TFT-FOS

Technobis Fibre Technologies

Fibre Optic Sensing

Deminsys

User Manual

Thank you for purchasing the Deminsys product. This instruction manual has been prepared for users of the Deminsys. To ensure correct use, please read this manual carefully before using these products.

- The contents of this manual may not be reproduced in whole or in part without permission.
- The contents of this manual are subject to change without notice
- Although every effort has been made to ensure the accuracy of this manual, if you note any points that are unclear or incorrect, contact Technical support and sales www.tft-fos.com
- Read the instruction manuals for any other products that you are using with this product (a computer or other peripheral equipment)
- If the product is used in a manner not specified by the manufacturer, the protection provided in the product may be impaired.

Notes, Notices and Cautions

NOTE: A NOTE indicates important information that helps you make better use of your computer.

NOTICE: A NOTICE indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

CAUTION: A CAUTION indicates a potential for property damage, personal injury, or death.

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June 2011

Contents

1 FINDING INFORMATION

NOTE: Additional information may ship with your Deminsys Unit

User Manual (this document), Demo Software, Warranty and Regulatory Information

Documentation and software are located on the Deminsys USB Stick. Readme files may be included on your USB Stick to provide last-minute updates about technical changes to your product or advanced technical reference material for technicians or experienced users.

Serial Number and Version

These labels are located at the front of your product. Use the Serial Number to identify your system when you contact technical support. The Version is the number of channels.

Solutions

Troubleshooting hints and tips, articles from technicians, and online courses, frequently asked questions is to be found on our website: www.tft-fos.com.

Upgrades

Upgrade information for the Deminsys Firmware, Demo software is to be found on our website: www.tft-fos.com.

Customer Care

Contact information, service call and order status, warranty and repair information is to be found on our website: www.tft-fos.com.

Service & Support

Service call status and support history, service contract, online discussions with technical support is to be found on our website: www.tft-fos.com.

Reference

System documentation, details on Deminsys configuration, product specifications and white papers is to be found on our website: www.tft-fos.com.

2 SAFETY

Intended application of this product

Use this product only for measuring strain in the FBG's. Do not use this product for other purposes.

Do not repair nor disassemble

The Deminsys contains Sled. Never attempt to disassemble the equipment by yourself; doing so may result in Damage to the eye or equipment failure. Never attempt to disassemble any part of the equipment unless instructed to do so in this manual. If you notice any problems with the equipment, turn off the power and contact Technical support and sales www.tft-fos.com.

Do not cut the fibre

When the unit is in operation high power density light emitted by the SLED travels through the fibre's. Cutting the fibres may result in hazardous situations.

Do not look into Fibre optic connectors

When the unit is in operation high power density light emitted by the SLED travels through the fibre's. On the outside of the unit the connectors are covered with a plug. When the plug is removed a shutter closes the connector. Do not try to open the shutter to look into the connector. Looking into the connector may result in permanent damage to the eye.

AC adapter

Preferably use the specified AC adapter. Using a wrong adapter may result in fire or electric shock. Using another AC adapter is permitted but it must be a Class I adapter with a SELV type power output. For more information on the output requirements of the adapter or power supply check the appendix.

Do not repair nor disassemble

The AC adapter of the Deminsys contains a high- voltage power supply. Never attempt to disassemble the equipment by yourself; doing so may result in electric shock or equipment failure. Never attempt to disassemble any part of the equipment unless instructed to do so in this manual. If you notice any problems with the equipment, turn off the power and contact Technical support and sales www.tft-fos.com.

Ethernet Cable

Use an SFTP Ethernet Cable with a maximum length of <30m

Camera link Cable

Use a Camera link Cable with a maximum length of < 3m

5V DC power supply

Never connect the Deminsys to a DC power supply network.

3 SPECIFICATIONS

Optical	
Wavelength of operation	830 – 870 nm
Number of optical channels	1 – 4
Maximum number of sensors per channel[1]	8
Maximum sampling frequency	20 kHz
Repeatability[2]	
Wavelength	<= 2 pm
Strain	<= 3 µstrain
Temperature	< 0.1 °C
Spectral spacing sensors	> 5 nm
Signal noise	0.015 pm/√Hz
Dynamic range @ 32 sensors	-1500 / +2500 µstrain
Dynamic range @ high performance fibres[3]	-3000 / +10000 µstrain
Optical connectors	E-2000/APC, 0.1 dB loss

Environmental	
Operating temperature	-15 / +55 °C
Operating altitude	<= 15000 ft
Operating humidity	20% ~ 90% RH non-condensing
Impact shock resistance (front direction)	200 G’s
EMC emission	Compliant to EN 55022 laboratory level
EMC immunity	Compliant to EN 61000-4- 2,3,4,6 Industrial level
EMI/EMC	RTCA/D0-160-F (s 21, cat B)
Vibrations	RTCA/D0-160-F (s 8.5, cat S)

Electrical	
Interface	Giga Ethernet / Camera Link
Input voltage	5 V
Input current at 20°C	0.9 A

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[1] This is a typical number based on strain limits for standard fibres. Fibres with higher strain limits require more spectral bandwidth and thus fewer sensors per channel.

[2] Measured over 1 hour, standard uncertainty (1 sigma distribution)

[3] Contact Technobis Fibre Technologies for specific information.

AC/DC Converter	100–240 VAC, 50-60 Hz
Max power consumption[4]	< 20 W

Mechanical – Deminsys Industrial and Python

Dimensions	80 x 80 x 240 mm
Weight	1000 grams

Mechanical – Deminsys Ultra

Dimensions	70 x 70 x 130 mm
Weight	650 grams

Safety

Ingress protection	IP51
Safety class	Class III
Installation category (overvoltage CAT)	Category I
Pollution degree	Degree 2

[4] The power consumption for the Deminsys Ultra is less than 14 Watts.

4 GENERAL INFORMATION

4.1 System Overview

4.1.1 Description

Deminsys, the world's fastest multi sensor / multi-channel FBG interrogator, identifies four channels with typically 8 sensors per channel. The system is especially developed for the interrogation of signals up to 20 kHz for each sensor and the sample frequency is independent of the number of sensors. The system is self-calibrating meaning it can be coupled to pre-installed fibres in any construction. A trade-off between the number of FBG's per fibre, sample frequency or the dynamic range gives the customer a more flexible interrogator.

4.1.2 Applications

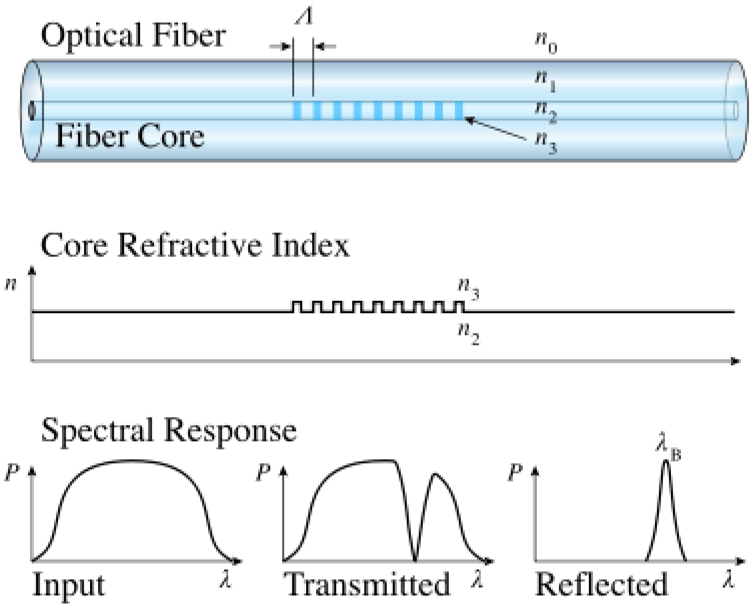
Technobis Fibre Technologies currently supports the following four interrogator versions: **Industrial**, **Ultra**, **Python** and **D-Light**. The complete specifications of the Industrial are also available in the Ultra and the Python. However the Ultra is smaller, lighter and satisfies various environmental requirements stated in the RTCA/DO-160-F standard (Environmental Conditions and Test Procedures for Airborne Equipment), which makes it suitable for research aircraft flights.

The Python has been enhanced with low and constant signal latency, which is a key requirement in order to experience the sensation of haptic feedback in real time. Such enhancements make the Deminsys Python particularly useful for integration in medical or humanoid devices. The D-Light is a cost trade-off version based on the Industrial version, specifically for universities. It supports a maximum of 3 channels with the option for the low and constant signal latency.

Technobis Fibre Technologies identifies a growing number of application fields which show a significant grow in their usage of fibre optics sensing solutions: **Aerospace**, **Offshore**, **Medical**, **Robotics**, **Automotive**, **High-tech** industry, etc.

4.1.3 How it Works

A Fibre Bragg Grating (**FBG**) is a type of distributed Bragg reflector constructed in a short segment of optical fibre that reflects particular wavelengths of light and transmits all others. This is achieved by adding a periodic variation to the refractive index of the fibre core, which generates a wavelength specific dielectric mirror. A fibre Bragg grating can therefore be used as an inline optical filter to block certain wavelengths, or as a wavelength-specific reflector.



The principle of Fibre Bragg Grating is shown in the image above. Broadband light enters the optical fibre. In a number of places, a grating is applied, a longitudinal periodic variation in the refractive index of the core of the fibre. Each grating has a unique spacing that determines the wavelength to be reflected by the grating, which can then be detected at the beginning of the fibre where measurements are taken.

Thermal or mechanical stresses cause strain variations in the fibre; the variations cause a varying period and with that a variation in the reflected wavelength. The measured wavelength varies linearly with temperature and/or strain. By giving each grating its own period and thereby a unique reflection wavelength, every measuring point on the fibre can be distinguished in the detection process. This is one of the properties that make multiplexing possible.

4.2 Contact Technobis Fibre Technologies

To contact Technobis Fibre Technologies electronically, you can access the following website:

www.tft-fos.com

or send an e-mail to:

info@technobis.nl

NOTE: When you need to contact Technobis Fibre Technologies, use the electronic addresses, telephone numbers, and codes as provided here. If you need assistance in determining which codes to use, contact a local or an international operator.

NOTE: The contact information provided was deemed correct at the time that this document went to print and is subject to change.

NOTE: Check the website for the latest information.

Technical Support phone	+31 (0) 251 248432
Technical Support fax	+31 (0) 251 242835
Sales Information	+31 (0) 6 20609552
Main Office Address	Geesterweg 4b
	1911 NB, Uitgeest
	The Netherlands

4.3 Organization of the Manual

This document has the following sections:

System Summary

This section provides a general overview of the system written in non-technical terminology. The summary outlines the uses of the system in supporting the activities of the user and staff.

Getting Started

This section provides a general walkthrough of the system from initiation through exit. The logical arrangement of the information shall enable the functional personnel to understand the sequence and flow of the system. We make screen prints to depict examples of text under each heading.

Troubleshooting

This section provides general information on how to deal with system related problems. Several typical situations are identified. A general approach is described on how to resolve these situations.

Appendices

This section provides the reader and/or user with more detailed operation and technical information for the Deminsys device.

4.4 Acronyms and Abbreviations

ADC	Analog-to-Digital Converter
CCD	Charge Coupled Device
Deminsys	De-multiplexing Interrogator System
FBG	Fibre Bragg Grating
LED	Light Emitting Diode
POST	Power-On Self Test
SLED	Super luminescent Light Emitting Diode
UDP	User Datagram Protocol
UTP	Unshielded Twisted Pair
FTP	Foiled Twisted Pair
STP	Shielded Twisted Pair
S/FTP	Screened Fully shielded Twisted Pair
DBI	Type of fibre connector
HTTP	Hyper Text Transfer Protocol
I/O	Input / Output
IP	Internet Protocol
TLV	Type-Length-Value
RJ45	Registered Jack 45, type of connector
MAC	Media Access Control
RAM	Read Only Memory
CoG	Center of Gravity
TEC	Thermo Electric Cooler
CD	Compact Disc

5 SYSTEM SUMMARY

5.1 Deminsys OEM Kit

The Deminsys OEM Kit as delivered consists of the following parts:

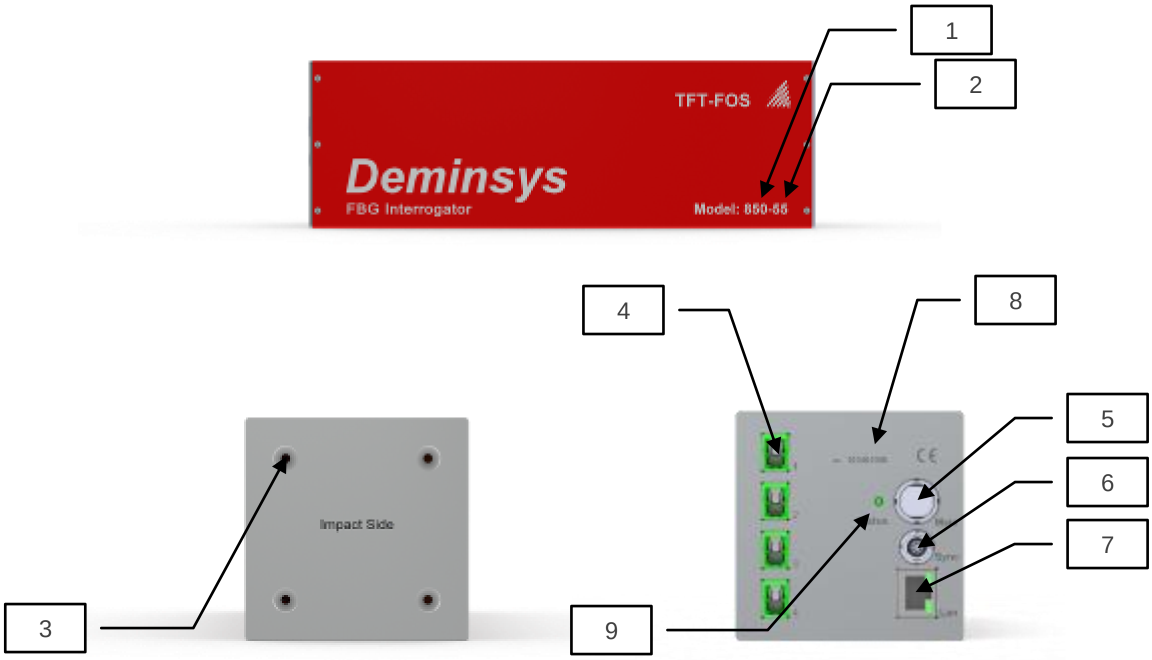
- Deminsys interrogator
- Power supply for the interrogator
- Ethernet cable to connect the interrogator to the host
- FBG sensor for demonstration purposes
- USB stick with software and manuals
- User Manual, printed out
- Laptop with pre-installed software (Optional)

This package allows the customer to setup and run the Deminsys system with minimal handlings. The Deminsys provides a standard UDP interface for data acquisition, a Telnet command interface and a Web-server for device control. All these interfaces utilize the same gigabit Ethernet connection. This allows any host system capable of supporting these interfaces, to connect and drive the Deminsys system. Next to these basic interfaces the Deminsys Python also provides a Camera Link interface for a low and constant latency signal for instance for haptic feedback applications.

For demonstration purposes the delivered software is intended to be installed and used on a PC with a Windows 7 operating system. The demonstration software the usability of the Deminsys interrogator on the LabView platform. LabView itself is not supplied but only an executable build from the LabView development environment.

