Manual Number: MCT1UB01
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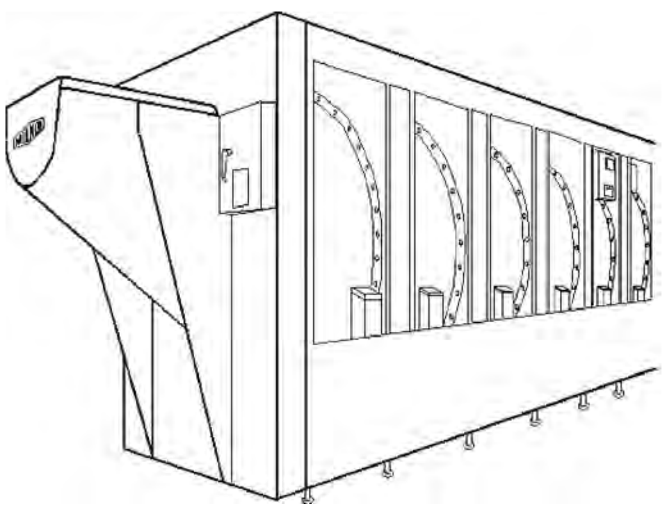
Controller Reference

Mentor® Mark 10 Controller for CBW® Systems



PELLERIN MILNOR CORPORATION Post Office Box 400, Kenner, Louisiana 70063–0400, U.S.A.

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1 Commissioning

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1.1 About the Mentor® Manual

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1.1.1 Scope

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This manual provides information about the Milnor® Mentor® controller for CBW® systems. Consult the other manuals available for your system for more detailed information. See the manual on water flow features for detailed descriptions of how the CBW® washer system works and how to use it most efficiently.

1.1.2 Trademarks

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

Table 1. Trademarks

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

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1.2 How to Contact Milnor®

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Your authorized Milnor® dealer can assist you with your Milnor® machine and knows about the local conditions that may be pertinent to the installation, use, or maintenance of the machine. Contact your dealer first. For assistance from the Milnor® factory, refer to Table 2 for contact information.

Table 2. Pellerin Milnor® Corporation Contact Information

Purpose	Department	Telephone	FAX	E-mail/Web site
Order or ask about replacement parts	Parts	504–712–7775 or 800–299–1500	504–469–9777	parts@milnor.com
Get advice on installing, servicing, or using	Customer Service/ Technical Support	504–712–7780	504–469–9777	service@milnor.com www.milnor.com (Customer Service)
Learn about, request, or enroll in Milnor® service seminars	Training	504–712–7716	504–469–9777	training@milnor.com
Determine warranty eligibility or claim status	Warranty Administration	504–712–7735	504–469–9777	service@milnor.com (Attention: Warranty)
Ask about, comment on, or report an error in equipment manuals	Technical Publications	504–712–7636	504–469–1849	techpub@milnor.com
European contacts	Milnor® International	+ 32 2 720 5822	—	milnor@milnor.be
Ask about the shipping weight of your machine before it arrives at your facility	Logistics Department	504–712–7686	504–471–0273	—

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Post Office Box 400
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Telephone: 504-467-9591
http://www.milnor.com

2 Configuring the Mentor® Controller

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2.1 Assigning Functions

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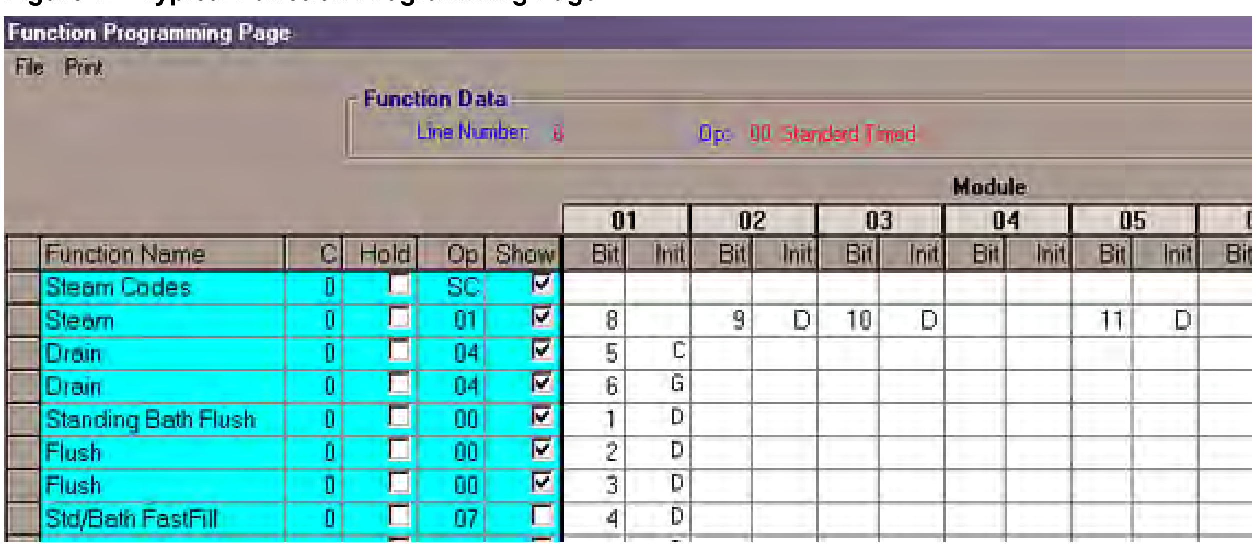
This document applies to all Mentor® software versions. For Mentor® systems using software with a date code of 98xxx or later, refer also to Section 8.2 : Programming Generation3 Mentor® Inputs and Outputs, page 265 .

Functions are the specific actions commanded by wash formulas, including opening drains and water valves and injecting steam or chemicals. Functions are programmed separately from formulas so that once each function is assigned certain operating characteristics, it can be included in any formula without the extra programming that would be required otherwise. This grouping of functions across modules also allows for consistency of the function in each module. For example, a few keystrokes on the function programming page can create a function to drain each module equipped with a drain valve after half the reversals between transfers have occurred. Once created, this function becomes available for use in all formulas; it only needs to be selected and given a value on the formula programming page. Consequently, the programmer can specify the function (drain halfway between transfers) rather than programming all the properties for the function each time it is used.

Most functions other than chemicals are defined for each Mentor® system at the Milnor® factory before delivery. However, in some cases functions may need to be modified, added, or removed. This document details how to use the function programming page of the Mentor® controller to accomplish these tasks. A portion of a typical page is illustrated in Figure 1 .

Figure 1. Typical Function Programming Page



2.1.1 Function Programming Page Menus

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2.1.1.1 File Menu

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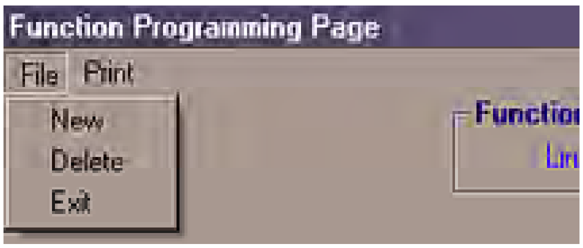
The file menu of the function programming page is used to add a new function and assign characteristics to it, to delete existing functions, and to exit the page. Figure 2 shows the **File** menu in its opened (drop-down) state. Note the control key shortcuts displayed beside each function.

Figure 2. Function Menus



2.1.1.1.1 New

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This menu item allows a user with programmer rights to add new functions to the Mentor® system if the required equipment and devices are available on the tunnel washer.

2.1.1.1.2 Delete

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To delete an existing function from the function programming page, select the desired function by selecting the function in the grid, then selecting **File/Delete**. Select **File/Exit** to exit the function programming page after deleting the function.

2.1.1.1.3 Exit

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The **Exit** menu selection closes the function programming page and returns the Mentor® operational display to the screen. To ensure that all recent changes are saved, select a function other than the last one modified before exiting this page.

2.1.1.2 Print Menu

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Click this menu item to immediately print the function programming page on the Windows default printer.

2.1.2 Function Data Area

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As shown in Figure 1: Typical Function Programming Page, page 25 , the function data area consists of two data types: **Line Number** and **Op Code**. Whenever a function is selected in the grid of the function programming page, these data change to reflect the selected function.

2.1.2.1 Line Number

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The line number of the selected function is displayed here. This number corresponds to the line number in the function data area of the formula programming page, allowing verification of which function is being used in cases where multiple functions have similar names.

2.1.2.2 Op Code

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Op codes (operation codes) are sets of rules which define how functions work. Certain op codes, such as 00 and 01, represent simple rules for operation. Op code 00 causes the function to operate only on the basis of time (e.g., a flush function causes a water valve to open for 10 seconds). Similarly, op code 01 (steam) causes the function to operate based on temperature (e.g., a steam function opens a steam valve until a set temperature is achieved). Other op codes are much more restrictive and apply only to specific operations. There are over 40 different op codes of many different types to cover all possible functions required for the Mentor® controller to efficiently operate the tunnel washer and related devices, such as flow splitters.

2.1.2.2.1 Op Code 00: Standard Timed

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The standard timed op code is the default op code. Operating according to time only, a function with an op code of 00 stays on until the programmed time expires, even if the tunnel transfers during this time. A commanded value of 255 causes the function to remain enabled until one of the following three conditions is met:

- Power to the tunnel is turned off or lost accidentally,
- The tunnel enters a hold condition and the Hold code for the function is enabled, or
- The timer is reset by a formula commanding a value of less than 255 for the function.

2.1.2.2.2 Op Code 01: Steam

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Each module may have a single steam function or cooldown function, but not both. Functions with op code 01 operate according to a desired temperature, but begin operation only after the desired liquor level for its module is achieved. For proper operation of a function coded for steam, disregard the *init code*, and set the *hold code* (explained elsewhere in this document) to **No**. A steam function causes the steam valve for its module to open any time the actual temperature in that module is less than the commanded temperature minus the differential temperature as set in **Configuration/Operating Parameters/Program Constants**. However, steam functions may also operate according to *steam codes* or as overridden by a function with a higher priority (e.g., drain). These cases are explained elsewhere in this document.

2.1.2.2.3 Op Code 02: Fast Fill

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Each module may have a single *fast fill* function. Unless overridden by a function with a higher priority, the fast fill function opens the fast fill water valve for its module whenever the liquor level drops below low level, and closes the valve when the liquor level rises above high level. Operation in this manner is dependent upon the function having been armed before the level drops below low. The function is armed when the drain is opened and closed at startup, and whenever the function op code is first configured for fast fill. The function is not disarmed when the tunnel transfers. The value, init code, and hold code for the function are disregarded.

2.1.2.2.4 Op Code 03: Hold

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A module may have any number of functions configured as *hold functions*. This function type is enabled when the tunnel is operating normally, and is disabled when the tunnel is in a hold condition. Most commonly, these functions are used to control inlet water valves, pumps, etc. that must be shut off when the tunnel is in hold. The value, init code, and hold code for the function are disregarded.

2.1.2.2.5 Op Code 04: Drain

BNTUUP19.C15 0000239019 A.2 A.9 A.4 1/2/20 2:11 PM Released

A module may have any number of functions configured as *drain functions*. This function type operates like a standard timed function except that all other functions in the module are disabled while the drain function is enabled. However, all other function timers continue to count down, even though the output is turned off by the drain function. Several drain functions in one module wired in parallel allow draining a module at several init codes.

NOTE: Beginning with Milnor® date 92641 (August 12, 1992), all tunnel modules with two drain valves are furnished with an individual, separate function-controlled pilot valve for each drain valve. This allows for more accurate partial draining, which is helpful in certain automatic purge pockets and interval purge operations, as described in Section 4.3 : Interval Purge, Automatic Empty Pockets, and Automatic Purge Pockets, page 127 . Drain1 is the function name for the drain valve in the drain sump where water exits the module (i.e., not the sump containing the steam line, if any). The adjacent drain valve is Drain2. To quickly and fully drain a module, actuate both Drain1 and Drain2 for at least 10 seconds. To partially drain a module, actuate only Drain1 for at least four seconds.

2.1.2.2.6 Op Code 05: Cooldown

BNTUUP19.C16 0000239018 A.2 A.9 A.3 1/2/20 2:11 PM Released

Each module may have a single cooldown function or steam function, but not both. Functions with op code 05 operate according to a desired temperature. The init code is disregarded. Upon actuation of this function, the cooldown water inlet valve remains open and count-up begins after all other influencing factors are satisfied, but transfer is prevented until the actual temperature is less than commanded. A desired temperature of 000 disables cooldown. To insure that only the desired module is cooled, this feature must only be used in a module that drains to the sewer or is equipped with bath exchange or a flow-not valve. This will prevent unwanted cooler water from counterflowing into an adjacent module. To avoid thermal shock, the module cooldown function can be combined with a module drain and overhead tank fill so at transfer the now cooler water is quickly drained and the module refilled with preheated water.

2.1.2.2.7 Op Code 06: Chemical

BNTUUP19.C17 0000239016 A.2 A.9 A.4 1/2/20 2:11 PM Released

Chemical functions operate on time or quantity. Once actuated, a chemical function remains enabled until the commanded value expires, including during any intervening transfer(s). A commanded value of 255 causes the function to remain enabled until one of the following three conditions is met:

- Power to the tunnel is turned off or lost accidentally,
- The tunnel enters a hold condition and the Hold Code for the function is enabled, or
- The timer is reset by a formula commanding a value of less than 255 for the function.

CAUTION: **Risk of poor or inconsistent wash quality** — Injections of a duration less than 10 seconds are not recommended for the following reasons:

▶ Fine adjustments are not possible (e.g., a 1-second change to a 3-second injection is a difference of one third).

▶ Erratic response time caused by mechanical lag of the chemical pump, draining of delivery tubes, etc. is more detrimental (e.g., a ½ second lag 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 longer injection times, thus improving quantity control.
- Use two pumps or valves to inject a small or large quantity of the same chemical, if desired.

Op code 06 is used to specifically identify a chemical function so the procedures for manual injection of extra chemicals and first dosing are able to recognize the appropriate functions. First dosing uses this information for calculating chemical injection amounts at startup and following an empty or purge pocket formula. For more information, see “Interval Purge, Automatic Empty Pockets, and Automatic Purge Pockets” elsewhere in this manual.

2.1.2.2.8 Op Code 07: Fast Fill Standing Bath

BNTUUP19.C18 0000239015 A.2 A.9 A.4 1/2/20 2:11 PM Released

Each module may have only one *fast fill* function. Unless overridden by a function with a higher priority, a fast fill function opens the fast fill water valve for that module whenever the liquor level drops below low level, and closes when the liquor level rises above high level. The value, init code, and hold code of the function are disregarded.

This op code should only be used on standing baths or flushing baths, where no water counterflows into the module, and all overflow out of the module goes to the sewer.

2.1.2.2.9 Op Code 08: Modulating Water with Flowmeter

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Available starting with Mentor® version 20200, this op code allows operation of a modulating water valve to be controlled by an electronic flowmeter. Values are programmed in either gallons per minute or liters per minute.

This op code is required for each PulseFlow® pump used on PulseFlow® tunnel washers. For PulseFlow® machines, disable the Hold code. Compatibility and init codes are not used for PulseFlow® pump functions.

2.1.2.2.10 Op Code 09: Early Call

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The *early call* function is used primarily when the tunnel discharges to a Milnor® extractor. A function with this op code turns off at transfer regardless of the remaining enabled time. This function is typically wired to the extractor's early call input, which causes the extractor to prepare for its next load after minimum extract time has expired, but before the end of maximum extract time. Proper use of a function with this op code can increase production by reducing the number of tunnel holds caused by the extractor not being ready to accept the next load.

2.1.2.2.11 Op Code 80-8B: Overhead Fill Tanks

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2.1.2.2.11.1 Hot Water Valves

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Functions 80, 84, and 88 cause the corresponding hot water valve on the overhead fast fill tank (tank 1, 2, or 3, respectively) to operate as required by the tank. This may include modulating to the commanded temperature (where the value of the function is desired temperature, not time), operating under tank level switch control (where the init code is ignored), functioning during tunnel holds (ignores programmed hold code and imposes **Hold=No**), and looking backward to the goods in the previous module when appropriate. The tank hot water function is disabled when the tank drain function is enabled.

2.1.2.2.11.2 Cold Water Valves

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Functions 81, 85, and 89 cause the corresponding overhead cold water valve on the fast fill tank (tank 1, 2, or 3, respectively) to operate as required by the tank. This may include modulating to the commanded temperature (where the value of the function is desired temperature, not time), operating under tank level switch control (where the init code is ignored), functioning during tunnel holds (ignores programmed hold code and imposes **Hold=No**), and looking backward to the goods in the previous module when appropriate. The tank cold water function is disabled when the tank drain function is enabled.

2.1.2.2.11.3 Steam Valves

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Functions 82, 86, and 8A cause the corresponding overhead fast fill tank steam valve (tank 1, 2, or 3, respectively) to operate as required by the tank. This may include maintaining the commanded temperature after high level in the tank is first achieved (where the value of the function is desired temperature, not time), functioning during tunnel holds (ignores programmed hold code and imposes **Hold=No**), and looking backward to the goods in the previous module when appropriate. The tank steam function is disabled when the tank drain function is enabled or the tank level is below low level.

2.1.2.2.11.4 Drain Valves

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Functions 83, 87, and 8B cause the corresponding overhead fast fill tank drain valve (tank 1, 2, or 3, respectively) to operate as a standard function, except that the tank valves for hot water, cold water, and steam are disabled when the drain function is enabled. Init codes D (for a drain and fill at transfer) and G (for a mid-cycle drain and fill) are the only valid init codes. For a drain and fill at transfer, the tank drain function must be designated for backward compatibility, as explained later in this document.

2.1.2.2.12 Op Code 9A: Flow Splitter Stop Reuse Cooldown

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This op code stops the *flow splitter* from pumping hot water back to the reuse tank if the temperature of the water in the tank is already above the desired temperature. The function energizes when the reuse tank temperature is above the desired temperature plus the configured differential, stopping the introduction of heated water from the flow splitter into the reuse tank. When the temperature of the water in the reuse tank falls to between the desired temperature and the desired temperature plus the differential, the function de-energizes, causing the flow splitter to resume pumping water from the flow splitter to the reuse tank.

2.1.2.2.12.1 How the Mentor® Controller Determines the Desired Reuse Tank Temperature

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The temperature of the liquor in the reuse tank is monitored by the Mentor® controller. If a steam output is programmed for module 1 and the “Reuse Enabled” checkbox is selected, the reuse tank temperature is adjusted to satisfy the requirements of either the formula in the last storage position or the formula in the first module, according to the four rules below:

- If only the formula in the first module desires to control reuse tank temperature, the tank temperature will be adjusted to match the temperature for the formula in the first module.
- If only the formula in the last storage position desires to control reuse tank temperature, the tank temperature will be adjusted to match the module 1 temperature of the formula in the last storage position.
- If both the formula in module 1 and the formula in the last storage position desire to control reuse tank temperature, the tank temperature will be adjusted to match the cooler of the two desired temperatures.
- If neither the formula in the last storage position nor the formula in module 1 desire to control the reuse tank temperature, the feature is disabled.

NOTE: This function requires that a steam output be programmed for one or both of the formulas involved (those in module 1 and in the last storage position); **however, a steam valve does not have to be present**.

NOTE: Op code 0A (dual temperature) is ignored for reuse temperatures. The temperature of the reuse tank is controlled by the value of the steam function, not the value of 0A.

2.1.2.2.12.2 How Temperature Differentials Work

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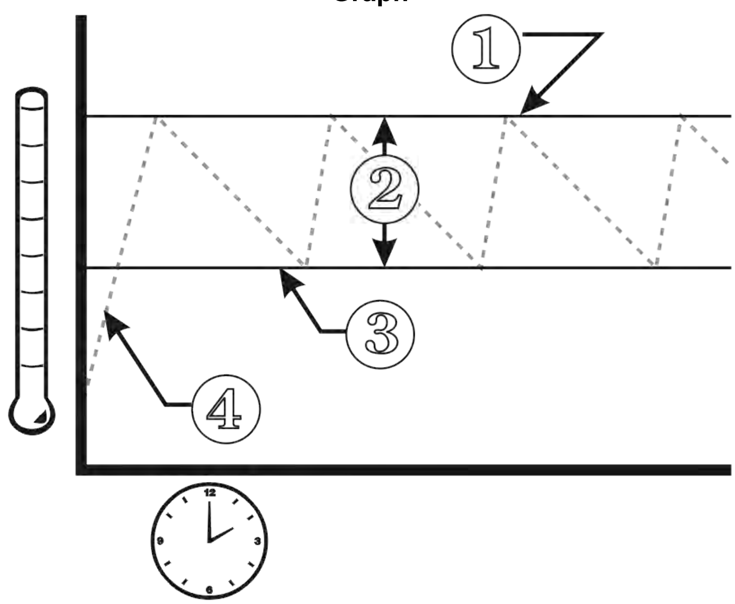
The Mentor® controller employs three configuration values defined as temperature differentials. These values are called **Differential Reuse Temp for Steam**, **Differential Reuse Temp of Cooldown**, and **Differential Temperature**. Each of these values allows for a user-defined temperature **range**, rather than a single degree setpoint. Without this allowable range, the controller would actuate steam and cold water valves with extreme frequency in an effort to maintain exactly the desired temperature. Such frequent actuation would cause accelerated wear on the valves and other components, usually with very little benefit.

Temperature differentials are defined on the **Program Constants** page of the Mentor® controller (accessed from the operational display through **Configuration/Operating Parameters/Program Constants**).

Differential Temperature This value controls the steam valves in the modules of the tunnel washer. A simplified temperature curve in a sample module is shown in Figure 3 . Briefly explained, a module equipped with steam and processing a wash formula with a specific temperature will steam to the desired temperature. At the desired temperature, the steam valve will close. The steam valve will open again only when the temperature in the module falls to the desired temperature **minus the differential temperature**. See Section 4.1 : Programming Mentor® Formulas, page 102 for more information.

Figure 3. Differential Temperature

Graph



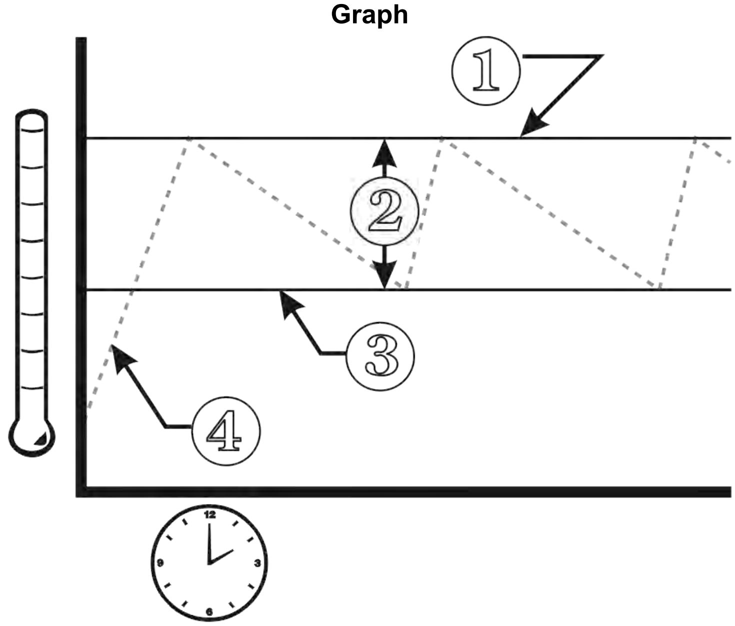
Legend

1. Programmed temperature (steam turns off)
2. Configured temperature differential
3. Steam turns on at or below this temperature
4. Bath temperature

Differential Reuse Temp for Steam The value entered in this field is the amount of cooling allowed in the reuse tank before steam is injected to return the temperature to the desired. The temperature curve of the reuse tank during steaming is shown in Figure 4 .

Figure 4. Differential Temperature for Steaming the Reuse Tank

Graph



Legend

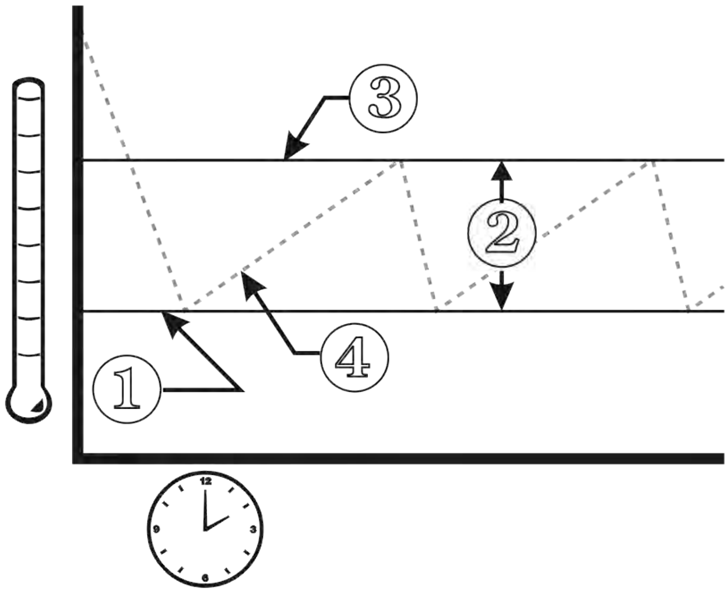
1. Programmed temperature (steam turns off)
2. Configured temperature differential
3. Steam turns on at or below this temperature
4. Reuse tank temperature

Differential Reuse Temp of Cooldown The value entered in this field is the amount of heating allowed in the reuse tank before cold water is injected to lower the temperature to the desired.

The temperature in the reuse tank may rise above the desired temperature when the bath temperatures commanded in the last modules of the tunnel washer are significantly higher than the temperatures commanded in the first module. The temperature curve of the reuse tank during cooldown is shown in Figure 5 .

Figure 5. Differential Temperature for Cooling the Reuse Tank

Graph



Legend

1. Programmed temperature (cold water turns off)
2. Configured temperature differential
3. Cold water turns on at or above this temperature
4. Reuse tank temperature

2.1.2.2.13 Op Codes 97-99: Reuse Tank

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2.1.2.2.13.1 Steam

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Op code 97 enables the function when the temperature in the reuse (flush) tank falls below the lower of the desired temperature for the formula in module 1 or the last storage position. The function is enabled when the reuse tank temperature falls below the desired temperature for module 1 minus the value entered in the **Differential Reuse Temp for Steam** field on the **Program Constants** screen. The function is disabled when the reuse tank temperature rises above the desired temperature in module 1 plus the value entered in the **Differential Reuse Temp of Cooldown** field. The value and init code of this function are ignored, and the programmed hold code is ignored and replaced with **Hold=N**.

2.1.2.2.13.2 Cooldown Drain

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Op code 98 is used in conjunction with op code 99 (described below). If the reuse (flush) tank cooldown function (op code 99) is admitting cooldown water to the tank, this op code opens the drain whenever the liquor level in the tank is above high. The value, init code, and hold code are ignored. The drain closes again when the liquor level in the tank falls below high level.

2.1.2.2.13.3 Cooldown Cold Water

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Op code 99 enables the function when the temperature in the reuse (flush) tank rises above the desired temperature in module 1 plus the value entered in the **Differential Reuse Temp of**

Cooldown field on the **Configuration/Operating Parameters/Program Constants** screen. The function is disabled when the reuse tank temperature falls below the desired temperature in module 1 minus the value entered in the **Differential Reuse Temp for Steam** field. The value and init code of this function are ignored, and the programmed hold code is ignored and replaced with **Hold=N**. A function assigned op code 9A (Flow Splitter Stop Reuse Cooldown) is also enabled when the function assigned this op code is enabled.

2.1.2.2.14 Op Code 0A: Dual Temperature

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This op code provides the second bath temperature in a dual temperature bath. Temperature is initially controlled by the steam function for the current formula. At the specified init code, the *dual temperature* function takes over. This function is governed by the steam code of the current formula. Consequently, it operates in the same manner as the steam function. The dual temperature function will hold the count and/or maintain temperature as dictated by the steam code.

2.1.2.2.15 Op Code +n: Modified Module Assignment

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Standard functions can be controlled by formula data “n” modules beyond (after) the current module. These op codes correspond to op code -n (Section 2.1.2.2.16 : Op Code -n: Modified Module Assignment, page 34). A typical application of this op code is *long distance compatibility*, wherein goods in the extraction device might taint the extracted liquor which is returned to the reuse (flush) tank. This feature also depends on the presence of an optional valve set to discharge tainted liquor to the sewer. If the optional valve set is present, the function bit named LD2, Color, or Nasty in the last or next-to-last module would be assigned an op code of +n to monitor the goods in the extraction device. If goods in the extraction device activate the LD2 function bit, the extracted water is drained to the sewer rather than the reuse tank.

For example, assume red goods are in the press and white goods are in the last storage position. If the liquor pressed from the red goods is reused to flush the white goods down the tunnel load chute, the white goods may be tinted pink. However, if the optional normally open valve from the last module to the reuse tank is closed, and the optional normally closed valve from the last module to the sewer is opened, the red tinted bath liquor will be drained to the sewer. Fresh water will make up the necessary water in the reuse tank, preventing tinting of the white goods. The closing and opening of the two aforementioned valves can be controlled with an op code of +1 on the valve set in the last module, instructing the Mentor® controller to operate the valve set according to the formula there (one position beyond the location of the valve set).

2.1.2.2.16 Op Code -n: Modified Module Assignment

BNTUUP19.C35 0000239156 A.2 A.9 A.3 1/2/20 2:11 PM Released

This is a standard function operation controlled by formula data “n” modules prior to (before) the current module. A typical application is the loading conveyor bypass function (CRAB), which overrides the unload-end photo-eye on Milnor® Conlo and Conwa loading conveyors, permitting the tunnel to transfer an empty pocket when the *pass empty* formula or goods code occupies the last storage position in the loading conveyor. CRAB must recognize the formula in the last storage compartment (just prior to module 1). Normally, this function is controlled by a function on module 1, thus requiring an op code of -1. If the function were to be controlled by module 2, an op code of -2 would be required.

2.1.2.2.17 Op Code 0B: Bang-Bang Modulating Water - Hold

BNTUUP19.C36 0000239155 A.2 A.9 A.3 1/2/20 2:11 PM Released

This op code roughly simulates the operation of a modulating water valve by varying how long a non-modulating valve is held open or closed. This op code is rarely used since modulating water valves and flowmeters have become more accessible.

2.1.2.2.18 Op Code 0C: Modulating Valve without Flowmeter

BNTUUP19.C37 0000239154 A.2 A.9 A.3 1/2/20 2:11 PM Released

Available starting with Mentor® version 20200, this op code allows commanding a modulating valve to open to a particular percentage, without input from a flowmeter. The value is programmed as **percent open**, ranging from 0 to 100 percent.

2.1.2.2.19 Op Code 0D: Programmable Hold

BNTUUP19.C38 0000239153 A.2 A.9 A.3 1/2/20 2:11 PM Released

This op code is available on Mentor® versions 20200 and later. A module may have any number of functions configured as *programmable fill functions*. This function type is enabled when the tunnel is operating normally, and is disabled when the tunnel is in a hold condition. The **Programmable Fill** op code is similar to op code 03 (**Hold**), with one exception—functions using this op code are enabled by programming an **on time** of 255 for each formula where the function is desired. The init code and hold code for the function are disregarded.

2.1.2.2.20 Op Code 0E: Flow Control Valve

BNTUUP19.C39 0000239152 A.2 A.9 A.3 1/2/20 2:11 PM Released

Available starting with Mentor® version 20200, this op code is used to control a programmable flow valve. Programming any value other than **0** into the formula causes the function to be **on** at all times, regardless of init code, hold code, or CBW® rotation. A value of **0** turns the function **off**.

2.1.2.2.21 Op Code SC: Steam Code

BNTUUP19.C40 0000239151 A.2 A.9 A.3 1/2/20 2:11 PM Released

This op code allows programming selected steam codes on the formula programming screen.

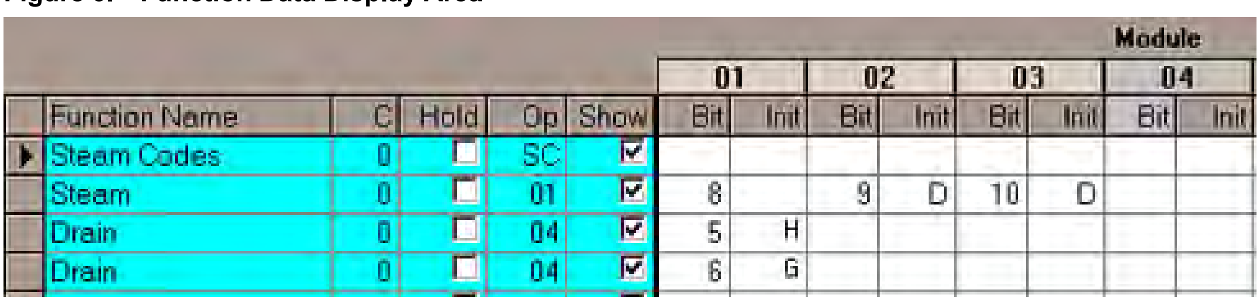
2.1.3 Main Screen Grid Area

BNTUUP19.C41 0000239178 A.2 A.9 A.3 1/2/20 2:11 PM Released

2.1.3.1 Module Row

BNTUUP19.C42 0000239176 A.2 A.9 A.3 1/2/20 2:11 PM Released

Figure 6. Function Data Display Area



					Module							
					01		02		03		04	
Function Name	C	Hold	Op	Show	Bit	Init	Bit	Init	Bit	Init	Bit	Init
Steam Codes	0	☐	SC	☑								
Steam	0	☐	01	☑	8		9	D	10	D		
Drain	0	☐	04	☑	5	H						
Drain	0	☐	04	☑	6	G						

The numbers in the light gray shaded horizontal area of the **Function Programming** page represent the tunnel modules. Immediately below each two-digit module number are two columns, named *Bit* and *Init*.

The **Bit** column indicates the specific output relay operated by the function.

The **Init** column displays the initialization (init) code for the function. The init code determines when during the mechanical action of the tunnel washer the function (output relay) is turned on. The value of the function determines how long the function remains enabled, either for a specific number of seconds or until a specific level or temperature is achieved.

2.1.3.2 Function Name

BNTUUP19.C43 0000239175 A.2 A.9 A.3 1/2/20 2:11 PM Released

All functions other than chemicals are named and coded at the Milnor® factory before a Mentor® system is shipped. However, the owner/operator may prefer a different name or to change the names of functions from English to another language.

CAUTION: **Avoid Data Loss** — Before making any changes to the Function Programming page, make a backup of all Mentor® controller data (**File/Backup Memory**, from the operational display).

To change the text in the **Function Name** column, click twice on the name to be changed. The first click will select the function and the second will activate the text cursor (a flashing vertical bar) in the **Function Name** field. Delete the old function name and enter the desired name.

CAUTION: **Avoid Data Loss** — To avoid losing programmed function data, always move the cursor to a field other than the one last changed, or press **Enter**, before using any menu selection to close the current page. Failure to follow this procedure will cause the last data programmed to revert to the previous value.

2.1.3.3 C = Compatibility

BNTUUP19.C44 0000239174 A.2 A.9 A.3 1/2/20 2:11 PM Released

For functions other than chemicals (designated by op code 06), a function can be controlled by the formula in a module other than the one in which it occurs. If the function is controlled by a module earlier in the tunnel (e.g., a function in module 04 is controlled by the formula in module 03), then use *Backward compatibility. Forward compatibility* controls functions in one module according to the formula in a module further along in the tunnel (e.g., a function in module 04 is controlled by the formula in module 05).

2.1.3.4 Hold

BNTUUP19.C45 0000239173 A.2 A.9 A.3 1/2/20 2:11 PM Released

The *hold code* for a function defines how the function operates if the tunnel enters a hold condition while the function is enabled. If the hold code is **Yes** (box is checked), the function will be disabled even though the programmed value has not expired or the programmed temperature is not achieved. If the hold code is **No** (box is not checked) and the tunnel enters a hold condition while the function is enabled, the function will continue to operate, regardless of the hold condition, until the programmed value has expired or the temperature has been achieved.

TIP: When programming the Hold code for any function, ask "If this function is operating when the tunnel goes into hold, should the function turn off?" If the answer is yes, put an "X" in the Hold column for that function.

Certain functions require that the hold code be set to **No**. For example, steam should normally remain enabled during holds to insure that steam won't turn off if the machine enters a hold condition because it took too long to achieve temperature. In this example, temperature might never be achieved. Also, a *flow-not* function (as used with *bath exchange*) should not be disabled before the next transfer, regardless of the hold condition of the tunnel. Premature termination of a flow-not function could cause contamination of the goods for which the bath exchange was initiated.

2.1.3.5 Op = Op Code

BNTUUP19.C46 0000239172 A.2 A.9 A.3 1/2/20 2:11 PM Released

Enter the desired op code (operational code) from the drop-down list. All available op codes are described in detail in Section 2.1.2.2 : Op Code, page 27 .

2.1.3.6 Show

BNTUUP19.C47 0000239171 A.2 A.9 A.3 1/2/20 2:11 PM Released

Check this box to cause the function to appear on the **Formula Programming** page. This is necessary for functions with variable values, such as steam, drain functions, and chemicals. Certain functions which are not varied from one formula to another are not usually shown on the **Formula Programming** page. These include functions assigned to flushes and fast fills, among others. Generally, if a function is dependent upon another function to start, it is not shown on the **Formula Programming** page. Showing non-essential functions causes unnecessary lines on the programming page and tends to complicate programming.

2.1.3.7 Bit Column

BNTUUP19.C48 0000239170 A.2 A.9 A.3 1/2/20 2:11 PM Released

2.1.3.7.1 For Software Versions Before 98xxx

BNTUUP19.C49 0000239169 A.2 A.9 A.3 1/2/20 2:11 PM Released

Because bits are assigned per module according to the number of output relays associated with that module, module 01 normally contains bits 01 through 16. Other modules, unless equipped with additional outputs, contain bits 01 through 08.

The available functions are determined by how the relay outputs are physically wired to other devices on the tunnel washer, so this data is entered at the Milnor® factory. Bits and their corresponding functions need only be changed if equipment is added to or removed from the tunnel washer after manufacture.

2.1.3.7.2 For Software Versions 98xxx and Later

BNTUUP19.C50 0000239191 A.2 A.9 A.3 1/2/20 2:11 PM Released

For software versions 98xxx and later of the Mentor® controller, outputs are assigned by their number in the output array. That is, all outputs are numbered sequentially from 1 to the number of outputs available on the machine. Assignment of a particular output relay to a specific machine function is a simple matter of wiring the desired function (device) to an available output relay, then using the Bit column of the Mentor® software to assign that function to the chosen output relay. Note that assignment and deletion of bits should only be necessary if equipment is added or removed after manufacture. Details of this procedure are described in Section 8.2 : Programming Generation3 Mentor® Inputs and Outputs, page 265 .

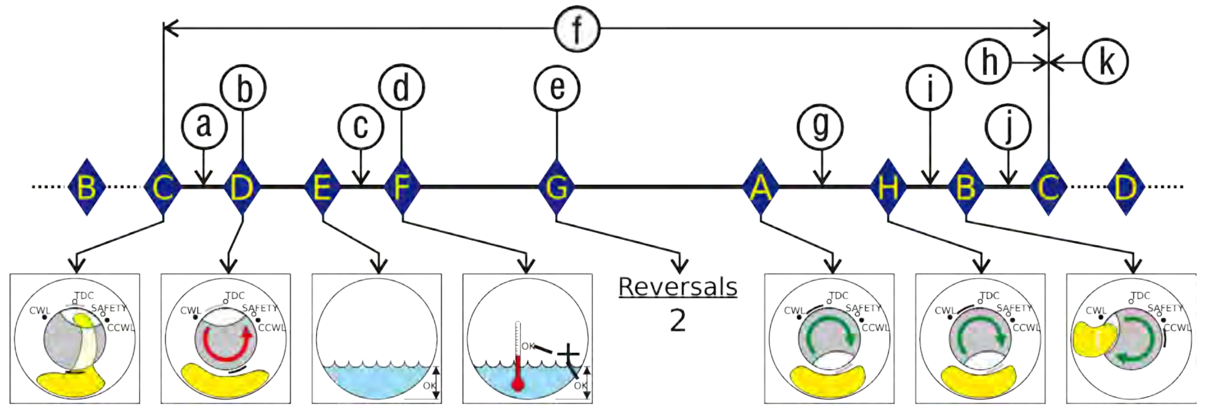
2.1.3.8 Init Column

BNTUUP19.C51 0000239189 A.2 A.9 B.2 5/19/20 11:08 AM Released

The init column displays the initialization code (init code) for each bit in a module. There are 16 available init codes to allow a function to be started at almost any point during a formula. Some of the init codes described below correspond to configuration values entered on the **Configuration/Operating Parameters/Program Constants** page. For example, an init code of "I" will cause the function to begin when the number of reversals remaining in the formula is equal to the value entered for **Reversals for Init Code I** on the **Program Constants** page, and if the tunnel is not already committed to transfer. Keep in mind that a reversal consists of one clockwise rotation and one counterclockwise rotation of the tunnel.

Figure 7. Sequence and Description of Init Codes

Graphic



Legend

A . . . **Init codes A, I, J, K, and L**: Action begins when counts remaining equal INITx (x=A, I, J, K, L, respectively), but before tunnel is committed to transfer.

B . . . **Init code B**: Action begins during transfer when the target passes CCWL just before memory shifts (while goods are still sliding down the transfer scoop).

C . . . **Init code C**: Action begins when transfer is complete and cylinder pauses at TDC limit switch, just after the memory shifts. This init code is only available on earlier Mentor® controllers.

D . . . **Init code D**: Action begins when tunnel starts truning after TDC pause. Tunnel rotation always starts counterclockwise (CCW).

E . . . **Init code E**: Action begins following a transfer after tunnel starts turning and water levels are OK.

F . . . **Init code F**: Action begins following transfer after tunnel starts turning and both water levels and temperatures are OK. Count-up starts now.

G . . . **Init code G**: Action begins when count-up reaches halfway point (when half the time until next transfer has elapsed).

H . . . **Init code H**: Action begins when tunnel is committed to transfer (as the clockwise switch CWL sees the target and the transfer scoop beings to lift the goods.

a . . . TDC pause time: set on the **CBW Output Timers** page, described in “How to Configure the MentorMentor® Controller” elsewhere in this manual (see Contents)

b . . . Tunnel cylinder starts turning

c . . . Time required to achieve water levels and/or temperatures

d . . . Start of count-up

e . . . Time determined by number of reversals specified in Init A

f . . . Memory for module X

g . . . Init A plus one reversal

h . . . Tunnel cylinder stops turning

I . . . 1.5 second minimum

j . . . 2.25 second maximum

k . . . Memory shift from Module X to Module X+1

2.1.3.8.1 Init Code A: At “x” counts remaining but before committed to transfer

BNTUUP19.C52 0000239188 A.2 A.9 A.3 1/2/20 2:11 PM Released

This init code will enable the corresponding function when the number of reversals remaining in the formula is equal to the value entered for **Reversals for Init Code A** on the **Program Constants** page, provided the tunnel is not committed to transfer at this time. For example, if **Reversals for Init Code A** is configured for five reversals, then a function with init code A normally begins when five reversals remain in the formula. The exception is if the tunnel is committed to transfer before the number of reversals remaining equals the value programmed for **Reversals for Init Code A**.

For example, if **Reversals for Init Code A** is configured for eight reversals, functions assigned to operate at init code A will normally occur when there are eight reversals remaining before transfer. However, if the longest formula in the tunnel is only seven reversals, the tunnel will commit to transfer before init code A is achieved, so the function will not occur.

2.1.3.8.2 Init Code B: During transfer after CCW limit is passed

BNTUUP19.C53 0000239187 A.2 A.9 A.3 1/2/20 2:11 PM Released

This init code occurs while the goods in each module are sliding down the transfer scoop during transfer. The counterclockwise proximity switch CCW no longer sees the proximity switch target. If a module is to be drained before the next batch arrives, this init code is used to open the drain in module X+1 to which the goods in module X are about to be transferred. When used along with backward compatibility, this init code may be used to drain a module of high temperature liquor before temperature sensitive goods (e.g., blood work) is transferred into the module.

2.1.3.8.3 Init Code D: After tunnel starts turning after pause at TDC

BNTUUP19.C54 0000239186 A.2 A.9 A.3 1/2/20 2:11 PM Released

Functions assigned init code D begin when the tunnel resumes turning after the pause (pause occurs with target at top dead center). This init code is the most commonly used for all functions, including chemicals, steam, etc.

2.1.3.8.4 Init Code E: After transfer and water levels satisfied

BNTUUP19.C55 0000239185 A.2 A.9 A.3 1/2/20 2:11 PM Released

Init code E occurs only after the tunnel has completed transfer and water levels in all modules are first achieved. Use this init code for chemicals in formulas processing goods that are sensitive to water level.

2.1.3.8.5 Init Code F: After transfer and both levels and temperature satisfied

BNTUUP19.C56 0000239206 A.2 A.9 A.3 1/2/20 2:11 PM Released

Functions using this init code occur only after the tunnel has transferred, water levels in all modules are achieved, and all temperatures are met. Use this init code for chemicals in formulas processing goods that are sensitive to water level and temperature.

2.1.3.8.6 Init Code G: When count-up reaches halfway point

BNTUUP19.C57 0000239205 A.2 A.9 A.3 1/2/20 2:11 PM Released

This init code occurs when half of the programmed number of reversals have expired. One application of init code G is to drain a module containing goods with a large quantity of solid soil. The drain empties the sump. This code may also be used to provide a maintenance dose of chemical during long formulas.

