FTB Manufacturing Co., Ltd.

MTG-63/100 RS485 Modbus RTU

Communication User’s Manual

Version 1.00

May 2025

Table of Contents

1. Basic Specifications

1-1. Operating Voltage: DC 22–26V.

1-2. Environmental Conditions:

Operating Temperature Range: 5°C to 50°C.

Operating Humidity Range: 5% to 85% RH.

Storage Temperature: -20°C to 85°C.

1-3. Communication Protocol: Modbus RTU.

1-4. Pressure Output: Analog output of 4–20mA for pressure values.

1-5. NPN Open Collectors: 5 modes to choose from (NO/NO), (NO/NC), (NC/NC), (NC/NO), and OFF.

2. Modbus RTU Communication

2-1. Communication Format: Each data frame consists of 8 data bits, no parity, and 1 stop bit.

2-2. Response Time: 20ms response delay after receiving a complete packet.

2-3. Data Access: Only one register can be read or written at a time during communication.

2-4. Pressure Reading Procedure: Read the integer part of the pressure value first, followed by the decimal part.

2-5. When the pressure value (integer) is read, the pressure value (decimal) is updated synchronously.

2-6. Registers

Address	Register	(R/W)	Range	Data Type	Default	Memory
0x0000	Pressure Value (integer)	R	-1000~30000	16-bit integer	**X**	**X**
0x0001	Pressure Value (decimal)	R	-9999~9999	16-bit integer	**X**	**X**
0x0002	Zeroing Range Setting	R/W	0~15	16-bit integer	0	**V**
0x0003	Positive Pressure Units	R/W	0~9	16-bit integer	0(kg/cm^2)	**V**
0x0004	Negative Pressure Units	R/W	0~9	16-bit integer	9(blank)	**V**
0x0005	Gauge Maximum Value	R/W	0~30009	16-bit integer	40	**V**
0x0006	Gauge Minimum Value	R/W	-1000~0	16-bit integer	0	**V**
0x0007	Gauge Type	R/W	0~2	16-bit integer	0	**V**
0x0008	Pressure Calibration	R/W	-1000~1000	16-bit integer	0	**V**
0x0009	Alarm Mode	R/W	0~4	16-bit integer	4	**V**

0x000A	Alarm1 (integer)	R/W	-30000~30000	16-bit integer	15	**V**
0x000B	Alarm1 (decimal)	R/W	-9999~9999	16-bit integer	0	**V**
0x000C	Alarm2 (integer)	R/W	-30000~30000	16-bit integer	15	**V**
0x000D	Alarm2 (decimal)	R/W	-9999~9999	16-bit integer	0	**V**
0x000E	Hysteresis pressure (integer)	R/W	0~30000	16-bit integer	0	**V**
0x000F	Hysteresis pressure (decimal)	R/W	0~9999	16-bit integer	0	**V**
0x0010	Hysteresis time (second)	R/W	0~15	16-bit integer	0	**V**
0x0011	ID	R/W	0~255	16-bit integer	255	**V**
0x0012	Baud Rate	R/W	0~2	16-bit integer	1	**V**
0x00FF	Zeroing Setting	W	1	16-bit integer	**X**	**V**

2-7. Data Reading (Function Code = 03):

HMI → Inquire Pressure Gauge ID 1 (Pressure Value - integer)

ID	Function	Address-H	Address-L	Data of Length	CRC-L	CRC-H
0x01	0x03	0x00	0x00	0x01	0x84	0x0A

Pressure Gauge ID 1 → reply to HMI current (Pressure Value - integer) =1000 (Data-H + Data-L=0x03E8=1000)

ID	Function	Number of Byte	Data-H	Data-L	CRC-L	CRC-H
0x01	0x03	0x02	0x03	0xE8	0xFA	0x72

2-8. Data Writing (Function=06):

HMI → Set Pressure Gauge ID 1 (Positive Pressure Unit) =BAR

ID	Function	Address-H	Address-L	Data-H	Data-L	CRC-L	CRC-H
0x01	0x06	0x00	0x04	0x00	0x01	0x09	0xCB

Pressure Gauge ID 1 → Reply to HMI Positive Pressure Unit set BAR

ID	Function	Address-H	Address-L	Data-H	Data-L	CRC-L	CRC-H
0x01	0x06	0x00	0x04	0x00	0x01	0x09	0xCB

3. Pressure Settings

3-1. Positive Pressure Setting

3-1-1. Gauge Type = 0 (Positive Pressure).

