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# Technical Reference— 100 Formula Mark II/III/IV/V Washer-Extractors



**Read the  
separate  
Safety  
Manual  
before  
installing,  
operating,  
or servicing**

# Please Read

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## ABOUT THIS MANUAL

**Scope**—This reference manual provides commissioning, programming, operating, and troubleshooting information of importance to managerial, supervisory, and technical personnel. It applies to Milnor® washer extractors with 100 formula microprocessor controllers and software with date code 91002 and later. This includes Mark II, III, IV, and V.

Other manuals are also furnished with the machine. Refer to the operator manual, safety manual, installation manual, service manual, and electrical schematic manual for the indicated information.

**Normal Display Sequence at Each Power Up**—The messages appearing at start up should be as shown in “OPERATING WASHER-EXTRACTORS . . .” (see Table of Contents). Any other message(s) or a blank display indicates an error condition which must be corrected before the machine will operate.

**Manual Number/Date Code (When To Discard or Save)**—The manual number/date code is located on the inside front cover, upper right corner just above the manual name. Whenever the manual is reprinted with new information, part of this number changes. **If the *date code* after the “/” changes, the new version applies to all machines covered by the old version, but is improved— thus the old version can be discarded. If the *manual number* before the “/” changes, the new manual covers only new machines.** Example: Discard MATMODELAE/8739**CV** when MATMODELAE/8739**DV** is received (minor improvements). Also, discard MATMODELAE/8739**DV** when MATMODELAE/8746**AV** is received (major improvements). But keep MATMODELAE/8746**FV** when MATMODEL**BE**/8815**AV** is received, since the new manual no longer applies to machines originally shipped with the old manual.

**Documents and Change Bars**—The individual documents comprising this manual use the same revision criteria as the manual. Text documents also display change bars. Example: When section MSOP0599AE/9135**BV** becomes MSOP0599AE/9135**CV**, change bars with the letter “C” appear next to all changes for this revision. For a major rewrite (e.g., MSOP0599AE/9226**AV**), all change bars are deleted.

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# **Section Commissioning**

**1**

## **Important Owner/User Information—Machines with a Keypad**

Take the following important steps before placing this machine in operation:


1. Ensure safety of laundry personnel.
2. Protect against data loss.
3. Customize data (configure, formula, and productivity data).

### **1. Ensure Safety of Laundry Personnel**

Ensure that all personnel who will operate or maintain this machine read the safety manual **before permitting them access to the machine**. Ensure that all user manuals are available to the appropriate personnel and that all precautions explained in the safety and other user manuals are observed.

### **2. Protect Against Data Loss**

Follow the safeguards listed below to protect against data loss caused by human tampering, electromagnetic interference (EMI), physical damage to the data storage medium, or loss of power to random access memory (RAM).

1. Keep the *Run/Program* keyswitch set to *run* (  ) and secure the keys. Users must understand proper use of this control. See "ABOUT THE USER CONTROLS. . ." (see Table of Contents).
2. Keep all electric box doors closed and locked. Secure the keys.
3. Leave machine power on for 48 hours before customizing data. This fully charges the microprocessor battery, which will then supply power to the RAM for 90 days even if machine power is off.
4. Replace the battery board every five years. A capacitor on the processor board can supply power to the RAM for several hours with the battery removed.
5. Keep electronic back-up data and/or a printed record of all field-programmed data (e.g., wash formulas, configure values, step names, chemical names) in case of data loss. See the instructions for downloading and printing this data if the machine has this capability.
6. For machines that accumulate productivity data (e.g., count of loads processed), transcribe any needed data frequently, as described in the instructions for data accumulation.

### **3. Customize Data**

#### **3.1. When to Customize Data**

- When commissioning the machine
- When restoring a machine to service after a lengthy shutdown
- When required by error message
- After replacing the CPU board
- After upgrading software (replacing EPROMs)
- After adding or removing optional equipment

#### **3.2. What Customizing Requires**—Verify configuration. Program formulas and clear productivity data, if applicable. See the programming and operating sections in this manual for instructions.



**3.3. Data Accessibility**—Configure and formula data can only be altered while the keyswitch is in the *program* position (data is keyswitch-protected). Productivity data, because it is accumulated in the run mode, cannot be keyswitch-protected and is accessible to anyone. Data is accessible to the extent described in the following table:

**Table 1: Data Type and Accessibility**

			Ways Data Can Be Used and Altered				
			Data can be read				
			Data can be over-written				
			Data can be up/downloaded				
			Data can be cleared				
Type of Data		Machines Data Applies To					Contents after clearing
<b>Configure Data</b>		dryer (includes gains)	Yes	Yes	Yes	Yes	example values
		shuttle, single-stage press	Yes	Yes	No	Yes	zeros
		two-stage press, Cobuc, Linear Costo, discharge sequencer	Yes	Yes	No	No	n.a.
		washer (and textile)-extractor, centrifugal extractor	Yes	Yes	Yes	No	n.a.
<b>Formula Data</b>	<b>step, chemical names</b>	washer (and textile)-extractor	Yes	Yes	Yes	Yes	example values
	<b>formulas</b>	washer (and textile)-extractor, centrifugal extractor, dryer	Yes	Yes	Yes	Yes	empty
<b>Productivity Data</b>		washer (and textile)-extractor, centrifugal extractor, dryer	Yes	No	No	Yes	empty

**3.4. If Data Becomes Corrupt**—If the microprocessor senses that data is unusable or unreliable, an error message will appear (usually at power-up), possibly preventing machine operation. The consequences and appropriate actions for each error message are explained in the troubleshooting instructions. Follow these instructions exactly to ensure that corrupt data is completely eliminated and replaced with valid data. Failure to do so may result in unsafe operation or machine damage.

— End of BICM3K01 —

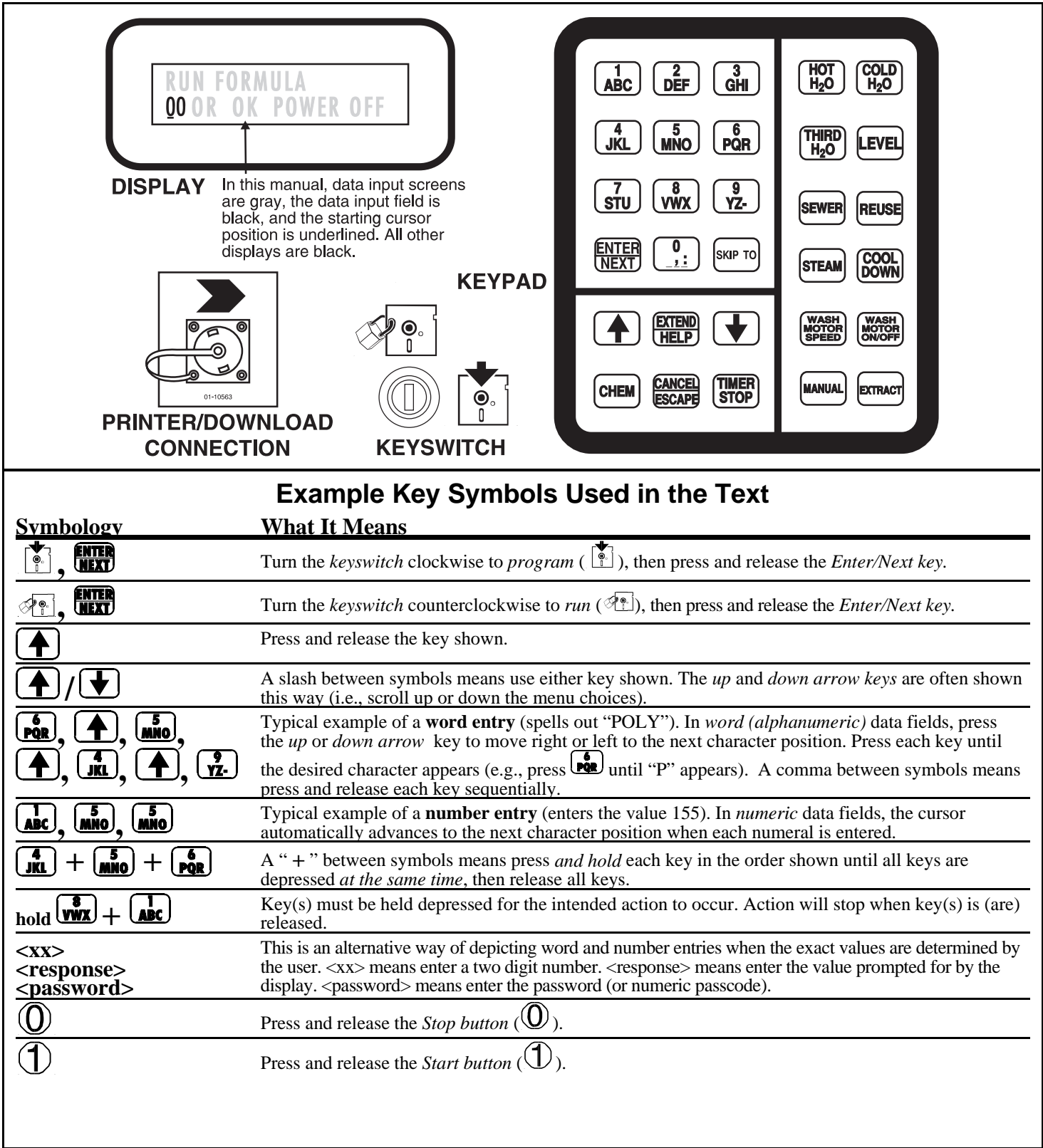
## **ABOUT THE USER CONTROLS— MACHINES WITH A KEYPAD**

User controls are of two types—electro-mechanical controls (switches, buttons, and status lights) and micro-processor interface controls (display, keypad, keyswitch, and printer/download connection). Controls are mounted on one or more nameplates on the machine or a separate electric box.

**NOTE: Do not attempt to use your machine merely by referring to the descriptions of controls. Read the operating, programming, and troubleshooting instructions throughout this and the operator manual.**

### **Electro-Mechanical Controls**



Electro-mechanical controls vary with machine model and are explained in the machine-specific operator manual furnished with the machine.



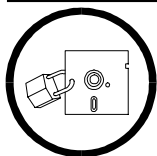
## Microprocessor Interface Controls

These controls, shown in FIGURE 1, include the *keyswitch*, *display*, and *keypad*, located on the main nameplate (position on nameplate varies), and the *printer/download connection*, located on its own nameplate. These controls permit the user to pass data to and from the microprocessor controller.

**NOTE:** This section folds out so that you may continue to refer to FIGURE 1 as you review the remainder of this manual.

**Keyswitch**—This key-operated switch provides security for all field-programmed data in memory. With the *keyswitch* set to *run* (  ), this data cannot be changed. The key cannot be removed in the *program* (  ) position.

### ▲ CAUTION ▲



**DATA LOSS HAZARD**—Improper use of the *keyswitch* may corrupt program data.

- ➡ **Return to the run mode only when the display says *Ok Turn Key to Run*.**
- ➡ **Only power off or on with the *keyswitch* at *run*.**
- ➡ **Do not leave the key accessible to unauthorized personnel.**

**Display**—This two- or four-line device displays *messages* and *data entry screens*. *Messages* inform the user as to the machine's operating status or alert the user to conditions that must be satisfied before operation can continue. ***Message displays* in this manual are normally black.**

*Data entry screens* prompt the user to enter data at the keypad. As keys are pressed, the data appears in the data input field on the display. A blinking *cursor* always shows where the next character will be entered. ***Data input screens* in this manual are gray, the data input field is black, and the starting cursor position is underlined.**

**Keypad**—The 12- or 30-key keypad is used for programming, making selections (e.g., selecting formulas in a washer-extractor), responding to display messages, certain normal operating procedures, and manual operation. Applicable procedures are explained in the remainder of this manual and depicted using symbols to indicate pressing keys on the keypad. These symbols are explained in the “Example Key Symbols Used in the Text” in FIGURE 1. Keep FIGURE 1 folded out when reviewing procedures elsewhere in the manual that require the keypad.

**NOTE:** Some keys on the 30-key keypad are not used on some machines.

**Printer/Download Connection (if so equipped)**—Connect a Milnor<sup>®</sup>-supplied printer here to print field-programmed data (e.g., formulas) and accumulated data (e.g., count of loads processed), if applicable. Connect a Milnor<sup>®</sup>-supplied serial downloader here or interconnect between machines to copy field-programmed data between devices. Printing and downloading, if applicable, are explained elsewhere in this manual.

# **Section Programming**

**2**

# PROGRAMMING THE MARK II, III, IV, AND V MICROPROCESSOR WASHER-EXTRACTOR CONTROLLER

← Fold out FIGURE 1 in “ABOUT THE USER CONTROLS . . .” (see Table of Contents) for the meaning of the display and key symbols used in this section.

## Selections on the Program Menu

- 0 = **Ok Turn Key To Run** —Safely return to the *run mode*. See caution below.
- 1 = **Add/Change Formula**—Add a new formula, change or delete an existing formula, and add/delete steps.
- 2 = **Copy Old To New**—Copy existing formula to unused formula number.
- 3 = **Change Step Names**—Assign names to step name numbers for use when programming formulas.
- 4 = **Change Chem Names**—Assign names to chem name numbers for use when programming formulas.
- 5 = **Configure** —Tell the controller which model and options it is controlling.
- 6 = **Down Load**—Copy data electronically to avoid repetitive programming and provide secure backup.
- 7 = **Clear All Memory (voluntarily)**—Clear memory before completely reprogramming the machine.
- 8 = **Print Data**—Print out formulas, configure codes, chemical names and step names. (Accumulated data can also be printed—See “MANUAL MODE MENU FUNCTIONS . . .”)

## To Access the Program Menu

RUN FORMULA  
00 OR OK POWER OFF

When the *Run Formula* menu and *selection 00* are displayed as shown at left,



Accesses the *Program Menu*.

PROGRAM 0 MENU  
OK TURN KEY TO RUN

When the *Program Menu* is displayed as shown at left,



Scrolls the available *program modes*.

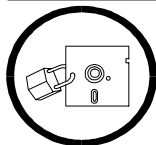
or <x> Selects a *program mode*, where <x> is a number from 0 to 8. See following pages for how to access and utilize each program mode.

or ((0)), ,  Returns to the *run mode*.



Once any program mode has been accessed, returns to the *run mode* or displays instructions on how to escape.

## ⚠ CAUTION ⚠



**DATA LOSS HAZARD**—Improper use of the *Program/Run keyswitch* may corrupt program data.

➡ Return to the run mode only when the display says *OK Turn Key To Run*.

➡ Only power off or on with the *Program/Run keyswitch* at run.

➡ Do not leave key accessible to unauthorized personnel.

If FORM xx INCOMPLETE  
TURN KEY TO PROG

or CLEAR MEMORY NOW  
PRESS 4+5+6

ever appears, data is unreliable and must be deleted. See “WASHER-EXTRACTOR ERROR MESSAGES” for more information.

## 1 = ADD/CHANGE FORMULA

At the start of formula programming, the controller prompts for a *formula number* and *formula name*. At the start of each step (e.g., flush, break, intermediate extract), the controller prompts for a *step name* and pauses to permit *deleting or duplicating the step*. You may enter formula information *sequentially* or *move around* to specific data. You may use or bypass the *help screens*. You may *abort a new formula* or *delete an existing one*. The last step may be a bath or an extract. When you end a formula, the controller prompts for the *type of rotation* to end with. In *WTB+* models, it also prompts for *dry code data*. *Formulas 01 through 98* are available for programming.

**NOTE:** Two non-programmable formulas are also furnished—*formula 00*, used to commission a new machine (see “OPERATING . . .”) and *formula 99*, used to develop new formulas (see “MODIFYING FORMULAS . . .”).

PROGRAM 1 MENU  
ADD/CHANGE FORMULA

When the *Program Menu* and *mode 1, Add/Change Formula* is displayed, as shown at left,



Accesses *mode 1* and prompts for a *formula number*.

### To Select a Formula Number

ADD/CHANGE FORMULA  
ADD/CHANGE FORMULA  
05 FORMULA 05

Formula name  
(default name  
shown)

“ADD” or “CHANGE” blinks  
for unused or existing formula

With the cursor at *formula number* as shown at left,



Scrolls the *unused* formula numbers.



Scrolls the *existing* formulas.



Accesses the selected formula. Cursor goes to *formula name field*.



Aborts formula programming and returns to *Program Menu*.

**To Name or Rename a Formula**—Every formula initially has the *default formula name* “FORMULA xx” where *xx* is the formula number. This may be overwritten with any name up to 16 characters.

F05 FORMULA 05

F05 SHEETS  
S01

Default formula name

Formula name field  
(Any name up to 16  
characters may be entered)

With the cursor in the *formula name field*, as shown at left,



Moves the cursor right/left within the *formula name field*.

<x>

Enters a character at the cursor where <x> is any letter, number, or symbol on the alphanumeric keypad.



Accepts *formula name* and prompts for the first step name.

**To Select a Step Name**—Step names are selected *by number* from the 16 pre-named step names available (see *mode 3, Change Step Names*). The default is 00 which names the step “STEP xx,” where *xx* is the *step number*.

With the cursor at the *step name number*, as shown at left,

F05 SHEETS  
S01 00 STEP 01  
S01 01 FLUSH

Step Name

Step name number

00=default



Scrolls the *step names*.

<xx>

Enters a *step name by number*, where <xx> is a number from 00 to 15.



Accepts the selected *step name*. Page A of this step appears with *nocursor* to permit deleting or duplicating this step.



Only if this is step 1, returns to *formula name*.

## To Delete or Duplicate a Step

**F05 TMMQFFHC3BLLLLLS**  
**S01** When *page A*, shown at left, first appears with **no blinking cursor**, the current step may be *deleted* or *duplicated*.

**CANCEL** + **ENTER**  
**ESC** + **ENTER**

**Deletes this step.** The next higher step becomes the current step. The controller prevents deleting an *End Formula* or a bath between two extracts. To *delete an entire formula*, see “To Abort a New Formula in Step 1 or Delete an Existing Formula” in this section.

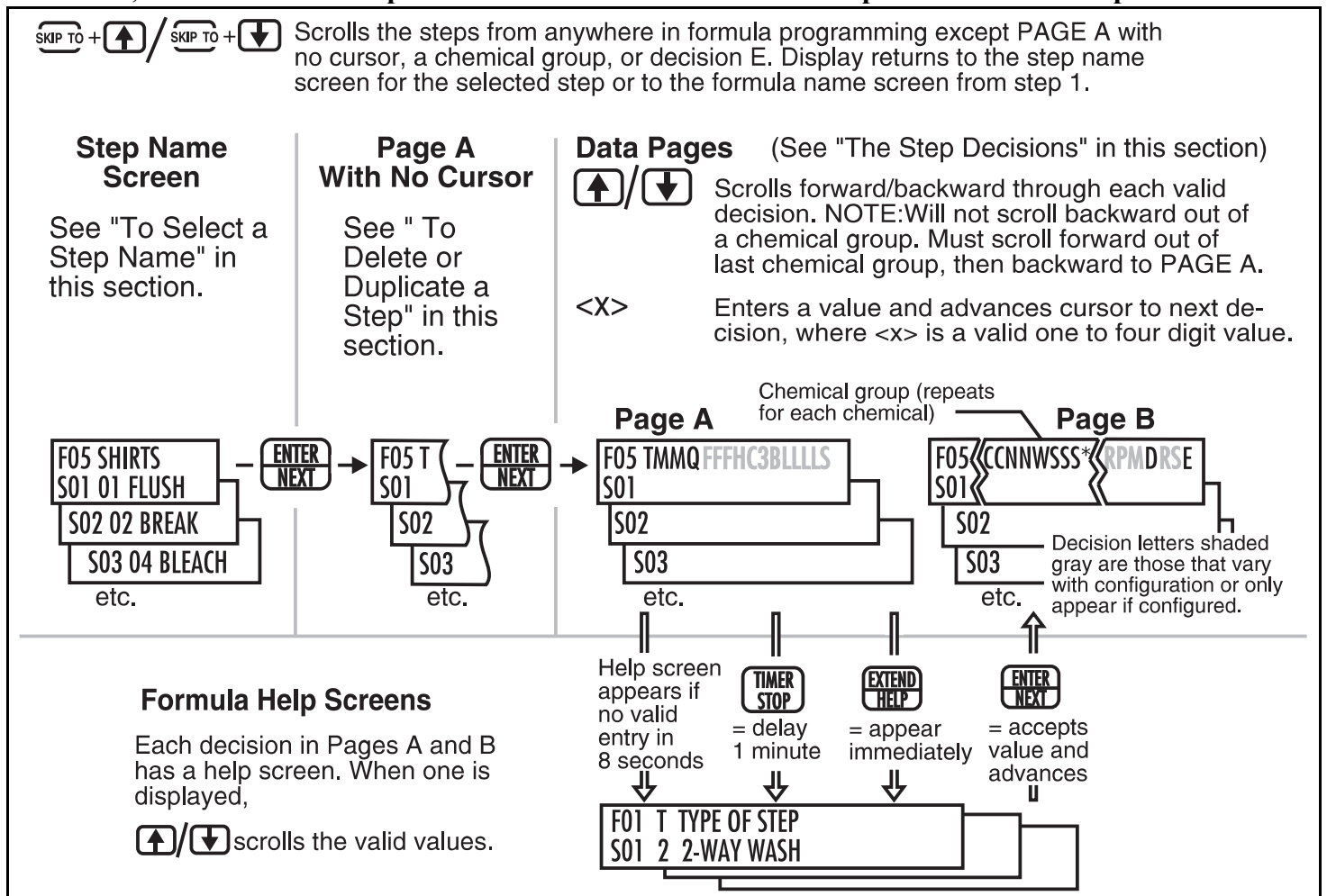
or **EXTEND** + **ENTER**  
**HELP** + **ENTER**

**Duplicates this step.** If this is *step 1*, the duplicated step becomes the new *step 1*, and all following steps move one number higher. Controller prevents duplicating an *End Formula* or an extract.

or **ENTER**  
**NEXT**

**Advances to *T* (Type of Step) without deleting or duplicating this step.**

**To Create or Move Around Steps and Use the Help Screens**—Each *step* has a *step name screen* and two *data pages* (*pages A and B*). Each data page has several *decisions* (e.g., duration, bath temperature, chemicals) represented by letters on *pages A and B*. Create steps for a new formula sequentially as the controller guides you through. Move around among steps, screens, pages, and decisions of an existing formula as shown in FIGURE 1, below. See “The Step Decisions” in this section for a full explanation of each step decision.



**FIGURE 1** (MSOP0234BE)  
 How To Move Around In a Formula and Use the Help Screens



### To End a Formula Without a Final Extract (Following a Bath)

F05 TMMQCCCHC3BLLLLLS  
 F05 T TYPE OF STEP  
 S06 0 END FORMULA

With cursor at *page A*, *decision T*, following last step, as shown above,

(0) or ENTER NEXT Commands *End Formula* and prompts:

END FORMULA #05 ?  
 0 NO [1=YES]

ABC, ENTER NEXT Confirms ending the formula and prompts *Dry Code?* (WTB+ only) or *How to End?*  
 or  
 (0), ENTER NEXT Cancels ending the formula and returns to *Type of Step*.

### To End a Formula With a Final Extract

Page A Page B  
 F05 TMMQCC RPMDRSE  
 S06 6050 ----0--

With cursor *page A*, *decision T*, of final extract step, as shown above,

<T> Commands one of three types of final extract, where <T> is 4, 6, or 7, and prompts for a *duration* (MMQ). See "The Step Decisions."  
 <MMQ> Commands a *duration* where <MMQ> is a 3-digit number and prompts for a *drain destination* if applicable.

At *page B*, as shown above,  
 <R> Commands a *drain destination*, where <R> is 0 or 1 and prompts *Dry Code?* (WTB+ only) or *How to End?*

### To Abort a New Formula in Step 1 or Delete an Existing Formula

F05 TMMQCCCHC3BLLLLLS  
 F05 T TYPE OF STEP  
 S01 0 END FORMULA

Scroll to *step 1*, *page A*, *decision T*. When the display is as shown above,

(0), ENTER NEXT Commands *End Formula* at *step 1* and prompts:

DELETE FORMULA #05?  
 0 NO [1=YES]

ABC, ENTER NEXT Confirms deleting the formula and returns to the *Program Menu*.  
 or  
 (0), ENTER NEXT Cancels deleting the formula and returns to *Type of Step*.

After confirmation:

\*\*PLEASE WAIT\*\*  
 PROGRAM 0 MENU  
 OK TURN KEY TO RUN

NOTE: Whether ending with or without a final extract, decisions continue as explained below.



### To Pass Dry Code Data From a WTB+ Machine—(Skip this information if not a WTB+ machine.)

If the "Program Post Dry?" configure decision=1 (yes) then dry code data passed to the dryer via a Miltrac® controller, must originate at the washer. The controller will prompt for the following:

DRY CODE?  
 00

The *dry code* entered here will be passed to the receiving dryer with each batch processed with this formula. When the display at left appears,

<xx> Enters a dry code, where <xx> is a two digit number from 00 to 15.

ENTER NEXT Accepts the selected dry code and prompts *Destination Code?*

DRY DESTINATION ?  
 00

All batches washed with this wash formula will be routed to the destination identified here. When the display at left appears,

<xx> Identifies the destination, where <xx> is a two digit number from 00 to 15.

ENTER NEXT Accepts the selected destination code and prompts *How to End?* (see next page).

**FIGURE 2** (MSOP0234BE)  
**The Step Decisions At a Glance**

**FIGURE 3** (MSOP0234BE)  
**Formula Worksheet**

**Type of Step: Types of Baths and Extracts Available**—*End Formula*, three types of *bath* step,

F05 TMMQFFFHC3BLLLLS

F05 T TYPE OF STEP

S01 0 END FORMULA...

and four types of *extract* step are available. The control prevents an extract as step 01, or as step 02 if step 01 is a no water bath. It also prevents two successive extract steps.

See “To End a Formula Without a Final Extract. . .,” and “To Abort a New Formula in Step 1 or Delete an Existing Formula” in this section.

1 1-WAY WASH.... Increases mechanical action and saves energy. Use for small pieces which cannot tangle.

2 2-WAY WASH.... Use for sheets or other large pieces which tangle unless cylinder reverses.

3 SOAK WASH..... **Cylinder does not turn.** Use for delicate fabrics and overnight bath soak (see below).

4 PRE+FIN EXT... Minimum time = 180 seconds. Machine extracts for 90 seconds, then the timer stops while the cylinder stops, jogs, and redistributes. Then machine extracts (with a 90-second low speed extract before accelerating to E2 if the machine has E1 and E2) for the remaining commanded extract time. Use only with goods that tend to plaster, as this function may cause unwanted extract recycles.

5 INT EXTRACT... For extracts between baths. Also for final extract at low (E1) speed if machine is equipped with two-speed extract.

6 FINAL EXT..... E1 duration dictated by *configure decision G* (see *mode 5, Configure*) then E2 for remainder of commanded extract time.

7 DOUBLE EXT.... Minimum time = 180 seconds. Use with mats to purge entrapped water. Machine extracts for 90 seconds (at low speed if machine has 2 speed extract, or at 50% if machine has variable speed extract). Timer stops as cylinder slows and runs at drain speed for 30 seconds then re-enters extract for remaining commanded time.

**Using Soak Wash To Create an Overnight Bath Soak Formula**—In *step 1*, command *Type of step (T)*=3 (*Soak Wash*), *duration of step (MMQ)*=600 (*one hour*), *drain type (D)*=2 (*Do Not Drain*). Command the temperature, water valves, and level desired. Accept *End Formula* in *step 2* to exit, then return to the formula and duplicate *step 1* as many times as hours of soak are desired. Modify the formula to add chemicals and/or perform other functions where desired. Take care to delete any duplicated functions from steps where not needed. **Power, air pressure, and steam (if used) must remain on as long as this formula is running.**

**Duration of Step**

F05 TMMQFFFHC3BLLLLS

F05 MMQ BATH TIME

S01 001=00.25 MIN..

*MMQ* indicates minutes (*MM*) and quarter minutes (*Q*).

010=01.00 MIN.. 1 minute (default)

113=11.75 MIN.. 11 minutes and 45 seconds (example)

633=63.75 MIN.. 63 minutes and 45 seconds (maximum)

**Bath Temperature**—Prerequisites: Appears if *temp probes* enabled (*configure decision T*). Accessible if this

F05 TMMQFFFHC3BLLLLS

F05 FFF

S01 000 TEMP °F

is a *bath step* (other than a *no water bath*). *FFF* (Fahrenheit) or *CCC* (Centigrade) appears per *configure decision A*. If a temperature is commanded, thermo modulation or steaming is required; otherwise, the cursor returns here for temperature correction.

000 TEMP °F.. No temperature requirement for this bath. Value displayed reverts to “---.”

050 TEMP °F.. 50° F. or 010 TEMP °C.. 10° C (default and minimum, if 000 not commanded)

205 TEMP °F.. 205° F. or 095 TEMP °C.. 95° C (maximum).

**Water Valves: Available Valves and Ways To Control Them**—*Configure decision K* determines which water valves are displayed. Valves are accessible if this is a bath step.

**When hot, cold, (and 3rd) water valves are configured**

Each water valve is a separate decision. 3rd water appears only if enabled. Unless stated otherwise, all selections apply to each valve.

hot cold 3rd

F05 TMMQCCC**HC**3B L S  
 S01

OFF 0.....Off for this bath  
 ON 1.....On during fill  
 ↑°C(or↑°F) 2.....On during fill if actual temperature is *below* commanded (*raises* temp).  
 Not available for *cold* water valve.  
 ↓°C(or↓°F) 3.....On during fill if actual temperature is *above* commanded (*lowers* temp).  
 Not available for *hot* water valve.

Examples:

F05 TMMQCCC**HC**3B L S  
 S01 110.....Split hot/cold

001.....3rd only

**When cold, 2nd, (and 3rd) water valves are configured**

cold 2nd 3rd

F05 TMMQCCCC**23**B L S  
 S01

OFF 0.....Off for this bath  
 ON 1.....On during fill  
 No other selections are available.

F05 TMMQCCCC**23**B L S  
 S01 110.....Split cold/2nd

001.....3rd only

**Water Valves: Regulating Incoming Water Temperature With Thermo-Modulation**

Prerequisite: Hot water valve enabled (*configure decision K*). *Thermo-modulation* regulates incoming water temperature by turning the water valve(s) on and off during fill to maintain commanded temperature. When programming, it is helpful to know the *split water temperature* (temperature achieved by opening hot and cold simultaneously).

F05 TMMQCCC**HC**3B L S  
 S01 230.....Hot and cold both modulate. Use this method when desired temperature is *near split* or when split water temperature is unknown or varies significantly.

130.....Hot=on, cold =modulates. This provides a faster more accurate fill (fewer temperature swings) when the commanded temperature is known to be *hotter than split*.

210.....Hot =modulates, cold=on. This provides a faster more accurate fill (fewer temperature swings) when the commanded temperature is known to be *colder than split*.

**NOTE 1:** If desired, modulate *hot* and *3rd* when *3rd* is *cold* water, or *cold* and *3rd* when *3rd* is *hot* water.

**NOTE 2:** Modulation controls the *average* temperature of the *incoming* water. Bath temperature may vary due to inconsistent incoming water temperature/pressure and because it is influenced by the temperature of the preceding bath.

**Shaking Sand and Loose Dirt Out of Walk-Off Mats With a No-water Bath**

Prerequisites: Only available in *step 1*. *Step 2* must be a *bath*. In the first bath step, specify no temperature (000), all water valves *off* (0), and no liquor level (0) as shown below. Provided *Do Not Drain* is *not* commanded for this bath's drain, when the drain valve opens at the end of this bath, the cold water valve opens for the shorter of the time stipulated in *configure decision G* or the *Drain Wash Out configure decision*.

F05 TMMQCCC**HC**3B L S  
 S01 000000 0


All of these decisions must be assigned a zero value.

F05 TMMQCCCC**23**B L S  
 S01 000000 0



**Water Valves: Lowering Bath Temperature with *Cooldown*** —Any bath in which a *cooldown* occurs actually consists of two bath steps with *no drain* between them. In the latter step, specify the desired *cooler* temperature, *all water valves off*, and *any* bath level. The controller will automatically insert a one minute duration (*MMQ=010*) in the current step and *Do Not Drain (D=2)* in the former step. **The cooldown temperature must always be 15°-20°F (8°-11°C) higher than the hottest ambient or cold water temperature that will be encountered, or it may take a long time or be impossible to achieve the commanded cooldown temperature.** Commanding *no water* (all water valves *off*) in a step following an extract or in a machine with no *cooldown (configure decision J)*, will result in the error:

F05 COOLDOWN ILLEGAL  
S01 PRESS NEXT

If the display at left appears,  
 Returns the cursor to the first water valve decision.

**Bottom Fill (Fill Through Door or Bottom)**

F05 TMMQFFFHC3BLLLLS  
F05 FILL HOW B  
S01 DOOR 0.....  
BOTTOM 1.....

Prerequisites: Appears if machine has *spray rinse (configure decision M)*; accessible if this is a *bath* step.  
Fill through door (default).  
Fill through bottom (mandated with thermo-modulated water if only one temp probe).

**Liquor Level: Methods of Level Control**—The *level decision* is accessible if this is a *bath* step. The controller will use one of three methods of level control, as determined by *hardware-dependent configure decisions N* and *U* as shown in the table at right. The possible methods include *selecting preset levels (L)*, *specifying inches or centimeters (LL)*, and *specifying a quantity of water (LLLL)*.

**Determining Level Control Method**

N =Metered Water		
↓	U	=Electronic Level Sensing
0	0	L (preset levels 0, 1, 2, 3)
0	1	LL (inches/centimeters)
1	0	LLLL (units of water)
1	1	

**Liquor Level: Selecting Preset Levels**

F05 TMMQFFFHC3BL S  
F05 LEVEL L  
S02 NO WATER 0.....  
LOW LEVEL 1.....  
MED LEVEL 2.....  
HIGH LEVEL 3

Prerequisites: *Metered water* and *electronic level sensing* both *disabled*. Value is one digit.  
No water (see “Water Valves: Shaking Sand and Loose Dirt Out . . .”).  
Default if this is *not* a *no water* bath.  
Mandated prior to extract.

**Liquor Level: Specifying Inches or Centimeters (Electronic Level Sensing)**

F05 TMMQFFFHC3BLL S  
F05 LEVEL LL  
S02 00....  
<xx>...  
<yy>...  
<zz>...  
17....

Prerequisites: *Metered water* disabled, *electronic level sensing* enabled. Units are *inches* or *centimeters* as specified in *configure decision A*. Value is two digits.  
No water (see “Water Valves: Shaking Sand and Loose Dirt Out . . .”).  
Minimum level for a bath not preceding an extract, where <xx> is the value specified in the *Low Level configure decision* (default if this is not a *no water* bath).  
Minimum level for a bath preceding an extract, where <yy> is the value specified in the *Med Level configure decision*. If a value lower than <yy> is entered and an extract is programmed for the next step, the controller will automatically replace this lower value with <yy>.  
Maximum level for any bath, where <zz> is the value specified in the *High Level configure decision*.  
17 inches (or centimeters)—example.

Liquor Level: Specifying Quantity of Water (Metered Water)

F05 TMMQFFFHC3BLLLLLS

F05 LEVEL LLLL

S01 0000

Prerequisite: *Metered water* enabled. Value is four digits.

Units used (e.g., gallons, liters, pounds, etc.) are established by the *Counts Per 100 configure decision*. Enter the quantity of water desired for this bath.

0000..No water (see “Water Valves: Shaking Sand and Loose Dirt Out of Walk Off Mats with a *No-water Bath*” in this section).

0150..150 units of water (gallons, liters, etc.)—example.

9999..Largest number that can be entered (see caution).

⚠ CAUTION ⚠

**MACHINE MALFUNCTION HAZARD**—Because any units can be used, the control permits entering any number up to 9999. Machine will overflow if too high a number is entered.

🔊 Make sure number entered here corresponds to the units established by the *Counts Per 100 configure decision* and is within the machine’s capacity.

**Steam Injection and How To Select the Steam Code**—Prerequisite: Steam enabled (*configure decision H*). Accessible if this is a *bath step* (not a *no water bath*). No steam and six steaming choices are available. Each steaming choice specifies the value shown in the list of choices below left, for each of three conditions (*early*, *after*, and *timer*) explained in the box below right.

F05 TMMQFFFHC3BLLLLLS

EARLY AFTER TIMER

NO STEAM

NO YES RUNS 1

NO NO STOPS 2

NO YES STOPS 3

YES YES RUNS 4

YES NO STOPS 5

YES YES STOPS 6

**Early:** *Yes* starts steaming at lowest level. Use *yes* when machine has only cold water valve or when plant has only low-temperature hot water. *No* starts steaming when commanded level achieved. Use *no* when machine has both hot and cold water valves if commanded temperature is lower than hot water temperature.

**After:** *Yes* resumes steam in this bath if temperature falls below commanded, once initially achieved. *No* prohibits further steam once temperature is achieved. Use *no* if chemicals or goods may be harmed by steam after chemical injection (as in bleach baths), otherwise use *yes*.

**Timer:** *Runs* while steaming or *stops* until temperature first achieved. Use *runs* if temperature need not be exactly maintained throughout bath and/or when it is certain that commanded temperature will be nearly achieved while filling. Use *stops* if temperature must be achieved before adding chemicals; otherwise the *start chemical injection when level and temperature are achieved* selection will be unavailable for this bath.

**Chemicals:**

**Applicable Decisions**—Chemical decisions are only accessible if this is a *bath step*, but any number of available chemicals can be commanded in the same bath. The available chemicals are those enabled in the *# of Chem Valves configure decision*. **For each chemical desired, the controller repeats the chemical decisions highlighted at left**, including *chemical number (CC)*, *chemical name (NN)*, *when to start injection (W)*, *duration of injection (SSS)*, and *signal with chemical (\*)*. If *chemical number 16 (signal only)* is selected, the control skips *SSS* and *\**. If optional *chem-wait (chemsave)* is functioning on this machine, when a chemical injection is called for, the machine timer will stop in response to a *wait* signal from the chemical system. See “HOW CHEMWAIT WORKS.”

F05 CCNNWSSS\*RPMDRSE

S01

## This Chemical: Number (CC) and Name (NN)

F05 CCNNWSSS\*RPMDRSE

CCNN CHEM# AND NAME

0000 NO CHEMICAL

0200 CHEMICAL 02....

xx00 ILLEGAL CHEM....

1600 CHEMICAL 16....

0100 CHEMICAL 01....

0301 ALKALI.....

Although *chemical number* and *chemical name* are separate decisions, they share the same help screen so they are both explained here.

No chemicals (or no additional chemicals) in this bath (default).

*Chemical 02* (example). Cursor advances to *NN* from any valid *chemical number*.

An invalid value was entered, where *xx* is a number outside the range specified in the # of *Chemical Valves configure decision*. Cursor remains at *CC* for correction.

Signal *without* chemical. Cursor advances to *NN*, then *W*, but skips *SSS* and *\**.

Names *chemical 01* (example) by chemical number (default).

Gives *chemical 03* the name *Alkali* (example). See *mode 4, Change Chem Names*.



In the help screen, accepts the *chemical number and name*. The cursor advances to *W* for a valid chemical or to the next decision following the chemical decisions for *chemical 00* (no chemical).

## This Chemical: When To Start Injection

F05 CCNNWSSS\*RPMDRSE

F05 W WHEN START

S01 0 WITH FILL

0 WITH FILL..

1 LEVEL OK...

2 LEV+ °C OK

Use this decision to ensure that chemicals are injected into the bath safely (e.g., acceptable concentrations and bath temperatures). To avoid injecting two or more chemicals simultaneously, use *Do Not Drain* (see *programming decision D=drain type*) to combine two or more bath steps into one bath, with one injection in each.

As the machine is filling.

When level is satisfied.

or 2 LEV+ oF OK. When level and temperature are both satisfied (only available when steaming to a specified temperature with timer stops while steaming is commanded).

## This Chemical: Duration of Injection (in seconds)

F05 CCNNWSSS\*RPMDRSE

F05 SSS

CHEM ADD 001 SECS....

CHEM ADD 127 SECS....

One second (minimum and default). See caution below.

127 seconds (maximum). This value automatically inserted if any higher value entered.

### ▲ CAUTION ▲

**RISK OF POOR OR INCONSISTANT WASH QUALITY—Short injections (less than 10 seconds) *do not* work for the following reasons:** 1) Fine adjustments are not possible (e.g., a 1 second change to a 3 second injection is +/- one third). 2) Erratic response time (due to pump mechanical lag, draining of the delivery tubes, etc.) is more detrimental (e.g., a 1/2 second delay in a 3 second injection yields 17% less than expected, versus only 5% less for a 10 second injection).

☞ 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.

## This Chemical: Signal With Chemical

F05 CCNNWSSS\*RPMDRSE

F05 SIGNAL? \*

S01 NO 0

S01 YES 1

The signal occurs at the time specified by the *when to start injection* decision. The commanded injection will not start until the signal is cancelled by the operator.



**Basket Speed**—If wash and/or extract speeds are programmable in this machine, the control displays *SPD* or *RPM*, as explained below. If not, this field is blank.

F05 CCNNWSSS*SPDDRSE	Prerequisites for <i>SPD</i> : Appears if machine has <i>two speed wash</i> (configure decision R). Accessible if this is a bath step.
F05 SPEED SPD	
S02 NORMAL 0.....	Normal speed
S02 LOW 1.....	Low speed
F05 CCNNWSSS*RPMDRSE	Prerequisites for <i>RPM</i> : Appears if machine has <i>variable speed</i> (configure decision W). Accessible if this is a bath step or if this machine has variable speed <i>extract</i> (e.g., <i>FxP model</i> – configure decision C).
F01 SPEED RPM	
S01 WASH -15	
WASH -05.....	5 RPMs—Minimum allowable wash speed in RPM's
WASH -36.....	36 RPMs—Maximum allowable wash speed in RPM's
WASH -30.....	30 RPMs—Default and normal wash speed in RPM's
EXTRACT 025.....	25%—Minimum allowable percent of nominal extract speed
EXTRACT 100.....	100%—Maximum allowable percent of nominal extract speed
EXTRACT 100.....	100%—Default and normal percent of nominal extract speed

**Basket Rotation During Draining and Previous Fill (Drain Type)**—Prerequisites: Accessible if this is a bath step *and not a cooldown*.

F05 CCNNWSSS*RPMDRSE	Because the machine must enter extract from drain (distribution) speed, if the next step is an <i>extract</i> , the control changes a selected 1, 2, or 3 to 0; or a 5, 6, or 7 to 4.
F05 DRAIN TYPE D	
STD DRAIN SPD 0..	Basket turns clockwise at drain (distribution) speed.
2-WAY WASH SPD 1...	Wash speed, reversing; more mechanical action while draining.
DO NOT DRAIN 2...	Use for functions later in this bath such as to inject chemicals, raise temperature or level or change basket speed without draining. Also see “Type of Step: Using Bath Soak To Create an Overnight Soak Wash Formula” in this section. Avoid this selection when programming a <i>no-water bath</i> to shake loose dirt out of walk-off mats.
STOP W DRAIN 3...	Basket stationary; no mechanical action while draining.
STOP W FILL 4...	Basket stationary during <i>previous</i> fill; drain speed while draining.
STP FILL+DRAIN 5...	Basket stationary during draining and <i>previous</i> fill.
STP FILL+NO DR 6...	Basket stationary during <i>previous</i> fill; no drain.
DRAIN+SPRAY 7...	Sprays for the last 25 seconds of drain if machine has <i>spray rinse</i> .

### Drain Destination (Sewer or Reuse)

F01 CCNNWSSS*RPMDRSE	Prerequisites: Appears if machine has <i>reuse drain</i> (configure decision L). Accessible if this is a bath step and <i>not a Do Not Drain</i> or if this is an extract step.
F05 DRAIN TO R	
S02 SEWER 0..	Drain to sewer (default)
S02 REUSE 1...	Drain to reuse

### Spray Rinse

F05 CCNNWSSS*RPMDRSE	Prerequisites: Appears if machine has <i>spray rinse</i> (configure decision M). Accessible if this is an <i>intermediate extract</i> .
F05S/RINSE S	
S03 NO [1=YES] 0..	Do not spray.
YES [0=NO] 1..	Sprays for the last 25 seconds of the <i>intermediate extract</i> .

2 = COPY OLD TO NEW

PROGRAM 2 MENU  
COPY OLD TO NEW

When the *Program Menu* and *mode 2, Copy Old to New* is displayed,  

ENTER  
NEXT

Accesses *mode 2* and waits for the user to scroll existing formulas.

CANCEL  
ESCAPE

For Quick Return to Program Menu  
Aborts *mode 2* and returns to the *Program Menu* any time during the following procedure.

COPY OLD TO NEW

When this display appears,  

↑ / ↓

Scrolls the *existing formulas* (must scroll, cannot select by number).

COPY SOURCE  
xx SHEETS

When scrolling begins, this display appears, where *xx* is the formula number and *Sheets* is an example formula name. When the desired *source* formula appears,  

ENTER  
NEXT

Confirms this is the *source formula* and prompts for a *destination*.

COPY DESTINATION  
00

When this display appears,  

↑ / ↓

Scrolls the *unused formula numbers*,  
or <xx> Enters a *destination formula number*, where <xx> is a number from 01 to 98.

COPY DESTINATION  
xx ALREADY EXISTS

This display appears if the selected formula already exists, where *xx* is the *existing formula number*. The control prevents overwriting an existing formula.

COPY DESTINATION  
yy FORMULA yy

This display appears if the selected formula is unused, where *yy* is the *unused formula number*.  

ENTER  
NEXT

Copies the *source formula to the destination formula number* except that the source formula name is not copied. The new formula is named the same as the formula number (e.g., *Formula 12*).

PROGRAM 0 MENU  
OK TURN KEY TO RUN



*Program Menu* re-appears.

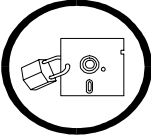
3 = CHANGE STEP NAMES

The following are the *default English step names* supplied with the controller.



<b>00</b> This names the step the same as the step number and is not available for field-programming.	<b>01</b> = Flush	<b>05</b> = Rinse	<b>09</b> = Softener	<b>13</b> = Name me
	<b>02</b> = Break	<b>06</b> = Antichlor	<b>10</b> = Mildcide	<b>14</b> = Name me
	<b>03</b> = Wash	<b>07</b> = Sour	<b>11</b> = Finish	<b>15</b> = Name me
	<b>04</b> = Bleach	<b>08</b> = Soursoft	<b>12</b> = Starch	

Equivalent non-English names, in one other language specified by the customer, are also supplied. *Configure decision B (Language)* determines which language (English or foreign) is displayed. The names associated with step name numbers 01 through 15 may be field-changed. Because step names are selected *by number* when programming formulas, any change to a step name will change the name in all formulas its step name number is used in.


**CAUTION**




**DATA LOSS HAZARD**—All field-changed step names are erased and lost whenever memory is cleared or *configure decision B (Language)* is changed. The English default step names or their foreign language equivalents will reappear.

-  **ALWAYS** re-enter any field-changed step names whenever memory is cleared.
-  **ALWAYS** configure language (English or foreign) before changing step names.

PROGRAM 3 MENU

CHANGE STEP NAMES

ENTER NEXT

When the *Program Menu* and *mode 3, Change Step Names* is displayed, Accesses the *step name menu*, and displays step name 01.

