TEMPSENS

CE

Thermal & Cable Solutions

A250+/A450+ PL/TL Video

Non-contact Infrared Pyrometers

USER MANUAL

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Chapter - 1

General Information

Congratulations on choosing this high quality and highly efficient Tempsens pyrometer for non contact temperature measurement.

Please read this user manual carefully, step by step, including all notes of security, operation and maintenance before installing the pyrometer. This manual contains all the necessary instructions for set up and operation of the pyrometer. This section provides an overview about important safety regulations.

Some Important Safety Regulations Given Below

1. Safety Precaution

Each person working with pyrometer must read the user manual before operation. The pyrometer has only to be used for the purpose described in manual. The pyrometer works only with a potential free low voltage of range 24VDC. This voltage is not harmful for user. The pyrometer may contain harmful material and hence it should not be disposed of with normal waste.

2. Packaging and Storage

Always use a shock proof package for shipment of pyrometer. It should be sealed to protect it against humidity. Also protect the lens of pyrometer with cover. They should be stored at the temperature range from -20°c to 70°c.

3. Limit of Liability and Warranty

All general information and notes for handling, maintenance and cleaning of this instrument are offered according to the best of our knowledge and experience.

Tempsens reserves the right to revise this document and to make change from time to time in the content hereof without obligation to notify any person or persons of such revisions or changes

Tempsens instruments have a warranty of two year from the invoice date. This warranty covers manufacturing defects and faults which arise during operation only if they are the results of defects caused by Tempsens.

Tempsens does not accept liability for any damages or losses which might occur, including consequential damages and financial losses, as a result of use of the instrument.

4. Copyright

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Chapter - 2

Introduction

A250+/A450+ PL/TL/Video are specially designed highly accurate digital pyrometers to provide high performance and low maintenance of non contact temperature measurement in demanding industrial environment.

2.1 Product Key Features, Application and Range

The A250+/A450+ PL/TL/Video pyrometers are especially designed for industrial purposes. They are suitable for high temperature measurement ranging from 210°C to 3000°C.

These pyrometers have solid body in stainless steel housing, which provides high operation safety even in rough industrial environment, and large variety of focusable optics which can be easily used in all industrial areas.

These pyrometers have OLED display which shows temperature and provides menu selection via parameterizaion keys. A250+/A450+ PL/TL/Video have fast response time of 2msec. The RS-485 for long distance communication between pyrometer & PC software Infrasoft. Response time, emissivity, sub-range and peak picker selection can be preset ex-works or adjustable through available software.

The pyrometer temperature measurement method utilizes the fact that objects emit thermal radiation in an amount that directly corresponds to their own temperature and surface emissivity.

The pyrometer sensor detects the amount of infrared radiation emitted by the measured object (target). The infrared signal is analyzed and the temperature it represents is analyzed by built-in microprocessor. A250+/A450+ PL/TL/Video work in 4-wire technology.

The applications in which Tempsens pyrometers can be used are

- ✓ Preheating
- ✓ Annealing
- ✓ Tempering
- ✓ Welding
- ✓ Forging
- ✓ Hardening
- ✓ Melting
- ✓ Sintering
- ✓ Soldering
- ✓ Rolling
- ✓ Brazing
- ✓ Normalizing

Standard Item supplied with A250+/A450+ PL/TL/Video

- ✓ Tempsens pyrometer
- ✓ Connection cable 12-core (length - 5 m)
- ✓ Tempsens software CD
- ✓ Manual
- ✓ Certificate of calibration

2.2 Technical Specifications

Model	A250+ PL/TL/Video	A450+ PL/TL/Video
Temperature Range (Analog sub-range adjustable)	210°C….1350°C 250°C….1800°C 300°C....2500°C 350°C....3000°C	600°C….2500°C
Spectral Range	1.6 µm	1.0 µm
Photodetector Type	InGaAs	Si
Distance to Spot Size Ratio	75:1 (210°C….1350°C) 150:1 (250°C….1800°C) 300:1 (300°C….2500°C) 300:1 (350°C.... 3000°C)	300:1 (600°C….2500°C)
Emissivity (ε)	0.1….1.0 adjustable	
Response Time	2 msec adjustable upto 10 sec	
Accuracy	± 0.3% of the measured value + 1°C	
Repeatability	0.1% of reading in °C + 1°C	
Sighting Options	Laser Pilot Light (PL) / Through The Lens (TL) / Video output	
Analog Output	0-20mA, 4-20mA (User selectable)	
Digital Output	RS-485/RTU Modbus Serial Interface (User selectable)	
Relay Output	Relay output with hysteresis 60V DC / 42V AC RMS, 0.4A	
Operating Temp. Range	0°C…….70°C 0°C…..200°C (With water cooling jacket)	
Storage Temp. Range	-20°C…70°C	
Adjustable Parameters and Features via Software/ Keypad	Emissivity, Response Time, Clear Time(Peak Picker), Analog Output, Analog Scale (Sub Range), Unit Of Temperature(°C/°F), Record feature, Match Temperature etc.	
Power Supply	12V to 28V DC with reverse voltage protection	
Power Consumption	Max 2.5 watt - PL/TL models Max 3.5 watt - Video models	
Laser Power	<1 m watt (Only PL Model)	
Protection Class	IP65	
Housing	Stainless Steel	
Isolation	Power supply, Digital output and Analog output are galvanically islolated against each other	
Operating Humidity	10-95%, Non-Condensing Conditions	
Weight & Dimensions	1200g Dia= Ø56 mm; Length=185.5mm	

2.3 Video Specifications

Model	A450C+ PL/TL/Video
Pixles	640 x 480
Video Format	PAL
Video Output	CVBS
Impedance	75R
Image Sensor	1/4 " CMOS
Maximum Analog Video Cable Run	Upto 40m Special Co-axial Cable Used
Cable Connection Type	BNC
Operating Temperature	0°C ..... 65°C

Dimensions

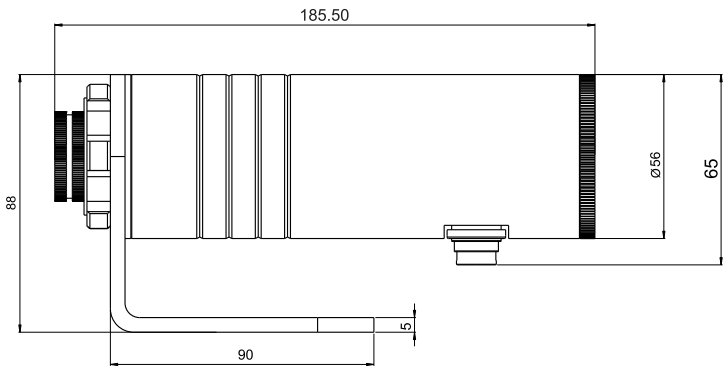


Fig. 1 Dimensions of Pyrometers

2.3 Optics

The pyrometer measure temperature by receiving heat radiation from the object whose temperature has to be measured. This heat radiation is passed through the lens sensor and then converted to an electrical signal. The farther the measured object from the pyrometer, the larger the area that will be measured.

Table 1 :Some fixed optics focus is as below

		Spot Sizes(mm)				
Focused working distances WD (mm)	**Length L**	**A250+ 210°C - 1350°C (75:1)**	**A250+ 250°C - 1800°C (150:1)**	**A250+ 300°C - 2500°C 350°C - 3000°C (300:1)**	**Length L**	**A450+ 600°C - 2500°C (300:1)**
475	14.00	6.40	3.20	1.60	13.60	1.60
500	13.20	6.70	3.40	1.70	12.70	1.70
700	8.70	9.40	4.70	2.40	8.50	2.40
800	7.40	10.70	5.40	2.70	7.20	2.70
1000	5.70	13.40	6.70	3.40	5.50	3.40
1500	3.50	20.00	10.00	5.00	3.40	5.00
2000	2.40	26.70	13.40	6.70	2.30	6.70
3000	1.40	40.00	20.00	10.00	1.30	10.00
5000	0.50	66.70	33.40	16.70	0.50	16.70
9000	0	120.00	60.00	30.00	0	30.00

Adjusting the required measuring distance:-

To achieve the spot sizes mention in the table above required measuring distance must be adjusted. This can be done between the smallest and the biggest limit value. For releasing the optics has to be turned anti clock wise. Then it can be pushed or pulled to find the correct measuring distance. For fixing the optics has to be turned clock wise.

Adjusting the measuring distance with the help of the table:-

The table mentions the minimum and maximum measuring distance for each optics as well as serval other values. The length “L” can we measured with a caliper. This length "L" can reach max. upto 14 mm.

Adjusting the measuring distance with help of the thru lens view finder:-

The focusable optics is correctly adjusted to the required distance, if the measuring object is shown as a sharp image in the view finder . A circle marks the position of the measuring spot.

Adjusting the measuring distance with help of the laser targeting light:-

On the focused measuring distance the laser has a smallest spot size.

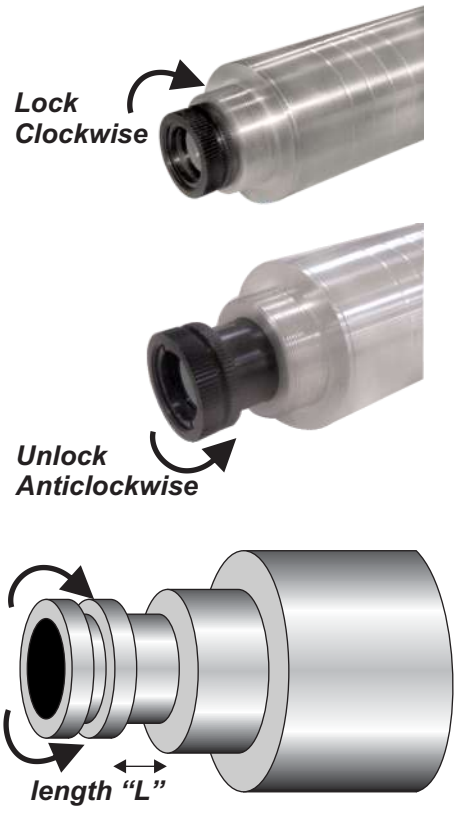


Fig. 2 Adjusting Measuring Distance

Chapter - 3

Basics & Installation of the Pyrometer

3.1 Basics of Infrared temperature measurement of an object

Each and every object emit definite amount of infrared radiation and its intensity varies according to the temperature of object. Wavelength of infrared radiation lies approximately between 0.7 to 14 μm depending on the material and properties of object. Infrared radiations are sometimes also referred to as “heat radiations” depends mostly on the material. This material dependent constant value is known as “emissivity”, have a look at appendix B for emissivity values.

3.1.1 Emissivity (Ɛ)

Emissivity is the ratio of energy radiated from an object to the exterior and energy radiated from blackbody. The emissivity varies with the surface condition of the object and also with temperature variation and wavelength. If this value is not accurate, then the true temperature cannot be measured. In other words a variation or change in emissivity will cause a change in the measurement.

If the value of emissivity low, your measured results may contain some errors due to interfering infrared radiations form objects which are behind the target object like heating systems, fireclay brisk etc. Usually such type of problems occurs while measuring very thin materials like glass, plastic etc or some reflecting surface.

This error can be reduced if the sensor is shielded from reflecting radiation sources and also by properly, carefully installing the device.

By the application of Kirchhoff's law of thermal radiation “at thermal equilibrium, the emissivity of the body is equal to its absorptivity (α)”. So for perfect black body, Ɛ is 1 while any real object would have Ɛ less than 1. Also the transmissivity (τ) and reflectivity (ρ) is zero. The sum of absorptivity, reflectivity and transmissivity is always 1.

$$\alpha + \rho + \tau = 1$$

By emissivity factor materials can be categorized as

- ✓ Metals
- ✓ Non metals
- ✓ Transparent materials

3.1.2 Calculation of emissivity of target object

There are various methods to do so but one of most prominently used is Calculate the actual temperature of target object using a RTD, Thermocouple etc. Measure the object's temperature by pyrometer and adjust emissivity settings in pyrometer unless correct temperature value is reached. Hence correct emissivity is measured of the target object.

3.2 Installation

3.2.1 Mechanical installation of pyrometer

After all preparations are completed you can install pyrometer. Installation of pyrometer depends on the type of bracket you are using and the type of surface.

3.2.2 Distance of pyrometer from object

The desired spot size on the target will determine the maximum measurement distance and the focal length of the optical module. To avoid wrong readings the spot size of target must contain entire field view of the pyrometer. The pyrometer must be mounted so the entire field of view is the same or smaller than the desired target size. This is indicated in the below diagram.

