1 YEAR

OMEGA™

User's Guide

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FOM-Series

Fiber Optic Monitor for Temperature Measurement

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Notice

Permanent damage may be done to the thermometer if the power supply connections are not done correctly. Only approved USB power supply modules should be used to operate this FOM-L201/H201 thermometer.

This product does not contain any user-serviceable parts. Opening this precision instrument will void its warranty and may disturb its factory calibration. Always seek servicing from Omega.

To assure cleanliness of the optical connector, keep the protection cap on unused connectors at all times.

Fiber optic probes and extension cables are fragile and will break if the bending radius becomes less than ~1 cm, even temporarily. Probe and extension cable breakages are not covered under the standard Omega warranty.

Most drawings and screenshots presented in this manual are given only for illustration purposes and are not necessarily presented to be easily readable (to save space). For more details, please refer to the applicable marketing materials (e.g., brochures, etc.) and software (e.g., Omega Fiber Optic Sensing).

The Omega products are CE marking certified.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

1 OMEGA WARRANTY NOTICE

Your FOM-L201/H201 units are guaranteed (Parts and Workmanship) for one full year from the date of purchase. Upon written notification of any defect, Omega will either repair or replace any faulty product or components thereof. A Return Authorization Number (RMA) must be obtained from Omega Inc. or authorized distributor prior to any merchandise return.

Due to the unique nature of the fiber optic probes that are used with this Omega transducer system, probes and extension cables are not guaranteed.

When using any electrical appliance, basic safety precautions should be followed, including the following:

- Do not operate in wet / damp environments
- Do not operate in explosive atmospheres
- Keep product surface dry and clean.

Always make sure all electrical installations are made in accordance with local authorities' regulations and laws.

1.1 Certifications

Test Name Standards	Test Specifications	Minimum Performance Criterion Required	Results
Conducted Emissions FCC part 15 (2018) subpart B	Class A 150kHz-30MHz	N/A	Pass
Radiated Emissions FCC part 15 (2018) subpart B	Class A 30MHz-1GHz	N/A	Pass
Conducted Emissions CISPR11 (2015) A1 (2016)	Group 1 - class A 150kHz-30MHz	N/A	Pass
Radiated Emissions CISPR11 (2015) A1 (2016)	Group 1 - class A	N/A	Pass
Conducted Emissions ICES-003 (2016)	Class A 150kHz-30MHz	N/A	Pass
Radiated Emissions ICES-003 (2016)	Class A 30MHz-1GHz	N/A	Pass
Electrostatic Discharge Immunity IEC61000-4-2 (2008)	Contact: ±4kV Air: ±2kV , ±4kV, ±8kV	B	Pass
Radiated Electromagnetic Field Immunity IEC61000-4-3 (2006) A1 (2007) A2 (2010)	80MHz-1000MHz: 10V/m 1.4GHz-2GHz: 3V/m 2GHz-2.7GHz: 1V/m	A	Pass
Electrical Fast Transient Immunity IEC61000-4-4 (2012)	Power: ±2kV / 5kHz I/O Ports: N/A Communication Ports: N/A	B	Pass
Surge Immunity IEC61000-4-5 (2014)	Power: ±2kV L-PE / ±1kV L-L I/O Ports: N/A Communication Ports: N/A	B	Pass
Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields IEC61000-4-6 (2013)	Power: 3V I/O Ports: N/A Communication Ports: N/A	A	Pass
Power Frequency Magnetic Field Immunity IEC61000-4-8 (2009)	Continuous Field: 30A/m / 50Hz & 60Hz	A	Pass
Voltage Dips, Short Interruptions and Voltage Variation Immunity on AC Input IEC61000-4-11 (2004)	Voltage dips: 0%Un during 1 cycle 40%Un during 10 cycles (at 50Hz) 40%Un during 12 cycles (at 60Hz) 70%Un during 25 cycles (at 50Hz) 70%Un during 30 cycles (at 60Hz) Short interruptions: 0%Un during 250 cycles(at 50Hz) 0%Un during 300 cycles (at 60Hz)	 B B C C C C C C	Pass

Safety

Low Voltage Directive	IEC 61010-1 (2010)

Environmental

Environmental protection	IEC 60529	IP20
RoHS Directive	2015/863/EU	
WEEE Directive	2012/19/EU	
REACH Directive	CE No 1907/2006	

The Omega products are CE marking certified.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Omega takes environmental matters very seriously. Therefore, all our products are compliant with the RoHS Directive 2015/863/EU and REACH Regulation CE No 1907/2006. Please contact us if you need to dispose of any products as per the WEEE Directive 2012/19/EU.

2 GETTING STARTED

Your FOM-L201/H201 series temperature-sensing instruments allow you to take full advantage of the benefits inherent to fiber optic sensing technology. It offers accurate and reliable temperature measurements, combined with extraordinary insensitivity to EMI/RFI, high voltage insulation and disturbance free sensing due to the non-electrical nature of the sensor element used.

Not only does the FOM-L201/H201 family of products gives access to reliable measurements, it also offers a simple user interface that makes the technology easy to use. Moreover, no special calibration is required when changing the fiber optic sensor probes.

The FOM-L201 and FOM-/H201 are very similar instruments; the main difference between the two is that the FOM-H201 includes an internal rechargeable battery, which should last about 10 hours of continuous use. Please note that the FOM-L201 could also be converted easily into a portable instrument by simply connecting the unit to an external USB power battery bank, available on the open market.

When a specification or feature is applicable to both the FOM-L201 and the FOM-H201, the instrument is referred as “FOM-L201/H201” in this user guide.

The thermometer is packaged in a small package, which is ideally suited for laboratory and industrial applications.

The unit is fitted with a micro-USB connector (). This interface allows for powering the unit as well as for all data transfer, to or from a Windows computer. The transfer protocol is a fast serial scheme, a standard in the industry. If you have the FOM-H201 model, the internal battery will be charged whenever the USB port is connected to a power source (such as your computer or wall-USB power supply.

This thermometer includes the latest developments in fiber optic temperature measurement technologies. Most types of GaAs-based probes now available on the market are supported, even probes manufactured by Omega’ competitors. It will also interface with and read marginal probes, or probes with dirty connectors, and so forth. It will give you years of excellent service.

The Omega Fiber Optic Sensing software package is an excellent complement to your thermometer. This Windows software allows the user to configure the FOM-L201/H201more easily than using the few keys available on the instrument itself. It should be noted that some functions are programmable only from Omega Fiber Optic Sensing.

Temperature logging can be performed in two ways:

1- Directly in the instrument, using a user supplied microSD memory card (in theory, up to  2 TB)

2- With Omega Fiber Optic Sensing. In this case, logging can be done concurrently from 6 instruments (up to 64 channels)
3- Logging rate from one sample per second
4- Both logging methods can be used simultaneously.

A serial RS-485 communication port is available; this could be useful for Modbus communication (industrial applications).

An optional analog output module is available. It features 8 channels and can be programmed to operate with 0-10 V or 4-20 mA outputs, and the outputs are completely programmable (any analog output can be assigned to any optical channel or can be assigned to the minimum or maximum value of any combination of optical channels).

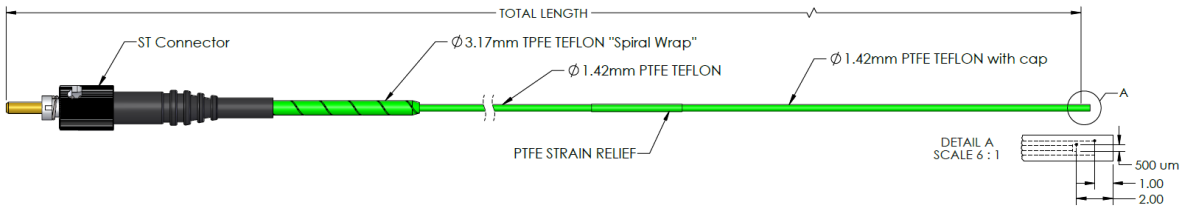
2.1 FOM-L201/H201 product specifications

Resolution	0.1 °C
Accuracy	± 1.0 °C (1.8°F)
Usable Temperature Range	-80 to 300 °C (112 to 572°F) (Cryogenic calibration available on special order)
Number of channels	2 to 8
Probe length	2 to 10 meters standard, extension cable accessory available
Sensor	GaAs dielectric epoxy tipped optical fiber probes
Response time	Typically, 0.2 to 0.5 second, per channel (Probe and setting configuration dependent) Sampling rate is ~ 5 Hz (per channel) Note: to guarantee the 0.2 sec acquisition time, acquisition mode must be in fixed-time acquisition mode (non-AGC).
Probe compatibility	All Omega fiber optic probes and most competitive GaAs probes
Unit	°C only (°F selectable in Omega Fiber Optic Sensing software)
Data logging	On user supplied micro-SD card (), from 1 sec
Operating temperature	-40 °C to 55 °C, non-condensing
Storage temperature	-40°C to 65°C
Local display	Display of temperature readings as well as various user information
Analog outputs	Optional external module (4-20 mA and 0-10 V, software selectable), with 8 programmable outputs
Serial port	RS-485 port (Modbus) – Non electrically insulated
Standard interface	Micro-USB connector
Power	5 VDC (USB port), ~150 mA (up to 500 mA when the FOM-H201 battery is charging)
Internal battery	FOM-H201 only: Capacity of 2,500 mA-h (enough for about 10 hours of continuous use)
Firmware upgradability	Through USB port ( )
Size	7.17 x 4.92 x 2.72 in (182L x 125W x 69H mm)
Weight	FOM-L201: 0.45 kg. FOM-H201: 0.6 kg.

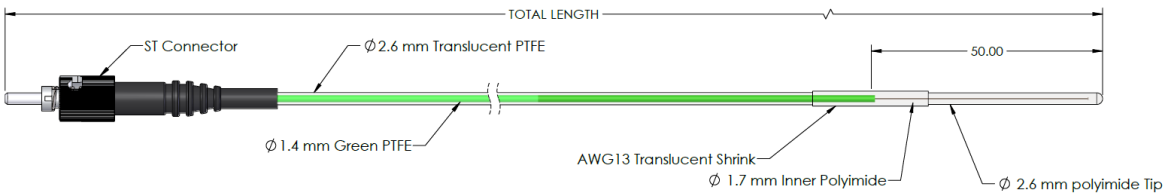
All technical specifications are subject to change without notice.

The following figure gives a description of the various probe configurations that are optionally available from Omega.

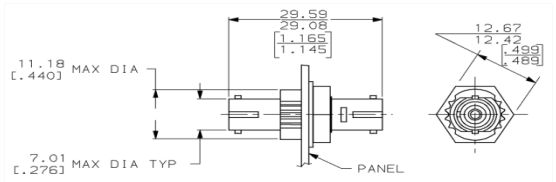
FOS-LT-*



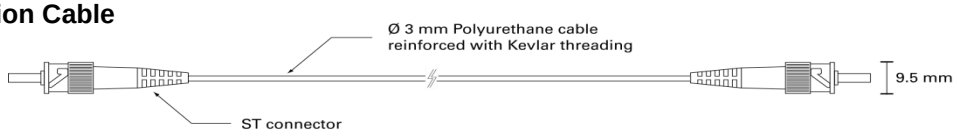
FOS-LU-*



ST-ST Coupling:



ST-ST Extension Cable



2.2 Calibration

Your FOM-L201/H201thermometer comes factory-calibrated. Experience has shown that re-calibration is not required over the whole product life; however, if your ISO company rules state that an annual re-calibration is required, then it is your responsibility to comply with those rules. For laboratory applications, a new calibration is standard every 12 months or whenever performance verification indicates that calibration is necessary; NIST traceable calibration certificates are available. All calibrations are performed at the factory. Contact your Omega Representative for further information.

3 UNPACKING

Before using your FOM-L201/H201thermometer, check the box content to be sure all items have been included. Your package should normally contain:

- FOM-L201 or FOM-H201 instrument
- USB cable
- User manual (this manual) (paper copy not included, supplied as a PDF document downloadable from the Internet)
- Calibration Certificate.

