SERIES SMC RATIO:FEEDER® CONTROLLER
WITH DUAL STROKING OPTION

Price $4.00

GETTING TECHNICAL ASSISTANCE

The H.E. Anderson Company is anxious to assist our customers with installation and use of our products. Our technical people are available each weekday from 8:30 a.m. to 4:30 p.m. central time. You may call us toll free at **1-800-331-9620** from anywhere in the U.S.A. and Canada. If no one is available, we will promptly return your call.

Before you call, we suggest that you review this manual. You may find the answer to your question there. But even if you do not, reviewing the manual will help us to help you.

There is some information you should have available when you call. You should know the version number of your controller program. Section 5.1, page 5-1 tells how to find the version number. You should also write down the current settings of your controller, PPS, FEED RATIO, and MAX FLOW. Also, you should note the number of pumpheads of each type, and their model numbers. We may not need all this information, but having it available at the start can sometimes save a lot of time and trouble for you. You can record these settings below for easy reference.

EC PPS SETTING (KEY 6, THEN 4)

____ ____ ____ ____

EC FEED RATIO (FR) DISPLAY (KEY 3, THEN 4)

____ ____ ____ ____

pH PPS SETTING (KEY 6, THEN 5)

____ ____ ____ ____

pH FEED RATIO (FR) DISPLAY (KEY 3, THEN 5)

____ ____ ____ ____

MAX FLOW SETTING (KEY 9)

____ ____ ____ ____

C O N T E N T S

F I G U R E S

SERIES SMC RATIO:FEEDER®

MICROPROCESSOR INJECTOR CONTROLLER

1 INTRODUCTION

This manual covers only the electronic injector controller. You should have separate manual(s) which cover other system components.

The Series SMC metering pump controller uses the latest in microcontroller technology to provide you with the most advanced controller available. It is specifically designed to work with Anderson Ratio:Feeder® multi-head injectors.

This controller is programmed to work only with the flow measuring device supplied with your system. The flow measuring device can be a turbine meter or other device which supplies a pulse output proportional to water flow.

It is designed to be easy to use. It has security features which can protect against accidental changes or tampering.

You do not need to read this entire manual. However, there is some information which you should read. You will need it to set up the controller for your particular installation. Once this is done, you will not have to refer to the manual unless you need to make changes which are beyond the scope of the front panel instructions.

Read the following section which describes the features available in your controller. You should also read Chapter 2 INSTALLATION. Once the controller is installed you will need to read Chapter 3 to learn how to progrm the unit..

You will also want to read Section 3.4 USING THE FLOW ALARM to see how and if you want to use this feature. Other sections cover optional features. You need to read these only if you want to use those specific features.

It is a good idea to familiarize yourself with Chapter 4 TESTING AND TROUBLESHOOTING. This will show you how to determine that your controller is operating properly and alert you to possible problems.

1.1 FEATURES

The controller has several built-in features which make it very flexible. We will summarize them here. Some of them will be covered in greater detail under specific headings for each feature.

1.1.1 Independent Fertilizer and Acid Feed

This controller can independently control fertilizer feed and acid/base feed. The controller can control up to three pumphead manifolds to feed fertilizers. Each of these manifolds can have multiple pumpeads. In addition, a fourth manifold can independently control an acid, base, or other chemical(s) which needs to be independent of the others.

1.1.2 Display

The controller has a four digit LCD display. Normally this display displays the water flow rate in gallons per minute. If no water is flowing it will display **OFF**. It can also display flow totals, programming settings, and alarm indications.

There are two built-in totalizers; one is resettable. Both are eight digits and can totalize up to 99,999,990 gallons. Either can be displayed four digits at a time on the LCD display by using the key pad.

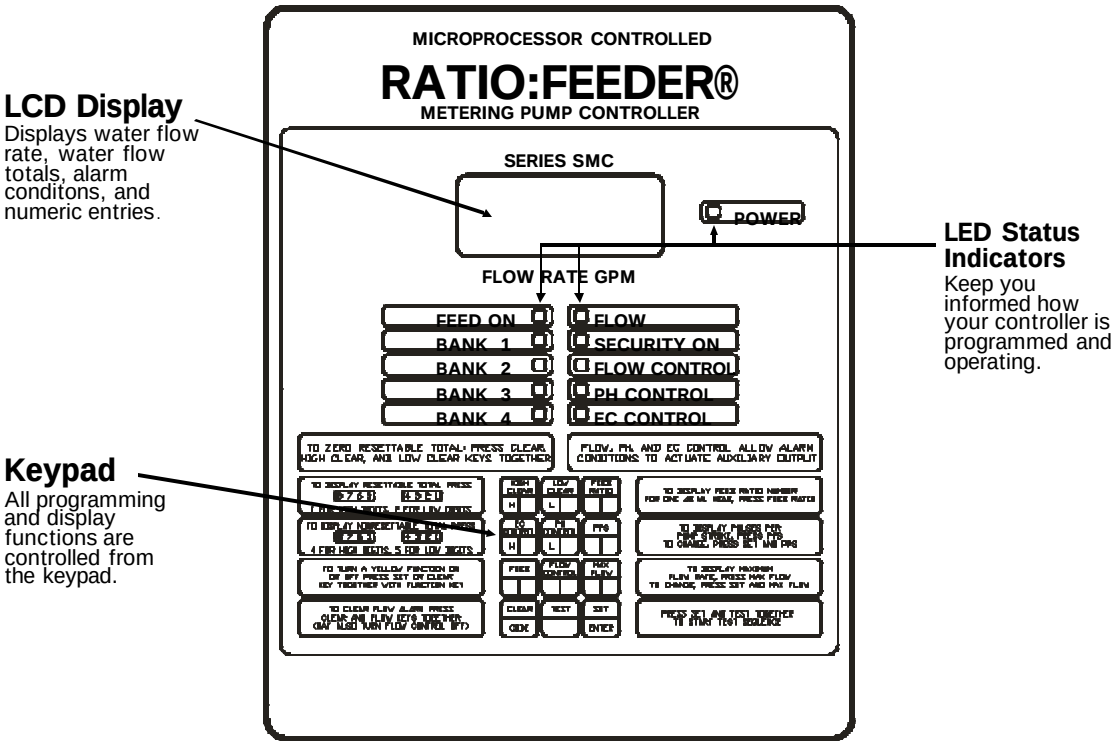


Figure 1-1
The Controller Front Panel

1.1.3 Flow Alarm

There is a built in high flow alarm; its use is op tional. An alarm con di tion will sound the built-in au di ble alarm. Using the alarm is covered in detail later. The three alarm con di tions are high flow, pH, and EC. The display will show **FLO**, When there is a flow alarm condition. This displays will alternate with the flow rate display about every two seconds. *NOTE: If there is very lit tle or no wa ter flow ing the dis play may up date ev ery four or six seconds.*

High flow is an in ter nal alarm gen er ated by the controller if it detects water flow greater than the MAX FLOW setpoint.

1.1.4 Feed Control

You may turn off all chem i cal feed at any time from the front panel. Turn ing off chem i cal feed does not affect the alarm or flow totalizing func tions.

Turning off chemical feed will suspend automatic control until feed is turned back on.

1.1.5 Auxiliary Output

There is an auxiliary 24 VAC output which can be used to drive an external device. This could be a re mote alarm, or a re lay to shut down the watering system if a flow alarm oc curs.