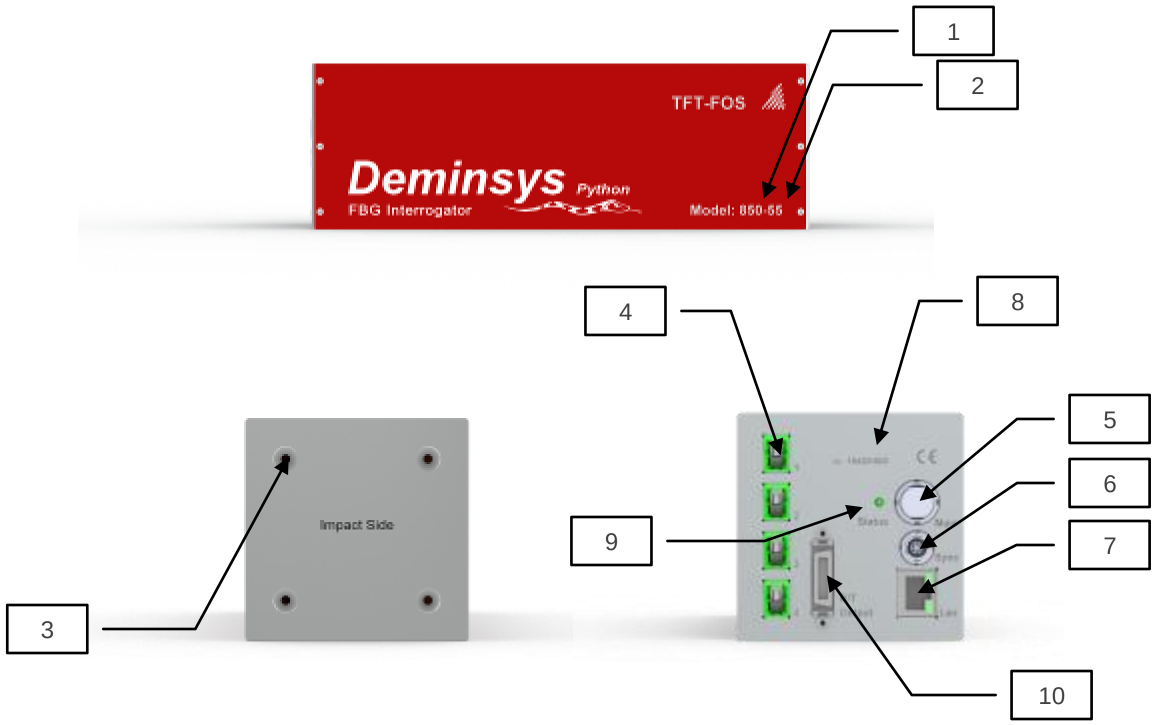
5.2 Instrument views

5.2.1 Deminsys Industrial



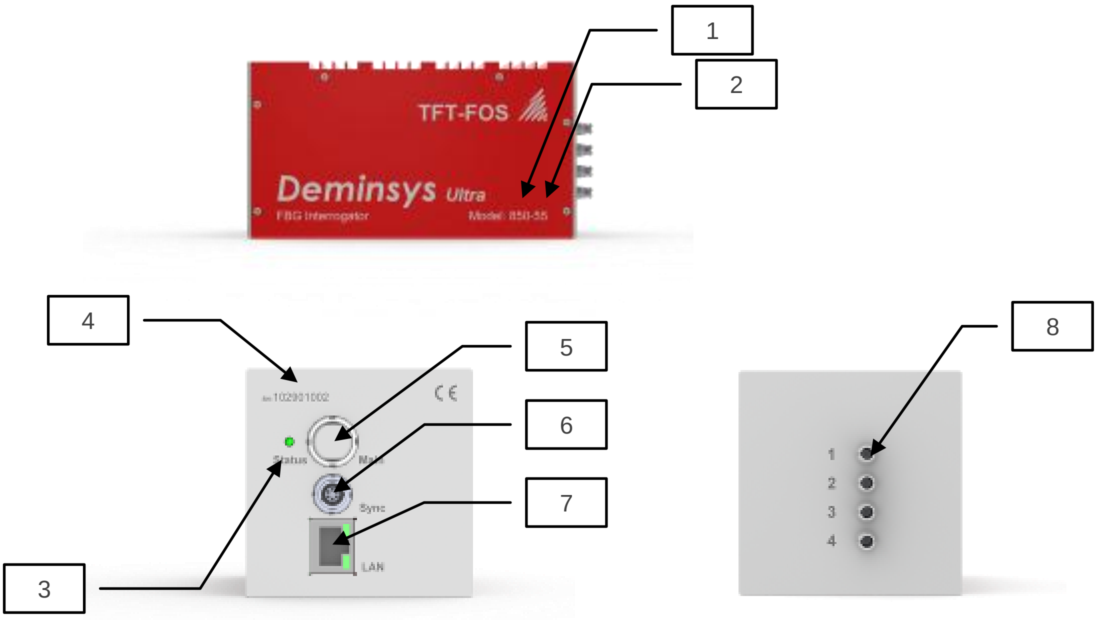
1. Model number
2. Bandwidth
3. Countersunk mounting holes M4 (max. depth 8mm)
4. E-2000 fibre connectors
5. Power connector
6. Synchronization Signal connector
7. Gigabit Ethernet connector
8. Serial number
9. Status light

5.2.2 Deminsys Python



1. Model number
2. Bandwidth
3. Countersunk mounting holes M4 (max. depth 8mm)
4. E-2000 fibre connectors
5. Power connector
6. Synchronization Signal connector
7. Gigabit Ethernet connector
8. Serial number
9. Status light
10. Camera Link connector

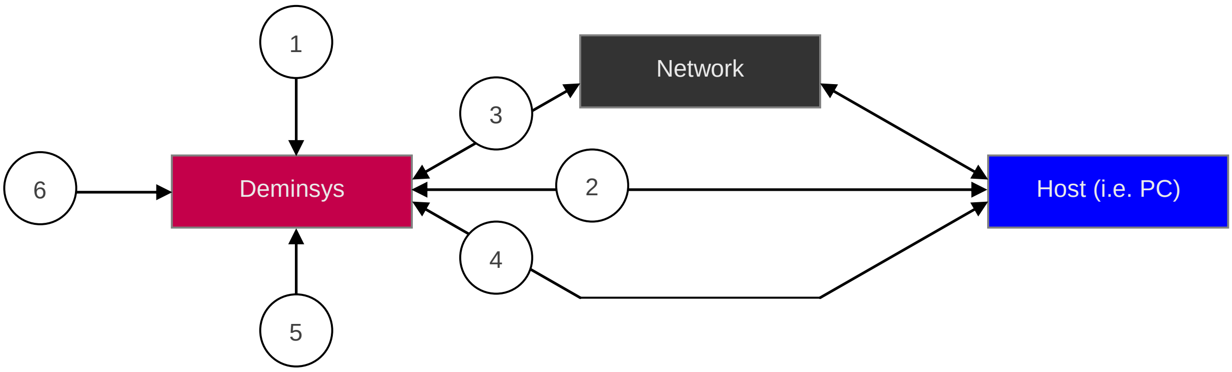
5.2.3 Deminsys Ultra



1. Model number
2. Bandwidth
3. Status light
4. Serial number
5. Power connector
6. Synchronization Signal connector
7. Gigabit Ethernet connector
8. DBI fibre connector

5.3 Deminsys interfaces

As described in the previous paragraph the Deminsys system is operated through a Gigabit Ethernet or a Camera Link connection. The following image demonstrates the possible interfaces and data flows for the Deminsys and its host system.



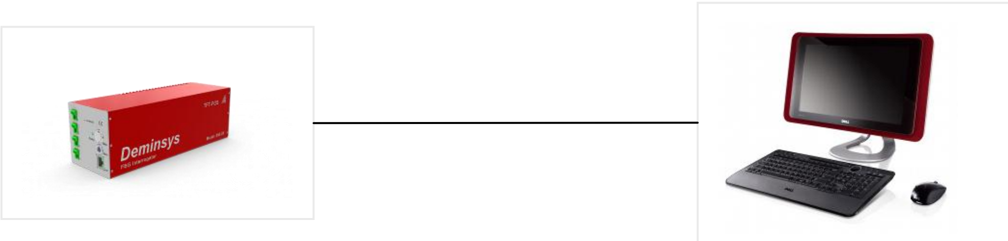
1. Power Supply
    a. TFT-FOS qualified power supply
2. Direct Gigabit Ethernet connection
    a. UDP protocol for data streaming
    b. Telnet protocol for the command interface
    c. HTTP protocol for the command interface through a web-server
3. Gigabit Ethernet connection through a network
    a. UDP protocol for data streaming
    b. Telnet protocol for the command interface
    c. HTTP protocol for the command interface through a web-server
4. Camera Link connection
    a. Camera Link protocol for data streaming
    b. RS232 protocol for the command interface through the Camera Link connection
    c. No connection through Ethernet is possible when using Camera Link
5. Synchronization input
    a. Optical isolated active low input
6. Optical acquisition connection channels
    a. I/O fibres, each for typically 8 FBG sensors.

6 GETTING STARTED

6.1 Turn on the device and connect to the network

The Deminsys Interrogator can operate in a number of different network configurations. These configurations are described in detail in Appendix B.1. For the purpose of getting started with the Interrogator device the following paragraphs will refer to the 1-on-1 configuration where the Interrogator device is directly connected to the host.

NOTE: For detailed procedure steps consult Appendix A “**Connecting the Deminsys**”



STEP-1 Before actually turning on the device the first step is to connect the correct interfaces with the computer. For a standard Deminsys device the following connection must be made before turning on the machine:

- Ethernet connection
- Sensor fibres
- Power supply

For the Python version the Ethernet connection can be replace by the Camera Link connection. The image above shows a typical Deminsys (network) configuration. Multiple Deminsys devices can be connected through the network and accessed by one or more hosts.

STEP-2 The second step is to detect the IP address of the Deminsys device. The detection of the device can be done by means of a request or with a broadcast message send from the device.

When the IP address is available one of the interfaces can be used to set the settings and start the acquisition. This can be done by TLV commands through a Telnet connection or by means of the Web server.

For the Python version the second step can be skipped when a link is made using the Camera Link interface. The Camera Link interface is a direct connection and TLV commands can be given over the serial link available in the Camera Link interface.

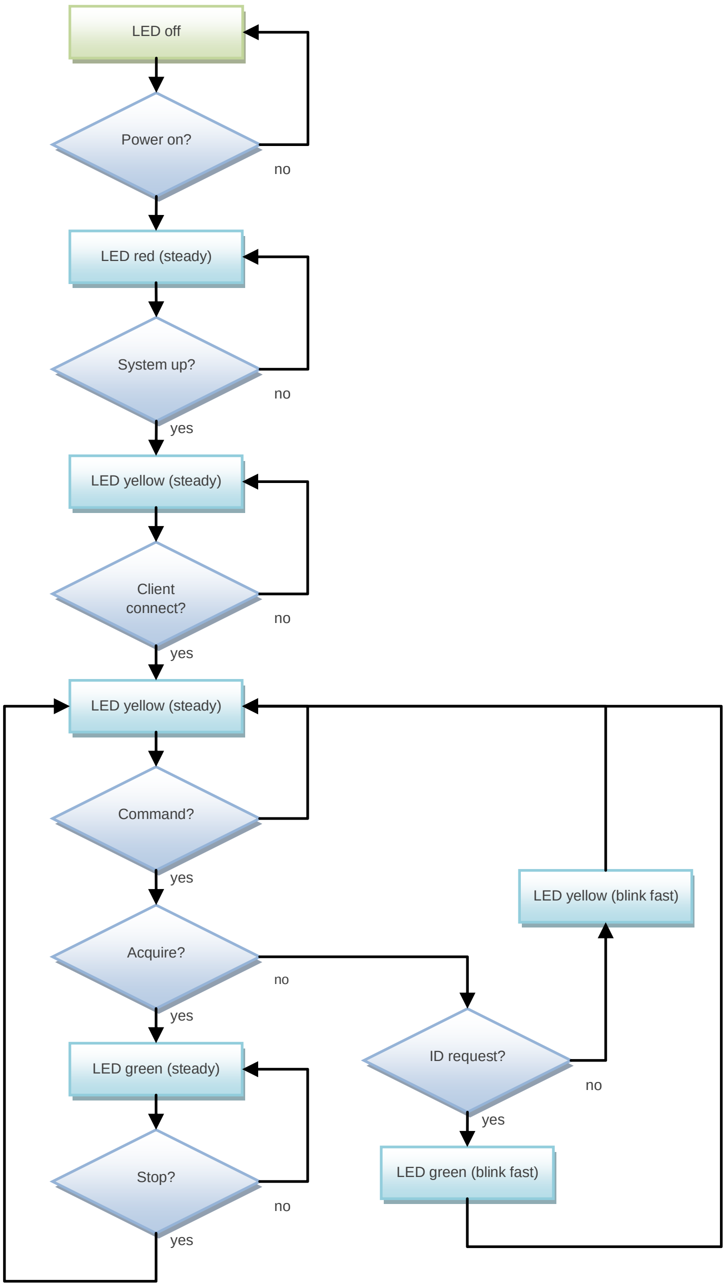
6.2 Applying the power

After the power is applied to the Deminsys interrogator several LED's on the faceplate side indicate the status of the device: a single multicolor LED directly on the faceplate and 2 bi-colored LED's on the RJ45 Ethernet connector.

6.2.1 Faceplate LED

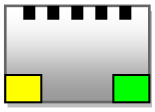
The ID request command is used to identify the Interrogator when used in a pool of Interrogators attached to the same network.

When the interrogator is not connected with any client after start-up the interrogator will send out its Ethernet settings. This is done with the use of a broadcasted UDP message.



6.2.2 Ethernet connector LED's

The LED's of the Ethernet connector (RJ45) indicate the status of the attached Ethernet link. They are bi-colored and show both colors separately. They have the following functions:



Left LED	Color	Indication	Note
Off	NA	No Link	
On	Yellow	Link Achieved	

Right LED	Color	Indication	
Off	NA	No Link	Error
On	Yellow	1 Gbps, no activity	
Blink	Yellow	1 Gbps, activity	
On	Yellow & Green	100 Mbps, no activity	Error
Blink	Yellow & Green	100 Mbps, activity	Error
On	Green	10 Mbps, no activity	Error
Blink	Green	10 Mbps, activity	Error

NOTE: Both 10 and 100 Mbps modes are not supported by the Interrogator. Attaching it to these type networks will result in erroneous operation of the device.

6.2.3 Synchronization Input

The Interrogator supports an optical isolated input, active low synchronization input on a LEMO FGG.0B.306 CLAD 42 type connector. Edges generated by asserting and/or negating this input will be detected by the acquisition process and inserted into the data stream and stored in the payload data packet. This will allow for accurate synchronization of the acquired data with external events.

Synchronization input should be connected to pin 6 (V+) and pin 5 (V-). Input voltage should be between 3Volt minimum and 24 Volt maximum. Other pins on the connector should not be used. Typically the maximum cable length is 2 meters. For longer cables additional measures are necessary.

6.3 Device settings

The Interrogator contains a set of settings that configures the device for Ethernet use and measurement. Some of the settings are internally stored, while others have to be configured for each measurement. The settings can be viewed and changed with TLV commands or with the Interrogator webpage.

