AST

$C\epsilon$

Accurate Sensing Technologies

We measure accurate temperature in extreme conditions

AST IR-CAST 2C
Non-contact Infrared Pyrometers

USER MANUAL

Index

Chapter - 1
General Information

Congratulations on choosing this high quality and highly efficient AST 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.

AST 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

AST 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 AST.

AST 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

All rights reserved . this document may contain proprietary information and shall be respected as a proprietary document to AST with permission for review and usage given only to the rightful owner of the instrument with which this document is associated.

Chapter-2

Introduction

AST IR-CAST 2C are specially designed highly accurate digital two-color rectangular measuring field IR pyrometers for non-contact temperature measurement specially used in foundries for molten metal.

2.1 Application, Range and Working Principle

The digital AST IR-CAST 2C pyrometer use ratio method in which 2 adjacent wave lengths are used for measurement of temperature. They are suitable for high temperature measurement ranging from 700°C to 1700°C.

AST IR-CAST 2C pyrometers are suitable for industrial purpose due to following advantages:

- The pyrometer gives accurate reading even when metal stream moves with in rectangular area.
- 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.

AST IR-CAST 2C has a fast response time of 20msec. Pyrometer have RS-232, RS-485 & USB 2.0 outputs. Response time, emissivity, sub range and peak picker selection can be preset ex works or adjusted 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. Two color pyrometer involves measuring thermal radiance at two different wavelengths and inferring the temperature from the ratio of these spectral radiances. Radiance ratio thermometers can be significantly more accurate than single band thermometers in many applications.

The application in which AST pyrometer can be used is:
- Molten Metal

If the target is within this rectangular area, it gives an accurate temperature reading even when liquid moves within this area.
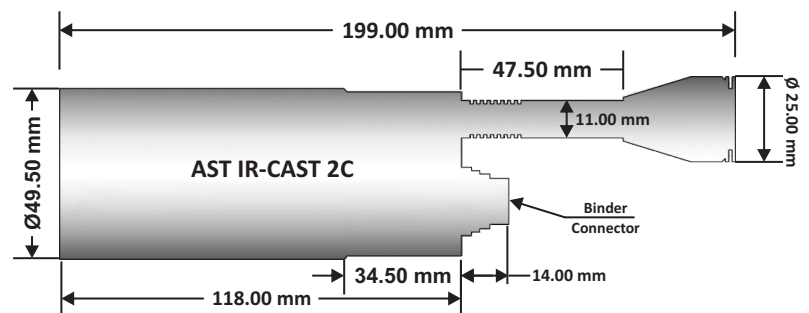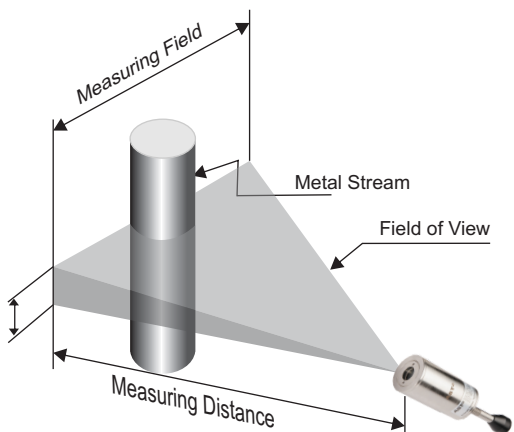
2.2 Technical Specifications

Model	AST IR-CAST 2C
Measured Temperature Range (Analog sub range adjustable)	700° - 1700°C
Emissivity Range	0.1....1 adjustable (for single color mode)
Emissivity slop	0.75....1.25 slop adjustable (for two color mode)
Spectral Range	single colour (1.0....1.15µm) two colour (0.7....1.15µm & 1.0...1.15µm)
Photodetector Type	Si / Si
Response Time	20msec. Adjustable upto 10 sec
Accuracy	± 0.5% +1°C of measured value
Repeatability	0.1% of reading in °C +1°C
Analog Output	4-20 mA or 0-20mA or 0-10 V User selectable
Digital Output	USB 2.0, RS-232 & RS-485 (Isolated) User Selectable
Distance to Spot Size Ratio	D_V = 166:1 (V = Vertical) D_H = 33:1 (H = Horizontal)
Power Supply	24V DC
Power Consumption	Max. 2.5 Watt.
Sighting	Through the lens sighting (TL)
Protection class	IP 65
Operating temperature range	0°C......70°C, 0°C......200°C(with cooling jacket)
Isolation	Power supply and digital output and analog output are galvanically isolated against each other
Operating humidity	10 - 95% non - condensing conditions
Dimensions/Weight	Dia. = Ø49.5 mm; Length = 118 mm / Weight = 0.6 kg
Adjustable Parameters via software	Emissivity, Emissivity Slope, Analog output, Address, Switch off limit, Response time, Peak picker, Analog output sub range, switches b\w 2-color or single color

Note :   1. After power supply initialization, keep pyrometer under stable temperature condition for 15 Min. to get above stated accuracy.

      2. Pyrometer instrument should be properly earthed before giving the power supply.

Standard Item supplied with AST IR-CAST 2C:-
- ☑ AST pyrometer
- ☑ Connection cable 12-core (length - 5 m)
- ☑ Digital cable 3-core (length - 1.5 m)
- ☑ USB cable
- ☑ AST software CD
- ☑ Manual
- ☑ Certificate of calibration

2.3 Optics

The pyrometer measure temperature by receiving heat radiation from the object whose temperature has to be measured. This heat radiation is passes through the lens to the sensor and is then converted to an electrical signal. The farther the measured object is from the pyrometer, the larger the area that will be measured by the pyrometer. Depending on customer need, the pyrometer is designed with fixed optics.

