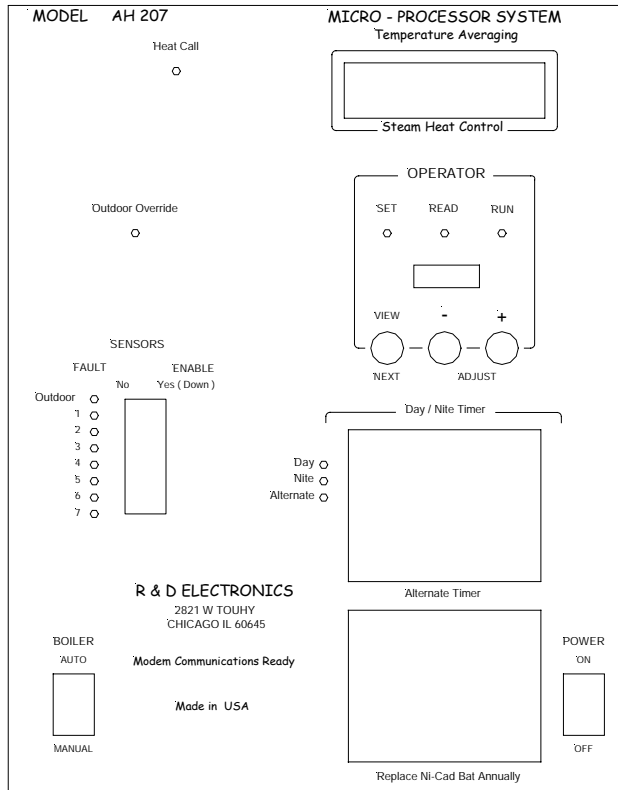


**-- OWNERS MANUAL -- Model AH207,
207M -- Temperature Averaging Steam
Heating Control**



The R&D Electronics model AH207 offers the latest technology in controlling commercial and multifamily steam heated buildings using remote temperature monitoring. Steam piping systems do not distribute heat evenly due to factors such as the length of piping, inadequate venting, improperly sized radiators, etc.

Environmental variables such as wind, direct sunlight, building envelope leaks, misc. gas and electric utilities all effect room temperature imbalance. Strategically locating multiple sensors throughout the building provides the most reliable and accurate temperature control for widely varying conditions.

The R&D Electronics Model AH207 consists of a main panel, up to 7 remote indoor sensors, and an outdoor override sensor. The main panel has 17 LED which indicate all important ON/OFF operating

conditions, including heat call, sensor faults, outdoor override, and the present time schedule. A simple 3 position slide switch labeled SET, READ, and RUN operates the 32 character LCD display.

Three key switches perform data entry and display. The next key will scroll through the menu lists. The increase and decrease keys will change the setpoint values. Pressing both the increase and decrease keys together will display an additional system configuration menu.

A built-in time clock mounted on the front panel programs the Day/Night setpoint schedule. The second or alternate time clock can be programmed either as an evening or morning boost, or a mid-day setback. When the alternate time clock is ON, the alternate clock schedule overrides the Day/Night schedule, activating the third temperature setpoint. If the average building temperature falls below the building setpoint shown in the RUN menu, the heat call circuit will close. After steam builds, and the average temperature of the building rises the amount of the temperature rise shown in the SET menu, the heat call circuit will open. The Outdoor Override setting (typically 55 F.) programs the warm weather shutdown. A hardware option is available to control (1) a vacuum pump, (2) a combustion air damper, or (3) multiple boilers.

The building setpoint can be programmed to proportionally increase a small amount (typically 1.5F, though you may change it) as outdoor temperature decreases. The starting reference is 70 F. outdoors, at which point the building setpoint is equal to the day temperature shown in the SET menu. As outdoor temperature decreases and reaches 30F., the building setpoint will be +.75F., and at -10F. outdoors the setpoint will be +1.5F.

Mini rocker switches can disable a sensor from being included in the building average temperature. An open or shorted sensor wire is automatically considered out of range and excluded from the average building temperature and the respective fault LED turns on.

A manual bypass switch located on the front panel will close the heat call circuit in the unlikely event of a control failure.

