

User Manual

MSG-21

Masibus IIoT Gateway



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1. INTRODUCTION

Foreword

Thank you for purchasing

MSG-21 (Masibus IIOT Gateway)

This manual describes the basic functions and operation methods. Please read through this user's manual carefully before using the product.

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 the MASIBUS Sales office or sales representative. Under no circumstances may the contents of this manual, in part or in whole, be transcribed or copied without our permission.

Trademarks

Our product names or brand names mentioned in this manual are the trademarks or registered trademarks of Masibus Automation and Instrumentation (P) Ltd. (herein after referred to as **masibus**).

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.


Safety Precautions

The product and the instruction manual describe important information to prevent possible harm to users and damage to the property and to use the product safely.

Understand the following description (signs and symbols), read the text and observe descriptions.

DESCRIPTION OF SIGNS

 WARNING	<i>This indicates a danger that may result in death or serious injury if not avoided.</i>
--	---

 CAUTION	<i>This indicates a danger that may result in minor or moderate injury or only a physical damage if not avoided.</i>
--	--

2. SPECIFICATIONS

2.1 Technical Specification Sheet

Table 1 Technical Specification

MSG-21 Masibus IIoT Gateway	
CPU	ARM Cortex - M4 Core, 192MHz
Memory Size	4MByte (stores data when network fails)
RTC with battery backup	Yes
LED Indication	STAT indication, RS485 Transmit indication (TX), RS485 Receive indication (RX), GSM Signal Strength (RSSI), MQTT Server Connectivity (NET), Power Supply Indication (PWR)
Hardware Interface	1 x ETH 10/100BaseT/TX 1 x RS485 2 x Digital Input 2 x Digital Output
Protocol and Interface	Modbus RTU Master and Firmware upgrade Via RS485, DHCP server, Web Server and Telnet via Ethernet Port, MQTT, NTP and FOTA (Firmware and Configuration update from FTP server) via cellular Network
Serial Communication	Baud rate (kbps): 9600/19200/38400/57600/115200 3 - pin plug in screw terminal
Ethernet	1 x RJ45(10 x 100Mbps)
Antenna Connector	1 x SMA Female
SIM Card Slots	1 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/B7/B8/B20/B28/B31/B72
Digital Input (optional)	No of Channels: 2 Input Frequency: 1KHz max Pulse Width: 500 uSec Mode of Operation: Normal (ON/OFF) / Pulse Counter Counter Resolution: 32 Bit Input Impedance: 5100 Ω Input Voltage Range:24 VDC (+/- 10%) Ext. Power Supply
Digital Output(optional)	No of Channels:2 Output Type: Open collector (Sink type) (external +24V DC required) Pulse Width: 10mSec Maximum Current: 100mA per output Mode of Operation: Discrete (ON/ OFF), Impulse (Single Pulse) mode Vce ON: 1.1V max

Supply Voltage	9 to 36VDC, < 5W, 2 - Pin plug - in screw terminal, Reverse polarity protected
Operating Temperature Range	0°C to 55°C
Relative Humidity	20 ~ 95% RH (Non-Condensing)
Enclosure	Dimensions (mm): 111 (W) x 75 (H) x 25 (D) Material: ABS plastic, DIN rail mount
Ingress Protection Rating	IP20
Weight	140g approx.

Isolation (Withstanding voltage)

- Between primary terminals* and secondary terminals**: At least 1500 V AC for 1 minute
- Between primary terminals* and grounding terminal: At least 1500 V AC for 1 minute
- Between grounding terminal and secondary terminals**: At least 1500 V AC for 1 minute

* *Primary terminals indicate power (DC+ and DC-) terminals*

** *Secondary terminals indicate RS485, Digital Input and Digital Output.*

Insulation resistance: 20MΩ or more @ 500 V DC between power terminals and secondary terminal

3. INSTALLATION & MECHANICAL DETAIL

3.1 Safety Precautions in Installation



1. To minimize the possibility of fire or shock hazards, do not expose this instrument to rain or excessive moisture.
2. 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.

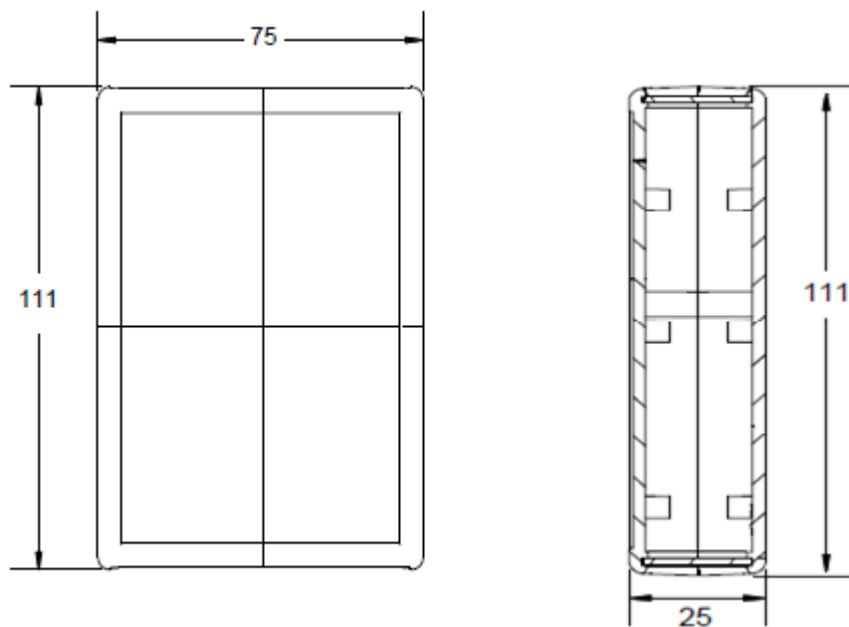


Be sure all personnel involved in installation, servicing, and programming are qualified and familiar with electrical equipment and their ratings

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.