2.1.3.8.7 Init Code H: During transfer when tunnel is committed

BNTUUP19.C58 0000239204 A.2 A.9 A.3 1/2/20 2:11 PM Released

This init code occurs when the tunnel is committed to transfer (the clockwise proximity switch sees the target). It is at this point that the transfer scoop begins to lift the goods out of the bath in preparation for transfer. If a module is to be drained before the next batch arrives, this init code is used to open the drain in module X+1 to which the goods in module X are about to be transferred.

When used along with backward compatibility, this init code may be used to drain a module of high temperature liquor before temperature sensitive goods (e.g., blood work) is transferred into the module.

2.1.3.8.8 Init Code I, J, K, and L: At “x” counts remaining but before committed to transfer

BNTUUP19.C59 0000239203 A.2 A.9 A.3 1/2/20 2:11 PM Released

See Section 2.1.3.8.1 : Init Code A: At “x” counts remaining but before committed to transfer, page 39 for a complete explanation of the operation of these init codes.

2.1.3.8.9 Init Codes M, N, O, and P: At “x” counts after transfer

BNTUUP19.C60 0000239202 A.2 A.9 A.3 1/2/20 2:11 PM Released

These init codes occur at a pre-programmed number of counts after transfer. The number of counts for each of these four init codes is defined on the **Program Constants** page. These op codes are available only in versions 97200 and later of the Mentor® software.

2.1.3.8.10 Init Code Q

BNTUUP19.C61 0000239201 A.2 A.9 A.4 1/2/20 2:11 PM Released

This init code is always active. If this init code has a non-zero value (e.g., 1) in a formula, functions using this code are ON any time the tunnel has power. The function turns OFF if **Hold** is checked and the tunnel enters a “Hold” condition. This init code will start a function for operation between tunnel start-up and the first transfer. Init code Q is available only in versions 20101 and later of the Mentor® software.

2.1.3.8.11 Init Code ST: Steam

BNTUUP19.C62 0000239200 A.2 A.9 A.3 1/2/20 2:11 PM Released

Assign this init code to all steam functions. Because steam is controlled by temperature rather than time, other init codes would have no effect on steaming.

BNTUUP21 / 2019314 BNTUUP21 0000246770 A.12 1/2/20 2:11 PM Released

2.2 How to Configure the Mentor® Controller

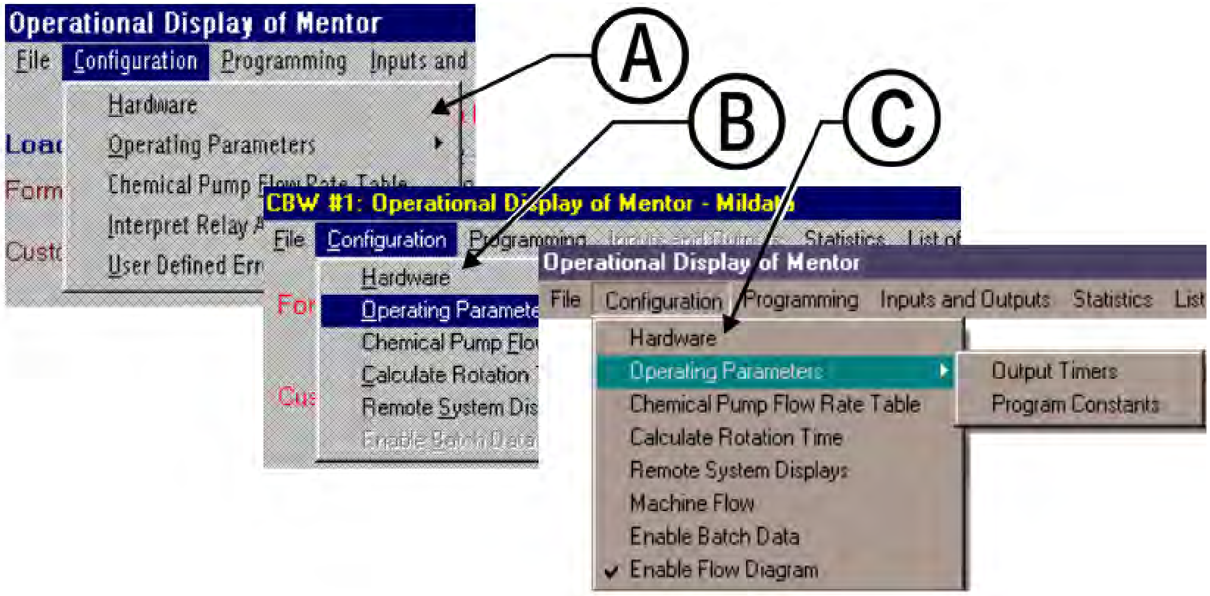
BNTUUP21.C01 0000246768 A.2 A.12 A.4 1/2/20 2:11 PM Released

The Mentor® control system for Milnor® Continuous Batch Washers can be configured to control a vast array of options and variations on the base equipment. Because of this ability to control so many different parameters in varying situations, the controller must be configured before use. In the very purest terms, the configuration procedure tells the controller what type of tunnel device it's controlling and what options and user preferences are involved. This document defines the parameters that may require adjustment, either because of manufacturing specifications or customer requirements.

All configuration information addressed in this document is accessible through the **Configuration** menu on the Mentor® operational display (see Figure 8). Note that some items are contained in sub-menus within the **Operating Parameters** area of the main **Configuration** menu.

Figure 8. Mentor® Configuration Menu

Typical Menus by Software Version



Legend

A . . . Typical menu before software version 98xxx
B . . . Version 20403 menu
C . . . Version 20607 menu

2.2.1 CBW® Hardware Configuration

BNTUUP21.C02 0000246800 A.2 A.12 A.3 1/2/20 2:11 PM Released

The **CBW Hardware Configuration** screen contains parameters of both fixed (hardware dependent) and variable (user preferences) types. For example, the number of storage positions for the system is not likely to change unless the storage conveyor or rail loading system is changed, and this value must accurately match the system for proper operation. Conversely, whether the controller displays temperature in Fahrenheit or Celsius scales is entirely at the discretion of the owner/user.

Figure 9. Hardware Configuration Page (version 20B02 shown)

2.2.1.1 Number of Storage Positions

BNTUUP21.C03 0000246799 A.2 A.12 A.3 1/2/20 2:11 PM Released

Enter a number here equal to the number of compartments on the loading conveyor or the number of bags available in the rail system queue. The Mentor® controller displays the number of loading system positions on the operational display. Use 00 if the tunnel washer is not associated with any loading device (i.e., batch codes are entered directly into the first module). Use 01 for Miltrac™ loading, to display the data for the incoming batch. The range is 00 to 16 storage positions.

2.2.1.2 Number of Modules

BNTUUP21.C04 0000246798 A.2 A.12 A.3 1/2/20 2:11 PM Released

Enter the number of modules making up the tunnel washer. Use 00 only for troubleshooting with factory guidance. From 0 to 20 modules may be configured here.

2.2.1.3 Number of Overhead Fill Tanks

BNTUUP21.C05 0000246797 A.2 A.12 A.3 1/2/20 2:11 PM Released

Enter the number of overhead fast fill tanks on the tunnel washer. One analog to digital board at address A0H is required for overhead fill tanks, along with four functions (with specific operational codes) per tank.

2.2.1.4 Number of Interpret Relay Output Boards

BNTUUP21.C06 0000246796 A.2 A.12 A.3 1/2/20 2:11 PM Released

This decision does not appear in Mentor® software versions 98xxx or later. Interpret relays are used to control devices (e.g., chemical pumps) that require more electrical current than the board-level output relays can faithfully conduct. For software versions earlier than 98xxx, enter the number of output boards used for chemical outputs. Interpret relays are assigned to board-level output relays on the **Interpret Relay Assignments** page of the **Configuration** menu.

2.2.1.5 Number of Input/Output Boards

BNTUUP21.C07 0000246795 A.2 A.12 A.3 1/2/20 2:11 PM Released

This decision does not appear in Mentor® software versions before 98xxx. For software versions 98xxx and later, enter the number of input/output boards in the control system for the tunnel washer. Each board of this type contains 8 output relays and 16 microprocessor input channels. The valid range for this decision is 0 to 15 boards, with valid addresses for these boards starting at 01H and extending to 0FH.

2.2.1.6 Number of Output Boards

BNTUUP21.C08 0000246794 A.2 A.12 A.3 1/2/20 2:11 PM Released

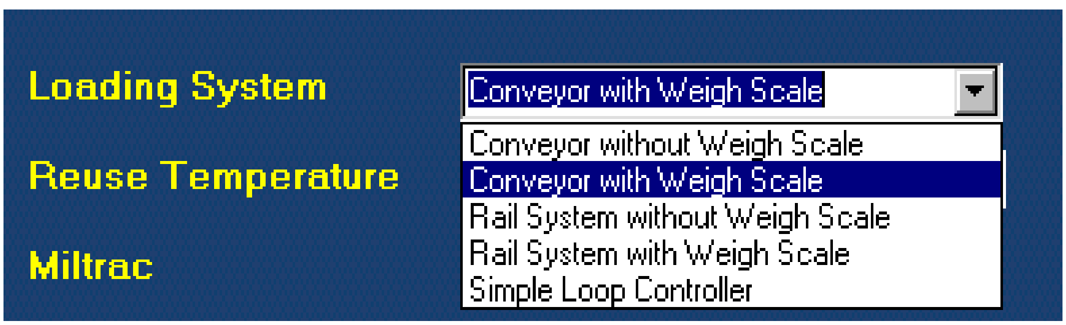
This decision does not appear in Mentor® software versions before 98xxx. For software versions 98xxx and later, enter the number of output boards in the control system for the tunnel washer. Each board of this type contains 24 output relays. The valid range for this decision is 0 to 15 boards, with valid addresses for these boards starting at 11H and extending to 1FH.

2.2.1.7 Loading System

BNTUUP21.C09 0000246792 A.2 A.12 A.4 1/2/20 2:11 PM Released

The loading system is the conveyor or rail system used to load the tunnel washer. The selections below cover most possibilities. Consult with the Milnor® factory if necessary to determine which selection best fits the specific loading device in your system.

Figure 10. Loading System Menu (Pre-98xxx Software Date Code Shown)



Conveyor without Weigh Scale denotes a loading conveyor not equipped with a weigh scale. The Milnor® CONLO line of loading conveyors is included in this class.

Conveyor with Weigh Scale denotes a loading conveyor equipped with a weigh scale. The Milnor® CONWA line of loading conveyors is included in this class. This selection requires the presence of a load cell analog to digital board at address 20H.

Rail System without Weigh Scale denotes a system consisting of trolley-mounted bags suspended from a rail above the tunnel washer. This selection is used if the rail system does not employ a weighing station for loaded bags.

Rail System with Weigh Scale denotes a system similar to the one described above, but with the addition of a weighing station of some type for loaded bags. This selection requires the presence of a load cell analog to digital board at address 20H.

Simple Loop Controller indicates the tunnel washer is loaded by a 16-bag FIFO (first in, first out) rail system.

Simple Loop with Weigh Scale loading is performed by a 16-bag FIFO rail system equipped with a weigh scale. This option is available only on Mentor® software with date codes of 98xxx or later. This selection requires the presence of a load cell analog-to-digital board at address 20H.

Ronan Gamma Weighing System denotes the presence of a Ronan Gamma weighing system in a Regenex Continuous Batch Fiber Recovery System (CBFRS). This selection is only available if the **Paper** selection is checked on the **Configuration/Hardware** page, and is not available in Mentor® software versions earlier than 98xxx. For Mentor® controls operating CBFRS systems and having software versions of 98xxx or later, the Ronan system must provide a signal to the INT 0 pin of the standard input/output board at address 80H. Each pulse represents two pounds (0.91 kilograms).

2.2.1.8 Reuse Temperature

BNTUUP21.C10 0000246948 A.2 A.12 A.3 1/2/20 2:11 PM Released

Select the temperature control abilities of the tunnel washer reuse tank. This decision must match the hardware provided on the tunnel. This selection requires an temperature-sensing analog to digital board at address A0H.

No Reuse Temperature indicates that the temperature of the reuse tank is not monitored. The temperature of the water in the tank will not be adjusted either up or down to accomodate specific formulas.

Reuse Cooldown indicates that the reuse tank is equipped with a temperature sensing device and a cold water valve. These are used together to lower the temperature of the water in the reuse tank to suit the formula in either the first module of the tunnel washer or the last storage position of the loading system.

Reuse Steam indicates that the reuse tank is equipped with a temperature sensing device and a steam valve. These are used to raise the temperature of the water in the reuse tank to suit the formula in either the first module of the tunnel washer or the last storage position of the loading system.

Reuse Steam and Cooldown indicates that the reuse tank is equipped with a temperature sensing device, a cold water valve, and a steam valve. These are used to raise or lower the temperature of the water in the reuse tank to suit the formula in either the first module of the tunnel washer or the last storage position of the loading system.

2.2.1.9 Miltrac™

BNTUUP21.C11 0000246947 A.2 A.12 A.4 1/2/20 2:11 PM Released

Enables/disables the tunnel washer as a Miltrac™ device for discharge only or both loading and discharge.

No Miltrac™ System the tunnel is not part of a Miltrac™ system.

Miltrac™ Discharge Only Miltrac™ controls batches only after discharge from the tunnel washer.
Miltrac™ Loading and Discharge Miltrac™ controls batches both before loading and after discharge from the tunnel washer.

2.2.1.10 Units of Temperature

BNTUUP21.C12 0000246946 A.2 A.12 A.4 1/2/20 2:11 PM Released

Enter the temperature scale to be used for water temperatures on all Mentor® screens.

Fahrenheit provides that all temperature units will be degrees Fahrenheit.
Celsius provides that all temperature units will be degrees Celsius.

2.2.1.11 Allied Weight

BNTUUP21.C13 0000246945 A.2 A.12 A.4 1/2/20 2:11 PM Released

Enables/disables allied weight passing. This displays the data value corresponding to the first cake position. An 8 input/16 output board is required, which provides a 12-bit data path allowing for weight values from 0 to 409.5 units. For Mentor® software with date codes prior to 98xxx, the additional board address must be 4FH.

If your system passes weight to allied devices in whole pounds or kilograms, rather than tenths, ground pin 18 on connector MTA4 on the Allied Weight board. The Mentor® control system passes only whole weight units when this input is grounded. Contact the Milnor® factory for more information.

2.2.1.12 PulseFlow®

BNTUUP21.C14 0000246944 A.2 A.12 A.4 1/2/20 2:11 PM Released

Indicates that this machine has the pumps and valves that the PulseFlow® features require for operation. This decision does not appear in Mentor® software with date codes before 20901.

2.2.1.13 Remote Soil Select

BNTUUP21.C15 0000246943 A.2 A.12 A.4 1/2/20 2:11 PM Released

When enabled, allows for remote formula or goods code entry in binary format. For Mentor® software with date codes prior to 98xxx, the inputs used are 25 through 32 at MTA3 on the board at address 80H.

2.2.1.14 Remote Customer Select

BNTUUP21.C16 0000246942 A.2 A.12 A.4 1/2/20 2:11 PM Released

When enabled, allows for remote customer code entry in binary format. For Mentor® software with date codes prior to 98xxx, the inputs used are Standard Inputs 10 and 11 on 8 input/16 output board 00H, and 17 through 24 at MTA4 on the 8 input/16 output board at address 80H.

2.2.1.15 Electronic Level Sensing

BNTUUP21.C17 0000246941 A.2 A.12 A.3 1/2/20 2:11 PM Released

This selection is not used in the Mentor® controller software.

2.2.1.16 Paper

BNTUUP21.C18 0000246940 A.2 A.12 A.3 1/2/20 2:11 PM Released

This selection is not available in Mentor® software versions earlier than 98xxx, and should only be used when the Mentor® system controls a Regenex Continuous Batch Fiber Recovery System (CBFRS). When enabled, this selection allows the operational display to accommodate up to 48 modules with no reuse tank, no overhead fill tanks, and only one formula entry.

2.2.1.17 Data Pass

BNTUUP21.C19 0000246939 A.2 A.12 A.4 1/2/20 2:11 PM Released

Enables/disables **Allied Data Pass**. This permits the use of outputs (Standard Outputs 17-32 on pre-98xxx versions) to supply binary processing data to allied post-wash devices, including those using relay logic and/or non-serial communications protocols. This selection is usually not necessary in a Miltrac™-equipped installation. One 24-output board is required (at address 10H for pre-98xxx versions). See Table 3 for the available post-wash codes which may be passed.

Table 3. Allied Data Pass Post-wash Codes

Code	Number of Codes Available	Range		Standard Outputs
		Decimal	Binary	
Dry code	16	00–15	0000–1111	17–20
Dryer cooldown	4	00–03	00–11	21–22
Destination	8	00–07	000–111	23–25
Third press pressure	1	0–1	0–1	26
Low press pressure	1	0–1	0–1	27
No press pressure	1	0–1	0–1	28
New customer	1	0–1	0–1	29
New formula	1	0–1	0–1	30
Single cake	1	0–1	0–1	31
Start press	1	0–1	0–1	32

NOTE: **Data Pass** uses potential-free relay contact closures to pass post-wash codes from the last tunnel module and is thus necessary only in non-Miltrac™ installations. However, **Allied Data Pass** may also be implemented in a Miltrac™ system should the need arise, as when an allied press is employed in an otherwise entirely Milnor® system.

2.2.1.18 Extra Data Pass Board

BNTUUP21.C20 0000247006 A.2 A.12 A.4 1/2/20 2:11 PM Released

Requires a 24-output board at address 16h. This allows the Mentor® controller to pass 12 bits of weight data (tenths of a unit) and the formula number.

2.2.1.19 Workwear

BNTUUP21.C21 0000247005 A.2 A.12 A.3 1/2/20 2:11 PM Released

This selection is not available on G3 tunnels. Workwear tunnels are equipped with drains and fast fill valves on each module for the frequent flushing of solids from the modules. Select this option to have the Mentor® controller monitor inputs for the manual flush switches on the tunnel. If a manual flush is commanded, the Mentor® controller prevents the tunnel from transferring.

2.2.1.20 Metric

BNTUUP21.C22 0000247004 A.2 A.12 A.3 1/2/20 2:11 PM Released

This selection causes certain fields to be displayed in metric system units.

2.2.1.21 Remote Efficiency Display

BNTUUP21.C23 0000247003 A.2 A.12 A.3 1/2/20 2:11 PM Released

This decision is not available in Mentor® software versions 98xxx and later. For tunnel systems with Mentor® controllers and the optional remote efficiency display, the remote light emitting diode display shows run time as a percentage of total power-on time for the tunnel.

2.2.1.22 Allied Electronic Loading

BNTUUP21.C24 0000247002 A.2 A.12 A.3 1/2/20 2:11 PM Released

Confirm this decision to enable the Mentor® controller to use an external program to communicate with an allied loading system with the NetDDE protocol.

2.2.1.23 Allied Electronic Discharge

BNTUUP21.C25 0000247001 A.2 A.12 A.3 1/2/20 2:11 PM Released

Confirm this decision to enable the Mentor® controller to use an external program to communicate with an allied discharge system with the NetDDE protocol.

2.2.1.24 Electronic Chemical Interface

BNTUUP21.C26 0000247000 A.2 A.12 A.4 1/2/20 2:11 PM Released

Confirm this decision to enable the Mentor® controller to use an external program to communicate with an allied chemical controller with the WinSock communications protocol. This feature is detailed in Section 8.5 : Milnor® Electronic Chemical System Interface for CBW® Systems, page 283 .

2.2.1.25 Goods Code Entry

BNTUUP21.C27 0000246999 A.2 A.12 A.5 1/2/20 2:11 PM Released

Enable this decision to allow entry of a **goods code** rather than a **formula**. When enabled, the operator enters a goods code for each batch, then the Mentor® controller uses the formula assigned to the goods code in the **Goods Code** menu item of the **Programming menu** (see Section 5.2.3.3.5 : Goods Codes, page 156). All formulas are programmed as usual (as if the option was not selected), and the modules and storage positions on the Mentor® operational display still show the corresponding formula number.

2.2.1.26 Manual Weight

BNTUUP21.C28 0000246998 A.2 A.12 A.3 1/2/20 2:11 PM Released

This decision is not available in Mentor® software versions earlier than 98xxx. When enabled, this option allows the operator to manually enter the weight of the batch in the first storage position.

2.2.2 CBW® Output Timers

BNTUUP21.C29 0000247043 A.2 A.12 A.3 1/2/20 2:11 PM Released

As shown in Figure 11 , output timers for the tunnel system are divided into two groups: **Rotation Timers** and **Other Values**. Rotation timers are "watchdog" timers that monitor the time between actuation of adjacent rotation proximity switches, as well as certain other timed values that control how the tunnel system functions. Rotation timer values are generally set according to how the proximity switches were set at the Milnor® factory and usually should not be changed unless mechanical modifications are made to the tunnel. Other timers include owner-variable values that generally can be changed to improve the efficiency of the tunnel without being mechanically detrimental to the machine.

Figure 11. CBW® Output Timers Page

2.2.2.1 Rotation Timers

BNTUUP21.C30 0000247042 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.2.1.1 Top Dead Center to Safety

BNTUUP21.C31 0000247041 A.2 A.12 A.3 1/2/20 2:11 PM Released

This field provides the Mentor® controller with the maximum time, in tenths of a second, between the actuation of the **Top Dead Center** proximity switch and the **Safety** proximity switch.

2.2.2.1.2 Counter Clockwise to Top Dead Center

BNTUUP21.C32 0000247040 A.2 A.12 A.3 1/2/20 2:11 PM Released

This field indicates the maximum allowable time, in tenths of a second, that may occur between actuation of the **Counter Clockwise** proximity switch and the **Top Dead Center** proximity switch.

2.2.2.1.3 Motor Brake at Top Dead Center

BNTUUP21.C33 0000247039 A.2 A.12 A.3 1/2/20 2:11 PM Released

This field tells the Mentor® controller how long, in tenths of a second, to actuate the motors in braking mode after the **Top Dead Center** proximity switch is made.

2.2.2.1.4 Half Motor Start Time

BNTUUP21.C34 0000247038 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the time, in tenths of a second, after the first half of the tunnel motors start and before the second half of the motors start.

2.2.2.1.5 Clockwise to Counter Clockwise

BNTUUP21.C35 0000247037 A.2 A.12 A.3 1/2/20 2:11 PM Released

This field contains the maximum allowable time, in tenths of a second, between actuation of the **Clockwise** proximity switch and the **Counter Clockwise** proximity switch.

2.2.2.1.6 Maximum Time to Start Rotation

BNTUUP21.C36 0000247036 A.2 A.12 A.3 1/2/20 2:11 PM Released

This field is the maximum allowable time, in tenths of a second, between when power is applied to the tunnel and when the Mentor® controller signals the operator to press CONTROL + D to begin tunnel rotation.

2.2.2.1.7 Pause at Top Dead Center

BNTUUP21.C37 0000247035 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the time, in tenths of a second, that the tunnel should pause at top dead center to allow the goods to slide down the transfer scoop to the next module or out of the tunnel.

2.2.2.1.8 Motor Coast before Reversal

BNTUUP21.C38 0000247034 A.2 A.12 A.4 1/2/20 2:11 PM Released

This field contains the time, in tenths of a second, between when power is removed from the motors and when they are restarted in the opposite direction. This setting applies primarily to normal (non-transferring) reversals.

TIP: The tunnel washer basket should transition smoothly from counter-clockwise to clockwise rotation during normal reversals. If the reversals seem jerky or rough, make this value smaller. For example, if this value is 0.8 seconds and reversals are not smooth, adjust this value to 0.7 seconds and observe the tunnel again.

2.2.2.1.9 Motor Coast (Anti-Plug)

BNTUUP21.C39 0000247062 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the time, in tenths of a second, after power is removed from the motors and before they are restarted in the opposite direction. This setting is used for transfers to jog the goods so they slide down the transfer scoop more reliably.

2.2.2.2 Error Timers

BNTUUP21.C40 0000247061 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.2.2.1 Maximum Time in Hold

BNTUUP21.C41 0000247075 A.2 A.12 A.3 1/2/20 2:11 PM Released

This value is the maximum time, in tenths of a second, for which the tunnel washer will continue to reverse after being placed in a hold condition. If this value is exceeded, the tunnel stops and an error message is displayed.

2.2.2.2.2 Maximum Time to Clear or Block Load Eye

BNTUUP21.C42 0000247074 A.2 A.12 A.3 1/2/20 2:11 PM Released

This defines the maximum time, in tenths of a second, that the *Load Eye Blocked* signal will be ignored. This timer is used to signal an error if the load chute does not empty properly or an undesired bag is dropped.

2.2.2.2.3 Maximum Time for Level and Temperature

BNTUUP21.C43 0000247073 A.2 A.12 A.3 1/2/20 2:11 PM Released

This field informs the Mentor® controller how long, in tenths of a second, to wait for both level and temperature to be achieved before signaling that an error condition has occurred.

2.2.2.3 PulseFlow® Timers

BNTUUP21.C44 0000247072 A.2 A.12 A.4 1/2/20 2:11 PM Released

2.2.2.3.1 PulseFlow® Time After Hold

BNTUUP21.C45 0000247071 A.2 A.12 A.3 1/2/20 2:11 PM Released

This timer sets the duration, in tenths of a second, that the tunnel washer PulseFlow®operates after the number of counts is satisfied or after the machine goes into a hold condition. This value is used to calculate the PulseFlow® flow rate.

2.2.2.3.2 PulseFlow® High Level Debounce

BNTUUP21.C46 0000247070 A.2 A.12 A.3 1/2/20 2:11 PM Released

This timer is used only for pumped flow pumps in middle tunnel modules. The timer sets the duration, in tenths of a second, that the tunnel washer must see a level below the high level in the module being pumped from. Pumped flow pumps turn off when the level in the source module is below high level for the time set in this timer.

2.2.2.3.3 Maximum Time to Lose High Level

BNTUUP21.C47 0000247069 A.2 A.12 A.3 1/2/20 2:11 PM Released

In Mentor® version 20B04 this timer sets the maximum time the high level input can be present for a pumped flow PulseFlow® pump. The Mentor® controller signals an error and stops the tunnel washer if the high level input is present when this timer ends.

2.2.2.4 Other Values

BNTUUP21.C48 0000247068 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.2.4.1 Calibration Weight

BNTUUP21.C49 0000247067 A.2 A.12 A.4 1/2/20 2:11 PM Released

The calibration weight is the known weight or mass used in calibrating the loading device weigh scale. The value entered here should be the weight of some reliably reproducible weight, such as that of a full unopened bag of dry chemical or a bucket of liquid chemical. For a complete description of this value, see Section 3.1 : How to Calibrate the Load Conveyor Scale, page 79 .

2.2.2.4.2 Module Supplying Batch Data

BNTUUP21.C50 0000247066 A.2 A.12 A.3 1/2/20 2:11 PM Released

This field informs the Mentor® controller which module of the tunnel washer is used to supply batch data to the next device in the system. The value of this field is usually the last module of the tunnel.

2.2.2.4.3 Start Load Conveyor after Transfer

BNTUUP21.C51 0000247099 A.2 A.12 A.3 1/2/20 2:11 PM Released

This field contains the duration, in tenths of a second, that the Mentor® controller is to run the load conveyor after a transfer is initiated.

2.2.2.4.4 Start Flush after Transfer

BNTUUP21.C52 0000247098 A.2 A.12 A.3 1/2/20 2:11 PM Released

This field contains the minimum duration, in tenths of a second, that the Mentor® should flush the load chute after a transfer is initiated. The amount of water used to flush the goods into the tunnel washer is programmed on the formula page. The minimum value for this timer is 5 seconds.

2.2.2.4.5 Level Debounce Time

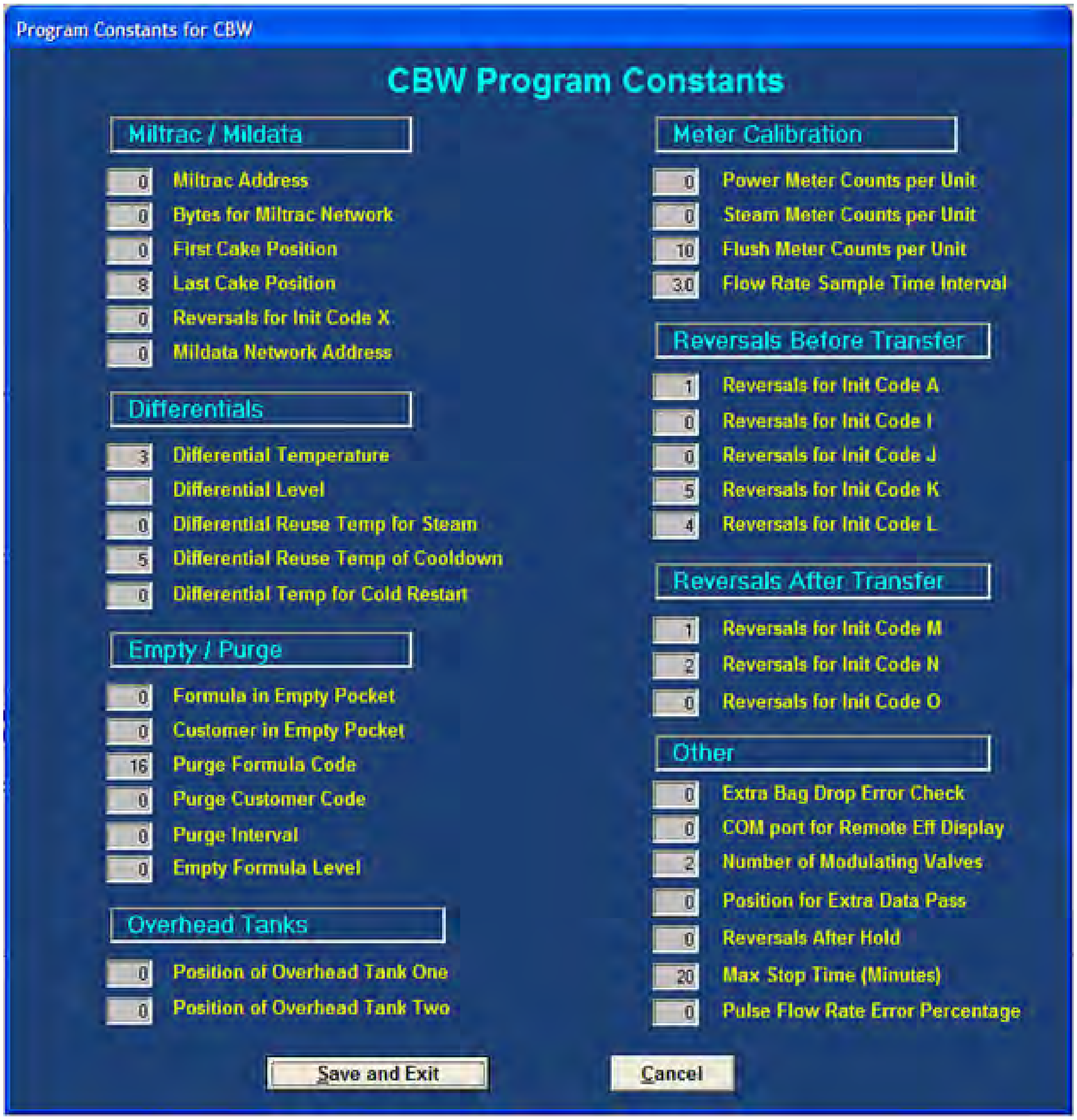
BNTUUP21.C53 0000247097 A.2 A.12 A.3 1/2/20 2:11 PM Released

If a non-zero value is entered here, the CBW® controller will not recognize that level is lost until this time expires. This decision is most often used with G4 models to prevent a false indication that level has been lost.

2.2.3 CBW® Program Constants

BNTUUP21.C54 0000247095 A.2 A.12 A.3 1/2/20 2:11 PM Released

Figure 12. CBW® Program Constants Page



2.2.3.1 Miltrac™/Mildata® Constants

BNTUUP21.C55 0000247094 A.2 A.12 A.4 1/2/20 2:11 PM Released

2.2.3.1.1 Miltrac™ Address

BNTUUP21.C56 0000247093 A.2 A.12 A.4 1/2/20 2:11 PM Released

This is the logical address, in hexadecimal, that the Mentor® controller occupies on the Miltrac™ network.

2.2.3.1.2 Bytes for Miltrac™ Network

BNTUUP21.C57 0000247092 A.2 A.12 A.3 1/2/20 2:11 PM Released

This determines how the Mentor® controller communicates with the Miltrac™ system. Set this value to **0** to use new Miltrac™ protocol, or to the actual byte value for earlier versions of the Miltrac™ system. Contact the Milnor® factory for more information.

2.2.3.1.3 First Cake Position

BNTUUP21.C58 0000247091 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the first cake position that the Mentor® controller reports to the Miltrac™ system. The usual value for this field is the first module of the tunnel.

2.2.3.1.4 Last Cake Position

BNTUUP21.C59 0000247090 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the last cake position that the Mentor® controller reports to the Miltrac™ system. The usual value for this field is the last module of the tunnel.

2.2.3.1.5 Reversals for Init Code X

BNTUUP21.C60 0000247121 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of reversals before transfer when Init Code X is actuated.

2.2.3.1.6 Mildata® Network Address

BNTUUP21.C61 0000247120 A.2 A.12 A.4 1/2/20 2:11 PM Released

This is the address of the Mentor® controller on the Mildata® network.

2.2.3.2 Differentials

BNTUUP21.C62 0000247119 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.3.2.1 Differential Temperature

BNTUUP21.C63 0000247139 A.2 A.12 A.3 1/2/20 2:11 PM Released

This value is the number of degrees below the desired bath temperature that the liquid in a module is allowed to fall before steam is injected to return the temperature to the desired.

2.2.3.2.2 Differential Level

BNTUUP21.C64 0000247138 A.2 A.12 A.3 1/2/20 2:11 PM Released

If equipped for electronic level sensing, this is the acceptable range for the desired level.

2.2.3.2.3 Differential Reuse Temperature for Steam

BNTUUP21.C65 0000247137 A.2 A.12 A.3 1/2/20 2:11 PM Released

This value is the number of degrees below the desired temperature that the reuse tank will be allowed to fall before steam is injected to return the temperature to the desired. See Section 2.1 : Assigning Functions, page 25 for more information.

2.2.3.2.4 Differential Reuse Temperature for Cooldown

BNTUUP21.C66 0000247136 A.2 A.12 A.3 1/2/20 2:11 PM Released

This value is the number of degrees above the desired temperature that the reuse tank will be allowed to rise before cold water is injected to return the temperature to the desired. See Section 2.1 : Assigning Functions, page 25 for more information.

2.2.3.2.5 Differential Temperature for Cold Restart

BNTUUP21.C67 0000247135 A.2 A.12 A.3 1/2/20 2:11 PM Released

This value is used only on tunnels that are heated by a heat exchanger instead of steam. If the tunnel washer start command is issued when the actual temperature is below the desired temperature by the value set here, the tunnel washer performs a cold restart.

2.2.3.3 Empty/Purge Constants

BNTUUP21.C68 0000247149 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.3.3.1 Formula in Empty Pocket

BNTUUP21.C69 0000247148 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of the formula to be passed when an empty pocket is desired.

2.2.3.3.2 Customer in Empty Pocket

BNTUUP21.C70 0000247147 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of the customer to be passed when an empty pocket is desired.

2.2.3.3.3 Purge Formula Code

BNTUUP21.C71 0000247146 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the formula number passed when a purge pocket is commanded.

2.2.3.3.4 Purge Customer Code

BNTUUP21.C72 0000247145 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the customer number passed when a purge pocket is commanded.

2.2.3.3.5 Purge Interval

BNTUUP21.C73 0000247144 A.2 A.12 A.3 1/2/20 2:11 PM Released

This value is usually set to 0 and its function overtaken by programming an automatic purge. If enabled and set to any value other than 0, the tunnel will unconditionally purge all pockets after the set number of transfers.

2.2.3.3.6 Empty Formula Level

BNTUUP21.C74 0000247143 A.2 A.12 A.3 1/2/20 2:11 PM Released

If the tunnel system is equipped with electronic level sensing, this is the level to be achieved in each module as an empty pocket formula is passed.

2.2.3.4 Overhead Tanks

BNTUUP21.C75 0000247142 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.3.4.1 Position of Overhead Tank One

BNTUUP21.C76 0000247141 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of the module into which the first overhead fill tank dumps.

2.2.3.4.2 Position of Overhead Tank Two

BNTUUP21.C77 0000247140 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the module number into which the second overhead tank dumps.

2.2.3.5 Meter Calibration

BNTUUP21.C78 0000247160 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.3.5.1 Power Meter Counts per Unit

BNTUUP21.C79 0000247159 A.2 A.12 A.3 1/2/20 2:11 PM Released

Enter the number of counts the power meter requires to register one unit.

2.2.3.5.2 Steam Meter Counts per Unit

BNTUUP21.C80 0000247158 A.2 A.12 A.3 1/2/20 2:11 PM Released

Enter the number of counts the steam meter requires to register one unit of steam.

2.2.3.5.3 Flush Meter Counts per Unit

BNTUUP21.C81 0000247157 A.2 A.12 A.3 1/2/20 2:11 PM Released

Enter the number of counts the flow meter for flushing the goods into the tunnel washer requires to register one unit of water.

2.2.3.5.4 Flow Rate Sample Time Interval

BNTUUP21.C82 0000247156 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the frequency, in tenths of a second, that the flow meters are checked by the controller.

2.2.3.6 Reversals Before Transfer

BNTUUP21.C83 0000247155 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.3.6.1 Reversals for Init Code A

BNTUUP21.C84 0000247154 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of reversals before transfer that this init code is actuated.

2.2.3.6.2 Reversals for Init Code I

BNTUUP21.C85 0000247153 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of reversals before transfer when Init Code I is actuated.

2.2.3.6.3 Reversals for Init Code J

BNTUUP21.C86 0000247152 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of reversals before transfer when Init Code J is actuated.

2.2.3.6.4 Reversals for Init Code K

BNTUUP21.C87 0000247151 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of reversals before transfer when Init Code K is actuated.

2.2.3.6.5 Reversals for Init Code L

BNTUUP21.C88 0000247170 A.2 A.12 A.4 1/2/20 2:11 PM Released

This is the number of reversals before transfer when Init Code L is actuated.

2.2.3.7 Reversals After Transfer

BNTUUP21.C89 0000247169 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.3.7.1 Reversals for Init Code M

BNTUUP21.C90 0000247168 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of reversals after transfer when Init Code M is actuated.

2.2.3.7.2 Reversals for Init Code N

BNTUUP21.C91 0000247167 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of reversals after transfer when Init Code N is actuated.

2.2.3.7.3 Reversals for Init Code O

BNTUUP21.C92 0000247166 A.2 A.12 A.3 1/2/20 2:11 PM Released

This is the number of reversals after transfer that this init code is actuated.

2.2.3.8 Other Constants

BNTUUP21.C93 0000247165 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.3.8.1 Extra Bag Drop Error Check

BNTUUP21.C94 0000247164 A.2 A.12 A.4 1/2/20 2:11 PM Released

This is the number of seconds after the *Maximum Time to Block/Clear Eye* timer expires within which the tunnel will stop if the eye is blocked.

2.2.3.8.2 COM Port for Remote Efficiency Display

BNTUUP21.C95 0000247163 A.2 A.12 A.3 1/2/20 2:11 PM Released

Enter the COM port on the Mentor® computer where the optional remote efficiency display is connected.

2.2.3.8.3 Number of Modulating Valves

BNTUUP21.C96 0000247162 A.2 A.12 A.3 1/2/20 2:11 PM Released

For standard (non-PulseFlow®) tunnels, enter the number of modulating water valves available on this tunnel washer. This option requires one digital to analog board per two modulating valves, starting at address 31H.

For PulseFlow® tunnels, set this value to the number of PulseFlow® pumps. Do not include the flush pump on Module 1.

2.2.3.8.4 Position for Extra Data Pass

BNTUUP21.C97 0000247161 A.2 A.12 A.3 1/2/20 2:11 PM Released

Enter the module where the extra data pass board is connected. This board is usually connected to Module 1 and often used to pass batch weight to the chemical system.

2.2.3.8.5 Reversals After Hold

BNTUUP21.C98 0000247227 A.2 A.12 A.3 1/2/20 2:11 PM Released

Enter the minimum number of reversals the tunnel washer must complete after a hold condition and before a transfer.

2.2.3.8.6 Maximum Stop Time (Minutes)

BNTUUP21.C99 0000247226 A.2 A.12 A.3 1/2/20 2:11 PM Released

If the tunnel is stopped—typically by pressing **Ctrl-K**—for longer than the time entered here, the reversal count resets to 0 of 20 counts. When the tunnel is re-started, the 20 counts will execute before the normal programmed counts are resumed.

2.2.3.8.7 Foreign Language Display

BNTUUP21.CA0 0000248063 A.2 A.12 A.3 1/2/20 2:11 PM Released

For 98xxx and later versions of the software, select the desired foreign language from the drop-down list.

2.2.3.8.8 PulseFlow® Program Constants

BNTUUP21.CA1 0000248062 A.2 A.12 A.3 1/2/20 2:11 PM Released

2.2.3.8.8.1 PulseFlow® Pump __ Initial Value

BNTUUP21.CA2 0000248061 A.2 A.12 A.3 1/2/20 2:11 PM Released

Set a value to be used as the digital-to-analog output for each PulseFlow® pump. The Mentor® controller will use this value until it determines a new value. The valid range for this value is 0 to 4095.

2.2.3.8.8.2 PulseFlow® Rate Error Percentage

BNTUUP21.CA3 0000248060 A.2 A.12 A.4 1/2/20 2:11 PM Released

This decision is used on PulseFlow® tunnel washers only. Set this value to a minimum percentage of the desired flow rate.

For Mentor® version 20B04, the Mentor® controller will signal an **error** if the actual PulseFlow® flow rate is less than this percentage of the desired flow rate. The tunnel washer will enter a hold condition if the error is not cleared.

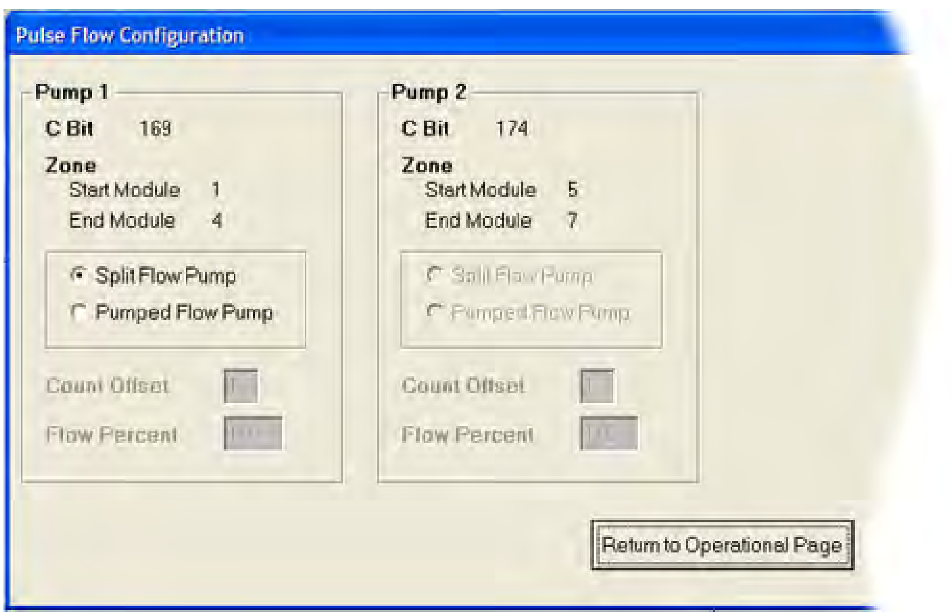
For Mentor® versions before 20B04, the Mentor® controller will signal a **warning** if the actual PulseFlow® flow rate is less than this percentage of the desired flow rate.

2.2.4 PulseFlow® Configuration

BNTUUP21.CA4 0000248058 A.2 A.12 A.3 1/2/20 2:11 PM Released

This menu item applies only to PulseFlow® tunnel washers. Use this display to configure each PulseFlow® pump as either a **split flow** pump or a **pumped flow** pump.

Figure 13. PulseFlow® Configuration Screen



Split flow pump pumps water from the PulseFlow® tank to the module in a PulseFlow® zone that is closest to the discharge end of the tunnel. The PulseFlow® features require at least one split flow pump for each PulseFlow® zone in the tunnel system to provide rinse water. **The pump on the last two modules of the tunnel must be a split flow pump.**

Pumped flow pump pumps water from one module in a PulseFlow® zone to the adjacent module toward the load chute. PulseFlow® tunnel systems require pumped flow pumps if a PulseFlow® zone must be divided into sub-zones. PulseFlow® zones are divided if they include more than five modules.

For pumped flow pumps, set a **count offset** and a **flow percent** on this page.

Count offset this pump should start operating this number of reversals before the main pump starts. This value is usually set to 0.
Flow percent this pump should operate at a speed that will move this percentage of the flow of the main pump. This value is usually set to 95.

2.2.5 Chemical Pump Flow Rates

BNTUUP21.CA5 0000248056 A.2 A.12 A.3 1/2/20 2:11 PM Released

By determining the flow rates of each chemical pump, chemical values can be programmed into formulas by quantity rather than time. The calibration procedure described below should be repeated periodically to ensure that the flow rates have not changed due to normal pump wear, changes in chemical viscosity, etc.

