

RS 485 Communications

RS 485 allows a multidrop network connection of up to 32 devices on two or four wires and provides reliable communications for distances up to 4000 ft (1200 M) at data rates up to 100 Kbaud. (up to 10 Mbaud over shorter distances). Two wire, RS 485 supports a half duplex mode of communications; ie, communications in one direction at a time. Four wire, RS 485 can support full duplex or half duplex modes of communication.

The RS 485 interface produces a ± 5 V differential voltage on two wires. The line driver operates in three states called tri-state operation.

Logic 1
Logic 0
High-Impedance

In the disabled or high impedance state the line driver draws no current and appears not to be present on the line. Transmission lines in Honeywell devices are internally biased to improve noise immunity during the high-impedance state and the lines are common mode isolated to ± 6.2 Vdc.

Tri-stating allows up to 32 transmitters to exist on a single network, although only one can be active at any one time. Each device in a multidrop network must be given a unique address to prevent conflicts between devices on the network.

It is recommended that terminating resistors (R_t), matching the characteristic impedance of the communication cable, be placed across the connections of the devices at the extreme ends of the link. These resistors serve to sharpen the leading and trailing edges of the data pulses and eliminate reflected transmissions. Most twisted pair, RS 485 rated, communications cables have a characteristic impedance of 100 to 120 ohms.

Recommended communication cables are:

Belden 9271 Twin-ax $Z_o = 124$ ohm
Belden 9729 2 twisted/shielded pairs $Z_o = 100$ ohm
Alpha 5121C - required for CE mark installations

Typical Wiring Nomenclature:

SDA / RDA = Tx- / Rx-
SDB / RDB = Tx+ / Rx+

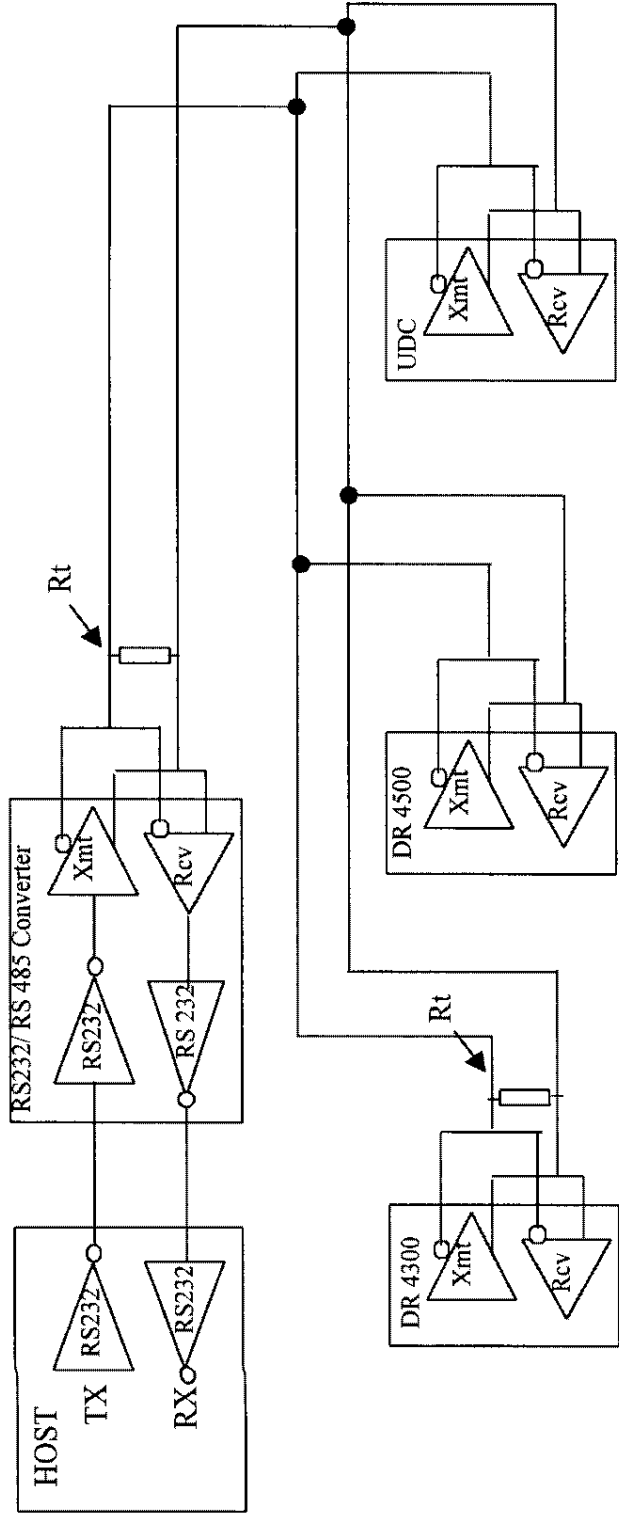


Figure 1

RS 232/RS 485 Serial Communication Converters

Data acquisition, remote setpoint adjustments and loop tuning adjustments are typical applications which require communication between a host device, such as a PC or a PLC, and Honeywell recorders and controllers. Since many host devices only support RS 232 electrical connections, an RS 232 to RS 485 converter is required. Figure 1 shows a typical circuit diagram of a communication link.

In links using two wire RS485 communications, data can only be transmitted in one direction at a time. Therefore, the users application driver must properly control or time the communications so that data collisions do not occur. Many converters provide an "Auto Send Data" feature which enables the transmit driver when transmit data is sensed and places the driver in the high impedance state when the transmission is completed. Also, the receiver of the sending device must be turned off while its transmitter is sending data. Most converters have an 'Echo-off' feature to accomplish this.

B&B Electronics @ Ph: 815-433-5100 is a Honeywell recommended supplier of RS485 converters and interfaces.

