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Aurora Multivariable Sensor 213MM4-R0 User Manual

texol Inc.

A professional provider of vibration analysis, monitoring, and diagnostic solutions, dedicated to maximizing the value of your products and equipment.



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1 Aurora System Overview

1.1 Description

This sensor instruction manual will have the target of ensuring that you have the capability to install the 213MM4-R0 digital multivariable sensor onto your equipment and use your terminal device to obtain digital signals.

How to select, configure, and deploy a third-party relay device hub between the sensor and your terminal device, as well as how to perform analysis, diagnosis, and prediction on the collected digital signals, are not included within the scope of this instruction manual.

1.2 Item Description

The items of the Aurora digital multivariable sensor include the 213MM4-R0 sensor and its base and magnetic base accessories.

1.2.1 213MM4-R0 Smart Sensor and Its Accessories Introduction

1.2.1.1 213MM4-R0 RS485 Wired Digital Tri-axial Multivariable Sensor

213MM4-R0 is an RS485 wired transmission smart vibration sensor that measures medium-to-high bandwidth response ranges. The 213MM4-R0 has built-in tri-axial vibration and temperature sensors, which can sense and output the machine equipment's raw medium-to-high frequency vibration signals and temperature signals in real time. It will adopt the Command over RS485 interface to transmit raw data to third-party receivers or gateways connected to it. In addition, 213MM4-R0 provides sampling frequencies of 26,667, 13,333, 6,666, 4,444, 3,333, and 2,666 data points per second available for configuration; and 213MM4-R0 also provides raw data output of acceleration and velocity, for you to choose when issuing commands.



Figure1-1 213MM4-R0 Wired Tri-axial Digital Multivariable Sensor

1.2.1.2 Multivariable Sensor Base 3838 and Magnetic Base 3838M

Aurora provides two types of fixtures for you to fix the 213MM4-R0 on the monitored equipment, which are magnetic and non-magnetic respectively.

When you purchase a non-magnetic fixture 3838, the package will contain a non-magnetic fixture as shown in Figure1-2 and a pair of M3 socket head cap screws as shown in Figure1-4. Its method of use is to apply glue to one side of the fixture to adhere and fix it on the equipment surface, and then use screws to lock and fix the smart sensor on the fixture.

When you purchase a magnetic fixture 3838M, the package will contain a magnetic fixture as shown in Figure1-3 and a pair of M3 socket head cap screws as shown in Figure1-4. Its method of use is to attach one side of the fixture onto the equipment surface by magnetic force, and then use screws to lock and fix the smart sensor on the fixture.



Figure1-2 Multivariable Sensor Base 3838



Figure1-3 Multivariable Sensor Magnetic Base 3838M



Figure1-4 M3 Socket Head Cap Screw

2 213MM4-R0 Digital Multivariable

Sensor Introduction

2.1 213MM4-R0 Function Description

2 213MM4-R0 is a sensor that measures tri-axial medium-to-high bandwidth vibration, which can sense and output the machine equipment's raw high-frequency vibration signals in real time. The white arrow on the exterior defines its measurement direction. 213MM4-R0 also has a built-in temperature sensor at the same time, which can synchronously measure the equipment's surface temperature.

213MM4-R0 provides sampling frequencies of 26,667, 13,333, 6,666, 4,444, 3,333, and 2,666 data points per second available for configuration.

213MM4-R0 provides raw data output of acceleration and velocity for you to choose when issuing commands. After selection, the data will output the raw vibration values of acceleration or velocity according to the user's settings.

If you need the smart sensor to analyze the OA magnitude defined by ISO-10816/ISO-20816 for you, you will need higher-level smart sensors, such as 213MM3-R0, 213MM2-R1 which are also RS485 wired versions, or 213MM1-B1 which is a Bluetooth version.

If you need the smart sensor to analyze vibration energy corresponding to various rotating equipment damage modes for you, or need to analyze the vibration energy of your custom damage

modes, or even further utilize the feature data of the smart sensor to establish a remaining useful life model for your equipment and achieve the purpose of life estimation, we would also recommend that you adopt higher-level smart sensors, such as 213MM2-R1 which is also an RS485 wired version, or 213MM1-B1 which is a Bluetooth version.

If you want to use other higher-level sensors and apply them, please refer to the operation instruction manuals of various sensors or edge gateways for their operation methods.

2.2 213MM4-R0 Communication

Architecture

213MM4-R0 adopts Command over RS485 to transmit raw vibration signals to any relay device hub that supports Command over RS485 conversion, and then transmits raw vibration signals to various edge gateways via wired or wireless networks.

The original manufacturer SYSCOM provides Command instructions and/or sample programs for users to develop software themselves to monitor your equipment.

Table2-1 on the right explains various RS485 connection setting parameters of 213MM4-R0.

Baudrate	115,200 bit/sec
Data bit	8 bits
Parity	None
Stop bit	1 bit
Flow control	None

Table2-1 213MM4-R0 RS485 Connection Parameters

2.3 213MM4-R0 Line Definition

213MM4-R0 requires external supply of 12-24V DC power supply. Its wiring definition is shown in Table2-2 on the right, red wire is positive pole, black wire is negative pole. Green wire and yellow wire are RS485 DATA+ and DATA- respectively. For usage method, please refer to 錯誤! 找不到參照來源。 description.

Red	VDC+ (12~24V)
Thin Black	GND
Green	RS485 DATA+
Yellow	RS485 DATA-
Thick Black	Shielding

Table2-2 213MM4-R0 Wiring Definition

2.4 213MM4-R0 Indicator Light Definition

As shown in Figure2-1 on the right, 213MM4-R0 has three LED lights on the top surface. From top to bottom in order are PWR, TX, RX indicator lights.



Figure2-1 213MM4-R0 Indicator Light Definition

As shown in Table2-3 on the right, if the PWR indicator light of smart sensor 213MM4-R0 is in a continuous flashing state, it indicates that the sensor is currently in the middle of receiving raw vibration signals; under the receiving state, it will continuously and uninterruptedly output raw vibration signals. If this indicator light exhibits a flashing state, it indicates that the sensor is currently in Standby (waiting) mode, waiting for the user to issue Command. If PWR indicator light is continuously OFF, it indicates power supply is abnormal or sensor is damaged, please check power supply status, or further contact agent service. If PWR, TX, RX are all continuously ON, it indicates 213MM4-R0 firmware is damaged and has entered recovery mode, please further contact agent service.

