



**ATOLL SOLUTIONS**

## **Atoll MODBUS-RTU EDGE Gateway User Manual**



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#229, Second Floor, 2A Main, 5<sup>th</sup> Cross, HAL 3<sup>rd</sup> Stage, Bangalore, India -560 075.

Web: [www.AtollSolutions.com](http://www.AtollSolutions.com) Email: [info@atollsolutions.com](mailto:info@atollsolutions.com)

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## Revision History

Date	Revision	Remarks
30/10/2014	0.1	First version created
30/07/2015	1.0	Changed Enclosure related stuff and EDGE Gateway.
08/10/2016	2.0	Made changes to add CONFIX and other details.
22/12/2016	3.0	Microfit pin connectors for the AR-301R/RM & AR-201R/RM

## **Table of Contents**

1. Introduction .....	5
2. Atoll MODBUS EDGE Gateway Features: .....	5
2.1 General features: .....	5
2.2 Communication: .....	5
2.3 Navigation (Only for AT501 series) .....	6
2.4 External Interfaces .....	6
2.5 External Connectors .....	6
3. Atoll MODBUS Gateway Ordering Info .....	6
4. Product details .....	7
4.1 Dimension: .....	7
4.2 LED arrangement: .....	7
4.3 Power and I/O connector .....	8
4.4 GSM and GPS Antenna .....	10
4.5 PIN Assignment for AR/AT-301 and AR/AT-201 gateways .....	11
5. Electrical and Environmental Specification .....	12
6. Installation details .....	16
6.1 General Instructions .....	16
6.2 Wiring diagram .....	16
6.3 SIM Card placement Instructions .....	17
7. Software .....	18

8. Atoll MODBUS-RTU Starter Kit .....	18
9. Legal Notice .....	19
9.1 Customer Support: .....	19
9.2 Usage Restriction: .....	19
10. Warranty and Return Policy .....	19
10.1 Warranty Period: .....	19
10.2 Warranty Coverage: .....	19
10.3 Product Repair: .....	20
10.4 RMA (Return Merchandise Authorization) .....	20

## Introduction

This document talks about details of Atoll's GPRS/GPS based MODBUS-RTU EDGE gateway (AR/AT-501R). Atoll's AR-501R or AT-501R platform enables customers to monitor, track and control various MODBUS assets. Applications include tracking and monitoring of Modbus devices such as GENSETS, SOLAR INVERTERS, Variable Frequency Drives (VFD), Wind Farms, Motors, and Compressors etc. Its small, rugged, lightweight aluminum design makes it easy to install and use in multitude of applications. Numerous I/O's in this platform allows customers to monitor and control a range of external hardware also.

Some key application areas include:

- Industrial M2M communications
- Remote Monitoring, Control and Diagnostics
- Vehicle, Container Tracking
- Metering
- Warehousing
- Logistics and Freight Management

There are two distinct models available in this platform:

- Atoll MODBUS EDGE GATEWAY (**AR-501R with RS232 and AR-501RM with RS485**)
- Atoll MODBUS EDGE GATEWAY with Tracking feature (AT-501R with RS232 and AT-501RM with RS485)

## Atoll MODBUS EDGE Gateway Features:

### General features:

- Powerful CortexM4 Microprocessor based design with 2+MB of Flash for event storage.
- Wide voltage input range from 6 to 31 Volt
  - Ideal for automotive applications.
- Optional battery charger with 1100 mAH Battery
  - Ideal for remote monitoring
- Enclosure:
  - Light weight yet Rugged Aluminium Enclosure
- Dimension
  - 67mm x 93 mm x 27mm(without Antenna connectors)

### Communication:

- GSM/GPRS
  - DUAL-Band EGSM 900 / 1800 MHz (Quad Band option also available)
  - Embedded TCP/IP, FTP, SMTP
  - Remote AT commands
  - License free Python Engine
  - Low power: 1.5mA @ Idle
- SMA Antenna connector for GSM
  - Different options of Antennas available
- Optional Speaker and Microphone support for voice communication (Amplifier needs to be outside)

## Navigation (Only for AT501 series)

- 48 channel GPS Architecture
- Sensitivity
  - Acquisition: -147 dBm
  - Navigation: -160 dBm
  - Tracking: -163 dBm
- Positional Accuracy [CEP50]
  - Autonomous Positional Error < 2.5 m
- Accuracy
  - Speed < 0.01 m/s
  - Heading < 0.01 deg
- Time to first Fix (90% @ -130dBm)
  - Hot Start: 1 second
  - Cold Start: < 35 seconds

