

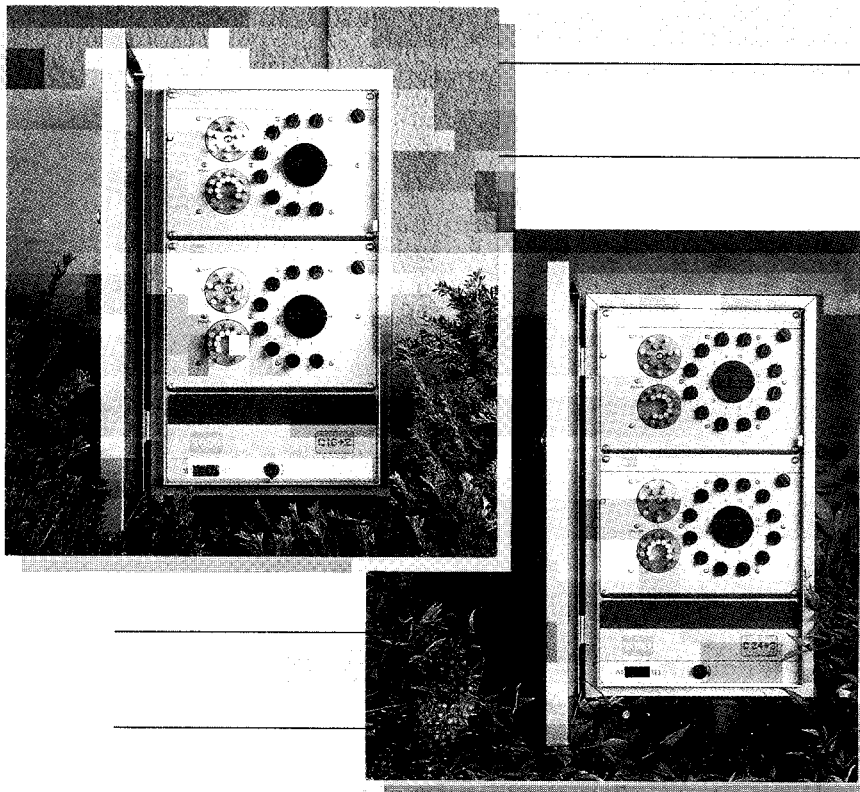
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# *C16+2 and C24+2 Controller*

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## *Operating Instructions*

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# INTRODUCTION

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The C16+2 or C24+2 Controllers, designed for use in commercial automatic watering systems, provide precision operation of 16 or 24 sprinkler stations and two independent drip stations. The C16+2 and C24+2 Controllers are engineered for easy programming and operation. The operating instructions inside the controller housing cover are often all the instruction required for complete controller operation. However, thorough familiarization with controller features and functions is recommended prior to operating the controller for the first time. Reading these instructions completely should help eliminate any questions concerning programming and/or operation of the controller.

## Features

- Electromechanical Design - offers reliability and ease of programming.
- 2 to 18 Hours Station Run Time on Drip Station.
- Automatic, Semi-automatic and Manual Operation.
- Independent or Sequential operation of two 8 or 12 station timing mechanisms.
- Mode Switch - allows setting of automatic, manual or drip operations.
- Supply Line Filter (normally open hydraulic models) - screens out debris before entering control system.
- Circuit Breaker Protection - easily reset; eliminates need for fuse.
- Pump/Master Valve Circuit - allows a pump or master valve to be operated from controller.
- Dual Programming (electric models) - provides ability to water lawn areas only, or lawn and shrub areas.
- Non-removable Hour and Day Wheel Pins - offers convenient setting of watering cycle times.
- 11 watering cycle start times per day.
- 7 Day Watering Cycle (6 day wheel optional) - offers flexibility in establishing watering cycles.
- 5 to 60 Minute Station Run Times.

