MicroCal P4

Portable Calibrator

User Manual MM850600 ed. 01

INTRODUCTORY NOTE

*This manual contain with all the information you need to operate and maintain the portable calibrator **MicroCal P4** and his accessories.*

Eurotron has used the best care and efforts in preparing this book and believes the information in this publication are accurate. The Eurotron products are subjected to continuous improvement, in order to pursue the technological leadership; these improvements could require changes to the information of this book.
Eurotron reserves the right to change such information without notice.

*Any maintenance operation must be carried out by qualified personnel only. **Eurotron** supplies instructions and operative procedures for any operation on the instrument. We recommend to contact our technicians for any support requirements.*

*MicroCal P4 are fully tested in conformity with the directive n°89/336/CEE Electromagnetic Compatibility. **Eurotron** shall not be liable in any event, technical and publishing error or omissions, for any incidental and consequential damages, in connection with, or arising out of the use of this book.*

CE

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SUMMARY

1 MicroCal P4 Ordering Code

3209 STD - A - B - C

*Each **MicroCal P4 STD** pack comes with: one pressure calibrator, charger, instruction manual, Eurotron calibration certificate*

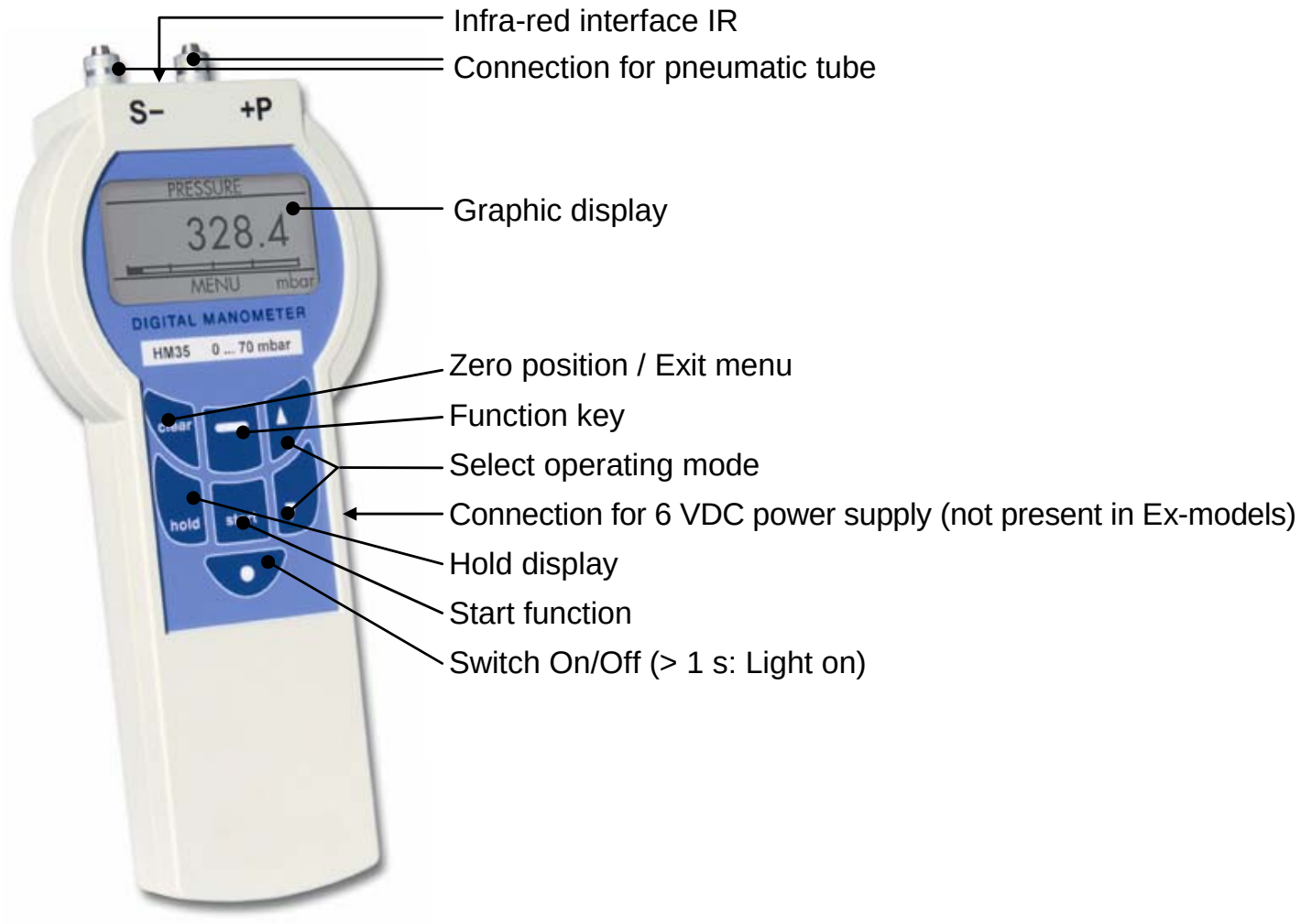
3209 IS - A - B - C

*Each **MicroCal P4 IS is Eex ia IIC T4 compliant** and the pack comes with: one pressure calibrator, charger, instruction manual, Eurotron calibration certificate*

Table A	**Sensor Accuracy**
0	±0.2% ±1 digit
1	±0.1% ±1 digit
2	±0.05% ±1 digit

Table B	**Sensor Range - Available accuracy**
D - 25m	25 mbar gauge and differential dry sensor - 0.1% / 0.2%
D - 70m	70 mbar gauge and differential dry sensor - 0.05% / 0.1% / 0.2%
D - 200m	200 mbar gauge and differential dry sensor - 0.1% / 0.2%
D - 300m	300 mbar gauge and differential dry sensor - 0.05% / 0.1% / 0.2%
D - 500m	500 mbar gauge and differential dry sensor - 0.1% / 0.2%
D - 1000m	1000 mbar gauge and differential dry sensor - 0.05% / 0.1% / 0.2%
A - 1100m	1100 mbar absolute sensor - 0.1% / 0.2%
D - 2000m	2000 mbar gauge and differential dry sensor - 0.05% / 0.1% / 0.2%
G - 2000m	2000 mbar gauge wet sensor - 0.1% / 0.2%
A - 2000m	2000 mbar absolute dry sensor - 0.05% / 0.1% / 0.2%
D - 7500m	7500 mbar gauge and differential dry sensor - 0.05% / 0.1% / 0.2%
G - 7500m	7500 mbar gauge wet sensor - 0.1% / 0.2%
A - 7500m	7500 mbar absolute dry sensor - 0.05% / 0.1% / 0.2%
D - 17	17 bar gauge and differential dry sensor - 0.05% / 0.1% / 0.2%
G - 17	17 bar gauge wet sensor - 0.1% / 0.2%
G - 35	35 bar gauge wet sensor - 0.1% / 0.2%
G - 70	70 bar gauge wet sensor - 0.1% / 0.2%
G - 90	90 bar gauge wet sensor - 0.1% / 0.2%

2 Operating Elements



Please note this warning symbol in these operating instructions!

