TESTEQUITY

Model TE-1055 Ethernet Interface Instructions

Scope

This document describes how the TestEquity 1055 Ethernet Converter integrates with TestEquity Chambers.

Please read the ICS Model 8099 Ethernet-Modbus Instruction Manual FIRST to configure the device to your computer or network (especially Section 2), and for detailed device instructions.

COMPATIBILITY NOTES:

1. This Ethernet Interface Converter is NOT compatible with Watlow WatView software.
2. The webserver pages are compatible with the F4T only if Data Map 2 is selected in the F4T's Modbus menu. This puts the F4T in "F4 Compatibility Mode". This is because the converter's webserver only responds to F4 commands, not the native F4T commands.

Introduction

The Ethernet communications is achieved through an ICS Electronics 8099 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 F4 Controller used on TestEquity chambers. The 8099 converts these simple commands into the Modbus RTU packet protocol and adds the CRC checksum to make a complete Modbus RTU packet.
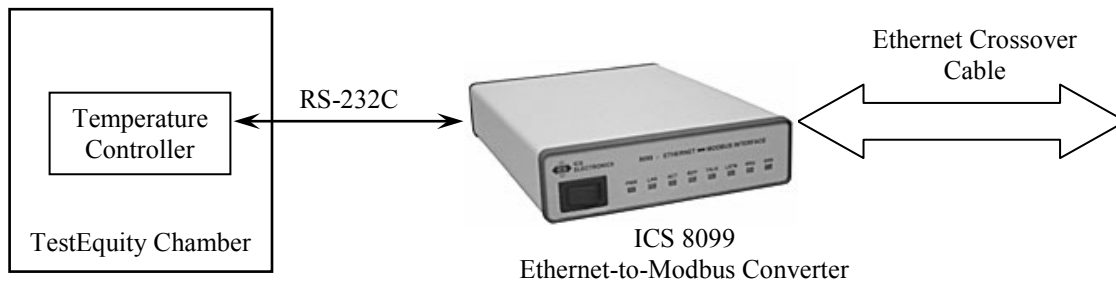
Serial Communications Parameters

The ICS 8099 is set at the factory for 9600 baud and a Modbus address of 1. All TestEquity chambers currently ship with the F4 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 8099 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.

The home page (index.html) has links to three different TestEquity-specific web pages. The index page is served when the converters IP addresse is entered in any web browser.

Please read the ICS Model 8099 Ethernet-Modbus Instruction Manual FIRST to configure the device to your computer or network (especially Section 2), and for detailed device instructions.

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

Temperature Chamber with Part Monitor Page (part_temperature.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.

Temperature-Humidity Chamber Page (humidity.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.

Model TEC1 Temperature Chamber Page (tec1.html) – For TestEquity TEC1 Thermoelectric Temperature Chamber only.

CAUTION: Changing °C-°F in Temperature-Humidity chambers will erase all stored profiles in the F4 Controller! For Temperature-only chambers, the profiles will convert °C-°F and remain stored. This function has been removed from the webserver pages in converters shipped after November 11, 2015.

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 8099. These commands do resemble the final command that the F4 Controller sees, but the ICS 8099 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.

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). This mode is NOT compatible with the converter's webserver pages.

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. This mode IS compatible with the converter's webserver pages.

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.

Additional Resources

Additional resources can be downloaded from http://icselect.com/ab_note.html under "VXI-11 Ethernet Application Notes".

IMPORTANT NOTE: The examples shown in documentation from ICS are for illustration purposes only. They may not represent the correct setup or configuration for TestEquity chambers. Sample programs from ICS may change critical setup parameters, resulting in improper chamber operation. They are provided as a guideline for how to write your own programs only. Correct setup parameters are documented in the TestEquity chamber manuals.

ICS Manual Errata

To reflect the standard decimal point configuration of 0.0° in TestEquity chambers, the ICS Electronics manual, Page 3-27, 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