## External Interfaces

- Inputs/Outputs
  - 4 Digital outputs (Max 31 V)
  - 4 Digital Inputs (0-31 V)
  - 4 Analog Inputs (0-31V)
- Two Serial Ports
  - First RS232 (Tx/Rx) or RS485 (Option need to be chosen while ordering: Ax501-R for RS232 and Ax501-RM for RS485 models)
  - Second RS232 (This is debug serial port. This can be used for other interfacing also).
- One CAN interface (Optional)
- One Isolated Ignition Input (Optional)

## External Connectors

- 20 PIN (2x10) I/O socket. (43045-2000)
- 4 PIN (2x2) Power Socket (43045-0400)
- SMA Antenna Connector for GSM/GPRS
- SMA Antenna Connector for GPS (Only for AT series products)

## Atoll MODBUS Gateway Ordering Info

There are four parts available to order. They are described below:

- **AR-501R:** Atoll MODBUS EDGE gateway with RS232 MODBUS RTU port
- **AR-501RM:** Atoll MODBUS EDGE gateway with RS485 MODBUS RTU port
- **AT-501R:** Atoll MODBUS Tracker gateway with RS232 MODBUS RTU port
- **AT-501RM:** Atoll MODBUS Tracker gateway with RS485 MODUS RTU port

**Note:** There are options available to customers to go to volume production AR/AT gate ways with features they really want in their product. We have versions like AR/AT- 301Rx, AR/AT-201Rx with sub set of features. Please discuss with Atoll team for details.

## Product details

### Dimension:

Atoll' Ax501-R series of gateways are built with rugged yet lightweight Aluminum enclosure. The size is **93mmx67mmx28mm** (Length of 93mm does not include Antenna connector length)

### LED arrangement:

Figure- 1 below shows Antenna and LED arrangement AR-501Rx gateway. Note: **For AT-501Rx**, there is additional GPS antenna and 4<sup>th</sup> LED indicating GPS fix status.



Figure1: GSM/GPS Antenna connector and LED positions

Below table gives details of LED color and indications:

STATUS LED	COLOUR	INDICATION
Power Status	Green	<ul style="list-style-type: none"><li>Indicates Main power status</li><li>This POWER status LED glows continuously.</li></ul>
GSM Status	Red	<ul style="list-style-type: none"><li>Indicates GSM status</li><li>This LED blinks after an interval of 4secs continuously, once the SIM gets registered to the network</li><li>This LED will blink 10-12 times with an interval of 1 sec and give a long delay, if this repeats, SIM is not registered yet.</li></ul>
Data Transmission	Green	<ul style="list-style-type: none"><li>Indicates data transmission (SMS in/out, data transmitted to server etc.)</li><li>It blinks at fast rate when data transmission takes place.</li></ul>
GPS Indication LED (for AT501 only)	Green	<ul style="list-style-type: none"><li>Blinking LED indicates GPS Fix</li></ul>

### Power and I/O connector

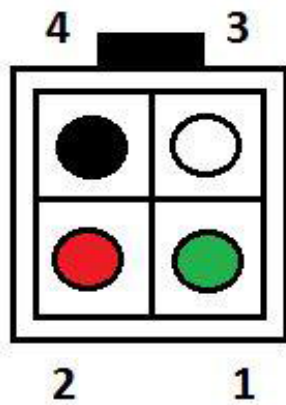
Atoll uses Micro-Fit 3.0™ Right Angle Header, 3.00mm Pitch type connector for power and Input/Outputs. Atoll also provides mating connectors with Teflon coated color coded wires as part of the gateway.

Figure:3 below shows Ax-501Rx enclosure with connector positions:



### Power connector:

Figure 4 below shows power connector numbering with wire color scheme.



