

Management number LG-18Y504

Operating manual

IT Controllers for Mini-excavator

Model No. JRN-330K

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Japan Radio Co., Ltd.

Locator Engineer Group

Automotive Business Department

Communication Products Division

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1. Outline

This document describes the function and performance of an IT controller for JRN-330K mini excavator (hereinafter referred to as "the present device").

This device is an IT controller equipped with GPS and 3G cellular communication function for mini excavators.

2. Features

As an IT controller for mini excavators

- Equipped with GPS function. Position, get current time from GPS.
- Equipped with mobile communication function. SMS reception and mail transmission / Reception are performed.
- Supply power supply from the battery of the construction machine.
- Even when the power supply is interrupted from the battery of a construction machine, it is possible to send and receive at least one set of mail within 48 hours.
- Debugging and software update of this device are possible by serial communication with a personal computer.

3. Equipment configuration

Table 3.1 Components of the IT controller for mini excavators

No.	Item name	Remarks	Quantity
1	3G Communications Module (WCDMA)	Cinterion PHS8-P(Gemalto product)	1
2	Built-in battery pack	NBB-3300	1
3	SIM card	Customer-provided	1

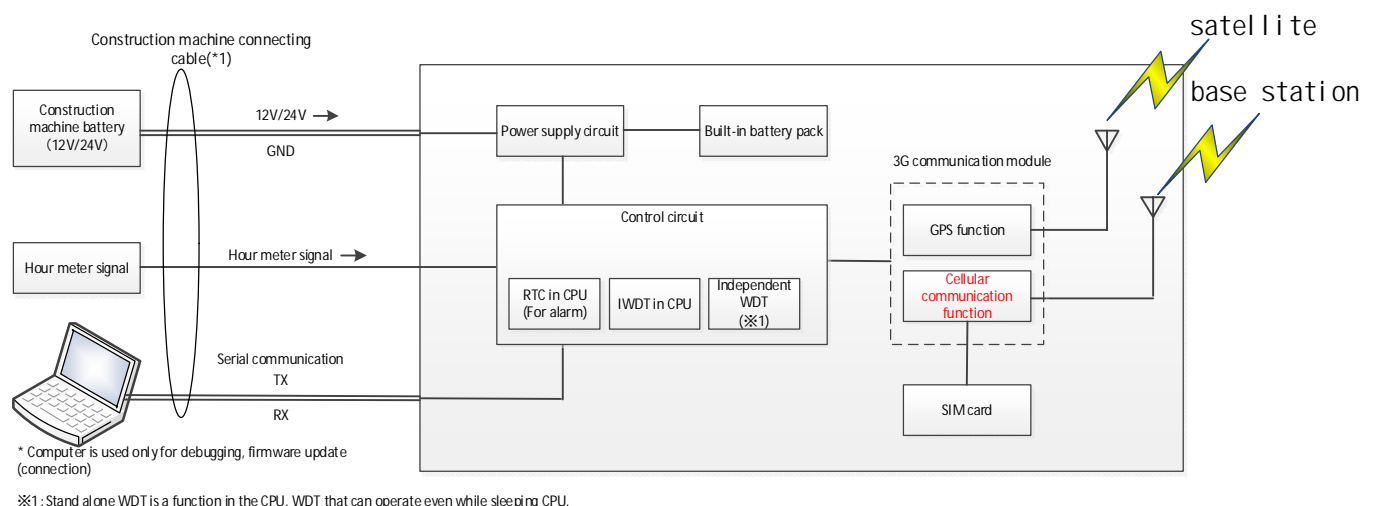


Figure 3.1 Configuration diagram

NOTE 1. The power cable requires a fuse (recommended current rating: 2[A]) to protect against overcurrent. Insert the fuse into the battery line.

4. Function

It has the following control function.

(1) Communication function with mail server.

Mail transmission and reception are performed between this device and a mail server.

