



MSC-ME-MS/ZB

Modbus-RTU (RS485/802.15.4 Wireless) to
Modbus TCP Protocol Converter

User Manual

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1. Introduction

1.1 About the User Manual and Design Guide

Thank you for purchasing MSC-ME-MS/ZB device. This manual describes the basic functions and operation methods of MSC-ME-MS/ZB. Please read through this user's manual carefully before using the product.

The manual covers all aspects of operation of the instrument. Please read instructions carefully before altering any configuration parameter.

Note: Both MSC-ME-MS and MSC-ME-ZB device has same working, the only difference is that COM-2 of MSC-ME-ZB device has wireless interface whereas MSC-ME-MS device has RS485 interface.

1.2 An Overview of MSC-ME-MS/ZB

The MSC-ME-MS/ZB device is a gateway between serial Modbus-RTU Devices and Modbus TCP clients. This is ideal for many types of Serial Modbus devices like Energy Meters, PLCs, drives etc. Where the data is collected on RS485 -Modbus-RTU protocol and transfers it to Modbus TCP Protocol.

1.3 List of Accessories

No	Item name	Quantity	Remark
MSC-ME-MS			
1	MSC STUDIO Configuration Software	1	
2	User Manual	1	
MSC-ME-ZB			
1	MSC STUDIO Configuration Software	1	
2	User Manual	1	
3	Antenna	1	
4	USB to micro usb cable	1	
5	Antenna extension cable	1	Optional On request

1.4 Safety precautions

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

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

1.4.1 General Note

The user manual, the accompanying texts and the documentation are written for the use of the products by qualified personnel. When using the products, all safety instructions and all valid legal regulations have to be followed. Technical knowledge is presumed. The user has to assure that all legal regulations are followed.



Warning

This indicates a damage of product if not avoided.

1.4.2 Personnel Qualification

The MSC-ME-MS/ZB must only be installed configured and removed by qualified personnel. Professional qualification in the following specific areas of electrical engineering is required:

- Security and protection of health at work
- Mounting and attaching of electrical equipment
- Measurement and analysis of electrical functions and systems
- Evaluation of the security of electrical equipment

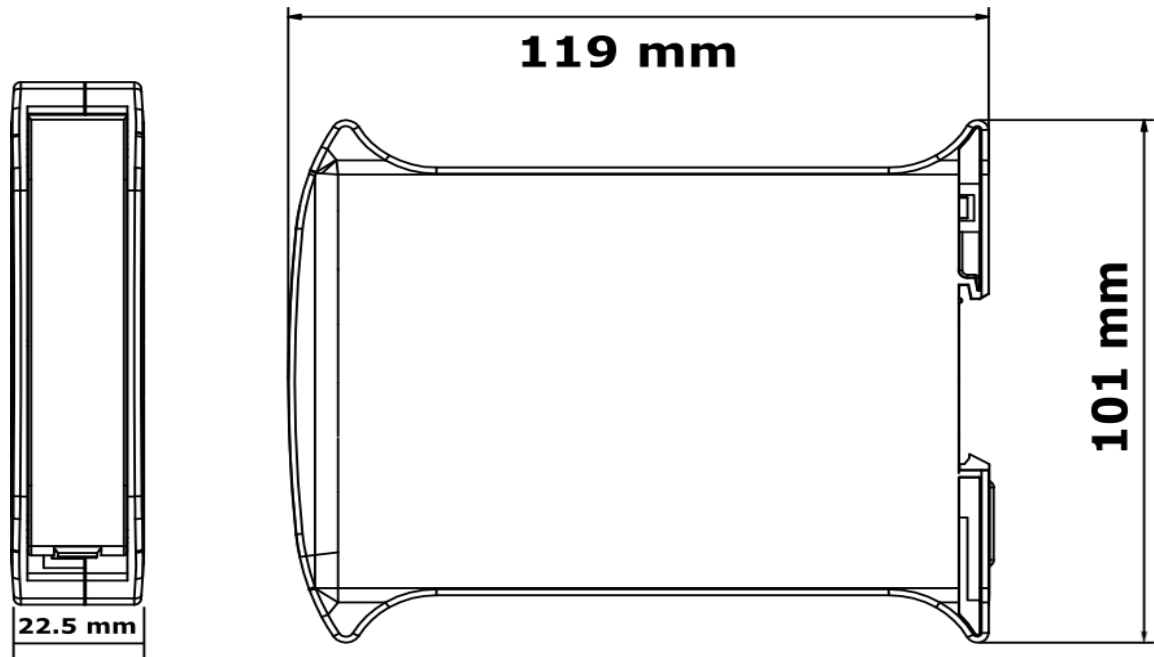
Important: Prior to installation and use of your device you must read and understand all instructions in this manual in order to avoid any damage.

2. Mechanical guidelines

2.1 Physical Dimensions

The Device's enclosure is shown below. The module clips directly onto an industry standard DIN rail. The module power and RS485 communications wiring is on a separate plug in connector on the upper side of the housing.

Mounting Suitable for DIN rail in compliance with EN-50022



2.2 Mounting Device on DIN rail

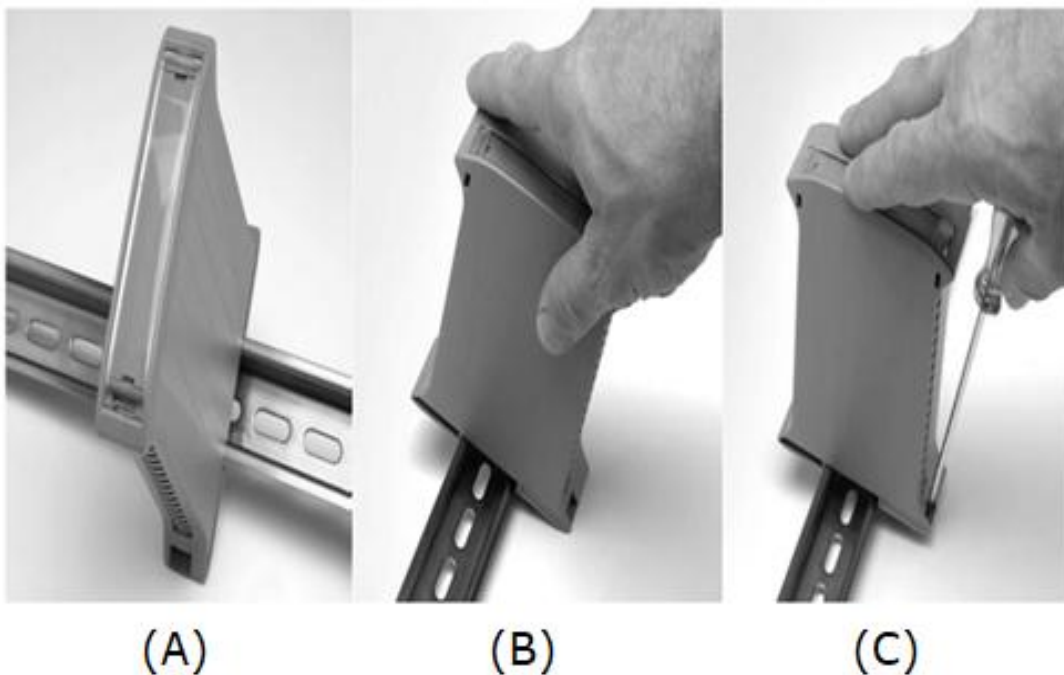


Fig <A> Electronic equipment's usually have the DIN rail mounting hook at the bottom; therefore we maintained this standard

**Fig ** demonstrates How to mount the enclosure on the DIN rail:

Insert the upper part of the enclosure onto the DIN rail and press until The Hook clicks itself

Fig <C> demonstrates How to remove the enclosure from the DIN rail:

Unhook the lower part using a screw driver and lift the enclosure from the DIN rail.