3.2 Mechanical Dimension

Figure 1 Mechanical Dimension



Dimension without plug-in connector (mm): 111(W) x 75(H) x 25(D)
Dimension with connector (mm): 140(W) x 113(H) x 25(D)

4. TERMINAL CONNECTIONS

4.1 Terminal connections on MSG-21 Enclosures

4.1.1 Sticker File details

Figure 2 Front Sticker Image



4.1.2 Terminal connection detail for MSG-21 Enclosure

Table 2 Terminal Connection Detail

No.	Terminal Type	Description (Left to Right Direction)
1	MSTB Connector 2-pin for 24DC input power Part No: -MC 1,5/2-ST-3,5 (1840366) Manufacturer: Phoenix Contact	DCIN+ DCIN-
2	MSTB Connector 3-pin for Digital Input Channel Part No: - MC 1,5/3-ST-3,5 (1840379) Manufacturer: Phoenix Contact	1+(Positive) 2+(Positive) CI (Negative)
3	MSTB Connector 3-pin for Digital Output Channel Part No: - MC 1,5/3-ST-3,5 (1840379) Manufacturer: Phoenix Contact	1+(Positive) 2+(Positive) CO(Negative)
4	MSTB Connector 3-pin for RS485 Part No: - MC 1,5/3-ST-3,5 (1840379) Manufacturer: Phoenix Contact	D+ D- G(Ground)
5	RJ45 Socket for Ethernet Part No: -TCT-LPJK7002A98NL Manufacturer: Link-PP	For RJ45 based Ethernet connection for web server

4.2 How to connect wires

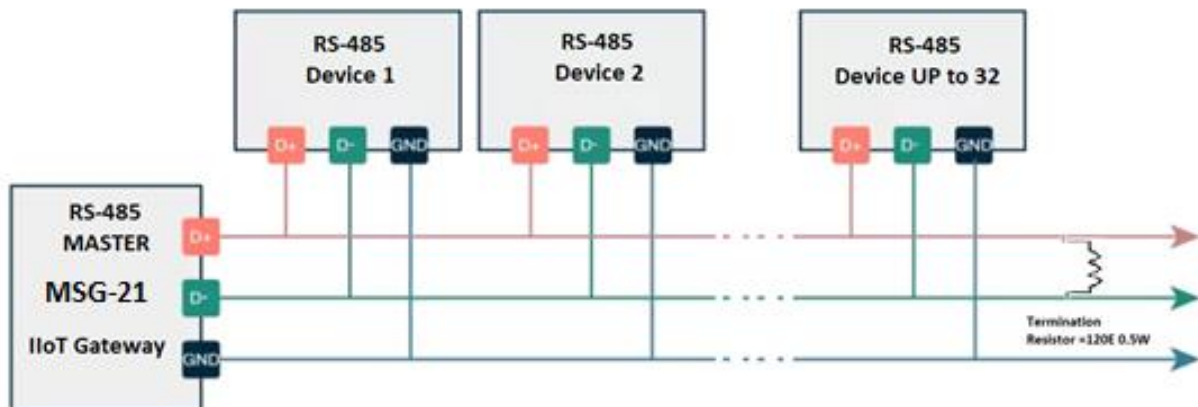
Before carrying out wiring, turn off the power and check that the cables to be connected are not alive because there is a possibility of electric shock.



NOTE:

- ✓ All wiring must confirm to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for Voltage, Current and temperature rating of the system.
- ✓ Provide power from a single-phase instrument power supply. If there is a lot of noise in the power line, insert an insulating transformer into the primary side of the line and use a line filter on the secondary side. Do not place the Power Supply and I/O cables close to each other.
- ✓ Use repeater after each set of 32 instruments connected in RS-485 Communication.
- ✓ Unused terminals should not be used as jumper points as they may be internally connected, which may cause damage to the unit.
- ✓ Supply voltage must be below maximum voltage rating specified on the label.

Figure 3 RS485 Connection Details



5. CONFIGURATION GUIDELINES

5.1 Parameter Configuration

Using a webserver, the MSG-21 Gateway's parameter configuration is simple to set up. By sending an HTTP request to the device IP address using a web browser like Google Chrome, anyone can access the web server. The MSG21 device's default IP address is 192.168.100.110. The device's websites are as shown below after receiving a successful HTTP response.

Make that the computer or system is connected to the same IP address network and subnet.

For the Webserver login, the default user name and password are

- Username : Admin
- Password : Admin

After updating any parameter on any web page, you must use the "Save" button. Only after performing a power ON/OFF recycling or hitting the "Reboot" button will saved parameters take effect.

The **MSG-21** device will reset after pressing the 'Reboot' button. The STAT LED will be in the OFF condition after pressing the "Reboot" button.

Remote firmware and configuration parameter updates for the MSG-21 device are possible via an FTP server. Please see Annexure 1 for more information.

5.1.1 System Info Page

Figure 4 System Info Web Page

System Information	
Model:	MSG-21
Firmware Version:	0.0.1
Hardware Version:	0.0.1
IMEI No:	123456789987654
IMSI No:	1234567890
MAC Address:	FF-FF-RR-ER-FF-FF
Date/Time:	Thu, 18 Nov 2021 07:00:45 GMT
Load Parameters From Local Disk:	<input type="button" value="Load"/>
Save Parameters To Local Disk:	<input type="button" value="Save"/>

This page offers configuration details for **MSG-21** devices, including the most recent hardware and software releases, the IMEI and SIM card numbers for cellular modems, the MAC address, and the current day and time.