Some fixed optics focus is as below:-

Manufactured working distances WD (mm)	Spot Sizes (mm)		Measuring Field
	700° - 1700°C		
	FOV$_v$ 166:1	FOV$_H$ 33:1	
350	2.1	10.5	
500	3	15	
700	4.2	21	
1000	6	30	
2000	12	60	
3000	18	90	
5000	30	150	
Aperture (A)	4		

* Manufactured working distance (WD) mentioned on the pyrometer.

For Installed spot size calculation.

If the pyrometer is not installed at manufactured working distance (WD) then spot size at actual installed distance should be calculated.

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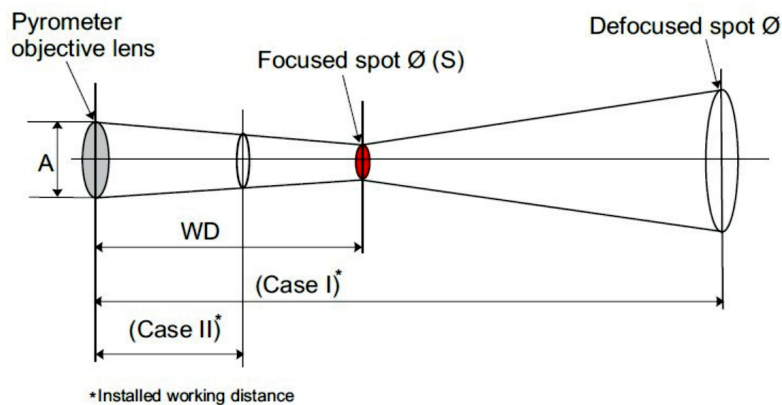
Case-I: *If installed working distance is greater than manufactured working distance*

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

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

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

For Installed spot size calculation, horizontal & vertical spot size should be calculated separately by putting the parameters from the fixed optics table.

(A) Vertical Spot Size Calculation for example, if factory made working distance is 1000mm & pyrometer is AST IR-CAST 2C(700° - 1700°C) then spot size is 30mm (as given in table). If user installed this pyrometer at 5000mm then spot size is not 150mm (as given in table), user should have to calculate as given method.

Installed spot size at 5000mm = (5000/1000) x (6 + 4) - 4 = 46mm

(B) Horizontal Spot Size Calculation For example, if factory made working distance is 1000mm & pyrometer is AST IR-CAST 2C(700° - 1700°C) then spot size is 6mm (as given in table). If user installed this pyrometer at 5000mm then spot size is not 30mm (as given in table), user should have to calculate as given method..

Installed spot size at 5000mm = (5000/1000) x (30 + 4) - 4 = 166mm

Final spot size should be

46mm

166mm
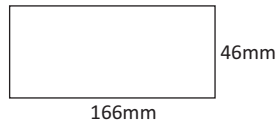
Chapter - 3

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. The minimum width of the pouring stream must be 33% of the width of the horizontal measuring width.
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).

Minimum Width of the Pouring Stream

Working distance(WD) (mm)	350	500	700	1000	2000	3000	5000
Width of the measuring area (mm)	10.5	15.0	21.0	30.0	60.0	90.0	150.0
Minimum width of the pouring stream (mm)	3.5	5.0	7.0	10.0	20.0	30.0	50.0

3.1.2 Correct Positioning of the pyrometer

With through the lens sighting (TL)

Measuring Area

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

For Molten Metal pouring

Note: The reticule rectangle *(TL) is only for indication of measuring area, not exactly shows the measuring area.*

3.1.3 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, it can be fastened correctly.
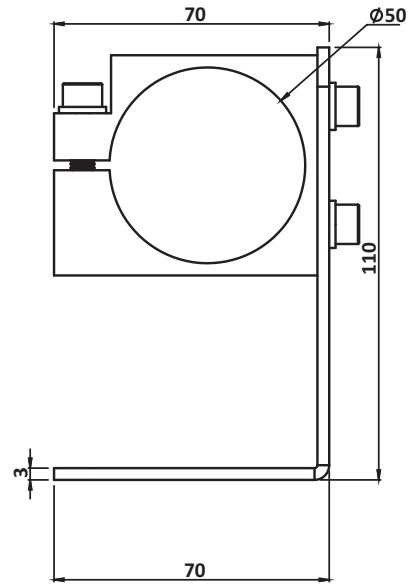
3.1.4 Ambient temperature

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 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.
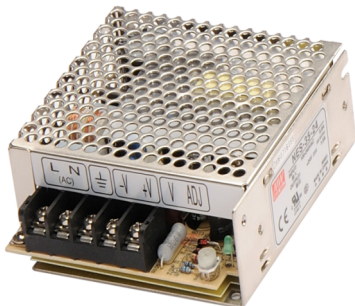
3.2 Mechanical accessories

Water pressure	:	< 10 bar
Air pressure	:	< 0.5 bar
Air consumption	:	2...3 m³/h
Ambient temperature	:	< 200°C
Metal	:	Stainless steel
Weight	:	2.75 Kg

Water Cooling Jacket with Adjustable Flange PL
(Reference no: 8000-02)

Water Cooling Jacket with Adjustable Flange TL
(Reference no: 8000-06)

Air pressure	:	< 0.5 bar
Air consumption	:	2...3 m³/h
Metal	:	Aluminium
Weight	:	0.15 Kg

Dry, clean air (Oil and dust free)

FOR 6 mm INSIDE
DIAMETER HOSE

GRUB SCREW FOR
FIXING PYROMETER

Air purge unit
(Reference no: 8000-04)

3 x M6 THRU AT 120°

Metal	:	Stainless Steel
Weight	:	0.9 Kg

Adjustable Mounting Stand
(Reference no: 8000-07)

Metal   : Stainless Steel
Weight   : 0.45 Kg

Adjustable mounting support
(Reference no: 8000-05)