PWR continuously flashing (60ms)	213MM4-R0 receiving raw vibration signals.
PWR flashes once	213MM4-R0 Standby mode.
PWR, TX, RX all continuously ON	213MM4-R0 firmware damaged, entered recovery mode.

Table2-3 213MM4-R0 Work Status Indicator Light Definition

As shown in Table2-4 on the right, when uploading or downloading raw vibration signals between smart sensor 213MM4-R0 and various edge sensors, TX and RX indicator lights will exhibit flashing state. If TX and RX indicator lights are continuously OFF, it indicates signal wiring between 213MM4-R0 and edge sensor is abnormal, edge sensor has not issued Command, or sensor is damaged, please check above possibilities, or further contact agent service.

TX flashes once	213MM4-R0 uploads data through RS-485 interface
RX flashes once	213MM4-R0 downloads parameters through RS-485 interface

Table2-4 213MM4-R0 Data Exchange Indicator Light Definition

2.5 213MM4-R0 Digital Multivariable Sensor Raw Vibration Signal Output Description and Flow

2.5.1 213MM4-R0 Digital Multivariable Sensor Raw Vibration Signal Output Description

213MM4-R0 will adopt Command over RS485 communication to transmit raw vibration signals to various Gateways connected to it. This section will introduce its Command output flow.

The data of 213MM4-R0 is time-domain signals, users can use it for basic monitoring applications of any type of medium-to-high bandwidth equipment, to output data and perform further analysis and judgment.

213MM4-R0 provides 26,667, 13,333, 6,666, 4,444, 3,333, and 2,666 raw vibration signal (raw signal) data points per second for users to choose. And based on these raw vibration signals, users can apply in equipment basic monitoring applications with measurement bandwidth lower than 5KHz, 5KHz, 2.5KHz, 1.667KHz, 1.25KHz, 1KHz according to the set number of vibration signal data points per second.

2.5.2 213MM4-R0 Digital Multivariable Sensor Raw Vibration Signal Output Flow

213MM4-R0 adopts Command over RS485 communication interface to transmit raw vibration signals to various edge gateways connected to it.

Before you read the raw vibration signals of 213MM4-R0, please first refer to the description of Table2-2 in Section 2.3 to configure power for 213MM4-R0. And likewise refer to the description of Table2-2 in Section 2.3 to establish physical Com port connection between 213MM4-R0 and terminal device or Device Hub. If your terminal device or Device Hub only provides USB port, then you can adopt any commercially available RS485 to USB adapter to connect your sensor to terminal device or Device Hub.

You only need to comply with the 213MM4-R0 raw signal sampling flow shown in Figure2-2 on the right to issue commands, then you can obtain raw vibration signals of the sampling rate and length you need.

- CRC16 : The Checksum command of the following Commands will all need to use CRC16, and all are produced by combining Bytes from Start Bytes to Checksum. If Checksum is incorrect, the sensor will not execute any work, nor give return message. CRC16 calculation rules can refer to the following website <https://cht.nahua.com.tw/software/crc16/index.php> .

