PS-416M
User & Service Manual

PATIENT SIMULATOR

METRON

METRON:

USA
1345 Monroe NW, Suite 255A
Grand Rapids, MI 49505
Phone: (+1) 888 863-8766
Fax: (+1) 616 454-3350
E-mail: *metronus@aol.com*

FRANCE
30, rue Paul Claudel
91000 Evry, France
Phone: (+33) 1 6078 8899
Fax: (+33) 1 6078 6839
E-mail: *metronfrance@infonie.fr*

NORWAY
Travbaneveien 1
N-7044 Trondheim, Norway
Phone: (+47) 7382 8500
Fax: (+47) 7391 7009
E-mail: *support@metron.no*

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METRON warrants that the PS-416M Patient Simulator will substantially conform to published specifications and to the documentation, provided that it is used for the purpose for which it was designed. METRON will, for a period of twelve (12) months from date of purchase, replace or repair any defective analyzer, if the fault is due to a manufacturing defect. In no event will METRON or its local representatives be liable for direct, indirect, special, incidental, or consequential damages arising out of the use of or inability to use the PS-416M Patient Simulator, even if advised of the possibility of such damages. METRON or its local representatives are not responsible for any costs, loss of profits, loss of data, or claims by third parties due to use of, or inability to use the PS-416M Patient Simulator. Neither METRON nor its local representatives will accept, nor be bound by any other form of guarantee concerning the PS-416M Patient Simulator other than this guarantee. Some jurisdictions do not allow disclaimers of expressed or implied warranties in certain transactions; therefore, this statement may not apply to you.

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Rev No	Date Entered	Reason	Signature of Person Entering Change
0	-	Initial Release	

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1. Introduction

This chapter describes the METRON PS-416M Patient Simulator's features and specifications.

1.1 PS-416M Features

METRON's PS-416M is a high performance simulator designed to simplify patient monitor testing, and is designed to be used by trained service technicians. It simulates electrocardiogram, respiration, dynamic blood pressure and static temperature.

It offers three preprogrammed automatic test modes (ECG rate, ECG performance rate, and BP level), plus a built-in ECG lead continuity test. Arrhythmia selection includes two supraventricular, two-conduction; eight ventricular, one paced; and one fetal/maternal ECG simulation.

1.2 Specifications

1. ECG General

Lead Configuration:	12-lead simulation derived from one resistively divided analog signal.
RL, RA, LA, LL, V1-6	
Output Impedance	
Limb leads:	500 or 1000 ohms to RL
V Leads:	1000 ohms to RL
High Level Output:	0.5 V/mV of low level (Lead II)

2. Normal Sinus

Rates:	30, 60, 80, 120, 180, and 300 BPM
Rate Accuracy:	± 1% of selection
Amplitudes:	0.5mV, 1.0mV, 1.5mV and 2.0mV (Lead II)
Amplitude Accuracy:	± 5%. (Lead II 1.0mV)
Automatic ECG Rate Test	

3. Manual ECG Performance Test

Square Wave:	2.0Hz 1.0 V p-p biphasic
DC pulse:	4.0 sec. 1.0 mV
Sine Waves:	0.1, 0.5, 10, 40, 50, 60 and 100 Hz
Triangle Wave:	2.0 Hz
Amplitude:	0.5mV, 1.0mV, 1.5mV and 2.0mV (Lead II)
Amplitude Accuracy:	± 5%. (Lead II 1.0mV)

4. Automatic ECG Performance Test

Gain/Damping:	2 Hz square wave
Frequency Response	
Low Frequency:	4 second DC pulse
Band Pass:	10 Hz sine
Monitor:	-3dB point: 40 Hz sine
Power Line Notch Filter:	50 Hz sine
Linearity:	2 Hz triangle wave

5. ECG Lead Test

Display flashes if lead resistance is <3 kOhms (DC lead wire only)

6. Blood Pressure General

Input/Output Impedance:	300 Ohms
Exciter Voltage Range:	2 to 16 volts
Exciter Frequency Range:	DC to 4000 Hz
Output Sensitivity:	5 or 40 µV/V/mmHg
Accuracy:	± 1% full scale ✂ 1 mmHg
Calibrated Rate:	80 BPM

7. Dynamic Blood Pressure Selections

Atmosphere:	0 mmHg
Arterial:	120/80 mmHg
Left Ventricle:	20/0 mmHg
Right Ventricle:	25/0 mmHg
Pulmonary Artery:	25/10 mmHg
Pulmonary Wedge:	10/2 mmHg
Static Levels:	0, 20, 40, 80, 100, 200, 250, 300 mmHg

8. Arrhythmia Selections

Atrial Fibrillation 1 & 2
Premature Atrial Contraction
Premature Ventricular Contraction (PVC)
Early PVC
R on T PVC
Multifocal PVCs
Bigeminy
Bigeminy Run of 5 PVCs
Ventricular Tachycardia
Ventricular Fibrillation
Second Degree Type 2
Right Bundle Branch Block
Asynchronous Pacemaker
Fetal/Maternal ECG

9. Respiration

Normal Physiological Simulation

Baseline Impedances:	500 to 1000 Ohms
Impedance Variations:	0.1, 0.2, 0.5, 1.0, and 3.0 Ohms
Rates:	0 (Apnea), 15, 20, 30, 40, 60, 120 BPM
Output Configuration:	Lead 1, 11, RL-LL

10. Temperature

30°C / 86°F, 37°C / 98.6°F, 40°C / 104°F

Compatible with YSI 400/700 series.

Accuracy: ± 0.25°C

1.3 General Information

Display/Control:	2-digit numeric display keys 5 switches for BP, respiration, temperature and Power On/Off	
ECG Output Connectors		
High Level:	Standard phone jack	
Low level:	10 AHA color-coded standard safety banana connectors with detachable banana to snap adapter.	
Power:	9 V alkaline battery or battery eliminator	
Case:	High impact plastic	
Weight:	0.5 kg / 1.1 lbs.	
Dimensions:	Height: 47 mm / 1.8 in. Width: 138 mm / 5.4 in. Length: 190 mm / 7.5 in.	
Standard Accessories:	PS-416M Patient Simulator	(P.N. 17020)
	110 V or 220 V AC Adapter	(P.N. 17021)
	Carrying Case	(P.N. 17022)
	Snap-to-Banana Adapters (10pk)	(P.N. 17023)
	User and Service Manual PS-416M	(P.N. 17025)
Optional Accessories:	Unterminated or prewired BP Cable	(P.N. 17440)
	Unterminated or prewired 400/700 YSI-series Temperature Cable	(P.N. 17443)

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2. Installation

This chapter explains unpacking, receipt inspection and claims, and the general procedures for PS-416M setup.

