

COMMON SENSE MANUAL

Second Edition

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CONTROLLER FEATURES

- up to 80 Crop Zones
- 4, 8, or 12 valve control
- up to 16 crops
- Manual Mode- waters according to a preset program at the touch of a key
- Auto Mode- automatic time-based watering
- Remote Mode- automatic environment driven irrigation controlled from a Boom Spooler or GO-1
- Daily Programming - direct jog capability
- Flexibility- Daily Delay Multipliers which allow you to modify the time between waterings/mistings to match changing environment conditions.

ORIENTATION

This section should help you get to know the basic hardware components of Boom control and programming: the keypad, the screen, and magnets.

KEYPAD

CSC Controller Module Keypad

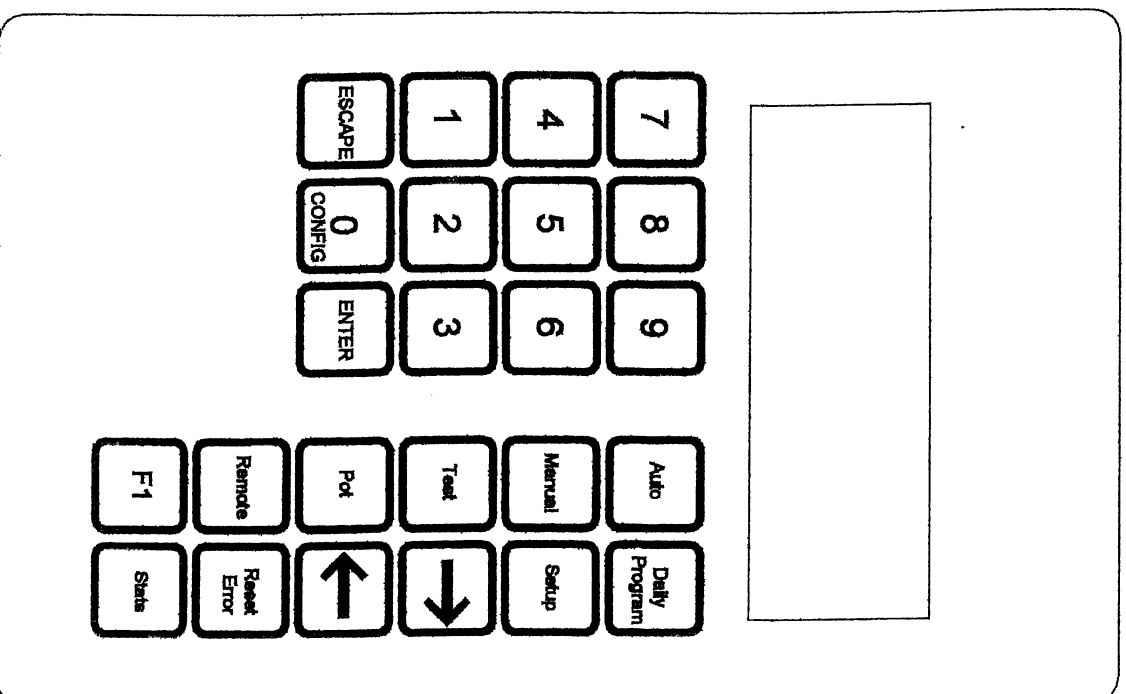


Figure 1—Common Sense Controller Module Keypad

Main Editing Keys

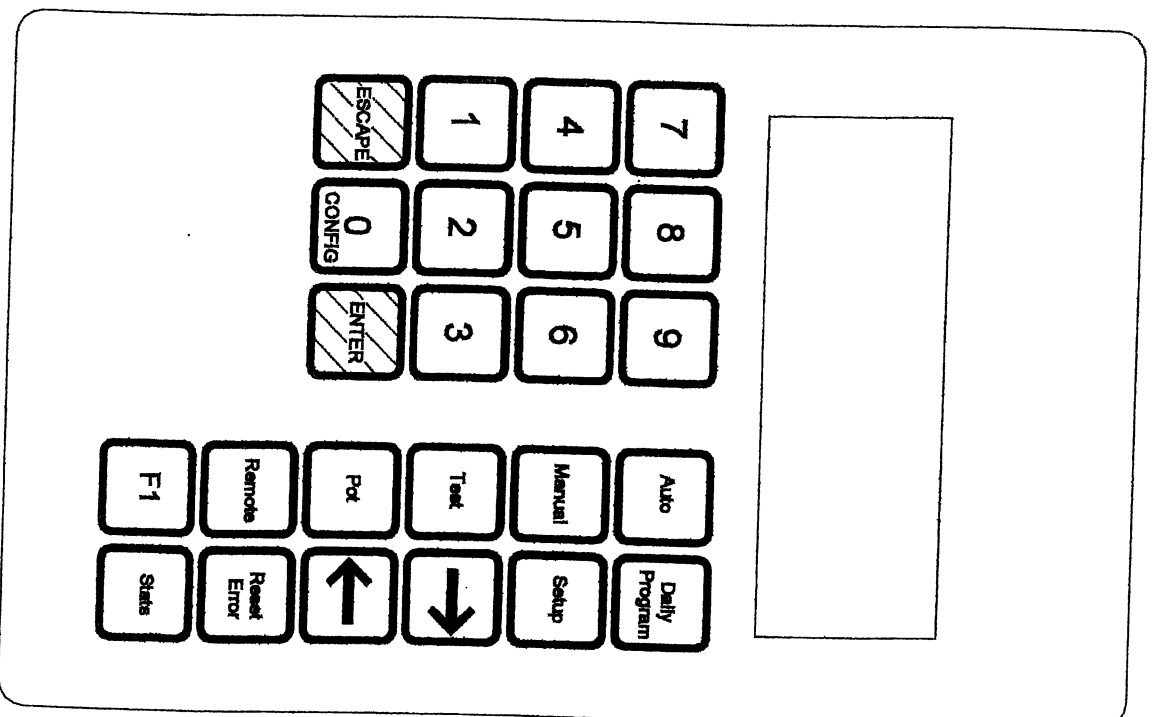


Figure 2—Main Editing Keys

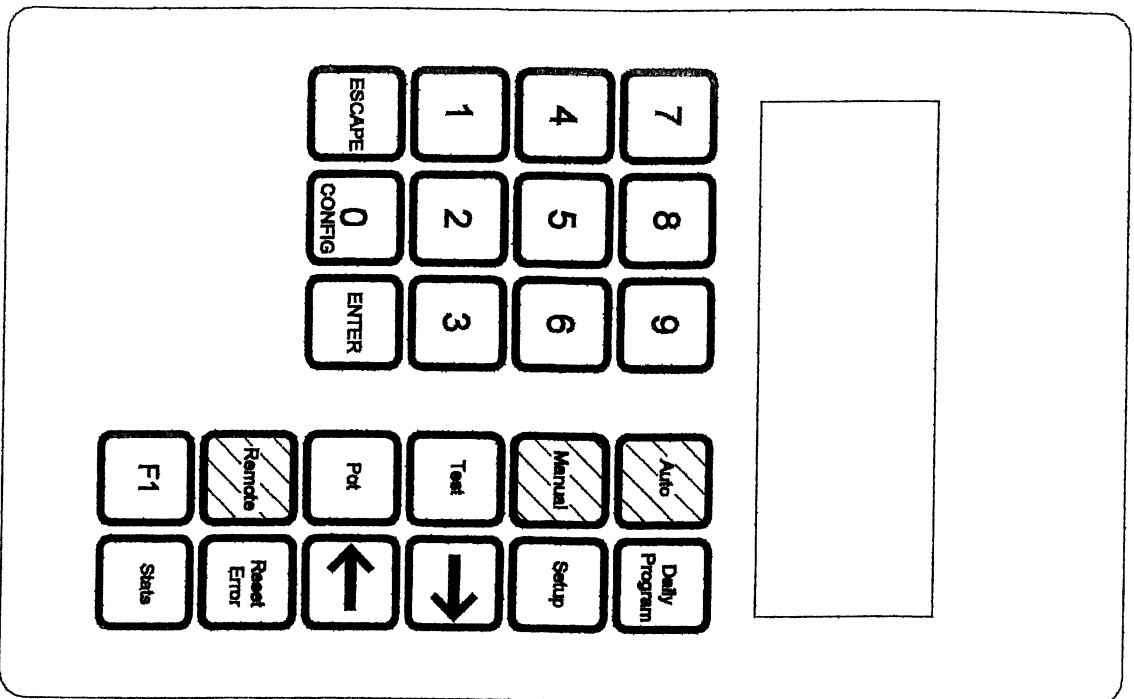


Press this key to save entered information and move to another screen



- 1) Press This Key to Exit a screen without saving anything.
- 2) Press This Key to exit a screen loop (a series of screens that keeps repeating). Press [ENTER] first to save information and move to a screen in the loop where you don't plan to enter anything, *then* press [EXIT] to leave the loop.

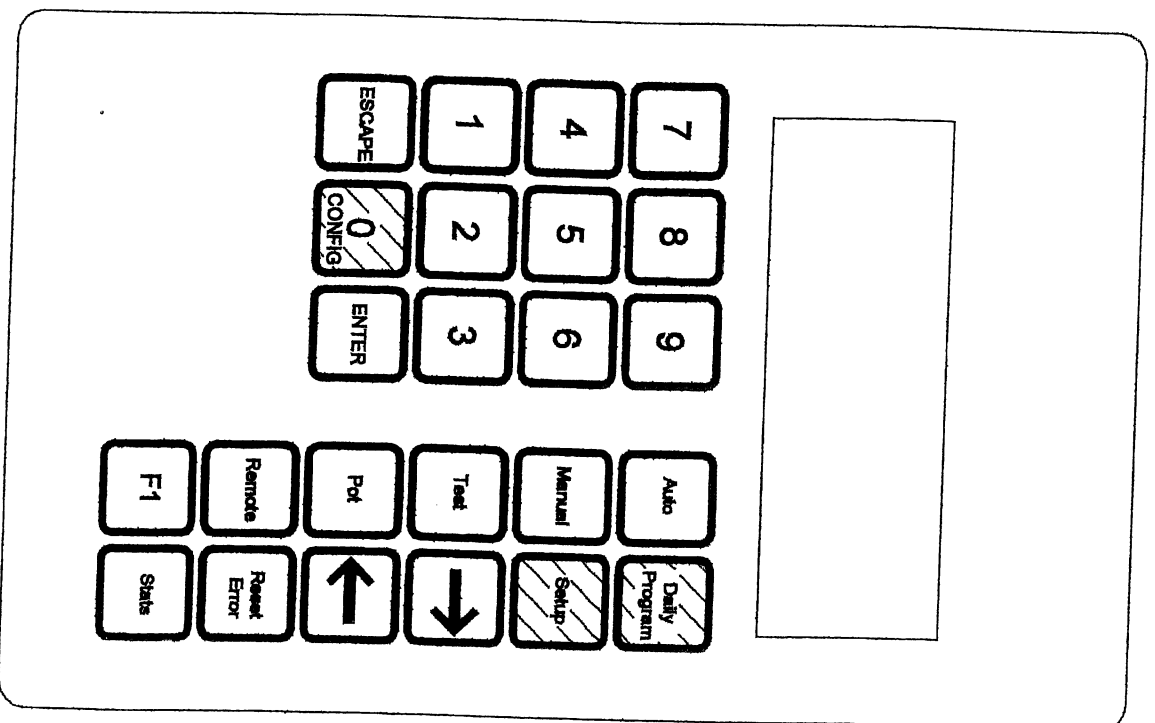
Main Mode Keys



Press one of these to enter the corresponding mode (mode roughly means method of operation).

Figurs 3—CSC Mode Keys

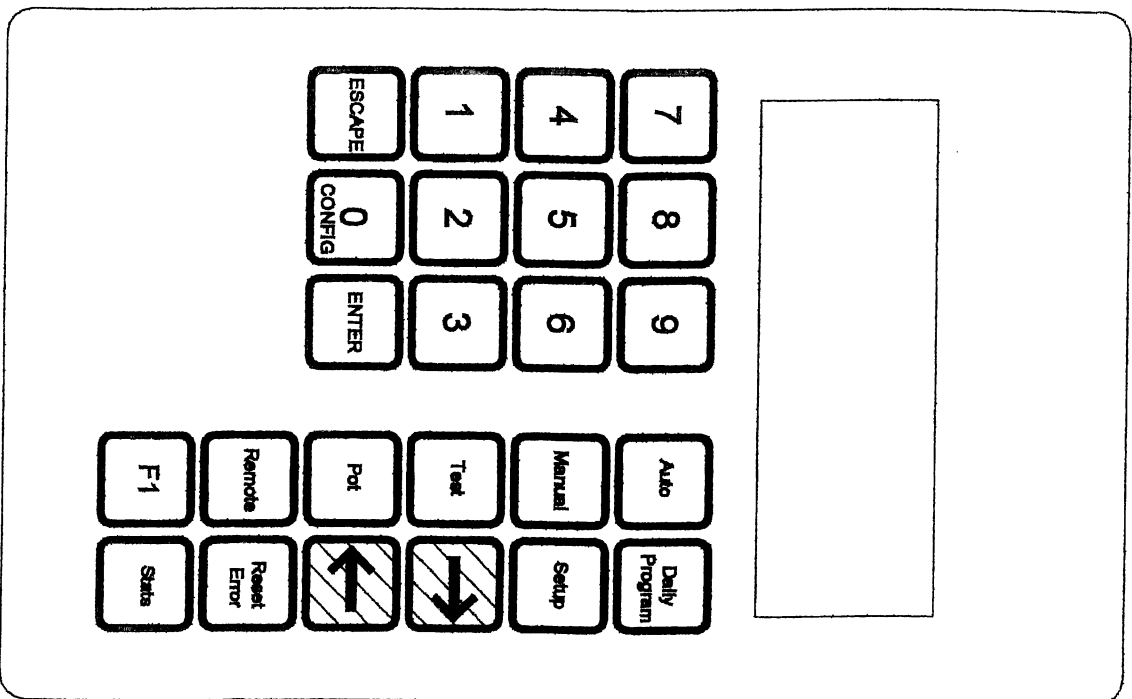
Menu Keys



First Press
the desired
Mode key;
then press
one of
these Menu
Keys to
enter the
corresponding
menu for
that mode.
These
menus are
generally
different for
each mode.

Figure 4—CSC Menu Keys

Arrow Keys

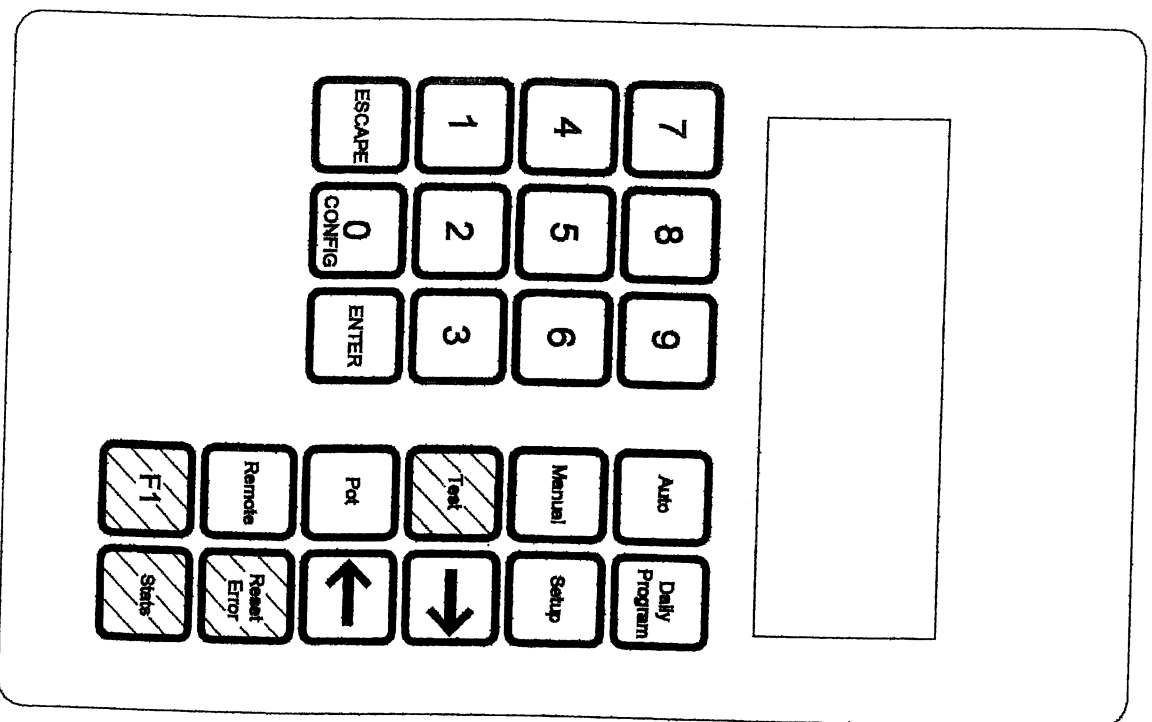


Use these
Keys to:

- 1) Move between fields in a screen.
- 2) Show additional Information that doesn't initially fit on the screen.

Figure 5—CSC Arrow Keys

Miscellaneous Keys



Press this key to access the 'Test Mode' (actually a menu of procedures for testing your boom equipment).



Press This key to access the screen where valve delay (the amount of time between when the magnet sensor senses a magnet and the valves turn on to water the plants) is determined.



Press this key to clear an alarm and allow the boom to continue working.



Shows a journal of what the boom has done since you last cleared the stats, *and* what the boom is doing at this moment.

Figure 6—Misc Keys

MAGNETS AND MAGNET READERS

Magnets are used as boundary markers for zones, and as out-of-range markers. All of the magnets which delineate zones are located on one rail, to be read by the forward and reverse sensors on the corresponding side of the boom. The out-of-bounds magnets are located at the ends of the bay on the other rail, and the boom has a sensor just for them.

