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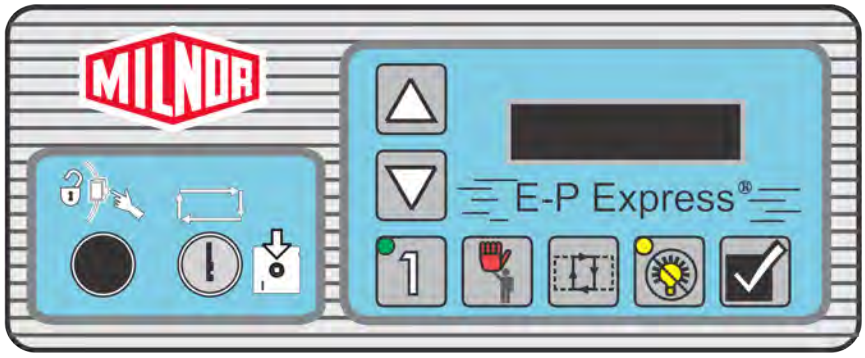
Controller Reference

The E-P Express® Controller



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Preface

1 About this Manual

1.1 Scope

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This manual provides commissioning, programming, operating, and troubleshooting instructions for Milnor® washer-extractors using the E-P Express® or E-P Express® Gear Guardian® microprocessor control system. See the installation manual for information on machine installation procedures and mechanical requirements. See the service manual for preventive maintenance, service procedures, and mechanical parts identification. See the schematic manual for electrical parts identification and electrical troubleshooting instructions.

1.2 The Normal Display at Start-up

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The start-up display sequence for E-P Express® or E-P Express® Gear Guardian® machines is described in document Section 3.1 : Running a Formula, page 44

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that this manual does not give?** If we get better data or more data after the manual is available, we will add it to a newer version of the manual.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 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 Section 1.2.2 : 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.

1.2.1 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.

1.2.2 Major Design Considerations

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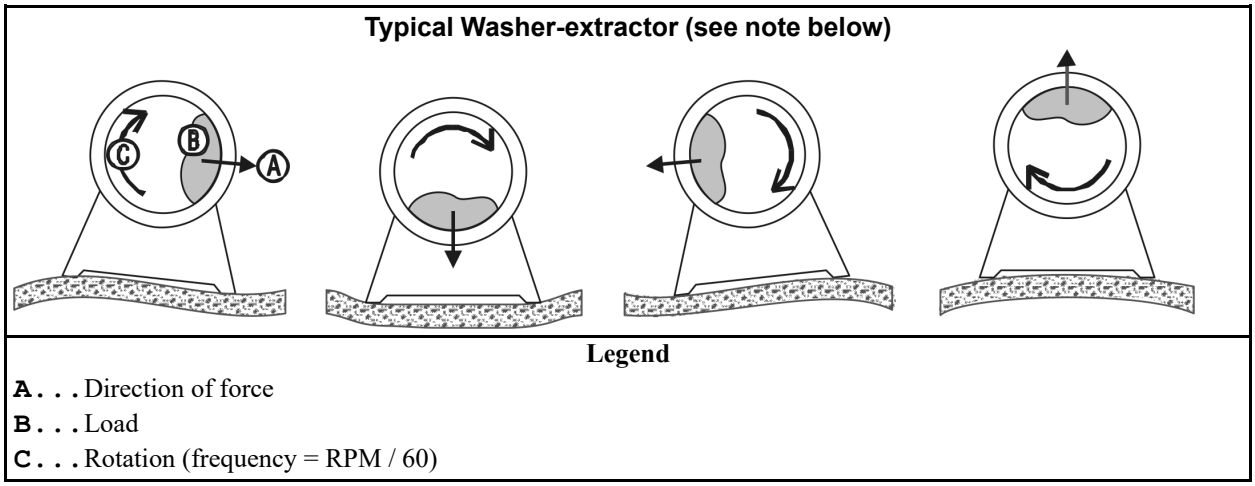
- Vibration and/or noise can be felt or heard outside of the laundry room as a result of the following, if supporting structures are not sufficiently rigid:
  - Extraction (the spinning cylinder) in washer-extractors and centrifugal extractors, imparts sinusoidal forces to supporting structures as shown 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.

1.2.3 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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1.3 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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1.4 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.

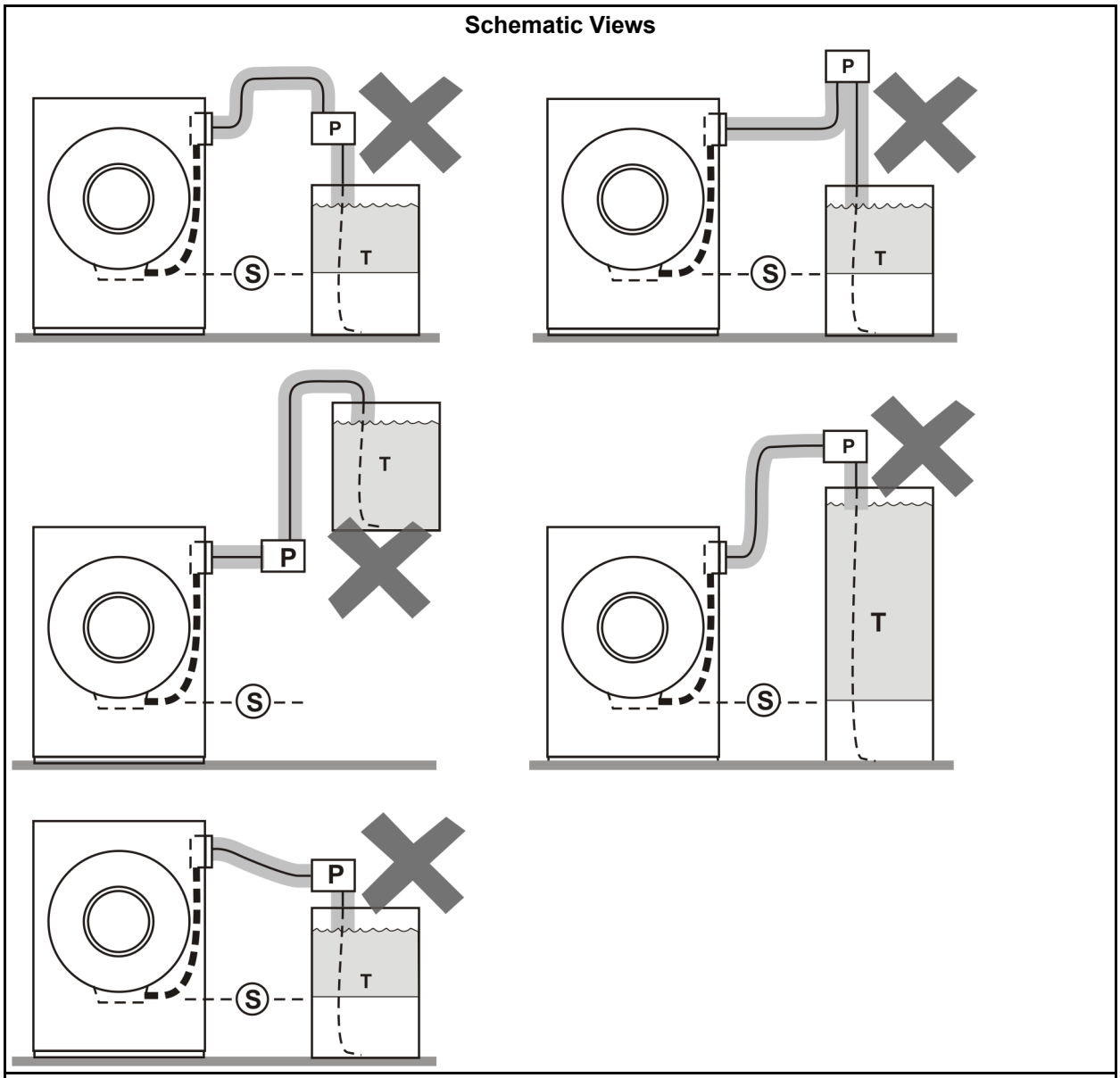
Incorrect Configuration or Connection of Equipment — Many chemical systems:

