

# Application Note

## Pyrometer TPT 300V/2-B-SI

Version 1.0

## Table of Content

1	History	3
2	General Information	3
3	Specification	3
3.1	Absolute Maximum Ratings	3
3.2	Technical Specification	4
3.3	Dimensions	4
3.4	Terminals	5
4	Wiring	5
5	RS232 Protocol	6
5.1	RS232 Settings	6
5.2	TPT Modes	6
5.3	Protocol Definition	6
5.3.1	Request Software Version and Serial Number	6
5.3.2	Set Output Format	7
5.3.3	Set Output Mode	7
5.3.4	Set Output Data Rate	7
5.3.5	Set Emissivity Factor	8
5.3.6	Read Emissivity Factor	8
5.3.7	Software Reset	8
5.3.8	Request Result Data	8
6	TPT Sensor Terminal Software	9
6.1	User Interface	9
6.2	TPT Modes and Protocol Definitions	10
6.2.1	“Free Running” and “On Request”	10
6.3	Program Functions	10
6.3.1	TPT Connection	10
6.3.2	Scan Function	11
6.3.3	Configuration File “Devices.ini”	11
6.3.4	Select TPT Device	12
6.3.5	Changing Sensor Parameter	12
6.3.6	Visualization of Measuring Results	12
7	Additional Information	12

## 1 History

Ver.	Document name	Date	Purpose	Author
1.0	TPT_300V_2-B-SI_Application_Note.doc	09.02.2007	Creation	M. Basel

## 2 General Information

TPT 300 is a contact-less temperature measuring system - called pyrometer - based on the detection of infrared radiation.

TPT 300 is equipped with a lens and an infrared sensor (Thermopile) in front. It has to be pointed at the target object.

The basic working principle is:

- Detection of infrared radiation with a Thermopile sensor
- Further analog signal processing
- Calculation of the objects temperature using a microcontroller
- Providing the objects temperature at digital or analog output

The main fields of applications are temperature measuring in industrial applications i.e. at moving or inaccessible parts.

## 3 Specification

### 3.1 Absolute Maximum Ratings

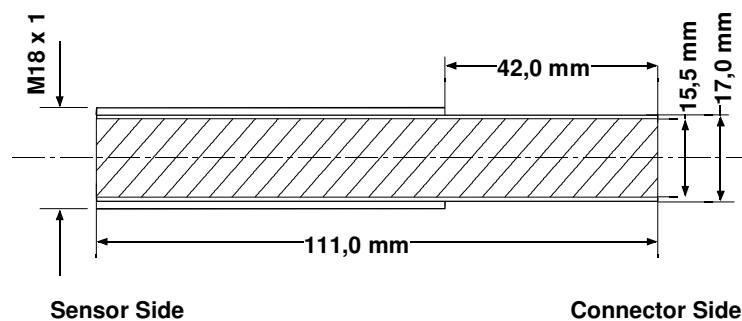
**CAUTION: Exceeding these values may destroy this part! This part is not guaranteed to work properly under these conditions.**

Parameter	Condition	Value	Unit
Operating Voltage		-1 .. 30	V
Ambient Temperature Range		-20 .. +85	°C

