



**PREFACE**

This manual describes how to use the NS-1000E Warewash Chemical Dispenser. Material in this manual is subject to change without notice. Manual revisions will be made on an as needed basis. Special circumstances involving important design, operation or application information will be released via Equipment Technical Bulletins.

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**INTRODUCTION**

**OVERVIEW**

The NS-1000E is a two- or three-chemical product dispensing system for use with probe or probeless control of conveyor or door type warewashing machine applications.

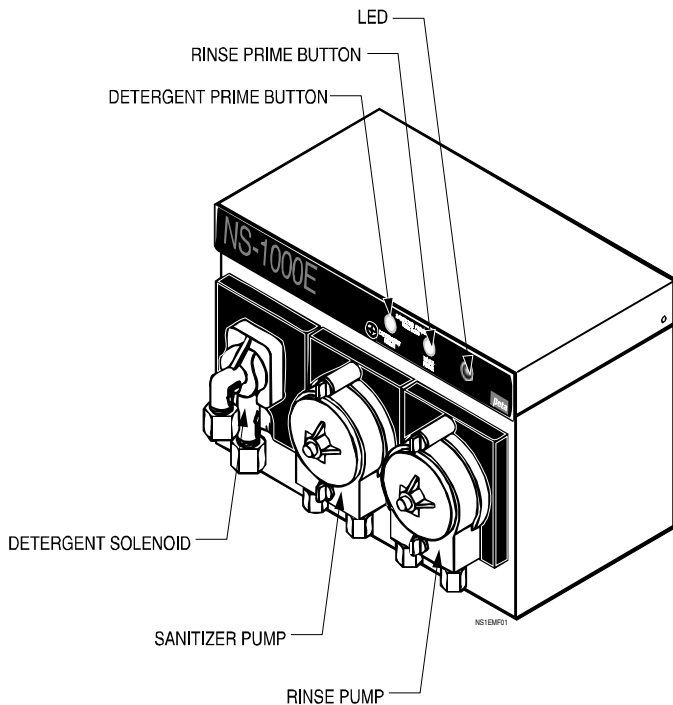


Figure 1. NS-1000E Typical Three-Product System

Figure 1 shows a three-product system, with a solenoid for dry detergent dispensing and two pumps for liquid rinse and sanitizer.

**FEATURES DESCRIPTION**

The following table lists the features and configurations available.

**NS-1000E STANDARD CONTROL FEATURES**

Model Icons	Model Numbers	Detergent Pump	Detergent Solenoid	Sanitizer Pump	Rinse Pump
	NS-1002RE		√		
	NS1102DE	√			
	NS1103RE		√		√
	NS-1102RE		√		√
	NS-1203E	√			√
	NS-1202E	√			√
	NS-1203SRE		√	√	√
	NS-1303SE	√		√	√

\*All models can be configured for 24 Volt input or with single or double transformers for line voltage. Pressure switch operation available on all 24-Volt and single transformer models.

**General**

**Three Digit Display**

All programming is done through three pushbuttons and the three-digit alphanumeric display located on the PCB.

**Priming**

The detergent pump and rinse pump are primed with their separate prime buttons. Both buttons are held down simultaneously to prime the sanitizer pump (see Figure 3 on page 10).

**Probe Detergent Operations**

**Wash Tank Concentration**

Setpoint is programmed in Beta Units for accurate and repeatable control.

**Wash Tank Concentration or Temperature**

Either can be displayed real time on the 3-digit alphanumeric display.

### Low Detergent Alarm

When wash tank concentration fails to reach setpoint during the alarm delay time (range 0-180 seconds), an alarm sounds. After an alarm is present, the alarm delay time for future detergent feed cycles is set to 1/2 the programmed alarm delay time and will reset to the programmed alarm delay time only after the setpoint is reached. Power off/on will not reset the alarm delay time.

### Overfeed Stop

When a low detergent alarm is present, the detergent feed stops if the setpoint is still not reached during the overfeed stop delay time (range 0-240 seconds). Turning power off, then back on will reset the overfeed stop alarm.

### Reduced Feed Rate

Detergent feed rate can be programmed (in 10% steps) to operate from 10%-100% of full speed when wash tank concentration is within 5 Beta Units of setpoint. This will help prevent setpoint overshoot when using very concentrated chemicals.

## Probeless Detergent Operations

### Recharge Dose for Conveyor Machines

Detergent recharge dose time (range 0-60 seconds) is delivered when the cumulative rinse on time (range 0-60 seconds) is reached.

### Recharge Dose for Door Machines

**Sump type** - Detergent recharge dose time (range 0-20 seconds) is delivered each time the rinse cycle power starts.

**Fill and dump type** - Detergent recharge dose time (range 0-20 seconds) is delivered each time the wash cycle power starts.

### Initial Fill Charge for Conveyor Machines

Detergent initial fill charge time (range 0-240 seconds) is delivered when an initial fill is signaled by the initial machine power, a manual switch closed by the operator, or a pressure switch input from the initial fill line.

### Initial Fill Charge for Door Machines

**Sump type** - Detergent initial fill charge time (0-240 seconds) is delivered when rinse power on time exceeds 20 seconds.

**Fill and dump type** - Initial charge time should be set to zero.

## Rinse Operation

Rinse pump delay time after a rinse cycle start can be programmed (range 0-99 seconds). Rinse pump speed (range 0-99%) and rinse pump run time (range 0-99 seconds) are programmed to deliver the desired amount of product.

## Sanitizer Operation

Sanitizer pump can run with either the detergent pump (destainer application) or the rinse pump (sanitizer application). Application and pump speed (range 0-99%) are programmed during setup to deliver the correct amount of product.

## TERMS

The following terms are used in this manual.

### Alphanumeric Display

A display on the PCB used for programming (see **Figure 3**).

## Beta Units

A means of indicating the detergent concentration in the wash tank. The probe measures the conductance of the solution. This electrical measurement is converted into and displayed as Beta Units. Each Beta Unit change represents a 5% conductance change. (For example, 23 Beta Units is 95% as great as 24 Beta Units, and 105% of 22 Beta Units.)

## LED

A light emitting diode. The LED on the NS-1000E unit indicates power (see **Figure 1**).

## PCB

Printed Circuit Board that contains the electronics for the NS-1000E.

## Squeeze Tube

Tubing designed for use in peristaltic pumps.

# SPECIFICATIONS

## PHYSICAL DIMENSIONS, CONSTRUCTION & MOUNTING

### Three Product Enclosure

Size	Height	Width	Depth
	5.5	8	5.63 (in)
	14	20.3	14.3 (cm)

### Weight

With 2 transformers and 3 pumps: 5.6 lb. (2.5 kg)

### Cabinet Material

Type 304 stainless steel

### Mounting

Wall mounted with 2 keyhole slots.

### Two Product Enclosure

Size	Height	Width	Depth
	5.5	5.5	5.63 (in)
	14	14	14.3 (cm)

### Weight

With 2 transformers and 2 pumps : 5.3 lb. (2.4 Kg)

### Cabinet Material

Type 304 stainless steel

### Mounting

Wall mounted with 2 keyhole slots and a single hole in the backplate.