2.1 Receipt, Inspection and Return

1. Inspect the outer box for damage.
2. Carefully unpack all items from the box and check to see that you have the following items:
   - PS 416M Patient Simulator (P.N. 17020)
   - Battery Eliminator (P.N. 17021)
   - Carrying Case (P.N. 17022)
   - 10 Pack, Snap-to-Banana Adapters (P.N. 17023)
   - PS-416M User and Service Manual (P.N. 17025)
3. If you note physical damage, or if the unit fails to function according to specification, inform the supplier immediately. When METRON AS or the company's representative, is informed, measures will be taken to either repair the unit or dispatch a replacement. The customer will not have to wait for a claim to be investigated by the supplier. The customer should place a new purchase order to ensure delivery.
4. When returning an instrument to METRON AS, or the company representative, fill out the address label, describe what is wrong with the instrument, and provide the model and serial numbers. If possible, use the original packaging material for return shipping. Otherwise, repack the unit using:
   - a reinforced cardboard box, strong enough to carry the weight of the unit.
   - at least 5 cm of shock-absorbing material around the unit.
   - nonabrasive dust-free material for the other parts.

   Repack the unit in a manner to ensure that it cannot shift in the box during shipment.

METRON's product warranty is on page ii of this manual. The warranty does not cover freight charges. C.O.D. will not be accepted without authorization from METRON A.S or its representative.

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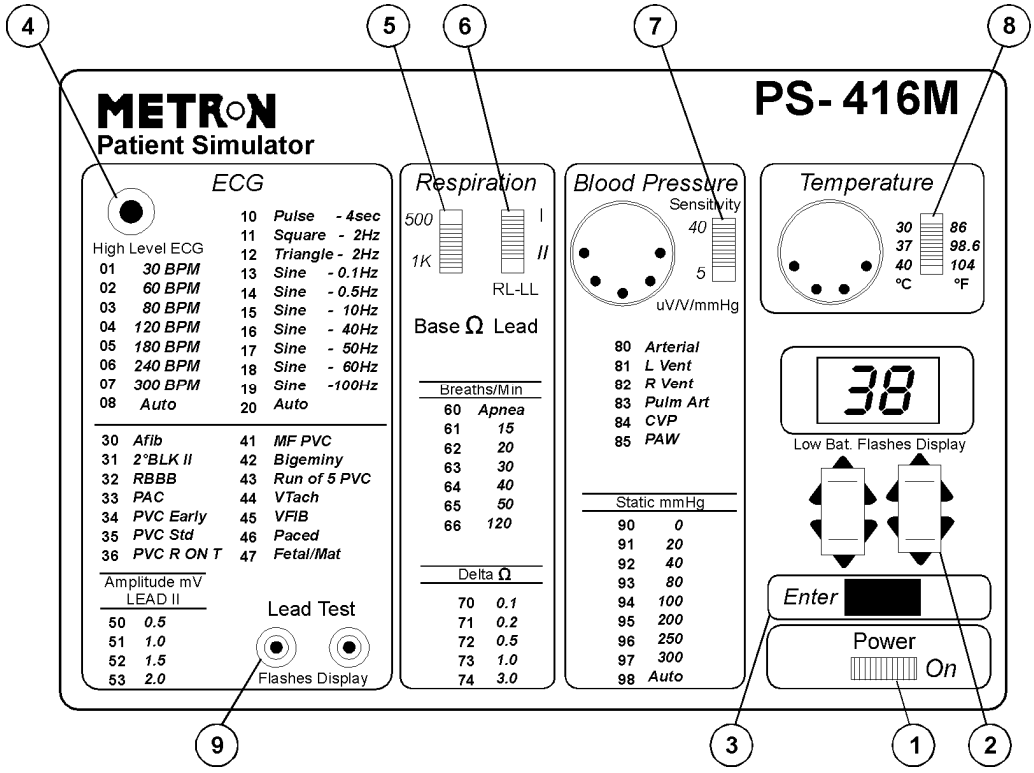
3. Operating PS-416M

This chapter explains the PS-416M operating controls and terminals.

3.1 Control Switches and Terminals

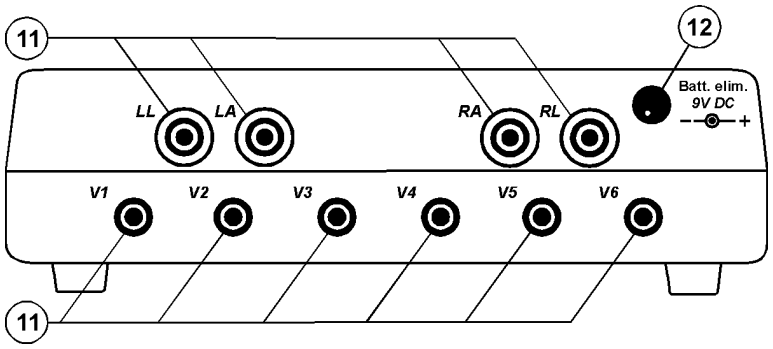
Front Panel



1.	**Power Switch**	Turns the power on and off.
2.	**LCD Display Keys**	Sets LCD display waveform values. Use the right key to enter units, and the left key to enter tens. Press the top of the key to increase the value. Press the bottom of the key to decrease the value.
3.	**Enter**	Pressing this stores newly specified waveform value set by the keys.
4.	**High Level ECG Connector**	Standard phone jack connecting the high level ECG output signal.
5.	**BASE Ω (Baseline Impedance) Slide Switch**	Sets the impedance between each lead. The respiration parameter (breathing rate/min) is selected and stored in the display.
6.	**LEAD Slide Switch**	Determines which lead is in use. The position of

		the switch must correspond to the type of patient monitor in use.
7.	**Blood Pressure Slide Switch (µV/V/mmHg)**	Sets the sensitivity to match the input sensitivity of the patient monitor (either 5 or 40 ☞V/V/mmHg). The waveform is selected and stored in the display.
8.	**Temperature Slide Switch**	Sets the temperature to be used.
9.	**Lead Test Terminals**	For testing ECG leads. Connect each end of the lead to one of the two Lead Test Terminals. The LCD display will flash if the lead is OK.

