

INSTALLATION INSTRUCTIONS

I. APPLICATION: Refer to data sheet for more detail application information.

The Model C-30 is a differential temperature control for use with solar DHW or space heating systems. The C-30 output operates a pump or fan to perform solar collection. Standard features include a field adjustable storage high temperature limit (105-212°F), and field selectable Recirculate freeze protection. Other features include an ON/OFF/AUTO mode switch, "POWER ON" and "OUTPUT" L.E.D. indicators.

- * For drain-down systems use C30-1S-2F.
- * For solar pool, spa or hot tub systems, use C35.
- * For temperature monitoring plus differential control, specify C100 (DHW) or C120 (space heating).

II. INSTALLATION:

Installation must be performed by trained service personnel, and in accordance with NEC and local codes.

CAUTION
Disconnect all power during C30 installation.

1. MOUNTING:

Choose a centralized location which minimizes wiring runs. Ensure sufficient side to side clearance to allow screwdriver access to cover screws and access to the mode switch. Actual mounting to wall is via two wood or sheet metal screws.

PUMP MOUNTING: C30 attaches directly via I.E. Fit Kits to Taco 006, 007, 008 and Grundfos UPS 20-42F, UP 25-42SF, UP 26-64F, UP 25-64SF, UM 25-18SU. Fit Kits contain all necessary hardware and instructions.

VALVE MOUNTING: Fit Kits are available for mounting to Sunspool valves.

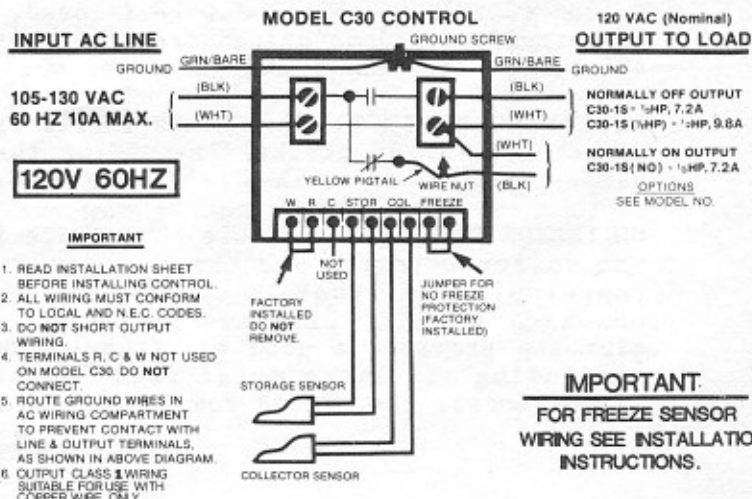
2. LINE VOLTAGE WIRING:

Refer to wiring label. Wire size and type depends on load size, horsepower and local codes. Label shown is for 120VAC model. For 230VAC model, see label on inside cover of C30.

IMPORTANT: Line cord and outlet models ("LCO" or "-LC") are intended for use with portable systems only. Do not mount or install with stationary or permanent systems. For LC and LCO models, ensure there is a grounded (3-wire) outlet with adequate power capacity. Do not use extension cords. Refer to rating label on side of C30 for output rating.

INPUT POWER: 120VAC+ 10%, 60 HZ
240VAC optional. See model label on C30.

OUTPUT POWER: 1/3 HP, 7.2A Maximum
1/2 HP, 9.8A optional. See model label on C30.



C30 terminal strips have special wire clamps that allow good electrical connection to plain, stripped wire ends. No wire lugs are required. Care should be taken to properly dress ground wires to ensure that **ground conductors do not contact wiring terminals.**

Additional wiring (a yellow pigtail) is provided for a "Normally ON" output (Model C-30-1S(NO) only). Connection is made to the yellow pigtail and the "Output L0" terminal. **CAUTION:** Terminate yellow pigtail before applying AC power to the C-30.

SENSOR MOUNTING/LOCATION AND WIRING

SENSOR MOUNTING/LOCATION AND WIRING IS CRITICAL FOR RELIABLE AND PROPER FUNCTIONING OF THE SYSTEM. SEE FREEZE SECTION (NEXT PAGE) FOR FREEZE SENSOR WIRING.