6.3.1 Ethernet

The Interrogator Ethernet settings are divided into a fixed setting for the Interrogator MAC address and configurable settings for the Interrogator IP configuration.

6.3.1.1 MAC address

The 48-bit Interrogator MAC address is composed of 3 fields: 2 fixed and one static, i.e. fixed but varies per Interrogator:

MAC address bits		Value
47...24	Vendor ID (fixed)	00.20.92
23...16	Range ID (fixed)	13
15...0	Serial number (static)	00.00...FF.FF

6.3.1.2 IP address

The Interrogator holds the following configurable IP-settings. Upon power up, their values are extracted from internal non-volatile RAM:

IP settings	Factory default
IP configuration per DHCP	Off
Interrogator static IP address	192.168.0.199
Interrogator IP netmask	255.255.0.0
UDP destination address	255.255.255.255
UDP source port	50001
UDP destination port	50001

NOTE: When IP per DHCP is switched on, the Interrogator will search on the network for a DHCP server to obtain its IP-configuration. When there is no DHCP server available, the Interrogator will start after 90 seconds with searching with AUTO IP an address in the range 169.254.x.x. IP configuration per DHCP does not affect the UDP settings.

6.3.2 Finding the device IP address

Due to its architecture the Interrogator only has the network to communicate with the outside world. Now this implies a so called 'Catch 22' situation: how to address the device over the network as it only has the network to obtain its current address settings?

To break up this situation, the Interrogator will after power-up and internal configuration broadcast every 5 seconds a message containing its current address settings over the network. During this time the faceplate LED will blink yellow slowly. It will continue to do so until a network client establishes a connection with the Interrogator on the broadcasted address, e.g. by opening the webpage or starting a Telnet session.

When the DHCP functionality of the Interrogator is enabled the Interrogator must first get an IP address from the DHCP server. When the IP address for the Interrogator is acknowledged the IP address is updated in the broadcast message. When the broadcast message indicates that DHCP is active the initial IP address during the DHCP request in the broadcast message is the latest saved IP address. After the IP address is acknowledged a connection can be made. The Interrogator will not respond on request from the latest saved address.

6.3.2.1 Broadcast message

The broadcasted message is contained in a UDP packet on port 50001 and has the following data content:

[MAC address, IP address, DHCP status]

MAC and IP address are both in hex format, the DHCP status is indicated with 'DHCP=ON' or 'DHCP=OFF'. An example of the communicated MAC address is 0020920130001 meaning that the MAC address is 00:20:92:13:00:01. An example of the communicated IP address is C0A800C7, which means that the IP address is 192.168.0.199.

6.3.2.2 Broadcast Request

It is also possible to request the Interrogator network information from the interrogator connected on a network. To request the information a broadcast UDP message must be send to port 50001. If any interrogator is in reach of the network a reply will be send.

The following request can be done:

M	reply contains MAC address in hex format
I	reply contains IP address in hex format
MI	reply contains MAC and IP address in hex format

6.4 Measurement settings

A measurement requires a number of parameters to be set correctly that can be divided into the following separate procedures:

- Configuring the acquisition
- Configuring the destination of the output data stream.
- Configuring the light source
- Configuring the range limits
- Configuring the destination address
- Setting the time counter
- Setting the sensor detection settings

6.4.1 Acquisition settings

By setting these parameters the acquisition process of the interrogator is configured:

Acquisition parameter	Range	Default
Down-sampling factor	1...20000	1
Discrimination mode	Sub sampling / Averaging	Averaging
Number of sensors	1...32	1
Threshold	1...65535	1000
Acquisition name	8 characters (ASCII)	Deminsys

These values remain valid as long as the Interrogator is powered up, so also in between subsequent acquisitions.

6.4.2 Data Format settings

The data format settings specify the output in the UDP packet.

Data format parameter	Range	Default
CoG packaging factor	1…1417 DIV (3 + <numberofsensors> * 3)	1
Raw data	On|Off	Off
Black Level corrected data	On|Off	Off
Center of Gravity	On|Off	Off

6.4.3 Setting range limits

Whenever the Raw, Black-level corrected and/or sensor data are selected for output, the Interrogator will output a packet at a rate of:

Rate = 20.000 / Down-sampling factor

A strategy to obtain a better throughput is to pack the sensor values of multiple scans into a single UDP packet. This yields both data size reduction (single payload header per set of sensor values) as UDP packets/sec reduction. The CoG Packing Factor describes how many Center-Of Gravity data scans are packed into one UDP packet. Whenever only sensor-data is selected for output the upper range for the Packing factor is limited to ensure that the packet output rate is at least 1 per second, i.e.:

CoG Packing Factor^{MAX} = 20.000 / Down-sampling factor

6.4.4 SLED settings

The light source within an interrogator is an SLED. The interrogator can contain up to 4 SLED boards, each SLED can individually be switched on or off. The default state of the SLEDs is power-off. The optical power and temperature of each SLED is controlled. Before the SLED can become active the TEC controller, which controls the SLED temperature, needs to be enabled.

6.4.5 Destination address

Before acquisition data can be send the UDP destination settings must be specified. These settings exist out of the MAC address, IP address and port of the host PC. It is possible to set a destination address other than the address which is used for the interface for the settings.

The MAC address is a 48 bits address space, e.g. 0xF04DA2799BCD. The IP address is an IPv4, 32 bits address space, address. In human readably form this address can be for example 192.168.0.199 (in hexadecimal form: 0xC0A800C7)

6.4.6 Time counter

The Interrogator offers a possibility to set a counter, this counter can be used to set a reference time. The counter value is also integrated in the UDP acquisition packet. If the counter is not set the counter starts at zero at startup.

6.4.7 Sensor detection settings

The interrogator offers the possibility to calculate the algorithm for sensor detection. Previously mentioned are the threshold and the number of sensors to detect. Besides these settings the input for the algorithm must be specified. The Interrogator offers the possibility to calculate a black level table and subtract this from the raw data.

The black level table is calculated with the use of a number of line scans from the acquisition in idle state. These values are subtracted with result that the black leveled data is around zero.

The sensor detection algorithm can have as input the raw data or the black leveled data. With the number of sensors to detect and the threshold the algorithm works.

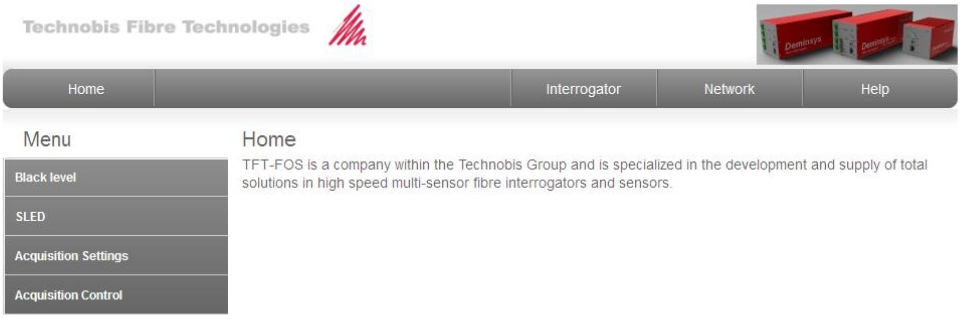
6.5 Communication Interface

The interrogator has multiple interfaces; these interfaces are used to change settings or to receive acquisition data. The following interfaces are available:

- **Web-server** for controlling the interrogator operation from a web-browser
- **TLV commands** for controlling the interrogator operation from a 3rd party software program:
    - Ethernet, Telnet
    - Serial bus on Camera Link (only supported with the Python version)
- **UDP data**, sending acquisition data and IP configuration data to a host PC

6.5.1 Web-server

The web-server of the Deminsys can be opened with Internet Windows Internet Explorer or Mozilla Firefox. Navigate to the IP address (default: **http://192.168.0.199**) of the interrogator in the search entry and the home page of the web server will be opened in your web browser. With the web-server basic acquisition and network parameters can be set and the acquisition can be started and stopped.



In this case the user should have or make its own acquisition software, which accepts the UDP data packages send to the destination host.

In the figure above the homepage of the internal web-server of the interrogator is shown.

Home

Return to the home page of the web-server.

Interrogator

Shows interrogator information, e.g. version, IP address and MAC address information.

Network

Shows the current IP address, IP setting and subnet mask. On this page it is also possible to change these values.

Help

A small explanation of the front LED is shown here and the possibility to identify the interrogator. When the identify functionality is active the front LED of the interrogator will flash green. This way it is possible to identify and distinguish the interrogator when multiple interrogators are connected to the same network.

Black level

This page offers the possibility to start the black level action. Recommended is that the black level action is performed with 1024 lines. Then the black level data will be averaged over 1024 lines.

SLED

Offers the possibility to enable the SLED’s and shows the status information of the SLED’s.

Acquisition Settings

The settings for the acquisition can be set, e.g. the destination address, number of sensors, etc. These settings can only be changed when no acquisition is active.

Acquisition Control

Here the acquisition can be started or stopped.

6.5.2 TLV commands

The Interrogator can be interfaced with the use of TLV commands to retrieve or write information from or to the Interrogator. Multiple channels can be used to send the TLV commands. The standard interrogator is equipped with an Ethernet interface where communication is done through a Telnet protocol.

6.5.2.1 Python

For the Python interrogator it is also possible to communicate with the serial (RS232) line of the Camera Link interface. Also on the serial line the TLV commands are used. After startup of the interrogator both channels (RS232 on Camera Link or Telnet on Ethernet interface) are available but only the channel that is used first will stay active and can be used to control the Python.

6.5.3 UPD data

The acquisition data of the Interrogator is communicated with the use of UDP. The format of the UDP payload packets is described in detail in Appendix A.

7 TROUBLE SHOOTING

7.1 Device

No LEDs active on the front plate

- The power supply is not connected correctly, check if power cable and 220 V plug is connected correctly.

No broadcast message received

- The Interrogator is not correctly connected to the network. See if the LEDs on the front panel of the interrogator indicate a correct working of the network.
- A firewall is active, disable all firewalls.
- Host and interrogator are not configured in same network. Check the network settings on your host.

Website is not loaded, IP address is correct

- The subnet mask is not correctly configured, change the subnet mask to a correct setting or change the IP address.
- Conflicting IP addresses change one of the IP addresses.
- Make sure it is the correct IP address. If the IP address is presented in the search tool and the DHCP functionality is active make sure the displayed IP address is from the DHCP range. If DHCP is active and the Interrogator gets no IP address the IP address in the broadcast is the last saved IP address. This IP address is not functional. If no IP address is given from a DHCP server an automatic IP address must become active. An automatic IP address must be in the range: 169.254.x.x.

Telnet server does not respond, website works

- Another client is connected to the Interrogator. Only one connection can be made to the Interrogator. First close all other connections.
- The previous session is not closed properly, restart the interrogator.

No acquisition data is received, telnet session works

- If LEDs on front are correct the interrogator is sending data. And the destination settings are not correct. Make sure the destination IP, MAC address and UDP port are correct.
- No acquisition data is selected. Make sure to select acquisition data to start the acquisition.

Sensor acquisition data received but no sensors detected.

- The SLEDs are not active; Make sure the SLEDs are active. SLEDs will be automatically disabled during a black level action.
- No fibres are connected to the interrogator.

7.1.1 Network

Check the network cable connector

Ensure that the network cable is firmly inserted into both the network connector on the side of the host and the network port on the interrogator.

Check the network lights on the network connector

No light indicates that no network communication exists. Replace the network cable.

Restart the computer and logon tot the network again

Check out your network settings

Contact your network administrator or the person who set up your network to verify that your network settings are correct and that the network is functioning.

7.1.2 Software

Check the software documentation or contact the software manufacturer for troubleshooting information

- Ensure that the software is compatible with the operating system installed on your computer
- Ensure that your computer meets the minimum hardware requirements needed to run the software
- See the software documentation for information
- Ensure that the program is installed and configured properly
- Verify that the device drivers do not conflict with the program
- If necessary, uninstall and then reinstall the program

Back up your files immediately

Use a virus-scanning program to check the hard drive, floppy disks, or CD's

Save and close any open files or programs and shut down your computer through the start menu

Scan the computer for spyware

If you are experiencing slow computer performance, you frequently receive pop-up advertisements, or you are having problems connecting to the Internet or your device, your computer might be infected with spyware. Use an anti-virus program that includes anti-spyware protection (your program may require an upgrade) to scan the computer and remove spyware.

7.1.3 Power

Check the power light

When the power light is lit or blinking, the device has power. If the power light is blinking, the device is in standby mode. If the light is off, check the power connector and the power adapter.

Test the electrical outlet

Ensure that the electrical outlet is working by testing it with another device, such as a lamp or a multi-meter.

Check the AC adapter

Check the AC adapter cable connections. If the AC adapter has a light, ensure that the light is on.

Connect the interrogator AC adapter directly to an electrical outlet

Bypass power protection devices, power strips, and the extension cable to verify that the device turns on.

Eliminate possible interference

Turn off nearby fans, fluorescent lights, halogen lamps, or other appliances.

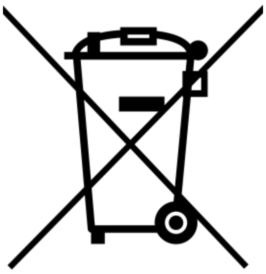
7.2 Technical Update Service

The Technical Update Service of Technobis Fibre Technologies provides a proactive e-mail notification of software and hardware updates for your system and documentation. The service is free and can be customized for content, format, and how frequently you receive notifications. To enroll for the Technobis Fibre Technologies Technical Update service, go to www.tft-fos.com/services.

On your request technical updates regarding software can be downloaded when applicable. Deminsys firmware is updated through the systems Gigabit Ethernet connection. This can be done either locally or from a remote location. Contact Technobis Fibre Technologies for a specific agreement on firmware update possibilities.

8 ENVIRONMENT INFORMATION

WEEE directive



This symbol means that your inoperative electronic appliance must be collected separately and not mixed with the household waste. The European Union has implemented a specific collection and recycling for which producers' are responsible.

This appliance has been designed and manufactured with high quality materials are components that can be recycled and reused. Electrical and electronic appliances are liable to contain parts that are necessary in order for the system to work properly but which can become a health and environmental hazard if they are not handled or disposed in the proper way. Consequently, please do not throw out your inoperative appliance with the household waste.

If you are the owner of the appliance, you must deposit at the appropriate local collection point or leave it with the vendor when buying a new appliance.

- If you are a professional user, please follow your supplier's instructions.
- If the appliance is rented to you or left in your care, please contact your service provider.

9 EUROPE - EUROPEAN UNION

European Community Declaration of Conformity

Hereby, Technobis fibre Technologies, declares that the Deminsys system is in compliance with the essential requirements and other relevant provisions of the Directive 2004/108/EC of the European Parliament and of the Council.

This equipment can be used in all countries that are member of the European Union and that are member of the European Free Trade Association.

The test reports and D.O.C. can be requested by e-mail: info@technobis.nl

Test report number for the assessment according to Directive 2004/108/EC (EMC).

10 APPENDICES

A Connecting the Deminsys

This section describes in detail the steps to take in connecting a Deminsys to the host system, to configure it and start an acquisition session. The network configuration used for this procedure is the 1-on-1 configuration; an out of the box Deminsys directly connected to the host system, in this case a Windows PC with a 1 Gbit Ethernet connection.

