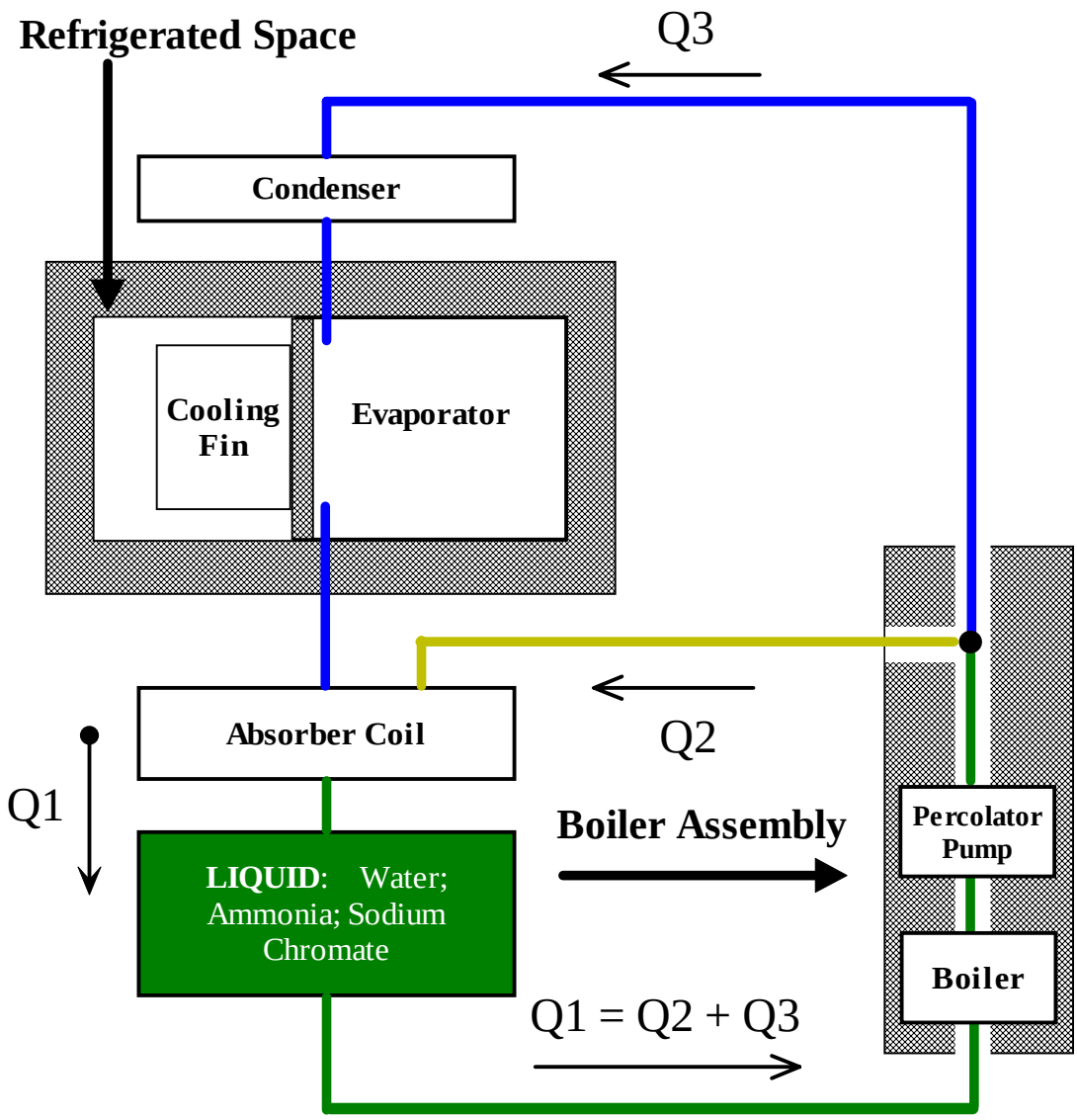


ARP 2.0 & ARP + Fan Control v2.1

Troubleshooting Guide

Terms -- Conditions & Contact Information

By use of this document for installation and operation of the ARP Control, the user is agreeing to the ARPC L.L.C. terms and conditions found in document ARPC LLC License Agreement.pdf. Also, the end user needs to understand that the ARP Control can be turned off at any time, thereby removing the ARP Control function and reverting to the operation of the refrigerator to its previous state. Power surges can turn off the ARP Control just the same as any equipment in an RV, thus it is the operators responsibility to insure that the control is functioning.

The document "ARPC LLC License Agreement.pdf" can be downloaded at web address

http://www.ARPrv.com

or, please send any request to e-mail address below, ARPC L.L.C. will supply information in a timely manner:

ARPrvSafe@gmail.com

Cover Diagram

The diagram on the cover is a block diagram showing the flow of the refrigerant fluids. Q1 is the liquid water and ammonia which enters the boiler. Within the boiler ammonia is turned to gas Q3, and in turn forces the remaining water Q2 up the pump tube. At the top of the pump tube the two paths for the fluids Q2 and Q3 diverge. The ammonia gas Q3 cools the refrigerated space and then returns to the absorber coil where the water Q2 enters. Within the absorber coil the two fluids are recombined to reconstitute the refrigerant Q1 to repeat the cycle.

CONTENTS

SAFETY

1.1 Acronyms and Abbreviations

ARP: ARP Control
RTD: ARP Control temperature sensor; Resistance temperature detector is the type of sensor used.
Q: Flow of fluid either as a gas or liquid.
SPAR: Single Pressure Absorption Refrigerator.

1.2 Hazard Information

Hazard information includes terms, symbols and instructions used in this manual or on the equipment to alert operating and service personnel to the recommended precautions in the care, use and handling of the ARP Control.

1.3 Terms & Warnings Symbols

DANGER	Imminent hazards which, if not avoided, will result in serious injury or death.
WARNING	Potential hazards which, if not avoided, could result in serious injury or death.
CAUTION	Potential hazards which, if not avoided, could result in minor or moderate injury.

1.4 Work Safely

There are many ways to install the ARP Control. **Make safety your first priority!** The installer's knowledge, skill, and ability are important for safely installing the system and maintaining or troubleshooting it. If you are unsure of your ability to use the ARP as diagnostic tool, have a qualified individual do the work.

