Introducing CRTM-R1

ULVAC

Compornents Division

Measurement Instruments Department

Introduction

We plan to release the newly developed CRTM-R1 as the successor to the CRTM-9200.

- Significantly improved Rate stability
- Fewer frequency jumps
- Ability (CI value) measurable
- Logs can be stored on the CRTM console

CRTM-R1

CTM

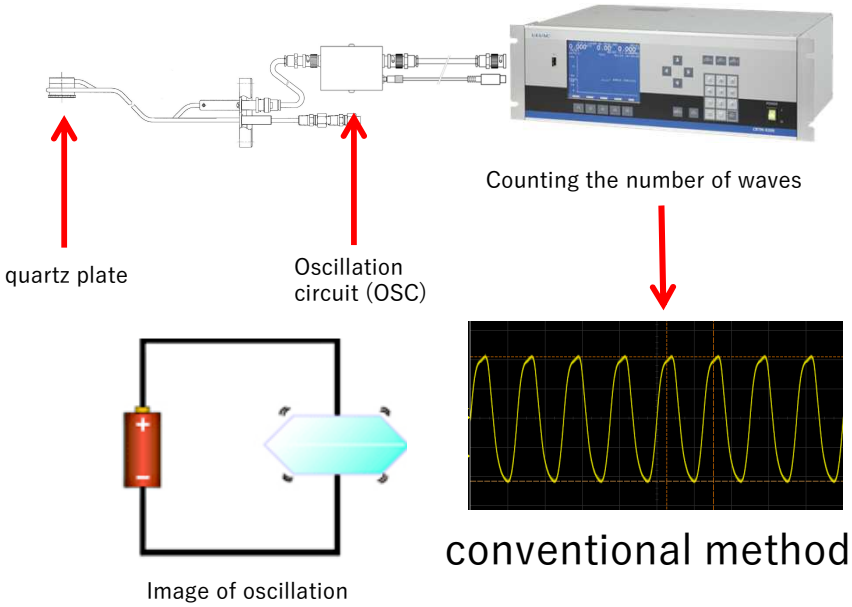
comparison table

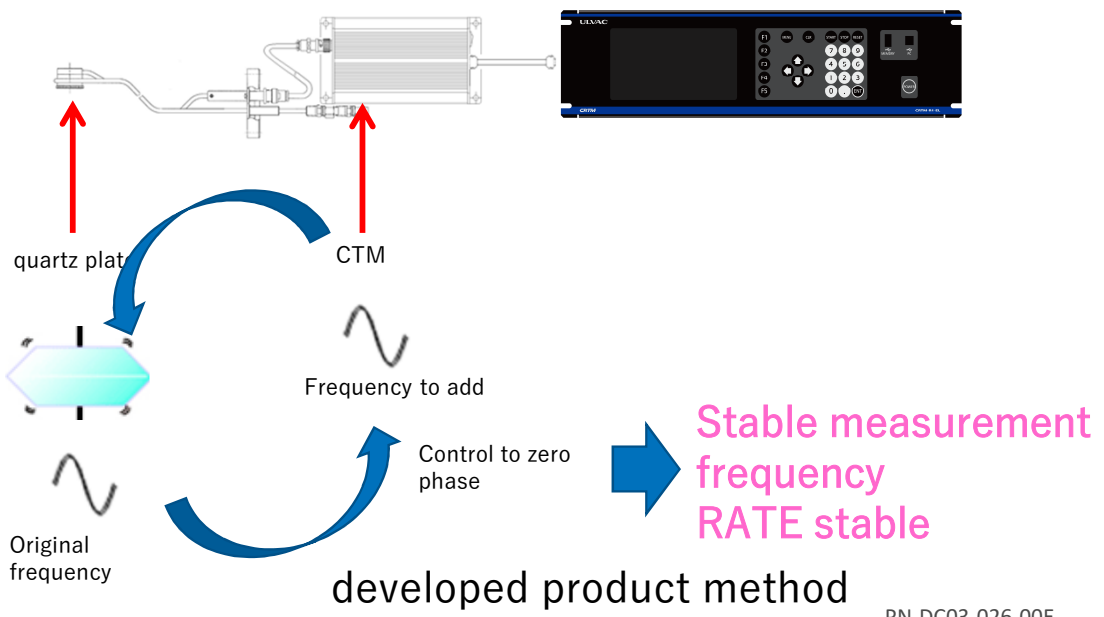
	CRTM-R1 		CRTM-9200 	
Frequency resolution [mHz]	1	◎	1.25	○
Rate resolution [Å/s] @ 5MHz	0.0018	◎	0.0022	○
Number of simultaneously measured sensors	8	◎	4	○
sampling rate [msec]	100	○	250	△
Number of digital inputs	Standard 14 ch, maximum 56 ch	◎	Standard 12 ch, maximum 24 ch	△
Number of digital outputs	Standard 8 ch, maximum 32 ch	○	Standard 16 ch, maximum 32 ch	○
Number of analog outputs	Standard 2 ch, maximum 16 ch	○	No standard, 8ch maximum	△
External dimensions (mm) W x D x H	480×300×130	○	480 x 300 x 149	△
Weight (kg)	5.2	○	8	△
Communication	RS-232C Ethernet	○	RS-232C	△

Impedance method (developed product)

Conventional CRTM oscillates Xtal with an oscillator and counts its pulses with a counter to measure Xtal's resonant frequency. In the Impedance method developed this time, the frequency is changed so that the phase of the frequency signal with the frequency signal added to Xtal becomes zero at the resonance point, and the value is used as the resonance frequency of Xtal.

