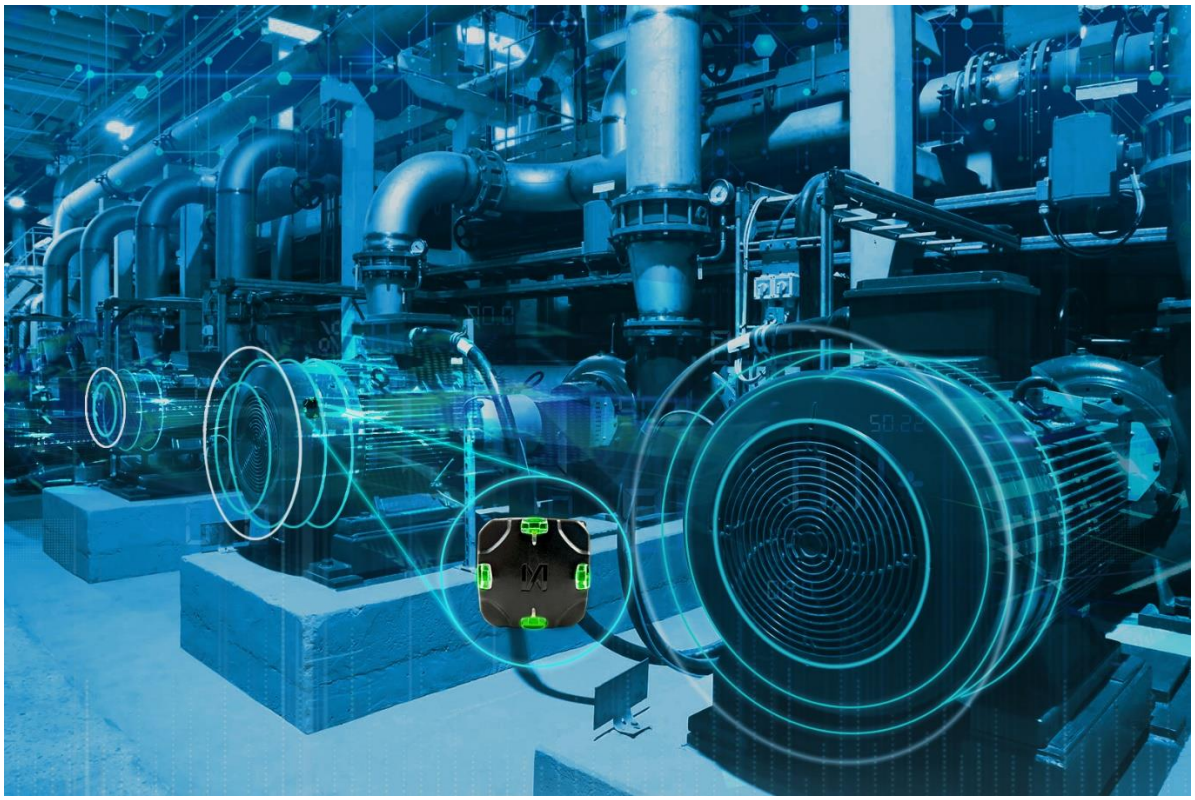
INFINITE UPTIME
POWERING RELIABILITY THROUGH INNOVATION

MODBUS Integration



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Overview

We continue to improve the application by increasing performance and adding new product features. The enhancement is the ability of interfacing vEdge device to Modbus RTU master. This document describes the vEdge Modbus RTU (Slave) specifications.

Scope

The scope of this document is limited to Modbus RTU Slave implementation in the vEdge device (hardware v1.6).