3-1-2. The minimum pressure value is forced to zero, and the negative pressure unit is forcibly set to blank.

3-1-3. The maximum pressure value is 40 by default, and the positive pressure unit is kg/cm2 by default.

3-1-4. The maximum value can be set in the range of 0~30009.

Example:

- The maximum value =30000; the maximum pressure value =30000.

Example:

- The maximum value =30001~30009 meaning the maximum pressure value = (30001-30000) * 0.1~0.9 = 0.1~0.9.

3-1-5. Pressure values from 0.1 to 0.9 are rounded to 4 decimal places.
Pressure values from 1 to 99 are rounded to 3 decimal places.
Pressure values from 1000 to 9999 are rounded to 2 decimal places.

3-2. Negative Pressure Setting

3-2-1. Gauge Type = 1 (Negative Pressure).

3-2-2. The maximum pressure value is forcibly set to zero, and the positive pressure unit is forcibly set to blank.

3-2-3. The maximum pressure value is -76 by default, and the negative pressure unit is cmHg by default.

3-2-4. The minimum value can be set in a range of -1000~0.

3-2-5. Pressure values from -1-99 are rounded to the 3rd. decimal place.
Pressure values from 100-1000 are rounded to the 2nd. decimal place.

3-2-6. When adjusting the negative pressure unit, the default value of the minimum value is as follows:

Unit	kg/cm^2	bar	psi	mpa	kpa	inHg	cmHg	mmHg	mbar
Default	-1	-1	-15	-1	-100	-30	-76	-760	-1000

3-3. Compound Pressure Setting

3-3-1. Gauge Type = 2 (Compound Pressure).

3-3-2. There are only the following unit settings, the default is kg/cm2 with negative pressure unit cmHg:

3-3-2-1. The positive pressure unit kg/cm^2 is paired with the negative pressure unit: cmHg or mmHg or inHg or mbar or kg/cm^2.

3-3-2-2. The positive pressure unit psi is paired with the negative pressure unit inHg.

3-3-2-3. The positive pressure unit bar is paired with the negative pressure unit bar or mbar or inHg.

3-3-2-4. The positive pressure unit mbar is paired with the negative pressure unit mbar.

- If you select the wrong unit, the program will automatically set it to the correct unit.
- If kg/cm2 is selected for positive pressure, but inHg is selected for negative pressure, the program will set the negative pressure to cmHg.
- If bar is selected for positive pressure, but cmHg is selected for negative pressure, the program will set the negative pressure to bar.

3-3-3. The range can be set between 0~30009.

3-3-4. The minimum value of the gauge is fixed according to the negative pressure unit and cannot be adjusted.

cmHg is -76; mmHg is -760; inHg is -30; bar is -1; kg/cm2 is -1; and mbar is -1000.

3-3-5. The pressure values are rounded to the 2nd decimal place.

4. Pressure Unit Setting

Unit	kg/cm^2	bar	psi	mpa	kpa	inHg	cmHg	mmHg	mbar	Blank (none)
Setup code	0	1	2	3	4	5	6	7	8	9

5. Baud Rate

5-1. Default Baud Rate 19200

5-2. Baud Rate Setting 0=9600, 1=19200, 2=38400

6. ID Setting

6-1. Default ID 255

6-2. Total 256 IDs (0~255)

7. Zeroing Setting

7-1. Transmit the following code, reset to zero.

ID	Function	Address-H	Address-L	Data of Length	CRC-L	CRC-H
0x01	0x06	0x00	0xFF	0x01	.....	.....

8. Zeroing Range Setting

8-1. Default = 0

8-2. Range 0~15, 1~15 represents 1~15%

Example:

- **Positive pressure at zeroing range 10 on the maximum value of 4kg/cm².**
  4 * 10% = 0.4 kg/cm² -> 0 to 0.4 kg/cm² considers zero.

Example:

- **Negative pressure at zeroing range 10 on the maximum value of -76 cmHg.**
  -76 * ±10% = -7.6 cmHG -> -7.6 to 0 cmHg considers zero.