(2) Information notification function at set time (linkage function with server)

Voluntarily notify information to the server at the set time (daytime batch, nighttime batch)

(3) Alarm notification function (linkage function with server)

It notifies information to the server autonomously according to the event generated by this equipment. The types of events are as follows.

a) Intrusion alarm function

b) Out-of-area alarm (generation / release) function

c) Battery disconnection alarm (generation / release) function

(4) Command reception processing function

To perform processing to a command transmitted from a server.

Command reception processing function

a) Machine status inquiry function

b) Intrusion alarm effective time setting function

c) Area setting function

d) Communication stop / resume function

e) Communication test function

f) Communication capacity confirmation function

g) Calendar change function

h) Time difference setting function

(5) Communication function

It has the following functions to communicate with the server.

a) Destination setting (fixed)

b) Batch transmission timing

c) Retry transmission

(6) Operation time acquisition function

While the hour meter signal is ON (while the engine is in operation), the time is counted, and the count value is integrated. Get the total operating time. Note that total operating time is stored in nonvolatile memory.

(7) GPS information acquisition function

Acquisition of GPS information shall be made every 30 minutes (0 minutes, 30 minutes per hour). After starting the device, the GPS module is started immediately.

When the GPS information can be positioned normally, the date and time of the GPS information is reflected on the RTC of the apparatus. When the positioning fails, the RTC is not updated. The time correction shall be implemented 24 hours after the previous implementation times. Positioning satellites (NMEA sentences) shall be

GPS only (GLONASS is not used). GPS data is received (application acquires data) At the time of GPS positioning. However, when the application does not perform positioning even after one minute has passed from the GPS information acquisition time (start), the acquisition processing is ended as non-positioning.

(Surveyor system: WGS-84)

(8) Sleep control function

a) When all the following three conditions are satisfied shift to sleep to reduce current consumption.

1) GPS positioning is not performed.

(The application is not acquiring GPS information)

2) No response processing has been performed by receiving the command or by receiving it.

3) While the engine is stopped (the hour meter signal is OFF)

b) To recover from sleep, perform immediately under any of the following conditions.

1) Engine operation (hour meter signal ON)

2) Activation signal input from communication module (SMS reception from operation)

3) Time reached at the date and time setting

4) Serial input from PC 5) Changing battery connection status

(9) Setting information holding function

Save necessary setting values in nonvolatile memory.

Items to be saved are as follows

● Items to be saved during operation

• Total uptime

• Current battery alarm condition

• Intrusion alarm effective setting time, day of the week information

• Unsent mail data

• Area information

• Communication stopped state

• Number of mail transmission / reception bytes, number of mails

• Mail transmission retry count accumulated value

● Items to be set at factory shipment, items to be held

• When checksum Exclusive Logical calculation value

(10) Fail-safe function

To incorporate a fail-safe processing for preventing hang-up into software or hardware, and to make the processing only fail-safe and not to occur frequently.

A) Reset by CPU's WDT time-up

b) Reset by CPU independent WDT time up

C) Restart by software at system error

d) Regular Reset of Communication Module

(11) Serial communication function with personal computer

Communicate with the personal computer using RS232C 1ch.

(12) Display (LED) function

a) When the engine is on and it is within range, blinking at a slow cycle (1000ms on / 1000ms off)

b) When the hour meter signal is ON, and when it is out of service area, it blinks earlier (200ms on / 200 m turn off)

c) It turns off when the hour meter signals OFF or when the battery on the construction machine side is not connected (when the built-in battery is operating)

(13) Date and time setting function

Features such as GPS data acquisition, daytime and nighttime batches are available that can be operated in time. A request time is set to an RTC (for alarm), and when the request time comes, the request time is notified to a connection server.

(14) Software rewrite function

The software is rewritten from the external personal computer to the present device

via serial.

(15) Hardware protection function

To avoid an internal temperature rising of this device, mail transmission shall be as follows. When a trigger for mail transmission occurs, if the temperature is equal to or higher than a certain temperature, the mail is not transmitted, and the mail is saved as non-transmitted mail in the nonvolatile memory.

Maximum of 10 mail transmission processing (including retry due to communication error) shall be made.

