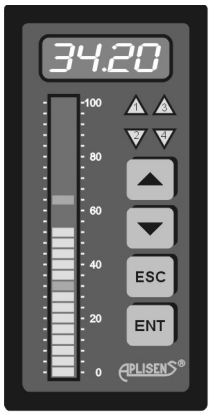
PMS970T, PMS970P

programmable panel meters



PMS970T

PMS970P

Operating manual

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SYMBOL	*DESCRIPTION*
	CAUTION or WARNING: Tells you about the risk of electrical shock.
	CAUTION, WARNING or IMPORTANT: Tells you of circumstances or practices than can effect the instrument's functionality and must refer to technical documentation.
	INFORMATION: Helpful information.

1. INTRODUCTION

1.1 General information

PMS970T and PMS970P are precision panel meters for a wide range of industrial applications. Provides measurement of voltage and current process signals, analog signal retransmission, ON/OFF relay control and serial interface communication. Two versions are available: PMS970T with dual digital/analog display and PMS970P with single, big digit display.

1.2 Features

Measurement

User programmable 4-digit read-out of voltage or current signals is provided. Filtering time-constant, read-out rounding and decimal point position may be also programmed. The unit features also a 16 point linearisation routine.

Bargraph indication

26 point, tricolour LED bargraph (PMS970T version) allows easy judgement of levels and threshold values.

Control outputs

Depending on version, 2 or 4 relay outputs are available. Threshold levels with individual hysteresis and ON/OFF function are user programmed. The special function called „alternate output control" allows optimal control of cascaded pumps.

Analog output

The instrument has optional 4-20mA fully isolated output for analog retransmission.

Serial interface

The isolated RS-485 optional interface allows system connection.

1.3 Safety

⚠ *Hazardous voltage exist within enclosure. Only trained personnel should perform installation and service. Electrical wiring should be performed in accordance with all applicable national standards and regulations. Instrument is protected in accordance with Class II of EN-61010 for 230VAC version and Class III for 24AC/DC supply version.*

- read the manual carefully before installation,
- disconnect power supply before installation and wiring,
- do not touch the terminals while power is being supplied,
- do not attempt to operate the instrument if any damage is found,
- do not operate the unit in aggressive or explosive environment,
- do not expose the instrument to condensing moisture,
- provide sufficient air circulation to keep the temperature in specified range.

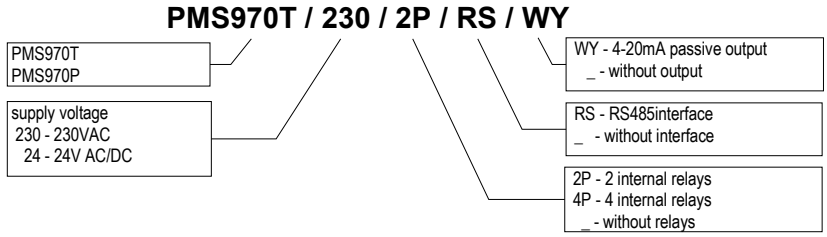
1.4 Electromagnetic compatibility

Instrument meets EN-61326 EMC requirements for industrial environment.

Follow listed below instructions to provide proper operation in real conditions:

- Do not install the product near devices generating strong electromagnetic fields,
- wire the lines connected to the meter separately from power lines carrying high voltages or currents,
- use twisted or shielded signal lines in noisy environment,
- always apply functional grounding,
- apply external surge protectors close to the unit if long lines are connected,
- apply additional filtering in noisy environment.

1.5 Product marking



2. INSTALLATION

2.1 Unpacking

The shipping carton should contain:	PMS970T or PMS970P meter	1 pcs,
	fixing clip	2 pcs,
	operating manual	1 pcs.

Unpack the instrument and check it for obvious signs of damage. If any damage occur notify the supplier and do not attempt further use. If the unit appears to be in good condition read the Operating Manual before installation and use.

