ADVANTEST®

ADVANTEST CORPORATION

R3031

GPS Integrated Network Reference

Operation Manual

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Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that Advantest bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

If the equipment is used in a manner not specified by Advantest, the protection provided by the equipment may be impaired.

- **Warning Labels**

  Warning labels are applied to Advantest products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

  Symbols of those warning labels are shown below together with their meaning.

  DANGER: Indicates an imminently hazardous situation which will result in death or serious personal injury.

  WARNING: Indicates a potentially hazardous situation which will result in death or serious personal injury.

  CAUTION: Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

- **Basic Precautions**

  Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

  - Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
  - When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
  - When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.
  - Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
  - Connect the power cable to a power outlet that is connected to a protected ground terminal. Grounding will be defeated if you use an extension cord which does not include a protected ground terminal.
  - Be sure to use fuses rated for the voltage in question.
  - Do not use this instrument with the case open.
  - Do not place anything on the product and do not apply excessive pressure to the product. Also, do not place flower pots or other containers containing liquid such as chemicals near this

product.

- When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.
- When using the product on a cart, fix it with belts to avoid its drop.
- When connecting the product to peripheral equipment, turn the power off.

- **Caution Symbols Used Within this Manual**

Symbols indicating items requiring caution which are used in this manual are shown below together with their meaning.

DANGER: Indicates an item where there is a danger of serious personal injury (death or serious injury).

WARNING: Indicates an item relating to personal safety or health.

CAUTION: Indicates an item relating to possible damage to the product or instrument or relating to a restriction on operation.

- **Safety Marks on the Product**

The following safety marks can be found on Advantest products.

 : ATTENTION - Refer to manual.

 : Protective ground (earth) terminal.

 : DANGER - High voltage.

 : CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

The following parts used in the instrument are main parts with limited life.
Replace the parts listed below before their expected lifespan has expired to maintain the performance and function of the instrument.
Note that the estimated lifespan for the parts listed below may be shortened by factors such as the environment where the instrument is stored or used, and how often the instrument is used.
The parts inside are not user-replaceable. For a part replacement, please contact the Advantest sales office for servicing.

Each product may use parts with limited life.
For more information, refer to the section in this document where the parts with limited life are described.

Main Parts with Limited Life

Part name	Life
Unit power supply	5 years
Fan motor	5 years
Electrolytic capacitor	5 years
LCD display	6 years
LCD backlight	2.5 years
Floppy disk drive	5 years
Memory backup battery	5 years

- **Hard Disk Mounted Products**

The operational warnings are listed below.

- Do not move, shock and vibrate the product while the power is turned on.
  Reading or writing data in the hard disk unit is performed with the memory disk turning at a high speed. It is a very delicate process.

- Store and operate the products under the following environmental conditions.
  An area with no sudden temperature changes.
  An area away from shock or vibrations.
  An area free from moisture, dirt, or dust.
  An area away from magnets or an instrument which generates a magnetic field.

- Make back-ups of important data.
  The data stored in the disk may become damaged if the product is mishandled. The hard disc has a limited life span which depends on the operational conditions. Note that there is no guarantee for any loss of data.

- **Precautions when Disposing of this Instrument**

When disposing of harmful substances, be sure dispose of them properly with abiding by the state-provided law.

Harmful substances: (1) PCB (polycarbon biphenyl)
(2) Mercury
(3) Ni-Cd (nickel cadmium)
(4) Other
Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

Example: fluorescent tubes, batteries

Environmental Conditions

This instrument should be only be used in an area which satisfies the following conditions:

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- Altitude of up to 2000 m

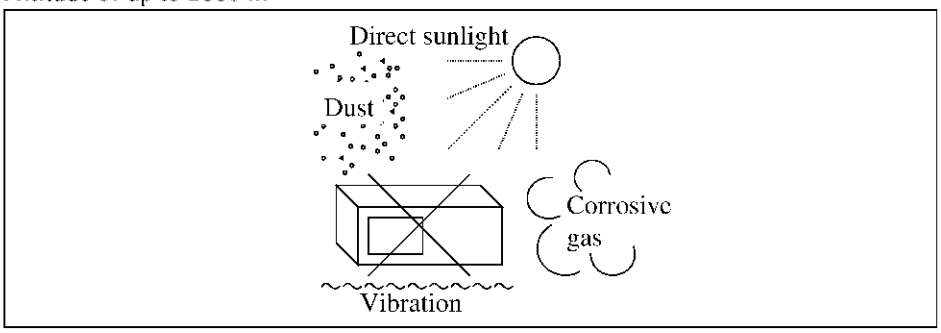


Figure-1 Environmental Conditions

- Operating position

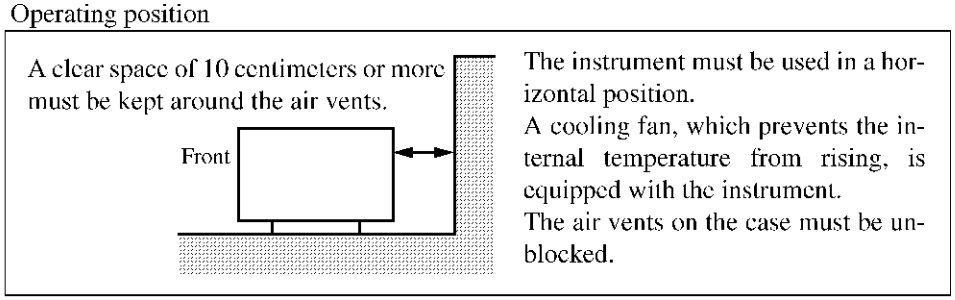


Figure-2 Operating Position

- Storage position

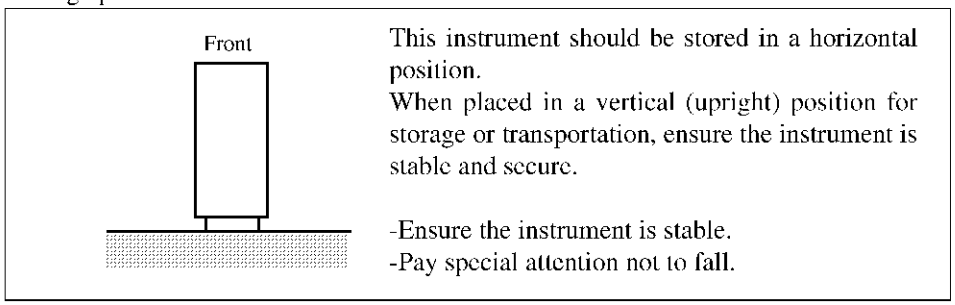


Figure-3 Storage Position

- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  Impulse withstand voltage (over-voltage) category II defined by IEC60364-4-443

  Pollution Degree 2

Types of Power Cable

Replace any references to the power cable type, according to the following table, with the appropriate power cable type for your country.

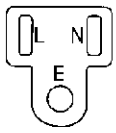
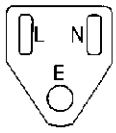
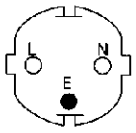
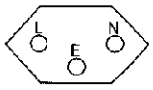
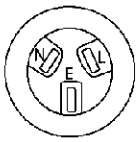
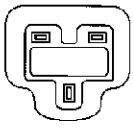
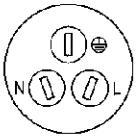
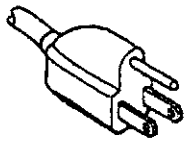
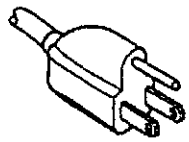
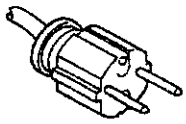
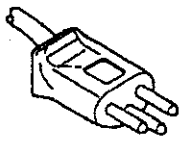
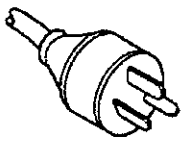
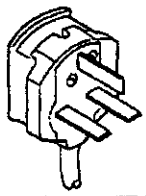
Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
	CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
	SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
	SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
	BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417
	CCC:China	250 V at 10 A Black 2 m (6 ft)	Straight: A114009 (Option 94) Angled: A114109

Table of Power Cable Options

There are six power cable options (refer to following table).

Order power cable options by Model number.

	Plug configuration	Standards	Rating, color and length	Model number (Option number)
1		JIS: Japan Law on Electrical Appliances	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
2		UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
3		CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
4		SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
5		SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
6		BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417

PREFACE

This manual describes how to use the R3031 GPS integrated network reference.

The contents of this manual are subject to change without notice.

The addresses and phone numbers of local sales offices of Advantest are listed at the end of this manual.

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1 OVERVIEW

1.1 Product Overview

Conventional frequency standard use the inherently stable-oscillation characteristics of crystal or rubidium. In contrast, the R3031 utilizes a relatively new concept to generate ultra-stable frequencies.

The R3031 obtains the one-second signal from the global positioning system (GPS) used for navigation systems and uses it as the reference to regenerate frequencies.

Features

(1) Ensures an outstanding frequency precision of 10^{-12}/day. (POS MODE : HOLD)

(2) Achieves a frequency precision of 10^{-10}/10-min about 3 hours after turning on the power. (POS MODE : HOLD)

(3) When the built-in crystal oscillator is backed up by an external battery, a frequency precision of 10^{-10}/10-min is achieved about 60 minutes after turning on the power. (POS MODE : HOLD)

(4) Selection of diverse frequencies and clocks including digital communication clock and color subcarrier for television broadcasting.

(5) Provides calibration-free reference frequencies for measurement.

(6) Digital signal processing technology makes the R3031 immune to phase variations due to radio wave transmission or S/A*.

(7) For fixed-position, the R3031 can operate by receiving from at least one satellite.

* S/A: Intentional degradation in precision by the Department of Defense for strategic reasons.

Note: ***/day means the average for 24 hours and /10-min means the average for 10 minutes.***

1.2 Uses

The R3031 is suitable for various applications. In general, conventional frequency standards are operated and controlled by tracing them to the national standard periodically.

The R3031 can be used to generate high-precision frequencies with a precision of 10^{-12}/day relative to the GPS system, without tracing to the national standard.

(1) When using the R3031 as a highly stable, installed frequency source

In this case, to obtain highly stable frequencies by synchronizing the R3031 with the ultra-stable, atomic frequency standard mounted on the GPS satellites, the GPS satellites must be continuously tracked.

(2) When using the R3031 on site

In this case, the GPS satellites cannot be continuously tracked and therefore the overall stability of the R3031 is equal to that of the built-in crystal oscillator. However, by using a backup battery and a unique frequency control algorithm, the R3031 is designed to be activated quickly.
For details on the operating procedures for the above applications, see chapter 4.

1.3 Accessories

To operate the R3031, the antenna and connection cable recommended by Advantest are required. If the accessories recommended by Advantest are not available, use equivalent products with the corresponding specifications.

Table 1-1 List of Accessories

Product	Model name	Maker	Specifications
Portable antenna	CCAD20AD01	Matsushita Electric Works, Ltd	Gain : 23dB (min.) Connector : SMA Supplied cable : 5m (antenna cable) Power supply with fixed magnet: +5V/ 25mA or less
Installed antenna	CCAH32AD01	Matsushita Electric Works, Ltd	Gain : 33dB (min.) Connector : Type N Supplied cable : None Power supply with fixed pole: +5V/ 27mA or less
50m antenna cable	PR-5FB-50C(5DFB) Coaxial cable	Miyazaki Electronic Wire & Cable Co., Ltd.	Connector : Type N Cable loss (typ.) : 14 dB
100m antenna cable	PR-10FB-100C(10DFB) Coaxial cable	Miyazaki Electronic Wire & Cable Co., Ltd.	Connector : Type N Cable loss (typ.) : 18 dB
Line amplifier	LA20RPDC-N	WR	Gain : 20dB Connector : Type N Power supply : +5V/ 10mA Required when the antenna cable exceeds 100 m.
Front handle set	A02701	ADVANTEST	C series 2U
Rack mount set	A02463	ADVANTEST	EIA single
Rack mount set W	A02464	ADVANTEST	EIA double
Rack mount set	A02263	ADVANTEST	JIS single
Rack mount set W	A02264	ADVANTEST	JIS double

1.4 Options

Table 1-2 List of Options

Name	Option code	Frequency
64kHz OUT option	OPT3031+10	64 kHz + 8 kHz + 0.4 kHz or 64 kHz + 8 kHz can be switched between.
1.544MHz OUT option	OPT3031+11	1.544MHz
2.048MHz OUT option	OPT3031+12	2.048MHz
3.58MHz OUT option	OPT3031+13	3.58MHz
5MHz OUT option	OPT3031+14	5MHz
6.312MHz OUT option	OPT3031+15	6.312MHz
27MHz OUT option	OPT3031+16	27MHz
155.52MHz OUT option	OPT3031+17	155.52MHz

2 BEFORE USE

Read the following subsections before using the R3031.

2.1 Checking the Accessories

(1) Make sure that the external appearance is not damaged.

(2) Check the quantity and standard against the standard accessory list (Table 2-1) below.

If any parts are damaged or missing, contact your local Advantest sales office.

Table 2-1 List of Standard Accessories

Product name	Stock No.	Quantity	Remarks
1. Power cable	*	1	
2. Power fuse	DFT-AA1A	2	
3. N-SMA conversion adapter	JCF-AA001JX36	1	
4. Operation manual	ER3031	1	

:* ***ADVANTEST provides the power cables for each country. Refer to yellow page of "Table of Power Cable Options" at this manual.*

Note: ***When ordering accessories, use the stock No.***

2.2 Operating Environment Conditions

Install the R3031 in a location that meets the following conditions.

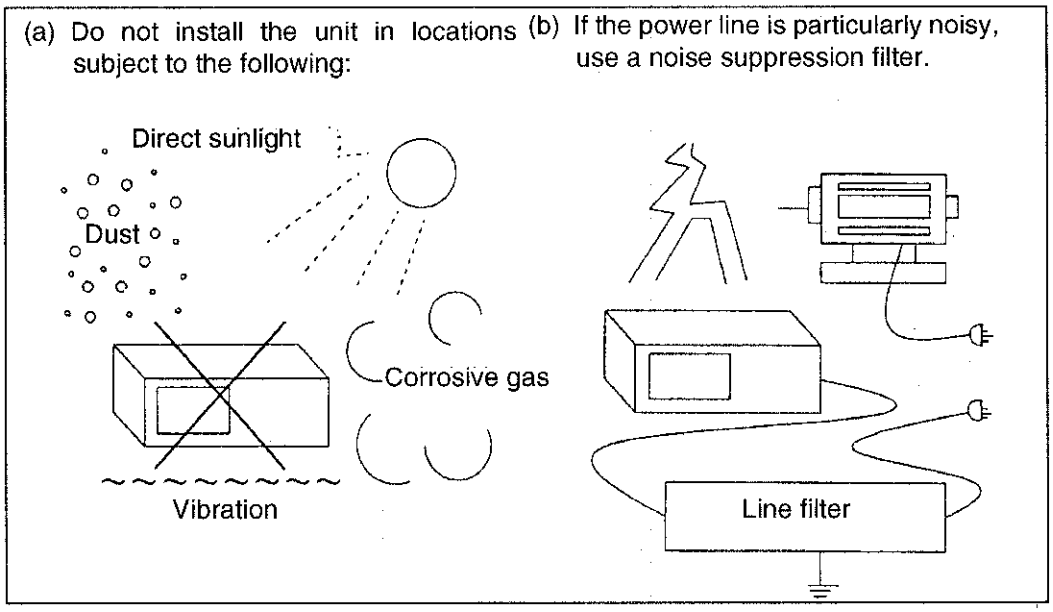


Figure 2-1 Operating Environment Conditions

- Temperature:
  0°C to 40°C(operating temperature), -20°C to +60°C (storage temperature)
- Relative humidity:
  85% or less (without condensation)
- Locations where corrosive gas is not present
- Locations not exposed to direct sunlight
- Locations where dust is not present
- Locations not subject to vibration
- Locations not subject to noise
- Locations not subject to large temperature changes
  (The recommended temperature change is 23°C ± 1°C)

The R3031 is designed to withstand the noise of the AC power line, however, use it where there is little line noise.

