microsyst

COMPETENCE IN
MEASUREMENT

CE

PROGRAMMABLE TRIPLE ISOLATED TEMPERATURE TRANSMITTER WITH UNIVERSAL INPUT

MS9054

v 1.01

USER MANUAL

PLOVDIV 2018

I. ADVANTAGES

- ✔ Universal input with integrated liner for 11 thermoresistances and 10 thermocouples as well as 3 customizable sensors.
- ✔ Four-, three- or two-wire circuit for connection of thermal resistance
- ✔ There is no need to calibrate the analog input for thermocouple type sensors
- ✔ Automatic temperature correction of the cold end of all thermocouples - ON / OFF
- ✔ Galvanic isolation between input, output and power supply.

II. DESIGNATION AND OPERATION

MS9054 is offer as **MS9054-A** - with active output or **MS9054-P** - with passive output..
MS9054 is an universal input temperature transmitter for the most common RTD (resistance temperature detectors) and thermocouples. Transmitters have standard linearization with polynomials up to ninth degree for 11 thermoresistances, 10 thermocouples as well as three non-standard types of sensors with polynomial to third degree. The connection of the resistor sensors can be configured for a four-, three- or two-wire circuit.

The **MS9054** has a triple galvanic isolation between input, output and power supply. Programming is performed on MODBUS RTU SLAVE protocol. Output signal is current 0/4 ÷ 20 mA. Transmitters are designed for DIN rail mounting.

III. SPECIFICS

For programming the transmitters, Microsyst offers:

- ■ Base software for „Windows” OS
- ■ USB/TTL Serial programming converter
- ■ Instructions for user configuration of the transmitters
- ■ Instructions for complete system setup and configuration of the transmitters

⚠	• MS9054 is connected via USB 5 mini connector, though the signals are TTL! • MS9054 must not be connected directly to a USB port of a PC ! • MS9054 must be powered during setup !
	• The transmitters have a factory-set input for all sensors and ranges • The user doesn’t need to set-up the input. • When setting the input, the standards must be in Class 0.01.
	• For normal operation, it is sufficient for the user to select an input signal or sensor, possibly connecting it, and match the output / input.

IV. TECHNICAL DATA

Analog input (universal, user chosen)	Resolution - 16bits	
Thermoresistance - RTD	Pt385-10,50,100,200,500,1000; Pt391-100, Pt392-100; Cu482-100; Ni617-100; Ni672-120	
Current through RTD	420µA for 2 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-compensation of the cold end with the possibility of disabling	Integral sensor with 0.25 °C error without correction	
Customizable inputs and ranges	0 ÷ 400 Ω and 0 ÷ 4 kΩ	
	±73,125 mV for thermocouple with ATC	
Temperature drift	< 30 ppm / °C	
Measurement time	350 ms	
Analog input	Resolution - 12 bits	
Refresh time	350 ms	
Lower and upper limit - NAMUR level detection	-1,56% ... +105,4% of the range i.e. for 4-20 mA - limitation of 3.75 ÷ 20.86 mA	
Supplying a passive output !	(9 ÷ 32) V DC – only for **MS9054 P**	
Galvanic isolation	***Triple*** – between input, output and power supply	
Communication		
MODBUS RTU SLAVE protocol	9600, 19200bps; parity – NONE, EVEN ; 1 , 2 stop bit	
Signal levels	TTL Serial - Rx, Tx, Dir, GND	
Communication port	Coupling - Mini 5 USB	
Maximum output load	**MS9054 A**	**MS9054 P**
	650 Ω	650 Ω for 24VDC
Consumption	≤ 1,6 W	
Transmitter supply	Supply voltage : 24 VDC ±30% ; (15÷32) VDC	
Indication	3 LED	
Operating conditions		
Temperature and relative humidity without condensation	Operating conditions: -25 ÷ 70 °C / 20 ÷ 85 % rh Storage conditions: -10 ÷ 70 °C / 20 ÷ 90 % rh	
Dimensions		
Overall dimensions (WxHxL)	In accordance to DIN IEC 61554 – 22,5x89,2x53 mm	
Installation	M36 DIN rail (EN 50022)	
Weight	max 50 g	