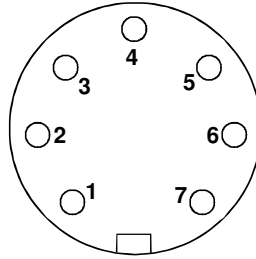
### 3.2 Technical Specification

Parameter	Condition	Value	Unit
Lens Type		IR Lens (Si)	
Field of View		± 5	°
Spectral Sensitivity		8 .. 14	µm
Emission Coefficient		0.1 – 1 (adjustable via RS232)	
Target Temperature Range		0 – +300	°C
Ambient Temperature Range		0 – +85	°C
Operating Voltage	Full ambient temp. range	9 – 24	V
Supply Current	Full ambient temp. range, typical value, no output load	22	mA
Digital Output Type		RS232	
Digital Output Settings		9600 Baud, 8 Bit, No Parity, 1 Stop Bit	
Data Output Rate		< 10 (adjustable via RS232)	Hz
Accuracy of Target Temp. Measuring	Tambient = 25 °C	± 1% of Full Scale Range resp. ± 3 °C	
Accuracy of Target Temp. Measuring	Full ambient temp. range	± 1.5% of Full Scale Range resp. ± 4.5 °C	
Resolution Digital		0.3	°C
Analog Output Characteristics		TTarget[°C] x 5V/300°C	V
Analog Output Range		0.2 – 4.8	V
Resolution Analog		0.3	°C
Analog Output Source Resistance		40	Ω
Housing		Stainless steel	
Protection class		IP 65	

### 3.3 Dimensions



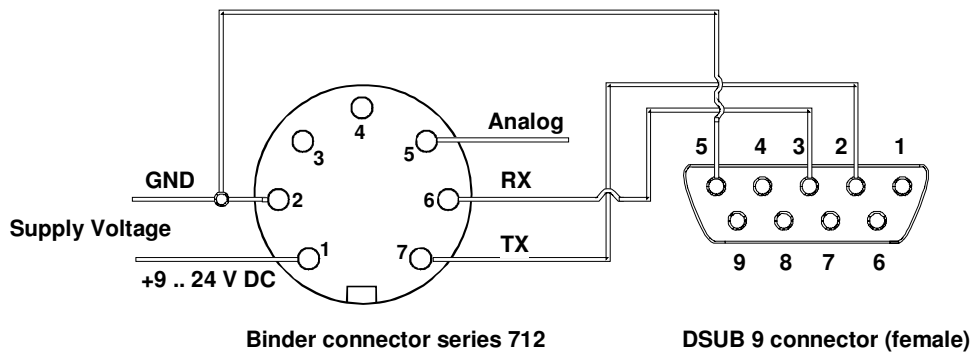
### 3.4 Terminals



Connector (Franz-Binder series 712, 7 poles)

Pin	Symbol	Description	Type
1	+VS	Supply Voltage	Supply
2	GND	Ground potential	Supply
3	NC		
4	NC		
5	AN	Analog Output (Voltage, Current)	Analog Output
6	RX/A	Receive Data (RS232)	Digital Input/Output
7	TX/B	Transmit Data (RS232)	Digital Input/Output

## 4 Wiring



**Please take care: pin numbers are marked on the Binder and on most DSUB connectors!**

## 5 RS232 Protocol

### 5.1 RS232 Settings

The port settings are fixed at:

Parameter	Setting
Baudrate	9600
Data Bits	8
Parity	None
Stopp Bits	1

### 5.2 TPT Modes

There are two modes implemented in TPT sensors: the Free Running mode and the On Request mode.

In the Free Running mode the sensor cyclically sends measuring results via RS232. In this mode no further communication (for instance changing sensor parameters) is possible. The only telegram which is accepted in this mode is the "Set On Request Mode" telegram, which stops sensor output.

In On Request mode the sensor only sends data via RS232 after user has sent any request telegram. Only in this mode the changing of sensor parameters is possible.

NOTE: Updating the analog output is directly correlated with updating the RS232 output. Only if output data are sent via RS232 the analog output is updated. Two cases are possible: the "Request Result Data" telegram causes updating serial and analog output and - on the other hand - the cyclically sending data in Free Running Mode.