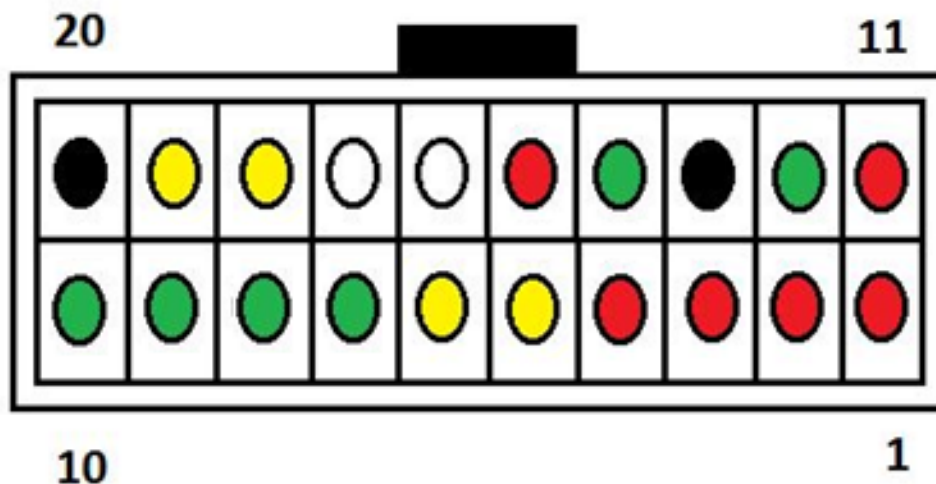
The table given below provides signal details of power connector:

4 pin Power Connector		
PIN NUMBER	WIRE COLOUR	FUNCTION
1	GREEN	IGNITION ( 6-24V)
2	RED	+VE POWER (12-24V)
3-4	BLACK	GROUND



## I/O Connector:

Figure 5 below shows I/O connector numbering with wire color scheme:



The table below shows PIN details of I/O connector:

20 pin I/O Connector			
S.NO	PIN NUMBER	WIRE COLOUR	FUNCTION
1.	1	RED	DIGITAL OUTPUT
2.	2	RED	DIGITAL OUTPUT
3.	3	RED	DIGITAL OUTPUT
4.	4	RED	DIGITAL OUTPUT
5.	5	YELLOW	DIGITAL INPUT(6-24V)
6.	6	YELLOW	DIGITAL INPUT(6-24V)
7.	18	YELLOW	DIGITAL INPUT(6-24V)
8.	19	YELLOW	DIGITAL INPUT(6-24V)
9.	11	RED	RS232 – TRANSMIT TX (for Ax-501R) RS-485 – DATA+ (for Ax-501RM)
10.	12	GREEN	RS232 – RECEIVE RX (for Ax-501R) RS-485 –DATA- (for Ax-501RM)
11.	14	GREEN	RS-232 TX DEBUG

12.	15	RED	RS-232 RX DEBUG
13.	7	GREEN	ADC INPUT (0-30V)
14.	8	GREEN	ADC INPUT (0-30V)
15.	9	GREEN	ADC INPUT (0-30V)
16.	10	GREEN	ADC INPUT (0-30V)
17.	13	BLACK	GROUND
18.	20	BLACK	GROUND
19.	16	-	NC-
20.	17	-	NC-

## GSM and GPS Antenna

Antenna connector allows transmission of radio frequency (RF) signals between the modem and an external customer-supplied antenna. Atoll provides 50Ω SMA Female coaxial jack. As an option Atoll provides WIP Antenna with 50Ω SME male coaxial jack connector.

Note: GPS Antenna connector is available only for AT-501Rx series of gateways only.

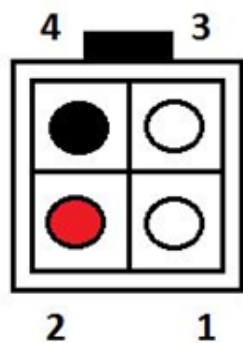
## PIN Assignment for AR/AT-301 and AR/AT-201 gateways

### 20 PIN connector:

PIN No	AR/AT-301-R	AR/AT-301RM	AR/AT-201R	AR/AT-201RM
1	Digital Output 1	Digital Output 1	Not connected (NC)	Not Connected (NC)
2	Digital Output 2	Digital Output 2	NC	NC
3& 4	NC	NC	NC	NC
5	Digital Input 1	Digital Input 1	NC	NC
6	Digital Input 2	Digital Input 2	NC	NC
7 to 10	NC	NC	NC	NC
11	RS232 Tx	RS485 Data+ (B)	RS232 Tx	RS485 Data+(B)
12	RS32 Rx	RS485 Data-(A)	RS232 Rx	RS485 Data-(A)
13	GND	GND	GND	GND
14 to 19	NC	NC	NC	NC
20	GND	GND	GND	GND