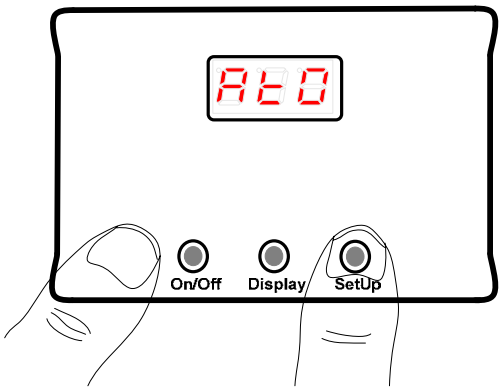
1.5 Operation Safety

The ARP Control and 'ARPrvSafe' infer that the use and operation of this control can add a level of safety to your absorption refrigeration system in your RV. No other RV absorption refrigerator control monitors the boiler temperature, and turns off the heat source to the refrigerator before damage can be done to the internal fluids in the refrigerator cooling unit. The ARP cannot prevent RV refrigerator failure if the manufacture built the cooling unit in a manner that would result in premature failure. In addition, if damage to the cooling unit has occurred before the ARP was installed; the ARP cannot remedy this damage

---

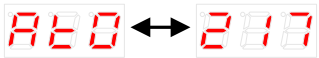
SETUP MODE

2.1 AtO Setting

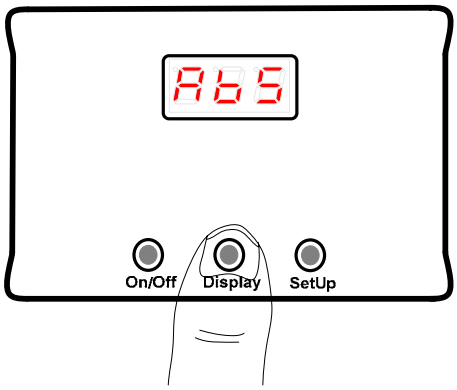


When the control is off, the SetUp mode is activated by holding the right **SetUp** button and then momentarily pressing the **On/Off** button. When **AtO** is displayed, release the **SetUp** button. See section 7.1 for further info.

AtO will display followed by its value as follows:



The **AtO** value is the present set-point and is affected by the Auto Tune value and the C-L or C-H control modes, more on this below.

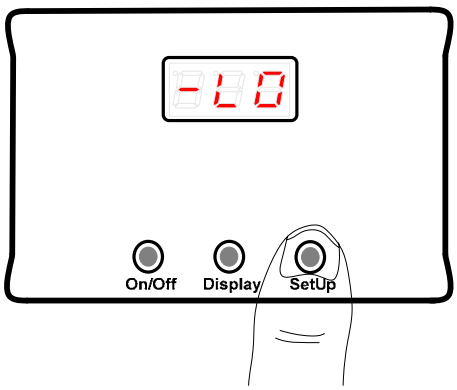


2.2 AbS Setting

Momentarily press the **Display** button to advance to the next setting.

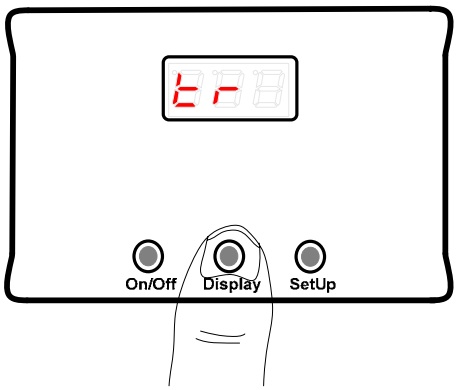
AbS is the maximum temperature the boiler has reached. The example below, 200C (See 2.8 Temperature Units) would be the maximum temperature recorded by the ARP.

Please see section 7.2 for further info.



By pressing the **SetUp** button, the **AbS** value will be cleared. When the AbS value has been cleared, **-LO** will flash on the display until the control is put into the ARP mode to record a new maximum value.

Please note that if **AbS** is greater than 250°C (482°F) there may be a wiring issue, please contact ARP technical support.

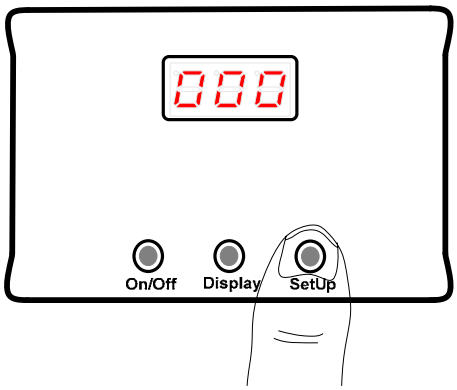


2.3 tr Setting

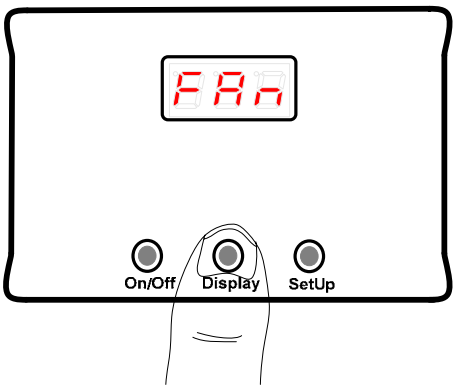
Advance to the next setting by pressing the **Display** button again.

Tr is the number of times that the ARP Control has triggered since the value was last cleared. The following example shows that the ARP turned off the fridge twice:

Please see section 7.3 for further info.



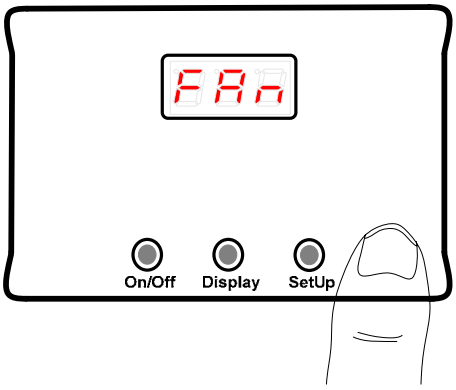
Press the **SetUp** button to clear the value.



2.4 FAn Setting

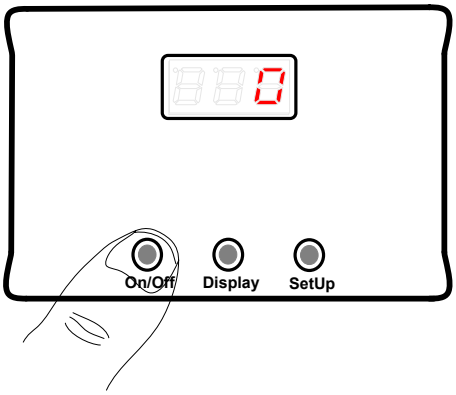
FAn is the temperature setting at which the ARP will turn on/off the fan. There are six fan temperature settings to select.

For a v2.0 control, the fan setting is a fixed number 0, and cannot be changed.