CANCEL ESCAPE

**For a Quick Return to the Program Menu**  
Aborts *mode 3* and returns to the *Program Menu* any time during the following procedure. Any changes are retained.

CHANGE STEP NAMES

01 FLUSH

Step name number

Step name

When cursor is here, you are at the step name menu.

When this display appears, where 01 is the *step name number* and *Flush* is the *step name*,

↑ / ↓

Scrolls the step names,

or 0 1 3 CH

Selects step name 03 (example) and displays the name associated with this number (can enter any number from 01 to 15).

ENTER NEXT

Accesses the selected step name.

CHANGE STEP NAMES

03 WASH

Step name 03 accessed

Example: Step name 03 can now be changed. Enter up to eight characters.

↑ / ↓

Moves the cursor right/left within the eight character field.

S, ↑, U, ↓, D, ↑, S

Enters *Suds* (example). Press each key one or more times until the desired character appears.

CHANGE STEP NAMES

03 SUDS

ENTER NEXT

When the new step name is entered, Returns to the *step name menu* (select another step name to change),

or CANCEL ESCAPE

Returns to the *Program Menu*.

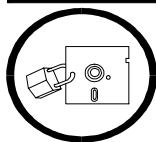
## 4 = CHANGE CHEM NAMES

The following are the *default English chemical names* supplied with the controller.

<b>00</b> This names the chemical the same as the chem number and is not available for field-programming.	<b>01</b> = Alkali	<b>06</b> = Chlorine Bleach	<b>11</b> = Sour+softener
	<b>02</b> = Soap	<b>07</b> = Oxygen Bleach	<b>12</b> = Starch
	<b>03</b> = Detergent	<b>08</b> = Antichlor	<b>13</b> = Anti-mildew
	<b>04</b> = Soap+alkali	<b>09</b> = Sour	<b>14</b> = Anti-bacteria
	<b>05</b> =Deterg+alkali	<b>10</b> = Softener	<b>15</b> = Finishing Chems
			<b>16-64</b> = Chem Name xx

Equivalent non-English names, in one other language specified by the customer, are also supplied. *Configure decision B, Language*, determines which language (English or foreign) is displayed. The names associated with chem name numbers 01 through 64 may be field-changed. Because chemical names are selected *by number* when programming formulas, any change to a chemical name will change the name in all formulas its chem name number is used in.

### ⚠ CAUTION ⚠



**DATA LOSS HAZARD**—All field-changed chemical names are erased and lost whenever memory is cleared or *configure decision B (Language)* is changed. The English default chemical names or their foreign language equivalents will reappear.

➡ **ALWAYS** re-enter any field-changed chemical names whenever memory is cleared.

➡ **ALWAYS** configure language (English or foreign) *before* changing chemical names.

PROGRAM **4** MENU  
CHANGE CHEM NAMES

When the *Program Menu* and *mode 4, Change Chem Names* is displayed,



Accesses *the chemical name menu* and displays the first editable name.

### For a Quick Return to the Program Menu



Aborts *mode 4* and returns to the *Program Menu* any time during the following procedure. Any changes are retained.

CHANGE CHEM NAMES  
01 ALKALI

Chemical name  
Chemical name number  
When cursor is here,  
you are at the *chemical name menu*.

When this display appears, where *01* is the *chemical name number* and *Alkali* is the *chemical name*,



Scrolls the chemical names,



or Selects chemical name **13** (example) and displays the name associated with this number (can enter any number from 01 to 64).



Accesses the selected chemical name.

CHANGE CHEM NAMES  
13 ANTI-MILDEW

Chemical name 13  
accessed

Example: Chemical name 13 can now be changed. Enter up to 15 characters.



Moves the cursor right/left within the 15 character field.



Enters *Mildistat* (example). Press key one or more times until desired character appears.

CHANGE CHEM NAMES  
13 MILDISTAT

When the new chemical name is entered,



Returns to the *chemical name menu* (select another name to change),



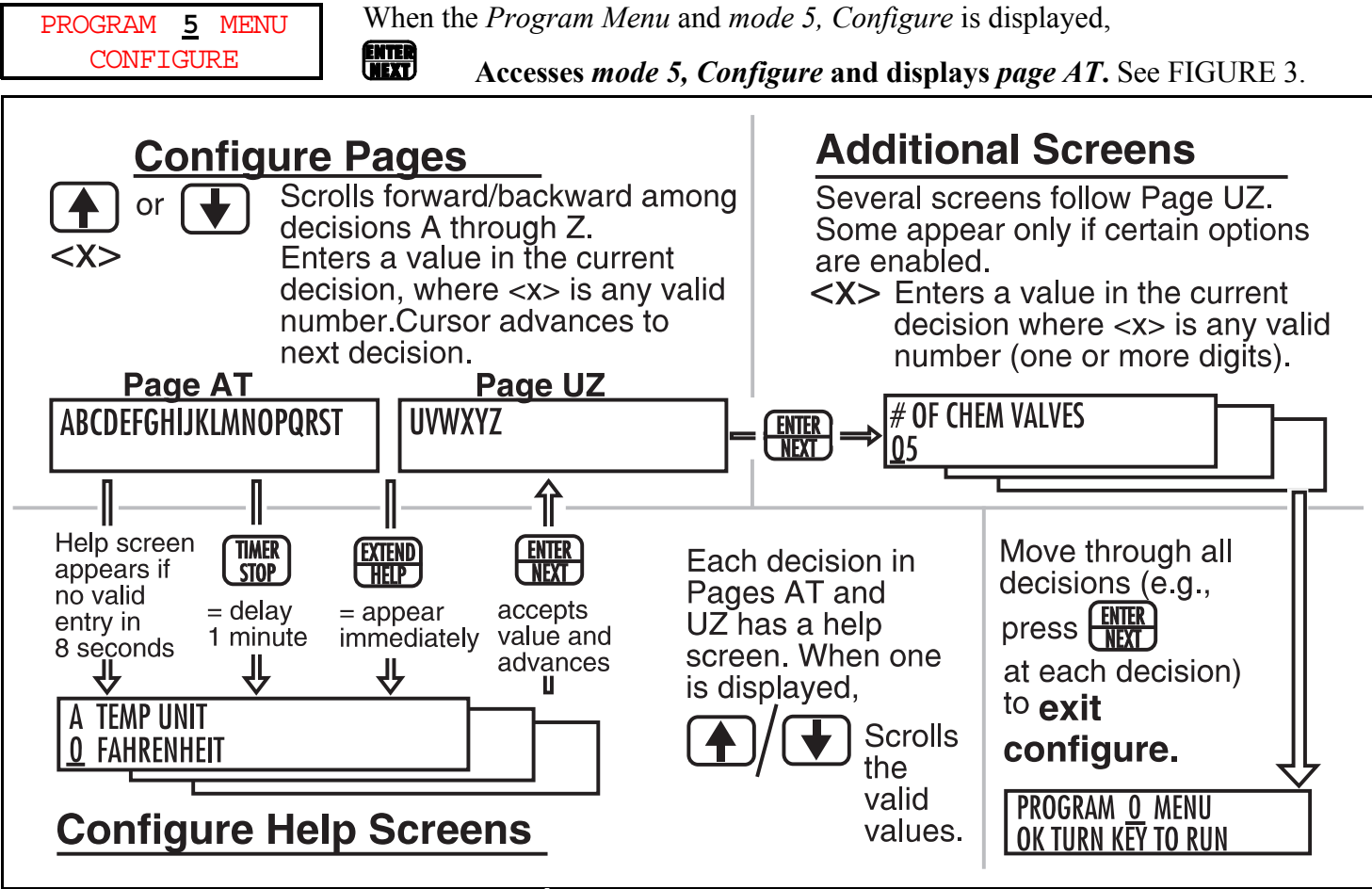
Returns to the *Program Menu*.

## 5 = CONFIGURE (and Why It Is Necessary)

Because the controller software is written to accommodate different machine models and options as well as certain user preferences (e.g., which language to display), it is necessary to *configure* the controller to match each specific machine. Hardware-based configure decisions must match the machine hardware and they must be changed to match subsequent hardware changes. User preferences may be set and subsequently changed as desired.

**Where To Find Configure Requirements**—See “IMPORTANT OWNER/USER INFORMATION . . .” (see Table of Contents) for the circumstances that require reconfiguring and reprogramming. The metal *configure nameplate* on the machine shows factory configuration. Make all hardware-based configure decisions conform to this nameplate, except to conform to any subsequent hardware changes. All configure decisions are explained in this section. Decisions are marked to indicate which are discretionary and which are hardware-based.

**How To Access, Move Through, and Exit Program Mode 5, CONFIGURE and Use the Help Screens**—The *configure mode* has two *pages* consisting of several *decisions*, each with a *help screen*. It also has several *additional screens*. **Once you have accessed *configure*, you must move through all decisions to exit** and return to the *Program Menu*. However, you need not view the help screens.



## The Configure Decisions

Some configure decisions on *page AT* influence subsequent configure decisions. For example, *decision H (steam error)*=1 mandates *decision T (temp probes)*=1 or 2. The control allows the user to enter T=0, 1, or 2, but it will subsequently insert the value 1. If the user commands T=2, the control will retain this value. *Decision C (machine type)* =1(*FXP machine*) is an example of a lockout. This selection mandates *decision W(variable spd opt)*=1, so the cursor skips over *decision W*. Other lockouts are built into the configure decisions.

Several of the *additional screens* that follow *page UZ*, will only appear if certain values are entered for certain previous decisions. All possible screens are shown and explained here.

### Configure Decisions for Pages AT and UZ

Configure Decision (Page and Help Screen)	D=Discretionary H=Must Accommodate Hardware		Explanation
	Selections		
Page AT			
ABCDEFGHIJKLMNQRST A TEMP UNIT 1 CENTIGRADE	D	0=Fahrenheit, inches, and month/day/year 1=Celsius, centimeters, and day/month/year	Determines temperature units, length units, and date format for display and hard copy.
ABCDEFGHIJKLMNQRST B LANGUAGES 0 ENGLISH	D	0=English 1=Foreign	Specifies whether to display prompts, messages, step names and chemical names in English or the customer-specified non-English language. <div><div>WARNING</div><div>DATA LOSS HAZARD—If step or chemical names were field programmed, these can be lost if the language choice is changed now. See modes 3 and 4.</div></div>
ABCDEFGHIJKLMNQRST C MACHINE TYPE 0 STANDARD W/E	H	0=Standard W/E..... 1=FXP machine..... 2=Staph Guard..... 3=BWP machine..... 4=E-style machine..... 5=WTB+ machine..... 6=WTB– machine..... 7=E-style Staph Gua.....	A standard W/E is any Mark II machine other than: xxxxxFxP (e.g., 36021F8P) xxxxxSPx (e.g., 60044SP2) 36021BWP xxxxxExN (e.g., 64046E6N) fully automated loading/unloading (see note below) semi-automated loading/unloading (see note below) (reserved for future use)

**NOTE:** If the machine is intended for WTB+ or WTB- operation, this takes precedence. Thus, select 5, not 4 above for a 64046E6N intended for WTB+ operation. *WTB+* machines may be dryell type (for sling loading) or non-dryell type (for other types of loading). As of this writing, one model, the 64046E6N, can be specially equipped with a dryell. Any open-pocket, tilting model may be used for non-dryell applications. Both dryell and non-dryell machines must be equipped with one additional I/O board and one additional output board (see “MANUAL MODE MENU FUNCTIONS . . .”—see Table of Contents). Dryell machines must be configured for both *WTB+* and *dryell*; non-dryell machines must be configured for *WTB+* .

WARNING

CRUSH HAZARD—Gaps around shell front or at rear of machine can close due to tilting or push down motion at unexpected times if this decision is answered incorrectly or corrected after initial configuration.

B



## Configure Decisions for Pages AT and UZ, continued

Configure Decision (Page and Help Screen)	D=Discretionary H=Must Accommodate Hardware		Explanation																												
		Selections																													
<p>ABCD<b>E</b>FGHIJKLMNOPQRST D EXTRACT SPEEDS 0 1 EXT SPEED</p>	H	0=one extract speed 1=two extract speeds	As of this writing, <i>two-speed extract</i> is optional on some machines, standard on some machines, and not available on others. Do not confuse with <i>variable speed extract</i> (see <i>configure decision W</i> ).																												
<p>ABCD<b>E</b>FGHIJKLMNOPQRST E DRYELL 0 NO [1=YES]</p>	H	0=no 1=yes	Only accessible if this is a WTB+ machine. Answer yes if this WTB+ machine is equipped with an optional dryell (elbow for mating the door to a dry loading chute in the tilt-rearward position).																												
<p>ABCDEF<b>G</b>HIJKLMNOPQRST F ANTI-PLUG 0 1.7 SECS</p>	H	0=1.7 seconds 1=2.0 seconds 2=2.3 seconds 3=3.2 seconds	<p>This is the <i>dwelt time</i> between when the wash motor turns off and restarts in the reverse direction.</p> <p><b>⚠ WARNING ⚠</b> <b>MACHINE DAMAGE HAZARD</b>—A shorter dwell time than the factory selection can damage wash motor or belt/gear train. Longer dwell times are acceptable.</p>																												
<p>ABCDEF<b>G</b>HIJKLMNOPQRST DRAIN G BATH EXTRACT (SEC) 0 30 30</p> <p>or if D above = 1 DRAIN G BTH EXT E1-2 0 30 30 45</p>	H	<p><b>BATH EXTR E1-E2</b></p> <table> <tr><td>0=</td><td>30</td><td>30</td><td>45</td></tr> <tr><td>1=</td><td>45</td><td>45</td><td>60</td></tr> <tr><td>2=</td><td>60</td><td>60</td><td>90</td></tr> <tr><td>3=</td><td>75</td><td>75</td><td>105</td></tr> <tr><td>4=</td><td>90</td><td>90</td><td>90</td></tr> <tr><td>5=</td><td>90</td><td>120</td><td>120</td></tr> <tr><td>6=</td><td>30</td><td>60</td><td>90</td></tr> </table>	0=	30	30	45	1=	45	45	60	2=	60	60	90	3=	75	75	105	4=	90	90	90	5=	90	120	120	6=	30	60	90	<p>This is <i>drain time</i> in seconds after each bath or before each extract, and also the <i>delay time</i> from E1 to E2 (low to high speed extract) if machine has <i>two speed extract</i> (see <i>configure decision D</i>, page AT).</p> <p><b>⚠ WARNING ⚠</b> <b>MACHINE MALFUNCTION AND DAMAGE HAZARDS</b>—Shorter drain times than the factory selection may not permit a full drain before extract, resulting in possible damage to either or both extract motors. Longer drain times are acceptable.</p>
0=	30	30	45																												
1=	45	45	60																												
2=	60	60	90																												
3=	75	75	105																												
4=	90	90	90																												
5=	90	120	120																												
6=	30	60	90																												
<p>ABCDEF<b>G</b>H IJKLMNOPQRST H STEAM ERROR 1 5 MIN</p>	H	0=no steam 1=5 minutes 2=10 minutes 3=50 minutes	<i>Steam injection</i> is standard on certain machines and optional on others. It permits steaming for time indicated before the <i>too long to steam</i> error appears.																												
<p>ABCDEF<b>G</b>H I<b>J</b>KLMNOPQRST I FILL ERROR 0 3 MIN</p>	D	0=3 minutes 1=5 minutes 2=10 minutes 3=30 minutes	Permits filling for the time indicated before the <i>too long to fill</i> error appears.																												
<p>ABCDEF<b>G</b>H I<b>J</b>KLMNOPQRST COOLDOWN J ERROR 1 5 MIN</p>	H	0=no cooldown 1=5 minutes 2=10 minutes 3=15 minutes	<i>Cooldown</i> is standard on certain machines and optional on others. It permits cooling down for time indicated before the <i>too long to cool</i> error appears.																												
<p>ABCDEF<b>G</b>H I<b>J</b>KLMNOPQRST WATER OPT K H+C 0</p>	H	0= <i>hot</i> + <i>cold</i> water valves (standard in America) 1= <i>cold</i> + 2nd water valves (standard in Europe and other areas) 2= <i>hot</i> + <i>cold</i> + 3rd water valves (optional) 3= <i>cold</i> + 2nd + 3rd water valves (optional)																													

## Configure Decisions for Pages AT and UZ, continued

Configure Decision (Page and Help Screen)	D=Discretionary H=Must Accommodate Hardware	Selections	Explanation
ABCDEFGHIJK <b>L</b> MNOPQRST REUSE OPT L NO [1=YES] <u>0</u>	H	0=no 1=yes	Optional <i>reuse drain</i> permits draining to sewer or reuse (as commanded in formula programming).
ABCDEFGHIJK <b>M</b> NOPQRST SPRAY OPT M <u>0</u>	H	0=no spray (standard on most machines) 1= <i>spray rinse</i> (standard on certain open pocket machines) 2= <i>spray down</i> (standard on certain two pocket machines)	
ABCDEFGHIJK <b>N</b> OPQRST METERED WATER N NO [1=YES] <u>0</u>	H	0=no 1=yes	Optional <i>metered water</i> feature provides for commanding a metered quantity of water for each bath of a formula.

Configure decision O is not currently used.

ABCDEFGHIJK <b>N</b> <b>O</b> <b>P</b> QRST BALANCING OPT P NO [1=YES] <u>0</u>	H	0=no 1=yes	<i>Hydraulic (water) balancing</i> feature is standard on certain machines. It is not an option.
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Configure decision Q is not currently used.

ABCDE <b>F</b> GHIJKLMNOP <b>Q</b> RST TWO SPEED WASH R NO [1=YES] <u>0</u>	H	0=no 1=yes	Not currently available. If cursor does not skip this letter, answer <i>no</i> . Do not confuse with variable speed wash, which is now available for most machines (see <i>configure decision W</i> , page UZ).
ABCDE <b>F</b> GHIJKLMNOP <b>Q</b> R <b>S</b> T AMPSAVER OPT S NO [1=YES] <u>0</u>	H	0=no 1=yes	Optional <i>ampsaver</i> feature reduces maximum amperes required by a group of machines.
ABCDEFGHIJKLMNOP <b>Q</b> R <b>S</b> <b>T</b> TEMP PROBES T 1 TEMP PROBE <u>1</u>	H	0=no temperature probes 1=one probe 2=two probes	Number of temperature probes depends on model and method of filling with water.

## Page UZ

<b>U</b> VWXYZ U ELEC. LEVEL <u>0</u> NO [1=YES]	H	0=no 1=yes	As of this writing, <i>electronic level sensing</i> is standard on all open pocket models 42026xxx and larger. It is not an option.
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Configure decision V is not currently used.



## Configure Decisions for Pages AT and UZ, continued

Configure Decision (Page and Help Screen)	D=Discretionary H=Must Accommodate Hardware	Selections	Explanation
<div>UVWXYZ</div> <div>W VARIABLE SPD OPT</div> <div><u>1</u> VARIABLE SPEED</div>	H	0=no 1=yes	As of this writing, <i>variable speed</i> is standard on some machines, optional on some machines, and not available on some machines. Variable speed applies to wash speed only on some machines and to both wash and extract speeds on other machines. <div><b>▲ CAUTION ▲</b></div> <b>MACHINE MALFUNCTION AND DAMAGE HAZARDS</b> —The variable speed inverter was programmed at the factory. The constants are written inside the electrical box housing the inverter. Changing these constants may result in damage to goods or the machine.
<div>UVWXYZ</div> <div>X MANUAL PASSWORD</div> <div><u>1</u> YES [0=NO]</div>	D	0=no—Password (numerical pass code) not required for manual modifications to a running formula. 1=yes—Password required.	

Configure decisions Y and Z are not currently used.

## Additional Configure Screens




Configure Decision (Screen)	D=Discretionary H=Must Accommodate Hardware		Explanation
	Selections/Range		
Password (numeric pass code) Screen (only appears if <i>decision X</i> , page <i>UZ</i> = 1)			
PASSWORD: <u>1234</u>	D	0000-9999	The four digit pass code configured here must be entered by the operator before making manual formula modifications.
Electronic Level Sensing Screens (only appear if <i>decision U</i> , page <i>UZ</i> = 1)			
<b>NOTE:</b> <i>Low</i> , <i>med</i> , and <i>high</i> levels shown below do not set the levels for the machine; thus, they do not necessarily coincide with the traditional levels <i>one</i> (starch), <i>two</i> (wash), and <i>three</i> (rinse). However, they set the ranges within which levels are specified in the formula. They also provide safety lockouts. <i>Tilt level</i> does set the level the machine will achieve while tilted.			
LOW LEVEL <u>06</u>	D	<u>Inches</u> <u>(Centimeters)</u> 06-10                      (15-25)	Minimum level that can be commanded for any bath and thus, the minimum level required for steaming.
MED LEVEL <u>10</u>	D	10-16                      (25-40)	Minimum level required in a bath preceeding an extract. If a lower level is commanded, the control will insert the value configured here when the wash formula is saved.

## Additional Configure Screens, continued

Configure Decision (Screen)	D=Discretionary H=Must Accommodate Hardware		Explanation
	Selections/Range		
HIGH LEVEL <u>16</u>	D	16-38 (40-99)	Maximum level that can be commanded for any bath.
TILT LEVEL <u>06</u>	D	06-38 (15-99)	In a tilting machine, the actual level that will be achieved when machine is tilted up to load, if a formula is pre-selected.
TAP OFFSET COUNTS <u>0000</u>	H	0000-9999 counts	This value adjusts the transducer output to compensate for offsetting conditions (such as location of level sensor) specific to each machine. It is determined for each machine at the factory (and the value shown on a nameplate), but may be re-calibrated in the field. See “ADJUSTING LEVEL SENSING APPARATUSES . . .” for calibration procedure.
Screens that Always Appear (not dependent on prior configure decisions)			
D/A OFFSET COUNTS	H	0000-2000; contact factory for correct value	<b>Applies to single-motor models only.</b> This value is set at the Milnor factory and should not be changed. It compensates for manufacturing tolerances in components used to control motor speed.
D/A COUNTS RPM <u>05</u>	H	000-100; contact factory for correct value	<b>Applies to single-motor models only.</b> This is the number of counts sent from the microprocessor to the digital-to-analog board to cause the basket to turn at one revolution per minute.
E-1 BALANCE RPM'S <u>05</u>	H	150-300; contact factory for correct value	<b>Applies to single-motor models only.</b> This is the maximum low extract speed allowed until the machine is dynamically balanced.
# OF CHEM VALVES <u>05</u>	H	00-15 valves	This is the number of valves or pumps used to inject chemicals, whether flush valves on an optional <i>flushing supply injector</i> , peristaltic pumps (supplied by others) or optional <i>liquid supply valves</i> . Do not count the <i>manifold flush valve</i> , if any.
NUMBER OF PROG. OUTPUTS <u>21</u>	H	00-21 Outputs	This is the number of optional programmable outputs present on the machine.
DRAIN WASH OUT <u>00</u> SS	D	00-45 seconds	If a <i>no-water bath</i> is commanded (to shake out loose, dry soil) and provided <i>do not drain</i> is <b>not</b> commanded for a bath's drain, when the drain valve opens at the end of the bath, the cold water valve also opens for the shorter of the time stipulated here or the drain time stipulated in <i>configure decision G</i> .

**ENTER**  
**NEXT** Accepts the selected choice and advances to next decision. Cursor moves forward only.

## Additional Configure Screens, continued

Configure Decision (Screen)	D=Discretionary H=Must Accommodate Hardware		Explanation
	Selections/Range		
Metered Water Screens (only appear if <i>decision N, page AT = 1</i> )			
COUNTS PER 100 <u>1483</u>	D	0000-9999	Establishes the units measured by the electronic flowmeter. Enter the number of flowmeter counts resulting from flowing 100 gallons, 100 liters, etc., whichever is the unit of choice. The same unit must be used when programming formulas. See flowmeter calibration procedures.
OFFSET VALVE TIME <u>048</u>	H	000-255 tenths of seconds	Reduces, by the value entered here, the time the water valve will open to admit the metered quantity commanded. This compensates for the tendency of the valve/flowmeter to <i>overshoot</i> the commanded quantity. See flowmeter calibration procedures.
WTB- / WTB+ Screens—Miltrac Address, below, appears for <i>WTB+</i> and <i>WTB-</i> machines ( <i>decision C, page AT = 5</i> or 6). Remaining screens only appear for <i>WTB+</i> machines ( <i>decision C, page AT=5</i> ).			
NOTE: Discharge time, discharge dwell time, and number of discharge sequences, below, control basket rotation and duration of discharge (machine tilted forward with door open). Use these configure decisions to ensure all goods are discharged.			
MILTRAC ADDRESS <u>048</u>	H	000-255	This value must match the address (discrete indentification code) assigned to this machine in the Miltrac <sup>®</sup> controller. See Miltrac <sup>®</sup> manual.
DISCHARGE CW CCW TIME(10ths) <u>30</u> <u>30</u>	D	01-99 tenths of seconds (each field)	This is the duration of clockwise (CW) and counterclockwise (CCW) rotation during discharge.
<b>&lt;xx&gt; For each direction, enters the time</b> , where <xx> is a two digit number. Cannot scroll decisions or values. <b>Do not use</b>  /  .			
 <b>Accepts the displayed value</b> and advances to the next decision.			
DISCHARGE DWELL TIME(10ths) <u>20</u>	D	00-50 tenths of seconds	The duration of the pause between each reversal of rotation of the basket during discharge.
NUMBER OF DISCH SEQUENCES <u>20</u>	D	02-20 sequences	The number of times the direction of rotation changes during discharge. Each movement in either the CW or CCW direction counts as one sequence.
END TIME IN MIN. <u>2</u>	D	0-8 minutes	The minimum time the machine will run in the <i>how to end</i> method (commanded in formula programming) before desiring to discharge. Specify sufficient time to assure that any plastered goods work loose.

Additional Configure Screens, continued

Configure Decision (Screen)	D=Discretionary H=Must Accommodate Hardware		Explanation
		Selections/Range	
<div>PROGRAM POST DRY?</div> <div> <div>0</div> NO [1=YES] </div>	D	0=no 1=yes	In some installations, dry code and destination code are not passed to the machine from the downstream device. 1 (yes) causes the controller to prompt for these codes during formula programming.
Dryell Screens (only appear if <i>decision E, page AT=1</i> )			
<div>DRYELL DELAY SECS.</div> <div> <div>000</div> </div>	D	000-255	This is the delay time after loading is completed, before moving the dryell up. Provide enough time to ensure that the goods and water enter the machine.
<div>DRYELL FLUSH SECS.</div> <div> <div>000</div> </div>	D	000-255	Specify how long to flush water into the dryell during loading.

## 6 = DOWN LOAD

**What Downloading Does**—Downloading transfers *all* formulas, step names, chemical names, and configure codes (if specified) from one machine to another via a *serial communication cable*. This eliminates the need to enter the same data repeatedly. It can also transfer this data between a machine and a Milnor<sup>®</sup> *serial downloader* (Milnor<sup>®</sup> part number KXMIC00508) for convenient data retrieval in the event of computer memory loss.

Downloading completely replaces all of the above mentioned data (configure codes are downloaded only if specifically commanded). Selective downloading (e.g., transferring only certain wash formulas) is not possible.

**When and When Not To Download**—The reliability and usefulness of downloaded data depends on the similarity between the sending machine and any receiving machines. Abide by the following table.

Similarity between sending and receiving machines			Should you download?	Actions required after downloading
Software	Basic model	Options		
Identical	Identical	Identical	<b>Yes –include configure.</b>	none
Identical	Identical	Different	<b>Ok—probably exclude configure.</b>	Check configure (see caution).
Identical	Different	Different	<b>Probably not.</b>	Reconfigure then revise formulas.
Different	doesn't matter	doesn't matter	<b>No</b> —will result in scrambled, unusable data.	

### ⚠ CAUTION ⚠

**MACHINE MALFUNCTION HAZARD**—Machine may malfunction, possibly causing unsafe operation, damage to machine and/or damage to goods if not properly configured.

☞ After downloading, reconfigure in accordance with each receiving machine's configure nameplate. This may be omitted only where all machines have *identical* configurations.

**The General Procedure**—Downloading is done in the following stages:

1. *Connect* all participating devices via a temporary serial cable (if a permanent cable is not already installed).
2. *Set up* each machine (not the *serial downloader*), using *mode 6, Download*.
3. *Initiate and monitor* the downloading.

## Making Connections

**Machine To Machine**—If a serial cable is not permanently installed (in conduit) between participating machines, install a temporary cable. See “THE EXTERNAL SERIAL LINK CABLES. . .” (see Table of Contents).

### ⚠ CAUTION ⚠

**MACHINE MALFUNCTION HAZARD**—Temporary cables (not enclosed in conduit) are susceptible to electromagnetic interference (EMI) which can disrupt machine operation.

☞ Remove temporary cable as soon as downloading is completed.


**Machine To/From Serial Downloader**—Two sets of instructions appear on the downloader: *To Download*—copying data *from a machine to the downloader* and *To Upload*—copying data *from the downloader to one or more machines*. Connect the lead from the downloader box to the *Printer/Download socket* on the machine (*step 1* on the downloader instructions for *both downloading and uploading*). Ready light should be *on*.

## Setting Up Participating Machines (not the *serial downloader*)

Depending on the type of downloading, there will be none, one, or several slave (receiving machines), and none or one master (sending) machine. **Designate *all* slave machines first.**

For each participating machine, access *mode 6, Download*. You will be prompted for the following information: *type of download* to be performed, whether this machine is a *slave (sending)* or *master (receiving)* machine, and for slave (receiving) machines, whether to *receive configure data*.

PROGRAM 6 MENU DOWN LOAD
-----------------------------

When the *Program Menu* and *mode 6, Down Load* is displayed,  accesses the *Down Load Devices menu* and displays the first selection.

### For a Quick Return to the Program Menu



Aborts *mode 6* prior to designating slave/master and returns to the *Program Menu*. After designating slave/master, see “Aborting Downloading In Progress” in this section.

For each of the decisions explained below,



Scrolls the menu selections,

or <x> Specifies a menu selection, where <x> is the menu item number.



Accepts the displayed selection and advances to the next decision.

### Specify the Type of Download

DOWN LOAD DEVICES 0 MACHINE<==>MACHINE
---

Make the *same* selection for *all* participating devices.

This is the correct choice for all types of downloading covered by this instruction.

1 MACHINE<==>TAPE . . . . . No longer used. See manual MATM2MICxE for instructions on retrieving data previously stored on cassette tape.

2 MILDATA=>MACHINE . . . Data will transfer from a Milda<sup>®</sup> PC to machine(s). See Milda<sup>®</sup> manual for procedure.

### Specify Slave (Receiving) or Master (Sending)

DOWN LOAD STATUS 0 SLAVE . . . . .
---------------------------------------

Make the appropriate selection for each participating machine.

This machine will *receive* data (default). **All receiving machines must be designated *first*.**

1 MASTER . . . . . This machine will *send* data. **Must be designated last** (see next page before accepting).

### Specify Whether To Download Configure Data (if this is a receiving machine)

RECEIVE CONFIG ? 0 NO [1=YES] . . . . .
--

Make the selection likely to most closely match this machine's *configure nameplate*.

Configure data will *not* be downloaded. This machine will retain its current configuration.

1 YES [0=NO] . . . . . Configure data *will* be downloaded. Configuration will match the sending machine.

(S) xxxx BAUD 0000 WAITING FOR MASTER
--

When the display at left appears, this receiving machine is ready to accept download data. xxxx=9600 (fast data transfer rate) for all types of downloading covered by this instruction. If xxxx=0300 (slow data transfer rate), this indicates that *1=Machine<==>Tape* was incorrectly specified above.



## Initiating, Monitoring, and Aborting a Download

Once any receiving machines are set-up and awaiting data, downloading may be *initiated*. Displays are provided for *monitoring* the progress of downloading. You may *abort the download process* at any time. **However, if a download in progress is halted, all receiving devices will contain a mixture of old and new data, and will not operate properly until program memory is successfully downloaded or reprogrammed.**

### Initiating Downloading

Between Machines	Machine to Serial Downloader (see <i>To Upload</i> on downloader box)	Serial Downloader to Machine (see <i>To Download</i> on downloader box)
1. <b>Designate master.</b> Downloading begins immediately.	1. <b>Clear memory in the serial downloader</b> as explained in the <i>To Upload</i> instructions on the serial downloader. 2. <b>Designate master.</b> Uploading begins immediately.	1. <b>Command <i>Transmit</i></b> , as explained in the <i>To Download</i> instructions on the serial downloader.

### Monitoring Downloading in Progress

#### Normal Displays During Downloading:

(M) 9600 BAUD xxxx  
RECEIVING DATA

Slave (receiving) machines

(S) 9600 BAUD xxxx  
TRANSFERRING DATA

Master (sending) machine

Display indicating successful completion (appears on all machines):

PROCESS COMPLETED  
NEXT TO PROCEED

The displays at left appear during downloading, where xxxx is a scrolling hexadecimal number, indicating byte location currently downloading. At 9600 baud, downloading takes about one minute. While downloading to/from the serial downloader, the *Transmit light* or *Receive light* (as appropriate) should be *on*. When downloading is successfully completed,



On each machine, returns to *Program Menu*.

**NOTE:** After downloading to the serial downloader, label the downloader with the *machine model and software version*.

#### Error Displays During Downloading:

(S) 9600 BAUD 000  
WAITING FOR MASTER

ERROR IN CHECK SUM  
NEXT TO PROCEED

If, during downloading, either display shown at left appears on a receiving machine, data transfer to that machine was unsuccessful. If the *Receive light* fails to illuminate when downloading from a machine to the serial downloader, data transfer was unsuccessful. Check the serial cable connections and repeat the download process.

### Aborting Downloading In Progress

**CANCEL  
ESCAPE**

Aborts the download process for any receiving machine on which it is commanded, or for all machines if commanded on the sending machine. The machine receiving the abort command displays the following:

DOWN LOAD ABORTED  
NEXT TO PROCEED

Repeat the download process for any receiving machine on which downloading was aborted; otherwise, the machine will contain a mixture of old and new data.



## 7 = CLEAR ALL MEMORY (VOLUNTARILY)

This mode clears all user-programmed formulas, step names and chemical names on command. The step names and chemical names originally supplied with the machine will reappear. Configure codes are unaffected when memory is cleared voluntarily, but the control must be reconfigured after first commissioning the machine or after the display says *Clear Memory Now*. See also “IMPORTANT OWNER/USER INFORMATION” (see Table of Contents).

PROGRAM **7** MENU  
CLEAR ALL MEMORY



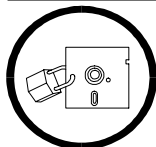
When the *Program Menu* and *mode 7, Clear All Memory* is displayed,  
Accesses *mode 7* and prompts the user to clear memory or cancel.

### For a Quick Return to the Program Menu



Aborts *mode 7* without clearing memory and returns to the *Program Menu*.

### ⚠ CAUTION ⚠



**DATA LOSS HAZARD**—The following key strokes will delete all user programmed data.

If this mode was entered accidentally, press to cancel this procedure.

4+5+6=CLEAR MEMORY  
CANCEL = ESCAPE

When this display appears (no cursor),



Clears all user-programmed formulas, step names,  
and chemical names.

CLEARING MEMORY  
\*\*PLEASE WAIT\*\*

This display appears while the controller is clearing memory. When memory is cleared, the display returns to the *Program Menu*.



Aborts *mode 7* without clearing memory.  
Display returns to the *Program Menu*.

## 8 = PRINT DATA

This mode permits printing the current *formulas*, *configure codes*, *chemical names* and *step names* (see FIGURE 4) on a printer meeting the requirements explained in “REQUIREMENTS AND SETTINGS FOR THE EPSON LX300 PRINTER” (see Table of Contents). The printer is connected to the machine through the *Printer/Download socket*. A mating plug is provided with the machine for wiring the printer interface cable. See “THE EXTERNAL SERIAL LINK CABLES. . .”.

PROGRAM 8 MENU  
PRINT DATA

ENTER  
NEXT

When the *Program Menu* and *mode 8, Print Data* is displayed,

Accesses *mode 8* and prompts for the type of data to print.

### For a Quick Return to the Program Menu

CANCEL  
ESCAPE

Aborts *mode 8* any time prior to the start of printing and returns to the *Program Menu*.

PRINT DATA  
0 FORMULAS . . . . .

When this display appears, select the type of data to print from the choices shown.

Prints formulas 00, 99, and the range of formulas specified below.

1 CONFIGURATION . . . . . Prints the configure codes.

2 CHEMICAL NAMES . . . . . Prints the 64 field-programmable chemical names.

3 STEP NAMES . . . . . Prints the 15 field-programmable step names.

↑ or ↓

Scrolls the choices

ENTER  
NEXT

Accepts the selected choice and prompts for today's date.

DATE: MM - DD - YYYY  
mm - dd - yyyy

When configure decision A=0

When configure decision A=1

DATE: DD - MM - YYYY  
dd - mm - yyyy

This display permits entering today's date, which will appear on the printout. *mm*, *dd*, and *yyyy* are numbers representing month, day, and year, respectively. Note that month/day or day/month order depends on *configure decision A*. The date is retained (in unprotected memory) for about 48 hours with power off.

<mm> or <dd> or <yyyy> enters a value at the indicated cursor location, where <mm> is a number from 01 to 12, representing the month, <dd> is a number from 01 to 31 representing the day, and <yyyy> is a number representing the year (e.g., 1993).

ENTER  
NEXT

Accepts the displayed value and advances to next field or decision.

START STOP  
xx yy

This display only appears if *Formulas* was selected above. Formulas 00 and 99 are always printed. Enter the range of additional formulas to be printed, where *xx* is the starting formula and *yy* is the ending formula, inclusive.

<xx>, ENTER  
NEXT Enters the lowest formula number, where <xx> is greater than 00 and less than or equal to <yy>.

<yy>, ENTER  
NEXT Enters the highest formula number, where <yy> is greater than or equal to <xx> and less than 99. Printing begins.

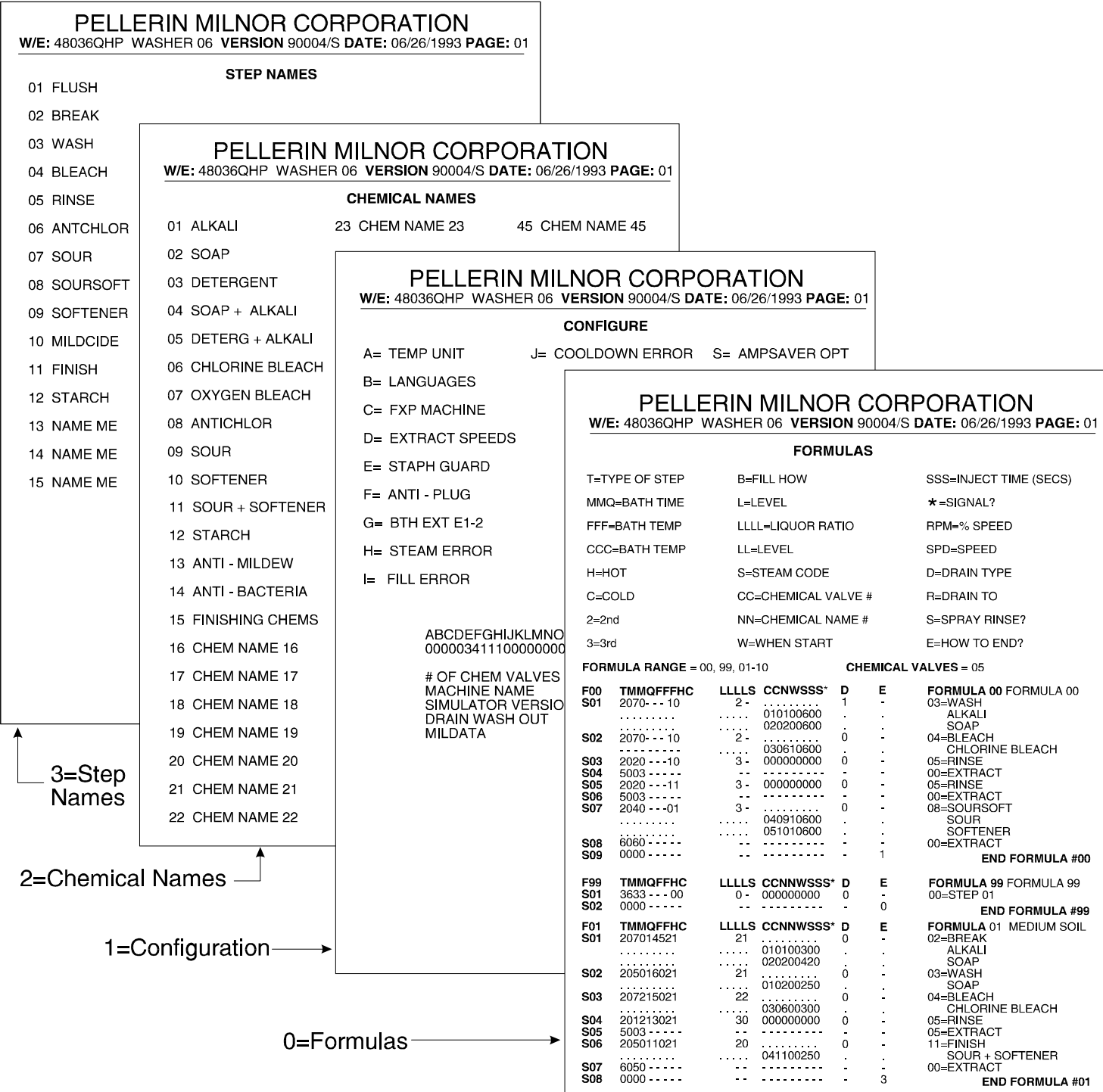


FIGURE 5 (MSOP0234BE)  
Example Printouts Using Mode 8, Print Data

PRINTING . . . .  
\*\* PLEASE WAIT \*\*

During printing, this display appears. When printing is concluded, the display returns to the *Program Menu*.



**Section**  
**Operating**

**3**

# OPERATING WASHER-EXTRACTORS USING MARK II, III, IV, AND V MICROPROCESSOR CONTROLLERS


The washer-extractor controller is used on several types of washer-extractors. Each type has its own electro-mechanical controls, operating procedures, and operator manual. This section provides information, encompassing all washer-extractor types, to assist management personnel in establishing procedures and training operators. “WTB+ SUPPLEMENTAL OPERATING INFORMATION” (see Table of Contents) provides additional information for machines configured for *WTB+* operation.

## Procedures Used in Normal Operation

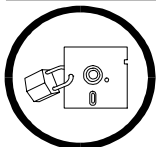
Refer to the “Summary of Operation” at the end of this section and use the “OPR” numbers to cross-reference the operating steps *for your machine* with the procedures explained below. ➡

⬅ Refer to FIGURE 1 in “ABOUT THE USER CONTROLS . . .” (see Table of Contents) for the meaning of display and key symbols used in this section.

See the “Description of Controls . . .” in the operator manual for depictions of the nameplates containing the controls explained here.

**OPR 1: Verify Switch Positions**—The machine must be in the *Run mode* for operation. Verify that the *Run/Program keyswitch* is set to *run* (  ) with the key removed, and if not, consult management.

### ⚠ CAUTION ⚠







**DATA LOSS HAZARD**—Improper use of the *Program/Run keyswitch* may corrupt program data.

- ⬅ **Return to the run mode only when the display says *OK Turn Key To Run*.**
- ⬅ **Only power off or on with the *Program/Run keyswitch* at run.**
- ⬅ **Do not leave key accessible to unauthorized personnel.**

Machines configured for *WTB+* operation (automatic loading and unloading) have operator controls for selecting and de-selecting automatic operation. See “WTB+ SUPPLEMENTAL OPERATING INFORMATION.”

Optionally, the machine may be furnished with *Overnight Bath Soak*; it may also be linked to a *Mildata*® and/or *Ampsaver*® system. Operator controls are furnished for selecting and de-selecting these modes of operation.

**Overnight Bath Soak**—When the *Alternate Drain switch* is set to *on* (  ), all machine functions are disabled and the drain valve is held closed via an alternate compressed air source. Thus, goods can be soaked overnight with the machine shut down. The *Alternate Drain switch* must be set to *off* (  ) before the machine can resume operation. See OPR 14 for more information.

**Mildata**—Mark II machines may link to a *Mildata computer* which permits a bank of washers to download formulas from and provide accounting and other data to the Mildata computer. Set the *Remote/Local switch* to *remote* (  ) to place a washer-extractor on-line. When on-line, each time the operator selects a formula, the Mark II controller requests the selected formula from Mildata. For example, if the operator selects *formula 0005*, the machine receives and runs whatever formula is currently associated with that formula number in the Mildata computer. When operating on line, the machine displays the message “PLEASE WAIT,” while it is requesting and downloading the formula from the Mildata computer. To take the machine off-line, set the *Remote/Local switch* to *local* (  ). The machine will then run the selected formula stored in the machine’s formula memory.

**Ampsaver**—Machines may also link to an *Ampmaster controller* which temporarily delays a machine from entering extract, if necessary to prevent the total amperes drawn by a bank of machines from exceeding a preset maximum. This reduces electric consumption. Set the *Ampsaver/Machine switch* to *Ampsaver* (↔) to place the machine on-line. The machine will then respond to any request from the Ampmaster controller to delay entering extract. When properly set, this system will save energy and not significantly delay the production output of any machine. To take the machine off-line, set the *Ampsaver/Machine switch* to *machine* (→).

**NOTE:** *Sequenced Chemical Injection (Chemwait)* is a Milnor<sup>®</sup> system which permits a single chemical source to supply a bank of washer-extractors by delaying chemical injection into one machine whenever that chemical source is currently supplying another machine. *Miltrench* is a Milnor<sup>®</sup> system which delays draining one machine until another machine finishes draining, to avoid overflowing a common drain trench. The washer-extractor software accommodates both of these systems. Once either system is commissioned, all machines connected to it remain on-line and cannot be taken off-line by the operator.

**OPR 2: Energize the Microprocessor Controller**—The external disconnect switch (furnished by the owner/user) provides/removes *all* power to/from the machine (but not necessarily to/from non-Milnor electrical devices mounted to the machine). The *Master switch* (⊕/⊗) provides/removes power to/from the Mark II controller.

⚠ **DANGER** ⚠



**ELECTROCUTION AND ELECTRICAL BURN HAZARDS**—Contact with high voltage will electricute or burn you. Power switches on the machine and the control box do not eliminate these hazards. High voltage is present at the machine unless the main machine power disconnect is off.

- 👉 Do not unlock or open electric box doors.
- 👉 Do not remove guards, covers or panels.
- 👉 Do not reach into the machine housing or frame.
- 👉 Keep yourself and others off of machine.
- 👉 Know the location of the main machine disconnect and use it in an emergency to remove all electric power from the machine.

To power-up the machine, verify that all utilities are on (electricity, water, air, steam, and chemicals), set the *Master switch* to on (⊕) and view the start-up displays, as follows:

COPYRIGHT PELLERIN MILNOR 1990-93	Copyright statement (may repeat).
ALL RIGHTS RESERVED 'MARK-II WE' 90009/S	Software date code/language version (e.g., /S indicates Spanish).
FORMULA CHECK SUM 02C8	The check-sum changes with any programming changes. Record the check-sum after each programming session, to protect against unauthorized programming.

**OPR 3: Compose the Load**—The operator is responsible for maintaining proper *load size*, as explained in “DETERMINING LOAD SIZE” (see Table of Contents).