2.3 Mechanical Specifications

Module Case	ABS Plastic
Width	22.5 mm
Height	101 mm
Depth	119 mm
Weight	150g Approx.
Colour	Light grey

3. Technical specification

3.1 Technical Specification of MSC-ME-MS

Voltage Requirements	
Logic Supply voltage	18 - 32Vdc
Logic Supply Current	100mA max @24V
Power Consumption	< 5W
Ethernet port Specifications	
Network interface	Ethernet 10/100Base-T(auto-detecting)
Connector	RJ45 connection (auto-crossover)
Protocols	Modbus TCP/IP Server
Modbus Tcp Protocol Specification	
NO of Client for Modbus TCP/IP	Up to 15
Available Function Codes	(FC=03) :Read Holding Registers
	(FC=06) :Write single Registers
	(FC=16) :Write multiple Registers
Available holding registers	READ : 40001 to 42048
Address range	WRITE : 42049 to 43072
Modbus TCP - Maximum No. of Read/Input Registers	2048
Modbus TCP - Maximum No. of Write/Output Registers	1024
Configuration and Diagnostics	MSC Studio Software
Serial Port Specifications	
Communication Port	RS485 port 1 & 2 (D+, D-, GND) (2-wire half-duplex)
Communication Speed(Baud rate)	9600, 19200, 38400, 57600, 115200 bps.
Parity	ODD, EVEN, NONE
Data bits	8
Stop bit	1,2
Protocols	Modbus RTU master
Modbus Serial - Maximum Slave Configuration Support	64
Environmental Specifications	
Operating Temperature	0° C to 55° C
Storage Temperature	-10° C to 70° C
Humidity (Non-condensing)	30 to 95% RH

3.2 Technical Specification of MSC-ME-ZB

Voltage Requirements	
Logic Supply voltage	18 - 32Vdc
Logic Supply Current	100mA max @24V
Power Consumption	< 5W
Ethernet port Specifications	
Network interface	Ethernet 10/100Base-T(auto-detecting)
Connector	RJ45 connection (auto-crossover)
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NO of Client for Modbus TCP/IP	Up to 15
Available Function Codes	(FC=03) :Read Holding Registers
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	WRITE : 42049 to 43072
Modbus TCP - Maximum No. of Read/Input Registers	2048
Modbus TCP - Maximum No. of Write/Output Registers	1024
Configuration and Diagnostics	MSC Studio Software
Serial Port Specifications	
Communication Port	COM-1: RS485 port (D+, D-, GND) (2-wire half-duplex) COM-2: modbus over Wireless comm. Port
Communication Speed(Baud rate)	9600, 19200, 38400, 57600, 115200 bps.
Parity	ODD, EVEN, NONE
Data bits	8
Stop bit	1
Protocols	Modbus RTU master
Modbus Serial - Maximum Slave Configuration Support	64
Wireless Specification	
Operating frequency band	ISM 2.4 - 2.5 GHz
Supported Channels	12 channels : 12 to 23
Operational protocol	Digi mesh
Indoor/urban range	Up to 90 m (300 ft.)
Outdoor RF line of-sight range	Up to 3200m (2 miles)

Transmit power output (maximum)	63 mW (+18dBm)
RF data rate	250,000 b/s
Receiver sensitivity	-101 dBm
Environmental Specifications	
Operating Temperature	0° C to 55° C
Storage Temperature	-10° C to 70° C
Humidity (Non-condensing)	30 to 95% RH

Note: Range figure estimates are based on free-air terrain with limited sources of interference. Actual range will vary based on transmitting power, orientation of transmitter and receiver, height of transmitting antenna, height of receiving antenna, weather conditions, interference sources in the area, and terrain between receiver and transmitter, including indoor and outdoor structures such as walls, trees, buildings, hills, and mountains.

4. Connection Details

4.1 Wiring Detail

4.1.1 MSC-ME-MS

Following diagram shows the wiring of the power supply and RS-485 and power supply Connection.



Warning: Failure to follow improper installation practice of RS485 wiring and power supply wiring may cause failure of Device specifically communication failures.

- COM-1(com-A): RS485 communication port 1
- COM-2(com-B): RS485 communication port 2
- 24V DC power connector

Note: There are two **com-ports** available for serial communication as redundancy support Modbus RTU master. User can use only one port at a time i.e. While com port 1 is in working mode(Enable) then com port 2 will be in disable mode and vice versa.

4.1.2 MSC-ME-ZB



COM2: is wireless communication port MSC-ME-ZB device can communicate wirelessly using this com port.

Note: be sure that antenna on this com port is fixed well for proper wireless communication

COM1: RS485 communication port

Note: User can use only one port at a time i.e. while com port 1 is in working mode (Enable) then com port 2 will be in disable mode and vice versa.

Wireless configuration usb port: configuration of wireless device parameter. Use usb to micro usb cable to configure wireless device please go through wireless configuration process to communicate over wireless port.

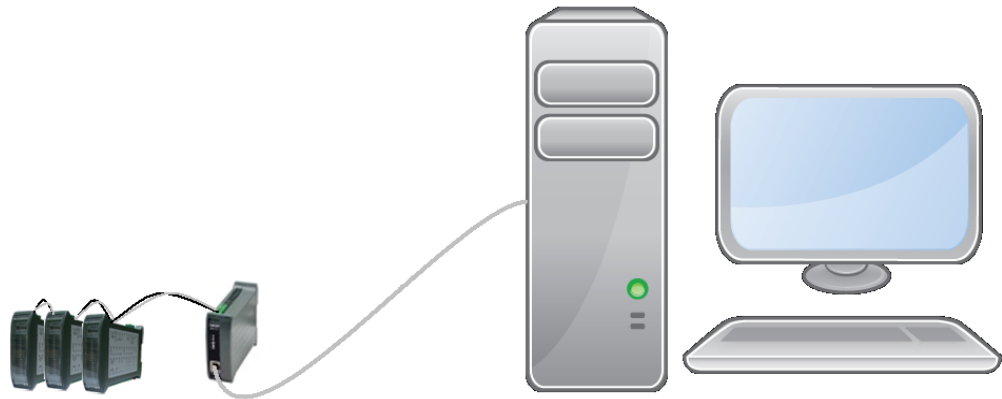
Power supply: 24V DC power connector

4.2 Ethernet connection setup

Ethernet connection is required, either through a network or directly to a PC. For Ethernet connection standard RJ45 connector is used.