Honeywell Universal Modbus RTU Protocol

Protocol refers to the specific format or structure of the communicated message. Modbus RTU protocol operates in a master-slave operation; ie, the host or master queries the specific slave device and the slave responds in an appropriate manner. The slave devices never initiate a query. Slave devices may have addresses from 1 to 247.

General RTU Message format:

Query= [Slave address, Function code, Data, CRC 16]

Response=[Slave address, Function Code*, Data, CRC,16]

* if error occurs, 80(Hex) is added to Function Code and Data = error code

Modbus RTU uses single byte, Function codes to read or write various types of data.

Honeywell devices support the following function codes:

- 01 Read Coil Status
- 02 Read Input Status
- 03/04 Read 16 bit integer or IEEE -32 bit floating point Registers
- 05 Force single Coil
- 06 Preset single Register -16 bit, integer format only
- 08 Loopback test (not supported in RSX,VRX, VPR or UDCS300 devices)
- 16 Preset Multiple Registers
- 17 Report Device ID
- 20 Read General Reference (Read/upload device configuration)
- 21 Write General Reference (Write/download device configuration)

Honeywell has universally mapped specific types of data, such as Process Variables, loop SetPoints, control OUTputs, TUNing variables, etc. to identical register addresses in all Honeywell supported Recorder/Controller Products. That is, Analog Input values can be acquired starting at address 1800(Hex) in all devices. Please reference Honeywell's Modbus RTU Serial Communications User Manual, Form# 51-55-25-66, Appendix A for additional register mapping information.

Communication Parameters:

Honeywell Modbus devices operate with the following data communication parameters:

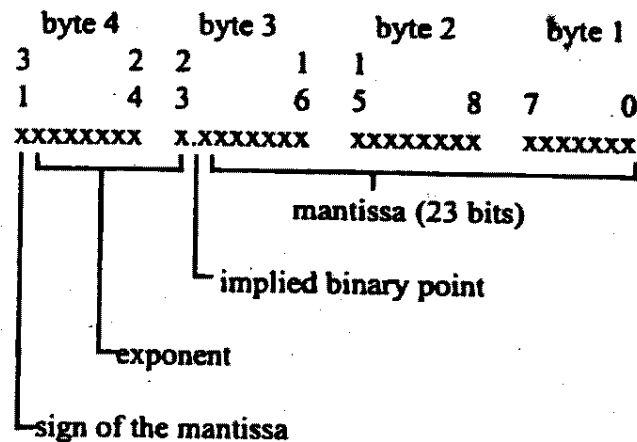
- 8 Bit binary data , 1 start bit, one stop bit, no parity
- Baud rates from 300-38.4 Kbaud (not all instruments support all Baud rates)
- CRC-16 error checking
- LSB transferred first
- Idle line exceeding 3.5 character times is interpreted as end of message

IEEE 754- 32 bit Floating Point Format

The Floating Point data format consists of four contiguous bytes containing a 23-bit signed binary mantissa with an 8-bit biased binary exponent. The bits are numbered from 31 to 0, left to right. Byte 4 contains bits 31-24, byte 3 contains bits 23 to 16, and so on. A description of the layout and accompanying figure follow:

BITS	DESCRIPTION
0-22	Mantissa
23-30	Exponent: 8-bit unsigned value
31	Sign of the mantissa: 0 = positive, 1 = negative

An implied binary point exists between bits 22 and 23. Note that the transmission order is byte 1 to byte 4.



The formula for calculating the floating point number is: $+ / - . \text{mantissa} \times 2^{\text{exponent}}$

Mantissa and Sign

The mantissa is defined by a sign bit (31) and a 23-bit binary fraction. This binary fraction is combined with an "implied" value of 1 to create a mantissa value which is greater than or equal to 1.0 and less than 2.0.

The mantissa is positive if the sign bit is zero (reset), and negative if the sign bit is one (set). For example:

<u>DECIMAL</u>	<u>HEXADECIMAL</u>	<u>BINARY</u>
100	42C80000	01000010 11001000 00000000 00000000

The sign bit is zero, indicating a positive mantissa. Removing the sign bits and exponent bits, the mantissa becomes:

<u>HEXADECIMAL</u>	<u>BINARY</u>
480000	xxxxxxxx x1001000 00000000 00000000

Add an "implied" value of one to the left of the binary point:

<u>BINARY</u>
1.1001000 00000000 00000000

Using positioned notation, this binary number is equal to:

$$1.0 + (1 \times 2^{-1}) + (0 \times 2^{-2}) + (0 \times 2^{-3}) + (1 \times 2^{-4}) = 1.0 + 0.5 + 0.0 + 0.0 + 0.0625 = 1.5625$$

Exponent

The exponent is defined by an unsigned 8-bit binary value (bits 23 through 30). The value of the exponent is derived by performing a signed subtraction of 127 (decimal) from the 8-bit exponent value.

<u>DECIMAL</u>	<u>HEXADECIMAL</u>	<u>BINARY</u>
100	42C80000	01000010 11001000 00000000 00000000

removing the sign and mantissa bits, the exponent becomes:

<u>DECIMAL</u>	<u>HEXADECIMAL</u>	<u>BINARY</u>
133	85	x1000010 1xxxxxxxx xxxxxxxxx xxxxxxxxx

or:

$$1 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$$

Subtract a bias of 127 from the exponent to determine its value: $133 - 127 = 6$.

Mantissa and Exponent Combination

Combining the mantissa and exponent from the two previous examples:

$$\text{float number} = \text{mantissa} \times 2^{\text{exponent}}$$

$$\text{float number} = 1.5625 \times 2^6 = 1.5625 \times 64 = 100.0$$