

**1500-GWLD**  
Revision 1.0  
**Griswold Modbus™ Slave**  
**Protocol Interface**  
August 1997

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**Please Read This Notice**

Successful application of the 1500 card requires a reasonable working knowledge of the Griswold Valve Actuator, and the application in which the combination is to used. For this reason, it is important that those responsible for implementing the 1500 satisfy themselves that the 1500 and Griswold Valve Network combination will meet the needs of the application.

This manual is provided to assist the user. Every attempt has been made to assure that the information provided is accurate and a true reflection of the product's installation requirements. In order to assure a complete understanding of the operation of the 1500 with the Griswold equipment, the user should read all applicable Griswold documentation.

Under no conditions will ProSoft Technology, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of the 1500 product.

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**WARNING**

**The 1500 card will allow remote access to commands in the Griswold Valve Actuators. The User is responsible for assuring that any applicable regulations concerning the remote operation of equipment are adhered to.**

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## **APPENDICES**

### Appendix A

Modbus Register Map

### Appendix B

Port 1 : Modbus Slave Port RS-232/485 Cable  
Port 2 : Griswold Valve Network RS-485 Cable

## 1.0 Product Specifications

The ProSoft Technology, Inc. 1500-GWLD card is a hardware product designed to be the communications front end between the Griswold Valve Network and a Modbus Master Host.

The product includes the following functionality:

### **Modbus Slave Specifications**

- Protocol modes:
  - RTU mode with CRC-16 error checking
- Supported Modbus Function codes:
  - 3 Read Multiple Data Registers
  - 16 Preset (Write) Multiple Data Register
- Supports broadcast commands from host
- RS-232 or RS-485 electrical interface

### **Griswold Network Interface**

- RS-485 electrical interface
- Actively polls up to 32 units for valve position
- Allows host to set valve positions

### **General Specifications**

- Modbus pre-configured to:
  - Baud Rate: 9600 Baud
  - Mode: RTU
  - Data Bits: 8
  - Stop Bits: 1
  - Parity: None
- Griswold communications pre-configured to:
  - Data Bits: 8
  - Stop Bits: 1
  - Parity: None
- Configuration via dip switches
  - Modbus Slave Address : 1 to
  - Griswold Baud Rate: 300 to 19200

### **Hardware Specifications**

- 4"x5" form factor
- Two male 9-pin D shell connectors
- Communication status lights - Active and Fault for each port
- 9 to 30 VDC external power (Approx 110 ma at 9VDC)

## 2.0 Modbus Slave Port Functionality

### 2.1 Modbus Communications

The 1500-GWLD Modbus Slave card runs the RTU version of the Modbus protocol. This capability allows the module to communicate data from up to 32 Griswold Valve Heads to a Modbus Master host, and vice-versa. The module supports both point-to-point implementations as well as multi-drop implementations.

The following discusses the functional capabilities of the 1500-GWLD card.

#### 2.1.1 Modbus Command/Reply Cycle

Successful communications between the card and a host will always consist of the following two transactions:

Command: Message from master giving instruction to slave.

Reply: Response to command.

A slave station will respond to a master issued command in several ways.

Data Message: If the command was executed by the 1500-GWLD board, the response message will include the data requested, or an acknowledgment that the command was executed.

Error Message: If the command could not be executed by the 1500-GWLD board, for whatever reason, an error response message is transmitted to the master. The error response message consists of the original function code (or'd with 80hex) and an error code.

No Reply: If the master does not detect a reply within its timeout period, the master should re-transmit the command, before a time out error is issued. If the Slave could not decode the message or an error occurred preventing the Slave from recognizing the message, no response will be issued.

#### 2.1.2 Command Types

The 1500-GWLD can respond to three types of commands from the master; read data, write data, and a diagnostic command. These are overviewed below:

Read Data: The following types of data read commands are supported:  
3 Read Multiple Registers

Write Data: The following data write command is supported:  
16 Multiple Register Write

#### 2.1.3 Command Error Checking

When the 1500-GWLD cannot execute a command, an error code is generated and returned to the master. Error codes generated at the slave will usually be indicative of an illegal function, an illegal address, bad data, or the inability to complete a transaction because of a network problem.

