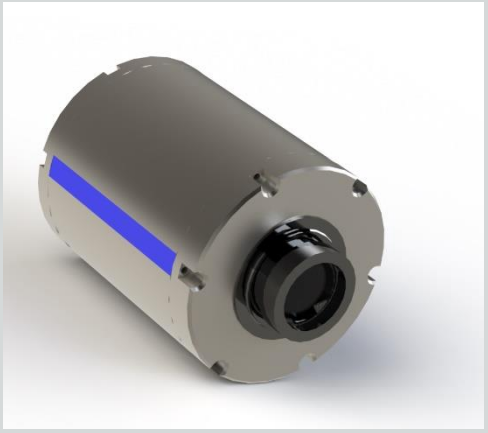
Operator's Manual

GRUPPO PEDERCINI HEALTHCARE DIVISION



TGBF1
Infrared Camera

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1 General Notes

1.1 Intended use

Thank you for choosing the TGBF infrared camera.
The TGBF calculates the surface temperature based on the emitted infrared energy of objects. The two-dimensional detector (FPA - focal plane array) allows a measurement of an area and will be shown as thermal image using standardized palettes. The radiometric processing of the picture data enables the user to do a comfortable detailed analysis with the software GP CONNECT.

The TGBF is a precise instrument and contains an extremely sensitive infrared detector and a high- quality lens.

The alignment of the camera to **intensive energy sources** (e.g. devices which emit laser radiation or reflections of such equipment) can cause an **irreparable defect of the infrared detec tor**. This is also valid if the camera is switched off.

Such kinds of damages are excluded from warranty.

Read the manual carefully before the initial start-up. The producer reserves the right to change the herein described specifications in case of technical advance of the product.

- Avoid abrupt changes of the ambient temperature.
- Avoid static electricity, arc welders, and induction heaters. Keep away from very strong EMF (electromagnetic fields).
- In case of problems or questions which may arise when you use the infrared camera, please contact our service department.

- All accessories can be ordered according to the referred part numbers in brackets [ ].

1.2 Warranty

Each single product passes through a quality process. Nevertheless, if failures occur contact the customer service at once. The warranty period covers 24 months starting on the delivery date. After the warranty is expired the manufacturer guarantees additional 6 months warranty for all repaired or substituted product components. Warranty does not apply to damages, which result from misuse or neglect. The warranty also expires if you open the product. The manufacturer is not liable for consequential damage or in case of a non- intended use of the product.

If a failure occurs during the warranty period the product will be replaced, calibrated or repaired without further charges. The freight costs will be paid by the sender. The manufacturer reserves the right to exchange components of the product instead of repairing it. If the failure results from misuse or neglect the user has to pay for the repair. In that case you may ask for a cost estimate beforehand.

1.3 Scope of delivery

- TGBF
  1 lens
- USB-cable: m (standard scope of supply, no IP67 protection class)
  m, 3 m, 5 m, 10 m, 20 m (optional, for industrial applications, with IP67)
- Table tripod
- Process interface cable incl. terminal block (1 m)
- Software package GP CONNECT
- Operators manual
- Aluminum case
- TGBF robust hard transport case (IP67)

1.4 Maintenance

Never use cleaning compounds which contain solvents (neither for the lens nor for the housing).

1.4.1 Cleaning

Blow off loose particles using clean compressed air. The lens surface can be cleaned with a soft, humid tissue (moistened with water) or a lens cleaner (e.g. Purosol or B+W Lens Cleaner).

1.5 Model overview

The cameras of the TGBF series are available in the following basic versions:

Model	Model code	Temperature range	Spectral range	Frame rate	Typical applications
TGBF	IR	-20 to 900 °C -4 to 1652°F 200 to 1500 °C 392 to 2732°F(optional)	8 - 14 µm	80 Hz	Real-time thermographic images in high speed; Detection of smallest temperature differences

Table 1: Model overview

2 Technical Data

2.1 General specifications

Environmental rating:	IP67 (NEMA-4)
Ambient temperature:	0...70 °C [32...158°F]
Storage temperature:	-40...70 °C (-40...85 °C [-40...158°F]
Relative humidity:	10...95 %, non-condensing
Material (housing):	Aluminum, anodized
Dimensions:	Ø40 x 100 - 125 mm (depending on lens and focus position)
Weight:	237-251 g (depending on lens)
Cable length (USB 2.0):	1 m (standard), 3 m, 5 m, 10 m, 20 m
Vibration[1)]:	IEC 60068-2-6 (sinus shaped) IEC 60068-2-64 (broadband noise)
Shock[1)]:	IEC 60068-2-27 (25 G and 50 G)

1) Used standards for vibration and shock:

IEC 60068-1:1988 + **Corr.** 1988 + **A1**: 1992 **DIN EN 60068-1**:1995-03 „Umweltprüfungen - Teil 1: Allgemeines und Leitfaden“
IEC 60068-2-6:2007 **DIN EN 60068-2-6; VDE 0468-2-6**:2008-10 „Umgebungseinflüsse - Teil 2-6: Prüfverfahren - Prüfung Fc: Schwingen (sinusförmig)“
IEC 60068-2-27:2008 **DIN EN 60068-2-27; VDE 0468-2-27**:2010-02 „Umgebungseinflüsse - Teil 2-27: Prüfverfahren - Prüfung Ea und Leitfaden: Schocken“
IEC 60068-2-47:2005 **DIN EN 60068-2-47**:2006-03 „Umgebungseinflüsse - Teil 2-47: Prüfverfahren - Befestigung von Prüflingen für Schwing-, Stoß- und ähnliche dynamische Prüfungen“
IEC 60068-2-64:2008 **DIN EN 60068-2-64; VDE 0468-2-64**:2009-04 „Umgebungseinflüsse - Teil 2-64: Prüfverfahren - Prüfung Fh: Schwingen, Breitbandrauschen (digital geregelt) und Leitfaden“

Figure 1: Used standards

Stress program (camera in operation):

Shock, half sinus 25 G – testing Ea 25 G (acc. IEC 60068-2-27)			
Acceleration	245 m/s^2	(25 G)	
Pulse duration	11 ms		
Number of directions	6	(3 axes with 2 directions each)	
Duration	600 Shocks	(100 Shocks each direction)	
Shock, half sinus 50 G – testing Ea 50 G (acc. IEC 60068-2-27)			
Acceleration	490 m/s^2	(50 G)	
Pulse duration	11 ms		
Number of directions	6	(3 axes with two directions each)	
Duration	18 Shocks	(3 Shocks each direction)	
Vibration, sinus shaped – testing Fc (acc. IEC60068-2-6)			
Frequency range	10 - 500 Hz		
Acceleration	29.42 m/s^2	(3 G)	