3.3. Electrical Accessories

AST IR CAST 2C 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.
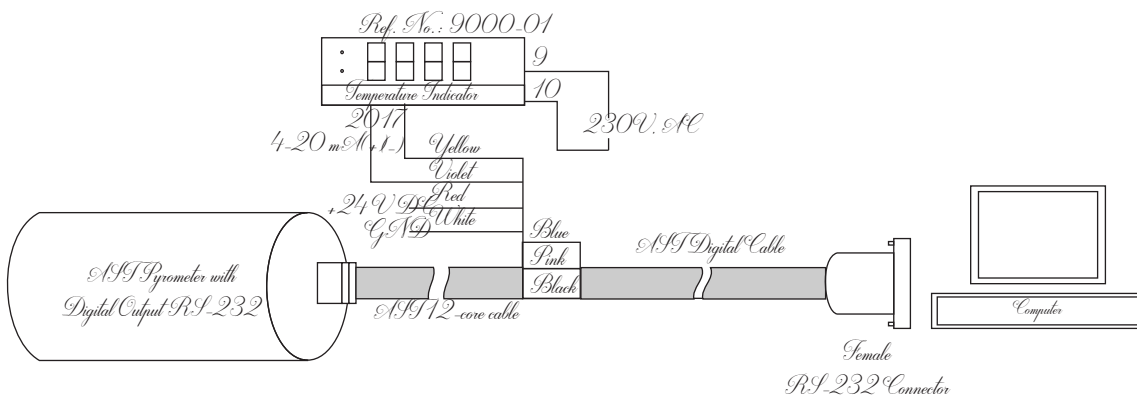
Device has following specifications
Power supply I/P   :   100 - 240VAC, 0.9A
                                 50/60 Hz
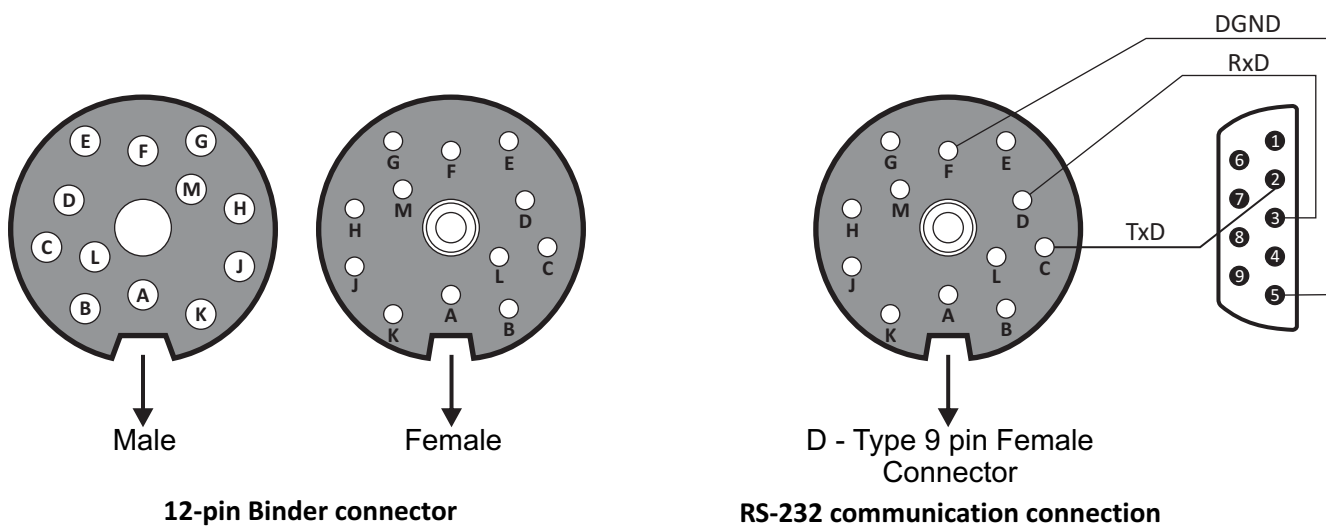Power supply O/P   :   +24V DC, 1.5 A

Power supply unit
(Reference no: 9000-02)

3.3.1 Connector pin assignment on the back of the pyrometer

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

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

Male   Female

RS-232 communication connection

D - Type 9 pin Female Connector

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.

Open screw for USB 2.0   LED Light

Note: If user requires IP65, then USB 2.0 cap must be screw fixed at the back.

