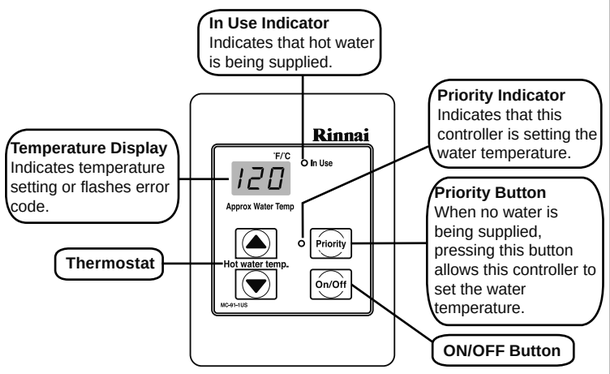
Controller



Diagnostic Use of the Controller

1. To display error codes, press the ON/OFF button followed by the ▲ thermostat button to cycle through the error codes.
2. To display the water flow through the water heater, press the ▲ thermostat button (hold for 2 seconds) and then press the ON/OFF button while continuing to hold the ▲ thermostat button.
3. To display the outlet water temperature, press the ▼ thermostat button (hold for 2 seconds) and then press the ON/OFF button while continuing to hold the ▼ thermostat button.

To Change the Temperature Scale (ºF / ºC)

With the water heater turned off, press and hold the ON/OFF button until the display changes to the other temperature scale (about 5 seconds).

To Turn Off the Controller Sound (Mute)

To turn the sound off (mute), press and hold both the ▲ and ▼ thermostat buttons until a “beep” is heard (about 5 seconds).

Gas Pressure Setting

NOTE: For additional installation and commissioning information refer to the Operation and Installation Manual.

WARNING

This appliance must be installed, serviced and removed by a trained and qualified person. During pressure testing of the consumer piping, ensure gas valve is turned off before unit is shut off. Failure to do so may result in serious injury to yourself or damage to the unit.

APPLIANCE OPERATING PRESSURES

Table 1

		Water Inlet Max.	Gas Inlet Min./Max		Forced Low		Forced High	
			NAT.G	LPG	NAT.G	LPG	NAT.G	LPG
RC98HPi	Short flue length	150 PSI	5”W.C. /10.5”W.C.	8”W.C. /13.5”W.C.	0.85”W.C.	1.22”W.C.	2.4”W.C.	3.6”W.C.
	Long flue length				1.08”W.C.	1.46”W.C.	2.7”W.C.	4.0”W.C.

Check whether your flue length is short or long. See Dip Switches Settings below.

Commissioning

With all gas appliances in operation at maximum gas rate, the flowing inlet pressure at the incoming test point on the Rinnai water heater should read 5” W.C. - 10.5” W.C. on natural gas and 8” W.C. - 13.5 W.C. on propane gas. If the pressure is lower, the gas supply is inadequate and the unit will not operate to specification. Check the gas meter regulator and pipework for correct operation/sizing and correct as required.

Gas Pressure Setting

Ensure gas pressure check under Commissioning has been completed first! The regulator is electronically controlled and factory pre-set. Under normal circumstances it does not require adjustment during installation. Make adjustments only if the unit is not operating correctly and all other possible causes for incorrect operation have been eliminated.

1. Turn OFF the gas supply.
2. Turn OFF the 120 V power supply.
3. Remove the front panel from the appliance.
4. Check the gas type using the data plate on the side of the unit. If using a spare PC board, check that the gas type switches are in the correct position (switch 1 of SW2: ON for natural gas, NG, and OFF for propane, LPG). See dip switch settings section below. (ON is towards the right and OFF is towards the left.)
5. Attach the pressure gauge to the burner test point, located on the gas control (Fig. 2).
6. Turn ON the gas supply.
7. Turn ON the 120 V power supply.
8. If a controller is installed, turn the unit ON with the controller. Select the maximum delivery temperature and open all available hot water taps at full.
9. Set the unit to “Forced Low” combustion by setting No. 7 switch of the SW1 set to ON (Fig. 3).
10. Check the burner test point pressure.
11. Remove the rubber access plug and adjust the regulator screw on the modulating valve (Fig. 4) as required in Table 1. Replace the rubber access plug.
12. Set the unit to “Forced High” combustion by setting both No. 7 and No. 8 switches of the SW1 set to ON (Fig. 5). Ensure maximum water flow.
13. Check the burner test point pressure.
14. Adjust the high pressure potentiometer (POT) on the PC board as required to the pressure shown in Table 1.
15. Return the unit to normal operation by setting switches 7 and 8 of the SW1 set back to OFF (Fig. 6). Close all water taps.
16. Turn OFF the gas supply and 120 V power supply.
17. Remove the pressure gauge and install sealing screw.
18. Turn ON the gas supply and 120 V power supply.
19. Operate the unit and check for gas leaks at the test point.
20. Install the front panel.

