Communication unit CMC Operation Manual

※Operation Manual for Communication unit CMC

Model: CMC(CMC-BC,CMC-BM,CMC-TR)

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〈Contents〉

1. Introduction

1.1. Construction of the documents

The documents of the communication units CMC are as follows.

Kind of document	Name of the document	# of documents
Operation manual	Communication unit CMC Operation Manual	YSDA-3495
Installation manual	Communication unit CMC Installation Manual	YSDA-3496
Block Diagrams	Communication unit CMC Block Diagrams	YSDA-3493

1.2. Application

This document describes the operation of communication unit for transport system, OHT, OHS, etc.

1.3. Related Rules, Laws

(1) FCC Part15 Subpart C: 2010
FCC ID : ZBQVEHICLECMC
(2) FCC Part15 Subpart B: 2010 Class A

1.4. Abbreviations

(1) CMC : **C**ommunication **M**odem **C**ontroller
(2) CMC-BM : **C**ommunication **M**odem **C**ontroller : **B**ase **M**odem
(3) CMC-BC : **C**ommunication **M**odem **C**ontroller : **B**ase **C**ontroller
(4) CMC-TR : **C**ommunication **M**odem **C**ontroller : **TR**ansformer
(5) COM : **CO**mmunication Modem

2. Safety

2.1. Alert Boxes

2.1.1.General

(1) Read and understand fully this manual and attached documents before operating the products.
(2) Engage specialists in electrical and mechanical works.
(3) Don't improve the product by yourselves.
(4) Be sufficiently proficient with the equipment, the relevant safety knowledge and the precautions prior to using this product.

In the content of this "Safety Precautions ", items which need to be alert shall be classified into "DANGER", "WARNING" and "CAUTION".

2.1.2.Definitions of DANGER, WARNING and CAUTION

⚠ DANGER: An imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING: A potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION: A potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

[Note 1]

Medium degree of injuries or light injuries refers to injuries, e.g., burns and electric shock, which do not require hospitalization of or prolonged hospital visit by the victims. As material losses refers to expanded losses pertaining to the damage of property and equipment.

[Note 2]

Depending on the situation, the events described under "WARNING" may also result in severe outcome. In either case, make sure that the advice is followed.

After reading, make sure this information shall be kept at places where it can always be read by users.

2.1.3.Precautions on use

	⚠ DANGER
	Follow the following advice strictly to avoid electric shock or burns.
⚠	1. Don't enter the operation area of the vehicle. Work on the ladder may collide to the vehicle and may cause injury.
⚠	2. Don't touch the vehicle on the track when Power Supply Panel output the power.
⚠	3. Don't touch the moving parts of the vehicle while it is in operation. Doing so may cause injuries.
⚠	4. Only those who received training for maintenance and teaching can do maintenance and teaching.
⚠	5. Make sure the earth terminals for the relate equipment shall be grounded. Not doing so may cause electric shock.
⚠	6. Don't break the cable, impose excessive stress, place heavy weights, or pinch it between items. Doing so may cause electric shock.
	⚠ WARNING
⚠	1. Don't use the equipment at locations where water, corrosive atmosphere, or flammable gas is present, or beside flammable items. Doing so may cause life and fails.

2.1.4.Storage

	PROHIBITION
	1. Don't store the equipment at locations where it is subject to rain, ater hazardous gas or liquid.
	MANDATORY ACTION
	1. Store the equipment at locations in not subjected to sunshine. Store it at predetermined relative humidity and temperature. 0 degrees C. - 50 degrees C., 90% RH and below, no dew.

2.1.5.Installation

	WARNING
	1. Don't climb on top of the equipment or place heavy items on it. Doing so may cause injuries.
	2. Don't block the air inlet and outlet ports or allow foreign particles to enter them. Doing so may cause fire.
	3. Follow the installation direction strictly as it is so design for dissipation of heat, fails or fire.
	4. Don't hit the equipment with strong impact. Doing so may cause equipment fails.

2.1.6.Maintenance and Inspection

	PROHIBITION
	1. Don't engage non-specialist technicians to disassemble and repair the equipment.
	DANGER
	1. Before servicing CMC-BC, CMC-BM, CMC-TR, always shut off the power supply. If the communication signals are overlaid onto the non-conductive power line, also shut off the power source of the non-conductive power line before starting maintenance on CMC-BM and CMC-TR. Not doing so may cause electric shock.

3. Outline of Communication Unit CMC

3.1. Overview

The communication unit CMC (**C**ommunication **M**odem **C**ontroller) is used for the communication between the ground Vehicle Controller and several vehicles in the conveyance system made by MURATEC AUTOMATION CO., LTD.

The communication signals are overlaid onto the power line for non-conductive power supply to the vehicles. In some systems, a separate signal lines may be used.

CMC meet the requirements of FCC Part15 Subpart C. The FCC ID is as follows.

FCC ID of CMC: ZBQVEHICLECMC

It modulates the signals sent from the Vehicle controller and transmits the modulated signals to the vehicles. It also demodulates the signals sent from the vehicles and transmits them to the Vehicle controller.

The communication method in use is FSK (frequency shift keying).

The communication frequencies are as follows.

	From		to	Frequency
(1)	CMC	→	Vehicles：	300.33 kHz
(2)	Vehicles	→	CMC：	353.25 kHz

3.2. CMC configuration

Figures 1 to 3 show the basic configuration of CMC.

CMC consists of the following units.

(1)CMC-BC (**C**ommunication **M**odem **C**ontroller ：**B**ase **C**ontroller)
- Printed circuit NBV-BC2
- DC power supply (5V)
- Case

(2)CMC-BM (**C**ommunication **M**odem **C**ontroller ：**B**ase **M**odem)
- Printed circuit BV-BM3
- DC power supply (24V)
- Case

(3)CMC-TR(**C**ommunication **M**odem **C**ontroller ：**TR**ansformer)
- Communication transformer（transmission, reception）
- Case