** For 3-wire RTD the result is the arithmetic mean of the last two measurements.*

OUTPUT	Range	Accuracy	Temperature drift
Current, mA DC	0 / 4 ÷ 20 mA	0.05 %	0.003 % / °C
Establishing time, s	0.5 sec / 63% of established value		

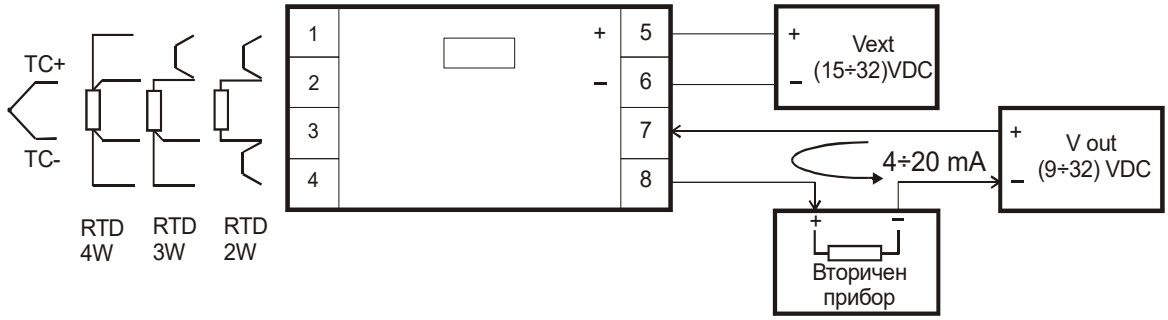
MEASUREMENT RANGE AND ACCURACY					
Sensor	**Standard**	**Range**		**Accuracy**	**Drift, µV / °C**
TC	**-**	**°C**	**µV without ATC**	**°C with ATC**	
J	IEC 584 part 1	-210 ÷ 1200	-8095÷ 69553	0.3	1
K	IEC 584 part 1	-200 ÷ 1372	-6458÷ 54886	0.4	1
S	IEC 584 part 1	-50 ÷ 1768	-236 ÷ 18693	0.5	1
B	IEC 584 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
Non-standard TC	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. At a cold end temperature of 25 °C, the upper limit for TC type E is 950 °C.
- The accuracy is specified as a % of FS and does not include the sensors' errors.

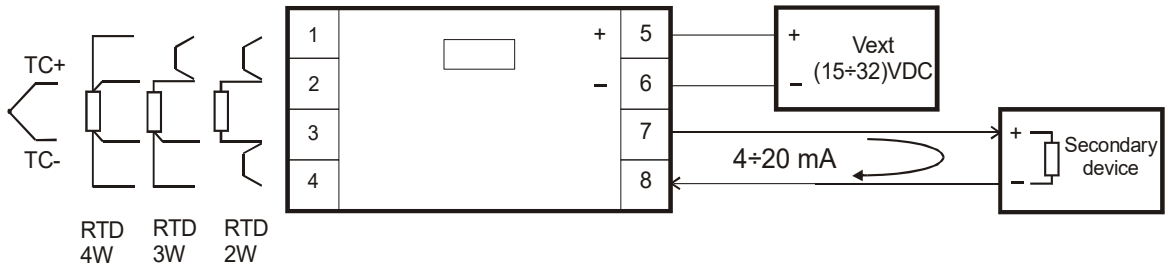
V. TERMINALS AND CONNECTION SCHEMATIC

- **Terminals:**

Transmitter MS9054P- Passive



Transmitter MS9054A- Active



- **Connecting the outputs of MS9054:**

INPUT – THERMORESISTOR, Ω и kΩ		**Marking**	**Terminal**
Four-wire connection	Two wires, shorted at one end of the sensor	4W	1.2
	Two wires, shorted at the other end of the sensor		3.4
Three-wire connection	Two wires, shorted at one end of the sensor	3W	3.4
	One wire – bridge between terminal 1 and 2		2
Two-wire connection	One wire – bridge between terminal 1 and 2	2W	2
	One wire – bridge between terminal 3 and 4		3