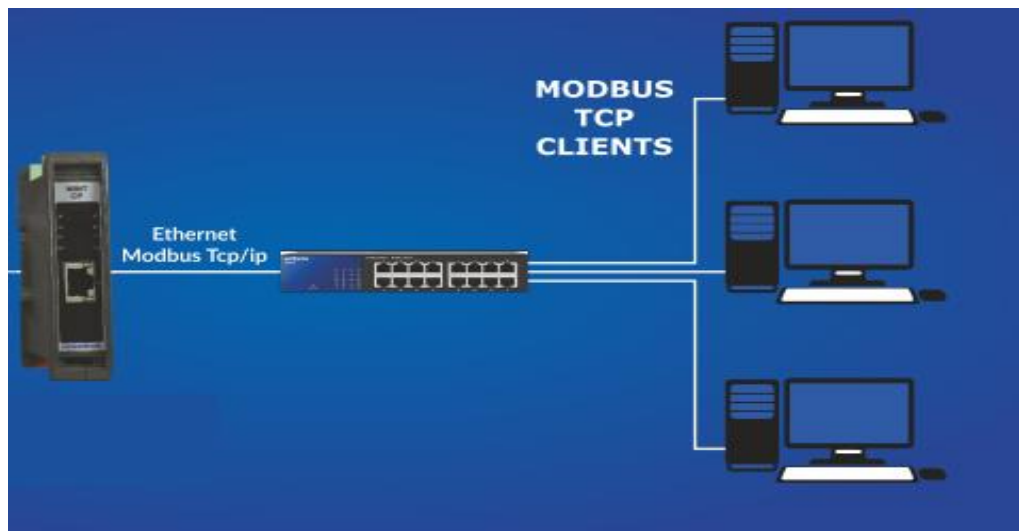
4.2.1 Direct connect to the PC

If PC is not connected to the network then PC should have an Ethernet card installed. Which help to connect MSC-ME-MS module to direct connect to the PC using simple Ethernet cable (RJ45). The MSC-ME-MS device is shipped with a default IP address 192.168.100.110. This address is in the address area reserved for local networks not connected to the internet.



4.2.2 Connect to PC via Ethernet/LAN

If any Ethernet network is available, the MSC-ME-MS can be connected to any Ethernet connection or hub belonging to the network. If the PC is connected to a network, there is a possibility that the default IP address of the MSC-ME-MS is outside the range of the network (address does not belong to the IP subnet to the network). In this case local network administrator can assign new or free IP address to the MSC-ME-MS.



4.3 RS485 Network Wiring guide

RS485 is designed to be used with a single twisted pair cable. One of the restrictions of this system is that the common mode voltages of the nodes on the network should not exceed -7V or +10V.

In order to ensure that this condition is met, it is recommended that the 0V connections on the modules be connected together. For modules that are far apart, a second twisted pair should be used as the 0V link.

In certain applications where there are strong possibilities of an earth loop being caused by the 0V link, the link should be tied to the 0V terminal on each module through a 100ohm resistor, to limit the earth loop current. Where earth loop problems exist, it may be necessary to isolate the RS485 network either using optical fiber or an isolated RS485 repeater.

4.3.1 RS485 Cabling Methodology

Method-1, Single Twisted pair, No shield

In this case, "Earth" is ground and it is inexpensive, easy to install. This kind of cabling is suitable. If conduits are used for communication cables, power supply cables are not available and environment is free from electrical noise. This method is not recommended for industrial applications.

Method-2, Shielded single twisted pair + Earth wire

One pair is used for RS-485 communications and extra wire used specifically for a ground wire.

Method-3, Shielded single twisted pair cable

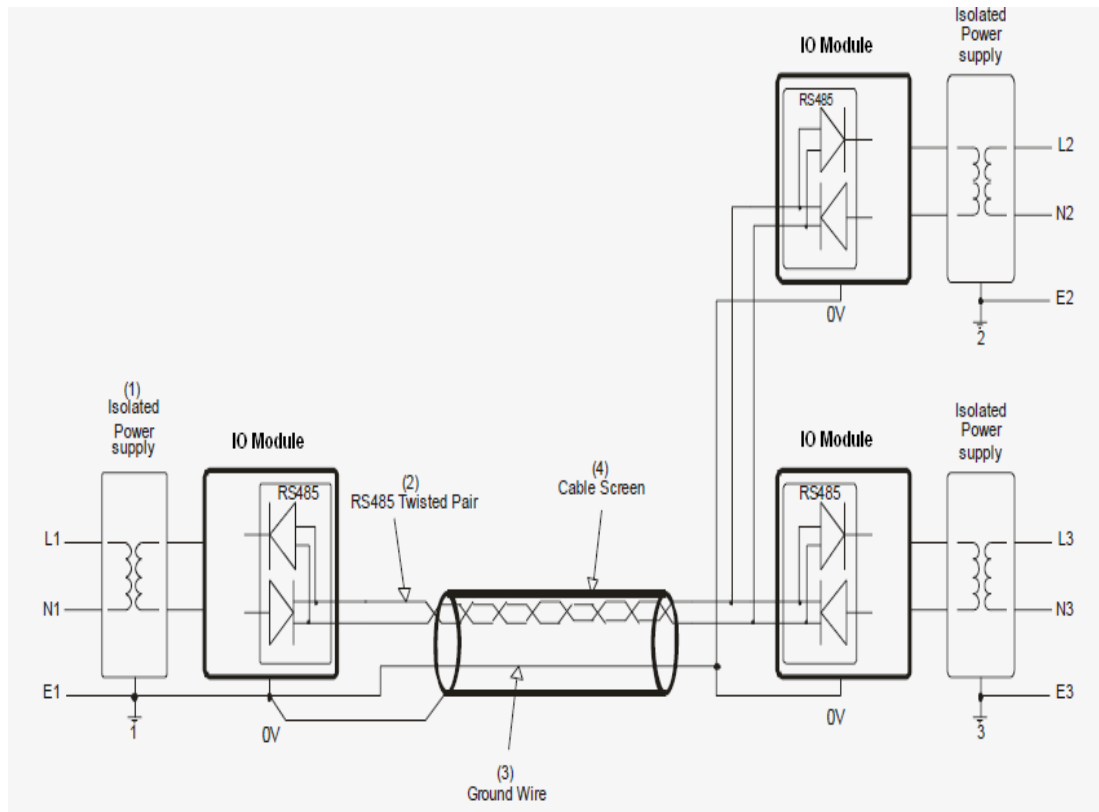
One pair is used for RS-485 communications and shield is used for return.

Method-4, Shielded twisted pair, 2 pairs

One pair is used for the RS-485 communications and another pair is used for ground. Method 2 to 4 would reduce noise induced through ground potential differences. This is the preferred option in areas where there is a potential for high electrical noise or if cabling lacks the cleanliness of conduit or wire trays. The drawback of the three conductor option is elevated cable pricing and is slightly more difficult to install. Care must also be taking using this option not to create a ground loop.