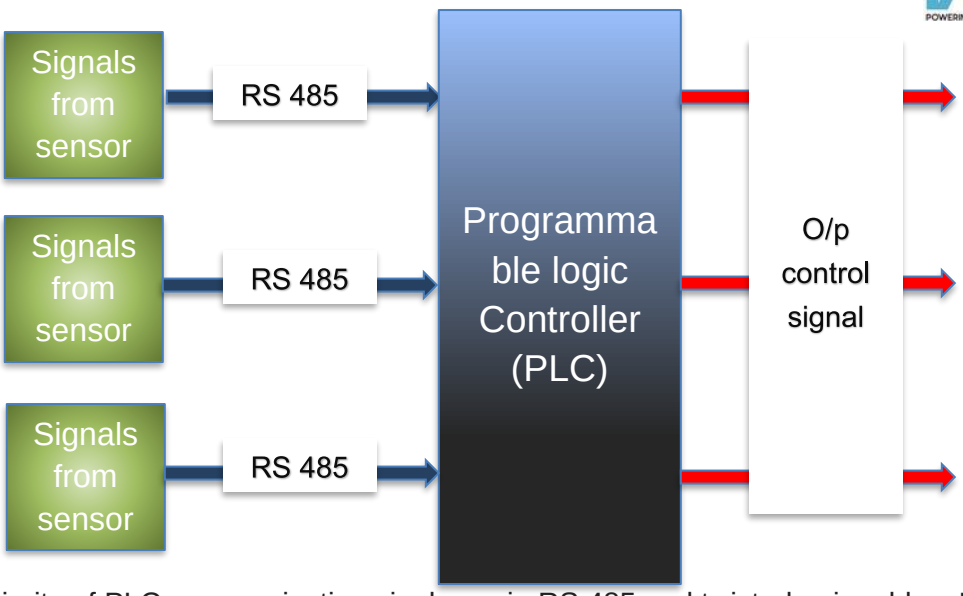
Features and functions

Features and functions are addressed by the implementation

- Modbus RTU slave functionality can interface to PLC and other Modbus master devices over RS 485.
- Streaming parameters along with the operation status of the device is available over Modbus
- The same hardware can be used with an additional RS485 driver chip.
- You can configure the RS485 / Modbus configuration over the mobile app.
  This includes the slave id and serial port configuration. Standard baud rates are supported.

Introduction

RS-485 is the common name for serial communications standard defined by the Electronics Industry Association. It is also named as EIA/TIA-485. RS-485 communicate digital information over twisted pair wire from transmitters to receivers. 31 RS-485 transceivers devices can be connected to one master (Depends on hardware Driver circuit used in the Master).
System utilize balanced outputs and differential inputs, which provide better noise immunity. This results in the ability to operate over longer distances.
These devices are commonly used to link programmable logic controllers (PLC), supervisory control and data acquisition (SCADA) systems, remote terminal units (RTU) and other equipment in custom networked systems.
The PLC receives information from connected sensors or input devices, processes the data, and triggers outputs based on pre-programmed parameters.



The vast majority of PLC communications is done via RS 485 and twisted pair cables. Most PLCs have an RS485 port and are capable of handling communications with host computers, printers, terminals, and other devices.
PLCs are used in industrial automation to increase reliability, system stability and performance, minimizing the need for human operators and the chances of human error.

Implementation

Hardware

The vEdge hardware supports an x/x RS485 driver for the physical connection to PLC. The connector is ring-type M8 with 4 pins - V+, V- (0), and RS485 (A, B). The serial port supports all the standard baud rates from 1200 to 115200 baud. Refer to the specifications table for more details.

NOTE: Ideally 31 slave devices can be connected to one master (Depends on hardware Driver circuit used in the Master). With standard RS485 design, the Modbus network can be extended up to 600 m without repeater with 9600 Baud.

Firmware

The vEdge firmware has Modbus RTU slave function code 03 functionality implemented. It supports reading of a single register as well as a block of registers.

The specifications table

Sr. No.	Parameter	Details
1	RS-485 connector	Ring connector * V+(Red), V-(Black) A (White)and B (Gray)
2	Modbus Standard	v1.01
3	Function code	03 (single holding register) Address reference: 4XXXXX

**This pin configuration is for 4 pin ring connector.*

Device port Specifications:

Sr.No.	Parameter	Supported Values	Default Value
1	Baud rates	4800, 9600, 14400, 19200, 38400, 57600, 115200	19200
2	Data bits	8	8
3	Parity	NONE, ODD, EVEN	NONE
4	Stop bit	1	1
5	Slave id	1-127	99