DESIGN HIGHLIGHTS

- * Motorola MC68HC11 operates in single chip mode. Internal ram, rom, and eeprom.
- * Modem operation from any PC with standard communications software.
- * Operator setpoints are retained in eeprom (permanent memory).
- * Includes (1) one outdoor, (6) six room zone sensors. A seventh sensor is optional.
- * Warm Weather Shutdown or outdoor cutoff .
- * Monitors actual building temperatures in up to seven room zones.
- * Select sensors individually for inclusion in the average building temperature.
- * Corrects the desired building temperature setpoint for extreme weather conditions.
- * Temperature data logging and boiler runtime for 48 hrs. Select either room zone sensor.
- * All sensors have fault protection circuits and LED indicators.
- * 32 Character BACKLIT LCD.* Setback Timer Weekend/Weekday programmable with 4 mo. battery back-up* Includes a 2nd relay contact to operate a combustion air damper* Front panel activation of emergency backup. Manual bypass for all relay outputs.
- * Plug-in panel for quick service *without having to disconnect the field wiring.*
- * 16 Gauge steel enclosure with means for a padlock.

OPTIONAL

- * Pre starts a vacuum pump, and delays pump turnoff.
- * Additional relay outputs for a second and third boiler, with early shut down for a second stage.

OPERATOR ADJUSTMENT

SET

1 DAY TEMPERATURE SETPOINT: {72}

The AH207 will set the average building temperature, although the maximum or minimum worst case room temperatures may vary greatly. Usually, the average day temperature must be set between 70 and 75 degrees to assure that all locations will receive enough heat. The more closely a building is balanced, the lower you may set the average day temperature. Keep in mind that air infiltration may

cause floors to be 2-4 degrees colder than temperatures measured by the heat sensors 5 feet above the floor.

2 *NIGHT TEMPERATURE SETPOINT:* {68}

The amount of night setback is a compromise between fuel savings, and comfort. During an 8 hour night setback period, a setback of 3 and 7 degrees will save nearly as much fuel as a 10 degree setback, and cause less discomfort.

3 *ALTERNATE TEMPERATURE SETPOINT:* {70 to 74}

Typically a Monday thru Friday setback from 9AM to 3PM, or a 7-day boost from 4PM to 9PM.

4 *OUTDOOR CUTOFF:* {55}

55 F. to 60 F. works well in most buildings. Also known as Warm Weather Shutdown.

5 *HEATING CYCLE LENGTH:* {1.0}

A typical setting is 1.0 deg. F. To determine the most efficient T Rise setting, you will need to experiment. If your setting is too low, short cycling will result. The boiler will turn off too soon, leaving radiators at the far end of the building only half full of steam. If your setting is too high, unnecessary overshoot and too much time between heating cycles can result.

6 *COLD WEATHER BOOST:* {1.5}

The building setpoint can be programmed to proportionally increase a small amount as outdoor temperature decreases. The starting reference is 70 F. outdoors, at which point the building setpoint is equal to the day temperature shown in the SET menu. As outdoor temperature decreases and reaches 30F., the building setpoint will be +.75F., and at -10F. outdoors the setpoint will be +1.5F. The more air tight the building, the lower you may set the Cold Weather Boost.

PANEL ROCKER SWITCHES: {YES}

Selects the room sensors to be included in the average building temperature.

READ

Place the OPERATOR slide switch in READ. Press VIEW NEXT. The READ menu will display the 7 room zone sensors, the outdoor temperature, and heat call and timer schedule status.

RUN

The RUN menu will display (1) the average building temperature, (2) the calculated building setpoint determined by the present time schedule and outdoor temperature, (3-5) boiler runtime history for the last 2 days and the 14 day average, (6) zone data logging for 2 hrs. in six 20 minute intervals, (7-10) zone data logging for 12 hrs. in six 2 hr. intervals for a total of 48 hrs. Data log reads oldest first (upper left) and most recent last (lower right) (Also see SYSTEM: Line 3).

Restoring Factory Default Operator Settings: To Reset the SET and SYSTEM user variables to factory default settings: (1) turn Power switch OFF, (2) hold the NEXT key while turning the Power back ON.

Manual Bypass: Turn POWER switch OFF. Place BOILER switch in MANUAL to activate a single boiler. To activate combustion air, vacuum pump or additional boilers, open control door and set required toggles switches sw2 thru sw5 on terminal wiring board to UP.

Notes on 48 hr. data logging: The six displayed numbers are the average of readings every 30 seconds and update every two hours. The min. or max. room temperatures could be +/- 2 degrees above or below the average temperature over time. You may calibrate the time scale by resetting control power *before* collecting the data 48 hrs. later. Special data collection sheets from R&D Electronics are available.

