Accurate **S**ensing **T**echnologies

We measure accurate temperature in extreme conditions

AST A250C FO-PL

Non-contact Infrared Pyrometers

USER MANUAL

AST - Accurate Sensing Technologies

188A, B-169 (Part), B-188 (A),
Road No. - 5, Mewar Industrial Area, Udaipur - 313003 (Rajasthan) INDIA
Phone : +91-9352506032
Email : sales@astinfrared.com

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Chapter - 1

General Information

We are pleased that you have chosen this high quality and highly efficient AST pyrometer for non-contact temperature measurement.

Please read this manual carefully, step by step before performing any operation with the Pyrometer. It contains all the necessary instructions for set up and operation of the pyrometer. When operating the instrument, it is necessary to follow the general safety instructions.

1.1 Safety Measures

This section provides an overview about important safety regulations.

1.1.1 General

Each person working with the pyrometer must have read the user manual before operation. The Pyrometer has only to be used for the purpose described in the manual.

1.1.2 Safety Precaution

The Pyrometer works only with a potential-free low voltage of range 24V DC. This voltage is not harmful for the user.

1.1.3 Maintenance and use of Pyrometer

Pyrometer can be operated by the qualified person who has got instructions from the supervisor. It is strongly prohibited to do technical modifications of the device without permission of the manufacturer.

1.1.4 Environmental Protection

The lens or its coating may contain harmful materials and hence it should not be disposed of with normal waste.

1.1.5 Packaging and storage

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

1.1.6 Warranty

AST A250C FO-PL instruments have a warranty of two years from the invoice date. AST will replace defective parts, which arises from design errors or manufacturing faults. In case, if pyrometer is opened, disassembled or modified then the guarantees will loss.
AST does not accept liability for any damage or losses which might occur, including consequential damages and financial losses, as a result of use of the equipment.

1.1.7 Copyright ©

Chapter - 2

Introduction

AST A250C FO-PL is specially designed highly accurate digital two color pyrometer with fiber optic to provide high performance and low maintenance of non contact temperature measurement in demanding industrial environment. They are designed for areas with high ambient temperature (upto 250°C) without cooling or in areas where strong electromagnetic interference can influence correct measurement because the fiber & optical head do not contain any electronic part.

2.1 Application, Range and Working Principle

AST A250C FO-PL is highly accurate two color pyrometer with fiber optics especially designed for rough industrial environment for temperature measurement of metals, ceramic or graphite. They are suitable for high temperature measurement ranging from 350°C to 1350°C.

AST A250C FO-PL pyrometers are suitable for industrial purpose due to following advantages:

- Measurement of temperature is not affected by emissivity of object.
- Measurement of object temperature is possible where dust, moisture & other contaminants are present in surrounding environment.
- The measuring object can be smaller than spot size.
- The pyrometer can be switched between 1-colour & 2-colour mode.

These pyrometers have solid body in stainless steel housing which provides high operation safety even in rough industrial environment, and large variety of optics with fixed focus which can be easily used in all industrial areas. The radiation from hot object is focused on the detector by optics which then travel into mono fiber cable with flexible stainless steel protection tube and converted into electrical signals. This signal is then linearized and converted into standard analog & digital outputs.

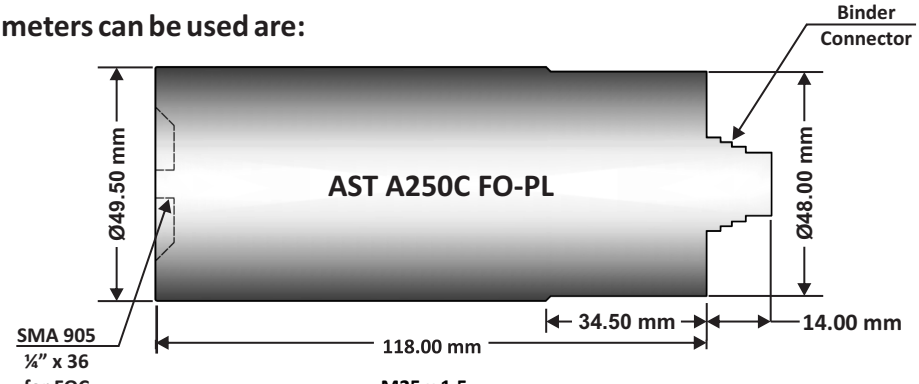
AST A250C FO-PL has a fast response time of 100msec. Pyrometers have RS-232 or RS-485 outputs. Response time, emissivity, sub range and peak picker selection can be preset ex works or adjusted through available software.

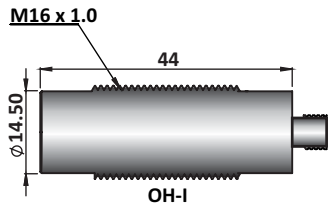
According to application there are two optical heads small (head 1) & big (head 2).The heat radiation, enter from optical head, to the lens system & travel through mono glass fiber with flexible stainless steel protection tube where it is transmitted along to the converted .The optical head contains only the lens system, the electronic are located in the converter box, so the measurement is possible in atmospheric condition upto 250°C.

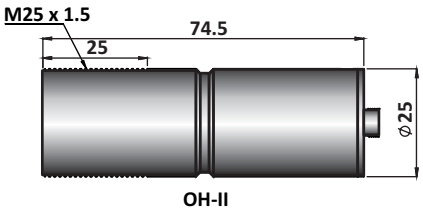
Two color pyrometer involves measuring thermal radiance at two different wavelengths and inferring the temperature from the ratio of these spectral radiance. Radiance ratio thermometers can be significantly more accurate than single band thermometers in many applications.

The applications in which AST pyrometers can be used are:

- Induction heating
- Annealing
- Welding
- Forging
- Sintering
- Melting
- Rolling mills
- Rotary kilns







2.2 Technical Specifications

Model	A250C FO-PL
Temperature Range (Analog sub-range adjustable)	350°C....1000°C 450°C....1350°C
Spectral Range	1.5 µm/1.6 µm
Photodetector Type	InGaAs/InGaAs
Distance to Spot Size Ratio	100:1 OH(I) 100:1 OH(II) 200:1 OH(I) 200:1 OH(II)
Emissivity (ε)	0.1....1.0 adjustable(Single Color mode)
Emissivity Slope (ε1 / ε2)	0.75...1.25 slope adjustable (Two color mode)
Response Time	100 msec adjustable upto 10 sec
Accuracy	± 1.0% of the measured value + 1°C
Repeatability	0.5% of reading in °C + 1°C
Sighting Option	Laser Pilot Light (PL)/Through the Lens(TL)
Analog Output	0-20mA, 4-20mA, 0-10V (User selectable)
Digital Output	Bluetooth RS-232/RS-485 (User selectable) *At a time only one digital output possible
Operating Temp. Range at fiber	Max. 250°C at fiber optic cable, 0°C....70°C at pyrometer end
Storage Temp. Range	-20°C...70°C
Adjustable Parameters and Features via Software	Emissivity, Emissivity Slope, Response Time, Clear Time(Peak Picker), Analog Output, Analog Scale(Sub range),Sensor type (Switches b\w 2-color or single color), Switch off level, Unit Of Temperature(°C/°F), Communication mode(Comm.mode), Record feature etc
Power Supply	12V DC to 28V DC with reverse voltage protection
Power Consumption	Max 2.5 watt
Laser Power	<1 m watt
Protection Class	IP65
Housing	Stainless Steel
Isolation	Power supply, *Digital output and Analog output are galvanically islolated against each other * Not applicable for USB 2.0 digital output
Operating Humidity	10-95%, Non-Condensing Conditions
Weight & Dimensions	600g Dia= Ø 49.5 mm; Length=118mm

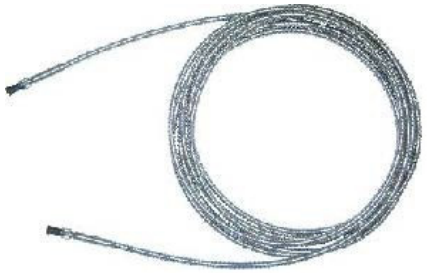
Note : After power supply initialization, keep pyrometer under stable temperature condition for 30 - 35 minutes for to get above stated accuracy.
Laser should be used only for targeting purpose. In normal measuring laser should be turned off to get correct measurements.

2.3 Fiber Optics Cable:

The radiation, from object coming through optical head, is transported by the lens into the mono fiber cable with flexible stainless steel protection where it is transmitted to the converter. It can withstand ambient temperature upto 250°C without cooling because there is no electronic part.

Length : *2.5m scop of delivery; 5m, 7.5m, 10m, 15m, 30m on request*

Ambient temp. : *Max 250°C*



Replacement Fibre Optic 2.5mtr (Reference no: 5000-01)

2.4 Optics

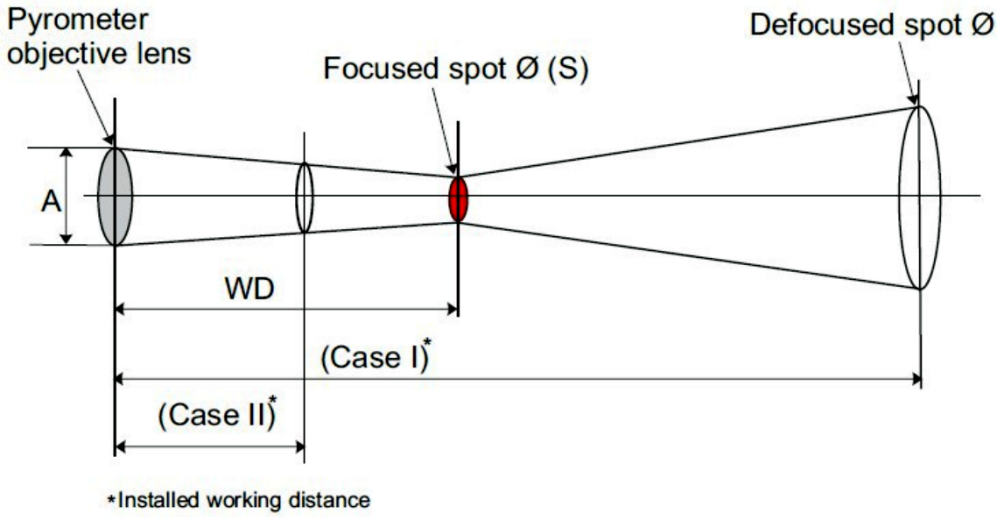
Pyrometer receives heat radiation from the measured object, which is converted to an electrical signal after passing through the lens. The measured object can be at any distance from pyrometer however as far as the object from pyrometer the measured area (Spot size) will be larger.
Depending on the application the instrument will be delivered with a small or big optical head:

Type I – "Optical head-I" is suitable for use in confined spaces due to very small dimensions. The optics is adjusted to one of the measuring distances mentioned in following table.
Type II – This optical head is fixed adjusted optical head and is bigger in size than "optical head-I"

Standard Specification of Optical Head:-

		350°C - 1000°C	450°C - 1350°C
Optical Head	Working Distances (mm)	Spot Sizes(mm)	Spot Sizes(mm)
 Optical Head - I	120	1.2	1.2
	260	2.6	2.6
	700	7	7
 Optical Head - II	90	0.5	0.5
	200	1	1
	600	3	3
	4500	23	23

User can easily find out the spot size For example, if factory made working distance is 260mm & pyrometer is AST 250 FO-PL then spot size is 6.5mm for head-I (as given in above table). If user installed this pyrometer at 700mm then spot size is not 17.5mm (as given in table), user should have to calculate as given below method.