- 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

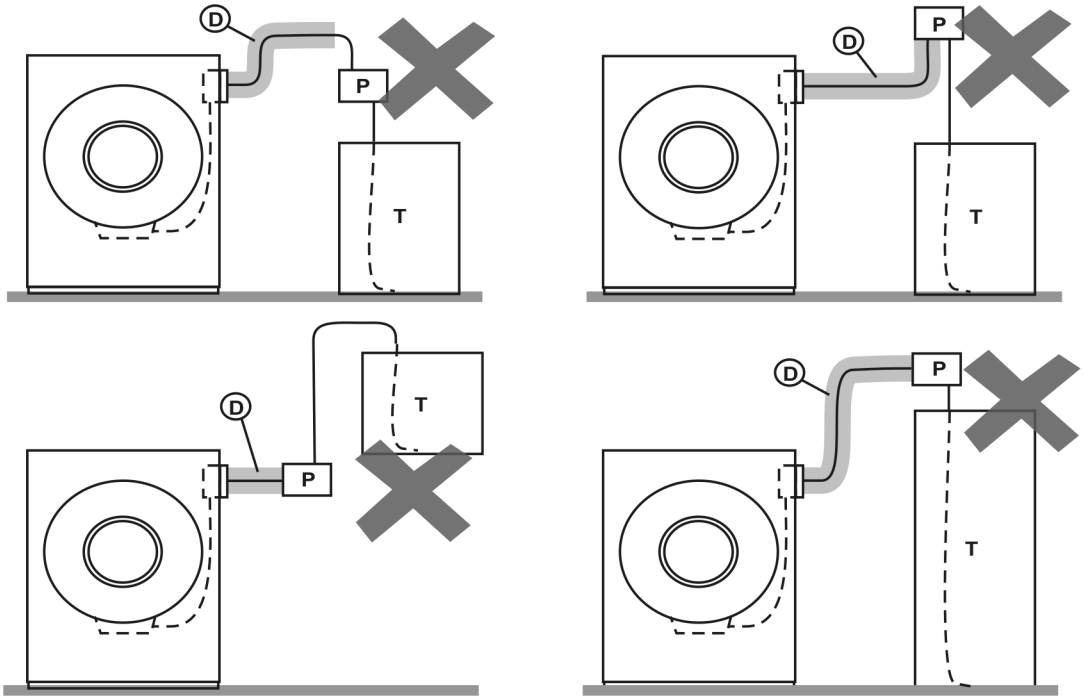


Legend

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

Schematic Views



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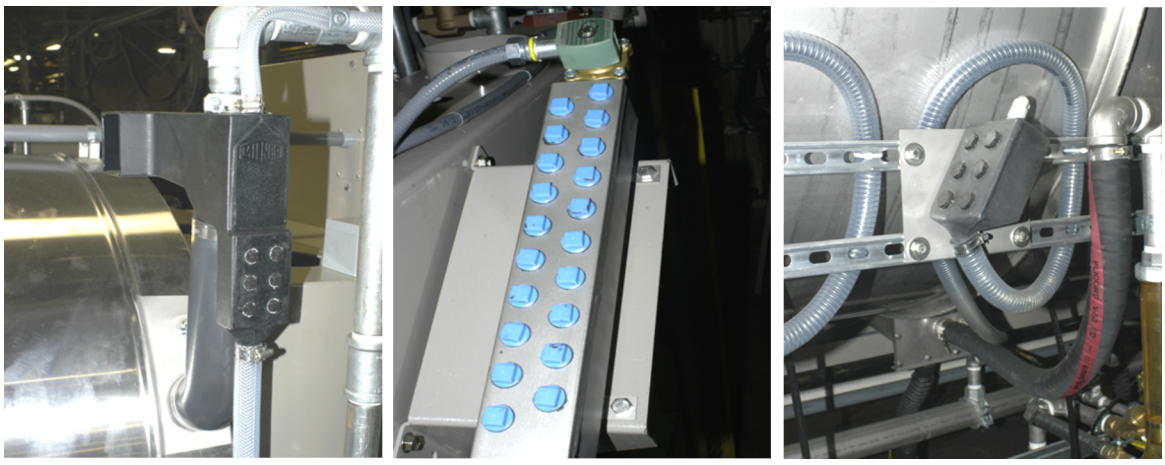
Use the chemical manifold supplied. — There is a manifold on the machine to attach chemical tubes from a chemical pump system. The manifold has a source of water to flush the chemical supplies with water.

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



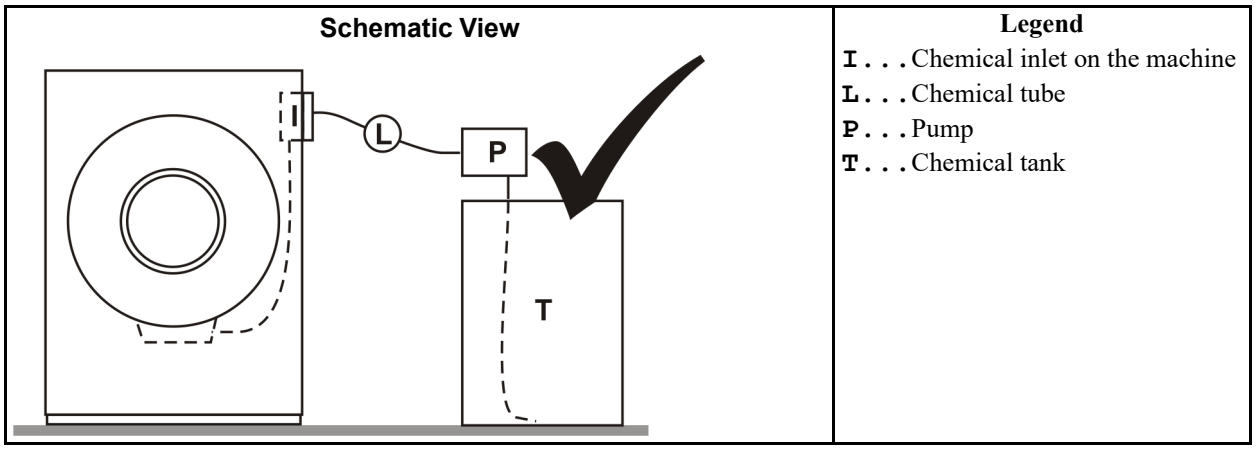
Close the line. — If the pump does not always close the line when it is off, use a shutoff valve to do this.

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 Electrical Connections for Liquid Chemical Systems

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WARNING: **Electric Shock Hazard —** Contact with high voltage electricity will kill or seriously injure you. Even when the machine is not running, three-phase power and control circuit power are still present at several locations within the cabinet and at some electrical components.

CAUTION: **Injury and Damage Hazard —** 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 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 Pump Signal Connections

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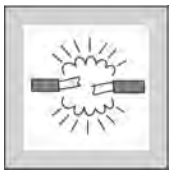
The E-P Express® controller closes certain relay contacts when chemicals are desired and to flush the chemical system after each injection. These signals are alternating current at the control circuit voltage and cannot be made potential-free. Any device driven by this signal can draw up to 37 milliamperes.

NOTE: The manifold flush signal is effective only if the chemical supply system provided by others is properly designed and connected to a flushing water source.

CAUTION: **Component Damage Hazard —** Board components will burn out and require board replacement if devices driven by inject signals do not meet the above electrical specifications. Pumps usually draw a higher current than specified above, and will cause board damage.



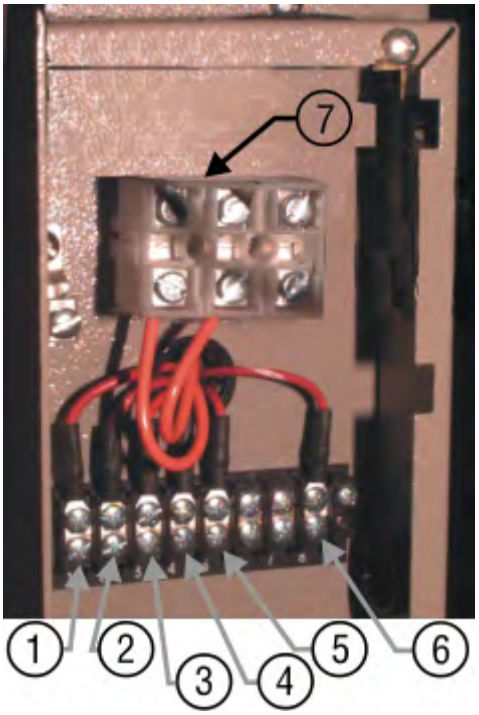
This machine provides signals for five chemicals and a manifold flush. Table 3: Chemical Injection Signals, page 12 contains the connection details for these signals. All chemical signal connections are available on terminal strip TBS, as shown in Figure 6: Pump Signal Connections, page 13 . This terminal strip is located in the electrical enclosure on the left rear of the machine, where the machine power connections are made.

Table 3. Chemical Injection Signals

Signal Component	Chemical	Relay	Processor Board Connection	TBS Terminal Number
Chemical 1	Detergent	K2	M5–3, 1	1
Chemical 2	Bleach	K5	M5–6, 1	2
Chemical 3	Sour	K4	M5–5, 1	3
Chemical 4	Softener	K3	M5–4, 1	4
Chemical 5	Starch	K1	M5–2, 1	5
Manifold Flush	none	K9	M3–5, 1	6

Figure 6. Pump Signal Connections

Electrical Connections Enclosure



Legend

1. Detergent signal
2. Bleach signal
3. Sour signal
4. Softener signal
5. Starch signal
6. Chemical signal common
7. Machine power connections

1.5.3 Timer Stop Connections

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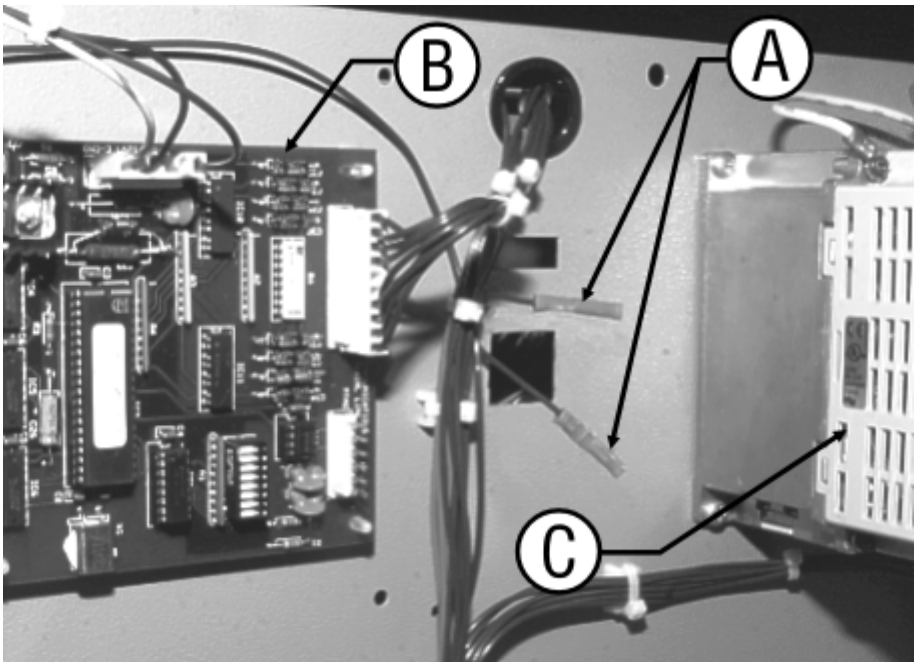
This feature is not available on coin-operated machines. Timer stop is a feature of the E-P Express® control which stops the machine timer while a certain input to the microprocessor is grounded. When multiple machines without this feature are connected to a common chemical supply system, the quantity of chemical injected can vary widely if two or more machines request chemical simultaneously. When timer stop is properly wired with the chemical supply system, the supply system stops the timers in certain linked machines when one machine requests chemical. When the chemical injection is completed, the chemical supply system terminates the **timer stop** command, and the stopped timers resume counting.