Modbus Register Map

Sr. No.	Parameters	Modbus Address	Data Type	Unit
1	OP_STATE Note: OP_STATE: 0 -Idle, 1-Operation, 2-Caution, 3-Warning	40001	INT	
2	TOTAL_ACCELERATION	40003	Float	(m/s2)2
3	VELOCITY_RMS_X	40005	Float	mm/s
4	VELOCITY_RMS_Y	40007	Float	mm/s
5	VELOCITY_RMS_Z	40009	Float	mm/s
6	TEMPERATURE	40011	Float	degC
7	AUDIO	40013	Float	dB
8	WIFI_RSSI	40015	Float	dB
9	TIMESTAMP	40017	Float	ms
10	TIMESTAMP	40019	Float	ms
11	ACCEL_MAIN_FREQ_X	40021	Float	Hz
12	ACCEL_MAIN_FREQ_Y	40023	Float	Hz
13	ACCEL_MAIN_FREQ_Z	40025	Float	Hz
14	DIAGNOSTIC_FEATURE_KEY_1 Note: For all diagnostic parameters, needs to configure the diagnostic fingerprint first at dashboard.	40051	Float	
15	DIAGNOSTIC_FEATURE_1	40053	Float	mm/s
16	DIAGNOSTIC_FEATURE_KEY_2	40055	Float	
17	DIAGNOSTIC_FEATURE_2	40057	Float	mm/s
18	DIAGNOSTIC_FEATURE_KEY_3	40059	Float	
19	DIAGNOSTIC_FEATURE_3	40061	Float	mm/s
20	DIAGNOSTIC_FEATURE_KEY_4	40063	Float	
21	DIAGNOSTIC_FEATURE_4	40065	Float	mm/s
22	DIAGNOSTIC_FEATURE_KEY_5	40067	Float	
23	DIAGNOSTIC_FEATURE_5	40069	Float	mm/s
24	DIAGNOSTIC_FEATURE_KEY_6	40071	Float	
25	DIAGNOSTIC_FEATURE_6	40073	Float	mm/s
26	DIAGNOSTIC_FEATURE_KEY_7	40075	Float	
27	DIAGNOSTIC_FEATURE_7	40077	Float	mm/s
28	DIAGNOSTIC_FEATURE_KEY_8	40079	Float	
29	DIAGNOSTIC_FEATURE_8	40081	Float	mm/s
30	DIAGNOSTIC_FEATURE_KEY_9	40083	Float	
31	DIAGNOSTIC_FEATURE_9	40085	Float	mm/s
32	DIAGNOSTIC_FEATURE_KEY_10	40087	Float	
33	DIAGNOSTIC_FEATURE_10	40089	Float	mm/s
34	DIAGNOSTIC_FEATURE_KEY_11	40091	Float	
35	DIAGNOSTIC_FEATURE_11	40093	Float	mm/s
36	DIAGNOSTIC_FEATURE_KEY_12	40095	Float	
37	DIAGNOSTIC_FEATURE_12	40097	Float	mm/s

38	DIAGNOSTIC_FEATURE_KEY_13	40099	Float	
39	DIAGNOSTIC_FEATURE_13	40101	Float	mm/s
40	MAC_ID_BLE	40111	HEX/INT	
		40112	HEX/INT	
		40113	HEX/INT	
41	MAC_ID_WIFI	40114	HEX/INT	
		40115	HEX/INT	
		40116	HEX/INT	
42	FIRMWARE_VERSION_1	40117	INT	
43	FIRMWARE_VERSION_2	40118	INT	
44	CURRENT_SAMPLING_RATE	40119	INT	
45	CURRENT_BLOCK_SIZE	40120	INT	
46	LOWER_CUTOFF_FREQ	40121	INT	Hz
47	HIGHER_CUTOFF_FREQ	40122	INT	Hz
48	SLAVE_ID	40151	INT	
49	DATA_BIT	40152	INT	
50	BAUDRATE	40153	Float	
51	PARITY	40155	INT	
52	START_STOP_BIT	40156	INT	
53	FLOW_CONTROL	40157	INT	
54	TOTAL_ERRORS	40158	INT	
55	TOTAL_REGISTER_SIZE	40159	INT	

Note: Baud rate of 1200 & 2400 This particular baud rate is slow. Hence it is suggested to read single registers or in small blocks of 3 - 4 registers. Larger block sizes tend to take more time and transmissions are hampered by the internal sensor functionality resulting in no response on Modbus.

Topologies

Based on the application, you may need to acquire data from other third-party modules. These modules can be connected to PLC/controller over RS485 in a multi-drop chain. The following section explains the various topologies.
RS 485 network must be implemented in a multi-drop network only. Other topologies like star topology, ring topology are not recommended. In a multi-drop network, the positions of slave devices are based on the application, panel layouts, and wiring plan. Modbus master must be present at any one end of the RS485 network (trunk).