Effective centrifugal extraction (drawing the water from the goods by spinning the cylinder) depends on proper distribution in the cylinder. If the machine cannot adequately distribute the goods, it will be out of balance and its vibration safety devices will prevent it from achieving normal extract speed. The knowledgeable operator can minimize severe imbalances and intervene to correct those that occur, as explained below. Methods used to achieve distribution are specific to the type of machine—*open pocket*, *balancing*, or *divided cylinder*.

**Open Pocket Models**—These models distribute the load by turning the cylinder at drain (distribution) speed, just prior to extract. Drain speed is just fast enough to hold the goods against the cylinder, but slow enough to permit the goods to spread out as they pass through the draining bath.

If goods do not spread out sufficiently and a severe imbalance occurs, the machine will return to wash speed and attempt to redistribute the goods (extract recycle). Persistent recycles waste time and energy, and usually indicate a need for operator intervention. If goods are netted or tangled, distribution may not be possible. Observe the machine during extract and if necessary, stop the machine and untangle the goods.

**Balancing (Some Open Pocket Models)**—These machines can counteract an unbalanced load by sensing an imbalance and filling the rib(s) opposite the imbalance with water. A set of lights is provided for monitoring the balancing system. Refer to the “Description of Controls . . .” in the operator manual for an explanation of these lights. If persistent recycles occur, observe these lights to determine if the balancing system is operating properly.




**Divided Cylinder Models**—In these machines, proper distribution is achieved when the weight of goods in each compartment is approximately equal *at the start of extraction*. Load pockets with approximately equal amounts of similar goods. If the bulk or absorbancy of goods in one pocket are very different from those in another pocket, or if the goods in one pocket are already wet, it will be too difficult to determine how much to load each pocket to ensure that their weights with absorbed water approximately match.

**OPR 4: Open/Close Hand-Operated Shell (Outer) Door(s)**—Machine power must be on to open the door. Safeguards prevent the door from being opened during, and immediately after manually terminating a cycle. **These safeguards are for the operator’s protection. Never attempt to bypass them, nor operate the machine if there is any evidence of malfunctioning safeguards.**

**! DANGER !**



**CRUSH, ENTANGLE AND SEVER HAZARDS**—Contact with the turning cylinder can crush your limbs. Contact with the goods being processed can cause the goods to wrap around your body or limbs and dismember you. The turning cylinder and goods are normally isolated by the locked cylinder door.

-  **Do not attempt to open the door or reach into the cylinder until the cylinder is stopped.**
-  **Do not operate the machine with a malfunctioning door interlock.**
-  **Do not touch goods inside or hanging partially outside the turning cylinder.**

Opening the door silences the operator alarm. Closing the door sounds the operator alarm if a formula was previously selected. The shell door must be mechanically pressed against the shell to seal it before processing begins. Door operation is specific to the type of machine—*rigid* or *suspended*.

**Rigid Models**—The door on these models has a hand-operated latch with an electric interlock. To open the door, simultaneously hold the *Stop button* (⓪) and press the door latch. Close the door firmly to latch and seal it.

**Suspended Models**—Although the door configuration varies greatly within this range of models, all doors have an air-retracted, spring-extended plunger which holds the door closed. 42" divided cylinder machines have a hand-wheel door seal which must be loosened before opening the door and tightened before starting the cycle. All other models have an air operated door seal that automatically de-pressurizes when the door is opened and pressurizes when the cycle is started. The controller will delay retracting the door plunger long enough to de-pressurize the seal.

To open the door, hold the *Door Open button* (Ⓜ). When the door plunger retracts, pull the door until it clears the latch, then release the *Door Open button*. On tilting machines, make sure the door is latched open before tilting. To close the door, swing it closed with sufficient force to latch it.



**OPR 5: Open/Close Power-Operated Shell Door (some open pocket models)**—Power operated doors are controlled by the operator and governed by the same safeguards as hand-operated doors. On machines configured for *WTB+* operation, the door also operates automatically.

**⚠ WARNING ⚠**



**STRIKE AND CRUSH HAZARDS**—The moving door can strike you or crush or pinch your limbs if caught between the door and machine.

- 👉 Keep yourself clear of movement areas and paths.
- 👉 Keep both hands on the controls while operating.
- 👉 Do not operate the machine with malfunctioning manual two-hand controls.

To open the door, simultaneously hold the *Door Open button* ( ) and hold the *Hydraulic Door switch to open* ( ). Continue to hold until the door reaches its open limit. To close the door, simultaneously hold the *Door Open button* ( ) and hold the *Hydraulic Door switch to close* ( ). Continue to hold until the door latches.

**OPR 6: Tilt Rearward/Forward (tilting models)**—Tilting is controlled by the operator. Machines configured for *WTB+* operation also tilt automatically. Machines that tilt rearward to load are able to *fill while tilted*, which reduces cycle time. Tilt operation is specific to the type of machine—*Hydro-cushion* or *spring-mounted*.

**⚠ DANGER ⚠**



**CRUSH HAZARD**—The machine can crush your body or limbs if you are caught between the tilting housing and a stationary object.

- 👉 Keep yourself and others clear of movement areas and paths.
- 👉 Keep both hands on the controls while operating.
- 👉 Do not operate the machine with malfunctioning manual two-hand controls.

**OPR 6A—Tilt rearward to load (if machine has two way tilting) as follows:**

**Hydro-Cushion models**—Set the *Rear/Front Tilt switch* to *front* ( ). Simultaneously hold the *Start button* ( ① ) and hold the *Up/Down Tilt switch to up* ( ) until the desired angle is reached, or the machine stops at its tilt limit.

**Spring-mounted models**—Simultaneously hold the *Start button* ( ① ) and the *Up/Down Tilt switch to down* ( ) until the desired tilt angle is reached or the machine stops at its tilt limit.

**NOTE:** If a formula was selected before tilting, the drain valve(s) close(s) and the machine partially fills. **Close the door before returning to non-tilted, otherwise the drain will open letting the water out.**

**OPR 6B—Return to non-tilted from tilt rearward as follows:**

**Hydro-Cushion models**—Simultaneously hold the *Start button* ( ① ) and the *Up/Down Tilt switch to down* ( ) until the machine reaches its non-tilted position.

**Spring-mounted models**—Simultaneously hold the *Start button* ( ① ) and the *Up/Down Tilt switch to up* ( ) until the machine reaches its non-tilted position.


**OPR 6C—Tilt forward to unload as follows:**

**Hydro-Cushion models**—Set the *Rear/Front Tilt switch* to *rear* ( ). Simultaneously hold the *Start button* ( ① ) and the *Up/Down Tilt switch to up* ( ) until the desired tilt angle is reached, or the machine stops at its tilt limit.

**Spring-mounted models**—Simultaneously hold the *Start button* ( ① ) and the *Up/Down Tilt switch to up* ( ) until the desired tilt angle is reached or the machine stops at its tilt limit.

**OPR 6D—Return to non-tilted from tilt forward as follows (all models):** Simultaneously hold the *Start button* ( ① ) and hold the *Up/Down Tilt switch to down* ( ) until the machine reaches its non-tilted position.

**OPR 7: Jog the Cylinder (open pocket models)**—Jogging (briefly turning the cylinder with the door open) is controlled by the operator. Machines configured for *WTB+* operation also jog automatically. On *non-tilting* models, jog the cylinder to loosen the goods before unloading. On *tilting* models, jog with the machine tilted forward to discharge the goods and jog with the machine tilted rearward to help pull in the goods being loaded.




**⚠ DANGER ⚠**

**CRUSH HAZARDS**—Contact with the rotating cylinder can crush your limbs.

- ➡ Keep yourself and others clear of cylinder and goods during jogging operation.
- ➡ Keep both hands on the controls while operating.
- ➡ Do not operate the machine with malfunctioning manual two-hand controls.

To jog the cylinder, simultaneously hold the *Start button* (①) and hold the *Jog switch* to either position (clockwise (↻) or counter-clockwise (↻) as desired). Cylinder turns until buttons are released.

**OPR 8: Align the Cylinder and Load/Unload Using Inching and Autospot (divided cylinder models)**—To load/unload the machine, each pocket, in turn, is aligned with the outer door(s). *Inching* permits aligning each pocket visually by turning the cylinder with the outer door(s) open. *Autospot*, if furnished, permits selecting a pocket, then turning the cylinder until it automatically stops at the selected pocket. *Autospot-door open* permits turning the cylinder with the outer door(s) open. *Autospot-door closed* (see OPR 9) requires the outer door(s) to be closed when turning the cylinder.



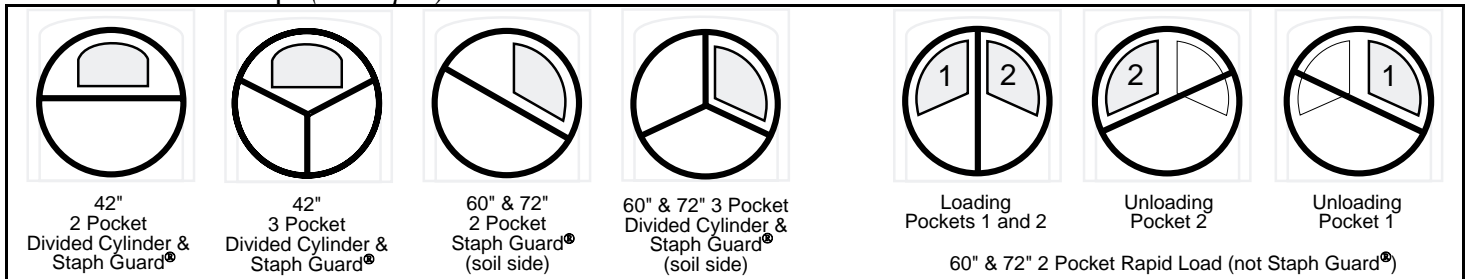
**⚠ DANGER ⚠**

**CRUSH HAZARDS**—Contact with the turning cylinder can crush your limbs.

- ➡ Keep yourself and others clear of cylinder and goods during inching or Autospot operation.
- ➡ Keep both hands on the controls while operating.
- ➡ Do not operate the machine with malfunctioning manual two-hand controls.

With the shell (outer) door(s) *open*, load/unload the machine as follows:


- Align a pocket**—Cylinder pockets are numbered 1, 2, (and 3, if three pocket). Pockets on all but Rapid Load models are identified by a stamped number or by rivets (one, two, or three rivets—see FIGURE 2) on the inner doors. Rapid Load models are always furnished with Autospot, which positions the pockets as shown in FIGURE 1. Select a direction of rotation (*inching*, e.g., ↻) or a pocket (*Autospot*, e.g., ②) with the *Auto-spot/Inch selector switch* then simultaneously hold the *Start button* (①) or *Inch button* and *Door Open button* (ⓘ). Release buttons when the cylinder approaches the desired pocket (*inching*) per FIGURE 1, or when rotation stops (*Autospot*).



**FIGURE 1** (MSOP0239BE)  
**Divided Cylinder Pocket Positions for Loading and Unloading**

2. **Load/unload the pocket**—Open the inner door(s), remove/add goods then close inner door(s) securely.

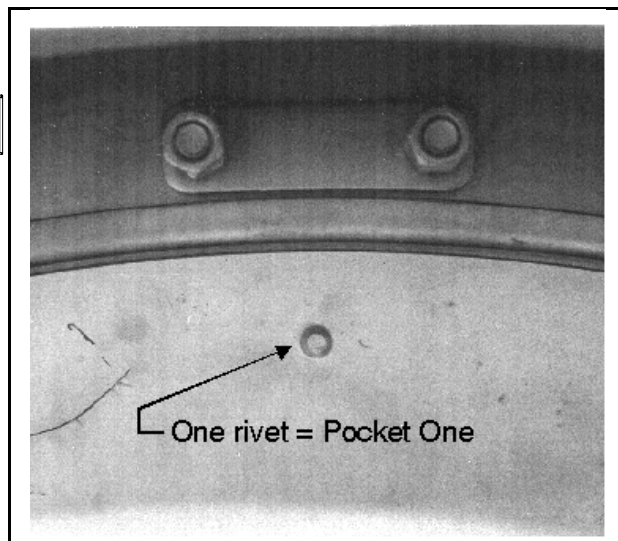
**⚠ WARNING ⚠**



**EXPLOSION HAZARD**—An improperly seated inner door latch can cause the inner door to open during operation, damaging the cylinder and shell.

A damaged cylinder can rip apart during extract, puncturing the shell and discharging metal fragments at high speed.

- ☞ Ensure inner door is securely latched after loading and unloading.
- ☞ Do not operate a machine with any evidence of damage or malfunction.



**FIGURE 2** (MSOP0239BE)  
**Rivet(s) Used To Identify Pockets**

3. Repeat procedure for each pocket.

**OPR 9: Align the Cylinder and Load/Unload Using Autospot—Door Closed**—This option functions the same as in OPR 8, except that the cylinder will not turn with the shell door(s) open. Instead, close the shell (outer) door(s) before selecting a pocket, then observe the *Cylinder Spotted light* (☞). This light will illuminate when cylinder rotation begins and go out when the selected pocket is in position.

**OPR 10: Spray To Compact the Goods (Rapid Load models)**—When loading, the operator opens both doors to simultaneously load both pockets (see FIGURE 1). *Spray down* permits the operator to compact the goods by wetting them down when the load becomes too bulky for more to fit easily in the pocket. Water from a *spray down* operation may be retained for use in the first bath or discarded as desired. Because both pockets of a *Rapid Load* machine are loaded simultaneously, *spray down* injects water into both pockets simultaneously.

Activate *spray down* at the keypad as follows:

**RUN FORMULA**

**00 OR OK POWER OFF**

**DRAIN? 0=NO 1=YES**

**0**

↑=STOP ↓=SPRAY

CANCEL=EXIT

When the *Run Formula* menu is displayed as shown at left,



Accesses *spray down* and prompts whether to drain spray down water.



Closes drain to retain *spray down* water for the next formula.



or Leaves drain open.

When the *spray down* menu is displayed, as shown at left,



Before achieving level 3, starts spray. Spray stops at Level 3.



Before achieving level 3, stops spray.



hold After achieving level 3, sprays as long as key is held.



Ends the *spray down* session and returns to *Run Formula* menu.



or Ends the *spray down* session and starts a selected formula.

**NOTE 1:** The *spray down status light* (⬆) illuminates whenever the spray down water valve is open.

**NOTE 2:** If *spray down* was with the drain closed, the water is retained for the first bath of the next formula unless power is lost, air pressure is lost, or the drain is manually commanded to open.

**OPR 11: Add Chemicals**—A washer-extractor may be equipped with a five-compartment supply injector, a pumped chemical system by others, or a central liquid supply system (chemical inlet valve supplied by Milnor<sup>®</sup>, chemical storage and delivery system by others). If the machine has a supply injector, the operator adds measured quantities of chemicals to the appropriate compartments as required for each load. This is normally done before starting the cycle, but may also be done during the cycle (see OPR 13C), if required by the formula. Management personnel who determine the formulas, must instruct the operator as to chemical type, quantity, and location (supply injector pocket to load) for each formula. See “USING THE FLUSHING TYPE AUTOMATIC SUPPLY INJECTOR” for more information. If a pumped chemical or central liquid supply system is used, observe this system periodically to ensure that chemicals are automatically delivered to the machine when called for.

**OPR 12: Select a Formula**—The machine can contain up to 98 field-programmed (local) wash formulas. The machine also contains two permanent formulas: *formula 00*, used to commission a new machine (explained below) and *formula 99*, used to develop new formulas (explained in “MODIFYING FORMULAS . . .”). The machine may also be connected to a Mildata computer providing access to up to 1000 (remote) formulas. With Mildata, the operator selects either a formula, a work order, or a goods code (as configured), then enters cake data. Cake data is the set of batch codes assigned to each load to identify it.

**NOTE:** Machines configured for WTB+ operation require cake data, whether or not the machine is linked to Mildata. However, the procedures differ because the cake data is normally passed to each system machine, including the washers, electronically (see “WTB+ SUPPLEMENTAL OPERATING INFORMATION”).

It is preferable to select the formula just before starting the cycle except on *tilt-to-load* machines, which will pre-fill during tilt-up if the formula is selected before tilting rearward to load.

Select a *local* formula when the machine is *not* on-line to Mildata as follows:

RUN FORMULA


00 OR OK POWER OFF

When the *Run Formula* menu is displayed as shown at left,  
<xx> **selects formula**, where <xx> is a two digit number from 01 to 98. The formula name and number appear if a valid formula was selected. “DOES NOT EXIST” appears for a non-existent formula. A valid formula sounds the operator signal, if the shell door is closed.

REMOTE FORMULA 000

W/ORDER 00000000

GOODS CODE 0000

or  /  **Scrolls the available formula numbers.**

Select a *remote* formula, work order, or goods code and enter cake data when on-line to Mildata as follows:

When one of the prompts shown at left appears,  
<response> **Selects formula, work order, or goods code**, where <response> is a four, ten, or five digit number, respectively. Cannot scroll.



**Accepts the value entered above.**

CUSTOMER CODE

Maximum Number of Characters

Alphanumeric or Numeric

Batch Code		
Customer Code	A	10
Employee Number	A	5
Weight	N	3
Pieces	N	4
Lot Number	A	10

When each prompt shown at left appears,  
<response> **Enters the requested batch code** where <response> is the number or alpha characters described at left. Codes are determined locally.



- **After each code, accepts entered value and prompts for next code.**
- **After the last batch code, downloads the formula from Mildata<sup>®</sup>.** Formula name and number appear if valid data was entered. “INVALID FORM DATA” (or similar) appears for any invalid data.
- **After formula is downloaded, displays and permits changing each code previously entered.**

**Select Formula 00 to commission a new machine.**—*Formula 00* (see FIGURE 3) is similar to a medium soil formula. Because it may not take advantage of supplied options, it is only intended to help commission a new machine. It will run on any machine with two water valves to test the following:

- Filling to levels 2 and 3.
- Hot, cold, and split water (or cold, 2nd, and cold+2nd, if cold only). No temperatures are commanded.
- 60 second chemical injections from valves 01 through 05.
- Wash reversing, intermediate extract, and final extract.
- Draining to sewer. The first drain is at wash speed and all others are at distribution speed.

**NOTE 1:** *Formula 00* is available provided the machine is *not* on-line to Mildata.

**NOTE 2:** Even if the password is enabled, the controller permits modifying *formula 00* (see “MANUAL FORMULA MODIFICATIONS...” ) without the password. However, *formula 00* cannot be copied, deleted, or permanently changed.

F00	TMMQFFHC	LLLLS	CCNWSSS*	D	E	FORMULA 00	FORMULA 00
S01	2070---10	2-	.....	1	-	03=WASH	
	.....	.....	010100600	.	.	ALKALI	
	.....	.....	020200600	.	.	SOAP	
S02	2070---10	2-	.....	0	-	04=BLEACH	
	.....	.....	030610600	.	.	CHLORINE BLEACH	
S03	2020---10	3-	000000000	0	-	05=RINSE	
S04	5003----	--	-----	-	-	00=EXTRACT	
S05	2020---11	3-	000000000	0	-	05=RINSE	
S06	5003----	--	-----	-	-	00=EXTRACT	
S07	2040---01	3-	.....	0	-	08=SOURSOFT	
	.....	.....	040910600	.	.	SOUR	
	.....	.....	051010600	.	.	SOFTENER	
S08	6060----	--	-----	-	-	00=EXTRACT	
S09	0000----	--	-----	-	1		END FORMULA #00

**FIGURE 3** (MSOP0239BE)  
**Printout of Formula 00 (used to commission a machine)**

**RUN FORMULA**  
**00 OR OK POWER OFF**

When the *Run Formula* menu and selection 00 is displayed as shown at left,



Accesses *formula 00*.

**RUN FORMULA**  
**00 FORMULA 00**



Silences the operator signal and starts the process (see OPR 13).



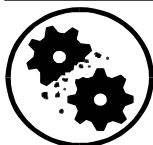
Cancels *formula 00* access.

**OPR 13: Start/Stop the Cycle**—The Start button (①) starts processing and the Stop button (⓪) stops processing, as further explained below. (See also “WTB+ SUPPLEMENTAL OPERATING INFORMATION” for machines configured for *WTB+* operation.)

Some machines move externally during processing. Movement varies with the type of machine—*rigid*, *Hydro-Cushion*®, or *spring-mounted*.

**Rigid Models**—A rigid machine is securely anchored to the foundation which absorbs most of the vibrating forces generated by the machine. The operator should periodically check to be sure all anchor bolts are secure and request servicing immediately if any anchor bolts are found to be loose

### ⚠ CAUTION ⚠




**INJURY AND MACHINE DAMAGE HAZARDS**—Extraction forces can cause an inadequately anchored rigid machine to jerk out of position, damaging the machine and injuring personnel.

☞ Check anchor bolts frequently.

☞ Never operate an improperly anchored machine.



**Hydro-Cushion Models**—On these models, the shell is pushed down two inches onto seats to hold it rigid in the frame during washing. At the start of extract, the shell is released so it can vibrate freely within the frame.




⚠ **WARNING** ⚠

**CRUSH HAZARD**—Machine can crush body parts caught in gaps around shell front that close due to push down/release motion and machine vibration.

👉 Keep clear of moving parts.

**Spring-Mounted Models**—On these models, the shell is permitted to vibrate within the frame during the entire cycle. On tilting models, the shell automatically tilts rearward approximately 10 degrees at the start of distribution, then returns to the non-tilted position at the end of extract.



⚠ **WARNING** ⚠

**CRUSH HAZARD**—Machine can crush body parts caught in gaps around shell front and at rear of machine that close due to vibration and tilting.

👉 Keep clear of moving parts.

When the machine loaded, the door is closed, and the supply injector (if any) is charged with chemicals, start processing as follows:

RUN FORMULA

08 SHEETS

With a valid wash formula displayed as in the example at left,

①

**Starts the cycle and silences the operator signal.** Various displays appear so operator can monitor the formula in progress (FIGURE 4).

A wash cycle can be stopped then either resumed or cancelled (OPR 13A). The cycle can also be resumed after a power interruption (OPR 13B), because the washer-extractor controller remembers the step it was in. If a supply injector is used and the formula in progress requires additional chemicals, the operator signal sounds, the timer stops, and the display shows which chemical(s) to add (OPR 13C). When the cycle ends, a signal and display message alert the operator (OPR 13D).

**OPR 13A**—If necessary, stop, then either resume or cancel the wash formula in progress as follows:

3 WIRE DISABLED  
FAULT: SEE MANUAL

CANCEL  
SCAPE

①

or

①

**Disables the three-wire circuit**, immediately stopping all machine functions and displaying an error message. If this is a bath, water, chemical, and steam valves close and the drain opens, draining the machine. (See “MANUAL FORMULA MODIFICATIONS . . .” for how to stop the formula timer without draining the machine.)




**Cancels the formula.** Display returns to the *Run Formula* menu.

**Resumes the formula *where the count left off* in the interrupted step**, as stipulated in the note below.

**NOTE:** How the machine recovers depends on whether the interruption occurred during a *bath*, *drain*, or *extract*.

- Bath—machine achieves level and temperature again, even if these were already achieved before the interruption. (If the machine is configured for *metered water*, the control prompts “REFILL WITH WATER?” Answer *yes* to inject the commanded quantity or *no* for no water.)
- Drain—the drain duration will be repeated.
- Extract—the machine will perform an extract recycle.




**OPR 13B—When power is restored after a power loss, resume or cancel the interrupted formula as follows:**

NEXT TO RESTART AT Fxxxx Syy	When the display at left appears, where xxxx and yy are the interrupted formula/step,		<b>Confirms that the formula will be resumed,</b>
	or		<b>Cancels the formula</b> and returns to <i>Run Formula menu</i> . Enter the password if requested (otherwise, resume the formula).
PRESS START	When the display at left appears,		<b>Resumes the formula <i>at the beginning of the interrupted step</i></b> , as stipulated in the note in OPR 13A.


**OPR 13C—Respond to the operator signal to add supplies as follows:**

1. Read the display to determine chemical(s) to be added.
2. Load the supply compartment(s), add through soap chute, or flush manually as instructed locally. To flush supplies manually, load *compartment one* and hold the *Flush/Spray switch to manual flush*.
3. Press the *Signal Cancel button*. If a *signal only* was commanded, processing resumes immediately. If a *signal with chemical* was commanded, the supply compartment is flushed for the commanded time.


**OPR 13D—Respond to the end-of-cycle signal as follows:**

message PLEASE UNLOAD ME	When the display at left appears, where <i>message</i> describes cylinder motion,		or		<b>Silences the signal and completes the cycle, except as follows:</b> If <i>message</i> = “break cake,” cylinder motions continue until completed. If <i>message</i> = “tumbling,” the operator can open the door to pull down any plastered goods. After closing the door again,
					Resumes “tumbling” for two minutes.



**OPR 14: Overnight Soak**—An overnight soak can be performed on any washer-extractor; however, the procedure varies depending on whether or not the machine is equipped with the *overnight bath soak* option. B



**To initiate an overnight soak using the bath soak option,** start the field-programmed overnight soak formula, verify that the machine has stopped filling, select the *Alternate Drain* function (  ) to hold the drain closed and disable all other machine functions), and turn power off.

**To initiate an overnight soak without the bath soak option,** start the field-programmed overnight soak formula. Make sure power and compressed air remain on.

**To end overnight soak if the bath soak option is used,** turn power on, return to normal functioning (  ) (machine will not operate otherwise), cancel the formula (OPR 13A), and unload.

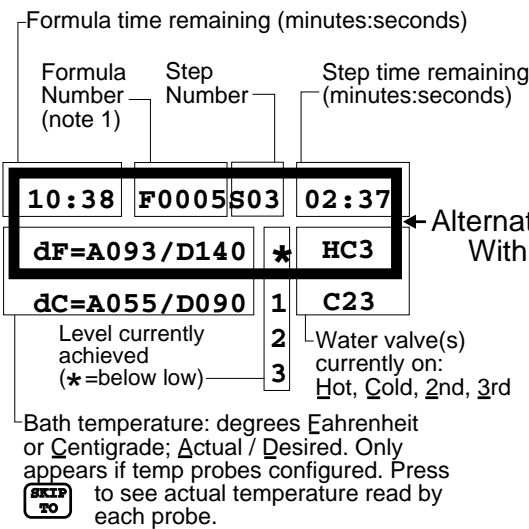
**To end the overnight soak if the bath soak option is not used,** cancel the formula (OPR 13A) and unload.

**OPR 15: Return Control To Soil Side (Staph-Guard<sup>®</sup> models)**—These machines have doors and controls on both cylinder ends so they can be loaded from the *soil side* and unloaded to the *clean side*. To maintain the segregation of soiled goods and clean goods, the outer doors on each end are interlocked so that only one door can be opened at a time. The *Soil Side* (  ) and *Clean Side* (  ) *Status lights* indicate to both operators which side has control. When the cycle ends, control is automatically transferred to the clean side for unloading.

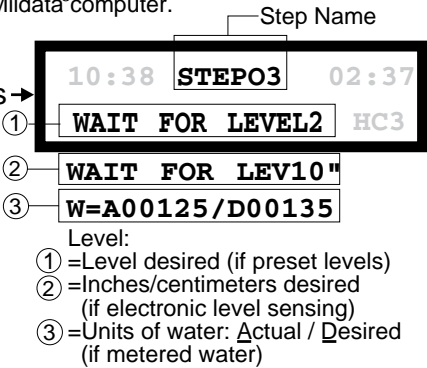
**To return control to the soil side,** close the clean side outer door (must be closed to transfer control), press the *Release button* (  /  ), and verify by the status lights that control has returned to the soil side.

**NOTE 1:** Where data on the display is shown shaded, this information was explained on another display.

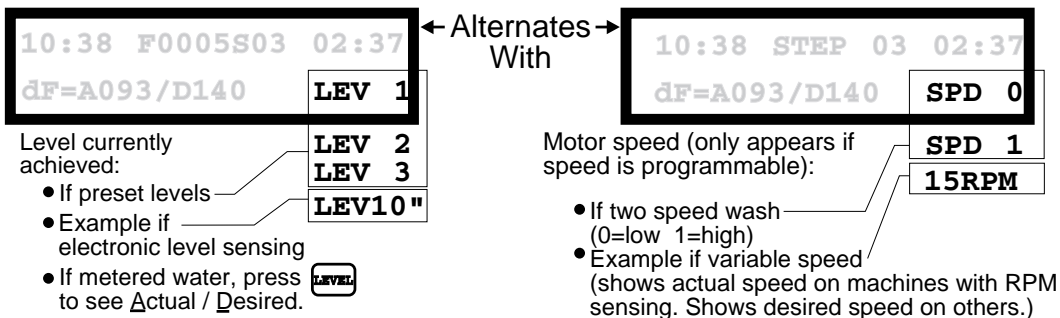
**Bath Displays Before Level Satisfied—No Chemicals Actuated**  
(see NOTE 2)



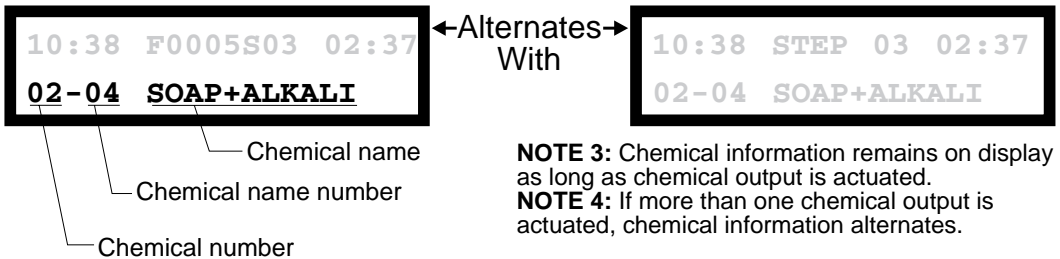
**NOTE 2:** If machine is not part of a Mildata® system, formulas 0000-0099 are the internal formulas (of which 01-98 are field programmable). With Mildata®, formulas 0001-9999 are those requested from the Mildata® computer.



**Bath Displays After Level Satisfied—No Chemicals Actuated**



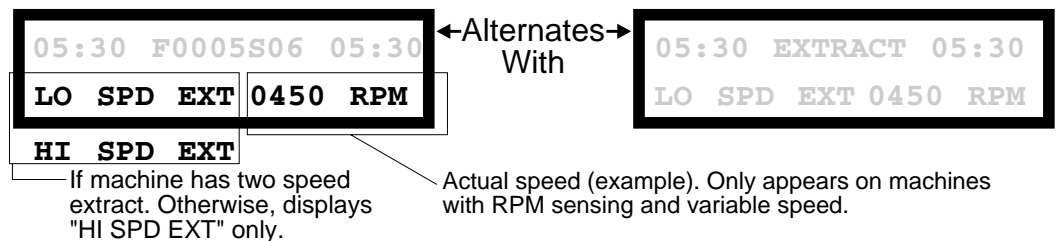
**Bath Displays—Chemicals or Signal Actuated**  
(see NOTES 3 and 4)



**Drain Display**



**Extract Displays**



**FIGURE 4** (MSOP0239BE)  
**Displays While Running a Wash Cycle**



## Summary of Operation

The operator actions listed here correspond to the headings in “Normal Operation . . .” in the operator manual.

### Start the Operating Day

**Be safe.** Comply with all safety instructions.

Verify switch positions (OPR 1).

Energize microprocessor controller (OPR 2).

**Run the Wash Cycle**—The following table lists six types of washer-extractors. For each type, it lists the part number of the operator manual (in parentheses) and the sequence of actions when running wash cycles.

Open Pocket Non-Tilt (MAUPQOPRAU or MAUPOOPRAU)		Open Pocket Tilt Forward Only (MAUPLOPRAU)		Open Pocket Tilt Both Way*** (MAUPNOPRAU or MAUEWOPRAU)		Divided Cylinder except Rapid Load and Staph-Guard (MAUPDOPRAU)		Rapid Load (MAUPROPRAU)		Staph® Guard (MAUPSOPRAU )		+
Action	OPR	Action	OPR	Action	OPR	Action	OPR	Action	OPR	Action	opr	
compose load	3	compose load	3	select formula	12*	compose load	3	compose load	3	compose load	3	
load machine	3	load machine	3	tilt rearward	6A	align/load pkts	8**	align/load pkts	8**	open soil door	4	
close door	4	close door	4,5	jog to pull in	7	close outer door	4	spray/compact	10	align/load pkts	8**	
add chemicals	11	add chemicals	11	close door	4,5	add chemicals	11	close both doors	4	close soil door	4	
select formula	12*	select formula	12*	return non-tilt	5B	select formula	12*	add chemicals	11	add chemicals	11	
start cycle	13*	start cycle	13*	add chemicals	10	start cycle	13*	select formula	12*	select formula	12*	
				start cycle	13*			start cycle	13*	start cycle	13*	
<b>Wash cycle in progress.</b> 1. If the operator desires to stop or terminate the formula, see OPR 13A. 2. If power is lost, see OPR 13B. 3. If the operator signal sounds to prompt the operator to add chemicals, see OPR 13C.												
respond to end of cycle	13D	respond to end of cycle	13D	respond to end of cycle	13D	respond to end of cycle	13D	respond to end of cycle	13D	respond to end of cycle	13D	
open door	4	open door	4,5	open door	4,5	open outer door	4	open both doors	4	open clean door	4	
jog to loosen	7	tilt forward	6C	tilt forward	6C	align/unload	8**	align/unload	8**	align/unload	8**	
unload machine	-	jog/discharge	7	jog/discharge	7					close clean door	4	
		return non-tilt	6D	return non-tilt	6D					return soil side	15	
* If desired to perform an overnight bath soak, see OPR 14 also. ** If machine has <i>Autospot-door closed</i> , see OPR 9 also. *** For machines configured for <i>WTB+</i> operation, this is the manual operation summary only. See operator manual for automatic operation.												

**Monitor Normal Operation**—See FIGURE 4.

## WTB+ SUPPLEMENTAL OPERATING INFORMATION

This section supplements “OPERATING WASHER-EXTRACTORS THAT USE THE MARK II, III, IV, AND V MICROPROCESSOR CONTROLLER” (see Table of Contents) for machines configured for *WTB+* operation. A machine equipped for *WTB+* operation can cyclically receive, process, and discharge loads automatically, under the direction of a Miltrac system controller.

**NOTE:** *WTB+* is not a model number or part of a model number. As of this writing, it is an informal label given to certain washer-extractor models, furnished with certain optional hardware, and configured for operation within an automated laundry system. The + in *WTB+* distinguishes it from no-longer manufactured machines such as the 72044*WTB* used in older Milnor<sup>®</sup> *hands-off* washing systems and from washer-extractors used in semi-automated systems, designated *WTB-*.

### WTB+ Procedures Used in Normal Operation

**WTB+ Modes of Operation**—In addition to the operating modes described in “OPERATING WASHER EXTRACTORS . . .,” *WTB+* machines can be set for *automatic*, *semi-automatic*, or *stand-alone* operation.

**Automatic Mode**—In this mode (normal operating mode), the machine is on-line to the washing system. When powered on and started, the machine will operate automatically (load, run a formula, discharge, wait for an available load or discharge device) in response to commands from the system controller unless stopped due to an error. Leave the *Manual/Automatic keyswitch* set to *automatic* for normal automatic operation.

**NOTE:** Automatic loading and unloading sequences vary with different washer-extractor models, optional equipment, interfacing devices, and software versions. See “DEVICE COMMUNICATION FOR *WTB+* . . .”

**Semi-Automatic Modes**—A *Load Allowed/Not Allowed switch* and a *Discharge Allowed/ Not Allowed switch* may be furnished for each machine in the system. These controls will be located on the system control box, not on the machine. Use these to disable/enable loading (receiving) and unloading (discharging) respectively. For example, set the *Load Allowed/ Not Allowed switch* to *Not Allowed*, to prevent a machine from taking another load after it discharges its current load. This will only disable loading; the machine will perform all other functions automatically.

**Stand-Alone Mode**—Although Milnor<sup>®</sup> recommends against using the machine in a *stand-alone* mode for normal production, this may be done provided personnel understand the safety considerations and comply with applicable safety instructions. Stand-alone operation is the same as for a washer-extractor not equipped for *WTB+* (see “OPERATING WASHER EXTRACTORS . . .”). Set the *Manual/Automatic keyswitch* to *manual* to take the machine off-line for stand-alone operation or error correction.

**Recovery Actions**—Before the machine will begin operating on-line, it must move to the loading position (tilted rearward, door open fully, and dryell, if furnished, up and locked) and receive load status information from the operator. If automatic mode is selected, the operator alarm will sound as soon as the *Master switch* is set to *on*.

### ⚠ DANGER ⚠



**STRIKE / CRUSH HAZARD**—Machines in the washing system move automatically and will strike or crush anyone in their path.

- ☞ Do not enter the washing system's restricted area without authorization.
- ☞ Do not attempt to operate a WTB+ washer-extractor in stand-alone mode while other machines in the washing system are operating automatically.

If the machine is not in the loading position, it will move to this position when started.

WAIT FOR  
*condition*

When the display at left appears, where *condition* is any condition displayed below,

①

**Starts the machine and silences the operator alarm.** The machine moves to the loading position.

While the machine is in motion, the controller displays the following:

WAIT FOR  
DRYELL LOCKED UP

WAIT FOR  
FULL DOWN

WAIT FOR  
DOOR FULL OPEN

**NOTE:** If the machine is already in the loading position at power-up, the controller will immediately prompt for load status and cake data, as explained below. The operator may start the machine (press the *Start button*) before or after entering cake data. Once the machine is started and all data is entered, the machine functions under the control of the washing system. The machine may summon a shuttle at any time.

### ⚠ DANGER ⚠



**STRIKE / CRUSH HAZARD**—A traveling machine such as a shuttle can strike, crush, or entrap you if you enter its path. Traveling machines or their components can move automatically in any direction. Placing a system machine on line by energizing the machine control may immediately summon a shuttle or other traveling machine.

- ☞ Keep yourself and others clear of movement areas and paths.
- ☞ Understand the consequences of placing a system machine on line.
- ☞ Know the location of all emergency stop switches, pull cords, and/or kick plates and use them in an emergency to stop machine motion.
- ☞ Know the location of the main machine disconnect and use it in an emergency to remove all electric power from the machine.

When the machine is in the loading position, the controller prompts for the status of the load, as follows:

DO I HAVE A LOAD?  
0 NO [1=YES]

0 , NEXT

(No) starts automatic operation (tells Miltrac *load desired*) unless loading has been disabled (see “Semi-Automatic Modes”).

or 1 ABC , NEXT

(Yes) displays the following prompt.

I AM  
0 LOADING [1=DISC]

0 , NEXT

(Loading) closes the door then prompts for cake data.

or 1 ABC , NEXT

(Discharging) prompts for cake data then tells Miltrac *discharge desired* (unless discharging has been disabled).

**Cake Data**—Cake data is the set of batch codes assigned to each load to identify it. Some cake data is used by the washing system to determine the processing and routing of loads. This data is passed electronically, from one device to the next, concurrent with the movement of loads. Some data is also needed by the Mildata<sup>®</sup> computer (if used) for accounting and other administrative purposes. At power-up and after correcting certain errors, if a load remains in the machine, the operator must supply cake data for it. The controller will prompt for the data needed.

**RUN FORMULA**      **00**

**CUSTOMER CODE**

Maximum Number of Characters

Alphanumeric or Numeric

Batch Code		
Customer Code	A	10
Employee Number	N	5
Weight	N	3
Pieces	N	4
Lot Number	A	10
Dry Code	N	2
Destination Code	N	2

When the display at left appears,  
**<xx>**      **Selects the formula**, where <xx> is a two-digit number from 01 to 98. The formula name and number appear if a valid formula was selected. “INVALID FORMULA” appears for a non-existent formula.

**NEXT**      **Accepts the value entered above.**

When any prompt shown at left appears (depends on configuration),  
**<response>**      **Enters the requested batch code**, where <response> is the number or alpha characters described at left.

**NEXT**      **After each code, accepts entered value and prompts for next code.**

## Summary of Operation

The operator actions listed here correspond to headings in “Normal Operation . . .” in the WTB+ operator manual (MAUEWOPRAU).

### Start the Operating Day

- Be safe.** Comply with all safety instructions.
- Verify switch positions (see “WTB+ Modes of Operation” herein).
- Energize microprocessor controller (see “Recovery Actions” herein).
- Energize machine control (see “Recovery Actions” herein).
- Enter cake data (see “Cake Data” herein).

**Monitor Normal Operation**—In addition to the processing displays described in “OPERATING WASHER-EXTRACTORS . . .” several displays indicate the machine’s status during loading and unloading (see “Recovery Actions” herein).

## Error Correction

Should an error requiring operator attention occur during loading, processing, or discharging, the operator alarm will sound and an error message will be displayed. See “WASHER-EXTRACTOR ERROR MESSAGES” for an explanation of the error condition. If the error occurred during loading or discharging or was the result of a power loss, the machine will execute the recovery sequence, with one of the following consequences:

- If the operator answers *no* to the *Do I have a load?* prompt, the controller returns to the *load desired* status, regardless whether the error occurred during loading, processing or discharging.
- If the operator answers *yes* to the *Do I have a load?* prompt and the error occurred during loading or processing, the controller prompts for load data then starts (or restarts) the formula.
- If the operator answers *yes* to the *Do I have a load?* prompt and the error occurred during discharge, the controller prompts for load data then restarts the discharge sequence.

## USING THE FIVE-COMPARTMENT FLUSHING SUPPLY INJECTOR

Five-compartment supply injectors are optional on most rigid washer-extractor models and standard on most suspended models. FIGURE 1 depicts the supply injector used on 75-135 lb. capacity models. Injectors on other models vary in appearance but not in function.

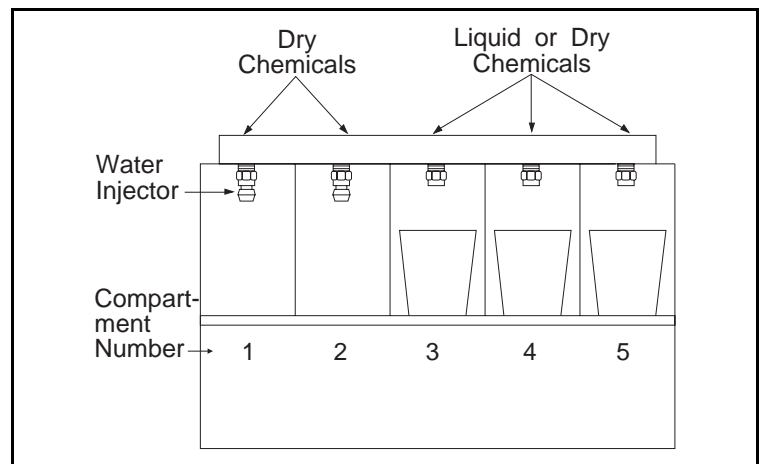
### General Guidelines

*Compartments 1 and 2* are intended for dry chemicals (e.g., soap, alkali) which may be placed directly into the compartment.

*Compartments 3, 4, and 5* may be used for liquid or dry chemicals (e.g., bleach, sour, softener) and are furnished with plastic cups. Liquid chemicals are recommended because they are more easily measured and diluted. When dry chemicals are to be injected from cups, drill a 1/8" (3mm) diameter hole just above the base of the cup to allow it to drain automatically.

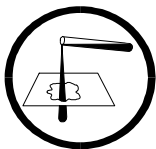
Restrict starch to compartment 5, if possible.

**NOTE:** All machines are furnished with a soap chute which may be used to manually inject chemicals directly into the cylinder at any time.



**FIGURE 1** (MSOP0207AE)  
**Five-Compartment Flushing Supply Injector**  
**for 75-135 Pound Washer-Extractors**  
**(Injectors for Other Machines Similar)**

### ⚠ CAUTION ⚠



**MACHINE DAMAGE HAZARD**—Stainless steel surfaces can corrode if chemicals (e.g., bleach) dry on them, leaving residue. Rubber and plastic components (other than plastic cups) can deteriorate from exposure to chemical concentrates.

☞ **Keep surfaces clean.**

## Operator Guidelines

### Load Chemicals According to Formula Instructions

For *System 7 (non-programmable) controllers*, refer to the wash formula descriptions for chemical loading instructions (which chemicals to preload into which pockets).

For *E-P Plus or Mark II, III, IV, and V controllers*, refer to the wash formula descriptions for any fixed (factory-supplied) formulas employed. For field-programmed formulas, refer to instructions prepared locally.

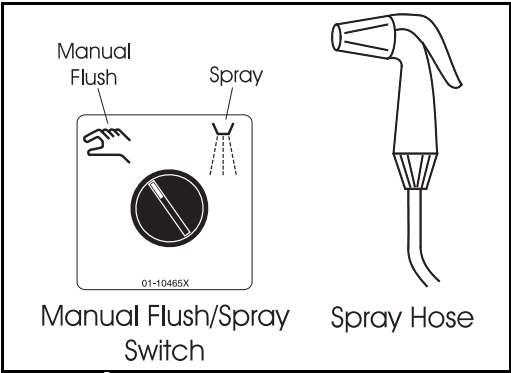
Load the supply injector before starting a cycle. Each chemical is automatically *flushed* into the washer at the proper moment. If supply compartments need to be re-loaded during the cycle, the operator signal and a display message will alert you.

Protect Against Corrosion Damage

- When loading compartment 3, 4, or 5, place chemical into cup and direct flushing water into it. Do not place chemical directly into the compartment. This is especially true for dry bleach.
- Avoid spilling any chemically active concentrate directly onto machine surfaces.
- Spray all supply compartments with water at the end of each day’s production.
- Carefully clean away any rust from the supply injector at least once a week.
- Notify management if injection water does not completely flush chemicals into the machine, or if machine components corrode.

Some washer-extractors are equipped with a *Manual Flush switch* and/or spray hose shown in FIGURE 2.

- Hold the switch at *Manual Flush*, to flush the contents of the first compartment into the basket.
- Hold the switch at *Spray* and use the hose to assist chemicals into the cylinder and to clean the supply injector at the end of the day.



**FIGURE 2** (MSOP0207AE)  
**Manual Flush/Spray Switch  
and Spray Hose**

Formula Development Guidelines

Protect Against Corrosion Damage

- Verify that chemical injection durations ensure complete flushing. It is recommended to extend injections 30 seconds beyond the required time, for safety.
- If surface deterioration persists, check for intermittent low water pressure. If dry bleach is used, try changing the brand of bleach.

**Determine Bleach Quantity and Concentration**—The supply cups are large enough to contain all the chemicals required for a given bath. For bleaching, however, a concentration higher than 1% may be required. For the normal practice of 64 ounces (1893 ml) of 1% solution per 100 pounds (45 kg) of goods, use the quantities and concentrations shown in the table at right. These may be used with complete confidence since the diluting action of the supply injector will reduce the actual strength of the bleach to less than 1% prior to injection.

**Determine the Type of Starch**—The supply injector is normally connected to a source of hot water. However, some types of dry starch may require cold water to prevent them from becoming too “gooey.” If you have difficulty injecting dry starch automatically, the supply injector can be modified to flush one compartment with cold water. Consult the Milnor<sup>®</sup> factory for more information.