3 Description

The MICROCAL P4 digital pressure gauge is a pressure-measuring instrument with an integrated pressure sensor for the measurement of differential, relative or absolute pressures and vacuum. Its versatile range of functions and high precision render it suitable for a wide range of applications. Via the infrared interface (IR) and SCPI (Standard Commands for Programmable Instruments) commands, the MICROCAL P4 can communicate with a PC. Its operation is very simple, and supports the user in his measurement tasks.

3.1 Operating modes

- Pressure measurement / Differential pressure
- Min./Max. values
- Mean value (average)
- Pressure change rate
- Data logging

Selectable configuration possibilities:

- Data logging
  → Interval time, print/transfer, deleted memory
- Configuration
  → Measurement units, display filter, auto. switch-off time, auto zero, lighting level, etc.
- Average period (period for determining average value)
- Date and Time (real-time clock)
- Calibration
  → Date of last calibration date, manual recalibration

Correct usage

The explosion-proof version is designed as a test and measuring instrument for temporary use within the process, and is certified for EEx ia IIC T4 (Zone1).
Its correct usage does not include permanent or long-term measurement without supervision.

3.2 Safety information

The pressure values and overload levels stated on the rating plate and quoted in these operating instructions must not be exceeded, as otherwise the pressure sensor could be destroyed or there could be a risk of injury.
Only use pressure hoses with a maximum loading capacity corresponding to that necessary for the application.
Ensure that the pneumatic hoses are securely fitted! Do not use damaged or kinked hoses.
Do not open up the instrument (this would void the guarantee and the Ex-certification).
The instrument must be stored within the permissible storage temperature range.

The instrument without Ex-protection must not be put into operation in an explosive environment!

Wear eye protection if working with pressures > 1bar!

3.3 Notes for instruments with Ex-protection

The battery compartment must not be opened inside the Ex-area!

In areas where there is a risk of explosion, the instrument may only be used with the approved types of batteries. The battery types to be used, depending on the temperature class, can be found on Page 33 of the Appendix to the Operating Instructions.
Only use approved batterys type LR6 according to IEC 60086-1 provided by the manufacturer, as described in the appendix.

4 Operation

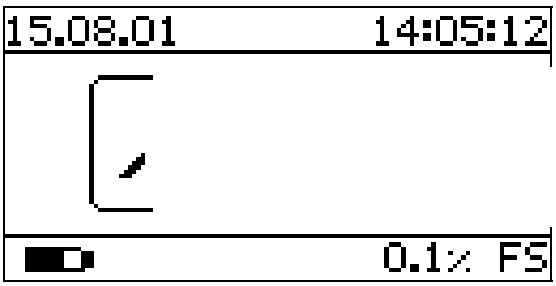
4.1 Switching on and off

Switching on — Briefly press the On/Off key ( ) (< 1 s)
For precise measurements, the MICROCAL P4 must first be switched on for at least 1 minute (warm-up phase).

Switching off — Briefly press the On/Off key ( ) (< 1 s), or automatic switch-off 3,10 or 60 minutes after the last time key operation
(automatic switch-off does not take place during Average, Change Rate and Data Logging measurements or in IR and network operation).

4.2 Working

- The MICROCAL P4 switches on automatically when the supply voltage is connected.
- The MICROCAL P4 continues to work in battery mode following an interruption of the supply voltage
- In case of a change in temperature, the MICROCAL P4 must be allowed to adapt to the new ambient temperature for a least 30 minutes while switched off in order to attain the best measurement accuracy.
- The day/time, battery level and accuracy will be briefly displayed at switch on:



- After switch-on, the MICROCAL P4 switches to the last operational mode used, e.g.:

- With the display filter activated, wait until the transient effect finishes (approx. 5 s).

4.3 Lighting

Switching on — Press the On/Off-key ( ) for > 1 s

Brightness control — In the Menu, select the Configuration → Lighting function and select an adjustment of Off, Level 1, Level 2 or Level 3.
The Ex-version MICROCAL P4 only has the levels Off and Level 1.

Switching off — Briefly press the On/Off key ( ) (< 1 s)
(switch off the instrument), or automatic switch-off after 20 s.
With mains operation, the MICROCAL P4 must be switched off manually.

4.4 Pneumatic connection

Designation	Pressure range
Hose 4/6 mm	≤ 7,5 bar
NPT1/8“ internal	10 ... 90 bar
Plug in nipple „Rectus“ Type 20	≤ 30 bar
M10 x 1 internal thread (for „Minimess“ connector)	all

ENSURE THAT THE PNEUMATIC HOSES ARE CONNECTED CORRECTLY!
+P HIGHER PRESSURE
S+ LOWER PRESSURE (NOT AVAILABLE WITH THE ABSOLUTE AND RELATIVE PRESSURE VERSION)

When screwing onto a coupling, it is important to hold the coupling steady with a wrench to prevent any turning!
Never secure by holding the casing itself!

4.4 Functions and operating modes

Key		clear	hold	[redacted] 1)	Start 2)
	Functions				
	PRESSURE	Zero: sets measured value to zero 3)	Freezes all current measurement values	To Menu selection	--
	Difference				
▲	MIN/MAX	Sets Max/Min to current measured value			
▼	AVERAGE 4)	Sets measured value to zero 3)		Stop/Menu	Starts measuring
	CHANGE RATE 5)				
	Data logging		--		Starts data logging

1. Once a measurement procedure has been started, the menu selection is blocked.
2. During a measurement procedure (after Start has been pressed), you can switch between functions. This permits, for example, the observation of the Min/Max function during data logging.
3. The Clear key has no function in the absolute pressure instruments.
4. The AVERAGE function creates an arithmetic average value of all measured values during the time period selected in the menu. After expiry of the time period, the average value will be displayed.
5. Measurement of the leak rate (diff/gauge sensor) or tendency (abs. sensor). The pressure change (Change Rate) from the start time to the current time will be displayed. The first display occurs 10 s after the start.