Rear Panel



10.	**Low level ECG Connectors**	10 AHA color-coded 4mm safety terminals. Snap-to-banana adapters for the terminals are supplied with the PS-416M.
11.	**Battery Eliminator**	Micro jack for connecting the 9V plug-in power supply transformer for use in operating the unit from any standard electrical outlet.

NOTE
Use only METRON's AC Adapter plug-in power supply transformer supplied with the unit.

3.2 Use

1. **Power.** The power switch is the slide-switch situated at the bottom right-hand corner of the panel. The instrument should be switched off when not in use, to save the battery. A flashing display indicates low battery power.

2. **Battery Replacement** The battery is situated in the base of the instrument. Use a 9 volt alkaline battery (Duracell® MN1604 or equivalent).

NOTE
Do not use mercury, air or carbon-zinc batteries.

3. **Top Panel Controls and Connectors**

   Display and Keyboard

   The PS-416M has a two-digit display. To the left of the LCD display is a listing of available waveforms and two-digit codes. Access a waveform by displaying its corresponding two-digit code. Use the two keys below the LCD display to enter units and tens (the right key is for units; the left is for tens). Pressing the top of the keys increases the values, while pressing the bottom of the keys decreases the values. The selected waveform is stored by pressing **Enter**. Repeat the above procedure if you de-

sire to store several waveforms. By using the left-hand key (tens), you can switch between waveforms stored in the instrument.

When the apparatus is switched on, the display will show the program version for a short period before switching into standard mode.

NOTE
When the instrument is switched off, all stored information will be canceled.

Manual ECG, High Level Output

The high level ECG output signal is a Lead II waveform with 0.5V/mV of low level Lead II. The high level ECG connection (standard phone jack) is situated in the upper left-hand corner of the instrument.

Respiration

The respiration signal is transferred via ECG connections. The position of the LEAD switch determines which lead is in use. The position of the switch must correspond to the type of patient monitor being used. The BASE (baseline impedance) switch sets the impedance between each lead. The respiration parameter (breathing rate/min.) is selected and stored in the display.

Blood Pressure

The sensitivity switch (pVN/mmHg) must be set to match the input sensitivity of the patient monitor (either 5 or 40 pVN/ mmHg). The waveform is selected and stored in the display. Prewired cables (P.N. 17440) and diagrams for connecting various types of monitors are available from Metron AS. Unterminated cables are also available.

CABLE CONNECTION MATRIX
BLOOD PRESSURE CABLE

DIN Plug Pin No.	Color	Function
4	Black	Output (+)
1	Red	Output (-)
3	White	Exciter (+)
5	Green	Exciter (-)
2	Blue	ECG ref

Temperature

(See below). The type of cable used determines the type of probe simulated, either 400 or 700 series YSI probes. Temperature is selected by a slide switch. Prewired 400/700 YSI-series temperature cables to connect to the temperature connector are available from Metron AS (P.N. 17443). Unterminated cables are also available.

CABLE CONNECTION MATRIX
UNIVERSAL TEMPERATURE CABLES

DIN Plug Pin No.	Color	OUTPUT 1 400 Series	OUTPUT 2 700 Series
1	Green	Tip	No conn.
2	Red	No conn.	Tip
3	White	No conn.	Ring
4	Black	Barrel	Barrel

Lead Testing

ECG leads should be tested regularly. Connect each end of a lead to one of the two Lead Test terminals. The display will flash if the lead is OK.

4. **Rear Panel Connectors**

Low-Level ECG Leads

There are ten AHA color-coded 4mm safety terminals located on the rear panel. Snap-to-banana adapters for the terminals are supplied with the PS-416M (P.N. 17023).

Battery Eliminator

METRON's AC Adapter plug-in power supply transformer allows you to use the PS-416M anywhere a standard electrical outlet is available. To attach the AC Adapter insert the adapter's small connector into the micro jack labeled "Batt. Elim. 9V DC" on the right rear of the unit. Plug the large connector into the nearest standard electrical outlet.

NOTE
Remove the batteries and disconnect the AC Adapter if you do not intend to use the PS-416M for an extended period of time.

4. Control and Calibration

This chapter explains PS-416M maintenance procedures, including testing and calibration.

4.1 Required Equipment

- Digital multimeter, 10pV resolution, 0.1% accuracy.
- Frequency counter
- Oscilloscope
- Power supply variable V/A

4.2 Preparation

1. Set the switches on PS-416M as follows:

   Power: Off

   Base: 1K

   Lead: II

   Sensitivity: 40

   Temperature: 30°C

2. Connect a current to the battery contact. Adjust the voltage from 9V ± 0.2V with a power limitation of 70mA ± 20mA.

4.3 Function Testing

1. Turn the Power Switch on. The LCD display will briefly show the software version number, before showing the active ECG function (03). Press the Key Switches beneath the display and check that the number displayed increases or decreases with each press. Press **Enter** and check that the display flashes once.

2. Measure the current consumption from the power supply.

   Requirement: 19mA ± 2mA.

3. Measure the operating voltage in PS-416M with the multimeter. The following values are acceptable:

Testpoints - +	Value	Maximum Deviation
TP10 - TP4	+5V	± 0.2V
TP10 - TP5	-5V	± 0.4V
TP10 - TP9	+1.24V	± 0.03V
TP14 - TP11	+7V	+6 - 1V
TP14 - TP12	-7V	+1 - 6V
TP14 - TP13	+5V	± 0.2V

4. Connect the frequency meter to TP1 and read the frequency. Requirement: 2MHz ± 0.002MHz.

5. Connect the frequency meter to TP2 and read the frequency. Requirement: 100Hz ± lHz.

6. Short circuit the 'Lead Test' terminals and check that the display is flashing. Remove the short circuit.

7. Slowly reduce the voltage from the power supply until the display just begins to flash. Measure the operating voltage with the multimeter. Requirement: 6.2V ± 0.3V. Measure also the voltage between TP-13 and TP-14. If the voltage is lower than 4.8V, adjust TR1 until the voltage is 4.8V. Turn the current up again to 9V.

8. Connect the oscilloscope to the High Level ECG contact and check that there is a 80BPM ECG signal when function 03 is activated. The R-impulse will have an amplitude of approximately 0.5V.

9. Set the power switch to Off. Measure the resistance from the RL output to the RA, LA and LL outputs. To measure LA, the Lead switch must be in position II. To measure LL, the Lead switch must be in position I. Requirement: 1000 ohms ± 30 ohms.

10. Repeat test 9, only this time with Base-ohms in position 500. To measure LA, the Lead switch must be in position II. To measure LL, the Lead switch must be in position I.

    Requirement: 500 ohms ± 15 ohms.

