Maintenance sheet

CT-199
8J3166-1

A. Troubleshooting

If the error code is indicated on the green LED (Refer to Section **C**) on the PCB (Part #701) of the water heater (and/or the remote controller), refer to Section **B**.

<< It takes a long time to get hot water at the fixtures >>
- The time it takes to deliver hot water from the water heater to your fixtures depends on the length of piping between the two. The longer the distance or the bigger the pipes, the longer it will take to get hot water.
- If you would like to receive hot water to your fixtures more quickly, you may want to consider a hot water recirculation system.

<< The water is not hot enough or turns cold and stays cold >>
- Compare the flow and temperature. Refer to the "Output temperature chart" in the Installation manual.
- Check cross plumbing between cold water lines and hot water lines.
- Check if the gas supply valve is open fully , the gas line is sized properly, and the gas supply pressure is within specified limits. Refer to the "Gas supply and gas pipe sizing" in the Installation manual.
- Check the set temperature, and change the set temperature with the remote controller or the DIP switch setting. Refer to Section **D**.
- Refer to the **"Water circuit"** in this section.
- Is the Easy-Link or Multi-Unit System set up correctly?

<<The water is too hot>>
- Check the set temperature and lower.

<<The hot water is not available when a fixture is opened>>
- Refer to **"Power supply circuit"** and **"Water circuit"** in this section.
- Check if the gas supply valve is open fully, the gas line is sized properly, and the gas supply pressure is within specified limits.
- Is the Easy-Link or Multi-Unit System set up correctly?

<<Fluctuation in hot water temperature>>
- Check if the filter on the cold water inlet is cleaned. (Part #406)
- Check if the gas line is sized properly and and the gas supply pressure is within specified limits.
- Check for cross connection between cold water lines and hot water lines.
- Refer to the **"Water circuit"** in this section.
- Is the Easy-Link or Multi-Unit System set up correctly?

<<Unit does not ignite when water goes through the water heater>>
- Refer to **"Power supply circuit"** and **"Water circuit"** in this section.
- Check if the inlet water temperature is too high. If it is too close to the set temperature, the water heater won't activate.
- Is the gas supply turned on?

<<The fan motor is still spinning after operation has stopped>>
- This is normal. After operation has stopped, the fan motor keeps running from 15 to 70 seconds in order to re-ignite quickly, as well as purge all the exhaust gas out of the flue.

<<Abnormal sound from water heater>>
- An abnormal sound from the water heaters is caused by not enough air supply or incorrct installations. The water heater needs more combustion air. Refer to the "101" error code in the section B.

<<Power supply circuit>>
- Check the power supply, and make sure that the water heater has 120 VAC.
- Is the power switch inside water heater turned on? (Part #706)
- Press the "ON/OFF" button of the built-in controller (the remote controller, if it is installed*) and make sure that the STAND BY LED on the controller is lit. Run the water.
- Check if the green LED on the PCB (Part #701) of the water heater is lit. If so, the power supply circuit of the water heater is under normal condition. Next, refer to **"Water circuit"** in this section.
- Check the fuse on the surge box (Part #703), and if it has a brown spot, need to replace it.
- If the green LED on the PCB (Part #701) isn't lit, some electrical parts may be broken. **Consult the manufacturer.**

<<Water circuit>>
- Turn on the power button on the built-in controller (the remote controller if it is installed*), and then check if the STAND BY LED will light up.
- Open all hot water faucets, and make sure that there is enough water flow. This water heater needs at least 0.5 GPM (1.9 L/m) water flow (at the default set temperature) to operate.
- Check for reverse connection and cross connection.
- Check to see if the filter on the cold water inlet is clogged or if there is sediment buildup in the filter. (Part #406)
- Check if water ways in the water heater are frozen. If so, thaw them. Refer to the Installation manual to protect your water heater from freezing.
- Check if the inlet water pressure is higher than 40 psi. If it's lower than 40 psi, increase the pressure.
- Check for connections and breakage of wires (Part #402).
- Check if the motor drive of the flow adjustment valve (Part #402) is locked due to scale buildup, and/or water leakage. If so, consult the manufacturer.

***If a remote controller is installed, it will take priority over the built-in controller.**

B. Error codes

The 341, 751 and 941 error codes are applied to the CT-199 Indoor only.