## OPERATING CONDITIONS

### Ambient Operating Temperature

36 to 120°F (2 to 49°C)

## Electrical Power Configurations

100 to 120 VAC, 50/60 Hz, 0.5 Amperes maximum.  
200 to 240 VAC, 50/60 Hz, 0.25 Amperes maximum.  
Applications over 240 Volts AC require optional transformer(s).  
24 VAC, 3 Amperes maximum with external transformer.

## COMPONENTS

### Fuse

Type IEC 127, 3 Amperes, 5 x 20 mm, or Type AGC, 250 Volts, fast blow, 3 Amperes

### Pumps

Peristaltic, dual roller, self-priming and self-checking.  
24 Volts DC

### Tube Materials

#### Detergent

Flex, Silicone, Viton, Norprene, Nordel, C-Flex

#### Rinse

Flex, Silicone, Norprene, Nordel, C-Flex

#### Sanitizer

Flex, Silicone, Norprene, Norprene (food grade)

## Speed & Displacement (Run with Water)

### Detergent Pump (3/16 ID Tube)

100 rpm: 5 oz/148 ml per min

### Detergent Pump (1/4 ID Tube)

100 rpm: 8 oz/240 ml per min

### Rinse Pump - (1/16 ID Tube)

Adjustable 10 - 80 rpm: 0.07 to 0.68 oz/2 to 20.0 ml per minute

### Sanitizer Pump - (1/8 ID Tube)

Adjustable 10 - 80 rpm 0.3 to 2.0 oz/ 8 to 60 ml per minute

## Hydraulic Performance

### Detergent Pump

Maximum vacuum: 8 inches (200 mm) of Mercury [Hg]  
Maximum pressure: 20 psi (1.4 bar)

### Rinse & Sanitizer Pumps

Maximum vacuum: 8 inches (200 mm) of Mercury [Hg]  
Maximum pressure: 30 psi (2.1 bar)

## Solenoid

### Voltage

24 VDC

### Flow

3 GPM water at 50 psi, maximum inlet pressure is 100 psi

### Temperature

160°F (71°C)

## Conductivity Probe Input Measurement Range

660 to 12,800 microsiemens when using 0.4 constant (K factor) probes at 65°C. Readout is in Beta Units.

## Low Detergent Alarm (Probe Operation)

An adjustable, audible alarm. The indicator LED on the front panel flashes approximately 2 times per second when the alarm sounds.

# INSTALLATION & SETUP PROCEDURES

## PHYSICAL INSTALLATION



*Refer installation and service to qualified personnel only.*

*Installation must comply with all applicable plumbing and electrical codes.*

### Mounting the Unit

Carefully select a place to mount the unit. Remember that there must be room around it for access to switches, buttons, wires and tubing, and to swing the top door open for both installation and maintenance. The unit is normally mounted against a stable wall with the pumps side-by-side and their tube openings at the bottom. Avoid steam and other sources of moisture, such as from spray or splash. Do not subject the unit to temperatures outside the range 36 °F to 120 °F (2 °C to 49 °C).

You may accomplish wall mounting using the 2 keyhole slots on the interior back panel, plus the third mounting hole. A mounting bracket kit is available for dishmachine top mounting applications (see **Recommended Spare Parts & Accessories**).

The PCB door is held closed by a captive hold down screw that fits through a slot in the door. The pump door is held closed by the PCB door.

### Installing the Conductivity Probe

If suitable for the application, use the washer manufacturer's predrilled access hole. Otherwise, punch a 7/8 inch (2.2 centimeter) hole through the wash tank in a location that will provide accurate sampling of the detergent solution. Typically, you would mount the probe about 4 inches (10 centimeters) above the bottom of the tank, away from any heater elements, corners or any mechanical components (such as water level floats). Smooth the edges (so gaskets will seal well) and mount the probe.

### Installing the Detergent Bulkhead Fitting

Punch a hole in the wash tank in a suitable location above the water level line. For best results, mount the fitting directly above the point where the probe is located. Bulkhead fitting for a typical installation is included in the installation kit supplied with the NS-1000E, or with the powder/solid detergent hopper.

### Connecting the Pressure Switch

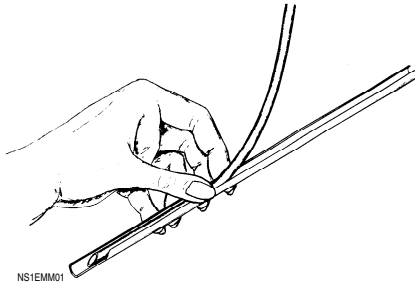
When using the NS-1000E with a single transformer, a pressure switch can be used to sense demand for rinse (and sanitizer). In these installations, the pressure switch should be connected to the machine rinse line downstream of the rinse solenoid, either directly or through the rinse injector fitting. Use a 1/4-inch line for this purpose.

## Connecting Chemical Supply Lines

DELIVERY LINES		
Pump Type	Inlet (in Inches)	Outlet (in Inches)
Detergent	1/4	1/4
Rinse	1/4 or 1/8	1/4 or 1/8
Solenoid	1/4	1/4

### Detergent, Rinse, and Sanitizer Input Lines

Connect the 1/4 or 1/8 inch line to the nut on the left (inlet side) of the pump squeeze tubes. Tighten the nuts on the fittings. Make sure the connection is airtight. Run the lines to the chemical drums, and secure the end of each supply line into its respective container. Use a snap-in standpipe for liquid detergent lines. The snap-in standpipe is a rigid three-quarter round U-shaped tube section 18 inches long. Cut the line at a 45° angle. Press the feed end of the line into the open part of the U. Leave the bottom of the standpipe slightly lower than the inlet of the line.



### Detergent Pump and Sanitizer Output Lines

Connect the 1/4-inch line to the nut on the right (outlet side) of the detergent or sanitizer pump squeeze tubes. Tighten the nut on the fitting. Run the feed line to a bulkhead or injector fitting. Use as short a line as possible and keep the lines away from steam pipes, open flues or other areas where they may be accidentally damaged by machine operators. In this and other output line runs, always try to avoid uphill runs. Secure the line into the fitting.

### Rinse Pump Output Line

Connect the 1/8 or 1/4 inch line to the nut on the right (outlet side) of the rinse pump squeeze tube. Tighten the nut on the fitting. Run the feed line to the plastic injector/check valve fitting. Follow the instructions included in the installation kit.



*The rinse pump is capable of pumping against 40 psi but it is not advisable to operate at this level. The rinse pump tubing life will be severely shortened. Most dishwasher manufacturers specify no more than 25 psi in the washer rinse line, and the water pressure should always be below this specification to ensure optimum performance and results.*

### Plumbing Connections to Water Solenoid

Solenoids are used to supply water to a powder or solid detergent hopper. The compression fittings on the solenoid inlet

and outlet accept either 1/4 inch plastic line or 1/4 inch copper tube. Follow the flow arrows on the solenoid when making connections. Consult the instructions supplied with the detergent hopper.