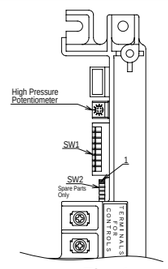


Fig. 1

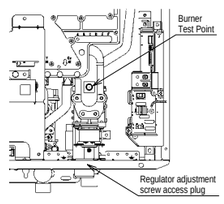


Fig. 2

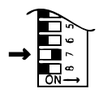


Fig. 3

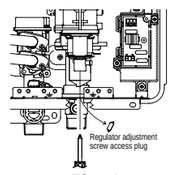


Fig. 4

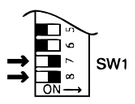


Fig. 5

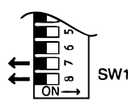


Fig. 6

Troubleshooting

Important Safety Notes

There are a number of (live) tests that are required when fault finding this product. Extreme care should be used at all times to avoid contact with energized components inside the water heater. Only trained and qualified service technicians should attempt to repair this product. Before checking for resistance readings, disconnect the power source to the unit and isolate the item from the circuit (unplug it).

(SV1, SV2, SV3, SV4 and POV) Gas valve and Modulating solenoids: (Set meter above 2K)

Wire color	Voltage	Resistance	Connector #	Pin #'s
(Main) Black - Pink	11 ~ 13 VDC	24 ~ 28 ohms	B3	7 - 8
(SV1) Black - Blue	11 ~ 13 VDC	37 ~ 43 ohms	B4	7 - 6
(SV2) Black - Yellow	11 ~ 13 VDC	37 ~ 43 ohms	B5	7 - 5
(SV3) Black - Red	11 ~ 13 VDC	37 ~ 43 ohms	B6	7 - 4
(SV4) Black - Orange	11 ~ 13 VDC	37 ~ 43 ohms	B2	7 - 3
(POV) Orange - Orange	2 ~ 15 VDC	67 ~ 81 ohms	B2	10 - 11

(M) Water Flow Control Device Servo or Geared Motor:

Red - Blue	11 ~ 13 VDC	22 ~ 28 ohms	G2	3 - 1
Grey - Brown	4 ~ 6 VDC	N / A	G2	7 - 6
Grey - Yellow	N / A	N / A	G2	7 - 5

NOTE: The grey wire listed above turns to black at G connector on the PCB.

(QS) Water Flow Sensor:

Black - Red	11 ~ 13 VDC	5.5 ~ 6.2 K ohms	E5	7 - 6
Yellow - Black	4 ~ 7 VDC	1 ~ 1.4 Mega ohms	E5	E1 - G7

By-pass Flow Control:

Brown - White	2 ~ 6 VDC (Unit in operating mode)	15 ~ 35 ohms	G1	12 - 8
Orange - White			G1	10 - 8
Yellow - White			G1	9 - 8
Red-White - Ground			G1	11 - 8

(IG) Ignition System:

Grey - Grey	90 ~ 110 VAC	N / A	D1	1 - 2

(FM) Combustion Fan Motor:

Red - Black	6 ~ 45 VDC	N / A	L1	1 - 2
White - Black	5 ~ 10 VDC	9.2 ~ 9.4 K ohms	L1	2 - 4
Yellow - Black	11 ~ 13 VDC	3.5 ~ 3.9 K ohms	L1	2 - 3

Set your meter to the hertz scale. Reading across the white and black wires at terminals 2 and 4 you should read between 60 and 420 hertz.

Thermal Fuse / Overheat Switch:

Red - White	11 ~ 13 VDC	Below 1 ohms	B1 E1	E9 - B13

Flame Rod:

Place one lead of your meter to the flame rod and the other to ground. With the unit running you should read between 5-150 VAC. Set your meter to the µ amp scale and series your meter in line with the flame rod. You should read 1 µ amp or greater for proper flame circuit. In the event of low flame circuit remove the flame rod and check for carbon or damage.

Heat Exchanger and Outgoing Water Temperature Thermistors:

Check all thermistors by inserting meter leads into each end of the thermistor plug. Set your meter to the 20 K scale and read resistance. Applying heat to the thermistor bulb should decrease the resistance. Applying ice to the thermistor bulb should increase the resistance. See below for examples of typical temperatures and resistance readings.