Options:

- USB power supply module (universal input: 100-240 VAC, 50/60 Hz; output: 5 VDC 1 A)
- Fiber optic temperature sensor probes
- Fiber optic extension cables and extension bundles
- Fiber optic couplings and feedthroughs
- Omega Fiber Optic Sensing software package™ (downloadable from the Internet)
- LabView, MATLAB, Python software interfaces (downloadable from the Internet)
- Carrying case, for the FOM-L201 or FOM-H201 and accessories.

Make sure all listed items have been received and are in good condition. Note any evidence of rough handling in transit; immediately report any damage to the shipping agent. Should a part be missing or damaged, please contact your distributor immediately. Returns must be made with the original packaging, accompanied by an authorization number (RMA). Your distributor will provide you with information concerning the return of merchandise.

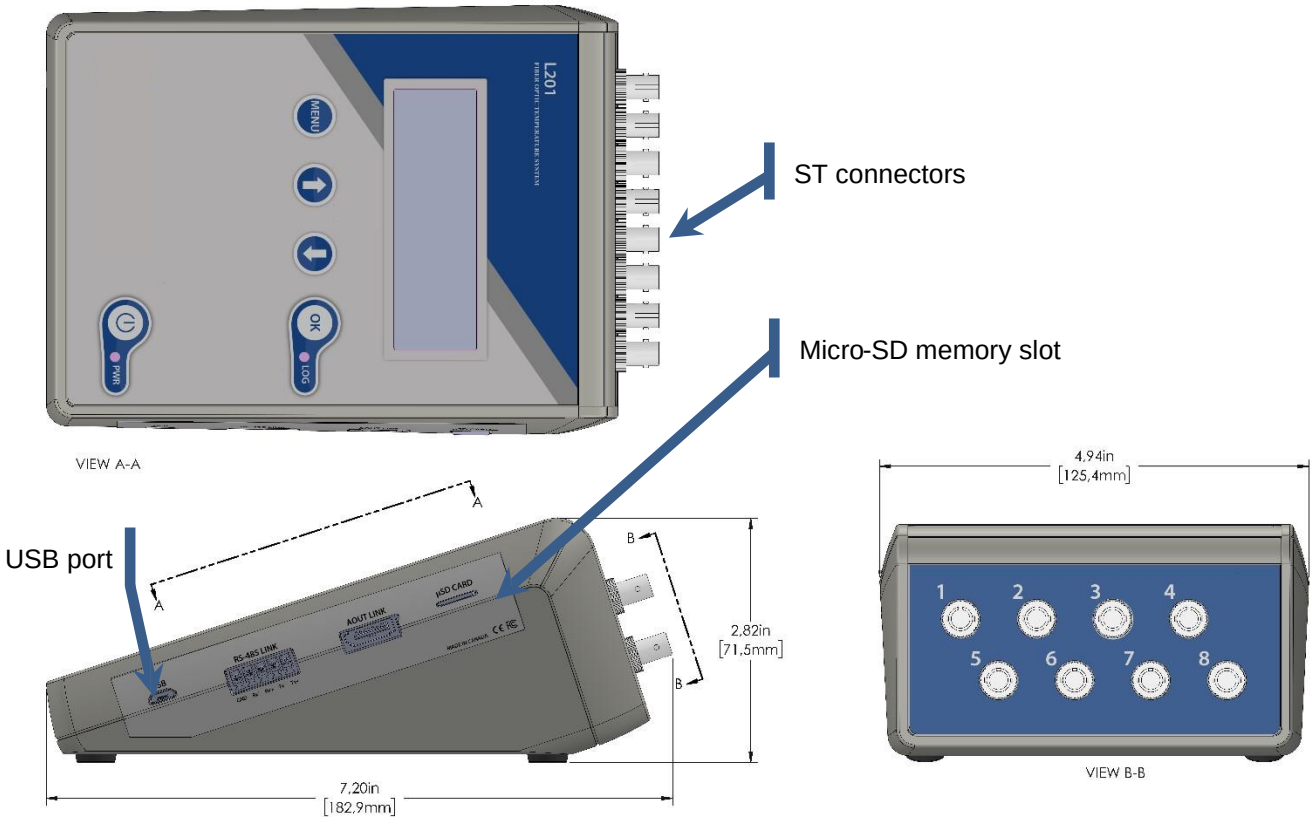
The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipment becomes necessary.

4 QUICK Introduction

The best way to familiarize yourself with your new FOM-L201/H201 instrument is, of course, to use it! This chapter shows you to prepare your unit and do some initial measurements. The detailed instructions are given in the next Chapter.

Your new FOM-L201/H201comes calibrated and ready to use. This figure shows the main view of the monitor, along with the top and side (where the electrical connections are available) views.

For the FOM-H201, you may need to connect it to a power source for a few hours to make sure the internal battery has enough charge to use it without power connection.



Information: The FOM-H201 battery charging status is not indicated on the above drawing.

4.1 Making your first measurements

4.1.1 Using the FOM-L201/H201

To make your first temperature measurements, do as follows:

- Remove the dust cap on the optical connectors of the FOM-L201/H201 (located on the top of the monitor).
- Remove the dust cap on the probe connectors.
- Insert each probe connector into a sensor connector on the monitor. Make sure the two mating parts are properly aligned and twist the connector clockwise to fasten it securely. **Notice**: Do not apply force on this connector!
- Turn your FOM-L201/H201on by pressing the ON button for at least one second. After a few seconds, a “splash” screen will display some information such as firmware version, calibration date, etc. Then the temperature is immediately displayed, for up to 8 channels.
- Place a sensor tip on a warmer surface (such as your hand): you can observe the temperature variation on the display.
- You can power it down by briefly pressing again this key.

4.1.2 Logging temperature data on the microSD card

A microSD memory card slot, where a SD card () can be inserted to allow for in-instrument temperature logging[1]. Reading the SD card content can be done by removing the card from the instrument and reading it with a USB adapter on a PC computer. Data files can also be transferred to a PC using Omega Fiber Optic Sensing; however, this could be a long process for large files. When removing the card, it is suggested to stop the logging process by powering down the instrument (this is not mandatory but would be safer).

See section 5.3 for more information about reading back data from the microSD card.

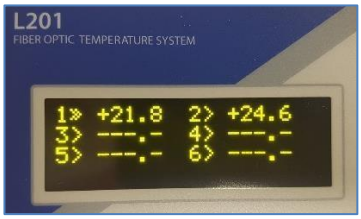
[1] It is highly recommended to get your microSD memory cards () from Omega, even if they are relatively expensive. The Omega cards feature a wide temperature range and are ruggedized, for demanding industrial applications.

5 FOM-L201/H201THERMOMETER HARDWARE REFERENCE

5.1 Display description

The display can show 4 different screen contents. You can navigate from one to the next by pressing the "Menu" key.

1- The default screen is the Temperature screen, where up to 8 temperature values are displayed, as shown here:



   a. A double arrow is displayed for any channel reading where an offset has been programmed for that channel (as shown for channel # 1 above)

2- The Percentage screen, where the power level of each sensor is given. Normally, for a healthy probe, the reading should be 100%. See section 5.4 for information on how to interpret this "%" reading.

3- The Enable screen. This allows you to enable or disable a specific channel. Normally all channels are enabled, but if you want fast refresh rates from one or a few probes, it is highly suggested to disable any unused channels[2].

4- The Setup screen. To move through the screen, you can use the "OK" button to move from one field to the next and use the 2 arrow keys to change the flashing parameter value. This can be used to configure the following parameters:

   a. Date and time

      Notice: The FOM-L201/H201 will lose its date and time information after about 10 days if not turned on while being connected to a power source. Even the FOM-H201 should be turned on from time to time to avoid losing its date and time.

   b. Logging status, information only. To enable or disable logging, press the "OK" button when you are *not* in this Setup menu.

   c. Logging rate (on microSD card). Note: Independently, Omega Fiber Optic Sensing can also log temperatures, and it can be set to a different logging rate.

   d. AGC, ON or OFF. For best speed, this should be OFF. The ON position is recommended for installations where you are dealing with probe weaker signals, such as when using extension cables and feedthroughs (typically for transformer applications).

   e. Hold, 0 to 9. This indicates the number of "holds" since the last good reading. Normally, a value of "0" should be appropriate, unless you are using probes with weak signal, in which case it could avoid a probe from alternating from "no reading" to "reading". In other words, this represents the number of reading cycles the thermometer will do before abdicating.

[2] The FOM series scans continuously all enabled channels in a sequential manner. The acquisition time for each channel is about 0.1 (fixed gain, AGC off) to 0.4 second (AGC on), which means that it takes about 1 to 4 seconds to refresh all channels. If you disable any unused channels, then the overall refresh rate will be faster.

The setup screen is shown here:

The following parameters cannot be set from the FOM-L201/H201panel, you must use the Omega Fiber Optic Sensing software to set them.

1- RS-485 serial port and Modbus parameters; 2- Analog output parameters; 3- Channel naming.

5.1.1 FOM-H201 battery charging status

The FOM-H201 panel includes a LED indicator that can take 2 states:

- Yellow when the battery is being charged (not yet fully charged)
- Green when fully charged.

5.2 Modbus port configuration

The serial RS-485 port found on the side of the FOM-L201/H201instrument is intended to be used as a Modbus slave port. You can configure its parameters (baud rate, parity, etc.) with Omega Fiber Optic Sensing. When using this port, be careful with grounding, as this port is non-insulated. The port can be configured either as a 2W configuration (half-duplex, 2 wires) or as a 4W configuration (full-duplex, 4 wires).

The mating connector (not included with the instrument) is Phoenix part # 1827622, or Digikey part # 2778837-ND. Contact Omega for more information.

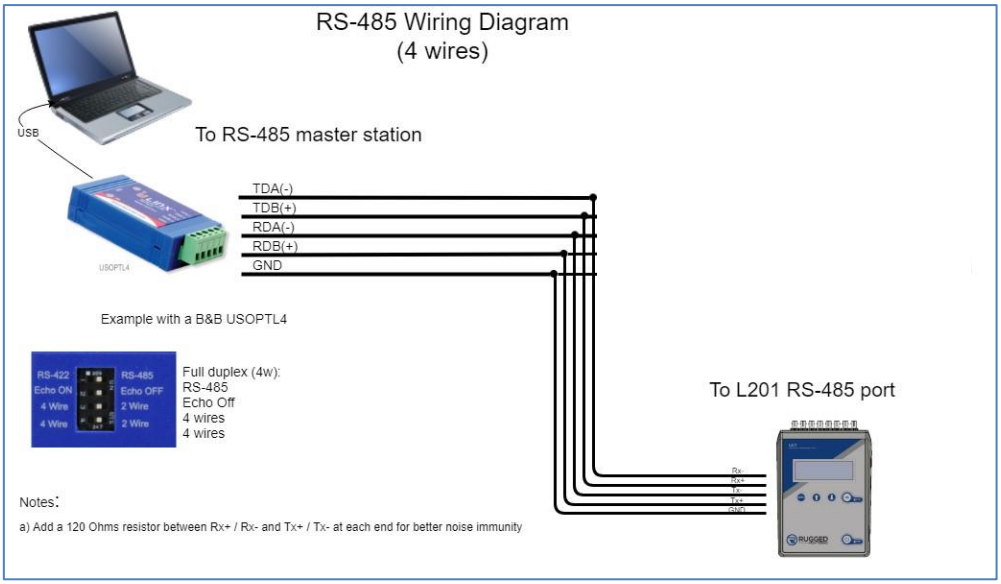
The following guidelines should be followed when wiring the Phoenix terminal blocks:

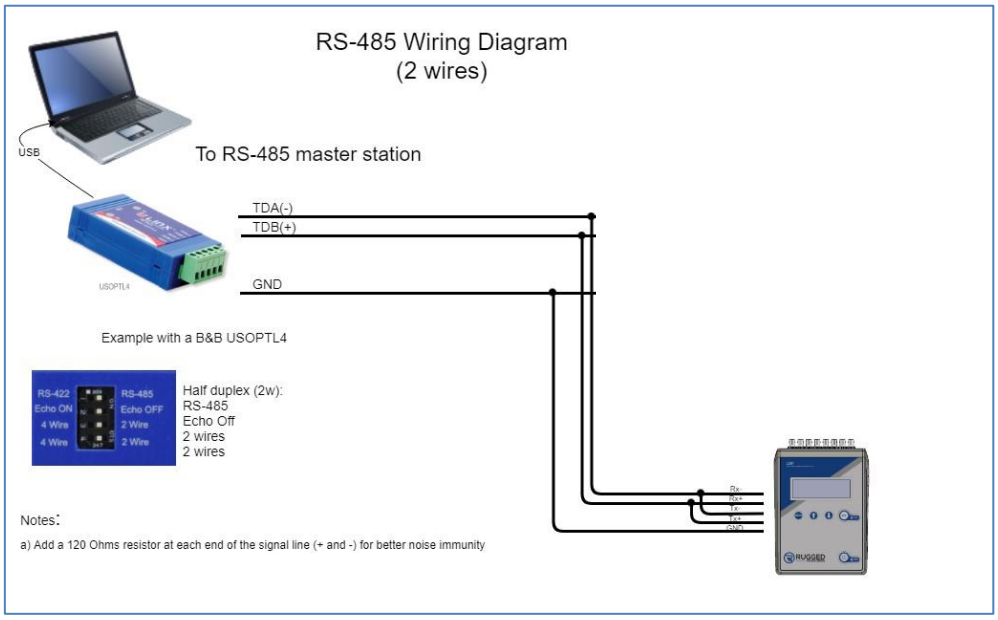
- Current and voltage should be limited to 5 A[3] and 240 VAC
- Wire gauge range is 12-30 AWG (0.2 to 2.5 mm)
- Torque on screws should be 0.5 to 0.6 Nm (4.4 to 5.3 Lb-In).

