microsyst

COMPETENCE IN MEASUREMENT

CE

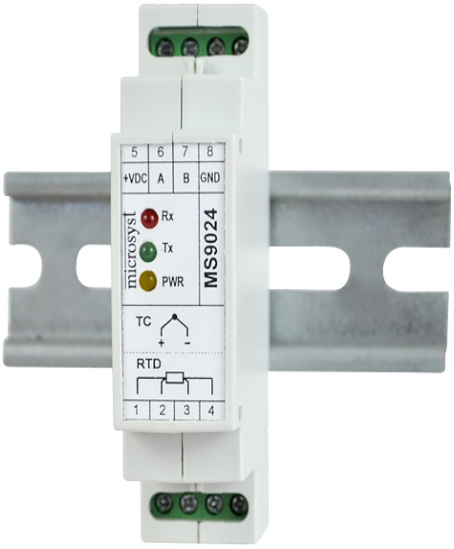
TEMPERATURE TRANSMITTERS

with

UNIVERSAL INPUT

MS9024 and MS9034

v 1.01



TECHNICAL INFORMATION

PLOVDIV 2016

Document revision 2016-01-29

I. ADVANTAGES

- ✔ Universal input with standard linearization for 11 RTDs and 10 thermocouples, and three user selectable sensors
- ✔ 4-, 3- or 2-wire connection of the RTD
- ✔ No need from calibration of the analogue input at sensors type thermocouple
- ✔ Automatic temperature compensation of the cold junction of all thermocouples
- ✔ Galvanic insulation between input and output signal in MS9024

II. FUNCTION AND SYSTEM DESIGN

MS9024 and **MS9034** are universal input temperature transmitters for the most common RTDs and thermocouples. In transmitters there is standard linearization with standard up to degree nine for 11 RTDs, 10 thermocouples and three non-standard types of sensors with standard up to degree three. The electrical connection of the RTD sensors can be configured for 4-, 3- or 2-wire scheme.

The output signal is transmitted via RS485 interface with MODBUS RTU SLAVE protocol for MS9024 or 2-wire current loop 4÷20 mA for MS9034. The transmitters are suitable for Din Rail mounting.

III. FEATURES

For programming transmitters Microsyst offers:

- ■ Basic software for OS „Windows”
- ■ Communicators for programming USB/RS485 for MS9024 and USB/TTL Serial for MS9034
- ■ Instruction for user transmitters configuration
- ■ Instruction for complete system set up and transmitters configuration.

⚠	• MS9034 connects via USB 5 mini connector, but signals levels are TTL ! • MS9034 must not be connect directly to USB port and computer ! • The output of the MS9034 in Tune Mode must be powered !
	• Transmitters are factory setting for all input sensors and ranges. • There's no need for users to adjust the input. • When setting input, standards should come to class 0.01.
	• For normal work, the user has to select the input signal or sensor, possibly connected, as well as the compliance of the input/output.

IV. TECHNICAL INFORMATION

Analogue input (universal, user selectable)		Resolution - 16bits
Resistive temperature sensor - RTD		Pt385-10,50,100,200,500,1000; Pt391-100, Pt392-100; Cu482-100; Ni617-100; Ni672-120
Current via RTD sensor		420µA for 2 wire and 4 wire connection; 210 µA for 3 wire
Thermocouple – TC		Range ±73,125 mV.....J, K, S, B, T, E, N, R, C, XK(L) GOST
TC-cold junction compensation		Integral sensor to 0.25 °C without error correction
User configurable inputs ranges.		0 ÷ 400 Ω and 0 ÷ 4 kΩ
		±73,125 mV for thermocouple with ATC
Temperature drift		< 10 ppm / °C
Measurement time		350 ms
Analogue output for MS 9034		Resolution- 12 bits
Time to refresh		350 ms
Over-range and under-range detection – NAMUR level detection		-1,56% ... +105,4% of range i.e. for 4-20 mA – restriction 3,75 ÷ 20,86 mA
Connection		
For MS 9024 *galvanic insulation*		RS485 2WIRE MODBUS RTU SLAVE 9600, 19200bps; parity – NONE, EVEN ; 1 , 2 stop bit
For MS 9034		TTL Serial - Rx, Tx, Dir, GND
Connection facilities		.
For MS 9024		Terminals AWG16-22 – 4 blocks
For MS 9034		5 Pin Mini USB Connector
Power supply	MS9024	MS9034
Supply voltage	24 VDC ±30%	9 ÷ 33 VDC
Display elements		
Only for MS 9024		3 LED Indication
Operating conditions		
Ambient operating temperature range		0 … 50 °C
Operating relative humidity		20 … 85 % rh
Size		
Dimensions (WxHxL)		according to DIN IEC 61554 – 22,5x89,2x53 mm
Assembly		M36 DIN rail (EN 50022)
Weight		Max .....g
Storage		
Storage temperature range Storage relative humidity		-10 … 70 °C 20 … 90 % rh

* At 3 wire RTD the result is average of the last two measurements.

