



MODBUS Application Note

Model	CTM-ONE
Revision	Rev 1.1

Revision Control

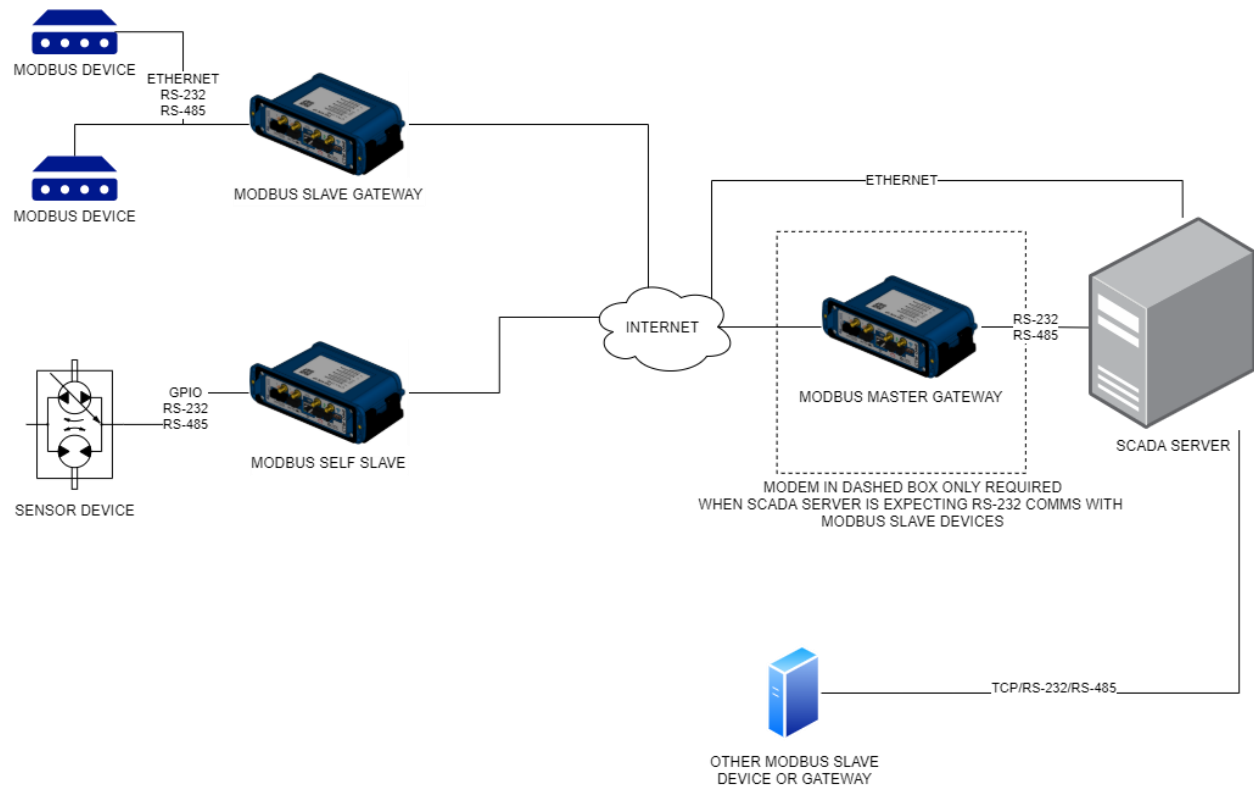
Description	Revision	Date
Initial release	Rev 1.0	2021-08-26
Added screenshots and general reorganization	Rev 1.1	2021-09-13

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MODBUS Network Diagram

This diagram shows the 4 configurations the CTM-ONE can support. MODBUS Slave Gateway will typically be the most common configuration used on the CTM-ONE.