1.1.6 Security

The controller has a built-in security function. Its use is optional. The controller can be made se cure at any time by en ter ing a four digit se cu rity code. Any time af ter that programming functions will be protected from changes, un less the con trol ler is de-secured by re en ter ing the code.

1.1.7 Test Sequence

There is also a test func tion. This al lows quick de ter mi na tion of proper op er a tion and

helps pin point prob lems. The many LED in di-ca tors also pro vide vi sual in di ca tion of proper operation.

1.1.8 Battery Back-Up

The con trol ler mem ory is backed up by a long life lith ium bat tery. If power is lost, flow totalizing and chem i cal feed will stop, but all pro gram ming in for ma tion and flow to tals will be re tained. When power is re stored the unit will start func tion ing ex actly as when power was lost.

If for some reason the battery fails or is re moved when power is off the con trol ler will de tect the loss of mem ory and will force the user to en ter a new PPS set ting upon power up. All other pro gram ming set tings, in clud ing se cu rity code will also be lost and must be re-entered.

1.1.9 Circuit Protection

The controller includes some protection against external voltage spikes and other problems. However we cannot guarantee that it will be pro tected from all the strange things that happen in the real world. You should fol low the rec om men da tions given in Sec tion 2.4 to pro vide max i mum pro tec tion of your in vest ment.

2 INSTALLATION

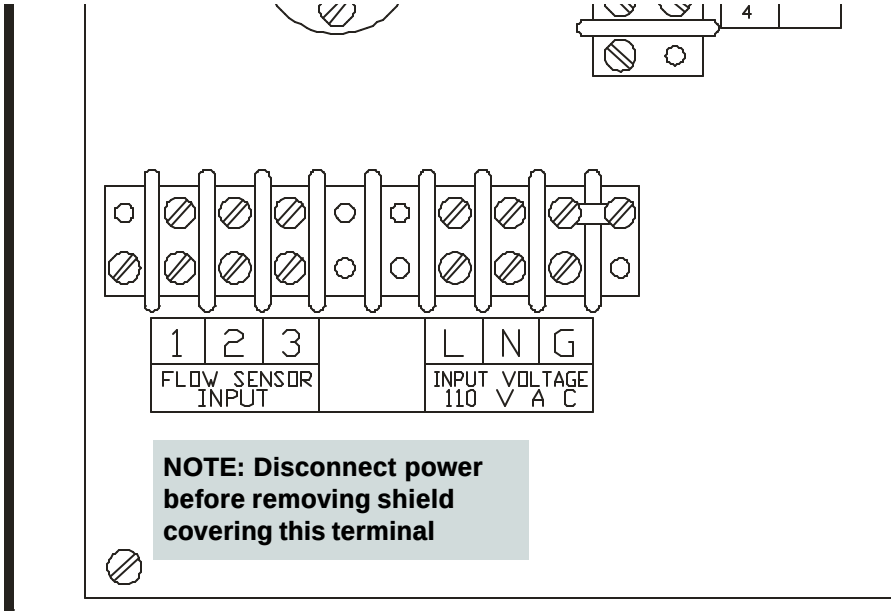


Figure 2-1
Power and Flow Device Connections

2.1 MOUNTING

Mounting for this unit is very flexible. There are a few simple things to consider when selecting a location:

(1) Select a location close to a power source and close to the flow measuring device and manifold valves. We recommend the total cable length between flow device and controller not exceed twenty feet.

(2) The location should be out of direct sunlight, be protected from extreme heat, and be free of vibration.

(3) The enclosure is water resistant and the unit is well sealed against water spray. However, you should choose a location where it will not be subjected to constant water spray or spray from the bottom.

Mount the unit securely, using the four holes located on the upper and lower flanges.

2.2 ELECTRICAL CONNECTIONS

NOTE: All electrical connections should be made before power is applied.

2.2.1 Power Connections

If your controller comes wired for 120 VAC operation, you normally will not have to make any power connections. Simply plug the unit into a grounded AC receptacle.

If you need to have your connections in conduit, you will have to disconnect the AC power cord from the power terminal block. Refer to Figure 2-1. for power connections. You must remove the terminal block shield to expose the connections. You should have a qualified electrician remove the cord and make the following connections:

(1) Remove the terminal block shield.

(2) Remove the line cord bushing and replace with a conduit connector.

(2) Connect the ground wire to terminal **G**.

(3) Connect line neutral to **N**.

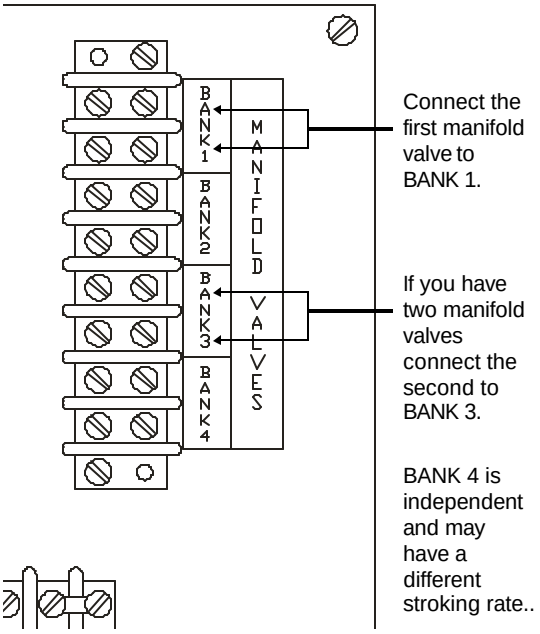


Figure 2-2
Manifold Valve Connections

(4) Connect the hot line connection to **L**.

(5) Replace the terminal block shield.

2.2.2 Flow Measuring Device Connections

(1) Connect the shield to terminal **1**.

(2) Connect the black wire to **2**.

(3) Connect the red wire to **3**.

NOTE: We recommend that the controller and flow measuring device be no further apart than is allowed by the cable supplied with the unit. If more distance is absloutely necessary, be sure to use shielded cable for the extension. DO NOT RUN THIS CABLE IN THE SAME CONDUIT WITH THE MANIFOLD VALVE CABLES.

2.2.3 Manifold Valve Connections

The manifold valve terminal block is located on the upper right of the panel mounted to the rear of the enclosure. The valve outputs are 24 VAC. Valve coil ratings should be 30 Volt-Amps. or less.

Refer to Figure 2-2. for valve connections. You may connect up to four manifold valves to the controller. Banks 1 through 3 are for fertilizer and all operate at the same pumping rate. Valve operation is staged: that is only one valve is actuated at a time. This provides better performance and chemical blending. **BANK 4** is independent and may have a different stroking rate.

If you have only a single manifold, connect the valve to **BANK 1** on the terminal block. If you have two fertilizer manifolds, connect the second valve to **BANK 3**. This will allow the second manifold to make pump strokes exactly in between the first. A third and fertilizer valve may be connected to **BANK 2**.

2.2.4 Auxiliary Control Output

The auxiliary control output connections are the top two connections on the terminal block located in the upper right corner of the main circuit board. They are labeled "CONTROL OUTPUT 24 VAC."

It is activated by the high flow alarm. It is rated at 24 VAC @ 1 Amp. This output can be used to control a relay, valve, or external alarm. Section 3.6 tells more about how to use the auxiliary control output.