Table 3 System Info Parameter

Parameter	Description
Model	Device Model Name
Firmware Version	The device's current software version
Hardware Version	The device's current hardware version
IMEI No	Cellular modem IMEI number
IMSI No	The SIM's IMSI number This is used for cellular communication
MAC Address	MAC address
Date/Time	Date and Time Currently Used

The "Load" button allows you to load the Parameters configuration file from the local disc by entering the location of the file on your PC or local network.

'Save' Button: The current parameter setting can be downloaded using this button and stored in a file on the local system or PC.

5.1.2 General Info Page

The web server login credentials, NTP server settings, SIM section, and data logging memory option are all configured via the General Configuration Page. Observed as in the illustration below

Logged data will be erased when the Data Logging option is set to Disable

Figure 5 General Web Page

Table 4 General Configuration Parameter

Parameter	Description	Default	Format	Range
Admin Username	the username for the web server It is just required to access the web server.	Admin	String (R/W)	1 ~ 5 characters
Admin Password	It is just required to access the web server.	Admin	String (R/W)	1 ~ 5 characters
Device ID	The device ID is specified. It's used to deliver SMS messages with device ID and periodic data frames to a MQTT server.	MSG21-DEV-1	String (R/W)	1 ~ 20 characters
Device Description	The only need is that the device be recognized.	MSG21	String (R/W)	1 ~ 20 characters
NTP server 1 URL	specifies the NTP server's URL. It is used to synchronize the time on the device.	2.pool.ntp.org	String (R/W)	1 ~ 256 characters
NTP Port 1	Indicates the NTP Port. It is utilized to synchronize the device's time.	123	Integer (R/W)	1 ~ 65535
NTP server 2 URL	specifies the NTP server's URL. It is used to synchronize the time on the device.	2.pool.ntp.org	String (R/W)	1 ~ 256 characters
NTP Port 2	Indicates the NTP Port. It is utilized to synchronize the device's time.	123	Integer (R/W)	1 ~ 65535

Time Zone	It is used to set a device's time using either IST or UTC.	IST	Option	IST/UTC
SIM Selection	To use a SIM card, select the cellular option.	Disable	Option	Disable/SIM1
Data Logging	Enable or disable the data frame logging based on the likelihood of a cellular network failure. The Device sends the logged data once the network is back online.	Enable	Option	Enable/Disable

5.1.3 Communication Page

The Ethernet parameter, SIM card parameter, serial configuration, and choice of Input and Output data delivered to the MQTT server are all configured on the Communication Page.

Figure 6 Communication Web Page

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System Info.

General

Communication

MQTT

Digital In/Out

Modbus

SMS

Ethernet

Internet Protocol: Static

IP Address: 192.168.100.110

Subnet Mask: 255.255.255.0

Gateway: 192.168.100.254

SIM 1

SIM Pin:

Username:

Password:

APN: internet

Baud Rate: 9600

Parity: none

Data Bits: 8

Stop Bits: 1

Poll Time (mSec): 3000

Timeout (mSec): 1000

MQTT Periodic Data to Server

Send MODBUS Data

Send DI Data

Send DO Data

Save
Reboot

Table 5 Communication Parameters

Parameter	Description	Default	Format	Range
Internet Protocol	MSG-21 IP address selection	Static	Option	Static/DHCP
IP address	MSG-21's IP address (in static mode only)	192.168.100.110	XXX.XXX.XXX.XXX(R/W)	1 ~ 15 characters
Subnet Mask	MSG-21's subnet mask address (in static mode only)	255.255.255.0	XXX.XXX.XXX.XXX(R/W)	1 ~ 15 characters
Gateway	MSG-21's gateway address (in static mode only)	192.168.100.254	XXX.XXX.XXX.XXX(R/W)	1 ~ 15 characters
SIM Pin	SIM card PIN for your cellular network. Use just if your SIM card is locked.	Empty	String (R/W)	1 ~ 5 characters
User name	Username for your SIM card's mobile network account. Use only when your mobile service provider specifies.	Empty	String(R/W)	1 ~ 20 characters
Password	Your SIM card's account password for your mobile network. Use only when your mobile service provider specifies.	Empty	String(R/W)	1 ~ 20 characters
APN	The SIM card's access point name (APN), which links your device to the internet.	internet	String(R/W)	1 ~ 30 characters
Modbus Baud rate	Baud rate for RS485 port Modbus communication.	9600	Option	9600/ 19200/ 38400/ 57600/ 115200
Modbus Parity	Parity for RS485 Port Modbus communication.	none	Option	none/ even/ odd
Modbus Data Bits	Number of data bits for RS485 Port Modbus communication.	8	Option	7/8 Bit
Modbus Stop Bits	Number of stop bits for RS485 Port Modbus communication.	1	Option	1/2 Bit
Modbus Poll Time (mSec)	Polling time for Modbus communication on RS485 Port. The device uses this time to determine when to send the next Modbus master query to the Modbus slave device.	3000(mSec)	Integer(R/W)	100 ~ 100000 (mSec)
Modbus Timeout (mSec)	Response timeout for Modbus communication on RS485 Port. This time decides the waiting period of Modbus slave response.	1000(mSec)	Integer(R/W)	10 ~ 10000 (mSec)
Send D/I Data	Periodically send measured digital input data to the MQTT server.	Enable	Check Box	Enable/Disable
Send D/O Data	Periodically send measured digital output data to the MQTT server.	Enable	Check Box	Enable/Disable
Send Modbus Data	Periodically send Modbus master data to the MQTT server.	Enable	Check Box	Enable/Disable

5.1.4 MQTT Page

The MQTT server Parameter is configured via the MQTT web page.

Figure 7 MQTT Web Page

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System Info.

