www.ames.si

SMART AIR TEMPERATURE, PRESSURE AND HUMIDITY SENSOR

TPR159

Description and user manual

TECHNICAL DESCRIPTION

TPR159 is in inteligent sensor for atmospheric pressure, air temperature and relative humidity measurements. It has a built in CMOS microprocessor, which enables additional processing of measured parameters and various printout formats.

TPR159 uses three different sensors for its operation:

Measurement of atmospheric pressure

For atmospheric pressure measurements TPR159 uses SMD-hibrid integrated circuit, including piezoresistive pressure sensor and AD converter.

Measurement of air temperature.

Pt100 resistance is used as temperature sensor.

Measurement of relative humidity

For relative humidity measurement a kompenzated semiconductor detector is used.

Detectos are shielded from sun radiation and rainfall with ribbed casing made of white UV-resistant plastic..

On bottom end of transistor there are a mechanical element for fixing and a 4-pin water-resistand connector for computer connection.

Sensor is mounted in vertical position on demanded height; all electrical wires must be protected from overvoltage. Connection with sensor is made with 4-wire shielded cable and is independent from wires resistances.

Depending on sensor distance from control computer there are optins for RS232, RS485(two-wire) or SDI-12 communication.

- RS232 protocol maksimal cable length up to 20 m
- RS485 protocol maksimal cable length up to 1200 m (2x shielded twisted pair)
- SDI-12 protocol maksimal cable length up to 60 m
-

Sensor enables measurement of current (1 sec) and average (1, 2, 5, 10, 30 ali 60 min) values of individual parameters

Data from sensor TPR159 can be obtained in two ways (depends on settings)

- sensor sends data every second or at the end of averaging time.
- data is called with an appropriate command

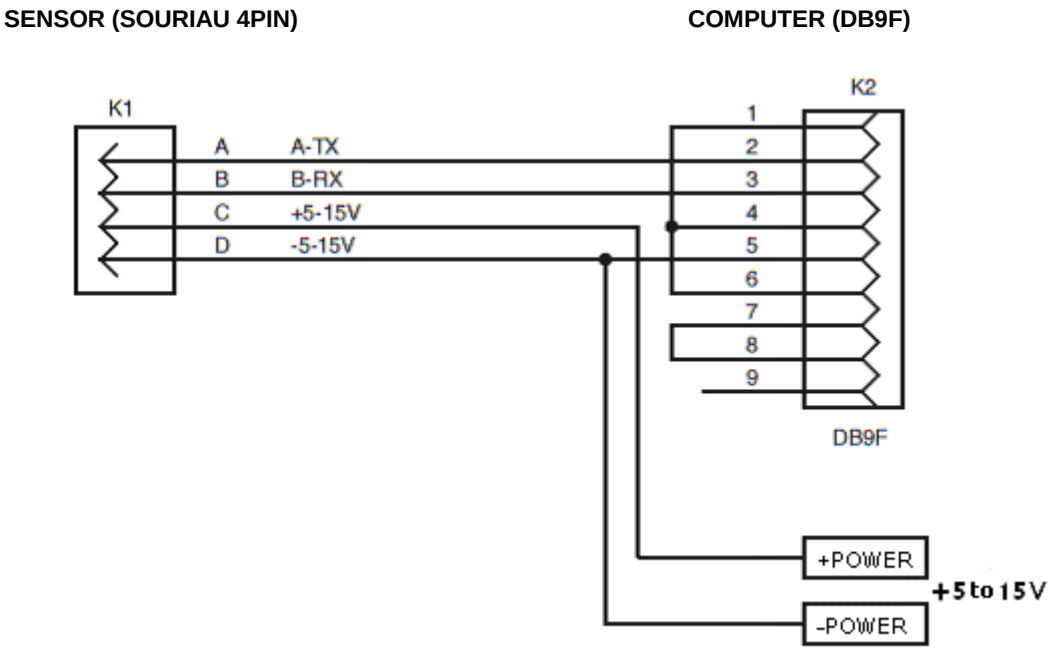
For setting-up sensor via RS232 bus, we must use an appropriate cable and a terminal program

PIN	A	B	C	D
SIGNAL	A - TX	B - RX	+5-15V	GND

Connector on sensor

PIN	1	2	3	4	5	6	7	8	9
SIGNAL	-	TX	RX	-	GND	-	-	-	-

For connection to computer a standard 9 pin female (DB9F) connector is used.



