8099
LAN TO MODBUS INTERFACE

DESCRIPTION

ICS's Model 8099 Ethernet-to-Modbus Interface is an specialized Ethernet to Serial Interface that provides Modbus RTU packet communication to adapt Modbus slave devices to a Network. The 8099 lets the user send simple read-write messages over the network to control and query slave Modbus devices. The 8099 does all of the Modbus RTU packet formatting and handles the response packets. The 8099 has both RS-232 and RS-485 interfaces so it can be connected directly to a single Modbus slave device or it can be connected to multiple Modbus devices via an RS-485 network.

The 8099 is VXI-11 compliant and works in test systems that incorporate LXI or VXI-11 instruments. Use the 8099 to incorporate test chamber control in your LAN based test systems or to control Modbus devices over the company network.

VXI-11.3 Compliant

The 8099 is a VXI-11.3 instrument so it fits in with todays new test equipment architectures like LXI that use Ethernet networks. VXI-11 is a communication standard developed by the VISA consortium in 1995 in conjunction with the VISA Specification. VXI-11.3 is the sub-specification for network instruments on TCP/IP networks.

Operation

The user sends commands to the 8099 that sets the Modbus device address, specifies the register to be read or written to and the data value. The 8099 converts these commands into the Modbus packet format, adds the CRC checksum and trans-
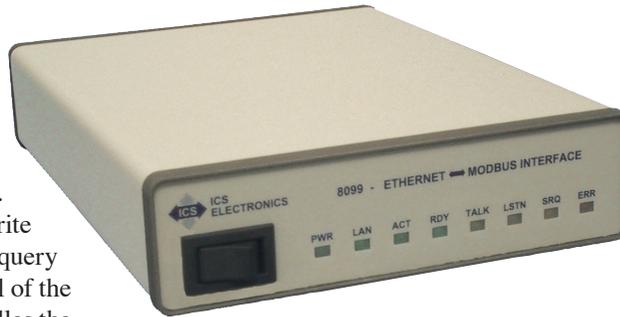
8099 Interface

mits the messages to the Modbus device. Received packets are checked and the responses to queries are returned to the network client. The 8099's command syntax includes an optional question mark to enable automatic response reading by ICS's VXI-11 Keyboard Control program and other smart programs.

Modbus communication faults, exception messages and other errors are reported to the user through a Modbus error register in the 8099's 488.2 Status Structure. The user can set up the 8099's IEEE-488.2 Status Reporting Structure to generate a Service Request (similar to a GPIB SRQ) on an error or simply read the Modbus Error register if a problem occurs.

Easy Programmability

The 8099 can be easily controlled by the different programming techniques that are in common use with today's Test and Measurement systems. Each 8099 includes ICS's VXI-11 keyboard program that lets you interactively link to and control VXI-11 instruments. You can send commands and queries to the 8099 and use the 8099 to control modbus devices.

- VXI-11.3 Compatible
  Works with virtually any computer or test language.

- Converts simple ASCII commands into Modbus RTU packets.
  Relieves user from having to generate and check RTU packets.

- Expanded Modbus RTU Command Set includes Floating Point commands
  Controls a wider range of Modbus devices.

- Provides both single ended RS-232 and balanced RS-422/RS-485 serial signals.
  Connects to single devices and Modbus networks.

- Internal webserver for changing network and serial settings.
  Easy setup from any computer.

- Includes ICS's VXI-11 keyboard program.
  The easy way to test Modbus commands and devices without writing a program.

- Includes prototype html control pages for Watlow F4 and EZ Zone Controllers.
  Starter web pages for OEM product control.