The **Chemical Pump Flow Rate** table (see Figure 14: Chemical Pump Flow Rate Table, page 60) lists all available chemical outputs in the **Chemical Outputs** column, and the units value in the right column. The following procedure sets the units of chemical delivered per second from each pump, providing the Mentor® controller with the necessary information to convert a programmed quantity of chemical injection to a specific chemical injection time.

CAUTION: **Avoid Chemical Burns** — Some chemicals used in tunnel systems are highly reactive and concentrated. Contact with these concentrated chemicals can cause blindness and tissue damage.

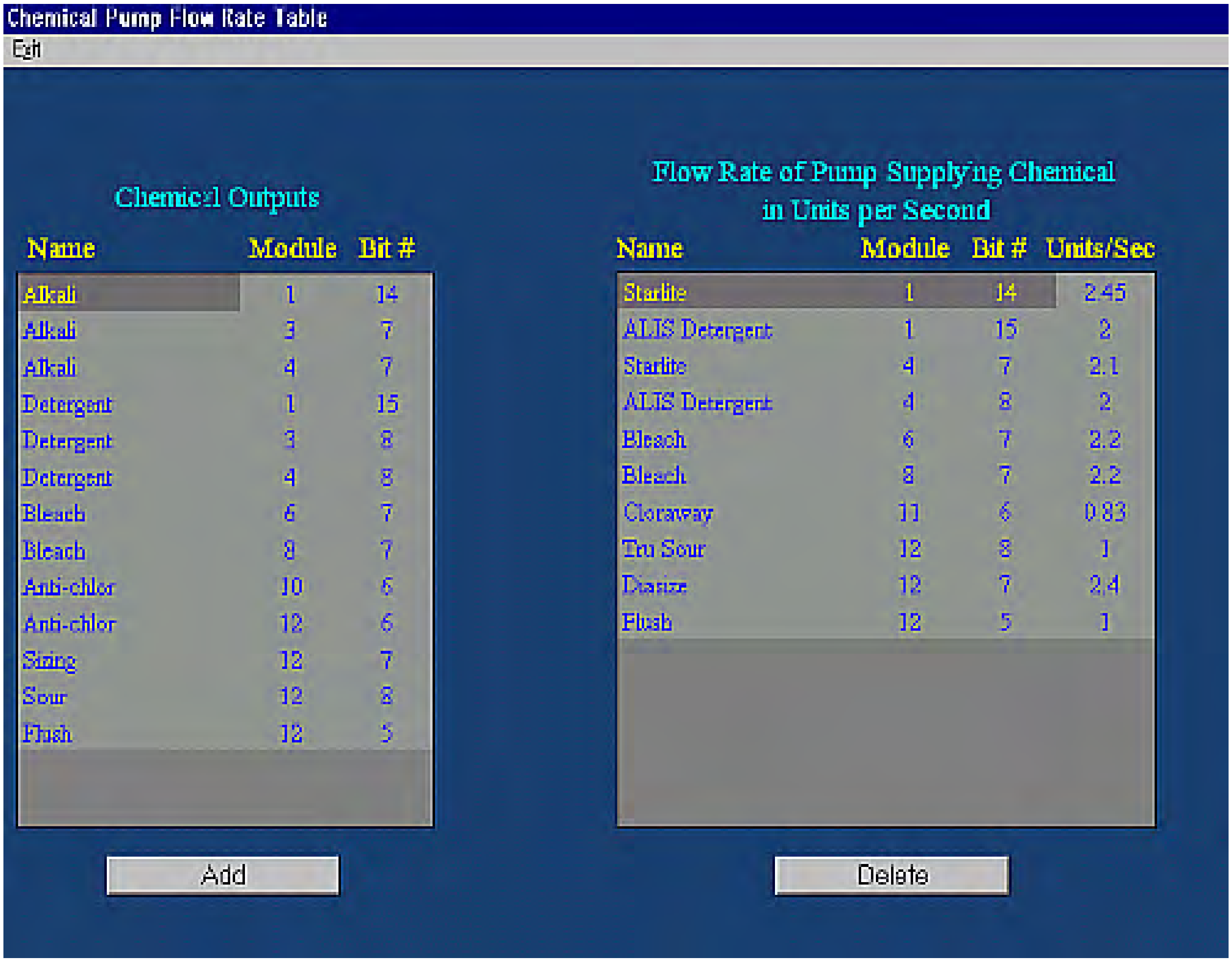
- Always wear eye protection when working near chemicals.
- Protect all exposed skin—including your face and hands—from accidental chemical splashes.
- Wash your hands thoroughly after contact with chemical hoses, pumps, or containers.

1. Using all appropriate safety procedures, determine the flow rate of each chemical by removing the chemical injection line from the tunnel washer and placing it in a calibrated bucket. Manually activate the chemical output for a specific number of seconds.
2. Divide the units delivered by the seconds the output was actuated. The resulting number is the flow rate in units per second for that output. An example of this calculation is provided below:

   120 units delivered / 30 seconds injection time = 4 units per second flow rate
3. Securely re-connect the chemical outlet line to the tunnel washer.
4. From the **Flow Rate** table, select the chemical output in the left column and click the **Add** button. The output is copied to the right column with a default **Units/Sec** value of 1.
5. Click once on the **Units/Sec** value to make it available for modification, then enter the calculated flow rate. In the case of our example, the default value of 1 would be replaced with the calculated value of 4.

6. Using all due caution and accuracy, repeat this procedure for each chemical output.
7. When all chemical flow rates are entered, click once on the **Exit** button in the upper left corner of the screen.

Figure 14. Chemical Pump Flow Rate Table



2.2.6 Calculate Rotation Time

BNTUUP21.CA6 0000248124 A.2 A.12 A.3 1/2/20 2:11 PM Released

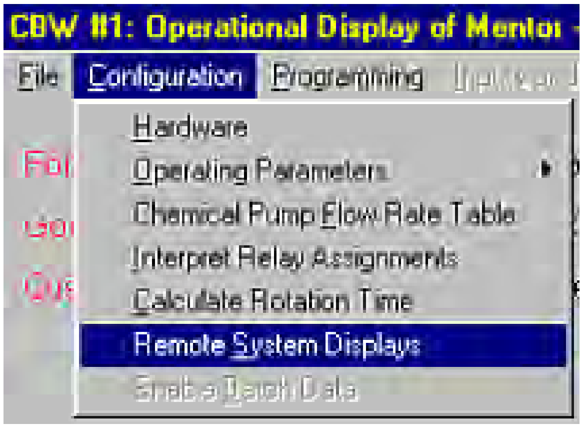
This menu item calculates the average rotation time of five rotations. If the tunnel is less than five counts from transferring, the sample will begin after the transfer. Hover the cursor over the calculated time on the **Formula Programming** page to view the rotation time.

2.2.7 Remote System Displays

BNTUUP21.CA7 0000248122 A.2 A.12 A.3 1/2/20 2:11 PM Released

Mentor® software versions 20202 and later can be configured to show the displays of remote Mildata® devices and machine programmers on the Mentor® operational display. Three remote devices can be monitored with software versions starting at 20202, while nine devices can be monitored with versions 20300 and later. Figure 15 shows the menu selection you'll use to configure the remote devices.

Figure 15. Remote System Display Menu

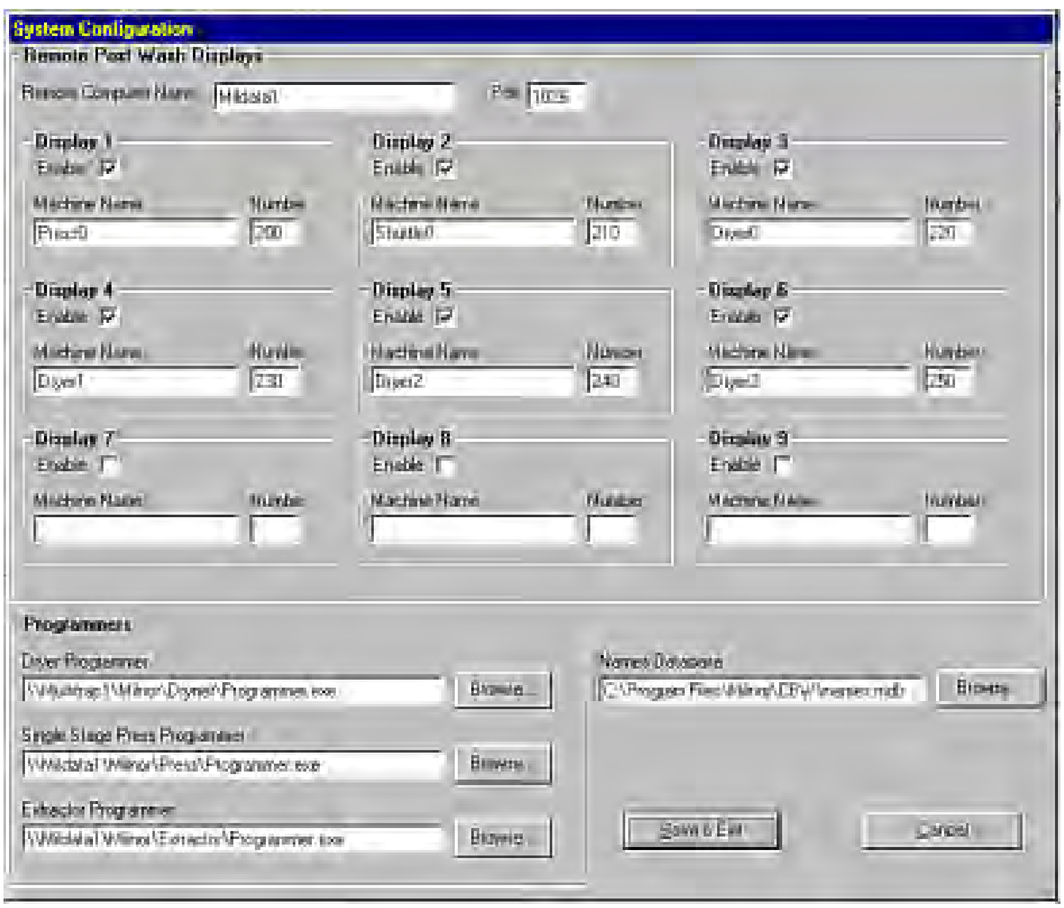


2.2.7.1 Remote Post-wash Displays

BNTUUP21.CA8 0000248119 A.2 A.12 A.4 1/2/20 2:11 PM Released

The **Remote Post-wash Displays** section of the **System Configuration** screen (Figure 16) prompts for the information necessary for displaying remote device information.

Figure 16. System Configuration Screen



Remote Computer Name Enter the name of the Mildata® computer. This name is usually "Mildata1" unless it was changed after the computer left the Milnor® factory.
Port Enter the TCP/IP port number used by the Mildata® computer for network connections.

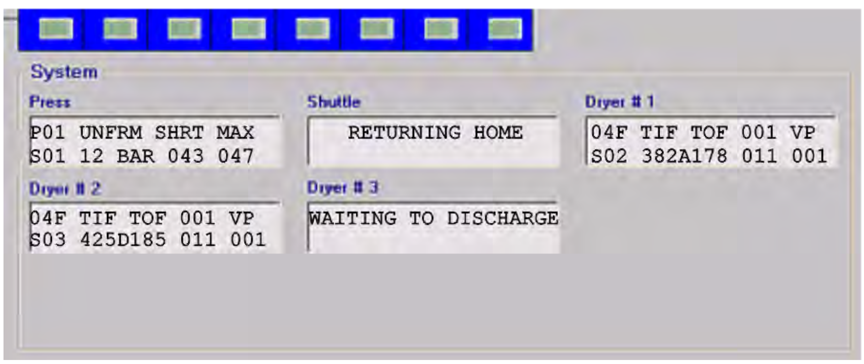
TIP: To find the TCP/IP port number, open **Online Communicator** on the Mildata® computer. The port number (xxxx) is shown in the "Network Connections on Port xxxx" line.

For version 20202 and later, there are nine boxes (**Display 1** through **Display 9**) on the **System Configuration** screen, each representing one device that can be viewed on the Mentor® computer. Use the guidelines below for each device you want to monitor.

Enable Click in this box to enable the remote display for this device.
Machine Name Enter a name for the machine to appear on the Mentor® operational display.
Number Enter the device number used by the Mildata® system to address the machine. Mildata® device numbers start at 0 and count up for each additional device.

TIP: The device number is **not** the same as the Mildata® address for the device. The **Remote System Display** feature operates only when valid device numbers are entered for each machine.

Figure 17. Operational Display with Remote Data



2.2.7.2 Programmers

BNTUUP21.CA9 0000248118 A.2 A.12 A.3 1/2/20 2:11 PM Released

Configure the path to any of the machine programmers to have the programmer appear in the **Programming** menu. Either enter the path to the programmer directly, or click the **Browse** button to browse local and network drives for the files. This feature is available in Mentor® software versions 20300 and later, and provides access to programmers for Milnor® dryers, single stage press extractors, and centrifugal extractors.

For example, the path to the dryer programmer is typically `\\Multitrac1\Milnor\Drynet\Drymk2.exe`.

2.2.7.3 Names Database

BNTUUP21.CB0 0000248117 A.2 A.12 A.4 1/2/20 2:11 PM Released

This feature is available in Mentor® software versions 20300 and later. Configure the path to the database of names used by the Milnor® MultiTrac system. This setting makes customer and formula names created on the Mentor® computer available to the Mildata® computer and to devices on the MultiTrac system. The names database is usually located at `\\Multitrac1\Milnor`

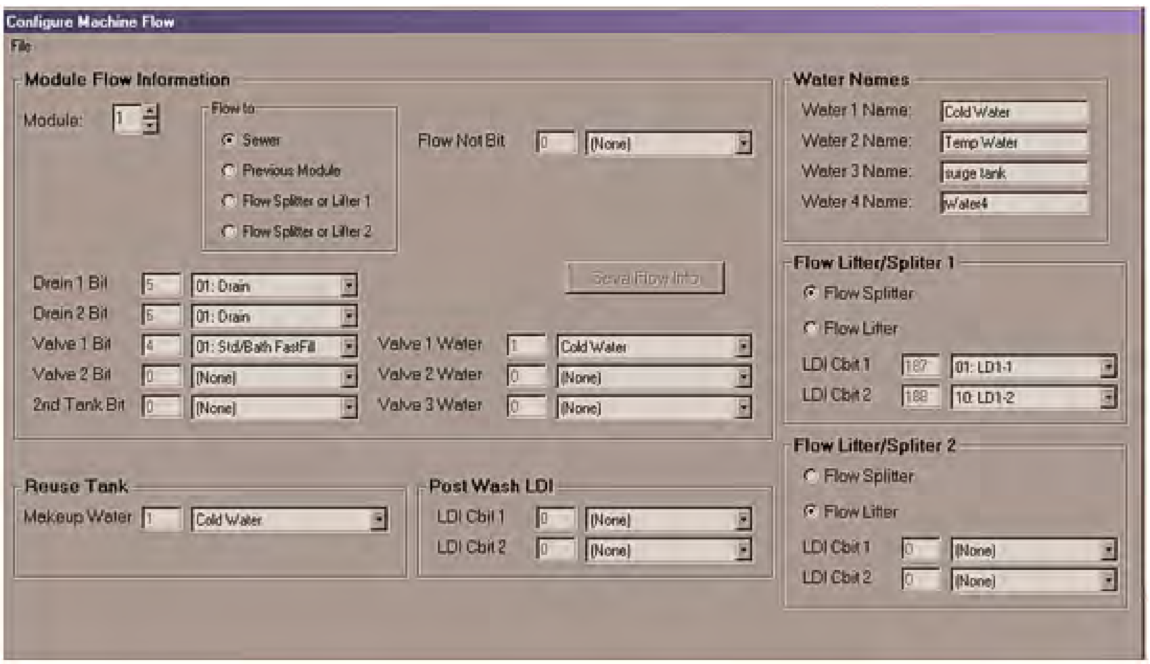
\Miltrac\Names.mdb. Either enter the path to the database directly, or click the **Browse** button to browse local and network drives for the file.

TIP: If problems arise, verify that the Milnor folder on the MultiTrac computer is shared.

2.2.8 Mentor® Machine Flow Diagram

Mentor® versions 20500 and later can be configured to display dynamic valve and flow information on the **Operational** display. Select **Configuration/Machine Flow** to open the window shown in Figure 18 .

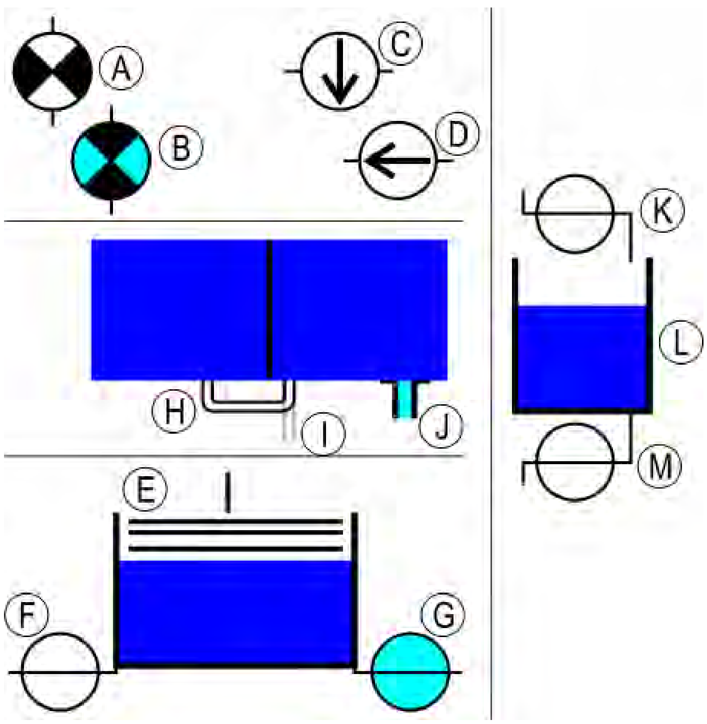
Figure 18. Configure Machine Flow Window



In this window, define the function related to each output. The available choices are shown as assigned on the function page (see Section 2.1 : Assigning Functions, page 25 and Section 8.2 : Programming Generation3 Mentor® Inputs and Outputs, page 265), preceded by the module number. For example, **02: Drain 1** is the function in module 2 that controls the drain valve

Figure 19. Flow Diagram Symbols

Symbols



Legend

A . . . Valve (closed position)
B . . . Valve (open position)
C . . . LDI (sewer position)
D . . . LDI (reuse tank position)
E . . . Flow splitter
F . . . Pump (not running)
G . . . Pump (running)
H . . . Flownot valve disabled (normal counterflow)
I . . . Flownot valve enabled
J . . . Drain to sewer open
K . . . Last module to surge tank
L . . . Surge tank
M . . . Surge tank to reuse tank

The **Module Flow Information** group of decisions must be completed for each tunnel washer module. The **Save Flow Info** button becomes available when any decision in this group is changed. Click it to save any changes.

In the **Flow to** section, select the destination for all flow from the active module. If the active module is equipped with **Flow Not**, select the bit that controls the valves.

For the drain and valve functions, select the appropriate bits. Each module other than Module 1 may display up to three water valves. Each water valve controls water from one source, which must be selected. Modulating valves on any module must be configure as either Valve 1 or Valve 2.

TIP: Special considerations for Module 1: For Module 1 only, use the **Valve 1** field for the fast fill bit that opens the flush valve. Use the **Valve 3** field for the bit that enables a second reuse tank, if present.

Enter a name for each water header in the **Water Names** section; a maximum of four water headers can be used.

For each **Flow Lifter/Splitter**, configure whether the device is a flow lifter or a flow splitter. If the flow lifter/splitter is equipped with long distance incompatibility (LDI), select the LDI bits.

Configure the **Makeup Water** decision to the header which supplies water to the reuse tank.

For post-wash devices equipped with long distance incompatibility, configure the bits in the **Post Wash LDI** area.

Click the **Save Flow Info** after configuring each module, then select **File/Exit** to return to the operational display.

2.2.9 Enable Batch Data

BNTUUP21.CB2 0000248194 A.2 A.12 A.3 1/2/20 2:11 PM Released

This menu selection is available on Mentor® software versions 20300 and later, but is not available if the Mentor® is running in Mildata® mode. Click on this menu item to enable batch data collection and graphing.

2.2.10 Interpret Relay Assignment

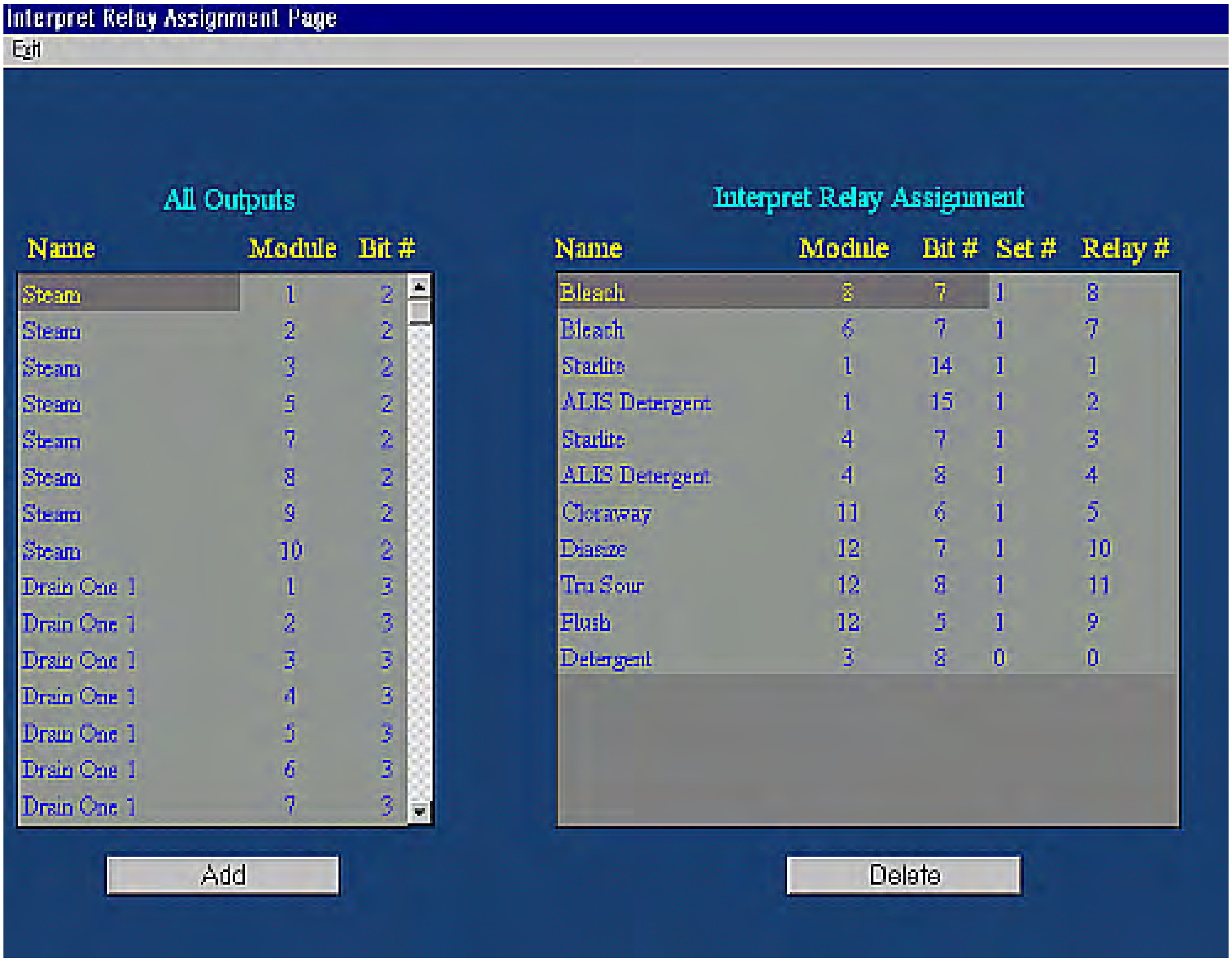
BNTUUP21.CB3 0000248192 A.2 A.12 A.3 1/2/20 2:11 PM Released

This menu item and its associated page are not available in Mentor® software versions 98xxx and later. For these versions of the Mentor® software, refer to Section 8.2 : Programming Generation3 Mentor® Inputs and Outputs, page 265 .

With software earlier than 98xxx, this page allows the user to assign a specific output to a specific interpret relay. This is accomplished by copying an output from the **All Outputs** column to the **Interpret Relay Assignment** column, then specifying the interpret relay set number (the desired interpret relay board) and relay number.

To assign an output to an interpret relay, click once on the output, then click the **Add** button. Once the output is copied to the **interpret relay assignment** column, click once on the **set number** field to highlight it, then enter the desired number. Use the same procedure to assign the relay number. Once an assignment is made, the associated interpret relay will actuate whenever its assigned output operates.

Figure 20. Interpret Relay Assignment Page



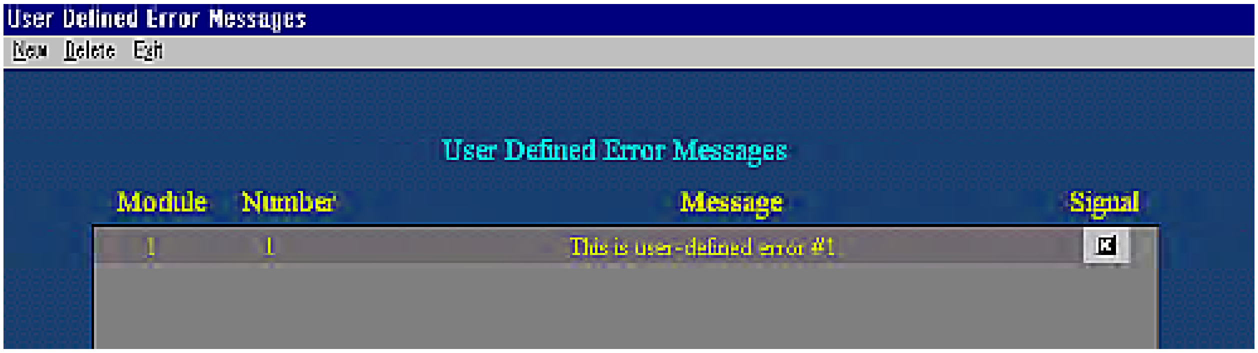
2.2.11 User-defined Error Messages

BNTUUP21.CB4 0000248190 A.2 A.12 B.2 5/19/20 11:20 AM Released

This menu item and its associated page is not available in Mentor® software versions 98xxx and later. For these versions of the Mentor® software, refer to Section 8.2 : Programming Generation3 Mentor® Inputs and Outputs, page 265 .

Error messages are triggered to appear on the screen by certain inputs to the Mentor® controller. This allows the user to define certain error messages to appear when specific inputs are made. Refer to Figure 21 and the following procedure to define error messages.

Figure 21. User Defined Error Messages Page



1. At the **User Defined Error Messages** screen, click on **New** to define a new message.
2. Enter the module number and input number to be monitored in the **Module** and **Number** columns.
3. In the **Message** column, enter the text of the message as it is to occur on the Mentor® operational display.
4. If the tunnel should signal the operator and go into a hold condition when this error occurs, place an "x" in the **Signal** column. If no signal is programmed, the message will appear on the screen as long as the condition exists, but operator intervention will not be required if the condition is self-correcting.
5. To delete a user-defined error, click once on the error to highlight it, then select **Delete**.
6. Click on the **Exit** menu selection to save the changes and return to the operational display.

BNTUUP17 / 2019206 BNTUUP17 0000236447 A.6 1/2/20 2:11 PM Released

2.3 How to Manage the Users and Customers Lists

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The Mentor® controller takes advantage of the abilities of the personal computer to restrict access to certain key functions (e.g., programming) from the general staff of the facility in which it is installed. By allowing only personnel who are trained in proper programming techniques to access these functions, the efficiency of the tunnel system can be finely tuned and maintained. The assignment of knowledgeable personnel to the list with programming access is the key to proper management of users, and is described in the first part of this document (Section 2.3.1 : Managing the User List, page 68).

Similarly, the Mentor® controller is capable of maintaining a list of customers whose goods are processed in the Mentor®-equipped facility. If this list is accurately maintained and employed as goods are queued for loading into the tunnel system, there will be few if any accounting errors leading to the charging of goods to an incorrect or nonexistent customer account. The screens and procedures used in customer management are described in Section 2.3.2 : Customer Names, page 71 of this document.

Management of both users and customers lists is available only to users who are established in the users list with programmer rights and are logged in with their correct user name and password. Establishing the first user with programmer privileges is part of installing the Mentor®

system, and is also discussed in detail in the document entitled “Mentor® Hardware Replacement and Software Recovery.” For the purposes of the current document, we are assuming that the following procedures are being performed by an authorized user with programmer rights.

When an authorized programmer logs in to the Mentor® control system through the **Login prompt** of the operational display, the **Configuration** and **Programming** menus on that page become available. User and customer list management options are available within the **programming** menu, as shown in Figure 22 .

Figure 22. Programming Menu

2.3.1 Managing the User List

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For the future benefit of management and to instill appropriate habits in all personnel, every employee who will operate the tunnel system through the Mentor® controller should be required to log in at the beginning of each shift and log out before leaving their post. For those personnel who have been trained appropriately and are granted programmer rights, this logging in is required for access to the restricted features of the controller.

While operator tracking is not currently implemented for employees without programmer privileges, no harm will be done by establishing each qualified employee as a user without programmer rights, and moreover, at such time as non-programmer logging is added to the Mentor® software, proper procedures will already be a part of the routine for each employee beginning his shift.

2.3.1.1 Adding a New User

BNTUUP17.T01 0000236445 A.2 A.6 A.4 1/2/20 2:11 PM Released

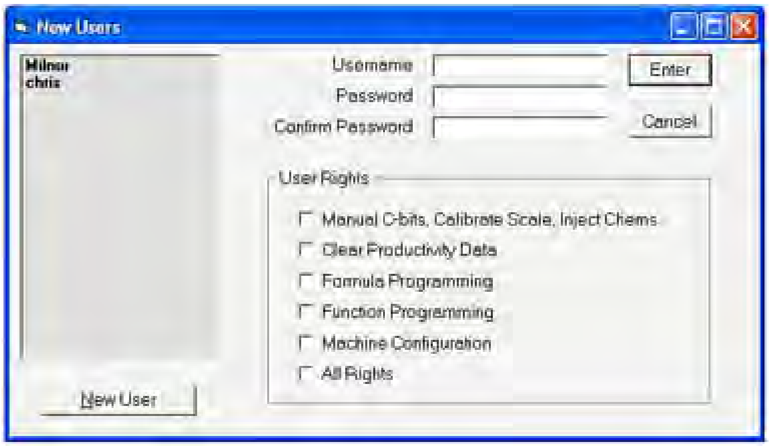
Adding a new user to the Mentor® control system is a simple matter, consisting essentially of entering information about the new user into a computer list. The following information contains all necessary details of the procedure.

1. Log in as a pre-existing user with programmer rights. When the Mentor® controller was installed and configured, at least one member of the management/supervisory team at the

facility was added to the user list with programmer rights. As programmer rights are required to access the **Programming** menu (shown in Figure 22: Programming Menu, page 68), this person must log in before further steps can be performed.

2. Access the **Programming** menu from the operational display, then select the **New Users** menu item. A dialog box similar to the one shown in Figure 23 appears.

Figure 23. New User



3. Enter a user name for the new user. This should be something easy for the user to remember and meaningful to management. The user's name or employee identification number are typical choices.
4. Enter a password for the new user. The password should be easy for the user to remember, but very difficult for other employees to guess. Common passwords such as the name of a spouse or pet provide very little security. More useful are passwords including both alphabetic and numeric digits. There is no required minimum length for passwords with the Mentor® system, but shorter passwords are more readily guessed than longer ones.
5. Confirm the password. This entails re-entering the password in the appropriate box exactly as it was entered in the **Password** box.
6. Select the rights to be granted to this user.

Manual C-bits, Calibrate Scale, Inject Chems the minimum level of rights required to allow a user to manually actuate c-bits, to calibrate the weigh scale on a weighing loading conveyor, and to manually inject chemicals.

Clear Productivity Data allows the user to clear washer productivity data.

Formula Programming allows the user to view machine timers and counters, but not change them. The user has full access to the items listed below:

- Formula Programming page
- machine programmers
- goods compatibility
- customer names and goods codes
- steam disinfection
- chemical pump flow rates

- memory copying and restoration

Function Programming allows access to the function table and the input table
Machine Configuration allows full access to these items:

- hardware configuration
- memory copying and restoration
- machine timers and counters
- interpret relay assignments on G1 and G2 machine models
- user-defined errors on G1 and G2 machine models
- remote system display configuration
- flow diagram configuration
- enable/disable batch data

All Rights allows the user all rights listed above, plus add/delete user, enable diagnostics, and exit the program

7. Click the mouse cursor on the **Enter** button if all information is correct, or click on **Cancel** to cancel the procedure and start over. The user's name is valid as soon as the **Enter** button is clicked.

2.3.1.2 Deleting an Existing User

BNTUUP17.T02 0000236444 A.2 A.6 A.4 1/2/20 2:11 PM Released

Of course, if users can be added to the controller's list, there should be a facility for removing them. The following procedure details how to remove a user name from the list maintained in the Mentor® controller computer.

1. Log in as a user with programmer rights. As programmer rights are required to access the **Programming** menu (shown in Figure 22: Programming Menu, page 68), the person performing this procedure must be logged in as a programmer before further steps can be performed.
2. From the operational display, select the **Delete Users** option from the **Programming** menu. A window similar to the one shown in Figure 24 appears.

Figure 24. Delete User

3. Using the mouse cursor, click once on the user name to be deleted, highlighting it. When the desired user name is highlighted, click the mouse cursor one time on the **Delete** button. To abort the procedure and close the **Delete User** window, click on the **Cancel** button.

   NOTE: If there are several users in the user list, it may be necessary to scroll down the list to find the desired item. Either drag the scroll indicator on the right side of the list down until the desired item is visible, or highlight a visible name and press the down arrow key to move the highlight to the appropriate name.

4. Immediately upon clicking either the **Delete** or **Cancel** buttons, the **Delete User** window closes. If the **Delete** button was clicked, the user name is removed from the list and cannot be recovered. To reinstate a former user in the list, follow the procedure defined in Section 2.3.1.1 : Adding a New User, page 68 .

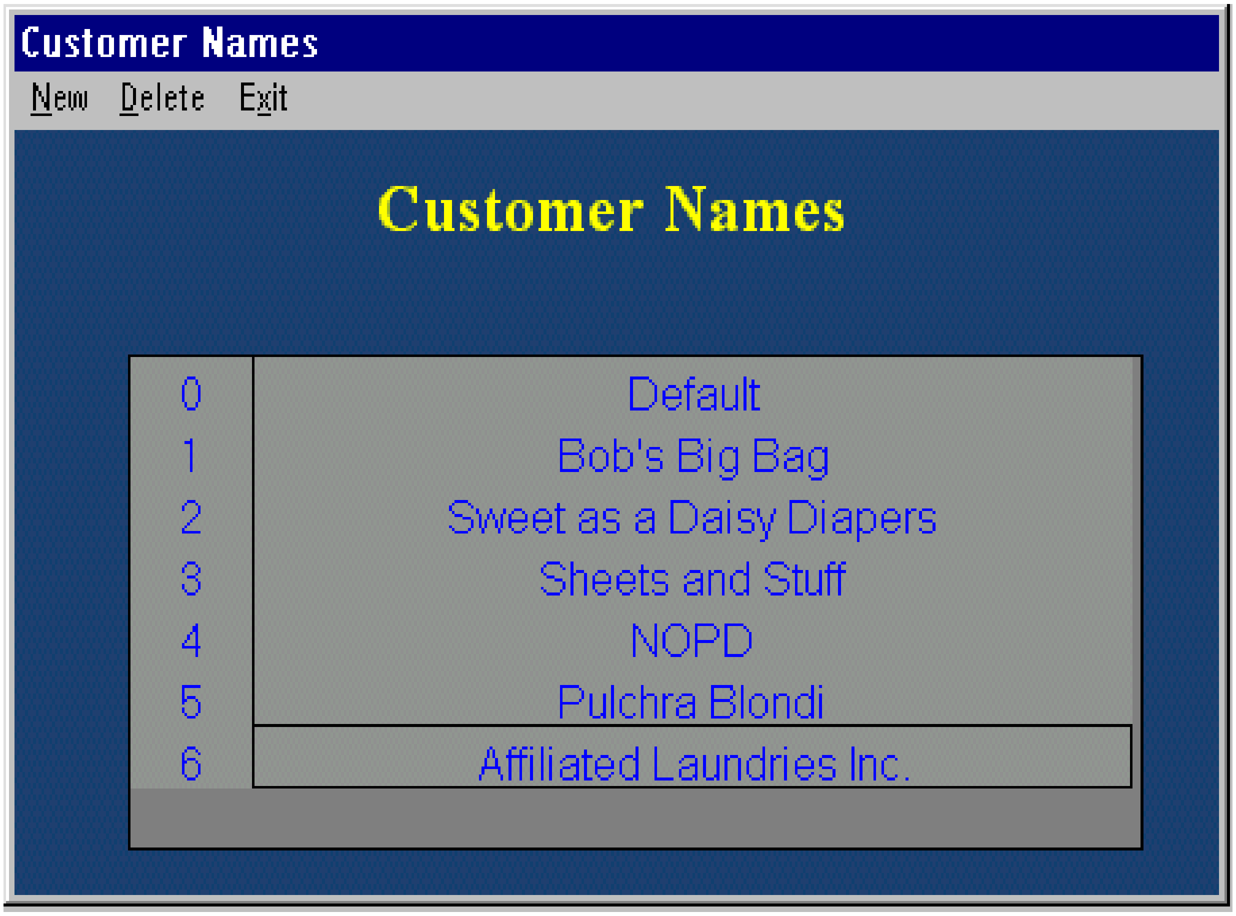
2.3.2 Customer Names

The list of customer names is used whenever an operator selects the customer to be associated with a load of goods from the **Load Customer** window, as shown in Figure 25 . The **Load Customer** list allows the operator to choose from a list showing the full name of the customer, rather than entering a numeric code from memory or a handwritten list.

Figure 25. Load Customer Window

The following procedures are used to modify the list of current customers to accurately match the accounts for the laundry facility. Keep in mind that these modifications directly impact the **Load Customer** window, as well as certain accounting data screens. Only the accounts in the **Customer Names** list will appear in the **Load Customer** window or any accounting report.

Figure 26. Customer Name



2.3.2.1 Adding a New Customer

BNTUUP17.C04 0000236576 A.2 A.6 A.4 1/2/20 2:11 PM Released

To add a new customer to the list of customer names, first log into the Mentor® system as a user with programmer rights, then access the **Customer Names** window from the **programming** menu of the operational display. The **Customer Names** window is shown in Figure 26 .

Select **New** from the menu in the **Customer Names** window. This action immediately adds a blank entry to the bottom of the list.

To modify the new entry with a customer name, click the mouse cursor one time in the region where the customer number line and the customer name column intersect. When the customer name region is the background color and surrounded by a thin black outline, click again inside the outlined area. The background color of the customer name region changes from gray to white, and a vertical bar text cursor appears in the region, indicating that text may be entered.

Enter the customer name as it should appear in all Mentor® screens and reports, then press **Enter**. The customer name is available immediately.

2.3.2.2 Deleting an Existing Customer

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To delete an existing customer from the list of customers, access the list as described in Section 2.3.2.1 : Adding a New Customer, page 73 . With the customer list visible, scroll or use the mouse cursor to select the customer name to delete. When the desired customer name is highlighted, click once on the **Delete** menu selection. The selected customer name is immediately removed from the list of customers.

BNTUUP13 / 2019123 BNTUUP13 0000222361 B.2 5/19/20 3:43 PM Released

2.4 Steam Disinfection Option on CBW® Tunnel Washers

BNTUUP13.C01 0000222360 A.2 B.2 A.3 1/2/20 2:11 PM Released

Steam disinfection is an optional feature available with Mentor® versions 20100 and later consisting of software and associated external circuitry. Although the menu selection shown in Figure 27: Location of **Steam Disinfect** Menu Selection, page 75 may be available on your specific Mentor® controller, the optional external circuitry is required for steam disinfection to operate.

Consult with the proper local or national regulatory authorities for required temperatures.

2.4.1 Operation

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When the operator starts a CBW® tunnel washer with this option, the Mentor® controller checks the status of a microprocessor input (described in Section 2.4.3 : Standard Inputs and Outputs for Steam Disinfect, page 75). If this input is grounded, the controller assumes that the tunnel washer has been turned off for at least three hours and prompts the operator that the tunnel must be disinfected before goods can be processed. When the operator acknowledges this, the controller commands the tunnel to begin reversing rotation and opens steam valves in each module.

When the programmed disinfection temperatures are achieved in all modules, the controller maintains the temperatures for three minutes. At the end of the disinfection period, the tunnel washer re-arms the disinfection circuit for the next cycle. As part of resetting the circuit, the steam disinfection input is removed, allowing the controller to operate the tunnel and transfer goods as programmed.

2.4.2 Setting Module Disinfection Temperatures

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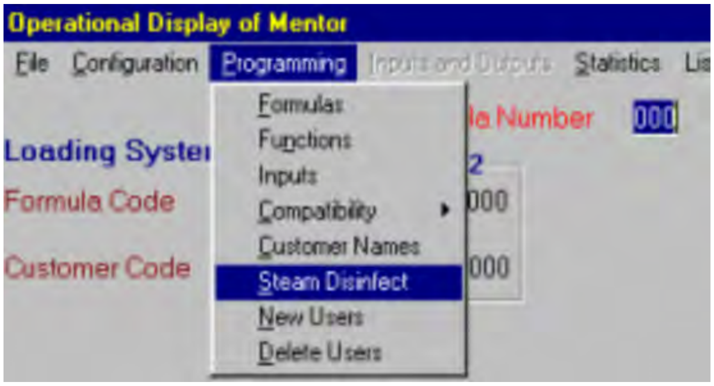
The required temperature for each module is set individually through the **Steam Disinfect** selection in the **Programming** menu on the **Mentor Operational Display**, as shown in Figure 27 .

Figure 27. Location of Steam Disinfect Menu Selection

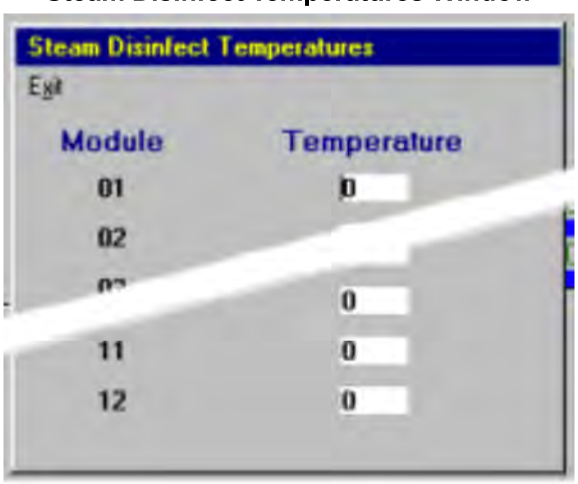


When **Steam Disinfect** is selected from the Mentor® **Programming** menu, a window opens similar to Figure 28: Setting Temperatures, page 75 . Enter the required temperature for each module in the **Temperature** column, pressing the **Tab** key to advance to the next module.

TIP: Hold the **Shift** key and press the **Tab** key to move backward through the module settings.

After entering the temperature for the last module, click on **Exit** at the upper left of the **Temperatures** window to return to the **Mentor Operational Display**. If the associated external circuitry is present, the Mentor® controller will require steam disinfection the next time it is started.

Figure 28. Setting Temperatures

Steam Disinfect Temperatures Window	**Legend**
	**A. . .** Module number **B. . .** Required temperature

2.4.3 Standard Inputs and Outputs for Steam Disinfect

BNTUUP13.C04 0000222356 A.2 B.2 A.3 1/2/20 2:11 PM Released

At start-up, the Mentor® controller checks the microprocessor input at MTA39-6 on the tunnel washer processor board. If this input is grounded, the steam disinfection process must be run to clear the input and allow the tunnel washer to transfer goods from one module to the next.

Three minutes after the programmed temperatures are achieved in each module, the third output on the standard input/output board at address 80H is enabled, clearing the input at MTA39-6 and allowing the tunnel washer to transfer. At the same time, the steam disinfection circuit is reset for the next tunnel start-up.

BNTUUP14 / 2019314 BNTUUP14 0000222354 A.10 1/2/20 2:11 PM Released

2.5 About the Simple Loop Controller Loading System

BNTUUP14.C01 0000222353 A.2 A.10 A.3 1/2/20 2:11 PM Released

The **Simple Loop Controller** is a feature of the Mentor® CBW® tunnel washer controller which manages loading the tunnel washer from a rail system. The rail system can have a maximum of 16 positions: one loading position and 15 bag positions. Mentor® configuration decisions allow selection of a **Simple Loop Controller** with or without a weighing scale.

2.5.1 Configuration

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1. Select the system which loads the tunnel washer on the **Hardware Configuration** page of the Mentor® controller software. The configuration procedure and available options are described in Section 2.2.1 : CBW® Hardware Configuration, page 42 . Choose the correct option according to whether the loading system provided with your tunnel washer incorporates a weighing scale.
2. In the **Number of Storage Positions** decision, configure the number of storage positions available on the rail. The value entered here must equal the number of bags on the rail system plus the one loading position. For example, if the rail system holds 12 bags, enter “13” for the number of storage positions.

NOTE: The loading station is not a position on the rail; it is a data entry position only.

The number of storage positions in a simple loop controller system cannot exceed 16; thus, 15 is the maximum number of bags possible with this loading system option.

