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Controller Reference

Using the E-P Plus® Control on MWF_, MWR_ & MWT_ Models

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Preface

1 About This Manual

1.1 Scope

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This manual tells how to start, program, operate, and repair washer-extractors with the Milnor® E-P Plus® microprocessor control. See the installation manual for installation procedures and mechanical requirements. See the maintenance manual for maintenance and repair procedures and to identify parts. See the schematic manual for electrical parts and electrical repair instructions.

1.2 The Normal Display at Start-up

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The start-up display sequence for the E-P Plus controller is described in 3.1: Running a Formula, page 55 .

1.3 If this Manual Does Not Have the Necessary Data

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This manual has the best data that was available when your machine was made. If you cannot find the necessary data:

- **Are you looking for data about a component not made by Milnor® but used on your machine—for example, a motor or a brake caliper?** We usually do not put the instructions of component manufacturers in Milnor® manuals. You can find some of these instructions in the part of the Milnor® website that gives maintenance data (http://milnortechnicalsupport.force.com/pkbmilnor/). You can also find instructions for many components on the manufacturers' websites.
- **Are you looking for data about a Milnor® component on your machine that this manual does not give?** If we get better data or more data after the manual is available, we will add it to a newer version of the manual. Speak with the Milnor® Customer Support group. They can give you newer instructions if they are available or help you if not.

1.4 Trademarks

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These words are trademarks of Pellerin Milnor® Corporation and other entities:

Table 1. Trademarks

AutoSpot™	GreenFlex™	MilMetrix®	PulseFlow®
CBW®	GreenTurn™	MilTouch™	Ram Command™
Drynet™	Hydro-cushion™	MilTouch-EX™	RecircONE®
E-P Express®	Mentor®	MILRAIL™	RinSave®
E-P OneTouch®	Mildata®	Miltrac™	SmoothCoil™
E-P Plus®	Milnor®	PBW™	Staph Guard®
Gear Guardian®			

1 Commissioning

1.1 Important Data About this Machine

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Complete these two procedures before you use this machine:

1. Make sure that all laundry personnel are safe.
2. Change and make a check of the data contained in the memory of the machine (configuration, formulas, and formula accumulator data).

1.1.1 Make Sure That All Laundry Personnel are Safe

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Personnel who will use or do maintenance on this machine must read the safety manual first. Make all user manuals available to the correct personnel. Be sure that all personnel obey all precautions in the applicable manuals.

1.1.2 Change the Data

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1. Make sure that the controller configuration is correct for how you will use the machine.
2. Change the wash formulas if necessary for better results.
3. Make sure that you erased the formula count accumulator to make the formula count accurate.

1.1.2.1 When to Change Data

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Make a check of the data:

- when commissioning the machine
- when required by error message
- after replacing the microprocessor board
- after upgrading the software
- after adding or removing optional equipment

Make the necessary changes.

1.1.2.2 Steps that are Necessary When You Change Data

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1. Make a check of the machine configuration.
2. Write wash formulas.
3. Erase the formula accumulator data, if applicable. See the applicable sections in this manual for instructions.

1.1.2.3 Data Accessibility

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The key switch must be in the **Program** position to change configuration and formula data. The microprocessor controller changes the formula accumulator data while the machine operates. Thus, the key switch can not prevent changes to the accumulator data. You can use the data as given in Table 2 .

Table 2. How to Read and Change Data

Data Type	How to Change Data
Configuration Data	You can read and change data.
Formula Data	You can read, change, and erase data.
Accumulator Data	You can read and erase data.

1.1.2.4 Replace Incorrect Data

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If the microprocessor finds incorrect data, the display will show an error message, usually when the machine first gets power. The error can prevent machine operation. The troubleshooting instructions tell about each error and how to repair it. Obey these instructions to make sure that incorrect data is replaced with correct data. You can cause dangerous operation or damage to the machine if you do not obey these instructions.

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1.2 Determining Load Size

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You will not do damage to the machine with a large load if you follow these rules:

1. The goods are made of common cotton or synthetic materials.
2. The load can balance in the cylinder before the extract step.
3. The extract speed has not been increased above the designed maximum.
4. You do not program so many extract steps that you do damage to the motor.

For common goods, the size of the machine sets the quantity you can put in the machine.

These items determine the maximum load weight of soiled goods:

- the volume of the machine's cylinder, and
- the material and weight of the goods.

Do not try to load the machine to its maximum weight capacity with bulky fabrics.

Use the size of the machine, the type of the goods, the amount of soil, and the wash quality when you load the machine.

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1.3 Vital Information About the Forces Imparted to Supporting Structures by Laundering Machines

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This document replaces Milnor® document BIWUUI02.

All laundering machines impart static and dynamic forces to the supporting structures (foundation and soil, floor, and building). Static forces include the machine weight plus the weight of the goods and water. Dynamic forces are those imparted by various machine movements as explained in 1.3.2: Major Design Considerations, page 5 . The dynamic forces imparted to supporting structures can cause vibration and noise outside of the laundry room if supporting structures are inadequate.

1.3.1 Disclaimer of Responsibility

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Pellerin Milnor Corporation accepts no responsibility for damage or loss as a result of:

- inadequate supporting structures
- interference with the use of the facility caused by machine operation

The facility owner/operator is solely responsible to ensure that:

- supporting structures are strong enough, with a reasonable safety factor, to safely support the operating machine or group of machines
- supporting structures are rigid enough to isolate vibrations and noise to the laundry room

If the owner/operator does not possess the necessary expertise to ensure that the facility can safely and functionally accommodate the equipment, it will be necessary to consult the appropriate expert(s), such as a structural engineer, soils engineer, and/or architect.

1.3.2 Major Design Considerations

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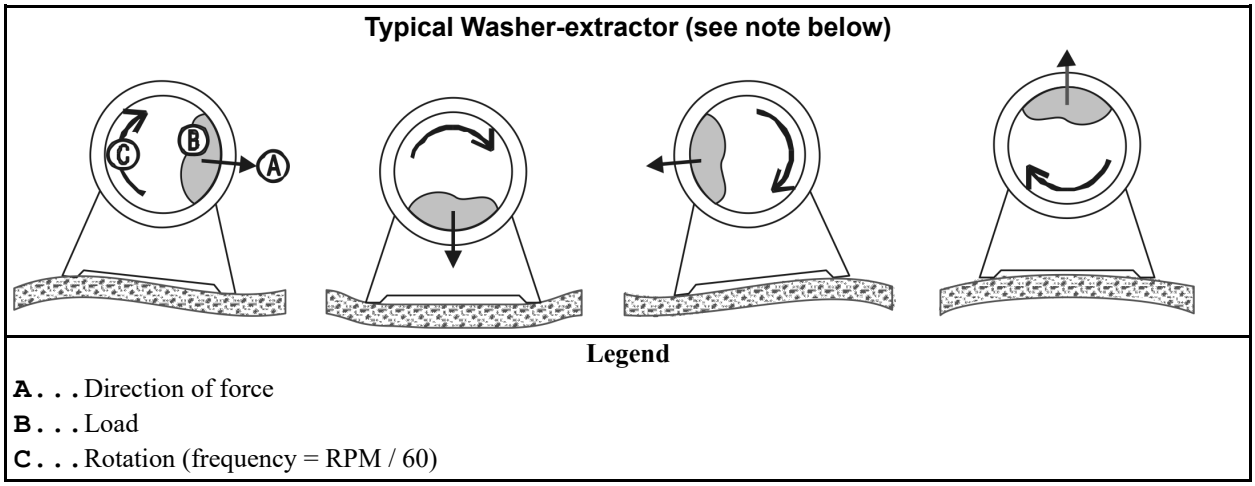
- Vibration and/or noise can be felt or heard outside of the laundry room as a result of the following, if supporting structures are not sufficiently rigid:
  - Extraction (the spinning cylinder) in washer-extractors and centrifugal extractors, imparts sinusoidal forces to supporting structures as shown in Figure 1: How Rotating Forces Act On the Foundation, page 6 . In rigid washer-extractors, these forces are up to 30 times that of suspended washer-extractors of the same capacity.
  - Extraction forces can be magnified many times if the rotation frequency matches the resonant frequency of supporting structures. To avoid this, supporting structures must have a

natural resonant frequency many times greater than any possible rotation speed of the machine or combination of rotation speeds of all machines.

- Each time goods fall in the rotating cylinder of a washer, washer-extractor, centrifugal extractor, or dryer, this can impart a force to the supporting structures.
- The intermittent start and stop actions of large components inside the machine, particularly in a tilting washer-extractor, press-extractor, or centrifugal extractor, can impart intermittent forces to the supporting structures.

- The possibility of adverse consequences is significantly greater for upper floor installations than for installations at grade. Always consult a structural engineer for such an installation.
- The possibility of adverse consequences is significantly greater for installations at grade if subsidence causes a void between the foundation and the soil or if the soil itself does not provide adequate strength and rigidity. Some possible remedies are the addition of pilings or a deeper foundation, installed as to be monolithic with the existing foundation.
- Machine forces can cause damage to the machine or the floor without the correct anchorage.
- Applicable building codes, even when met, do not guarantee sufficient structural support and isolation of machine forces to the laundry room.

Figure 1. How Rotating Forces Act On the Foundation



NOTE: This figure applies to both rigid and suspended washer-extractors and to both at-grade and upper floor installations.

1.3.3 Primary Information Sources

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Milnor® provides, or can provide the following information of use to engineers and architects, for the given machine model:

- The machine dimensional drawing, found in the installation manual, specifies the machine's required anchorage.
- The Milnor® Service Department can provide static and dynamic load values and frequency (extract speed) values on request.

NOTICE: All data is subject to change without notice and may have changed since last printed. It is the responsibility of the potential owner/operator to obtain written confirmation that any data furnished by Milnor® applies for the model number(s) and serial number(s) of the purchased machine(s).

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1.4 Prevent Damage from Chemical Supplies and Chemical Systems

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All Milnor® washer-extractors and CBW® tunnel washers use stainless steel with the ANSI 304 specification. This material gives good performance when chemical supplies are correctly applied. If chemical supplies are incorrectly applied, this material can be damaged. The damage can be very bad and it can occur quickly.

Chemical supply companies usually:

- supply chemical pump systems that put the supplies in the machine,
- connect the chemical pump system to the machine,
- write wash formulas that control the chemical concentrations.

The company that does these procedures must make sure that these procedures do not cause damage. **Pellerin Milnor Corporation accepts no responsibility for chemical damage to the machines it makes or to the goods in a machine.**

1.4.1 How Chemical Supplies Can Cause Damage

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Dangerous Chemical Supplies and Wash Formulas — Some examples that can cause damage are:

- a very high concentration of chlorine bleach,
- a mixture of acid sour and hypo chlorite,
- chemical supplies (examples: chlorine bleach, hydrofluosilicic acid) that stay on the stainless steel because they are not quickly flushed with water.

The book “Textile Laundering Technology” by Charles L. Riggs gives data about correct chemical supplies and formulas.

Incorrect Configuration or Connection of Equipment — Many chemical systems:

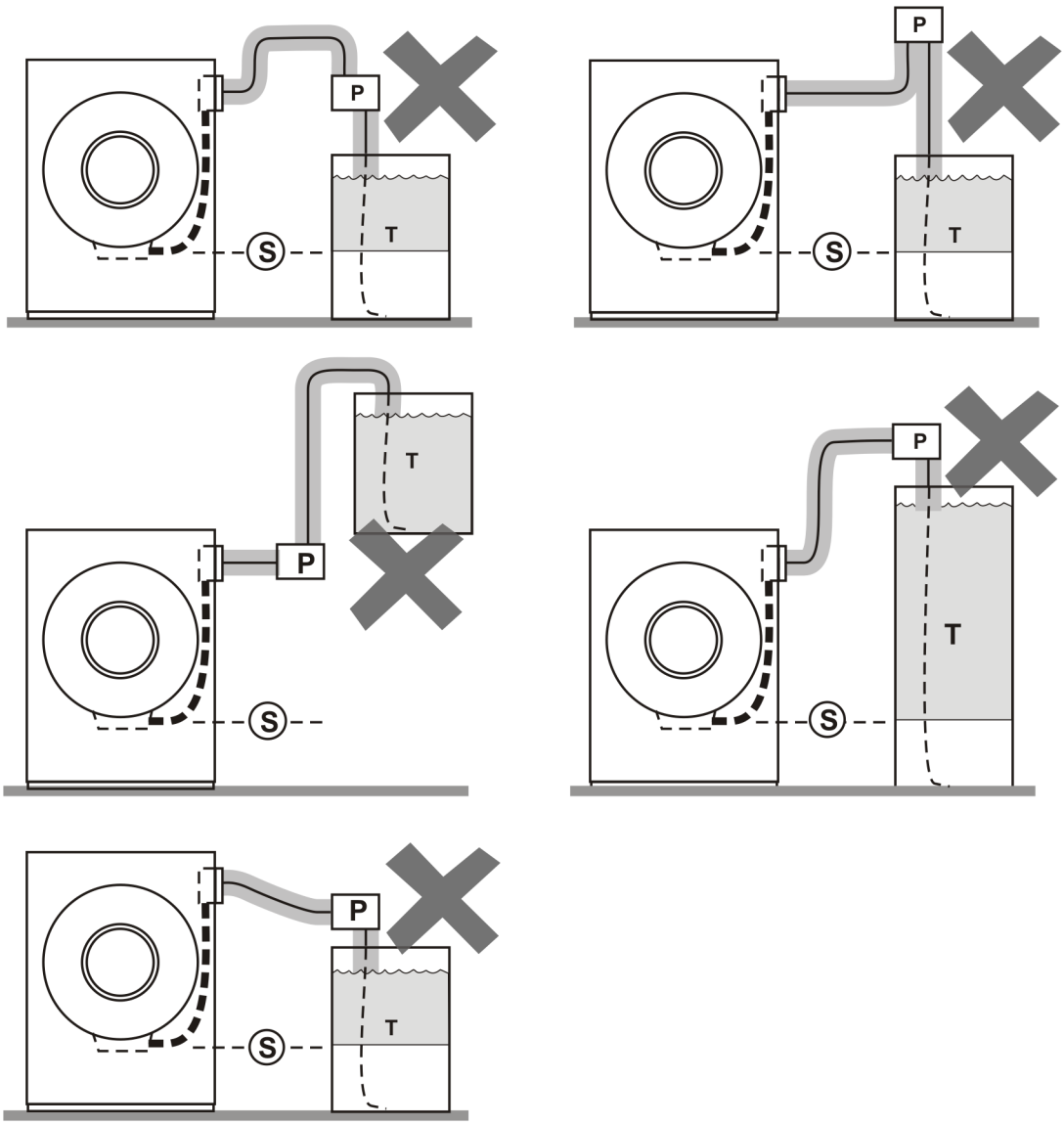
- do not prevent a vacuum in the chemical tube (for example, with a vacuum breaker) when the pump is off,
- do not prevent flow (for example, with a valve) where the chemical tube goes in the machine.

Damage will occur if a chemical supply can go in the machine when the chemical system is off. Some configurations of components can let the chemical supplies go in the machine by a siphon

(Figure 2: Incorrect Configurations That Let the Chemical Supply Go In the Machine by a Siphon, page 8). Some can let chemical supplies go in the machine by gravity (Figure 3: Incorrect Configurations That Let the Chemical Supply Go In the Machine by Gravity, page 9).

Figure 2. Incorrect Configurations That Let the Chemical Supply Go In the Machine by a Siphon

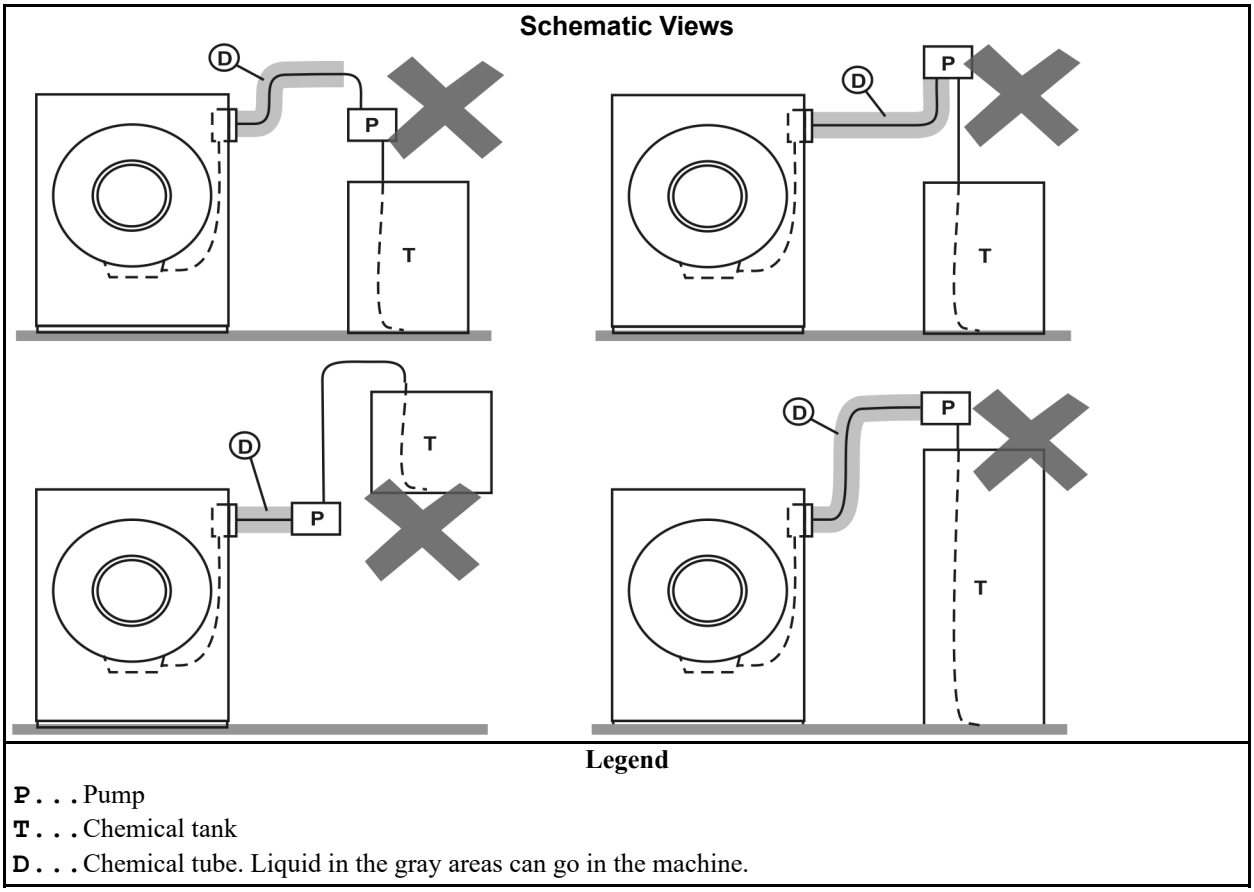
Schematic Views



Legend

P . . . Pump
T . . . Chemical tank
S . . . The siphon occurs above here. Liquid in the gray parts of the chemical tube and tank can go in the machine.

Figure 3. Incorrect Configurations That Let the Chemical Supply Go In the Machine by Gravity



Legend

P . . . Pump
T . . . Chemical tank
D . . . Chemical tube. Liquid in the gray areas can go in the machine.

1.4.2 Equipment and Procedures That Can Prevent Damage

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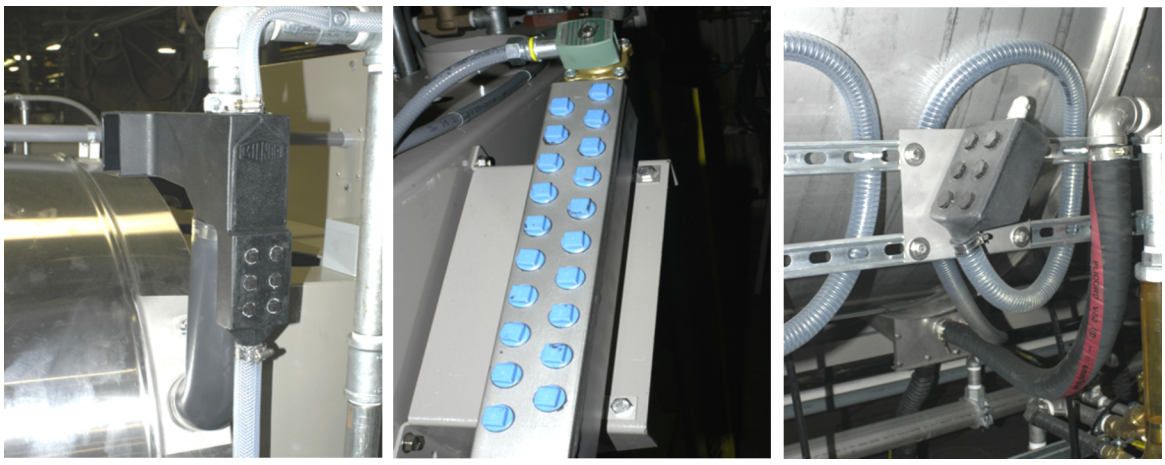
Use the chemical manifold supplied. — There is a manifold on the machine to attach chemical tubes from a chemical pump system. The manifold has a source of water to flush the chemical supplies with water.

Figure 4. Examples of Manifolds for Chemical Tubes. Your equipment can look different.