Example: 59°F = 11.4 ~ 14KΩ; 86°F = 6.4 ~ 7.8KΩ; 113°F = 3.6 ~ 4.5KΩ; 140°F = 2.2 ~ 2.7KΩ; 221°F = 0.6 ~ 0.8KΩ

Outgoing Water Thermistor:

White - White	N / A	See example above	E4	3 - 4

Heat Exchanger Temperature Thermistor:

Pink - Pink	N / A	See example above	E2	5 - 10

Surge Protector:

White - White	108 ~ 132 VAC	N / A	C2	1 - 3
Black - White	108 ~ 132 VAC	N / A	C1	1 - 3

With the power off you can check the continuity through the surge protector. Place a meter lead on the top pin #1 of the surge protector and pin #3 on the bottom of the surge protector. Check across the top pin #3 and bottom pin #1. If you read continuity across these two points then the surge protector is good. If you do not get continuity then replace the surge protector.

Remote Controls:

Terminals A1	10 ~ 13 VDC	1.5 ~ 3.0 K ohms	A	1 - 3

Frost Protection:

This unit has frost protection heaters mounted at different points to protect the water heater from freezing. The heaters located on the hot water outlet line should have a resistance reading of 180-207 ohms through each of these heaters. The heater located on the heat exchanger piping should have a resistance reading of 156-180 ohms and the one located in the water flow sensor valve should have a resistance reading 24-28 ohms.

Amp Fuses:

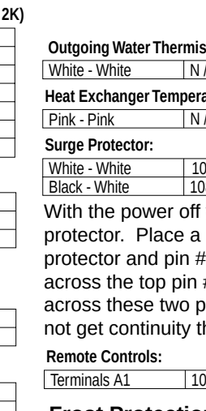
This unit has one inline (7) amp glass fuse. Remove the fuse and check continuity through it. If you have continuity through the fuse then it is good. Otherwise the fuse is blown and must be replaced.

Dip Switches Settings

Adjust switches 2 and 3 in the bank of 8 depending on your altitude according to the table below.

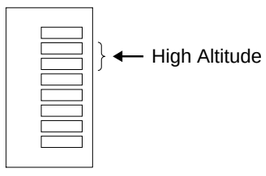
The original PC boards on the water heaters do not have the bank of 6 switches. Only spare PC boards have this bank.

RC98HPi



Move switch 1 to OFF for long flue lengths. See below.

Adjustment for long flue length:
1. Determine theequivalent length using the formula:
   Equivalent length = Straight lengths + [no. of 90º elbows x 6]
   (Two 45º elbows = one 90º elbow)
2. If the equivalent length is greater than 21 ft then move switch no. 1 to OFF. If the equivalent tength is longer than 41 ft the heater may not work properly. The installer should be called.



WARNING

DO NOT adjust the other switches unless specifically instructed to do so. Incorrect Dip Switch Settings can cause the Rinnai water heater to operate in an unsafe condition and may damage the water heater and void the warranty.

SW No.	NOTES								
2	High Altitude	Off	Level 0 0-2000 ft (0-610 m)	Off	Level 1 2001-5200 ft (610-1585 m)	On	Level 2 5201-7700 ft (1585-2347 m)	On	Level 3 7701-10200 ft (2347-3109 m)
3		Off		On		Off		On	

Error Codes

03 Power interruption during Bath fill (Water will not flow when power returns)
- Turn off all hot water taps. Press ON/OFF twice.

10 Air Supply or Exhaust Blockage
- Ensure Rinnai approved venting materials are being used.
- Check that nothing is blocking the flue inlet or exhaust.
- Check all vent components for proper connections.
- Ensure vent length is within limits.
- Ensure condensation collar was installed correctly.
- Verify dip switches are set properly.
- Check fan for blockage.
- Burner sensor error (see code 31)

11 No Ignition
- Check that the gas is turned on at the water heater, gas meter, or cylinder.
- Ensure gas type and pressure is correct.
- Ensure gas line, meter, and/or regulator is sized properly.
- Bleed all air from gas lines.
- Verify dip switches are set properly.
- Ensure appliance is properly grounded.
- Disconnect EZConnect or MSA controls to isolate the problem.
- Ensure igniter is operational.
- Check igniter wiring harness for damage.
- Check gas solenoid valves for open or short circuits.
- Remove burner cover and ensure all burners are properly seated.
- Remove burner plate and inspect burner surface for condensation or debris.

