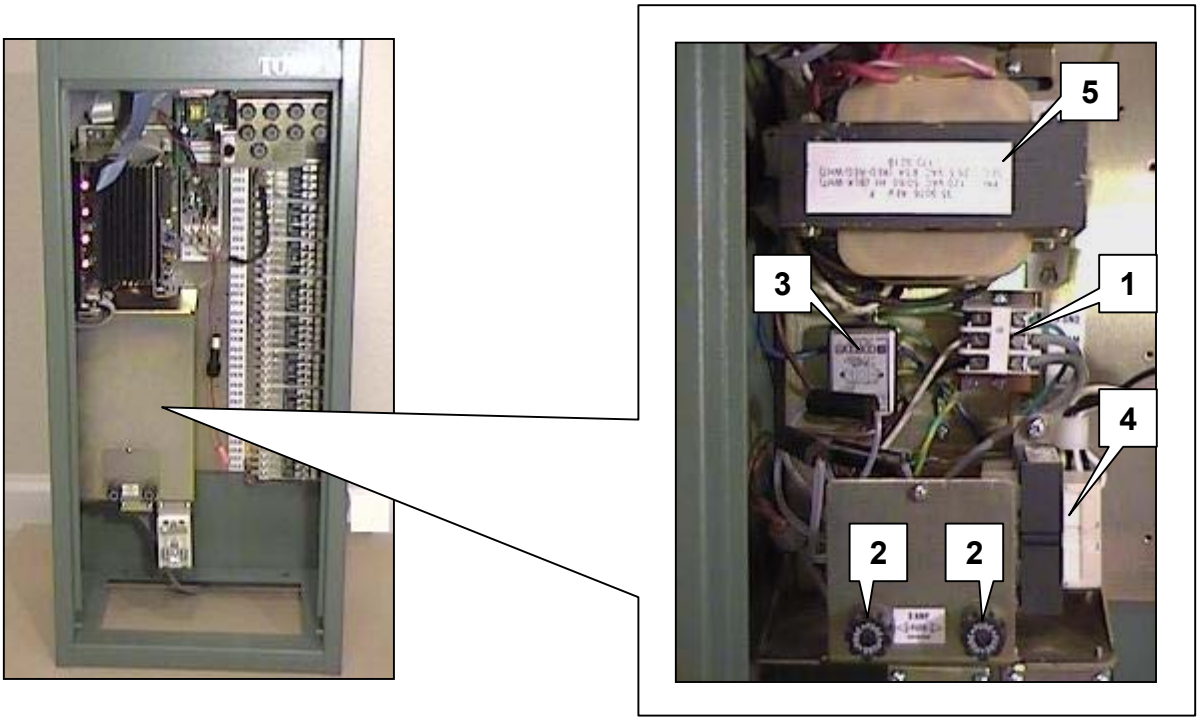
115 VAC Power Supply Assembly



1. **Three position Terminal Block:** Connection for incoming 115 VAC power. Top position is for the ground wire, center position is used for the common wire and the bottom position is for the hot wire. Terminal lugs are clearly identified by a decal to the right of the terminal block.

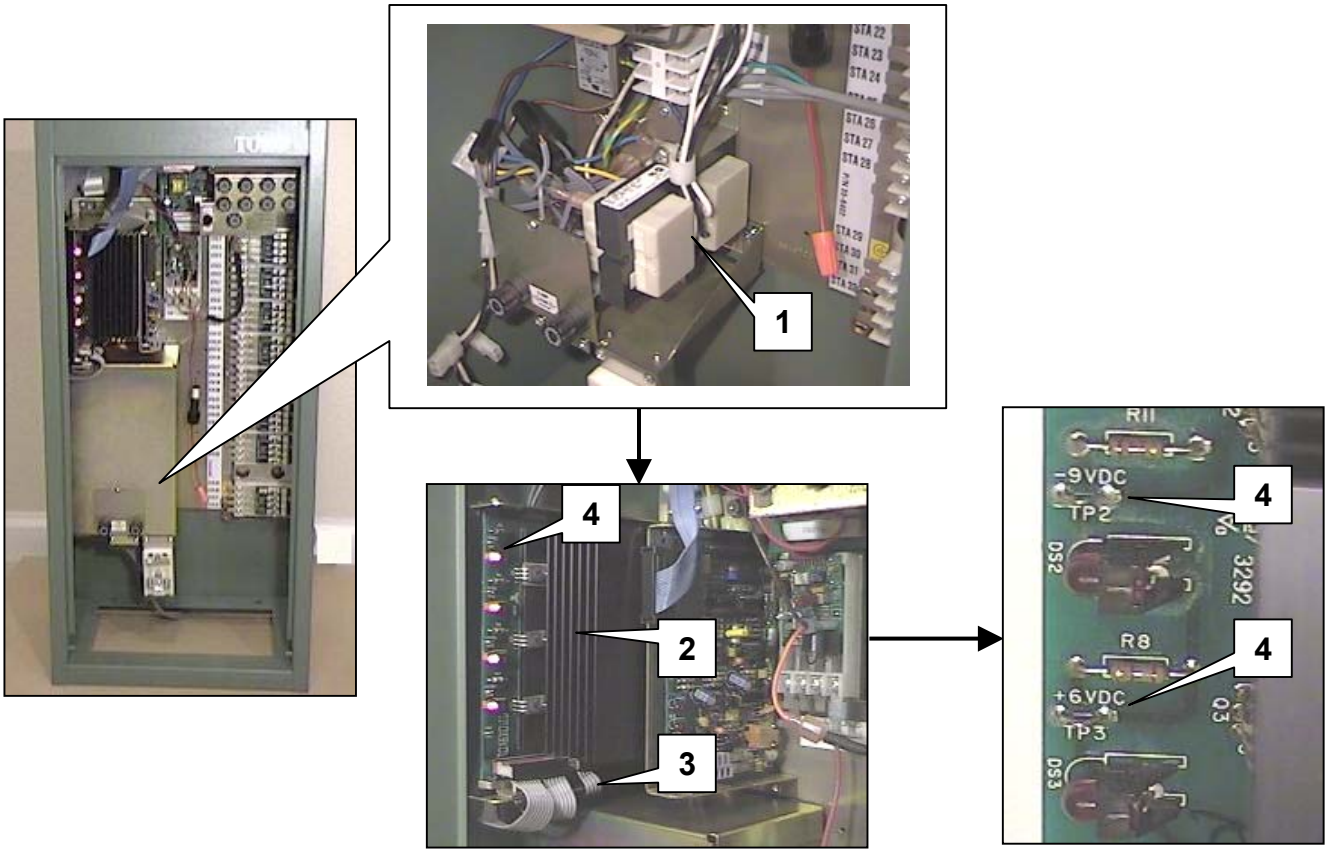
2. **3.0 amp fast blow fuse:** One fuse is wired to the incoming 115 VAC hot wire and one to the 115 VAC common wire. They protect the internal components of the controller ie Timing Mechanism, Power Supply Board, Voltage Monitor Board, Pump/Current Board, and transformers from damage caused by electrical shorts on those components. **Note:** Problems with solenoids or 24 VAC wiring in the field do not effect these fuses.