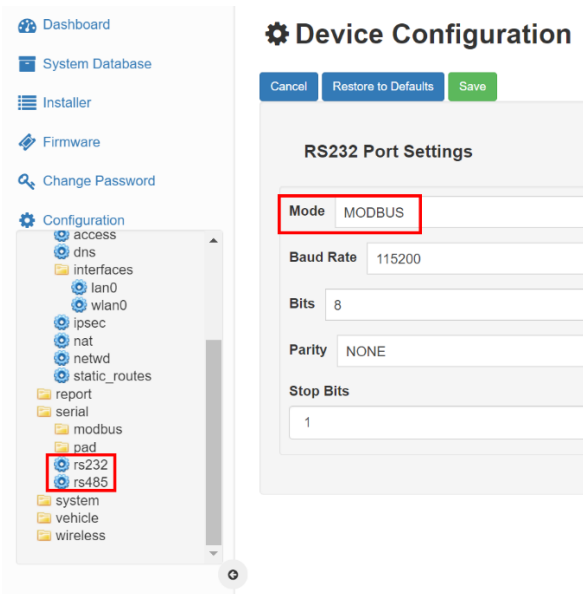


MODBUS Application Note

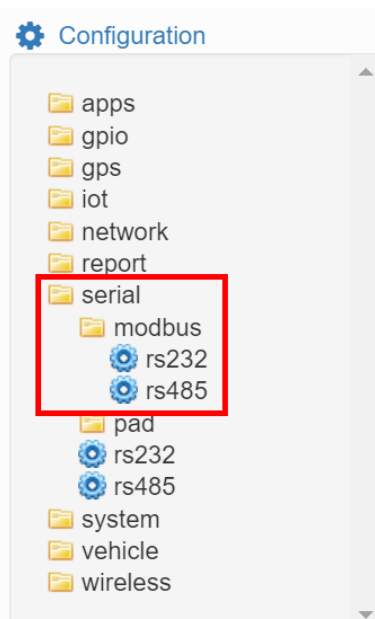
The CTM-ONE can support 4 types of MODBUS:

- MODBUS Master Gateway
- MODBUS Slave Gateway
 - TCP Slave
 - Serial Slave
 - Self-Slave

The mode setting of the serial port **must** be set to MODBUS for the RS-232/RS-485 port setting for MODBUS configuration to work even if no physical RS-232 or RS-485 devices are physically connected to the CTM-ONE.

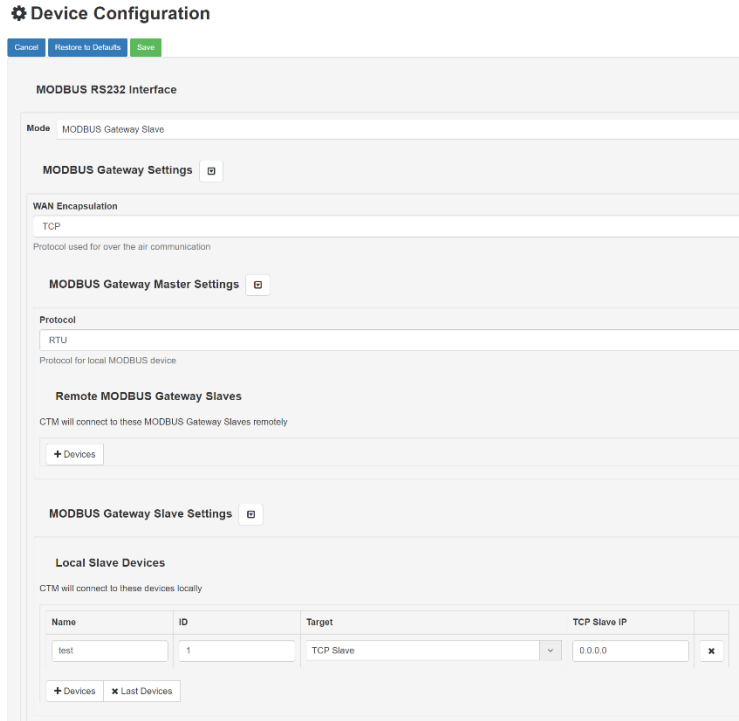


MODBUS Configuration is available on the CTM-ONE Web UI under the Serial → MODBUS tab

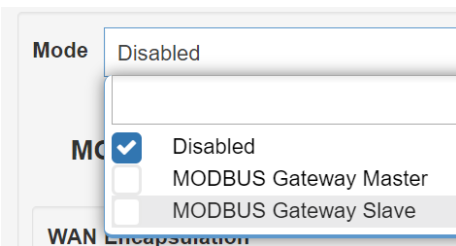


The RS-232 and RS-485 tabs expand for specific MODBUS functionality. The CTM-ONE supports simultaneous RS-232 and RS-485 protocols so individual configurations can exist for either protocol.

