MODBUS CONVERTER

2390

MODBUS RTU REGISTER CONVERTER

- Converts existing Modbus Registers and data types for a new Modbus controller. *Transparent conversion of registrs and data.*
- Both serial ports provide RS-232 and 2 or 4-wire RS-485 signals. *Compatible with all Modbus RTU Slave Devices.*
- Pre-programmed Watlow F4 to F4T and EZ-ZONE Conversion tables simplify setup. *Use the internal tables as is or use them as a starting point for your conversion table.*
- 239x Table Loader software loads your conversion table from an Excel worksheet. *Eliminates line-by-line data entry.*
- Plug-in screw terminal strips for easy wire connections. *No special tools or soldering required.*

☑ *RoHS Compliant*

DESCRIPTION

ICS's 2390 Modbus Register Converter allows a user to replace an existing Modbus Slave Device with newer Modbus Slave Device without having to modify the application program. The 2390 converts the register number in a modbus packet to the equivalent register number for the replacement Modbus Device. The 2390 conversion also converts the data type as needed for the replacement Modbus device. Queries can read as floating point, 32-bit or 16-bit values and returned to the Modbus Master in the existing data type format. The 2390 can also operate as a Serial to Modbus RTU converter for testing the Modbus device communication or for debugging. As a serial interface, the 2390 can control a Modbus RTU Slave Device with simple ASCII command strings.

The 2390 works with all Modbus RTU Slave Devices. A typical application is the replacement of an older Modbus process controller like a Watlow F4 with a newer EZ-ZONE or F4T.

2390 Modbus Register Converter

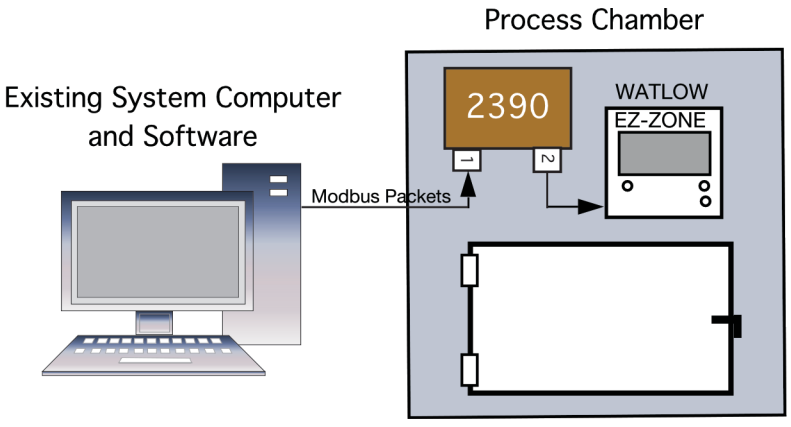
Background

Many process control applications, test systems and temperature chambers were built years ago with early process controllers that used the Modbus RTU protocol. Over the years, these manufacturers and their customers have made major investments in the application programs used to run and maintain these systems. As the systems age or need to be repaired, converting to a new, more capable process controller without a software change is a desirable option.

Upgrading a system with a new controller with similar functions means different register numbers and/or data types. Changing the application software for existing systems can be a difficult and expensive process. Often the old software used obsolete compilers and cannot be redone or operate on today's computers.

The 2390 Solution

ICS's 2390, with its ability to mimic the current Modbus Slave Device, provides an economical way to replace older Modbus devices without redoing the application programs. The setup is very straight forward. The user identifies the Modbus registers being used in the existing device and the equivalent registers in the new Modbus device. The register numbers, variable types and the desired conversion mode can be entered directly into the 2390's Registerr Conversion Table or into an Excel worksheet and uploaded into the 2390. The 2390 is then switched to the Modbus mode and placed in the serial path between the existing system computer and the new Modbus device as shown in the figure below. The system then runs with the replacement controller without the need to change the application software.



2390 used to update a chamber with a Watlow EZ_ZONE Controller

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2390 Operating Modes

The 2390 has two operating modes: Modbus RTU and SCPI. When the modes are switched, the new mode is saved as the new power on setting.

Modbus RTU Operating Mode

In the Modbus mode, the 2390 acts as a Modbus Slave Device on Port #1 and as a Modbus Master on Port #2. The 2390 uses the information stored in its Register Conversion Table to convert received Modbus RTU packets with the older Modbus registers and data types to packets with the new Modbus Device register numbers and data types. Data flow is bidirectional.

The Register Conversion Table lets the user save constants such as the Slave Device model number which may not have a direct correlation with the new Modbus Device. The Register Conversion Table also lets the user assign memory space for write-read functions that do not translate to the new Modbus Slave Device.

The 2390 can be configured to drive multiple Modbus devices on a RS-485 network. When its Modbus address is disabled, the 2390 uses the received Modbus address to address devices connected to Port #2.