Case-I: ***If installed working distance is greater than manufactured working distance***

$$\text{Installed Spot size} = \frac{\text{Installed working distance (Case I)}}{\text{WD}} \times (S + A) - A$$

Case-II: ***If installed working distance is smaller than manufactured working distance***

$$\text{Installed Spot size} = \frac{\text{Installed working distance (Case II)}}{\text{WD}} \times (S - A) + A$$

Chapter - 3

Installation of the Pyrometer

3.1 Installation

3.1.1 Location selection

Qualified operating personnel 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.
2. Know your pyrometer spot size according to point 2.3.
3. Pyrometer ambient temperature should be within 0° to 70°C (read 3.1.4).

3.1.2 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.

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

Due to fiber optic cable the pyrometer can be placed remote from high temperature area. The optical head containing sensor is placed at the object whose temperature is to be measured. The radiation from hot object is focused on the detector by optics which then travel into mono fiber cable with flexible stainless steel protection tube and converted into electrical signals. This signal is then linearized and converted into standard analog & digital outputs.

3.1.3 Mounting of pyrometer

To install the sensor head at the place of measurement a mounting support is supplied as an accessory, after losing the clamp screws, it can be fastened correctly.

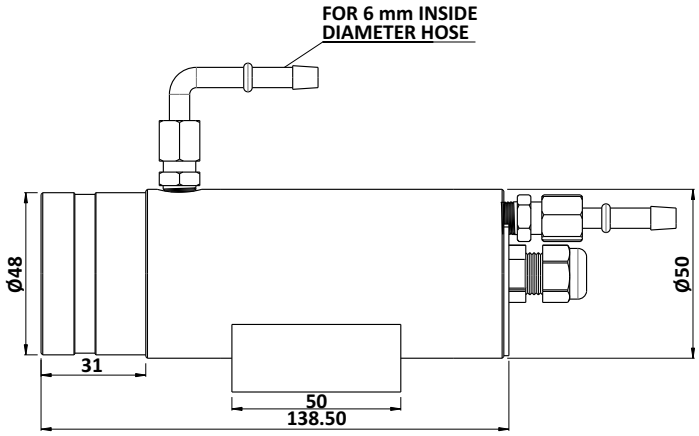
3.1.4 Ambient temperature

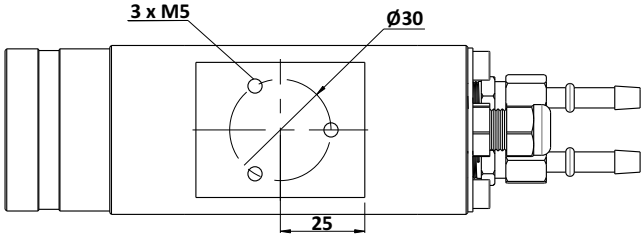
The allowed operation temperature for the pyrometer is 0°C to +70°C. But the temperature at fiber optic & optical head is 250°C max. Therefore, if sensor head is to be used above 250°C water cooling jacket with built in air purge unit is used otherwise it may damage the pyrometer. The ambient temperature is dependent on the temperature and flow rate of cooling water. Details of air purge & water cooling jacket is given in point 3.2.

3.1.5 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.

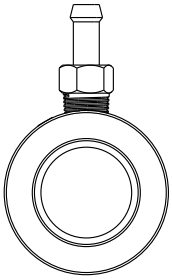
3.2 Mechanical accessories

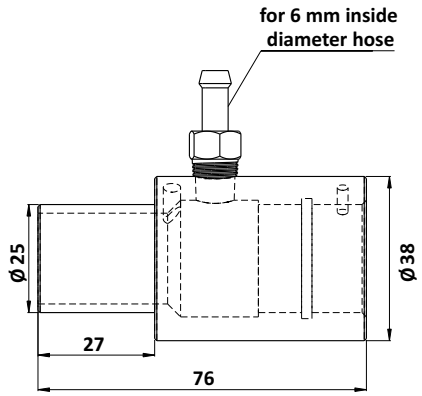




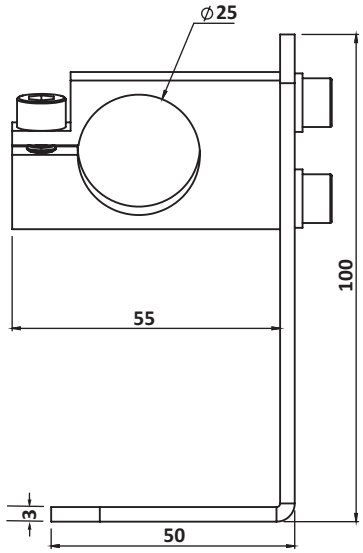
Water pressure	:	< 10 bar
Air pressure	:	< 0.5 bar
Air consumption	:	2...3 m³/h
Ambient temperature	:	< 200°C
Metal	:	Stainless steel
Weight	:	1.35 Kg

Water Cooling Jacket Incl. Air Purge Unit- Optical Head-II
(Reference No: 8000-01)

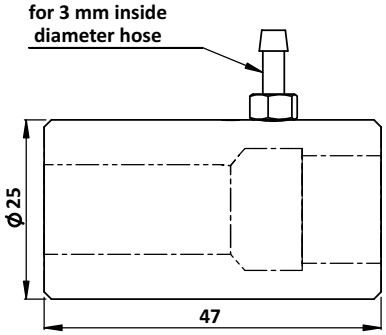




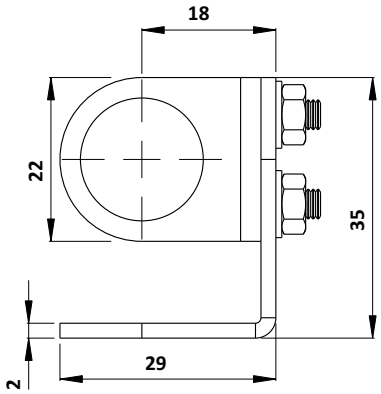
Air Purge Unit-Optical Head-II
(Reference No: 8200-01)



Adjustable Mounting for Optical Head-II
(Reference no: 8200-03)

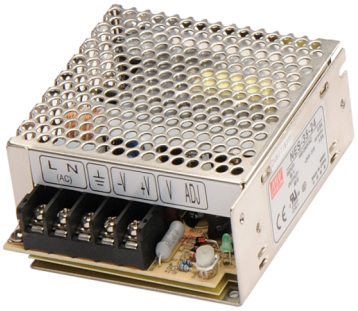


Air Purge Unit for Optical Head-I
(Reference No: 8200-02)



Adjustable Mounting for Optical Head-I
(Reference No: 8200-04)

3.3. Electrical Accessories

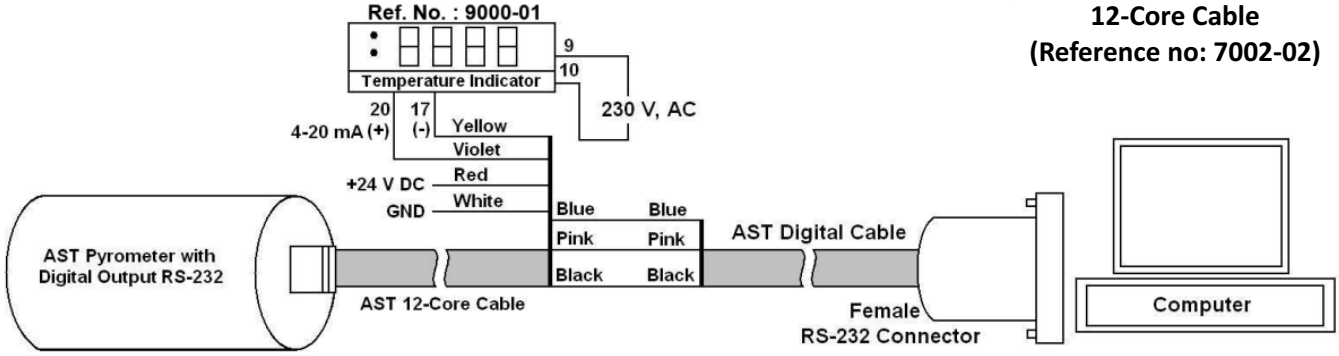


Power Supply Unit
(Reference no: 9000-02)

AST A250C FO-PL is powered by 24V DC (well stabilized ripple max 50mV).The input power supply is 110/230v AC check the polarity before connecting the device

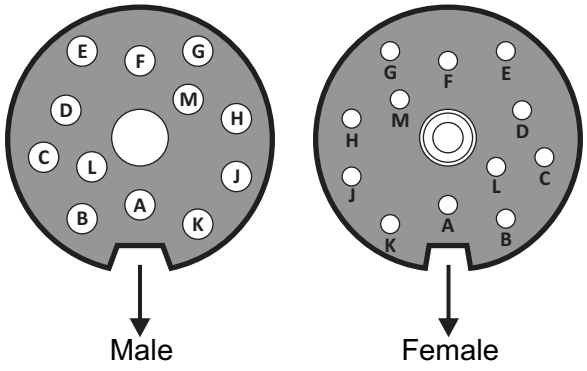
12-Core Cable
(Reference no: 7002-02)

3.3.1 Connector Pin Assignment On The Back of The Pyrometer

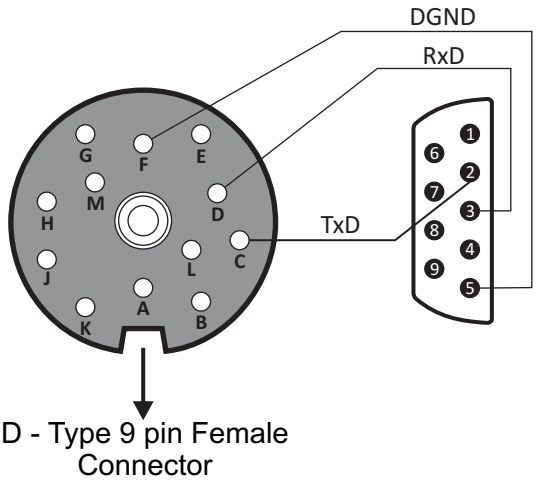


RS-232 Connection

Pin	Colour	Indication	Used for
A	Red	+ 24 V DC In	Power supply
G	White	Ground	
C	Blue	TxD (RS-232) / D- (RS-485)	RS-232/ RS-485 communication
D	Pink	RxD (RS-232) / D+ (RS-485)	
F	Black	RS-232 communication	
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		
H	Yellow	- (0-10V)	Analog voltage output
B	Grey	+ (0-10V)	
E	Blue-Yellow	N/A	Not used
L	Red-Grey	N/A	



12-pin Binder connector

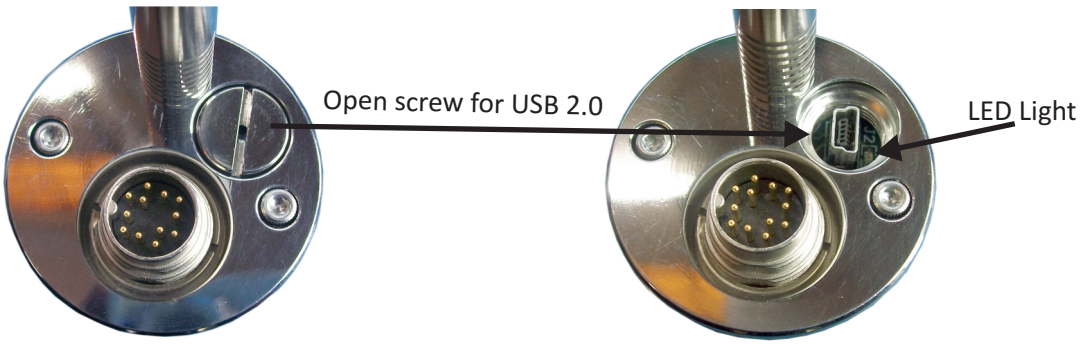


RS-232 communication connection

3.3.2 USB 2.0 Connection:

When pyrometer is connected to USB 2.0 cable, it is powered through USB 2.0. At this stage only USB 2.0 output is provided. For Analog output and Laser to work DC supply (+24V DC) must given to pyrometer.