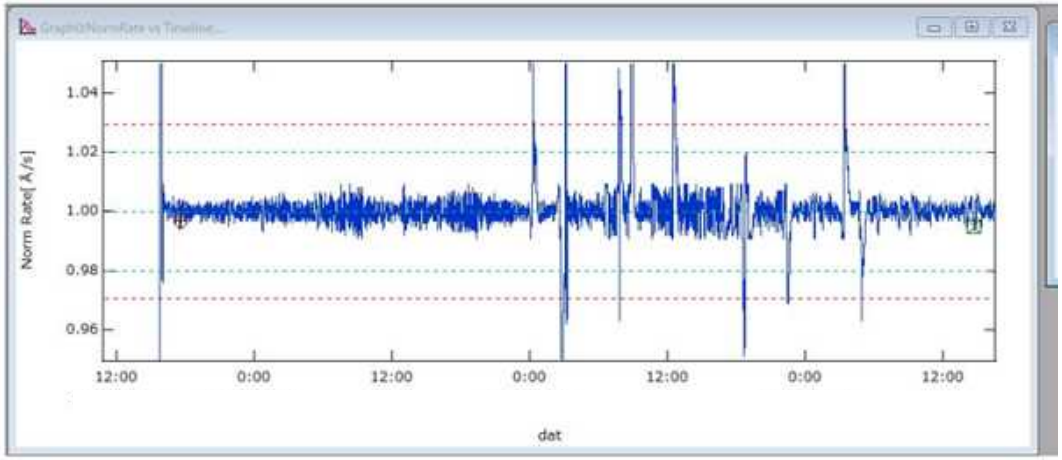
By controlling the frequency of this resonant point and constantly continuing the output, it is possible to measure the resonant frequency of Xtal, which is more stable.



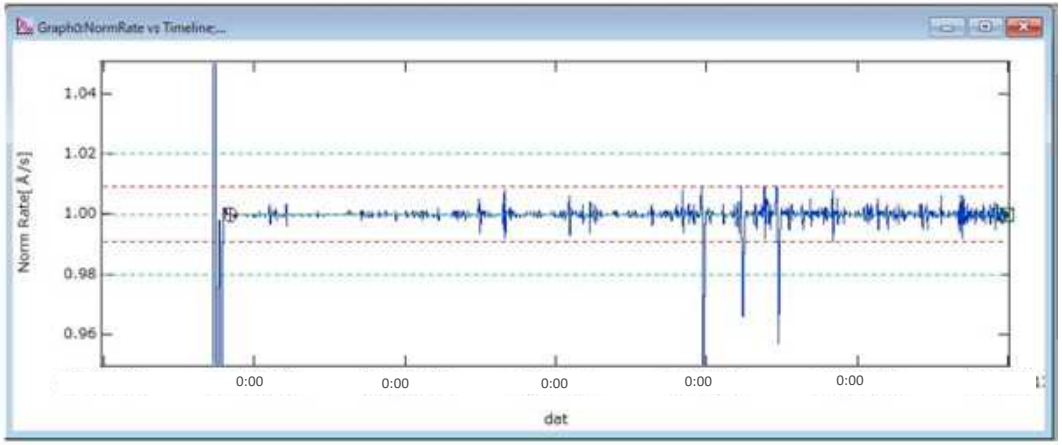


Rate stability example (new vs. old)

CRTM-9200



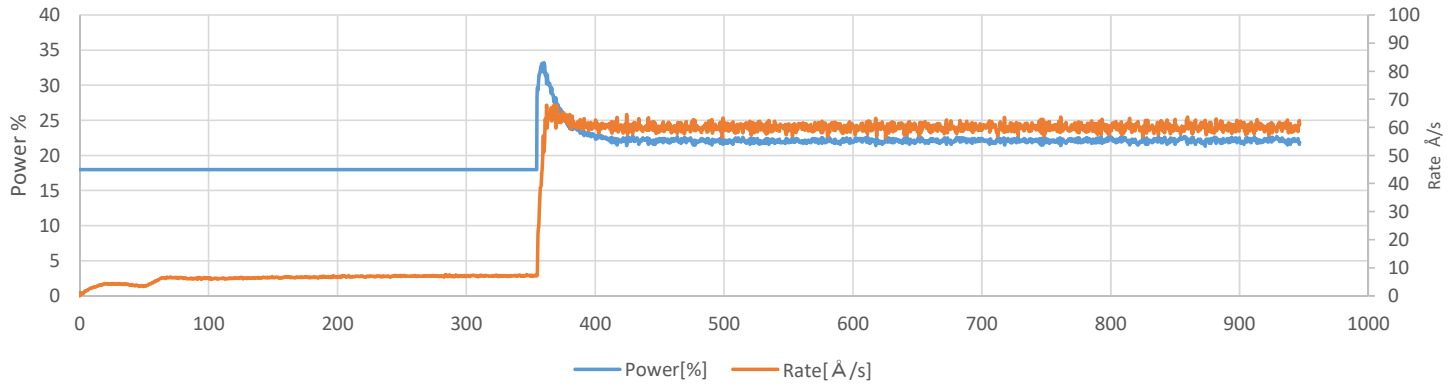
CRTM-R1



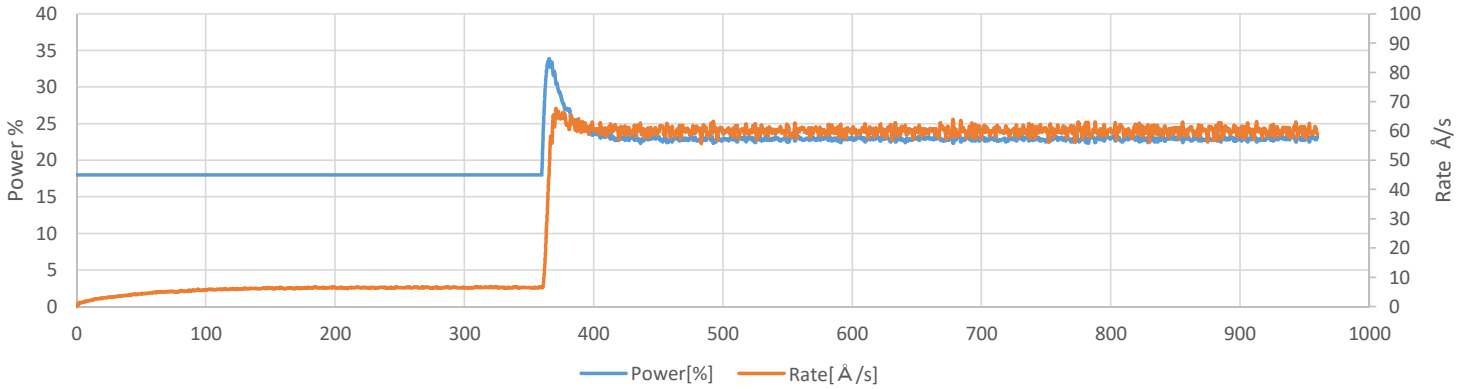
This is the result of comparison film formation between CRTM - 9200 and CRTM-R1 for organic materials using Power as the evaporation source.

