Rauland

MODEL 2490 PROGRAMMABLE MASTER CLOCK INSTALLATION AND OPERATION

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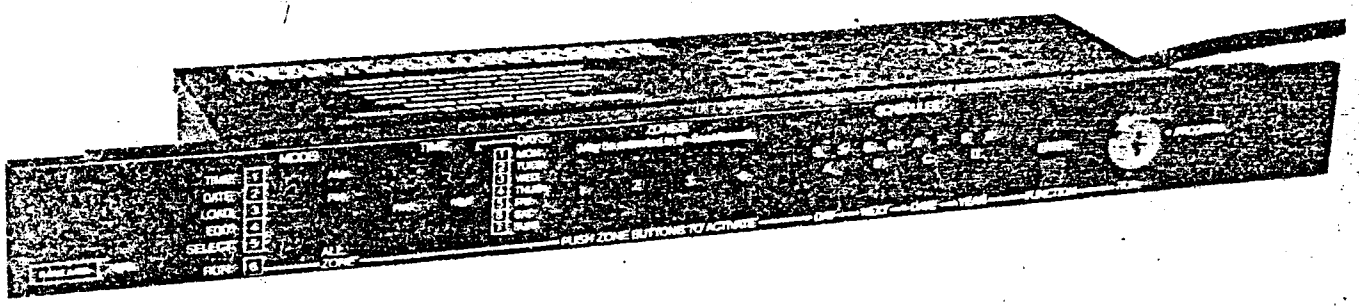

Figure 1. Model 2490 Programmable Master clock

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GENERAL

This manual tells how to plan the installation of the Rauland 2490 Programmable Master Clock, and how to install and operate it.

To avoid frustration and costly errors, study the planning, installation, and programming sections of this manual and fill out the various programming charts before beginning the installation. There are extra charts at the end of this manual. The descriptions of the front-panel displays, the push buttons, and the rear outputs are primarily intended as reference sources.

Description

The Rauland 2490 Programmable Master Clock (Figure 1) can correct both analog and digital clocks. It can also signal equipment when to begin and end an "event" (such as ringing a bell, or turning lights or cooling equipment on and off). It can store up to 500 such events, place them in as many as four Schedules, and automatically vary this programming for up to 100 holidays.

The 2490 clock has push buttons for manually controlling each Zone, activating all of the Zones simultaneously, and selecting up to four program Schedules.

Daylight Saving changes can be programmed to occur automatically.

During a power failure, all of the events programming will be retained in the clock's non-volatile memory. After the power has been restored, the time display will flash, indicating that the "Time" and the "Date" need to be reset (exactly as in conventional alarm clocks). An optional battery back-up module will keep the time and date current during a power failure.

UNPACKING

The model 2490 Programmable Master Clock is shipped fully assembled. All of the hardware needed to mount the clock in either a rack or a desk-top cabinet is included. Locate the following mounting hardware before discarding the packing material:

Qty.	Description	RAULAND PART NO.
4	#10 Speed Nut, for untapped mounting holes.	AB1889
4	#10 x 1/2" Pan-head, Slotted Thread-forming Screw, for untapped mounting holes.	WA102
4	#10-32 x 1/2" Hex-head, SEMS, Unslotted Machine Screw, for tapped mounting holes.	WA202
2	Key (see the main parts list in the back of this manual).	

The clock was carefully checked and tested before leaving the factory. If the unit has been damaged, carefully inspect the shipping container and the unit for indication of improper handling. Notify the transportation company without delay to place your claim.

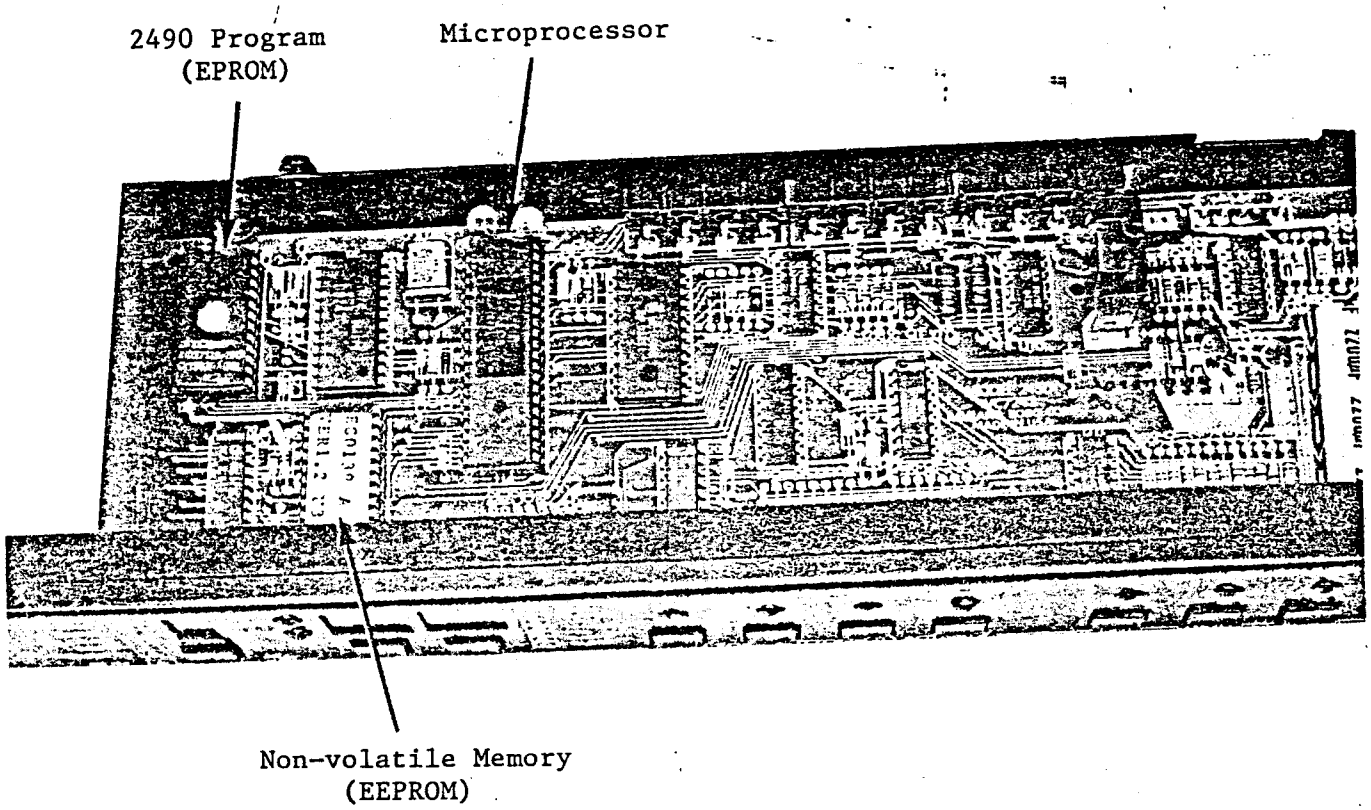


Figure 2. Model 2490 Programmable Master Clock (Overview)

SPECIFICATIONS

Capacity: Up to 500 events and 100 holidays (any combination of Zones and Schedules) may be programmed and stored.

LED Digit Display:
MODE (Set Time [1], Set Date [2], Load Events [3], Edit Events [4], Select Zones and Schedules [5], Run [6], Zone Days and Schedules [7], Zone Durations [8], Correction Codes [9], Zone-Schedule Configuration [A], Enter Holidays [b], and Review and Delete Holidays [C]).
TIME (Hours and Minutes).
DAYS (Monday [1] through Sunday [7]).