SCREENS

The screens are very basic, generally containing few software components.

There is the menu type, containing only menu options denoted by numbers which are accessible only through pressing those numbers:

- 1) STATISTICS
- 2) CROP STATUS
- 3) ERRORS
- 4) CLR STATS/ERRORS

Figure 7—Stats- Central Menu

Then there is the type which has no menu or options but instead contains labeled data-entry 'fields'

```
START CROP ZONE: 01
END CROP ZONE: 01
VALVES      34
TOT ZONES: 02 CROP: 01
```

Figure 8—Crop 01 Edit Location Screen

- Besides data-entry fields, these may exhibit three types of information on their bottom lines:
- Software Location information- tells which crop one is editing/displaying (see above bottom right).
 - Configuration information- tells, for instance, how many zones the boom is configured to have (See above bottom left & below bottom right).
 - Directions- relevant pointers on what to do in a particular screen (See below middle two lines).

```

CROP : 02
ENTER CROP # TO
EDIT
TOTAL CROPS : 02

```

Figure 9—the ‘Choose a Crop to Edit’ Screen

TUTORIALS

These tutorials are intended to help you acquire a knowledge of the basic skills necessary for everyday operation of this equipment.

TUTORIAL 1: GETTING ACQUAINTED WITH THE BOOM/USER INTERFACE

This Tutorial is designed to help you get a feeling for how the keys interact with the screen, and how screens are structured.

Press any “Mode” button (Manual, Auto, or Remote- it doesn’t matter) and then press



to access the Configuration Menu (Config menu).

1	}	SET CLOCK
2	}	CROP ZONE DEFULTS
3	}	SPEED DEFAULTS
4)	NUMBER OF CROPS

There are four options on this screen, each leading to a new menu or screen. You select one by pressing the number key for that option. Press 1 to select "SET CLOCK".

DAY 1 09:32

ENTER NEW DAY/TIME

There should be a dark blank 'flashing' alternately with the 1. That means that you may enter a number into the space that is currently holding 1. Press

2

to 'tell' the controller that it is on day 2 of its 7 day schedule (totally arbitrary choice). The blank should still be flashing in that spot. This is useful if you have made a mistake, e.g. pressing [4] instead of [2], and need to correct it. But in this case, just move on by pressing the right pointed arrow key:

→

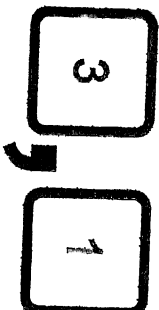
The blank should be 'over' (alternating in the space with) the first digit of the time (in this case, "0"). Assume that it is 2:31 p.m., which is 14:31 in military time. Press

1, 4

Note that the blank shifts back over the first digit (now a "1") in the hour space. To move to the minutes space, press the right-pointing arrow key:

→

Press [3], [1] to enter the time.



When you have done this, you are finished with this screen. Press



to save the data you have entered and exit the screen. You should be back here:

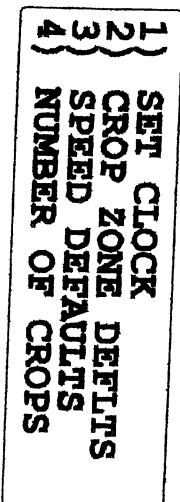


Figure 10— The CONFIG menu

If you want to go back and program the time to match your actual local time, go ahead.

TUTORIAL 2: Basic Boom Configuration

This Tutorial is designed to show you how to complete the basic configuration process which is the same for each mode.

Beginning

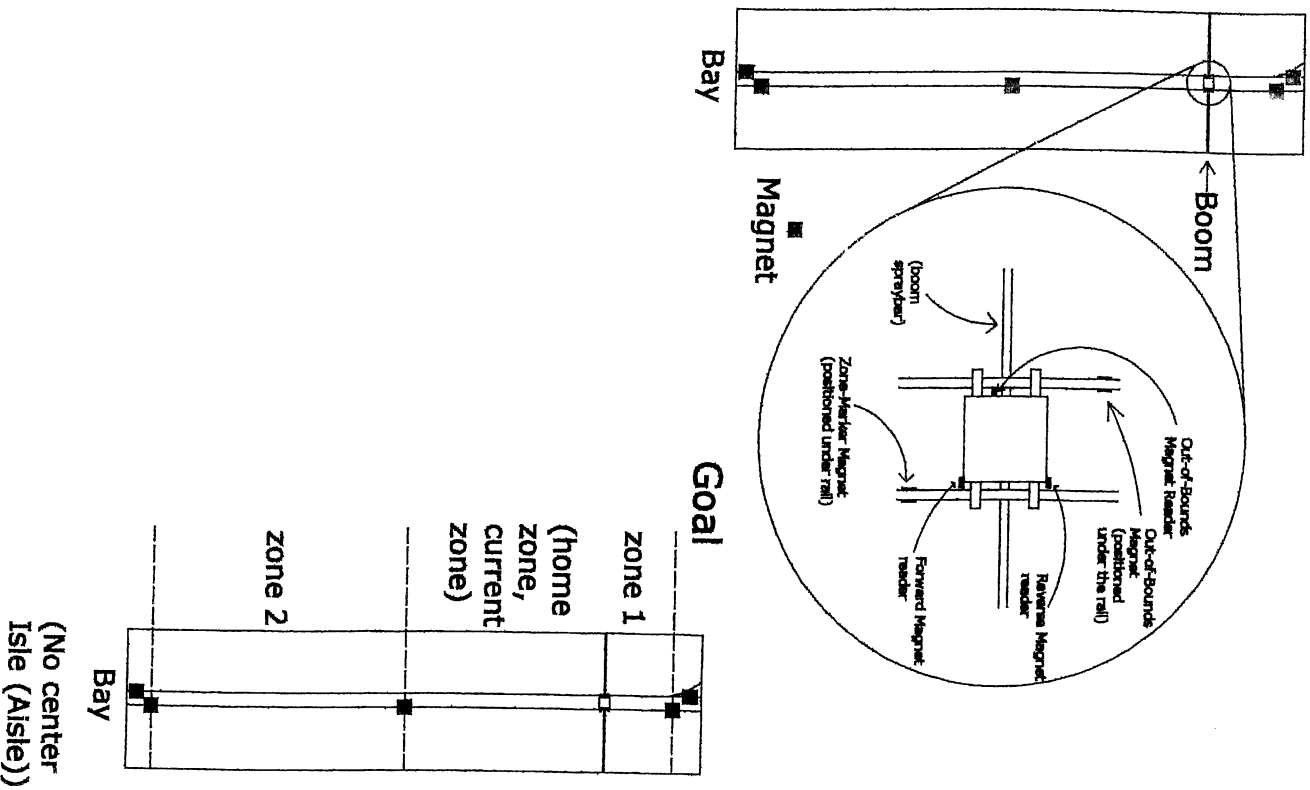


Figure 14—Tutorial 2 Overview

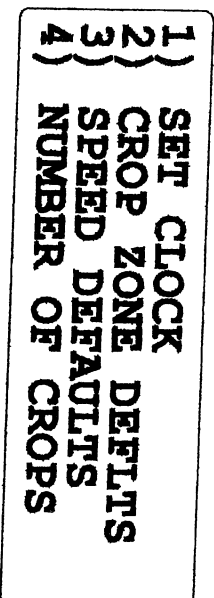
Note that there are three zone magnets, and two spaces between them. Each of these spaces is called a "crop zone" (controller lingo). So the bay has two crop zones total. Also note that this boom has only two spray bars, each of which has a separate valve. So the boom has two "Valves" (in controller lingo) - see APPENDIX 6: BAY LAYOUT on page 50 for a more thorough overview of bay layout

Press any "Mode" button (Manual, Auto, or Remote- it doesn't matter) and then press



to access the Configuration Menu (Config menu).

Press



You should be looking at this screen:

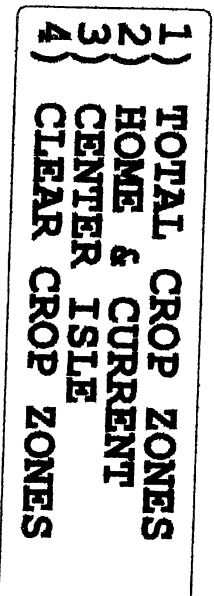
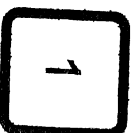


Figure 12--The "CROP ZONE DEFAULTS" sub-menu

Press

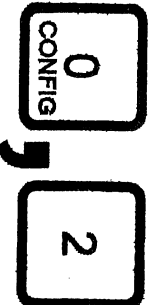


Now you should be looking at this screen:

TOTAL CROP ZONES : 02
TOTAL NUMBER OF
CROP ZONES (1-80)

Figure 13—TOTAL CROP ZONES screen

Press



To enter "02" as the "TOTAL (NUMBER OF) CROP ZONES"

Press



That should take you back to this screen:

1) TOTAL CROP ZONES
2) HOME & CURRENT
3 } CENTER ISLE
4) CLEAR CROP ZONES

Figure 14—The "CROP ZONE DEFAULTS" sub-menu

You've set up the bay hardware to have two crop zones; You've told the boom that it has two crop zones total; If you have followed the installation instructions, zone 01 is at the end of the bay where the sweep is (call this the "back end" of the bay), and the zone numbers increase in the forward direction (towards the "front end" of the bay).

Now it is time to program the Home and Current Zones; first, quick definitions:

Home Zone: the zone that the boom goes to when it has nothing to do.

Current Zone: the zone that the boom is in right now.

You should be here:

```

1 ) TOTAL CROP ZONES
2 ) HOME & CURRENT
3 ) CENTER ISLE
4 ) CLEAR CROP ZONES

```

Figure 15—The “CROP ZONE DEFAULTS” sub-menu

Press

2

Now you should be here:

```

HOME : 01
CURRENT : 01
ASSIGN A CROP ZONE
TOTAL CROP ZONES : 02

```

In a bay with more crop zones, you might want to put the Home Zone near the middle, so it can go anywhere in the bay quickly. In this case, set it as Zone 1.

The Current Zone is obviously Zone 1 (see tutorial overview graphic). Set it at Zone 1, and then press

ENTER

- and that brings you back here:

```

1 ) TOTAL CROP ZONES
2 ) HOME & CURRENT
3 ) CENTER ISLE
4 ) CLEAR CROP ZONES

```

What about option 3, “CENTER ISLE”? If you have an aisle cutting widthwise (perpendicular to the boom rails) across the bay, and there are no plants in it, then you probably don’t want to water it. Make sure you position magnets on either side and make a mental note on which number Zone it is in. Designating this ‘crop zone’ as a Center Aisle prevents the boom from watering it.

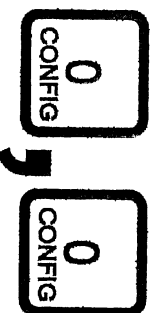
Note: This tutorial bay has no center Isle (Aisle).

This is the "CENTER ISLE" screen:

```

CENTER ISLE: 00
00 = NONE
ASSIGN A CROP ZONE
TOTAL CROP ZONES: 02
  
```

Press



to enter "00" which tells the boom that there is no Center Isle (see screen above).
Then press



once, and press



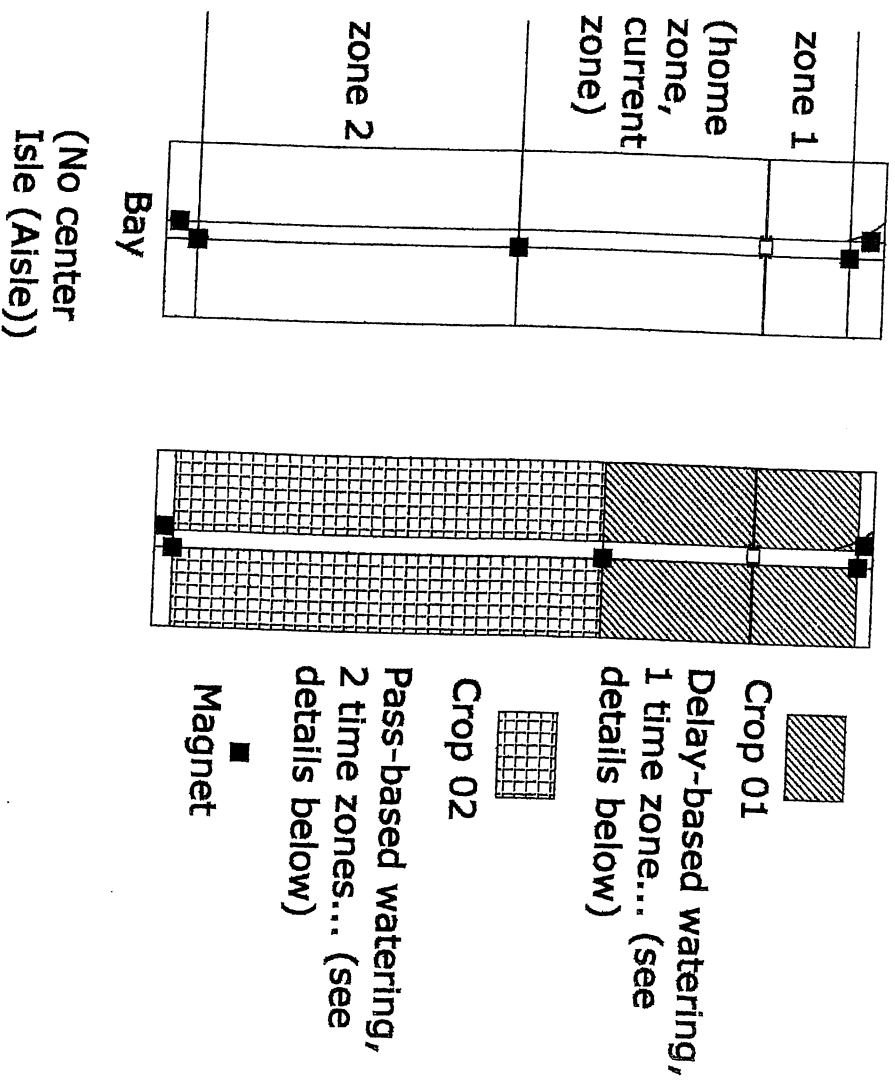
twice (to exit out of the Crop Zone Defaults menu and the Config menu).
And you're done!

TUTORIAL 3: Programming Crops into the Controller

This Tutorial is designed to teach you to place and edit crops. Crop locations are the same across all modes, and are remembered between modes (when you change them in one mode, they change in all modes). It is also designed to teach you the basics of programming crop irrigation settings in Auto Mode.

Beginning

Goal



(No center
Isle (Aisle))

Figure 16—Overview of Tutorial 3

(Detailed Goals- part of the overview shown above)

Crop 01

Delay-based misting

Scheduled for all 7 days of schedule

Priority Level 1

1 Time Zone: 08:00- 18:00 hrs

Delay of 10 minutes between passes

Jog Speed (Pass Speed) = 08

Crop 02

Pass-based watering

Scheduled for all 7 days of schedule

Priority Level 2

2 time zones: 1) 08:00-11:00 hrs; 2) 14:00-17:00 hrs

1st time zone- 08 passes

2nd time zone- 06 passes

Jog speed = 06

Translation:

I want the boom to do one misting pass at speed 8 over crop 01 every 10 minutes between 8 a.m and 6 p.m.

I want the boom to do eight watering passes at speed 6 over crop 02 beginning at ~8:00 a.m. I also want it to do 6 watering passes over crop 02 beginning at ~2:00 p.m.

Steps

The hardware should be set up, and the boom configured, as shown above left. (This beginning configuration is precisely the result of tutorial 2)

Press:



to enter Auto Mode

Press:



to enter the Setup Menu for Auto Mode:

- 1) DISPLAY CROP
 - 2) EDIT CROP

Figure 17—Auto Mode- Setup Menu

Note: The Setup Menu is different for each mode. In this tutorial, we are working exclusively in Auto Mode.

There are two main menus here. One is view-only- "DISPLAY CROP". The other is the working area- "EDIT CROP". This last one is the one relevant to this tutorial. Press



CROP : 01
 ENTER CROP # TO
 EDIT
 TOTAL CROPS : 16

There is an implicit menu here: you may choose either crop 01 or crop 02. Choose crop 01. This menu choice launches you on a big loop of screens which guides you through the process of programming crop 01, and eventually leads back to this same screen, with crop 02 'ready for programming'. Then you can go through the loop, programming crop 02. Ready?
 Press



That should put you at this screen:

```

START CROP ZONE : 01
END CROP ZONE : 01
VALVES 1 2
TOT ZONES : 02 CROP : 01

```

When you assign a crop a location, there are a couple of things to remember:

- Assign crops rectangular 'blocks' of the bay area; if the area occupied by one crop is not rectangular, break it up into rectangular areas and assign them separately (see how below)
- Instead of assigning the crop zones like this: "put crop 01 in zones 1,2,3, and 4", we assign them like this: "put crop 01 in zones 1 through 4". In that case zone 1 is the "start crop zone" (lower number), and zone 4 is the "end crop zone" (higher number)

Valves correspond to spray bars. They divide the bay like zones do, only lengthwise. For an explanation of these, check Appendix _____. But before doing that, go through this example, and see if you can get a feel for how they work.

Next to each specification available for editing (i.e. "START CROP ZONE", "END CROP ZONE", "VALVES"), there is a two-space area for typing a number. Places like this, where we enter data by typing, are called "fields" in GTI controller jargon.

Notes: You move between spaces in a field by typing in them. You move between fields within in a screen by pressing the arrow keys. Finally, you move between screens using the [ENTER] and [EXIT] keys.

Now, lets get moving:

The first digit of the first field should be 'flashing'

Type [0],[1]

Press the right arrow key

Type [0],[1](we are specifying that this block of Crop 01 begins and ends in Crop Zone 01)

Press the right arrow key ([->])

Type [3],[4] (we are using valves (~spraybars) 3 and 4 (the mist bars, one for each side of the bay) to mist this crop).