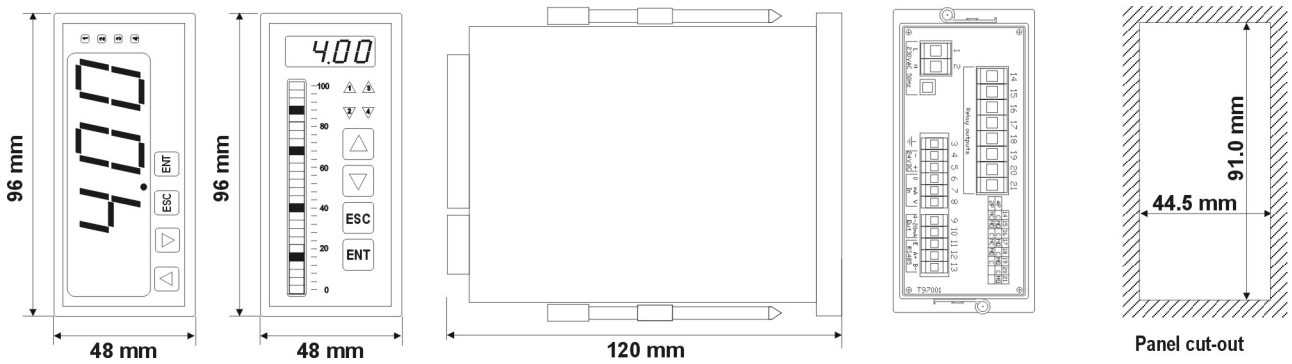


Fig.1 PMS970T / PMS970P basic dimensions.

2.2 Mechanical assembly

The unit is designed for front panel mounting. It requires panel cut-out according to the specification with proper distance to other devices.

Mounting procedure:
- put the meter from the front side into the panel cut-out,
- attach 2 fixing clips on brass rivets,
- tighten the screws just enough to hold the housing firmly in place.

2.3 Electrical connections

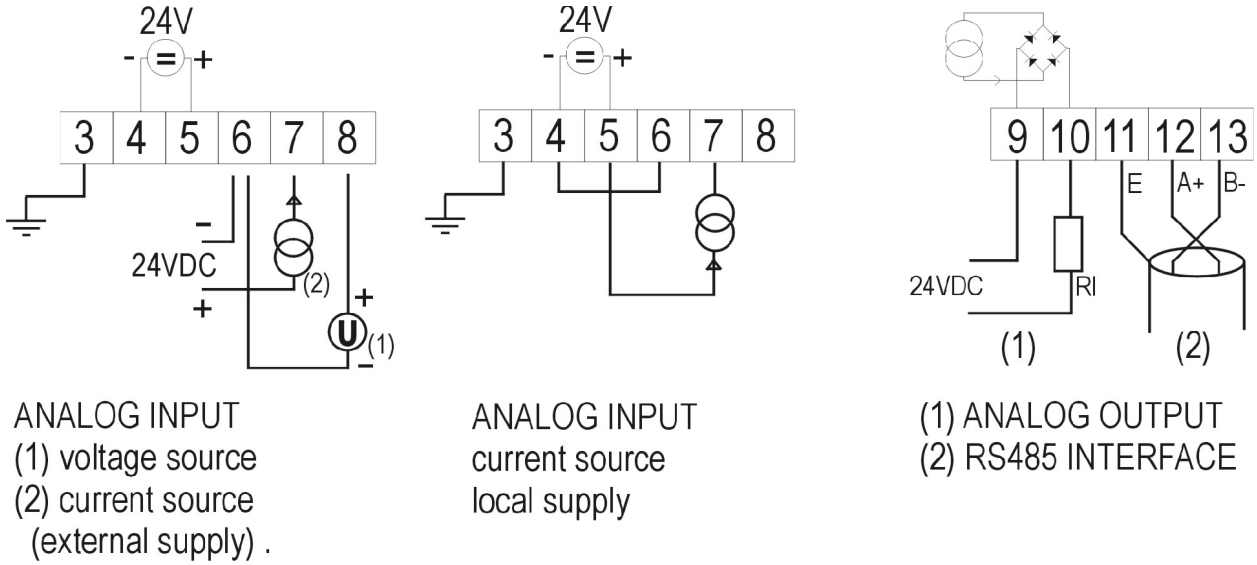
Disconnect power supply before installation and wiring. Check power supply voltage on instrument's label.

Terminal 3 is functional ground terminal. It should be grounded as short as possible to provide proper noise rejection. Signal line shields should be also connected here.

Electrical connection procedure:
- check proper mechanical installation of the unit,
- unplug terminal blocks on the rear wall,
- make required connections according to wiring table and diagrams,
- replug terminal blocks,
- check the connections before applying power INCORRECT CONNECTIONS CAN DAMAGE YOUR METER!