2.3 CIRCUIT PROTECTION

We have done our best to design this product to stand up to adverse electrical supplies. The circuit is fused and we have included MOV devices to suppress voltage spikes coming in over the AC line. However, MOV's cannot protect under all conditions and do not last forever. Each time the MOV takes a rally big spike it is damaged a little. After enough spikes it will fail.

For the best protection you should buy a spike suppressor (you can get them at Radio Shack). This device goes between the line cord and wall socket. If you have a big storm that damages any of your other equipment, you should replace your spike suppressor; it may have been damaged by the storm even though it may appear to be OK.

3 PROGRAMMING & KEYPAD FUNCTIONS

All programming and display functions are con trolled from the key pad. This sec tion de scribes in de tail how to use each func tion.

Once you have fully programmed the con trol ler you may want to use the se cu rity function to protect against unauthorized or accidental changes.

Dual Output (Dual PPS) Option

This option provides two independent output stroking rates which permits widely different feed ratios for different solutions. For ex am ple: high feed for nu tri ent so lu tions and low feed for acid or chlorine. Banks 1,2,& 3 all stroke at the same rate, al though strok ing is stag gered. Bank 4 can stroke at a different rate. If you have this options, the unit will dis play **EorP** any time the **FR** or **PPS** keys are pressed

3.1 SETTING THE FEED

One of the best fea tures of the controller is the ease with which you can control and op ti mize the chem i cal feed for your par tic u lar cir cum stances. We will show you two dif ferent methods of custom programming your controller. They are: (1) Programming for a spe cific max i mum flow and (2) Pro gramming for a spe cific feed ra tio. See AP PEN DIX B. for some useful feed ratio formulas and ex amples.

Fig ure 3-1. shows how to en ter new PPS values and display the PPS, FR and MAX FLOW val ues. En tering a PPS value is a three step process. First Press the SET and then the PPS key. *NOTE: The SET key must be pressed first and must re main pressed when you press the PPS key. The dis play will show* **EorP***, and waits for the next in put. Now press either the* **4** *key to access the settings for banks(man i folds) 1,2, & 3, or the* **5** *key to access the set tings for bank 4. The fi nal step is to en ter a new PPS value.*

When entering the PPS, the dis play will dis play **––––** and the alarm will sound. En ter the new value and press the SET/ENTER key. The alarm should stop sounding. You may abort an en try by press ing the CLEAR key before all four digits are entered.

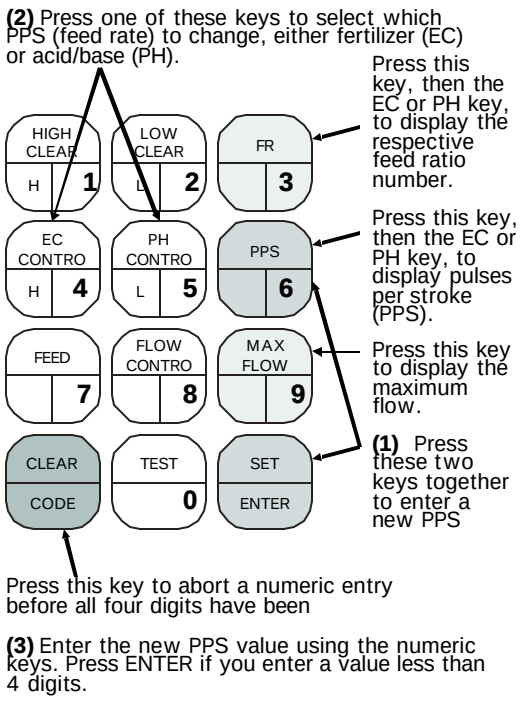


Figure 3-1
Setting PPS to Adjust Feed

3.2 MANUAL PROGRAMMING OF FERTILIZER FEED

The following sections on programming pertain only for manually programming the fer til izer feed. When set ting the in de pend ent acid/base feed, you should adjust the PPS and pumphead set tings for op ti mum strok ing rate and stroke capacity to achieve the desired pH.

3.2.1 Programming for Your Maximum Flow

In most irrigation systems the highest flow will be less than the maximum rated

flow of the unit. If this is your case, you may reset the pulses per stroke to correspond to a lower maximum flow.

There are good reasons for doing this. It increases the feed capacity of your injector. This may allow you to feed a given chemical with fewer pumpheads. Or you may be able to mix your fertilizer at lower concentrations for easier dissolving. It also maximizes the feed pulse rate for better mixing.

You may already know the maximum flow of your irrigation system. If you do not, you can measure it with the controller. Simply turn on the maximum amount of water you will ever need and read the flow on the display. Of course you will have to have your unit installed to do this.

We suggest that you program your controller for a maximum flow about ten per cent above the maximum you will normally have. This allows for flow variations due to changes in pressure, or other factors.

Once you have determined the maximum flow it is easy to program the controller.

You need to find the PPS (pulses per pump stroke) value to enter. There are two methods to do this: trial and error, simple mathematics, or a combination of the two.

Start by referring to APPENDIX A. for the specifications for your model. Figure 3-1. shows how to display and change the values.

Enter the PPS value given in the chart and then display the MAX FLOW value; it should equal the value in the chart. Now you can determine a new value of PPS for your lower maximum flow.

We will cover the mathematical method first.

Mathematical Method

Display the PPS value. Now display the current MAX FLOW value. You may compute a new PPS value for your maximum flow by using the following equation:

$$\text{New PPS} = \frac{\text{New MAX FLOW} \times \text{Current PPS}}{\text{Current MAX FLOW}}$$

The PPS value is directly proportional to the MAX FLOW value; this makes computations very easy.

Round off your answer to the nearest integer and enter that PPS value into the controller. Now display MAX FLOW. This value may not exactly match the value you used in the computation, but it should be very close. Differences are due to rounding off the PPS value.

Now display FR (feed ratio number). This is the new value you should use when computing all your chemical concentrations.

Trial and Error Method

Display the PPS value. Now display the current MAX FLOW value. Enter a lower value for PPS and display the resulting MAX FLOW. If the new value for MAX FLOW is too low, then enter little tle higher value for PPS; if MAX FLOW is too high, enter a little lower value for PPS. Repeat until you determine the value of PPS which gives MAX FLOW closest to the value you want. You will probably not be able to get the desired value exactly.

Now display FR (feed ratio number). This is the new value you should use when computing all your chemical concentrations.

3.2.2 Programming for Feed Ratio

You might want to set your controller to pump at a specific feed ratio. The controller makes it very easy to change the feed ratio by displaying the feed ratio number (FR) for a single high capacity (40 ml per stroke) pump-head.

First, you need to know the overall value of FR you want. Multiply that value by the number of heads you will be using to pump the chemical. This gives you the FR value you will want to set in the controller.

Example: You want to use three pumpheads to feed at an overall feed ratio of 1:200. Multiply 3 x 200 to get the FR value of 600 for a single pumphead. This is the value (600) that you should use in the computations.

Now you need to determine the PPS (pulses per pump stroke) value to enter to give that value of FR. There are two methods to do this: trial and error, simple mathematics, or a combination of the two.

Start by referring to Appendix A. for the specifications for your model. Refer to Figure 3-1. to see how to display and change the values.

