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Transportation Damage

All SAM units are packaged in approved shipping containers. Terms of sale are F.O.B. point of shipment and title passes to the consignee at the time of shipment upon signature of the carrier agent.

All units should be carefully inspected upon arrival and claims for damage should be filed against the carrier. In the event of damage the consignee should:

1. Note all damage on the delivery receipt.
2. Notify carrier immediately and request an inspection.
3. If damage is concealed notify as soon as possible.
4. File a claim with supporting documents:
 - a) Bill of Lading
 - b) Paid freight bill
 - c) Invoice
 - d) Inspection report

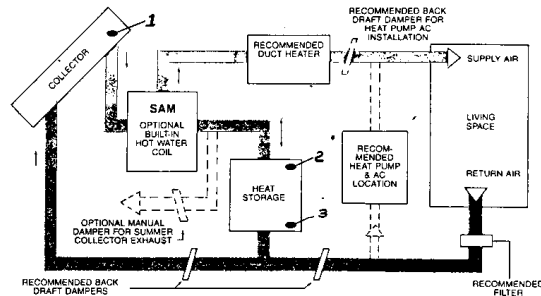
General

1. The SAM unit is designed for the following air flows. Detailed system design is extremely important for a good solar installation.

MODEL	BLOWER			STATIC PRESSURE						
	H.P.	Volts	Amps	2 1/2"	5"	7 1/2"	1.0"	1.25"	1.5"	2.0"
SAM-10	1/2	115	10 max	1600	1200	1200	1100	700	—	—
SAM-20	3/4	115	14 max	2100	1800	1600	1400	1100	500	—
SAM-30	1 1/2	115	16 max	—	3000	2200	2000	1800	1500	800

2. Read carefully the section on controller connections. **EXTREME CAUTION** must be used in connecting the SAM controller to prevent damage.
3. Evaluate carefully the auxiliary furnace or heat pump circuit to determine the proper SAM controller connections.
 AC power should be removed from the SAM and auxiliary equipment before connecting the SAM controller.
5. Good ducting practices should be used; eliminating sharp bends, etc.
6. The optional hot water coil is installed within the storage inlet/outlet. Holes

7. Check with local codes and engage a competent electrician to connect the SAM.



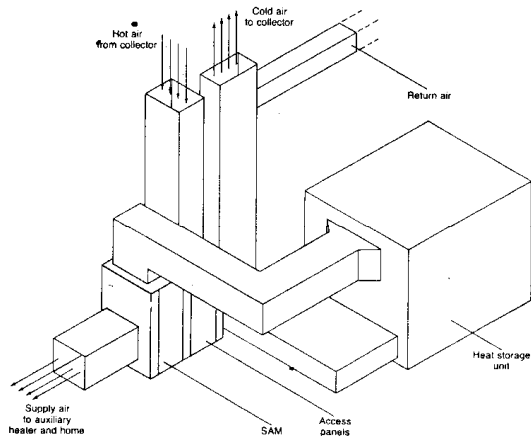
8. Refer to the above chart for typical sensor locations:

SENSOR #1 (COLLECTOR SENSOR) Usually located on the lower plate of the collector or above the plate, such that it closely reflects the collector temperature.

SENSOR #2 (HOT STORAGE SENSOR) In a rock storage usually located in the top 6 inches of the rock. Typically installed in a horizontal copper pipe for easy installation and removal.

SENSOR #3 (COLD STORAGE SENSOR) In a rock storage usually located in the bottom 6 inches of the rock. Typically installed in a horizontal copper pipe for easy installation and removal.

9. Refer to the following chart for a pictorial of a SAM installation:



Introduction

Thermostat signals are directed to the SAM controller and the appropriate response is initiated.

1. No heat requested by thermostat. S/W switch in Winter position.

The SAM is inactive until the collector temperature is 45°F greater than cold storage temperature. Then collected heat will be directed to storage, also heating hot water if the optional Hot Water Coil is used. Collection will continue until the difference between collector temperature and cold storage temperature is 25°F.