If the installation location is subject to noise, use a noise suppression filter.

Note: ***For the GPS radio waves used by the R3031, the 1.575 GHz carrier wave is modulated with 1.024 MHz spectrum spread and therefore stable reception is possible even at low field strength. However, if there is a PDC, MCA, or other station with high field strength which prevents stable reception, use a band-pass filter.***

2.3 Power Supply

WARNING!
Be sure to use the R3031 with the specified power requirements. Supplying the wrong power to the R3031 may damage the unit.

- Power requirements
  The operating power requirements for the R3031 are shown in Table 2-2.

Table 2-2 AC Power Requirements

Power supply	Condition
Power voltage	90 V to 132 V, 198 V to 250 V (100 V/200 V automatic switching)
Frequency	50Hz / 60Hz / 400Hz
Power consumption	50 VA or less

- Checking and replacing the power fuse
  The rating of the power fuse is 1 A/250 V for the input voltages of 90 V to 132 V and 198 V to 250 V.
  Make sure that the fuse is stored in the power fuse holder in the rear panel.

- Replacing the power fuse
  ① Unplug the power cable from the AC power connector.
  ② Fit the tip of a screw driver into the ditch of the fuse holder. Then, while pressing lightly, turn the holder counterclockwise by about 60 and release the screw driver. When the fuse holder is protruding from the R3031 by about 3 mm, pull it out.
  ③ If the fuse has blown, replace it with a new one.

  Note: If the rating of the fuse is wrong, replace it with a new one with the specified rating.

  ④ Put the new fuse into the fuse holder, replace the holder into the R3031, and then plug the power cable into the AC power connector.

WARNING!
1. ***To protect the R3031 from fire hazards, be sure to use a fuse of the same type and rating.***
2. ***Using the R3031 with a fuse of the wrong rating may damage the unit.***
3. ***When replacing the fuse, be sure to unplug the power cable from the R3031.***

- Checking and connecting the power cable
  ADVANTEST provides the power cables for each country. Refer to yellow page of "Table of Power Cable Options" at this manual.

WARNING!

1. ***If the R3031 seems abnormal, unplug the power cable immediately.***
2. ***Power cable***
   - ***To avoid electrical and fire hazards, use the supplied power cable.***
   - ***When using the R3031 overseas, use a power cable which complies with the safety standard of the country where it is used.***
   - ***When plugging or unplugging the cable, always hold the plug.***
3. ***Protective ground***
   - ***Plug the power cable into an AC outlet with a protective ground terminal.***
   - ***Using an extension cord without a protective ground terminal will disable the protective ground.***

2.4 Warm-Up Time

When the R3031 has adjusted to the ambient temperature, turn on the power and allow the unit to warm up for about 60 minutes.

(The 60-minute warm-up time includes 30 minutes for the crystal oscillator to stabilize and another 30 minutes for the system operation to stabilize.)

Note1: During the 30 minutes it takes for the crystal oscillator to stabilize, the progress is displayed on the "FREQ" line on the initial steady screen.

Note2: After the crystal oscillator has warmed up, the R3031 performs radical frequency acquisition in about 30 minutes for rapid frequency stabilization. In this condition, both the "FIL BK STG" and "CONT STG" indicators on the steady frequency control status screen display "0/5".

Note3: If the built-in crystal oscillator is backed up by an external battery, the radical frequency acquisition can be performed without the 30-minute warm-up time by selecting "No" from the warm-up selection screen (initial screen) displayed immediately after turning on the power.

2.5 Time Required for Satellite Tracking and Fixed-Position Calculation

In order to use the R3031 in locations where accurate position information is not available, the unit must track at least four GPS satellites immediately after turning on the power. The time taken to do this depends on the antenna installation conditions. It may take up to 15 minutes to track the first satellite, and about 60 minutes to track four satellites and complete the fixed-position calculation.

The satellite tracking statuses can be checked from the "SAT", "TRCK SAT", and "ACQ SAT" indicators under "SYSTEM STATUS". During the fixed-position calculation, "FIXING" is displayed for "POS MODE" and if the calculation is proceeding, the progress is displayed on the "POS MODE" line on the Position Measuring Screen. When the last fixed position has been calculated in about 60 minutes, the status indication shifts to "HOLD" automatically. If "HOLD" is not displayed within 60 minutes, four satellites have not yet been tracked. In this case, check the condition of the antenna and the cable connections.

If from one to three "SAT" indications are displayed for "SYSTEM STATUS", the latitude, longitude, and altitude of the installation location must be entered. If no satellites are tracked, check the condition of the antenna and the cable connections. If they are normal, the R3031 may have failed. In this case, contact the service department of Advantest, a local sales office, or an agency.

When Non-HOLD is set for POS MODE, this instrument does not go into HOLD mode and continually updates its current position. If the instrument is moved while in Non-HOLD mode, the current position is calculated according to the distance it is moved. Under these conditions, the normal output frequency deviation of $\pm 1 \times 10^{-11}$/day cannot be guaranteed because precision GPS radio wave control and ambient temperature variations of +23°C ± 1°C are not available.

Note 1: If no satellite can be tracked even though the antenna is installed in a good place, the setting of the initial position on the R3031 may be greatly different from the actual position. In this case, first set the position measuring mode (POS) on the steady position measuring screen to "HOLD", enter approximate values for the latitude and longitude (to the nearest degree), and then set the position measuring mode (POS) to "FIXING" to start the satellite tracking operation.

Note 2: The position measurement result calculated by "FIXING" contains errors inherent to the GPS system. Therefore, when multiple R3031 units are operated at the same time, the position measurement result by "FIXING" may vary slightly from unit to unit.

2.6 Generating High Stability Reference Signals

In order to generate reference signals with a high degree of stability, the R3031 requires that accurate position information be entered.
Prior to first time usage, or after any subsequent moves, check the position measuring screen to see if its current position information (latitude, longitude, and altitude) is displayed correctly. If the position information is incorrect or not precisely known, set the position measuring mode (POS MODE) to FIXING to determine the current position. To accomplish this, signals from at least four satellites must be used. It will take this instrument about one hour to determine its position using these signals.
When the current position has been fixed, POS MODE automatically changes from FIXING to HOLD. If the instrument is subsequently moved, change the POS MODE to FIXING again to redetermine the position.

If the current position (latitude, longitude, and altitude) can be determined using a map, you can enter the position information (provided the margin of error is not more than ± 50 m) into the R3031. Set POS MODE to HOLD, then set position information for LAT (latitude), LON (longitude), and HGT (altitude). If the information entered is incorrect, there is a possibility that this instrument will not be able to track satellites, so make sure the information is accurate.
Set POS MODE to Non-HOLD if you use this instrument while carrying it. The current position can be recalculated every second.
Under these conditions, the normal output frequency deviation of $\pm 1 \times 10^{-11}$/day cannot be guaranteed because precision GPS radio wave control and ambient temperature variations of +23°C ± 1°C are not available.

For details on how to set POS MODE, refer to Chapter 5 "Operation."

2.7 Cleaning, Storage, and Transportation

- Cleaning

  Clean the LCD protection filter periodically with a soft cloth.

  Note: Do not use an organic solvent such as benzine or acetone which may damage plastics.

- Storage

  The storage temperature range is -20°C to +60°C. When the R3031 will not be used for a long time, put a vinyl cover on it, or put the unit in a corrugated carton and store it in a dry place not exposed to direct sunlight.

- Transportation

  When transporting the R3031, use the original packing materials or equivalent ones. If the original package is missing, use a corrugated carton at least 5 mm thick. Stuff cushioning materials completely around the R3031, pack the accessories and more cushioning materials into the carton, close it, and then tie it with packing string.

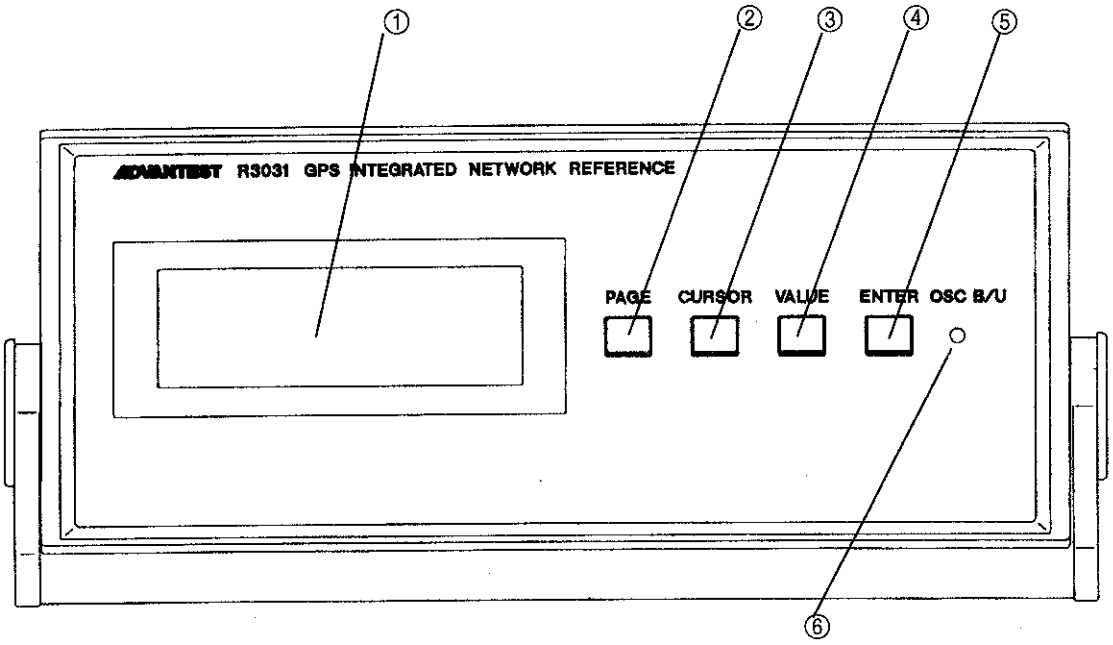
2.8 Notes on Use

WARNING!

1. ***If you notice smoke, abnormal sound or odor, turn off the power and unplug the power cable immediately.***
2. ***Do not open the case. The case of the R3031 is not intended to be opened by the user, and can only be opened by a customer engineer. There are high-temperature and high-voltage sections inside the R3031.***

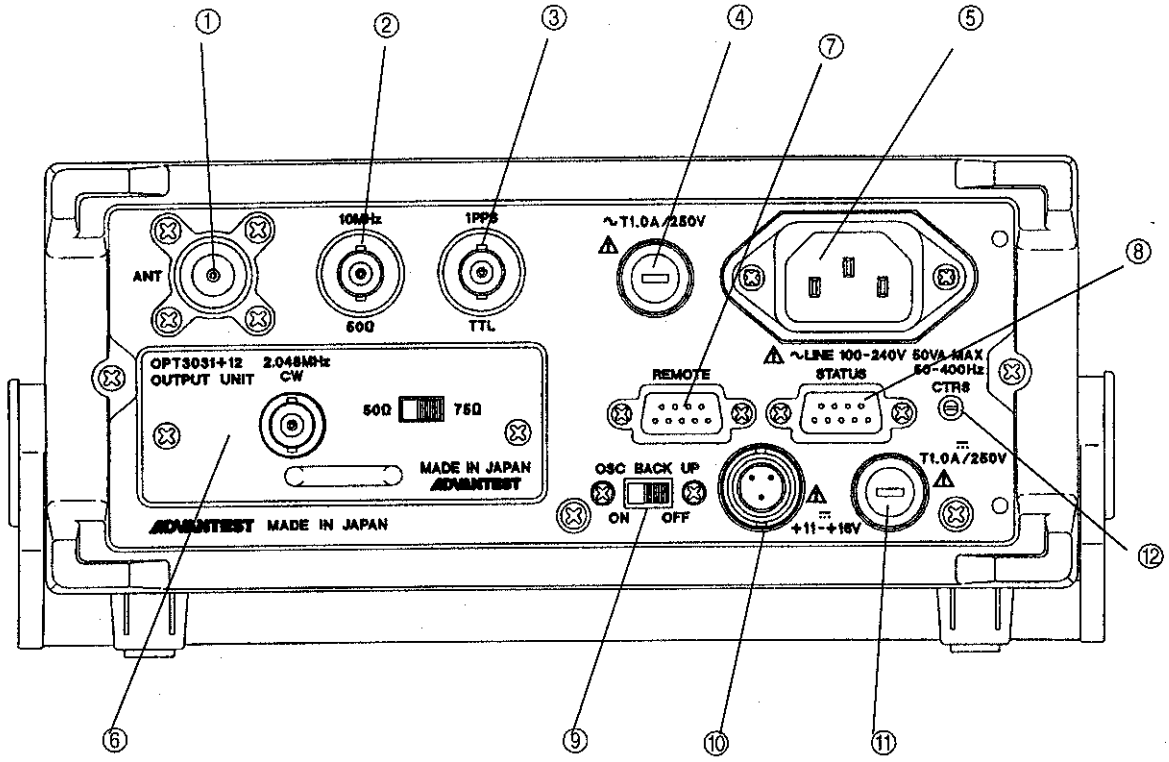
3 PANEL DESCRIPTIONS

3.1 Front Panel



① LCD display	Dot-matrix type LCD display with 20 characters by 4 lines
② PAGE key	In steady condition, the display information consists of eight pages that are switched by pressing this key.
③ CURSOR key	Used to select screen settings. Initially, the cursor is located to the left of the most significant digit of each setting. Each time this key is pressed, the cursor moves to the right. After reaching the least significant digit of setting, the cursor moves to the most significant digit of the next setting. After reaching the least significant digit of the last setting, the cursor moves to the most significant digit of the top setting.
④ VALUE key	Used to select the parameter setting at the cursor position and enter numerals.
⑤ ENTER key	Establishes the entry of selected or input items. The selected items are changed only when this key is pressed.
⑥ OSC B/U indicator	This indicator lights in green when DC power for crystal oscillator backup is input to the "OSC BACK UP" connector on the rear panel and the switch is turned on.

3.2 Rear Panel



① ANT input connector	This antenna input connector receives the 1.57542 GHz radio wave from the GPS satellites. This connector is an N-type connector with 50 ohm impedance.
② 10 MHz output connector	The frequency of this 10 MHz output signal is synchronized with the atomic frequency standard mounted on the GPS satellites. This connector is a BNC-type connector with 50 ohm impedance.
③ 1PPS output connector	This 1PPS output signal is the one-second signal for the Universal Time Coordinated (UTC) that is extracted from the received GPS radio waves. This connector is a BNC-type connector with the TTL level.
④ Fuse	This fuse is an AC power fuse. T1.0 A/250 V is used.
⑤ LINE input connector	This connector is used for AC input from 100 to 240 V without switching.
⑥ Option output	Mounted when there are optional specifications.
⑦ REMOTE connector	Used to transmit and receive serial data to/from an external device such as a personal computer.
⑧ STATUS connector	Used to output the operating condition of the R3031.
⑨ OSC BACK UP switch	Set this switch to "ON" to back up the built-in crystal oscillator by means of an external DC power supply.

⑩ DC input connector

Used as an input for an external DC power supply to back up the built-in crystal oscillator. The input voltage range is +11 to +16 V and the power consumption is 830 mA maximum.

⑪ Fuse

This fuse is an external DC input fuse. T1.0 A/250 V is used.

WARNING!

1. ***To protect the R3031 from fire hazards, be sure to use fuses of the same type and rating.***
2. ***Using the R3031 with a fuse of the wrong rating may damage the unit.***
3. ***When replacing the fuse, be sure to unplug the power cable from the R3031.***

⑫ LCD contrast adjustment knob

Used to adjust the contrast of the LCD display on the front panel.

4 OPERATING PROCEDURE

The R3031 is suitable both for use as an installed frequency standard and use on portably.

Note1: When using the R3031 as an installed frequency source
In this case, the GPS satellites must be continuously tracked as mentioned in (1) in subsection 1.2. Therefore, install the antenna on a roof, housetop, or other open space.