3. **RFI Filter Assembly:** Helps filter electrical noise that may exist on the 115 VAC incoming power wires. This is not a surge suppressor and has nothing to do with the lightning protection provided with the controller. It fails very seldom, but can fail in two ways (1) fails open and allows no power to flow through it and (2) fails closed in a shorted mode and will blow the 3.0 amp fuses. If it fails it is usually after a lightning storm on controllers poorly grounded.

4. **115 VAC – 24 VAC Transformers:** These two transformers provide 24 VAC to the Power Supply Assembly and Pump/Current Board and will be discussed in detail on a following page.

5. **115 VAC – 24 VAC Transformer:** This large 8.5 amp transformer provides 24 VAC to the field and will be discussed in detail on a following page.

115 – 24 VAC Transformers for Power Supply Board



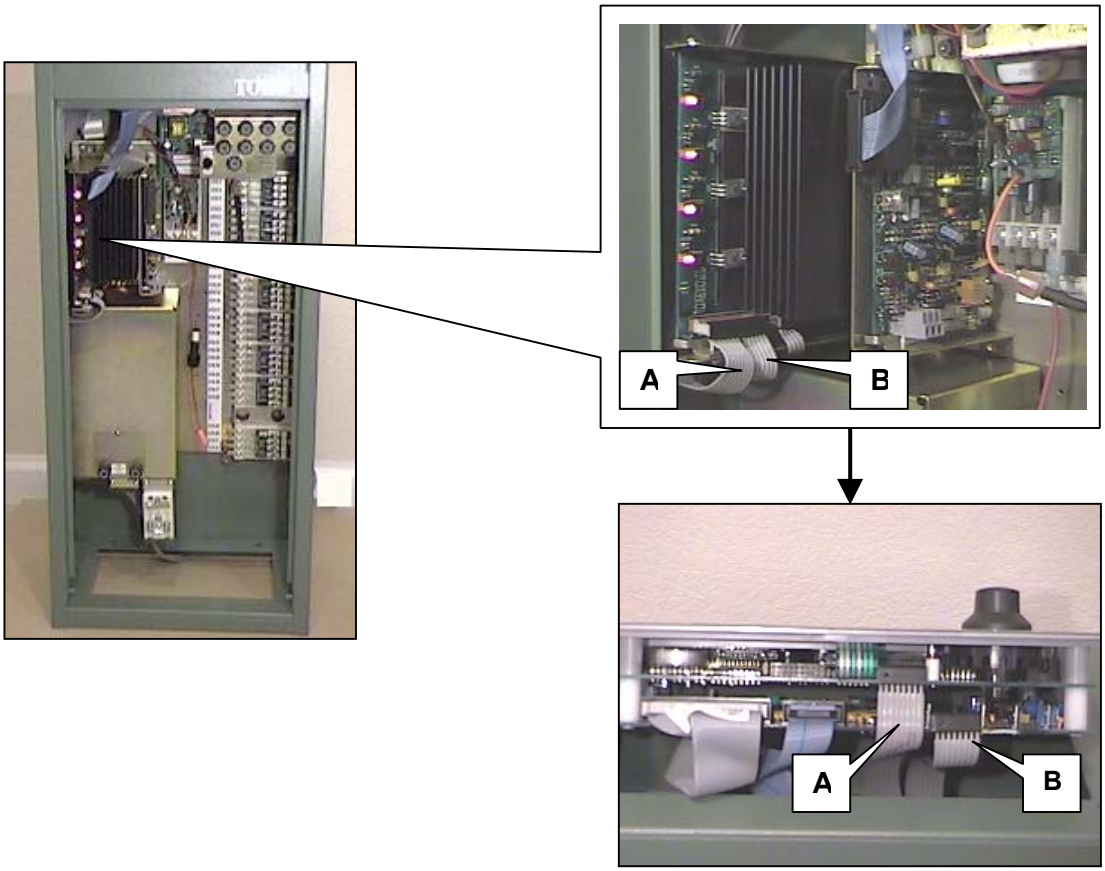
1. These two 24 VAC transformers supply power to the **"Power Supply Board"** and also to the **"Pump/Current Board".**

2. The **"Power Supply Board"** feeds the appropriate voltage to the **"Timing Mechanism"** and is an extremely important component of the NW8000 satellite.