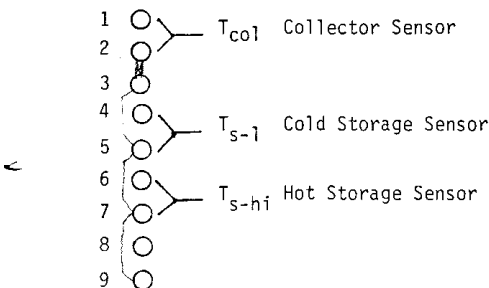
2. No heat requested by thermostat. S/W switch in Summer position. With the S/W switch in the summer position hot collection air is used to heat hot water. The SAM will be inactive until the temperature of the collector is 140°F. Air flow will then be directed from collector to storage, heating the domestic hot water. It is recommended that a bypass damper be placed in the storage ducting exhausting this hot air outside, bypassing storage. Collection will stop when collector temperature drops to 115°F, or when the water reaches the temperature determined by the aquastat.
3. Thermostat requesting stage 1 (W_1) heat.
 - A. If the collector temperature is greater than the programmed delivery temperature (PDT), heat will be directed from the collector to the home. This is adjustable in the field, but the controller is delivered with a PDT of 85°F.
 - B. If collector temperature is less than PDT, heat will be directed from storage to home, provided storage temperature is greater than PDT.
 - C. If neither collector or storage are above PDT, the controller will turn on the auxiliary furnace.
4. Thermostat requesting stage 2 (W_2) heat. This condition usually means that solar heat has been unable to keep up with the home heating demands. The SAM controller will turn on the auxiliary furnace to also supply heated air until the home temperature is brought up to stage 1. The installer can program the SAM blower to either shut off or continue operation.

Controller Connections

Refer to figure 1 for terminal numbers

EXTERNAL SENSORS (Terminals 1-9)

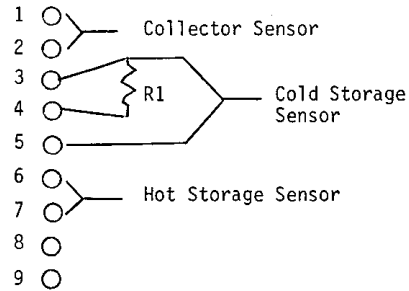
A typical sensor connection would appear as follows:



T_{CO1} -COLLECTOR TEMP (Terminals 1 & 2)
Connect the collector sensor between pins 1&2.

DIFF. OFFSET (Terminals 3,4 & 5)
Normally not used--The controller is delivered with a differential offset (difference between collector temperature and cold storage temperature to start collection) of 45°F, and a hysteresis (difference between collector temperature and cold storage temperature to stop collection) of 25°F. These temperatures can be changed by doing the following:

1. Instead of connecting the cold storage sensor to terminal numbers 4 & 5 connect the sensor to terminal numbers 3 & 5.
2. Connect a resistor (R_1) between terminal numbers 3 & 4. The resistance value can be chosen from the following table.

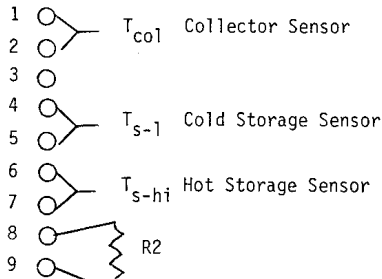


DIFF. ON °F	DIFF. OFF °F	RESISTOR (R_1) ohms
45	25	None
40	20	4,700
35	15	10,000
30	10	16,000
25	5	24,000

T_{S-1} LOW STORAGE TEMP (Terminals 4 & 5)
Connect the sensor to cold storage, between terminal numbers 4 & 5. This would be changed to terminal numbers 3 & 5 if the differential offset is changed by a resistance value.

T_{S-hi} STORAGE TEMP (Terminals 6 & 7)
Connect the sensor from hot storage to terminals 6 & 7.

T_{S-ref} REFERENCE STORAGE TEMP (Terminals 8&9)
Normally no connection--The controller compares the temperature of the collector sensor or the temperature of the hot storage sensor to the PDT to determine if solar heat is available. The controller is delivered with a PDT of 85°F. This PDT can be changed by connecting a resistor R_2 to terminals 8 and 9.