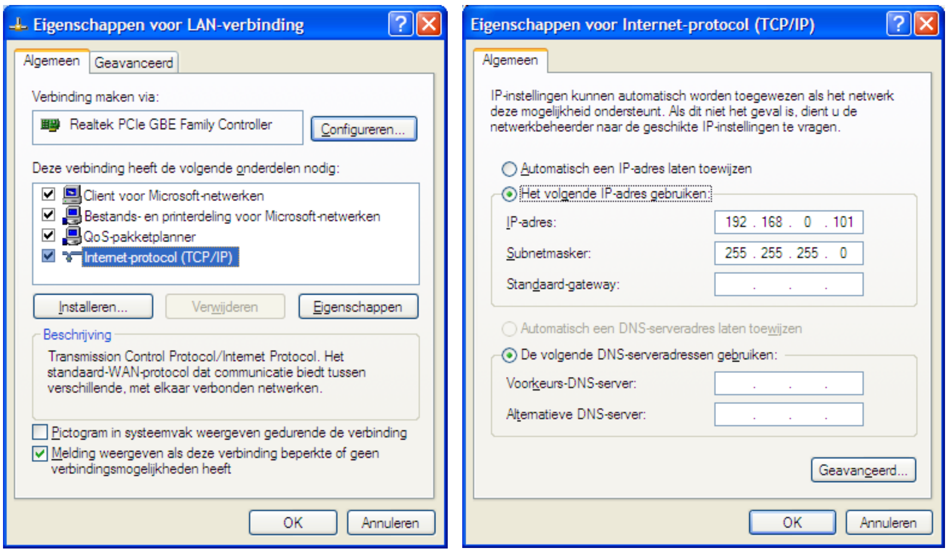
The procedure described in the following paragraphs is divided in three (3) major steps:

1. Create a connection between the Deminsys and the host PC
2. Set the acquisition parameters for the Deminsys
3. Start an acquisition session and collect measurement data

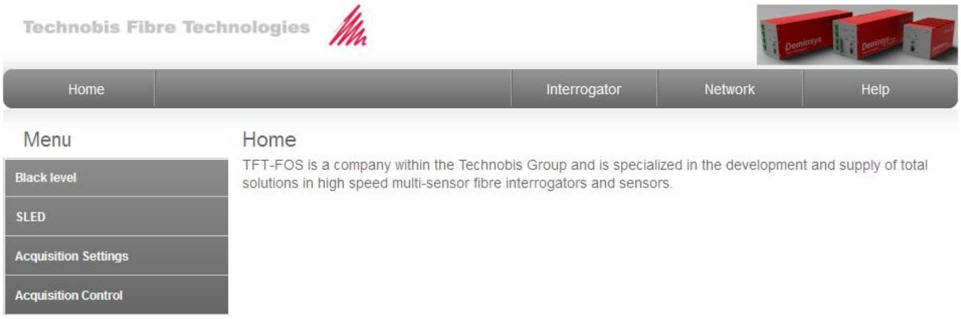
A.1 Connect the Deminsys

Follow the next steps to connect the Deminsys to the host PC:

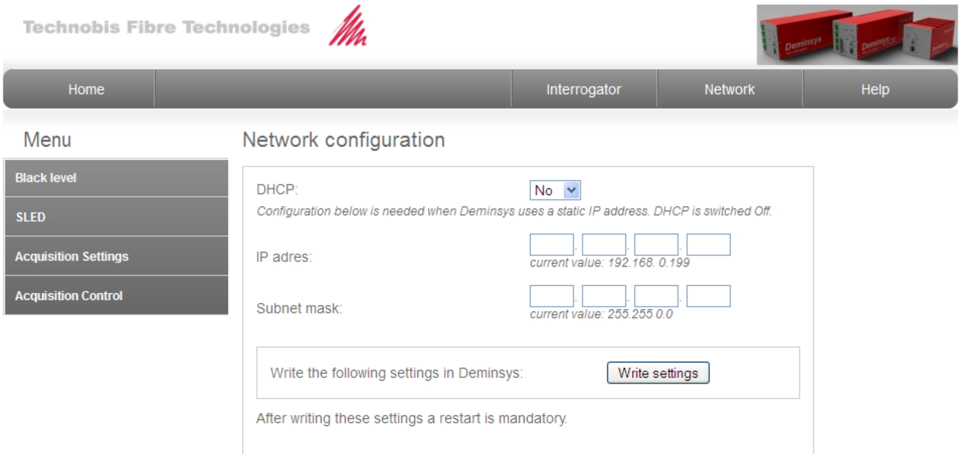
1. Connect the Ethernet cable between the Deminsys with and the PC.
2. Select the properties of the Ethernet connection used on the PC and select the IP settings:



3. Select an IP address that is compatible with your network settings. A typical IP available address is **192.168.0.101**. Make sure the subnetmask must be set to **255.255.255.0**.
4. At this point the Deminsys can be reached through its build-in web-server (see next page). Open your internet browser and navigate to the URL **http://192.168.0.199**. This is the default IP address of the interrogator itself.



5. Through the web-server interface all important parameters can be configured. As long as acquisition is not started all parameters can be changed in arbitrary order with the exception of the black level calibration. When the black level action is started the SLED's are turned off automatically and need to be restarted.
6. Select the **Network** page. By default DHCP is turned **off**, the interrogator IP address is set to **192.168.0.199** and the interrogator subnetmask is set to **255.255.0.0**.

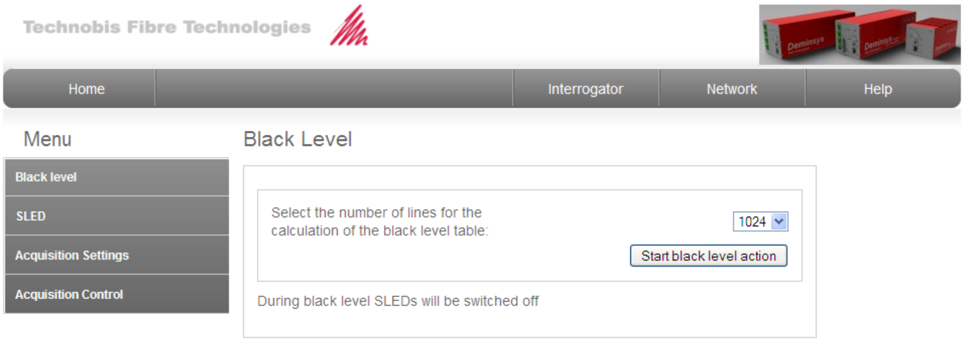


7. Once the connection is configured the SLED's can be turned on and the acquisition parameters can be set (see next paragraph)

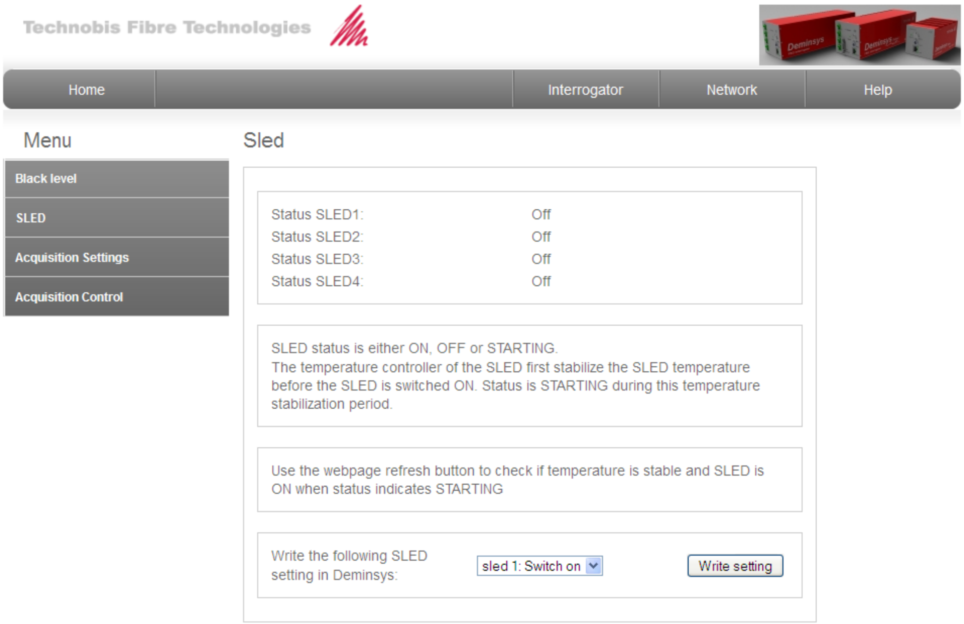
A.2 Set parameters

Preparing the Deminsys for acquisition requires a few parameters to be set. Continue from the last step of the previous paragraph where a suitable connection is established.

1. Select the **Black level** page from the Menu.

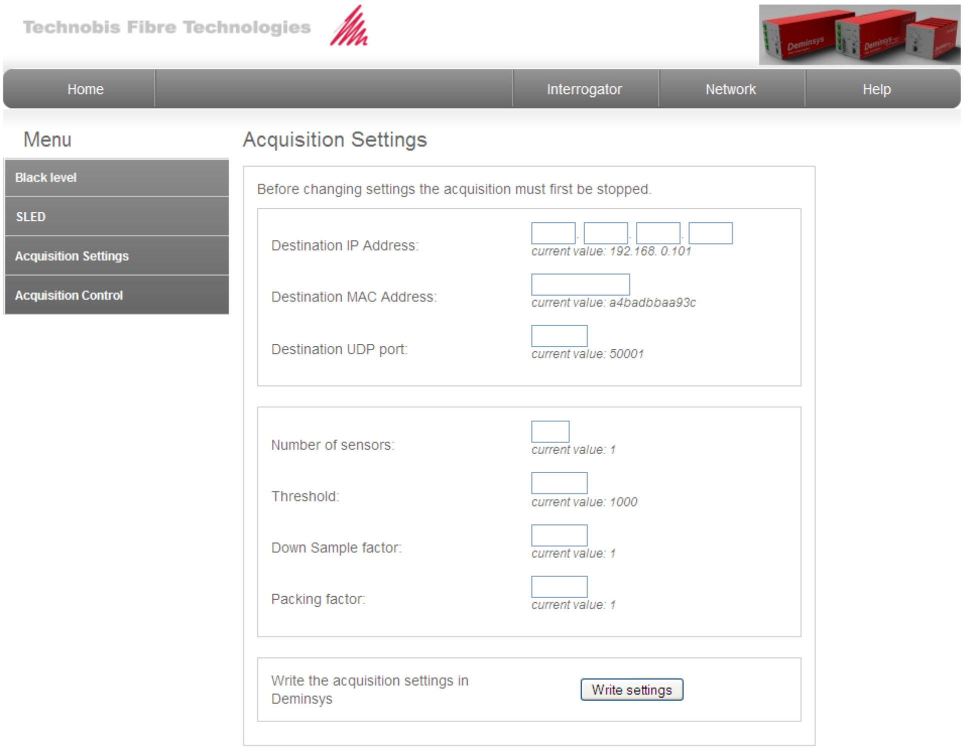


2. Calibrate the system by starting the black level action. It's recommended to use the 'number of lines' value of 1024. Once the button is selected the **SLED** page is automatically opened.



3. Each SLED can be turned on separately depending on the connected sensor channels. The channel numbers as displayed on the front face of the Deminsys correspond to the SLED numbers. It's not necessary to turn on all SLED's each time. If only one channel is used also only the associated SLED is required be turned on.

4. Once the light source(s) is (are) turned on, the **Acquisition Settings** can be configured.

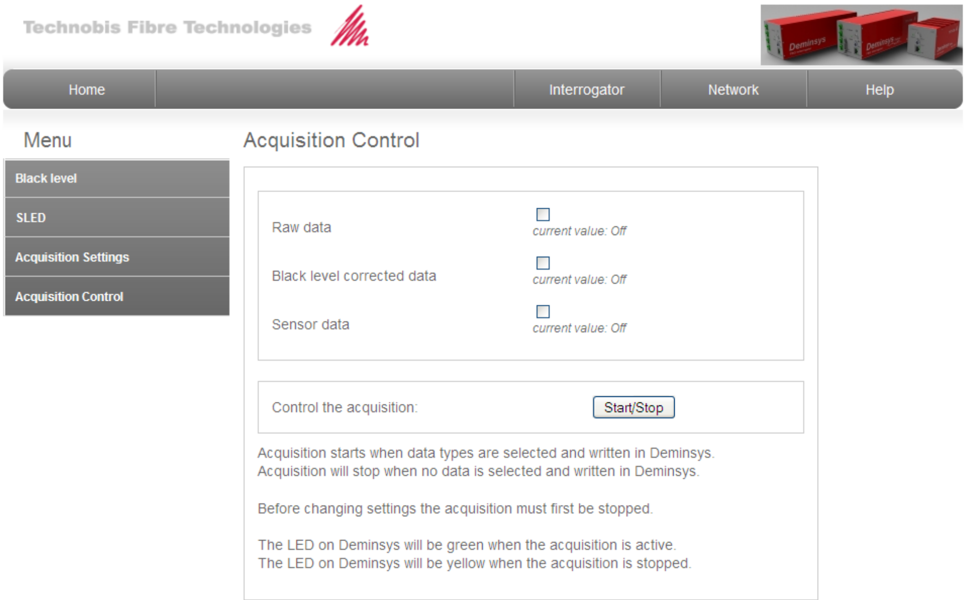


5. The so-called 'Destination' settings refer to the communication settings of the host. In this case the Windows PC. These settings allow the acquisition data to be sent to any host capable of receiving UDP data through the Ethernet network. Make sure these 'Destination' settings comply with the host Ethernet settings.
6. The next parameters determine which sensors and how you wish them to interrogate:
    a. The **Number of sensors** is the total number of FBG sensors of all fibres together connected to the Deminsys channels.
    b. The **Threshold** value is used to detect the sensor signals. Depending on the quality of the used FBG sensors and their reflected light intensity, the threshold value may need to be changed to a lower or higher value.
    c. The **Down Sample factor** actually defines the sample-rate as the acquisition data appears at the host. Internally all sensors are always interrogated with a sample rate of 20 kHz (!). This factor allows the data to appear to the host at a lower rate. When set to a value higher than 1 the data stream is averaged to that factor.
    d. The **Packaging factor** allows the UDP data payload to be sent in a more bandwidth effective manner. For typical small sized applications it's recommended to use the default value of 1.
7. At this point the system is ready for acquisition. Communication and acquisition settings are configured and the system is ready to interrogate the sensors and relay the measurement data to the host for processing.
8. The next paragraph will describe a typical acquisition scheme for illustration purposes.

A.3 Start acquisition

Starting off from the last step of the previous paragraph; all parameters are set.

1. Select the **Acquisition Control** page to initiate acquisition.



2. For normal operation it is only required to start the acquisition of **Sensor data**. The Deminsys has a build-in algorithm to process raw data taking the black level calibration into account. In cases where it is required to have the raw and/or black level corrected data as well, the Deminsys interrogator can provide that as well. For now, let's start acquiring only sensor data. Select the 'Sensor data' checkbox and click the **Start/Stop** button.

