

**IMPAC Pyrometer
Series 140 with Ethernet TCP/IP Interface**



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1 General

This manual is supplemental to the standard Series 140 manuals and only contains information relevant to Ethernet use. It is not intended to be a standalone reference. For information about operating our Series 140 pyrometers, please refer to the standard Series 140 manuals.

1.1 Differences from the Series 140 Manual

- No onboard parametrizing or test button, only key for laser targeting light
- No serial interface RS232/485
- No external clearing of peak picker
- Interface Ethernet TCP/IP with baud rate 10/100 Mbit/s autodetect
- Ethernet-IP: 192.168.1.1 (setting ex works), Ethernet (MAC-Address)
- LC display shows temperature and emissivity (emissivity can be changed via Ethernet)
- Analog output 0/4 ... 20 mA
- Maximum ambient temperature 0 ... 60 °C
- 24 V AC (48...62Hz) or 12...30 V DC, approx. 4 VA
- Can be used with *InfraWin-ET*

1.2 Legend



Note: The note symbol indicates tips and useful information in this manual. All notes should be read to effectively operate the instrument.



Attention: This sign indicates special information which is necessary for a correct temperature measurement.



Warnings and Cautions: The general warnings and cautions symbol signifies the potential for bodily harm or damage to equipment.

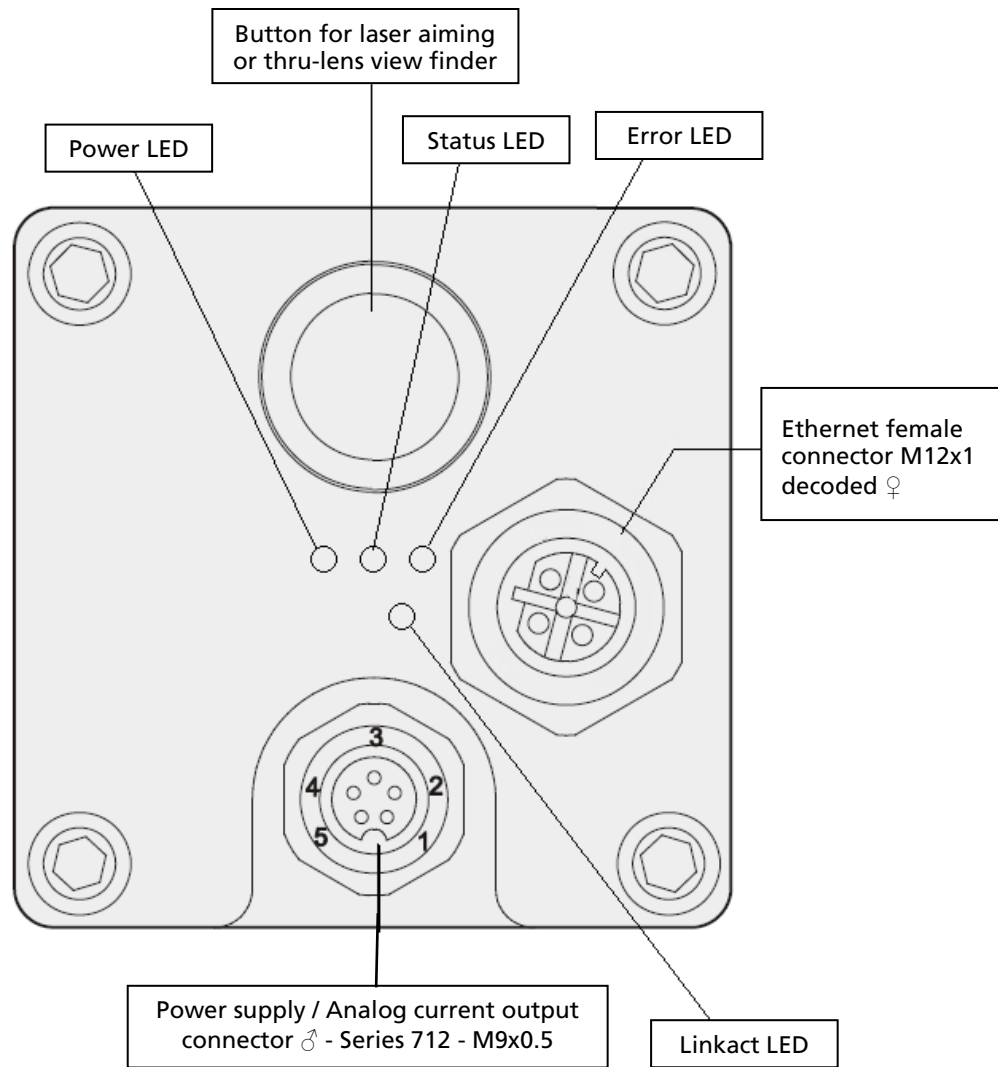
MB Shortcut for Temperature range (in German: **Messbereich**).