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. Pyrometer instrument should be properly Earthed before giving the power supply.
4. Connect remaining wires as per your requirement (details given in table above).
5. Provide insulation for not used end points of 12-core cable.
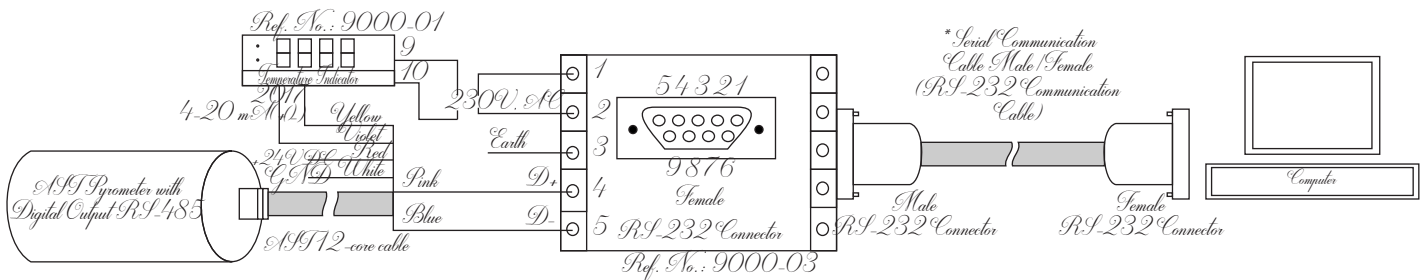6. Now, the pyrometer can be switch ON.
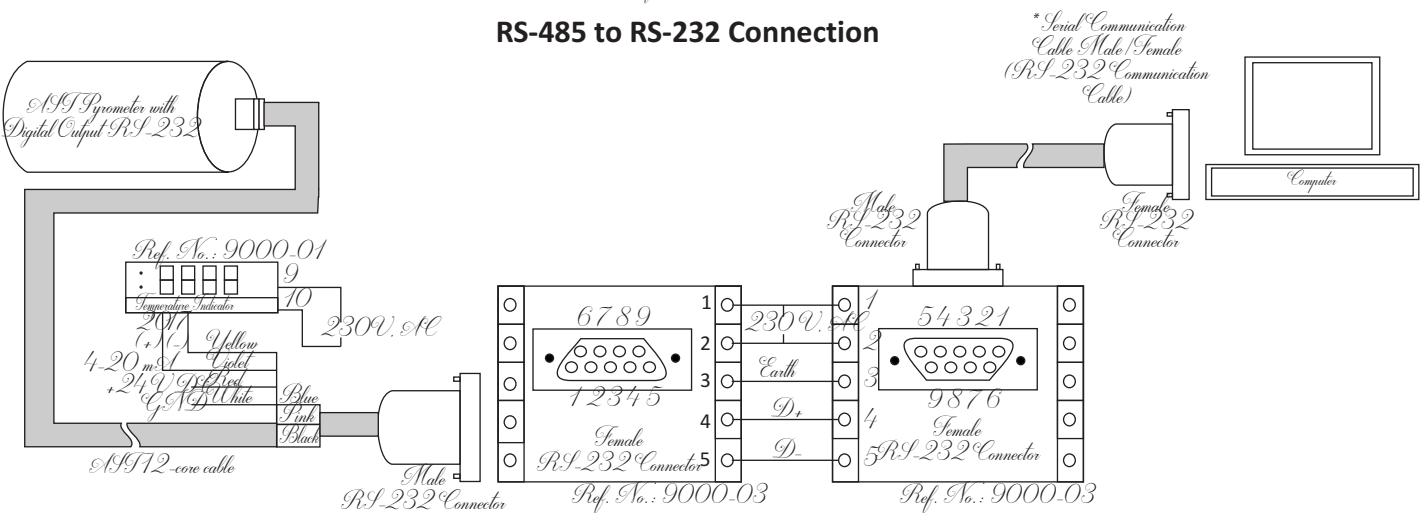
3.3.3 Converter RS-232 ↔ RS-485 :

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
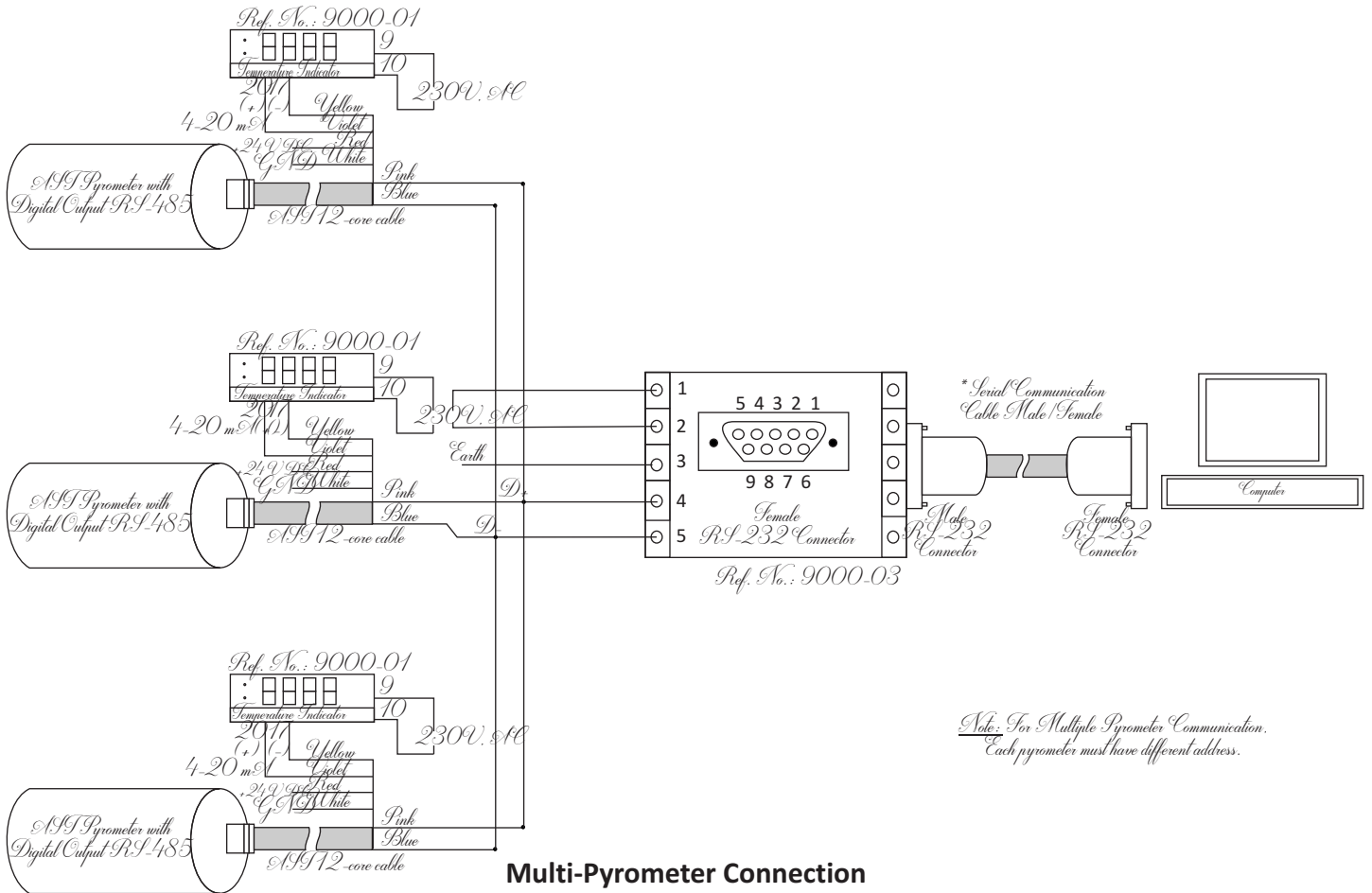(Reference no: 9000-03)**