Notes: Valve (spraybar) 3 covers the same area as valve 1, and the same for 4 & 2; the only difference is that valves 3 & 4 control misting bars, and valves 1 & 2 control watering bars.

Notes: The way Valves are entered is different from the usual number-typing. To choose a valve, press its number (i.e. to select "valve 2", press [2]). If you mistakenly selected a valve, press its number again to deselect it. If you mistakenly deselected a valve, press its number again- and it reappears on the screen. And so on and so forth.

Press [ENTER] to move to the next screen.

Surprise! back at the same screen. This is a mini-loop that really isn't relevant right now, but useful in assigning multiple rectangular areas in a bay to a single crop; you see, when you enter in data on the second (or third, or fourth...) time through, it does not overwrite the data from the first time; it merely adds a second 'block' of bay area to crop 01 (unless, of course, you purposely override what you entered in the previous time through).

To leave this loop, press [ESCAPE] once. You should now be at this screen.

```

1 ) DELAY BASED
2 ) PASS BASED
   WATER MODE: DELAY
   CROP : 01

```

Press [1] (remember the goals).

```

SCHEDULE: 1234567
DEFAULT SPEED: 12
PRIORITY: 1 CROP: 01

```

First, don't press anything yet.

The Schedule is exactly the way we want it.

We do need to change the default speed (jog speed, in this context) to 08. To do this,

Press [->]

Type [0], [8]

Now look at the priority level. By default, it is set to "2" change it to "1".

Press [->]

Type [1]

We're done with this screen. continue on by pressing [ENTER]

```

TIME ZONE: 01
ENTER TIME ZONE TO
EDIT (1-6) CROP: 01

```

This is the beginning of a small, three-screen loop inside the 'big loop' (sort of like the crop location screen mini-loop). However, right now, we only want to program one time zone, so go through it only once:

Press [ENTER] (Time Zone 01 should be automatically ready for programming).

You should now be here:

```

TIME ZONE: 1
START TIME: 00:00
END TIME: 00:00
DELAY : 000 CROP : 01

```

Type [0],[8] (for 08:00hrs start time)

Press [->] twice

Type [1],[8] (for 18:00hrs end time)

Press [->] twice

Type [0],[1],[0] (for delay of 10 min. (delay is automatically measured in minutes))

Press [ENTER] to save the information you entered and leave the screen.

You should be here:

```

1) ENABLE
2) DISABLE
ENABLED
CROP:01 TIME ZONE:01

```

For the purposes of this tutorial, we choose "ENABLE" (this puts the Time Zone in use):

Press [1]

Press [ENTER]

WARNING—*Do not program a time zone with an end time lower than the start time, so don't program a time zone that overlaps between two days. In other words, don't program a time zone over midnight e.g. one that begins at 20:00hrs and ends at 08:00 hrs.*

That should bring you back to the beginning of the loop, except with Time Zone 2 now ready for programming.

```

TIME ZONE: 02
ENTER TIME ZONE TO
EDIT (1-6) CROP:01

```

Since the goal for this crop only includes one time zone, we leave the loop by pressing [ESCAPE].

That should put you back at the beginning screen of the big screen loop, except with crop 02 ready for programming this time:

```

CROP : 02
ENTER CROP # TO
EDIT
TOTAL CROPS : 02

```

Press [ENTER] to begin programming Crop 02.

Edit it to the following specifications:

```

Start Crop Zone: 02
End Crop Zone 02
Valves 1 & 2
Pass Based
Schedule: 1234567
Default (jog) speed: 06
Priority: 2

```

Press [ENTER] to reach the Choose-a-Time Zone screen:

```

TIME ZONE : 01
ENTER TIME ZONE TO
EDIT (1-6) CROP : 01

```

Go ahead and press [ENTER] (Time Zones can be different for different crops)

Notice the slightly different look:

```

TIME ZONE:1
START TIME: 00:00
END TIME: 00:00
PASSES : 00 CROP : 02

```

In the lower left-hand corner, the screen has a field for the number of passes to be performed during the given time zone, instead of the length of the delay between waterings/mistings. That's because you chose to make this crop's irrigation pass based, not delay based.

WARNING—As before, do not program a time zone with a end time lower than the start time, so don't program a time zone that overlaps between two days. In other words, don't program a time zone over midnight e.g. one that begins at 20:00hrs and ends at 08:00 hrs.

Edit this time zone to the following specifications:

Start time: 8:00hrs

End time: 11:00hrs

Passes: 08

Press [ENTER]

Enable the Time Zone.

Press [ENTER] again.

Note how you are back at the Choose-a-time-zone screen, with Time Zone 02 ready to be edited.

```
TIME ZONE: 02
ENTER TIME ZONE TO
EDIT (1-6) CROP: 02
```

Press [ENTER].

Edit this Time Zone to the following specifications:

Start time: 14:00hrs

End time: 17:00hrs

Passes: 06

Also, Enable this Time Zone.

When you're back at the Choose-a-time zone screen, you're finished; Press [ESCAPE] a few times to go back to the Auto Mode starting screen.

You're done!

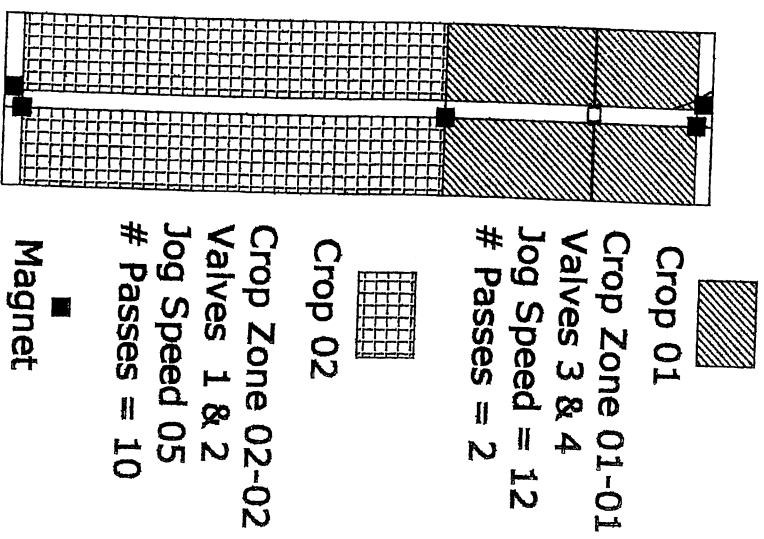
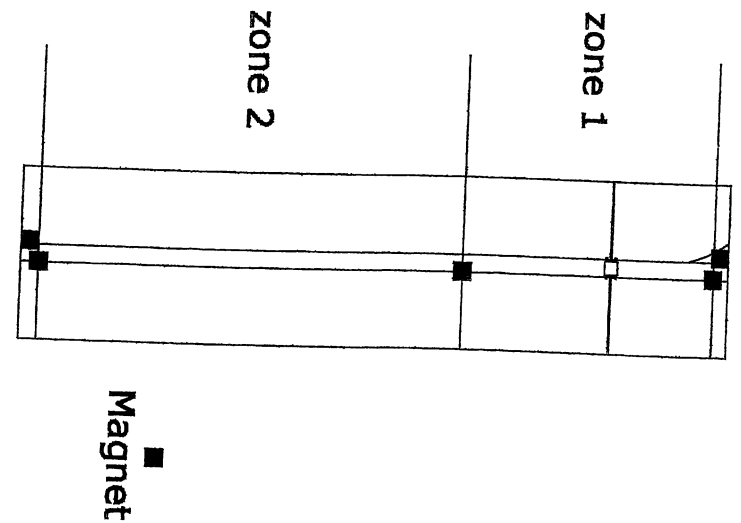
TUTORIAL 4: Working in Manual Mode

This is designed to help you get to know how to operate the boom in Manual Mode.

Since this is more about irrigation programming than configuration or crop location, lets use the bay from the previous example.

Beginning

Goal



Press [ESCAPE] a few times to get back to the beginning screen of whatever mode you are in, then press



To enter Manual Mode.
Press



To enter the Manual Mode Setup Menu. Notice how this menu is different from the Auto Mode Setup Menu.

```

1 ) START
2 ) DISPLAY CROP
3 ) DISPLAY PASSES
4 ) EDIT CROP

```

Before you Press [1] for START (which tells the boom to perform according to a program), you have to write an irrigation program for the boom to perform on demand. Here's how:

Press [4] to access the "EDIT CROP" Screens (notice how options 2 and 3 are display, or read-only options). That should put you here:

```

CROP : 01
ENTER CROP # TO
EDIT
TOTAL CROPS : 02

```

Press [ENTER]

```

START CROP ZONE : 01
END CROP ZONE : 01
VALVES
TOT ZONES : 02 CROP : 01

```

Fill out this screen:

```

Start Crop Zone: 01
End Crop Zone: 01
Valves: 34

```

Then Press [ENTER] to save the information on the screen.

This will loop you back to the same screen. Press [ESCAPE] to exit this mini-loop, since we are done programming crop location for Crop 01.

You should now be here:

```

SPEED: 12
PASSES: 00

```

Fill out this screen:

(Keep the Speed at 12)

PASSES: 02

Press [ENTER]. That puts you back at the Choose-a-crop-to-edit screen, with Crop 02 ready for editing:

```

CROP: 02
ENTER CROP # TO
EDIT
TOTAL CROPS: 02

```

Fill out this crop, in the same manner as before, to the following specifications:

Crop Zones 02-02

Valves 1&2

(Jog) Speed 05

10 Passes

Now you have a program ready, so that, (barring any unforeseen circumstances), whenever you press [1] in the Manual Mode Setup Menu or [Daily Program] on the keypad (while in Manual Mode), the boom will do the required tasks: 2 misting passes over crop 01 at speed 12 and 10 watering passes over crop 02 at speed 05, in this case.

TUTORIAL 5: Working in the Auto Mode Daily Program Menu

The Auto Mode Daily Program Menu is useful for controlling the boom 'on the spot', and daily modifications to the regular program created in the Auto Mode Setup Menu. Lets say that we're working with the same program created in that menu in Tutorial 3, Identical in every respect including configuration, crop location, and irrigation programs.

Jogging the Boom

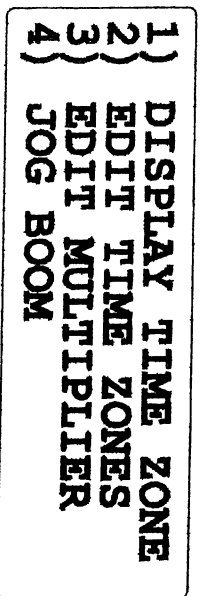
Let's say that one day you just decided to start the plants in zone 2 fresh and early with a good watering. Press



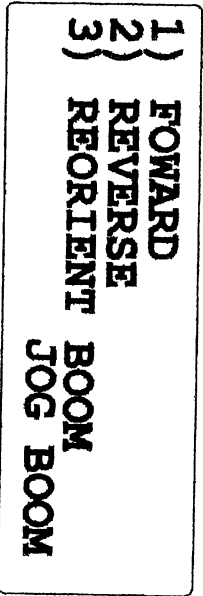
and then press



To access the Auto Mode Daily Program Menu (shown below):

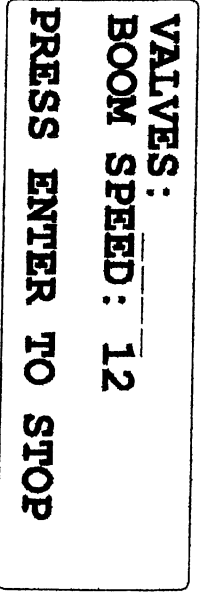


To make the boom perform actions 'on command', Press [4] ("JOG BOOM")



Press 1 (remember, the home zone in Tutorial 3 was Crop Zone 01, and the boom isn't doing anything (presumably) so it should be in its home zone.) to go forward, toward Crop Zone 2

This screen should be displayed:



As the boom is approaching the boundary between Crop Zone 01 and Crop Zone 02, You should be getting ready to press [1] & [2] at the same time to turn valves 1 & 2 on just before you reach the boundary (why just before? to accommodate valve delay- see Appendix ___) (The goal is to have both spraybars turn on exactly at the boundary. As you are approaching, also use the Arrow keys to change the speed of the boom incrementally up or down to your desired speed for this pass.

Water as many passes as you want. To water more than one, press [ENTER] once you go a little past the end of the zone, to stop the boom and shut the valves. That puts you back here:

- | | | |
|----|----------|----------|
| 1) | FORWARD | |
| 2) | REVERSE | |
| 3) | REORIENT | BOOM |
| | | JOG BOOM |

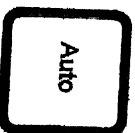
To do another pass heading in the reverse direction, press [2] and then press [1] & [2] together again taking account of the time it takes the water to start flowing. Adjust up or down from speed 12 to reach your desired speed, and finish the pass.

Try to turn the valves off, taking account of the time it takes the water to stop flowing, in such a way as to have the watering stop at the Zone boundary. Then, if you want to do another pass, let the boom move past the boundary into Crop Zone 1, and then after a while stop, then change the direction to forward and try to turn on the valves so that the boom waters starting exactly at the zone boundary.

If you're wondering how the boom adjusts for valve timing issues, check Appendix __ for an explanation of "Valve Delay"

The Multiplier

The Multiplier is a tool for modifying your overall program temporarily, in response to environmental conditions. The effect of the multiplier lasts until 00:00 hrs (midnight, the beginning of the next day). The multiplier acts on delay times, stretching or compressing them, depending on the percent multiplier you choose. To access this feature, press



Then



That should put you at this screen:

```

1 ) DISPLAY TIME ZONE
2 ) EDIT TIME ZONES
3 ) EDIT MULTIPLIER
4 ) JOG BOOM

```

Press [3] to Choose "EDIT MULTIPLIER"

```

CROP : 01
ENTER CROP # TO
EDIT
TOTAL CROPS : 16

```

Press [ENTER] (if you wanted to change the multiplier for crop 02, press [0], [2] and then press [ENTER]).

```

MULTIPLIER : 100
SET DELAY MULTIPLIER
(25-300) CROP : 01

```

The multiplication is measured in percent, not 'times'. Look in the bottom left-hand corner. The screen gives you a certain range of percent modifications you may make. You may make the delays as low as 25 % (1/4 times) as long, or up to 300% (3 times) as long as they are normally.

Say that today is especially humid and slightly cloudy. You decide to increase delay times to twice their normal length. To do this:

Type [2], [0], [0] (for 200% multiplication)

Press [ENTER], which brings you back to the previous screen.

You have doubled the 10 minute delay in Tutorial 3 to 20 minutes. Incidentally, it doesn't matter how many time zones you set up for a particular crop; the multiplier increases or decreases the delay times for all of the time zones by the same proportion. For instance, suppose that this crop had another time zone, which had a delay set to 20 minutes; That delay would be changed to 40 minutes.

Press [ESCAPE] to get ready for the next section

Editing Time Zones in the Daily Program Menu

You might want to use this function if you have differing conditions throughout a particular day. For instance, suppose the weather forecast included a cloudy, cool morning and a sunny, hot afternoon. Let's take Crop 02 and change its watering program to reflect these conditions:

You should be here. If you aren't, then get to this screen, in the Auto Mode Daily Program menu:

```
1 ) DISPLAY TIME ZONE
2 ) EDIT TIME ZONES
3 } EDIT MULTIPLIER
4 ) JOG BOOM
```

Press [2]

```
CROP : 01
ENTER CROP # TO
EDIT
TOTAL CROPS : 16
```

Press [0], [2], [ENTER] to select crop 02.

```
TIME ZONE : 01
ENTER TIME ZONE TO
EDIT (1-6) CROP : 02
```

We want to give the crop less passes in the morning (cloudy morning) and more in the afternoon.
Press [ENTER]

```
TIME ZONE:1
START TIME: 07:25
END TIME: 10:00
PASSES : 08 CROP:02
```

Change the number of Passes to 03

Press [ENTER]

Press [1] to enable your modified time zone

Press [ENTER] to go back to this screen, with Time Zone 02 ready:

```
TIME ZONE : 02
ENTER TIME ZONE TO
EDIT (1-6) CROP : 02
```

Press [ENTER] to select Time Zone 02.


```

TIME ZONE: 2
START TIME: 16:00
END TIME: 18:00
PASSES: 06 CROP: 02

```

Change the start time to 15:00, the end time to 17:00, and the number of passes to 08

Now Press [ENTER]

Press [1] to enable this modified Time Zone program

Press [Enter] to confirm this choice and leave the screen.

You should be here:

```

TIME ZONE: 03
ENTER TIME ZONE TO
EDIT (1-6) CROP: 02

```

This, by the way, shows the capabilities of the system; if you wanted to add an extra time zone just for today, you could do it. But That is not the purpose of this tutorial, so press [ESCAPE].

You have successfully modified the normal watering program to reflect today's environmental conditions! Keep in mind, though, that the modifications only last until midnight. The boom is designed so that it reverts back to its usual program at that time.

TUTORIAL 6: Working in Remote Mode

Most of the work done in remote mode is done in the Config and Setup menus. The Daily Program Menu really isn't applicable here. Since Tutorials 1 & 2 dealt with the Config menu, which is identical across all modes, This tutorial deals strictly with The Remote Mode Setup Menu.

Programming Crops in Remote Mode

Press [ESCAPE] a few times to reach the initial screen for whatever mode you are presently in. Then Press [REMOTE] to access the Remote Mode. The screen should look like this:

```

REMOTE DAY2 17:03
BOOM IDLE
WAITING FOR NEXT CMD
ZONE: 09

```

Now press [Setup] to access the Remote Mode Setup Menu:

```

1) DISPLAY CROP
2) EDIT CROP
3) EDIT ADDRESS

```

Notice the similarity between the Remote and Auto Mode Setup Menu Screens: The only difference (so far) is that the Remote Mode Setup Menu Screen has an extra item: "3) EDIT ADDRESS"

Let's say that you just purchased a new Boom Spooler and are planning to run your boom from some environmental controller. The bay configuration and crop locations are identical to those in Tutorial 3. Even the crops themselves are identical.