CE Approved

RoHS Compliant
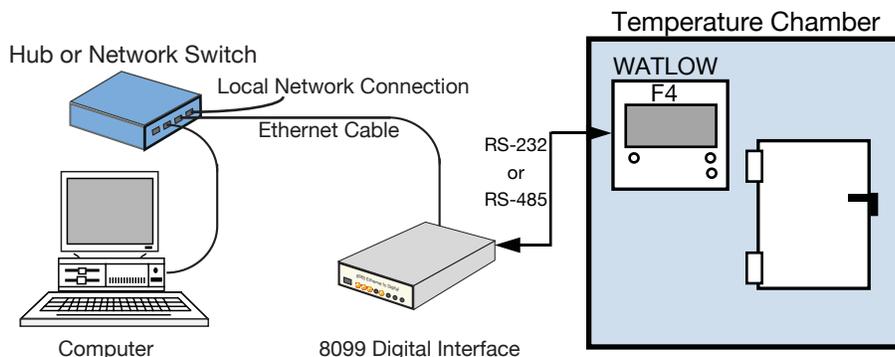
Figure 1   A typical 8099 Application

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Easy Programmability cont'd

If you program with LabVIEW, National Instruments' VISA library communicates with VXI-11.3 instruments like the 8099 as a TCPIP resource. NI's Measurement and Automation Explorer also finds and communicates with the 8099 as with any other VXI-11 compliant device.

Agilent's and National Instrument's VISA libraries are both VXI-11 compliant. If you are a Visual Basic or C/C++ programmer, you can write your program to make calls to either companies's VISA library. If you program with VEE, Agilent's IO Library treats the 8099 as any other LAN instrument and makes it available to your program.

If you use Linux or any flavor of UNIX such as SunOS, IBM-AIX, HP-UX, or Apple's OS X, you can communicate with the 8099 through RPC over TCP/IP.

Remote Procedure Calls

RPC (or Remote Procedure Calls) provides an invisible communication medium that allows the developer to concentrate on his program. RPC calls are commonly used on LINUX, UNIX, and all UNIX like operating systems with C language programs. However, they can be used on any operating system that includes a protocol converter utility (rpcgen). The rpcgen utility converts the RPC language description of the protocol in the VXI-11 Specification to generate the client stubs for writing programs with RPC calls.

The VXI-11 Specification is available at http://www.vxibus.org or from ICS's website. For more information about RPC programming, refer to ICS's Application Note AB80-3 and AB80-11.

JAVA

The 8099 can be programmed with JAVA and the resulting program run on any computer with JAVA capability. JAVA programming examples and library are available at SourceForge on the Internet.

Application Notes

ICS has developed several Application Notes that describe the VXI-11 protocol and how to program VXI-11 devices. They include RPC examples and information on how to customize the HTML pages served by the 8099's webserver. These Application Notes are available at http://www.icselect.com/ab_note.

Network Settings

The 8099, like all network devices, has several network settings that have to be set for the 8099 to operate properly on the user's network. The 8099 ships with its network configuration set to a static IP address. The user can change the 8099's IP address or set the 8099 to accept a dynamic IP address from a DHCP server. The 8099 includes a unique ICS COMM_timeout feature for recovering broken links and a KeepAlive function for verifying socket connections. The rear panel LAN Reset button can be used to reset the network settings to their factory default values at any time.

There are three ways the user can change the 8099's Network settings. The simplest way is to use a standard web browser and interact with the 8099's WebServer. The second way is to use ICS's VXI-11 Configuration Utility which runs on any Win 98 or Win32 PC and does not require a VISA library. The third method is to use ICS's defined RPC Commands from any computer operating system with RPC capability.

All settings are saved in nonvolatile Flash memory and are recalled when the 8099 is powered-on or reset.

SCPI Parser and Status Reporting

The 8099's SCPI command parser lets the user configure and query the 8099's interface settings with SCPI commands. The SCPI commands cover the 8099's serial communication settings, Status Reporting Structure Register settings, data format and Modbus timeout. The IEEE-488.2 *SAV 0 command saves the current configuration settings in nonvolatile Flash memory so they can be recalled when the 8099 is powered-on or reset.