INPUT-TC		Marking	Terminal
Two-wire connection with compensation wire	Positive terminal	TC +	2
	Negative terminal	TC -	3

- **Connecting the outputs:**

***MS9054 - A** – with active current output – the output current circuit is powered by the transmitter*
****MS9054 - P** – with passive current output – the output current circuit is powered by an external source and is measured by a secondary instrument*

MS9054-P passive output	Parameter	Marking	Terminal
Захранващо напрежение за трансмитера	(15 ± 32) VDC	+V : plus	5
		-V : minus	6
Към положителен терминал на външен източник	4 ÷ 20mA	+ I : plus	7
Към положителен токов вход на вторичен прибор		- I : minus	8

MS9054-A active output	Parameter	Marking	Terminal
Transmitter supply voltage	(15 ± 32) VDC	+V : plus	5
		-V : minus	6
Output – Positive current terminal	4 ÷ 20mA	+ I : plus	7
Output – Negative current terminal		- I : minus	8

VII. COMMUNICATION

The transmitters are MODBUS RTU SLAVE devices, with the possibility of communicating at 9600 or 19200 bps.

Addresses other than those specified in the parameter table should not be used. It can accept or send up to 128 bytes in a single request.

⚠	• **MS9054 has only one output signal 4÷20 mA**. Some of the parameters are not applicable for this transmitter.
	• Access to programming is dependent on an internal jumper. By standard, hardware programming is enabled.

MODBUS FUNCTION	**IMPLEMENTED MODBUS FUNCTIONS**
01	Reading single bits.
03	Reading HOLDING REGISTERS, 0 < REG ADR < 127 – registers in non-volatile memory, 128 < REG ADR < 256 – registers in operative memory. When adding 512 - FLOAT values are read in format IEEE 754, (without adding 512, they are read in format EXP, S.B0,B1,B2).
05	Storing a single bit, 439<COIL ADR<512;
06	Storing one HOLDING REGISTER, 0 < REG ADR < 127 – in non-volatile memory; 128 < REG ADR < 256 in RAM (only some addresses)
16	Record multiple successive HOLDING REGISTERS. Field of action as function 06, plus addresses > 512. For REG ADR > 512, the function is designed to record FLOAT values in the IEEE754 format.

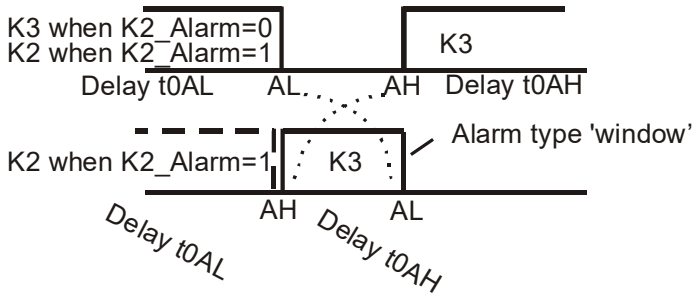
Symbol	Address, type	Function	
Measured variable, outputs			
Input (PV)	728, Float	Input variable. Dimension **DimPV**.	R
AOUT	726, Float	Output. Dimension **DimAOut**.	R/W
ColdEnd T2	730, Float	Temperature T2 of the terminals. (T2_Enable) – in RTD, it must be specified whether to measure. In all other cases, the cold end is measured. Dimension - the same as **DimT2**.	R
Measurement correction, filter * The following 4 parameters only apply to PV formation, even if T2 control is selected			
IN OFFSET	524,Float	Input offset. It is added to the measured input parameter to for PV. Dimension - **DimPV**	R/W
Fin	26,LSByte	Input filter. A lower value corresponds to a heavier filter. Range is 1÷127. At 127, the function is turned off.	R/W
ZnFin	528, Float	Field of effect of the input filter. Outside of it, it delays the new measurement for **FinTime**. Dimension - **DimPV**	R/W
FinTime	25, LSByte	Time to take a measurement outside the ZnFin zone (x~350ms). Range 0÷255. Acts independently of the value of Fin.	R/W
String parameters – variable dimensions * The string parameters are only informative. Size – 2 byte (1 hold register), ASCII			
DimAOut	210, String	Type AOUT. Contains '_V' or 'mA' depending on the output	R
DimT2	211, String	Measurement units of temperature T2. Contains '*C' or '*F'. If T2 is not measured, displays '--'. DimT2='ER', i.e. error in measuring the temperature of the terminals.	R
DimPV	212, String	Dimension of measured variable. Contains '*C' or '*F' when choosing a temperature sensor. At input 0 ÷1 (10)V, 0 ÷ 20mA, repeats **DimLIN.** When there's a measurement error PV, DimPV='ER'.	R
DimCtrl	213, String	Parameters' **ALARM LO, ALARM HI, AOUT LO, AOUT HI** dimension. If control is done according to PV, repeats **DimPV.** If control is done according to T2**,** repeats **DimT2.**	R
DimLIN	24, String	Measurement unit for input 0(2) ÷ 1(10)V, 0(4) ÷ 20mA.	R/W
Parameters for user setting of output AOut			
AOut_LO	558, Float	Value of input, corresponding to lower limit of AOUT : (for 0 / 4mA or 0 / 2V). Dimension **DimCtrl**	R/W
AOut_HI	560, Float	Value of input, corresponding to upper limit of AOUT : (for 20mA or 10V). Dimension **DimCtrl**	R/W
TypeAOut	488,Coil	Choosing type of AOUT : **0 - I(mA) or 1 - U(V)** Normally, the transmitter has one analogue part connected to the output, i.e. the corresponding setting is used. If there are two analog parts connected to the output, this indicates which one to operate. The other will transmit incorrect values.	R/W