Frequency change	1 Octave/ min		
Number of axes	3		
Duration	1:30 h	(3 x 0.30 h)	
Vibration, broadband noise – testing Fh (acc. IEC60068-2-64)			
Frequency range	10 - 2000 Hz		
Acceleration	39.3 m/s^2	(4.01 G_{RMS}))	
Frequency spectrum	10 - 106 Hz	0.9610 $(m/s^2)^2/Hz$	(0.010 G^2/Hz)
	106 - 150 Hz	+6 dB/ Octave	
	150 - 500 Hz	1.9230 $(m/s^2)^2/Hz$	(0.020 G^2/Hz)
	500 - 2000 Hz	-6 dB/ Octave	
	2000 Hz	0.1245 $(m/s^2)^2/Hz$	(0.00126 G^2/Hz)
Number of axes	3		
Duration	3 h	(3 x 1 h)	

2.2 Electrical specifications

Power Supply:	5 VDC (powered via USB 2.0 interface)
Current draw:	Max 500 mA
AO: Output Standard Process Interface (TGIPI out)	0 - 10 V (Main measure area, measure area, internal temperature, flag status, recording status, line scan status, alarm, frame sync, fail-safe, and external communication)
AI: Input Standard Process Interface (TGIPI in)	0 - 10 V (Emissivity, ambient temperature, reference temperature, uncommitted value, flag control, triggered snapshots, triggered recording, triggered linescanner, triggered event grabber, reset peak-/value-hold, switch temperature range)
DI: Digital Input Standard Process Interface	Flag control, triggered snapshots, triggered recording, triggered linescanner, triggered event grabber, reset peak-/value-hold, switch temperature range
Digital interface:	USB 2.0

2.3 Measurement specifications

	TGBG1S	TGBF1H
Temperature ranges	-20...100 °C; 0...250 °C; (20) 150...900 °C[1]; Option: 200...1500 °C -4...212°F; 32...482°F (68) 302...1652°F; Option:392...3732 °F	
Sightingrange/lowenergyrange[2]	-	
Spectral range	8 - 14 µm	
Detector	UFPA, 382 x 288 pixel @ 80 Hz (switchable to 27 Hz)	
Lenses (FOV)	18° x 14° (F=1,1), 29° x 22° (F=0,9), 53° x 38° (F=0,9); 80° x 54° (F=0,9)	
System accuracy [3]	±2,0°C / ±2,0% for body 0,3°C ±35,6°F / ±2,0% for body 32,54°F	
Thermal sensitivity (NETD):	75 mK[4] with 29°, 53° and 80°; 0.1 K[4] with 18°	40 mK[4] with 29°, 53° and 80°; 60 mK[4] with 18°
Warm-up time	10 min	
Emissivity	0.100...1.100	
Software	GP CONNECT	

[1] Accuracy statement effective from 150 °C (302°F)

[2] The sighting range is used to align the cameras; at ε<1 and activation of the extended temperature range a temperature measurement up to 1500 °C (2732°F) is possible

[3] At ambient temperature 23±5 °C (73,4 ±9°F); whichever is greater

[4] Value is valid at 40 Hz and 25 °C (77°F) room temperature

2.4 Optical specifications

- Make sure that the focus of thermal channel is adjusted correctly. If necessary, focus the thermal imaging camera with the optics. The turning out of the optics leads to the focus setting "near" and the turning in of the lens to the focus setting "infinity".
- The visual camera is adjusted with the supplied focusing tool. For this purpose, the focusing tool with the two pins is placed on the visual camera and is focused to "near" by a left turn and focused to "infinity" by a right rotation.

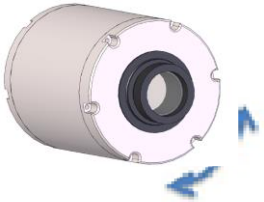


Figure 2: Focusing by turning the exterior lens ring of camera

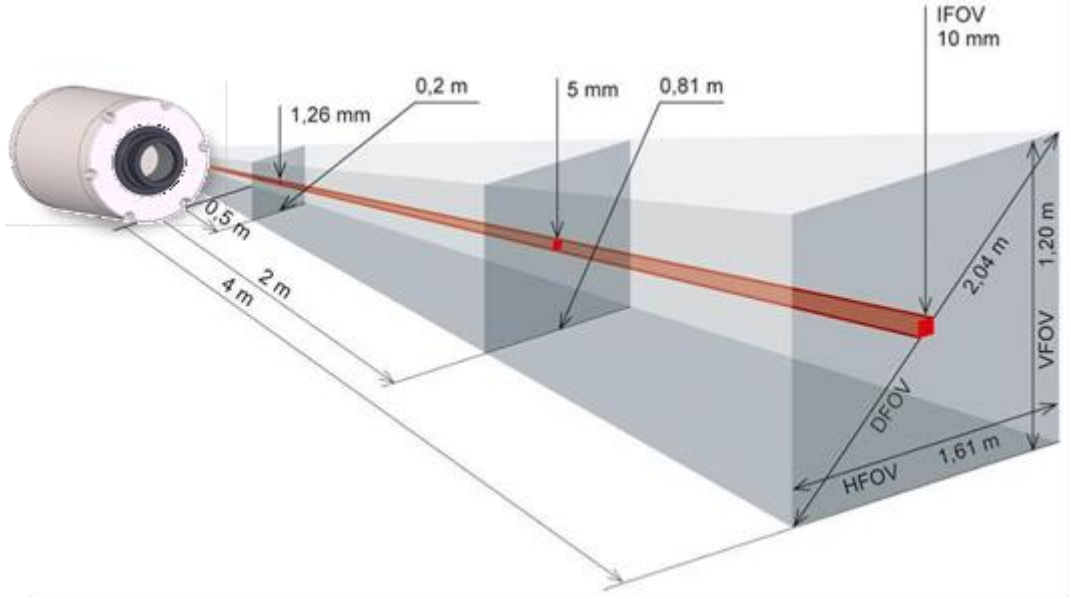


Figure 3: Measurement field of the infrared camera TGBF representing the 23° x 17° lens

- **HFOV**: Horizontal enlargement of the total measuring at object level
- **VFOV**: Vertical enlargement of the total measuring at object level
- **IFOV**: Size at the single pixel at object level
- **DFOV**: Diagonal dimension of the total measuring field at object level
- **MFOV**: Recommended, smallest measured object size of 3 x 3 pixel

The following tables with examples showing what spot sizes and pixel sizes will be reached in which distance. For individual configuration there are different lenses available. Wide angle lenses have a radial distortion due to their large opening angle; the software GP CONNECT has an algorithm which corrects this distortion. As an alternative to the tables below, the optics calculator can also be used on the website.