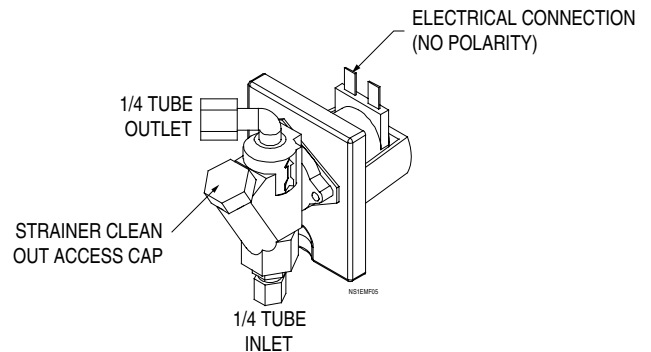


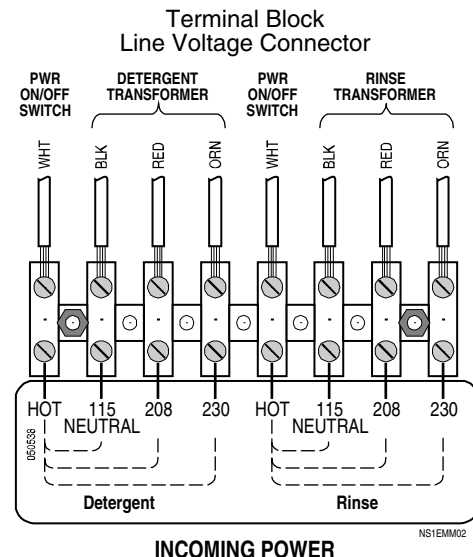
Figure 2. Brass Solenoid Valve

## ELECTRICAL CONNECTIONS



*Dangerous voltages may be present in the enclosure even when the power switch is set to off. Refer installation and service to qualified personnel only. Installation must comply with all applicable electrical codes.*

Locate electrical circuits on the dishwasher that provide power as described in **Specifications**. Power must be supplied to the NS-1000E when the dishwasher is in operation (wash and/or rinse cycle) and must be turned off when the dishwasher is off. Connect the 2 legs of each power source to their appropriate terminals inside the enclosure, as detailed on the power wiring label. See the **Appendix** for dishwasher and mode specific details.

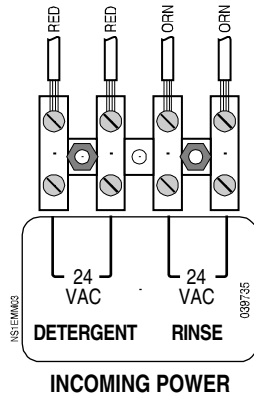


*The terminal block is designed for one or two power sources. When only using one power source, connections are made to the left terminals labeled "detergent".*



When connecting 200 VAC power, use the 208 VAC input.

Terminal Block  
24 Volt Connection



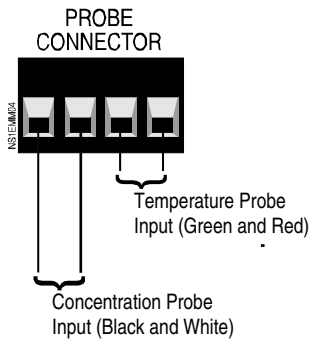
24-Volt versions of the NS-1000E are available without internal transformers. These should also be wired through the terminal block, as illustrated. The wiring label indicates the detergent and rinse power positions.



Power wires should be routed through the bottom of the dispenser directly to the terminal block. Cut wires to reduce excess length. Coiling extra wire in the NS-1000E, or having extra power wire loops near the PCB can produce electrical “noise”, causing unwanted changes to programmed settings.

### Probe Connections

You may use a temperature-compensated conductivity probe or a conductivity-only probe with the NS-1000E. The PCB has 4 connections for the probe installation. When a noncompensated probe is used, only the left 2 connectors are used.



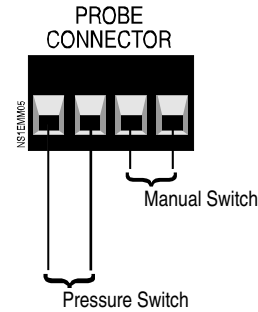
1. Bring the probe wires into the NS-1000E through the bottom access hole.
2. Remove probe connector from PCB and loosen the compression screws.
3. Insert the conductivity wires from the probe into the 2 left positions of the connector and tighten the screws.

4. Insert the temperature probe wires into the two right positions (if temperature compensated probe is used) and tighten the screws.
5. Insert the probe connector into its socket on the PCB.



Probe-input wires are low voltage. As such, probe wires should never be run through conduit with power wires because power wires can alter probe readings.

### External Triggers for Probeless Conveyor Initial Fill Charge



If an external signal is to be used to trigger the initial fill charge in a probeless operation, set up one of the following options.

#### Manual Switch

Connect a dry contact (no external power) switch to the two right side positions of the Probe Connector terminal. Locate the switch so that it is convenient to the dishmachine operator.

#### Pressure Switch

Install a dry contact (no external power) switch in the dishmachine water fill line. Connect this switch to the two left side positions of the Probe Connector terminal.

### External Alarm

The external alarm is a 24VDC output at 1 amp, and is located on J1, next to the silkscreen “EXT AL” label. (see Figure 3). Pin 1 (left side) is positive, and Pin 2 (right side) is negative. The output runs in parallel to the Audible Alarm (also shown in Figure 3). If the Audible Alarm is on, the external alarm is also on. If the Audible Alarm is pulsing, the external alarm is also pulsing.

### Programming Procedures

#### General

Controls for the NS-1000E are on the PCB located inside the enclosure lid.

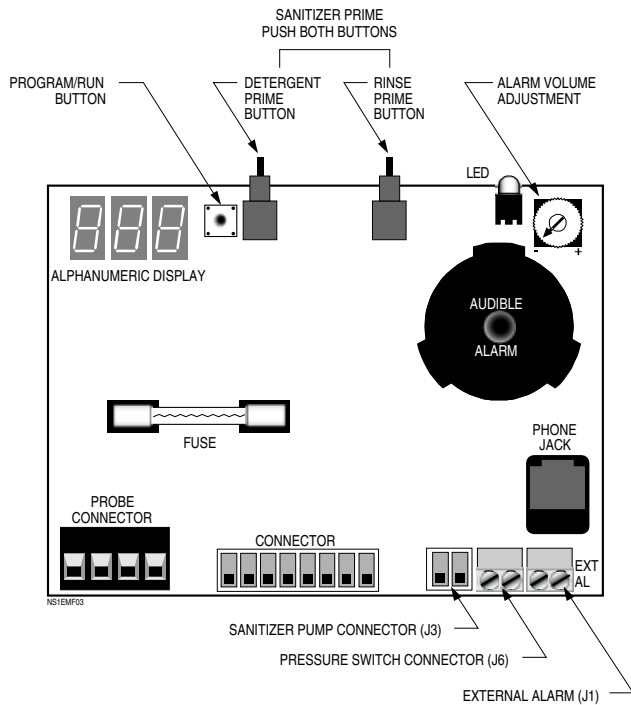
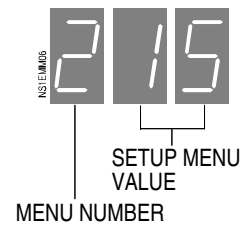


Figure 3. PCB Controls and Probe Connections

The Program/Run button is used to change from the run mode to the programming mode, to scroll through the programming steps and to change the operating information on the display LEDs.



To place the NS-1000E in the programming mode, open the top door of the NS-1000E and hold down the Program/Run button for 5 seconds. The setup information is displayed on the PCB alphanumeric display (see Figure 3). The left digit is the setup menu number and the two right digits are the setup menu value. See the table on the next page for specific menu numbers and values.