LED Indicators:
AM, PM.
ZONES 1 through 8 (depending upon configuration).
SCHEDULES A through D (depending upon configuration).
ENTER/FUNCTION (flashes to indicate the need to press ENTER to enter or delete the displayed programming).

Switches:
MODE (to select the programming mode or activate all of the Zones simultaneously).
FWD (to increment the "TIME" display settings in a program or edit mode, or review events in an Edit mode).
REV (to decrement the "TIME" display settings in a program mode, or enter the delete function in an Edit mode).
ZONES (to program or manually activate the first four Zones; in Mode 1, Zone 1 [with FUNCTION] selects 12- or 24-hour time display; in Mode 2, Zone 1 selects the year, Zone 2 the month, and Zone 3 the day's date; in Mode 9, Zones 1 and 2 select the Correction Code entries [in the four-Schedule configuration]).
SCHEDULES (to program Schedules or additional Zones; if the push buttons are configured as Zones, they will manually activate the outputs, just like the "ZONE" buttons).
ENTER (to enter programs or to activate special functions).
PROGRAM/RUN (key switch to select programming or execution).

Outputs:
1-4 (Zones): Combined maximum sink capability: 1 Ampere, 35 VDC.
5-8 (Zones or Sync): Combined maximum sink capability: 100 mA, 35 VDC.
DIG: Capable of connecting up to five pieces of associated equipment (e.g., TC5000, 2480 Programmer, 2417 modules).
5 VDC, 100 mA: This can be used as an auxiliary power supply (e.g., for buffer modules). The "-" terminal is the chassis ground (or "clock common").

Power Required: 120 volts, 60 Hz, 12 watts.

SPECIFICATIONS (Continued)

Dimensions:	19 inches wide x 1-3/4 inches high x 3-3/4 inches deep (48.3 cm x 4.4 cm x 9.5 cm).
Net Weight:	3.8 lbs. (1.7 kg).
Panel Finish:	Attractive black finish with white-screened lettering.
Associated Equipment:	2400CC Crystal-Controlled Oscillator Module. 2415 24-VAC Power Supply for all secondary clocks. 2416 120-VAC Power Supply for digital clocks. 2417 Correction Adapter Module for "DIG" output. 2418 AC Output Buffer Module. 2419 DC Output Buffer Module. 2452 Flush-Mount Kit. 2454 Battery Back-Up Module. 2480 Eight-Zone Programmer. 2491 Wall-Mount Kit. 2493 Instruction Panel for rack-mounting. 2495 Chrome dress panel.

WARNING

This equipment generates, uses, and can radiate radio-frequency energy. If it is not installed and used in accordance with this instruction manual, it may cause interference with radio communications. It has been tested and found to comply with the limits for a Class-A computing device pursuant to Subpart J of Part 15 of the FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. However, operation of this equipment in a residential area is likely to cause interference, in which case the users will be required to correct this interference at their own expense.

FRONT-PANEL DESIGNATIONS

Refer to IL0248, on page 9, for the following explanations.

LED Indicators

"MODE": When the key switch is in "RUN," this display shows "6"; the remaining modes are selected by the push button beneath the display while the key switch is in the "PROGRAM" position.

1 (TIME): For setting the time.

2 (DATE): For setting the year, month, and day.

Note: When the date has been set (e.g., 3/23/87), the clock automatically computes the day of the week (in this example, "1" for Monday). The day of the week can be viewed in the "RUN" mode by holding in the FUNCTION button and then pressing the DAY button.

3 (LOAD): For entering event programming (time, Zone, and Schedule).

4 (EDIT): For reviewing and changing the events stored in the memory.

5 (SELECT): For choosing which Zones and Schedules can be activated.

6 (RUN): For executing the programmed events.

7: For entering the days on which each Zone and Schedule will be active.

8: For entering the length of time that events will last on each Zone.

9: For entering the codes for correcting secondary clocks (see KI-1390).

A: For programming the "SCHEDULES" push buttons as Zones or Schedules.

b: For entering holiday Schedules and Daylight Saving Time changes.

C: For reviewing and deleting holiday events.

"AM" and "PM": The appropriate LED lights to indicate AM or PM time when the clock is in the 12-hour mode; neither LED lights when the clock is in the 24-hour mode.

"TIME": Two double LED displays normally show the current time in hours and minutes in Mode 6, and programming times in Modes 1, 3, and 4.

In Mode 2, the right display shows the year, month, and day in conjunction with Zone Push Buttons 1, 2, and 3.

In Mode 5, the display is blank.

In Mode 7, the right display shows days of the week.

"TIME" (continued): In Mode 8, the right display shows how long an event will last on each Zone (1-59 seconds or "00" for latched operation).

In Mode 9, the right display shows the Correction Codes (in conjunction with Zone Push Buttons 1 and 2).

In Mode A, the right display shows the Zone-Schedule configuration ("0" = 4 Zones and 4 Schedules; "1" = 6 Zones and 2 Schedules; and "2" = 8 Zones).

In Modes b and C, the displays show the month and day for holiday events.

Holding in the FUNCTION button and then pressing the calendar push buttons while the clock is in Mode 6 will cause the corresponding calendar settings to appear on these displays:

a) holding in FUNCTION and DAY will cause the right "TIME" display to show the day of the week (1-7 for Monday-Sunday);
b) holding in FUNCTION and DATE causes the left "TIME" display to show the month and the right "TIME" display to show the day's date; and
c) holding in FUNCTION and YEAR will cause the right "TIME" display to show the year.

"ZONES": In the "RUN" mode, these LEDs light while the corresponding Zone is activated. When NEXT and FUNCTION are held in, these LEDs show which Zones will be activated during the next event. In the programming modes, these show which Zones or functions have been programmed or will be programmed when ENTER is pressed (the meaning of each LED varies with the mode).

"SCHEDULES": When the clock is configured for six or eight Zones, the LEDs representing Zones will function like the "ZONES" LEDs. In the "RUN" mode, LEDs representing Schedules do not light when events are executed or when NEXT and FUNCTION are held in, but they do light during programming functions, to show which Schedules have been programmed or will be programmed when ENTER is pressed.

