

RS-M8196F

Motion Control Module

User Guide
(Version 1.0)



ICP DAS CO., LTD.

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1 RS-M8196F Introduction

The RS-M8196F is a remote serial 6-axis stepping/pulse-type servo motion controller which uses Modbus RTU as its communication protocol. The RS-M8196F is a slave in a Modbus RTU network and supports all standard Modbus function codes. Three serial interfaces are provided (RS-232, RS-485 and RS-422) and the user can select any of the three serial interfaces for communication. The RS-M8196F can expand a PLC system by adding 6-axis motion control support.

The motion controller is suitable for general-purpose motion control applications. In addition to its wide speed range, this intelligent motion controller also has a variety of built-in motion control functions, such as 2- to 6-axis linear interpolation, 2- and 3-axis circular interpolation, 3-axis helical interpolation, T/S-curve acceleration/deceleration, and automatic home search, etc. In addition the RS-M8196F acts as an FRnet master and can control up to 16 remote DIO slaves (128 digital outputs and 128 digital inputs). FRnet is a two-wire serial bus and has a scan interval of 0.72 ms and it is specifically designed for easy and cost effective wiring. ICPDAS provides a large range of FRnet I/O terminal boards and modules.

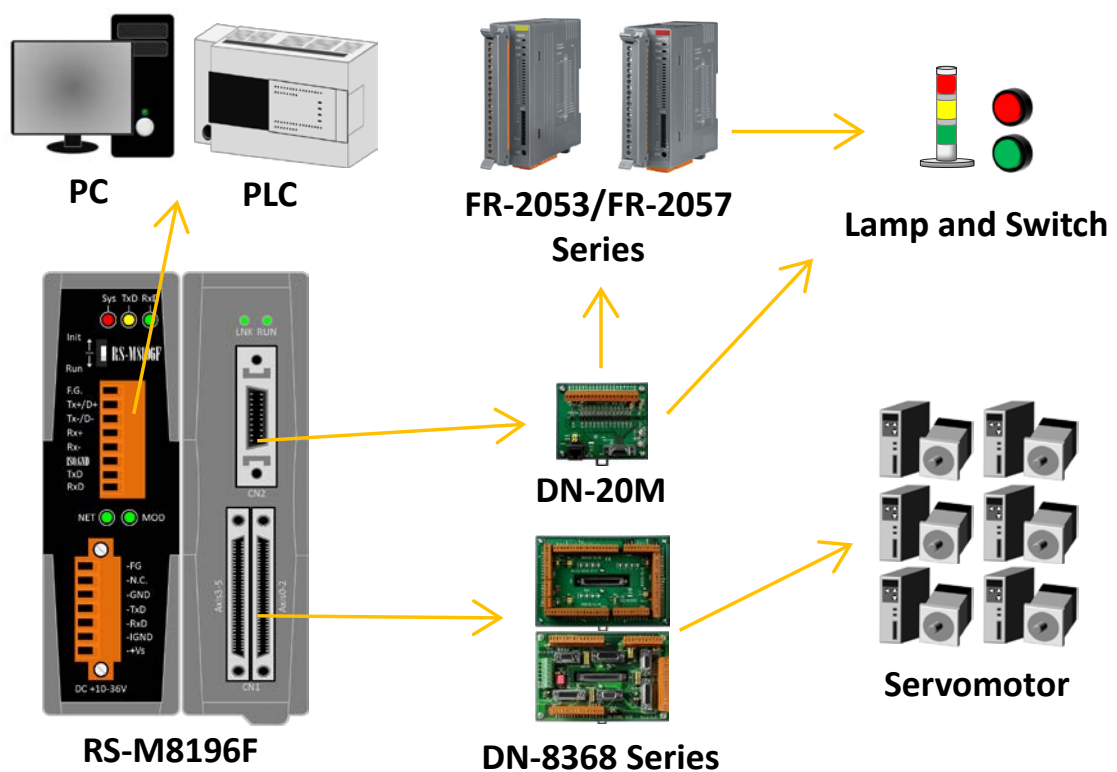


Figure 1.1 RS-M8196F application diagram

1.1 Features

- Remote control via Modbus RTU
- DSP-based motion control module
- Maximum pulse output frequency: 4 Mpps
- Maximum encoder input frequency: 12 MHz
- Independent 6-axis motion control
- 2- To 6-axis linear/2- to 3-axis circular interpolation function
- Continuous interpolation
- 4-step home mode with auto-searching
- Synchronized start motion
- Programmable T/S-curve acceleration and deceleration
- Software limit protection
- Software FIFO for arbitrary curve motion
- High-speed position latch
- High-speed compare trigger and auto-increment compare mode
- Expandable remote I/O: 128 DI and 128 DO via a two-wire FRnet interface.

1.2 Specifications

- Communication Protocol: Modbus RTU
- Number of Axes: 6
- Maximum Pulse Output Rate: 4 MHz
- Command Type: Pulse Command
- Pulse Output Mode: CW/CCW, PULSE/DIR, A/B pulse
- Linear Interpolation: Any 2 to 6 of 6 axes
- Circular/Helical Interpolation: Any 2 to 3 of 6 axes
- Speed Curve Profile: T/S-curve
- Mechanical Switch Input: Home, LMT+/-, NHOME, LTC, EMG
- Servo I/O Interface: Input: INP, ALM, RDY, Output: SVON, ALM_RST, ERC
- Ring Counter Mode: 32-bit
- Position Control Mode: Relative and absolute position
- Position Compare Trigger: 4 MHz
- Encoder Interface: A/B pulse, Up/Down
- Encoder Counter: 32-bit
- Encoder Counting Rate: 12 MHz
- Digital Input Channels: Local: 12 DI, Expandable: 128 DI
- Digital Output Channels: Local: 3 DO, Expandable: 128 DO

- I/O Isolation (with DN-8368): 2500 Vrms optical isolation
- Connector: 68-pin VHDCI Connector and 20-pin SCSI-II
- Power Consumption: +24V
- Operating Temperature: 0 ~ +60 °C
- Storage Temperature: -20 ~ +80 °C
- Ambient Relative Humidity: 5 ~ 90 % RH, non-condensing