Good installation practice for RS485 systems:

- Use RS485 shielded twisted cable to prevent electrical noise pickup.
- Use a screened cable to prevent electrical noise pickup. This screen must be earthed at one end only, UNIT-1.
- Do not carry RS485 and power supply in same cables.
- Do proper termination and/or shielding to provide isolation from high frequency interference, RFI, and transient



4.4 Led Indications

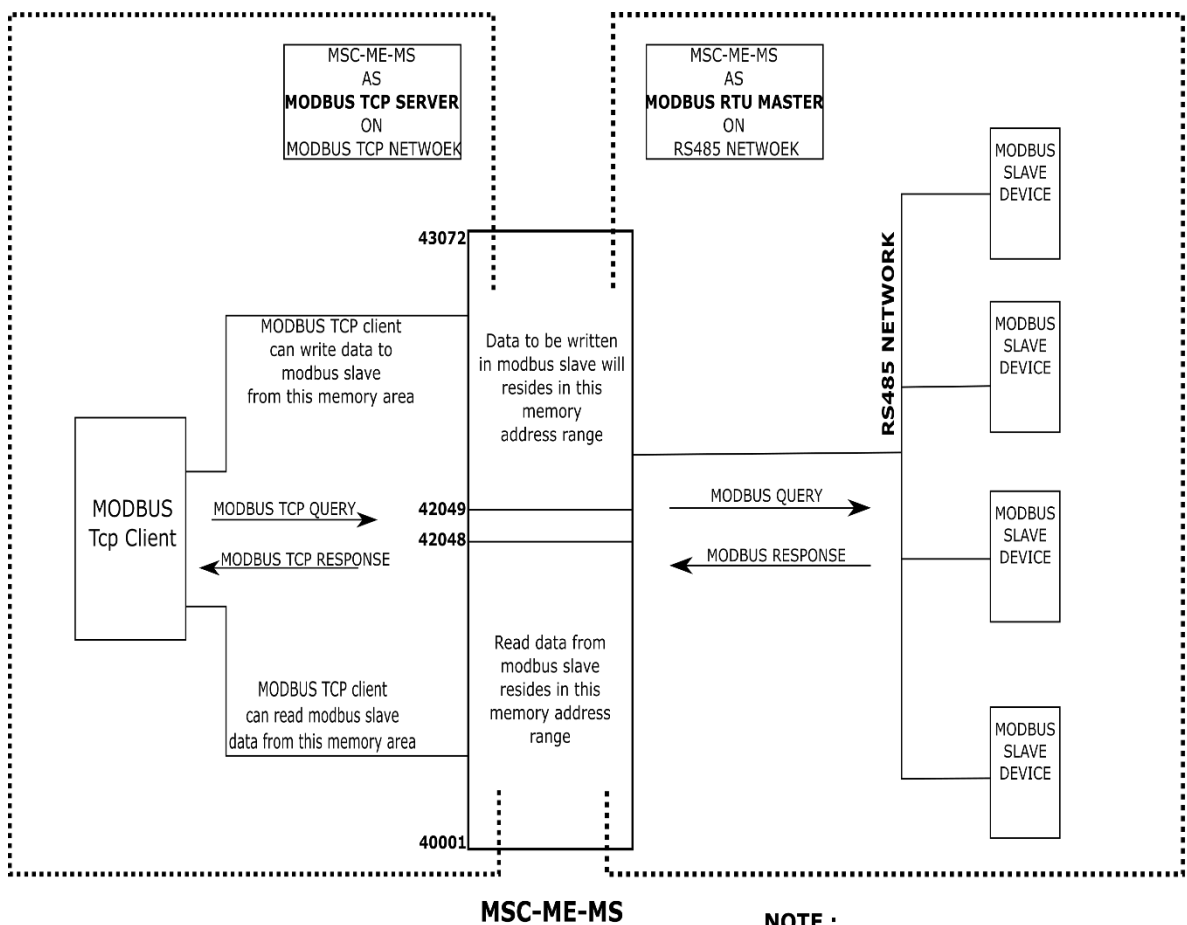
Name	Indication
P: Power supply	power supply is been provided
S: Status	healthy condition of microcontroller
IO: Diagnostic	Device's all Parameters are in factory Default states
M: Memory	data communication with flash memory
R1: com-1-receive	data receive activity at com port 1
T1: com-1-transmit	data transmission activity from com port 1
R2: com-2-receive	data receive activity at com port 2
T2: com-2-transmit	data transmission activity from com port 2

5. Device operation and configuration

5.1 MSC-ME-MS/ZB operational overview

Note: Both MSC-ME-MS and MSC-ME-ZB device has same working, the only difference is that COM-2 of MSC-ME-ZB device has wireless interface whereas MSC-ME-MS device has RS485 interface.

Below image demonstrates operational overview of MSC-ME-MS as gateway between modbus RTU slaves and modbus TCP client. Data management between MODBUS TCP and MODBUS Serial done by the means of modbus serial to modbus TCP register mapping. Hence it is necessary to map this register addresses using MSC Studio tool at the time of MSC-ME-MS device setup.



NOTE :
TO READ DATA FROM OR WRITE DATA TO MODBUS SLAVE BY MODBUS TCP CLIENT IT IS COMPULSORY TO MAP MODBUS SLAVE'S DATA ADDRESS TO SPECIFIC MODBUS TCP ADRESS INSIDE MSE-ME-MS DEVICE USING MSC CONFIGURATION SOFTWARE

5.2 How Address mapping works?

Suppose user wants to acquire data of some modbus RTU slave using MSC-ME-MS device, user will have to perform below mapping task in MSC Studio tool.

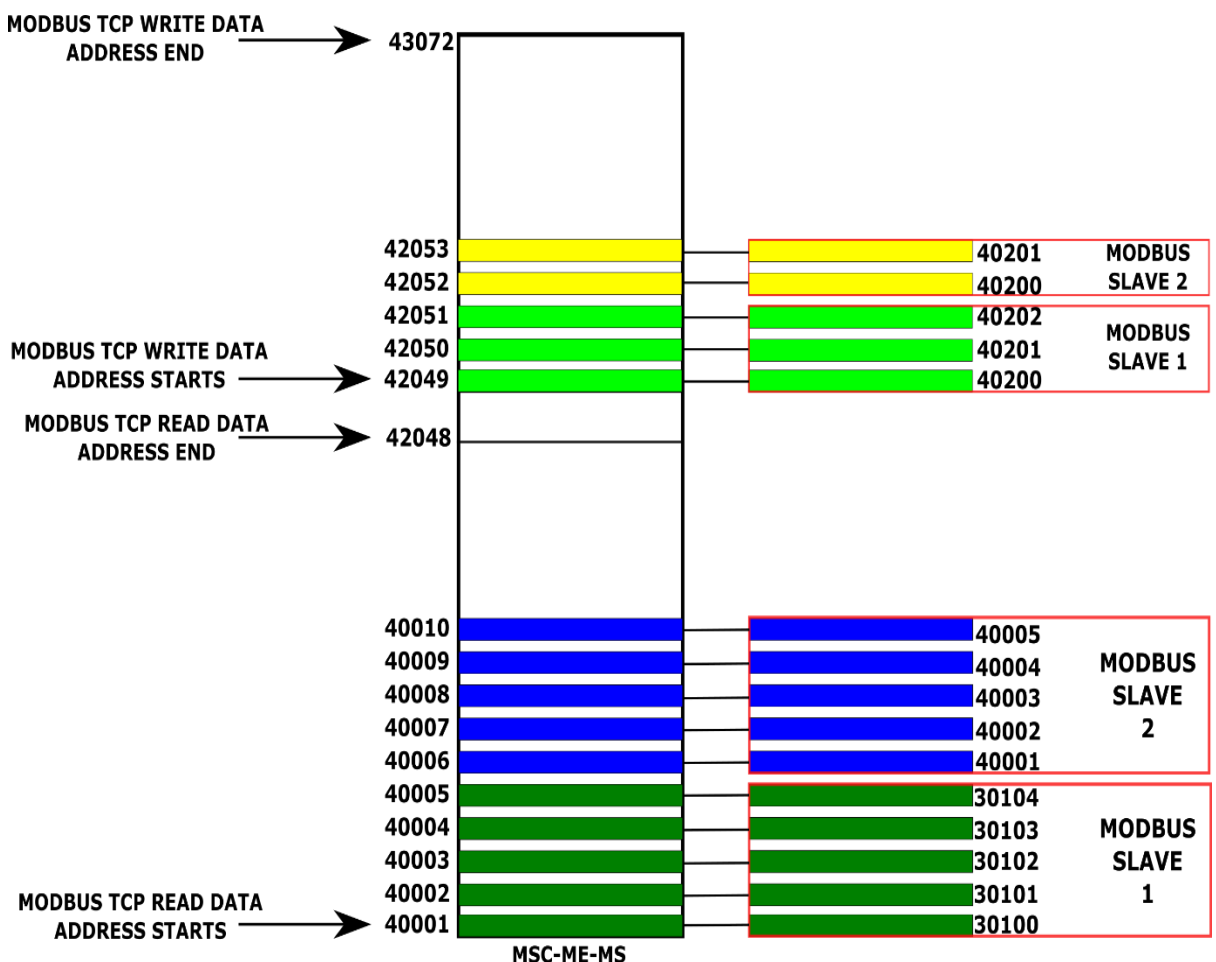
NOTE: MSC-ME-MS allows maximum 2048 read register and maximum 1024 write register.