11. Measure the resistance from the V1 output to the V2,V3,V4,V5 and V6 outputs.

    Requirement: 1000 ohms ± 30 ohms.

12. Measure the resistance between TP10 and TP14 with the multimeter.

    Requirement: >10 Mohms.

13. Measure the resistance between the connections on the temperature contact. The following table shows the required parameters:

	TEMP 30°C Min. - Max.	**TEMP 37°C Min. - Max.**	**TEMP 40°C Min. - Max.**
Pin4-Pin 1	1k8-1k83	1k34-1k37	1k19-1k21
Pin4-Pin 2	4k79-4k88	3k57-3k65	3k16-3k23
Pin4-Pin 3	24k0-24k5	18k0-18k4	16k0-16k3

14. Set the power switch in position while momentarily holding down **Enter**. The display will only show 0 in the right-hand column (the left column will be blank). PS-416M is now in

    test/calibration mode. Connect a 10V ± 10mV voltage to J9 (the BP contact), pins 3 and 5. Minus to pin 5. Check the voltage after connecting the power.

15. Measure and note the voltage between TP14 and TP16 (typ. <1mV). Set the display at 1 and press **Enter**. Measure the voltage once more and adjust P5 until the difference between the voltages is 120mV ± 200☞V.

16. Repeat the previous instruction, only this time with the Sensitivity switch set to position 5. Check that the voltage between TP14 and TP16 is 15mV ± 40☞V. If necessary, adjust P5 and repeat operation 15.

17. Set the display at 2 and press **Enter**. Measure the resistance between TP7 and TP10 with the multimeter. Adjust P1 until the voltage is half the reference voltage between TP10 and TP9 (nom. -0.62v) ± lmV.

18. Measure the voltage between TP6 and TP10 with the multimeter. Adjust P2 until the voltage is half the reference current between TP10 and TP9 (nom. 0.62v) +lmV.

19. Measure and note the voltage between LL(+) and RA(-) (typ. < 100☞V). Set the display at 3 and press **Enter**. Measure the voltage once more and adjust P4 until the difference between the voltages is 2mV ± 20☞V. Measure the voltages between the outputs and check that they are within the limits in the following table:

Connectors	Low limit	Nom. Value	High limit
RL - RA	1.20 mV	1.35 mV	1.50 mV
RL-LA	2.40mV	2.65mV	2.90mV
RL-LL	3.00 mV	3.35 mV	3.70 mV
RL-V1	2.70 mV	3.02 mV	3.30 mV
RL-V2	3.30 mV	3.72 mV	4.10 mV
RL-V3	4.00 mV	4.49 mV	5.00 mV
RL-V4	4.50 mV	5.06 mV	5.60 mV
RL-V5	4.00 mV	4.49 mV	5.00 mV
RL-V6	3.30 mV	3.72 mV	4.10 mV

20. Set the display at 4. Set the Base-ohms switch to 500 and the Lead switch to II. Measure the resistance between LL and RA. Move between test functions 4 and 5 on the display (remember to press **Enter**), and adjust P3 until the difference is 3 ohms ± 0.03 ohms.

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5. Component Functions and Parts

This chapter provides a detailed description of the functions of the main components of the PS-416M, as well as a parts list for cross reference. Reference is made to the component location and circuit diagrams to assist servicing personnel. These diagrams are foldouts, and located in Appendix A.

5.1 Theory of Operation

The PS-416M Patient Simulator is battery driven, and based on a Motorola microprocessor. The unit is operated from a control panel, and generates simulated signals for testing ECGs and patient monitors. The signals are sent from the PS-416M via contacts situated on the front and top of the unit. The status of the signals is then displayed on an LCD panel.

The unit is illustrated by a component location diagram and two circuit diagrams. The first circuit diagram 1 includes the microprocessor, operating elements, display, power supply and circuits for simulating temperature measurements. The second circuit diagram comprises mainly analogue amplifiers and circuits for generating waveforms for blood pressure and ECG.

5.2 Functions Description

1. **Power Supply**

   The unit is powered from either an internal 9 V battery or an external battery eliminator. Diode D1 protects against a wrong polarization. Power switch SW1 takes the 9V current to the power supply circuits. A serial voltage regulator (IC5) supplies the circuits with +5V. The circuit has an output that resets the microprocessor when the +5V supply falls below 4.75V. A capacitive switch regulator (IC6) generates -5V from the +5V current.

   At the upper left of Circuit Diagram 1 is a DC/DC converter, which generates ± 7V to the blood pressure output. The converter is galvanically shielded from the transformer (TR1). The timer (IC7) generates a rectangular current of approximately 30KHz, which is amplified by transistors Q1 and Q2. The primary development at TR1 is a resonance with a multilayer capacitor (C26). The secondary AC signal is equalized by diodes D2, D3, D7 and D8, and smoothed out by tantalum capacitors C15 and C16. Voltage Regulator IC20 regulates the +5V power that is used by the D/A converter on the blood pressure output.

2. **Microprocessor**

   The microprocessor (IC1) contains: CPU, ROM, RAM ND converter, parallel I/O and serial I/O. Y1 functions as a clock and timer for the processor. The frequency at pin TP1 is the crystal frequency / 4 = 2MHz.

Ports E0 to E4 are connected to the switches on the control panel. These are read 50 times per second. If a switch changes its status from off to on, the program in the processor will execute the function that was linked to the operation.

The LCD display is controlled through Port B via the LCD drivers IC2 and IC3. The processor's timer generates a 100Hz rectangular signal (output A3), which drives the rear panel of the display. This signal can be monitored at pin TP2. The processor controls three D/A converters. Two of these are situated in IC8, while the third is situated in IC15. IC8 is loaded in parallel through Port C, with control signals at Port A 4-6. IC15 is loaded in series, because this is easier when the signal is to be led through optical connectors to obtain galvanic separation.

The A/D converter in the processor is used to monitor the current from the battery. The voltage is reduced by resistors R2 and R3, and led to the ND converter via port E5. The +5V power is used as a reference by the ND converter at VRH.

IC-21 is a serial EEPROM, which is set aside for future use.

3. **Lead Test**

   The resistance between test plugs J4 and J5 is determined by measuring the voltage drop over R4. The current from R4 is led to the processor input E6 via resistor R88. If the power falls below the threshold internally in the processor), the program in the processor will cause the display to flash.

4. **Temperature Output**

   The temperature output comprises a 3-way slide switch with a resistance array that simulates thermistors, which are used for measuring temperatures. The resistances are precise and designed to give accurate values. By varying the position of the switch, the ohm values for the 3 different positions can be entered.