## Ordering Information

Model Number	Description	Operates Valve Models
173-06-01 174-06-01 173-01-01 174-01-01	16 Station Electric, Metal Cabinet 24 Station Electric, Metal Cabinet 16 Station Hydraulic, Metal Cabinet 24 Station Hydraulic, Metal Cabinet	2XX-XX-XX Electric 24 VAC - ↑ 06, 07, 16, 26, 27
170-50 170-52	Locking Pedestal 16+2 or 24+2 Pedestal Adapter	2XX-XX-XX N.O. Hydraulic ↑ 01, 11, 21

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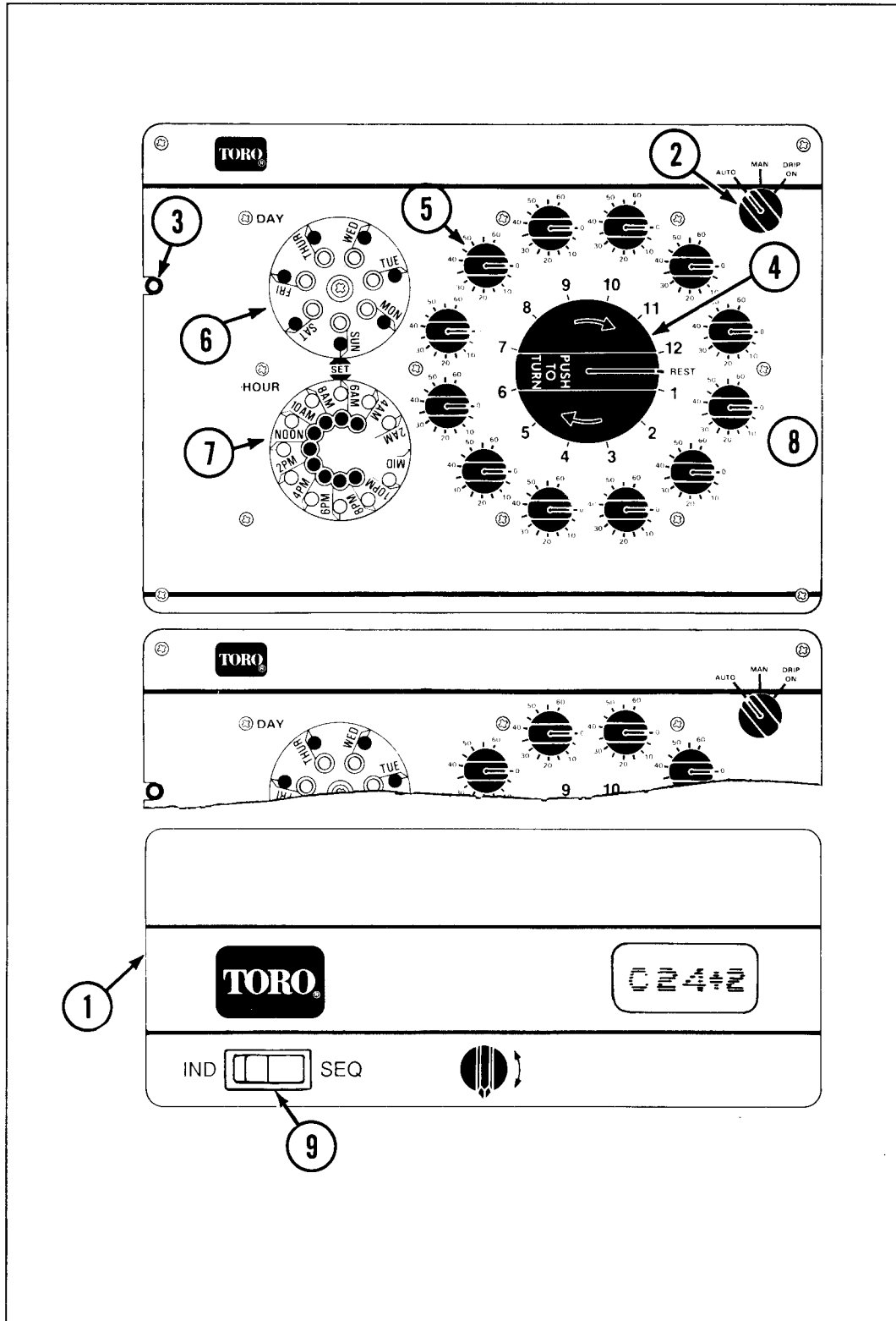
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# CONTROLLER COMPONENTS



