2. Introduction

The system interface MNS Digital Gateway is an industrial PC equipped with interface cards and ports required for communication internally to M10x and externally to process control systems as well as to the MNS Digital Edge Gateway which provides condition monitoring features and functions as well as edge connectivity to ABB Ability™ cloud based solutions.



Figure 1: MNS Digital Gateway

One MNS Digital Gateway can communicate internally to up to 128 M10x / field devices by Modbus RTU. If more than 128 M10x / field devices are installed, then additional MNS Digital Gateway have to be configured.

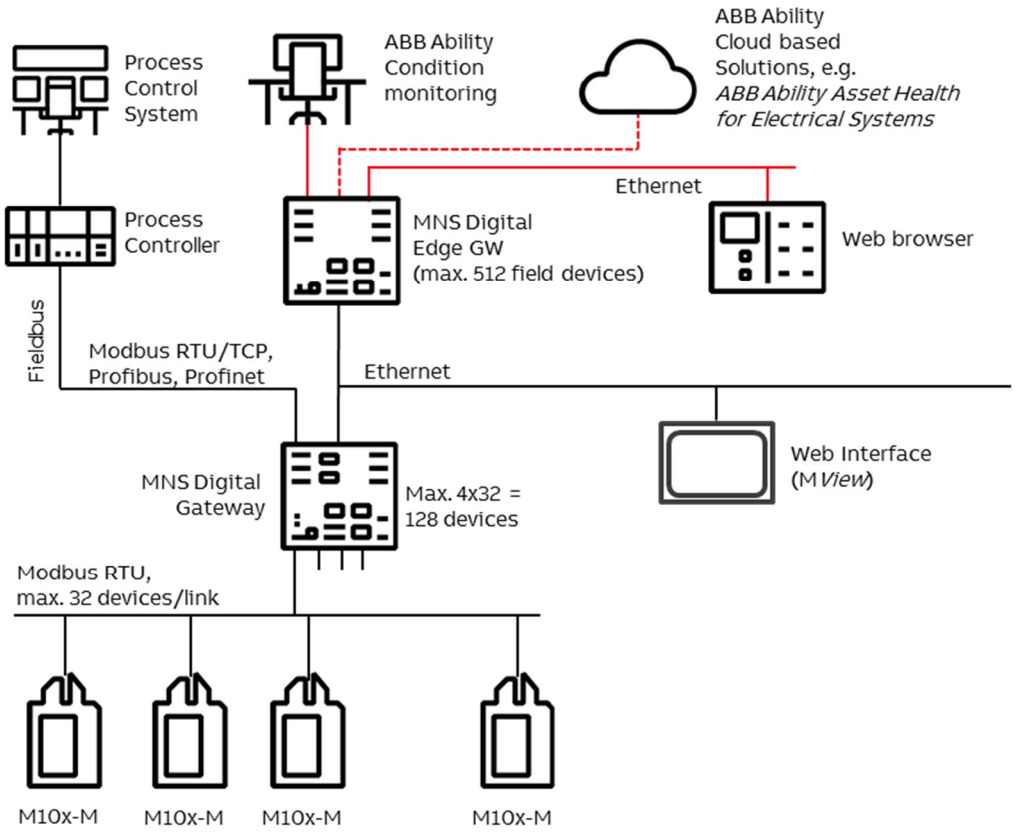


Figure 2: MNS Digital System Configuration with M10x

2.1. Hardware Types and Technical Data

The configuration of MNS Digital Gateway depends on the selected communication protocol to the DCS. For the Modbus communication to DCS the hardware shown in the table below is applicable

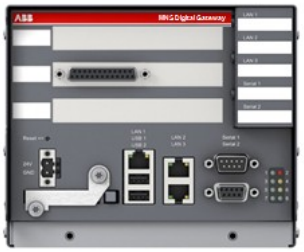
Fieldbus Protocol	Modbus		
Fieldbus Hardware Interface	RS 485 & Ethernet TCP/IP IEEE 802.3	RS 422 & Ethernet TCP/IP IEEE 802.3	RS 232 & Ethernet TCP/IP IEEE 802.3
MNS Digital Gateway ID	1TGE120021R0810		
Picture			

Table 1 MNS Digital Gateway Modbus Hardware

For communication to M10X, MNS Digital Gateway is connected via RS485 with Modbus RTU protocol. As one segment of Modbus RTU is only able to support 32 devices, MNS Digital Gateway for M10x is supplied with four Modbus RTU port to support a maximum of 128 number of devices.