Washer Capacity pounds (kg)	Bleach Quantity and Concentration ounces (ml)
35 (15.9)	6 ounces (177) of 4%
50 (22.7)	8 ounces (237) of 4%
55 (24.9)	9 ounces (266) of 4%
60 (27.2)	10 ounces (296) of 4%
75 (34.0)	12 ounces (355) of 4%
90 (40.8)	14 ounces (414) of 4%
125 (56.7)	15 ounces (444) of 4%
135 (61.2)	16 ounces (473) of 4%
200 (90.7)	16 ounces (473) of 8%
250 (113.4)	20 ounces (591) of 8%
300 (136.1)	24 ounces (710) of 8%
450 (204.1)	36 ounces (1065) of 8%
700 (317.5)	56 ounces (1656) of 8%

## MODIFYING FORMULAS IN PROGRESS

The operator can manually override certain programmed values (e.g., commanded bath temperature) and invoke certain functions (e.g., chemical injection) on the Mark II, III, IV, and V microprocessor washer-extractor and FxW controllers, *while a formula is in progress*. This can be done either 1) one action at a time, with the formula running (*method A*), or 2) one or more actions simultaneously, with the formula temporarily suspended, using the *manual mode (method B)*. *Method A* applies to baths, drains, and extracts. *Method B* only applies to baths. Certain actions are exclusive to each method.

If a password is not enabled (*configure decision X*), both methods are available to anyone. If a password is enabled, both methods are password-protected.

### Method A: Individual Modifications With the Formula Running

#### Method A: General Procedure

10:38 F0005S03 02:37  
dF=A093/D140 LEV2

When a formula is running and a run display such as the example at left appears,

**<command>** Either 1) causes the commanded action to occur or 2) prompts for the password, where <command> is the key or key combination explained in “Method A: Actions Available. . .” below.

ENTER PASSWORD :






If the display shown at left appears,

**<password>** Enters the password, where <password> is the four digit numerical pass code configured. The initial command that prompted the password must be re-entered; however, the controller will permit several actions to be performed after entering <password>, provided the key strokes are no more than ten seconds apart. The *Start button* (①) and *Stop button* (⓪) are not password-protected.

INVALID PASSWORD :

If the display shown at left appears, an invalid or no password was entered. Repeat <command>, <password>, <command> with the valid password.

**Method A: Actions Available During Wash, Drain, and Extract**—The following actions (other than manually stopping and starting the timer) can be invoked with the formula timer stopped or running.

-  Stops the formula timer. Any functions in progress continue.
-  Resumes timing if the timer is stopped.
- ① Stops the formula in progress. Any functions in progress, cease. ① resumes the formula.
- ①,  Cancels the formula in progress. Formula cannot be resumed.
-  Extends a bath or extract in progress one minute (repeat for each additional minute).  
Extends a drain in progress ten seconds (repeat for each additional ten seconds).
-  Cancels a bath, a drain proceeding a bath, or an extract in progress, and proceeds to the next step. This action will not cancel a drain proceeding an extract.

Method A: Actions Available During Wash Only

**WASH MOTOR SPEED** + **↑** / **↓**

**Increases/decreases basket speed** (if so equipped). If machine has *two speed wash*, during a bath, this action moves the commanded speed between 0 (normal) and 1 (low). If the machine is equipped with *variable speed*, this action increases/decreases the RPMs (if speed is programmed in RPMs), or increases/decreases the percent of normal speed (if speed is programmed in percent). The display skews approximately two units per second.

**LEVEL** + **↑** / **↓**

**Raises/lowers the commanded level.** If the machine is configured for *preset levels*, this action moves *commanded* level between 1 (below low level), 2 (low level), and 3 (high level). If levels are programmed in inches/centimeters, this action increases/decreases the inches/centimeters *commanded*, within the allowable limits configured. This action is unavailable on machines with *metered water*.

If level was previously achieved, the display only shows *actual* level, not *commanded* level. When commanded level is raised, the controller injects water using the water valves/thermo-modulation commanded for this bath in the formula. Lowering the commanded level has the following limitations: 1) the controller will not permit lowering the *commanded level in a bath preceeding an extract* and 2) *the machine will not respond by draining, but it will remain at a lower level if the higher commanded level was not achieved.*

**ENTER NEXT** + **↑** / **↓**

**Raises/lowers commanded bath temperature** (if so equipped). A higher *commanded* temperature can be achieved by thermo-modulation or steaming if conditions permit. The machine can only achieve a lower commanded temperature by thermo-modulation and only if the commanded level is not yet achieved.

hold **CHEM** + <x>

**Injects a chemical** (from Chem 1 to Chem 8, if so equipped) any time during a bath (without consideration for level/temperature achieved), as long as keys are held depressed. <x> is the chemical number from 1 to 8. Injection continues for one second after keys are released.

hold **CHEM** + **0** + <y>

**Injects a chemical** (from chem 9 to chem 15, if so equipped) any time during a bath (without consideration for level/temperature achieved) as long as keys are held depressed. <y> is the number from 1 to 7, indicated by the table at right.

<y>	Chemical
1	9
2	10
3	11
4	12
5	13
6	14
7	15

hold **CHEM** + **↓**

**Flushes the supply injector manifold** (if so equipped) as long as keys are held depressed.



# Method B: Multiple Modifications With the Formula Temporarily Suspended Using Manual Mode (accessible during baths only)

## Method B: General Procedure

10:38 F0005S03 02:37  
dF=A093/D140 LEV2

When a formula is running and a run display such as the example at left appears,



Either 1) places the machine in *manual mode* or 2) prompts for the password. In *manual mode*, the timer stops, all water/steam/chemical valves close, and the *manual mode* display appears.

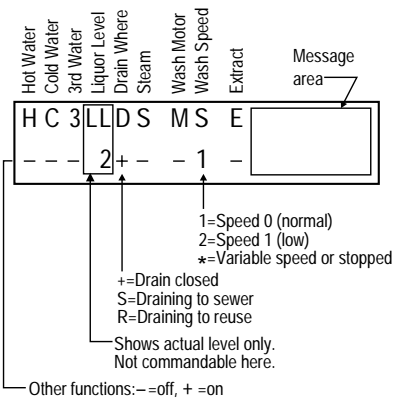
ENTER PASSWORD :

If the display shown at left appears,

<password> Enters the password, where <password> is the four digit numerical pass code configured. Press within ten seconds after entering <password>.

INVALID PASSWORD :

If the display shown at left appears, an invalid or no password was entered. Repeat , <password>, with the valid password.



When the *manual mode* display appears, (alternating with the normal run displays) as shown at left,

<command> Causes the commanded action to occur, where <command> is the key or key combination explained in “Method B: Actions Available” below.



Turns off any action currently invoked.

Exits *manual mode* (resumes timing and normal run displays) if all manual actions were cancelled. Any chemical injections that were interrupted will not be resumed.

**Method B: Actions Available**—The following actions can be invoked in the *manual mode*. Any one or more actions invoked by the following commands, except for those that require holding the keys depressed, will be terminated with .

- Injects hot water** (if so equipped). Water valve closes at level 3. Hold key depressed for more water.
- Injects cold water**. Water valve closes at level 3. Hold key depressed for more water.
- Injects third water** (if so equipped). Water valve closes at level 3. Hold key depressed for more water.
- Closes steam/water valves, displays *cooldown* message, and injects cooldown water** (if so equipped).
- Injects steam** (if so equipped and level 1 is satisfied). Steam valve closes once bath temperature reaches 270°F (27°C). Hold key depressed for more steam.

- Closes water/steam/chemical valves, disables reuse drain (if equipped), and drains bath to sewer.
- Disables sewer drain, closes water/steam/chemical valves, and drains bath to reuse (if so equipped).
- Turns the wash motor on. Motor starts with a delay, but powers off instantly with brake not applied.
- Displays basket speed (if equipped with two-speed or variable speed wash).
- + / Increases/decreases basket speed as explained in *method A*.
- + If level 2 is satisfied, drains to sewer and either 1) accelerates to extract speed, or 2) prompts for an extract speed (if two-speed extract).
- + If level 2 is satisfied, drains to reuse (if so equipped) and either 1) accelerates to extract speed, or 2) prompts for an extract speed (if two-speed extract).

HC3LLDS MS E EXTRACT  
---02\*- -\* - 0=L 1=H

If the extract speed prompt shown in the message area of the *manual mode display* at left appears,

<x> Accelerates to the commanded extract speed if level 2 is satisfied, where <x> is 0 (low extract) or 1 (high extract).

hold + <x> Injects a chemical (from chem 1 to chem 8, if so equipped) as long as keys are held depressed, where <x> is the chemical number.

hold + + <y> Injects a chemical (from chem 9 through chem 15, if so equipped), where <y> is the number from 1 through 7 indicated by the table at right.

<y>	Chemical
1	9
2	10
3	11
4	12
5	13
6	14
7	15

hold + Flushes the supply injector manifold (if so equipped) as long as the keys are held depressed.

## Using Formula 99 to Develop/Test a New Formula

*Formula 99* is a 63.75 minute bath with no water or any other functions and with the cylinder stopped. To develop/test a process without programming a new formula, run *Formula 99* and use the “Method B” procedures described herein.

**NOTE 1:** *Formula 99* is available provided the machine is not on line to Mildata®.

**NOTE 2:** Even if the password is enabled, the controller permits modifying *Formula 99* without the password. However, *Formula 99* cannot be copied, deleted, or permanently changed.

# **Section**

# **Troubleshooting**

**4**

# ERROR MESSAGES ON THE MARK II, III, IV, AND V MICRO-PROCESSOR WASHER-EXTRACTOR CONTROLLER

## Errors At Power-Up (or Power Restoration)

**Memory Errors**—These errors occur when field data stored in the microprocessor's memory becomes unreliable as a result of: 1) a power loss while the controller is in a *program mode*, 2) improper use of the *Run/Program keyswitch*, 3) a loss of back-up power to microprocessor components, or 4) a power surge at power-up. The risk of these errors occurring is minimized and data restoration is simplified if the precautions in "IMPORTANT OWNER/USER INFORMATION . . ." (see Table of Contents) are followed.

ACCUM. DATA ERROR  
NEXT TO CLEAR DATA

Accumulator data (e.g., count of loads processed) has become unreliable.

**NEXT**

**Resets counters to zero** (the only action permitted).

CLEAR MEMORY NOW  
PRESS 4 + 5 + 6

Formula data and possibly configure data have become unreliable.

**4**  
JKL

**5**  
MNO

**6**  
PQR

**Clears field-programmed formulas, and step/chemical names** (the only action permitted).

After clearing formula data, perform the following actions:

1. Step through all configure decisions and verify each value (*program mode 5, Configure*).
2. Rename steps and/or chemicals, if desired (*program modes 3, Change Step Names* and *4, Change Chem Names*).
3. Program the formulas (*program mode 1, Add/Change Formulas*).

CONFIG ERROR  
TURN KEY TO PROG

Configure data has become unreliable.



**Accesses mode 5, Configure, and displays Page A-T for reconfiguration**  
Step through all configure decisions and verify each value.

LOST WATER DATA  
NEXT TO PROCEED

(Machines with *metered water* only) Water data for a formula which was resumed after a power loss has become unreliable. Controller cannot tell if machine has water.

**NEXT**

**Clears the error message. The user is prompted whether or not to refill.**

**Hardware Errors**—These errors usually result from hardware failure. See precaution on next page.

**board name FAILED**  
CHECK THIS BOARD

These messages available in English only

The controller detects a failed or missing control circuit board. *board name* can be *16/8 BOARD*, *16 OUT #1*, *16 OUT #2*, *A/D BOARD*, or *D/A BOARD*. This error can also result from configuring the machine for an option not furnished, installing a new board, or installing software that was configured for an option not on this machine.

**CANCEL**  
**ESCAPE**

**Clears the error message**, permitting access to the *Program Menu*. It also permits running a formula, if the cause of the error has been corrected.

\*--KEYPAD ERROR--\*  
**key name**

The keypad key named on the second line shorted or failed to release, requiring keypad replacement. See also *display freezes* in "Errors While Programming."

# Errors While Operating

**PRECAUTION:** Before troubleshooting operating errors, review safety instructions in applicable manuals.

**Errors That Disable the Three-Wire Circuit (Immediately Stops All Machine Functions)**—The *three-wire relay* provides control circuit power to the machine. Once energized by momentarily depressing the *Start button*, the *three-wire relay* is held energized by its own normally open contact, in series with numerous other safety devices (e.g., motor overloads, tilt limit switches, door interlock). Should any of these contacts open, even momentarily, all machine functions stop immediately, inlet valves close, the drain opens, the operator alarm sounds, and the appropriate *error* message appears.

3 WIRE DISABLED  
FAULT : message

These messages available in English only

The *three-wire relay* became de-energized for the reason indicated by *message*.  
1 Resumes the cycle (or enables the *three-wire circuit*), clears the error message, and silences the operator alarm, providing the cause of the error has been corrected.

Message	Explanation
DOOR	Door interlock relay indicates door is or was open.
WASH OVERLOAD	Wash motor overload opened.
VARIABLE SPEED	Variable speed drive unit malfunctioned. Check the variable speed drive unit display for an error code and refer to the manual for this unit.
DRAIN OVERLOAD	Drain motor overload opened.
E1 OVERLOAD	E1 (low-speed extract) motor overload opened.
E2 OVERLOAD	E2 (high-speed extract) motor overload opened.
FRONT UP	Front of machine not full down, or front down switch, relay, or circuitry malfunctioned.
REAR UP	Rear of machine not full down, or rear down switch, relay, or circuitry malfunctioned.
SEE MANUAL	The controller cannot determine why the <i>three-wire relay</i> opened. Most often, this is the result of pressing a <i>Stop button</i> . Otherwise, see <i>three-wire circuit</i> in schematic manual.

The following errors function uniquely. On machines with *Mark I* or *Mark II* controllers, other than those configured for *WTB+* operation, the error disables the *three-wire circuit*, immediately stopping all machine functions. Once the cause of the error has been rectified, a *three-wire error message* appears, which must then be cleared, and the machine started, as previously explained. With *WTB+*, the error immediately stops all machine functions, but does not disable the *three-wire circuit*. Once the cause of the error has been rectified, automatic operation resumes. On *Mark III* and later controllers, the error indirectly causes the *three-wire circuit* to drop out. Once the cause of the error is rectified, press the *Start button*, then the *Signal Cancel button* to resume operation.

BEARING PRESSURE  
FAULT: MUST CLEAR

(On machines manufactured after December 17, 1997) Bearing pressure switch detects insufficient air pressure to maintain required pressure in the bearing housing.

BRAKE FAULT MUST BE  
CLEARED TO RESTART

Brake pressure switch detects insufficient air pressure in the brake release air cylinder to guarantee brake has released. Possible causes include low air pressure, a leaking air cylinder piston cup, pinched or leaking air lines, a leaking quick-release air valve, or a faulty pressure switch or pilot air valve. On Hydro-Cushion® models, low air pressure can result from an air line that is too small to handle the pushdown and the brake, which operate simultaneously.

**board name FAILED**  
**CHECK THIS BOARD**

The controller detects a failed *or missing* control circuit board. See “Hardware Errors” under “Errors At Power-Up . . .” in this section.

### Errors That Interrupt the Cycle,

**Usually Requiring Corrective Action**—These errors stop the formula timer and sound the operator alarm, but they do not open the *three-wire circuit*. Except where noted otherwise, the operator alarm is silenced and operation resumes as soon as the error is rectified, without additional operator action.

**CHECK DRAIN CLUTCH**

(FxF models only) Controller detects *speed switch* is not open (cylinder not turning at drain speed) when it desires extract. Possible causes are *electric drain clutch* not engaged, *drain motor* did not accelerate basket, or *speed relay* failed.

*normal run data*  
**CHECK LEVEL SWITCH**

Controller detects an error in the *level switch* circuit (e.g., *high level* is made and *low level* is not made).

*normal run data*  
**CHECK *type* PROBE**

Controller detects a steam or water temperature probe malfunction (where *type* is *STEAM* or *WATER*). Check probe position and connections at resistor board. If OK, disconnect probe and verify that lead-to-lead resistance is 2K to 35K ohms and that lead-to-ground resistance is infinite. **Once the cause of the error is remedied, press the *Signal Cancel* button to clear the error message, silence the operator alarm, and resume operation.**

*normal run data*  
**TOO LONG TO COOL**

The allotted time to cool down to the commanded temperature was exceeded (*configure decision J*). Check *cooldown* procedures in “Programming . . .” in this manual.

*normal run data*  
**TOO LONG TO FILL**

The allotted time to fill to the commanded liquor level (*configure decision I*) has been exceeded. Check for low water pressure.

*normal run data*  
**TOO LONG TO STEAM**

The allotted time to achieve the commanded temperature by steam injection (*configure decision H*) has been exceeded. Check for low steam pressure.

### Conditions That Interrupt the Cycle,

**Usually Not Requiring Corrective Action**—These conditions are normally self-correcting.

**AMPSAVER HALT**

(Machines with Ampsaver<sup>®</sup> option) The machine desires to extract but the Ampmaster controller is delaying this action until the current drawn by other machines in the system falls below the specified level (an energy saving feature).

**MILTRENCH HALT**

(Machines with Miltrench option) The machine desires to drain but the Miltrench controller is delaying this action until other machines in the system finish draining (protects against overflowing the drain trench).

*normal run data*  
**RECYCLE FAILURE**

Machine recycled five times in a single extract step. The controller will now attempt to balance the load by repeating the previous step. If problem persists, check load balance and *excursion switch* adjustment.

**SPEED SWITCH OPEN**

Controller detects *speed switch* is open—a normal condition when machine is slowing from extract. It indicates a *speed switch* circuit malfunction if cylinder is stationary.

## Errors That Interrupt Loading and Discharging

**(machines configured for WTB+ operation)**—These errors halt automatic operation and sound the operator alarm. Pressing the *Signal Cancel button* clears the error message, silences the operator alarm, and permits the machine to return to the recovery position, once the cause of the error is rectified. The controller then prompts the user for any required batch data (see “WTB+ SUPPLEMENTAL OPERATING INFORMATION”). When this data is entered, operation begins.

DISCHARGE ABORTED	The discharge sequence, initiated by the Miltrac controller, was terminated (not completed). This occurs if, during discharge, Miltrac is set to a <i>program mode</i> or loses power, or the <i>manual desired</i> input is made.
INVALID FORMULA	(Machines without Mildata <sup>®</sup> option) Miltrac requested a formula which is not programmed in this machine's formula memory.
INVALID FORM DATA	(Machines with Mildata <sup>®</sup> option) Miltrac requested a formula which is not programmed in Mildata <sup>®</sup> .
LOADING ABORTED	The loading sequence initiated by Miltrac was terminated (not completed). This occurs if, during loading, Miltrac is set to a <i>program mode</i> or loses power, or if either the <i>manual desired</i> or <i>load terminate</i> input is made.

## Errors That Interrupt User Actions

—These error messages inform the user of proper procedure.

INVALID PASSWORD	An invalid password was entered or no password was entered within 10 seconds of the <i>ENTER PASSWORD</i> message, in response to a manual intervention command.
MANUAL EXTRACT : MUST HAVE LEVEL 2	An attempt was made to command an extract manually from a bath in which <i>level 2</i> (required prior to an extract) was not yet achieved. First, command <i>level 2</i> , then permit time to achieve this level before commanding an extract.
PRESS CLEAN SIDE TRANSFER TO START	(Staph-Guard <sup>®</sup> models only) Clean side operator must press the <i>Control Release button</i> , thus transferring control to soil side before a new cycle can be started.

## Additional Errors That Interrupt User Actions (Mildata<sup>®</sup> Option)

INVALID WORK ORDER	User entered a <i>work order number</i> that is not programmed in Mildata <sup>®</sup> . Enter a valid number.
INVALID GOODS CODE	User entered a <i>goods code</i> that is not programmed in Mildata <sup>®</sup> . Enter a valid number.
INVALID CUST CODE	User entered a <i>customer code</i> that is not programmed in Mildata <sup>®</sup> . Enter a valid number.
INVALID EMPLOYEE #	User entered an <i>employee number</i> that is not programmed in Mildata <sup>®</sup> . Enter a valid number.
INVALID FORM DATA	User entered an <i>formula number</i> that is not programmed in Mildata <sup>®</sup> . Enter a valid number.
DATA UNLOCATABLE	User entered a valid code which has invalid data associated with it (e.g., user entered a <i>goods code</i> that is programmed in Mildata <sup>®</sup> , but the <i>formula code</i> assigned to that <i>goods code</i> is not programmed).

## Errors While Programming

### If a Keypad Error Occurs While Programming

*display freezes*

If the display stops responding to *valid* keypad commands, a keypad malfunction probably occurred. (The controller cannot detect and display a *Keypad Error* in any *program mode*.) If a replacement keypad is available, it is permissible for authorized service personnel, observing the hazard statement below, to replace the keypad with power on. This procedure will usually regain keypad function, thus avoiding data loss due to power loss while the machine is in the *program mode*.

#### ⚠ DANGER ⚠



**ELECTRIC SHOCK HAZARD**—Although the keypad conductors on the Mark II washer-extractor controller are potential-free, accessing the keypad connections will expose other live conductors within the electric box/enclosure.

☞ Keypad replacement must be done *only* by qualified service personnel.


☞ Ensure that body parts and metal tools do not come in contact with conductors.

**Errors While Programming Formulas**—See “1=ADD/CHANGE FORMULA” under “PROGRAMMING . . .” for a complete explanation of the following errors and the *formula programming* procedure.

**CCNN CHEM # AND NAME**  
**0600 ILLEGAL CHEM**

An attempt was made to program a chemical injection using a chemical number for which the machine is not configured (e.g., *chemical 06* on a machine with only five chemicals).

**ESCAPE? PUSH ENTER**  
**TIL END OF FORMULA**

An attempt was made to exit formula programming by pressing —an improper procedure. The user must first move to the end of the formula (*end formula* or *final extract*).

**FORM xx INCOMPLETE**  
**TURN KEY TO PROG**

An attempt was made to exit formula programming by turning the *keyswitch* to *Run* without first returning to the *Program Menu*. This is an improper procedure which causes the data for formula *xx* to become unreliable. *xx* is the formula number.



**Deletes the incomplete formula.** If no other memory errors are detected, the controller permits returning to the *Run mode*.

**Fxx TMMQCCCHC LS**  
**Syy ILLEGAL INSERT!**

An attempt was made to duplicate this step when this would result in an *illegal* condition (e.g., adjacent extract steps or two *end formula* steps). *xx* and *yy* are the formula and step numbers, respectively.

**Fxx TMMQCCCHC LS**  
**Syy ILLEGAL DELETE!**

An attempt was made to delete this step when this would result in an *illegal* condition (e.g., adjacent extract steps).

**Fxx COOLDOWN ILLEGAL**  
**Syy PRESS NEXT**

An attempt was made to create a *cooldown* step when the prerequisites are not met. Prerequisites are: 1) *cooldown* is configured (*configure decision J*), 2) the *cooldown* is not the first step in a program, and 3) the preceding step is not an extract.

**MEMORY IS FULL**  
**PRESS NEXT**

Formula memory will be exceeded with the next step, so this formula must be deleted.




**Deletes this incomplete formula.**



**Errors While Configuring**—See “5=CONFIGURE” under “PROGRAMMING . . .” for a complete explanation of the *configuration* procedure.

ESCAPE? GO TO END  
OF CONFIGURATION

An attempt was made to exit the *configure mode* by pressing —an improper procedure. Once in this mode the user must move through all decisions, whether or not they are to be changed.

**Errors While Downloading**—See “6=DOWNLOAD” under “PROGRAMMING . . .” for a complete explanation of the following errors and the *download* procedure.

DOWN LOAD ABORTED  
NEXT TO PROCEED

The user manually aborted the download on this machine, or on the sending machine, if this is a receiving machine.

ERROR IN CHECK SUM  
NEXT TO PROCEED

This receiving machine received unreliable data, possibly due to a bad connection in the serial link. Repeat the download once the problem is corrected.

[S] 9600 BAUD 000  
WAITING FOR MASTER

If this display appears after downloading has begun, this receiving machine is not receiving data, possibly due to a bad connection in the serial link. Repeat the download once the problem is corrected.

B

Warning Messages

RUN FORMULA  
CHECK BRAKE PADS

This display appears only during the start of a formula when the brake pad input is made on machines with a disc brake. Using appropriate safety precautions, check the brake pads for wear. Replace if necessary. See instructions for replacing and checking brake pads in the installation and service manual.

## MONITORING MICROPROCESSOR INPUTS AND OUTPUTS FOR MARK II AND III WASHER-EXTRACTORS

This section identifies all inputs and outputs used in the Mark II and III, microprocessor controller. The current state of all inputs (made or not made) and the current state of most outputs (energized or not energized) can be displayed *while a formula is running or stopped due to an error condition*. This is real-time information. Any change in the state of the input or output is displayed *as it occurs*.

**NOTE 1:** See “MANUAL MODE MENU . . .” (see Table of Contents) for instructions on testing outputs and viewing inputs *while the machine is idle*.

**NOTE 2:** See “DEVICE COMMUNICATION FOR WTB+ WASHER-EXTRACTORS . . .” for additional information about inputs and outputs on machines configured for *WTB+* operation.

Inputs

10:38 F0005S03 02:37  
dF=A093/D140 LEV2

3 WIRE DISABLED  
FAULT : SEE MANUAL

0 = First 16 inputs (8/16 Board #1)  
1 = Second 16 inputs (8/16 Board #2  
- WTB + only)  
2 = Third 16 inputs (direct inputs-  
processor board)

(0) A B C D E F G H I J K L M N O P
- - + + - - - + - - - - -

Top line shows input letter (see  
"Table of Inputs"). Bottom line shows  
status: - = not made, + = made.

When a formula is running and a normal run display or error display similar to the displays at left appears,

- hold 7
- Displays the *first* 16 inputs: (0) A through P.
- hold 7 + 1
- Displays the *second* 16 inputs: (1) A through P.
- hold 7 + 2
- Displays the *third* 16 inputs: (2) A through P.

When the *input status display* appears as in the example at left, see the “Table of Inputs” below, for input descriptions.

Table of Inputs

Dis- play Code	(0) A through P (8/16 Board #1)		(1) A through P (8/16 Board #2 - WTB+ only)		(2) A through P (direct inputs -processor board)	
	Input Name	Connector/Pin	Input Name	Connector/Pin	Input Name	Connector/Pin
A	Rear Up	1MTA3-10	Dryell Locked Up	2MTA3-10	Mildata	MTA38-8
B	Door Closed	1MTA3-9	Dryell Down	2MTA3-9	Program Key	MTA38-3
C	Level 3 or Extract Position	1MTA3-8	Eye Blocked	2MTA3-8	Signal Cancel	MTA38-2
D	Level 2 or Wash Position	1MTA3-7	Door Full Open	2MTA3-7	Coarse Balance	MTA38-5
E	Level 1 or Not Used	1MTA3-4	Allied Load Terminate	2MTA3-4	Excursion	MTA38-6
F	Check Drain Clutch	1MTA3-3	Allied Start Discharging	2MTA3-3	Three Wire	MTA38-7
G	Don't allow Chems	1MTA3-2	Manual Desired (WTB+)	2MTA3-2	Brake Pad	MTA39-3
H	Speed Switch	1MTA3-1	Not Used	2MTA3-1	Not Used	MTA39-2
I	Ampsaver	1MTA4-10	Full Down (tilted rearward)	2MTA4-10	Clean Control Request	MTA39-1
J	Front Not Down	1MTA4-9	Full Up (tilted forward)	2MTA4-9	Drain Saver (Miltrench)	MTA39-6
K	Not Used	1MTA4-8	Timer Stop Input	2MTA4-8	Load Requested (WTB-)	MTA39-5
L	Brake is Off	1MTA4-7	Unload Allowed	2MTA4-7	Manual Desired (WTB-)	MTA39-4
M	E2 Overload	1MTA4-4	Load Allowed	2MTA4-4	—	—
N	E1 Overload	1MTA4-3	Allied Start Loading	2MTA4-3	—	—
O	Drain Overload	1MTA4-2	Not Used	2MTA4-2	—	—
P	Wash Overload	1MTA4-1	Load Terminate	2MTA4-1	—	—

NOTE: Formula bit and weight bit inputs are available on a third input board, but cannot be viewed.

Outputs

10:38 F0005S03 02:37  
dF=A093/D140 LEV2

3 WIRE DISABLED  
FAULT : SEE MANUAL

0 = First 16 outputs (on 8/16 Board #1 and 16 Out Board #1)  
1 = Second 16 outputs (on 16 Out Board #1 and 8/16 Board #2- WTB + only)  
2 = Third 16 outputs (on 16 Out Board #2)

(0)    a b c d e f g h i j k l m n o p  
      - - - - + - - - - - + - - - +

Top line shows output letter (see tables of outputs). Bottom line shows status: - = not energized, + = energized.

When a formula is running and a normal run display or error display similar to the displays at left appears,

- hold 8
- Displays the *first* 16 outputs: (0) a through p.
- hold 8 + 1
- Displays the *second* 16 outputs: (1) a through p.
- hold 8 + 2
- Displays the *third* 16 outputs: (2) a through p.

**NOTE:** The fourth 16 and last 8 outputs (see tables) are not viewable because they apply to functions on *WTB+* models that never occur while a formula is running and cannot be tested while the output displays are accessible.

When the *output status display* appears as in the example at left, see the following tables of outputs for output descriptions.

Table of *First 16 Outputs: (0) a through p*

Dis- play Code	Output Name	Connector/Pin		
		Common	Normally Open	Normally Closed
8/16 Board #1				
a	Drain Motor	1MTA5-9	1MTA5-8	1MTA5-10
b	Cooldown	1MTA5-6	1MTA5-5	1MTA5-7
c	Extract Position	1MTA5-4	1MTA5-3	1MTA5-1
d	Chem 4	1MTA5-2	1MTA6-10	1MTA6-3
e	Chem 1	1MTA6-1	1MTA6-2	N/A
f	Chem 3	1MTA6-4	1MTA6-5	N/A
g	Chem 2	1MTA6-6	1MTA6-7	N/A
h	Chem 5	1MTA6-8	1MTA6-9	N/A
16 Out Board #1				
i	High Extract	1MTA13-9	1MTA13-8	1MTA13-10
j	Balance / Spray Down / Transfer Control	1MTA13-6	1MTA13-5	1MTA13-7
k	Low Extract	1MTA13-3	1MTA13-4	1MTA14-10
l	CW Wash	1MTA13-1	1MTA13-2	1MTA15-10
m	CCW Wash	1MTA14-8	1MTA14-7	1MTA14-9
n	Steam Valve	1MTA14-5	1MTA14-6	N/A
o	Signal	1MTA14-3	1MTA14-4	N/A
p	Three Wire Relay	1MTA14-1	1MTA14-2	N/A

**Table of *Second* 16 Outputs: (1) a through p**

Dis- play Code	Output Name	Connector/Pin		
		Common	Normally Open	Normally Closed
16 Out Board#1				
a	Brake Release	1MTA15-7	1MTA15-8	N/A
b	Water Valve #1	1MTA15-5	1MTA15-6	N/A
c	Water Valve #2	1MTA15-3	1MTA15-4	N/A
d	Water Valve #3	1MTA15-1	1MTA15-2	N/A
e	Sewer Drain	1MTA16-7	1MTA16-8	N/A
f	Reuse Drain	1MTA16-5	1MTA16-6	N/A
g	Wash Clutch	1MTA16-3	1MTA16-4	N/A
h	Push Dn/Bot Fil/Wash Pos.	1MTA16-1	1MTA16-2	N/A
8/16 Board #2 - WTB+ Only (optional)				
i	Discharge Commanded	2MTA5-9	2MTA5-8	2MTA5-10
j	Dryell Up Lock Release	2MTA5-6	2MTA5-5	2MTA5-7
k	Load/Unload Allowed	2MTA5-4	2MTA5-3	2MTA5-1
l	Load Commanded	2MTA5-2	2MTA6-10	2MTA6-3
m	Flush Dryell	2MTA6-1	2MTA6-2	N/A
n	Load Desired	2MTA6-4	2MTA6-5	N/A
o	Dryell Move Up	2MTA6-6	2MTA6-7	N/A
p	Dryell Move Down	2MTA6-8	2MTA6-9	N/A

**Table of *Third* 16 Outputs: (2) a through p**

Dis- play Code	Output Name	Connector/Pin		
		Common	Normally Open	Normally Closed
16 Out Board #2 (optional)				
a	Chem 14	2MTA13-9	2MTA13-8	2MTA13-10
b	Chem 9	2MTA13-6	2MTA13-5	2MTA13-7
c	Chem 13	2MTA13-3	2MTA13-4	2MTA14-10
d	Flush	2MTA13-1	2MTA13-2	2MTA15-10
e	Chem 15	2MTA14-8	2MTA14-7	2MTA14-9
f	Chem 11	2MTA14-5	2MTA14-6	N/A
g	Chem Save	2MTA14-3	2MTA14-4	N/A
h	Drain Saver (Miltrench)	2MTA14-1	2MTA14-2	N/A
i	Chem 10	2MTA15-7	2MTA15-8	N/A
j	Amp Saver	2MTA15-5	2MTA15-6	N/A
k	Chem 6	2MTA15-3	2MTA15-4	N/A
l	Chem 7	2MTA15-1	2MTA15-2	N/A
m	Chem 8	2MTA16-7	2MTA16-8	N/A
n	Chem 12	2MTA16-5	2MTA16-6	N/A
o	Recirculate	2MTA16-3	2MTA16-4	N/A
p	Machine Moving	2MTA16-1	2MTA16-2	N/A

**Table of *Fourth* 16 Outputs: (not viewable)**

B

Output Name	Connector/Pin		
	Common	Normally Open	Normally Closed
<b>8/16 Board #3 (optional)</b>			
Drycode Bit 0	3MTA5-9	3MTA5-8	3MTA5-10
Drycode Bit 1	3MTA5-6	3MTA5-5	3MTA5-7
Drycode Bit 2	3MTA5-4	3MTA5-3	3MTA5-1
Drycode Bit 3	3MTA5-2	3MTA6-10	3MTA6-3
Destination Code Bit 0	3MTA6-1	3MTA6-2	N/A
Destination Code Bit 1	3MTA6-4	3MTA6-5	N/A
Destination Code Bit 2	3MTA6-6	3MTA6-7	N/A
Destination Code Bit 3	3MTA6-8	3MTA6-9	N/A
<b>16 Out Board #3 - WTB+ Only (optional)</b>			
Discharge Desired	3MTA13-9	3MTA13-8	3MTA13-10
Load/Unload Terminate	3MTA13-6	3MTA13-5	3MTA13-7
Deflate Dryell Up Seal	3MTA13-3	3MTA13-4	3MTA14-10
Flag Down	3MTA13-1	3MTA13-2	3MTA15-10
Dryell Blow	3MTA14-8	3MTA14-7	3MTA14-9
Discharge Terminated	3MTA14-5	3MTA14-6	N/A
Sequencer Load Desired	3MTA14-3	3MTA14-4	N/A
Sequencer Load Allowed	3MTA14-1	3MTA14-2	N/A

**Table of *Last* 8 Outputs: (not viewable)**

Output Name	Connector/Pin		
	Common	Normally Open	Normally Closed
<b>16 Out Board #3 - WTB+ Only (optional)</b>			
Sequencer Flag Down Discharge	3MTA15-7	3MTA15-8	N/A
Sequencer Load/Unload Terminate	3MTA15-5	3MTA15-6	N/A
Sequencer Discharge Desired	3MTA15-3	3MTA15-4	N/A
Sequencer Discharge Allowed	3MTA15-1	3MTA15-2	N/A
Start Discharging	3MTA16-7	3MTA16-8	N/A
Start Loading	3MTA16-5	3MTA16-6	N/A
Not Used	3MTA16-3	3MTA16-4	N/A
Not Used	3MTA16-1	3MTA16-2	N/A

## MONITORING MICROPROCESSOR INPUTS AND OUTPUTS FOR MARK IV AND V WASHER-EXTRACTORS

This section identifies all inputs and outputs used in the Mark IV and V washer-extractor controller. The current state of all inputs (made or not made) and the current state of most outputs (energized or not energized) can be displayed *while a formula is running or stopped due to an error condition*. This is real-time information. Any change in the state of the input or output is displayed *as it occurs*.

Many inputs and outputs are located on input/output boards. Each board has 16 input devices, eight output relays, and 25 status lights. One light blinks when the board is sending signals. Each of the remaining lights represents an input (green) or output (red) and illuminates when the corresponding input or output is made.

Some outputs are located on output boards. Each board has 16 input devices, eight output relays, and 25 status lights. One light blinks when the board is sending signals. Each of the remaining lights represents an output and illuminates when the corresponding output is made.

**NOTE 1:** See “MANUAL MODE MENU . . .” (see Table of Contents) for instructions on testing outputs and viewing inputs *while the machine is idle*.

**NOTE 2:** See “DEVICE COMMUNICATION FOR WTB+ WASHER-EXTRACTORS . . .” for additional information about inputs and outputs on machines configured for *WTB+* operation.



Inputs

10:38 F0005S03 02:37  
dF=A093/D140 LEV2

3 WIRE DISABLED  
FAULT : SEE MANUAL

0 = First 16 inputs (8/16 Board #1)  
1 = Second 16 inputs (8/16 Board #2)  
2 = Third 16 inputs (8/16 Board #3)  
3 = Fourth 16 inputs (direct inputs-processor board)  
↓

(0) A B C D E F G H I J K L M N O P  
- - + + - - - + - - - - -

Top line shows input letter (see "Table of Inputs"). Bottom line shows status: - = not made, + = made.

When a formula is running and a normal run display or error display similar to the displays at left appears,

- hold 7
- Displays the *first* 16 inputs: (0) A through P.
- hold 7 + 1
- Displays the *second* 16 inputs: (1) A through P.
- hold 7 + 2
- Displays the *third* 16 inputs: (2) A through P.
- hold 7 + 3
- Displays the *fourth* 16 inputs (3) A through P.

When the *input status display* appears as in the example at left, see the “Table of Inputs” below, for input descriptions.

Table of Inputs

Display Code	Light number	(0) A through P (8/16 Board #1)		(1) A through P (8/16 Board #2 - WTB+ only)	
		Input Name	Connector/Pin	Input Name	Connector/Pin
A	0	Rear Up	1MTA4-1	Dryell Locked Up	2MTA4-1
B	1	Door Closed	1MTA4-2	Dryell Down	2MTA4-2
C	2	High Level or Extract Position	1MTA4-3	Eye Blocked	2MTA4-3
D	3	Medium Level or Wash Position	1MTA4-4	Door Full Open	2MTA4-4
E	4	LowLevel or Not Used	1MTA4-5	Allied Load Terminate	2MTA4-5
F	5	Check Drain Clutch	1MTA4-6	Allied Start Discharging	2MTA4-6
G	6	Chem Save/Varspd OL	1MTA4-7	Manual Desired (WTB+)	2MTA4-7
H	7	Speed Switch	1MTA4-8	Not Used	2MTA4-8
I	8	Ampsaver	1MTA4-11	Full Down (tilted rearward)	2MTA4-11
J	9	Front Not Down	1MTA4-12	Full Up (tilted forward)	2MTA4-12
K	10	Tilt Level	1MTA4-13	Timer Stop Input	2MTA4-13
L	11	Brake is Off	1MTA4-14	Unload Allowed	2MTA4-14
M	12	E2 Overload	1MTA4-15	Load Allowed	2MTA4-15
N	13	E1 Overload	1MTA4-16	Allied Start Loading	2MTA4-16
O	14	Drain Overload	1MTA4-17	Not Used	2MTA4-17
P	15	Wash Overload	1MTA4-18	Load Terminate	2MTA4-18

Table of Inputs continued

Display Code	Light Number	(2) A through P 8/16 Board #3 - WTB+ only		(3) A through P (direct inputs--processor board)	
		Input Name	Connector/ Pin	Input Name	Connector/ Pin
A	0	Formula Bit 0	3MTA4-1	Mildata	MTA38-8
B	1	Formula Bit 1	3MTA4-2	Program Key	MTA38-3
C	2	Formula Bit 2	3MTA4-3	Signal Cancel	MTA38-2
D	3	Formula Bit 3	3MTA4-4	Coarse Balance	MTA38-5
E	4	Formula Bit 4	3MTA4-5	Excursion	MTA38-6
F	5	Formula Bit 5	3MTA4-6	Three Wire	MTA38-7
G	6	Weight Bit 0	3MTA4-7	Brake Pad	MTA39-3
H	7	Weight Bit 1	3MTA4-8	Not Used	MTA39-2
I	8	Weight Bit 2	3MTA4-11	Clean Control Request	MTA39-1
J	9	Weight Bit 3	3MTA4-12	Drain Saver (Miltrench)	MTA39-6
K	10	Weight Bit 4	3MTA4-13	Load Requested (WTB-)	MTA39-5
L	11	Weight Bit 5	3MTA4-14	Manual Desired (WTB-)	MTA39-4
M	12	Weight Bit 6	3MTA4-15	—	—
N	13	Weight Bit 7	3MTA4-16	—	—
O	14	Not Used	3MTA4-17	—	—
P	15	Not Used	3MTA4-18	—	—

Outputs

10:38 F0005S03 02:37  
dF=A093/D140 LEV2

3 WIRE DISABLED  
FAULT : SEE MANUAL

When a formula is running and a normal run display or error display similar to the displays at left appears,

- hold 8 Displays the *first* 16 outputs: (0) a through p.
- hold 8 + 1 Displays the *second* 16 outputs: (1) a through p.
- hold 8 + 2 Displays the *third* 16 outputs: (2) a through p.
- hold 8 + 3 Displays the *fourth* 16 outputs: (3) a through p.
- hold 8 + 4 Displays the *fifth* 16 outputs: (4) a through p.
- hold 8 + 5 Displays the *sixth* 16 outputs: (5) a through p.

**NOTE:** The fourth 16 and last 8 outputs (see tables) are not viewable because they apply to functions on *WTB+* models that never occur while a formula is running and cannot be tested while the output displays are accessible.

When the *output status display* appears as in the example at left, see the following tables of outputs for output descriptions.

- 0 = First 16 outputs (8/16 Board #1 and Output Board #1)
- 1 = Second 16 outputs (Output Board #1)
- 2 = Third 16 outputs (8/16 Board #2 and Output Board #2)
- 3 = Fourth 16 outputs (Output Board #2)
- 4 = Fifth 16 outputs (8/16 Board #3 and Output Board #3)
- 5 = Sixth 16 outputs (Output Board #3)

(0)	a	b	c	d	e	f	g	h	i	j	k	l	m	n	p
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Top line shows output letter (see tables of outputs). Bottom line shows status:  
— = not energized, + = energized.

**Table of First and Second 16 Outputs—Pages 0 and 1**

Display Code	Light number	(0) a through p 8/16 Board #1 / Output Board #1			Light number	(1) a through p Output Board #1		
		Output Name	Connector/Pin			Output Name	Connector/Pin	
			Common	Normally Open			Common	Normally Open
8/16 Board #1					24 Output Board #1			+
a	0	Drain Motor	1MTA5-10	1MTA5-19	8	Brake Release	1MTA13-9	1MTA13-19
b	1	Cooldown	1MTA5-9	1MTA5-18	9	Water Valve #1	1MTA13-10	1MTA14-1
c	2	Extract Position/ 2 speed wash	1MTA5-8	1MTA5-17	10	Water Valve #2	1MTA14-11	1MTA14-2
d	3	Chem 4	1MTA5-7	1MTA5-16	11	Water Valve #3	1MTA14-12	1MTA14-3
e	4	Chem 1	1MTA5-4	1MTA5-14	12	Sewer Drain	1MTA14-4	1MTA14-13
f	5	Chem 3	1MTA5-3	1MTA5-13	13	Reuse Drain	1MTA14-4	1MTA14-14
g	6	Chem 2	1MTA5-2	1MTA5-12	14	Wash Clutch	1MTA14-10	1MTA14-5
h	7	Chem 5	1MTA5-1	1MTA5-11	15	Push Dn/ Bot Fil/Wash Pos.	1MTA14-10	1MTA14-15
24 Output Board #1								
i	0	High Extract	1MTA13-1	1MTA13-11	16	Not Used	1MTA4-10	1MTA4-6
j	1	Balance/ Spray Down/ Transfer Control	1MTA13-2	1MTA13-12	17	Not Used	1MTA4-10	1MTA4-16
k	2	Wash clutch	1MTA13-3	1MTA13-13	18	Not Used	1MTA4-10	1MTA4-7
l	3	CW Wash	1MTA13-4	1MTA13-14	19	Not Used	1MTA4-10	1MTA4-17
m	4	CCW Wash	1MTA13-5	1MTA14-15	20	Not Used	1MTA4-10	1MTA4-8
n	5	Steam Valve	1MTA13-6	1MTA14-16	21	Not Used	1MTA4-10	1MTA4-18
o	6	Signal	1MTA13-7	1MTA14-17	22	Not Used	1MTA4-10	1MTA4-9
p	7	Three Wire Relay	1MTA13-8	1MTA14-18	23	Not Used	1MTA4-10	1MTA4-19

**Table of Third and Fourth 16 Outputs--Pages 2 and 3**

B

Display Code	Light number	(2) a through p 8/16 Output Board #2 / Output Board #2			Light number	(3) a through p 24 Output Board #2		
		Output Name	Connector/Pin			Output Name	Connector/Pin	
			Common	Normally Open			Common	Normally Open
8/16 Board #2--WTB+ only (optional)					24 Output Board #2 (optional)			+
a	0	Discharge Commanded	2MTA5-10	2MTA5-19	8	Chem 10	2MTA13-9	2MTA13-19
b	1	Dryell Up Lock Release	2MTA5-9	2MTA5-18	9	Amp Saver	2MTA13-10	2MTA14-1
c	2	Load/Unload Allowed	2MTA5-8	2MTA5-17	10	Chem 6	2MTA14-11	2MTA14-2
d	3	Load Commanded	2MTA5-7	2MTA5-16	11	Chem 7	2MTA14-12	2MTA14-3
e	4	Flush Dryell	2MTA5-4	2MTA5-14	12	Chem 8	2MTA14-4	2MTA14-13
f	5	Load Desired	2MTA5-3	2MTA5-13	13	Chem 12	2MTA14-4	2MTA14-14
g	6	Dryell Move Up	2MTA5-2	2MTA5-12	14	Recirculate	2MTA14-10	2MTA14-5
h	7	Dryell Move Down	2MTA5-1	2MTA5-11	15	Machine Moving	2MTA14-10	2MTA14-15
24 Output Board #2 (optional)								
i	0	Chem 14	2MTA13-1	2MTA13-11	16	Not Used	2MTA4-10	2MTA14-6
j	1	Chem 9	2MTA13-2	2MTA13-12	17	Not Used	2MTA4-10	2MTA14-16
k	2	Chem 13	2MTA13-3	2MTA13-13	18	Not Used	2MTA4-10	2MTA14-7
l	3	Flush	2MTA13-4	2MTA13-14	19	Not Used	2MTA4-10	2MTA14-17
m	4	Chem 15	2MTA13-5	2MTA13-15	20	Not Used	2MTA4-10	2MTA14-8
n	5	Chem 11	2MTA13-6	2MTA13-16	21	Not Used	2MTA4-10	2MTA14-18
o	6	Chem Save	2MTA13-7	2MTA13-17	22	Not Used	2MTA4-10	2MTA14-9
p	7	Drain Saver (Miltrench)	2MTA13-8	2MTA13-18	23	Not Used	2MTA4-10	2MTA14-19

**Table of Fourth and Fifth 16 Outputs—Pages 4 and 5**

Display Code	(4) a through p 8/16 Board #3 / Output Board #3			(5) a through p Output Board #3		
	Output Name	Connector/Pin		Output Name	Connector/Pin	
		Common	Normally Open		Common	Normally Open
	<b>8/16 Board #3 (optional)</b>			<b>Output Board #3--WTB+ Only (optional)</b>		
a	Drycode Bit 0	3MTA5-10	3MTA5-19	Sequencer Flag Down Discharge	3MTA13-9	3MTA13-9
b	Drycode Bit 1	3MTA5-9	3MTA5-18	Sequencer Load/Unload Terminate	3MTA13-10	3MTA14-1
c	Drycode Bit 2	3MTA5-8	3MTA5-17	Sequencer Discharge Desired	3MTA14-11	3MTA14-2
d	Drycode Bit 3	3MTA5-7	3MTA5-16	Sequencer Discharge Allowed	3MTA14-12	3MTA14-3
e	Destination Code Bit 0	3MTA5-4	3MTA5-14	Start Discharging	3MTA14-4	3MTA14-13
f	Destination Code Bit 1	3MTA5-3	3MTA5-13	Start Loading	3MTA14-4	3MTA14-14
g	Destination Code Bit 2	3MTA5-2	3MTA5-12	Not Used	3MTA14-10	3MTA14-5
h	Destination Code Bit 3	3MTA5-1	3MTA5-11	Not Used	3MTA14-10	3MTA14-15
	<b>24 Output Board #3--WTB+ Only (optional)</b>					
i	Discharge Desired	3MTA13-1	3MTA13-11	Not Used	3MTA14-10	3MTA14-6
j	Load/Unload Terminate	3MTA13-2	3MTA13-12	Not Used	3MTA14-10	3MTA14-16
k	Deflate Dryell Up Seal	3MTA13-3	3MTA13-13	Not Used	3MTA14-10	3MTA14-7
l	Flag Down	3MTA13-4	3MTA13-14	Not Used	3MTA14-10	3MTA14-17
m	Dryell Blow	3MTA13-5	3MTA13-15	Not Used	3MTA14-10	3MTA14-8
n	Discharge Terminated	3MTA13-6	3MTA13-16	Not Used	3MTA14-10	3MTA14-18
o	Sequencer Load Desired	3MTA13-7	3MTA13-17	Not Used	3MTA14-10	3MTA14-9
p	Sequencer Load Allowed	3MTA13-8	3MTA13-18	Not Used	3MTA14-10	3MTA14-19

# MANUAL MODE MENU FUNCTIONS ON MARK II, III, IV, AND V WASHER-EXTRACTORS

This section describes functions on the Mark II, III, IV, and V microprocessor washer-extractor controllers (including outerwear machines) that are available when the machine is *idle* (formula not running) and in the *run* mode.