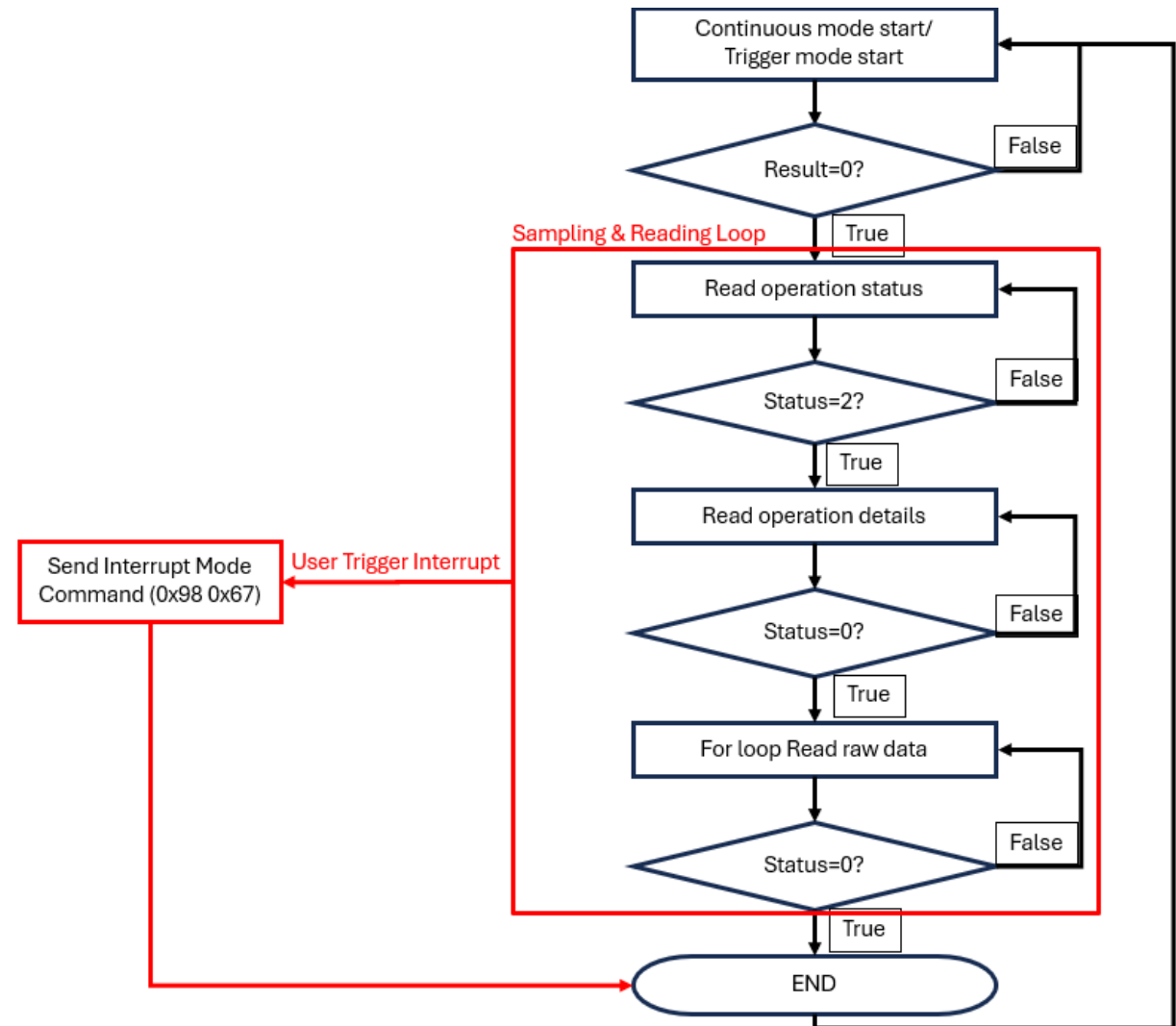


Figure2-2 213MM4-R0 Raw Vibration Signal Flowchart

- Continuous mode start : Related setting information for continuous mode acquisition, specifically a hexadecimal code command composed of 12 Bytes, as shown in Table2-5 , among which:
 - Start Bytes: Start code, fixed as 5353.
 - Length Bytes: Length, fixed as C(12).
 - CMD : Fixed as BA45.
 - BandWidth: Sensor bandwidth setting (e.g. 01 indicates around 2.56K data points per second).
 - Data Length: Data length, varies according to different bandwidths (e.g. when bandwidth is 1K, each read can obtain up to 20s length data, but when bandwidth is 10K, then each read can only obtain up to 2s length data).
 - Unit: Unit of output raw vibration values (e.g. 00 represents value unit is gravitational acceleration g).
 - Checksum: CRC16 check code produced by combining total 8 Bytes from Start Bytes to Unit.
 - End Bytes: End code, fixed as 5354.

Bytes	Name	
2	Start Bytes	0x53 0x53
1	Length Byte	0xC (12)
2	CMD	0xBA + 0x45
1	BandWidth	0x01 : 1K 0x02 : 1.25K 0x03 : 1.667K 0x04 : 2.5K 0x05 : 5K 0x06 : 10K (Type : U8)
1	Data Length	Min : 1 Max : 20 (Type : U8)
1	Unit	0x00 : acceleration (g) 0x01 : velocity (mm/s)
2	Checksum	CRC16
2	End Bytes	0x53 0x54

Table2-5 213MM4-R0 Continuous mode start Send

- When you have set the command, at this time when the sensor responds, specifically a hexadecimal code command composed of 8 Bytes, as shown in Table2-6 , among which:
 - Start Bytes: Start code, fixed as 5B.
 - Length Bytes: Length, fixed as 08.
 - CMD: Fixed as BA45.
 - CMD result: Whether command instruction issued successfully.
 - Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD result.
 - End Bytes: End code, fixed as 5D.

Bytes	Name	
1	Start Bytes	0x5B
1	Length Byte	0x08 (8)
2	CMD	0xBA + 0x45
1	CMD result	0x00 : OK. 0x01 : Wrong band width or length. 0x02 : Failed.
2	Checksum	CRC16
1	End Bytes	0x5D

Table2-6 213MM4-R0 Continuous mode start Response

- Trigger mode start: Related setting information for trigger mode acquisition, specifically a hexadecimal code command composed of 14 Bytes, as shown in Table2-7 , among which:
 - Start Bytes: Start code, fixed as 5353.
 - Length Bytes: Length, fixed as E(14).
 - CMD: Fixed as A956.
 - BandWidth: Sensor bandwidth setting (e.g. 01 indicates around 2.56K data points per second).
 - Data Length: Data length, varies according to different bandwidths (e.g. when bandwidth is 1K, each read can obtain up to 20s length data, but when bandwidth is 10K, then each read can only obtain up to 2s length data).
 - Unit: Unit of output raw vibration values (e.g. 00 represents value unit is gravitational acceleration g).
 - Trigger: Trigger level, data collection will only start after the raw vibration value reaches (or exceeds) the set condition.

Bytes	Name	
2	Start Bytes	0x53 0x53
1	Length Byte	0xE (14)
2	CMD	0xA9 + 0x56
1	BandWidth	0x01 : 1K 0x02 : 1.25K 0x03 : 1.667K 0x04 : 2.5K 0x05 : 5K 0x06 : 10K (Type : U8)
1	Data Length	Min : 1 Max : 20 (Type : U8)
1	Unit	0x00 : acceleration (g) 0x01 : velocity (mm/s)
2	Trigger	Type : U16 Scale : 0.001
2	Checksum	CRC16
2	End Bytes	0x53 0x54

Table2-7 213MM4-R0 Trigger mode start Send

- Checksum: CRC16 check code produced by combining total 10 Bytes from Start Bytes to Trigger.
- End Bytes: End code, fixed as 5354.

- When you have set the command, at this time when the sensor responds, specifically a hexadecimal code command composed of 8 Bytes, as shown in Table2-8 , among which:

- Start Bytes: Start code, fixed as 5B.
- Length Bytes: Length, fixed as 08.
- CMD: Fixed as 9A56.
- CMD result: Whether command instruction issued successfully.
- Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD result.
- End Bytes: End code, fixed as 5D.

Bytes	Name	
1	Start Bytes	0x5B
1	Length Byte	0x08 (8)
2	CMD	0x9A + 0x56
1	CMD result	0x00 : OK. 0x01 : Wrong band width or length. 0x02 : Failed.
2	Checksum	CRC16
1	End Bytes	0x5D

Table2-8 213MM4-R0 Trigger mode start Response

- **Interrupt Mode:** Sensor interrupt command. From starting to wait or collect data until data parsing is completed, if it needs to stop midway, it can be stopped by this command, specifically a hexadecimal code command composed of 9 Bytes, as shown in Table2-9 , among which:

- **Start Bytes:** Start code, fixed as 5353.
- **Length Bytes:** Length, fixed as 9(9).
- **CMD:** Fixed as 9867.
- **Checksum:** CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD.
- **End Bytes:** End code, fixed as 5354.

Bytes	Name	
2	Start Bytes	0x53 0x53
1	Length Byte	0x9 (9)
2	CMD	0x98 + 0x67
2	Checksum	CRC16
2	End Bytes	0x53 0x54

Table2-9 213MM4-R0 Interrupt Mode Send

- When you have set the command, at this time when the sensor responds, specifically a hexadecimal code command composed of 8 Bytes, as shown in Table2-10 , among which:
 - Start Bytes: Start code, fixed as 5B.
 - Length Bytes: Length, fixed as 8(8).
 - CMD: Fixed as 9867.
 - CMD result: Whether command instruction issued successfully.
 - Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD result.
 - End Bytes: End code, fixed as 5D.

