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The CSU Automatic Irrigator

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The use of completely automatic watering devices for greenhouses has now become practical with the introduction of inert media. Previous experience with automatic devices at CSU on plants grown in soils indicate danger of applying too much water, running into problems of deficient aeration. With inert media, overwatering is wasteful, but should not lower quality and production of carnations. In fact, one of the initial problems with inert media is underwatering. An automatic device is essential, since, as with manual ventilation, somebody is likely to forget to flip the switch for watering, or leave it on for an indefinite period. Carnation response to variations in the environment when grown in inert media is much faster than when grown in soils. Failure to water is likely to result in a more severe check. Manual irrigation is not desirable for plants in inert media.

A wiring diagram and parts list is given for an automatic device developed at CSU (Fig. 1) for those who may wish to construct their own instrument. Cost of parts should not exceed \$200.00 to \$250.00. The particular instrument has an additional advantage in that it may be used at any time with a solar accumulator now under development and testing at Fort Collins. It cannot be used to automatically time irrigation cycles for carnations grown in soils since the maximum cycle length is 180 seconds. As a general rule, a 120 to 150 second cycle is more than sufficient to adequately irrigate Idealite or Scoria. The instrument will handle up to 39 individual units. That is, if the water supply system is adequate to handle one bench at a time, the apparatus will sequentially water 39 benches.

Figure 2 is the wiring diagram for 110 volt a.c.

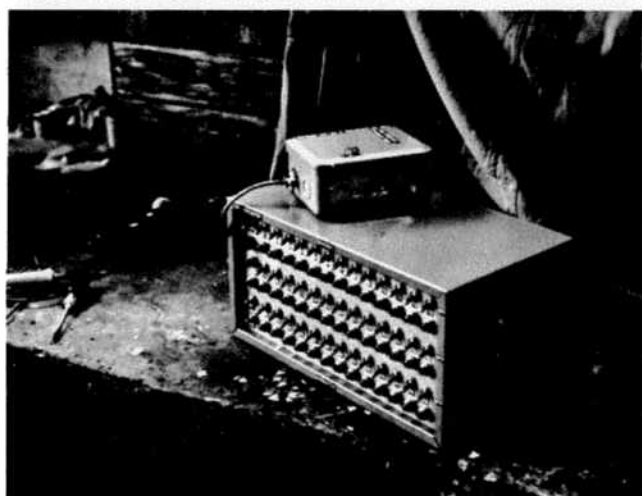


Fig. 1. CSU automatic irrigation timer, showing the Dayton primary timer and main timer console.

system. Table 1 lists the necessary parts. Since many growers use 24 volt a.c. in order to avoid metal conduit for wiring, it is necessary to insert a 110 to 24 volt transformer immediately after fuse F, and specify all relays to operate on 24 volts. The plug A-2 to the main timer must be changed to a five pin plug since the clock motor operates on 110 vac. Otherwise, the system as shown in Fig. 2 will operate entirely on 24 vac.

Operation

Power to the system is provided through plug A-1, switch S and fuse F. Indicator lights are indicated by