Recommendation: As this port is not electrically insulated inside the FOM, it is strongly suggested to use an insulated interface to connect the Modbus communication to a PC computer. Omega recommends the use of Model USOPTL4, available from B&B Electronics (web site: http://www.bbelec.com/USOPTL4).

The following drawings show examples of typical wirings for a Modbus communication scheme (4W and 2W).

[3] Current limitation for DC situations is much lower, in the order of 0.2 A at 240 VDC.





5.3 How to access the logged data

To log temperature data, a microSD card must be inserted in the card slot. This card must be formatted in FAT or exFAT, and up to 2 TB (in theory) is supported. When removing the card, it is suggested to stop the logging process by pressing the “OK” button. Each time a new log is started, a new file is generated with a set file name (YYMMDD_HHMMSS.csv), with tab delimitation; the date and time used are those current when the file is generated.

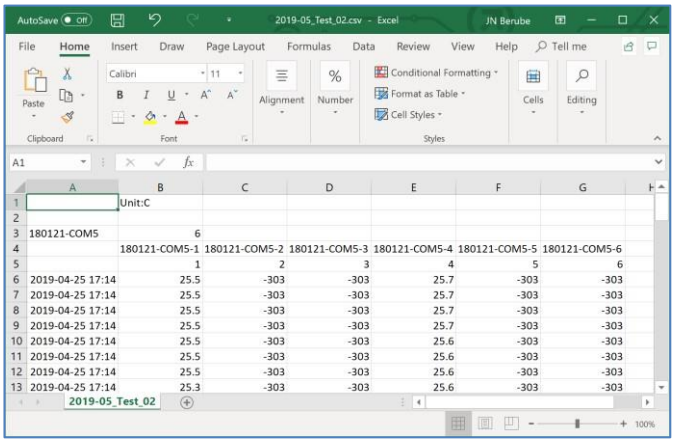
To read the logged data, you have two possibilities:

- You must remove the card from the FOM-L201/H201and to read it with a PC using an appropriate microSD card reader. You should configure your Excel application, so Excel is automatically invoked when you open a .csv file.

- Data files stored in the microSD card can be downloaded using the Omega Fiber Optic Sensing software. See Section 6.4 for more information. Please note that the file that is currently being open for data logging cannot be downloaded; you must first stop the acquisition and then do the download. Notice: Downloading large file can be time consuming.

Information: -302 means that this channel is disabled and -303 means that no probe was detected for that channel.

Here is an example of a .csv file.

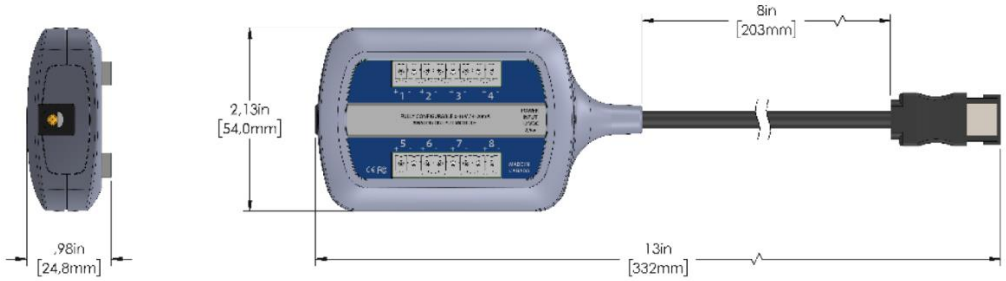


	A	B	C	D	E	F	G
1		Unit:C					
2							
3	180121-COM5	6					
4		180121-COM5-1	180121-COM5-2	180121-COM5-3	180121-COM5-4	180121-COM5-5	180121-COM5-6
5		1	2	3	4	5	6
6	2019-04-25 17:14	25.5	-303	-303	25.7	-303	-303
7	2019-04-25 17:14	25.5	-303	-303	25.7	-303	-303
8	2019-04-25 17:14	25.5	-303	-303	25.7	-303	-303
9	2019-04-25 17:14	25.5	-303	-303	25.7	-303	-303
10	2019-04-25 17:14	25.5	-303	-303	25.6	-303	-303
11	2019-04-25 17:14	25.5	-303	-303	25.6	-303	-303
12	2019-04-25 17:14	25.5	-303	-303	25.6	-303	-303
13	2019-04-25 17:14	25.3	-303	-303	25.6	-303	-303

5.4 Analog output module

The optional analog output module is easy to use; it is also very flexible. To configure it, you will need to run the Omega Fiber Optic Sensing software; see next chapter. Here are some features, with some comments:

- Voltage outputs. You can select 0-10 V. Please note that this requires a ground connection, so be careful with ground loops, which can easily fool the voltage values.
- Current outputs. 4-20 mA is the industry norm. This is a better choice for industrial applications, as it is ground isolated (no ground loops).
- Any output is completely programmable:
    - It is not hard-assigned to any specific optical channel
    - One output can reflect the temperature values of many optical channels (e.g., minimum or maximum temperature read from many channels)
    - For each output, you can define the low and high temperatures (the difference between these two would be the “span”
    - With “Error Style”, you can define the behavior of the output if no temperature is read for that output.



The following figure shows the Analog Outputs tab, from Omega Fiber Optic Sensing. You are referred to the next chapter (Omega Fiber Optic Sensing) for clarifications on how to set the various parameters.

ANALOG OUTPUTS

NALOG OUTPUT ID	NAME	TYPE	SCALING MIN TEMPERATURE	SCALING MAX TEMPERATURE	ERROR OUTPUT	SOURCE	L/HIGHEST CHANNELS
01	Aout_01	4-20 mA	-100.00	200.00	Max Val	Highest	1, 2, 3, 4, 5, 6, 7, 8
02	Aout_02	4-20 mA	-100.00	200.00	Min Val	2	Not Available
03	Aout_03	4-20 mA	-100.00	200.00	Min Val	3	Not Available
04	Aout_04	4-20 mA	-100.00	200.00	Min Val	4	Not Available
05	Aout_05	4-20 mA	-100.00	200.00	Min Val	5	Not Available
06	Aout_06	4-20 mA	-100.00	200.00	Min Val	6	Not Available
07	Aout_07	4-20 mA	-100.00	200.00	Min Val	7	Not Available
08	Aout_08	4-20 mA	-100.00	200.00	Min Val	8	Not Available

Notice: This module is not *plug-and-play*: it must be installed (plugged in to the FOM) when the instrument is powered off, otherwise it will not be initialized correctly, and it will not work.

5.5 Interpretation of "%" results

The FOM-L201/H201system is fitted with an algorithm that gives an evaluation about probe signal strength or signal quality index. This is expressed as a percentage value, with 100% being the highest score, and 0% meaning no signal (no probe or broken probe). The % reading of probes can be obtained in two ways:

1- Form the instrument panel, by clicking the "Menu" button once.
2- With Omega Fiber Optic Sensing, by selecting the DATA tab. See section 6.2.

Dirty connectors will contribute to lower probe strength; always assure that all fiber connections are clean before evaluating probe performance.

For installations where extension cables and/or feedthroughs, it is highly recommended to turn on the "AGC" auto-gain feature. You can control the AGC setting either from the instrument panel or from Omega Fiber Optic Sensing.
Note: In Omega Fiber Optic Sensing, the "no-AGC" mode is called "Fixed time", in the General tab. Be advised that having the AGC feature on will slow the acquisition time; thus, for fast acquisition it is recommended to turn off the AGC feature.

Based on experience, a power value of 65% or more is considered as being satisfactory.

Notice: These values are approximate and may change slightly from instrument to instrument.

6 OMEGA FIBER OPTIC SENSING SOFTWARE DESCRIPTION

Omega Fiber Optic Sensing is particularly interesting for FOM-L201/H201 users as it provides a convenient complement to how instrument parameters are controlled and how temperature data is acquired. It offers a friendlier procedure to load various parameters, such as optical channel parameters that would otherwise require being set by hand using the instrument panel. The goals and purposes of this software packages are as follows:

Display temperature information

- Can provide results in graphical form
- Can log temperatures to a Windows file, independently from the logging feature the instrument itself

- Initialize and manage the optical channel and associated control parameters
- You can work with “virtual” instruments, i.e., you can develop instrument configurations without having a physical instrument connected to your PC • It allows for transferring configurations between instruments • And more.

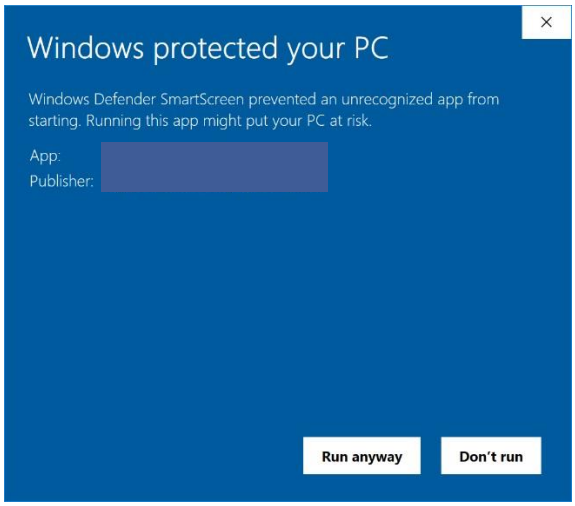
6.1 Installation and initial operation

6.1.1.1 Installing the USB serial driver

When installing the Omega Fiber Optic Sensing software, a serial driver (FTDI) that is required to connect your instrument via a USB link ( ) will be installed; this installation is normally done automatically by the installation process. If this driver is already installed (for example, when upgrading the Omega Fiber Optic Sensing software), then this driver installation will not take place.