4.6 Menu selection and set-up

4.6.1 Navigation within the Menu selection

clear	Brief (< 1 s)	1 level back
	Long (> 1 s)	Back to the function level/operating modes
▲▼	Selection of Set-up/Functions	

The functions shown inverted on the display will be carried out if the Function key ([redacted]) is pressed.
The currently selected setting for values is marked with '✓'. In the following table, the default values are correspondingly marked (factory settings).

Key	[redacted]	[redacted]	[redacted]	Notes
	Data logging			
		Interval		Interval period
			✓	

Key	[redacted]	[redacted]	[redacted]	Notes
				Set with ▲/▼/ EDIT/OK
▲		Print Data Logging		
▼			Press 'Start'	Print/send via IR
		Clear Memory		
			Press 'Clear'	Deletes the data memory
	Configuration			
		Pressure Unit		
			✓	
		Display Filter		Filters the display values 1)
			✓	
		Auto-Off		Auto. switch-off
			✓	
		Auto-Zero		
				Sensor auto-zeros at switch-on if measured value < 1% FS
			✓	
		Beep		Warning beeper
			✓	
		Lighting		
				Only Level 1 possible for Ex-models
▲			✓	
▼		IR Interface		
			✓	At switch-on, the automatic connection to the PC is activated for 2 minutes
				Automatic connection is de-activated
	Average period			Time period for average value

Key	[redacted]	[redacted]	[redacted]	Notes
		✓		
				Set with ▲/▼/EDIT/OK
	Date & Time			
		dd.mm.yyyy		Set with ▲/▼/ EDIT/OK
		hh:mm:ss		Set with ▲/▼/ EDIT/OK
	Calibration			
		History		Displays the last calibration date
		Manual re-calibration		Manual re-calibration of the zero point and limit value

NOTE: WITH THE FILTER FUNCTION ACTIVE, SHORT-TERM MEASUREMENT VARIATIONS SHOULD BE SUPPRESSED, RESULTING IN A STEADIER DISPLAY. MEASURED VALUES VIA THE INTERFACE AND IN THE DATA LOGGING MEMORY WILL NOT BE FILTERED.

4.7 Data logging

4.7.1 Data recording

Every time that the Data Logging is started, an information header ("Header") will first be saved: The measured values will then be saved sequentially. "Stop" will be saved after every interruption of the logging or if manual storage is carried out. At the end of all the data loggings, "End" will be saved. Measured values can be uniquely identified by their header.

Designation	Example 1	Data Logging	Type of Data [2)]
Date	01.01.2001	Header	INTEGER
Time	12:00:00		
Interval	30 s		DISCRETE
Function	PRESS		
Unit	mbar		
	1000.0	Measurement series [1)]	FLOAT
	1001.1		
	1001.5		
	1000.3		
	999.7		
	Stop		DISCRETE
	End		DISCRETE

Designation	Example 2	Manual saving	Type of Data [2)]
Date	01.01.2001	Header 1st measurement	INTEGER
Time	12:00:00		
Interval	Manual		DISCRETE

Designation	Example 2	Manual saving	Type of Data [2]
Function	PRESS		
Unit	inHg		
	29.92	1st measured value [1]	FLOAT
	Stop		DISCRETE
Date	01.01.2001	Header 2nd measurement	INTEGER
Time	12:00:33		
Interval	Manual		DISCRETE
Function	PRESS		
Unit	inHg		
	29.29	2nd measured value [1]	FLOAT
	Stop		DISCRETE
Date	01.01.2001	Header 3rd measurement	INTEGER
Time	12:01:45		
Interval	Manual		DISCRETE
Function	PRESS		
Unit	inHg		
	28.00	3rd measured value [1]	FLOAT
	Stop		DISCRETE
	End		DISCRETE

1. „Over“ (data type DISCRETE) for invalid pressure value
2. For the Data Type key.
3. User-interval period will, for example, be displayed as follows, “user 01:15:00”

4.7.2 Transfer of data to a PC

(with MICROCAL P4 Communication Software)

1. Install the IR (IrDA) -adapter according the instructions of the manufacturer.
2. Install the MICROCAL P4 Communication Software.
3. Start the MICROCAL P4 Communication Software.
4. Place the instrument max. 20 cm from the IR (IrDA)-Adapter and switch it on. Ensure a line-of sight connection between instrument and IR-adapter!
   If there is no communication with the instrument for more than 2 minutes, the IR interface of the instrument turns off automatically! By restarting the instrument the IR interface is reactivated.

4.7.3 Deleting data

1. In the **Menu**, select the **Data Logging → Clear Memory** function.
2. Press the **Clear** key.

4.8 Communication

4.8.1 IR/RS232-Protocol

COM-Port Settings

Baudrate	9600
Data bits	8
Parity	no
Protocol	no
Stop bit	1

Communication Protocol
Coding
The characters are transfered as ASCII-Code.

Sending a command from PC to the instrument

<SCPI Command> [SP <Parameter 1>] [, <Parameter 2>] [, <Parameter 3>] [, ...]
HT [* <CS>] CR

Examples:

Setting the time to 07:08:09:

S Y S T : T i m e SP 0 7 , 0 8 , 0 9 HT * 2 5 5 CR (with checksum)
S Y S T : T i m e SP 0 7 , 0 8 , 0 9 HT CR (without checksum)

Reading the time:

S Y S T : T i m e ? HT * 1 4 2 CR (with checksum)
S Y S T : T i m e ? HT CR (without checksum)

Response from instrument to PC

<Return Value 1> [, <Return Value 2>] [, <Return Value 3>] [, ...] HT * <CS> CR

SCPI Command:	SCPI command according the table on following pages
CS:	Checksum
Return Value:	Response from instrument
[ ]	Option

ASCII-character	Hex-Code	Meaning
SP	0x20	Space
HT	0x09	Horizontal Tabulation
CR	0x0D	Carriage Return
*	0x2A	Asterisk
,	0x2C	comma

SCPI Commands
There is no difference between small and capital letters.