Bytes	Name	
1	Start Bytes	0x5B
1	Length Byte	0x8 (8)
2	CMD	0x98 + 0x67
1	CMD result	0x00 : OK. 0x01 : Failed.
2	Checksum	CRC16
1	End Bytes	0x5D

Table2-10 213MM4-R0 Interrupt Mode Response

- Read operation status : Read current sensor internal operation status, specifically a hexadecimal code command composed of 9 Bytes, as shown in Table2-11 , among which:

- Start Bytes: Start code, fixed as 5353.
- Length Bytes: Length, fixed as 09(9).
- CMD: Fixed as 8778.
- Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD.
- End Bytes: End code, fixed as 5354.

Bytes	Name	
2	Start Bytes	0x53 0x53
1	Length Byte	0x09 (9)
2	CMD	0x87 + 0x78
2	Checksum	CRC16
2	End Bytes	0x53 0x54

Table2-11 213MM4-R0 Read operation status Send

- When you have set the command, at this time when the sensor responds, specifically a hexadecimal code command composed of 8 Bytes, as shown in Table2-12 , among which:

- Start Bytes: Start code, fixed as 5B.
- Length Bytes: Length, fixed as 08(8).
- CMD: Fixed as 8778.
- Status: Current sensor status:
 - ◆ 00: Idle.
 - ◆ 01: Sampling in progress.
 - ◆ 02: Sampling completed.
 - ◆ 03: Waiting for trigger signal.
 - ◆ 04: Failed.
- Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to Status.
- End Bytes: End code, fixed as 5D.

Bytes	Name	
1	Start Bytes	0x5B
1	Length Byte	0x08 (8)
2	CMD	0x87 + 0x78
1	Status	0x00 : Idle. 0x01 : in progress. 0x02 : completed. 0x03 : Wait for Trigger. 0x04 : Failed.
2	Checksum	CRC16
1	End Bytes	0x5D

Table2-12 213MM4-R0 Read operation status Response

- Read operation details : Read information acquired by the sensor, used for subsequent reading of raw vibration values, specifically a hexadecimal code command composed of 9 Bytes, as shown in Table2-13 , among which:
 - Start Bytes: Start code, fixed as 5353.
 - Length Bytes: Length, fixed as 09(9).
 - CMD: Fixed as 7889.
 - Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD.
 - End Bytes: End code, fixed as 5354.

Bytes	Name	
2	Start Bytes	0x53 0x53
1	Length Byte	0x09 (9)
2	CMD	0x78 + 0x89
2	Checksum	CRC16
2	End Bytes	0x53 0x54

Table2-13 213MM4-R0 Read operation details Send

- When you have set the command, at this time when the sensor responds, specifically a hexadecimal code command composed of 8~53 Bytes, as shown in Table2-14 , among which:
 - Start Bytes: Start code, fixed as 5B.
 - Length Bytes: Length, if Status is not 0, length is 8 (without BandWidth, Data Length Second, Part, Unit, and Data per second information); if 0, length is determined by Data per second.
 - CMD: Fixed as 7889.
 - Status: Current information returned after sensor receives Command.
 - BandWidth: Bandwidth set for the sensor.
 - Data Length Second: Data length set for the sensor.
 - Part: Section reading per axis, 1 section is 253 data points (e.g. bandwidth 1K, reading 1 second of data, section number is 11); when reading data for that axis, it needs to execute that number of times

Bytes	Name	
1	Start Bytes	0x5B
1	Length Byte	0x08~0x35 (8~53)
2	CMD	0x78 + 0x89
1	Status	0x00 : OK. 0x01 : Fail. 0x02 : Data overflow.
1	BandWidth	0x01 : 1K 0x02 : 1.25K 0x03 : 1.667K 0x04 : 2.5K 0x05 : 5K 0x06 : 10K
1	Data Length Second	Min : 0 Max : 20 (Type : U8)
2	Part	0x0001~0x00D3
1	Unit	0x00 : acceleration 0x01 : velocity
2~40	Data per second (2 * Data Length Second)	1st second, 2nd second,..., 20th second (Type : U16)
2	Checksum	CRC16
1	End Bytes	0x5D

Table2-14 213MM4-R0 Read operation details Response

(sections) to obtain complete vibration values for that axis.

- Unit: Vibration value unit of sensor.
- Data per second: Returns data volume per second of that length according to data length settings.
- Checksum: CRC16, CRC16 check code produced by combining total 5~50 Bytes from Start Bytes to Data per second.
- End Bytes: End code, fixed as 5D.

- Read raw data : Read raw vibration values in sections, mainly to read raw vibration values for user viewing and subsequent processing, specifically a hexadecimal code command composed of 12 Bytes, as shown in Table2-15 , among which:
 - Start Bytes: Start code, fixed as 5353.
 - Length Bytes: Length, fixed as 0C(12).
 - CMD: Fixed as 679A.
 - Part: Section number per axis, read from Read operation details, 1 section is 253 data points (e.g. bandwidth 1K, reading 1 second of data, section number is 11); when reading data for that axis, complete section number needs to be executed to obtain complete vibration values for that axis.
 - Axial: Three axes X, Y, Z; when reading, please first complete reading section vibration data for X axis, then switch to Y axis reading until Z axis section reading is completed (if bandwidth 1K, reading 1 second of data, must execute 33 times to complete reading X, Y, Z

Bytes	Name	
2	Start Bytes	0x53 0x53
1	Length Byte	0x0C (12)
2	CMD	0x67 + 0x9A
2	Part	0x0001~0x00D3 (Maximum 253 pieces of 1-axis data at a time)
1	Axial	0x01 : X-Axial 0x02 : Y-Axial 0x03 : Z-Axial
2	Checksum	CRC16
2	End Bytes	0x53 0x54

Table2-15 213MM4-R0 Read raw data Send

three-axis vibration values completely).

- Checksum: CRC16, CRC16 check code produced by combining total 8 Bytes from Start Bytes to Axial.
- End Bytes: End code, fixed as 5354.

- When you have set the command, at this time when the sensor responds, specifically a hexadecimal code command composed of 9~1021 Bytes, as shown in Table2-16 , among which:
 - Start Bytes: Start code, fixed as 5B.
 - Length Bytes: Length, if CMD result is not 0, length is 9 (without CMD Payload information); if 0, length is determined by CMD Payload.
 - CMD: Fixed as 679A.
 - CMD result: Whether command instruction issued successfully.
 - CMD Payload: Read raw vibration values per section, after reading every 4 bytes combine into float32 vibration value.
 - Checksum: CRC16, CRC16 check code produced by combining total 6~1018 Bytes from Start Bytes to CMD Payload.
 - End Bytes: End code, fixed as 5D.