Note2: When using the R3031 on portably
In this case, it may not be possible to track the GPS satellites continuously if the antenna is installed in inferior conditions, and therefore the R3031 may not be able to track four GPS satellites immediately after turning on the power. If the R3031 can track at least one GPS satellite, the "POS MODE" indication displays "HOLD". In this case, frequency control can be performed by entering the position information including the latitude ("LAT"), longitude ("LON"), and altitude ("HGT"). If you use a map (1/25,000) issued by the Geographical Survey Institute of your country, the latitude and longitude can be calculated to the nearest second or less and the altitude to the nearest 10 m or less.
If no satellite can be tracked, the built-in crystal oscillator enters the free-run mode and the "FREQ" indication for "SYSTEM STATUS" changes to "HOLD/OVER". The output frequency in this case runs at an aging rate of $\pm 5 \times 10^{-10}$/day based on the last frequency accuracy that existed until that time. When GPS satellites have been tracked, the frequency stabilization operation is restarted. The output frequency precision does not change radically depending on the satellite tracking status.

Note3: Checking the position;
When the R3031 is moved, check the position measuring screen to see if its current position information (latitude, longitude, and altitude) is displayed correctly. If not, set the position measuring mode (POS MODE) to FIXING to determine the current position. When the position is incorrect, there is a possibility that the instrument will not be able to track satellites.
For details on POS MODE, refer to Section 2.6 "Generating High Stability Reference Signals."

4.1 Operating Procedure

(1) Turning the power on

- Connecting the R3031 to an AC power supply
  The R3031 does not have a power switch because it is designed for continuous operation. When you plug the power cable into an AC outlet, the R3031 starts operation immediately.
- Connecting the R3031 to an DC power supply (for crystal oscillator backup)
  This connection is used to back up the built-in crystal oscillator.

WARNING!
For DC power input, be sure to observe the polarity and the rated voltage range (+11 VDC to +16 VDC). Using the R3031 with the wrong polarity or voltage range may damage it.

Note1: When turning the power back on after turning it off, leave the R3031 for at least a minute, otherwise a self-diagnosis error may occur.

Note2: When turning the power on after keeping the R3031 at circumstance, a self-diagnosis error may occur due to variations in the oscillation start time of the built-in crystal oscillator. If this error occurs, first turn the power off, leave the R3031 for a minute or more, and then turn the power back on.

(2) Installation and connections

① Install the antenna.

Note: When the antenna is used on portably, install the antenna in an open space such as in front of a window.

② Connect the antenna to the R3031 with the antenna cable.

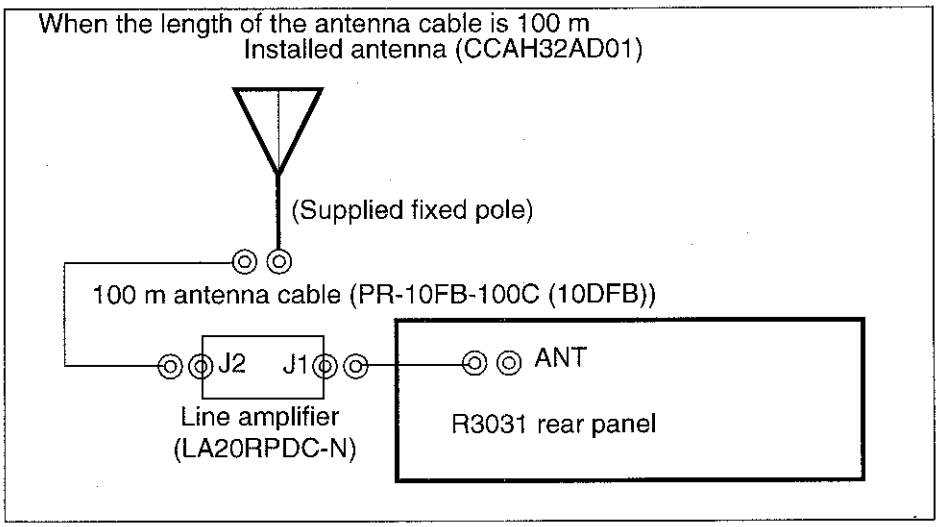


Figure 4-1a Example of Antenna Connection (Installed Antenna)

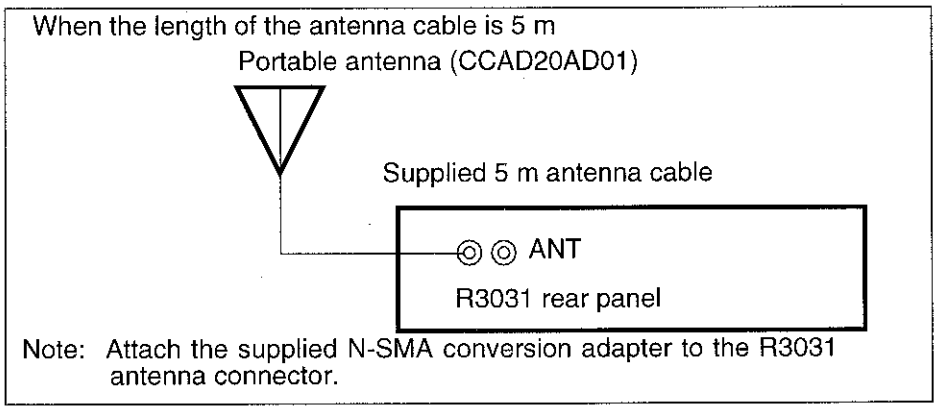


Figure 4-1b Example of Antenna Connection (Portable Antenna)

③ Plug the power cable into the AC inlet of the R3031.

④ Plug the power cable into the AC outlet.
The initial screen appears. (See subsection (3).)

(3) From the initial operation screen to the steady operation screen

①When the power is supplied, the following initial screen appears.

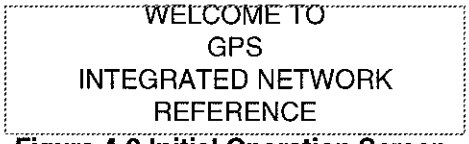


Figure 4-2 Initial Operation Screen

The self-diagnosis program is activated in several seconds and the following screen appears.

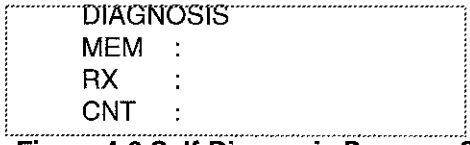


Figure 4-3 Self-Diagnosis Program Screen

When self diagnosis is completed, the following screen appears.

Normal case

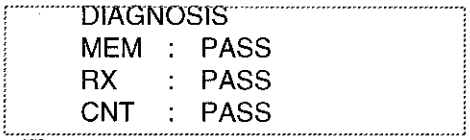


Figure 4-4 When the Result of Self Diagnosis is Normal

A message asking whether the built-in crystal oscillator is warmed up appears.

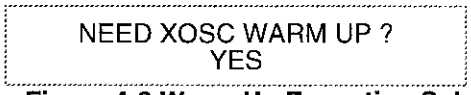


Figure 4-6 Warm-Up Execution Selection Screen

Abnormal case

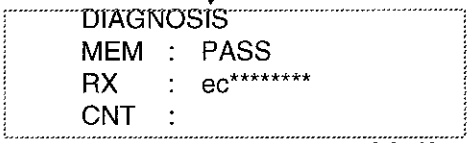


Figure 4-5 When the Result of Self Diagnosis is Abnormal

Execute the above procedure again from the beginning or inform Advantest's service department of the symptom.

② To warm up the built-in crystal oscillator, press the ENTER key *1; otherwise, select "NO" with the VALUE key and then press the ENTER key *2.

Note: ***If neither of the above operations is performed within 5 minutes, the R3031 assumes that "YES" was selected and starts warming up the built-in crystal oscillator.***

↓

The steady operation screen appears.

Note1: ***The R3031 takes about 60 minutes to warm up.***

The first 30 minutes are required to stabilize the crystal oscillator and the last 30 minutes are required to stabilize the system operation.

Note2: ***"NO" can be selected only when the built-in crystal oscillator is backed up by a battery.***

③ The steady operation screen is used to monitor the satellite tracking and frequency control statuses.

The steady operation screen consists of eight pages that are switched by the PAGE key. (See subsection (4).)

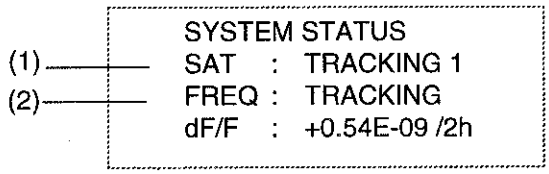


Figure 4-7 Initial Display of the Steady Screen

(1) "SAT" indicates the satellite tracking status.

"ACQUIRING" indicates that the R3031 is tracking the GPS satellites.
"TRACKING n" indicates that the R3031 has tracked n GPS satellites. It takes about 15 minutes after turning on the power to display "TRACKING n".

(2) "FREQ" indicates the frequency control status.

"ACQUIRING" indicates that the R3031 is performing frequency acquisition.
"TRACKING" indicates that the R3031 is performing frequency synchronization. It takes a maximum of 12 hours after turning on the power to display "TRACKING".

In addition, it takes about 24 hours to achieve the precision synchronization condition. The frequency departure of the R3031 can be monitored directly with "dF/F". In this case, the frequency control function displays the deviation with respect to the GPS signal.

The "HOLD/OVER" indication shows that frequency control is disabled. In this case, the cause is displayed on the 4th line as follows:

If the necessary number of satellites for frequency control could not be tracked,
"LACKING IN SAT" is displayed.
If the TI counter for phase difference detection incurs trouble,
"TI ERROR" is displayed.

Note ***If the number of satellites necessary for frequency control cannot be tracked, "HOLD/OVER" is displayed. If the necessary number of satellites have been tracked within one hour, the "FIL BK STG" and "CONT STG" indications remain unchanged; otherwise, both the "FIL BK STG" and "CONT STG" indications display "0/5" and the frequency acquisition mode is entered again. In the latter case, the dF/F calculation is initialized.***

④ (For installed type only)

In 48 hours after turning on the power, the "dF/F" indication displays "±1.00E-11/24h" or less, indicating that the frequency control operation is normal. However, if a power failure occurs, the built-in crystal oscillator stops and the specified stability cannot be achieved. If a power failure may occur, use of an uninterruptible power supply is recommended.

Note1: Checking the position;
When the R3031 is moved, check the position measuring screen to see if its current position information (latitude, longitude, and altitude) is displayed correctly. If not, set the position measuring mode (POS MODE) to FIXING to determine the current position. When the position is incorrect, there is a possibility that the instrument will not be able to track satellites.
For details on POS MODE, refer to Section 2.6 "Generating High Stability Reference Signals."

Note2: If satellite tracking is not completed in 15 minutes after turning on the power, set the position measuring mode (POS) on the position measuring screen to "HOLD", enter approximate values for the latitude and longitude (to the nearest degree), and then reset the position measuring mode (POS) to "FIXING".

Note3: If there are large variations in the ambient temperature or if the GPS radio wave reception conditions are inferior, the "dF/F" indication may not display "±1.00E-11/24h or less ".

(4) Steady operation screen

Upon completion of the initial screen, the following screens are displayed.
In steady condition, the display information consists of eight pages that are switched by the PAGE key.
For details on each screen, see chapter 5.

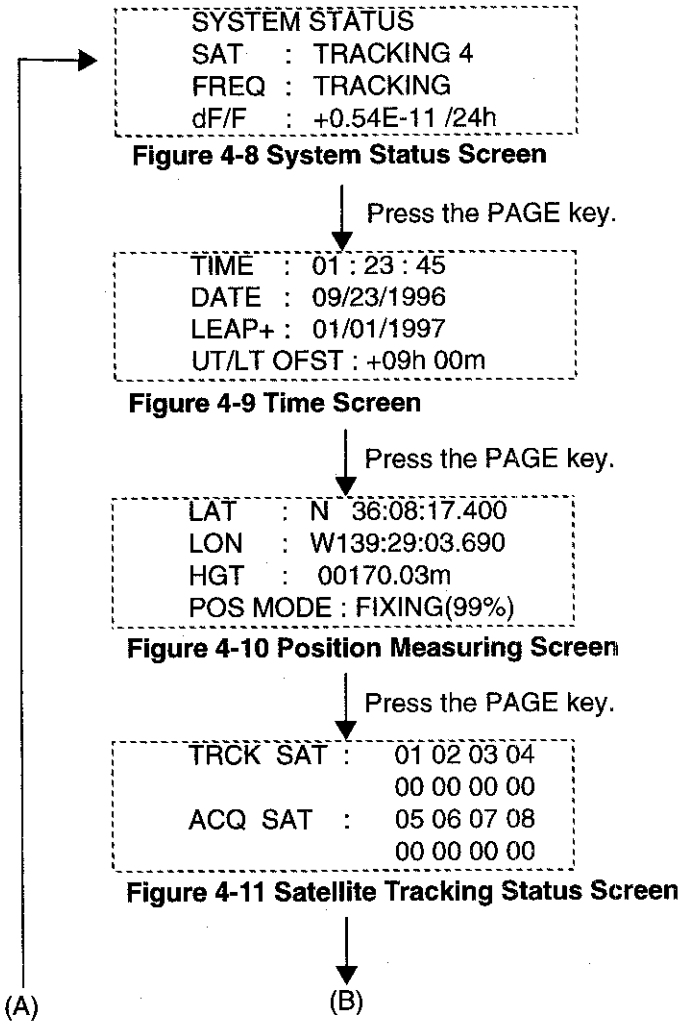


Figure 4-8 System Status Screen

Figure 4-9 Time Screen

Figure 4-10 Position Measuring Screen

Figure 4-11 Satellite Tracking Status Screen

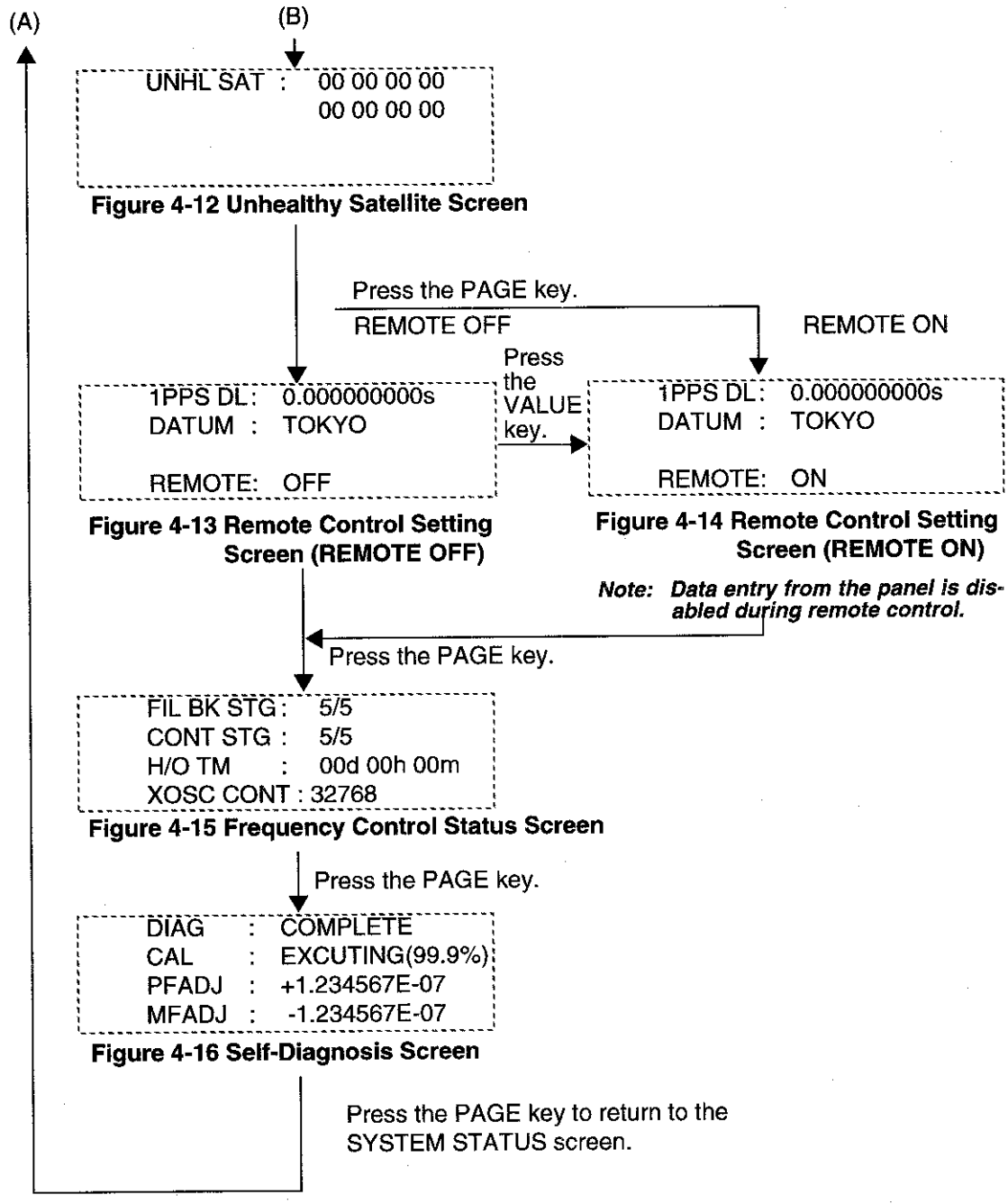


Figure 4-12 Unhealthy Satellite Screen

Figure 4-13 Remote Control Setting Screen (REMOTE OFF)

Figure 4-14 Remote Control Setting Screen (REMOTE ON)

Note: ***Data entry from the panel is disabled during remote control.***

Figure 4-15 Frequency Control Status Screen

Figure 4-16 Self-Diagnosis Screen

5 OPERATION

5.1 Basic Key Operation

"PAGE" key : Used to switch pages of the steady screen. There are eight pages of the steady screen.