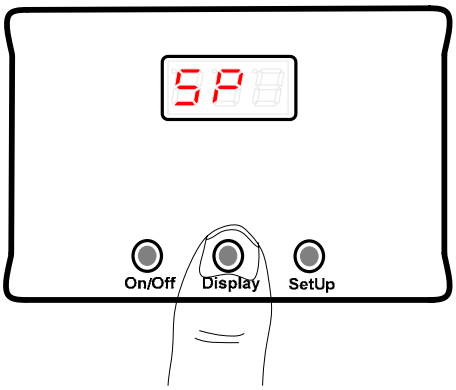
By momentarily pressing the **SetUp** button the fan control temperature can be set at a desired value.

Fan Setting	On Temperature °F	OFF Temperature °F
000	Fan Off	
001	90	75
002	100	85
003	110	95
004	120	105
005	130	115
006	140	125

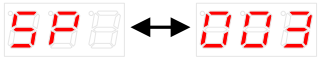


To exit fan set point adjustment mode, press and hold **On/Off** button till **O** shows up and then release the button. The display will resume flash **FAn** and its setting alternatively. Now you can advance to the next variable.

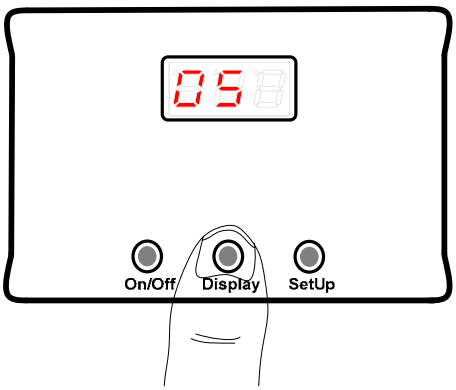
2.5 SP Setting



SP raises the set-point value of the ARP Control. The default setting for **SP** is **3**.

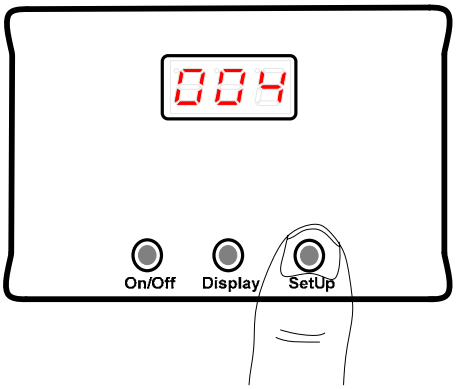


See section 8.2 for further information.



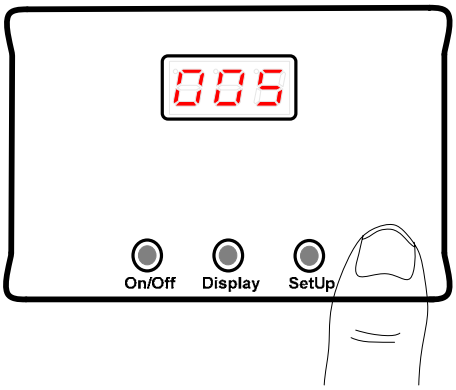
2.6 OS Setting

The OS setting works in conjunction with the Fridge Type setting. Before making any changes please see section 2.10. If the user does not want to use either the Norcold or Dometic settings, this value can be changed to his/her desired value. If OS is greater than zero (default setting), the OS value will override the Fridge Type settings below.

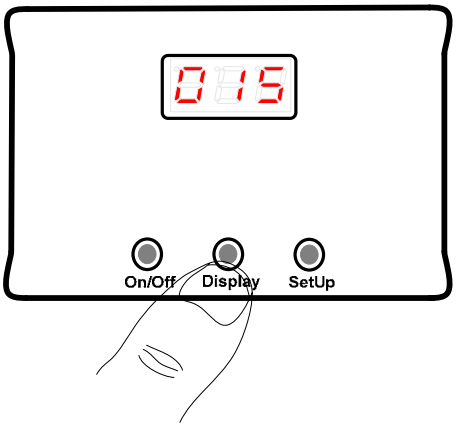


2.7 Adjustment of SP and OS Settings

By pressing the **SetUp** button the control enters into the adjustment mode. Both **SP** and **OS** are adjusted in the same manner as described below:

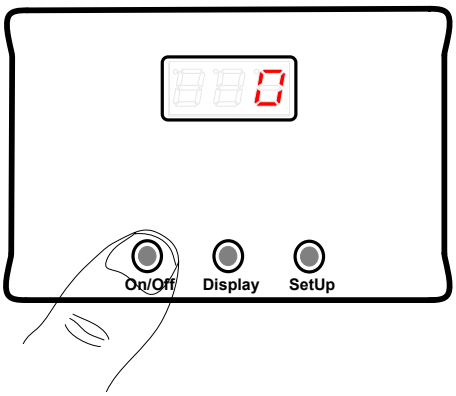


When in adjustment mode, each subsequent press of the **SetUp** button will increment the value by 1.

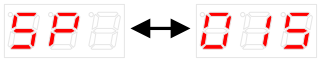


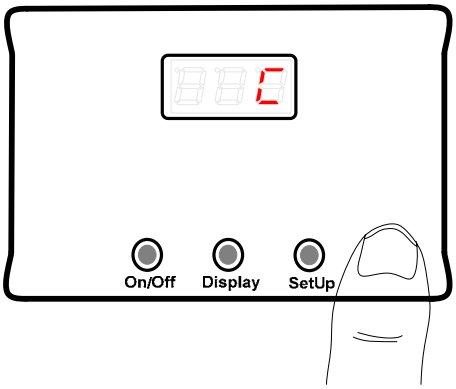
To adjust the 10s place, each press of the **Display** button increments the value by 10.

By pressing the Display button 3 times, the values rollover to zero.



To exit the adjustment mode once the desired value is displayed, hold the **On/Off** button until the display shows **O** and then release the button. The display will resume the alternating flash of the setting name and the value.



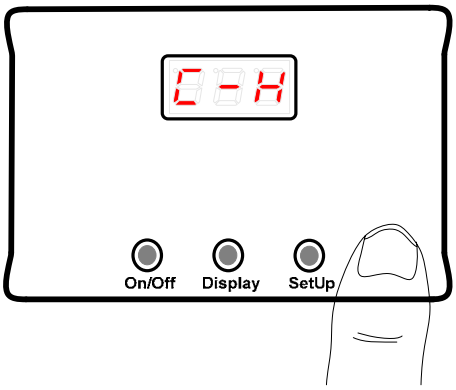


2.8 Temperature Units

The next setting changes the units from degrees Celsius (**C**) to degrees Fahrenheit (**F**). **C** is the default value.