SCPI Operating Mode

In the SCPI mode, the 2390 operates like an IEEE-488.2 compatible serial device and accepts ASCII character strings. The 2390 responds to the 488.2 Common Commands and uses SCPI commands to configure the 2390 and to query its status. SCPI stands for Standard Commands for Programmable Instruments and is the command syntax used in most GPIB and other instruments.

The 2390 also operates as a Serial to Modbus Interface to control Modbus Slave Devices as shown in Figure 2. The 2390 responds to simple ASCII command strings that can be generated by a terminal emulation program like Hyperterm or ReatTerm. They provide full control for reading and writing to registers, for coils and for discrete inputs. The 2390 converts the ASCII command strings into Modbus RTU packets and transmits them to the Modbus Slave Device. Received packets are validated and any response data is returned to the host controller. Multiple Modbus devices can be addressed when the 2390 is used on a RS-485 network.

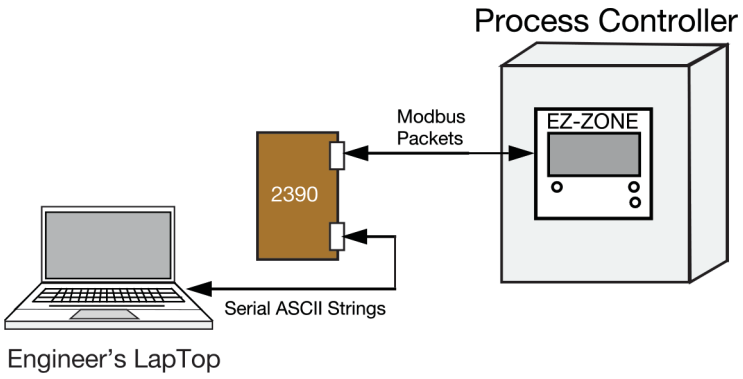

Figure 2 Using a 2390 for Serial Control of Modbus Slave Devices

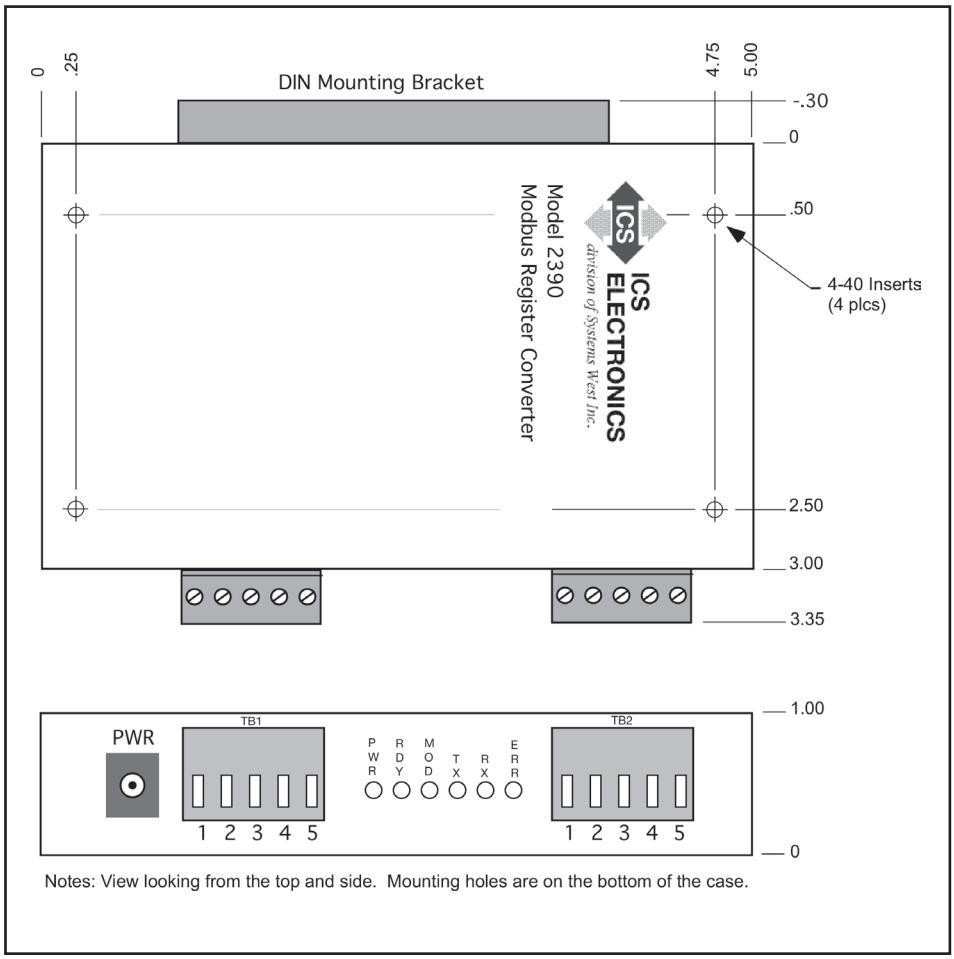

Figure 3 2390 Outline Dimensions

Table Loader Program

ICS's supplies a 239x Table Loader utility program for uploading the contents of an Excel csv file to the 2390's Register Conversion Table. This provides a fast upload experience for the user and is less error prone than manually loading each line in the Register Conversion Table. Other benefits are ease of multiple uploads, configuration control and setup documentation.

