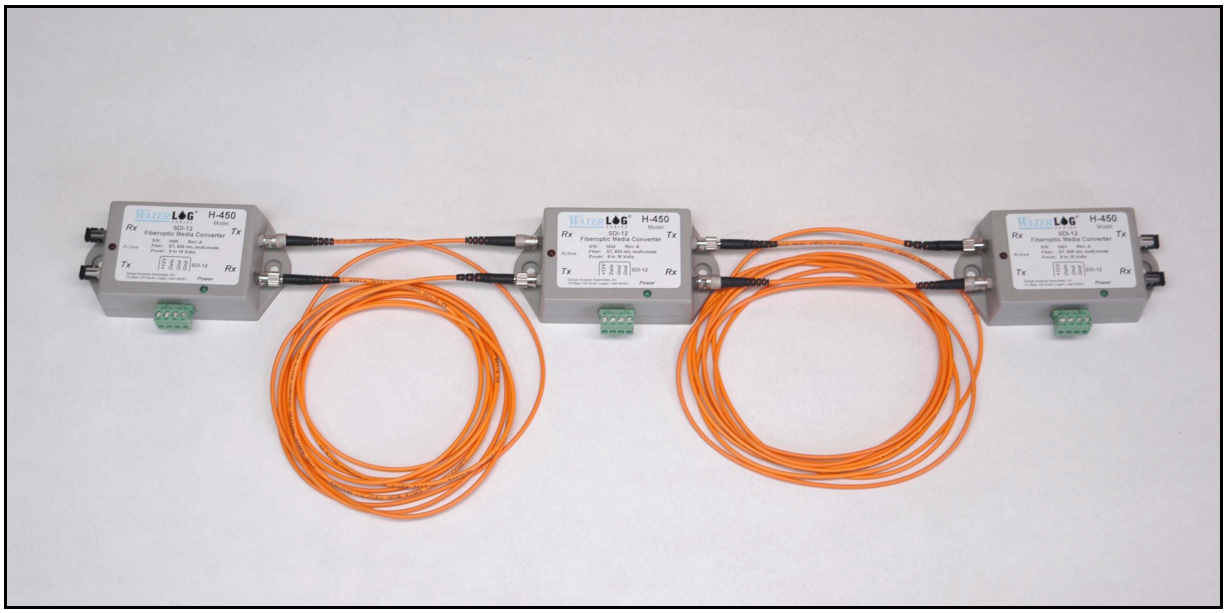
Model
H-4501

SDI-12 Fiberoptic Media Converter

WATERLOG® SERIES

Owner's Manual
Version 1.0



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User Agreement/ *WATER*LOG® Warranty

1. NATURE OF THE PRODUCT

This agreement accompanies a fiberoptic media converter, circuitry and other electronic equipment in an enclosed housing, and packaged together with written instructional materials. The packaged electronic circuitry and instructional materials herein are collectively referred to as the "PRODUCT." The PRODUCT is made available from DESIGN ANALYSIS ASSOCIATES, INC., of 75 West 100 South, Logan, Utah 84321 (hereinafter referred to as "DESIGN ANALYSIS"), and contains information and embodies technology that is confidential and proprietary to DESIGN ANALYSIS, and the availability and use of the PRODUCT is extended to you, the USER, solely on the basis of the terms of agreement which follow.

2. ACKNOWLEDGMENTS BY USER

Opening the package which encloses the accompanying PRODUCT indicates your acceptance of the terms and conditions of this agreement and constitutes an acknowledgment by you of the confidential and proprietary nature of the rights of DESIGN ANALYSIS in the PRODUCT.

3. DUTIES OF YOU, THE USER

In consideration for the access to and use of the PRODUCT extended to you by DESIGN ANALYSIS and to protect the confidential and proprietary information of DESIGN ANALYSIS, USER agrees as follows:

(a) USER agrees that they will not remove from the exterior of the housing of the PRODUCT any safety warnings or notices of proprietary interest placed thereon by DESIGN ANALYSIS.

(b) USER agrees that they shall not disassemble or otherwise reverse engineer the PRODUCT.

(c) USER agrees to treat the PRODUCT with the same degree of care as USER exercises in relation to their own confidential and proprietary information.

4. TERM

USER may enjoy these rights only as long as their possession of the PRODUCT shall continue to be rightful. These rights will cease if the PRODUCT is returned to DESIGN ANALYSIS under the terms of any redemption offer, warranty, or money-back guarantee, or if USER transfers the PRODUCT to another party on terms inconsistent with this agreement.

5. LIMITED WARRANTY

(b) What is Covered

DESIGN ANALYSIS warrants that for a period of twelve months from the time of delivery the functions to be performed by the PRODUCT will be substantially in compliance with USER documentation. DESIGN ANALYSIS also warrants that the PRODUCT will be free from defects in materials and workmanship for a period of ONE YEAR from the date of delivery.

(b) What USER Must Do

If the product fails to satisfy the above warranty, USER must notify DESIGN ANALYSIS in writing within the applicable period specified above and reasonably cooperate with the directions they received from DESIGN ANALYSIS.