1.3 Dimensions

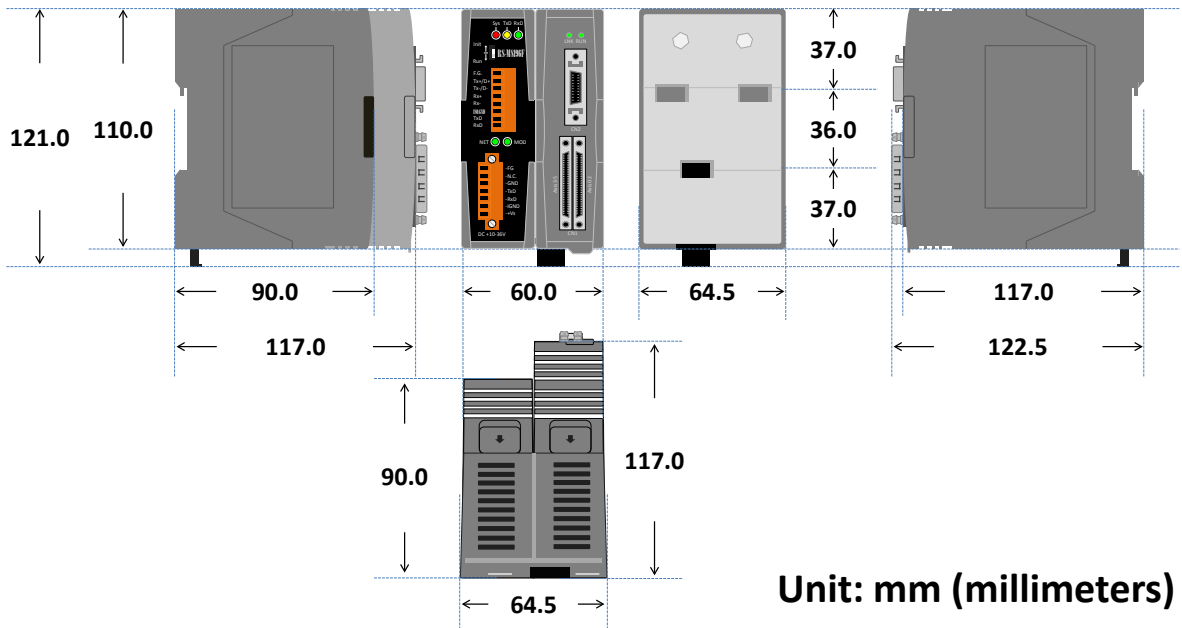


Figure 1.2 housing dimensions

1.4 Packaging and optional accessories

The package contains the following items:

- RS-M8196F x 1
- CA-0910 (RS-232 data transmission line) x 1
- Screw Driver (1C016) x 1

Other optional accessories items:

Table 1.1 optional accessories

Model No.	Description
DN-8368UB	Photo-isolated universal Snap-on wiring terminal board
DN-8368GB	Photo-isolated general purpose wiring terminal board
DN-8368MB	Photo-isolated Snap-on wiring terminal board for Mitsubishi MELSERVO-J2 servo amplifier
DN-20M	General purpose digital input and remote digital I/O (FRnet) extension board
FR-2053HTA	16-channel isolated sink/source input module
FR-2053HT	16-channel isolated digital input module with 20-pin screw terminal connector
FR-2057HTA	16-channel isolated source output module with 20-pin screw terminal connector
FR-2057HT	16-channel isolated digital output module with 20-pin screw terminal connector
CA-MINI68-15	68-pin VHDCI to SCSI-II connector cable, length 1.5 M
CA-SCSI20-M1/M3/M5	20-pin SCSI-II male connector cable (for Mitsubishi J2 series motor), length 1 M / 3 M / 5 M.
CA-26-MJ3-15/30/50	26-pin HD D-Sub male cable for Mitsubishi servo amplifier, 1.5/3/5 M. (for MELSERVO-J3/J4 series)
CA-26-PA4-15/30/50	26-pin HD D-Sub male cable for Panasonic servo amplifier, 1.5/3/5 M. (for MINAS A4/A5 series)
CA-26-YSV-15/30/50	26-pin HD D-Sub male cable for Yaskawa servo amplifier, 1.5/3/5 M. (for Sigma II/III/V series)
CA-26-TTA-15/30/50	26-pin HD D-Sub male cable for Teco servo amplifier, 1.5/3/5 M. (for TSTA-A/A+ series)
CA-26-DAA2-15/30/50	26-pin HD D-Sub male cable for Delta A2 servo amplifier, 1.5/3/5 M. (for ASDA-A2 series)
CA-26-DAB2-15/30/50	26-pin HD D-Sub male cable for Delta B2 servo amplifier, 1.5/3/5 M. (for ASDA-B2 series)
CA-26-FFW-15/30/50	26-pin HD D-Sub male cable for Fuji servo amplifier, 1.5/3/5 M. (for FALDIC-W and ALPHA5 smart series)

2 Hardware Configuration

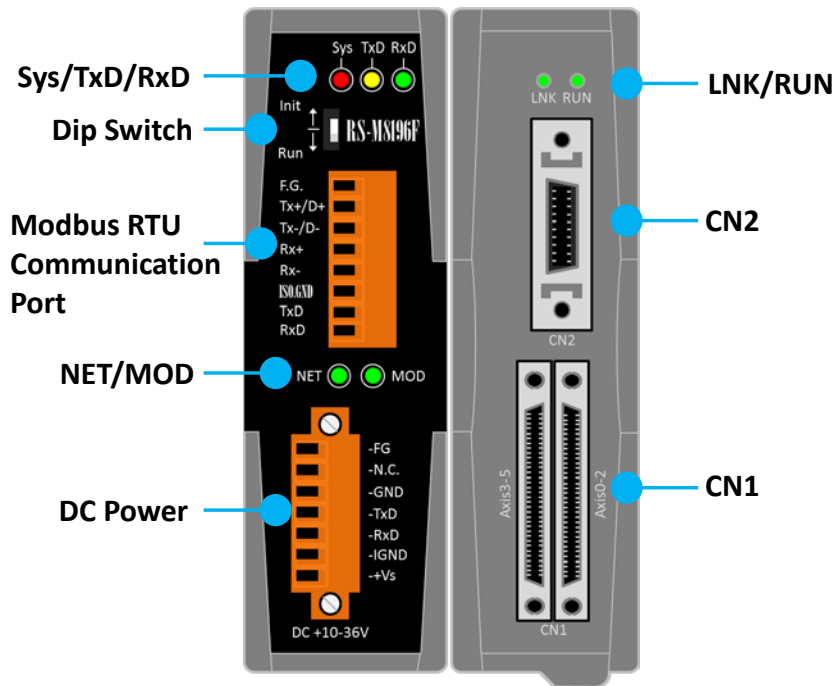


Figure 2.1 RS-M8196F device

Table 2.1 hardware configuration

Name	Description
DC Power	External power input (24V) and RS-232 communication port. RS-232 communications port for the Modbus RTU settings and firmware updates.
Modbus RTU Communication Port	Modbus RTU communications port (RS-485/RS-422/RS-232) ◦
CN1	Motion control signal port; connect to the DN-8368 series terminal board.
CN2	Universal I/O and FRnet communication ports; connect to the DN-20M terminal board.
Dip Switch	Switch for enabling/disabling the firmware execution. <ul style="list-style-type: none"> Init: Initial mode. Disables firmware execution. This mode is necessary for changing the Modbus RTU settings or firmware update. Run: Firmware execution mode (default). Firmware normal program execution (default).