"CURSOR" key : Used to select the parameter to be set. Pressing this key moves the cursor to the right within the same line or moves it from the bottom line to the top line.

"VALUE" key : Used to change the parameter setting.

"ENTER" key : Used to establish the selected parameter. If this key is not pressed, the parameter is not changed even if the display is changed.

5.2 Screen Description

There are two types of parameters displayed on the screen: parameters that are only displayed and parameters that can be set. The parameters that can be set are double-underlined.

(1) Warm-up execution selection screen

```
NEED XOSC WARM UP ?
YES
```

YES Warms up the built-in crystal oscillator.
NO Does not warm up the built-in crystal oscillator.

(2) System status screen

```
SYSTEM STATUS
SAT  :  TRACKING 4
FREQ :  TRACKING
dF/F  :  +0.54E-11 /24h
```

SAT : Satellite tracking status
- TRACKING4 Indicates the number of satellites that have been tracked.
- ACQUIRING Indicates that there is no satellite tracked and one or more satellites being tracked.
- No display Indicates that there is no satellite tracked and no satellites being tracked.

FREQ : Frequency control status
- TRACKING Indicates that the R3031 is under frequency synchronization.
- ACQUIRING Indicates that the R3031 is under frequency acquisition.
- HOLD/OVER Indicates that frequency control is disabled. The cause is displayed on the 4th line as follows:
  - "LACKING IN SAT" The necessary number of satellites could not be tracked during frequency control.
  - "TI ERROR" The TI counter for phase difference detection incurred trouble.
  - "WARM UP (**%)" The warmed-up sequence is proceeding. (The progress is displayed as a percentage.)

dF/F: **.**E-**/*** Output frequency precision and measuring time (Settings: 1m, 10m, 30m, 2h, 12h, 24h)

(3) Time screen

```
TIME  :  01 : 23 : 45
DATE  :  09/23/1996
LEAP+:  01/01/1997
UT/LT OFST : +09h 00m
```

TIME :	**:**:**	Time (hour:minute:second)
DATE:	**/**/**	Date (month/day/year)
LEAP :	**/**/**	Notice on a leap second (month/day/year)
UT/LT OFST :	***h **m	Offset time to convert world time to local time h: -23 to +23, m: 00 to 59

(4) Position measuring screen

```
LAT   :  N 36:08:17.400
LON   :  W139:29:03.690
HGT   :       00170.03m
POS MODE : FIXING (99%)
```

LAT :	***: **:**.***	Latitude setting N00:00:00.000 to N90:00:00.000 S00:00:00.000 to S90:00:00.000
LON :	****: **:**.***	Longitude setting W000:00:00.000 to W180:00:00.000 E000:00:00.000 to E180:00:00.000
HGT :	******.**m	Altitude setting (-1000.00 to +18000.00) (Sea level)
POS MODE:		Position measuring mode
	FIXING	Current position is under measurement.
	HOLD	Position is fixed.
	Non-HOLD	The current position is always being recalculated (because the R3031 position is not fixed).

Note1: ***The latitude, longitude, and altitude settings are valid only when POS MODE is HOLD.***

Note2: ***When S00:00:00.000 and W000:00:00.000 are set and the power is turned off, N00:00:00.000 and E000:00:00.000 will result the next time the power is turned on.***

Note3: ***When Non-HOLD mode is set, the output frequency deviation of*** $\pm 1 \times 10^{-11}$ ***/day cannot always be guaranteed because the current position is not fixed.***

Note4: ***Checking the position;***
When the R3031 is moved, check the position measuring screen to see if its current position information (latitude, longitude, and altitude) is displayed correctly. If not, set the position measuring mode (POS MODE) to FIXING to determine the current position. When the position is incorrect, there is a possibility that the instrument will not be able to track satellites.
For details on POS MODE, refer to Section 2.6 "Generating High Stability Reference Signals."

(5) Satellite tracking status screen

```
TRCK SAT  :01 02 03 04
           00 00 00 00
ACQ  SAT  :05 06 07 08
           00 00 00 00
```

TRCK SAT : ** ** ** ** Indicates the IDs of the satellites which have been tracked (01 to 32).
ACQ SAT : ** ** ** ** Indicates the IDs of the satellites which are currently being tracked (01 to 32).

(6) Unhealthy satellite screen

```
UNHL SAT  : 00 00 00 00
            00 00 00 00
```

UNHL SAT : ** ** ** ** Indicates the IDs of unhealthy (defective) satellites (01 to 32).

(7) Remote control setting screen

```
1PPS DL:  0.000000000s
DATUM  :  TOKYO

REMOTE:   OFF
```

```
1PPS DL:  0.000000000s
DATUM  :  TOKYO

REMOTE:   ON
```

1PPS DL: 0.000******s Correction value according to the antenna cable length (0.000000000s to 0.000999999s)
DATUM : ****** Geodetic system setting (See subsection A.2.)
Set "TOKYO" for use in Japan.
REMOTE : Remote control status
OFF Remote control off
ON Remote control on (Data entry from the panel is disabled.)

(8) Frequency control status screen

```
FIL BK STG  :  5/5
CONT STG    :  5/5
H/O TM      :  00d 00h 00m
XOSC CONT   :  32768
```

FIL BK STG :*/* Internal operation status (filter band switching status)
Initial condition : 0/5 (wide band)
Steady condition : 5/5 (narrow band)
CONT STG :*/* Internal operation status (loop gain switching status)
Initial condition : 0/5 (high gain)
Steady condition : 5/5 (low gain)
H/O TM: **d **h **m Elapsed time for the "HOLD/OVER" status
XOSC CONT : ***** Frequency adjustment value for the built-in crystal oscillator
Can be set only when the "HOLD/OVER" condition is met.
(0 to 65535 $\fallingdotseq$ -2×10^{-7} to $+2\times10^{-7}$)

(9) Self-diagnosis screen

```
DIAG  :  COMPLETE
CAL   :  EXCUTING(99.9%)
PFADJ :  +1.234567E-07
MFADJ :  -1.234567E-07
```

DIAG : ******** Self-diagnosis program (for checking the operation of the built-in GPS receiver and the time interval counter)

EXECUTE	Execution command
EXECUTING	During execution
COMPLETE	Completed
ec********	Error (*: error code)

CAL : ********* Automatic frequency control range measurement for the built-in crystal oscillator

EXECUTE	Execution command
EXECUTING(**.*%)	During execution
COMPLETE	Completed

Note: Cannot be executed when either "FIL BK STG" or "CONT STG" in the frequency control status screen is 0/5.

PFADJ : +*.******E-** Displays the positive maximum value within the frequency control range measured through the CAL operation. Can be set manually.
+0.000001E-10 to +9.999999E-05

MFADJ : -*.******E-** Displays the negative maximum value within the frequency control range measured through the CAL operation. Can be set manually.
+0.000001E-10 to +9.999999E-05

5.3 Parameter Setting

(1) NEED XOSC WARM UP ? YES/NO

YES : When turning the power on after keeping the R3031 at a cold stand by select "YES" to warm up the unit for about 30 minutes to stabilize the built-in crystal oscillator.

NO : When the power is turned off while the built-in crystal oscillator of the R3031 is backed up by an external battery and then the power is turned back on, select "NO". This omits the warming up of the built-in crystal oscillator.

(2) FREQ:WARM UP (**%) **= 00 to 99

Indicates the progress setting for the 30-minute warm-up sequence. The warm-up time can be shortened by increasing the progress setting.

(3) dF/F measurement time: 1m/10m/30m/2h/12h/24h

Normally, set the measurement time to 24 hours (the largest setting) with the highest measurement precision. In 48 hours after turning on the power, make sure that the deviation of the output frequency (dF/F) is ±1E-11 or less (POS MODE : HOLD). Although the measurement precision becomes low, the short-time frequency acquisition status can be monitored by reducing the measurement time.

Note 1: ***The measurement time cannot be selected during acquisition of the initial data ("--------/1m" is displayed).***

Note 2: ***In 48 hours after turning on the power, the dF/F data is affected by frequency acquisition and therefore the "dF/F" indication may exceed ±1E-11.***

Note 3: ***If there are large variations in the ambient temperature or if the GPS radio wave reception conditions are inferior, the "dF/F" indication may exceed ±1E-11.***

Note 4: ***Select the measurement time in the steady condition from 1 minute (1m), 10 minutes (10m), 30 minutes (30m), 2 hours (2h), 12 hours (12h), and 24 hours (24h).***

Time after turning on the power	*Selectable measurement time*
Within 1 hour	*1 minute*
Within 2 hours	*1 minute, 10 minutes*
Within 12 hours	*1 minute, 10 minutes, 30 minutes*
Within 24 hours	*1 minute, 10 minutes, 30 minutes, 2 hours*
Within 48 hours	*1 minute, 10 minutes, 30 minutes, 2 hours, 12 hours*
After 48 hours	*1 minute, 10 minutes, 30 minutes, 2 hours, 12 hours, 24 hours*

The display format for each measurement time is the fixed decimal point format. If the measured value for each measurement time is 9.99 or more, the indication displays "±9.99E-**!".

1 minute	*"±*.**E-06"*	
10 minutes	*"±*.**E-07"*	
30 minutes	*"±*.**E-08"*	
1 hour	*"±*.**E-09"*	
12 hours	*"±*.**E-10"*	
24 hours	*"±*.**E-11"*	** indicates a number from 0 to 9.*

Note 5: ***When the measurement time is changed by using the VALUE key, be sure to press the ENTER key to establish the settings.***

(4) UT/LT OFST: Universal time/local time conversion (**h**m=00h00m to ±23h59m)

When using the R3031 in Japan, set 9 hours and 00 minute (+09h00m), which is the offset time of the Japanese standard time (JST) from the world time.

(5) LAT : Latitude (N/S**:**:**.***)
LON : Longitude (E/W***:**:**.***)
HGT : Altitude (±*****.**)
POS MODE (Position measuring mode: FIXING/HOLD)

If four or more satellites can be tracked with the air conditions where the R3031 antenna is installed, set the position measuring mode to "FIXING". In this condition, statistical processing of the position measurement result is made. Then, in one hour, the R3031 enters the fixed-position mode automatically using the result of the processing as the fixed position information. In the fixed-position mode, frequency stabilization with at least one satellite is possible.
If four or more satellites cannot be tracked with the air conditions where the R3031 antenna is installed, set the position measuring mode to "HOLD" after turning on the power and then enter the position information (with an error of ±50 m or less) calculated using a map. In this condition, frequency stabilization with at least one satellite is possible.
To calculate the present position with a precision of 100 m or less, a map (1/25,000 or 1/50,000 scale) issued by the Geographical Survey Institute of Your country can be used.
In order to generate reference signals with a high degree of stability, the R3031 requires that accurate position information be entered.
Prior to first time usage, or after any subsequent moves, check the position measuring screen to see if its current position information (latitude, longitude, and altitude) is displayed correctly. If the position information is incorrect or not precisely known, set the position measuring mode (POS MODE) to FIXING to determine the current position. To accomplish this, signals from at least four satellites must be used. It will take this instrument about one hour to determine its position using these signals.
When the current position has been fixed, POS MODE automatically changes from FIXING to HOLD. If the instrument is subsequently moved, change the POS MODE to FIXING again to redetermine the position.
If the current position (latitude, longitude, and altitude) can be determined using a map, you can enter the position information (provided the margin of error is not more than ± 50 m) into the R3031.
Set POS MODE to HOLD, then set position information for LAT (latitude), LON (longitude), and HGT (altitude). If the information entered is incorrect, there is a possibility that this instrument will not be able to track satellites, so make sure the information is accurate.
Set POS MODE to Non-HOLD if you use this instrument while carrying it. The current position can be recalculated every second.
Under these conditions, the normal output frequency deviation of $\pm 1 \times 10^{-11}$/day cannot be guaranteed because precision GPS radio wave control and ambient temperature variations of +23°C ± 1°C are not available.

(6) 1PPS DL: Delay time correction for the one-second signal (0.000******s=0 to 000999999ns)

The one-second signal output from the R3031 synchronizes with the one second of the Universal Time Coordinated (UTC) within 1 μs at the position installed antenna. Set the delay time correction for the one-second signal (1PPS DL) when the delay time caused by the antenna cable length is to be entered and the one-second signal output from the R3031 will be synchronized with the one second of the Universal Time Coordinated (UTC) within 1 μs.
When the recommended antenna cable is used, set the following delay time; otherwise, check the cable specifications and then set an appropriate delay time.

Recommended antenna cable for the R3031	Set delay time (s)
PR-10FB-100C(10DFB)(100 m)	0.000000408 s
PR-5FB-50C(5DFB)(50 m)	0.000000423 s

(7) DATUM: Geodetic system setting

When the position display and position information are to be entered based on the Tokyo geodetic system used in Japan, set "TOKYO". When they are to be entered based on the GPS geodetic system, set "WGS-84". For details on the geodetic system used in each country, see the geodetic system table in subsection A.2 in the Appendix.

(8) REMOTE: Remote control (ON/OFF)

To enable remote control with a personal computer, set this parameter to "ON". In the remote control mode, the setting of the page and this parameter can be changed. To disable remote control, set this parameter to "OFF".

(9) XOSC CONT: Frequency control data for the built-in crystal oscillator (0 to 65535)

This parameter is frequency control data for the built-in crystal oscillator. When receiving the GPS radio waves, the internal microprocessor changes this data and therefore manual setting is disabled.
When the "HOLD/OVER" condition lasts for a long time in which the GPS radio waves cannot be received, the 10 MHz output frequency of the R3031 varies at an aging rate of $\pm 5\times10^{-10}$/day, $\pm 1\times10^{-8}$/month, or $\pm 2\times10^{-8}$/year. In this condition, by changing this parameter within a range from 0 to 65535 while monitoring the 10 MHz output frequency on a frequency counter using other frequency standards as the reference, the output frequency can be manually calibrated within a range of about $\pm 2\times10^{-7}$. The minimum resolution is about 6×10^{-12} per one digit.

(10) DIAG: Self-diagnosis program status (Activated: EXECUTE, Executing: EXECUTING, Terminated: COMPLETE)

Set this parameter to execute the self-diagnosis program for maintenance of the R3031. Normally, this parameter is set to "COMPLETE". To execute the self-diagnosis program, change this parameter to "EXECUTE" and then press the ENTER key. Normally, the execution time is about 15 seconds. While the program is being executed, "EXECUTING" is displayed and when it is completed, "COMPLETE" is displayed. If an error occurs, the error code is displayed and the self-diagnosis program is terminated. In this case, contact a local office of ADVANTEST.