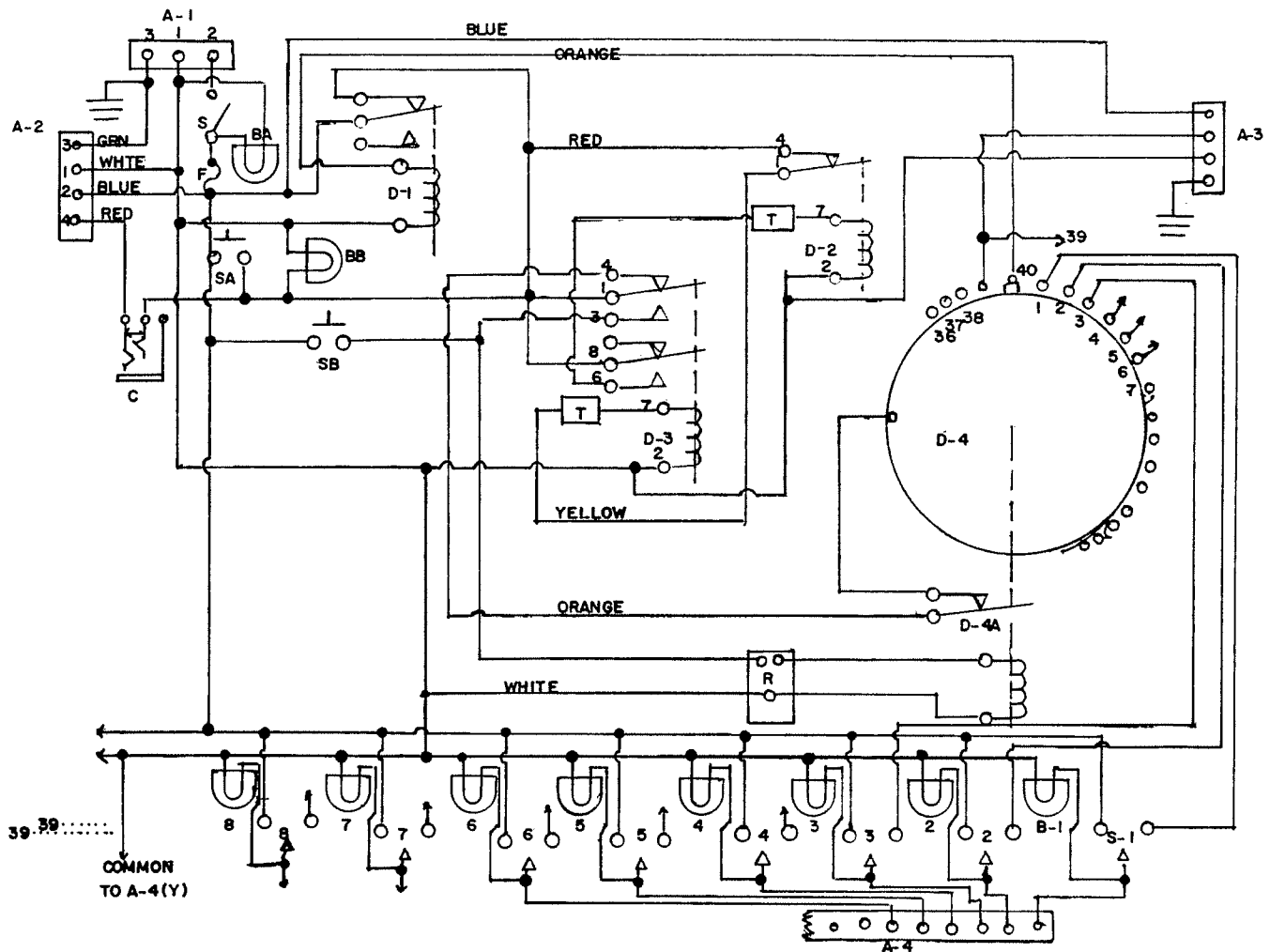


Fig. 2. Wiring diagram for main irrigation timer. System designed for 110 volts a.c. For 24 volt a.c. operation, replace A-2 with a 5 pin plug, install a 110 to 24 volt a.c. transformer after fuse F, so that all lines in main timer and "blue" lead to A-2 carry 24 volts. The primary timer clock motor attached to A-2 requires 110 v.a.c. Specify that all relay coils operate on 24 volts instead of 110. Eliminate or change series resistances to all indicator lights. See Table 1 for parts.