5. **ECG Outputs**

   The ECG waves are generated from matrices in the processor. The processor updates the 8-bit D/A converter in IC8 (channel A) 500 times per second. IC-10 amplifies the signal and the amplitude is set by P4. P1 adjusts the amplification in the D/A converter. From pin 7 at IC10 (TP-8), the ECG signal is led to the resistive power elements. These organize the correct amplitude levels on all the ECG contacts. The output impedance for 4 of the outputs can be set at 500 ohms or 1000 ohms by slide switch SW7. The impedance can also be modulated at the LL or LA output, depending on the position of slide switch SW6. Refer to section on respiration.

   IC19 sets the voltage reference level for the two D/A converters in IC8. The reference voltage is amplified in the first half of the microprocessor (IC1). The second half of the microprocessor is used to drive the high level output for the ECG signal. The amplification is not adjustable.

Output A7 on the processor is connected to the amplifier chain so that a short impulse here will simulate a pace-impulse at the ECG output. Resistors R36, R37, R38 and R39 set the level for the pace-impulse.

6. **Respiration**

   The other A/D channel in IC8 (Channel B) is used to generate the respiration signal. This is generated according to the same principle as the ECG signal, and is amplified in IC9. P2 adjusts the amplification in the D/A converter, while P3 adjusts the rate of modulation at the ECG output. The signal controls the resistance in two matching resistive optical connectors. One of these is used for feedback, while the other simulates respiration by modulating the output impedance for the ECG signal.

7. **Blood Pressure**

   The blood pressure output is isolated from the rest of the equipment to separate several connected instruments galvanically. Blood pressure data is transferred serially from the processor to voltage regulator IC5, a 12-bit D/A converter. The interface has optical separation via the optical connectors IC12, IC13, and IC14. Statistical values or waveforms for blood pressure are generated from matrices in the processor. The D/A converter is updated by new amplitude values 500 times per second. The signal is amplified in IC16, and the level adjusted by P5. Slide switch SW8 sets two fixed sensitivity levels at the output. The exciter signal from the blood pressure meter is used as a reference for the D/A converter.

5.3 Component Parts

COMPONENT PART	*TYPE/VALUE*	*QTY.*	*DIAGRAM REFERENCE*
Board	AR-048	1	
Microprocessor	MC68HC711E9CFN	1	IC1
LCD-driver	74HC4543P	2	IC2, 1C3
Display	NCno SP530P	1	IC4
Volt. regulator	LP2951CN	2	IC5, 1C20
Volt. converter	MAX1044CPA	1	IC6
Timer	ICM7555CN	1	IC7
D/A-converter	AD7528JN	1	IC8

COMPONENT PART	TYPE/VALUE	QTY.	DIAGRAM REFERENCE
Op.ampl	LT1013DN8	4	IC9, 1C10, 1Cl1, 1C16
Opto coupler	6N136HP	3	IC12, 1C13, 1C14
DIA-converter	DAC8043FP	1	IC15,
Opto coupler	VTL5C7	2	IC17, 1C18
V-ref.	LM-385Z 1V2	1	IC19,
Transistor	BC547C	2	Q1, Q20
Diode	1N4002	1	D1
Diode	1N4148	4	D2, D3, D7, D8
Zenerdiode	17Vbip. BZW06-17B	1	D4
Krystall	8 MHz HC-18/U	1	Y1
Resistor	20R 1% 0.5W	1	R7
Resistor	24R9 1% 0.5W	1	R9
Resistor	34R8 1% 0.5W	1	Rll
Resistor	35R7 1% 0.5W	1	R13
Resistor	40R2 1% 0.5W	1	R15
Resistor	56R2 1% 0.5W	1	R75
Resistor	75R 1% 0.5W	3	R46, R47, R48
Resistor	84R5 1% 0.5W	1	R17
Resistor	93R1 1% 0.5W	1	R79
Resistor	100R 1% 0.5W	1	R29
Resistor	150R 1% 0.5W	1	R85
Resistor	174R 1% 0.5W	2	R50, R76
Resistor	200R 1% 0.5W	1	R49
Resistor	249R 1% 0.5W	8	R63, R64, R65, R66, R67, R69, R70, R71
Resistor	332R 0.10 % 0.5W	I	R84
Resistor	348R 1% 0.5W	1	R19
Resistor	365R 1% 0.5W	3	R82, R86, R87
Resistor	412R 1% 0.5W	1	R21
Resistor	499R 1% 0.5W	6	R52, R54, R56, R58, R60, R62
Resistor	576R 1% 0.5W	1	R23
Resistor	1K18 0.50% 0.5W	1	R8
Resistor	1K33 0.50% 0.5W	1	R10
Resistor	1K78 0.50% 0.5W	1	R12
Resistor	2K0 1% 0.5W	4	R28, R72, R73, R74
Resistor	2K32 0.10% 0.5W	1	R83
Resistor	3K16 0.50% 0.5W	1	R14
Resistor	3K57 0.50% 0.5W	1	R16
Resistor	3K74 1% 0.5W	1	R80
Resistor	4K75 0.50% 0.5W	1	R18
Resistor	4K99 1% 0.5W	2	R4, R68

COMPONENT PART	TYPE/VALUE	QTY.	DIAGRAM REFERENCE
Resistor	5K6 1% 0.5W	2	R37, R39
Resistor	11K 1% 0.5W	4	R42, R45, R77, R78
Resistor	14K 1% 0.5W	4	R5, R44, R26, R35
Resistor	15K8 0.50% 0.5W	1	R20
Resistor	17K8 0.50% 0.5W	1	R22
Resistor	18K 1% 0.5W	1	R3
Resistor	20K 1% 0.5W	1	R6
Resistor	23K7 0.50% 0.5W	1	R24
Resistor	28K 1% 0.5W	1	R43
Resistor	40K2 1% 0.5W	3	R31, R33, R36
Resistor	47K5 1% 0.5W	2	R2, R57
Resistor	53K6 1% 0.5W	2	R55, R59
Resistor	61K9 1% 0.5W	1	R30
Resistor	64K9 1% 0.5W	2	R53, R61
Resistor	75K 1% 0.5W	1	R38
Resistor	76K8 1% 0.5W	1	R34
Resistor	80K6 1% 0.5W	4	R25, R32, R40, R51
Resistor	97K6 1% 0.5W	1	R27
Resistor	165K 1% 0.5W	2	R41, R88
Resistor	10M 5% 0.5W	1	R1
Resistor nettv.	47Kx 8	2	RP1, RP2
Potmeter	1K0 1 turn	2	P1, P2
Potmeter	1K 20 turn	1	P5
Potmeter	10K 20 turn	1	P4
Potmeter	100K 20 turn	1	P3
Cer. capacitor	22pF 100V	2	Cl, C20
Multilay. cap.	1n 100V X7R	2	C20, C24
Multilay. cap.	10nF 50V X7R	1	C26
Multilay. cap.	22nF 50V X7R	1	C21
Multilay. cap.	100nF 50V X7R	20	C5, C6, C7, C8, C9, C12, C25, C13, C14, C17, C18, C19, C22
Tantalum cap.	10☞F 25V	5	C3, C4, C10, C15, C16
Electrolyte Capacitor	100☞F 16V rad.	1	Cll
Transformer	CAN1979A	1	TR1
Slide Switch	4PDT MSS4200	4	SW1, SW6, SW7, SW8
Slide Switch	4P3T MSS4300	1	SW5
Switch	ET05J 1V3BE (on) off (on)	2	SW2, SW3
Switch	15 501	1	SW4
Nut to Switch	16.300.09	1	