When the timer in a machine is stopped, the current formula event continues until the timer resumes counting. If water valves are open when the timer stops, they will close when the desired level is reached. Chemical injection signals will stop after the designated time, but the manifold flush signal will not occur until the timer starts. All other actions (cylinder reversing, extract speed, drain speed, etc.) that are in progress when the timer is stopped will continue until the timer starts again and the programmed time for the current event expires.

Milnor® provides two wires terminated with butt connectors in the rear console of the machine, as shown in Figure 7: **Timer Stop** Connections, page 14 . One wire originates electrically from pin 6 of M5 on the processor board. The other wire is electrically identical to pin 16 of M6 on the processor board. For **timer stop** to operate, the chemical system should include a normally open contact between these two connectors. When the contact is open, the machine runs normally. When the contact is closed, the machine timer stops until the contact opens again.

Figure 7. Timer Stop Connections

Inside of Rear Console (T_E shown, others similar)



Legend

A . . . Timer stop connections

B . . . Processor board

C . . . Inverter`

2 Programming

2.1 Controls on E-P Express® Washer-extractors

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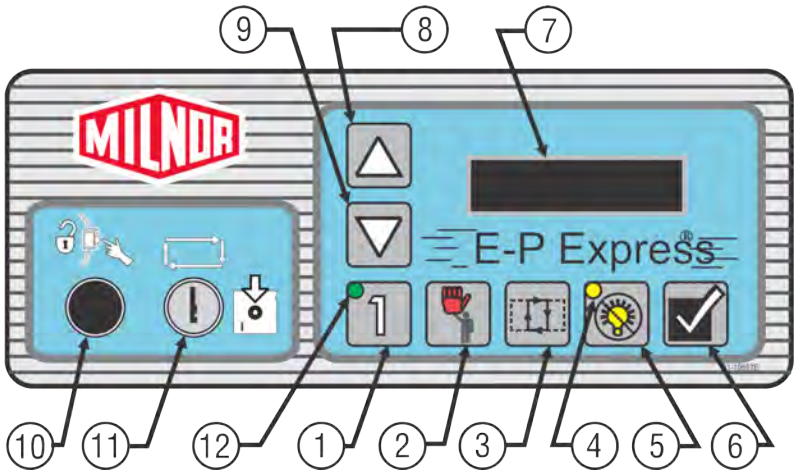
The controls on these Milnor® washer-extractors include push-buttons, some of which include indicator lights. Other controls include a mechanical button to open the door and a key-switch. Some of these controls operate differently in the three machine modes. This document gives the function of each control in the different machine modes.

Figure 8. E-P Express® Control Panel

Typical Panel



Legend

1. Start button
2. Terminate button
3. Manual mode button
4. Operator signal light
5. Signal cancel button
6. Next button
7. Display
8. Scroll up button
9. Scroll down button
10. Door unlock button
11. Run/program key-switch
12. Run indicator light

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. 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 set formula. The formula starts if the machine has power and the door is closed. To see the microprocessor inputs, hold the **Start** button (1) while you push the **Scroll Up** button (▲).

2. The **Terminate** button ( ) cancels all remaining steps in the formula and starts the shut-down procedure for the machine. You cannot continue a formula after you use the **Terminate Program** button.
3. The **Manual mode** button ( ) has no effect while a formula is running. Push this button when the display says “Run Formula xx” to start manual mode, where the controls operate as specified in Section 2.1.2 : Control Functions During Manual Operation, page 17 .
4. 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.
5. 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, push this button to indicate that the chemical has been added and to continue operation
6. The **Next** button ( ) is not used during normal operation.
7. The display on these machines is a vacuum fluorescent type displaying two lines of twenty characters each.
8. 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.
9. 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.
10. The **Door unlock** button ( ) releases the door lock, allowing the latch on the door to operate. Hold this button depressed and press firmly on the door latch lever to open the door for load and unloading.
11. The **Run/program** keyswitch must be in the **Run** position ( ) unless the machine is being configured or programmed. All control descriptions listed under Section 2.1.1 : Control Functions During Normal Operation, page 15 are based on the keyswitch being in the **Run** position. Refer to Section 2.1.3 : Control Functions During Programming, page 17 for descriptions of how the controls operate with the keyswitch in the **Program** position ( ).
12. The **Run Indicator** light, in the upper left corner of the **Start** button, is illuminated when a formula is started by pressing 1. If the operator terminates the formula before it runs to completion (with), the light goes off when any coast time expires and the door is unlocked. If the formula runs to completion, the light goes off when the coast time following the final extract step expires.

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 (1), 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 **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.
3. Use the **Manual** button ( ) to enter manual mode when the machine is idle.
4. The **Operator Signal** light does not operate when the controller is in manual mode.
5. The **Signal Cancel** button ( ) has no function in manual mode.
6. The **Next** button ( ) has no function in manual mode.
7. 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.
8. 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.
9. At the manual menu, the **Scroll Down** button ( ) displays the available menu items in reverse numeric order.
10. The **Door unlock** button ( ) unlocks the door latch. The function of this button is the same whether the machine is in normal operating mode or manual mode.
11. 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.
12. The **Run Indicator** light is not activated 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 (1) 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 **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**.

3. The **Manual** button is not used in the programming mode.
4. The **Operator Signal** light is not used in the programming mode.
5. The **Signal Cancel** button is not used in programming.
6. Use the **Next** button () to confirm any choice and move to the next decision in the sequence.
7. The display presents the programming menus and choices within those menus, including all configuration and formula parameters.
8. The **Scroll Up** button () scrolls the available choices upward from the lowest available number.
9. Use the **Scroll Down** button () to change the selected programming parameter to the next lower-numbered choice.
10. The **Door unlock** button () has no function in programming mode.
11. 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 Section 2.1.1 : Control Functions During Normal Operation, page 15 .
12. The **Run Indicator** light is not actuated during programming.

2.2 Selecting an Industry Formula Set

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.

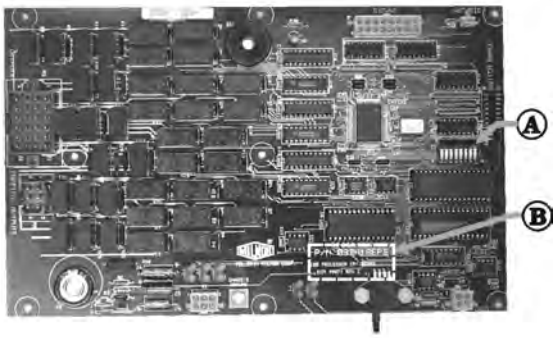
The microprocessor board holds the DIP switches as shown in the following figure also shows the **on** and **off** positions. Set the switches to the desired positions according to the following table. Turn the machine **on**; the display will show the current configuration.

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 9. 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)

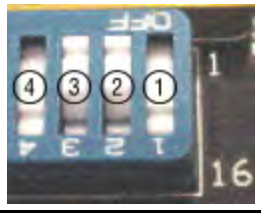


Table 4. DIP Switch Settings for Industry Configurations

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 Express® Control

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The microprocessor controller used in this washer extractor operates in three modes, depending on whether the machine is being used to process goods (the **Run mode** or **Formula menu**) or is 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 Section 2.3.2 : How to Return to Run Mode (Option 0), page 21)
- Option 1: ADD/CHANGE FORMULA (detailed in Section 2.3.3 : How to Add or Change a Formula, page 22)
- Option 2: CONFIGURE (detailed in Section 2.3.4 : How to Configure the Controller, page 30)
- Option 3: STANDARD FORMULAS (detailed in Section 2.3.5 : Restoring the Standard Formulas, page 33)
- Option 4: DATA TRANSFER (detailed in Section 2.3.6 : Data Transfer (Option 4), page 36)

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.**
	Clears all memory and accesses the first configuration decision.
LANGUAGE ? 0=ENGLISH 0	First configure decision.

2.3.2 How to 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

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Washer extractors with the Milnor® E-P Express® control system have the capacity for up to 30 unique wash formulas. The space for these formulas is allocated in memory whether or not the formulas are actually used.

The user interface employs similar procedures for creating a new formula and for changing an existing formula. Both procedures are detailed below, in Section 2.3.3.3 : How to Create a New Formula, page 23 and Section 2.3.3.5 : How to Change a Formula, page 24 . The control system will inform the person programming the machine whether the selected formula has already been programmed.