031: Incorrect DIP switch setting
- Check the DIP switch settings on the PCB. Refer to Section **D**.

101: Warning for the "991" error code
- Check the gas type of the house (and/or the building).
- Check if there is any blockage in the intake air and/or exhaust. Refer to the "Venting Instructions" in the Installation manual.
- If the water heater is installed as a direct-vent system, check whether there is enough distance between the intake air terminal and the exhaust terminal. Refer to the "Vent termination clearances" in the Installation manual.
- Check the total vent length. Refer to the "Venting instructions" in the Installation manual.
- Check the altitude/elevation of area of where the water heater is installed. Refer to the **"High-altitude function"** of Section for the correct DIP switch settings.
- Check if there is grease and/or dirt in the burner (Part #101) and the fan motor (Part #103), especially if the water heater has been installed in a contaminated area.
- Check if there is dust and lint in the heat exchanger.
- Check the manifold pressure of the water heater. Refer to the rating plate of the water heater.

111: Ignition failure*
- Check the gas supply and inlet gas pressure.
- Check if the Hi-limit switch (Part #412) is functioning properly.
- Check for connection/breakage of wires (Part #413, 708, 709, 711), and/or soot on the flame rod (Part #108). And then if the O.H.C.F (Part #413) has a breakage, **consult the manufacturer**. Check if there is a buzzing spark ignition sound coming from the burner (Part #101) when water heater prepares for combustion.
- Listen for the double "clunk" sound coming from the gas valve assembly (Part #102) when water heater goes into combustion.
- (Only if sparking and/or clunk sound) Check the voltage on each wire to gas valve assembly (Part #102) and/or the igniter assembly (Part #711). Refer to **"Appendix A"** in Section **C**.
  *No sparking sound >>>>> Refer to #1 at **"Appendix A"** in Section **C**.
  *No clunk sound >>>>> Refer to #2 at **"Appendix A"** in Section **C**.
- Check if there is leaking from the heat exchanger (Part #401).
- Check if there is dust and lint in nozzles of the manifold (Part #102).
- Check the current on the flame rod (Part #108). Refer to #3 at **"Appendix A"** in Section **C**.

121: Loss of flame*
- Check the gas supply and inlet gas pressure.
- Check if the Hi-limit switch (Part #412) is functioning properly.
- Check for connection/breakage of wires (Part #413, 708, 709, 711), burn marks on the computer board (Part #701), and/or soot on the flame rod (Part #108). And then if the O.H.C.F (Part #413) has a breakage, **consult the manufacturer**.
- Check if there is leaking from the heat exchanger (Part #401).
- Check if there is dust and lint in nozzles of the manifold (Part #102).
- Check the current on the flame rod (Part #108). Refer to #3 at **"Appendix A"** in Section **C**.

311,321,331,341: Disconnected/short-circuited thermistor*
- Check for connection/breakage of wires and/or debris on the thermistor (Part #407, 408, 411, 715, 718).
- Check the thermistor resistance. Refer to "Appendix D" in Section C.

391: Air-fuel ratio rod failure*
- Check for connection/breakage of wires (Part #709) and/or soot on the flame rod (Part #108).

441: Flow sensor failure (Only Easy-Link & Multi-Unit Systems)
- Check for connection/breakage of wires and/or debris on the flow sensor impeller (Part #402).

510,551: Abnormal main gas solenoid valve and gas solenoid valve
- Check for connection/breakage of wires (Part #708) and/or burn marks on the computer board (Part #701).
- Reset power supply of the water heater.
- Check the voltage of each valve on the gas valve assembly (Part #102). Refer to **"Appendix C"** in Section **C**.

611: Fan motor fault*
- Check for connection/breakage of wires, dust buildup in the fan motor (Part #103) and/or burn marks on the computer board (Part #701).
- Check for frozen/corrosion of connectors of the fan motor (Part #103).
- Check the voltage between blue wire and each wire of the fan motor (Part #103). Refer to "Appendix B" in Section C.

651: Flow adjustment valve fault (Only Easy-Link & Multi-Unit Systems)
- Inspect the flow adjustment valve (Part #402), for connection/breakage of wires, locked motor drive due to scale buildup, and/or water leakage.
- Check the voltage between black wire and red wire. Refer to "Appendix F" in Section C.