If the tenth e-mail transmission fails, retrying is not performed even when retry is possible

5. Product Specifications

5.1. General specification

No.	Item	Specification / Performance
1	Power supply voltage	DC+10~+32V (It can operate with voltage less than DC + 10 V when there is remaining battery capacity of built-in battery)
2	Battery pack	Ni -MH rechargeable battery, 500mAh/3.6V
3	Consumption current	Maximum operation : 650 mA or less @12V, 25°C Standby operation : Average 10 mA or less @12V, 25°C Operate 48 hours with built-in battery operation (Note 1)
4	Ambient	Storage temperature : -40 to + 85 ° C Operating temperature : -30 to + 70 ° C Humidity: 0 to 95% RH (noncondensing)
5	Dimensions	110(W) × 50(D) × 25(H) ※No protrusion is included
6	Mass	185g or less
7	Case body	PBT Duranex 711 SA (black) (made by Polyplastics)
8	Protective structure	Dustproof / Waterproof: IP 55

(Note 1) 48 hours of operation is possible under the following specific test conditions. When the built-in battery is fully charged, the reception environment of GPS and WCDMA is good under the 25 ° C environment, conditions of 1 mail reception and 4 mail transmission (1 set of mail transmission / reception) for 48 hours.

5.2. Serial Communication Interface Specification

No.	Item	Specification / Performance
1	Data transmission method	Specification / Performance
2	Signal level	RS-232C
3	Transmission speed	19,200 bps
4	Frame length	variable length
5	Data length	8 bits
6	Start bit	1 bit
7	parity bits	None
8	stop bit	1 bit
9	Send line feed code	CR+LF
10	Receive line feed code	CR、CR+LF

5.3. GPS specification

No.	Item	Specification / Performance
1	GPS module	Communication module Cinterion PHS8-P built-in GPS module
2	Reception method	30ch simultaneous
3	Reception frequency	L1 1575.42 MHz
4	Output	NMEA-0183 compatible (V2.3)
5	Positioning method Standalone	Standalone GNSS
6	Geodetic system	WGS-84
7	Time UTC	UTC
8	Receive sensitivity (Note 1)	Cold start: -138 dBm or less

5.4. WCDMA communication specification

No.	Item	Specification / Performance
1	Terminal type name	Cinterion PHS8-P (Gemalto product)
2	Radio frequency	UMTS/HSPA+: Four band, 800/850/1900/2100MHz
3	Transmission output (Note 2)	Class 3 (+16dBm min) for UMTS 2100, WCDMA FDD BdI Class 3 (+16dBm min) for UMTS 1900, WCDMA FDD BdII Class 3 (+16dBm min) for UMTS 850, WCDMA FDD BdV Class 3 (+16dBm min) for UMTS 800, WCDMA FDD BdVI
4	Receive sensitivity (Note 3)	-99 dBm or less (normal temperature)
5	HSPA specification	3GPP Release 6, 7 DL 14.4Mbps, UL 5.7Mbps UE CAT. 1-12 supported Compressed mode (CM) supported according to 3GPP TS25.212
6	UMTS Specification	3GPP Release 4 PS data rate – 384 kbps DL / 384 kbps UL CS data rate – 64 kbps DL / 64 kbps UL
7	SMS specification	Point-to-point MT and MO Cell broadcast Text and PDU mode

(Note 2 and Note 3) This device is a design assurance value of the single device, and the performance of the device is guaranteed in the state of being fitted to the building machine. Please check the communication status in the production environment before using it.