ELECTRICAL DATA	
Power Supply	24V DC (19 – 31V DC)
Power Consumption	Typical 800mA, maximum 1000mA
MECHANICAL DATA	
Weight	2.5 kg
Dimensions H x W x D	140 x 160 x 165 mm
ENVIRONMENTAL DATA	
Storage Temperature	-20°C to + 70°C
Operating Temperature	0°C to 55°C
Degree of Protection	IP51
MTBF (Mean Time Between Failures)	46 years @ 40°C

Table 2 MNS Digital Gateway Technical Data

2.2. Modbus Standard

MODBUS is a serial data communication protocol and was originally developed as a communication language for MODICON programmable controllers, its rights now reside with the Modbus-IDA organization.

The software on the MNS Digital Gateway supports the pure Master-Slave operation as defined in the MODBUS RTU specification. This manual describes the MNS Digital Gateway communication with MODBUS protocol in RTU and TCP modes.

The MODBUS communication protocol is implemented within the MNS Digital Gateway to enable MNS Digital to provide interface possibilities to process control systems or any other external systems that supports MODBUS RTU / TCP protocol handling.

The MODBUS configuration can be used in point to point configuration or in multi-drop mode. In Master-Slave MODBUS architecture, the MNS Digital Gateway is always used in a slave (TCP Server) mode. The master station controls the traffic on the bus, in this case, by PCS/DCS or PLC system. The MNS Digital Gateway responds to the queries received from master station as per the MODBUS specification.