For the next 3 settings, press the **SetUp** button to change the setting. Following is an example of the display for each setting:

Please see 9.1 for further info

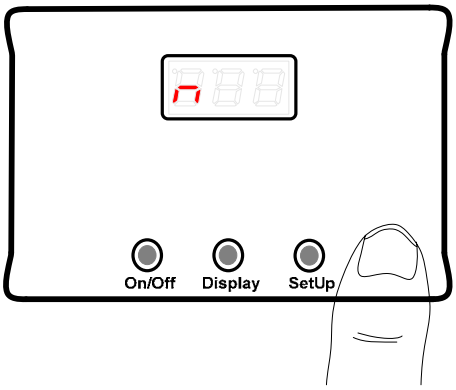


2.9 Control Mode

The ARP has two control modes as follows:

The **C-H** mode is the control high mode. This is the default mode and would be considered the plug-n-play mode. The **C-H** mode has a higher set-point value than the **C-L** mode.

The **C-L** mode is the control low mode. This mode is for fine tuning your control so that the maximum protection for your fridge is achieved. Please see 9.2 for further info.



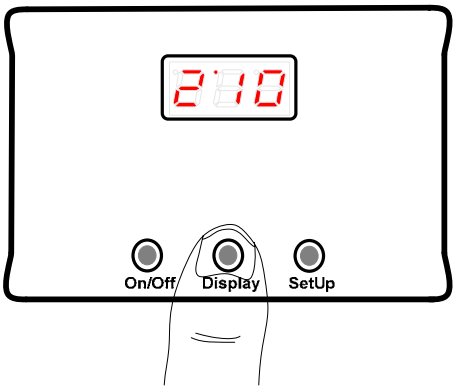
2.10 Fridge Type - Norcold or Dometic

The fridge type setting sets the OS value for your fridge. The default is **n** for Norcold and will work with most Dometic fridges also.

n: OS = 3 on this setting.

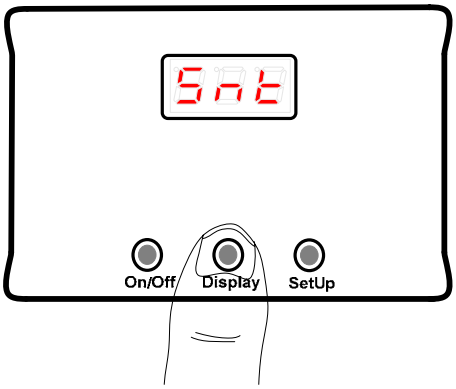
d: OS = 6 on this setting.

If a Dometic fridge does not restart easily after the ARP turns off the fridge with the default setting (**n**), select the Dometic setting (**d**). OS Setting 2.6 overrides the Fridge Type settings in this section.



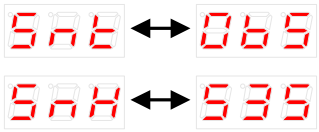
2.11 Software Version

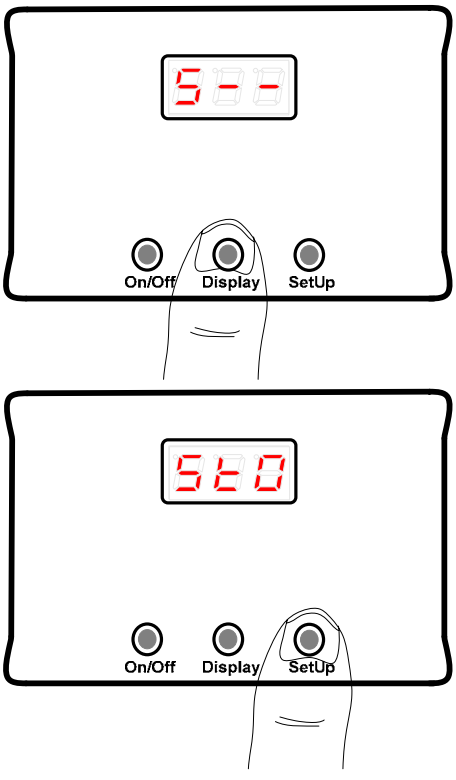
The next setting is the software version. This software version example is **2.10** which is the ARP + Fan Control version**.**



2.12 Serial Number

The next two settings display the ARP control serial number. Following is an example of what the display will flash out for the serial number 65,535





2.13 Store Settings & Turn off Setup

The last variable shown is **S--**, any settings that have been changed can be stored by momentarily pressing the **SetUp** button.

Release the **SetUp** button as soon as **StO** is displayed. **StO** has to be displayed for the control to save the new settings.

Press **Display** button again the variable display will restart from **AtO.**

If you do not want to save the changes of settings, just turnoff the control by pressing the **On/Off** button.

ARP ERROR MESSAGES

3.1 Err

There are two events that can result in this message.

1) In ARP Mode a single dot followed by **Err** indicates that the ARP memory is cleared. This can happen if the device has not been Auto Tuned, or on rare occasions surges/brown-outs less than minimum voltage level of 10.5VDC or greater than 22VDC. Hold down the **On/Off** button till the display is off. Then, restart the control in Auto Tune mode in order to restore correct settings.

2) If during Auto Tune **Err** is displayed, please contact ARP technical support.

3.2 OPn

This message will be flashed on the LED display to warn the operator that there is an error with the RTD and/or the RTD wiring. The ARP is disabled (will not activate the ARP relay) because it cannot function without the RTD. Thus, the cooling unit is **not** protected by the ARP at this point; the refrigerator operates just as it did when it came from the manufacture.

Operator must take action to resolve the cause of the RTD error.

Possible causes of RTD error:

a) RTD has failed OPEN. Test RTD resistance with Ohm meter that has less than 0.3mA current for the Ohm test function.

b) RTD wires from control to the sensor are broken or have a bad connection. A resistance test from the control to the wire connections at the RTD should show open or high resistance in this case. If RTD wire has become frayed or has an intermittent connection, moving the wire while observing the resistance of the wire under test should show a change of resistivity. Replace any wires that indicate high resistance.

c) RTD has measured in excess of 250°C.

3.3 SHt

If the RTD sensor is shorted, **SHt** will be flashed out. User should take out the sensor and check its resistance value by using the table at the end of this document. If the resistance substantially differs from the table, the sensor has failed. Please contact ARP Control for a new RTD.

3.4 -LO

The ARP temperature sensor is measuring a value lower than 0°C (32°F).

3.5 OFF

Depending on the conditions, it will take about 4-5 hours before the ARP turns off the system and warns the operator by displaying **OFF** on the LED. At this point the operator must restart their system by turning off the ARP after the boiler has cooled. As a rule of thumb, one should be able to touch the boiler housing without burning your hand when the boiler has cooled to a safe temperature.