3. For documentation purposes a third party software application is used to capture an UDP payload packet as provided by the Deminsys interrogator. For each single record such a packet is generated. The next page shows the converted content of the payload package. The actual packet itself contains only binary code.

```
No.     Time          Source                    Destination               Protocol Info
 350072 17.512439     192.168.0.199             192.168.0.101             CIGI      192.168.0.199 =>
192.168.0.101 (53 bytes)[Malformed Packet]

Frame 350072: 95 bytes on wire (760 bits), 95 bytes captured (760 bits)
    Arrival Time: Apr 19, 2011 16:35:26.209115000 West-Europa (zomertijd)
    Epoch Time: 1303223726.209115000 seconds
    [Time delta from previous captured frame: 0.000004000 seconds]
    [Time delta from previous displayed frame: 0.000004000 seconds]
    [Time since reference or first frame: 17.512439000 seconds]
    Frame Number: 350072
    Frame Length: 95 bytes (760 bits)
    Capture Length: 95 bytes (760 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ip:udp:cigi]
    [Coloring Rule Name: UDP]
    [Coloring Rule String: udp]
Ethernet II, Src: ChessEng_13:00:01 (00:20:92:13:00:01), Dst: Dell_ba:a9:3c (a4:ba:db:ba:a9:3c)
    Destination: Dell_ba:a9:3c (a4:ba:db:ba:a9:3c)
    Source: ChessEng_13:00:01 (00:20:92:13:00:01)
    Type: IP (0x0800)
Internet Protocol, Src: 192.168.0.199 (192.168.0.199), Dst: 192.168.0.101 (192.168.0.101)
User Datagram Protocol, Src Port: 65535 (65535), Dst Port: 50001 (50001)
Common Image Generator Interface (1), 192.168.0.199 => 192.168.0.101 (53 bytes)
[Malformed Packet: CIGI]
    [Expert Info (Error/Malformed): Malformed Packet (Exception occurred)]
        [Message: Malformed Packet (Exception occurred)]
        [Severity level: Error]
        [Group: Malformed]

0000  a4 ba db ba a9 3c 00 20 92 13 00 01 08 00 45 3e   .....<. ......E>
0010  00 51 00 00 40 00 ff 11 f8 e0 c0 a8 00 c7 c0 a8   .Q..@...........
0020  00 65 ff ff c3 51 00 3d 00 00 01 10 01 02 01 01   .e...Q.=........
0030  44 65 6d 69 6e 73 79 73 00 00 00 00 00 00 00 10   Deminsys........
0040  00 00 1c 08 2f 5b 22 7e 03 e8 00 01 01 00 4a 7a   ..../["~......Jz
0050  e6 04 ff 80 03 00 80 00 00 80 00 00 80 00 00      ...............
```

4. As marked with the color yellow, the parameters identify the packets provided by a Deminsys interrogator:
    a. Source IP address → 192.168.0.199 (Deminsys)
    b. Target IP address → 192.168.0.101 (PC)
    c. Source port → 65535 (Deminsys)
    d. Target port → 50001 (PC)
    e. Packet frame size → 95 bytes
    f. Payload data size → 53 bytes
    g. Etc…
5. The complete UDP packet contains 95 bytes. 42 bytes are used as the header information. The actual sensor data (payload) is stored in the rest of the packet – in this case – 53 bytes.
6. The structure of this payload is described in **Appendix C “Payload data structure”.**

B Network configurations

The Deminsys Interrogator can be used in different network configurations. These will be described in detail in this Appendix.

To establish a physical link between 2 endpoints, cable wiring must be such that the transmitter on one end must be connected to the receiver on the other end and vice-versa. If the cable wiring is done so that Transmit on one end is wired to Transmit on the other and Receive is wired to Receive, the link will not come up.

Hubs and switches are deliberately wired opposite the way end stations are wired, so that when a hub or switch is connected to an end station, a "straight through" Ethernet cable can be used and the pairs will match up properly. When two hub/switches are connected to each other, or two end stations are connected to each other, a "crossover" cable is used to make sure that the correct pairs are connected.

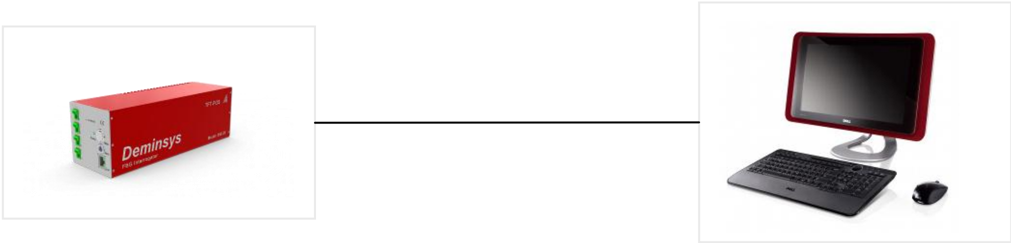
The standard wiring for end stations is known as "MDI" (Media Dependent Interface), and the standard wiring for hubs and switches is known as "MDIX" (Media Dependent Interface with Crossover). On certain devices, it is possible for hardware to automatically correct errors in cable selection, making the distinction between a "straight through" cable and a "crossover" cable unimportant. This capability is known as Auto Cross (Auto-MDIX). All 1000Base-T compliant interfaces support Auto-MDIX, so does the Interrogator.

They also support Auto-Negotiation, i.e. they automatically configure to the highest communication speed that both end-points advertise during auto-negotiation. Hereto both end-points must have this (configurable) option enabled. Whenever one endpoint is set for a fixed configuration, auto-negotiation will fail and the link will not come up (properly). Auto-Negotiation is commonly enabled on PC‟s. The Interrogator however only supports the 1000Base-T standard. Connecting it to a 10/100Base-T network will result in erroneous operation of the Interrogator.

Once a physical link is established, PC‟s have their network connections configured in either DHCP-client (most common) or Static-IP mode. DHCP is most common as in this setting the user does not need to have any TCP/IP network knowledge to obtain a working network connection. It requires however the presence of a DHCP server somewhere in the network that hands out the IP-information.

A user that uses Static-IP configuration commonly has (some) knowledge on TCP/IP networking. The advantage is that it does not rely on additional network services for correct functioning.

B.1 1-on-1 configuration



A.1.1 Link Configuration

This will succeed if both endpoints have link negotiation set to either auto-negotiation (link at 1Gbps) or set identical (link at set speed).

A.1.2 IP configuration

Due to the lack of a DHCP server both endpoints need to rely on static-IP configuration.

B.2 Single network device configuration

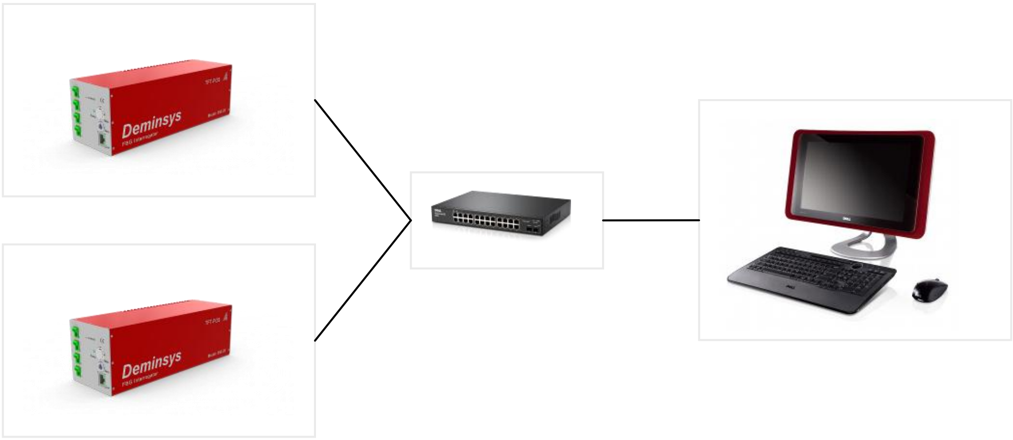
A.1.3 Link Configuration

This will succeed for the Interrogator whenever a 1000Base-T compliant switch is used. This configuration allows for the PC to use a different speed than 1Gbps as long as the data bandwidth remains within the slowest network bandwidth. The switch provides the network speed translation.

A.1.4 IP configuration

Assuming that the dotted green line depicts a connection to a company LAN containing a DHCP server, both the Interrogator and the PC will obtain an IP-address within the same LAN-segment. Whenever the DHCP server or the company LAN lacks, both endpoints need to rely on static-IP configuration.

B.3 Multiple network devices configuration



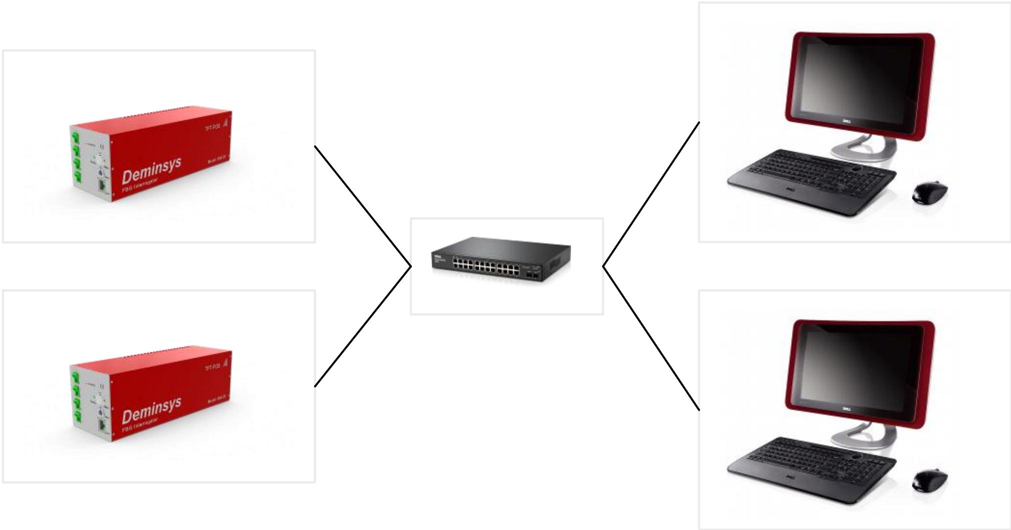
A.1.5 Link Configuration

This will succeed for the Interrogators whenever a 1000Base-T compliant switch is used. This configuration allows for the PC to use a different speed than 1Gbps as long as the total data bandwidth remains within the slowest network bandwidth. The switch provides the network speed translation.

A.1.6 IP configuration

Assuming that the dotted green line depicts a connection to a company LAN containing a DHCP server, all Interrogators and the PC will obtain a different IP-address within the same LAN-segment. Whenever the DHCP server or the company LAN lacks, all endpoints need to rely on static-IP configuration with different addresses.

B.4 Many-to-More configuration



A.1.7 Link configuration

This will succeed for the Interrogators whenever a 1000Base-T compliant switch is used. This configuration allows for the PC"s to use a different speed than 1Gbps as long as their individual data bandwidth remains within their network bandwidth. The switch provides the network speed translation.

A.1.8 IP configuration

Assuming that the dotted green line depicts a connection to a company LAN containing a DHCP server, all Interrogators and the PC will obtain a different IP-address within the same LAN-segment. Whenever the DHCP server or the company LAN lacks, all endpoints need to rely on static-IP configuration with different addresses.

C Payload data structure

This appendix describes the so called payload format of the data packet generated by a Deminsys interrogator. It describes the content of the packets as they are received at the application level. The sections indicated between the ‘<’ and ‘>’ characters are to be considered as one or more binary characters placed consecutive in the file.

Section	<payload>
Contents	<protocol_id><generic_section><data_protocol_id><data_section>

The payload is not intended to be self-describing in the way that, for example, XML is. To allow for future modification of the packet format, the first part of the payload is an identifier that uniquely determines the meaning of the subsequent information. This chapter describes the currently defined formats; others may be defined in the future.

Section	<protocol_id>
Contents	1 byte hexadecimal (0x00..0xFF)
Description	8-bit protocol version number

C.1 Generic section

Independent of the actual sensor data format, each packet is started with a generic header containing the following items:

Section	<generic_section>
Contents	<interrogator_id><type_id><version_id><measurement_id> <last_sync_edge_seconds><last_sync_edge_nseconds><sample_seconds> <sample_nseconds><threshold><discrimination_id><cog_packing_factor> <sequence_id>

Each item has the following layout and meaning:

Section	<interrogator_id>
Contents	3 bytes hexadecimal (0x000000..0xFFFFFF)
Description	24-bit unique number identifying the interrogator. Taken from the least 24-bits of the MAC address which is on its turn derived from its unique serial number

Section	<type_id>
Contents	1 byte hexadecimal (0x00..0xFF)
Description	8-bit number identifying the interrogator type

Section	<version_id>
Contents	1 byte hexadecimal (0x00..0xFF)
Description	8-bit number identifying the version of the interrogator type

Section	<measurement_id>
Contents	8 byte ASCII text string
Description	user definable measurement bound text string

Section	<last_sync_edge_seconds>
Contents	unsigned 32 bit integer
Description	seconds counter of the last occurrence of a signal level change on the ‘sync’-input since start of device or since user set reference time

Section	<last_sync_edge_nseconds>	
Contents	32 bit binary value	
Description	bit 29..0	nanoseconds counter of the last occurrence of a signal level change on the ‘sync’-input since start of device or since user set reference time
	bit 31	‘0’ - since start of device ‘1’ - since user set reference time
	bit 30	‘0’ - falling edge on „sync“-input ‘1’ - rising edge on „sync“-input

Section	<sample_seconds>
Contents	unsigned 32 bit integer
Description	seconds counter since start of device or since user set reference time

Section	<sample_nseconds>	
Contents	32 bit binary value	
Description	bit 30..0	nanoseconds counter since start of device or since user set reference time
	bit 31:	‘0’ - since start of device ‘1’ - since user set reference time

Section	<threshold>
Contents	unsigned 16 bit integer
Description	value indicating the applied sensor threshold value during the measurement

Section	<discrimination_id>	
Contents	16 bit binary value	
Description	bit 15	‘0’ – supplied data is averaged ‘1’ – supplied data is sub-sampled
	bit 14..0	value of scan window over which to average/sub-sample

Section	<cog_packing_factor>
Contents	unsigned 8 bit value
Description	Value indicating the amount of scans of which the CoG values are packed in a single UDP-packet. Value is used when only CoG values are supplied, i.e. when <data_protocol_id> = 0x04 or 0x0C, otherwise this value defaults to 1. Range: 1..<cog_packing_factor>MAX, with <cog_packing_factor>max = 1431 DIV (3 + <numberofsensors> * 3)

Section	<sequence_id>
Contents	unsigned 32 bit integer
Description	4 byte wrap around counter, incremented per CCD-acquisition

Each data section is thus preceded by a generic section of 38 bytes

C.2 Data protocol id

Within the current packet format, different data formats may be defined.

Section	<data_protocol_id>
Contents	1 byte hexadecimal (0x00..0xFF)
Description	8-bit protocol version number

Currently 3 data formats are defined: raw data, black level corrected data and Center-of-Gravity (CoG) data. As a result 3 version numbers for these are allocated:

0x01	raw data
0x02	black level corrected data
0x04	center-of-gravity data

Bit-wise OR-ed patterns are allowed. When multiple bits are set, the samples are sent in the order listed above. The actual data outputted depends on the user defined operating mode of the interrogator.

Whenever center-of-gravity data is selected (data_protocol_id bit 2 is set) bit 3 of the data_protocol_id indicates the following:

0x08 center-of-gravity data based on raw or black level corrected data:

‘0’ black level corrected data

‘1’ raw data

C.3 Data section

The data section combines the data from the sync input with the sensor data:

Section	<data_section>
Contents	<sync_data><sensor_data>

A.1.9 Sync data

The Sync data reflects the signal on the external Sync input at the time of the sample.