General

Communication

MQTT

Digital In/Out

Modbus

SMS

Server Settings

Server URL:

Server Port:

Client ID:

Username:

Password:

Keep Alive(Sec):

Clean Session

Will Settings

Will Flag

Will-retain

Will Topic:

Will Message:

Will QoS:

Topic Settings

Publish Data Topic :

Alert Topic:

QoS:

Subscribe Topic:

Subscribe Topic Max QoS :

Periodic Data Publish Time (Sec) :

Periodic Frame Format(JSON):

```

{"ts":$ts$,"values":
{"IMEI":$IMEI$,"ID":$DEV_ID$,"FRAME":$FRAMES$,"DI1":$DI_1$,"DI2":$DI_2$,"DO1":$DO_1$,"DO2":$DO_2$}}

```

Certificate Settings

TLS/SSL

Server Authentication

Client Authentication

Server (Root CA) Certificate:

Client Certificate:

Private Client Key:

Save Certificate

Save

Reboot

Table 6 MQTT Configuration Parameters

Parameter	Description	Default	Format	Range
Server URL	MQTT server URL	test.mosquitto.org	String(R/W)	1 ~ 256 characters
Server Port	Port number for MQTT	1883	Integer(R/W)	1 ~ 65535
Client ID	MQTT server client ID	MSG21CID001	String(R/W)	1 ~ 256 characters
Username	MQTT server username, which is necessary for MQTT server login.	Empty	String(R/W)	1 ~ 256 characters
Password	MQTT server password, which is necessary to log in to the MQTT server.	Empty	String(R/W)	1 ~ 256 characters
Keep alive (Sec)	Time for the keep-alive message	120	Integer(R/W)	1 ~ 3600 (Sec)
Clean session	The last MQTT messages are removed by the Server and the Client in the event of a missing ACK if the parameter "Clean Session" is selected. If left unchecked, the most recent MQTT messages are stored on the server and client. Since all ACK messages are successfully sent, they try to transmit them again in the event of an improper disconnect or a missing ACK (valid only for QoS 1 and QoS 2).	Disable	Check Box	Enable/Disable
Will Flag	When connected to the server, the device will publish the Will topic if the "Will Flag" field is checked. With this functionality, the Server will post this subject to all of the MQTT Clients who have subscribed to it in the event of an incorrect disconnection.	Disable	Check Box	Enable/Disable
Will Topic	Specify the will topic. It is used for the Will message.	MSG21/WILL	String(R/W)	1 ~ 256 characters
Will Message	Specify the payload of the Will message.	MSG21/WILL MSG	String(R/W)	1 ~ 256 characters
Will QoS	Set the QoS type for which the Will message is defined.	0[ZERO]	Option	0/ 1/ 2
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.	Disable	Check Box	Enable/Disable
Periodic Data Topic	Specify the Periodic Published Topic for the periodic data sent to the MQTT server.	MSG21/PERIODIC	String(R/W)	1 ~ 256 characters
Alert Topic	Sending alert data to the MQTT server requires specifying the Alert Topic.	MSG21/ALERT	String(R/W)	1 ~ 256 characters
QoS	In the field "QoS" the QoS type for Periodically data sent is defined.	0[ZERO]	Option	0/ 1/ 2
Subscribe Topic	When sending Subscribe data to the MQTT server, provide the Subscribe Topic.	MSG21/SUB	String(R/W)	1 ~ 256 characters
Subscribe Topic Max. QoS	Set the QoS type Subscribe Topic.	0[ZERO]	Option	0/1/2

Periodic Data Publish Time (Sec)	Configure the periodic publish data interval for periodic publish data transmitted to the MQTT server.	60 (Sec)	Integer(R/W)	5 ~ 86400 (Sec)
Periodic Frame Format (JSON)	Specify the Publish Data Format in JSON	Default String	String(W)	1 ~ 4096 characters
TLS/SSL	Enable or Disable TLS/SSL Option. It is used for secure server login	Disable	Check Box	Enable/Disable
Server Authentication	Enable or Disable the server authentication. It is used for secure server login.	Disable	Check Box	Enable/Disable
Client authentication	Enable or disable the Client authentication.	Disable	Check Box	Enable/Disable
Server Certificate	Specify the server certificate. It Applicable when Client authentication enable	Empty	String(R/W)	1 ~ 4096 characters
Client Certificate	Specify the client certificate. It Applicable when Client authentication enable	Empty	String(R/W)	1 ~ 4096 characters
Client Key	Specify the client key. It Applicable when Client authentication enable	Empty	String(R/W)	1 ~ 4096 characters

'Save Certificate' Button: The server certificate, client certificate, and client key are saved using this button.

The MQTT server disconnects the **MSG-21** device if it does not receive any payload from the **MSG-21** device within 1.5 times the Keep Alive time period.

See the Default Publish Data Frame Format string in JSON

```
{“ts”:$ts$,”values”:{“IMEI”:$IMEI$,”ID”:$DEV_ID$,”FRAME”:$FRAME$,”DI1”:$DI_1$,”DI2”:$DI_2$,”DO1”:$DO_1$,”DO2”:$DO_2$}}
```

5.1.5 Digital In/Out Page

The settings of digital input and output are configured using this digital input-output configuration.

Figure 8 Digital In/Out Web Page

The screenshot shows the Masibus IOT Gateway web interface. On the left is a navigation menu with options: System Info, General, Communication, MQTT, Digital In/Out (highlighted), Modbus, and SMS. The main content area is titled 'Digital Input' and contains a table with columns: No, Enable, Mode, Filter Time (mSec), Count From Last, Step Alarm Counts, SMS Alarm, Server Alarm, SMS Alarm Group, and SMS Description. Below this is a 'Digital Output' section with a table with columns: No, Enable, Mode, Impulse Time (mSec), and Retain Last Value. At the bottom of the configuration area are 'Save' and 'Reboot' buttons.

No	Enable	Mode	Filter Time (mSec)	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

No	Enable	Mode	Impulse Time (mSec)	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"/>

DIGITAL INPUT

The setup options for the digital input channel are listed in the following table. User can operate the digital input channel in ON/OFF or Counter Mode.