12 Flame Failure
- Check that the gas is turned on at the water heater and gas meter. Check for obstructions in the flue outlet.
- Ensure gas line, meter, and/or regulator is sized properly.
- Ensure gas type and pressure is correct.
- Bleed all air from gas lines.
- Ensure proper Rinnai venting material was installed.
- Ensure condensation collar was installed properly.
- Ensure vent length is within limits.
- Verify dip switches are set properly.
- Ensure appliance is properly grounded.
- Disconnect keypad.
- Disconnect EZConnect or MSA controls to isolate the problem.
- Check power supply for loose connections.
- Check power supply for proper voltage and voltage drops.
- Ensure flame rod wire is connected.
- Check flame rod for carbon build-up.
- Disconnect and re-connect all wiring harnesses on unit and PC board.
- Check all components for electrical short.
- Check gas solenoid valves for open or short circuits.
- Remove burner plate and inspect burner surface for condensation or debris.

14 Thermal Fuse
- Check gas type of unit and ensure it matches gas type being used.
- Check for restrictions in air flow around unit and vent terminal.
- Check for low water flow in a circulating system causing short-cycling.
- Ensure dip switches are set to the proper position.
- Check for foreign materials in combustion chamber and/or exhaust piping.
- Check heat exchanger for cracks and/or separations.
- Check heat exchanger surface for hot spots which indicate blockage due to scale build up. Refer to instructions in manual for flushing heat exchanger.
- Measure resistance of safety circuit.
- Ensure high fire and low fire manifold pressure is correct.
- Check for improper conversion of product.

16 Over Temperature Warning
- Check for restrictions in air flow around unit and vent terminal.
- Check for low water flow in a circulating system causing short-cycling.
- Check for foreign materials in combustion chamber and/or exhaust piping.
- Check for clogged heat exchanger.

25 Condensate Trap Error
- Condensate container is full.
- Check condensate drain path for blockage.
- Replace condensate trap

31 Burner Sensor Error
- Measure resistance of sensor.
- Replace sensor

32 Outgoing Water Temperature Sensor Fault
- Check sensor wiring for damage.
- Measure resistance of sensor.
- Clean sensor of scale build up.
- Replace sensor.

33 Heat Exchanger Outgoing Temperature Sensor Fault
- Check sensor wiring for damage.
- Measure resistance of sensor.
- Clean sensor of scale build up.
- Replace sensor.

52 Modulating Solenoid Valve Signal Abnormal
- Check modulating gas solenoid valve wiring harness for loose or damage terminals.
- Measure resistance of valve coil.

61 Combustion Fan Failure
- Ensure fan will turn freely.
- Check wiring harness to motor for damaged and/or loose connections.
- Measure resistance of motor winding.

65 Water Flow Servo Faulty (does not stop flow properly)

If blank screen is present on remote control then the flow control has shorted out. Unplug flow control. If remote lights up and unit starts operating then replace flow control assembly.

71 SV0, SV1, SV2, SV3, SV4 Solenoid Valve Circuit Fault
- Check wiring harness to all solenoids for damage and/or loose connections.
- Measure resistance of each solenoid valve coil.