Enter the PPS value given in the chart and then display the FR value; it should equal the value in the chart. Now you can determine a new value of PPS for the FR you want.

We will cover the mathematical method first.

Mathematical Method

Display the PPS value. Now display the current FR value. You may compute a new PPS value for your FR by using the following equation:

$$\text{New PPS} = \frac{\text{New FR x Current PPS}}{\text{Current FR}}$$

The PPS value is directly proportional to the FR value; this makes computations very easy.

Round off your answer to the nearest integer and enter that PPS value into the controller. Now display FR.

Trial and Error Method

Display the PPS value. Now display the current FR value. Remember that higher values for PPS mean higher FR values. Enter a higher or lower value for PPS and display the resulting FR. If the new value for FR is too low, then enter little higher value for PPS; if FR is too high, enter a little lower value. Repeat until you find the value of PPS which gives FR closest to the value you want; you probably will not be able to get exactly the value you want.

3.2.3 Using the Results

You will probably find that you cannot get the exact feed ratio you want, but you should be able to get close enough to use an even value in computations. For example you might be able to get FR values of 396 or 404, but not exactly 400. This depends on the pulses per gallon figure for your flow measuring device. In general, the larger the value of FR, the closer to the desired value you will be able to get.

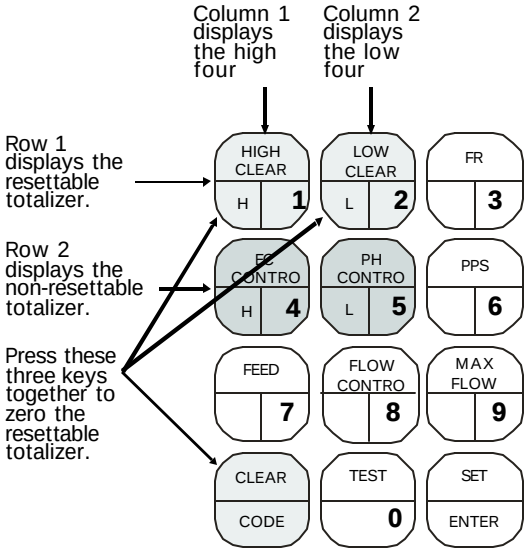


Figure 3-2
Using the Totalizers

Now display MAX FLOW. If this value is less than the maximum flow in your system, you have a conflict. You must either restrict your maximum flow to the value shown or increase the chemical capacity in another way; usually by increasing chemical concentration or by adding pump-heads.

3.3 THE FLOW TOTALIZERS

The controller has two flow totalizers. One is resettable. Both are eight digits, so each can totalize up to 99,999,990 gallons. Both totalizers increment ten gallons at a time. Since there are only four digits on the display only half the digits can be displayed at a time.

Figure 3-2. shows how to access the totalizers and to zero the resettable total.

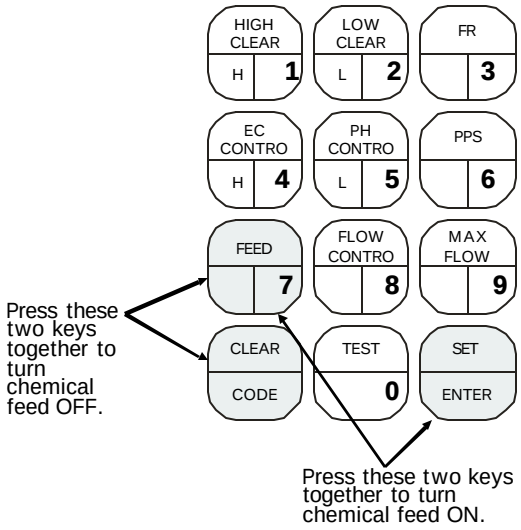
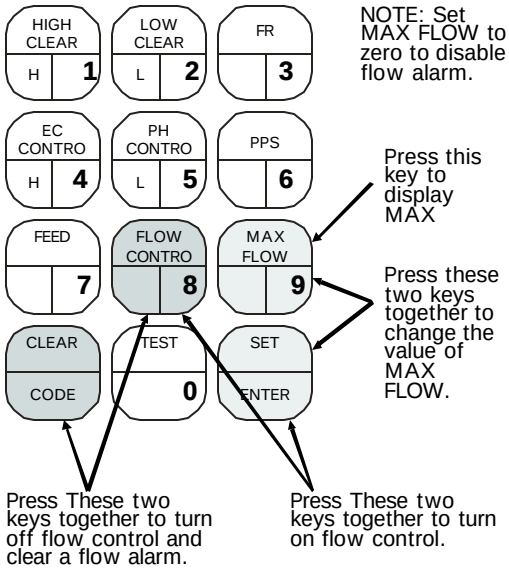


Figure 3-3
Turning Chemical Feed OFF and ON



NOTE: If security is off, clearing a flow alarm will turn flow control off. If you want flow control, you must turn it back on after clearing

Figure 3-4
Using the Flow Alarm

Flow to tals may be dis played at any time. However, the resettable total cannot be zeroed when se cu rity is on.

3.4 TURNING CHEMICAL FEED OFF AND ON

You can eas ily turn the chem i cal feed off and on from the front panel. This al lows you to stop feed ing with out shut ting off the water. Fig ure 3-3. shows how to turn chem i cal feed off and on. This function is protected and may not be changed when se cu rity is on.

3.5 USING THE FLOW ALARM

A unique fea ture of the con trol ler is the flow alarm. Its use is optional. The audible alarm can be used to alert you that you are ex ceed ing the ca pac ity of the in jec tor (which affects performance), or it could be used with the auxiliary control output (Section 3.6) to shut down the sys tem if a ma jor leak occurs.

Figure 3-4. shows how to set and clear the flow alarm.

The flow alarm will trigger any time the water flow exceeds the MAX FLOW setpoint. The audible alarm will sound and the dis play will dis play **FLO** al ter nately with the flow rate. This indicates the type of alarm.

The flow alarm will not reset if the flow later drops be low the setpoint. This is to prevent os cil la tion from oc cur ring if the aux il iary control is used to shut off the water. That would cause the alarm con di tion to go away which would turn the wa ter back on. We do not want that to happen.

NOTE: Clearing a flow alarm is not affected by security. However, if security is off, the key se quence which clears the flow alarm will also turn off flow control of the aux il iary out put. This will be in di cated by the sta tus LED. If you are us ing flow con trol, you must turn it back on. If security is on, flow control is not affected. See Section 3.6 to see how to use the auxiliary control.

Any time you en ter a new value for PPS the con trol ler au to mat i cally sets a new value

for MAX FLOW. This value is the flow at which the injector is making its maximum of thirty strokes per minute. You may change MAX FLOW if you want to, making it either higher or lower.

Figure 3-4. shows how to enter a new MAX FLOW value. When entering the MAX FLOW, the display will display **F–––** and the alarm will sound. Enter the number and press the SET/ENTER key. The alarm should stop sounding. You may abort an entry by pressing the CLEAR key before all four digits are entered.

But remember that if you change the PPS the controller will change MAX FLOW. You should check MAX FLOW any time you change the PPS and change MAX FLOW if needed.

You may disable the flow alarm by setting MAX FLOW to zero.

This function is protected and may not be changed when security is on.

3.6 USING THE AUXILIARY CONTROL OUTPUT

The auxiliary control output is a 24 VAC output. It can be actuated by the flow alarm.