5.5. Built-in battery specification

No.	Item	Specification / Performance
1	Type name	NBB-3300
2	Type	Nickel-hydrogen secondary battery
3	Nominal voltage	3.6V (1.2V×3 cells)
4	Nominal capacity	500mAh

5.6. External connector specification

No.	Item	Specification / Performance
1	Case body (cap)	Made by TE Type name 174264-2 [Construction machine side mating connector type name: TE made 2822346-1]
2	Double lock plate	Type name 174265-7 Yellow, flame retardant UL94V-2
3	Contact type name	Type name 171631-1 Applicable wire range(SQ): 0.2~0.5 Outer diameter of insulation coating (mm): ϕ 1.4 to ϕ 2.4Meets AVSSH 0.5f
4	Rubber plug	Type name 2822352-1 S size, NBR / black Outer diameter of insulation coating (mm): ϕ 1.4 to ϕ 2.4Meets AVSSH 0.5f
5	Cavity plug	Type name 2822357-1

6. Block Diagram

Figure 6.1 shows the block diagram.

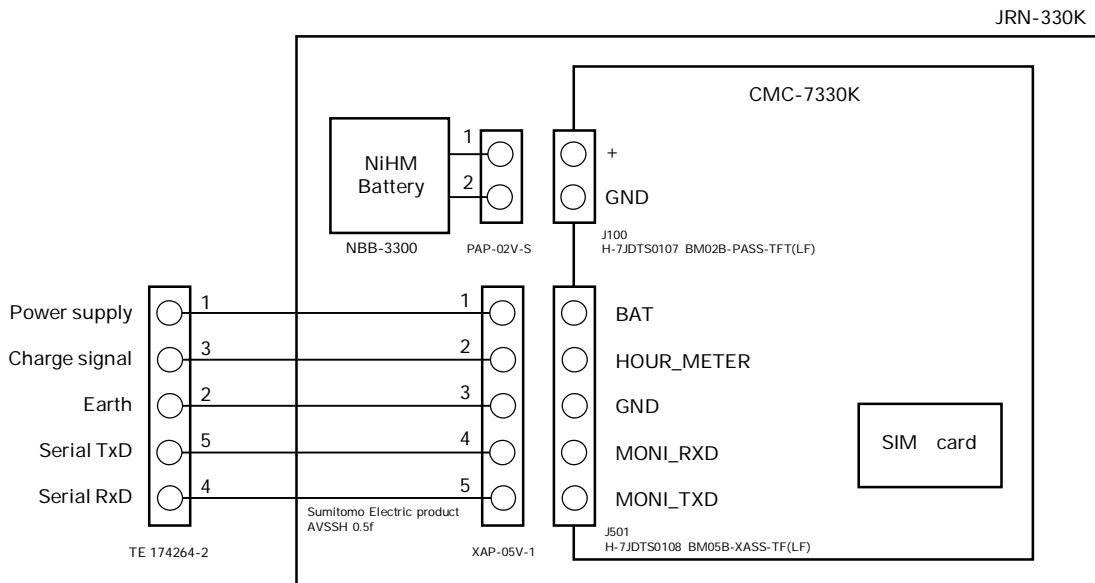


Figure 6.1 Block Diagram

7. External interface specification

7.1. External connector

Signal lines of the connector connected to the construction machine are shown.

Table 7.1 Signal line chart

IT side Terminal number	Pin name	Remarks
1	Power supply	External power input 10V to 32V
2	Earth	Ground
3	Hour meter signal	Hour meter signal 0 V to 32 V Non-operation: Less than 4 V (typ), Operation: 4 V (typ) or more(Threshold 3.32 V (min) to 4.77 V (max)))
4	Serial RxD	RS232C Input signal (to this equipment)
5	Serial TxD	RS232C Output signal (from this equipment)