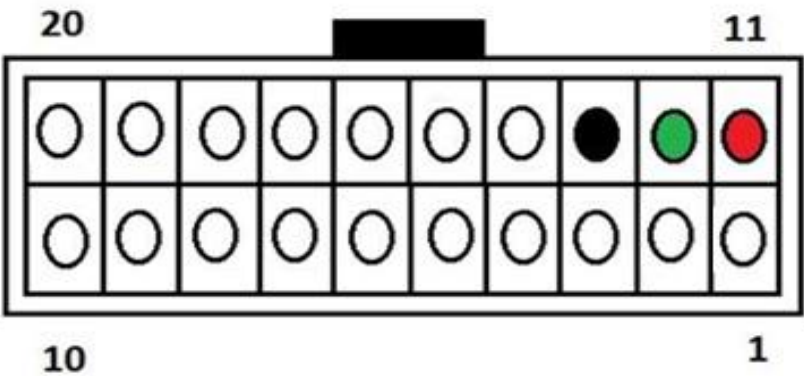
AR-201R/AR-201RM MICROFIT PIN OUT DIAGRAM

4 PIN MICRO FIT CONNECTOR



4 PIN MICRO FIT CONNECTOR			
S.NO	PIN NUMBER	WIRE COLOUR	FUNCTION
1.	1	GREEN	NA
2.	2	RED	+VE POWER (12-24V)
3.	3-4	BLACK	GROUND

20 PIN MICRO FIT CONNECTOR



## 20 PIN MICRO FIT CONNECTOR

S.NO	PIN NUMBER	WIRE COLOUR	FUNCTION
1.	1	NA	NA
2.	2	NA	NA
3.	3	NA	NA
4.	4	NA	NA
5.	5	NA	NA
6.	6	NA	NA
7.	18	NA	NA
8.	19	NA	NA
9.	11	RED	RS 232 - TRANSMIT TX(for AR201R) RS 485 – Data+(B)(for AR201RM)
10.	12	GREEN	RS 232 - RECEIVE RX(for AR201R) RS 485 – Data-(A)(for AR201RM)
11.	14	NA	NA
12.	15	NA	NA
13.	7	NA	NA
14.	8	NA	NA
15.	9	NA	NA
16.	10	NA	NA
17.	13	BLACK	GROUND
18.	20	NA	NA
19.	16	NA	NA
20.	17	NA	NA

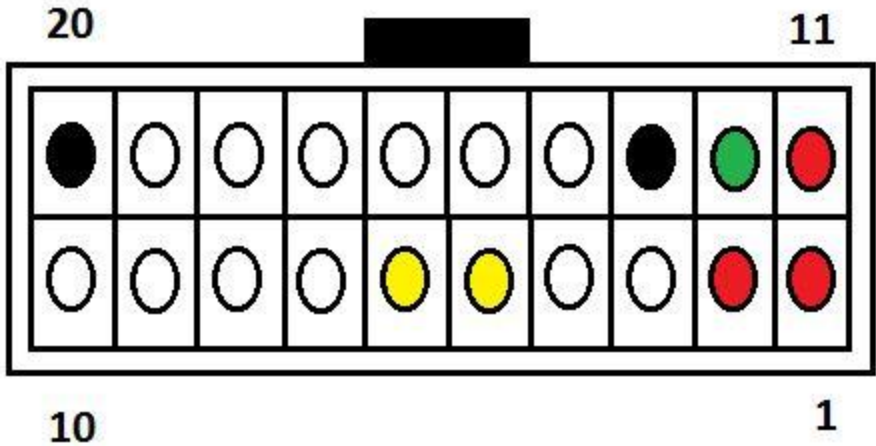
# AR-301R / AR-301RM PIN OUT DIAGRAM

## 4 PIN MICRO FIT CONNECTOR



4 PIN MICROFIT CONNECTOR			
S.NO	PIN NUMBER	WIRE COLOUR	FUNCTION
1.	2	RED	+VE POWER
2.	3-4	BLACK	GROUND

## 20 PIN MICRO FIT CONNECTOR



20 PIN MICRO FIT CONNECTOR			
S.NO	PIN NUMBER	WIRE COLOUR	FUNCTION
1.	1	RED	DIGITAL OUTPUT
2.	2	RED	DIGITAL OUTPUT
3.	5	YELLOW	DIGITAL INPUT
4.	6	YELLOW	DIGITAL INPUT
5.	11	RED	RS232 – TRANSMIT TX(for AR301R) RS 485 Data+(B) (for AR301RM)
6.	12	GREEN	RS232 – TRANSMIT TX(for AR301R) RS 485 Data-(A) (for AR301RM)
7.	13	BLACK	GROUND
8.	20	BLACK	GROUND