Connector	***Pin number***	***Symbol***	***Terminal description***	***Rating***
POWER SUPPLY 230VAC version	1	L	supply	AC 230V 50Hz
	2	N	supply	
POWER SUPPLY 24VAC/DC version	1		supply	24V AC/DC
	2		supply	
SIGNAL INPUT, EXCITATION OUTPUT	3		functional ground	
	4	-	excitation output	DC 24V
	5	+	excitation output	
	6	0	signal ground	
	7	mA	current input	20mA
	8	V	voltage input	10V
ANALOG OUTPUT, SERIAL INTERFACE	9	4-20mA	analog output	4-20mA
	10	4-20mA	analog output	
	11	E	RS485 ground	
	12	A+	RS485 line	
	13	B-	RS485 line	
RELAY OUTPUT 2P version	14	C	AL1 relay common	1A / 250VAC
	15	NO	AL1 relay NO	
	16	C	AL2 relay common	
	17	NO	AL2 relay NO	
	18	C	AL3 relay common	
	19	NO	AL3 relay NO	
	20	C	AL4 relay common	
	21	NO	AL4 relay NO	

Connector	Pin number	Symbol	Terminal description	Rating
RELAY OUTPUT 4P version	14	NC	AL1 relay NC	1A / 250VAC
	15	NO	AL1 relay NO	
	16	C	AL1 relay common	
	17	NC	AL2 relay NC	
	18	NO	AL2 relay NO	
	19	C	AL2 relay common	
	20		not connected	
	21		not connected	



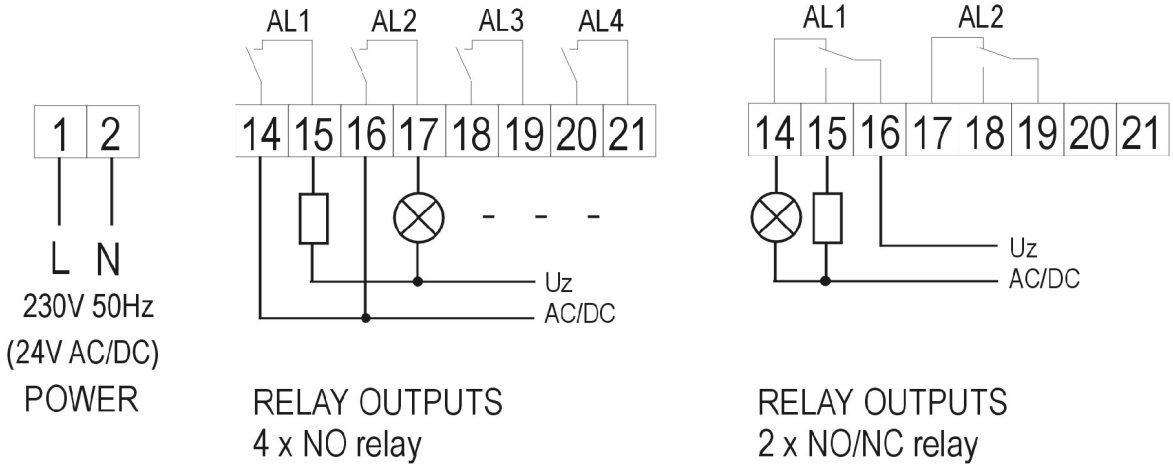


Fig. 2 Wiring diagrams.

3. Meter operation.

3.1 Programming

⚠ *Incorrect programming may cause incorrect read-out and uncontrolled output relay operation!*

The meter has many user-selected programme settings. All settings may be done with front panel push-buttons. Set-points levels are programmed directly in normal mode. Other settings require entering programme mode. Programming menu is code protected.

Button function in programming mode.

Button	*Description*	*Comments*
▲	- scrolling up through menu functions and options - increasing numerical values	
▼	- scrolling down through menu functions and options - decreasing numerical values	
ESC	- ESCAPE - go to previous menu level	
ENT	- ENTER, access to function - selected value/option confirmation	

*To enter programming mode press ESC key for 2 seconds until „Code" message appear. Then press **ESC, ▲, ▲, ENT** combination. „Fn00" message should appear.*

In programming menu several functions are available. Detailed function description is given in the table.

Use cursor buttons to navigate through the functions and ENT button to enter selected function. Numerical values should be set digit by digit. Flashing digit should be adjusted using cursor buttons and stored with ENT button.
All the settings are stored in non-volatile memory while leaving the programming menu.

Programming menu.