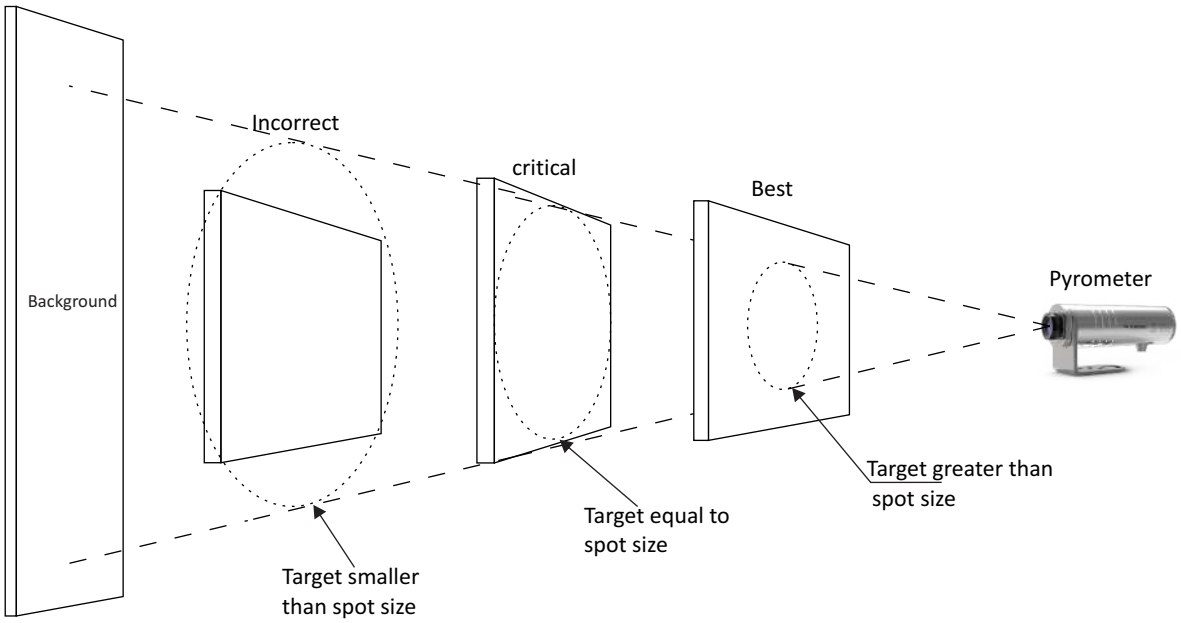


Fig.3 Proper mounting of pyrometer

3.2.3 Viewing Angles

The pyrometer can be placed at any angle from the target object up to 30°.indicated in the below diagram.

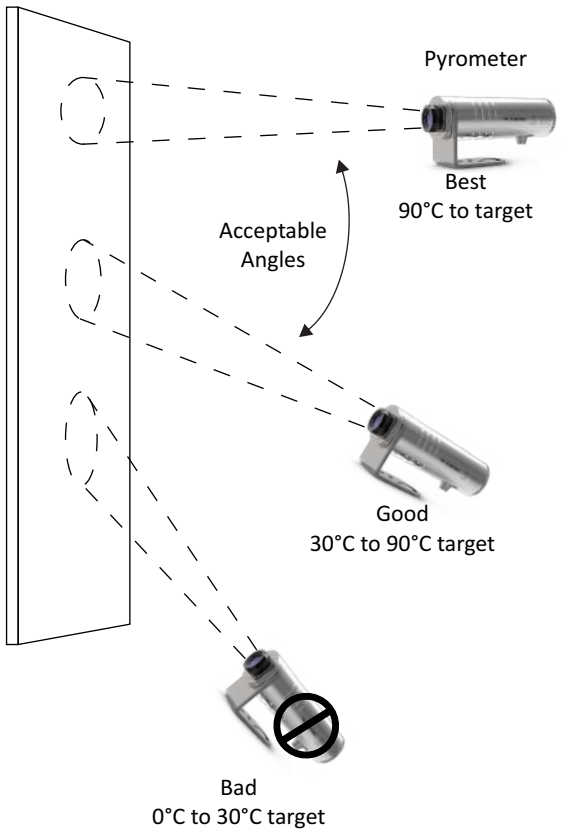


Fig. 4 Pyrometer Acceptable Viewing angles

3.3 Location selection

Qualified operating person should do the installation. Location should be good enough so that pyrometer should get continuous infrared radiation.

Pyrometer distance from object is according to below points:-

1. Pyrometer spot size should be small than object size.(read 3.2.2 & 3.2.3)
2. Know your pyrometer spot size according to point 2.3.
3. Pyrometer ambient temperature should be within 0° to 70°C (read 3.3.3).

3.3.1 Correct Positioning of the pyrometer

With pilot light (PL)

A laser targeting light will help to correct the position of the pyrometer. It is recommended that laser should be switched off while measurement. It will increase the life of laser. To avoid measuring errors caused by a too big spot size the pyrometer must be fixed in the correct measuring distance, so that the object under measurement fills the spot size.

With through the lens sighting (TL)

In case of through the lens sighting a reticule circle marks the position of the measuring spot. This circle is true-sided and parallax-free.

With composite Video output

In case of video output a reticle circle on the center of camera view marks the positioning of the measuring spot. The camera view shows real temperature of the target and reticle on the center of the view.

Note: *The laser spot (PL) / reticule circle (TL) is only for indication of measuring spot, not exactly shows the measuring area.*

3.3.2 Mounting of pyrometer

To install the pyrometer at the place of measurement a mounting support is supplied as an accessory, after losing the clamp screws, pyrometer can be mounted correctly in the mounting clamp.

3.3.3 Ambient temperature

The allowed operation temperature for the pyrometer is 0°C to 70°C. Therefore if pyrometer is to be used above 70°C upto 200°C water cooling jacket with built in air purge unit is used otherwise it may damage the pyrometer. The ambient temperature is dependent on the temperature and flow rate of cooling water. Details of water cooling jacket& air purge are given in point 3.4.1.

3.3.4 Atmospheric conditions

The pyrometer cannot receive the full infrared energy for the measurement if atmospheric conditions like smoke, dust or steam are present and hence it result in measuring error. An air purge unit can be helpful to avoid contamination such as dust and humidity on the lens. The air supplied should be at normal temperature with oil & moisture free. The air purge generates an air stream shaped like a cone and blows particles from the lens area.

3.4 Mechanical Accessories

3.4.1 Water Cooling Jacket

This accessory is very important in order to use pyrometer at higher temperature. A normal pyrometer can withstand a temperature of 0-70°C. For higher temperature applications the device must be used with water cooling jacket upto 200°C.(for mechanical drawing refer Appendix C.)

- Water pressure : < 10 bar
- Air pressure : < 0.5 bar
- Air consumption : 2...3 m³/h
- Ambient temperature : < 200°C
- Metal : Stainless steel
- Weight : 3.0 Kg

Fig. 5 Water Cooling Jacket
(Reference no: 8500-09

3.4.2 Air Purge

This accessory is used to keep dust, moisture, airborne particle and vapours away from the lens head so that correct sighting of target object can be done. (for mechanical drawing refer Appendix C.)

- Air pressure : < 0.5 bar
- Air consumption : 2...3 m³/h
- Metal : Aluminium
- Weight : 0.5 Kg
- Dry, clean air (Oil and dust free)

Fig. 6 Air Purge Unit
(Reference no: 8500-05)

3.4.3 Adjustable mounting stand

This adjustable mounting stand will provide appropriate movement to the pyrometer. (for mechanical drawing refer Appendix C.)

- Metal : Stainless Steel
- Weight : 0.9 Kg

Fig. 7 Adjustable Mounting Stand
(Reference no: 8000-07)

3.4.4 Mounting Clamp

Mounting clamp can be used to hold the pyrometer.(for mechanical drawing refer Appendix C.) Fig. 8.

- Metal : Stainless Steel
- Weight : 0.45 Kg

Fig. 8 Mounting Clamp
(Reference no: 8500-04)

3.4.5 Mounting Flange

Fig. 9 Mounting Flange
(Reference no: 8500-07)

3.4.6 Mounting Plate

Fig. 10 Mounting Plate
(Reference no: 8500-08)

3.5 Combination of Accessories

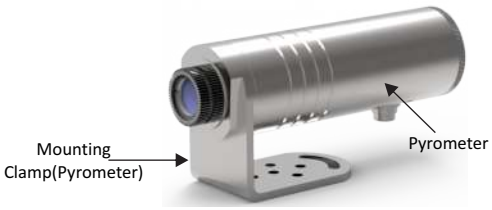


Fig. 11 Pyrometer with Mounting Clamp
Reference No. (8500-04)

Fig. 12 Pyrometer with
Mounting Flange (8500-07) + Air Purge (8500-05)
+ Water Cooling Jacket (8500-09)

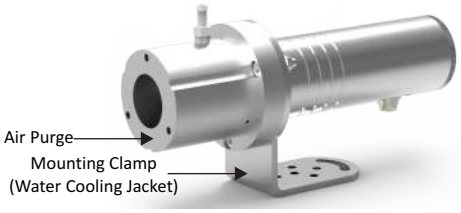


Fig. 13 Pyrometer with
Air Purge (8500-05) + Mounting Clamp (8500-06)

Fig. 14 Pyrometer with
Mounting Flange (8500-07) + Air Purge (8500-05)

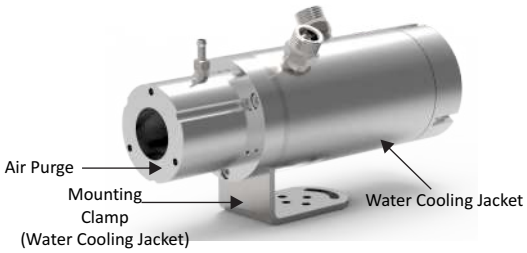


Fig. 15 Pyrometer with
Mounting Clamp (8500-06) + Air Purge (8500-05)
+ Water Cooling Jacket (8500-09)

3.6 Electrical Installation

3.6.1 Power Supply

24V DC (well stabilized ripple max 50mV).The input power supply is 110/230v AC. Check the polarity before connecting the device.

Device has following specifications

Power supply I/P : 100 - 240VAC, 0.35A
50/60 Hz
Power supply O/P : +24V DC, 0.625A

Fig. 16 12-Core Cable
(Reference no: 7002-02)

Fig. 17 Power Supply Unit
(Reference no: 9000-02)

3.6.2 Connector pin assignment on the bottom of the pyrometer

For connecting pyrometer with computer via connector pin (on the bottom of pyrometer) connection diagram is shown as under .Different colors and their indication is also shown in the table 2. So connections need to be done according to color, indication, used for particular purpose as in the table2.

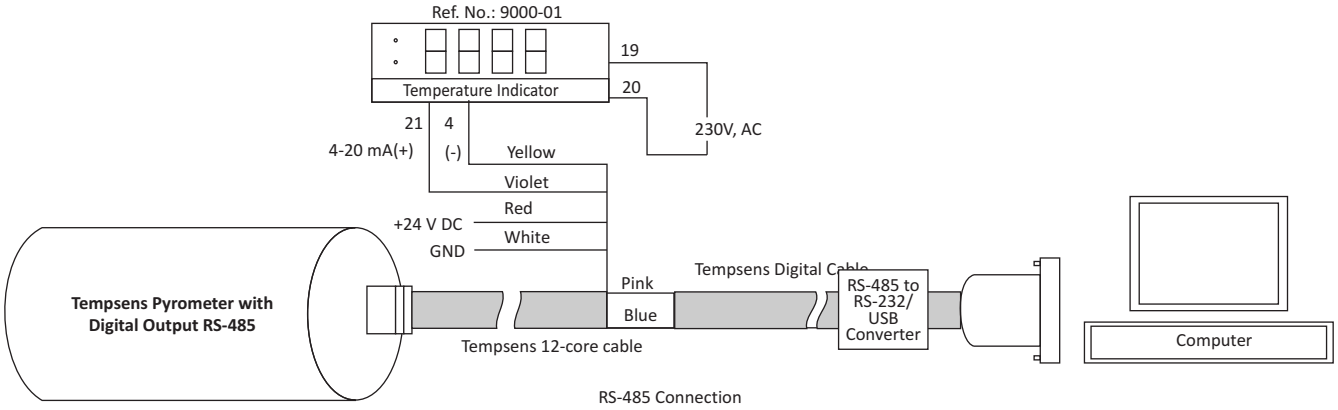


Fig. 18 Connecting pyrometer (RS-485 Converted) with computer

Table 2 : Color code & Pin specification for pyrometer connections

Pin	Colour	Indication	Used for
A	Red	24 V DC	Power supply
G	White	Ground	
C	Blue	D- (RS-485)	RS-485 communication
D	Pink	D+ (RS-485)	
F	Black	Relay Terminal 1	Relay Terminal
B	Grey	Relay Terminal 2	
H	Yellow	(-) 4-20mA / 0-20mA	Analog current output
M	Violet	(+) 4-20mA / 0-20mA	
J	Brown	Short/Open both wires for laser ON/OFF	Laser ON/OFF
K	Green		
E	Blue-Yellow	CVBS GND	For connecting CVBS Camera Analog output
L	Red-Grey	CVBS Signal	

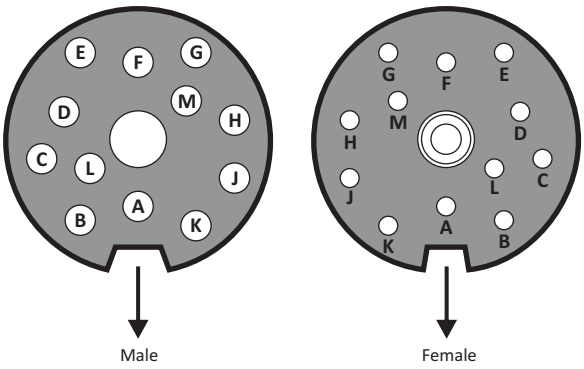


Fig. 19 12-pin Binder connector

Note : 1 Male - 12 pin binder connector is present on pyrometer side.
2. Female - 12 pin binder connector is present on 12 core cable side.