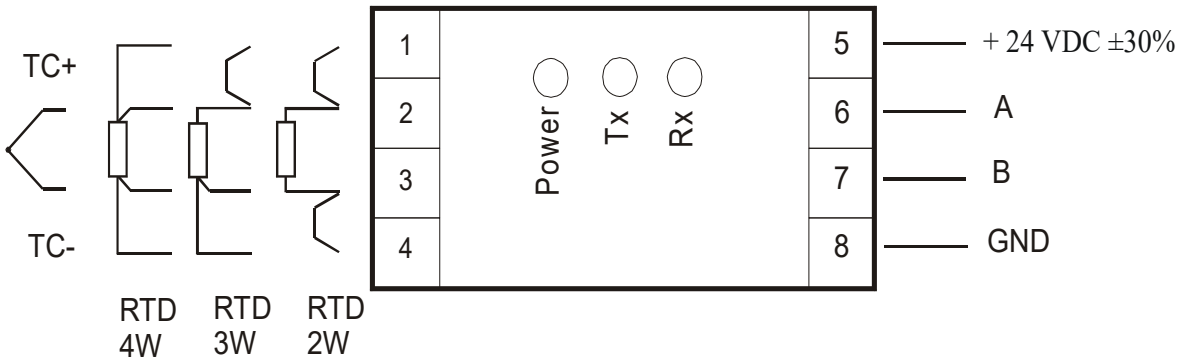
MEASUREMENT RANGE AND ACCURACY					
Sensor	**Standard**	**Range**		**Accuracy**	**Drift, µV / °C**
TC	**-**	**°C**	**µV without ATC**	**°C with ATC**	
J	IEC 584 part 1	-210 ÷ 1200	-8095÷ 69553	0.3	1
K	IEC 584 part 1	-200 ÷ 1372	-6458÷ 54886	0.4	1
S	IEC 584 part 1	-50 ÷ 1768	-236 ÷ 18693	0.5	1
B	IEC 584 part 1	44 ÷ 1820	0 ÷ 13820	0.5	1
T	IEC 584 part 1	-200 ÷ 400	-5603 ÷ 20872	0.4	1
E	IEC 584 part 1	-200 ÷ 1000	-8825 ÷ 76373 *	0.3	1
N	IEC 584 part 1	-200 ÷ 1300	-3990÷47513	0.4	1
R	IEC 584 part 1	39 ÷ 1768	226 ÷ 21103	0.5	1
C	IEC 584 part 1	0 ÷ 2320	0 ÷ 37107	0.5	1
XK – GOST – L	GOST P.585-2001	-200 ÷ 800	-9488 ÷ 66466	0.3	1
RTD	**-**	**°C**	**Ω**	**°C**	**mΩ /°C**
Pt10_385	EN 60751	-200 ÷ 850	1,852÷39,048Ω	0.7	0.04
Pt50_385	EN 60751	-200 ÷ 850	9,26÷195,24Ω	0.3	0.04
Pt100_385	EN 60751	-200 ÷ 850	18,52÷390,48Ω	0.15	0.04
Pt200_385	EN 60751	-200 ÷ 850	37,04÷780,96Ω	0.15	0.04
Pt500_385	EN 60751	-200 ÷ 850	92,6÷1950,24Ω	0.15	0.04
Pt1000_385	EN 60751	-200 ÷ 850	185,2÷3904,8Ω	0.15	0.04
Pt100_391	GOST	-200 ÷ 850	17,24 ÷ 395,16Ω	0.15	0.04
Pt100_392	JIS C1604-81	-200 ÷ 660	17,08 ÷337,03Ω	0.15	0.04
Cu100_482	GOST	-180 ÷ 260	20,53 ÷ 185,6Ω	0.15	0.04
Ni100_617	DIN 43760	-70 ÷ 180	69,29 ÷ 223,21Ω	0.15	0.04
Ni120_672	Edison Curve	-80 ÷ 260	66,60 ÷ 380,31Ω	0.15	0.04
TC non standard	User Curve	-	**±73,125 mV**	-	1 **µV / °C**
Resistive input	**-**	**Ω**	**Ω**	**%**	**ppm/°C**
0 ÷ 400 Ω	-	0 ÷ 400	0.1 ÷ 400	0.01	10
0 ÷ 4000 Ω	-	0 ÷ 4000	0.1 ÷ 4000	0.01	10