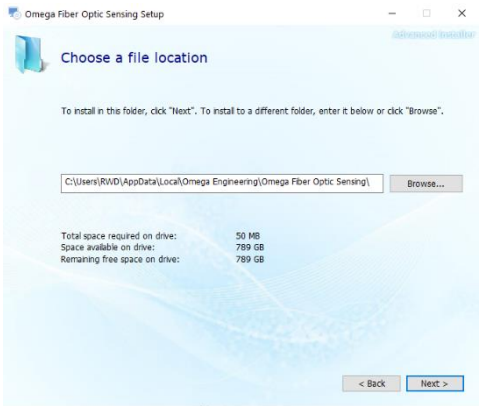
6.1.1.2 Software installation

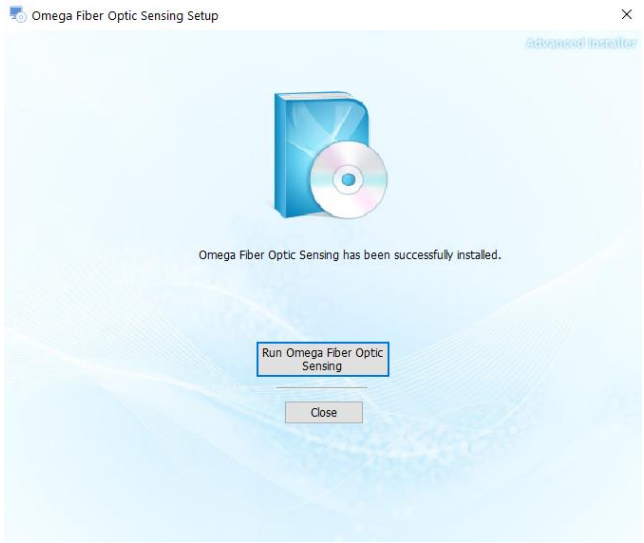
Get a copy of Omega Fiber Optic Sensing from Omega, at https://www.omega.com; you will need to request access online. You can also write an email to temperature@omega.com. Simply run this setup program (no unzipping is required). Windows-10 users: If you get this left window, below, you need to click on “More info”. Then, in the next window (shown at right), you need to click “Run anyway”.



Notice: To reinstall the software, or install a new version, you will need to first uninstall the older version. This must be done by using the “Programs and Features”, found in Windows Control Panel.

You get this window, shown below (1st picture). Click Next. Here you can accept or change the location where Omega Fiber Optic Sensing will be installed (2nd picture). Click Next. Click Install to start the installation process.

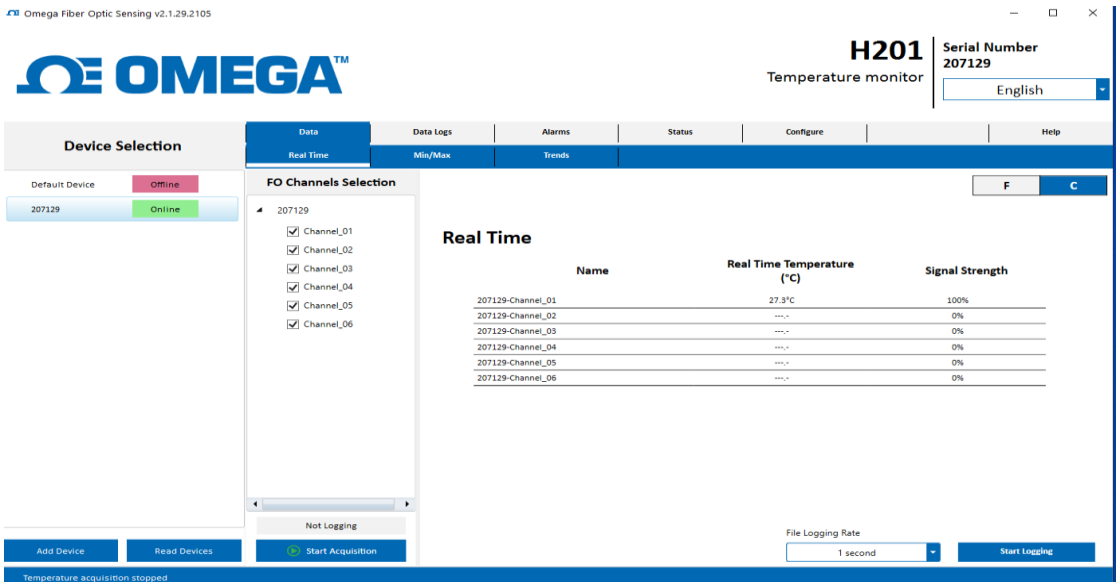




No internet connection is normally required to perform the Omega Fiber Optic Sensing installation; one exception could be that your NET Framework 4.7.2 tool needs to be upgraded. The current version of Omega Fiber Optic Sensing has been fully tested with Windows-10.

Connect your instruments (up to 6) to your PC. Each instrument must have its own USB port (); you can use a USB hub if necessary.

You get this window if one FOM-L201/H201is already connected:



The instrument can basically operate in two modes of operation:

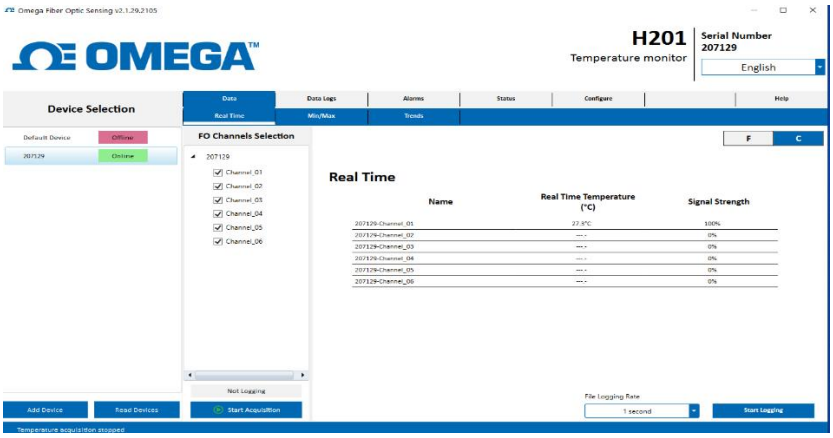
- Data mode, where temperature values can be displayed in number or trend form. This will show temperatures for up to 6 connected instruments. If you do data logging, all temperatures from all instruments will be logged in a single file.

- Configuration mode: here you can configure your selected instrument (only one at a time).

These 2 modes of operation are explained below.

6.2 Data mode (temperature acquisition)

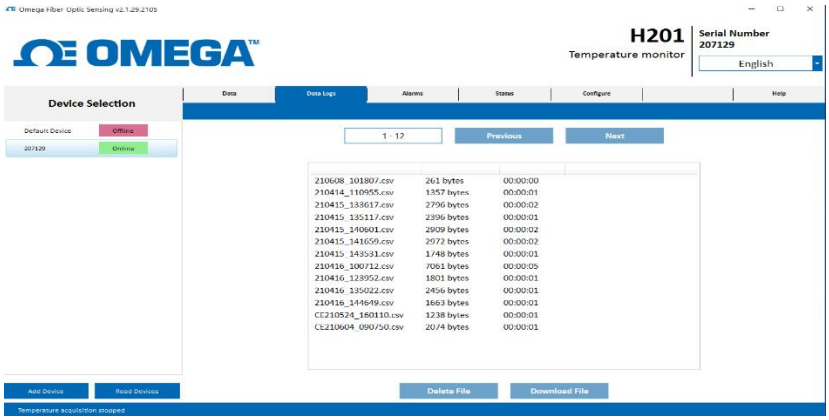
By clicking on DATA (from the top menu bar, at left) as shown above, your instrument will be in data mode whereby it will continuously acquire temperature data from all connected instruments. This is shown here (6-channel instrument, with only 1 probe):



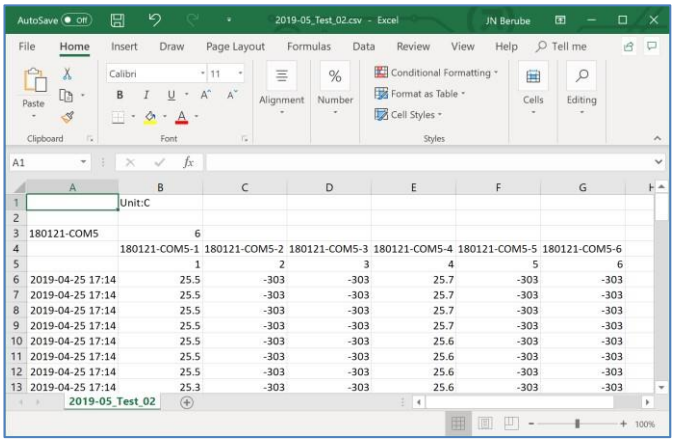
This window shows all temperatures in number format (ºC or ºF). If select from the menu either MIN/MAX or TRENDS (graphics), you can see the same data presented in different ways including in graphical form.

6.2.1 Logging data to a PC file

The data mode allows also to log data to a PC file. Click the Start Logging button at the bottom of the window, and an open file dialog will open and press Data Logs tab to access previous files, as shown here:

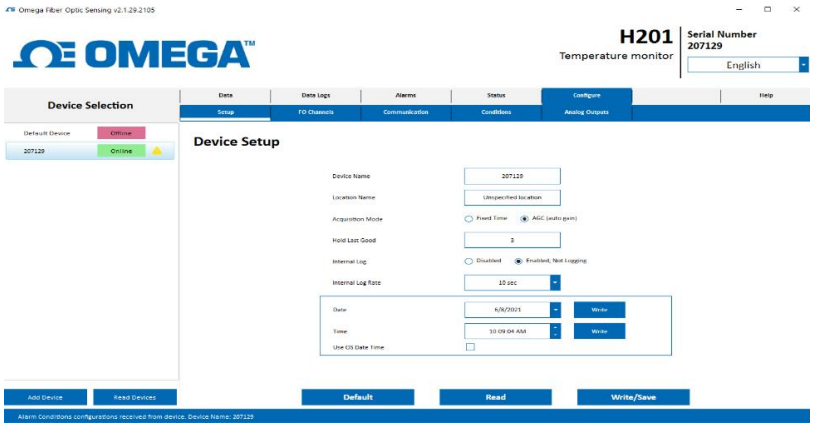


The file is a .csv that can easily be read by Excel, as shown here:



6.3 Device configuration mode

Click on the instrument serial number of the instrument you wish to configure (the list of instruments is in the left pane of this window). Then click on CONFIGURE from the menu bar; you will get:



After a few seconds, this Configuration window is populated, and you can change any parameters you want (some fields, in light grey, are for information only and are not changeable); do not forget to click the "Write/Save", button, to save your new parameters to the instrument.

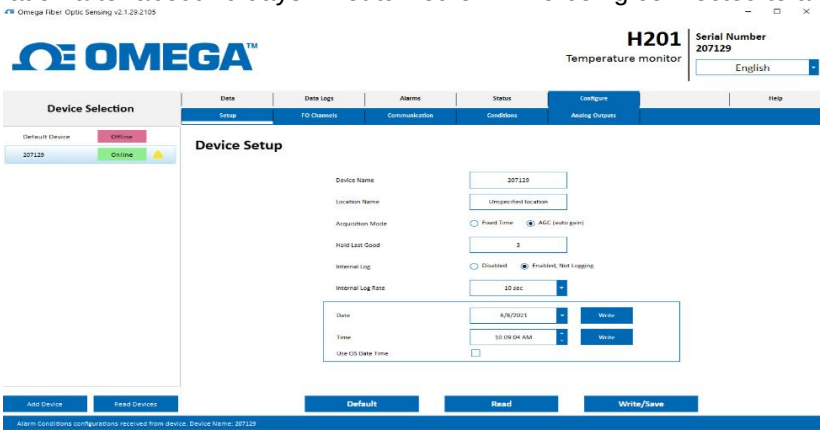
Please note that this window works with only one instrument at a time, by opposition to the Display window where all temperatures from all connected instruments can be displayed.

As part of configuring your instrument, you can select other tabs, to configure other parameters, such as the analog outputs (if this option is available on your instrument). The most important are described here; for the others, you are invited to click on the various buttons and learn what they can do for you.