Figure 3-4. (Previous page) shows how to turn this control function on and off.

When turning on this function, the LCD display will display **FL 1**. When turning off this function, the LCD display will display **FL 0**.

There are two special things to remember about flow control:

(1) If security is off, clearing a low alarm will also turn flow control off. If you are using flow control, you must turn it back on. If security is on, flow control status is unaffected.

(2) If the flow alarm is disabled by setting MAX FLOW to zero, flow control will automatically be turned off.

This function is protected; its status may not be changed when security is on.

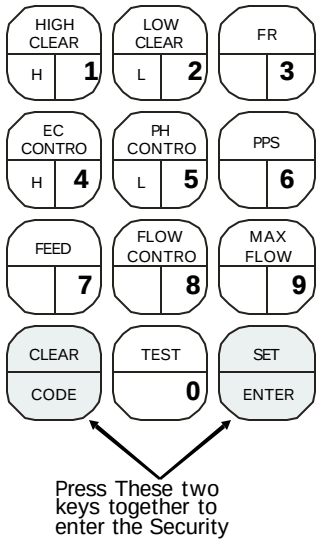


Figure 3-5
Entering the Security Code

3.7 USING THE SECURITY FEATURE

Use of the security feature is optional. When you receive your controller the security function is not active.

Figure 3-5. shows how to enter the security code.

3.7.1 Setting the Security Code

IMPORTANT - The first time you press the CODE-ENTER key combination the display will prompt by showing C---. You may enter up to four digits which will be displayed as you enter them. These four digits then become the code and the controller is set to the secured mode. Be sure you remember the code you enter or write it down and keep it in a safe place. You will not be able to make any programming changes without reentering this code.

The code may be one to four digits long. If less than four digits the SET/ENTER key must be pressed after code entry. A code value of 0 is not a valid code. You may abort an entry by pressing the CLEAR key before all four digits are entered.

You may confirm that security is on by observing the **SECURITY ON** LED on the front panel.

If you at tempt to make any pro gram ming change with se cu rity on, the dis play will dis play **COdE** and the alarm will make a short beep.

3.7.2 Turning Security OFF and ON

To turn security off reenter the security code ex actly as you en tered it the first time. The only dif fer ence is that the dis play will not show the numbers as entered. Instead the dashes will drop to the bot tom of the dis play as the num bers are en tered. Once you have en tered the code the alarm will stop sounding and the front panel LED will go off. You may now make any programming changes you wish.

If you en ter a wrong code the dis play will dis play **COdE** and the alarm will make a short beep.

You turn se cu rity back on ex actly as you turned it off. **You must turn se cu rity back on to re-se cure the sys tem.**

If you hap pen to for get the se cu rity code, it is pos si ble to clear the code from the system. This is covered in APPENDIX C.

4 TESTING AND TROUBLESHOOTING

We have designed and manufactured your controller to make it as trouble free as possible. By using the internal test program and by ob serv ing the front panel dis play and in di ca tors, you will be able to pin point many problems.

If you have a prob lem with your con troller, fol low through this sec tion. Then if you need tech ni cal as sis tance, re fer to the page GETTING TECHNICAL ASSISTANCE in the front of this man ual.

4.1 DISPLAYING THE VERSION NUMBER

When ever you call us we will ask you for the version number of your controller program. You may display the version at any time. Figure 4-1. shows how to display the program version number. Write it down exactly as displayed be fore you call.

4.2 OBSERVING THE INDICATORS

You can tell a lot about the operation of your con trol ler just by ob serv ing the LED in di ca tor lights. These in di ca tors, to gether with the test sequence (Section 5.3) will allow you to pin point most prob lems with the controller. They will also help identify many problems with the overall injection system. Here are some things to look for, along with what they mean.

4.2.1 The POWER Indicators

There are two power indicators. One is on the front panel. The other is on the lower right of the sys tem cir cuit board. You must open the en clo sure to see this LED in di ca tor.

NOTE: Dangerous voltages are present inside the enclosure. Use caution when opening the door or working inside. Except for check ing in com ing power, the unit should be disconnected from the power source when ever the door is open.

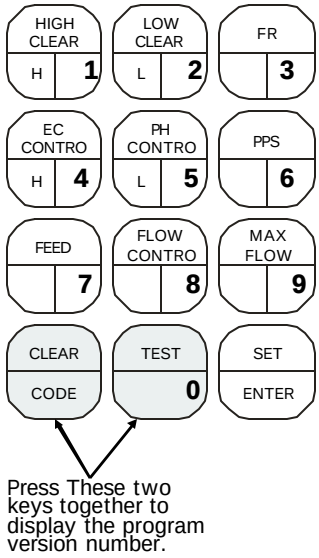


Figure 4-1
Displaying the Version Number

(1) *Front Panel POWER in di ca tor is OFF, in ter nal power in di ca tor is OFF.*

This means that there is no power to the sys tem cir cuit board. There is most likely a problem with the power to the board. Check the elec tri cal cir cuits and break ers to see that power is reach ing the con troller. If power is getting to the controller the problem is likely with the 24 volt transformer and connections. **These should be checked by a qual i fied elec trician.**

(2) *Front Panel POWER in di ca tor and dis play are OFF, in ter nal power in di ca tor is ON.*

This means the on board power supply has failed. The system circuit board needs to be replaced.

(3) *Front Panel POWER in di ca tor is OFF, but dis play is on.*

If there are any other in di ca tor lights on, or if there is any thing show ing on the display, the prob lem is most likely with the indicator LED itself. This should not af-

fect op er a tion. Fixing it re quires re place-ment of the sys tem cir cuit board.

4.2.2 The LCD Display

There should always be something show ing on the dis play. If the power in di ca-tor is on, but the display is blank, there is a problem with the system circuit board. It should be replaced.

4.2.3 The FEED ON Indicator

The FEED ON in di ca tor shows that chem-ical feed is turned on.

(1) *FEED ON in di ca tor is OFF, wa ter is flow-ing, BANK lights are always* **OFF***.*

You have prob a bly turned the feed OFF. Turn the feed back on. See Sec tion 3.3.

(2) *FEED ON in di ca tor is ON, wa ter is flow-ing, but BANK lights are always OFF.*

Run the TEST sequence. See Sections 5.3 and 5.3.3.

(3) *FEED ON in di ca tor is OFF, wa ter is flow-ing, BANK lights are flashing in se-quence.*

The prob lem is most likely with the FEED ON indicator LED itself. Check this by running the TEST sequence (Section 5.3). This should not affect operation. Fixing it re quires re place ment of the sys-tem cir cuit board.

4.2.4 The FLOW Indicator

This in di ca tor should be blink ing any time the water is flowing. This indicates pulses are be ing re ceived from the flow mea sur ing device.

(1) *Water is flowing but FLOW indicator is OFF. Dis play shows OFF.*

This indicates a problem with the flow measuring device or its connections to the controller. See the manual which covers this device for checking it. If it checks out OK there is a problem with the sys tem cir cuit board. It should be re-placed.

(2) *Wa ter is flow ing, dis play in di cates flow, FLOW in di ca tor is OFF.*

The problem is most likely with the FLOW in di ca tor LED it self. Check this by running the TEST sequence (Section 5.3.1). This should not af fect op er a tion. Fixing it re quires re place ment of the sys-tem cir cuit board.

