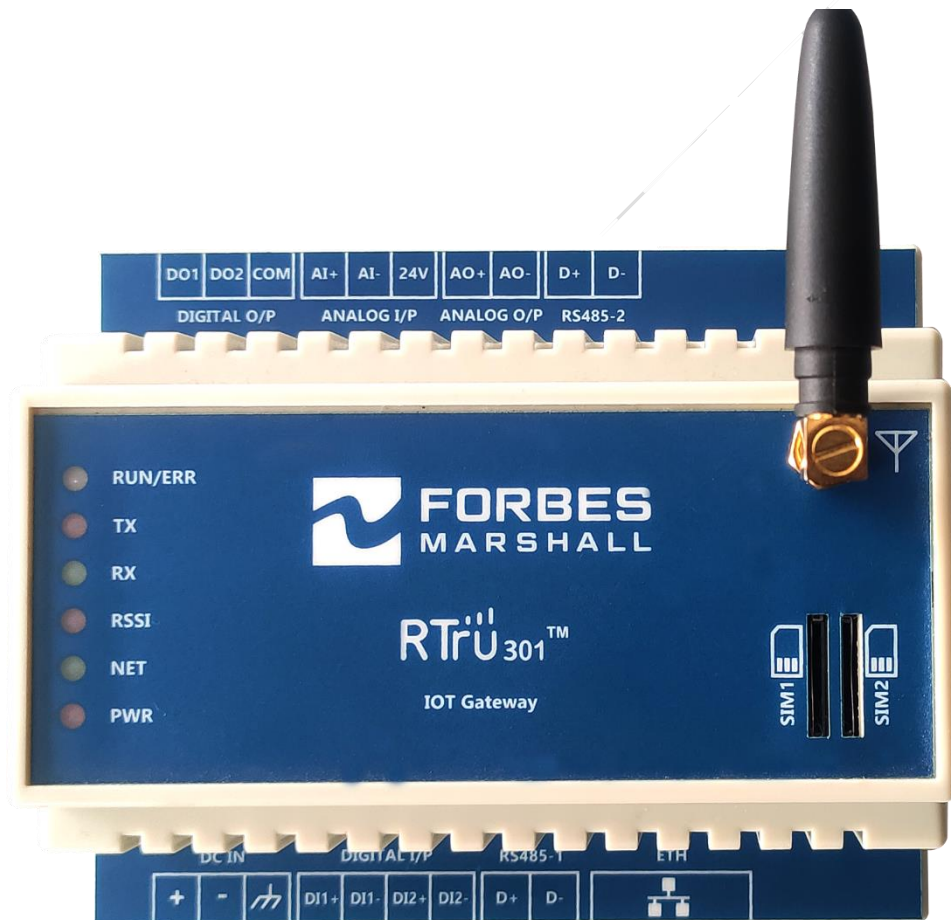


RTru301

IoT Gateway

User's Manual

Version 0.0



Forbes Marshall Pvt. Ltd.
Plot # B-85, Chakan, MIDC Phase-II
Sawardari, Tal Khed, Dist. Pune 410501. INDIA

Purpose of this document

The purpose of this document is to equip the reader with the necessary information required for the safe installation, operation and maintenance of this device, prior to its commissioning. The information within this document is aimed towards those individuals who are technically qualified and experienced in the assembly, installation and operation/ maintenance of the device.

To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact the customer support division of the Manufacturer before proceeding.

Whilst the information in this document aims to be as accurate as possible, the Manufacturer makes no warranty or representations with respect to the information herein. The proper utilization of this information is ultimately the responsibility of the Customer.

Intended use

In order to ensure optimum functionality, the device needs to be utilized solely for those purposes and in those manners as prescribed herein. The Customer is responsible for making certain that the operating conditions for the device correspond to the technical specifications defined. Furthermore, the Customer is also responsible for ensuring that any personnel that operate or maintain the device are made aware of the implications of using or operating the device in unsuitable conditions.

The Manufacturer does not assume any liability for damages resulting from the failure to use the device for its intended purpose or for damage caused by external forces or any other external factors.

Qualified Personnel

The product described in this documentation may be installed, operated and maintained only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products.

The Customer must ensure that operating personnel read and understand these instructions as well as the specified hazard statements, warning and caution notes. Furthermore, the operating personnel must be familiar with the applicable health, safety and accident prevention regulations and comply with them.

General Safety & Security

The Customer must consider the necessity of any protective clothing for its employees in the vicinity in order to provide protection against hazards of temperature (high or low), chemicals, radiation, dangers to eyes and face, noise and falling objects.

There is always a possibility of risk of injury if heavy products are handled manually. Customers are requested to analyze the risk and use appropriate handling methods by taking into consideration the task, the individual, the working environment and the load. Furthermore, it is the Customer's responsibility to ensure that general instructions for proper use of tools and safety of equipment, piping and plant construction must also be complied with and "Warning Notices" need to be put up wherever necessary.

The Customer is solely responsible to prevent unauthorized access to its plants, systems, machines and networks, its information technology infrastructure, firewalls network, internet and appropriate security measures.

Incorrect installation, operation or maintenance of the device in potentially explosive atmospheres may lead to ignition of the atmosphere and cause risk of fatal injury, death or damage to personal property. Please note that the Customer is solely liable for any hazards, damage or injury caused to its personnel or property due to the Customer's failure to comply with the safety instructions above and as established throughout the course of this manual.

Limitation of Liability and Optimum performance

For optimum performance, the Product should only be used in conjunction with components and accessories supplied by the Manufacturer. If the product accessories and components from other manufacturers are used, these must be recommended or approved by the Manufacturer.

The Manufacturer shall not be liable and the Warranty shall not apply, if the Product (i) is used in any manner that is inconsistent with the intended purpose or design of the Product as described in user manual, product literature and/or technical documentation provided by the Manufacturer of the Product; (ii) is altered in any way; (iii) is used or maintained in any manner that is inconsistent with Manufacturer's instructions or warnings ("User Instructions") provided along with the Product; (iv) subjected to any other misuse, lack of proper storage & handling, commissioning, maintenance, faulty repair, neglect, or servicing by persons other than Manufacturer's authorized person and/or failure to operate in permissible ambient conditions.

Compliance with Laws & Directives

Observe the test certification, provisions and laws applicable in your country during connection, assembly and operation.

Product Disposal

It is necessary to dispose of this product only in accordance with local regulations at the authorized, qualified collecting point specified for equipment and its parts. Kindly refer to the components mentioned in this document. Please follow all waste disposal guidelines (Management & Handling) as published by local governing authorities and local environmental laws.

IMPORTANT

**Read this User Manual thoroughly and understand its contents completely
Before installing and powering-up the Positioned.**

Nomenclature and symbols

Product

Product refers to the **RTru 301** IOT gateway.

Nomenclature

This manual contains notes and instructions, which the user must observe to ensure the safety of all user personnel and to protect the product and equipment connected to it. These are highlighted using specific symbols and appear based on the severity levels as follows.



Indicates an imminently hazardous situation which if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation which if not avoided, could result in death or serious injury.



If used with the safety alert symbol indicates a potentially hazardous situation which if not avoided may result in minor to moderate level injury.

CAUTION

If used without the safety alert symbol indicates a potentially hazardous situation which if not avoided may result in damage to property.

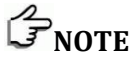
NOTICE

If used without the safety alert symbol indicates a potentially hazardous situation which if not avoided may result in undesirable state or result.



This highlights important information about the product, using the product or part of the documentation that will be beneficial to the user.

General Notes



Dear User,

This manual does not provide for every possible contingency situation that may arise during the installation, operation and maintenance of the product.

For information or situations not covered by this manual, please contact your local Forbes Marshall Service support.

The content herein is based on the latest data available at the time of going to print and is subject to change due to ongoing product improvements in the future.



The successful operation of this product depends on its proper handling, installation, operation and maintenance.

This product must be used for the sole purpose described in this manual.

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1. INTRODUCTION

Product Introduction

The **RTru301** IoT Gateway is used to monitor a device's interface data remotely and send it to a central location over the internet using a cellular communication network. The **RTru301** will read the data from the inbuilt I/O channels such as inputs. Additionally, it will read data from any device over Modbus or HART® protocols. The **RTru301** Device has an inbuilt cellular modem which helps to get connected to the internet over a GSM network. The **RTru301** Device can change the status of digital output and generates the analog output current (4 ~ 20mA) based on an SMS configuration.

Notice

The contents of this manual are subject to change without notice as a result of continuous improvements to the instrument's performance and functions.

Every effort has been made to ensure accuracy in the preparation of this manual. Should any errors or omissions come to your attention, however, please inform FORBES MARSHALL Sales office or sales representative. Under no circumstances may the contents of this manual, in part or in whole, be transcribed or copied in any form without our written permission.

Trademarks

Our product names or brand names mentioned in this manual are the trademarks or registered trademarks of Forbes Marshall (P) Ltd. (**hereafter referred to as Forbes Marshall**).

Adobe®, Acrobat®, and Postscript® are either registered trademarks or trademarks of Adobe Systems Incorporated. All other product names mentioned in this user's manual are trademarks or registered trademarks of their respective companies.

Checking the Contents of the Package

Unpack the box and check the contents before using the product. If the product is different from which you have ordered, if any parts or accessories are missing, or if the product appears to be damaged, contact your sales representative.

List of Accessories

The product is provided with the following accessories according to the model and suffix codes (see the table below). Check that none of them are missing or damaged.

Table 1 List of Accessories

No	Item name	Part number	Qty	Remarks
1	Cellular-Antenna	Part No: ET-LT2.5R-SMRA Manufacturer: ETEILY TECHNOLOGIES	1	Internal

Product Ordering Code

Table 2 Product Ordering Code

Ordering Code RTru301										
Model	Mounting		Input Type 1		Input Type 2		Output Type 1		Output Type 2	
RTru301	X		X		X				X	
	D	Din Rail	N	None	N	None	N	None	N	None
			1	AI (4 ~ 20mA)	1	Digital Input	1	AO (4 ~ 20mA)	1	Digital Output

2. SPECIFICATIONS

2.1 Technical Specification Sheet

RTru301 IoT Gateway

CPU	ARM Cortex-M4 Core, 192MHz
External Memory	4MBit(Store the data when network Fails)
RTC With Battery Backup	Yes
Temperature Sensor	Yes
Expansion Connector	Yes(SPI & I2C)
LED Indication	Run/Error indication, Serial Transmit(TX), Serial Receive(RX), Cellular Signal Strength(RSSI), Server Connectivity(NET), Power Supply Indication(PWR)
Hardware Interface	1 x ETH 10/100BaseT/TX 2 x RS485 (1 Port optional) 2 x Digital Input optional 2 x Digital Output optional 1 x Analog Input with HART® Master(Isolated) optional 1 x Analog Output (4-20mA) optional
Protocol And Interface	Modbus RTU Master and Firmware upgrade Via RS485, DHCP server, Web Server and Telnet via Ethernet Port, MQTT and NTP via cellular
Serial Communication	Baud rate : 9600/19200/38400/57600/115200, 2 Pin Plugging Screw Terminal
Ethernet	1 x RJ45(10 x 100Mbps)
Antenna Connector	1 x SMA Female
SIM Card Connector	2 x Micro SIM(3FF)
Cellular Communication	4G Module Frequency Band: GSM 900/1800 MHz LTE-TDD B34/B38/B39/B40/B41 LTE-FDD B1/B3/B5/B8
Analog Input(Optional)	Input type: Current(4-20mA) Accuracy : 0.125% Full Scale Input Impedance: 250 Ω
Analog Output(Optional)	Output type: Source(4-20mA) Accuracy : 0.25% Full Scale Load capacity: 500 Ω @24 VDC Max.
Digital Input	Input Voltage Range: 24 VDC(+/- 10%)Ext. Power Supply Contact Type: Dry Contact
Digital Output(Optional)	Output Type: Open Collector (Sink Type) Max. Current: 50mA/output
Power Supply	9 to 36VDC, <10W, 3-Pin Plugging Screw Terminal. Reverse polarity protected.
Operating Temperature Range	0°C to 55°C
Relative Humidity	0 ~ 95%RH(Non-Condensing)
Enclosure	107mm(W) X 88mm(H) x 63mm(D), ABS plastic, Din Rail Mounting, IP20, Weight (230g approx.)
Certification	EN/IEC 61326-1:2012 (Industrial)