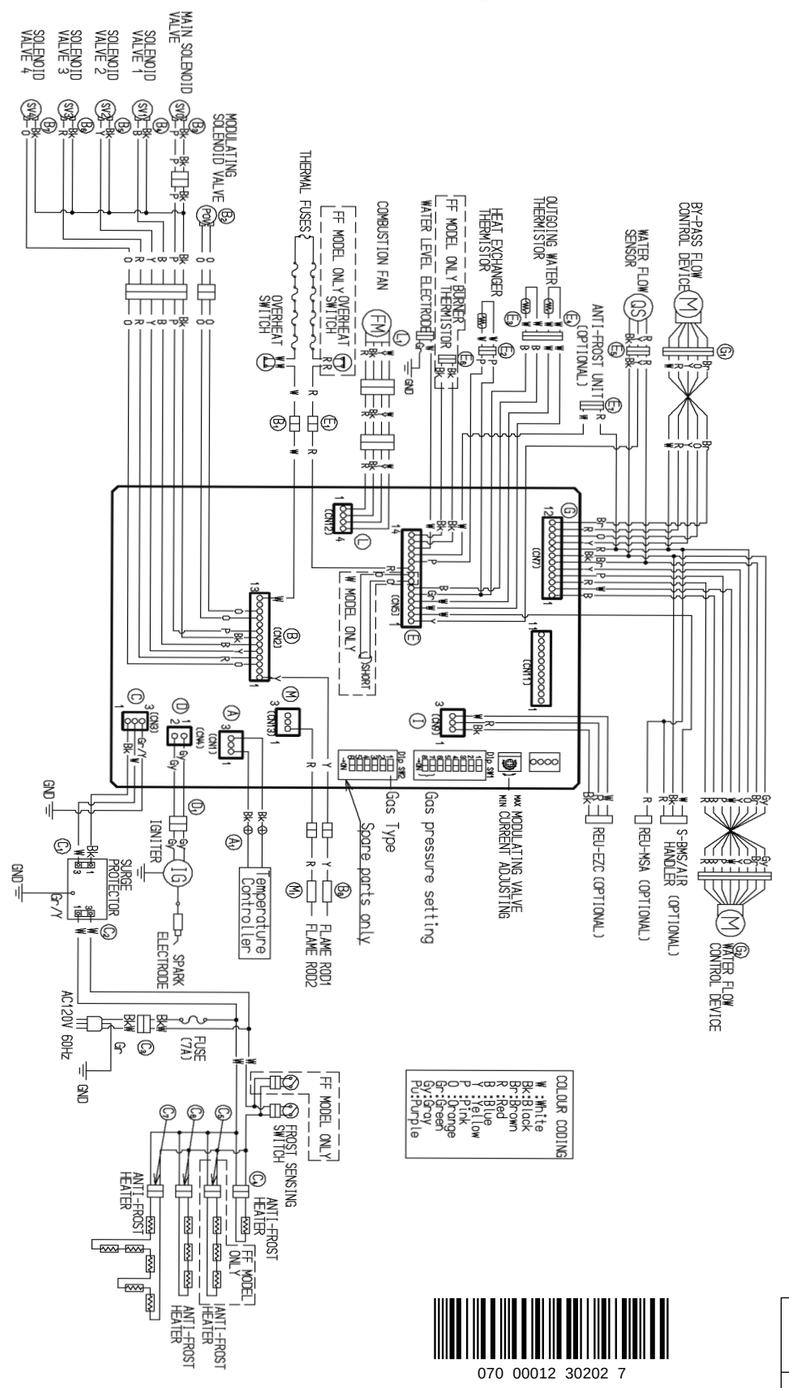
72 Flame Sensing Device Fault
- Ensure flame rod is touching flame when unit fires.
- Check all wiring to flame rod for damage.
- Remove flame rod and check for carbon build-up; clean with sand paper.
- Check inside burner chamber for any foreign material blocking flame at flame rod.
- Measure micro amp output of sensor circuit with flame present.
- Replace flame rod.

73 Burner Sensor Circuit Error
- Check sensor wiring and PCB for damage.
- Replace sensor

LC Scale Build-up in Heat Exchanger (when checking maintenance code history “00” is substituted for “LC”)
- Flush heat exchanger. Refer to instructions in manual.
- Replace heat exchanger.

No Code (Nothing happens when water flow is activated.)
- Clean inlet water supply filter.
- On new installations ensure hot and cold water lines are not reversed.
- Check for bleed over. Isolate unit from building by turning off hot water line to building. Isolate the circulating system if present. Open your pressure relief valve; if unit fires, there is bleed over in your plumbing.
- Ensure you have at least the minimum flow rate required to fire unit.
- Ensure turbine spins freely.
- Measure the resistance of the water flow control sensor.
- Remote control does not light up but you have 12 VDC at the terminals for controls.

