Model TE-1056 Ethernet Interface Instructions

Scope

This document describes how the TestEquity 1056 Ethernet Converter integrates with TestEquity Chambers.

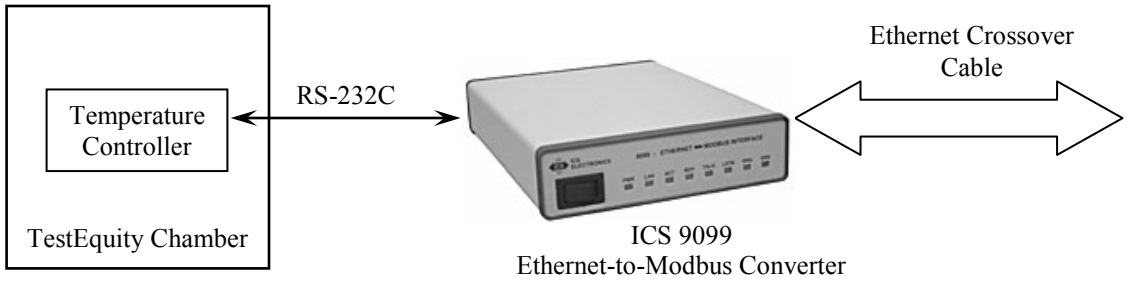
Please read the ICS Model 9099 Ethernet-Modbus Instruction Manual FIRST to configure the Ethernet Converter to your computer or network (especially Section 2, pages 2-7 through 2-11) for detailed device instructions.

COMPATIBILITY NOTES:

1. This Ethernet Interface Converter is NOT compatible with Watlow WatView software. The F4 must be connected to the computer via its RS-232 interface to work with Watlow Watview software.
2. This Ethernet Interface Converter is NOT compatible with Watlow Composer software. The F4T must be connected to the computer via its native Ethernet interface to work with Watlow Composer Software.

Introduction

The Ethernet communications is achieved through an ICS Electronics 9099 Ethernet-to-Modbus Interface Converter. It lets the user send simple commands with ASCII values over a 10/100 Mb/s TCP/IP network to control and query the Watlow Controllers used on TestEquity chambers. The 9099 converts these simple commands into the Modbus RTU packet protocol and adds the CRC checksum to make a complete Modbus RTU packet.



Serial Communications Parameters

The ICS 9099 is set at the factory for 9600 baud and a Modbus address of 1. All TestEquity chambers currently ship with the F4/F4T communication parameters set for 9600 baud and an address of 1. You do not need to check or change anything.

TestEquity chambers shipped around October 2004 or earlier may have the F4 baud rate set for 19200 and it must be changed to 9600. This is located in Main Page\Go to Setup\Communications. If you are unable to change the setting from 19200, then this menu has been locked. Call TestEquity at 877-512-3457 or 805-480-0638 for instructions on how to access this menu if it is locked or has a password.

Internal Web Server

The ICS 9099 as purchased from TestEquity has internal web pages designed for use with TestEquity Chambers. Functions include Setpoint entry and readback, readback of actual chamber temperature and humidity, and Event Output setting/readback. Web pages for the F4T controllers add the ability to set manual ramp rate parameters.

The home page (index.html) has links to seven different TestEquity-specific web pages. The index page is served when the converter's IP address is entered in any web browser.

F4 Temperature Page (F4_Temp.html) – For TestEquity temperature-only chambers, except Model TEC1. Compatible with the F4T controller only if Data Map 2 is selected in the F4T's Modbus menu.

F4 Temp-Humidity Page (F4_Hum.html) – For all TestEquity Temperature-Humidity Chambers. Adds the ability to control and monitor the humidity. Compatible with the F4T controller only if Data Map 2 is selected in the F4T's Modbus menu.

F4 Temp with Part Monitor Page (F4_Part.html) – For all TestEquity temperature-only chambers with Option 006, configured for either monitor or cascade (part-temperature) control. Adds the ability to monitor the part temperature reading from the F4 Controller's Input 3. This page is NOT compatible with the F4T controller.

Model TEC1 Temperature Page (EZ.html) – For TestEquity TEC1 Thermoelectric Temperature Chamber only.

F4T Temperature Page (F4T_Temp.html) – For TestEquity temperature-only chambers. The F4T Controller must be set to Data Map 1 in its Modbus menu.

F4T Temp-Humidity Page (F4T_Temp_Hum.html) – For TestEquity Temperature-Humidity Chambers. The F4T Controller must be set to Data Map 1 in its Modbus menu.

F4T Cascade Control Page (F4T_Cascade.html) – For TestEquity temperature-only chambers with cascade (part-temperature) control and Model 155. The F4T Controller must be set to Data Map 1 in its Modbus menu.