Press [2] to select "EDIT CROP"

```

CROP: 01
ENTER CROP # TO
EDIT
TOTAL CROPS: 02

```

Press [ENTER] (might as well start with crop 01).

```

START CROP ZONE: 01
END CROP ZONE: 01
VALVES      34
TOT ZONES: 02 CROP: 01

```

Nothing is different (yet). That's because both configuration and crop location carry across all modes. For the purposes of this tutorial, a change in crop location is not necessary.

Press [ESCAPE] (that was another mini-loop)

```

SPEED: 12
PASSES: 02
STAGGER DELAY: 000
CROP: 01

```

Now things look different: Remote Mode is really more like manual Mode than Auto Mode. You give the boom a certain set of actions to perform (number of passes over such-and-such a crop at speed *z*, etc.) and it performs this whole set of actions (program) on command. The only difference in this respect is that whereas in Manual Mode a human is telling the boom to water, in Remote mode, it is the higher controller that tells the boom to start the program.

Notice that even the number of passes and the speed of the passes has been preserved from Auto Mode. The only thing that didn't carry over is the whole time zone thing.

Assigning the Boom an Address

Look at the Remote Mode Setup Menu:

```

1) DISPLAY CROP
2) EDIT CROP
3) EDIT ADDRESS
  
```

The third option on the list is "EDIT ADDRESS"

Press [3] to access this option

```

DEVICE ADDRESS : 01
SET DEVICE ADDRESS
  
```

This is the screen where you give your boom a tag, an address, so that the higher controller has a place to send its orders. For this tutorial, just keep the boom's address as "01".

Obviously, if you had more than one boom, you would have to assign each a different number.

APPENDICES

APPENDIX 1: MODES

The different modes serve as 'spaces' for different levels of equipment automation/grower management. The three main modes are Manual, Automatic, and Remote, in ascending order of automation. These allow the grower varying levels of hands-on control, from direct command (i.e. commanding the boom to make x number of passes over a particular crop at such and such a speed) to environment driven watering managed by a higher central controller.

Each main mode has its advantages. With Manual Mode, a human decides when to water. This allows for intensive involvement on the part of the grower. Auto Mode allows the grower to have the boom water in his absence through timing technology. Remote mode allows advanced higher controller units such as an environmental controller or the GO-1 to control the boom from a central location, and in the case of the GO-1, utilize VPD technology (Adaptive Irrigation) to water plants based on estimated evapotranspiration rates.

Test is a specialized secondary mode (actually more like a menu) which does not figure into the general everyday operation of the equipment; therefore it is placed last.

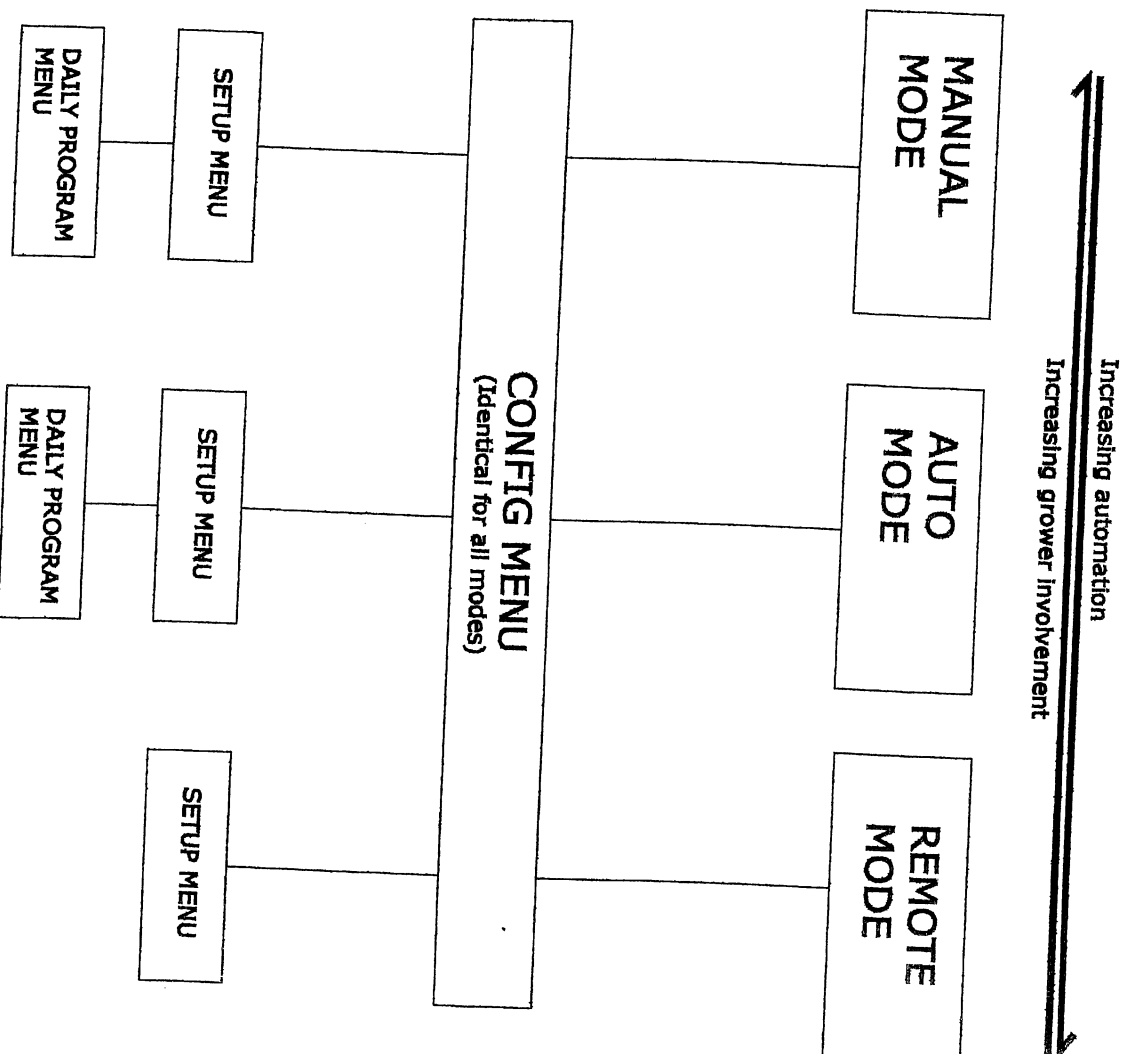


Figure 18—The Big Picture

APPENDIX 2: MANUAL MODE

Manual mode is the most “hands-on” direct control mode. Here you may:

- Write a program detailing several tasks all of which the boom is to perform upon the touch of a single button.
- Determine when the crop needs watering based on your own judgement, and press that button to start the watering program.

Setup

The Setup menu is where you 'describe' (program) the tasks that you want your boom to perform. It is also the place where you tell the boom to perform the programmed tasks.

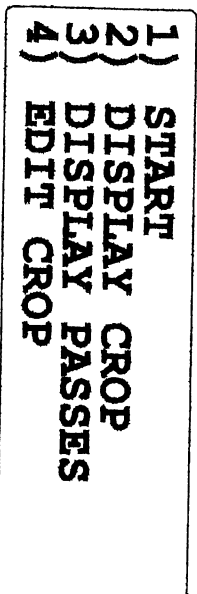


Figure 13— The Manual Mode Setup Menu

“1) Start” starts the program (assuming that you have written one). In other words, choosing this option tells the boom to begin performing the programmed tasks (collectively called “the program”)

“2) Display crop” is your spatial observation option. This tells you which crops are where by providing zone and valve coordinates for any crop you choose. It also what tasks you have programmed the boom to perform on that crop.

“3) Display passes” is your temporal observation option. This tells you how many passes have been performed upon a single crop since the start of the program.

“4) Edit crop” is your programming option. Here you determine the location and number of passes for each crop- the information that you can only look at in options 2 and 3.

Note: When you choose “Display _____ (crop, passes, etc.)” options, keep in mind that the display is only a window onto the screen, and sometimes the screen is much, much bigger than the display will show at once. In cases like this, press the arrow keys to move the window to another part of the screen and display more information.

The manual mode setup menu is structured thus:

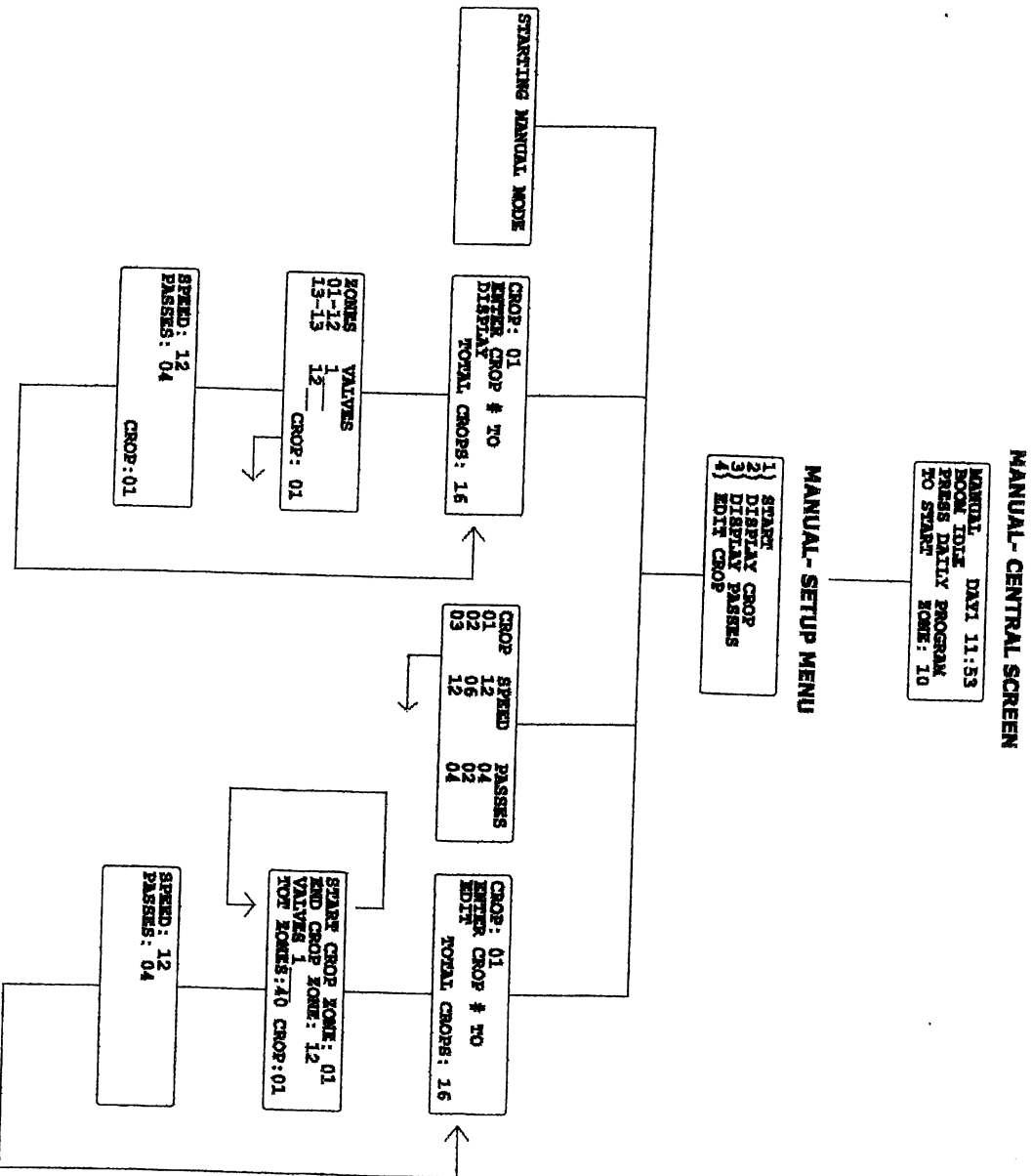


Figure 20—Manual: Setup Map

It is the “Edit Crop” option that most concerns us here.

Choosing “4) EDIT CROP” brings you to a choose-a-crop menu:

CROP: 01
ENTER CROP # TO
EDIT
TOTAL CROPS: 02

Type in the number of the crop that you want to edit and press [ENTER]. That brings you to the crop location screen for Manual Mode:

```

START CROP ZONE : 01
END CROP ZONE : 01
VALVES
TOT ZONES : 02 CROP : 01

```

To the right of each colon (:) is something called a "data field" ("field" for short)

Fill these fields in by pressing the desired numbers. (the only way to move between spaces in a field is to put something in your current space, which causes the blank to move to the next space (or back to the first space after you insert a character in the last space.)

To move to the next field press one of the arrow keys. When the blank is in the last data field in the screen, pressing an arrow key moves it back to the first field.

When you are finished filling the coordinates for one rectangular location of the crop in the bay, move on by pressing [ENTER].

This loops you back to the same screen, now empty. Don't worry; the action of pressing the [Enter] key saved the information you entered.

If you want to allocate another rectangular area of the bay to this crop, go ahead; if not, press [EXIT] to leave this one-screen loop.

That puts you at the irrigation settings screen for this crop:

```

SPEED : 12
PASSES : 00

```

fill in the screen as desired. The methods of navigating within and between fields just described are universal throughout the software of the Common Sense Controller.

When you are done, press [ENTER] to move on. That places you back at the choose-a-crop screen, with Crop 02 ready to be selected:

```

CROP : 02
ENTER CROP # TO
EDIT
TOTAL CROPS : 02

```

You may repeat the process, cycling through the crops ad infinitum.

NOTE: once you have assigned cells in a bay to a certain crop, you may not unassign them or re-assign them to another crop. In the first case, the programming is not set up to unassign areas in a bay, and in the second case, if you reassign cells in a bay to

another crop what you get is not overwriting, but overlapping- the boom then waters the area, say, twice as much, for the first crop *and* for the second crop, treating the cell like it contains both crops.

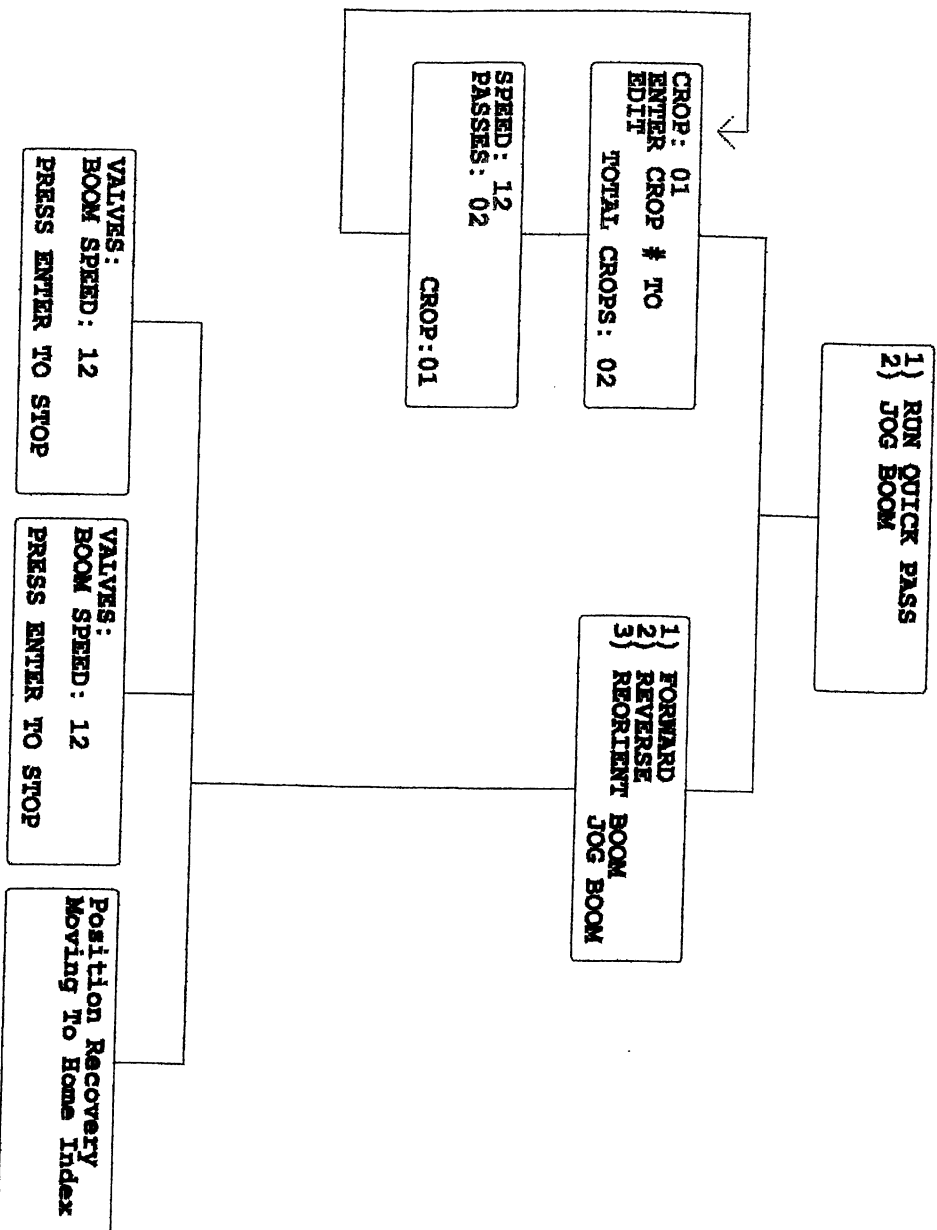
Notes: To unassign or reassign cells, you have to erase the location programming for an entire crop: press [**config**] to enter config mode then press [2] to choose menu option 2, "crop zone defaults" then press [4] to choose "clear crop zones". Enter the number of the crop whose location you wish to erase, and press [**ENTER**]. This erases that crop from the bay. To give the crop a new location in the bay, assign cells to it just like it's any other crop: in the setup menu.