CRTM-R1 can perform stable measurements.

Rate Control Examples (Old vs. New)



CRTM-9200



CRTM-R1

This is the result of RATE control of Al with CRTM -9200 and CRTM-R1 under the same conditions.

There is no difference in controllability.

Film formation conditions
- CRTS -4 (Crystal:UCR 5MHz Au)
- EB Power
- No Filter for RATE

About frequency skipping

There are two main factors in frequency jumping.

・Vibration mode changes from main resonance to sub-resonance

・Frequency fluctuations caused by peeling of the film attached to the crystal plate

What is sub-resonance?

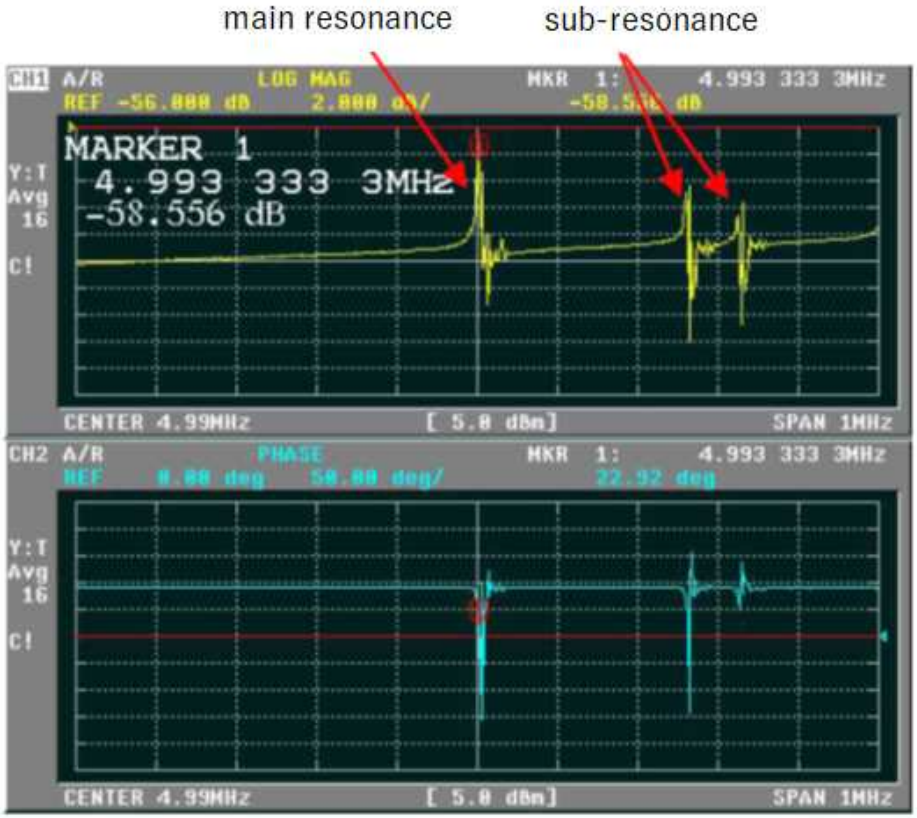
In addition to the fundamental vibration (main resonance), a crystal plate has several other vibration modes called sub-resonance (which exists in the frequency band above the frequency of the main resonance). This is a must because of the nature of a crystal plate.

Normally, it oscillates at the main resonance, which is the easiest to oscillate, but in the following cases, it is easier to jump to the sub-resonance.

・When the crystal plate starts to oscillate

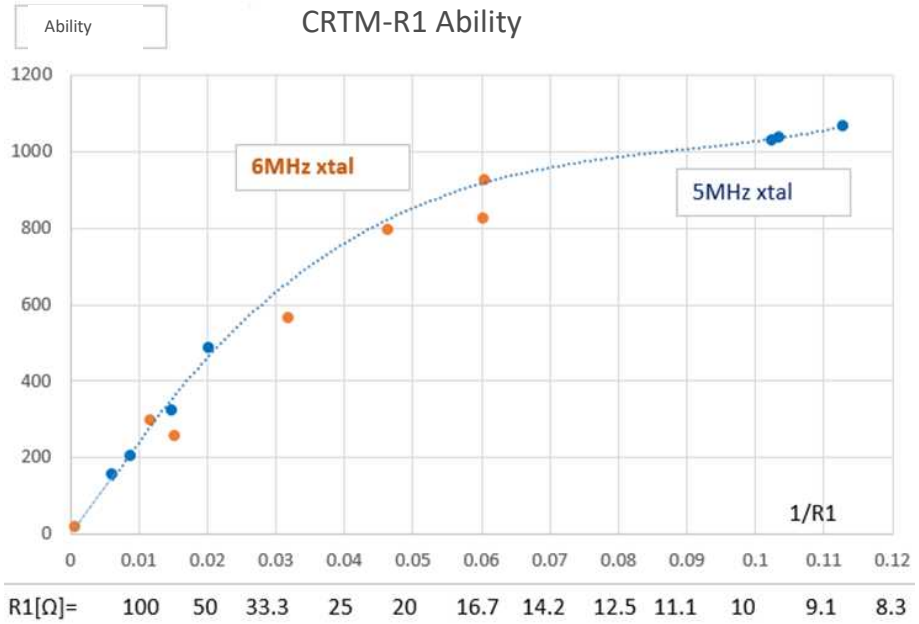
・When a film is attached to a crystal plate and oscillation is difficult

The CRTM-R1 measurement system controls phase and measures frequency even when oscillation is difficult because of the film on the crystal plate, making it difficult to jump to sub-resonances.



Resonant point images of main and sub-resonances

Ability (CI value) feature



It is the result of measuring a crystal plate with different film thicknesses on a desk. When the membrane is attached, the Ability value decreases.

Until now, we have only been able to measure frequency, so any abnormalities on the quartz plate were judged only by the frequency value.