	Note: The dip switch setting takes effect after the power has been reset.
Sys(red light)	On: Power is on and firmware is running. Blinking: Power is on but firmware is not running. Off: The power is off.
Tx(yellow)	Flashing: transmitting data via RS-232. Off: No data transmission.
Rx(green)	Blinking: receiving data via RS-232. Off: No receiving data.
NET(green)	On: Ethernet connection Blinking: Modbus RTU data transmission. Off: No data transmission.
MOD(green)	Flashing: firmware is running. On or off: firmware is not running (Dip switch is in “Init” position or I-8196F card is not properly plugged into its slot)
LNK(green)	I-8196F function indicator
RUN(green)	I-8196F function indicator

2.1 Power input and RS-232 port

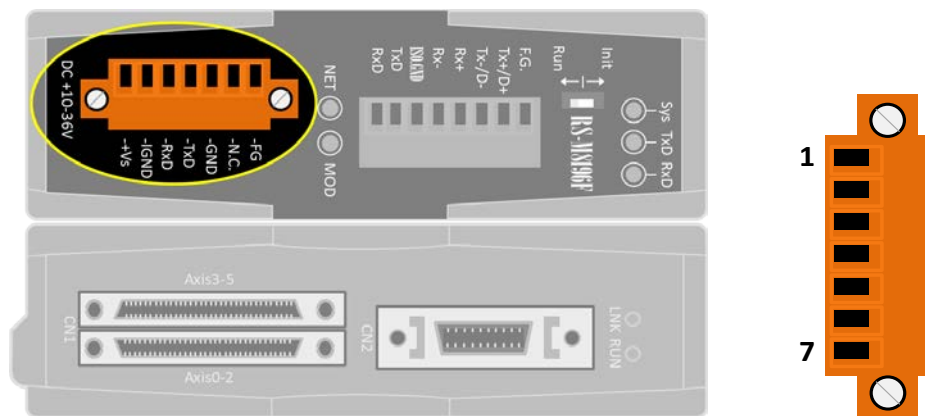


Figure 2.2 power input and RS-232 port

Table 2.2 power input and RS-232 communications port

No	Name	Description	
1	FG	Frame ground	
2	N.C.	Reserved	
3	GND	RS-232	Ground
4	TxD		Transmit data wire
5	RxD		Receive data wire
6	IGND	Electrical ground	
7	+Vs	External power supply DC 24V input	

2.2 Modbus RTU communication port

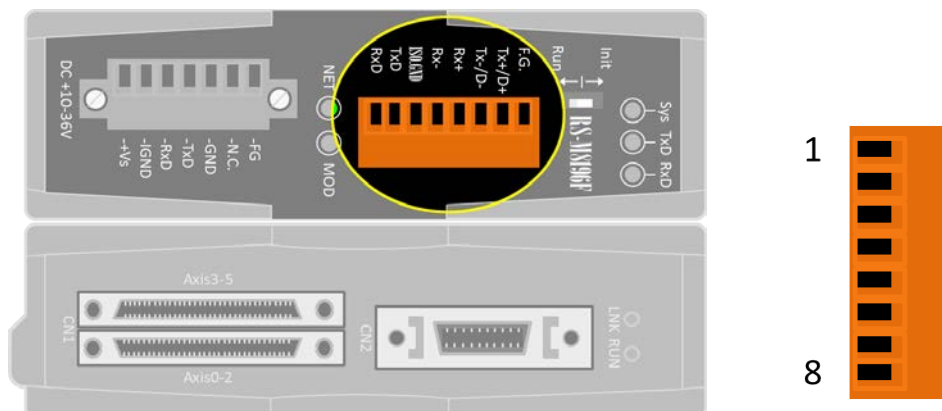


Figure 2.3 Modbus RTU communication port

Table 2.3 Modbus RTU communication port definition

No	Name	Description
1	F.G.	Frame ground
2	Tx+/D+	RS-422 transmit data wire (+)/RS-485 data wire (+)
3	Tx-/D-	RS-422 transmit data wire (-)/RS-485 data wire (-)
4	Rx+	RS-422 receive data wire (+)
5	Rx-	RS-422 receive data wire (-)
6	ISO.GND	RS-232 ground
7	TxD	RS-232 transmit data wire
8	RxD	RS-232 receive data wire