Table 7 Digital Input Parameters

Parameter	Description	Default	Format	Range
Enable	Enables or disables the digital input source.	Enable	Check Box	Enable/Disable
Mode	Digital input mode	ON/OFF	Option	ON/OFF/Counter
Filter Time(mSec)	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. Applicable in ON/OFF mode only	0(mSec)	Integer(R/W)	0 ~ 10000 (mSec)
Count from Last	Enables or disables the digital input count from the last stored value	Enable	Check Box	Enable/Disable
Step alarm count	Max. alarm count for sending alarm SMS msg	0	Integer(R/W)	0 ~ 65535
SMS alarm	Enables or disables the SMS alarm when an alarm occurs	Disable	Check Box	Enable/Disable
Server Alarm	Enables or disables the Server alarm when an alarm occurs	Disable	Check Box	Enable/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	12345	String(R/W)	1 ~ 5 characters
SMS Description	SMS alert message	DI-CH-1(CH-1) DI-CH-2(CH-2)	String(R/W)	1 ~ 20 characters

When the last count option in the digital input configuration is disabled, the last value of the digital input as a counter will be removed. The digital input counter here starts at zero.

DIGITAL OUTPUT

The configuration of the digital output channel is shown in the Table. User can operate the digital output in ON/OFF or impulse mode. For a predetermined amount of time, it is in sink mode in impulse mode.

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.

Table 8 Digital Output Parameters

Parameter	Description	Default	Format	Range
Enable	Enables or disables the Digital output source.	Enable	Check Box	Enable/Disable
Mode	Digital output mode selection	On/OFF	Option	ON/OFF/Impulse
Impulse Time	Impulse Time of output	1000(mSec)	Integer (R/W)	1 ~ 10000 (mSec)
Retained Last Value	Enables or disables the digital output generated based on last stored value	Enable	Check Box	Enable/Disable

5.1.6 Modbus Page

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

Figure 9 Modbus Web Page

No	Slave ID	Function Code	Reg. Start Address	Reg. Length	Data Format	Tag Name
1	1	3	1	1	Uint_16	Tag1
2	2	3	1	1	Uint_16	Tag2
3	3	3	1	1	Uint_16	Tag3
4	4	3	1	1	Uint_16	Tag4
5	5	3	1	1	Uint_16	Tag5
6	6	3	1	1	Uint_16	Tag6
7	7	3	1	1	Uint_16	Tag7
8	8	3	1	1	Uint_16	Tag8
9	9	3	1	1	Uint_16	Tag9
10	10	3	1	1	Uint_16	Tag10
11	11	3	1	1	Uint_16	Tag11
12	12	3	1	1	Uint_16	Tag12
13	13	3	1	1	Uint_16	Tag13
14	14	3	1	1	Uint_16	Tag14
15	15	3	1	1	Uint_16	Tag15
16	16	3	1	1	Uint_16	Tag16

Table 9 Modbus Configuration Parameters

Parameter	Description	Default	Format	Range
Max Modbus Client	Number of Modbus slave devices or Modbus queries for Modbus communication.	0	Integer(R/W)	0 ~ 16
Slave ID	Modbus slave device ID for Modbus communication.	1 ~ 16	Integer(R/W)	1 ~ 247
Function Code	Function code for Modbus communication	3	Integer(R/W)	1 / 2 / 3 / 4 / 5 / 6 / 15 / 16
Reg. Start Address	Start address of Modbus query for Modbus communication	1	Integer(R/W)	1 ~ 65535
Register Length	Read Modbus register length for Uint (unsigned integer) 16	1	Integer(R/W)	1 ~ 128
Data Format	Data format for Modbus register read	Uint_16	Integer(R/W)	Bool / Int_16 / Uint_16 / Int_32 / Uint_32 / Float / Float Swap / Double / Double Swap
Tag Name	Specify the Tag Name.	Tag1	String(R/W)	1 ~ 20 characters

5.1.7 SMS Page

Users can enter their mobile phone numbers on the SMS page to get alert SMS messages.

Figure 10 SMS Web Page

Group No.	Mobile No.
1	<input type="text"/>
2	<input type="text"/>
3	<input type="text"/>
4	<input type="text"/>
5	<input type="text"/>

Table 10 SMS Configuration Parameters

Parameter	Description	Default	Format	Range
Mobile No	User mobile number to receive alert on SMS. Specify the Mobile no with country code ex.+91XXXXXXXXXX	Empty	String(R/W)	1 ~ 13 characters

See the below table for STAT LED indication

Table 11 STAT LED Indication

No Error	STAT (Green) LED Glow
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
SIM card Not Detected	Error (Red) LED Glow

6. OPERATION INFORMATION

6.1 MQTT Communication

MQTT is a Client Server publish/subscribe messaging transport protocol. It is light weight, open, simple, and designed so as to be easy to implement. These characteristics make it ideal for use in many situations, including constrained environments such as for communication in Machine to Machine (M2M) and Internet of Things (IoT) contexts where a small code footprint is required and/or network bandwidth is at a premium.

MQTT Client

An MQTT client is any device that runs an MQTT library and connects to an MQTT broker over a network.

MQTT Broker

The broker is at the heart of any publish/subscribes protocol. Depending on the implementation, a broker can handle up to millions of concurrently connected MQTT clients. The broker is responsible for receiving all messages, filtering the messages, determining who is subscribed to each message, and sending the message to these subscribed clients. The broker also holds the session data of all clients that have persistent sessions, including subscriptions and missed messages. Another responsibility of the broker is the authentication and authorization of clients.

ClientID

The client identifier (ClientID) identifies each MQTT client that connects to an MQTT broker. The broker uses the ClientID to identify the client and the current state of the client. Therefore, this Id should be unique per client and broker.