2.5.2 Installation

BNTUUP14.C03 0000222385 A.2 A.10 A.4 1/2/20 2:11 PM Released

The simple loop controller requires two inputs: **Data Valid** and **Bag Ready**. Both of these inputs are shown on the **Standard and Direct Inputs** page (see Section 5.2.3.4 : Inputs and Outputs Menu, page 157).

Data Valid input This input is wired to direct input MTA38-4. The **Data Valid** input is usually provided by the button the operator presses to hoist a bag onto the rail to signal the Mentor® controller that the operator moved a bag from the loading area onto the rail. This input must be present for at least one second to ensure detection by the Mentor® controller.

A weighing scale in the loading system requires a time delay relay on the hoist to delay lifting for three seconds to allow accurate weight measurement.

Bag Ready input This input is wired to 00MTA4-3 on the standard input board at address 00H. The **Bag Ready** input signals the Mentor® controller that a bag is in position above the tunnel washer load chute and is ready for loading into the tunnel washer.

2.5.3 Display

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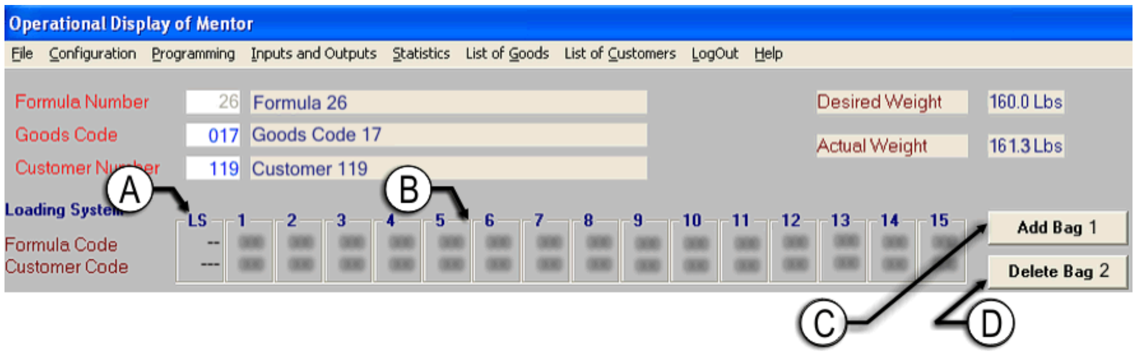
When the **Simple Loop Controller** is configured, the display appears similar to the detail shown in Figure 29 .

Figure 29. Simple Loop Controller on Mentor® Operational Display



Legend

A. . . Loading station
B. . . Storage positions 1 through 15
C. . . Add Bag _ button
D. . . Delete Bag _ button

The **Loading System** screen region shows a representation of the load station and each bag position controlled by the simple loop controller.

Display or Action	**Explanation**
LS	The leftmost position (item A in Figure 29) represents the load station, where the operator loads each bag and enters data according to the bag contents.
1 ... 15	Each numbered box represents a storage location and the contents of the bag at that position.
- - - - -	Dashed lines in the load station or any storage positions represent positions without a bag.

Bag positions along the rail are displayed in numeric order, starting immediately to the right of the load station position.

2.5.4 Operation

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The data in the loading station position is moved to the **last empty position** when

- the **Data Valid** input is made, or
- the operator selects the **Add Bag _** button.

NOTE: The **last empty position** is defined as the storage position box furthest to the right and containing only dashes.

The data in each position shifts one position to the right and the last bag position that contained data becomes dashed when

- the tunnel washer transfers, or
- the operator selects the **Delete Bag _** button.

The **Simple Loop Controller** inserts empty pockets if the **Bag Ready** input is made when the rail is empty (all storage positions except the load station contain dashes).

3 Configuring Other Devices

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3.1 How to Calibrate the Load Conveyor Scale

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This document describes how to configure and calibrate the weighing mechanism of the Milnor® CONWA loading conveyor on Milnor® CBW® systems with the Milnor® Mentor® control system. The CONWA conveyor uses a series of colored lights to prompt the operator to load batches of goods that are consistent in weight for each wash formula. If the loading conveyor is improperly configured or out of adjustment, wash quality and/or productivity may be degraded. In extreme cases, tunnel jams may occur.

3.1.1 Configure Mentor®

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Configuration of the Mentor® controller simply tells the computer what types of devices are attached to it and how the information to and from those devices should be interpreted.

3.1.1.1 Define the Loading System

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The Mentor® controller uses several screens or pages of information to record what devices are connected to it, along with other functional characteristics. The first of these pages, the **CBW Hardware Configuration** page, is shown in Figure 30 . Among the selections available on this page is the **Loading System** field.

Figure 30. CBW® Hardware Configuration Page (Partial View)

Before proceeding further with these calibration and configuration instructions, verify that the installed CBW® system employs and is configured for a Milnor® CONWA loading conveyor.

Verify the model of the loading conveyor. The most apparent characteristic of a CONWA conveyor is the large bank of four “traffic lights” on the conveyor. These lights are used to direct the operator in loading the device. If these lights are not present, the tunnel system is probably equipped with a Milnor® CONLO loading conveyor—a non-weighing loading conveyor.

After the loading conveyor is verified to be a weighing (CONWA) model, the configuration of the Mentor® controller must be verified to ensure that the correct loading device is designated. This is accomplished by logging in to the Mentor® system with programmer rights (see below note), then selecting the **Configuration** menu. From the available choices on the **Configuration** menu, select the **Hardware** display page (Figure 35: Calibrate to Zero Screen, page 84). The entry in the **Loading System** field should read **Conveyor with Weigh Scale**.

NOTE: Log in to the Mentor® controller by selecting the **Login** menu item from the **Operational Display**. In the box that appears, enter your login name and password. If the login name in was previously given programmer rights, the **Configuration** and **Programming** menus will become available (change from gray to black text). If these menus do not become available, consult laundry management.

If necessary, change the loading system configuration by clicking the left mouse button over the downward pointing arrowhead to the immediate right of the current **Loading System** entry. This action will cause a list of possible loading devices to drop down. Move the mouse to highlight the desired loading system (**Conveyor with Weigh Scale** or **Rail System with Weigh Scale**) and click the left mouse button. The list of devices will close, leaving the chosen selection visible on the display.

Select **Save and Exit** to make the changes permanent and return to the **Operational Display**.

3.1.1.2 Set the Number of Storage Positions

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The only other setting on the **CBW Hardware Configuration** page that applies to the loading system is the **Number of Storage Positions** field, located near the upper left corner of the display (Figure 30: CBW® Hardware Configuration Page (Partial View), page 79). This field controls how many storage positions are displayed on the Mentor® **Operational Display**. Count the compartments on the loading conveyor capable of holding goods, then enter the correct number in this field. The last two numeric digits of the machine model number (see machine nameplate) also indicate the number of compartments. For example, a device with a model number of CONWA308 is a weighing conveyor with eight compartments. Valid entries are from 1 to 12, inclusive. The entry of “1” is rarely used with conveyor systems, but is often applied to rail loading systems.

3.1.1.3 Set the Calibration Weight

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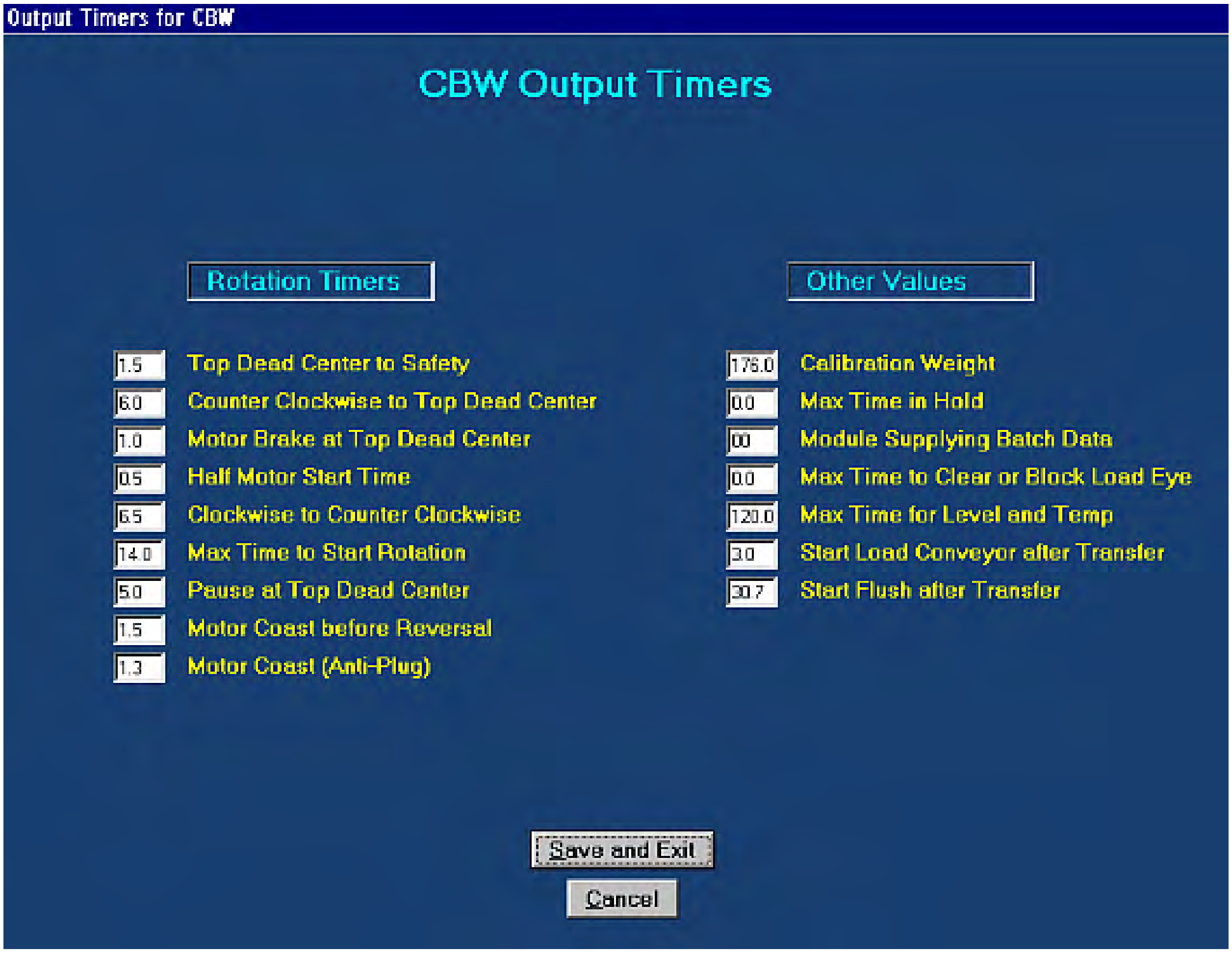
The CONWA conveyor determines the weight of the goods in the first storage position by comparing the signal from the load cell to two reference points: with a load weight of 0 (empty) in the first storage position, and with a value determined with a known weight in the first storage position.

While the setting of the two reference points is accomplished later in this document, the known weight used for calibration should be determined and configured before calibration begins. Log in to the Mentor® controller as described in the previous note, then select the **Configuration** menu. From the options available, highlight **Operating Parameters**. From the next menu, select

Output Timers. The **Calibration Weight** field is at the top of the Other Values column, as shown in Figure 31 .

Figure 31. CBW® Output Timers Page



Place the mouse cursor over the **Calibration Weight** text box and click the left mouse button once. With the entire number highlighted (white text on a blue background), enter a new calibration weight.

NOTE: The **Calibration Weight** field automatically assumes one decimal place on the number entered. To set the calibration weight to 50.0 units, enter 500 (without a decimal) in the text box.

Common items used for calibration weights include nearly anything of a known weight that can be placed in the first storage position of the conveyor. Full bags of dry chemicals, barbell weights, or even a person of known and relatively constant weight may be used if appropriate precautions are followed to prevent falls and other injuries.

WARNING:

Avoid Serious Injury — Standing on a moving conveyor can cause serious injuries, including head injuries and broken bones. Before allowing anyone to stand on the scale, make certain the tunnel is not committed to transfer by waiting at least 15 seconds after the tunnel has been manually placed in hold.

With the new calibration weight entered, select and click on **Save and Exit**. To discard the changes and revert to previous values on this screen, select and click on **Cancel**.

3.1.2 Calibrate Conveyor-to-Mentor® Interface

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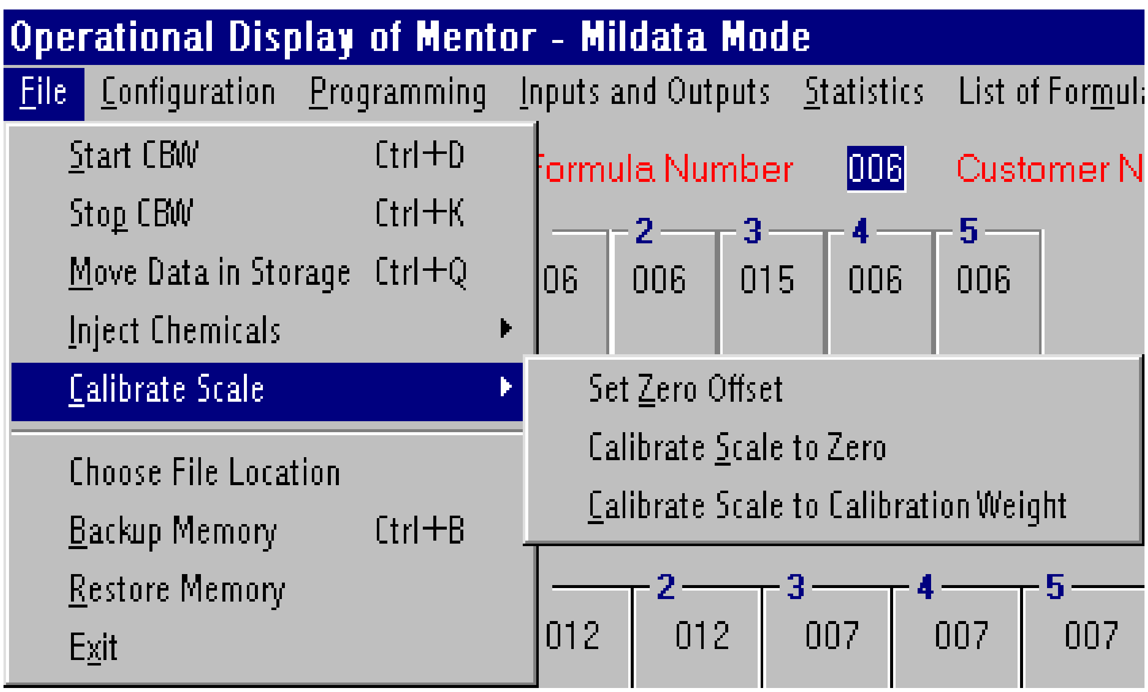
The weighing conveyor sends signals to the Mentor® controller as variations in voltage; weight applied to the loading conveyor causes the voltage output of the load cell to increase. The weight present in the first compartment of the conveyor is calculated by comparing the voltage from the loaded conveyor to the voltages measured when the conveyor is empty and when it is loaded to a known weight.

For accurate weight calculation, the load cell interface must be adjusted so the voltage produced with an empty conveyor falls within the acceptable range. The Mentor® controller uses a menu system (Figure 32) to provide an easy method of accomplishing this adjustment, as described below.

Figure 32. Calibrate Scale Menu



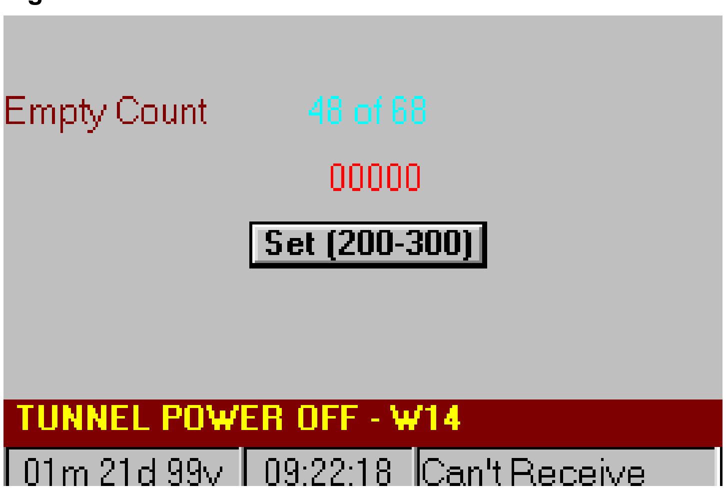
1. In the Mentor® cabinet, locate the weigh scale interface board. This board, shown in Figure 33: Load Cell Interface to Control, page 83 , can be identified by the single amber LED and the small potentiometer adjusting screw, which looks like a very small brass screw. This screw is used to adjust the *zero offset*.

2. At the Mentor® computer, select **File/Calibrate Scale/Set Zero Offset**. The **Calibrate Scale** menu is illustrated in Figure 32 .
3. Observe the five digits above the **Set** button near the lower left corner of the Mentor® display (see Figure 34: Set Zero Offset, page 83) and press gently on the weigh scale. After noting whether counts increase or decrease with pressure, remove all external forces (people, tools, etc.) from the weigh scale.
4. If the counts increase when pressure is applied to the conveyor, turn the potentiometer adjusting screw so that counts fall in the range of 200 to 300 **without passing 0**.
5. If the counts decrease when pressure is applied to the conveyor, turn the potentiometer adjusting screw past 0 and continue turning until the range of 200 to 300 is achieved.
6. With the counts in the appropriate range, position the mouse cursor over the **Set** button and click the left mouse button once. The zero offset is correct.

Figure 33. Load Cell Interface to Control

Board	Legend
	1. Potentiometer adjusting screw

Figure 34. Set Zero Offset



The load cell must be calibrated to provide accurate data to the Mentor® controller. This device is affected by any change in weight, whether the result of a load being added, someone leaning against the conveyor, a slight shift of the conveyor frame, etc. Therefore, it is imperative to periodically re-calibrate the scale and to verify that no objects other than goods being loaded are in contact with the conveyor during weighing. **Local conditions may require daily calibration of the load cell.**

3.1.3 Calibrate the Load Scale

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With the load cell interface properly calibrated, the Mentor® controller must be calibrated with two known values. These allow the controller to determine the weight of the goods by comparison to the weight of the empty conveyor and the weight of the conveyor with a known weight in the first storage position.

3.1.3.1 Calibrate Scale to Zero

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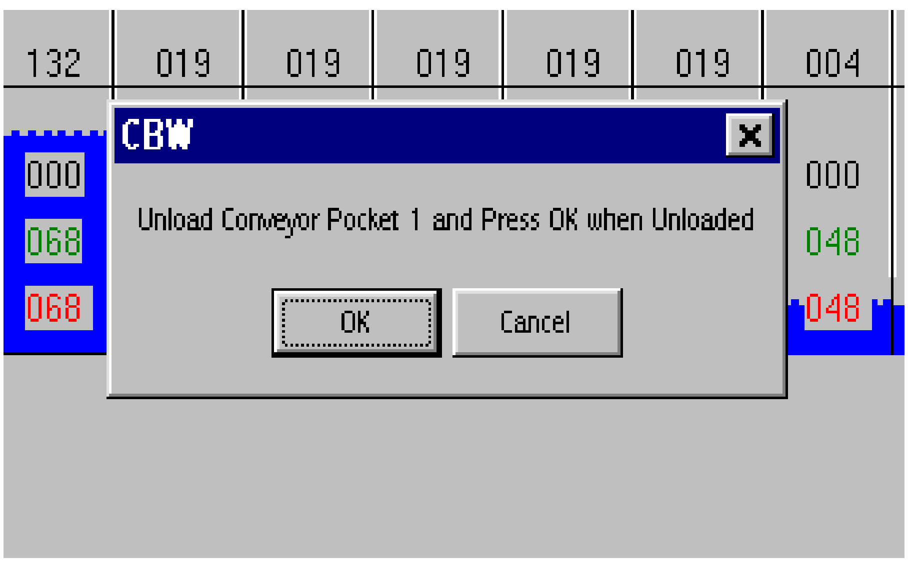
1. To provide a true reading of the weight of the empty conveyor, verify that there are no goods in the first storage position and that there are no people or equipment leaning on the conveyor.
2. At the Mentor® computer, select **File/Calibrate Scale/Calibrate Scale to Zero**. Again verify that the first storage position is empty and that there are no people or objects touching the conveyor. When prompted (see Figure 35), click the left mouse button on **OK**. If it becomes necessary to abort this procedure before completion, click on the **Cancel** button.

Figure 35. Calibrate to Zero Screen



3.1.3.2 Calibrate Scale to Calibration Weight

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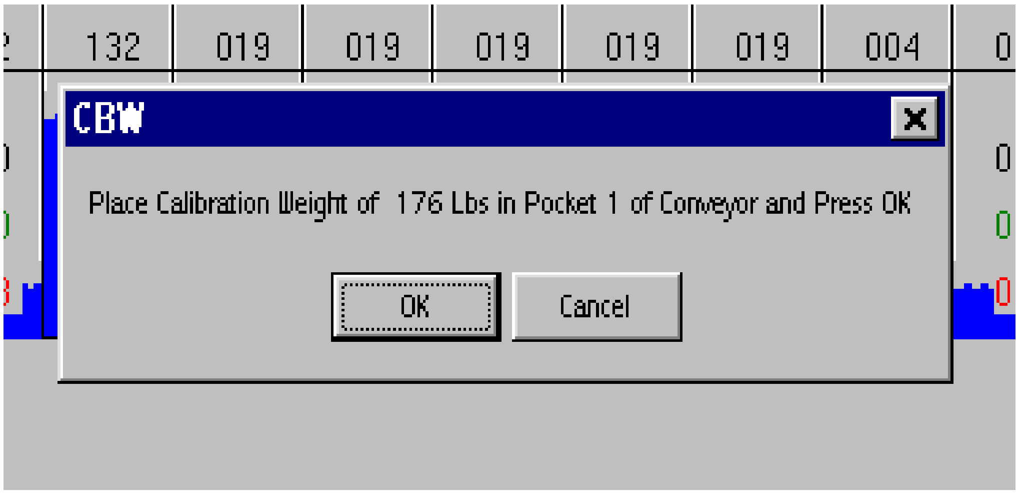
1. The final step in calibrating the weigh scale is providing a known weight for comparison to the zero value set in Section 3.1.3.1 : Calibrate Scale to Zero, page 84 . Select **File/Calibrate Scale/Calibrate Scale to Calibration Weight** at the Mentor® computer.
2. Place a weight of the given value in the center of the first storage position. The weight for which the Mentor® controller prompts is the weight entered according to Section 3.1.1.3 : Set the Calibration Weight, page 80 ”.

3. When the desired weight is properly placed in the first storage position, click the mouse on the **OK** button of the screen illustrated in Figure 36 . Click on the **Cancel** button to terminate this procedure without making changes.

Figure 36. Calibrate to Weight Screen



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3.2 How to Calibrate Water Flow Meters Used on the Milnor® CBW® Washer

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Depending on options purchased, the Milnor® Continuous Batch Washer may be equipped with float-type visual flow meters, electronic paddlewheel flow meters, electronic magnetic flow meters, or a combination of types.

3.2.1 About Visual (Sight Glass) Flow Meters

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These flow meters (see Figure 37: Typical Visual (Sight Glass) Flow Meter, page 86) operate by forcing a weight of specific mass and size upward in a clear plastic cone of specific dimensions. As the flow rate increases, the weight moves up, increasing the gap between the sides of the weight and the inside of the cone and allowing the increased flow to pass. The flow rate is read on the scale along the outside of the plastic cone at the **top** of the weight. Visual flow meters of three different sizes are used in Milnor® applications, depending on the expected flow rate:

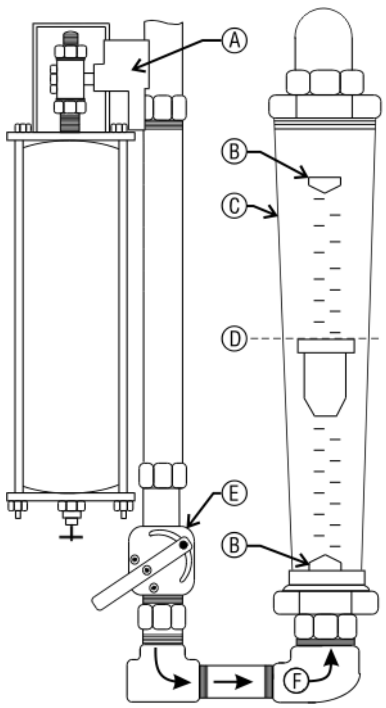
- 0.88 to 11.00 US gallons (3.3 to 42.0 liters) per minute
- 4.0 to 44.0 US gallons (15.0 to 167.0 liters) per minute
- 6.6 to 79.0 US gallons (30.0 to 200.0 liters) per minute

This type of flow meter does not require calibration, but must be installed absolutely vertical and kept clean. Verify that the centerline of the cone is plumb in all planes, or else the indicated flow rate will be incorrect. Carefully clean mineral and rust deposits from the inside of the plastic cone with a non-abrasive pad and a cleaning solution such as a calcium, lime and rust remover; or a citrus based cleaner.

NOTE: Use care when removing sight glasses from flow meters. Plastic sight glasses may become brittle over time.

Figure 37. Typical Visual (Sight Glass) Flow Meter

Flow Meter



Legend

A . . . Air-operated valve
B . . . Movable marker
C . . . Flow meter sight glass
D . . . Read flow rate at top of indicator weight
E . . . Hand-operated lockable vernier adjusting valve
F . . . Direction of flow

3.2.2 Electro-mechanical (Paddlewheel) Flow Meters

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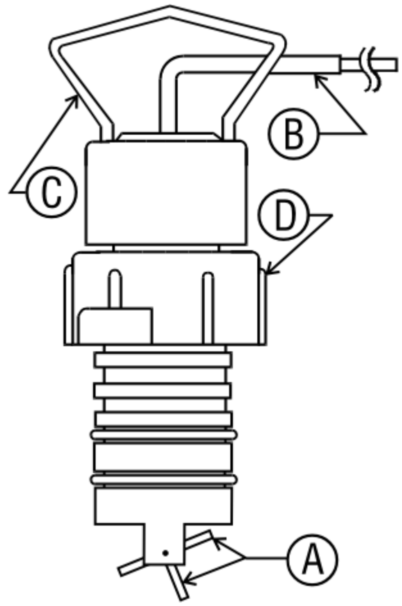
Paddlewheel flowmeters are used when flow rates of clean water need to be automatically collected. As the water flows past the flowmeter, it causes the paddlewheel to spin. The rotations of the spinning paddlewheel are counted and transmitted to the Mentor® computer. While the machine is running, the Mentor® computer continuously collects the number of paddlewheel rotations (called “counts”) from each flowmeter and the time that the flowmeter is active. Using these data and the user-calibrated “Counts per Quantity” value, the Mentor® controller calculates and displays the quantity of fresh and reuse water used per minute, as well as the cumulative total quantities of water.

Figure 38. Typical Electro-mechanical Flow Meter

Illustration	Legend
	**A . . .** Paddlewheel **B . . .** Shielded lead to tunnel washer input/output board **C . . .** Protective bail and paddlewheel axis indicator **D . . .** Cap for attachment to pipe fitting

3.2.2.1 Operational Theory

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Electro-mechanical paddlewheel flow meters operate according to the **Hall effect**. The Hall effect is the voltage created when magnetic field passes around an active electrical conductor. In the specific case of paddlewheel flow sensors, there is no moving mechanical linkage between the paddlewheel in the pipe and the sensing unit outside the pipe. Instead, a conductor in the sensing unit carries a small electrical current. When fluid flows past the flow meter, the paddlewheel spins at a speed proportional to the velocity of the fluid in the pipe. The blades of the paddlewheel are magnetized, so the magnetic field around each blade passes around the conductor in the sensing unit, altering the electrical current. The current alterations caused by each paddlewheel blade are counted for a period of time, resulting in a number that represents the fluid velocity. The final calculation that results in flow rate as **units per period** includes factors to account for the inside diameter of the pipe, the viscosity of the fluid, and several other variables.

3.2.2.2 Calibration Procedure Using a Weighing Device

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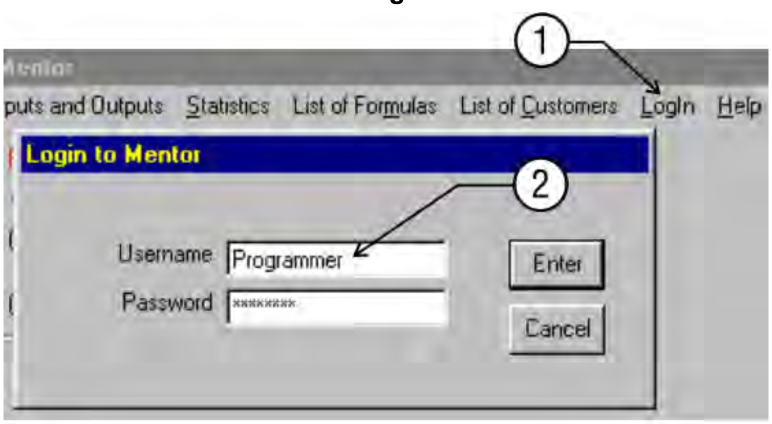
The Milnor® factory uses the following calibration procedure during machine assembly and testing. If your laundry facility has the space and equipment necessary to capture and accurately weigh a large quantity of water, this method is more accurate even with smaller sample sizes than the method described in Section 3.2.2.3 : Flow Meter Calibration when a Weighing Device is not Available, page 91 .

This method requires a calibration container and a means of accurately weighing the container when it is filled with water. To minimize rounding errors and improve the accuracy of the calibration procedure, the calibration container should be as large as can be safely handled and weighed. A large drum (55 gallons or more) is suitable. The procedure should also be performed two or more times and the results averaged.

1. Place the calibration container and weighing device near the tunnel washer flow meter that will be calibrated.
2. Record the weight of the empty calibration container.
3. Replace the piping just downstream of the flowmeter with a piece of flexible hose of similar inside diameter. This tubing should be long enough to conveniently reach the calibration container.
4. Place the free end of the flexible hose in the calibration container. Secure the hose so it won't fall out of the drum when you turn the water on.
5. At the Mentor® controller, log in (Figure 39) with programmer rights so you can change the **Counts per Quantity** value later.

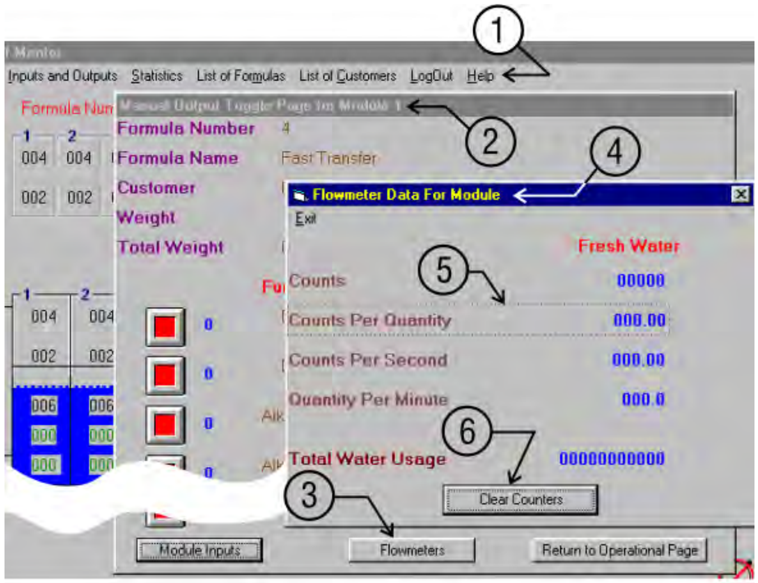
Figure 39. Logging into the Mentor® controller

Mentor® Login Screen	**Legend**
	1. **Login** selection on **Mentor operational display** 2. **Login** window. The **Username** entered here must have programmer privileges, and a valid password must be entered.

6. On the **Mentor operational display**, put the mouse cursor on a blank area within the module where the flow meter is electrically connected, then click the right mouse button once. The **Manual Output Toggle** page for the module appears. The **Mentor operational display** and the **Manual Output Toggle** page are shown in Figure 40 .

Figure 40. Flow meter calibration

Outputs and Flowmeters Screens



Legend

1. **Mentor operational display** screen
2. **Manual output display** screen
3. Flowmeters button on **output display** screen
4. **Flow meter data** page (typical)
5. **Counts per Quantity** calibration value
6. **Clear Counters** button on **Flow meter** data page

7. Position the mouse cursor on the **Flowmeters** button at the bottom of the **Manual Output Toggle** page and click the left mouse button once. The **Flowmeter data** window appears, as shown in Figure 40 .
8. Click the mouse once on the **Clear Counters** button to clear the contents of all counters.
9. Open the water inlet until the calibration container is nearly full, then shut off the water. **Do not overfill the container**. Record the weight of the container with its contents.
10. Subtract the weight of the empty container from the weight of the container when filled, as shown below. The difference between the filled weight and the empty weight is the weight of the water flowed into the calibration container.

$$W_f - W_e = W_w$$

Where:

W_f = Weight of calibration container and water when filled

W_e = Weight of empty calibration container

W_w = Weight of water flowed into container

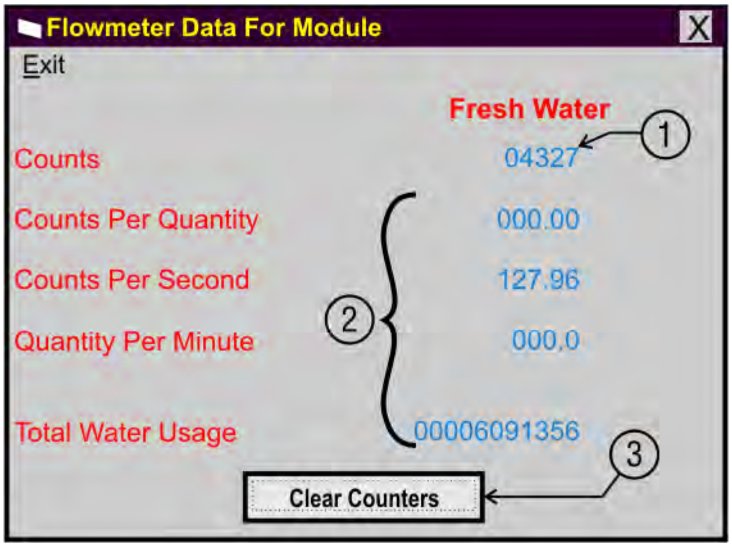
1232 pounds - 218 pounds = 1014 pounds

559 kg - 99 kg = 460 kg

11. At the Mentor® controller, record the number displayed for **Counts**, as shown in Figure 41 .

Figure 41. Elements of Flowmeters Screen

Flowmeters Display



Legend

1. **Counts** value (record this number for calibration calculations)
2. Calculated values are not accurate until after calibration
3. Click mouse on this button to clear counters

12. Convert the weight of water flowed to the units that will be used in programming tunnel wash formulas. Some helpful conversion factors are given in Table 4 . Record this value.

$$W_w / D = Q_f$$

Where:

W_w = Weight of water flowed into container

D = Density of water (weight per unit volume)

Q_f = Quantity of water flowed

1014 pounds / 8.33 pounds per gallon = 121.73 gallons

459.76 kilograms / 1 kilogram per liter = 459.76 liters

Table 4. Units Conversion Factors for Clean Water

To convert from	to	multiply by
U.S. pounds	kilograms	0.454
	liters	0.454
	gallons	0.12
kilograms	U.S. pounds	2.205
	liters	1
	gallons	0.264

13. Divide the **Counts** value (Figure 41) by the calculated quantity of water flowed (gallons, pounds, liters, etc.) to determine the **Counts per Quantity**.

$$Counts / Q_f = Counts\ per\ Quantity$$

Where:

Counts = copied **from** top line of Flowmeters display

Q_f = Quantity of water flowed

Counts per Quantity = calculated value used for calibration

4327 counts / 121.73 gallons = 35.55 counts per gallon

4327 counts / 459.76 liters = 9.41 counts per liter

14. Enter the **Counts per Quantity** value for the desired flow meter in the **Fresh Water** or **Reuse Water** column of the **Flowmeter data display**, depending on the flowmeter being calibrated. If the **Counts per Quantity** values are gray, return to the **Operational display** and log in with programmer rights as described earlier in this procedure. If the **Counts per Quantity** values are the same color as the other values on this display, adjust the value by placing the mouse cursor on the number and clicking the left mouse button once. Delete the existing numbers and enter the correct value, then press the **Tab** key on the Mentor® controller keyboard to write the value to memory.
15. Return the tunnel washer to operating condition by replacing the piping downstream of the flow meter and draining the calibration container.
16. For other flow meters, repeat this procedure.

3.2.2.3 Flow Meter Calibration when a Weighing Device is not Available

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Sometimes flow meters may need to be calibrated when there is no convenient method of weighing the water flowed into the container. Although the calibration is usually less accurate than the factory procedure, a replacement flowmeter can be calibrated without a weighing device if a graduated calibration container is available.

NOTE: Recognize that the nominal capacity of standard steel and plastic drums includes a certain amount of headspace—usually 1 to 2 inches (25 to 50mm) to allow for expansion of the original contents. Therefore, filling a standard drum brim full will result in flowing an additional amount of water, approximately 4 percent.

1. Place the calibration container near the tunnel washer flow meter that will be calibrated.
2. Replace the piping just downstream of the flowmeter with a piece of flexible hose of similar inside diameter. This tubing should be long enough to conveniently reach the calibration container.
3. Place the free end of the flexible hose in the calibration container. Secure the hose so it won't fall out of the container when you turn the water on.
4. At the Mentor® controller, log in (see Figure 39: Logging into the Mentor® controller, page 88) with programmer rights so you can change the **Counts per Quantity** value later.
5. On the **Mentor operational display**, put the mouse cursor on a blank area within the module where the flow meter is electrically connected, then click the right mouse button once. The **Manual Output Toggle** page for the module appears. The **Mentor operational display** and the **Manual Output Toggle page** are shown in Figure 40: Flow meter calibration, page 89 .
6. Position the mouse cursor on the **Flowmeters** button at the bottom of the **Manual Output Toggle** page and click the left mouse button once. The **Flowmeter data** window appears, as shown in Figure 40: Flow meter calibration, page 89 .
7. Click the mouse once on the **Clear Counters** button to clear the contents of all counters.
8. Open the water inlet until the water level in the calibration container reaches exactly to a graduation of known quantity, then shut off the water.

9. At the Mentor® controller, record the number displayed for **Counts**, as shown in Figure 41: Elements of Flowmeters Screen, page 90 .
10. Divide the **Counts** value by the quantity of water flowed (gallons, liters, etc.) to determine the **Counts per Quantity**.

Counts / Q_f = Counts per Quantity

Where:

Counts = copied **from** top line of Flowmeters display

Q_f = Quantity of water flowed

Counts per Quantity = calculated value used for calibration

4327 counts / 121.73 gallons = 35.55 counts per gallon

4327 counts / 459.76 liters = 9.41 counts per liter

11. Enter the **Counts per Quantity** value for the desired flow meter in the **Fresh Water** or **Reuse Water** column of the **Flowmeter data display**, depending on the flowmeter being calibrated. If the **Counts per Quantity** values are gray, return to the **Operational display** and log in with programmer rights as described earlier in this procedure. If the **Counts per Quantity** values are the same color as the other values on this display, adjust the value by placing the mouse cursor on the number and clicking the left mouse button once. Delete the existing numbers and enter the correct value, then press the **Tab** key on the Mentor® controller keyboard to write the value to memory.
12. Return the tunnel washer to operating condition by replacing the piping downstream of the flow meter and draining the calibration container.
13. For other flow meters, repeat this procedure.

3.2.2.4 Comparative Calibration Procedure

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In cases where it's impossible to calibrate the flowmeters by weighing or measuring the amount of water, the flowmeters which provide input to the control system can be calibrated to correspond to the sight glass flow meter. This method is somewhat less accurate than methods involving weighing or measuring the amount of water because it depends on the accuracy of the sight glass flow meter.

1. Set up the tunnel washer with power on but rotation stopped.
2. Establish a steady water flow. Higher flow rates will yield more accurate calibration than low flow rates.
3. Ensure that **all** water valves are closed except the one corresponding to the flow meter to be calibrated.
4. Use the manual throttling valve to set the flow so the sight glass flow meter (Figure 37: Typical Visual (Sight Glass) Flow Meter, page 86) indicates a flow where there is a calibration mark (e.g., 30 gallons per minute). The value indicated on this flow meter will be used for variable Q_f when calculating the counts per quantity as described below.
5. Access the Mentor® display of flow meter data (shown in Figure 40: Flow meter calibration, page 89).
6. Simultaneously start a timer and clear the **Counts** value on the flow meter data display.

7. After a few minutes, record the **Counts** value and the time the valve was open.
8. Calculate the **Counts per Quantity** according to this equation:

$$Counts / [(T / 60) \times R_I] = Counts\ per\ Quantity$$

Where:

Counts = value indicated on the top line of the Mentor® flowmeters display

T = time water valve is open (in seconds)

R_I = flow rate indicated by sight glass flow meter

9. Repeat this process several times, adjusting the **Counts per Quantity** value after each trial.
10. Enter the **Counts per Quantity** value on the Mentor® display.

3.2.3 Magnetic Flow Meters

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Magnetic flow meters, shown in Figure 42: Typical +GF+ Signet Magnetic Flow Meter, page 94 and Figure 43: Typical Burkert 8045 Magnetic Flow Meter, page 95 , calculate flow rate by measuring the voltage created when a conductor (the fluid being measured) moves through the magnetic field created by the flow meter. The voltage produced is proportional to the velocity of the fluid. The flowmeter converts this low voltage analog signal to a digital signal (pulses) for use by the controller.

Magnetic flow meters are used when the fluid is unsuitable for a paddlewheel flow meter. This may be because the fluid is contaminated with lint which would foul the paddlewheel, or because the fluid is not chemically compatible with the paddlewheel material.

3.2.3.1 Operational Theory

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Magnetic flow meters, like the paddlewheel type described in Section 3.2.2 : Electro-mechanical (Paddlewheel) Flow Meters, page 86 , also operate according to the **Hall effect**, which describes that a voltage is created when an electrical conductor passes through a magnetic field. The most obvious difference between paddlewheel and magnetic flow meters is that magnetic flow meters do not require a paddlewheel extending into the fluid flow.

Because the fluid used in laundering is primarily water, it is electrically conductive. The magnetic flow meter passes an electrical current through the liquid in close proximity to a magnetic field. The voltage produced is proportional to the velocity of the fluid. The flow meter measures the voltage produced and includes several other factors in calculating the flow rate in **units per period**. Pipe diameter, fluid temperature, viscosity, and conductivity must be considered. These values and others are included in the factors entered during calibration.

3.2.3.2 +GF+ Signet Magnetic Flow Meter

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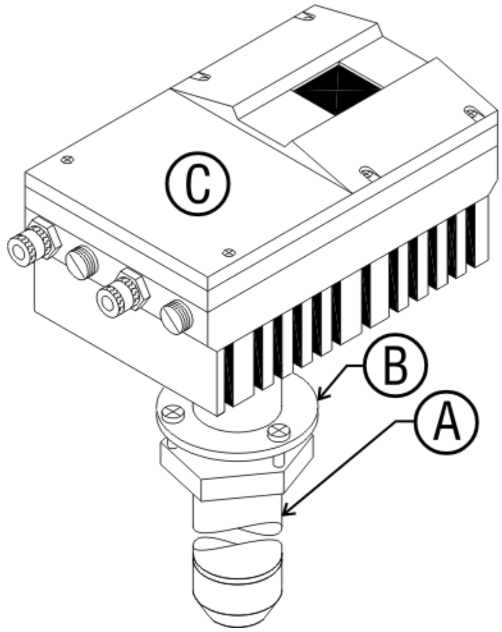
While this type of flow meter operates on a different principle than that of the electro-mechanical meter, the calibration procedure is the same. Use any of the procedures described in Section 3.2.2.2 : Calibration Procedure Using a Weighing Device, page 87 through Section 3.2.2.4 : Comparative Calibration Procedure, page 92 .

Figure 42. Typical +GF+ Signet Magnetic Flow Meter

Flow Meter	Legend
	**A** . . . Sensing probe **B** . . . Mounting device **C** . . . Sending unit

3.2.3.3 Burkert Magnetic Flow Meter

BNTUUP18.C08 0000236659 A.2 A.8 A.4 1/2/20 2:11 PM Released

As of January 18, 2002, the Burkert magnetic flow meter is compatible only with Mentor® version 20005A.

3.2.3.3.1 Description

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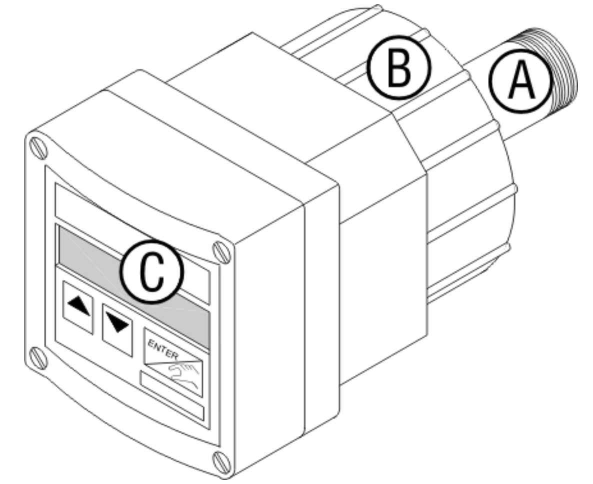
The Burkert model 8045 MID magnetic flow meter is used on some tunnel washer configurations. The flow meter is attached via a Burkert type S030 stainless steel fitting of 1 1/4 inch nominal size. The operating principle is similar to other magnetic flow meters, with the addition of this device being able to communicate with a valve positioner to automatically modulate water flow.