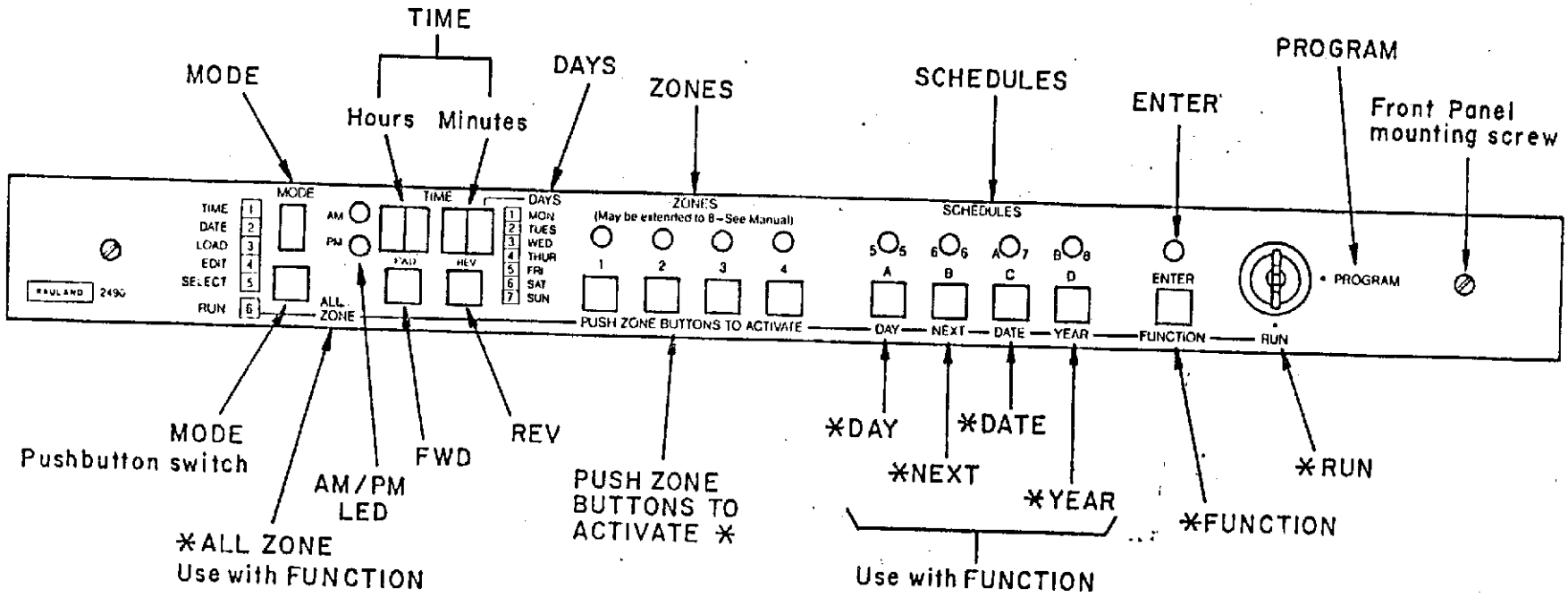
"ENTER": During programming, this LED flashes to indicate that the ENTER push button must be pressed to enter the displayed information into the programming memory or (in the editing modes) to delete the information. Moving to another display without pressing ENTER will leave the programming unchanged.

Switches:

KEY SWITCH: This selects either RUN (Mode 6, the normal setting, which executes the programmed events) or PROGRAM (the setting for programming the clock). These settings affect the meaning of some of the push buttons and displays on the front panel.

ENTER/FUNCTION: In the "RUN" mode, this activates the alternate functions of the other push buttons. In the "PROGRAM" mode, this push button will enter or delete the displayed information (depending upon the mode).

MODE/ALL ZONE: In the "RUN" mode, pressing this with FUNCTION activates all of the Zones. In the "PROGRAM" mode, this button selects the programming modes.



*Peculiar to RUN position of KEY switch

MODEL 2490 PROGRAMMABLE MASTER CLOCK (Front Panel)

IL0248

FWD (Forward): In the "PROGRAM" modes, pressing and releasing this push button will usually cause the right display to increment by one or advance both displays to the next stored event; holding it in will advance the left display (hours or months).

REV (Reverse): Works the same way as the FWD push button except (1) it decrements the time or other setting and (2) instead of going through stored events in reverse order, it activates the delete function for them.

ZONES: In the "RUN" mode, each Zone activates while its push button is held in. In the "PROGRAM" mode, these buttons usually select the Zones for an event. In Mode 1, ZONE 1 (with FUNCTION) selects 12- or 24-hour time display. In Mode 2, the first three ZONE buttons select the year, the month, and the day's date, respectively. In Mode 9, the first two ZONE buttons select the two Correction Codes (when the clock is configured for four Schedules).

DAY: With FUNCTION, causes the right "TIME" display to show the present day of the week (the front-panel "DAYS" chart gives the numerical code).

NEXT: With FUNCTION, causes the "TIME" displays to show the time of the next event that will be executed, and lights the LED of each Zone involved in that event. If no more events are scheduled for that day, the "6" in the "MODE" display will flash, and the "TIME" displays will remain blank.

DATE: With FUNCTION, causes the "TIME" displays to show the current month and day of the month.

YEAR: With FUNCTION, causes the right "TIME" display to show the current year.

REAR-PANEL DESIGNATIONS

Refer to IL0247 (on the next page) for the following explanations:

"ZONE 1-4": Each output, when activated, is grounded to the clock common. The four terminals' combined maximum current-sink capacity is 1 Ampere DC; the load may be distributed among them in any way.

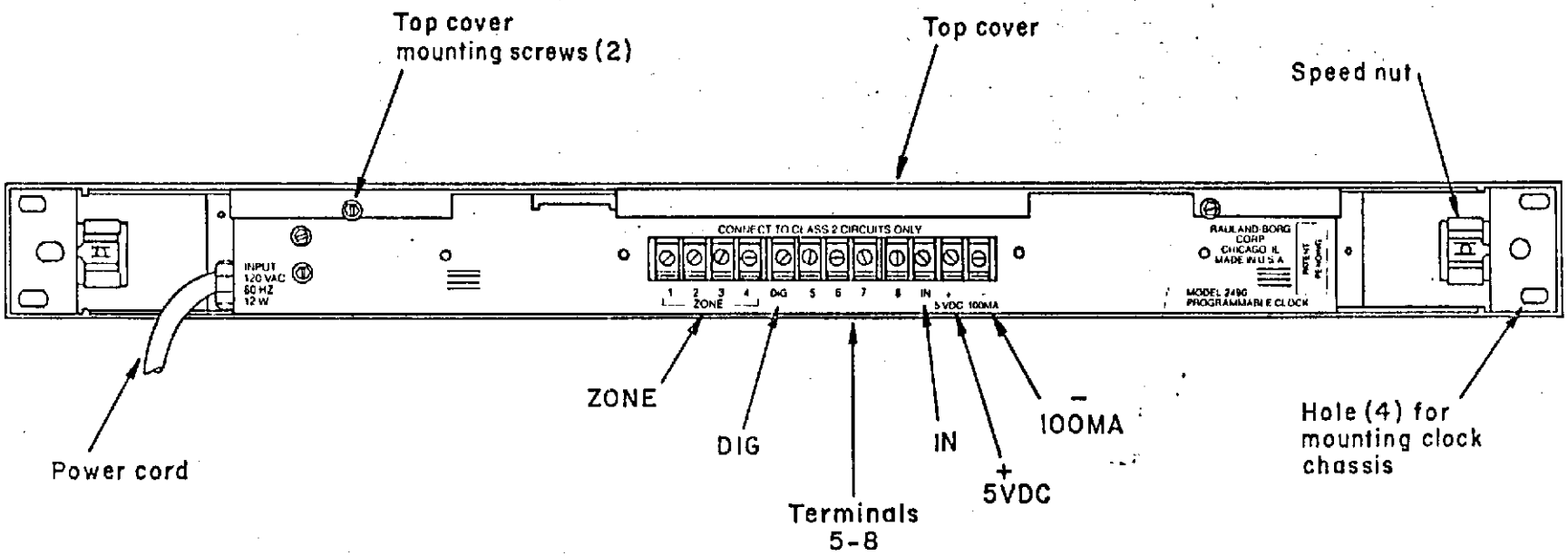
"DIG" (Digital): This outputs serial data pulses to control a digital timekeeping device (e.g., digital secondary clocks, 2480 Programmer, the clock in the Telecenter 5000). For digital secondary clocks, a 2417 Correction Adapter Module is required.

"5-8": Depending upon the configuration set in Mode A, these terminals will operate either as additional Zones or as synchronized outputs for secondary-clock corrections. As Zones, they operate much like the outputs for Zones 1-4, except that their combined current-sink capability is 100 mA DC. As sync outputs, they provide a solid-state output for secondary-clock correction through interface devices.

IN" (Input): Not used.