Isolation (Withstanding voltage)

Between primary terminals* and secondary terminals**: 500 V AC for 1 minute

Between primary terminals* and grounding terminal: 500 V AC for 1 minute

Between grounding terminal and secondary terminals**: 500 V AC for 1 minute

* Primary terminals indicate power terminals

** Secondary terminals indicate RS485/Analog output/Analog input/Digital Input/Digital Output/Ethernet.

Insulation resistance: 200M Ω or more @ 500VDC between power terminals and secondary terminal

3. PRODUCT VIEW

3.1 Front View - RTru301

Figure 1 Front View - RTru301 IoT Gateway

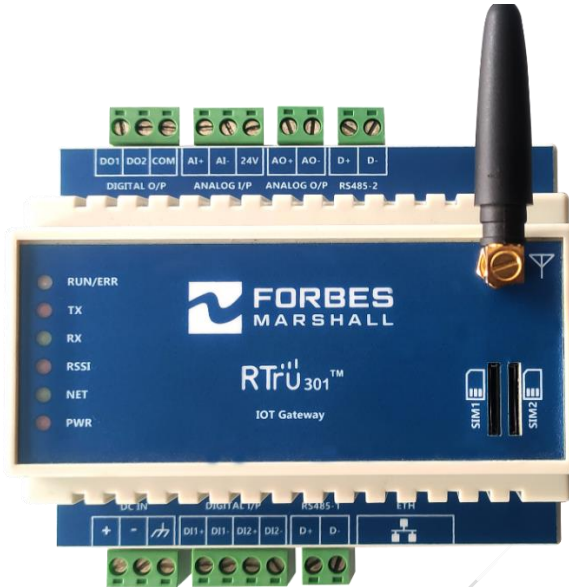


Table 3 Terminal connection Details

No.	Terminal Type	Description (Left to Right Direction)
1	MSTB Connector 3-pin for 24DC input power Part No:-MSTB-2.5/3-ST-5.08 (1757022) Manufacturer : Phoenix Contact	DCIN+ DCIN- EARTH
2	MSTB Connector 4-pin for Digital Input Channel Part No:-MSTB-2.5/4-ST-5.08 (1757035) Manufacturer : Phoenix Contact	DI1+(Positive) DI1-(Negative) DI2+(Positive) DI2-(Negative)
3	MSTB Connector 2-pin for RS485-1 Part No:-MSTB-2.5/2-ST-5.08 (1757019) Manufacturer : Phoenix Contact	D+ D-
4	RJ45 Socket for Ethernet Part No:-TCT-LPJK7002A98NL Manufacturer : Link-PP	For RJ45 based Ethernet connection for Web Server
5	MSTB Connector 3-pin for Digital Output Channel Part No:-MSTB-2.5/3-ST-5.08 (1757022) Manufacturer : Phoenix Contact	DO1 DO2 COMM
6	MSTB Connector 3-pin for Analog Input(4 ~ 20mA) Part No:-MSTB-2.5/3-ST-5.08 (1757022) Manufacturer : Phoenix Contact	AI+(Positive) AI- (Negative) 24V+
7	MSTB Connector 2-pin for Analog Output(4 ~ 20mA) Part No:-MSTB-2.5/2-ST-5.08 (1757019) Manufacturer : Phoenix Contact	AO+(Positive) AO-(Negative)
8	MSTB Connector 2-pin for RS485-2 Part No:-MSTB-2.5/2-ST-5.08 (1757019) Manufacturer : Phoenix Contact	D+ D-

4. INSTALLATION & MOUNTING DETAIL

4.1 Safety precautions during installation

WARNING

To minimize the possibility of fire or shock hazards, do not expose this instrument to rain or excessive moisture.

Do not use this instrument in areas under hazardous conditions such as excessive shock, vibration, dirt, moisture, corrosive gases or oil. The ambient temperature of the areas should not exceed the maximum rating specified.

WARNING

Ground the device. Otherwise, it may cause an electric shock or fire.

The protective conductor terminal is marked with a label on the product terminals with the following symbol:

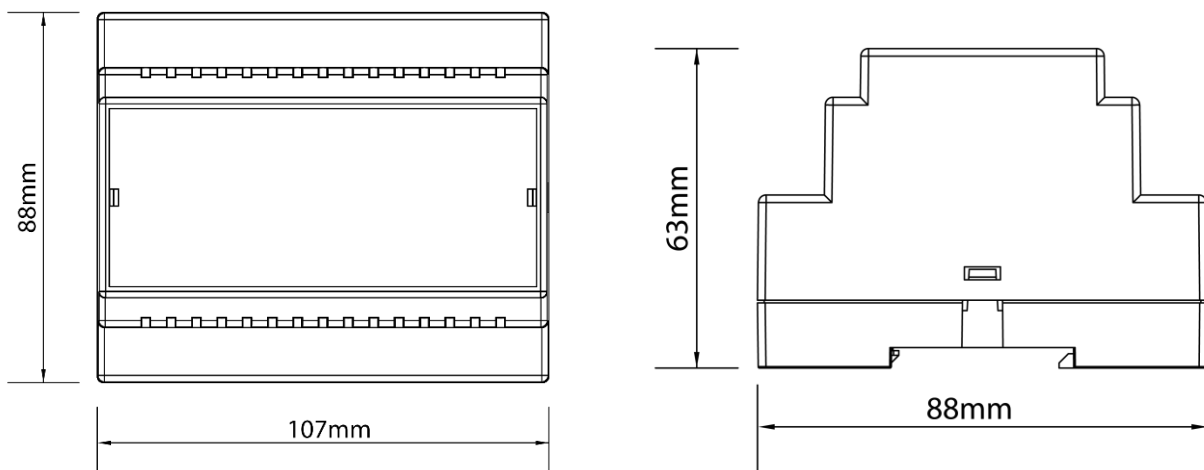


Also ensure that earthing of the premises has been done properly.

CAUTION

- Be sure all personnel involved in installation, servicing, and programming are qualified and familiar with electrical equipment and their ratings
- Do not install, store, or use it in the place with a lot of dust, corrosive and flammable gases, vibrations and shocks exceeding the allowed values, place low or high temperature outside of the installation condition, direct sunlight and near equipment generating strong radio waves or magnetic fields, It may cause accidents.
- This equipment can be damaged if incorrect power source voltage is applied. This equipment can be damaged if the power source is applied with incorrect polarity on its respective terminal. Never plug unit power supply connectors or power supply cables in the terminal while the main power source is ON.

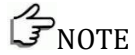
4.2 Mechanical Dimension



Dimension without plug-in connector (mm): 107(W) x 88(H) x 63(D)
Dimension with connector (mm): 107(W) x 113(H) x 80(D)

4.3 DIN Rail Mount

Installing the module on a DIN rail



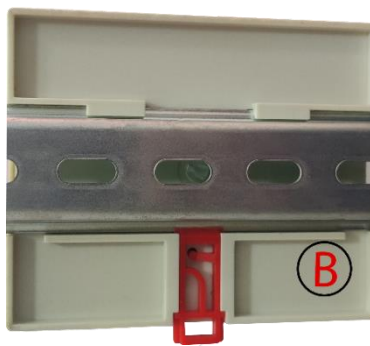
NOTE

Before Mounting **RTru301** Device on Din rail, Remove the Antenna and terminal connectors. After Fitting on Din rail, mount the Antenna connector and Terminal connectors on **RTru301** Device.

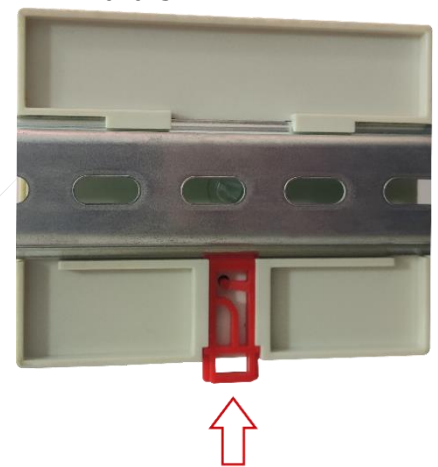
Step 1: Fit the module on the Part A of the rail



Step 2: Fit the module on the part B of the rail



Step 3: Press the red lock and load it to DIN Rail until it clicks.



Un-installing the module from a DIN rail



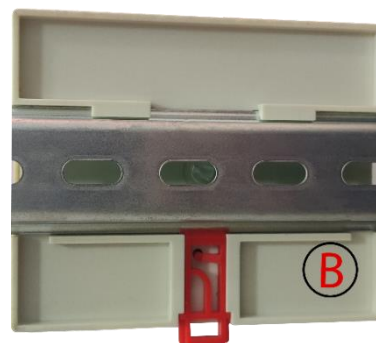
NOTE

Before Removing the **RTru301** Device from the Din rail, Remove the Antenna and terminal connectors.

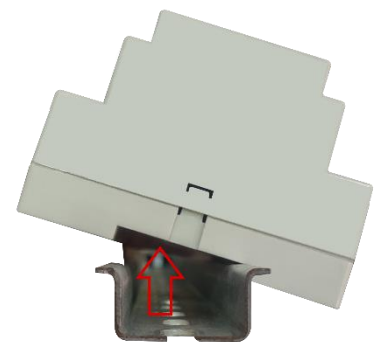
Step 1: Pull the red lock down from the DIN Rail.



Step 2: Pull the module away from part B of the rail



Step 3: Remove the Module from DIN Rail




5. TERMINAL CONNECTIONS

5.1 Sticker of RTru301 IoT Gateway

Figure 2 Front Sticker



Figure 3 Serial No Sticker

 FORBES MARSHALL	
Product Name	RTru301
Serial Number	XXXXXXXX
MAC Address	XX-XX-XX-XX-XX-XX
Supply Voltage	24VDC(18-36VDC)
Power(W)	<7W@24VDC
Modem Details	GSM/GPRS/EDGE/LTE
Freq.(MHz)	850/900/1800/2100/2600

5.2 Connecting the RTru301

WARNING

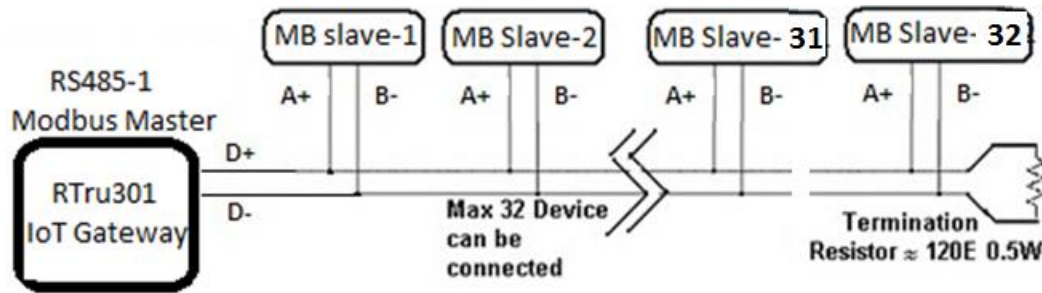
Before carrying out wiring, turn off the power and check that the cables to be connected are not live because there is a possibility of electric shock.

NOTE

1. All wiring must conform to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for voltage, current and operating temperature rating of the system.
2. Provide power from an external 24VDC power supply. **Do not place 24VDC Power supply and I/O cables close to each other.**

3. Use a repeater after each set of 32 slaves connected to the RS-485 Port 1 (Modbus Master) communication.
4. Unused terminals should not be used as jumper points as they may be internally connected, which may cause damage to the unit.
5. Supply voltage must be below maximum voltage rating specified on the label.