1.3 Terminology

The used terminology corresponds to the VDI- / VDE-directives 3511, part 4.

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2 Connections



2.1 Electrical Installation

2.1.1 Pin Assignment of the Male Socket

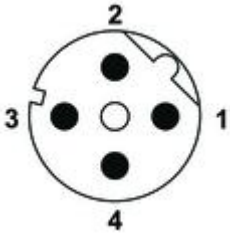
Pin	Color	Indication
1	Brown	0 V power supply
2	White	+ 24 V power supply (or 24 V AC)
3	Black	Screen only for cable extensions, don't connect at switchboard
4	Green	+ loutp. analog output
5	Yellow	- loutp. analog output

2.1.2 Bus Interface Connector

The Series 140 Ethernet Pyrometer is equipped with one M12 female connector d-coded for the Ethernet communication.

M12 Ethernet Pin Assignment

Pin	Wire Color	Signal	Indication
1	Yellow	TxD+	Transmission Data+
2	Orange	TxD-	Transmission Data-
3	White	RxD+	Data Ground
4	Blue	RxD-	Receiver Data+



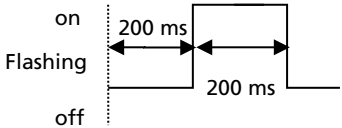
2.1.3 Bus Cable

The maximum permissible cable length between two Ethernet devices is 100 meters. Only Ethernet patch cables or crossover cables with quality level CAT5e or higher combined with an M12 connector system (D-type) may be used to connect Ethernet devices.

Cable type	Shielded Twisted Pair Standard
Line	Transmission properties in conformity with ISO/IEC 11801
Connection geometry	M12 D-coded in accordance with IEC 61076-2-101
Protection type	IP 65/67 (when connected)

2.1.4 LED Status Indicator

Status LED

Status	Description
LED continuous	"Ethernet ok", the communication between the control system and the pyrometer is established and the process data communication is active
LED flashing	 <p>No process data can be exchanged in this state. The pyrometer is located in the "config mode" and Ethernet is initialized.</p>

Link/Activity LED

Status	Description
OFF	No bus connection
ON	Connection is established, but no activity The instrument is on a fully functional network
Flashing	Connection and communication active

Error LED

Status	Description
OFF	Communication is ok
Flashing	Indicates internal errors of bus, configuration problems, or errors while initializing Ethernet

Power LED

Status	Description
OFF	Power OFF
ON	Indicates power is ok

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3 Ethernet

To use the Series 140 Ethernet pyrometers with a client system platform, independent commands and data in ASCII format can be exchanged via TCP/IP. The pyrometer was designed to act as a TCP/IP server.

The network settings can only be changed if the pyrometer is in polling mode.

3.1 Network-addresses, network-connections

After switching on, the pyrometer waits for data communication with a network participant and is always prepared to react to ICMP messages (e. g. PING Request and Reply). The functions of the ARP-protocol are also available.

3.1.1 IP-Address

The factory setting for the IP-address is 192.168.1.1, the IP-Address is modifiable by using the delivery software *"InfraWin-ET"*.

3.1.2 Netmask

If the IP-Address is outside of the IP-Address range and/or the IP-Address range is subdivided differently, the netmask must be modified using the software *"InfraWin-ET"*.

3.1.3 Data Port

The TCP-transfer to send and receive is realized using the data port "default 2000". Should this be a problem (e.g. due to a firewall), the port may be modified using the software *"InfraWin-ET"*.

3.2 TCP-connection setup

In the characteristic application in the TCP/IP-protocol, after switching on, the pyrometer is in the state "Passive Open" under an IP-Address and port number that was determined in the configuration. A connection must be established on the TCP/IP level before data can be exchanged. From this point onwards, commands can be sent from the client to the pyrometer.

After a successful connecting, a full duplex data connection is available. The data stream is protected by the TCP/IP-protocol in both directions.