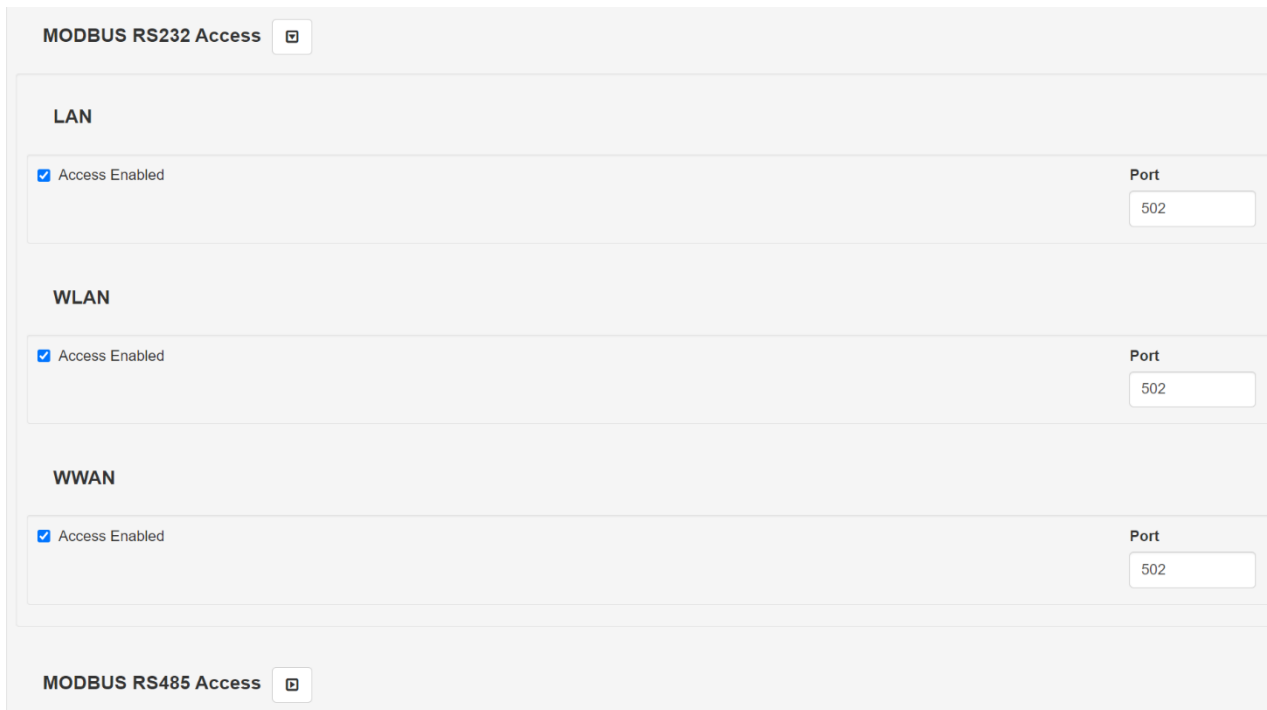
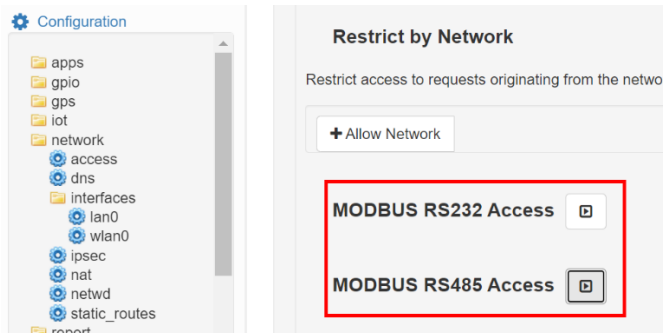
For ethernet-based MODBUS communication (TCP / RTU over UDP) either MODBUS RS-232 or RS-485 can be used.



The “Mode” defines the Gateway Master or Gateway Slave operating state.



Access must also be enabled for routing data via the wireless network when using MODBUS.