Figure 4 RS485 Port 1 (Modbus Master) Connection Details



6. CONFIGURATION GUIDELINES

The default configuration can be set by pressing the default switch at least 2s during power ON. When the switch is pressed the RUN (green) LED blink every 200ms. See the below table for RUN/Error LED indication

Figure 5 RUN/ERROR LED Indication

No Error	RUN (Green) LED Glow
Default switch pressed for >= 2s at Power ON	RUN(Green) LED Blink every 200ms
Configuration parameter memory not detected	Error(Red) LED will blink every 100ms
Configuration parameter file error	Error(Red) LED will blink every 500ms
Data logging memory not detected	Error(Red) LED will blink every 1500ms
RTC not detected	Error(Red) LED will blink every 3000ms
Selected SIM card Not Detected	Error(Red) LED Glow

6.1 Parameter Configuration

RTru301 IoT Gateway device offers a facility for users to configure parameters of the device using a web server. Web server pages can be obtained in PC or system by sending an HTTP request (<http://192.168.100.110>) to device on device IP address by a web browser such as Google Chrome®. The default device IP address is 192.168.100.110. After getting a successful response from the device, the webpage of the device is seen as shown in the image below. Ensure that the PC or system is in the same IP address network and range.

The default Username and Password for web server login are:

Username: Admin

Password: Admin

The Pages in web server are:

DEVICE INFO
GENERAL
COMMUNICATION
MQTT
INPUT-OUTPUT
HART®
MODBUS
SMS
CALIBRATION

Device Info Page

Figure 6 Webpage – Device info

FORBES MARSHALL

DEVICE INFO GENERAL COMMUNICATION MQTT INPUT-OUTPUT HART MODBUS SMS CALIBRATION

System Information

Software Version: 1.5 Hardware Version: 2.0

IMEI No: 860936050053176 SIM No: 404980296692596

MAC Address: 4-91-62-f9-55-8a

Parameters Save/Load

Load Para. From Local Disk Save Para. to Local Disk

The device info Configuration Page provides the information of **RTru301** devices such as current Hardware & software version, cellular modem IMEI No and SIM card no.

Option	Description
Software Version	Show the current software version of the RTru301 Device
Hardware Version	Show the Current Hardware Version of the RTru301 Device
IMEI No	Show the IMEI Number of Cellular modem of the RTru301 device
SIM No	Show the IMSI number of the SIM Which is use for the cellular communication
MAC Address	Show the MAC address of the RTru301 Device

'Load Para. From Local Disk' Tab:

This Tab is used for loading the Parameters configuration file from the local disk by providing the path of the config. file in the local system or PC.

'Save Para. To Local Disk' Tab:

This Tab is used to download the current parameter configuration in a file in the local system or PC.

General Page

The General Configuration Page is used to configure the web server login username and password, NTP server configuration, SIM section and data logging memory option. Seen as show in the image below

Figure 7 Webpage - General

FORBES MARSHALL

DEVICE INFO. **GENERAL** COMMUNICATION MQTT INPUT-OUTPUT HART MODBUS SMS CALIBRATION

General

Admin Username: Admin Password: Device Id:

Device Description: NTP Server 1 Url: NTP Port1:

NTP Server 2 Url: NTP Port 2: Time Zone:

SIM Selection: Data Logging:

Option	Description	Range	Default
Admin Username	Specifies the username for Web server Login. It is required only for web server login.	Text	Admin
Admin Password	Specifies the password for Web Server Login. It is required only for web server login.	Text	Admin
Device ID	Specifies the device ID. It is used for Sending SMS with Device ID and Periodic Data Frame Sending to MQTT Server with device ID.	Text	"FM-DEV-001"
Device Description	Specifies the device Description. It is required only for identification of the device	Text	"FM-DEMO-DEVICE"
NTP server 1 URL	Specifies the NTP server URL. It is used for synchronization of time of the device	Text	"2.pool.ntp.org"
NTP Server Port 1	Specifies the NTP Port. It is used for synchronization of time of the device. The NTP Server Port 1. Range: 1 ~ 65535	Number	123
NTP server 2 URL	Specifies the NTP server URL. It is used for to synchronize the time of the device	Text	"2.pool.ntp.org"
NTP Server Port 2	Specifies the NTP Port. It is used to synchronize the time of the device. Range: 1 ~ 65535	Number	123
Time Zone	It is used to set the time of a device based on IST or UTC.	IST/UTC	IST
SIM Selection	Select the SIM card Option for Cellular communication.	Disable/SIM1/SIM2/Both	Disable
Data Logging	Enable or disable the data frame logging in case cellular network failure occurs. The device sends the logged data when the network is restored.	On/Off	YES



NOTE

-Logged data will be erased when the Data Logging option is disabled.

Communication Page

The Communication Page is used to configure the Ethernet parameter, SIM card parameter, serial configuration and selection of Input and Output data sent to the MQTT server.

Figure 8 Webpage – Communication

FORBES MARSHALL

DEVICE INFO. GENERAL **COMMUNICATION** MQTT INPUT-OUTPUT HART MODBUS SMS CALIBRATION

Ethernet

DHCP: OFF IP Address: 192.168.100.110 Subnet Mask: 255.255.252.0

Gateway: 192.168.100.254

SIM 1

SIM Pin: 0 Username: 0 Password: 0

APN: airtelgprs.com

SIM 2

SIM Pin: 0 Username: 0 Password: 0

APN: airtelgprs.com

Modbus Master

Baud rate: 9600 Parity: none Data Bits: 8

Stop Bits: 1 Poll Time (s): 3 Timeout (ms): 1000

MQTT Periodic Data to Server

☒ Send AI data ☒ Send DI data ☒ Send AO data

☒ Send DO data ☒ Send HART data ☒ Send MODBUS data

☐ Send Diagnostic data

Save Reboot


Option	Parameter Description	Range	Default
DHCP	Select the Device IP address configuration	DHCP/ Static	Static
IP address	Specifies the device IP address if selected as static mode	Text	192.168.100.110
Subnet Mask	Specifies the device subnet mask address	Text	255.255.255.0
Gateway	Specifies the device Gateway address.	Text	192.168.100.254
SIM PIN1	Specifies the PIN for your cellular network SIM card 1. Use only when the SIM card is Locked.	Text	NULL
SIM1 Username	Specifies the user name for your cellular network account for SIM card 1. Use only when required by your cellular service provider.	Text	NULL
SIM1 Password	Specifies the password for your cellular network account for SIM card 1. Use only when required by your cellular service provider.	Text	NULL
SIM1 APN	Identifies the access point name of the SIM card 1 that connects your device to the correct cellular network	Text	Internet
SIM PIN2	Specifies the PIN for your cellular network SIM card 2. Use only when the SIM card is Locked.	Text	NULL
SIM2 Username	Specifies the user name for your cellular network account for SIM card 2. Use only when required by your cellular service provider.	Text	NULL
SIM2 Password	Specifies the password for your cellular network account for SIM card 2. Use only when required by your cellular service provider.	Text	NULL
SIM2 APN	Identifies the access point name of the SIM card 2 that connects your device to the correct cellular network	Text	Internet
Modbus Baud rate	Specifies or set the baud rate for Modbus communication on RS485 Port 1	9600/ 19200/ 38400/ 57600/ 115200	9600
Modbus Parity	Specifies or sets the parity for Modbus communication on RS485 Port 1	None/ Even/ Odd	8
Modbus Data Bits	Specifies or sets the number of data bits for Modbus communication on RS485 Port 1	7/8 Bit	1
Modbus Stop Bits	Specifies or sets the stop bits for Modbus communication on RS485 Port 1	1/2 Bit	None
Modbus Poll Time(sec)	Specifies or sets the polling time for Modbus communication on RS485 Port 1. This Time is used to decide when the next Modbus master query is sent from the device to the Modbus slave device. Range: 1 ~ 100s	Number	3
Modbus Timeout(msec)	Specifies or sets response timeout for Modbus communication on RS485 Port 1. This time	Number	Enable

	decides the waiting period of Modbus slave response. Range 10 ~ 10000ms		
Send A/I Data	Send measured analog input data to the MQTT server periodically.	On/Off	Enable
Send D/I Data	Send measured digital input data to the MQTT server periodically.	On/Off	Enable
Send A/O Data	Send measured analog output data to the MQTT server periodically.	On/Off	Enable
Send D/O Data	Send measured digital output data to the MQTT server periodically.	On/Off	Enable
Send HART® Data	Send HART® master data can be sent to the MQTT server.	On/Off	Enable
Send Modbus Data	Send Modbus master data to the MQTT server.	On/Off	Enable
Send Diagnostic Data	Send diagnostic data to the MQTT server.	On/Off	Disable

MQTT Page

The MQTT configuration web page is used to configure the MQTT server Parameter.

Figure 9 Webpage - MQTT



DEVICE INFO. GENERAL COMMUNICATION **MQTT** INPUT-OUTPUT HART MODBUS SMS CALIBRATION

Server Settings

Server Url:

test.mosquitto.org

Server Port:

1883

Client Id:

FM/12345

Username:

0

Password:

*

Keep Alive(s):

120

☐ Clean Session

Will Settings

☐ Will Flag

Will Topic:

TEST/WILL

Will Message:

Test Will Message

Will Qos:

0

☐ Will-retain

Will Qos:

0

☐ Will-retain

Topic Settings

Periodic Data Topic :

FM/PERIODIC

Alert Topic:

FM/ALERT

Qos:

0

Diagnostic topic:

TEST/DIAG

Subscribe Topic:

FM/SUB

Subscribe Topic Max Qos :

0

Periodic Data Publish Time (minutes) :

1

Diagnostic Data Publish Time (minutes):

60

Certificate Settings

☐ Server Authentication

☐ Client Authentication

Server Certificate:

Client Certificate:

Client Key:

Save Certificate

Save

Reboot

Option	Description	Range	Default
MQTT URL	Specifies the URL for MQTT server	Text	"test.mosquitto.org"
MQTT Port	Specifies the MQTT Port. Range: 1 ~ 65535	Number	1883
Client ID	Specifies the Client ID for MQTT server	Text	"FM DEMO CLIENT"
Username	Specifies the username for MQTT server which is required for MQTT server login.	Text	NULL
Password	Specifies the password for MQTT server which is required for MQTT server login.	Text	NULL
Keep alive(s)	Set the delay with which the Keep Alive message is sent on MQTT is defined. Range: 1 ~ 3600s	Number	120s
Clean session	If the field "Clean Session" is checked, the last MQTT messages are deleted by the Server and the Client in case of missing ACK. If unchecked, then Server and the Client hold the last MQTT messages. In case of incorrect disconnection or missing ACK, they try to send them again since all the ACK messages are exchanged correctly (valid only for QoS 1 and QoS 2).	On/Off	Disable
Will Flag	If the field "Will Flag" is checked, the device will publish the Will topic at the connection to the Server. With this feature, in case of incorrect disconnection, the Server will publish this topic to all the MQTT Clients that are subscribed to it.	On/Off	Disable
Will Topic	Specify the will topic. It is used for the Will message.	Text	"TEST/WILL"
Will Message	Specify the payload of the Will message.	Text	"Test Will Message"
Will QoS	Set the QoS type for which the Will message is defined.	Number	0[ZERO]
Will Retain	In the field "Retained Will" the device will send the Will message with Retain flag enabled. In this way, the server will hold the last Will message.	On/Off	Disable
Periodic Data Topic	Specify the Periodic Published Topic for the periodic data sent to the MQTT server.	Text	"TEST/PERIODC"
Alert Topic	Specify the Alert Topic for the Alert data sent to the MQTT server.	Text	"TEST/ALERT"
QoS	In the field "QoS" the QoS type for Periodically data sent is defined.	Number	0
Diagnostic Topic	Specify the Diagnostic Topic for the Diagnostic data sent to the MQTT server.	Text	"TEST/DIAG"
Subscribe Topic	Specify the Subscribe Topic for the Subscribe data sent to the MQTT server.	Text	"TEST/SUB"
Subscribe Topic Max. QoS	Set the QoS type Subscribe Topic.	Number	
Periodic Data Publish Time (min)	Set the periodic publish data interval for periodic publish data sent to the MQTT server. Value range 1 to 1440min	Number	1 (min)

Diagnostic Data Publish Time (min)	Set the interval for diagnostic data sent to the MQTT server. Value range 1 ~ 1440min	Number	60(min)
Server Authentication	Enable or Disable the server authentication. It is used for secure server login.	Text	Disable
Client authentication	Enable or disable the Client authentication.	Text	Disable
Server Certificate	Specify the server certificate. It Applicable when Client authentication enable	Text	NULL
Client Certificate	Specify the client certificate. It Applicable when Client authentication enable	Text	NULL
Client Key	Specify the client key. It Applicable when Client authentication enable	Text	NULL

'Save Certificate' Tab:

This Tab is used to save the server certificate, client certificate and Client key



NOTE

If the MQTT server does not receive the any payload from the **RTru301** device within 1.5 times of the Keep Alive time period, MQTT server disconnects the **RTru301** device.