the prefix B. Thus, BA indicates that power is on, BB indicates when the system is cycling, and B-1 through B-39 show which benches, or units, are being watered. For 110 volts, a 25 K-ohm resistor must be hooked in series with each indicator light. For 24 volts, this should not be necessary. A Dayton 24 hour timer with adjustable cams is connected to plug A-2. This timer starts a cycle; up to a maximum of 6 per day, depending upon the length of an individual watering period, zero to 180 seconds. A cycle may be started manually by pushing switch SA, and the system may be stepped to any particular unit by pushing switch SB. Jack C is for the solar accumulator plug-in. The system will operate with or without the solar accumulator. If, for example, a maximum of 4 cycles per day are set on the Dayton timer, the solar accumulator will prevent watering if insufficient light has been

accumulated since the last irrigation. The watering period will be skipped to the next period. Skipping will continue until sufficient light is accumulated. Under completely automatic operation, one, two or three days may be skipped during the winter, or 4 waterings per day may occur during the summer.

An impulse from the Dayton timer through jack C latches the impulse relay D-1 to the closed position and the system begins to time. Relay D-3 and D-2 are solid state delay timers, D-3 being adjustable between 0 and 180 seconds. The time each unit is on is controlled by D-3. At the end of, say, a 120 second watering period, D-3 switches and causes D-4 to step to the next unit. Cycling continues until position 40 on D-4 is reached, at which time relay D-1 is latched open, the system stops, ready for the next cycle to be initiated by the Dayton timer. Relay D-2 is a one

Table 1. Parts list for CSU Automatic Irrigator. Publication of a particular manufacturer's name is not meant to be an endorsement.

1. A Plugs

- A-1: Main power plug, 3 contact, Cinch-Jones 5-303-CCT
- A-2: Primary timer plug, 4 contact, Cinch-Jones, P-304
- A-3: Additional timer plug, 4 contact, Cinch-Jones, P-304
- A-4: Cannon, 47 pin plug, MS 3102A 36-8S
(Mates to these plugs and receptacles will be required.)

2. B Pilot lamps (All lamps wired in series with 75 K ohm resistors for 110 volt a.c., OALCO 810B-431(neon glow G.E., T-3 1/4, S.C. Bay, Min.).

- BA: Main power on
- BB: Cycling operation
- B-1 through B-39: Individual unit operation.

3. C 3 conductor phone jack for solar accumulator, "Littel-plug" 267.

4. D Relays

- D-1: DPDT latching relay, Potter-Brumfield, PC11A, 110 v.a.c., specify v.a.c. for 24 volt operation.
- D-2: DPDT delay on operate relay 1 second delay, Potter-Brumfield, CDA38-70012, 110 v.a.c. or CDA 38-30001 for 24 v.a.c.
- D-3: DPDT delay on operate relay, 10 to 180 seconds adjustable, Potter-Brumfield, CD38-70005, 110 v.a.c. or CD38-30003 for 24 v.a.c.
- D-4: 40 position, single pole stepping switch, steps on release, Clare type 20, 1-13 interrupter, C.P. Clare and Co.

5. R Low voltage AC to DC rectifier for D-4, Clare RP8047

6. S Switches

- S: Main power switch, SPST, Cutler-Hammer, 750K13
- SA and SB: push button switches, Cutler-Hammer, 8440K2
- S-1 through S-39: SPDT toggle switches, Cutler-Hammer, 7503K12

7. Primary timer: Dayton 24 hour clock, short range timer. Available from Grainger, 2E025.

8. Sockets for D-2 and D-3: Amphenol type, RS Octal sockets, 78R58 Fuseholder, HJM.

second delay, insuring positive operation of D-3, and D-4A is an integral part of D-4, preventing relay chatter, particularly double pulsing of D-1.

Part R, indicated in the wiring diagram is a 110 to 24 volt rectifier for operating D-4. Switches S-1 through S-39 permit any unit to be shut off, placed on automatic, or watered manually. However, the system will step through these units even if they are turned off. Total timing will not vary. By duplicating the wiring diagram with a second main timer, and plugging it into A-3, the number of units can be increased to 78, each cycle being initiated by the same Dayton primary timer attached to plug A-2. However, the cams on the Dayton timer cannot be placed closer together than the period it requires to complete an entire cycle.