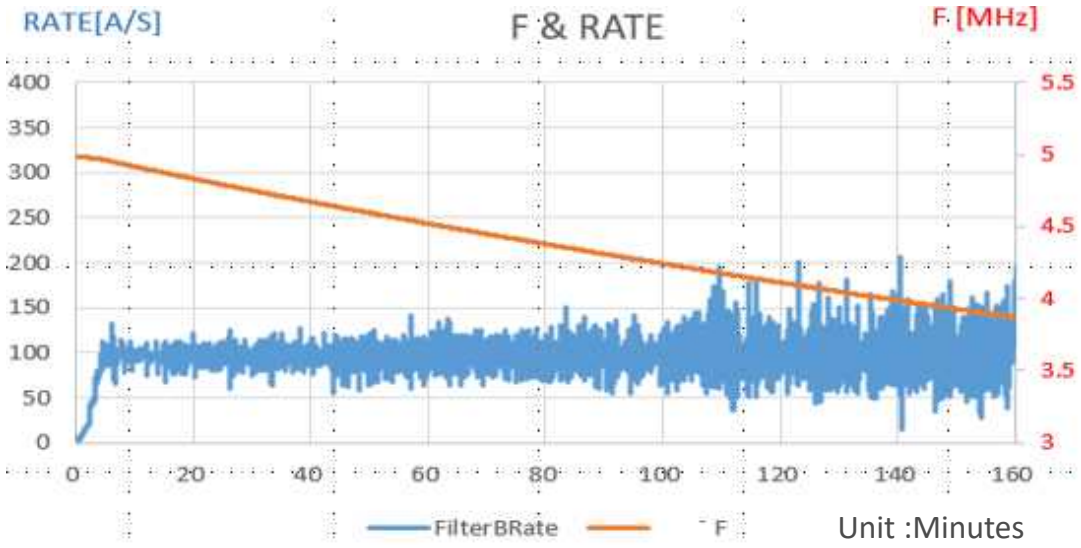
By measuring Ability, it is thought that the following can be judged.

・Abnormal performance of a single crystal plate when it is replaced with a new crystal plate or abnormal installation when it is replaced

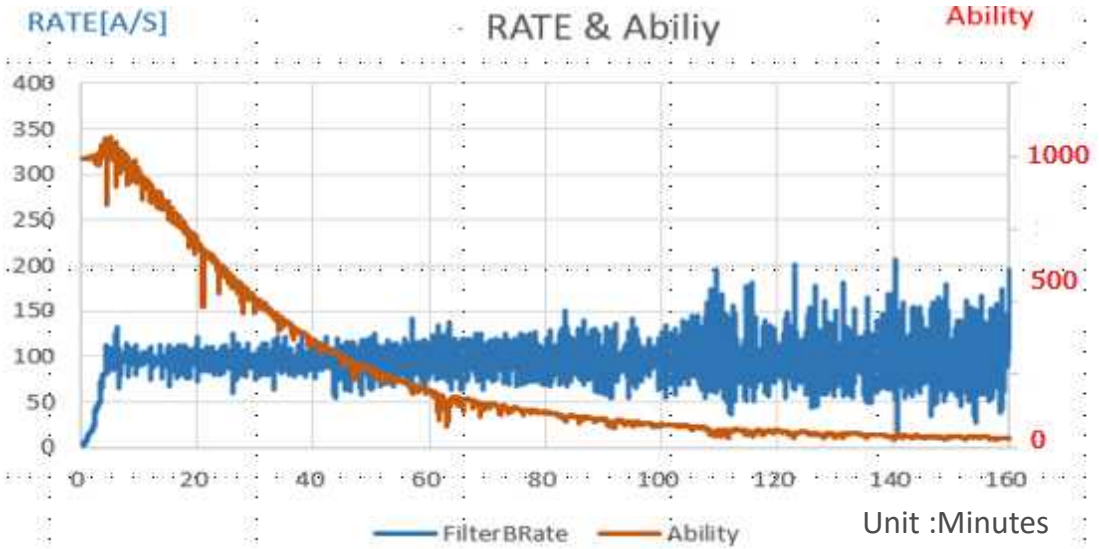
・Anomaly detection when Ability suddenly decreases during film formation (Anomaly with film on quartz plate)

Behavior during Al film formation

Real data of RATE, frequency and Ability on a 5MHz crystal plate.



Correlation between RATE and frequency [F]



Correlation between RATE and Ability

As the frequency decreases (consumes), the RATE tends to run wild, and the Ability tends to decrease.

logging function

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
TIME(yyyy/	TIME(hh:i	TOTAL_T	ProcessPr	DepoProg	LayerNo	PhaseNo	SensorNo	Status	Frequenc	Ability	Film Thicl	Zratio	Power[%]	RawRate1	FilterRate	FN-FN-1	ERROR FL	STATA
2022/3/28	50:04.5	6	1	10	1	2	0	RATE COI	5.96092	999	0	5.6	0	0	0	5.960921	0	0
2022/3/28	50:04.6	92	1	10	1	2	0	RATE COI	5.96092	999	3.05E-07	5.6	0	0.02438	0.00305	-2.00E-09	0	0
2022/3/28	50:04.7	184	1	10	1	2	0	RATE COI	5.96092	999	9.14E-07	5.6	0	0.01219	0.00609	-1.00E-09	0	0
2022/3/28	50:04.8	278	1	10	1	2	0	RATE COI	5.96092	999	1.68E-06	5.6	0	0.01219	0.00762	-1.00E-09	0	0
2022/3/28	50:04.9	388	1	10	1	2	0	RATE COI	5.96092	999	2.53E-06	5.6	0.1	0.03657	0.00853	-3.00E-09	0	0
2022/3/28	50:05.0	482	1	10	1	2	0	RATE COI	5.96092	999	3.44E-06	5.6	0.1	0.02438	0.00914	-2.00E-09	0	0
2022/3/28	50:05.2	607	1	10	1	2	0	RATE COI	5.96092	999	4.40E-06	5.6	0.2	0.01219	0.00958	-1.00E-09	0	0
2022/3/28	50:05.2	703	1	10	1	2	0	RATE COI	5.96092	999	5.41E-06	5.6	0.1	0	0.01009	0	0	0
2022/3/28	50:05.3	794	1	10	1	2	0	RATE COI	5.96092	999	6.48E-06	5.6	0.1	0.02438	0.01067	-2.00E-09	0	0
2022/3/28	50:05.4	894	1	10	1	2	0	RATE COI	5.96092	999	7.59E-06	5.6	0.1	0.02438	0.01117	-2.00E-09	0	0

You can now keep logs on the CRTM itself.