Input-Output Page

This Input-Output Configuration is used to configure the parameters of analog input, analog output, digital input and digital output.

Figure 10 Webpage – INPUT-OUTPUT

DEVICE INFO. GENERAL COMMUNICATION MQTT **INPUT-OUTPUT** HART MODBUS SMS CALIBRATION

Analog Input

No	Enable	Zero	Span	Hysteresis	High Threshold	Low Threshold	SMS Alarm	Server Alarm	SMS Alarm Group	SMS Description
CH-1 (4 to 20 mA)	<input checked="" type="checkbox"/>	4000	20000	2000	15000	5000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	12345	AI-CH-1
CH-2 (Temp.)	<input checked="" type="checkbox"/>	NA	NA	4	45	10	<input type="checkbox"/>	<input type="checkbox"/>	12345	AI-CH-2

Digital Input

No	Enable	Mode	Filter Time (millisec)	Count From Last	Step Alarm counts	SMS Alarm	Server Alarm	SMS Alarm Group	SMS Description
CH-1	<input checked="" type="checkbox"/>	On/Off	0	<input checked="" type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	12345	DI-CH-1
CH-2	<input checked="" type="checkbox"/>	On/Off	0	<input checked="" type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	12345	DI-CH-2

Analog Output

No	Enable	Zero	Span	Retain Last Value
CH-1 (4 to 20 mA)	<input checked="" type="checkbox"/>	4000	20000	<input checked="" type="checkbox"/>

Digital Output

No	Enable	Mode	Impulse Time (millisec)	Retain Last Value
CH-1	<input checked="" type="checkbox"/>	On/Off	1000	<input checked="" type="checkbox"/>
CH-2	<input checked="" type="checkbox"/>	On/Off	1000	<input checked="" type="checkbox"/>

Save Reboot

ANALOG INPUT

The Table provide the configuration of analog input channel 1(4-20mA) and channel 2(internal temperature measurement)

Option	Description	Range	Default
Interface Enable	Enables or disables the analog input source.	On/Off	Enable
Zero	Specifies the zero value for the analog input channel 1. Range: -1999 ~ +20000	Number	4000
Span	Specifies the span value for the analog input channel 1. Range: 0 ~ 20000	Number	20000
Hysteresis	Specifies the input value to keep an alarm ON or OFF during High and Low alarm states	Number	2000
High Threshold	Specifies the input value that generates a high alarm event when High Alarm is ON. Range: 0 ~ 100	Number	15000
Low Threshold	Specifies the input value that generates a low alarm event when Low Alarm has occurred. Range: 0 ~ 100	Number	2000
SMS alarm	Enables or disables the SMS alarm when an alarm occurs	On/Off	Disable
Server Alarm	Enables or disables the server alarm when an alarm occurs	On/Off	Disable
SMS alarm Group	Specify a group for the SMS alarm received. for Ex.123 means the alarm SMS send to Group No 1, 2 and 3 which are specified in SMS web page	Text	12345
SMS Description	Specifies the SMS description for the SMS	Text	AI-CH-1

NOTE

-The value of Low or High Threshold is in between the value of Zero and Span in analog input channel 1

-The rang of Low or High Threshold for analog input channel 2 is 0 ~ 100

DIGITAL INPUT

The table provides the configuration of the digital input channel. The digital input channel can be worked as On/Off or Counter Mode.

Option	Description	Range	Default
Interface Enable	Enables or disables the digital input source.	On/Off	Enable
Mode	Set the digital input mode	On/Off Counter	On/Off
Filter Time(ms)	The Filter Time is the length of time that a newly changed input to the last state before it is accepted as a valid input. It is used only in ON/OFF mode. Range: 0 ~ 10000 ms. Applicable in On/Off mode only	Number	0ms
Count From Last	Enables or disables the digital input count from the last stored value	On/Off	Enable

Step alarm count	Specifies the input value for the counter alarm. Range: 0 ~ 65535	Number	0
SMS alarm	Enables or disables the SMS alarm when an alarm occur	On/Off	Disable
Server Alarm	Enables or disables the Server alarm when an alarm occur	On/Off	Disable
SMS alarm Group	Specify a group for the SMS alarm received. for Ex.123 means the alarm SMS send to Group No 1, 2 and 3 which are specified in SMS web page	Text	12345
SMS Description	Specifies the SMS description for the SMS	Text	DI-CH-1 for CH-1 and DI-CH-2 for CH-2

NOTE

-The last value of digital input as counter will be erased when the last count option in digital input configuration is disabled. In this case the digital input counter starts from zero.

ANALOG OUTPUT

The Table provides the configuration of the Analog output. The analog outputs can be generated based on last stored value on device power ON/OFF

Option	Description	Range	Default
Interface Enable	Enables or disables the Analog output	On/Off	Enable
Zero	Specifies the zero value for the analog output channel. It is fixed at 4000	Number	4000 [Fixed Value]
Span	Specifies the span value for the analog output channel it is fixed at 20000	Number	20000 [Fixed Value]
Retained Last Value	Enables or disables the analog output generated based on last stored value	On/Off	Enable

NOTE

The last value of analog output will be erased when the last retained option in analog output configuration is disabled (analog output value is set to zero)

DIGITAL OUTPUT

The Table provides the configuration of the digital output channel. The Digital output can be worked as on/off or impulse mode. In Impulse mode it is in sink mode for a defined time interval.

Option	Description	Range	Default
Interface Enable	Enables or disables the Digital output source.	On/Off	Enable
Mode	Set the Digital output mode	On/Off Impulse	On
Impulse Time	Specifies the Impulse Time. Range: 1 to 10000ms	Number	1000(ms)
Retained Last Value	Enables or disables the digital output generated based on last stored value	Number	Enable


NOTE

The last value of digital output will be erased when the last retained option in digital output configuration is disabled. In this case the digital output is set to the OFF state.

HART® Page

The HART® configuration parameter can be set in the HART® configuration page.

Figure 11 Webpage – HART®



DEVICE INFO. GENERAL COMMUNICATION MQTT INPUT-OUTPUT **HART** MODBUS SMS CALIBRATION

No of Client	Query Time(sec)	Query Timeout (msec)	Query Attempts
<input type="text" value="1"/>	<input type="text" value="5"/>	<input type="text" value="1000"/>	<input type="text" value="0"/>

No	Polling ID	Manufacturer ID	Device Type	Client ID	Pub. Interval(M)	Pub. Topic	Change ID
1	<input type="text" value="1"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	FM/HTDEV1	Change
2	<input type="text" value="2"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV2	Change
3	<input type="text" value="3"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV3	Change
4	<input type="text" value="4"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV4	Change
5	<input type="text" value="5"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV5	Change
6	<input type="text" value="6"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV6	Change
7	<input type="text" value="7"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV7	Change
8	<input type="text" value="8"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV8	Change
9	<input type="text" value="9"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV9	Change
10	<input type="text" value="10"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV10	Change
11	<input type="text" value="11"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV11	Change
12	<input type="text" value="12"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV12	Change
13	<input type="text" value="13"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV13	Change
14	<input type="text" value="14"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV14	Change
15	<input type="text" value="15"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>	TEST/HTDEV15	Change

Get Device Data

Save

Reboot

Option	Description	Range	Default
No of Client	Specifies the No of HART® slave device or HART® Request Query for the HART® communication. Range: 0 ~ 15	Number	0[ZERO]
Query Time(sec)	Specifies or sets the Query Time for HART® communication. This Time is used to decide when the next HART® query is sent from the device to the HART® slave device. Range: 1 ~ 100s	Number	5
Query Responses Time out(ms)	Specifies or sets Query Response Timeout for HART® communication. This time decides the waiting period of HART® slave response. Range: 10 ~ 10000ms	Number	1000

Query Attempts	Specifies or sets number of Query retry counts for HART®	Number	0[ZERO]
Polling ID	Specifies HART® slave device ID for HART® communication. Range: 0 ~ 15	Number	1 ~ 15
Manufacturer's ID	Shows the manufacturer's ID of the HART® Device. This is a 'read only' parameter.	Text	
Device Type	Shows the device type of HART® Device. This is a 'read only' parameter.	Text	
Client ID	Shows the Client ID of HART® Device. This is a 'read only' parameter.	Text	
Publishing Interval (min)	Specifies interval for HART® data published on the MQTT server with HART® data topic. Range: 1 ~ 1440min	Number	1
Publish Topic	Specifies the publish topic for HART® data published on the MQTT server.	Text	"TEST/HTDEV1"
Change ID	This tab is used to change the HART® Polling ID		


'Get Device Data' Tab:

This Tab is used to Read the Manufacturer's ID, Device Type and Client ID of the HART® Device which are configured.

Modbus Page

The Modbus master configuration can be set in the Modbus configuration page.

Figure 12 Webpage – Modbus



DEVICE INFO. GENERAL COMMUNICATION MQTT INPUT-OUTPUT HART **MODBUS** SMS CALIBRATION

No of Client

No	Slave ID	Function Code	Reg. Start Address	Reg. Length	Data Format	Pub. Interval(M)	Sub.	Pub. Topic
1	<input type="text" value="1"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	FM/MBDEV1
2	<input type="text" value="2"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV2
3	<input type="text" value="3"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV3
4	<input type="text" value="4"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV4
5	<input type="text" value="5"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV5
6	<input type="text" value="6"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV6
7	<input type="text" value="7"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV7
8	<input type="text" value="8"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV8
9	<input type="text" value="9"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV9
10	<input type="text" value="10"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV10
11	<input type="text" value="11"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV11
12	<input type="text" value="12"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV12
13	<input type="text" value="13"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV13
14	<input type="text" value="14"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV14
15	<input type="text" value="15"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV15
16	<input type="text" value="16"/>	<input type="text" value="3"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="Uint_16"/>	<input type="text" value="1"/>	<input type="checkbox"/>	TEST/MBDEV16

Save Reboot

Option	Description	Range	Default
No of Client	Specifies the number of Modbus slave devices or Modbus queries for Modbus communication. Range: 0 ~ 16	Number	0
Slave ID	Specifies Modbus slave device ID for Modbus communication. Range: 1 ~ 247	Number	1 ~ 16
Function Code	Specifies the Function code for Modbus communication	Number	3
Reg. Start Address	Specifies start address of Modbus query for Modbus communication	Number	1
Register Length	Specifies the read Modbus register length. Range: 1 ~ 64 for Uint (unsigned integer) 16.	Number	1
Data Format	Set the data format for the Modbus register read	Bool/ int16/ Uint16/ int32/ Uint32/ Float/ Swap Float/ Double/ Swap Double	UINT_16
Publishing interval (min)	Specifies Interval for Modbus data published on MQTT server with Modbus topic. Range: 1 ~ 1440min	Number	1(min)
Subscribe Topic	Specifies subscribe topics for Modbus query received from the MQTT server.	Text	Disable
Publish Topic	Specifies the publish topic for Modbus data published on the MQTT server.	Text	"TEST/MBDEV1"

SMS Page

The SMS page is used to specify the user mobile number for receiving alert SMS messages.