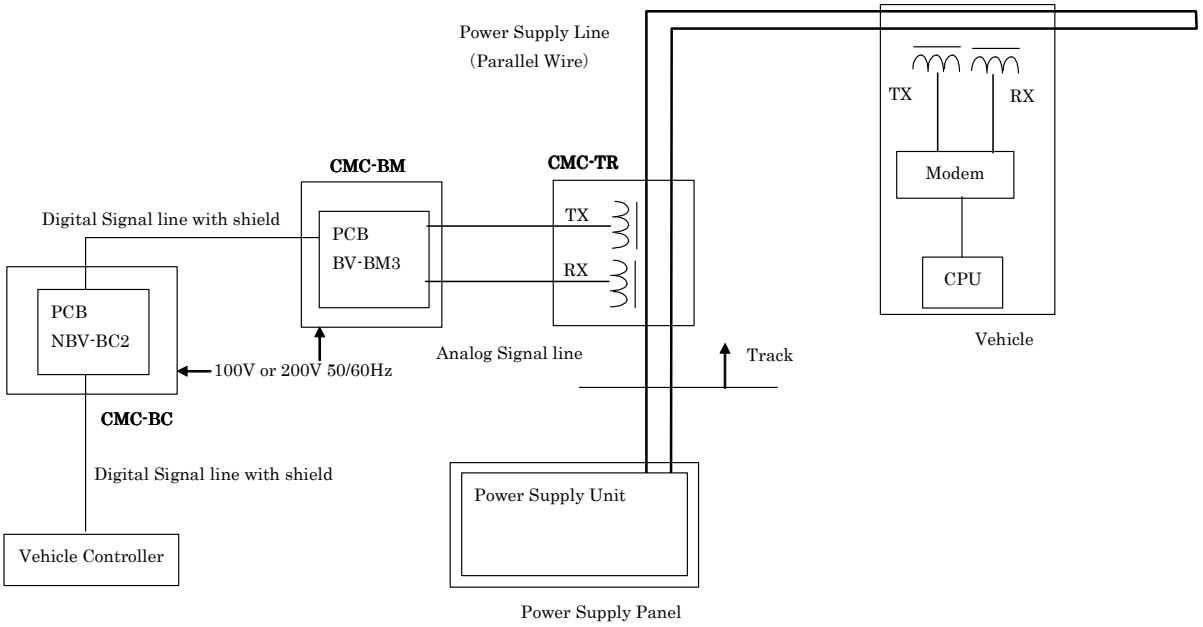

Fig. 1 Basic configuration of CMC

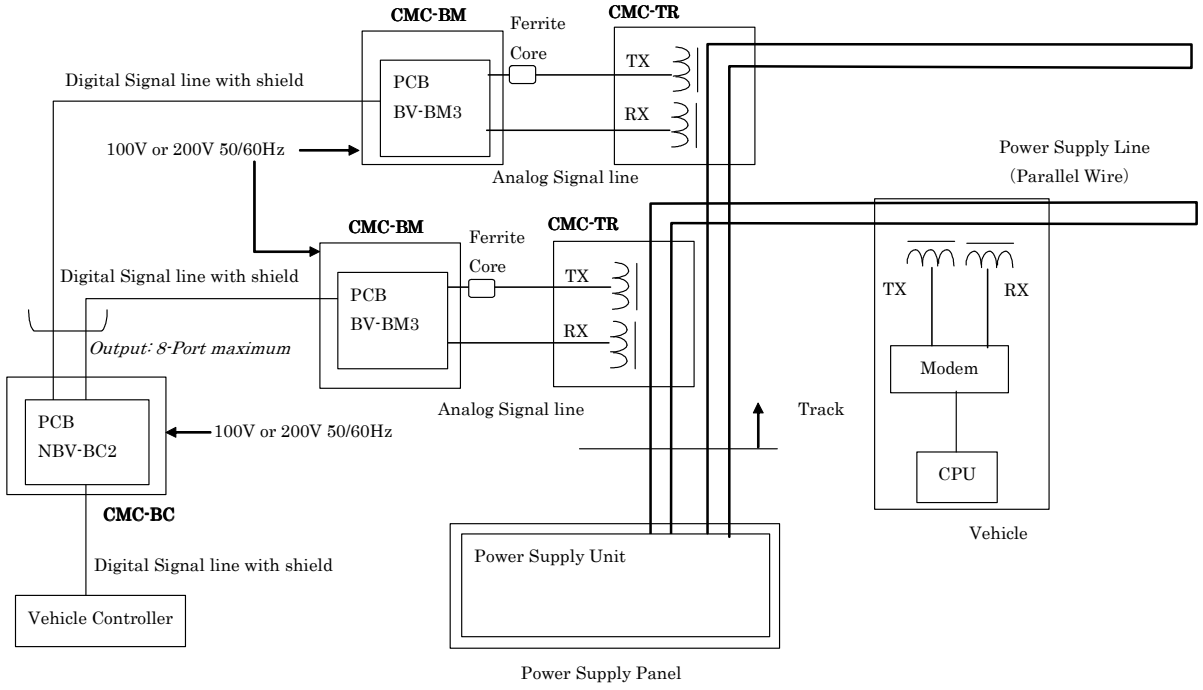

Fig. 2 Modified CMC configuration Example 1

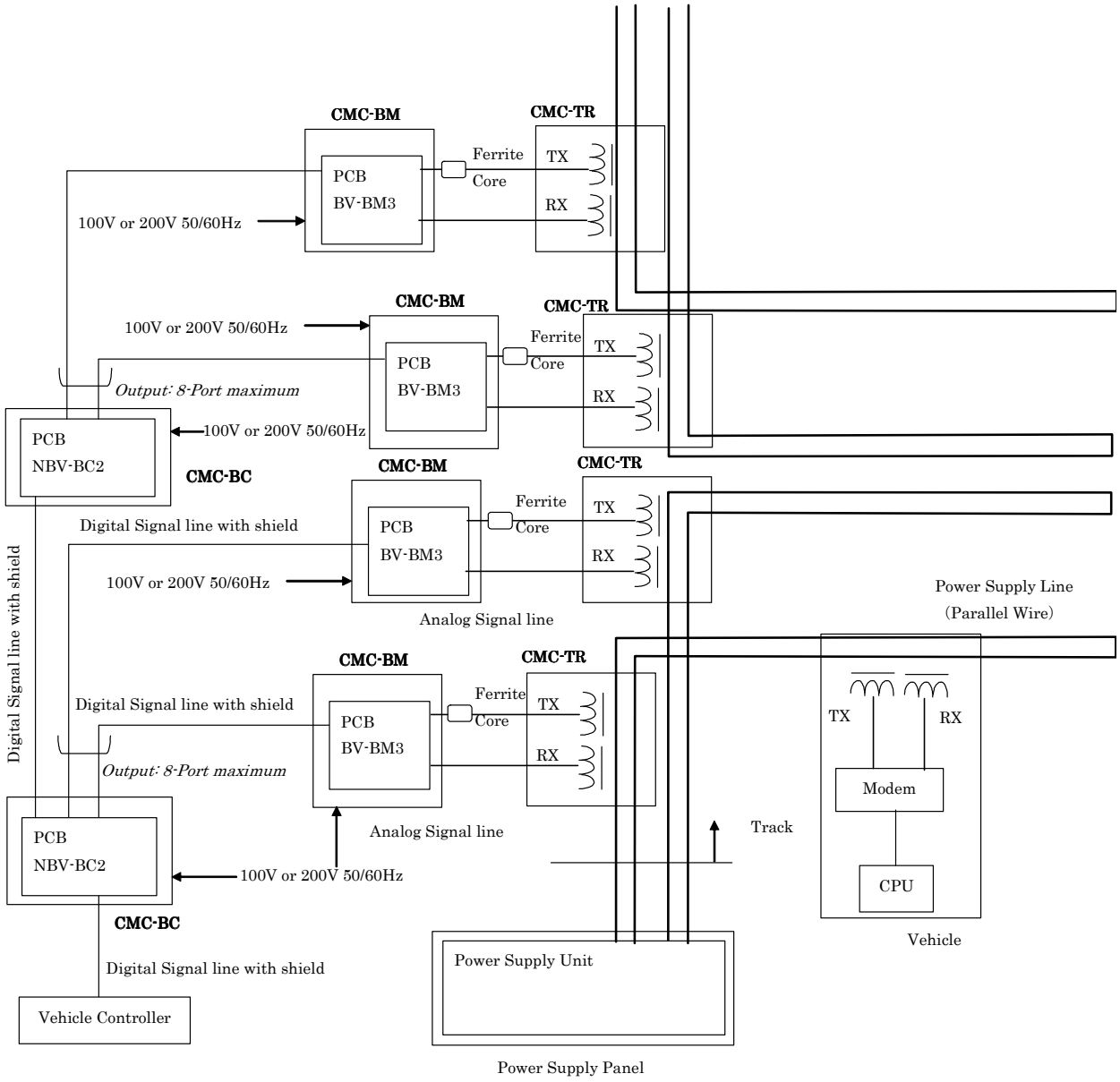

Fig. 3 Modified CMC configuration Example 2

3.3. Function of each unit

3.3.1.CMC-BC (**C**ommunication **M**odem **C**ontroller :**B**ase **C**ontroller)

This is an interface unit to handle the signals from/to the vehicle controller. It also serves as the multiplexer for several CMC-BM units.

CMC-BC can work in two different modes, master mode and slave mode. It allows the user to use the multiple units according to the scale of the conveyance system.

The CMC-BC unit may vary in its outward form depending on the conveyance system. However, the internal configuration is common.

Figure 4 shows the block diagram of CMC-BC.

Figure 5 shows the outward form of the CMC-BC's main printed circuit board NBV-BC.

Figure 6 shows for example the outward form of the CMC-BC unit.

3.3.2.CMC-BM(**C**ommunication **M**odem **C**ontroller :**B**ase **M**odem)

This is a modem unit to handle the signals from/to several vehicles.

It incorporates a driver that modulates the digital signals sent from CMC-BC to analog signals and overlay the converted signals onto the non-conductive power line or signal line.

It also demodulates the analog signals sent from the vehicles to digital signals and transmits them to CMC-BC.

The CMC-BM unit may vary in its outward form depending on the conveyance system. However, the internal configuration is common.

Figure 4 shows the block diagram of CMC-BM.

Figure 7 shows the outline form of the CMC-BM's main printed circuit board BV-BM2.

Figure 8 shows for example the outline form of the CMC-BM unit.

3.3.3.CMC-TR(**C**ommunication **M**odem **C**ontroller :**TR**ansformer)

Transmission transformer overlays the signals from CMC-BM onto the non-conductive power line or signal line.

The reception transformer receives the signals from vehicles overlaid in the non-conductive power line or signal line.

Figure 9 shows the outer forms of the transformers.

3.4. The Block Diagram of CMC

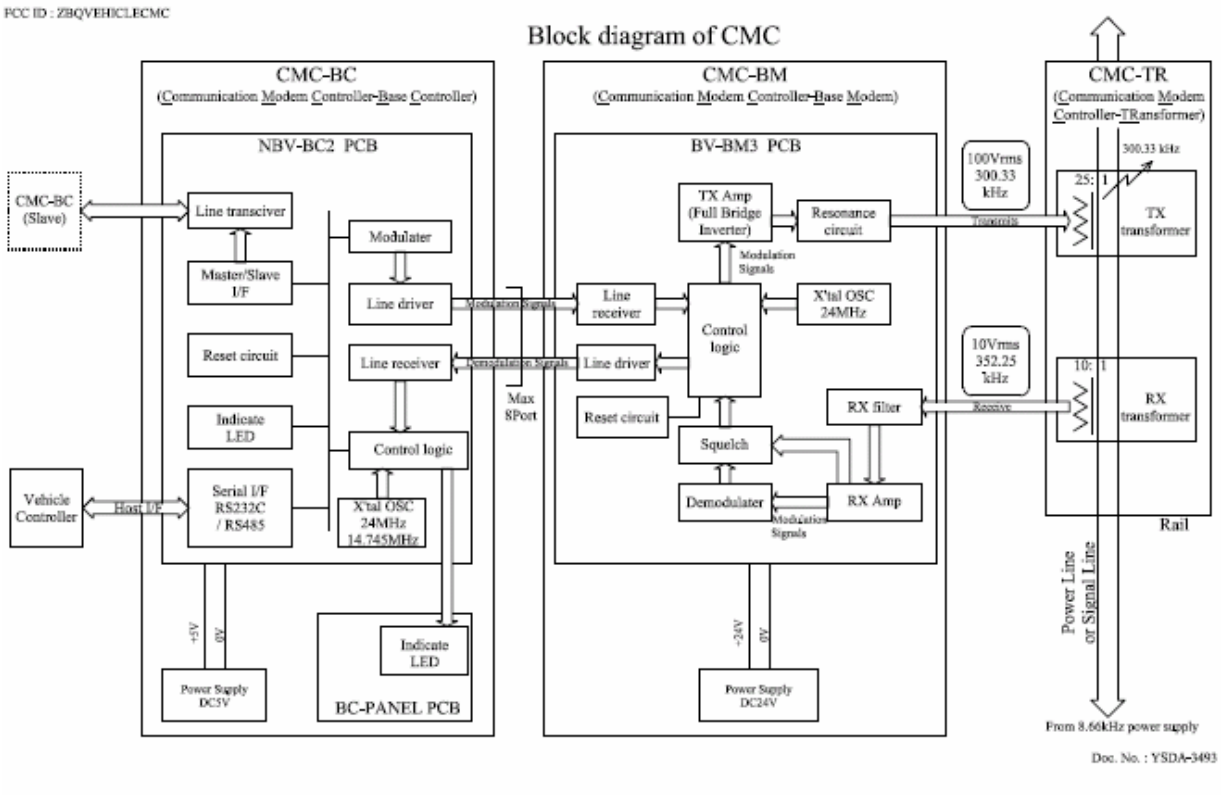

Fig. 4 The block diagram of CMC

CMC is a communication unit between a vehicle controller and vehicles.
The communication signals modulate current signals of a power line/or signal line .
The vehicle controller controls vehicle movement by transmitting and receiving this signal.