Table 2:

382 x 288 px	Focal length [mm]	Minimum measurement distance*	Angle	Distance to measurement object [m]											
					0.02	0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
O29 Standard lens	13	0.35 m	29°	HFOV [m]		0.057	0.111	0.16	0.27	0.53	1.06	2.1	3.2	5.3	15.7	52.5
			22°	VFOV [m]		0.042	0.081	0.12	0.20	0.40	0.80	1.6	2.4	4.0	11.9	39.6
			37°	DFOV [m]		0.071	0.137	0.20	0.34	0.67	1.32	2.6	4.0	6.6	19.7	65.7
			1.3 mrad	IFOV [mm]		0.1	0.3	0.4	0.7	1.3	2.7	5.4	8.0	13.4	40.2	133.9
O13 Telephoto lens	20	0.45 m	18°	HFOV [m]			0.066	0.099	0.16	0.33	0.65	1.3	1.9	3.2	9.7	32.4
			14°	VFOV [m]			0.050	0.075	0.12	0.25	0.49	1.0	1.5	2.5	7.4	24.6
			23°	DFOV [m]			0.083	0.124	0.20	0.41	0.82	1.6	2.4	4.1	12.2	40.7
			0.9 mrad	IFOV [mm]			0.2	0.3	0.4	0.9	1.7	3.5	5.2	8.6	25.9	86.3
O53 Wide angle lens	8	0.25 m	53°	HFOV [m]		0.103	0.20	0.30	0.50	1.0	2.0	4.0	5.9	9.9	29.6	98.6
			38°	VFOV [m]		0.073	0.14	0.21	0.35	0.70	1.4	2.8	4.1	6.9	20.7	68.9
			66°	DFOV [m]		0.127	0.25	0.37	0.61	1.22	2.4	4.8	7.2	12.0	36.1	120.3
			2.2 mrad	IFOV [mm]		0.2	0.4	0.7	1.1	2.2	4.4	8.8	13.2	21.9	65.8	219.4
O80 Super wide angle lens	6	0.2 m	80°	HFOV [m]	0.087	0.17	0.33	0.49	0.82	1.7	3.3	6.7	10.0	16.6	49.9	166.4
			54°	VFOV [m]	0.056	0.11	0.21	0.31	0.51	1.0	2.0	4.1	6.1	10.2	30.6	101.9
			96°	DFOV [m]	0.103	0.20	0.39	0.58	0.97	2.0	3.9	7.8	11.7	19.5	58.5	195.1
			3.0 mrad	IFOV [mm]	0.2	0.3	0.6	0.9	1.5	3.0	6.0	12.0	18.1	30.1	90.3	300.9

** Note: The accuracy of measurement can be outside of the specifications for distances below the defined minimum distance.*

3 Mechanical Installation

3.1 Dimensions

The TGBF is equipped with two metric M4 thread holes on the bottom side (6 mm depth) and can be installed either directly via these threads or with help of the tripod mount (also on bottom side).

	The tightening torque of the M4 screws for mounting the TGBF camera should be between **1 ..1.5 Nm** and must not exceed **2 Nm**.

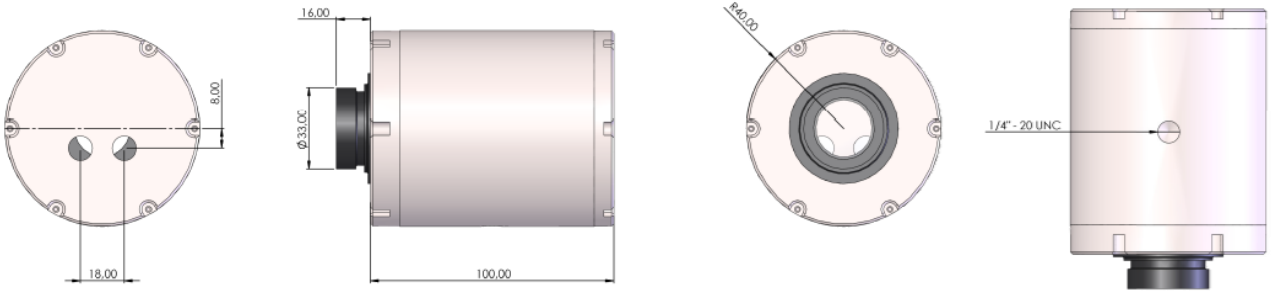


Figure 4: TGBF, dimensions [mm]

3.2 Changing the lens

The TGBF camera is offered with several different lenses[1)] (lenses depending on the camera variant). To change a lens, rotate it as shown below.

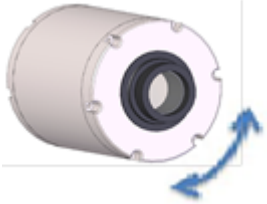


Figure 5: Change lens for TGBF

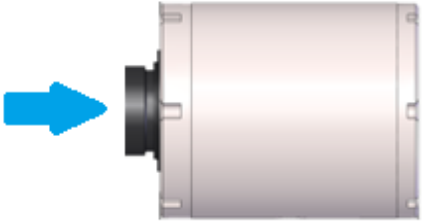


Figure 6: Inserting the lens

To get the best possible measurements when inserting the lens into the camera body, make sure that the label on the lens is screwed in at the same height as the label from the housing.

3.3 Mounting accessories (optional)

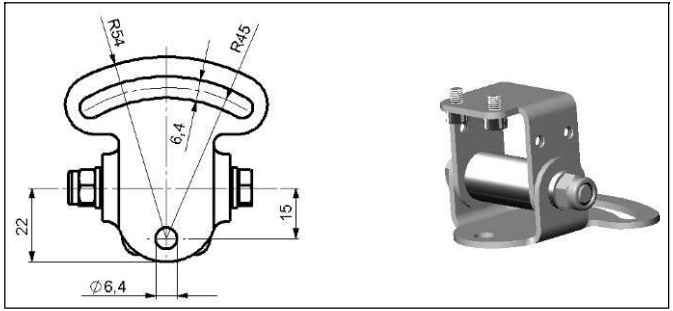


Figure 7: Mounting base, stainless steel, adjustable in 2 axes [**Part No.: 107ACPIMB**]

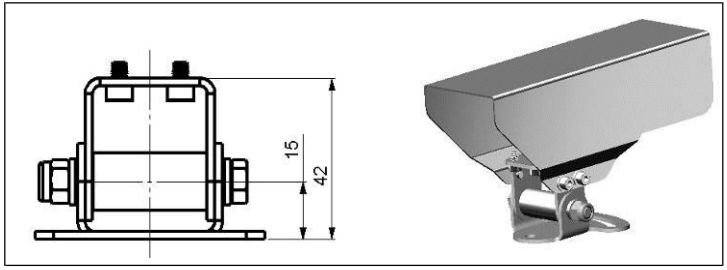


Figure 8: Protective housing, stainless steel, Incl. Mounting base [**Part No.: 107ACPIPH]**

3.3.1 Outdoor protective housing

- The infrared camera TGBF and the USB server can also be used for outdoor applications by using the outdoor protective housing.
- The outdoor protective housing can be used for any TGBF camera (lenses up to 90° FOV)
- In addition, the industrial TGIPI can be installed as an accessory without housing
- For detailed information see installation manual.