#### 2.1.4 Data Integrity

As in all good protocols, there must exist a level of data integrity checking to verify, with some degree of assurance, the quality of the transmitted data. The Modbus protocol supports two types of error checking:

- RTU Mode : 16 bit cyclic redundancy check (CRC-16)
- One bit parity check

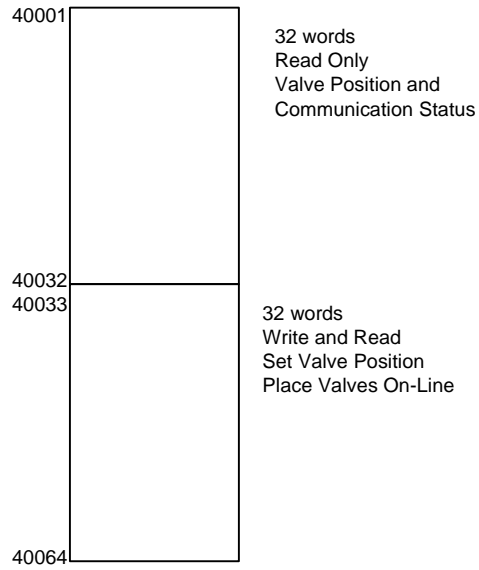
**CRC-16**: When the master generates a message, a 16 bit CRC value is added to the end of the transmitted packet. The CRC value is generated using a series of bit shifts and manipulations. The receiving station executes the same

calculation on the data and verifies the transmitted CRC. Any discrepancy will cause the message to be disregarded.

**Parity:** Parity checking can be added as an additional level of data security. If parity checking is selected, even or odd parity can be implemented.

**2.2 Modbus Register Map**

A pre-defined register map has been provided for the 1500-GWLD unit. This map is detailed in Appendix A, but the following diagram gives an overview of the layout and size.



### 3.0 Hardware Setup

#### 3.1 1500 Card Setup

##### 3.1.1 Connecting Power to the 1500 Card

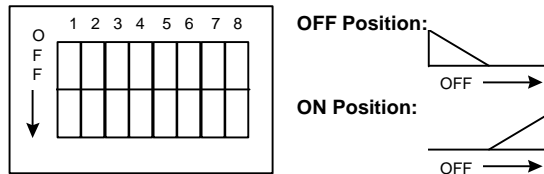
The 1500 Card requires an external source of DC voltage. The DC source voltage should be between 9V and 30V. The power is connected to TB1, located near the two 9 pin serial port connections.

The connection to TB1 is as follows:

TB1-1            9-30 VDC (+)  
 TB1-2            Common (-)

##### 3.1.2 Dip Switch Configuration

The 1500 card is configured primarily through two sets of dip switches. These switches are read initially on power up only. The function of the dip switches is as follows (a value of one (1) is registered when the a switch is in the ON position):



##### SW1 : Modbus Port Configuration

Switch Position	Function	Positions
1	Griswold Port Baud Rate Selection	3 2 1
2		0 0 0    300
3		0 0 1    600
		0 1 0    1200
		0 1 1    2400
		1 0 0    4800
		1 0 1    9600
		1 1 0    19200
	1 1 1    19200	
4	Not Used	
5		
6		
7		
8		

##### SW2 : Modbus Slave Address Configuration

Switch Position	Function	Positions
1	Modbus Address Select	1    Address Bit 0    Value = 1
2		2    Address Bit 1    Value = 2
3		3    Address Bit 2    Value = 4
4		4    Address Bit 3    Value = 8
5		5    Address Bit 4    Value = 16
6		6    Address Bit 5    Value = 32
7		7    Address Bit 6    Value = 64
8		8    Address Bit 7    Value = 128
Example Addresses = 0 to 63		
		8 7 6 5 4 3 2 1    Address
		0 0 0 0 0 0 0 0    Invalid
		0 0 0 0 0 0 0 1    1
		0 0 0 0 0 0 1 0    2
		0 0 0 0 0 0 1 1    3