[CMC-BC]

Communication signals from the vehicle controller are transmitted to CMC-BC as RS232C or RS485. When communication signal is “1”, The Modulator of CMC-BC modulates 285.7 kHz FSK signal frequency. When communication signal is “0”, The Modulator of CMC-BC modulates 315.8 kHz FSK signal frequency.

The modulation signal is transmitted to CMC-BM through a line driver of RS485.This modulation signals transmit to CMC-BM as RS485.

[CMC-BM and CMC-TR]

The modulation signal is received from CMC-BC through a line receiver of RS485.

TX Amp of CMC-BM is full bridge inverter. The modulation signals are converted into a gate signal of full bridge inverter. The inverter transmits the modulation signal through resonance circuit and CMC-TR.

3.5. Outline form of CMC

3.5.1. CMC-BC (**C**ommunication **M**odem **C**ontroller :**B**ase **C**ontroller)

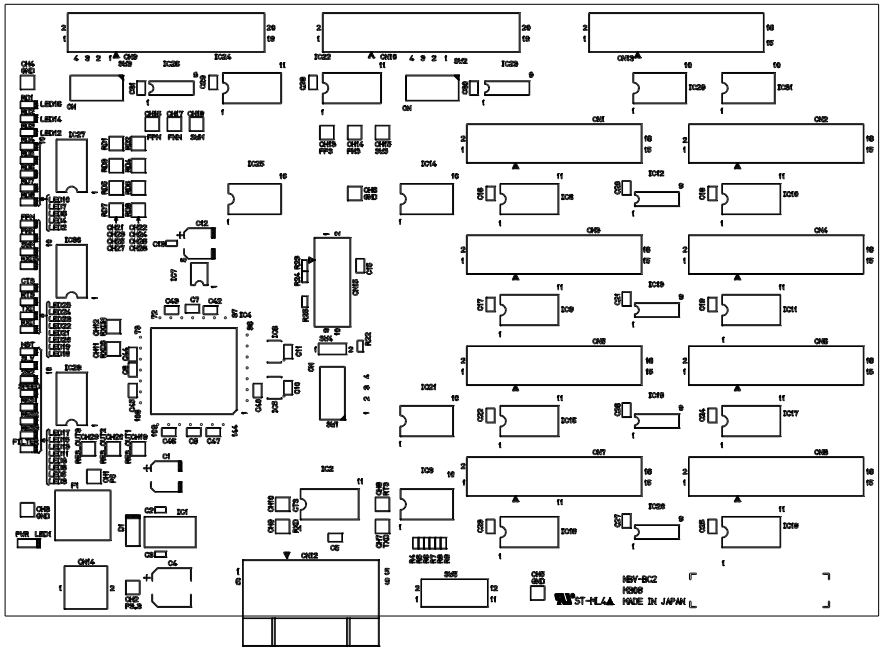

Fig. 5 Outward form of the CMC-BC's main printed circuit board NBV-BC2

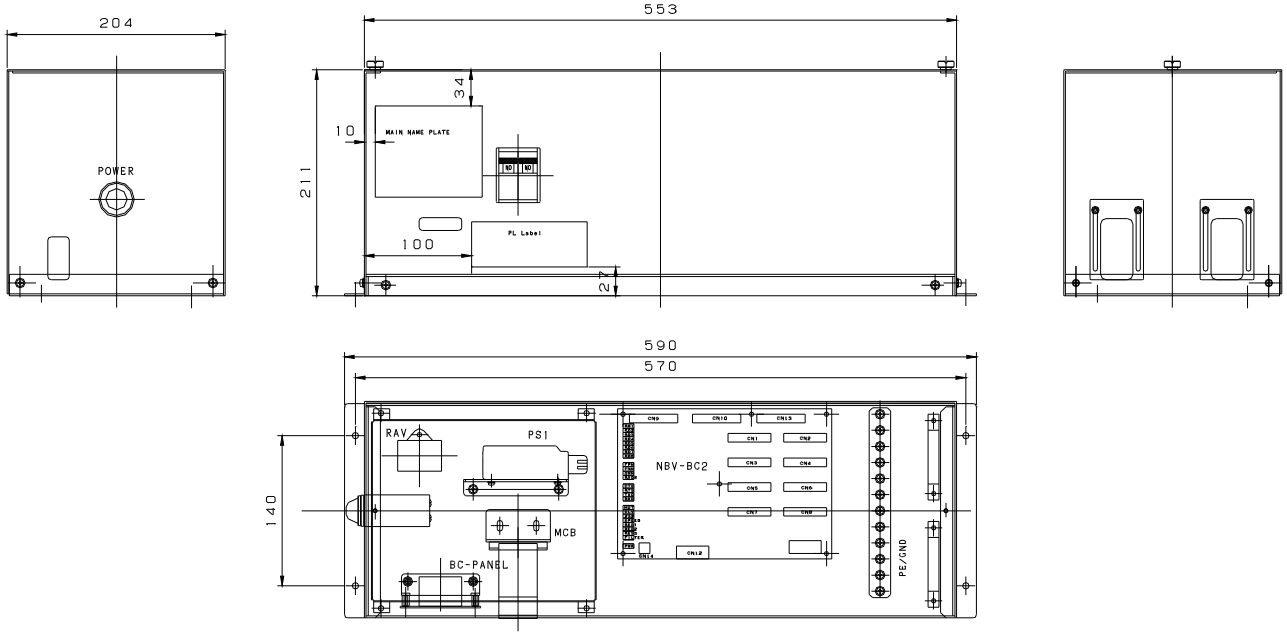

Fig. 6 For example the outward form of the CMC-BC unit

3.5.2.CMC-BM(**C**ommunication **M**odem **C**ontroller :**B**ase **M**odem)