2.2.1. Basics

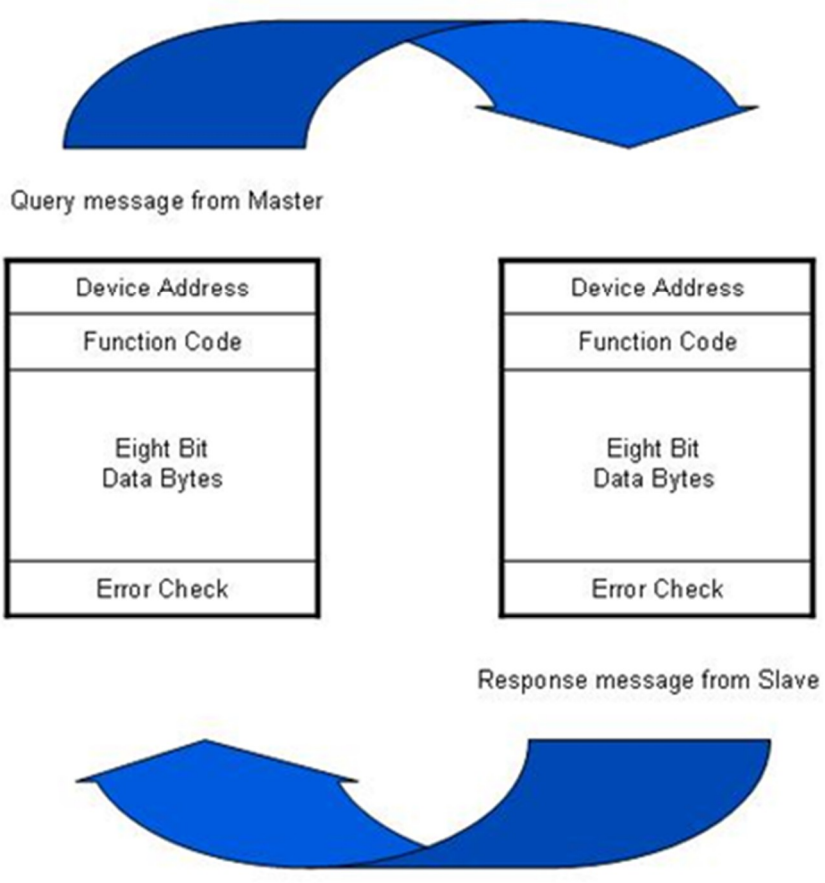


Figure 3 Master Slave Query Response Cycle

3. Interfaces

3.1. Front View

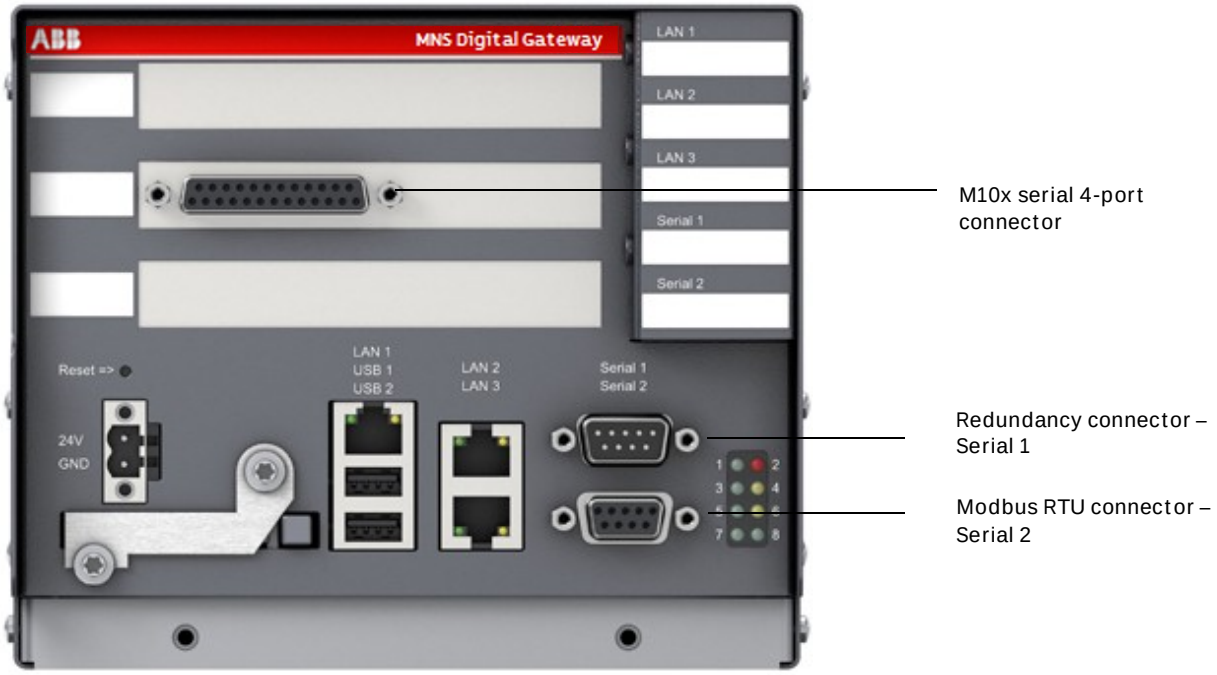


Figure 4 MNS Digital Gateway front view

POWER SUPPLY	
Button Reset	Reset button (Restart of MNS Digital Gateway)
24V	Power Supply +24VDC
GND	Power Supply 0V
CF CARD	
CF Card	CF card is protected against unintentional removal after closing the flap and connecting the power supply
PORTS	
LAN 1	LAN 1 Interface (Modbus TCP)
LAN 1 – LED left, green	Link LAN 1 active
LAN 1 – LED right, yellow	Communication Ethernet LAN 1
LAN 2	LAN 2 Interface (Switchgear Control Network)

LAN 2 – LED left, green	Link LAN 2 active
LAN 2 – LED right, yellow	Communication Ethernet LAN 2
LAN 3	LAN 3 Interface (Not used)
LAN 3 – LED left, green	Link LAN 3 active
LAN 3 – LED right, yellow	Communication Ethernet LAN 3
USB 1, 2	Not used
Serial 1	Redundancy Interface (male plug)
Serial 2	Modbus RTU Interface (female plug)
LED INDICATIONS	
LED 1	MNS Digital Gateway Run indication (CF card application loaded and running)
LED 2	MNS Digital Gateway Fault
LED 3	Application dependent (see section LED indication, page 60)
LED 4	Application dependent (see section LED indication, page 60)
LED 5	Application dependent (see section LED indication, page 60)
LED 6	DCS Communication active
LED 7	MNS Digital Gateway Power On Indication
LED 8	Application dependent (see section LED indication, page 60) In redundant configurations: MNS Digital Gateway primary

Table 4 Front View Connectors, LED and Push Buttons

3.2. Power Supply

The MNS Digital Gateway requires 24V DC supply voltage. The connection is on the left side of the device with terminal plugs:

– Terminal 1 connects to +24V DC

– Terminal 2 connects to 0V DC

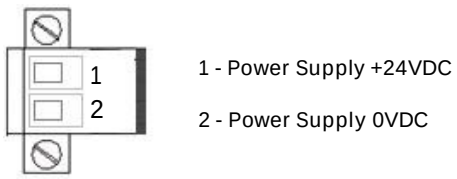


Figure 5 Power Supply Connector

4.2. CF Card Installation

The Compact Flash (CF) card is required to start and run the MNS Digital Gateway. The procedure to create the CF card configuration and copy all mandatory files is described in the MNavigate help file.

Only Industrial Grade CF cards shall be utilized to ensure correct function of the MNS Digital Gateway in the switchgear environment!