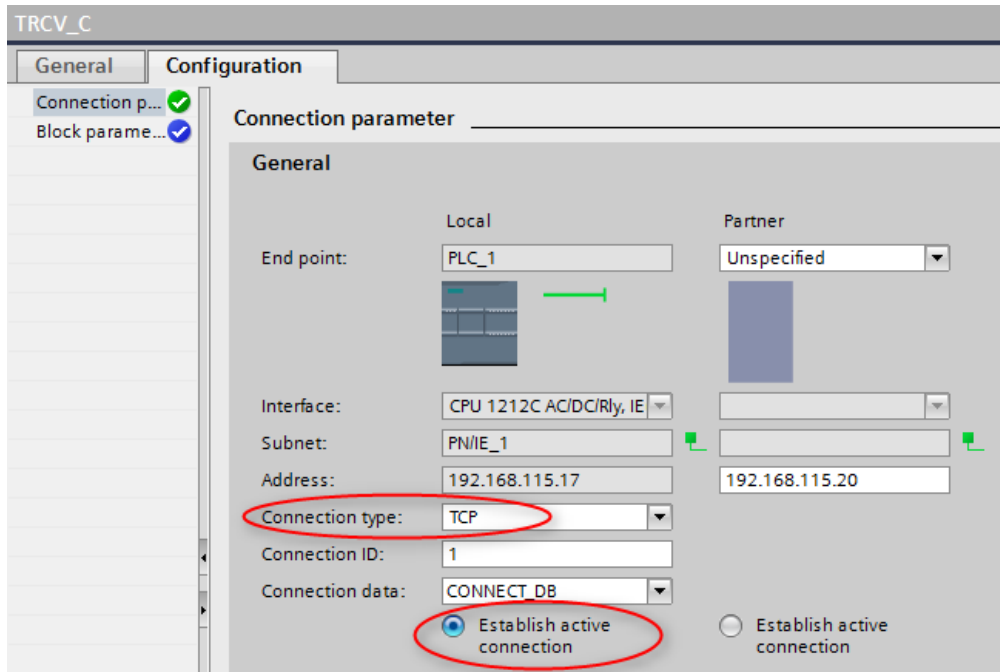
3.3 IT-Functions

The pyrometer also supports functions like Webserver and FTP functions. The IT functions can be used simultaneously with the Ethernet communication.

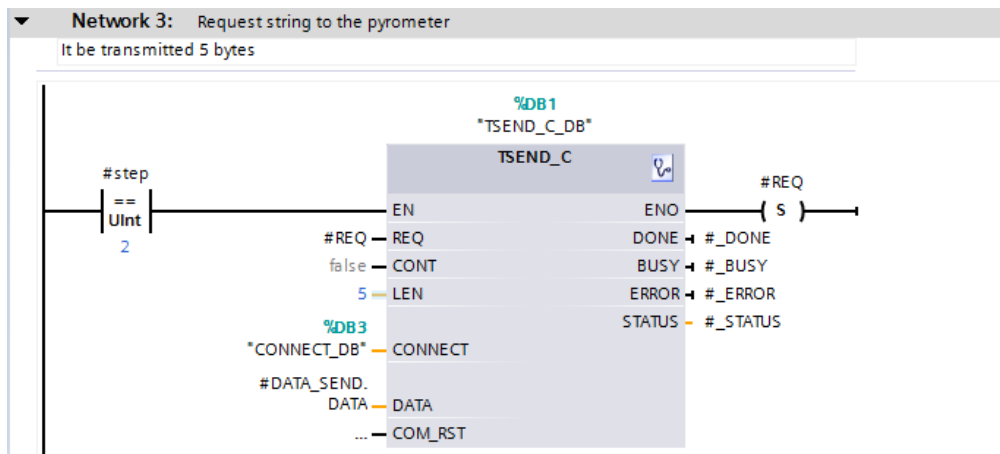
3.4 Example Program for a S7-1200

Any Ethernet based programming tool can be used for connecting the Series 140 Ethernet pyrometer. The following example shows how the pyrometer can be integrated into an Ethernet network. A Siemens PLC S7-1200 control system is used.

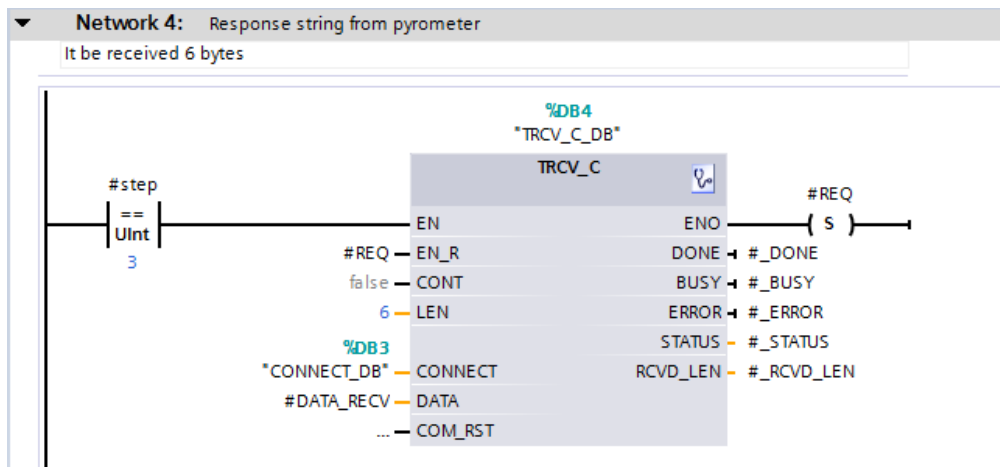
The pyrometer operates as a server and the Ethernet connection is established by the PLC. For a Siemens PLC, the following blocks are required. The function blocks TSEND_C and TRCV_C manage the client connection to the pyrometer. The two blocks simplify the implementation of a client application by encapsulating the functionality of three function blocks TCON, TDISCON and TSEND or TRCV.