 **DANGER** Care must be exercised during a restart in this situation. It may be that the refrigeration unit needs maintenance that is beyond the abilities of the operator. If the ARP keeps trigging due to high boiler temperatures at each successive attempt to restart the refrigerator, the ammonia in the system may need to be remixed, or the cooling unit may have completely failed. Because one cannot easily remove the refrigerator and tip it over to mix the fluids such as described in the burping section 4.5, the motion of driving may resolve this situation. The motion of driving helps mix the fluids and will help cool the boiler thereby mix the ammonia back into the system fluids. It is emphasized that you are in charge of safety, please take your problems to a qualified service facility if you do not feel qualified to resolve any issues that may affect safety.

3.6 ARP Reset

The ARP can be turned off, and the refrigerator will resume operation as it did from the factory. By turning the ARP off and then back on, the control will be reset and resume monitoring boiler temperature.

DANGER Please remember that when the ARP is turned off, the refrigerator will resume operation if the fridge is not turned off before the reset procedure. If your fridge has overheated, there is a problem that should be addressed by qualified persons.

INTRODUCTION to FRIDGE REPAIR

4.1 Refrigerant

The SPAR RV refrigerator, when constructed properly is extremely reliable due to the fact that the process is quite simple. The refrigerant (working fluids) consists of water, ammonia, and sodium chromate.

4.2 Boiler Operation

The heart driving you RV refrigerator is at the boiler. The boiler can also be called the *generator* due to the fact that in the boiler assembly of your SPAR cooling unit the ammonia is separated from the other components of the refrigerant. Thus, the ammonia that cools your refrigerator is generated.

4.3 Boiler Pump

The heat source that drives your SPAR simply separates the water and ammonia. Ammonia boils at a lower temperature than water, thus the heat source boils the ammonia. Just like a coffee percolator, the ammonia gas transports the liquid water up a pump tube, at the top of the pump tube the ammonia gas raises and the water descends by the effect of gravity.

4.4 ARP Control and the Boiler

The ARP control is effective because of the simple physics. If there is no ammonia in the boiler assembly of your SPAR, the boiler pump will not work. The result, the normal temperatures required to drive the SPAR system will rise. It takes heat energy to change the ammonia from liquid to gas, when this heat energy is not changing the ammonia from liquid to gas; the heat energy starts to destroy the SPAR. Restated, without ammonia in the boiler, the heat energy will cause a temperature to rise until the water in the SPAR starts to boil, this damages your refrigerator. The ARP control prevents the water from boiling in the SPAR when installed and setup correctly.

4.5 Burping a SPAR

Folks that have been around RV and stationary refrigerators such as a Servel have heard of '*burping*' the refrigerator. Burping is necessitated by the fact that the ammonia has not completed the SPAR process and returned to the boiler. Burping consists of turning the refrigerator over onto its top. The burping procedure simply will remix the ammonia and water in your SPAR. As long as the system has not been damaged by overheating and blockage of the system, the refrigerator will resume operation once the ammonia is returned to the boiler. In most cases, burping is not necessary when the ARP controls the boiler temperature.

4.6 Abnormalities and Operator Discretion

The ARP will turn off the heat source driving your SPAR process before burping is necessary. But it must be taken into account that the ARP has sensed a rise in temperature due to an abnormality in your SPAR. The ARP cannot determine the cause of the abnormality. This is the responsibility of the operator. Other than off-level operation of the SPAR, and boiler over heating due to wind currents that result in stagnation within the cooling unit compartment, it is beyond

the scope of this document to cover all of the causes for the SPAR boiler to overheat.

In the following sections of the Troubleshooting Guide are suggestions to help you resolve situations that may arise. Again, it is the operator's responsibility to insure that safe operation of the SPAR is in effect. Although the ARP can give an operator feedback, the operator must have discretion to make decisions responsibly and act on one's own. If there is doubt, please take your RV to a qualified RV service center if you are having problems related to the ARP control and/or your refrigerator. Following are ideas to consider that could get you up and running, these suggestions are circumstantial and are solely provided as assistance to help you make good decisions while on the road.

HEAT SOURCES

5.1 Temperature & Pressure

The boiler temperature is an over all indicator of your refrigerator health. It is advised to check and adjust your LP gas pressure, check your gas flame and adjust if necessary. Only then record your '*normal*' boiler temperatures using both LP gas and the electric heat source for future troubleshooting reference. Please note, for the following discussion, the LP gas temperature measured by the ARP is generally about 10°C (18°F) higher than the temperature measured by the 120VAC. A rule of thumb is that the LP gas temperature will range from 170°C (338°F) to 190°C (374°F) depending on the make and model of your SPAR. The boiler temperature can vary with the RTD location on the boiler tube also.

There are two main causes of low boiler temperature, low LP gas pressure and low cooling unit pressure. Low cooling unit pressure is covered in section 6.1.

5.2 Low LP Gas Pressure

Low LP gas pressure results in a cold gas flame. The simple test for this problem is to check the LP gas pressure with a manometer and make sure there is 11 inches water column pressure.

5.3 Test Each Heat Source

An alternative to testing the gas pressure, use the shore power (120VAC) heater to run your refrigerator. If your ARP control measures *"normal"* temperatures in the range given above, but the LP gas does not, one can deduce that there is an issue with the LP gas portion of your refrigerator.

To test the electric heater, use the gas flame. If the boiler temperature is at its normal value using gas, but lower than normal using 120VAC, there may be a problem with your 120VAC operation.

SPAR PRESSURE

6.1 Low Cooling Unit Pressure

The temperature at which a liquid changes phase from liquid to gas (boils) is dependent on two physical qualities: temperature and pressure. The temperature measured at your boiler is dependent upon your cooling unit pressure. If the pressure inside your cooling unit goes down, the temperature at which your boiler will boil the refrigerant goes down also. Previous to the ARP, the pressure inside the cooling unit could only be measured by a cooling unit rebuilder. Now, the ARP can be used as an indicator by which to measure the cooling unit pressure. The first telltale sign of cooling unit failure is low temperatures measured at the boiler of your cooling unit. If your heat sources are confirmed to work fine, and you are measuring low boiler temperatures, there

may be low cooling unit pressures indicating failure of the cooling unit.

⚠ **WARNING** Please take your refrigerator to be checked by a qualified service technician to rule out any cause that will result in low temperature readings by the ARP.

DIAGNOSTIC VARIABLE

7.1 AtO Base Value

The AtO base value is calculated during an Auto Tune session, and is not adjustable other than by running Auto Tune again. The AtO base value may be read when SP= 0. The value of AtO can be changed by the control modes C-H or C-L and the SP values.

7.2 AbS

The AbS value is the absolute maximum temperature measured at the boiler since the last time that the value was zeroed. This variable is very handy for testing and setting the refrigeration control values. Auto Tune always zeros this value.