4.2.5 The Flow Display

The flow rate dis play should nor mally be steady. There are sev eral pos si ble causes of erratic flow readings. If you are getting un-sta ble flow read ings or spu ri ous flow alarms, check the fol low ing.

(1) *Er ratic wa ter flow*

Check to make sure that water flow is stable and is not quickly varying due to pumps or valves be ing quickly turned on and off.

(2) *Improper ca ble or rout ing*

Only properly grounded shielded cable should be used to connect the flow de-vice to the controller. Unshielded cable can allow voltage spikes from motors and other electrical machinery to be fed into the controller. This cable should be routed away from valve and other elec tri-cal wir ing.

(3) *Ca ble too long*

The longer the cable between the flow device and controller the greater the chance of electrical noise problems. If your con trol ler is lo cated too far from the flow de vice, you may have to re lo cate it. We rec om mend the to tal ca ble length not ex ceed twenty feet.

(4) *Fouled flow mea sur ing de vice*

Trash in the water line can foul turbine meters and paddle wheels and cause them to stick. Rust and magnetic parti-cles can collect on magnetic paddle wheels, causing problems.

4.2.6 The BANK Indicators

The bank indicators flash when each manifold valve is energized. They should flash in se quence when wa ter is flow ing.

(1) *Water is flowing, BANK indicators always off, FEED ON indicator is OFF.*

The feed is turned OFF. Turn on the feed. See Section 3.3.

(2) *Water is flowing, BANK indicators always off, FEED ON indicator is ON.*

Run the TEST sequence. See Sections 5.3 and 5.3.3.

4.2.7 The CONTROL Indicators

Run the TEST sequence. See Sections 5.3 and 5.3.1. If they all light up during the test, you should be sure you are setting the control status properly. See Section 3.6.

4.3 THE TEST SEQUENCE

The test sequence may be run at any time. If you observe carefully while the test sequence runs, you can get a very good indication of the nature of any problems with your injection system. Following the test sequence, the controller is returned to its previous status, including any actuated alarms.

Figure 4-2. shows how to start the test sequence.

4.3.1 Display and Indicators

The first part of the test sequence checks out the LCD display, the LED status indicators. You should observe the following:

(1) The LCD display should display **8888**. If any segments are not on, there is a problem with the system circuit board. It should be replaced.

(2) The FEED ON, SECURITY ON, and the three control status indicators should all be on. If they are not, there is a problem with the system circuit board. It should be replaced.

4.3.2 Alarm and Control Test

The audible alarm and auxiliary control output are also checked during the first part of the test. Look for the following:

(1) The audible alarm should sound. If it does not, the alarm may be disconnected, or it has failed. It should be reconnected or replaced.

(2) The auxiliary control will be actuated. If you are not using this feature, this will not affect you. If you are, anything connected to this output will turn on for about two seconds.

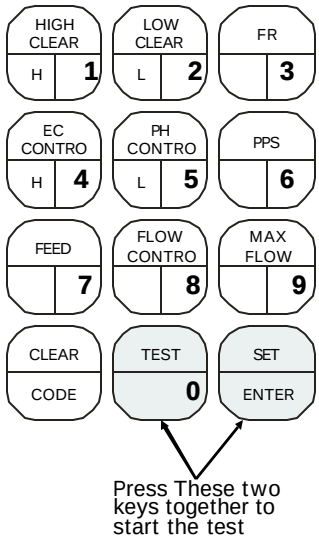


Figure 4-2
Starting the Test Sequence

4.3.3 The Valve Sequence

The second part of the test sequence actuates the valve outputs. Check to see that each BANK indicator lights in sequence. The display will show the number of each bank as the valve is actuated.

Check to see that each manifold valve in your injector is operating properly, If things are working properly, each bank of heads in your system will make a pump stroke.

If an indicator does not light and the corresponding bank of heads does not stroke, there is a problem with the system circuit board. It should be replaced.

If the indicators all work, but a manifold valve does not work properly, first check to see that the valve is getting the 24 VAC supply voltage. This voltage should be present

only when the bank in di ca tor for that valve is lit.

If the volt age is pres ent, there is a problem with the manifold valve. Problem areas could be the valve coil or the internal mechan i cal parts. For the lat ter, re fer to the user manual cov er ing me chan i cal main te nance.

NOTE: Re mem ber that the test se quence makes a pump stroke each time it is run. If no water is flow ing, run ning the test se quence several times in succession can flood your water lines with concentrated chemical. If water is flowing when the test is run, the stroking rate in the test sequence may be faster or slower than the current flow actuated stroking rate. In any case, running the test sequence may cause temporary vari a tions in pH and EC read ings.

4.4 LOSS OF PROGRAMMING

Loss of programming is indicated by an im me di ate alarm con di tion on power up and display of the **–– – –** prompt.

Only two things can cause loss of programming information: a faulty lithium battery or a failure on the system cir cuit board. Bat tery fail ure is far more likely.

Here is an easy test for a bad battery. When you get the alarm and **– – – –** prompt, program in any value for PPS. Now disconnect power from the controller. Wait a few sec onds and re con nect power. If the prompt reappears and the alarm sounds the battery is dead and should be replaced.

5 REPAIR

IMPORTANT: Disconnect power before removing circuit

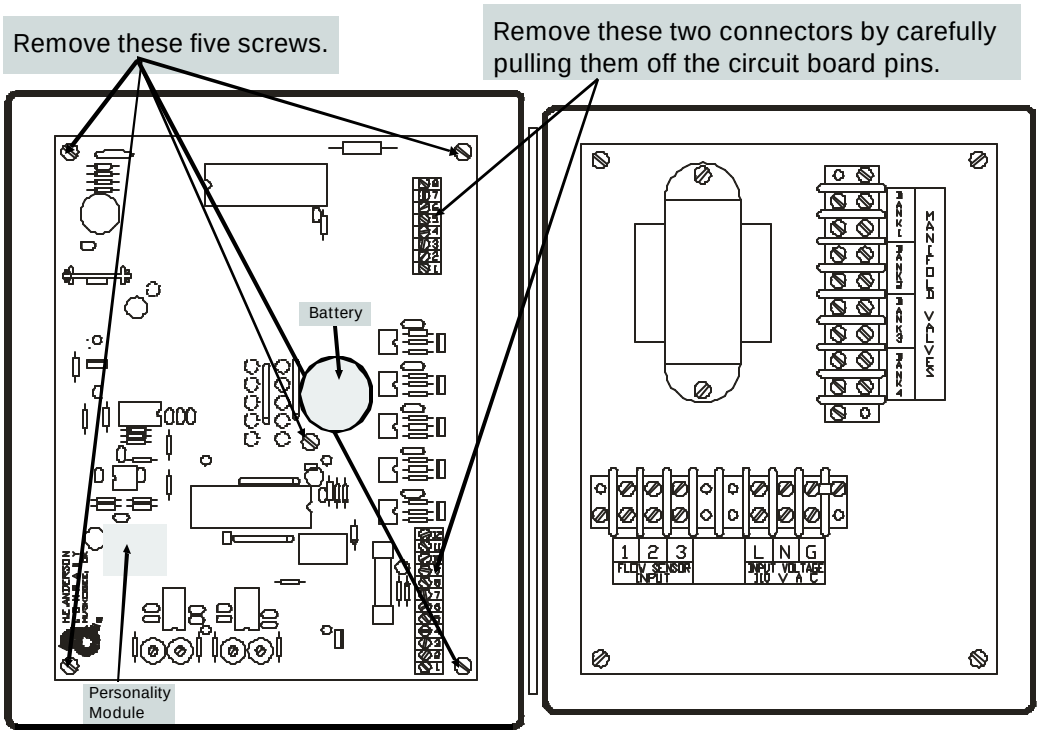


Figure 5-1
Removing the System Circuit Board

The only repairs you should attempt are replacement of the battery or the system circuit board. The controller is designed for easy replacement of the circuit board.