Send request string to the pyrometer:



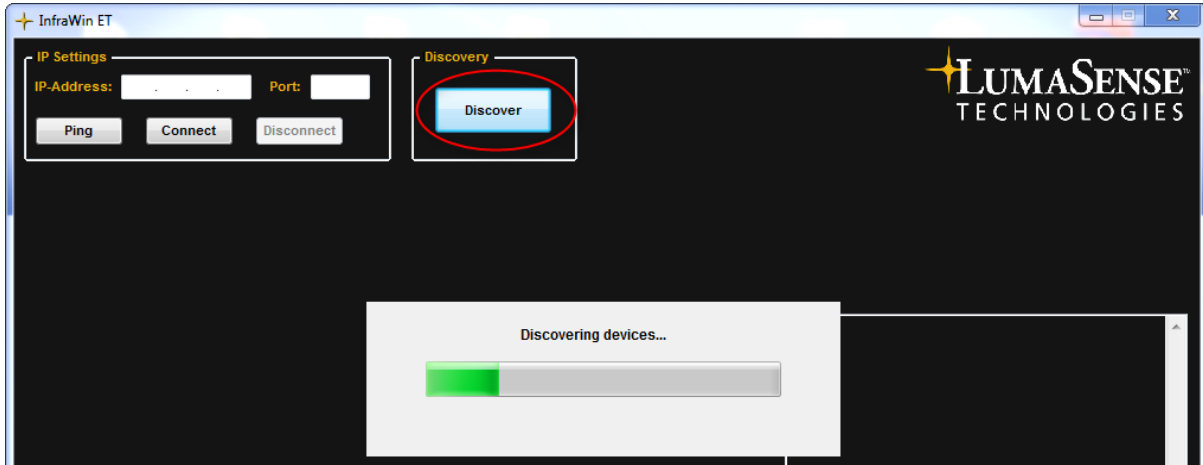
Receive Response string from pyrometer:



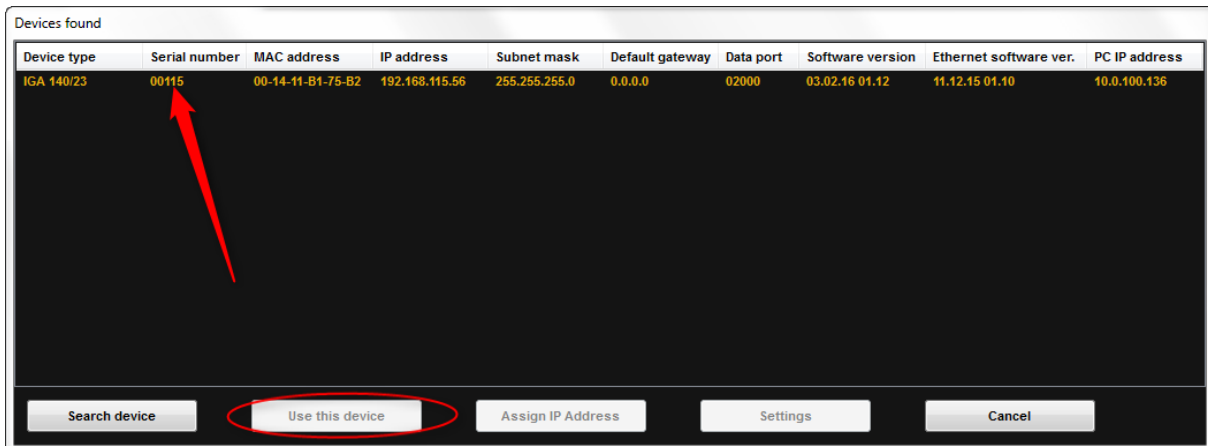
4 *InfraWin-ET*

For pyrometers of Series 140-ET a special version of the measurement and evaluation software *InfraWin* is available. This version, *InfraWin-ET*, can be used to read out and change various parameters of the instrument.

After starting the software, press the push button “Discover” to search for all connected pyrometers in the network.



All found pyrometers will then be listed on the screen.



Select the desired pyrometer by clicking on it and confirm your selection using the push button “Use this device”.