Daily Program

The Daily Program Menu is a whole lot less complicated than the setup menu:

MANUAL MODE: DAILY PROGRAM

(The most basic boom operation level available)



To enter the "Manual Mode Daily Program" menu, press the Daily Program key on the keypad *after* you have entered Manual mode (The Setup and Daily Program menus differ in different modes).

1) RUN QUICK PASS is the menu option which allows you to tell the boom to water a specific crop with x number of passes. Choose the option, specify the crop in the choose-a-crop screen, and then specify the number of passes and what speed the boom is to move at during these passes.

2) JOG BOOM is the option which allows you to literally walk the boom, choosing the direction of motion, the speed of motion, and which valves are on. This option is the closest to hand watering of all the boom's watering methods. In this state, the boom ignores magnets, and all external inputs except for your direct commands; move the boom towards a crop, then *just before* the boom begins to move over the crop (this is to allow for valve delay), turn on the appropriate valves (spraybars) to water that crop. Turn the valves off *just before* the boom leaves that crop's zone, to allow for valve delay.

APPENDIX 3: AUTO MODE

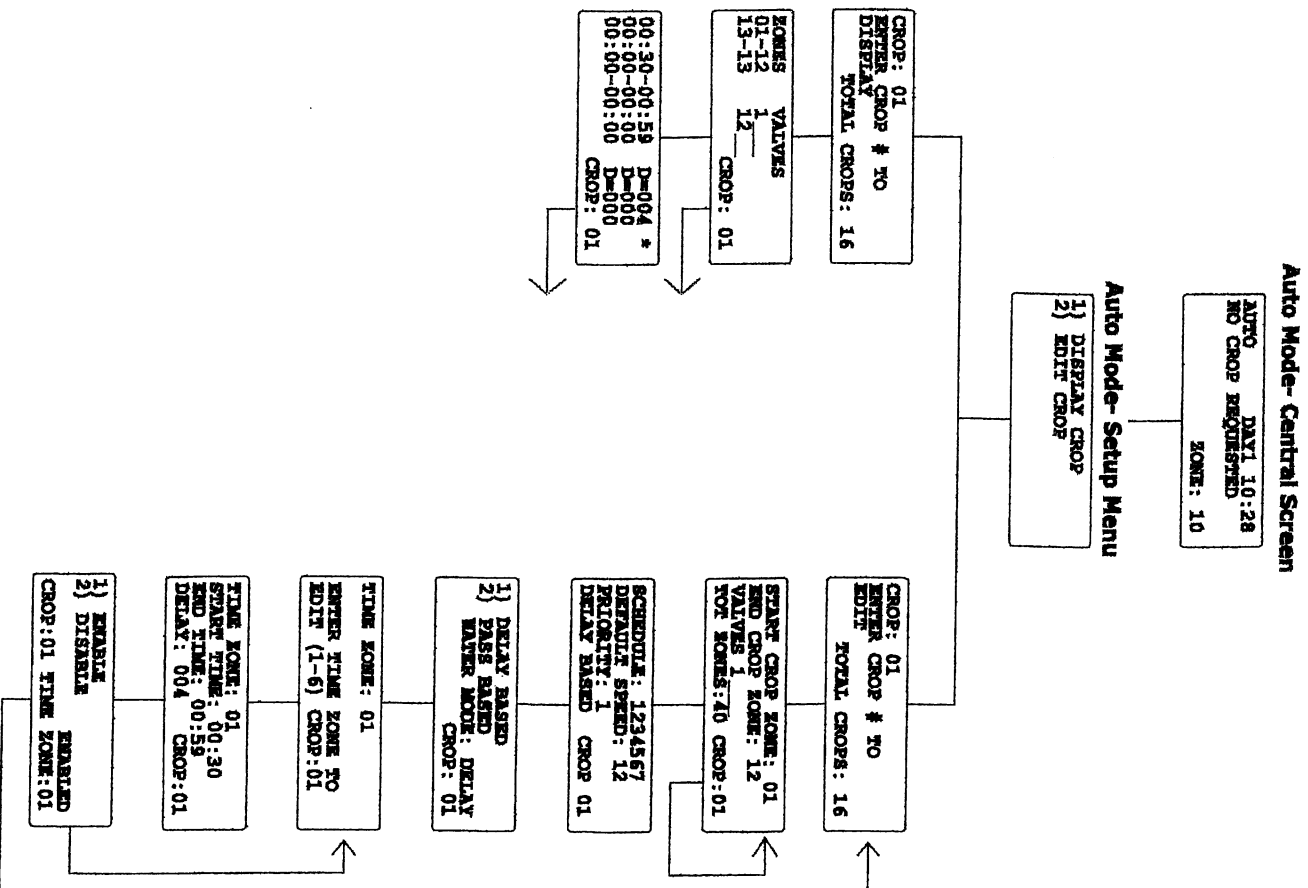
Automatic Mode allows you to:

- Program the boom to water crops whether or not you are present
 - Lessen labor needs by reducing the necessity of a human 'boom supervisor'
 - Utilize time-interval based watering- you may set the boom to mist a crop every 15 minutes from 4 p.m. to 6 p.m., for instance
 - Utilize scheduled heavy watering for bedding plants.
 - Jog the boom (in the Daily Program Menu)
- You get to Auto Mode by:

- Pressing [ESCAPE] until the screen stops changing (this should put you at the initial screen of whatever mode you are currently in.)
- Then pressing [Auto] to enter Auto mode (this should place you at the auto mode initial screen).

Setup Menu

Once you are in Auto Mode, you may press [Setup] to access the Setup menu.



Display Crop

Press [1] to Display the crops assigned to your boom. Here's how this works:

The screen should now be a choose-a-crop screen; the crops are not presented in a list, so you have to enter the number of the crop that you want displayed. Press [ENTER] to confirm your crop choice.

There are three main types of crop information: location info, irrigation settings, and the irrigation program.

- The screen first shows **crop location information**, namely the crop zone and valve coordinates of the blocks of bay area assigned to that crop (in the form in which these blocks were assigned). To access more of this type of info (say, the stuff that couldn't fit on the screen at first), press arrow keys. Press [ENTER] to move on to the next kind of information (irrigation settings)
- The screen next shows **irrigation settings information**- schedule, default speed (in default meaning in lieu of daily multipliers)XXXXXpriority, and irrigation control method (delay/pass). Press [ENTER] to move on to look at the actual irrigation program for this crop.
- Finally, the screen shows the **irrigation program** for this crop- the time zones and passes or delays associated with each.
- Press [ENTER] to loop back to the next crop, in this case, crop 02. If you forgot to look at something about crop 01, just type [0],[1] in the choose a crop screen and press [ENTER] to reselect crop 01.
- Press [ESCAPE] a few times anywhere in the process to go back to the Auto mode central screen.

Edit Crop

As we have before mentioned, There are three types of Crop information. It is necessary that the crop programmer know how to access and change each of these (((((((pieces)))))) of information.

The programming is linear rather than web-like, meaning that screens occur in sequence in lines and loops, instead of radiating out from a central screen.

There is one big loop in "EDIT CROP" - the crop loop. This consists of a series of screens which guide you in programming all aspects of the crop, then land you back at the choose-a-crop screen, from where you then go back through the loop, for another crop.

If you are already in Auto mode, press the [Setup] key.

Press [2] to select the "EDIT CROP" option.

Voila! The choose-a-crop screen; press [ENTER] (crop 01 should be ready for programming).

(You program the info in the same order as it is displayed in the "DISPLAY CROP" series of screens.)

Note that you can only assign one rectangular 'block' of bay area to a crop at a time, once you have entered the coordinates for one block, you must press [ENTER] to loop back (this is a mini-loop inside the big loop) to the same screen, where you may assign another block. And so on, and so forth. When you're done programming Crop location, press [ESCAPE] to leave this self-repeating screen.

This next screen is where you set the crop to be watered on a pass or delay basis. Press [1] to make it delay based or [2] to make it pass based. Press [ENTER] to confirm your choice and move on to the next screen.

You set the schedule, default screen, and priority level here. Press the arrow keys a few times. Do you see the different parts of the screen that you move to? A part of a screen in which you may type numbers, and to which you may move by pressing an arrow key, is called a field.

Once you've finished programming this screen, you're finished with crop irrigation settings- now onto the actual irrigation program!

There are two types of irrigation programs: delay and pass based. The programming processes of these slightly diverge at this point. In both contexts, the screens for a loop that cycles through successive time zones.

For a Delay based program:

You should be faced with a 'choose-a-time zone' screen. There are six time zones available in a day. That means that you can divide a 24 hr day into up to 6 intervals of time each of which has a different delay length, if you so choose. You select one of these time zones in the same way that you choose a crop in the 'choose-a-crop' screen.

Once you've chosen one, press [ENTER] to confirm your choice.

Set start and end times to this time interval

WARNING—*Always program a time zone with a start time lower than the end time, so don't program a time zone that overlaps between two days. In other words, don't program a time zone over midnight; e.g. one that begins at 20:00hrs and ends at 08:00 hrs.*

Set the delay length (the time between waterings)

Press [ENTER]

You should be shown a screen prompting you to enable or disable the time zone. (If a time zone is enabled, the boom follows its directions. If it is disabled, the boom ignores it. This is a useful feature, especially if you have two time zones set for the same time, one for a cloudy day having longer delays, and one for a sunny day, having shorter delays. You may choose which one to activate depending on the weather.)

Select one of the options, and press [ENTER].

That should bring you to Time Zone 2.

If you want to program crop 02 now, press [ESCAPE] once to reach the 'choose-a-crop' screen, and select crop 02.

If you are finished programming the crops go back to the Auto Mode Setup Menu by pressing Escape a few times.

For a Pass-based program:

Here also you should be faced with a 'choose-a-time zone' screen. There are six time zones available in a day. You choose one of these in the same way that you choose a crop in the 'choose-a-crop' screen.

Once you've chosen one, press [ENTER] to confirm your choice.

Set start and end times to the time zone, and the number of passes. The time zones don't have to fill up the day, but they must be long enough for the boom to accomplish the designated number of passes, allowing for any interruptions caused by the demands of higher priority crops, etc.

WARNING—*As before, do not program a time zone with a end time lower than the start time, so don't program a time zone that overlaps between two days. In other words, don't program a time zone over midnight; e.g. one that begins at 20:00hrs and ends at 08:00 hrs.*

Press [ENTER]

- Enable or disable the time zone, Press [ENTER] to confirm your choice.
- That should put you back at Time Zone 2

If you want to program crop 02 now, press [ESCAPE] once to reach the 'choose-a-crop' screen, and select crop 02.

If you are finished programming the crops go back to the Auto Mode Setup Menu by pressing Escape a few times.

Daily Program Function

The Auto Mode Daily Program Function allows you to make temporary changes to your irrigation settings. All changes made to irrigation settings in the Daily Program Menu are applied until 12 o'clock midnight the following night, at which time they are cancelled.

In addition, the most basic boom control method (jogging) is included here so that in case of sensor failure, magnet loss or other problems of the same nature, you may still water your plants, albeit laboriously, controlling the boom's every action.

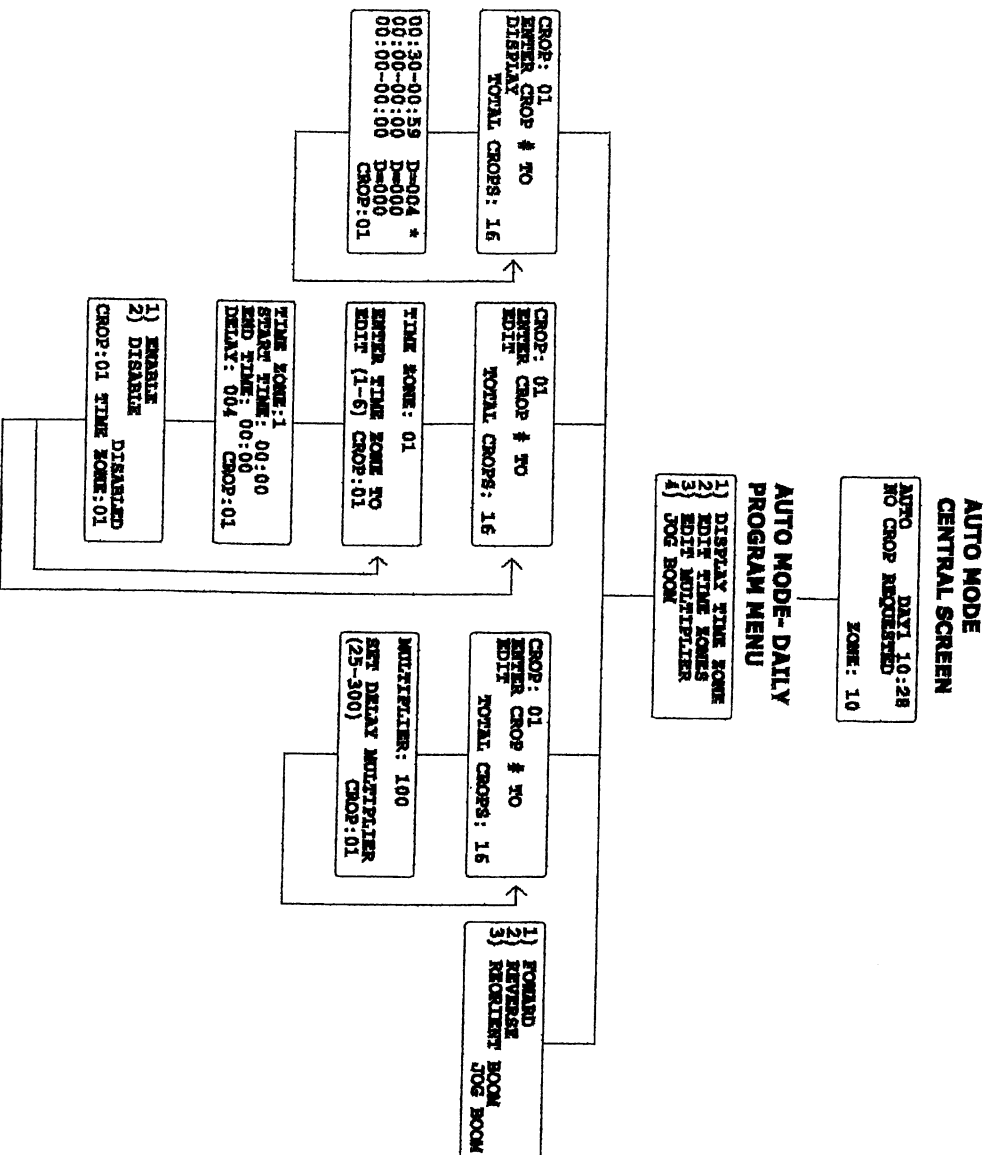


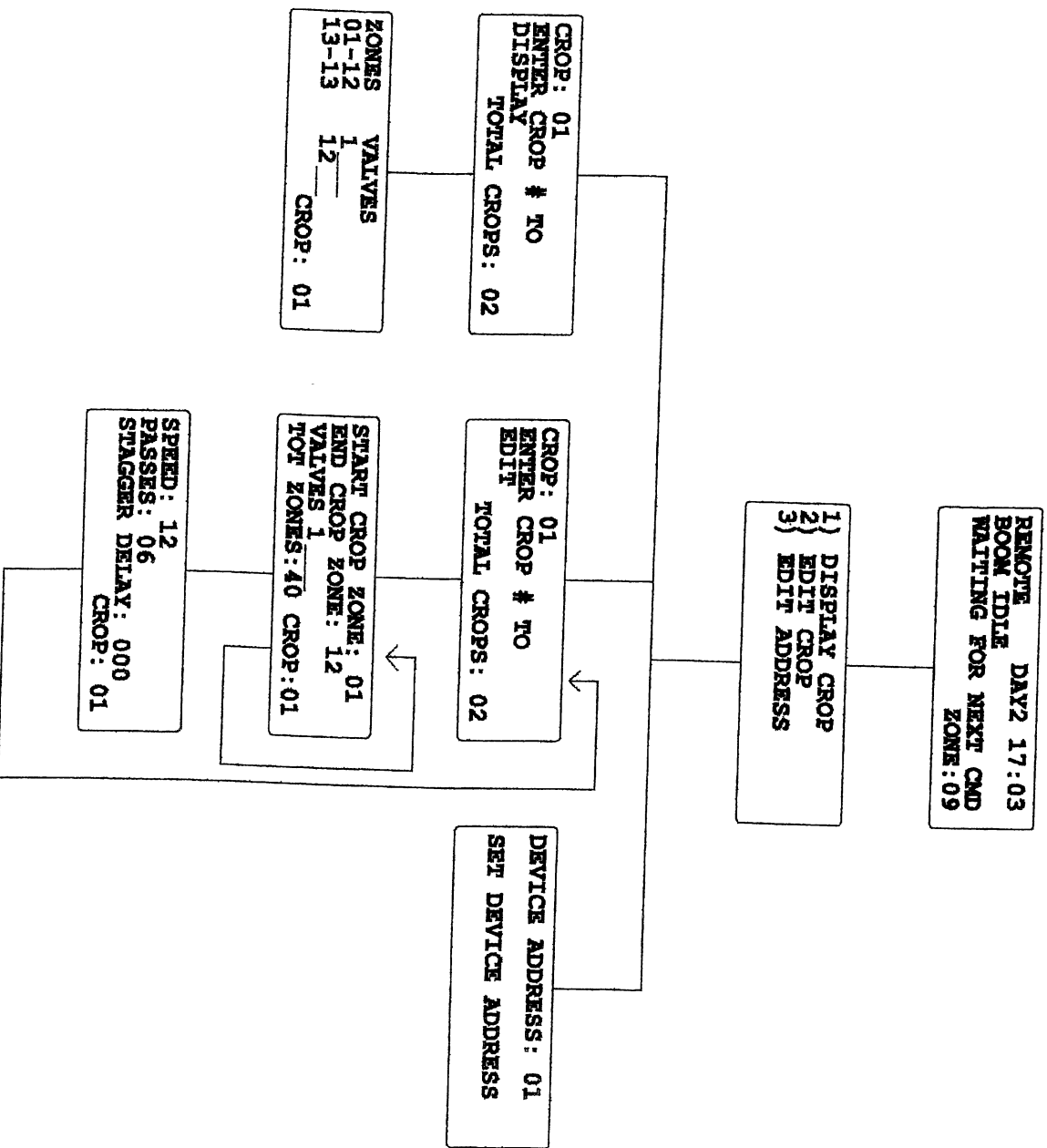
Figure 21—AUTO MODE- DAILY PROGRAM Software Map