Clean Session

The clean session flag tells the broker whether the client wants to establish a persistent session or not. In a persistent session (Clean Session = false), the broker stores all subscriptions for the client and all missed messages for the client that subscribed with a Quality of Service (QoS) level 1 or 2. If the session is not persistent (Clean Session = true), the broker does not store anything for the client and purges all information from any previous persistent session.

Username/Password

MQTT can send a user name and password for client authentication and authorization.

Will Message

The last will message is part of the Last Will and Testament (LWT) feature of MQTT. This message notifies other clients when a client disconnects ungracefully. When a client connects, it can provide the broker with a last will in the form of an MQTT message and topic within the CONNECT message. If the client disconnects ungracefully, the broker sends the LWT message on behalf of the client

Quality of Service (QoS)

The Quality of Service (QoS) level is an agreement between the sender of a message and the receiver of a message that defines the guarantee of delivery for a specific message.

There are 3 QoS levels in MQTT:

1. At most once (0)
2. At least once (1)
3. Exactly once (2).

When you talk about QoS in MQTT, you need to consider the two sides of message delivery:

1. Message delivery from the publishing client to the broker.
2. Message delivery from the broker to the subscribing client.

QoS 0 - at most once

The minimal QoS level is zero. This service level guarantees a best-effort delivery. There is no guarantee of delivery. The recipient does not acknowledge receipt of the message and the message is not stored and re-transmitted by the sender. QoS level 0 is often called "fire and forget".

QoS 1 - at least once

QoS level 1 guarantees that a message is delivered at least one time to the receiver. The sender stores the message until it gets a acknowledge packet from the receiver that acknowledges receipt of the message. It is possible for a message to be sent or delivered multiple times.

QoS 2 - exactly once

QoS 2 is the highest level of service in MQTT. This level guarantees that each message is received only once by the intended recipients. QoS 2 is the safest and slowest quality of service level.

The MQTT communication parameter are described in [section 6.1.4](#). See the procedure below to setup the MQTT configuration

1. Navigate to the Device's MQTT Webpage.
2. Enter the URL, Port, Username, and Password for the MQTT Server.
3. Specify the MQTT will Flag, Will Topic, and Will Message.
4. Specify the MQTT Publish Topic, Alert Topic, Subscribe Topic, and Publishing Interval.
5. To connect the MQTT server with TLS/SSL, a server and client authentication certificate are used.

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

Table 12 NET LED 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

6.2 Cellular Communication

The Cellular communication parameter are described in [section 6.1.2](#). See the procedure below to setup the cellular configuration

1. Ensure that the Pre-activated SIM card is properly inserted into the device, now on the General Web page, choose the SIM1 option under the SIM selection parameter.
2. Set up the **MSG-21** device's NTP server URL and NTP port to synchronize the time. The **MSG-21** device contacts the cellular network's NTP server with an NTP request. The device synchronizes with UTC time if it receives a response. Every 12 hours, the **MSG-21** device contacts the NTP server to seek time synchronization. For redundancy, there are two NTP servers available.
3. To send SMS alerts, choose the Time format. Such as IST or UTC.
4. Now select the data logging option to have data logged in the event of a cellular network outage or server disconnect. When the network or MQTT server connection is restored, the **MSG-21** device delivers the Logged data to the MQTT server.
5. By hitting the 'Save' button, user might just save all of the **MSG-21** device's parameters.

6. Set the SIM Related Parameters such as SIM Pin, Username, and Password on the Communication Webpage for the inserted SIM card if necessary. To establish a data connection, the **MSG-21** device must be setup with an APN. On the webpage for the **MSG-21** Device, the user must input the APN provided by the cellular network service provider.
7. The User will select the data that the MQTT server needs, such as Modbus data, digital input, and digital output.
8. By selecting the "Save" option, all of the **MSG-21** device's settings can be stored. To restart the device, tap the "Reboot" button after that.
9. Once the cellular modem has been successfully and error-free powered on, the IMEI and SIM No. are shown in the device information web page. The **MSG-21** device's RSSI and NET LEDs can be used to verify network connectivity.

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

Table 13 RSSI (Receiving Signal Strength Indication)

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

6.3 Digital Input Interface

The **MSG-21** device has two digital input channels. These digital Input channels can be set to be either digital input (ON/OFF) or pulse counter.

The filter time is the amount of time that must pass before a freshly altered input to a channel is acknowledged as a valid input. It is utilized to reduce input noise. The filter time has a minimum and maximum value of 0ms and 10,000ms, respectively. Only the ON/OFF mode is relevant to this parameter.

The configuration of the digital input parameters described in [Section 6.1.5](#). Follow the steps below to configure the digital input channel.

1. In the web page, configure the Digital Input channel parameter. Filter Time, SMS alarm, Server Alarm, SMS alarm Group, SMS description, and so on.
2. The count from the Last and Step alarm count used in the Digital Input counter mode.
3. Save and reboot the configuration changes by pressing the 'Save' and 'Reboot' buttons. The device is reset by pressing the 'reboot' button.
4. When the Digital Input is set to ON/OFF, it detects high and low logic levels. Based on the Filter Time in mSec, a true event from High to Low or Low to High will be considered.
5. If the Digital Input mode is selected as the counter mode, the counter will begin counting from the last stored value of the counter if the 'count form last' option is enabled; otherwise, the counter will begin counting from zero.
6. Based on the Step alarm count and counter Roll over, the SMS and Server alarm will be generated. The counter's roll over value is 4294967294.
7. When the send Digital Input data option is enabled in the communication web page, the value of Digital input channels 1 and 2 can be monitored by publishing periodic data based on a defined publishing interval on the MQTT server.

8. Depending on the option selected, the device will either send the alarm event to the MQTT server or the SMS alarm group number via SMS.