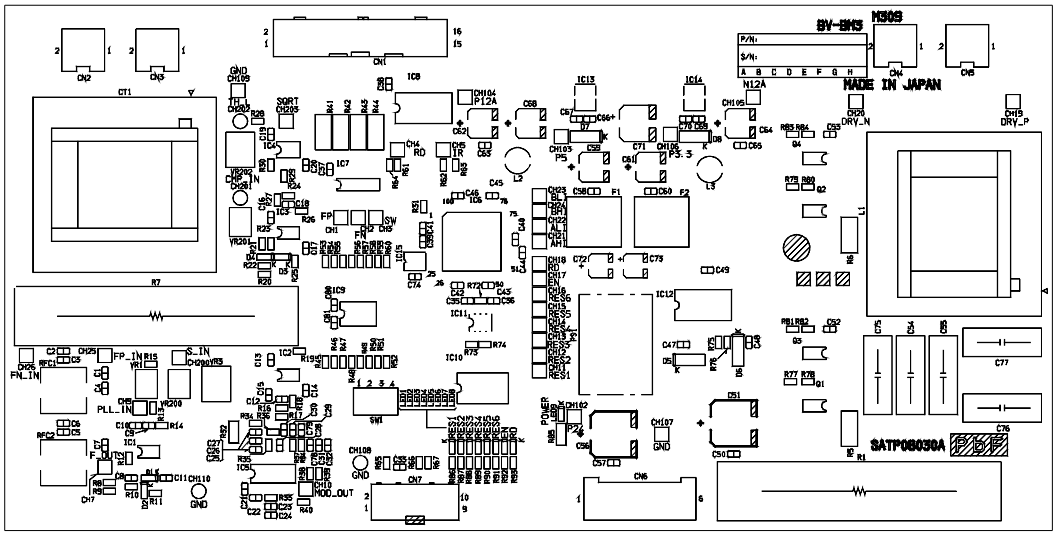

Fig. 7 The outline form of the CMC-BM's main printed circuit board BV-BM3

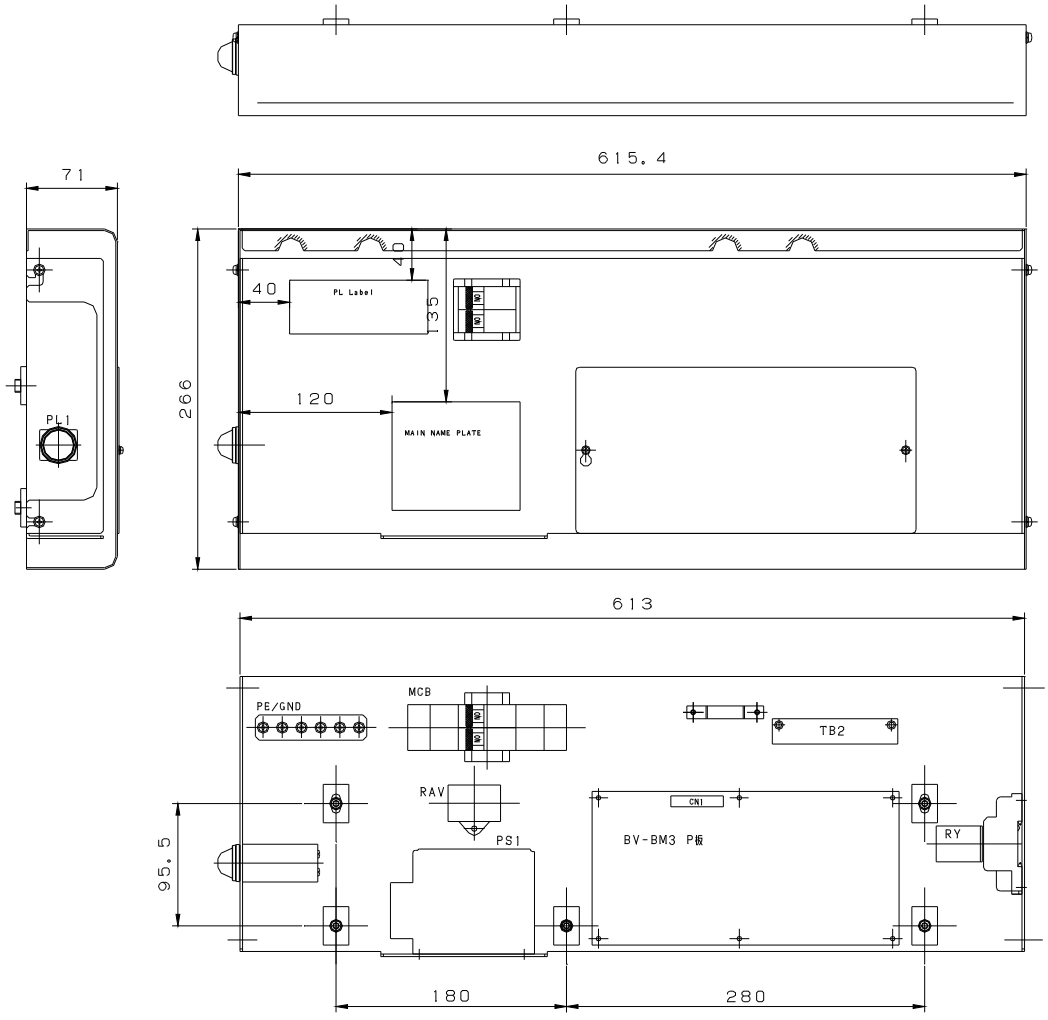

Fig. 8 For example the outline form of the CMC-BM unit

3.5.3. CMC-TR(**C**ommunication **M**odem **C**ontroller :**TR**ansformer)

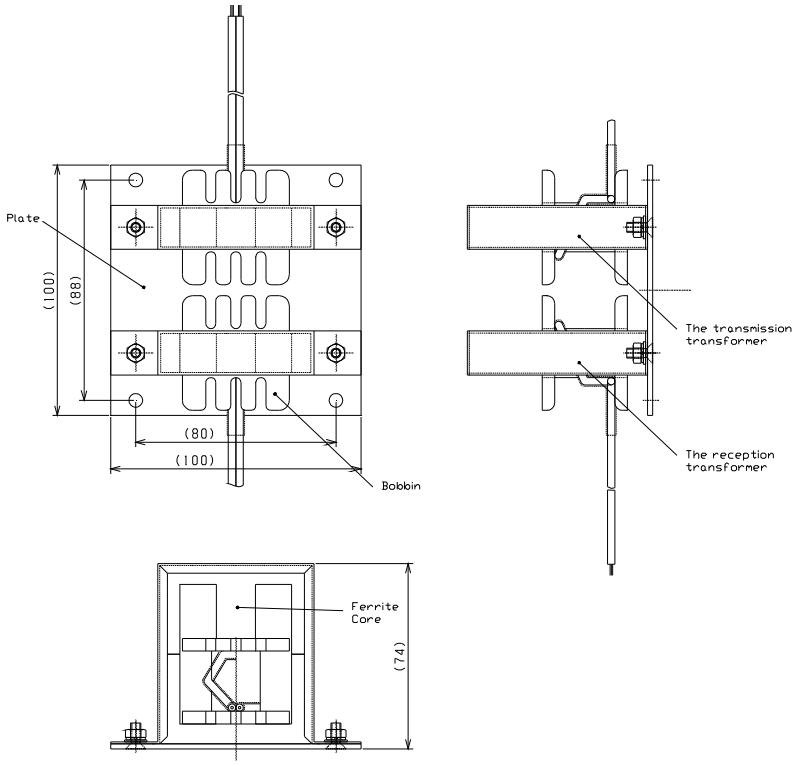

Fig. 9 The outer forms of the transformers

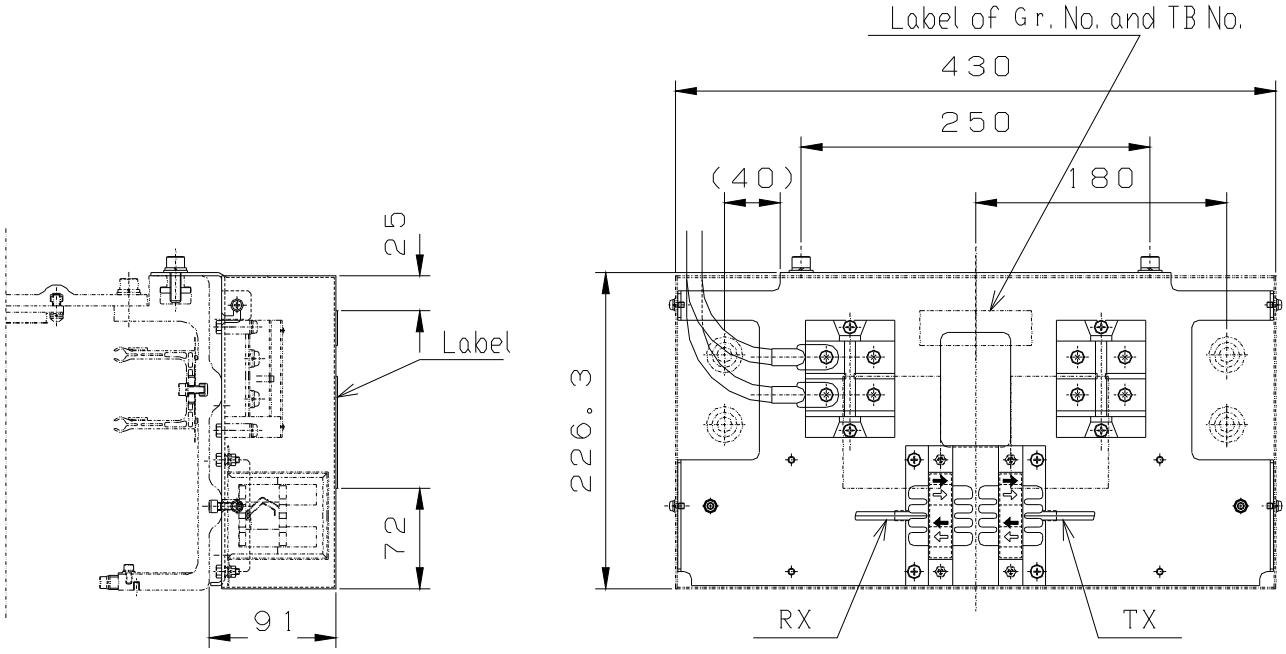

Fig. 10 For example the outline form of the CMC-TR unit

3.6. FCC standard

The transmission assembly in the communication unit CMC meets FCC Part15 Subpart C as the intentional radiator.

FCC ID of CMC： ZBQVEHICLECMC

FCC WARNING

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

- Properly shielded and grounded cables and connectors must be used for connection to vehicle controller and CMC-BC in order to meet FCC emission limits.
- Properly shielded and grounded cables and connectors must be used for connection to CMC-BM and CMC-BC in order to meet FCC emission limits.
- TX transformer of CMC-TR with ferrite core must be used for RF interference suppression.

Note:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

[Note.1]

The FCC certificate position may vary because different case materials and shapes are adopted for different customers.

4. CMC-BC Board Setting

4.1. CMC-BC Board Check

4.1.1. Purpose

Check for short circuit and earth ground fault before energizing CMC-BC board for the safety.

4.1.2. Required Materials

- Wiring Diagrams, Checklist
- Multimeter, Phillips-head Screw Driver (+2), Wrench, Tape Measure
- Vehicle

4.1.3. Tips, Precautions and Prohibited Actions

<Precautions>

- Set the barricade with colored-cones and safety bars around the work area.
- Measure the short-circuit and the earth fault after confirming it has no voltage.

<Prohibited Actions>

- Work in the energized status is prohibited.

4.1.4. Procedures

A) After confirming that the CMC-BC board's CPM is OFF (see Fig. 11), check for short circuit and earth ground fault on the secondary side of the CPM. (Make sure you confirm that the AC power voltage is zero V before measuring the resistance. Since the primary side of the CMP is connected to the indicator lamps, short circuit check should show 3 - 4KΩ. The ground fault shall be open.)

B) Check for short circuit and earth ground fault on the secondary side of CP1 through CP8. The CPM must be OFF at this time. Both short circuit and earth ground fault checks on the secondary side of CP1 through CP 8 shall indicate open.

C) Confirm that all connectors on the NBV-BC printed circuit board are firmly connected. Lock the connecters with connector fastenings. (If any connecter is loose, communications will fail.)

D) Firmly insert the 232C cable from the OHVC to CN12 on the NBV-BC printed circuit board. (If loose, communications will fail.)

E) Set the NBV-BC P board's DIP switches (SW 1, 2 and 3) in accordance with provided specifications. (If they are not set, communications will fail.)

F) Measure the voltage of primary side of CPM

G) After confirming that everything is good, turn ON the circuit breaker on the power distribution panel to energize the CMC-BC board.

<Prohibited Actions>

Hereafter, Work in the energized status is prohibited.