"+" and "-": This can be used as an auxiliary power supply (5 VDC, 100 mA). The "-" is the chassis ground (or "clock common").

To remove top cover, loosen mounting screws.
Lift top cover.



MODEL 2490 PROGRAMMABLE MASTER CLOCK (Rear View)

IL0247

EQUIPMENT PLANNING

To figure out what additional equipment is needed, consider how reliable the site's 120-VAC power is, what clock outputs are needed, what loads they will carry, how the secondary clocks will be powered, and where the unit will be mounted. These matters will be taken up under the next five subheadings. Also plan the events programming, explained in the next main heading, because this could affect the use of the outputs.

AC Power Source

If the AC power in the area is frequently interrupted, the customer may wish to have a 2454 Battery Back-up, which will enable the clock to maintain the current time to within a minute's accuracy for several hours.* If the 60-Hertz frequency of the power source is not accurate, the customer may wish to have a 2400CC Crystal Control, which would maintain the accuracy of the current time, both normally and while the clock is powered by the battery.

Outputs

Secondary digital clocks may be driven from the "DIG" output if a Rauland 2417 Correction Adapter Module is used. This arrangement enables output terminals "7" and "8" to be used for analog secondary clocks or as Zone outputs. Another advantage of this arrangement is that it does not require a Correction Code (see KI-1390, "Secondary Clock Correction"); thus, there is greater flexibility in accommodating additional types of secondary clocks.

Output terminals "5" through "8" are used in pairs to correct secondary clocks. In the four-Zone, four-Schedule configuration, secondary clocks requiring odd-numbered Correction Codes must be connected to terminals "5" and "6," and those requiring even-numbered Codes, to "7" and "8." If only one type of clock is to be corrected via these terminals, the six-Zone, two-Schedule configuration could be used, and the connection for either odd- or even-Code clocks would be made to terminals "7" and "8," leaving "5" and "6" free to be used as Zones.

However, clocks using Correction Code 18 need three outputs, which means that (1) only terminals "1" through "4" could be used as Zones, and (2) no other type of secondary clocks could be connected to these terminals (the "DIG" output could still be used for digital secondary clocks, the TC5000, etc.).

Analog clocks requiring Correction Code 19 use only two output terminals; however, no other Correction Code can be used at the same time, so no other kind of clock (except digitals connected to the "DIG" output) could be connected to the 2490. Terminals "5" and "6" could be used as Zone outputs.

A maximum of two Correction Codes can be used: an odd-numbered one, and an even-numbered one. Thus, two kinds of secondary clocks requiring different odd-numbered or even-numbered Codes could not be accommodated on a single 2490 master clock (connecting digital secondary clocks to the "DIG" output would allow the use of an even-numbered Correction Code for analog secondary clocks).

To handle additional types of secondary clocks, add a second 2490 Master Clock. To provide additional Zones, add a 2480 Eight-Zone Programmer.

Loads

AC LOADS MUST NEVER BE CONNECTED DIRECTLY TO THE 2490; always use Rauland 2418 (VP0030) AC buffers (each requires a 10-milliampere DC input and can handle a 10-Ampere, 110 VAC load).

Outputs "1" through "4" have a combined current-sink capability of 1 Ampere DC, and Outputs "5" through "8" have a combined current-sink capability of 100 milliamperes DC. Thus, heavier-current loads should normally be wired to the first four terminals. To accommodate DC loads that exceed the current-sink capabilities of the 2490 outputs, use Rauland 2419 (VP0031) DC Buffers (each requires a 10-milliampere DC input and can handle a 5-Ampere 60-VDC load). Loads exceeding the current capabilities of the buffers can be accommodated by dividing them among more than one buffer.

The 2490's auxiliary power output can supply up to 100 milliamperes of 5-VDC power. If more power is needed, use the auxiliary power output of a Rauland school amplifier (1.2 Amperes, 28 VDC), the PSX30A Power Supply (1.2 Amperes, 28 VDC), or the 6400 Power Supply (400 milliamperes, 24 VDC).

In choosing which equipment to connect to the same Zone output, be sure to consider these factors as well: (a) the length of time that they are to remain on (e.g., you would not combine bells, which need to be turned on only momentary, with lights, which need to be turned on for several hours), and (b) the desirability of always operating them at the same time.

Power Supplies for the Secondary Clocks

Secondary clocks using 24-VAC power need a 2415 Power Supply (see KI-1356). Secondary clocks using 120 VAC power may be powered by a 2416 Power Supply (see KI-1355) or directly from a 120-VAC line. Consult the manual of the desired power supply for the number of clocks it can power, the cabling requirements, and typical hook-up information. Further information is in the manuals for the secondary clocks being used, in KI-1470 ("Secondary Clocks Applications"), and in KI-1390 ("Secondary Clock Correction").

Mounting Location

The front panel supplied with the 2490 has black enamel with white lettering. Should the unit be mounted with other equipment having silver panels, the customer may wish to purchase a 2495 Chrome Front Panel for the 2490. A 2493 Chrome Instruction Panel can also be purchased; it would require an additional 1-3/4 inches of vertical rack space.

Be sure to allow extra rack space if you plan to mount accessories such as a battery back-up, a crystal control, or buffers on or adjacent to the 2490. You may also need to order a blank dress panel to cover the extra space.

PLANNING INDIVIDUAL EVENTS

An "event" is simply the automatic grounding of a Zone output terminal to the clock common. This circuit closure, in turn, is used to control external devices connected to the clock. The output may activate for a programmed time

between one and 59 seconds (to ring bells, for instance), or it may be left on until it is turned off again by another event at a different time (to control lights or heating equipment, for instance).

Entering an event entails three pieces of information: the time at which the event will take place, which Zone outputs will be activated, and which Schedule is involved. From one to eight Zones, in any combination, may be included in each event.

The "Schedules" determine whether or not entire groups of events will be executed. So long as a Schedule is excluded from Mode 5, events having only that Schedule will never execute; Mode 7 can exclude Schedules from particular days of the week; and the Modes b and C can exclude events on particular days. Thus, a quick entry in one of these modes is all that is needed to control large numbers of events. For example, there could be one schedule for normal days, a second for week-ends, a third for holidays, etc.; or, again, there could be different schedules for different parts of the building.

Completing the Event Programming Chart is an important part of planning. It helps determine how many Zones are needed and is indispensable in programming the master clock. You will also need to fill out a chart showing which Zones and Schedules are active on each day of the week, and how long each Zone will stay turned on once it has been activated. These charts will be explained in the next two major headings.

Copies of the Event Program Chart are included in this manual. The chart provides a Schedule-planning tool and, after the installation, a hard copy of programmed events for administrative records.

The columns on the Event Program Chart correspond with the layout of the clock's front display panel and to the order in which the programming data is entered. For each event, enter a line of information on the chart as follows (sample entries are provided in IL0242, on the next page):

"EVENT NO.": This is for your reference only--to keep track of the number of events, etc.; it is not prgrammed into the clock. On the next page, we chose to use one number for multiple events at the same time (event numbers 5 and 10), to make it easier to identify multiple events.

"TIME": In these two columns, enter the hour and minute at which each event is to occur. For the 12-hour clock format, the time ranges from 12:00 to 11:59; for the 24-hour clock format, the time ranges from 00:00 to 23:59.

"AM/PM": Use these columns only for the 12-hour clock format. Put a check mark in the appropriate column to specify whether the time entered under the previous heading is AM or PM. Skip these columns for the 24-hour clock format.