Figure 13 Webpage – SMS

The screenshot displays the 'SMS' configuration page within the Forbes Marshall web interface. The top navigation bar includes tabs for 'DEVICE INFO.', 'GENERAL', 'COMMUNICATION', 'MQTT', 'INPUT-OUTPUT', 'HART', 'MODBUS', 'SMS' (highlighted), and 'CALIBRATION'. Below the navigation bar, there is a table with two columns: 'Group No.' and 'Mobile No.'. The table contains five rows, each with a group number (1 to 5) and a text input field for the mobile number, which currently shows '+91'. At the bottom of the page, there are two buttons: 'Save' and 'Reboot'.

Group No.	Mobile No.
1	+91
2	+91
3	+91
4	+91
5	+91

Save Reboot

Option	Description	Range
Mobile No	Specify the user mobile number to receive alert on SMS	Number

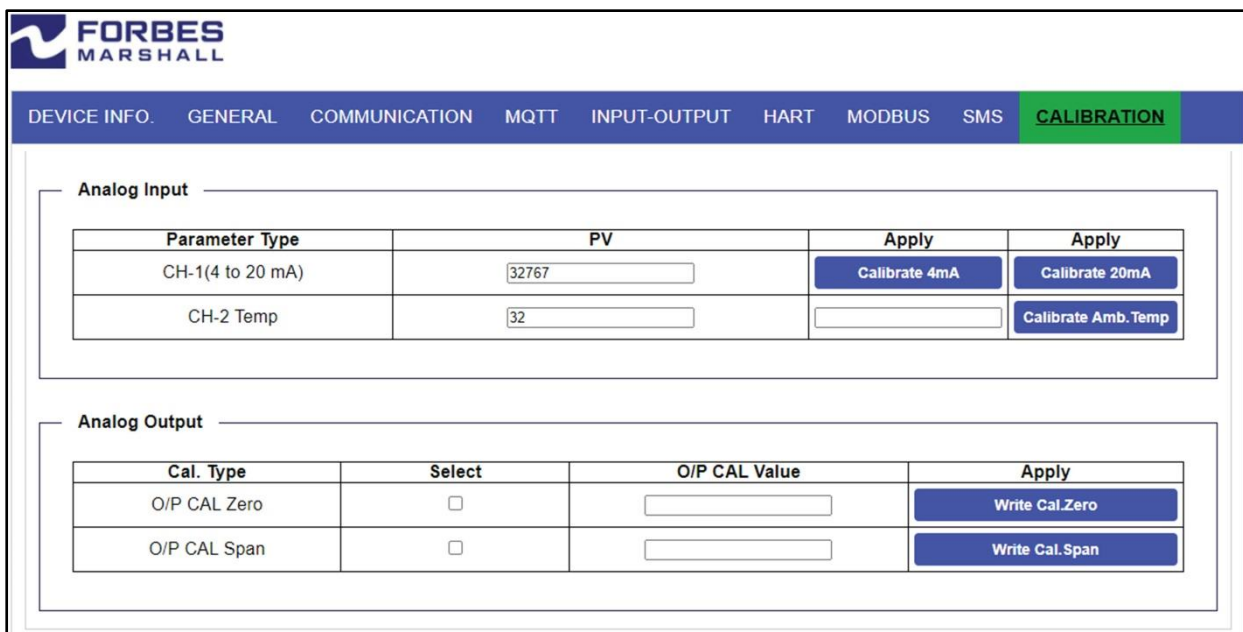
NOTE

-It is necessary to Press the 'Save' Tab after changing the any parameter in any web page. Saved parameters will have effect only after a power ON/OFF recycle is done or by pressing the 'Reboot' tab.

-The **RTru301** device will reset after pressing the 'Reboot' tab. If the 'Reboot' tab is press then after the RUN/ERR LED will be in the OFF state

Calibration Page

Figure 14 Webpage – Calibration



The screenshot shows the 'CALIBRATION' tab selected in the top navigation bar. The page is divided into two main sections: 'Analog Input' and 'Analog Output'.

Analog Input Section:

Parameter Type	PV	Apply	Apply
CH-1(4 to 20 mA)	<input type="text" value="32767"/>	<input type="button" value="Calibrate 4mA"/>	<input type="button" value="Calibrate 20mA"/>
CH-2 Temp	<input type="text" value="32"/>	<input type="text"/>	<input type="button" value="Calibrate Amb. Temp"/>

Analog Output Section:

Cal. Type	Select	O/P CAL Value	Apply
O/P CAL Zero	<input type="checkbox"/>	<input type="text"/>	<input type="button" value="Write Cal.Zero"/>
O/P CAL Span	<input type="checkbox"/>	<input type="text"/>	<input type="button" value="Write Cal.Span"/>

Option	Description	Range
Analog Input	To Calibrate 4 ~ 20mA for analog input and display source data	Number
Analog Output	To Calibrate 4 ~ 20mA for analog output (Zero/Span Calibration)	Number

7. INPUT OUTPUT INTERFACE CHECK

7.1 Cellular Communication

The Cellular and MQTT Configuration parameters are described in [Section 6.1](#). Follow the step by step procedure below to set up the cellular configuration:

- Carefully insert a **pre-activated** SIM card to the device.
- Now open the web server of the **RTru301** device to configure SIM related Parameters and MQTT parameters.
- Enable the SIM Option in the web server
- The APN must be configured to **RTru301** device for making a data connection. An APN is provided by the cellular network service provider.
- If required, set the Username, Password and SIM PIN for the inserted SIM card.
- Configure the NTP server URL and NTP Port for the **RTru301** device time synchronization with UTC. The RTru301 device sends an NTP request to the NTP server on the cellular network. If it receives a response then the device synchronizes with UTC time. The **RTru301** device sends an NTP request to the NTP server every 12hrs for Time synchronization. Two NTP servers are provided for redundancy.
- Set the MQTT parameters for the **RTru301** Device Data publish such as periodic, diagnostic, Modbus and HART® Data.
- Select the Time format to send the Epoch timestamp with data published to MQTT server. i.e. UTC or IST
- Select the data logging option for the data logged in case of cellular network failure or server disconnection. The **RTru301** Device sends the logged data when the network or server connection is restored.
- Save all parameters of the **RTru301** device by pressing 'Save' Tab and press the 'Reboot' tab to reset the device.
- The IMEI and SIM nos. are shown in the device info web page when the cellular modem is powered on successfully without any error.
- Check the connectivity of the network of the **RTru301** device with help of RSSI and NET LEDs.

The RSSI or cellular signal strength can be observed based on the RSSI LED

Table 4 RSSI (Receiving Signal Strength Indication)

Good : ≥ -85 dbm	LED ON
Low : ≥ -100 to ≤ -86 dbm	LED blinking at 1s interval
Very low : < -100 dbm	LED OFF

The network LED shows the status of network connection and MQTT server connection.

Table 5 Network Status Indication

Both network and MQTT are connected	LED ON
No network connected	LED OFF
MQTT not connected	LED blinking at 1s interval
Cellular initialization is in progress	LED blinking at 200ms interval

7.2 Modbus Communication

Modbus is an industrial automation protocol used for sending and receiving digital information across a single, external RS-485 serial bus. The maximum 16 number of Modbus slave devices connected to the RS485 Port 1 of the **RTRu301** device or the device can read a maximum of 64 registers from the Modbus slave devices.

The serial configuration and modbus parameter configuration are described in [Section 6.1](#). See the below step to configure Modbus parameter to read Modbus registers from the slave devices.

The following settings must match with the externally connected Modbus slave devices. Select the appropriate Modbus serial communication:

Figure 15 Modbus Serial configuration

The figure shows a 'Modbus Master' configuration window. It contains the following fields:

- Baud rate: 9600 (dropdown)
- Parity: none (dropdown)
- Data Bits: 8 (dropdown)
- Stop Bits: 1 (dropdown)
- Poll Time (s): 3 (input box)
- Timeout (ms): 1000 (input box)

The **RTRu301** device sends the query to the slave device and waits for a response from the slave devices based on the poll time and response time set.

For monitoring Modbus devices on an MQTT server, specify the no. of the client, slave ID, function code, start address, register length, data format, publish interval and publish topic in the Modbus web page configuration. **Please refer figure 12 for Modbus slave device configuration.**

To read 5 Holding registers (function code 3) with addresses from 40001 ~ 40005, enter value 1 in the Reg. Start address input box and value 5 in Reg. Length.

Figure 16 Modbus web page

The figure shows a 'Modbus web page' configuration interface. It includes a 'No of Client' input box with the value 1. Below it is a table with the following columns: No, Slave ID, Function Code, Reg. Start Address, Reg. Length, Data Format, Pub. Interval(M), Sub., and Pub. Topic. The table contains one row with the following values: 1, 1, 3 (dropdown), 1, 5, Uint_16 (dropdown), 1, ☐, and TEST/MBDEV1. Below the table, there is explanatory text: 'Above Modbus configuration can be understood as. RTRu 301 device will read data from slave device with ID = 1. with function code 3 (HOLDING REGISTER). and start address of 1 and length of five registers. Note : If user want's to read data from 40001 just enter Reg. Start address as 1.'

The Modbus data register length in the data format below:

Table 6 Register length data format

Bool	1 Bit
Int 16	1 Modbus Register
Uint 16	1 Modbus Register
Int 32	1 Modbus Register

Uint 32	1 Modbus Register
Float	2 Modbus Register
Float Swap	2 Modbus Register
Double	4 Modbus Register
Double Swap	4 Modbus Register

The Read data from the Modbus slave devices can be set to the MQTT server by enabling the Modbus data send option in the communication webpage.

Apply the configuration changes by pressing 'Save' and 'Reboot' Tab. By pressing 'Reboot' Tab the device is reset. The Modbus communication can be checked by monitoring the Tx and Rx LED activity on the device. The **RTru301** device sends the data to MQTT server which is defined in MQTT web page on Modbus Topic based on defined publishing interval.

See the below example for the Float (ABCD) and Swap Float conversion (CDAB)

For Float Value: 10.4802

Modbus register 0:0x4127, Modbus Register1:0xae6

For Swap Float Value: 10.4802

Modbus register 0:0xae6, Modbus Register1:0x4127

See the below example for Double (ABCD) and Double Swap conversion (CDAB)

For Double Value: 10.4802

Modbus register 0:0x4024,

Modbus Register1:0xf5dc,

Modbus Register2:0xc63f,

Modbus Register 3:0x1412

For Double Swap Value: 10.4802

Modbus register 0:0xF5dc,

Modbus Register1:0x4024,

Modbus Register2:0x1412,

Modbus Register3:0xc63f

See the JSON format for the payload of Modbus Topic which are sent on MQTT server

```
{"ts":1628937275000,"values":{"IMEI":123456789123456,"ID":"FM-DEV 001","FRAME":0,"ST":0,"S1_1":0,"S1_2":5}}
```

Table 7 JSON Key Description for Payload of Modbus Topic

ts	Time stamp of JSON data in epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	Device ID
FRAME	Type of data in frame live data, log data 0=Live,1=Logged
ST	Status of Modbus slave 1 = connected, 0 = not connected
S1_1	Combination of Modbus slave id and register start address e.g. "S1_1" S1 = SLAVE ID 1, 1= Register number1.
S1_2	Combination of Modbus slave id and register start address e.g. "S1_1" S1 = SLAVE ID 1, 2= Register number2

7.3 HART® Communication

The HART® (Highway Addressable Remote Transducer) Protocol is an industry standard protocol for sending and receiving digital information across analog wires between field devices and control and monitoring systems. It preserves the traditional 4 ~ 20mA signal, and provides simultaneous

transmission of digital communication signals on the same wiring. Thus enabling a bi-directional communication with smart instruments without disturbing the 4 ~ 20mA analog signal. In that way primary process variables and control signal information is carried by the 4 ~ 20mA, while additional process measurements, device configuration and parameter information, calibration, and diagnostics information is accessible through the HART® protocol.