(11) CAL (Activated: EXECUTE, Executing: EXECUTING, Terminated: COMPLETE, Progress: **.**%)

The R3031 enters the high-speed frequency acquisition mode immediately after turning on the power, in order to achieve a frequency deviation of $\pm 1 \times 10^{-9}$ or less within one hour. To do this, accurate positive and negative maximum values for the variable frequency range of the built-in crystal oscillator are required. When CAL is executed, the R3031 measures the value accurately utilizing the GPS radio waves. The CAL operation takes about 4 hours to perform. To cancel the CAL operation, change the "EXECUTING" indication to "STOP" and then press the ENTER key.
If the R3031 is turned on or off frequently, for example, when used portably, execute CAL once every six months.

Note1: ***CAL can be activated only when both the "FIL BK STG" and "CONST STG" indicators display "1/5" or higher.***

Note2: ***Upon completion of the CAL operation, both the "FIL BK STG" and "CONT STG" indications display "0/5" and the R3031 enters the frequency acquisition mode again.***

(12) PFADJ: Positive maximum value of frequency range (+*.******E-**)
MFADJ: Negative maximum value of frequency range (-.******E-**)

These parameters make it possible to display the maximum value for the variable frequency range calculated by the CAL operation as well as set the maximum value for the variable frequency range measured by other methods.

* To obtain the maximum value for the variable frequency range without the CAL function, a frequency counter may be used to measure them using other frequency standards as the reference. In this case, disable the reception condition of the R3031 and set "XOSC CONT" to "65535" (for the positive maximum value of the variable frequency range) or "0" (for the negative maximum value of the variable frequency range).

6 ANTENNA AND CABLE CONNECTIONS

To allow the R3031 to receive the GPS radio waves, an antenna and cable must be connected to lead the radio waves into the unit. This section describes how to connect the antenna and cable.

(1) Configuration

The R3031 uses the built-in GPS receiver to receive the GPS radio waves. Therefore, an antenna must be installed on an open space.

(2) Antenna

The R3031 supplies +5 V to the antenna line to activate the antenna built into the preamplifier. The maximum output current of the antenna is 50 mA. When using an antenna other than the supplied accessory, check the power consumption before connecting it to the antenna connector of the R3031.
The recommended portable antenna mentioned in subsection 1.3 is provided with an antenna cable with an SMA connector. When using this antenna, use the supplied N/SMA conversion adapter.

(3) Cable connection conditions

When using other than the recommended cable mentioned in subsection 1.3, observe the following points:

- Use a low-loss coaxial cable with a characteristic impedance of 50 ohms.
- The average field strength of the GPS radio waves is about -130 dBm at the ground surface. The recommended reception field strength for the R3031 ranges from -110 dBm to -85 dBm. Select the specifications and the length of the cable so that this condition is satisfied.

(4) Determining the reception condition

The reception condition can be determined by means of the "SAT" indication under "SYSTEM STATUS" on the LCD on the front panel. When the "SAT" indication displays "ACQUIRING", the GPS satellites are being tracked; when it displays "TRACKING n", n GPS satellites have been tracked.
As detailed reception condition information, the "TRCK SAT" indication displays the IDs of the satellites that have been tracked and the "ACQ SAT" indication displays the IDs of the satellites that are currently being tracked. Install the antenna in a location such that the "TRCK SAT" indication displays the most IDs of the tracked satellites.

Note ***When either of the following conditions is met, the "FREQ" indication for "SYSTEM STATUS" changes to "HOLD/OVER":***

1. ***When "FIXING" is displayed for "POS MODE" in the position measuring screen, three satellites or less have been tracked.***
2. ***When "HOLD" is displayed for "POS MODE" in the position measuring screen, no satellites have been tracked.***

(5) Antenna connection

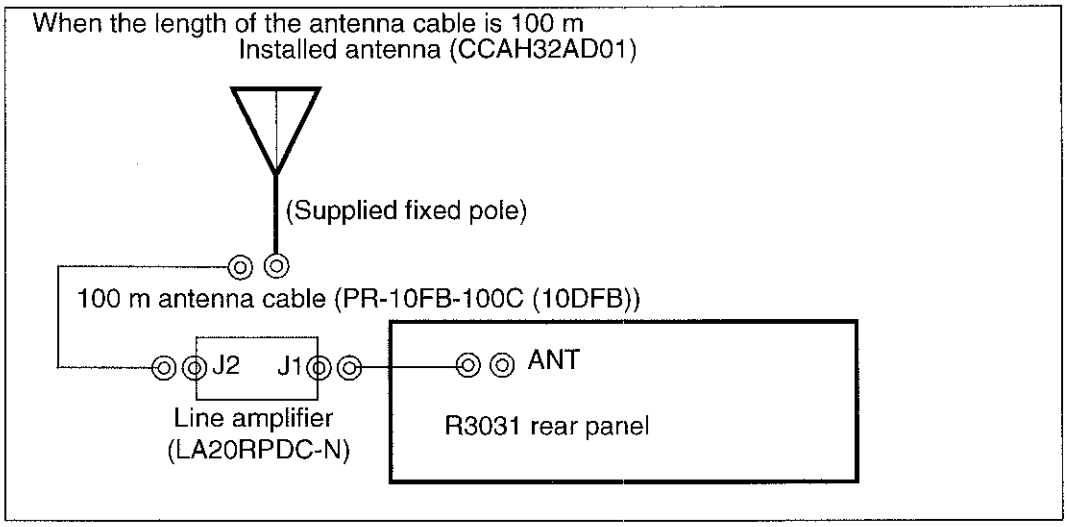


Figure 6-1a Example of Antenna Connection (Installed Antenna)

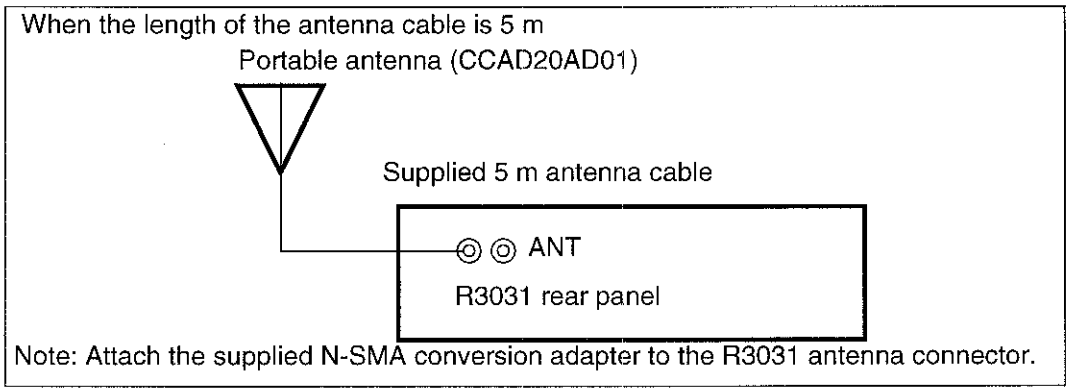


Figure 6-1b Example of Antenna Connection (Portable Antenna)

7 EXAMPLE USE

The R3031 must receive the GPS signal correctly to generate a highly stable reference signal. Although the purpose of the R3031 is not position measurement, the R3031 must track four satellites about 60 minutes after turning on the power to generate the Universal Time Coordinated (UTC), which is the reference signal for frequency control.

However, when the location information (latitude, longitude, and altitude) of the R3031 is available, at least one satellite can be tracked by entering the location information, allowing the Universal Time Coordinated (UTC) to be generated and frequency control to be performed normally.

7.1 When Four or More Satellites Can Be Tracked

Operating procedure

① Make sure that the power voltage conforms to the power requirement of the R3031 and then plug the power cable into an AC outlet.
The R3031 executes self-diagnosis. If no failure is detected, the following message appears.

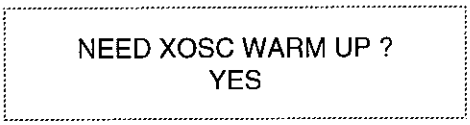


Figure 7-1 Warm-Up Execution Selection Screen

② When turning the power on, press the ENTER key to warm up.
In the case of warming up sufficiently and a build-in crystal oscillator being backed up by external batteries even if a main power is off, select "NO" with the VALUE key and then press the ENTER key because warm-up time is unnecessary.

③ When the steady operation screen appears , press the PAGE key to display the position measurement screen and then, set the POST MODE to FIXING.

Note: ***Checking the position;***
When the R3031 is moved, check the position measuring screen to see if its current position information (latitude, longitude, and altitude) is displayed correctly. If not, set the position measuring mode (POS MODE) to FIXING to determine the current position. When the position is incorrect, there is a possibility that the instrument will not be able to track satellites.
For details on POS MODE, refer to Section 2.6 "Generating High Stability Reference Signals."

This completes the operation.
The following messages appears and automatic satellite tracking is started and at the same time, the system executes the frequency control algorithem. However the following shown time is necessary to generate the high stabilized signal.
The R3031 can display dF/F(output frequency precision) and the status of frequency stability can be monitored by using this value.

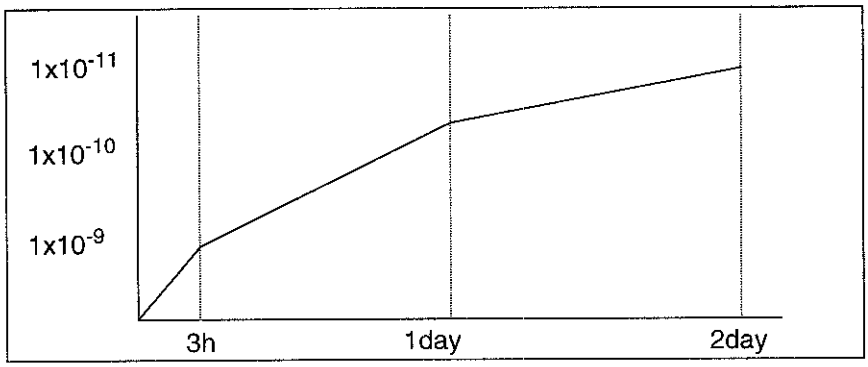


Figure 7-2 Warm-Up Characteristics (Standard)

```
SYSTEM STATUS
SAT  :  TRACKING 4
FREQ :  TRACKING
dF/F  :  +3.54E-11 /24h
```

Figure 7-3 Precision Monitoring Screen

7.2 When Four or More Satellites Cannot Be Tracked

When four or more satellites cannot be tracked, the position information (latitude, longitude, and altitude) must be entered.

Operating procedure

① Make sure that the power voltage conforms to the power requirement of the R3031 and then plug the power cable into an AC outlet.
The R3031 executes self-diagnosis. If no failure is detected, the following message appears.

```
NEED XOSC WARM UP ?
YES
```

Figure 7-4 Warm-Up Execution Selection Screen

② When the steady operation screen appears, press the PAGE key twice to display the following screen.

```
LAT   :  N xx : xx : xx. xxx
LON   :  Wxxx:xx : xx. xxx
HGT   :        xxxxxx. xxm
POS MODE : FIXING (99%)
```

Figure 7-5 Position Information Entry Screen

③ Using the CURSOR key, the VALUE key, and the ENTER key respectively, set the POS MODE to HOLD and then enter the current latitude "LAT", longitude "LON", and altitude "HGT".

This completes the operation.
The following messages appears and automatic satellite tracking is started and at the same time, the system executes the frequency control algorithm. However the following time is required to generate the high stable out put signal.
The R3031 displays the dF/F(output frequency precision) and the status of frequency stability can be monitored by using this value.

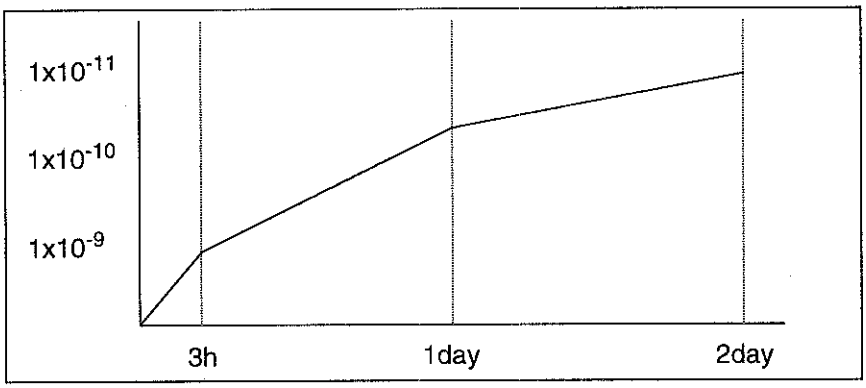


Figure 7-6 Warm-Up Characteristics (Standard)

```
SYSTEM STATUS
SAT  :  TRACKING 1
FREQ :  TRACKING
dF/F  :  +3.54E-11 /24h
```

Figure 7-7 Precision Monitoring Screen

Note: ***If the present location is entered incorrectly, the correct output frequency deviation cannot be obtained.***

8 I/O INTERFACES

This section provides the specifications of the input and output signals for the R3031 and the necessary conditions to obtain high-precision frequencies.

8.1 GPS Radio wave Input and Antenna Feed Output

The R3031 requires an antenna to receive the GPS radio waves. Antennas other than the recommended one can be used so long as the following specifications are satisfied:

Input frequency :	1.575 GHz
Recommended input level:	Approx.-85 dBm to -110 dBm/50 ohms
Feed output:	+5 VDC, 50 mA maximum
Number of channels :	1
Connector:	N-type receptacle

8.2 10 MHz Output

The R3031 is provided with a standard 10 MHz output with the following specifications:

Output frequency :	10 MHz
Precision:	$<\pm 1\times10^{-11}$/day to UTC
Output level :	0.5 Vrms or more
Output waveform:	Sine wave
Output impedance :	Nominal 50 ohms
Connector:	BNC-type receptacle

8.3 UTC1pps Output

This signal is the 1 Hz signal regenerated from the GPS radio waves.

Output period:	1 second
Precision:	$\pm 1\,\mu s$ or less to UTC
Output level :	TTL
Duty :	Hi:Lo = 200 ms:800 ms
On-time edge polarity:	Negative
Output connector :	BNC-type receptacle

8.4 System Monitor Output

The frequency acquisition (ACQ), frequency precision control (TRACKING), hold over (H/O), and system alarm (ALM) signals are output from the STATUS terminal on the rear panel.

1. Frequency acquisition signal (ACQ) — Set to "ON" if neither "FIL BK STG" nor "CONT STG" reaches 5/5.
2. Frequency precision control signal (TRACKING) — Set to "ON" if both "FIL BK STG" and "CONT STG" reach 5/5.
3. Hold over signal (H/O) — Set to "ON" if no satellites are tracked and frequency control is disabled.
4. System failure signal (ALM) — Set to "ON" if a failure is detected by self diagnosis.

Output connector: 9-pin, D-SUB, male
Output format : Open collector
Maximum drive current: 30 mA
Maximum applied voltage: 30 V
Pin assignment

Pin No.	Signal name	Pin No.	Signal name
1	ACQ (HOT)	6	ACQ (RTN)
2	TRACKING (HOT)	7	TRACKING (RTN)
3	H/O (HOT)	8	H/O (RTN)
4	ALM (HOT)	9	ALM (RTN)
5	GND		

8.5 Built-In Crystal Oscillator Backup Input

When using the R3031 on site, if a DC voltage of +11 to +16 VDC is supplied to this input during transportation, rapid frequency acquisition can be performed when the power is turned on. The maximum power consumption is 830 mA.

Pin No.	Signal name
1	GND
2	N.C
3	+11V to +16V

Applicable connector: PM12BPG-3S
(Hirose Electric Co., Ltd.)

8.6 Remote Control and Data Input/Output

When "REMOTE" is set to "ON" in the remote control setting screen, remote control using the REMOTE terminal on the rear panel is enabled.