Figure 43. Typical Burkert 8045 Magnetic Flow Meter

Flow Meter	Legend
	**A. . .** Sensing probe **B. . .** Mounting device **C. . .** Transmitter

3.2.3.3.2 Calibration Procedure

BNTUUP18.C10 0000236686 A.2 A.8 A.6 1/2/20 2:11 PM Released

Display or Action	Explanation
▼ + ENTER (5 seconds)	Press these two buttons simultaneously and hold them for five seconds to enter the **Calibration** menu.
`LANGUAGE`	**Language** is the first parameter of the **Calibration** menu. If necessary, press ▲ and ▼ to scroll to **ENGLISH**.
ENTER	Accepts the selected language and advances to the next decision.
`UNIT`	Select **UNIT** to continue with calibration, or scroll to **TOTAL** to exit the calibration menu.
ENTER	Accepts “UNIT” to continue with calibration.
`FLOW`	At this display, press ▲ and ▼ to scroll to the desired units of flow (U.S. gallons per minute).
`US GAL/M`	Press ENTER to select this choice and continue.
`DEC PT`	After accepting flow units, the display prompts for the number of decimal places. **NOTE:** In some cases, the transmitter may automatically default the DEC PT decision to **0** (no decimal places).
▲ / ▼	Scroll to select **DECPT 0** for no decimal places.

TIP: Different revisions of software may exist in the Burkert magnetic flow meters on your machines, depending on the build date of the flow meters. These software revisions vary primarily in how the K-factor is calibrated and entered, although the differences are minor. Differences in the calibration procedures are shown in the following procedure as **Tips**, similar to this statement. CBW® washers built after February 2004 may employ flow meters with any software version, so you should carefully observe the prompts on the flow meter and use the calibration procedure that corresponds to the prompts.

`K-FACTOR`

The K-factor is a calibration constant used by the transmitter to adjust the raw readings to the specific environment and manufacturing tolerances of the flow meter. This constant can be calculated manually for any implementation of the meter. However, for the application covered here, Milnor® has previously calculated the value.

Advances the transmitter control to choose how the K-factor will be entered. Use ▲ / ▼ to scroll.

TIP: For flow meters with newer versions of the Burkert software, the transmitter control displays the current K-factor at this time. Press , then press ▲ or ▼ to scroll to the desired value. If the transmitter control prompts **K-FITING**, you have determined that the flow meter is using a newer software version. For newer software, scroll to **4.32** (the K value of the fitting used in CBW® washers), then press . Then scroll to **VALID Y**, and press again to confirm the value. For older software, follow the instructions below.

`TEACH N`

Indicates that a pre-calculated K-factor will be entered. Press to accept **TEACH N**.

Locate the *specific cell constant* on the side of the transmitter. This value is written on a sticker on the side of the transmitter, and is usually in the form of **0.9xx**. Calculate the necessary K-factor by multiplying the specific cell constant of the sensor times the value for the sensor fitting, as shown below:

$$K_{fitting} \times F_s = K\text{-}factor$$

Where:

$K_{fitting}$ = 4.32 for the Milnor® CBW® washer

F_s = *specific cell constant* from side of transmitter, typically about 0.9xx

To enter the calculated K-factor with the transmitter keypad, press until the proper digit appears, then press to advance to the next digit.

`K=0.945`	Example display of K-factor. Press to accept the displayed value.
/	Scroll to the **PULSE** decision and press to access the value.
`PU=00.10`	Enter 00.10 for this value, indicating that one meter pulse represents 0.1 gallon. Press until the proper digit appears, then press to advance to the next digit.
	Accepts the displayed value and advances to the next decision.
/	Scroll to the **FREQUENC** display, and select 60 Hz.
`F=60 HZ`	Press to accept this value.
/	Scroll to the **END** display, and press to finish calibration.

3.2.3.3.3 Zeroing the Flow Meter

BNTUUP18.C11 0000238939 A.2 A.8 A.3 1/2/20 2:11 PM Released

After calibration, the flow meter needs to know what condition represents no flow (0 gallons per minute).

For this procedure to be accurate, the flow meter pipe must be completely full of water, but not flowing.

Display or Action	Explanation
+ + (5 seconds)	Press and hold all three keys for five seconds to gain access to the **TEST** menu.
/	Scroll to the **CALIB 0** selection, then press to enter this menu.
`CALIB Y`	Press or until this display appears, then press .
`MEASURE`	Indicates that the flow meter is setting the zero flow value. This display will appear for about 12 seconds.
`FLOW`	Indicates that the flow meter is zeroed. Press or until **END** appears in the display, then press .

3.2.4 Burkert Valve Positioner

BNTUUP18.C12 0000238938 A.2 A.8 A.3 1/2/20 2:11 PM Released

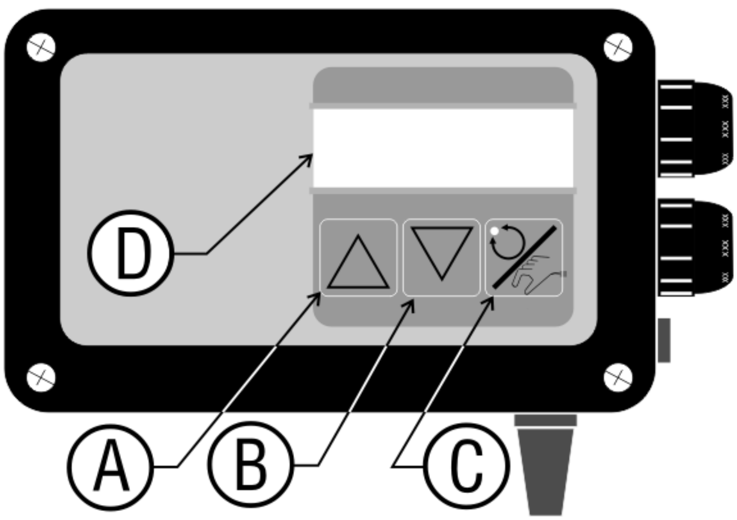
3.2.4.1 Description

BNTUUP18.C13 0000238936 A.2 A.8 A.3 1/2/20 2:11 PM Released

Burkert model 2632 angle-seat valves equipped with Burkert model 1067 valve positioners are available on some tunnel washer configurations. The control panel of the valve positioner is shown in Figure 44 .

Figure 44. Typical Burkert Valve Positioner Control

Control Panel



Legend

A. . . Scroll up button
B. . . Scroll down button
C. . . Automatic/Manual button
D. . . Display

3.2.4.2 Setup

BNTUUP18.C14 0000238935 A.2 A.8 A.3 1/2/20 2:11 PM Released

This procedure must be repeated for each valve equipped with a positioner.

Display or Action	Explanation
(5 seconds)	Hold the **Automatic/Manual** button depressed for five seconds to enter the **Configure** menu.
▲ / ▼	Use the **Scroll** buttons to select the **Input** field.
`INPUT`	With the **Input** field selected, press **Automatic/Manual** to see the available choices.
`0...10V`	Use the **scroll** buttons to select the **0 to 10 volt** input range.
	Accepts the selected input range.
`END`	Scroll to the **End** selection and press to exit the **Configure** menu.

3.2.5 Mentor® Configuration for Burkert Magnetic Flow Meters and Valve Positioners

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As of January 18, 2002, this information and some of the Mentor® screens that appear here apply only to Mentor® version 20005A.

1. On the **Function Programming** page, enter each valve and assign a bit to the valve in the appropriate module. The relay controlled by this bit operates a blocking valve. The bit is enabled when the valve position is greater than 0 and disabled when the valve position equals 0.
2. Also on the **Function Programming** page, assign one of the two possible *op codes* to each modulating valve bit.
   - Use *op code 08* if a flow meter controls the modulating valve to achieve the desired flow rate. When a flow meter is attached to the valve, the values programmed in wash formulas are flow rates in gallons per minute.
   - Use *op code 0C* if there is no flow meter controlling this valve. When no flow meter is involved, the values programmed in wash formulas are in percent open, from 0 to 100 percent.
   - When two valves share the same flow meter, one must use *op code 08*, and the other must use *0C*.
3. When assigning bit numbers to valves, always assign the lowest numbered bit to valve 1. The next lowest bit is assigned to valve 2, etc.
4. Log into Mentor® as a user with **Programmer** privileges before attempting to configure the flow meter counts per unit. The **Mentor Login** screen is shown in Figure 39: Logging into the Mentor® controller, page 88 .
5. Configure the flow meter counts per unit on the **Modulating Valves** selection of the **Inputs and Outputs** menu. This **Modulating Valves** screen, shown in Figure 46 , also allows manual adjustment of the valves.
6. For each valve with an *op code* of 08 (flow rate), enter a value of 10. Valves with an *op code* of 0C (percent open) will not allow entry of a count value.
7. On the **Formula Programming** page (Figure 47), enter the desired flow rate or valve position for each module in each wash formula. If no value is entered for a valve, the valve remains closed.

Figure 45. View of Function Programming Page

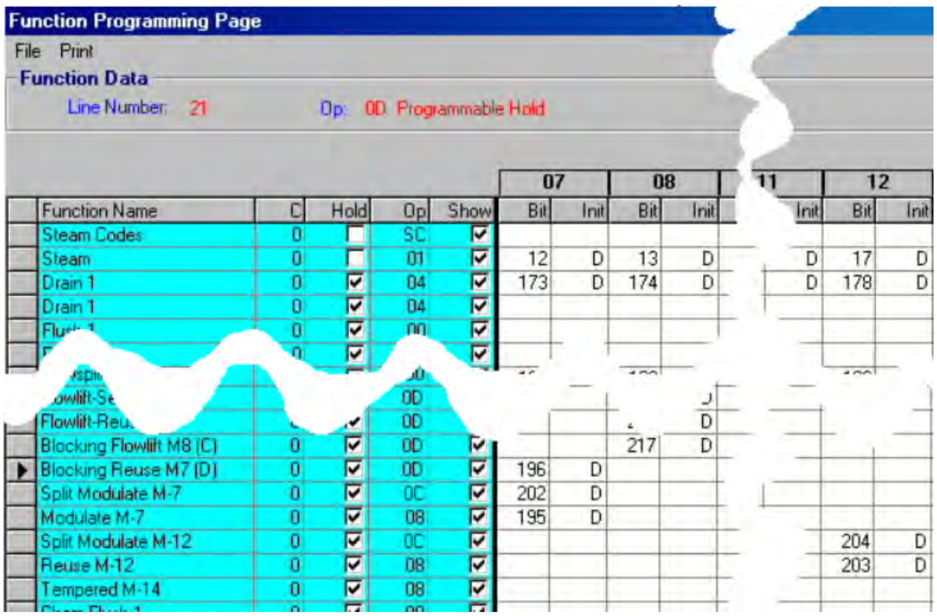


Figure 46. View of Modulating Valves Screen

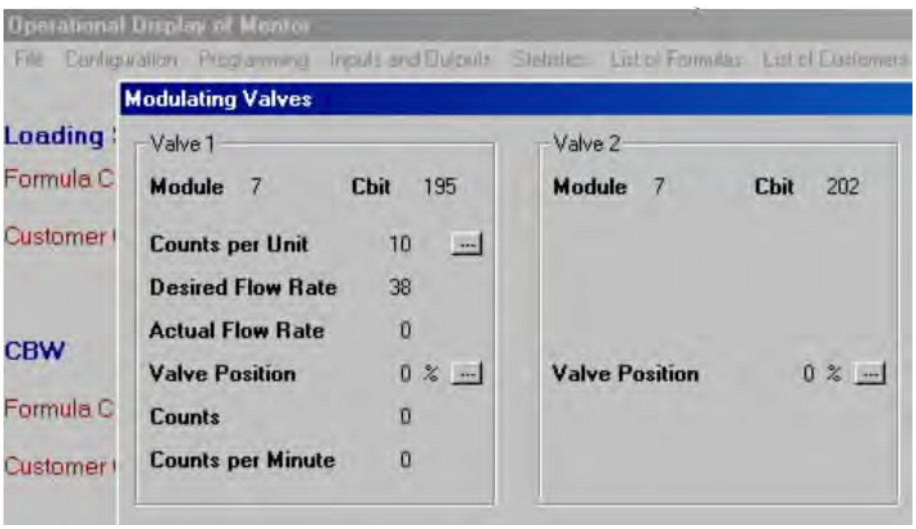
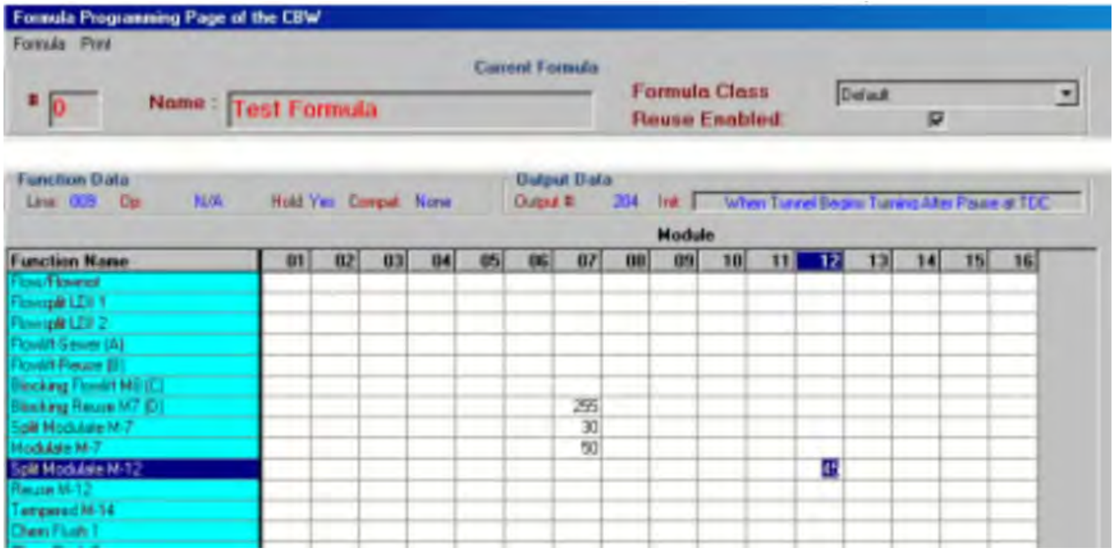


Figure 47. View of Formula Programming Page



4 Programming Mentor® Formulas

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4.1 Programming Mentor® Formulas

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A formula is a set of instructions and conditions that controls how the Milnor® CBW® tunnel washer operates. These formulas are programmed in a simple format by someone knowledgeable in the needs and goals of the facility. Once programmed and saved to the Mentor® computer, the Mentor® control system converts these formulas into instructions the tunnel can execute and communicates them to the tunnel.

4.1.1 Description of the Formula Programming Page

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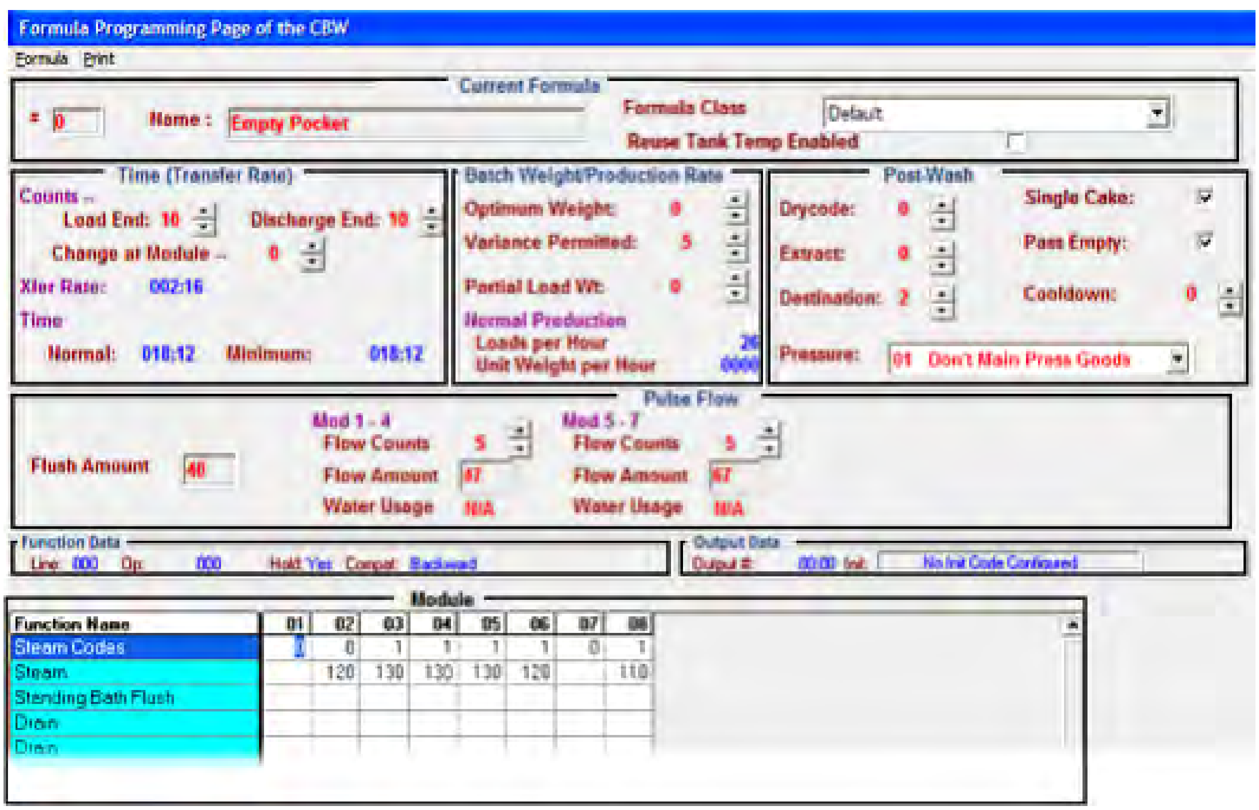
The **Formula Programming** page consists of a menu area and seven distinct zones, as shown in Figure 48 . Each zone contains information related to one or more specific aspects of a wash formula.

Figure 48. Zones of Mentor® Programming Page



4.1.1.1 Menu

BNTUUP20.C03 0000239644 A.2 A.8 A.3 1/2/20 2:11 PM Released

The menu area of the Formula Programming page is the second line from the top of the display. The two items are **Formula** and **Print**.

4.1.1.1.1 Formula

BNTUUP20.C04 0000239643 A.2 A.8 A.3 1/2/20 2:11 PM Released

CAUTION: Avoid Data Loss — To avoid losing programmed data, always move the cursor to a row other than the one last changed or press **Enter** before using any menu selection to close the current formula programming page. Failure to follow this procedure will cause the last data programmed to revert to the previous value.

4.1.1.1.1.1 New

BNTUUP20.C05 0000239642 A.2 A.8 A.3 1/2/20 2:11 PM Released

This menu selection replaces the current formula on the screen with a copy of Formula 0, ready to accept data from the programmer. This function can be accessed through the menu or by holding the control key (Ctrl) and pressing **N** (**Ctrl-N**) from any formula programming page. Whatever data is stored in Formula 0 when the **New** command is given will be automatically added to the new formula.

4.1.1.1.1.2 Open

BNTUUP20.C06 0000239641 A.2 A.8 A.3 1/2/20 2:11 PM Released

Select this menu option to open an existing formula on the formula programming page. Selecting this option or pressing **Ctrl-O** from the formula programming page opens a list of available formulas. Select the desired formula from the list and click **Load**. The selected formula will appear in the programming page, ready for modification.

4.1.1.1.1.3 Copy

BNTUUP20.C07 0000239640 A.2 A.8 A.3 1/2/20 2:11 PM Released

A quick and easy method of creating multiple similar formulas is to completely program the first formula of the set, then copy that formula to other formula numbers and make the necessary modifications. Do this by selecting this menu option or pressing **Ctrl-C**. In the dialog box that appears, select the source formula from the **Formula to Copy** list (available formulas) on the left of the window. The source formula is the one on which subsequent formulas will be based. Then enter the new number in the **Copy To** box on the right of the window. If the number entered here is already assigned to a formula, an error message will appear and the operation will not be allowed. Enter an unused formula number.

NOTE: While formula numbers must be unique, all other characteristics of the new formula may be the same as or different from the original formula. For example, if Formula 12 is called Blue Napkins, that formula can be duplicated in every respect except for the formula number, including name, processing actions, etc. However, there can never be two formulas with the same formula number.

4.1.1.1.1.4 Delete

BNTUUP20.C08 0000239639 A.2 A.8 A.3 1/2/20 2:11 PM Released

To delete an existing formula, select this option or press **Ctrl-D**. When the list of available formulas appears, select the formula to be deleted and click **Delete** once.

4.1.1.1.1.5 Exit

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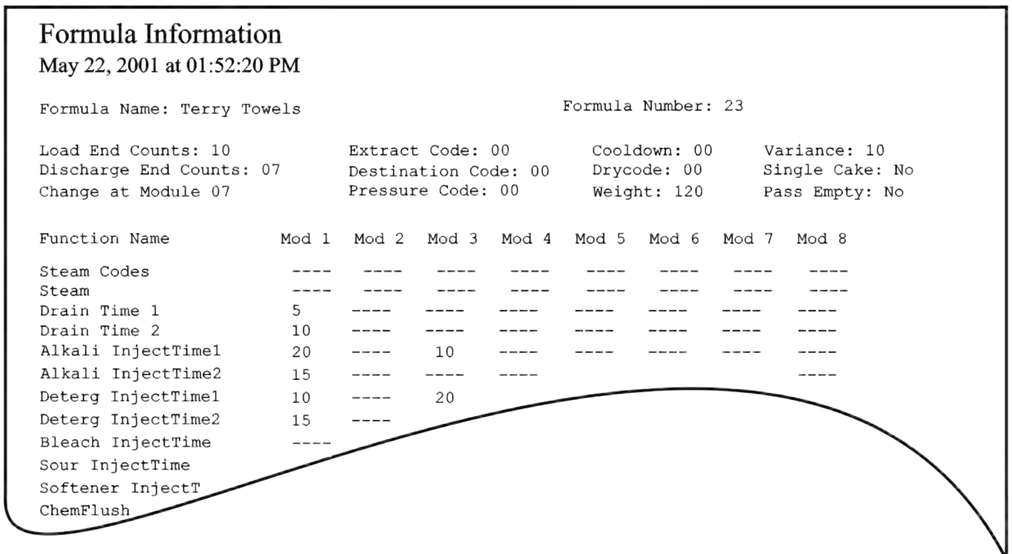
This selection (or pressing **Ctrl-X**) closes the formula programming page and returns the user to the Operational Display.

4.1.1.1.2 Print

BNTUUP20.C10 0000239637 A.2 A.8 A.4 1/2/20 2:11 PM Released

This menu selection allows a user with programmer rights to print either the current formula, or all formulas. A typical report generated from this selection is shown in Figure 49 .

Figure 49. Sample Formula Information Report


Formula Information
May 22, 2001 at 01:52:20 PM

```
Formula Name: Terry Towels                          Formula Number: 23

Load End Counts: 10          Extract Code: 00      Cooldown: 00     Variance: 10
Discharge End Counts: 07     Destination Code: 00  Drycode: 00      Single Cake: No
Change at Module 07          Pressure Code: 00     Weight: 120      Pass Empty: No

Function Name          Mod 1  Mod 2  Mod 3  Mod 4  Mod 5  Mod 6  Mod 7  Mod 8

Steam Codes            ----   ----   ----   ----   ----   ----   ----   ----
Steam                  ----   ----   ----   ----   ----   ----   ----   ----
Drain Time 1           5      ----   ----   ----   ----   ----   ----   ----
Drain Time 2           10     ----   ----   ----   ----   ----   ----   ----
Alkali InjectTime1     20     ----   10     ----   ----   ----   ----   ----
Alkali InjectTime2     15     ----   ----   ----                        ----
Deterg InjectTime1     10     ----   20
Deterg InjectTime2     15     ----
Bleach InjectTime      ----
Sour InjectTime
Softener InjectT
ChemFlush
```

Older versions of the Mentor® software provided a **Print** selection on the menu bar. This selection is replaced by a third-party software (Easy Print Screen™ © 1997 by MicroSeconds, Inc.), which is provided on the Mentor® CD. If Easy Print Screen is not installed on your Mentor® computer, install it from the CD.

4.1.1.2 Current Formula Zone

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Immediately below the menu line is the Current Formula zone, as shown in Figure 50 . The four fields of this zone are Formula Number (#), Name, Formula Class, and Reuse Enabled.

Figure 50. Current Formula Zone of Formula Programming Page

4.1.1.2.1 Formula Number

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The formula number is the unique code by which each programmed formula is identified. Mentor® allows values from 000 through 999; however, Miltrac™ systems recognize only 255 formula numbers (000-254), and Milrail systems recognize only 000-064. This number is used by the Mentor® controller for determining compatibility relationships between formulas in adjacent modules, on the operational display, and for selection of the dedicated empty and purge formulas. Once assigned by the programmer, this number cannot be changed unless the formula is copied to another number and the original formula and number are deleted.

4.1.1.2.2 Name

BNTUUP20.C13 0000239670 A.2 A.8 A.3 1/2/20 2:11 PM Released

This field displays the full name of the formula. When programming formulas, it may be best to assign meaningful names to each formula so they can be easily identified later. While a formula name may be up to 50 characters long, some on-screen lists may allow viewing of as few as 12 characters. With thoughtful naming and appropriate use of abbreviations, formula names may be kept short enough to be completely visible. One possible approach to having formula names that are both understandable in the drop-down list and explanatory in the formula programming page is to make use of combination names. For example a formula name of “WhiteVisaNap—White Visa Napkins” provides sufficient information in both views.

When programming or editing a formula, this field can be changed by replacing the old name with new text. Click once on the formula name, then make whatever changes are desired. The changes are saved when the programming screen is closed or when another formula is opened for editing.

4.1.1.2.3 Formula Class

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Formula class is a drop-down menu of all compatibility grades created by the programmer. Formula classes are groups of formulas which are sufficiently alike to be considered *compatible* with each other. If each individual formula of the maximum 999 possible were considered for incompatibility with every other formula, the result would be an unmanageable number of combinations. Formula classes allow a group of several individual formulas to be handled according to one set of compatibility rules.

For example, if a facility requires 30 different formulas to efficiently handle its various goods types and customers, the compatibility table without the benefit of formula classes would be 30 columns by 30 rows, or 900 entries. However, if there are eight white table linen formulas, all eight can be grouped into a single formula class. If this same approach is applied to all other similar formulas required by the facility, the compatibility table for the 30 formulas mentioned above will be reduced to a much smaller size. Using formula classes, a matrix of three columns by three rows might well suffice.

Because compatibility is based on the interactions among wash formulas, it is best to program as many formulas as possible before assigning them to formula classes. While programming each formula, accept the default formula class. Then, upon completion of all formula programming, determine what formula classes are necessary and create them according to the procedure described in the document on Using Compatibility (see Table of Contents). After the formula classes are created, open each formula and select the desired formula class by clicking once to highlight the text box, then scrolling to the desired class.

4.1.1.3 Time (Transfer Rate) Zone

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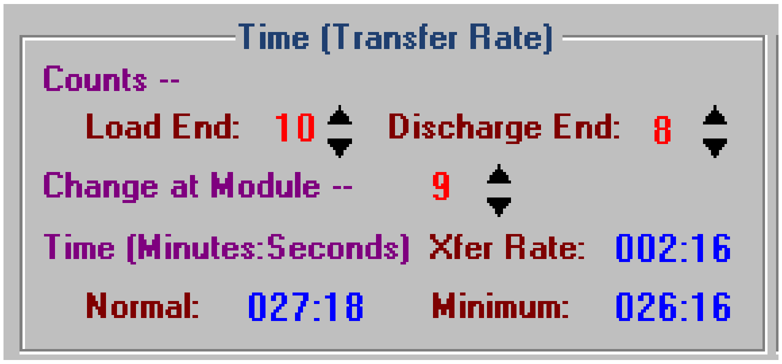
The Time zone of the formula programming page (Figure 51) allows the viewing and editing of the number of reversals a formula will perform before the goods are transferred to the next module.

Figure 51. Time (Transfer Rate) Zone



4.1.1.3.1 Load End Counts

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Load End Counts is the minimum number of reversals the formula will perform in the load end of the tunnel before transferring the goods to the next module. If formula X requires 10 reversals at the load end and all other formulas currently in the tunnel require fewer reversals, then formula X will be the one controlling transfer for the entire tunnel. However, if any formula in the tunnel requires more reversals than formula X, formula X will continue to reverse until the longer formula is ready for transfer. Change the value of this field by clicking on either the up or down arrows at the right of the value.

4.1.1.3.2 Discharge End Counts

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Discharge End Counts is the minimum number of reversals this formula will perform in modules beyond the module specified in the **Change at Module** field, provided it is the formula with the most reversals currently in the tunnel. Change the value of this field by clicking on either the up or down arrows at the right of the value.

4.1.1.3.3 Change at Module

BNTUUP20.C18 0000239699 A.2 A.8 A.3 1/2/20 2:11 PM Released

This field determines the first module of the “discharge end” of the tunnel for the purpose of changing the counts. Usually, the discharge end begins with the first module of the rinse zone. Change the value of this field by clicking on either the up or down arrows at the right of the value.

4.1.1.3.4 How “Change at Module” Aids Production

BNTUUP20.C19 0000239698 A.2 A.8 A.3 1/2/20 2:11 PM Released

Assume the formula shown in Figure 51: Time (Transfer Rate) Zone, page 106 is the longest formula in a tunnel of 12 modules. Because most formulas require more time to wash than to rinse, this formula is programmed to require a minimum of 10 reversals until it reaches module 9, then to require only 8 reversals. If this formula is followed by a series of batches using a load end count of 8 or fewer, then the number of reversals between transfers will be 10 until this formula reaches module 9, then only 8 reversals will be required to satisfy the formula. The only exception to this occurs if there is a formula further into the tunnel than this one, which requires more reversals than the minimum discharge end count for this formula. Through proper sequencing of batches, nearly every transfer can be made to occur at the minimum number of reversals, thus maximizing tunnel throughput.

4.1.1.3.5 Transfer (Xfer) Rate, Normal Time, and Minimum Time

BNTUUP20.C20 0000239697 A.2 A.8 A.3 1/2/20 2:11 PM Released

The transfer rate is calculated according to the number of reversals and the time required for each, plus a certain amount of time for transfer to be completed. A reversal is one clockwise and one counter-clockwise rotation of the cylinder. Assuming the machine does not enter a hold condition, the transfer rate determines the time between transfers according to the approximate formula below:

$$T = (R \times 10.25) + 34$$

Where:

T = Time between transfers, and

R = Formula transfer rate

The normal time is the number of minutes and seconds between when a batch of goods with this formula enters the load scoop and exits the last module of tunnel. This time is the product of the load end transfer rate and the number of modules comprising the tunnel. This time assumes that the number of counts required at the load end is maintained throughout the tunnel, as would be the case if every module of the tunnel were running this same formula simultaneously.

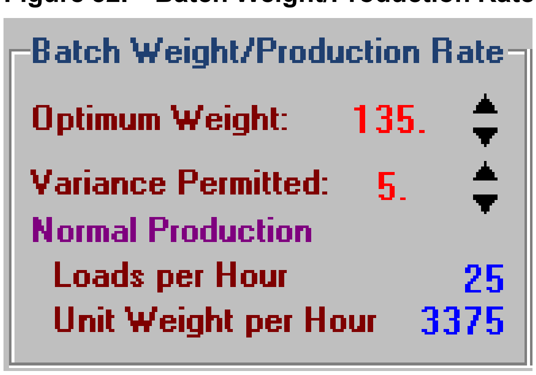
The minimum time is the sum of the load end transfer rate multiplied by the number of load end modules, plus the discharge end transfer rate times the number of discharge end modules. For example, according to the data shown Figure 51: Time (Transfer Rate) Zone, page 106 , the minimum time is based on the assumption that this formula is the longest formula in the tunnel. If every other formula in the tunnel requires 10 reversals or fewer before transfer, the total time for a batch to pass completely through the tunnel is 27 minutes and 18 seconds.

4.1.1.4 Batch Weight/Production Rate Zone

BNTUUP20.C21 0000239695 A.2 A.8 A.3 1/2/20 2:11 PM Released

This zone, illustrated in Figure 52 , contains information relevant to how the loading conveyor or rail system should be loaded for goods requiring this formula.

Figure 52. Batch Weight/Production Rate Zone



4.1.1.4.1 Optimum Weight

BNTUUP20.C22 0000239694 A.2 A.8 A.3 1/2/20 2:11 PM Released

This field is the ideal weight, expressed as soiled weight, for a batch requiring this formula. Change the value of this field by clicking on the up and down arrows to the right of the value. Generally, cotton goods are processed with heavier batch weights than goods containing significant amounts of synthetic fibers, but actual optimum weights must be determined by the internal dimensions of the tunnel cylinder and experimentation with the specific goods being processed. Soil content and the amount of moisture in the soiled goods must also be considered. For systems configured for a Milnor® loading device with a weigh scale or certain other weighing loading devices, the values entered here are communicated to the loading device to aid in consistent loading of the tunnel.

4.1.1.4.2 Variance Permitted

BNTUUP20.C23 0000239693 A.2 A.8 A.3 1/2/20 2:11 PM Released

The variance is the range above and below the optimum weight which the loading device will consider sufficiently accurate. For instance, assume the optimum weight for a formula is 135 pounds, as shown in Figure 52: Batch Weight/Production Rate Zone, page 107 . With a variance of 5 pounds, a load weighing between 130 and 140 pounds will be accepted.

4.1.1.4.3 Partial Load Weight

BNTUUP20.C24 0000239692 A.2 A.8 A.3 1/2/20 2:11 PM Released

Used primarily with G4 tunnel washers, the value entered here is the maximum weight of a partial load if the Detect Partial Load option is enabled on the Hardware Configuration screen. Any load with a weight that is equal to or less than the number entered here will be flagged as a partial load. Any load with a weight that is greater than the number entered here will be counted as a full load.

4.1.1.4.4 Normal Production

BNTUUP20.C25 0000239691 A.2 A.8 A.3 1/2/20 2:11 PM Released

The normal production of a formula is based on the optimum weight, the number of tunnel modules, and the normal batch time described above. Loads per hour is the number of loads that can be processed in the tunnel washer at the normal time shown in the Time zone of this display. Unit weight per hour is simply the number of loads per hour multiplied by the optimum weight of each load.

4.1.1.5 Post-Wash Codes Zone

BNTUUP20.C26 0000239720 A.2 A.8 A.3 1/2/20 2:11 PM Released

Post-wash codes are passed from the tunnel washer to the device which receives the goods as the tunnel discharges them. The available codes are shown in Figure 53 .

Figure 53. Post-Wash Codes Zone

For all fields except **Single Cake** and **Pass Empty**, the value may be changed by either clicking on the up or down arrows to the right of the field, or placing the text cursor within the field and editing the value directly.

4.1.1.5.1 Drycode

BNTUUP20.C27 0000239719 A.2 A.8 A.3 1/2/20 2:11 PM Released

The value entered in this field represents the drycode that should be used by the dryer in processing the goods. This number corresponds to the specific drycode which the dryer will run when it receives this batch. Valid drycode numbers are 01 through 16 unless Mildata® is used in the system; Mildata® allows up to 100 drycodes.

4.1.1.5.2 Extract

BNTUUP20.C28 0000239718 A.2 A.8 A.3 1/2/20 2:11 PM Released

The extract code is similar to the drycode. Valid numbers of 01 through 16 inform the centrifugal extractor which extract formula to perform when loaded with goods processed with this formula.

4.1.1.5.3 Destination

BNTUUP20.C29 0000239717 A.2 A.8 A.3 1/2/20 2:11 PM Released

This value is used to route goods after discharge from the dryer. If this system employs the Milnor® Miltrac™ goods tracking system, there are a maximum of 64 destination codes. For non-Miltrac™ systems, there are a maximum of eight destination codes.

4.1.1.5.4 Pressure

BNTUUP20.C30 0000239716 A.2 A.8 A.3 1/2/20 2:11 PM Released

This drop-down menu allows the programmer to choose whether to extract/main press the goods, and if so, what pressure to use. Select “0” to press the goods at standard extraction or pressure. Select a value of “1” to avoid extracting/main pressing the goods. Use “2” to achieve the lowest extract pressure, or “3” to achieve low extract pressure. If the press provides only two extract pressures and a “3” is entered here, the press defaults to a value of “0” and processes the goods at standard pressure.

4.1.1.5.5 Single Cake

BNTUUP20.C31 0000239715 A.2 A.8 A.3 1/2/20 2:11 PM Released

A check in this box indicates that this batch should be handled as a single cake batch, thus preventing a combination of two or more batches with this same formula into a dryer, even if that dryer is capable of handling two or more batches of this size simultaneously. Consequently, the dryer will use the "partial load" drycode corresponding to the drycode number entered earlier. This field is also used for large bed linen or other item that may be difficult to separate if processed at the maximum capacity of the dryer.

4.1.1.5.6 Pass Empty

BNTUUP20.C32 0000239749 A.2 A.8 A.3 1/2/20 2:11 PM Released

This check box should be enabled for the dedicated automatic pass empty pocket formula and the dedicated automatic purge pocket formula. A check here informs the receiving device that there are no goods to be processed, thus saving the press from cycling with no goods, etc. This field does not influence tunnel loading.

CAUTION: **Avoid Improper Loading of Extraction Device** — If a formula which is actually used to process goods is coded with the pass empty value, double loads may well occur in the pre-press.

4.1.1.5.7 Cooldown

BNTUUP20.C33 0000239748 A.2 A.8 A.3 1/2/20 2:11 PM Released

This field applies only if Data Pass is enabled on the **Configuration/Hardware** page. The value entered here is passed to the dryer along with the load to invoke the desired cooldown in non-Milnor® dryers (Milnor® dryers cool down automatically).

4.1.1.6 PulseFlow® Zone

BNTUUP20.C34 0000239746 A.2 A.8 A.3 1/2/20 2:11 PM Released

Values and prompts appear in this zone only if the tunnel washer is configured as a PulseFlow® machine.

Figure 54. The PulseFlow® Zone of the Formula Programming Page

4.1.1.6.1 Flush Amount

BNTUUP20.C35 0000239745 A.2 A.8 A.3 1/2/20 2:11 PM Released

Enter the amount of water to flush into the first module as these goods are loaded into the tunnel washer. This value is a volume only and does not consider any value for time.

4.1.1.6.2 Flow Counts

BNTUUP20.C36 0000239744 A.2 A.8 A.3 1/2/20 2:11 PM Released

For each split flow pump, the pump turns on when this number of counts remains before the goods transfer to the next module. For pumped flow pumps, this value is automatically filled when the counts for the main pump are programmed.

4.1.1.6.3 Flow Amount

BNTUUP20.C37 0000239743 A.2 A.8 A.3 1/2/20 2:11 PM Released

Enter the amount of water to flow when PulseFlow® is active. For pumped flow pumps, this value is automatically filled when the amount for the main pump is programmed. This value is a volume only and does not consider any value for time. The units are determined by the flowmeter setup.

4.1.1.6.4 Water Usage

BNTUUP20.C38 0000239742 A.2 A.8 A.3 1/2/20 2:11 PM Released

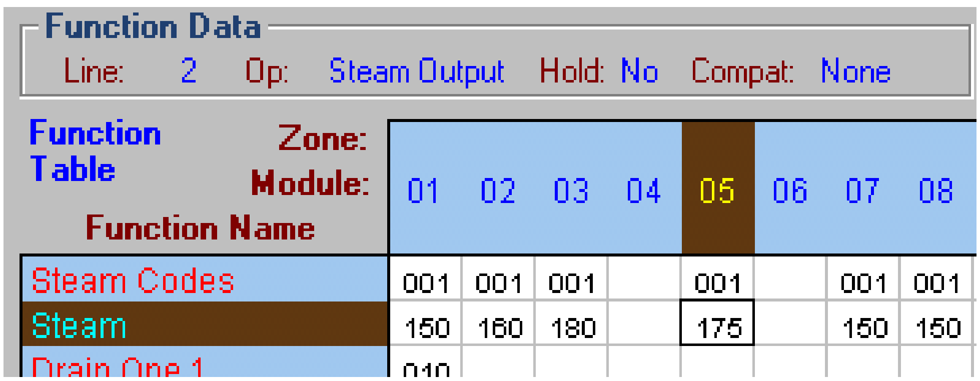
This is the PulseFlow® water usage, not the fresh water usage. This value is for information only. This value is the result of dividing the optimum weight by the flow amount.

4.1.1.7 Function Data Zone

BNTUUP20.C39 0000239741 A.2 A.8 A.3 1/2/20 2:11 PM Released

The Function Data zone (Figure 55) contains non-editable information to prompt the programmer on how the function was defined and to aid in understanding the relationships between functions and the current formula.

Figure 55. Function Data Zone



The Line value indicates the current line number in the Function Table grid (described below). It has no relation to the programmed functions described in the document about Assigning Functions.

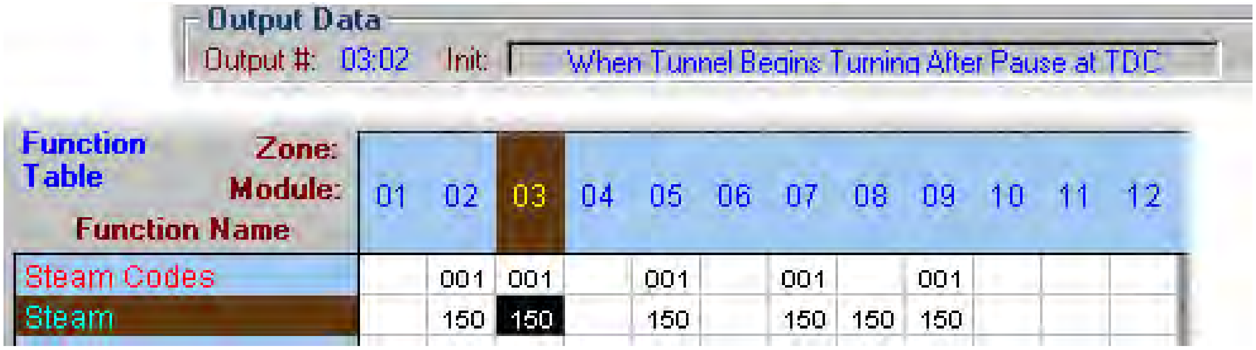
The **Op**, **Hold**, and **Compat** values represent the operational, hold, and compatibility characteristics of the function currently highlighted in the Function Table grid below. These values can be changed according to procedures described in “Assigning Functions” (see Contents).

4.1.1.8 Output Data Zone

BNTUUP20.C40 0000239762 A.2 A.8 A.4 1/2/20 2:11 PM Released

The output data zone displays information relating to the output relay which operates the selected function. See Figure 56 .

Figure 56. Output Data Zone and Partial View of Function Table



The Output Number field (Output #) displays the current module and output relay (bit) in the format Module:Bit. This is closely connected to how the tunnel and control system are wired during manufacture and programmed on the **Function Programming** page, this it is not editable on this display. The Init field shows the initialization code that controls when the highlighted function operates. Init codes are explained in detail in “Assigning Functions” (see Contents).

In Figure 56 above, the output number is 03:02 and is defined to initialize when the tunnel begins turning after the pause at top dead center. Notice that module 03 is highlighted in the function table, corresponding to the “03” part of the output number. The “02” part of the number denotes that this is the second output in that module.

4.1.1.9 Function Table

BNTUUP20.C41 0000239760 A.2 A.8 A.3 1/2/20 2:11 PM Released

The Function Table of the **Formula Programming** page consists of functions arranged vertically along the left side of the grid and module number arranged horizontally across the top of the grid. Where a function (row) and a module number (column) intersect is the value for that function in that module.

To change the value of a function for the current formula, select the cell where the desired function intersects with the desired module. If the cell turns from white to black, the selected function is not available in that module (i.e., the function is not wired or programmed on the Function Programming page for that module). If the cell is outlined in black, enter the desired value for the function. Remember that function values are usually seconds of time, but are degrees for temperature functions or units for chemical functions if the chemical functions were assigned on the Chemical Pump Flow Rate page. If the cell changes to contain a downward-pointing arrow, a drop-down menu is available. Click on the arrow to view the available choices, then click on the desired option.

4.1.2 How to Program a Formula

BNTUUP20.C42 0000239759 A.2 A.8 A.3 1/2/20 2:11 PM Released

Tunnel formulas are programmed at the Mentor® controller by assigning values—time, temperature, or quantity—to the desired functions in each module. As a batch of goods moves through the tunnel from the load end to the discharge end, the formula moves along with it, causing the desired actions in each module.

4.1.2.1 The Formula Menu

BNTUUP20.C43 0000239758 A.2 A.8 A.3 1/2/20 2:11 PM Released

The Formula menu provides the tools for creating, editing, copying, and deleting formulas, as explained earlier in the Menu part of this document. The programmer may ultimately save time by examining existing formulas for one that is similar to the desired formula. Copying an existing source formula to a new target formula prevents the necessity of entering data that was already programmed in the source formula, as well as eliminating errors that may be introduced by inaccurate entering of the program data. The procedure for copying and editing an existing formula is described later in this document.

If the desired formula has no significant relation to an existing formula, choose **New** from the menu, then proceed with programming as described below.