- * Table value. Temperature of the cold junction 25 °C upper limit for TC type E is 950 °C.
- Accuracy is defined as the electric % of the range and without influence of sensors and their connections .

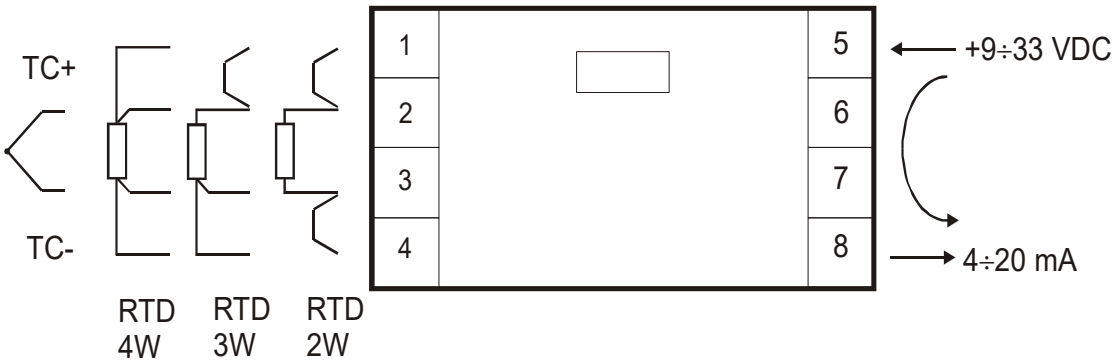
V. TERMINALS AND CONNECTIONS

- Terminals:

Transmitter MS9024



Transmitter Ms9034



- **Input connections for MS9024 and MS9034:**

INPUT – RTD, Ω and kΩ		Symbol	Terminal
4 wire connection	Two wires, shorted to one end of the sensor.	4W	1,2
	Two wires, shorted in the other end of the sensor.		3,4
3 wire connection	Two wires, shorted to one end of the sensor.	3W	3,4
	Connection between terminals 1 and 2.		2
2 wire connection	Connection between terminals 1 and 2.	2W	2
	Connection between terminals 3 and 3.		3

INPUT – TERMOCOUPLE		Symbol	Terminal
2 wire connection with compensation wire	Positive terminal	TC +	2
	Negative terminal	TC -	3

- Output connection:

MS9024	OUTPUT – RS485	Symbol	Terminal
Supply voltage	24 VDC ± 30%	+V	5
Data terminals		A	6
		B	7
Bulk		GND	8

** In some MICROSYST devices, terminals marking for RS485 interface are: A corresponds to IO+ and B corresponds to IO-.*

MS9034	OUTPUT – 4 ÷ 20mA	Symbol	Terminal
Supply voltage	9 ÷ 33 VDC	+V	-
Terminal - Positive current terminal	4 ÷ 20mA	+ I	5
Terminal - Negative current terminal	4 ÷ 20mA	- I	8

VII. COMMUNICATION

Transmitters are MODBUS RTU SLAVE devices, with possible transmission rate 9600 or 19200 bps . ***You must not use addresses outside those specified in the parameters table. Accept or send up to 128 byte in one query.***

⚠	• MS9034 has only one output signal 4÷20 mA .Some of the parameters are not relevant for this transmitter.
	• Access to programming depends on the internal jumper. Standard programming hardware is permitted.