4.1 Operating modes

Using *InfraWin-ET* the operating mode of the software can be selected. Possible selection are:

Polling Mode

Burst Mode

Transparent Mode

4.1.1 Polling Mode

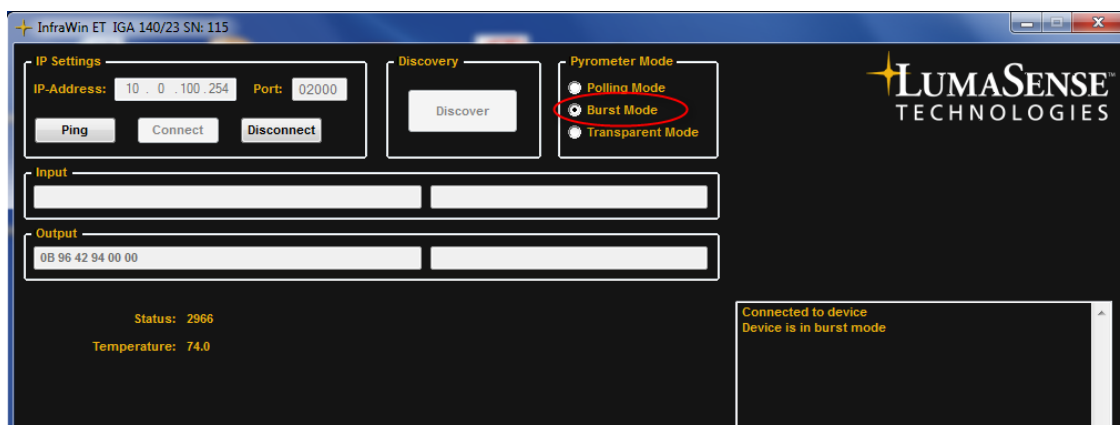
With the Polling Mode a data exchange will be started. The measuring temperature as well as the internal temperature of the pyrometer will continuously be read out.

Using the pull down menus, respectively the white input boxes various pyrometer parameters can be changed. The sample time can be set to values between 0 and 5 seconds using the slider.



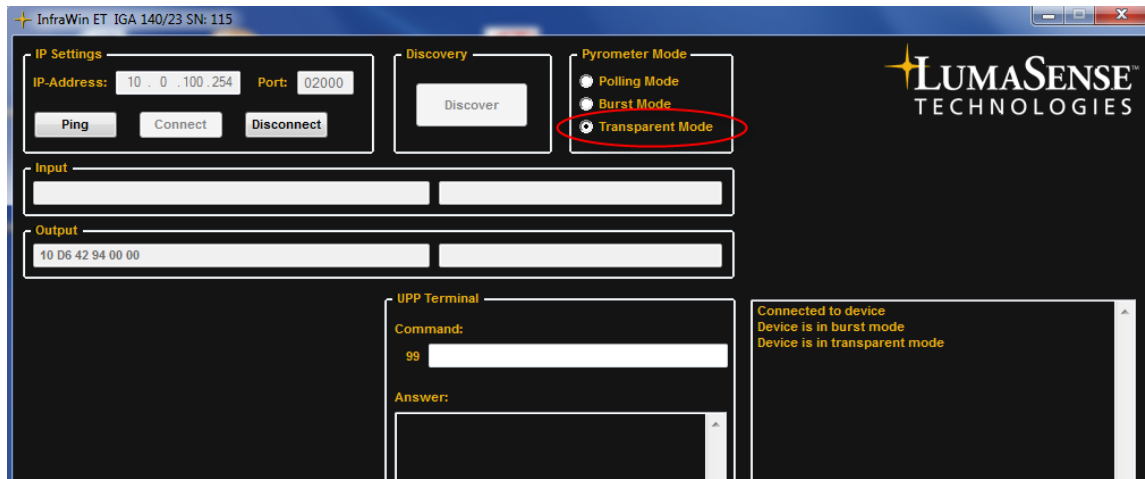
4.1.2 Burst Mode

In Burst Mode the current temperature value of the pyrometer is continuously transferred with maximal data transfer rate.



4.1.3 Transparent Mode

The Transparent Mode allows direct access to the pyrometer. Therefore the UPP command has to be sent as ASCII sequence according to the pyrometer's operation manual (without address byte), e.g. "ms".

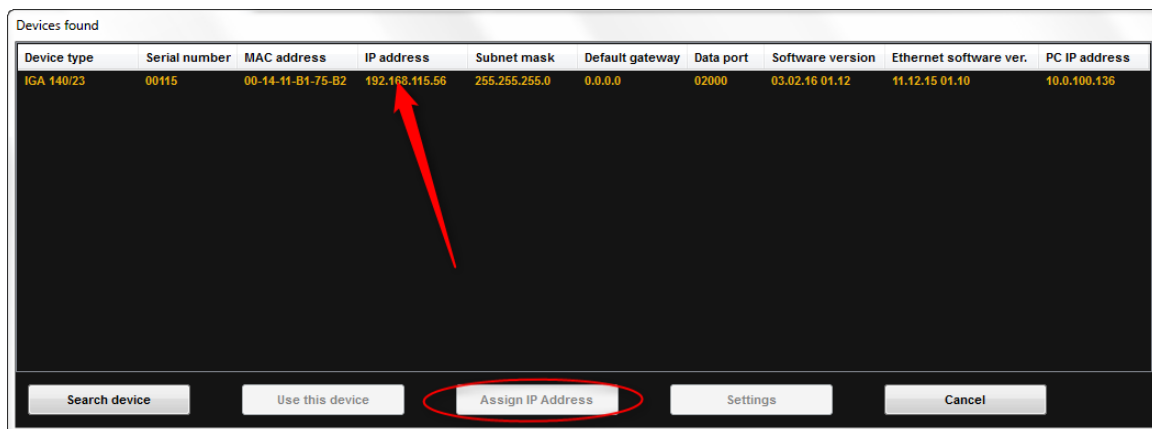


The connection to the pyrometer can be terminated by using the push button "Disconnect".