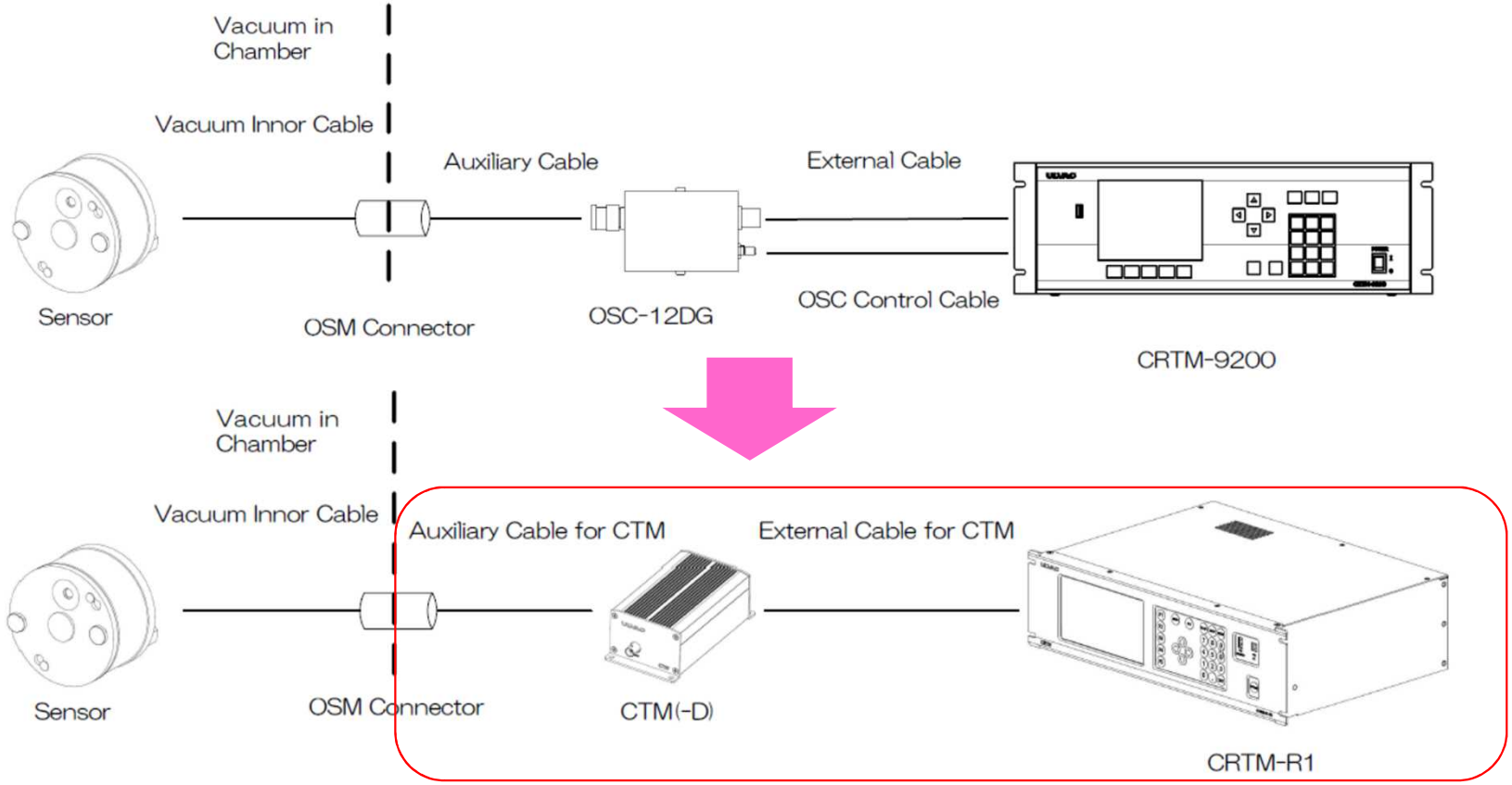
Information such as process and digital input/output can be easily transferred to USB memory in csv format, so you can check the log on your PC.

- Checking for anomalies that occurred during the process
- Analysis of measured data

Replaced by CRTM-9200

If you are replacing an existing CRTM-9200, you will need to change from CRTM-R1 to the CTM auxiliary cable. It can not be diverted.

The OSM connector, internal cable and sensor can be used without modification.

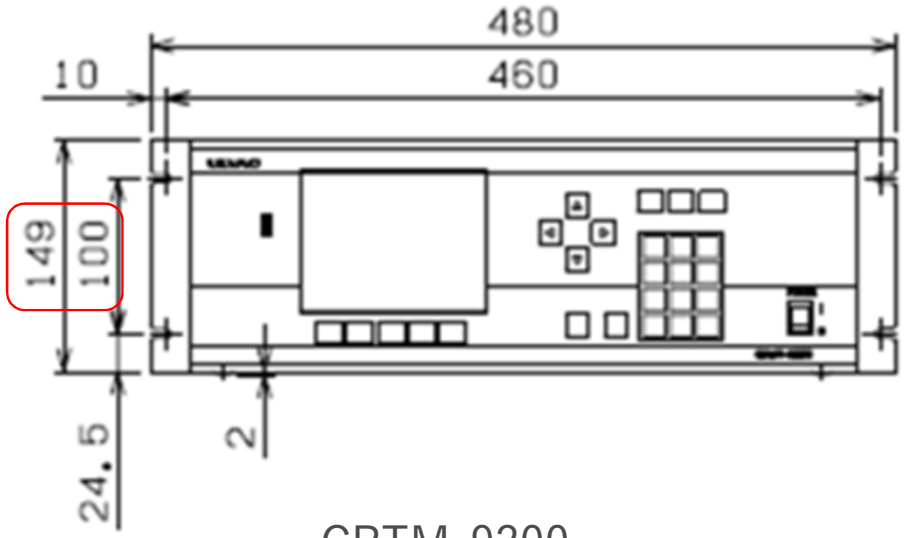


Replacement parts for CRTM-R1

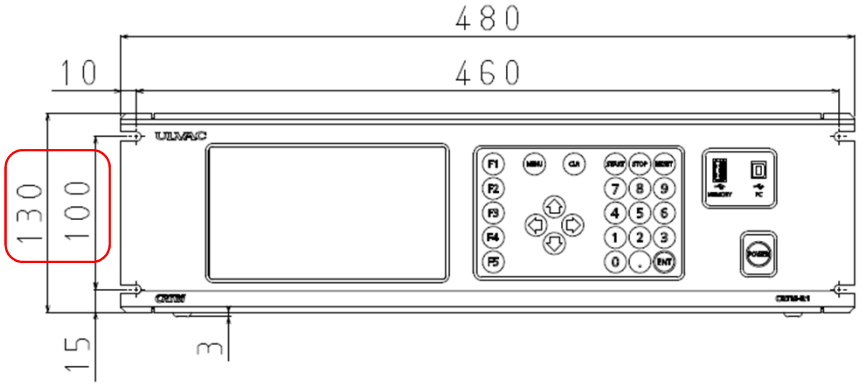
Replacement from CRTM-9200 (Appearance Dimensions)

The CRTM-9200 and mounting position remain unchanged.