The CF card slot is located on the MNS Digital Gateway front side. To remove or insert the CF card the power supply connector has to be removed and the metal cover has to be lifted. This ensures that CF card can only be removed/inserted while power supply is off.

CF card shall be inserted with the correct side up and with care as the card is mechanically coded and insertion should not be forced.

The following example shows the ABB standard CF card.



Figure 7 CF Card Insertion



Figure 8 CF Card Insertion Detail

5.Communication Interface Connection

5.1. Switchgear Bus Network

The communication between MNS Digital Gateway and M10x is established via Modbus RTU protocol.

Modbus RTU is a single master / multiple slave type of protocol which is suitable for a multi drop wiring installation as supported by RS485 hardware. In this case, M10x-M device acts as a Modbus slave while MNS Digital Gateway acts as a Modbus master.

RS485 is a balanced two-wire transmission and multi-drop system. RS485 supports 32 devices (one master and 31 slave devices) over distance up to 1.2 km in a single segment. 120 ohm resistors are required as terminators for both end of each communication link. The MNS Digital Gateway has an inbuilt terminating resistor on its serial port which acts as a first point, while for the last point, one 120 ohm resistor needs to be installed

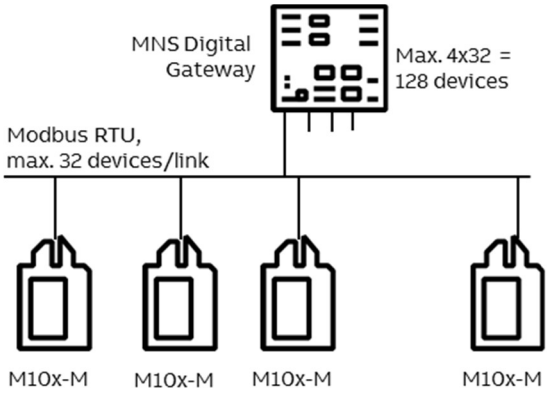


Figure 9 Hardware connection between MNS Digital Gateway and M10x

The settings required in M10x to establish the communication between M10x and MNS Digital Gateway are the device address, baud rate, Modbus stop bit and Modbus parity check. The following table shows the setting required for the M10x communication.

Baud Rate	Stop Bit	Parity Check
9600	1	Even
19200 (to be used along with EMax ACB)		
38400 (default)		
57600*		

*57600 Baud shall be set for max. data throughput but installation has to be handled with care and max. stub length of communication cables have to be considered for reliable communication !

Table 5 M10x Communication setting

7. Configurations

7.1. Initial Values – IP Configuration

MNS Digital Gateway requires parameter settings as initial values for network operation. The parameters are required depending on MNS Digital Gateway configuration. Additionally parameter for Web Server, OPC Server and Fieldbus are also required.

The parameters have to be loaded onto the Compact Flash (CF) card using MNavigate tool before power up. After successful communication between MNavigate and MNS Digital Gateway (either direct or via network) the parameters can then be changed from MNavigate through the network.



Any change of communication related parameter for Ethernet network (e.g. IP address) requires a restart of MNS Digital Gateway. Fieldbus communication related parameter (e.g. comm. speed, or slave address) can be change during runtime of MNS Digital Gateway.

Parameter	Default Value	Range	Remarks
IP Address LAN 2 (LAN2)	192.168.200.100		Settings according to network administrator
Subnet Mask LAN2	255.255.255.0		Settings according to network administrator
Broadcast Address LAN2	192.168.200.255		Calculated automatically
Default Gateway LAN2	0.0.0.0		Settings according to network administrator
IP Address LAN 1 (LAN1)	192.168.100.100		Settings according to network administrator
Subnet Mask LAN1	255.255.255.0		Settings according to network administrator
Broadcast Address LAN1	192.168.200.255		Calculated automatically
Default Gateway LAN1	0.0.0.0		Settings according to network administrator
IP Address LAN 3 (LAN3)	192.168.171.100		LAN 3 is not used
Subnet Mask LAN3	255.255.255.0		LAN 3 is not used
Broadcast Address LAN3	192.168.171.255		Calculated automatically

Default Gateway LAN3	192.168.171.1		LAN 3 is not used
Time Synchronization	RTC	RTC, NTP	RTC=internal clock, NTP=if external NTP server is available
Time Server Address	0.0.0.0		Settings according to network administrator

Table 10 MNS Digital Gateway Default Parameters – IP Configuration

7.2. Settings – IP Configuration

All configuration settings and parameterization for the MNS Digital Gateway are configured with the MNavigate software tool.