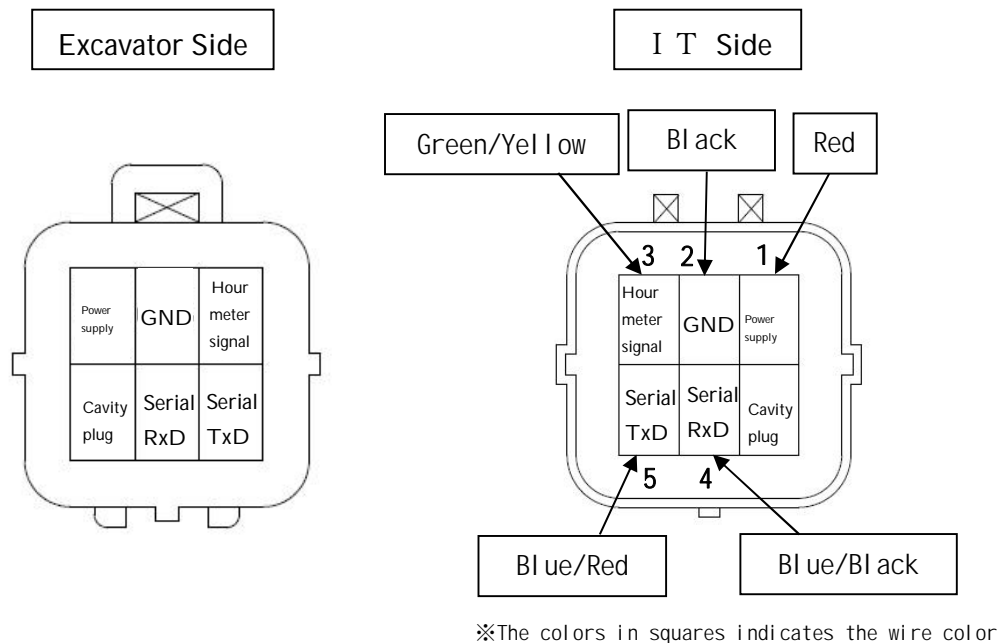


Figure 7.1 Connector Pin Assign

8. Outline drawing

Figure 8.1 shows the outline drawing.