661: Bypass valve fault*
- Inspect the bypass valve (Part #403), for connection/breakage of wires, locked motor drive due to scale buildup, and/or water leakage.
- Check the voltage between brown wire and red wire. Refer to "Appendix F" in Section C.

701: Computer board fault*
- Check for connection/breakage of wires (Part #714), and check the resistance between white wire and red wire. Refer to "Appendix A" in Section C.
- Check the outlet thermistor (Part #408) for proper readings as it may need to be cleaned.

711: Gas solenoid valve drive circuit failure*
- Refer to the "111" and "121" error codes in this section.

721: False flame detection*
- Clean the flame rod (Part #108).
- Check if there is leaking from the heat exchanger (Part #401).

741: Miscommunication between water heater and remote controller
- Check the model type of the remote controller. Model No. 100112572 (TM-RE40)
- Inspect the connections between the water heater and remote controller. Refer to the "Temperature Remote Controller" in the Installation manual.
- Check the power supply of the water heater.
- If this error code appears only on the green LED in the PCB (Part #701), check the voltage on the remote controller terminal on the PCB. Refer to "Appendix E" in Section C.
- If this error code appears only on the remote controller, replace the PCB (Part #701).
- If this error code appears on both the PCB (Part #701) and the remote controller, replace the remote controller.

751: Miscommunication between water heater and built-in controller
- Check the power supply of the water heater.
- If this error code appears only on the green LED in the PCB (Part #701), check the voltage on the built-in controller terminal on the PCB. Refer to "Appendix E" in Section C.
- If this error code appears only on the built-in controller, replace the PCB (Part #701).
- If this error code appears on both the PCB (Part #701) and built-in controller (Part #722), replace the built-in controller (Part #722).

761: Miscommunication between Parent unit and Child units for Easy-Link System
- Check if the connections between the parent unit and the child units are correct. Refer to the "Easy-Link system" section in the Installation manual.

941: Abnormal exhaust temperature (Only Indoor)
- Check for connection/breakage of wires, dust buildup in the fan motor (Part #103) and/or burn marks on the computer board (Part #701).
- Check the exhaust thermistor resistance. Refer to "Appendix D" in Section C.

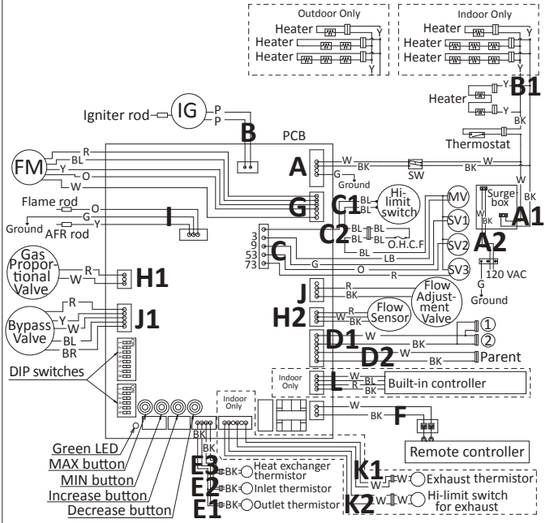
991: Imperfect combustion*
- Refer to the "101" error code in this section.

*These error codes will be cleared when water flow stops in a single unit installation.

C. Wiring diagram and check point of the water heater

The tech should power the heater off and then on to reset the error code.

W: WHITE BK: BLACK LB: LIGHT BLUE
R: RED BL: BLUE Y: YELLOW
G: GREEN O: ORANGE BR: BROWN P: PURPLE



Appendix A (For error code 111)

Check the following points during ignition stage.

1. Refer to check point **"B"** on the wiring diagram above.
Check the voltage between purple wires. (Normal: 108 to 132 VAC)
Is the voltage within normal range?
Yes >> Replace the igniter assembly (Part #711).
No >> Go to Next.

2. Refer to check points **"C" and "H1"** on the wiring diagram above.
Check the voltages below:
C: Between blue wire and light blue wire (#3). (Normal: 93 to 120 VDC)
C: Between blue wire and orange wire (#53). (Normal: 93 to 120 VDC)
H1: Check the voltage between white wire and red wire. (Normal: 1 to 15 VDC)
Are these voltages within normal range?
Yes >> Replace the gas valve assembly (Part #102).
No >> Replace the PCB (Part #701).