APPENDIX 4: REMOTE MODE

Remote mode has special capabilities:

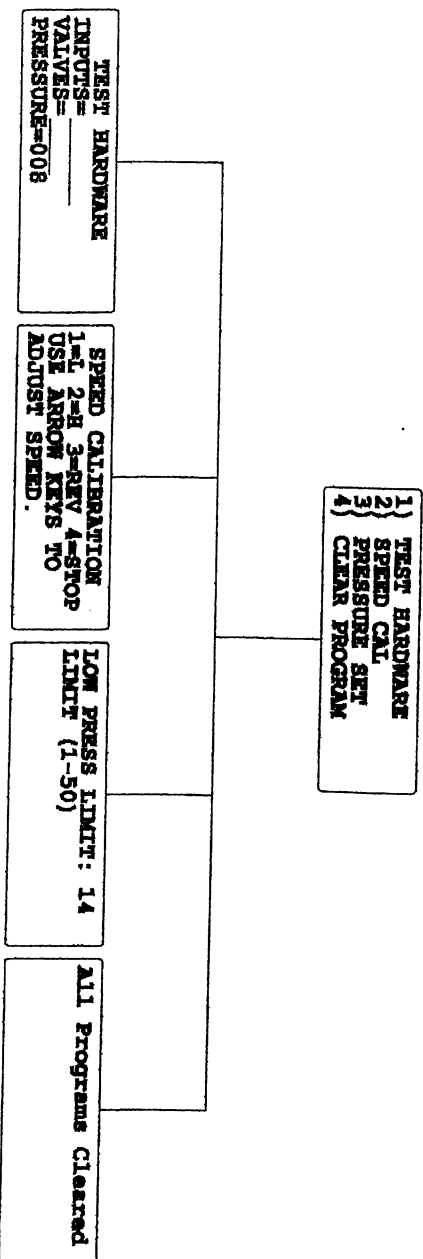
Higher-level controllers determine when the boom waters. The boom is idle and stays in its home zone until it receives an order to perform a certain set of actions for a particular crop. In this sense it differs greatly from Manual Mode. In which the boom performs all actions programmed for all crops after the grower/operator chooses "START" or presses "DAILY PROGRAM". Whereas in manual Mode, all crops get watered in indiscriminate order, according to the specifications, Remote Mode allows crops to be treated as individual units by a higher controller.

Programming is possible (even of tasks normally performed in Auto and Manual Modes, e.g. timed or forced watering) for multiple booms from a central location.



APPENDIX 5: TEST MODE

Test mode has two purposes. The first is testing and calibrating your equipment. The second is performing system-wide administrative tasks. The first function is reflected in the first two menu options, and likewise, the second function utilizes the last two menu options



Test Hardware

This is the Test Hardware screen:

```

TEST HARDWARE
INPUTS= _____
VALVES= _____
PRESSURE=000
  
```

Notice that in this screen there are three places for the display of information:

- Inputs (= magnet readers)
- Valves (= spray bars)
- Pressure (N/A)

Inputs

There are 6 possible inputs (think of them as slots for mag readers) on your boom.

- 1 = Index
- 2 = (Not Used)
- 3 = Collision
- 4 = Job Reverse
- 5 = Job Forward
- 6 = Motion

Valves

There are by default 4 spaces, or slots, for valves (since every boom comes with a board equipped to handle up to 4 valves). If you have ordered extra valve 'cards' (mini electronic boards that fit onto the main, or 'mother' board) for your boom, you may have 8 or 12 spaces.

Pressure

This feature is not available.

Speed Calibration

You set your highest speed (represented by 'speed 24') and lowest speed (represented by "speed 1") in this screen.

```
SPEED CALIBRATION
1=L 2=H 3=REV 4=STOP
USE ARROW KEYS TO
ADJUST SPEED.
```

Pressing "3" causes the boom to start moving.

To set the Lowest Speed for your boom, press the left arrow key [←] and hold until the boom reaches the slowest speed you ever want it to move at. Then press [1] to notify the boom that it is to recognize this speed as the lowest speed, "speed 1"

To set the Highest Speed, Press the right arrow key [→] and hold until the boom reaches the fastest speed you ever want it to run at. Then press [2] to notify the boom that this is the highest speed, or "speed 24"

You may want to use a watch and a knowledge of the distance between posts on the side of the bay to set these speeds to relatively precise rate units.

When you are done, press [4] to stop the boom.

Pressure Set

While this feature does have a screen all its own, it has not been implemented, and so is not available.

Clear Program

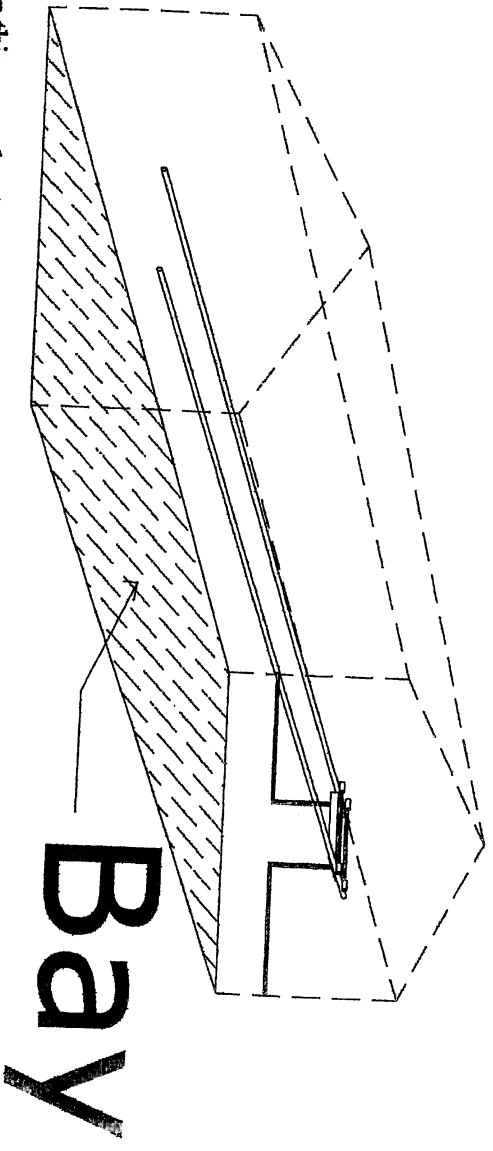
Choosing this option erases all information that you have entered into the boom controller, leaving only the basic framework- i.e., no configuration, no crop locations, no irrigation settings- If you want to use the boom again, you have to re-enter the information in the config and setup menus.

```
All Programs Cleared
```

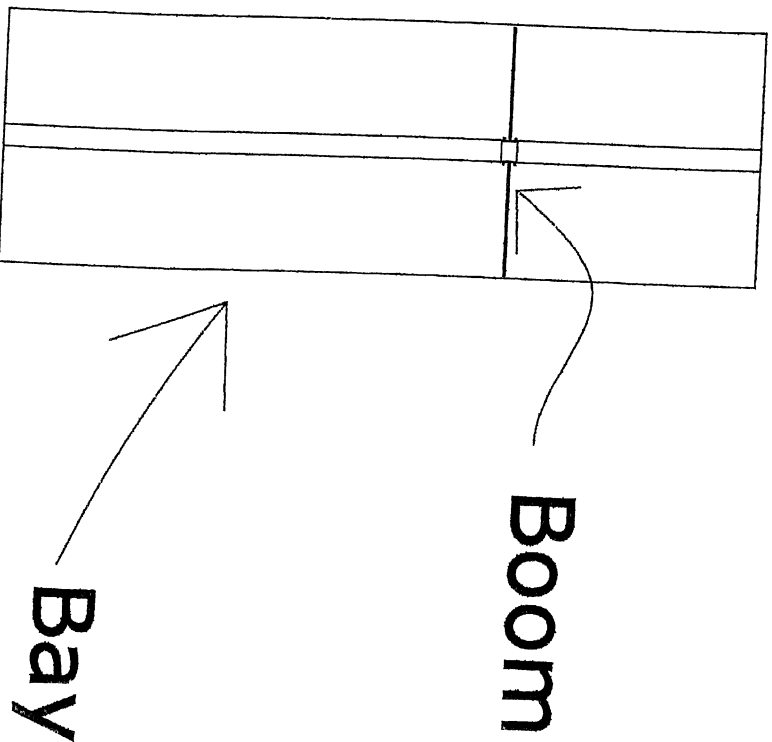
APPENDIX 6: BAY LAYOUT

For the purposes of this manual, and in terms of boom control, a Bay is an area in a greenhouse assigned to one boom.

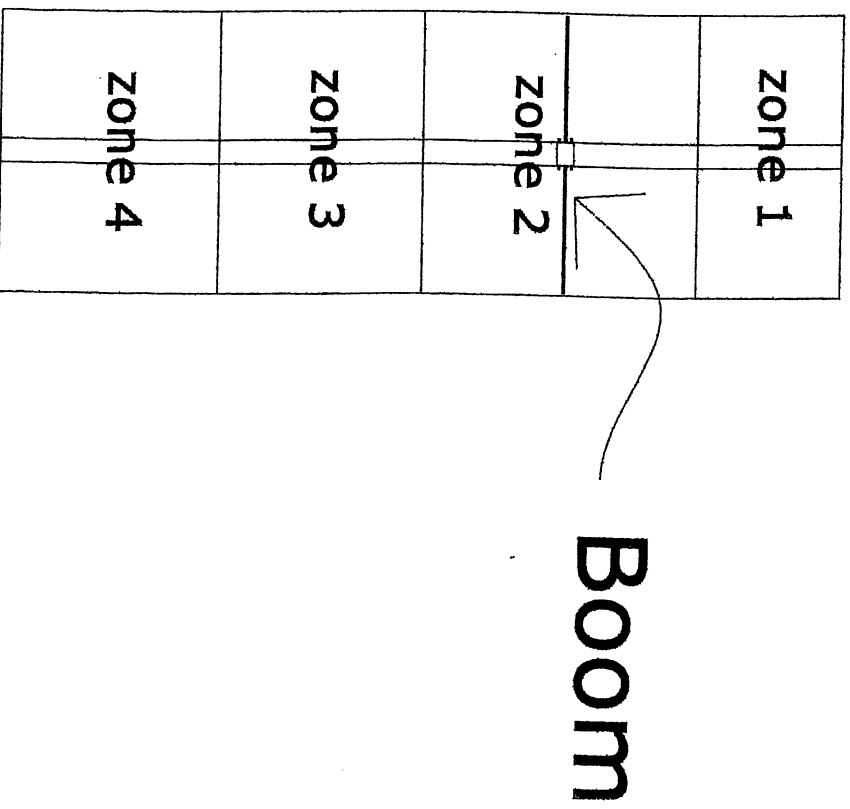
Figure 22



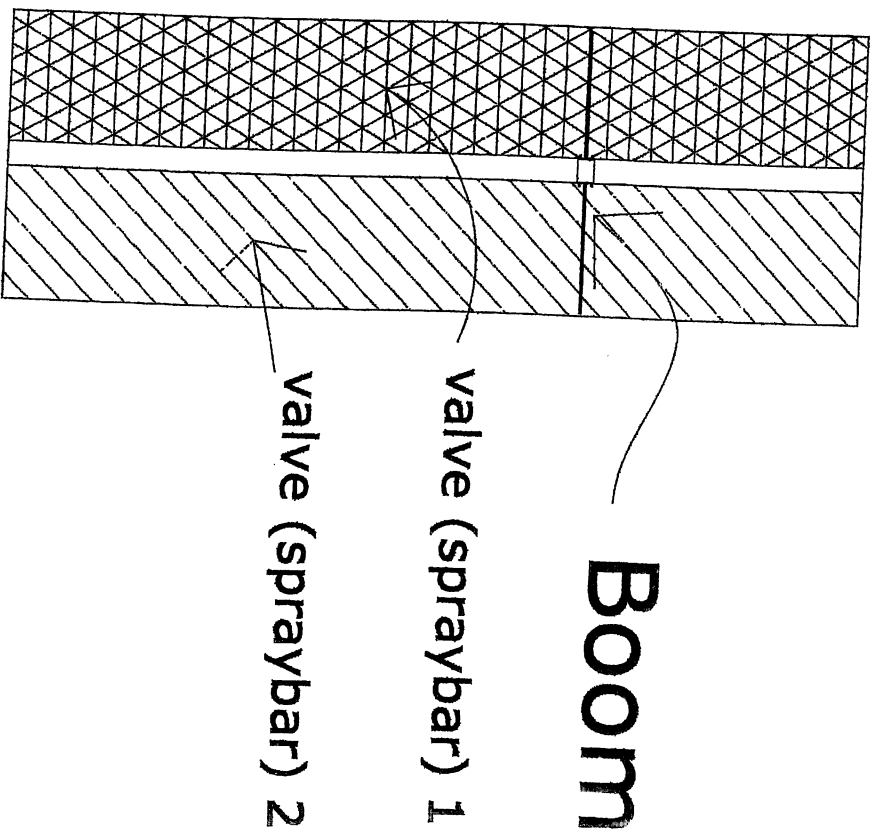
In this manual, a boom and bay are symbolized in the following manner:



A Bay may be divided widthwise into Zones, delineated by rail magnets.



A bay may be divided lengthwise into Spray Bars (actually the area that a spray bar waters), which are also called valves, because one valve controls each spraybar.



Note: You may have more than one spray bar positioned to water the same area. This is useful if you want to mist and water crops in the same spray bar area (i.e. in different zones in that spray bar area)

Together, Zones and Spray Bars delineate Cells. A cell is the intersection of a Zone and a Valve (Spray Bar). A cell is the smallest unit of bay area.

Bay layout is similar to a coordinate system

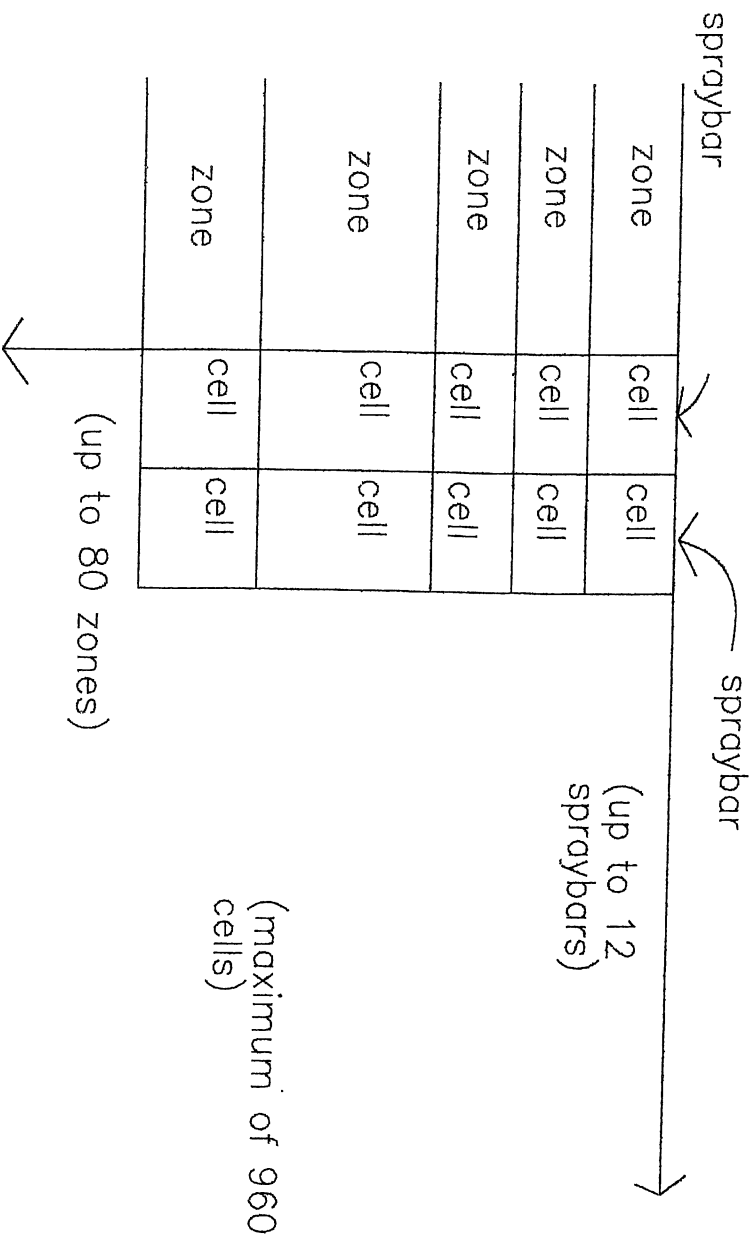
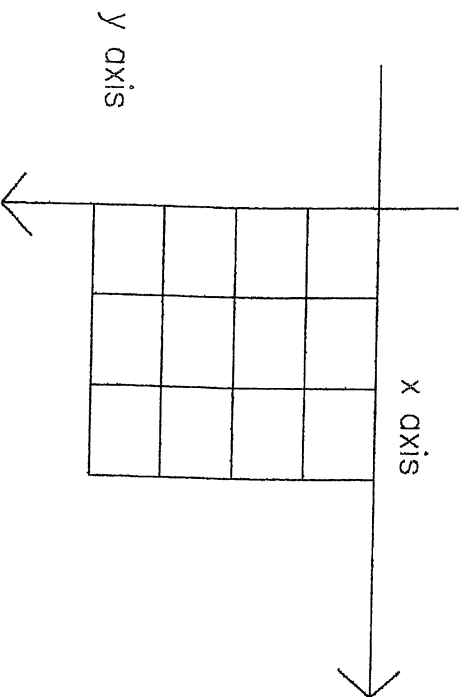