Menu function	**Description**	**Available options**	**Factory setting**	**Comments**
Fn00	input selection	**I**-0-20mA current input active, **U**-0-10V voltage input active	**I**	
Fn01	linearization points	**2 – 16**	**2**	2 - linear scale
Fn02	display scaling	**P01** - **Pnn** scaling points	**P01 : 00.00** : **0000** **P02 : 20.00** : **2000**	Define input value and display value for each scaling point-(1)
		-9.99 - **99.99** input value (with DP)		
		-999 - **9999** display value		
Fn03	decimal point	**0000**; **0.000**; **00.00**; **000.0**	**00.00**	Leading zeros are suppressed
Fn04	display rounding	**1**, **2**, **5**, **10**	**1**	1 - without rounding
Fn05	filter time-constant	**0** – 0, **1** - 60ms, **2** - 120ms, **3** - 240ms, **4** - 480ms, **5** - 960ms, **6** - 1.92s, **7** - 3.84s, **8** - 7.68s, **9** - 15.36s	**0**	
Fn06	bargraph mode	**3C** – three colour (green, yellow, red) **1C** - single colour (green)	**3C**	(2)
Fn07	set-point mode	**AL1, AL2, AL3, AL4**	**AL1 : H : 1** **AL2 : L : 1** **AL3 : H : 1** **AL4 : L : 1**	(3)
		H - high **L** - low **A -** alternate		
		1 – 9999 hysteresis [display divisions]		
Fn08	output scaling	**P01** - zero (low) **P02** - full scale	**P01 : 0000 : 4.00** **P02 : 2000 : 20.00**	Define meter's display value and output current for both scaling points.
		-999 - **9999** meter's display value		
		03.00 - **21.00** [mA] output current		
Fn09	all reset	**Code** (4)		Reset to factory setting

Menu function	Description	Available options	Factory setting	Comments
Fc01	serial comm. address	**01**h -**F7**h - address (001-247)	**01**	
Fc02	serial comm. speed	**1.2**, **2.4**, **4.8**, **9.6**, **14.4**, **19.2** kbps	**9.6**	
Fc03	serial comm. parity	**no**-no parity **even**-even parity **odd**-odd parity	**even**	

Remarks:

(1) - The meter is factory set to linear scale with two scaling points. If non-linear scale is needed the required number of scale points should be set in Fn01 function at first. Then, the input and display values for each point should be set. Doubled input values are automatically rejected. Scaling point values are automatically sorted by input values in ascending order, after each Fn02 function access.

(2) - In 1 colour mode the bargraph is green with red set-points.
In 3 colour mode the central zone between AL3 and AL4 is green. Zones AL1 - AL3 and AL2 - AL4 are yellow. Zones above AL1 and below AL2 are red. Relation AL2<=AL4<=AL3<=AL1 should be true for proper colour zone display.
Bargraph 0% indication corresponds to the lowest scaling point, while 100% corresponds to the highest scaling point of the digital display analog.

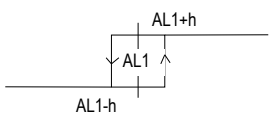
(3) - The set-point number is equal to relay number, excluding alternate mode. Overall hysteresis is equal to twice the value set in Fn07 function.

(4) - While „code” message appears, press ENT button four times.

Meter's programming example

Parametr	***Zadana wartość***	***Numer funkcji***	***Nastawy***
input type	current	Fn00	I
scaling points number	2	Fn01	2
input range	4-20mA	Fn02	P01 : 04.00 : 0000 P02 : 20.00 : 3000
display range	0-3000		
decimal point position	000.0	Fn03	000.0
rounding	none	Fn04	1
filter time constant	240ms	Fn05	3
AL1 „ON” level	>2500	(1)	AL1 : 2500
AL2 „ON” level	<1000	(1)	AL2 : 1000
AL1 hysteresis	10	Fn07	AL1 : H : 0005
AL2 hysteresis	20		AL2 : L : 0010
output current at zero display	5mA	Fn08	P01 : 0000 : 05.00
output current at full scale (3000) display	19mA		P02 : 3000 : 19.00

(1) - settings available in normal mode



AL1=2500 - set-point value
AL1+h=2505 - turn-on level
AL1-h=2495 - turn-off level
h=5 - programmed value
H=2xh - overall hysteresis

Fig.3 Hysteresis definition.