2.3.3.1 Quick Reference for E-P Express® Programming

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This part of this document briefly describes how to program a wash formula. For a more detailed description of navigating through the programming capabilities of this controller, see Section 2.3.3.2 : Moving through the Operations and Decisions, page 23 . More information on creating and deleting formulas is in Section 2.3.3.3 : How to Create a New Formula, page 23 and Section 2.3.3.4 : How to Delete a Formula, page 24 , respectively. Section 2.3.3.5 : How to Change a Formula, page 24 describes how to modify an existing formula, and explains each programming decision.

1. Apply power to the machine.
2. After the normal power-up display and start-up safety delay, turn the **Run/Program keyswitch** to the **Program** position ( ).
3. Scroll (/) to **ADD/CHANGE FORMULA** and press the **Next button** ( ) to confirm your choice.
4. Scroll (/) to an unused formula number (01 through 30) to add a new formula. The cursor will flash on “CHANGE.”
5. Press the **Next button** ( ) to confirm your choice.
6. Select the type of step (TT) from the available options (00 through 14).

   TIP: At this point, you can delete the formula by setting the type of step for Step 01 to “00.”

7. Press the **Next button** ( ) to confirm your choice and advance to the next decision (MMQ).
8. Scroll the first (tens) digit to the desired value, then press the **Next button** ( ) to confirm your choice and advance to the next digit.
9. Scroll the second (units) digit to the desired value, then press the **Next button** ( ) to confirm your choice and advance to the next digit.
10. Scroll the third (quarter-minutes) digit to the desired value, then press the **Next button** ( ) to confirm your choice and advance to the next decision.

11. For chemical injection in any bath step, use the **scroll buttons** (▲ / ▼) to enable or disable each chemical. Enable a chemical for injection by setting its value to **1**; disable a chemical by setting its value to **0**. Press the **Next button** (☑) after each chemical selection to confirm your choice and advance to the next chemical.

TIP: Press the terminate button ( ) to cancel the current choice and move the cursor to the previous decision.

12. Repeat this procedure for each step in the formula.
13. After the last desired step in the formula (usually an extract), add a step of type **00** to mark the end of the formula. The controller returns to the **Add/Change Formula** menu.

2.3.3.2 Moving through the Operations and Decisions

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Each step is completely programmed on a single display:

Display or Action	Explanation
F14 TT MMQ C:12345 S01 00	In this example, "F14" at the left end of the display represents the formula number. "S01" below it represents the step number within that formula. When programming a formula position (e.g., Formula 14) for the first time, the TT field (type of step) will always be 00 (end formula) until you change it to another valid type of step.

2.3.3.3 How to Create a New Formula

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Creating a new formula with the E-P Express® controller entails adding and defining steps in one of the blank formula slots.

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. If the selected formula number hasn't already been programmed, it is selected for **add**. If the number has already been programmed, it is selected for **change**, as shown in the following two displays.
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.
F07 TT MMQ C:12345 S01 00	Formula 07, Step 01 selected for programming.

2.3.3.4 How to Delete a Formula

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Display or Action	Explanation
F03 TT MMQ C:12345 S01 00	Delete an existing formula by making step 01 an **End Formula** step. Set the TT value for step 01 of the formula to 00.

2.3.3.5 How to Change a Formula

BNCXUP12.C07 0000208358 A.5 D.3 A.4 1/2/20 1:35 PM Released

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

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Display or Action	Explanation
F03 TT MMQ C:12345 S01 06 070 11000	When there is no cursor blinking on the display, steps can be reviewed, added or deleted.
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. Steps can only be inserted or deleted while the help screen is present, i.e., the 1 button is depressed.
☑ / ✋	Insert or delete steps **if the Insert/Delete Step help screen is visible.**

2.3.3.5.2 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 Step 02 and all the following steps move to the next higher numerical position. Duplication of **End Formula** or **Extract** steps is prevented by the controller.
F03 TT MMQ C:12345 S01 NEW STEP01 DUPED	This display indicates that the new step has been created as a copy of the previous step. Chemicals and injection times are not copied into the new step.

2.3.3.5.3 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 TT MMQ C:12345
01 STEP DELETED
```

This display indicates that the selected step has been deleted from the wash formula.

2.3.3.5.4 How to Save Changes

BNCXUP12.C13 0000208538 A.5 D.3 A.4 1/2/20 1:35 PM Released

The control automatically saves the changes when you answer "Yes" to "End Formula #xx?"

Display or Action	Explanation
Fxx **TT** TYPE OF STEP Sxx **00** End Formula	Step type 00 indicates that the formula is finished.
☑	Accepts the selected step type (00 = End Formula) and prompts for confirmation to end the formula.
END FORMULA #xx ? 0 NO [1=YES]	Confirmation display for end of formula. Select "0 NO" by pressing ☑ to continue programming this formula. Select "1 YES" by pressing ▼ then ☑ to save this formula and return to the menu system.

2.3.3.6 The Step Decisions

BNCXUP12.C14 0000208537 A.5 D.3 A.4 1/2/20 1:35 PM Released

2.3.3.6.1 TT = Step Type

BNCXUP12.C15 0000208536 A.5 D.3 A.4 1/2/20 1:35 PM Released

Display or Action	Explanation
F12 **TT** MMQ C:12345 S01 **03** SPLIT SOAK	This is an example of a formula programming display with the **Step type** field selected. There are 15 types of steps available for programming, although every step type is not available in every condition. For example, an extract operation can never be the first step in a formula nor immediately follow another extract. Press ▼ or ▲ to scroll to the desired step type, then press ☑ to choose the selected step type and move to the step time decision.

2.3.3.6.1.1 End of formula (TT=00)

BNCXUP12.C16 0000208535 A.5 D.3 A.4 1/2/20 1:35 PM Released

This is the last step of any formula. When you program an **End of formula** step by entering **00 End of formula** and pressing ☑, the controller saves the programmed formula and returns to the **Add/Change Formula** screen.

2.3.3.6.1.2 Soak (TT=01, 02, or 03)

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Soaking serves to expose the goods to water and any included chemicals without mechanical action which might damage certain textiles. In this machine, **all soak baths are performed at high water level** and the selected waters (hot, cold, or split). Any chemicals may be injected.

The step timer begins counting when high level is achieved and continues for the programmed amount of time. When the step time expires, the controller commands the motor to turn the

cylinder clockwise for four seconds at wash speed, then to accelerate to drain speed. A few seconds after the cylinder reaches drain speed, the drain opens. The next step begins after the fixed drain time and coast time expire. Coast time is not counted if the next step is an extract.

01=Hot soak Use hot soaks to maximize the activity of the injected chemicals when there is little or no chance of stains being set by the high temperature. Temperatures above 120 degrees Fahrenheit (49 degrees Celsius) usually make the removal of protein-based soils more difficult.

02=Cold soak Use cold soak steps for goods that contain protein stains. The low temperature is usually less effective than higher temperatures at activating certain chemicals, but the chance of setting stains is much lower.

03=Split soak If the temperature of incoming hot water alone is higher than 120 degrees Fahrenheit (49 degrees Celsius), soaking with both hot and cold water simultaneously will remove more soil than a cold flush. A split soak is also less likely to set protein stains than a hot soak if the temperature of the split fill is consistently lower than 120 degrees Fahrenheit.

2.3.3.6.1.3 Flush (TT=04, 05, or 06)

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A flush is usually used early in a formula, prior to bleaching, to dilute and remove debris and loose soil before chemicals are added. Flushes are also used to raise or lower the temperature of the goods. Machines with the E-P Express® controller conduct **all flushes at high water level** with the programmed waters (hot, cold, or split). Any chemicals may be injected, although this is not common.

For any flush operation on the E-P Express® controller, the step timer begins counting when high level is achieved and continues for the programmed time. The cylinder reverses at wash speed while the step timer is counting down. When the step time expires, the controller commands the motor to turn the cylinder clockwise for four seconds at wash speed, then to accelerate to drain speed. A few seconds after the cylinder reaches drain speed, the drain opens. The next step begins after the fixed drain time and coast time expire. Coast time is not counted if the step about to begin is an extract.

04=Hot flush Use hot flushes to remove the maximum amount of debris and loose soil when there is little or no chance of stains being set by the high temperature. Temperatures above 120 degrees Fahrenheit (49 degrees Celsius) usually make the removal of protein-based soils more difficult.

05=Cold flush Use one or more cold flush steps to remove debris and loose soil from goods that might contain protein stains before adding detergent. The low temperature is likely to be less effective than higher temperatures at removing certain types of soil, but the chance of setting stains is much lower.

06=Split flush If the temperature of incoming hot water is higher than 120 degrees Fahrenheit (49 degrees Celsius), flushing with both hot and cold water simultaneously will remove more soil than a cold flush. A split flush is also less likely to set protein stains than a hot flush if the temperature of the split fill is consistently lower than 120 degrees Fahrenheit.

2.3.3.6.1.4 Wash (TT=07, 08, or 09)

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Wash steps include break, suds, bleach suds, and carryover operations, and occur after the final flush if one or more flushes are used. **All wash steps programmed with this controller use low water level**. The first step to introduce chemicals to the machine cylinder is usually called a break

and includes the injection of alkali and detergent. Suds and bleach suds steps follow the break step.

Carryover steps use the chemicals retained in the goods after draining the previous step to prolong chemical contact at a higher temperature without introducing more chemicals. The drain prior to a carryover step also removes suspended soil and reduces bath alkalinity for better bleaching.

07=Hot wash This step type causes the machine to fill exclusively through the hot water valve. Generally, the bath temperature should be as hot as is practical for suds baths, with some considerations. While higher temperatures increase the effect of detergents, there is a risk of setting certain stains if they were not sufficiently removed with earlier, cooler baths. High bath temperatures may also introduce creases into some synthetic fabrics by heating the fibers above the temperature at which they become plastic. When this happens, rapid cooling will often set the creases beyond the ability of other equipment to remove them. For the best effect, introduce chlorine bleach when the bath temperature is about 150 degrees Fahrenheit (66 degrees Celsius). Bleaching with chlorine at temperatures above 160 degrees Fahrenheit (71 degrees Celsius) is likely to damage fibers.

08=Cold wash This step type uses only water at or near the temperature at which it entered the plant. In especially warm climates, this water may be at or above the temperature achieved by using split water in other areas. Program a cold wash any time the split water temperature might cause undesired results, including wrinkles or fiber damage.

09=Split wash This type of step fills the machine by fully opening both the hot and cold water valves simultaneously. This results in the fastest possible fill and a bath temperature that is satisfactory for many applications. While certain factors such as pressure differences between hot and cold water supplies cannot be predicted, the approximate temperature of split water will be one half of the total of both the hot and cold water temperatures.

2.3.3.6.1.5 Rinse (TT=10, 11, or 12)

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Bath operations between the bleach step and the finish step are usually called rinses. Rinses serve to remove the last of the loosened soil and most of the chemicals from the goods. In machines with the E-P Express® controller, **rinse steps are always performed at high water level** and the programmed temperature. This controller also allows the injection of any desired chemicals during rinse operations.

10=Hot rinse Rinsing with hot water removes more detergent and other chemicals from the goods than a cold or split rinse, but also may have many of the same adverse affects as a hot wash. Consider the temperature of the hot water supply and the goods being laundered when programming this type of step.

11=Cold rinse Use a cold rinse to remove most of the remaining chemicals from the goods without the energy cost of hot water. Keep in mind, however, that a cold bath immediately following a hot bath may thermoset creases in some synthetic fabrics.

12=Split rinse Because both the hot and cold water valves are open for a split rinse, the fill time is approximately half of the time required for either a hot or cold rinse. Also, there is less chance for fabrics to crease than with a hot rinse, and more remaining soil and chemicals are removed than with a cold rinse.

2.3.3.6.1.6 Finish (TT=13)

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The finish operation is usually the final bath operation of the wash formula. This controller allows the injection of any chemical, with sour, starch, and softener being the most common. **The bath level is always low**, and the water temperature is almost always cold. In locations where the incoming cold water is so cold that chemicals do not mix readily with the water, the machine can be configured to fill all finish steps with split water.

2.3.3.6.1.7 Extract (TT=14)

BNCXUP12.C22 0000208672 A.5 D.3 A.4 1/2/20 1:35 PM Released

Extract operations are used between bath steps to remove water, chemicals, and suspended soil; and as the final operation in a formula to remove water for faster drying.

2.3.3.6.1.8 Quick Reference for Step Types

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Table 5. Summary of Step Types

Step Name	TT Code	Temperature	Basket Motion	Basket Speed
End of Formula	0 0	N/A	N/A	N/A
Soak	0 1	Hot	None	None
	0 2	Cold		
	0 3	Split		
Flush	0 4	Hot	Reversing	Wash speed
	0 5	Cold		
	0 6	Split		
Wash	0 7	Hot	Reversing	Wash speed
	0 8	Cold		
	0 9	Split		
Rinse	1 0	Hot	Reversing	Wash speed
	1 1	Cold		
	1 2	Split		
Finish	1 3	Cold (see note)	Reversing	Wash speed
Extract	1 4	N/A	Clockwise	Extract speed
Note: A configuration decision allows the filling of finish steps for all formulas with either cold or split water.				

2.3.3.6.2 MMQ = Step Time

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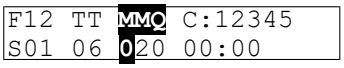
Display or Action