Control Page
The home page (index.html) has a button for Go to Control Page (control.html). This allows you to manually type individual commands. This is useful for troubleshooting purposes. The web page has examples of commands for both the F4 and F4T controllers.

F4 Modbus Communication

The F4 Controller relies on a communication protocol called Modbus. Data for the device is organized into registers. Register data is set by sending a Write command to a specific register, and is examined by sending a Read command to a register. The commands to read and write data in registers are performed by commands sent to the ICS 9099. These commands do resemble the final command that the F4 Controller sees, but the ICS 9099 also generates and sends a block checksum based on all the characters of each message and sends it to the F4 Controller.

Modbus Register Read / Write Commands:
The R? command is the basic read command. The '?' is optional and is included so programs like ICS's VXI-11 Keyboard control programs can automatically read back and display the response from a query. Below is the read and write syntax.

R? reg, n Read register command
Reg = Modbus register
n = number of registers to send

The W command writes 16-bit integers to a register.

W reg, data Write register command
Reg = Modbus register
Data = ASCII data written as 16-bit decimal value

Common Modbus register numbers for a variety of controller functions appear on the following page.

Common F4 Modbus Registers

Temperature Registers

Register	Function	Description	Read/Write
100	Input 1 Value, Status	Chamber Temperature	r
300	Set Point 1, Value	Temperature Set Point	r/w
606	Decimal Point, Analog Input 1	To determine decimal placement	r
901	°F or °C, System	°F or °C	r/w

Humidity Registers (for humidity chambers only)

Register	Function	English Display	Read/Write
104	Input 2 Value, Status	Chamber Humidity (% RH)	r
319	Set Point 2, Value	Humidity Set Point (% RH)	r/w
616	Decimal Point, Analog Input 2	To determine decimal placement	r

Part Temperature Monitor Registers (for temperature chambers with option 006 only)

Register	Function	Description	Read/Write
108	Input 3 Value, Status	Part Temperature	r
626	Decimal Point, Analog Input 3	To determine decimal placement	r

Digital Output Registers

Register	Function	Description	Read/Write
2000	Digital Output 1, Condition	Event 1 (Off/On)	r/w 0 or 1
2010	Digital Output 2, Condition	Event 2 (Off/On)	r/w 0 or 1
2020	Digital Output 3, Condition	Event 3 (Off/On)	r/w 0 or 1
2030	Digital Output 4, Condition	Event 4 (Off/On)	r/w 0 or 1
2040	Digital Output 5, Condition	Event 5 (Off/On)	r/w 0 or 1
2050	Digital Output 6, Condition	Event 6 (Off/On)	r/w 0 or 1
2060	Digital Output 7, Condition	Event 7 (Off/On)	r/w 0 or 1
2070	Digital Output 8, Condition	Compressor (Read Only)	r 0 or 1

The entire listing of Modbus registers for the Series F4 Controller is found in the Watlow Series F4 User's Manual, Chapter 7. This manual is located at www.testequity.com/manuals.

Reading Chamber Temperature Example for F4 Controller

The Temperature Controller sends data over the Modbus interface with an implied decimal point. It is left to the user to remember this, and to scale the data accordingly. The Temperature Controller has been configured by TestEquity to display one decimal point in the temperature reading. If the configuration should change, then the program would not report the correct temperature reading. To remedy this problem, always read the number of decimal points used by before running the program.

```
Command: R? 606,1<lf>          ! Send read command to F4 register 606
Response: iData <lf>           ! Returned variable iData represents ASCII
                               ! numeric characters that are converted in this
                               ! example to integer.
                               ! 0 = no decimal point
                               ! 1 = one decimal point

Command: R? 100,1<lf>          ! Send read command to F4 register 100
Response: fTemp <lf>           ! Read the value of register 100. fTemp
                               ! represents ASCII numeric characters,
                               ! converted to float type.

if iData = 1 then              ! Check iData
        fTemp = fTemp / 10     ! 1=means that data has decimal and
endif                          ! we need to divide by ten.
print “Chamber Temp is”, fTemp
```

Set Chamber Setpoint Examples for F4 Controller

```
Command: W 300, 230 <lf>       ! Send write command to register 300 and
                               ! change the temperature setpoint to 23.0 degrees.

Command: W 300, 1005 <lf>      ! Send write command to register 300 and
                               ! change the temperature setpoint to 100.5 degrees.

Command: W 300, -255 <lf>      ! Send write command to register 300 and
                               ! change the temperature setpoint to -25.5 degrees.
```

F4T Mode

The following common registers are applicable in the F4T Mode (Data Map 1).