Checksum (CS)
The use of the checksum is optional. A * indicates a following checksum. The ASCII-character * is included in the calculation of the checksum. The checksum is calculated from the low byte.

Example:
Reading the date

S	Y	S	T	:	D	a	t	e	?	HT	*	
53	59	53	54	3A	44	61	74	65	3F	09	2A	hex
83	89	83	84	58	68	97	116	101	63	09	42	dez

sum: 37D hex low byte: 7D hex
893 dez 125 dez

The checksum is 125 decimal.
Command:
S Y S T : D a t e ? HT * 1 2 5 CR (with checksum)
S Y S T : D a t e ? HT CR (without checksum)

Return Value
Command processed:
Return Value = o k
Example for response: o k HT * 1 3 CR

Error

Return Value	Meaning
er-001	RS232 Protocol checksum Error
er-110	Header Error; Too short Header Error; Too many subnodes Header Error; Query not at leaf node Header Error; Multiple querys Header Error; Characters after query Header Error; Too long
er-113	Undefined Header; Undefined command
er-109	Missing parameter Missing parameter; Boolean expected Missing parameter; String expected Missing parameter; Discrete expected Missing parameter; Not of expected type
er-101	Invalid character; Terminator expected
er-108	Invalid parameter; Out of bounds Invalid parameter; Too long
er-203	Command Protected
er-999	EEProm Read/Write Error
er-002	Fatal Command Execution Error

Example: Checksum Error
Response: e r – 0 0 1 HT * 200 CR

After command with response value
Example: reading time (07:08:09)
Response: 0 7 , 0 8 , 0 9 HT * 1 9 5 CR

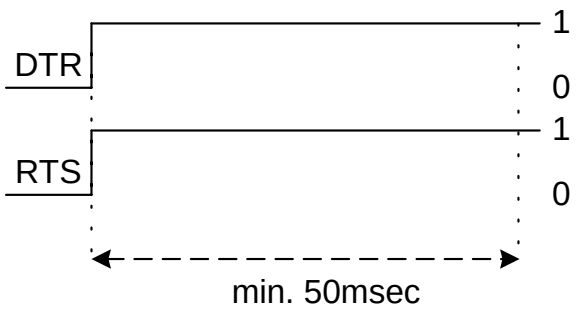
ATTENTION
AFTER EVERY COMMAND WAIT FOR THE RESPONSE OF THE INSTRUMENT (MAX. 680 MS).

4.8.2 IR-Hardware of the instrument

The **hardware** of the IR-connection of the instrument is compatible with **IrDA-Standard 1.0**.

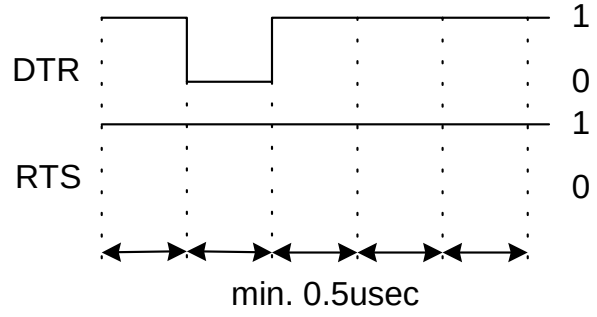
IR (IrDA)- Adapter
A **passive IrDA-adapter** has to be used which is compatibel to **IrDA-Standard 1.0**. The IrDA adapter ACT-220L+ from ACTiSYS Corp. (www.actisys.com) is available as accessories.
The following explanations apply to this type.

4.8.2.1 Initialisation



Remarks
ACT-220L/220L+ are programmed by toggling the control lines RTS and DTR. These lines may not be low at the same time during operation. In this condition the ACT-220L/220L+ goes in power down mode. If DTR and RTS are low at the same time or in an undefined condition, both lines must be set high for at least 50 ms to leave the power down mode.

4.8.2.2 Setting the baudrate



Remarks
Before setting the baudrate the ACT-220L/220L+ has to be initialised according Initialisation. The baudrate is set to 9600 bps according the opposite diagram.
A PC usually needs more than 0.5 us for an I/O-Instruction.

4.8.2.3 Control commands

The control commands are largely defined by the Standard Commands for Programmable Instruments (SCPI).

Command	Sub-node 1	Sub-node 2	Transfer Parameters	Parameter Data Type
MEASure	:PRESsure		<interval>	INTEGER
	:PRESsure?		---	---
	:TEMPerature?		---	---
UNITs	:PRESsure		<unit>	DISCRETE
	:PRESsure?		---	---
SYSTem	:DATE		<yyyy>,<mm>,<dd>	INTEGER
	:DATE?		---	---
	:TIME		<hh>,<mm>,<ss>	INTEGER
	:TIME?		---	---
	:ERRor	[:NEXT]?	---	---
	:VERSion?		---	---
	:BEEPer	:STATe	<state>	BOOLEAN
	:BATTery?		---	---

Command	Sub-node 1	Sub-node 2	Transfer Parameters	Parameter Data Type
	:RANGe?		---	---
	:TOLerance?		---	---
	:IDENt?		---	---
	:SET	:FILTer	<state>	BOOLEAN
		:ZERO	---	---

Parameter limits	Feedback data	Feedback data type	Description	Remarks
0, 10, 25	<value>	FLOAT	Continuous transfer of measured values	Continuous measurement with 10 or 25 M/s. Stops with Interval=0
---	<value>	FLOAT	Query measured pressure value	Individual value
---	<value>	FLOAT	Query sensor temperature	°C, individual value
mbar, bar,.... atm	---	---	Pressure unit input	
---	<unit>	DISCRETE	Query pressure unit	E.g., mbar, bar,.... atm
yyyy: 2001 ...2099 mm: 1...12 dd: 1... xx	---	---	Input date	yyyy: year, mm: month dd: day
---	<yyyy>,<mm>,<dd>	INTEGER	Query date	yyyy: year, mm: month dd: day
0...23, 0...59, 0...59	---	---	Input time	hh: hours, mm: minutes ss: seconds
---	<hh>,<mm>,<ss>	INTEGER	Query time	hh: hours, mm: minutes ss: seconds
---	<Error_number>, "<Error_description> (;<Device-dependent info>)"	INTEGER, STRING	Query SCPI Error Queue	STRING with ‚fixed text' and optional ‚free text', separated by a semicolon, maximum 255 digits