EVENT PROGRAM CHART - MODEL 2490

EVENT NO.	TIME		AM/PM		ZONES				SCHEDULE (ZONE)			
	HRS.	MINS.	AM	PM	1	2	3	4	A(5)	B (6)	C (7)	D(8)
1	08	00	✓		✓	✓	✓	✓	✓			
2	08	35	✓				✓	✓	✓			
3	08	40	✓AM	PM	✓1	✓2	✓3	✓4	✓A	B	C	D
4	08	45	✓		✓	✓	✓	✓	✓			
5	09	00	✓		✓	✓	✓	✓		✓		
	09	00	✓AM	PM	1	✓2	✓3	4	✓A	B	C	D
6	09	30	✓		✓	✓	✓	✓		✓		
7	10	00	✓		✓	✓	✓	✓	✓			
8	10	05	✓AM	PM	✓1	✓2	✓3	✓4	A	✓B		D
9	01	30		✓	✓	✓	✓	✓		✓		
10	02	30	AM	✓PM	✓1	✓2	✓3	✓4	✓A	B	C	D
	02	30		✓	✓			✓		✓		
			AM	PM	1	2	3	4	(5)A	(6)B	(7)C	(8)D
			AM	PM	1	2	3	4	(5)A	(6)B	(7)C	(8)D

IL0242

"SCHEDULE": An event may be programmed with up to four Schedules (depending upon the clock's configuration). Enter a check mark in the appropriate column to specify each Schedule in which the event is to occur. (If the clock is configured for eight Zones, then no Schedule can be entered, and all events will, by default, be on the same Schedule.)

Note: 1. If desired, the clock can be programmed in the 12-hour mode and then run in the 24-hour mode, or vice versa

2. Events that occur at the same time on the same Schedule or combination of Schedules should be listed as one event. If such events are entered separately (e.g., "7:30 AM, Zones 1 & 2, Schedules A & B" and "7:30 AM, Zone 3, Schedules A & B"), the 2490 will automatically combine them as one event (e.g., "7:30 AM, Zones 1, 2, & 3, Schedules A & B"). However, the 2490 will not combine separate Schedules (e.g., "7:30 AM, Zone 4, Schedule A" and "7:30 AM, Zone 4, Schedule B" will not be combined with each other or with "7:30 AM, Zones 1, 2, & 3, Schedules A & B").

3. Equipment that is to operate only on certain days may be connected to Zones that are programmed to operate only then (this is the only way to automatically vary the day-to-day Schedule with the eight-Zone configuration). When the same equipment is to operate at different times on different days, use separate Schedules.

Latched Events

A Zone that is programmed with a duration of "00" seconds (in Mode 8) can be used to keep devices on for any length of time beyond 59 seconds. To turn the device on initially, simply program it as a regular event.

To turn it off, simply program any event that does not tell that Zone to turn on. Here are examples of such events:

a) A regular event that does not include the latched Zone.
b) An event that cannot be executed because all of the Schedules in it have been turned off by Modes 5, 7, or C.
c) An event that cannot be executed because it does not include any Zone or Schedule (this would be a special "non-event" programmed just to turn off a latched event).

Every time an event is scheduled, the 2490 prepares to turn off any Zone that is latched on. To keep the Zone on, there has to be an event at the same time that tells the 2490 "turn it on," which the 2490 will interpret as "keep it on." For example, here is one way of latching an event on from 8:00 to 10:00 (assume that all are on the same Schedule and that Zone 4 is set for "00" duration and the others for a three-second duration):

8:00 Zone 4
8:15 Zone 1, 2, 3, 4
8:30 Zone 1, 4
9:00 Zone 3, 4
9:30 Zone 2, 4
10:00 Zone 1, 2, 3

Suppose, however, that the 8:15 event for Zones 1-3 were on a different Schedule that would not be turned on every day. You would then have to program two events for 8:15: one for the first three Zones and their Schedule, and a second for Zone 4 and its Schedule. If no regular event were programmed for 10:00, you would have to program a "non-event" to turn Zone 4 off (a "non-event" might consist of only a time, or of a time and a Zone without any Schedule, or of a time and a Schedule without any Zone).

PLANNING EVENTS BY DAY, ZONE, AND SCHEDULE

The clock is set by the factory to execute events on all four Zones and Schedule A Monday through Friday (see IL0243, below). This means, for example, that an event programmed for 8:00 AM, Zones 1 and 2, and Schedule A will execute Monday through Friday (assuming that these zones and this schedule have also been selected in Mode 5). No events will execute on Saturday and Sunday.

EVENTS BY DAY, ZONE, AND SCHEDULE

DAY	DAY NO.	ZONE				SCHEDULE
		1	2	3	4	A
MON.	1	✓	✓	✓	✓	✓
TUE.	2	✓	✓	✓	✓	✓
WED.	3	✓	✓	✓	✓	✓
THU.	4	✓	✓	✓	✓	✓
FRI.	5	✓	✓	✓	✓	✓
SAT.	6					
SUN.	7					

IL0243

If other daily programming is required, refer to the following text and to the entries for a typical application shown in IL0244 (at the top of the next page):

DAY NO.: The number of the day of the week (according to the front-panel listing on the 2490).

ZONE: A check mark indicates that the Zone is to be active at some time during the corresponding day of the week.

SCHEDULE: A check mark indicates that the Schedule is to be used during the corresponding day of the week.

In the schedule depicted in IL0244, the same events will occur on Monday through Thursday. A second group of events will occur on Friday, and a third combination will occur on the week-end.

EVENTS BY DAY, ZONE, AND SCHEDULE

DAY	DAY NO.	ZONE				SCHEDULE			
		1	2	3	4	A	B	C	D
MON.	1	✓	✓		✓	✓			✓
TUE.	2	✓	✓		✓	✓			✓
WED.	3	✓	✓		✓	✓			✓
THU.	4	✓	✓		✓	✓			✓
FRI.	5	✓	✓	✓	✓		✓	✓	
SAT.	6				✓	✓		✓	
SUN.	7				✓	✓		✓	

IL0244

At the back of this manual are blank charts for planning events by day, Zone, and Schedule. You will want to refer to your events-planning chart in filling out this chart.

PLANNING ZONE DURATIONS

Each Zone can be programmed to remain active for one to 59 seconds after it is turned on, or to remain on until it is turned off by another event (see "Latched Events," above). The clock is set by the factory as a four-Zone, four-Schedule configuration; each Zone is programmed for a three-second duration for each Zone (see IL0245, immediately below).

DURATION PROGRAM

ZONE	DURATION	DESCRIPTION
1	03	(ANY AREA)
2	03	(ANY AREA)
3	03	(ANY AREA)
4	03	(ANY AREA)
5		
6		
7		
8		

IL0245

DURATION: The length of time a Zone remains on after it has been from "01" to "59" seconds. A duration of "00" indicates that a Zone will remain ON for a latched operation.

DESCRIPTION: Identify the devices or area of a Zone.

Once you have determined what equipment will be attached to each Zone output, it should be relatively easy to work out appropriate durations. Take the following example of a typical installation:

DURATION PROGRAM

ZONE	DURATION	DESCRIPTION
1	02	LIBRARY
2	05	INSIDE BELLS
3	10	ATHLETIC STADIUM
4	00	OUTSIDE LIGHTS
5		
6		
7		
8		

IL0241

The first three zones control bells; the areas where the bells are installed require different-length signals for self-evident reasons. The fourth Zone controls lights, and so requires a latched operation.

There are charts for planning Zone durations at the back of this manual.