3.6.3 Power ON Pyrometer

1. Connect the 12-core cable with 12-pin connector of pyrometer.
2. Connect supply wire (Red(+), White(-)) of 12 core cable with 24V DC power supply.
3. Connect remaining wires as per your requirement (details given in table 2 above).
4. Provide insulation for not used end points of 12-core cable.
5. Switch ON 24V DC Power Supply, pyrometer is ready for the temperature measurement.

3.6.4 Converter RS-485 to RS-232

Fig. 21 Converter RS-485 to RS-232
(Reference no: 9000-03)

The pyrometer can communicate with PC usingr RS-485.

RS-485 is well suited for long distance transmission. Standard on PC is RS-232, so a converter is used which converts RS-485 to RS-232.

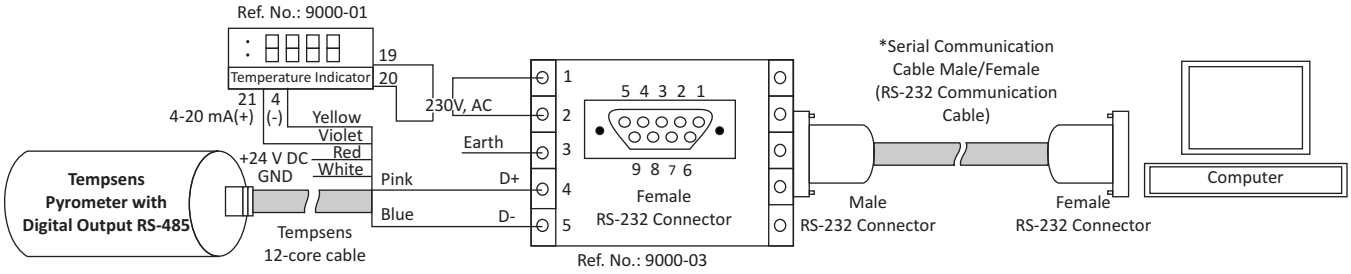
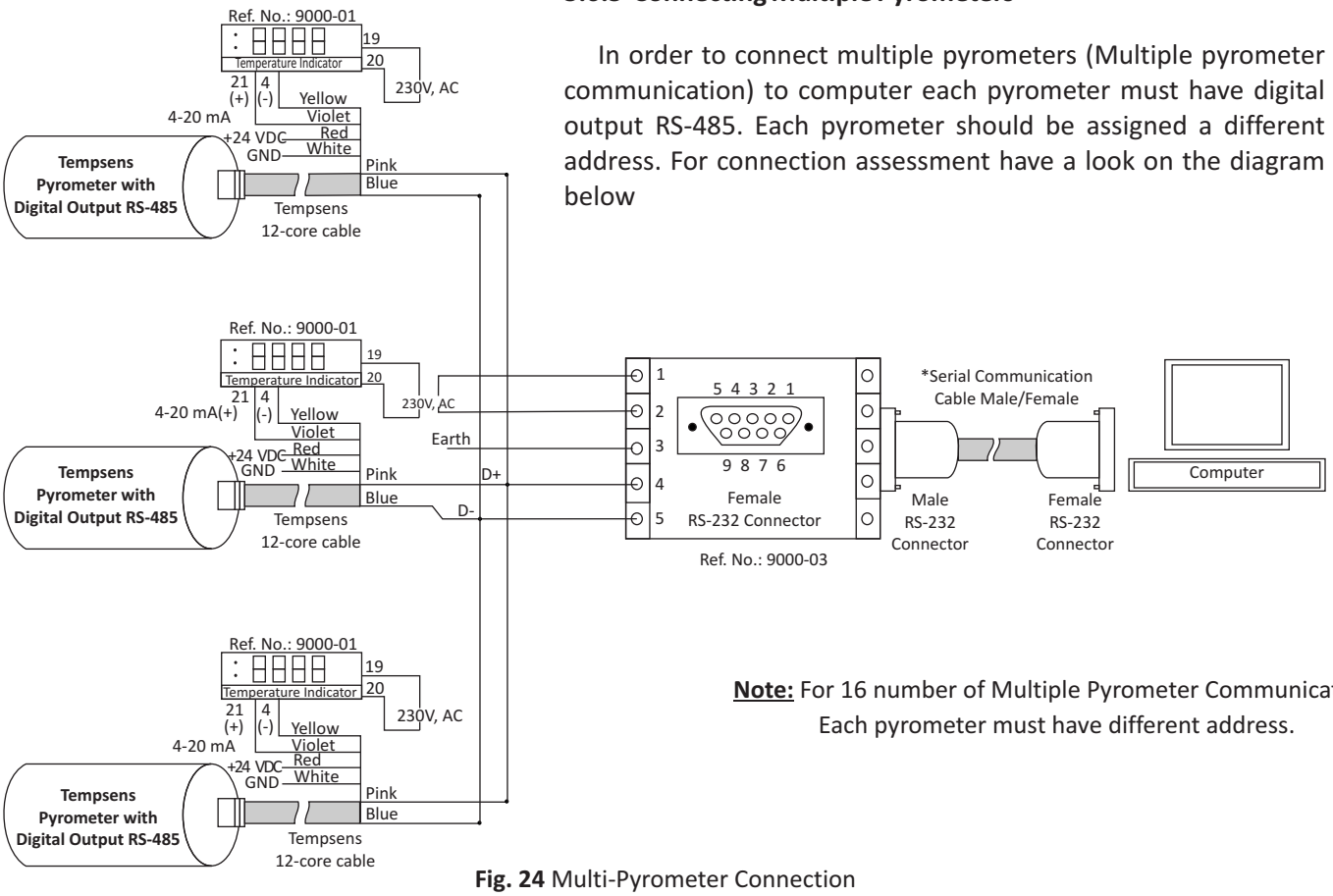


Fig. 22 RS-485 to RS-232 Connection

Fig. 23 Serial Communication Cable Male/Female
(RS-232 Communication Cable)

3.6.5 Connecting Multiple Pyrometers

In order to connect multiple pyrometers (Multiple pyrometer communication) to computer each pyrometer must have digital output RS-485. Each pyrometer should be assigned a different address. For connection assessment have a look on the diagram below



Note: For 16 number of Multiple Pyrometer Communication, Each pyrometer must have different address.

Fig. 24 Multi-Pyrometer Connection

Fig. 25 Temperature Indicator
(Reference no: 9000-01)

3.6.6 Display Instrument

To display the measured temperature 7 segment digital indicator is used. Display temperature according to 4...20mA/0...20mA/0...10V analog output. Device has following specifications:

Power supply I/P	:	100 to 240 V, AC/DC
Analog I/P	:	4....20 mA/0...20mA/0...10V
Retransmission	:	4....20 mA/0...20mA/0...10V
Power supply O/P	:	24V, DC
Display	:	4 Digits
Alarm	:	2

Fig. 26 Display & Parameterizer P-120
(Reference no: 9001-01)

3.6.7 Display & Parameterizer

P-120 is a high precision LED indicator for non contact temperature measurement. With indication of measured temperature user can easily parameterize a connected Tempsens digital pyrometer without any PC.

Device has following specification:

Power supply	:	100 – 240V, AC or 24V, DC
DC analog O/P	:	0-20 mA or 4-20 mA
Digital interface	:	RS-232 or RS-485
Pilot light	:	Pilot light On/Off with keys
Alarm with Hysteresis	:	2 Nos.

Chapter - 4

Setting at the instrument

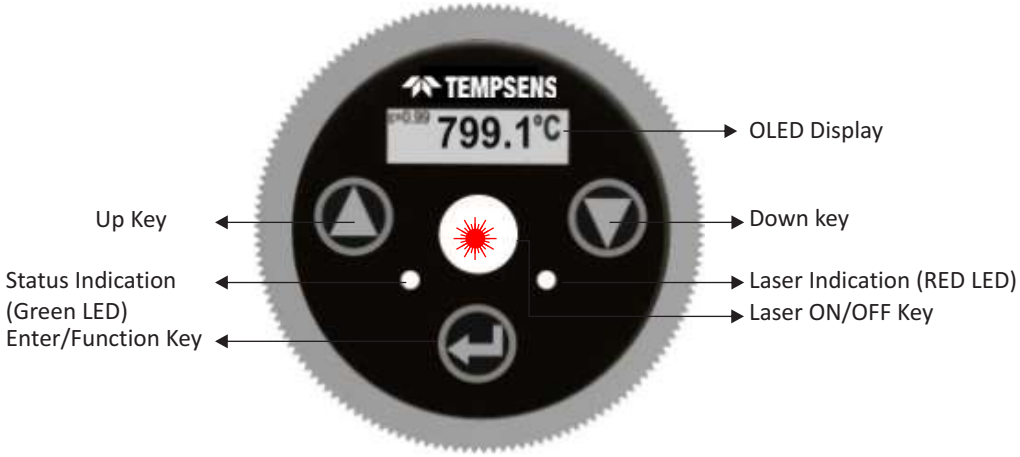


Fig. 27 For PL Model

User can power up the unit by using connection cable at 24V DC input. After power up sensor starts an initializing routine for some seconds. After this the object temperature is shown in the OLED display.
Note : In TL and Video model laser indication, Red LED and laser ON/OFF switch are not available

4.1 Operation

The programming keys FUNC, UP and DOWN enable the user to set the device on-site. Normally, OLED shows temperature or error. To view different parameter FUNC key is pressed repeatedly. To change values of parameters UP & DOWN keys are used. After changing values in any parameter by UP & DOWN key finally FUNC key should be pressed to save that value in device. If FUNC key is not pressed after changing parameter value than device will automatically take the old value & device will start showing temperature. If any key is not pressed for more than 5 sec. than device will automatically shows the temperature.

4.2 Key Description

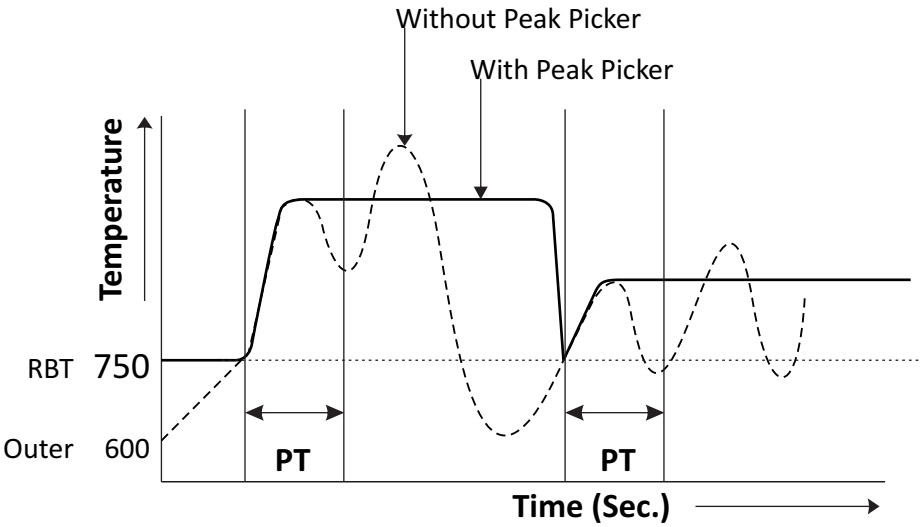
Up Key: This key changes the options to the next available value in the upward order.
Down Key : This key changes the options to the next available value in the downward order.
Enter/Function Key : This key is used for various function selection.
Status Indication(GreenLED):under normal condition green LED glows continuously which indicates pyrometer is working correctly. If this LED blinks (getting ON & OFF) Indicates something is wrong which may be due to any of the following reasons
1. Target temperature is above the analog high range of pyrometer or target temperature is below the analog low range of pyrometer
2. Internal temperature is above ambient temperature high range of pyrometer(70°C) or internal temperature is below ambient temperature low range of pyrometer(0°C).
Laser Indication : When laser is ON (Red LED ON), Laser is OFF(Red LED OFF). User can operate laser by two methods:

Method 1. : By using green and brown wires
If Green and brown wires are short than red LED will glow which indicates laser is ON
If Green and brown wires are open than red LED will be OFF which indicates laser is OFF.