While USB 2.0 is connected RS-232 / RS-485 communication is not possible. LED light indicates USB 2.0 operation.



Power ON Pyrometer:

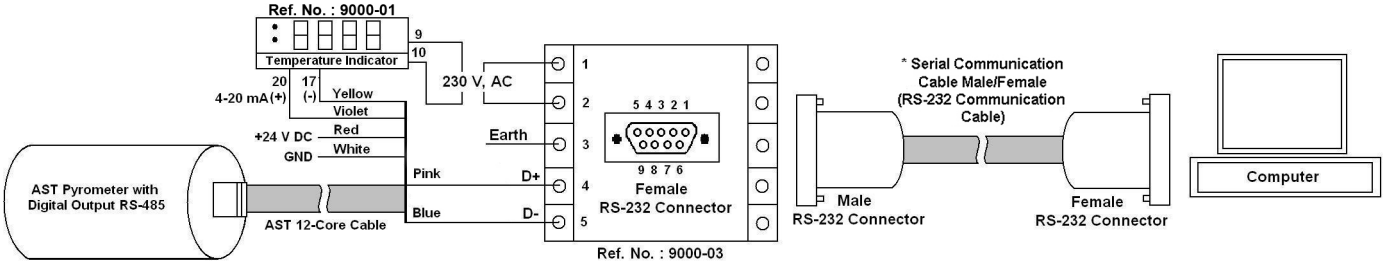
1. Connect the 12-core cable (Supplied with pyrometer) with pyrometer 12-pin binder connector given at the back side of pyrometer.
2. Connect the 12-core cable supply wire with +24V DC as given in table above.
3. Connect remaining wires as per your requirement (details given in table above).
4. Provide insulation for not used end points of 12-core cable.
5. Now, the pyrometer can be switch ON.

3.3.2 Converter RS-232 ↔ RS-485 :

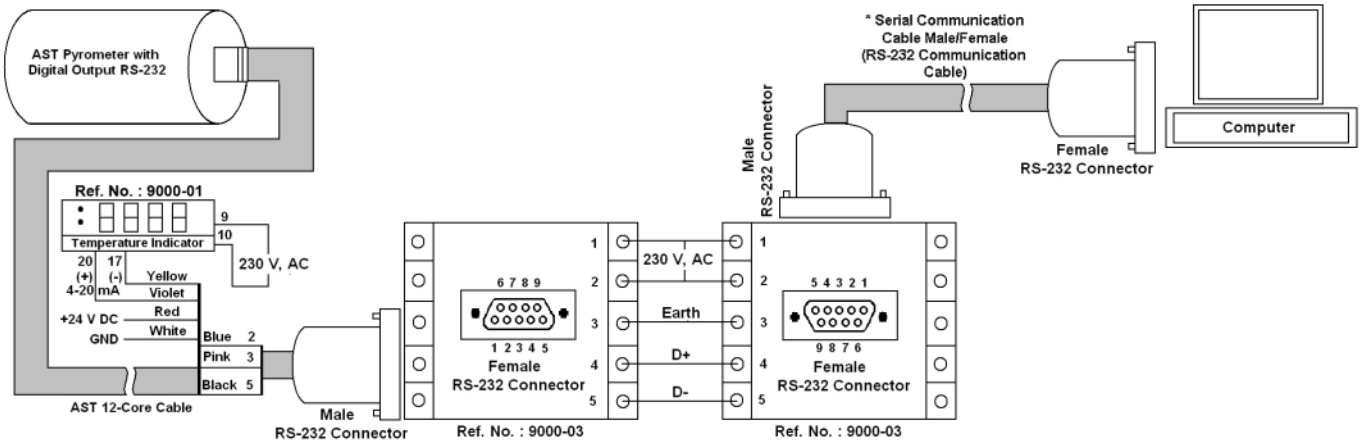
The pyrometer can communicate with PC using RS-232 or RS-485. RS-232 is used only for short distances.

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.

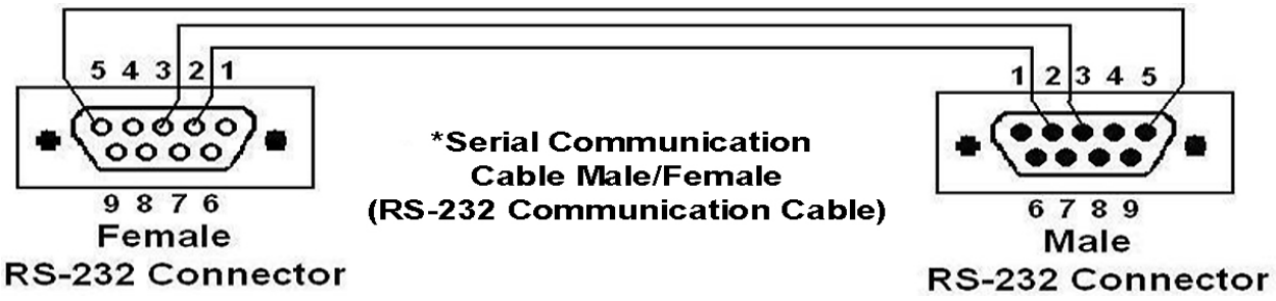
Converter RS-232 ↔ RS-485
(Reference no: 9000-03)

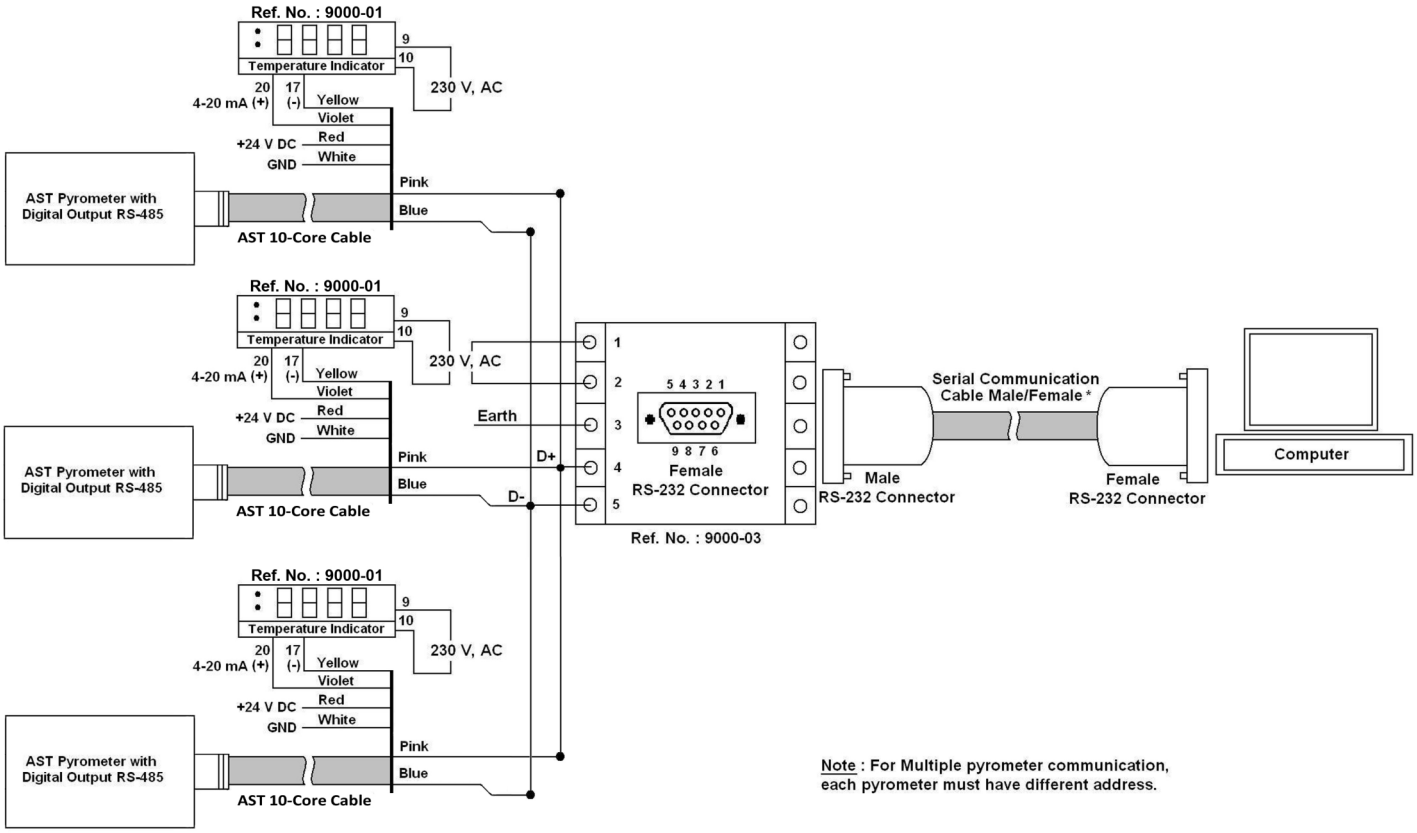


RS-485 to RS-232 Connection



RS-232 to RS-485 to RS-232 Connection





Multi-Pyrometer Connection

3.3.3 Display Instrument

Temperature Indicator
(Reference no: 9000-01)

To display the measured temperature 7 segment digital indicator is used. Device has following specifications:

Power supply I/P	:	85 to 265 V, AC/DC
Analog I/P	:	4....20 mA
Retransmission	:	4....20 mA
Power supply O/P	:	24V, DC
Display	:	4 Digits
Alarm	:	2

3.3.4 Display & Parameterizer

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

AST P-120 is a high precision LED indicator for non contact temperature measurement. With indication of measured temperature user can easily parameterize a connected AST 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