ELECTRICAL INSTALLATION

"Equipment Planning," starting on page 12, will help you determine what equipment is needed for a given installation. The manuals for that equipment, KI-1390 ("Secondary Clock Correction"), and KI-1470 ("Secondary Clock Applications") contain extensive procedures and wiring diagrams for the many types of equipment and applications that can be made with this master clock. The Telecenter and Director Series manuals contain information on connecting a master clock to that equipments' terminals (see also KM0806, "Master Clock Wiring in School Sound Systems and Telecenter Systems," at the back of this manual).

Information pertaining to the 2450 Master Clock applies equally to the 2490 except for the latter's outputs designated as "5-8." These connections will vary, depending upon the 2490's Zone configuration:

a) In the four-Zone configuration, the 2490's terminals 5-8 correspond exactly with the 2450's "Sync" terminals 1-4.

b) In the six-Zone configuration, the 2490's terminals 7 and 8 can serve as either Sych 1 and 2 or Sync 3 and 4.
c) In the eight-Zone configuration, no "Sync" outputs are available (but the "DIG" output is available in any Zone configuration).

Buffers, Power Supplies, and Arc Suppression

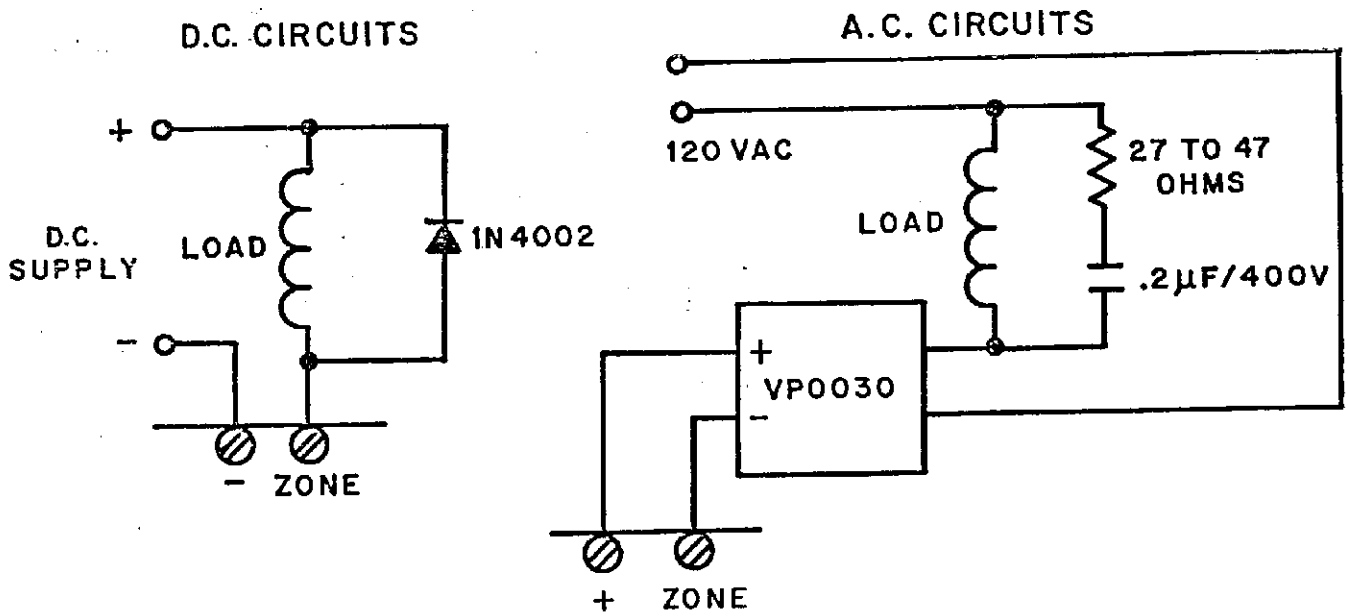
All outputs of the model 2490 Master Clock are solid-state DC. No 2490 output connection should be made to any AC voltage source. Make sure that the operating limits listed in the specifications are not exceeded. If necessary, use auxiliary power supplies and AC or DC Buffers, as explained in the "Equipment Planning" section.

Do not use a master-slave combination of electro-mechanical relays. If an inductive load is switched by the 2490, be sure to install arc suppression (see KM0806, below).

CAUTION

DO NOT CONNECT ANY AC VOLTAGE SOURCE DIRECTLY TO THE OUTPUTS OF THE 2490 CLOCK. Refer to the appropriate wiring diagrams.

ARC SUPPRESSION



KM0806 O

Wiring the 2490 Outputs

DO NOT PLUG IN THE POWER CORDS OF THE 2490 OR ITS ASSOCIATED EQUIPMENT UNTIL ALL OF THE OTHER WIRING HAS BEEN COMPLETED AND THE UNITS HAVE BEEN MOUNTED.

Refer to "Mechanical Installation," below, to plan the location of the 2490 and its associated equipment. Pull through the wiring to this location. Allow enough slack so that the wires can be pulled through the front of the rack or other enclosure and connected to the 2490 before the latter is mounted. This slack will also facilitate any subsequent servicing.

Rest the 2490 on a sturdy surface in front of its mounting site and make the output connections.

MECHANICAL INSTALLATION

The 2490 clock measures 19 inches wide by 1-3/4 inches high by 3-3/4 inches deep (48.3 cm x 4.5 cm x 9.5 cm). The clock may be installed in a standard 19-inch rack, turret, or Rauland desk-top cabinet. The model 2491 Wall Box Mounting Kit will also accommodate the clock (see KI-1499). Be sure to allow extra rack space for any accessories mounted with the clock (refer to the "Equipment Planning" section of this manual).

Rack- and Turret-Mounting

Step 1. Remove the two screws and washers securing the front panel to the clock chassis, then remove the panel. Set these parts aside in a safe place. Remove the red lens from the LED displays and set it aside with the panel.

Step 2. If the mounting holes are tapped or extruded, skip to Step 3. Otherwise, slide the four #10 speed nuts over the appropriate mounting holes in the channel rails. The smooth side of the speed nuts must face outward.

Step 3. Position the clock chassis in the rack and secure it to the channel rails using the appropriate #10 screws provided:

for tapped holes, use the unslotted machine screws;
for untapped holes, use the slotted thread-forming screws.

Step 4. Replace the red lens over the display: the two holes fit over the "AM" and "PM" LEDs, and the lens should fully cover the "TIME" displays.

Step 5. Replace the front panel on the clock chassis with the screws and washers removed in Step 1.

Desk-Top Cabinet Mounting

To mount the clock in the Rauland model PCB300 Desk-Top Cabinet, follow the procedures described immediately above for rack-mounting.

POWER CONNECTIONS

After the output connections have been completed and the 2490 has been mounted, plug its power cord into a three-wire grounded outlet that can provide 120-VAC, 60-Hertz power. This will automatically turn on the clock.

> If a 2454 Battery Back-up Module is installed with the master clock, CONNECT THE AC POWER FIRST, THEN THE BATTERY. When turning off the 2490, disconnect the battery first, then the AC cord. Reversing these procedures will needlessly drain the battery.

When AC power is first connected, the LED displays will flash (after an initial delay of 5-10 seconds), indicating there has been an interruption in the AC power (even if there is a battery back-up). In a new installation or in an existing one where the clock does not have a battery back-up and it has been programmed in the 12-hour format, the "TIME" display will show "12:00" (after installation, the "TIME" display will show the current time if there is a battery back-up, or "12:00" (AM) if there is no battery back-up (the clock would have to be reprogrammed for the 24-hour format).

SELECTING THE PROGRAMMING MODES

When the key switch is in the RUN position, the clock will be in Mode 6. Turning the key to PROGRAM will put the clock in Mode 1. Pressing and releasing the MODE push button will step the clock through Modes 2 to 5 and then back to Mode 1 again. So long as the ENTER button is not pressed, stepping through the various modes will not affect the programming.