## 1 ACCESS PANEL

The Access Panel removes easily for servicing controller. Non-removable rotating latch knob secures panel in place.

## 2 MODE SELECTOR SWITCH

The Mode Selector Switch sets required mode of controller operation: AUTO (automatic) MAN (manual) or DRIP ON.

## 3 CIRCUIT BREAKER RESET BUTTON

The 24 VAC side of controller circuitry is protected by a circuit breaker which can be reset in the event of a 24 VAC malfunction. (See Troubleshooting for more information).

## 4 STATION SELECTOR

The Station Selector is rotated clockwise automatically or manually to indicate or select the station in operation.

## 5 STATION KNOB

A Station Knob, one for each sprinkler watering station, controls the length of operating time (0 or 5 to 60 minutes).

*Note: Drip watering station operates independently of all sprinkler stations and is not affected by placement of the Station Selector or Station Knobs. Drip station operation is controlled exclusively by the RED pins in the DAY and HOUR wheels and/or the DRIP ON position of the Mode Selector Switch.*

## 6 DAY WHEEL

The DAY Wheel serves three functions: 1) indicates current day of week, 2) controls daily operating schedule for sprinkler watering stations ( Gray pins ) and 3) controls daily operating schedule for drip watering station ( Red pins ).

*Note: An optional 6 day wheel (P/N 35-2292) can be installed to accommodate every other day or every third day watering schedules. See Page 6 for more information.*

## 7 HOUR WHEEL

The HOUR Wheel serves three functions: 1) indicates current time of day, 2) controls watering cycle start time(s) for sprinkler watering stations (Gray pins ) and 3) controls start time(s) and length of operating time for drip watering station (Red pins).

## 8 SHRUB WHEEL (Not Shown)

The Shrub Wheel, located within the controller housing (electric models only) can be programmed to separate shrub sprinkler stations from lawn sprinkler stations when dual programming feature is utilized.

## 9 IND/SEQ SWITCH

The IND/SEQ Switch is used to set the independent operation of each Timing Mechanism (TM) when set to the IND position, or when set to the SEQ position, allows the upper TM to automatically start the lower TM to complete a watering cycle.