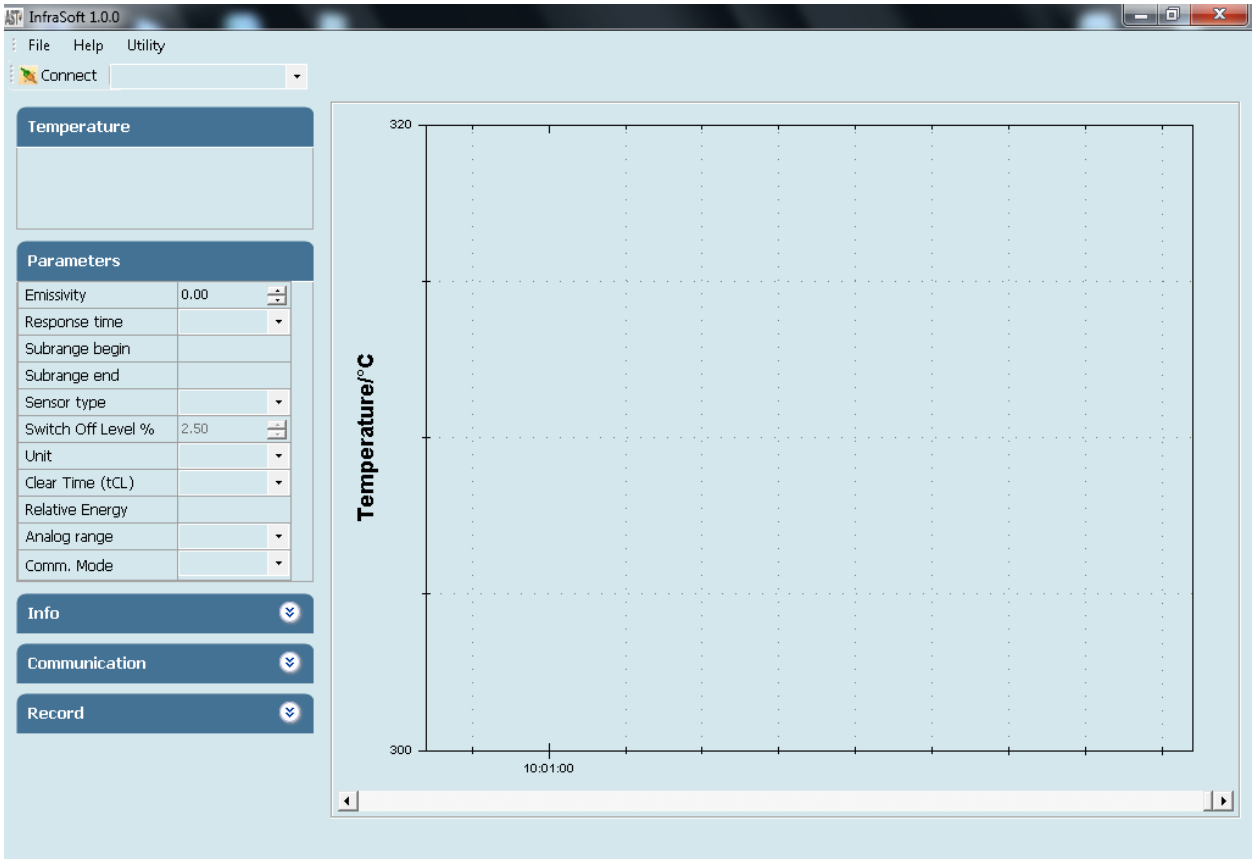
Chapter - 4

Software Installation

The provided AST software offers possibilities to connect three pyrometers simultaneously for parameter setting, view real time graph, offline graph and to evaluate measuring data.

4.1 Installation

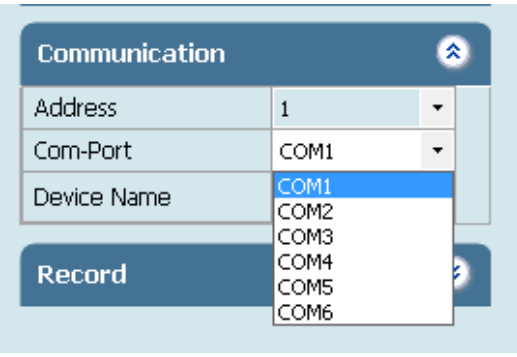
Install the pyrometer software using the installation guide file on CD ROM.After installation of the software; Double click the application. It will open the screen of software.



4.2 Parameters in main screen

4.2.1 Communication

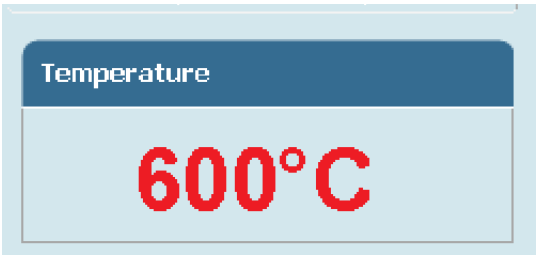
Communication between the AST pyrometer and the software is implemented via a cable connected between the pyrometer and the PC serial port. This enables the acquisition and recording of data, as well as the transfer of commands from the software application to the AST pyrometer. Communication can be 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.

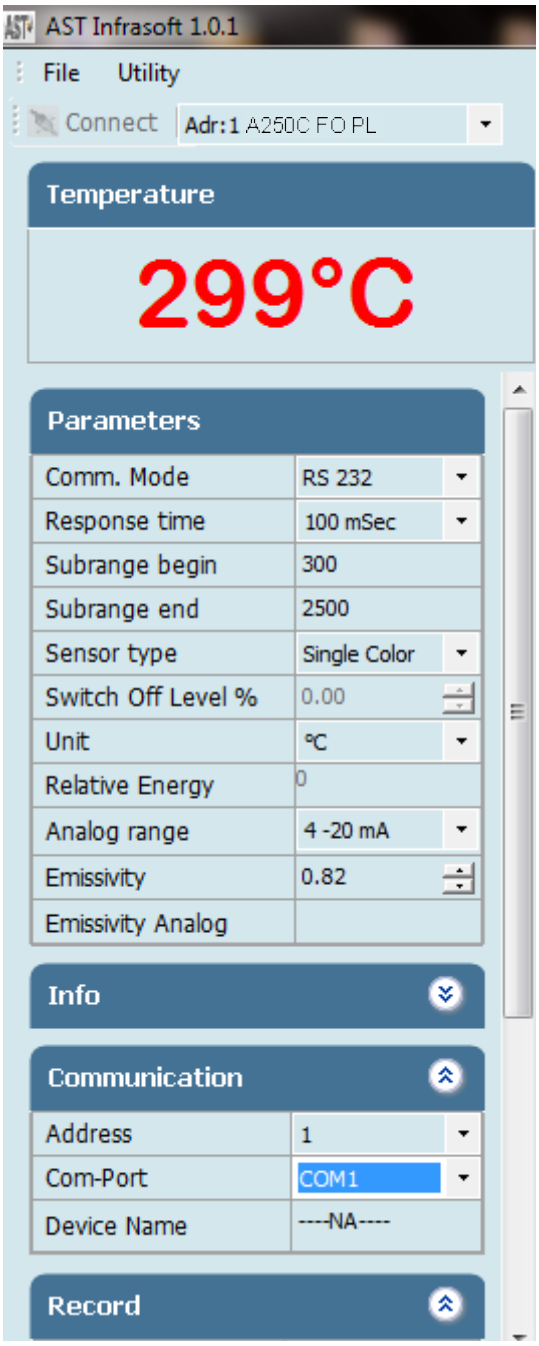
4.2.2 Temperature

It shows the temperature measured by the pyrometer



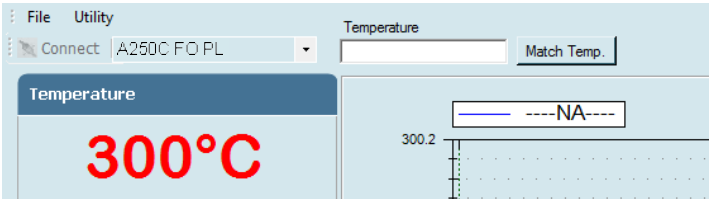
4.2.3 Parameter Setting

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) Match This parameter is used to match the known target temperature value to be displayed by the pyrometer. The User can enter the required temperature in window provided. This value can be set by clicking on the “Match Temp.” parameter in the software. The pyrometer automatically adjusts the emissivity so that the temperature display indicates the same temperature.



(C) 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.

(D) 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.

(E) 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).

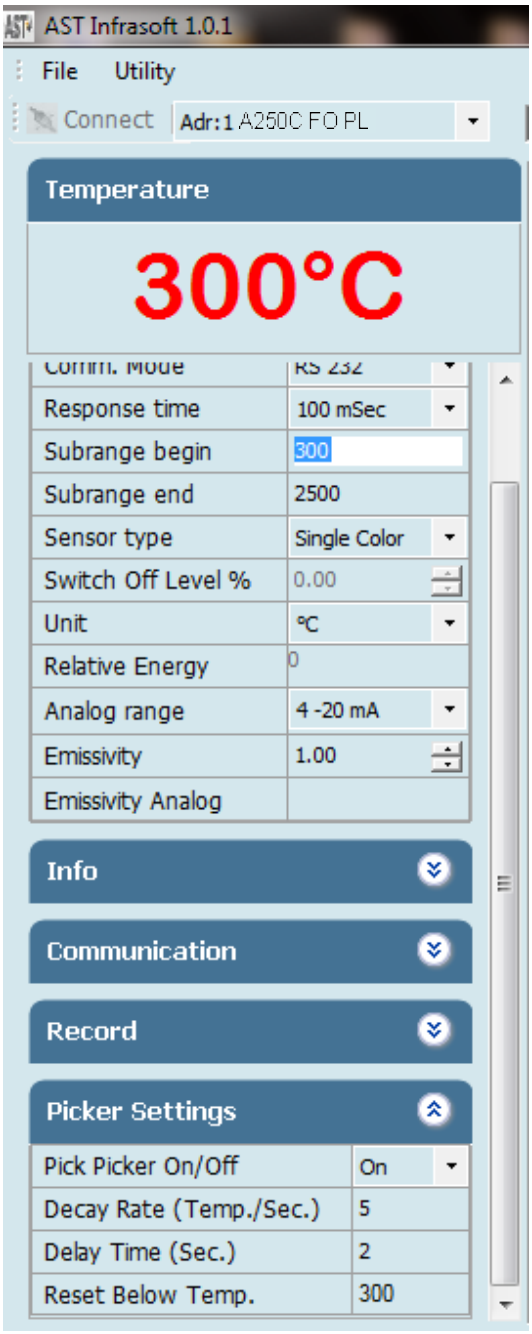
(E)Switch off level% (for two color pyrometer) The switch of level is the function that is used to avoid measurement errors caused by signals, which are too low. Although factory default is set to 15 %, the switch off limit can be adjusted between 2 and 50%.

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

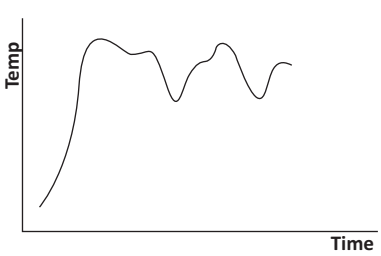
(G)Peak Picker If the peak picker is switched on, the highest last temperature value will always be displayed and stored. This feature is particularly useful when object temperature is not uniform across its dimension or the pyrometer is not constantly viewing an object to be measured.