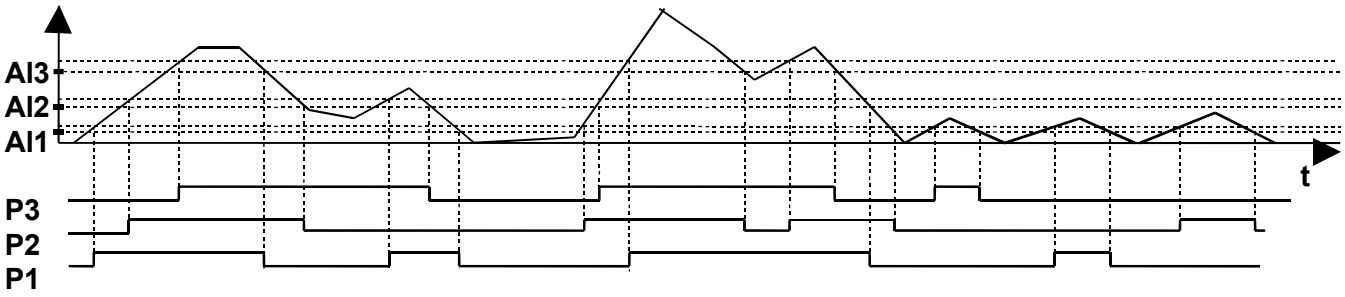
3.2 Set-point programming

Set-points are programmed in normal mode of the meter using front panel buttons. Press ▲ button for 3 seconds to enter AL1 or AL3 programming. Choose AL1 or AL3 with cursors and press ENT button. Adjust each flashing digit using ▲ ▼ buttons and store the value with ENT button. Similarly AL2 and AL4 are programmed while activated with ▼ button.

The relation AL2<=AL4<=AL3<=AL1 should be true in 3 colour bargraph mode for proper colour zone display.

3.3 Alternate output control

PMS970 has built-in “alternate output control” function, called also “alternate lead/lag control”. While “A” option in Fn07 menu function is set, corresponding set-point belongs to “alternate output group”. The group may consist of 2, 3 or 4 set-points and relays but the relays are not dedicated to certain set-points. Relays in the group are activated with special queue algorithm. After each ON/OFF sequence the relay is assigned to be the last in the queue. In this way the ON time of the grouped relays is equally shared. In the case of the failure of one of the controlled devices, remainig devices still work on all grouped set-points. The diagram below illustrates the principle of 3 level group operation.
Alternate output control is typically used for level control applications with cascaded pumps.



3.4 Error codes

Error code	*Description*	*Possible reasons*	*Operation*
ErrF	calibration memory error	-abnormal EMC condition -internal fault	Turn off the meter for 5 s. If message reappears after power-up contact the service.
InIF	calibration memory initialization		Turn off the meter for 5 s. If message reappears after power-up contact the service.
ErrU	user memory error	-abnormal EMC condition -internal fault	Turn off the meter for 5 s. If message reappears after power-up press ENT button. Meter reads factory settings with momentarily displayed InIU message.
InIU	user memory initialization		If the message appears after each power-up contact the service.
display flashing	input under/overrange		-check signal source -check input circuitry
9999 (flashing)	display overrange	-incorrect meter settings -incorrect input connection -internal fault	-check signal source -check meter's scaling -check input circuitry
-999 (flashing)	display underrange	-incorrect meter settings -incorrect input connection -internal fault	-check signal source -check meter's scaling -check input circuitry

3.5 Serial communication

PMS-970 has serial communication option with RS-485 internal module installed. The meter works with Modbus RTU protocol as slave device. Function 3 (register read) and function 16 (multiple registers write).

The data exchanged with the meter are variable type “V” or parameters “P”. Parameters are also accesible from programming menu.

Variables are read-only (R). Parameters are read-only type (R) or read/write type (R/W).

Variables and parameters are grouped for simplicity and functionality:

Group	*Register range*	*Description*
1	400002-400003	digital read-out, decimal point position, general status, set-point status
2	400004-400008	set-point values, output current
3	400009-400015	bargraph read-out
4	400033-400084	programming menu settings without serial port settigs
5	400097-400099	serial port settings
6	418435	Modbus firmware identification

Data blocks exchanged with PMS970 should contain only registers specified in tables below. In other case 0x02 exception code (ILLEGA_DATA_ADDRESS) is returned.

Modbus Function 16 limitations:
1. In response to (R) specified register write attempt, 0x02 exception code (ILLEGA_DATA_ADDRESS) is returned.
2. Registers from the range 40048-40080 must be sent in one frame. Register 40048 must contain the number of scaling points used. Following registers contain scaling points data. Each point definition requires two registers with input and read-out values. For two-point scaling next to 40048 register four registers and no more must be sent. Excessive data in the range of 40048-40080 causes 0x02 exception return. Unused set-point data fields in the meter are automatically cleared (filled with 25000 (0x61A8) control value). Signal values in scaling data must be unique. In other case exception code 0x03 (ILLEGA_DATA_VALUE) is returned. Scaling data transmitted to the meter must be sorted by input value in ascending order. In other case exception code 0x03 is returned.

Example - 2-point scaling - 4-20mA input with 0-1000 read-out.

Data to be sent in one frame:	40048 :	2
	40049 :	400
	40050 :	0
	40051 :	2000
	40052 :	1000

During manual programming with front keys the meter returns exception code 0x06 (SLAVE_DEVICE_BUSY) and no other data. The same exception is returned during internal EEPROM write process.