# CONTROLLER PROGRAMMING

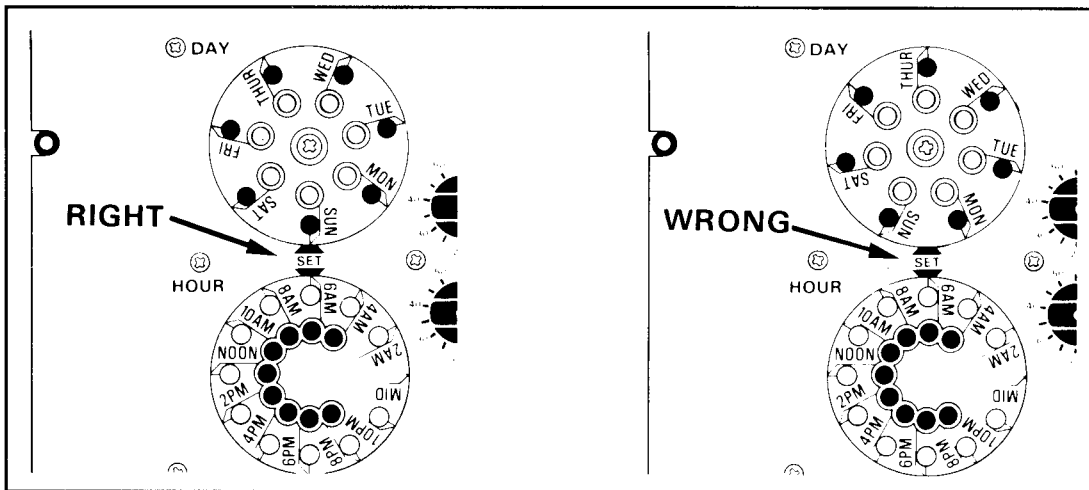
## SET CURRENT TIME OF DAY

Rotate HOUR Wheel clockwise until current time of day aligns with SET Indicator.

**NOTE:** Pins represent hours shown on HOUR Wheel. Locate current time by estimating its position on HOUR Wheel and set accordingly.

## SET CURRENT DAY OF WEEK

Rotate DAY Wheel clockwise to align current DAY pin with SET Indicator. If optional 6 Day Wheel is installed, align any pin with SET Indicator.



**NOTE:** Controller malfunction will occur if DAY Wheel is set between pins.

## SET DAY WHEEL FOR SPRINKLER WATERING SCHEDULE

Position all Gray pins accordingly:

**OUT** - (Pulled outward until pin stops). **No watering required.**

**MIDDLE** - (Pushed in half way - a slight detent can be felt). **Operate lawn sprinkler stations only** - NOTE: This pin position applies to electric control models only.

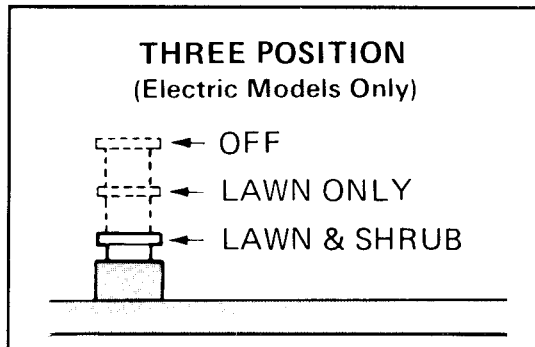
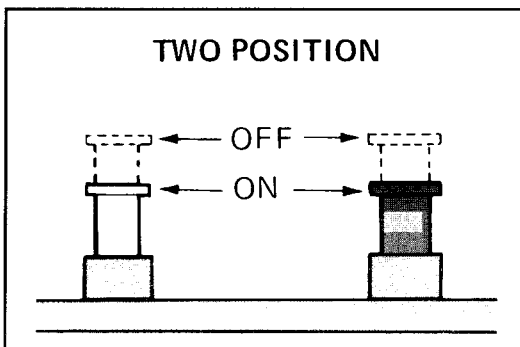
**IN** - (Pushed in until pin stops). **Operate lawn and shrub sprinkler stations.**

## SET DAY WHEEL FOR DRIP WATERING SCHEDULE

Position all Red pins accordingly:

**OUT** - (Pulled outward until pin stops). **No drip watering required.**

**IN** - (Pushed in until pin stops). **Operate drip station.**



### SET HOUR WHEEL FOR SPRINKLER WATERING START TIME(S)

Position all Gray pins accordingly:

**OUT** - (Pulled outward until pin stops). **No watering required at indicated time.**

**IN** - (Pushed in until pin stops). **Sprinkler watering cycle starts at indicated time.**

***Note:** The watering cycle can be started (11) times per day. When setting more than one start time, first consider the total length of time required to complete one watering cycle (add all station operating time together) and space start times accordingly. Any start time which occurs during a watering cycle in progress will be bypassed.*

### SET HOUR WHEEL FOR DRIP WATERING SCHEDULE

Each Red pin serves two functions for drip station operation: 1) to establish start time(s) and 2) to provide approximately two hours of operating time.