If you don't do any programming for 60 seconds, the NS-1000E will automatically return to the run mode. Use the Program/Run button to change to the next menu and the prime buttons to change the menu values. The detergent prime button increases the value and the rinse prime button decreases the value. Unused menu item numbers are automatically skipped. Each time you press a button while programming, the alarm beeps.

## PROBE OR PROBELESS PROGRAMMING

All menu steps are summarized on a drop-in card inside the NS-1000E. You must apply power to the detergent or rinse input while programming. To quickly change from programming to run mode, turn the NS-1000E power switch OFF then ON.

Menu N <sup>o</sup>	Probe Values	Probeless Values
1	Set to 01 for probe	Set to 02 for probeless
2	Low Detergent Alarm Delay Time 0-180 seconds in 10-second steps	Detergent Recharge Dose Trigger 0-60 secs of cumulative rinse on time. Conveyor machines only.
4	Detergent Concentration Setpoint 0-70 Beta units	Detergent Recharge Dose Time for Door Machines: 0-20 secs. Use the detergent prime button to set the desired amount. (see note 1). For Conveyor Machines: 0-6 seconds. Set "00" in menu 8, then return to menu 4 and use the detergent prime button to set desired amount (see note 2).
5	Detergent Overfeed Stop Delay Time 0-240 seconds in 10-second steps after alarm condition	Detergent Initial Fill Charge Time 0-240 seconds in 10-second steps. Use the detergent prime button to set desired amount. (see note 3).
6		Rinse Pump Delay Time 0-99 seconds
7		Rinse Pump Speed 0-99% of maximum speed
8		Rinse Pump Run Time 0-99 seconds Set to 00 for continuous run time for conveyor machines.
d	Reduced Detergent Feed Rate 01 = 1 second ON/9 seconds OFF to 09 = 9 seconds ON/1 second OFF 10 = ON continuously	Detergent Initial Fill Charge Trigger 00 to start feed with machine power on. 01 to start feed with external trigger.
E		Sanitizer Control Set to 00 for feed with rinse or 01 for feed with detergent.
F		Sanitizer Pump Speed 0-99% of maximum speed.

NS1EMF02



1. To set the recharge dose for a door machine while in menu 4, pump the desired dose amount into a graduated container by pressing the Detergent prime button to start the pump and pressing it again to stop the pump when the desired amount is reached. The display will show the run time (range 0 to 20 seconds). In the run mode, the measured dose will be delivered.
2. To set the recharge dose for a conveyor machine while in menu 4, pump ten times the desired dose amount into a graduated container by pressing the Detergent prime button to start the pump and pressing it again to stop the pump when the desired amount is reached. By pumping 10 times the desired amount, high accuracy can be assured even for very small doses. The display will show the run time (range 0 to 60 seconds). In the run mode, 1/10 of that amount will be delivered.
3. To set the initial fill charge dose (for a door or conveyor machine) while in menu 5, pump the desired amount into a graduated container by pressing the Detergent prime button to start the pump and pressing it again to stop the pump when the desired amount is reached. Since the initial fill charge time range is 0 to 240 seconds and only two digits of the display are available for this value, the display will only show the approximate run time. For example, a 02 indicates a range between 20 and 29 seconds. A 15 indicates a range between 150 and 159 seconds. In the run mode, the measured dose will be delivered.

## EXTERNAL OPERATOR CONTROLS

The NS-1000E includes a power ON/OFF switch, 2 prime buttons, and a system status indicator LED.

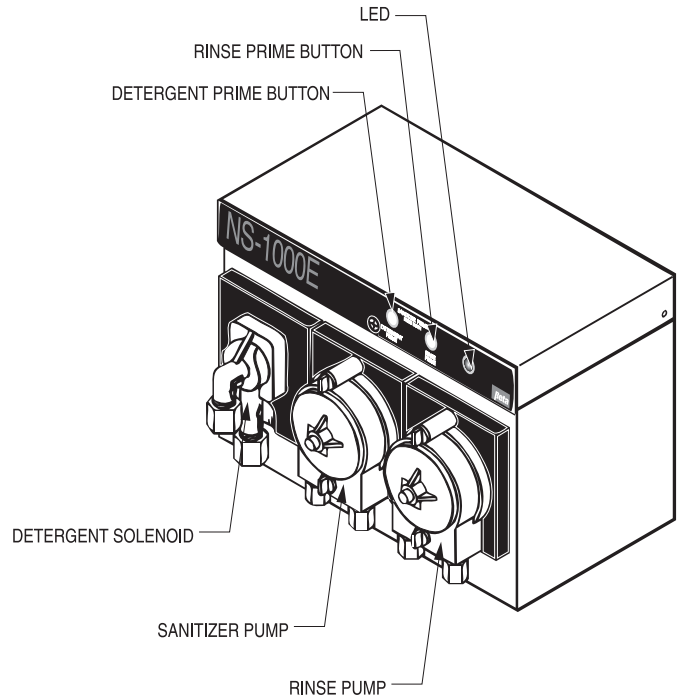


Figure 4. NS-1000E LED and Prime Buttons

### Power ON/OFF Switch

This double-pole, single-throw switch, mounted on the bottom the unit, provides control over the incoming power to the NS-1000E. It accommodates 1 or 2 transformers or the 24 Volt supply for the 24 Volt units.

### Detergent Prime Button

There must be power to either detergent or rinse inputs for this button to work. The detergent pump/solenoid runs as long as this button is pressed.

### Rinse Prime Button

There must be power to either detergent or rinse inputs for this button to work. The rinse pump runs as long as this button is pressed.

### Sanitizer Priming

When an auxiliary sanitizer pump is used, priming can be done by pressing the detergent and rinse prime buttons simultaneously.

### Alarm Adjustment Dial

The alarm volume adjustment dial (located in the upper right corner of the PCB) adjusts the volume of the audible alarm. The volume range is 0 to 93 dB.



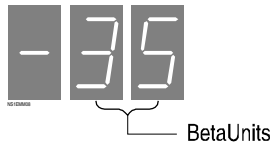
## Alarm & LED

The internal audible alarm and the LED on the front panel together provide the following operating status information:

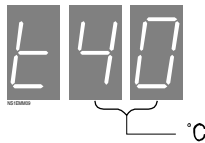
Input power to detergent or rinse terminals	Indicator is on continuously
Detergent or rinse feeding	Indicator is flashing slowly
Rinse delay	Indicator is flashing rapidly
Detergent low	Indicator is flashing rapidly and alarm is pulsing (Probe operation only)
Overfeed Stop	Indicator and alarm are on continuously (Probe operation only)

## Probe Mode Display

While operating in Probe Run Mode, the display shows actual tank concentration in Beta Units or temperature in degrees C.



Note that the first tank concentration display character may be a hyphen (-) or blank. It is not a minus sign. To toggle between displaying tank concentration and temperature, briefly press the program/run button.

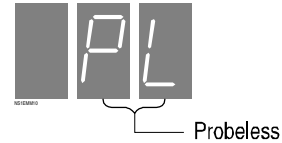


You may use the following chart to convert to degrees Fahrenheit.

°C	°F
0	32
10	50
20	68
25	77
30	86
35	95
40	104
45	113
50	122
55	131
60	140
65	149
70	158
80	176
90	194
100	212

## Probeless Mode Display

While operating in probeless run mode, the display shows a PL to indicate probeless mode.