PMS-970 Modbus register assignment:

Register number/ address	Variable/parameter	Type	Value range	Dafault value	Comments
40002/ 0x0001	*digital read-out*	V (R)	**-999** - **9999 (0xFC19-0x270F)**	**-**	
40003/ 0x0002	*Status*	V (R)	**0-65535 (0x0000-0xFFFF)**	**-**	bit0 (LSB): PP=**1** - manual programming in progress bit1: EAL=**1** - set-point programming in progress bit2: WEE=**1** - memory write in progress bit3: MIG=**1** - display flashing bit4: UND=**1** - input underrange bit5: OVR=**1** - input overrange bit6: MBAR1=**1-** bargarph LED01flashing bit7: MBAR26=**1** - bargarph LED01flashing bit8: ALR1=**1** - AL1 relay ON bit9: ALR2=**1** - AL2 relay ON bit10: ALR3=**1** - AL3 relay ON bit11: ALR4=**1** - AL4 relay ON bit13,bit12:DPH,DPL - DP position (Fn03): **00** - „0000” **01** - „0.000” **10** - „00.00” **11** - „000.0” bit14: Input type : **0** - current **1** - voltage b15: - not used
40004/ 0x0003	*Set-point 1 level*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**1800 (0x0708)**	AL1
40005/ 0x0004	*Set-point 2 level*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**200 (0x00C8)**	AL2
40006/ 0x0005	*Set-point 3 level*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**1500 (0x05DC)**	AL3
40007/ 0x0006	*Set-point 4 level*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**500 (0x01F4)**	AL4
40008/ 0x0007	*Output current*	V (R)	**-32768** - **32767** (**0x8000**-**0x7FFF**)	**-**	$*10^{-3}$mA
40009/ 0x0008	*Mnimum read-out*	P (R)	**-999** - **9999 (0xFC19-0x270F)**	**0 (0x0000)**	
40010/ 0x0009	*Maximum read-out*	P (R)	**-999** - **9999 (0xFC19-0x270F)**	**2000 (0x07D0)**	
40011/ 0x000A	*Bargraph height*	V (R)	**0**-**27** (**0x0000**-**0x001B**)	**-**	**0** - *Display underrange (LED01 flashing)* **27** - *Display overrange (LED26 flashing)*

Register number/ address	Variable/parameter	Type	Value range	Dafault value	Comments
40012/ 0x000B	*Bargraph colour 0108*	V (R)	**0-65535 (0x0000-0xFFFF)**	**-**	Colour codes: 00 - off 01 - green 10 - red 11 - orange bit1,bit0: LED01(lowest) bit3,bit2: LED02 bit5,bit4: LED03 bit7,bit6: LED04 bit9,bit8: LED05 bit11,bit10: LED06 bit13,bit12: LED07 bit15,bit14: LED08
40013/ 0x000C	*Bargraph colour 0916*	V (R)	**0-65535 (0x0000-0xFFFF)**	**-**	Colour codes: see above bit1,bit0: LED09 bit3,bit2: LED10 bit5,bit4: LED11 bit7,bit6: LED12 bit9,bit8: LED13 bit11,bit10: LED14 bit13,bit12: LED15 bit15,bit14: LED16
40014/ 0x000D	*Bargraph colour 1724*	V (R)	**0-65535 (0x0000-0xFFFF)**	**-**	Colour codes: see above bit1,bit0: LED17 bit3,bit2: LED18 bit5,bit4: LED19 bit7,bit6: LED20 bit9,bit8: LED21 bit11,bit10: LED22 bit13,bit12: LED23 bit15,bit14: LED24
40015/ 0x000E	*Bargraph colour 2532*	V (R)	**0-65535 (0x0000-0xFFFF)**	**-**	Colour codes: see above bit1,bit0: LED25 bit3,bit2: LED26 bit15-bit4: -
...				**-**	
40033/ 0x0020	*Identification number*	P (R)	**0-65535 (0x0000-0xFFFF)**	**-**	0 - no number available
40034/ 0x0021	*Actual scaling points number*	P (R)	From **2 (0x0002)** to Fn01 setting	**2 (0x0002)**	Actually defined in Fn02 number of scaling points.
40035/ 0x0022	*Input type*	P (R/W)	**0 (0x0000)** - current [mA] **1 (0x0001)** - voltage [V]	**0 (0x0000)**	Fn00