5.1 CIRCUIT BOARD REMOVAL

Disconnect power before opening the enclosure. Carefully pull off the power and valve terminal blocks. Remove the five screws shown in Figure 5-1. Carefully remove the circuit board.

5.2 CIRCUIT BOARD REPLACEMENT

Carefully position the replacement circuit board behind the front panel. Be sure the keyboard and display fit properly in the front panel cut-outs. Replace the five retaining screws. Carefully press on the power and valve terminal blocks. **Be sure they are properly aligned on the pins.**

5.3 BATTERY REPLACEMENT

Replace with a Panasonic type BR2330 lithium battery or equivalent (available from H.E. Anderson Co. if you cannot find it locally). **NOTE:** You may replace the battery with a type BR2325 (Radio Shack), but battery life will be shorter.

Refer to Figure 5.1. Carefully remove the old battery and install the new one. Be sure the + side is toward you. **NOTE: You will now need to completely reprogram your controller.**

6 FACTORY SERVICE

You may return your entire control unit or system circuit board to us, prepaid, for repair. The charge will be a fixed labor charge plus parts and return postage. Charges for units under warranty will be for transportation only. Refer to our Limited Warranty in the back of this manual for details of the warranty. Turn around time in our plant is normally one to two days.

Refer to our current price list or call H.E. Anderson Company for the prices of these options. Our shipping address is:

H.E. Anderson Company
2100 Anderson Drive
Muskogee, Oklahoma 74403 USA

APPENDIX A.
Specifications and Default Settings

System Type and Version	Minimum PPS	Maximum PPS	Default PPS	FR at Default PPS	MAX FLOW (GPM)	Pulses per Hundred Gallons
2" Turbine Meter **b2.1.0**	4	3668	232	632	200	3472
3" Turbine Meter **b3.1.0**	4	2620	372	1419	450	2480
4" Turbine Meter **b4.1.0**	4	541	206	3807	1200	512
6" Turbine Meter **b6.1.0**	4	228	166	7272	2300	216

APPENDIX B.
Formulas and Examples

SYMBOLS:

FR = Feed ratio number (This is the number displayed by pressing the FR (3) key on the controller keypad.)
ppm N = parts per million nitrogen
ppm K = parts per million potassium
% N = percent nitrogen in fertilizer
% K_2O = percent K_2O in fertilizer
Example: For potassium nitrate (13-0-44) % N = 13 and % K_2O = 44
G = gallons of fertilizer concentrate mixed in tank at one time
Lbs. = pounds of fertilizer in G gallons of concentrate solution
P = number of pumpheads pumping a given solution
DS = pumphead dial setting

FORMULAS:

To calculate the amount of dry fertilizer to add to the concentrate tank when making the

(1) (Nitrogen) $$\text{Lbs.} = \frac{(FR)(\text{ppm N})(G)}{(P)(\%}$$

(2) (Potassium) $$\text{Lbs.} = \frac{(FR)(\text{ppm K})(G)}{(P)(\%}$$

stock concentrate solution:

(3) (Nitrogen) $$DS = \frac{(FR)(\text{ppm N})(G)}{(P)(\text{Lbs.})(\%}$$

(4) (Potassium) $$DS = \frac{(FR)(\text{ppm K})(G)}{(P)(\text{Lbs.})(\%}$$

To calculate the dial setting for a specific ppm when the mixture is known:

To calculate the ppm contribution for a given amount of fertilizer at a given dial setting:

(5) (Nitrogen) $$\text{ppm N} = \frac{(P)(DS)(\text{Lbs.})(\%\ N)(120)}{(FR)(G)}$$

(6) (Potassium) $$\text{ppm N} = \frac{(P)(DS)(\text{Lbs.})(\%\ K_2O)(100)}{(FR)(G)}$$

EXAMPLE:

In our example we will calculate the mixtures and dial settings to apply 100 ppm potassium and 150 ppm nitrogen using potassium nitrate (13-0-44) and amonium nitrate (33-0-0). We will have two solutions, each fed separately. Since potassium nitrate will contribute both potassium

and ni tro gen, we will do those com pu ta tions first. Then we will com pute the mix ture and setting for amonium ni trate. The com pu ta tions are done on the fol low ing page.

The FR num ber in our ex am ple is 632. We will be mix ing 50 gal lons of each fer til izer con cen-trate at a time, so G = 50. Ppm K = 100 and ppm N = 150. From the fer til izer for mula (13-0-44)

(2) (Potassium) Lbs. = $\frac{(FR)(ppm\ K)(G)}{}$ = $\frac{(632)(100)(50)}{}$ = 71.8 Lbs.

we find % K_2O = 44. Cal cu la tions will be rounded off. First we aill ap ply For mula 2 to cal cu late how much potassium nitrate we will need:

To get 100 ppm potassium we need 71.8 pounds of potassium nitrate. Since Fertilizers come in 25 pound bags, we will make things easy by us ing three 25 pound bags in each 50 gal-

(4) (Potassium) DS = $\frac{(FR)(ppm\ K)(G)}{}$ = $\frac{(632)(100)(50)}{}$ = **9.6**

lon mix ture of con cen trate. This gives Lbs. = 75. We will now ap ply For mula 4 to cal cu late the dial set ting needed to get 100 ppm K at this mix ture.

(5) (Nitrogen) ppm N = $\frac{(P)(DS)(Lbs.)(\%\ N)(120)}{}$ = $\frac{(1)(9.6)(75)(13)(120)}{}$ = 35.5 ppm

We will set our po tas sium ni trate pumphead at 9.6. We will now ap ply For mula 5 to find out how much nitrogen is coming from the potassium nitrate.

Now we can fig ure how much ni tro gen we need from amonium ni trate by sub tract ing the

(1) (Nitrogen) Lbs. = $\frac{(FR)(ppm}{}$ = $\frac{(632)(114.5)(5}{}$ = 91.4 Lbs.

con tri bu tion from po tas sium ni trate from the to tal needed. This gives us 150 – 35.5 = 114.5 ppm. We will use For mula 1 to fig ure how much amonium ni trate we need in our con cen trate.

Again we will make thngs easy by mix ing our con cen trate in con ve nient in cre ments. We will

(3) (Nitrogen) DS $\frac{(FR)(ppm\ N)(G)}{}$ = $\frac{(632)(114.5)(50)}{(1)(100)(33)(120}$ = **9.1**

mix 100 pounds of amonium ni trate in each 50 gal lons of so lu tion. Using these fig ures, we can fi nally ap ply For mula 3 to cal cu late the dial set ting of our amonium ni trate pumphead.