Method 2. : By using Laser ON/OFF key present on keypad.
User can also operate laser by using laser ON/OFF key but in this condition the green and brown wires should be open.

4.3 Adjustable Parameters

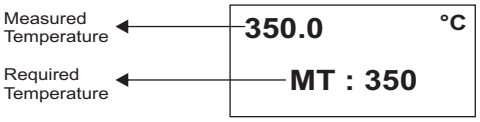
OLED Display	Parameters	Description
EMI	Emissivity	By pressing function key emissivity will be shown. It is the relationship between the emissions of a real object and the emission of a black body radiation source at the same temperature. For a correct measurement it is necessary to adjust emissivity. Emissivity depends on the surface condition of the material, the spectral range of the pyrometer and the measuring temperature. Different material has different emissivity ranging from 0.1 to 1.0.user can change emissivity by up/down key on the instrument.
SP	Set Point	Instrument is equipped with a relay contact controlled by the measuring signal. The turn on temperature of relay is adjusted within the measuring range. The relay contact is “OPEN” below the adjusted value, it is “CLOSE” above it.
HST	Hysteresis (Hyst.)	The relay contact close when temperature exceeds the set point. It opens only if the temperature falls below a value which consists of set point and the adjusted hysteresis. It can be adjusted from 2° to 20°C. ***Example :*** *if set point value is 900°C and Hysteresis set to 10. Then relay operation as below mentioned:* 1. *Relay contact OPEN below 910°C temperature.* 2. *Relay contact CLOSE above 910°C temperature.* 3. *Once relay contact CLOSED than relay contact is OPEN's when temperature falls below 890°C.*
ALO	Ana. Sub range Lo	Analog sub-range is adjustable within the basic range, user can set lower analog sub-range here.
AHI	Ana. Sub range HI	User can set the analog sub-range higher value here. Minimum span between lower & higher value is 51°C
AO	Analog Output	User can select the output from 4…20mA or 0…20mA
UNIT	Temp. Unit	User can select °C or °F unit.
ADD	Sensor Address	For communicating with pyrometer via software users have to give a address. The address may be 1 to 255.
TAU	Response Time	The response time can be set from 2 msec to 10sec.
BD	Baud Rate	Select desired baud rate (4800, 9600, 19200 and 38400) according to your MODBUS communication requirement. Note: Tempsens Infrasoft application communicates only at 19200 baud rate.
PIC	Peak Picker	The Peak picker can be switched ON –OFF by using up down key. If the peak picker is switched on, the highest last temperature value will always be displayed and stored. This feature is particularly useful when object temperature is not uniform across its dimension or pyrometer is not constantly viewing an object to be measured. **Peak Picker Function** When peck picker is ON, the picker menu is enabled for setting of the parameters like Reset below temperature and Peak time.

OLED Display	Parameters	Description
(a) RBT	**Reset Below Temperature**	User can set RBT within the limit of pyrometer temperature sub range. This function sets the temperature above peak action start. **Ex.** RBT : 750°C Outer : 600°C PT : 1 sec. 
(b) PT	Picker Time	When temperature is increased from RBT, it captures the peak in define time period.That time period is known as picker time (PT). The Time period is selectable in the range of (0.01Sec to 30 Sec.) Note: at selection of **0.0 Sec,** pyrometer works in peak picker mode without time dependent.
OLED OFF Time	**OLED OFF Time**	The User can set OLED OFF time from 1 min. to 30 min. or continue ON. If user select OFF time as 1 min., then OLED display will turn ON till 1 min. and after 1 min. OLED display will turn OFF(Only OLED display will turn OFF, Pyrometer is ON.) By pressing any key, OLED will resume again with display. If user select continue ON option, then OLED display is continues.
IT	Internal Temperature	It shows the internal temperature of pyrometer.

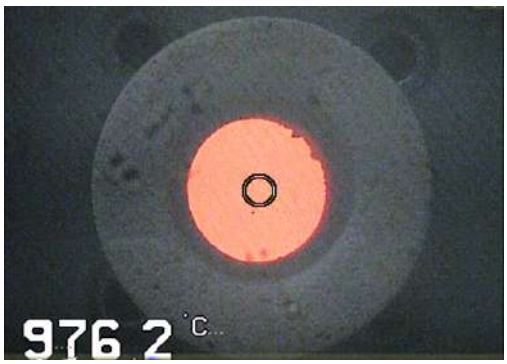
Enter / Function Key : This key is used for function selection and to save desired changes.

ExT	Exposure Time	This parameter be used for only video output. The user can set the exposure value to clear and improve the picture quality of the target body. This function is used to set the exposure time value from 0 to 255. Exposure time value will be reflected in the camera when the value is adjusted and saved.

4.4 Special Function (Match Temperature)

MT	**Match Temperature**	This parameter is used to match the known target temperature value to be displayed by the pyrometer. After that below display will be shown.  Measured Temperature : This indicates target temperature. Required Temperature : User can change and set required temperature by simultaneously press UP and DOWN keys. Press Enter for confirmation. Now pyrometer measured temperature will automatically set to your required temperature. Meaning of Massages on OLED display : 1. ε > 1.0 : If calculated emissivity of required temperature is greater than 1.0 than emissivity will not change, save in pyrometer and also the measured temperature will not change. 2. ε < 0.1 : If calculated emissivity of required temperature is less than 0.1 than emissivity will not change, save in pyrometer and also the measured temperature will not change. Note 1 : For MATCH TEMPERATURE parameter Peak picker should be OFF (PIC) if suppose it is found ON than below shown massage will be displayed. **NO WORK** **PICKER ON** Note 2 : If any key is not pressed till 5sec. time duration the pyrometer will automatically comes out of match temperature function and start displaying target temperature.

4.4 Composite Video Baseband Signal (CVBS) Output:



This Tempsens A+ series also support CVBS (75 Ohms) video output with OSD (On Screen Display) functionality. The composite video output can be seen online on external display through composite video card or TV Tuner. The real time temperature can be monitored from the video output, focusing on the hot spot area of the target body. The exposure quality can be observed through video output while adjusting the exposure time parameter in the menu. CVBS output feature enables the user to monitor the real time condition of the high temperature target body while observing the target temperature simultaneously.

The CVBS output supported by Tempsens A+ series is PAL (Phase Alternating Line) format. The countries which support video format other than PAL may need PAL/NTSC/SECAM video converter as per requirement.

Note : The pyrometer may require 20-25 minutes stabilization time for the accurate temperature measurement depending upon the field environment and target behavior.

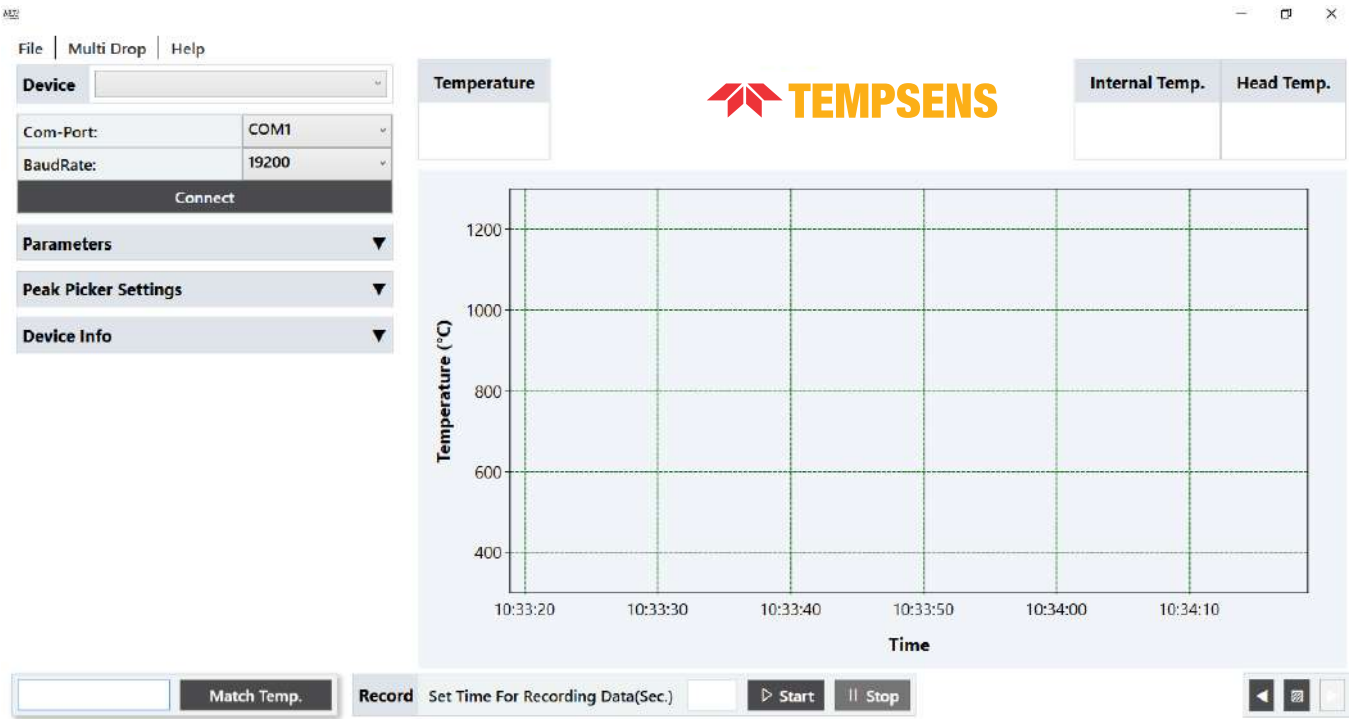
Chapter - 5

Software Installation

The provided Tempsens software “InfraSoft” offers digital PC interface RS-232 & RS-485. Using this software we can set all the parameters like response time, analog scale, emissivity, clear time, communication mode. This software provide all necessary information about pyrometer.

5.1 Installation

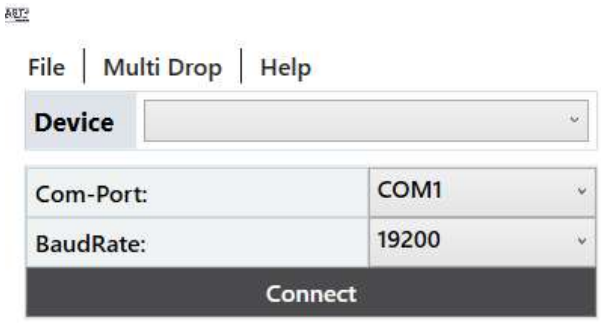
Install the pyrometer software using the installation guide file on CD ROM & restart your PC as per guidelines provided for installation. After installation of the software; Double click the application. It will open the screen of software.



5.2 Parameters in main screen

5.2.1 Communication

Communication between the Tempsens pyrometer and the software is implemented via a cable connected between the pyrometer and the PC serial port. This enables the acquisition and recording of data, as well as the transfer of commands from the software application to the Tempsens pyrometer. Communication can be done by clicking on “Communication panel" and select correct COM Port address where pyrometer is connected. Also user has to select address of the pyrometer(Example: Default 01/ printed on the pyrometer sticker). Then click on CONNECT Button.



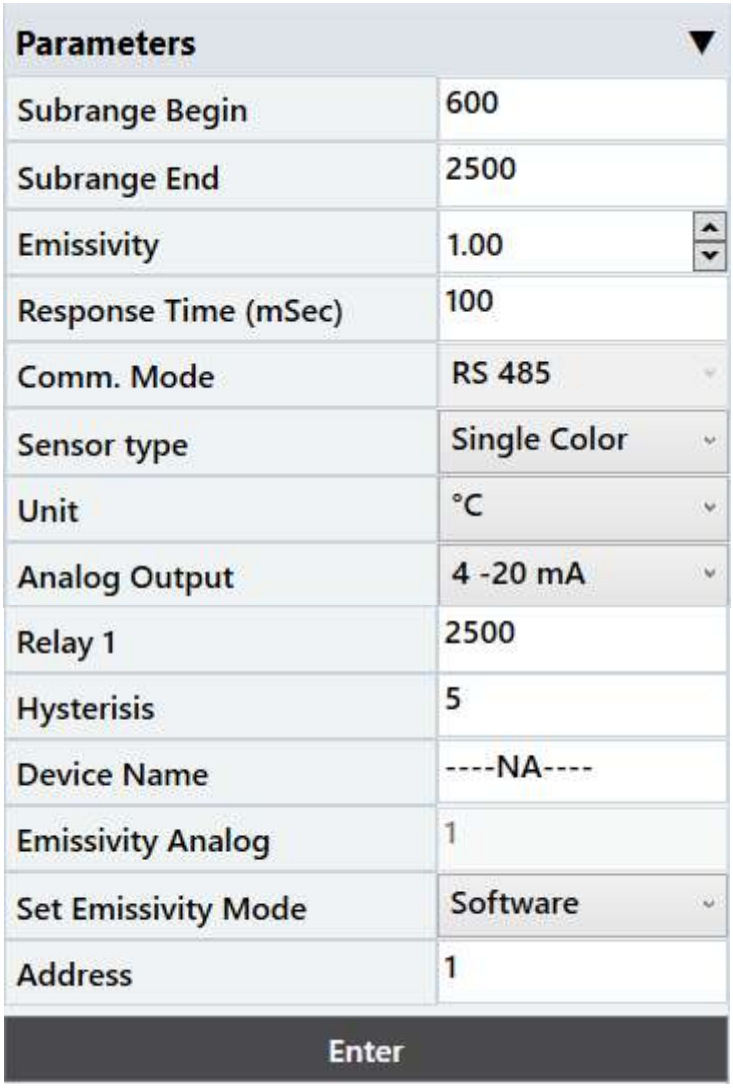
For communication of multiple pyrometers, select different com port and address.