1.1 MODBUS Slave Gateway

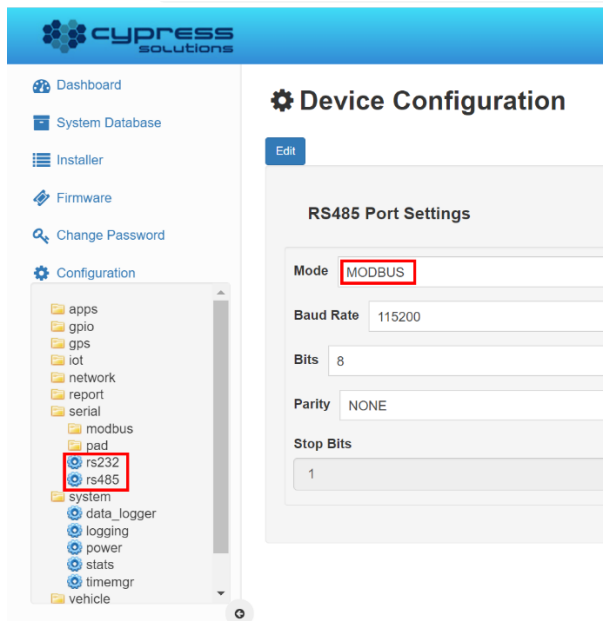
The CTM-ONE is a remote device and is connected physically to another MODBUS Slave Device. Slave Gateway can communicate with local devices via Ethernet, RS-232 or RS-485, GPIO Input/Output (Self Slave). The most common is the Slave Gateway communicating via one protocol, ie RS-232, not RS-232 and Ethernet at the same time although this is also possible.

1.1.1 Required Configuration Settings

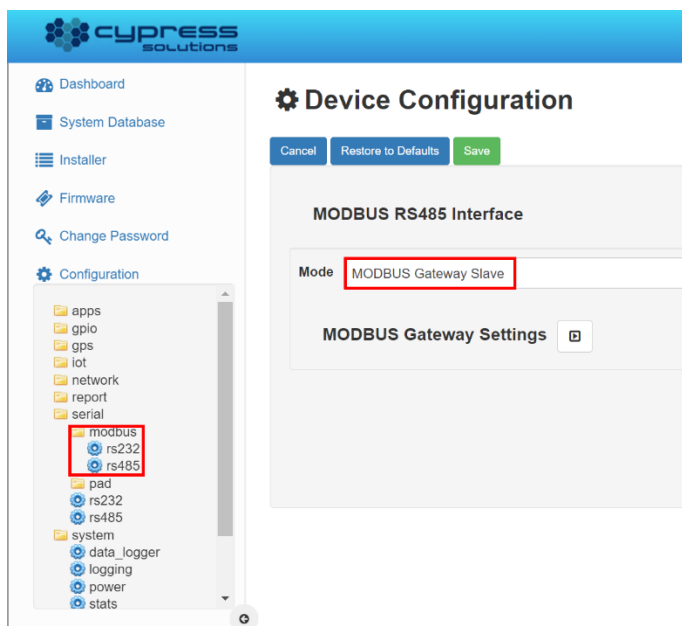
What it handles	Setting Name	Value
Configure device to act as a Slave Gateway	Mode	MODBUS Gateway Slave
Protocol used to communicate with remote Master Gateway	WAN Encapsulation	TCP or RTU over UDP - Should match Master Gateway
Enable WWAN access to serial data for Master	Navigate to network → access → MODBUS RS-232 Access or MODBUS RS-485 Access	Enable and port number
Slave Gateway requires a list of all the slaves connected to it and their pre-determined addresses.	Remote MODBUS Gateway Slaves 1. Name 2. ID 3. Target 4. TCP Slave IP	1. Friendly Name 2. Slave ID 3. Self-Slave, TCP Slave, Serial ASCII, Serial RTU 4. LAN IP of TCP Slaves only. Else leave as 0.0.0.0.

Example of setting up a MODBUS **TCP Slave** with the CTM-ONE acting as the **Master Slave Gateway**.

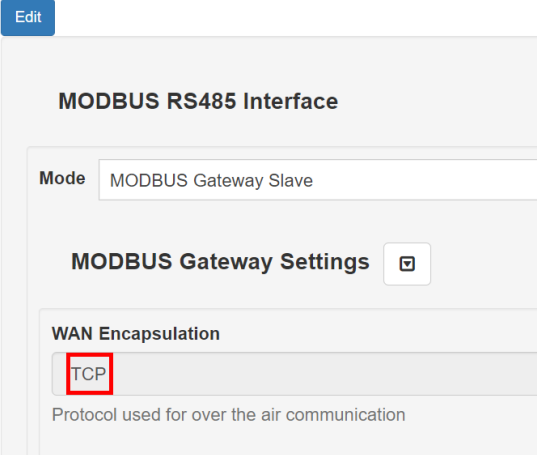
Step 1: Select a Serial “mode” either RS-232 or RS-485 and set the mode to “MODBUS”. Do not worry about Baud Rate, etc. This is only required if there is a slave device that is using RS-232 or RS-485.