HART® slave devices include sensors, transmitters and various actuators that respond to commands. Basically the HART® data is superimposed on the 4 ~ 20mA current loop making use of the frequency shift keying (FSK) principle, via a FSK modem integrated in field devices. This enables devices to communicate digitally using the HART® protocol, while analog signal transmission takes place at the same time.

HART® devices have the capability to operate in one of two network configurations: Point-to point connection or Multi drop mode. Using the polling address structure of the HART® protocol, the polling address of the field devices will vary in a range of 0 ~ 15.

1. Point to Point

In point-to-point mode the digital signals are overlaid on the 4 ~ 20mA loop current. Both the 4 ~ 20mA current and the digital signal are valid signaling protocols between the controller and measuring instrument or final control element.

The polling address of the instrument is set to "0". Only one instrument can be put on each instrument cable signal pair. One signal, generally specified by the user, is specified to be the 4 ~ 20mA signal. Other signals are sent digitally on top of the 4 ~ 20mA signal. For example, pressure can be sent as 4 ~ 20mA, representing a range of pressures, and temperature can be sent digitally over the same wires. In point-to-point mode, the digital part of the HART® protocol can be seen as a kind of digital current loop interface.

2. Multi-drop

The HART® communication protocol enables the capability to connect several two-wire measurement devices in a (typical) multi drop network configuration, depending on the protocol revision.

All the devices are supplied from one voltage source and with a constant current consumption (usually 4mA). The master represents the sum of all the analog signals belonging to the devices in the network.

The host distinguishes the field devices by their preset polling addresses that must be unique in a range of 1~15. This address can be set by sending a special command to the devices. Standard HART® commands are used to communicate with field instruments to determine process variables or device parameter information. The connection diagrams of HART® slave devices are as below:

Figure 17 2-Wire HART® Device Connection

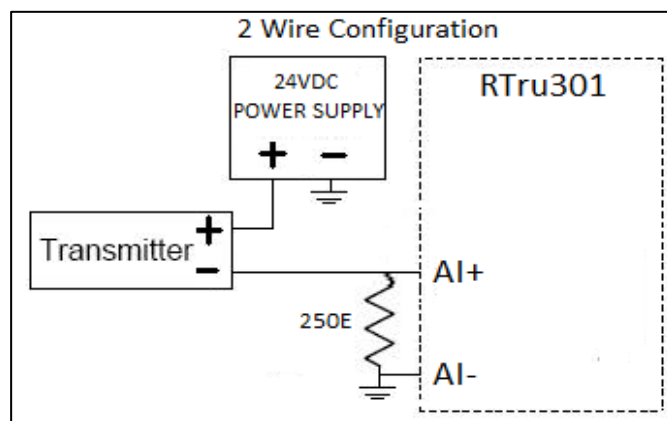


Figure 18 3-Wire HART® Device Connection

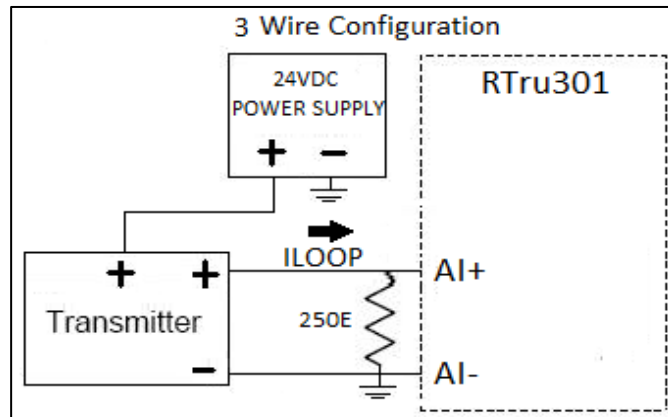


Figure 19 4 Wire HART® Device Connection

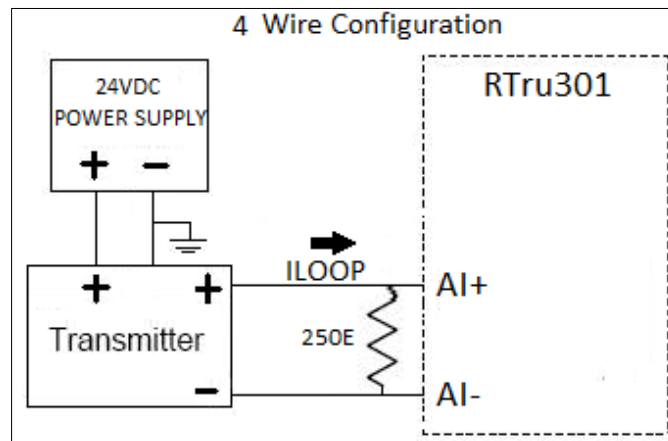
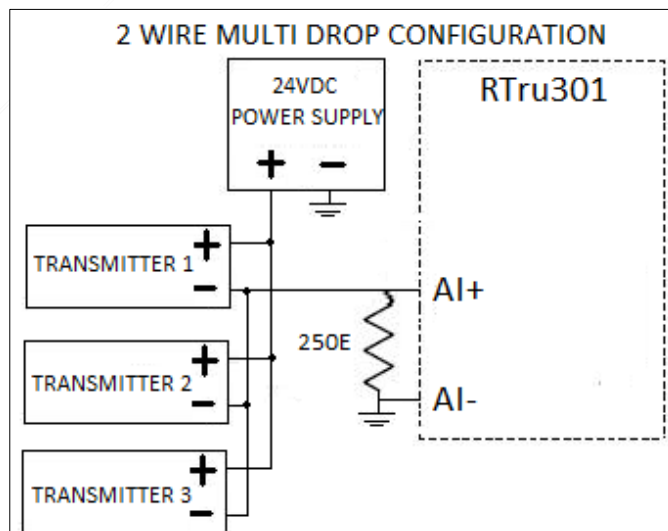


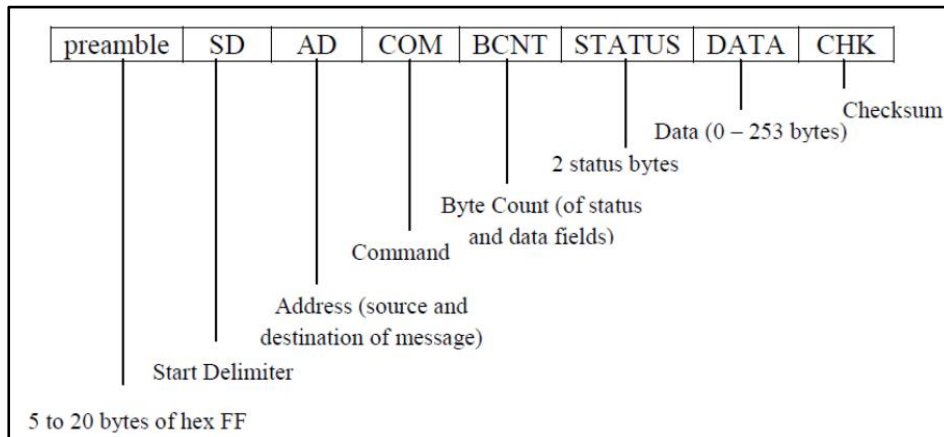
Figure 20 Multi-Drop HART® Device Connection



Packet structure

Each command or reply is a message, varying in length from 10 ~ 12 bytes to typically 20 or 30 bytes. HART® provides two telegram formats, long and short format, which use different forms of addressing. On the other hand, the HART® message structure is equal for long and short format. The request HART® packet has the following structure:

Table 8 HART® Packet Structure



Preamble

This element consists of 5 ~ 20 characters. All bytes in these characters are set to the logic value 1, in such a way that each character represents the hexadecimal number 0xFF.

Start delimiter

The start byte uses for recognizing a message's start. It indicates which participant is sending (master, slave, and slave in burst mode) and whether the short frame or the long frame format is used. In case the message has the long format, the start byte will contain the hexadecimal value 82 when it is sent by a master. On the other hand, the value 81 indicates that it is a "Burst mode" message.

Code	Meaning
0x01	Burst Mode short access
0x02	Request short access
0x06	Response short access
0x81	Burst mode long access
0x82	Request long access
0x86	Response long access

Address

Specifies the destination address implemented in one of the HART® schemes. Each HART field instrument must have a unique address. A message sent by a master contains the address of the target slave. When a telegram/message is sent on the HART network, the field device that recognizes the address as its own will read this message and send back a response.

Command

This is a one byte numerical value representing which command is to be executed

Number of data bytes

Specifies the number of communication data bytes to follow.

Status

The status field is absent for the master and is two bytes for the slave. This field is used by the slave to inform the master whether it completed the task and the current health status.

Data

Data contained in this field depends on the command to be executed.

Checksum

Checksum is composed of an XOR of all the bytes starting from the start byte and ending with the last byte of the data field, including those bytes.

The **RTru301** IoT Gateway device Read four types of HART® variable: Primary Variable (PV), Secondary Variable (SV), Third Variable (TV), and Fourth Variable (QV), unit of each variable and Loop current.

The **RTru301** device sends a request to HART® slave device based on the Polling ID set. The **RTru301** device sends a HART® request to next slave based on the time(in seconds) set in HART® Query Time parameter. The Query response time is used to set the **RTru301** waiting time for the response from the HART® slave device. The Query attempt is used to set the no. of requests sent to the HART® slave device when no response is received.

The Tab 'Get Device Data' is used to show the device information of connected devices. The **RTru301** Device can change the Polling Address of the HART® slave device.