# MAINTENANCE

## PERIODIC MAINTENANCE

### Pump & Squeeze Tube Replacement Schedule

Since every installation is different (chemicals, tube runs, operating frequency, *and so on*), an exact tube replacement schedule cannot be specified. With use, the tube slowly evolves from round to oval and the amount of chemical pumped decreases. By regularly checking the amount of chemical pumped, you can determine general tube life. It is recommended that you closely monitor the time it takes the original tube to reach the end of its flex life, and then establish a replacement schedule. Replacing tubes at regularly scheduled intervals ensures more accurate product use and reduces service calls. In general, short feed lines of a large diameter will improve pump tube life.



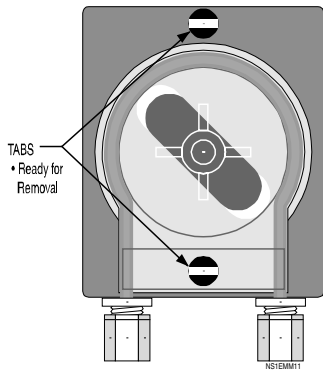
*It is very important not to let the tubes become worn to the point where they tear and allow chemicals to saturate the pump housing.*

### How to Replace Pump Cartridges and Squeeze Tubes

Only the cartridge replacement should be done in the field. Tube replacement can be accomplished later. Note that each product has different delivery line configurations and squeeze tubes. Refer to the table in the **Installation and Setup Procedures** section under **Connecting Chemical Supply Lines** for the available tubing sizes. Refer to the **Specifications** for tubing materials.

#### To Remove:

1. Turn off power to the unit.
2. Remove the cartridge from the motor housing by twisting the two quarter turn fasteners at top and bottom (rotate the tabs as shown).

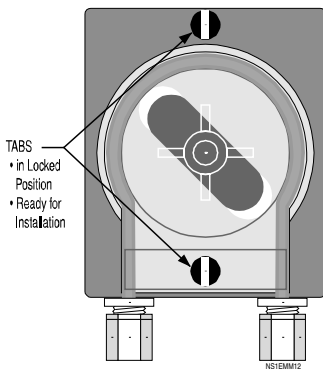


*Wear adequate protective clothing such as gloves and glasses.*

3. Remove the supply and feed lines from the old pump squeeze tubing and connect them to the new pump squeeze tubing.

**To Install:**

1. Align and engage the pump drive spline with the motor gear by rotating the roller assembly.



2. Turn the pin tabs to vertical.
3. Hold the cartridge vertically and press the pin tabs into the motor housing until you hear a distinct click.

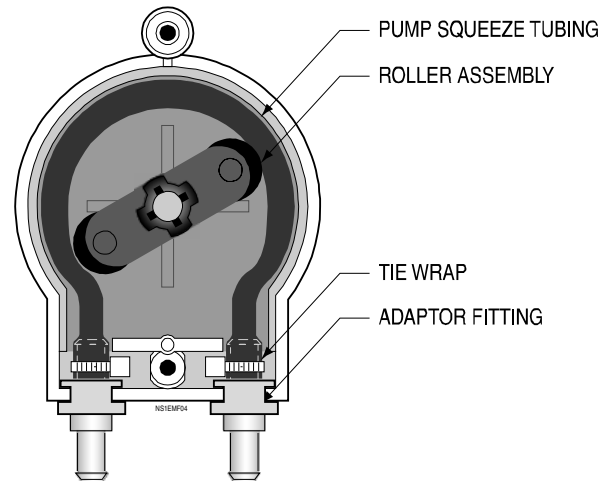


*It is very important that the tabs are vertical and that you press them firmly enough to hear them click. Incorrect installation could damage the pump.*

**How to Change the Pump Squeeze Tubing**

1. Remove the cartridge as described above.
2. Remove the small screw at the bottom of the rear cover and lift the cover from the cartridge.
3. Pull the adapter fittings rearward until they clear the cartridge.
4. Pull the roller assembly rearward to release the pump squeeze tubing.
5. Cut the tie wraps holding the pump squeeze tubing to the adapter fitting and pull the tubing from the fittings.
6. Replace the pump squeeze tubing making certain to use the proper size tube.

7. Push the adapters on to the ends of the tubing and secure with tie wraps. Make certain that the "buckles" of the tie wraps are both facing the same direction. This will keep the tube from twisting in the cartridge.
8. When using B-Flex tubing, coat the inside of the cartridge with a liberal amount of Silicone 111 lubricant.
9. Press the 2 adapter fittings into the cartridge so that the tie wrap "buckles" face toward the center of the pump. See Figure 5 below. Remember, the tube must not be twisted during the assembly.



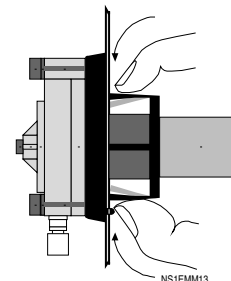
*Figure 5. Pump Cartridge*

10. Push the roller assembly onto the cartridge shaft using a twisting motion to engage the rollers properly with the pump squeeze tubing.
11. Return the rear cover and secure with the small screw at the bottom. The flat side of the cover should face inward.

**How To Replace Pump Motor & Solenoid Subassemblies**

**To Remove:**

1. Ensure power is off to the washer.
2. Remove the pump cartridge from the motor assembly, leaving the chemical lines attached.
3. Remove the electrical connections at the back of the motor.



4. Compress the two flex ears on the back of the motor until the motor slides out through the hole in the cabinet.

**To Replace:**

1. Locate the alignment tip of the motor housing so it is in the down position.

- Slide the pump motor/solenoid housing into the enclosure hole. The holding ears will expand to hold the pump motor/solenoid in place. Verify that both ears popped out and are locked in place.
- Reinstall the electrical connections at the back of the motor.
- Install the pump cartridge.
- Prime the pump to verify proper pump rotation (clockwise). If the direction is wrong, switch the motor wires.

### Cleaning The Probe

You must clean the conductivity probe tips (electrodes) on a regular basis to ensure control accuracy. The water conditions (for example, water hardness) and the type of soil load are the primary factors in determining a cleaning schedule.

### Adding a Pressure Switch

The Pressure Switch can be used only with a single Transformer or with a single (detergent) 24 Volt input NS-1000E. The Pressure Switch is located in the lower left side of the bottom plate and is connected to J6 on the PCB (see Figure 3).

## TROUBLESHOOTING

Refer to the assembly drawings and the complete unit wiring diagram in the **Appendix**, and the PCB illustration in **Internal Controls Description**. To order replacement spares, see **Recommended Spare Parts and Accessories**. Please order using the item number.

### No Power

- Is the On/Off switch on?



*The following procedure is to be performed only by qualified personnel.*

#### For units connected directly to line voltage:

- Is proper line power voltage connected to the power input terminals in the unit? Check both transformers. Is a PCB fuse blown?
- With the power wiring harness unplugged from the PCB, is 24 VAC measured across the transformer secondary wires when power is supplied from the washer? If not, replace the transformer. If yes, replace the PCB.

#### For units powered with 24 Volts:

- Is 24 Volts connected to the input terminal block? Is the PCB fuse blown?
- If the above is verified, replace the printed PCB.