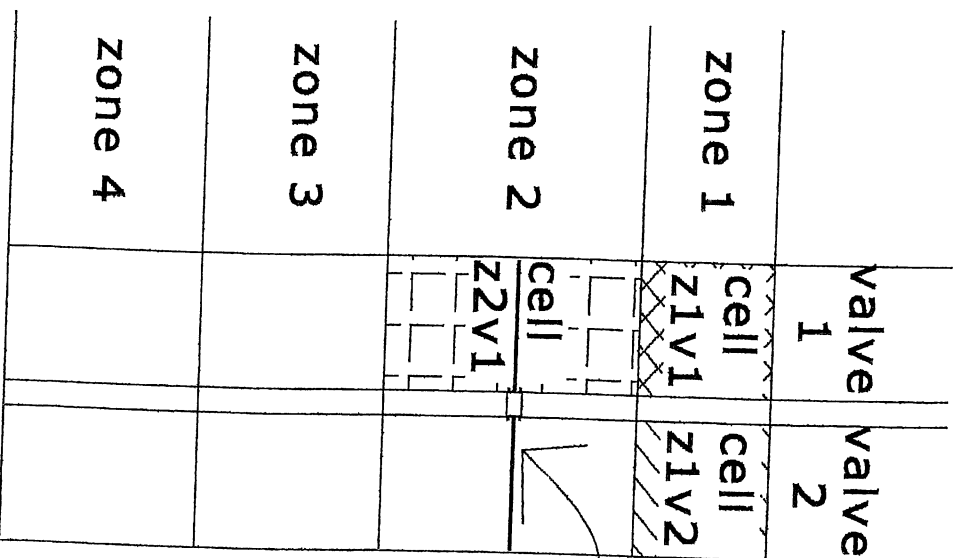
Figure 23—bay layout

Figure 24—coordinate visual aid

Figure 25— bay coordinate layout

Each cell has a (y) coordinate (zone number, e.g. z5) and(x) coordinate (valve number, e.g. v2) and when you assign a cell to a crop you must give both coordinates.

	1	2	3	4
1	1,1	1,2	1,3	1,4
2	2,1	2,2	2,3	2,4
3	3,1	3,2	3,3	3,4
4	4,1	4,2	4,3	4,4

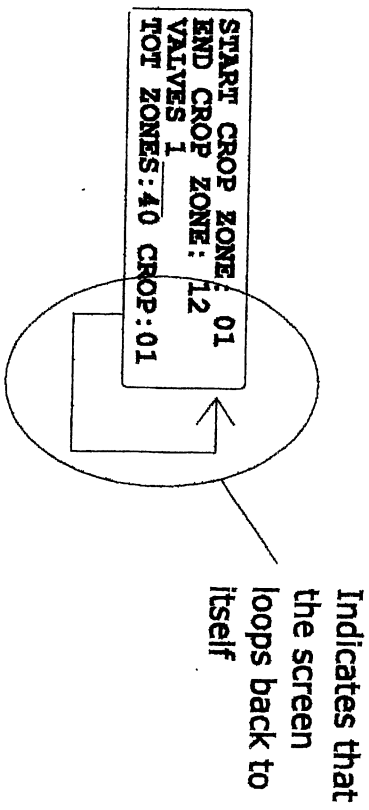
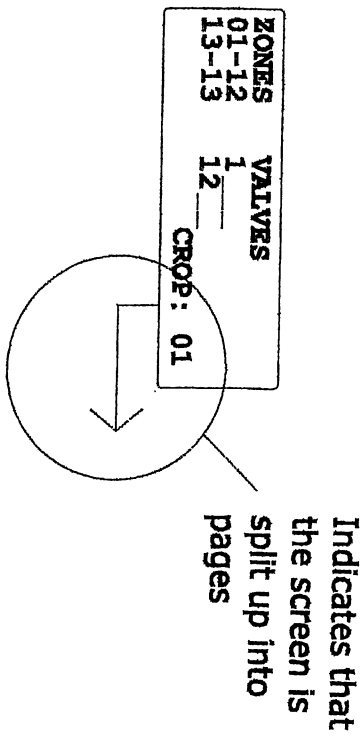


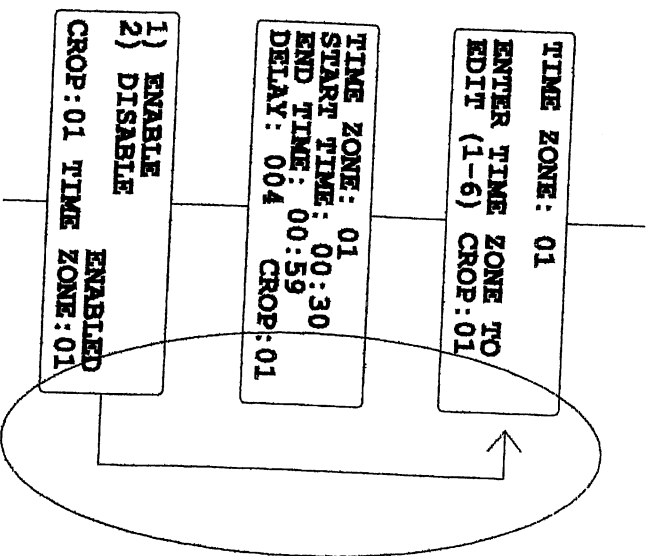
Boom

The way the boom bay coordinate system works is slightly different from a traditional cartesian coordinate system- there are no negative numbers, and the y coordinate (zone number) is featured first in the ordered pair, e.g. (z1, sb1) (see figures 11 & 12). The bay coordinate system is only intended to function as an aid to boom programming.

APPENDIX 7: SOFTWARE MAPS

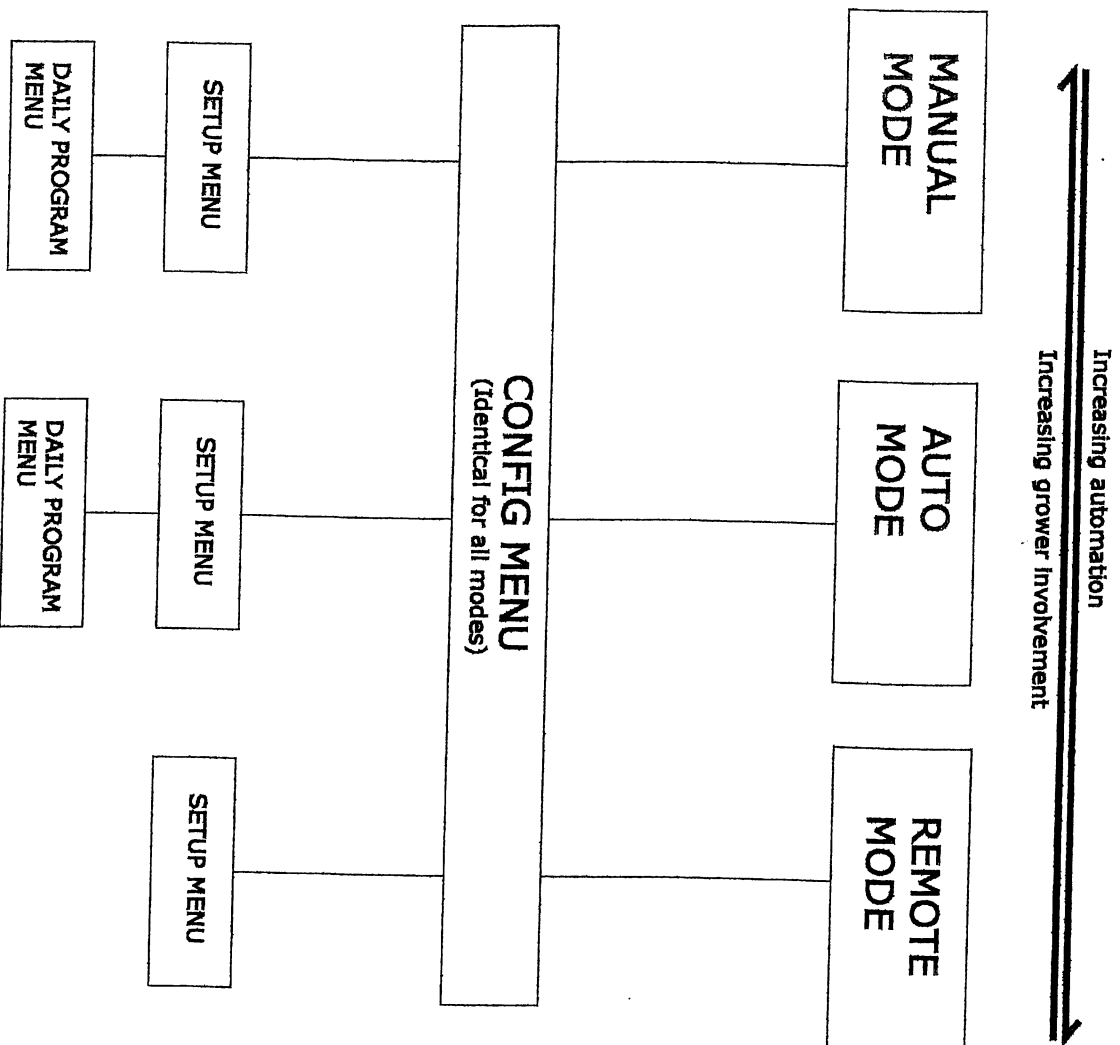
KEY





Indicates a screen loop which loops back from the screen at the tail end of the arrow to the screen at the head of the arrow.

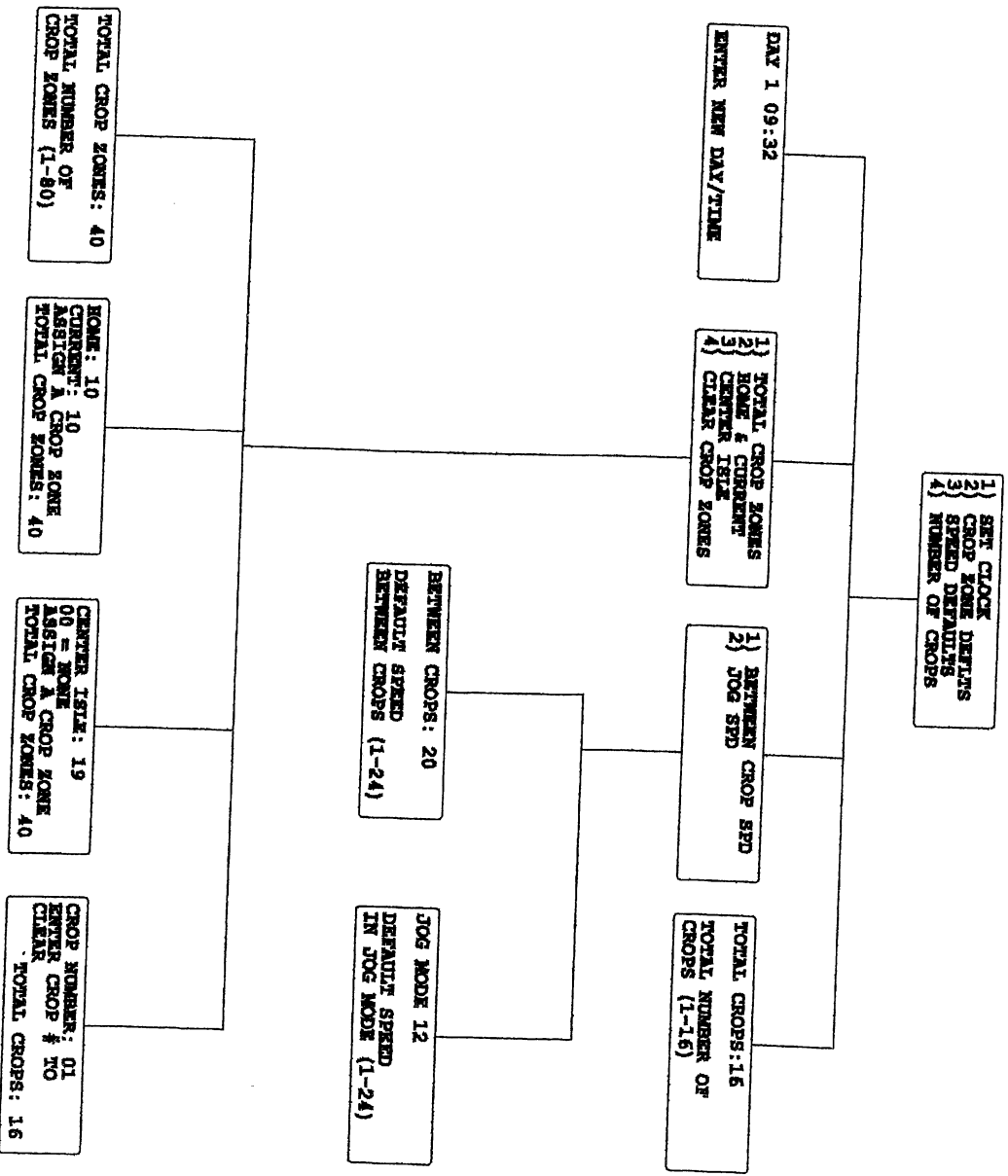
THE BIG PICTURE



Figures 28—The Big Picture

CONFIG

CONFIG MENU



MANUAL MODE

Setup

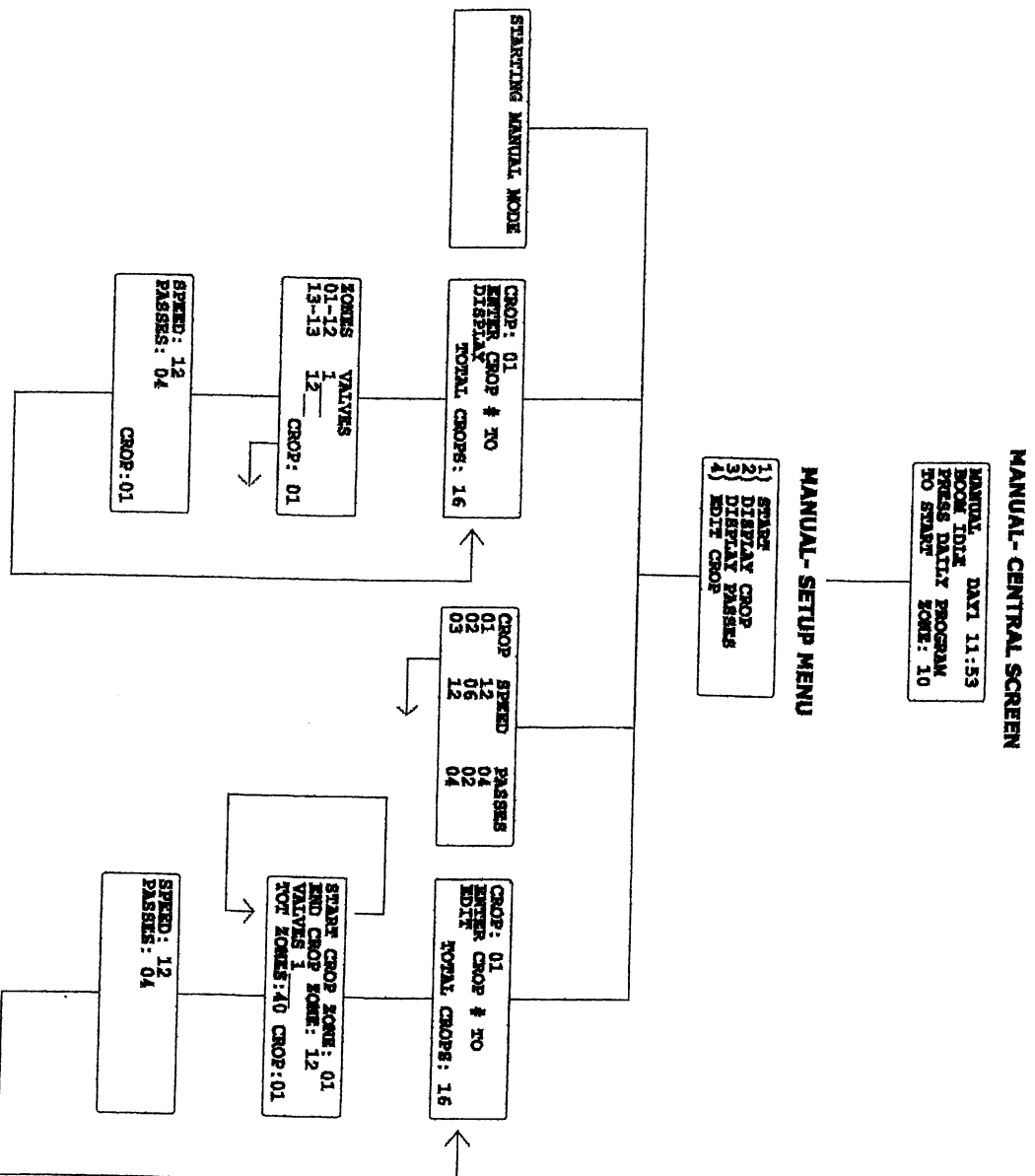


Figure 27 Manual: Setup Map

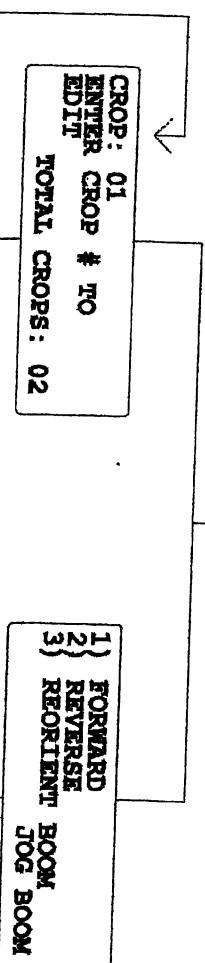
Daily Program

In Manual Mode, Daily Program merely starts the watering process set up in the Manual Mode Setup Menu.

