User Manual

Version 1.0.0 Oct 2021

DNP-211

DNP3 Master to Modbus TCP Server Gateway

Warranty

All products manufactured by ICP DAS are under warranty regarding defective materials for a period of one year, beginning from the date of delivery to the original purchaser.

Warning

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Document Revision

Version	Author	Date	Description
1.0.0	Ming	2021/10/06	First Released Revision

Contents

1. Introduction

1.1. DNP3 Introduction

DNP3 (Distributed Network Protocol 3) is a communication protocol used between automation components. The protocol is formulated with reference to IEC 870-5. The purpose is to unify the communication method of SCADA so that SCADA can use the DNP3 protocol to communicate with master stations, remote terminal units (RTUs), intelligent electronic devices (IEDs), etc., and are mainly used in utilities such as electric and water companies.

The DNP3 protocol has certain of reliability and allows reliable communications in the adverse environments that electric utility automation systems are subjected to being specifically designed to overcome distortion induced by electromagnetic interference (EMI), aging components, and poor transmission media. A large number of CRC check codes are used in the protocol to ensure the accuracy of data. It is suitable for high security, Data communication field of medium speed and medium amount of data.

1.2. Modbus TCP Introduction

Modbus TCP is a variant of the Modbus family of simple, vendor-neutral communication protocols intended for supervision and control of automation equipment. Specifically, it covers the use of Modbus messaging in an "Intranet" or "Internet" environment using the TCP/IP protocols. The most common use of the protocols at this time is for Ethernet attachment of PLC's, I/O modules, and gateways to other simple field buses or I/O networks.

1.3. About DNP-211

DNP-211 is a gateway that supports DNP3 master and Modbus TCP server protocol conversion. As long as the master device supports Modbus TCP protocol, it can connect the existing DNP3 network with the Ethernet-based master device. For DNP3 network, DNP-211 is a DNP3 master device. It supports several commonly used data groups and variables and can communicate with slave devices. From the perspective of Modbus TCP network, DNP-211 is a Modbus TCP server, which can receive commands from Modbus TCP client, and process these commands to reply or send related DNP3 data. All DNP3 I/O data and Modbus mapping can be configured through DNP-211 utility software.