Bytes	Name	
1	Start Bytes	0x5B
2	Length Byte	0x0009~0x03FD (9~1021)
2	CMD	0x67 + 0x9A
1	CMD result	0x00 : OK. 0x01 : Failed.
0~1012	CMD Payload (If result is not failed)	MSB → LSB,MSB → LSB,...,MSB → LSB Axial Data... (Maximum 253 pieces of 1-axis data at a time)
2	Checksum	CRC16
1	End Bytes	0x5D

Table2-16 213MM4-R0 Read raw data Response

2.6 213MM4-R0 Digital Multivariable Sensor Reading Other Information

213MM4-R0 adopts Command over RS485 communication interface to transmit other information to various edge gateways connected to it.

2.6.1 213MM4-R0 Digital Multivariable Sensor Reading Other Information

Before reading other information of 213MM4-R0 sensor, please first refer to the description of Table2-2 in Section 2.3 to configure power for 213MM4-R0. And likewise refer to the description of Table2-2 in Section 2.3 to establish physical Com port connection between 213MM4-R0 and work computer. Establish physical Com port connection between 213MM4-R0 and terminal device or Device Hub. If your terminal device or Device Hub only provides USB port, then you can adopt any commercially available RS485 to USB adapter to connect your sensor to terminal device or Device Hub.

- Read sensor ID : Read sensor ID information, specifically a hexadecimal code command composed of 9 Bytes, as shown in Table2-17 , among which:

- Start Bytes: Start code, fixed as 5353.
- Length Bytes: Length, fixed as 09(9).
- CMD: Fixed as 619A.
- Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD. If Checksum is incorrect, sensor will not execute any work, and will not give return message. As shown in Figure2-3 on the right, CRC16 calculation rules can refer to the following website <https://cht.nahua.com.tw/software/crc16/index.php>.
- End Bytes: End code, fixed as 5354.

Bytes	Name	
2	Start Bytes	0x53 0x53
1	Length Byte	0x09 (9)
2	CMD	0x61 + 0x9A
2	Checksum	CRC16
2	End Bytes	0x53 0x54

Table2-17 213MM4-R0 Read sensor ID Send

Modbus RTU CRC

Last update: 09/29/2026 11:55:02

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The RTU checksum (CRC) calculation follows these rules:

- Step 1: Set the 16-bit temporary register (CRC temporary register) to 0xFFFF.
- Step 2: Exclusive OR. The first 8-bit byte message instruction and the lower 16-bit CRC register are used to perform an Exclusive OR and store the result in the CRC register.
- Step 3: Shift the CRC register one bit to the right and fill the high-order bits with 0.
- Step 4: Check the value shifted to the right. If it is 0, store the new value from Step 3 into the CRC register. Otherwise, use Exclusive OR 0xA001 with the CRC register and store the result into the CRC register.
- Step 5: Repeat steps 3 and 4 to complete all 8-bit operations.
- Step 6: Repeat steps 2 through 5, fetching the next 8-bit message instruction, until all message instructions have been processed. Finally, the value of the CRC register is the CRC checksum. It is important to note that the CRC checksum must be swapped within the checksum of the message instruction.

Enter Modbus data (separated by spaces).	Check Code (CRC)
53 53 10 88 DB 30 33 30 30 31 01	4B 64

[calculate](#)

Figure2-3 CRC16 Calculation Rules

- When you have set the command, at this time when the sensor responds, specifically a hexadecimal code command composed of 13 Bytes, as shown in Table2-18 , among which:

- Start Bytes: Start code, fixed as 5B.
- Length Bytes: Length, fixed as 0D(13).
- CMD: Fixed as 619A.
- Sensor ID: Sensor ID.
- Checksum: CRC16, CRC16 check code produced by combining total 10 Bytes from Start Bytes to Sensor ID. Users can confirm whether there is a problem with the read information through the check code. As shown in Figure2-3 on the right, CRC16 calculation rules can refer to the following website <https://cht.nahua.com.tw/software/crc16/index.php>.
- End Bytes: End code, fixed as 5D.

Bytes	Name	
1	Start Bytes	0x5B
1	Length Byte	0x0D (13)
2	CMD	0x61 + 0x9A
6	Sensor ID	XXXXXX
2	Checksum	CRC16
1	End Bytes	0x5D

Table2-18 213MM4-R0 Read sensor ID Response

- Read Firmware Version Number : Read sensor firmware version information, specifically a hexadecimal code command composed of 9 Bytes, as shown in Table2-19 , among which:

- Start Bytes: Start code, fixed as 5353.
- Length Bytes: Length, fixed as 09(9).
- CMD: Fixed as 45BC.
- Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD. If Checksum is incorrect, sensor will not execute any work, and will not give return message. As shown in Figure2-4 on the right, CRC16 calculation rules can refer to the following website <https://cht.nahua.com.tw/software/crc16/index.php>.
- End Bytes: End code, fixed as 5354.

Bytes	Name	
2	Start Bytes	0x53 0x53
1	Length Byte	0x09 (9)
2	CMD	0x45 + 0xBC
2	Checksum	CRC16
2	End Bytes	0x53 0x54

Table2-19 213MM4-R0 Read Firmware Version Number Send

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The RTU checksum (CRC) calculation follows these rules:

- Step 1: Set the 16-bit temporary register (CRC temporary register) to 0xFFFF.
- Step 2: Exclusive OR. The first 8-bit byte message instruction and the lower 16-bit CRC register are used to perform an Exclusive OR and store the result in the CRC register.
- Step 3: Shift the CRC register one bit to the right and fill the high-order bits with 0.
- Step 4: Check the value shifted to the right. If it is 0, store the new value from Step 3 into the CRC register. Otherwise, use Exclusive OR 0xA001 with the CRC register and store the result into the CRC register.
- Step 5: Repeat steps 3 and 4 to complete all 8-bit operations.
- Step 6: Repeat steps 2 through 5, fetching the next 8-bit message instruction, until all message instructions have been processed. Finally, the value of the CRC register is the CRC checksum. It is important to note that the CRC checksum must be swapped within the checksum of the message instruction.