### 5.3 Protocol Definition

#### 5.3.1 Request Software Version and Serial Number

User System → TPT Sensor	TPT Sensor → User	Notes
„V“	<Version and Serial Number>	ASCII- Format

<Version and Serial Number> is given as follows:

*HL-Planartechnik TPT V2.1 0414001-2 <CR> <LF>*

HL-Planartechnik	manufacturer company
TPT	product family (pyrometer)
V2.1	software version
0414001-2	serial number, format: yy ww nnn – c which means: year (2 digits), week of year (2 digits), consecutive number in the week (3 digits), product code ("2" is the code for TPT 300 V/2-B)
<CR> <LF>	carriage return, linefeed

### 5.3.2 Set Output Format

Set "Format Object and Ambient Temperature"		
User System → TPT Sensor	TPT Sensor → User	Notes
"I"	"I" Echo	ASCII- Format

See 5.3.8 for format definition.

Set "Format Object Temperature"		
User System → TPT Sensor	TPT Sensor → User	Notes
"I"	"I" Echo	ASCII- Format

See 5.3.8 for format definition.

### 5.3.3 Set Output Mode

Set "Free Running" Mode		
User System → TPT Sensor	TPT Sensor → User	Notes
"F"	"F" Echo	ASCII- Format

Free Running Mode means, that result data is cyclically updated at analog and digital output. The output data rate is adjustable (see 5.3.4).

Set "On Request" Mode		
User System → TPT Sensor	TPT Sensor → User	Notes
"f"	"f" Echo	ASCII- Format

On Request Mode means, that the sensor only sends data, if the user has sent any request telegram before.

### 5.3.4 Set Output Data Rate

Step	User System → TPT Sensor	TPT Sensor → User	Notes
1	"O"	"O" Echo	ASCII- Format
2	<Data Rate Code>	<Data Rate Code> Echo	ASCII- Format

Permitted values of Data Rate Code:

Data Rate Code	Output Data Rate
0	100 ms
1	500 ms
2	1000 ms
3	5000 ms
4	10000 ms

Note: No reset is necessary to activate the new settings.

### 5.3.5 Set Emissivity Factor

Step	User System → TPT Sensor	TPT Sensor → User	Notes
1	"e"	"e" Echo	ASCII- Format
2	<Emissivity>	<Emissivity> Echo	Binary- Format

Emissivity is adjustable in range of 1 – 100 %. Parameter <emissivity> must be given as one-byte integer value. For instance: E=100% corresponds to 64hex respectively ASCII "d".

Note: No reset is necessary to activate the new settings.

### 5.3.6 Read Emissivity Factor

Step	User System → TPT Sensor	TPT Sensor → User	Notes
1	"E"	"E" Echo	ASCII- Format
2	<Emissivity>	<Emissivity> Echo	ASCII- Format

### 5.3.7 Software Reset

Step	User System → TPT Sensor	TPT Sensor → User	Notes
1	"q"	No Echo	ASCII- Format

Software Reset activates internal watchdog circuitry. It takes about 1 second until software reset is done and sensor acts normal (as after power-up).

### 5.3.8 Request Result Data

User System → TPT Sensor	TPT Sensor → User	Notes
„R“	<Result Data>	ASCII- Format

There are two output formats available. If "Format Object and Ambient Temperature" is selected, the <Result Data> is given as follows:

```
+255:+784 <CR> <LF>
+255                sensor temperature in tenth of degree C
:                   colon (delimiter)
+784                object temperature in tenth of degree C
<CR> <LF>          carriage return, linefeed
```

If "Format Object Temperature" is selected, the <Result Data> is given as follows:

```
+784 <CR> <LF>
+784                object temperature in tenth of degree C
<CR> <LF>          carriage return, linefeed
```