MODBUS FUNCTION	IMPLEMENTATION MODBUS FUNTIONS
01	Reading single bits.
03	Reading HOLDING REGISTERS, 0 < REG ADR <127 – registers in EPROM, 128 < REG ADR < 256 – registers in RAM. By adding 512 - FLOAT values are reading in format IEEE 754, (without adding 512 are in format EXP, S.B0,B1,B2).
05	Writing single bit, 439<COIL ADR<512;
06	Writing single HOLDING REGISTER, 0 < REG ADR < 127 – in EPROM; 128 < REG ADR < 256 in RAM (only certain addresses);
16	Writing multiple consecutive HOLDING REGISTERS. Area of activity as function 06, plus addresses >512. When REG ADR >512 the function is intended to write FLOAT values as format IEEE754

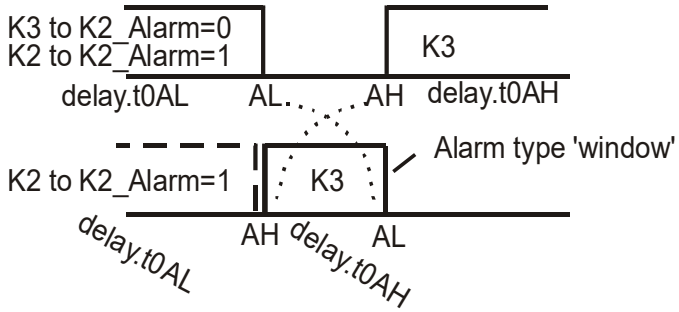
Symbol	Address, type	Function	
Measured value, outputs			
Input (PV)	728, Float	Input value. Dimension **DimPV**.	R
AOUT	726, Float	Output. Dimension **DimAOut**.	R/W
Cold junction T2	730, Float	Temperature terminal T2 . RTD sensor should be set whether to measure (T2_Enable). For any other type of input is measured Dimension **DimT2**.	R
Correction of measurement, filter * Next 4 parameters refer only to the formation of PV, even being selected control T2.			
IN OFFSET	524,Float	Offset in input. Added to the measured input value to form PV. Dimension - **DimPV**	R/W
Fin	26,LSByte	Input filter. Lower value – "heavier" filter. Range 1 ÷ 127. For 127 function is turned off.	R/W
ZnFin	528, Float	Effect zone of the input filter, outside perceived a new measurement with a delay **FinTime**. Dimension - **DimPV**	R/W
FinTime	25, LSByte	Time perception measurement outside the area ZnFin (x~350ms). Range 0 ÷ 255. Act independently of the value of Fin.	R/W
String parameters – dimensions and values * All string parameters are auxiliary and do not participate in the management. Size – 2 byte (1 hold register), ASCII			
DimAOut	210, String	Type AOUT. Contains '_V' or 'mA' according to the output.	R
DimT2	211, String	Units of temperature terminals T2. Contains '*C' or '*F'. If T2 not measured, contains '--'. The transmitter, produce only for RTD or other, but without TC, if sensor for T2 is missing, DimT2='ER', i.e. error in reading the temperature of the terminal.	R
DimPV	212, String	Dimension of measurement value . Contains '*C' or '*F' when choosing temperature sensor. Input 0 ÷1 (10)V, 0 ÷ 20mA, repeated **DimLIN.** If an error in the reporting of PV, DimPV='ER'.	R
DimCtrl	213, String	Dimension of parameters **ALARM LO, ALARM HI, AOUT LO, AOUT HI**. If control is PV, repeat **DimPV.** If control is T2**,** repeat **DimT2.**	R
DimLIN	24, String	Unit at input 0(2) ÷ 1(10)V, 0(4) ÷ 20mA.	R/W
Parameters for user set up outputs AOut			
AOut_LO	558, Float	Input value, corresponding to the lower limit of the AOUT : (0 / 4mA or 0 / 2V). Dimension **DimCtrl**	R/W
AOut_HI	560, Float	Input value, corresponding to the upper limit of the AOUT : (20mA or 10V). Dimension **DimCtrl**	R/W
TypeAOut	488,Coil	Sets the type of AOUT : **0 - I(mA) or 1 - U(V)** Normally the transmitter is with one analogue part, related to the output, i.e. used the relevant setting. If there are two analogue sections connected to the output, which to operate is indicated here. The other will transmit incorrect values	R/W

RangeAOut	489,Coil	Sets range AOUT. 0 – 0% ÷ 100% (0 ÷ 20mA or 0 ÷10V) 1 - 20% ÷ 100% (4 ÷ 20mA or 2 ÷10V)	R/W