Parameter limits	Feedback data	Feedback data type	Description	Remarks
---	<version>	FLOAT	SCPI query and firm-ware version	e.g. '2001.0' , 'FW:300'
ON, OFF	---	---	Beeper enable / disable	
---	<value>	INTEGER	Query battery state	Range 0...100, value in %
---	<range>	STRING	Query sensor measurement range (in mbar)	e.g. "1,000 mbar"
---	<tolerance>	STring	Query sensor tolerance	e.g. '0.05 %FS'
---	<type, MOD, S/N>	STRING	Query instrument identification	e.g. "MICROCAL P400DLH200, MOD00A,1234567"
ON, OFF	---	---	Set filter for display	
---	---	---	Zero measure pressure value (ZERO)	

Command	Sub-node 1	Sub-node 2	Transfer parameter	Parameter data type
SYSTem	:SET	:AOFF	<time>	DISCRETE
		:OFF	---	---
		:AZERo	<state>	BOOLEAN
		:INTerval	<interval>	DISCRETE
		:AVERage	<interval>	DISCRETE
	:CONFig	:IRDA	<status>	BOOLEAN

DIAGnostic	:ERRors?		---	---

DISPlay	:BRIGhtness		<level>	DISCRETE

MEMory	:COPY	:DLOG?	---	---
	:DELete	:ALL	---	---

*CLS			---	---
*IDN?			---	---
*STB?			---	---
*TST?			---	---
*RST			---	---

Parameter limits	Feedback data	Feedback data type	Description	Remarks
3min, 10min, 60min	---	---	Set auto Off time	
---	---	---	Switch off instrument	
ON, OFF	---	---	Enable/disable auto zero	
25M./s, 10M./s, 1s ... 24h	---	---	Set interval time for Data Logging	Similar to Menu
10s, 30s ... 24h	---	---	Set time period for Average	Similar to Menu
OFF	---	---	Set auto IrDA connection	

---	<err>,<err>,<err>... <message>	INTEGER DISCRETE	Query the BIT-Error memory Query the BIT-error memory	Variable amount of Feedback data, err: 0...255 If Error memory deleted: 'No Errors!'

off, level 1, level 2, level 3	---	---	Brightness setting for LCD backlight	EX-instrument only off and Level 1, similar to Menu

---	<data>	diverse	Select Memory Data Logging (cyclic)	Complete reading, Format: see 3.6.1

---	---	---	Delete Memory Data Logging	

---	---	---	Delete Status and Error Memory	
---	<type, MOD, S/N>	STRING	Query instrument identification	See SYST:IDENT?
---	<data>	INTEGER	Query Status Byte	
---	<data>	INTEGER	Initiate a Self-Test	
---	---	---	Reset command	

4.8.2.4 Data Type Key

Designation	Description	Example
INTEGER	Decimal number, whole numbers only	123
FLOAT	Floating-point number	123.45
I-FLOAT	Floating-point number, transferred as an INTEGER. This means that it will not be transferred in the floating-point format, but as an INTEGER – value coded according to the IEEE-754 standard.	3242721280 (corresponds to -12.5)
DISCRETE	Discrete values, do not use “ in the text, similar to Menu selection	mbar
BOOLEAN	Boolean values: ON or OFF (similar to DISCRETE)	ON
STRING	Character string	"ABCDE“

4.8.2.5 Notes regarding control commands

- Cyclical commands — Commands that last longer are processed cyclically.
  They will be automatically interrupted if a command occurs that requires an output.
- " (Inverted commas) — A STRING is identified by inverted commas and a full-stop.
  These must be transferred with it (unlike DISCRETE).
- ' (apostrophe) — An apostrophe is used, for example for emphasis.
  The apostrophe itself will not be transferred.
- ( ) (brackets) — Parameter inside round brackets are optional
  The brackets themselves will not be transferred.
- , (comma) — The comma is used to separate arguments. The next argument must follow immediately after the comma (no SPACE, ASCII-Code 32_{dez}).

4.9 Battery replacement

The battery compartment must not be opened inside the Ex-area!

4.10 Notes for instruments with Ex-certification

Only use battery type LR6 according to IEC 60086-1 approved by the producer, as described in the appendix.

Open the battery compartment and insert 3 x 1,5 V Mignon cell AA, IEC LR6.

Always replace all three batteries at the same time!
Ensure correct polarity!

Dispose of used batteries in accordance with environmental regulations!

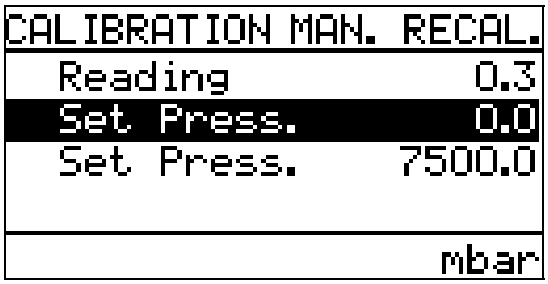
4.11 Calibration

Re-calibration may only be carried out by specialist staff and with the corresponding pressure standards.
We recommend that you have the MICROCAL P4 re-calibrated at least once a year, and, in case of highest demands for precision, several times a year.

4.11.1 Manual re-calibration

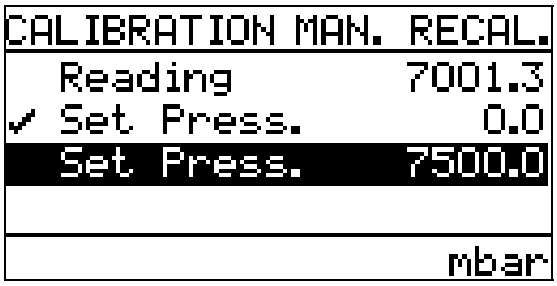
In the Menu, select the **Calibration** → **Manual Calibration** function.

Zero point (Offset)
1. Open the pressure connection or, with the absolute pressure unit, set the given pressure value to the normal pressure.
2. Press the Function key ( )
   ➔ the zero point will be re-calibrated.



4.11.2 Full-scale value

1. Set the given pressure value to the normal pressure.
2. Press the Function key ( )
   ➔ the full-scale value will be calibrated and the MICROCAL P4 returns to normal operation.