3. The small 4 pin cable towards the back of the board is the connection cable from the transformers to the "Power Supply".

4. The **"Power Supply Board"** has 4 red indicator lights lining its front edge. Each light indicates the presence of a specific DC voltage that is feed to the **"Timing Mechanism".** Below each light is a small loop of wire and a voltage value which allows for troubleshooting the board with a volt meter. The four voltage measurements from top to bottom are -5 VDC, -9 VDC, +6 VDC and +12 VDC. **Note:** Be sure to pay close attention to the polarity of the cables on your volt meter since there are positive and negative measurements on the board. If the **"Timing Mechanism"** does not function properly it is most likely the **"Power Supply Board".** Visually check the lights and then measure for proper voltage to determine if the board is bad. The following page details symptoms for each transformer failure. **Note:** The **"Power Supply Board"** can be bad even though all lights and voltages measure correctly. This does not happen often, but if the TM does not function properly even though the above tests check out, replace the board with one you know works.

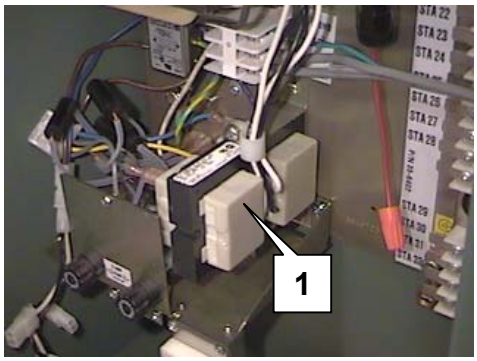
Power Supply Board / TM Connection

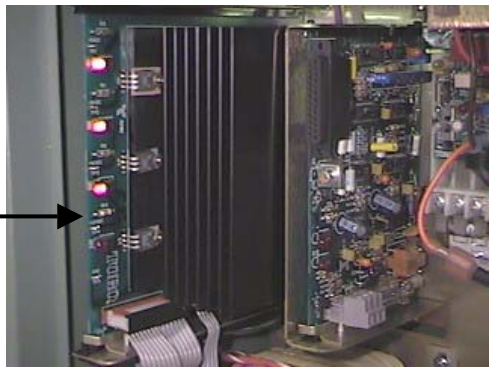


A. **The "Power Supply Board"** feeds power to the **"Timing Mechanism"** through two cables located on the bottom front edge of the board. The left cable on the **"Power Supply Board"** is also the left cable that connects to the middle board on the **"Timing Mechanism".** This cable will be marked with a red stripe, which matches the red marking beneath its pin connector on the TM.

B. The right cable connects to the bottom board on the "**Timing Mechanism"** and will be marked with a yellow stripe, which matches the yellow marking beneath its pin connector on the TM.