Enter Modbus data (separated by spaces).	Check Code (CRC)
53 53 10 88 DB 30 33 30 30 31 01	4B 64

[calculate](#)

Figure2-4 CRC16 Calculation Rules

- When you have set the command, at this time when the sensor responds, specifically a hexadecimal code command composed of 15 Bytes, as shown in Table2-20 , among which:

- Start Bytes: Start code, fixed as 5B.
- Length Bytes: Length, fixed as 0F(15).
- CMD: Fixed as 45BC.
- Firmware Version Number: Sensor firmware version information, e.g.: 0x00002001 (V2.0.0.2).
- Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD. If Checksum is incorrect, sensor will not execute any work, and will not give return message. As shown in Figure2-4 on the right, CRC16 calculation rules can refer to the following website <https://cht.nahua.com.tw/software/crc16/index.php>.
- End Bytes: End code, fixed as 5D.

Bytes	Name	
1	Start Bytes	0x5B
1	Length Byte	0x0F (15)
2	CMD	0x45 + 0xBC
8	Firmware Version Number	Ex:0x00002002 (V2.0.02)
2	Checksum	CRC16
1	End Bytes	0x5D

Table2-20 213MM4-R0 Read Firmware Version Number Response

- Read Temperature : Read sensor temperature information, specifically a hexadecimal code command composed of 9 Bytes, as shown in Table2-21 , among which:

- Start Bytes: Start code, fixed as 5353.
- Length Bytes: Length, fixed as 09(9).
- CMD: Fixed as 34CD.
- Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD. If Checksum is incorrect, sensor will not execute any work, and will not give return message. As shown in Figure2-5 on the right, CRC16 calculation rules can refer to the following website <https://cht.nahua.com.tw/software/crc16/index.php>.
- End Bytes: End code, fixed as 5354.

Bytes	Name	
2	Start Bytes	0x53 0x53
1	Length Byte	0x09 (9)
2	CMD	0x34 + 0xCD
2	Checksum	CRC16
2	End Bytes	0x53 0x54

Table2-21 213MM4-R0 Read Temperature Send

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The RTU checksum (CRC) calculation follows these rules:

- Step 1: Set the 16-bit temporary register (CRC temporary register) to 0xFFFF.
- Step 2: Exclusive OR. The first 8-bit byte message instruction and the lower 16-bit CRC register are used to perform an Exclusive OR and store the result in the CRC register.
- Step 3: Shift the CRC register one bit to the right and fill the high-order bits with 0.
- Step 4: Check the value shifted to the right. If it is 0, store the new value from Step 3 into the CRC register. Otherwise, use Exclusive OR 0xA001 with the CRC register and store the result into the CRC register.
- Step 5: Repeat steps 3 and 4 to complete all 8-bit operations.
- Step 6: Repeat steps 2 through 5, fetching the next 8-bit message instruction, until all message instructions have been processed. Finally, the value of the CRC register is the CRC checksum. It is important to note that the CRC checksum must be swapped within the checksum of the message instruction.

Enter Modbus data (separated by spaces).	Check Code (CRC)
53 53 10 88 DB 30 33 30 30 31 01	4B 64

[calculate](#)

Figure2-5 CRC16 Calculation Rules

- When you have set the command, at this time when the sensor responds, specifically a hexadecimal code command composed of 11 Bytes, as shown in Table2-22 , among which:

- Start Bytes: Start code, fixed as 5B.
- Length Bytes: Length, fixed as 0B(11).
- CMD: Fixed as 34CD.
- Temperature: Current temperature of sensor.
- Checksum: CRC16, CRC16 check code produced by combining total 5 Bytes from Start Bytes to CMD. If Checksum is incorrect, sensor will not execute any work, and will not give return message. As shown in Figure2-5 on the right, CRC16 calculation rules can refer to the following website <https://cht.nahua.com.tw/software/crc16/index.php>.
- End Bytes: End code, fixed as 5D.

Bytes	Name	
1	Start Bytes	0x5B
1	Length Byte	0x0B (11)
2	CMD	0x34 + 0xCD
4	Temperature	MSB →LSB 、 Type is U32 、 Scale : 0.001
2	Checksum	CRC16
1	End Bytes	0x5D

Table2-22 213MM4-R0 Read Temperature Response

2.7 Control 213MM4-R0 Sensor's LED

- LED Indicator Identification: To control the sensor's LED, specifically a hexadecimal code command composed of 10 Bytes, as shown in Table2-23, among which:
 - Start Bytes: Start code, fixed as 5353.
 - Length Bytes: Length, fixed as 0A(10).
 - CMD: Fixed as 23DE.
 - Function: Indicator light that user wants to display.
 - Checksum: CRC16, CRC16 check code produced by combining total 6 Bytes from Start Bytes to CMD. If Checksum is incorrect, sensor will not execute any work, and will not give return message. As shown in Figure2-6 on the right, CRC16 calculation rules can refer to the following website <https://cht.nahua.com.tw/software/crc16/index.php>.
 - End Bytes: End code, fixed as 5354.

Bytes	Name	
2	Start Bytes	0x53 0x53
1	Length Byte	0x0A (10)
2	CMD	0x23 + 0xDE
1	Function	0x00 : Disable (Default) 0x01 : All LEDs flash every 0.05 seconds 0x02 : TX LED is always on 0x03 : RX LED is always on
2	Checksum	CRC16
2	End Bytes	0x53 0x54

Table2-23 213MM4-R0 LED indicator identification Send

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The RTU checksum (CRC) calculation follows these rules:

- Step 1: Set the 16-bit temporary register (CRC temporary register) to 0xFFFF.
- Step 2: Exclusive OR. The first 8-bit byte message instruction and the lower 16-bit CRC register are used to perform an Exclusive OR and store the result in the CRC register.
- Step 3: Shift the CRC register one bit to the right and fill the high-order bits with 0.
- Step 4: Check the value shifted to the right. If it is 0, store the new value from Step 3 into the CRC register. Otherwise, use Exclusive OR 0xA001 with the CRC register and store the result into the CRC register.
- Step 5: Repeat steps 3 and 4 to complete all 8-bit operations.
- Step 6: Repeat steps 2 through 5, fetching the next 8-bit message instruction, until all message instructions have been processed. Finally, the value of the CRC register is the CRC checksum. It is important to note that the CRC checksum must be swapped within the checksum of the message instruction.

Enter Modbus data (separated by spaces).	Check Code (CRC)
53 53 10 88 DB 30 33 30 30 31 01	4B 64

calculate

Figure2-6 CRC16 Calculation Rules

- When you have set the command, at this time when the sensor responds, specifically a hexadecimal code command composed of 8 Bytes, as shown in Table2-24 , among which:

- Start Bytes: Start code, fixed as 5B.
- Length Bytes: Length, fixed as 08(8).
- CMD: Fixed as 23DE.
- Result: Status of indicator light reading is OK or NG.
- Checksum: CRC16, CRC16 check code produced by combining total 6 Bytes from Start Bytes to CMD. If Checksum is incorrect, sensor will not execute any work, and will not give return message. As shown in Figure2-6 on the right, CRC16 calculation rules can refer to the following website <https://cht.nahua.com.tw/software/crc16/index.php>.
- End Bytes: End code, fixed as 5D.