Wire Diagram



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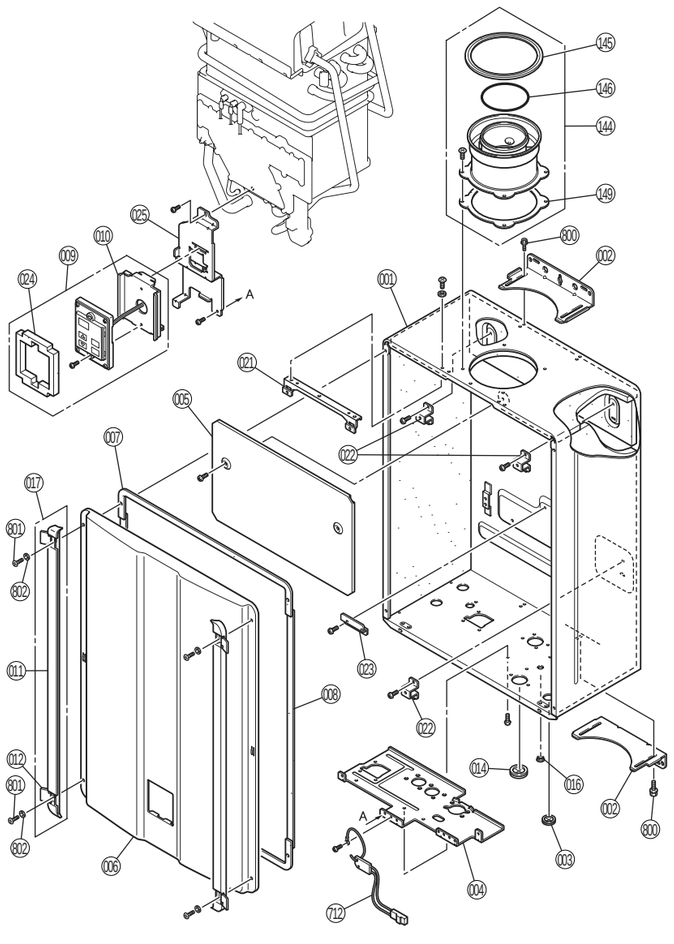
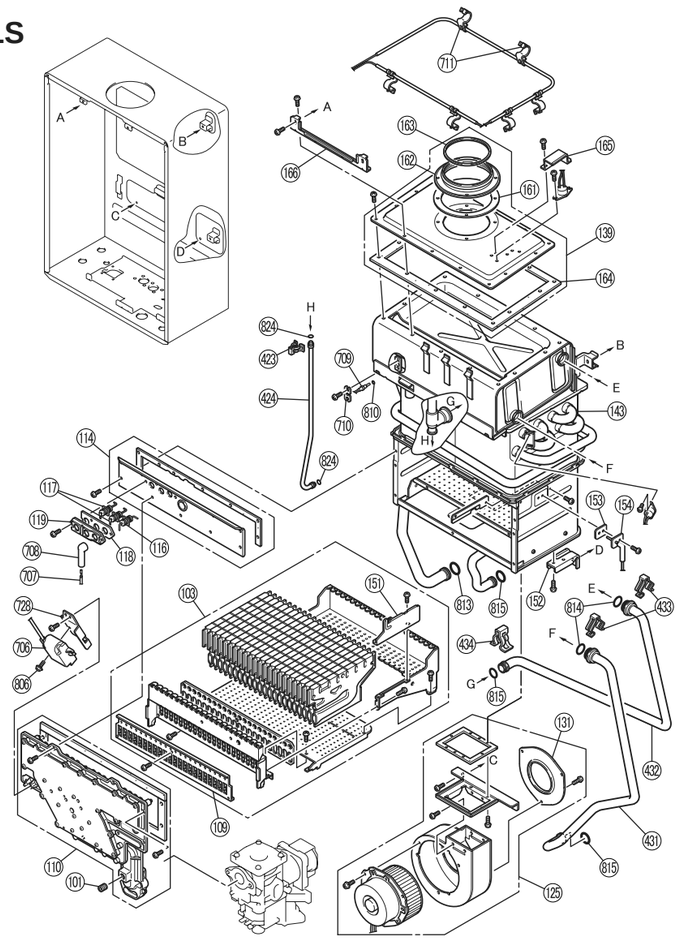
RC98HPi (KA3237FFUD-US)

U290-661X01(00)