Section	<sync_data>
Contents	1 byte hexadecimal (0x00 || 0xFF)
Description	0x00 input level below threshold 0xFF input level over threshold

Note: using a byte value allows for simple analog sync data in future versions.

A.1.10 Sensor data

Depending on the <data_protocol_id>, the sensor data section contains the following data:

Section	<sensor_data>
Contents	[<raw_data>][<bl_data>][<cog_data>] || [<cog_data_01>[..cog_data_pf]]

The following paragraphs describe each in more detail.

A.1.10.1 Raw data

The raw data section provides the data as it is taken directly from the sensor, i.e. without any processing. As the sensor contains 256 pixels which are converted by a 16-bit ADC, this section thus contains 512 bytes of data.

Section	<raw_data>
Contents	<pixel_00><pixel_01>..<pixel_254><pixel_255>

Section	<pixel_xx>
Contents	2 bytes hexadecimal (0x0000..0xFFFF)
Description	16-bit offset binary value, 0x0000 reflects black (no light)

A.1.10.2 Black-level corrected data

The black-level corrected data section provides the sensor data after black level correction. As the sensor contains 256 pixels which are converted by a 16-bit ADC this section thus contains 512 bytes of data. Whenever the measured black level of a pixel exceeds the value of the current measurement a value of 0x0000 is returned for that pixel.

Section	<bl_data>
Contents	<bl_pixel_00><bl_pixel_01>..<bl_pixel_254><bl_pixel_255>

Section	<bl_pixel_xx>
Contents	2 bytes hexadecimal (0x0000..0xFFFF)
Description	16-bit offset binary value, 0x0000 reflects black (no light)

A.1.10.3 Center-of-Gravity data

The current version of the interrogator supports a maximum of 32 sensors: 4 fibres with a maximum of 8 sensors each. As center-of-gravity values can only be calculated for attached sensors, the length of this section thus depends of the configuration of the attached fibres.

The center-of-gravity value is expressed as a pixel coordinate on the CCD-sensor, i.e. in the range 0 to 255, inclusive. This means 8 bits are required for the magnitude part of the resulting fibre sensor data. The fractional resolution has to be at least 3 digits, i.e. 10 bits and the magnitude 8 bits, resulting in 18 bits. As the packet is byte-oriented 24 bits are returned for each center-of-gravity value with the actual position value placed in the least significant 18 bits.

Sensor indices, i.e. center-of-gravity values, are determined from CCD pixel coordinate 0 up to 255. Each time a pixel value during a CCD sensor scan exceeds a threshold, the presence of a fibre sensor is assumed and its CoG is calculated.

Ideally, each fibre is individually projected on subsequent quarters of the CCD sensor. Fibre sensor indexing can then be related to the quarter they are positioned in, i.e. fibre sensors found in the first quarter are indexed from 0 to 7, ones found in the second quarter from 8 to 15 and so on. This can allow for easier detection of erroneous fibre connection. The user can opt for this or just for a regular linear indexing (1..n) over the complete CCD sensor. The MSB of the given CoG value indicates the numbering type. The sensor indexing remains the same as long as the fibre configuration is not changed. The CoG values are preceded by a status field containing 3 bytes with status information on the CoG calculation of the scan.

Section	<cog_data>
Contents	<cog_status_field><cog_sensor_01>[..<cog_sensor_nn>]

Section	<cog_status_field>
Contents	<cog_status><numberofsensors><numberofpeaksfound>

Section	<cog_status>	
Contents	1 bytes hexadecimal (0x00 | 0x80 | 0x81)	
Description	0x00	correct scan (<numberofsensors> == <numberofpeaksfound>)
	0x80	incorrect scan (<numberofsensors> > <numberofpeaksfound>) Packet padded with CoG value 0x800000 after <numberofpeaksfound>
	0x81	incorrect scan (<numberofsensors> < <numberofpeaksfound>) Calculated CoG values after <numberofsensors> removed

Section	<numberofsensors>
Contents	1 bytes hexadecimal (0x00..0xff)

Section	<numberofpeaksfound>
Contents	1 bytes hexadecimal (0x00..0xff)

Section	<cog_sensor_xx>	
Contents	24 bit binary value	
Description	bit 17..0	CoG value in 0:8:10 fixed point format
	bit 22..18	fibre sensor index
	bit 23	‘0’ – quarter indexing ‘1’ – linear indexing

The value <numberofsensors> is a configuration parameter that for the current Deminsys is limited to 32 sensors. The value <numberofpeaksfound> results from the CoG algorithm which due to its mathematics is limited to half of the number of pixels of the CCD sensor, i.e. 128.

With a maximum of 32 fibre sensors (4 fibres with 8 sensors each) this section thus contains at least 6 bytes and at most 99 bytes.

A.1.11 Exception Handling

Due to the high sampling rate it is not possible to change dynamically from UDP package size. This implies that a change in number of sensors found cannot be handled dynamically (changing size of UDP package) during measurement in the interrogator. Hence missing a sensor, or finding an extra sensor, during measurement causes an exception and should be handled by interrogator and host.

The following situations can occur:

- One or more sensor peaks disappear during measurement
- One or more sensor peaks appear during measurement

In either case the situation occurs that the resulting data volume does not match the expected data volume so a modification of the resulting data volume is required to allow the hardware to function correctly. Furthermore it must be signaled to the user/host unambiguously that the situation has occurred so that corrective actions can be taken.

A.1.11.1 One or more sensor peaks disappear during measurement

This requires the data volume to be expanded up to the expected volume with fictive CoG values. Furthermore it can cause the sensor numbering to be erroneous, depending on the position of the disappearing peak(s):

- All peaks in front of disappeared peaks (i.e. on lower numbered pixels) within the fibre segment of the CCD will remain correctly numbered
- All peaks after disappeared peaks (i.e. on higher numbered pixels) within the fibre segment of the CCD will be incorrectly numbered

As during scanning the amount of peaks are counted, only at the end of the scan it can be determined that peak(s) is/are missing and as incrementing occurs whenever a peak is encountered, the resulting erroneous sensor number<>CoG value combination(s) cannot be corrected for within the interrogator pipeline structure.

A.1.11.2 One or more sensor peaks appear during measurement.

This requires the data volume to be reduced down to the expected volume by flushing additionally acquired CoG values. Furthermore it can cause the sensor numbering to be erroneous, depending on the position of the appearing peak(s):

- All peaks in front of appeared peaks (i.e. on lower numbered pixels) within the fibre segment of the CCD will remain correctly numbered
- All peaks after appeared peaks (i.e. on higher numbered pixels) within the fibre segment of the CCD will be incorrectly numbered

As during scanning the amount of peaks are counted, only at the end of the scan it can be determined that peak(s) is/are added and as incrementing occurs whenever a peak is encountered, the resulting erroneous sensor number<>CoG value combination(s) cannot be corrected for.

A.1.11.3 Exception Status signaling

To determine the status of the scan an additional field is added in front of the provided CoG values containing both the NumberofSensors and the NumberofPeaksFound values. Based on their values the following conditions can occur:

- **NumberofSensors == NumberofPeaksFound**

  The scan contains no abnormalities and all values can be processed as normal

- **NumberofSensors > NumberofPeaksFound**

  The scan misses peaks causing dummy values added at the end of the packet to cause the number of values provided to match the expected value NumberofSensors. To allow distinction between measured values and added values, all padded values are given the value 0x800000, i.e. bit 23 indicating an illegitimate value, bits22..18 indicating sensor „0" (out of sequence) and bits17..0 indicating CoG value 0.0 (impossible position).

- **NumberofSensors < NumberofPeaksFound**

  The scan contains additional peaks causing the last CoG values to be removed at the end of the packet to cause the number of values provided to match the expected value NumberofSensors.

A.1.12 Packaged Center-of-Gravity data

Whenever <data_protocol_id> = 0x04 or 0x0C the Center-of-Gravity payload of subsequent scans can be packed into a single UDP packet to optimize network usage. The amount of subsequent scans that are packed is selected with the <cog_packing_factor>. The maximum value for this <cog_packing_factor> is dependent of the amount of attached sensors <numberofsensors> according to:

$$\text{<cog\_packing\_factor>}^{max} = 1431 \text{ DIV } (3 + \text{<numberofsensors>} * 3)$$

A.1.13 Payload sizes

Based on the above the following payload sizes can be determined:

Data Protocol ID	Mode	Payload size
0x01	RAW	1+38+1+1+512 = 553
0x02	BL	1+38+1+1+512 = 553
0x03	RAW+BL	1+38+1+1+512+512 = 1065
0x04	COG	1+38+1+1+((6...99)*<cog_packing_factor>)
0x05	RAW+COG	1+38+1+1+512+(6...99)=559...652
0x06	BL+COG	1+38+1+1+512+(6...99)=559...652
0x07	RAW+BL+COG	1+38+1+1+512+512+(6...99)=1071...1164

D TLV commands

The communication with Deminsys is based on TLV messages. A TLV message can be divided in three parts:

TLV	**=**	**<Type><Length><Value>**
In which,		
Type	=	A code which indicates the kind of field that this part of the message represents.
Length	=	The size of the value field in bytes, decimal numbering.
Value	=	Variable sized set of bytes which contains data for this part of the message.

The Type and Length fields are fixed in size and the value field is of variable size. The Type field exists out of two ASCII characters, the Length value exists out of three ASCII characters.

The TLV commands can be given by a Telnet connection with the interrogator. The Telnet port, port 23, must be used to establish a connection with the Interrogator. Manny operating systems and data acquisition programs support telnet connections and therefore telnet is selected. Also terminal emulator programs as Putty and Tera Term can be used to set up a telnet connection with the interrogator.

The python interrogator is also equipped with a Camera Link board. With the use of this extension board it is also possible to send the TLV‟s using the serial line available in the Camera Link cable. After start-up both communication channels are available, only the first used channel will stay available.

The TLV messages are grouped in the following groups:

- Start & Stop Commands
- System Commands
- Acquisition Commands
- Network Commands
- SLED Commands
- Camera Link Commands

In general, the prefix **s** is used to set values and the prefix **g** is used to get values from the interrogator. The prefix **a** represents acknowledge and the prefix **n** represents a negative acknowledge.

When a negative acknowledgment is received the second byte indicates the fault. The following faults can be determined:

C – The Command is unknown

L – The Length of the value field is not correct

P – The Parameter is not correct

D.1 Start & Stop Commands

sA

This type is used to set the acquisition parameters and start the acquisition . This command can be given during measurement to stop the acquisition. In the value field the following values can be used:

C	Centre of gravity in formation based on black level data
c	Centre of gravity information based on raw data
b	Black level data
B	Black level table
r	raw data

Example:

Command	**Answer**	**Description**
sA001r	a0000	This starts the acquisition of raw data.
sA001b	a0000	This starts the acquisition of black level corrected data.
sA002rC	a0000	This starts the acquisition of raw data and sensor data, black leveled data is used as input for calculation.
sA000	a0000	The acquisition stops

During the measurement the configuration cannot be changed. The measurement needs to be stopped before the settings can be changed. The only monitoring commands allowed during measurement are the monitoring commands for temperature, SLED currents and TEC current. Hence, unless explicitly mentioned b y the command, it is not possible to use a TLV during measurement.

D.2 System Commands

sB

This type is used to calculate the black level correction values in the FPGA. In the value field the number of iterations is defined. The value field can be 0x1 to 0xa. The number of lines over which the black level correction is calculated, is 2 to the power of the value field. It is recommended to use the maximum number of lines for the black level action, the value field must then be 0xa (1024 lines).

Example:

Command	Answer	Description
sB001a	a0000	The Black level action starts, the averaged value is taken over 1024 lines

gB

This type is used to request the status of the black level action. If the black level action is active a 0x1 value is returned.

Example:

Command	Answer	Description
gB000	a00010	The black level action is completed or not active

A time-stamping unit in the interrogator places the time when the CCD line scan was started in the UDP data packet. A time stamp consists of a 32-bit second value and a 3 2-bit nanosecond value. The nanosecond-counter counts up to 999,999,999 (decimal) and then wrap s to 0 , increasing the second counter by 1. Both counters are reset to zero on power up. In order to set the counters to values corresponding with a real world time (wall clock time or start of measurement), the following commands can be used to load the counters with any value. The internal counter will be set to these values when the sync command is communicated.

sa

This type is used to set the counter for the number of seconds in the FPGA (time sync between Deminsys and host PC). The number of digits in the value field is eight, the value is specified in hexadecimal value.

Example:

Command	Answer	Description
sa00800000001	a0000	Setting the counter on one second

ga

This type is used to get the value of the counter with the number o f seconds in the FPGA. The number of digits in the return message in the value field is eight, the value is specified in hexadecimal value.

Example:

Command	Answer	Description
ga000	a000800000001	Reading the counter which gives the current value on read out.

sb

This type is used to set the value of the counter containing the nanoseconds in the FPGA (time sync between Deminsys and host PC). The number of digits in the value field is eight, the value is specified in hexadecimal value.

Example:

Command	Answer	Description
sb00800000001	a0000	Setting the counter on one nanosecond.

gb

This type is used to get the counter containing the nanoseconds in the FPGA. The number of digits in the return message in the value field is eight, the value is specified in hexadecimal value. The nanoseconds value is only updated after a request of the timer containing the seconds.

Example:

Command	Answer	Description
gb000	a000800000001	Reading the counter which gives the current value on read out.

sc

This type is used to sync the counter values. The value field contains 1 digit, at this moment the digit is ignored.

Example:

Command	Answer	Description
sc0010	a0000	Syncs the counter values

sd

This type is used to reset the sequence counter. No data in the value field.

Example:

Command	Answer	Description
sd000	a0000	Resets the counters in the interrogator

ge

This type is used to get the temperatures in the system . In the value field one digit is used. The digit indicates which temperature is requested.

0x0	request main board temperature
0x1	request FPGA temperature
0x2	request PHY temperature

Temperatures are in hexadecimal value. This command can be given during measurement.

Example:

Command	Answer	Description
ge0010	a000223	Reading the temperature of the sensor, indicating 35 degrees Celsius.
ge0012	a000237	Reading the temperature of the PHY, indicating 55 degrees Celsius. Value is printed in hexadecimal format.

gv

This type is used to get the version of the FPGA firmware. The value field is left empty. The return message contains the version, 5 characters indicate the version number.

Example:

Command	Answer	Description
gy000	a00052.0001	This gets the version number of the firmware of the FPGA. In this example the version number is 2.001.

vv

This type is used to get the version of the PPC software. The value field is left empty. The return message contains the version.

Example:

Command	Answer	Description
vv000	a00050.3.0	This gets the version number of the software of the PPC. In this example the version number is 0.3.0.

D.3 Acquisition Commands

sW

This type is used to set the number of sensors connected to the system. The number of digits in the value field is two.

Example:

Command	Answer	Description
sW0020a	a0000	Sets the number of sensors, in this example 10 sensors. Hexadecimal values are used.

gW

This type is used to get the number of sensors connected to the system. The return message contains the number defined number of sensors. The value field of the return message exists out of 2 digits.

Example:

Command	Answer	Description
gW000	a000201	Gets the number of sensors set, in this example 1 sensor. Hexadecimal values are used.

sX

This type is used to set the threshold for the centre of gravity calculation. The number of digits in the value field is four, the value is specified in hexadecimal value.

Example:

Command	Answer	Description
sX00403e8	a0000	Sets the threshold for sensor detection, in this example the threshold is 1000. Hexadecimal values are used.

gX

This type is used to get the threshold for the centre of gravity calculation. The return messages contains the specified the threshold. The value field of the return message exists out of 4 digits.