**NOTE:** See “MODIFYING FORMULAS IN PROGRESS” (see Table of Contents) for instructions on manually modifying a *running formula*. See “MONITORING MICROPROCESSOR INPUTS AND OUTPUTS . . .” for instructions on viewing inputs and outputs *while the machine is running*.

## Selections (Modes) on the Manual Menu



- 0=Turn Output On**—Actuate individual outputs for testing. This is called *bare manual*.
- 1=Look at Inputs**—View the on/off status of each input *during idle conditions*.
- 2=Data Accumulation**—View, print, and clear the accumulated counts of loads processed.

## To Access the Manual Menu

RUN FORMULA  
00 OR OK POWER OFF

When the *Run Formula menu* and *selection 00* is displayed as shown at left,  
 **Accesses the manual menu.**

TURN OUTPUT ON  
0

When *selection 0, Turn Output On*, on the *manual menu* is displayed as shown,  
 /  **Scrolls the available manual modes,**  
or **<x>** **Selects a manual mode,** where **<x>** is a number from 0 to 2. See the following information for how to access and utilize each manual mode.

or  **Returns to the Run Formula menu (run mode).**

## 0=Turn Output On (Bare Manual)

**How Bare Manual Works**—Bare manual permits turning certain outputs *on* and *off*, one at a time, for testing, when the machine is idle. Note that outputs appear in a different order on the *bare manual menu* herein, than on the *output status displays* (see “MONITORING MICROPROCESSOR INPUTS AND OUTPUTS . . .”).

### To Actuate Outputs in Bare Manual

TURN OUTPUT ON

0

When selection 0, *Turn Output On* on the *manual menu* is displayed as shown,



Accesses mode 0 and displays *Press Start*.



Closes the *three-wire circuit* permitting output actuation and displays the *bare manual menu*.

ABORT MANUAL OPER

00

When selection 00 on the *bare manual menu* is displayed, as shown at left,



Scrolls the outputs.

or <xx> Selects an output by number, where <xx> is a menu item number on the “Table of Bare Manual Outputs.”



or Returns to the *Run Formula menu*.

COUNTER CLOCKWISE

02

When an output is selected as in the example 02, *Counter Clockwise*, at left,



Turns the output *on*. See table for consequences.



Turns the output *off* and permits selecting any other output for testing.

**Table of Bare Manual Outputs  
for 100-Formula, Multi-motor Washer-Extractor Controller**

Menu Item	Output Name on Display	Applicable Machines	Standard or Option	Consequences of Actuating the Output
00	Abort Manual Oper	all	S	Return to <i>Run Formula menu</i> .
01	Clockwise	all	S	Turn basket clockwise at wash speed.
02	Counter Clockwise	all	S	Turn basket counterclockwise at wash speed.
03	Drain Speed	all	S	Turn basket at drain speed (clockwise).
04	Clutch 1	all	S	Clutch is normally engaged when <i>Master switch</i> is <i>on</i> . Clutch disengages when this output is turned on then off.
05	Water Valve #1	all	S	Opens valve.
06	Water Valve #2	all	S	Opens valve.
07	Water Valve #3	all	O	Opens valve.
08	Sewer Drain	all	S	Output <i>on</i> closes drain.
09	Reuse Drain	all	O	Output <i>on</i> opens drain.
10	Brake	all	S	Output <i>on</i> releases brake.
11–15	Chemical (1 thru 5)	all	S	Operates selected chemical inject device.
16–25	Chemical (6 thru 15)	all	O	Operates selected chemical inject device.
26	Steam	all	O	Opens steam valve.
27	Cooldown	all	O	Opens cooldown valve.

Menu Item	Output Name on Display	Applicable Machines	Standard or Option	Consequences of Actuating the Output
28	P-Dn (pushdown)	Hydro <sup>®</sup> cushion	S	Actuates push-down devices, lowering shell onto pads. Output <i>off</i> de-actuates push-down <i>and releases clutch</i> .
	BotFil (bottom fill)	BWP	S	Closes diverter valve to door and opens valve to bottom.
	W-Tilt (wash tilt position)	spring-mount, tilt	S	Moves housing to the wash tilt position.
29	Signal	all	S	Sounds operator alarm.
30	Aux Bal	self-balance	S	Enables balancing circuit.
	Spray Down	Rapid Load	S	Opens spray down valve.
	(transfer clean/soil)	Staph <sup>®</sup> Guard	S	Transfers control to clean-side.
31	Manifold Flush	all	S	Operates manifold flush valve for supply injector.
32	Disch. Command	WTB+	S	Moves machine to full up and door full open if prerequisites met.
33	Load Command	WTB+	S	Moves machine to full down and door full open if prerequisites met.
34	Ld/Unld Terminate	WTB+	S	Closes door if all other prerequisites are met.
35	Disch. Terminated	WTB+	S	Signals allied receiving device that discharging is completed.
36	Disch. Desired	WTB+	S	Signals allied receiving device that discharging is completed.
37	Discharging	WTB+	S	Signals allied receive device that discharging is in progress.
38	Start Loading	WTB+	S	Signals allied loading device to start loading the machine.
39	Flag Down	WTB+	S	Signals shuttle to stop at the machine.
40	Load Desired	WTB+	S	Signals allied loading device that machine desires a load.
41	Dryell Up	WTB+	O	Moves dryell up if all prerequisites are met.
42	Dryell Down	WTB+	O	Moves dryell down if all prerequisites are met.
43	El Lock Release	WTB+	O	Releases the dryell up lock.
44	Flush Dryell	WTB+	O	Injects flushing water into the dryell.
45	Dryell Blow	WTB+	O	Turns on the valve that blows air into the dryell flush water line to purge it of water.
46	Seq Load Desired	WTB+	O	Signals the discharge sequencer this machine desires a load.
47	Seq Load Allowed	WTB+	O	Signals Milrail that a load is allowed.
48	Seq Flag Dn Disch	WTB+	O	Actuates the flag on the shuttle rail that stops the shuttle in front of this machine.
49	Seq Load/Unld Term	WTB+	O	Resets the discharge sequencer following loading or unloading.
50	Seq Disch. Desired	WTB+	O	Signals the discharge sequencer this machine desires to discharge.
51	Seq Disch. Allowed	WTB+	O	Signals the shuttle that discharge is allowed.



**Table of Bare Manual Outputs  
for 100-Formula, Single Motor Washer-Extractor Controller**

Menu Item	Output Name on Display	Standard or Option	Consequences of Actuating the Output
00	Abort Manual Oper	S	Returns to run formula menu.
01	Clockwise	S	Turns basket clockwise at wash speed.
02	Counter Clockwise	S	Turns basket counterclockwise at wash speed.
03	Door Unlock	S	Unlocks door.
04	Water Valve #1	S	Opens valve.
05	Water Valve #2	S	Opens valve.
06	Water Valve #3	O	Opens valve.
07	Sewer Drain	S	Output <i>on</i> closes drain.
08	Reuse Drain	O	Output <i>on</i> opens drain.
09	Brake	S	Not Used
10-14	Chemical (1 thru 5)	S	Operates selected chemical inject device.
15-24	Chemical (6 thru 15)	O	Operates selected chemical inject device.
25	Steam	O	Opens steam valve.
26	Cooldown	O	Opens cooldown valve.
27	Signal	S	Sounds operator alarm.
28	Alternate Accelerator/Decelerator	S	Signals inverter for use; alternates acceleration or deceleration constants.
29	Manifold Flush	S	Operates manifold flush valve for supply injector.
30	Recirc. Pump	O	Enables recirculation pump.
31	Machine to Machine	O	Enables valve from machine to machine.
32	Machine to Tank	O	Enables valve from machine to tank.
33	Tank to Machine	O	Enables valve from tank to machine.
34	Transfer Control	S	Transfers machine control to clean side.
35	Brake Release	S	Releases autospot brake.
36	Clean Buzzer	S	Sounds the operator alarm on clean side.

## 1=Look at Inputs (While Idle)

The current state of all microprocessor inputs (made or not made) can be displayed while the machine is *idle*. This is real-time information. Any change in the state of the input is displayed *as it occurs*.

**NOTE:** This procedure accesses the same *input status displays* explained in “MONITORING MICRO-PROCESSOR INPUTS AND OUTPUTS . . .” (see Table of Contents), but permits viewing these displays *while the machine is idle*. See the referenced section for descriptions of the displays, input descriptions, and for instructions on viewing these displays *while a formula is running*.

LOOK AT INPUTS

1

When selection 1, Look At Inputs, on the manual menu is displayed as shown at left,

ENTER  
NEXT

Displays the first 16 inputs.

7  
STU

1  
ABC

Displays the second 16 inputs.

7  
STU

2  
DEF

Displays the third 16 inputs.

CANCEL  
ESCAPE

Returns to the *Run Formula* menu.

## 2=Data Accumulation

**How Data Accumulation Works**—The controller stores data pertaining to loads processed. This data can be used for both accounting purposes and to gauge efficiency of operation. The controller stores data for the last load processed and also accumulates totals per formula as well as for all formulas combined since the last time the data was cleared. This data can be viewed on the display or printed. The data includes:

- **Loads**—The number of loads processed (if applicable).
- **Formula Number**—(if applicable).
- **Run Time**—Total time to process a load including drain, distribution, coast and any *error time* (see below).
- **Wait Time**—The time span between when one formula ends and when the next one begins (with machine power on). Wait time is always applied to the formula that follows it. If the machine remains on and idle overnight, this entire time is applied to the wait time for the first load processed the following day. **Turn power off then back on before starting the first load to exclude idle time outside of normal operating hours.**
- **Error Time**—The time during which normal operation is suspended due to an error condition. This time is included in *run time* (see above).


**NOTE:** The accumulators will store data for formulas 00 through 99, whether these are internal or downloaded from Mildata<sup>®</sup>. They do not store data on Mildata<sup>®</sup> formulas higher than 99. However, Mildata<sup>®</sup> itself provides this capability.

Selections (Modes) on the Data Accumulation Sub-Menu




- 0=Display Data—Display accumulated data on the microprocessor display.
- 1=Print—Print out hard copy of accumulated data on a serial printer.
- 2=Clear—Erase all accumulated data.

To Access the Data Accumulation Menu

DATA ACCUMULATION  
2


When selection 2, Data Accumulation, on the manual menu is displayed as shown at left,  
 **Accesses Data Accumulation and displays the choices.**

0 0=DISPLAY DATA  
1=PRINT 2=CLEAR

When the Data Accumulation choices are displayed as shown at left,  
 /  **Scrolls the choices.**  
or <x> **Selects one of the displayed choices,** where <x> is a number from 0 to 2.  
or  **Returns to the Run Formula menu (run mode).**

0=Display Data—Accumulated data may be displayed in three ways, as shown in the “Table of Displayed Data” below.

0 0=DISPLAY DATA  
1=PRINT 2=CLEAR

When 0=Display Data is chosen from the Data Accumulation choices, as shown at left,  
 **Accesses Display Data and displays the choices.**

0 0=LAST LOAD  
1=FORMS 2=TOTAL





When the Display Data choices are displayed as shown at left,  
<x> **Selects a type of data to display,** where <x> is a number from 0 to 2.  
 **Displays the selected data,** as explained in the “Table of Displayed Data,” below.  
If 1=Forms is accessed,  
 /  **Scrolls the formulas,**  
or <xx> **Selects a formula,** where <xx> is the two-digit formula number.  
 **Returns to the Data Accumulation choices.**


Table of Displayed Data


Data Type: 0=LAST LOAD	1=FORMS (formulas)	2=TOTAL
Data Displayed: Formula number of last load run <div>LAST RUN WAIT ERR F#xx 000 000 000</div> <div>hours1/10 minutes1/10 hour</div>	Formula 15 <div>F# LDS RUN WAIT ERR 15 000 0000 0000 000</div> <div>hours1/10 hour</div>	Total number of loads run <div>LOAD RUN WAIT ERR 0000 00000 00000 000</div> <div>hours1/10 hour</div>


**1=Print**—Accumulated data may be printed on a serial printer that conforms to the “REQUIREMENTS AND SETTINGS FOR THE EPSON LX300 PRINTER” (see Table of Contents). FIGURE 1 is an example printout.


1 0=DISPLAY DATA  
1=PRINT 2=CLEAR

DATE: MM-DD-YYYY  
DATE: DD-MM-YYYY  
00

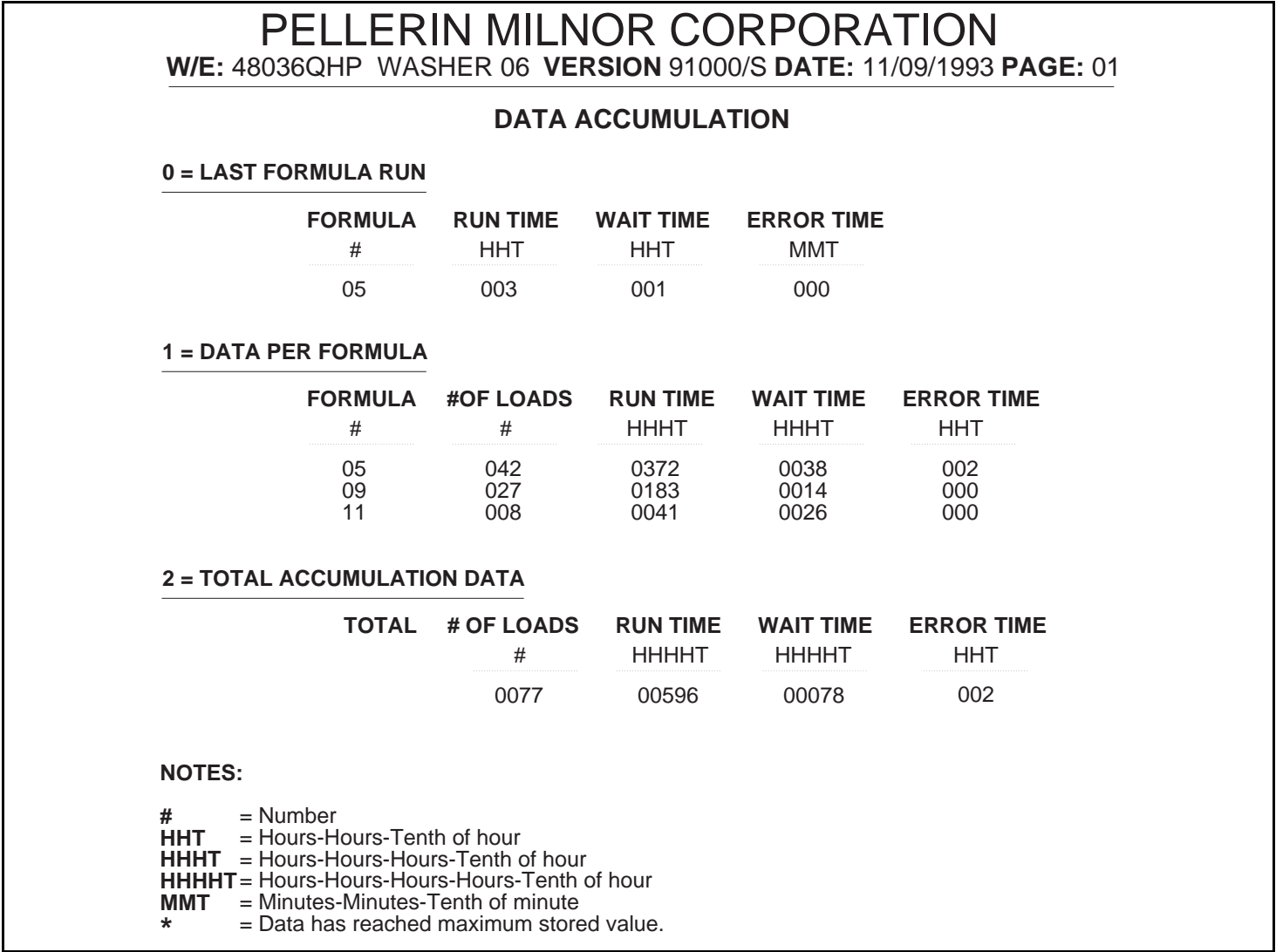
When 1=Print, is chosen from the *Data Accumulation* choices, as shown at left,  **Accesses the print function** and prompts for the date.

When one of the *date entry displays* is displayed as shown at left,  **Enters the first value**, where <xx> is the two-digit number for the month or day (depending on the format configured) and advances the cursor to the second field.

 **Enters the second value** and advances the cursor to the third value.

 **Enters the year**, where <yyyy> is the four digit number for the year and sends the data to the printer. When all data has been sent, the *Data Accumulation menu* reappears.


Month-day-year or day-month-year format, depending on the format configured.




**FIGURE 1** (MSOP0254BE)  
**Example Data Accumulation Printout**


**2=Clear**—Accumulated data may be cleared whenever the machine is idle. All data is cleared simultaneously.

2 0=DISPLAY DATA  
1=PRINT 2=CLEAR

When 2=Clear is chosen from the *Data Accumulation* choices as shown at left,  
 **Accesses the *clear* function** and prompts the user to continue or cancel.

NEXT TO CLEAR DATA  
CANCEL=ESCAPE

When the display shown at left appears,  
 **Clears all accumulated data from memory** and returns to the *Data Accumulation* choices.

or  **Exits the *clear* function without clearing the accumulators** and returns to the *Data Accumulation* choices.



**Section**

**5**

# **Supplemental Information**

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# NOTICE

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As this manual was being printed, Pellerin Milnor Corporation began a manufacturing change which may affect how this manual applies to your machine. The six-position DIP switch on each printed circuit board is being replaced with two sixteen-position rotary switches. The switches (DIP and rotary) are used to set the logical address for each board that communicates with the microprocessor in the machine, or with a higher-level control system (e.g., a Mildata network).

Because the change to rotary switches corresponds so closely to the release of this manual, we are supplying you with documentation on how to set both types of switches.

If your machine uses printed circuit boards containing one DIP switch, refer to MSFDA401DE to set the address on replacement boards. If your machine uses printed circuit boards containing rotary switches, refer to MSFDA401EE.



## Hardware Components of Serial Microprocessor Controllers

### 1. General

Milnor® serial microprocessor controls are designed specifically for Milnor® machines and systems. Along with certain external electromechanical relay logic and sensing devices, they control all machine and system functions. **Not every microprocessor controller includes all the components described in this section.**

### 2. Microprocessor Components

**Note 1:** This is a list of all components for Milnor® microprocessor controllers. Not every Milnor® microprocessor controller includes all of the following components.

**2.1. Keypad or Keyboard**—Depending upon the model and type of machine, the keypad may have 12, 30, or 58 buttons. The different keypads are not interchangeable.

**2.2. Keyswitch**—Selects run/program modes. The key may be removed only when the switch is set to the *Run* position.



**CAUTION [1]: Prevent Unauthorized Programming**—To prevent unauthorized programming, store the programming key so that it is not available to unauthorized personnel. Improper programming can damage equipment and goods.

**2.3. Display**—Depending upon the type and model of machine, the display may be either liquid crystal, vacuum fluorescent, or cathode ray tube (CRT), which is a typical computer monitor. Different types of displays are not interchangeable.

**Liquid crystal graphic display**—This display is identified by colored characters and graphics, usually on a black or white background. It's currently used only on certain washer-extractor models with the Milnor Mark VI control system.

**Liquid crystal text display**—This type of display is identified by dark gray characters on a lighter gray background, or by green characters on a dark gray background.

**Vacuum fluorescent display**—The bright green characters on a black background make this display highly visible. This is the most common display for Milnor® washer-extractors, textile machines, and dryers.

**Cathode ray tube (CRT)**—The CRT display resembles a television screen in appearance and function. This type of display is most commonly used in Miltrac™ and Mildata® systems, which require the display of graphics such as boxes and lines. It is also used on Milnor CBW® tunnel washers.

**2.4. Power Supply**—The power supply converts the alternating current at the control circuit voltage to direct current voltages of 12 volts positive and negative, and 5 volts positive. One or more of these values are adjustable, depending on the specific power supply used in each application.

The Milnor™ CBW® system employs two different power supplies to convert alternating current from the control circuit to direct current for the microprocessor and peripheral boards.

**2.4.1. Control Console Power Supply**—The power supply referenced as ESPS in the schematic

diagrams is a 40-watt power supply located in the Miltron™ or Mentor™ cabinet. It powers the peripheral boards located within this cabinet, including the optional load cell interface board and the analog to digital board for a weighing conveyor, as well as the microprocessor board and the memory expansion board.

**Tip:** For maximum reliability and to minimize the chances of the processor board resetting due to low voltage, adjust the power supply voltage for 80186 processors to 5.10 VDC at the processor board.

In systems operated via the Miltron™ controller, this power supply also provides electricity to the monitor interface board. In Mentor™-controlled tunnel systems, the monitor interface board is contained within the Mentor™ computer enclosure and powered by the computer power supply.

**2.4.2. Tunnel Power Supply**—The power supply referenced as PSO in the schematic diagrams is a 120-watt unit which powers the peripheral boards located on the tunnel washer. All three voltages output by this device are adjustable.

If adjustment is necessary, set the 5 volts output to provide at least positive 4.8VDC at the electric box on the module farthest from the power supply. This measurement must be made with an accurate digital voltmeter. Verify that the positive and negative 12 volts outputs are set at positive and negative 12.00VDC, respectively.

If the 5 volts reading at the peripheral board nearest the PSO power supply is at least positive 5.25VDC, and the voltage at the peripheral board farthest from PSO is positive 4.8VDC or less, suspect one or more loose connections or inadequate wiring somewhere between the two peripheral boards.

**2.5. Power Supply** —The power supply converts the alternating current at the control circuit voltage to direct current voltages of 12 volts positive and negative, and 5 volts positive. One or more of these values are adjustable, depending on the specific power supply used in each application.

- The 12 volts positive is used to power all boards other than the microprocessor board. This value is not adjustable.
- The 12 volts negative is used by the analog to digital (A/D) board. This value is not adjustable.
- The 5 volts output powers the microprocessor. This value is adjustable and very sensitive. For devices using microprocessors other than the 80186, the power supply must be adjusted to provide actual voltage of 4.95VDC to 5.10VDC at the microprocessor board. Use an accurate digital voltmeter to measure this value. For devices with 80186 microprocessors, the power supply voltage should be 5.10VDC at the processor board.

A wire of at least 14AWG (2.5 sq mm) must be connected between the ground points on the microprocessor and the peripheral boards. This ground wire is installed at the factory if both enclosures are mounted on the same machine (e.g., washer-extractors). The ground wire must be provided during installation if the microprocessor enclosure and its associated peripheral board enclosures are remote from one another (e.g., dryers).

Some machines, including Milnor® dryers, employ a second identical power supply to provide power for the peripheral boards, which are mounted in an enclosure separate from the microprocessor enclosure.

**2.6. Central Processing Unit (CPU) Board**—Also referred to as the microprocessor, the central processing unit processes data received from the various inputs, stores information, and responds to each keypad entry with the appropriate action. It may be mounted in an enclosure separate from its peripheral boards. The CPU board contains EPROMs programmed by the Milnor® factory with fixed instructions (software) that determine how the machine functions. Depending upon machine model/type, the processor chip may be one of three Intel models: the 8085, the 8088, or the 80186.

Although the EPROMs do not require battery backup, the CPU board utilizes a battery which normally provides power to retain the user-programmable memory for two to three months without external power.

**2.7. Memory Expansion Board**—Increases memory space available to the processor. This board is used with 8088 CPU boards in some applications.

**2.8. Battery**—Provides memory retention backup when power is off. The battery is mounted directly on 8085 CPU boards, and mounted separately for 8088 and 80186 CPU boards. A capacitor on the 8088 and 80186 CPU boards provides enough power to retain memory for several hours after the battery has been disconnected. Once fully charged, the battery backup is reliable for two to three months with no power applied.

**2.9. Opto-Isolator Board**—Optically isolates inputs to the microprocessor for electronic noise immunity. Opto-isolators are incorporated into the 8088 and 80186 CPU board; thus this separate board is only required for machines employing Intel 8085 CPUs.

**2.10. Input/Output Board**—The 16/8 input-output board contains 16 solid-state signal input devices and eight output relays. The input devices are capable of faithfully conducting a low VA 12VDC ground signal to the microprocessor. The output relays are socket-mounted SPDT, 12VDC electromechanical relays with contacts capable of faithfully conducting a maximum of 25VA at 110/120VAC (0.2 ampere or 200 milliamperes at 110/120VAC) or 12.5 VA at 24VAC (0.5 ampere or 500 milliamperes at 24VAC). The output will be either 24VAC or 110/120VAC, depending on the machine model/type.

These outputs and their power source are intended only to drive another relay with higher contact ratings, that in turn may drive a pump, valve, solenoid, etc., from a separate power source. Never use these outputs to directly drive a pump, valve, or solenoid unless the maximum current required never exceeds the above values. Higher ampere or VA loads will burn out traces on the printed circuit board or possibly overload and damage the control circuit transformer.

This board has 25 status lights. The amber light flashes when the board is communicating. Each of the 24 remaining lights represent an input (green lights) or output (red lights) on that board, and illuminates when the corresponding input or output is made. This board has two rotary dials which must be adjusted to set the board's address (see Section 4 "Assigning Board Addresses" in this document). This board also has convenient test points that can be used to test voltage to the board.

**Standard input/output board**—used in all devices requiring input/output boards, except those listed below.

**High-speed input/output board**—used only in the following devices and configurations: E6N, J6N, and T6N washer-extractors equipped with and configured for both variable basket speed and electronic balancing; Milrail configured for high-speed boards, and all configurations of the M7E centrifugal extractor.

**2.11. Output Board**—A 24-output board contains 24 output relays identical to those described in Section 2.10 “Input/Output Board”.

**2.12. Analog to Digital Convertor Board**—Converts analog voltage signals, such as temperature, to a digital signal that can be utilized by the CPU. Up to a maximum of eight channels may be provided on a single board. Although seemingly identical, the analog to digital boards used to sense air temperature in the dryer, water temperature in washer-extractors and textile machines, water temperature in the tunnel, and weight for a weighing conveyor are all different. The different types are clearly marked with different part numbers, which are mentioned in the wiring diagram set and are not interchangeable.

All analog to digital boards have one status light which flashes when the board is communicating. The board has two rotary dials which must be adjusted to set the board's address (see Section 4 “Assigning Board Addresses”). This board also has convenient test points that can be used to test voltage to the board.

**2.13. Digital to Analog Convertor Board**—Converts digital signals from the processor to analog signals with voltages between 0 and 5VDC (e.g., provides the analog signal to the dryer gas valve position actuator and dye machine steam position actuator).

This board has one status light which flashes when the board is communicating. The two rotary dials must be adjusted to set the board's address (see Section 4). This board also has convenient test points that can be used to test voltage to the board.

**2.14. CRT (Video Display) Board**—Receives display instructions from the processor and generates the signals to the video monitor to create the desired displays; used in controllers such as the Miltron™ and Miltrac™ controllers and Device Master™ systems.



**CAUTION [2]: Avoid Component Damage**—The CRT board can be installed backwards, even though the cabinet and bracketry makes this difficult, and labelling on the parent board states the proper orientation. Use care to orient the board correctly, otherwise microprocessor components may be damaged.

CBW® systems with the Mentor™ controller use a standard computer video display adapter, housed within the Mentor™ computer, to transmit signals from the Mentor™ computer to the video monitor. Thus, Mentor™ systems do not have a separate video display board as described here.

**2.15. Resistor Boards**—Although visually similar, resistor boards vary according to the application. The different types are clearly marked with part numbers, which are mentioned in the electrical schematic diagrams and are not interchangeable.

**For temperature-sensing systems**—used with analog to digital boards in washer-extractors and dye-extractors as part of temperature-sensing system; not required on tunnel systems because the necessary circuitry is included on other standard CBW® circuit boards.

**For modulating gas valves**—used with digital to analog boards in the temperature control circuit of gas dryers; converts 0-5VDC to 4-20 milliamperes for controlling the modulating gas valve.

**For modulating steam valves**—used with digital to analog boards in temperature control circuit of older steam dryers; converts 0-5VDC to 4-20 milliamperes for modulating steam valve. See Section 2.20 “4-20mA Output Board” in this document.

- 2.16. Signal Conditioner for Thermocouple**—Amplifies and filters the output from a thermocouple so an analog to digital board can convert the signal to digital values for the microprocessor.
- 2.17. Rotation Safety Board**—Used in dryers. Reads rotational safety proximity switch to confirm that the basket is turning.
- 2.18. Temperature Probe**—Two types of temperature probes are used, depending on equipment type:
- Thermistor temperature probe**—a temperature-sensitive resistor whose resistance value changes with respect to temperature; uses include washer-extractors, textile machines, and tunnel systems.
  - Thermocouple temperature probe**—a closed loop of two dissimilar metals which produces a voltage with respect to the change in temperature between the two junctions. Thermocouples are used in dryers.
- 2.19. Weigh Scale Interface Board**—In the electrical circuit, this device is between the weighing conveyor (CONWA) load cell and the weighing conveyor analog to digital board. It filters and interprets the signals from the conveyor load cell to the analog to digital board.
- 2.20. 4-20mA Output Board**—Used on newer textile machines and steam dryers with temperature control. See Section 2.15 “Resistor Boards” in this document.
- 2.21. 8 Output/16 Input Chemical Flow Meter Board**—This board is used with the metered chemical injection option on textile machines. Eight outputs and eight counters respectively are assigned to chemical valves and chemical flow meters. Two of the counters are non-isolated direct inputs to the microprocessor on this board and are capable of counting pulses of 0 to 5VDC at a frequency of up to 10kHz. The remaining six counters are optically isolated from the peripheral board microprocessor and are capable of counting pulses from 0 to 12VDC at a frequency up to 150 Hz.

### **3. Serial Communications Port**

All Milnor® serial microprocessors have a serial port with a nine-pin receptacle and plug to communicate with other devices via one of several special serial cables. If supported by the software, downloading and printing of data is accomplished through this port. These actions are described in the programming section of this manual.

For more information on the various separate serial cables required for these functions, see the related section in document BICWUC01, if applicable.

**Table 1: Board Application by Device (Part A)**

		Board Name															
		Weight Scale Interface															
		Rotation Safety															
		Chemical Flow Meter															
		Thermocouple Signal Conditioner															
		Steam Valve (4-20mA)															
		Gas Valve Resistor															
		Temperature Sensing Resistor															
		Opto-isolator															
		CRT															
		Digital to Analog															
		Analog to Digital															
		Output															
		Input/Output															
		CPU															
Device																	
CBW System*	Number	1	2		1		1										1
	Note(s)		+	1	9												5
Device Master*	Number	1	2				1										
	Note(s)		1	1													
Miltrac*	Number	1					1										
	Note(s)																
VERTSTO	Number	1	2				1										
	Note(s)																
Linear COSTA	Number	1	1														
	Note(s)		1														
Link Master	Number	1															
	Note(s)																
Textile*	Number	1	1	2	1	1			1		1						
	Note(s)				4										1		

Notes:

- \* Intel 80186 central processing unit
- 1 Boards can be added for options
- 2 Used on steam dryers with temperature control, and all gas dryers
- 3 Used on washer-extractors with temperature option
- 4 Analog to digital boards vary according to application. See the descriptions of these boards elsewhere in this section.
- 5 Required for weighing conveyors on tunnel washing systems
- 6 Required for reuse/cooldown and/or overhead fill tanks on tunnel washing systems
- 7 Mark I washer-extractor control used Intel 8085 central processing unit
- 8 Notes 3 and 4 apply
- 9 One board required per each 8 modules (see also Notes 1, 4, 5, and 6)
- 10 Two boards required, plus one additional board per module

**Table 2: Board Application by Device (Part B)**

		Board Name															
		Weight Scale Interface •														•	
		Rotation Safety •														•	
		Chemical Flow Meter •														•	
		Thermocouple Signal Conditioner •														•	
		Steam Valve (4-20mA) •														•	
		Gas Valve Resistor •														•	
		Temperature Sensing Resistor •														•	
		Opto-isolator •														•	
		CRT •														•	
		Digital to Analog •														•	
		Analog to Digital •														•	
		Output •														•	
		Input/Output •														•	
		CPU •														•	
Device																	
COBUC	Number	1	2														
	Note(s)		1	1													
COSHA	Number	1	2														
	Note(s)		1														
Dryer	Number	1	2	1	1	1				1		1		1			
	Note(s)				4	2				2	2						
Extractor	Number	1	2	1													
	Note(s)		1	1													
Press	Number	1	2	1	1												
	Note(s)		1	1													
W/E (Mark I)	Number	1	1	1	1			1	1								
	Note(s)	7	1	1	8	1											
W/E (Mark II-VI)	Number	1	1	1	1	1									1		
	Note(s)		1	1	8	1			1								
Notes: * Intel 80186 central processing unit 1 Boards can be added for options 2 Used on steam dryers with temperature control, and all gas dryers 3 Used on washer-extractors with temperature option 4 Analog to digital boards vary according to application. See the descriptions of these boards elsewhere in this section. 5 Required for weighing conveyors on tunnel washing systems 6 Required for reuse/cooldown and/or overhead fill tanks on tunnel washing systems 7 Mark I washer-extractor control used Intel 8085 central processing unit 8 Notes 3 and 4 apply 9 One board required per each 8 modules (see also Notes 1, 4, 5, and 6) 10 Two boards required, plus one additional board per module																	

#### 4. Assigning Board Addresses

The input/output board, output board, analog to digital board, and digital to analog board each have two rotary switches which establish the address for each board. This allows each board to communicate serially with the microprocessor in its device while sending and receiving its own messages. In a battery of machines, the rotary switches are identical for each identical peripheral board in each identical machine (e.g., the first input/output board (I/O-1) in each washer-extractor has identical rotary switch settings). When a microprocessor must communicate with a higher level control (e.g., when all dryers communicate with the MilData® system), the higher level control must know the address of each microprocessor. For 8088 microprocessors, the high level control knows the address of each device because that information was established during configuration (e.g., see *Miltrac Address* configure decision in the programming manual for any device that communicates with Miltrac).



**Table 3: Rotary Switch Settings**

COSHA													
COBUC													
Device Master													
Dryer													
Textile													
Linear COSTO													
One-Stage Press													
Two-Stage Press													
Extractor													
VERTSTO													
Washer-Extractor													
Board													
Analog to Digital	SW2		2*			2	2		2	2			
	SW1		1*			1	1		1	1			
Digital to Analog	SW2		3*				3		3	3			
	SW1		1*				1		1	1			
Input/Output #1	SW2		0	0	0	0	0	0	0	0	0		
	SW1		1	1	1	1	1	1	1	1	1		
Input/Output #2	SW2		0*	0	0*	0	0	0*	0*	0	0	0	0
	SW1		2*	2	2*	2	2	2*	2*	2	2	2	2
Input/Output #3	SW2				0*	0*	0*				0*	0*	0*
	SW1				3*	3*	3*				3*	3*	3*
Input/Output #4	SW2				0	0*					0*	0*	0*
	SW1				4	4*					4*	4*	4*
Output #1	SW2		1		1	1	1		1	1	1*		
	SW1		1		1	1	1		1	1	1*		
Output #2	SW2		1*		1*	1*			1		1*		
	SW1		2*		2*	2*			2		2*		
Output #3	SW2		1						1*		1*		
	SW1		3						3*		3*		
Notes:													
* Optional boards													
1 See schematics for rotary switch positions on tunnel washer system devices.													

— End of BICMDF01 —

## How to Upgrade Microprocessor EPROM Chips

Milnor® microprocessor software is continually upgraded to improve performance and maximize efficiency. Depending on the software change, the new software EPROM (Erasable, Programmable Read-Only Memory) chips may be offered for sale or for no charge to the customer. When a set of these chips is changed in the field, ensure that the software version being installed matches the machine hardware, and that the chips are installed in the proper socket positions and orientation.

### 1. How to Change EPROMs



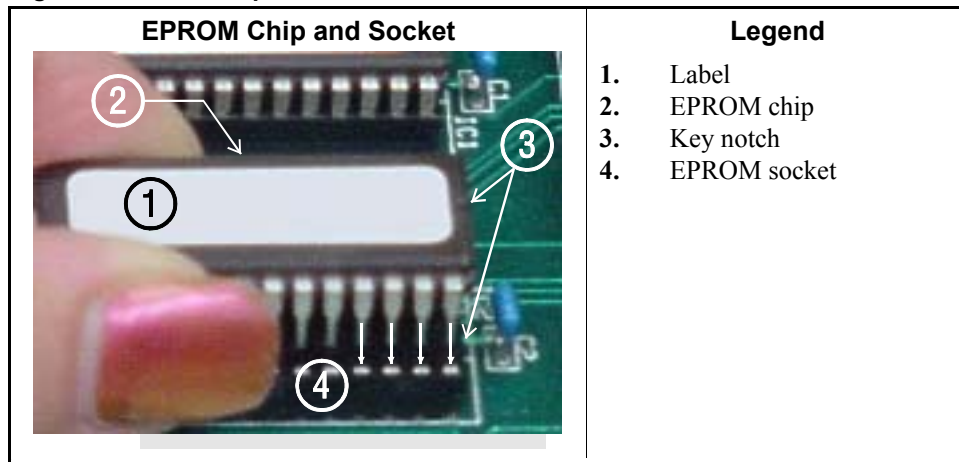
**WARNING 1: Electrocution and Electrical Burn Hazards**—Contact with high voltage will electrocute or burn you. Power switches on the machine and the control box do not eliminate these hazards. High voltage is present at the machine unless the main machine power disconnect is off.

- Do not attempt unauthorized servicing, repairs, or modification.
- Lock out and tag out power at the main machine disconnect before servicing, or in accordance with factory service procedures.

#### 1.1. Remove and Replace EPROM Chips

1. Make sure all power to the machine is off.
2. Locate the chips as described in Section 2 “Location of EPROM Chips”. Note the orientation of the chips as shown in the figure(s) below.
3. Use a chip removal tool or another small flat tool to carefully remove each EPROM chip from its base. Be sure to note the numerical order of each chip and the orientation to the key notch on the socket.
4. Install new chips, making sure the key notch on each chip is properly oriented and that all pins enter the proper holes in the socket, as shown in Figure 1. If necessary, slightly bend the pins on the EPROM chip to align the pins with the holes in the socket. After inserting each chip, verify that all pins are seated in the socket.

Figure 1: EPROM Chip Identification and Installation



**CAUTION [2]: Machine Damage Hazards**—Incorrectly installing any EPROM chip may destroy or damage the chip or cause the machine or the display to operate erratically.

- Match each chip with its corresponding socket. Each EPROM chip will operate in only one socket, although it may physically fit into others.
- Align each chip so every pin mates with the correct hole in the socket.

**1.2. Verify Proper EPROM Chip Installation**—After installing new EPROM chips, apply power to the machine and turn the machine on. If the chips are properly installed, the display will continue with the normal display sequence when powering up. If the display is blank or appears unusual, turn the machine off at once and verify that the chips are correctly oriented in the sockets.

## 2. Location of EPROM Chips

Depending on machine model and type, the microprocessor may be an Intel 8085, Intel 8088, or Intel 80186. Each microprocessor board requires at least one EPROM chip for proper operation, but these chips may be located differently on each type of processor board. The following information describes the location and arrangement of the EPROM chips on each type of board, as well as the favored location for checking the voltages required by each type of board.

**Table 1: Processor Boards and Applications**

Processor Part Number	Typical Machine Applications	Comments
08BNCMPAD_	System 7 (e.g., 30015M5G)	
08BN785A_	30-inch E-P Plus	
08BN788A_	---see above---	
08BH18EP_	36- and 42-inch E-P Plus	20 MHz; brown output and chemical connectors
08BH18EPA_	---see above---	15 MHz; brown output and chemical connectors
08BH18EPB_	---see above---	15 MHz; white output and chemical connectors
08BH18EPC_	---see above---	11 MHz
08BH18EPD_		20 MHz; white output and chemical connectors
		8085 non-serial
08BSP_	Mark 2 washer-extractors, etc.	8085 serial with 4 EPROMs
08BSPA_	Mark 2 textile machines	8085 serial with 2 EPROMs
08BSPAA_	replacement for 08BSP_ and 08BSPA_	uses jumpers on processor board to match EPROM type
08BSPC_		Revisions A through D use same software; revision E software is different
08BSPD_	tunnel washers (with expanded memory board)	8088 serial with 2 EPROMs; same as Rev. E of 08BSPC_
08BSPDA_		8088 serial with 4 EPROMs; expanded memory added to processor board
08BSPE_		80186 serial with 1 EPROM and 4 UART chips
08BSPE1_		80186 serial with 1 EPROM and 1 quad-UART chip
08BSPE2_	Mark 6 devices (with graphic display)	
08BT168A_	E-P OneTouch (e.g., 30015T5E)	

**2.1. 8085 Processor Boards (except Coin Machines)**—See Figure 4. Install EPROM #1 at the end of the row nearest the corner of the board, then #2, #3, and #4. Chip #4 goes next to the two chips soldered to the board. See Figure 3 for where to check for proper voltages.