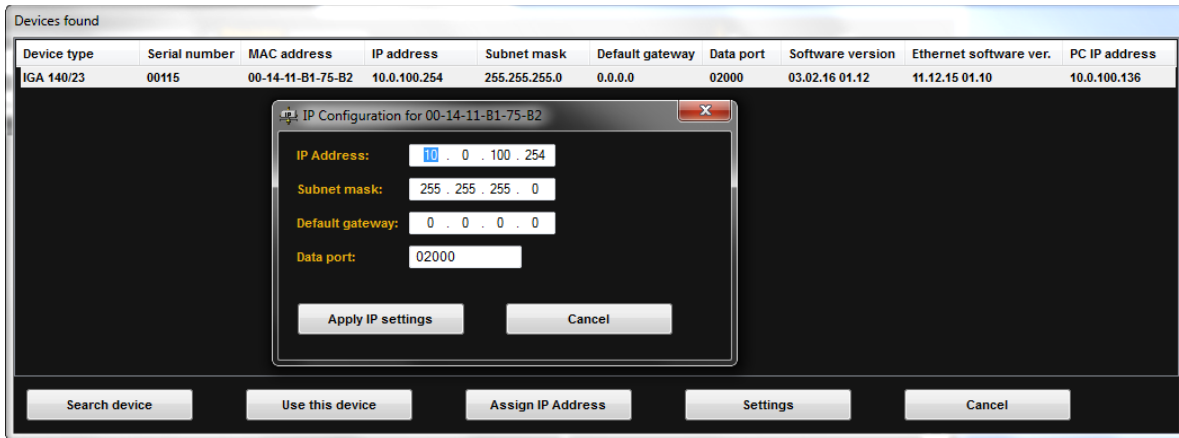
4.2 Change of the IP address

In order to change the IP address, first search for the pyrometer in the network by using the push button "Discover".

Then select the desired pyrometer by clicking on it and confirm your selection using the push button „Assign IP Address“.



In the following window the IP address can be changed.

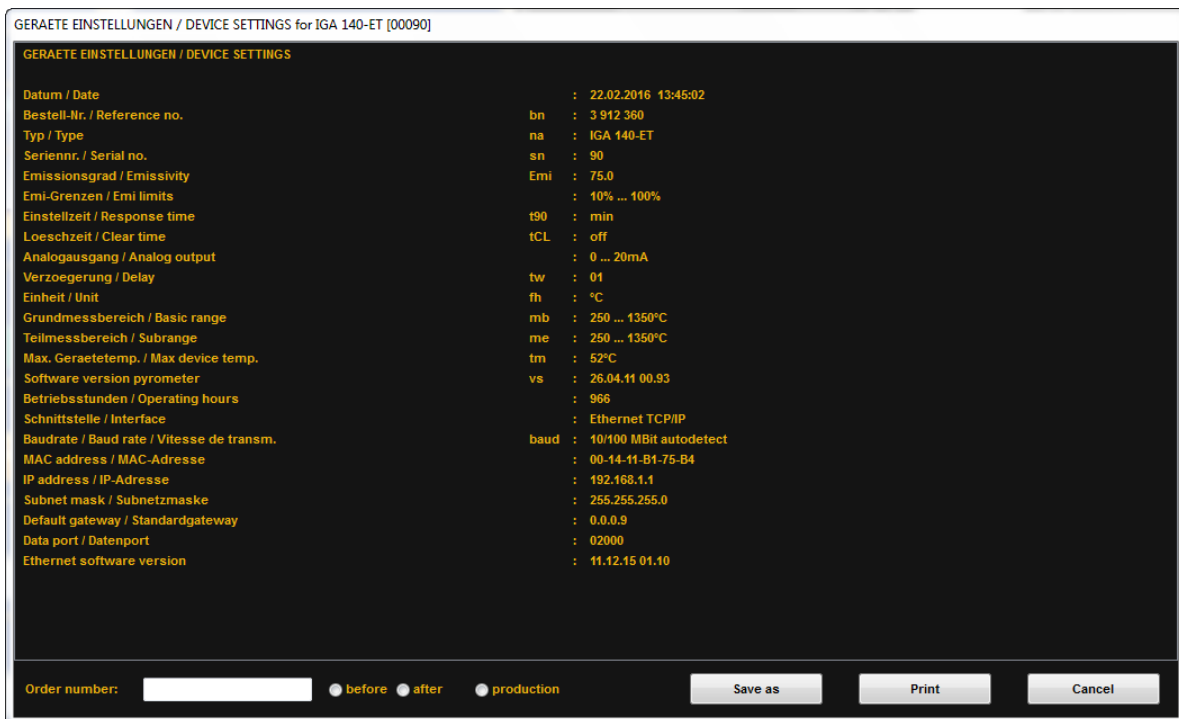


4.3 Display of pyrometer settings

In order to display the current pyrometer settings, first search for the pyrometer in the network by using the push button "Discover".