SETBACK TIMER

The setpoint becomes Day when the day/night timer displays the word "ON". The ON period should begin approximately 30 minutes before the time you expect people to resume activity. Set the OFF period to begin at approximately 30 minutes before the time you expect activity to decline. The Day and Alternate Timers have 6 ON and 6 OFF entries. A 5 day (MO thru FR) and a 2 day (SA, SU) group schedule will program the entire week using only 2 of 6 available schedule periods. When the optional Alternate timer is installed, the 3rd setpoint overrides the Day Timer schedule when it displays the word "ON". See Alternate Setpoint for scheduling the optional Alternate timer as a Boost or Setback. NOTE: Clock programming procedure is affixed to the control enclosure.

The battery back-up will fully charge in 24 Hrs., and will keep the setback timer running for 4 mo. without power. The power on/off switch does not remove the power which charges the battery. Replace 1.5V Ni-Cad or NiMH battery back-up every 1-3 yrs.

FIELD SERVICING -- Testing the remote sensors.

MAIN PANEL AND TERMINAL BOARD

If the 3AG 1A fuse on the terminal board is bad, you may try replacing it. On rare occasions, there may be a fault on the terminal board. It is easiest to replace the main panel with a known good panel before attempting to determine whether the terminal board is defective. You may order field replacements for either board.

Room Sensors: If a sensor warning light is on, you will need to know if the sensor wiring is open, shorted, or whether the sensor is actually defective. The sensors are extremely reliable, and wiring defects occur 50 times as frequently as defective sensors. If the radiators are turned off within an apartment where there is a remote sensor, the sensor warning light may turn on and falsely indicate a bad sensor, or if the sensor high limit in the SYSTEM menu is set below the current room temperature, the warning light will also turn ON.

Problem: All the sensor warning lights are ON. You must determine whether the panel is good.

1. Connect a digital volt meter DVM (-) lead to **TS1** terminal 2 [outdoor sensor (-)] or sensor common. Connect the DVM (+) lead to the (+) terminal of any sensor input. Verify dvm read 12.8 to 13.8 Vdc. If not true, then the main panel is defective.

2. Sometimes a (+) lead sensor wire will short to ground elsewhere in the building. If there is an additional system short to conduit ground, it will be necessary to trace both shorts before reconnecting the defective sensor line. Two shorts in your system can result in the “grounding” of the +13Vdc. Isolate each sensor from the terminal board one at a time to locate the second short.

3. *Test the microprocessor analog inputs:* Connect the DVM (-) lead to the outdoor sensor (-) terminal or common. Connect the DVM (+) lead to the zone sensor (-) terminal under test. The voltage at the (-) terminal should be directly proportional to **Table 2**, the room sensor temperature chart. The sensors should read between 2.1 and 3.1 volts (60 to 85 F). The display should read the correct temperature.

4. *Testing for reversed sensor polarity and shorted lines:* If in step 1 the DVM reads 12 to 13 Vdc, then the sensor wiring is either shorted, or the sensor polarity is reversed. Try disconnecting the sensor and reversing the wiring polarity.

5. *Testing for an open line:* If in step 1 the DVM reads 0, then the line is either open, or the sensor is defective. Try disconnecting the sensor and using your DVM in the Ohms position to read the resistance of the line and the sensor. For most DVM's, the resistance of a sensor will be between 1 and 10 Meg. Ohms. If you can read the resistance correctly, then the wire is probably OK, and the sensor itself is defective. Otherwise, you may have to go to the apartment and measure the voltage across the sensor. If you measure +13Vdc without the sensor connected, then the line is good. If the sensor is good, you will read approx. 13Vdc - 2.5Vdc or 10.5Vdc across the sensor.

6. If the results of the above steps indicate a shorted line, then you will either have to replace the entire line, or cut the line in half, then half again, etc. to determine where the short is located. Most often, it will be due to a staple through a wire within an apartment, or the wire got cutoff at the floor.

TABLE 1 -- ROOM SENSOR VOLTAGE TO TEMPERATURE CONVERSION

SENSOR		SENSOR		SENSOR		SENSOR		SENSOR	
Vdc.	DEG.F.	Vdc.	DEG.F.	Vdc.	DEG. F.	Vdc.	DEG. F	Vdc.	DEG. F.
2.10	60	2.34	66	2.58	72	2.82	78	3.06	84
2.14	61	2.38	67	2.62	73	2.86	79	3.10	85
2.18	62	2.42	68	2.66	74	2.90	80		
2.22	63	2.46	69	2.70	75	2.94	81		
2.26	64	2.50	70	2.74	76	2.98	82		
2.30	65	2.54	71	2.78	77	3.02	83		

Outdoor sensors: 1. Place 3 1/2 digit volt meter or DVM (-) at **TS1** terminal 2 [outdoor sensor (-)], and DVM (+) at **TS1** terminal 3 [pipe temperature sensor (+)]. Verify that dvm reads 13 Vdc, or replace front panel.