MANUAL MODE: DAILY PROGRAM

(The most basic boom operation level available)

1) RUN QUICK PASS
2) JOG BOOM



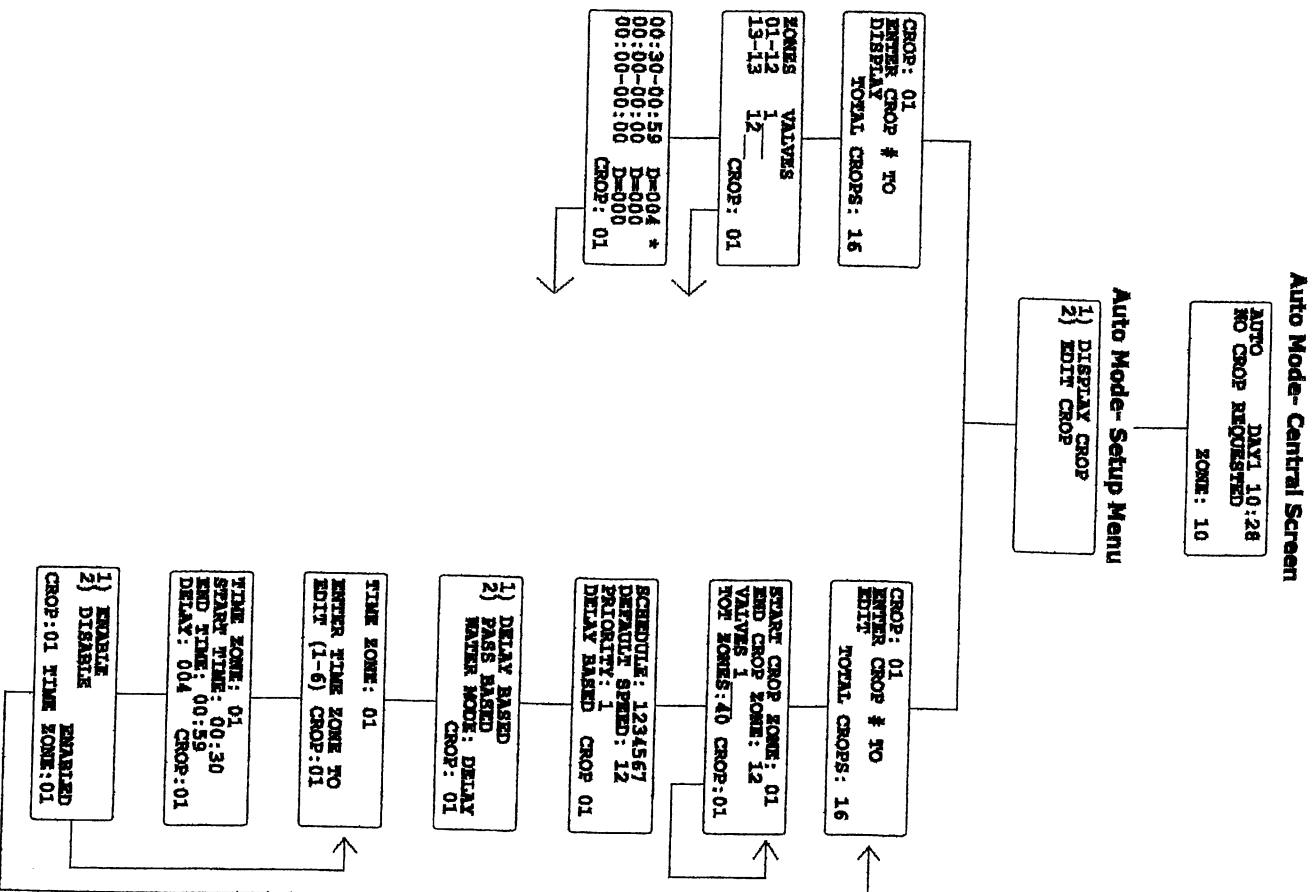
AUTO MODE

Setup

VALVES:
BOOM SPEED: 12
PRESS ENTER TO STOP

VALVES:
BOOM SPEED: 12
PRESS ENTER TO STOP

Position Recovery
Moving To Home Index



Daily Program

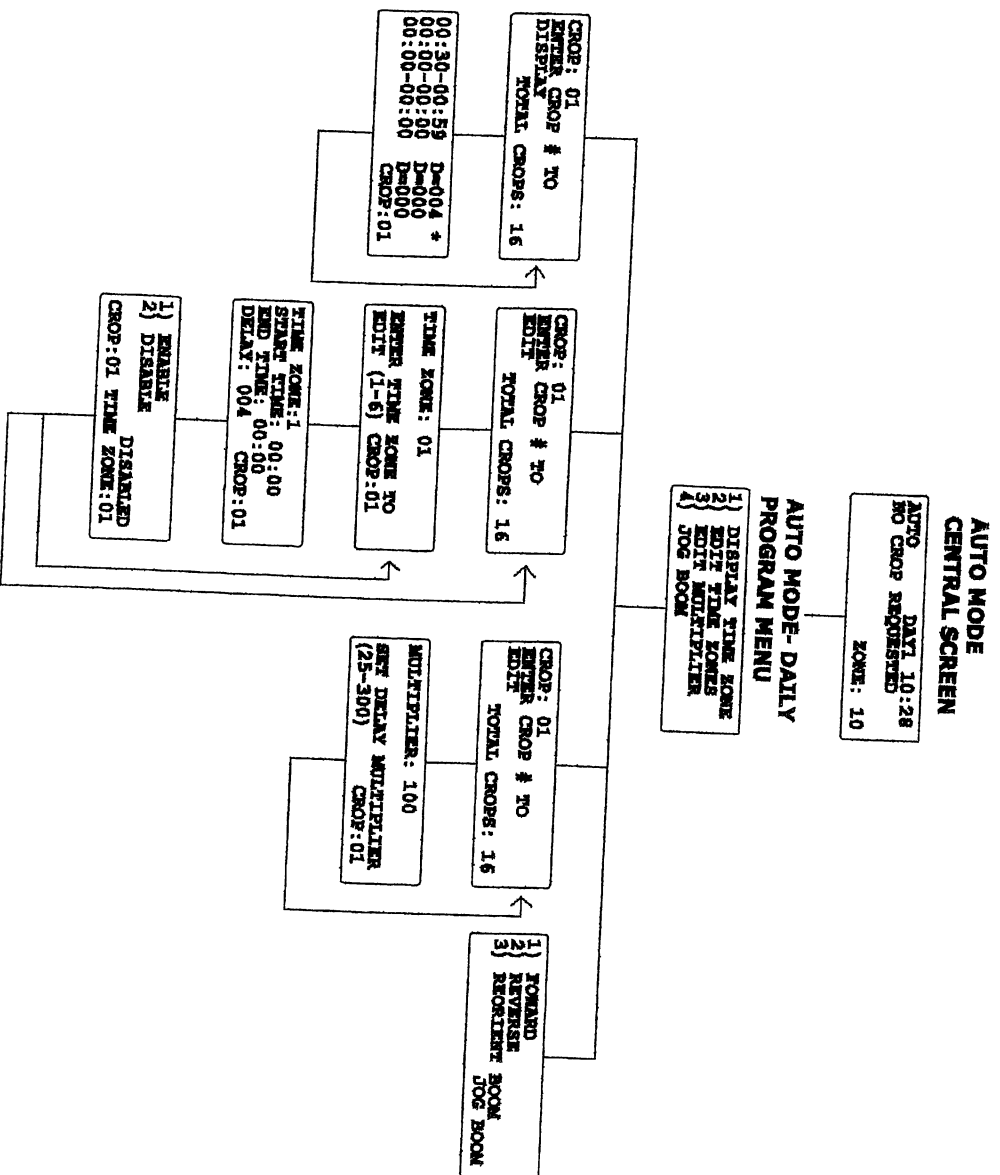
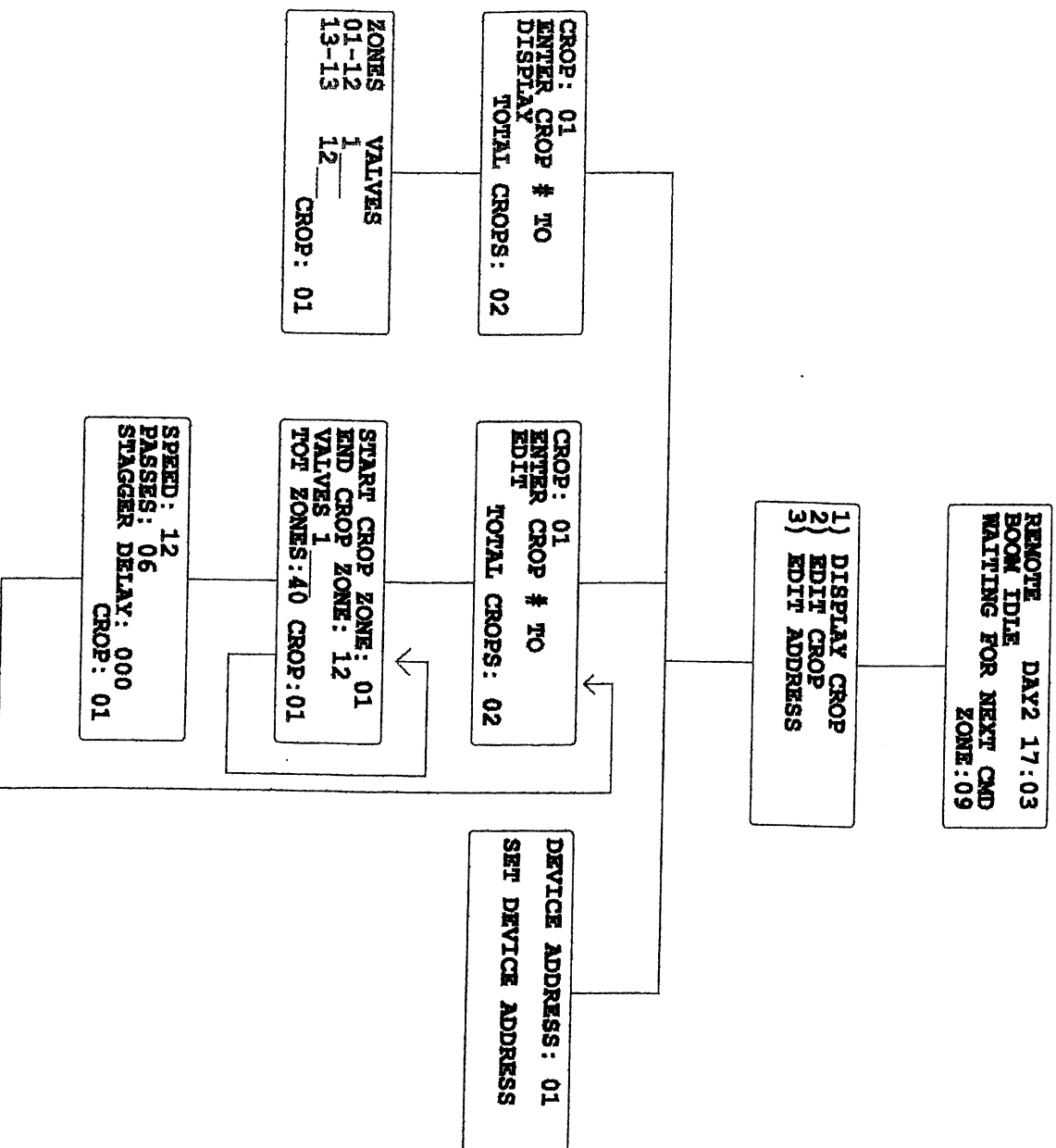


Figure 29--AUTO MODE-DAILY PROGRAM Software Map
REMOTE MODE



APPENDIX 8: THE F-1 KEY and VALVE DELAY

The F-1 key accesses the Valve Delay Screen

```

ENTER MIN VALVE
DELAY TIME: 0000
(120 TICKS/SEC)
  
```

from any of the modes' initial screens.

There's a time lag between when the boom orders the valves to open, and when the water starts spraying (or misting) out of the spraybars. If the boom had only one sensor, positioned exactly above

the spraybar, then the valves might receive the order to open exactly when the spraybar passed over the zone boundary, but the time lag would mean that some of the zone probably wouldn't get watered.

Now, it may seem that this difficulty is not entirely solved by having forward and reverse magnet sensors on the boom - and it isn't, without valve delay. Normally, with forward and reverse magnet sensors, you run the risk of starting irrigation too early, because the magnet sensor senses the magnet a while before the spraybar crosses the Crop Zone boundary. However, the Valve Delay function allows you to set a speed-calibrated delay between when the boom senses the magnet and when it turns on the valves, to cause the spray bars to start watering at the boundary.

GTT recommends a delay of 0070 for booms with the standard distance between crop zone magnets. A larger or smaller distance may require a modification of the delay setting.

APPENDIX 9: THE STATS MENU

The Stats Menu contains a record of what your boom is doing and what it has done since you last cleared the stats. To reach it, press



Viola!

1) STATISTICS
 2) CROP STATUS
 3) ERRORS
 4) CLR STATS/ERRORS

Option 1) ("STATISTICS") brings you here:

CROP	TIME	PASSES
01	00000	00000
02	00000	00000

This screen tells you 1) how much time the boom has spent actually physically watering/ misting each crop and 2) how many passes the boom has performed on each crop.

Option 2) ("CROP STATUS") brings you here

CROP	REMAIN	ZONE
01	D=000	T=01
02	P=003	T=02

This screen tells you 1) how many minutes of delay are left for your delay based crops or how many passes are still to be performed on your pass-based crops and 2) what time zone each crop is currently in.

Option 3:

SYSTEM ERRORS
INDEX ERRORS: 0
RECOVERY ERRORS: 1
PRESS ANY KEY

This screen tells you how many errors have occurred since you last cleared the stats.

There are two kinds of errors:

Index errors (the kind where the boom senses an out-of-bounds magnet and has to reset its 'mental' position in the bay to reflect the reality of being at the extreme end of the bay.

Recovery errors (where the boom has had to recover itself after a power outage)

Option 4:

STATS CLEARED

Clears all the stats, allowing them to begin accumulating all over again.

APPENDIX 10: THE "RESET ERROR" KEY

The "Reset Error" Key is shown below.



If the boom has a motion (spinning wheels) or collision error, it stops what it is doing (to avoid burning through wheels or crushing personnel). You have to give it permission (hopefully after you

solve the blockage or remove the obstacle, etc.) to start doing its normal routine again by pressing this button.

GTT CONTACT INFORMATION

For Customer Support, Contact GTT at:

(859) 626-3001

(859) 582-5202

GLOSSARY

alarm - a device which signals a problem in the network, calling the user at a specified number and/or signalling visually via the display.

bay - the area in a greenhouse assigned to a single boom

blank - a 'window' over a text character, or text space, which enables the end user to change the character/ fill in a character in that blank. Its presence over any letter/number is denoted by the flashing of that letter/number.

Boom - In the context of this manual, an automated, self propelled computerized irrigation machine, mounted on railings and having a spray bar (or number of spray bars) which it moves over crops in a direction perpendicular to the orientation of those spraybars.

cell - a rectangular subdivision of bay area (a 'plot') defined by the intersection of a zone and a spray bar domain.

center isle - a widthwise aisle containing no plants and cutting through a bay, which, if it is between zones, must be assigned a zone of its own.

character - the most general term for any single letter, number, or symbol represented on the GTT GO-1 Keypad

crop - in the context of this manual, a watering program that the grower creates, which may address the needs of a group of plants

crop zone - widthwise section of a bay

crop zone magnet - a magnet used to define the boundary between two crop zones

field - a region or rectangle within a screen, the contents of which may be changed in some fashion by the end user. (i.e. one may enter text)

home zone- the zone that the boom is programmed to stay in when it is not watering or en route to a watering job.

menu- a list of choices, usually relevant to one aspect of boom programming.

mode- 1) a way, or method, of boom operation 2) a set of screens which are constructed to be used in such a method (this last definition is the one usually denoted by 'mode' in this manual).

pass count- The number of times that the boom is to pass over the plants. This and the watering speed of the boom (the speed at which the boom is moving while it waters) are the main means of controlling the actual amount of water distributed to plants, since flow rate is more or less constant.

screen - a division of the software/ interface which usually has a single function and serves as a help to navigation.

screen loop- a series of screens which proceed from the selection of options on a list and which eventually bring the user back to that same list.

space- a specific part of a field capable of holding exactly one typed character

spray bar - a horizontal tube studded underneath with nozzles and blocked at one end, in which water enters through one end of the tube, and exits through the nozzles.

spray bar domain/"valve area"- a lengthwise section of the bay determined by the watering span of a particular spray bar

strictly numerical entry field- a field in which the user may 'type' only numbers

time zone- an interval of time between a start time and an end time, used to assign a boom different irrigation programs for different times of day.