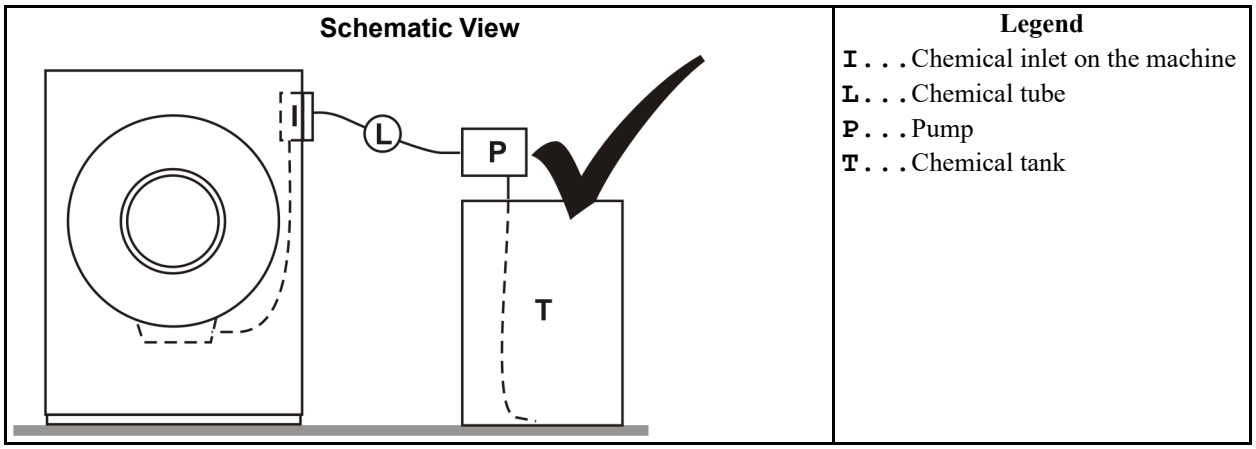
Close the line. — If the pump does not always close the line when it is off, use a shutoff valve to do this.

Do not let a vacuum occur. — Supply a vacuum breaker in the chemical line that is higher than the full level of the tank.

Flush the chemical tube with water. — If the liquid that stays in the tube between the pump and the machine can flow in the machine, flush the tube with water after the pump stops.

Put the chemical tube fully below the inlet. — It is also necessary that there is no pressure in the chemical tube or tank when the system is off.

Figure 5. A Configuration that Prevents Flow in the Machine When the Pump is Off (if the chemical tube and tank have no pressure)



Prevent leaks. — When you do maintenance on the chemical pump system:

- Use the correct components.
- Make sure that all connections are the correct fit.
- Make sure that all connections are tight.

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1.5 Connecting Chemical Systems

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Multiple methods are available on E-P Plus® washer-extractors to accommodate chemical systems. Use this section to help determine the best method of chemical injection and how to connect the chemical system. Always consult the schematic manual for this machine before connecting chemical systems to the machine.

DANGER: **Electric Shock Hazard —** Contact with high voltage electricity will kill or seriously injure you. Even with the **Master Switch off** and/or any **Emergency Stop switches off**, three-phase power and control circuit power are still present at several locations within electric boxes and electrical components.

DANGER: **Injury and Damage Hazards —** Improper wiring can cause the machine to malfunction, risking injury to personnel, damage to machine components, and damage to goods.

- Electrical and piping connections described in this section must be made only by qualified, authorized personnel.
- Lock off and tag out power at the external disconnect switches for the washer-extractor and for any chemical devices that provide power to the interpret relay box (if furnished) before proceeding.
- Do not rely merely on the information in this section when wiring. Consult all applicable electrical schematics.
- Do not reroute or rearrange any wires not specifically permitted by this instruction.
- Do not connect a common wire to ground. Use the common terminal furnished.

CAUTION: **Risk of Poor or Inconsistent Wash Quality —** Injection times of less than 10 seconds are discouraged because fine adjustments are not possible and factors such as pump lag time may cause significant variations in the amount of chemical delivered.

- Size pumps or valves small enough for adequate control (i.e., for longer injection times).
- Use two pumps or valves to inject a small or large quantity of the same chemical, if required.

1.5.1 Maximizing Chemical Injection Precision

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Injection of a consistent amount of chemical is important in controlling wash quality and using chemicals economically. When chemicals are injected by units of time, as is done with most washer-extractors, injections of short duration can be imprecise because of two reasons:

- Fine adjustments to the delivered quantity are not possible. For example, if an injection of three seconds is extended by one second, the quantity delivered is theoretically increased by more than 30 percent. However, if an injection of 20 seconds is increased by one second, the theoretical quantity is increased by only five percent.
- Variations in the time between the start of the chemical signal and the start of the chemical delivery into the machine can cause significant differences in the quantity of chemical injected. In this case, if a pump starts more slowly some times than others, or if the delivery tubes are partially empty at the start of the inject period, the quantity of chemical delivered may vary significantly. As an example, assume a peristaltic pump moves chemical along the delivery tube at a rate of three feet per second. If the delivery tube is empty for three feet along its

length, then one second of the injection time is spent injecting air rather than chemical. If the programmed injection time is only three seconds, then one third of the desired chemical is not being delivered. However, if the programmed injection time is 20 seconds, the chemical delivery is only five percent less than desired.

- Increasing the programmed injection time makes any variation less significant. Use pumps and/or valves sized to allow inject times of at least 10 seconds. If injection times for a specific chemical vary widely from one formula to another, consider using two pumps or valves for the same chemical. Actuate one pump for injecting small quantities, and use both pumps or valves for larger quantities.

1.5.2 Available Chemical Injection Methods

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All machine models are equipped with a chemical chute for the introduction of dry chemical supplies directly into the bath liquor. Automatic or manual flushing is provided on most models to reduce the risk of corrosion. One or more other chemical injection devices, described below, are available according to machine model.

1.5.2.1 Chemical Injection Output Signals

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Five discrete signals (for chemicals 1 through 5) are furnished standard on all washer extractors. These signals are available at a terminal strip on all E-P Plus® machines. Check the nameplate on the machine to verify the model.

Starting with E-P Plus software version WUH7JA/2200N, Milnor provides six discrete chemical signals on H_J and X_J washer-extractors. The sixth chemical signal is between MTA3-1 (common) and MTA3-10.

1.5.2.2 Optional Five-Compartment Flushing Chemical Injector

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An externally mounted five-compartment dry supply injector is offered as an option on some models. The five electrically operated flush valves are wired to chemical injection output signals at a terminal strip on the machine (usually terminal strip TBA).

1.5.2.3 Liquid Chemical Tube Connectors

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A five or six port liquid chemical inlet manifold is standard equipment on most models. Use these valveless inlets to connect tubes from remote chemical supply injection systems that are not continuously pressurized and that deliver chemicals only when an injection is commanded.

1.5.3 Considerations for Pumped Chemical Systems

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Pumped chemical systems deliver chemicals to the machine intermittently usually via peristaltic pumps. Inlets on the machine must be unrestricted at all times (valveless). The supplied pumped chemical inlets meet this requirement.

An inherent risk of this method of chemical injection is that concentrated chemicals can dribble into the machine after it is shut down for the evening, causing machine and/or linen damage. Because Milnor® has no control over the design or installation of pumped chemical systems, Pellerin Milnor Corporation accepts absolutely no responsibility for damage to its equipment or textiles therein caused in this way. Much more information on this subject is provided in 1.4: Prevent Damage from Chemical Supplies and Chemical Systems, page 7 . Consult this document before connecting a pumped chemical system.

1.5.4 Connecting Devices to Receive Injection Signals

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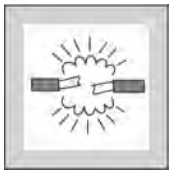
For 36-inch and 42-inch V_J models, injection signals provide either 110VAC/50Hz or 120VAC/60Hz potential. For 30-inch V_J and all F_J/F_B, H_J, and X_J models, injection signals provide either 220VAC/50Hz or 240VAC/60Hz potential. Each signal can accomodate one apparatus not exceeding 37 milliamperes. Inject signals cannot be made potential-free.

CAUTION: **Avoid Component Damage —** Board components will burn out and require board replacement if devices driven by inject signals do not meet the electrical specifications. Pumps generally draw a higher current and will burn out board components.



1.5.5 Connecting Chemicals to H_J, X_J, and 30-inch V_J Models

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Acquire signals at connector TBS near the rear access panel, next to the incoming power connections. See the following table for connection details.

Table 3. Chemical Injection Signals for H_J, X_J, and 30-inch V_J Models

Signal Component	Chemical	Relay	Processor Board Connection	Terminal Number
Chemical 1	Detergent	CR01M	M5-3	95
Chemical 2	Bleach	CR02M	M5-6	93
Chemical 3	Sour	CR03M	M5-5	91
Chemical 4	Softener	CR04M	M5-4	75
*Chemical 5	Starch	CR05M	M5-2	85
**Chemical 6	—	CR06M	M3-10	
Common	all	—	—	6

* Chemical 5 is not used if the machine is equipped and configured for ChemSave. In this case, relay CR05M closes whenever the machine desires to inject a chemical.

** Chemical 6 is available only on H_J and X_J models with version software WUH7JA/2200N or later.

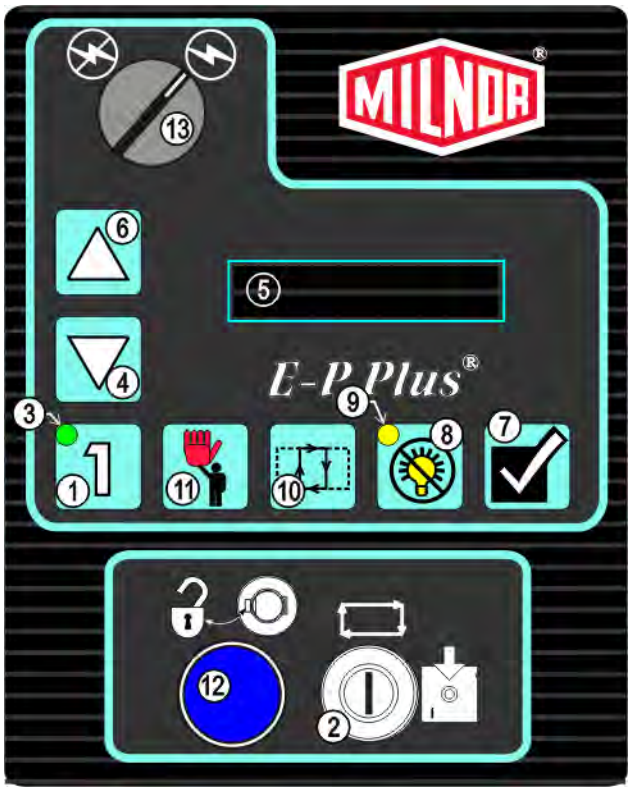
2 Programming

2.1 Controls on E-P Plus® Washer-extractors

The controls on these Milnor® washer-extractors include push-buttons, some of which include indicator lights. Some of these controls operate differently in the three machine modes. This document gives the function of each control in the different machine modes.

Figure 6. Typical Control Panels

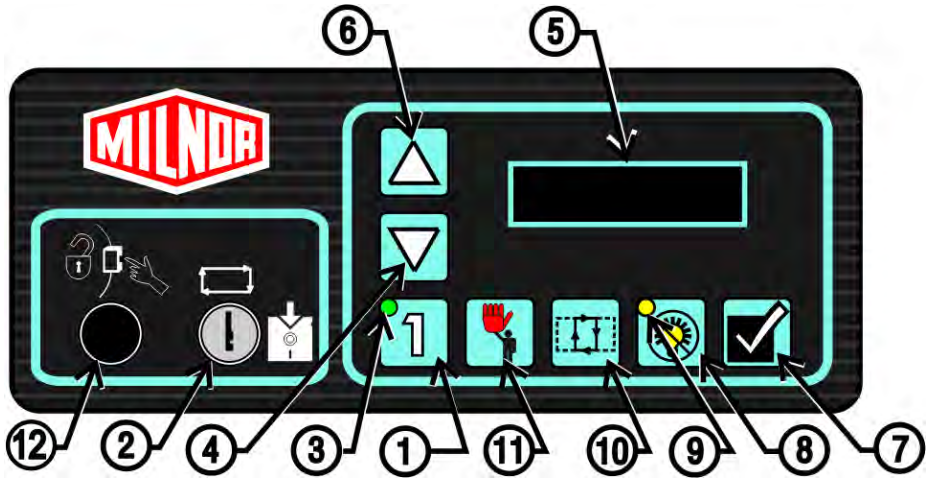
Control Panel for X_J Models



Legend

1. **Start** button
2. **Run/Program** key-switch
3. **Run Indicator** light
4. **Scroll Down** button
5. Display
6. **Scroll Up** button
7. **Next** button
8. **Signal Cancel** button
9. **Operator Signal** light
10. **Manual Mode** button
11. **Terminate** button
12. **Door Unlock** button
13. **Master switch** for power

Control Panel for V_J Models



2.1.1 Control Functions During Normal Operation

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The machine operates correctly when the control circuit has power and the key-switches are at the **Run** and **Automatic** positions.

Normal operation is the state of the machine when the machine control circuit is energized and the **Run/Program** keyswitch is in the **Run** position. The machine may be either idle (waiting to run a formula) or running. If the machine is idle, the message on the display will begin with "Run Formula" and include a formula number on the second line.

1. Push the **Start button** (1) to start the wash formula. The formula begins if the machine has power and the door is closed. To see the status of the microprocessor inputs, hold the **Start button** and push the **Scroll Up button**.
2. The **Run/Program keyswitch** must be in the **Run** position ( ) unless the machine is being configured or programmed. All control descriptions listed under 2.1.1: Control Functions During Normal Operation, page 15 are based on the keyswitch being in the **Run** position. See 2.1.3: Control Functions During Programming, page 18 for descriptions of how the controls operate with the keyswitch in the **Program** position ( ).
3. The **Run Indicator light**, in the upper left corner of the **Start button**, lights when a formula is started by pressing 1. If the operator stops the formula before it stops automatically, the light goes off when any coast time expires and the control unlocks the door. If the formula runs to completion, the light goes off when the coast time following the final extract step expires.
4. When selecting a specific formula to run, press the **Scroll Down button** ( ) to display the next lower numbered formula in memory. Push this button with the lowest formula displayed (Formula 01) to select the highest numbered available formula (maximum of 30 formulas). For troubleshooting, hold the **Manual button** and press the **Scroll Down button** to view the status of the second 12 outputs.
5. The display on these machines is a vacuum fluorescent type displaying two lines of twenty characters each.
6. The **Scroll Up button** ( ) functions in much the same manner as the **Scroll Down button** described above. Push this button to display the next higher numbered formula in memory. For troubleshooting, hold the **Manual button** and press the **Scroll Up button** to view the status of the first 12 outputs. Hold the **Start button** and press the **Scroll Up button** to view the status of the microprocessor inputs.
7. The **Next button** ( ) is used during normal operation only for troubleshooting. Holding the **Signal Cancel**, **Manual**, and **Next buttons** simultaneously displays the raw pressure data and the actual number of inches detected by the bath level pressure transducer.
8. Push the **Signal Cancel button** ( ) to silence the operator signal buzzer which sounds when a formula completes normally. Also, if a signal is programmed with a chemical injection in any formula, this button must be pressed to indicate that the chemical has been added and to resume operation. For troubleshooting bath level problems, hold the **Signal Cancel**, **Manual**, and **Next buttons** simultaneously to display the raw pressure data and the actual number of inches detected by the bath level pressure transducer.
9. The **Operator Signal light**, in the upper left corner of the **Signal Cancel button** ( ), is a visual indicator that operator attention is required. This light is illuminated simultaneously with the sounding of the operator signal buzzer.

10. The **Manual button** ( ) has no effect while a formula is running except when troubleshooting bath level errors. Pushing this button when the display says “Run Formula xx” initiates manual mode, where the controls function as described in 2.1.2: Control Functions During Manual Operation, page 17 . For troubleshooting bath level problems, hold the **Signal Cancel**, **Manual**, and **Next buttons** simultaneously to display the raw pressure data and the actual number of inches detected by the bath level pressure transducer.
11. The **Terminate button** ( ) cancels all remaining steps in any running formula and initiates the shutdown procedure for the machine. Formulas ended in this manner cannot be resumed.
12. The **Door Unlock button** ( ) unlocks the door. For safety, you must also hold this button to open or close the optional power-assisted door or to jog or tilt the machine.

2.1.2 Control Functions During Manual Operation

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Manual operation is used primarily for troubleshooting the machine by activating outputs and viewing inputs.

1. The **Start button** ( ), when pressed while the **Manual button** is held down, activates the selected menu function. Depress the **Start** and **Manual buttons** simultaneously to view the software date code. For other manual menus, release the **Start button** when the menu appears on the display.
2. The **Run/Program keyswitch** has no effect on how the manual mode operates. However, the status of the switch (either + or –) is displayed in field F in the **Test Inputs** menu.
3. The **Run Indicator light** is not activated during manual operation.
4. At the manual menu, the **Scroll Down button** ( ) displays the available menu items in reverse numeric order.
5. In the manual menu, the display presents user prompts and selected information. The software date code and machine configuration are displayed; inputs and outputs and their respective statuses are shown in those modes. Other menu selections display DIP switch settings, as well as temperature and level testing information.
6. The **Scroll Up button** ( ) displays the next higher numbered mode in the manual menu. For example, pressing this button once will scroll from the **Software Date Code** mode to the **Test Inputs** mode.
7. The **Next button** ( ) has no function in manual mode.
8. The **Signal Cancel button** ( ) has no function in manual mode.
9. The **Operator Signal light** does not operate when the controller is in manual mode.
10. Use the **Manual button** ( ) to enter manual mode when the machine is idle.
11. The **Terminate button** ( ) cancels manual mode and returns the controller to the normal operation or programming mode, depending on the setting of the **Run/Program** keyswitch. Any outputs that were manually actuated while in manual mode are turned off.

12. The **Door Unlock button** ( ) functions normally during manual operation.

2.1.3 Control Functions During Programming

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The programming mode is used to modify the actions performed in a wash formula or to create new wash formulas.

1. The **Start button** ( ) is used in combination with the **Next button** ( ) or the **Terminate button** ( ) to delete or insert a step in a wash formula, respectively.
2. The **Run/Program keyswitch** allows programming when set to . The **Program menu** includes selections for adding and changing wash formulas, configuring the controller, and restoring the standard formulas provided with the machine. The keyswitch must be set to the **Run position** ( ) for normal machine operation, as described in 2.1.1: Control Functions During Normal Operation, page 15 .
3. The **Run Indicator light** is not actuated during programming.
4. Use the **Scroll Down button** ( ) to change the selected programming parameter to the next lower-numbered choice.
5. The display presents the programming menus and choices within those menus, including all configuration and formula parameters.
6. The **Scroll Up button** ( ) scrolls the available choices upward from the lowest available number.
7. Use the **Next button** ( ) to confirm any choice and move to the next decision in the sequence.
8. The **Signal Cancel button** is not used in programming.
9. The **Operator Signal light** is not used in the programming mode.
10. The **Manual button** is not used in the programming mode.
11. The **Terminate button** ( ) returns the user to the main programming menu (top line of display reads **Program X Menu**) from the **Add/Change Formula** and the **Standard Formulas** menus. The **Terminate button** has no effect after the **Configure menu** has been accessed, or after any parameter of any formula has been accessed in the **Add/Change Formula** menu.
12. The **Door Unlock button** ( ) is not used during programming.

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2.2 Selecting an Industry Formula Set

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This document gives data about all current Milnor® E-P Express® controlled washer-extractors and Milnor® E-P Plus® controlled washer-extractors with one type of processor board. You can identify this board by “P/N 08BH18EP_ ” near the Milnor® symbol on the processor board.

The Milnor® factory sets each washer-extractor controller for the specified operation. You can change the DIP switches on the processor board to change the machine configuration for a different operation. This document describes how to set the DIP switches. A different operation nameplate is necessary on some models. Get operation nameplates from your dealer or the Milnor® parts department.

To change industry configuration, turn the machine **off**. Then lock off and tag out power to the machine at the wall disconnect before accessing the processor board.

WARNING: **Electrified parts inside —** can shock or electrocute you.

▶ Turn off and lockout/tagout electric power before you open an electrical cabinet.

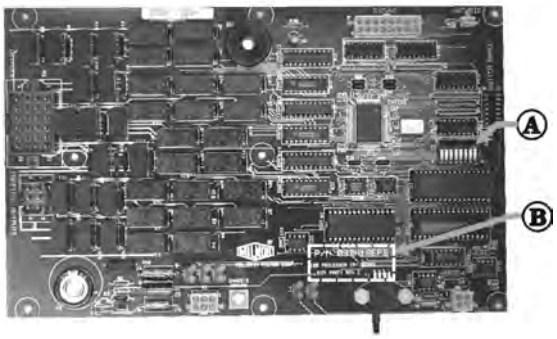
The microprocessor board holds the DIP switches as shown in the following figure also shows the **on** and **off** positions. Set the switches to the desired positions according to the following table. Turn the machine **on**; the display will show the current configuration.

CAUTION: **Risk of improper configuration —** On some machines, the processor board is installed in the control box so that the labels printed on the DIP switch appear inverted.

▶ Do not assume that the switch is right side up. Always reference the labels (**OFF**, **ON**, **1**, **2**, etc.) **printed on the switch** when setting DIP switches.