The 8099's Status Reporting Structure includes a Modbus Error Register. The Status Reporting Structure can be enabled so that it can generate a Service Request for virtually any error combination or the errors can just be cascaded into the Status Register where they can be queried by the user.
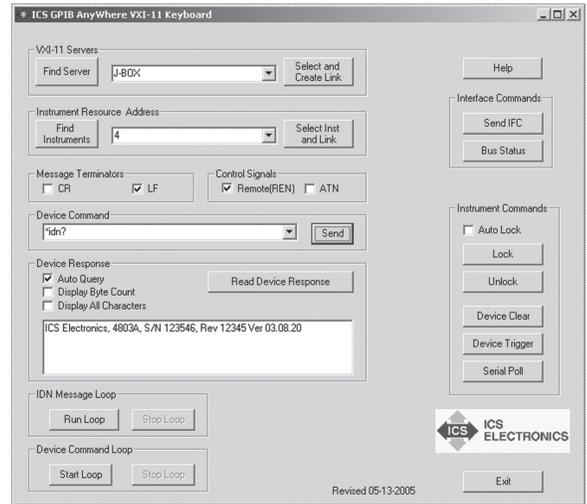

VXI-11 Keyboard

OEM Customization

The 8099's firmware allows the OEM user to store a custom IDN message and other interface setup parameters in the 8099's Flash memory. The user can also alter the appearance of the HTML pages used by the 8099's WebServer to include the user's company name, logo and even page layout. All of these changes effectively integrates the 8099 into the user's system and makes the 8099 appear as part of the company's product line. See Application Notes AB80-5 for the HTML modification instructions.

The 8099's WebServer also includes two prototype HTML control pages that allow a user to control a Temperature-Humidity Chamber with a Watlow F4 and a Temperature Plate with a Watlow EZ Zone Controller. Application Notes AB80-7 and AB80-8 describe how an OEM user can convert the prototype HTML control pages into custom pages for his products.
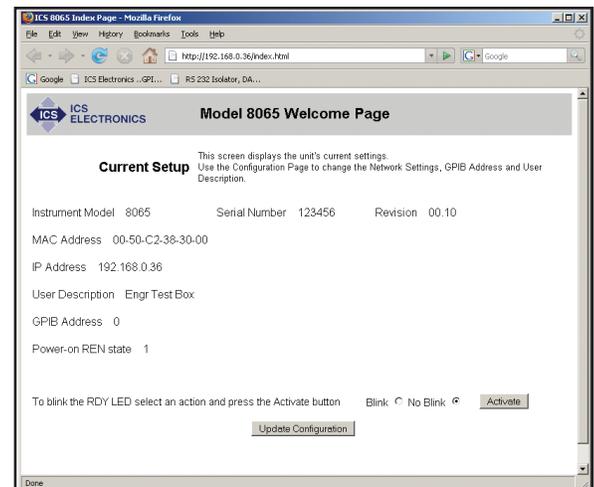
8099 Welcome Page

Supported Standards

VXI-11 Capabilities
Fully VXI-11.3 compliant

VXI-11.3	Device Interface
Sockets	15 + 1 for UDP
Channel types	Data, Abort and Interrupt
Links	64
Interface Name	intr0 for general use

VXI-11.3 Functions
All VXI-11.3 functions including device read, write, local, remote, clear, readstb, lock and unlock.

RPC Protocol
Conforms to ONC RPC Version 2, VXI-11

Ethernet Interface
Type	IEEE 802.3 compliant
Speeds	10BaseT (10 Mb/s)
	100BaseT (100 Mb/s)
IP Address	Static or DHCP
Factory setting	192.168.0.254 static
Interface name	any [inst0]

WebServer Capabilites
Provides the following HTML 4.01 compatible web pages:
- Welcome
- Configuration
- Confirmation
- Reboot
- 404, 500 and 501 Error pages

IEEE 488.2 Capabilities:
Runs all required 488.2 Common Commands, incorporates an extended IEEE-488.2 Status Reporting Structure and the Message Exchange Protocol.