SENSOR MOUNTING AND LOCATION

It is best to mount sensors directly on collectors or storage tank. If not possible, mount strap-on sensor to piping as close as possible to collector or tank. The accuracy of SB, or SW sensors is enhanced when thermally conductive grease (e.g. Radic Shack 276-1372 or Wakefield #120-2) is applied between sensor and mounting surface. Mechanically mount sensors, (e.g. bolt, hose clamp, etc.) do **NOT** tape or solder. **Always insulate sensor and adjacent plumbing to minimize the effects of ambient temperature.**

IMPORTANT: I.E. sensors are designed and tested to withstand temperatures up to 400°F - degradation of performance will occur above 400°F. Do not expose sensors to soldering or open flame whereby temperatures of 400°F may be reached. Protect the wire/epoxy end of the sensors from direct rain exposure - **never submerge sensors.**

WIRING: A good connection between wiring and sensor leads is crucial to accurate, reliable control operation. Using wire nuts, twist the sensor connections together. To ensure a weatherproof connection, fill the wire nuts with a sealant (silicone, bathtub caulk, G.E. RTV, etc.). The splice should be enclosed in a small box, or enclosed so that it is not exposed to weather.

TYPES OF WIRE: Sensor wire should be an 18 AWG insulated pair (thermostat wire, Belden 8461 or equiv.). Sensor wires that are exposed to weather should be suitable for the purpose (neoprene jacket). For sensor wiring runs that travel near other electrical equipment, wiring to electrical equipment, ham/CB radio transmitters or other sources of electrical interference, shielded wire is recommended. For indoor wiring use 18AWG, two conductor polyethylene jacketed wire (i.e. Belden #8760). For outdoor wiring use a neoprene jacketed type (i.e. Belden #8428). If shielded wire is used, ground the shields to the C30 enclosure via circuit board mounting screws (next to sensor terminals). Do **not** ground the shields at the sensor end of sensor wiring.

LIGHTNING PROTECTION: Though little can be done to protect any control from a direct lightning strike, grounding the collector array will prevent possible damage from "near strikes" that can produce high energy static discharges.

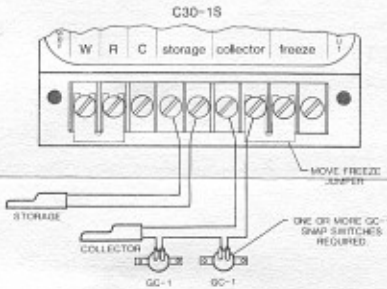
COLLECTOR GROUNDING: Ensure that there is a good electrical ground path between the collector array and the coldwater service pipe. This path should be via copper plumbing that is uninterrupted by teflon taped fittings, dielectric unions, plastic fittings etc.. If you are not positive that the system plumbing provides a good electrical ground path, connect the collector array (including all large metal frame parts) to a ground rod using #8 AWG copper wire. Locate the ground rod as close to the collector array as possible.

4. FREEZE PROTECTION AND FREEZE SENSOR CONNECTION

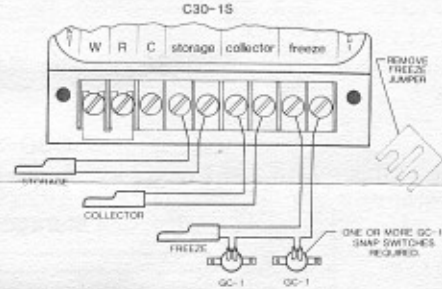
C30-1S controls have recirculate type freeze protection that may be activated by either the collector or separate freeze sensor. Controls are shipped with freeze protection disabled (jumper installed across freeze sensor terminals). If recirculate type freeze protection is desired, wire freeze sensors as shown below.

IMPORTANT: Recirculate freeze protection will not operate during a power outage. Recirculate freeze protection is not recommended for use in climates where freezing temperatures are common or last for extended periods. Sensor placement is extremely critical for protection of the entire collection system and exposed plumbing. Due to the difficulty in determining all susceptible freeze points, Independent Energy, Inc. requires that a minimum of two (2) freeze sensors be used. Placement of freeze sensors at the coldest points of the array will help ensure that freeze protection will start early enough to protect the entire collection system. Freeze sensors should also be located to ensure that once recirculation has started, the entire collection system is heated before the sensors react to stop freeze protection.