Figure 7. Location of DIP Switches

Processor Board



Legend

A.	DIP switch
B.	Board identification area
1.	OFF
2.	ON
3.	ON
4.	OFF

DIP Switch (Partial View)

Table 4. DIP Switch Settings for Industry Configurations

Industry Configuration	Switch Settings							
	S1	S2	S3	S4	S5	S6	S7	S8
Correctional Facilities	ON	ON	ON	ON	This switch is not used on V_J and F_J models.	On prevents/Off allows skipping steps.*	These switches are not used in these models.	
Hotels and Motels	OFF	ON	ON	ON				
Athletic Laundries	ON	OFF	ON	ON				
Healthcare Facilities	OFF	OFF	ON	ON				
Restaurants	ON	ON	OFF	ON				
Commercial Laundries	OFF	ON	OFF	ON				
Shirt Laundries	ON	OFF	OFF	ON				
Offshore Laundries	OFF	OFF	OFF	ON				
Gear Guardian®	ON	ON	ON	OFF				
* Setting S6 off enables the operator to cancel any step in progress except a drain before an extract.								

NOTE: The Gear Guardian® configuration is available with machine software WUT5XGGA or WUMWRXGG only.

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2.3 Programming the E-P Plus® Controller

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The microprocessor controller used in this washer extractor operates in three modes, depending on whether the machine is processing goods (the **Run mode** or **Formula** menu), being programmed with operating characteristics to be used when a wash formula is started (the **Program** mode), or being tested (the **Manual** or **Test** mode). This document describes the available operator actions and display feedback in the **Program** mode.

The **Program** mode is accessible only when the **Run/Program keyswitch** is set to the **Program** position ( ), as described below. From the **Program** menu, there are four options available:

- Option 0: OK TURN KEY TO RUN (detailed in 2.3.2: Return to Run Mode (Option 0), page 21)
- Option 1: ADD/CHANGE FORMULA (detailed in 2.3.3: How to Add or Change a Formula (Option 1), page 22)
- Option 2: CONFIGURE (Detailed configure instructions are provided elsewhere in the manual. See the table of contents.)
- Option 3: STANDARD FORMULAS
- Option 4: DATA TRANSFER

Each of these options is described in detail in this document. For information on how to start the machine and run a formula, see the appropriate section listed in the table of contents of this manual.

2.3.1 How to Avoid Data Loss

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CAUTION: **Avoid Corrupting Formula Data —** Never turn the **Run/Program key-switch** from the **Program** position to the **Run** position unless the display says **OK Turn Key to Run**.

▶ Failure to follow this direction will result in the loss of all formula modifications entered during the current programming session. Formulas not modified during this session will not be affected.

CAUTION: **Avoid Corrupting Configuration Data —** Never shut off machine power, turn off the **Master switch**, or press the **Emergency Stop button** to exit the **Program** mode.

▶ Once the **Configure** menu has been accessed, all configure decisions must be confirmed by pressing the **Next button** ( ) before another action can be taken.

▶ Failure to follow this direction will result in corruption of machine memory.

Use the following procedures to clear corrupted formula and configuration memory and restore valid data.

Display or Action	Explanation
CHECKSUM ERROR TURN KEY TO PROGRAM	This display indicates that all memory will be cleared. **The machine controller must be reconfigured and any new formulas or modifications to standard formulas must be re-programmed.**
	Accesses the first configuration decision.
LANGUAGE ? 0=ENGLISH 0	First configure decision.

2.3.2 Return to Run Mode (Option 0)

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Option 0 allows for a safe return from the **Program** mode to the **Formula** menu, preserving any changes that were made during the programming session and maintaining the integrity of programming and configuration data.

Display or Action	Explanation
PROGRAM 0 MENU OK TURN KEY TO RUN	This is **Option 0** of the **Program** menu. From this display, return to the **Formula** menu or select another available menu option.
	Returns to **Run mode** (**Formula** menu)
or	
▲ / ▼	Scrolls the available choices in the **Program** menu.

2.3.3 How to Add or Change a Formula (Option 1)

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Milnor® E-P Plus® washer-extractors have the capacity for a maximum of 30 formulas.

2.3.3.1 What are Formulas, Steps, and Decisions?

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A formula includes all the procedures that the machine does automatically. These procedures start when you put a load in the machine. The procedures stop when the machine completes all operations. In some models, there is an alarm at the end of a formula

Different types of steps make formulas. You set values for each step when you write the formula.

1. Set a bath step or an extract step.
2. Set the values in the step.

Bath steps can turn the basket, open the water valves, and put chemicals in the machine. When the machine completes all the necessary procedures in a step, the subsequent step starts. The formula stops and the alarm comes on when the last step stops.

Each step includes several **programming decisions**. You must answer the questions to build the wash formula. You must usually choose one answer from a list. For example, the water level decision in a bath step can be answered with either “1” for low level or “2” for high level. Other programming decisions, such as step time and bath temperature, require you to enter a value within a range of values.

The user interface uses similar procedures to create a new formula and for changing an existing formula. Both procedures are detailed below, in 2.3.3.4: Create a New Formula, page 24 and 2.3.3.6: Change an Existing Formula, page 25 . The control system tells you whether the selected formula exists.

2.3.3.2 About the Help Screens

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Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 0000----- -------	This example shows **Page A** of the programming menu, with the cursor at the first decision (**T**=Type of Step).
03 T TYPE OF STEP 01 0 END FORMULA	This is a typical programming **help screen**. The display will automatically show a help screen if you do not make a correct entry in four seconds or less.
	Accepts the selected value for the current decision and advances the cursor to the next decision, regardless of the status of the help screen.
	At either **Page A** or **Page B**, this keystroke displays the formula and step name for the selected step, if the display has not shown a help screen.
MODIFYING FORMULA 03 - STEP 01	This example shows a typical display of the formula name and the step name.

2.3.3.3 Moving Forward and Backward through Steps and Decisions

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Each step has two displays: **Page A** and **Page B**.

Display or Action	Explanation
03 TMMQFFFHC SCWSS* 01	This is **Page A**. In this example, the "03" at the left end of the display represents the formula number. The "01" below it represents the step number within that formula. The **CWSS*** decisions shown underlined repeat for each chemical programmed in this step.
03 SPD D E 01	This is **Page B**. When the cursor is advanced past the last decision on **Page A**, **Page B** appears for the remaining decisions in this step. The decisions required on both pages vary according to machine model and options.

2.3.3.3.1 Actions when the Cursor is at the Step Number

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Display or Action	Explanation
03 TMMQFFFHC SCWSS* 02 xxxxxxxxx xxxxxx	Typical display with cursor at **step number**
▲ / ▼	Indexes forward/backward through the step numbers in this formula.
☑	Accesses the selected step and positions the cursor at decision **T**, or saves all changes and exits this formula if this is the last step of an existing formula.
✋	Exits this formula, clearing the formula if it has not been saved, or discarding any changes to a previously existing formula.

2.3.3.3.2 Actions when the Cursor is at a Decision within a Step

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Display or Action	Explanation
03 TMMQFFFHC SCWSS* 02 xxxxxxxxx xxxxxx	Typical display with cursor at a d**ecision** within a step
▲ / ▼	Indexes forward/backward through the valid choices for this decision.
☑	Moves the cursor forward among **Pages A** and **B** through each valid decision in a specific step. This accepts the standard or default decision if another choice was not previously made.

Moves the cursor backward among the two pages, through each valid decision within a specific step, except in the following cases:

- If the cursor is at decision **T** on **Page A**, it will move to the step number.
- If the cursor is at the first decision on **Page B**, it will back up to the first valid decision (**C**) for the first chemical commanded in this bath.

1 Displays the name of the formula and step being modified.

2.3.3.4 Create a New Formula

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Creating a new formula with the E-P Plus controller entails adding and defining steps using one of the existing but blank formula numbers.

Display or Action	Explanation
PROGRAM 1 MENU ADD/CHANGE FORMULA	This is **Option 1** of the **Program** menu. From this display, either access a formula by number to change or create, or select another available menu option.
☑	Accesses the formula list for selection of a formula number to change or create.
ADD/CHANGE FORMULA 00 RETURN TO MENU	This is the **Add/Change Formula** display. From this display, either back up to the **Program** menu, or begin creating or changing a formula.
▲ / ▼	Scrolls the available formula numbers. These keystrokes select a formula for adding if the formula number hasn't already been programmed. The number is selected for **change** if it has already been programmed.
ADD/CHANGE FORMULA 23 FORMULA NUMBER 23	Formula 23 is available for **adding** because it does not currently exist.
ADD/CHANGE FORMULA 07 FORMULA NUMBER 07	Formula 07 is available for **changing** because it already exists.
☑	Accesses the selected formula for programming. Valid formula numbers are 01 through 30.
07 TMMQFFFHC LSCWSS* 01 205012523 200----	Formula 07, Step 01 selected for programming. Refer to 2.3.3.6.2: The Step Decisions, page 26 for detailed programming instructions.

2.3.3.5 Delete an Existing Formula

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Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 0000------ ------	Delete an existing formula by making step 01 an **End** step. Accomplish this by setting the **T** value for step 01 of the formula to 0.

2.3.3.6 Change an Existing Formula

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2.3.3.6.1 How to Insert or Delete a Step in an Existing Formula

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Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 112217513 2121250	Cursor blinking on step number indicates that adding or deleting a step is allowed.
1	Provides a help screen for inserting and deleting steps, as shown below.
START+NEXT/TERM TO INS/DELETE THIS STEP	This is the help screen for inserting and deleting steps.
☑	Advances the cursor without deleting or duplicating the selected step. This key accesses the next step and allows for modification of the values there.
▼	Scrolls through the available choices for the decision indicated by the cursor.

2.3.3.6.1.1 Inserting a Step

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Display or Action	Explanation
1 + ☑	Duplicates the selected step to the next numerical position. If this is Step 01, the duplicated step becomes the new Step 01 and all the following steps move to the next higher numerical position. Duplication of **End Formula** or **Extract** steps is prevented by the controller.
03 TMMQFFFHC LSCWSS* 01 NEW STEP01 DUPED	This display indicates that the new step has been created as a copy of the previous step.

2.3.3.6.1.2 Deleting a Step

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Display or Action	Explanation
1 + ✋	Deletes the selected step. The next step becomes the current step by assuming the number of the step that was just deleted. All following steps move one number lower. Deletion of **End Formula** is prevented in all cases. A **Bath** step cannot be deleted if it falls between two **Extract** steps.
03 TMMQFFFHC LSCWSS* 01 STEP DELETED	This display indicates that the selected step has been deleted from the wash formula.

2.3.3.6.2 The Step Decisions

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A maximum of 30 formulas may be programmed, with a maximum combined total of 225 steps in all formulas.

Display or Action	Explanation
	This is a typical **Type of Step** decision display. The actual format of the display varies according to the specific machine controller and certain configure decisions.
	0 End formula: The last step of each formula must be of type **0**. This step is automatically added as a last step if the previous step is type **6** (final extract). The basket moves or stops as directed by the **How to End** programming decision, described in 2.3.3.6.7: Concluding Decisions, page 34 . A formula may be ended without a final extract by setting the last step to type **0**. If the last step before the **End Formula** step is a type other than final extract, the controller will ask “End Formula #xx?”. Setting the first step of an existing formula to type **0** deletes the formula, as described in 2.3.3.5: Delete an Existing Formula, page 24 .
	1 One-way wash: Washing routine which may increase mechanical action and reduce energy consumption to some degree. Use for smaller pieces where tangling and “roping” is not a consideration. The basket rotates clockwise at the programmed wash speed for the duration of the step.
	2 Two-way wash: Washing routine for items which tend to rope and tangle unless reversed. The basket rotates clockwise for some period of time, then pauses for a few seconds before rotating in the opposite direction.
	3 Soak wash: The cylinder does not turn when this step type is programmed. Use this step type only when no mechanical action is required, as for especially delicate fabrics. Consider chemical concentrations, bath time, and liquor temperature when using this type of step.
	4 Intermediate extract 1 (E1): This is low extract speed for H_J, F_J, V_J, and X_J models. For other models, this is low extract speed, used for extractions between baths or for final extract at low speed if machine has two-speed extract.

5 This selection differs with machine model. For F_J, H_J, V_J, and X_J models, this causes an intermediate extract (E2). For other models, this is the final extract sequence. In final extract the machine runs at intermediate extract speed for a duration determined by machine model and configuration, then runs at high extract speed for the remainder of the programmed extract time. The formula ends when the commanded extract time expires.

6 Final extract (E3): For certain models only, this is the sequence leading to the highest extract speed. The machine executes an intermediate extract 1 (**E1**) for a duration of 100 seconds. After 100 seconds at **E1**, the machine accelerates to **E3** (high extract speed) for the remainder of the programmed extract time. When the programmed extract time ends, the cylinder stops and the formula ends.

CAUTION: **Avoid damage to extract motor —** For H_J model machines with software date code 95005 or earlier, the minimum valid time for a final extract step is 1:45 (MMQ=013). Attempts to program final extract steps shorter than 1:45 may cause the controller to continue indefinitely in high extract. Machines running software dated 95006 or later will terminate at the programmed time, but short extract times may not allow the machine to achieve high extract speed.

▶ Never program a final extract step for less than 1:45 (MMQ=013) unless the machine has software dated 95006 or later.

▶ If the step timer stops counting down at about 1:20 in a final extract, press z to terminate the program, then edit the formula to increase the duration of the final extract beyond 1:45.

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 1	Duration of step in minutes, minutes, and quarter minutes.
	000 Invalid entry. Controller defaults this entry to 001 (15 seconds).
	001 00.25 minutes; 00:15 seconds is minimum programmable time for a bath step.
	013 01.75 minutes; 01:45 seconds is the minimum valid time for an extract step. Programming an extract step shorter than this may cause the timer to stop counting down.
	113 11.75 minutes; 11:45
	633 63.75 minutes; 63:45 is the maximum programmable time for any single step. To achieve a bath time longer than 63:45, program two consecutive bath steps with the first ending with a **No Drain**. This effectively doubles the maximum allowable bath time.

The total time required for a formula to run to completion includes factors other than the total of the times of each step in the formula. For these machines, add 0:40 distribution time each time

the machine enters an extract step from a bath step. Also, add 1:00 for each standard drain (drain speed), or 1:00 for each two-way wash drain.

Display or Action	Explanation
	Temperature decision appears only if the machine is supplied with and configured for temperature control (**Temp Control = Yes**). Detailed configure instructions are provided elsewhere in the manual. See the table of contents.
— — —	Display if no temperature is commanded. The cursor skips to the next decision.
050°F / 010°C	Minimum temperature in any bath
205°F / 095°C	Maximum temperature in any bath
	Control of hot water valve
0	Hot water valve off
1	Hot water valve on
2	Raises temperature of filling water. See 2.3.3.6.2.1: How to Modulate Water Valves to Regulate Incoming Water Temperature, page 29 for more information.
3	invalid response—not allowed
	Control of cold water valve
0	Cold water valve off
1	Cold water valve on
2	invalid response—not allowed
3	Lowers temperature of filling water. See 2.3.3.6.2.1: How to Modulate Water Valves to Regulate Incoming Water Temperature, page 29 for more information.
	Third water only appears if machine is supplied with and configured for this option.
0	Third water valve off
1	Third water valve on
2	Raises temperature of filling water if connected to a hot water source
3	Lowers temperature of filling water if connected to a cold water source

If a temperature is programmed in a step, the control requires either modulated water (H=2 and C=1 or 3, or C=3 and H=1 or 2) or steam injection, otherwise the cursor returns to the temperature decision for correction. See 2.3.3.6.2.1: How to Modulate Water Valves to Regulate Incoming Water Temperature, page 29 for details on how to regulate the temperature of incoming water.

2.3.3.6.2.1 How to Modulate Water Valves to Regulate Incoming Water Temperature

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When programming a thermo-modulated temperature for a bath using both hot and cold water valves, the relationship between the desired temperature and the temperature of a split fill (hot and cold valves open simultaneously) is important.

If the desired temperature is hotter than the normal split temperature, a faster, more accurate fill with a more constant temperature is achieved by programming the hot water valve open (H=1) and the cold water valve to open only to lower the fill temperature (C=3).

If the desired temperature is colder than the normal split temperature, similar results can be achieved by programming the hot water valve to open only to raise the fill temperature (H=2) and the cold water valve to remain open constantly (C=1).

2.3.3.6.3 How to Use Cooldown

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A cooldown bath is used to gradually lower the temperature of goods (usually synthetics and blended fabrics) to reduce the chance of setting wrinkles. When a cooldown is programmed, the drain type for the previous bath step is automatically changed to **Do Not Drain**, so the goods are not cooled too quickly by coming in direct contact with the incoming cooldown water.

These items are required before the controller will allow you to program a cooldown step:

1. The machine must be equipped with a separate **cooldown water valve**. This valve and its associated piping reduces the flow of cold water into the machine so the temperature falls gradually.
2. The machine must be configured for temperature control (**Temp Control** = YES). Detailed configure instructions are provided elsewhere in the manual. See the table of contents.
3. The machine must be configured for cooldown (**Cooldown Error** = 1, 2, or 3).
4. The bath step with the high temperature must immediately precede the cooldown step, and it must have a temperature programmed in degrees (for example, 180 degrees Fahrenheit). Failure to program a temperature in the bath preceding a cooldown results in an error message.

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 03 2050180 10 140----	This is a typical step preceding a cooldown step. Note that a specific temperature is programmed (shown underlined).

A cooldown is programmed as a separate bath step following the bath in which the cooldown is desired. In the cooldown step, command a desired cooldown temperature with all water valves programmed off (0). The E-P Plus control automatically inserts a **no drain** in the previous bath and 010 in MMQ for the cooldown step, for a step time of 1:00.

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 04 2010100 00 -------	This is a typical cooldown step. Note that all configured water valves are programmed off. The programmed step time for a cooldown will always be changed to one minute (MMQ = 010). Any valid **bath** step type may be used here (T = 1, 2, or 3)

NOTE: The commanded cooldown temperature must always be at least 15 degrees Fahrenheit (8 degrees Celsius) hotter than the hottest ambient temperature or the hottest cold water temperature that will be encountered. If this rule is not followed, achieving the desired cooler temperature may take a long time, or even be impossible.

During operation, the cooldown bath step starts immediately when the previous (high-temperature) bath ends.

1. The cooldown valve opens when the cooldown step begins. The cooldown valve does not close until the end of the cooldown step.
2. When high water level is achieved, the drain opens until the water level falls below high level, then the drain closes.
3. The drain continues to open and close as needed to maintain high water level.
4. The step timer starts 15 seconds after the desired cooldown temperature is achieved. The timer runs for one minute.
5. When the one-minute step time expires, the cooldown valve closes and the drain opens. The drain remains closed only if the machine was programmed to not drain, as to prolong the cooldown or allow the injection of chemicals into the cooler bath.

Display or Action	Explanation
`ILLEGAL COOLDOWN STEP. PRESS START`	This display results from commanding all water valves off (0) in a bath **following an extract step**, or if a temperature was not specified in the previous bath step.
1	If the machine is configured for cooldown, this keystroke returns the cursor to the time field (MMQ). If the machine is not configured for cooldown, but is configured for temperature control, this keystroke returns the cursor to the temperature field (FFF). If temperature control is not configured, this keystroke returns the cursor to the first water valve field.

2.3.3.6.4 How to Select the Bath Level

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Display or Action	Explanation
`03 TMMQFFFHC LSCWSS*` `01 X`	The values of all bath levels are determined by machine configuration. Detailed configuration instructions are provided elsewhere in the manual. See the table of contents.
1	Low bath level; usually used for baths with chemical injections.
2	The next higher bath level; usually used for baths with chemical injections.
3–5	Intermediate bath levels
6	High bath level; used for cooldown (always) and rinsing (at programmer's discretion)

2.3.3.6.5 How to Select the Steam Code

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Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 X	Appears only if the machine is supplied with and configured for temperature control (**Temp control**=yes) and steam (**Steam error** greater than 0).
0	no steam in this bath

The available steam codes are combinations of three **yes/no** decisions, as described below. These decisions are summarized in Table 5: Summary of E-P Plus Steam Code Choices, page 32 .

- **Early** defines when steaming should begin. Answer **Yes** to start steaming at the lowest safe level. Answer **No** if steaming should only begin after the commanded level is achieved. Usually, a "Start Steaming Early" code (4, 5, or 6) is used when the machine receives only cold water or when the hot water in the plant has a relatively low temperature. Use a **No** response if the machine has both hot and cold water valves and the commanded temperature is lower than the hot water temperature.
- **After** defines whether steam is allowed in this bath after temperature has been achieved once and subsequently fallen below the commanded temperature. A **No** response prevents a second steaming after temperature is first achieved. Use **No** if chemicals or goods may be damaged by steam after a chemical injection (as in bleach baths). Answer **Yes** if temperature should be maintained for the full duration of the bath step and goods or chemistry will not be adversely affected by the introduction of steam into the cylinder.
- **Timer** defines whether the timer runs or stops while steaming up to temperature. **Stops** causes the timer to stop counting until the commanded temperature is first achieved. **Runs** is for use when some temperature fluctuations are acceptable or when it is certain that the commanded temperature will be nearly achieved while filling. Use **Stops** if temperature must be achieved before adding chemicals, otherwise software will suppress this chemical-add choice.

1 Early=No; After=Yes; Timer=Runs. Control does not start steaming until commanded liquor level is achieved; if necessary, steam is allowed after temperature is first achieved; timer runs while steaming up to temperature.

2 Early=No; After=No; Timer=Stops. Control does not start steaming until commanded liquor level is achieved; steam is not allowed after temperature is first achieved; timer stops while steaming up to temperature.

3 Early=No; After=Yes; Timer=Stops. Control does not start steaming until commanded liquor level is achieved; if necessary, steam is allowed after temperature is first achieved; timer stops while steaming up to temperature.