Peak Picker Functions :

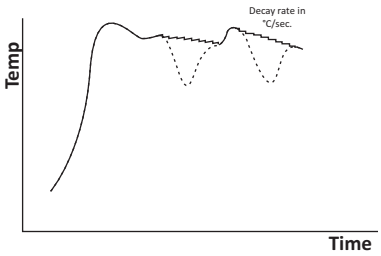
Peak picker can be turn ON & OFF by using the software. When Peak picker is ON, the peak picker menu is enabled for setting of the parameters like decay rate function, reset below temperature and peak picker delay.



(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.

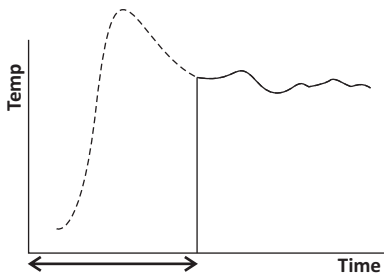


Without Decay Rate



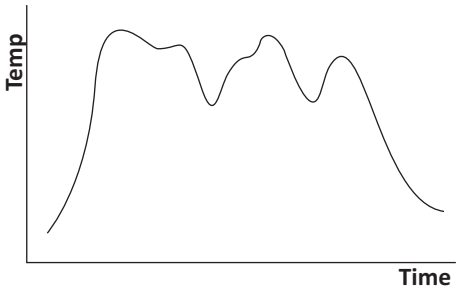
With Decay Rate

(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.

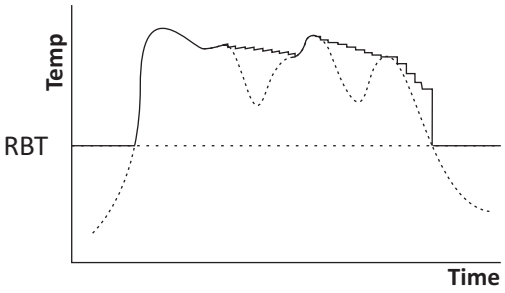


Delay Time (sec.)

(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].

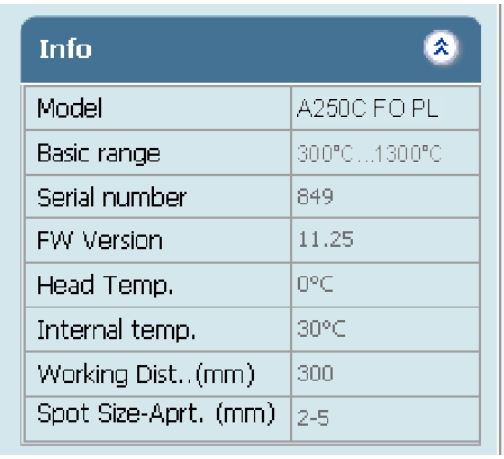
Note: For connection diagram from RS-232 to RS-485 & RS-485 to RS-232 *Refer Page No:-9*

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

4.2.4 Device information

Pyrometer specific information will be displayed in the Info Panel

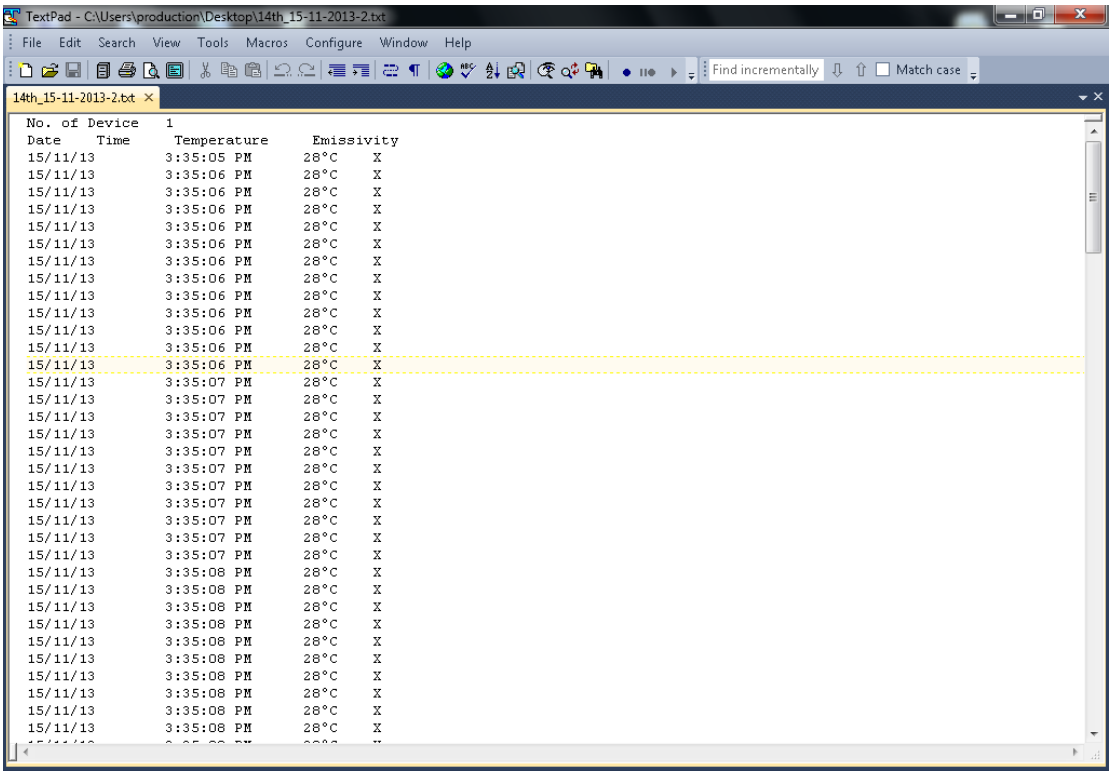
This screen shows the Model, basic range, serial number, version, Head temperature, internal temperature, working distance, spot size-apperture.



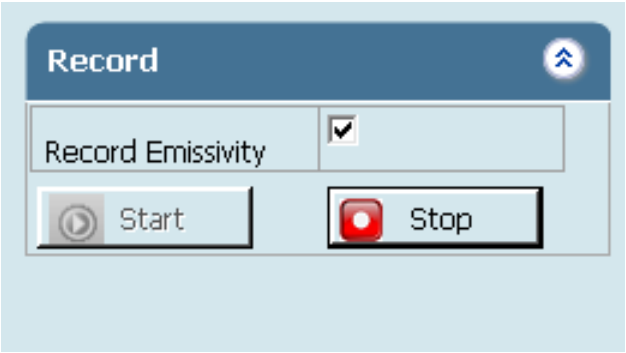
4.2.5 Record

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.

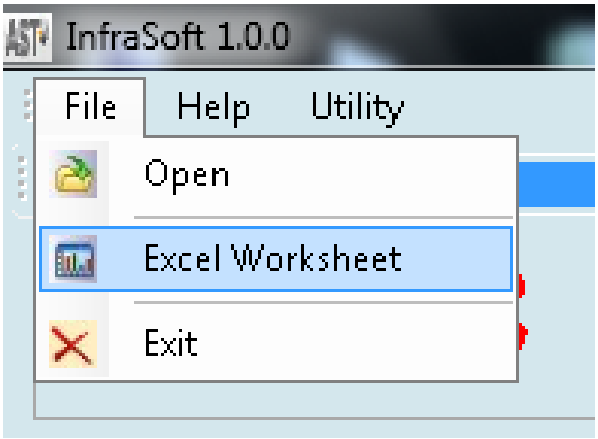
Record will be saved as ***.txt*** format.



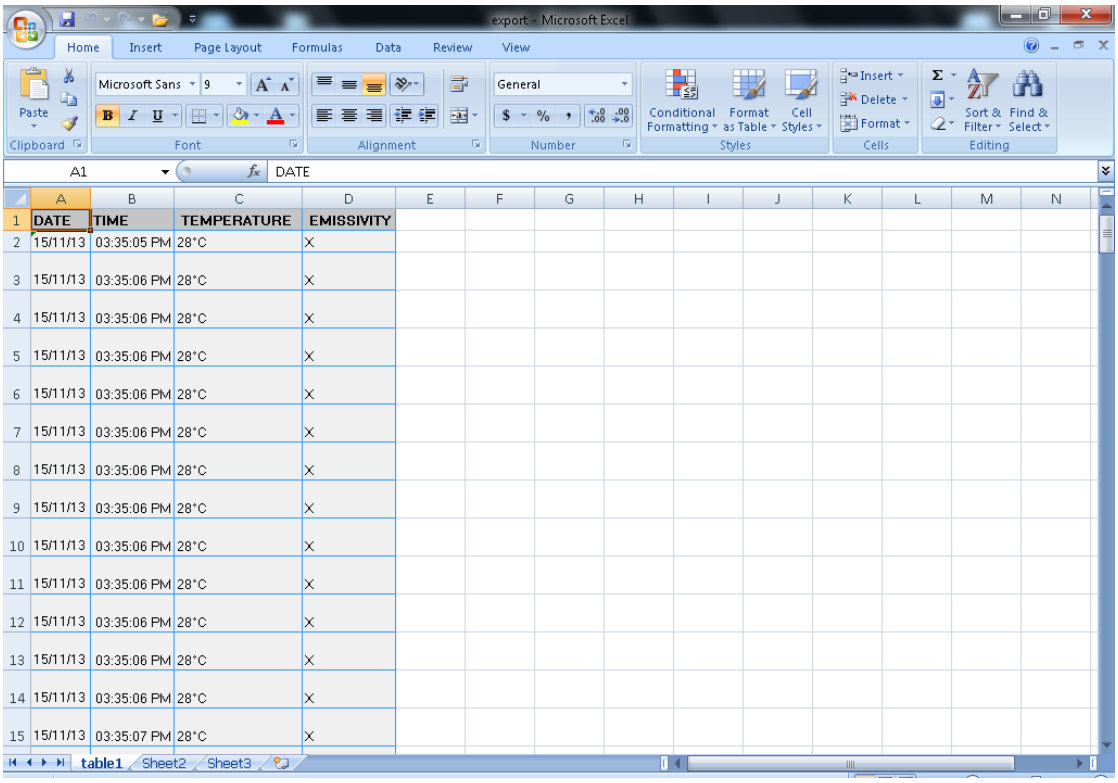
To record emissivity, click on ***Record Emissivity*** button.