Figure 9: Outdoor protective housing for TGBF camera, USB server and industrial TGIPI

4 Electrical Installation

At the back side of the TGBF there are the two connector plugs. The left plug is for the USB cable. The right connector plug is only used for the process interface.

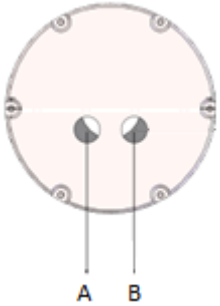


Figure 10: Backside of the camera with connectors

1 Plug for USB cable

2 Plug for TGIPI cable

4.1 Process interface

The process interface (electronics within cable as well as industrial interface) must be powered separately (5-24 VDC). Before switching on the power the TGIPI cable must be connected to the camera.

The TGBF is equipped with a process interface (cable with integrated electronics and terminal block), which can be programmed via the software as an Analog Input (AI) and Digital Input (DI) in order to control the camera or as an Analog Output (AO) in order to control the process. The signal level is always 0-10 V (DI = 24 V).

The process interface can be activated choosing the following options:

Analog Input (AI):	Emissivity, ambient temperature, reference temperature, uncommitted value, flag control, triggered recording, triggered snapshots, triggered linescanner, triggered event grabber, reset peak-/value-hold, switch temperature range
Analog Output (AO):	Main measure area, measure area, internal temperature, flag status, recording status, line scan status, alarm, frame sync, fail-safe, external communication
Digital Input (DI):	Flag control, triggered snapshots, triggered recording, triggered linescanner, triggered event grabber, reset peak- /value-hold, switch temperature range

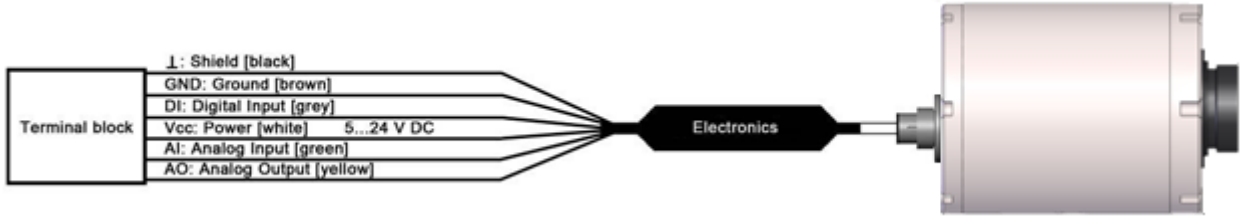


Figure 11: Configuration Standard Process Interface (TGIPI)

The standard process interface provides the following inputs and outputs:

Name	Description	max range[1]/ status
AI	Analog input	0-10 V [2]
DI	Digital input (active-low = 0...0,6 V)	24 V
AO	Analog output Alarm output	0-10 V 0/ 10 V

[1] Depending on supply voltage; for 0-10 V on the AO the TGIPI has to be powered with min. 12 V.
[2] The AI is designed for max. 24 V, the voltage level above 10 V is not interpreted

4.1.1 PIN allocation

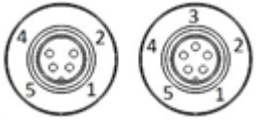
	USB	IPI
	**1** VCC	**1** INT
	2 GND	**2** SDA (I²C)
		3 SCL (I²C)
	4 D -	**4** DGND
	5 D +	**5** 3.3 V (Out)

Figure 12: Rear side of the camera

If the process interface of the camera is directly connected to external hardware[1)] (without using the supplied TGIPI cable) an activation of the field „**Support proprietary TGIPI cable**" in the menu **Tools/ Configuration/ Device (TGIPI)** in the GP CONNECT software is necessary.

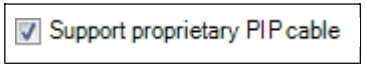


Figure 13: Support proprietary TGIPI cable

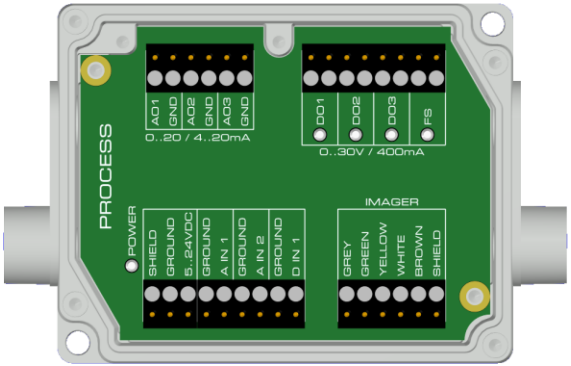
Consider that the input of the TGIPI is not protected if there is a direct TGIPI connection! A voltage > 3 V on the INT pin will destroy the device!

[1)] We recommend using only a switching contact between INT and DGND as external hardware (button, relay).

4.1.2 Industrial Process Interface (optional)

For use in industrial environment the industrial process interface with 500 V AC_{RMS} isolation voltage between TGBF and process is available (connection box with IP65, 5 m, 10 m or 20 m standard or high temperature cable for camera connection, terminal for process integration). [►Appendix D – Wiring diagrams TGIPI]

Pin assignment TGIPI cable (industrial process interface)



GREY	Interrupt
GREEN	SCL (I^2C)
YELLOW	SDA (I^2C)
WHITE	3.3 V
BROWN	GND
SHIELD	GND

Figure 14: Connections of the industrial Process Interface

The industrial process interface provides the following inputs and outputs:

Name	Description	max range[1]/ status
A IN 1 / 2	Analog input 1 and 2	0-10 V [2]
D IN 1	Digital input (active-low = 0...0,6 V)	24 V
AO1 / 2 / 3	Analog output 1, 2 and 3 Alarm output 1, 2 and 3	0/4-20 mA
DO1 / 2/ 3	Relay output 1, 2 and 3 [3]	open/ closed (red LED on) / 0...30 V, 400 mA
FS	Fail-safe relay	open/ closed (green LED on)/ 0...30 V, 400 mA

*[1] depending on supply voltage; for 0-20 mA on the AO the TGIPI has to be powered with min. 5V < (1.5 + working resistance * 0.021) < 24 V; Example: R_{Load} = 500 ohm → U_{min} = 1.5 + 500 * 0.021 = 12 V, R_{Load} = 100 ohm → U_{min} = 1.5 + 100 * 0.021 = 3.6 V → min. 5 V*
[2] the AI is designed for max. 24 V, the voltage level above 10 V is not interpreted
[3] active if AO1, 2 or 3 is/ are programmed as alarm output

The alarm output can be configured as a threshold between **0-4 mA** for **no alarm** and between **10-20 mA** as **alarm**. For values outside the respective range, the relay does not switch on the DO.