5.2.2 Temperature

It shows the temperature measured by the pyrometer

5.2.3 Parameter Setting

All user selectable device parameters can be set by using the software in the Panel "Parameter"



(A)Emissivity settings The emissivity can be set by clicking on "Parameters" and select or type in the desired emissivity directly in the description field. The emissivity value will be transferred to pyrometer by hitting the "TAB " button.

(B)Response time The desired response time can be chosen in the panel Parameter by clicking the appropriate list box (as per the values available in the drop box of response time). This parameter is use to set the analog response time of pyrometer.

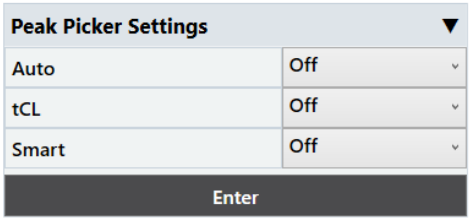
(C)Sub Range User can change the sub range of pyrometer in the panel Parameter. Sub range must be within the basic range of pyrometer, the minimum span between higher & lower range is 51. Analog output will be automatically set according to the sub-range by hitting "TAB" button.

(D)Sensor Type It shows pyrometer sensor type. User can change sensor type from two color to single color and vice versa (only applicable with two color pyrometer).

(E)Switch off level% (for two color pyrometer) The switch of level is the function that is used to avoid measurement errors caused by signals, which are too low. Although factory default is set to 15 %, the switch off limit can be adjusted between 2 and 50%.

(F)Unit User can change the measuring unit of temperature from “Centigrade" to “Fahrenheit" and vice versa.

(G) Peak Picker Setting Three Pickers are available in Pickers setting menu (Auto, tCL, Smart) & user can switch on any as per requirement, one at a time.



(G1) Auto "Auto" mode is used for discontinuous measuring task, such as object being transported on a conveyer belt in such a case the maximum value for each object has to be indicated. when the object passes the measuring beam of the pyrometer, the maximum value is stored until a new hot object appears in the measuring beam. The temperature which has to be recognized as "hot" is defined by the low limit of the adjusted sub range. The stored maximum value will be deleted when the temperature of the new hot object exceeds the low limit "from" of the sub range by at least

1°C. If a lower limit is not entered, the maximum value storage will be deleted whenever the low level of the full measuring has been exceeded.

(G2) Clear time (tCL) If the peak picker is switched on, the highest last temperature value will always be displayed and stored. As such, it may be beneficial to periodically clear and reset the stored values in order to obtain new temperature readings.

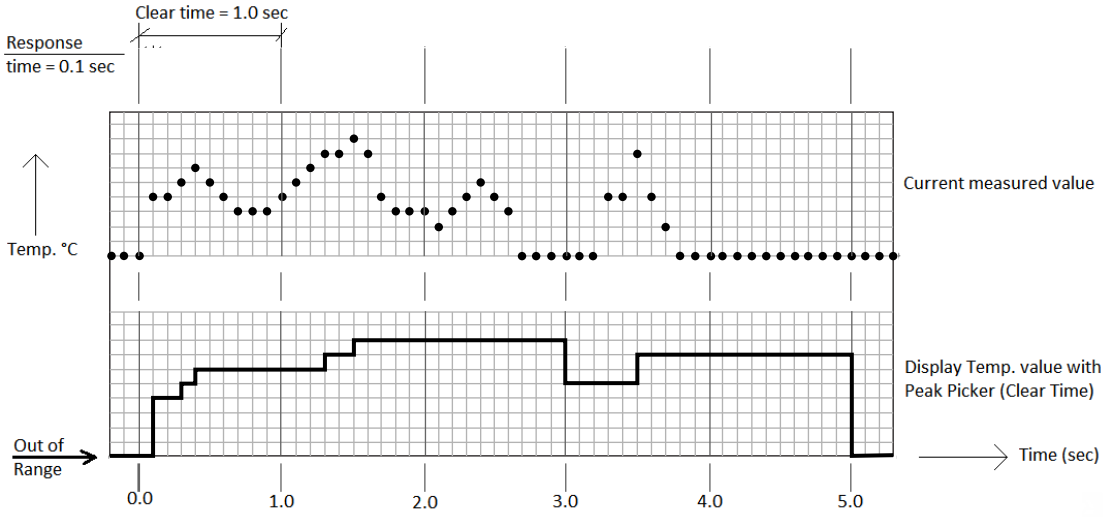
Example : If we set the tCl a s "6 sec" the highest last temperature value will be display for 6.0 sec to 12 sec then it capture next pick.

The following setting are possible :

OFF : At clear time "OFF" the maximum value storage is switched off and only momentary values are measured.

tCL (10msec...25sec) : Clear Time tCL can be set between 10msec and 25sec. When set, estimates the maximum values and holds it in two buffer memory. After the entered time, the storage will be deleted.

Clear Time feature is particularly useful when object temperature is not uniform across its dimension or the pyrometer is not constantly viewing an object to be measured. The peak picker works on two buffer memory to find maximum value over a defined interval. With the first memory, the highest measured value is held and is deleted alternately in the time interval set (clear time). The other memory retains the maximum value throughout the next time interval. The disadvantages of fluctuations in the display with the clock frequency are thereby eliminated.



Note:

The maximum value storage coincides with adjustments made to response time. Therefore:

(I) Clear time<= the adjusted response time is useless

(ii) Clear times must be at least 5 times longer than the response time.

(iii) Only maxima with full maximum value can be recorded, which appear at least 5 times longer than response time.

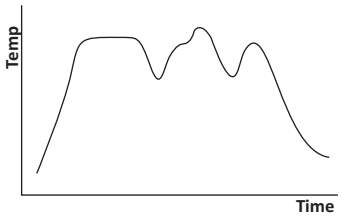
(G3) Smart If the smart picker is switched on, the highest last temperature value will always be displayed and stored. This feature is particularly useful when object temperature is not uniform across its dimension or the pyrometer is not constantly viewing an object to be measured.

Smart Picker Functions

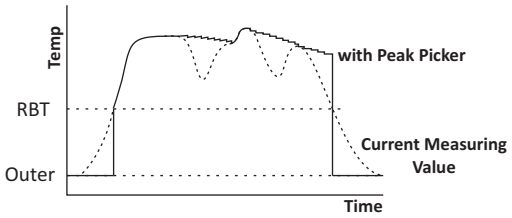
Smart picker can be turn ON & OFF by using the software. When Peak picker is ON, the peak picker menu is enabled for setting of the parameters like decay rate function, reset below temperature and peak picker delay.

Peak Picker Settings	▼
Picker Type	Smart
Decay Rate (Temp./Sec.)	0
Delay Time (Sec.)	0
Reset Below Temp.	-273
Enter	

(I)Decay rate The Decay rate range is 0.00 to 166.66°C/sec. or 0.00 to 300°F/sec. depending upon °F/°C unit's selection. The slowest Decay rate is 0 degrees per sec. This feature helps to eliminate erratic measurements and allows the peaked value to decay down to lower process temperature values as they occur. Decay rate is set to retain peak measured temperature value and ignore momentary decreases in measured temperature.

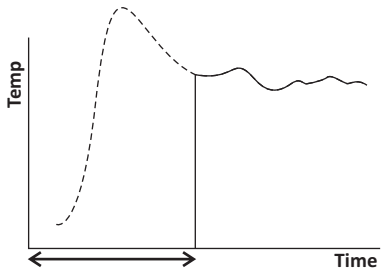


Without RBT



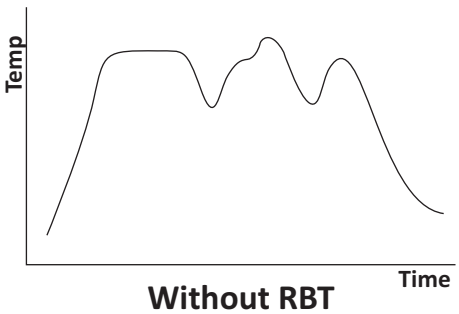
RBT with Decay Rate

(II)Delay Time This function set the delay time in sec. before peak picker function starts. The delay time is selectable in the range 0.02 to 10.00 sec. Zero (0) turns delay time OFF. This function is used to delay the start of peaking action for upto 10 sec. following the detection of leading edge of a new target.

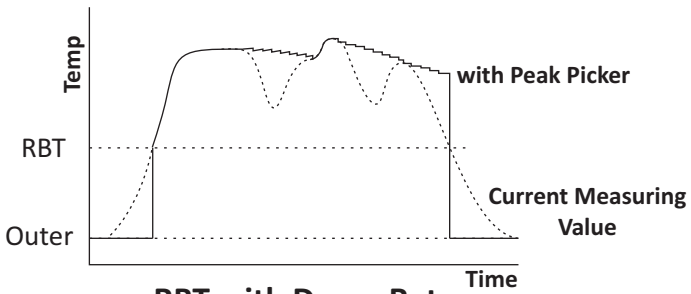


Delay Time (sec.)

(III) Reset Below Temperature(RBT) The user can set RBT within the limit of pyrometer sub range. This function sets the temperature above which peak picker action starts. When the target temperature matches or is below the selected value, the sensor indicates temperature without picking action.



Without RBT



RBT with Decay Rate

(H)Relative energy(for two color pyrometer) The relative energy shows a signal weakening which can be caused by contaminations of the optics or a viewing window or by dust in the field of view or a too small measuring object. Relative energy shows the measured intensity compared to the intensity, a black body radiation source would have at a determined ratio temperature of the pyrometer.

(I)Analog Range User can select the analog range from the option 4-20mA, 0-20 mA & 0-10V.

(J)Comm. Mode User can select the communication mode as per requirement [RS-232 / RS-485].

Note: For connection diagram from RS-232 to RS-485 & RS-485 to RS-232 *Refer Page No:-9*

To view parameters of multiple devices select the pyrometer name from the drop down list that appears at the top of the screen.

5.2.4 Device information

Pyrometer specific information will be displayed in the Info Panel

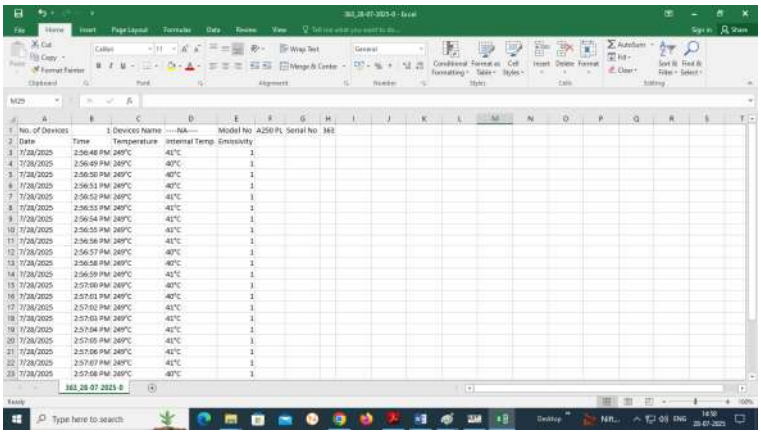
This screen shows the Model, basic range, serial number, version, Head temperature, internal temperature, working distance, spot size-apperture.

Device Info	
Model	AST A250 PL
Basic range	250°C...1800°C
Serial number	363
FW version	11.39
Working Dist(mm)	500
Spot Size-Aprt(mm)	5-11

5.2.5 Record

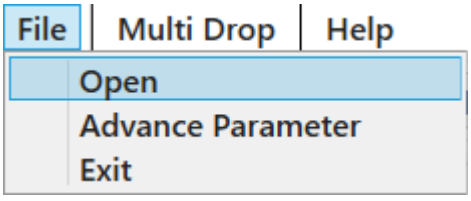
Record is for continuous data logging. It records the measured temperature, emissivity with current date & time.To start data logging click on start button. If user wants to record emissivity, click on record emissivity button. After Clicking Start button window appears where user can specify the file name & location.