### Properly Rated Fuse Blows Repeatedly

- Is there a mechanical problem with a motor or solenoid (for example, jammed tubing or frozen gears in the gearbox)?
- Do motor and/or solenoid resistance measurements fall in the approximate range from 4 to 100 ohms? If yes, go on to the next step. If no, replace suspect part(s) since a shorted motor or solenoid will cause the fuse to blow.



*Measure resistance only when the power is turned off. A short will typically measure less than 0.2 ohms; an open will typically measure more than 2000 ohms.*

- Are proper voltages measured across the appropriate output terminals (detergent drive and rinse drive) when power is applied? If not, replace the PCB. Maximum voltage is 33 to 34 VDC (without load). Rinse voltages may be lower depending on the speed setting.

### Detergent Feeds Too Often/Too Much Detergent Used

#### With Probe

- Ensure that this installation is a probe setup, not probeless.
- Check to see if the prime button is operating properly. If the PCB is not installed correctly, the prime button may be depressed continuously.
- Use the PCB display to check if the concentration setting is correct, or that the actual concentration value is close enough to the setpoint to keep the alarm from sounding. Are the probe electrodes clean?
- Is a dishwasher problem the cause? This could include fill valve on, too much rinse tank overflow into the wash tank, leaking or open drain valve, or wash motor not running to agitate the solution.
- While the detergent is feeding, short the two probe wires together (down at the probe). Does the detergent feed stop? If so, see **Detergent Does Not Feed at All** and **Checking the Detergent System Functions**. If not, go on to the next step.
- Are the probe wires loose or disconnected? If not, short across the two probe wire terminals on the PCB (instead of at the probe). This should stop the detergent feed.
- Replace the PCB if either of these tests does not stop the detergent feeding.

#### Probeless

- Check to see if the prime button is operating properly. If the PCB is not installed correctly, the prime button may be depressed continuously.
- Check the detergent control setup. (Refer to the original setup records.) If wrong, correct. If OK, replace the PCB.

### Detergent Does Not Feed at All

#### Probe

- Ensure that this installation is a probe setup, not probeless.
- Are the two probe wires shorted together? If so, the unit will never feed until this is corrected.
- Disconnect one of the wires at the probe to cause an open circuit. The indicator should flash slowly, indicating feeding, and the pump or solenoid should function. If so, see **Checking the Detergent System Functions**. If not, go on to the next step.
- Disconnect one of the probe wires from the PCB. If the detergent does not feed (or there is no voltage output from detergent drive), replace PCB.

- Before replacing the PCB, measure the voltage from the transformer secondary wires to ground. Approximately 14 VAC should be present. A transformer short to ground could cause the pump motor to run erratically.
- Replace the PCB if either of these tests (steps 5 and 6) does not start the detergent feeding.

#### Probeless

Check the detergent control setup. (Refer to the original setup records.) If wrong, correct. If OK, replace the PCB.

#### Checking the Detergent System Functions



*You may use this test to verify proper functioning of all of the detergent system: Probe input circuitry, detergent drive circuitry and the low detergent and overfeed alarm.*

#### With Probe

- Place the NS-1000E in the Program Mode and select Probe in Menu 1.
- Connect a forty-seven (47) ohm 1/4 or 1/2 watt resistor across the two PCB probe terminals, or at the end of the probe wires.
- Move the program to Menu 4 and set the Beta Units below 40.
- Cycle detergent power to the unit and observe that the detergent pump or solenoid is not feeding.
- Place NS-1000E in the Program Mode and select probe in Menu 1.
- Move the program to Menu 4 and set the Beta Units to 70.
- Cycle power to the unit. After a 7 second delay, the feed cycle will start.
- If the test did not perform as described, replace the PCB.

#### Standard Probeless

- Place NS-1000E in the Program Mode and select Probeless in Menu 1.
- Set Menu 8 to a number greater than 0, Menu d to 00 and the detergent recharge time in Menu 4 to 8 seconds.
- Cycle power to the unit and observe that the detergent pump runs or solenoid clicks on, feeds for 8 seconds and stops.
- If this test does not perform as described, replace the PCB.

#### Rinse Pump will Prime but not Feed

- Is the PCB receiving power?
- Adjust the feed rate setting in Menu 7 to a rate near mid-range, and check if there is adequate run time in Menu 8.
- Check to see if the Rinse prime button is operating properly. If the PCB is not installed correctly, the prime button may be depressed continuously.
- When using a pressure switch, short across the contacts. The pump should run at the programmed speed. If not, replace the PCB. If wired directly to the rinse solenoid, confirm that the rinse power is on from dishmachine.
- Is dishmachine rinse line solenoid opening?

#### Rinse Pump will Feed but not Prime

- Is the PCB too far back? If so, reinstall.
- Replace the PCB.

#### Rinse Pump will Neither Prime nor Feed

- Washer must be in wash/rinse cycle to prime pump.
- Check for a loose wire connection to the pump.
- When you push the Rinse Prime button, 33 to 34 VDC should be measured across the motor terminals. When shorting the pressure switch contacts, 0 to 34 volts DC should be measured, depending on what pump speed setting has been selected. This voltage will change as you increase or decrease the pump speed setting.
- If voltage in the proper range is present and the pump will still not run, remove the pump cartridge and observe the drive spline while you push the Rinse Prime button. If the drive spline does not turn, replace the motor assembly.
- Replace the PCB if either of these tests (steps 3 and 4) does not fix rinse pump.

#### Rinse Pump Feeds Continuously

Check the preset run time of the pump and the operation of the Rinse prime button. If the pump continues to run beyond that run time, replace the PCB.

#### Pump Will Not Pull the Chemical Out of the Drum

- Too much vacuum created. The supply line in the chemical drum may be up against either the side or bottom, the supply lines may be too long for a viscous product, or there may be a crimp in the intake supply line, thus exceeding the pump's vacuum specifications.
- There may be an air leak somewhere in the input supply line. Most often this is caused by inadequate sealing of the supply line into the line nuts.
- Squeeze tube is worn and the rollers can no longer squeeze the tube properly. Correct by changing the pump cartridge with the correct size squeeze tube and line nuts for the chemical being pumped.

## ACCESSORIES & SPARE PARTS

The items listed in this section provide you with quick reference numbers for some of the major parts and accessories. A complete exploded assembly drawing is located in the back of the manual.