0	0	0	0	0	1	0	0	4
0	0	0	0	0	1	0	1	5
0	0	0	0	0	1	1	0	6
0	0	0	0	0	1	1	1	7
0	0	0	0	1	0	0	0	8
0	0	0	0	1	0	0	1	9
0	0	0	0	1	0	1	0	10
0	0	0	0	1	0	1	1	11
0	0	0	0	1	1	0	0	12
0	0	0	0	1	1	0	1	13
0	0	0	0	1	1	1	0	14
0	0	0	0	1	1	1	1	15
0	0	0	1	0	0	0	0	16
0	0	0	1	0	0	0	1	17
0	0	0	1	0	0	1	0	18
0	0	0	1	0	0	1	1	19
0	0	0	1	0	1	0	0	20
0	0	0	1	0	1	0	1	21
0	0	0	1	0	1	1	0	22
0	0	0	1	0	1	1	1	23
0	0	0	1	1	0	0	0	24
0	0	0	1	1	0	0	1	25
0	0	0	1	1	0	1	0	26
0	0	0	1	1	0	1	1	27
0	0	0	1	1	1	0	0	28
0	0	0	1	1	1	0	1	29
0	0	0	1	1	1	1	0	30
0	0	0	1	1	1	1	1	31
0	0	1	0	0	0	0	0	32
0	0	1	0	0	0	0	1	33
0	0	1	0	0	0	1	0	34
0	0	1	0	0	0	1	1	35
0	0	1	0	0	1	0	0	36
0	0	1	0	0	1	0	1	37
0	0	1	0	0	1	1	0	38
0	0	1	0	0	1	1	1	39
0	0	1	0	1	0	0	0	40
0	0	1	0	1	0	0	1	41
0	0	1	0	1	0	1	0	42
0	0	1	0	1	0	1	1	43
0	0	1	0	1	1	0	0	44
0	0	1	0	1	1	0	1	45
0	0	1	0	1	1	1	0	46
0	0	1	0	1	1	1	1	47
0	0	1	1	0	0	0	0	48
0	0	1	1	0	0	0	1	49
0	0	1	1	0	0	1	0	50
0	0	1	1	0	0	1	1	51
0	0	1	1	0	1	0	0	52
0	0	1	1	0	1	0	1	53
0	0	1	1	0	1	1	0	54
0	0	1	1	0	1	1	1	55
0	0	1	1	1	0	0	0	56
0	0	1	1	1	0	0	1	57
0	0	1	1	1	0	1	0	58
0	0	1	1	1	0	1	1	59
0	0	1	1	1	1	0	0	60
0	0	1	1	1	1	0	1	61
0	0	1	1	1	1	1	0	62
0	0	1	1	1	1	1	1	63



### 3.1.3 1500 Jumper Configurations

The 1500 card has five sets of jumpers on the board. Generally, the default jumper positions will be adequate for most applications, with JP4 and JP5 being the only jumpers that should ever need to be reviewed. For completeness, we provide the following discussion on all of the jumper locations:

Jumper	Description	Positions	Default
JP1	Hardware Reset	Not Used	
JP2	Griswold Port Power (P2)	1-2 Non-Isolated Power 2-3 Isolated Power	1-2
JP3	Griswold Port Ground (P2)	1-2 Non-Isolated Power 2-3 Isolated Power	1-2
JP4	Modbus Port (P1) Termination Resistor	1-2 Connect 120 ohms on Rx lines (multidrop only) 2-3 Disconnect 120 ohms	2-3
JP5	Modbus Port (P1) RS-232 or RS-422/485 Select	1-2 RS-232 Select 2-3 RS-422/485 Select	2-3

### 3.2 Griswold Communications

The Grisold communications interface (Port 2) has been hard coded to operate at the following default conditions:

Parity	None
Stop Bits	1
Data Bits	8

The 1500 card will poll up to 32 valve heads for current position and report this data to a Modbus host.

## 4.0 Modbus Protocol Support

### 4.1 Modbus Commands

The 1500-GWLD card supports a command subset of the Modbus Specification consisting primarily of the Function Codes required to read and write data. The following sections detail the different commands supported by the card.

Function Code	Cmd	Address Range	Slave Driver Comments
3	Read Multiple Registers	40001 to 40064	The module returns word data from the register space.
16	Multiple Register Write	40033 to 40064	This is a register write command allowing a host to change values in the Griswold units by writing register values.