## Electrical and Environmental Specification

Parameter	Min	Max
Input Power Supply -DC	9-30V	9-30V
Operating Temperature	0 <sup>0</sup> C	+70 <sup>0</sup> C
Relative humidity - Operational	10%	90%

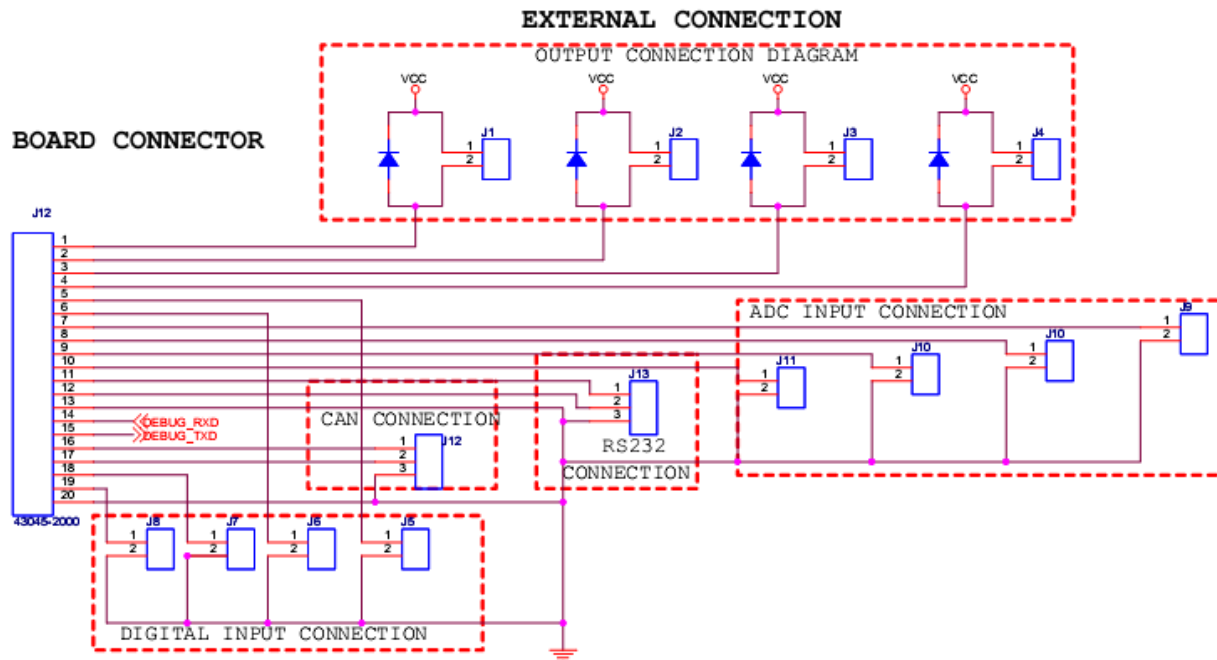
## Installation details

### General Instructions

- Make sure that there is no power applied during the installation.
- Atoll Ax-501Rx gateways must be installed indoors. If installation outside is needed, use of a waterproof housing (IP65) is needed.
- For AT-501 gateway, mount the GPS antenna with clear view of the sky. Any metal obstruction can interfere with satellite reception.
- The GPS antenna must be at least three (3) feet away from any GSM Antenna. Close proximity to GSM antenna may degrade or disrupt GPS reception.

### Wiring diagram

The below diagram provides snapshot of wiring recommendation. Please make sure that you use expert electrician in the field to do the wiring. If in doubt, please consult Atoll Solutions.