Example: Reading Data from modbus RTU slave:

Suppose User needs data of Input registers address starting from 30100 to 30104 of modbus RTU slave with address 1. MSC Studio tool will map this data automatically on respective modbus TCP holding registers, for example let say 40001 to 40005.

Now user can query to MSC-ME-MS using any modbus TCP client software like modscan32 to read holding registers 40001 to 40005.

Any change of value in modbus RTU slave input register 30100 to 30104 will directly reflect on modbus TCP 40001 to 40005 register address.



MSC-ME-MS DATA MAPPING EXAMPLE

Example: Writing Data to modbus RTU slave:

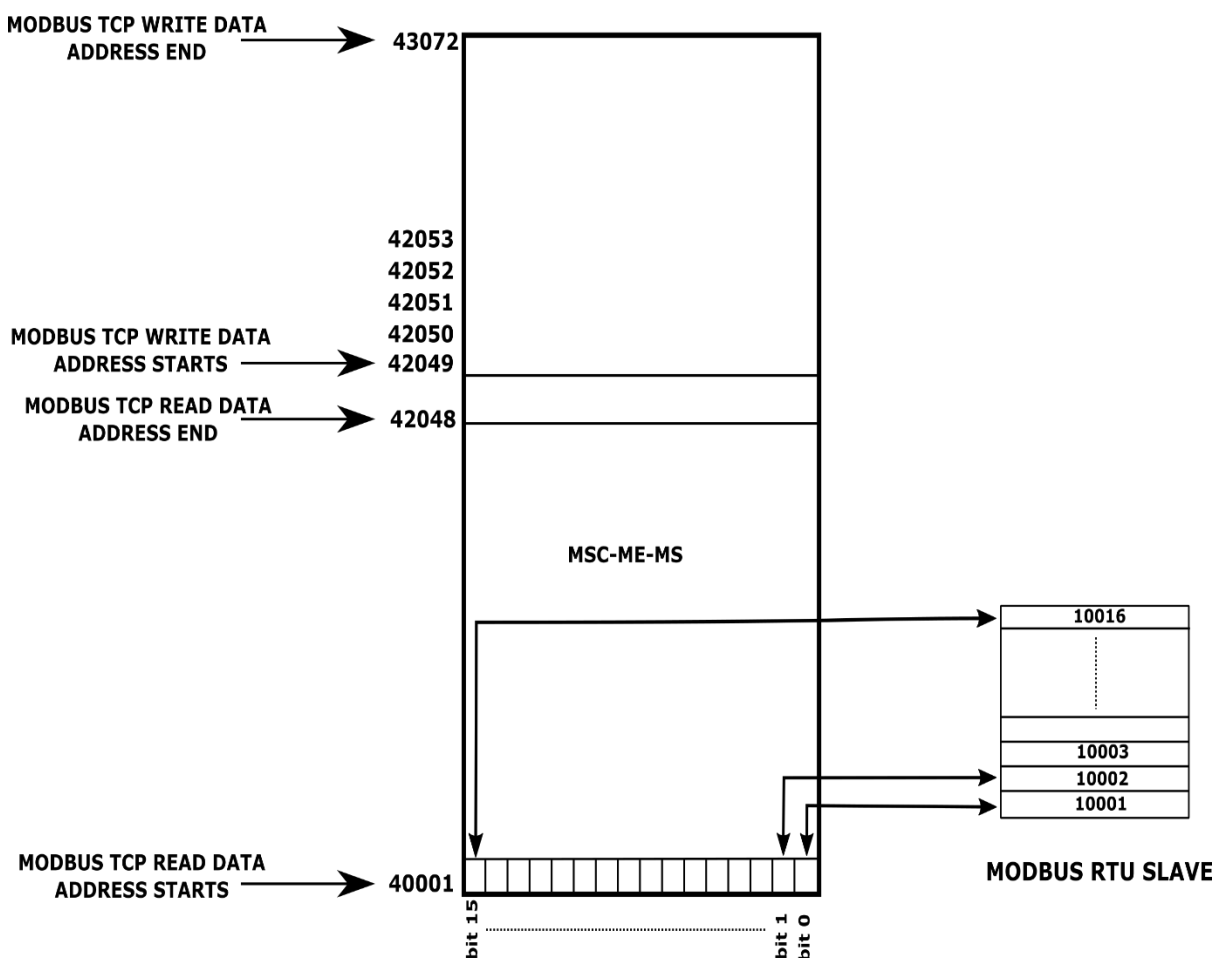
Same mapping rule applies when it is time to write data to modbus RTU slave. But Write address register for modbus TCP start from index 42049.

So looking at below mapping given in figure any changes made to 42049 register address will directly reflect to holding register 40200 of modbus slave address 1.

Example of mapping modbus function code 02

Below example demonstrates how to map modbus function code 02 to modbus tcp holding register. all the data of this modbus input status register will be mapped to individual bit of modbus tcp holding register.

User can map modbus function code 01,02,05,15 in this similar way.



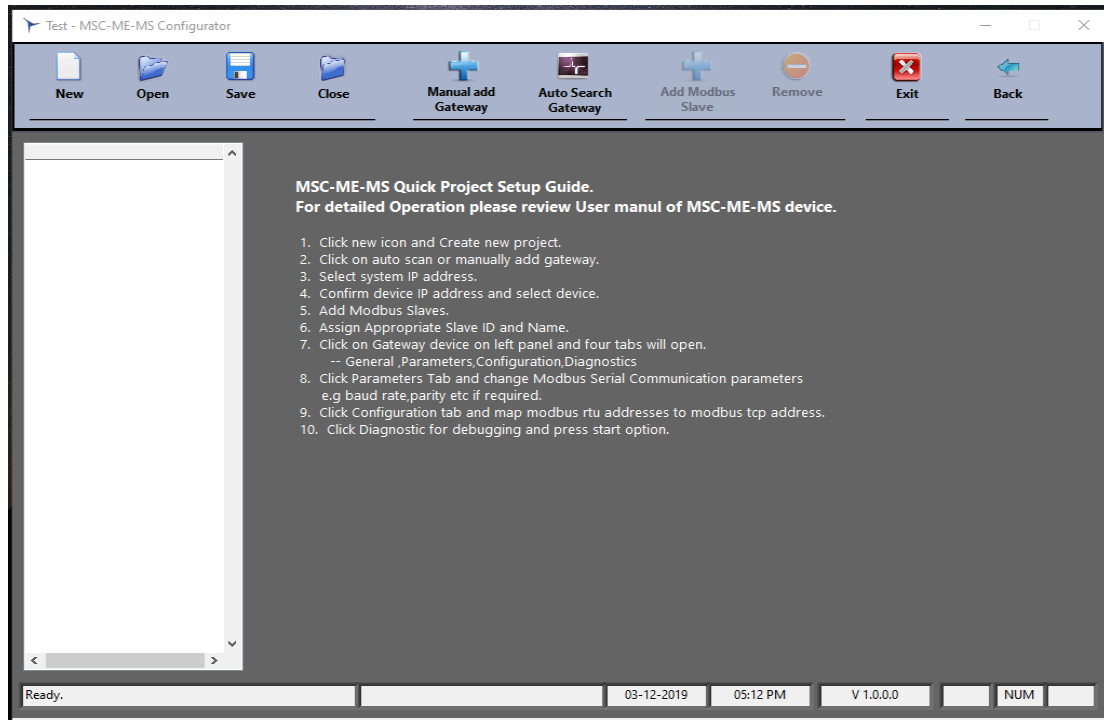
MSC-ME-MS Example of Mapping Modbus Function code 02 (Read Input Status)