Schematic diagram of power supply and RS232 connection between sensor and computer.

The sensors operational mode is set in system menu. All settings are saved in EEPROM for later use.

After every measurement interval instrument saves average, minimal and maximal data including time and date. This data can be obtained later with proper command from control computer.

Commands for sensor TPR159

For communication between interface and personal computer we can use terminal program with following settings:

COM X	(No. of communication port on which interface is connected X = 1, 2, 3, 4. etc.)
Baud rate 38400	Primary data transfer speed is 38400
Data: 8	
Parity: none	
Stop: 1	
Flow control: none	

HELP

STIME H:M:S D/M/Y	Set time-date
AVG t	t = 1, 2, 5, 10, 30, 60 [min]
VALI n	n = 0 - 100 [%]
SN n	Serial number
TIME	Read time-date
SERMODE	ON, OFF Interval, INS Instant print
DEFAULT	Restore DEFAULT
SPEED b	b = 1200,2400,2400,9600,19200,38400
SPp x0 y0 x1 y1	p=par. x0 y0 x1 y1 set straight
OFSP p n	p=par. n=offset
BPp	p=par. Read par BIN
CFG	Read configuration
TA	Read instant data
PA	Read average data
PINS	Read instant data AMES
PAVG	Read average data AMES

Temp RH Press Sun Speed Dir Chc(8)
<STX>24.7<T>43.1<T>954.7<T>-9999<T>-99.9<T>-999<T>093<ETX>

Command is always confirmed with sign <CR>=<ENTER>

STIME <H:M:S D/M/Y>

Command to set time and date on sensor.

Example: STIME 12:37:46 18/8/9 <CR>
Answer: T= 12:37:46 D= 18/08/09<CR><LF>

AVG t

Command to set averaging time.

[**1**]= 1 min, [**2**]= 2 min, , [**5**]=5 min, [**10**]=10 min, [**30**]=30 min, [**60**]=60 min

Example: AVG 1 <CR>
Answer: **Average 1 min***<CR><LF>*

Averaging time was set to 1 min.

VALI n

Command to set sensor, how many percent of measurements in averaging interval must be valid. Otherwise parameter generates an error status.

n = 0 - 100 [%]

Example: VALI 70 <CR>
Answer: **Validity=70% Count-mea=1260***<CR><LF>*

At least 70% of data in averaging interval must be valid to declare interval with no error.

SN n

Command to set sensors serial number.

Example: SN 3 <CR>
Answer: ***Serial Number: 00003****<CR><LF>*

Serial number is now SN 00003.

TIME

Command to retrieve current time and date.

Example: TIME <CR>
Answer: ***12:37:50 18/04/13****<CR><LF>*

SERMODE (ON, OFF ali INS)

SERMODE ON <cr> Command enables printout of calculated values to serial port
SERMODE INS <cr> Command enables constant printout of current values to serial port
SERMODE OFF <cr> Command disables printout of calculated values to serial port

DEFAULT

Comand sets sensors preprogrammed values to EEPROM

Example:DEFAULT <CR>

Answer: Resore default !<CR><LF>

SPEED b

Comand sets sensor speed of serial transmittion
b = 1200, 2400, 4800, 9600, 19200, 38400 (default 38400 bps)

Example: SPEED 19200 <CR>
Answer: **Serspeed Com0 19200 bps***<CR><LF>*

SPp x0 y0 x1 y1

Comand directly sets sensor constants for calculation of parameter value
P10 Temperature **P35** Relativne humidity **P47** Atmospheric pressure

P10 is temerature parameter.

Example: SP10 16002 87.25 22001 127.34 <CR>
Answer:

ar. Code x0 y0 x1 y1
T1 P 10 16002 87.25 ohm(-40.0 C) 22001 127.34 ohm(40.0 C)
**** SAVE EEPROM ! *****<CR><LF>***

OFSP p n

Command enables setting offset for parameter
P10 Temperatura **P35** Relativne humidity **P47** Atmospheric pressure

Example: OFSP 10 -0.2<CR>
Answer:

P 1 Offset: - 0.2
**** SAVE EEPROM ! ****

Temperature was lowered for 0.2 deg.C in whole range!
BPp

Command for constant print out of binary values of parameter p, with key <ESC> printout is canceled.
P=30 e.g. is parameter for water temperature.