The height decreases.



CRTM-9200

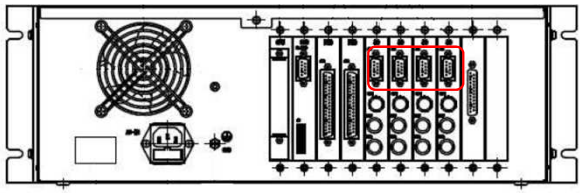


CRTM-R1

Replaced by CRTM-9200 (AO)

Change from D-sub 9-pin connector to BNC connector

Analog output	1ch (power output), 12bit, 0 to 9.99V, 2.54-mV resolution
Connector	D-SUB 9-pin female connector (for analog output and I/O3 output)



POWER	1	6	POWER COMMON
SOURCE SHUTTER	2	7	SOURCE SHUUTER COMMON
SENSOR SHUTTER 1	3	8	SENSOR SHUTTER 1 COMMON
SENSOR SHUTTER 2	4	9	SENSOR SHUTTER 2 COMMON
NC	5		

* NC : No Connection

Fig. 73 Connector pin assignment on SS card, SENSOR type SINGLE, DUAL.

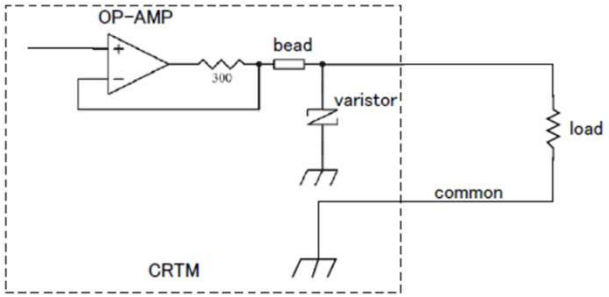


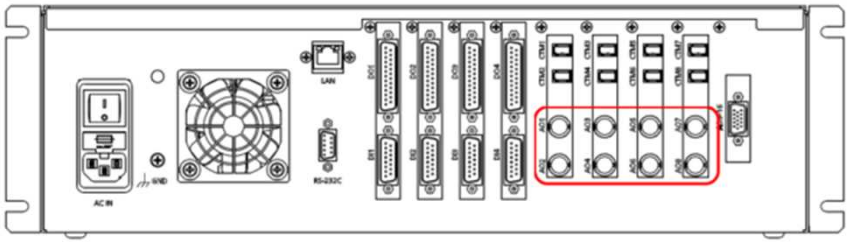
Fig. 75 Power output circuit.

CRTM-9200

Each port can be configured with a signal (Rate, Power, Thickness).

If the AO -1 is set to CTM 1, POWER or 0 ~ 10 V, it can be used as the POWER output in the same way as the CRTM -9200.

Resolution	16 bit
Output range	-10V to +10V Single-ended output
Connector	BNC connector female



※ The figure shows the case with the maximum number of optional cards installed.

Figure 2. AO connector

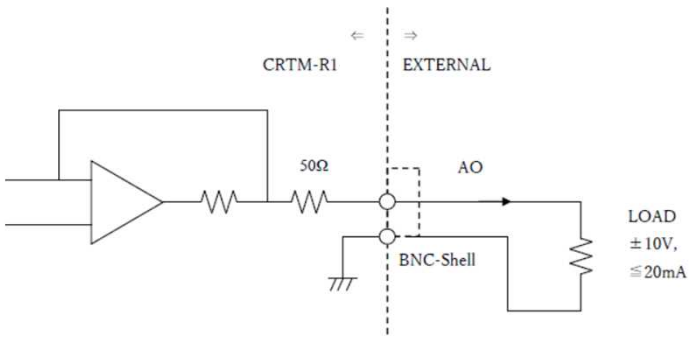


Figure 3. Example of AO wiring diagram

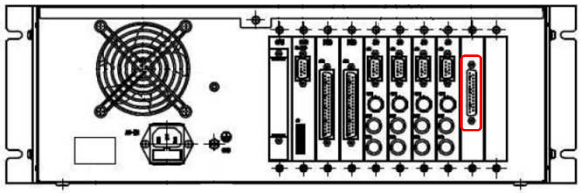
CRTM-R1

Replacement from CRTM-9200 (AO (additional optional))

Change from D-sub 25 pin connector to mini D-sub 15 pin connector

Analog output 8ch (evaporation rate, film thickness output), 12bit, 0 to 9.99V, 2.54-mV resolution, Fixed output

Connector D-SUB 25-pin female connector



Pin #	Signal	Descriptions
1	SS1 RATE	SS CARD1 evaporation rate: 0-10V
2	SS1 THICKNESS(THK)	SS CARD1 film thickness: 0-10V
3	SS2 RATE	SS CARD2 evaporation rate: 0-10V
4	SS2 THICKNESS(THK)	SS CARD2 film thickness: 0-10V
5	SS3 RATE	SS CARD3 evaporation rate: 0-10V
6	SS3 THICKNESS(THK)	SS CARD3 film thickness: 0-10V
7	SS4 RATE	SS CARD4 evaporation rate: 0-10V
8	SS4 THICKNESS(THK)	SS CARD4 film thickness: 0-10V
9-13	NC	
14-21	COMMON	
22-25	NC	

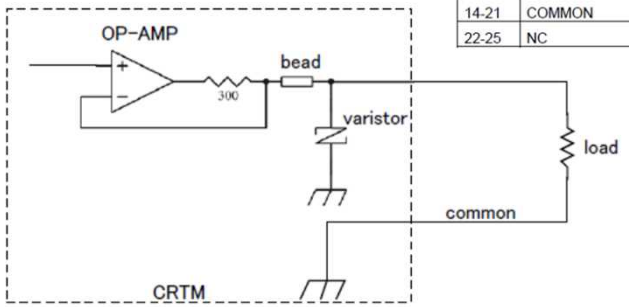


Fig. 81 Analog output circuit.