#### Spares

Printed circuit board	1201643
Solenoid valve assembly, brass	099312
Fuse, AGC 250 Volt 3 Amp (pack of 10)	042883
Pressure switch	040629
Blank plate	051606
Power switch	037598

Pump cartridge, Norprene, detergent	039556
Pump cartridge, Flex, detergent 1/4T-1/4T	092967
Tube kit, Norprene, detergent 1/4T-1/4T	039553
Tube kit, Flex high volume, detergent 1/4T-1/4T	1200413
Pump cartridge, Flex, rinse, 1/8T-1/8T	092853
Tube kit, Flex, rinse, 1/8T-1/8T	092849
Tube kit, Biwall, rinse, 1/8T-1/8T	096309
Pump cartridge, B-Flex, sanitizer, 1/4T-1/4T	092854
*Sight glass kit	098059
Norprene tube kit	057203
Pump Roller Assembly	039550
Quarter Turn Pin for Pump (pack of 10)	092353
Pump Motor Gearbox	092155

### **Accessory Kits**

Transformer Kit	091962
Probe Kit (Conductivity Only)	018079
Probe Kit (Temperature Compensated)	099925
Mounting Bracket Kit	018224

*\*Sight Glass must be used on all sanitizer pumps for NSF certification.*

# APPENDIX

## NS-1000E INTERNAL TRANSFORMER POWER CONNECTIONS

### NS-1000E with Two Internal Transformers

		TRANSFORMER CONNECTION/MACHINE POWER SOURCE	
MACHINE TYPE	PRODUCT	PROBE MODE	PROBELESS MODE
<b>Recirculating Door</b>	Detergent Initial Charge	Detergent Transformer/Wash Power	Detergent & Rinse Transformers/Rinse Power
	Det Recharge	Detergent Transformer/Wash Power	
	Rinse	Rinse Transformer/Rinse Power	
	Sanitizer	<b>NOTE:</b> Runs During Machine Rinse Cycle	
	Destainer	<b>NOTE:</b> Runs During Detergent Feed	
<b>Fill &amp; Dump Door</b>	Detergent Initial Charge		
	Det Recharge		Detergent Transformer/Wash Power
	Rinse		Rinse Transformer/Rinse Power
	Sanitizer		Runs During Machine Rinse Cycle
	Destainer		Runs During Detergent Feed
<b>Conveyor</b>	Detergent Initial Charge	Detergent Transformer/Wash Power	Detergent Transformer/Initial Fill Power OR Manual Button or Pressure Switch with Continuous Power
	Det Recharge	Detergent Transformer/Wash Power	Rinse Transformer/Rinse Power
	Rinse	Rinse Transformer/Rinse Power	Rinse Transformer/Rinse Power
	Sanitizer	<b>NOTE:</b> Runs During Machine Rinse Cycle	
	Destainer	<b>NOTE:</b> Runs During Detergent Feed	

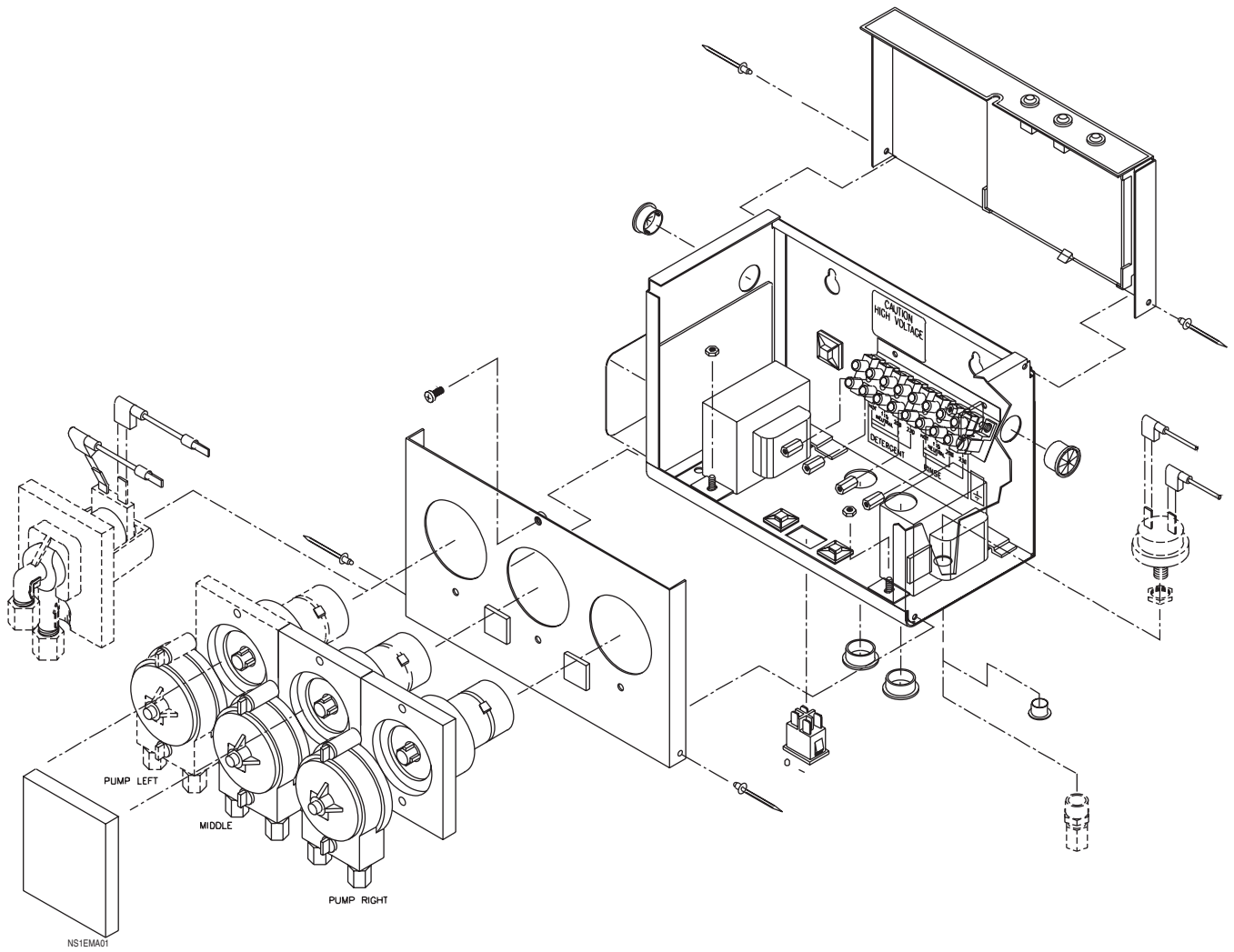
### NS-1000E with One Internal Transformer and a Pressure Switch

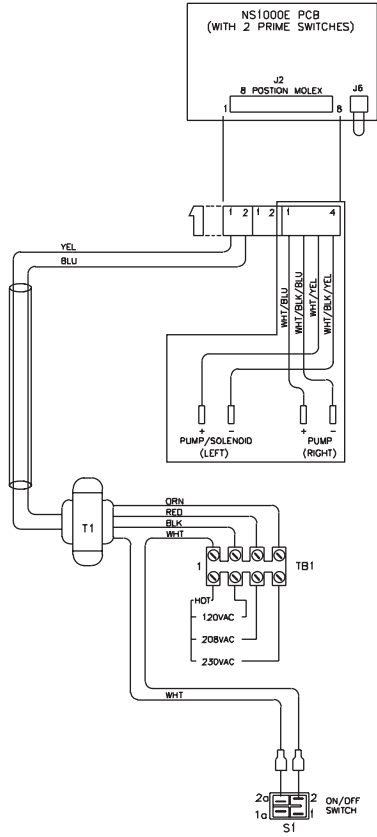
(Not applicable to machines with Split Wash and Rinse Power Source)

		TRANSFORMER CONNECTION/MACHINE POWER SOURCE	
MACHINE TYPE	PRODUCT	PROBE MODE	PROBELESS MODE
<b>Recirculating Door OR Conveyor</b>	Detergent Initial Charge	Detergent Transformer/Continuous Power During Entire Wash & Rinse Cycles	
	Detergent Recharge		
	Rinse		
	Sanitizer	<b>Note:</b> Runs During Machine Rinse Cycle	
	Destainer	<b>Note:</b> Runs During Detergent Feed	