6.3.1 SETUP tab

As shown in the window below, here you can set:

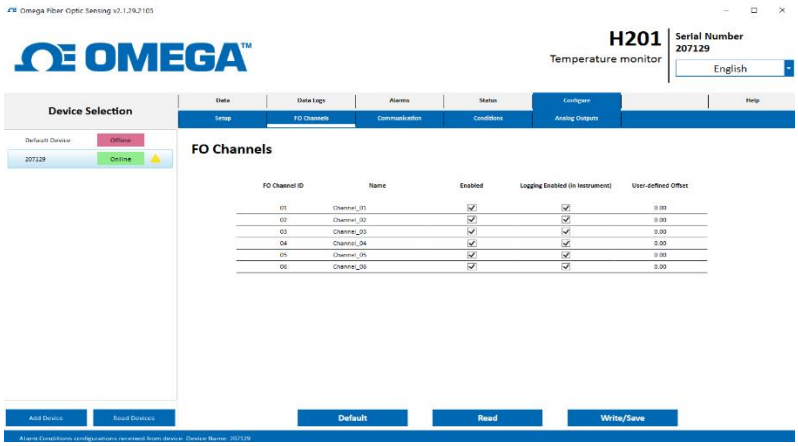
1- Acquisition Mode (AGC). For best speed, this should be Fixed. The AGC selection is recommended for installations where you are dealing with probe with weaker signals, such as when using extension cables and feedthroughs (typically for transformer applications).
2- Hold Last Good. This indicates the number of "holds" since the last good reading. Normally, a value of "0" should be appropriate, unless you are using probes with weak signal, in which case it could avoid a probe from alternating from "no reading" to "reading". In other words, this represents the number of reading cycles the thermometer will do before abdicating.
3- Internal logging and logging rate. You need a microSD card in your instrument to be able to log into your instrument.
4- Date and time update. You can update the time/date of your instrument here. The FOM-L201/H201 will lose its date and time information after about 10 days if not turned on while being connected to a USB power source.



6.3.2 CHANNELS tab

Here, you can do the following:

- Give alphanumeric names to optical channels
- Enable and disable optical channels. It may be useful to disable unused channels, to improve temperature update speed
- Enabling and disabling logging on the microSD card, independently for each channel
- Finally, you can force an offset for each channel. Please note that forcing an offset on a channel will defeat the instrument calibration.

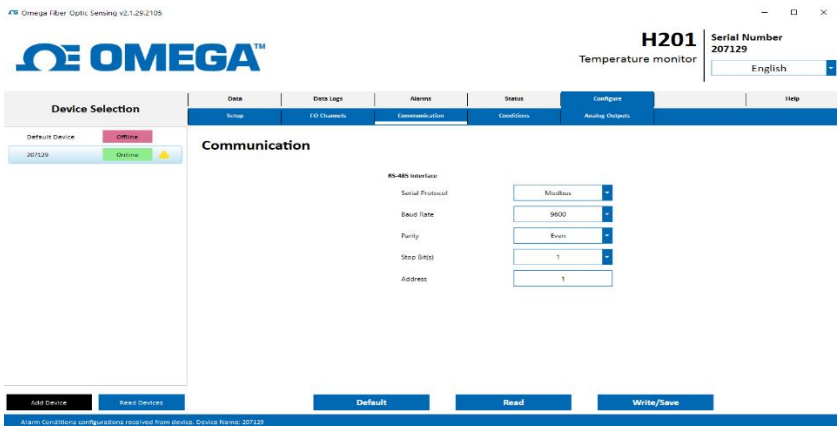


6.3.3 COMMUNICATION tab

Here you can select which protocol you want to enable on the serial RS-485 port. Currently, 4 choices are available:

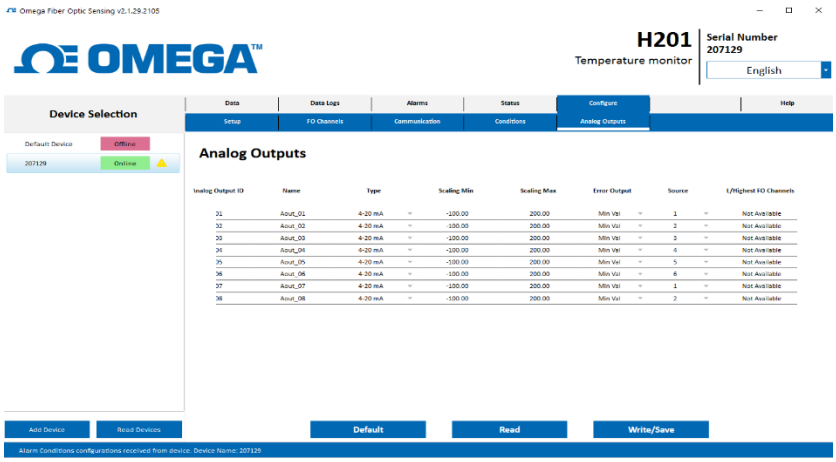
1- None
2- Modbus. Chapter 7 includes a description of the Modbus registers
3- IEC 60870-5-101. See T301 user guide for more information on this protocol (document User Guide)
4- DNP 3.0. See T301 user guide for more information on this protocol.

Once you have selected a protocol, you can change the baud rate, parity, stop bits and node address to communicate with your master device.



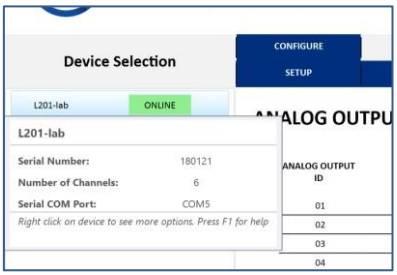
6.3.4 ANALOG OUTPUTS tab

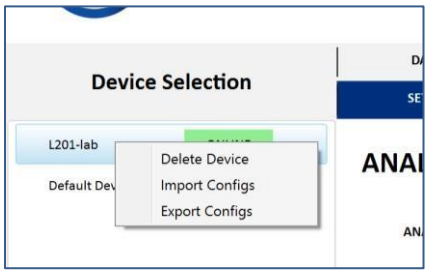
Analog output parameters can be set here. Refer to section 5.4 for more information for hints on how to set these outputs. Take note that the analog output module is an option on the FOM, so this setting will be only useful if that option is present on your FOM-L201/H201.



6.3.5 Importing / Exporting instrument configurations

Importing and exporting configurations are easy to do. If you place your mouse over the instrument name in the left pane, you will get the information shown here, and then by right clicking, you will get what is shown at right:



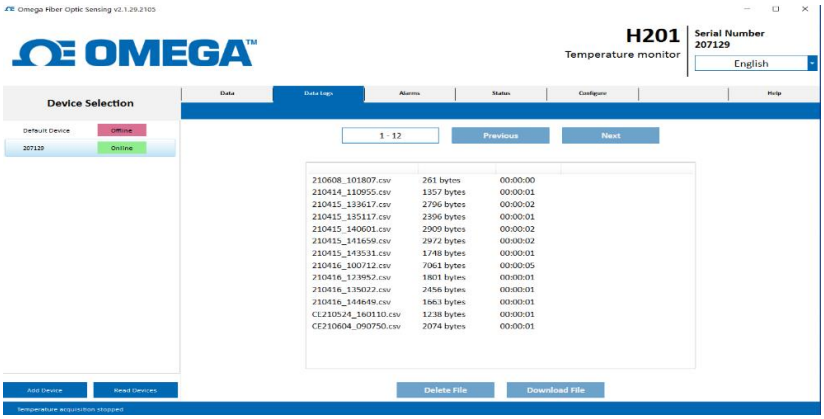


From here, you can click on Import or Export Configs. The Export function can be useful if you intend to configure multiple instruments with the same configuration.

6.4 Downloading data files

You can download data from you instrument by clicking on the DATA LOGS tab. Select a file and click the Download File button.

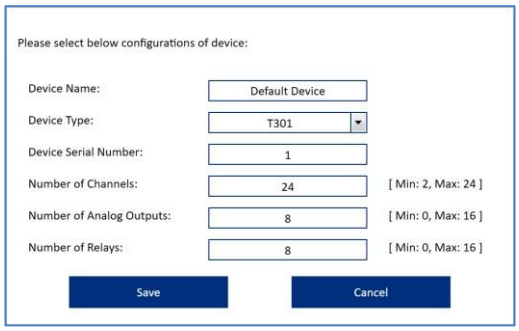
From the same window, one can also delete files stored in the instrument microSD.



6.5 Offline configurations

Omega Fiber Optic Sensing allows you to create offline configurations, i.e., configurations for instruments that are not connected to your PC (these can also be called virtual configurations). You can then save this configuration file, which could be later uploaded to a real instrument. It might be a good idea to call these virtual configurations by project number or name; when they will be uploaded to a real instrument later, then its name will change to the instrument actual serial number.

Click on the “Add Device” button found at the bottom left of the window. The following small window will open:



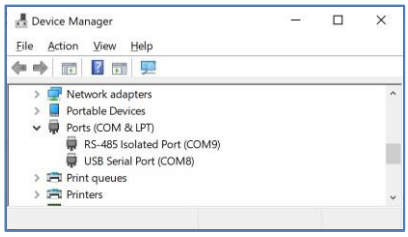
Fill the text boxes with values that your new instrument should have and click “Save”. From this point, you can continue to configure it as if this instrument were a real one. When you are done with your configuration, do not forget to click on “Write/Save”.

6.6 Firmware upgrade

If an upgrade is required on your instrument, please contact Omega to get a new firmware code file (with extension *.hex). Once you have this file, follow this procedure:

- Download from the web the following ST upgrade software:https://www.st.com/en/developmenttools/flasher-stm32.html). Install this program and run it to get to the first screen shown below.

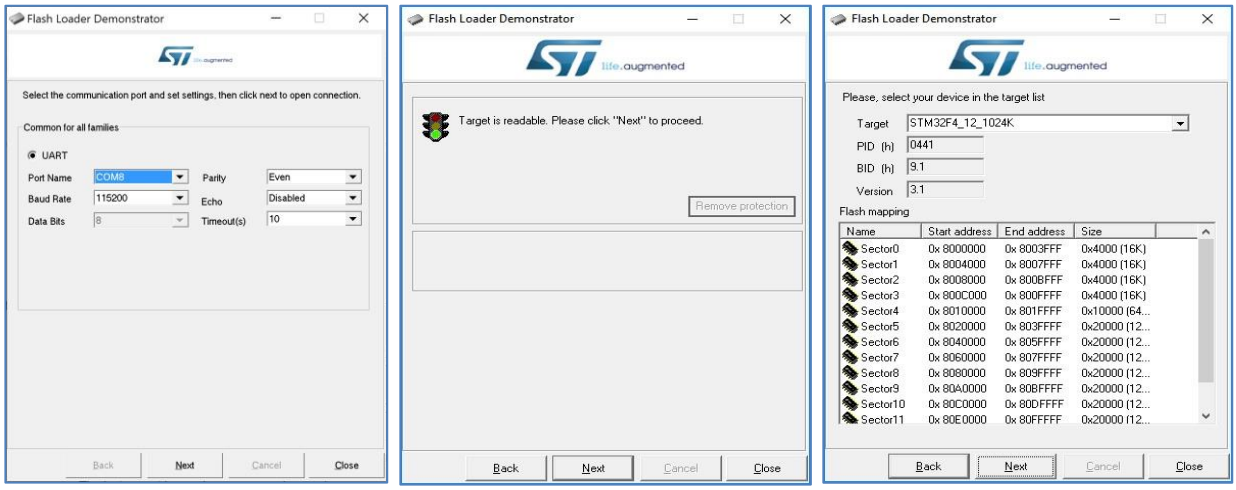
- You will need to know the serial port number used by your instrument to connect through the USB link. This is best done by invoking the Windows’ Device Manager utility, as shown here:



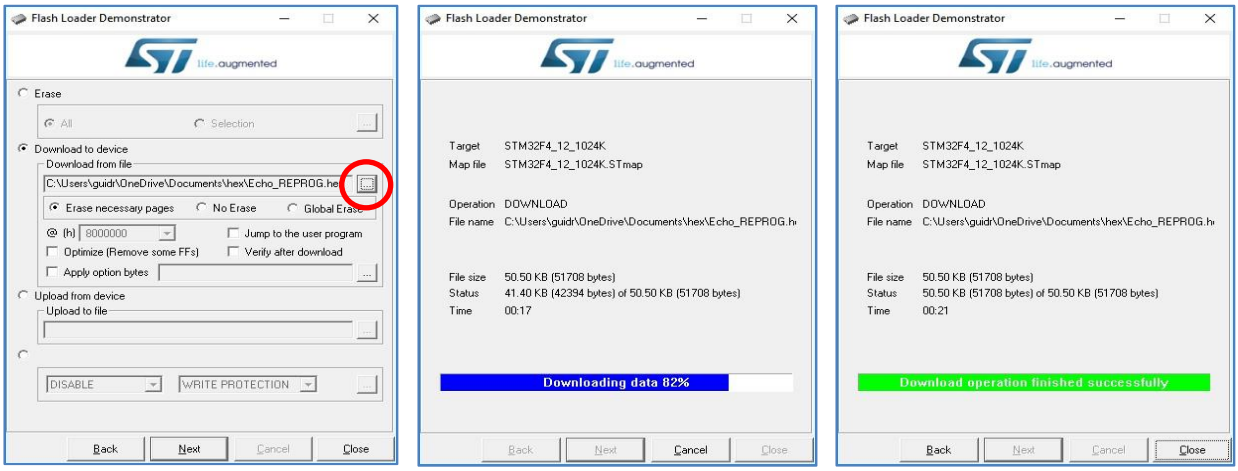
  In this example, as shown above, it would be COM8.