Example:

- **Compound pressure at zeroing range 10 on the minimum value of -76 cmHg and maximum value of 1kg/cm²**
  Positive Pressure: 1 * 10% = 0.1 kg/cm²
  Negative Pressure: -76 * 10% = -7.6 cmHG
  0.1 kg/cm² to -7.6 cmHG considers zero.

9. Pressure Calibration

9-1. Default Setting: Calibration Value = 0.

9-2. Range: -1000 to 1000, representing -1000% to 1000% correction.

9-3. Constraint: The calibrated pressure value must not exceed the maximum or minimum values of the gauge pressure.

Examples:

- Positive Pressure (0 to 10 kg/cm^2, -15% correction):
  - Measured pressure: 1 kg/cm^2 → Calibrated: 1 + (-0.15 × 10) = **0** kg/cm^2
  - Measured pressure: 9 kg/cm^2 → Calibrated: 9 + (-0.15 × 10) = 7.5 kg/cm^2
- Positive Pressure (0 to 10 kg/cm^2, +15% correction):
  - Measured pressure: 1 kg/cm^2 → Calibrated: 1 + (+0.15 × 10) = 2.5 kg/cm^2
  - Measured pressure: 9 kg/cm^2 → Calibrated: 9 + (+0.15 × 10) = **10** kg/cm^2
- Negative Pressure (-76 to 0 cmH_2O, -15% correction):
  - Measured pressure: -70 cmH_2O → Calibrated: -70 + (-0.15 × -76) = -58.6 cmH_2O
  - Measured pressure: -10 cmH_2O → Calibrated: -10 + (-0.15 × -76) = **0** cmH_2O
  - Measured pressure: -30 cmH_2O → Calibrated: -30 + (-0.15 × -76) = -18.6 cmH_2O
- Negative Pressure (-76 to 0 cmH_2O, +15% correction):
  - Measured pressure: -70 cmH_2O → Calibrated: -70 + (+0.15 × -76) = **-76** cmH_2O
  - Measured pressure: -10 cmH_2O → Calibrated: -10 + (+0.15 × -76) = -21.4 cmH_2O
  - Measured pressure: -30 cmH_2O → Calibrated: -30 + (+0.15 × -76) = -41.4 cmH_2O
- Compound Pressure (-76 cmH_2O to 35 kg/cm^2, -1% correction, fixed offset of 0.01 kg/cm^2):
  - Measured pressure: -0.76 cmH_2O → Calibrated: -0.76 + (0.01 × 1) = 0 cmH_2O
  - Measured pressure: 35 kg/cm^2 → Calibrated: 35 + (0.01 × 1) = 35 kg/cm^2
- Compound Pressure (-30 inH_2O to 15 psi, 1% correction, fixed offset of 0.01 psi):
  - Measured pressure: -0.02 inH_2O → Calibrated: -0.02 + (0.01 × 1) = 0 inH_2O
  - Measured pressure: 10 psi → Calibrated: 10 + (0.01 × 1) = 10.01 psi

10. Hysteresis (HYS) Pressure, (HYS) Time, and Alarm Modes (ALT 0-4)

※ HYS stands for HYS pressure, and X seconds stands for HYS time.

10-1. ALT. 0 (OFF) Mode:

- NPN/PNP switches remain OFF (R1/R2 OFF).

10-2. ALT. 1 (**NC/NO**) Mode:

R1 ON:

Pressure > AL1: Switch ON.

Pressure < (AL1 - HYS): After X seconds delay, switch OFF.

R2 ON:

Pressure < (AL2 + HYS): After X seconds delay, switch OFF.

Pressure < AL2: Switch ON.

ALt.1		
	「CV」≧ (AL1) → R1/AL1 ON ; 「CV」< (AL1 - H) → R1/AL1 OFF	「CV」≦ (AL2) → R2/AL2 ON ; 「CV」> (AL2+H) → R2/AL2 OFF

10-3. ALT. 2 (**NO/NC**) Mode:

R1 ON:

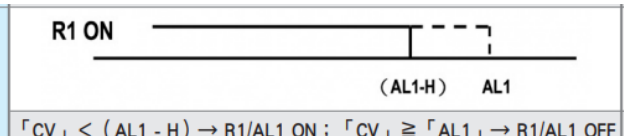
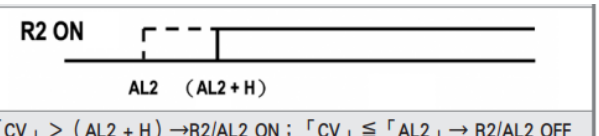
Pressure > AL1: After X seconds delay, switch OFF.