RS-485 to RS-232 Connection

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

Multi-Pyrometer Connection

3.3.4 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

3.3.5 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 "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.

4.1 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.
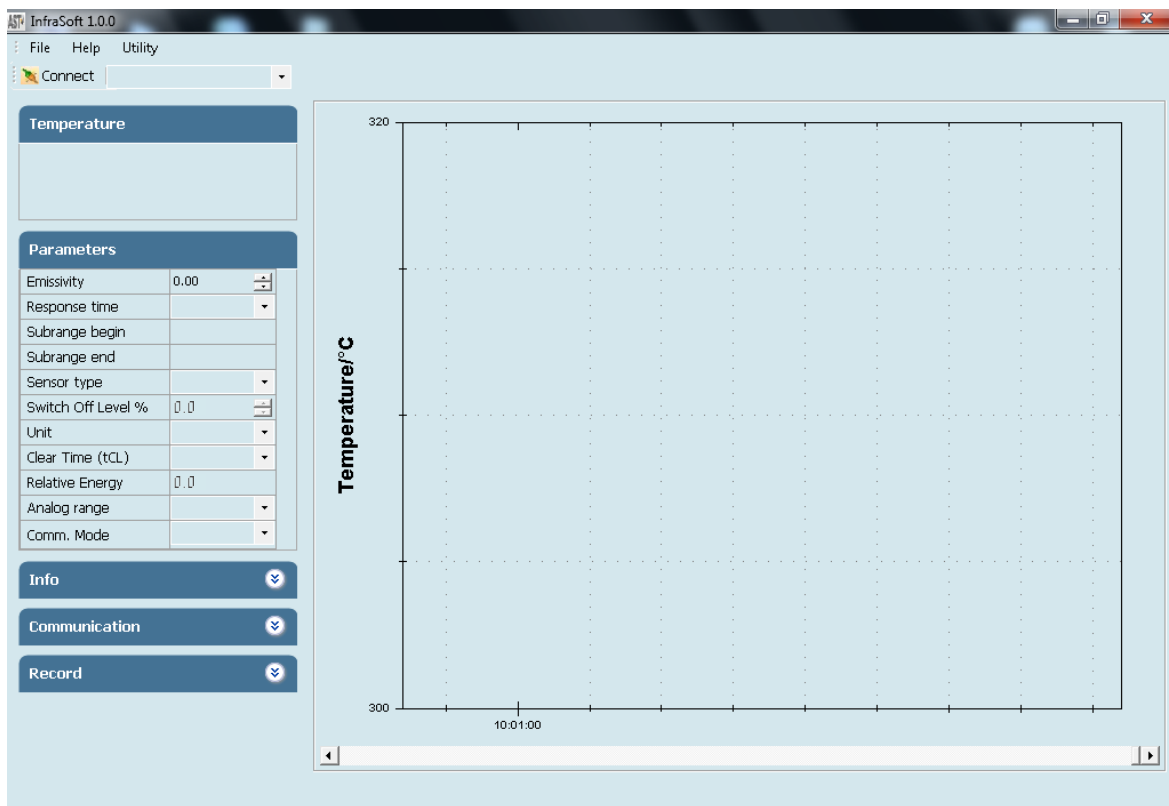
4.2 Parameters in main screen