Parameters for user input set up

№	Input	№	Input	№	Input
0	TC J	10	4-20 mA linear	**14**	Pt10 385
1	TC K	11	0-20 mA linear	**15**	Pt50 385
2	TC S	12	0-1V linear	**16**	Pt100 385
3	TC B	13	0-10 V linear	**17**	Pt200 385
4	TC T			**18**	Pt500 385
5	TC E	**25**	TC non-standard	**19**	Pt1000 385
6	TC N	**26**	RTD_4KΩ non-standard	**20**	Pt100 392
7	TC R	**27**	RTD 400Ω non-standard	**21**	Pt100 391
8	TC C	**28**	0-20mA non-standard	**22**	Cu100 482
9	TXK(L)	**29**	0-1V non-standard	**23**	Ni100 617
		30	0-10V non-standard	**24**	Ni120 672

SENS	28, LSByte	Selection of the sensor, according to the above table.	R/W
WIRE	32, LSByte	**4**- wire or 2 wire RTD connection. **Others values** – 3 wire RTD	R/W
PV LO	520, Float	Indication (value PV) input signal 0V/ 0/4mA. Dimension DimLIN (set)	R/W
PV HI	522, Float	Indication input signal 1(10)V/ 20mA. Dimension DimLIN	R/W
		Others	
T2_Enable	491,Coil	When RTD sensor to measure the temperature of the terminals T2 0-NO 1-YES ***(When sensor is not RTD, T2 always measured)***	R/W
Ctrl on T2	492,Coil	Control T2, i.e. how to work AOut and alarm levels. 0 - NO - control PV 1 - YES - control T2. Temperature T2 measured by build in device integral sensor and include in control, measured – without including offsets or using filter. In parallel with it continues to measured input parameter PV, which in this mode does not participate in operation, but is available in communication with the device. In this operation T2 measured, despite T2_Enable.	R/W
TC_COMP	493,Coil	COLD END compensation of TC 0 - YES - T2 is added to measured value 1 - NO - T2 is not added to measured value	R/W

C/F	447,Coil	Selection: **0-Celsius; 1-Fahrenheit** , during measuring temperature. Measurements are adaptive automatically, parameters – does not. In a non-standard input (linearization to user standard) or in linear input-adapt only T2 (cold junction). I.e. it's automatically, make sure, that the channel measured temperature, otherwise need to change the setting of the input respectively.	R/W
W_PROT	2120,Coil	Protection to write and change settings. ***Defined by jumper in the device.*** 0 - NO (possible parameters change) 1 - YES (device is protected to write)	R
Firmware	126,Int	In the production version is write, but can be overwritten!	R/W!
Alarm outputs K2, K3. **** Not used with MS9024 and MS9034***			
ALARM LO, HI	530,532, Float	Alarm limit outputs K2, K3. Dimension **DimCtrl.**  	R/W
T0AL	33,LSByte	Time to activation of lower alarm output (look graphic above),s	R/W
T1AL	34,LSByte	Time to activation of lower alarm input ,s	R/W
T0AH	35,LSByte	Time to operation of upper alarm output (look graphic above),s	R/W
T1AH	36,LSByte	Time to activation of upper alarm output ,s	R/W
K2_Alarm	490,Coil	0-K3 is Alarm Lo/Hi; K2 turned off 1-K3 is Alarm Hi; K2 is Alarm Lo Outputs K2 and K3 never switched on at once.	R/W
K2_state	2121,Coil	Outputs status K2.	R
K3_state	2122,Coil	Outputs status K3	R
AH(L)log	2123,4,Coil	Logical status of lower(upper) alarm, which is not affected by the times T0AL(H), T1AL(H).	R
System parameters			
INPUT Calibration			
IN_CAL_ MODE	209, LSByte	**Control MODE CALIBRATION INPUT** 0 – work mode 1 – inner calibration (independently after junction ~10s) 2 – submitted standard Pt1000 , 4 wire (requires conformation,resistance standard value is parameter Rstandard) 3 - submitted standard 10V (requires conformation) 4 - submitted standard 20mA (requires conformation) 5 - submitted connected standard. If sets 2,3 or 4 can not be changed without passing trough 0 or 5	R/W

CALIBRATION COEFICIENT (R/W)