FREEZE SENSOR CONNECTION TO C30: Freeze protection may be provided by using the collector sensor or separate freeze sensor terminals as shown below. One (1) or more GC-1 freeze snap switches must be wired in series with the freeze sensor. See diagrams below:



FREEZE SENSOR WIRING USING COLLECTOR SENSOR



FREEZE SENSOR WIRING USING A SEPARATE FREEZE SENSOR

5. STORAGE HIGH TEMPERATURE LIMIT

The standard C30-1S is supplied with a field adjustable high limit. Some units may have a factory set high limit (e.g. C30-1SH(160)).

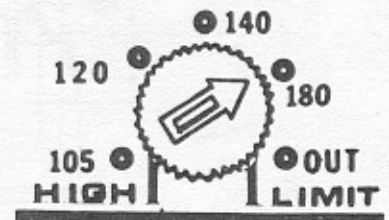
CAUTION

Solar systems can generate dangerously high water temperatures. Ensure that the user will be adequately protected by using either a tempering valve, C30 high temperature limit or other means. Consult local plumbing codes for allowable temperatures and safety precautions.

NOTE: The storage high temperature limit is compared to the temperature of the storage sensor which is normally located in or near the bottom of the storage tank. Temperature stratification is common in DHW tanks. The top temperature may be considerably hotter than the bottom of the tank where the storage sensor is located. Adjust the C-30 high limit accordingly.

BEFORE REMOVING COVER TO ADJUST THE STORAGE HIGH LIMIT THRESHOLD, ENSURE THAT POWER IS TURNED OFF.

Range: 105°F-212°F+. Clockwise position indicated by "OUT", defeats high limit. Rotate trimpot knob (on circuit board, see figure) until molded-in arrow points to the desired temperature.



III. OPERATION

MODE SWITCH

OFF-----Solar collection is disabled, Recirculate freeze protection (if enabled) active. Tests pump/fan TURN OFF operation.

AUTO-----Normal operating mode. Solar collection and recirculate freeze protection (if enabled) operate automatically.

ON-----Forces output on regardless of the differential temperature or high limit. Tests pump/fan TURN ON operation.

INDICATORS

POWER ON----Illuminates when AC power is applied to the C-30.

OUTPUT-----When illuminated, solar collection or recirculate freeze protection (if enabled) is operating.

SOLAR COLLECTION

Collection starts (output ON) when the collector/storage temperature difference increases to the TURN ON threshold. Collection stops (output OFF) when the temperature difference decreases to the TURN OFF threshold or if the storage temperature rises to the user adjusted high temperature setpoint. The standard differential temperature thresholds are 20°F ON, 5°F OFF. Optional thresholds are indicated on the C-30 model label (ie. C-30-1S(8/3) = 8°F ON, 3°F OFF).

RECIRCULATE FREEZE PROTECTION

If enabled, and when near freezing temperatures are reached at any of the freeze sensor locations, the output turns on to circulate warmer storage water through the collector array to prevent collector freezing. Recirculate freeze protection is initiated when the thermistor freeze sensor temperature falls to 40+2°F, or when the temperature at either of the GC-1 freeze snap switches (minimum of one (1) installed) falls to 44+2°F (contacts open). Freeze protection stops when all freeze sensor temperatures are above the freeze TURN OFF threshold. The thermistor freeze sensor stops freeze protection when its temperature rises to 44+2°F. The GC-1 freeze snap switch stops freeze protection (contacts close) when its temperature rises to 54+5°F.