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

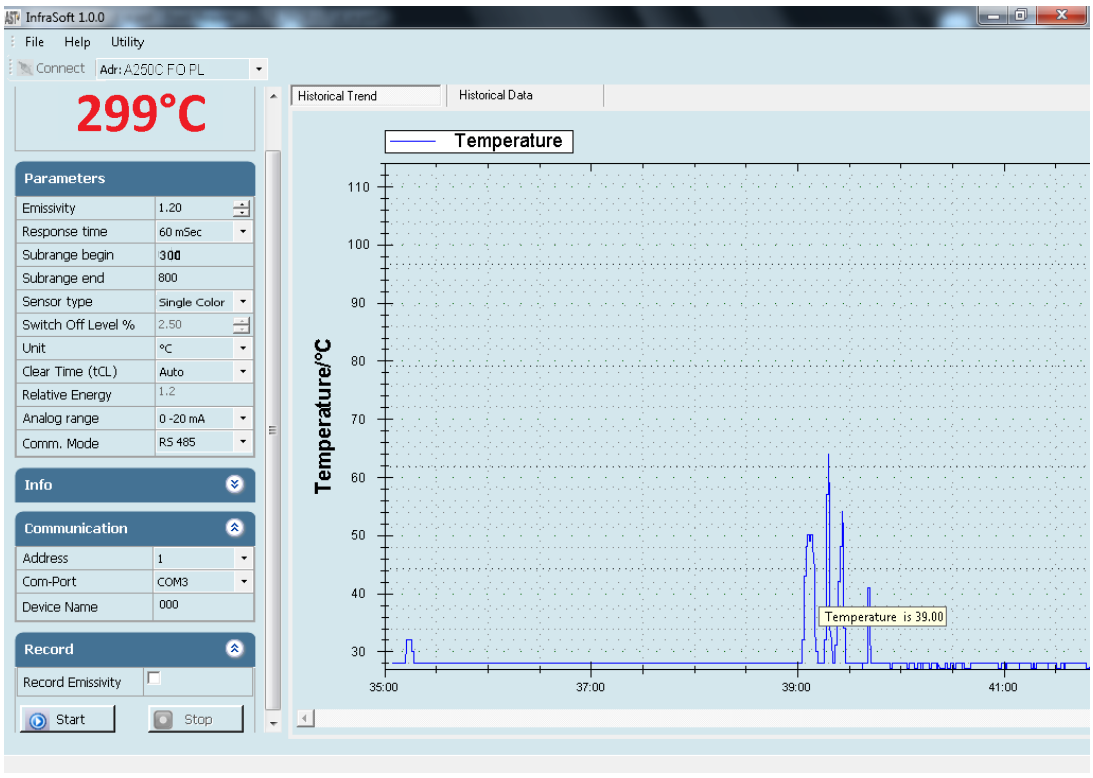


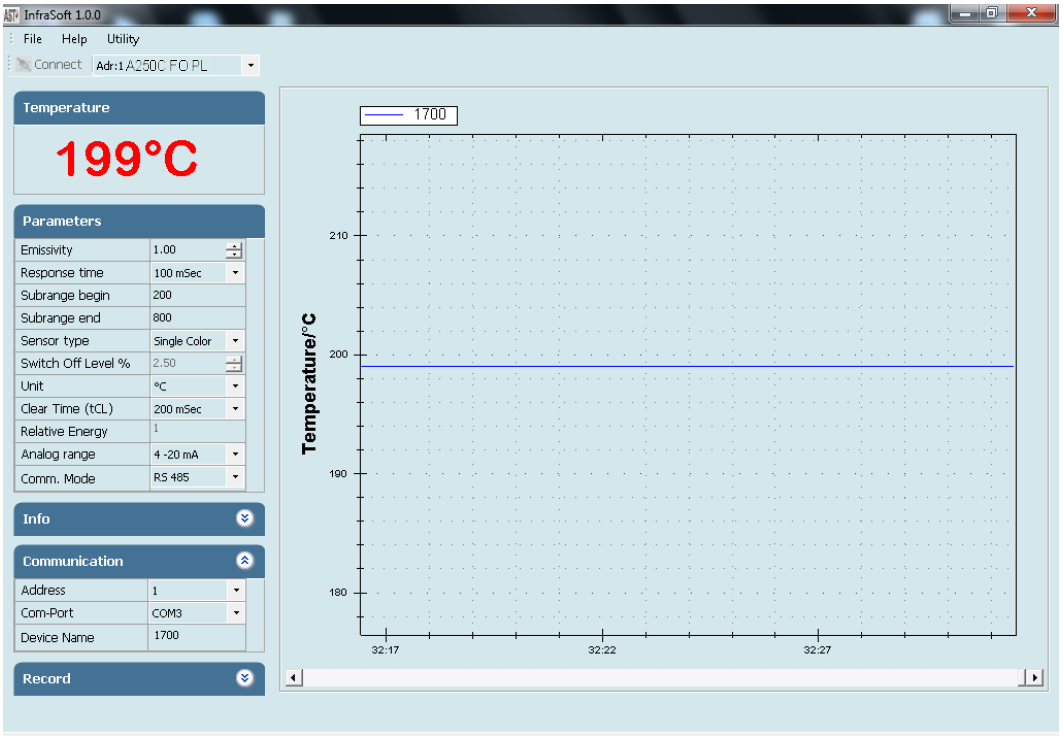
File will be stored in ***.xls*** format named as “export”.



	DATE	TIME	TEMPERATURE	EMISSIVITY
2	15/11/13	03:35:05 PM	28°C	X
3	15/11/13	03:35:06 PM	28°C	X
4	15/11/13	03:35:06 PM	28°C	X
5	15/11/13	03:35:06 PM	28°C	X
6	15/11/13	03:35:06 PM	28°C	X
7	15/11/13	03:35:06 PM	28°C	X
8	15/11/13	03:35:06 PM	28°C	X
9	15/11/13	03:35:06 PM	28°C	X
10	15/11/13	03:35:06 PM	28°C	X
11	15/11/13	03:35:06 PM	28°C	X
12	15/11/13	03:35:06 PM	28°C	X
13	15/11/13	03:35:06 PM	28°C	X
14	15/11/13	03:35:06 PM	28°C	X
15	15/11/13	03:35:07 PM	28°C	X

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

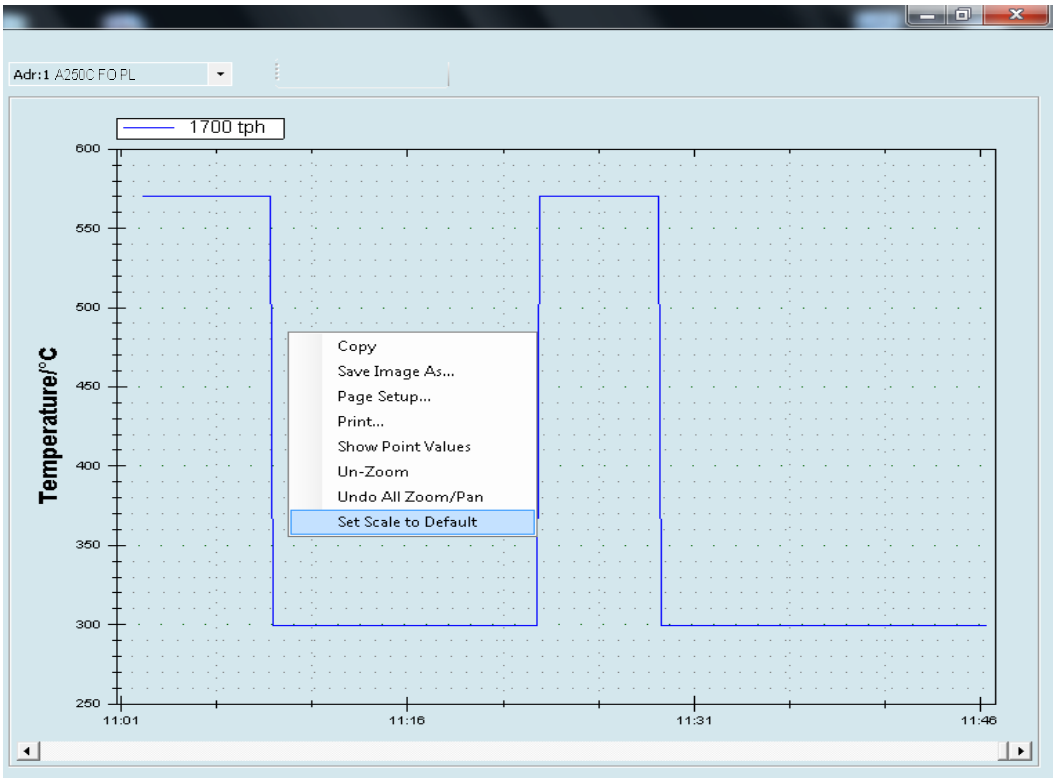




Temperature graph of connected pyrometer is displayed on right side of the screen. This shows the measured temperature corresponding to the time.

NOTE:

After connecting the pyrometer right click on the graph screen and choose "Set to default" option from pop-up menu.



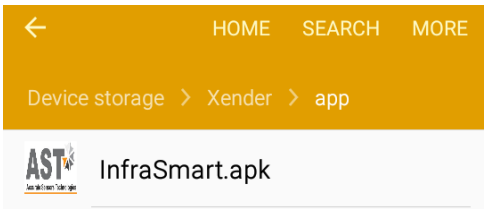
Chapter - 5

Android Application Software

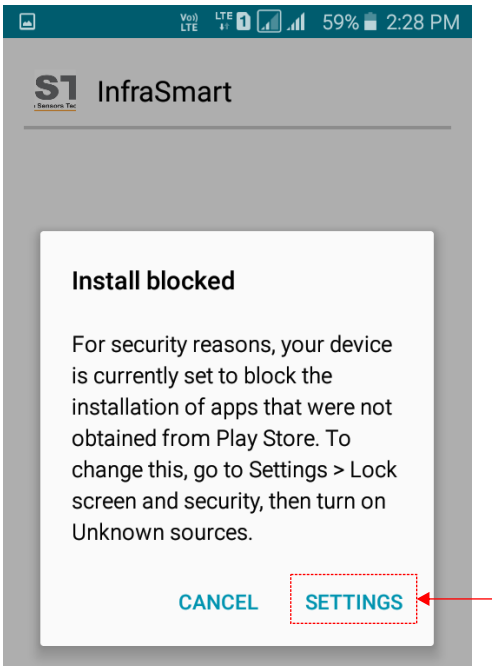
5.1 Installation Process

AST provides "**infrasmart .apk**" for android phone. This apk is in software CD.
Special Note: - This apk is compatible with android version 4.0 and above
Following are the predefined steps to install apk in a mobile.