Record will be saved as ***.txt*** format and the name of file will be user define.

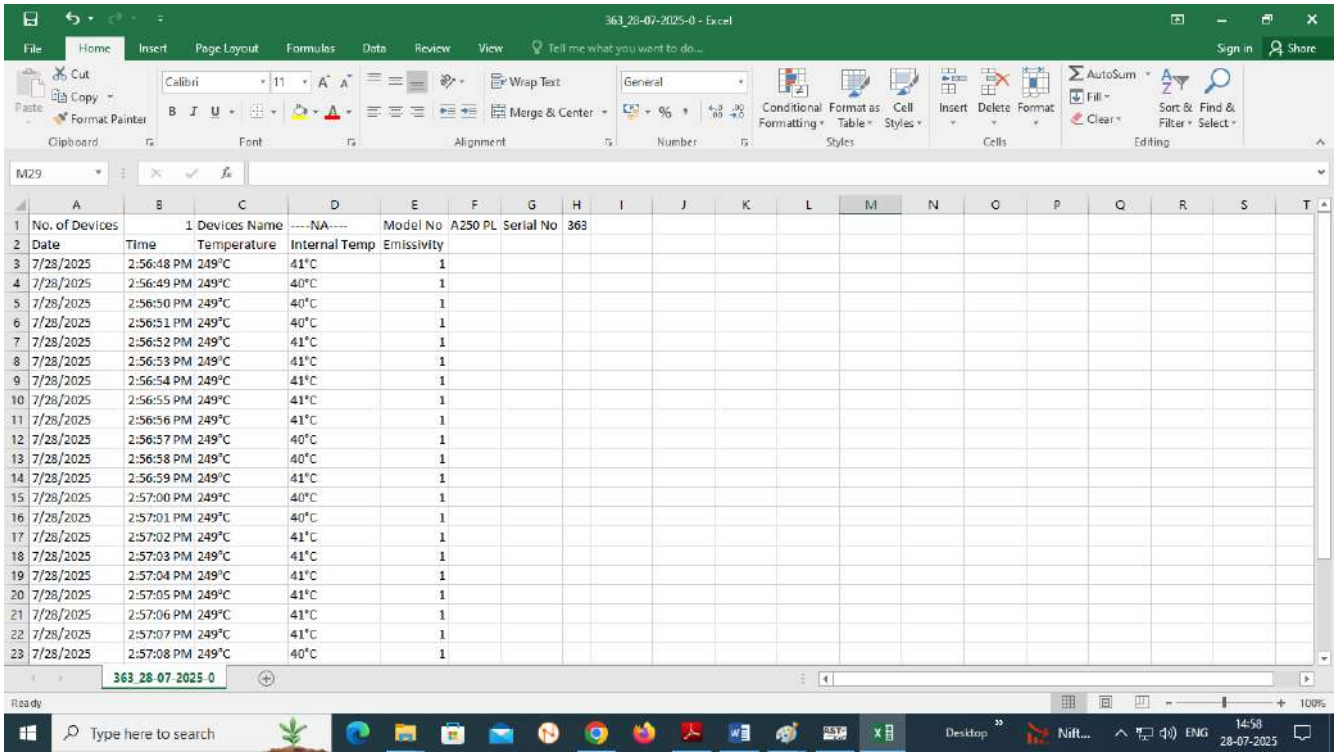


To record emissivity, click on ***Record Emissivity*** button.

If user wants file in Spreadsheet format, user can export by choosing Excel Spreadsheet in file menu.

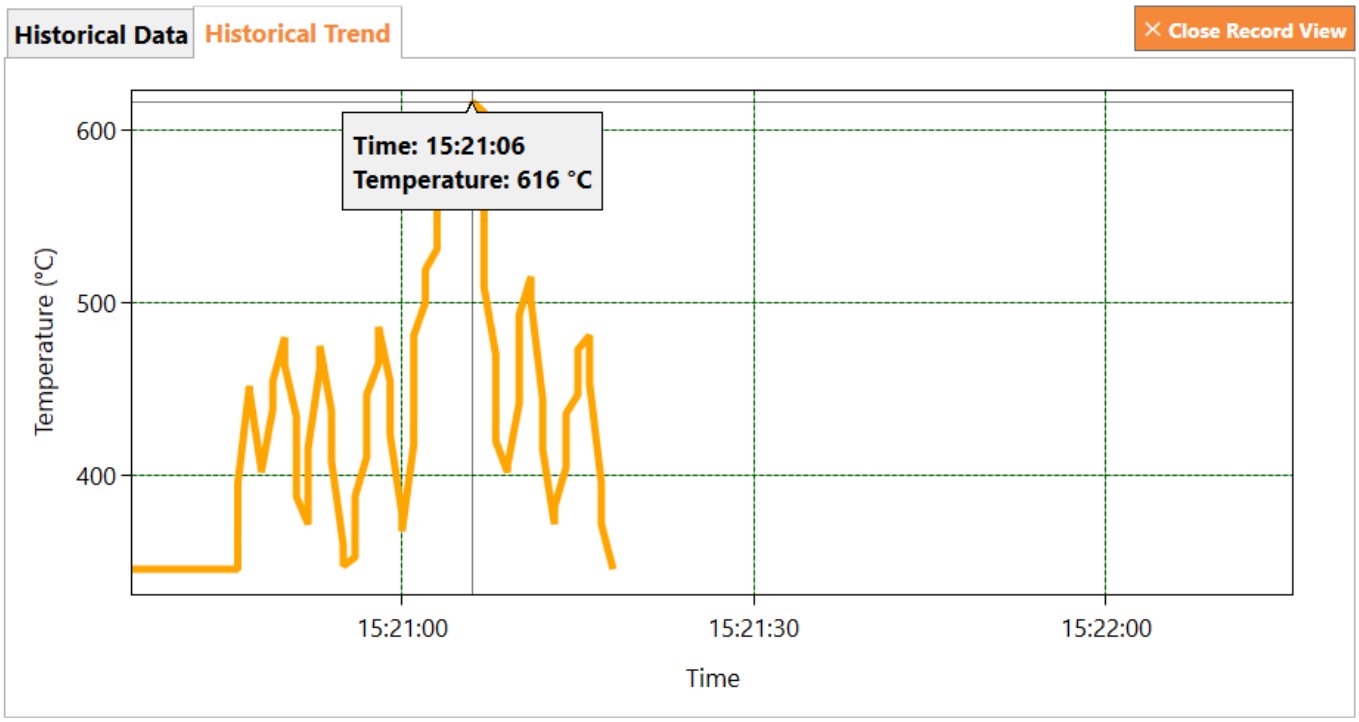


File will be stored in ***.xls*** format named as “export”. This “export.xls” file will be saved where the software is installed.

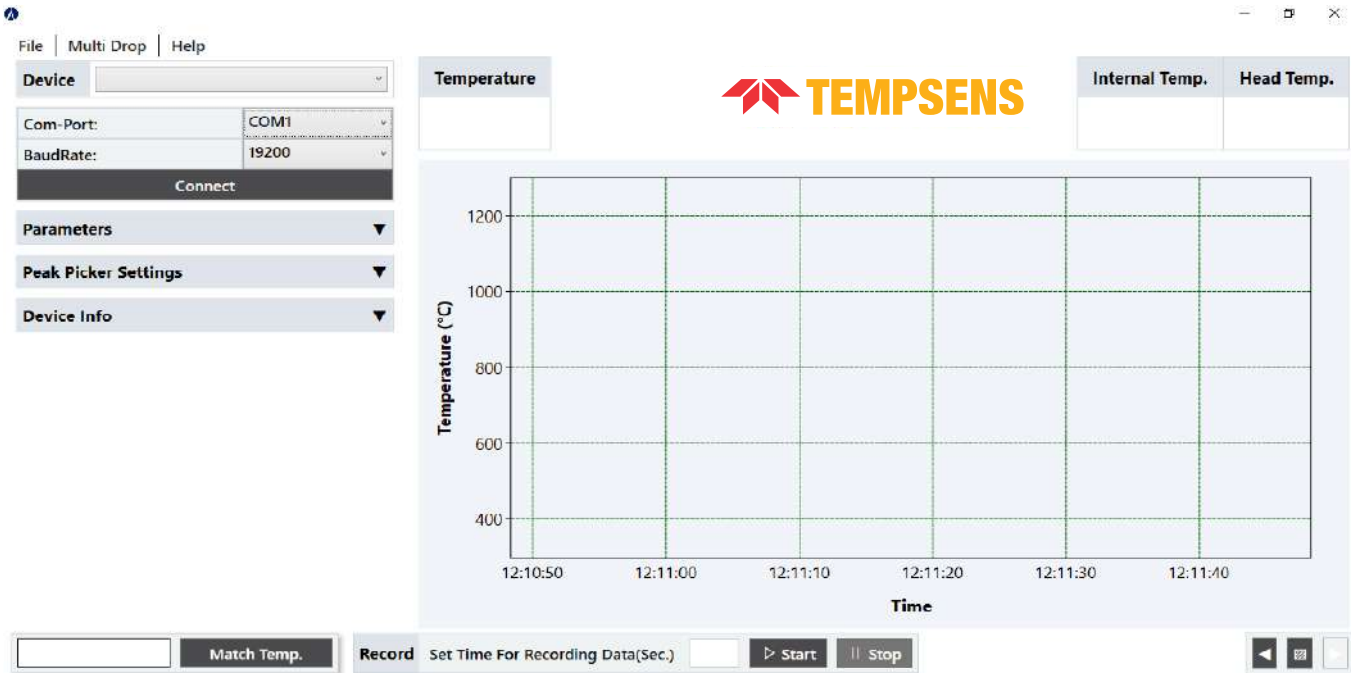


	A	B	C	D	E	F	G	H
1	No. of Devices	1	Devices Name	----NA----	Model No	A250 PL	Serial No	363
2	Date	Time	Temperature	Internal Temp	Emissivity			
3	7/28/2025	2:56:48 PM	249°C	41°C	1			
4	7/28/2025	2:56:49 PM	249°C	40°C	1			
5	7/28/2025	2:56:50 PM	249°C	40°C	1			
6	7/28/2025	2:56:51 PM	249°C	40°C	1			
7	7/28/2025	2:56:52 PM	249°C	41°C	1			
8	7/28/2025	2:56:53 PM	249°C	41°C	1			
9	7/28/2025	2:56:54 PM	249°C	41°C	1			
10	7/28/2025	2:56:55 PM	249°C	41°C	1			
11	7/28/2025	2:56:56 PM	249°C	41°C	1			
12	7/28/2025	2:56:57 PM	249°C	40°C	1			
13	7/28/2025	2:56:58 PM	249°C	40°C	1			
14	7/28/2025	2:56:59 PM	249°C	41°C	1			
15	7/28/2025	2:57:00 PM	249°C	40°C	1			
16	7/28/2025	2:57:01 PM	249°C	40°C	1			
17	7/28/2025	2:57:02 PM	249°C	41°C	1			
18	7/28/2025	2:57:03 PM	249°C	41°C	1			
19	7/28/2025	2:57:04 PM	249°C	41°C	1			
20	7/28/2025	2:57:05 PM	249°C	41°C	1			
21	7/28/2025	2:57:06 PM	249°C	41°C	1			
22	7/28/2025	2:57:07 PM	249°C	41°C	1			
23	7/28/2025	2:57:08 PM	249°C	40°C	1			

To see previous record open the file by clicking on menu ***File*** ⟶ ***open.***
Screen containing historical trend & historical data will appear.

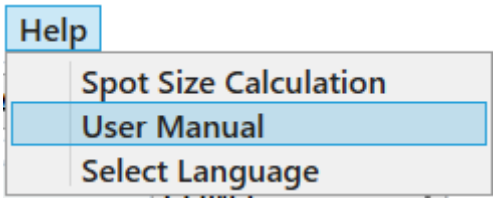


Temperature graph of connected pyrometer is displayed on right side of the screen. This shows the measured temperature corresponding to the time.



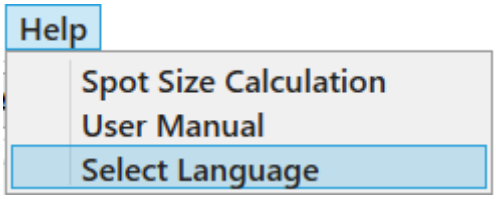
5.2.6 User Manual

If User wants to open the Product Manual then select help Menu and Open it, provided that PC should be online Mod.



5.2.7 Software Language

If User wants to Change Software Language, they open it in help menu and change it.



5.2.8 Match Temperature feature allows users to align the measured temperature with a master temperature by adjusting the emissivity accordingly.

How It Works:

- When matching the temperature, the Emissivity Type must be set to Software.
- Enter the Master Temperature (the reference temperature measured by another device) in the input box.
- Press the "ENTER" key to submit and apply the setting
- The pyrometer will then start reading the temperature the same as the master temperature.