Figure 2: Replacement Processor Board

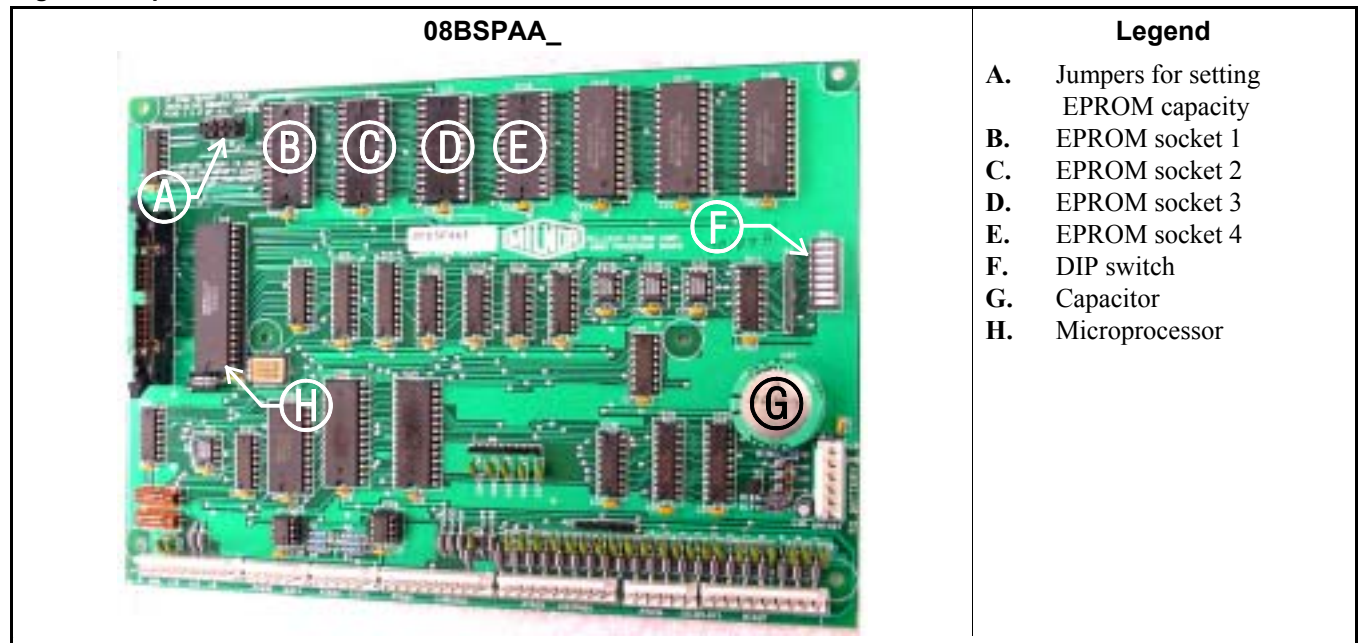


Figure 3: Where to Check Processor Board Voltages

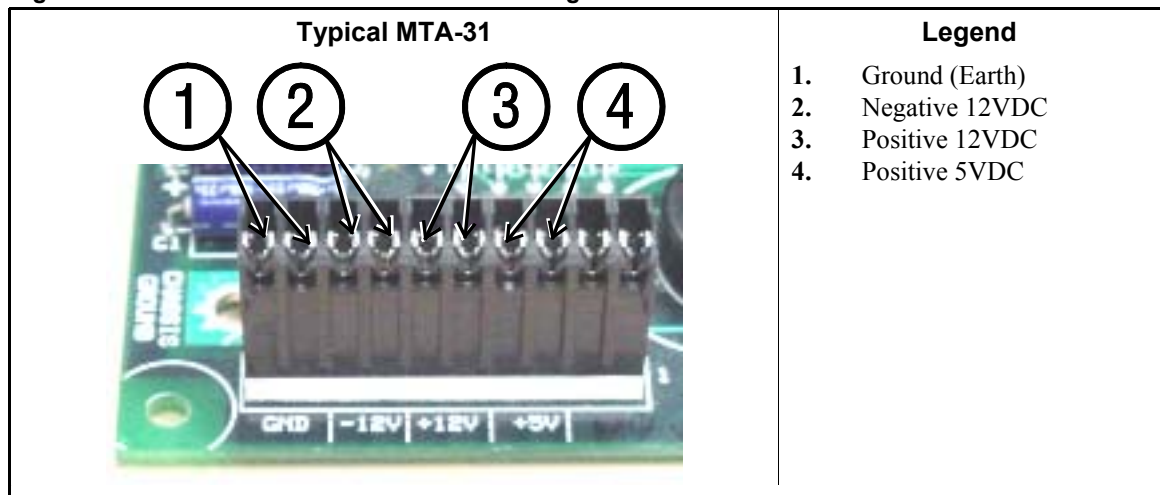
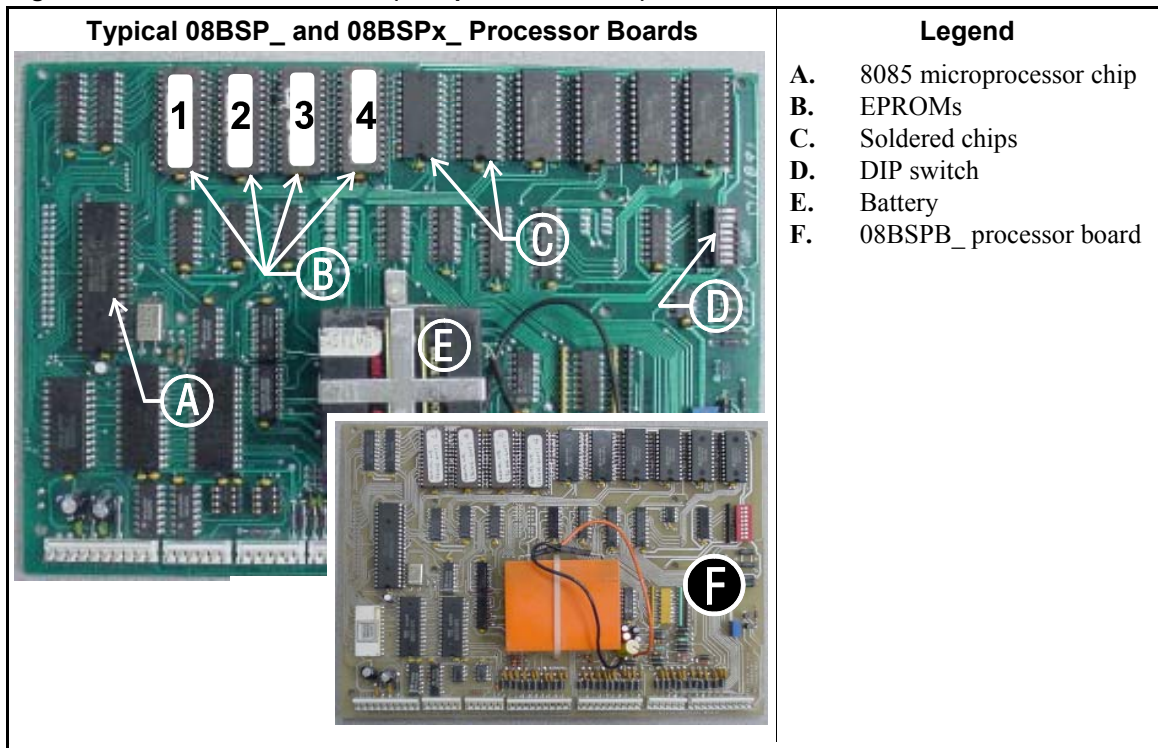
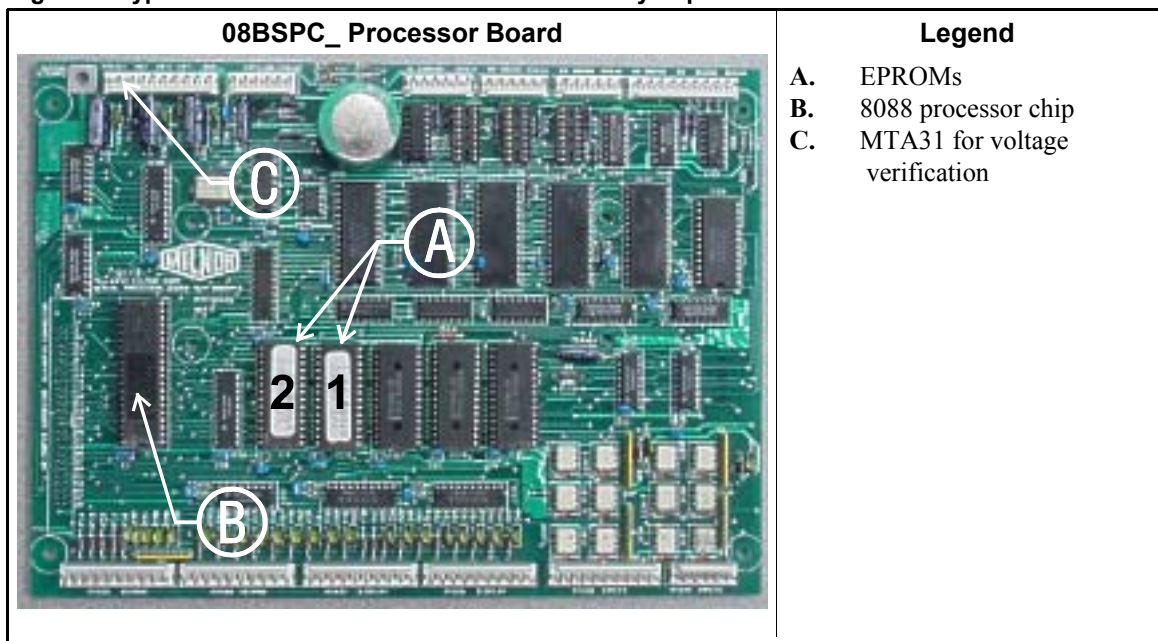


Figure 4: 8085 Processor Boards (Except Coin Machine)



- 2.2. 8088 Processor Boards without Memory Expansion Board**—See Table 2 “EPROM Locations for 8088 Processor Applications” and Figure 6. If the set consists of only one EPROM, install it in socket A of Figure 6. If two EPROMs comprise the set, install EPROM #2 in socket A and EPROM #1 in socket B. Always install the highest numbered EPROM in socket A. If the set consists of more than two EPROMs, a memory expansion board must be present in the machine along with the processor board.

Figure 5: Typical 8088 Processor Board without Memory Expansion Board

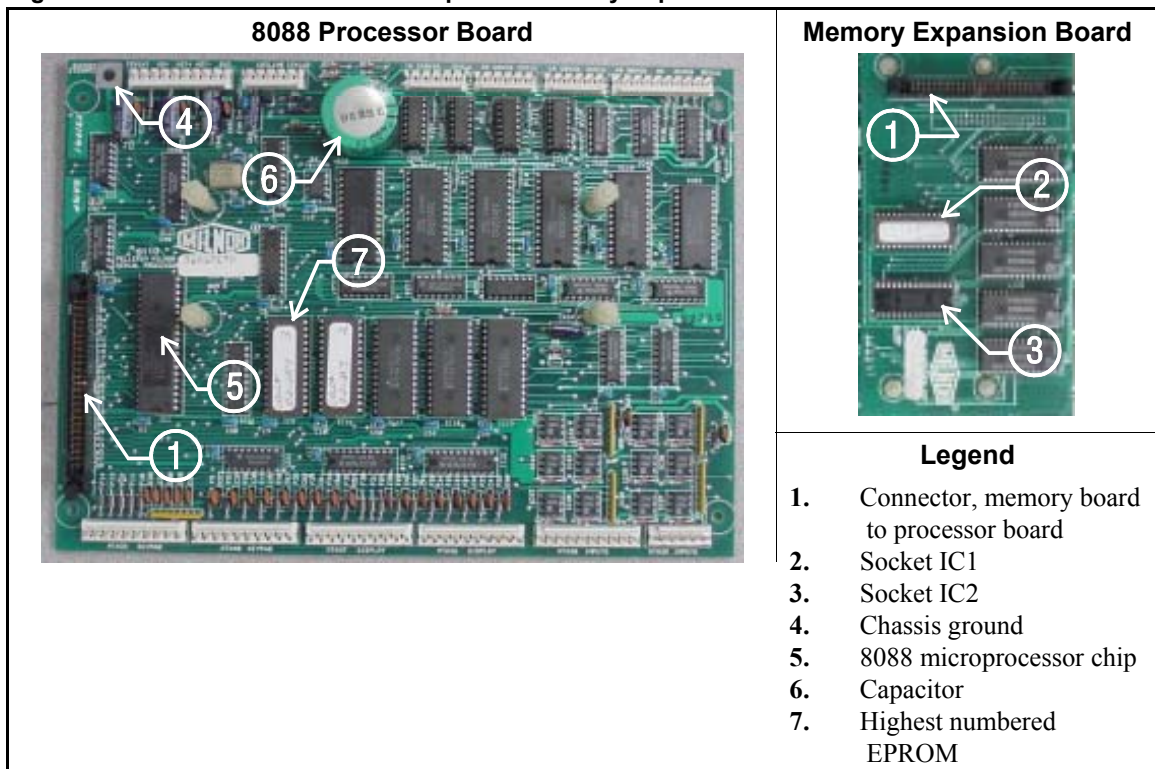




**Table 2: EPROM Locations for 8088 Processor Applications**

	EPROM Location by Socket			
EPROMs in Set	A	B	IC-1	IC-2
4 chips	4	3	2	1
3 chips	3	2	1	—
2 chips	2	1	—	—
1 chip	1	—	—	—

**Figure 6: 8088 Processor Board and Optional Memory Expansion Board**



**2.3. 8088 Processor Boards with Memory Expansion Board**—See Table 2 and Figure 6. If the EPROM set consists of three or more EPROMs, install the two highest numbered EPROMs (e.g., #3 and #4 of a four-chip set) on the processor board, with the highest numbered EPROM (EPROM #4 of a four-chip set) in socket A, and the EPROM with the second highest number (EPROM #3 of a four-chip set) in socket B. Install the remaining EPROM(s) on the memory expansion board with the highest numbered of the remaining EPROMs (e.g., EPROM #2 of a four-chip set) in socket IC-1 on the memory expansion board and EPROM #1 in socket IC-2.

**2.4. 80186 Processor Boards**—This processor board (see Figure 7) is used on all Milnor® system controllers (Miltron™, Mildata®, etc.) equipped with a color monitor. It is also used on fully-programmable washer-extractors, textile processing machines with software version 95000 and later, and other models. The single EPROM on this board is located in socket IC-2.

**Tip:** For maximum reliability and to minimize the chances of the processor board resetting due to low voltage, adjust the power supply voltage for 80186 processors to 5.10 VDC at the processor

board.

There are three major revisions of this board, both of which have Milnor part numbers starting with “08BSPE”. If the seventh character is a number “1,” the board is a later version with a single four-channel communications chip. If the seventh character of the part number is a letter, the board is an earlier version with four one-channel communications chips.

The third version of 80186 processor board—with part number “08BSPE2\_”—can be configured via a jumper on the board to operate either a vacuum fluorescent **text** display, or a flat panel **color graphic** LCD display. The jumper controls the serial communications port on MTA30.

#### Supplement 1

##### Rules for Replacing 80186 Processor Boards

Processor board “08BSPET” is obsolete. Depending on machine model and build date, this board can be replaced by either “08BSPE1T” or “08BSPE2T”, but new software is required. Contact Milnor's service engineering department to determine the appropriate replacement board and software.

Processor board “08BSPE1T” has been superseded by board “08BSPE2T”(see Figure 9). If your machine uses a two-line or four-line vacuum fluorescent text display, either “...E1T” or “...E2T” will work with your existing software. The most important difference between these two boards is jumper *J1* on the “...E2T” board for selecting the flat panel **color graphic** LCD display. This jumper must be set to the *TXT* or *NO* position for machines with a vacuum fluorescent display, or in the *GPX* (graphics) position for machines with a color LCD display.

Figure 7: Obsolete 80186 Processor Board

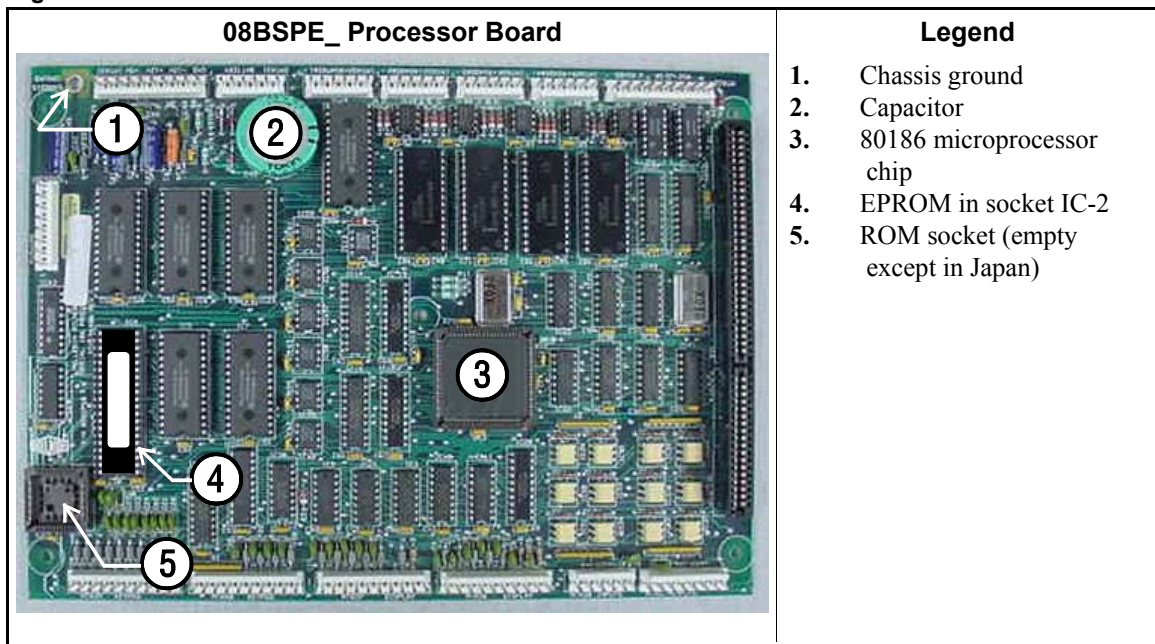




Figure 8: 80186 Processor Board

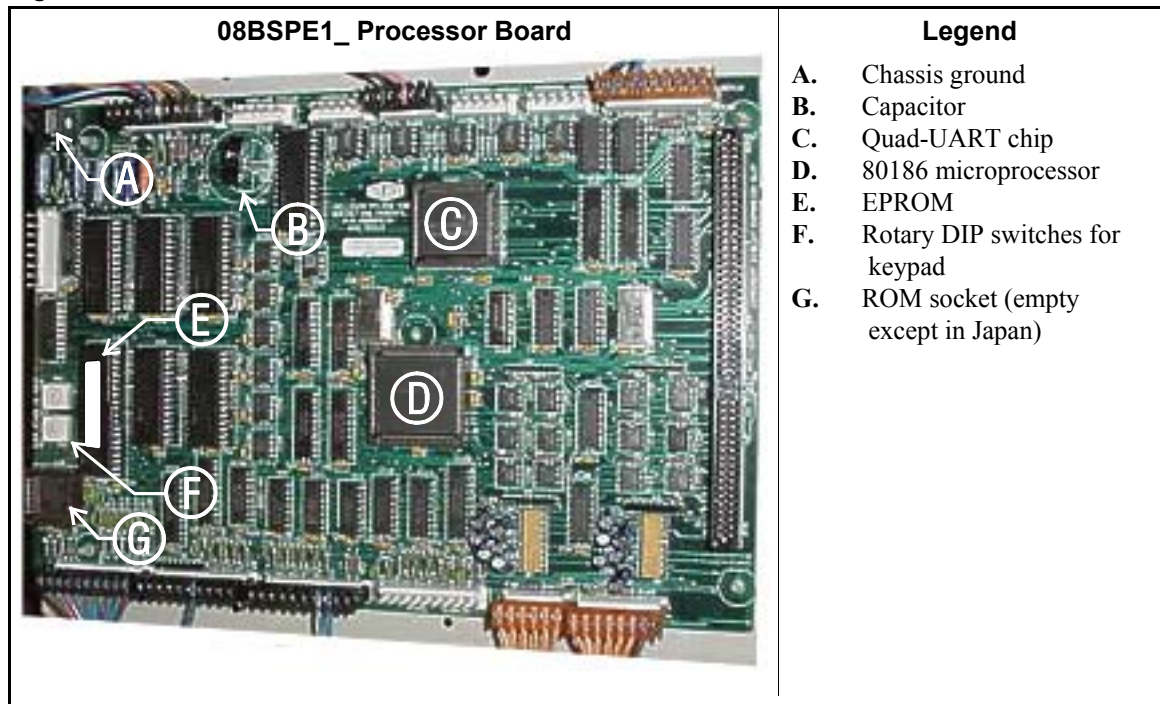
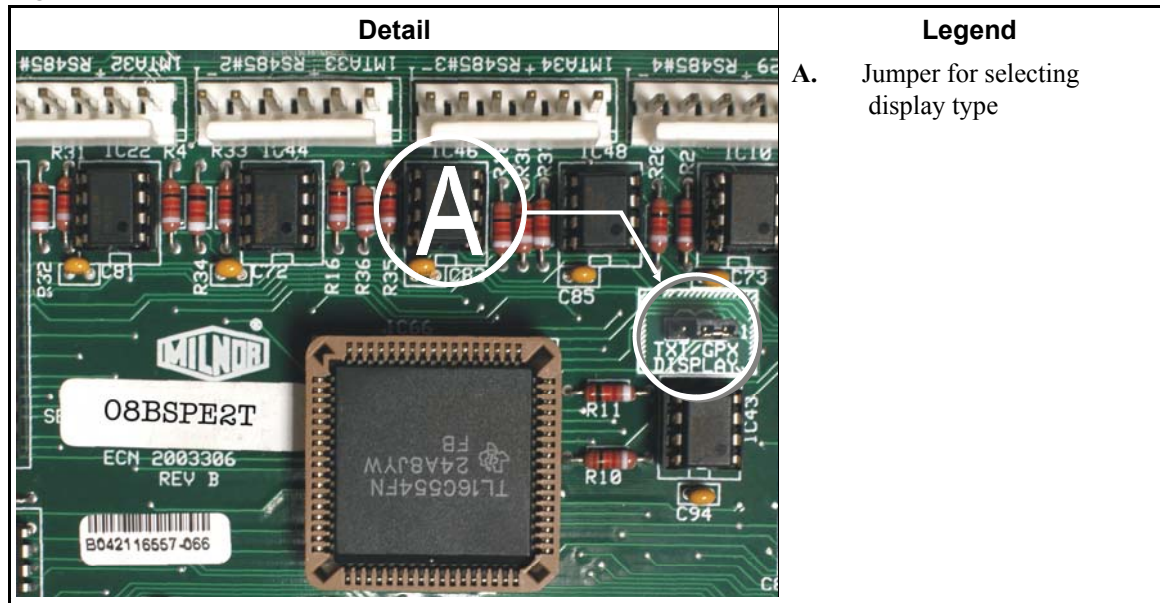


Figure 9: 08BSPE2\_ 80186 Processor Board



— End of BICMUM01 —

Memory Download Box Applications

Document..... BICUDC01  
Specified Date..... 20010807  
As-of Date..... 20010807  
Access Date..... 20010807  
  
Applicability..... YUD CUD  
Language Code..... ENG01

The memory download box is used to store configuration and formula data for most current models of Milnor® machines. Two types of download boxes (Figure 1) are available: one with a *Transmit* button on the front panel, and one without the button. The *Transmit* button is not required for machines—usually CBW® controllers and similar devices—which are capable of initiating the data transfer.

Figure 1: Download Box Identification

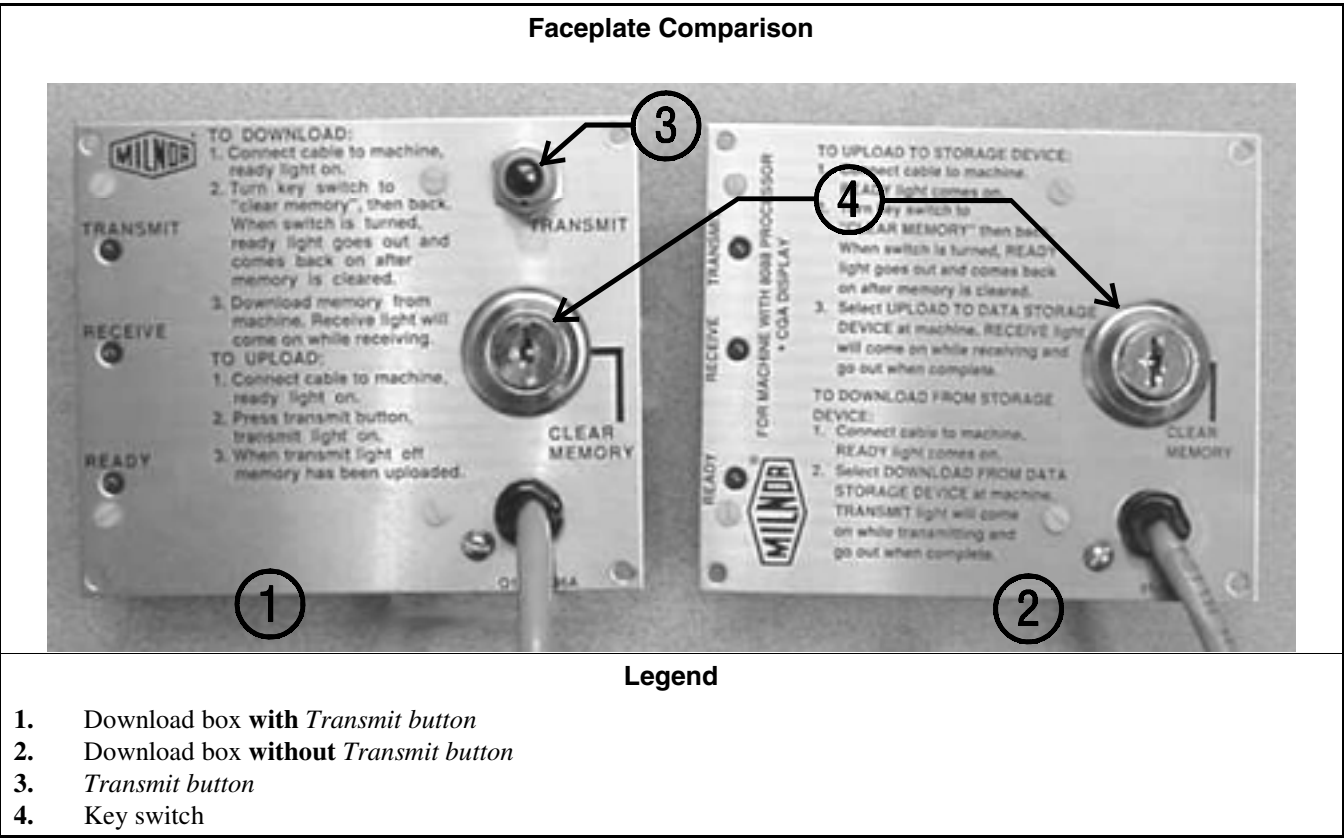
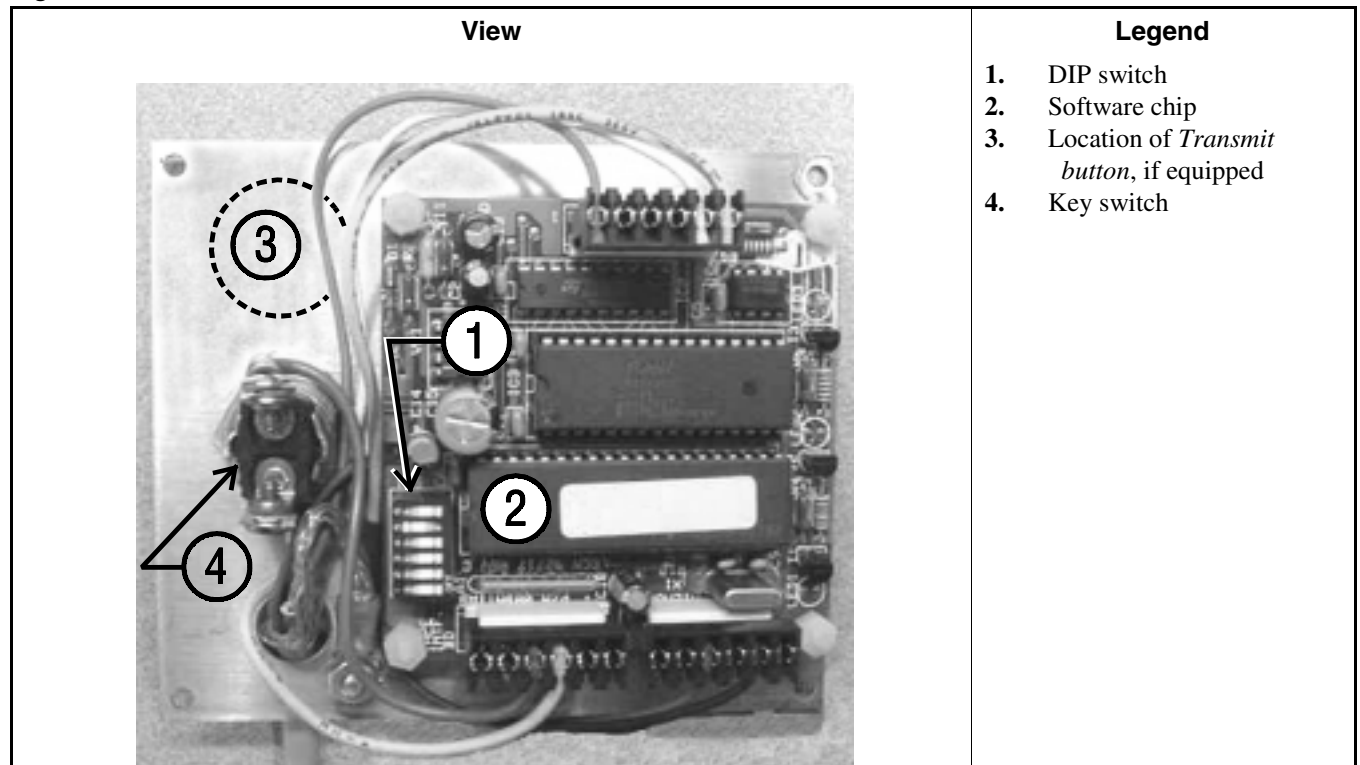


Figure 2: Rear View of Circuit Board



Supplement 1

Interpreting the DIP Switch Settings

Use the following codes and their definitions to set the DIP switch positions for the equipment, as shown in Table 1.

- A. All switch positions are OFF.
- B. Switch position 4 is ON; all other switch positions are OFF.
- C. Switch position 5 is ON; all other switch positions are OFF.
- D. Switch positions 1 and 5 are ON; all other switch positions are OFF.

**Note 1:** If necessary, a memory download box with the *Transmit* button may be used to store configuration and formula data from any machine that's capable of downloading. When using a button-equipped download box to store data from one of the devices listed in Table 1 as requiring the *Transmit* button, ignore the button. The download will begin when commanded from the device control panel.

**Table 1: DIP Switch Positions**

Processor Board	Software Version	DIP Switch Setting	Processor Board	Software Version	DIP Switch Setting
Uses Memory Download Box WITH Transmit Button			Uses Memory Download Box WITHOUT Transmit Button		
Washer-extractor Models			Miltron Controller for CBW System		
8088	All	C	8088	All	A
80186	98000-98003	C	80186	All	B
	98004-99004	not supported	Miltrac		
	99005-9900B	D	8088	All	A
	20000-20003	D	80186	All	B
FxW, FxP, and FxS Washer-extractor models			Milrail Rail Controller		
8088	All	C	8088	All	A
80186	98000-98003	C	80186	All	B
	98004-98009	not supported	Device Master		
	9800A-9800H	D	8085	All	not supported
	20000-2000B	D	8088	All	not supported
Textile and Dye Machine Models			80186	94000-94017	not supported
8088	All	C		94018	B
80186	95000-95305M	C		20000-present	B
	95305N-95306	D	Linear Costo Master		
	20000-20004	D	8085	All	not supported
Dryer Models			8088	All	not supported
8088	All	C	80186	94000-94011	not supported
80186	All	C		20000-present	B
Centrifugal Extractor Models			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		
8088	All	C			
80186	All	C			
Single-station Press Models					
8088	All	C			

## Construction of External Serial Link Cables

This document provides information for on-site fabrication of certain types of serial communication cables. An individual machine can be connected to certain makes and models of serial printer (see Note 1) using the printer cable described in Section 2.2. Programmable data can be transferred between compatible machines or between a machine and a Milnor serial memory storage device (see Note 2), using the download cables described in Section 2.3 and Section 2.4 respectively. These cable(s) connect to the cabinet-mounted 9-pin DIN type receptacle shown in Figure 1 and may be installed temporarily or permanently, as appropriate.

If the machine is connected to a Mildata® or Drynet (dryer/shuttle controller) network (see Note 3), downloading is more likely to be handled by these products. Another Milnor document—the related section in document BICCUC01—describes the permanent cables needed to communicate across a Mildata, Drynet, or Miltrac™ network. In the unlikely event that personnel will want to download data via the download cables described herein, rather than via Mildata, all energized machines on the Mildata network will receive the downloaded data. **Turn off power to any machines to which you do not wish to download.**

**Note 1:** The currently approved printers and printer configuration settings are provided in the related section in document BICWUI01. A pre-assembled machine-to-printer cable similar to the cable described here, is available from Milnor (P/N 10YMK2PNTR).

**Note 2:** 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.

**Note 3:** Mildata is Milnor's PC-based product for centralized data collection, productivity analysis, report generation, formula development and data downloading. Drynet permits supervisory and manual functions for a group of dryers and the shuttle that serves them to be performed from a central PC.

Applicable machines are provided with a single DIN receptacle for both downloading and printing. Only one function at a time (downloading or printing) can be performed using this connection.

### 1. Pin Identification

The download and printing functions use different data communication lines, but the DIN receptacle on the machine contains all of the pins used for either function. Figure 1 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 1 shows the function of each pin.

Figure 1: 9-Pin DIN Connector Pin Identification (from wire entry side of connectors)

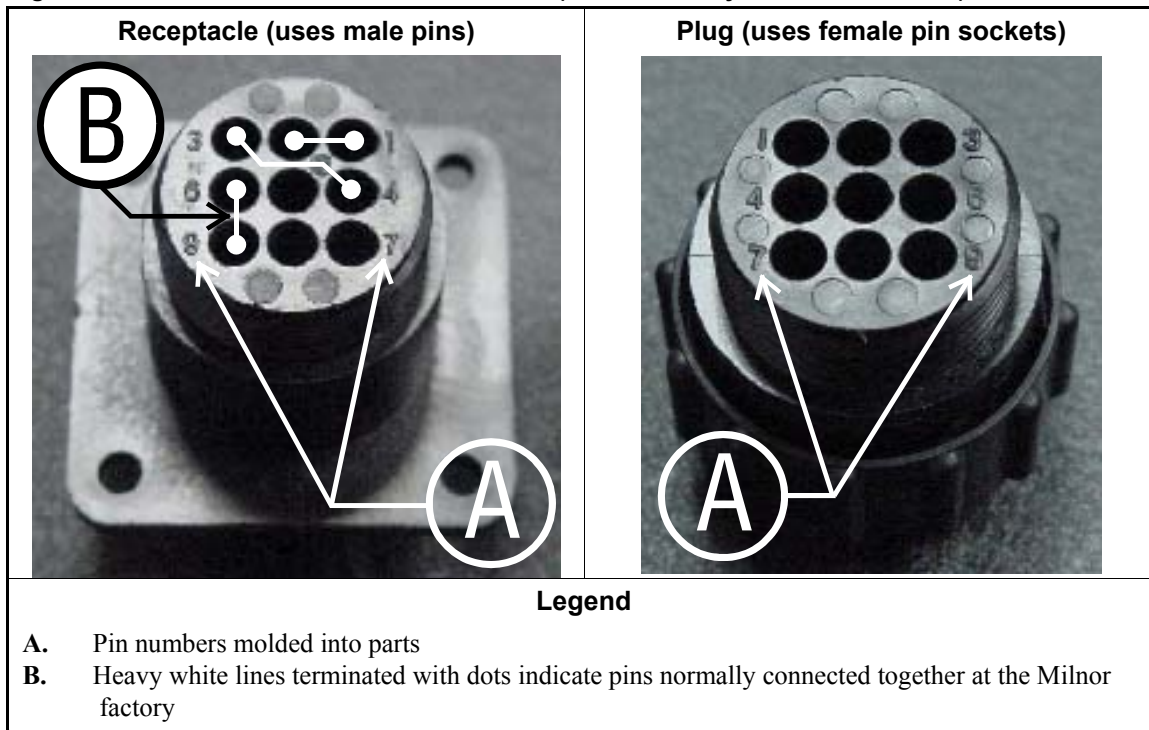


Table 1: External Serial Link Pin Assignments

Pin Number	Function	Receptacle Wiring (inside electrical enclosure)	
		Wire Number	Color Code
1	Serial low	DLL	Blue and black
2			
3	Serial high	DLH	Blue and red
4			
5	Clear to send (used for printing only)	CTS	Blue and orange
6	Electronic ground	2G	Blue and white
9			
7	Transmit data (used for printing only)	TXD	Blue and orange
8	+5 volts DC (used for serial memory storage device only)	V1	Blue



**CAUTION [1]: Risk of damage to electronic components**—Pin 8 is only used to supply +5VDC power to the download box and, if improperly connected, will damage components in both devices.

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

## 2. How to Wire the Cables

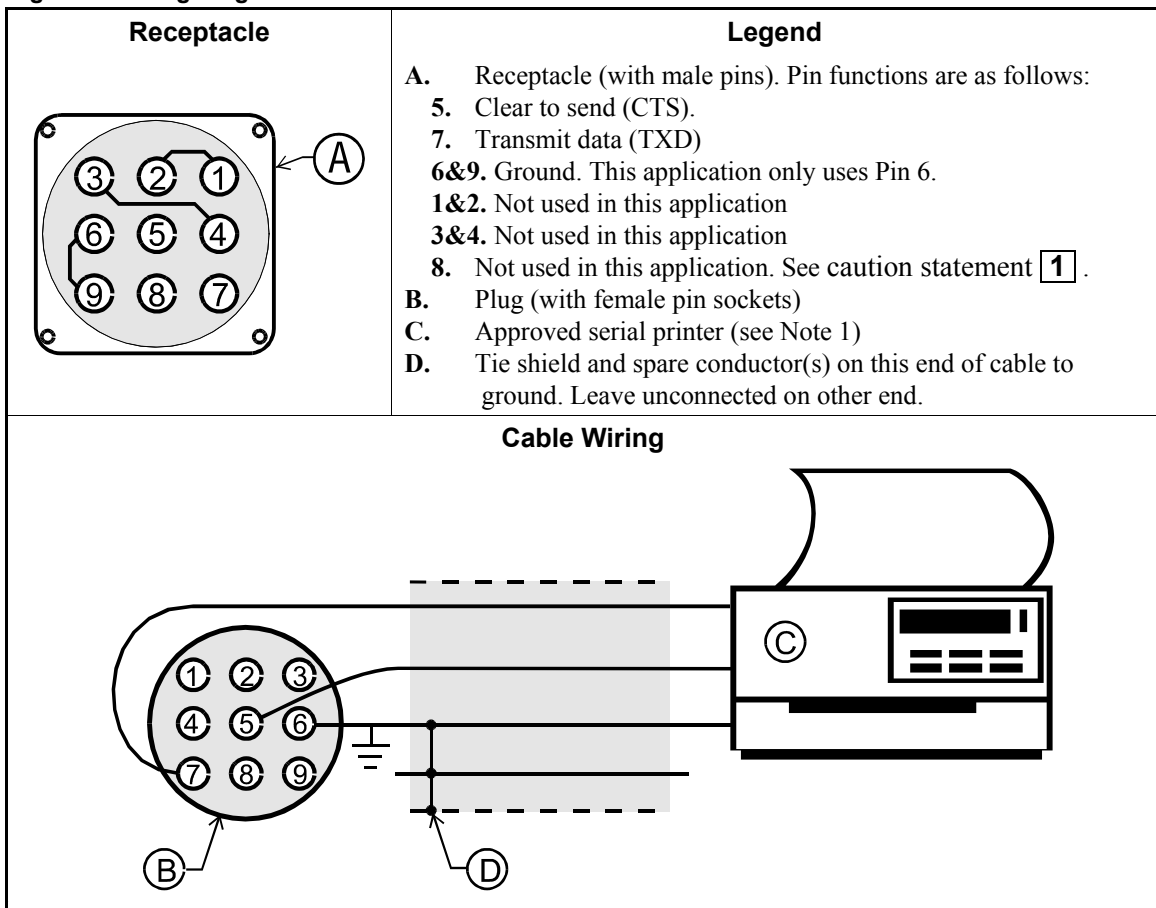
Because the DIN receptacle is wired to support different functions and because the data transferred across these cables can be corrupted by electrical noise, follow these instructions carefully.

**2.1. Cable Specifications**—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% coverage
- Four conductors with these specifications:
  - » Conductive material: Tinned copper, 20 AWG
  - » Insulation: 300VAC, color coded
  - » Preferred colors: red, black, green and white

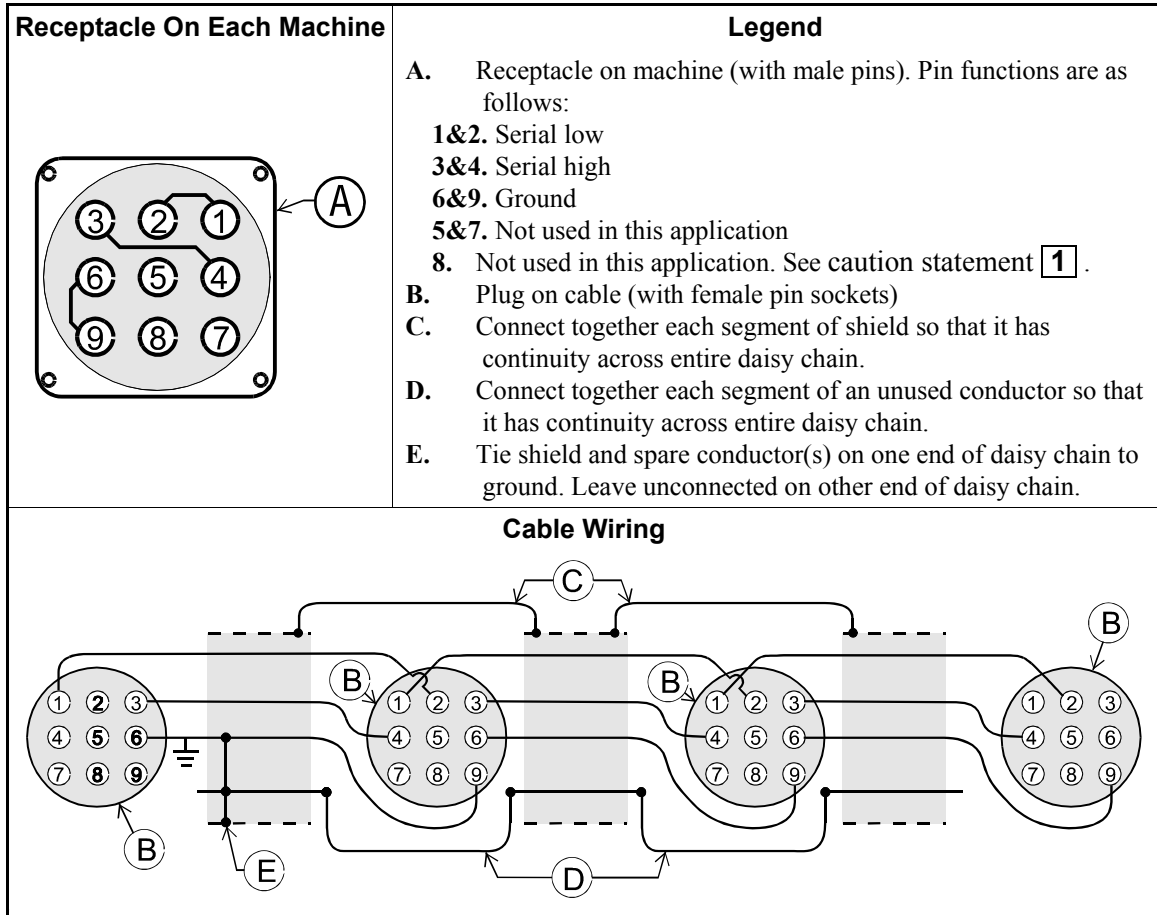
**2.2. Connecting a Machine to a Printer for “Print Data”**—Many Milnor microprocessor-controlled machines allow permanent or temporary connection of a serial printer for generating printed copies of formulas or status reports during operation. Figure 2 shows how to wire the machine-to-printer cable. Milnor has tested and approved certain printers for this application (see Note 1).

**Figure 2: Wiring Diagram for Cable to Connect a Machine to a Printer**



- 2.3. Connecting Two or More Machines for Machine-to-machine Transfer**—Figure 3 shows how to wire a cable to connect a bank of identical machines (the Figure 3 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 3: Wiring Diagram for Cable to Connect Two or More Machines**



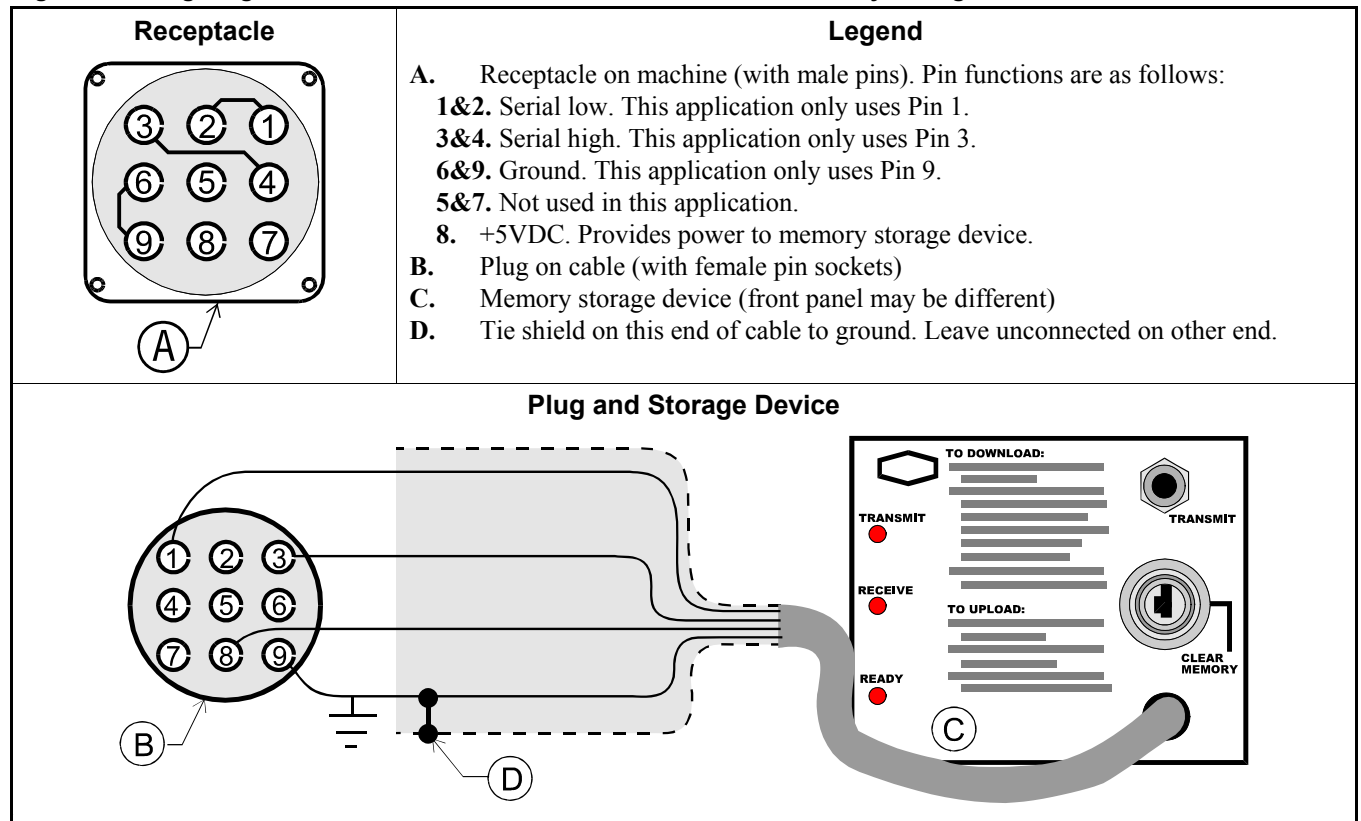
The internal connections on each receptacle (machine) between pins 1 and 2, 3 and 4, and 6 and 9 make it easier to wire the cable because it is not necessary to jumper these pins together on the cable. However, this also means that every plug on the daisy chain must be plugged into a receptacle. Otherwise,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

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

- 2.4. Connecting a Machine to a Serial Memory Storage Device**—The cable used with the serial memory storage device (download box) available from Milnor, see Note 2, is permanently attached to the storage device. Cable fabrication, as shown in Figure 4, 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 4: Wiring Diagram for Cable to Connect a Machine to a Serial Memory Storage Device**



— End of BICWUC01 —

## Printer Requirements and Settings

**Notice 1:** 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.

### 1. Cable Requirements

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

**Table 1: 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

### 2. Configuring the Citizen GSX-190 Printer

**Table 2** 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 2: Required Settings for Citizen GSX-190 Printer**

Menu	Data Field	Value	Menu	Data Field	Value
Install 1	Ribbon	Normal	Character	Slash zero	Off
	A.S.F.	Off		Character set	Graphics
	Emulation	Epson		Intl character set	U.S.A.
Print Style	Font	Draft		Code page	U.S.A.
	Emphasized	Off	Install 2	Tear off	Off
	Pitch	10 characters per inch		Paper out	Enable
	Font lock	Off		Auto linefeed	Off
Page Layout	Line spacing	6 lines per inch		Copy mode	Off
	Form length	Letter		Envelope	Off
	Page skip	Off	Serial I/F	Baud rate	9600
Print Mode	NLQ Dir	Uni-directional		Parity	Even
	Graphic Dir	Uni-directional		Data bits	8 bits
				Stop bits	1 bit
				Protocol	DTR

### 3. Configuring the Epson LX300 Printer

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 3: Required Settings for Epson LX300 Printer**

Data Field	Value	Data Field	Value
Character spacing	10 characters per inch	Tractor	Single
Shape of zero	0	Interface	Serial
Skip over perforation	Off	Bit rate	9600 bps
Character table	PC 437	Parity	Even
Auto line feed	Off	Data length	8 bits
Page length	11 inches	ETX/ACT	On
Auto tear off	Off		

#### 4. Previous Printer Models

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.

— End of BICWUI01 —

## USING THE EXTRACT TEST ON THE WASHER-EXTRACTOR MICROPROCESSOR CONTROLLER

The *extract test*, available on all machines that use the Mark II, III, IV, and V washer-extractor controller, is a convenient means for maintenance personnel to run the machine in extract for testing purposes. It is not for processing.