Below steps to change the polling ID of any HART® slave device

- 1) Write new Polling ID in 'Polling ID' input box that you want to change
- 2) Then after press the 'Change' Tab. **The RTru301 device change the Polling ID of HART® slave device**

Figure 21 HART® Web page

No	Polling ID	Manufacturer ID	Device Type	Client ID	Pub. Interval(M)	Pub. Topic	Change ID
1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-0	<button>Change</button>
2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-1	<button>Change</button>
3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-2	<button>Change</button>
4	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-3	<button>Change</button>
5	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-4	<button>Change</button>
6	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-5	<button>Change</button>
7	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-6	<button>Change</button>
8	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-7	<button>Change</button>
9	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-8	<button>Change</button>
10	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-9	<button>Change</button>
11	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-10	<button>Change</button>
12	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-11	<button>Change</button>
13	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-12	<button>Change</button>
14	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-13	<button>Change</button>
15	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	DEV-14	<button>Change</button>

Get Device DataSaveReboot

The **RTru301** Device send the Payload of HART® Publish Topic to MQTT server based on the defined publishing interval (in minutes)

See the JSON format for the payload of HART® Publish Topic which are sent on MQTT server

```
{
  "ts": 1628937275000,
  "values": {
    "IMEI": 123456789123456,
    "ID": "FM-DEV-123",
    "FRAME": 0,
    "H1_ST": 0,
    "H1_V1": 0,
    "H1_V2": 0,
    "H1_V3": 0,
    "H1_V4": 0,
    "H1_U1": 0,
    "H1_U2": 0,
    "H1_U3": 0,
    "H1_U4": 0,
    "H1_LC": 0
  }
}
```

Table 9 JSON Key Description for Payload of HART® Topic

ts	Time stamp of JSON data in epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	Device ID
FRAME	Type of data in frame live data, log data 0=Live,1=Logged
H1_ST	Status of H1=SLAVE ID, 1 = connected, 0 = not connected
H1_V1	Combination of HART® slave id and Primary Variable e.g. "H1_V1 H1 = SLAVE ID 1, V1= Value of Variable 1.
H2_V2	Combination of HART® slave id and Primary Variable e.g. "H1_V1 H1 = SLAVE ID 1, V1= Value of Variable 1.
H3_V3	Combination of HART® slave id and Primary Variable e.g. "H1_V1 H1 = SLAVE ID 1, V1= Value of Variable 1.
H4_V4	Combination of HART® slave id and Primary Variable e.g. "H1_V1 H1 = SLAVE ID 1, V1= Value of Variable 1.
H1_U1	Combination of HART® slave id and unit of Primary Variable e.g. "H1_U1" H1 = SLAVE ID 1, U1= unit of Primary Variable
H2_U2	Combination of HART® slave id and unit of Primary Variable e.g. "H1_U1" H1 = SLAVE ID 1, U1= unit of Primary Variable
H3_U3	Combination of HART® slave id and unit of Primary Variable e.g. "H1_U1" H1 = SLAVE ID 1, U1= unit of Primary Variable
H4_U4	Combination of HART® slave id and unit of Primary Variable e.g. "H1_U1" H1 = SLAVE ID 1, U1= unit of Primary Variable
H1_LC	Combination of HART® slave id and Loop current of device e.g. "H1_LC" H1 = SLAVE ID 1

7.4 Analog Input Interface

There are two channels provided for analog input:

- 4 ~ 20mA analog input measurement
- Device Internal Temp measurement (Using Diode)

Enable the **RTru301** device to get the external sensor data using the analog 4 ~ 20mA input and read the device internal temperature. The configuration of Analog input channel 1 and 2 can be described in [Section 6.1](#)

Scaled Unit by Zero and Span

The **RTru301** Device Read the Row value from the sensor device in mA. The reading of Row data can be scaled by Zero and span value.

Alarms

Use an alarm to send the alert report to server or on user mobile number when unusual changes occur in external connected sensor devices. Alarm event occurs when the value of external sensor reading is above or below the value specified in high or low threshold respectively.

High Threshold

Send alarm event when the reading value of sensor greater than the value specified in High Threshold

Low Threshold

Send alarm event when the reading value of sensor is less than the value specified in Low Threshold



NOTE

An alarm will be generated only once when A/I value cross its High or Low threshold and no additional alarm will be generated if the A/I value remains above or below High/Low threshold. A new alarm will be generated only when the existing alarm is cleared.

Hysteresis

An externally connected sensor value may sometimes fluctuate in the High or Low alarm condition. This causes high or low alarms to be generated by the device and the device sends multiple alarm events to server or user mobile number.

Hysteresis works with the high and low alarm thresholds to tell the device when to keep an alarm on without sending additional alarm events or when to turn off an alarm event. Use this to avoid repeated alarms during reading of sensor input value fluctuations.

For example, an external sensor input value increases to the high threshold and the device sends a high alarm event. However, the sensor input value continues to increase and decrease repeatedly between normal and high thresholds during this alarm condition. If you have not set a hysteresis range, the device sends an alarm event every time the sensor input value reaches the high threshold.

Use an alarm to send the alert report to server or on user mobile number when unusual changes occur in external connected sensor devices. An alarm event occurs when the value of external sensor reading goes above or below the value specified in high or low threshold respectively. See the example below for hysteresis works for the High and low alarm.

High hysteresis

If the high threshold is 15mA and the hysteresis value is 2mA, then the High alarm hysteresis is 13mA. This means that the alarm turns ON when the sensor input value reaches 15mA and remains ON if the sensor input value stays above 13mA. No additional alarm reports are sent during this alarm condition. The alarm turns OFF when the sensor input value falls below 13mA.

Low hysteresis

If the Low threshold is 5mA and the hysteresis value is 2mA, then the Low alarm hysteresis is 7mA. This means that the alarm turns on when the sensor input value reaches 5mA and remains ON if the sensor input value stays below 7mA. No additional alarm reports are sent during this alarm condition. The alarm turns OFF when the sensor input value is above 7mA.

The analog input parameter configuration described in [Section 6.1](#). See the below step to configure analog input channel measurement.

- Set the parameter for analog measurement. The analog input channel 1 and 2 can be calibrated by the Calibration web page. For the calibration of analog input channel 1 and 2 refer to [Section 8](#).
- Apply the configuration changes by pressing 'Save' and 'reboot' Tab. By pressing 'reboot' Tab the **RTru301** device is reset.
- The value of analog input channel 1 and 2 can be monitored on publishing periodic data based on a defined publishing interval to MQTT server when the send A/I data option is enabled in the communication web page.
- The **RTru301** device will send the alarm event on SMS to SMS alarm group number or the MQTT server based on the option selected.
- SMS format of the device sends to the user mobile number when High or Low alarm event occurs.

Figure 22 Analog Input Web page

No	Enable	Zero	Span	Hysteresis	High Threshold	Low Threshold	SMS Alarm	Server Alarm	SMS Alarm Group	SMS Description
CH-1(4 to 20 mA)	<input checked="" type="checkbox"/>	4000	20000	0	15000	5000	<input type="checkbox"/>	<input type="checkbox"/>	12345	AI-CH-1
CH-2(Temp.)	<input checked="" type="checkbox"/>	NA	NA	4	45	10	<input type="checkbox"/>	<input type="checkbox"/>	12345	AI-CH-2

Table 10 SMS Format - Analog Input

Device ID	FM-DEV-001
SMS Description	AI-CH-1
AI-CH-<Channel No><:AI channel value>	AI-CH-1:19800
<DD/MM/YYYY,HH:MM:SS>	18/11/2021,12:30:45

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the all input and output (A/I, D/I, A/O and D/O) option are enabled

```
{"ts": 1628937275000,"values":{"IMEI": 123456789123456,"ID": "FM-DEV-123","FRAME": 0,
"AI1": 14000,"AI2": 29,"DI1": 0,"DI2": 0,"AO1": 5000,"DO1": 0,"DO2": 0}}
```

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the only A/I option is enabled

```
{"ts": 1628937275000,"values":{"IMEI": 123456789123456,"ID": "FM-DEV-123","FRAME": 0,
"AI1": 14000,"AI2": 29}}
```

Table 11 JSON Key Description for Payload of Periodic Data Topics for Analog Input

ts	Time stamp of JSON data in epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	Device Id
FRAME	Type of data in frame live data, log data 0=Live,1=Logged
AI1	Value of A/I 1
AI2	Value of A/I 2
DI1	Value of D/I 1
DI2	Value of D/I 2
AO1	Value of A/O 1
DO1	Value of D/O 1
DO2	Value of D/O 2

See the JSON format for the payload of Alert topic which are sent on MQTT server

```
{"ts": 1637218845000,"values":{"IMEI": 123456789123456,"ID": "FM-DEV-123","FRAME": 0,
"ALERT": 0,"AI1": 1980}}
```

Table 12 JSON Key Description for Payload of Alert Topics for Analog Input

Ts	Time stamp of JSON data in epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	Device Id
FRAME	Type of data in frame live data, log data 0=Live,1=Logged
ALERT	Type of Alert (0: AI-1 ALERT,1 : AI-2 ALERT, 2 : DI-1 ALERT, 3 : DI-2 ALERT)
AI1 or AI2	Value of AI1 or value of AI2

Refer the value of analog input channel 1 in different condition

- 1) Measured current $> 3.6\text{mA}$ && Measure current $< 3.8\text{mA}$
Considered as Under Measurement, value of Analog input channel 1 = 32765
- 2) Measured current $> 20.5\text{mA}$ && Measured current $< 21.0\text{mA}$
Considered as Over Measurement, value of Analog input channel 1 = 32766
- 3) Measured current $\leq 3.6\text{mA}$ && Measured current $\geq 21.0\text{mA}$
Considered as Open Measurement, value of Analog input channel 1 = 32767
- 4) Measured current $\geq 3.8\text{mA}$ and Measured current $\leq 20.5\text{mA}$

In this A/I input range Measurement take Place.

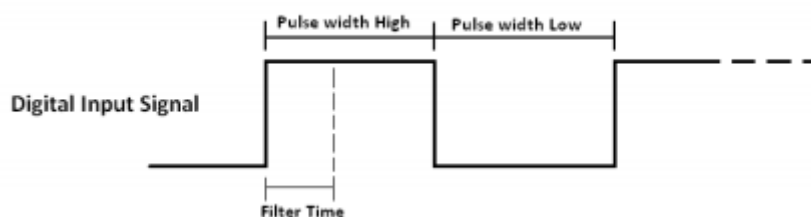
7.5 Digital Input Interface

The **RTru301** device has two isolated digital input channels. These digital Input channels can be configured as digital input (ON/OFF) or Pulse Counter.

Filter Time

The Filter Time is the length of time that a newly changed input to some channel should last for before it is accepted as a valid input. It is used to eliminate input noise. The minimum and maximum values for Filter time are 10ms and 10000ms respectively. This parameter is applicable in the ON/OFF mode **only**.

Figure 23 Digital Input Filter Time



The Digital input parameter configuration described in [Section 6.2](#). To configure the digital input channel follow the steps below:

- Set the Parameter of Digital Input channel in the web page. Such as Filter Time, SMS alarm, Server Alarm, SMS alarm Group, SMS description. The count from the Last and Step alarm count used in counter mode of Digital Input.
- Apply the configuration changes by pressing 'Save' and 'reboot' Tab. By pressing 'reboot' Tab the device is reset.
- If the Digital Input selected as ON/OFF mode then it senses High and low logic levels. A true event from High to Low or Low to high will be considered based on Filter Time in ms.
- If the Digital Input selected as counter mode, it will start to count from the last stored value of counter if the 'count form last' is enabled otherwise it start from the Zeros count.
- The SMS and Server alarm will be generated based on the Step alarm count and counter Roll over. The Roll over value of Counter is 4294967294.

- The value of Digital input channel 1 and 2 can be monitored on publishing periodic data based on a defined publishing interval to MQTT server when the send D/I data option is enabled in the communication web page.
- The device will send the alarm event on SMS to SMS alarm group Number or the MQTT server based on the option selected.
- SMS format of the device sends to the user mobile no when a digital input alarm event occurs.