Position all Red pins accordingly:

**OUT** - (Pulled outward until pin stops). **No drip watering required.**

**IN** - (Pushed in until pin stops). **Drip watering starts at time indicated next to pin and operates for two hours.**

***Note:** Drip station operation will be suspended for approximately 20 minutes when an automatic sprinkler watering cycle is started.*

### SET SPRINKLER STATION OPERATING TIME

Rotate Station Knob of each active station to desired operating time (5 to 60 minutes).

#### CAUTION

**Do not force Station Knob past 60 minute setting or severe controller damage may result. Set all unused stations to zero (0) operating time.**

**For systems using pump start relay: Pump circuit will activate simultaneously with any watering start (sprinkler or drip) in any mode (AUTO, MAN, or DRIP ON). To prevent possible pump damage due to excessive back pressure, assure all unused stations are set for zero operating time.**

***Note:** An unscheduled repeat watering cycle may occur immediately following an automatic water cycle if total operating time is less than 30 minutes. To prevent a repeat cycle simply add enough operating time to active stations to exceed 30 minutes total operating time. If pump start is not used on your system, extra time can be added to any unused stations as well.*

## CONTROLLER PROGRAMMING (Continued)

### PROGRAMMING THE SHRUB WHEEL (Electric Models Only)

Shrub plants normally require watering less frequently than lawns for proper growth and maintenance. Therefore, watering may be scheduled on selected days for lawn stations only. A Shrub Wheel located inside the controller is used to separate lawn from shrub stations and must be programmed according to which stations operate shrub stations.

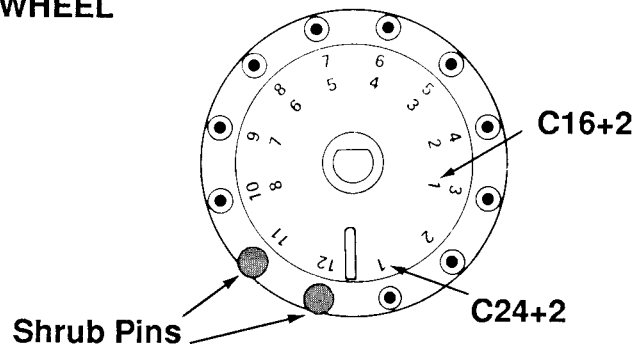


#### WARNING

**TO AVOID THE POSSIBILITY OF ELECTRICAL SHOCK, DISCONNECT 120 VAC POWER AT SOURCE PRIOR TO REMOVING CONTROLLER FRONT PANEL**

1. Turn latch knob on Access Panel to remove panel.
2. Remove timing mechanism (TM) corner screws and lift TM out. Detach wiring harness at quick disconnect plug and carefully set TM aside.
3. Insert shrub pin(s) provided into numbered hole(s) in shrub wheel corresponding to shrub station connection(s) on terminal block. Example: Two control valves operate shrub sprinklers and have been connected to terminals 11 and 12 on terminal block. Shrub pins must be installed in holes numbered 11 and 12 in shrub wheel.

#### SHRUB WHEEL



4. Rotate shrub wheel to align Station 1 as indicated in Figure above.
5. Reconnect TM wiring harness plug. Position TM into cabinet and secure with (4) corner screws.
6. Push in and rotate Station Selector Knob clockwise one revolution to REST position.
7. Install Access Panel and secure by turning latch knob.
8. Apply 120 VAC power to controller. Controller is now operational.

### INSTALLING OPTIONAL 6 DAY WHEEL

The optional 6 Day Wheel is available to accommodate a watering schedule which requires every third day watering. Install the 6 Day Wheel in the following manner:

1. Remove Phillips screw from center of Day Wheel.
2. Pull 7 Day Wheel from controller.
3. Insert 6 Day Wheel into controller turning wheel to engage ratchet mechanism. (Day Wheel will be flush with faceplate when fully inserted)
4. Secure with Phillips screw. (Do not over tighten).
5. Set Day Wheel to desired number (1-6).
6. Position Day Wheel pins as required. (See Page 4).