See SMS format of the device sends to the user mobile no when a digital input alarm event occurs.

Table 14 SMS Format - Digital Input

Device ID	MSG21-DEV-1
SMS Description	DI-CH-1
DI-CH-<Channel No>:1-High,0-Low	DI-CH-1:1
<DD/MM/YYYY, HH:MM: SS>	06/07/2022,10:10:20

- See the Configurable JSON Frame enter in Periodic Frame format.

```
{“ts”:$ts$,”values”:{“IMEI”:$IMEI$,”ID”:$DEV_ID$,”FRAME”:$FRAME$,”DI1”:$DI_1$,”DI2”:$DI_2$,”DO1”:$DO_1$,”DO2”:$DO_2$}}
```

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the Digital input and output option are selected based on above Configurable JSON Frame

```
{“ts”:1657097561000,”values”:{“IMEI”:123456789123456,”ID”:“MSG21-DEV-1”,“FRAME”:0,”DI1”:0,”DI2”:0,”DO1”:0,”DO2”:0}}
```

- See the Configurable JSON Frame enter in Periodic Frame format.

```
{“ts”:$ts$,”values”:{“IMEI”:$IMEI$,”ID”:$DEV_ID$,”FRAME”:$FRAME$,”DI1”:$DI_1$,”DI2”:$DI_2$}}
```

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the only Digital Input option is selected based on above Configurable JSON Frame

```
{“ts”:1657097561000,”values”:{“IMEI”:123456789123456,”ID”:“MSG21-DEV-1”,“FRAME”:0,”DI1”:0,”DI2”:0}}
```

Table 15 Digital Input - JSON Key Description for Payload of Periodic Data Topics

ts	Time stamp of JSON data in epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	MSG-21 Device Id
FRAME	Type of data in frame live data or log data,0=Live,1=Logged
DI1	Value of Digital Input 1
DI2	Value of Digital Input 2
DO1	Value of Digital Output 1
DO2	Value of Digital Output 2

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

```
{“ts”: 1657097561000,”values”:{“IMEI”: 123456789123456,”ID”: “MSG21-DEV-1”,“FRAME”: 0,”ALERT”: 2,”DI1”: 1}}
```

Table 16 Digital Input - JSON Key Description for Payload of Alert Topics

ts	Time stamp of JSON data epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	MSG-21 Device Id
FRAME	Type of data in frame live data, log data 0=Live,1=Logged
ALERT	Type of Alert (2: DI-1 ALERT, 3: DI-2 ALERT)
DI1 or DI2	Value of DI1 or Value of DI2

6.4 Digital Output Interface

The **MSG21** device has two digital output channels those are sink type (Open Collector). The digital output channels can be set to either ON/OFF or Impulse Mode (Single Pulse Mode).

During power on/off, the **MSG21** device can retain the status of the digital output channel. For the duration of the defined impulse time, the output is in sink mode in Impulse Mode (Single Pulse Mode) (mSec).

[Section 6.1.5](#) describes the Digital output parameter configuration. The Digital Output status can be changed by sending SMS to the device or a command to the device's subscription topic from the MQTT server.

The Digital Output can be monitored on a MQTT server's periodic frame. When the send Digital output data option is enabled in the communication web page, the **MSG-21** device will send the Digital output value on a periodic basis based on the MQTT publishing interval.

By pressing the 'Save' and 'Reboot' buttons, you can apply the configuration changes. The **MSG-21** device is reset by pressing the 'reboot' button. Change the status of any **MSG-21** device's digital output channel using the SMS format.

See the SMS format for changing the status of any digital output channel of MSG-21 device

Table 17 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 (Single Pulse) on any digital output channel of **MSG-21** device

Table 18 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 19 Format of Topic Published by MQTT Server- Digital Output SET/RESET

SET	{ "CMD": {"IMEI": "<IMEI No>", "DO1/DO2": "<SET/RESET>" } }	{ "CMD": {"IMEI": "123456789123456", "DO1": "SET" } }
RESET	{ "CMD": {"IMEI": "<IMEI No>", "DO1/DO2": "<SET/RESET>" } }	{ "CMD": {"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 20 Format of Topic Published by MQTT Server - Digital Output Impulse

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

Note: The User receives the Invalid command response in SMS when they send the ON/OFF SMS command to the **MSG-21** device and the **MSG-21** device is configured on Impulse mode through the webpage or vice versa

- See the Configurable JSON Frame enter in Periodic Frame format.

```
{“ts”:$ts$,”values”:{“IMEI”:$IMEI$,”ID”:$DEV_ID$,”FRAME”:$FRAME$,”DI1”:$DI_1$,”DI2”:$DI_2$,”DO1”:$DO_1$,”DO2”:$DO_2$}}
```

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the Digital input and output option are selected based on above Configurable JSON Frame

```
{“ts”:1657097561000,”values”:{“IMEI”:123456789123456,”ID”:"MSG21-DEV-1",“FRAME”:0,”DI1”:0,”DI2”:0,”DO1”:0,”DO2”:0}}
```

- See the Configurable JSON Frame enter in Periodic Frame format.

```
{“ts”:$ts$,”values”:{“IMEI”:$IMEI$,”ID”:$DEV_ID$,”FRAME”:$FRAME$,”DO1”:$DO_1$,”DO2”:$DO_2$}}
```

See the JSON format for the payload of Periodic data Topic which are sent on MQTT server when the only Digital Input option is selected based on above Configurable JSON Frame

```
{“ts”:1657097561000,”values”:{“IMEI”:123456789123456,”ID”:"MSG21-DEV-1",“FRAME”:0,”DO1”:0,”DO2”:0}}
```

Table 21 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	MSG-21Device Id
FRAME	Type of data in frame live data or log data ,0=Live,1=Logged
DI1	Value of Digital Input 1
DI2	Value of Digital Input 2
DO1	Value of Digital Output 1
DO2	Value of Digital Output 2

6.5 Modbus Communication

The maximum 16 number of Modbus slave devices connected to the RS485 Port of the **MSG-21** device or it can read a maximum of 128 registers from the Modbus slave devices.