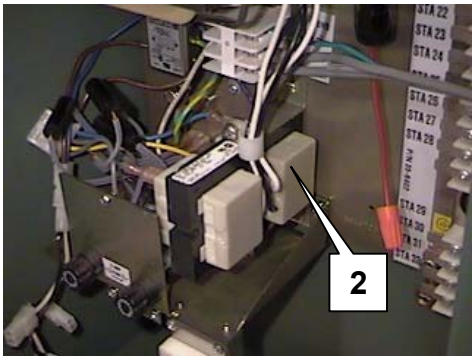
Power Supply Transformers





1. If the front transformer is lost the following symptoms will occur :

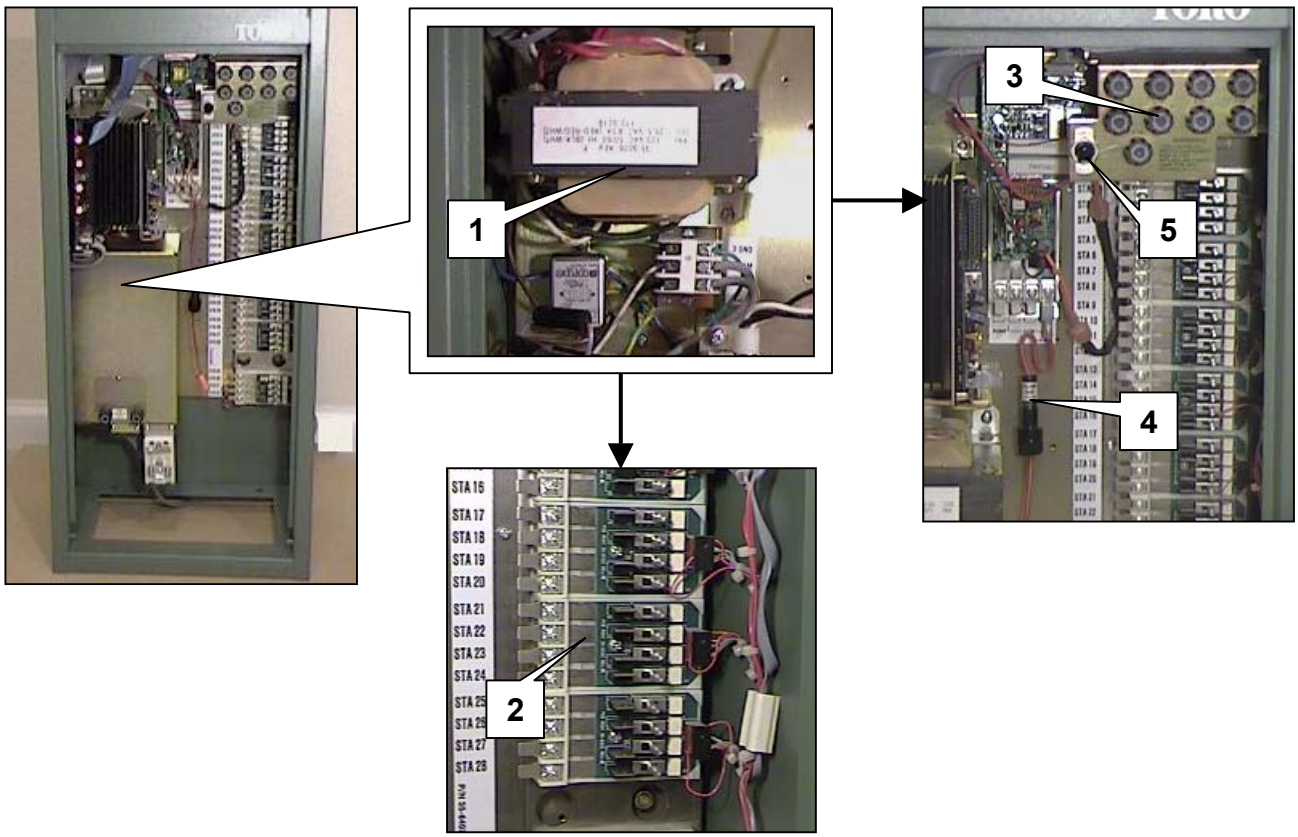
    a. All LCD readings, red lights and button functions will be lost on the TM.
    b. The bottom indicator light on the Power Supply Board will be out.
    c. The second indicator light from the bottom will dim and show a reading of approximately +3.1 VDC.
    d. The remaining two lights will show proper readings.



2. If the rear transformer is lost the following symptoms will occur :

    a. LCD readings on the TM will be lost, but the red light and button functions will remain.
    b. The top indicator light on the Power Supply Board will be out.
    c. The second indicator light from the top will dim and show a reading of approximately +1.9 VDC.
    d. The remaining two lights will show proper readings.

115-24 VAC Transformer for Output to Field



1. This large 8.5 amp transformer provides power to the **"4 Station Triac Cards",** which activate the field solenoids. It's an extremely reliable transformer and rarely fails.

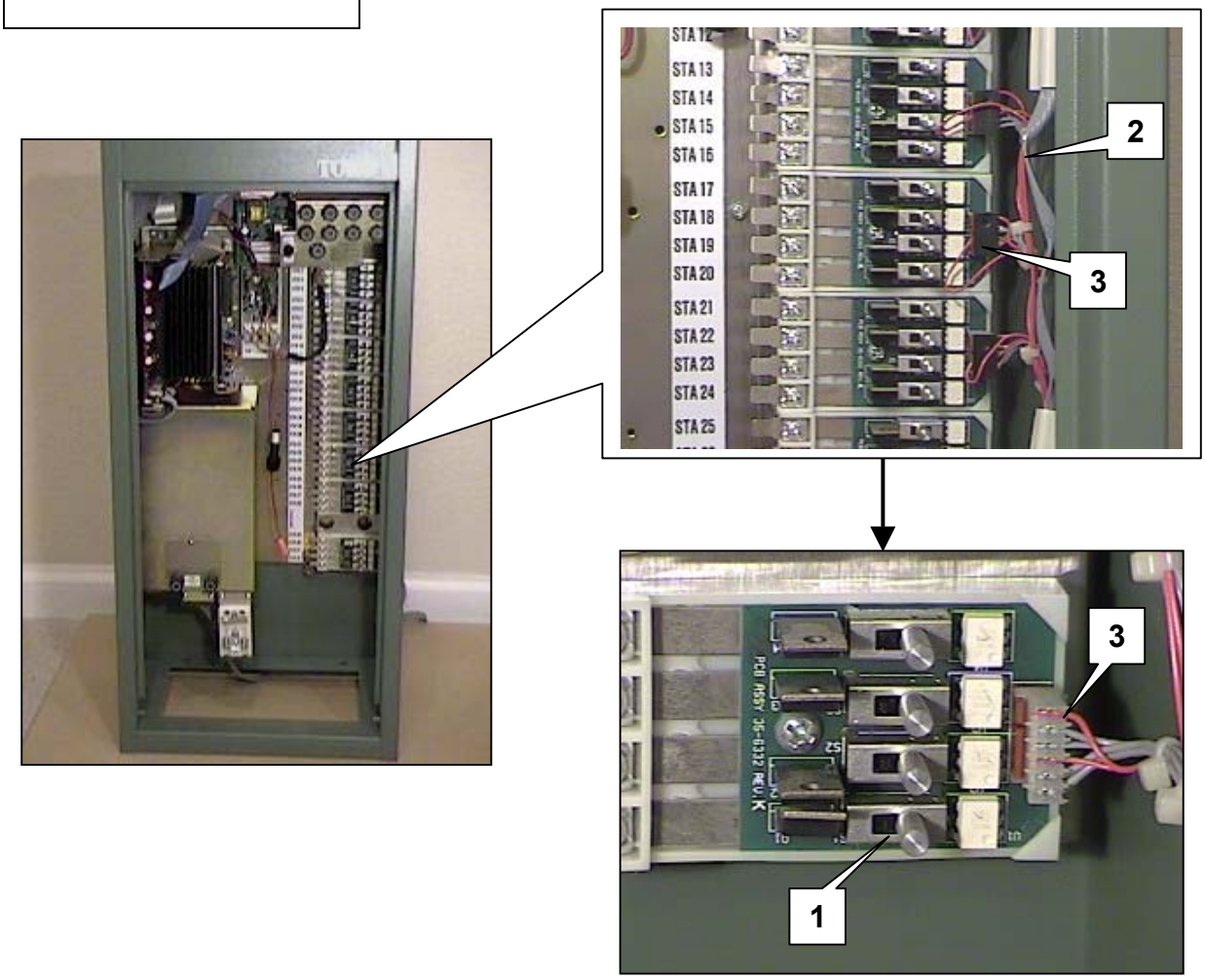
2. There are eight **"4 Station Triac Boards"** for a total of 32 stations in the NW8000 controller. They provide 24 VAC to the field solenoids by two different paths. The first is through a manual switch and the second is by an automatic signal from the **"Timing Mechanism".**