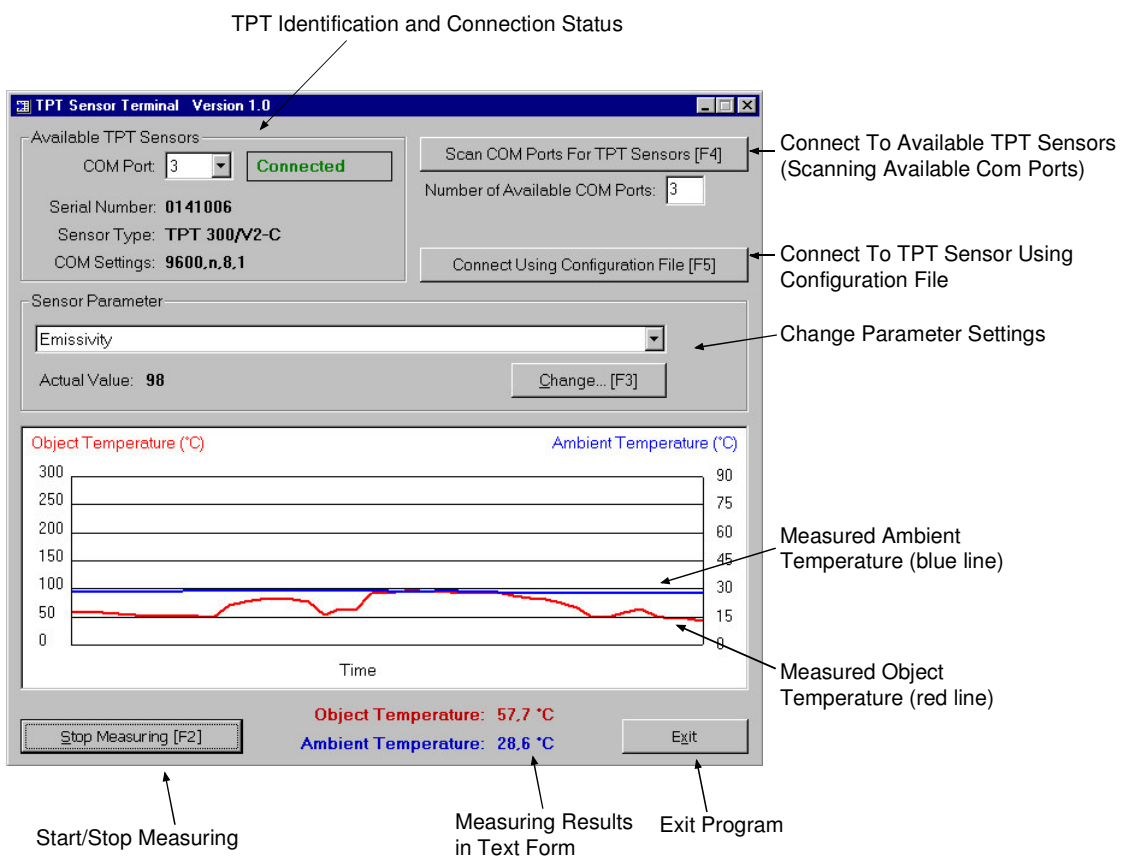
## 6 TPT Sensor Terminal Software

*TPT Sensor Terminal* is the PC software for the HL-Planartechnik pyrometer **TPT**. *TPT Sensor Terminal* is used to

- visualize the measured target object temperature and sensor temperature in a waveform diagram
- enable the user to set up the TPT sensor for his special application

### 6.1 User Interface

The figure below shows a screen shot of *TPT Sensor Terminal* and gives a short description of implemented functions.



## 6.2 TPT Modes and Protocol Definitions

*TPT Sensor Terminal* is used to enable the user to set up TPT sensor for the special application and to visualize measuring results without knowing the serial protocol which is implemented inside the sensor.

Nevertheless some essential information about this protocol respectively the internal sensor modes must be known.

### 6.2.1 “Free Running” and “On Request”

There are two modes available in TPT sensors: the **Free Running** mode and the **On Request** mode.

In the **Free Running** mode the sensor sends measuring results continuous via RS232. The *Data Output Rate* is adjustable by the *TPT Sensor Terminal* program (see 6.3.5). In this mode no further communication (i.e. changing sensor parameters) is possible. The only telegram which is accepted in this mode is the **Change To On Request** telegram. **Free Running** mode in *TPT Sensor Terminal* program is set by pressing the “Start Measuring” button. If results are shown in the waveform diagram **Free Running** mode is active.