The Modbus parameter configuration is described in [Section 6.1.6](#). See the below step to configure Modbus parameter to read Modbus registers from the slave devices.

The Modbus serial setting such as Baud Rate, Parity and Stop bit must match with the externally connected Modbus slave devices in Communication Web page.

The **MSG-21** 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 Max Modbus client, slave ID, function code, start address, register length, data format and publish interval in Modbus Webpage configuration.

To read 10 Holding registers (function code 3) with addresses from 40001 ~ 40010, enter value 1 in the Reg. Start address input box and value 10 in Reg. Length.

Table 22 Modbus Register Length Data Format

Data format	Data length
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 Registers
Float Swap	2 Modbus Registers
Double	4 Modbus Registers
Double Swap	4 Modbus Registers

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' Button. By pressing 'Reboot' Button the device is reset.

The Modbus communication can be checked by monitoring the TX and RX LED activity on the device. The **MSG-21** device sends the data to MQTT server which is defined in MQTT web page on Periodic Topic based on defined publishing interval.

See the Configurable JSON Frame enter in Periodic Frame format.

```
{“ts”: $ts$,“values”:{“IMEI”: $IMEI$,“ID”:$DEV_ID$,“FRAME”:$FRAME$,“ Slave_Status1”:$MB_STATE_1$,
“Datatype”: $MB_D_TYPE_1$,“Value_Register1”:$Tag1_1$,“ Value_Register2”:$Tag1_2$}}
```

See the JSON format for the payload of Modbus on Periodic Topic which are sent on MQTT server based on above Configurable JSON Frame

```
{“ts”:1657097561000,“values”:{“IMEI”:123456789123456,“ID”:"MSG21 DEV1",“FRAME”:0,“Slave_Status1”:0,
“Datatype”:“UINT16_T”,“Value_Register1”:100,“Value_Register2”:200}}
```

Table 23 JSON Key Description for Payload of Modbus

ts	Time stamp of JSON data in epoch time in ms
IMEI	IMEI number of cellular modem in device
ID	MSG-21 Device ID
FRAME	Type of data in frame live data or log data ,0=Live,1=Logged
Slave_Status1	Status of Modbus slave device, 1 = connected, 0 = not connected
Datatype	Selected Data Format ex. BOOL, INT16_T, UINT16_T, INT32_T, UINT16_T, FLOAT, SW_FLOAT, DOUBLE, or SW_DOUBLE
Value_Register1	Value of register start address 1 Tag1<Register Start Address>e.g. "Tag1_1 1 = Register Address1
Value_Register2	Value of register start address 2 Tag1<Register Start Address>e.g. "Tag1_2 2 = Register Address2

The Write the data to the Modbus slave devices can done by MQTT server. See the Modbus write Message format for the MQTT Publisher. Maximum 16 no of Data array register can be write in single write command.

Publish Command from the MQTT server:

```
{"CMD":{"IMEI":123456789123456,"MB_WR":{"REF":123,"D_TYPE":"UINT_16","SID":1,"FC":6,"START":1,"LEN":1,"DATA":[1525,1020]}}
```

Response From the MSG-21 to Subscribe topic of MQTT server:

```
{"ts":1657097561000,"values":{"IMEI":123456789123456,"ID":"MSG21-DEV-1","REF":123,"ACK":"OK"}}
```

Table 24 JSON Key Description for Payload of Modbus Write

IMEI	IMEI number of cellular modem in device
REF	Reference number from 0 to 65535
D_TYPE	DATA Type such as BOOL, INT_16, UINT_16, INT_32, UINT_32, FLOAT, FLOAT_SWAP
SID	Indicates to which slave request is sent.
FC	Function Code, 5 means Write Single Coil,15 Means Write multiple Coils, 6 means write single register,16 means write multiple registers
START	Starting address
LEN	No of register
DATA	Value of Modbus Register.

For the configurable JSON, the below key word must be specified in-between \$ Sign for the Key value.ex.\$ts\$

Table 25 JSON Key word for the Key value

ts	Time Stamp in epoch time in mSec
IMEI	IMEI number of cellular modem in device
DEV_ID	MSG-21 Device ID
FRAME	Type of Periodic data in frame live data or log data ,0=Live,1=Logged
DI_1	Value of Digital Input 1
DI_2	Value of Digital Input 2
DO_1	Value of Digital Output 1
DO_2	Value of Digital Output 2
Tag1_X	Value of Modbus Register, X = Address
MB_STAT_X	Status of Modbus slave device, X = Slave ID
MB_D_TYPE_X	Data Type of Modbus Slave Device, X = Slave ID

7. TROUBLESHOOTING TIPS

If a problem appears complicated, contact our Customer support representative.

IMPORTANT

Take note of the parameter settings when asking the vendor for repair.

Websserver of MSG-21 Does not Open

- Check the Device and PC or System in same IP network range
- Check the Ethernet cable is properly connected
- Check the Link and Activity LEDs of Ethernet connector are Glow
- Check the STAT LED Status

GSM Initialization Failed

- Check SIM Card is Properly inserted or not
- Check SIM PIN
- Check the Antenna connector
- Check the SIM PIN if its set already

8. REVISION HISTORY

Following Changes added in m132om101_Rev03 compared to m132om101_Rev02.

1. Configurable Frame Format updated
2. Periodic Publish time updated in Second.
3. Modbus Poll time Updated in millisecond.
4. Modbus Tag added in Modbus Page.
5. Modbus Write Message format Added.

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