3. Check the current through the yellow flame rod wire (Part #709). (Normal: more than 5 μA)
Is the current normal when there is a flame?
Yes >> Replace the PCB (Part #701).
No >> Replace the flame rod (Part #108).

Appendix B (For error code 611)

Refer to check point **"G"** in the diagram to the left and the following.
- Check the voltage between red wire and blue wire (Normal: 132 to 192 VDC).
- Check the voltage between yellow wire and blue wire (Normal: 13 to 17 VDC).
- Check the voltage between orange wire and blue wire (Normal: 2.0 to 6.5 VDC).

Are all of the voltages within normal range?
Yes >> Replace the fan motor (Part #103).
No >> Replace the PCB (Part #701).

Appendix C (For error code 510 and 551)

Refer to check point **"C"** in the diagram to the left and the following.
Check the voltage on each valve on the gas valve assembly.
- Between blue wire and light blue wire (#3) (Normal: 93 to 120 VDC).
- Between blue wire and green wire (#9) (Normal: 93 to 120 VDC).
- Between blue wire and orange wire (#53) (Normal: 93 to 120 VDC).
- Between blue wire and red wire (#73) (Normal: 93 to 120 VDC).

Are all of the voltages within normal range?
Yes >> Replace the gas valve assembly (Part #102).
No >> Replace the PCB (Part #701).

Appendix D (For error code 311, 321, 331, 341, and 941)

- Outlet thermistor (Find the marking of No.113 on the connector)
  Check point **"E1"**
- Inlet thermistor (Find the marking of No.42 on the connector)
  Check point **"E2"**
- Heat exchanger thermistor (Find the marking of No.12 on the connector)
  Check point **"E3"**

Check the resistance between black wire and black wire.

Temperature	°F	50	59	68	77	86	95
	°C	10	15	20	25	30	35
Resistance	kΩ	15.4	12.6	10.3	8.5	7.0	5.9

- Exhaust thermistor
  Check point **"K1"**

Check the resistance between white wire and white wire.

Temperature	°F	50	59	68	77	86	95
	°C	10	15	20	25	30	35
Resistance	kΩ	19.5	15.9	13.0	10.7	8.9	7.4

Are all of the check points normal?
Yes >> Replace the PCB (Part #701).
No >> Replace the thermistor (Part #407, 408, 411, 718).

Appendix E (For error code 741 and 751)

Error code 741: Refer to check point **"F"** on the wiring diagram above.
Error code 751 : Refer to check point **"L"** on the wiring diagram above.
Check the voltage on the remote controller and/or built-in controller on the PCB.
- Between black wire and white wire. (Normal: 11 to 25 VDC)

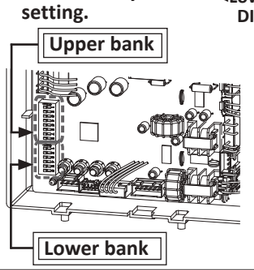
Is the voltage within normal range?
Yes >> Replace the remote controller and/or built-in controller.
No >> Replace the PCB (Part #701).

Appendix F (For error code 651 and 661)

Error code 651 : Refer to check point **"J"** on the wiring diagram above. Check the voltage between black wire and red wire. (Normal: 7 to 16 VDC)
Error code 661 : Refer to check point **"J1"** on the wiring diagram above. Check the voltage between brown wire and red wire. (Normal: 3 to 11 VDC)
Is the voltage within normal range?
Yes >> Error code 651: Replace the Flow adjustment valve (Part #402). / Error code 661: Replace the Bypass valve (Part #403).
No >> Replace the PCB (Part #701).

D. DIP switch settings on the computer board of the water heater

- **Locate the bank of DIP switches at the bottom left of the computer board of the unit.**
- **Change the DIP switch settings when the power supply is turned off.**
- **The dark squares indicate the correct DIP switch set positions. DEFAULT is the factory setting.**



*Factory setting

<Upper bank of DIP switches>

Vent settings (Indoor model only)

3"	Direct Vent	5 to 20 ft (1.5 to 6.1 m) (DEFAULT)	21 to 40 ft (6.2 to 12.2 m)	41 to 70 ft (12.3 to 21.3 m)
	Single Vent	5 to 45 ft (1.5 to 13.7 m) (DEFAULT)	46 to 70 ft (13.8 to 12.3 m)	N/A
4" venting		5 to 50 ft (DEFAULT) (1.5 to 15.2 m)	51 to 100 ft (15.3 to 30.5 m)	N/A
		ON 1 2 3 4 5 6 7 8 OFF	ON 1 2 3 4 5 6 7 8 OFF	ON 1 2 3 4 5 6 7 8 OFF

Set DIP switches shown in the table above depending on the vent length.