2.3 Motion control signal port (CN1)

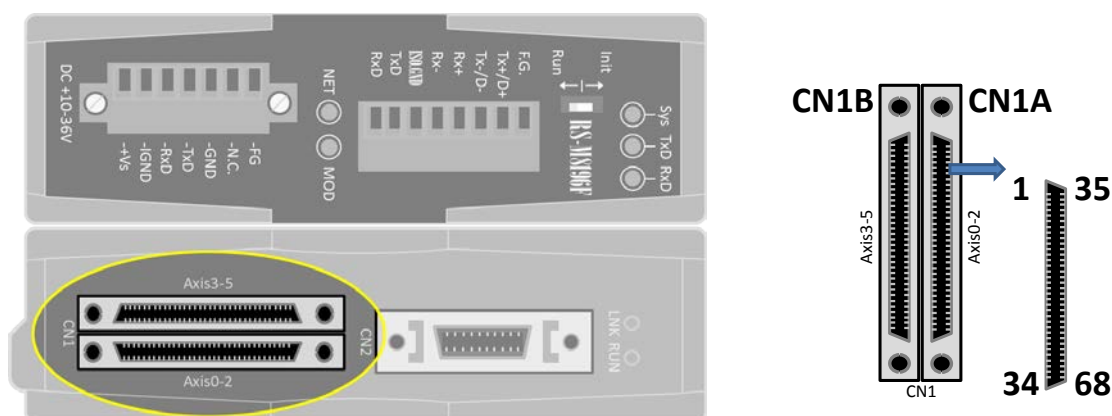


Figure 2.4 motion control port CN1

Table 2.4 motion control port CN1A pin definition

No	Name	I/O	Function	No	Name	I/O	Function
1	AOUT0	O	Analog Output	35	AIN0	I	Analog Input
2	AOUT1	O	Analog Output	36	AIN1	I	Analog Input
3	AOUT2	O	Analog Output	37	AIN2	I	Analog Input
4	AGND		Analog Ground	38	AGND		Analog Ground
5	DGND		Digital Ground	39	ERC0	O	Error Counter Clear
6	LTC0	I	Position Latch	40	SVON0	O	Servo On
7	EA0	I	Encoder A-Phase	41	RDY0	I	Servo Ready
8	EB0	I	Encoder B-Phase	42	INP0	I	Servo In-Position
9	EZ0	I	Encoder Z-Phase	43	ALM0	I	Servo Alarm
10	CW0	O	Clockwise pulse	44	SLD0	I	Slow Down
11	CCW0	O	Counter-Clockwise pulse	45	ORG0	I	Origin Signal
12	CMP0	O	Compare Trigger	46	MEL0	I	Minus End Limit
13	EMG	I	Emergency Stop	47	PEL0	I	Positive End Limit
14	ALMRST0	O	Servo Alarm Reset	48	DGND		Digital Ground
15	DGND		Digital Ground	49	ERC1	O	Error Counter Clear
16	LTC1	I	Position Latch	50	SVON1	O	Servo On
17	EA1	I	Encoder A-Phase	51	RDY1	I	Servo Ready
18	EB1	I	Encoder B-Phase	52	INP1	I	Servo In-Position
19	EZ1	I	Encoder Z-Phase	53	ALM1	I	Servo Alarm
20	CW1	O	Clockwise pulse	54	SLD1	I	Slow Down
21	CCW1	O	Counter-Clockwise pulse	55	ORG1	I	Origin Signal
22	CMP1	O	Compare Trigger	56	MEL1	I	Minus End Limit
23	GDO1	O	Generic Digital Output	57	PEL1	I	Positive End Limit
24	ALMRST1	O	Servo Alarm Reset	58	DGND		Digital Ground
25	DGND		Digital Ground	59	ERC2	O	Error Counter Clear
26	LTC2	I	Position Latch	60	SVON2	O	Servo On
27	EA2	I	Encoder A-Phase	61	RDY2	I	Servo Ready
28	EB2	I	Encoder B-Phase	62	INP2	I	Servo In-Position
29	EZ2	I	Encoder Z-Phase	63	ALM2	I	Servo Alarm
30	CW2	O	Clockwise pulse	64	SLD2	I	Slow Down
31	CCW2	O	Counter-Clockwise pulse	65	ORG2	I	Origin Signal

32	CMP2	O	Compare Trigger	66	MEL2	I	Minus End Limit
33	DGND		Digital Ground	67	PEL2	I	Positive End Limit
34	ALMRST2	O	Servo Alarm Reset	68	VCC		5V Digital Power from Bus

Table 2.5 motion control port CN1B pin definition

No	Name	I/O	Function	No	Name	I/O	Function
1	AOUT3	O	Analog Output	35	AIN3	I	Analog Input
2	AOUT4	O	Analog Output	36	AIN4	I	Analog Input
3	AOUT5	O	Analog Output	37	AIN5	I	Analog Input
4	AGND		Analog Ground	38	AGND		Analog Ground
5	DGND		Digital Ground	39	ERC3	O	Error Counter Clear
6	LTC3	I	Position Latch	40	SVON3	O	Servo On
7	EA3	I	Encoder A-Phase	41	RDY3	I	Servo Ready
8	EB3	I	Encoder B-Phase	42	INP3	I	Servo In-Position
9	EZ3	I	Encoder Z-Phase	43	ALM3	I	Servo Alarm
10	CW3	O	Clockwise pulse	44	SLD3	I	Slow Down
11	CCW3	O	Counter-Clockwise pulse	45	ORG3	I	Origin Signal
12	CMP3	O	Compare Trigger	46	MEL3	I	Minus End Limit
13	GDI11	I	Generic Digital Input	47	PEL3	I	Positive End Limit
14	ALMRST3	O	Servo Alarm Reset	48	DGND		Digital Ground
15	DGND		Digital Ground	49	ERC4	O	Error Counter Clear
16	LTC4	I	Position Latch	50	SVON4	O	Servo On
17	EA4	I	Encoder A-Phase	51	RDY4	I	Servo Ready
18	EB4	I	Encoder B-Phase	52	INP4	I	Servo In-Position
19	EZ4	I	Encoder Z-Phase	53	ALM4	I	Servo Alarm
20	CW4	O	Clockwise pulse	54	SLD4	I	Slow Down
21	CCW4	O	Counter-Clockwise pulse	55	ORG4	I	Origin Signal
22	CMP4	O	Compare Trigger	56	MEL4	I	Minus End Limit
23	GDO2	O	Generic Digital Output	57	PEL4	I	Positive End Limit
24	ALMRST4	O	Servo Alarm Reset	58	DGND		Digital Ground
25	DGND		Digital Ground	59	ERC5	O	Error Counter Clear
26	LTC5	I	Position Latch	60	SVON5	O	Servo On
27	EA5	I	Encoder A-Phase	61	RDY5	I	Servo Ready

28	EB5	I	Encoder B-Phase	62	INP5	I	Servo In-Position
29	EZ5	I	Encoder Z-Phase	63	ALM5	I	Servo Alarm
30	CW5	O	Clockwise pulse	64	SLD5	I	Slow Down
31	CCW5	O	Counter-Clockwise pulse	65	ORG5	I	Origin Signal
32	CMP5	O	Compare Trigger	66	MEL5	I	Minus End Limit
33	DGND		Digital Ground	67	PEL5	I	Positive End Limit
34	ALMRST5	O	Servo Alarm Reset	68	VCC		5V Digital Power from Bus

2.4 General-purpose I / O and FRnet ports (CN2)

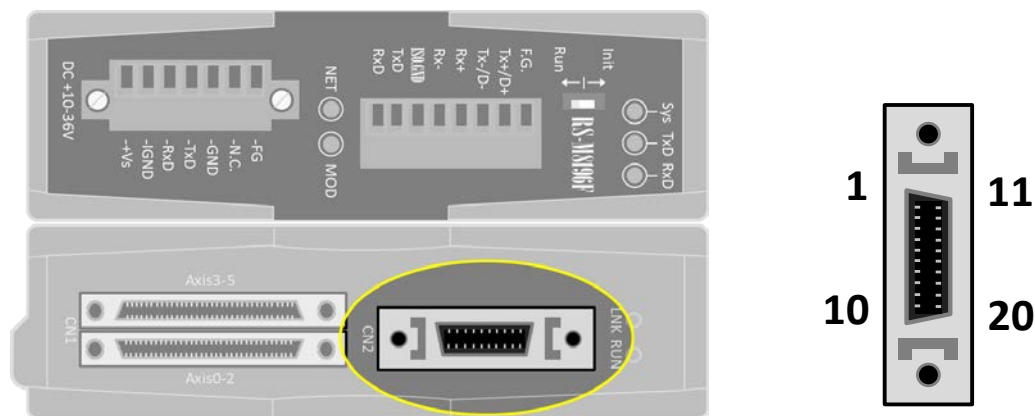


Figure 2.5 universal I / O and FRnet communication ports CN2

Table 2.6 universal I/O and FRnet communication port CN2 pin definition

No	Name	I/O	Function	No	Name	I/O	Function
1	FR_A	O	FRnet A Phase	11	DGND		Digital Ground
2	FR_B	O	FRnet B Phase	12	MPG_EMG	I	MPG Emergency Stop
3	FR_GND		GND of FRnet Signal	13	GDI10 / MPG_Axis5	I	Generic Digital Input or MPG Axis Selection
4	GDI9 / MPG_Axis4	I	Generic Digital Input or MPG Axis Selection	14	GDI8 / MPG_Axis3	I	Generic Digital Input or MPG Axis Selection
5	GDI7 / MPG_Axis2	I	Generic Digital Input or MPG Axis Selection	15	GDI6 / MPG_Axis1	I	Generic Digital Input or MPG Axis Selection
6	GDI5 / MPG_Axis0	I	Generic Digital Input or MPG Axis	16	GDI4 / MPG_Gain2	I	Generic Digital Input or MPG Magnification