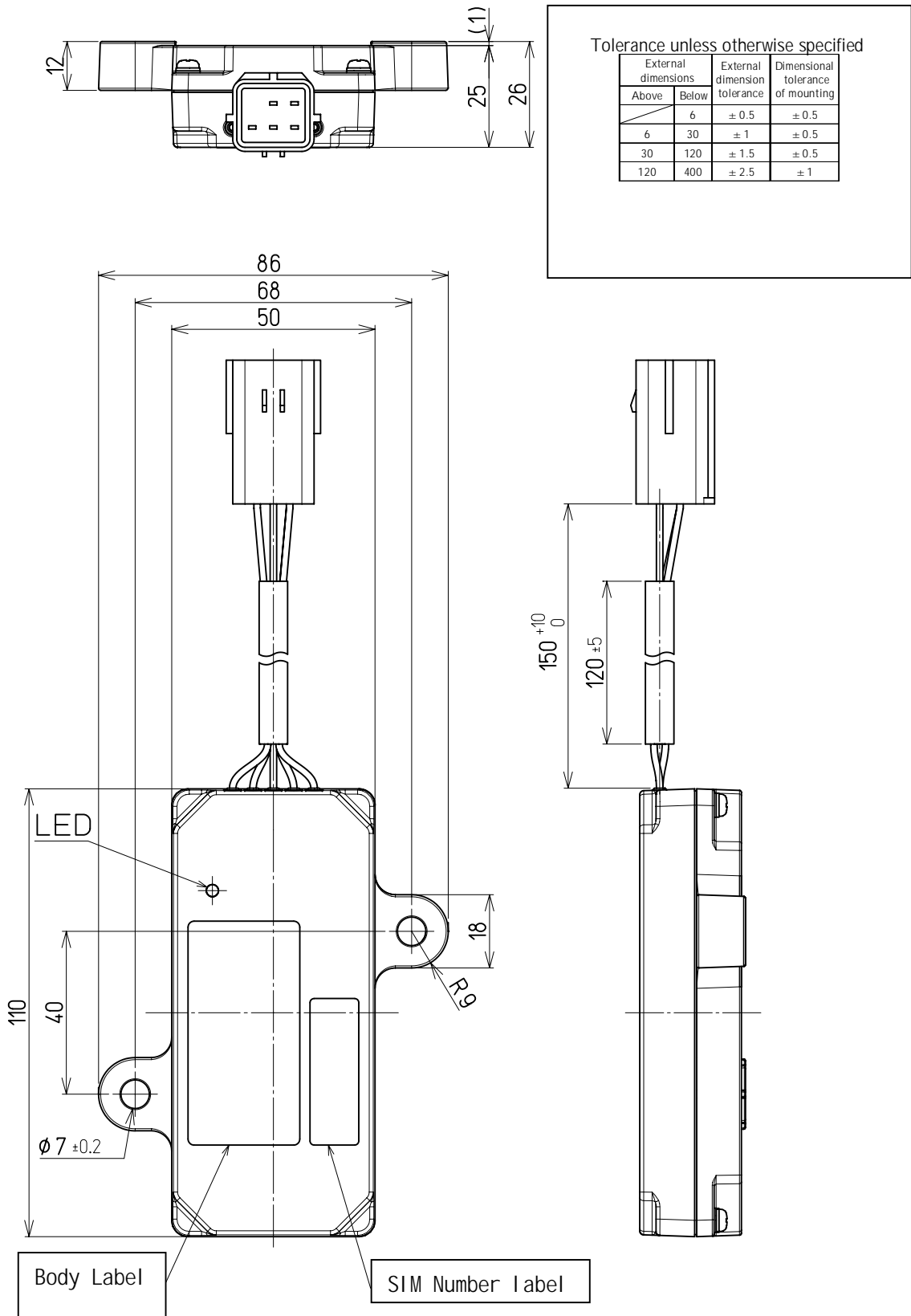


Figure 8.1 Outline Drawing

9. Handling Precautions

* In the text, "IT controller JRN - 330K" described in this specification is "this device"

9.1. Specification values

Please be sure to follow the specifications of this device. Using more than the specified value can cause a malfunction.

(1) Power supply voltage: Main unit (input voltage)

It is the maximum voltage that can be applied between the power supply terminal and The grounding terminal (GND), and exceeding this voltage may cause fire, electric shock or failure.

(2) Operating temperature

It is a temperature range that can operate with satisfying the specifications, and beyond this temperature range may not satisfy the performance.
It may cause malfunction

(3) Storage temperature

It is the temperature range when you keep it without operating it. If it exceeds this temperature range, performance may not be satisfied. It may cause malfunction.

9.2. Usage Notes

(1) Do not remove or disassemble the screw of this device for purposes other than maintenance. It may cause performance degradation, fire, electric shock or breakdown.

(2) Be sure to take countermeasures against static electricity when maintenance is performed by removing the screws of this device (battery replacement, etc.).

It may cause performance degradation or malfunction. After tightening the screws, check that the waterproof performance is appropriate.

Note: If you remove screws other than Japan Radio Co., Ltd. (battery replacement etc.) performance guarantee will not be possible.

(3) If this device is dropped or left outdoors for a long time, it will cause scratches, dirt and damage.

(4) This device is not designed for use in the following special environments:

Please do not use it under the following special circumstances as it may cause performance degradation or malfunction.

- Attachment of water, oil, chemical liquid, organic liquid agent etc. and in liquid
- In the dust
- Places where many corrosive gases such as salt wind, chlorine, hydrogen sulfide, ammonia, sulfur oxide, hydrogen chloride, bisulfite gas etc. are generated
- Strong environment of static electricity and electromagnetic waves

(5) Do not use on medical equipment, space, aviation equipment, disaster prevention, method equipment and other equipment that require high stability that affects human life.

(6) Do not use near a person wearing medical electrical equipment etc. There is a danger Of malfunction of medical equipment etc. due to influence of radio waves.

(7) Depending on the model, it may effect on-vehicle electronic equipment, so when installing or wiring, install and route it as far as possible from the on-board electronic equipment. Please install as far away as possible from car navigation and other antennas in particular. It may cause performance degradation.

(8) Do not damage, break, or process each cable. Do not place heavy objects on the unit, heat it, pull it, or forcibly bend it, the cable may be damaged, causing fire or electric shock.

(9) Do not deliberately put the unit in water or wet it Doing so may cause electric shock or malfunction. Wipe with water cloth and wipe with a dry cloth.