```
F12 TT MMQ C:12345
S01 06 032 03:30
```

Explanation

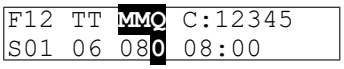
Typical programming display for step time. When the wash formula is running, the step timer begins counting from 00:00 when level is achieved for a bath step, or when the controller commands extract speed. The timer causes the current step to end when the programmed time elapses. Time is programmed in minutes, minutes, and quarter-minutes, with a maximum programmable time for each step of 633 (63 minutes and 45 seconds).



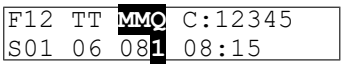
First digit of step time field selected to change. ▲ increases value of this digit; ▼ decreases value.

☑ Accepts value for this digit and selects next digit.

Cancels the current selection and moves the cursor to the previous selection.



Typical display after pressing ☑ to accept "0" as the first minutes digit, then pressing ▼ two times and ☑ once to select "8" as the second minutes digit. The controller is waiting for user input for quarter-minutes. The programmed time in minutes and seconds is displayed next to the programming fields.



Select the number of quarter-minutes desired, then press ☑ y to accept the desired step time and begin programming chemical injections.

2.3.3.6.3 C = Chemicals

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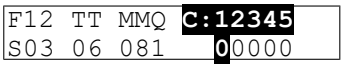
All types of steps other than **extract** and **end of formula** allow chemical injection. The duration of the injection signal for each chemical is 30 seconds unless chemical 1 is **configured** for another value as described in Section 2.3.4.2 : The Configure Decisions, page 31 .

Display or Action	Explanation
	Typical programming display for chemical injection.

The E-P Express® controller provides five separate injection signals and one manifold flush signal. Consult the person responsible for connecting the chemical supply system to the machine (usually the chemical supplier) for information on which chemical is connected to each signal. Record the chemical connection information in Table 6: Chemical Signals and Supplies, page 30 for future reference.

▲ / ▼ Toggles the selected chemical signal between 0 (off) and 1 (on). In each step all programmed chemicals are signalled simultaneously when the desired level is achieved. The chemical manifold flush signal activates 20 seconds after the chemical injection signal ends, and continues for 30 seconds.

☑ Accepts the current on/off status for the selected chemical signal and advances to the next signal. After programming chemical 5, this action advances to the next step in the formula.

Cancels the current selection and moves the cursor to the previous decision.

Table 6. Chemical Signals and Supplies

Chemical Signal (from display)	Chemical Name
1	(usually detergent)
2	(usually bleach)
3	(usually sour)
4	(usually softener)
5	(usually starch)

2.3.4 How to Configure the Controller

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Because the microprocessor control system used in this machine is capable of multiple languages and operating with many different chemical injection systems, each machine must be configured. This configuration informs the microprocessor of what language to use for displaying operator information and the duration of the inject time for chemical one.

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.

2.3.4.1 Moving through the Configure Screens

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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.
☑	Accesses 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.
CHEM 1 INJ TIME: SSS FORMULA 01 030	The value that appears here may vary according to how the controller was last configured. These values are always reset to 30 seconds whenever the standard formulas are restored, as described in Section 2.3.5 : Restoring the Standard Formulas, page 33 .
☑	Accepts the displayed selection.
✋	Accepts the displayed selection and reverts to the previous configure decision.

2.3.4.2 The Configure Decisions

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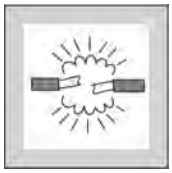
Display or Action	Explanation
LANGUAGE ? 0=ENGLISH 0	The language chosen here controls all programming and operational prompts on the machine display.
▼ / ▲	Scrolls the available languages, listed below. 0 = English 1 = Spanish 2 = French 3 = German 4 = Dutch 5 = Italian 6 = Portuguese
☑	Accepts the selected value for the current decision and advances the cursor to the next decision. This action is required for each configuration decision.
COLD OR SPLIT FINISH 0=COLD [1=SPLIT] 0	As described in Section 2.3.3.6.1.6 : Finish (TT=13), page 28 , the finish step for all formulas can be configured to fill with either cold water or split water (both hot and cold). If you find that finish chemicals, especially starch, don't mix well with cold water, set this decision to fill all finish steps with both hot and cold water. The split fill decision is more commonly used in cold climates.
▲ or ▼	Toggles the selection between “0=COLD” and “1=SPLIT.”
☑	Accepts the current selection and advances to the next configure decision.
TIME TO DRAIN SSS MIN=030 MAX=255 060	When the machine must be installed where draining is accomplished through solid piping instead of a drain trough, additional time may be required to completely drain the water from the machine. This decision sets the time after the drain opens until the controller signals the inverter to accelerate to extract speed. If low level is still achieved when this time expires, an error stating “Too Long to Drain” is displayed. The minimum value is 30 seconds; the maximum value is 255 seconds (4:15).

CAUTION: **Motor damage and inverter fault hazard** — The motor may be damaged and/or the inverter may trip frequently if the drain time is not long enough to allow most of the free water to exit the machine before extract begins.



▶ Factory testing has found that a drain time of 60 seconds provides some margin of safety for a machine that drains freely into an open trough. Increase drain time if the machine drains into an enclosed pipe, especially if that same pipe might simultaneously drain additional machines.

Display or Action	Explanation
▲ or ▼	Scrolls the selected digit.
☑	Accepts the currently selected digit and advances to the next digit. Advances to the next configure decision if pressed when the right-most digit is selected.
Fill Error Time: MM Min=00, Max=20 05	The range is from 00 to 20 minutes. Set the number of minutes that the machine can try to fill before the water valves close and the operator signal starts. When the error occurs, push ⊘ to open the water valves and start the timer again. If you set this value to 00, then the machine will start the operator signal if the machine does not fill in less than 10 minutes. The water valves remain open.
▲ or ▼	Scrolls the selected digit.
☑	Accepts the currently selected digit and advances to the next digit. Advances to the next configure decision if pressed when the right-most digit is selected.