- The calibration is always carried out in mbar.
- The calibration must take place at a stable room temperature of 22 °C ± 2 °C.
- A calibration value will only be accepted if it lies within ± 5 % of the full-scale value of the MICROCAL P4.
- With the pressure connections open, it is possible to only re-calibrate the zero point.
- The date of the last calibration will be stored in the Calibration History.
- In case of manual re-calibration, the previous measurement will become invalid.
  You should always carry out a complete accuracy check afterwards.

5 Specifications

5.1 Technical data

Measuring media	Instrument air or inert gases
Media-compatibility	all media that is compatible with stainless steel 18/8 (DIN 1.4305)
Linearity, hysterisis and repeatability accuracy	according to measuring range and use See Table 4.2
Units	according to measuring range and use See Table 4.3
Certification for Ex-Instruments	EEx ia IIC T4 (resp. T3)
Operating temperature	0 °C to 50 °C
Storage temperature	-20 °C to 60 °C
Humidity	max. 95 % rH. (non condensing)
Case protection	IP 54
Power supply	• 3 x 1,5 V Mignon-cell AA, IEC LR6 or accumulator (Ex-instruments: only accepted types according to appendix) • regulated 6 VDC plug-in mains supply unit (min. 6, max. 9 VDC, not for Ex-version)
Current consumption	< 25 mA resp. < 40 mA (Ex-version) without display light, IR and beeper
Battery life	approx. 90 h or 60 h respectively (Ex-version)
Infra-red interface	serial IR-protocol
Measuring rate	max. 25 measurements/s (Data logging, IR) 5 measurements/s (normal operation)
Display rate	2 measurements/s
Memory size	max. 10’742 measurements
Memory interval	manual, 10, 25 measurements/s 1, 2, 5, 10, 30 s 1, 2, 5, 10, 30 min 1, 3, 6, 12, 24 h user-defined (user)
Average period	10, 30 s 1, 2, 5, 10, 30 min 1, 3, 6, 12, 24 h user defined (user)
Display	LCD graphic display 128 x 64 points Background lighting
Pneumatic connection	4/6 mm hose (M8 x 0,5) or NPT 1/8" Plug in nipple „Rectus“ Type 20 M10 x 1 inner thread (for connector „Minimess“)
Case dimensions	200 x 93/58 x 39/28 mm
Weight including batteries	approx. 300 g

5.2 Measuring Range and Precision

The measured values display works in the range from -10 % to 110 % of the measurement range.

5.2.1 European Model

Measurement range	Unit	Pressure type	Resolution	Max. loading	Max. static pressure
		1)			
0 ... 25	mbar	d,g	0.001	125 mbar	17 bar
0 ... 70	mbar	d,g	0.01	350 mbar	17 bar
0 ... 200	mbar	d,g	0.01	1500 mbar	17 bar
0 ... 300	mbar	d,g	0.01	1500 mbar	17 bar
0 ... 500	mbar	d,g	0.1	4000 mbar	17 bar
0 ... 1000	mbar	d,g	0.1	4000 mbar	17 bar
0 ... 1100	mbar	a	0.1	4000 mbar	--
0 ... 2000	mbar	a,d,g	0.1	7000 mbar	17 bar
0 ... 7500	mbar	a,d,g	0.001	17000 mbar	17 bar
0 ... 10	bar	d,g	0.001	27 bar	27 bar
0 ... 17	bar	d,g	0.001	27 bar	27 bar
0 ... 35	bar	g	0.01	70 bar	--
0 ... 70	bar	g	0.01	140 bar	--
0 ... 90	bar	g	0.01	140 bar	--

Measuring range	Unit	Accuracy			
		Inert gases		Media compatibility	
		% FS	% Rdg.	% FS	% Rdg.
			2)		2)
0 ... 25	mbar	0.1 / 0.2	--	--	--
0 ... 70	mbar	0.05 / 0.1 / 0.2	0.1	--	0.1
0 ... 200	mbar	0.1 / 0.2	--	--	--
0 ... 300	mbar	0.05 / 0.1 / 0.2	0.1	--	0.1
0 ... 500	mbar	0.1 / 0.2	--	--	--
0 ... 1000	mbar	0.05 / 0.1 / 0.2	0.1	0.1 / 0.2	0.1
0 ... 1100	mbar	0.1 / 0.2	--	--	--
0 ... 2000	mbar	0.05 / 0.1 / 0.2	0.1	0.1 / 0.2	0.1
0 ... 7500	mbar	0.05 / 0.1 / 0.2	0.1	0.1 / 0.2	0.1
0 ... 10	bar	0.1 / 0.2	--	0.1 / 0.2	--
0 ... 17	bar	0.05 / 0.1 / 0.2	0.1	0.1 / 0.2	0.1
0 ... 35	bar	--	0.1	0.1 / 0.2	0.1
0 ... 70	bar	--	0.1	0.1 / 0.2	0.1
0 ... 90	bar	--	0.1	0.1 / 0.2	0.1

1) a = absolute pressure
d = differential pressure
g = relative pressure

2) 0.1 % of Rdg., but not less than 0.03 % FS.

5.2.2 USA Model

Measuring rage	Unit	Pressure type	Resolution	Max. Loading	Max. static pressure
		1)			
0 ... 10	inH_2O	d,g	0.0001	50 inH_2O	245 psi
0 ... 28	inH_2O	d,g	0.001	140 inH_2O	245 psi
0 ... 80	inH_2O	d,g	0.001	600 inH_2O	245 psi
0 ... 120	inH_2O	d,g	0.001	600 inH_2O	245 psi
0 ... 200	inH_2O	d,g	0.001	1600 inH_2O	245 psi
0 ... 14.5	psi	d,g	0.0001	58 psi	245 psi
0 ... 15.9	psi	a	0.0001	58 psi	--
0 ... 29	psi	a,d,g	0.001	100 psi	245 psi
0 ... 100	psi	a,d,g	0.001	245 psi	245 psi
0 ... 145	psi	d,g	0.001	390 psi	390 psi
0 ... 245	psi	d,g	0.01	390 psi	390 psi
0 ... 500	psi	g	0.01	1000 psi	--
0 ... 1000	psi	g	0.01	2000 psi	--
0 ... 1300	psi	g	0.01	2000 psi	--