The device calculates them automatically at calibration, except **RSP0 ÷ RSP3 and Rstandard**.
RSP3 - 512; **RSP2** - 514; **RSP1** - 516; **RSP0** - 518 - Standard calibration coefficient to 'Non standard input'. Convert linear input 0÷10000 (0÷1V, 0÷10V, 0÷20mA non standard.), µV(TC non standard.) , Ω (RTD400Ω non standard.), Ω/10 (RTD4KΩ non standard.), ==>measured value PV, with Standard up to degree three. *Normally not used or can not be set* .
Rref - 526: coefficient in converting **ADC ==> Ω ; Rref=R standard / ADC standard**
Rstandard -566**:** Value of the standard resistor (Ω), which connects during calibration IN_CAL_MODE=2,
K_C1-564: normalized 0 ÷ 20mA ==> 0÷10000; **K_C3**- 562 normalized 0 ÷ 10V ==> 0÷10000;
ADC system coefficient for increase and ranges.: **ch1 x2, x4, x8, x16, x32, x64** – 60 ÷ 65;
ch2 x1, x2, x4, x8, x16, x32– 67÷71; **ch1 0-1V**-72; **ch3 0-10V**-73; **ch1 TC-74**, Int

TestADC	208, Int	Service test value	R
REJECT	440, Coil	Normal Mode Rejection Ratio: **0 – 80dB 50Hz** **1 – 65dB 50/60Hz**	R/W
		OUTPUT Calibration	
TunMode	130, LSByte	0 – normal work mode output; 1 – fixed output 20% (4mA or 2V); 2 - fixed output 100% (20mA or 10V); 3 - fixed output 60% (12mA or 6V). 55 - BACKUP STORE. A backup of most parameters 56 - BACKUP RESTORE. Restore the state of the device of the backup • To calibrate outputs use mode 1 or 2. For this purpose the relevant actual values, reporting the related meter, must be recorded in AOUT. The device immediately correct its outputs. Mode 3 only checking. When calibration the output MUST be in range (not thou filled). Otherwise calibration must be repeated. • At power **TunMode = 0**.	R/W
• ***Parameters OUT and DAC write automatically from the device when calibrate.*** • ***May be directly entered. Parameters DAC values are 12 bit DAC***			
OUT_LmA, OUT_HmA	550,552, Float	Calibration values, measured current output, (mA)	R/W
OUT_LV, OUT_HV	554,556, Float	Calibration values, measured resistance output, (V)	R/W
DAC_LmA, DAC_HmA	56, 57,Int	DAC codes, corresponding to **OUT_LmA, OUT_HmA**	R/W
DAC_LV, DAC_HV	58, 59, Int	DAC codes, corresponding to **OUT_LV, OUT_HV**	R/W
DAClive	129, Int	Main DAC code	R

RS485 (UART TTL)					
ADDRESS	127,LSByte	MODBUS address the specific device. Dimension 1- 247.			R/W
Baud19200	442, Coil	Baud rate	**0 -** 9600 bps;	**1-** 19200 bps	R/W
EVEN	443, Coil	Parity	0-NONE;	1-EVEN	R/W
2STOP	444, Coil	Stop Bit	0 -1 stop bit;	1 - 2 stop bits	R/W
NoBroad	445, Coil	Broadcast	0 - enabled	1- disabled	R/W

VI. ACTIONS AGAINST INTERFERENCE

Recommendation for use for connecting wires

- ✔ For longer distance lines exposed to electromagnetic interference is desirable to use wire twisted pair.
- ✔ For better noise immunity can be used a shielded cable, which has to be grounded at only one of the junctions.
- ✔ Wires that transmit similar in type signals can be packed together, but if the signals are different, the wires must be separated to prevent electromagnetic interaction.
- ✔ When there have to be crossed wires with different types of signals, it should be done at an angle of 90 degrees and longer distance.
- ✔ Wires, which carry weak signals and wires connecting sensors to the controllers should not be near contractors, motors, generators, radio transmitters, which carry large currents.

WARRANTY CARD

Warranty Card № : .....

Warranty : ..... months

Serial number : .....

The product is bought by : .....

with invoice № : ...../..... ..... 20.....

WARRANTY CONDITIONS

The warranty consists of free repair of all manufacturing defects that can occur during the warranty period. **The repair is done by presenting of this warranty card in the service base with which is bought the product.** The warranty does not cover damage caused by poor transport, poor storage, incorrect usage, forces of nature, failure to follow instructions and when others made an attempt to remove the defects. In these cases the defect can only be removed for a fee.

Service during the warranty period and settlement of claims is done under the current legislation.

REPAIRS MADE IN THE SERVICE BASE

Service	Day of entry	Order number	Type of the repair	Date of delivery	Performer of the repair

Seller::..... Buyer::.....

Bulgaria, 4000 Plovdiv, 4 Murgash str.
Tel.: (+359 32) 642 519, 640 446 fax: (+359 32) 640 446
www.microsyst.net e-mail: info@microsyst.net