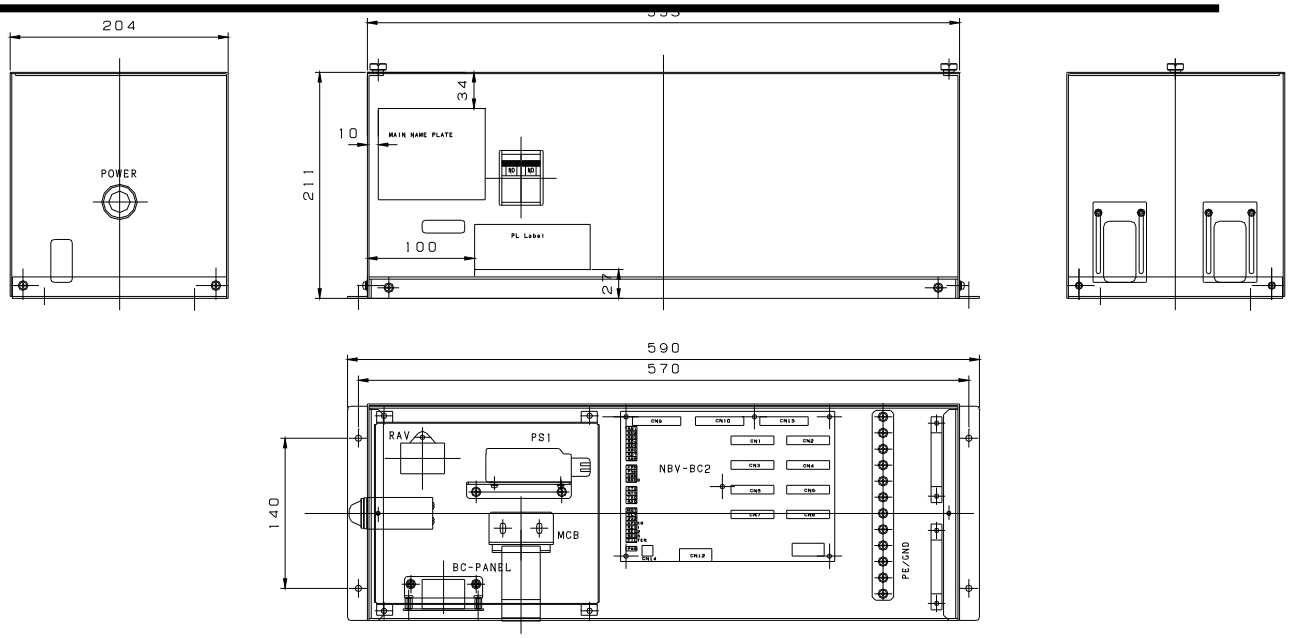

Fig. 11 For example the outward form of the CMC-BC unit

4.2. NBV-BC Printed Circuit Board DIP Switch Settings

4.2.1. Purpose

Set the station number etc. on site as when it is shipped with the initial settings.

4.2.2. Required Materials

- Connection Diagram, Checklist
- Precise Driver

4.2.3. Tips, Precautions and Prohibited Actions

<Precautions>

・ Appropriate settings are required for an appropriate BC. Otherwise, it will not communicate with.

4.2.4. Procedures

A) The settings for the NBV-BC's DIP-SWs are shown below. Refer to examples 1 through 4 to properly set up the target module.

Table. 1 DIPSW-1(Operation Mode)

SW	Function	Operation		Remarks
		OFF	ON	
1	Master/Slave Switch	Slave	Master	
2	Filter Enable/Disable Switch	Enable	Disable	
3	RS232C/RS485 Switch	RS232C	RS485	Available only in Master
4	Communications Speed Switch	19.2 Kbps	28.8 Kbps	See specifications

Table. 2 DIPSW-2(Terminal Resistance Settings)

SW	Function	Operation		Remarks
		OFF	ON	
1	Terminal Resistance Y/N	No	Yes	Refer to connection sample
2	Terminal Resistance Y/N	No	Yes	
3	Terminal Resistance Y/N	No	Yes	
4	Terminal Resistance Y/N	No	Yes	

Table. 3 DIPSW-3(Terminal Resistance Settings)

SW	Function	Operation		Remarks
		OFF	ON	
1	Terminal Resistance Y/N	No	Yes	Refer to connection sample
2	Terminal Resistance Y/N	No	Yes	
3	Terminal Resistance Y/N	No	Yes	
4	Terminal Resistance Y/N	No	Yes	

B) NBV-BC printed circuit board DIP-SW layout and connector layout are shown in the figure below.

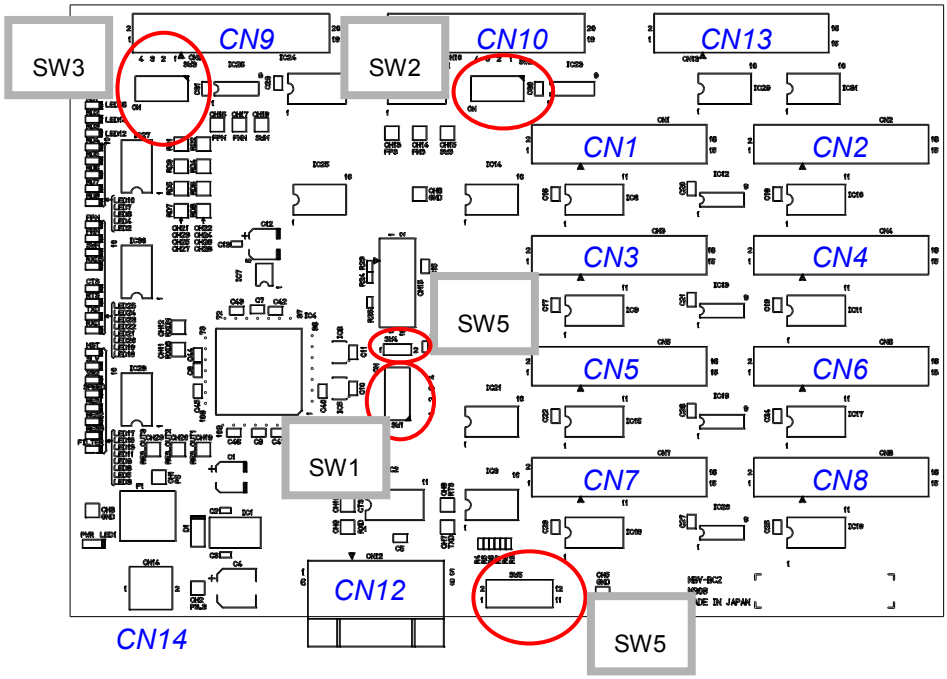

Fig. 12 NBV-BC Board Switch Layout

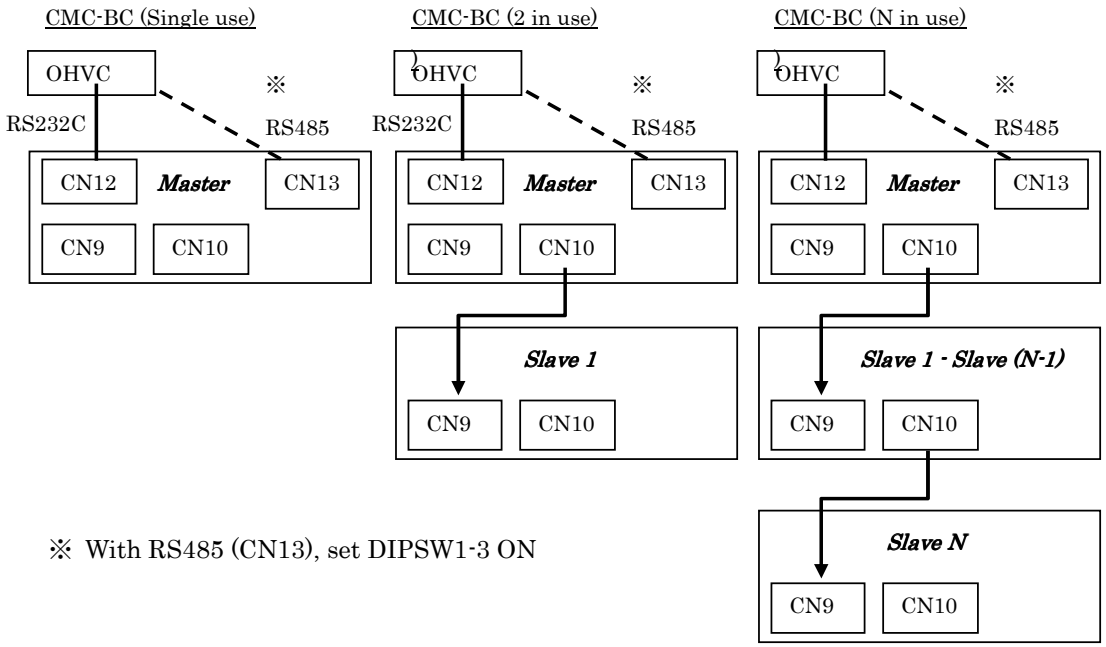

Fig. 13 NBV-BC Board Connection

Table. 4 CMC-BC DIP Switch Settings (Filter "Enable", communication speed:28.8kbps)

BC	Master/ Slave	DIP SW1			DIP SW2			DIP SW3			SW4	SW5
		No.	ON	OFF	No.	ON	OFF	No.	ON	OFF		
1	Master	1	○		1		○	1		○	Open	ALL Close
		2	○		2		○	2		○		
		3	○		3		○	3		○		
		4	○		4		○	4		○		
2	Master	1	○		1	○		1		○	Open	ALL Close
		2	○		2	○		2		○		
		3	○		3	○		3		○		
		4	○		4	○		4		○		
	Slave	1		○	1		○	1	○		Open	ALL Close
		2	○		2		○	2	○			
		3	○		3		○	3	○			
		4	○		4		○	4	○			
N	Master	1	○		1	○		1		○	Open	ALL Close
		2	○		2	○		2		○		
		3	○		3	○		3		○		
		4	○		4	○		4		○		
	Slave1 - Slabe (N-1)	1		○	1	○		1	○		Open	ALL Close
		2	○		2	○		2	○			
		3	○		3	○		3	○			
		4	○		4	○		4	○			
	Slave N	1		○	1		○	1	○		Open	ALL Close
		2	○		2		○	2	○			
		3	○		3		○	3	○			
		4	○		4		○	4	○			

Table. 5 CMC-BC DIP Switch Settings (Filter "Enable", communication speed:19.2kbps)

BC	Master/ Slave	DIP SW1			DIP SW2			DIP SW3			SW4	SW5
		No.	ON	OFF	No.	ON	OFF	No.	ON	OFF		
1	Master	1	○		1		○	1		○	Open	ALL Close
		2	○		2		○	2		○		
		3	○		3		○	3		○		
		4		○	4		○	4		○		
2	Master	1	○		1	○		1		○	Open	ALL Close
		2	○		2	○		2		○		
		3	○		3	○		3		○		
		4		○	4	○		4		○		
	Slave	1		○	1		○	1	○		Open	ALL Close
		2	○		2		○	2	○			
		3	○		3		○	3	○			
		4		○	4		○	4	○			
N	Master	1	○		1	○		1		○	Open	ALL Close
		2	○		2	○		2		○		
		3	○		3	○		3		○		
		4		○	4	○		4		○		
	Slave1 - Slabe (N-1)	1		○	1	○		1	○		Open	ALL Close
		2	○		2	○		2	○			
		3	○		3	○		3	○			
		4		○	4	○		4	○			
	Slave N	1		○	1		○	1	○		Open	ALL Close
		2	○		2		○	2	○			
		3	○		3		○	3	○			
		4		○	4		○	4	○			

4.2.5. Judgment

It passes if all of adjustments are performed and confirmed.