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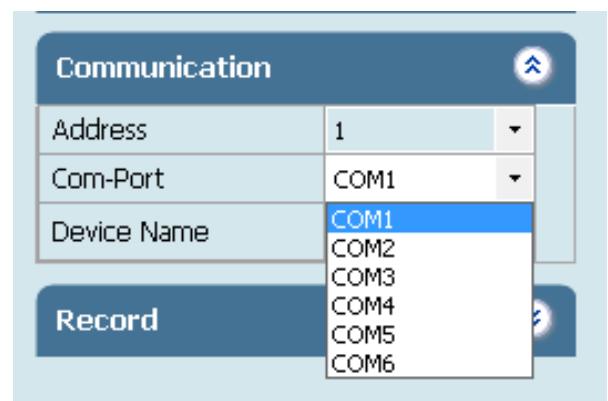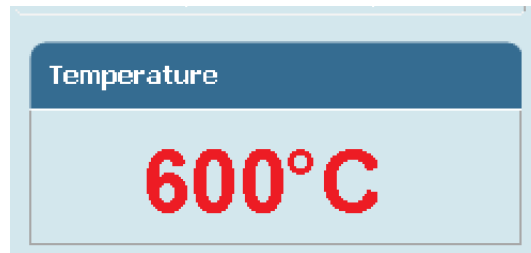
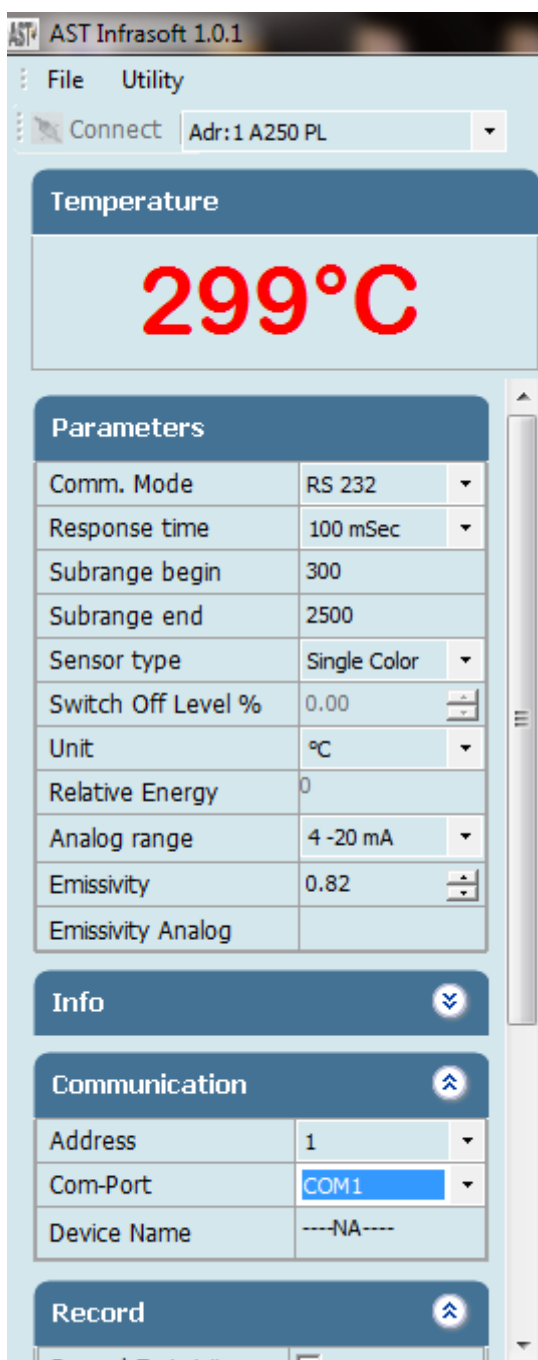For communication of multiple pyrometers, select different com port and address.

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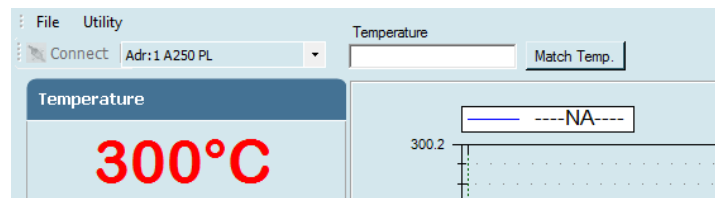
(C) Response time The desired response time can be chosen in the panel Parameter by clicking the appropriate list box (as per the values available in the drop box of response time). This parameter is use to set the analog response time of pyrometer.

(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.
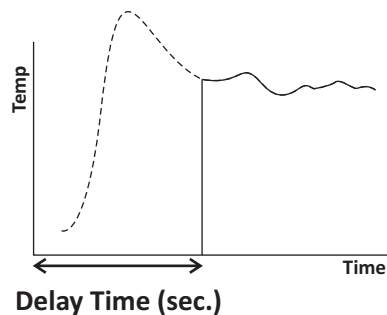
Peak Picker Functions :

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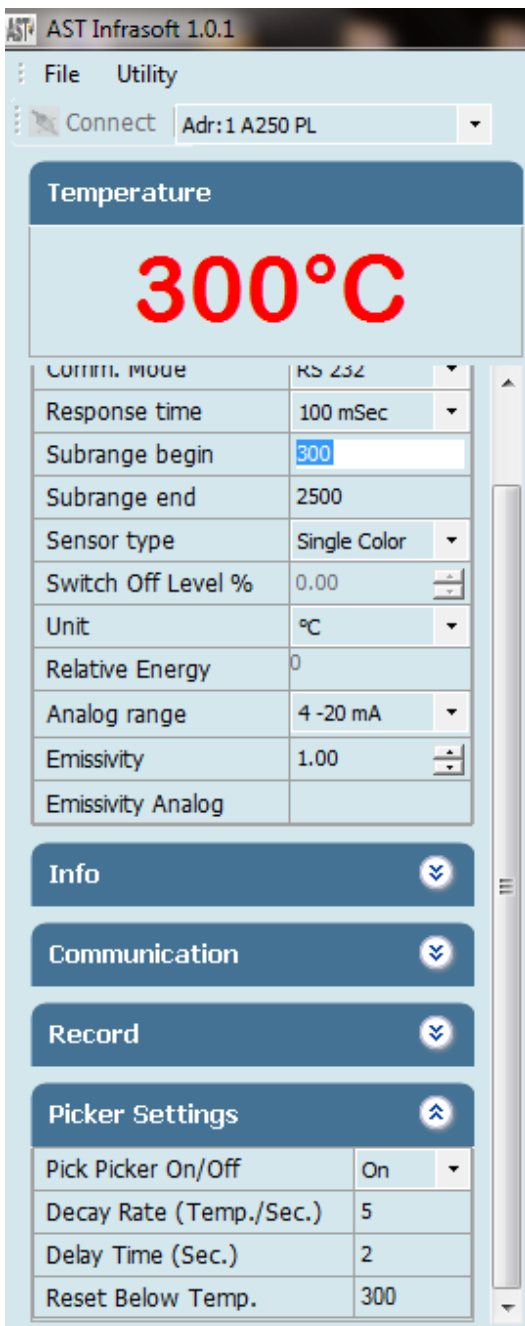
(I)Decay rate The Decay rate range is 0.00 to 166.66°C/sec. or 0.00 to 300°F/sec. depending upon °F/°C unit's selection. The slowest Decay rate is 0 degrees per sec. This feature helps to eliminate erratic measurements and allows the peaked value to decay down to lower process temperature values as they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