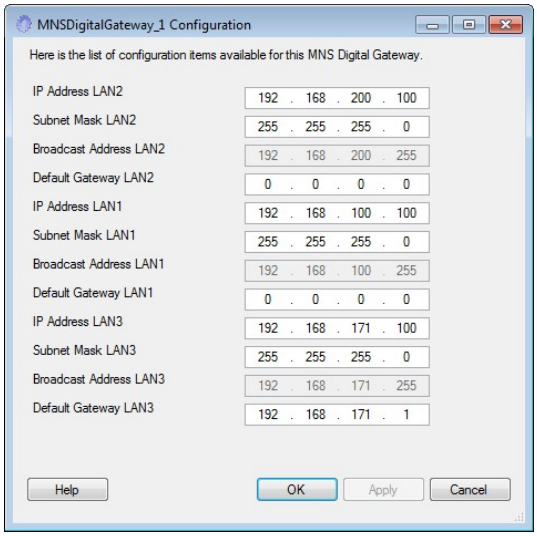


Figure 27 IP Address Settings

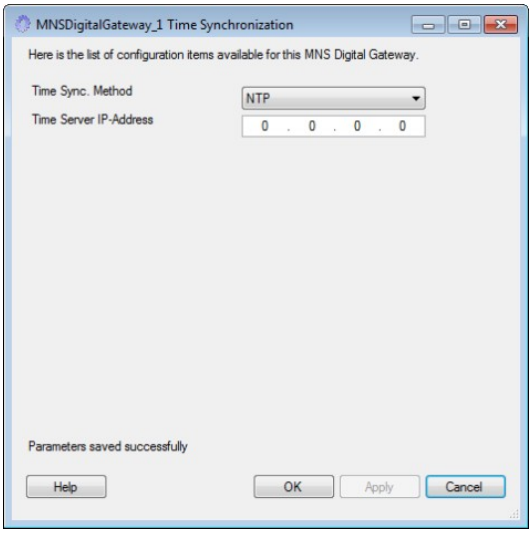


Figure 28 Time Sync Settings

MNS Digital Gateway does not support DHCP service to get automatic network address. If the default IP Address and Subnet Mask must be manually adjusted, the parameter above has to be modified and copied to the MNS Digital Gateway. Any change in the address requires the MNS Digital Gateway to be restarted before the change is activated.

It has to be ensured that the Subnet address (xxx.xxx.xxx.yyy) for LAN1, LAN2 & LAN3 port is different. For example LAN1 = 192.168.100.100 and LAN2 = 192.168.200.100

7.2.1. Definition of IP Addresses

An IP Address is a required setting in order to allow data communication in an Ethernet network. If the devices are integrated in a plant network, the local network administrator has to be consulted to find correct settings.

The Subnet Mask defines the size of the network. In typical applications the subnet mask is as per default settings. However, the local network administrator has to be consulted, if other IP addresses than the default settings apply.

The Broadcast Address is required for the MNS Digital Gateway to send data to other devices. Since the MNS Digital Gateway does not know which IP address is used by the other devices, data is sent as broadcast messages. The broadcast address is calculated automatically by MNavigate.

The Default Gateway is an address for a network gateway, if the switchgear control network is connected to a plant network. The gateway is not part of the MNS scope. If a gateway is used, the local network administrator is to be consulted for correct settings.



If it is not possible to communicate to the MNS Digital Gateway, please refer to the trouble shooting section in this document or the MNS Digital Gateway section in the MNavigate Help file

7.3. Settings – Serial Switchgear Bus

The serial switchgear bus setting defines the Modbus RTU setting of MNS Digital Gateway as a Modbus master to the M10x-M devices. This parameter needs to be set correctly in order to establish communication between MNS Digital Gateway and M10x-M. The list of parameter is shown in the following table

Parameter	Default Value	Range	Remarks
Master Address	99	1 - 127	Modbus RTU address of MNS Digital Gateway. Modbus RTU Master for connected M10x-M
Baudrate 1	38400	9600, 19200, 38400, 57600	MNS Digital Gateway Serial Interface Port 1: Communication Speed on Modbus RTU link between MNS Digital Gateway and M10x-M
Baudrate 2	38400	9600, 19200, 38400, 57600	MNS Digital Gateway Serial Interface Port 2: Communication Speed on Modbus RTU link between MNS Digital Gateway and M10x-M
Baudrate 3	38400	9600, 19200, 38400, 57600	MNS Digital Gateway Serial Interface Port 3: Communication Speed on Modbus RTU link between MNS Digital Gateway and M10x-M