### 4.2 Modbus Error Codes

The 1500-GWLD card supports the following Modbus Error Codes:

Code	Name	Description
0	All OK	The module is operating as desired
1	Illegal Function	An illegal function code request is being attempted
2	Bad Data Address	The address, or the range of addresses, covered by a request from the master are not within allowed limits
3	Bad Data Value	The value in the data field of the command is not allowed.
4	Incomplete Response Detected	This error indicates that an incomplete response was received to a master query. Often this will indicate that the slave device may be responding too quickly or that there may be excessive noise on the line.
6	Module Busy	The module busy status code is returned when a write command from the master has not yet been completed when a second write command is received

## 5.0 Diagnostics

Several hardware diagnostics capabilities have been implemented using the LED indicator lights on the front of the 1500 card. The possible conditions as indicated by the lights are:

### 5.1 LED Indicators

Several hardware diagnostics capabilities have been implemented using the LED indicator lights on the front of the module. The possible conditions as indicated by the lights are:

NAME	LED	Color	Status	Indication
Modbus (P1) ACTIVE	D1	Green	Blinking	The 1500 is receiving a command from the Modbus Host
			Steady ON or OFF	The 1500 is not detecting a valid command. If the master is transmitting, be sure all dip switches are set correctly and that the cable connection is correct.
Griswold (P2) ACTIVE	D2	Green	Blinking	The 1500 card is either transmitting and/or receiving data from a Griswold unit
			Steady ON or OFF	Check cable connections to verify polarity of terminations between 1500 card and Griswold units (See Appendix B)
Modbus (P1) COMM ERR	D3	Red	ON or Blinking	The Modbus port has detected a communications error condition. See Section 4.2
			OFF	No error conditions at this time.
Griswold (P2) FAULT	D4	Red	ON	The 1500 card has detected a communications error condition.
			OFF	No error conditions at this time.

*Should the configuration dip switches select an invalid address or an invalid baud rate, the LED indicators will alternate in an on/off fashion on 1/2 second intervals until correct values are selected.*

## 6.0 Support, Service and Warranty

### 6.1 Technical Support

ProSoft Technology survives on its ability to provide meaningful support to its customers. Should any questions or problems arise, please feel free to contact us at:

ProSoft Technology, Inc.  
9801 Camino Media  
Suite 105  
Bakersfield, CA 93311  
(805) 664-7208  
(805) 664-7233 Fax

Before calling for support, please prepare yourself for the call. In order to provide the best and quickest support possible, we will most likely ask for the following information (you may wish to fax it to us prior to calling):

1. Product Serial and Version Number
2. 1500 Configuration Information
  - Dip Switches
  - Jumpers
  - Communication cabling

### 6.2 Service and Repair

The 1500 card is an electronic product, designed and manufactured to function under somewhat adverse conditions. As with any product, through age, misapplication, or any one of many possible problems, the card may require repair.

The 1500 product has a one year parts and labor warranty according to the limits specified in the warranty. Replacement and/or returns should be directed to the distributor or Original Equipment Manufacturer from whom the product was purchased. If you need to return the card for repair, it is first necessary to obtain an RMA number from ProSoft Technology. Please call the factory for this number and display the number prominently on the outside of the shipping carton used to return the card.

### 6.3 Warranty

#### 6.3.1 General Warranty Policy

ProSoft Technology, Inc. (Hereinafter referred to as ProSoft) warrants that the Product shall conform to and perform in accordance with published technical specifications and the accompanying written materials, and shall be free of defects in materials and workmanship, for the period of time herein indicated, such warranty period commencing upon receipt of the Product.

This warranty is limited to the repair and/or replacement, at ProSoft's election, of defective or non-conforming Product, and ProSoft shall not be responsible for the failure of the Product to perform specified functions, or any other non-conformance caused by or attributable to: (a) any misapplication or misuse of the Product; (b) failure of Customer to adhere to any of ProSoft's specifications or instructions; (c) neglect of, abuse of, or accident to, the Product; or (d) any associated or complementary equipment or software not furnished by ProSoft.

Limited warranty service may be obtained by delivering the Product to ProSoft and providing proof of purchase or receipt date. Customer agrees to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to ProSoft, and to use the original shipping container or equivalent. Contact ProSoft Customer Service for further information.