			Selection				Selection
7	GDI3 / MPG_Gain1	I	Generic Digital Input or MPG Magnification Selection	17	GDI2 / MPG_Gain0	I	Generic Digital Input or MPG Magnification Selection
8	GDI1	I	Generic Digital Input	18	GDI0	I	Generic Digital Input
9	MPG_B	O	Manual Pulse Generator B Phase	19	MPG_A		Manual Pulse Generator A Phase
10	GDO0		Generic Digital Output	20	VCC		5V Digital Power from Bus

2.5 External terminal board

Port CN1 has to be connected to the "DN-8368" series terminal board and CN2 has to be connected to the "DN-20M" terminal board.

3 Wiring Example

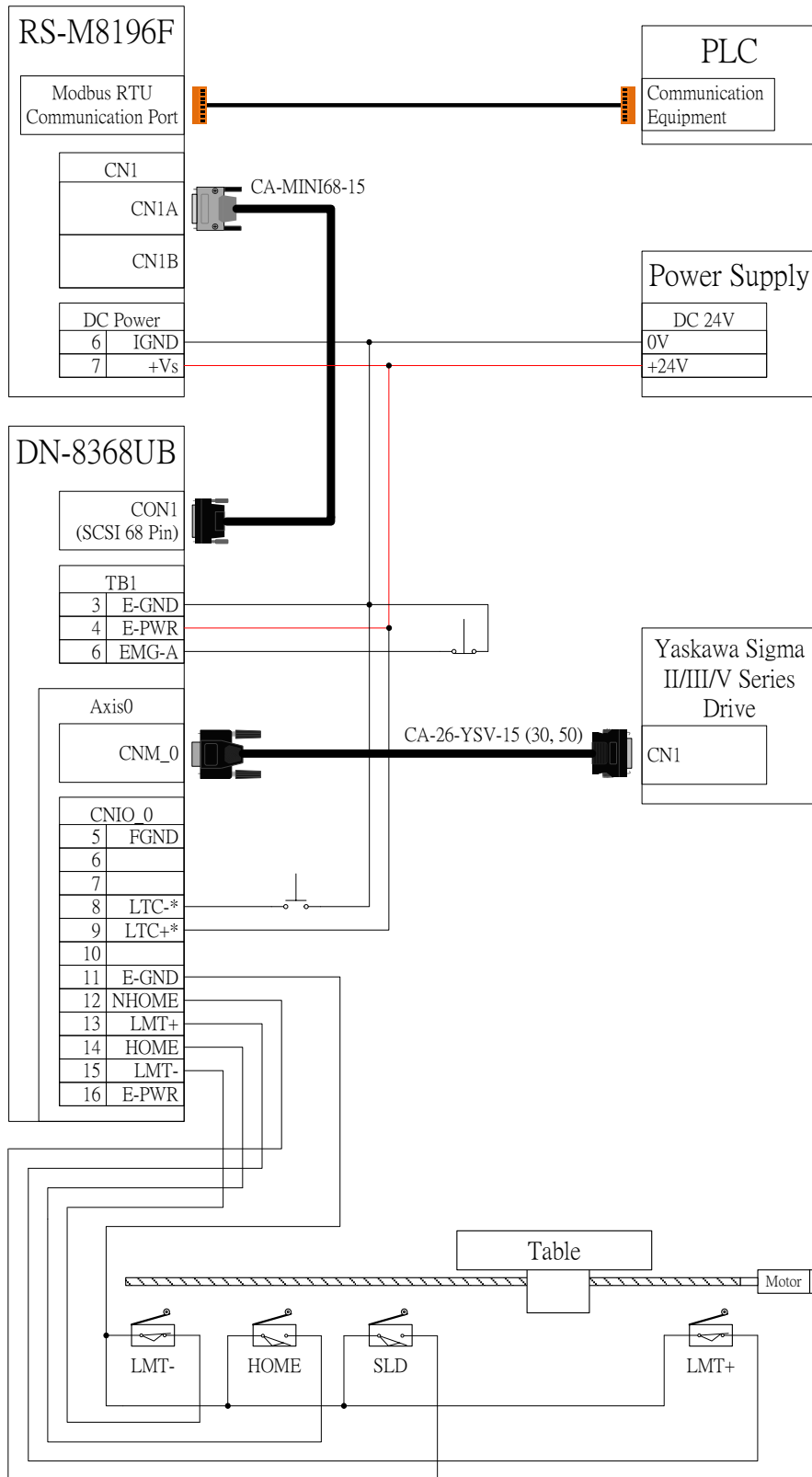
RS-M8196F provided for different servo drives models different terminal block and cables. Therefore RS-M8196F can easily be connected to the common servo motor brands on the market by selecting for the servo motor brands the corresponding terminal block and cable.

Perform the following these wiring steps:

1. Connect the RS-M8196F to a DC24V power input.
2. Connect the RS-M8196F to PLC communication equipment.
3. Connect one or two DN-8368 series terminal board to the CN1 port. Terminal board connected to the CN1A port defines the Axis 0 ~ 2 and the terminal board connected to CN1B is defines the Axis 3 ~ 5.
4. The pin definition of each axis are described in the DN-8368 User's Manual
5. Connect the DN-20M terminal board to the CN2 port if GPIO or FRnet I/O is needed. Refer to the DN-20M instruction manual for the signal pin definitions.
6. Turn on the power after all the connections are properly connected