Example:

Command	Answer	Description
gX000	a0004ffff	Gets the threshold value, in this example 6 5535. This is the default value.

sj

This type is used to set the packing factor for the acquisition. The packing factor only works when sensor (CoG) data is acquired. In the value field four digits are used to indicate the packing factor, in hexadecimal notation.

A strategy to obtain a better throughput is to pack the sensor values of multiple scans into a single UDP packet. This yields both data size reduction (single payload header per set of sensor values) as UDP packets/sec reduction. The maximum value for this <sensor_packing_factor> is dependent of the amount of attached sensors <numberofsensors> according to:

<sensor_ packing_factor>^{MAX} = 1417 DIV (3 + <numberofsensors> * 3)

Maximum value is 236, higher values will be ignored. Default one sensor is set, if mo re sensors are set the maximum value is lower. The minimum value for the package factor is 1.

Example:

Command	**Answer**	**Description**
sj0040003	a0000	Sets the packing factor for the UDP packets. In this example the value is 3, hexadecimal notation is used.

gj

This type is used to get the packing factor for the acquisition . In the value field of the return value three digits are used to indicate the packing factor, in hexadecimal notation.

Example:

Command	**Answer**	**Description**
gj000	a00040001	Gets the packing factor used during UDP packet generation. Default value is 1.

The interrogator offers the possibility to change the frequency of the acquisition. Default the Interrogator acquires 20.000 samples per second. This can be changed when using the following function. With these functions the acquisition can be sub sample or averaged.

sk

This type is used to enable the subsample or averaging functionality for the acquisition. In the value one digit is used to switch between subsample and averaging. Subsample is chosen with the value 1 and averaging is chosen with the value 0.

Example:

Command	**Answer**	**Description**
sk0010	a0000	Sets the acquisition to subsample or averaging. In this example averaging is chosen.

gk

This type is used to read the choice between subsample and averaging functionality for the acquisition. In the return value one digit is used to indicate subsample or averaging.

Example:

Command	Answer	Description
gk000	a00011	Gets the choice between subsample and averaging during acquisition. In this example subsample has been chosen.

sl

This type is used to set the factor for the subsample or averaging functionality for the acquisition. In the value field four digits are used to set the factor for the functionality.

Example:

Command	Answer	Description
sl00403e8	a0000	Sets the number of line scans used for the subsample or average functionality. Hexadecimal values are used.

gl

This type is used to read the factor for subsample or averaging functionality for the acquisition. In the return value four digits are used to indicate the factor for subsample or averaging.

Example:

Command	Answer	Description
gl000	a000403e8	Gets the number of line scans used during acquisition. In this example 1000 line scans are used. Hexadecimal value notation is used.

D.4 Network Commands

sC

This type is used to change the destination MAC address . The destination MAC address is used in the UDP packets to indicate the destination of the message. The value field contains the MAC address, a 12 digits hexadecimal value.

Example:

Command	Answer	Description
sC012f04da2799bcdr	a0000	This sets the destination MAC address

gC

This type is used to request the destination MAC address , the value field is left empty. The return message contains the MAC address in the value field.

Example:

Command	Answer	Description
gC000	a0012f04da2799bcd	This returns the destination MAC address active in the Interrogator. In this example the MAC address is: F0:4D:A2:79:9B:CD

sD

This type is used to set the destination IP address. The value field contains the IP address, an 8 character hexadecimal value.

Example:

Command	Answer	Description
sD008c0a80001	a0000	This sets the destination IP address, in this example the IP address is 192.168.0.1. In the command the IP address is represented in a hexadecimal value.

gD

This type is used to get the destination IP address . The value field is left empty. The return message contains the IP address, an 8 character hexadecimal value.

Example:

Command	Answer	Description
gD000	a0008C0A80001	This gets the destination IP address, in this example the IP address is 192.168.0.1. In the command the IP address is represented in a hexadecimal value.

sE

This type is used to set the source IP address . The value field contains the IP address, an 8 character hexadecimal value.

Example:

Command	Answer	Description
sE008c0	a80001a0000	This sets the source IP address, in this example the IP address is 192.168.0.1. In the command the IP address is represented in a hexadecimal value.

gE

This type is used to get the source IP address . The value field is left empty. The return message contains the IP address, an 8 character hexadecimal value.

Example:

Command	Answer	Description
gE000	a0008C0A80001	This gets the source IP address, in this example the IP address is 192.168.0.1. In the command the IP address is represented in a hexadecimal value.

sF

This type is used to set the destination UDP port . The value field contains the UDP port, a 4 character hexadecimal value.

Example:

Command	Answer	Description
sF004c351	a0000	This sets the destination UDP port for the acquisition data, in this example the UDP port is 50001. In the command the port is represented in a hexadecimal value.

gF

This type is used to get the destination UDP port . The value field is left empty. The return message contains the port, a 4 character hexadecimal value.

Example:

Command	Answer	Description
gF000	a0004c351	This gets the destination UDP port for the acquisition data, in this example the UDP port is 50001. In the command the port is represented in a hexadecimal value.

sG

This type is used to set the source UDP port . The value field contains the UDP port, a 4 character hexadecimal value.

Example:

Command	Answer	Description
sG004c350	a0000	This sets the source UDP port for the acquisition data, in this example the UDP port is 50000. In the command the port is represented in a hexadecimal value.

gG

This type is used to get the source UDP port . The value field is left empty. The return message contains the UDP port, a 4 character hexadecimal value.

Example:

Command	Answer	Description
gG000	a0004c350	This gets the source UDP port for the acquisition data, in this example the UDP port is 50000. In the command the port is represented in a hexadecimal value.

sy

This type is used to set the netmask for the interrogator. The value field contains the netmask, an 8 character hexadecimal value.

Example:

Command	Answer	Description
sy008ffff0000	a0000	This sets the netmask, in this example the netmask is 255.255.0.0. In the command the netmask is represented in a hexadecimal value.

gy

This type is used to get the netmask. The value field is left empty. The return message contains the netmask, an 8 character hexadecimal value.

Example:

Command	Answer	Description
gy000	a0008FFFF0000	This gets the netmask, in this example the netmask is 255.255.0.0. In the command the netmask is represented in a hexadecimal value.

sz

This type is used to set the Ethernet interface for DHCP or static IP. The value field contains the choice, indicated with one value. When the value is 0 DHCP is enabled and when the value is 1 a static IP is used.

Example:

Command	Answer	Description
sz0011	a0000	This sets the Ethernet interface to use a static IP address.

gz

This type is used to get the information regarding DHCP or static use of IP address. The value field is left empty. The return message contains the choice, indicated with one character. (more information can be found by type **sz**)

Example:

Command	Answer	Description
gz000	a00010	This gets the status of the Ethernet interface, in this example the DHCP functionality is enabled.

D.5 SLED Commands

gH

This type is used to get the sled current . The value field indicates from which sled a return value is wanted. The first digit indicates the SLED, numbered from 0x0 till 0x3. The value field in the return message contains the current, the value field is variable in length. This command can be given during acquisition.

Example:

Command	**Answer**	**Description**
gH0011	aH005123.2	This gets the sled current from the second SLED. The answer shows the current in mA and in decimal notation. In the example the current is 123.2 mA.

gI

This type is used to get the PD current . The value field indicates from which sled a return value is wanted. The first digit indicates the SLED, numbered from 0x0 till 0x3. The value field in the return message contains the current, the value field is variable in length. This command can be given during acquisition.

Example:

Command	**Answer**	**Description**
gI0012	aI0051.222	This gets the pd current from the third SLED. The answer shows the current in mA and in decimal notation. In the example the current is 1.222 mA.

gJ

This type is used to get the TEC current . The value field indicates from which sled a return value is wanted. The first digit indicates the SLED, numbered from 0x0 till 0x3. The second digit must be 2. The value field in the return message contains the current, the value field is variable in length. This command can be given during acquisition.

Example:

Command	**Answer**	**Description**
gJ0013	aJ005300.5	This gets the TEC current from the fourth SLED. The answer shows the current in mA and in decimal notation. In the example the current is 300.5 mA .

gK

This type is used to get the SLED temperature. The value field indicates from which sled a return value is wanted. The digit indicates the SLED, numbered from 0x0 till 0x3. The value field in the return message contains 5 digits. This command can be given during acquisition

Example:

Command	Answer	Description
gK0011	aK00525.00	This gets the temperature from the second SLED. The answer shows the temperature in degrees Celsius and in decimal notation. In the example the temperature is 25 degrees.

gL

This type is used to get the SLED software version . The value field indicates from which sled a return value is wanted. The digit indicates the SLED, numbered from 0x0 till 0x3. The value field in the return message contains 5 digits.

Example:

Command	Answer	Description
gL0010	aL0051.2.3	This gets the version of the software in the SLED. In this example from the first sled. The answer shows the version number and in decimal notation. In the example the version is 1.2.3.

sM

This type is used to set the SLED state . The value field indicates the destination of the message and which state is set. The first digit indicates the SLED, numbered from 0x0 till 0x3. The second digit represents the state. The reply contains the current state of the sled, this is indicated in 1 value.

0x0	SLED off
0x1	SLED on
0x2	TEC off
0x3	TEC on

Example:

Command	Answer	Description
sM00203	aM001[5]	When this TLV is send the TEC will go on for the first SLED.
sM00212	aM001	When this TLV is send the TEC will go off for the second SLED.

[5] represents one of the states, can be 1 till 5 (see command **gM**).

sM00221	aM001	When this TLV is send the SLED will go on for the third SLED, the SLED will only be active when the temperature is in range of the setpoint. And the TEC is enabled
sM00230	aM001	When this TLV is send the SLED will go off for the fourth SLED. The TEC will remain on.

gM

This type is used to get the SLED state . The value field indicates from which sled a return value is wanted. The digit indicates the SLED, numbered from 0x0 till 0x3. The value field in the return message indicates the state, see type sM specification for the digit representation.

0x1	SLED standby (SLED will go on when temperature are in correct range)
0x2	SLED on
0x3	Error
0x4	TEC on/SLED off
0x5	TEC off

Example:

Command	Answer	Description
gM0010	aM0010	When this TLV is send the status information of the first SLED will be shown in the answer.
gM0011	aM0011	When this TLV is send the status information of the second SLED will be shown in the answer.
gM0012	aM0012	When this TLV is send the status information of the third SLED will be shown in the answer.
gM0013	aM0013	When this TLV is send the status information of the fourth SLED will be shown in the answer.

D.6 Camera Link Commands

This appendix describes the TLV commands that are specific for use with a Camera Link interface board.

Certain Interrogators are equipped with a Camera Link interface that allows the payload data to be transferred over a Base Configuration Camera Link. The Camera Link data internally is derived from the generated Ethernet packet, each scan an Ethernet package is send to the Camera Link. The Interrogator emulates the behavior of a Line Scan sensor, i.e. the timing holds no frame information, only line information. The Camera Link clock depends on the setting of “clkRate”.

The following Camera Link commands are supported:

headerSkip

Holds the amount of bytes that needs to be stripped from the beginning of the Ethernet packet data. As the Camera Link data internally is derived from the generated Ethernet packet, not all data from the header will be relevant to be transferred over the Camera Link interface. The programmed value covers all bytes from the beginning of the packet starting at Destination MAC Address down to the subsequent bytes in the UDP payload data. The following table gives the Skip value for different modes and most common entries in de Ethernet packet.

clkRate

Controls the Camera Link clock rate. Basic internal frequency is 125MHz, allowing the following clock rates:

00	Divided by 2: 62.50MHz
01	Divided by 4: 31.25MHz
10	Divided by 6: 15.625MHz
11	Divided by 8: 7.8125MHz

baseConfig

The Interrogator allows for the following Base Configuration data widths:

00	8 bits
01	16 bits
10	24 bits
11	not used

clEna

Enables Camera Link output when set. It is required to first configure the Camera Link Configuration before enabling the Camera Link output.

ethSnoop

When set, data is snooped from the data transfer following into the Interrogator s UDP Ethernet interface. Any value set in „headerSkip only affects the data transferred over the Camera Link interface. It is advised to use this option only when the Ethernet interface also needs to be operational.

When cleared, data towards the Ethernet interface is blocked, causing the Camera Link interface to operate autonomously. If the Ethernet interface is active the real time behavior of the Camera Link interface cannot be guaranteed.

Data protocol id	Mode	Start payload	Start raw	Start black level	Start first cog sensor
0x01	RAW	42	83	-	-
0x02	BL	42	-	83	-
0x03	RAW+BL	42	83	595	-
0x04	COG	42	-	-	86
0x05	RAW+COG	42	83	-	598
0x06	BL+COG	42	-	83	598
0x07	RAW+BL+COG	42	83	595	1110

Skip value for different modes and positions in data package

The following TLV commands are used to implement the above functionality. The TLV commands can be given by the serial link over the Camera Link cable. The following settings need to be used for serial communication over Camera Link:

Baud rate	9600 (Standard for Camera Link)
Stop Bit	1
Data Bits	8
Parity	None
Flow control	None

sn

This type is used to set the number of bytes to be skipped from the Ethernet frame (**headerskip**) before the data is written on the Camera Link interface.

Example:

Command	Answer	Description
sn003005	a0000	This sets the number of bytes to skip to 5. The value is used in hexadecimal notation.

gn

This type is used to get the number of bytes to be skipped from the Ethernet frame (**headerskip**) before the data is written on the Camera Link interface.

Example:

Command	**Answer**	**Description**
gn0000	a0003004	This returns the settings for the number of bytes to skip from the Ethernet frame before setting it on the Camera Link interface. In this example the number of bytes is 4. The value is in hexadecimal notation.

so

This type is used to set the clock rate of the Camera Link interface. The value field exists out of one character. The following options are available:

0	62.5 MHz
1	31.25 MHz
2	15.625 MHz
3	7.8125 MHz

Example:

Command	**Answer**	**Description**
so0012	a0000	This sets the clock rate of the Camera Link interface at 31.25 MHz.

go

This type gets the current value for the clock rate of the Camera Link interface. (see **so** for more information)

Example:

Command	**Answer**	**Description**
go000	a00013	The return value shows the clock rate, in this example the clock rate is 7.8125 MHz.

sp

This type is used to set the base configuration of the Camera Link interface. The value field exists out of one character. The following options are available:

0	8 bits
1	16 bits
2	24 bits

Example:

Command	Answer	Description
sp0012	a0000	This sets the configuration of the Camera Link interface at 24 bits.

gp

This type gets the current configuration of the Camera Link interface. (see **sp** for more information)

Example:

Command	Answer	Description
gp000	a00013	The return value shows the clock rate, in this example the clock rate is 7.8125 MHz.

sq

This type is used to enable the clock of the Camera Link interface. The value field exists out of one character. When writing 1 the clock is enabled, when writing 0 the clock is disabled. Default value is: 0.

Example:

Command	Answer	Description
sq0011	a0000	This enables the clock of the Camera Link interface.

gq

This type shows if the clock o f the Camera Link interface is disabled or enabled. (See **sq** for more information)

Example:

Command	Answer	Description
gq000	a00011	The return value shows the status in the value field . In this example the clock is enabled.

sr

This type is used to enable the Ethernet output when the Camera Link interface is active. The value field exists out of one character. When writing 1 the Ethernet interface is enabled, when writing 0 the Ethernet interface is disabled. Default value is: 1.