1.4. Features

● Read / Write DNP3 outstations via Modbus TCP

● Configurable DNP3 Master

● Configurable Modbus TCP server

● Support Data Group 1, 10, 12, 20, 30, 40, 41

● Support Modbus function code 1, 2, 3, 4, 15, 16

● Provides Modbus register of connection status of DNP3 outstations

● Supports up to 32 DNP3 outstations

● Supports up to 16 Modbus client connections
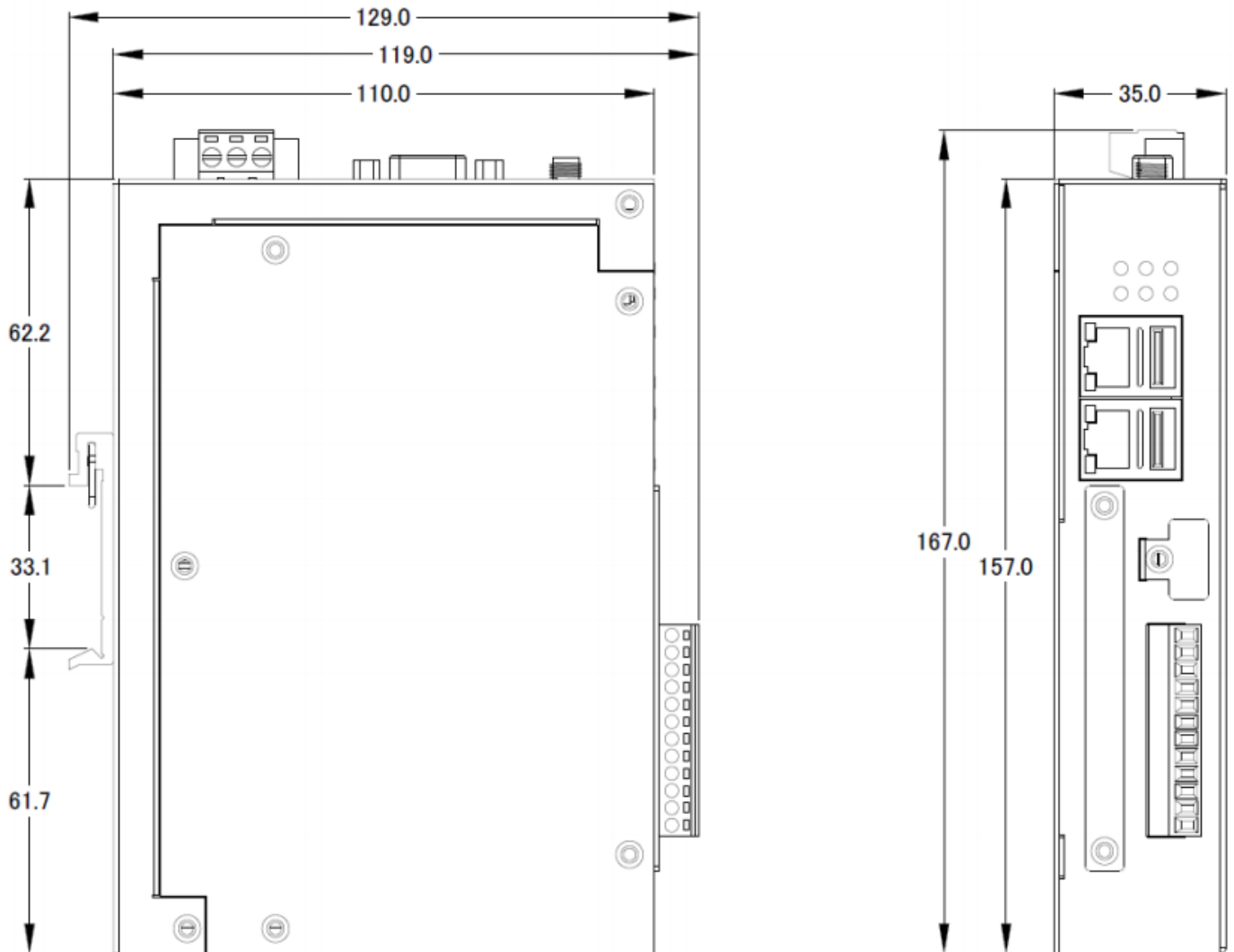
1.5. Specifications

System	
CPU	Cortex-A8, 1 GHz
SDRAM	512 MB
Flash	512 MB
FRAM	64 KB
LED Indicators	PWR (Power), RUN (System run), L1 (Firmware run), L2 (Modbus TCP connection), L3 (DNP3 connection)
Communication Ports	

VGA		1 (reserved)
Ethernet		RJ-45 x 2, 10/100/1000 Based-TX (Auto-negotiating, Auto MDI/MDI-X, LED indicators)
USB 2.0		2 (reserved)
Console Port		RS-232 (RxD, TxD and GND); Non-isolated
ttyO2		RS-485 (Data+, Data-); Non-isolated
ttyO4		RS-232 (RxD, TxD and GND); Non-isolated
ttyO5		RS-485 (Data+, Data-); 2500 VDC isolated
Protocol		
Modbus	Identity	Modbus TCP server
	Function	1, 2, 3, 4, 15, 16
	Connection	Max. 16 Modbus TCP clients
DNP3	Identity	DNP3 master
	Connection	Max. 5 MMS clients
	Group	1, 10, 12, 20, 30, 40, 41
	Data Point	DI: 8192 DO: 8192 Count: 2048 AI: 2048 AO: 2048
Power		
Supply Voltage		+12 to +48 VDC
Consumption		4.8 W
Connector		3-pin Removable Terminal Block
Mechanism		
Dimensions		35 mm x 167 mm x 119 mm
Casing		Metal
Installation		DIN-Rail
Environment		
Operating Temp.		-25°C ~ +75°C
Storage Temp		-30°C ~ +85°C
Humidity		10 ~ 90% RH, non-condensing

2.Hardware

2.1. Dimensions

Unit: mm

2.2. Appearance

VGA Port x1

LED Indicator x5
(RUN, PWR, L1, L2, L3)