Measuring range	Unit	Accuracy			
		Inert gases		Media compatibility	
		% FS	% Rdg.	% FS	% Rdg.
			2)		2)
0 ... 10	inH_2O	0.1 / 0.2	--	--	--
0 ... 28	inH_2O	0.05 / 0.1 / 0.2	0.1	--	0.1
0 ... 80	inH_2O	0.1 / 0.2	--	--	--
0 ... 120	inH_2O	0.05 / 0.1 / 0.2	0.1	--	0.1
0 ... 200	inH_2O	0.1 / 0.2	--	--	--
0 ... 14.5	psi	0.05 / 0.1 / 0.2	0.1	0.1 / 0.2	0.1
0 ... 15.9	psi	0.1 / 0.2	--	--	--
0 ... 29	psi	0.05 / 0.1 / 0.2	0.1	0.1 / 0.2	0.1
0 ... 100	psi	0.05 / 0.1 / 0.2	0.1	0.1 / 0.2	0.1
0 ... 145	psi	0.1 / 0.2	--	0.1 / 0.2	--
0 ... 245	psi	0.05 / 0.1 / 0.2	0.1	0.1 / 0.2	0.1
0 ... 500	psi	--	0.1	0.1 / 0.2	0.1
0 ... 1000	psi	--	0.1	0.1 / 0.2	0.1
0 ... 1300	psi	--	0.1	0.1 / 0.2	0.1

1) a = absolute pressure
d = differential pressure
g = relative pressure

2) 0.1 % Rdg., but not less than 0.03 %FS.

5.3 Measurement units

The following units of measurement can be selected depending on the measuring range:

Measurement ranges				mbar	bar	Pa	hPa	kPa	MPa	kg/cm^2	kg/m^2	mm Hg	cm Hg	mm Hg
Europa		USA								1)	1)	1) 2)	1) 2)	1) 2)
0 ... 25	mbar	0 ... 10	inH_2O	•	--	•	•	•	--	--	•	•	•	--
0 ... 70	mbar	0 ... 28	inH_2O	•	--	•	•	•	--	--	•	•	•	--
0 ... 200	mbar	0 ... 80	inH_2O	•	•	•	•	•	--	•	•	•	•	•
0 ... 300	mbar	0 ... 120	inH_2O	•	•	•	•	•	--	•	•	•	•	•
0 ... 500	mbar	0 ... 200	inH_2O	•	•	•	•	•	--	•	•	•	•	•
0 ... 1000	mbar	0 ... 14.5	psi	•	•	•	•	•	--	•	•	•	•	•
0 ... 1100	mbar	0 ... 15.9	psi	•	•	•	•	•	--	•	•	•	•	•
0 ... 2000	mbar	0 ... 29	psi	•	•	•	•	•	--	•	•	•	•	•
0 ... 7500	mbar	0 ... 100	psi	•	•	•	•	•	--	•	•	•	•	•
0 ... 10	bar	0 ... 145	psi	•	•	--	•	•	•	•	•	•	•	•
0 ... 17	bar	0 ... 245	psi	•	•	--	•	•	•	•	•	•	•	•
0 ... 35	bar	0 ... 500	psi	•	•	--	•	•	•	•	•	•	•	•
0 ... 70	bar	0 ... 1000	psi	•	•	--	•	•	•	•	•	•	•	•
0 ... 90	bar	0 ... 1300	psi	•	•	--	•	•	•	•	--	•	•	•

Measurement ranges				in Hg	mm H_2O	cm H_2O	m H_2O	in H_2O	ft H_2O	psi	lb/in^2 (psi)	lb/ft^2	torr (mmHg)	atm
Europa		USA		1) 2)	1) 3)	1) 3)	1) 3)	1) 3)	1) 3)	1)	1)	1)	1)	1)
0 ... 25	mbar	0 ... 10	inH_2O	•	•	•	•	•	•	•	•	•	•	--
0 ... 70	mbar	0 ... 28	inH_2O	•	•	•	•	•	•	•	•	•	•	--
0 ... 200	mbar	0 ... 80	inH_2O	•	•	•	•	•	•	•	•	•	•	•
0 ... 300	mbar	0 ... 120	inH_2O	•	•	•	•	•	•	•	•	•	•	•
0 ... 500	mbar	0 ... 200	inH_2O	•	•	•	•	•	•	•	•	•	•	•
0 ... 1000	mbar	0 ... 14.5	psi	•	•	•	•	•	•	•	•	•	•	•
0 ... 1100	mbar	0 ... 15.9	psi	•	•	•	•	•	•	•	•	•	•	•
0 ... 2000	mbar	0 ... 29	psi	•	•	•	•	•	•	•	•	•	•	•
0 ... 7500	mbar	0 ... 100	psi	•	•	•	•	•	•	•	•	•	•	•
0 ... 10	bar	0 ... 145	psi	•	•	•	•	•	•	•	•	•	•	•
0 ... 17	bar	0 ... 245	psi	•	•	•	•	•	•	•	•	•	•	•
0 ... 35	bar	0 ... 500	psi	•	•	•	•	•	•	•	•	•	•	•
0 ... 70	bar	0 ... 1000	psi	•	•	•	•	•	•	•	•	•	•	•
0 ... 90	bar	0 ... 1300	psi	•	--	•	•	•	•	•	•	•	•	•

1) In relation to the acceleration due to gravity of 9,81 m/s^2
2) at 0 °C
3) at 4 °C

5.3.1 Conversion factors

1 mbar	=	1 mbar	=
1 mbar	=	1 mbar	=
1 mbar	=	1 mbar	=
1 mbar	=	1 mbar	=
1 mbar	=	1 mbar	=
1 mbar	=	1 mbar	=
1 mbar	=	1 mbar	=
1 mbar	=	1 mbar	=
1 mbar	=	1 mbar	=
1 mbar	=	1 mbar	=
1 mbar	=		

5.4 Mains supply unit connection

With the exception of the Ex-Instrument, the unit can be operated from a regulated plug-in mains supply unit.

Input 100 - 240 V, 50 - 60 Hz
Output 6 VDC ± 10 %, 1,5 W

5.5 Maintenance and storage

The MICROCAL P4 requires no maintenance. It can be cleaned with a damp cloth. Do not use cleaning agents containing solvents!
See the relevant chapters for battery replacement und re-calibration.