(10) Do not operate while the construction machine is in operation, causing accidents.

- (1 1) In the unlikely event that foreign matter such as water or metal enters inside, please unplug the power cable and contact us. If used as it is, it may cause fire, electric shock or breakdown.
- (1 2) Clean the surface to remove dust and dirt, and wipe it with a clean cloth.
- (1 3) This device may not be able to communicate due to communication carrier interference or radio environment due to the use of radio waves.
For GPS positioning, time may vary depending on location and time of day, or positioning may not be possible.
In addition, some environments may experience significant errors.

9.3. Implementation notes

- (1) Be careful of static electricity when handling this equipment. It may break down due to static electricity. Be especially careful of static electricity to the external connector.
- (2) Connect and disconnect cables (connectors) with external power supply cut off. It may cause fire, electric shock or failure. Please avoid parallel and insert in parallel.
- (3) Be careful not to touch the terminals of the external connector with bare hands or oil hands.
- (4) Do not use or leave it in direct sunlight or high temperature places.
It may cause heat generation, deformation, or malfunction of the equipment.
- (5) Please install the main body and cable so as not to interfere with the operation of equipment such as operation and air bag.
- (6) Connect the cables (connectors) securely and fix them. It may cause the cable to come off or the connector to be damaged.
- (7) Do not install near high-voltage transmission lines or transformers or other equipment that generates magnetic fields. The device may not operate properly.

9.4. Overcurrent protection

- (1) This device does not contain a fuse for overcurrent protection.
To prevent danger, use the overcurrent protection fuse for the power supply line.

9.5. Storage Notes

- (1) Avoid places where there are many corrosive gases such as salt wind, chlorine, hydrogen sulfide, ammonia, sulfur oxides, hydrogen chloride, and bisulfite gas.
- (2) In places where there is a sudden change in temperature and humidity, dew condensation will occur on the whole device, so please avoid such an environment and store it in a place where there is little change in temperature.
- (3) Do not place it on an unstable place such as a wobbly table or a leaning place. It may fall and cause malfunction or injury.
- (4) Do not store in humid or dusty places. It may cause overheating, fire, or malfunction.

9.6. Transportation method

- (1) Do not throw or drop it. The set of equipment may be broken.
- (2) Do not get wet with water. Please be careful not to get wet during transportation during rainfall.

9.7. Disposal

- (1) Disposal of this equipment will be handled by our company and discarded.
Therefore, if there is a need for disposal due to aging, breakdown etc. of the Equipment, please contact our sales department, local branch office, branch office or business office.
- (2) Do not throw batteries into fire, explosion could result in fire or injury.

9.8. Others

- (1) Please note that we are not responsible for any defects or abnormalities that may have occurred as a result of misuse of the contents of this specification.
- (2) With regard to the equipment described in this specification, we may make changes to alternative parts to the extent that electric, mechanical and environmental resistance characteristics are not impaired.
- (3) If the case body becomes too hot to touch with your hand, please do not touch the case body directly, stop using it immediately, and contact our sales department or local branch office or sales office.
- (4) Do not do internal inspection / repair by the customer absolutely.
Inspection and repair by non-special maintenance personnel may cause fire or electric shock.
Please consult our sales department or local branch office, branch office, sales office or agent for internal inspection and repair.

10. Compliance with FCC and IC Rules and Regulations

• FCC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference, including interference that may cause undesired operation.

CAUTION:

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

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

• IC

CAN ICES-3(B)/NMB-3(B)

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil ne doit pas produire de brouillage, et(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

• FCC/IC

RF exposure compliance

- 1) To comply with FCC/IC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.
- 2) This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Normes d'exposition RF

- 1) Afin de se conformer aux normes FCC / IC RF exigences de conformité de l'exposition, une distance de séparation d'au moins 20 cm doit être maintenue entre l'antenne de l'appareil et les personnes.
- 2) Cet émetteur ne doit pas être co-localisées ou opérant en conjonction avec une autre antenne ou émetteur.