3. Each **"4 Station Triac Board"** is protected by a **3.2 amp slow blow fuse**. Each board can operate 3 solenoids per station for a total of 12 solenoids per board simultaneously without blowing the fuse. If one of the fuses blow, check for an electrical short in the 24 VAC field wiring or solenoid on one or more of the stations on that board. All other **"4 Station Triac Boards"** will operate normally as long as shorts are not present on those boards. **Note:** Replace fuses with the same amp rating as the original fuse. Using larger amp rated fuses can cause damage to the circuitry and /or fire.

4. The 24 VAC field common wires are protected by a **7.5 amp slow blow fuse**, which will allow for approximately 30 solenoids to operate simultaneously. When this fuse blows it's usually because too many stations have been switched on manually at one time.

5. This **on/off switch** allows the user to turn off power to the 24 VAC field solenoids if necessary. It must be in the on position for the **"4 Station Triac Boards "** to activate the field solenoids.

4 Station Triac Board

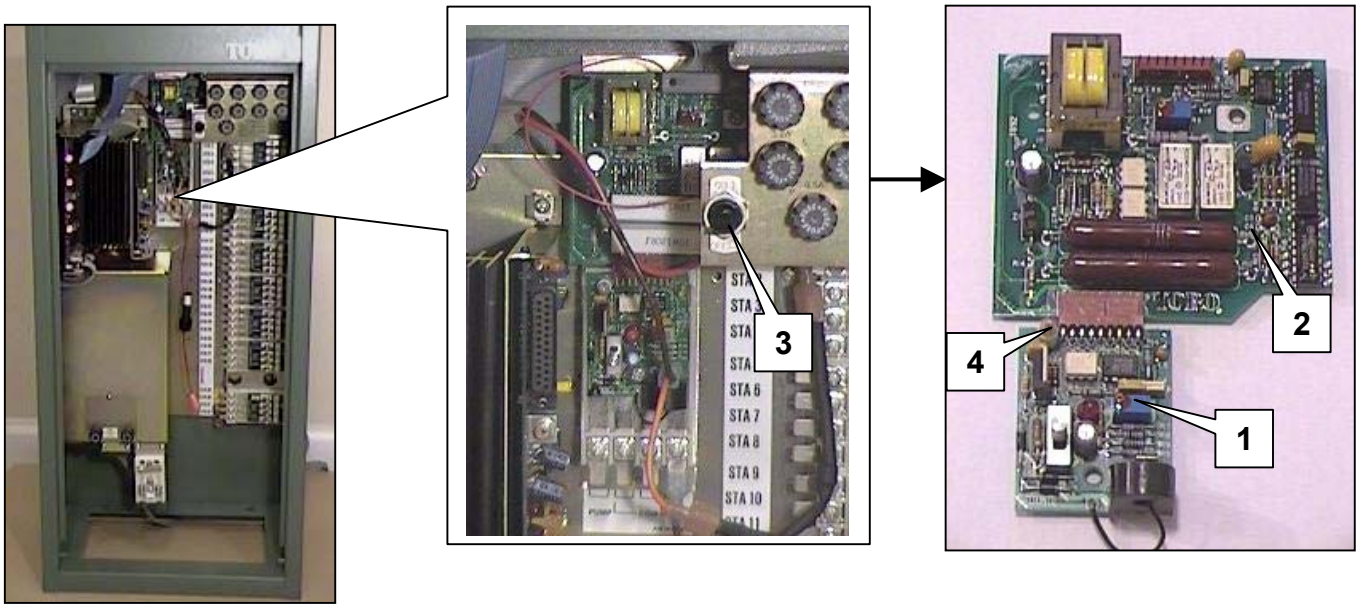


1. The **manual station switch** located on each **"4 Station Triac Board"** can be set in three different modes. The left position is manual on, the middle is manual off and the right position is auto. Remember the large 8.5 amp transformer provides 24 VAC to the **"4 Station Triac Board"** and that power can be released to the field solenoids in two ways (1) by manually moving the switch to the on position or (2) from an automatic signal sent from the **"Timing Mechanism".**

2. This cable connects each **"4 Station Triac Board"** to the **"Timing Mechanism"** and allows programmed or manual start commands to be sent from the TM.