(I) Copy apk file from CD to mobile.
(ii) Click on "**infrasmart.apk**" (Fig. 5.1)
(iii) Next screen will be as shown below, click on settings (Fig. 5.2)



(**Fig.** 5.1)

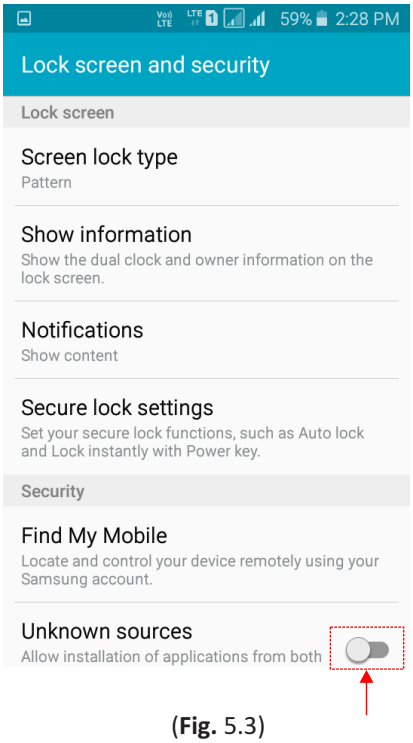


(**Fig.** 5.2)

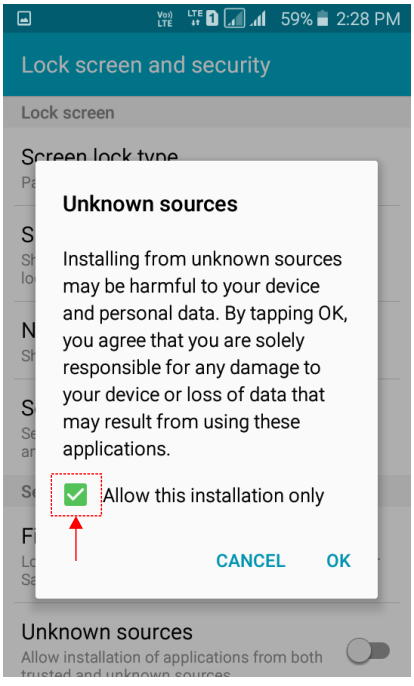
(IV) "On" unknown sources, Pop up window will appear as below. (Fig. 5.3)

Tick mark on "Allow this installation only "check box (indicated by arrow in below screen) and then click "OK". (Fig. 5.4)

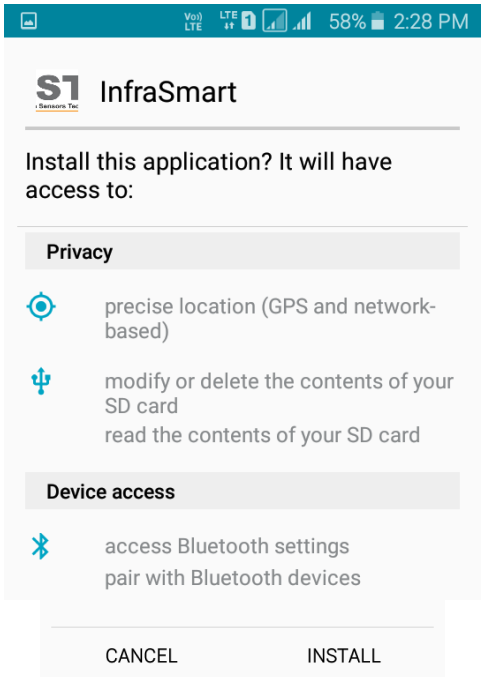
(V) Next click on Install tab (Fig. 5.5)



(**Fig.** 5.3)



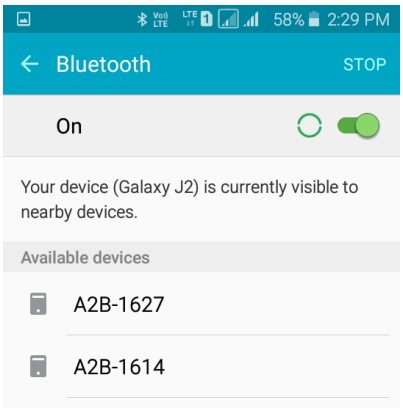
(**Fig.** 5.4)



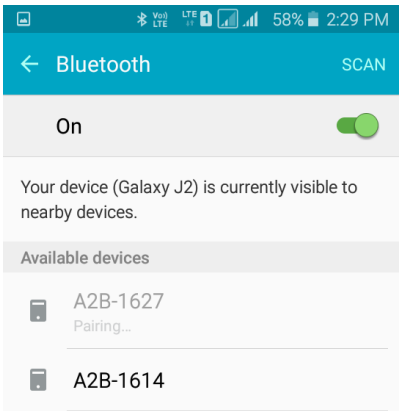
(**Fig.** 5.5)

5.2 Communication

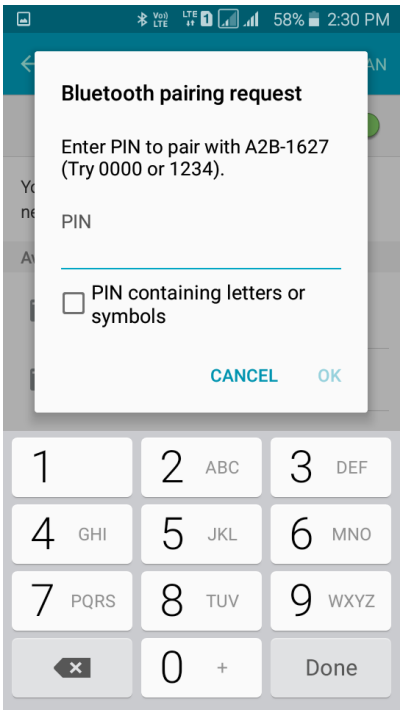
After installation, switch on Bluetooth of mobile. Scan for available devices. (Fig. 5.6)
Select the device name from list for pairing. (Fig. 5.7)
For pairing user need to enter pin no. Pin no will be reverse of last four digit of device name.(For eg:- if device name is A2B-1627 then pin will be 7261). (Fig. 5.8)



(**Fig**. 5.6)



(**Fig.** 5.7)



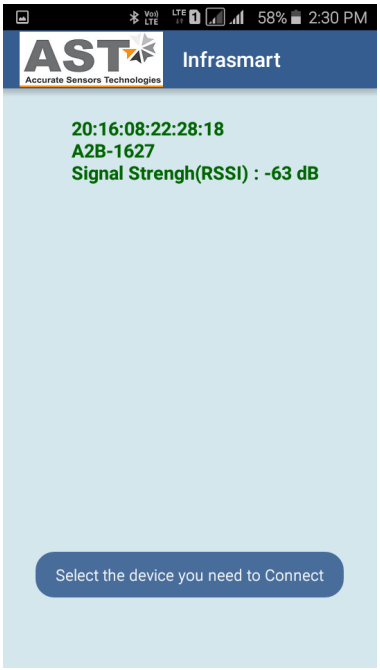
(**Fig.** 5.8)

Note: - Pairing require only one time until and unless it is not unpaired.

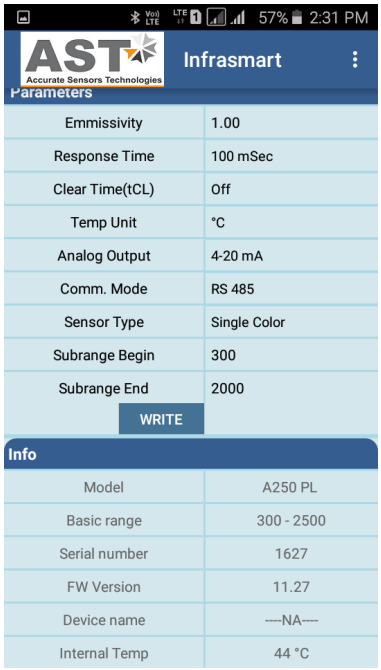
5.3 Operation

Open the Infrasmart application. Screen will appear as below, it will show all the devices which are paired. Select the device you need to connect. (Fig. 5.9)
Next screen will show all parameters of connected pyrometer. (Fig. 5.10)

Note: - Don't click any where on screen until all data is loaded.
For parameter setting refer Page no 12 (4.2.3)



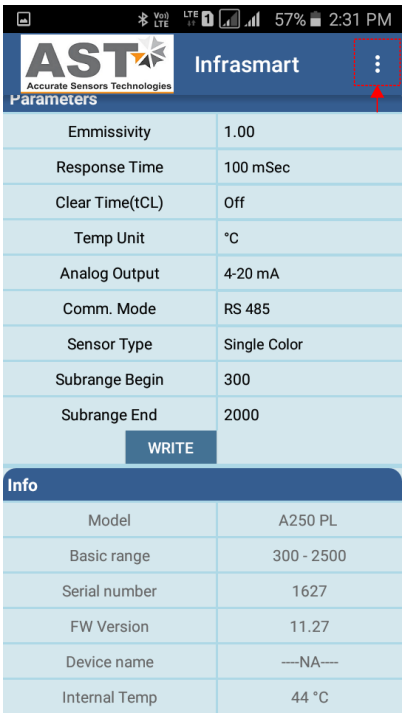
(**Fig.** 5.9)



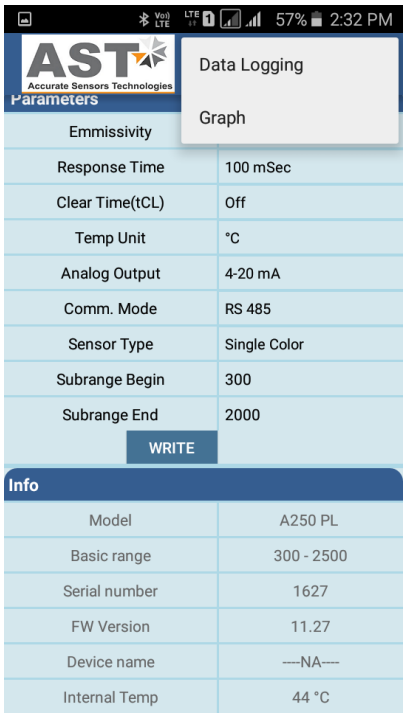
(**Fig.** 5.10)

5.4 Data logging & Online graph

For data logging user need to click on dots which is at the right side as shown by arrow in below screen (Fig. 5.11)
Next screen will be (Fig. 5.12)

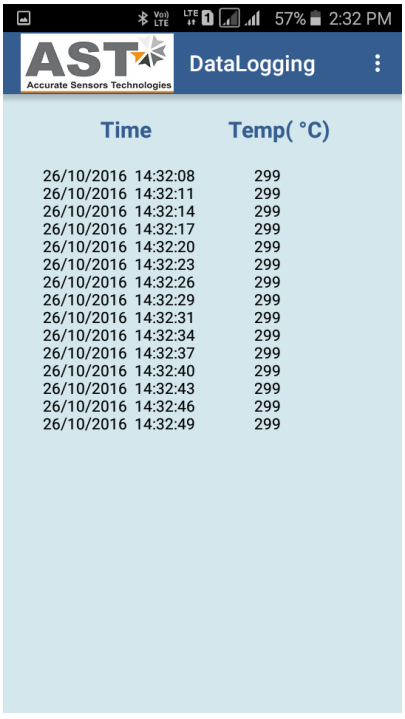


(**Fig.** 5.11)

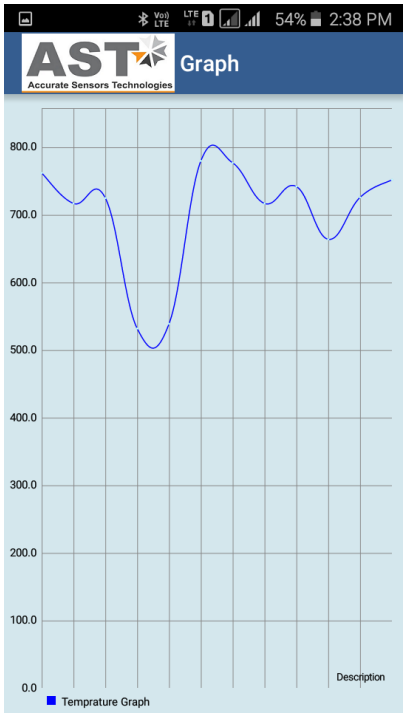


(**Fig.** 5.12)

For data logging click on data logging & to view online graph user can click on Graph(Fig. 5.13 & 5.14)