(c) What DESIGN ANALYSIS Will Do

DESIGN ANALYSIS will repair the PRODUCT or will endeavor to provide a replacement of same within a reasonable period of time. In the event that DESIGN ANALYSIS is unable to make the necessary repairs or replacement within a reasonable period of time, the original purchase price will be refunded upon the return of the PRODUCT to DESIGN ANALYSIS.

(d) Limitations

(i) THE ENTIRE REMEDY FOR BREACH OF THIS LIMITED WARRANTY SHALL BE LIMITED TO REPLACEMENT OF THE DEFECTIVE PRODUCT OR REFUNDING OF THE PURCHASE PRICE, AS SET FORTH ABOVE. IN NO EVENT WILL THE LIABILITY OF DESIGN ANALYSIS TO USER OR TO ANY OTHER PARTY EXCEED THE ORIGINAL PURCHASE PRICE OF THE PRODUCT, REGARDLESS OF THE FORM OF THE CLAIM.

(ii) EXCEPT FOR THE EXPRESS WARRANTIES ABOVE, DESIGN ANALYSIS SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING, WITHOUT LIMITATION, ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

(iii) UNDER NO CIRCUMSTANCES WILL DESIGN ANALYSIS BE LIABLE FOR SPECIAL, INCIDENTAL, CONSEQUENTIAL, INDIRECT, OR ANY OTHER DAMAGES OR CLAIMS ARISING FROM THE USE OF THIS PRODUCT, THIS INCLUDES LOSS OF PROFITS OR ANY OTHER COMMERCIAL DAMAGES, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT WILL DESIGN ANALYSIS BE LIABLE FOR ANY CLAIMS, LIABILITY, OR DAMAGES ARISING FROM MODIFICATION MADE THEREIN, OTHER THAN BY DESIGN ANALYSIS.

(iv) THIS LIMITED WARRANTY GIVES USER SPECIFIC LEGAL RIGHTS. USER MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THOSE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY.

6. GOVERNING LAW

This Agreement and its validity and interpretation shall be governed by the laws of the State of Utah, notwithstanding any choice of law rules of Utah or any other state or jurisdiction.

Chapter 1
Introduction

1.0 Introduction

The ***WATER*LOG®** H-4501 is a fiberoptic media converter for use with SDI-12 compatible data loggers and sensors. The fiberoptic link works over long distances and is ideal for areas with severe interference, such as near heavy electrical equipment, welding or radio equipment. Multiple repeaters can be daisy chained together to provide communication with multiple remote sensors.

The H-4501 is easy to use and works with any data recorder/logger with a SDI-12 interface. The Serial-Digital Interface (SDI-12) is ideal for data logging applications with the following requirements:

- Battery powered operation with minimal current drain
- Measurement data is transmitted digitally over long cable lengths without error
- Multiple sensors on a simple three-wire cable

The H-4501 has the following features:

- Simple to install, use, and maintain
- Fiberoptic link is immune to lightning, electrical noise, voltage surges, spikes and ground loops
- Range up to 2000m (1.2 miles)
- Multiple media converters can be daisy chained together
- Multiple H4501 modules can be interconnected in either a bus or ring architecture. When connected in a complete ring, the network provides fault tolerant operation. The link will continue to work even if one node is powered off or a fiber is disconnected or broken anywhere in the ring.
- Transparent operation, no setup or configuration needed
- The data logger can be connected to any node
- One or more sensors can be connected to any node
- Wide input power range (9 to 16 V).
- Works with multimode 62.5/125 micron glass fiber
- Two ST connectors (Tx & Rx) for each port
- Green LED indicates proper DC power
- Red LED indicates network activity

1.1 Description

Two or more media converters provide a fiberoptic SDI-12 data link. Multiple media converters may be daisy chained together to provide multiple remote sensor ports. SDI-12 communication detected by one media converter is forwarded to all other nodes. The link provides transparent communication; wake up breaks, addresses and data are all sent over the fiber link just as they are over a 3-wire SDI-12 connection. The H-4501 nodes simply transport the SDI-12 signals over the fiber link. The media converters do not alter or re-clock the SDI-12 messages (the link is DC coupled). Each media converter functions as a repeater, it squares off and amplifies the fiber signal, overcoming fiber and connector loss. All commands, addresses and responses are initiated by the data logger and attached sensors, the H-4501 does not initiate bus transactions. Multiple sensors can be connected to the SDI-12 port of an individual media converter.

1.2 Ring Architecture

The H-4501 modules can optionally be connected in a ring architecture. When the H-4501 modules are interconnected in a complete ring the network provides fault tolerant operation. The link will continue to work even if one node is powered off or a fiber is disconnected or broken anywhere in the ring. To implement a fiberoptic ring simply add a pair of fibers (Tx and Rx) between the first and last nodes of a daisy chain. Transmit messages are sent from a node in both directions (via the Tx ports). In a fiberoptic ring all other nodes in the ring will normally receive two copies of the message, one arriving from each direction in the ring. The nodes have special circuitry to detect and select the message which arrives first.