### When and When Not To Use the Extract Test

**Use the Extract Test To Test *Certain Repairs and Adjustments***—The extract test is helpful after replacing drive train components. Use this test to check the phasing of the drain or extract motors. **The extract test cannot be used to test the *Excursion switch* on suspended (Hydro-cushion<sup>®</sup> and spring mounted) machines or the *Accelerometer* on self-balancing machines because the test bypasses these devices.** Run a formula to test these switches. Machine maintenance must be performed only by qualified and authorized maintenance personnel, in strict compliance with published procedures and safety precautions.

**Do Not Use the Extract Test for Processing**—The extract test accelerates the machine to drain speed from a dead stop rather than from wash speed, as occurs when running a formula. If goods are in the machine, the drain motor may stall because it does not have sufficient torque. If extract speed is achieved, an imbalance may cause the machine to vibrate excessively because the extract test bypasses the out-of-balance sensing devices that would normally initiate an extract recycle. Either of these conditions can damage the machine.

### How To Run the Extract Test

#### ▲ CAUTION ▲



**MACHINE DAMAGE HAZARDS**—This test causes the cylinder to accelerate to drain speed from a dead stop. A normal size load can stall the drain motor. This test bypasses out-of-balance sensors. Severe imbalances may result.

- ☞ Never run this test with goods in the cylinder.
- ☞ Stop the test immediately if the shell bangs around inside the housing (suspended models).
- ☞ Never run this test on an improperly anchored rigid machine.

**RUN FORMULA**  
**00 OR OK POWER OFF**

When the *Run Formula* menu and selection 00 is displayed, as shown at left,

**EXTRACT**

**①**

**Displays the message *Extract Test* and sounds the operator alarm.**

**Initiates extraction and silences the operator alarm.** The cylinder accelerates to drain speed, then to extract with the balancing system enabled (if any). Verify that the cylinder rotates clockwise (observed from front of the machine), as the machine accelerates through drain to extract speed. The test continues until commanded to stop.

**②**

**Ends the extract test.** Braking continues for at least 30 seconds or until the *speed switch* contacts close. The message *Braking* appears during this time.

## HOW “CHEMWAIT” WORKS IN MILNOR MARK I, II, III, IV, AND V MICROPROCESSOR WASHER-EXTRACTOR CONTROLLERS

B

“CHEMWAIT” is a feature in the Milnor washer-extractor controller whereby a central chemical injection system can service several washer-extractors. When the chemical injection system is serving another machine, each washer-extractor controller can accept a command from the injection system to “stop the timer and do not start the injection signal.”

An independent output from Milnor to the chemical system declares: **“THIS MACHINE DESIRES TO INJECT ONE OR MORE UNNAMED CHEMICAL(S).”** (The same independent output is used regardless of the chemical(s) that will be subsequently requested.) To cause the Milnor timer to stop and delay the **“COMMENCE CHEMICAL INJECTION”** signals, an independent input from the chemical system to Milnor must respond, **“WAIT”** (within two seconds).

In the *absence* of a **“WAIT”** response, the Milnor signal(s) start two seconds after the inject request, or two seconds after the **“WAIT”** response is extinguished. The duration of the inject signals will be whatever is commanded in the washing program.

**“WAIT”** commands will be ignored unless the machine has desired to inject less than two seconds before.

When several washer-extractors desire chemicals simultaneously, it is the central chemical injection systems’ responsibility to decide which machine will receive chemicals first. It is also the central chemical injection systems’ responsibility to cope with the situation when one or more washer-extractors simultaneously desire more than one chemical, although the latter case may be avoided by only commanding one chemical injection at a time—using Milnor’s exclusive “do not drain” feature to subsequently inject more than one chemical in the same bath.

The **“DESIRES TO INJECT”** and **“WAIT”** signals must be via potential-free contacts capable of faithfully handling 10 MA (.01 amperes) at 5 VDC. The specific **“COMMENCE CHEMICAL INJECTION”** signals will be either 120 VAC or 240 VAC, depending on the specific MILNOR model, and via relay contacts capable of conducting a maximum of 9 VA (i.e., a maximum of either 80 MA (.08 amperes) at 120 VAC or 40 MA (.04 amperes) at 240 VAC).

**“CHEMWAIT”** is presently available in all Mark I, II, III, IV, and V controllers, but does require the optional #2 output board. Ask factory for more information.

B

## DEVICE COMMUNICATION FOR WTB+/DRYELL OPERATION—WASHER-EXTRACTOR SOFTWARE 9100x NOW AND LATER

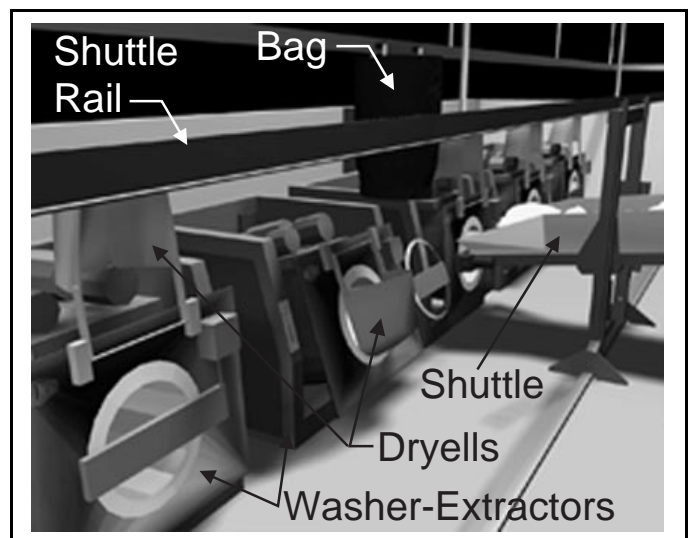
This section describes the concept of automatic operation of the washer-extractor configured for *WTB+* operation, equipped with a *dryell* and using software in the 9100x range. It will assist the technician in interfacing the machine with other components of the automated washing system.

**WTB+/Dryell Loading and Unloading**—A typical *WTB+* system such as shown in FIGURE 1 contains a bank of dryell-equipped, tilting washer-extractors, a rail loading system, and a shuttle conveyor (to move clean goods from the washer-extractors to the dryers). Loading and unloading is automatic. During washer-extractor loading, the washer-extractor tilts *rearward* to the *rear full down* position and the dryell moves to the down position. Bag(s) are then moved into position and the goods are dropped into the dryell which directs them into the washer. During washer-extractor discharge, the shuttle moves to the washer then the washer tilts *forward* to the *rear full up* position with the cylinder turning, causing the goods to discharge onto the shuttle.

### Controllers That Communicate With WTB+ Machines

The device movements described above are coordinated primarily by the *Miltrac central controller* located in the *system control box* (see *Miltrac manual*). However, the dryells, bags on the rail, and shuttle, which continually cross paths, require special coordination. This is handled by a *discharge sequencer*, also located in the *system control box*, and by direct links between each washer-extractor controller and both the shuttle controller and the rail controller. The washer controller may also communicate with a *Mildata*® computer, but *Mildata* has no control over the device movements described above.

**Device Interconnections**—Interconnections among controllers housed within the system control box (*Miltrac controller*, *Milnor sequencer*, *Milnor shuttle controller*, and sometimes *Milrail*) are factory wired. Interconnections between the system control box and other devices (washer-extractors, non-Milnor shuttle, non-Milnor rail system, and sometimes *Milrail*) are field wired. A standard serial communication cable as described in “THE EXTERNAL SERIAL LINK CABLES . . .” (see Table of Contents) links all Milnor device controllers with the *Miltrac controller*. All non-Miltrac communication is accomplished via inputs and outputs on the sequencer, washer, rail system, and shuttle controllers. On Milnor controllers, each input and output is assigned a connector and one or more pin numbers (MTA number), which appear in the device electrical schematics. For *WTB+* machines, see “MONITORING MICROPROCESSOR INPUTS AND OUTPUTS . . .” (see Table of Contents). MTA numbers for other devices are identified in the lists of inputs and outputs in the reference manual for the device.



**FIGURE 1** (MSFD0213AE)  
**A Typical WTB+ System**

**Allied Interface Requirements**—If an allied (non-Milnor) rail system and/or shuttle are utilized, these devices must be capable of communicating with the Milnor washer-extractors and system controllers via the inputs and outputs described herein. For signals to Milnor, the allied equipment must provide potential-free contacts capable of faithfully conducting low energy signals of 5 to 150 milliamps at 5VDC to 12VDC. These signals ground a Milnor computer input and go directly into the computer. Therefore, never run them adjacent to or in the same conduit with any other wires. For signals from Milnor, Milnor provides potential free contacts capable of faithfully conducting signals from 5 to 150 milliamps at 5VDC to 12VDC or up to 120 VAC. Do not use these contacts to directly energize any device requiring amps or volts outside of the ranges listed above.

**B WTB+ Loading and Discharge Sequences**—The following table applies to the microprocessor washer-extractor controller with software version 91002 and latter, configured for *WTB+* with *dryell* (see “5=CONFIGURE . . .” in “PROGRAMMING . . .”). The table describes a sequence of general conditions (states) of the controller and specific actions performed by it in the process of loading and discharging. All interfacing devices must respond to these actions as implied by this table, for proper system functioning.

**NOTES:**

1. Controller actions may consist of communicating (data *in* or *out*) or processing (*internal*). Communication (data in/out) may be with 1) Miltrac via the serial link, 2) the sequencer, rail system or shuttle via inputs/outputs, or 3) mechanisms on the washer itself (the machine the controller is on) via inputs/outputs.
2. Miltrac communication consists of *status* queries and *commands*. Miltrac continually asks the washer its *load-end* and *discharge-end* status (Miltrac always distinguishes between load and discharge end, even though they are the same on the washer). All Miltrac status lines are shown as data *out* to indicate this is the washer controller’s response to a Miltrac query. Miltrac issues commands based on these responses.
3. “Allied load-end” and “allied discharge-end” refer to *allied* devices that feed goods to and receive goods from the washer, respectively. These outputs are only used if the interfacing device is allied. Outputs to “Milrail,” “Milnor shuttle,” and “Milnor shuttle flag” are only used if these Milnor devices are used.
4. Actions are listed in order of occurrence. Any indented line in the “Action” column is an action that cannot begin until the data described by the previous, less-indented line is received.

Washer-Extractor Controller State	Action (See note 4)	Controller Data In, Data Out, or Internal Processing	Source (Data In) or Destination (Data Out)	Comments
00 Ask permission to lower dryell	Load end status= <i>cannot receive</i>	out	Miltrac	See note 1
	Turn on <i>sequencer load desired</i> output	out	sequencer	
	Wait for <i>load allowed</i> input	in	sequencer	
	Turn on <i>load desired</i> output	out	allied load-end	See note 3

Washer- Extractor Con- troller State	Action (See note 4)  See note 1→	Controller Data In, Data Out, or Internal Processing	Source (Data In) or Destination (Data Out)	Comments
<b>01</b>  <b>Prepare to lower dryell</b>	Turn on <i>deflate dryell up seal</i> and <i>release dryell up lock</i> outputs	out	this machine	
	Wait to lose <i>dryell locked up</i> input	in	this machine	
	Start a two second timer	internal	—	Allows time for lock to retract.
<b>02</b>  <b>Lower dryell</b>	Wait for timer = zero	internal	—	
	Turn on <i>dryell move down</i> output	out	this machine	
	Wait for <i>dryell down</i> input	in	this machine	
	Turn on <i>sequencer load allowed</i> output	out	Milrail	See note 3
	Start a five second timer	internal	—	Extra safety to assure dryell down
<b>03</b>  <b>Request a load</b>	Wait for timer = zero	internal	—	
	Turn off <i>deflate dryell up seal</i> , <i>release dryell up lock</i> , and <i>dryell move down</i> outputs	out	this machine	Turned on in states 01, 02
	Load end status = <i>want to receive</i>	out	Miltrac	See note 2
<b>04</b>  <b>Prepare to flag</b>	Wait for load end command = <i>get ready</i>	in	Miltrac	See note 2
	Turn off <i>sequencer load desired</i> and <i>sequencer load allowed</i> outputs	out	sequencer	Turned on in states 00, 02
<b>05</b>  <b>Flag for bags.</b>  <b>Verify machine in load- ing posi- tion</b>	Turn on <i>load/unload allowed</i> and <i>load commanded</i> outputs	out	this machine	Opens door and assures machine is tilted down
	Turn on <i>flag down</i> output		allied load-end	See note 3
	Wait for <i>full down</i> and <i>door full open</i> inputs	in	this machine	Full down = tilted rearward
	If Mldata, then request and wait for remote formula	out/in	Mldata	
	Load end status = <i>ready to receive</i>	out	Miltrac	See note 2
<b>06</b>  <b>Prepare to load</b>	Wait for load end command = <i>start receiving</i>	in	Miltrac	See note 2
	Turn on <i>dryell move down</i> output	out	this machine	Holds dryell tight against door



Washer- Extractor Con- troller State	Action (See note 4)  See note 1→	Controller Data In, Data Out, or Internal Processing	Source (Data In) or Destination (Data Out)	Comments
<b>07</b>  <b>Receive goods</b>	Turn on <i>flush dryell</i> output	out	this machine	
	Turn on <i>start loading</i> output	out	allied load- end	See note 3
	Wait for load end command = <i>receive complete</i> or <i>you're finished receiving—do not hold</i>	in	Miltrac	See note 2 and explanation below
	• If <i>receive complete</i>	—	—	This indicates one or more additional bags are to be loaded. Repeat states 04 through 07.
	load end status = <i>finished receiving</i> Go to state 04.	out	Miltrac	^
	• If <i>you're finished receiving—do not hold</i>	—	—	This indicates this was the last or only bag to be loaded.
	Load end status = <i>finished receiving</i>	out	Miltrac	^
	Turn off <i>dryell move down</i> output Go to state 08.	out	this machine	Turned on in state 06
<b>08</b>  <b>End loading</b>	Wait for load end command = <i>do nothing</i>	in	Miltrac	See note 2
	Load end status = <i>cannot receive</i>	out	Miltrac	See note 2
	Turn off <i>load desired, load/unload allowed, load commanded, flag down, and start loading</i> outputs	out	this machine/ allied	Turned on in states 00, 05, 07.
	Start <i>dryell flush timer</i> (configurable)	internal	—	See following explanation.
<b>09</b>  <b>End flushing</b>	Wait for dryell flush timer = zero	internal	—	Continue flushing for the <i>dryell flush time</i> configured to assure all goods flushed into machine.
	Turn off <i>flush dryell</i> output (turned on in state 07)	out	this machine	
	Start <i>dryell delay timer</i> (configurable)	internal	—	See following explanation.
<b>10</b>  <b>Prepare to raise dryell</b>	Wait two seconds	internal	—	Delay raising dryell and purge flush inlet with air for the <i>dryell delay time</i> configured to assure all flushing water drains into the machine.
	Turn on <i>dryell blow</i> output	out	this machine	
	Wait for dryell delay timer = zero	internal	—	
	Turn off <i>dryell blow</i> output	out	this machine	
	Turn on <i>deflate dryell up seal</i> output			
<b>11</b>  <b>Raise dryell</b>	Turn on <i>dryell move up</i> output	out	this machine	
	Wait for <i>dryell locked up</i> input	in	this machine	
	Turn off <i>deflate dryell up seal</i> and <i>dryell move up</i> outputs	out	this machine	Turned on in states 10, 11

Washer- Extractor Con- troller State	Action (See note 4)  See note 1→	Controller Data In, Data Out, or Internal Processing	Source (Data In) or Destination (Data Out)	Comments
<b>12</b>  <b>Go to washing position.</b>  <b>Signal loading complete</b>	Load end status = <i>cannot receive</i>	out	Miltrac	See note 2
	Turn on <i>load/unload terminate</i> output	out	this machine	Closes door
	Wait for <i>full down</i> and <i>door full closed</i> inputs	in	this machine	
	Turn off <i>load/unload terminate</i> output	out	this machine	Turned on in this state
	Turn on <i>sequencer load/unload terminate</i> output	out	sequencer	
	Start a two second timer	internal	—	Make sure sequencer sees signal
<b>13</b> <b>End signal</b>	Wait for timer=zero	internal	—	
	Turn off <i>sequencer load/unload terminate</i> output	out	sequencer	Turned on in state 12
<b>14</b>	Run the wash formula	internal	—	
<b>15</b>  <b>Ask permission to discharge</b>	Turn on <i>sequencer discharge desired</i> output	out	sequencer	
	Wait for <i>discharge allowed</i> input	in	sequencer	
	Discharge end status= <i>want to transfer</i>	out	Miltrac	See note 2
	Turn on <i>sequencer discharge allowed</i> output	out	Milnor shuttle	See note 3
	Turn on <i>discharge desired</i> output	out	allied discharge-end	See note 3
<b>16</b>  <b>Flag for shuttle</b>	Wait for discharge end command = <i>get ready</i>	in	Miltrac	
	Turn off <i>sequencer discharge desired</i> and <i>sequencer discharge allowed</i> outputs	out	sequencer	Turned on in state 15
	Turn on <i>sequencer flag down discharge</i> output	out	Milnor shuttle flag	See note 3
<b>17</b>  <b>Go to discharge position</b>	Turn on <i>load/unload allowed</i> and <i>discharge commanded</i> outputs	out	this machine	Opens door (would also tilt machine if left on—see below)
	Wait for <i>door full open</i> input		this machine	
	Turn off <i>load/unload allowed</i> and <i>dicharge commanded</i> outputs	out	this machine	Turn off outputs before machine starts tilting in case shuttle is not yet in position.
	Discharge end status = <i>ready to receive</i>	out	Miltrac	
	Wait for discharge end command = <i>start transfer</i>	in	Miltrac	
	Turn on <i>load/unload allowed</i> and <i>discharge commanded</i> outputs	out	this machine	Tilts machine forward
	Turn on <i>start discharging</i> output	out	allied discharge end	See note 3
	Wait for <i>full up</i> input	in	this machine	Full up = tilted forward

Washer- Extractor Con- troller State	Action (See note 4)  See note 1→	Controller Data In, Data Out, or Internal Processing	Source (Data In) or Destination (Data Out)	Comments
<b>18</b>  <b>Discharge goods. Go to loading position Signal discharge complete</b>	Load end status= <i>want to receive</i>	out	Miltrac	
	Run discharge sequence	internal	—	
	Turn off <i>discharge desired, sequencer flag down discharge, discharge commanded, and start discharging</i> outputs	out	this machine	Turned on in states 15, 16, 17
	Turn on <i>load commanded</i> output	out	this machine	Tilts machine rearward
	Turn on <i>discharge terminated</i> output	out	allied discharge end	See note 3
	Wait for <i>full down</i> input	in	this machine	Full down = tilted rearward
	Turn off <i>load/unload allowed, load commanded, and discharge terminated</i> , outputs	out	this machine	Turned on in states 17, 18
	Wait for discharge end command = <i>do nothing</i>	in	Miltrac	See note 2
	Turn on <i>sequencer load/unload terminate</i> output	out	sequencer	
	Start a two second timer	internal	—	Make sure sequencer sees signal
<b>19</b>  <b>End signal</b>	Wait for timer=zero	internal	—	
	Turn off <i>sequencer load/unload terminate</i> output	out	sequencer	Turned on in state 18
	Go to state 00	—	—	

# ADJUSTING LEVEL SENSING APPARATUSES AND SETTING LEVELS ON 100-FORMULA WASHER-EXTRACTORS AND TEXTILE MACHINES

## How Level Control Works

**Types of Level Sensing Apparatuses**—Three types of apparatuses are used on these machines: *float chamber assemblies*, *pressure switches*, and *pressure transducers*.

A *float chamber assembly* (FIGURE 1) is an open-top, metal tube connected to the shell below the water line. The height of water in the tube is the same as in the cylinder. Changes in the level cause a float, rod, and actuating arm to move, which in turn, actuate either of two switches. Each switch actuates at one pre-set level.

A *pressure switch* (FIGURE 2) actuates when the air inside an airtight chamber connected to the washer shell below the water line reaches a certain pressure. As the liquor level changes, the air pressure in the chamber changes. Each pressure switch actuates at one pre-set level.

A *pressure transducer* (electronic level control) works similar to a pressure switch, except that it produces a voltage which varies with changes in pressure. The varying voltage is converted into digital data which the microprocessor controller can interpret and display as inches or centimeters of water.

**Which Apparatuses and Methods of Level Control Are Used**—Table A, below, shows which apparatuses are used on various machine types. These apparatuses permit controlling the liquor level using the methods listed in the table, unless the machine is equipped and configured for *metered water* (specifying a quantity of water). In the latter case, the level sensing apparatuses are not used to control levels, but they are used by the microprocessor controller for certain internal lockouts (e.g., permit steaming only after low level is achieved).

**Table A: Apparatuses and Methods for Each Machine Type**

Machine Type	Level	Level Sensing Apparatus	How level is specified in wash formula (no <i>metered water</i> )
Divided cylinder models	Level 3=high (rinse)	pressure switch SPL3	Select one of the four pre-set levels
	Level 2=low (wash)	pressure switch SPL1	
	Level 1=below low (starch)	pressure switch SPL	
	Level 0=no water (shake out)	N. A.	
36021xxx and 36026xxx open pocket models	Level 3=high (rinse)	float chamber/switch SLL3	Select one of the four pre-set levels
	Level 2=low (wash)	float chamber/switch SLLL	
	Level 1=below low (starch)	pressure switch SPL1	
	Level 0=no water (shake out)	N. A.	
	OK to open door	pressure switch SPLS	N. A.
42026xxx and larger open pocket models	Processing levels	pressure transducer	Specify inches or centimeters within a pre-set range
	OK to open door		N. A.
	Fill while tilted		N. A.

**NOTE:** There is no separate *cooldown* level. Cooldown occurs at the commanded level in the bath in which cooldown is commenced.

## Determining Levels

**Washer-Extractors**—Ultimately, the local situation dictates the best processing levels to use. However, the factory levels shown in Table B, below, reflect “typical” processing conditions, and the user should carefully consider the consequences before changing these settings. For example, given normal load size and common fabric type, the factory settings for *level 2* and *medium* shown in the table below are the minimum required for a first bath. At lower levels the goods may not be fully wetted, resulting in poor washing and unbalanced extractions.

**Textile Machines**—Because textile processes vary greatly, the configure lockouts for textile machines are set initially to provide the widest range for commanding levels in the formula.

**Table B: Factory Levels (in inches and ( ) centimeters)**

Actual levels set on apparatus (machines with a float chamber assembly and/or pressure switches)				Configure values entered in microprocessor (machines with a pressure transducer)				
Cylinder Designation	Level 1 (starch)	Level 2 (wash)	Level 3 (rinse)	Cylinder Designation	Low (minium)	Medium (min. prior to extract)	High (maximum)	Tilt
<b>Divided Cylinder Washer-Extractors</b>				<b>F8W Outerwear Washer-Extractor</b>				
42044	4 (10)	7 (19)	12 (31)	30022	4 (10)	7 (19)	10 (25)	—
<b>36021xxx and 36026xxx Washer-Extractors</b>				<b>Open Pocket Washer Extractors—42026 and Larger</b>				
36021	3 (8)	8 (20)	13 (33)	42026	8 (20)	10 (25)	16 (41)	—
36026	3 (8)	8 (20)	13 (33)	42032	8 (20)	10 (25)	16 (41)	—
NOTE: <i>Ok to open door</i> level = 7 (18) This setting must not be changed.				48032	9 (23)	11 (28)	16 (41)	*
				48036	9 (23)	11 (28)	16 (41)	*
				52038	8 (20)	10 (25)	16 (41)	*
				64046	10 (25)	12 (31)	16 (41)	16 (41)*
				72046	10 (25)	14 (36)	18 (46)	18 (46)*
				72058	10 (25)	14 (36)	18 (46)	18 (46)*
				* On non-tilting models, the <i>tilt level</i> must be set to 00. On tilt- ing models, the factory settings is the same as high level.				
				<b>Textile Machines</b>				
				64046	4 (10)	15 (38)	38 (97)	6 (15)
				72058	4 (10)	15 (38)	38 (97)	6 (15)

## Precautions When Changing Factory Levels

1. *Pressure switch SPLLS*, used on 36021xxx and 36026xxx models to unlock the door at a safe level, must remain at the factory setting. (In other models, this level is specified in the software and cannot be changed.)
2. Never set the level for a first bath lower than needed to thoroughly wet the goods. Normally this will be the factory setting shown in the table for *level 2* or *medium*.
3. Never change float or pressure switch hierarchy. All lower level switches must make (i.e., L1 and L2 must both make for *level 2*; L1, L2, and L3 must all make for *level 3*.)
4. *Pressure switch* settings that vary more than one inch (2.5 cm) from the factory settings are not recommended.

## About Level Adjustments

### ⚠ CAUTION ⚠

**INJURY AND MACHINE DAMAGE HAZARDS**—A knowledge of machine programming, operating, and mechanical/electrical servicing is needed when making level adjustments. These adjustments must be performed only by qualified personnel, in strict compliance with published safety precautions.

**When Adjustments Are Needed**—If the mounted position of a *float chamber assembly* or part of it changes (which can occur when components are replaced), the switches will no longer actuate at the same levels. Similarly, a *pressure switch* may not actuate at the original level setting as a result of prolonged wear or replacement. In these situations, the pre-set levels must be re-established.

On machines with *pressure transducers*, the microprocessor may not properly interpret the transducer output as a result of prolonged wear or replacement of the transducer. In this situation, the transducer must be re-calibrated.

**Apparatuses Used To Make Level Adjustments**—*Level float*-controlled levels are adjusted by moving the clips on the float rod. *Pressure switch*-controlled levels are adjusted with the *trip point adjusting screw* on the switch. On machines with *pressure transducers*, actual processing levels are not pre-set (levels are specified in the formula), but ranges and tilt level are pre-set with the *low*, *medium*, *high*, and *tilt level* configure decisions. The transducer is calibrated with the *tap offset counts* configure decision.

**Measuring Levels Accurately**—The adjustment procedures require filling the machine to a level mark of known height. The amount of water needed to achieve a level will vary unpredictably if goods (which both absorb water and occupy space) are present or if the cylinder is rotating. **Always set levels/calibrate with the cylinder at rest and without goods.**

On divided cylinder machines (which hang level, front to back), use the graduated sight glass on the shell front to measure levels. The graduations are in inches or centimeters, depending on the machine's destination country.

The levels in open pocket cylinders (which slope down to the rear) are measured at the rear (deepest part) of the cylinder. Temporary marks must be placed on the cylinder rear wall, as explained below.

## Marking Levels on an Open Pocket Machine

### ⚠ DANGER ⚠



**CONFINED SPACE HAZARDS**—Confinement in the cylinder can kill or injure you. Hazards include, but are not limited to panic, burns, poisoning, suffocation, heat prostration, biological contamination, and crushing.

☞ **Do not enter the cylinder until it has been thoroughly purged, flushed, drained, cooled, and immobilized.**

1. Prepare the machine for safe entry and in accordance with all applicable codes (e.g., OSHA permit-required confined space entry requirements). Lock power off at the external disconnect switch.
2. On the inside of the cylinder, measure from the bottom rear and place clearly visible marks on the rear wall. If the machine has a *level float* and/or *pressure switches*, mark a line at each level to be set. If the machine has a *pressure transducer*, mark a line at *high* level. The cylinder will be stationary while filling, so the marks will not move.
3. When all personnel are clear, restore machine power.

## Level Setting Procedures

### (Machines With a *Float Chamber Assembly* and/or *Pressure Switches*)

**General Procedure**—Perform the following for each level to be set:

1. Close the door and run Formula 99. (The cylinder will be stationary and without water.)
2. Use the procedures described in “MODIFYING FORMULAS IN PROGRESS,” “Method B . . .” (see Table of Contents) to fill with cold water just to the mark for the level to be set.
3. Adjust the appropriate apparatus (*float chamber assembly* or *pressure switch*) as explained below, just enough to actuate (as indicated by the proper level number appearing on the display).

### Accessing and Adjusting the Float Chamber Assembly

#### ⚠ DANGER ⚠

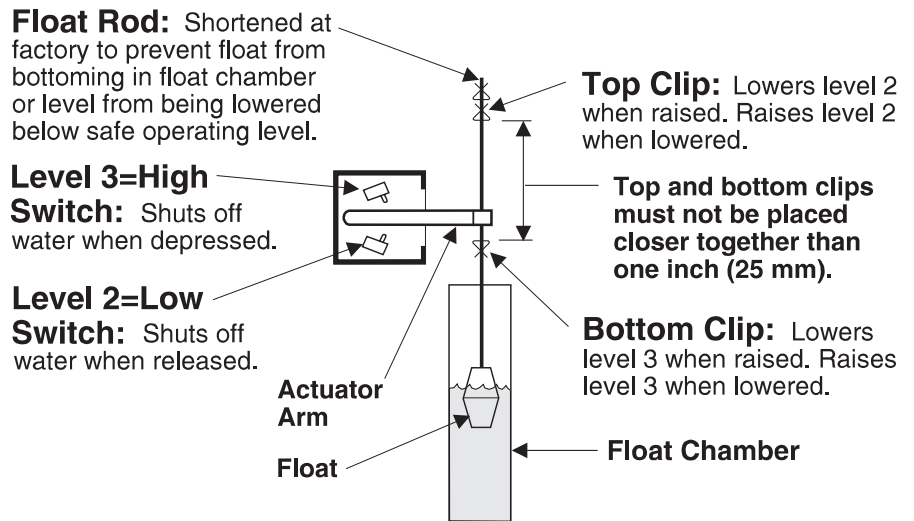


**ENTANGLE AND SEVER HAZARDS**—Contact with moving components normally isolated by guards, covers, and panels can entangle you and crush your limbs. These components move automatically.

✎ Do not service machine unless qualified and authorized.

The machine must remain powered on while adjusting the float rod clips. Use **extreme caution not to reach into the path of any apparatuses which could move, such as pulleys or belts**. On rigid models, the float chamber assembly (FIGURE 1) is located behind the shell. The float rod clips are accessible from the top of the machine. On suspended models, the level float is located within the frame. Remove the appropriate panel(s) for access.

Move clips as shown in FIGURE 1. Note that top and bottom clips must not be placed closer together than one inch (25 mm), otherwise the float rod can bind in the actuator arm.



**FIGURE 1** (MSSM0238BE)  
**Float Chamber Assembly—Clip Adjustment**

### Accessing, Identifying, and Adjusting Pressure Switches

#### ⚠ DANGER ⚠



**ELECTROCUTION AND ELECTRICAL BURN HAZARDS**—Contact with high voltage will electrocute or burn you. Power switches on the machine and the control box do not eliminate these hazards. High voltage is present at the machine unless the main machine power disconnect is off.

✎ Do not service machine unless qualified and authorized.

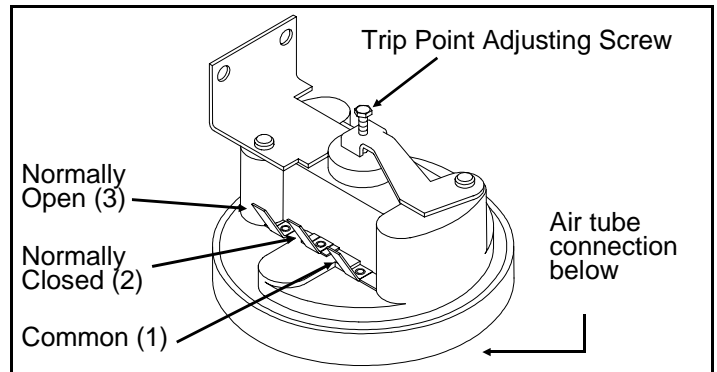


The machine must remain powered on when adjusting pressure switches. **Use extreme caution not to touch any electrical conductors on the switch or in the electric box. The trip point adjusting screw may become electrically energized when power is on. Use only an insulated screwdriver to make adjustments.**

Pressure switches (FIGURE 2) are located in the *low voltage control box*. A sticker on the switch and/or a tag in the control box identify the switches by the functional names given in Table A (e.g., SPL3).

The switch manufacturer calibrates these switches to actuate at a set pressure. When proper levels are verified at the Milnor factory, the *trip point adjusting screw* is painted with wax to hold its adjustment. **With an insulated screwdriver**, turn the *trip point adjusting screw* slowly. Turning clockwise causes the switch to actuate at a higher level; turning counter-clockwise actuates it at a lower level.

**NOTE:** A crimp, cut, or loose connection in the plastic air tube will prevent the pressure switch from functioning, causing the machine to overflow. Inspect air tubes periodically.



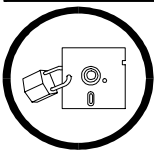
**FIGURE 2** (MSSM0240AE)  
**Pressure Switch**

## Range Setting, Calibrating, and Testing Procedures (Machines With a *Pressure Transducer*)

**Disabling *Metered Water* if the Machine Also Has a Flow Meter**—If the machine has a flow meter and is configured for *metered water* (configure decision N), then the pressure transducer is only used for internal lockouts. Never-the-less, the transducer must be properly calibrated. The procedures described herein for range setting and calibrating may be used in this instance provided *metered water* is disabled, as follows:

1. Write down (or print out) all configure decisions. This is necessary because the next step will cause certain configure values to be lost. These must be re-entered later.
2. Set configure decision N (*metered water*)=0. Now a calibration formula can be programmed, specifying levels in inches (or centimeters) of water, as explained elsewhere herein.

### ⚠ CAUTION ⚠



**DATA LOSS AND MALFUNCTION HAZARDS**—Existing formulas contain water quantity data which only applies to *metered water*. While *metered water* is disabled:

- ✎ Do not access existing formulas. The microprocessor will delete the water data.
- ✎ Do not run existing formulas. The water data will cause the machine to malfunction.

**Setting the Level Ranges and Tilt Level**—The *low*, *medium*, and *high level* configure decisions determine the ranges within which levels may be specified in the wash formula. See “PROGRAMMING . . .,” “5=CONFIGURE . . .” for how these values affect the ranges. Set these values as desired. The *tilt level* configure decision specifies the level a tilting machine will fill to while tilted. On non-tilting machines this level must be set to 00.

**Creating a Calibration Formula**—A one-step calibration formula is needed for calibrating and testing. Command a soak wash (cylinder does not turn), no temperature, cold water only, a level height (inches or centimeters) equal to high level (the height of the level mark), no steam, and no chemicals.



**Calibrating Tap Offset Counts**—Set the *tap offset counts* configure decision to 0000. Run the calibration formula and observe the water level. If the machine does not fill precisely to *high* level, adjust the *tap offset counts* configure value and run the formula again, repeating as required. Initially, change this value in fifty unit increments.

**If the level is too low**—enter 0050. *Increasing* the value in the range 0000 to 4095 *increases* the level achieved.

**If the level is too high**—enter 5050. *Increasing* the value in the range 5000 to 9095 *decreases* the level achieved.

**Enabling Metered Water if the Machine Also Has a Flow Meter**—If *metered water* was previously disabled, re-enable it as follows (if the transducer must be tested, do this after testing):

1. Set configure decision N (*metered water*)=1
2. Step through all configure decisions, comparing them with the recorded values. **Do not change the low level, medium level, high level, tilt level, and tap offset counts values, which were just established.** Verify that all other values are as previously recorded. The *counts per 100* and *offset valve time* values for *metered water* will probably need to be re-entered.

**Testing the Transducer**—If problems with the transducer are encountered (e.g., erratic levels), a qualified service technician can troubleshoot this condition as follows:


**1. Test for a faulty transducer:**

- a. Disconnect the pressure transducer output wire (2MTA3-4).
- b. Measure the voltages on the transducer. There should be +12VDC on the input pin and approx. 1 VDC on the output pin with no water in the cylinder.

**2. Test for an air leak:**

**▲ CAUTION ▲**

**The following step requires injecting water with the transducer output disconnected. The water supply must be shut off manually otherwise the machine will overflow.**

- a. With the output wire still disconnected, have an assistant run the calibration formula and manually shut off the cold water supply externally when high level is achieved.
  - b. While the machine is filling, measure the voltage on the output pin of the transducer. It should rise from 1.0VDC to some voltage less than 6.0VDC. It rises approximately 1VDC per 1 inches (28 cm) of water.
  - c. With the machine at high level, monitor the transducer output voltage. It should remain stable.
- 3. Test for effective shielding of the transducer box-to-low voltage control box cable.** The shield on this four conductor cable must be grounded to the copper bus bar in the low voltage control box and disconnected in the transducer box. Verify proper shielding as follows:
- a. Re-connect the wire to the output pin on the transducer.
  - b. Change the calibration formula *type of step* to a *two-way bath* and run this formula.
  - c. While the machine is filling with the cylinder rotating, hold  on the keypad.

05:38	STEP 01	05:00
2461/056/056		

The display will appear similar to the example at left. Monitor the middle numeric value on the bottom line of the display which is the actual level in centimeters. If this value goes to zero while the basket is turning and returns to the correct level during dwell, then the shield is not properly grounded.

# SETTING THE UNIT OF MEASURE AND CALIBRATING ELECTRONIC WATER FLOWMETERS USED ON WASHER-EXTRACTORS AND TEXTILE MACHINES

*Metered water* (formerly called *liquor ratio*) is a feature which permits the formula developer to specify a quantity of water (as opposed to a liquor level) for each wash step. On washer-extractors, the quantity injected when the formula is run is the quantity specified in the formula. On textile machines, the quantity of water injected is proportional to the ratio of actual load weight entered by the operator and nominal weight specified in the formula.

Washer-extractors and textile machines furnished with *metered water* are equipped with a flowmeter to measure the quantity of incoming water. The flowmeter is calibrated at the Milnor factory.

**NOTE:** Ensure that reuse water is free of lint and other solid contaminants which can become entangled in the flowmeter, causing it to malfunction.

## About These Procedures

**Why the Flowmeter Must be Calibrated**—Flowmeters have a paddle wheel that rotates at a speed proportional to the *speed* of the passing water, sending pulses to an electronic counter. The number of pulses for a given *speed* of water will vary slightly from one flowmeter to another. The number of pulses for a given *quantity* of water depends on the size of the pipe the flowmeter is in. A 2" (51 mm) diameter pipe will have a much lower pulse count than a 1" (25 mm) diameter pipe, for the same quantity. Calibration determines the ratio of pulses to quantity of water for the specific flowmeter and pipe. Initially, some unit of measure (e.g., pounds, gallons, kilograms, liters) must be chosen for calibrating. The Milnor factory uses *pounds*.

**What Calibration Values are Required**—The calibration values required by the microprocessor controller are *counts per 100* and *offset valve time*. These values are entered in *mode 5, Configure* (see “PROGRAMMING . . .” see Table of Contents).

**Counts per 100** is the number of flowmeter counts resulting from injecting 100 units of water (pounds, gallons, kilograms, liters). Once the *counts per 100* is established for a given unit of measure it may be converted to any other unit. The unit of measure that *counts per 100* is based on must also be used when programming formulas.

**Offset Valve Time** is the *reduction* in time that the water valve will remain open to admit the metered quantity commanded in the formula. This adjustment compensates for the tendency to *overshoot* the commanded quantity because of the time taken for the valve to close. The value is in tenths of seconds.

**NOTE:** The *counts per 100* must be finalized before determining the *offset valve time*.

## Setting the Unit of Measure

**When Setting the Unit of Measure is Required**—Every machine equipped with electronic flowmeters is calibrated at the Milnor factory and the *flowmeter calibration label* is marked with the *counts per 100* and *offset valve time* values. This label is located on the inside of the processor control board. A laundry desiring to program formulas in any unit other than pounds (the unit used by Milnor) must first convert the *counts per 100* shown on the calibration label to their preferred unit of measure and enter this value in the *counts per 100* configure decision.

**Conversion Procedure**—Use the following formula to convert from pounds to another unit of measure:

**Factory counts per 100 pounds x Multiplier listed below = New counts per 100**

<u>Desired Unit</u>	<u>Multiplier</u>
Gallons	8.33
Kilograms	2.2
Liters	2.2

**Example:** Factory counts per 100 pounds = 0532  
Desired units = Liters

New counts per 100 liters = 0532 x 2.2 = 1170

**NOTE:** Contact the Milnor factory for any unit not listed if the conversion factor cannot be determined.

## Calibrating

**When Calibration is Required**—If configuration label is lost, merely re-enter the values listed on the configuration plate (or convert to the desired units). Recalibration is only required for replacement flowmeters or if it is suspected that a flowmeter has lost its calibration as may eventually occur with use.

### Preparations for Calibrating

#### ⚠ CAUTION ⚠

**INJURY AND MACHINE DAMAGE HAZARDS**—Calibrating requires temporarily removing the cylinder water inlet hose. This procedure must be performed only by qualified maintenance personnel, in strict compliance with published safety precautions.

Obtain a container large enough to hold 460 pounds (208 kilograms, 55 gallons, 208 liters). Establish a means of accurately measuring the contents of the container (by weighing or determining volume).

Lock off machine power at the external disconnect switch, then remove the appropriate panels to gain access to the machine's water inlet piping. An internal hose connects the water inlet piping to the wash cylinder. Obtain eight feet (2.5 meters) of hose of the same diameter as the internal hose. Disconnect the internal hose and install the temporary hose such that incoming water will be injected into the measuring container. Make sure the hose is secured so it cannot jump out of the container.

Taking care to keep bystanders away from the machine, restore machine power. In *mode 5, Configure*, enter the initial counts per 100 value from Table A and enter 000 for the offset valve time.

Create a calibration formula consisting of one bath step. For this step, command no steam, cold water only, no chemicals, and whichever of the following water quantities is in the same units as the counts per 100 configure decision: 416 pounds, 189 kilograms, 50 gallons, or 189 liters.

**Table A: Initial Counts per 100**

Cylinder Size	Initial Value of Counts per 100			
	Pounds	Kilograms	Gallons	Liters
36021/36026	Consult Milnor factory			
42026				
42031/42044				
48032/48036	0540	1189	4498	1189
52038	0540	1189	4498	1189
60044	0225	0496	1874	0496
64046	0225	0496	1874	0496
72044/72058	0225	0496	1874	0496

## Summary of Calibration Procedure—The calibration procedure is in two parts:

- Part A. Determine the actual *counts per 100* value.** This is done by running the calibration formula, measuring the actual quantity injected (disregarding commanded quantity), reading the total counts, calculating the actual *counts per 100* units, entering this value in configure, and repeating the procedure until consistent results are achieved.
- Part B. Determine the *offset valve time*.** This is done by running the calibration formula, measuring the actual quantity injected, determining any difference between actual and commanded quantity (because the water valves do not close instantaneously when commanded quantity is achieved) then adjusting the *offset valve time* to eliminate discrepancies. This procedure is repeated until actual and commanded quantities are equal.

### Part A: Determining *Counts per 100*

#### ⚠ CAUTION ⚠

When first running the calibration formula, the measuring container may overflow.

☞ Increase the number of *counts per 100* to reduce the quantity of water injected.

1. Run the calibration formula. When the water valve closes, hold  on the keypad and read the display.

04:38	F0001S01	04:00
01784	01350	

The number on the lower left of the display (01784 in this example) is the total counts for this injection. Record this number.

2. Accurately measure the quantity of water injected. Record this value then drain the container.
3. Calculate the *counts per 100* using the following formula:

$$\frac{\text{Total counts}}{\text{Actual quantity}} \times 100 = \text{Counts per 100}$$

**Example:** Let's say the actual quantity is 395 pounds. Then,

$$\frac{1784}{395} \times 100 = 452 \text{ counts per 100 pounds}$$

4. Enter the result in the *counts per 100* configure decision.
5. Repeat steps 1 through 4. The quantity injected should be slightly more than the commanded quantity and the new *counts per 100* should be close to the previously calculated value. Repeat, if necessary, until the *counts per 100* value is consistent.

## Part B: Determining *Offset Valve Time*

1. Run the calibration formula.
2. Accurately measure the quantity of water injected, and compare this to the commanded quantity. Assuming actual is more than commanded, enter 010 (one second) into the *offset valve time* configure decision. (If actual is less than commanded, repeat Part A). Drain the container.
3. Repeat steps 1 and 2 as required, adjusting the offset valve time until actual and commanded quantities are equal. This is a trial and error process.
4. Once testing is completed, lock power off at the machine's external disconnect switch and restore the machine to its correct operational condition.

Pellerin Milnor has begun a manufacturing change which may affect how this manual applies to your machine. European-style wiring is replacing conventional wiring methods in electrical boxes. Because this change is being implemented one machine model at a time, not all models currently use European-style wiring.

Because this wiring change affects the chemical connections made in the field, it is important to refer to the correct manual section when making these connections. If your machine uses conventional wiring methods, refer to MSSM0262BE. If your machine uses European-style wiring, refer to MSSM0262CE.

The following list includes all washer-extractor models currently being shipped with European-style wiring and the date code of the day the change was implemented on that machine.

36021BWP	--97146
36030F8P	--97173
36030F8S	--97362
36030F8W	--97113
36026Q6P	--97073
36021Q6P	--97073
42026Q6P	--97146
42032F7W	--98107
42032F7P	--98107
36030F8J	--98107
42032F8J	--98107
36030Q6J	--97146

**BMP980025/98141**

## CONNECTING CHEMICAL SYSTEMS TO 100-FORMULA WASHER-EXTRACTORS AND TEXTILE MACHINES

Various methods, some standard and some optional, are available on all 100-formula washer-extractors and textile machines, to accommodate any of the commonly used allied (non-Milnor) chemical systems. Use this section to help determine the best method of chemical injection and how to connect the chemical system. Always consult the schematic manual before connecting chemical systems to the machine.

### ⚠ DANGER ⚠



**ELECTRIC SHOCK HAZARD**—Contact with high voltage electricity will kill or seriously injure you. Even with the Master Switch off and/or any emergency stop switches off, three-phase power and control circuit power are still present at several locations within electric boxes and electrical components.



**INJURY AND DAMAGE HAZARDS**—Improper wiring can cause 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 maintenance personnel.
- ✎ Lock off and tag out power at the external disconnect switches for the washer-extractor and for any chemical devices that provide power to the interpreter relay box (if furnished) before proceeding.
- ✎ DO NOT rely merely on the information in this section when wiring. Consult all applicable electrical schematics.
- ✎ DO NOT reroute or rearrange any wires not specifically permitted by this instruction.
- ✎ DO NOT connect a *common* wire to *ground*. Use the *common* terminal furnished.

## Chemical Injection Methods Available

(Item numbers correspond to those in FIGURE 1)

**1. Inject Signals**—An inject signal is an electric potential that occurs in response to a programmed chemical injection. Five discrete signals (chemicals 1 through 5) are always furnished. If *only these signals* are furnished, they are available at terminal strip *TBS* on BWP, QxP, and FxP models, and at Molex connector *WCS* on larger models.

Ten additional signals (chemicals 6 through 15) are optionally available. If these signals are furnished, then on BWP and QxP models, all 15 signals are available at terminal strips *TBS* and *TBT*. On BWP and QxP models furnished with interpret relays and on all other models (whether or not interpret relays are furnished) all 15 signals are available at terminal strip *TBA*.

Items 2 through 5 below operate off of inject signals. Disconnect the factory wired apparatus to use the inject signal for any other *low current* apparatus that meets the electrical specifications provided elsewhere herein.

**2. Supply Injector**—If a supply injector is furnished, the five electrically operated flush valves are wired to terminal strip *TBS*, *WCS*, or *TBA* (depending on model and options).

**3. Optional Interpret Relays**—Interpret relay contacts have a higher current carrying capacity than inject signals. The interpret relay coils are wired to *TBA* (see FIGURE 3). One set of contacts on each relay is wired to terminal strip *TBB* and connected to an internal power source. This power source may be replaced by an external, *separately fused* source, or merely disconnected, to provide potential-free (“dry”) contacts. Use interpret relays to actuate electrically operated apparatuses (e.g., pumps, valves) or provide potential-free signals for other controllers.