IV. POWER UP AND CHECKOUT PROCEDURE.

CAUTION

THE FOLLOWING CHECKOUT PROCEDURE SHOULD BE PERFORMED BY QUALIFIED INSTALLERS ONLY. TO AVOID DANGER OF ELECTRICAL SHOCK USE EXTREME CAUTION WHILE PERFORMING ANY OF THE FOLLOWING CHECKS

1. Check all input and output AC wiring for proper termination.
2. Temporarily remove sensor wiring from the C-30. Using an ohmmeter (or C-100 control with digital readout) check that each sensor circuit resistance (use R/T chart) corresponds with actual temperatures at sensor locations. This test will isolate "OPEN", "SHORTED", or "MIS-WIRED" sensor wiring.
3. Re-connect sensors and place the C-30 mode switch to "OFF".
4. Turn ON AC input power at the circuit breaker panel.
 - A. Verify that the C-30 "POWER ON" indicator is ON. If not check;
 - * That the jumper is installed between the "W" & "R" terminals.
 - * Input power at the C-30 "AC LINE" terminals with an AC voltmeter.
 - * If the "POWER ON" indicator still will not turn ON, C-30 is defective.

- B. With the mode switch in the "OFF" position, verify that the "OUTPUT" indicator is OFF. (PUMP/FAN OFF). If not check;
 * Recirculate freeze protection (if enabled) will override the mode switch ON position if freeze sensors are below the freeze threshold. To check if freeze protection is activating the C-30 output, temporarily "short" freeze sensor terminals. Output will turn off.
 * If freeze protection not selected, check freeze jumper for tight connection.
 * If "OUTPUT" indicator is still ON, C-30 is defective.
- C. Select the "ON" mode switch position. The "OUTPUT" indicator will turn ON. If not, the C-30 is defective.
- D. While in the "ON" mode the (PUMP/FAN) must turn ON. If not check;
 * If AC voltage is not at "OUTPUT" terminals with "OUTPUT" indicator ON, the C-30 is defective.
- E. Select the "AUTO" switch position. The C-30 is now selected for normal operation. If any control malfunction is suspected (ie. intermittent or abnormal turn on/ turn off operation) re-check sensor wiring. Use the procedure described in Section V for a basic check of control functional operation. To accurately check control operation use Model QC-1 "Quick Check" tester.

Temperature vs Resistance (°F vs ohms)
 10,000 ohm Thermistor @ 77°F

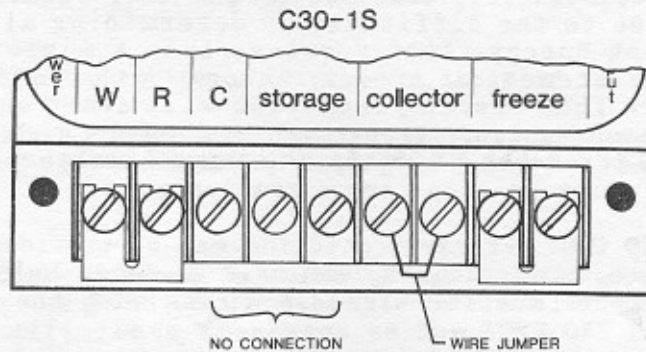
°F	Ohms	°F	Ohms	°F	Ohms	F	Ohms
32.0	32660	78.0	9760	123.0	3526	168.0	1453
33.0	31748	79.0	9526	124.0	3453	169.0	1427
34.0	30864	80.0	9299	125.0	3381	170.0	1401
35.0	30008	81.0	9078	126.0	3311	171.0	1376
36.0	29178	82.0	8862	127.0	3243	172.0	1351
37.0	28375	83.0	8653	128.0	3176	173.0	1326
38.0	27596	84.0	8449	129.0	3111	174.0	1303
39.0	26840	85.0	8250	130.0	3048	175.0	1279
40.0	26109	86.0	8057	131.0	2986	176.0	1256
41.0	25400	87.0	7869	132.0	2925	177.0	1234
42.0	24711	88.0	7685	133.0	2866	178.0	1212
43.0	24045	89.0	7507	134.0	2808	179.0	1191
44.0	23399	90.0	7333	135.0	2751	180.0	1170
45.0	22771	91.0	7164	136.0	2696	181.0	1149
46.0	22162	92.0	6999	137.0	2642	182.0	1129
47.0	21572	93.0	6839	138.0	2589	183.0	1109
48.0	21000	94.0	6683	139.0	2538	184.0	1090
49.0	20444	95.0	6531	140.0	2486	185.0	1071
50.0	19906	96.0	6382	141.0	2438	186.0	1052
51.0	19382	97.0	6238	142.0	2390	187.0	1034
52.0	18875	98.0	6097	143.0	2343	188.0	1016
53.0	18382	99.0	5960	144.0	2297	189.0	999
54.0	17904	100.0	5827	145.0	2253	190.0	982
55.0	17440	101.0	5696	146.0	2209	191.0	965
56.0	16990	102.0	5570	147.0	2166	192.0	948
57.0	16552	103.0	5446	148.0	2124	193.0	932
58.0	16127	104.0	5325	149.0	2083	194.0	916
59.0	15715	105.0	5208	150.0	2043	195.0	901
60.0	15314	106.0	5093	151.0	2003	196.0	886
61.0	14925	107.0	4981	152.0	1965	197.0	871
62.0	14547	108.0	4873	153.0	1928	198.0	856
63.0	14180	109.0	4767	154.0	1891	199.0	842
64.0	13823	110.0	4663	155.0	1855	200.0	828
65.0	13476	111.0	4562	156.0	1820	201.0	814
66.0	13139	112.0	4463	157.0	1786	202.0	800
67.0	12812	113.0	4367	158.0	1752	203.0	787
68.0	12494	114.0	4274	159.0	1719	204.0	774
69.0	12185	115.0	4182	160.0	1687	205.0	761
70.0	11884	116.0	4093	161.0	1656	206.0	749
71.0	11592	117.0	4006	162.0	1625	207.0	737
72.0	11308	118.0	3921	163.0	1595	208.0	725
73.0	11031	119.0	3838	164.0	1565	209.0	713
74.0	10763	120.0	3757	165.0	1536	210.0	701
75.0	10502	121.0	3678	166.0	1508	211.0	690
76.0	10248	122.0	3601	167.0	1481	212.0	679
77.0	10000						