4 Early=Yes; After=Yes; Timer=Runs. Control starts steaming at lowest safe level; if necessary, steam is allowed after temperature is first achieved; timer runs while steaming up to temperature.

5 Early=Yes; After=No; Timer=Stops. Control starts steaming at lowest safe level; steam is not allowed after temperature is first achieved; timer stops while steaming up to temperature.

6 Early=Yes; After=Yes; Timer=Stops. Control starts steaming at lowest safe level; if necessary, steam is allowed after temperature is first achieved; timer stops while steaming up to temperature.

Table 5. Summary of E-P Plus Steam Code Choices

Steam Code	Steaming can begin at the earliest safe level	Steaming can occur after temperature is initially achieved	Step timer runs or stops while steaming to the desired temperature.
0	No steam allowed in this bath		
1	No	Yes	Runs
2	No	No	Stops
3	No	Yes	Stops
4	Yes	Yes	Runs
5	Yes	No	Stops
6	Yes	Yes	Stops

2.3.3.6.6 Injecting Chemicals

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Display or Action

```
03 TMMQFFFHC LSCWSS*
01                 X
```

Explanation

Chemicals can be added to any bath other than a cooldown bath. A standard chemical injection can be prevented by commanding C = 0 (no chemical in this bath) or by commanding SS = 00 (zero seconds of chemical inject time). Up to five chemical injections per bath step are allowed.

0 No chemical in this bath

2 Inject chemical number 2

5 Inject chemical number 5 (five is maximum number of chemicals)

```
03 TMMQFFFHC LSCWSS*
01                 1
```

Select the option determining the point in the step at which this chemical will be injected.

0 Inject chemical while filling. The chemical will be injected simultaneously with the opening of the water valves.

1 Inject chemical when level satisfied. The chemical injection begins only after the commanded bath level has been achieved.

2 Inject chemical when level and temperature are satisfied. This option is only available if a steam code of 2, 3, 5, or 6 is used (2.3.3.6.5: How to Select the Steam Code, page 31) to achieve a specified temperature with **Timer Stops** commanded (also described in 2.3.3.6.5: How to Select the Steam Code, page 31).

Program the duration of the chemical injection in seconds. See Table 6: Codes for Inject Times of 100 Seconds and Longer, page 33 for how to enter inject times greater than 99 seconds.

00 Zero seconds, prohibits this chemical injection.

40 40 seconds. If no specific time is entered, the control automatically inserts a value of 40. Any other value between 00 and 255 (entered as "Q5") may be specified and will override the default duration

B9 119 seconds (example)

Q5 255 seconds (maximum duration)

Inject times longer than 99 seconds are programmed in the two-digit inject time field by using alphabetic characters to represent values greater than 99 in the first position. The letters "A" through "Q" are used, but not the letter "O." The second position is always a number between 0 and 9. Values of the alphabetic characters are defined in Table 6: Codes for Inject Times of 100 Seconds and Longer, page 33 below:

Table 6. Codes for Inject Times of 100 Seconds and Longer

Alphabetic Code	Value	Alphabetic Code	Value	Alphabetic Code	Value	Alphabetic Code	Value
A	100	E	140	I	180	M	220
B	110	F	150	J	190	N	230
C	120	G	160	K	200	P	240
D	130	H	170	L	210	Q	250

CAUTION: Risk of Poor or Inconsistent Wash Quality — If the duration of each chemical injection is determined by the machine controller, chemical injections should always have a duration of at least 10 seconds. With shorter injection times, fine adjustments are not possible, and variations in response times have an exaggerated effect on the quantity delivered.

- Select pumps or valves of the appropriate size to provide for longer injection times.
- If quantities of one chemical must vary greatly among formulas, use two pumps or valves for that chemical.
- If the injection duration is controlled by the chemical supply system (from others), then the injection duration programmed at the washer-extractor controller need only be sufficient to ensure detection by the chemical system.

Display or Action **Explanation**

Should the operator be signalled when the chemical is desired? The audible operator signal will not occur until the **When to start chemical injection** decision is satisfied. The commanded chemical injection will not begin until the operator manually cancels the signal.

0 No. A signal is not required with this chemical injection. Chemicals will inject without operator intervention.

1 Yes. A signal is required with this chemical injection. The signal will start when all conditions for the chemical (temperature and/or level) are satisfied. The actual injection will begin only after the signal is cancelled, as below.

During normal operation (formula running), this keystroke cancels the operator signal and allows chemical injection to begin if this decision is set to **1=Yes**.

After programming the first chemical, the controller returns to the first chemical decision to allow the programming of a second chemical.

0 No additional chemical in this bath. The cursor advances to the next decision.

3 Chemical 3 (or any other valid chemical number). Cursor advances to decision **W** for this chemical.

2.3.3.6.7 Concluding Decisions

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Display or Action	Explanation
	Select the wash speed for this step. The default value is **Wash 2** for factory-supplied formulas and new bath steps.

0 Wash speed 2: Normal wash speed.

1 Wash speed 1: High wash speed for use with goods requiring **less mechanical action.** Mechanical action is reduced because the higher speed reduces the distance the goods are dropped.

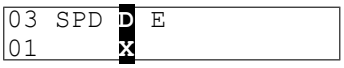
2 Alternate wash speed 2: Normal wash speed with the motor on and off times as set in the **alternate on time** and **alternate off time** configure decisions.

3 Alternate wash speed 1: High wash speed with the motor on and off (dwell) times as set in the **alternate on time** and **alternate off time** configure decisions.

CAUTION:

Machine Malfunction and Damage Hazard — The variable speed inverter used in all single-motor models was programmed at the Milnor factory for optimum performance with your machine. The constants necessary to maintain this performance are written inside the electrical box housing the inverter. Do not enter any values other than those listed for inverter constants.

Display or Action



Explanation

Select a drain type for this bath step. This decision controls whether the drain valve opens or remains closed when this bath step ends, and how the basket rotates (if at all) while the machine is filling and draining. Some of the selections below are valid only if the step following this bath is another bath step. For example, programming this decision as **1=Two way wash speed** is not allowed before an extract step because the goods would not be evenly distributed around the basket when the machine accelerated to extract speed.

NOTICE: Selected drain type may change automatically—The controller requires that the basket always accelerate to drain speed before advancing to extract speed, even if a stop or bath-speed drain type is programmed.

- **Standard** and **stop at fill** drain types are valid for bath steps followed by any other type of step.
- **Two-way wash speed, do not drain**, and **stop at drain** drain types will automatically change to a **standard** drain when an extract is programmed as the next step.
- **A stop at fill** and **drain** drain type will automatically change to a **stop at fill** drain type when an extract is programmed as the next step.

Table 7. Summary of Drain Type Choices

Drain Type	Help Screen Description	Basket Motion		Drain Valve
		During Fill Phase	During Drain Phase	
0	Standard	set by Type of Step decision for this step	standard drain speed	opens after distribution
1	2-way wash (see Note A below)	set by Type of Step decision for this step	reversing at wash speed	opens after programmed step time
2	Do not drain (see Note A below)	set by Type of Step decision for this step	none—following bath determines basket rotation	does not open
3	Stop at fill	stopped until desired level is achieved	rotates clockwise at standard drain speed	opens after distribution
4	Stop at drain (see Note A below)	set by Type of Step decision for this step	stopped	opens after programmed step time
5	Stop fill & dr (see Note A below)	stopped until desired level is achieved	stopped	opens after programmed step time
6	RinSave® (see Note B below)	set by Type of Step decision for this step	advanced drain sequence (described above)	opens 10-15 seconds after bath time ends

Table 7 Summary of Drain Type Choices (cont'd.)

Drain Type	Help Screen Description	Basket Motion		Drain Valve
		During Fill Phase	During Drain Phase	
Note A:	This selection is not valid immediately before an extract step. Refer to the Notice above this table for specifics.			
Note B:	This selection is available only when the machine is equipped and configured for this option.			

Display or Action	Explanation
0	**Standard drain speed**—Basket turns clockwise at drain (distribution) speed while draining. Standard drain speed varies by machine model, but is designed to impart about one G of acceleration to the goods. Basket movement while filling is determined by the **Type of step** decision and the specific design of the machine). Standard drain speed is valid for all following step types and with any configuration of options.
1	**Two-way wash speed**—While draining, the basket reverses at wash speed to provide more mechanical action among the goods. Do not use this selection if the next step will be an extract. If a bath is programmed with this option, then an extract is programmed immediately following the bath step, the controller will change the drain code from **1=Two-way wash speed** to **0=Standard drain speed** (see previous notice).
2	**Do not drain**—Bath liquor is retained for later operations in this same bath. Chemicals may be added, and temperature or level may be raised without draining. Basket movement during the fill phase of this step is determined by the **Type of step** decision. The next step begins immediately when the time for this step expires. This selection is not available if the next step is an extract. As described in the previous Notice, if a bath is programmed with this option, then an extract is programmed immediately following the bath step, the controller will change the drain code from **2=Do not drain** to **0=Standard drain speed**.
3	**Stop with fill**—The basket is kept stationary during the fill phase of this step, but rotates at drain speed while draining. This selection minimizes friction among the goods before they are thoroughly wetted. Standard drain speed during the drain phase better distributes the goods around the basket, and fabric abrasion is less likely because the goods are thoroughly wet from the just-completed bath.
4	**Stop with drain**—The basket is kept stationary while draining to prevent abrasion from mechanical action. During the fill phase of this step, basket motion is controlled by the **Type of step** decision. This selection is not valid if the next step is an extract. If a bath is programmed with this option, then an extract is programmed

immediately following the bath step, the controller will change the drain code from **4=Stop with drain** to **0=Standard drain speed.**

5 **Stop with fill and drain**—The basket is held stationary during both the fill and drain phases of this step. Basket rotation, as determined by the **Type of step** decision, begins only after the desired level is achieved. This selection is not valid if the next step is an extract. If a bath is programmed with this option, then an extract is programmed immediately following the bath step, the controller will change the drain code from **5=Stop with fill** and drain to **3= Stop with fill**.

6 **RinSave®**—This selection is available only on certain machine models with software WUV7J1B/2300K and later when configured for RinSave®. Detailed configure instructions are provided elsewhere in the manual. See the table of contents.

1. When the bath ends, the cylinder turns clockwise at wash speed for 8 seconds.
2. While the drain is closed, the cylinder accelerates to standard drain speed for 4 seconds.
3. The drain opens, and the cylinder turns at standard drain speed for a time determined by the configured machine size.
4. The cylinder accelerates to RinSave® speed for the remainder of the drain sequence.
5. If the next step is an extract, the cylinder accelerates to the programmed speed. If the next step is a bath, the cylinder decelerates to a stop.

```
03 SPD DRE
01       X
```

If the machine is equipped and configured for a second drain, select the drain destination for this step.

0 Drain to sewer

1 Drain to reuse

```
03 TMMQFFFHC LSCWSS*
02 X
```

The cursor returns to this display to program the next step unless the step just programmed is the last step of a formula or if the number of steps exceeds 50, in which case the cursor advances to decision **E**

```
END FORMULA #03
0 NO
```

Appears if **T=0** in previous display and this is not the last available step in this formula.

0 No. Aborts the previous **T=0** selection. Display returns to the **T** (type of step) decision.

1 Yes. Accepts that the formula ends here.

```
03 SPD D E
02       X
```

Determine how this formula should end.

Table 8. Summary of Choices for Ending a Formula (software versions WUV7J1B/2300P and later or WUH7JA/2200Z and later)

How to End	Help Screen Description	Basket Motion	Operator Signal Action
0	Stopped	coasts to stop	signal sounds after delay; signal on until operator pushes Signal Cancel button
1	Reversing	coasts to stop, then reverses at wash speed	basket reverses with signal on until operator pushes Terminate button
2	Drain Speed	coasts to stop, then runs clockwise at drain speed	basket runs with signal on until operator pushes Terminate button
3	Tumble	coasts to stop, then reverses at wash speed	signal on after two minutes of tumbling; operator must push Terminate
4	STOP 2Min Buz	coasts to stop; signal sounds after delay	signal on for two minutes after last step ends, then turns off
5	REVER 2Min Buz	coasts to stop, reverses at wash speed for two minutes, then stops; door unlocks after delay	signal on for two minutes, then turns off
6	DRAIN 2Min Buz	coasts to stop, runs clockwise at drain speed for two minutes, then stops; door unlocks after delay	signal sounds for two minutes, then shuts off
7	TUMBL 2Min Buz	coasts to stop, reverses at wash speed for two minutes	no signal while reversing; signal on for two minutes after basket stops, then door unlocks after delay

NOTE: End Codes 4, 5, 6, and 7 automatically shut off the operator signal two minutes after it begins sounding. The controller runs during this period to count down the time remaining for the signal to sound and turn it off when time expires. Because the controller remains active, silencing the operator signal manually before the two minute signal ends is the same as terminating the formula. Press to terminate the formula, thus silencing the signal.

Display or Action **Explanation**

0 **Stopped.** The basket coasts to a stop. After the appropriate end-of-formula delay, the signal sounds. The signal continues to sound until the operator presses .

1 **Reversing.** After the last step, the basket coasts to a stop, then begins reversing at wash speed while the signal sounds. The basket continues reversing with the signal on until the operator presses to silence the signal and end the formula.

2 **Drain speed.** After the last step, the basket coasts to a stop, then accelerates to drain speed while the signal sounds. The basket continues turning at drain speed with the signal on until the operator presses to silence the signal and end the formula.

3 **Tumble.** After the last step, the basket coasts to a stop, then begins reversing at wash speed. After two minutes of tumbing, the signal sounds. The basket continues tumbling at wash speed with the signal sounding until the operator presses to end the formula.

4 **Stopped with 2-minute buzzer.** This option is similar to the **0= Stopped** option, but the signal shuts off after two minutes. The door unlocks after a delay. The operator can end the formula before this time expires by pressing .

5 **Reversing with 2-minute buzzer.** This selection is similar to **1= Reversing,** but the signal shuts off and the basket stops after two minutes. The door unlocks after a delay. The operator can press to end the formula before this time expires.

6 **Drain speed with 2-minute buzzer.** This option is similar to option **2=Drain speed**, except the signal shuts off after sounding for two minutes. The door unlocks after a delay. The operator can end the formula before this time expires by pressing .

7 **Tumble with 2-minute buzzer.** This option is similar to **3=Tumble**, except the signal starts when reversing stops and sounds for two minutes, then shuts off. The door unlocks after a delay. The operator can end the formula before this time expires by pressing .

```
ADD/CHANGE FORMULA
00  RETURN TO MENU
```

Appears if step just previously programmed is the last step of the formula. The controller is prepared for adding or editing another formula, or returning to the **Programming menu**.

Returns to the **Program menu.**

```
  PROGRAM 0 MENU
0K TURN KEY TO RUN
```

This is the **Program menu**.

Saves changes and new formulas, then returns to the **Run mode**.

CAUTION:

Ensure programming changes are saved — If the program key is turned to at this point, all programming changes will be lost when power to the machine is turned off. Later software versions allow the person programming the machine to correct the error, as described below.

Display or Action	Explanation
RUN KEY TURNED EARLY ALL NEW CHANGES LOST	This message appears on later software versions only. It indicates that the key was turned to before was pressed.
	Returns the controller to the **Program menu.**
PROGRAM 0 MENU OK TURN KEY TO RUN	This is the **Program menu**, from which the operator can correctly save the modified formulas.
,	Saves all formula modifications and returns the controller to the **Run mode**.
PLEASE WAIT	This display indicates that the formula modifications are being saved in permanent memory.
RUN FORMULA 00 OK TO POWER OFF	This is the **Run Formula** display.

2.3.3.6.8 How to Save or Discard Changes

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Use the procedures detailed above to navigate in a formula and make changes. The following procedures should be used to return to the formula menu and either save or discard the changes made.

Display or Action	Explanation
	Saves all changes if the cursor is on the **Step Number**. This key may need to be pressed more than one time to exit the formula.
	Exits the formula and discards all changes made during this programming session.

2.3.4 Configure the Control (Option 2)

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Because the microprocessor control system used in this machine is capable of controlling several different models with a wide variety of options, each unit must be configured to match its specific model and type of washer-extractor. This configuration informs the microprocessor of the characteristics of this machine, such as the number of water valves, the presence of temperature control, cooldown, etc. Such decisions are discrete to the specific machine and must never be changed unless options are later added or removed. In addition to these hardware-specific decisions, certain configuration choices, such as the display of English or metric units, are left to the discretion of the owner/operator.

TIP: The Milnor® E-P Plus® Programmer software for Microsoft Windows allows the user to configure the machine and program formulas on a personal computer, then download the data to each machine through a special cable (Milnor part number KXMDSWBRS1). With the E-P Plus Programmer, descriptive names for each formula can be created and downloaded. When a machine is configured by using the front panel controls instead of the programmer software, all descriptive formula names will be replaced with “Formula XX,” where XX is the formula number.

CAUTION:

Configure Data may be Lost — If the controller loses power either accidentally or intentionally while in the **Configure mode**, all configuration data may be corrupted. Reconfigure the controller at installation and any time a memory error is detected. Although certain codes are discretionary and are so indicated below, most configure codes must match those shown on the metal configuration nameplate unless optional equipment has been added to or removed from the machine.

2.3.4.1 Moving Forward and Backward in Configure

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Display or Action	Explanation
PROGRAM 2 MENU CONFIGURE	This display indicates that the controller is in **Program mode** with the **Configure menu** selected for access.
☑	Access the **Configure menu** and displays the first configuration decision.
LANGUAGE ? 0=ENGLISH 0	The language option that appears here may vary according to how the controller was last configured.
☑	Accepts the displayed selection and automatically advances to the next configure decision.
✋	Accepts the displayed selection and reverts to the previous configure decision. In certain cases earlier decisions will affect later ones. For example, configuring for no temperature control will automatically configure the controller for **no steam**, even if temperature control is later configured.

2.3.4.2 The Configure Decisions

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Display or Action	Explanation
LANGUAGE ? 0=ENGLISH 0	Display of **Language** configuration decision. The language chosen here controls all programming and operational prompts on the machine display.
▲ / ▼	Scrolls the available languages, listed below. 0 = English 1 = Spanish 2 = French 3 = German 4 = Dutch 5 = Italian 6 = Portuguese
☑	Accepts the selected value for the current decision and advances the cursor to the next decision, regardless of the status of the help screen. This action is required for each configuration decision.

```
TEMP CONTROL ?
0=NO, 1=YES          1
```

Select **0=No** if this machine is not equipped with steam, cooldown, or the equipment required to provide or control these optional functions. If **0=No** is selected, the next available decision will be **Water Level Units.**

Select **1=Yes** if this machine is equipped with the necessary valves and supply piping to perform steaming and/or cooldown, as well as any necessary electronic boards to control these options.

```
TEMP UNITS ?
0=°F, 1=°C           0
```

Select **0=°F** to use Fahrenheit as the temperature scale.

Select **1=°C** to use Celsius as the temperature scale.

NOTE: This decision appears only if the machine is configured for temperature control (the value for the **Temp Control** decision, above, must be 1).

```
STEAM ERROR ?
0 = NO STEAM         0
```

This decision appears only if the machine is configured for temperature control (described above).

Select **0=No Steam** if the machine is not equipped for steaming, as in the case of a machine with temperature control used exclusively for cooldown.

Select from options 1 through 3 if steam is available: **1** = 5 minutes, **2** = 10 minutes, and **3** = 50 minutes. The number of minutes selected is the maximum time that the machine will steam in an attempt to achieve the desired temperature before a steam error is displayed. This self-clearing error does not stop machine operation. However, for formula steps where the timer is commanded to stop while steaming until the desired temperature is achieved, production may be severely restricted by steam errors.

```
COOLDOWN ERROR ?
0=NO COOLDOWN        0
```

This decision appears only if the machine is configured, and equipped with the mechanical and electrical hardware for temperature control (described above).

Select **0=No Cooldown** if the machine is not equipped for cooldown, as in the case of a machine with temperature control used exclusively for steaming.

Select from options 1 through 3 if cooldown is available: **1** = 5 minutes, **2** = 10 minutes, and **3** = 20 minutes. The number of minutes selected is the maximum time that the machine will cooldown in an attempt to achieve the desired temperature before an error is displayed. The error is self-clearing and does not stop machine operation. However, production may be severely restricted by cooldown errors if the cooldown temperature is set lower than the incoming cold water temperature.

```
WATER LEVEL UNITS?
0=CM 1=INCHES        1
```

Select **0=CM** to have the water level displayed in centimeters.
Select **1=Inches** to display water level in inches.

```
OFFSET HEIGHT ?
18
```

This value is set at the Milnor factory to compensate for the height difference between bottom of the cylinder and the location of the

pressure tube connection on the drain sump. Because the pressure tube between the pressure transducer and the cylinder connects at an elevation not exactly equal to the bottom of the cylinder, this value allows for an accurate display of the water level. The unit of this value is tenths of an inch, so a difference of 1.8 inches is entered as 18. The maximum allowable value is 3 inches prior to software version 97004, and 4.5 inches with software versions 97004 and later.

```
LEVEL 1 HEIGHT ?   6
```

This value is the depth of the water measured from the bottom of the cylinder. This level will be used for any programmed bath step commanding **Level 1**. **Level 1** must be achieved before steam is allowed in any bath commanding steam.

The minimum level that can be configured for Level 1 is 5 inches (13 centimeters) for V_J models. The minimum setting for H_J models is 4 inches (10 centimeters). See Table 9: Recommended Water Levels, page 43 for recommended water levels.

```
LEVEL 2 HEIGHT ?   8
```

This value is the depth of the water measured from the bottom of the cylinder. This level will be used for any programmed bath step commanding **Level 2**.