Then select the desired pyrometer by clicking on it and confirm your selection using the push button "Settings".

In the following window all current pyrometer settings will be displayed.



The setting can either be printed with the push button "Print" or can be saved with the "Save as" button.

5 Communication Modes and Boot-up Sequence

The pyrometer implements two separate communication modes, Polling mode and Burst mode, which are not active at the same time. The default mode of operation is the Polling mode and this is the mode the pyrometer always enters following power-up.

The two modes are not active at the same time, but the user can command the pyrometer to switch from one mode to the other. The details of each mode and how to switch between them is described in the following sections.

5.1 Polling Mode

The Polling mode is a polled protocol in ASCII format, which means that the control system sends a request message to the pyrometer to obtain a reading value and the pyrometer sends a response message containing the requested value.

5.1.1 Request string structure

The data exchange occurs in ASCII format. These commands are ignored in burst mode.

- The device responds to the entry of a command with: output (e.g. the measuring value) + CR (Carriage Return, ASCII 13), to pure entry commands with "ok" + CR, or "no" + CR.
- Every command starts with the 2-digit device address AA, followed by two lower case command letters, and finished with CR.
- The ASCII parameter "X" indicates a change to be made in a parameter. When used, the command contains the new value.
- A "?" after the lower case command letters answers with the limits of the respective settings (only at setting commands, not at query commands).

To take a look at the commands and a short description, please see Chapter 4.1.2.

Example: Entry: "00em" + <CR>
 The emissivity setting (ϵ) of the device with the address 00 is returned.

 Response string: "0970" + <CR>
 This means that the Emissivity = 0.97 or 97%

Description	Command	Parameters
Reading parameters:	AApa	Output 11-digit, decimal: Digit 1 und 2 (10...99 or 00): Emissivity Digit 3 (0 ... 6): Exposure time Digit 4 (0 ... 8): Clear time max. storage Digit 5 (0 ... 1): Analog output Digit 6 und 7: (00 ... 98): Internal temperature Digit 8 und 9 (00 ... 97): Address Digit 10 (0 ... 6 or 8): Baud rate Digit 11 (0,1, 3): Keyboard lock
Device type:	AAana	Output: "IS 140-ET", "IGA 140-ET", or "IGA 140/23-ET" (16 ASCII-characters)
Serial number:	AAasn	Output: XXXXX (dec. 5-digit)
Device type / software version:	AAave	Output: XYYZZ (6-digit decimal) XX = 65 YY = Month of software version ZZ = Year of software version
Detailed software version:	AAavs	tt.mm.yy XX.YY tt = day; mm = month; yy = year; XX.YY = software version
Reference number:	AAbn	Output: XXXXXX (hex 6-digit)



Note: The letter "l" means the small type of "L".

5.2 Burst Mode

The Burst mode establishes "streaming" data flow from the pyrometer with a selected sample rate to the user's control system. The simplicity of this protocol allows for the maximum data rate measurements. The data is "streaming" asynchronous and therefore the control system must receive it carefully. There are only limited commands supported in the Burst mode, such as "Start", "Stop" and "Setting the sample rate".

5.2.1 Data Format of Measuring Values in Burst Mode

Each recorded measuring value is transmitted as a TCP packet. The data values are represented always within the packets by 6 bytes.

Content	Format	Bytes	Function
Status	Word with sign	2	Each data package gets a new number to enable the client to recognize if data were read twice or if data packages were not read. Negative values (BIT15=1) identify a wrong data exchange with the pyrometer
Temperature	Float	4	Temperature in °C or °F depending on the Pyrometer type

5.2.2 Commands in Burst Mode

Each command starts with a \$ character and has to end with <CR>. These commands can be accessed in polling mode and burst mode.

Data Rate (TI = Sample Time)

Changes the sample time in ms for the measuring values transmission, the data rate acts only on the burst mode, in polling mode it has no effect. Initially the data rate is set to "0".

TI = Sample Time	
Command	"\$TIXXXX" + <CR> XXXXX = designated new sample time in ms Range = 00001...60000 (1ms to 60s) Example: "\$TI01000" + <CR> (It will set a sample time of 1s)
Response	"ok" + <CR> by correct request string "no" + <CR> by incorrect request string
Request the sample time	
Command	\$TI + <CR>
Response	"XXXXX" + <CR> The set sample time in ms

Change between Polling and Burst mode (IF = Interface)

Command switches between Polling and Burst mode. This command can also be used for starting and stopping of the burst modes.