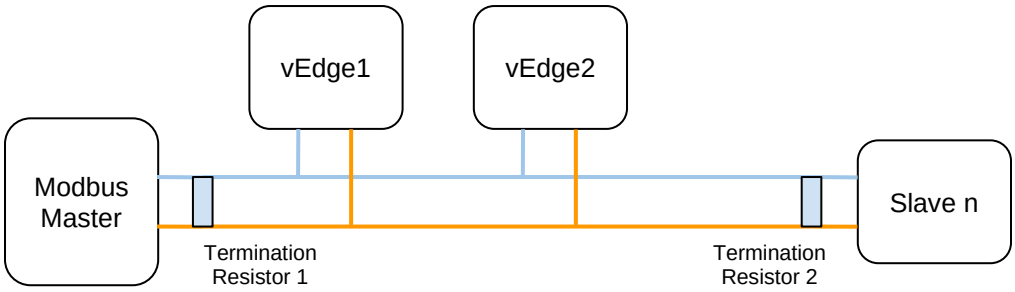
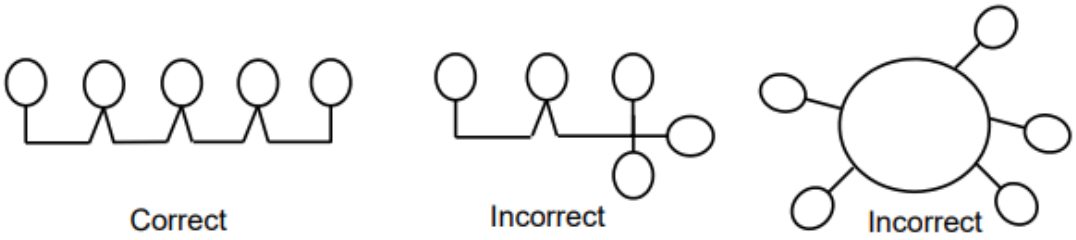


Figure 1

Infinite Uptime's vEdge devices can be placed in any location in the multi-drop chain. In RS485, the end devices must have termination resistors based on the length of the cable and the number of devices in the network. This protocol requires a master/slave architecture where only a single master is allowed per network.



The Master unit can be placed at any point on a bus, while still maintaining a bus topology.

Recommendations

For installation of the vEdge device for appropriate Modbus operation, follow these guidelines. These guidelines help in Modbus functionality.

Wiring

It is recommended to use a shielded twisted cable for routing the RS485 signal. The shield should be connected to the earth (mains earth or field earth) ONLY at one end of the cable.

There are two possible wiring options: Signal lines only - refer to the following figure 2.

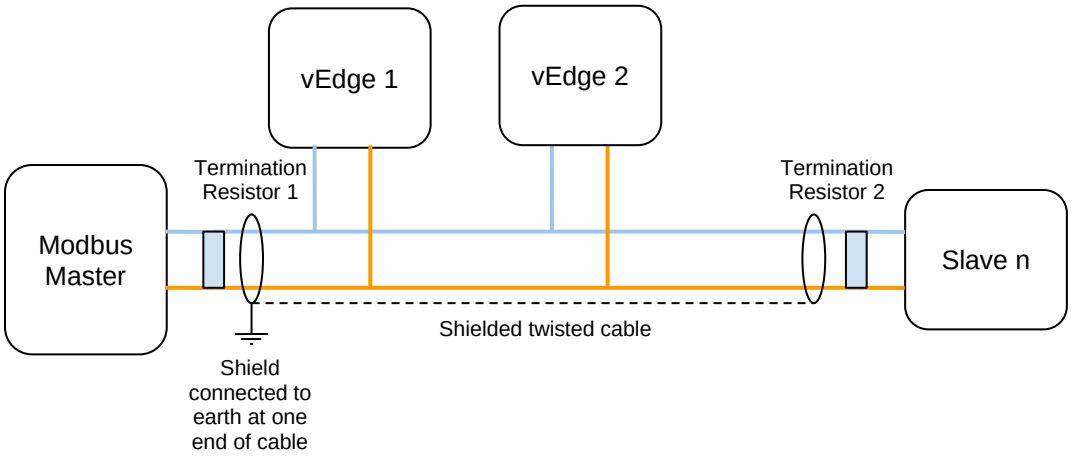


Figure 2 - Use of Shielded 2 core twisted cable (no supply ground)

Signal lines and the supply ground (power supply ground 0 Vdc) - refer to figure 3.