2. Move DVM (+) to **TS1** terminal 1 [outdoor sensor (+)] and measure the outdoor sensor voltage, then look up the corresponding temperature on the chart in Table 2. Replace the sensor if the DVM reading does not correspond with the outdoor temperature. Replace panel if outdoor temp. reading on control is not within +/- 3 F. of the measured value.

3. Move DVM (+) to **TS1** terminal 5 [water sensor (-)] and measure the water temp. voltage, then look up the corresponding temp. on the chart in Fig. 1. Replace the sensor if the DVM reading does not correspond with the pipe temperature. Replace panel if water temp. reading on control is not within +/- 4 F. of the measured value.

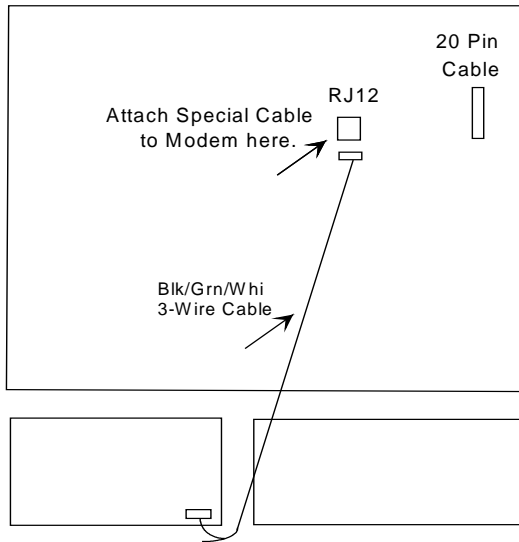
Table 2 -- OUTDOOR SENSOR -- voltage to temperature conversion

-20 F = 2.44 V	10 F = 2.61 V	50 F = 2.83 V	80 F = 3.00 V
10 F = 2.49	20 F = 2.66 V	60 F = 2.89 V	90 F = 3.05 V
0 F = 2.55 V	30 F = 2.72 V	70 F = 2.95 V	100 F = 3.10 V

MODEM OPERATION

If a modem is installed, any communications program such as Microsoft HyperTerminal, Works, or Procomm will work. Use the special cable provided from the 25 pin RS232 port on the modem to the 6 pin modular jack on the AH207. (1) Choose a name and setup a new dial-up connection. Data will be sent to the modem in the same format that it is displayed in the 32 character LCD. (2) Set your PC Modem Baud Rate to 9600 N, 8, 1 . First type "P" followed by the 3 digit passcode (see setup menu) to gain remote access to the control. All functions are available through the modem except it is not possible to (a) program the time clock, (b) choose which sensors will be included in the average temperature. (3) Your computer keyboard emulates the AH207 front panel switches as follows:

1	= SET	4	= SYSTEM	ENTER	= NEXT
2	= READ			(+)	= INCREASE
3	= RUN			(-)	= DECREASE



-- MODEM CONNECTIONS --

-- front panel rear view --

Note:

(1) Blk, Whi and Grn connection from processor brd. to main brd.