Bytes	Name	
1	Start Bytes	0x5B
1	Length Byte	0x08 (8)
2	CMD	0x23 + 0xDE
1	Result	0x00 : OK! 0x01 : Fail!
2	Checksum	CRC16
1	End Bytes	0x5D

Table2-24 213MM4-R0 LED indicator identification Response

3 213MM4-R0 Digital Multivariable Sensor Deployment Guide

213MM4-R0 digital multivariable sensor, its deployment work includes: on-site installation and fixing, on-site wiring. For details of various work, please refer to the following sections.

3.1 On-site Fixing Smart Sensor

Fixing fixtures of the smart sensor include two types: magnetic base and base.

Magnetic base is used for temporary testing occasions, long-term monitoring is not suitable to adopt magnetic base fixing. Equipment fixing surface must possess magnetic properties, when using only need to lock and fix this fixture with the smart sensor, then place on the machine with magnetic properties, as shown in Figure3-1.

Formal long-term monitoring please adopt base to fix smart sensor on equipment surface. As shown in Figure3-2 , base assembly includes a metal base and a pair of M3 screws.



Figure3-1 Magnetic Base



Figure3-2 Base Assembly

Fixing method between base and equipment surface uses AB glue for metal. As shown in Figure3-3 , recommended to adopt PowerBon® Resin series AB glue.



Figure3-3 Recommended AB Glue Brand and Model

As shown in Figure3-4 , before applying AB glue to base, please pre-lock screws into screw holes first, and reserve space of one to two threads, to avoid excessive AB glue squeezing into screw holes during fixing.



Figure3-4 Pre-locking Screws

As shown in Figure3-5 , apply AB glue after evenly mixing at 1:1 ratio onto base. Coating thickness is about 1mm, strictly avoid too thin and strictly avoid too thick, to prevent inability to fix or fixing time being too long.



Figure3-5 Applying AB Glue onto Base

As shown in Figure3-6 , fix fixture on equipment surface, and apply pressure for at least 10 minutes. If not adopting recommended AB glue brand and model, then apply pressure for at least twice the time according to recommended fixing time of that AB glue brand, to ensure bonding quality.



Figure3-6 Fixing Base on Equipment Surface

As shown in Figure3-7 , wait for AB glue to cure. AB glue of different brands requires different curing times, which range from about 1 hour to 24 hours, during which applying pressure is not needed. After complete curing, 213MM4-R0 smart sensor can be locked and fixed onto the base.



Figure3-7 Waiting for AB Glue Curing

Between 213MM4-R0 and 3838 base, fixing is done by a pair of M3 socket head cap screws, Figure3-8 shows the screw hole positions. After aligning holes of the smart sensor with holes of the base or magnetic base, lock and fix using socket head cap wrench to complete installation.

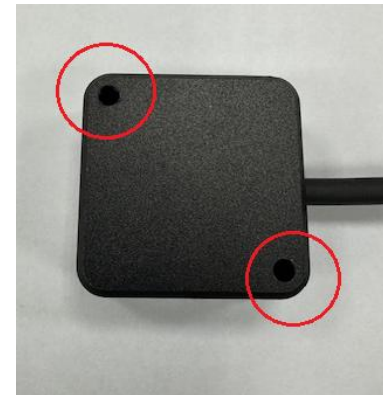


Figure3-8 Socket Head Cap Screw Locking

Figure3-9 shows the result of successfully mounting 213MM4-R0 digital multivariable sensor on equipment motor surface.



Figure3-9 Successfully Mount 213MM4-R0 Digital Multivariable Sensor

3.2 On-site Wiring

Please refer to wiring definition in Table2-2 to configure 12 - 24V DC power for 213MM4-R0, red wire is positive pole, black wire is negative pole. In addition, please connect green wire RS485 DATA+ and yellow wire DATA- to any brand Device hub selected by you.

4 Customer Service

TEXOL Inc. hereby extends twelve-hundred-thousand gratitude to you, thank you for adopting 213MM4-R0 smart vibration sensor.

We sincerely hope this product can one-hundred-percent fulfill your needs in usage, we also hope this instruction manual can very quickly and very clearly answer any of your questions regarding installation and usage of 213MM4-R0.

If during the process of using this sensor, whether because there are parts not completely clear in this instruction manual that cause any questions in your installation; or you feel there is still any room for improvement in this product, we whole-heartedly welcome you to contact TEXOL anytime through the following methods, we will also solve your questions for you as fast as possible.

- ✓ Phone contact: 03-6579836
- ✓ E-mail: customer.support@twnlsc.com

Appendix A. Datasheet

Model			213MM4-R0
Vibration measurement capability	Measurement direction		Triaxial (X, Y and Z)
	Amplitude		±16 g
	Sensitivity (±5%)		0.488 mg / LSB
	Frequency response		2 - 5 kHz
	ADC resolution		16 bits
Temperature measurement capability	Measurement Range		-20°C to 85 °C
	Sensitivity (±5%)		256 LSB/ °C
	ADC resolution		16-bit
Environmental resistance	Temperture		-20°C to 85 °C
	IP grade		IP65
Power supply	Power voltage		12 to 24 VDC
	Power consumption		0.45 W
	Reverse voltage protection		V
Sampling	Sampling rate V ^{1*}	Speed level 6th	~ 26,667 S/s (Maximum BW: 5 kHz)
		Speed level 5th	~ 13,333 S/s (Maximum BW: 5 kHz)
		Speed level 4th	~ 6,666 S/s (Maximum BW: 3.3 kHz)
		Speed level 3rd	~ 4,444 S/s (Maximum BW: 2.2 kHz)
		Speed level 2nd	~ 3,333 S/s (Maximum BW: 1.6 kHz)
		Speed level 1st	~ 2,666 S/s (Maximum BW: 1.3 kHz)
	Signal	Acceleration (g)	V ^{1*}
		Velocity (mm/s)	V ^{1*}
	Sampling mode	Software trigger	V ^{1*}
		Hardware trigger	X
	Time domain data cleaning		V
Communication	Method		RS485
	Protocol		Proprietary command
	Distance		100m
	Upload	Acceleration signal	V ^{1*}
		Velocity Signal	V ^{1*}
Appearance	Dimensions		38 x 38 x 18.1 mm
	Housing material		Aluminum alloy
	Water-proof method		Seal
	Wire		Flexible, insulated, 1m
	Wire connector		Pigtail V ^{2*}
	LED for running status		V ^{3*}
	LED for communication status		V ^{4*}
Device Management	FOTA		V ^{5*}