Gas type*

Propane: ON 1 2 3 4 OFF
Natural Gas: ON 1 2 3 4 OFF

Outdoor model*

ON 1 2 3 4 5 6 7 8 OFF

<Lower bank of DIP switches>

Temperature set

120 °F (50 °C) DEFAULT: ON 1 2 3 4 5 6 OFF
140 °F (60 °C): ON 1 2 3 4 5 6 OFF

Easy-Link System

Parent Unit: ON 1 2 3 4 5 6 OFF
Child Unit (DEFAULT): ON 1 2 3 4 5 6 OFF

Single unit is the same as the child unit.

High-altitude function

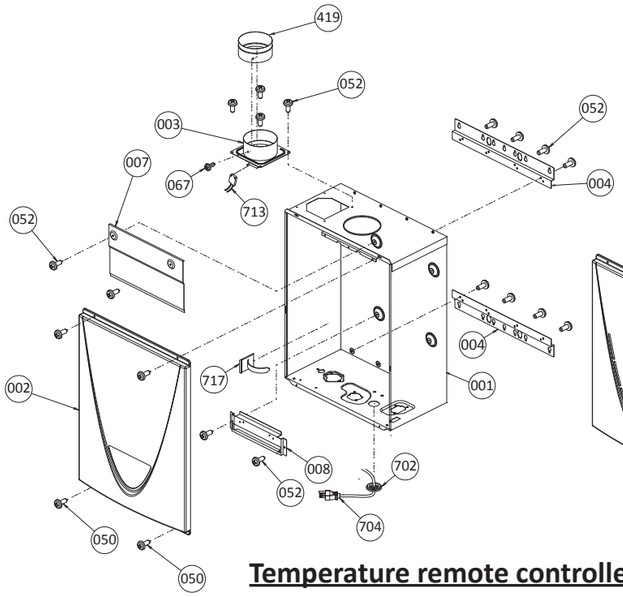
Indoor model		Outdoor model	
0 to 2,000 ft (0 to 610 m) DEFAULT	ON 1 2 3 4 5 6 OFF	0 to 2,000 ft (0 to 610 m) DEFAULT	ON 1 2 3 4 5 6 OFF
2,000 to 3,000 ft (611 to 914 m)	ON 1 2 3 4 5 6 OFF	2,000 to 4,000 ft (611 to 1,219 m)	ON 1 2 3 4 5 6 OFF
3,000 to 5,000 ft (915 to 1,524 m)	ON 1 2 3 4 5 6 OFF	4,000 to 6,000 ft (1,220 to 1,829 m)	ON 1 2 3 4 5 6 OFF
5,000 to 7,500 ft (1,525 to 2.286 m)	ON 1 2 3 4 5 6 OFF		
7,500 to 10,100 ft (2,287 to 3,078 m)	ON 1 2 3 4 5 6 OFF		

FM speed is increased automatically.