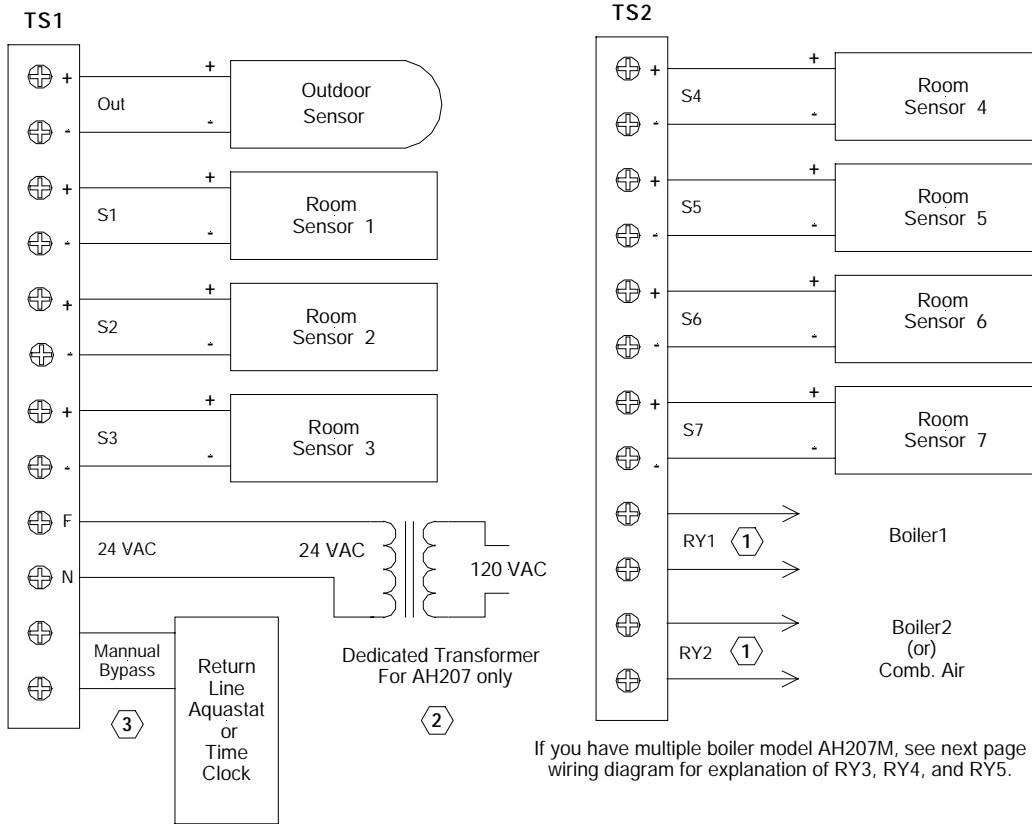
(2) RJ12 connection to modem on back of panel. The wireless receiver connects to the terminal board, not at the back of the front panel.

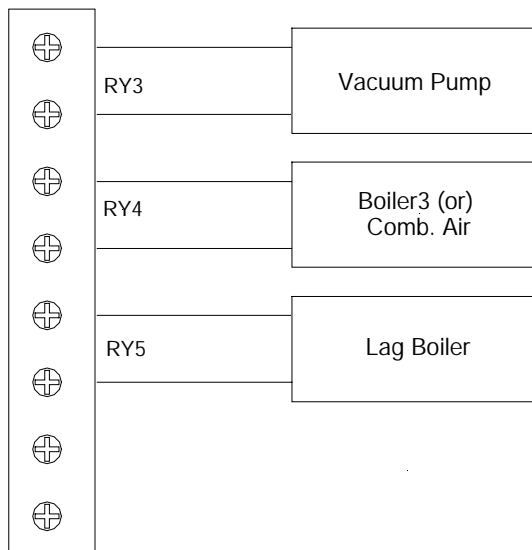
ORDERING INFORMATION

The model AH207 comes standard with 2 relay outputs for controlling (1) boiler, and (1) air damper or a second boiler. Order Model AH207M to operate a vacuum pump, a second boiler, and a third boiler which can be "staged" for early shutdown if wired to ry5.

AH207 WIRING DIAGRAM

ISSUE "A" 5-28-99





Model RF207M – multiple boiler and vacuum pump wiring

(RY3) is used only to turn on a vacuum pump which should precede a heat call. The pump lead time is adjust by changing the pump temperature differential within the setup menu. A vacuum pump will run an adjustable time period after the boilers turn off.

(RY4) is an addition contact closure simultaneous with (RY1) and (RY2).

(RY5) operates a lag boiler, turning on simultaneously with (RY1,2,4) but turning OFF part way through the heating cycle temperature rise. The early shutdown percentage is adjustable from 10 to 90% within the advanced setup menu. A lower setting will provide increased fuel saving, but care should be taken to verify that steam has reached the far end of the building before the heat cycle has ended.

Lead/lag or early shutdown for two boilers vs. a single Lo/Hi/Lo boiler

For two separate boilers and lead lag early shutdown applications, the lag boiler is attached to terminals (RY5). For single lo/hi/lo fire boilers with power burners, either (RY1,2 or 4) may be used to activate lo fire. (RY5), since it opens first is to be connected to the burner hi fire contact. To maintain a minimum boiler water temperature during summer, connect the boiler aquastat in parallel with (RY5) and the burner low fire contacts.