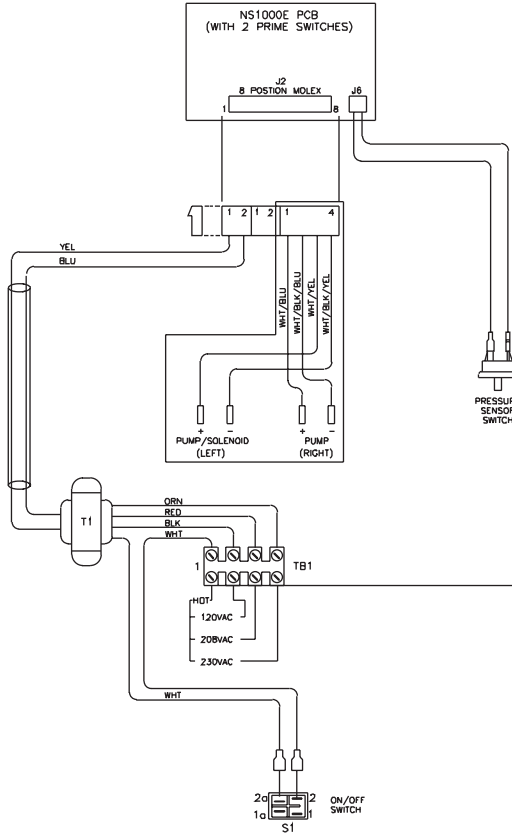
# APPENDIX

## ASSEMBLY DRAWINGS



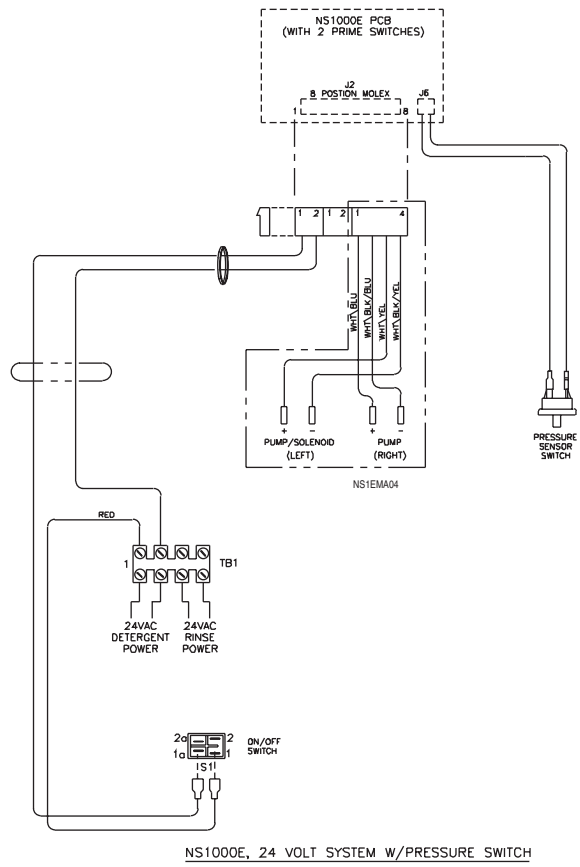
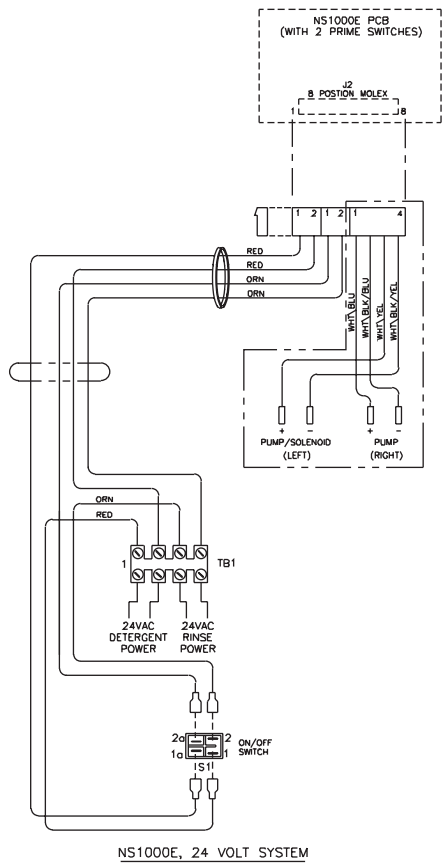


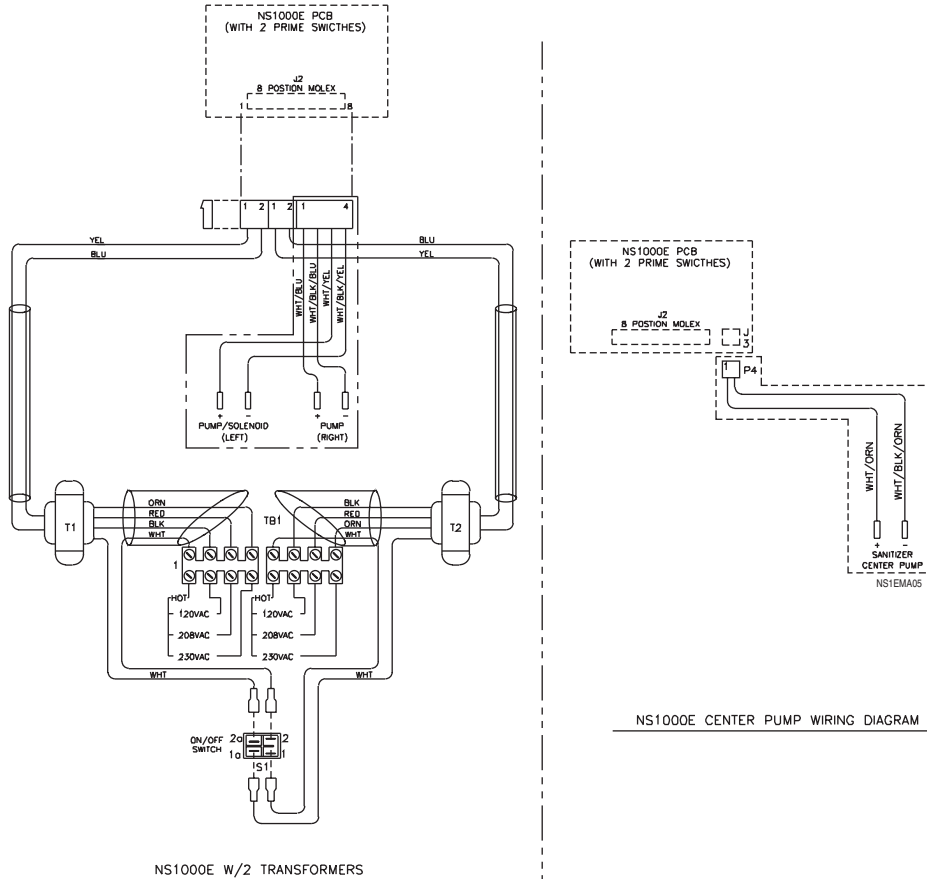
NS1000E, 1 TRANSFORMER



NS1EMA03

NS1000E, 1 TRANSFORMER W/ PRESSURE SWITCH





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