3.1 Connecting to Yaskawa Sigma II/III/V

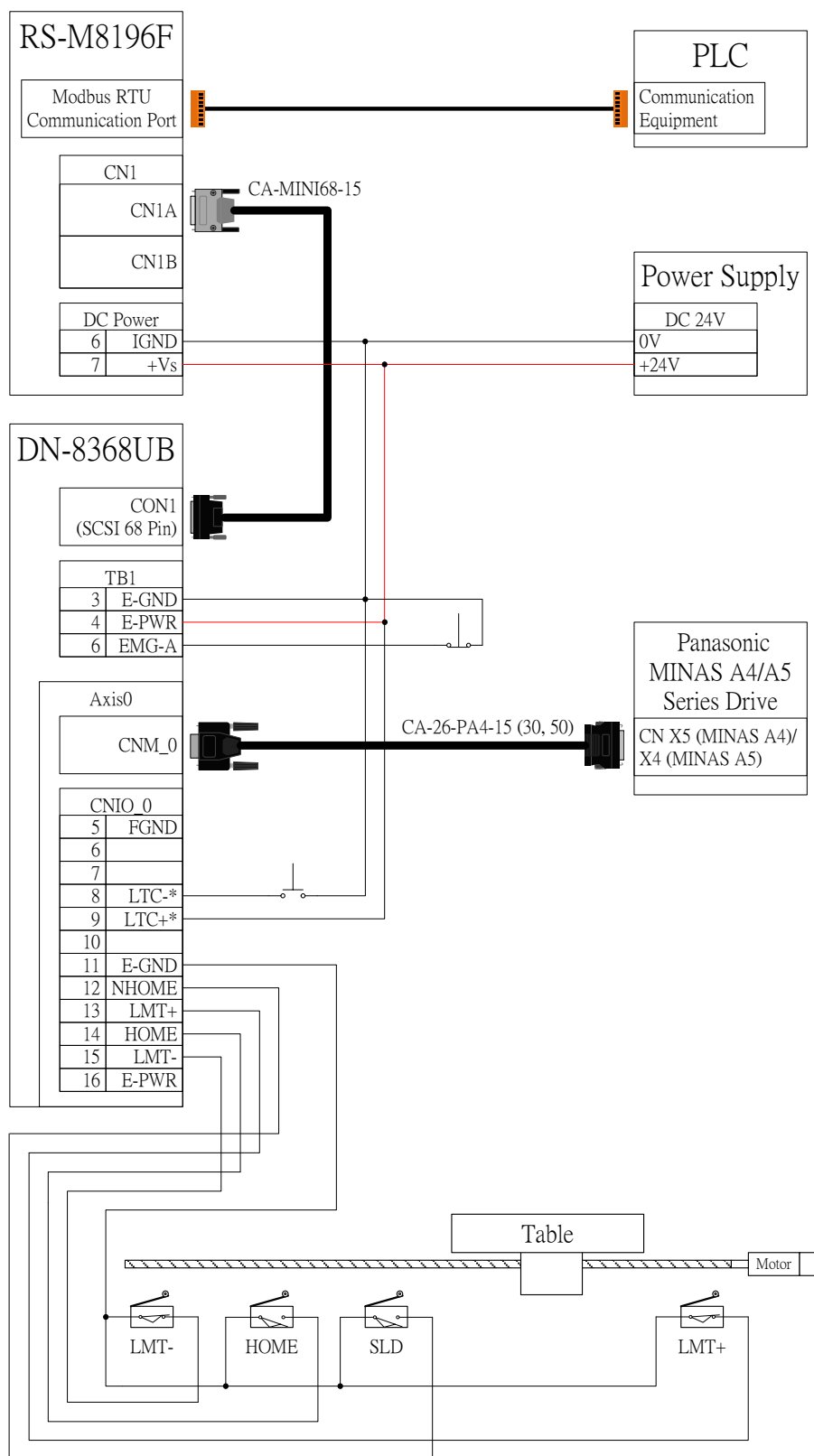
RS-M8196F to Yaskawa Sigma II/III/V Series Drives



*When using the LTC signal follow the input voltage setting of the DN-8368UB's jumper JP1 ~ JP3.

3.2 Connecting to Panasonic MINAS A4/A5

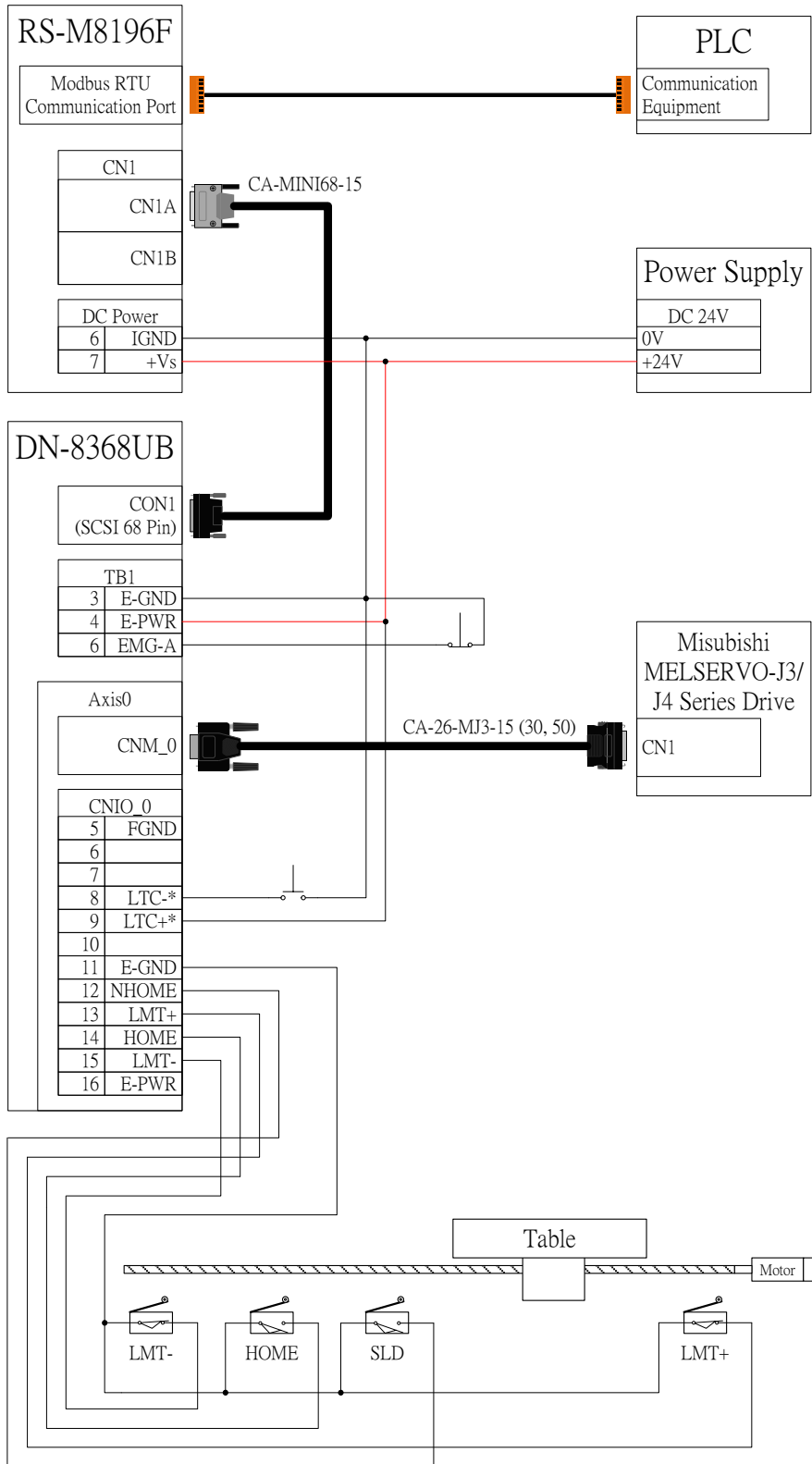
RS-M8196F to Panasonic MINAS A4/A5 Series Drives



*When using the LTC signal follow the input voltage setting of the DN-8368UB's jumper JP1 ~ JP3.