COMPONENT PART	TYPE/VALUE	QTY.	DIAGRAM REFERENCE
IC-socket	8-pin DIL	1	
IC-socket	20 pin SIL 48-157-42	2	
IC-socket	52 pin PLCC 48-109-41	1	
Space bar	Ritcho SRS4-4-0	4	
Battery el.cont	S-G9312#01 Female	1	J1
Test plug	Male	1	J4
Test plug	Female	1	J5
Phono-socket	LPV1120-01(black) Female	1	J6
Header	2 pol 5046	1	J2
Header	4-pol	1	J8
Header	6-pol	1	J7
Din 5 pole	180°	1	J9
Din 4 pole	270° 691-0400	1	J3

APPENDIX A: DIAGRAMS

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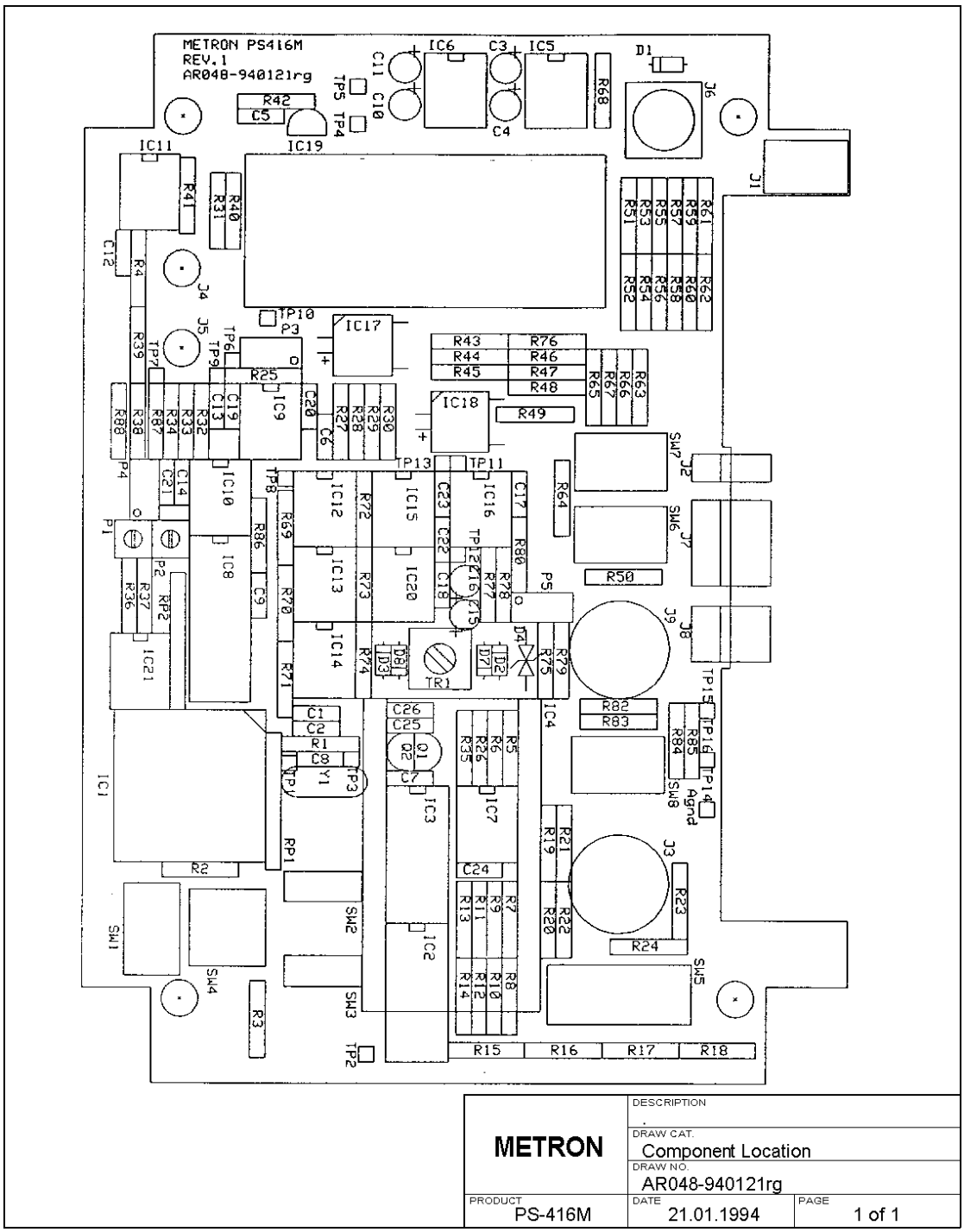
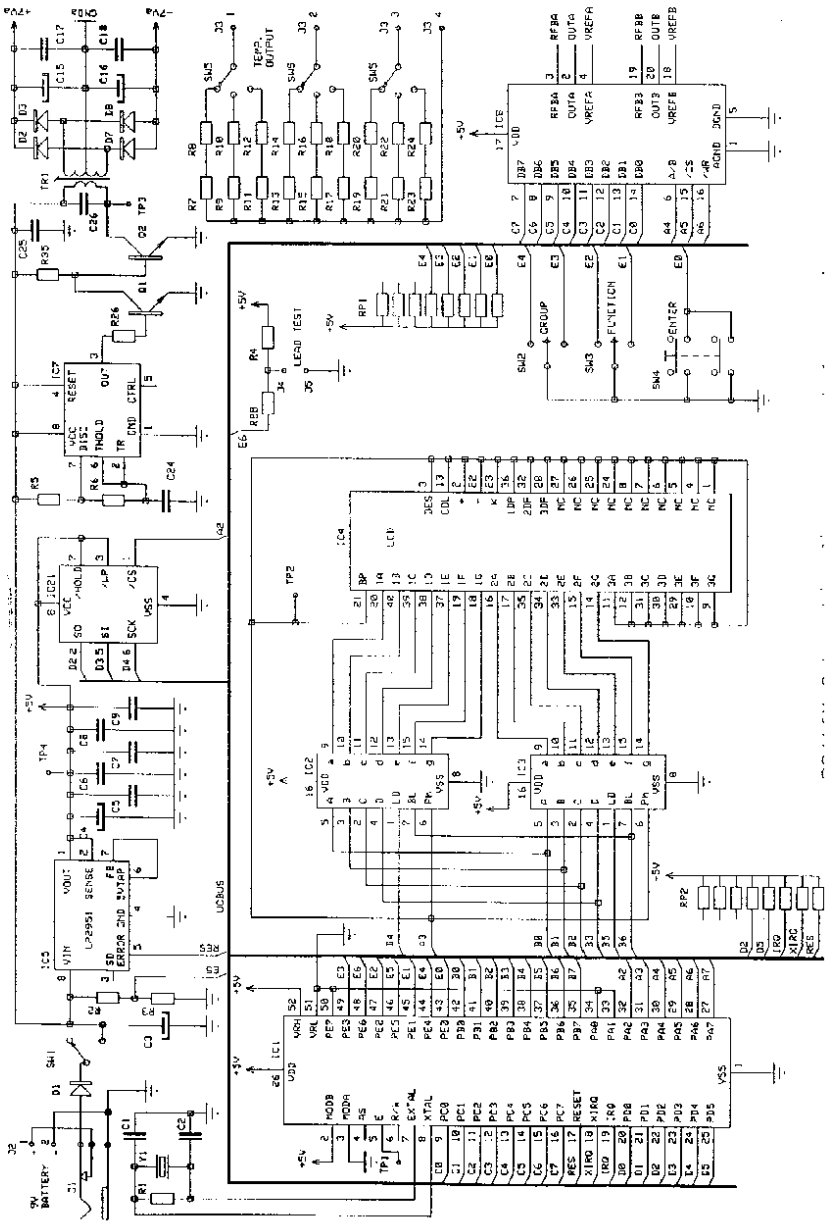
Component Location