Output data: Time, date, notice on a leap second, position, IDs of tracked satellites, IDs of satellites being tracked, filter bank stage, control stage, Elapsed H/O time, frequency control data, output frequency departure, output frequency departure measurement time, position measuring mode, progress of position measurement, self diagnosis result, and control range for built-in crystal oscillator

Input data: LCD display page, output frequency departure measurement time, position measuring mode, remote on/off, position, position measuring mode, UTC1pps, output phase adjustment, geodetic system setting, frequency control data, self diagnosis activation, calibration activation, local time offset, and control range for built-in crystal oscillator

Interface: RS-232

Communication parameter: 9600 baud, 8 bits, 1 start bit, 1 stop bit, no parity bit

Communication mode: Start-stop system, DCE

I/O connector : 9-pin, D-SUB, male

Pin assignment

Pin No.	Signal name	Pin No.	Signal name
1	N.C	6	N.C
2	RxD	7	N.C
3	TxD	8	N.C
4	N.C	9	N.C
5	GND		

Remote control code list :

No.	Command name	Header	Bytes	Status request input data	Contents	I/O	Example transmit/receive data
1	Page	KP	5	N/A	d (steady screen page) 0 to7	I	Receive format: KPd<CR><LF> Example receive data: 1 page KP1<CR><LF>
2	dF/F Output frequency precision	TR	6	N/A	Receive data: tt 1 minute: 06 2 hours: 09 10 minutes: 07 12 hours: 10 30 minutes: 08 24 hours: 11	I	Receive format: TRtt<CR><LF> Example receive data: 1minute TR06<CR><LF>
		TS	11	?	Transmit data: gdddvtt: g (sign) + : 0, - : 1 ddd (mantissa) 000 to 999 v 0: normal, 1: overflow tt (measurement time) Same as receive data.	O	Transmit format: TSgdddvtt<CR><LF> Example transmit data: +1.23E-11/24h TS0123011<CR><LF> Example transmit data: HOLD OVER: TS9999999<CR><LF>
3	TIME Time	TA	10	?	hh (hour) 00 to 23 mm (minute) 00 to 59 ss (second) 00 to 60	O	Transmit/receive format: TAhhmmss<CR><LF> Example transmit data: 23 hours, 59 minutes, 59 seconds TA235959<CR><LF>

Status request : To read parameter and data setting from the R3031, append "?", "CR", and "LF" at the end of each command.
Example: To request dF/F, send TS?<CR><LF>.

No.	Command name	Header	Bytes	Status request input data	Contents	I/O	Example transmit/receive data
4	DATE Date	DA	12	?	mm (month) 01 to 12 dd (day) 01 to 31 yyyy (year) 0000 to 9999	O	Transmit/receive format: DAmmddyyyy<CR><LF> Example transmit data: 01:07:19 DA01071999<CR><LF>
5	LEAP Notice on a leap second	LP	13	?	g (sign) +: 0, -: 1 mm (month) 01 to 12 dd (day) 01 to 31 yyyy (year) 1996 to 2999	O	Transmit format: LPgmmddyyyy<CR><LF> Example transmit data: July 1st, 1996, positive leap second LP007011996<CR><LF> Notice on a leap second is not given. LP000000000<CR><LF>
6	UT/LP OFST Universal time/local time conversion offset	AB	9	?	g (sign) +: 0, -: 1 hh (hour) 00 to 23 mm (minute) 00 to 59	I/O	Transmit/receive format: ABghhmm<CR><LF> Example transmit/receive data: +9 hours, 00 minute AB00900<CR><LF>
7	LAT Latitude	LA	14	?	w (direction) N: 0, S: 1 dd (degree) 00 to 90 mm (minute) 00 to 59 sssss (second) 00000 to 59999	I/O	Transmit/receive format: LAwddmmsssss<CR><LF> Example transmit/receive data: North, 36 degrees, 08 minutes, 17.400 seconds LA0360817400<CR><LF>
8	LON Longitude	LO	15	?	w (direction) E: 0, W: 1 ddd (degree) 00 to 180 mm (minute) 00 to 59 sssss (second) 00000 to 59999	I/O	Transmit/receive format: LOwdddmmsssss<CR><LF> Example transmit/receive data: East, 139 degrees, 29 minutes, 03.690 seconds LO01392903690<CR><LF>
9	HGT Altitude	HG	12	?	Meters above sea level g (sign) +: 0, -: 1 hhhhh (integer part) 00000 to 18000 pp (decimal place) 00 to 99	I/O	Transmit/receive format: HGghhhhhpp<CR><LF> Example transmit/receive data: +123.4 m above sea level HG0001234<CR><LF>
10	POS MODB Position measuring mode	PM	5	?	d (position measuring mode) 0: FIXING, 1: HOLD 2: Non-HOLD	I/O	Transmit/receive format: PMd<CR><LF> Example transmit/receive data: FIXING mode PM0<CR><LF>
11	Position measuring progress as a percentage	PG	7	?	ddd (position measuring progress as a percentage) 000 to 100	O	Transmit format: PGddd<CR><LF> Example transmit data: 99% PG099<CR><LF>
12	TRACK SAT ID list for satellites being tracked	ST	20	?	dd (satellite ID) 00 to 37 (00 indicates that there are no satellites being tracked.)	O	Transmit format: STddddddddddddddddd<CR><LF> Example transmit data: Satellites 00 to 08 are being tracked. ST0102030405060708<CR><LF>
13	ACQ SAT ID list for tracked satellites	SA	20	?	dd (satellite ID) 00 to 37 (00 indicates that there are no tracked satellites.)	O	Transmit format: SAddddddddddddddddd<CR><LF> Example transmit data: Satellites 09 to 16 have been tracked. SA0910111213141516<CR><LF>
14	UNHL SAT ID list for unhealthy satellites	SH	20	?	dd (satellite ID) 00 to 37 (00 indicates that there are no unhealthy satellites.)	O	Transmit format: SHddddddddddddddddd<CR><LF> Example transmit data: Satellites 17 to 24 are unhealthy. SH1718192021222324<CR><LF>
15	1pps DL UTC1pps Cable delay compensation time	AZ	10	?	dddddd (delay time (ns)) 000000 to 999999	I/O	Transmit/receive format: AZdddddd<CR><LF> Example transmit/receive data: 1 ns AZ000001<CR><LF>
16	DATUM Geodetic system	DM	6	?	dd (DATUM) 01 to 49	I/O	Transmit/receive format: DMdd<CR><LF> Example transmit/receive data: TOKYO DM46<CR><LF>
17	REMOTE Remote control	RO QU	4	N/A	Remote control ON Remote control OFF	I	Receive format: RO<CR><LF> Receive format: QU<CR><LF>

No.	Command name	Header	Bytes	Status request input data	Contents	I/O	Example transmit/receive data
18	FIL STG Filter bank stage	FS	5	?	d (stage No.) 0 to 5	O	Transmit format: FSd<CR><LF> Example transmit data: Stage 5 FS5<CR><LF>
19	CNT STG Control stage	CS	5	?	d (stage No.) 0 to 5	O	Transmit format: CSd<CR><LF> Example transmit data: Stage 5 CS5<CR><LF>
20	H/O TM Hold/over time	HO	11	?	v (overflow) 0: normal F: overflow dd (day) 00 to 99 hh (hour) 00 to 24 mm (minute) 00 to 60	O	Transmit format: HOvddhhmm<CR><LF> Example transmit data: 12th, 23 hours, 45 minutes HO0122345<CR><LF>
21	XOSC CONT Data for built-in crystal oscillator control	XD	9	?	ddddd 00000 to 65535	I/O	Transmit/receive format: XDddddd<CR><LF> Example transmit/receive data: 01234 XD01234<CR><LF>
22	DIAG Self diagnosis	DG	13	?	x (command) 0:complete (transmit command only) 1:execute (receive command only) 2:executing (transmit command only) dddddddd (error code) 00000000 to FFFFFFFF	I/O	Transmit format: DGxddddddddd<CR><LF> Example transmit data GPS RX CHANNEL 1 CORRELATION TEST ERROR DG016000000<CR><LF> Receive format DGx<CR><LF> Example receive data execute DG1<CR><LF>
23	CAL Calibration	CL	5	?	x (command) 0:complete (transmit command only) 1:execute (receive command only) 2:executing (transmit command only) 3:stop (receive command only)	I/O	Transmit/receive format: CLx<CR><LF> Example receive data execute CL1<CR><LF> Example transmit data complete
24	CAL Calculation progress	CG	8	?	dddd (progress as a percentage) 000.0 to 100.0	O	Transmit format: CGdddd<CR><LF> Example transmit data 99.9% CG0999<CR><LF>
25	PFADJ Positive maximum value of the built-in crystal oscillator control range	PF	13	?	dddddddd (mantissa) 0000000 to 9999999 ee (exponent) 05 to 10	I/O	Transmit/receive format: PFddddddddee<CR><LF> Example transmit/receive data: +1.234567E-07 PF123456707<CR><LF>
26	MFADJ Negative maximum value of the built-in crystal oscillator control range	MF	13	?	dddddddd (mantissa) 0000000 to 9999999 ee (exponent) 05 to 10	I/O	Transmit/receive format: MFddddddddee<CR><LF> Example transmit/receive data: +1.234567E-07 MF123456707<CR><LF>
27	WARM UP Selection of warm-up	WY WN	4	N/A	Executes the warm-up sequence. Omits the warm-up sequence.	I	Receive format: WY<CR><LF> Receive format: WN<CR><LF>
28	WARM UP Progress of the warm-up sequence	WG	7	?	ddd (progress as a percentage) 000 to 100	O	Transmit format WGddd<CR><LF> Example transmit data 99% WG099<CR><LF>

No.	Command name	Header	Bytes	Status request input data	Contents	I/O	Example transmit/receive data
29	Packed data output interval	PC	5	N/A	x 0 : Disables packed data output. 1 : Enables packed data output (1-second intervals)	I	Receive format: PCx <CR><LF> Example receive data: Packed data output setting PC1 <CR><LF>
30	Packed data output		27	N/A	hh (hour) 00 to 23 mm (minute) 00 to 59 ss (second) 00 to 60 MM (month) 01 to 12 dd (day) 01 to 31 yyyy(year) 0000 to 9999 s:(number of satellites being tracked) 0 to 8 f (frequency control status) 0 Initial or warm-up 1 ACQUIRING 2 TRACKING 3 HOLD/OVER g (dF/F sign) +: 0, -: 1 ddd (dF/F mantissa) 000 to 999 v (overflow) 0: normal,1: overflow tt (exponent)	O	Transmit format: DPhhmmssMMddyyyysfgdddvtt<CR><LF> Example transmit data: 01 hour, 23 minutes, 45 seconds, Jan. 23th, 1996 Eight satellites being tracked Frequency control: TRACKING Frequency deviation +0.12E-11 DP012345012319968200120 11<CR><LF>

Note1: The remote control function may stop if many remote control commands are entered rapidly. To recover the remote control function, turn the power off and then back on. To prevent the remote control function from stopping, put a wait time into the transmit timing for each remote control command.

Note2: N/A denotes "Not available".

Note3: The number of bytes in the table includes the header, CR, and LF.

8.7 Optional Outputs

The following frequencies can be output optionally in addition to the 10 MHz standard output frequency.

8.7.1 List of Output Frequencies

Name	Option code	Specifications					
		Frequency	Level	Output impedance	Waveform	Number of outputs	Connector
64kHz OUT option	OPT3031+10	64 kHz + 8 kHz + 0.4 kHz or 64 kHz + 8 kHz can be switched between.	$1V_{0\text{-}P}\pm10\%$	110 ohms	AMI	1	D-SUB 9pin female
1.544MHz OUT option	OPT3031+11	1.544MHz	0.5Vrms or more	50 or 75 ohms can be switched between.	Sine wave	1	BNC
2.048MHz OUT option	OPT3031+12	2.048MHz	0.5Vrms or more	50 or 75 ohms can be switched between.	Sine wave	1	BNC
3.58MHz OUT option	OPT3031+13	3.58MHz	0.5Vrms or more	50 or 75 ohms can be switched between.	Sine wave	1	BNC
5MHz OUT option	OPT3031+14	5MHz	0.5Vrms or more	50 or 75 ohms can be switched between.	Sine wave	1	BNC
6.312MHz OUT option	OPT3031+15	6.312MHz	0.5Vrms or more	50 or 75 ohms can be switched between.	Sine wave	1	BNC
27MHz OUT option	OPT3031+16	27MHz	$0.7Vrms\pm20\%$	50 or 75 ohms can be switched between.	Sine wave	1	BNC
155.52MHz OUT option	OPT3031+17	155.52MHz	0.3Vrms or more	50 ohms	Sine wave	1	SMA

8.7.2 64 kHz Output Options

The 64 kHz OUT frequency is output in the form of the AMI waveform. The two types of violation (8 kHz and 8 kHz + 0.4 kHz) can be switched between. The electrical specifications comply with the central clock recommendation in Article 1.2.2 in ITU-T, G703.

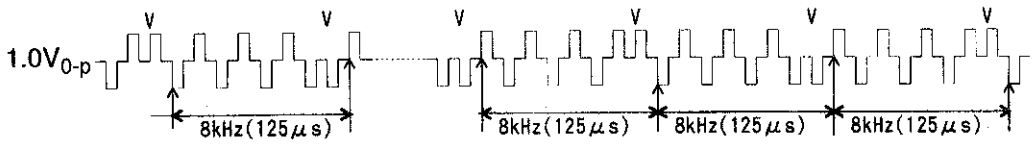
(1) Output connector: 9-pin, D-SUB female

(2) Pin assignment

PIN No.	Signal name	PIN No	Signal name
1	HOT	6	N.C
2	RTN	7	N.C
3	SHIELD	8	N.C
4	N.C	9	N.C
5	N.C		

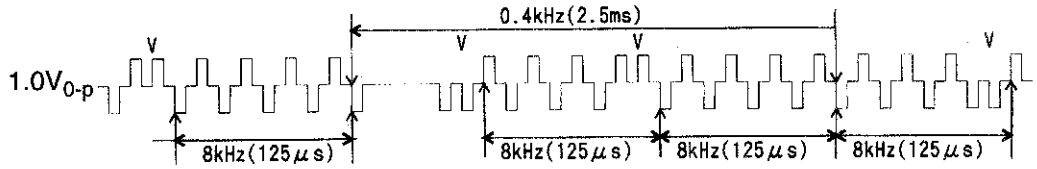
(3) Timing chart

① 64kHz+8kHz



V denotes violation. V is inserted 125 μs intervals.

② 64kHz+8kHz+0.4kHz



V denotes violation. V is inserted in 125 μs intervals and removed in 2.5 ms intervals.

9 OPERATING PRINCIPLE

The GPS receiver in the R3031 receives the radio waves from the GPS satellites to obtain highly stable frequencies by synchronizing the crystal oscillator frequency with the demodulated Universal Time Coordinated (UTC) signal (UTC1pps).

To achieve precision frequency synchronization, the R3031 employs a unique digital signal processing system named Frequency Locked Loop (FLL).

The GPS radio waves are received by the GPS receiver and then the UTC1pps signal (θi) is generated; this is the reference timing signal for the R3031. The phase comparator (TI counter) detects the phase difference between (θi) and the output of the crystal oscillator (θo). Based on the variations in the detected phase difference per unit time, the loop filter (software algorithm) calculates the frequency control data for the crystal oscillator to suppress the variations and then controls the oscillating frequency of the crystal oscillator by means of a D/A converter. By repeating this operation, highly stable frequencies with an ultra-high precision that are synchronized with the atomic frequency standard mounted on the GPS satellites can be obtained.

The loop filter consists of an estimation operator that suppresses radio wave transmission and S/A noise, a proportional operator that achieves high-speed frequency acquisition, and an integration operator that maintains the high-precision frequency synchronization condition.