Adjustment

The AbS value may be zeroed by pressing **SetUp** button. Please store any new settings as described in section 2.13.

Purpose

This variable is handy for recording the cooling unit boiler temperature while the cooling unit is in a known phase of its process, see Fig 1. For example, one wants to know the absolute maximum temperature of a cooling unit after the ARP has shut down the system due to an off-level overheat situation. This will aid the operator in setting the value of OS for a particular refrigerator installation. Use the AbS variable in combination with the No Set-Point mode when the ARP is not equipped with data collection capability for the recording of restart temperatures.

7.3 tr

The tr value is simply the number of times that the ARP has triggered since the last time the value was zeroed. When Auto Tune is run, tr value is zero.

Purpose

Knowing the number of times the control has triggered helps the owner understand situations where overheating of the cooling unit boiler occurs. For example, climbing steep grades in hot weather often will result in an ARP trigger event. Another example, RV rental firms can use this information for damage deposit and other bookkeeping purposes.

See section 2.3 for adjustment info.

CONTROL VARIABLES

8.1 Introduction to Control Variables

The ARP sets the following control variables to default values during an Auto Tune session. If the default values need to be adjusted, this section explains the variables and their function. Please note that most fridges work fine with the default settings.

8.2 SP

The SP variable simply raises or lowers the set-point value depending on the setting. Tuning the ARP for the maximum protection for your refrigerator installation mostly consists of finding the optimum value for SP. If the value is too low, the control will shut off your refrigerator unnecessarily. If the value of SP is too high, the refrigerator will not restart easily. For a majority of refrigerators, the default C-L Auto Tune value is the best

choice for SP. Please see 2.5 for adjustment method for SP. SP is used only in the C-L mode of operation; see 9.2 for adjustment of C-H/C-L modes.

Basics for the SP Variable:

- Auto Tune sets SP to a default value of 3 when in C-L mode.
- SP may be changed to any value between 0 and 30, where each increment is 1°C (~1.8°F).
- It is recommended to set SP to a minimum setting of SP= 1.
- If SP= 30, for all practical purposes the control will be in the C-H mode.

Factors that Affect the SP Variable:

- Auto Tune Elevation: Some refrigerators, not all, have a colder gas flame at high altitude. Thus, if the ARP is Auto Tuned at an elevation greater than 1000' above sea-level, the SP variable should be raised by about 2°C per 1000' of elevation decrease. This adjustment will allow the operator to drive from an altitude that the ARP was Auto Tuned at to sea-level without a false trigger of the control due to the rise of the gas flame temperature.
- Ambient Temperature: The air temperature has a slight effect on the refrigerator boiler temperature. If Auto Tune is preformed at temperatures lower than 16°C (~60°F), it is possible that SP will have to be set higher than the default value of 3 to compensate for a raise in ambient temperature.

8.3 OS

The OS value is the temperature overshoot value. If OS= 0, the OS value is controlled by the Fridge Type setting 2.10. Restated, the Fridge Type setting is not valid if OS is greater than 0. The default Norcold setting of 3 is adequate for most Norcold and Dometic refrigerators; a value of 6 is needed for some older Dometic refrigerators.

Purpose:

Because the ARP turns off the refrigerator heat source when the ammonia is not returning to the boiler, when the heat source is turned back on, a higher temperature is needed to start the refrigeration process. Fig 1 best demonstrates the necessity for the OS variable. Note that when the yellow boiler temperature curve reaches the purple set-point value AtO, the set-point is raised by the OS value. Also note that when the heat source is restarted, the temperature climbs above the point at which it was turned off at.

8.4 Control Variable Example

Fig. 1 demonstrates a boiler temperature curve for an older Dometic DM2652 refrigerator that has been tilted off-level to demonstrate the APP variables and their application. At 20 minutes the unit was tilted off-level. The yellow boiler temperature curve rises up to the set-point level AtO. At this point the ARP turns off the refrigerator heat source. In addition, the refrigerator is re-leveled. At the end of the timing period, the ARP turns on the heat source. Note that at 72 minutes the boiler temperature is at its maximum and below the OS value. At 122 minutes the overshoot period ends, returning the set-point to the initial AtO value.

ADJUSTMENT VARIABLES

9.1 C or F

This function simply toggles between Celsius and Fahrenheit. Default is Celsius. This setting only changes the LED display by toggling the units of temperature measurement. The ARP does not change its operation, just the manner in which it calculates temperature on the display.

Please see 2.8 for adjustment.

9.2 C-H or C-L Set-Point Methods

This function toggles between set-point control method high (C-H) and control

method low (C-L). Default is C-H, which allows the operator of the ARP Control to avoid fine tuning their control.

Purpose:

The ARP is designed to work on any absorption refrigeration system. Therefore, the operator has the ability to choose between the default (C-H) and the Operator Adjustable Control Method (C-L). C-L will take on the default Auto Tune values and increase the sensitivity of the ARP.

Please see 2.9 for adjustment method.

9.3 Fan Temperature Diagnostic

This function controls the temperature at which the fan will be turned on/off.

See sections 2.4 and the User Guide for more fan control details. The two preferred locations for the fan thermistor would be on the condenser or on the absorber coils because these respective temperature locations combined with the boiler temperature reading will help diagnose problems with the cooling unit. We will post more on our website www.ARPrv.com on troubleshooting methods.

