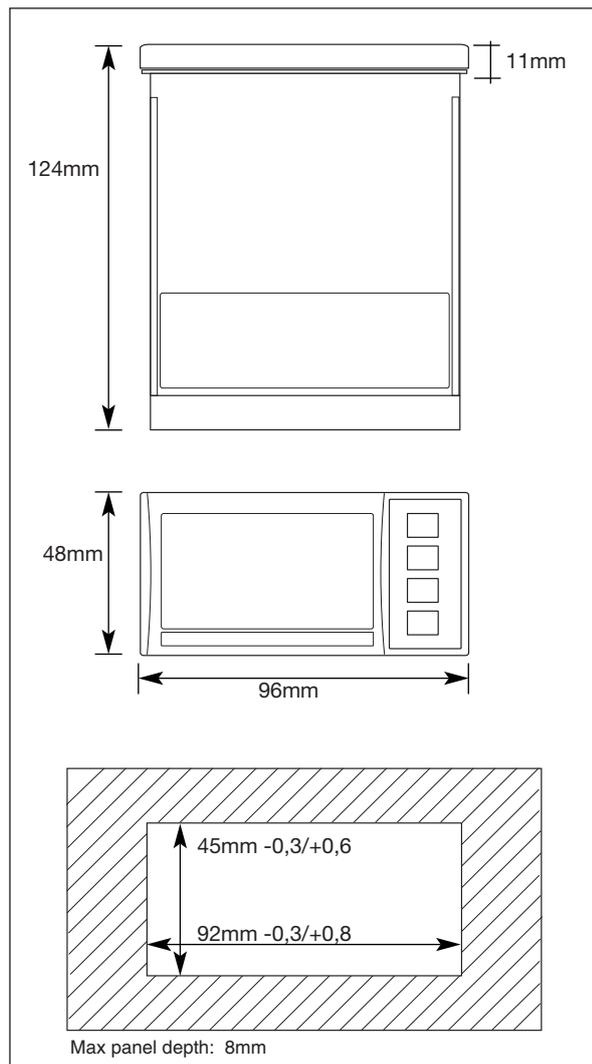
### (TF1) NPN/PNP/NAMUR (DC type) input connections



### (TF2) PICK-UP (AC type) input connections



## Dimensions



## Engineering Units Set