## INDEPENDENT OPERATION

Set Mode Selector switch to AUTO and set IND/SEQ switch to IND. An automatic watering cycle will start when an active day and active start time (determined by pin placement in Day and Hour Wheels) is reached.

The Station Selector will rotate (*clockwise*) automatically to the first station set with a minimum of 5 minutes running time and will operate this station until its set running time has elapsed. The Station Selector will continue this procedure with all remaining stations and complete the cycle by stopping at the REST position.

**Note:** When the SEQ/IND switch is set in the Independent (IND) position, each TM will operate independently based on the program set on its HOUR and DAY Wheels. Both TMs can start simultaneously in this mode. System must be capable of supporting the water demand if both TMs operate simultaneously.

**Note:** If only Drip Station is programmed to operate, the Station Selector will not rotate during operation.

## SEQUENTIAL (SEQ) OPERATION

On the upper timing mechanism (TM), an automatic watering cycle will start when an active day and active start time (determined by pin placement in DAY and HOUR Wheels) is reached. The Station Selector will rotate (clockwise) automatically to the first station set with a minimum of 5 minutes running time and will operate this station until its running time has elapsed. The Station Selector will continue this procedure with all remaining active stations on the upper TM. As the Station Selector approaches the REST position it will automatically switch operation to the lower TM to start its watering cycle program. Set programming as follows:

1. Set Mode Selector switch (upper and lower TM) to AUTO position.
2. Set IND /SEQ switch to SEQ position.
3. To prevent additional start times on the lower TM, pull all Gray Hour Wheel pins to OFF position. Leave Day Wheel Pins set as programmed for Independent Operation.
4. Place Station Selector Knob (both upper and lower, upper first) to REST position.
5. On upper TM set Day and Hour Wheels for desired watering schedule and start times.

**Note:** The length of operating time (0 to 60 minutes) must be set by the Station Knobs on the lower TM prior to automatic sequencing to the lower TM. Total running time of both TMs combined must not exceed 23 hours if daily watering is desired.

# MANUAL OPERATION

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## SEMI-AUTOMATIC OPERATION

1. Set Mode Selector switch to AUTO position.
2. Push Station Selector IN and rotate to Station 1 or first station in cycle required to operate. Release Selector just prior to station number. Selector will continue to rotate automatically and stop on station. The watering cycle will continue to operate as if automatically started.

### CAUTION

**Always rotate Station Selector clockwise! Counterclockwise rotation will cause severe controller damage.**

## SINGLE STATION OPERATION

1. Set Mode Selector Switch to AUTO position.
2. Push Station Selector IN and rotate to desired station. Release Selector just prior to Station number. Selector will continue to rotate automatically and stop on station.)
3. Set Mode Selector to MAN position. Station will operate continuously until Station Selector is rotated to another station or Rest position.

## DRIP STATION OPERATION

1. Assure Station Selector is in Rest position.
2. Set Mode Selector Switch to Drip On position. Drip station will operate continuously until Mode Selector Switch is set to MAN or AUTO position.

*Note: Neither Automatic or Manual operation of sprinkler stations can occur while controller is in Drip On mode.*

## SUSPEND CONTROLLER OPERATION

1. To suspend controller operation for any length of time, set Mode Selector Switch on each TM to MAN (Manual) position and assure station selectors are set to REST position. Controller will continue to keep current time and day, however, all watering operations will be suspended.
2. To resume Automatic operation, set Mode Selector to Auto.



## PROBLEM

Controller keeps correct time and day but will not start watering cycle automatically.

Water cycle starts again immediately upon completion of scheduled watering cycle.

Shrub sprinkler stations operate when controller is programmed to water lawn sprinkler stations only.