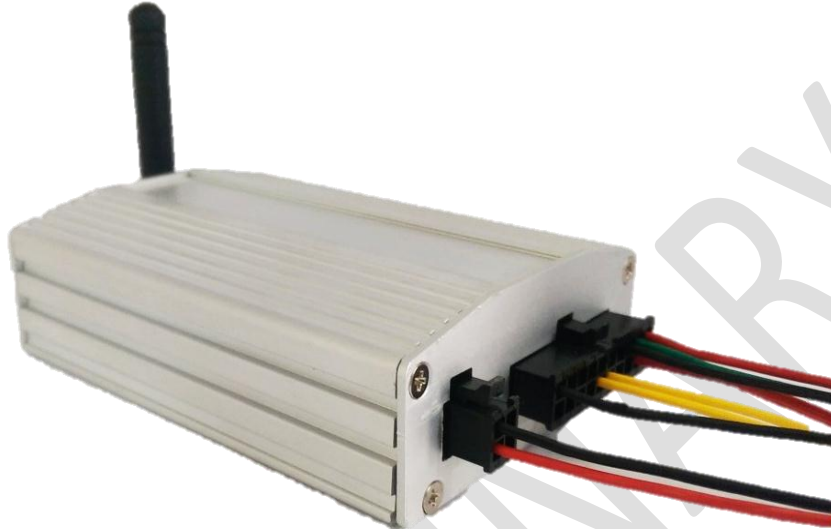




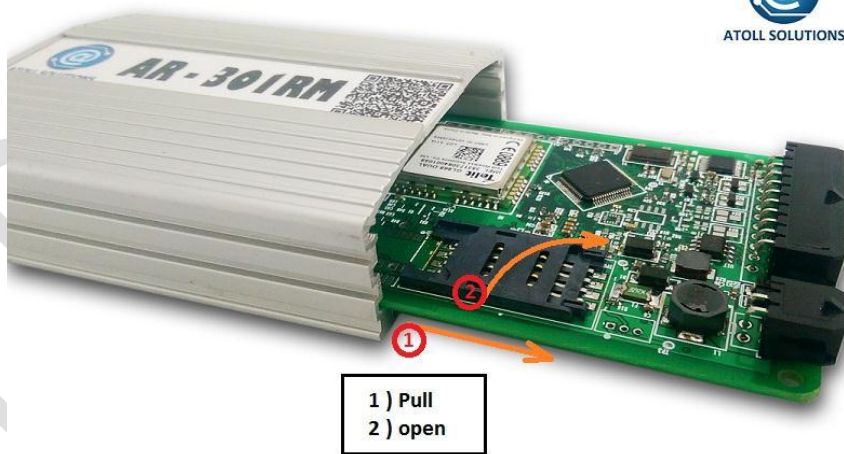
## SIM Card placement Instructions

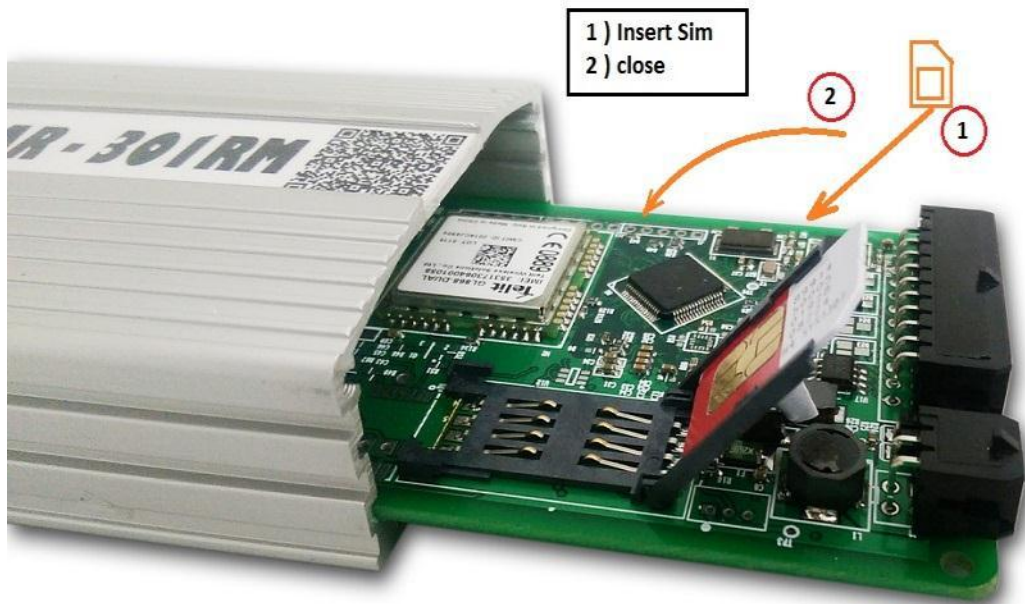
To avoid un-authorized usage of SIM, for Ax501 gateways, Atoll has placed SIM card tray inside the enclosure. Below is the procedure for customers to install and replace SIM cards.