The 239x Table Loader verifies that the 2390 is the correct device for the file before starting the upload. Cell content is tested to detect blank cells. The 2390 is queried after loading each line to see if it detected an error in the line. Detected errors are displayed for the user to correct at the end of the upload process. The Register Conversion Table is saved at the end of a successful upload.

Operating Modes

Modbus RTU and SCPI

Modbus Mode

2390 acts as a Modbus Slave Device and accepts Modbus RTU packets on Port #1 and as a Modbus Master on Port #2 to control Modbus RTU devices. Packet conversion uses data saved in the Conversion Table.

Modbus **Address Capability**

Port 1	1 to 247 [1]
Port 2	1 to 247 [1]

Conversion Table

Size	100 Registers
Register Num	0 to 65535
Data Types	Signed/unsigned Integers, Signed/unsigned 32-bit Floating Point, None Strings and Constants.
Data Dec. Pt.	0, 1, 2 or 3
Internal Tables	Watlow F4 to F4T, Watlow F4 to EZ-ZONE™

SCPI Mode

The 2390 operates as an IEEE-488.2 device and accepts serial commands on Port 1 to configure the 2390, to check status and to control one or more Modbus RTU devices. Commands listed in the Modbus Command Table.

Status Reporting Structure
IEEE-488.2 Status Byte, ESR, Modbus Error, Questionable and Operational Registers.

488.2 Common Commands
*CLS, *ESE, *ESE?, *ESR?, *IDN?, *OPC, *OPC?, *PSC, *RST, *SAV, *SRE, *SRE?, *STB, *TST?, AND *WAI.

SCPI Commands
The 2390 conforms to the SCPI 1994.0 Specification and uses SCPI commands to set or query:

- Baud rate
- Data bits
- Stop bits
- Parity
- RS-485 TX signal tristate enable
- Port Address
- Language (Mode)
- Conversion Table
  - Assign a line
  - Query number of lines
  - Clear All
- Talk Data Format
- User IDN Message

Serial Interfaces

Each port is individually configurable for single-ended RS-232 and 2 or 4-wire differential RS-485 signals. Signal selection is made by internal jumpers. Internal termination network is provided for the RS-485 RX signal pair.

RS-232 Signals	TxD, RxD, and Gnd
RS-485 Signals	Tx and Rx pairs or Tx/Rx pair RS-422 compatible
Baud Rates:	
Port #1	300 to 19,200. [19,200]
Port #2	9600 and 19,200 [19,200]
Data Bits	7 or 8 data bits, [8]
Parity	Even, odd or none [none]
Stop Bits	1 or 2 [2]
Buffers	1024 bytes

Modbus Commands

Complete set of Modbus RTU commands for reading/writing integers, coils and floating point registers, reading discretes and inputs. Floating Point conversion meets 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

Indicators

PWR	On when power applied.
RDY	Passed self test.
MOD	In Modbus Mode
TX	Transmitting on Port 1.
RX	Listening on Port 1 or addressed in X3.28 Mode.
ERR	On when an error detected.

Physical

Size, L x W x H
5.08 x 3.0 x 1.0 inches
(129 x 76.2 x 25.4 mm)

Mounting Options
Panel mount with 4-40 screws
DIN Rail, 35 mm DN Rail

Connectors:

Serial:	Removable 5-pin screw terminal strips for AWG wire sizes 12-26

LED Indicators:
PWR, RDY, MOD, TALK, LSTN, ERR

Temperature:

Operation	-10° C to +55° C
Storage	-40° C to +85° C

Humidity:
0-90% RH without condensation

Power: +5 to + 32 Vdc at 0.25 VA

Weight:

2390 only	0.69 lb. (0.31 kg)
Shipping	2 lb. (0.9 kg)

Supplied Accessories

Power Adapter 115±10% VAC, 60 Hz (std.)
Instruction Manual
Plug-in Terminal Strips

Optional Accessories

116159 Serial Adapter Cable, 4 inches long with DE-9P plug for RS-232 signals.

ORDERING INFORMATION

	Part Number
Modbus Register Converter (includes Power Adapter, Mating Terminal Strips, Manual and Configuration Disk)	2390
Modbus Register Converter (spare unit)	116222
Serial Adapter Cable, 239x to DE-9P for RS-232 signals. 4 inch long	116159