Example: BP10 <CR> (temperature)
Answer:

```
P10    CH=02     20853 bin      T1=  86.4 degC  < ESC >
P10    CH=02     20852 bin      T1=  86.4 degC  < ESC >
P10    CH=02     20852 bin      T1=  86.4 degC  < ESC >
P10    CH=02     20852 bin      T1=  86.4 degC  < ESC >
P10    CH=02     20852 bin      T1=  86.4 degC  < ESC >
```

< ESC > returns station in measurement mode

Example: BP35 <CR> (relative humidity)
Answer:

```
P35    CH=----   ---- bin      RH=  46.1 %     < ESC >
P35    CH=----   ---- bin      RH=  46.0 %     < ESC >
P35    CH=----   ---- bin      RH=  46.0 %     < ESC >
P35    CH=----   ---- bin      RH=  46.0 %     < ESC >
P35    CH=----   ---- bin      RH=  46.0 %     < ESC >
```

< *ESC* > returns station in measurement mode

Example: BP47 <CR> (atmospheric pressure)
Answer:

```
P47    CH=----   ---- bin      Press= 953.5 hPa        < ESC >
P47    CH=----   ---- bin      Press= 953.5 hPa        < ESC >
P47    CH=----   ---- bin      Press= 953.5 hPa        < ESC >
P47    CH=----   ---- bin      Press= 953.5 hPa        < ESC >
P47    CH=----   ---- bin      Press= 953.5 hPa        < ESC >
```

< *ESC* > returns station in measurement mode

CFG

Command prints out configuration settings
Example: CFG <CR>
Answer:

```
************************************************
** TPR159   AMES, driver  v 1.02 (c)    2012    **
************************************************
      Serial Number: 00006
      Interval print OFF
      Ins.Time:    1 sec
      Average 1 min
      Validity=70%    Count-mea=42

      Par.    Code      x0      y0      x1      y1

      T1      P 10    16002    88.48 ohm(-40.0 C)     22001   128.57 ohm(40.0 C)
      T2      P 11        0       0.0  1000     100.0
      RH      P 35        0       0.0  1000     100.0
      PR      P 47     6000     600.0  10500   1050.0
```

TA

Command retrieves instant data.

Example: TA <CR>
Answer:

21.8 51.3 956.0 -9999 -99.9 -999 087

Explanation:

	Temp	RH	Press	Sun	Speed	Dir	Chc(8)
<**STX**>	21.8<T>	51.3<T>	956.0<T>	-9999<T>	-99.9<T>	-999<T>	**087<ETX>\r\n**

PA

Command retrieves average data in last interval.

Example: PA <CR> Answer:

21.8 51.3 956.0 -9999 -99.9 -999 087

Explanation:

	Temp	RH	Press	Sun	Speed	Dir	Chc(8)
<**STX**>	21.8<T>	51.3<T>	956.0<T>	-9999<T>	-99.9<T>	-999<T>	**087<ETX>\r\n**

PINS

Command retrieves instant data. (Format AMES)

Example: TA <CR> ali PINS <CR>
Answer:

```
P  0    03:41:10        11/07/12        00:00   00/00/00        C
P 10      25.2  0
P 11      25.2  0       (temperature 2 for relative humidity
compensation )
P 35      46.9  0
P 47     952.8  0
034
```

INSTANT DATA

Parameter code	Data
<02>	STX
P0	transmittion time

	transmittion date

P10	Temperature (°C) (Instant value - 1sec)
P11	Temperature1 (°C) (Instant value - 1sec)
P35	Relative humidity RH (%) (Instant value - 1sec)
P47	Atmospheric pressure (hPa) (Instant value - 1sec)
	checksum in format "%03bu"<CR><LF> (8 bit SUM, module %256))
<03>	ETX

PA or PAVG

Command retrieves average data in last interval. (Format AMES)