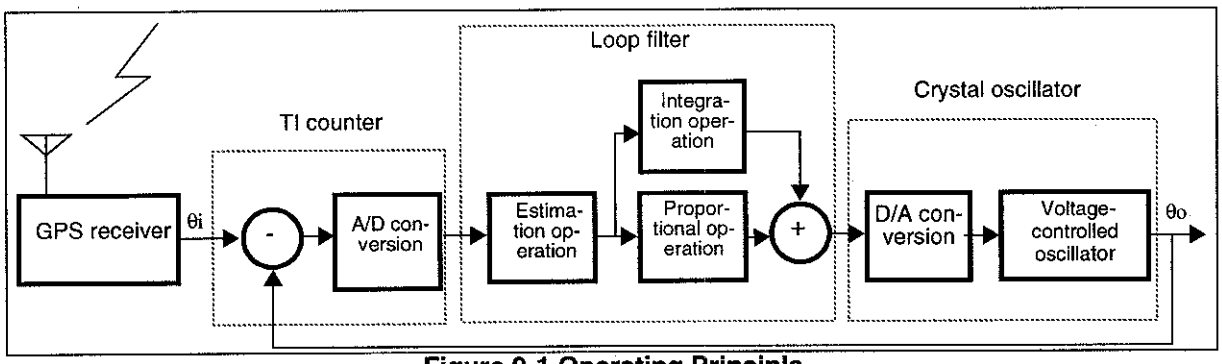


Figure 9-1 Operating Principle

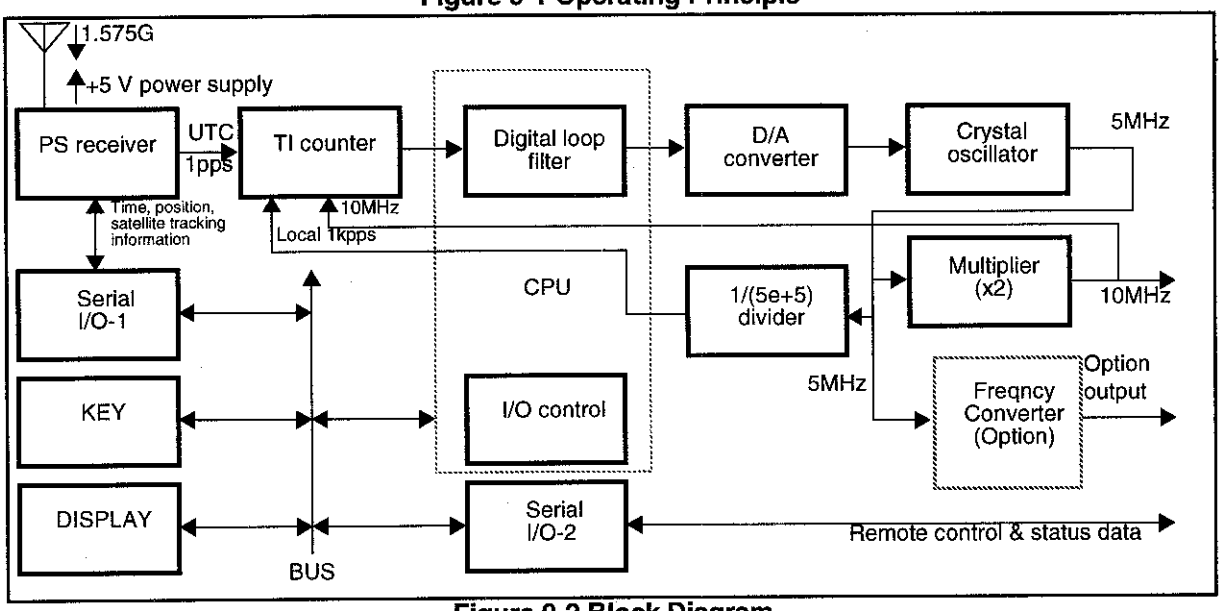


Figure 9-2 Block Diagram

10 SPECIFICATIONS

- GPS radio wave input
  - Frequency: 1575.42 MHz
  - Code: C/A (COARSE/ACQUISITION)
  - Maximum number of satellites tracked: 8
  - Minimum necessary number of satellites tracked: 1 (However, if the position information is not available, at least four satellites must be tracked only in the position measuring mode.)

- 10 MHz output (POS MODE : HOLD)
  - Frequency stability: During precision control by the GPS radio waves
    Root Allan Variance $\sigma y(\tau) < 5\times10^{-12}/\ \tau = 1$ day
    (with ambient temperature variations of +23 °C±1 °C)
  - GPS radio wave turned off, no tracked satellites
    Aging rate $<\pm5\times10^{-10}$/day
  - Frequency deviation: $<\pm1\times10^{-11}$/day (during precision control by the GPS radio waves, with ambient temperature variations of +23°C±1 °C)
  - Frequency acquisition time:
    $<\pm1\times10^{-9}$/10 minutes, in 1 hour after turning on the power (when backed up by an external battery)
    $<\pm1\times10^{-9}$/10 minutes, in 3 hours after turning on the power (when not backed up by an external battery)
    $<\pm1\times10^{-10}$/12hours, in 24 hours after turning on the power
  - Level: 0.5 Vrms or more / nominal 50 ohms
  - Waveform: Sine wave
  - Number of outputs: 1

- Universal Time Coordinated (UTC) 1pps output (UTC1pps)
  - Timing precision: ±1 μs or less (to the UTC)
    (during precision control by the GPS radio waves)
  - Level: TTL (Negative edge on-time to the UTC)
  - Number of outputs: 1

- Monitor display
  Position data, time (UTC, local time), satellite tracking status, output frequency departure, frequency control status

- Operation input
  Position data, local time offset

- System monitor output
  Electrical interface: Open collector
  Monitored data : Frequency acquisition, precise frequency control, hold/over, system alarm
  Number of outputs: 1 for each monitor data, a total of 4

- Remote control and data I/O
  Interface: RS-232
  Monitor data and all operation input data items
  Number of outputs: 1

- Plug-in slot
  1 slot (for optional frequency output)

- Option output
  In addition to the standard 10 MHz frequency, one of the following outputs can be selected and implemented.

- Power voltage
  100 VAC/200 VAC automatic switching
  Power voltage for 100 VAC operation : 100 to 120 V
  Power voltage for 220 VAC operation : 220 to 240 V
  Power consumption : 50 VA maximum
  Frequency : 50/60/400 Hz

  Built-in crystal oscillator backup input
  Inputs +11 to +16 VDC from an external battery.
  Built in when a precision of 10^{-9} or higher is required in 1 hour after turning on the power. Backs up the built-in crystal oscillator.

- Operating environment Temperature: 0°C to +40 °C
  Humidity: 85% RH or less

- Storage temperature range -20°C to +60°C

- Dimensions Approx. 212 (W) × 88 (H) × 360 (D) (excluding the antenna and cable)

- Mass 3.5 kg or less (excluding the antenna and cable)

Appendix

A.1 Abbreviations

Many abbreviations are used in the parameter screen of the R3031. The following shows the meaning of each abbreviation.

DIAGNOSIS: Self diagnosis

- MEM: Indicates the pass/fail condition of the internal memory with "PASS", "ec********".
- RX: Indicates the pass/fail condition of the GPS receiver with "PASS", "ec********".
- CNT: Indicates the pass/fail condition of the built-in counter with "PASS", "ec********".

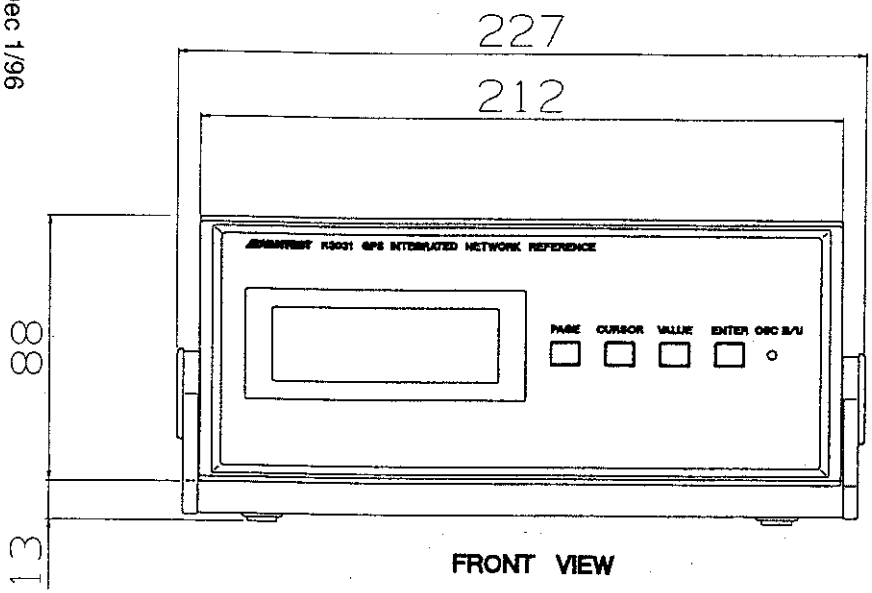
SYSTEM STATUS: Indicates the condition of the R3031 and parameter settings.

- SAT: Satellite tracking status
- FREQ: Frequency acquisition status
- dF/F: Frequency departure
- TIME: Current time
- DATE: Current date
- LEAP: Notice on a leap second
- UT/LT OFST: Offset hours and minutes to convert the UTC to the local time
- LAT: Latitude
- LOT: Longitude
- HGT: Altitude
- POS MODE: Current position measuring status
- TRCK SAT: IDs of the satellites that have been tracked
- ACQ SAT: IDs of the satellites currently being tracked
- UNHL SAT: IDs of unhealthy (defective) satellites
- 1PPS DL: Delay time compensation value for the antenna cable length
- DATUM: Geodetic system setting
- REMOTE: Remote control mode
- FIL BK STG: Internal operation status display
- CONT STG: Internal operation status display
- XOSC CONT: Control value for the built-in crystal oscillator (0 to 65535)
- DIAG: Self diagnosis
- CAL: Calibration of the built-in crystal oscillator
- PFADJ: Positive maximum value within the frequency control range for the built-in crystal oscillator
- MFADJ: Negative maximum value within the frequency control range for the built-in crystal oscillator

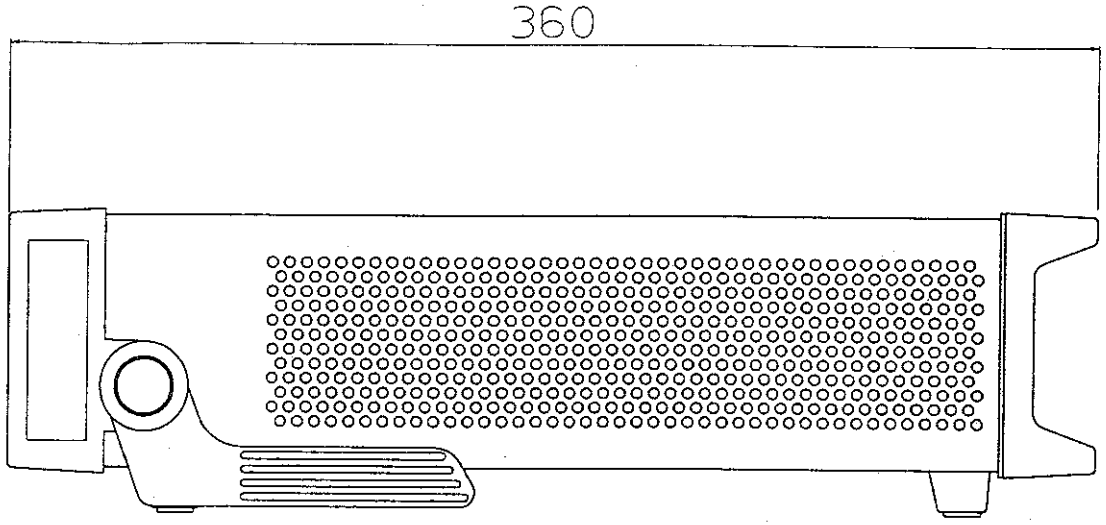
A.2 DATUM

LCD indication	ID	LOCAL GEODETIC SYSTEM	ELLIPSOID	DX	DY	DZ
ARC_1950	1	ARC_1950	Clarke_1880	-143.0	-90.0	-294.0
ARC_1960	2	ARC_1960	Clarke_1880	-160.0	-8.0	-300.0
AUST_1966	3	AUSTRALIAN_GEODETIC_1996	Australian_National	-133.0	-48.0	+148.0
AUST_1984	4	AUSTRALIAN_GEODETIC_1984	Australian_National	-134.0	-48.0	+149.0
BOGOTA_OBS	5	BOGOTA_OBSERVATORY	International	+307.0	+304.0	-318.0
CAMPO_INCHAU	6	CAMPO_INCHAUSPE	International	-148.0	+136.0	+90.0
CAPE	7	CAPE	Clarke_1880	-136.0	-108.0	-292.0
CARTHAGE	8	CARTHAGE	Clarke_1880	-263.0	+6.0	+431.0
CHATHAM_1971	9	CHATHAM_1971	International	+175.0	-38.0	+113.0
CHUA_ASTRO	10	CHUA_ASTRO	International	-134.0	+229.0	-29.0
CORREGO_ALLE	11	CORREGO_ALLEGRE	International	-206.0	+172.0	-6.0
EURO_1950_WE	12	EUROPEAN_1950_WestEurope	International	-87.0	-96.0	-120.0
EURO_1950_CY	13	EUROPEAN_1950_CYPRUS	International	-104.0	-101.0	-140.0
EURO_1950_EG	14	EUROPEAN_1950_EGYPT	International	-130.0	-117.0	-151.0
EURO_1950_IR	15	EUROPEAN_1950_IRAN	International	-117.0	-132.0	-164.0
EURO_1950_SI	16	EUROPEAN_1950_SICILY	International	-97.0	-88.0	-135.0
EURO_1979	17	EUROPEAN_1979	International	-86.0	-98.0	-119.0
GANDAJIKA	18	GANDAJIKA_BASE	International	-133.0	-321.0	+50.0
GEO_1949	19	GEODETIC_DATUM_1949	International	+84.0	-22.0	+209.0
HJORSEY	20	HJORSEY_1955	International	-73.0	+46.0	-86.0
IND (Thai)	21	INDIAN (Thailand/Vietnam)	Everest	+214.0	+836.0	+303.0
IND(Bungl)	22	INDIAN (Bngldsh/India/Nepal)	Everest	+289.0	+734.0	+257.0
IRE_1965	23	IRELAND_1965	Airy_Modified	+506.0	-122.0	+611.0
KERTAU_1948	24	KERTAU_1948	Everest_modified	-11.0	+851.0	+5.0
LIBERIA_1964	25	LIBERIA_1964	Clarke_1880	-90.0	+40.0	+88.0
LUZON	26	LUZON	Clarke_1866	-133.0	-77.0	-51.0
MASSAWA	27	MASSAWA	Bessel_1841	+639.0	+405.0	+60.0
MERCHICH	28	MERCHICH	Clarke_1880	+31.0	+146.0	+47.0
MINNA	29	MINNA	Clarke_1880	-92.0	-93.0	+122.0