During longer storage, remove the batteries from the instrument.
Do not drop below or exceed the admissible storage temperatures of -20 °C to 60 °C!

6 Warning messages and faults

Code	Fault / Display	Possible cause	Correction
	Does not switch on	Power supply missing	Possibly replace the batteries. Battery possibly inserted incorrectly. Possibly plug in power supply correctly.
	Instrument inaccurate	Re-calibration carried out inaccurately Not zeroed Natural aging of the pressure sensor	Re-calibrate Vent and press Zero Have it re-calibrated
	No change of the measured value	Excess pressure on sensor	Send instrument to the manufacturer for repair.
14	Pressure out of range!	Measurement range has been exceeded by more than 10 %.	Set up the permissible measurement pressure.
13	Pressure out of range!	Excess pressure on sensor Electrical fault	Send instrument to the manufacturer for repair.
06	Temperature out of range!	Pressure sensor exposed to temperature outside permissible range (< -5 °C or > 55 °C)	Observe permissible operating temperature and temperature of the medium.
04	Temperature out of range!	Used outside permissible temperature range	Observe permissible operating temperature.
15	Ref. Voltage Failure!	Internal reference voltage error	Send instrument to the manufacturer for repair.
07	Not calibrated!	Incorrect calibration of the instrument	Send instrument to the manufacturer for repair.
05	Low battery!	Battery voltage too low	Replace batteries
	No IR communication	Line-of-sight connection interrupted Separation too large PC-configuration	Re-establish line-of-sight connection Max. distance 50 cm Check IR connection

7 Accessories

Standard	3 x 1,5 V batteries IEC LR6 Operating instructions SCS Test certificate
Options (not with Ex-version)	6V mains supply unit 100 - 240 V, 50 - 60 Hz, 1,15 A Leather case with carrying strap Service-Set (transport case) Hand pump Infrared RS232 serial adapter NPT 1/8" adapter „Rectus“ adapter, type 20 Communication software for MS-Windows (95/98, 2000, XP)

8 Summary of technical characteristics

Characteristics	MICROCAL P4	MICROCAL P4Ex	Remarks
Basic functions			
1 pressure sensor installed			
Absolute pressure			
Differential pressure			
Relative pressure			
Vacuum (relative under-pressure)			The instrument is only calibrated
for inert gases			in the over-pressure range
Media compatibility rel./abs.			
Measuring ranges / Accuracy			See separate table
Calibrated temperature range 0 ... 50 °C			
Measuring functions			
Pressure / Differential pressure			
Min/Max			
Average			Average per time period
Change Rate			Tendency / leak rate
Other functions			
Set-up/Configuration			
Unit switchable			
Display filter			
Auto-off			
Record interval			Free choice
Average period			Free choice
Display rate	2 M/s	2 M/s	
Max. measurement rate	25 M/s	25 M/s	Approx..
Date / Time (real time)			
Analogue bar display			
Real time data logging			
Data logging / manual record			
Print record			
Number of records	10742	10742	Max.
Zeros with key			
Automatic zeroing			
Hold			
Display accuracy at start-up			
Low battery display			
Acoustic signal			For out-of-range / fault operation
Self-test			
Housing			
Hand-held			
Splash proof IP54			
Connections			
Tube 4/6 mm			M8 x 0,5
NPT1/8“ internal			
Plug-in nipple „Rectus“ Type 20			
M10 x 1 internal thread			For „Minimess“ 1215
Power supply socket		--	

Characteristics	MICROCAL P4	MICROCAL P4Ex	Remarks
Display			
Graphic display			
Lighting			Reduced brightness in Ex-version
Automatic contrast adjustment			for temperature changes
Power supply			
Battery			
External plug-mounted power module		--	
Digital interfaces			
Infrared interface			
SCPI protocol			Standard Commands for Programmable Instruments
Environmental conditions			
Operating temperature 0 ... 50 °C			
Storage temperature -20 ... 60 °C			
Humidity max. 95 %r.F.			Non-condensing
EEx ia IIC T4	--		

Appendix

Admissible batteries for instruments with Ex-certification for temperature class 4 (T4).

Manufacturer	Type / Designation
Leclanché SA, Switzerland	LONG LIFE Art.-Nr. 804.0 (carbon/zinc-batterie, R6)

Admissible batteries for instruments with Ex-certification for temperature class 3 (T3).

Manufacturer	Type / Designation
GP Batteries (Gold Peak Group)	GP Super Alkaline Battery GP15A-S2 AA Size 1,5 V
PHILIPS	PHILIPS POWERLIFE XXL LR6 AA 1.5V ULTRA ALKALINE
VARTA	UNIVERSAL Alkaline No: 4006 1.5V MIGNON LR6 AA AM3 MM1500
Energizer	Energizer INDUSTRIAL ALKALINE LR6 1.5V AA.EN9I.HP7.AM3.MIGNON.MN1500 No: LR6DP4I
Energizer	Energizer intelligent AA LR6 EAN 76 389 00 132519

Admissible accumulators for instruments with Ex-certification for temperature class 3 (T3).

Manufacturer	Type / Designation
VARTA	AccuPlus IIB Ni-Cd 1,2V, 750mAh, No. 5006 Mignon, AA, IEC KR 6
SANYO Electric Co., Ltd	NICKEL CADMIUM BATTERY (KR) N-600AA, 1,2V, 600mAh

More batteries with temperature classes on request.

9 CERTIFICATES

9.1 Warranty terms

Eurotron Instruments warrants its products against defects in materials and workmanship for the period declared from the date of the original retail purchase.

This warranty applies to the original purchaser only.

If the unit should malfunction, it must be returned during the warranty period, transportation prepaid, to **Eurotron** for evaluation. Upon examination, if the unit is found to be defective it will be repaired or replaced at no charge.
Direct all warranty and repair requests/inquiries to the **Eurotron** Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO **EUROTRON**, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM **EUROTRON**'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS).
Please include a copy of the original invoice or a small service charge may be applied.
The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

Eurotron's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of Eurotron's control.

9.2 Letter of conformity

This is to certify that the instrument has been manufactured and inspected to document procedures and where applicable, calibrated against standards which are traceable to National and International Standards.
The Instrument has been found to conform in all respects to specifications, drawings, workmanship standards and work order requirements.