1.3 DC Power

Each H-4501 is powered from the +12V terminal of its SDI-12 port. Normally the data logger provides +12V for the media converter connected to its SDI-12 port. Remote nodes require a separate 12V power source for powering the sensor(s) and attached media converter. Be aware the H-4501 media converters are not relatively low power devices (16mA receive, 65mA transmit). The internal fiberoptic receivers and associated electronics must be powered all of the time and cannot be shut down. The media converters only draw high power (65mA) when the SDI-12 data line is high during a break or as data is transmitted. All nodes (media converters) in a chain must have 12V power. If one node is powered off, the optical signals will be blocked at that node.

1.4 Optical Fiber and Connectors

Two fibers must be connected between each H-4501 media converter pair. One for transmit data and one for receive data. Connect the Tx (transmit) port of one module to the Rx (receive) port of its pair, and vice versa.

Normally 62.5/125 µm multimode glass fiber is best. However, 50/125 µM and 100/140 µm fiber will work. Single mode fiber will not work. Simplex fiberoptic cable with a 2.9mm jacket is inexpensive and readily available. Normal cable construction has a tight buffer, aramid yarn strength member and a PVC outer jacket. A similar duplex “zip cord” construction is also widely available.

The link power budget for the H-4501 is specified at 8dB (typ). Standard 62.5 µM fiber such as Corning® InfiniCor® 300 has a maximum attenuation of 2.9dB/km. Allowing 0.5dB x 2 for two connectors and 2000 meters of fiber, the link still has reasonable positive margin.

8dB budget - 1dB - 2.0km x 2.9dB/km = 1.2dB margin

The ST style connector utilizes a bayonet twist-lock connection with a 2.5mm ferrule. Fiberoptic patchcord cables can be purchased with pre-attached connectors. The connectors can also be readily applied at the job site. Connector preparation and installation is beyond the scope of this manual. Connectors with epoxy fixation and fiber polish finish have been found to work best. "Cleave and crimp" connector systems may not be suitable for outdoor applications.

1.5 Installation

The H-4501 and ST fiberoptic connectors are not weather tight. The H-4501 must be installed in a protected location or a weather tight enclosure. The housing has a 4-position connector for making power and SDI-12 connections. The connector can be detached while making the connections.

1.6 Testing

The H-4501 has a green LED which is illuminated when DC power is present. Make certain all the media converters in a daisy chain are powered.

The H-4501 has a red "active" LED which flashes when data is being transmitted. Whenever the data logger or a sensor in the system transmits data, the red LEDs of every node in the daisy chain should blink. The red LED can be used to locate a broken fiber or incorrect connection. Simply work backwards from the node which fails to blink to find the problem.

If the H-4501 modules are connected in a ring architecture an extra test is needed to ensure all of the fiber connections are working. In a ring architecture the network will continue to work if a fiber is disconnected or broken anywhere in the ring. To test for proper operation of a ring make the following tests:

1. Disconnect both the Tx and Rx fibers on the right hand side of one of the nodes. Check to make certain all nodes of the link still work (the red LED of every node in the daisy chain should blink when data is transmitted).
2. Reconnect the fibers on the right hand side of the node. Disconnect both the Tx and Rx fibers on the left hand side of the same node. Check to make certain all of the nodes still work. Reconnect the fibers on the left hand side of the node.

When troubleshooting the network fiber connections it is recommend the ring be opened at one point and the testing be done with a linear daisy chain architecture. When the ring is intact you will not be able to detect or locate a broken fiber connection.

Appendix A
Specifications

Fiberoptic Port

Fiber:	Specified for multimode 62/125 µm fiber
Wavelength:	820nm
Optical power budget:	8dB typ (62.5/125 µm fiber)
Link distance:	Up to 2000 meters (62.5/125µm fiber)
Output Power:	-12 dBm typ, 25° C

SDI-12 Port

Baud Rate:	1200
Protocol:	SDI-12, 7-bit even parity, 1 stop bit
Output Voltage Levels:	
Minimum high level:	3.5 volts
Maximum low level:	0.8 volts

Power Requirements

Voltage Input:	9 to 16.0 Volts DC
Supply Current:	
Standby:	16mA typ
Active	45mA typ, 65mA peak
Surge Protection:	Built in, 1.5 KVA

Environmental

Operating Temperature:	-40° C to +50° C
Storage Temperature:	-50° C to +70° C

Mechanical

Material: ABS plastic

Size	3.75" Long x 2.65" Wide x 1.25" Deep

Connectors

Fiberoptic:	4ea ST connectors with dust caps
SDI-12:	4-position plug-in terminal strip, Phoenix Combicon™

Fault Tolerant Ring Architecture:

Multiple H4501 modules can be interconnected in either a bus or ring architecture. When connected in a complete ring, the network provides fault tolerant operation. The link will continue to work even if one node is powered off or a fiber is disconnected or broken anywhere in the ring.

Warranty

The *WATER*LOG® H-4501 is warranted against defects in materials and workmanship for one year from date of shipment.

Notes

Specifications subject to change without prior notice due to ongoing commitment to product testing and improvement.