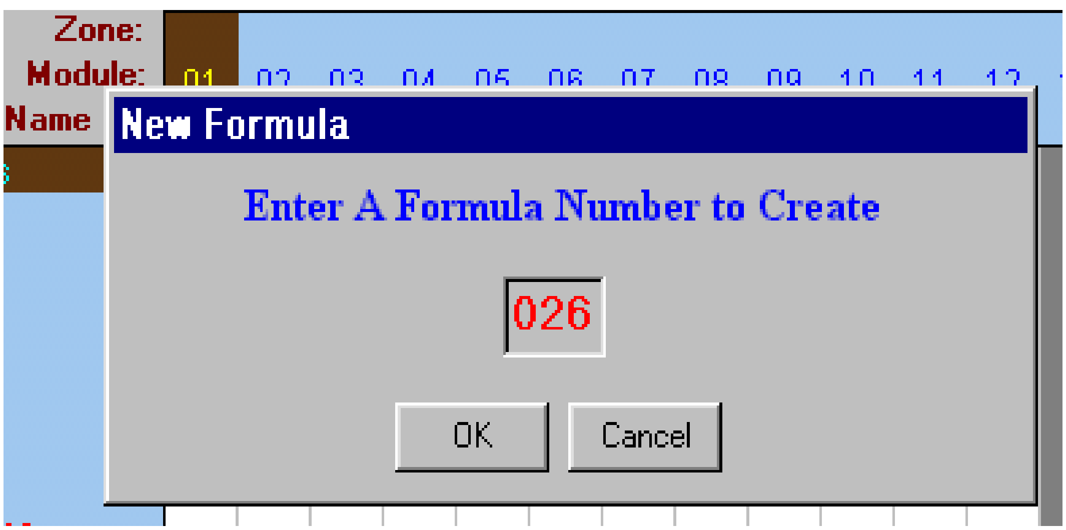
4.1.2.2 Creating a New Formula

BNTUUP20.T01 0000239756 A.2 A.8 A.3 1/2/20 2:11 PM Released

1. Select **New** from the Formula menu.
2. When prompted (Figure 57), enter a formula number for the new formula. This number must be one that is not already assigned to an existing formula.
3. Click once on the **OK** button to confirm the formula number.

The Mentor® controller will create a copy of Formula 0 with the new formula number. Formula 0 is usually assigned to the formula for an empty pocket, thus it will have minimal programming that might require modification.

Figure 57. New Formula Dialog Box

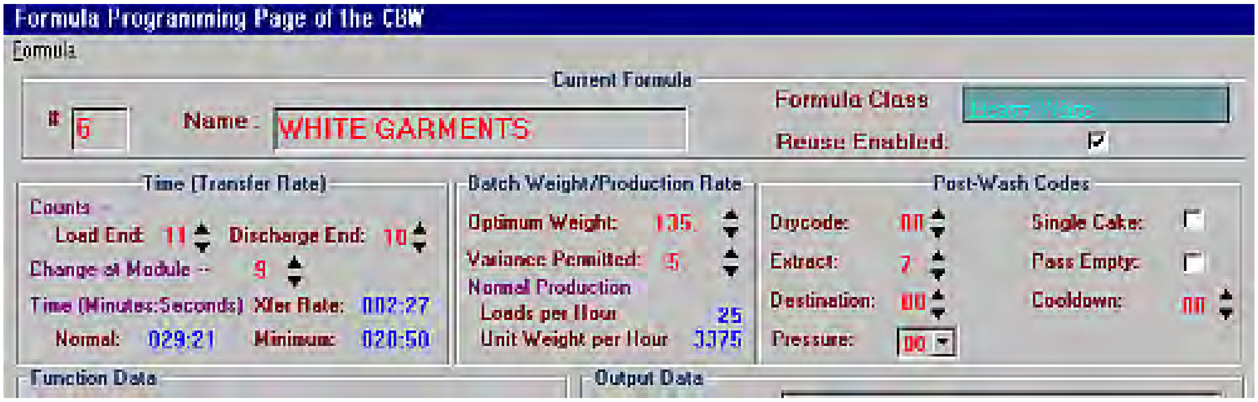


4.1.2.3 Programming the Formula Characteristics

BNTUUP20.C44 0000239754 A.2 A.8 A.3 1/2/20 2:11 PM Released

With the new formula created as a copy of Formula 0, it inherits all characteristics of Formula 0, including name, transfer time, and post-wash codes. Edit each item above the function table to reflect the new formula. For the example used here, the new formula is being created for white cotton table napkins, a heavy soil, all cotton item. Figure 58 illustrates the formula characteristics that should be verified or modified as necessary.

Figure 58. Formula Characteristics



NOTE: The information used for this sample formula is for explanation only. While the formula is valid for the system on which it is programmed, it may not provide desired results in other systems, such as those with shorter tunnels or varying options.

4.1.2.3.1 Name the Formula

BNTUUP20.C45 0000239753 A.2 A.8 B.2 5/19/20 11:37 AM Released

Enter a name for the formula that will be meaningful to the operator. While the Mentor® controller will accept up to 50 characters for the formula name, names longer than 12 characters might not be completely visible when the operator is prompted to select a formula.

4.1.2.3.2 When to Assign the Formula Class

BNTUUP20.C46 0000239773 A.2 A.8 A.3 1/2/20 2:11 PM Released

As explained in Section 4.1.1.2.3 : Formula Class, page 105 earlier in this document, the formula class should be assigned after all formulas are created and evaluated for efficient grouping. Accept the default value for this field until all formulas are programmed.

4.1.2.3.3 Define the Transfer Rate

BNTUUP20.C47 0000239772 A.2 A.8 A.3 1/2/20 2:11 PM Released

Transfer rate is determined in part by the number of reversals required before a load of goods passes from one module to the next. Adjust this value to maximize wash quality and production rate for each formula, beginning with the values for various soil levels shown in the following table.

Table 5. Approximate Transfer Rates by Soil Class

Soil Class	Recommended Time in Wash Zone	Examples of Goods
Light Soil	5-7 minutes	Operating room goods, sheets, towels, patient gowns, thermal bath blankets
Medium Soil	9-10 minutes	Incontinent pads, Visa table linen
Heavy Soil	10-12 minutes	Uniforms, cotton table napkins
Extra Heavy Soil	13-15 minutes	Shop towels, bar mops, industrial garments, diesel mechanic uniforms

The tunnel system described for this example is a typical 12-module tunnel. The first module is designated the flush zone, meaning no bath liquor can counterflow into this module. The next five modules (modules 2 through 6) comprise the wash zone. The time the goods are within the wash zone is the value stated in the table above. Other zones do not count in this calculation. Modules 7 through 9 are the bleach zone, and modules 10 and 11 are the rinse zone. The last module is designated the finish zone. For more detailed information on zones in the Milnor® CBW®, see “Using the Water Flow Features…” in manual MATCBWTRAE.

To achieve the recommended time of 10 to 12 minutes in the wash zone, first divide 10 minutes by the number of modules in the wash zone. In this example there are five wash zone modules, so there should be from 2:00 to 2:24 between transfers, as shown below:

10:00 ÷ 5 modules = 2:00 per module, or

12:00 ÷ 5 modules = 2:24 per module

Determine the number of seconds for one reversal of the tunnel. This value will be approximately 11.5 seconds, but should be measured with a stopwatch to ensure accuracy. When the cylinder stops, start the stopwatch. When the cylinder stops again at the same position, stop the stopwatch. For the most accurate measurement, average the times of several reversals.

Divide the required time in the wash zone (e.g., 2:24) by the time for one reversal (e.g., 11.5 seconds). Converting all time to seconds simplifies this calculation:

2:24 = 120 + 24 = 144 seconds

Therefore,

144 ÷ 11.5 = 12.52 reversals

Round this value to the nearest whole number. In this case, program 13 reversals in each module of the wash zone.

4.1.2.4 Programming Temperature in the Function Table

BNTUUP20.C48 0000239771 A.2 A.8 A.3 1/2/20 2:11 PM Released

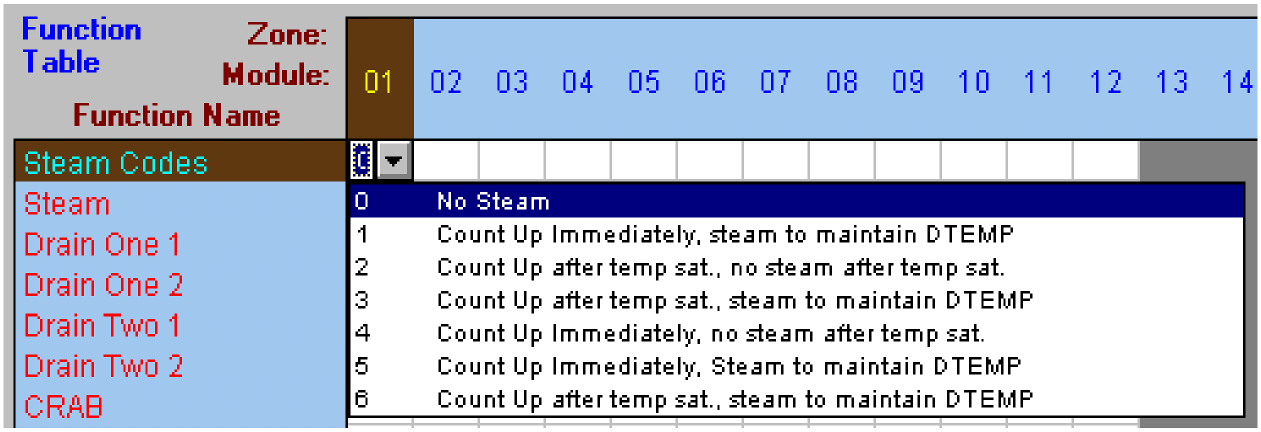
A logical approach to programming a new formula is to consider what actions are desired in each module, then to make the appropriate entries on the formula programming page to cause those actions to occur. The only significant exception to this approach is the assignment of temperature values.

4.1.2.4.1 Assigning Steam Codes

BNTUUP20.C49 0000239769 A.2 A.8 A.3 1/2/20 2:11 PM Released

Because bath temperatures should change gradually to prevent thermal shock, it is easier to program all steam codes and temperatures first, then program all other functions for a single module at one time. Steam codes control the relationship between steam and the reversal counter, as well as whether temperature is maintained after it is first achieved. Figure 59 illustrates the available steam codes.

Figure 59. Available Steam Codes



4.1.2.4.1.1 Steam Code 0

BNTUUP20.C50 0000239768 A.2 A.8 A.3 1/2/20 2:11 PM Released

Use steam code 0 if steam is available in the module, but will not be used for this formula. This steam code causes the Mentor® controller to ignore the temperature of the module.

4.1.2.4.1.2 Steam Code 1

BNTUUP20.C51 0000239767 A.2 A.8 A.3 1/2/20 2:11 PM Released

Use steam code 1 if reversals conducted before achieving the programmed temperature will not overly compromise wash quality. Using steam code 1, reversals are counted and steaming begins as soon as the liquor level in the module is achieved. When the desired temperature is achieved, the steam valve closes. When the temperature in the module drops by the number of degrees programmed for Differential Temperature (at **Configuration/Operating Parameters/Program Constants**), the steam valve opens again and remains open until the programmed temperature is achieved. This continues until the programmed number of reversals are counted. This is the most commonly used steam code.

4.1.2.4.1.3 Steam Code 2

BNTUUP20.C52 0000239766 A.2 A.8 A.3 1/2/20 2:11 PM Released

Use steam code 2 if reversals should only be counted after temperature is achieved and if temperature does not need to be maintained. Note that the tunnel normally continues reversing even though the counter is not engaged. The counter is engaged with the first reversal after temperature is achieved. Also, after the programmed temperature is achieved after transfer, steam in this module is not turned on again until the next load is transferred.

4.1.2.4.1.4 Steam Code 3

BNTUUP20.C53 0000239765 A.2 A.8 A.3 1/2/20 2:11 PM Released

Steam code 3 combines the counting characteristic of steam code 2 with the temperature maintenance characteristic of steam code 1. The counter is engaged only after temperature is first satisfied, and steam is turned on any time the temperature in the module falls below the programmed temperature minus the configured differential temperature.

4.1.2.4.1.5 Steam Code 4

BNTUUP20.C54 0000239764 A.2 A.8 A.3 1/2/20 2:11 PM Released

Use steam code 4 to begin counting reversals before temperature is achieved, but without steaming to maintain temperature after it is first achieved.

4.1.2.4.1.6 Steam Code 5

BNTUUP20.C55 0000239785 A.2 A.8 A.3 1/2/20 2:11 PM Released

Steam code 5 is similar to steam code 1, with the exception that differential temperature is not considered. If a value of 175 is programmed with a steam code of 5, steaming will stop at 175 degrees and begin again when the temperature falls to 174 degrees. One case for the use of this steam code is if the configured differential temperature is a relatively large value, perhaps 10 degrees. While this broad differential temperature may work well for most formulas, there may be one or two formulas requiring a much more limited temperature range. Steam code 5 effectively limits the temperature swing to a very narrow range, generally to within three degrees above or one degree below the desired temperature.

4.1.2.4.1.7 Steam Code 6

BNTUUP20.C56 0000239784 A.2 A.8 A.3 1/2/20 2:11 PM Released

Steam code 6 has all the characteristics of steam code 5, except counting starts only after temperature is first achieved.

4.1.2.4.2 Programming Temperature Values

BNTUUP20.C57 0000239783 A.2 A.8 A.4 1/2/20 2:11 PM Released

Desired temperatures are best determined by consultation between laundry management and the chosen chemical supplier, but the following information and guidelines should be considered.

Table 6 and Table 7 below represent the 12 modules of the sample tunnel washer used in this document.

Table 6. Module Temperature Characteristics (First 6 Modules)

	Module 1	**Module 2**	**Module 3**	**Module 4**	**Module 5**	**Module 6**
Zone	Flush	Wash	Wash	Wash	Wash	Wash
Steam?	Yes	Yes	Yes	No	Yes	No
Desired Temperature	165	175	175	not applicable	165	not applicable

Table 7. Module Temperature Characteristics (Second 6 Modules)

	Module 7	**Module 8**	**Module 9**	**Module 10**	**Module 11**	**Module 12**
Zone	Bleach	Bleach	Bleach	Rinse	Rinse	Finish
Steam?	Yes	Yes	Yes	Yes	No	No
Desired Temperature	155	150	135	120	not applicable	not applicable

As illustrated in the tables above, steam is available in modules 1 through 3, 5, and 7 through 10. The temperature in modules not equipped with steam valves is determined by the heat brought into the module with the goods at transfer and the counterflowing bath liquor from the next module.

As a general guideline for temperature management, command temperatures to change less than about 15 degrees Fahrenheit (approximately 8 degrees Celsius) from one module to the next. Note in the tables above how this guideline is implemented. While modules 4 and 6 cannot be controlled directly because they have no steam valves, the heat transferred with the goods and introduced through normal counterflow maintains acceptable temperatures in these modules.

Set the desired temperature value for each module by selecting the cell at the intersection of the "Steam" row and the desired module, then clicking again to access the value for editing. If the cell changes to black, then steam is not available in that module according to the function programming page. If the module is obviously equipped with a steam valve, verify that the steam function is enabled on the function page.

After entering the desired temperatures for all modules equipped with steam, press **Enter** in the last cell changed before exiting the formula programming page.

4.1.2.4.3 Programming Functions Other than Temperature

BNTUUP20.C58 0000239782 A.2 A.8 A.3 1/2/20 2:11 PM Released

When the steam code and temperature in each module of the tunnel have been assigned, all other functions of each module should be programmed. Ideally, after determining and programming temperatures, every function of the first module should be programmed. These may include drains, valves, and chemicals, among others.

4.1.2.4.3.1 Drains

BNTUUP20.C59 0000239781 A.2 A.8 A.3 1/2/20 2:11 PM Released

Most Milnor® tunnel washers are equipped from the factory with two drains in the first module of each zone. Each drain is normally controlled by two separate function bits, allowing each module with two drains to be emptied and refilled up to four times per formula. This is accomplished by assigning each function bit a different initialization (init) code.

Standard names for the two drains are *Drain One* and *Drain Two*. On the **Formula Programming** page, these drains and their init codes are called Drain One 1, Drain One 2, Drain Two 1, and Drain Two 2. If Drain One 1 is assigned an init code of G (when count-up reaches halfway point), and Drain One 2 is assigned an init code of H (during transfer when tunnel is committed), then Drain One can be opened at the midpoint of the formula and at the end of the formula. This allows, for example, a partial drain halfway through the formula, then a complete drain during transfer.

4.1.2.4.3.2 CRAB (Conveyor Bypass)

BNTUUP20.C60 0000239816 A.2 A.8 A.3 1/2/20 2:11 PM Released

CRAB is an output which bypasses the load end photo-eye of the conveyor when enabled. It allows the conveyor to advance empty pockets via the empty pocket formula without error messages. This function is usually assigned to be backward compatible with the previous position so the first module can signal the conveyor to allow transfer of an empty pocket. This function is programmed only for formulas within the Empty goods classification, including the empty pocket and purge pocket formulas.

4.1.2.4.3.3 Flow-Not

BNTUUP20.C61 0000239815 A.2 A.8 A.3 1/2/20 2:11 PM Released

The *Flow-not* function controls a valve which prevents the normal counterflow of bath liquor from the discharge end of the tunnel toward the load end. The *flow-not valve* diverts the contaminated bath liquor from the normal flow to the drain trough. A common application of this feature is if white goods must follow goods with a tendency to bleed (e.g., new red goods). Normal counterflow would allow the bath liquor contaminated with red dye to flow into the module with the white goods, thereby discoloring the white goods. By enabling the flow-not valve, the discolored bath liquor leaving the module is diverted to the sewer rather than the next upstream module.

4.1.2.4.3.4 Rinse Enhance

BNTUUP20.C62 0000239814 A.2 A.8 A.3 1/2/20 2:11 PM Released

Rinse enhance controls a valve which introduces additional fresh water into the rinse zone.

4.1.2.4.3.5 Rinse Flow

BNTUUP20.C63 0000239813 A.2 A.8 A.3 1/2/20 2:11 PM Released

Main incoming rinse water entering the CBW®. This is the main water source supplying all of the counter-flow water for the tunnel. It is usually piped to the last or next-to-last module.

4.1.2.4.3.6 Reuse Tank Drain

BNTUUP20.C64 0000239812 A.2 A.8 A.3 1/2/20 2:11 PM Released

Used for programming the reuse tank to drain if a formula in the last storage position is following an incompatible formula or to clean out a buildup of solids in the bottom of the tank.

4.1.2.4.3.7 Fast Fill Standing Bath

BNTUUP20.C65 0000239811 A.2 A.8 A.3 1/2/20 2:11 PM Released

A fast fill valve for a standing bath module. This is a module which never has counterflow or any form of continuous flow. This function will open the fast fill valve any time the level switch for that module signals a low level for a particular time period, usually for a few seconds. This function is most often used for the finish zone of the tunnel washer.

4.1.2.4.3.8 Wash Enhance

BNTUUP20.C66 0000239810 A.2 A.8 A.3 1/2/20 2:11 PM Released

Wash enhance controls a valve which introduces additional fresh water into the wash zone. Wash enhance should always be used in conjunction with rinse enhance. When used in conjunction with Rinse Enhance, a second water flow rate can be achieved.

4.1.2.4.3.9 Chemicals

BNTUUP20.C67 0000239809 A.2 A.8 A.3 1/2/20 2:11 PM Released

These functions are not pre-programmed at the Milnor® factory. Because of the many variables in chemical supply systems, chemical functions for each module must be programmed specifically for each installation. Refer to the document on programming chemicals for detailed information.

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4.2 Using Compatibility

BNTUUP15.C01 0000222416 A.2 A.9 A.4 1/2/20 2:11 PM Released

4.2.1 Description of Compatibility Types

BNTUUP15.C02 0000222414 A.2 A.9 A.4 1/2/20 2:11 PM Released

Milnor® CBW® tunnel washer systems provide three compatibility functions: chemical, goods, and long distance. This document describes the purpose and use of each of these functions.

4.2.1.1 Chemical Compatibility (First Dosing)

BNTUUP15.C03 0000222413 A.2 A.9 A.4 1/2/20 2:11 PM Released

The Mentor® controller has the ability to automatically adjust the amount of chemical injected according to a set of rules similar to, “If heavily soiled white goods follow an empty or purge pocket, inject up to three times as much chemical as the formula commands.” This ability—called *chemical compatibility* or *first dosing*—improves wash efficiency and reduces re-washes by bringing chemical concentrations in a module to the required concentration immediately. If chemical compatibility is not employed, two or three transfers might be required for the normal chemical injections to adjust chemical concentrations to the required levels.

4.2.1.2 Goods Compatibility (Bath Exchange)

BNTUUP15.C04 0000222496 A.2 A.9 A.3 1/2/20 2:11 PM Released

Goods compatibility, also known as bath exchange, is used to prevent contamination of good goods with bad liquor from the next module toward the discharge end of the tunnel. Milnor® tunnel washers employ counterflow to improve dilution, meaning that goods flow toward the discharge end of the tunnel washer (toward cleaner liquor), while the bath liquor flows in the opposite direction, toward goods with more soil. Goods compatibility handles situations in which the counterflowing bath liquor that the goods are about to enter is not compatible with the goods. An example of this is liquor from a load of new dyed goods. This liquor likely contains a high concentration of dye that would discolor any white goods it contacts. Bath exchange causes the bad liquor to drain out of the module before the good goods enter, thus preventing the white goods from contacting the colored liquor.

4.2.1.3 Long Distance Compatibility

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In much the same way as goods compatibility keeps goods from contacting incompatible bath liquor from an adjacent module, long distance compatibility guards against exposing goods to incompatible bath liquor from a non-adjacent module. The reuse tank is normally filled from the first module of the rinse zone, via the rinse zone flow splitter. This liquor is used to flush goods down the load scoop of the tunnel and to fill the first module. If one or more loads of colored goods prone to bleeding are in the rinse zone, the liquor sent to the reuse tank may contain sufficient dye to discolor light colored goods in the first module. If goods in the rinse zone (near the discharge end of the tunnel washer) are incompatible with goods in the last storage position (about to enter the tunnel washer), long distance compatibility can be used to divert the rinse zone liquor to the sewer rather than pumping it to the reuse tank.

4.2.2 Chemical Compatibility (First Dosing)

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Chemical compatibility, or *first dosing*, is a feature of the Mentor® controller which adjusts the programmed chemical injection if the formula previously in that module called for more or less of the chemical, or if the formula was the *empty pocket* or *purge pocket* formula (see Section 4.3 : Interval Purge, Automatic Empty Pockets, and Automatic Purge Pockets, page 127 for more information).

Chemical compatibility is enabled on the **Function Programming** page, then configured using the **First Dosing Multiplier to Set Upper Limit** table, both shown in Figure 60 . **The First Dosing**... table is accessed from the **Programming/Compatibility/First Dosing Multiplier Table** menu selection.

Figure 60. Sample Displays for Chemical Compatibility

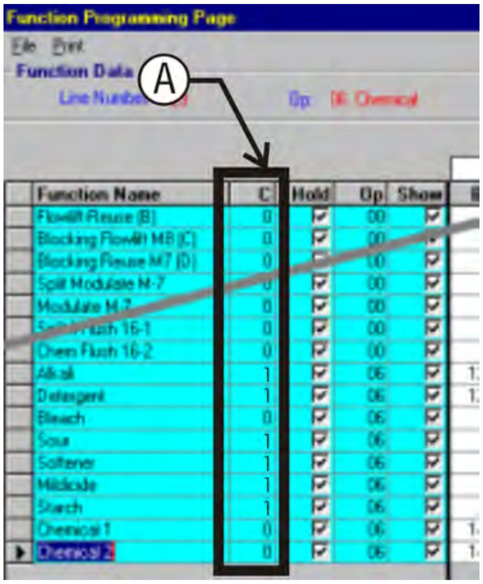
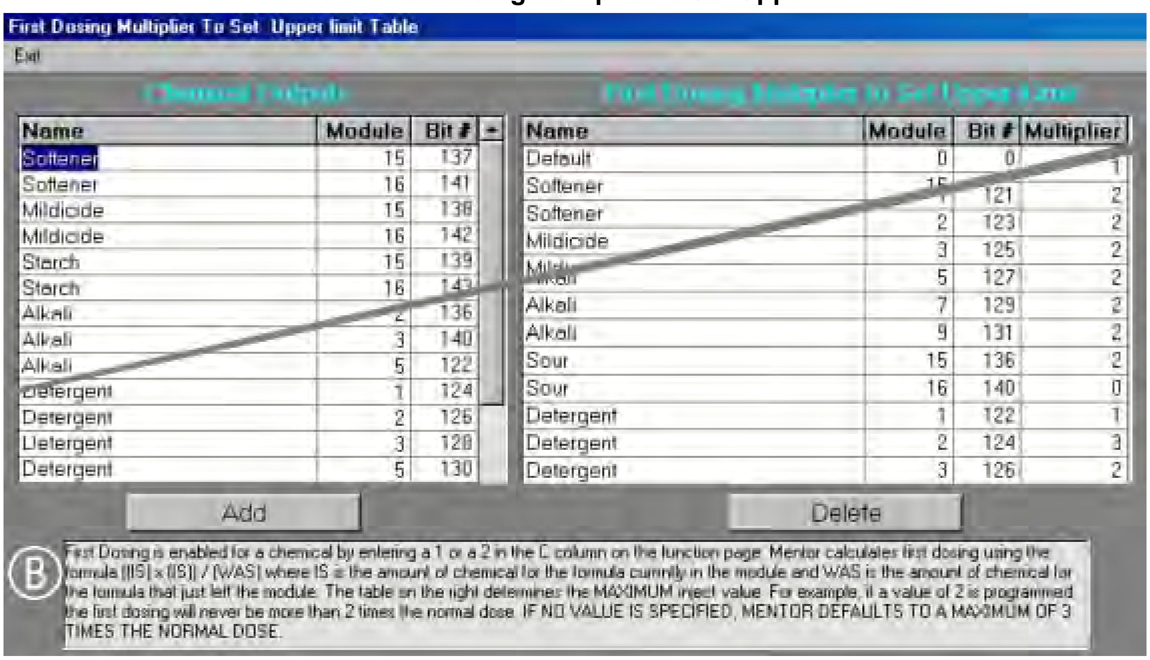
Function Page	Legend
	**A. . .** Compatibility column **B. . .** Multiplier description (not shown in versions prior to 90100)

Table of First Dosing Multiplier to Set Upper Limit



If either forward or backward compatibility is enabled for a chemical, the Mentor® controller calculates the required dosage of that chemical at each transfer. The internal formula used in this calculation is based on the amount of chemical that was injected during the formula that just left the tunnel pocket (*WAS*) and the amount that would normally be injected for the formula about to enter the pocket (*IS*, or the *maintenance dose*). This is the equation:

$$T_i = (IS)^2 / (WAS)$$

Where:

T_i = Desired duration of chemical “first dosing” injection in seconds

IS = Duration of normal maintenance dose for formula that **IS** in this module

WAS = Duration of dose that **WAS** injected in this module

An example makes this calculation easy to understand. Assume that heavy soiled white cotton goods are following light soil white cotton goods. Normal maintenance dosing would eventually bring chemical concentrations to the higher level desired for the heavy soil formula, but only after some batches had passed through with low chemical concentrations. The Mentor® controller sees the shortfall in this situation and adjusts the amount of chemical injected to bring concentrations to the correct level immediately. If the light soil white formula calls for 20 units of detergent, and the heavy soil formula calls for 30 units, the Mentor® controller makes the following calculation:

$$T_i = 30^2 / 20 = 900 / 20 = 45$$

Thus, the Mentor® controller will call for 45 units of detergent in the first load of heavy soil white goods to follow light soil white goods. However, if the heavy soil formula follows an empty pocket, the equation sets the *previous dose* value to 1, possibly resulting in the injection of far too much chemical (900 units in the example above). The *First Dosing Multiplier to Set Upper Limit* restricts the maximum value of the first dosing chemical injection to 1, 2, or 3 times the maintenance dose.

Let's use another example to show the effect of the *First Dosing Multiplier to Set Upper Limit*. Assume that a normal maintenance dose of a chemical is 30 seconds for heavy soil and 10 seconds for light soil. If heavy soil goods follows light soil goods, the first dosing equation works out like this:

$$T = 30^2 / 10 = 900 / 10 = 90$$

Because 90 is three times the normal maintenance dose, a *First Dosing Multiplier...* of 3 has no effect. However, if the *First Dosing Multiplier...* is set to 2, the injection will not be allowed to exceed two times the normal maintenance dose. This would limit the injection to a maximum of 60 units.

4.2.2.1 Chemical Outputs Table

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The **Chemical Outputs** table on the left of the **First Dosing Multiplier...** display is a list of all functions designated as chemicals by entering the *Chemical op code* (06) on the **Function Programming** page. This table also shows the module associated with the function, and the bit number (output relay) in the associated module.

Because all information in the **Chemical Outputs** table is derived from assigned chemical functions, the information on this page can only be modified on the **Function Programming** page, which is accessed through the **Programming/Functions** menu selections.

4.2.2.2 First Dosing Multiplier to Set Upper Limit Table

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On the right side of the display is the **First Dosing Multiplier to Set Upper Limit** table. This table includes the selected chemical functions from the **Chemical Outputs** table, plus an additional **Multiplier** column. The value entered in the multiplier column is how many times the normal chemical injection is commanded during the first dosing cycle under the following conditions:

- compatibility is enabled for this chemical **and**
- the previous formula in the pocket was either the empty pocket or purge pocket formula **or**
- the previous formula in the pocket did not call for this chemical **or**
- the formula used by the Mentor® controller to calculate first dosing would cause an even longer injection time.

4.2.2.2.1 How to Enable First Dosing for Chemicals

CAUTION: **Avoid Damaging Goods and Wasting Chemicals** — The first dosing equation described in Section 4.2.2 : Chemical Compatibility (First Dosing), page 120 applies to all chemicals on the **Function** page for which compatibility is enabled.

▶ **Do not enable compatibility for any chemical unless you understand the results.**

▶ Enter each chemical which uses forward compatibility or backward compatibility into the **First Dosing Multiplier** table, then adjust the **Multiplier** value.

1. On the **Function** page, set the *Compatibility* for the desired chemical to either *1=Forward* or *2=Backward*. Compatibility is available under column heading “C” (Compatibility), shown in Figure 60: Sample Displays for Chemical Compatibility, page 121 .

   NOTICE: The first dosing value for this chemical is now 3. Change this value in the **First Dosing Multiplier** table.

2. Copy each chemical with either forward or backward compatibility from the **Chemical Outputs** table to the **First Dosing Multiplier** table. Do not copy a chemical to the First Dosing Multiplier table if compatibility is not set for that chemical.
   a. Highlight the chemical in the **Outputs** table.
   b. Click **Add** to copy the chemical to the next available line of the **First Dosing Multiplier** table.
3. Adjust the multiplier value. Until you change the multiplier value, each chemical in the **First Dosing Multiplier** table has a multiplier of 1, which is the normal maintenance dose.
   a. Click one time on the **Multiplier** column to select it.
   b. Click again to edit the value.
   c. Enter the desired value and press **Enter** to save it.

4.2.2.2.2 Disabling First Dosing for a Chemical

To disable first dosing for a chemical, disable compatibility on the **Function Programming** page. If compatibility is disabled for a chemical, the programmed chemical injection value is used at each transfer.

CAUTION: **Avoid Damaging Goods and Wasting Chemicals** — Deleting a chemical from the **Multiplier** table does **not** prevent the Mentor® controller from adjusting the injection time.

- ▶ Chemicals with compatibility enabled and no entry in the **Multiplier** table are restricted to a maximum of three times the normal maintenance dose.
- ▶ Chemicals with compatibility enabled and an entry of “0” in the **Multiplier** table are restricted to a maximum of three times the normal maintenance dose.
- ▶ For safety and clarity, always add every chemical to the **Multiplier** table, even if compatibility is not enabled. Because the default multiplier for any chemical in the **Multiplier** table is 1, the effect of inadvertently enabling compatibility will be reduced. This value can be adjusted upward as necessary.

4.2.3 Goods Compatibility (Bath Exchange)

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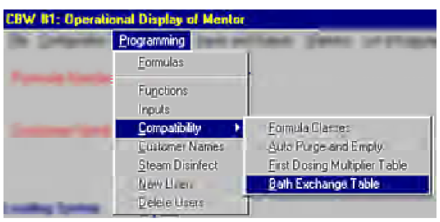
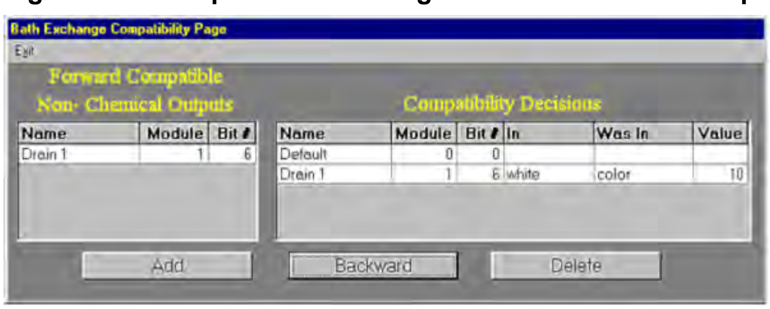
Goods compatibility makes use of the formula class optionally assigned to each wash formula and the bath exchange compatibility table. The Mentor® controller monitors the formula class of each batch of goods in the tunnel washer. According to the bath exchange compatibility table, the controller may command one or more empty or purge pockets between adjacent formulas. More information regarding goods compatibility is provided in Section 4.3 : Interval Purge, Automatic Empty Pockets, and Automatic Purge Pockets, page 127 .

Figure 61. Accessing the Bath Exchange Table



Use the menu selection sequence shown in Figure 2 to access the **Bath Exchange table**. You must be logged in at the Mentor® computer with programmer rights to access the **Programming** or **Configuration** menus.

Figure 62. Sample Bath Exchange Table for Forward Compatibility



Bath exchange can control outputs for either backward or forward compatibility.

- **Forward compatibility** controls functions in a particular module by comparing the goods coming into that module with the goods leaving it at the next transfer. This type of compatibility looks forward (toward the discharge end of the tunnel washer) to control functions. **Chemical** functions are most often controlled by forward compatibility if they're not controlled by **chemical compatibility** (see Section 4.2.2 : Chemical Compatibility (First Dosing), page 120).

- **Backward compatibility** controls functions by comparing the goods currently in a module with the goods that will replace them in the module at the next transfer. Backward compatibility looks backward (toward the load chute) to control functions. The functions controlled by backward compatibility are usually related to **water flow**.

4.2.3.1 Establish Formula Classes

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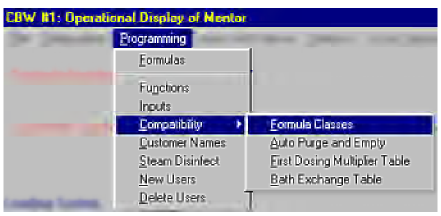
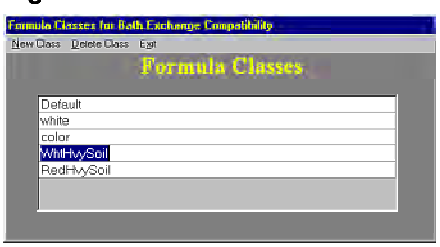
Wash formulas should only be assigned to formula classes after you've programmed as many formulas as possible. While you can always add new formulas to existing formula classes, the compatibility relationships between the formulas are more obvious when you can simultaneously evaluate the majority of the formulas. See Section 4.1.1.2.3 : Formula Class, page 105 for a description of **formula classes**.

Figure 63. Accessing the Formula Classes Screen



While any number of formula classes may be defined, additional classes complicate compatibility. For simplicity, define only the minimum number of formula classes that will handle the goods processed in this machine. Figure 64 shows a typical **Formula Classes** screen.

Figure 64. Formula Classes Screen



4.2.3.2 Determine Required Functions

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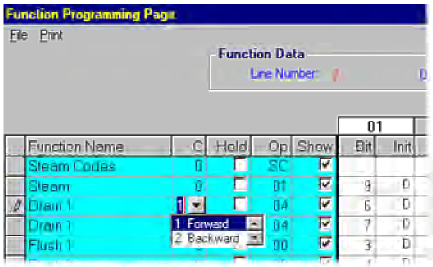
Functions that will be modified by **goods compatibility** must be configured as compatibility functions on the **Function Programming** page (Figure 65).

Figure 65. Compatibility Options on Functions Page



4.2.3.3 Select Forward or Backward Compatibility

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The general rules are that **forward compatibility** looks at the goods that just exited this module, compares those goods to the goods entering the module, and makes decisions (usually about chemical injection) based on the relationship. **Backward compatibility** looks at the goods that will enter this module at the next transfer, compares them to the goods currently in this module, and makes water flow decisions based on the relationship.

4.2.3.4 Add the Function to the Compatibility Table

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All outputs configured as compatible on the **Function Programming page** appear on the left side of the **Bath Exchange Compatibility page**. Any output that appears in the list is available for addition to the list of **Compatibility Decisions** on the right side, where the operational parameters of the output are configured.

4.2.3.5 Set the Function Compatibility Values

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The value field of the **Compatibility Decisions** table contains a numeric value which usually represents the number of seconds the output should operate when it's triggered. Any or all values may need adjustment to maximize the effect of the output without significantly increasing wash times or wasting utilities unnecessarily.

4.2.3.6 Assign Formulas to the Formula Class

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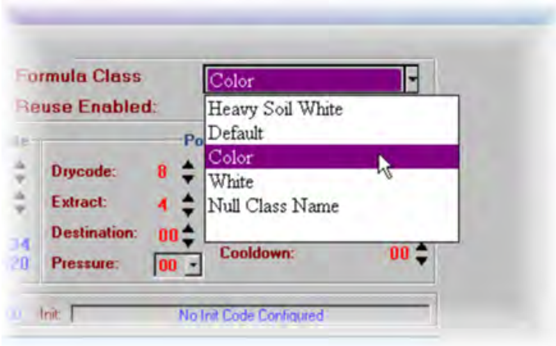
After you program the formulas and establish compatible formula classes, you still must assign formulas to formula classes to see any benefit from goods compatibility. Formula programming —including assigning formulas to formula classes—is described in Section 4.1 : Programming Mentor® Formulas, page 102 . On the **Formula Programming** page for each formula, select the appropriate **Formula Class**.

Figure 66. Selecting a Formula Class



4.2.4 Long Distance Compatibility

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This form of compatibility helps to prevent the exposure of goods to incompatible bath liquor entering the tunnel from the reuse tank, or in any other instance where two incompatible batches of goods are separated by one or more modules. In a simplified example, the Mentor® controller may compare the goods in the last module of the tunnel with the goods in the last storage position before module 1 of the tunnel. If the goods in the last module are likely to contaminate the bath liquor to the point of discoloring the goods in the last storage position as they are flushed into the first module, certain measures are taken.

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4.3 Interval Purge, Automatic Empty Pockets, and Automatic Purge Pockets

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4.3.1 Explanation of Interval Purge, Automatic Empty Pockets, and Automatic Purge Pockets

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These functions are usually initiated automatically but may also be initiated manually as explained elsewhere in this section.

4.3.1.1 Interval Purge

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Interval purge disregards all other programming and configuration to send a single purge pocket (defined in Section 4.3.1.3 : Automatic Purge Pockets, page 129) through the tunnel after each "x" number of transfers, where "x" is the value entered in the **Purge Interval** field of the **Configuration/Operating Parameters/Program Constants** display. Additionally, interval purge purges each tunnel module equipped with drain and refill capability if so commanded in the purge formula. Each module with drain and refill valves can be automatically drained, refilled with water, and steamed up to an average temperature. Chemical dosing should be avoided in the purge formula, as first dosing and chemical compatibility perform this function more efficiently.

A dedicated purge formula must be created and its code entered in the **Purge Formula** field of the **Configuration/Operating Parameters/Program Constants** display. The corresponding **Interval Purge** customer code (if any) must be entered in the **Purge Customer** field of the **Configuration/Operating Parameters/Program Constants** display. This should only be used on a CBW® which processes primarily one type of goods, especially heavily soiled goods which may leave accumulations of sand or other solids in the module sumps. In cases of purging for reasons of incompatibility, use automatic purge pockets, described in Section 4.3.1.3 : Automatic Purge Pockets, page 129 .

4.3.1.2 Automatic Empty Pockets

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An *empty pocket* is caused by allowing the tunnel washer to transfer while preventing the loading device (loading conveyor or rail system) from delivering a new batch of goods to the tunnel washer. Because all modules (pockets) of the tunnel transfer simultaneously, once an empty pocket is introduced, it maintains its position relative to the batches before and after it until it reaches the discharge end of the tunnel.

4.3.1.2.1 Benefits of Automatic Empty Pockets

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The *automatic empty pockets* function separates “good goods” from “bad baths” by inserting one or more empty pockets between *incompatible* batches. For example, if the goods that will next enter the first module of the tunnel are declared incompatible with the bath liquor remaining in the first module after transfer, the Mentor® controller will prevent the conveyor or rail system from advancing for a preset number of transfers. These empty pockets cause dilution of the contaminated bath liquor through the normal water flow of the Milnor® CBW®, so the goods about to enter the tunnel meet with a compatible bath. This automatic operation is programmed on the **Programming/Compatibility/Auto Purge and Empty** display.

Do not confuse the compatibility decisions for initiating an automatic empty pocket with forward or backward compatibility decisions.

Automatic empty pockets can be useful even when the first module is drained and refilled at transfer because the empty pockets maintain their position relative to all other batches in the tunnel.

4.3.1.2.2 Use of the Automatic Empty Pockets Capability

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To use automatic empty pockets, a dedicated *empty pocket formula code* (and *empty pocket customer code*, if appropriate) must be designated. The formula code for the dedicated empty pocket formula must be entered in the **Formula in Empty Pocket** field of the **Configuration/Operating Parameters/Program Constants** display. The corresponding code for the customer in empty pocket must also be entered on the **Program Constants** display. The formula code causes a specific formula to be executed in each module while it is empty of goods.

Usually, the empty pocket formula causes the module to achieve level and to steam to a temperature near the average temperature for all formulas processed in the tunnel. The designated empty pocket formula usually does not call for any chemical injections, as injecting chemicals into an empty pocket would be wasteful. Also, the first dosing capabilities of the Mentor® controller are such that chemical concentrations can quickly be returned to normal levels when goods are next introduced into the module.

4.3.1.3 Automatic Purge Pockets

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A *purge pocket* is caused by introducing an empty pocket (see Section 4.3.1.2 : Automatic Empty Pockets, page 128 above), and also opening the drain valve until the module (pocket) is drained, closing the drain valve, and refilling the module. Because all modules of the tunnel transfer simultaneously, once a purge pocket is introduced, it maintains its position relative to the batches before and after it until it reaches the discharge end of the tunnel. In this manner, if a load of white goods follows a load of red goods which have tinted the bath liquor, the bad (red) liquor is drained to the sewer and the module refilled with fresh water before the white goods arrive.

4.3.1.3.1 Benefits of Automatic Purge Pockets

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The *automatic purge pocket* function works similarly to automatic empty pockets described earlier. It separates goods of one formula class from incompatible baths left by a previous formula class by inserting one or more purge pockets between incompatible batches. Modules which are programmed to drain in the purge formula will drain the contaminated bath liquor to the sump and automatically refill from the fast fill valves. This causes the goods about to enter the tunnel to meet with a compatible bath. This automatic operation is programmed on the **Programming/ Compatibility/Auto Purge and Empty** display.

Do not confuse the compatibility decisions for initiating an automatic purge pocket with forward or backward compatibility decisions.

Automatic purge pockets can be useful even when the first module is drained and refilled at transfer because the purged pockets maintain their position relative to all other batches in the tunnel.

4.3.1.3.2 Use of the Automatic Purge Pockets Capability

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To use automatic purge pockets, a dedicated purge formula code (and purge customer code, if appropriate) must be designated. Enter the formula code for the dedicated purge formula in the **Purge Formula Code** field of the **Configuration/Operating Parameters/Program Constants** display. Enter the corresponding purge customer code on the **Program Constants** display. Automatic purge pockets and interval purge employ the formula referenced in the **Purge Formula Code** box of the **Program Constants** screen.

4.3.1.4 Comparisons of Interval Purge and Automatic Empty/Purge Pockets

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4.3.1.4.1 Interval Purge

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Interval purge passes a single purge pocket between batches based solely on how many transfers have occurred since the last interval purge. This feature is used to drain and refill any module equipped with drain and fast fill valves to flush any build up of sediment from the module—as may occur when goods with a high content of greasy soil or sand are processed. The formula and customer code for purge (assigned under **Configuration/Operating Parameters/Program Constants**) are automatically invoked for pockets passed in this manner.

NOTE: Workwear modules have drains and level switch-controlled fast fill valves, cold or hot, but not both. Standard linen modules can also be optionally fitted with these devices. Milnor® tunnels manufactured specifically for the food and beverage industry have drains on the wash and bleach zone modules, but not on the rinse and finish zone modules.

4.3.1.4.2 Automatic Empty/Purge Pockets

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Automatic empty pockets or *automatic purge pockets* command the passage of one or more empty or purged pockets (defined above) between batches. These empty/purged pockets are inserted solely according to the programmed incompatibility of the goods that will next enter the tunnel, as compared to the bath that remains in that module after transfer. This feature segregates incompatible goods if the tunnel does not have the bath exchange option. The incompatibility between adjacent batches are determined by the formula codes assigned to each batch. When certain incompatible characteristics are seen by the Mentor® controller, the formula code and customer code assigned to the empty formula or purge formula are automatically invoked. One or more pockets are then passed in this manner, as assigned in **Configuration/Operating Parameters/ Program Constants**.