**6.3.2 Limitation of Liability**

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Where directed by State Law, some of the above exclusions or limitations may not be applicable in some states. This warranty provides specific legal rights; other rights that vary from state to state may also exist. This warranty shall not be applicable to the extent that any provisions of this warranty is prohibited by any Federal, State or Municipal Law that cannot be preempted.

**6.3.3 Hardware Product Warranty Details**

Warranty Period : ProSoft warranties hardware product for a period of one (1) year.

Warranty Procedure : Upon return of the hardware Product ProSoft will, at its option, repair or replace Product at no additional charge, freight prepaid, except as set forth below. Repair parts and replacement Product will be furnished on an exchange basis and will be either reconditioned or new. All replaced Product and parts become the property of ProSoft. If ProSoft determines that the Product is not under warranty, it will, at the Customer's option, repair the Product using current ProSoft standard rates for parts and labor, and return the Product freight collect.

# Appendix A

## **Modbus Register Assignments**

### **Read Registers**

The following bit map may be applied to each of the 32 words

	<b><u>Bit</u></b>	<b><u>Description</u></b>	
	0	Valve Position #0 – Home	
	1	Valve Position #1	
	2	Valve Position #2	
	3	Valve Position #3	
	4	Valve Position #4	
	5	Valve Position #5	
	6	Valve Position #6	
	7	Valve Position #7	
0x0100	8	Valve unsealed	1 - ? Response to a query
0x0200	9		
0x0400	10	Valve is Active in Poll List	1 - Configured to be in Poll List
0x0800	11	Valve Position Change Active	1 - Valve may be rotating due to write command
0x1000	12		
0x2000	13	Valve In Failsafe Position	1 - FO response to query
0x4000	14	Valve Not Communicating	1 - Not Communicating
0x8000	15	Valve Communication Status	1 - Online

### **Function**

<b><u>Type</u></b>	<b><u>3</u></b>	<b><u>Description</u></b>
R	40001	Griswold Valve Status - Unit #1
R	40002	Griswold Valve Status - Unit #2
R	40003	Griswold Valve Status - Unit #3
R	40004	Griswold Valve Status - Unit #4
R	40005	Griswold Valve Status - Unit #5
R	40006	Griswold Valve Status - Unit #6
R	40007	Griswold Valve Status - Unit #7
R	40008	Griswold Valve Status - Unit #8
R	40009	Griswold Valve Status - Unit #9
R	40010	Griswold Valve Status - Unit #10
R	40011	Griswold Valve Status - Unit #11
R	40012	Griswold Valve Status - Unit #12
R	40013	Griswold Valve Status - Unit #13
R	40014	Griswold Valve Status - Unit #14
R	40015	Griswold Valve Status - Unit #15
R	40016	Griswold Valve Status - Unit #16
R	40017	Griswold Valve Status - Unit #17
R	40018	Griswold Valve Status - Unit #18
R	40019	Griswold Valve Status - Unit #19
R	40020	Griswold Valve Status - Unit #20
R	40021	Griswold Valve Status - Unit #21
R	40022	Griswold Valve Status - Unit #22
R	40023	Griswold Valve Status - Unit #23
R	40024	Griswold Valve Status - Unit #24
R	40025	Griswold Valve Status - Unit #25
R	40026	Griswold Valve Status - Unit #26
R	40027	Griswold Valve Status - Unit #27
R	40028	Griswold Valve Status - Unit #28
R	40029	Griswold Valve Status - Unit #29
R	40030	Griswold Valve Status - Unit #30
R	40031	Griswold Valve Status - Unit #31
R	40032	Griswold Valve Status - Unit #32

### **Write Registers**

<b><u>Bit</u></b>	<b><u>Description</u></b>
0	Valve Position #0 – Home
1	Valve Position #1
2	Valve Position #2
3	Valve Position #3
4	Valve Position #4
5	Valve Position #5
6	Valve Position #6
7	Valve Position #7
8 to 15	Not Used