RESISTANCE TO TEMPERATURE CHART

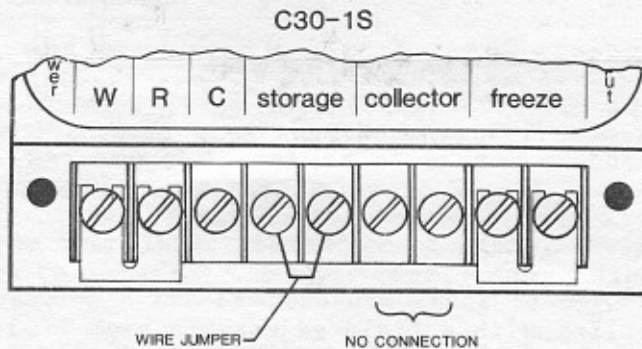
V. BASIC CHECK FOR C-30 FUNCTIONAL OPERATION

Order QC-1 "QUICK CHECK" Solar Control Tester for accurate testing.

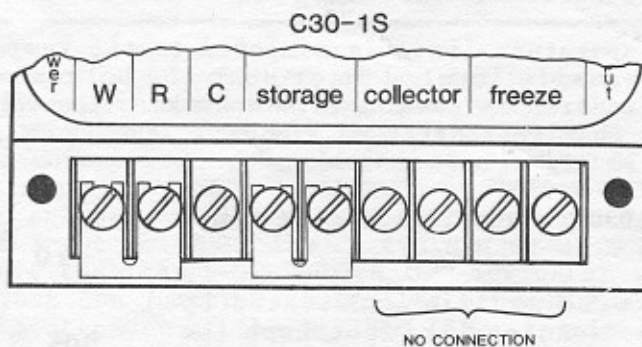
NOTE: To perform following checks, The C-30 mode switch MUST be in "AUTO" position. Basic C-30 operation may be checked by using the terminal jumpers supplied with the C-30 and a short jumper wire (or additional terminal jumper). Connect jumpers as shown below. While connecting jumpers, temporarily place the mode switch in the "ON" position. This will prevent the output from turning ON/OFF erratically while connections are being made.



OUTPUT ON
(Δ T ON, FREEZE OFF)



OUTPUT OFF
(Δ T OFF, FREEZE OFF)



OUTPUT ON
(RECIRCULATE FREEZE ON)
(Δ T OFF)