- To force the instrument to be in “upgrade” mode, you will now need to do the following:
  - Make sure the instrument is turned off
  - While pressing simultaneously both UP and DOWN arrow keys, turn on the power to the instrument. Important: hold down these 2 keys until the progress bar shown by the ST utility has started!
  - The instrument is now in reprogramming mode

- Make sure the Port Name and Baud rate (115,200) are correctly set as shown in the first figure below. Click Next, to get to the second figure. Click Next again, to get to the third figure.



- Click Next again, to get the fourth figure, below. Here, you need to select “Download to device” and select your firmware code file (*.hex), by clicking on the “. . .”, as shown by the red circle. Click Next. The fifth figure will show up with a download progress bar. You can now stop pressing the two arrow keys. The download process with take about one minute to complete, at which point the progress bar will turn green, as shown in figure sixth.



- The upgrade process is now finished.
- To get your instrument out of the firmware upgrade mode, turn the instrument off and after a few seconds turn it on again.

7 MODBUS REGISTER TABLE

This chapter gives a description of the Modbus registers included in the FOM-L201/H201instrument. If you want to connect to the FOM-L201/H201using the serial RS-485 port, you will need this information.

Version: 1.8

Ref: MODBUS Application Protocol Specification V1.1b3 Modbus.org **2.2 User Config** **User_config_struct**

Function code: **0x01** **Read Coils** **Read only**

1.1 System Info **Factory_struct**

Reg Address	Name	Description	1 bit	Encoding
0x0000	Relay1	Relay 1 state (given after Fail-safe [0x400] consideration)		0 = de-energized ; 1 = energized
0x0001	Relay2	Relay 2 state (given after Fail-safe [0x410] consideration)		0 = de-energized ; 1 = energized
0x0002	Relay3	Relay 3 state (given after Fail-safe [0x420] consideration)		0 = de-energized ; 1 = energized
0x0003	Relay4	Relay 4 state (given after Fail-safe [0x430] consideration)		0 = de-energized ; 1 = energized
0x0004	Relay5	Relay 5 state (given after Fail-safe [0x440] consideration)		0 = de-energized ; 1 = energized
0x0005	Relay6	Relay 6 state (given after Fail-safe [0x450] consideration)		0 = de-energized ; 1 = energized
0x0006	Relay7	Relay 7 state (given after Fail-safe [0x460] consideration)		0 = de-energized ; 1 = energized
0x0007	Relay8	Relay 8 state (given after Fail-safe [0x470] consideration)		0 = de-energized ; 1 = energized

Function code: **0x03** **Read Holding Registers** **Read only**

2.1 System Info **Factory_struct**

Reg Address	Name	Description	16 bits	Encoding
0x0000	Device	Type of Device	Unsigned	Define: 1 = FOM; 2 = T301; 4 = SL601; 8 = O201; 13 = R501; 20 = FOM-H201
0x0001	Model	Device Model	Unsigned	Reserved
0x0002	NbChannel	Number of Channels	Unsigned	1 to 32 for 1 to 32 channels
0x0003	CalibYY	Calibration Year	Unsigned	18 for 2018
0x0004	CalibMM	Calibration Month	Unsigned	1 to 12
0x0005	CalibDD	Calibration Day	Unsigned	1 to 31
0x0006	SerialNumberH	Unique ID Serial Number MSW	Unsigned	MSW of the 32 bits variable
0x0007	SerialNumberL	Unique ID Serial Number LSW	Unsigned	LSW of the 32 bits variable
0x0008	NbAout	Number of Analog Outputs	Unsigned	0 means option is not present, 8 = 8 analog output available
0x0009	NbRelay	Number of Relays	Unsigned	0 means option is not present, 8 = 8 relays available
0x000A-0x000F	*RFU*	*Reserved for Future use*	Unsigned	Set to 0x0000

Reg Address	Name	Description	16 bits	Encoding
0x0010	AcquisitionMode	Acquisition Auto Gain Mode	Unsigned	Define: 0 = Reserved; 1 = Fixed Time; 2 = AGC on
0x0011	TempAveraging	Averaging	Unsigned	50 to 100; 100 = 100% of last value (no avg) = default
0x0012	HoldLastGood	Hold Last Good value for x scan	Unsigned	0 to 9; Default = 3
0x0013	LogEn	Internal Logging Enable	Unsigned	0 = Disable; 1 = Enable Not Logging; 2 = Logging
0x0014	LogRate	Internal Logging Rate	Unsigned	Defines

0x0015	Date_yy	Device Internal Year (date)	Unsigned	18 for 2018
0x0016	Date_mm	Device Internal Month (date)	Unsigned	1 to 12
0x0017	Date_dd	Device Internal Day (date)	Unsigned	1 to 31
0x0018	TimeInSecH	Device Internal Time in second MSW	Unsigned	MSW of the 32 bits variable
0x0019	TimeInSecL	Device Internal Time in second LSW	Unsigned	LSW of the 32 bits variable
0x001A-0x00FF	*RFU*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*

2.3 Channel Config **User_channel_struct**

Reg Address	Name	Description	16 bits	Encoding
0x0110	CH01_Enable	Channel 01 Enable to scan	Unsigned	0 = Disable; Enable otherwise
0x0111	CH01_Offset	Channel 01 Temperature Offset	Signed	Temperature Offset x 100 [e.g. 125 for 1.25C]
0x0112-0x011D	CH01_Name	Channel 01 Name	Unsigned	24 bytes long string
0x011E-0x011F	*CH01_Reserved*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*
0x0120-0x012F	…	Channel 02	…	*Same as Channel 01 structure*
0x0130-0x013F	…	Channel 03	…	*Same as Channel 01 structure*
0x0140-0x014F	…	Channel 04	…	*Same as Channel 01 structure*
0x0150-0x015F	…	Channel 05	…	*Same as Channel 01 structure*
0x0160-0x016F	…	Channel 06	…	*Same as Channel 01 structure*
0x0170-0x017F	…	Channel 07	…	*Same as Channel 01 structure*
0x0180-0x018F	…	Channel 08	…	*Same as Channel 01 structure*
0x0190-0x019F	…	Channel 09	…	*Same as Channel 01 structure*
0x01A0-0x01AF	…	Channel 10	…	*Same as Channel 01 structure*
0x01B0-0x01BF	…	Channel 11	…	*Same as Channel 01 structure*
0x01C0-0x01CF	…	Channel 12	…	*Same as Channel 01 structure*
0x01D0-0x01DF	…	Channel 13	…	*Same as Channel 01 structure*
0x01E0-0x01EF	…	Channel 14	…	*Same as Channel 01 structure*
0x01F0-0x01FF	…	Channel 15	…	*Same as Channel 01 structure*
0x0200-0x020F	…	Channel 16	…	*Same as Channel 01 structure*
0x0210-0x021F	…	Channel 17	…	*Same as Channel 01 structure*
0x0220-0x022F	…	Channel 18	…	*Same as Channel 01 structure*
0x0230-0x023F	…	Channel 19	…	*Same as Channel 01 structure*
0x0240-0x024F	…	Channel 20	…	*Same as Channel 01 structure*
0x0250-0x025F	…	Channel 21	…	*Same as Channel 01 structure*
0x0260-0x026F	…	Channel 22	…	*Same as Channel 01 structure*
0x0270-0x027F	…	Channel 23	…	*Same as Channel 01 structure*
0x0280-0x028F	…	Channel 24	…	*Same as Channel 01 structure*
0x0290-0x029F	…	Channel 25	…	*Same as Channel 01 structure*
0x02A0-0x02AF	…	Channel 26	…	*Same as Channel 01 structure*
0x02B0-0x02BF	…	Channel 27	…	*Same as Channel 01 structure*

0x02C0- 0x02CF	…	Channel 28	…	*Same as Channel 01 structure*
0x02D0- 0x02DF	…	Channel 29	…	*Same as Channel 01 structure*
0x02E0- 0x02EF	…	Channel 30	…	*Same as Channel 01 structure*
0x02F0	CH31_Enable	Channel 31 Enable to scan	Unsigned	0 = Disable; Enable otherwise
0x02F1	CH31_Offset	Channel 31 Temperature Offset	Signed	Temperature Offset x 100 [e.g. 125 for 1.25c]
0x02F2- 0x02FD	CH31_Name	Channel 31 Name	Unsigned	24 bytes long string
0x02FE- 0x02FF	*CH31_Reserved*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*

2.4 Analog Output **Aout_struct**

Reg Address	Name	Description	16 bits	Encoding
0x0300	A01_Type	Analog 01 Type of output	Unsigned	Define: 0 = 4-20 mA; 1 = 0-10 V; 2 = 0-20 mA; 3 = 0-5 V
0x0301	A01_ErrStyle	Analog 01 Output if no valid signal	Unsigned	Define: 0 = min value; 1 = max value; 2 = Toggle max/min 1Hz
0x0302	A01_InChannelNb	Analog 01 Input channel number	Signed	-2 = lowest; -1 = highest; 0 = reserved; 1 = channel 1 etc.
0x0303	A01_Thigh	Analog 01 High value temperature	Signed	High temperature x 100 [e.g. 20000 for 200.00]
0x0304	A01_Tlow	Analog 01 Low value temperature	Signed	Low temperature x 100 [e.g. -10000 for -100.00]
0x0305	A01_EvalChEnH	Enabled channel for highest and lowest (one hot) MSW	Unsigned	MSW of the 32 bits variable (1 bit per channel)
0x0306	A01_EvalChEnL	Enabled channel for highest and lowest (one hot) LSW	Unsigned	LSW of the 32 bits variable (1 bit per channel)
0x0307- 0x030E	A01_Name	Analog 01 Name	Unsigned	16 bytes long string
0x030F	*A01_Reserved*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*
0x0310- 0x031F	…	Analog 02	…	…
0x0320- 0x032F	…	Analog 03	…	…
0x0330- 0x033F	…	Analog 04	…	…
0x0340- 0x034F	…	Analog 05	…	…
0x0350- 0x035F	…	Analog 06	…	…
0x0360- 0x036F	…	Analog 07	…	…
0x0370	A08_Type	Analog 08 Type of output	Unsigned	Define: 0 = 4-20 mA; 1 = 0-10 V; 2 = 0-20 mA; 3 = 0-5 V
0x0371	A08_ErrStyle	Analog 08 Output if no valid signal	Unsigned	Define: 0 = min value; 1 = max value; 2 = Toggle max/min 1Hz
0x0372	A08_InChannelNb	Analog 08 Input channel number	Signed	-2 = lowest; -1 = highest; 0 = reserved; 1 = channel 1 etc.
0x0373	A08_Thigh	Analog 08 High value temperature	Signed	High temperature x 100 [e.g. 20000 for 200.00]
0x0374	A08_Tlow	Analog 08 Low value temperature	Signed	Low temperature x 100 [e.g. -10000 for -100.00]
0x0375	A08_EvalChEnH	Enabled channel for highest and lowest (one hot) MSW	Unsigned	MSW of the 32 bits variable (1 bit per channel)
0x0376	A08_EvalChEnL	Enabled channel for highest and lowest (one hot) LSW	Unsigned	LSW of the 32 bits variable (1 bit per channel)
0x0377- 0x037E	A08_Name	Analog 08 Name	Unsigned	16 bytes long string
0x037F	*A08_Reserved*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*
0x0380- 0x03FF	*RFU*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*

2.5 Relays **Relay_struct**

Reg Address	Name	Description	16 bits	Encoding
0x0400	R01_FailSafe	Relay 01 Reverse logic	Unsigned	Define: 0 = Default; 1 = De-Energized if active
0x0401- 0x0408	R01_Name	Relay 01 Name	Unsigned	16 bytes long string