Register number/ address	Variable/parameter	Type	Value range	Dafault value	Comments
40036/ 0x0023	*Decimal point position*	P (R/W)	**0x0000** - 0000 **0x0001** - 0.000 **0x0002** - 00.00 **0x0003** - 000.0	**2 (0x0002)**	Fn03
40037/ 0x0024	*Read-out rounding*	P (R/W)	**1 (0x0001)** - do 1 **2 (0x0002)** - do 2 **5 (0x0005)** - do 5 **10 (0x000A)** - do 10	**1 (0x0001)**	Fn04
40038/ 0x0025	*Filetring level*	P (R/W)	**0** - **9 (0x0000** - **0x0009)**	**0 (0x0000)**	Fn05
40039/ 0x0026	*Brgraph colour mode*	P (R/W)	**1 (0x0001)** - single colour **3 (0x0003)** - tricolour	**3 (0x0003)**	Fn06
40040/ 0x0027	*Al 1 mode*	P (R/W)	**0x0000** - H (high) **0x0001** - L (low) **0x0002** - A (alternating)	**0 (0x0000)**	Fn07 - AL1 set-point mode setting
40041/ 0x0028	*Al 2 mode*	P (R/W)	- " -	**1 (0x0001)**	Fn07 - AL2 set-point mode setting
40042/ 0x0029	*Al 3 mode*	P (R/W)	- " -	**0 (0x0000)**	Fn07 - AL3 set-point mode setting
40043/ 0x002A	*Al 4 mode*	P (R/W)	- " -	**1 (0x0001)**	Fn07 - AL4 set-point mode setting
40044/ 0x002B	*Al1 hysteresis*	P (R/W)	**1** - **9999 (0x0001** - **0x270F)**	**1 (0x0001)**	Fn07 - AL1 set-point hysteresis
40045/ 0x002C	*Al1 hysteresis*	P (R/W)	- " -	**1 (0x0001)**	Fn07 - AL2 set-point hysteresis
40046/ 0x002D	*Al1 hysteresis*	P (R/W)	- " -	**1 (0x0001)**	Fn07 - AL3 set-point hysteresis
40047/ 0x002E	*Al1 hysteresis*	P (R/W)	- " -	**1 (0x0001)**	Fn07 - AL4 set-point hysteresis
40048/ 0x002F	*Scaling points number*	P (R/W)	**2-16 (0x0002** - **0x0010)**	**2 (0x0002)**	Fn01
40049/ 0x0030	*P01 input value*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**0 (0x0000)**	Fn02:P01
40050/ 0x0031	*P01 read-out value*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**0 (0x0000)**	Fn02:P01
40051/ 0x0032	*P02 input value*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**2000 (0x07D0)**	Fn02:P02
40052/ 0x0033	*P02 read-out value*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**2000 (0x07D0)**	Fn02:P02
40053/ 0x0034	*P03 input value*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P03 Initial value for unused point
40054/ 0x0035	*P03 read-out value*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P03
40055/ 0x0036	*P04 input value*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P04
40056/ 0x0037	*P04 read-out value*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P04

Register number/ address	Variable/parameter	Type	Value range	Dafault value	Comments
40057/ 0x0038	*P05 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P05
40058/ 0x0039	*P05 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P05
40059/ 0x003A	*P06 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P06
40060/ 0x003B	*P06 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P06
40061/ 0x003C	*P07 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P07
40062/ 0x003D	*P07 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P07
40063/ 0x003E	*P08 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P08
40064/ 0x003F	*P08 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P08
40065/ 0x0040	*P09 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P09
40066/ 0x0041	*P09 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P09
40067/ 0x0042	*P10 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P10
40068/ 0x0043	*P10 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P10
40069/ 0x0044	*P11 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P11
40070/ 0x0045	*P11 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P11
40071/ 0x0046	*P12 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P12
40072/ 0x0047	*P12 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P12
40073/ 0x0048	*P13 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P13
40074/ 0x0049	*P13 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P13
40075/ 0x004A	*P14 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P14
40076/ 0x004B	*P14 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P14
40077/ 0x004C	*P15 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P15
40078/ 0x004D	*P15 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P15
40079/ 0x004E	*P16 input value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P16
40080/ 0x004F	*P16 read-out value*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**25000 (0x61A8)**	Fn02:P16
40081/ 0x0050	*Read-out for low linear output*	P (R/W)	**-999 - 9999 (0xFC19-0x270F)**	**0 (0x0000)**	Fn08:P01