The minimum valid value for this decision is equal to the value of the **Level 1 Height** configured just before.

Use the same procedure to configure Levels 3 through 6 that you used to configure Level 2. Keep in mind that each level must be equal to or greater than the previous level. The maximum level that can be configured is 15 inches (38 centimeters) for V_J models. The maximum setting for H_J models is 16 inches (40 centimeters). See Table 9: Recommended Water Levels, page 43 for recommended water levels.

Table 9. Recommended Water Levels

Basket Dimension (from model number)	Suggested Level 1 (Low Level)		Suggested Level 6 (High Level)	
	Inches	Centimeters	Inches	Centimeters
30015	8	20	10	25
30022	8	20	10	25
36021	8	20	13	33
36026	8	20	13	33
42026	10	25	13	33
42032	10	25	13	33

Display or Action	Explanation
`EXTRA WATER ?` `0=NO, 1=YES  1`	Select **1=Yes** only if this machine is equipped with an optional third water valve. Configuring for extra water makes an additional programming decision available for bath steps, allowing reuse of water drained from earlier baths, for example.
`REUSE DRAIN ?` `0=NO, 1=YES  1`	Select **1=Yes** only if this machine is equipped with an optional second drain valve. Configuring for reuse drain makes an

additional programming decision available for bath steps, allowing draining to a reuse tank for use in later baths, for example.

```
RinSave Option ?
0=NO, 1=YES              0
```

RinSave® is an option available on certain rigid-mount machine models with software WUV7J1B/2300K and later. When this option is enabled, a value of 6 can be programmed into decision D (drain type).

```
MACHINE TYPE ?
3=3022V6J                3
```

Select the appropriate machine type as stated on the machine nameplate. One of the following two lists will appear, depending on the software version your machine uses.

version WUV7J1B:

0 = 30015T5J
1 = 30015V7J
2 = 30022T5J
3 = 30022V6J
4 = 36026V5J
5 = 36021/36026V7J
6 = 42026/42030V6J
7 = 36026X8J
8 = 42026/42032X7J
9 = 48040F7J/B
10 = MWF100J7

version WUH7JA:

0 = 30022VRJ
1 = 30022X8J
2 = MWF27J

CAUTION: **Avoid machine malfunction —** Improper configuration will cause machines to malfunction.

- Misconfigured V_J models will only run at one wash speed and one extract speed.

Display or Action	Explanation
`N/O Drain ?` `0=NO 1=YES 1`	Select **1=Yes** only if this machine is equipped with a normally-opened drain valve (usually the drain valve to the sewer).

The following two configure decisions are available on F_J and V_J models with software WUV7J1B/2200L and later and H_J and X_J models using software WUH7JA/2200G and later. The decisions allow the person programming the machine to program alternate **ON** and **OFF** times for basket rotation during wash steps. The values configured here are used only when a wash step is programmed with a basket speed (**SPD** decision) of 2 or 3.

NOTICE: Avoid unexpected values—Because of the nature of the memory used to store configure decisions, the values for alternate ON time and alternate OFF time may range randomly between three and 255 seconds before the values are configured the first time. This will not damage the machine, but might cause unexpected operation if wash speed 2 or 3 is programmed.

- Understand the consequences of all programming decisions before creating new formulas or changing the existing default formulas.

- To remove the random values from these two decisions and make wash speeds 2 and 3 equivalent to wash speeds 0 and 1, configure the alternate ON time for 20 seconds and the alternate OFF time to 3 seconds.

Display or Action	Explanation
ALT. ON TIME ? 003	This value is the time in seconds the motor drives the basket when wash speed 2 or 3 is selected. The range for this value is 003 seconds to 255 seconds.
ALT. OFF TIME ? 003	This value is the time in seconds the motor is off between basket reversals when wash speed 2 or 3 is selected. The range for this value is 003 seconds to 255 seconds.
Fill Error Time:MM Min=00, Max=15 00	This decision appears only on machine models with software WUV7J1B/2300K and later. If this value is set to **00**, the machine will wait 10 minutes for level to be achieved. If level is not achieved in 10 minutes, the operator signal sounds. The water valves remain open during the signal. If this value is set within the valid range (**01** through **15**), then the machine will wait the set time for level to be achieved. If level is not achieved in the set time, the water valves close. The operator must terminate the formula or reset the error timer. If the error timer is reset, the machine will try again to fill.

2.3.5 Restoring the Standard Formulas

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Programming mode 3 allows the owner/operator with access to a programming key to perform either of these two actions:

1. **Option 0** replaces all existing formulas with the factory default formulas for the selected industry configuration. This selection replaces formulas 1 through 10 with the standard industry formulas and removes all data from formulas 11 through 30.
2. **Option 1** replaces only formulas 1 through 10 with the standard industry formulas. This leaves any user-programmed data in formulas 11 through 30 intact.

CAUTION:

Avoid Data Loss — Other than the two methods described above, it is not possible to selectively delete field-modified or field-programmed formulas with this programming mode. This mode erases all field-programmed formulas 1 through 10 or 1 through 30 as specified. For selective deletions and modifications, use **Program mode 1** (Add/Change Formula).

2.3.5.1 Chart 1: Restore Standard Formulas (Part A)

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1. Start
2. Restore standard formulas?

This procedure replaces field-modified wash formulas with the standard formulas provided by Milnor®.

- YES: Continue to step 3
- NO: Skip to 1.: step 1, Part C, page 46

3. Enable **Program** menu

   Turn the **Run/Program** keyswitch to set the controller to the **Program** mode.

4. Select and Enable **Standard Formulas**

   Scroll to **Standard Formulas** (item 3 of the **Program Menu**), then confirm the selection.

5. Clear formulas 11 - 30?

   Do you want to **keep** or **clear** formulas 11 through 30?

   - YES: Continue to step 6
   - NO: Skip to 1.: step 1, Part B, page 46

6. Select and Confirm **Default 30 Formulas**

   Continue with this procedure to replace formulas 1 through 10 with the standard formulas and erase formulas 11 through 30.

7. Standard formulas written to memory

   The controller will pause for a few seconds while the standard formulas are written to the controller memory.

8. Return to **Run** mode

   When the display becomes active again, turn the **Run/Program** keyswitch to the **Run** position.

9. End

2.3.5.2 Part B

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1. Abandon operation?

   Abandon this operation to retain all current formulas.

   - YES: Skip to 1.: step 1, Part C, page 46
   - NO: Continue to step 2

2. Select and Confirm **Default 10 Formulas**

   Continue with this procedure to replace formulas 1 through 10 with the standard formulas, but keep all programmed formulas from 11 through 30.

3. Return to 7.: step 7, Part A., page 46

2.3.5.3 Part C

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1. Terminate process

Press the **Terminate** button to exit this procedure without changing any formulas.

2. Return to 8.: step 8, Part A., page 46

2.3.5.4 Restoring the Standard Formulas on Models Employing the Milnor® E-P Plus® and E-P Express® Controller

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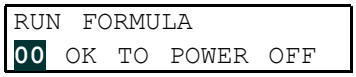
Display or Action	Explanation
PROGRAM 0 MENU OK TURN KEY TO RUN	This is **Option 0** of the **Program menu**. From this display, either return to **Run mode** or select another menu item.
▲ / ▼	Scrolls available choices (0 through 3) in the **Program menu**.
PROGRAM 3 MENU STANDARD FORMULAS	This is **Option 3** of the **Program menu.**
☑	Accesses the **Standard Formulas** option of the **Program menu.**
CORRECTIONAL LAUNDRY 0 DEFAULT 30 FORMULA	**Option 0** (Default 30 Formulas) of the **Standard Formula menu** effectively deletes all 30 formulas, then replaces formulas 1 through 10 with the factory-supplied standard formulas for the configured industry. Formulas 11 through 30 are replaced with blank formulas.
CORRECTIONAL LAUNDRY 1 DEFAULT 10 FORMULA	**Option 1** (Default 10 Formulas) deletes only formulas 1 through 10 and replaces them with the factory-supplied standard formulas for the configured industry. Formulas 11 through 30 are not modified with this selection.
▲ / ▼	Scrolls the available choices **(0 Default 30 Formulas** or **1 Default 10 Formulas)**.
✋	Cancels this procedure without changing or deleting any formulas.
PROGRAM 3 MENU STANDARD FORMULAS	If the procedure is cancelled, the display returns to **Option 3** of the **Program menu.**
☑	From either option **0** or option **1**, defaults the selected set of formulas: 1 through 30, or 1 through 10.
CORRECTIONAL LAUNDRY ** PLEASE WAIT **	Appears for approximately five seconds as the standard formulas are written to memory.
PROGRAM 3 MENU STANDARD FORMULAS	Replaces the previous display when the process is completed.

Scroll to **Program menu** item **0** before exiting **Program mode**.

This is **Program menu** item **0**. It's now safe to turn the **Run/Program keyswitch** to the **Run** position.

Returns to **Formula menu**.



Formula menu; run a formula or shut down the machine.

2.3.6 Data Transfer (Option 4)

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Certain Milnor® controllers described in this manual can transfer memory between the machine and a Milnor *serial memory storage device* or between two machines. Refer to Table 10: Controllers Capable of Transferring Memory, page 48 to determine the hardware and software requirements for memory transfer. See 5.3: Construction of External Serial Link Cables, page 80 for inter-machine cable specifications and assembly instructions.

Table 10. Controllers Capable of Transferring Memory

Machine Controller	Typical Machine Models	Controller Software Later Than	Processor Board Later Than
E-P Express®	30015T_X, 30022T_X	WUEPXPRSA/22004	08BH18EPYT REV. K
E-P Express® Gear Guardian®		WUT5XGGA/22GGF	
E-P Plus®	30015V_J, 36026V_J, 42026V_J	WUV7J1B/2200K	08BH18EPDT REV. K
	30015H_J, 30022H_J	WUH7J1A/2200E	
	30022X_J	all versions	

CAUTION: **Configuration data will be overwritten. —** When transferring data from one machine to another, the formulas and configuration data of the **Master** machine will be written to the **Slave** machine. Partial memory transfer is not possible.

▶ Record all configure data from the **Slave** machine before beginning the download, especially "Offset Height." Restore this value to the **Slave** machine after the download is finished.

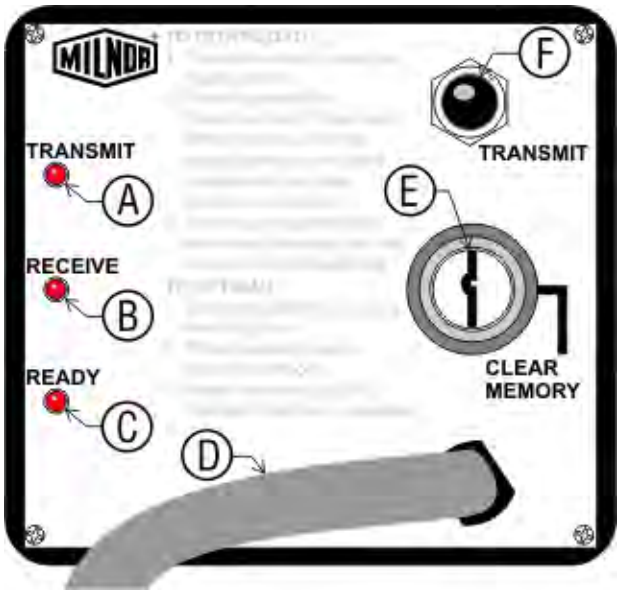
▶ For best results both machines in a machine-to-machine transfer must be identical models with identical options and controller software, and industry configuration (e.g., 36026V6J with steam, hot and cold water; software version WUV7J1B/2200K; and configured for Commercial Laundry facilities).

NOTICE: For data transfer to succeed, the processor boards on all included washer-extractors must have the Milnor part number specified in Table 10: Controllers Capable of Transferring Memory, page 48 with the specified software installed.

- The Milnor part number for the processor board appears on a white sticker near the Milnor logo on the processor board.
- The revision level of the processor board is white lettering stamped directly on the green circuit board, located below the part number sticker. Look for “REV. K.”
- The processor board software version appears on a white label affixed to one of the large integrated circuit components on the processor board.

Figure 8. Controls Identification on Serial Memory Storage Device

Serial Memory Storage Device



Legend

A . . . Transmit light
B . . . Receive light
C . . . Ready light
D . . . Data transfer cable
E . . . Clear Memory keyswitch
F . . . Transmit button

2.3.6.1 Establishing the Required Connections

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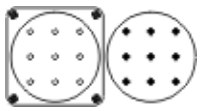
Display or Action	Explanation
	Turn off power to the machine before connecting the serial memory storage device or connecting the two machines together.
	Connect the storage device to the machine, or the two machines together, using the 9-pin round connector.
	Apply power to the machine(s). The storage device receives power through the connector from the power supply in the machine.
	Turn the key on the storage device to **Clear Memory**, then return the key to the normal vertical position. This process is handled automatically when transferring from one machine to another.

The **Ready** light on the storage device will remain off until the clearing process is complete. The clearing process is fully automatic and requires no user action beyond turning the key to **Clear Memory** and returning it to the normal position.

When the **Ready** light comes on again (after about 45 seconds), the storage device is ready to accept data from the machine controller.

CAUTION: **Ensure Data Integrity —** Clear the memory storage device before saving data to it.

- The memory storage device will hold all programming and configuration data for one machine, and can be re-used many times. However, this device will only accept new data when it's empty.
- Attempts to save data to a storage device that has not been cleared will fail, **even if the procedure appears successful**.

Display or Action	Explanation
RUN PROGRAM00 OK TO POWER OFF	When the **Run Program** display appears, switch from **Run** mode to **Program** mode.
	Turn the **Run/Program** keyswitch on the machine controller(s) from the **Run** position to the **Program** position.
PROGRAM 0 MENU OK TURN KEY TO RUN	Controller display when the **Run/Program** keyswitch is set to (**Program** position).
	Scroll down in the **Program** menu to **Data Transfer**. If two machines are connected together, this is required at both machines.
PROGRAM 4 MENU DATA TRANSFER	This is the **Data Transfer** menu selection. Follow the procedure in 2.3.6.2: Saving Data from the Machine to the Storage Device or a Second Machine, page 50 for making a copy of good data from the machine controller. Refer to 2.3.6.3: Restoring Saved Data to the Machine from the Storage Device or Another Machine, page 52 for instructions on restoring previously saved data from the storage device (or another machine) to the machine controller, as might be required after changing the processor board.

2.3.6.2 Saving Data from the Machine to the Storage Device or a Second Machine

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Display or Action	Explanation
	Confirms selection and advances to the **Data Transfer** menu.
DOWN LOAD DEVICES0 MACHINE<==>MACHINE	This is the **Data Download** sub-menu. Select the desired type of data transfer here.
DATA TRANSFER0 SLAVE	There are two selections available in the **Data Transfer** menu: **0= Slave** and **1=Master**.

For saving information **to** the data storage device or another machine, select **1=Master** at the machine controller. If two machines are connected, establish the one which will **receive** the data as the slave, and the **sending** machine as the master.

```
   DATA TRANSFER1
MASTER
```

The machine controller is set as the Master device, making the storage device the slave.

NOTE: The **Master** device is always the **sender** and controls when the data transfer starts. The **Slave** device is always the **receiver** and should be established and waiting for data before the **Master** device is confirmed.

NOTICE: Do not send data to the memory storage device until the storage device is cleared and ready to receive. The **Ready** light must be **on** when transfer begins or the stored data will not be valid.

Confirms selection of the machine controller as the **Master** and immediately begins the transfer. **All receiving (slave) machines must be established before the master machine is designated.**

```
PLEASE WAIT     AC35
TRANSFERRING DATA
```

While the data transfer is occurring, the four digits at the top right of the display scroll rapidly as the machine controller sends data.

The **Receive** light on the storage device illuminates when the data transfer begins, indicating that it is receiving data. The display on the slave machine scrolls quickly as data is accepted.

NOTE: Transfer times may vary somewhat, but the average is about 75 seconds.

```
COMPLETED       0000
TRANSFERRING DATA
```

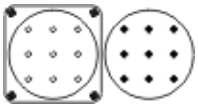
This display indicates that the machine controller delivered the data to the storage device.

The **Receive** light on the storage device goes off when the transfer successfully ends. If all three lights on the storage device begin blinking at any time during the transfer, the data being received by the storage device is invalid. Clear the memory in the storage device and perform the transfer again.

CAUTION: **Data Corruption Hazard —** If the machine controller indicates that the data transfer is complete but the **Receive** light on the data storage device is still illuminated, invalid data is stored in the storage device.

▶ Do not rely on the data in the storage device unless the machine controller indicated that the transfer completed, **AND** the **Receive** light on the storage device turned off automatically.

▶ Do not restore data from the storage device to the machine if the data is invalid. Restoring invalid data from the storage device to the machine controller will overwrite any formulas that have been changed or created since the data was last stored. These formulas can not be recovered.

Display or Action	Explanation
	Acknowledges that the data transfer is complete and returns to the **Program** menu.
PROGRAM 4 MENU DATA TRANSFER	**Data Transfer** menu display. Scroll to **Program** menu item **0**, then turn the **Run/Program** keyswitch to the **Run** position.
	Scroll the **Program** menu selections.
PROGRAM 0 MENU OK TURN KEY TO RUN	From item **0** of the **Program** menu, return to normal operating mode.
	Return to normal operating mode. Press if necessary to confirm that the key is at **Run**.
RUN PROGRAM00 OK TO POWER OFF	The **Run Program** display appears to indicate that it is safe to turn the machine off.
	Turn off power to the machine(s).
	Disconnect the memory storage device, remove the key, and put both in secure locations. For two machines, remove the connecting cable.

2.3.6.3 Restoring Saved Data to the Machine from the Storage Device or Another Machine

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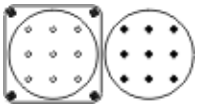
Display or Action	Explanation
	Turn off power to the machine(s) before connecting the serial memory storage device.
	Connect the storage device to the machine using the 9-pin round connector. For two machines, use a serial cable constructed as described in 5.3: Construction of External Serial Link Cables, page 80 .
	Apply power to the machine(s). The storage device receives power through the connector from the power supply in the machine.
RUN PROGRAM00 OK TO POWER OFF	When the **Run Program** display appears, switch from **Run** mode to **Program** mode.
	Turn the **Run/Program** keyswitch on the machine controller(s) from the **Run** position to the **Program** position.
PROGRAM 0 MENU OK TURN KEY TO RUN	Controller display when the **Run/Program** keyswitch is set to (**Program** position).
	Scroll down in the **Program** menu to **Data Transfer**.
PROGRAM 4 MENU DATA TRANSFER	This is the **Data Transfer** menu selection. Follow the procedure in 2.3.6.2: Saving Data from the Machine to the Storage Device

or a Second Machine, page 50 for making a copy of good data from the machine controller.

Confirms selection and advances to the **Data Transfer** menu.

```
   DATA TRANSFER0
SLAVE
```

The machine controller is set as the **Slave** device, making the storage device the **Master**. The **Master** device always controls when the data transfer starts and **sends** the data to the slave device. If transferring data from one machine to another, **the slave machine will receive the data sent from the master**.

Confirms the selection of the machine controller as the **Slave** device.

```
   DATA TRANSFER **
PLEASE WAIT **
```

Appears for three seconds as the machine controller prepares machine memory to accept data from the storage device. When this display appears, all memory in the machine controller is cleared.

```
PLEASE WAIT      0000
RECEIVING DATA
```

This display indicates that the machine controller is polling the data storage device for incoming data. The four characters at the right end of the top line show the memory location currently being written. These characters remain at “0000” until the transfer begins.

Press the **Transmit** button on the data storage device or confirm the **Master** setting on the sending machine to begin the transfer.

As soon as the **Transmit** button on the data storage device is pressed (or on the master machine), the storage device begins sending a continuous data stream to the slave machine controller. The machine display shows the progress of this display in the four characters on the top line. The transfer is complete when the display shows “FFFF.”

The **Transmit** light on the data storage device turns off when the transfer completes.

```
E-PXPRESS/TxX
SYSTEMCORRECTIONAL
LAUNDRY
```

Appears for about one half second as the machine controller updates all memory.

```
 CONFIG CHKSUM
1234FORMULA CHKSUM
4321
```

Appears briefly (about one half second) as the machine controller verifies that the checksums calculated for the downloaded data match the checksums sent by the data storage device.

```
COMPLETED        0000
```

This display indicates that the data received by the machine controller matches exactly the data sent by the storage device. The data transfer was successful.

Acknowledge that the data transfer is complete and returns to the **Program** menu.

```
  PROGRAM 4 MENU
DATA TRANSFER
```

Data Transfer menu display. Scroll to **Program** menu item **0**, then turn the **Run/Program** keyswitch to the **Run** position.

Scroll the **Program** menu selections.

PROGRAM 0 MENU OK
TURN KEY TO RUN

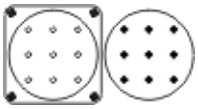
From item **0** of the **Program** menu, return to normal operating mode.

Return to normal operating mode. Press ☑ if necessary to confirm that the key is at **Run**.

RUN PROGRAM00 OK TO POWER OFF

The **Run Program** display appears to indicate that it is safe to turn the machine off.

Turn off power to the machine(s).



Disconnect the memory storage device, remove the key, and put both in secure locations.