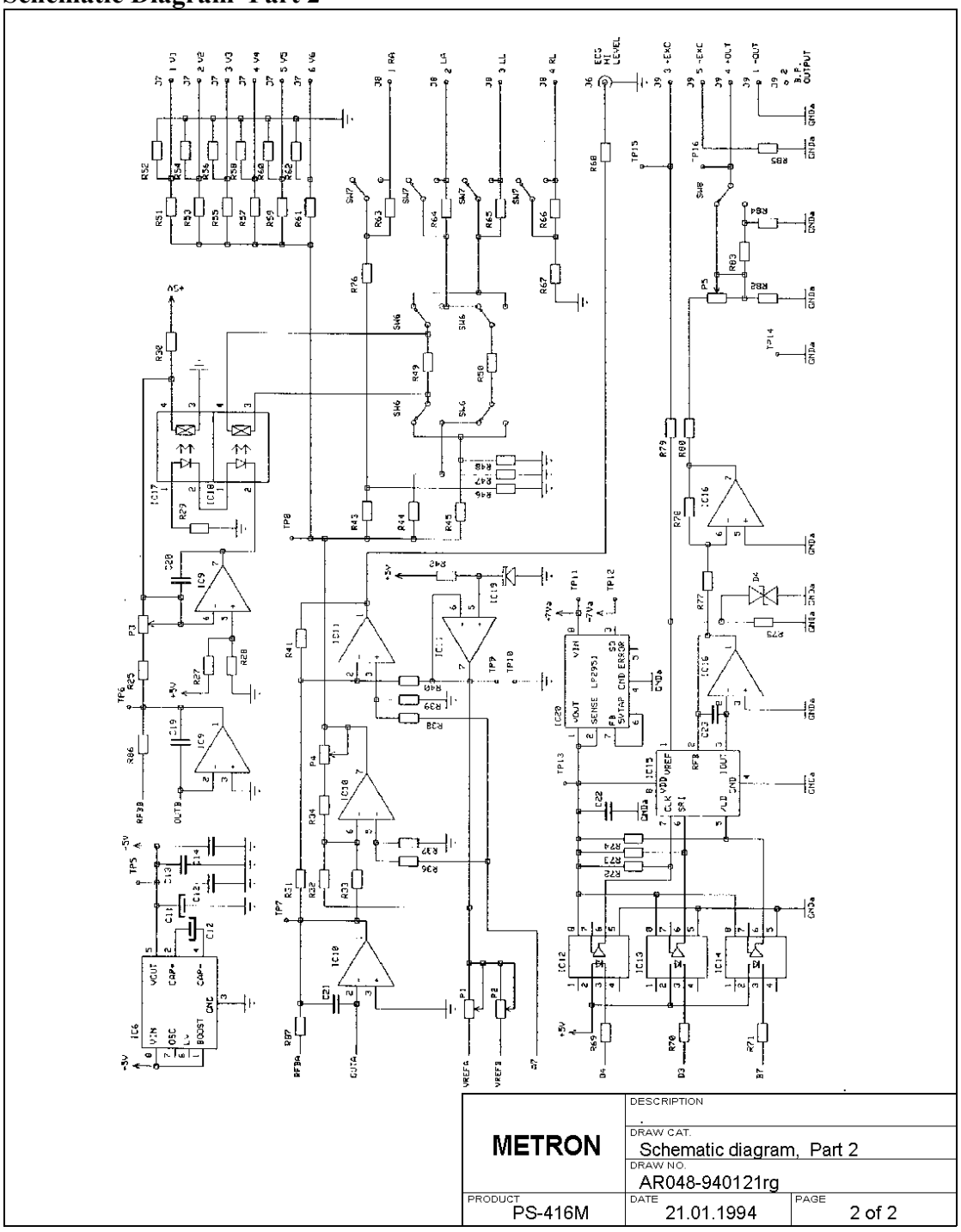


Schematic Diagram Part 1



METRON	DESCRIPTION .	
	DRAW CAT. Schematic diagram, Part 1	
	DRAW NO. AR048-940121rg	
PRODUCT PS-416M	DATE 21.01.1994	PAGE 1 of 2