Example:

Command	Answer	Description
sr0011	a0000	This enables the Ethernet interface during Camera Link.

gr

This type shows if Ethernet interface is disabled or enabled during Camera Link functions. (See **sr** for more information)

Example:

Command	Answer	Description
gr000	a00011	The return value shows the status in the value field . In this example the Ethernet interface is enabled.

ss

This type is used to enable the Camera Link interface. The value field exists out of one character. When writing 1 the interface is enabled, when writing 0 the interface is disabled. Default value is 0.

Example:

Command	Answer	Description
ss0011	a0000	This enables the Camera Link interface.

gs

This type shows if the Camera Link interface is disabled or enabled. (See **ss** for more information)

Example:

Command	Answer	Description
gs000	a00011	The return value shows the status in the value field . In this example the Camera Link interface is enabled.

st

This type is used to enable the data line of the Camera Link interface. The value field exists out of one character. When writing 1 the interface is enabled, when writing 0 the interface is disabled. Default value is 1.

Example:

Command	Answer	Description
st0011	a0000	This enables the interface during Camera Link.

gt

This type shows if the data line for the Camera Link interface is disabled or enabled. (See **st** for more information)

Example:

Command	Answer	Description
gt000	a00011	The return value shows the status in the value field . In this example the data line of the Camera Link interface is enabled.

su

This type is used to enable the serial line of the Camera Link interface. The value field exists out of one character. When writing 1 the interface is enabled, when writing 0 the interface is disabled. Default value is 1.

Example:

Command	Answer	Description
su0011	a0000	This enables the interface during Camera Link.

gu

This type shows if the serial line for the Camera Link interface is disabled or enabled. (See **su** for more information)

Example:

Command	Answer	Description
gu000	a00011	The return value shows the status in the value field . In this example the serial line of the Camera Link interface is enabled.

E Technical Support Policy

Technician-assisted technical support requires the cooperation and participation of the customer in the troubleshooting process and provides for restoration of the software programs, and hardware drivers to the original default configuration as shipped from Technobis Fibre Technologies. In addition to this technician assisted technical support, online technical support is available at www.tft-fos.com. Additional technical support options may be available for purchase.

Technobis Fibre Technologies provides limited technical support for the Deminsys device and any "Technobis Fibre Technologies installed" software. Support for third-party software and peripherals are provided by the original manufacturer. Repair services are provided pursuant to the terms and conditions of your limited warranty and any optional support service contract purchased with the device.

Definition of "Technobis Fibre Technologies-Installed" Software and Peripherals

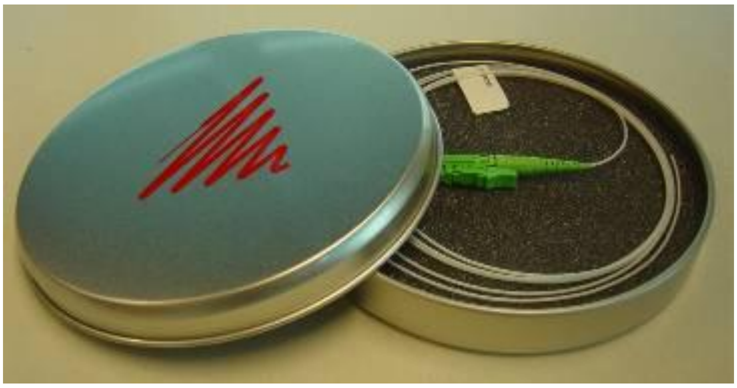
Technobis Fibre Technologies-installed software includes the Deminsys Demo Software program that is installed on the USB Stick during the manufacturing process.

Definition of "Third-Party" Software and Peripherals

Third-party software and peripherals include any peripheral, accessory, or software program sold by Technobis Fibre Technologies not under the Technobis Fibre Technologies brand (cables, software). Support for all third-party software and peripherals are provided by the original manufacturer of the product.

F Ordering Fibre Bragg Grating Sensors

Technobis Fibre Technologies offers you the possibility to order standard or custom FBG's. On the USB Stick that came with your Deminsys OEM Kit you can find in the folder "Documents" a FBG Quotation Form. Please use this form when you want to order FBG's from Technobis Fibre Technologies. Alternatively you can order FBG's from our support website fbg.tft-fos.nl.



If you have any additional questions please refer to paragraph 4.2, Contacting Technobis Fibre Technologies.

G Glossary

Terms in this glossary are provided for informational purposes only and may or may not describe features included with your particular device.

A

AC — **Alternating current** — The form of electricity that powers your device when you plug the AC adapter power cable into an electrical outlet.

Antivirus software — A program designed to identify, quarantine, and/or delete viruses from your computer.

B

Backup — A copy of a program or data file on a floppy, CD, DVD, USB Stick or hard drive. As a precaution, back up the data files from your hard drive regularly.

BIOS — **Basic input/output system** — A program (or utility) that serves as an interface between the computer hardware and the operating system. Unless you understand what effect these settings have on the computer, do not change them. Also referred to as system setup.

Bit — The smallest unit of data interpreted by your device/computer.

BPS — **Bits per second** — The standard unit for measuring data transmission speed.

Byte — The basic data unit used by your computer. A byte is usually equal to 8 bits.

C

C — **Celsius** — A temperature measurement scale where 0° is the freezing point and 100° is the boiling point of water.

Control Panel — A Windows utility that allows you to modify operating system and hardware settings, such as display settings.

D

Device — Hardware such as a disk drive, printer, or keyboard that is installed in or connected to your computer.

Device driver — See driver.

Domain — A group of computers, programs, and devices on a network that are administered as a unit with common rules and procedures for use by a specific group of users. A user logs on to the domain to gain access to the resources.

Driver — Software that allows the operating system to control a device such as a printer. Many devices do not work properly if the correct driver is not installed in the computer.

E

ESD — **Electrostatic discharge** — A rapid discharge of static electricity. ESD can damage integrated circuits found in computer and communications equipment.

F

Fahrenheit — A temperature measurement scale where 32° is the freezing point and 212° is the boiling point of water.

FBG — **Fibre Bragg Grating** — FBG is a longitudinal periodic variation of the index of refraction in the core of an optical fibre. The spacing of the variation is determined by the wavelength of the light to be reflected.

FC/APC — Special optical connector used in telecom and measurement applications

Fibre Optic — An optical device to transport light over long distances by making use of total internal reflection.

G

G — **Gravity** — A measurement of weight and force.

GB — **Gigabyte** — A measurement of data storage that equals 1024 MB (1,073,741,824 bytes). When used to refer to hard drive storage, the term is often rounded to 1,000,000,000 bytes.

GHz — **Gigahertz** — A measurement of frequency that equals one thousand million Hz, or one thousand MHz. The speeds for computer processors, buses, and interfaces are often measured in GHz.

GUI — **Graphical user interface** — Software that interacts with the user by means of menus, windows, and icons. Most programs that operate on the Windows operating systems are GUIs.

H

Hard drive — A drive that reads and writes data on a hard disk. The terms hard drive and hard disk are often used interchangeably.

Help file — A file that contains descriptive or instructional information about a product. Some help files are associated with a particular program, such as Help in Microsoft Word. Other help files function as standalone reference sources. Help files typically have a filename extension of .hlp or .chm.

HTML — **Hypertext markup language** — A set of codes inserted into an Internet web page intended for display on an Internet browser.

HTTP — **Hypertext transfer protocol** — A protocol for exchanging files between computers connected to the Internet.

Hz — **Hertz** — A unit of frequency measurement that equals 1 cycle per second. Computers and electronic devices are often measured in kilohertz (kHz), megahertz (MHz), gigahertz (GHz), or terahertz (THz).

I

I/O — **Input/output** — An operation or device that enters and extracts data from your computer. Keyboards and printers are I/O devices.

I/O address — An address in RAM that is associated with a specific device (such as a serial connector, parallel connector, or expansion slot) and allows the processor to communicate with that device.

K

Kb — **Kilobit** — A unit of data that equals 1024 bits. A measurement of the capacity of memory integrated circuits.

KB — **Kilobyte** — A unit of data that equals 1024 bytes but is often referred to as 1000 bytes.

Key combination — A command requiring you to press multiple keys at the same time.

kHz — **Kilohertz** — A measurement of frequency that equals 1000 Hz.

L

LAN — **Local area network** — A computer network covering a small area. A LAN usually is confined to a building or a few nearby buildings. A LAN can be connected to another LAN over any distance through telephone lines and radio waves to form a wide area network (WAN).

LED — **Light-emitting diode** — An electronic component that emits light to indicate the status of the computer.

LASER — **Light Amplification by Stimulated Emission Radiation**. A device with high optical power, high grade of coherence and a narrow bandwidth.

M

Mb — **Megabit** — A measurement of memory chip capacity that equals 1024 Kb.

Mbps — **Megabits per second** — One million bits per second. This measurement is typically used for transmission speeds for networks and modems.

MB — **Megabyte** — A measurement of data storage that equals 1,048,576 bytes. 1 MB equals 1024 KB. When used to refer to hard drive storage, the term is often rounded to 1,000,000 bytes.

MB/sec — **Megabytes per second** — One million bytes per second. This measurement is typically used for data transfer ratings.

Memory — A temporary data storage area inside your device/computer. Because the data in memory is not permanent, it is recommended that you frequently save your files while you are working on them, and always save your files before you shut down the computer. Your computer can contain several different forms of memory, such as RAM, ROM, and video memory. Frequently, the word memory is used as a synonym for RAM.

Memory address — A specific location where data is temporarily stored in RAM.

MHz — **Megahertz** — A measure of frequency that equals 1 million cycles per second. The speeds for computer processors, buses, and interfaces are often measured in MHz.

Ms — **Millisecond** — A measure of time that equals one thousandth of a second. Access times of storage devices are often measured in milliseconds.

N

Network adapter — A chip that provides network capabilities. A computer may include a network adapter on its system board, or it may contain a PC Card with an adapter on it. A network adapter is also referred to as a NIC (network interface controller).

NIC — See network adapter.

Ns — **Nanosecond** — A measure of time that equals one billionth of a second.

P

POST — **Power-on self-test** — Diagnostics programs, loaded automatically by the BIOS that perform basic tests on the major computer components, such as memory, hard drives, and video. If no problems are detected during POST, the computer continues the start-up.

Program — Any software that processes data for you, including spreadsheet, word processor, database, and game packages. Programs require an operating system to run.

R

Readme file — A text file included with a software package or hardware product. Typically, readme files provide installation information and describe new product enhancements or corrections that have not yet been documented.

Refresh rate — The frequency, measured in Hz, at which your screen's horizontal lines are recharged (sometimes also referred to as its vertical frequency). The higher the refresh rate, the less video flicker can be seen by the human eye.

Resolution — The sharpness and clarity of an image produced by a printer or displayed on a monitor. The higher the resolution, the sharper the image.

RFI — **Radio frequency interference** — Interference that is generated at typical radio frequencies, in the range of 10 kHz to 100,000 MHz. Radio frequencies are at the lower end of the electromagnetic frequency spectrum and are more likely to have interference than the higher frequency radiations, such as infrared and light.

ROM — **Read-only memory** — Memory that stores data and programs that cannot be deleted or written to by the computer. ROM, unlike RAM, retains its contents after you shut down your computer. Some programs essential to the operation of your computer reside in ROM.

S

Serial connector — An I/O port often used to connect devices such as a handheld digital device or digital camera to your computer.

Setup program — A program that is used to install and configure hardware and software. The setup.exe or install.exe program comes with most Windows software packages. Setup program differs from system setup.

Shortcut — An icon that provides quick access to frequently used programs, files, folders, and drives. When you place a shortcut on your Windows desktop and double-click the icon, you can open its corresponding folder or file without having to find it first. Shortcut icons do not change the location of files. If you delete a shortcut, the original file is not affected. Also, you can rename a shortcut icon.

Shutdown — The process of closing windows and exiting programs, exiting the operating system, and turning off your computer. You can lose data if you turn off your computer before completing a shutdown.

Software — Anything that can be stored electronically, such as computer files or programs.

Surge protectors — Prevent voltage spikes, such as those that may occur during an electrical storm, from entering the computer through the electrical outlet. Surge protectors do not protect against lightning strikes or against brownouts, which occur when the voltage drops more than 20 percent below the normal AC-line voltage level. Network connections cannot be protected by surge protectors. Always disconnect the network cable from the network connector during electrical storms.

SVGA — **Super-video graphics array** — A video standard for video cards and controllers. Typical SVGA resolutions are 800 x 600 and 1024 x 768. The number of colors and resolution that a program displays depends on the capabilities of the monitor, the video controller and its drivers, and the amount of video memory installed in the computer.

S-video TV-out — A connector used to attach a TV or digital audio device to the computer.

SXGA — **Super-extended graphics array** — A video standard for video cards and controllers that supports resolutions up to 1280 x 1024.

SXGA+ — **Super-extended graphics array plus** — A video standard for video cards and controllers that supports resolutions up to 1400 x 1050.

System board — The main circuit board in your computer. Also known as the motherboard.

System setup — A utility that serves as an interface between the computer hardware and the operating system. System setup allows you to configure user-selectable options in the BIOS, such as date and time or system password. Unless you understand what effect the settings have on the computer, do not change the settings for this program.

T

U

USB — **Universal serial bus** — A hardware interface for a low-speed device such as a USB-compatible keyboard, mouse, joystick, scanner, set of speakers, printer, broadband devices (DSL and cable modems), imaging devices, or storage devices. Devices are plugged directly in to a 4-pin socket on your computer or in to a multi-port hub that plugs in to your computer. USB devices can be connected and disconnected while the computer is turned on, and they can also be daisy-chained together.

UTP — **Unshielded twisted pair** — Describes a type of cable used in most telephone networks and some computer networks. Pairs of unshielded wires are twisted to protect against electromagnetic interference, rather than relying on a metal sheath around each pair of wires to protect against interference.

V

Virus — A program that is designed to inconvenience you or to destroy data stored on your computer. A virus program moves from one computer to another through an infected disk, software downloaded from the Internet, or e-mail attachments. When an infected program starts, its embedded virus also starts. A common type of virus is a boot virus, which is stored in the boot sectors of a floppy disk. If the floppy disk is left in the drive when the computer is shut down and then turned on, the computer is infected when it reads the boot sectors of the floppy disk expecting to find the operating system. If the computer is infected, the boot virus may replicate itself onto all the floppy disks that are read or written in that computer until the virus is eradicated.

V — **Volt** — The measurement of electric potential or electromotive force. One V appears across a resistance of 1 ohm when a current of 1 ampere flows through that resistance.

W

W — **Watt** — The measurement of electrical power. One W is 1 ampere of current flowing at 1 volt.

WHr — **Watt-hour** — A unit of measure commonly used to indicate the approximate capacity of a battery. For example, a 66-WHr battery can supply 66 W of power for 1 hour or 33 W for 2 hours.

WLAN — **Wireless local area network** — A series of interconnected computers that communicate with each other over the air waves using access points or wireless routers to provide Internet access.

Write-protected — Files or media that cannot be changed. Use write-protection when you want to protect data from being changed or destroyed. To write-protect a 3.5-inch floppy disk, slide its write-protect tab to the open position.

WWAN — **Wireless wide area network** — A wireless high-speed data network using cellular technology and covering a much larger geographic area than WLAN.

X

Z

Zip — A popular data compression format. Files that have been compressed with the Zip format are called Zip files and usually have a filename extension of .zip. A special kind of zipped file is a self-extracting file, which has a filename extension of .exe. You can unzip a self-extracting file by double-clicking it.