1* Configurable through utility

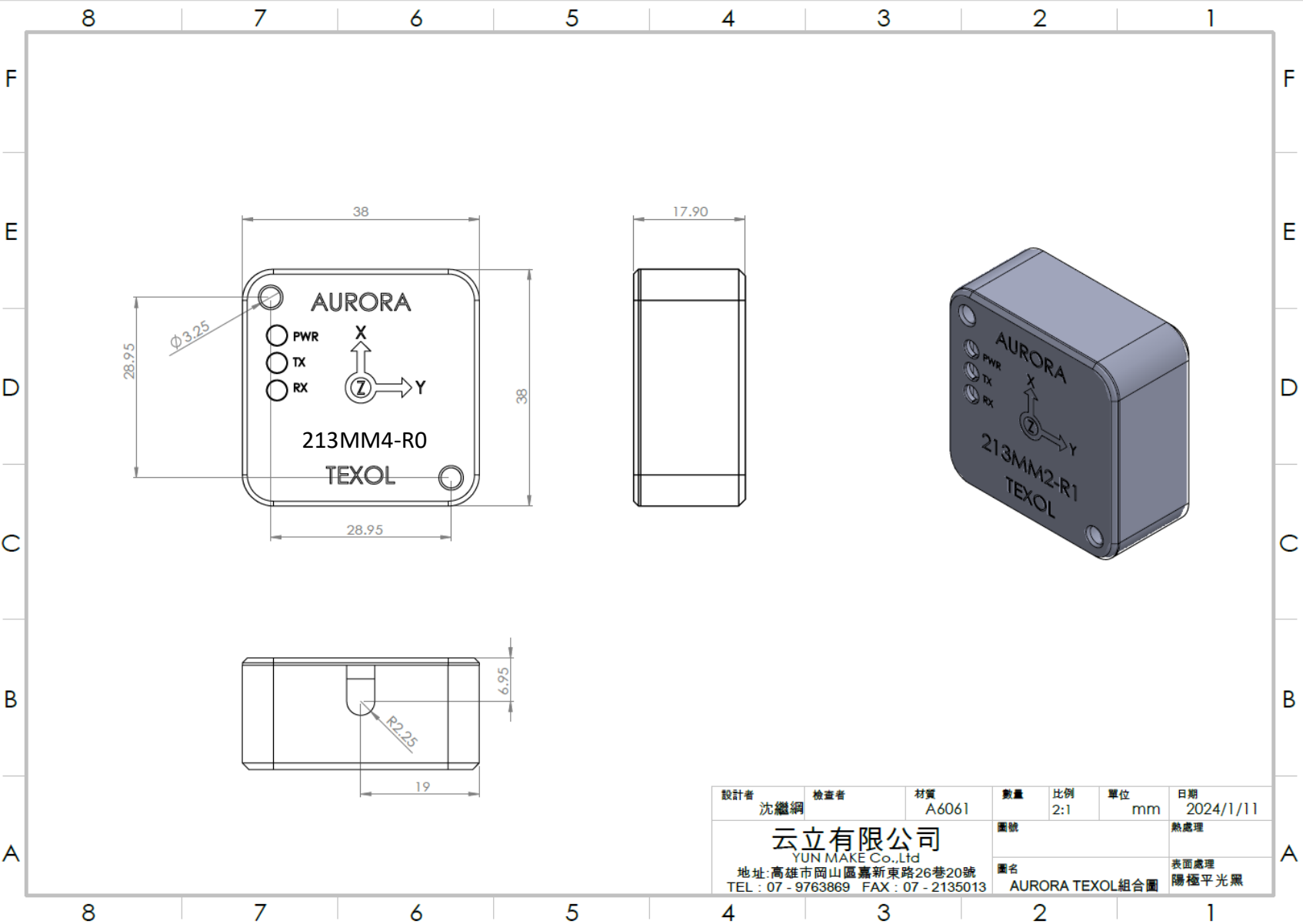
2* RED: 12-24 VDC in, BLACK: GND, GREEN: DATA+, YELLOW: DATA-, BLUE: N/A, BROWN: N/A, Thick BLACK: Shielding

3* GREEN LED Flas

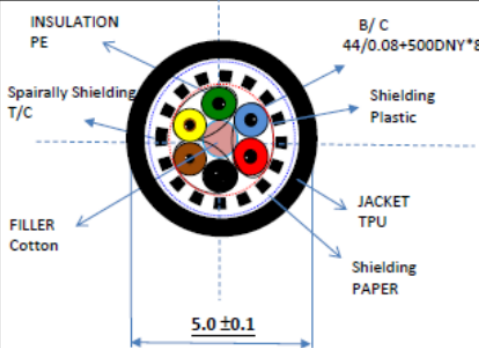
4* RED and Orange LED Flash

5* Manage through device management utility

Appendix B. Dimension Drawing



Appendix C. Aurora Cable Specification

DRAWING NO : YF200103				A1		SPECIFICATION				
REMARKS :						CONDUCTORS	Material	Bare Copper		
1. RoHS COMPLIANT							AWG	#24 * 3P		
2. REACH							Construction	44/0.08+500DNY		
							Material	PE		
						INSULATION	O. D.	0.85±0.05 mm		
							Color	1. BR*BK 2. YL*GN 3. BL*RD		
							Material	Plastic Myla		
						Shielding	Coverage	25% ↑		
						Spirally Shielding	Material	Tinned Copper		
							Coverage	90% ↑		
						FILLER	Material	Cotton		
							Shielding	Material	PAPEER	
								Coverage	25% ↑	
						JACKET	Material	TPU		
							THICKNESS AVG.	0.5 mm ↑		
							O. D.	5.0 ±0.1 mm		
							Color	BLACK		
						ELECTRIC CHARACTERS	Rater Temperature	-20 ~ 125℃		
Rated Voltage	300 (V-AC)									
Resistance of Insulation	10 MΩ/300m									
Withstand Voltage Spark	1 KV/sec									
製圖:	May	審核:	Philli	日期:	2020.03.02					

Appendix D. Manual Version and Description

[illegible]