CHEM 1 INJ TIME: SSS FORMULA 01 030	Display of **Chem 1 inject time** configuration decision. Some chemical systems use the duration of the chemical 1 injection signal to determine which wash formula is running. Only the injection time for chemical 1 is configurable; all other chemical signals are fixed at 30 seconds. By default, **Chem 1 inject time** for each formula is 30 seconds until changed. The minimum value is 1 second; the maximum value is 255 seconds (4:15).

2.3.4.2.1 About Chemical Injection with the E-P Express® Controller

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The normal duration for all chemical injection signals from this controller is 30 seconds. This period often allows delivery of the desired amount of chemical when pump sizes and other factors are used to control chemical volume more precisely.

Installations requiring more precise chemical metering may use programmable chemical supply systems (provided by others) to select chemical amounts according to the washer-extractor formula. Typically these chemical systems use the duration of the washer-extractor injection signal for Chemical 1 to determine which formula is running, then select the corresponding chemical program for that wash formula.

When the chemical supply system determines the wash formula and selects the appropriate chemical program for quantities, the chemical system still needs to know when to inject each chemical. The chemical system monitors the washer-extractor controller for chemical signals in each step calling for chemicals. When the washer-extractor requests a specific chemical, the chemical supply system injects the programmed quantity of that chemical.

For example, the E-P Express® controller may be configured so the Chemical 1 signal is five seconds in formula 01, ten seconds in formula 02, and 15 seconds in formula 03. When the washer-extractor controller signals for Chemical 1 to be injected, the Chemical 1 output relay is turned **on** for the configured duration. The chemical injection system then determines which formula the

washer-extractor is running and selects the chemical injection program corresponding to the wash formula.

Display or Action	Explanation
CHEM 1 INJ TIME: SSS FORMULA 01 030	Typical display with **formula number** field selected for change.
▲ / ▼	Scrolls the formula number up or down.
☑	Accepts the selected formula number and moves the cursor to the **injection time** field.
☜	Accepts the current digit of the formula number and moves the cursor **back** to the previous decision (Time to Drain).
1	Writes all data to memory and returns to the **Program** menu.
CHEM 1 INJ TIME: SSS FORMULA 04 030	Typical display with the first digit of the time field for formula 4 selected.
▲ / ▼	Scrolls the selected digit up or down. The maximum value for any signal is 255 seconds; the minimum value is 000 (no injection).
☑	Accepts the current digit of the inject time and moves the cursor **forward** to the next digit. When the third digit is selected, the cursor advances to the formula number for the next formula.
☜	Accepts the current digit of the inject time and moves the cursor **back** to the previous digit. If the first digit of the inject time is selected, the previous decision (Time to Drain) is displayed.

NOTE: All inject times return to the default value of 30 seconds any time the standard formulas are restored to memory. The procedure for restoring standard formulas is described below.

1	Accepts the current digit and saves all configure data.
PLEASE WAIT	Appears while the controller writes all configure data to memory.
PROGRAM 2 MENU CONFIGURE	Indicates that all configure data was successfully written to memory. Select another program menu option to continue.

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).

CAUTION:

Avoid Chemical Damanage to Goods — The injection time for Chemical 1 is 30 seconds for all default formulas. This may prevent certain supply systems from properly detecting which formula is running, or cause the injection time for chemical 1 to be longer than intended.

▶ Always verify the Chemical 1 injection time for each formula after restoring the standard formulas

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 35
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 35
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 35
   - 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 34

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 34

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**.

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

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

Returns to **Formula menu**.

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

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 7: Controllers Capable of Transferring Memory, page 36 to determine the hardware and software requirements for memory transfer. See Section 5.3 : Construction of External Serial Link Cables, page 63 for inter-machine cable specifications and assembly instructions.

Table 7. 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	

Table 7 Controllers Capable of Transferring Memory (cont'd.)

Machine Controller	Typical Machine Models	Controller Software Later Than	Processor Board Later Than
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.

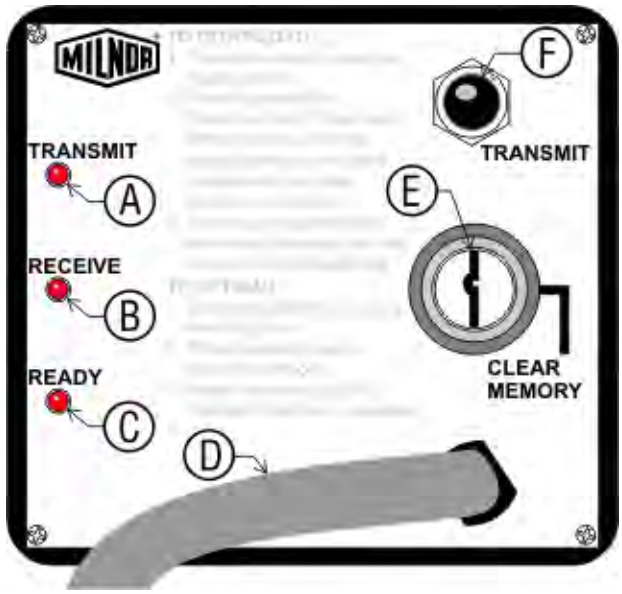
▶ Record all configure data from the **Slave** machine before beginning the download, especially "Offset Height." Restore this value to the **Slave** machine after the download is finished.

▶ 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 7: Controllers Capable of Transferring Memory, page 36 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 10. 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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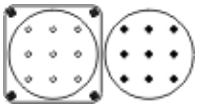
Display or Action	Explanation
	Turn off power to the machine before connecting the serial memory storage device or connecting the two machines together.
	Connect the storage device to the machine, or the two machines together, using the 9-pin round connector.
	Apply power to the machine(s). The storage 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 Section 2.3.6.2 : Saving Data from the Machine to the Storage Device or a Second Machine, page 39 for making a copy of good data from the machine controller. Refer to Section 2.3.6.3 : Restoring Saved Data to the Machine from the Storage Device or Another Machine, page 41 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

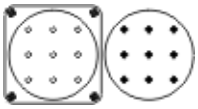
From item **0** of the **Program** menu, return to normal operating mode.

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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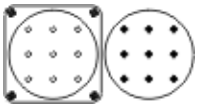
Display or Action	Explanation
	Turn off power to the machine(s) before connecting the serial memory storage device.
	Connect the storage device to the machine using the 9-pin round connector. For two machines, use a serial cable constructed as described in Section 5.3 : Construction of External Serial Link Cables, page 63 .
	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 Section 2.3.6.2 : Saving Data from the Machine to the Storage Device or a Second Machine, page 39 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.

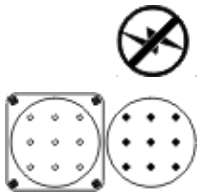
```
  PROGRAM 0 MENU OK
TURN KEY TO RUN
```

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.