5.3 MSC studio overview

Masibus MSC studio is software tool that is the collection of configuration and diagnosis software for many MSC series model. Running MSC studio

software opens window for model selection. Selecting MSC-ME-MS model will open MSC-ME-MS configurator tool which is used to configure device parameter or to diagnose data.

Below is figure of MSC-ME-MS configuration tool view.



5.4 MSC-ME-MS parameters Configuration overview.

MSC-ME-MS device works as modbus RTU master and as modbus tcp server so before device setup it is necessary to configure modbus RTU serial parameter and also modbus tcp parameters. Below are description of this parameter.

Modbus Serial Parameters

- **Baud rate** with the range from 9600 to 115200 can be configuring here.
- **Parity bit** for non-parity 0, even parity 1 and for odd parity 2 can be configure.
- **Delay (com) (ms):** Modbus RTU master Wait period between modbus RTU slave's successful response and next modbus query.
- **Timeout (com) (ms):** Modbus RTU master Wait period for expected response from slave within this configured time.
- **Timeout detect value:** if slave fails to respond query before time-out, then some value should be indicate that slave respond value.

Note: whenever MSC-ME-MS/ZB is unable to communicate with specific MODBUS RTU slave device and if timeout occurs than MSC-ME-MS/ZB will update mapped MODBUS TCP Holding register addresses with the value entered in this register. The range of this parameter is from 0 – 65535. **But Value 32000 is special case.** When value of this parameter is **32000** than MSC-ME-MS/ZB device will not update its mapped MODBUS TCP holding registers with

32000 value instead it will keep its last updated value in mapped MODBUS TCP holding registers.

- **Retry (com):** it is number of retry count that the query needs to be resend on its failure.
- **Watch (com) (ms):** it is a specified time, after that master resend request to the slave. It is much larger than timeout time. And it helps to reduce total query sending time.
- **Enable (COM-1):** port 1 selected for modbus RTU communication
- **Enable (COM-2):** port 2 selected for modbus RTU communication

Modbus tcp parameters

- **TCP/IP Ethernet communication:**

IP address, Mask and gateway are configured as per network comfort. According to factory setting, IP address is: 192.168.100.110

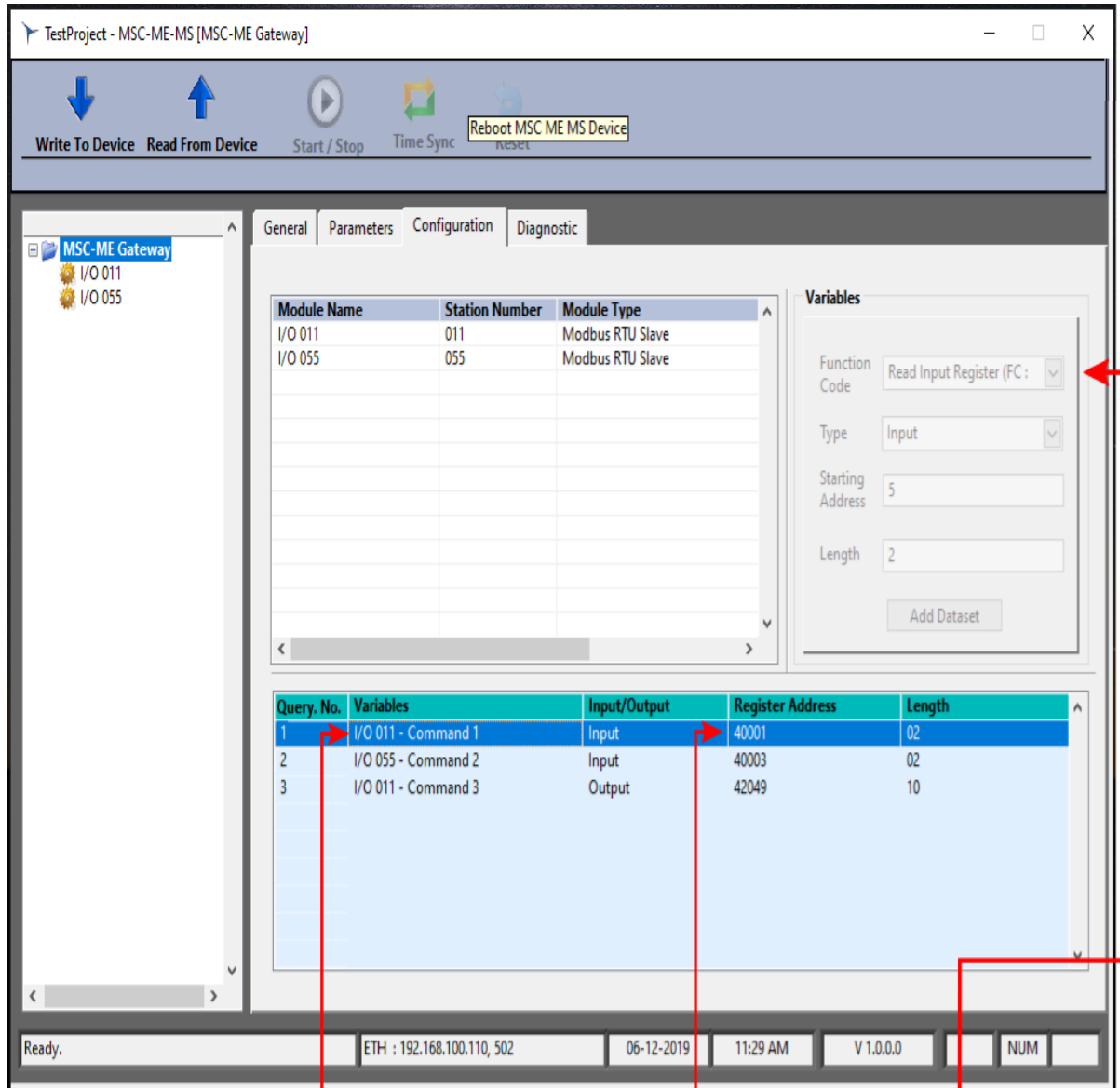
- **Port number** is by default considered as 502.