3.3 Connecting to Mitsubishi MELSERVO-J3/J4

RS-M8196F to Mitsubishi MELSERVO-J3/J4 Series Drives



*When using the LTC signal follow the input voltage setting of the DN-8368UB's jumper JP1 ~ JP3.

3.4 Connect the Modbus RTU communication port

Via RS-232:

Connect the ISO.GND, TxD and RxD pins to the PLC communication equipment (or PC serial port).

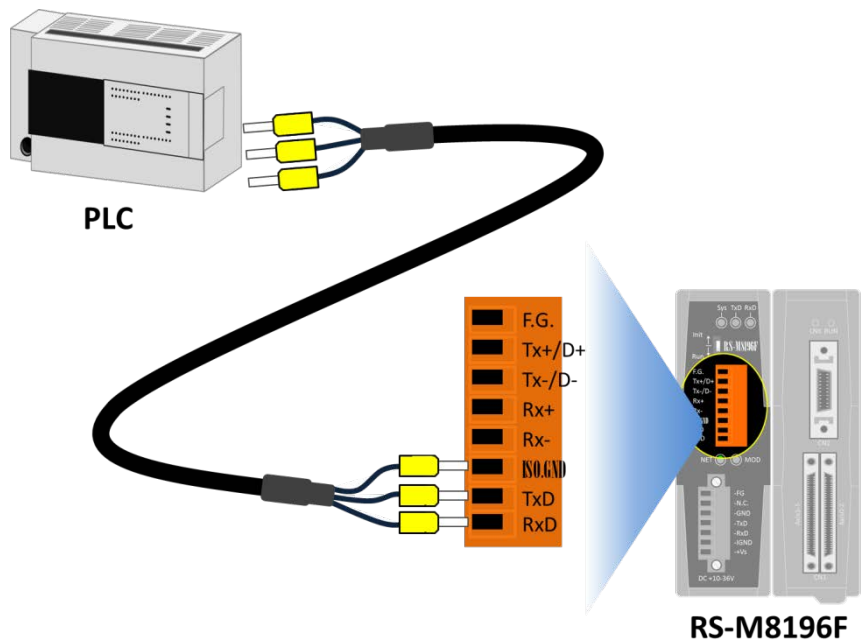


Figure 4.5 via RS-232

Via RS-422:

Connect the Tx+, Tx-, Rx+ and Rx- pins to the PLC communication equipment (or PC serial port).

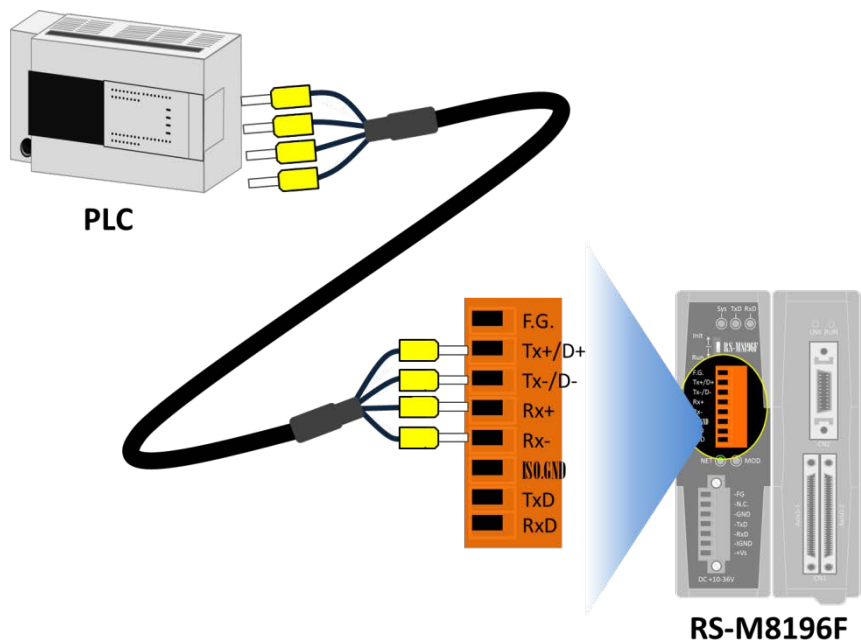


Figure 4.6 via RS-422

Via RS-485:

Connect the D+ and D- pins to the PLC communication equipment (or PC serial port).

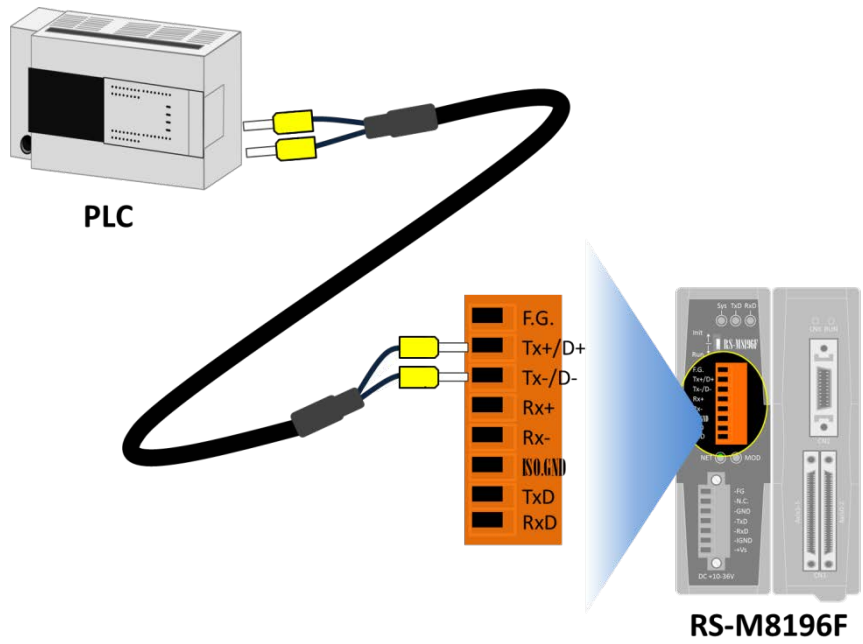


Figure 4.7 via RS-485

4 Modbus RTU Communication Parameter Settings

Step 1: Connect PC to serial port (RS-232)

Connect to the RS-M8196F to the PC COM port by using the RS-232 cable (CA-0910). The Tx, Rx and GND pins of CA-0910 have to be connected to the Rx, Tx and GND ports of the RS-M8196F. Connect the other end (9-pin, D-sub connector) to the RS-232 COM port of your desktop/laptop.