The process interface has an integrated **fail-safe mode**. This allows to control conditions like interruption of cables, shut-down of the software etc. and to give out these conditions as an alarm. The time constant of the fail-safe is 1.5 seconds.

Controlled conditions on camera and software	Standard Process interface 107ACPITGIPI	Industrial Process interface 107ACPITGIPIMACBxx
Interruption USB cable to camera	✓	✓
Interruption data cable camera - TGIPI	✓	✓
Interruption power supply TGIPI	✓	✓
Shut-down of GP CONNECT software	✓	✓
Crash of GP CONNECT software	-	✓
Fail-Safe-Output	0 V at analog output (AO)	open contact (fail-safe relay)/ green LED off

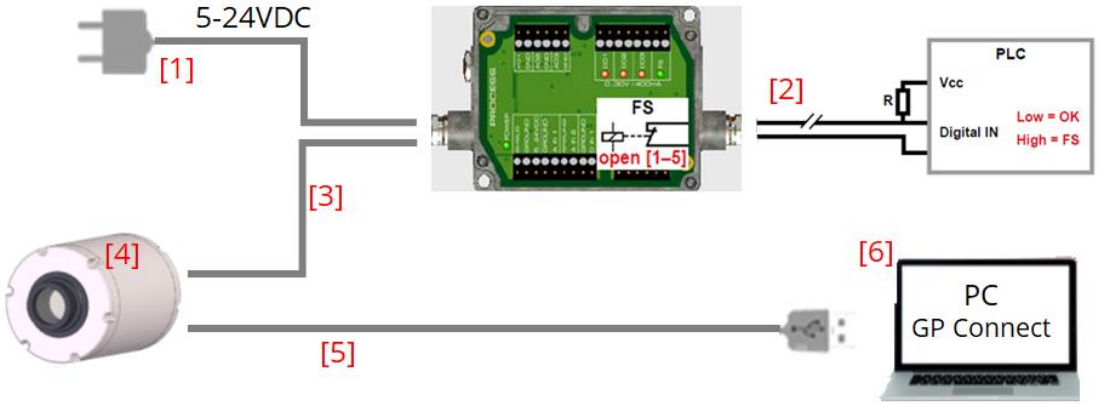


Figure 15: Fail-Safe monitoring states

Fail-Safe monitoring states

[1]	Breakdown of TGIPI power supply	[4]	Malfunction of TGBF
[2]	Cable break of fail-safe cable	[5]	Breakdown of TGBF power supply/ Interruption of USB cable
[3]	Interruption of cable TGBF-TGIPI	[6]	Malfunction of GP CONNECT software

4.2 USB cable extension

The maximum USB cable length is 20 m. For greater distances between TGBF and computer or for stand-alone solutions the optional TGBF NetBox or the USB Server Gigabit is provided:

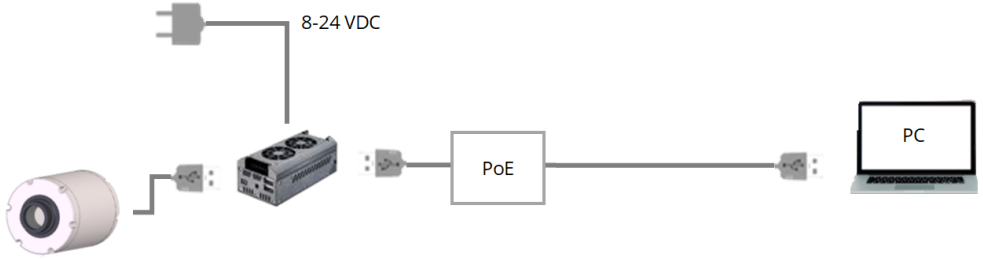


Figure 16: Ethernet direct communication with TGBF Netbox

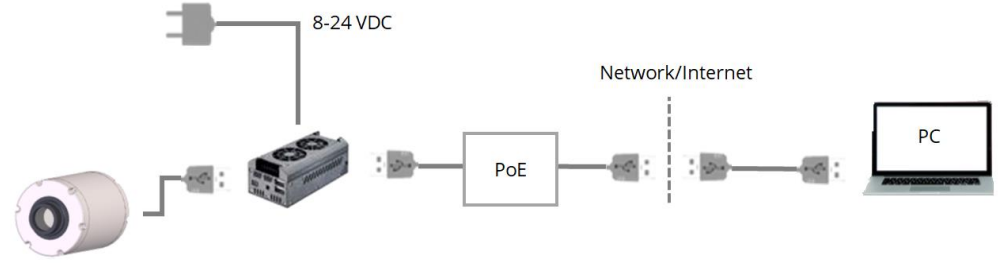


Figure 17: Ethernet network communication with TGBF Netbox

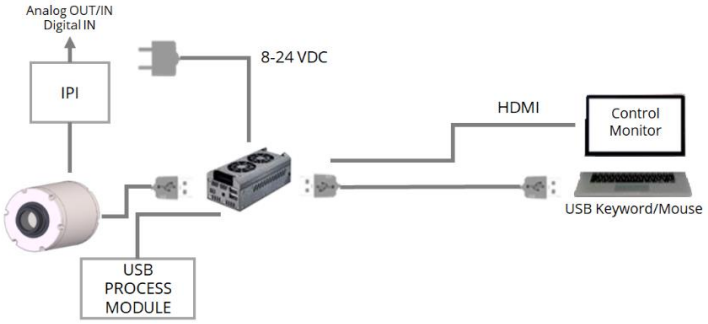


Figure 18: Stand-Alone operation with TGBF Netbox

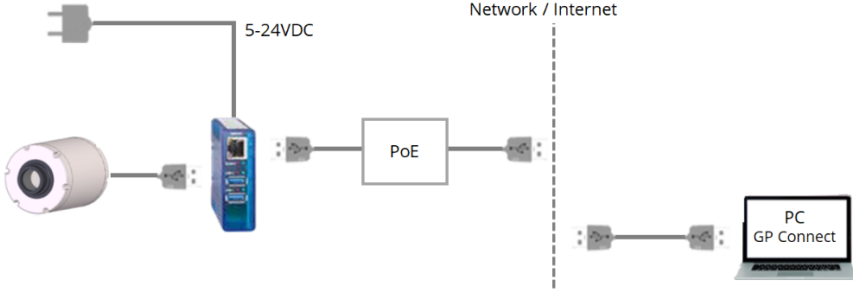


Figure 19: USB Server Gigabit

5 Software GP CONNECT

Minimum system requirements:

- Windows 7, Windows 8, Windows 10
- USB interface
- Hard disc with at least 30 MByte of free space
- At least 128 MByte RAM

A detailed description is provided in the software manual on the USB stick. See also **`Help`** menu in the GP CONNECT software (**`Help`** → **`Documentation`**).

Alternatively, the software can also be downloaded via the website under the following link: https://www.gruppopedercini.com/divisions/healthcare/

5.1 Installation and initial start-up

- All drivers are booted via Windows OS automatically. A driver installation is not necessary.
- By default the program starts automatically in the installed language.