5. CMC-BM Board Setting

5.1. CMC-BM Board Check

5.1.1. Purpose

Check for short circuit and earth ground fault before energizing CMC-BC board for the safety.

5.1.2. Required Materials

- Wiring Diagrams, Checklist
- Multimeter, Phillips-head Screw Driver (+2)

5.1.3. Tips, Precautions and Prohibited Actions

<Precautions>

- Strictly adhere to safety rules for high-place work.
- Measure the short-circuit and the earth fault after confirming it has no voltage.

<Prohibited Actions>

- Work in the energized status is prohibited.

5.1.4. Procedures

A) Check for short circuit and earth ground fault on the secondary side of the circuit breaker (see Fig. 14) on the CMC-BM board. Shut off the power for CP1 through 8 of CMC-BC. Since the line is connected to indicator lamp, short circuit check should show 3-4 kΩ. Earth ground fault shall be open.

B) Check for short circuit and earth ground fault on the secondary side of the circuit breaker for CP2 through CP5. (Both short circuit and earth ground shall be open.)

C) Check for short circuit and earth ground fault on the secondary side of the TB2. (Earth ground shall be open.)

D) When all checks are in good conditions, turn on a circuit breaker for CMC-BC, and it energize the BM board.

<Prohibited Actions>

Thereafter, work in the energized status is prohibited.

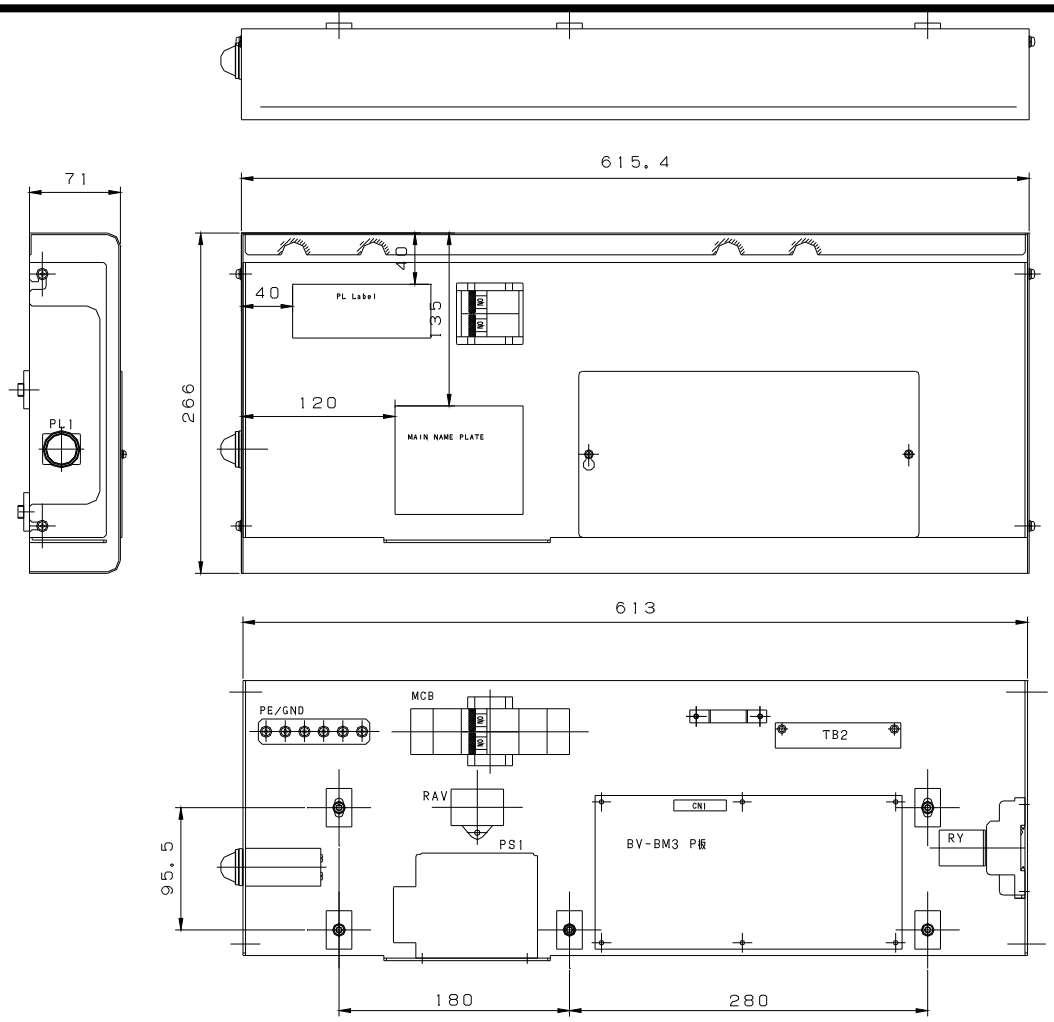

Fig. 14 For example the outward form of the CMC-BM unit

5.1.5. Judgment

It passes if all of adjustments are performed and confirmed.

6. Communications Adjustment

6.1. Prerequisites

A) Power supply panel start-up adjustments are complete.

B) All the CMC boards and all the power supply panels have been started up.

C) All the wiring of feeder cables (included dedicated communications lines) is appropriate. Especially perform a check the U/V direction using communications direction checker.

D) When OHVC, EPLC and the vehicle are all able to be powered up, turn the power on to all the equipment, then check the communications status between each device. Check that the power lamp is on for all devices.

E) No workers are near the tracks.

* Communications Flow

OHVC ←→ CMC-BC ←→ CMC-BM ←→ CMC-TR ←→

Track (Power feeder cables or communications wires) ←→ Vehicle

6.2. Check before Vehicle Start-Up (Track Power Panel is OFF)

6.2.1. Purpose

Check for the communication condition when track power panel is OFF.

6.2.2. Required Materials

- Feeder Cable Layout Drawings, Wiring Diagrams, Checklist
- Phillips-head Screw Driver (+2)

6.2.3. Tips, Precautions and Prohibited Actions

<Precautions>

・ Strictly adhere to safety rules for high-place work.

<Prohibited Actions>

・ Work in the energized state is prohibited.

6.2.4. Procedures

A) Turn on all of CMC-BC and CMC-BM. **Turn off the entire track power panel.**

B) Check that LED1～8 of the CMC-BC's NBV-BC board are not lit.

If any of LED1～8 is lit, refer to the troubleshooting guide.

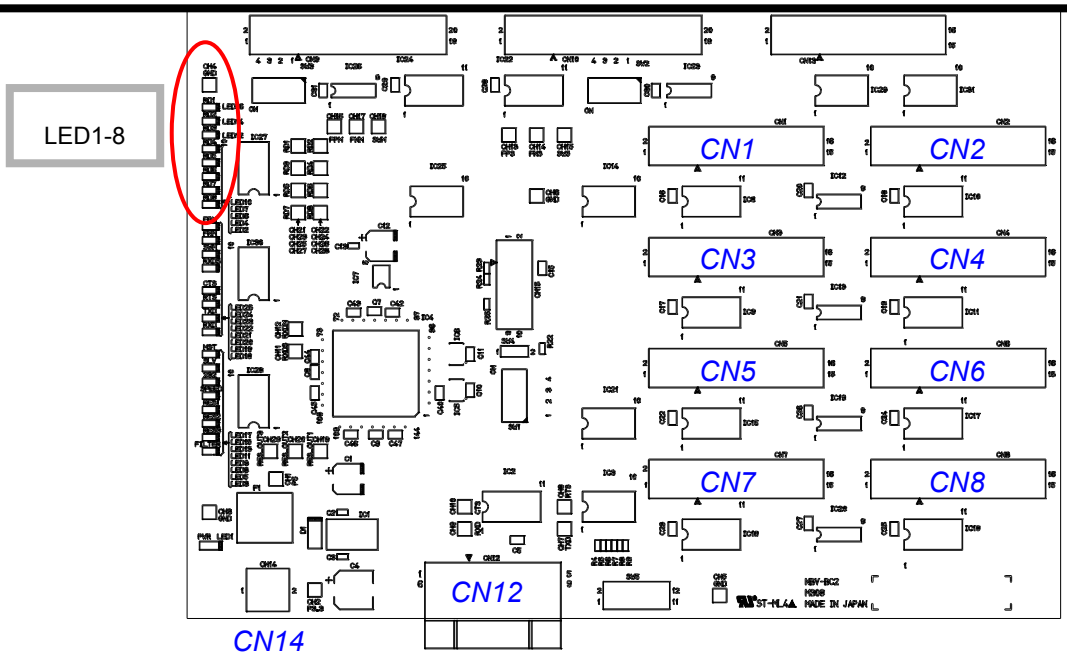

Fig. 15 CMC-BC Board's NBV-BC

6.3. Check before Vehicle Start-Up (Track Power Panel is ON)

6.3.1. Purpose

Check for the communication condition when track power panel is ON and no vehicles on the track.

6.3.2. Required Materials

- Feeder Cable Layout Drawings, Wiring Diagrams, Checklist
- Phillips-head Screw Driver (+2)

6.3.3. Tips, Precautions and Prohibited Actions

<Precautions>

- Strictly adhere to safety rules for high-place work.

<Prohibited Actions>

- Work in the energized state is prohibited.

6.3.4. Procedures

A) Turn on the electrical power board, and all of CMC-BC and CMC-BM.
B) Check that LED1～8 of the CMC-BC's NBV-BC board are not lit.
C) If any of LED1～8 is lit, refer to the troubleshooting guide.

6.4. Check and Adjustments of each Level of CMC-BM

6.4.1. Purpose

Check for the communication condition between one vehicle and the OHVC.