Step 2: Configure the Serial port selected, either RS-232 or RS-485 to the “MODBUS Gateway Slave” mode.



Step 3: Expand the “MODBUS Gateway Settings”. Make sure the WAN Encapsulation is set to TCP for MODBUS TCP (MODBUS RTU over UDP is also supported).



MODBUS RS485 Interface

Mode: MODBUS Gateway Slave

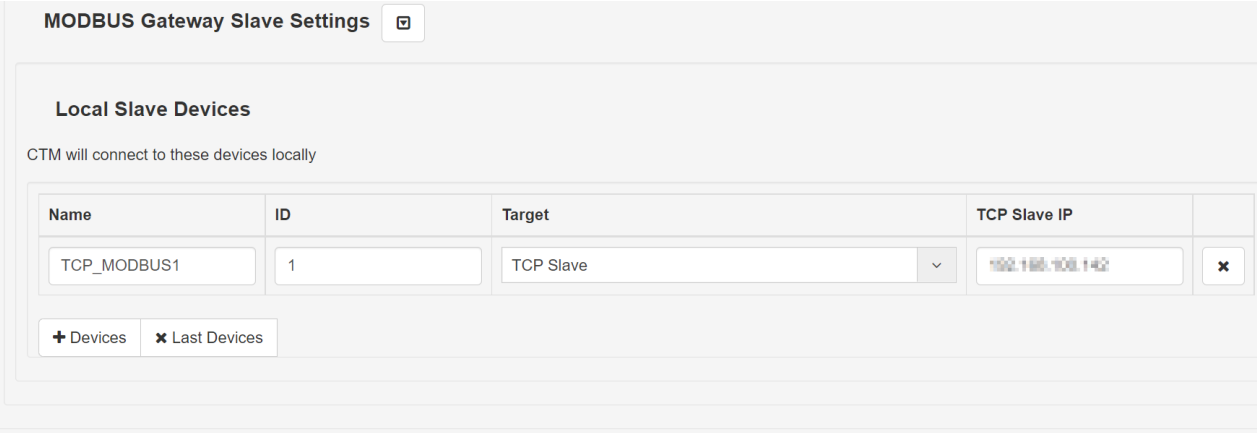
MODBUS Gateway Settings

WAN Encapsulation

TCP

Protocol used for over the air communication

Step 4: Expand the “MODBUS Gateway Settings” → “MODBUS Gateway Slave Settings” and define the “Local Slave Devices”.



MODBUS Gateway Slave Settings

Local Slave Devices

CTM will connect to these devices locally

Name	ID	Target	TCP Slave IP	
TCP_MODBUS1	1	TCP Slave	192.168.100.142	x

+ Devices x Last Devices

Select Save and Apply and the MODBUS TCP slave device will communicate with the MODBUS Master.

1.1.2 Example of a MODBUS Gateway Slave using connected to an RS-232 MODBUS Device

Device Configuration

MODBUS RS232 Interface

Mode: MODBUS Gateway Slave

MODBUS Gateway Settings

WAN Encapsulation
 TCP
 Protocol used for over the air communication

MODBUS Gateway Master Settings

MODBUS Gateway Slave Settings

Local Slave Devices
 CTM will connect to these devices locally

Name	ID	Target	TCP Slave IP	
Modbus_RS232	1	Serial Slave using ASCII	0.0.0.0	x

+ Devices x Last Devices

1.1.3 Example of Two MODBUS Slave devices connected to MODBUS Slave Gateway, one TCP one RS-232

Name	ID	Target	TCP Slave IP	
Modbus_RS232	5	Serial Slave using ASCII	0.0.0.0	x
Modbus_TCP	2	TCP Slave	192.168.190.142	x

2.1 MODBUS Master Gateway

The CTM-ONE is connected to a SCADA server. The CTM-ONE is not the remote device but resides where the SCADA server is located.

MODBUS Slaves or Slave Gateways communicate with the Master Gateway which then communicates with the SCADA server via RS-232 or RS-485.