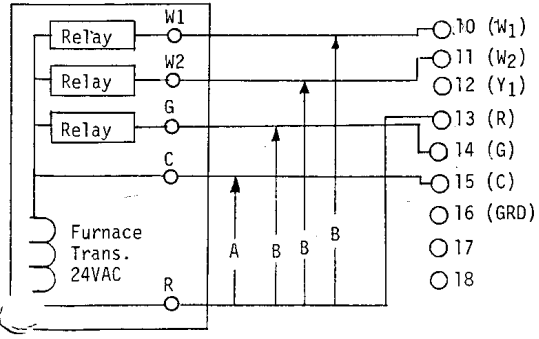
PDT °F	R ₂
85	None
90	200,000
100	60,400
110	32,400
120	21,000
130	14,700

OUTPUT TO AUXILIARY UNITS (Terminals 10-16)
 The auxiliary furnace/heat pump/duct heater wires are connected to these terminals. Extreme care must be used:

- All power must be removed from the SAM and auxiliary equipment before connecting leads.
- Study the schematic diagram of the auxiliary equipment to determine the proper connection.

Terminals ¹⁵ and ¹⁶ (common and ground) are wired together in the SAM controller. They can be used interchangeably. Auxiliary heating equipment with its own 24VAC transformer is wired directly to the SAM controller. The SAM controller then switches this 24VAC to the appropriate output terminal (W₁, W₂, Y₁, G).

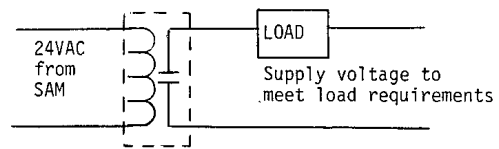
AUXILIARY FURNACE



A = 24VAC to SAM from furnace
 B = 24VAC from SAM to furnace

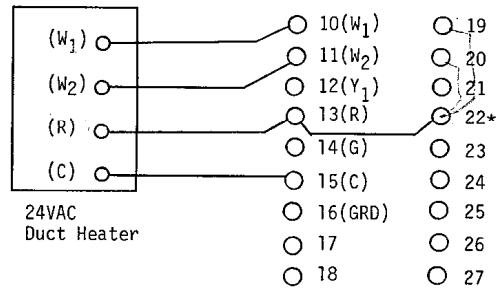
Refer to figure 5 for additional connection diagrams.

DO NOT CONNECT external equipment that has an output of more than 24VAC into the SAM. The maximum output from W₁, W₂, Y₁ or the Hot Water Pump relay is 1 amp. If your output requirement exceeds 1 amp use the 24VAC to close a relay that is capable of handling your load. A sample logic diagram for this follows:



Additional 24VAC Relay--Rated to meet your load requirements

IMPORTANT If 24VAC is not available from the auxiliary transformer, particularly where a duct heater is used we can obtain the necessary voltage from the SAM by connecting terminal 13 (R) to terminal 22 (R_HR_C).

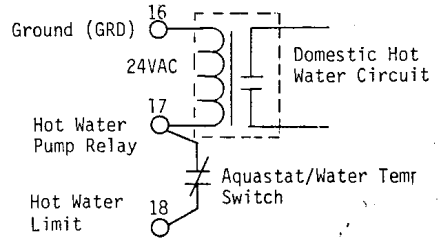


*Return

DO NOT USE IF DUCT HEATER HAS ITS OWN TRANSFORMER.

In parallel configurations it may be necessary to open controller wires UP1 and UP2. Refer to figure 6 for a description.

OUTPUT TO AUXILIARY UNITS (Terminals 16-18)
 If your system has a Hot Water Pump but does not have an aquastat controller a short must be placed from terminal 17 (hot water pump relay) to terminal 18 (aquastat controller). The hot water pump relay and the aquastat controller are connected as follows:



THERMOSTAT CONNECTIONS (Terminals 19-23)
Connect thermostat signals to these terminals and not to the auxiliary furnace. See figure 5 for examples of where air conditioner signals are connected to the auxiliary. Not all thermostats have all signals available. Only those available or necessary to your system.

STATUS OUTPUTS (Terminals 24-27)
Upon a particular mode being active there will be a 24 Volt AC signal between the terminal representing that mode and common (pin 15).

Solar Collection (winter) (Terminals 15 & 24)
24 Volts between pin 24 and pin 15. This voltage will become available when the collector is delivering heat to either the home or storage.