6.4.2. Required Materials

- Feeder Cable Layout Drawings, Wiring Diagrams, Checklist
- Oscilloscope, Phillips-head Screw Driver (+2)

6.4.3. Tips, Precautions and Prohibited Actions

<Precautions>

- Strictly adhere to safety rules for high-place work.

<Prohibited Actions>

- Work in the energized state is prohibited.

6.4.4. Procedures

Check and adjust the waveforms of all CMC-BM. Record the noise level, reception waveform level, and squelch.

In order to check the difference in reception levels according to location, check these 3 places in order: 1) next to the communications transformer 2) next to the INPUT 3) next to RETURN. Also, to make the waveform check as accurate as possible, use the same vehicle.

If the noise level is 0.5V or more, refer to the troubleshooting guide, take countermeasures, then record the capacity of the coaxial cable entrance capacitor after adjustments.

A) Check with an installed vehicle

<Attention>

Operate a vehicle and a maintenance lifter referring to the vehicle installation/removal instructions.

(1) Set the vehicle to AUTO MODE.
(2) Send an initial wait command from OHVC.
If communications are not established with the vehicle, refer to the troubleshooting guide.

B) Receiving waveform check (By communications transformer)

(1) Move a vehicle to a location By a communications transformer as shown in the figure below. Using the remote control, switch the vehicle communications side to transformer side only. Check feeder cable layout in provided feeder cable layout drawing.

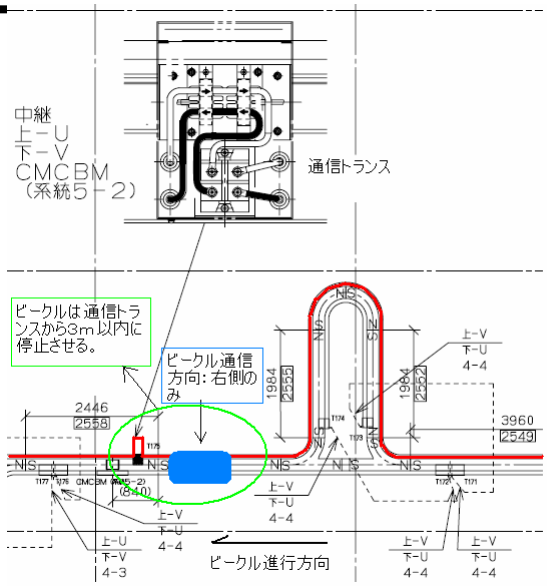

Fig. 16 Positioning OHV (By Communications Transformer)

(2) Procedures for receiving waveform check of BV-BM3 are as follows.

Connect an oscilloscope to BV-BM3 and monitor receiving waveform.

+ side: CH201 (CMP_IN)

- side: CH100 or CH101 (0V)

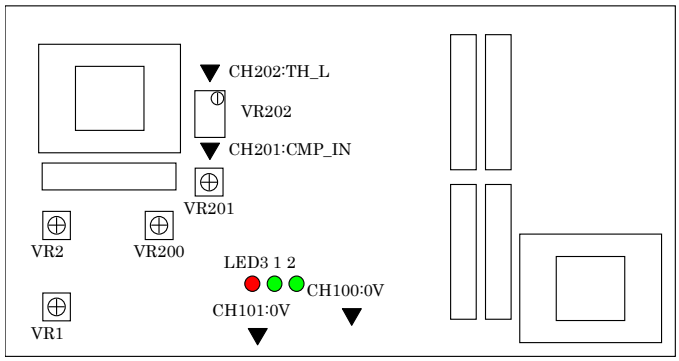

Fig. 17 BV-BM3 Check Pin Arrangement

(3) Monitor the minimum receiving waveform and the maximum noise level.

Range: 1V ~ 2V/DIV, 10mS ~ 20mS/DIV

Maximam Noise Level Communication Speed 19.2kbps･･･ 1.0V or below.

28.8kbps･･･ 0.5V or below.

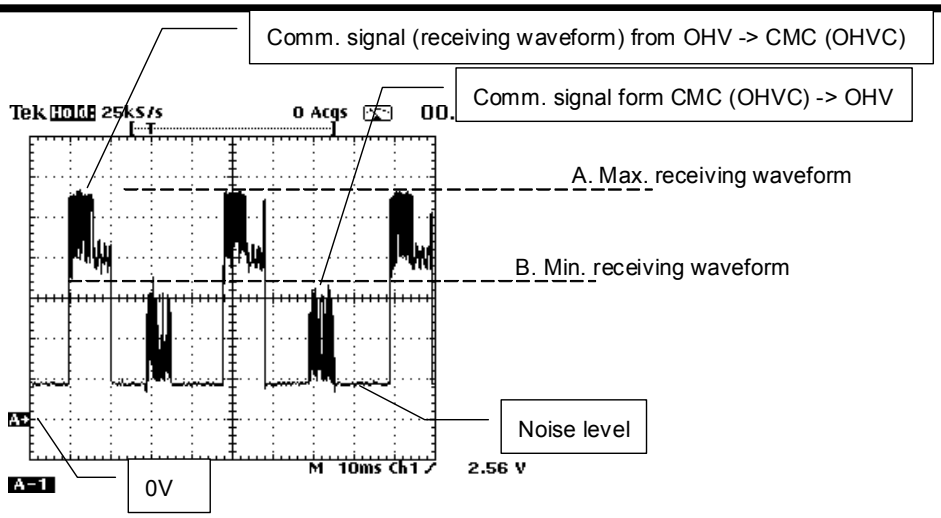

Fig. 18 Receiving Waveform

(4) Procedures for BV-BM3 receiving waveform adjustment are as follows.

Adjust the waveform level with variable resistance (VR1, VR2, VR200 and VR202) as you monitor the receiving waveform. Adjust variable resistance per one division in order of VR1→VR2→VR200→VR201.

Receiving waveform criteria;

Minimum level of receiving waveform communication speed :19.2kbps → 7V±0.5V

28.8kbps → 3V±0.5V

Squelch level 1.5V±0.5V

* If the receiving level does not decrease, rotate all variable resistance fully counter-clockwise.

* Lines with communication wires

If the receiving level does no decrease to the specified value, decrease the number of communication wire turns on the communications transformer. In case the minimum receiving level is 2V or less, increase the number of communication wire turns on the communications transformer.

Table. 6 Communication Wire Turns on Communications Transformer

Ded. Comm. Line : Length (One way)	Turn Count to Comm. Transformer
30m	1 turn
60m	2 turns
90m	3 turns
120m	4 turns
150m	5 turns

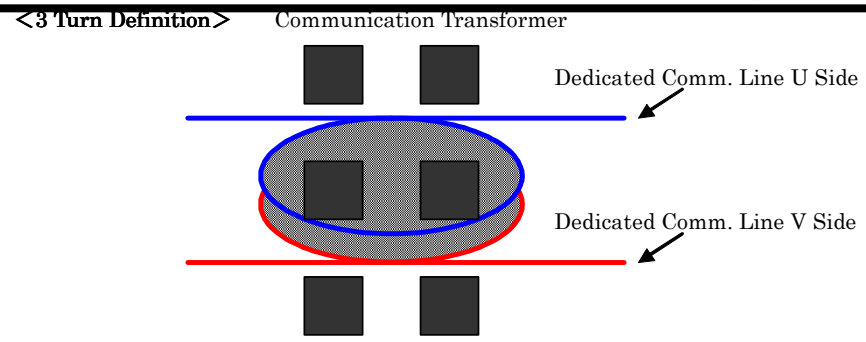

Fig. 19 Settings of Dedicated Communications Line (to the Communications Transformer) Turn Count

(5) Record the minimum receiving waveform and maximum noise level after adjustment. Save the reception waveform on the oscilloscope. Input the saved graphics to the PC, and save them so that which system has which graphics is understood.

C) Squelch check and adjustment

(1) Adjust BV-BM3 squelch following the steps below.

(2) Connect an oscilloscope to BV-BM3 and monitor squelch.

+ side: CH202 (TH_L)

- side: CH100 or CH101 (0V)

Range: 1.0V/DIV, 10mS ~ 20mS/DIV

(3) Adjust squelch level with the volume (VR202).

Squelch level criteria;

Minimum level of receiving waveform communication speed:19.2kbps → 7V±0.5V

28.8kbps → 3V±0.5V

Squelch level 1.5V±0.5V

(4) Record the adjusted squelch level.

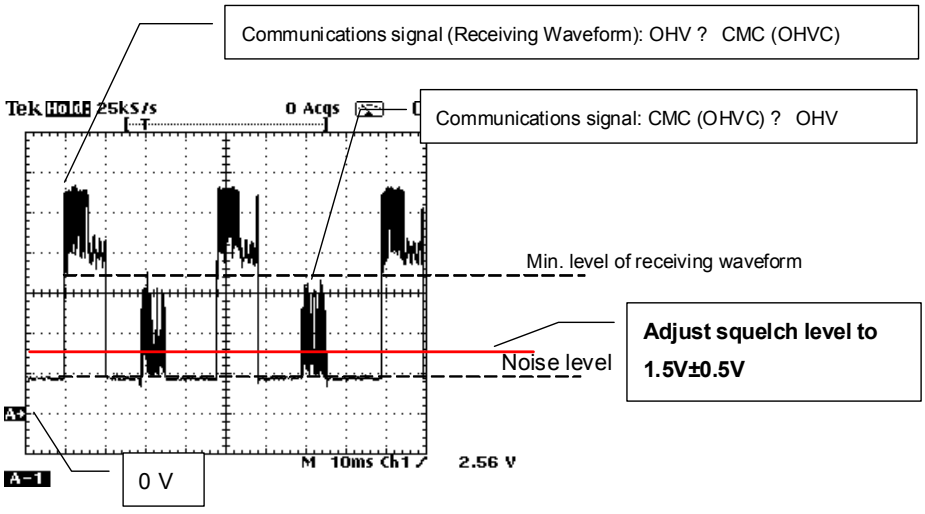

Fig. 20 Squelch Adjustments

D) Receiving Waveform Check (Next to INPUT)

(1) Move the vehicle to coaxial cable's Next to INPUT. Using the remote control, switch the vehicle's communications direction to the coaxial cable's INPUT side. Check the feeder cable arrangement on the Feeder Cable Arrangement Map.