Configuration of IP address using webserver

- MSC-ME-MS includes a web server. This allows IP address configuration, default gateway IP address and subnet mask. The web server can be accessed by most web browsers.
- Factory default IP address is: 192.168.100.110
- This address can be change by existing network through browser. The web page address for viewing the setup parameter is <http://192.168.100.110>.

5.5 MSC-ME-MS Query Configuration overview

Below figure shows how MSC-ME-MS will exchange data with modbus RTU slaves as configured by MSC-ME-MS configurator tool.



1.

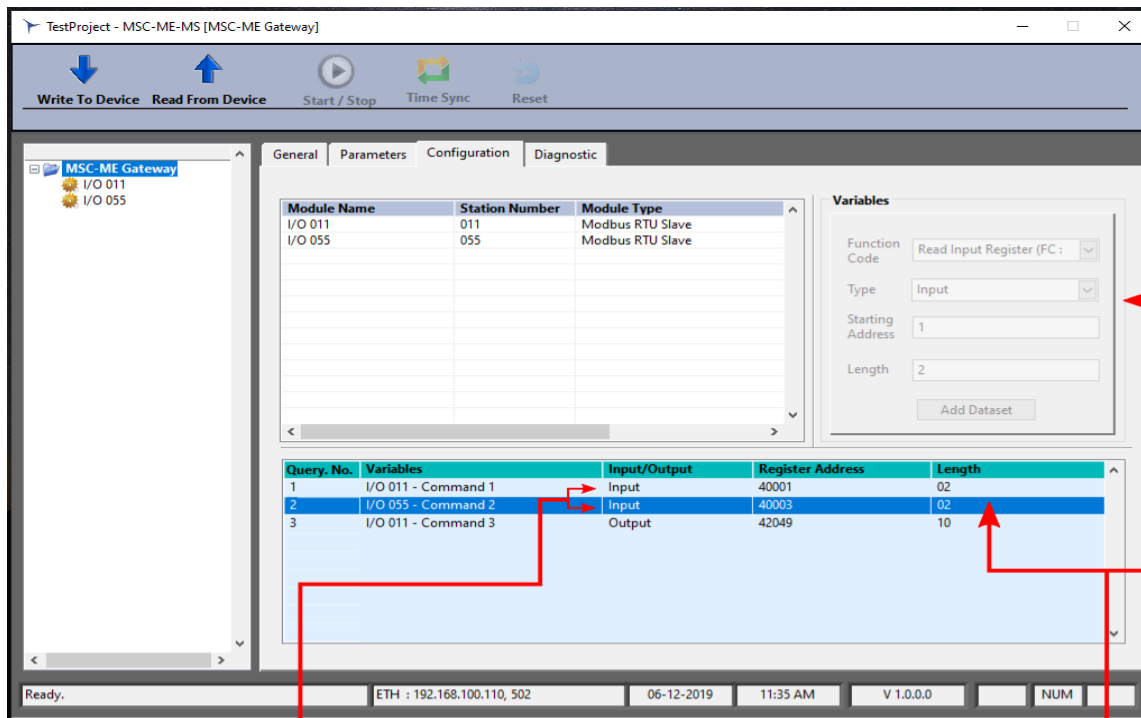
Command -1 is modbus RTU query
MSC-ME-MS will send Query
to slave device with id=11

3.

MSC-ME-MS will arrange received data
on this modbus tcp holding register
index

2.

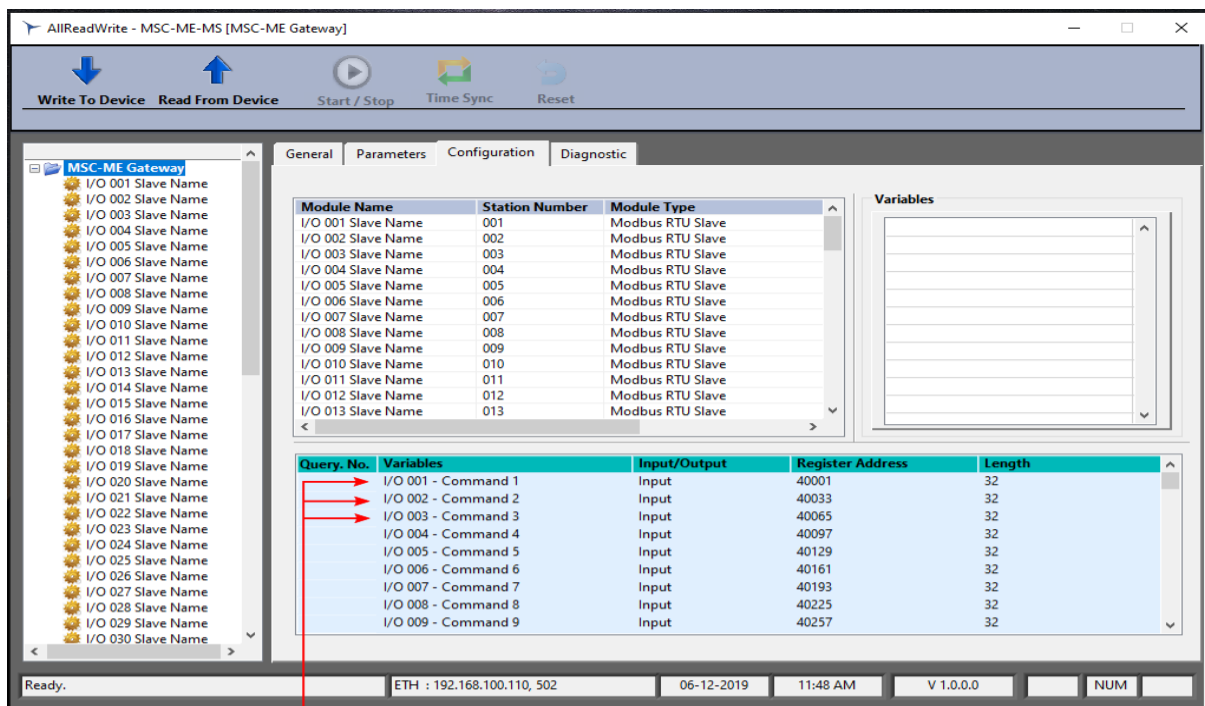
MSE-ME-MS will read Input Register
of slave 11 from address 5
and length of 2 registers



Execution time between command : 1 and command : 2 will depend on delay parameter.see parameter tab for this parameter information

After execution of command : 1 MSC-ME-MS will send Query to modbus RTU slave with device id=55

Command : 2 is configured to read input register of modbus slave id=55 from register index 1 and upto length of 2 register