Figure 24 Digital Input Web page

No	Enable	Mode	Filter Time (millisec)	Count From Last	Step Alarm counts	SMS Alarm	Server Alarm	SMS Alarm Group	SMS Description
CH-1	<input checked="" type="checkbox"/>	On/Off ▼	0	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	12345	DI-CH-1
CH-2	<input checked="" type="checkbox"/>	On/Off ▼	0	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	12345	DI-CH-2

Table 13 SMS Format - Digital Input

Device ID	FM-DEV-001
SMS Description	DI-CH-2
DI-CH-<Channel No>:1-High,0-Low	DI-CH-2:1
<DD/MM/YYYY,HH:MM:SS>	18/11/2021,12:30:45

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the all input and output (A/I, D/I, A/O and D/O) option are selected

```
{"ts": 1637218845000,"values":{"IMEI": 123456789123456,"ID": "FM-DEV-123","FRAME": 0,
  "AI1": 32767,"AI2": 29,"DI1": 0,"DI2": 0,"AO1": 5000,"DO1": 0,"DO2": 0}}
```

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the only D/I option is selected

```
{"ts": 1637218845000,"values":{"IMEI": 123456789123456,"ID": "FM-DEV-123","FRAME": 0,
  "DI1": 0,"DI2": 0}}
```

Table 14 JSON Key Description for Payload of Periodic Data Topics for Digital Input

ts	Time stamp of JSON data in epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	Device Id
FRAME	Type of data in frame live data, log data 0=Live,1=Logged
AI1	Value of A/I 1
AI2	Value of A/I 2
DI1	Value of D/I 1
DI2	Value of D/I 2
AO1	Value of A/O 1
DO1	Value of D/O 1
DO2	Value of D/O 2

See the JSON format for the payload of Alert topic which are sent on MQTT server

```
{"ts": 1637218845000,"values":{"IMEI": 860936050053176,"ID": "FM-DEV-123","FRAME": 0,
  "ALERT": 2,"DI1": 1}}
```

Table 15 JSON Key Description for Payload of Alert Topics for Digital Input

ts	Time stamp of JSON data epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	Device Id
FRAME	Type of data in frame live data, log data 0=Live,1=Logged
ALERT	Type of Alert (0: AI-1 ALERT,1 : AI-2 ALERT, 2 : DI-1 ALERT, 3 : DI-2 ALERT)
DI1 or DI2	Value of DI1 or Value of DI2

7.6 Digital Output Interface

The **RTru301** device has two isolated sink type digital output channels. The digital output channels can be configured as digital output (ON/OFF) or Impulse Mode. The **RTru301** device can retain the status of digital output channel during Power ON/OFF. **In Impulse mode the Pin is in sink mode for the defined impulse time (ms).**

The Digital output parameter configuration is described in [Section 6.1](#). The Digital Output status can be changed by sending SMS to device or command to subscription topic of device from the MQTT server. The Digital Output can be monitored on a periodic frame of MQTT server. The **RTru301** device will send the Digital output value periodically based on the defined publishing interval of MQTT when the send D/O data option is enabled in the communication web page. Apply the configuration changes by pressing 'Save' and 'reboot' Tab. By pressing 'reboot' Tab the **RTru301** device is reset.

Figure 25 Digital Output Web page

The screenshot shows a web interface titled "Digital Output". It contains a table with the following columns: No, Enable, Mode, Impulse Time (millisec), and Retain Last Value. There are two rows for CH-1 and CH-2. Both channels have "Enable" checked, "Mode" set to "On/Off", "Impulse Time" set to 1000, and "Retain Last Value" unchecked.

No	Enable	Mode	Impulse Time (millisec)	Retain Last Value
CH-1	<input checked="" type="checkbox"/>	On/Off	1000	<input type="checkbox"/>
CH-2	<input checked="" type="checkbox"/>	On/Off	1000	<input type="checkbox"/>

See the SMS format for changing the status of any digital output channel of **RTru301** device

Table 16 SMS Format - Digital Output SET/RESET

SET	&DO<Channel No> #<SET/RESET>	&DO1 #SET
RESET	&DO<Channel No> #<SET/RESET>	&DO2 #RESET

See the SMS format for generate the impulse on any digital output channel of **RTru301** device

Table 17 SMS Format - Digital Output Impulse

Impulse generated	&DO<Channel No> #IMPULSE	&DO1 #IMPLUSE
-------------------	--------------------------	---------------

See the Format of Topic published by MQTT server (Subscription Topic of Device) for changing the status (ON/OFF) of any digital output channel

Table 18 Format of Topic Published by MQTT Server- Digital Output SET/RESET

SET	{"IMEI":<IMEI No>,"<DO1/DO2>":"<SET/RESET>"}	{"IMEI":123456789123456,"DO1":"SET"}
RESET	{"IMEI":<IMEI No>,"<DO1/DO2>":"<SET/RESET>"}	{"IMEI":123456789123456,"DO1":"RESET"}

See the Format of Topic published by MQTT server (Subscription Topic of Device) for generating impulse of any digital output channel

Table 19 Format of Topic Published by MQTT Server - Digital Output Impulse

SET	{"IMEI":<IMEI No>,"<DO1/DO2>":"<IMPULSE>"}	{"IMEI":123456789123456,"DO1":"IMPULSE"}
-----	--	--

Note: The User receives the Invalid command response in SMS when they send the ON/OFF SMS command to the **RTru301** device and the **RTru301** device is configured on Impulse mode through the webpage or vice versa

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the all input and output (A/I, D/I, A/O and D/O) option are enabled

```
{"ts": 1628937275000,"values":{"IMEI": 123456789123456,"ID": "FM-DEV-123","FRAME": 0,"AI1": 19800,"AI2": 29,"DI1": 0,"DI2": 0,"AO1": 5000,"DO1": 0,"DO2": 0}}
```

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the only D/O option is enabled

```
{"ts": 1628937275000,"values":{"IMEI": 123456789123456,"ID": "FM-DEV-123","FRAME": 0,"DO1": 0,"DO2": 0}}
```

Table 20 JSON Key Description for Payload of Periodic Data Topics for Digital Output

ts	Time stamp of JSON data in epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	Device Id
FRAME	Type of data in frame live data, log data 0=Live,1=Logged
AI1	Value of A/I 1
AI2	Value of A/I 2
DI1	Value of D/I 1
DI2	Value of D/I 2
AO1	Value of A/O 1
DO1	Value of D/O 1
DO2	Value of D/O 2

7.7 Analog Output Interface

The **RTru301** device has one analog output channel (4 ~ 20mA). The device can generate the analog output current based on last retained value during Power ON/OFF.

The Analog output parameter configuration described in [Section 6.1](#). An analog output current can be generated by sending an SMS to **RTru301** device or via a command to subscription topic of device from the MQTT server. The **RTru301** device will send invalid command response over SMS when it receives an SMS command with analog value other than 3600 and 21000 or in between them. The analog Output can be monitored on a periodic frame of the MQTT server. The **RTru301** device will send the analog output value periodically based on the defined publishing interval of MQTT when the send A/O data option is enabled in the communication web page. Apply the configuration changes by pressing 'Save' and 'reboot' Tab. By pressing 'reboot' Tab the device is reset.

Figure 26 Analog Output Web page

No	Enable	Zero	Span	Retain Last Value
CH-1 (4 to 20 mA)	<input checked="" type="checkbox"/>	4000	20000	<input type="checkbox"/>

See the SMS format for analog output generation

Table 21 SMS Format - Analog Output

18mA analog output generation	&AO #<Analog output value>	&AO1 #5000
-------------------------------	----------------------------	------------

See the MQTT Frame format for analog output generation

Table 22 Format of Topic Published by MQTT Server - Analog Output

18mA analog output generation	{"IMEI":<IMEINO>,"AO1":<value>}	{"IMEI":123456789123456,"AO1":5000}
-------------------------------	---------------------------------	-------------------------------------

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the all input and output (A/I, D/I, A/O and D/O) option are enabled

```
{"ts": 1628937275000,"values":{"IMEI": 123456789123456,"ID": "FM-DEV-123","FRAME": 0,"AI1": 19800,"AI2": 29,"DI1": 0,"DI2": 0,"AO1": 5000,"DO1": 0,"DO2": 0}}
```

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the only D/O option is enabled

```
{"ts": 1628937275000,"values":{"IMEI": 123456789123456,"ID": "FM-DEV-123","FRAME": 0,"DO1": 0,"DO2": 0}}
```

Table 23 JSON Key Description for Payload of Periodic Data Topics for Analog Output

ts	Time stamp of JSON data in epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	Device Id
FRAME	Type of data in frame live data, log data 0=Live,1=Logged
AI1	Value of A/I 1
AI2	Value of A/I 2
DI1	Value of D/I 1
DI2	Value of D/I 2
AO1	Value of A/O 1
DO1	Value of D/O 1
DO2	Value of D/O 2

8. CALIBRATION

8.1 Analog Input Channel 1

- Connect the 4 ~ 20mA analog input source to analog input terminal of device.
- Apply 4mA analog input to the Analog input terminal of Device. The measured input value will be displayed on 'PV' input box on the calibration web page. Click on the 'calibrate 4mA' tab. Refer the Figure 27
- Apply 20mA analog input to the Analog input terminal of Device. The measured input value will be displayed on 'PV' input box on the calibration web page. Click on the 'calibrate 20mA' tab. Refer Figure 27
- Now the calibration of analog input channel 1 can be done.

8.2 Analog Input Channel 2

- The internal temperature value can be displayed on 'PV' input box in the calibration web page.
- Write the actual temperature in the 'Apply' input box and press the 'calibrate Amb.Temp' Tab. Refer Figure 27
- Now the calibration of analog input channel 2 can be done.

Figure 27 Calibration - Analog Input

Analog Input			
Parameter Type	PV	Apply	Apply
CH-1(4 to 20 mA)	<input type="text" value="32767"/>	<input type="button" value="Calibrate 4mA"/>	<input type="button" value="Calibrate 20mA"/>
CH-2 Temp	<input type="text" value="29"/>	<input type="text"/>	<input type="button" value="Calibrate Amb.Temp"/>

Step 1: enter current temperature value measured from calibrated device

Step 2: Press this button

8.3 Analog Output Calibration

- Connect the current measurement device with the A/O terminal of the device
- Tick on the select box of O/P CAL Zero and then write the value in O/P CAL Value which is measured by the current measurement device. Then after press the 'Write Cal. Zero' Tab.
- Tick on the select box of O/P CAL Span and then write the value in O/P CAL Value which is measured by the current measurement device. Then after press the 'Write Cal. Zero' Tab.
- Now the calibration of the analog output channel can be done.

Figure 28 Calibration - Analog Output

Analog Output			
Cal. Type	Select	O/P CAL Value	Apply
O/P CAL Zero	<input type="checkbox"/>	<input type="text"/>	<input type="button" value="Write Cal.Zero"/>
O/P CAL Span	<input type="checkbox"/>	<input type="text"/>	<input type="button" value="Write Cal.Span"/>

4 mA Calibration

20 mA Calibration

Step 1 : Click this box 4 mA output put will be generated.

Step 2 : Measure output mA and enter this reading here.

Step 3 : Press this button to complete 4mA calibration

9. REPLACEMENT OF BATTERY

9.1 Replacement of Battery from Battery Holder

If the value of Epoch Timestamp is 1046649762000 in payload of Periodic data Topic means the battery is drained.

- Switch off the external power supply connected to the **RTru301** device
- Measure the Battery voltage.

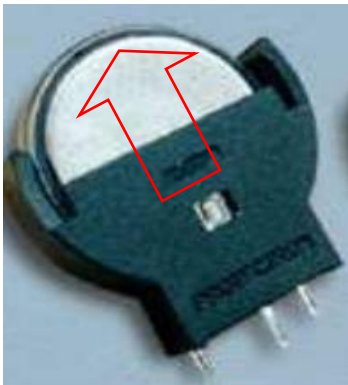
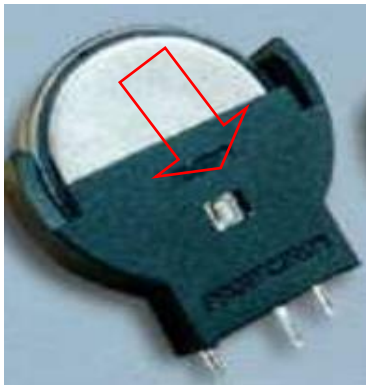
Battery voltage:

Good battery: $\geq 3\text{VDC}$

Low battery: $< 2.8\text{VDC}$ (Replace battery)

- If the Battery having low voltage then replace the battery. Always use a battery that is compatible with the existing used part no (CR2032)

See the blow instruction for Battery replacement.

Removing the battery from the holder	Inserting a new battery
STEP 1: Pull and Remove Battery from the holder as per direction shown below	STEP 2: Check +/- polarity before and then Insert new battery in holder as per direction shown below
	

10. TROUBLESHOOTING TIPS

Power supply healthy red LED does not glow

- Check Power Source and Connection
- Check red LED mounting and assembly
- Check Power Section and measure voltages (24V, 3.3V, 5V) at Test Points with respect to GND

Server (192.168.100.110) is not detected

- Check that the Ethernet cable connector is properly fitted and Link and Activity LEDs glow
- Check RUN/ERR LED must indicate healthy status

11. REVISION HISTORY

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