1. Insert the included USB stick into the according port on your computer.
2. Please start **Setup.exe**. Follow the instructions of the wizard until the installation is finished.

   The installation wizard places a launch icon on the desktop and in the start menu:
   `Start\Programs\ELETTRO2000\GP CONNECT\GP CONNECT`
3. To connect the camera to the PC, plug the USB cable to the camera first. Afterwards connect it with the PC (to disconnect the camera and the computer remove the USB cable from the computer first and then disconnect it from the camera).
4. Start the software.

At the initial start the software asks for the calibrations files which are available via internet or on the USB stick.

5. Install the calibration files at first start of the software.

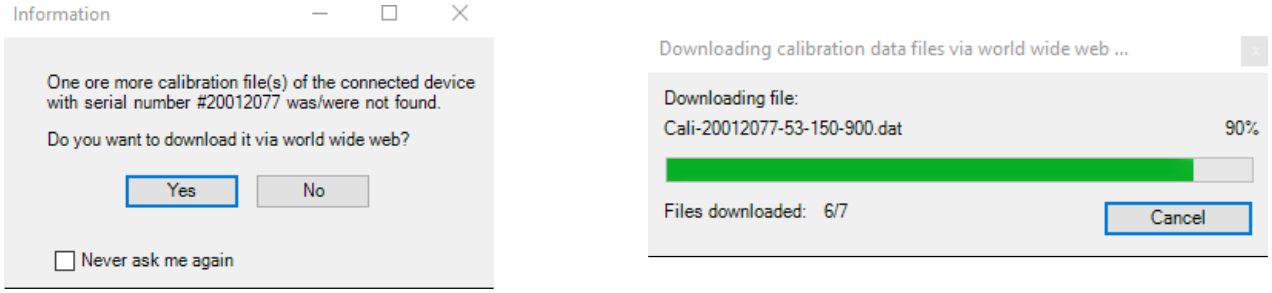


Figure 20: Calibration data transfer

After the calibration files have been installed the live image from the camera is shown inside a window on your PC screen.

1. Choose the desired language in the menu **`Tools` → `Language`**.

2. Adjust the focus of the image by turning the exterior lens ring at the camera.

5.2 Software window

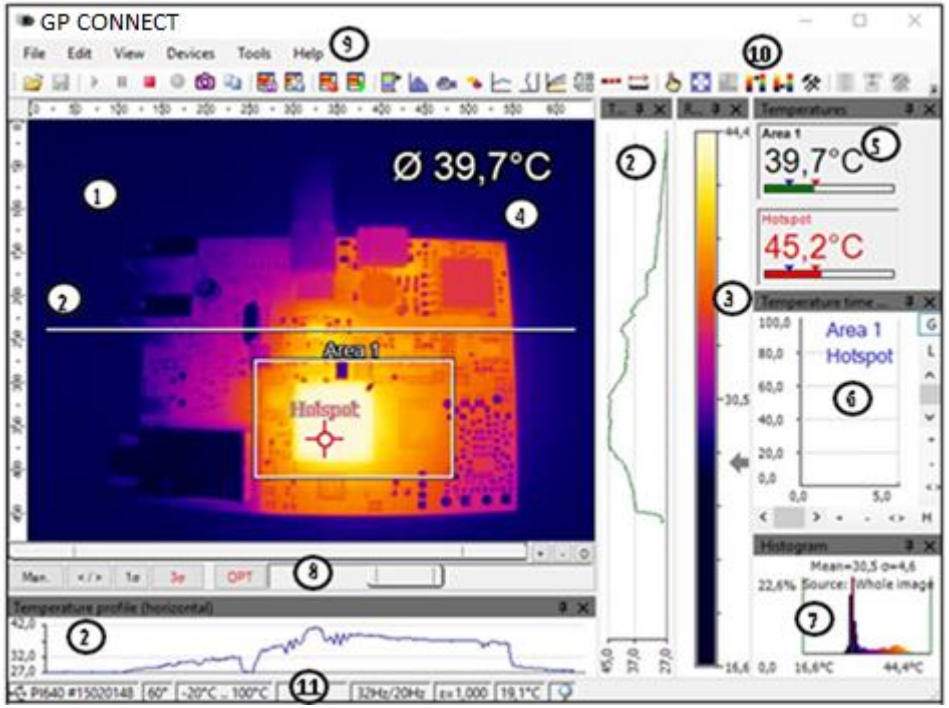


Figure 21: Software window

1 IR image from the camera

2 Temperature profile: Shows the temperatures along max. 2 lines at any size and position in the image.

3 Reference bar: Shows the scaling of temperature within the color palette.

4 Temperature of measure area: Analyses the temperature according to the selected shape, e.g. average temperature of the rectangle. The value is shown inside the IR image and the control displays.

5 Control displays: Displays all temperature values in the defined measure areas like Cold Spots, Hot Spots, temperature at cursor, internal temperature and chip temperature.

Alarm settings: Bar showing the defined temperature thresholds for low alarm value (blue arrow) and high alarm value (red arrow). The color of numbers within control displays changes to red (when temp. above the high alarm value) and to blue (when temp. below the low alarm value).

6 Temperature time diagram: Shows the temperature curves over time for selectable region of interest (ROI)

7 Histogram: Shows the statistic distribution of single temperature values.

8 Automatic / manual scaling of the palette (displayed temperature range): Man., </> (min, max), 1σ : 1 Sigma, 3σ : 3 Sigma, OPT: Palette optimization

9 Menu and Toolbar (Icons)

10 Icon enabling switching between color palettes

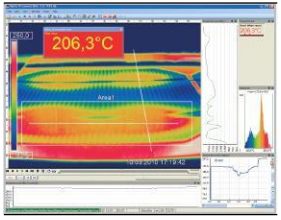
11 Status bar: Serial number, optic, temperature range, cursor position, device framerate/ display framerate, emissivity, ambient temperature, flag status

5.2.1 Basis features of the software GP CONNECT

Extensive infrared camera software

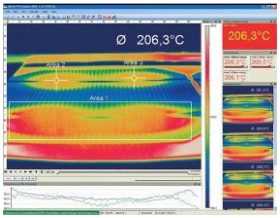
- No restrictions in licensing
- Modern software with intuitive user interface
- Remote control of camera via software
- Display of multiple camera images in different windows
- Compatible with Windows 7, 8 and 10

High level of individualization for customer specific display



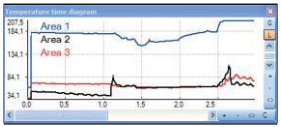
- Various language option including a translation tool
- Temperature display in °C or °F
- Different layout options for an individual setup (arrangement of windows, toolbar)
- Range of individual measurement parameter fitting for each application
- Adaption of thermal image (mirror, rotate)
- Individual start options (full screen, hidden, etc.)