3 Operating

3.1 Running a Formula

3.1.1 Applying Power

Display or Action	Explanation
	The **Run/Program keyswitch** must be set to the **Run** position before the main wall disconnect (fuse or circuit breaker) is closed to provide power to the machine.

When power is first applied to the machine, the display shows the software copyright information, machine name, and the checksum number. The checksum number changes with any programming change. To detect unauthorized programming, record the checksum at the end of each authorized programming session and compare it to the checksum displayed at each power up.

Some Milnor® washer extractors with E-P Plus® controls do not use a speed sensing device to verify that the basket has stopped rotating. Therefore, when power is first applied to the machine, at least 80 seconds must elapse before any further operations can be attempted. This provides sufficient time for the basket to coast to a complete stop if power was lost while the machine was in a high speed extract and restored before the basket stopped.

DANGER:

Entanglement Hazard — The linen inside or hanging partially outside a turning cylinder can suddenly wrap around your hand, arm, or body. The inertia of the spinning cylinder can cause the entangled linen to twist off or sever body parts. You can be killed or seriously injured.

- Never put any part of your body inside this machine or touch the linen while the machine is turning.

3.1.2 Selecting and Starting the Formula

3.1.2.1 Load Machine and Close Door

Load the machine to the rated capacity and securely close the loading door. Review 1.2: Determining Load Size, page 4 for guidelines on loading machines.

3.1.2.2 Selecting a Formula

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Display or Action	Explanation
RUN FORMULA 00 OK TO POWER OFF	This is the **Run Formula display**. From this display, the operator can disconnect power from the machine without risking damage to electronic parts, or he can select a formula to run, as described below.
▲	indexes **forward** through the 30 formulas.
▼	indexes **backward** through the 30 formulas.
RUN FORMULA 07 FORMULA NUMBER 07	Example display: Formula 07 selected for running.
1	starts the machine with the selected formula.
RUN FORMULA DOES NOT EXIST	indicates that the formula selected for running has not been programmed or is not available. This display appears for three seconds.

3.1.3 Unloading the Machine

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How a formula ends may depend on the machine type, how the last step of the formula was programmed, and whether the formula finishes without interruption or is terminated manually.

DANGER: **Entanglement Hazard —** The linen inside or hanging partially outside a turning cylinder can suddenly wrap around your hand, arm, or body. The inertia of the spinning cylinder can cause the entangled linen to twist off or sever body parts. You can be killed or seriously injured.

▶ Never put any part of your body inside this machine or touch the linen while the machine is turning.

When the formula ends or is terminated, the cylinder coasts for 25 seconds if the last step was a bath step. If the last step was an extract, the coast time may be as much as 180 seconds. These times are sufficient for the controller to be sure the cylinder has stopped before unlocking the door and allowing access to the cylinder.

Table 11. Coast Times (in seconds) at Program End or Termination

Model	Door Unlock Delay (DUD)	Bath	Low Extract	High Extract	Power-up Delay
30015T5J	25	DUD	75 + DUD	75 + DUD	100
30015V7J	25	DUD	45 + DUD	75 + DUD	100
30022T5J	25	DUD	75 + DUD	75 + DUD	100
30022V6J	25	DUD	45 + DUD	75 + DUD	100
36026V5J	25	DUD	75 + DUD	85 + DUD	100

Table 11 Coast Times (in seconds) at Program End or Termination (cont'd.)

Model	Door Unlock Delay (DUD)	Bath	Low Extract	High Extract	Power-up Delay
36026V7J	25	DUD	75 + DUD	85 + DUD	100
42026V6J	25	DUD	75 + DUD	85 + DUD	100
36026X8J	25	DUD	100 + DUD	150 + DUD	150
42026/42032X7J	25	DUD	100 + DUD	150 + DUD	150
48040F7J/B	25	DUD	100 + DUD	200 + DUD	160
Note: Coast time when an extract step ends normally does not include the door unlock delay.					

NOTE: Depending on the **How to End code**, the controller will describe how the cycle is ending and instruct the operator to press to escape this step in the cycle.

Display or Action	Explanation
UNLOCKING THE DOOR PLEASE WAIT	display during the last 15 seconds of coast, or during the entire coast time if the formula was manually terminated.
WAITING TO UNLOAD	At the end of the coast time, the operator alarm sounds.
	Silences the operator alarm. The door unlocks, and the machine may be unloaded.

3.1.4 The Display During Automatic Operation

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Display or Action	Explanation
23:04 F02S01 02:37 TEMP A168/D170 LEV 1	These two displays alternate during normal operation.
23:04 STEP 01 02:37 TEMP A168/D170 SPD 0	
23:04 F02S01 02:37	23:04 is the time remaining in the formula. F02S01 indicates that the current formula is 02 (F02) and the current step is 01 (S01). 02:37 is the time remaining in this step.
23:04 STEP01 02:37	STEP01 is the current step EXTRACT indicates that the machine is currently executing an extract. TIMEHALT indicates that the timer is stopped while a chemical is being injected. The chemical supplier must connect equipment for this option.
TEMP A168/D170 LEV 2	Temperature in this machine is measured in degrees Fahrenheit or Celsius, according to machine configuration.

A168 indicates that the current achieved temperature is 168 degrees. Temperature is displayed only if machine is equipped with and configured for temperature control.

D170 indicates that the desired temperature for this step is 170 degrees. Temperature is displayed only if the machine is equipped with and configured for temperature control.

LEV 2 indicates that the bath level achieved is Level 2.

```
SPD 0              LEV 2
```

SPD 0 indicates the bath speed (either 0 or 1) for this step.

WAIT FOR LEVEL 2 H indicates that Level 2 is programmed for this step, but is not yet achieved. The H indicates that the hot water valve is open; C indicates cold water, and 3 indicates extra water.

CHEM 03 is displayed when Chemical 03 is being injected. The number for each chemical (up to five may be connected) is displayed as the chemical is injected. See also 3.1.7: **How the Flush Valve Works**, page 59 for information about the chemical flush valve.

FINAL EXTRACT indicates that the step in progress is the final step of the wash formula.

3.1.5 How to Shorten, Terminate, or Suspend a Running Formula

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Display or Action	Explanation
☑ + 1	Cancels a step. Advances the step timer to zero for any bath, a drain not followed by an extract, or any extract in progress. The next step begins automatically. This operation is possible only if DIP switch 6 on the processor board is in the **off** position, allowing the cancelling of steps.
✋	Cancels the current formula and returns the machine to the Run **Formula** display.
RUN FORMULA 00 OK TO POWER OFF	This is the **Run Formula** display. The door interlock delay, described in 3.1.3: **Unloading the Machine**, page 56 , must expire before the door can be opened.

3.1.6 How to Restart after Power Loss

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The E-P Plus control remembers the formula and step it was executing if power fails or if the wall disconnect is turned off while the machine is operating in automatic mode.

Display or Action	Explanation
PRESS START TO RUN STEP xx – FORMULA yy	On most machine models, this display appears when power is restored. The formula and step which were in progress when power was interrupted are shown.
1	Resumes the formula at the displayed formula and step. If the outage occurred in a bath step, level and temperature (if commanded) must again be satisfied, even if these were already satisfied before power was lost. Any commanded chemicals will be injected again. If the outage occurred during a drain, that step will be repeated, then followed by the next commanded step. If the outage occurred during an extract step, the previous bath will be repeated before the extract step begins.
	Terminates the formula in progress.

3.1.7 How the Flush Valve Works

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The E-P Plus controller provides an output signal that activates the flush valve for 20 to 30 seconds after the last chemical has been injected into each bath. If a bath is shortened or terminated before or while this valve is energized, the flush valve will be turned off. Shortening or terminating a bath may prevent the flush valve from activating.

NOTE: On 48040F__ models, the chemical flush is pulsed two times for 10 seconds, with 10 seconds between pulses. If hot water is required to restore level while the flush valve is open, the flush valve closes and the flush timer halts until the hot water output turns off.

3.1.8 How Cooldown Works

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Goods must be cool enough to handle immediately after a wash cycle is finished. However, a drastic temperature change may set wrinkles in goods of certain fabrics. Therefore, many Milnor washer extractors employ a feature called cooldown to gradually lower the water temperature and thus provide cool goods at the end of the wash cycle without setting wrinkles.

For F_J, H_J, V_J, and X_J models, the cooldown valve is turned on until high (cooldown) level is reached. This causes the drain to open and the cooldown valve to close until high level is lost. When high level is lost, the drain closes and the cooldown valve opens. This process continues until the cooldown step is complete.

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3.2 How to Use and Erase the Formula Counter

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The microprocessor controller adds one count to a discrete counter for each formula near the end of each formula. The counter holds this value until you set the value to 0. Each formula counter has a maximum value of 999. A counter at the maximum value holds the maximum value until you set it to 0. You can only see or erase the count for each formula when the machine can operate correctly.

CAUTION: **Prevent Incorrect Data —** You can cause damage to the collected data if the machine does not have power for extended periods of time. An electrical surge can also cause damage to the collected data.

▶ Apply power to the machine for 15 seconds in each 48-hour interval to keep the correct formula count. See 1.1: Important Data About this Machine, page 3 for more data.

▶ Make sure that the count is accurate. Record the value in each counter. Set the value in each counter equal to 0 before it increases to 999 counts.

▶ If the display shows an **accumulator error**, set the values in all formula counters to 0. Detailed error messages can be found elsewhere in the manual. See table of contents.

Display or Action	Explanation
RUN FORMULA 00 OK TO POWER OFF	This is the correct display when the machine first gets power.
▼ / ▲	Move through the formula numbers (01–30) in one of the two directions to find a formula.
For each formula:	
☑	Shows the count in the top right corner of the display.
RUN FORMULA 038 05 FORMULA NUMBER 05	This machine cleaned 38 cycles with formula 05.
☑ + ✋	Sets the count in the formula counter equal to 0.

4 Troubleshooting

4.1 The E-P Plus® Manual Menu

4.1.1 The Manual Menu

4.1.1.1 Components

The **Manual menu** contains these selections:

1. **Software Date Code**—a display of the software type and date code, both of which are fixed in the software; and the industry type, which is determined by setting the DIP switches on the processor board.
2. **Test Inputs**—allows viewing of microprocessor inputs for testing when a formula is not running. Devices, including the door latch and the level transducer, provide signals to the microprocessor by grounding certain inputs. The status of these inputs can be monitored in this mode, and changes to the input status will appear instantaneously. Refer to 4.1.7: Viewing Inputs and Outputs During Operation, page 71 to view the status of inputs while the machine is operating.
3. **Test Outputs**—allows the actuation of outputs for testing when a formula is not running. Outputs are signals from the microprocessor to other devices, such as chemical pumps and motor contactors. Refer to 4.1.7: Viewing Inputs and Outputs During Operation, page 71 to view the status of outputs while the machine is operating.
4. **Test DIP Switch**—displays a hexadecimal number which is unique for each possible setting of the DIP switch. This number can be used with the appropriate tables to determine the industry configuration of the machine, as well as whether the machine is configured to allow the operator to skip certain steps during automatic operation.
5. **Test Temp and Level**—displays the pressure transducer voltage, actual level and calculated level on the top line; and the temperature sensor signal and actual temperature on the lower line. This menu selection is used with special testing equipment to calibrate the machine at the factory.

4.1.1.2 How to Access the Manual Menu

Display or Action	Explanation
RUN FORMULA 00 OK TO POWER OFF	The machine must be idle (power on, but not running a formula) before the **Manual menu** can be accessed. Also, the **Run/Program keyswitch** must be at the **Run** position ( ).

Accesses the **Manual menu.**

```
MANUAL MENU
1 SOFTWARE DATE CODE
```

Reverse type indicates blinking cursor position. Select one of the **Manual menu** modes or return to the **Run mode**, as described below.

Scrolls forward/backward through the available modes of the **Manual menu.**

Returns to the **Run mode.**

```
RUN FORMULA
00 OK TO POWER OFF
```

Run mode selected; control is awaiting selection of a valid formula number. The formula number that was selected when the **Manual menu** was accessed appears on the display.

4.1.1.3 How to Return to the Run Mode from the Manual Menu

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Display or Action	Explanation
	Enters the **Manual menu** from **Run mode**.
MANUAL MENU 1 SOFTWARE DATE CODE	This is the **Manual menu** display.
	Exits the **Manual menu** to the **Run mode**.
RUN FORMULA 00 OK TO POWER OFF	This is the **Run mode** display. Select a formula to run, or turn off machine power.

4.1.2 Determining the Software Version

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Display or Action	Explanation
	Accesses the **Manual menu**.
MANUAL MENU 1 SOFTWARE DATE CODE	**Manual menu** accessed and **Software date code mode** selected.
	Hold both buttons depressed to view the software date code and machine configuration information, as shown below.
EP-PLUS/H7J 97005 RESTAURANTS LAUNDRY	Machine style (H7J), software date code (97005) and configuration (Restaurants Laundry).
RUN FORMULA xx FORMULA NUMBER xx	**Run mode** display is restored when the button combination is released.

4.1.3 Viewing Microprocessor Inputs

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The on/off state of each input to the microprocessor can be displayed by using the **Test Inputs** selection of the **Manual menu**. The machine must be idle (not running a formula).

Display or Action	Explanation
	Accesses the **Manual menu**.
MANUAL MENU 2 TEST INPUTS	**Manual menu** accessed and **Test Inputs** mode selected.
	Accesses the **Test Inputs** mode.
ABCDEFGHIJKLMNOP (-) +--++----+----+- OFF	The input display code on the top row corresponds to a display code in the table of inputs in this section. The status of the input is displayed beneath each code. If the input is grounded, a "+" appears. Non-grounded inputs are represented by "–".
	Restores the controller to the **Run mode**.
RUN FORMULA 00 OK TO POWER OFF	This is the **Run mode** display. Select a formula to run, or shut down the machine.

Table 12. E-P Plus Inputs

Display Code	Input Name	Connector-Pin
A	Door closed	M6–1
B	not used	M6–9
C	Vibration switch tripped	M6–2
D	Input from Inverter	M6–10
E	not used	M6–3
F	Keyswitch in Program position	M6–11
G	not used except in 48040F7J/B	M6–4
	Brake is OFF (48040F7J/B only)	
H	Halt—external fault	M6–12
	Bearing pressurized (48040F7J/B only)	
I	Halt—bath time	M6–5
J	Front not down (48040F7J/B only)	M6–13
K	not used	M6–6
L	not used	M6–14
M	not used	M6–7
N	not used	M6–15
O	not used	M6–8
P	not used	M6–16

4.1.4 Actuating Microprocessor Outputs

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Machine functions may be tested individually or in groups by using the **Test Outputs** component of the **Manual menu**. The machine must be idle (not running a formula).

DANGER: **Crushing and Entanglement Hazard —** Bare manual outputs actuate washer-extractor mechanisms. Keep all personnel clear.

Display or Action	Explanation
[menu]	Accesses the **Manual menu**.
MANUAL MENU 3 TEST OUTPUTS	This is the **Manual menu** display with the **Test Outputs** component selected.
[menu] + [1]	Accesses the output testing selection.
TEST OUTPUTS 01 INJECT CHEMICAL 5	This is the **Output testing** display.
[▲] / [▼]	Indexes forward and backward through the output names, as shown in the table of outputs in this section.
TEST OUTPUTS 07 COLD WATER VALVE	Example display with output in place to be selected and subsequently actuated.
[1]	Accesses the selected output for actuation. All outputs are initially disabled when accessed.
COLD WATER VALVE 0=OFF 1=ON 0	Example display with output accessed and disabled.
[1]	Enables the output (turns the output on).
COLD WATER VALVE 0=OFF 1=ON 1	Example display with output enabled. The cold water valve is open.
[1]	If the output was already on, this keystroke turns it off.
COLD WATER VALVE 0=OFF 1=ON 0	Example display with output disabled. The cold water valve is closed.
[▲]	Disables (turns off) the output if it was previously enabled, and advances to the next output.
HOT WATER VALVE 0=OFF 1=ON 0	Display after pressing [▲] to advance to the next output.
[hand]	Disables the output if it was enabled, then returns to the **Run mode**.
RUN FORMULA 00 OK TO POWER OFF	Display of **Run mode.**

Table 13. E-P Plus Outputs

Output Number	Page-Column	Description	Device	Consequences of Actuation
1	0–a	Inject chemical 5	K1	Operates inject device for chemical 5
2	0–b	Inject chemical 1	K2	Operates inject device for chemical 1
3	0–c	Inject chemical 4	K3	Operates inject device for chemical 4
4	0–d	Inject chemical 3	K4	Operates inject device for chemical 3
5	0–e	Inject chemical 2	K5	Operates inject device for chemical 2
6	0–f	Hot water valve	K6	Opens valve
7	0–g	Cold water valve	K7	Opens valve
8	0–h	Drain solenoid	K8	Closes drain
9	0–i	Flush valve	K9	Opens flush valve
10	0–j	Cooldown (if equipped)	K10	Operates cooldown valve, if equipped
11	0–k	Extra water (if equipped)	K11	Operates extra water valve, if equipped
12	1–a	Reuse drain (if equipped)	K12	Operates reuse drain, if equipped
13	1–b	Steam (if equipped)	K13	Operates steam valve, if equipped
14	1–c	Inject chemical 6	K14	Operates inject device for chemical 6
15	1–d	not used	K15	
16	1–e	Door interlock	K16	Energizes door latch to locked position
17	1–f	Unlock door	K17	Energizes door latch to unlocked position
18	1–g	Wash clutch	K18	Engages wash clutch
19	1–h	Extract speed (use only with empty cylinder)	K19	Locks door, releases brake (if any), and turns cylinder at extract speed.
20	1–i	Distribution (drain) speed (Door must be closed)	K20	Locks door, releases brake (if any), and turns cylinder at drain speed.
21	1–j	Clockwise wash speed (Door must be closed)	K21	Locks door, releases brake (if any), and turns cylinder clockwise at wash speed.
22	1–k	Counter-clockwise wash speed (Door must be closed)	K22	Locks door, releases brake (if any), and turns cylinder counter-clockwise at wash speed.
23		Buzz signal	Board-mounted signal	Sounds operator alarm
24		Run light	Board-mounted light	Turns on light in Start button (\)
25		Reversing wash speed	Functional test	Locks door and reverses cylinder at wash speed.
26		High Speed extract	Functional test	Locks door and `turns cylinder clockwise at wash speed, then high extract speed.
27		Fill to level 1	Functional test	Locks door, closes drain, fills to level 1 with cold water.
28		Fill to level 2	Functional test	Locks door, closes drain, fills to level 2 with cold water.

4.1.5 Testing and Verifying the DIP Switch Settings

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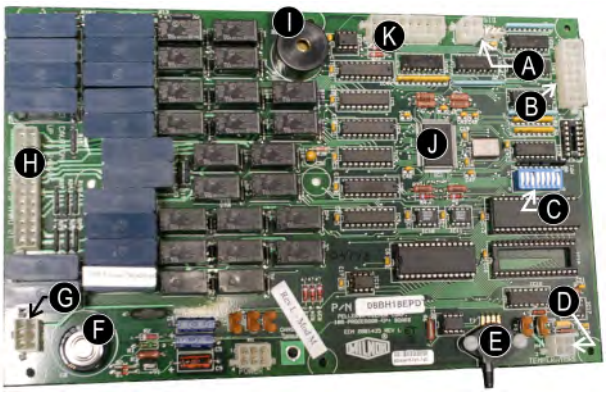
For all E-P Plus models, the set of default formulas is determined by how the DIP switches on the processor board are set. The bank of DIP switches is identified in Figure 9: Processor Board, page 66 .

Figure 9. Processor Board

Photograph of Typical Processor Board



Legend

- **A . . .** Display connectors
- **B . . .** Switch panel connector
- **C . . .** DIP switches
- **D . . .** Temperature probe connector (E-P Plus models only)
- **E . . .** Pressure transducer for level (E-P Plus models only)
- **F . . .** Capacitor to retain memory
- **G . . .** Outputs to chemical pumps
- **H . . .** Standard outputs
- **I . . .** Operator signal buzzer
- **J . . .** CPU chip
- **K . . .** Input connector

There is one unique number which identifies each possible combination of on/off settings at the DIP switch. While the industry configuration (switch 1 through switch 4) is readily available from the **Software version mode** (described in 4.1.2: Determining the Software Version, page 62), the settings of other switch positions are only apparent from this display or by looking at the processor board.

Display or Action	Explanation
[Manual]	Enters the **Manual menu** from the **Run mode**.
MANUAL MENU 1 SOFTWARE DATE CODE	This is the first item of the **Manual menu**.
[▼], [▼]	Scrolls down to the **Test DIP Switch** item.
MANUAL MENU 4 TEST DIP SWITCH	This is the **Test DIP Switch** item of the **Manual menu**.
[Manual] + [1]	Accesses the **Test DIP Switch** function and displays the DIP switch setting.
208	This is an example of the DIP switch display. Referencing this number in Table 14: Interpretation of **Test DIP Switch** Display, page 67 shows that the sample machine is configured for Correctional Laundries, and that switch position 5 is OFF and 6 is ON.
[Exit]	Terminates the **Manual menu** and returns controller to **Run mode**.

NOTICE: If the value that appears on the display is not shown in Table 14: Interpretation of **Test DIP Switch** Display, page 67 , add 64, 128, and 192 (the individual values of switch positions 7 and 8, respectively, and the total of 64 plus 128) to the value on the display, then check Table 14: Interpretation of **Test DIP Switch** Display, page 67 for the new value.