To enter the Special Programming Modes (7 through 9 and A through C), enter Mode 5, hold in the MODE button ("1" will appear on the "MODE" display), then press ENTER: this will put the clock into Mode 7. Pressing and releasing the MODE button will now step the clock through Modes 8 to C and back to 7.

SETTING THE TIME AND DATE

Turn the key switch to the PROGRAM position. The displays should light steadily, and the number in the "MODE" display should change to "1." All of the other LEDs (except "AM" or "PM") should be off.

Selecting the 12- or the 24-Hour Format (Mode 1)

To select either the 12- or the 24- hour format, hold in the ZONE 1 push button, then push and release ENTER. Each time the ENTER switch is pushed, the alternate format should be displayed (e.g., "12:00" and the "AM" LED for the 12-hour format, or "00:00" and no LED the for 24-hour format). When the display shows the desired format, release both push buttons.

Setting the Time (Mode 1)

The FWD (Forward) push button advances the time, and the REV (Reverse) push button moves the time back. Hold in the desired push button to change the hours; quickly push and release it to change the minutes. Advancing the minutes from "59" to "00" will cause the hour to advance by one; similarly, changing the minutes from "00" to "59" will cause the hour to decrease by one.

At the first depression of the FWD or REV push buttons, the "ENTER" LED will start flashing. This indicates that the ENTER button must be pushed to enter the changed information into the clock's memory. When the ENTER button is pushed, the clock sets the seconds to zero. Therefore, set the time one minute ahead of present time, then, at exactly "0" seconds, push ENTER. The "ENTER" LED should stop flashing and the clock should advance to Mode 2.

Daylight Saving Time changes can be made automatically (see "Holiday Programming," below).

Setting the Date (Mode 2)

Enter Mode 2. The current or the default ("87") year should appear in the right "TIME" display, a "2" should appear on the "MODE" display, and the LED for "ZONE 1" should light.

"ZONE 1" controls the year, "ZONE 2" the month, and "ZONE 3" the day's date. Entering a new setting in one will cause the clock to advance to the next one; you can also advance directly to the desired setting by pushing the appropriate ZONE button. An entry for the day's date will cycle the clock back to the year setting.

Use the FWD and REV buttons to change the setting, then press ENTER to record the new setting. To leave a setting unchanged, press another ZONE button or the MODE button.

SETTING THE ZONE/SCHEDULE CONFIGURATION (MODE A)

The unit comes pre-programmed to function as a four-Zone, four-Schedule unit. However it can be programmed to function with six Zones and two Schedules or with eight Zones and a single Schedule. Choosing the last two modes of operation limits the 2490's ability to correct secondary clocks.

THIS SETTING MUST BE MADE BEFORE ANY EVENT PROGRAMMING IS ENTERED. Because it changes the meanings of the "SCHEDULE" push buttons and output terminals, it changes the meaning of programmed events. Therefore, the 2490 erases all event-related programming (everything except Modes 1, 2, and C) whenever the Zone/Schedule configuration is changed.

THE WIRING OF THE OUTPUT TERMINALS MUST MATCH THE ZONE/SCHEDULE CONFIGURATION: you would not want to send clock-correction signals to a bell or cooling equipment, nor Zone-output signals to secondary clocks. For this reason, this setting is normally made by the installer and left alone.

Changing the Configuration

Step 1. Enter Mode A.

Step 2. Use the FWD and REV buttons to display "0," "1," or "2" in the right "TIME" window; the "ZONE" and "SCHEDULE" LEDs will light to show which push buttons will operate as Zones under the setting. The following chart lists the Zone/Schedule selections:

MODE Display	TIME Display	Zones	Schedules	Secondary-Clock Codes
A	0	4	4	2 allowed
A	1	6	2	1 allowed
A	2	8	1	0 allowed

Step 3. Press ENTER to program your selection (the display will blank out for a couple of seconds).

EVENT PROGRAMMING

For an event to be executed, several programming steps must match up: (a) the event must be entered in Mode 3; (b) it will thereafter appear in Mode 4, where the Zones and Schedules may be changed; (c) the Zones and Schedules included in the event must be selected in Mode 5; and (d) the Zones and Schedules must be selected for the current day of the week, in Mode 7. In addition, if a Holiday Schedule (Modes b and C) is entered for a given day, the Zones and Schedules must be programmed on.

These Modes provide great flexibility in controlling events without extensive reprogramming. To turn off a Zone or a Schedule indefinitely, do not include it in Mode 5; to have a Zone or Schedule operate on only certain days of the week, use Mode 7; to turn off a Zone or Schedule on special days, use Modes b and C (Holiday Programming).

Note that it is possible to execute part of an event. For example, if an event includes two Zones and two Schedules, excluding one of the Zones from Mode 5 would still allow the other Zone to activate; excluding only one of the Schedules would still allow both of the Zones to activate.

Note also that the exclusions are cumulative. If Schedule A is not selected in Mode 5 and Schedules B, C, and D are not selected in Mode 7, no events will be executed.

The events-programming modes that follow are presented in the order in which they come up on the "MODE" display. They may be programmed in any order, and it is not necessary to use the "edit" modes except for checking and making corrections.

Economy in Programming

A central maxim in programming is to use as few steps as possible, so that the processor can work efficiently, without wasting time over unnecessary

procedures. For the 2490, this would mean: (1) in programming individual events, to combine Schedules whenever the same Zones are involved, and (2) in the select modes (5, 7, and b), not to enter Zones and Schedules that will not be used. Having fewer events makes it easier to review them in the edit modes and speeds up the clock's searching for the "NEXT" event. Not selecting unused Schedules also speeds up the clock's "NEXT" search.

Entering Events (Mode 3)

When Mode 3 is selected, the "TIME" display will show the current time. Use the Event Programming Chart you filled out earlier as your guide. Use the FWD and REV push buttons to set the time of each event, use the ZONE switches to select the Zones, and use the SCHEDULE push buttons to select the Schedules (or "SCHEDULE" outputs configured as Zones by Mode A).

You can program an event that has a time but lacks Zones, Schedules, or both. Such a "non-event" is used to turn off latched Zones without turning on any other Zone (see "Latched Events" under "EVENT PLANNING," above).

Whenever any "TIME," "ZONE," or "SCHEDULE" element is changed by pushing the associated switches, the "ENTER" LED will flash until the ENTER switch is pushed to store that event (or you move on to another part of the programming). The event will be stored in memory as it is displayed when you push ENTER. When the ENTER switch is pushed, its LED will turn off to show that the event has been programmed and the clock is ready to accept a new event.

Reviewing, Changing, and Deleting Programmed Events (Mode 4)

Enter Mode 4 (Edit). The first event, counting from Midnight (12:00 AM or 00:00), should be displayed.

To review the events, keep tapping FWD until you have cycled through all of the events and have returned to the first event of the day.

To change an event, press the appropriate ZONE and SCHEDULE push buttons until the LEDs show the event that you want (the LEDs will toggle on and off as you press the corresponding push buttons); then press ENTER. (Should you wind up with two events having the same time and Schedules, the 2490 will automatically combine them into one event, which will appear in its new form the next time you review events). You cannot change the time of an event in this mode: you would have to delete the event in this mode and then reprogram the event at the desired time in Mode 3.