0x0409- 0x040F	R01_Reserved	*Reserved for Future use*	Unsigned	Set to 0x0000
0x0410- 0x041F	…	Relay 02	…	…
0x0420- 0x042F	…	Relay 03	…	…
0x0430- 0x043F	…	Relay 04	…	…
0x0440- 0x044F	…	Relay 05	…	…
0x0450- 0x045F	…	Relay 06	…	…
0x0460- 0x046F	…	Relay 07	…	…
0x0470	R08_FailSafe	Relay 08 Reverse logic	Unsigned	Define: 0 = Default; 1 = De-Energized if active
0x0471- 0x0478	R08_Name	Relay 08 Name	Unsigned	16 bytes long string
0x0479- 0x047F	*R08_Reserved*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*
0x0480- 0x04FF	*RFU*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*

2.6
Conditions **Alarm_struct**

Reg Address	Name	Description	16 bits	Encoding
0x0500	AL01_Enable	Condition 01 Enable/Disable	Unsigned	0 = Disable; Enable otherwise
0x0501	AL01_RLY	Condition 01 Associated relay (0 based)	Unsigned	0 to 7 for relay 1 to 8
0x0502	AL01_InChannelNb	Condition 01 Input channel number	Signed	-2 = lowest; -1 = highest; 0 = reserved; 1 = channel 1 etc.
0x0503	AL01_ConditionType	Condition 01 Condition type	Unsigned	0 = No signal; 1 = Less than; 2 = Greater than
0x0504	AL01_AlarmEn	Condition 01 General Condition	Unsigned	0 = Disable; Enable otherwise
0x0505	AL01_LogEn	Condition 01 Log event	Unsigned	0 = Disable; Enable otherwise
0x0506	AL01_Threshold	Condition 01 Temperature threshold (Celsius)	Signed	Temperature x 100 [e.g. 15000 for 150.00]
0x0507	AL01_Hysteresis	Condition 01 hysteresis (Celsius)	Signed	Temperature x 100 [e.g. 500 for 5.00]
0x0508	AL01_EvalChEnH	Enabled channel for highest and lowest (one hot) MSW	Unsigned	MSW of the 32 bits variable (1 bit per channel)
0x0509	AL01_EvalChEnL	Enabled channel for highest and lowest (one hot) LSW	Unsigned	LSW of the 32 bits variable (1 bit per channel)
0x050A- 0x0515	AL01_ConditionName	Condition string name	Unsigned	24 bytes long string
0x0516- 0x051F	*AL01_Reserved*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*
0x0520- 0x053F	…	Condition 02	…	*Same as Condition 01 structure*
0x0540- 0x055F	…	Condition 03	…	*Same as Condition 01 structure*
0x0560- 0x057F	…	Condition 04	…	*Same as Condition 01 structure*
0x0580- 0x059F	…	Condition 05	…	*Same as Condition 01 structure*
0x05A0- 0x05BF	…	Condition 06	…	*Same as Condition 01 structure*
0x05C0- 0x05DF	…	Condition 07	…	*Same as Condition 01 structure*
0x05E0- 0x05FF	…	Condition 08	…	*Same as Condition 01 structure*
0x0600- 0x061F	…	Condition 09	…	*Same as Condition 01 structure*
0x0620- 0x063F	…	Condition 10	…	*Same as Condition 01 structure*
0x0640- 0x065F	…	Condition 11	…	*Same as Condition 01 structure*
0x0660- 0x067F	…	Condition 12	…	*Same as Condition 01 structure*
0x0680- 0x069F	…	Condition 13	…	*Same as Condition 01 structure*
0x06A0- 0x06BF	…	Condition 14	…	*Same as Condition 01 structure*

0x06C0-0x06DF	…	Condition 15	…	*Same as Condition 01 structure*
0x06E0-0x06FF	…	Condition 16	…	*Same as Condition 01 structure*
0x0700-0x071F	…	Condition 17	…	*Same as Condition 01 structure*
0x0720-0x073F	…	Condition 18	…	*Same as Condition 01 structure*
0x0740-0x075F	…	Condition 19	…	*Same as Condition 01 structure*
0x0760-0x077F	…	Condition 20	…	*Same as Condition 01 structure*
0x0780-0x079F	…	Condition 21	…	*Same as Condition 01 structure*
0x07A0-0x07BF	…	Condition 22	…	*Same as Condition 01 structure*
0x07C0-0x07DF	…	Condition 23	…	*Same as Condition 01 structure*
0x07E0-0x07FF	…	Condition 24	…	*Same as Condition 01 structure*
0x0800-0x081F	…	Condition 25	…	*Same as Condition 01 structure*
0x0820-0x083F	…	Condition 26	…	*Same as Condition 01 structure*
0x0840-0x085F	…	Condition 27	…	*Same as Condition 01 structure*
0x0860-0x087F	…	Condition 28	…	*Same as Condition 01 structure*
0x0880-0x089F	…	Condition 29	…	*Same as Condition 01 structure*
0x08A0-0x08BF	…	Condition 30	…	*Same as Condition 01 structure*
0x08C0-0x08DF	…	Condition 31	…	*Same as Condition 01 structure*
0x08E0	AL32_Enable	Condition 32 Enable / Disable	Unsigned	0 = Disable; Enable otherwise
0x08E1	AL32_RLY	Condition 32 Associated relay (0 based)	Unsigned	0 to 7 for relay 1 to 8
0x08E2	AL32_InChannelNb	Condition 32 Input channel number	Signed	-2 = lowest; -1 = highest; 0 = reserved; 1 = channel 1 etc.
0x08E3	AL32_ConditionType	Condition 32 Condition type	Unsigned	0 = No signal; 1 = Less than; 2 = Greater than
0x08E4	AL32_AlarmEn	Condition 32 General Condition	Unsigned	0 = Disable; Enable otherwise
0x08E5	AL32_LogEn	Condition 32 Log event	Unsigned	0 = Disable; Enable otherwise
0x08E6	AL32_Threshold	Condition 32 Temperature threshold (Celsius)	Signed	Temperature x 100 [e.g. 15000 for 150.00]
0x08E7	AL32_Hysteresis	Condition 32 hysteresis (Celsius)	Signed	Temperature x 100 [e.g. 500 for 5.00]
0x08E8	AL32_EvalChEnH	Enabled channel for highest and lowest (one hot) MSW	Unsigned	MSW of the 32 bits variable (1 bit per channel)
0x08E9	AL32_EvalChEnL	Enabled channel for highest and lowest (one hot) LSW	Unsigned	LSW of the 32 bits variable (1 bit per channel)
0x08EA-0x08F5	AL32_ConditionName	Condition string name	Unsigned	24 bytes long string
0x08F6-0x08FF	*AL32_Reserved*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*

2.7 Alarms status

Reg Address	Name	Description	16 bits	Encoding
0x0900	AlarmLatchH	Alarm latch MSW (a write resets all latched alarms)	Unsigned	MSW of the 32 bits variable (1 bit per alarm)
0x0901	AlarmLatchL	Alarm latch LSW (a write resets all latched alarms)	Unsigned	LSW of the 32 bits variable (1 bit per alarm)
0x0902-0x090F	*RFU*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*

2.8 Device Ethernet Config

Reg Address	Name	Description	16 bits	Encoding
0x0A00-0x0A03	ETH0 IP	Device Eth0 IP address (RJ45)	Unsigned	IP [0].[1].[2].[3]

0x0A04- 0x0A07	ETH0 SubnetMask	Eth0 Subnet mask	Unsigned	IP [0].[1].[2].[3]
0x0A08- 0x0A0B	ETH0 Gateway	Eth0 Gateway	Unsigned	IP [0].[1].[2].[3]
0x0A0C- 0x0A0F	ETH0 DNS	Eth0 DNS server	Unsigned	IP [0].[1].[2].[3]
0x0A10	ETH0 Config	Eth0 port configuration bits	Unsigned	
0x0A11	ETH0 EnabledServices	Eth0 Services enabled	Unsigned	
0x0A12- 0x0A1F	*ETH0 Reserved*	*Eth0 Reserved for Future use*	*Unsigned*	*Set to 0x0000*
0x0A20- 0x0A23	ETH1 IP	Device ETH1 IP address (Fiber)	Unsigned	IP [0].[1].[2].[3]
0x0A24- 0x0A27	ETH1 SubnetMask	Eth1 Subnet mask	Unsigned	IP [0].[1].[2].[3]
0x0A28- 0x0A2B	ETH1 Gateway	Eth1 Gateway	Unsigned	IP [0].[1].[2].[3]
0x0A2C- 0x0A2F	ETH1 DNS	Eth1 DNS server	Unsigned	IP [0].[1].[2].[3]
0x0A30	ETH1 Config	Eth1 port configuration bits	Unsigned	
0x0A31	ETH1 EnabledServices	Eth1 Services enabled	Unsigned	
0x0A32- 0x0A3F	*ETH1 Reserved*	*Eth1 Reserved for Future use*	*Unsigned*	*Set to 0x0000*

2.9 Device String ID

Reg Address	Name	Description	16 bits	Encoding
0x0B00- 0x0B10	DeviceName	Device string name	Unsigned	31 bytes long string
0x0B20- 0x0B30	LocationName	Device location string name	Unsigned	31 bytes long string
0x0B40- 0x0BFF	*RFU*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*

Reg Address	Name	Description	16 bits	Encoding
0x0000	MajorVersion	Firmware Major Version	Unsigned	0 to 99
0x0001	MinorVersion	Firmware Revision	Unsigned	0 to 99
0x0002	GenError	System error code	Unsigned	Internal use

Function 0x04 code: **Read Inputs Registers** **Read only**

3.1 Data System Info **rData_SysInfo_struct**

0x0003	CalibError	Calibration CRC err (1 bit per channel)	Unsigned	Internal use
0x0004	InternalTemp	Internal temp x 100	Signed	Internal Temperature x 100 [e.g. 3846 for 38.46]
0x0007-0x00FF	*RFU*	*Reserved for Future use*	Unsigned	Set to 0x0000

2.10 Aging

Reg Address	Name	Description	16 bits	Encoding
0x0C00	AG1 Enable	Aging 1 Calculation enabled	Unsigned	0 or 1
0x0C01	AG1 Channel	Aging 1 Operating temperature reference	Signed	-3=average; -2=lowest; -1=highest; 0=reserved; 1=ch 1; etc.
0x0C02	AG1 EvalChEnH	Aging 1 Enabled channels for average/highest/lowest MSW	Unsigned	MSW of the 32 bits variable (1 bit per channel)
0x0C03	AG1 EvalChEnL	Aging 1 Enabled channels for average/highest/lowest LSW	Unsigned	LSW of the 32 bits variable (1 bit per channel)
0x0C04	AG1 UnityTemp	Aging 1 Unity temperature	Unsigned	Temperature x 100
0x0C05	AG1 InitialOperatingH	Aging 1 Initial operating hours MSW	Unsigned	MSW of the 32 bits variable (hours)
0x0C06	AG1 InitialOperatingL	Aging 1 Initial operating hours LSW	Unsigned	LSW of the 32 bits variable (hours)
0x0C07	AG1 InitialAgingH	Aging 1 Initial aging hours MSW	Unsigned	MSW of the 32 bits variable (hours)
0x0C08	AG1 InitialAgingL	Aging 1 Initial aging hours LSW	Unsigned	LSW of the 32 bits variable (hours)
0x0C09-0x0C1F	*AG1 RFU*	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*
0x0C20-0x0C3F	AG2	Aging 2	…	*Same as Aging 1 structure*
0x0C40-0x0C5F	AG3	Aging 3	…	*Same as Aging 1 structure*