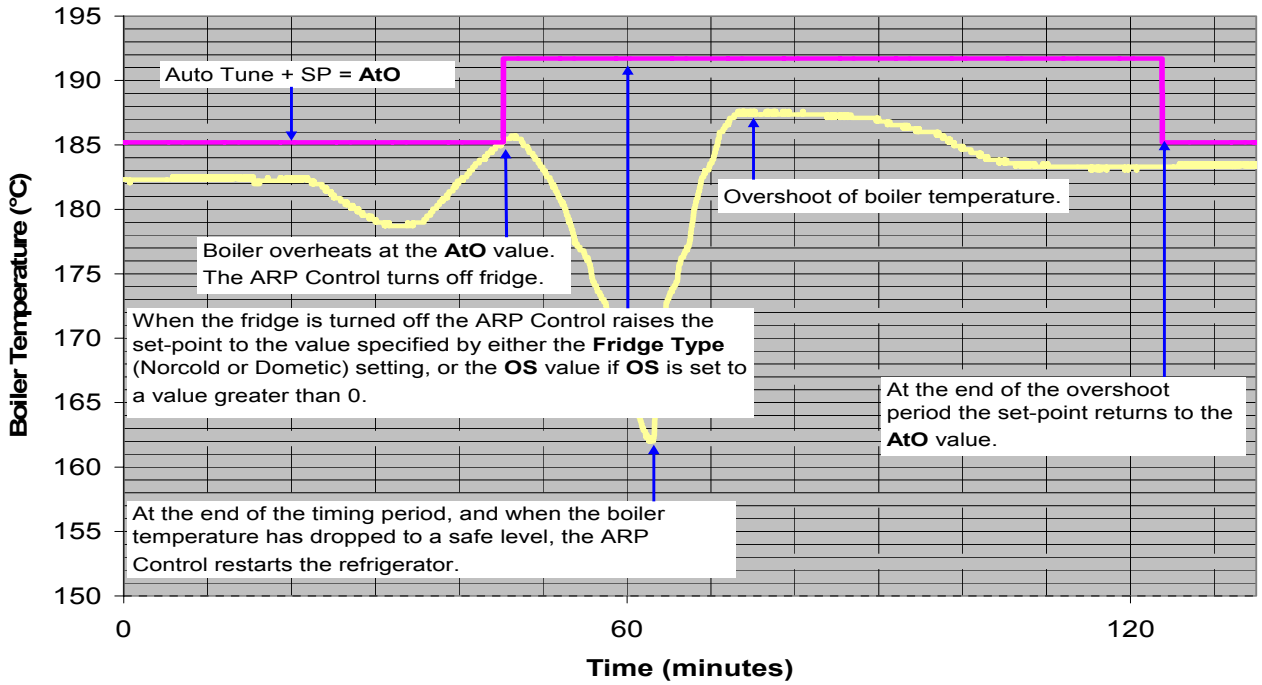
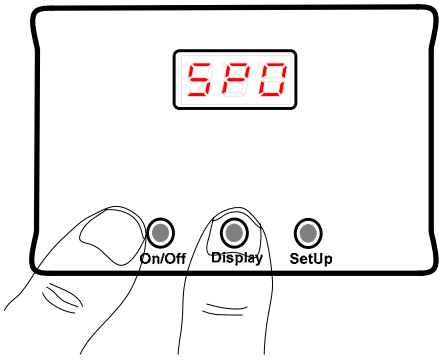


Fig. 1 Typical ARP Control Protection Cycle

NO SET-POINT MODE



The No Set-Point mode is used for testing of the refrigerator.

⚠ Caution must be used because the fridge has no overheat protection other than the factory thermal management methods.

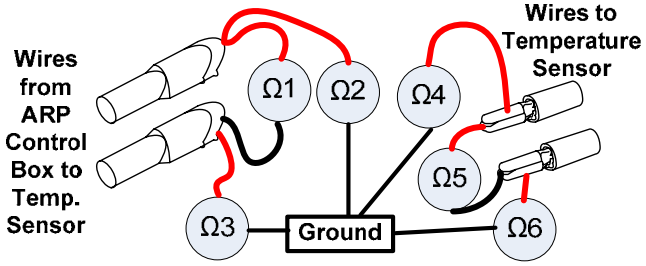
To place the control in the No Set-Point mode hold down the **Display** button and then momentarily press the **On/Off** button. **SP0** will display briefly. Always turn this mode off when tests are completed so that your fridge has protection from overheating.

BOILER TEMPERATURE SENSOR TABLE

Temp. (ºC)	Temp. (ºF)	ARP RTD (Ω)
1	33.8	1003.9
2	35.6	1007.8
3	37.4	1011.7
4	39.2	1015.6
5	41.0	1019.5
6	42.8	1023.4
7	44.6	1027.3
8	46.4	1031.2
9	48.2	1035.1
10	50.0	1039.0
11	51.8	1042.9
12	53.6	1046.8
13	55.4	1050.7
14	57.2	1054.6
15	59.0	1058.5
16	60.8	1062.4
17	62.6	1066.3
18	64.4	1070.2
19	66.2	1074.0
20	68.0	1077.9
21	69.8	1081.8
22	71.6	1085.7
23	73.4	1089.6
24	75.2	1093.5
25	77.0	1097.3
26	78.8	1101.2
27	80.6	1105.1
28	82.4	1109.0
29	84.2	1112.9
30	86.0	1116.7
31	87.8	1120.6
32	89.6	1124.5
33	91.4	1128.3
34	93.2	1132.2
35	95.0	1136.1
36	96.8	1140.0
37	98.6	1143.8
38	100.4	1147.7
39	102.2	1151.5
40	104.0	1155.4
41	105.8	1159.3
42	107.6	1163.1
43	109.4	1167.0
44	111.2	1170.8
45	113.0	1174.7
46	114.8	1178.6
47	116.6	1182.4
48	118.4	1186.3
49	120.2	1190.1
50	122.0	1194.0
51	123.8	1197.8
52	125.6	1201.7
53	127.4	1205.5
54	129.2	1209.4
55	131.0	1213.2
56	132.8	1217.1
57	134.6	1220.9
58	136.4	1224.7
59	138.2	1228.6
60	140.0	1232.4
61	141.8	1236.3
62	143.6	1240.1
63	145.4	1243.9
64	147.2	1247.8
65	149.0	1251.6
66	150.8	1255.4
67	152.6	1259.3
68	154.4	1263.1
69	156.2	1266.9
70	158.0	1270.8
71	159.8	1274.6
72	161.6	1278.4
73	163.4	1282.2
74	165.2	1286.1
75	167.0	1289.9
76	168.8	1293.7
77	170.6	1297.5
78	172.4	1301.3
79	174.2	1305.2
80	176.0	1309.0
81	177.8	1312.8
82	179.6	1316.6
83	181.4	1320.4
84	183.2	1324.2
85	185.0	1328.0
86	186.8	1331.8
87	188.6	1335.7
88	190.4	1339.5
89	192.2	1343.3
90	194.0	1347.1
91	195.8	1350.9
92	197.6	1354.7
93	199.4	1358.5
94	201.2	1362.3
95	203.0	1366.1
96	204.8	1369.9
97	206.6	1373.7
98	208.4	1377.5
99	210.2	1381.3
100	212.0	1385.1
101	213.8	1388.8
102	215.6	1392.6
103	217.4	1396.4
104	219.2	1400.2
105	221.0	1404.0
106	222.8	1407.8
107	224.6	1411.6
108	226.4	1415.4
109	228.2	1419.1
110	230.0	1422.9
111	231.8	1426.7
112	233.6	1430.5
113	235.4	1434.3
114	237.2	1438.0
115	239.0	1441.8
116	240.8	1445.6
117	242.6	1449.4
118	244.4	1453.1
119	246.2	1456.9
120	248.0	1460.7
121	249.8	1464.5
122	251.6	1468.2
123	253.4	1472.0
124	255.2	1475.8
125	257.0	1479.5
126	258.8	1483.3
127	260.6	1487.0
128	262.4	1490.8
129	264.2	1494.6
130	266.0	1498.3
131	267.8	1502.1
132	269.6	1505.8
133	271.4	1509.6
134	273.2	1513.3
135	275.0	1517.1
136	276.8	1520.9
137	278.6	1524.6
138	280.4	1528.4
139	282.2	1532.1
140	284.0	1535.8
141	285.8	1539.6
142	287.6	1543.3
143	289.4	1547.1
144	291.2	1550.8