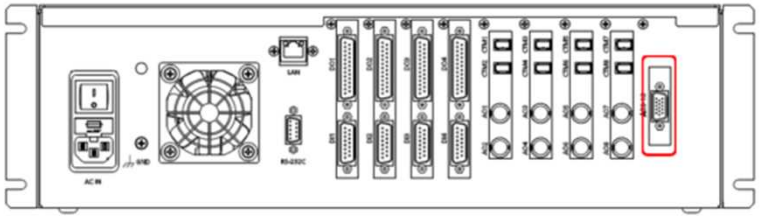
CRTM-9200

Each port can be configured with a signal (Rate, Power, Thickness).

Resolution 16 bit

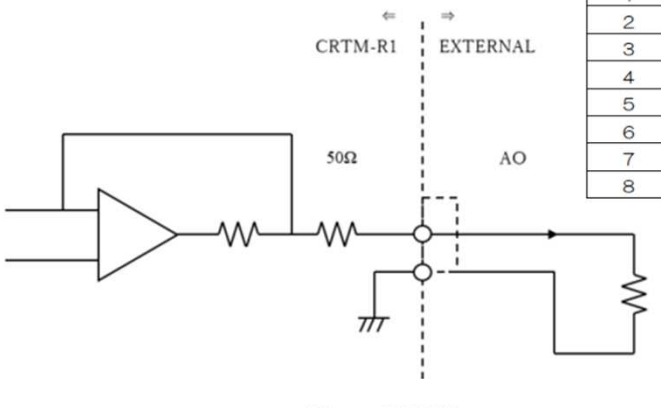
Output range -10V to +10V Single-ended output

Connector BNC connector female



※ The figure shows the case with the maximum number of optional cards installed.

Pin No.	Signal name	Pin No.	Signal name
1	AO-9	9	GND
2	AO-10	10	GND
3	AO-11	11	AO-14
4	AO-12	12	GND
5	AO-13	13	AO-15
6	GND	14	GND
7	GND	15	AO-16
8	GND		



CRTM-R1

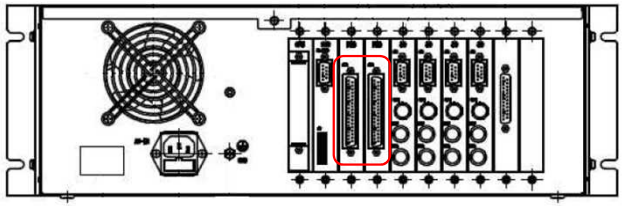
Replacement (DI) from CRTM-9200

Changed from D-sub 37 pin to D-sub 15 pin

INPUT 12ch (oscillator control signal, +9 to +15V applied upon power-on)

I/O programmable

Connector D-SUB 37-pin female connector



Port #	Signal Name	Port #	Signal Name
1	OUTPUT1 (17)	20	INPUT1 (13)
2	OUTPUT2 (18)	21	INPUT2 (14)
3	OUTPUT3 (19)	22	INPUT3 (15)
4	OUTPUT4 (20)	23	INPUT4 (16)
5	COMMON	24	COMMON
6	OUTPUT5 (21)	25	INPUT5 (17)
7	OUTPUT6 (22)	26	INPUT6 (18)
8	OUTPUT7 (23)	27	INPUT7 (19)
9	OUTPUT8 (24)	28	INPUT8 (20)
10	COMMON	29	COMMON
11	OUTPUT9 (25)	30	INPUT9 (21)
12	OUTPUT10 (26)	31	INPUT10 (22)
13	OUTPUT11 (27)	32	INPUT11 (23)
14	OUTPUT12 (28)	33	INPUT12 (24)
15	COMMON	34	COMMON
16	OUTPUT13 (29)	35	NC
17	OUTPUT14 (30)	36	NC
18	OUTPUT15 (31)	37	NC
19	OUTPUT16 (32)		

CRTM-9200

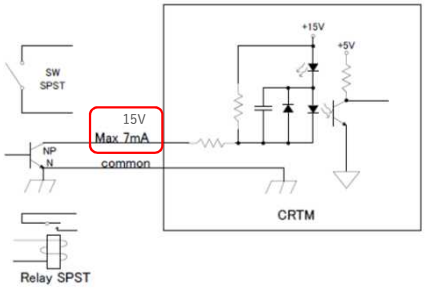


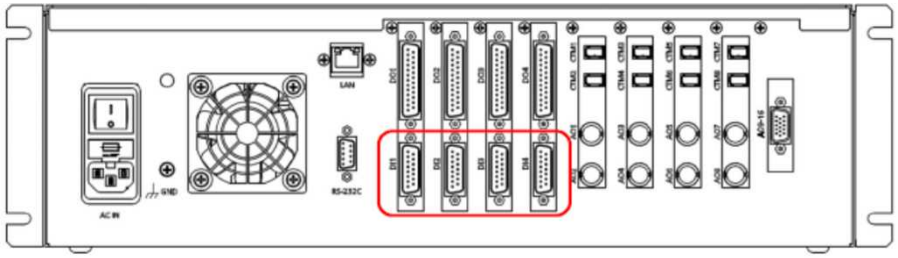
Fig. 79 Logic input circuit.

Specifications Photocoupler isolation input

Maximum applied voltage: 24VDC

TTL level input specification (High(min): 2.5V, Low(max): 1.1V)

Connector D-Sub15 male (Fitting with inch screw #4-40UNC)



※The figure shows the case with the maximum number of optional cards installed.