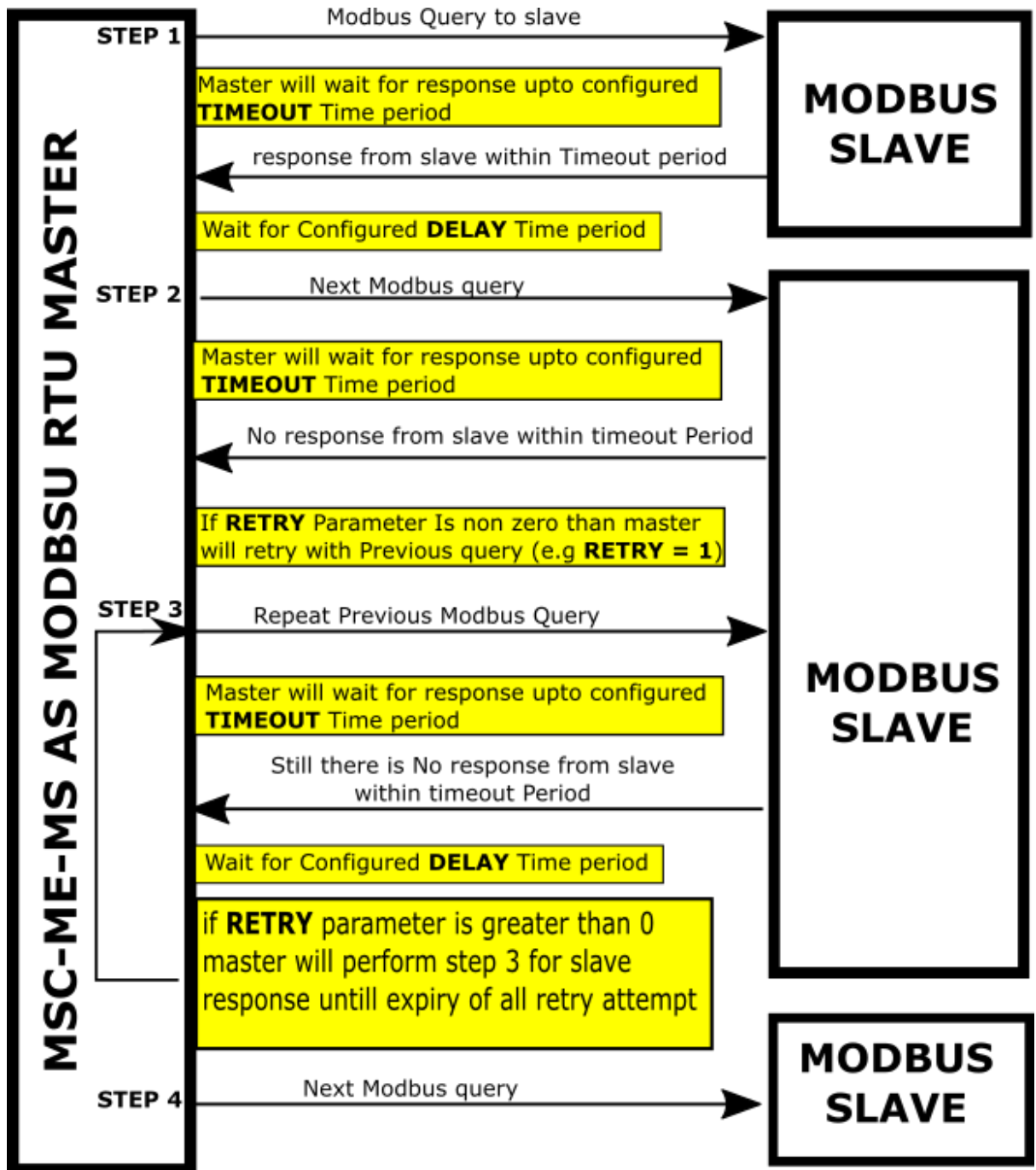


1. MSC-ME-MS will execute this modbus query in sequence which is shown in this window

2. MSC-ME-MS will continuously poll for data for all configured read query

5.6 MSC-ME-MS Modbus RTU communication flow

Below image is modbus RTU communication flow between MSC-ME-MS device and modbus RTU slaves. Please review modbus serial parameter description for better understanding of various parameter terms.



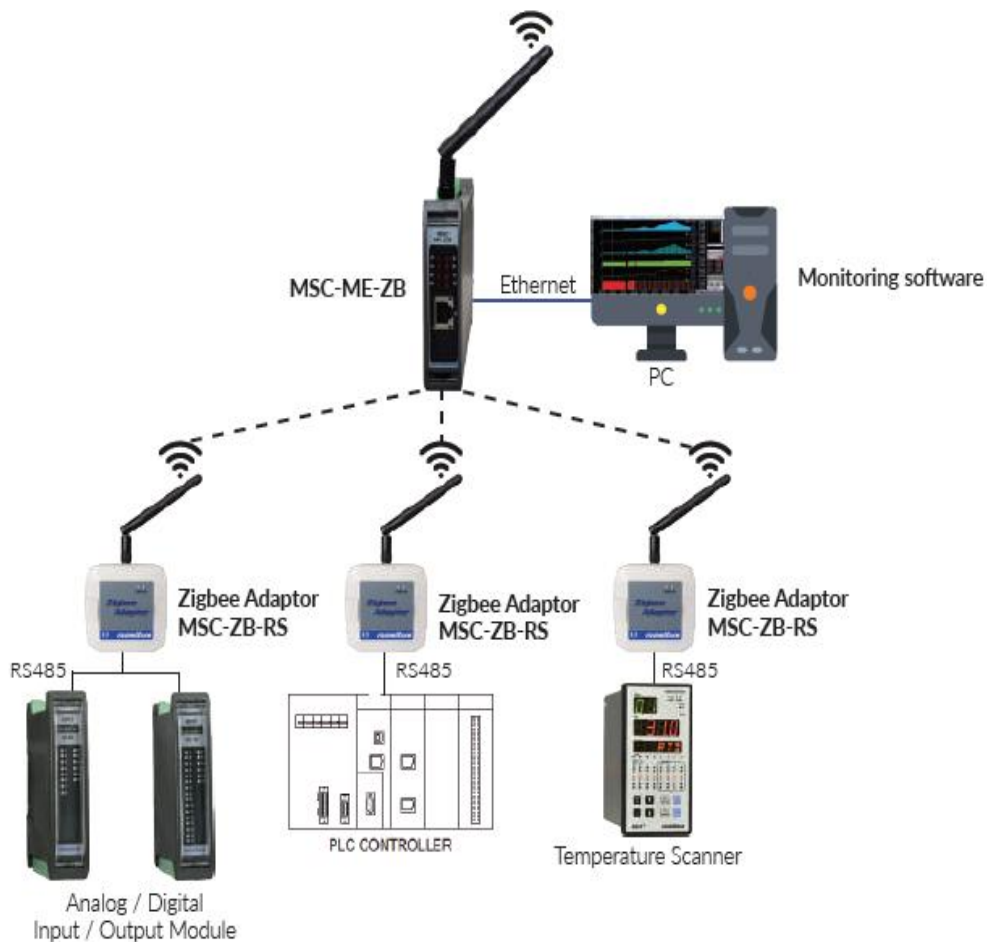
MSE-ME-MS AS MODBUS RTU MASTER
Query response structure between
MSC-ME-MS and modbus slave

5.7 MSC-ME-ZB working and wireless parameter configuration

In order to acquire data from modbus slave devices using MSC-ME-ZB, user will have to perform some wireless parameter configuration using MSC Studio software. For configuration of wireless parameters, MSC-ME-ZB device is shipped with usb to micro usb cable. Plug this cable in usb connector of device and computer and configure parameters using MSC studio software.

MSC-ME-ZB and MSC-ZB-RS both device uses same wireless module for communication. Therefore it is advised to review user manual of MSC-ZB-RS device to learn about wireless parameters and concept of wireless network formation.

Below figure demonstrates working architecture of MSC-ME-ZB device with masibus MSC-ZB-RS device.



Contact detail of service department

Sonepar India Pvt. Ltd.

B/30, GIDC Electronics Estate,
Sector-25, Gandhinagar-382016, Gujarat, India
Phone: +91 79 23287275-77 Fax: +91 79 23287281
Email: support.masibus@soneparindia.com
Web: www.masibus.com