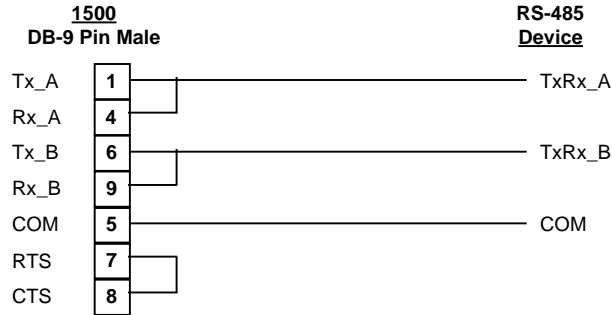
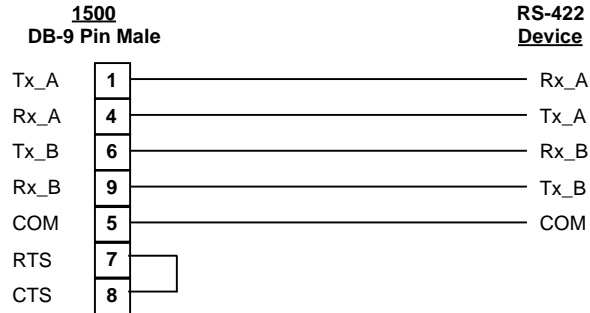
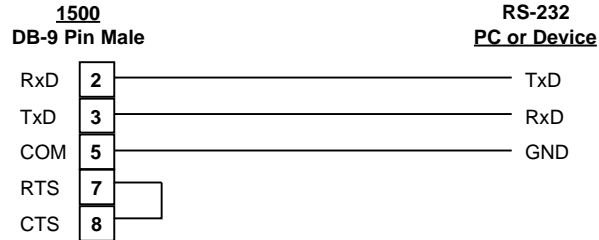
### **Function**

<b><u>Type</u></b>	<b><u>16</u></b>	<b><u>Description</u></b>
R/W	40033	Griswold Control Register - Unit #1
R/W	40034	Griswold Control Register - Unit #2
R/W	40035	Griswold Control Register - Unit #3
R/W	40036	Griswold Control Register - Unit #4
R/W	40037	Griswold Control Register - Unit #5
R/W	40038	Griswold Control Register - Unit #6
R/W	40039	Griswold Control Register - Unit #7
R/W	40040	Griswold Control Register - Unit #8
R/W	40041	Griswold Control Register - Unit #9
R/W	40042	Griswold Control Register - Unit #10
R/W	40043	Griswold Control Register - Unit #11
R/W	40044	Griswold Control Register - Unit #12
R/W	40045	Griswold Control Register - Unit #13
R/W	40046	Griswold Control Register - Unit #14
R/W	40047	Griswold Control Register - Unit #15
R/W	40048	Griswold Control Register - Unit #16
R/W	40049	Griswold Control Register - Unit #17
R/W	40050	Griswold Control Register - Unit #18
R/W	40051	Griswold Control Register - Unit #19
R/W	40052	Griswold Control Register - Unit #20
R/W	40053	Griswold Control Register - Unit #21
R/W	40054	Griswold Control Register - Unit #22
R/W	40055	Griswold Control Register - Unit #23
R/W	40056	Griswold Control Register - Unit #24
R/W	40057	Griswold Control Register - Unit #25
R/W	40058	Griswold Control Register - Unit #26
R/W	40059	Griswold Control Register - Unit #27
R/W	40060	Griswold Control Register - Unit #28
R/W	40061	Griswold Control Register - Unit #29
R/W	40062	Griswold Control Register - Unit #30
R/W	40063	Griswold Control Register - Unit #31
R/W	40064	Griswold Control Register - Unit #32

# APPENDIX B

## Communication Cable Connection Diagrams

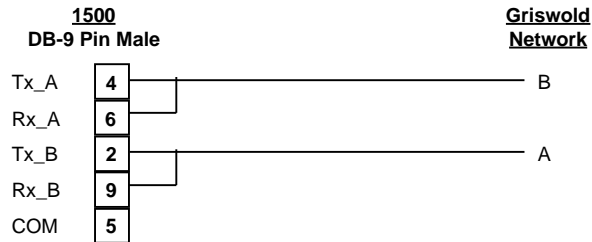
### PORT 1 - Modbus Slave Communication Port



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### PORT 2 – Griswold Communication Port

#### RS-485 CABLE CONFIGURATION





# MODBUS™ INTERFACE CONTROL CARD