1. Remove screws from connector side of the enclosure. Before doing this, you need to remove Antennas and connectors.



2. Place SIM card in to the SIM tray as shown in below pictures





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3. Screw the faceplate back and re-insert Antenna and connectors

## Software

Atoll provides comprehensive firmware embedded in our MODBUS-RTU EDGE gateway. Customers can configure this software to support their specific applications and cloud infrastructure.

Atoll provides easy to use, PC based configuration platform (Atoll CONFIX) for customers to configure Ax501 series gateways to interface to different MODBUS assets and other I/Os. Atoll CONFIX also allows customers to configure to send data to their private cloud (TCP/IP or HTTP). Please look at Atoll CONFIX documentation and instruction videos to learn more.

Atoll MODBUS-RTU Starter Kit

For first time customers, Atoll provides AR/AT-501 based starter kit. This is the best way to kick start customers to interface their MODBUS and other sensors to their chosen cloud. If customer has good knowledge about their application and assets, we have seen customers able to use our gateway and get data in less than 20 minutes !!!

Starter Kit contains

- One AR/AT-501Rx gateway,
- Atoll CONFIX installer and user guide for PC (MS Windows 7 or 10 support)
- One Atoll CONFIX interface board (This helps customers to connect our Gateway to Laptop for configuration)

## Legal Notice

### Customer Support:

Atoll Solutions are excited to offer our customers an easy “out of box” experience by providing board support package, software demos, user manuals and other electro mechanical documentation to get our products up and running. We also provide further electronic (email, wiki and discussion forum) support for evaluation of our modules using corresponding Atoll boards.

Customer product development support is not part of standard offering from Atoll Solutions. If customers are interested, Atoll can offer product development services around Atoll Gateways.

### Usage Restriction:

Atoll products are excellent starting point for customer’s applications development. But, selection and usage of Atoll Solutions products for a particular application is responsibility of customers. In order to minimize risks associated with customer applications, the customer must use adequate design and operating safeguards to minimize inherent or procedural hazards.

Atoll Solutions products are not intended for use in life support Solutions and appliances, nuclear Solutions or Solutions where malfunction can reasonably be expected to result in personal injury, death or severe property or environmental damage. Any use of products by the customer for such purposes are at the customer’s own risk.

## Warranty and Return Policy

### Warranty Period:

Atoll Solutions guarantees hardware products against defects in workmanship and material for a period of twelve (12) months from the date of shipment.

### Warranty Coverage:

Atoll Solutions at its sole discretion, to either repair or replace the defective hardware product at no charge. Shipment costs in both directions are the responsibility of the customer. The warranty is void if the hardware product has been altered or damaged by accident, misuse or abuse. The warranty is void if the damage is due to the shipping of the Products and other external causes like problems with electrical power, usage not in accordance with product instruction, and problems caused by use of parts and components not supplied by Atoll Solutions.

This warranty does not cover any items that are in one or more of the following categories:

- a. Software and/or device drivers,
- b. External devices,
- c. Accessories or parts added to products after the products shipped from Atoll Solutions.
- d. All Warranty terms are subject to change without prior notice.

## **Product Repair:**

- Atoll Solutions shall repair the defective products covered under this warranty that are returned to Atoll Solutions.
- Atoll Solutions shall own all parts removed from repaired products.
- Atoll Solutions will use parts made by various manufacturers in performing the repair. This can be different from the components used in the original products.
- The repaired products shall be warranted subjected to the original warranty only (If the original warranty period left was three months, the repaired product warranty will be only for three months)
- Customers shall agree that an independent third party assigned by Atoll Solutions may repair the products covered under this limited warranty.

## **RMA (Return Merchandise Authorization)**

- Customer shall enclose the completed "Atoll Solutions RMA Service Form" with the returned packages.
- Customers shall provide all the relevant information of the defect in the "Atoll Solutions RMA Service Form". This will reduce delay in defect identification and repair.
- Customers shall take responsibility to ensure that the packages of defective Products are durable enough to be resistant against further damage and deterioration during shipment. In case of damages occurred during the transportation, the repair is treated as "Out of Warranty".