NOTE: MODBUS Master Gateway is ONLY required when the SCADA server expects to communicate with the Slave devices via RS-232. If the SCADA server can communicate via TCP/Ethernet, Master Gateway is not required.

2.1.1 Required Configuration Settings

What it Handles	Setting Name	Value
Configure device to act as a Master Gateway	Mode	MODBUS Gateway Master
Protocol used to communicate with remote Slave Gateway	WAN Encapsulation	TCP or RTU over UDP - Should match Slave Gateway
Protocol used to local talk to SCADA Server via RS-232/485	Protocol	ASCII or RTU - Must match SCADA Server
Master Gateway requires a list of ALL Slaves it is trying to communicate with.	Remote MODBUS Gateway Slaves 1. Name 2. ID 3. IP 4. Port	1. User Friendly Name 2. Remote Slave's ID 3. IP of Remote Slave Gateway 4. Port used for this specific Slave

3.1 MODBUS Self-Slave Data

The CTM-ONE is a remote device and maps modem inputs/Outputs to MODBUS ID's and responds to queries.

The CTM-ONE Slave can also send modem-specific data in MODBUS format, for example RF signal strength, etc.

3.1.1 CTM-ONE Self-Slave Input Register Chart

Register	Hex Value Example	Value Example	Conversion	SYSDB Value
1-4		0 or 12	12 Volts	AIN1-6
7	04BE	1214 (16-bit INT)	$1214/100 = 12.14$ Volts	GPIO_VCC
8	0048	72 (16-bit INT)	-72	CELL_RSSI
9	003E	62 (16-bit INT)	62 Celsius	GPIO_TEMP
10	1D07	7431 (16-bit INT)	Convert Hex to Dec Hex 1D 07 1D = 29 07 = 7 Day 29 Month 7	GPS Day & Month derived from GPS_IS08601
11	07E5	2021 (16-bit INT)	Year 2021	GPS Year derived from GPS_IS08601
12	120D	4621 (16-bit INT)	Convert Hex to Dec Hex 12 0D 12 = 17 0D = 59 17 Hours 59 Minutes	GPS Hours & Minutes derived from GPS_IS08601
13	3241	12865 (16-bit INT)	Convert Hex to Dec Hex 32 41 32 = 50 41 to Ascii = A 50 Seconds GPS_VALID=A=True	GPS Seconds & Valid Flag derived from GPS_IS08601 and GPS_VALID
14,15	3F5C 14E6	0.85969388 (32bit Float)	0.85969388 Radians Multiply by 180/pi 49.25683099735 Degrees	GPS Latitude
16,17	C009 6377	-2.14669585 (32bit Float)	-2.14669585 Radians Multiply by 180/pi -122.9966121036 Degrees	GPS Longitude
18	0014	20 (16-bit INT)	20 m/s 72 km/hour	GPS Speed
19	00F7	247 (16-bit INT)	247 degrees	GPS Heading

3.1.2 CTM-ONE Self-Slave Input Register Chart

Register	Hex Value Example	Value Example	Conversion	SYSDB Value
1-4		0 or 1	Active or Not Active, No Conversion	DIN1-4

3.1.3 CTM-ONE Self-Slave Output Register Chart (Coils)

Register	Hex Value Example	Value Example	Conversion	SYSDB Value
1-4		0 or 1	Active or Not Active, No Conversion	DOU1-4

MODBUS Cheat Sheet – Applies to Entire Application Note

	Master	Master Gateway	Slave Gateway	Slave
Address Data Mapping	Knows all Slaves' IDs and the data they can provide	Contains a list of all Slaves' IDs and their WAN addresses (IP/Port)	Contains a list of all local Slave IDs and their LAN addresses	Contains Register and Coil Data
Local Transfer Protocol	Preconfigured to know how to communicate with each other. <ul style="list-style-type: none"> • "Serial RTU" • "Serial ASCII" 		Preconfigured to know how to communicate with each other. <ul style="list-style-type: none"> • "TCP" • "Serial RTU" • "Serial ASCII" 	
WAN Encapsulation (Over the Air Transfer Protocol)	No Knowledge	Preconfigured to know how to communicate with each other. "TCP" or "RTU over UDP"		No Knowledge
Data Conversions		Gateways will convert data from ASCII to RTU to and vice-versa to satisfy its respective "Local Transfer Protocol" as well as "WAN Encapsulation"		

Technical Support

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