Pressure < (AL1 - HYS): Switch ON.

R2 ON:

Pressure > (AL2 - HYS): Switch ON.

Pressure < (AL2 - HYS): After X seconds delay, switch OFF.

ALt.2		
	「CV」< (AL1 - H) → R1/AL1 ON ; 「CV」≧「AL1」→ R1/AL1 OFF	「CV」> (AL2 + H) →R2/AL2 ON ; 「CV」≦「AL2」→ R2/AL2 OFF

10-4. ALT. 3 (**NC/NC** Switch) Mode:

R1 ON:

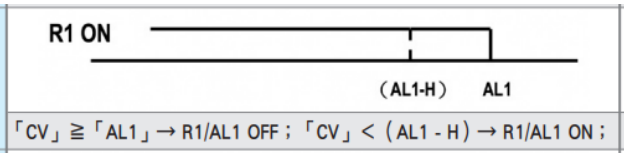
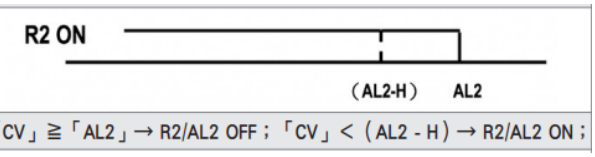
Pressure > AL1: Switch OFF.

Pressure < (AL1 - HYS): After X seconds delay, switch ON.

R2 ON:

Pressure > AL2: Switch OFF.

Pressure < (AL2 - HYS): After X seconds delay, switch ON.

ALt.3		
	「CV」≧「AL1」→ R1/AL1 OFF ; 「CV」< (AL1 - H) → R1/AL1 ON ;	「CV」≧「AL2」→ R2/AL2 OFF ; 「CV」< (AL2 - H) → R2/AL2 ON ;

10-5. ALT. 4 (**NO/NO**) Mode:

R1 ON:

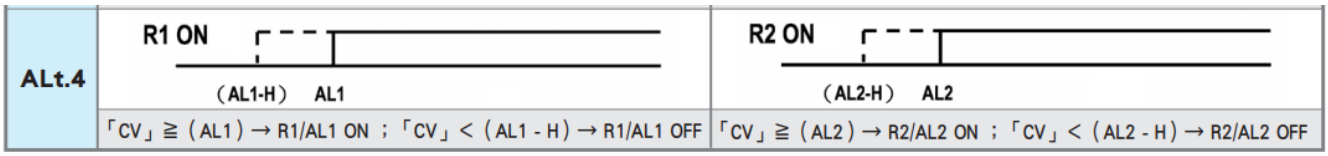
Pressure > AL1: Switch ON.

Pressure < (AL1 - HYS): After X seconds delay, switch OFF.

R2 ON:

Pressure > AL2: Switch ON.

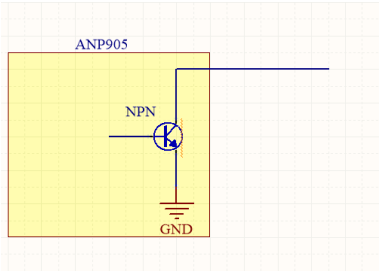
Pressure < (AL2 - HYS): After X seconds delay, switch OFF.



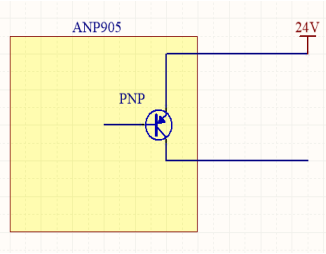
11. NPN/PNP Switch Description

11-1. Schematic diagram of the switch:

NPN Switch



PNP Switch



12. ID and Baud Rate Return to Factory Default Settings

12-1. Before supplying power, connect Reset to GND.

12-2. After power is supplied, the ID will be reset to 255, and the Baud Rate will be reset to 1 (19200).

13. Wiring Diagram for 4–20mA Output