In **On Request** mode the sensor only gives results after user has send the request telegram which is defined in the protocol definition. Only in this mode the communication to change sensor parameter is possible. **On Request** mode in *TPT Sensor Terminal* program is set by pressing the “Stop Measuring” button. If no measuring results are seen in the waveform diagram **On Request** mode is set.

There are two important information for the user concerning the described modes:

1. If *TPT Sensor Terminal* tries to connect to available sensors, the first action is setting the sensor in **On Request** mode. In the next step *TPT Sensor Terminal* requests for serial number and sensor type identification.
2. **Updating the analog output voltage** only happens if the sensor is either in *Free Running* mode or the user requests for measuring results in *On Request* mode. **Updating analog output voltage is coupled with updating results via digital output (RS232).**

**If it's intended to use analog output only (without serial connection), the user has to take care that *Free Running* mode (result visualization in waveform diagram must be going on) during leaving TPT Terminal, otherwise no updating of analog output would take place.**

## 6.3 Program Functions

### 6.3.1 TPT Connection

There are two ways to connect to TPT sensors:

1. Using the “Scan” function
2. Using a configuration file

### 6.3.2 Scan Function

First the user has to enter the value "Number of available COM Ports". After pressing the button "Scan COM Ports For TPT Devices" the program tries to connect to TPT devices at any COM port in the range of 1 up to the number which the user has entered in the text box. Scanning process is indicated by a red label below the text box. As a result all ports with TPT devices are listed in the list box in the frame "Available TPT Sensors".

### 6.3.3 Configuration File "Devices.ini"

The configuration file format is shown below. See the example for two connected sensors at COM 1 and COM 2:

```
[Devices]
Number=2
[Device1]
Comport=1
Settings=9600,N,8,1
[Device2]
Comport=2
Settings=9600,N,8,1
```

The file name must be "Devices.ini" and file location has to be the application path.

The user has to type

- the number N of devices he wants to connect (max. 16) in the entry "Number" of the section "Devices" and
- the corresponding COM ports in the subsequent sections "Device1" to "DeviceN".

The COM settings are fixed for the time being (9600 Baud, no parity, 8 bits, 1 stop bit). If more than two devices should be connected, the user has to type corresponding number of sections as shown below:

```
[Device3]
Comport=3
Settings=9600,N,8,1
[Device4]
Comport=7
Settings=9600,N,8,1
...
```

#### 6.3.4 Select TPT Device

The available devices are listed in the frame “Available TPT Sensors”. The connection state is shown in the black frame next to the list box for the COM ports. To select a device the user has to click on the desired COM port in the list box.

Following information are given in this frame:

1. Serial number. Format is: production year, production week, consecutive number per week (yywwNNN)
2. Sensor Type
3. COM settings

#### 6.3.5 Changing Sensor Parameter

Changing sensor parameter is possible only in On Request mode (measuring must be switched off).

Following parameters can be changed:

1. **Emissivity.** Emissivity is given in percent and can be changed in the range of 1 .. 100.
2. **Data Output Rate.** Data Output Rate can be set to values 100 ms, 500 ms, 1000 ms, 5000 ms, 10000 ms.
3. **Output Format.** Here two options are selectable: indication of target object temperature only or indication of target object temperature and ambient temperature both.

User has to select the desired parameter in the list box of the frame “Sensor Parameter” and then press the button “Change...”. In the appearing sub dialog then the selection of new parameter value can be done. After finishing this the new parameter value is shown in the main window as the “Actual Value”.

#### 6.3.6 Visualization of Measuring Results

Measuring results are shown in a waveform diagram. The actualizing rate is equal to the actual setting of the *Data Output Rate*. Corresponding to the setting *Output Format* the object temperature only or both object and ambient temperature is shown.

## 7 Additional Information

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