**Without Decay Rate**   **With Decay Rate**
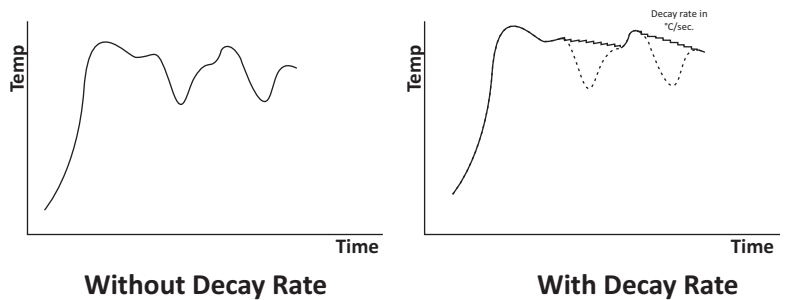
(II)Delay Time This function set the delay time in sec. before peak picker function starts. The delay time is selectable in the range 0.02 to 10.00 sec. Zero (0) turns delay time OFF. This function is used to delay the start of peaking action for upto 10 sec. following the detection of leading edge of 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**
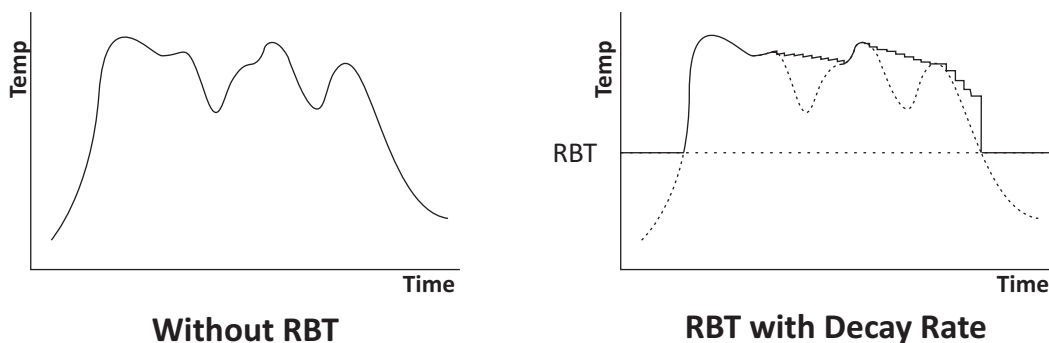
(H)Relative energy(for two color pyrometer) The relative energy shows a signal weakening which can be caused by contaminations of the optics or a viewing window or by dust in the field of view or a too small measuring object. Relative energy shows the measured intensity compared to the intensity, a black 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.

Info	
Model	AST A250 TL
Basic range	300°C...1300°C
Serial number	849
FW Version	11.25
Head Temp.	0°C
Internal temp.	30°C
Working Dist..(mm)	300
Spot Size-Aprt. (mm)	2-5

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 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.