IF = Interface	
Command	"\$IFX" + <CR> X = 0 Polling mode / Burst stop X = 1 Burst mode / Burst start
Response	"ok" + <CR> by correct request string "no" + <CR> by incorrect request string

Dataport (DP = Dataport)

Changes or reads the TCP dataport. The new dataport is activated after restarting the pyrometer.

DP = Dataport	
Command	"\$DPXXXXX" + <CR> XXXXX = designated new Dataport Range = 01024...65535 Example: "\$DP03000" + <CR> (It will set a dataport of 3000)
Response	"ok" + <CR> by correct request string "no" + <CR> by incorrect request string
Request the Dataport	
Command	\$DP + <CR>
Response	"XXXXX" + <CR> The set dataport

Ethernet Settings (IP = IP-Settings)

This command sets or requests the IP-Settings of the converter. The IP-Address, Subnet and Gateway must be valid in form a.b.c.d, with a, b, c, d from 0 to 255.



Attention: The IP-Settings will take effect immediately after the command is executed. The converter will perform a software reset and the new settings will be activated.

IP = IP Settings	
Command	"\$IPxxx.xxx.xxx.xxx yyy.yyy.yyy.yyy zzz.zzz.zzz.zzz" + <CR> xxx.xxx.xxx.xxx = IP-Address yyy.yyy.yyy.yyy = Subnet-Address zzz.zzz.zzz.zzz = Gateway-Address Example: "\$IP192.168.115.020 255.255.255.000 000.000.000.000" + <CR> "24 49 50 31 39 32 2E 31 36 38 2E 31 31 35 2E 30 32 30 00 32 35 35 2E 32 35 35 2E 32 35 35 2E 30 30 30 00 30 30 30 2E 30 30 30 2E 30 30 30 2E 30 30 30 0D" in hexadecimal
Response	no acknowledgment
Request settings	
Command	"\$IP" + <CR>
Response	"xxx.xxx.xxx.xxx yyy.yyy.yyy.yyy zzz.zzz.zzz.zzz" + <CR> The set IP-Settings

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6 Reference Numbers

6.1 Instrument Reference Numbers

Type	Temperature Range	Laser Targeting Light	Thru-lens View Finder
IS 140-ET	MB 14: 550 ... 1400 °C	3 912 100	3 912 110
IS 140-ET	MB 16: 600 ... 1600 °C	3 912 120	3 912 130
IS 140-ET	MB 18: 650 ... 1800 °C	3 912 140	3 912 150
IS 140-ET	MB 25: 750 ... 2500 °C	3 912 160	3 912 170
IS 140-ET	MB 33: 900 ... 3300 °C	3 912 180	3 912 190
IS 140-ET	MB 18 L: 550 ... 1800 °C	3 912 200	3 912 210
IGA 140-ET	MB 13: 300 ... 1300 °C	3 912 300	3 912 310
IGA 140-ET	MB 18: 350 ... 1800 °C	3 912 320	3 912 330
IGA 140-ET	MB 25: 450 ... 2500 °C	3 912 340	3 912 350
IGA 140-ET	MB 13.5 L: 250 ... 1350 °C	3 912 360	3 912 370
IGA 140-ET	MB 20 L: 300 ... 2000 °C	3 912 380	3 912 390
IGA 140-ET	MB 25 L: 350 ... 2500 °C	3 912 400	3 912 410
IGA 140/23-ET	MB 7: 50 ... 700 °C	3 911 610	3 911 620
IGA 140/23-ET	MB 9: 75 ... 900 °C	3 911 630	3 911 640
IGA 140/23-ET	MB 13: 100 ... 1300 °C	3 911 650	3 911 660
IGA 140/23-ET	MB 18: 150 ... 1800 °C	3 911 670	3 911 680

6.2 Cable Reference Numbers

Connection Cable	Reference Number
Cables for power supply and analog output, 5 m, with angled connector	3 821 070
Cables for power supply and analog output, 10 m, with angled connector	3 821 080
Cables for power supply and analog output, 15 m, with angled connector	3 821 090
Cables for power supply and analog output, 30 m, with angled connector	3 821 100
Cables for power supply and analog output, 2 m, with straight connector	3 821 750
Cables for power supply and analog output, 5 m, with straight connector	3 821 760
Cables for power supply and analog output, 10 m, with straight connector	3 821 770
Cables for power supply and analog output, 15 m, with straight connector	3 821 780
Cables for power supply and analog output, 20 m, with straight connector	3 821 790
Cables for power supply and analog output, 25 m, with straight connector	3 821 800
Cables for power supply and analog output, 30 m, with straight connector	3 821 810

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