Solar Distribution (Terminals 15 & 25)
24 Volts between pin 25 and pin 15. This voltage will become available when the home is being heated from solar heat in the storage.

Auxiliary Furnace (Terminals 15 & 26)
24 Volts between pin 26 and pin 15. This voltage will become available upon activation of stage 1 of the auxiliary heating.

Solar Collection (summer) (Terminals 15 & 27)
24 Volts between pin 27 and pin 15. This voltage will become available when the summer/winter switch is in the summer position and the collector is delivering heat. This voltage will also become available when the summer/winter switch is in the winter position and the aquastat switch is closed.

Installation Check out

- A. Refer to figure 1 for terminal connections.
- B. Refer to figure 2 for damper positions.
- C. Optional-Refer to figure 3 for additional controller logic. It would be necessary to short terminal 17 (hot water pump relay) to terminal 18 (hot water pump limit) to obtain all Voltage readings.
- D. Connect the 3 sensors to controller.
- E. Connect the SAM to 110VAC. Input for 110VAC is located below the SAM controller.
- F. Do the following tests:
 1. Collector to Storage Mode
(Condition #1 of figure 3)
ACTION: Short terminals 1 & 2
(T_{col} -collector temp.)
COMMENT: This simulates a high temperature condition at the collector and activates the following:
 - A. The SAM blower motor will turn on.
 - B. Air flow will take place from collector to storage.

Collection to House Mode
(Condition #2 of figure 3)
ACTION: Short terminals 1 & 2
(T_{col} -collector temp.)
Short terminals 19 & 22
(W_1 and $R_H R_C$)

COMMENT: This simulates a high temperature condition at the controller and a requirement for stage 1 heating by the home. The following should take place:

- A. The SAM blower motor will turn on.
- B. Air flow will take place from collector to home.

3. Storage to House Mode
(Condition #4 of figure 3)
ACTION: Short terminals 6 & 7
(T_s -hi storage temp.)
Short terminals 19 & 22
(W_1 and $R_H R_C$)

COMMENT: This simulates a high storage temperature and a requirement for stage 1 heating by the home. The following should take place:

- A. The SAM blower motor will turn on.
- B. Air flow will take place from storage to home.

G. Remove 110VAC power from the SAM. Remove power to the auxiliary equipment. Connect thermostat connections to the SAM. Connect auxiliary equipment to the SAM. Connect power to the SAM and auxiliary equipment.

H. Repeat step F numbers 1, 2 and 3.

I. Complete the following steps:

1. Storage and Auxiliary to Home
(Condition #5 of figure 3)
ACTION: Short terminals 6 & 7
(T_s -hi storage loop)
Short terminals 19 & 22
(W_1 and $R_H R_C$)
Short terminals 20 & 22
(W_2 and $R_H R_C$)

COMMENT: This simulates a high storage temperature and a requirement for stage 1 and stage 2 heating by the home. The following should take place:

- A. The SAM blower motor will turn on.
- B. Air flow will take place from storage to home.
- C. The auxiliary furnace will turn on.

2. Auxiliary to Home
(Condition #6 of figure 3)
ACTION: Short terminals 19 & 22
(W_1 and $R_H R_C$)

COMMENT: The auxiliary furnace will be turned on.

- A. The SAM blower motor will turn on.
- B. Air flow will be from storage through auxiliary furnace through home.

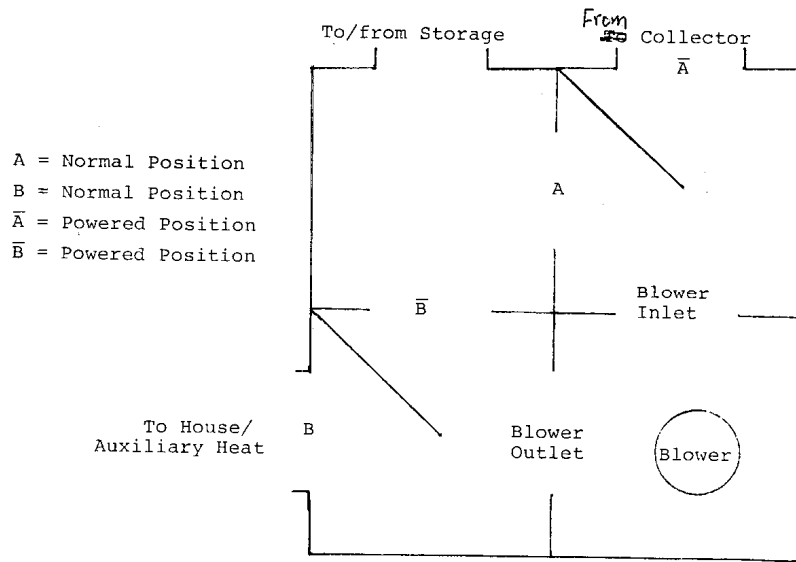
NOTE: Refer to figure 3 and figure 6 for any changes in logic due to opening UP1 and UP2.