3. When a station is turned on using the manual switch the 24 VAC follows a different path through the board vs. the path it follows when activated automatically. Therefore a situation can occur in which you can operate a station manually, but not automatically. If this occurs remove the black cap from the cable connector on that **"4 Station Triac Board"** and using a non-metallic pointed device (a sharp pencil works well) make sure that the red and gray wires are pushed tightly into the connector. If this does not solve the problem replace the **Triac Board**. If this doesn't work replace the cable (which seldom occurs).

Pump/Current and Voltage Monitor Boards



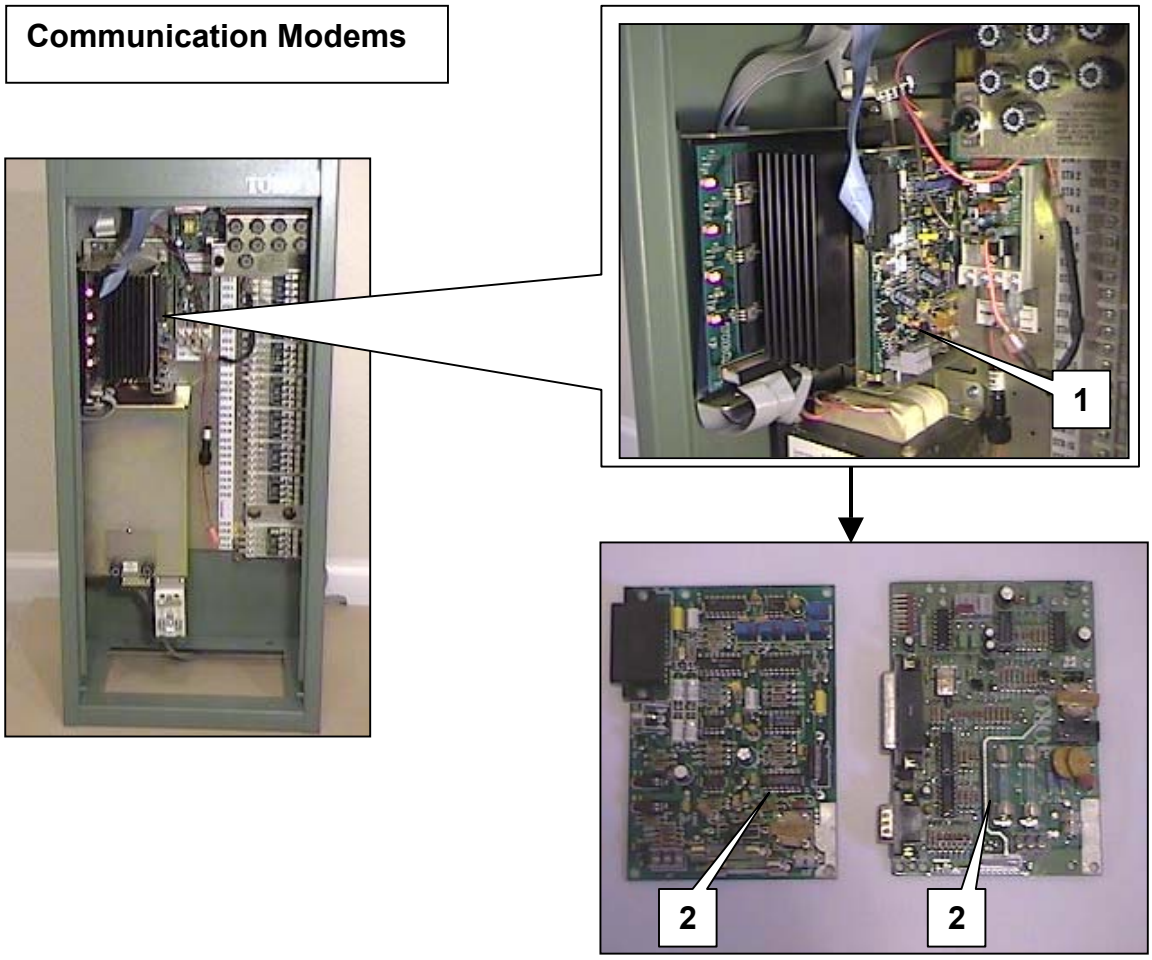
1. **The "Pump/Current Board"** is located just above the pump terminal and 3 common terminals in the center of the controller. The **"Pump/Current Board"** allows the NW8000 controller to record and store in memory the actual current running through the pump and station triacs. This is made possible by selecting "**config, set, tri.amps "** mode from the **"Timing Mechanism**". This begins a 7 second test for each station beginning with the pump circuit and measures and records the actual current running through each circuit. This can be used later to compare what was recorded vs. what is actually happening at the present time, helping you to troubleshoot existing problems and even future problems. This can be seen by selecting " **water, run, triacs"**, which displays each station and the current actually flowing compared to the recorded current.. This information is also sent to the "Central" and is the source for the **"over/under triac"** messages that are displayed from time to time. **Note:** if the controller has been "initialized" all original memory data is lost and the potential for "over current" readings for each station will exist because "0" amps are registered in memory. If this happens run the **"config, set, tri.amps"** again for that controller.

2. **The "Voltage Monitor Board"** allows the NW8000 controller to set up and monitor the 24 VAC output from the large 8.5 amp transformer. It can be reviewed by selecting **"config, review, cal.volt"**. This function helps the operator determine if individual field station circuits are showing non-complying holding voltages to the field. **Note:** The **"tri.amps"** test must be performed first before this function can be selected.