Note :
If the Master Temperature exceeds the allowed limit (i.e., the calculated emissivity falls out of range), an alert message will be displayed: “Emissivity cannot be less than or greater than the allowed limit."

Chapter - 6

Maintenance

In case of any queries, questions regarding repair, solutions to problems, calibration and assistance you may contact our sales representatives. Most of problems can be solved telephonically.

6.1 Cleaning Lens

The lens should be kept clean all the time as it aims at center of target object. When cleaning lens care should be taken and it can be done as follows :

- Firstly blow off lightly loose particles with “canned air” which is used for cleaning computer equipment or a small bellows squeeze (used for cleaning lenses).
- Now brush out gently remaining particles with a soft hair brush, a soft lens tissue can also be used.
- At last clean remaining particles “dirt” using a cotton or soft lens tissue dampened in distilled water. Do not scratch the surface.

In case of finger prints or any other grease material uses any of the following removing elements:

- Kodak lens cleaner
- Ethanol
- Denatured alcohol

Gently wipe with a soft, clean cloth after application of any of the above elements and wipe until you are able to see colours on the surface, then allow to air dry.

Do not wipe the surface dry, as this may result in scratches on the surface.

Note: Do not use any cleaners containing ammonia or simple ammonia to wash or clean the optical lens of pyrometer as this may permanently damage the surface of lens.

Chapter - 7

Serial communication protocol-MT500

This protocol is developed to use in the half duplex addressable communication mode. Master device should periodically issue requests to each Slave device. The request contains an address of polling “Slave” device. Slave device reply only on the requests issued by Master. Each Slave has its own address to recognize the issued request. Tempsens sensors always operate as Slave devices. Using RS485 serial communication option allows connecting more than one sensor to Master device. Tempsens sensors always perform delay of 5 ms before sending an answer on Master request to meet RS485 hardware requirement.

MT500_Tempsens protocol uses only RD (Batch Read) and WD (Batch Write) commands. Sending other MT500 protocol commands causes sensor to consider it as error condition and answer with unknown command reply. Symbols enclosed within apostrophes (‘symbol’) means ASCII representation of the symbols. String enclosed with quotation mark (“string”) means ASCII representation of the string (ended by ‘\0’). Data format is: 8 data bit, 1 stop bit, No parity, baud-rate 19200.

Description	Address	Items	Parameters
Emissivity	'0400'	'01'	Object emissivity multiplied by 1000. Refer user manual for adjustable range.
Emissivity slope	'0401'	'01'	Emissivity slope parameter multiplied by 1000. Refer user manual for adjustable range.
Response time (τ)	'0105'	'01'	Parameter specifies analog and serial output response time. See Table 1.
Upper basic range	'0100'	'01'	Upper measurement range limit in °K (read only)
Lower basic range	'0101'	'01'	Lower measurement range limit in °K (read only)
Analog output type	'0F01'	'01'	'0000': 4 to 20 mA (Default); '0001': 0 to 20 mA, '0002': 0 to 10 Volt; '0003': K type TC; '0004': J type TC
Upper sub range	'0102'	'01'	Upper analog scale value in °K
Lower sub range	'0103'	'01'	Lower analog scale value in °K
Station number	'0200'	'01'	Adjustable between '0001' to '0255'
Temperature unit	'0201'	'01'	Flag is used to instruct PC SW to show temperature '0000': Centigrade (Default); '0001': Fahrenheit
Switch off level	'0107'	'01'	Parameter multiplied by 10. Adjusted between 0 and 100%, Default set to 15%.
Sensor mode	'0204'	'01'	'0000' = Single color; '0001' = Two color This parameter is useless for single color sensors.
Internal temperature	'0006'	'01'	Temperature inside device case in °C (read only)
Head temperature	'0007'	'01'	Temperature inside optical head m°C(only for E –series pyrometers) (read only)
Clear time(tCL)	'0303'	'01'	Adjustable between 0 to 12, Default 0, 0=OFF, 1=Auto. 2-12 = 10msec to 25sec [refer to page-13(clear time)]
Laser control	'0F00'	'01'	'0000': LASER OFF; '0001': LASER ON (Default)
Communication type selection	'0F03'	'01'	'0000':RS-485;, '0001': RS-232 (Default)
Set point	'1700'	'01'	Set point for relay actuation (only for E –series pyrometers)
Hysteresis	'1800'	'01'	Hysteresis value relay actuation
LCD back light control	'1801'	'01'	'0000': BL OFF; '0001': BL ON(Default) (Only for E-series pyrometers)
Device name	‘1D00'	‘01'	10 Bytes “Hot end “, if less then 10 bytes pad with space at end.
Working distance (mm)	‘1D01'	‘01'	10 Bytes “1000 “, if less then 10 bytes pad with space at end.
Spot size-apperture (mm)	‘1D02'	‘01'	10 Bytes “1000-6000” if less then 10 bytes pad with space at end. ‘-’ sign between spot size and apperture is compulsory
Relative energy (read only)	‘0002'	‘01'	Relative energy multiply by 1000 for 2 color pyrometers only

Device model number (read only)	'0E00'	'01'	10 bytes “Pyro450C “', if less than 10 byte pad with space at end
Firmware version	'1300'	'01'	Firmware version number of device (read only)
Sensor serial number (read only)	'1400'	'01'	6 bytes in hex, if less than 6 bytes pad with '0' at start. Only numbers allowed.
Device type (read only)	'1301'	'01'	'0001': Single color; '0002' : Two color '0003': Thermopile; '0004' : Reserved
Real temperature and status code (read only)	'0000'	'02'	Calculated object temperature in °K and status of sensor (As shown in Appendix A). First process status code then real temperature.

Batch Read (RD)command

Byte 1	Bytes 2,3	Bytes 4, 5	Bytes 6-9	Bytes 10, 11	Byte 12	Bytes 13, 14
1 Byte	2 Bytes	2 Bytes	4 Bytes	2 Bytes	1 Byte	2 Bytes
STX	Station ID	RD	Address	Items	ETX	Checksum

Byte 1: Always STX (0x02)
Bytes 2, 3: The Station Number of the device to read from (2 Hex digits)
Bytes 4, 5: The command to execute (RD)
Bytes 6-9: This is the starting address to read from. Must be 4 bytes long
Bytes 10, 11: This is the number of addresses (items) to read. Must be 2 bytes long
Byte 12: Always ETX (0x03)
Bytes 13, 14: The checksum is the lowest 8 bits of the sum of bytes 2 through 12

Example : Read two parameters starting from address 0000, from the station number 10 (0AH). This will read addresses 0000 and 0001.

Byte 1	Bytes 2, 3	Bytes 4, 5	Bytes 6-9	Bytes 10, 11	Byte 12	Byte 13, 14
STX	0A	RD	0000	02	ETX	2E
0x02	0x30, 0x41	0x52, 0x44	0x30,0x30,0x30,0x30	0x30, 0x32	0x03	0x32, 0x43,

Checksum is calculated as the lowest 8 bits of the sum of the Hex codes for bytes 2 to 12.
Example : 70ARD 000002[1] +0x30 +0x41 + 0x52 + 0x44 + 0x30 + 0x30 + 0x30 + 0x30 + 0x30 + 0x32 + 3(ETX) = 22C → Checksum is 2C lower byte of the result.

Reply
The reply length is L = (N * 4) + 8, Where N = the number of requested Items.
If the command is successful, the reply length will be at least 12 bytes. It consists of the STX, followed by four bytes for each requested item, then the ETX and Checksum.

Byte 1	Bytes 2, 3	Bytes 4, 5	Bytes 6-9	Bytes 10-13	Byte L-2	Byte L-1, L
STX	Station	RD	Data 1	Data N	ETX	Checksum

Reply to above command if address '0000' contains value 1497 and address '0001' contains value 0000.

Byte 1	Bytes 2, 3	Bytes 4, 5	Bytes 6-9	Bytes 10-13	Byte 14	Byte 15-16
STX	0A	RD	059D	0000	ETX	AC
0x02	0x30, 0x41	0x52, 0x44	0x30,0x35,0x39,0x44	0x30, 0x30, 0x30, 0x30	0x03	0x41, 0x43

in the event of an error, the reply is

Byte 1	Byte 2, 3	Byte 4, 5	Byte 6
NAK	0A	'R', 'D'	01 (Error Code)
0x15	0x30, 0x41	0x52, 0x44	0x30, 0x31

Batch Write (WD) command

Byte 1	Bytes 2, 3	Bytes 4, 5	Bytes 6-9	Bytes 10, 11	Bytes 12-15	Bytes (L-6) - (L-3)	Byte L-2	Byte L-1, L
STX	Station ID	WD	Address	No. of Items	Data 1	Data N	ETX	Checksum

Byte 1	Bytes 2, 3	Bytes 4, 5	Bytes 6-9	Bytes 10, 11	Bytes 12-15	Byte 16	Byte 17,18
STX	0A	WD	0400	01	03E8	ETX	74
0x02	0x30, 0x41	0x57, 0x44	0x30, 0x34, 0x30, 0x30	0x30, 0x31, 0x30, 0x30	0x30, 0x33, 0x45, 0x38	0x03	0x37, 0x34

Reply

If the command is successful, the reply is

Byte 1	Byte 2, 3	Byte 4, 5
ACK	0A	'W', 'D'
0x06	0x30, 0x41	0x57, 0x44

In the event of an error, the reply is

Byte 1	Byte 2, 3	Byte 4, 5	Byte 6
NAK	0A	'W', 'D'	01 (Error Code)
0x15	0x30, 0x41	0x57, 0x44	0x30, 0x31

Error Codes

Error Code	Description	Comments
'1'	Invalid check sum	See how to calculate a check sum
'2'	Unknown command	Protocol uses only RD (Batch Read) and WD (Batch Write) commands
'3'	Data length error	Number of items in WD (Batch Write) command doesn't match number of data bytes
'4'	ETX not found	ETX (0x03) not present in command
'5'	Illegal Address	number of items in a request is set to 0; memory segment number in a request is out of 0-25; Wrong command value, No data at requested address;
'6'	More items requested	More than 99 items were requested in command
'7'	Unsuccessful write	It informs Master that it should repeat WD command

Table 1

Tau (τ)	Analog Response Time, ms	Serial Response Time, ms
1	2	20
3	6	50
5	10	100
10	20	200
30	60	300
50	100	500
100	200	1000
300	600	2000
500	1000	3000
1000	2000	4000
3000	6000	5000
5000	10000	10000

Appendix A

DATA	Comments
Status code	'0000' : No error '0001' : Signal is lower than sensor sensitivity '0002' : Out of range due to T brightness minimum '0003' : Too low energy '0004' : Signal is higher than sensor sensitivity '0006' : Sharp brightness jump '0007' : Non stable object measurement '0011' : Internal temperature warning '0013' : Thermopile ambient temperature too low '0014' : Thermopile ambient temperature too high '0015' : Pyrometer in testing mode '0016' : Pilot light ON '0017' : Measurement below lower basic range '0018' : Measurement exceeds upper basic range '0019' : Pyrometer in warm up period

Broadcast Message

WD (Batch Write) command with Station ID of 0 is considered as broadcast message. Sensors process this command regardless of their Station Number and do not issue replies.

It is useful when master issues a request to change the same parameters of more than one Slave devices.