Controller will not sequence to lower TM.

Controller does not operate.

Station run time not accurate.

## SOLUTION

Mode Selector not in AUTO position. DAY Wheel not correctly aligned with SET indicator (see Page 4). Watering program pins not set correctly (see pages 4 and 5).

Check total sprinkler watering time. It must exceed 30 minutes.

Check Shrub Wheel for proper programming (see page 5).

Check IND/SEQ switch, place switch in SEQ position. Check Mode switch, place in AUTO position. Check controller circuit breaker for tripped position.

Check power source for possible blown fuse or "tripped" circuit breaker. Check controller circuit breaker for tripped position.

Station timing knob assembly not adjusted properly. See Adjusting Station Timing.

**Note:** The controller circuit breaker provides protection to the 24 VAC circuitry from a short circuit or overload condition (usually due to an exposed field wire or defective valve solenoid). If the circuit breaker is "tripped" open, all controller operation will stop. Prior to resetting circuit breaker try to determine the cause of failure and make corrections as needed.



## ADJUSTING STATION TIMING

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- 1. Set Mode Switch to AUTO position.
- 2. Rotate station knob of station requiring adjustment to 60 minute position.
- 3. Push Station Selector IN and rotate to station, stopping just prior to station number. Selector will continue to rotate automatically and stop on station.
- 4. Rotate Station Knob counterclockwise to zero. If Station Selector rotates to next station before Station Knob reaches zero, use adjustment procedure "A" below. If Station Selector does not rotate to next station on zero setting, use adjustment procedure "B" below.

"A" Insert 1/16" allen wrench into center of Station Knob. Holding Station Knob, turn adjusting screw clockwise two turns, repeat Steps 2 and 3. Rotate and hold Station Knob at zero position. Turn allen wrench counterclockwise slowly until Station Selector rotates to next station.

"B" Repeat Step 3. Holding Station Knob at zero, insert 1/16" allen wrench into center of knob. Turn adjustment screw counterclockwise slowly until Station Selector rotates to next station.

## SPECIFICATIONS

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- UL Listed
- 16 and 24 (plus 2 drip) station models
- Locking metal cabinet, wall or pedestal mounted (pedestal optional)
- Internal transformer
  - Input 115 VAC
  - Output 24 VAC, 40 VA
  - CSA and Export Model available
- Maximum Output to Valves- 1.1 Amps.
- Dimensions- 19" H, 11" W, 5.25" D (Electric)
  - 19" H, 11" W, 7.25" D (Hydraulic)
- .50" Conduit Inlet for 115 VAC Primary Line
- 1.50" Conduit access hole for 24 VAC Field Wires

## The Toro Limited Warranty for Irrigation Division Equipment

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The Toro Company warrants, to the owner, each new piece of equipment (featured in the current catalog at date of installation) against defects in material and workmanship provided they are used for irrigation purposes under manufacturer's recommended specifications for the period described above. Product failures due to acts of God (i.e., lightning, flooding, etc.) are not covered by this warranty.

Toro is not liable for failure of products not manufactured by Toro even though such products may be sold or used in conjunction with Toro products.

During such warranty period, Toro will repair or replace, at its option, any part found to be defective. Toro's liability is limited solely to the replacement or repair of defective parts. There are no other express warranties.

Return the defective part to your local Toro distributor, who may be listed in your telephone directory Yellow Pages under "Sprinkler Systems" or "Irrigation Supplies", or contact the Customer Service Department at The Toro Company, P.O. Box 489, Riverside, California, 92502. Phone 800-FOR-TORO for the location of your nearest Toro distributor.

This warranty does not apply where equipment is used, or installation is performed, in any manner contrary to Toro's specifications and instructions, nor where equipment is altered or modified.

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**ALL IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR USE, ARE LIMITED TO THE DURATION OF THIS EXPRESS WARRANTY.**

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