Schematic Diagram Part 2



METRON	DESCRIPTION .	
	DRAW CAT. Schematic diagram, Part 2	
	DRAW NO. AR048-940121rg	
PRODUCT PS-416M	DATE 21.01.1994	PAGE 2 of 2

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APPENDIX B: ERROR REPORT FORM, PS-416M

PS-416M PATIENT SIMULATOR ERROR REPORT FORM

USA
1345 Monroe NW, Suite 255A
Grand Rapids, MI 49505
Phone: (+1) 888 863-8766
Fax: (+1) 616 454-3350
E-mail: *metronus@aol.com*

FRANCE
30, rue Paul Claudel
91000 Evry, France
Phone: (+33) 1 6078 8899
Fax: (+33) 1 6078 6839
E-mail: *metronfrance@infonie.fr*

NORWAY
Travbaneveien 1
N-7044 Trondheim, Norway
Phone: (+47) 7382 8500
Fax: (+47) 7391 7009
E-mail: *support@metron.no*

METRON

From: (name) Address:	Phone: Fax: Date:

PS-416M Error Report

Product:
Version:

Type

☐ Wrong results	☐ Error messages, without reason
☐ Program stops, no reaction	☐ Wrong responses on commands.
☐ Other	

Description of the situation prior to the error:

Description of the error:

(METRON use internally)

Received date:	Comments:	☐ Critical
Correction date:		☐ Minor
Ref No.		☐ Normal

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APPENDIX C: Suggestion Form, PS-416M

PS-416M PATIENT SIMULATOR SUGGESTION FORM

USA
1345 Monroe NW, Suite 255A
Grand Rapids, MI 49505
Phone: (+1) 888 863-8766
Fax: (+1) 616 454-3350
E-mail: *metronus@aol.com*

FRANCE
30, rue Paul Claudel
91000 Evry, France
Phone: (+33) 1 6078 8899
Fax: (+33) 1 6078 6839
E-mail: *metronfrance@infonie.fr*

NORWAY
Travbaneveien 1
N-7044 Trondheim, Norway
Phone: (+47) 7382 8500
Fax: (+47) 7391 7009
E-mail: *support@metron.no*

METRON

From: (name) Address:	Phone: Fax: Date:
PS-416M Improvement Suggestion	Product: Version:

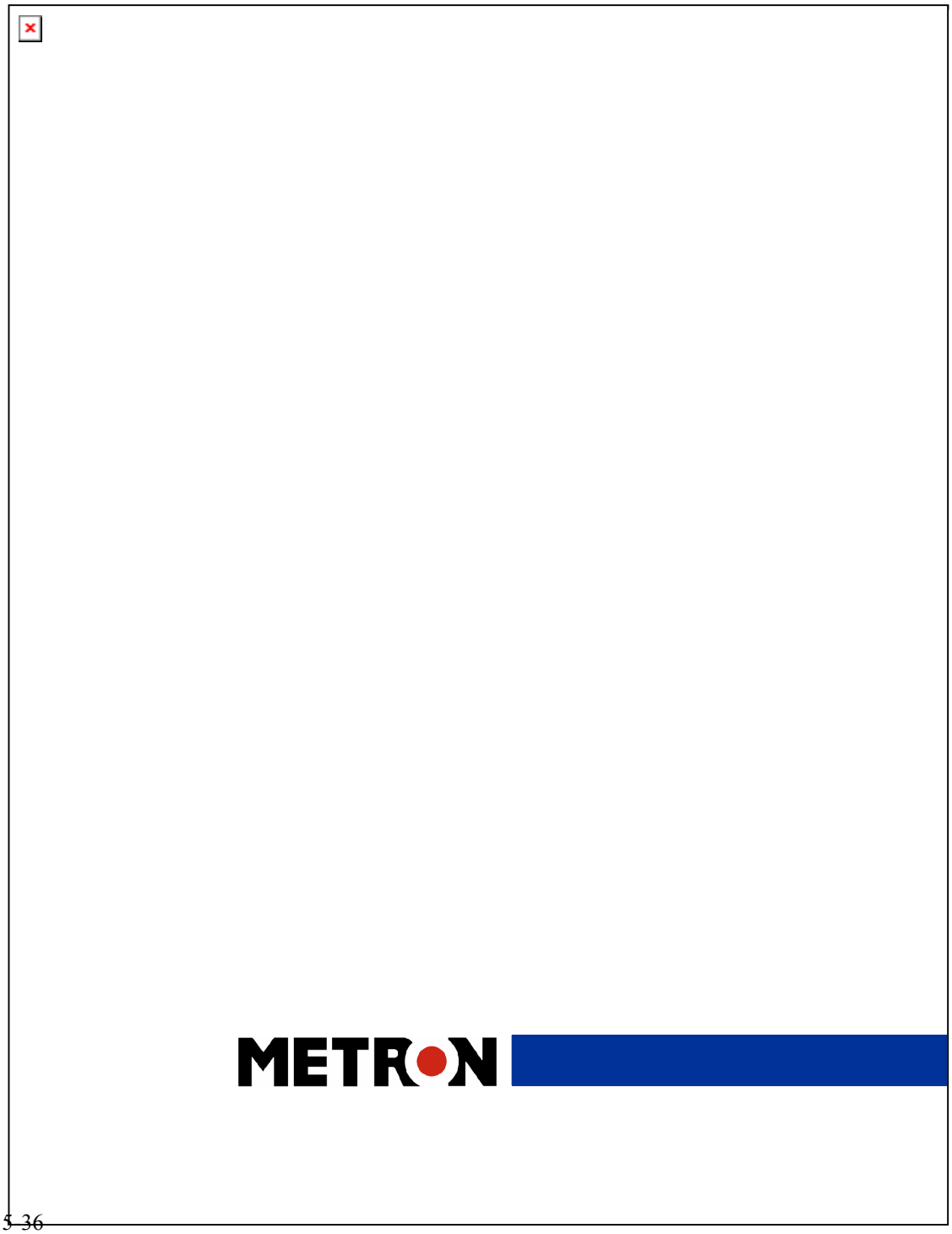
Type

☐ One window	☐ Presentation
☐ Several windows	☐ Options, configuration possibilities
☐ Documentation	☐ Other

Description of the suggested improvement:

(METRON use internally)

Received date:	Comments:
Correction date:	
Ref No.	


METRON