3.2 Temperature Data **rData_Temp_struct**

Reg Address	Name	Description	16 bits	Encoding
0x0101	CH01_Status	Channel 01 Current status	Unsigned	Error code: 0 = Valid; 2 = Disabled; 3 = No Signal
0x0102	CH02_Status	Channel 02 Current status	Unsigned	…
0x0103	CH03_Status	Channel 03 Current status	Unsigned	…
0x0104	CH04_Status	Channel 04 Current status	Unsigned	…
0x0105	CH05_Status	Channel 05 Current status	Unsigned	…
0x0106	CH06_Status	Channel 06 Current status	Unsigned	…
0x0107	CH07_Status	Channel 07 Current status	Unsigned	…
0x0108	CH08_Status	Channel 08 Current status	Unsigned	…
0x0109	CH09_Status	Channel 09 Current status	Unsigned	…
0x010A	CH10_Status	Channel 10 Current status	Unsigned	…
0x010B	CH11_Status	Channel 11 Current status	Unsigned	…
0x010C	CH12_Status	Channel 12 Current status	Unsigned	…
0x010D	CH13_Status	Channel 13 Current status	Unsigned	…
0x010E	CH14_Status	Channel 14 Current status	Unsigned	…
0x010F	CH15_Status	Channel 15 Current status	Unsigned	…
0x0110	CH16_Status	Channel 16 Current status	Unsigned	…
0x0111	CH17_Status	Channel 17 Current status	Unsigned	…
0x0112	CH18_Status	Channel 18 Current status	Unsigned	…
0x0113	CH19_Status	Channel 19 Current status	Unsigned	…
0x0114	CH20_Status	Channel 20 Current status	Unsigned	…
0x0115	CH21_Status	Channel 21 Current status	Unsigned	…
0x0116	CH22_Status	Channel 22 Current status	Unsigned	…
0x0117	CH23_Status	Channel 23 Current status	Unsigned	…

0x0118	CH24_Status	Channel 24 Current status	Unsigned	…
0x0119-0x011F	*Status_Rsv*	*Reserved*	*Unsigned*	*0x0000*
0x0121	CH01_Gain	Channel 01 Current Gain	Unsigned	0 to 23
0x0122	CH02_Gain	Channel 02 Current Gain	Unsigned	…
0x0123	CH03_Gain	Channel 03 Current Gain	Unsigned	…
0x0124	CH04_Gain	Channel 04 Current Gain	Unsigned	…
0x0125	CH05_Gain	Channel 05 Current Gain	Unsigned	…
0x0126	CH06_Gain	Channel 06 Current Gain	Unsigned	…
0x0127	CH07_Gain	Channel 07 Current Gain	Unsigned	…
0x0128	CH08_Gain	Channel 08 Current Gain	Unsigned	…
0x0129	CH09_Gain	Channel 09 Current Gain	Unsigned	…
0x012A	CH10_Gain	Channel 10 Current Gain	Unsigned	…
0x012B	CH11_Gain	Channel 11 Current Gain	Unsigned	…
0x012C	CH12_Gain	Channel 12 Current Gain	Unsigned	…
0x012D	CH13_Gain	Channel 13 Current Gain	Unsigned	…
0x012E	CH14_Gain	Channel 14 Current Gain	Unsigned	…
0x012F	CH15_Gain	Channel 15 Current Gain	Unsigned	…
0x0130	CH16_Gain	Channel 16 Current Gain	Unsigned	…
0x0131	CH17_Gain	Channel 17 Current Gain	Unsigned	…
0x0132	CH18_Gain	Channel 18 Current Gain	Unsigned	…
0x0133	CH19_Gain	Channel 19 Current Gain	Unsigned	…
0x0134	CH20_Gain	Channel 20 Current Gain	Unsigned	…
0x0135	CH21_Gain	Channel 21 Current Gain	Unsigned	…
0x0136	CH22_Gain	Channel 22 Current Gain	Unsigned	…
0x0137	CH23_Gain	Channel 23 Current Gain	Unsigned	…
0x0138	CH24_Gain	Channel 24 Current Gain	Unsigned	…
0x0139-0x013F	*Gain_Rsv*	*Reserved*	*Unsigned*	*0x0000*
0x0141	CH01_SigStr	Channel 01 Current Signal Strength (100% - 0%)	Unsigned	0 to 100 for 0% to 100% (make sure signal is valid [status])
0x0142	CH02_SigStr	Channel 02 Current Signal Strength (100% - 0%)	Unsigned	…
0x0143	CH03_SigStr	Channel 03 Current Signal Strength (100% - 0%)	Unsigned	…
0x0144	CH04_SigStr	Channel 04 Current Signal Strength (100% - 0%)	Unsigned	…
0x0145	CH05_SigStr	Channel 05 Current Signal Strength (100% - 0%)	Unsigned	…
0x0146	CH06_SigStr	Channel 06 Current Signal Strength (100% - 0%)	Unsigned	…
0x0147	CH07_SigStr	Channel 07 Current Signal Strength (100% - 0%)	Unsigned	…
0x0148	CH08_SigStr	Channel 08 Current Signal Strength (100% - 0%)	Unsigned	…
0x0149	CH09_SigStr	Channel 09 Current Signal Strength (100% - 0%)	Unsigned	…
0x014A	CH10_SigStr	Channel 10 Current Signal Strength (100% - 0%)	Unsigned	…
0x014B	CH11_SigStr	Channel 11 Current Signal Strength (100% - 0%)	Unsigned	…
0x014C	CH12_SigStr	Channel 12 Current Signal Strength (100% - 0%)	Unsigned	…
0x014D	CH13_SigStr	Channel 13 Current Signal Strength (100% - 0%)	Unsigned	…
0x014E	CH14_SigStr	Channel 14 Current Signal Strength (100% - 0%)	Unsigned	…

0x014F	CH15_SigStr	Channel 15 Current Signal Strength (100% - 0%)	Unsigned	...
0x0150	CH16_SigStr	Channel 16 Current Signal Strength (100% - 0%)	Unsigned	...
0x0151	CH17_SigStr	Channel 17 Current Signal Strength (100% - 0%)	Unsigned	...
0x0152	CH18_SigStr	Channel 18 Current Signal Strength (100% - 0%)	Unsigned	...
0x0153	CH19_SigStr	Channel 19 Current Signal Strength (100% - 0%)	Unsigned	...
0x0154	CH20_SigStr	Channel 20 Current Signal Strength (100% - 0%)	Unsigned	...
0x0155	CH21_SigStr	Channel 21 Current Signal Strength (100% - 0%)	Unsigned	...
0x0156	CH22_SigStr	Channel 22 Current Signal Strength (100% - 0%)	Unsigned	...
0x0157	CH23_SigStr	Channel 23 Current Signal Strength (100% - 0%)	Unsigned	...
0x0158	CH24_SigStr	Channel 24 Current Signal Strength (100% - 0%)	Unsigned	...
0x0159-0x015F	*SigStr_Rsv*	*Reserved*	*Unsigned*	*0x0000*
0x0161	CH01_Amplitude	Channel 01 Current Amplitude	Unsigned	Signal amplitude (internal use)
0x0162	CH02_Amplitude	Channel 02 Current Amplitude	Unsigned	...
0x0163	CH03_Amplitude	Channel 03 Current Amplitude	Unsigned	...
0x0164	CH04_Amplitude	Channel 04 Current Amplitude	Unsigned	...
0x0165	CH05_Amplitude	Channel 05 Current Amplitude	Unsigned	...
0x0166	CH06_Amplitude	Channel 06 Current Amplitude	Unsigned	...
0x0167	CH07_Amplitude	Channel 07 Current Amplitude	Unsigned	...
0x0168	CH08_Amplitude	Channel 08 Current Amplitude	Unsigned	...
0x0169	CH09_Amplitude	Channel 09 Current Amplitude	Unsigned	...
0x016A	CH10_Amplitude	Channel 10 Current Amplitude	Unsigned	...
0x016B	CH11_Amplitude	Channel 11 Current Amplitude	Unsigned	...
0x016C	CH12_Amplitude	Channel 12 Current Amplitude	Unsigned	...
0x016D	CH13_Amplitude	Channel 13 Current Amplitude	Unsigned	...
0x016E	CH14_Amplitude	Channel 14 Current Amplitude	Unsigned	...
0x016F	CH15_Amplitude	Channel 15 Current Amplitude	Unsigned	...
0x0170	CH16_Amplitude	Channel 16 Current Amplitude	Unsigned	...
0x0171	CH17_Amplitude	Channel 17 Current Amplitude	Unsigned	...
0x0172	CH18_Amplitude	Channel 18 Current Amplitude	Unsigned	...
0x0173	CH19_Amplitude	Channel 19 Current Amplitude	Unsigned	...
0x0174	CH20_Amplitude	Channel 20 Current Amplitude	Unsigned	...
0x0175	CH21_Amplitude	Channel 21 Current Amplitude	Unsigned	...
0x0176	CH22_Amplitude	Channel 22 Current Amplitude	Unsigned	...
0x0177	CH23_Amplitude	Channel 23 Current Amplitude	Unsigned	...
0x0178	CH24_Amplitude	Channel 24 Current Amplitude	Unsigned	...
0x0179-0x017F	*Amplitude_Rsv*	*Reserved*	*Unsigned*	*0x0000*
0x0181	CH01_Temperature	Channel 01 Current Temperature	Signed	Temperature x 100 [e.g. 12345 for 123.45]
0x0182	CH02_Temperature	Channel 02 Current Temperature	Signed	...
0x0183	CH03_Temperature	Channel 03 Current Temperature	Signed	...
0x0184	CH04_Temperature	Channel 04 Current Temperature	Signed	...
0x0185	CH05_Temperature	Channel 05 Current Temperature	Signed	...
0x0186	CH06_Temperature	Channel 06 Current Temperature	Signed	...
0x0187	CH07_Temperature	Channel 07 Current Temperature	Signed	...
0x0188	CH08_Temperature	Channel 08 Current Temperature	Signed	...

0x0189	CH09_Temperature	Channel 09 Current Temperature	Signed	…
0x018A	CH10_Temperature	Channel 10 Current Temperature	Signed	…
0x018B	CH11_Temperature	Channel 11 Current Temperature	Signed	…
0x018C	CH12_Temperature	Channel 12 Current Temperature	Signed	…
0x018D	CH13_Temperature	Channel 13 Current Temperature	Signed	…
0x018E	CH14_Temperature	Channel 14 Current Temperature	Signed	…
0x018F	CH15_Temperature	Channel 15 Current Temperature	Signed	…
0x0190	CH16_Temperature	Channel 16 Current Temperature	Signed	…
0x0191	CH17_Temperature	Channel 17 Current Temperature	Signed	…
0x0192	CH18_Temperature	Channel 18 Current Temperature	Signed	…
0x0193	CH19_Temperature	Channel 19 Current Temperature	Signed	…
0x0194	CH20_Temperature	Channel 20 Current Temperature	Signed	…
0x0195	CH21_Temperature	Channel 21 Current Temperature	Signed	…
0x0196	CH22_Temperature	Channel 22 Current Temperature	Signed	…
0x0197	CH23_Temperature	Channel 23 Current Temperature	Signed	…
0x0198	CH24_Temperature	Channel 24 Current Temperature	Signed	…
0x0199-0x019F	*Temperature_Rsv*	*Reserved*	*Signed*	*0x0000*

3.3 Aging statistics

Reg Address	Name	Description	16 bits	Encoding
0x0200	AG1 OperatingH	Operating hours (excluding initial operating hours) MSW	Unsigned	MSW of the 32 bits variable (hours x 100)
0x0201	AG1 OperatingL	Operating hours (excluding initial operating hours) LSW	Unsigned	LSW of the 32 bits variable (hours x 100)
0x0202	AG1 AgingH	Aging hours (excluding initial aging hours) MSW	Unsigned	MSW of the 32 bits variable (hours x 100)
0x0203	AG1 AgingL	Aging hours (excluding initial aging hours) LSW	Unsigned	LSW of the 32 bits variable (hours x 100)
0x0204	AG1 Temperature	Real time operating temperature	Signed	Temperature x 100
0x0205	AG1 AgingRate	Real time aging rate	Unsigned	Rate x 100
0x0206-0x023F	AG1 RFU	*Reserved for Future use*	*Unsigned*	*Set to 0x0000*
0x0240-0x027F	AG2	Aging 2	…	*Same as Aging 1 structure*
0x0280-0x02BF	AG3	Aging 3	…	*Same as Aging 1 structure*

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The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contactingOMEGA:

Purchase Order number under which the productwas PURCHASED,

Model and serial number of the product under warranty, and

Repair instructions and/or specific problems relative to the product.

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