- The values in the "Displayed Value" column of Table 14: Interpretation of **Test DIP Switch** Display, page 67 appear on the display only when DIP switch positions 7 and 8 are OFF. Switch positions 7 and 8 do not affect how the washer-extractor operates.
- If the total of the displayed value plus 64 equals a value in the table, then switch position 7 is ON.
- If the total of the displayed value plus 128 equals a value in the table, then switch position 8 is ON.
- If the total of the displayed value plus 192 equals a value in the table, then switch positions 7 and 8 are ON.

Table 14. Interpretation of Test DIP Switch Display

Displayed Value	Switch Settings								Industry
	1	2	3	4	5	6	7	8	
192	1	1	1	1	1	1	0	0	Correctional
193	0	1	1	1	1	1	0	0	Hotel/Motel
194	1	0	1	1	1	1	0	0	Athletic
195	0	0	1	1	1	1	0	0	Healthcare Facilities
196	1	1	0	1	1	1	0	0	Restaurants
197	0	1	0	1	1	1	0	0	Commercial Laundries
198	1	0	0	1	1	1	0	0	Shirt Laundries
199	0	0	0	1	1	1	0	0	Offshore Laundries
200	1	1	1	0	1	1	0	0	Gear Guardian
208	1	1	1	1	0	1	0	0	Correctional
209	0	1	1	1	0	1	0	0	Hotel/Motel
210	1	0	1	1	0	1	0	0	Athletic
211	0	0	1	1	0	1	0	0	Healthcare Facilities
212	1	1	0	1	0	1	0	0	Restaurants
213	0	1	0	1	0	1	0	0	Commercial Laundries
214	1	0	0	1	0	1	0	0	Shirt Laundries
215	0	0	0	1	0	1	0	0	Offshore Laundries
216	1	1	1	0	0	1	0	0	Gear Guardian
224	1	1	1	1	1	0	0	0	Correctional
225	0	1	1	1	1	0	0	0	Hotel/Motel
226	1	0	1	1	1	0	0	0	Athletic
227	0	0	1	1	1	0	0	0	Healthcare Facilities
228	1	1	0	1	1	0	0	0	Restaurants
229	0	1	0	1	1	0	0	0	Commercial Laundries

Table 14 Interpretation of Test DIP Switch Display (cont'd.)

Displayed Value	Switch Settings								Industry
	1	2	3	4	5	6	7	8	
230	1	0	0	1	1	0	0	0	Shirt Laundries
231	0	0	0	1	1	0	0	0	Offshore Laundries
232	1	1	1	0	1	0	0	0	Gear Guardian
240	1	1	1	1	0	0	0	0	Correctional
241	0	1	1	1	0	0	0	0	Hotel/Motel
242	1	0	1	1	0	0	0	0	Athletic
243	0	0	1	1	0	0	0	0	Healthcare Facilities
244	1	1	0	1	0	0	0	0	Restaurants
245	0	1	0	1	0	0	0	0	Commercial Laundries
246	1	0	0	1	0	0	0	0	Shirt Laundries
247	0	0	0	1	0	0	0	0	Offshore Laundries
248	1	1	1	0	0	0	0	0	Gear Guardian

4.1.6 Testing Temperature and Level Sensors

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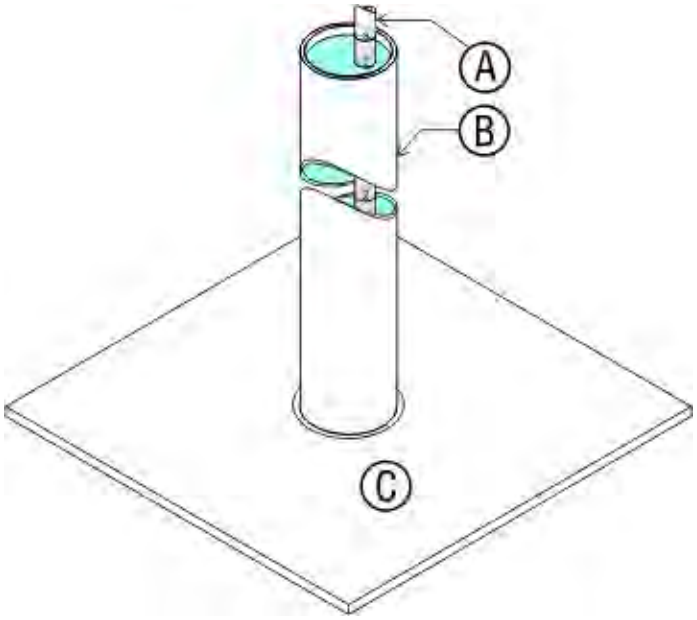
The **Test Temperature & Level** selection on the **Manual menu** is used primarily by the Milnor® factory for testing and calibration of machines before delivery. For testing a temperature or level sensor in the field, the input to the sensor (level or temperature) must be controlled, but the sensor must remain connected to the processor board. The temperature sensor can be tested with a container of ice and water. A probe inserted in a container filled with ice and water will register approximately 32 degrees Fahrenheit (0 degrees Celsius).

Testing the pressure transducer requires a fixture similar to the one illustrated in Figure 10: Level Sensor Testing Fixture, page 69 . As the graduated plastic tube from the transducer is lowered below the surface of the water, the displayed level values rise. If the values don't change, verify that there is absolutely no leaking in the pressure tube or at its connection to the transducer.

Figure 10. Level Sensor Testing Fixture

Fixture	Legend
	**A . . .** graduated tube from pressure transducer **B . . .** cylinder filled to near top with water **C . . .** base plate

Display or Action	Explanation
R00088 A:01.7 C:01.0 R00099 A:082F [TEMP]	The top line of the display applies to the level sensing circuit. The "R" and the five characters immediately following it on the top line indicate the voltage being delivered by the pressure transducer on the processor board (see Figure 9: Processor Board, page 66). The "A" value is the actual instantaneous level read by the transducer. Because this display is only available when the drain is open, the actual level will normally reflect no water in the machine cylinder, although the number will be above 0. The "C" value is a calculated average of the transducer levels, used to negate the effects of rising and falling water levels caused by the reversing wash motion. Again, in normal conditions, this value will reflect that there is no water in the machine, although it may fluctuate between two values (e.g., 1.0 and 2.0) as it adjusts to the nearest whole inch. When using the level sensor test fixture (Figure 10: Level Sensor Testing Fixture, page 69), the display should indicate approximately the level to which the graduated plastic tubing is inserted into the water. The bottom line of the display applies to the temperature sensing circuit. Similar to the "R" value of the top line, the first six characters of the bottom line indicate the voltage being delivered by the temperature probe to the processor board (see Figure 9: Processor Board, page 66). The "A" value on the bottom line is the temperature in degrees Fahrenheit detected by the temperature probe.

4.1.6.1 Testing the Pressure Transducer Circuit

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The pressure transducer (illustrated in Figure 11: Pressure Transducer Component Identification, page 71) outputs a microvolt-level signal that increases proportionally according to the pressure in the plastic tube. The instrumentation amplifier magnifies this signal by a factor of 1000 for the microprocessor. Because only very sensitive voltmeters are capable of reading a signal of less than one millivolt, better results are available by measuring the output voltage from the instrumentation amplifier. This procedure is described below:

CAUTION: **Electrocution and Electrical Burn Hazards —** Electric box doors—Operating the machine with any electric box door unlocked can expose high voltage conductors inside the box.

1. Locate the instrumentation amplifier on the processor board. This is a small integrated circuit chip with eight leads in socket IC20, near the pressure transducer.
2. Set your digital voltmeter to read a maximum of 5 volts DC. The output of this component, even when failed, will not exceed 5 VDC.
3. Locate pin 6 on the instrumentation amplifier. Note the notch in one end of the amplifier chip. If the board is oriented so the notch on the chip is at the left side of the chip, then pin 1 is the leftmost pin on the bottom row. Count pins counterclockwise to pin 6. If the orientation of the board is maintained (pin 1 at the lower left), then pin 6 will be the second chip from the right on the top row. This is the amplifier output pin.
4. Put the positive lead from your voltmeter on pin 6 of the amplifier chip, and the negative lead to a reliable electronic ground. Pin 5 (rightmost pin on top row) of the amplifier chip provides a suitable ground.

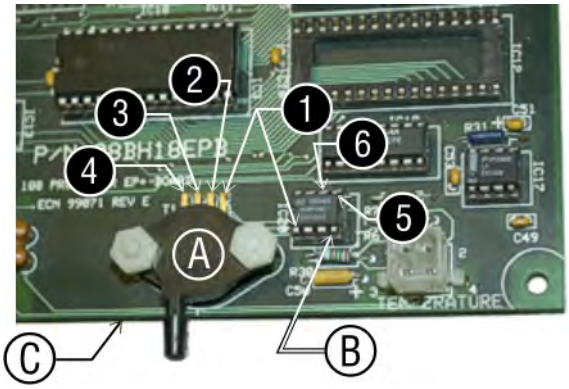
The output voltage read on the meter should be approximately 0.085 volts per inch of water in the machine cylinder. That is, if the machine is filled to a level of 4 inches (10 cm), the voltage measured between pins 5 and 6 of a functioning amplifier will be about 0.33 volts.

NOTE: If your voltmeter is capable of reading microvolts, the transducer can be tested without the effect of the instrumentation amplifier. The notched pin on the transducer is pin 1 (ground). The reference voltage of slightly less than 1.5 VDC is applied to pin 3. Pins 2, 3, and 4 will all read the reference voltage relative to pin 1. The output voltage between pins 2 and 4 should equal approximately 0.085 millivolt per inch of water.

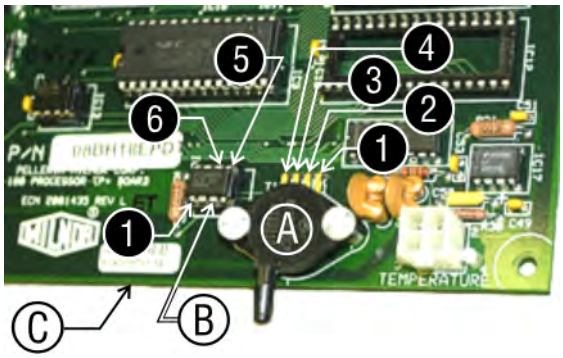
If the voltage is lower than expected, first check for leaks in the plastic tube connected to the pressure transducer. If no leaks are found, or if the voltage is significantly higher than expected, replace the processor board.

Figure 11. Pressure Transducer Component Identification

"Rev. E" Processor Board



"Rev. L" Processor Board



Legend

A . . . Pressure transducer
B . . . Instrumentation amplifier
C . . . Edge of processor board
1 . . . Pin 1 of each component
2 . . . Pin 2
3 . . . Pin 3
4 . . . Pin 4
5 . . . Pin 5
6 . . . Pin 6

4.1.7 Viewing Inputs and Outputs During Operation

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While the machine must be idle to actuate outputs, inputs and outputs can be viewed (but not turned on or off) while the machine is operating.

Display or Action	Explanation
`23:04 F02S01 02:37` `L=A1/D1 Hot Wash`	This is a typical display while the machine is running a formula.
1 + ▲	displays the inputs. A plus sign (+) indicates the input is grounded, while a minus sign (–) indicates the input is not grounded.
`ABCDEFGHIJK` `+++--------`	typical display of input status while the machine is running. Refer to Table 12: E-P Plus Inputs, page 63 to determine which input is represented by each character on the display.
⊞ + ▲	displays the first 11 outputs (Page 0). A plus sign (+) indicates the output is actuated, while a minus sign (–) indicates the output is turned off.

displays the last 11 outputs (Page 1).

```
PAGE abcdefghijk
 0   -+----+----
```

typical display of first page of outputs (Page 0) while the machine is running. Refer to Table 13: E-P Plus Outputs, page 65 to determine the component represented by each character on Page 0 and Page 1.

4.1.8 Viewing Water Level and Temperature Data During Operation

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Display or Action	Explanation
	displays pressure transducer raw data and actual water level in tenths
`03:45 STEP #01 05:36` `08240 081 080  LEV 2`	From left to right, the bottom line displays the pressure transducer raw data, the actual water level and the filtered water level in tenths, and the desired level.
	displays the calculated level, the desired level, and the temperature
`03:48 STEP #01 05:36` `LC07/LD07/T103 LEV 2`	From left to right, the bottom line displays the calculate water level, the desired water level, and the water temperature. The level values on this display take into account any configured **offset height** (see 2.3.4.2: The Configure Decisions, page 41).

4.2 Error Messages

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4.2.1 Error Messages at Power Up

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If an error message appears during power up, the error must be cleared before the machine can be run or programmed.

Display or Action	Explanation
`ACCUMULATOR ERROR` `TERMINATE TO CLEAR`	The microprocessor performs a memory check each time the machine is turned on. This error message appears if the microprocessor detects that the accumulator data is corrupt, in which case all accumulators must be reset to zero.
	Resets all accumulators and clears the error message. See 3.2: How to Use and Erase the Formula Counter, page 60 for more information.
`CHECKSUM ERROR, TURN` `KEY TO PROGRAM`	Appears if there is illegal data in the configuration, formula, or industry memory areas. Use the following procedure to clear this error.

1. Reconfigure the machine according to the configuration information in 2.3: Programming the E-P Plus® Controller, page 20 .
2. Reinstall the standard (default) formulas according to the default formula loading procedure in 2.3: Programming the E-P Plus® Controller, page 20
3. Reprogram any lost wash formulas according to 2.3: Programming the E-P Plus® Controller, page 20 .

`MEMORY: FLASH IS NOT TALKING`

This message appears when the microprocessor cannot read from the flash memory.

1. Lock off and tag out power to the machine.
2. Replace flash memory. Contact the Milnor® factory to ensure that the replacement memory is the most current version for your machine.
3. Restore power to machine.
4. Reconfigure the machine according to the configuration information in 2.3: Programming the E-P Plus® Controller, page 20 .
5. Reinstall the standard (default) formulas according to the default formula loading procedure in 2.3: Programming the E-P Plus® Controller, page 20 .
6. Reprogram lost wash formulas according to 2.3: Programming the E-P Plus® Controller, page 20

`A/D BOARD IS NOT TALKING`

This error message indicates that the analog to digital board is not communicating with the microprocessor.

1. Lock off and tag out power to the machine.
2. Check the connections at both ends of the ribbon cable between the processor board and the analog to digital board.
3. Restore power.
4. If the error persists, lock off and tag out power to the machine. Have a qualified service technician replace the suspect board.

4.2.2 Error Messages during Normal Operation

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If an error message appears on the bottom line of the display while the machine is running, the timer shown on the top line will stop counting. When the error is corrected, the timer resumes

counting down. To troubleshoot most errors, suspend the formula in progress and turn power off. Do not terminate the formula if it is to be resumed after the error is corrected. See 3.1.5: **How to Shorten, Terminate, or Suspend a Running Formula**, page 58 for more information.

Display or Action	Explanation
DOOR NOT CLOSED	This error message indicates that the door input is not made while the machine is running. Verify that the door is closed, then check the door switch and its connection to the microprocessor. Press 1 if necessary to resume operation after the error is corrected. **Never operate this machine while this message is present.**
CHECK LEVEL SWITCH	The level switch may be faulty, perhaps reporting that level 2 was achieved before level 1. Check the pressure transducer, or the level switch and its input connection to the microprocessor.
LEVELS STILL MADE	The microprocessor is still receiving information that a level is made just before or during an extract step, or immediately before the fill for a bath step. This error is self-clearing when level is lost.
TOO LONG TO FILL	For software WUH7JA, this error indicates that the time to fill to level exceeded 10 minutes. Check the water valves, strainers, supply lines, and water pressure. The machine will continue to fill until level is reached, at which time the error will automatically clear and normal operation will resume. This software is used on 30022X8J machine models. For software WUV7J1B with version 2300K and later, you can configure the time before this error appears. This software is used on all machines with V_J in the model number, as well as 36026X8J and 420__X7J machine models. • If configure decision **Fill Error Time** is set to **00**, then the machine will continue to fill until the programmed level is reached. • If configure decision **Fill Error Time** is set to a value greater than 00, the machine will signal the error and turn off the water valves. The operator can choose to reset the error timer and try to fill again or to cancel the formula.
	Cancel the formula.
	Reset the fill error timer and try to fill again
TOO LONG TO STEAM	The configured maximum time to steam up to the desired temperature has been exceeded. Check the steam valve, strainer, main steam header and pressure, etc. Steaming will continue until temperature is achieved, when the error will automatically clear and normal operation will resume.
TOO LONG TO COOL	The configured maximum time to cool down to the desired temperature has been exceeded. Check the cooldown valve and strainer if equipped, cold water pressure, and position of vernier

valve on cooldown inlet. Cooldown will continue until the desired temperature is achieved, when the error will automatically clear.

TOO LONG TO DRAIN

The machine did not drain properly in the allotted drain time. This self-correcting error will clear when the water level in the basket is low enough to begin the next operation. The drain time before this message appears is controlled by a configure decision. Detailed configure instructions can be found elsewhere in the manual. See table of contents.

CHECK PROBE

This error message indicates that the resistance of the temperature probe is outside the specified range. Test the probe by disconnecting the probe leads from the processor board and checking the resistance with an accurate digital ohmmeter. Resistance between the two leads must be between 2K and 35K Ohms. Resistance between each lead and ground must be infinite.

EXTERNAL FAULT

On most machines, this error indicates that the programmed chemical injection failed, usually because the chemical supply system is empty. When chemicals are added and can be injected, this error clears automatically, allowing operation to resume.

On 48040F7J/F7B models, this error indicates that the bearing air pressure is below the minimum required to help protect the bearing from water contamination.

BRAKE PRESS. FAULT

This error appears only on machine models equipped with a cylinder brake. The message indicates that the brake is engaged when it should be disengaged. This is usually because the machine is not receiving sufficient air pressure to open the normally-closed brake. Check the plant compressed air supply.

INVERTER FAULT

This error message appears if the microprocessor does not receive an input from the inverter within 14 seconds of the beginning of the formula. After 14 seconds without an inverter input, the timer stops, the basket is stationary, and the drain valve opens. To recover, press the **Next** key ( ).

VIBRATION SW TRIPPED RECOVERY SEQUENCE

When the vibration switch closes, the timer stops. After 45 to 85 seconds, the basket reverses at wash speed as the cylinder fills with water. When low level is achieved, the cylinder reverses for one additional minute at wash speed, then accelerates to extract speed.

5 Supplemental Information

5.1 The E-P Plus® and E-P Express® Hardware

The Milnor® E-P Plus® and E-P Express® microprocessor controls are designed specifically for Milnor® washer-extractors. Along with certain external electromechanical relay logic and sensing devices, they control all machine and system functions. Not every Milnor® microprocessor system includes all the following components.

5.1.1 Keyswitches

5.1.1.1 Run/Program Keyswitch

This keyswitch allows controlling who has the necessary access to modify wash formulas. Formulas can be modified only when this switch is turned from the **Run** position ( ) to the **Program** position ( ). To safeguard wash formulas, keep this key in a secure place with restricted personnel access.

5.1.1.2 Automatic/Test Keyswitch (E-P Plus® Models Only)

This keyswitch allows only employees with access to the appropriate key to operate the machine in **Test mode** for troubleshooting. **Test mode** can be accessed only when this switch is turned from the **Automatic** position ( ) to the **Test** position ( ). To reduce the risk of personal injury and machine damage, keep this key in a secure place with restricted personnel access.

5.1.2 Display

The display is a vacuum fluorescent display consisting of two lines of 20 characters each. This type of display is easily identified by green characters on a black background when operating, or a nearly black background when not operating.

5.1.3 Power Supply

The power supply provides a regulated specific voltage to the processor board and certain auxiliary boards and devices. The power supply also converts control circuit alternating current voltage to +12 volts direct current, –12 volts direct current, and +5 volts direct current. The power supply is switchable between 120 volts and 240 volts alternating current input voltage.

Although the +12VDC and –12VDC are not adjustable, the +5VDC is rather sensitive and the power supply must be adjusted so **the actual voltage at the processor board is between 5.04VDC and 5.06VDC** as measured by an accurate digital voltmeter. If this voltage is not within the stated range, the machine may malfunction.

5.1.4 CPU Processor Board

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The central processing unit (CPU) processes data received from the various inputs, stores information, and responds to each push button entry with the appropriate action. Data is stored in one or more of the following types of memory chips on the CPU board, depending on the machine model.

SRAM **Static Random Access Memory** stores the accumulator (formula count) data as long as the machine has power, or via a capacitor for approximately 24 hours with power off. This type of component is also used to retain the last formula and step in progress when power is turned off at the machine while a formula is running. SRAM is used in all E-P Plus® and E-P Express® controllers.

Flash Memory Similar to EEPROM memory in function, **flash memory** can be electrically erased and reprogrammed, but is faster and can retain more data than EEPROM memory. Flash memory is used on processor boards for F_J, H_J, X_J, and V_J models, and all E-P Express® models. The two flash memory chips reside in sockets IC2 and IC12. The chip in socket IC12 contains operating instructions and the complete set of industry standard formulas. As software updates are made available, the owner/operator may choose to replace this chip. The chip in socket IC2 holds the industry formulas and user changes to those formulas, as well as machine configuration data. The chip in socket IC2 will not normally need replacing for software updates.

5.1.5 Outputs

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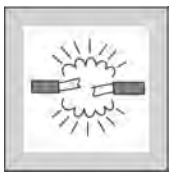
Depending on the processor board, output relays may be either socket-mounted to a separate output board, or permanently soldered to the processor board. H_J, F_J, V_J, and X_J models, as well as all E-P Express® models, use the 188 processor board with soldered relays. The SPST (single pole, single throw) relays have the same load parameters as those used in other models (25VA).