Video recording and snapshot function (IR or BI-SPECTRAL)

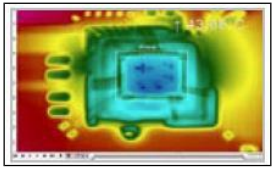


- Recording of video sequences and detailed frames for further analysis or documentation
- BI-SPECTRAL video analysis (IR and VIS) in order to highlight critical temperatures
- Adjustment of recording frequency to reduce data volume
- Display of snapshot history for immediate analysis

Extensive online and offline data analysis

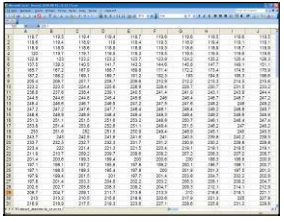


- Analysis supported by measurement fields, hot and cold spot searching, image subtraction
- Real time temperature information within main window as digital or graphic display (line profile, temperature time diagram)
- Slow motion repeat of radiometric files and analysis without camera being connected
- Editing of sequences such as cutting and saving of individual images
- Various color palettes to highlight thermal contrasts



- Individual setup of alarm levels depending on the process
- BI-SPECTRAL process monitoring (IR and VIS) for easy orientation at point of measurement
- Definition of visual or acoustic alarms and analog data output
- Analog and digital signal input (process parameter)
- External communication of software via COM-Ports and DLL
- Adjustment of thermal image via reference values

Temperature data analysis and documentation



- Triggered data collection
- Radiometric video sequences (*.ravi) radiometric snapshots (*.tiff)
- Text files including temp. information for analysis in Excel (*.csv, *.dat)
- Data with color information for standard programs such as Photoshop or Windows Media Player (*.wmv, *.tiff)
- Data transfer in real time to other software programs DLL or COM-Port interfaces

Figure 22: Non-contact thermometry

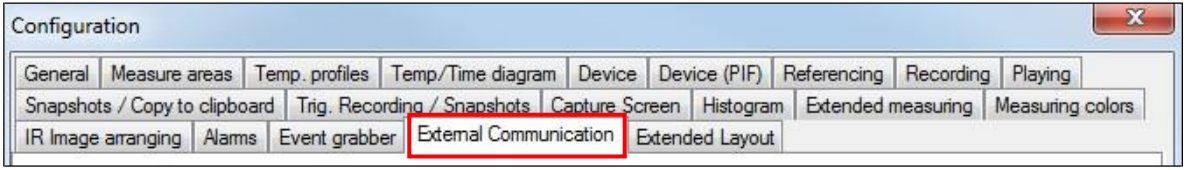
Appendix A – Quick start for serial communication

Introduction

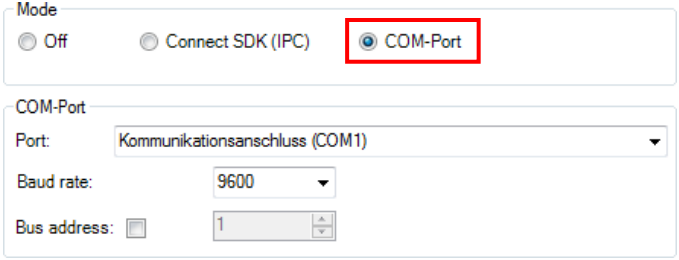
One special feature of the GP CONNECT software contains the possibility to communicate via a serial COM- Port interface. This can be a physical COM-Port or a virtual COM-Port (VCP). It must be available on the computer where the GP CONNECT software is installed.

Setup of the interface

1. Open the **`Configurations`** dialog and enter the tab "**`External Communication`**" to enable the software for the serial communication.



2. Select the mode "**`COM-Port`**" and choose the appropriate port.



3. Select the baud rate that matches the baud rate of the other communication device. The other interface parameters are 8 data bits, no parity and one stop bit (8N1).

These parameters are used in many other communication devices too. The other station must support 8 bit data.

4. Connect the computer with the communication device. If this is a computer too, use a null modem cable.

Command list

The command list is provided on the USB stick and in the GP CONNECT software (**`Help` → `SDK`**). Every command must expire with CR/LF (0x0D, 0x0A).

Appendix B – Interprocess Communication (IPC)

The description of the initialization procedure as well as the necessary command list is provided on the USB stick and in the GP CONNECT software (**`Help` → `SDK`**).
2 SDK packages are available (included on USB stick):

1. **Connect SDK:** requires the GP CONNECT software
2. **Direct SDK:** no GP CONNECT software required, supports Linux and Windows

The communication to the process imager device is handled by the GP CONNECT software (**`Imager.exe`**) only. A dynamic link library (**`ImagerIPC2.dll`**) provides the interprocess communication (IPC) for other attached processes. The DLL can be dynamically linked into the secondary application. Or it can be done static by a lib file too. Both **`GP CONNECT.exe`** and **`ImagerIPC2.dll`** are designed for Windows 7/ 8/ 10 only. The application must support call-back functions and polling mode.

The **`ImagerIPC2.dll`** will export a bunch of functions that are responsible for initiating the communication, retrieving data and setting some control parameters.

The main difference to the former Version 1 (**`ImagerIPC.dll`**) is the support of more than one TGBF via multiple instances of GP CONNECT.

Appendix C – GP CONNECT Resource Translator

A detailed tutorial is provided on the USB stick.

GP CONNECT is a **.Net Application**. Therefore it is ready for localization. Localization as a Microsoft idiom means a complete adaption of resources to a given culture. Learn more about the internationalization topics consult Microsoft's developer documentation on

http://msdn.microsoft.com/en-us/goglobal/bb688096.aspx.

If desired the localization process can be illustrated in detail. Also the resizing of buttons or other visible resources and the support of right-to-left-languages are supported. Experts who have the appropriate tools should handle it. Nevertheless we have developed the small tool "**Resource Translator**" to make the translation of the resources of the GP CONNECT application possible for everybody.

This tool helps to translate any visible text within the GP CONNECT application.

Appendix D – Wiring diagrams TGIPI

Analog Output:

The maximum load impedance is 500 Ohm.

The analog output can be used as a digital output too. The current value for "**no alarm**" and "**alarm on**" is set within the software.