FIGURE 1

1		TCOL	OR (W1) 10	19	1st Stage Heating	OR
2			DE (W2) 11	20	2nd Stage Heating	OR
3		Diff Offset	VE (V1) 12	21	Air Conditioning	VE
4		TS-L	RI (R) 13	22	Return	OR
5			GN (G) 14	23	Fan	OR
6		TS-HI	(C) 15	24	Solar Collector	OR
7			(GRD) 16	25	Solar Distribution	OR
8		TS-REF	Hot Water Pump Relay 17	26	Aux. Furnace	VE
9			Hot Water Limit 18	27	Solar Collector	

TERMINAL REFERENCE CHART

FIGURE 2



A = Normal Position
 B = Normal Position
 \bar{A} = Powered Position
 \bar{B} = Powered Position

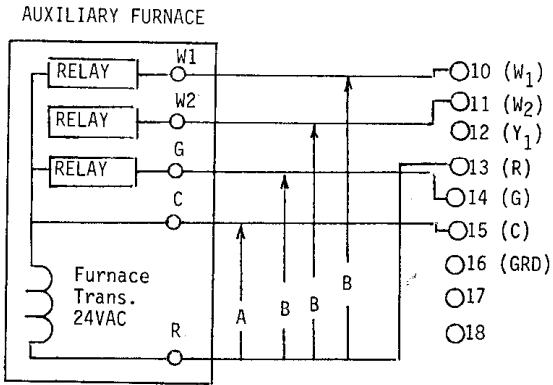
DAMPER OPERATION

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FIGURE 5(A)

TYPICAL AUXILIARY FURNACE CONNECTION

NOTE: G output 24VAC is on only if W₁ output 24VAC is on.

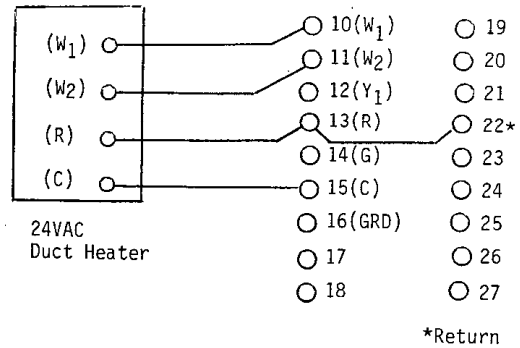


A = 24VAC to SAM from furnace
 B = 24VAC from SAM to furnace
 Note connection of furnace terminal R to W₁, W₂ or G, FIGURE 5(C)

FIGURE 5(B)