So, we can get our desired feed of 100 ppm potassium and 150 ppm nitrogen by using these mix tures and dial set tings: 75 pounds of po tas sium ni trate in 50 gal lons of so lu tion and feed ing at a dial set ting of 9.6 on one pumphead, and 100 pounds of amonium ni trate in 50 gal-lons of solution and feed ing at a dial set ting of 9.1 on the sec ond pumphead.

Once you de ter mine your mix tures you can use the for mu las to fig ure dial set tings for dif fer-ent ppm values.

NOTES:

If you do not know how many pumpheads you will need for a so lu tion, fig ure the mix ture for a sin gle pumphead. If the dry chem i cal re quired is too much to disolve, set your mix ture to the max i mum con cen tra tion you can get, and then ap ply For mulas 3 and 4 for one pumphead. If you get a dial set ting value greater than 10, you need more than one pumphead. A value from 10 to 20 means two pumpheads are needed, 20 to 30 - three, and so on. The dial setting value ob-tained in this way is the total of the dial set tings for all pumpheads pump ing that so lu tion.

APPENDIX C.
Clearing the Security Code

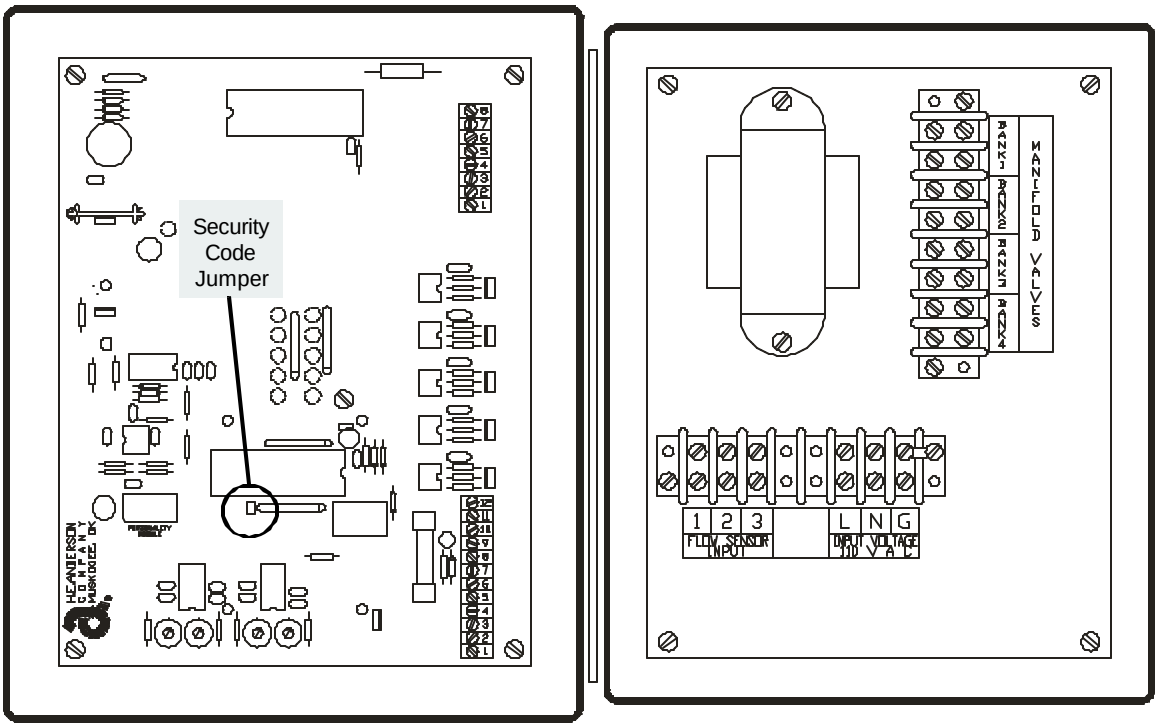


Figure C-1
Locating the Security Code Jumper

At some point it may be necessary to clear out the security code. This could be due to forgetting the code, or to periodically change it. The code can not be changed simply by a key combination rom the key pad. The simple procedure to clear the code is give be low.

(1) open up the unit.

(2) Refer to Figure C-1, above, to locate the security code jumper pins just below the microprocessor. There you should find two pins with a small jumper clip atttached to one pin.

(3) Remove the jumper clip and replace it so that it connects both jumper pins together.

(4) Now, on the key pad, press the CODE and ENTER keys together. This is the same combination used to enter the security code. (Refer to Figure 3-6.) However, with the jumper pins connected, this will clear the security code. The display should display **COdE**.

(5) Remove the jumper and replace it on a single pin. A new security code may be entered as described in Section 3.7. NOTE: As long as the two jumper pins are connected together, no security code can be entered and the unit can not be made secure. If you do not want to use the security feature, you might want to leave the jumper connected to both pins to prevent accidental entry of a security code.

(6) Close the unit.

RATIO:FEEDER® LIMITED WARRANTY

WHAT IS COVERED

The H.E. Anderson Company of Muskogee, Oklahoma, will make any necessary repairs and/or replace any parts of any Ratio:Feeder® product made necessary because of defects in materials or workmanship for fifteen months from date of manufacture. Warranty repairs and/or replacements will be performed without charge to the owner by H.E. Anderson Company within a reasonable time after prepaid delivery of the defective product to the H.E. Anderson Company, 2100 Anderson Drive, Muskogee, Oklahoma 74403.

WHAT IS NOT COVERED

This warranty specifically excludes failure of any parts or materials caused by chemical attack or damage caused by operation above rated capacity or pressure. Further, this warranty does not cover wear or failure caused by sand or other foreign materials which may be found in water that is passed through our products, or damage caused by freezing or exposure to water temperatures above 60 ºC (140 ºF).

This warranty does not cover damage caused by failure to follow prescribed installation instructions and limitations issued by H.E. Anderson Company. In addition, this warranty does not cover service adjustments, repairs, or replacements caused by misuse, negligence, alteration, accident, or lack of specified maintenance.

This warranty does not cover components used by, but not manufactured by H.E. Anderson Company, in the manufacture of our products except to the extent of said component manufacturer's warranty.

This warranty specifically excludes liability for consequential damages or for charges for labor or expense in making repairs or adjustments, or losses of time or inconvenience.

This warranty gives you specific legal rights and you may also have other legal rights which may vary from state to state. H.E. Anderson Company does not authorize any person to create for it any other obligation or liability in connection with these products. ANY IMPLIED WARRANTY APPLICABLE TO THESE PRODUCTS IS LIMITED TO THE DURATION OF THIS WARRANTY. H.E. Anderson Company shall not be liable for consequential damages resulting from breach of this written warranty.

NOTE: Some states do not allow limitation on how long an implied warranty will last or the exclusion of limitations of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

WHAT TO DO IF THERE IS A QUESTION REGARDING WARRANTY

(1) Promptly notify the consumer advisor at H.E. Anderson Company by telephone at 800-331-9620 or 918-687-4426.

(2) Confirm the report in writing (or via FAX at 918-682-3342) to the H.E. Anderson Company, stating the circumstances surrounding the problem.

PURCHASER'S OBLIGATION

(A) Purchaser must give H.E. Anderson Company immediate written notice on discovery of defect.

(B) Purchaser must pay for shipment of the defective product to the H.E. Anderson Company, 2100 Anderson Drive, Muskogee, Oklahoma 74403.