Digital Input:

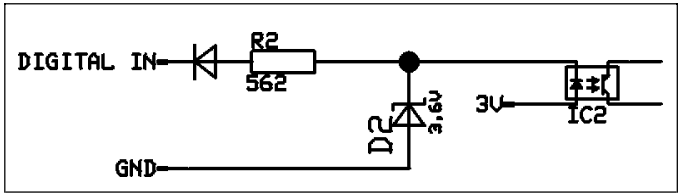


Figure 23: Digital input

The digital input can be activated with a button to the TGBF GND-Pin or with a low level CMOS/TTL signal: Low level 0...0.6 V; High level 2...24 V

Example Button:

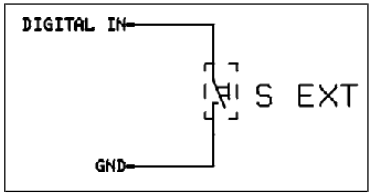


Figure 24: Button

Analog input (usable voltage range: 0 ... 10 V):

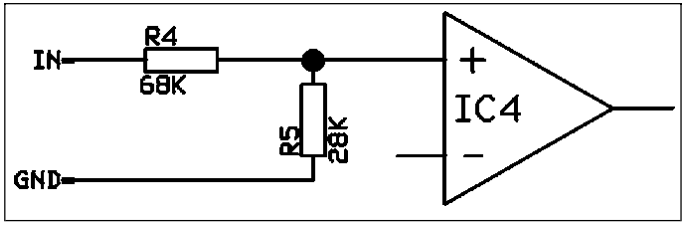


Figure 25: Analog input

The analog output must be set to "Alarm". The range for AO1-AO3 can be set in the software (no alarm: 0-4 mA/ alarm: 10-20 mA).

REL1-3 (DO1-DO3): U_{max} = 30 VDC

I_{max} = 400 mA

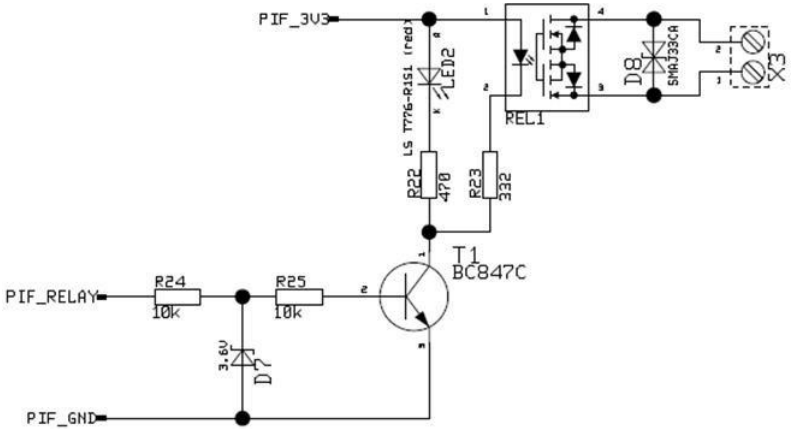
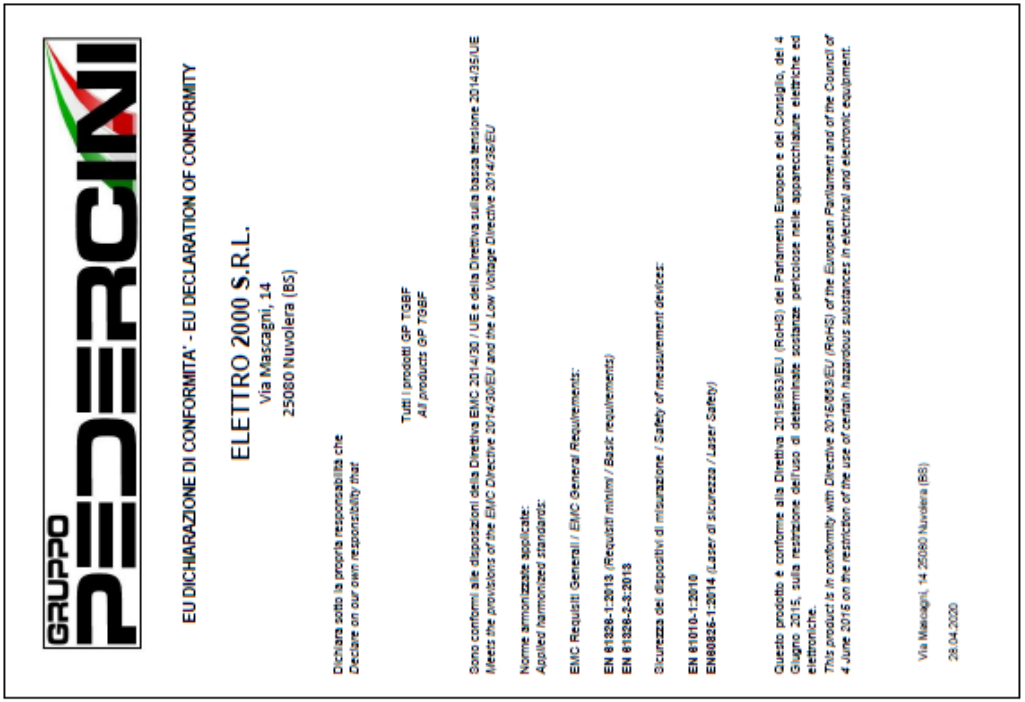


Figure 26: Relay output at industrial TGIPI

Appendix E – Declaration of Conformity



GRUPPO PEDERCINI

EU DICHIARAZIONE DI CONFORMITA' - EU DECLARATION OF CONFORMITY

ELETTRO 2000 S.R.L.
Via Mascagni, 14
25080 Nuvolera (BS)

Dichiara sotto la propria responsabilità che
Declare on our own responsibility that

Tutti i prodotti GP TGBF
All products GP TGBF

Sono conformi alle disposizioni della Direttiva EMC 2014/30 / UE e della Direttiva sulla bassa tensione 2014/35/UE
Meets the provisions of the EMC Directive 2014/30/EU and the Low Voltage Directive 2014/35/EU

Norme armonizzate applicate:
Applied harmonized standards:

EMC Requisiti Generali / *EMC General Requirements:*

EN 61326-1:2013 /Requisiti minimi / *Basic requirements)*
EN 61326-2-3:2013

Sicurezza dei dispositivi di misurazione / *Safety of measurement devices:*

EN 61010-1:2010
EN60825-1:2014 /Laser di sicurezza / *Laser Safety)*

Questo prodotto è conforme alla Direttiva 2015/863/EU (RoHS) del Parlamento Europeo e del Consiglio, del 4 Giugno 2015, sulla restrizione dell'uso di determinate sostanze pericolose nelle apparecchiature elettriche ed elettroniche.
This product is in conformity with Directive 2015/863/EU (RoHS) of the European Parliament and of the Council of 4 June 2015 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Via Mascagni, 14 25080 Nuvolera (BS)

28.04.2020

Avvertenza per il consentito: responsabilità del consentito e dei proprietario, art. 8 (9) 9108

EU Conformity Statement

This product and - if applicable - the supplied accessories too are marked with "CE" and comply therefore with the applicable harmonized European standards listed under the EMC Directive
2004/108/EC, the RoHS Directive 2011/65/EU. 2012/19/EU (WEEE directive): Products marked with this symbol cannot be disposed of as unsorted municipal waste in the European Union.

FCC compliance

This equipment has been tested and found to comply with the limits for a digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.