3. **The on/off switch** for the **"4 Station Triac Boards"** must be in the on position for any of these functions to work properly. A white light on the **"Pump/Current Board"** will illuminate when the switch is in the on position.

4. This light must be illuminated for the above functions to work properly. The controller will still function, but the current and voltage readings will not record accurately, which can send false errors to the "central". If the light is out while the switch is on you have two choices to correct the problem (1) replace the **"Pump/Current Board"** or (2) order lamp replacement kit #91.1888, which includes a serviceable lamp socket that allows bulb (#363-3311) replacement in the future. **Note:** this failure also effects the readings from the **"Voltage Monitor Board".**

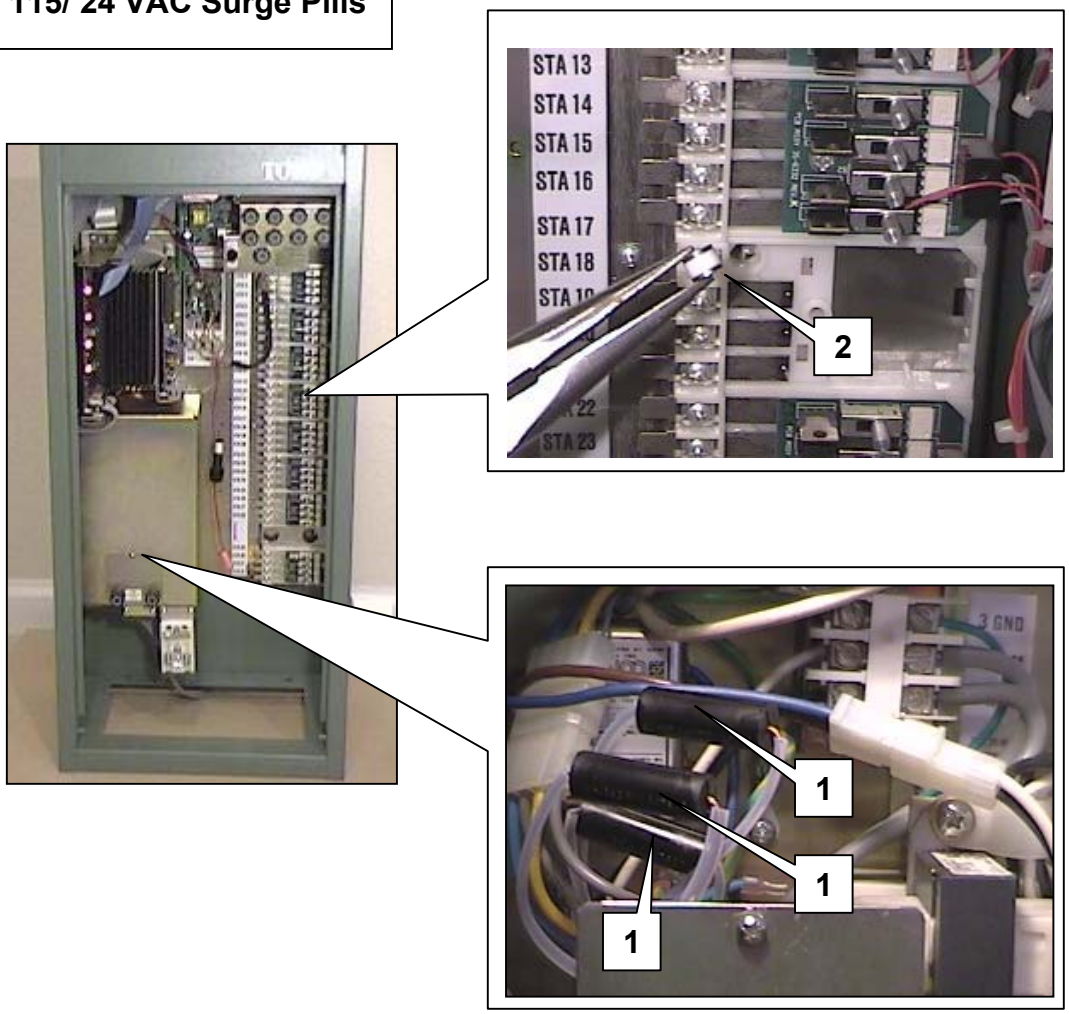
Communication Modems



1. **The "Modem"** is the component that receives and transmits information between the "Central" and the NW8000 controller. There are two types of **"Modems"** (1) **Standard** and (2) **Universal**. The Standard Modem is used when communicating to the field through "Communication Cable" and the Universal Modem is used with "Radio" or "Telephone" communication to the field. **Note:** The Universal Modem will work with "Communication Cable", but is more expensive and not necessary in this application. The Standard Modem will not work in place of the Universal Modem. Two indicator lights are located on the Standard Modem one for Receive (Rx) and one for Transmit (Tx). While the "Central" scans the field controllers the Rx light will blink continuously because every controller receives the signal. The Tx light will blink only when the controller talks back to the "Central". Lack of communication to a particular controller can be the result of four components (1) the "Timing Mechanism" (2) the "Modem" (3) the cable that connects the two or (4) the connection to the "Communication Cable". The **"Modem"** is usually the first place to look. First check the 2 fuses located on the board for continuity with a volt meter and observe the Rx and Tx lights for proper activity. If a problem is not quickly noticed it becomes a process of removing and replacing one component at a time to solve the issue. **Note:** Replace components from another controller that you know is working properly. Do not replace with components on your shelf unless you know for sure that they are in working condition. Too many hours have been wasted while troubleshooting controllers as a result of replacing bad components with other bad components off the shelf.