Milnor® washer extractors with E-P Express® 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 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 Section 1.3 : Determining Load Size, page 6 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 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 a formula ends normally or is terminated, the door remains locked while the cylinder coasts to a stop. The door unlocks 80 seconds after the formula ends.

Display or Action	Explanation
UNLOCKING THE DOOR ** PLEASE WAIT **	display during the coast period when a formula ends.
WAITING TO UNLOAD U	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 L=A1/D1 Hot Wash	These two displays alternate during normal operation while any chemical injection signal is enabled. The number on the right end

23:04 STEP# 01 02:37 CHEM 1+2 025	of the bottom line indicates the number of seconds remaining in the longest programmed injection.
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 EXTRACT 02:37	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.
L=A0/D2 Hot Rinse	L=A0/D2 indicates that level 1 (low level) has not been achieved, and level 2 is desired. A1/D2 indicates that level 1 is achieved, but level 2 (high level) is desired. The programmed step type appears to the right of the level indicator. The step type includes the temperature range, indicating which water valves are used to fill the machine.

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 Section 3.1.3 : Unloading the Machine, page 45 , must expire before the door can be opened.

3.1.6 How to Restart after Power Loss

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The E-P Express® 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 must again be satisfied, even if it was 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 Express® controller provides an output signal that activates the flush valve for 20 to 30 seconds 15 seconds after the last chemical injection for each bath ends. 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.

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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 Section 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 Testing and Troubleshooting

4.1 Error Messages

4.1.1 Error Messages at Power Up

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 Section 3.2 : How to Use and Erase the Formula Counter, page 47 for more information.

Display or Action	Explanation
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 Section 2.3 : Programming the E-P Express® Control, page 20 .
2. Reinstall the standard (default) formulas according to the default formula loading procedure in Section 2.3 : Programming the E-P Express® Control, page 20 .
3. Reprogram any lost wash formulas according to Section 2.3 : Programming the E-P Express® Control, page 20 .

Display or Action	Explanation
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 Section 2.3 : Programming the E-P Express® Control, page 20 .
5. Reinstall the standard (default) formulas according to the default formula loading procedure in Section 2.3 : Programming the E-P Express® Control, page 20 .
6. Reprogram lost wash formulas according to Section 2.3 : Programming the E-P Express® Control, page 20 .

4.1.2 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 Section 3.1.5 : How to Shorten, Terminate, or Suspend a Running Formula, page 46 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 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 information can be found elsewhere in the manual. See table of contents.

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.

THREE WIRE DISABLED

The three-wire relay de-energized. This relay provides control circuit power to the machine. Once energized by momentarily depressing the **Start** button, it is held energized by its own normally open contacts, along with motor overloads, door interlocks, etc. Should any of these contacts open even momentarily, the machine stops and this display appears. This error can only be cleared by depressing the **Start** button, and only then if the error has been cleared.

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.

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4.2 The E-P Express® Manual Menu

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4.2.1 The Manual Menu

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4.2.1.1 Components

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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 Section 4.2.6 : Viewing Inputs and Outputs During Operation, page 57 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 Section 4.2.6 : Viewing Inputs and Outputs During Operation, page 57 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.

4.2.1.2 How to Access the Manual Menu

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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.

4.2.1.3 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.

4.2.2 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.
E-P EXPRESS/T 21001 HEALTHCARE LAUNDRY	Machine style (/T = T_X), software date code (21001), and configuration (Healthcare Laundry).
RUN FORMULA xx FORMULA NUMBER xx	**Run mode** display is restored when the  button combination is released.

4.2.3 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 8. E-P Express® Inputs

Display Code	Input Name	Connector-Pin
A	Door closed	M6–1
B	Low Water Level	M6–9
C	Vibration switch tripped	M6–2
D	Input from Inverter	M6–10
E	High water level	M6–3
F	Keyswitch in Program position	M6–11
G	not used	M6–4
H	Halt—external fault	M6–12
I	Halt—bath time	M6–5
J	not used (Door open desired on MWR_ models with WUMWRXGG software)	M6–13
J	Door open desired	M6–13
K	not used	M6–6
L	not used	M6–14

4.2.4 Actuating Microprocessor Outputs

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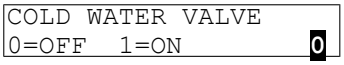
Machine functions may be tested individually or in groups by using the **Test Outputs** component of the **Manual menu**. The machine must be idle (not running a formula).

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

Display or Action	Explanation
	Accesses the **Manual menu**.
MANUAL MENU 3 TEST OUTPUTS	This is the **Manual menu** display with the **Test Outputs** component selected.
+ 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.

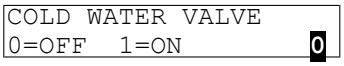


Example display with output accessed and disabled.

Enables the output (turns the output on).

Example display with output enabled. The cold water valve is open.

If the output was already on, this keystroke turns it off.



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.

Display after pressing ▲ to advance to the next output.

Disables the output if it was enabled, then returns to the **Run mode**.

Display of **Run mode.**

Table 9. E-P Express® Outputs

Output Number	Page-Column	Description	Device	MTA	Consequences of Actuation
1	0–a	Inject chemical 5	K1	5–2/5–11	Operates inject device for chemical 5
2	0–b	Inject chemical 1	K2	5–3/5–1	Operates inject device for chemical 1
3	0–c	Inject chemical 4	K3	5–4/5–1	Operates inject device for chemical 4
4	0–d	Inject chemical 3	K4	5–5/5–1	Operates inject device for chemical 3
5	0–e	Inject chemical 2	K5	5–6/5–1	Operates inject device for chemical 2