Some F4T parameters are contained within 32 bits (IEEE Float). Notice that only one (low order) of the two registers is listed. By default, the low order word contains the two low bytes of the 32-bit parameter. As an example, in the table below see Actual Chamber Temperature. Note that it lists register 27586. Because this parameter is a float, it is actually represented by registers 27586 (low order bytes) and 27587 (high order bytes).

Parameter Name	Register	Data Type and Access (Read or Write)
Temperature Set Point	2782	IEEE Float RW
Temp Closed Loop Set Point*	2810	
Actual Chamber Temperature	27586	IEEE Float R
Humidity Set Point	2942	IEEE Float RW
Hum Closed Loop Set Point*	2970	IEEE Float R
Actual Chamber Humidity	28906	IEEE Float R
Event 1	16594	Unsigned 16-bit RW
Event 2	16596	Unsigned 16-bit RW
Event 3	16598	Unsigned 16-bit RW
Event 4	16600	Unsigned 16-bit RW
Event 5	16822	Unsigned 16-bit RW
Event 6	16824	Unsigned 16-bit RW
Event 7	16826	Unsigned 16-bit RW

* Instantaneous Set Point during a ramp

F4 Compatibility Mode for F4T Controller

The following common registers are available in the F4 Compatibility Mode (Data Map 2). This will allow you to use software that was written for the original F4 Controller. Only a limited set of parameters are available in this compatibility mode, but it should be sufficient for most applications.

Parameter Name	Register	Data Type and Access (Read or Write)
Temperature Set Point	300	16-bit Signed RW
Actual Chamber Temperature	100	16-bit Signed R
Humidity Set Point	300	16-bit Signed RW
Actual Chamber Humidity	319	16-bit Signed R
Event 1	2000	16-bit Signed RW
Event 2	2010	16-bit Signed RW
Event 3	2020	16-bit Signed RW
Event 4	2030	16-bit Signed RW
Event 5	2040	16-bit Signed RW
Event 6	2050	16-bit Signed RW
Event 7	2060	16-bit Signed RW

Temperature and Humidity Set Points and Readings

Write Temperature Set Point	**WF 2782, value**
Write Humidity Set Point	**WF 2942, value**
Read Chamber Temperature	**RF? 27586**
Read Chamber Humidity	**RF? 28906**

Event Outputs (Chamber Functions and uncommitted outputs, 7 total)

Turn (Event 1) ON	**W 16594, 63**	Event 1 is "Power"
Turn (Event 1) OFF	**W 16594, 62**	
Turn (Event 2) ON	**W 16596, 63**	Event 2 is "Humidity" in Humidity models
Turn (Event 2) OFF	**W 16596, 62**	Event 2 is "Purge" in Temp-only models Event 2 is "LN2" in Model 3007C

The same syntax applies to events 3 through 7

Event 3 = 16598
Event 4 = 16598
Event 5 = 16600
Event 6 = 16602
Event 7 = 16604

Manual Ramp Parameters (Ramp to Set Point without a profile)

Ramp Action (Temperature)	**W 2794, ##** (where ## is one of the four numerical choices below) Off = 62 Startup = 88 Set Point = 85 Both = 13
Ramp Scale (Temp. °/Minutes)	**W 2796, 57**
Ramp Scale (Temp. °/Hours)	**W 2796, 39**
Ramp Rate (Temperature)	**WF 2798, value** (0 to 99,999)

Floating Point Variables
EZ-Zone PM Series controllers use two consecutive register to control a value or to read back a process variable. The two registers hold an IEEE-754 32-bit floating point word. The registers are read and written to in the low word-upper word order.

Floating Point Write
The WF command writes the num value in floating point format to two consecutive registers starting with the low word register.

To enter a temperature setpoint:

WF 2160, 50	'writes 50.0°C to registers 2160 and 2161
WF 2160, 15.5	'writes 15.5°C to registers 2160 and 2161

Floating Point Read
The RF? query reads a 32-bit floating point value from two sequential register in low word-upper word order. The RF? does not require the number of register to read since it is fixed at two registers.

To read the actual chamber temperature:

RF? 360	'reads registers 360 and 361

The [?] is an optional symbol for smart programs like ICS's GPIBKybd program. These programs can recognize the command as a query and automatically read the response.

ICS Manual Errata

To reflect the standard decimal point configuration of 0.0° in TestEquity chambers with the F4 Controller, the ICS Electronics manual, Page 3-33, should be corrected as follows:

3.8.5 Writing to the Modbus Device

The W command writes 16-bit integers to a register. The command parameters depend upon the specific Modbus device. In the following example, a value of 50.0 is written to register 300. i.e.

W 300, 500	'sets F4 temperature setpoint to 50.0