2. There are 3 versions of **Standard Modems** that exist in inventories today. All work fine in the NW8000 controller as long as the "Communication Cable" is in good condition. These versions are part #35-8646, #89-7519 and #102-0864. The original Modem (#35-8646) has two ½ amp fuses and does not have a 9-pin connector. The other two Modems have two ¾ amp fuses and 9-pin connectors. **Note:** The original Modem has a greater ability to withstand AC noise on the "Communication Cable" than the other two Modems. It is not uncommon to see old Modems working on the system while newer Modems will not. This is due to AC noise on the "Communication Cable" and that issue **must** be resolved before all Modems will work. This is not an issue of a malfunctioning modem, it is an issue with the integrity of the Communication Cable.

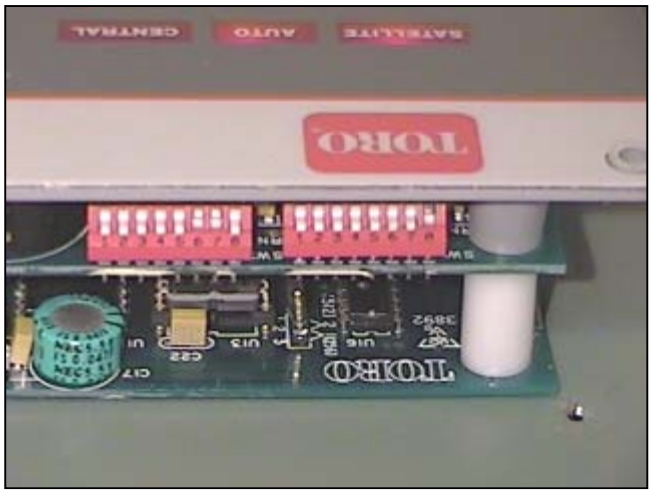
115/ 24 VAC Surge Pills



1. These 3 **"Surge Pills"** are part of the surge protection devices supplied with the NW8000 controller. Two of them protect the 115 VAC incoming hot and common power wires just down stream of the 3.0 amp fuses and the 3rd is wired between the hot and common wires just beyond the "RFI filter". **"Surge Pills"** are gas filled and trip to ground at certain voltages. Pills protecting 115 VAC generally trip at approximately 250 volts. Each time a pill trips it will trip at a lower voltage until it eventually trips at line voltage (in this case 115 VAC). When this occurs the pill acts as an electrical short and will blow the fuse at the 115 VAC line voltage. Your Toro Distributor may have equipment to check these pills. If you do not have access to a testing device simply disconnect either end of the pill and see if the fuse remains intact. **Note:** The controller must be properly grounded for the **"Surge Pills"** to work effectively.

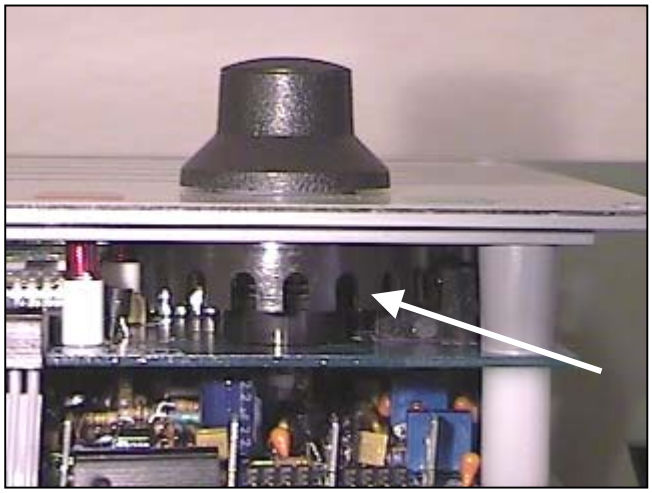
2. Each station is also protected by a "Surge Pill", which operates exactly like the larger pills that protect the incoming power wires. However, pills used for 24 VAC circuits begin to blow at a voltage of approximately 120 volts. They also will trip at lower voltages each time they are hit until they finally blow at the 24 VAC line voltage. These devices can be checked in the same manner as above. To test or replace you must loosen the **"4 Station Triac Board",** remove the station terminal tab and pull the pill from its installed location. **Note:** The controller and/or the stations will work without the pills installed, but will **not** be protected from lightning surge until replaced.

Address Dip Switches



The **"Dip Swithes"** located below the top plate of the **"Timing Mechanism"** are use to set the address for the controller, so the "Central" knows which TM it is talking to. The outside switch is for the CSG or Group and the inside switch is for the controller number. Three things to watch out for when installing a new TM into an existing pedestal are (1) make sure you have set the correct address for that controller (2) when inserting the TM into the pedestal be sure the swiches do not rub against the edge of the pedestal and clear the address and (3) do not set two addresses the same, this can result in communication failures with one or both controllers.

Programming Rotary Switch



The **"Rotary Swicth"** helps toggle between certain programming functions on the **"Timing Mechanism".** If it fails those functions can no longer be accessed during programming. The **"Rotary Switch"** is an optical device and therefore needs to remain reletively clean to funtion properly. The switch can fail prematurely in extremely dusty conditions such as new construction. If this occurs simply buy a can of compressed air (used to clean computer components) and spray the lower part of the **"Rotary Switch".** If this does not work the TM will need to be replaced and sent in for repair.