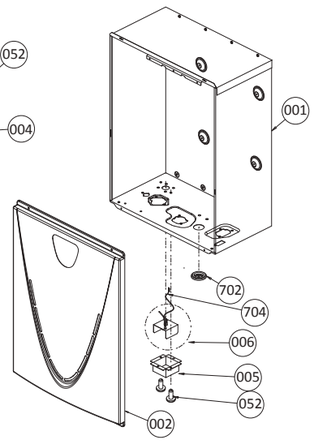
E. Components diagram / Parts list

Case assembly

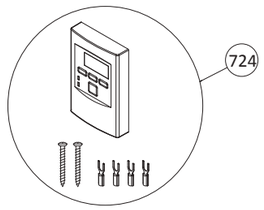
Indoor model



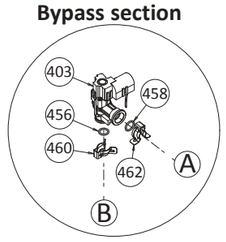
Outdoor model



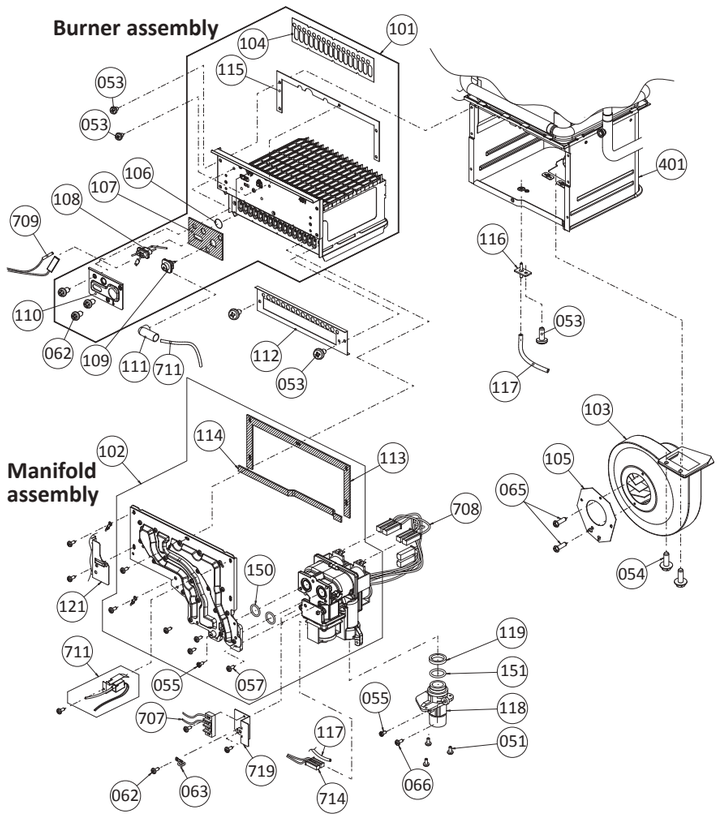
Temperature remote controller



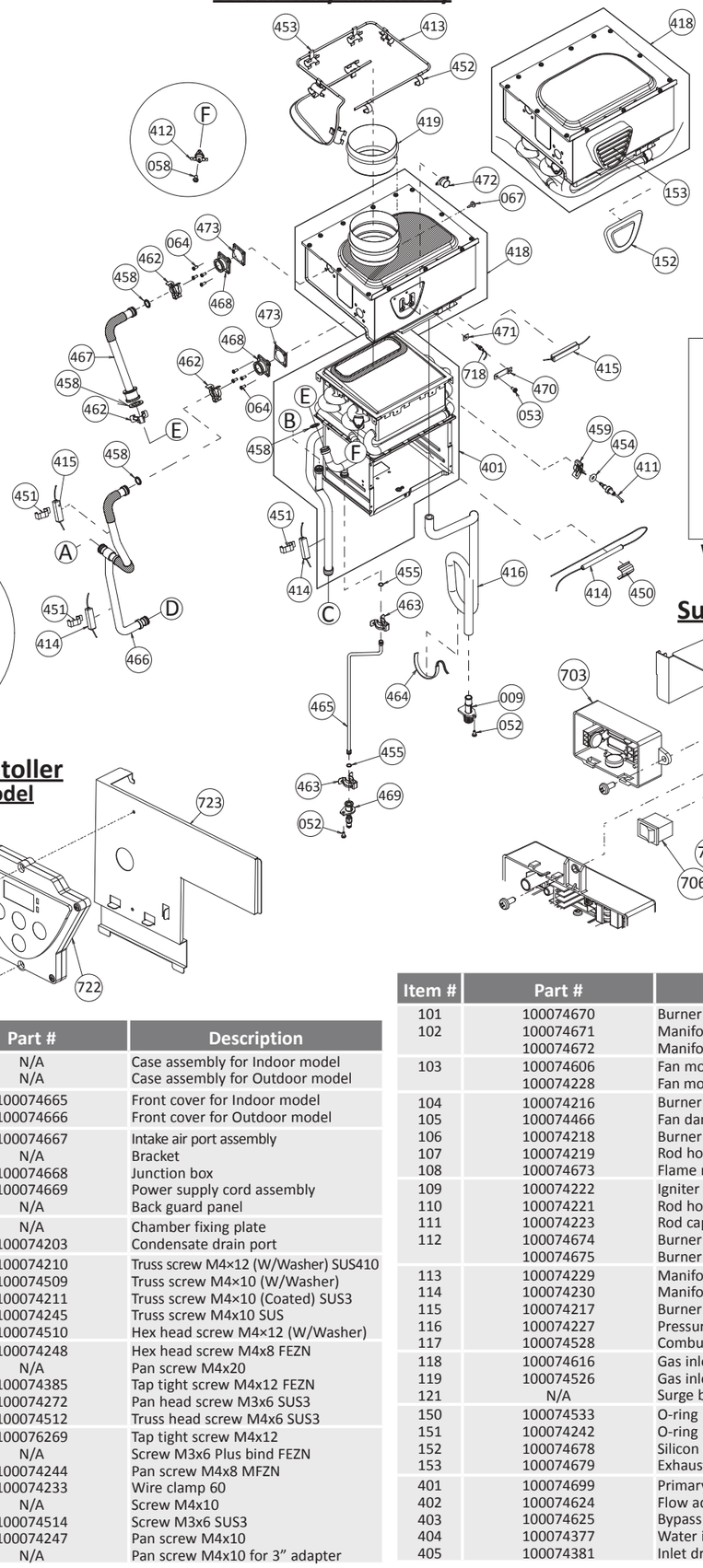
Bypass section



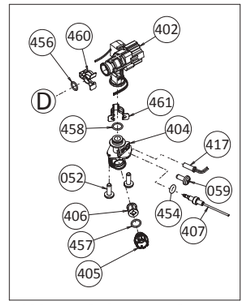
Burner assembly



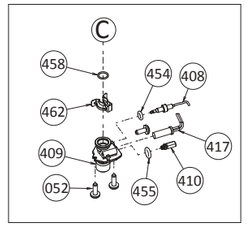
Water way assembly



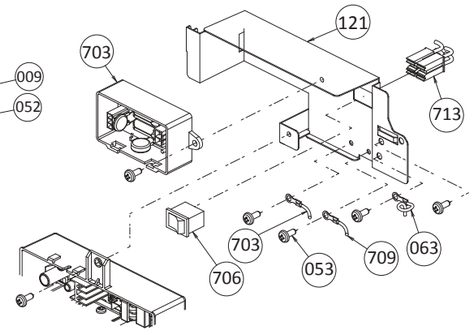
Water inlet section



Water outlet section



Surge box



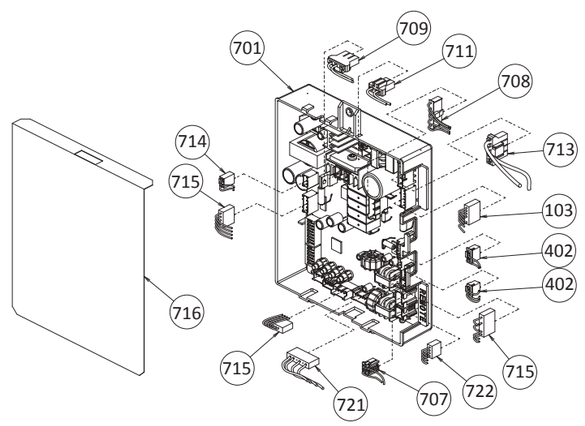
Built-in contoller

Indoor model

Item #	Part #	Description
001	N/A N/A	Case assembly for Indoor model Case assembly for Outdoor model
002	100074665 100074666	Front cover for Indoor model Front cover for Outdoor model
003	100074667	Intake air port assembly
004	N/A	Bracket
005	100074668	Junction box
006	100074669	Power supply cord assembly
007	N/A	Back guard panel
008	N/A	Chamber fixing plate
009	100074203	Condensate drain port
050	100074210	Truss screw M4×12 (W/Washer) SUS410
051	100074509	Truss screw M4×10 (W/Washer)
052	100074211	Truss screw M4×10 (Coated) SUS3
053	100074245	Truss screw M4x10 SUS
054	100074510	Hex head screw M4×12 (W/Washer)
055	100074248	Hex head screw M4x8 FEZN
056	N/A	Pan screw M4x20
057	100074385	Tap tight screw M4x12 FEZN
058	100074272	Pan head screw M3x6 SUS3
059	100074512	Truss head screw M4x6 SUS3
060	100076269	Tap tight screw M4x12
061	N/A	Screw M3x6 Plus bind FEZN
062	100074244	Pan screw M4x8 MFZN
063	100074233	Wire clamp 60
064	N/A	Screw M4x10
065	100074514	Screw M3x6 SUS3
066	100074247	Pan screw M4x10
067	N/A	Pan screw M4x10 for 3” adapter