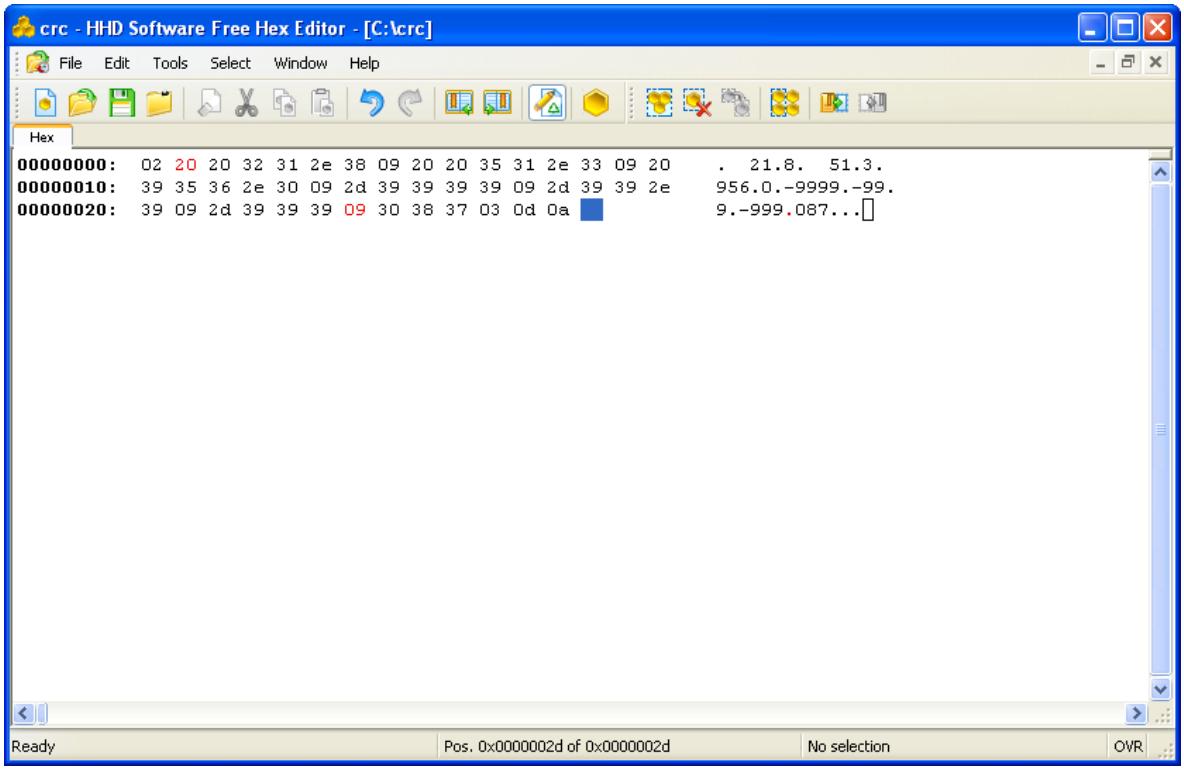
Example: PA <CR> ali PAVG <CR>
Answer:

```
P  0    03:46:04       11/07/12       03:46   11/07/12       C
P 10     25.1    25.2  03:45    25.0  03:45    25.2    0.0    0
P 11     25.0    25.2  03:45    25.0  03:45    25.0    0.1    0
P 35     47.1    47.3  03:45    46.9  03:45    47.1    0.0    0
P 47    952.8   952.9  03:45   952.8  03:45   952.8    0.0    0
193
```

Koda parametra	Podatek
<02>	STX
P0	transmittion time
	transmittion date
	averaging time

	averaging date
	location (station name)
P 10 **P 11** **P 35** **P 47**	Avg.: average value
	Max.: maximal value / time of maximum
	Min.: minimal value / time of minimum
	Termin. val.: average value in last minute of interval
	St. dev.:standard deviation
	Validity of parameter data (00 – OK)
	Checksum v formatu "%03bu"<CR><LF> (8 bit SUM, module %256)
<03>	ETX

Explanation of CRC module %256 calculation



We must add all characters from red to red included them!

21.8 51.3 956.0 -9999 -99.9 -999 087
<**STX**> 21.8<T> 51.3<T> 956.0<T>-9999<T>-99.9<T>-999<T>**087<ETX>\r\n**
I---------- Vse karakterje sešteješ ----------I

Sum is 1623 (dec)

1623/256= 6.339 ….

From this follows 256 x 6 = 1536

1623-1536= **87 (residue of module 256) (printout format is %03u that is 087)**

CRC is residue of module 256

In program language C CRC=sum%256;

APPENDIX