For more information write us at, info@tempsens.com

Appendix B

Typical emissivity values for various materials available:

All the emissivity values shown in the table are only approximate, as it depends various parameters and it may affect the emissivity of a material. These parameters are as under:

1. Temperature
2. Thickness of material
3. Angle of measurement
4. Spectral range of measurement
5. Geometry
6. Surface quality (polished, rough , oxidized, sandblasted)
7. Transmission

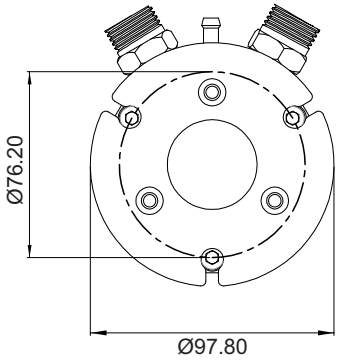
Material	Emissivity*
Aluminum, polished	0.05
Aluminum, rough surface	0.07
Aluminum, strongly oxidized	0.25
Asbestos board	0.96
Asbestos fabric	0.78
Asbestos paper	0.94
Asbestos slate	0.96
Brass, dull, tarnished	0.22
Brass, polished	0.03
Brick, common	0.85
Brick, glazed, rough	0.85
Brick, refractory, rough	0.94
Bronze, porous, rough	0.55
Bronze, polished	0.10
Carbon, purified	0.80
Cast iron, rough casting	0.81
Cast iron, polished	0.21
Charcoal, powdered	0.96
Chromium, polished	0.10
Clay, fired	0.91
Concrete	0.54
Copper, polished,	0.01
Copper, commercial burnished	0.07
Copper, oxidized	0.65
Copper, oxidized to black	0.88
Electrical tape, black plastic	0.95
Enamel **	0.90
Formica	0.93
Frozen soil	0.93
Glass	0.92
Glass, frosted	0.96
Gold, polished	0.02
Ice	0.97
Iron, hot rolled	0.77
Iron, oxidized	0.74
Iron, sheet galvanized, burnished	0.23
Iron, sheet, galvanized, oxidized	0.28
Iron, shiny, etched	0.16

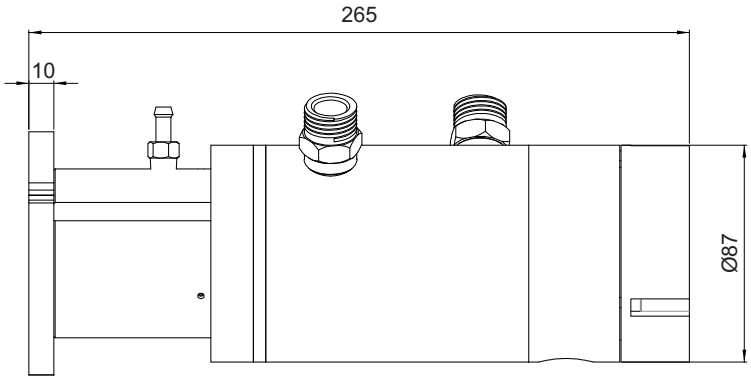
Material	Emissivity*
Iron, wrought, polished	0.28
Lacquer, Bakelite	0.93
Lacquer, black, dull	0.97
Lacquer, black, shiny	0.87
Lacquer, white	0.87
Lampblack	0.96
Lead, gray	0.28
Lead, oxidized	0.63
Lead, red, powdered	0.93
Lead, shiny	0.08
Mercury, pure	0.10
Nickel, on cast iron	0.05
Nickel, pure polished	0.05
Paint, silver finish**	0.31
Paint, oil, average	0.94
Paper, black, shiny	0.90
Paper, black, dull	0.94
Paper, white	0.90
Platinum, pure, polished	0.08
Porcelain, glazed	0.92
Quartz	0.93
Rubber	0.93
Shellac, black, dull	0.91
Shellac, black, shiny	0.82
Snow	0.80
Steel, galvanized	0.28
Steel, oxidized strongly	0.88
Steel, rolled freshly	0.24
Steel, rough surface	0.96
Steel, rusty red	0.69
Steel, sheet, nickelplated	0.11
Steel, sheet, rolled	0.56
Tar paper	0.92
Tin, burnished	0.05
Tungsten	0.05
Water	0.98
Zinc, sheet	

Appendix C

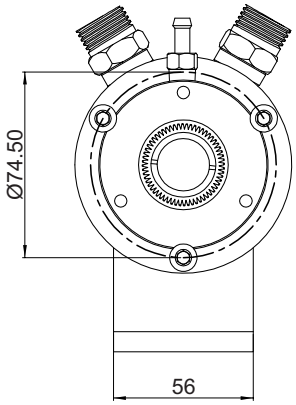
Mechanical Drawings

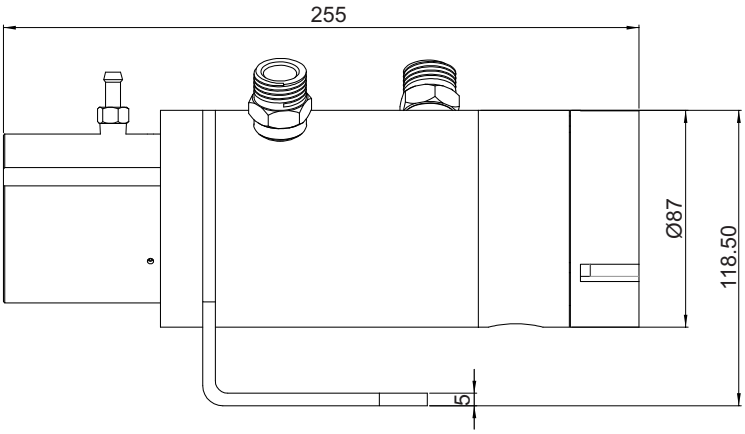
1. Water Cooling Jacket





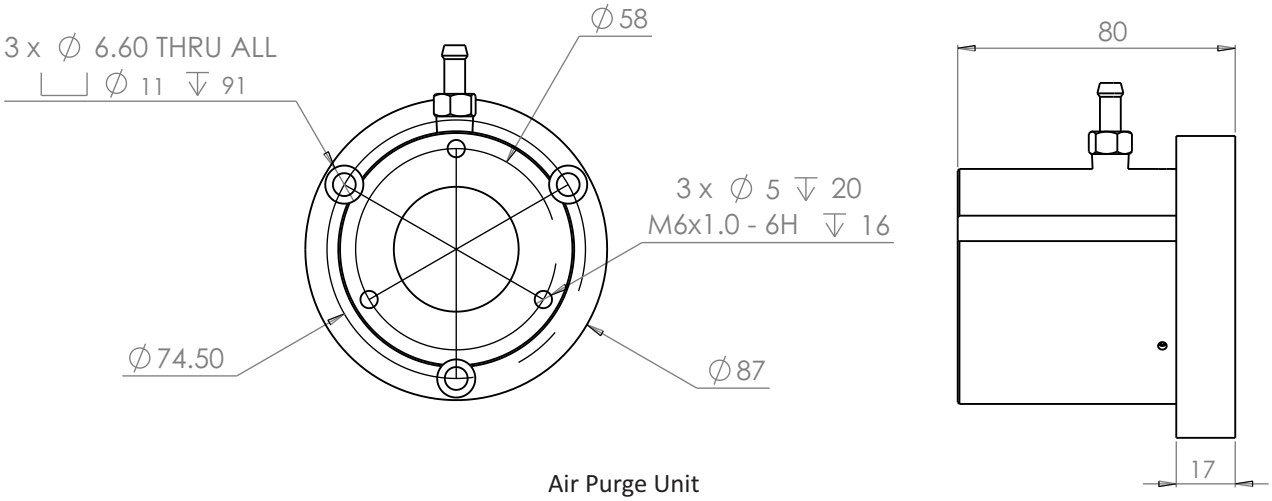
Water cooling Jacket(8500-09) with Mounting Flange (8500-07)





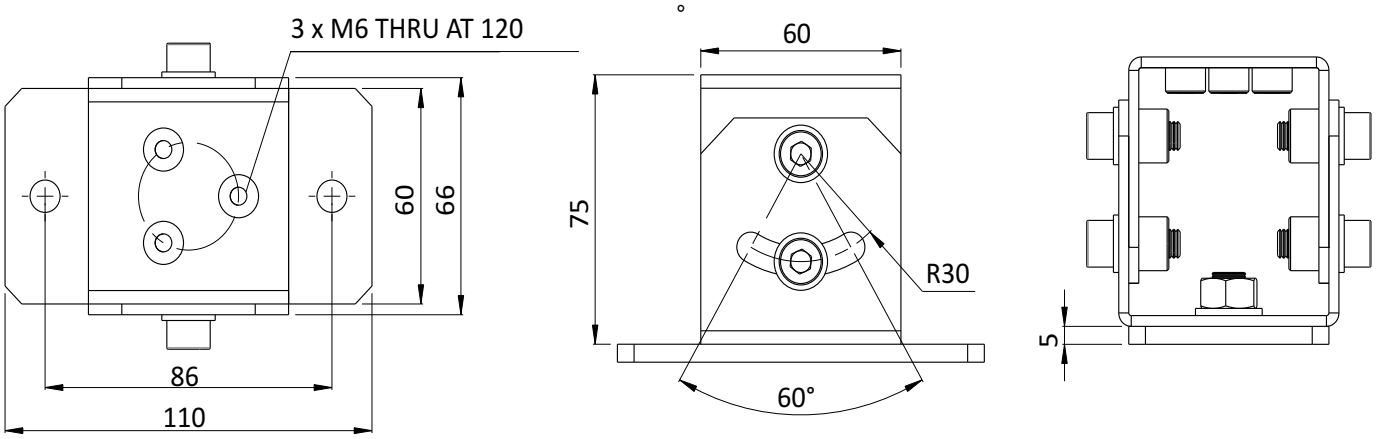
Water Cooling Jacket (8500-09) with Mounting Clamp (8500-04)

2. Air Purge Unit



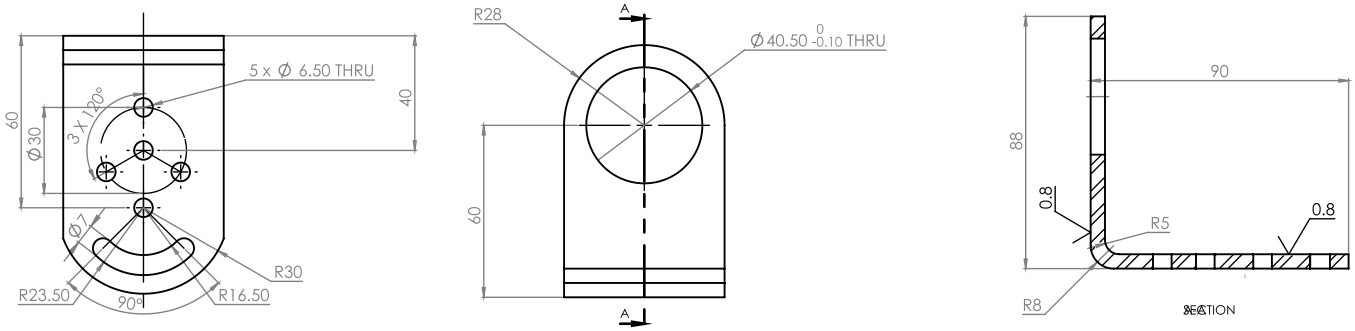
Air Purge Unit
(Reference no: 8500-05)

3. Adjustable Mounting Stand



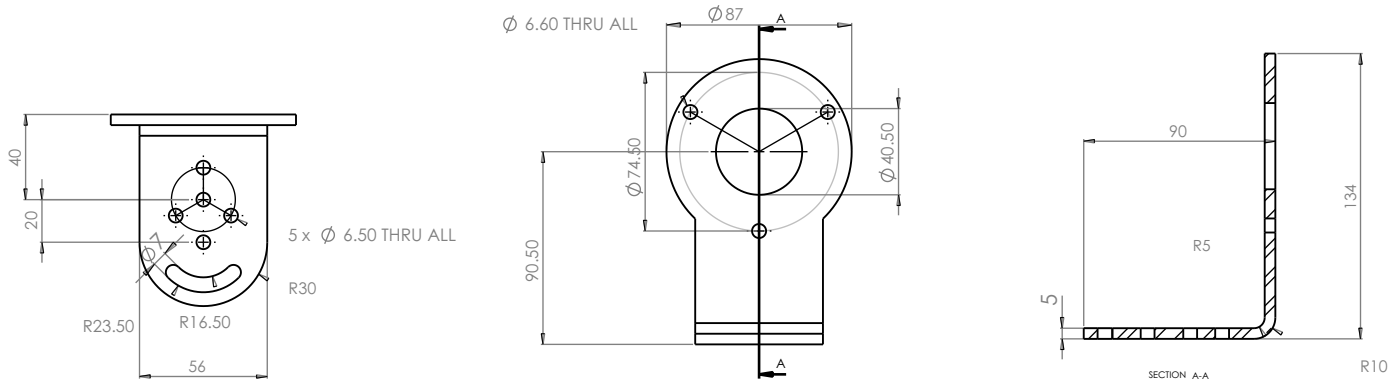
Adjustable Mounting Stand
(Reference no: 8000-07)

4. Mounting Clamp (Pyrometer)



Mounting Clamp
(Reference no: 8500-04)

5. Mounting Clamp Water Cooling Jacket



Mounting Clamp water cooling Jacket
(Reference no: 8500-06)

Information

Maintenance

The pyrometer has no internal parts, which have to be cleaned. The lens can be cleaned with compressed air, which is dry and free of oil. If the protection glass requires more thorough cleaning, use a soft, dry cloth such as that used to clean camera lenses.

Packing instructions

To transport or store the instrument, please use the original box or a box padded with sufficient shock absorbing material. For storage in humid areas or shipment overseas, the device should be placed in welded foil (ideally along with silicone gel) to protect it from humidity.

Warranty

A250+/A450+ PL/TL/Video instruments have a warranty of two years from the invoice date. This warranty covers manufacturing defects. User-induced faults are not covered under this warranty.

Software warranty

The windows compatible software was thoroughly tested on a wide range of windows operating systems. Nevertheless, there is always a possibility that windows or PC configuration or some other unforeseen condition exists that would cause the software not to run smoothly. The manufacturer assumes no responsibility or liability and will not guarantee the performance of the software. Liability regarding any direct or indirect damage caused by this software is excluded.

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