Item #	Part #	Description
101	100074670	Burner assembly
102	100074671 100074672	Manifold with gas valve assembly LP Manifold with gas valve assembly NA
103	100074606 100074228	Fan motor for Indoor model Fan motor for Outdoor model
104	100074216	Burner gasket
105	100074466	Fan damper for Indoor model
106	100074218	Burner window
107	100074219	Rod holder gasket
108	100074673	Flame rod
109	100074222	Igniter rod
110	100074221	Rod holder
111	100074223	Rod cap
112	100074674 100074675	Burner damper LP Burner damper NA
113	100074229	Manifold gasket A
114	100074230	Manifold gasket B
115	100074217	Burner holder gasket
116	100074227	Pressure port
117	100074528	Combustion chamber tube
118	100074616	Gas inlet
119	100074526	Gas inlet ring
121	N/A	Surge box plate
150	100074533	O-ring P18 NBR (Black)
151	100074242	O-ring P20 NBR (Black)
152	100074678	Silicon ring for Outdoor model
153	100074679	Exhaust port for Outdoor model
401	100074699	Primary heat exchanger assembly
402	100074624	Flow adjustment valve / Flow sensor
403	100074625	Bypass valve
404	100074377	Water inlet
405	100074381	Inlet drain plug

Computer board assembly



Item #	Part #	Description
406	100074382	Inlet water filter
407	100074626	Inlet thermistor
408	100074374	Outlet thermistor
409	100074681	Water outlet
410	100074383	Outlet drain plug
411	100074281	Heat exchanger thermistor
412	100074280	Hi-Limit switch
413	100074334	Overheat-cut-off fuse
414	100074682	Pipe heater
415	100074683 100074684	Inlet heater for Indoor model Inlet heater for Outdoor model
416	100074685	Drain tube
417	100074629	Inlet heater
418	100074700 100074701	Secondary heat exchanger for Indoor model Secondary heat exchanger for Outdoor model
419	100310706	3” PVC adapter
450	100074703	Pipe heater fixing plate
451	100074310	Heater fixing plate 16
452	100074251	Fuse fixing plate 18
453	100074331	Fuse fixing plate 14
454	100076303	O-ring P4 FKM
455	100076305	O-ring P6 FKM
456	100076306	O-ring P14 FKM
457	100076307	O-ring P15 FKM
458	100076308	O-ring P16 FKM
459	100074282	Fastener “4-11”
460	100074290	Fastener “14-22”
461	100074410	Fastener “16A”
462	100074389	Fastener “16-25A”
463	100074297	Fastener “6-15”
464	100074686	Flat heater
465	100074687	Drain pipe
466	100074689	Cold pipe
467	100074690	Stainless heat exchanger out pipe
468	100074691	Header connection
469	100074692	Drain port
470	100074291	Thermistor fixing plate
471	100074296	Exhaust thermistor gasket
472	100074289	Hi-limit switch for exhaust
473	100074693	Gasket
701	100074696	Computer board
702	100076470	Rubber grommet
703	100076100	Surge box
704	100074601 100074697	120 VAC wire for Indoor model 120 VAC wire for Outdoor model
706	100074326	120 VAC Power ON-OFF switch
707	100074650	Remote controller wire
708	100074651	Gas valve wire
709	100074652	Flame rod wire
711	100074640	Igniter assembly
713	100074655 100074656	Switch wire with thermostat for Indoor model Switch wire with thermostat for Outdoor model
714	100074657	Proportional gas valve wire
715	100074658	24V cables
716	100074375	Computer board cover
717	N/A	Cable clamp for Indoor model
718	100074316	Exhaust thermistor for Indoor model
719	100074644	Remote fixing plate
721	100074659	Exhaust Hi-limit switch wire
722	100287658	Built-in controller for Indoor model
723	100074661	Fixing plate
724	100112572	Temperature remote controller
N/A	100076516	Communication cable for linking.*

*Refer to p. 9 on the Installation manual.