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

Parameters for user setting of input

№	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	Sensor choice, according to the table above	R/W
WIRE	32, LSByte	**4**- four or two-wire connection of RTD. **Other value** – three-wire connection of RTD	R/W
PV LO	520, Float	Display (value of PV) of input signal 0V/ 0/4mA. Dimension DimLIN (chosen)	R/W
PV HI	522, Float	Display of input signal 1(10)V/ 20mA. Dimension DimLIN	R/W
Others			
T2_Enable	491,Coil	If the RTD sensor measures the temperature of the T2 terminals 0-NO 1-YES ***(When the sensor is not RTD, T2 is always measured)***	R/W
Ctrl on T2	492,Coil	T2 control, i.e. how to operate the AOut and alarm levels. 0 - NO - PV control 1 - YES - T2 control. The temperature T2 is measured by an integral sensor incorporated in the device and controlled as measured - without the addition of an offset or a filter. At the same time, the input PV is still measured, which in this mode is not part of the control but only available when communicating with the unit. In this mode, T2 is measured regardless of T2_Enable.	R/W
TC_COMP	493,Coil	COLD END compensation of TC input 0 - YES - T2 to be added to the measuerment 1 - NO - PV is as if there is 0 ° C on the cold end	R/W

C/F	447,Coil	Choice: **0-Celsius; 1-Fahrenheit** , when measuring temperature. The measurements adapt automatically, the parameters don't. For non-standard input (user polynomial linearization) or linear input, only T2 (cold end) is adapted. i.e. it is automatic when it is certain that the channel is measuring a temperature, or the input setting must be changed accordingly.	R/W
W_PROT	2120,Coil	Settings save or change protection. ***Determined by a jumper in the device.*** 0 - NO (possible change in parameters) 1 - YES (parameters can't be changed)	R
Firmware	126,Int	The production version is recorded but can be overwritten!	R/W!
Alarm outputs K2, K3. **** Not used in MS9024 and MS9034***			
ALARM LO, HI	530,532, Float	Alarms are outputs K2, K3. Dimension **DimCtrl.**  	R/W
T0AL	33,LSByte	Time to activate output for lower alarm level (look at graph above),s	R/W
T1AL	34,LSByte	Lower alarm level output active time. s	R/W
T0AH	35,LSByte	Time to activate output for upper alarm level (look at graph above),s	R/W
T1AH	36,LSByte	Upper alarm level output active time, s	R/W
K2_Alarm	490,Coil	0-K3 is Alarm Lo/Hi; K2 is off 1-K3 is Alarm Hi; K2 is Alarm Lo Outputs K2 and K3 are never active simultaneously.	R/W
K2_state	2121,Coil	Output K2 state.	R
K3_state	2122,Coil	Output K3 state.	R
AH(L)log	2123,4,Coil	Logic state of lower (upper) alarm, which is not influenced by T0AL(H), T1AL(H).	R
Service parameters			
Input calibration			
IN_CAL_MODE	209, LSByte	**Control of INPUT CALIBRATION MODE** 0 – operating mode 1 – internal calibration (ends after ~10s) 2 – reference Pt1000, four-wire (confirmation is required, value of reference is parameter Retalon) 3 — reference 10V (confirmation required) 4 — reference 20mA (confirmation required) 5 – confirms the reference value. If 2, 3 or 4 are selected, the setting can't be changed without going through 0 or 5 first.	R/W