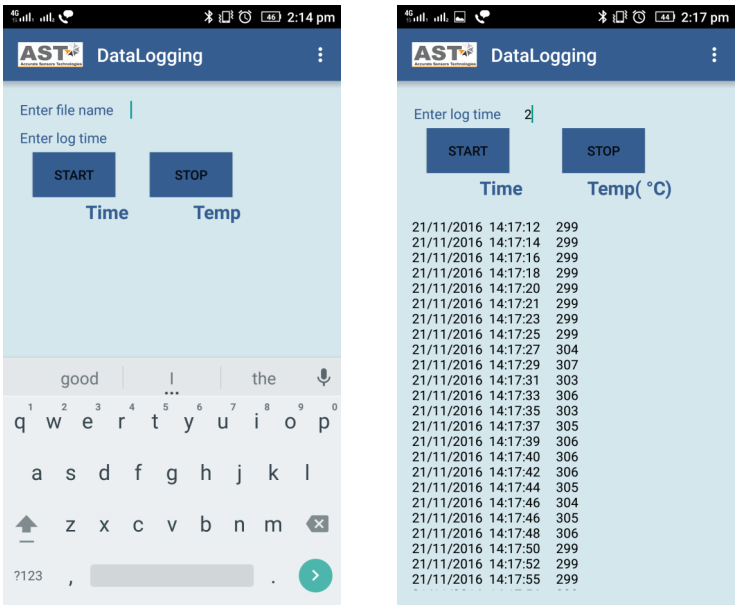


(**Fig.** 5.13)



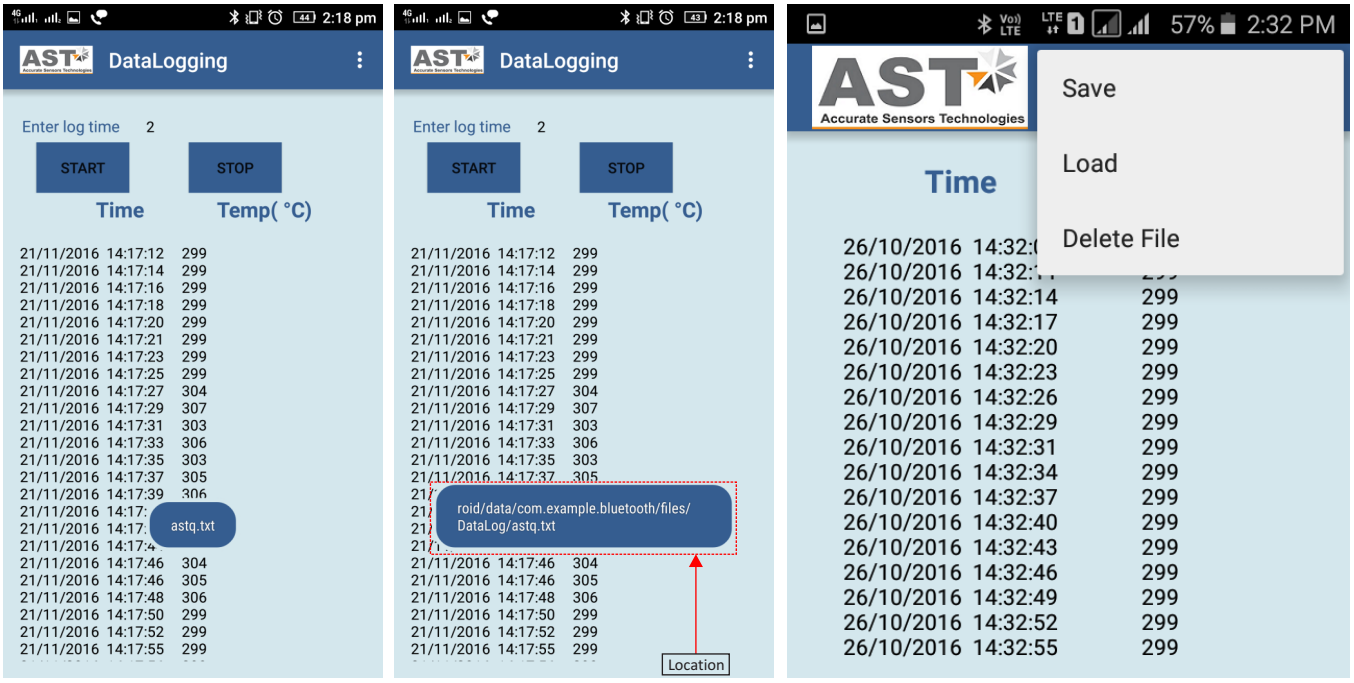
(**Fig.** 5.14)

To Start data logging, Enter file name & log time then click on start tab.



Note : If file name or log time is not enter within 5 sec then time out error will appear.

To save data logging click on save button.
Location where file is saved will be shown on data logging screen as shown(Fig. 5.15).



(**Fig.** 5.15)

To load file user need to enter file name

Basic Information Of Bluetooth

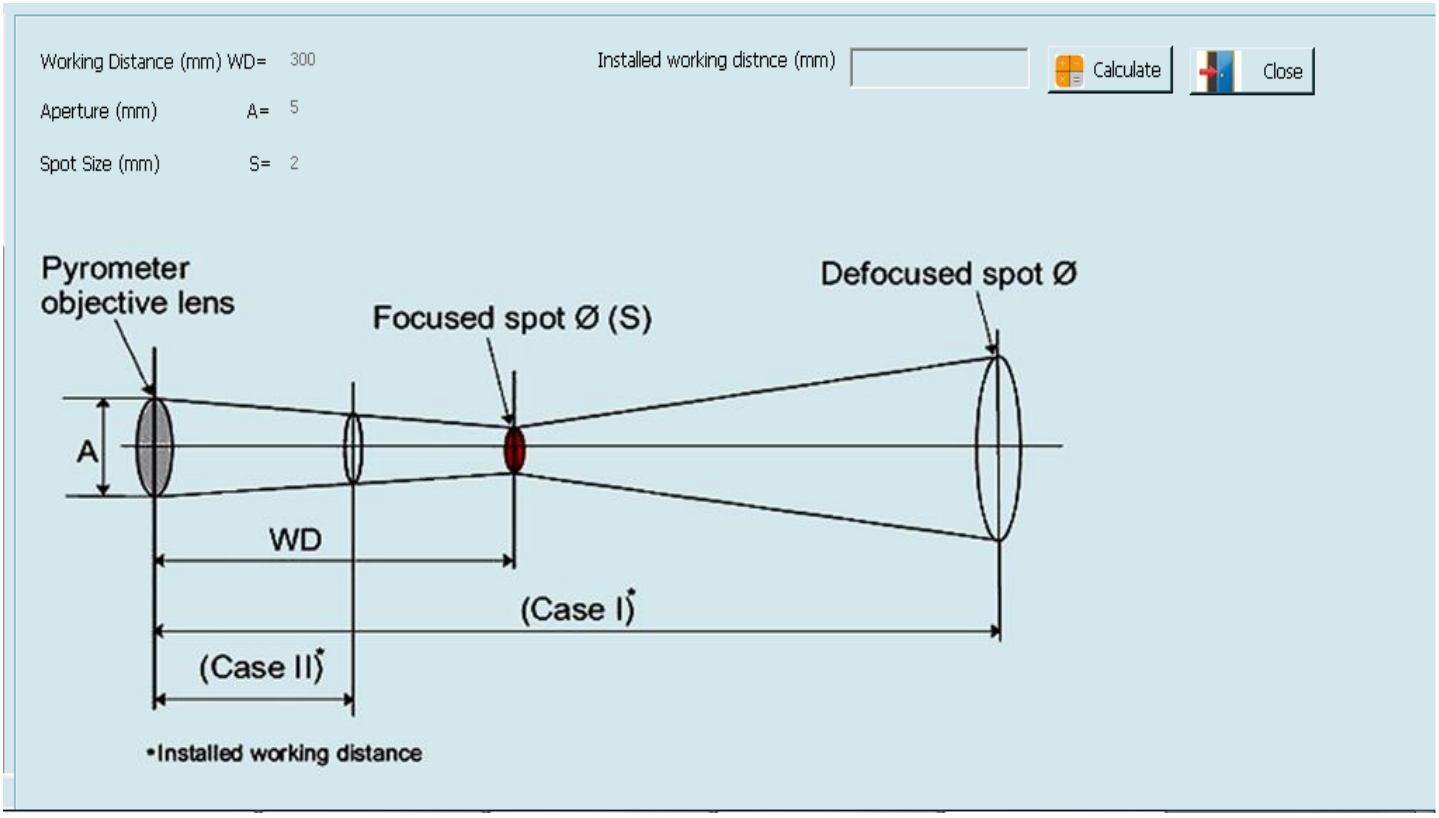
- Bluetooth Communication range is up to 5 meter in the line of site condition. Line of sight is a type of propagation that can transmit & receive data only where transmit & receive stations are in view of each other without any sort of an obstacle between them.
- Pyrometer works as a slave and mobile works as master.
- Pyrometer Bluetooth pair with multiple devices but can communicate with only single device at a time.

Chapter - 5

Calculate Spot Size

To calculate Spot Size click on ***Utility*** → ***Calculate Spot Size***

This option is used to calculate the spot size at installed working distance of the Pyrometer. When you click on calculate spot size the new window will open.



WD = Manufactured working distance in (mm).

A = It shows the value of lens opening (Aperture in mm)

S = Manufactured spot size of the pyrometer (mm)

User has to enter the value of WD, A, S, of the installed pyrometer (These values are given in section – 2.3). Now, putting the value of "Installed working distance" it will show the value of "Installed spot size".

Chapter - 6

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. AST sensors always operate as Slave devices. Using RS485 serial communication option allows connecting more than one sensor to Master device. AST sensors always perform delay of 5 ms before sending an answer on Master request to meet RS485 hardware requirement.

MT500_AST 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 “AST450C “', 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 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.

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 14-15
STX	0A	RD	059D	0000	9C
0x02	0x30, 0x41	0x52, 0x44	0x30,0x35,0x39,0x44	0x30, 0x30, 0x30, 0x30	0x39, 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
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
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, sales@astinfrared.com

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

AST A250C FO PL 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.

Limit of liability

AST not liable for any damages that arise from the use of any examples or processes mentioned in this manual.

Specifications are subject to change without notice

ABOUT US

AST - Accurate Sensing Technologies

Accurate Sensing Technologies along with 3T - True Temperature Technologies established in 1994 focusing on the development and commercialization of non-contact temperature measurement technologies.

Based on these technologies, AST/3T has bought to the market a line of pyrometers for the remote measurement of target temperatures using no physical contact. AST/3T pyrometers use a totally new approach for remote temperature measurement achieving high accuracy.

The following products are available from AST/3T

- Single color pyrometer
- Ratio (2 color) pyrometer
- Fiber optics with single color and two color pyrometer
- Multi wavelength pyrometer specially for Aluminum & other Non - ferrous application
- Black Body calibration sources
- Special system for automatic Isothermal Extrusion (MOMAS)
- Parameter setting Devices

AST

Accurate Sensing Technologies

www.astinfrared.com

AST - Accurate Sensors Technologies

Misgav Industrial Park,

Misgav 20174, Israel

Ph. : +972-4-9990025, Fax. : +972-4-9990031

E-mail: info@accuratesensors.com

AST - Accurate Sensing Technologies

188A, B-169 (Part), B-188 (A),

Road No. - 5, Mewar Industrial Area, Udaipur - 313003 (Rajasthan) INDIA

Phone : +91-9352506032

Email : sales@astinfrared.com