To see previous record open the file by clicking on menu **File ────▶ open.**
Screen containing historical trend & historical data will appear.
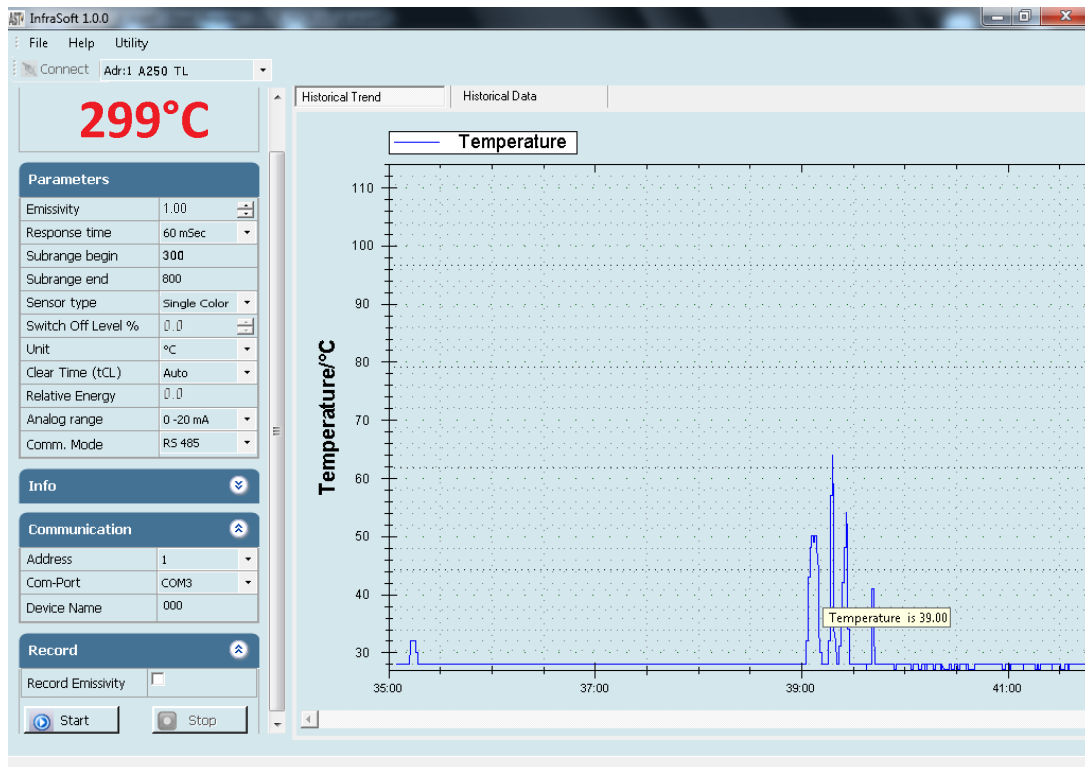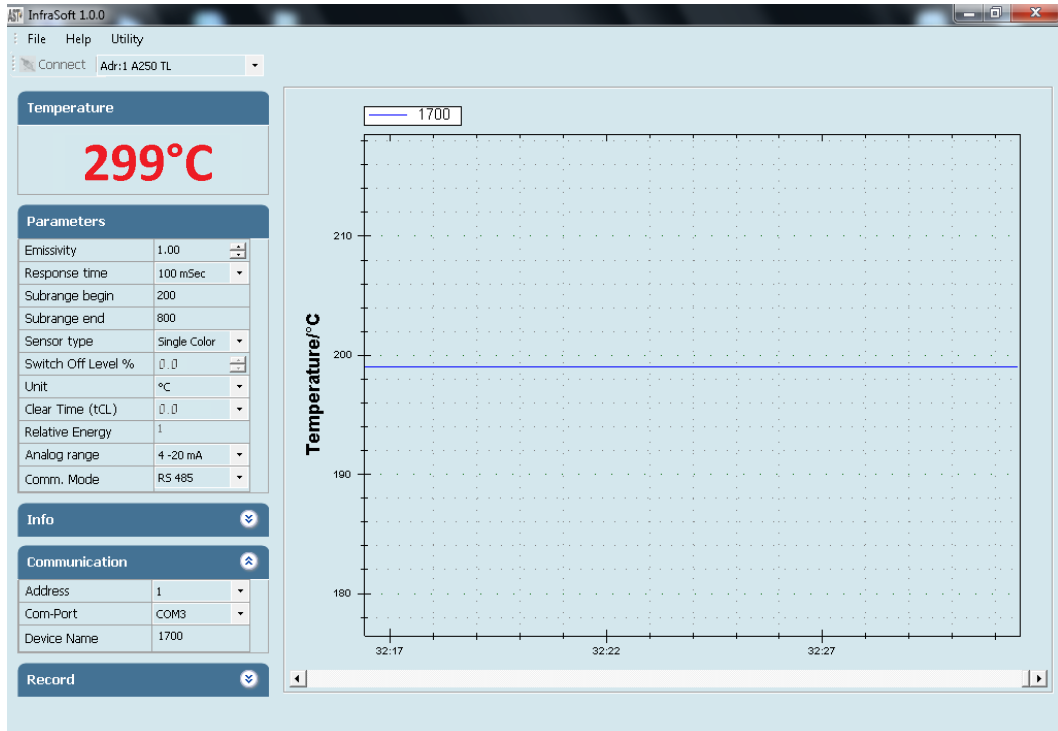
Temperature graph of connected pyrometer is displayed on right side of the screen. This shows the measured temperature corresponding to the time.

Note:
After connecting the pyrometer right click on the graph screen and choose "Set to default" option from pop-up menu.
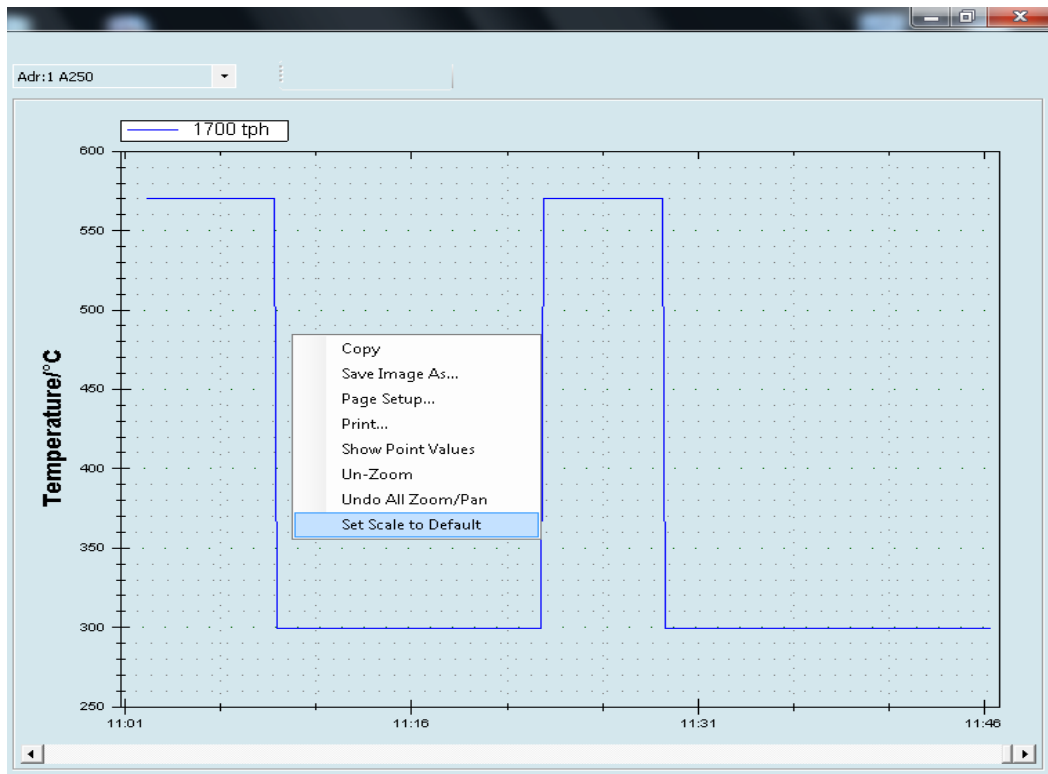
Chapter - 5
Calculate Spot Size

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 IR-CAST 2C 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

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