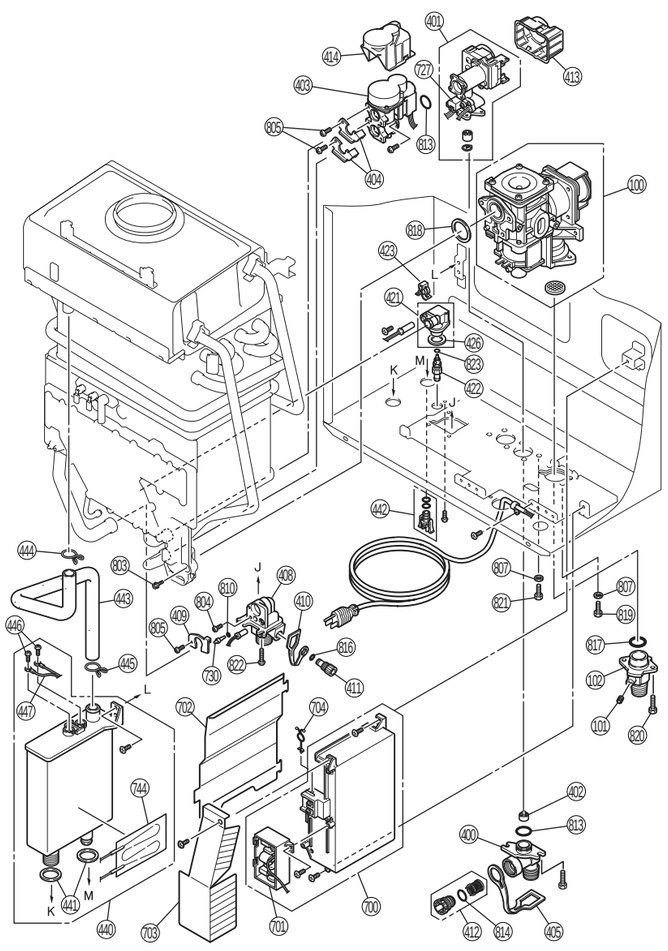
EXPLODED VIEW - CABINET



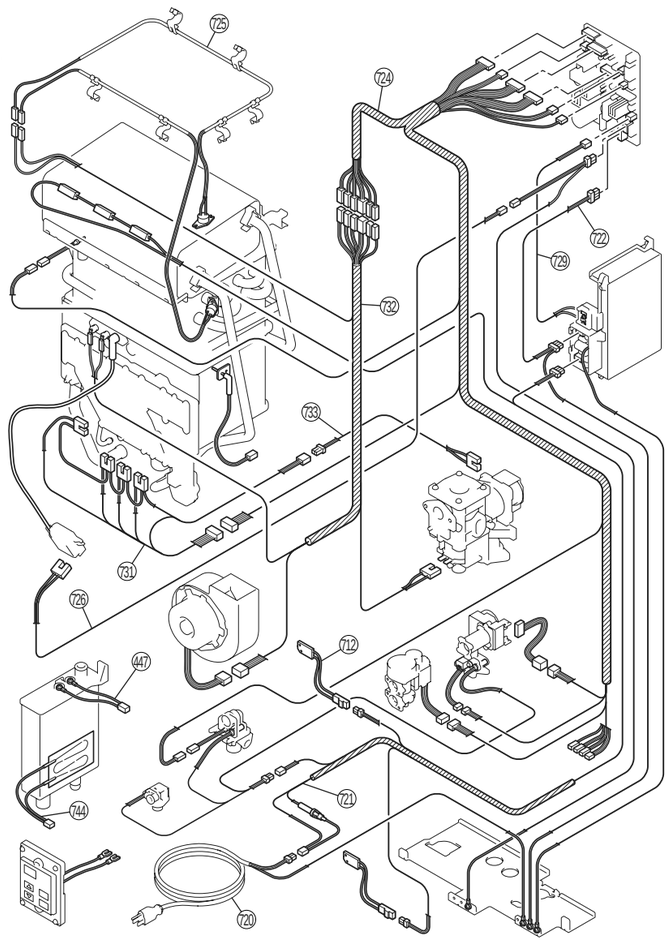
EXPLODED VIEW - INTERNALS



EXPLODED VIEW - INTERNALS



EXPLODED VIEW - ELECTRICAL



PARTS LIST

Item	Description	Part Number	Qty
001	Main Body	109000142	1
002	Wall Bracket	109000143	2
003	Rubber Bushing	109000015	1
004	Connection Reinforcement Panel	109000118	1
005	Heat Protection Plae	H73-065	1
006	Front Panel	109000144	1
007	Gasket - Top and Bottom	109000120	2
008	Gasket - Side	109000121	2
009	Temperature Controller	103000021	1
010	Temperature Controller Bracket	109000156	1
011	Screw Cover	109000122	2
012	Screw Cover Lid	109000150	4
014	Rubber Bushing	U245-125	1
016	Packing	109000016	1
017	Screw Cover Assembly	109000123	2
021	Reinforcement Bracket	109000124	1
022	Attachment Bracket	109000125	3
023	Reinforcement Bracket	U273-113	1
024	Tempereture Controller Packing	109000157	1
025	Temperature Controller Bracket	109000145	1
100	Gas Controller Assembly	106000034	1
101	Test port set screw	109000151	2
102	Gas Connection 3/4" NPT	CU195-1866	1
103	Burner Unit Assembly LPG	106000024	1
103	Burner Unit Assembly NG	106000035	1
109	Damper LPG	106000025	1
109	Damper NG	106000039	1
110	Manifold Assembly NG	106000036	1
110	Manifold Assembly LPG	106000037	1
113	Pressure Point Sealing Screw	C10D-5	1
114	Combustion Chamber Sight Glass Plate	106000038	1
116	Electrode	H73-120	1
117	Flame Rod	105000093	2
118	Electrode Packing	109000126	1
119	Electrode Holder	109000127	1
121	Tube Joint	109000146	1
122	Vent Tube	109000147	1
125	Fan Motor All Assembly	108000037	1
131	φ40 Bell Mouth	109000158	1
132	Combustion Chamber Fan Bracket	109000148	1
135	Air Inlet Box All Assembly	108000038	1
139	Air Inlet Duct	108000039	1
143	Heat Exchanger Assembly	107000062	1
144	Flue Connection Assembly	108000040	1
145	O-ring	108000017	1
146	O-ring	108000018	
149	Gasket	109000159	1
151	Burner Attachment Bracket	109000160	1
152	Reinforcement Bracket	109000128	1