**4. Optional Pilot Air Valves**—If these electrically operated valves are furnished, they are wired to terminal strip *TBS*, *WCS*, or *TBA*, (depending on model and options) at the factory. Use pilot air valves to actuate air-operated apparatuses (e.g., chemical valves).

**5. Optional Liquid Supply Valves**—If these air-operated valves are furnished, they are tubed to the pilot air valves. Use these valves with pressurized liquid chemical delivery systems (e.g., ring main).

**6. Pumped Chemical Inlets**—A five-port inlet is standard on rigid models and a 15 port inlet is optional on all models. Use these valveless inlets only with systems that are not continuously pressurized and that deliver chemicals only when an injection is commanded (e.g., peristaltic pumps).

**Sequenced Chemical Injection (Chemwait)**—When coupled with an allied chemical controller of appropriate capability, the Chemwait feature permits a single chemical source to supply a bank of washer-extractors by delaying chemical injection into one machine whenever that chemical source is currently supplying another machine. See “HOW CHEMWAIT WORKS . . .” (see Table of Contents).

## Connecting Apparatuses to Inject Signals

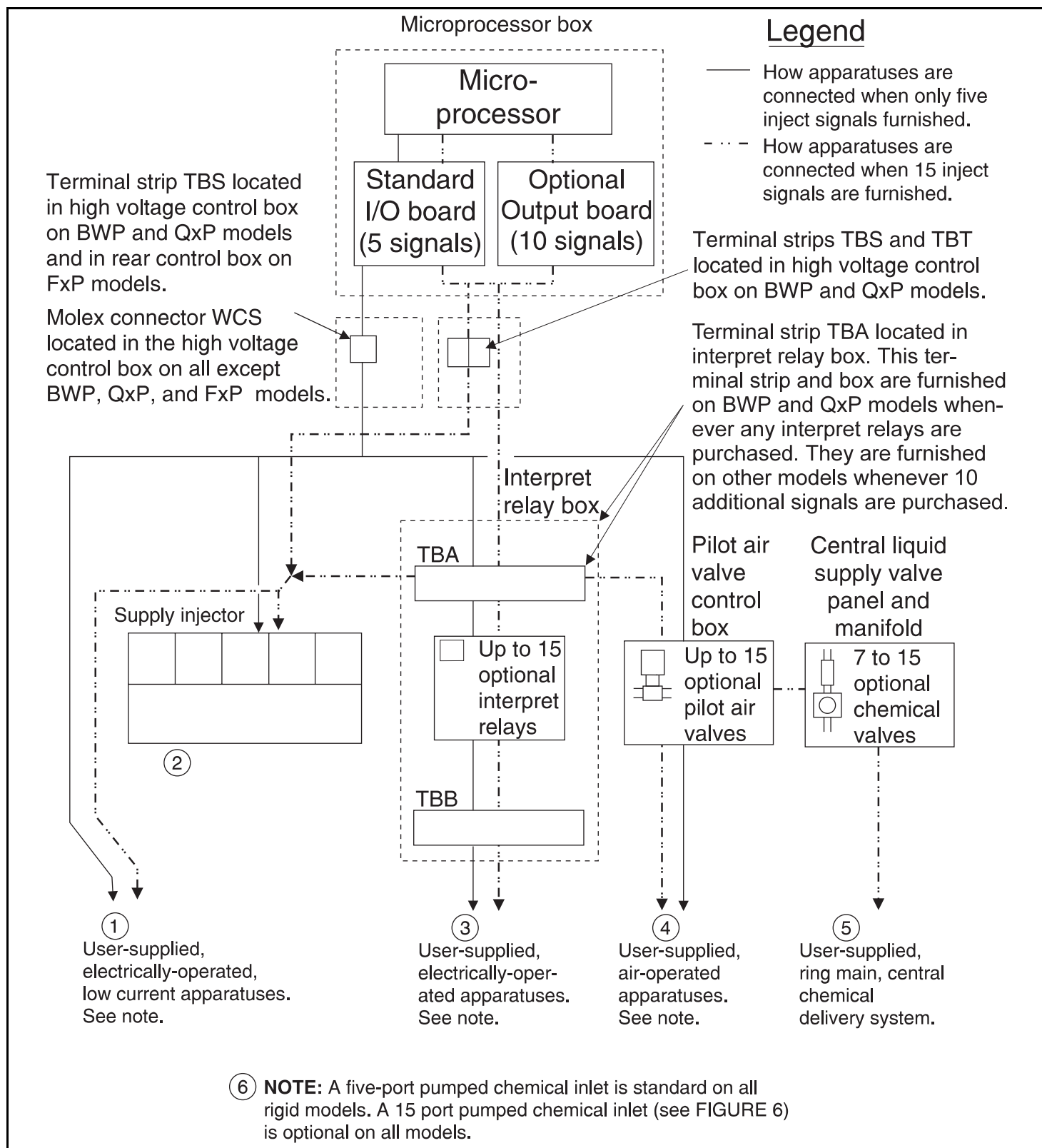
**Electrical Specifications**—Inject signals provide a 110VAC, 50Hz or 120VAC, 60Hz potential. Each signal can accommodate one apparatus not exceeding 37 milliamperes. Inject signals cannot be made potential-free.

### ⚠ CAUTION ⚠



**COMPONENT DAMAGE HAZARD**—Board components will burn out, requiring board replacement if devices driven by inject signals do not meet the electrical specifications. (Pumps generally draw a higher current and will burn out board components.)





**FIGURE 1** (MSSM0262BE)  
**Schematic Illustration of Available Chemical Injection Methods**

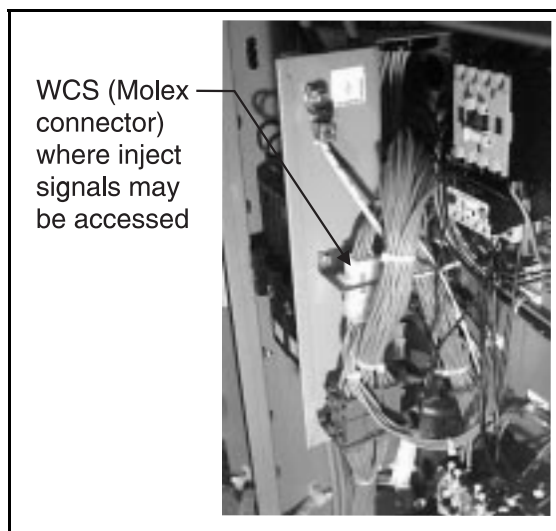
**BWP, QxP and FxP Models With Five Signals Only**—Acquire signals at terminal strip *TBS*, located in the *high voltage control box* on BWP and QxP models and in the *rear control box* on FxP models. *Terminals 1 through 5* are *chemicals 1 through 5*, respectively and *terminal 8* is *common*. The specified voltage is enabled between the appropriate terminal and *common* whenever an injection is called for.

**Other Models With Five Signals Only**—Acquire signals at Molex connector *WCS* in the *high voltage control box* (see FIGURE 2). *Pins 1 through 5* are *chemicals 1 through 5* respectively and *pin 7* is *common*. The specified voltage is enabled between the appropriate pin and *common* whenever an injection is called for.

**BWP and QxP Models With 15 Signals and No Interpret Relays**—Acquire all 15 signals at *TBS* and *TBT* in the *high voltage control box*. *Terminals 1 through 7* on *TBS* and *1 through 8* on *TBT* are *chemicals 1 through 15* respectively. *Terminal 8* on *TBS* is *common*. The specified voltage is enabled between the appropriate terminal of *TBS* or *TBT* and *common*, whenever a chemical injection is called for.

**Other Models With 15 Signals and No Interpret**

**Relays**—Acquire all 15 chemical signals and a *manifold flush* signal at *TBA* (see FIGURE 3). *Terminals A through Q* on this terminal strip are *chemicals 1 through 15* respectively and *Terminal R* is the *flush*. *Terminal TB1* provides a multi-pin *common*. The specified voltage is enabled between the appropriate terminal of *TBA* and *common* whenever a chemical injection or flush is called for.



**FIGURE 2** (MSSM0262BE)  
**Locating WCS in High Voltage**

## Connecting Apparatuses to Interpret Relays

**Electrical Specifications**—The internal power source provides a 110VAC, 50Hz or 120VAC, 60Hz potential. Each interpret relay can accommodate one apparatus, not exceeding 0.6 amperes. The total current drawn by all apparatuses must not exceed 10 amperes. When apparatuses are driven by external power, do not exceed 1 ampere at 250VAC per relay contact.

### ⚠ CAUTION ⚠



**COMPONENT DAMAGE HAZARD**—Interpret relay contacts will fail, requiring relay replacement if devices exceed the specified current load.

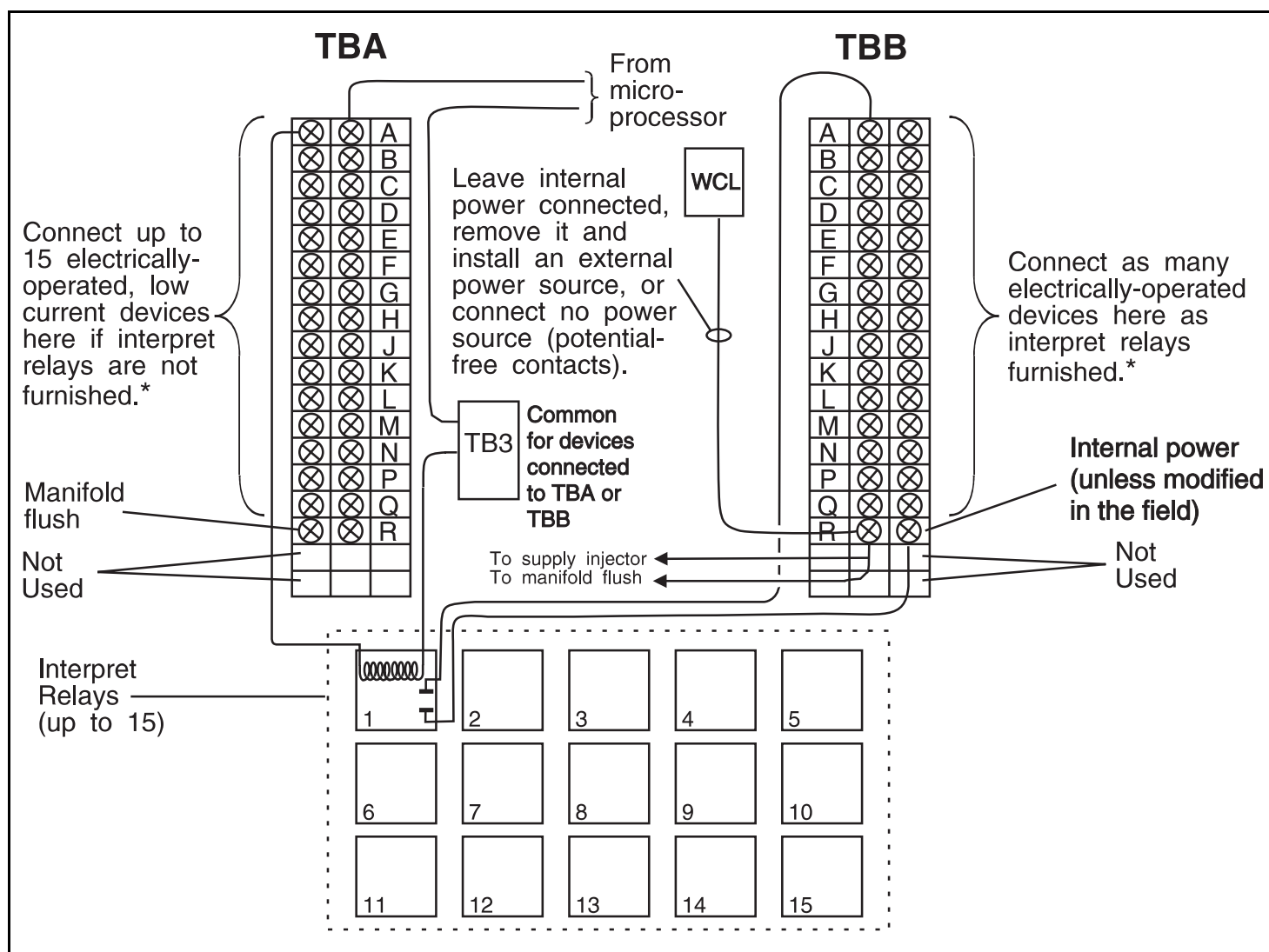
**Using Internal Power**—When interpret relays (up to 15) are furnished, chemical signals are available at *TBB* in the *interpret relay box*. *Terminals A through Q* are *chemicals 1 through 15* respectively. *Terminal TB1* provides a multi-pin *common*. The specified voltage is enabled between the appropriate terminal of *TBB* and *common* whenever a chemical injection is called for. As shown in FIGURE 3, *terminal R* of *TBB* is used to supply power internally to one contact on each interpret relay.

**Using External Power or Potential-Free Contacts**—As shown in FIGURE 3, *TBB*, terminal *R*, which receives power via *WCL*, not only supplies power to the interpret relay contacts but also to the pumped chemical inlet manifold flush valve and/or supply injector flush valves, if furnished. To disconnect the internal power source, remove all of the wires from the left side of *terminal R*, but maintain the connections between the removed wires. **Make certain that any external power source connected to terminal *R* is separately fused.**

## ⚠ WARNING ⚠

**Consider carefully the potential hazards of having more than one power source in a single enclosure.**

If an external power source is wired to *TBB*, terminal *R*, then the voltage provided by this source is enabled between the appropriate terminal of *TBB* and the user-supplied *common* (not *TBI*) whenever a chemical injection is called for. If no power source is connected to *TBB*, terminal *R*, then a potential-free signal (contact closure) is enabled between the appropriate terminal (*A* through *Q*) of *TBB* and *TBB*, Terminal *R*, whenever an injection is called for.

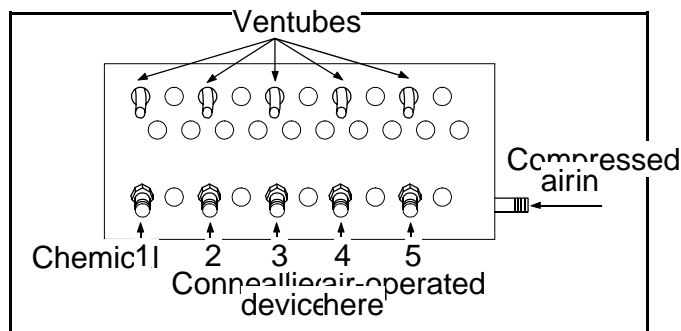


**FIGURE 3** (MSSM0262BE)  
**Connections Inside the Interpret Relay Box**

## Pressurized Chemical Systems

These systems use chemical valves on the machine to admit chemicals from pressurized lines (e.g., ring main systems). The machine may be furnished with pilot air valves only, to which the customer may attach air-operated chemical valves, or with pilot valves and chemical valves.

**Connecting Air-Operated Chemical Valves to Pilot Air Valves**—When chemical injection pilot valves are furnished, they are located in an *air valve box* dedicated to this function. Connect incoming compressed air where indicated in FIGURE 4. See the installation manual for compressed air specifications. Pilot valves are arranged from left to right, beginning with *chemical 1*, when facing the connections, as shown in FIGURE 4 (however spacing varies with the number of valves furnished). Pilot valve connections accept 1/4" (6.3 mm) OD, 0.17" (4.3 mm) ID tubing. Tubing used by Milnor is rated for 310 psi (2.137 MPa) working pressure at 72°F (22°C) and 1250 psi (8.618 MPa) minimum burst pressure at 73°F (23°C). If air-operated, liquid chemical valves are also furnished, these will be pre-connected to the pilot valves; however, these may be disconnected and the pilot valves used to drive other devices, if desired.

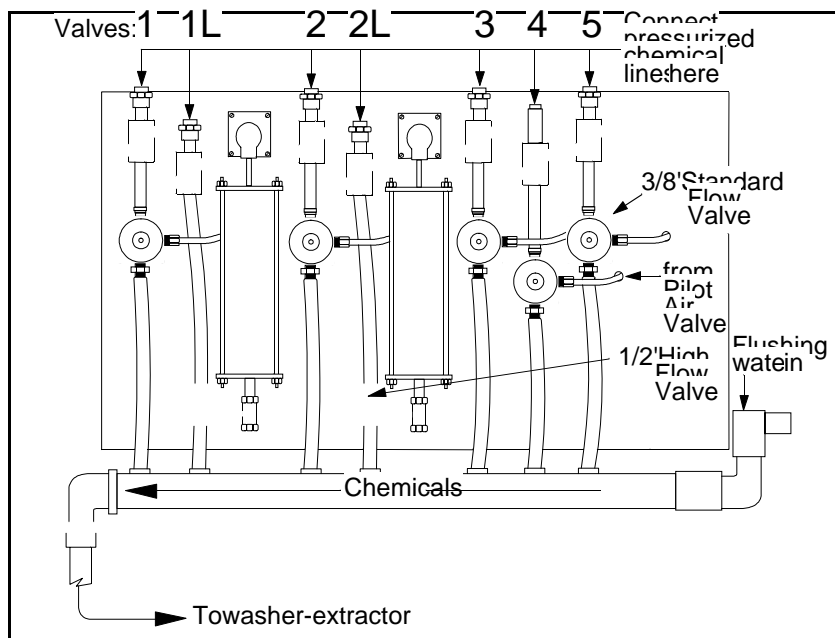


**FIGURE 4** (MSSM0262BE)  
**Arrangement of Pilot Air Valves**

## Connecting Pressurized Liquid Chemical Lines to Air-Operated Valves

If air-operated chemical valves are furnished, between seven valves (two standard flow plus five high flow) and 15 valves will be supplied. Although each valve can be devoted to a separate chemical, the high flow valves are usually used to speed up injection when an extra large quantity of a chemical also injected via a standard flow valve is required (e.g., large doses of alkali in early heavy soil baths followed by smaller doses in later baths). Thus, the basic seven-valve set normally accommodates five chemicals as shown in FIGURE 5. When air-operated chemical valves are furnished by Milnor, corresponding pilot air valves and associated air connections between pilot and chemical valves are also furnished. All chemicals are injected into a manifold which is automatically flushed with water after every injection.

Standard flow valve connections (1, 2, 3, 4, 5, etc.) are 3/8" NPT. High flow valve connections (1L, 2L, etc.) are 1/2" NPT. Chemical piping should adhere to chemical system manufacturer specifications. The water inlet for flushing is internally connected to the main cold water inlet on some machines. An external, 1/2" NPT connection is required on other machines. Because the output relay-to-pilot valve wiring and the pilot valve to chemical valve air connections vary with the number and combination of valves furnished, it's best to test each chemical output to determine which output (chemical 1, 2, 3, etc.) operates which valve (1, 1L, 2, 2L, etc.). See "MANUAL MODE MENU FUNCTIONS . . ."



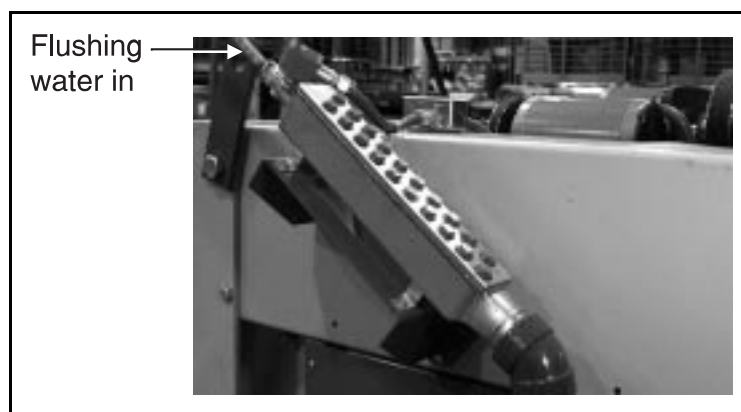
**FIGURE 5** (MSSM0262BE)  
**Arrangement of Liquid Chemical Valves**

## Pumped Chemical Systems

These systems deliver chemicals to the machine intermittently usually via peristaltic pumps. Inlets on the machine must be unrestricted at all times (valveless). The 5 and 15 port pumped chemical inlets meet this requirement.

**Risk Associated With Pumped Chemical Systems**—An inherent risk of this method of chemical injection is that concentrated chemicals can dribble into the machine after hours, when the machine is not in operation, causing machine and/or linen damage. Because Milnor has no control over the design or installation of pumped chemical systems, **Pellerin Milnor Corporation accepts absolutely no responsibility for damage to its equipment or textiles therein, caused in this way.** Much more information on this subject is provided in document B2TAG86033, “Pumped Chemical Installation and Precautions.” Consult this document before connecting a pumped chemical system.

**Connecting Flushing Water to 15-Port Inlets**—Flushing water is required for 15-port inlets. It is internally piped to the incoming cold water inlet on some machines. When not internally piped, a 1/2" NPT external water line must be connected where indicated in FIGURE 6.



**FIGURE 6** (MSSM0262BE)  
**15-Port Pumped Chemical Inlet**

## CONNECTING CHEMICAL SYSTEMS TO 100-FORMULA WASHER-EXTRACTORS AND TEXTILE MACHINES WITH EUROPEAN WIRING

Various standard and optional methods are available on all 100-formula washer-extractors and textile machines, to accommodate any of the commonly used allied (non-Milnor) chemical systems. Use this section to help determine the best method of chemical injection for your laundry and how to connect the chemical system. Always consult the machine schematic manuals before connecting chemical systems.

### ⚠ DANGER ⚠



**ELECTRIC SHOCK HAZARD**—Contact with high voltage electricity will kill or seriously injure you. Even with the Master Switch off and/or any emergency stop switches off, three-phase power and control circuit power are still present at several locations within electric boxes and electrical components.



**INJURY AND DAMAGE HAZARDS**—Improper wiring can cause the machine to malfunction, risking injury to personnel, damage to machine components, and damage to goods.

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

## Chemical Injection Connection Methods Available

### Chemical Injection Output Signals

Five discrete signals, released in response to programmed chemical injections for chemicals 1 through 5, are furnished standard on all washer-extractors. Ten additional signals (chemicals 6 through 15) are optionally available on most machines. Often these start signals are used to operate other electrically-operated, low-voltage chemical injection devices like interpreter relays and pilot valves. These devices, in turn, are used to operate a higher voltage chemical injection device.

These signals, each capable of a maximum electrical load of 9VA at 120VAC, can be accessed at terminal strip *TBA*. Disconnect the factory wired apparatus to use these start signals for any other low current apparatuses.

### Liquid Chemical Tube Barbed Connectors

Barbed fittings, furnished standard on F-style machines, provide for the connection of tubes from remote chemical supply injection systems. The F8P and F7P are furnished with six barbed connectors, while outerwear machines are furnished with ten connectors.

One chemical injection output signal is required for each connector, and at least five are provided standard.

### Five Compartment Flushing Chemical Injector

A five-compartment dry supply injector mounted externally on the washer-extractor is furnished standard on most washer-extractors in lieu of a pumped chemical style system. The flushing chemical injector is offered optionally on the Q style microprocessor machines and outerwear machines.

Each electrically operated flush valve located in a supply compartment is wired to terminal strip *TBA* and uses a chemical injection output signal.

### Optional Interpreter Relays

One or more interpreter relays (up to 15) mounted in a control box are optionally available and connected to the standard chemical injection outputs on washer-extractors. These relays can be used to operate other electrically-operated, high voltage chemical injection devices like pumps and valves.

These relays, each capable of a maximum electrical load of 1 ampere at 250VAC, have one set of contacts on each relay wired to terminal strip *TBA* and connected to an internal power source. The internal power source may be replaced by an external, separately fused source, or merely disconnected, to provide potential-free ("dry") contacts.

### Optional Pilot Air Valves

Pilot air valves are optionally available to actuate air-operated chemical injection valves or other similar air-operated devices supplied by others. A maximum of 15 of these normally-closed air valves are available and are connected to corresponding chemical injection output signals.

Each air-operated valve is wired to terminal strip *TBA* and uses a chemical injection output signal.

### Optional Central Liquid Chemical Supply System/Valves

Seven air-operated chemical injection valves are optionally available for use with up to seven different chemicals on most models. The system includes two 1/2" high flow and five 3/8" standard flow air-operated valves. Individual standard flow central liquid chemical valves are also optionally available up to a maximum of 8 additional standard flow valves in the system for a maximum of 15 valves. Each individual valve includes the necessary interpreter relay and pilot valve.

Chemical injection valves are wired to terminal strip *TBA* and use a output signal, interpreter relay, and pilot valve for each optional chemical valve. These valves are used with pressurized liquid chemical delivery systems like a ring main.

## Optional Peristaltic Pump Connections

Up to fifteen 1/2" barbed fittings for separate peristaltic hose connections are optionally available. Automatic flush can be added optionally with peristaltic pump connections.

The connections are provided standard with five chemical output signals, and additional signals must be added to operate more than five peristaltic hose connections. These valveless inlets are used only with systems that are not continuously pressurized and that deliver chemicals only when an injection is commanded.

## Sequenced Chemical Injection (Chemwait)

A chemical injection sequencer supplied by others interfaces with the machines to supply each machine with chemicals one at a time.

See "HOW CHEMWAIT WORKS . . ." (see Table of Contents).

## Connecting Apparatuses to Chemical Injection Signals

**Electrical Specifications**—Inject signals provide a 110VAC, 50Hz or 120VAC, 60Hz potential. Each signal can accommodate one apparatus not exceeding 37 milliamperes. Inject signals cannot be made potential-free.

### ⚠ CAUTION ⚠



**COMPONENT DAMAGE HAZARD**—Devices driven by injection output signals which exceed electrical specifications will burn out board components, requiring board replacement. (Pumps generally draw a higher current and will burn out board components.)

**BWP and QxP Models With Five Signals Only**—Acquire signals at terminal strip *TBA*, located in the *high voltage control box*. *Points 86 through 90* are *chemicals 1 through 5*, respectively, *point 109* is *flush*, and *point 6* is *common*. The specified voltage is enabled between the appropriate terminal and *common* whenever an injection is called for.

**FxP, FxS, and FxW Models With Five Signals Only**—Acquire signals at terminal strip *TBA* in the *rear control box*. *Points 47 through 51* are *chemicals 1 through 5*, *point 62* is *flush*, *point 6* is *common*. In *FxS* models, *point 63* is the soap chute. The specified voltage is enabled between the appropriate terminal and *common* whenever an injection is called for.

**BWP and QxP Models With 15 Signals and No Interpret Relays**—Acquire all 15 signals at *TBA* in the *high voltage control box*. *Points 86 through 90* are *1 through 5* respectively and *points 94 through 102* are *6 through 14* respectively. *Point 108* is chemical 15. *Point 109* is *flush*. The specified voltage is enabled between the appropriate terminal of *TBA* and *common*, whenever a chemical injection is called for.

**FxP and FxW Models With 15 Signals and No Interpret Relays**—Acquire all 15 signals at *TBA* in the *high voltage control box*. *Points 52 through 61* are chemicals *6 through 15* respectively. The specified voltage is enabled between the appropriate terminal of *TBA*, whenever a chemical injection is called for.

**FxW Models With 15 Signals and Interpret Relays**—Acquire all 15 signals at *TBA* in the *high voltage control box*. *Points 68 through 82* are *1 through 15* respectively. The specified voltage is enabled between the appropriate terminal of *TBA* and *common*, whenever a chemical injection is called for.



**Electrical Specifications**—The internal power source provides a 110VAC, 50Hz or 120VAC, 60Hz potential. Each interpret relay can accommodate one apparatus, not exceeding 0.6 amperes. The total current drawn by all apparatuses must not exceed 10 amperes. When apparatuses are driven by external power, do not exceed 1 ampere at 250VAC per relay contact.

## Using Internal Power

The diagram illustrates the wiring for the TBA and TBB terminal blocks. The TBA block has terminals A through R, and the TBB block has terminals A through R. A WCL (Wire Control Line) is connected to the TBB block. A common terminal block TB3 is connected to both TBA and TBB. The diagram shows connections for 'From micro-processor', 'Leave internal power connected, remove it and install an external power source, or connect no power source (potential-free contacts)', 'Connect up to 15 electrically-operated, low current devices here if interpret relays are not furnished.\*', 'Connect as many electrically-operated devices here as interpret relays furnished.\*', 'Internal power (unless modified in the field)', 'Not Used', 'To supply injector', 'To manifold flush', 'Interpret Relays (up to 15)', and 'Manifold flush'.

**FIGURE 1** (MSSM0262CE)  
**Connections Inside the Interpret Relay Box**

## Using External Power or Potential-Free Contacts

As shown in Figure 1, *TBB*, terminal *R*, which receives power via *WCL*, not only supplies power to the interpret relay contacts but also to the pumped chemical inlet manifold flush valve and/or supply injector flush valves, if furnished. To disconnect the internal power source, remove all wires from the left side of terminal *R*, but maintain the connections between the removed wires. Make certain that any external power source connected to terminal *R* is separately fused.

### ⚠ WARNING ⚠

Consider carefully the potential hazards of having more than one power source in a single enclosure.

If an external power source is wired to *TBB*, terminal *R*, then the voltage provided by this source is enabled between the appropriate terminal of *TBB* and the user-supplied common (not *TBI*) whenever a chemical injection is called for. If no power source is connected to *TBB*, terminal *R*, then a potential-free signal (contact closure) is enabled between the appropriate terminal (*A* through *Q*) of *TBB* and *TBB*, Terminal *R*, whenever an injection is called for.

## Pressurized Chemical Systems

These systems use chemical valves on the machine to admit chemicals from pressurized lines (e.g., ring main systems). The machine may be furnished with pilot air valves only, to which the customer may attach air-operated chemical valves, or with pilot valves and chemical valves.

### Connecting Air-Operated Chemical Valves to Pilot Air Valves

When chemical injection pilot valves are furnished, they are located in an *air valve box* dedicated to this function. Connect incoming compressed air where indicated in Figure 2. See the installation manual for compressed air specifications. Pilot valves are arranged from left to right, beginning with *chemical 1*, when facing the connections, as shown in Figure 4 (however spacing varies with the number of valves furnished). Pilot valve connections accept 1/4" (6.3 mm) OD, 0.17" (4.3 mm) ID tubing. Tubing used by Milnor is rated for 310 psi (2.137 MPa) working pressure at 72°F (22°C) and 1250 psi (8.618 MPa) minimum burst pressure at 73°F (23°C). If air-operated, liquid chemical valves are also furnished, these will be pre-connected to the pilot valves; however, these may be disconnected and the pilot valves used to drive other devices, if desired.

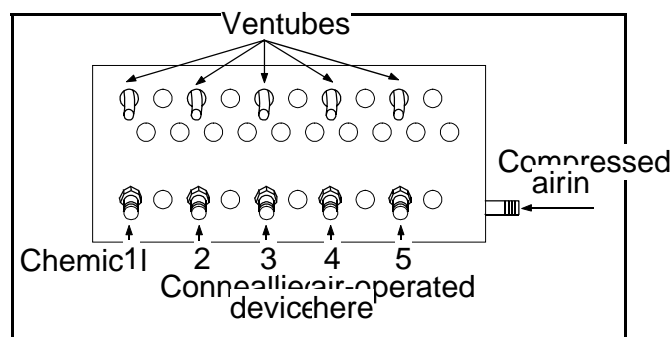
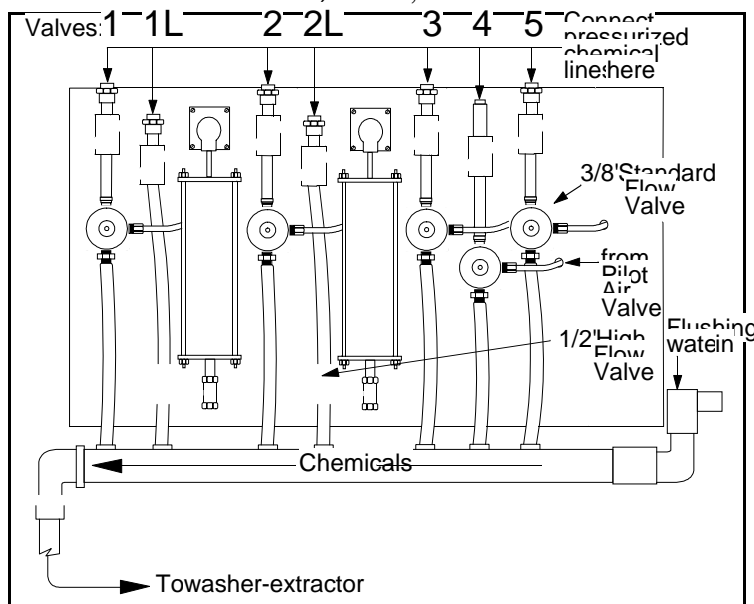


FIGURE 2 (MSSM0262CE)  
Arrangement of Pilot Air Valves

**Connecting Pressurized Liquid Chemical Lines to Air-Operated Valves**—If air-operated chemical valves are furnished, between seven valves (two standard flow plus five high flow) and 15 valves will be supplied. Although each valve can be devoted to a separate chemical, the high flow valves are usually used to speed up injection when an extra large quantity of a chemical also injected via a standard flow valve is required (e.g., large doses of alkali in early heavy soil baths followed by smaller doses in later baths). Thus, the basic seven-valve set normally accommodates five chemicals as shown in Figure 3. When air-operated chemical valves are furnished by Milnor, corresponding pilot air valves and associated air connections between pilot and chemical valves are also furnished. All chemicals are injected into a manifold which is automatically flushed with water after every injection.

Standard flow valve connections (1, 2, 3, 4, 5, etc.) are 3/8" NPT. High flow valve connections (1L, 2L, etc.) are 1/2" NPT. Chemical piping should adhere to chemical system manufacturer specifications. The water inlet for flushing is internally connected to the main cold water inlet on some machines. An external, 1/2" NPT connection is required on other machines. Because the output relay-to-pilot valve wiring and the pilot valve to chemical valve air connections vary with the number and combination of valves furnished, it is best to test each chemical output to determine which output (chemical 1, 2, 3, etc.) operates which valve (1, 1L, 2, 2L, etc.). See "MANUAL MODE MENU FUNCTIONS . . ."



**FIGURE 3** (MSSM0262CE)  
**Arrangement of Liquid Chemical Valves**

## Pumped Chemical Systems

These systems deliver chemicals to the machine intermittently usually via peristaltic pumps. Inlets on the machine must be unrestricted at all times (valveless). The 5 and 15 port pumped chemical inlets meet this requirement.

### Connecting Flushing Water to 15-Port

**Inlets**—Flushing water is required for 15-port inlets. It is internally piped to the incoming cold water inlet on some machines. When not internally piped, a 1/2" NPT external water line must be connected where indicated in FIGURE 6.

### Risk Associated With Pumped Chemical Systems

—An inherent risk of this method of chemical injection is that concentrated chemicals can dribble into the machine after hours, when the machine is not in operation, causing machine and/or linen damage. Because Milnor has no control over the design or installation of pumped chemical systems, **Pellerin Milnor Corporation accepts absolutely no responsibility for damage to its equipment or textiles therein, caused in this way.** Much more information on this subject is provided in document B2TAG86033, "Pumped Chemical Installation and Precautions."

Consult this document before connecting a pumped chemical system.



**FIGURE 4** (MSSM0262CE)  
**15-Port Pumped Chemical Inlet**

## FUNCTIONAL DESCRIPTION OF WASHER-EXTRACTOR OPTIONS AFFECTING PROGRAMMING

Various options that may be on your machine are briefly explained here. Some of these options are referred to throughout the manual.

### Chemical Supply Options

**Sequenced Chemical Injection (Chemwait)**—The Chemwait system allows a single chemical source to supply a bank of washer-extractors by delaying chemical injection into one machine whenever the chemical source is currently supplying another machine. For a complete description of Chemwait, see “HOW “CHEM-WAIT” WORKS IN MILNOR MARK I, II, III, IV, AND V MICROPROCESSOR WASHER-EXTRACTOR CONTROLLERS” (see Table of Contents).

**Miscellaneous Chemical Supply Options** —The following chemical supply-related options are available on washer-extractors. For more information about these options, see “Connecting Chemical Supply Systems.”

- Five Compartment Flushing Chemical Injector (See “Using the Five-Compartment Flushing . . .”)
- Ten Additional Chemical Output Signals
- Control Box with one Normally Closed Pilot Air Valve for External Chemical Valves, etc.
- Additional Normally Closed Pilot Air Valves
- Control Box with One Interpreter Relay
- 15 Peristaltic Pump Connections
- Central Liquid Chemical Supply System with Seven Valves
- Add Central Liquid Chemical Valves
- Additional Interpreter Relay

### Dual Drain Valve for Water Reuse

A dual drain valve allows the machine to drain to either the sewer or a reuse water reservoir. The machine can be programmed to drain to one or the other for each drain in a formula.

### Overnight Bath Soak

An Overnight Bath Soak allows goods to soak overnight with the machine shut down. For complete instructions, see “OPERATING WASHER-EXTRACTORS . . .,” “OPR 14: Overnight Soak.”

## **Ampsaver System**

The Ampsaver Master Sequencer allows for electricity savings by reducing the total amperes drawn by a bank of machines by temporarily delaying a machine from entering extract. Each machine must have the Ampsaver machine controller so they will respond to requests by the Ampsaver Master Sequencer to delay entering extract. When properly set, the system will save energy without significant delay in production.

## **Download/Upload Interface Box**

A Download/Upload Interface Box allows machine programming and configuration data to be loaded into this memory storage device (e.g., for safekeeping in case of accidental memory loss, etc.), or loaded from the box onto multiple washer-extractors (e.g., if all washer-extractors in the system should be programmed alike). See “PROGRAMMING THE MARK II, III, IV, AND V MICROPROCESSOR WASHER-EXTRACTOR CONTROLLER,” “6=DOWNLOAD” for more about how to use the Download/Upload Interface Box.

## **Data Display Printer**

The Epson model LX300 printer allows printing wash formula and related information from the machine controller. See “PROGRAMMING THE MARK II, III, IV, AND V MICROPROCESSOR WASHER-EXTRACTOR CONTROLLER,” “8=PRINT DATA” for more about printing programming data. See “REQUIREMENTS AND SETTINGS FOR THE EPSON LX300 PRINTER” for connections and settings required for display printer operation.

## **Optional Cylinder Speeds**

The cylinder speed options are as follows:

**Low Speed Extract**—Adds a separate motor for low speed extract operation.

**Variable Speed Wash**—Adds an electronic AC Variable Frequency Controller and appropriate software to command wash speeds different from standard.

## **Miltrench**

The Miltrench system allows a delay in the draining of some machines to prevent overflowing a common drain trench. The system allows only one machine to drain at a time causing other machines preparing to drain to wash reverse until the currently draining machine has completed its drain. See “PROGRAMMING THE MARK II, III, IV, AND V MICROPROCESSOR WASHER-EXTRACTOR CONTROLLER” for appropriate configuration for Miltrench.

**NOTE:** If power is lost while a machine is in Miltrench Halt the machine will resume with Miltrench Halt. If power is lost during a drain, the machine will resume with the drain.

## Definitions of Terms and Abbreviations

**AutoSpot**—a control mechanism with which the operator can automatically align one cylinder pocket of a divided cylinder machine with the loading doors

**bath**—a general term for any step of a wash formula during which the goods are exposed to water with or without chemicals.

**CPU (central processing unit)**—integrated circuit component, usually an Intel 8088 and its ancillary devices, that interprets programming instructions and inputs to the microprocessor and provides outputs to other devices

**CCW**—counterclockwise cylinder rotation, as viewed from the load end; see also CW

**central liquid supply system**—chemicals are constantly supplied to the machine under pressure; valves on the machine open and close to regulate the flow of chemicals into the machine

**checksum**—one of several numbers generated by the control that represents the amount of data in a specific memory area; any change in a checksum indicates that data has changed

**clean side**—the side of a pass-through machine from which clean goods are unloaded after processing

**code, customer**—the code that identifies the one of 1,000 possible owners of a batch

**code, destination**—the code that identifies the one of 64 (with the Miltrac™ controller) or one of eight (if allied data pass) desired post-dry or no-dry destination of a batch

**code, dry**—code that identifies the one of 16 full-dry and 16 partial-dry cycles for a batch

**code, formula**—code that identifies the one of 16 basic wash formulas used to process a batch

**code, goods**—code that identifies the one of 256 goods classifications that describe a batch and invoke any variations to the basic formula used

**configure**—microprocessor programming for various software and hardware options on the machine

**control**—an electrical enclosure, usually housing a keypad, at which the user commands actions and programs the machine; also includes all electromechanical devices on the machine involved with its operation; also referred to as “controller”

**cooldown**—used to gradually cool goods to prevent the setting of wrinkles. In a washer equipped with the cooldown option (an additional level switch, a manual throttling valve, and an on/off cooldown water valve), this is a method of reducing the temperature of the goods through repeated partial draining and refilling with cold water. The cooldown rate is controlled by the manual throttling valve.

**CPU**—central processing unit; the main computer chip in a microprocessor control system that processes data, as well as the board on which the CPU chip is mounted

**customer code**—see **Code, customer**

**CW**—clockwise cylinder rotation direction as viewed from the front of the machine

**cycle**—operations undertaken in a specific order to process goods; a cycle normally ends with the device ready to accept another load

**cylinder**—the perforated basket inside the machine shell which contains the goods and is rotated by the motors

**cylinder pocket**—one of the two or three divisions of a divided cylinder washer-extractor into which goods are loaded for processing

**daisy chain**—method of linking two or more serial type microprocessor controls with one four-conductor shielded cable. All data passes via this cable, regardless of which machines are communicating.

**default password**—see **Password, default**

**default value**—value used by the microprocessor control if no other value has been set by the programmer

**destination**—area or zone of a laundry facility to which goods will be routed after drying, or before pressing if the destination is a “no-dry” station

**destination code**—see **Code, destination**

**DIP switches**—dual in-line package switches; a row of (usually six or eight) miniature switches in a single housing used to permanently select or configure certain options on microprocessor boards; on Milnor® microprocessor controls these switches are used most often to specify the communications address for each machine in a system

**discretionary data field**—any field in the microprocessor control system that can be updated through the keyboard or keypad; also, a machine configuration field, such as temperature units, that is not limited by hardware or equipment in the machine

**display**—the component by which the machine provides data to the operator; the component may be one of several types, including vacuum fluorescent or liquid crystal (two lines of 20 alpha-numeric characters), color graphic liquid crystal (320 pixels by 240 pixels), or CRT monitor of various resolutions.

**door, manual**—machine door which is opened and closed by hand, without power assistance

**door, power operated**—machine door which is normally operated through electro-mechanical controls rather than manually; usually, the machine must be energized for the door to operate

**download**—process of transferring data, usually configuration and programming instructions, from a machine to another machine or to a memory storage device

**drain speed**—one of several ways to end a wash formula; goods are kept in motion at a speed approximating the force of gravity (1g) until the operator is ready to discharge them

**dry code**—see **Code, dry**

**EPROM**—erasable programmable read-only memory; the portion of some Milnor® microprocessor control systems used to store the fixed instructions (software) that determine how the machine functions

**extraction**—the removal of excess water from goods discharged from the tunnel washer

**formula**—instructions used by the machine control to operate motors, valves, and other components during a standard cycle

**formula code**—see **Code, formula**

**goods**—articles processed or conveyed by a machine

**hardware**—electronic boards that control the machine

**hold code**—function of a programmable output which answers the question, “If a hold condition is encountered while this function is actuated, should the function continue to operate even if its commanded parameters have not been achieved?”

**inching**—a control mechanism with which an operator can manually align one pocket of a divided cylinder machine with the loading doors

**input, direct**—signals that enter the processor board directly; direct inputs are provided by switches on the machine, including limit switches, the *Signal Cancel* button, and the *Run/Program* keyswitch

**input, standard**—signals to the microprocessor controller that certain standard conditions exist; these inputs enter the processor board through the standard input/output board(s); include *Bag Ready*, *Load Conveyor Ready*, and remote customer and goods codes, etc.

**jogging**—intermittent rotation of the cylinder on certain Milnor® machines can be used to dislodge goods from the cylinder wall after extraction, or to assist in discharging goods from the tilted cylinder, etc.

**level switch**—device that signals the controller when the bath liquor has reached a preset level

**liquor**—bath solution, usually consisting of water and chemicals at a specified temperature, for processing goods

**load**—the amount of goods, measured by weight or pieces, that a machine normally handles during a cycle

**loading device**—in a system, this is the device which loads another device; example: a shuttle may be the loading device for a dryer

**loading direction**—the direction the goods are loaded into or onto a device

**MMQ**—minutes, minutes, and quarter minutes (e.g., 043 = 4 minutes and 45 seconds); see also **SS** and **SSS**

**model**—designation of machine without regard to options; for most devices, the model includes some dimensional representation of the effective machine size

**motor contactor box**—enclosure containing the high voltage motor contactors

**password**—three-character code entered to access or change values in certain display pages, used to prevent unauthorized programming. The instructions for changing the password are contained in a separate document sent only to the owner of the machine. See also **Minipass**

**password, default**—password when shipped from the Milnor® factory that automatically replaces any field-programmed password after a failed Program Memory check, or if a new password has not been entered since the processor board memory was cleared or a new processor board was installed

**permanent press**—a fabric or finish which is heat-set after the article is manufactured to minimize wrinkling and to retain creases

**program mode**—mode which allows programming of wash formulas, dry cycles, and other discretionary data; see also **Run mode**

**pumped chemical supply system**—chemicals flow into the machine when the machine control or operator commands the pump to operate

**reversing**—one of several ways to end a wash formula; goods are kept in motion at wash speed by the rotating cylinder until the operator is ready to discharge them

**run mode**—mode of operation that allows devices to run automatically; see also **Program mode**

**software**—fixed information contained in EPROMs (programming by Milnor®) or on disk files that determines how a machine or computer operates

**soil side**—the side of a pass-through machine into which soiled goods are loaded for processing

**spray-down**—a feature which allows the operator to facilitate loading the machine by spraying the goods with water as they are loaded

**SS (SSS)**—seconds, i.e., “SS” means two digits (usually 00-99 seconds), “SSS” means three digits (usually 000-255 seconds); see also **MMQ**

**step timer**—counts time for each individual step in a formula or dry code

**supply injector**—compartmented hopper into which chemicals are loaded before beginning a wash cycle; the chemicals are flushed from the hopper compartments into the machine automatically when commanded by the control

**thermistor**—temperature sensing device that varies its resistance to an electrical current with regard to temperature; used frequently in CBW® washers, washer-extractors, and textile machines



## Definitions of Terms and Abbreviations

**three-wire circuit**—circuit that provides control power for all machine functions; any of several safety devices in the three-wire circuit will open the circuit and stop machine operation if a malfunction is detected; once open, the three wire circuit can only be closed by manual intervention and then only if the condition that opened the circuit is rectified

**Thermo-water**—method of controlling incoming water temperature by modulating (alternately and oppositely opening and closing) the hot and cold water valves

**toggle switch**—one of several types of hand-operated switches with a single operating lever that can be moved to two or more positions (e.g., the *Master* switch)

**trickle charge**—process of slowly and continuously charging a microprocessor backup battery during machine operation to maintain a full charge

**tumbling**—goods are kept moving after the cycle is complete until the operator is ready to discharge them

**washer-extractor**—machine that both washes and extracts (spins the goods) to remove a large percentage of the absorbed water

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