4.3.1.4.3 Summary of Usage

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Both **Automatic Empty/Purge Pockets** and **Interval Purge** invoke dedicated formula codes, and dedicated customer codes if used. Although any module with drain and refill capabilities can be commanded to do so under either function, it is best to either drain, refill, etc. under **Automatic Purge Pockets**, or to use the formula compatibility features (**Programming/Compatibility/Auto Purge and Empty**) for this purpose.

As a general rule, it is more common to use **Automatic Empty/Purge Pocket**s to separate incompatible goods when the tunnel does not have bath exchange features, and to use *Bath Exchange* when the tunnel has bath exchange features. Use **Interval Purge** for draining and refilling modules to periodically and unconditionally remove any sediment built up in them.

NOTE: Bath exchange is described in more detail in the section on compatibility (see Table of Contents).

4.3.1.5 What the Empty and Purge Formula and Customer Code Program Constants Do

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1. The Mentor® controller assigns the configured batch codes in the empty formula and empty customer program constants fields to all automatic empty pockets, and assigns the dedicated batch codes in the purge formula and purge customer fields to all interval purge pockets and automatic purge pockets. See below note.
2. If *load error detection* (**Configuration/Operating Parameters/Output Timers/Max Time to Clear or Block Load Eye**) is configured, when empty or purge pockets are initiated either automatically or manually, the Mentor® controller knows that goods will not drop into the

tunnel load chute at transfer. Mentor® then revises the load error detection logic according to the status of the **Pass Empty** checkbox on the formula programming page for the empty and purge formulas.

NOTE: For more accurate accounting by customer, the Mentor® controller assigns dedicated customer codes for the empty or purge customer to all empty and purge pockets, respectively. It is acceptable to use the same customer code for both the customer in empty pocket and purge customer codes (**Configuration/Operating Parameters/Program Constants** display).

4.3.1.6 How To Set Up the Empty and Purge Formulas

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The empty and purge formulas should be similar. Where appropriate, each should call for steaming to an average temperature and be assigned a formula transfer rate of 05 (or the lowest count of the lightest formula) in the **Time** (**Transfer Rate**) area of the formula programming page. This ensures that transfer time is governed only by any real formulas in the tunnel and is not delayed by the transfer time for the empty or purge formulas. For the purge formula, a 15 second drain (usually starting immediately after transfer) should be commanded in all modules with drain and fast refill valves. Chemical compatibility will automatically re-dose chemicals afterward.

4.3.2 How To Use Automatic Empty Pockets or Automatic Purge Pockets to Separate Incompatible Batches

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Automatic empty pockets and automatic purge pockets keep incompatible goods from sharing the same bath liquor. Shared liquor may reduce wash quality because of soils or dyes left in the module by previous batches.

In some versions of the Mentor® software, the terms *Formula Class* and *Compatibility Grade* are used interchangeably. Be aware that formula classes as addressed in the **Programming/Compatibility/Formula Classes** menu are identical to compatibility grades addressed in the upper right corner of the **Programming/Formulas** screen.

4.3.2.1 Program All Formulas

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The first step in employing the compatibility features of the Mentor® controller is to create all necessary formulas, accepting “Default” as the compatibility grade. The compatibility grade will be changed later, after all formulas are created and fully evaluated for inclusion in a compatibility class.

4.3.2.2 Create Formula Classes

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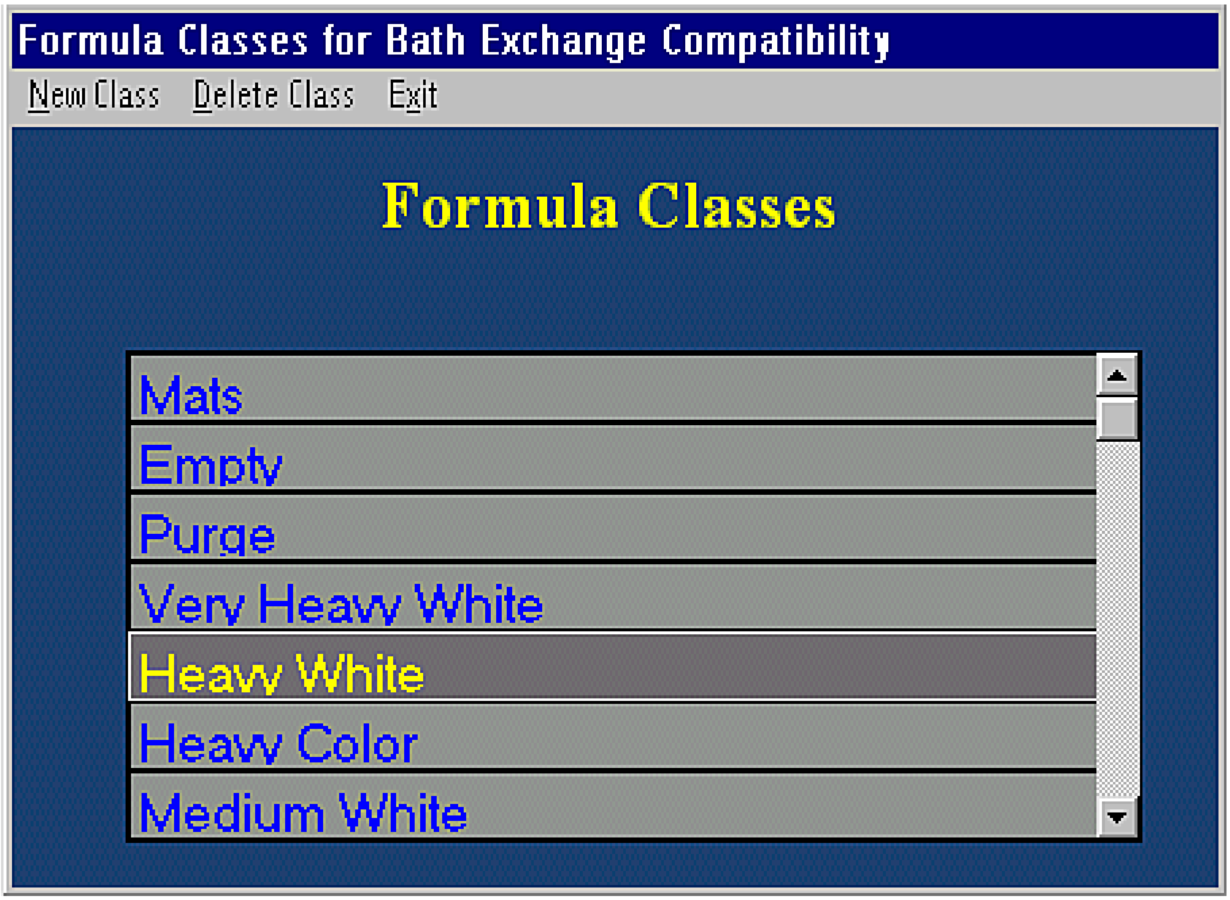
The evaluation of formulas and their inclusion in *formula classes* is best performed with a thorough understanding of wash chemistry and goods characteristics as they relate to the individual installation. Each wash formula appears in one and only one formula class. The programmer must consider the acceptable quality of wash against the required programming time to determine how many formula classes are necessary. More formula classes will add flexibility, but at the cost of more complex programming and more time required.

After all formulas have been programmed, create a formula class appropriate for one or more of the existing formulas (**Programming/Compatibility/Formula Classes/New Class**). The screen used for creating formula classes is shown in Figure 67 .

Figure 67. Formula Classes Screen



A common formula class is Heavy White, which typically contains all formulas for heavily soiled white goods, such as kitchen apparel and napkins. Another formula class is Dark Color Dye, which typically includes new, unfaded goods with a tendency to bleed dye into the bath liquor.

4.3.2.3 Define the Compatibility List

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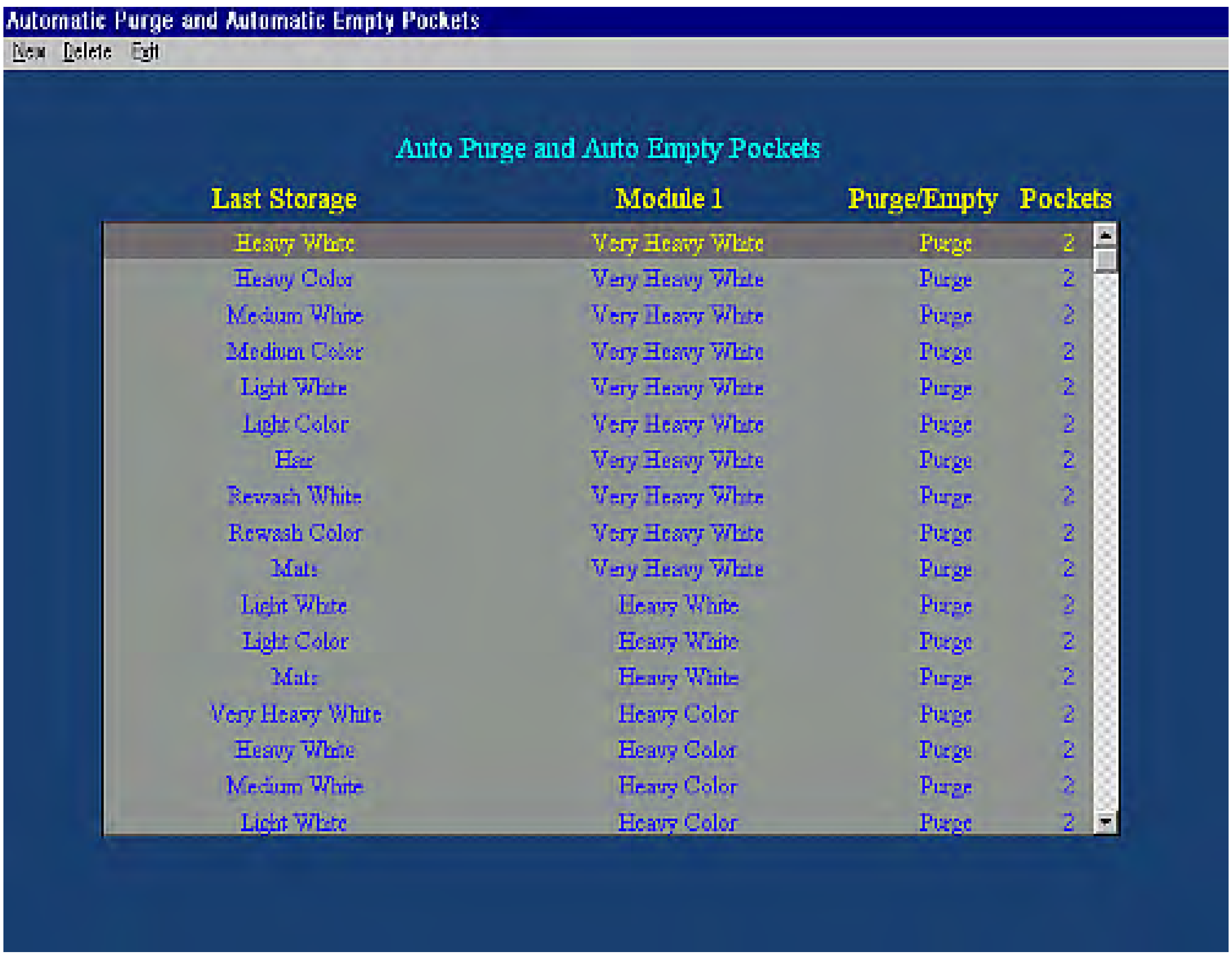
Defining the compatibility list is a simple procedure which tells the Mentor® controller how many empty pockets or purge pockets to insert between batches from different compatibility grades (formula classes).

1. The first step is to create a new entry in the Automatic Purge and Empty Pockets table (**Programming/Compatibility/Auto Purge and Empty**). Figure 68: Compatibility Matrix Screen, page 133 illustrates this table. From the Automatic Purge and Automatic Empty Pockets screen, click **New** to create a new compatibility entry.
2. Click once in the table underneath the Last Storage column heading of the new compatibility entry to reveal a drop-down menu of all available formula classes, then select a formula class from the list. This defines the formula class in the last storage position (the next batch to enter

the tunnel), which will follow the class defined in the next step. For convenience, it is often best to begin with the formula class at the top of the list.

3. Click once in the Module 1 column to select the formula class currently in the first module of the tunnel, and select a formula class from the list. If the formula classes were defined properly (i.e., broadly enough), an entry will be required for every formula class other than the class entered in the "Last Storage" column on the same row.
4. In the Purge/Empty column, select whether to purge or pass one or more empty pockets between the goods in the first module and the last storage position.
5. In the Pockets column, enter the desired number of purges or empties.
6. Repeat this procedure for each formula class, ensuring that all combinations of formula classes in the last storage position column are associated with all formula classes in the column for the first module of the tunnel.

Figure 68. Compatibility Matrix Screen



As described in the section on interval purge, etc. (see Table of Contents), an empty pocket operates according to the empty pocket formula which is usually programmed to steam to an average temperature but not inject any chemicals. A purge pocket formula is usually programmed to drain, refill, and steam to an average temperature without chemicals. If drain valves are available and production is considered more important than water consumption, a purge pocket will impact production less than two or more empty pockets.

4.3.2.4 An Example of Formula Compatibility

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For an example of how to program compatibility, consider three formula classes: sheets/terry, very heavy white, and dark color dye.

- Sheets/terry can contain formulas for most hotel goods, including bed sheets and terrycloth items, but not bar mops or kitchen towels, which contain a large amount of grease and other solids.
- Grease-laden white goods are assigned to the very heavy white formula class.
- Dark color dye goods are likely to leave the bath liquor contaminated with dye, thus staining white goods exposed to bath liquor in which these goods have been processed.

Because of the limited number of formula classes used in this example, compatibility can be described in a simple matrix of three columns and three rows. While actual values can only be determined by evaluating the goods and formulas for an installation, the following values are reasonable for this example:

1. If the first module of the tunnel contains a formula from the very heavy white formula class (e.g., bar mops), and the last storage position contains a formula from the sheets/terry formula class (e.g., bed sheets or hand towels), then a reasonable entry in the Automatic Purge and Automatic Empty Pockets table would be to purge two pockets.
2. If the first module of the tunnel contains a formula from the Dark Color Dye formula class, a reasonable entry would be to purge two to three pockets before a formula from any other class. This helps insure that the goods in the last storage position are not tinted by the dye remaining in the bath liquor from the Dark Color Dye formula.

4.3.3 How To Use Interval Purge

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The *interval purge* feature causes a purge pocket to pass through the tunnel after a specified number of batches have transferred. Enter the purge formula code and the purge customer code under **Configuration/Operating Parameters/Program Constants**, and the desired number of transfers between each purge into purge interval. The Mentor® controller will operate normally, but after each specified number of transfers, a purge pocket will be introduced into the tunnel (no goods will be dropped into the first module, which will be drained, refilled, steamed to an average temperature, etc. according to the purge formula).

4.3.4 How To Manually Initiate Automatic Empty Pockets and Automatic Purge Pockets

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If the tunnel system is loaded by a Milnor® compartmented loading conveyor, *automatic empty pockets* and *automatic purge pockets* can be initiated manually. To do this, leave each conveyor compartment empty, but tell the Mentor® controller that each compartment contains the formula code and the optional customer code for the empty or purge formula, as appropriate. The tunnel will accept the non-existent batches of goods and perform the functions specified by the empty pocket or purge codes as previously explained. The conveyor switches must be set to allow it to pass empty pockets.

4.3.5 How Load Error Detection Is Modified for Automatic Empty Pockets and Auto-Purge

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A photoeye on the tunnel load scoop detects goods that enter the tunnel (standard input 15—load eye blocked). If load error detection is enabled (by specifying a window of time under **Configuration/Operating Parameters/Output Timers/Max Time to Clear or Block Load Eye**), the Mentor® controller recognizes the formula or goods codes for the empty or purge formula as the "legitimate" empty and purge formulas respectively, and makes the decisions shown in Table 8 if the empty and purge formulas have the **Pass Empty** box checked on the formula programming page.

Table 8. Modification of Load Error Detection

Formula Code that just entered Module 01 matches Empty Formula or Empty Customer	Goods blocked then cleared photoeye during "Max Time to Clear or Block Load Eye"	Mentor® controller initiates a hold condition	Error Message
No	Yes	No	—
No	Didn't block eye	Yes	Too Long to Block Eye
No	Didn't block eye	Yes	Too Long to Block Eye
Yes	No	No	
Yes	Yes	Yes	Load Eye was Blocked

4.3.6 How To Manually Purge Workwear Tunnel Washers

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Workwear tunnel washers are equipped with a manual purge capability. It is recommended to use this feature only outside of normal operating hours and with the tunnel empty of goods, because the module drains and the tunnel holds during the purge.

1. Energize the tunnel.
2. Starting at the discharge module, open the drain valve by clicking on each module to access the **Manual Output Toggle** page. Click on the drain output, changing it from red to green, which indicates that the drain is open. Do not open more drains simultaneously than the drain trough can safely drain to the sewer.
3. On the Function Programming page (**Programming/Functions**), write down the *op codes* of the fast fill valves. In most cases, this code is 01 for a *standard fast fill valve* or 07 for a *fast fill standing bath*. Change these op codes to 00 (standard timed) for flushing.

4. Starting again with the discharge module on the Mentor® operational display, successively activate the fast fill valves in each module for 10 seconds to flush the sump of each module free of soil. Turn off each fast fill valve before going to the next module.
5. Starting once again at the discharge module, close each drain.
6. Refer back to the notes on fast fill op codes from step 3 to restore all Op codes to their previous values.
7. If the tunnel is so equipped, purge the *flow splitter tank* and *flow lifter tank* as explained in "Rinse Zone Flow Splitters and Wash Zone Flow Lifters."

5 Operation

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5.1 CBW® Tunnel Washer Controls

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This document describes the physical switches, buttons, and lights on the tunnel washer and related equipment. This document does not describe how to use the features of the Mentor® software (see Section 5.2 : The Mentor® Operational Display, page 145 and Section 5.3 : Tunnel Start-up and Shut-down, page 175).

5.1.1 Mentor® Console

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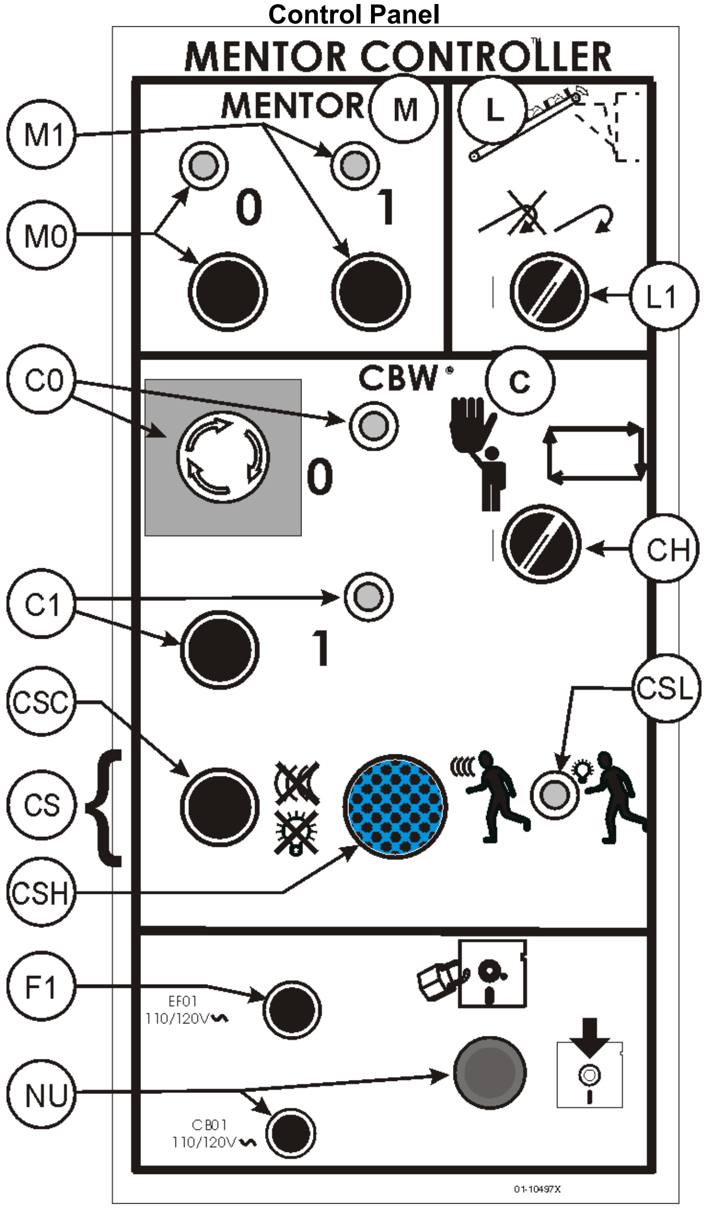
Figure 69. Mentor® Console-mounted Controls

Control Panel



Legend

- `M. . .` **Mentor® group**, as follows:
- `M0 . .` **Mentor Off** button and light
- `M1 . .` **Mentor On** button and light
- `L. . .` **Loading conveyor group**, as follows:
- `L1 . .` **Loading Conveyor Off/On** switch (if used)
- `C. . .` **CBW® (tunnel) group**, as follows:
- `C0 . .` **Tunnel Emergency Stop** button (one of several) and Off light.
- `C1 . .` **Tunnel Power On** button and light
- `CH . .` **Tunnel Run/Hold** switch
- `CS . .` **Operator signal** controls, as follows:
- `CSC .` **Signal Cancel** button
- `CSH .` Audible alarm (horn)
- `CSL .` **Operator Signal** light
- `F1 . .` Panel fuse.
- `NU . .` Not used

5.1.1.1 Mentor® Group (M)

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Mentor Off button and light (M0) Press this button to remove Mentor® control circuit power, stop the tunnel if it is running (improper procedure), cause the Mentor® computer to switch to UPS power, and initiate Mentor® shutdown. The Mentor® control circuit is de-energized when this light is on.

Mentor On button and light (M1) Press this button to energize the 110-120VAC Mentor® control circuit which powers the Mentor® computer via the UPS (uninterruptable power supply), initiating Mentor® boot-up and allowing the tunnel to start, as explained below. The circuit is energized when this light is on.

5.1.1.2 Loading Conveyor Group, if used (L)

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Loading Conveyor Off/On switch (LC) (plugged if loading conveyor not used) affects loading conveyor motion, as follows:

prevents the loading conveyor from advancing, but does not prevent transfer. Batch codes will continue to shift, possibly requiring manual correction. Conveyor power remains energized.

allows normal, automatic operation.

5.1.1.3 CBW® (Tunnel) Group (C)

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Tunnel Emergency Stop button and Off light (C0) See the explanation of **emergency stop** switches below. Tunnel control circuit power is de-energized when the **Off** light is illuminated.

Tunnel Power On button and light (C1) Pressing this button energizes the 110-120VAC tunnel control circuit (various control boxes on the tunnel and ancilliary components) if the Mentor® control circuit is energized, no emergency stop buttons are depressed, and other conditions are met. When energized, the control circuit initiates certain such as filling the tunnel to normal water levels. Cylinder rotation does not begin, but tunnel operation via the Mentor® controller is allowed. The circuit is energized when this light is on.

Tunnel Run/Hold switch (CH) affects normal automatic operation as follows:

places the tunnel in hold and prevents transfer.

allows normal automatic operation.

Operator signal controls (CS) visually and audibly alert the operator when operator intervention is required, such as when an error condition occurs, and allow cancelling the signal after correction. These controls include:

Signal Cancel button (CSC) terminates the operator signal if the condition is satisfied.

Audible alarm (horn) (CSH) sounds while the condition is present.

Signal light (CSL) illuminates while the condition is present.

5.1.2 Emergency Stop Switch (locking push button)

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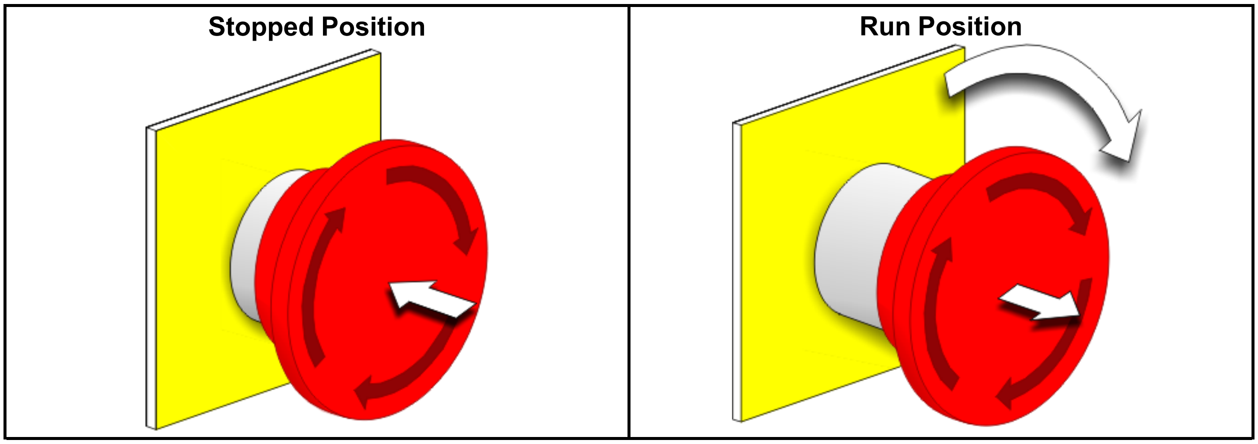
One or more **emergency stop** switches (Figure 70) are provided on the device. When pressed, any emergency stop switch removes power from the machine controls, stops the machine and locks in the depressed (switch actuated, machine stopped) position. When safe to do so, turn the button clockwise to unlock the switch. To resume operation, perform the device's normal startup procedure.

Figure 70. Emergency Stop Switch



NOTICE: Press the **emergency stop** switch immediately in an emergency situation. This disables the 3-wire circuit while maintaining power to the microprocessor controller.

Display or Action	Explanation
	This symbol represents the emergency stop switch in Milnor® documents other than electrical wiring diagrams.

5.1.3 CONLO/CONWA

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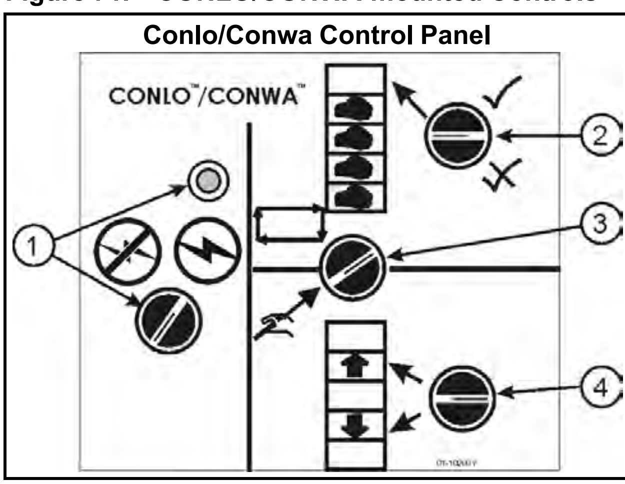
Figure 71. CONLO/CONWA-mounted Controls



Legend

1. **Master** switch and **Master On** light
2. **Pass Empty Pocket** switch
3. **Move Automatic/Manual** switch
4. **Manual Forward/Reverse** switch

Master switch and Master On light (1) applies to the loading conveyor 110-120VAC control circuit as follows:

Energizes the loading conveyor control circuit to allow operation. Light is illuminated.

De-energizes the control circuit to prevent or stop operation. Light is off.

Pass Empty Pocket switch (2) determines what happens when an empty pocket (an empty conveyor compartment) is next to enter the tunnel, as follows:

The tunnel will not accept the empty pocket (tunnel enters a hold when the first empty pocket is ready to enter the first module).

✓ The tunnel will accept the empty pocket.

Move Automatic/Manual switch (3) determines what causes the loading conveyor to move, as follows:

The loading conveyor advances automatically at each transfer.

Conveyor movement is controlled by the **Manual Forward/Reverse** switch.

Manual Forward/Reverse switch (momentary, center off) (4) When the loading conveyor is set to manual operation, this switch causes the loading conveyor to move as follows:

The loading conveyor increments **forward** (moves forward one pocket). The conveyor continues to increment while the switch is held or until a loaded compartment reaches the tunnel loading position. The controller will not allow using this switch to load a batch into the tunnel.

The loading conveyor increments **backward**. The conveyor continues to increment while the switch is held or until a loaded compartment reaches the first position.

5.1.4 Tunnel

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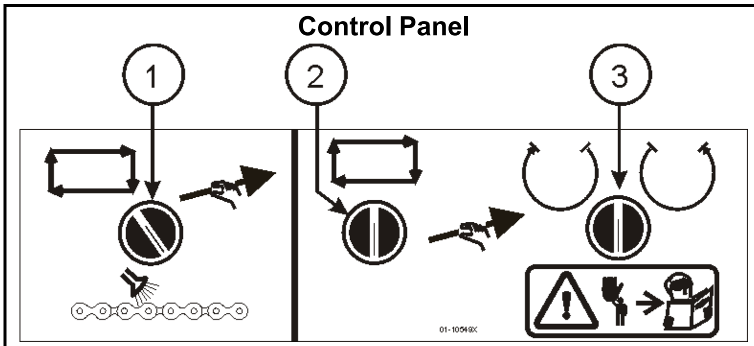
Figure 72. Tunnel-mounted Controls



Legend

1. **Chain Lubrication** switch
2. **Automatic/Manual Rotation** switch
3. **Jog** switch (momentary, center off)

Chain Lubrication switch (momentary) (1) controls how the tunnel drive chains are lubricated, as follows:

The controller automatically lubricates the chains once each cycle.

Hold this switch to continuously spray the chains with lubricant.

Automatic/Manual Rotation switch (2) determines what controls tunnel cylinder rotation, as follows:

The cylinders rotate automatically.

Cylinder rotation is controlled by the **Jog** switch.

Jog switch (momentary, center off) (3) When rotation is set to the **manual** position, this switch causes the tunnel cylinders to turn, as follows:

rotates the cylinders clockwise (when viewed from the loading end) while the switch is held.

rotates the cylinders counterclockwise while the switch is held.

5.1.5 Reuse Tank

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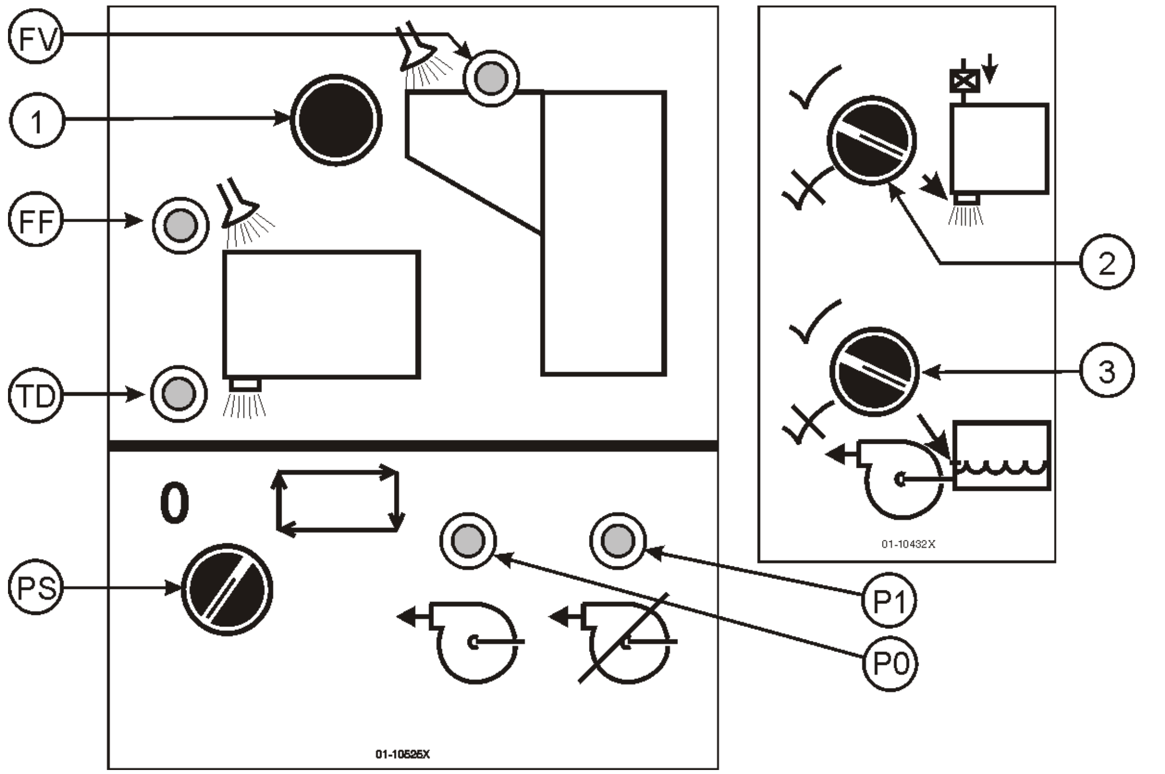
Figure 73. Reuse Tank Electric Box-mounted Controls Control Panels

Control Panels



Legend

1 . . . **Load Chute Flush** button
2 . . . **Makeup Water** switch
3 . . . **Flush Pump When Level Below Low** switch
PS . . **Pump Automatic/Off** switch
FV . . **Flush Valve On** light—illuminates when the flush valve opens automatically or manually, flushing the load chute.
FF . . **Reuse Tank Fresh Fill On** light—illuminates when the reuse tank fresh water fill valve opens, admitting fresh water to the tank.
P1 . . **Pump On** light (one per pump)—illuminates when the indicated pump is running.
P0 . . **Pump Should Run But Did Not** light (one per pump)—illuminates when the indicated pump is commanded to run, but is not running. The light may remain illuminated. Likely problems include low air pressure, the **Pump Automatic/Off** switch is **off**, a circuit breaker tripped, or the pump motor contactor is defective.
TD . . **Tank Draining** light—illuminates when the reuse tank drain valve opens to discharge water to the sewer.

Load Chute Flush button (1) The load chute flush valve opens and remains open while this button is depressed, flushing the load chute with water.

Makeup Water switch (2) Use this switch when cleaning the tank. While the tank drain valve is commanded open for cleaning, this switch affects the makeup water valve, as follows:

✓ The valve opens to admit fresh water when the tank level drops below low level, flushing the tank.

✗ The valve remains closed, allowing the tank to drain empty.

Flush Pump When Level Below Low switch (3) The flush pump runs constantly during operation to maintain a trickle flow into module one. This switch affects flush pump operation, as follows:

✓ The pump runs regardless of reuse tank condition.

✗ The pump shuts off if tank level drops below low while the drain valve is open.

Pump Automatic/Off switch (PS) affects operation of the flush pump, as follows:

0 The pump is disabled (may be needed during testing, troubleshooting, etc.)

The pump operates automatically.

5.1.6 Flow Splitter and Flow Lifter Controls

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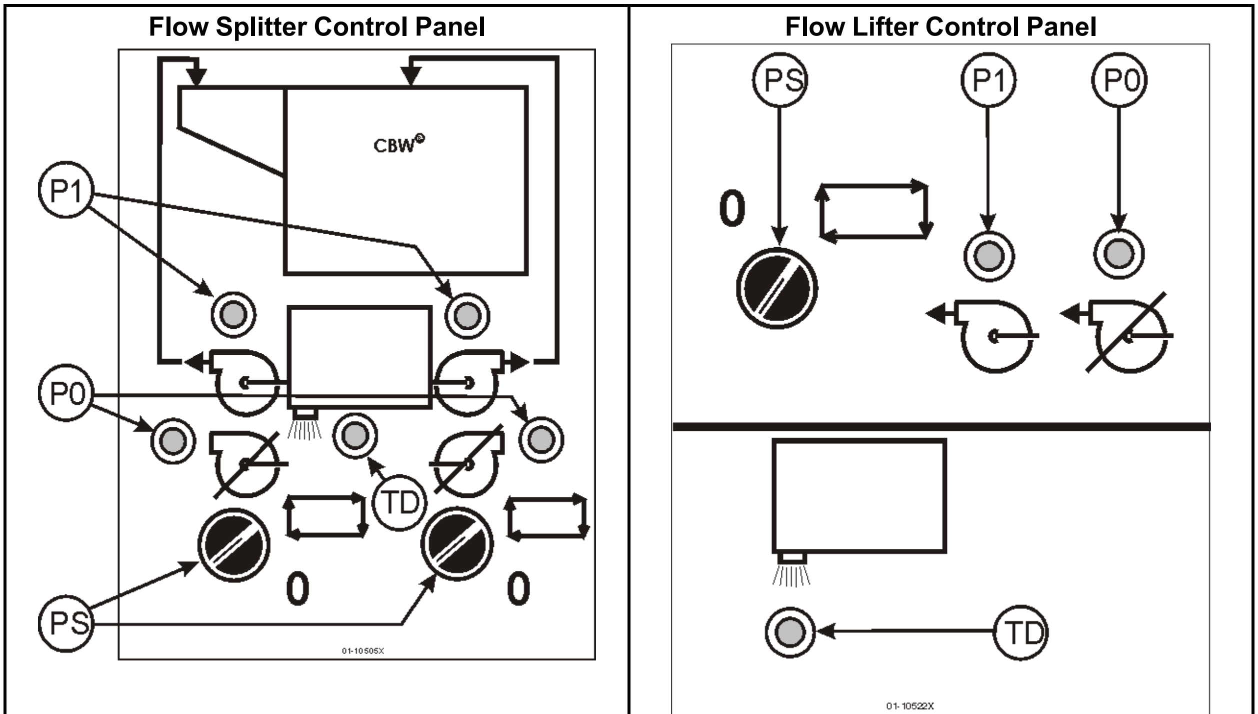
The controls on the flow splitter and flow lifter (if used) function the same as their counterparts on the reuse tank. Refer to Section 5.1.5 : Reuse Tank, page 142 for explanations of these controls.

Figure 74. Controls Mounted on the Flow Splitter and Flow Lifter



Legend

PS. . Pump Automatic/Off switch
P1. . Pump On light (one per pump)
P0. . Pump Should Run But Did Not light (one per pump)
TD. . Tank Draining light

5.1.7 Holding (Surge) Tank Controls

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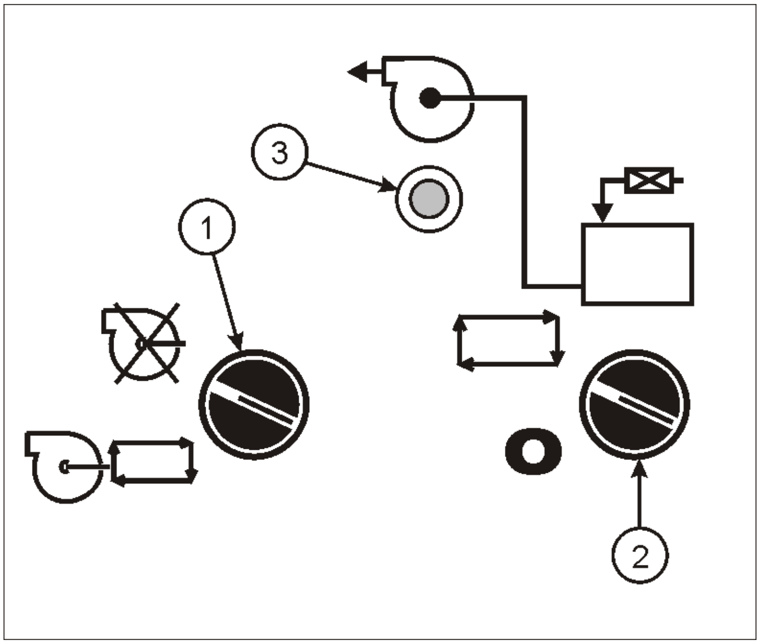
Figure 75. Controls Mounted on the Holding (Surge) Tank

Control Panel

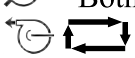


Legend

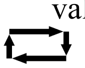
1. **Pumps Automatic/Off** switch
2. **Makeup Water** switch
3. **Pump Should Have Run But Did Not** switch

Pumps Automatic/Off switch (1) Affects operation of the surge tank-to-reuse tank pump and the surge tank-to-rinse zone pump, as follows:

 Both pumps are disabled.

 Both pumps run automatically.

Makeup Water switch (2) This switch is used in conjunction with tank cleaning. While the tank drain valve is commanded open for cleaning, this switch affects operation of the makeup valve water valve, as follows:

 The valve opens to admit fresh water as soon as the tank level drops below low level, causing the tank to be sluicied (flushed).

0 The valve remains closed, allowing the tank to drain.

Pump Should Have Run But Did Not light (3) This light illuminates while either pump is commanded to run, but that pump did not run. Likely causes are a tripped motor overload or the pumps are disabled by the **Pumps Automatic/Off** switch.

5.1.8 Workwear Models Only

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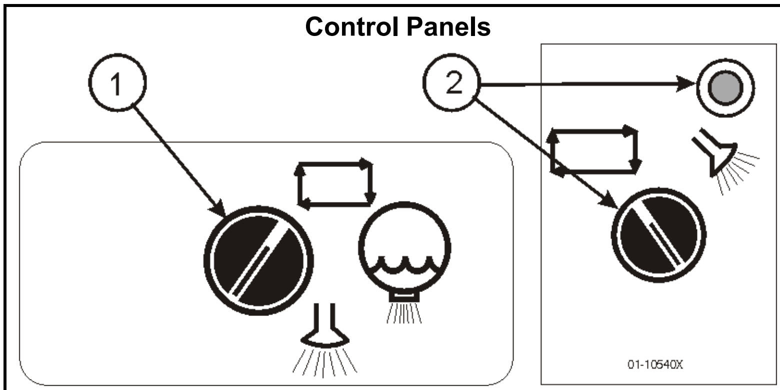
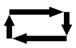
Figure 76. Controls Mounted on the Module and Flow Splitter



Legend
1. **Automatic/Drain/Flush** switch
2. **Automatic/Flush** switch and **Flush** light

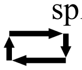
Automatic/Drain/Flush switch (on workwear module) affects how the module drain sump is flushed, as follows:

 The sump is drained and flushed as programmed.

 The drain valve opens, draining the sump empty.

 The drain valve opens, and the makeup valve opens to flush the drain sump with fresh water.

Automatic/Flush switch and light (on flow splitter tank, if used) allows flushing the flow splitter tank as follows:

 The tank is set for automatic operation. Light is off.

 The tunnel enters a hold, the surplus pump runs to drain water from the tank while the tank level is not below low level, and the makeup valve opens to flush the tank with fresh water while the tank level is not above high level. The light is illuminated.

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5.2 The Mentor® Operational Display

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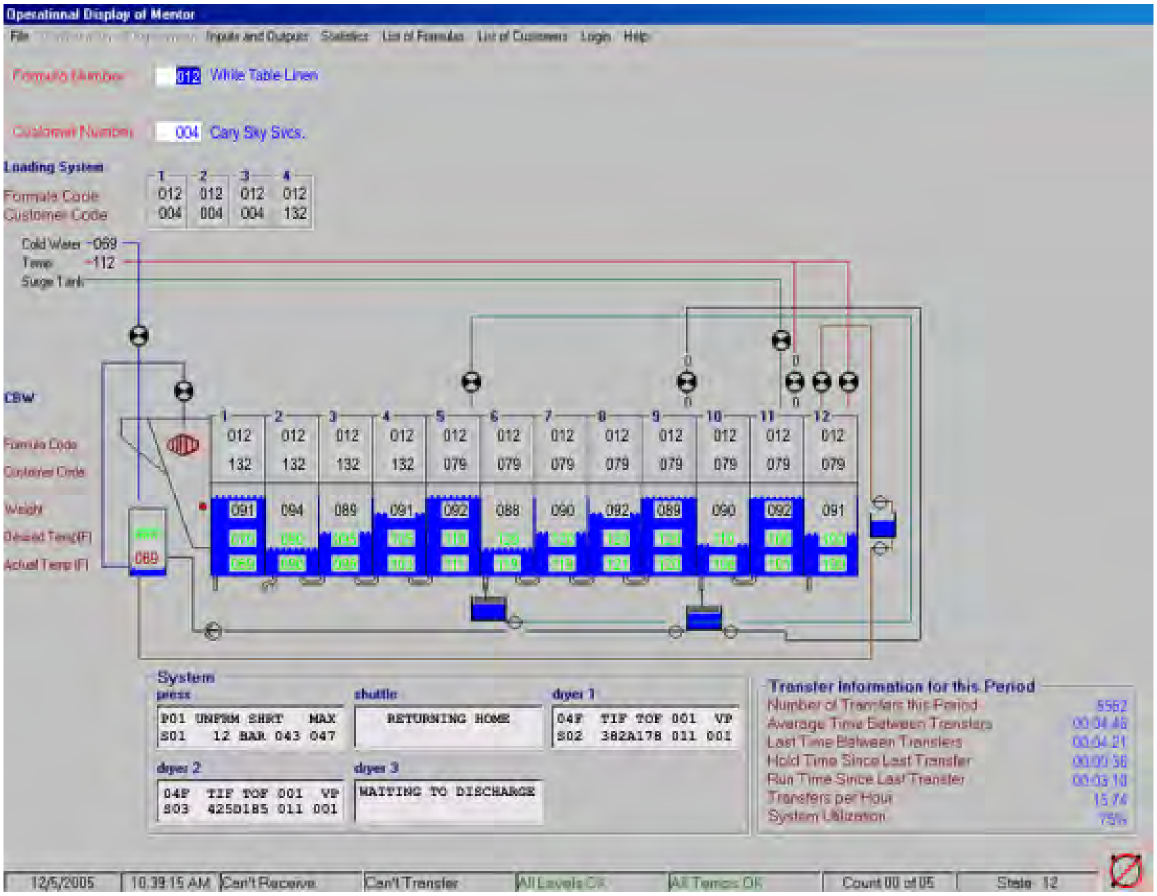
The Mentor® operational display (Figure 77) provides a central location for all the information required to operate the Milnor® CBW® tunnel washer system. This document describes the information visible on the display and the functions available to the operator. As well as the information readily visible on the display, there are other displays which are accessed by clicking the left mouse button in certain regions of the operational display.