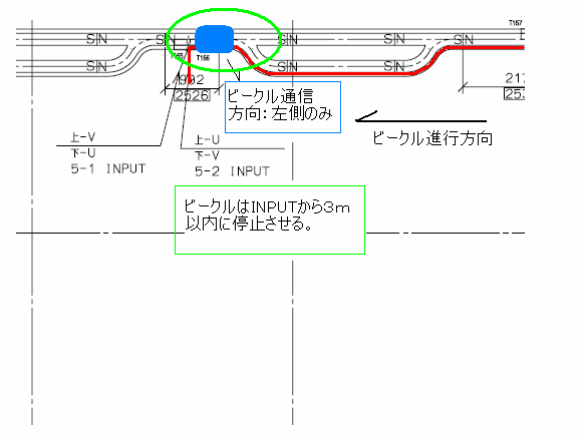

Fig. 21 Example of OHV Arrangement (By INPUT)

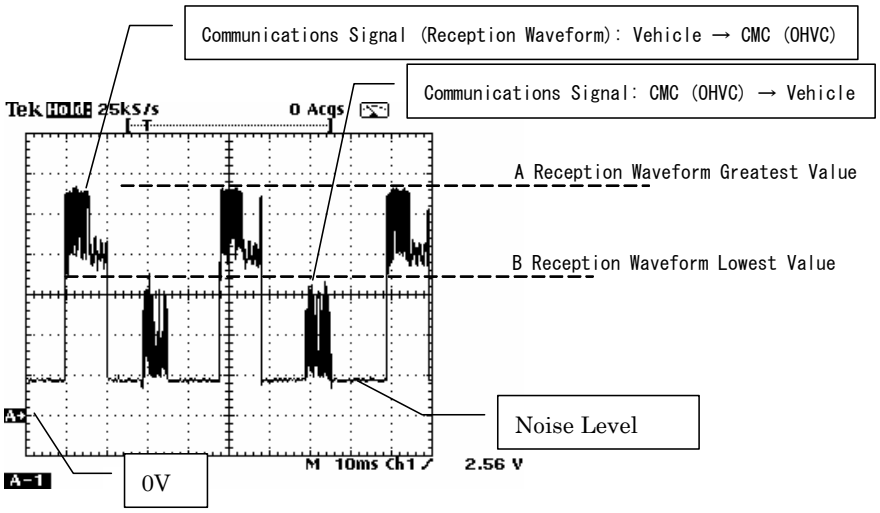

Fig. 22 Receiving Waveform

(2) Monitor the minimum receiving waveform and the maximum noise level.

Range: 1V ~ 2V/DIV, 10mS ~ 20mS/DIV

Maximam Noise Level Communication Speed 19.2kbps・・・ 1.0V or below.

28.8kbps・・・ 0.5V or below.

(3) Record the monitored minimum receiving waveform.

Save the waveform to the oscilloscope and download the saved screen to PC. Save the screen with an indication showing which line the screen belongs to.

E) Receiving waveform check (By RETURN)

(1) Move the vehicle to next to RETURN. Using the remote control, switch the vehicle's communications direction to the RETURN side.

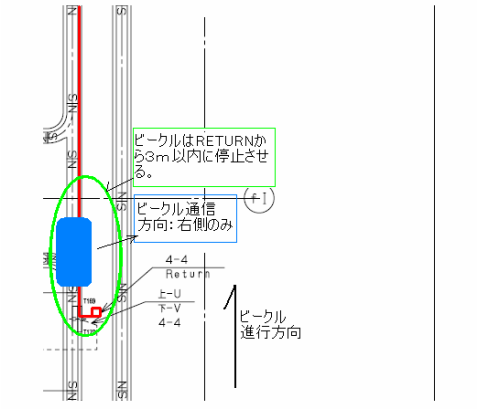

Fig. 23 Example of OHV Arrangement (By RETURN)

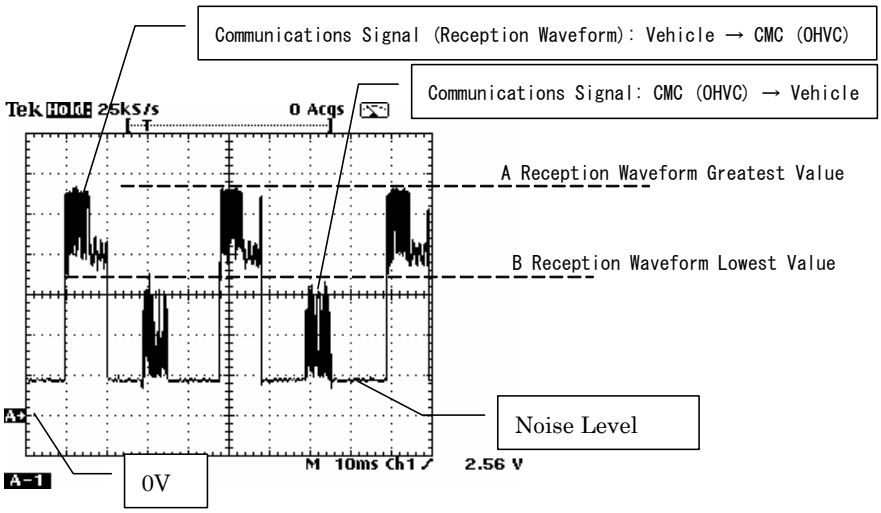

Fig. 24 Reception Waveform

(2) Monitor the minimum receiving waveform and the maximum noise level.

Range: 1V ~ 2V/DIV, 10mS ~ 20mS/DIV

Maximam Noise Level Communication Speed 19.2kbps・・・ 1.0V or below.

28.8kbps・・・ 0.5V or below.

(3) Record the monitored minimum receiving waveform.

Save the waveform to the oscilloscope and download the saved screen to PC. Save the screen with an indication showing which line the screen belongs to.

F) Install a cover of the CMC-BM when the adjustment is completed.

G) Check and adjust all CMC-BM.

H) Load the data saved on an oscilloscope to the maintenance PC, and organized the data.

6.4.5. Judgment

It passes if all of adjustments for all CMC-BM are performed or confirmed.

7. Specification

Unit name	CMC
Baud rate	19.2kbps-38.4kbps
Communication method	Serial Communication, Async HDX
Modulation method	2 value FSK(frequency shift keying)
Demodulation method	Analog PLL demodulation
Communication Frequency	CMC -> Vehicles：285.7kHz and 315.8 kHz (transmits) Vehicles -> CMC：342.9 kHz and 363.6 kHz(Receive)
bit error rate	$< 1\times10^{-4}$
Frame error rate	$< 1\times10^{-2}$

7.1. CMC-BC (**C**ommunication **M**odem **C**ontroller ：**B**ase **C**ontroller)

Unit name	CMC-BC
Manufacturer	MURATEC AUTOMATION CO., LTD.
Weight	Approx. 10 kgf *Case materials and shape vary with the system
Size	590mm (W) x 204 mm (L) x 211 mm (H) *Case materials and shape vary with the system
Power consumption	10W
Input 1	200V AC 1φ or 100V AC 1φ 50/60Hz
Input 2	Vehicle controller—CMC-BC RS232C/RS485
Output 1	CMC-BC—CMC-BM RS485 8 ports max.
Output 2	CMC-BC—CMC-BC RS485 1 port
Output 3	CMC-BC—CMC-BM 200V AC 1φ or 100V AC 1φ 50/60Hz

7.2. CMC-BM(**C**ommunication **M**odem **C**ontroller ：**B**ase **M**odem)

Unit name	CMC-BM
Manufacturer	MURATEC AUTOMATION CO., LTD.
Weight	Approx.7kgf *Case materials and shape vary with the system
Size	613mm (W) x 266 mm (L) x 71 mm (H) *Case materials and shape vary with the system
Power consumption	20W
Input 1	CMC-BC—CMC-BM 200V AC 1φ or 100V AC 1φ 50/60Hz
Input 2	CMC-BC—CMC-BM RS485
Input 3	CMC-TR—CMC-BM Analog signal 4 ports max.
Output 1	CMC-BM—CMC-TR Analog signal 2 ports max.

7.3. CMC-TR(**C**ommunication **M**odem **C**ontroller :**TR**ansformer)

Unit name	CMC-TR
Manufacturer	MURATEC AUTOMATION CO., LTD.
Weight	Approx. 5 kgf *Case materials and shape vary with the system
Size	430 mm (W) x 226 mm (L) x 91 mm (H) *Case materials and shape vary with the system
Power consumption	MAX 1W *When communication signal transmitted through the non-conductive power line
Input 1	CMC-BM—CMC-TR Analog signal
Output 1	CMC-TR—CMC-BM Analog signal

8. Error process

[Note.1]

Before servicing CMC-BC, CMC-BM, CMC-TR, always shut off the power supply.

[Note.2]

If the communication signals are overlaid onto the non-conductive power line, also shut off the power source of the non-conductive power line before starting maintenance on CMC-BM and CMC-TR.

<Communication error trouble shooting>

Vehicle Controller issues a communication error

- Is Vehicle Controller sending communication signals?
  - Check the settings for Vehicle Controller.
- Are the power indicator lights of CMC-BC and CMC-BM illuminated?
  - Is the power supply of 200V AC 1φor 100V AC 1φ50/60Hz connected?
    - Is the input fuse burnt?
      - Replace the fuse.
    - Turn the power supply OFF. Is the input resistance of the DC power almost 0 ohm?
      - Replace the DC power supply.
- Is the power LED of the print circuit NBV-BC illuminated?
- Is the power LED of the print circuit BV-BM2 illuminated?
  - Replace the print circuit board
- Is the connection between CMC-BM and CMC-TR normal?
  - Restore connection.

END