SCPI Capabilities:
The 8099 conforms to the SCPI 1994.0 Specification and uses SCPI commands to set:
- Baud rate select
- Data bits 7 or 8
- Stop bits 1 or 2
- Parity Odd, Even or None
- RS485 Half-Duplex operation
- Talk Format HEXlist or ASCii

LXI Conformance:
The 8099 conforms to the LXI 1.1 Specification for Class C instruments except does not self generate IP addressees. The 8099's VXI-11.3 and IEEE-488.2 conformance exceeds LXI requirements.

Serial Interface

Full duplex serial interface with single ended RS-232 and differential RS-422 (RS-485) signals. Signal selection made by jumpers on the 8099. RS-485 half-duplex operation enabled with a SCPI command.

RS-232 Signals	TxD, RxD, RTS, CTS, DSR and DTR
RS-422 Signals	Tx and Rx pairs
Baud Rates:	300, 600, 1.2K, 2.4K, 4.8K, 9.6K, 19200, 28800,38400, 57600, 76800, and 115200.
Data Bits	7 or 8 bits
Parity	Odd, even or none
Stop Bits	1 or 2

Modbus RTU Commands

Modbus commands accept ASCII decimal values or HEX values starting with #h. Code is the Modbus RTU command code produced by the 8099. Integer and register values from 0 to 65,535. Floating Point per IEEE-754.

Cmd	Code	Function
C n	-	Sets Device Address
RC? reg, n	0x01	Reads coils *n* from register *reg*
RI? reg, n	0x02	Reads Discrete Inputs *n* from register *reg*
R? reg, n	0x03	Reads *n* words starting with register *reg*
RF? reg	0x03	Reads floating point value from register *reg* and *reg+1*
RR? reg,n	0x04	Reads *n* words starting with register *reg*
RE?	0x07	Reads Exception value
WC reg,b	0x05	Writes boolean *b* to coil
W reg, w	0x06	Writes word *w* to a single register *reg*
WB reg, n, w...w	0x10	Writes multiple words *n* to a single register *reg*
WF reg, n	0x10	Writes a floating point value *n* to register *reg* and *reg+1*
L w	0x08	Performs loopback test
D time		Sets serial timeout in ms
E?		Queries Modbus Error Register

Compatible Controllers

The following is a partial list of compatible Modbus RTU Slave Controllers:
- Watlow F4, 96, SD and EZ Zone series
- Cincinnati SubZero EZT550

Indicators

PWR	Indicates power on
LAN	Unit connected to an active LAN
	Blinks to identify the unit.
ACT	Transferring messages to/from the network
RDY	Unit has passed self test
TALK	Unit asked to send data
LSTN	Unit sent a command or data
SRQ	Service Request asserted
ERR	Blinks for a soft VXI-11 error and On for command errors

Controls

Power	Front panel switch
LAN Reset	Rear panel push-button that resets the network settings.

Physical

Size, L x W x H
7.29 x 5.57 x 1.52 inches
(185.2 x 141.5 x 38.6 mm)

Weight 3 lbs. (1.4 kg.)

Construction Lead Free

Connector and Headers
Serial I/O:	DB-25 female connector with lock studs
Ethernet:	RJ-45

Temperature
Operation	-10° C to +70° C
Storage	-40° C to +85° C

Humidity
0-90% RH without condensation

Power
9 to 32 Vdc @ 3 VA

Approvals
EEC Standards EN 61000-6-4:2001, EN 61000-6-2:2001, EN 55024:2003, and EN 55022:2003.

Included Accessories

Instruction Manual
LAN Crossover Cable.
Support CD-ROM with VXI-11 Utilities.
UL/CSA/VDE approved AC power Adapters
 US - 115±10% Vac, 60 Hz (std.)
 -E Europe - 230±10% Vac, 50/60 Hz
 -B UK - 230±10% Vac, 60 Hz
 -U Japan - 100±10% Vac, 50/60 Hz
 -A Australia/China - 230±10% Vac, 60 Hz

ORDERING INFORMATION

Part Number

Ethernet to Modbus Interface (Includes Instruction Manual and Configuration Disk)	8099
Ethernet to Modbus Interface with 230 VAC adapter. Specify plug style: -E (Europe), -B(UK), -A(Australia/China), -U(Japan)	