6	0–f	Hot water valve	K6	3–2/3–1	Opens valve
7	0–g	Cold water valve	K7	3–3/3–1	Opens valve
8	0–h	Drain solenoid	K8	3–4/3–1	Closes drain
9	0–i	Flush valve	K9	3–5/3–1	Opens flush valve
10	0–j	not used	K10	3–6/3–1	
11	0–k	not used	K11	3–7/3–1	
12	1–a	not used	K12	3–8/3–1	
13	1–b	not used	K13	3–9/3–1	
14	1–c	not used	K14	3–10/3–1	
15	1–d	not used	K15	3–11/3–1	
16	1–e	not used (Door open desired on MWR_ models with WUMWRXGG software)	K16	3–13/3–14	
16	1–e	Door lock	K16	3–13/3–14	
17	1–f	Unlock door	K17	3–15/3–16	Energizes door latch to unlocked position
18	1–g	not used	K18	3–18/3–17	
19	1–h	Extract speed (use only with empty cylinder)	K19	3–19/3–17	Locks door and turns cylinder at extract speed

Table 9 E-P Express® Outputs (cont'd.)

Output Number	Page-Column	Description	Device	MTA	Consequences of Actuation
20	1–i	Distribution (drain) speed (Door must be closed)	K20	3–20/3–17	Locks door and turns cylinder at drain speed.
21	1–j	Clockwise wash speed (Door must be closed)	K21	3–21/3–17	Locks door and turns cylinder clock-wise at wash speed.
22	1–k	Counter-clockwise wash speed (Door must be closed)	K22	3–22/3–17	Locks door and turns cylinder counter-clockwise at wash speed.
23	0	Buzz signal	Signal on board	none	Sounds operator alarm
24	0	Run Light	Light on board	none	Turns on light in Start button (\)
25	0	Reversing wash speed	Functional test	none	Locks door and reverses cylinder at wash speed.
26	0	High extract speed	Functional test	none	Locks door and turns cylinder clock-wise at wash speed, then high extract speed.
27	0	Fill to level 1	Functional test	none	Locks door, closes drain, fills to level 1 with cold water.
28	0	Fill to level 2	Functional test	none	Locks door, closes drain, fills to level 2 with cold water.

4.2.5 Testing and Verifying the DIP Switch Settings

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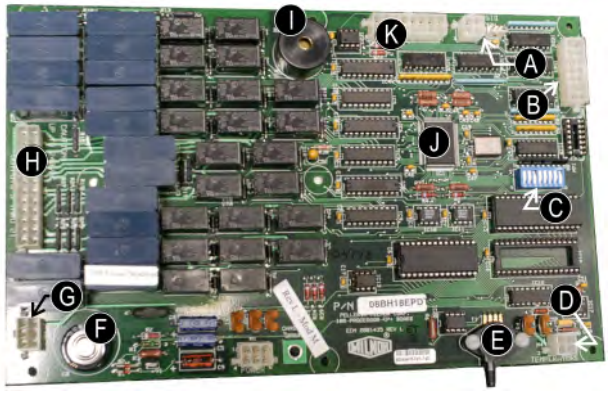
For all E-P Express® models, the set of default formulas is determined by how the DIP switches on the processor board are set. The bank of DIP switches is identified in Figure 11: Processor Board, page 56 .

Figure 11. 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 Section 4.2.2 : Determining the Software Version,

page 53), the settings of other switch positions are only apparent from this display or by looking at the processor board.

Display or Action	Explanation
	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**.
	Accesses the **Test DIP Switch** function and displays the DIP switch setting.
052	This is an example of the DIP switch display. Referencing this number in Table 10 shows that the sample machine is configured for Restaurants Laundry, and that switch positions 5 and 6 are enabled.
	Terminates the **Manual menu** and returns controller to **Run mode**.

Table 10. Interpretation of Test DIP Switch Display

Industry Configuration	Standard Display Value	Value if Position 5 is ON	Value if Position 6 is ON	Value if Both Positions 5 and 6 are ON
Correctional	0	16	32	48
Hotel/Motel	1	17	33	49
Athletic	2	18	34	50
Healthcare	3	19	35	51
Restaurants	4	20	36	52
Commercial	5	21	37	53
Shirt Laundry	6	22	38	54
Offshore	7	23	39	55

4.2.6 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.
	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 9: E-P Express® Outputs, page 55 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 9: E-P Express® Outputs, page 55 to determine the component represented by each character on Page 0 and Page 1.

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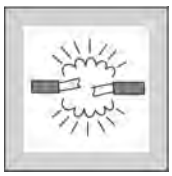
Depending on the processor board, output relays may be either socket-mounted to a separate output board, or permanently soldered to the processor board. H_J, F_J, V_J, and X_J models, as well as all E-P Express® models, use the 188 processor board with soldered relays. The SPST (single pole, single throw)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

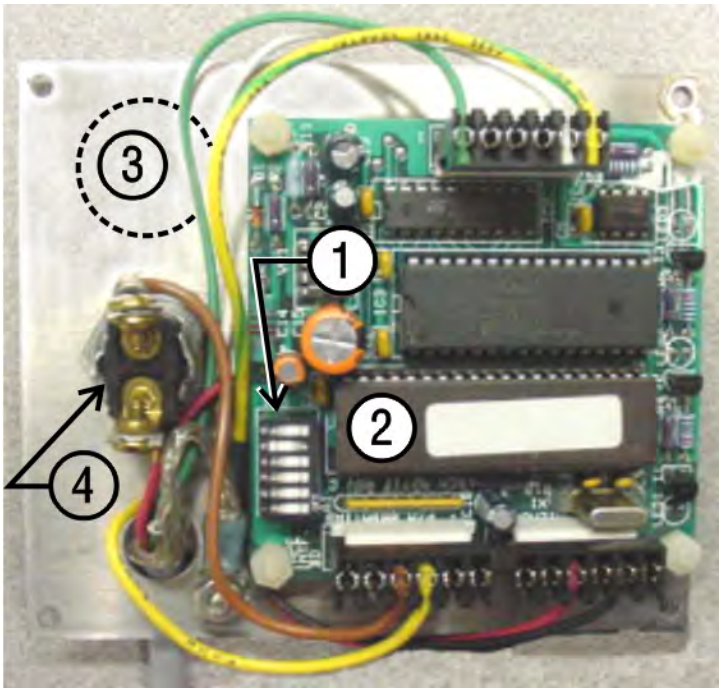
View	Legend
	**1 . . .** DIP switch **2 . . .** Software chip **3 . . .** Location of **Transmit button**, if equipped **4 . . .** Key switch

Table 11. 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 Section 5.3.2.2 : Connecting Two or More Machines for Machine-to-machine Transfer, page 65 and Section 5.3.2.3 : Connecting a Machine to a Serial Memory Storage Device, page 66 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 64 and may be installed temporarily or permanently, as appropriate.

NOTE: The currently approved printers and printer configuration settings are provided in Section 5.4 : Printer Requirements and Settings, page 67 . 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 64 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 12: External Serial Link Pin Assignments, page 64 shows the function of each pin.

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

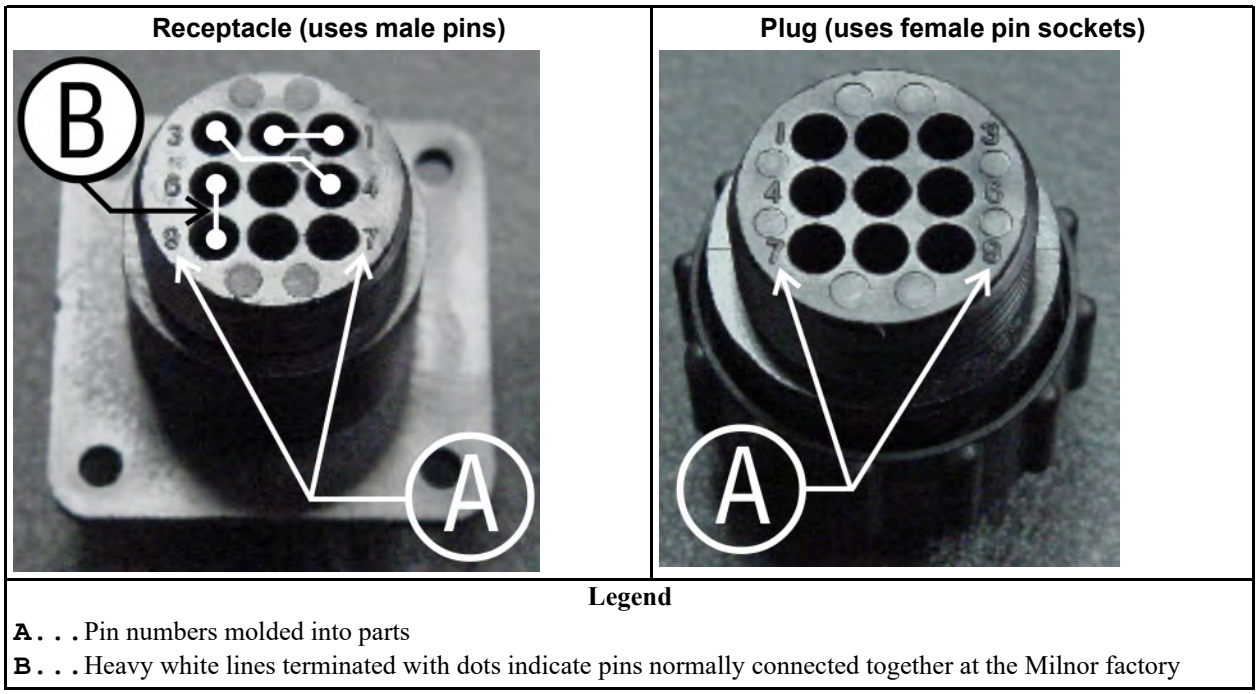


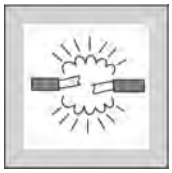
Table 12. External Serial Link Pin Assignments

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			

Table 12 External Serial Link Pin Assignments (cont'd.)

Pin Number	Function	Receptacle Wiring (inside electrical enclosure)	
		Wire Number	Color Code
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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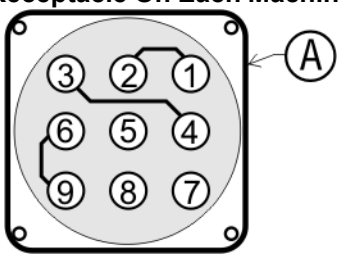
Figure 15: Wiring Diagram for Cable to Connect Two or More Machines, page 66 shows how to wire a cable to connect a bank of identical machines (the Figure 15: Wiring Diagram for Cable to Connect Two or More Machines, page 66 example shows connections for four machines) so that data programmed on one 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

Receptacle On Each Machine



Legend

A . . . Receptacle on machine (with male pins). Pin functions are as follows: **1&2**=Serial low; **3&4**=Serial high; **6&9**=Ground; **5&7**=Not used in this application; **8**= Not used in this application. See previous, related caution statement.

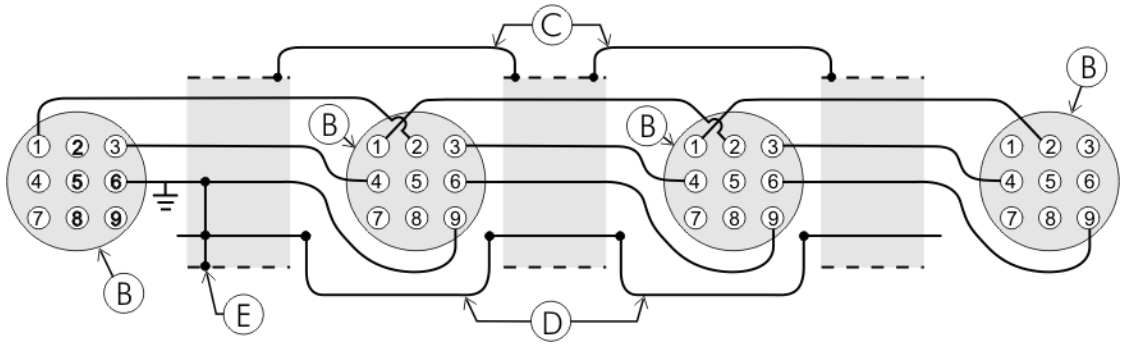
B . . . Plug on cable (with female pin sockets)

C . . . Connect together each segment of shield so that it has continuity across entire daisy chain.

D . . . Connect together each segment of an unused conductor so that it has continuity across entire daisy chain.

E . . . Tie shield and spare conductor(s) on one end of daisy chain to ground. Leave unconnected on other end of daisy chain.

Cable Wiring



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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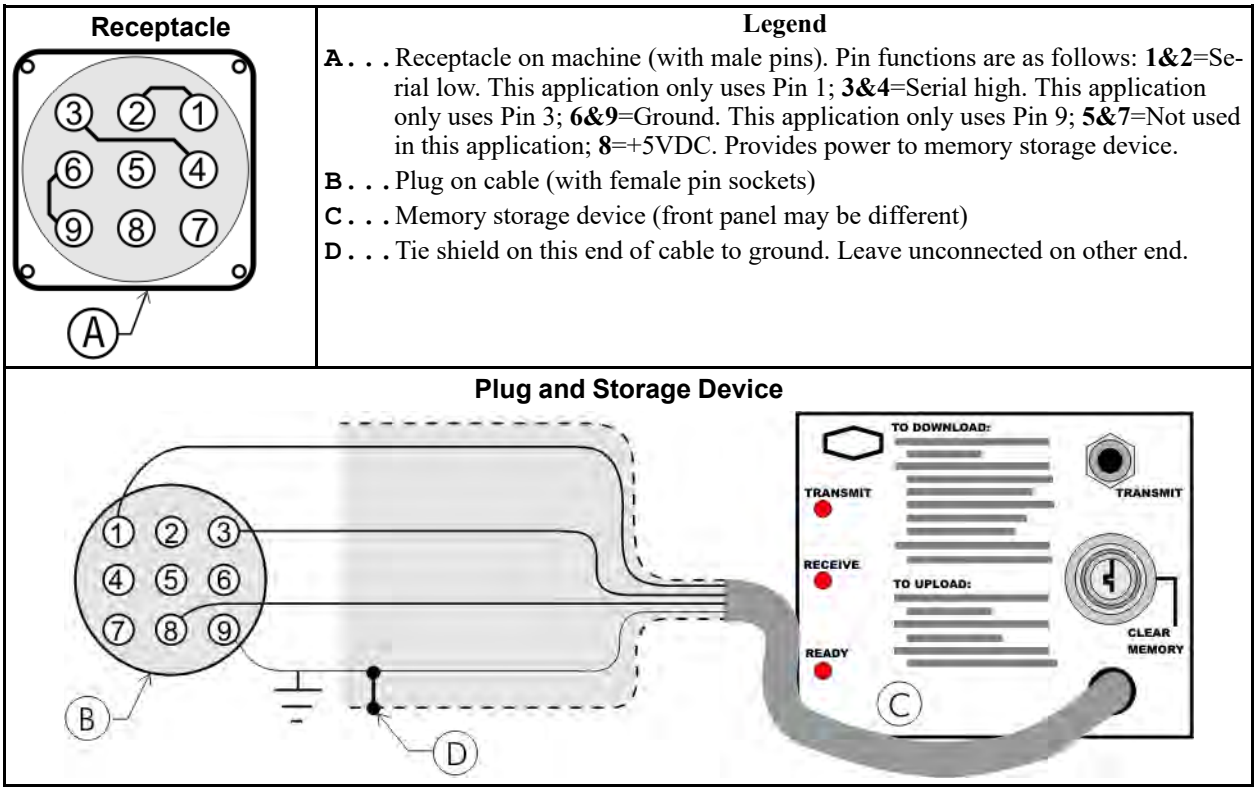
The cable used with the serial memory storage device (download box) available from Milnor, see related note in Section 5.3 : Construction of External Serial Link Cables, page 63 , is permanently attached to the storage device. Cable fabrication, as shown in Figure 16: Wiring Diagram for Cable to Connect a Machine to a Serial Memory Storage Device, page 67 , 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 13. 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 14: Required Settings for Citizen GSX-190 Printer, page 68 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 14. 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 15. 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.