Item	Description	Part Number	Qty
153	Burner Sensor Gasket	109000149	1
154	Burner Thermistor	105000100	1
161	Outlet pipe packing	109000161	1
162	Outlet pipe	107000064	1
163	O-ring	108000018	2
164	Packing	109000162	2
165	OHS cover	109000163	1
166	Reinforcement Bracket	109000129	1
400	Water Inlet 3/4" NPT	H73-501-2	1
401	Water Flow Servo and Sensor Assembly	107000055	1
402	Rectifier	M8D1-15X01	1
403	By-pass Flow Assembly	M6J-1-4	1
404	Stop Bracket	AH69-310	2
405	Plug Band	109000018	1
408	Hot Water Outlet 3/4" NPT	107000056	1
409	Stop Bracket	U211-322X01	1
410	Plug Band (small)	109000019	1
411	Drain Valve	107000021	1
412	Water Filter Assembly	H98-510-S	1
413	Cover	109000130	1
421	Drain Connection	107000057	1
422	Drain Plug	107000058	1
423	Clip	109000131	2
424	Connecting Pipe	107000059	1
426	Packing	109000153	1
431	Connecting Pipe - Inlet	107000060	1
432	Connecting Pipe - HEX	107000061	1
433	Clip	109000132	2
434	Clip	109000133	1
440	Condensate Trap	109000134	1
441	Packing	109000154	2
442	Condensate Trap Plug	109000135	1
443	Condensate Drain Tube	109000136	1
444	Band	109000137	1
445	Band	109000138	1
446	Screw	109000155	2
447	Conection Harness	105000105	1
700	PC Board	105000094	1
701	Surge Protector	105000014	1
701	Surge Protector with Terminals	BU195-1873-2X01	1
702	PC Board Cover Side	109000164	1
703	PC Board Cover Front	109000139	1
704	Clip	109000140	1
706	Ignitor	105000018	1
707	High TensionCord	105000095	1
708	Electrode Sleeve	AU206-218	1
709	Thermistor	105000096	1
710	Thermistor Clip Large	CP-90172	1
711	Thermal Fuse Clip	109000141	5

Item	Description	Part Number	Qty
712	Frost Sensing Switch	105000097	2
713	Anti Frost Heater 120V	105000098	1
715	Valve Heater 120V Assembly	105000099	1
716	Anti Frost Heater Clip B	105000026	2
717	Anti Frost Heater Clip A	AU124-618X01	1
718	Anti Frost Heater Clip C	105000027	1
719	Inlet Air Thermistor	105000029	1
720	Power Cord	105000030	1
721	Fuse Harness	105000101	1
722	Power Harness	105000107	1
723	Solenoid Valve Harness	105000102	1
724	Sensor Harness	105000103	1
725	Thermal Fuse Harness Assembly	105000104	1
726	Ignitor Harness	105000112	1
727	Flow sensor	105000041	1
728	Ignitor Attachment Plate	109000165	1
729	Temperature Controller Harness	105000042	1
730	Thermistor	105000108	1
731	Solenoid Connection Harness	105000109	1
732	AWG#18 Harness	105000110	1
733	Connection Harness	105000111	1
743	Secondary Heat Exchanger Heater	107000063	1
744	Heater and Harness	105000106	1
800	Screw	ZIHD0510UK	8
801	Screw	CP-30580-3	4
802	Washer	CF83-41430	4
803	Screw	CP-30627-414	3
804	Screw	U217-449	1
805	Screw	ZAA0408UK	3
806	Screw	CP-80452	1
807	Washer	AU48-174X01	2
810	O-ring	M10B-2-4	2
811	O-ring	M10B-2-3	1
812	O-ring	M10B-2-6	2
813	O-ring	M10B-2-18	3
814	O-ring	M10B-2-16	3
815	O-ring	M10B-2-14	4
816	O-ring	M10B-2-7	1
817	O-ring	M10B-1-24	1
818	Packing	C36E3-7	1
819	Screw	ZQAA0512UK	2
820	Screw	ZQAA0514UK	4
821	Screw	ZQAA0508UK	2
822	Screw	ZBA0512UK	3
823	O-ring	M10B-2-5	1
824	O-ring	M10B-2-6	2
888	Tech Sheet	100000149	1
889	Manual	100000150	1
900	Front Panel Label	100000148	1