WARNING: **Avoid damage to electronic boards —** Although the relays on 188 processor boards are capable of handling higher loads, failure to restrict current loads to the values stated above may cause traces on the processor board to fail, thus destroying the board.



5.1.6 Option Outputs (E-P Plus® Models Only)

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The 188 E-P Plus® processor board used in F_J, H_J, X_J, and V_J models includes the option output relays as well as the standard output relays directly on the board. All 22 of the output relays on the 188 processor board are identical.

5.1.7 Temperature Probe (E-P Plus® Models Only)

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A thermistor temperature probe is provided in the machine sump if the machine is equipped for optional temperature control. This probe is a resistor that changes value according to temperature.

5.1.8 Pressure Sensor (E-P Plus® Models Only)

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The 188 E-P Plus® processor board contains a pressure transducer unit mounted directly to the board. This transducer produces a very small voltage (about 0.085 millivolt per inch of water) that increases as the water level in the basket rises. For E-P Plus® models, detailed information on the Pressure Transducer Circuit is provided. See table of contents.

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5.2 Serial Memory Storage Device Applications

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A serial memory storage device similar to one shown below can be used to store machine configuration and formula data for most current models of Milnor® machines. DIP switches inside the storage device allow you to configure the device to accept data from several different machine types and software versions. Use this document to determine the proper DIP switch setting for your machine. After verifying the switch settings, label the storage device with the date, machine name, and serial number to avoid confusion when the device is needed to restore data to a machine.

Figure 12. Serial Memory Storage Device

Figure 13. Rear View of Circuit Board

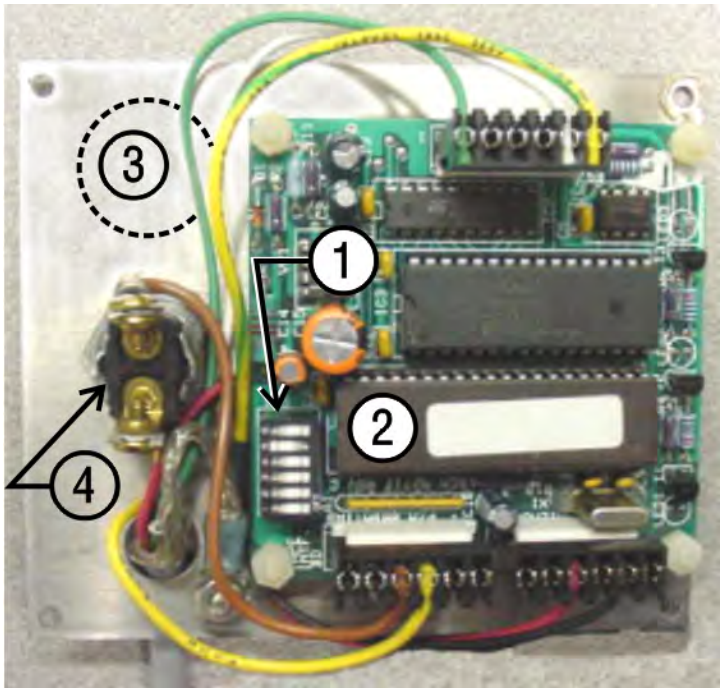
View	Legend
	**1 . . .** DIP switch **2 . . .** Software chip **3 . . .** Location of **Transmit button**, if equipped **4 . . .** Key switch

Table 15. DIP Switch Positions for E-P Plus® and E-P Express® Machines (External transmit button required)

Processor Board Part Number	Processor Board Revision Code	Machine Software and Revision	Storage Device Software and Revision	DIP Switch Setting
30015HxJ and 30022HxJ Models				
08BH18EPDT	K	WUH7JA/2200E	WUNTIA/00008	E
VxJ Models				
08BH18EPDT	K	WUV7J1B/2200K	WUNTIA/00008	E
30015T5X and 30022T5X Models				
08BH18EPYT	K	WUEPXPRSA/22004	WUNTIA/00008	E
All E-P Express Gear Guardian Models				
08BH18EPYT	K	WUT5XGGA/22GGF	WUNTIA/00008	E
08BH18EPWT	K	WUMWRXGG/(any)	WUNTIA/00008	E

Key:

A	All switch positions OFF
B	Position 4 ON; all others OFF
C	Position 5 ON; all others OFF
D	Positions 1 and 5 ON; all others OFF
E	Positions 4 and 5 ON; all others OFF

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5.3 Construction of External Serial Link Cables

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This document provides information for on-site fabrication of certain types of serial communication cables. Programmable data can be transferred between compatible machines or between a machine and a Milnor® *serial memory storage device* (see related note below), using the download cables described in 5.3.2.2: Connecting Two or More Machines for Machine-to-machine Transfer, page 82 and 5.3.2.3: Connecting a Machine to a Serial Memory Storage Device, page 83 respectively. These cable(s) connect to the cabinet-mounted 9-pin DIN type receptacle shown in Figure 14: 9-Pin DIN Connector Pin Identification (from wire entry side of connectors), page 81 and may be installed temporarily or permanently, as appropriate.

NOTE: The currently approved printers and printer configuration settings are provided in 5.4: Printer Requirements and Settings, page 84 . A pre-assembled machine-to-printer cable similar to the cable described here, is available from Milnor (P/N 10YMK2PNTR).

NOTE: The Milnor *serial memory storage device* (also known as a *download box*) contains nonvolatile memory to hold a back-up copy of the programming and configuration data for **one machine**. This data is transferred between the machine and the memory storage device via the DIN receptacle on the machine. Two models are currently available: KXMIC00507 and KXMIC00508. The already wired cable and DIN connector are included as part of the memory storage device. Consult the Milnor Service department to determine the correct device for a particular application.

5.3.1 Pin Identification

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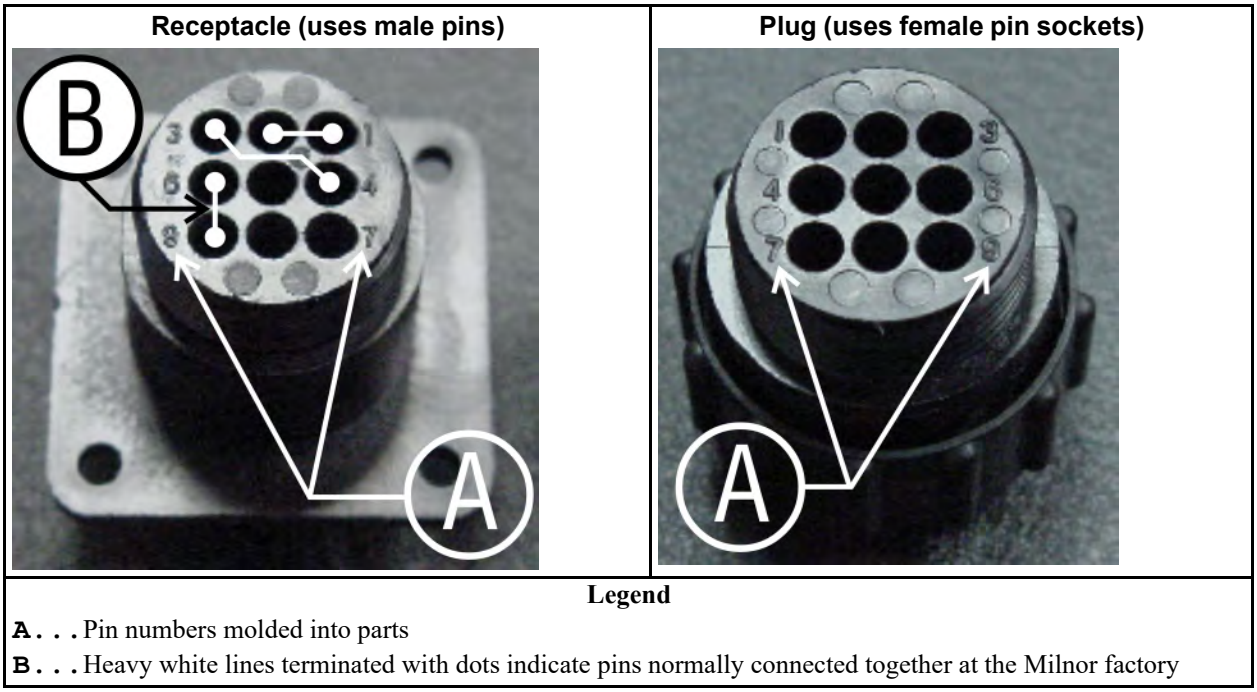
Figure 14: 9-Pin DIN Connector Pin Identification (from wire entry side of connectors), page 81 illustrates the DIN receptacle (which uses male pins) and the mating plug (which uses female pin sockets), each viewed from the **wire entry** side. The receptacle is normally installed and wired at the Milnor factory. The plug and female pin sockets for customer use are provided in a bag inside the electric box. Table 16: External Serial Link Pin Assignments, page 81 shows the function of each pin.

Figure 14. 9-Pin DIN Connector Pin Identification (from wire entry side of connectors)



Legend

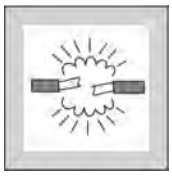
A . . . Pin numbers molded into parts

B . . . Heavy white lines terminated with dots indicate pins normally connected together at the Milnor factory

Table 16. External Serial Link Pin Assignments

Pin Number	Function	Receptacle Wiring (inside electrical enclosure)	
		Wire Number	Color Code
1	Serial low	DLL	Blue and black
2			
3	Serial high	DLH	Blue and red
4			
5	Clear to send (not used on these models)	CTS	Blue and orange
6	Electronic ground	2G	Blue and white
9			
7	Transmit data (not used on these models)	TXD	Blue and orange
8	+5 volts DC (used for serial memory storage device only)	V1	Blue

CAUTION:



Risk of damage to electronic components — Pin 8 is only used to supply +5VDC power to the download box and will damage components in both devices if not properly connected

▶ Never connect pin 8 to any other pin in the connector, a printer, or another machine.

5.3.2 How to Wire the Cables

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Because the DIN receptacle is wired to support different functions and because the data transferred across these cables can be corrupted by electrical noise, follow these instructions carefully.

5.3.2.1 Cable Specifications

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Multi-conductor shielded cable that meets the following minimum requirements must be used in the applications covered herein. Conforming cable may be purchased from Milnor (P/N 09V300A04S) or purchased from another source:

- Jacket: 600VAC insulation
- Shielding: braided, tinned copper, minimum 85 percent coverage
- Four conductors with these specifications:
  - Conductive material: Tinned copper, 20 AWG
  - Insulation: 300VAC, color coded
  - Preferred colors: red, black, green and white

5.3.2.2 Connecting Two or More Machines for Machine-to-machine Transfer

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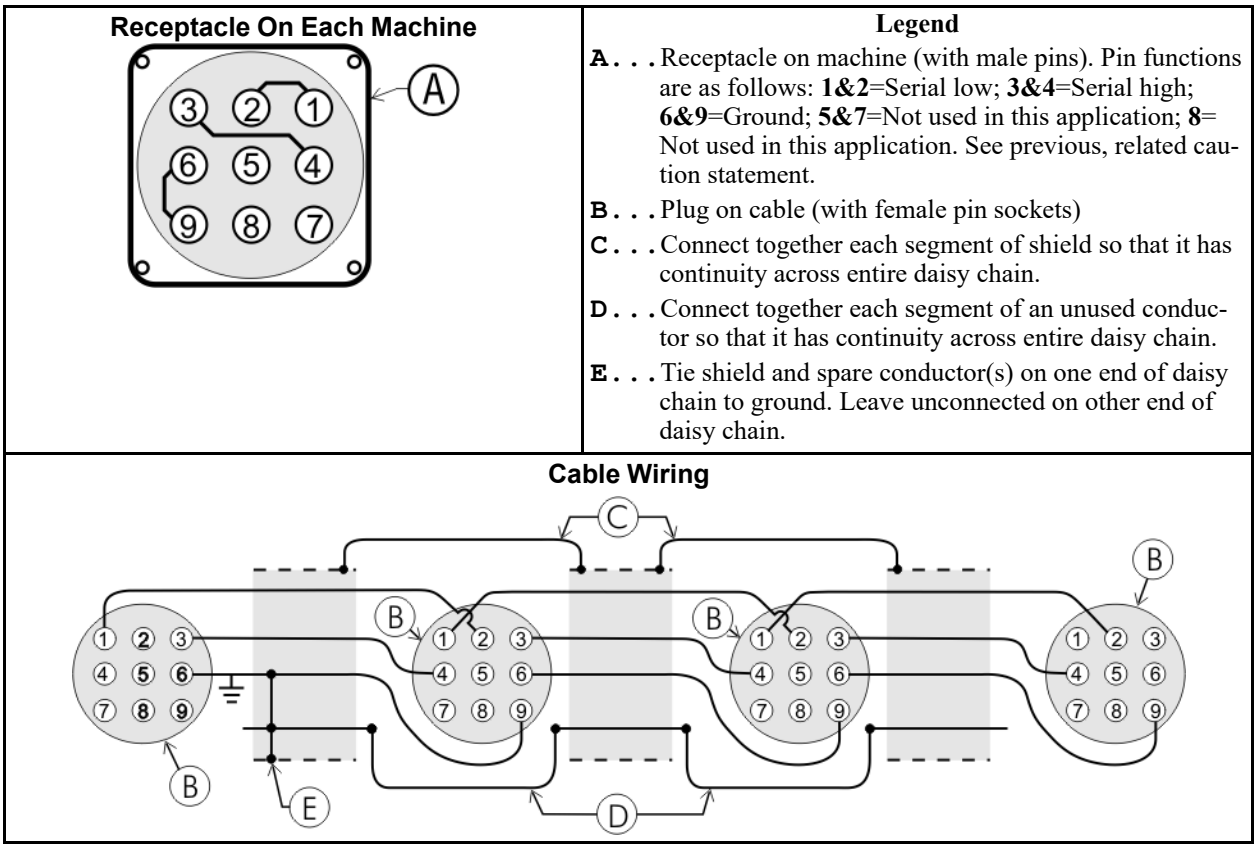
Figure 15: Wiring Diagram for Cable to Connect Two or More Machines, page 83 shows how to wire a cable to connect a bank of identical machines (the Figure 15: Wiring Diagram for Cable to Connect Two or More Machines, page 83 example shows connections for four machines) so that data programmed on one machine in the group can be downloaded to all other machines simultaneously. This cable is referred to as a daisy chain because it runs in segments from machine to machine, connecting all machines in the group.

Figure 15. Wiring Diagram for Cable to Connect Two or More Machines



The internal connections on each receptacle (machine) between pins 1 and 2, 3 and 4, and 6 and 9 make it easier to wire the cable because it is not necessary to jumper these pins together on the cable. However, this also means that every plug on the daisy chain must be plugged into a receptacle. Otherwise, the serial low, serial high, and ground conductors will not have continuity across the entire daisy chain and some machines will not receive data.

Rules and details about downloading among machines are fully described in the programming section of the reference manual.

5.3.2.3 Connecting a Machine to a Serial Memory Storage Device

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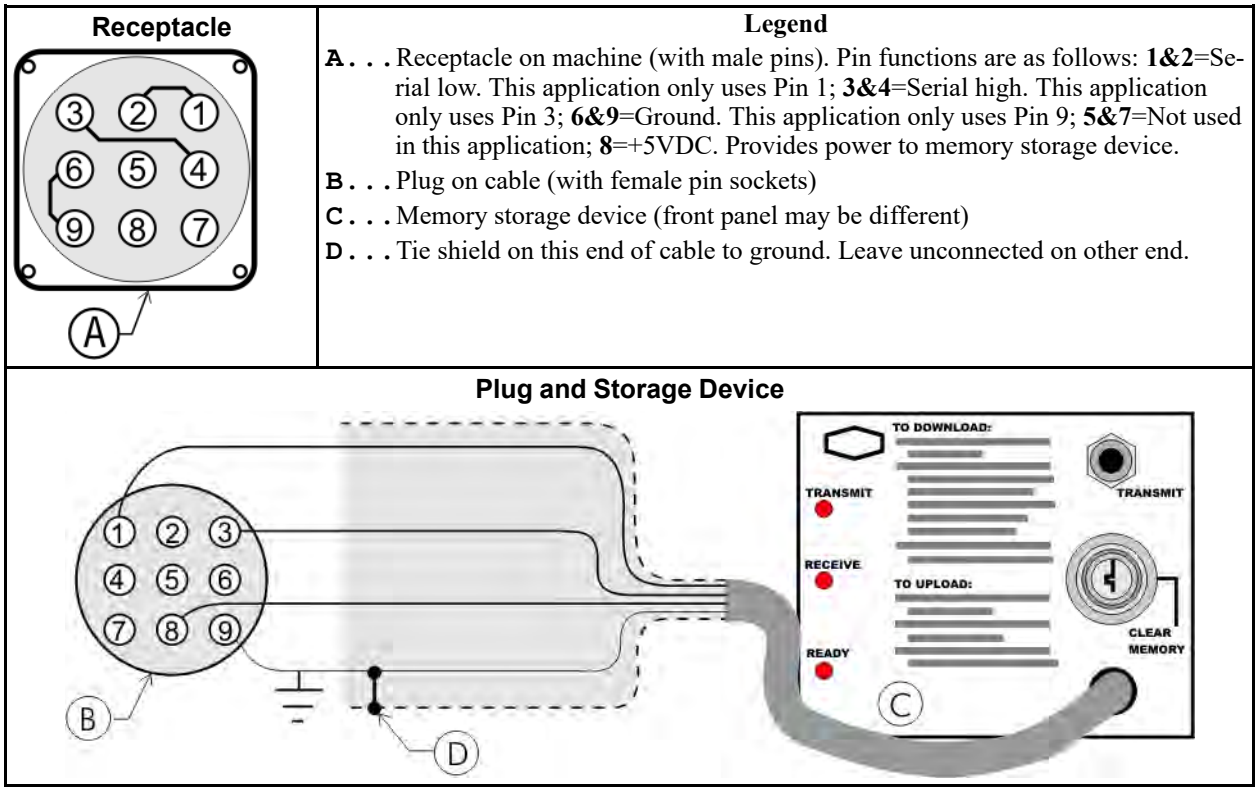
The cable used with the serial memory storage device (download box) available from Milnor, see related note in 5.3: Construction of External Serial Link Cables, page 80 , is permanently attached to the storage device. Cable fabrication, as shown in Figure 16: Wiring Diagram for Cable to Connect a Machine to a Serial Memory Storage Device, page 84 , is not required except for replacing a damaged cable. The memory storage device is the only application in which the power conductor (Pin 8) is used.

Figure 16. Wiring Diagram for Cable to Connect a Machine to a Serial Memory Storage Device



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5.4 Printer Requirements and Settings

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NOTICE: Because of the many differences among printer makes and models, Milnor® cannot ensure suitability or troubleshoot printers other than those described in this document (or certain older approved models), with the required interface cable.

5.4.1 Cable Requirements

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The printer must be connected to the printer port on the machine using the appropriate one of the following Milnor interface cables:

Table 17. Milnor Printer Cables

Printer Cable Part Number	Description
10YMK2PNTR	100-formula washer-extractor, dryer, extractor, and Miltron (CBW®) controllers
10YCBWPNTR	Non-serial Miltron (CBW) controller
08MPSERCBL	Mentor® (CBW) and Mildata® controllers

5.4.2 Configuring the Citizen GSX-190 Printer

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Table 18: Required Settings for Citizen GSX-190 Printer, page 85 lists the required settings for this printer model to work properly with Milnor equipment. To print the current settings stored in your printer, move the **Menu** slide switch on the printer to the **VuePrint** position, then hold the **Print** button for three seconds. Hold the **Menu** button for three seconds to enter the **VuePrint** menu system to make changes.

Table 18. Required Settings for Citizen GSX-190 Printer

Menu	Data Field	Value
Install 1	Ribbon	Normal
	A.S.F.	Off
	Emulation	Epson
Print Style	Font	Draft
	Emphasized	Off
	Pitch	10 characters inch
	Front lock	Off
Page Layout	Line spacing	6 lines per inch
	Form length	Letter
	Page skip	Off
Print Mode	NLQ Dir	Uni-directional
	Graphic Dir	Uni-directional

Menu	Data Field	Value
Character	Slash zero	Off
	Character set	Graphics
	Intl character set	U.S.A.
	Code page	U.S.A.
Install 2	Tear off	Off
	Paper out	Enable
	Auto linefeed	Off
	Copy mode	Off
	Envelope	Off
Serial I/F	Baud rate	9600
	Parity	Even
	Data bits	8 bits
	Stop bits	1 bit
	Protocol	DTR

5.4.3 Configuring the Epson LX300 Printer

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The Epson model LX300 printer was supplied by Milnor prior to March 2001 to print data from microprocessor controllers with printing functions. When shipped from Milnor, this printer was configured to operate correctly with Milnor equipment. If the printer is replaced or must be reconfigured for any reason, refer to the user's guide and the following table.

Table 19. Required Settings for Epson LX300 Printer

Data Field	Value
Character spacing	10 characters per inch
Shape of zero	0
Skip over perforation	Off
Character table	PC 437
Auto line feed	Off
Page length	11 inches
Auto tear off	Off

Data Field	Value
Tractor	Single
Interface	Serial
Bit rate	9600 bps
Parity	Even
Data length	8 bits
ETX/ACT	On

5.4.4 Previous Printer Models

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The Epson LX300 printer replaced the Epson LX-810, which replaced the Epson LX-800. For information on these older printer models, request document MSSM0251AE from the Milnor factory.