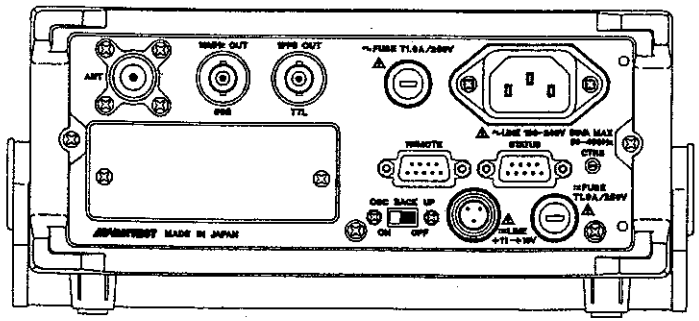
LCD indication	ID	LOCAL GEODETIC SYSTEM	ELLIPSOID	DX	DY	DZ
NAHRWAN	30	NAHRWAN	Clarke_1880	-247.0	-148.0	+369.0
NA_1927_CON	31	NORTH_AMERICAN_ 1927_CONUS	Clarke_1866	-8.0	+160.0	+176.0
NA_1927_AL	32	NORTH_AMERICAN_ 1927_ALASKA	Clarke_1866	-5.0	+135.0	+172.0
NA_1927_CAN	33	NORTH_AMERICAN_ 1927_CANADA	Clarke_1866	-10.0	+158.0	+187.0
NA_1927_C_AM	34	NORTH_AMERICAN_ 1927_C_AMER	Clarke_1866	-0.0	+125.0	+194.0
NA_1983	35	NORTH_AMERICAN_1983	GRS-80	-0.0	-0.0	0.0
OLD_EGYPTIAN	36	OLD_EGYPTIAN	Helmert_1906	-130.0	+110.0	-13.0
OLD_HAWAIIAN	37	OLD_HAWAIIAN	Clarke_1866	+61.0	-285.0	-181.0
OMAN	38	OMAN	Clarke_1880	-346.0	-1.0	+224.0
BR_1936	39	ORD_SRVY_GRT_BRITAIN_1936	Airy	+375.0	-111.0	+431.0
PIT_AS_1967	40	PITCAIRN_ASTRO_1967	International	+185.0	+165.0	+42.0
QUAT_NAT	41	QUATAR_NATIONAL	International	-128.0	-283.0	+22.0
QORNOQ	42	QORNOQ	International	+164.0	+138.0	-189.0
SCHWARZECK	43	SCHWARZECK	Bessel_1841_in_Nambia	+616.0	+97.0	-251.0
SA_1969	44	SOUTH_AMERICA_1969	South_America_1969	-57.0	+1.0	-41.0
TIMB_1948	45	TIMBALAI_1948	Everest	-689.0	+691.0	-46.0
TOKYO	46	TOKYO	Bessel_1841	-128.0	+481.0	+664.0
ZANDERIJ	47	ZANDERIJ	International	-265.0	+120.0	-358.0
WGS-1972	48	WGS-1972	WGS-72	-0.0	-0.0	+4.5
WGS-1984	49	WGS-1984	WGS-84	-0.0	-0.0	0.0



FRONT VIEW

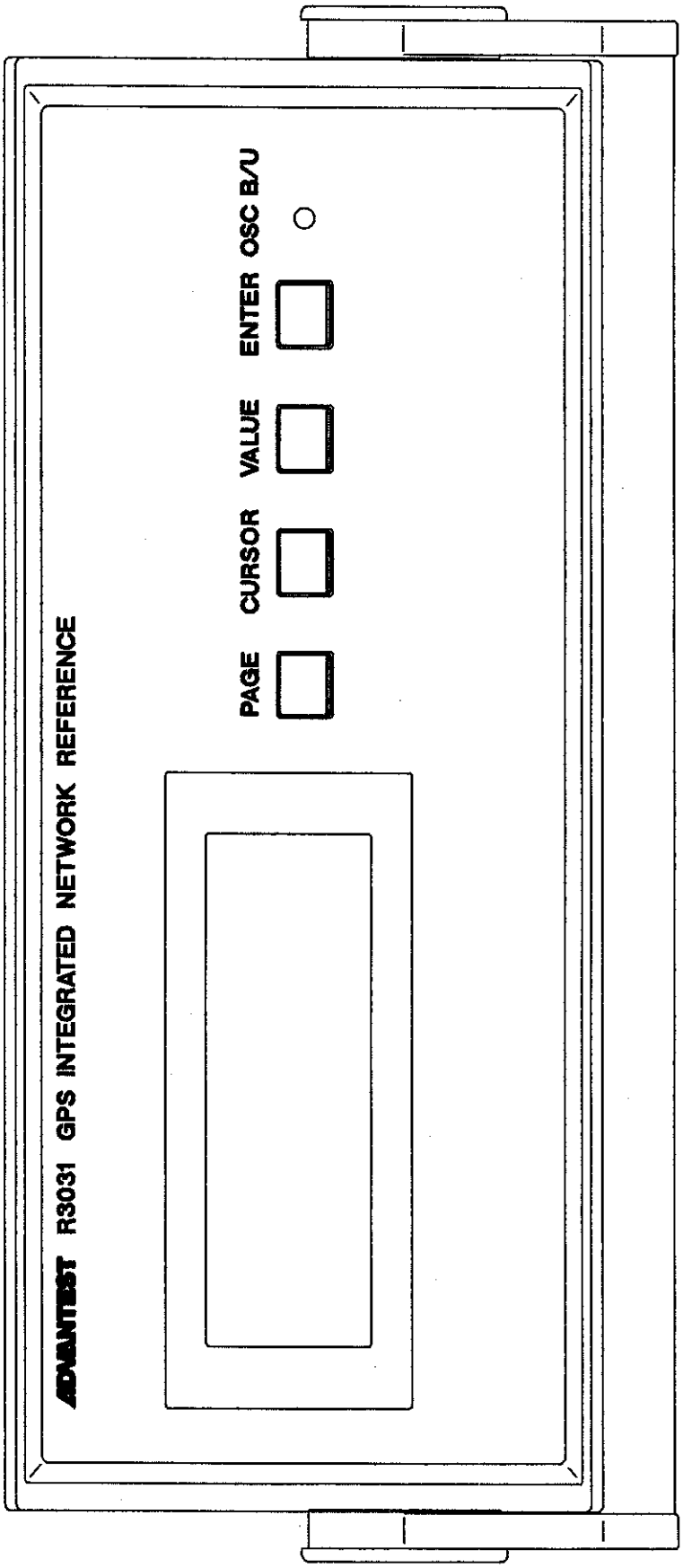


SIDE VIEW

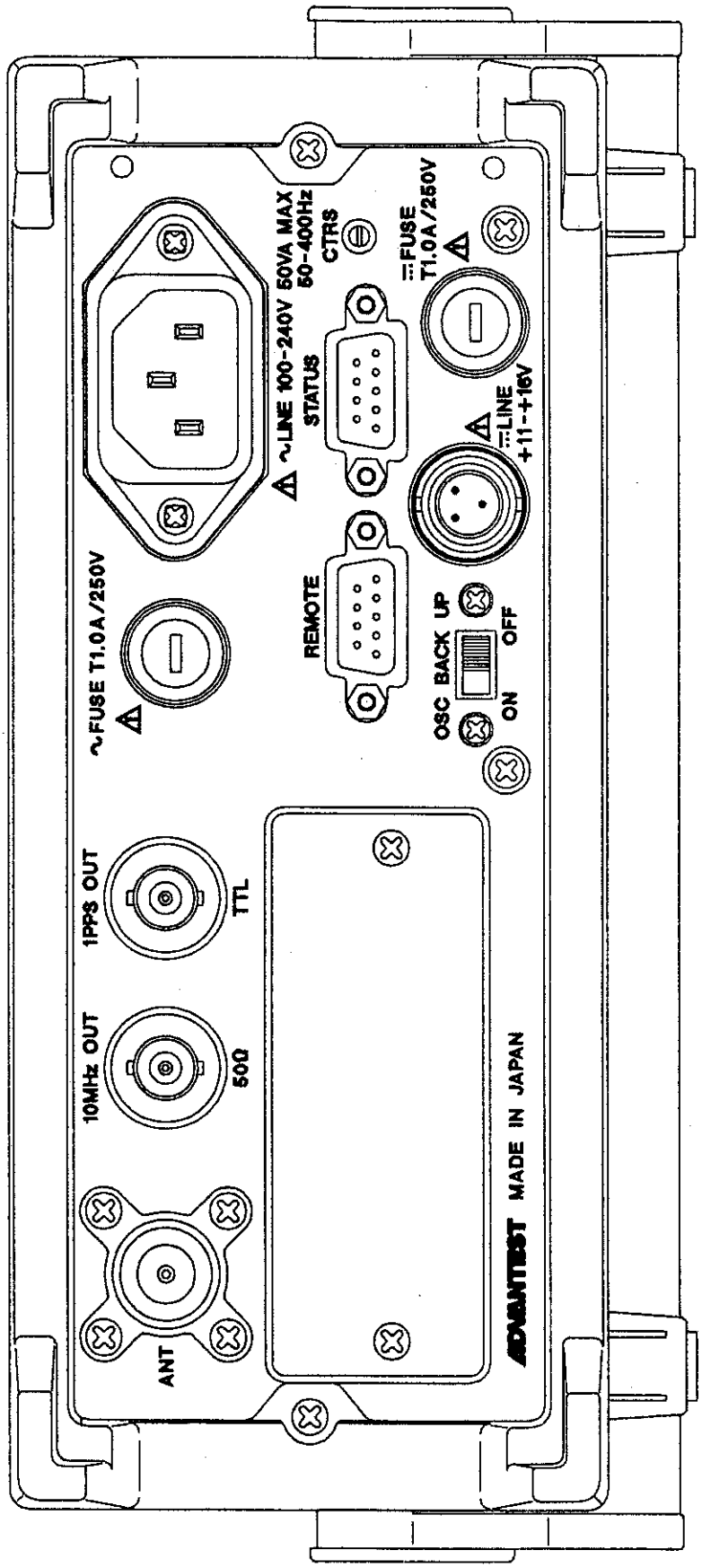


REAR VIEW

R3031 EXTERNAL VIEW

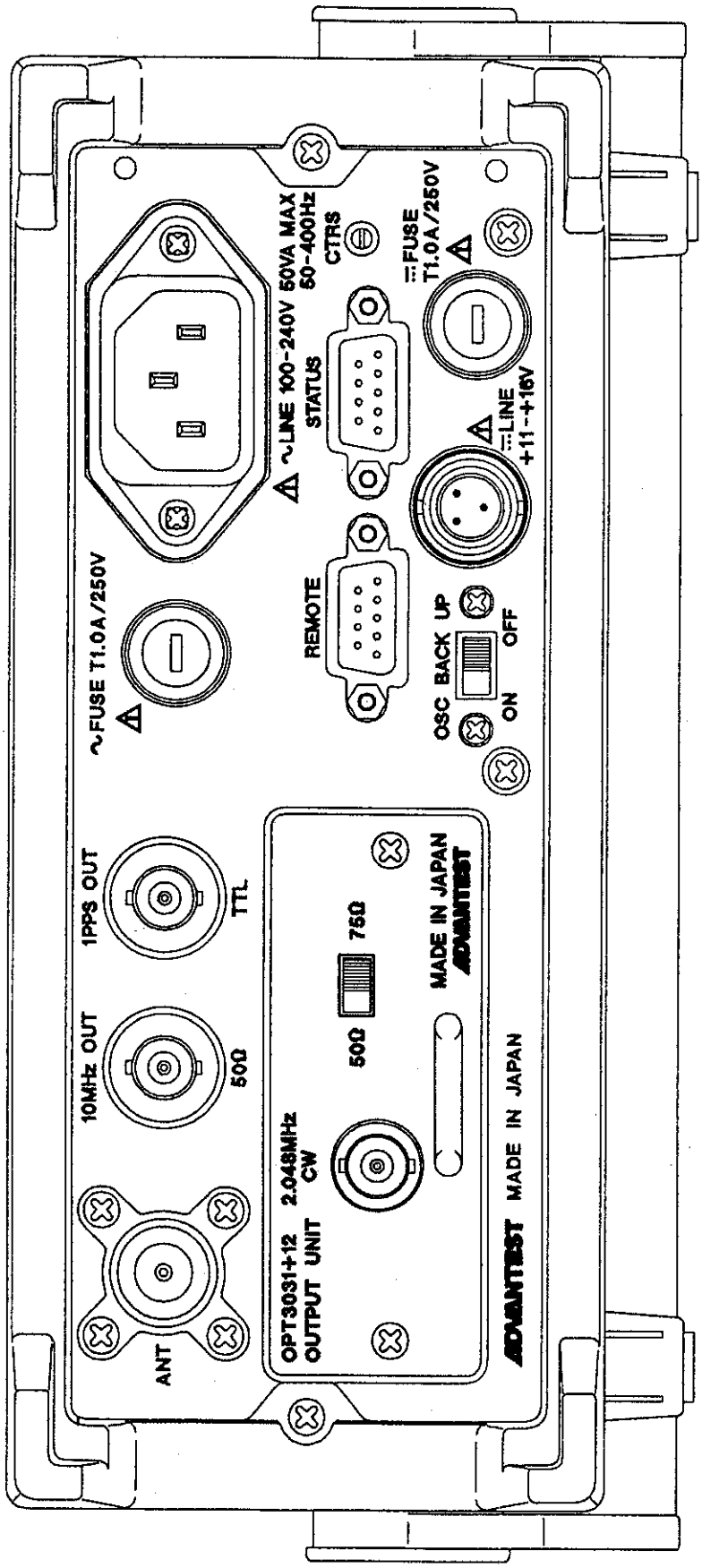


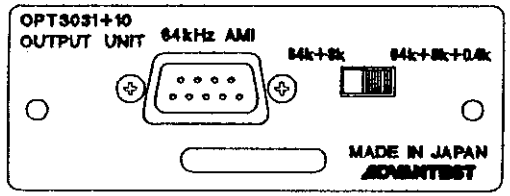
R3031 FRONT VIEW

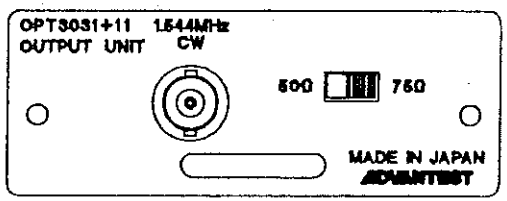


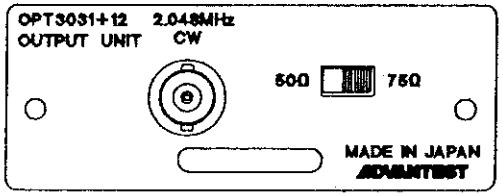
R3031 REAR VIEW

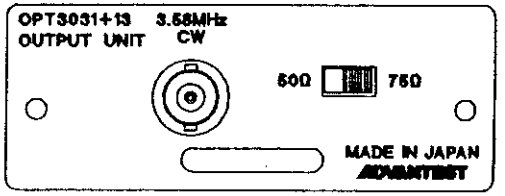
R3031 REAR VIEW (OPT3031-12)

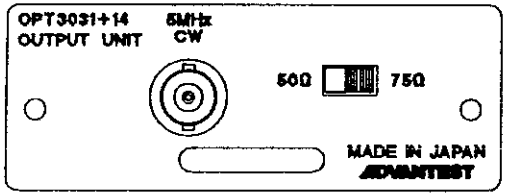


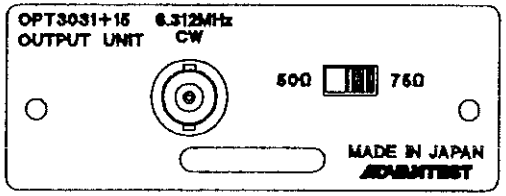


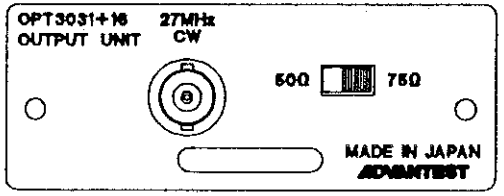


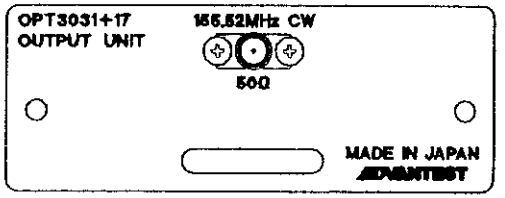












R3031's OPTION FRONT VIEW

ALPHABETICAL INDEX

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1. Unless otherwise specifically agreed by Seller and Purchaser in writing, Advantest will warrant to the Purchaser that during the Warranty Period this Product (other than consumables included in the Product) will be free from defects in material and workmanship and shall conform to the specifications set forth in this Operation Manual.

2. The warranty period for the Product (the "Warranty Period") will be a period of one year commencing on the delivery date of the Product.

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   (a) any modifications, maintenance or repairs other than modifications, maintenance or repairs (i) performed by Advantest or (ii) specifically recommended or authorized by Advantest and performed in accordance with Advantest 's instructions;

   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than Advantest or its agents);

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   (f) Advantest's incorporation or use of any specifications or designs supplied by Purchaser;

   (g) the occurrence of an event of force majeure, including, without limitation, fire, explosion, geological change, storm, flood, earthquake, tidal wave, lightning or act of war; or

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CUSTOMER SERVICE DESCRIPTION

In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

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