USB 2.0 x2

Ethernet Port x2

Terminal Block

- TxD — Console Port
- RxD — (RS-232)
- GND
- TxD — tty04
- RxD — (RS-232)
- GND
- D+ — tty05
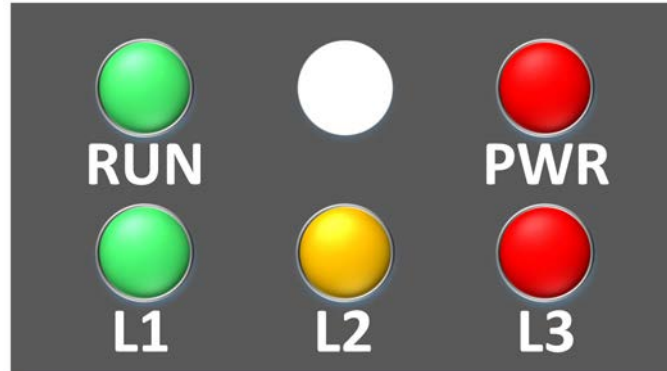- D- — (RS-485)
- GND.ISO
- D+ — tty02
- D- — (RS-485)
- GND.ISO
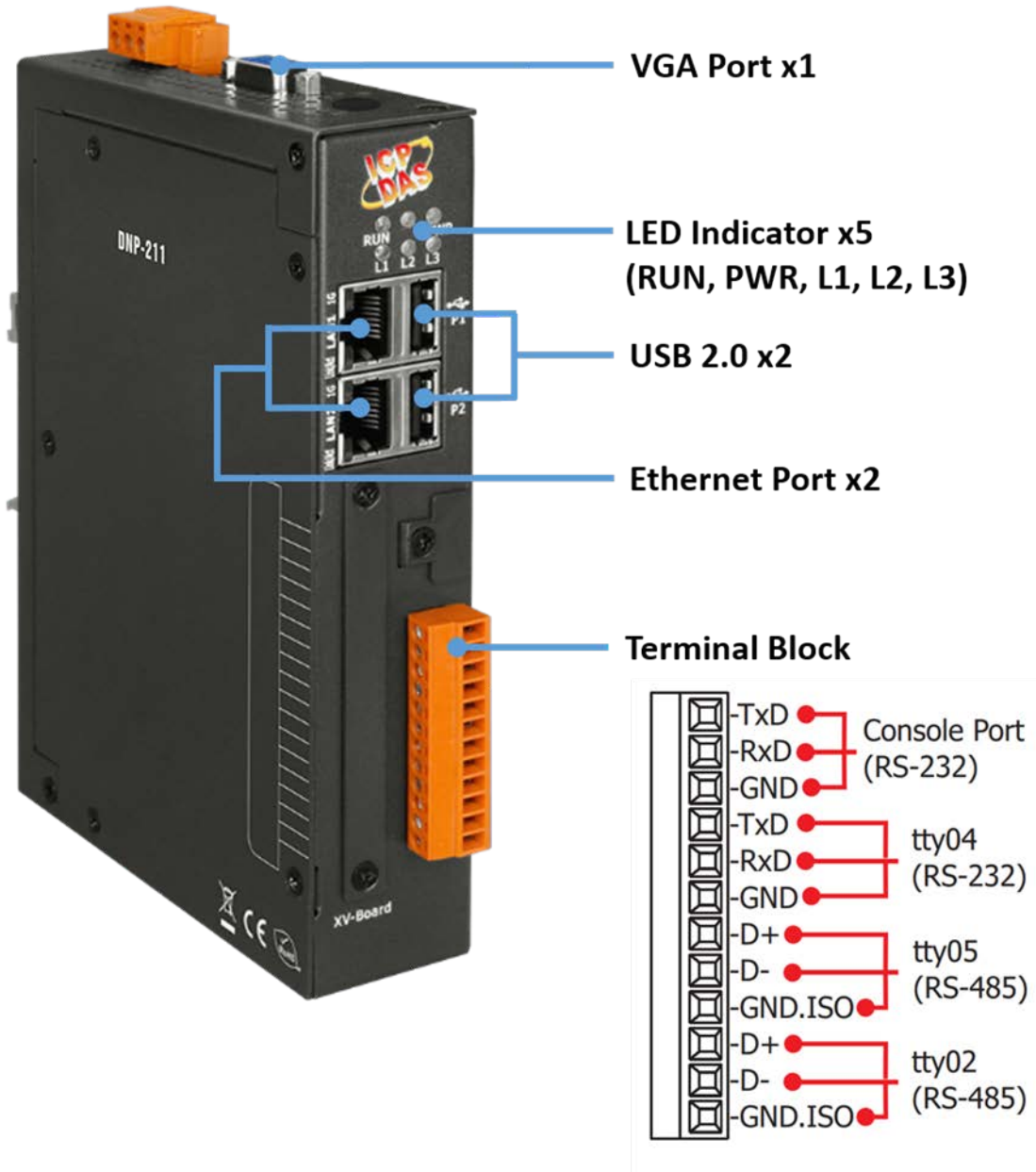
2.3. LED Indicator

There are five LEDs to indicate the various states of the DNP-211. The following is the illustration of these five LEDs.