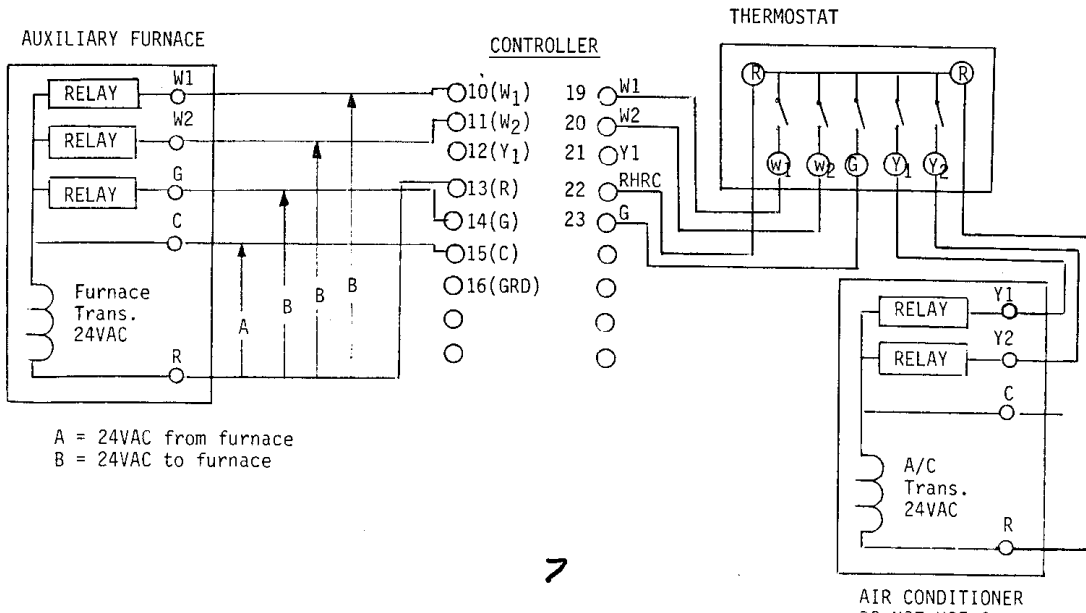
TYPICAL DUCT HEATER CONNECTION

NOTE: Do not use if duct heater has its own internal transformer.



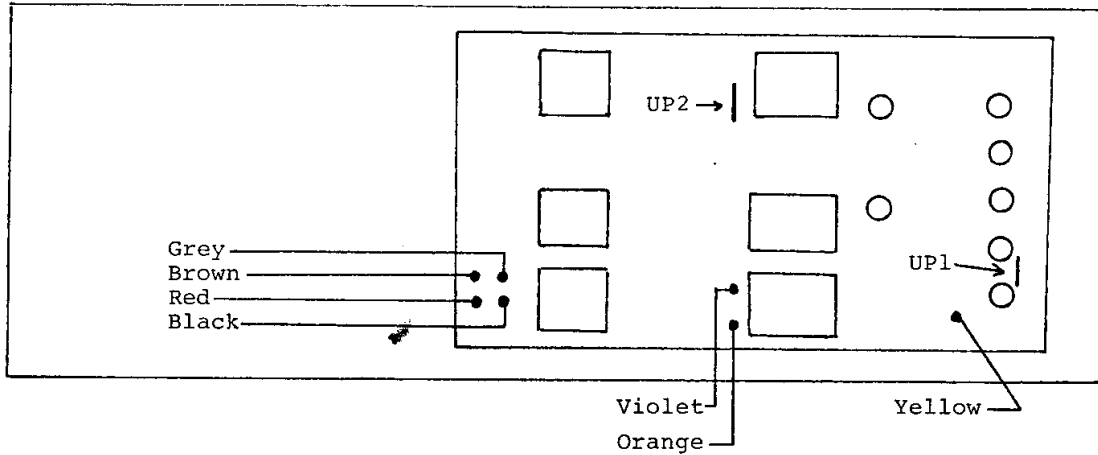
TYPICAL AUXILIARY FURNACE/AIR CONDITIONER CONNECTION

NOTE: Furnace transformer is used with SAM.
 A/C transformer is used independently of SAM.



A = 24VAC from furnace
 B = 24VAC to furnace

BACK OF CONTROLLER



Shorting bars UP1 and UP2 are opened to provide additional controller options.

UP1 open (see figure 3 for controller logic) will turn off the SAM blower and shut the damper to the home when auxiliary heat is requested. Therefore the SAM blower would be turned off when W_1 is requested and solar is not available or W_2 is requested. Typical for a parallel connection.

UP2 open (see figure 3 for controller logic) will stop the auxiliary fan voltage (G) from appearing between terminals 14 & 15 under all conditions except a fan on condition from the thermostat.

LOCATION OF UP1 & UP2

FIGURE (7) - DUCT SPECIFICATIONS

Specifications

1. SAM control unit
2. Inlet for hot air duct from collector—
19" x 12"
3. Inlet/outlet for duct to heat storage—19" x 12"
4. Outlet to auxiliary heater/house—
19" x 15"

Two access doors are provided on each side of the Solar Air Mover.