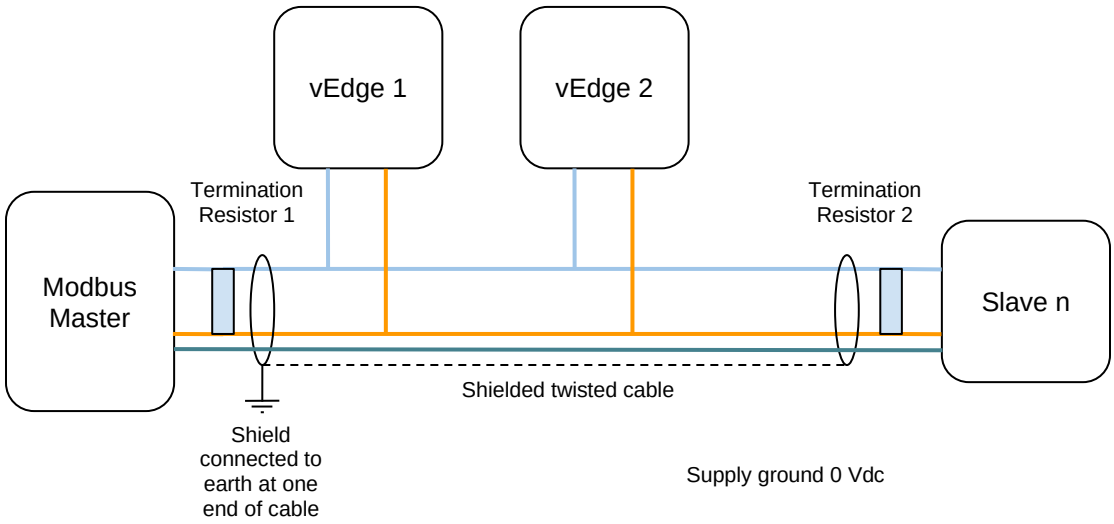


Figure 3 - Use of Shielded twisted cable with supply ground (0 Vdc)

Termination

Both ends of the RS485 must terminate with 120 ohm termination resistance. The resistance is based on the length of cable, the number of devices, and the communication parameters. For small lengths of cable (less than 5m) and low baud rates, termination resistors may not be required.

For vEdge, the termination resistance has to be mounted from outside based on its position in the multi-drop network.

Configuration

vEdge is a vibration monitoring device with a Modbus interface for the acquisition of vibration parameters. vEdge can be configured as per the need of the application. The configuration involves the setting of vibration parameters, Modbus configuration, and configuration of the host to acquire the desired parameters from vEdge.

For more details about the configuration of vibration parameters please contact IU sales.

The Modbus configuration involves the setting of slave ID and communication parameters (baud rate, etc.).

- The configuration in the host involves sampling intervals and reading of vibration parameters from vEdge. The details of these parameters, including the address map, have been given in the earlier section of this document **Modbus register map**.
- vEdge supports both single register read and multiple registers read (block read). It is recommended to read the parameter in multiple blocks rather than all in one block.
- The baud rate must be configured as high as possible to ensure proper coordination between Modbus operation and the vibration sensing and processing in vEdge devices.

Following are the recommended maximum block size (number of Modbus registers) for various combination of Fmax, LOR, and RS485 baud rates:

Fmax = 325

Baud rate	LOR 1600	LOR 800	LOR 400	LOR 200	LOR 100
Below 4800	15	35	35	35	35
4800	100	100	100	100	100
9600	100	100	100	100	100
14400	100	100	100	100	100
19200	100	100	100	100	100
Above 19200	100	100	100	100	100

Block size

Fmax = 648

Baud rate	LOR 1600	LOR 800	LOR 400	LOR 200	LOR 100
Below 4800	50	50	50	50	50
4800	100	100	100	100	100
9600	100	100	100	100	100
14400	100	100	100	100	100
19200	100	100	100	100	100
Above 19200	100	100	100	100	100

Block size

Fmax = 1300

Baud rate	LOR 1600	LOR 800	LOR 400	LOR 200	LOR 100
Below 4800	70	70	70	70	N. A.
4800	70	70	70	70	N. A.
9600	100	100	100	100	N. A.
14400	100	100	100	100	N. A.
19200	100	100	100	100	N. A.
Above 19200	100	100	100	100	N. A.

Block size