LED Name	LED Status	Description
PWR	ON	Power on
	OFF	Power failure
RUN	Blink	OS is running
	OFF	OS stops running
L1	Flash every second	Firmware is running
	Other	Firmware stops running
L2	Flash every 500 ms	Modbus TCP disconnected
	OFF	No Warning
L3	Flash every 500 ms	At least one DNP3 outstation disconnected
	OFF	No Error

3. Getting Started With DNP-211

3.1. Preparations for Devices

In addition to the DNP-211, please prepare the following:

1. **Power Supply: +12 ~ +48 VDC** (Ex: DP-665)
2. **Ethernet Hub or Switch** (Ex: NS-205)
3. **PC/NB:** Can connect to the network and set the network

3.2. Hardware Wiring

Connect the DNP-211 with the RJ-45 Ethernet port LAN1 to an Ethernet hub/switch and PC. You can also link directly the DNP-211 to PC with an Ethernet cable.

After power is connected, please **wait 1 minute** for DNP-211 start-up procedure. When the **"RUN"** indicator starts **flashing** and "**PWR**" indicator is **constantly lit**, it represents the boot is complete. After the module boots successfully, if the **"L1"** indicator flashes every second, it means the firmware is running.

3.3. DNP-211 Utility

3.3.1. Download DNP-211 Utility

(補上網頁下載位置圖)

Download and install IEC850_211_S_Utility

名稱	修改日期	類型	大小
DNP_211_Utility_v100.zip	2021/9/30 下午 0...	壓縮的 (zipped) ...	343 KB
DNP_211_Utility_v100.exe	2021/9/30 上午 1...	應用程式	53 KB
Renci.SshNet.dll	2021/1/24 下午 0...	應用程式擴充	786 KB

3.3.2. DNP-211 Utility Introduction

The DNP_211_Utility is as below:

DNP-211 Communication Configure

Gateway Type: Display gateway type of the DNP-211.

Gateway IP: Modbus TCP IP address of the DNP-211 (LAN1 IP).

Port: Modbus TCP port of the DNP-211

ComPort Baud: Com port data baud rate of DNP3 side (ttyO2, 4, 5).

Databit: Com port data bit of DNP3 side (ttyO2, 4, 5).

Parity: Com port data parity of DNP3 side (ttyO2, 4, 5).

Stopbit: Com port data stop bit of DNP3 side (ttyO2, 4, 5).

DNP3 Master ID: Master ID, cannot be the same as slave (0 ~ 65519).

Modbus Slave ID: Modbus ID of the DNP-211.

Slave Amount: Number of DNP3 slaves.

DNP3 Outstation Communication Configure

Number tab: Select outstation

Communication Mode: Select connection mode (TCP, UDP, Serial)

    TCP mode:

        Remote IP, Remote Port: IP and port of target outstation.

    UDP mode:

        Remote IP, Remote Port: IP and port of target outstation.

        Source IP, Source Port: IP and port of the DNP-211.

    Serial mode:

ComPort: Select the Com port connected to outstation.

Communication ID: DNP3 outstation ID (0~65519).

Set button: Set the connection parameter of the selected outstation.

Outstation I/O Configure

I/O Type: Added I/O type of the slave (map with Group_Variation)

Group_Variation: Added I/O type of the slave (map with I/O Type)

Start Index: Added I/O start address at the DNP3 slave

Amount: Amount of the I/O item

Output mode: DO / AO output mode (only for write command)

Description: User's self-filled description

Utility Button

Import: Import the existing GatewayConfig.toml configuration file

Export: Export the current settings to the GatewayConfig.toml

Modbus Map: Display the Modbus Address table for currently set

Upload: Upload the GatewayConfig.toml configuration file or
d2m_xxxxxxxx.tar.gz firmware file to DNP-211

Note: DNP-211 must be rebooted after upload configuration or firmware file.