CALIBRATING COEFFICIENTS (R/W)

The transmitter calculates them automatically during calibration, except **RSP0 ÷ RSP3** and **Retalon**.
RSP3 - 512; **RSP2** - 514; **RSP1** - 516; **RSP0** - 518 - Polynomial calibrating coefficients for '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), ==> process variable PV, via a polynomial of third order. *Normally, they are not used and no set-up.*
Rref - 526: conversion coefficient **ADC ==> Ω ; Rref=R etalon / ADC etalon**
Retalon -566**:** Value of reference resistance (Ω), which is connected during calibration IN_CAL_MODE=2,
K_C1-564: converts 0 ÷ 20mA ==> 0÷10000; **K_C3**- 562 converts 0 ÷ 10V ==> 0÷10000;
ADC system coefficients for gain 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 variable	R
REJECT	440, Coil	Normal Mode Rejection Ratio: **0 – 80dB 50Hz 1 – 65dB 50/60Hz**	R/W
		Output calibration	
TunMode	130, LSByte	0 – normal operating mode of 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. Creates a reserve copy of most parameters 56 - BACKUP RESTORE. Restores to a state, saved in a reserve copy • Modes 1 and 2 are used for calibrating outputs. For that, the real values, measured by another device, must be stored in AOUT. The device corrects its output instantly. Mode 3 is to verify only. When calibrating, the output must be in its range. If not so, the calibration must be repeated. • When power on the supply **TunMode = 0**.	R/W
• ***Parameters OUT and DAC are stored automatically in the device during calibration.*** • ***Can be entered directly. Parameters DAC are the values of a 12 bit DAC***			
OUT_LmA, OUT_HmA	550,552, Float	Calibrating values, measured at current output, (mA)	R/W
OUT_LV, OUT_HV	554,556, Float	Calibrating values, measured at voltage 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	Current DAC code	R

RS485 (UART TTL)			
ADDRESS	127,LSByte	MODBUS address of the specific device. Range 1- 247.	R/W
Baud19200	442, Coil	Baud rate , bps **0 -** 9600 bps; **1-** 19200	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. RECOMMENDATIONS AGAINST INTERFERENCE

Recommendations for the use of connecting wires

- For longer distances for lines subjected to electromagnetic interference, it is desirable to use a twisted pair conductor..
- For better noise protection, a shielded cable may be used, which must be grounded at one end only.
- Wires that carry similar type of signals can be packed together, but if the signals are different, the wires must be separated to prevent electromagnetic interaction.
- When wires with different signals have to be crossed, it must be done at an angle of 90 degrees and a long distance.
- Wires, which carry weak signals and wires connecting the sensors to the controller must not be near contactors, motors, generators, radios and wires, which carry large currents.

WARRANTY CARD

Warranty Card № : .....

Warranty term : ..... months

Factory number : .....

The article is bought by : .....

With Invoice № : ...../..... ..... 20..... y.

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	Date of entering	Order number	Type of repair made	Date of delivering	The repair is made be

Seller:..... Customer:.....

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