145	293.0	1554.6
146	294.8	1558.3
147	296.6	1562.0
148	298.4	1565.8
149	300.2	1569.5
150	302.0	1573.3
151	303.8	1577.0
152	305.6	1580.7
153	307.4	1584.5
154	309.2	1588.2
155	311.0	1591.9
156	312.8	1595.6
157	314.6	1599.4
158	316.4	1603.1
159	318.2	1606.8
160	320.0	1610.5
161	321.8	1614.3
162	323.6	1618.0
163	325.4	1621.7
164	327.2	1625.4
165	329.0	1629.2
166	330.8	1632.9
167	332.6	1636.6
168	334.4	1640.3
169	336.2	1644.0
170	338.0	1647.7
171	339.8	1651.4
172	341.6	1655.1
173	343.4	1658.9
174	345.2	1662.6
175	347.0	1666.3
176	348.8	1670.0
177	350.6	1673.7
178	352.4	1677.4
179	354.2	1681.1
180	356.0	1684.8
181	357.8	1688.5
182	359.6	1692.2
183	361.4	1695.9
184	363.2	1699.6
185	365.0	1703.3
186	366.8	1707.0
187	368.6	1710.7
188	370.4	1714.4
189	372.2	1718.0
190	374.0	1721.7
191	375.8	1725.4
192	377.6	1729.1
193	379.4	1732.8
194	381.2	1736.5
195	383.0	1740.2
196	384.8	1743.8
197	386.6	1747.5
198	388.4	1751.2
199	390.2	1754.9
200	392.0	1758.6
201	393.8	1762.2
202	395.6	1765.9
203	397.4	1769.6
204	399.2	1773.3
205	401.0	1776.9
206	402.8	1780.6
207	404.6	1784.3
208	406.4	1787.9
209	408.2	1791.6
210	410.0	1795.3
211	411.8	1798.9
212	413.6	1802.6
213	415.4	1806.3
214	417.2	1809.9
215	419.0	1813.6
216	420.8	1817.3
217	422.6	1820.9
218	424.4	1824.6
219	426.2	1828.2
220	428.0	1831.9
221	429.8	1835.5
222	431.6	1839.2
223	433.4	1842.8
224	435.2	1846.5
225	437.0	1850.1
226	438.8	1853.8
227	440.6	1857.4
228	442.4	1861.1
229	444.2	1864.7
230	446.0	1868.4
231	447.8	1872.0
232	449.6	1875.6
233	451.4	1879.3
234	453.2	1882.9
235	455.0	1886.6
236	456.8	1890.2
237	458.6	1893.8
238	460.4	1897.5
239	462.2	1901.1
240	464.0	1904.7
241	465.8	1908.4
242	467.6	1912.0
243	469.4	1915.6
244	471.2	1919.2
245	473.0	1922.9
246	474.8	1926.5
247	476.6	1930.1
248	478.4	1933.7
249	480.2	1937.4
250	482.0	1941.0

BOILER TEMPERATURE SENSOR TROUBLESHOOTING



Each of the Ω1, Ω2, Ω3,…is a representation of using a millimeter to measure the resistance either between the two wires or from the respective wire to the ground. Please note that the color code of the wire has no meaning because there is no polarity for the temperature sensor. Thus, Ω2 or Ω3 maybe either the white or green wire.

Values:

Ω1 ≈ 2.2M

Ω2 ≈ 2.2M

Ω3 ≈ 1k

Ω4 = OPEN or OL on typical millimeter

Ω5 ≈ Use Boiler Temperature Sensor Table above to determine this value.

Ω6 = OPEN or OL on typical millimeter.

FAN TEMPERATURE SENSOR TABLE

Temp. (°C)	Temp. (°F)	Fan Sensor (Ω)
0	32	32624
1	33.8	31007
2	35.6	29480
3	37.4	28036
4	39.2	26672
5	41	25381
6	42.8	24161
7	44.6	23006
8	46.4	21912
9	48.2	20877
10	50	19897
11	51.8	18968
12	53.6	18088
13	55.4	17253
14	57.2	16462
15	59	15711
16	60.8	14999
17	62.6	14323
18	64.4	13681
19	66.2	13072
20	68	12493
21	69.8	11943
22	71.6	11420
23	73.4	10923
24	75.2	10450
25	77	10000
26	78.8	9572
27	80.6	9165
28	82.4	8777
29	84.2	8408
30	86	8056
31	87.8	7721
32	89.6	7401
33	91.4	7097
34	93.2	6807
35	95	6530
36	96.8	6266
37	98.6	6014
79	174.5	5773
39	102.2	5543
40	104	5324
41	105.8	5114
42	107.6	4914
43	109.4	4723
44	111.2	4540
45	113	4365
46	114.8	4198
47	116.6	4038
48	118.4	3885
49	120.2	3739
50	122	3599
51	123.8	3465
52	125.6	3336
53	127.4	3213
54	129.2	3095
55	131	2982
56	132.8	2874
57	134.6	2770
58	136.4	2671
59	138.2	2575
60	140	2484
61	141.8	2396
62	143.6	2312
63	145.4	2231
64	147.2	2153
65	149	2079
66	150.8	2007
67	152.6	1938
68	154.4	1872
69	156.2	1809
70	158	1748
71	159.8	1689
72	161.6	1633
73	163.4	1578
74	165.2	1526
75	167	1476
76	168.8	1428
77	170.6	1381
78	172.4	1336
79	174.2	1293
80	176	1252
81	177.8	1212
82	179.6	1173
83	181.4	1136
84	183.2	1101
85	185	1066
86	186.8	1033
87	188.6	1001
88	190.4	970
89	192.2	940
90	194	912
91	195.8	884
92	197.6	857
93	199.4	831
94	201.2	806
95	203	782
96	204.8	759
97	206.6	737
98	208.4	715
99	210.2	694
100	212	674
101	213.8	655
102	215.6	636
103	217.4	618
104	219.2	600
105	221	583
106	222.8	566
107	224.6	550
108	226.4	535
109	228.2	520
110	230	506
111	231.8	492
112	233.6	478
113	235.4	465
114	237.2	452
115	239	440
116	240.8	428
117	242.6	417
118	244.4	406
119	246.2	395
120	248	384
121	249.8	374
122	251.6	364
123	253.4	355
124	255.2	346
125	257	337