Register number/ address	Variable/parameter	Type	Value range	Dafault value	Comments
40082/ 0x0051	*Read-out for linear output*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**2000 (0x07D0)**	Fn08:P02
40083/ 0x0052	*Low linear output value*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**400 (0x0190)**	Fn08:P01 (default 4.00mA)
40084/ 0x0053	*High linear output value*	P (R/W)	**-999** - **9999 (0xFC19-0x270F)**	**2000 (0x07D0)**	Fn08:P02 (default 20.00mA)
...					
40097/ 0x0060	*Serial communication slave address*	P (R)	**1 - 247 (0x0001-0x00F7)**		Fc01
40098/ 0x0061	*Communication speed*	P (R)	**3 (0x0003)** - 2400bps **4 (0x0004)** - 4800bps **5 (0x0005)** - 9600bps **6 (0x0006)** - 19200bps	**5 (0x0005)**	
40099/ 0x0062	*Parity*	P (R)	**0 (0x0000)** - no parity **1 (0x0001)** - even parity **2 (0x0002)** - odd parity	**1 (0x0001)**	
...				**-**	
418435/ 0x4802	*Modbus Firmware ID*	P(R)	**10000 (0x2710)**	**-**	

3.6 Display test.

PMS970 has special test procedure for LED display, relays and version check. The test is initiated when the meter is powered-up with ▲ key pressed. LED segments are lighted-up in following cycle:

- four digit meter version code,
- digital display (all segments simultaneously),
- alarm leds with output relays activation,
- bargraph green (all segments simultaneously),
- bargraph red (all segments simultaneously).

The ENT key toggles between simultaneous and single segment activation during test. ESC key closes the test.

4. TECHNICAL SPECIFICATION

CATEGORY	PARAMETER	VALUE	COMMENTS
INPUT	Accuracy	+/-0.1% FS	
	Temperature coefficient	+/- 100ppm / °C	
	Internal resolution	15 bit	
	Sampling rate	16,6Hz	
	Filter time constant	0-15,36s	
	Noise rejection	>=65dB	f=50Hz
CURRENT INPUT	Range	0..20mA	-0.1 .. +21mA
	Input resistance	<56om	
	Max. input current	internally limited	
	Overvoltage protection level	-0.6...+36V=	transil
VOLTAGE INPUT	Range	0...10V	-0.05 .. +10.5V
	Input resistance	>=50kom	
	Overvoltage protection level	-0.6...+36V=	transil
CONTROL RELAY OUTPUT	Rating	1A / 250VAC	
	Contact configuration (2P version)	2 x NO/NC	
	Contact configuration (4P version)	4 x NO	
	Open contact withstand voltage	1000VAC	
	Contact life mechanical / electrical	$15x10^6$ / 10^6	
	Load capacity	250VA	resistive load
ANALOG OUTPUT	Range	3..21mA	
	Output voltage range	10-30VDC	
	Accuracy	+/- 0.1%	
	Resolution	12 bit	
	Temperature coefficient	+/- 100ppm / °C	
	Output voltage effect	+/-20ppm / V	
	Overvoltage protection level	36V	transil
	Refresh rate	30Hz	
SERIAL INTERFACE	Type	RS485	
	Protocol	Modbus RTU	
	Transmission speed	2.4, 4.8, 9.6, 19.2kbps	
	Data bits	8	
	Overvoltage protection level	+7 / -12V	transil
SENSOR EXCITATION	Voltage	24VDC, +5/-10%	
	Current max	25mA	
	Current limit	continuous	
	Overvoltage protection level	36V	
POWER SUPPLY	Voltage - AC 230V version	230VAC +10/-20%	
	- AC/DC 24V version	20-35VDC 18-26VAC	
	Power consumption	<6W	

CATEGORY	PARAMETER	VALUE	COMMENTS
DISPLAY	Digits	4	Green LED
	Digit hight	7mm	(PMS970T)
		20mm	(PMS970P)
	Bargraph resolution	26	(PMS970T)
ENVIRONMENTAL	Operating temperature	5..40°C	
	Storage temperature	-10 .. +70°C	
	Humidity (relative)	10-95%	without condensing
	Enclosure protection (front)	IP-65	
	Enclosure protection (rear)	IP-20	
	Pollution degree	2	
	Overvoltage category	II	
ELECTRIC	Power supply - other circuits	2300VAC	
ISOLATION	Relay outputs - other circuits	2300VAC	
	Signal input - functional ground	1000VDC	
	Excitation output - other circuits	1000VDC	
	Analog output - signal input	1000VAC	
	RS485 - signal input	1000VAC	
MECHANICAL	Dimensions	48x96x120mm	
	Panel cut-out	44.5x91mm	
	Panel thickness	0..15mm	
	Horizontal spacing	>70mm	axis to axis
	Vertical spacing	>120mm	axis to axis
COMPLIANCE	Electrical safety	EN 61010	
	EMC	EN 61326	

5. REVISION HISTORY

VERSION	*MODBUS FIRMWARE ID*	*DATE*	*CHANGES INFO*
2.01		05.2004	
3.00		12.2004	serial communication added
3.05		04.2005	3.00 fixed, display test added
3.06	10000	05.2005	Modbus Firmware ID register added