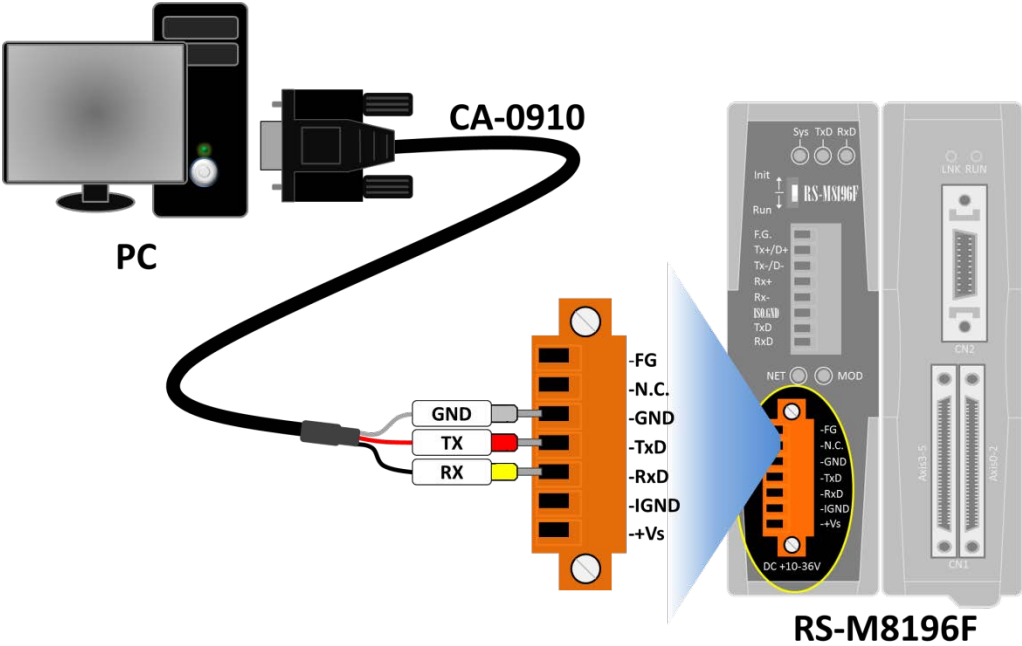


Figure 4.1 connect to PC serial port

Step 2: Set RS-M8196F to Initial Mode

First set the DIP-switch to "Init" position, then power up the RS-M8196F.

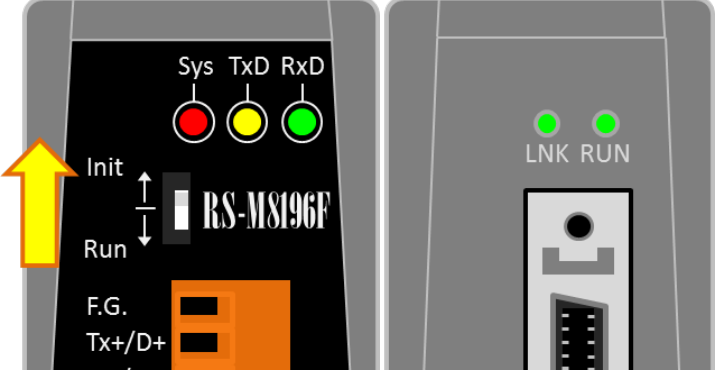


Figure 4.2 switch to the initial mode

Step 3: Execute the configuration tool “COMSetting”

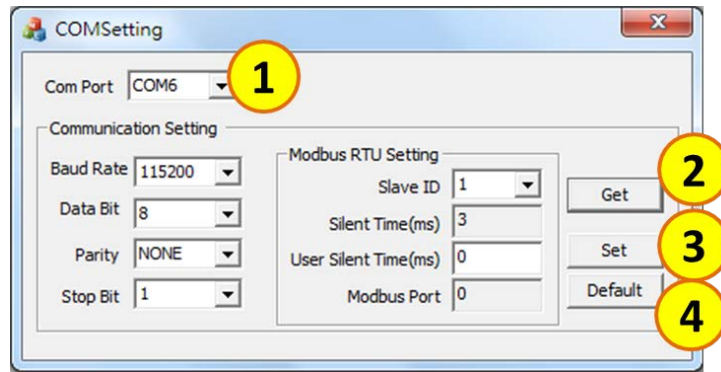


Figure 4.3 Modbus RTU configuration tool

1. Click the drop-down menu and select the PC’s COM port number to which the RS-M8196F is connected
2. Click the **Get** button to read the current configuration.
3. Specifies the field value, and then click the **Set** button to change the configuration.
4. Click the **Default** button to restore the default configuration.

Factory default setting:

Baud Rate: 115200

Data Bit: 8

Parity: NONE

Stop Bit: 1

Slave ID: 1

Silent Time: 3

User Silent Time: 0

Modbus Port: 0

Step 4: Switch off the RS-M8196F and set the DIP-switch to “Run”.

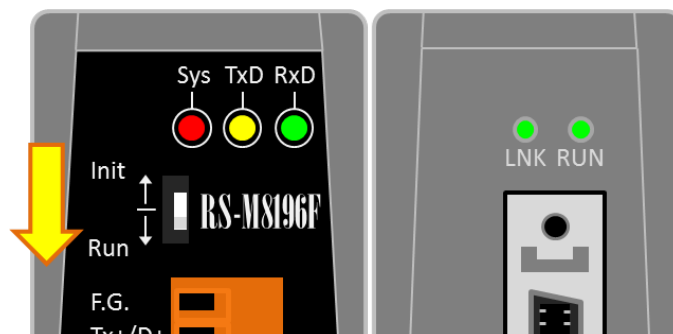


Figure 4.4 switch to the run mode

Step 5: Reset the power. Now the RS-M8196F is using the new configuration.

5 Software Support

RS-M8196F Libraries

Libraries are provided for the RS-M8196F which allows the user to remotely control the device from the PC without having to understand the Modbus communication. The libraries (DLL, Dynamic-link library) support all current Windows operation systems versions.

EzGo Utility

EzGo is a Windows-based utility which assists the user in creating a connection to the remote RS-M8196F device and allows the execution of simple motion commands. Furthermore it can be used for monitoring motion path and DIO status.