To delete an event, bring it onto the display and enter the delete function by pressing REV: a "d" will appear on the "MODE" display and the "ENTER" LED will flash. Press ENTER to make the deletion. So long as the "d" appears on the display, you can press FWD to advance through the events and then press ENTER to delete the displayed event. To exit the delete mode, press REV again; the "MODE" display should change to "4" (alternatively, you can exit Mode 4).

Selecting Zones and Schedules (Mode 5)

This might be considered the "manual override" mode, in that any Zone or Schedule not programmed in it will never be executed until this mode is repro-

which will work with Rauland's analog secondary clocks, and "20," which will work with Rauland's digital secondary clocks.

To select different Correction Codes, enter Mode 9: (a) If the 2490 is configured for eight Zones, the "MODE" display will flash, indicating that no Correction Codes may be used; (b) if the 2490 is configured for six Zones, the "MODE" display will light steadily with a "9," the right "TIME" display will show a two-digit number selected from "00" to "20," and the "ZONE 1" LED will glow (however, the ZONE 2 push button will not respond); (c) if the 2490 is configured for four Zones, an entry in "ZONE 1" or the pressing of ZONE 2 will cause the "ZONE 2" LED to glow.

Use the FWD and REV switches to cycle through the Correction Codes shown on the right "TIME" display. Enter the desired Code by pressing ENTER. The following "rules" apply:

1. When two Correction Codes are allowed, entering a Code while the "ZONE 1" LED is lit will automatically erase the second Code. Thus, the first Code should be entered first; if only one Code is used, place it in the "ZONE 1" position. Odd and even Codes can be entered in either order; the order of entry is not related to the output terminals.

2. Out of the 20 Codes, one even and one odd Code can be selected. No other Codes can be used with Codes 18 and 19. If an invalid code entry is tried, the right "TIME" display will reset to "00."

CLEARING MEMORY

All the events in the master clock can be erased by first turning off all power to the clock (disconnect the battery first, if one has been installed, then the AC source). Turn the key switch to the "PROGRAM" position. Hold in the ENTER push button while you turn on the AC power; you can then release the ENTER button. The displays will remain blank for up to 10 seconds. When they reappear, the clock will be in the 12-hour mode, and the time, date, and all events will have been erased. However, the programming in Modes 7, 8, 9, and A will not be affected. If there is an optional battery back-up, be sure to reconnect it after restoring the AC power to the clock.

PROGRAMMING SEASONAL CHANGES

Mode b can be used to program up to 100 holidays for special scheduling (usually to silence bells during the holiday). This mode is also used to program Daylight Saving Time changes. Mode C is used to review, change, and delete the events entered in Mode b. Since the dates of most holidays and of time changes vary from year to year, most of the entries here will require annual changes.

Entering Holiday Events (Mode b)

Enter Mode b. The "TIME" displays will show "01/01," for "January 1." Hold in the FWD and REV push buttons to cycle through the months, and quickly push and release these buttons to cycle through the days. After selecting the

desired date, use the ZONE and SCHEDULE push buttons to select the Zones and Schedules you want to be active on that date (exactly as in programming individual events). When the date and the LEDs are correct, enter the programming by pressing ENTER. Do not enter Zones or Schedules that will not be used on that day.

Note: (1) You cannot add events through holiday programming. This is an added selection process for the individual events entered in Mode 3. The Zones and Schedules selected in this mode must also be entered in Modes 5 and 7.

(2) NEVER SELECT ALL ZONES AND SCHEDULES: (a) this would not make sense in a Mode whose sole purpose is to exclude events; and (b) the 2490 may interpret such an entry as a time change (see the following subheading).

(3) The 2490 looks for holiday-event programming only at Midnight or when a new time is entered in Mode 1. Thus, if a holiday event is programmed on the holiday itself, the 2490 will ignore it (unless a time is entered in Mode 1 afterwards).

Entering Daylight Saving Time Changes (Mode b)

A special holiday "event" will cause the 2490 to automatically advance the time one hour in the Spring or set the time back one hour in the Fall. These "events" are entered in Mode b, just like actual holiday events.

Enter Mode b. Use the FWD and REV buttons to bring the desired date onto the "TIME" displays, select all of the Zones and Schedules, using their push buttons, then press ENTER. An entry like this for a day in April will cause the time on the master clock to advance one hour (at 2 AM); an entry in October will cause the time to go back one hour; an entry in any other month will have no effect. The secondary clocks will respond within the capability of their correction cycle (usually at the 12-hour correction time).

Important: When reprogramming the dates for the Daylight Saving Time changes each year, be sure to delete the previous year's changes.

If a holiday event excluding only certain Zones and Schedules is required for the same day as a time change, it can be programmed in Mode b as a separate event.

Reviewing, Changing, and Deleting Holiday Events (Mode C)

Enter Mode C: the holiday with the earliest date will appear, with the date in the "TIME" displays and the selected Zones' and Schedules' LEDs glowing (if no holiday events have been programmed, the "C" will flash in the "MODE" display).

To review the stored events, press and release the FWD button (the REV button does not function in this mode). The ENTER LED continually flashes in this mode, indicating that it serves only to delete the event currently shown. The events cannot be altered. To change an event, delete it in this mode (by pressing ENTER), then re-enter it with the desired changes in Mode b.

MANUALLY ACTIVATING ZONES (Mode 6)

While the clock is in the "RUN" Mode, it is possible to turn on any or all of the Zone outputs by pressing the appropriate push buttons on the front panel. The Zones will remain on so long as the buttons are held in.

To Activate Individual Zones

Hold in the corresponding ZONE switch: the Zone will turn on and its LED will light. As many of these buttons may be held in at a time as desired (however, to avoid an excessive power surge, stagger the activation of Zones with heavy equipment). SCHEDULE buttons configured as Zones will act the same way; those configured as Schedules will not respond when they are pushed.

To Activate All of the Zones Simultaneously

Hold in the ENTER button, then press the ALL ZONE (MODE) switch. As was explained in the preceding paragraph, activating the Zones individually is the preferred method when heavy equipment is controlled by the master clock.

DISPLAYING THE NEXT EVENT

Hold in the green FUNC button, then hold in the NEXT button: the 2490 will look for the next event that it will execute; events whose Zones or Schedules have not been selected in Modes 5, 7, and b (if there is a holiday event for that day) will be passed over. While the clock is searching, the displays will blank out. Normally, the search will end quickly; however, if there is a long list of events that will not be executed on that day, the search could take a minute or longer.

Continue holding in FUNC and NEXT until the displays light up. The "TIME" displays will show the time that the event is to take place, and the LED of each Zone that is to be activated will glow; Schedules are not displayed in this mode (however, the LEDs of those "SCHEDULE" outputs that have been configured as Zones will light, just like the "ZONE" LEDs). If no more events will be executed that day, a "6" will flash in the "MODE" display (the 2490 does not search past the Midnight of the present day).

DISPLAYING THE CALENDAR SETTINGS

The 2490's calendar settings can be viewed on the "TIME" display by holding in FUNC and then holding in the appropriate calendar push button (the alternate functions of the "SCHEDULE" push buttons).

Displaying the Day of the Week

Holding in FUNC and then DAY will bring a single-digit number onto the right "TIME" display. To the right of this display, on the front panel, is a list of these numbers and the days that they represent (e.g., 1 = Monday, 7 = Sunday).

Displaying the Date (Month and Day)

Holding in FUNC and DATE will bring the date onto the "TIME" display. The left display will show the month, and the right display will show the day's date (not to be confused with the day of the week). For example, "05/01" is May 5.

Displaying the Year

Holding in FUNC and YEAR will bring a two-digit number onto the right "TIME" display. This number represents the last two digits of the year (e.g., "87" for 1987).