Pin No.	Signal name	Pin No.	Signal name
1	DI-COM	9	DI-7
2	DI-14	10	DI-6
3	DI-13	11	DI-5
4	DI-12	12	DI-4
5	DI-11	13	DI-3
6	DI-10	14	DI-2
7	DI-9	15	DI-1
8	DI-8		

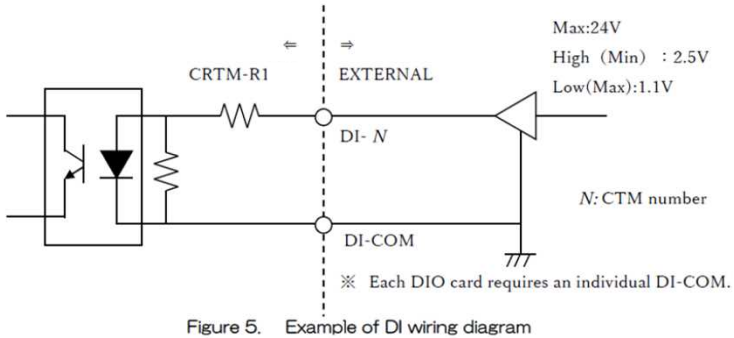


Figure 5. Example of DI wiring diagram

CRTM-R1

The maximum applied voltage is 24 VDC.

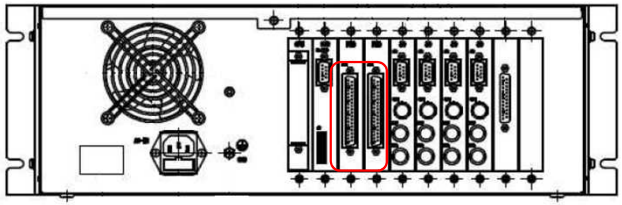
High is recognized when a voltage of 2.5 V or more is applied.

Replacement (DO) from CRTM-9200

Changed from D-sub 37 pin to D-sub 25 pin

OUTPUT 16ch (optical MOS relay output (rated value: 60VAC, 500mA))

Connector D-SUB 37-pin female connector



Port #	Signal Name	Port #	Signal Name
1	OUTPUT1 (17)	20	INPUT1 (13)
2	OUTPUT2 (18)	21	INPUT2 (14)
3	OUTPUT3 (19)	22	INPUT3 (15)
4	OUTPUT4 (20)	23	INPUT4 (16)
5	COMMON	24	COMMON
6	OUTPUT5 (21)	25	INPUT5 (17)
7	OUTPUT6 (22)	26	INPUT6 (18)
8	OUTPUT7 (23)	27	INPUT7 (19)
9	OUTPUT8 (24)	28	INPUT8 (20)
10	COMMON	29	COMMON
11	OUTPUT9 (25)	30	INPUT9 (21)
12	OUTPUT10 (26)	31	INPUT10 (22)
13	OUTPUT11 (27)	32	INPUT11 (23)
14	OUTPUT12 (28)	33	INPUT12 (24)
15	COMMON	34	COMMON
16	OUTPUT13 (29)	35	NC
17	OUTPUT14 (30)	36	NC
18	OUTPUT15 (31)	37	NC
19	OUTPUT16 (32)		

CRTM-9200

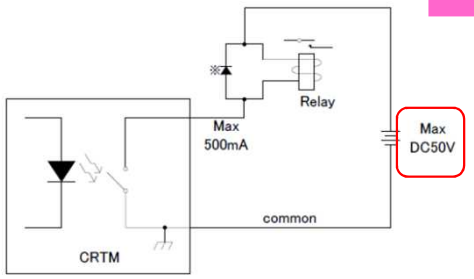
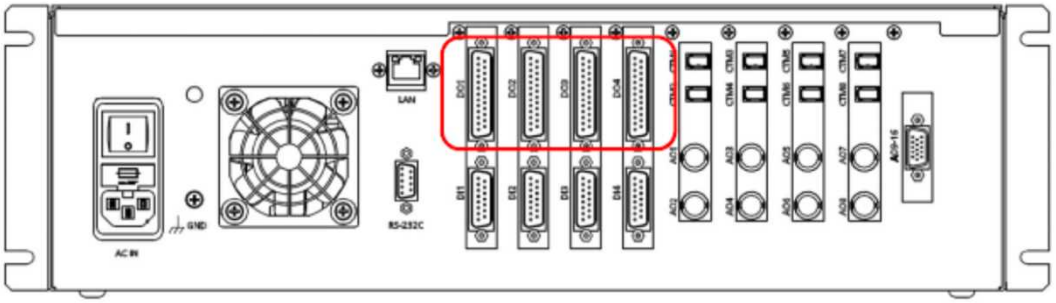


Fig. 78 Logic output circuit.

Specifications Optical MOS relay output (60 VAC rated, 500 mA), individually isolated

Connector D-Sub25 male (Fitting with inch screw #4-40UNC)



※ The figure shows the case with the maximum number of optional cards installed.

Pin No.	Signal name	Pin No.	Signal name
1	DO-7	14	DO-7COM
2	DO-6	15	DO-8
3	DO-6COM	16	DO-8COM
4	DO-5	17	NC
5	DO-5COM	18	NC
6	DO-1	19	NC
7	DO-1COM	20	NC
8	DO-2	21	NC
9	DO-2COM	22	NC
10	DO-3	23	NC
11	DO-3COM	24	NC
12	DO-4	25	NC
13	DO-4COM		

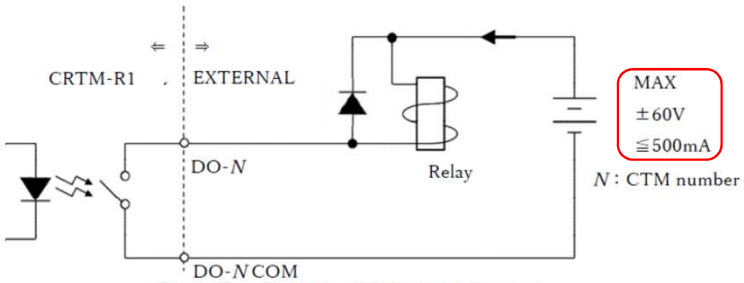


Figure 7. Example of DO wiring diagram

CRTM-R1

Replacement from CRTM-9200 (Other FAQs)

Q. Can I use the power cord as it is?

A. You can use it as is.

Q. Can I use the RS-232 C cable as is?

A. You need to change from a crossover cable to a straight-through cable.

Q. Can I use RS-232 C commands as is?

A. The RS -232 C command is partially compatible. For details, refer to the instruction manual.

Q. Can I save the CRTM-9200 settings and load them into CRTM-R1?

A. The settings are not available. Please set it again.

Q. Can I use the internal cable as is?

A. You can use it as is.