Figure 77. Operational Display



5.2.1 Title Bar

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The top line of the operational display is a title bar (Figure 78) which indicates the current window. All windows in the Mentor® controller software have title bars for quick reference. The **Menu** bar, located immediately below the title bar, is described in Section 5.2.3 : Menu Bar, page 147 .

Figure 78. Title Bar of Operational Display

5.2.2 Transfer Information

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Beginning with Mentor® software version 20300, productivity data is displayed on the operational display. The data shown here is described in detail in Section 5.4.1 : Productivity Data, page 179 .

5.2.3 Menu Bar

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The second line of the operational display, and all other Mentor® controller displays, is the menu bar. This bar contains one or more drop-down menus, each of which is explained in more detail elsewhere in this manual. The menu bar for the operational display is shown in Figure 79 .

To view the contents of any drop-down menu, position the mouse cursor over the title of the menu to be viewed and click the left mouse button one time. If a menu is gray, as the **Configuration** and **Programming** menus appear in this figure, the menu is not available. For example, only users with programmer rights are allowed to configure or program the Mentor® controller; therefore, these menus are not available unless the user currently logged in has programmer rights.

Figure 79. Menu Bar

5.2.3.1 File Menu

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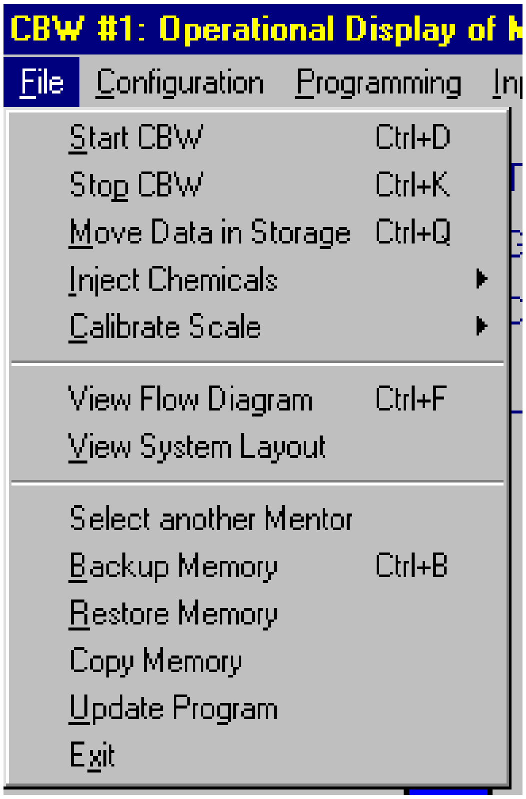
The selections available on the **File** menu (see Figure 80) include those used to start and stop the tunnel system, and to make copies of the Mentor® configuration for backup purposes. Depending on the version of the Mentor® software at your installation, this and other menus may not appear exactly as shown in this document. Certain operations, including starting and stopping the tunnel system, are not available if the Mentor® software is installed in Mildata® mode.

Figure 80. File Menu (Mentor® version 20403)



5.2.3.1.1 Start CBW®

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This selection starts tunnel rotation; however, reversals are counted only after all necessary conditions are met (e.g., water level achieved in all modules, temperature achieved in modules so programmed, etc.). Execute this command by clicking the left mouse button once when the command is selected, or by pressing **Ctrl-D** (hold the control key—labelled Ctrl on the keyboard—and press D).

5.2.3.1.2 Stop CBW®

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This selection stops tunnel rotation unless the tunnel is already committed to transfer when the command is issued. Execute the command by highlighting it and clicking the left mouse button, or by pressing **Ctrl-K** on the keyboard.

5.2.3.1.3 Move Data in Storage

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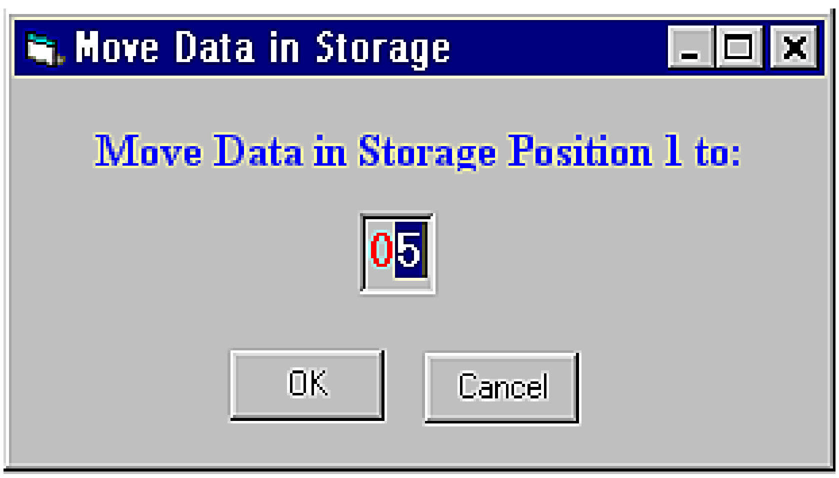
Use this menu item to move the data for the batch in the first storage position to any other storage position. This function is often used at start-up if the loading conveyor is empty. Reference the **Loading System** area of Figure 77: Operational Display, page 146 , noting especially that the loading system consists of five positions. The specifics for this function follow:

1. With the loading conveyor empty, the operator loads the first storage position and encodes the correct formula and customer data for the batch.

2. The operator uses the **Move Data in Storage** command (Figure 81) to move the data for batch 1 to the storage position to be occupied by this batch when the conveyor is completely filled. Assuming the conveyor was empty at the beginning of this process, the **first** batch loaded will occupy the **last** storage position (storage position 5) when the conveyor is filled.
3. The operator then advances the loading conveyor forward one compartment to allow loading another batch. At this time the data for batch 1 is in storage position 5 according to the example system here, but the goods are in storage position 2. This mismatch must be corrected before the goods enter the tunnel.
4. The operator loads a second batch into the first storage position and encodes it, then advances the conveyor.
5. Because the second batch loaded will occupy the next-to-last storage position when the conveyor is filled, the operator moves the data for the second batch to the next-to-last storage position.
6. This procedure continues until the conveyor is filled and all batches are aligned with their respective codes.

Figure 81. Move Data in Storage Window



If the above procedure is used to fill empty compartments that have advanced beyond the first loading position, the same sequence is used, except the first batch loaded will ultimately occupy the last **empty** storage position (not the last conveyor compartment).

5.2.3.1.4 Inject Chemicals

BNTUUO20.C09 0000241333 A.2 A.13 A.3 1/2/20 2:11 PM Released

This choice commands the injection of one, two, or three charges of chemicals to quickly raise the chemical concentration in each module to the operating level. Use this command during the morning start-up procedure.

5.2.3.1.5 Calibrate Scale

BNTUUO20.C10 0000241332 A.2 A.13 A.3 1/2/20 2:11 PM Released

This menu item contains the necessary commands to calibrate the weighing loading device for accurate load weight detection. See Section 3.1 : How to Calibrate the Load Conveyor Scale, page 79 for detailed procedures.

5.2.3.1.5.1 Set Zero Offset

BNTUUO20.C11 0000241331 A.2 A.13 A.3 1/2/20 2:11 PM Released

This selection adjusts the interface between the controller and the weighing unit of the conveyor.

5.2.3.1.5.2 Calibrate Scale to Zero

BNTUUO20.C12 0000241330 A.2 A.13 A.3 1/2/20 2:11 PM Released

This is the tare function of the scale. When this command is issued, the user is prompted to unload the first pocket of the loading conveyor. When the first pocket of the conveyor is empty, press **OK** to set the zero point.

5.2.3.1.5.3 Calibrate Scale to Calibration Weight

BNTUUO20.C13 0000241329 A.2 A.13 A.3 1/2/20 2:11 PM Released

The final step in calibrating the weighing load conveyor is to **Calibrate Scale to Calibration Weight**. Place a known weight (a bag of dry chemical, a person of known weight, etc.) in the first pocket of the load conveyor and press **OK**. The weight prompted for in this command is controlled by the entry for Calibration Weight on the **Configuration/Output Timers** page.

5.2.3.1.6 View Flow Diagram

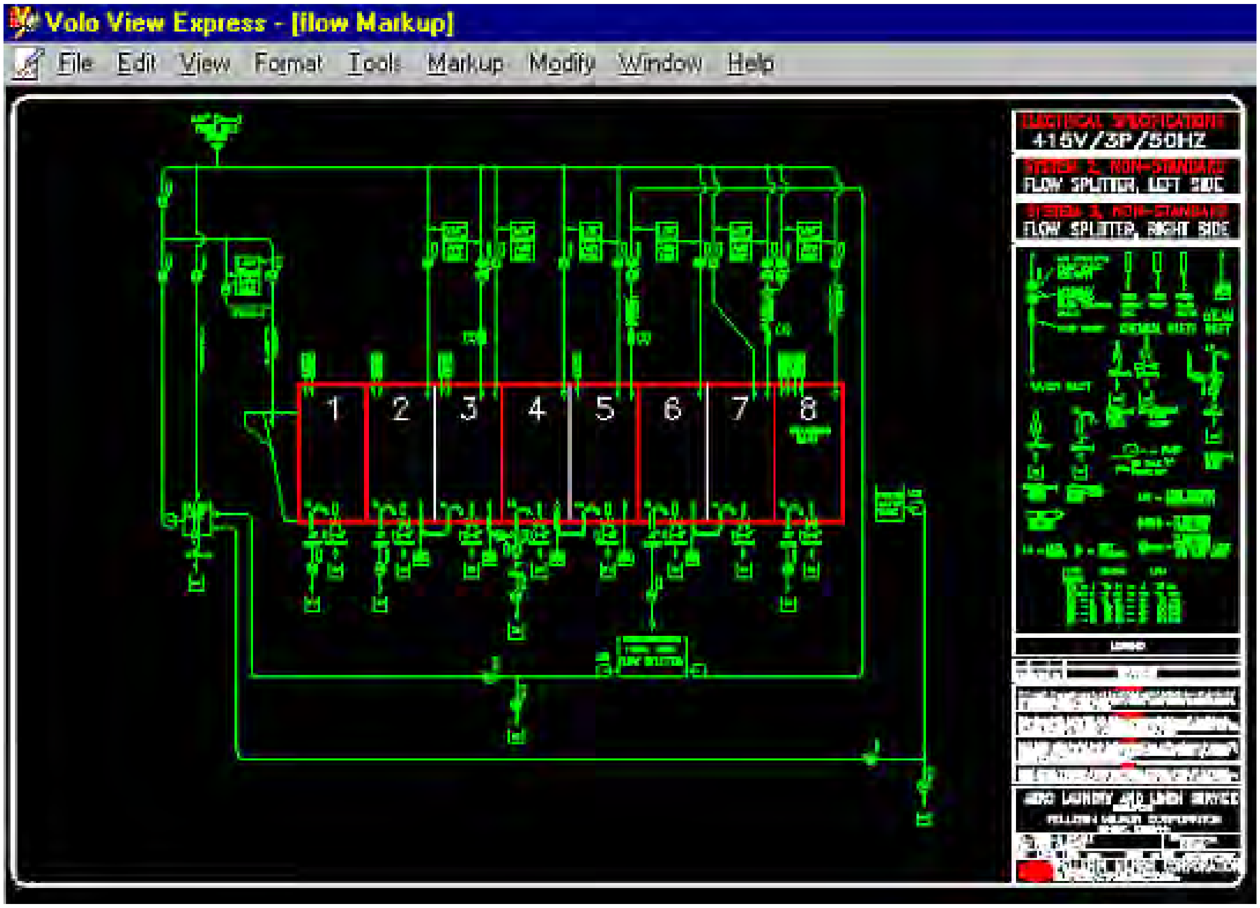
BNTUUO20.C14 0000241328 A.2 A.13 A.4 1/2/20 2:11 PM Released

The flow diagram is a representation of how the bath liquor flows through the tunnel washer and ancillary devices. This diagram is created at the Milnor® factory specifically for each tunnel washer as the machine is built. Mentor® software versions 20302 and later provide this menu selection to view the flow diagram on the Mentor® computer.

1. Copy the CAD drawing of the flow diagram into the `CBW` directory on the Mentor® computer.
2. Rename the flow diagram file to `Flow.dwg`.
3. Verify that Volo View viewing software is installed on the Mentor® computer.

A typical flow diagram and system layout drawing are shown in Figure 82: Sample Flow Diagram, page 151 and Figure 83: Sample System Layout, page 152 , respectively.

Figure 82. Sample Flow Diagram



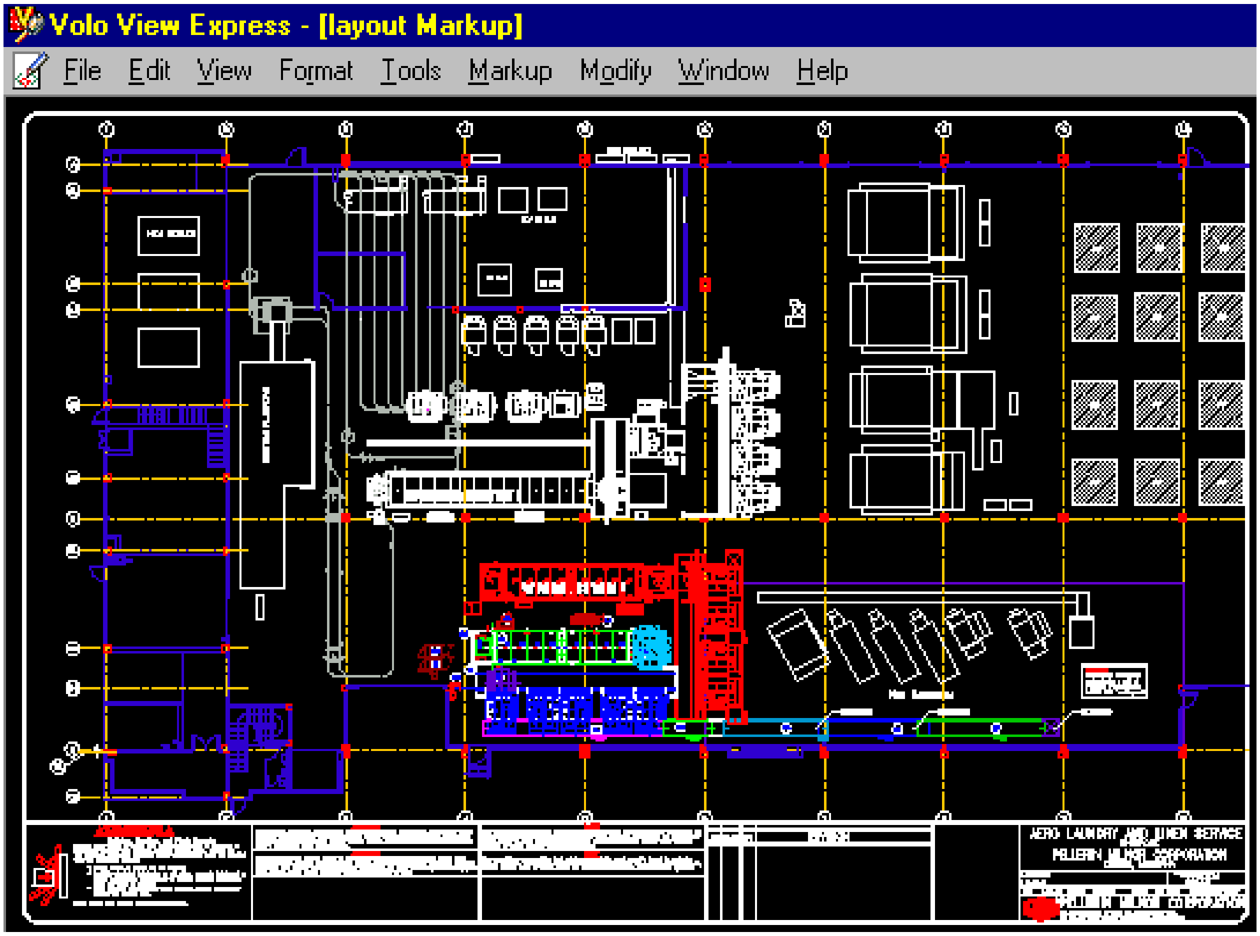
5.2.3.1.7 View System Layout

BNTUUO20.C15 0000241326 A.2 A.13 A.4 1/2/20 2:11 PM Released

The system layout drawing (Figure 83) is a representation of the physical arrangement of the tunnel washer and its associated devices, including loading and discharge devices. This diagram is created at the Milnor® factory or your equipment dealer specifically for your tunnel washer facility. Mentor® software versions 20302 and later provide this menu selection to view the system layout on the Mentor® computer.

To enable this feature, use the procedure described in Section 5.2.3.1.6 : View Flow Diagram, page 150 , but rename the system layout diagram to `Layout.dwg`.

Figure 83. Sample System Layout



5.2.3.1.8 Select another Mentor®

BNTUUO20.C16 0000241529 A.2 A.13 A.4 1/2/20 2:11 PM Released

This option, available only if the Mentor® software is installed in Mildata® mode, allows an operator to monitor multiple tunnel systems from a single Mentor® computer. Tunnel operation, including starting or stopping the tunnel and actuating outputs, is not allowed if the Mentor® software is installed in Mildata® mode.

NOTE: This selection serves the same purpose as the **Set File Location** menu selection in earlier versions of the Mentor® software.

Add to List Click this button to make additional Mentor® systems available for viewing. When the **Database Location** window opens, enter a name for the machine to be viewed and the path to the `Miltron.MDB` file for that machine. The added machine appears in the selection list.

Delete from List Highlight any machine in the list and click this button to remove it. Note that the `Miltron.MDB` file is not deleted, but is only removed from the list of files shown in this Mentor® installation.

Set as Default Highlight any machine in the list and click this button to cause the selected machine to be the active one when this Mentor® system is started.

5.2.3.1.9 Backup Memory

BNTUUO20.C17 0000241780 A.2 A.13 A.3 1/2/20 2:11 PM Released

To create a backup for data restoration, stop tunnel rotation and execute this command. When prompted, insert a disk in the drive and press **OK**.

5.2.3.1.10 Copy Memory

BNTUUO20.C18 0000241779 A.2 A.13 A.3 1/2/20 2:11 PM Released

This option is available only on Mentor® software versions 20301 and later, and then only if a user is logged in with programmer privileges. Select the **Copy Memory** menu item to copy the formulas and configuration information from another Mentor® computer, either across the local area network or from a floppy disk. Miltrac™ and Mildata® address information is **not** copied. The **Copy Memory** function is especially useful in installations with multiple CBW® machines running the same set of formulas.

When first actuated, the computer searches the network for other Mentor® computers and lists them as possible sources. If no other Mentor® computers are found, insert a backup diskette from another Mentor® and select the floppy drive as the source.

5.2.3.1.11 Restore Memory

BNTUUO20.C19 0000241817 A.2 A.13 A.3 1/2/20 2:11 PM Released

This command restores Mentor® configuration and formula programming from a previously saved backup disk. Tunnel power must be off for this command to be available.

5.2.3.1.12 Update Program

BNTUUO20.C20 0000241816 A.2 A.13 A.3 1/2/20 2:11 PM Released

This selection is available only if the user is logged in with programmer privileges. Use this item to install diskette-supplied software updates from Milnor®.

5.2.3.1.13 Exit

BNTUUO20.C21 0000241815 A.2 A.13 A.3 1/2/20 2:11 PM Released

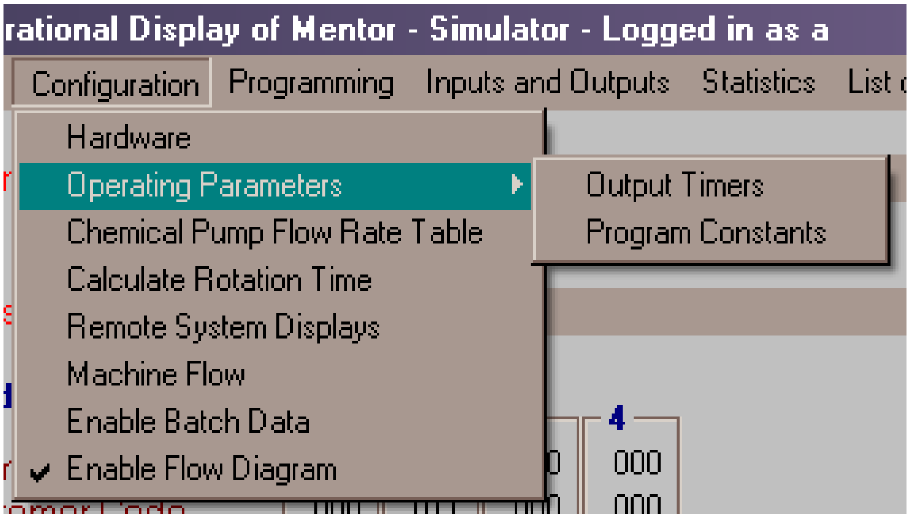
Select this option to terminate the Mentor® control software. If the user is logged in with programmer rights, the option to shut down the computer also appears. Tunnel power must be off for this command to be available.

5.2.3.2 Configuration Menu

BNTUUO20.C22 0000241813 A.2 A.13 A.3 1/2/20 2:11 PM Released

Figure 84 shows the configuration menu, which contains menu items relating primarily to the mechanical and electrical characteristics of each tunnel system. In most cases these settings do not require changes unless devices are added or removed from the tunnel.

Figure 84. Configuration Menu



5.2.3.2.1 Hardware

BNTUUO20.C23 0000241812 A.2 A.13 A.3 1/2/20 2:11 PM Released

The hardware page provides information about the physical characteristics of the tunnel system to the Mentor® controller. Items such as the numbers of storage positions and modules are entered here.

5.2.3.2.2 Operating Parameters

BNTUUO20.C24 0000241811 A.2 A.13 A.4 1/2/20 2:11 PM Released

This menu item allows access to two separate pages of configuration information: the **output timers** page and the **program constants** page. These pages are described in detail in Section 2.2.2 : CBW® Output Timers, page 49 and Section 2.2.3 : CBW® Program Constants, page 53 .

5.2.3.2.3 Chemical Pump Flow Rate Table

BNTUUO20.C25 0000241810 A.2 A.13 A.4 1/2/20 2:11 PM Released

The page accessed from this menu item allows the programmer to tell the Mentor® controller how many units per second each chemical pump provides to a module. This allows for programming chemicals in terms of quantity, with the Mentor® controller determining the correct inject time required to achieve the desired quantity. See the related section in Section 2.2.5 : Chemical Pump Flow Rates, page 59 for details.

5.2.3.2.4 Calculate Rotation Time

BNTUUO20.C26 0000241809 A.2 A.13 A.4 1/2/20 2:11 PM Released

This selection calculates rotation time averaged over five rotations. See Section 2.2.6 : Calculate Rotation Time, page 60 .

5.2.3.2.5 Remote System Displays

BNTUUO20.C27 0000241808 A.2 A.13 A.4 1/2/20 2:11 PM Released

See Section 2.2.7 : Remote System Displays, page 60 .

5.2.3.2.6 Machine Flow

BNTUUO20.C28 0000241850 A.2 A.13 A.3 1/2/20 2:11 PM Released

Configure the Mentor® controller to display the correct information when the flow diagram is enabled.

5.2.3.2.7 Enable Batch Data

BNTUUO20.C29 0000241849 A.2 A.13 A.3 1/2/20 2:11 PM Released

This selection causes the Mentor® controller to collect batch data for graphing. It is not available if the controller is running in Mildata® mode.

5.2.3.2.8 Enable Flow Diagram

BNTUUO20.C30 0000241848 A.2 A.13 A.3 1/2/20 2:11 PM Released

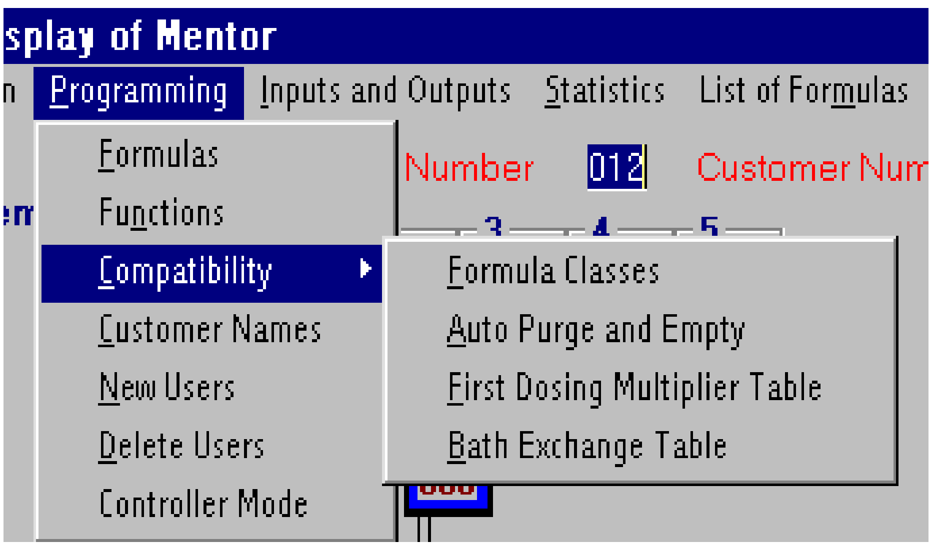
Displays the tunnel washer water flow on the Mentor® main display.

5.2.3.3 Programming Menu

BNTUUO20.C31 0000241846 A.2 A.13 A.3 1/2/20 2:11 PM Released

The programming menu contains all functions and commands required to create and modify wash formulas on a correctly configured Mentor® system. This menu is shown in Figure 85 .

Figure 85. Programming Menu



5.2.3.3.1 Formulas

BNTUUO20.C32 0000241845 A.2 A.13 A.3 1/2/20 2:11 PM Released

This selection accesses the formula programming page, where all Mentor® formulas are created and modified. More detailed information about creating formulas is provided in Section 4.1 : Programming Mentor® Formulas, page 102 .

5.2.3.3.2 Functions

BNTUUO20.C33 0000241844 A.2 A.13 A.3 1/2/20 2:11 PM Released

Functions are the individual outputs which are actuated in a particular sequence and under certain conditions to control how the tunnel washer operates. More detailed information about defining functions is provided in Section 2.1 : Assigning Functions, page 25 .

5.2.3.3.3 Compatibility

BNTUUO20.C34 0000241843 A.2 A.13 A.3 1/2/20 2:11 PM Released

Compatibility prevents the interaction of goods with incompatible baths and/or chemical concentrations. More detailed information about compatibility is provided in Section 4.2 : Using Compatibility, page 119 .

5.2.3.3.4 Customer Names

BNTUUO20.C35 0000241842 A.2 A.13 A.3 1/2/20 2:11 PM Released

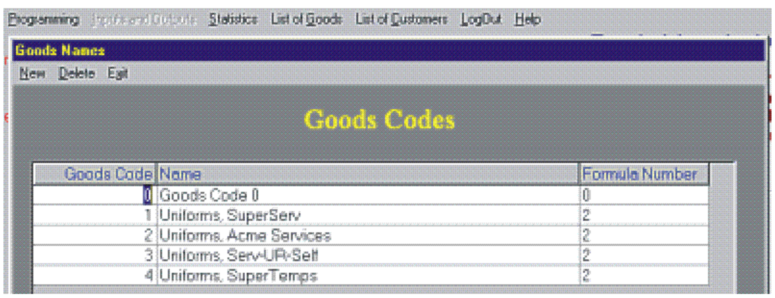
This command provides a page for adding and deleting customer names. The names entered here are accessed through the **List of Customers** menu during operation. See Section 5.2.3.7 : List of Customers Menu, page 162 for more information.

5.2.3.3.5 Goods Codes

BNTUUO20.C36 0000241841 A.2 A.13 A.7 1/2/20 2:11 PM Released

This selection—available on Mentor® versions 20402 and later—opens a page for naming goods codes and assigning a formula number to each one. This menu item appears only when the **Goods code entry** decision is enabled on the **Hardware** page of the **Configuration** menu.

Figure 86. Goods Codes Assignment Page



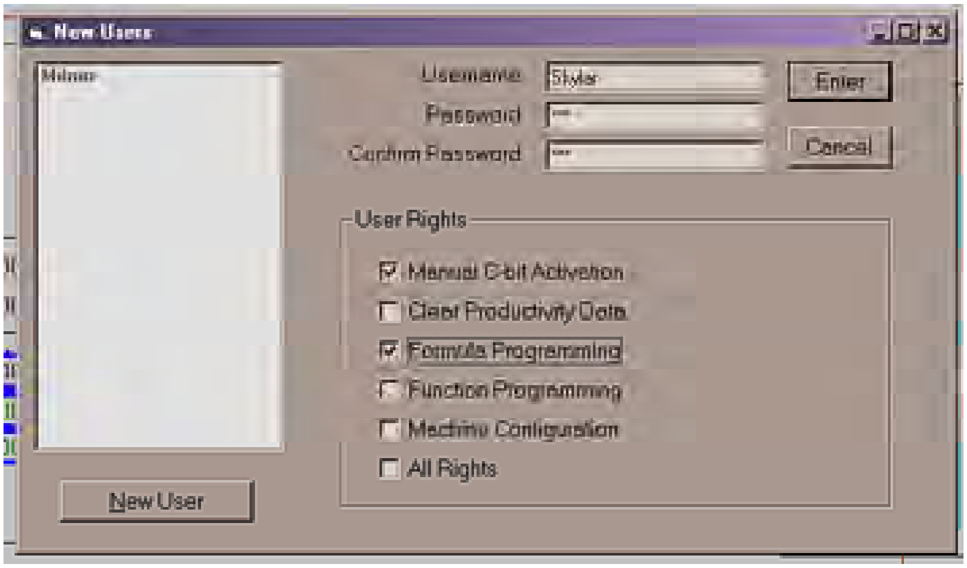
5.2.3.3.6 New Users

BNTUUO20.C37 0000241889 A.2 A.13 A.3 1/2/20 2:11 PM Released

Use this option to enter a new user (operator or programmer) for the tunnel system. The user must select or be assigned a user name and password, and programmer rights can be granted or denied for each user.

To change the password for any user, enter the existing user name and a new password. The Mentor® computer will prompt you that the user already exists and ask if you want to change the password to the one you entered.

Figure 87. New User Window



5.2.3.3.7 Delete Users

BNTUUO20.C38 0000241888 A.2 A.13 A.3 1/2/20 2:11 PM Released

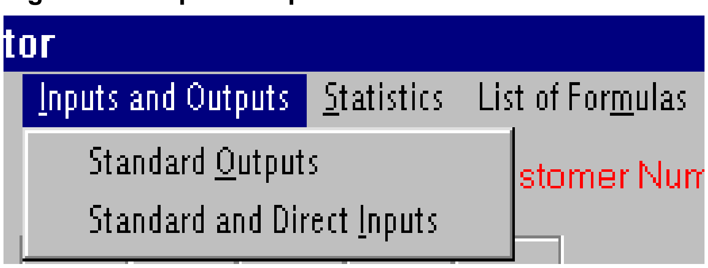
Delete tunnel system operators or programmers with this option.

5.2.3.4 Inputs and Outputs Menu

BNTUUO20.C39 0000241901 A.2 A.13 A.8 1/2/20 2:11 PM Released

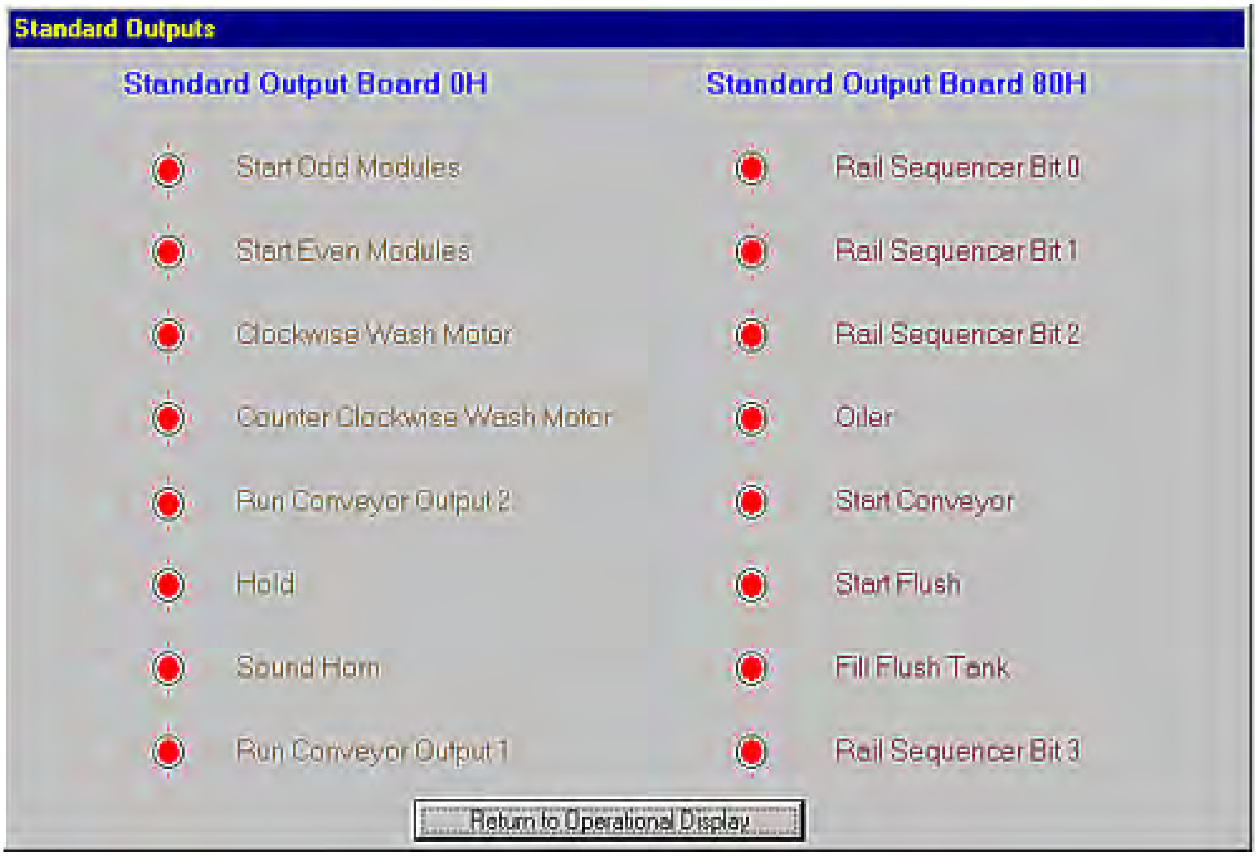
This menu allows the viewing of standard outputs and inputs, and direct inputs. These items can not be changed from these screens, but the on/off status of any item is displayed as it happens. Figure 88 shows the options available on this menu item.

Figure 88. Inputs/Outputs Menu



Standard Outputs This page (Figure 89) displays the 16 standard outputs of the tunnel system.

Figure 89. Standard Outputs Page



Standard and Direct Inputs This page displays the 12 direct inputs and the 32 standard inputs provided by standard input boards 0H and 80H. A red light adjacent to an input indicates the input is not made, while a green light indicates that the input is made. This page is shown in Figure 90 , and the connector and pin for each input are listed in Table 9: Standard and Direct Input Connections, page 159 .

Figure 90. Standard and Direct Inputs Page

Table 9. Standard and Direct Input Connections

Direct Inputs		Standard Input Board 0H		Standard Input Board 80H	
Input Name	**MTA-Pin**	**Input Name**	**MTA-Pin**	**Input Name**	**MTA-Pin**
Mentor® power off pressed	38–3	Circuit breaker, flush box	A–3–10	Remote customer bit 0	B–3–10
Program key	38–2	Rail empty	A–3–9	Remote customer bit 1	B–3–9
Signal cancel	38–1	Bag ready	A–3–8	Remote customer bit 2	B–3–8
Data valid	38–4	Halt rail	A–3–7	Remote customer bit 3	B–3–7
Operator hold switch	38–5	Do not tare	A–3–4	Remote customer bit 4	B–3–4
Three-wire circuit	38–6	Overload flush pump	A–3–3	Remote customer bit 5	B–3–3
Safety limit	39–5	Load conveyor ready	A–3–2	Remote customer bit 6	B–3–2
Top dead center limit	39–4	Hole desired	A–3–1	Remote customer bit 7	B–3–1
Clockwise limit	39–3	Load conveyor overload	A–4–10	Remote formula bit 0	B–4–10
Counterclockwise limit	39–8	Remote customer bit 8	A–4–9	Remote formula bit 1	B–4–9
CBW alignment	39–7	Remote customer bit 9	A–4–8	Remote formula bit 2	B–4–8
Unused	—	All contactors energized	A–4–7	Remote formula bit 3	B–4–7

Table 9 Standard and Direct Input Connections (cont'd.)

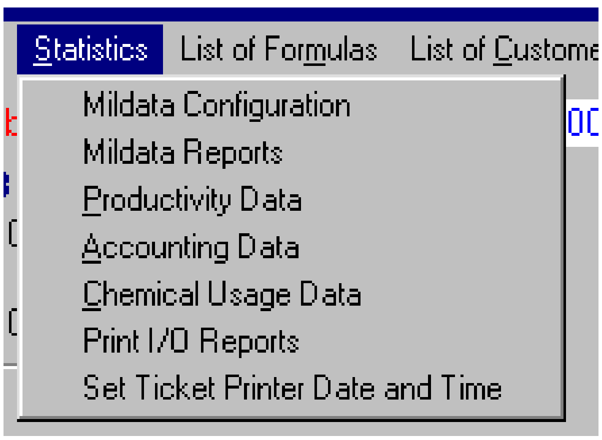
Direct Inputs		Standard Input Board 0H		Standard Input Board 80H	
Input Name	**MTA-Pin**	**Input Name**	**MTA-Pin**	**Input Name**	**MTA-Pin**
		Flush tank low level	A–4–4	Remote formula bit 4	B–4–4
		Flush tank high level	A–4–3	Remote formula bit 5	B–4–3
		Load chute eye blocked	A–4–2	Remote formula bit 6	B–4–2
		Circuit breaker, standard output box	A–4–1	Remote formula bit 7	B–4–1

5.2.3.5 Statistics Menu

BNTUUO20.C40 0000241896 A.2 A.13 A.5 1/2/20 2:11 PM Released

The statistics menu, shown in Figure 91 , provides access to screens of information on tunnel productivity, accounting data, and chemical usage. See Section 5.4 : Statistical Reports, page 178 for more detailed information on this menu.

Figure 91. Statistics Menu



5.2.3.5.1 Mildata® Configuration

BNTUUO20.C41 0000241895 A.2 A.13 A.4 1/2/20 2:11 PM Released

This item displays the **Mildata Configuration** page exactly as it appears on the Mildata® controller.

5.2.3.5.2 Mildata® Reports

BNTUUO20.C42 0000242042 A.2 A.13 A.3 1/2/20 2:11 PM Released

This item displays the Mildata® Report Generator exactly as it appears on the Mildata®controller.

5.2.3.5.3 Productivity Data

BNTUUO20.C43 0000242041 A.2 A.13 A.3 1/2/20 2:11 PM Released

This screen displays information on the number of transfers, operational timers (hold and run times, etc.), and the efficiency of the tunnel as measured by cumulative transfers, hold time, and run time.

5.2.3.5.4 Accounting Data

BNTUUO20.C44 0000242040 A.2 A.13 A.3 1/2/20 2:11 PM Released

The two views available from this selection show the cumulative number of transfers made for each programmed formula, with or without displaying the customer name.

5.2.3.5.5 Chemical Usage Data

BNTUUO20.C45 0000242039 A.2 A.13 A.3 1/2/20 2:11 PM Released

This screen displays the total number of units injected and the cumulative inject time for each chemical.

5.2.3.5.6 Print I/O Reports

BNTUUO20.C46 0000242038 A.2 A.13 A.3 1/2/20 2:11 PM Released

Use this selection to print information on the machine inputs and outputs. Both reports list the input or output number and name, the module to which each is assigned, and the board containing the device. The **Input Report** lists the connector and pin number of each input. The **Output Report** lists the connector and pin number for the common and the normally open contacts of each output.

5.2.3.5.7 Set Ticket Printer Date and Time

BNTUUO20.C47 0000242037 A.2 A.13 A.3 1/2/20 2:11 PM Released

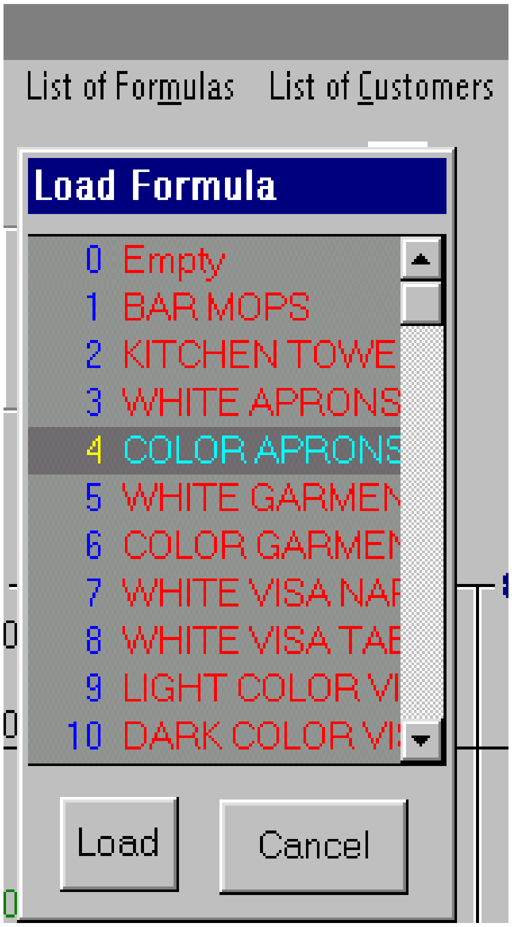
This selection synchronizes the tunnel processor board with the date and time set on the Mentor® controller computer. Because this synchronization is carried out automatically each time the tunnel system is started, this function should be used only with the advice of Milnor® factory personnel.

5.2.3.6 List of Formulas Menu

BNTUUO20.C48 0000242035 A.2 A.13 A.4 1/2/20 2:11 PM Released

Operators use this menu to select an existing formula for execution by the tunnel washer. Each available formula appears in a list (Figure 92). To load the desired formula into the first storage position, highlight the formula and click once on **Load**. Click **Cancel** to return to the operational display.

Figure 92. List of Formulas Menu



5.2.3.7 List of Customers Menu

BNTUUO20.C49 0000242033 A.2 A.13 A.3 1/2/20 2:11 PM Released

Operators use this menu to select an existing customer code for accounting purposes. Each available customer code appears in a list (Figure 93). To load the desired code into the first storage position, highlight the customer code and click once on **Load**. Click **Cancel** to return to the operational display.

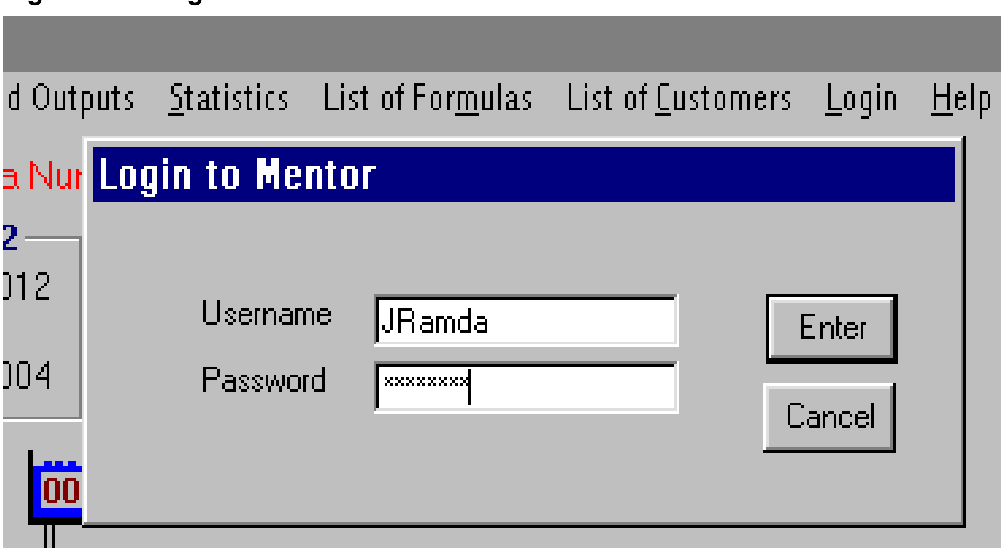
Figure 93. List of Customers Menu

5.2.3.8 Login Menu

BNTUUO20.C50 0000242074 A.2 A.13 A.3 1/2/20 2:11 PM Released

This menu tracks the current operator or programmer for the Mentor® controller. Only personnel with user names and passwords are allowed access to certain functions, particularly those relating to programming and configuring the system. The login screen is shown in Figure 94 .

Figure 94. Login Menu

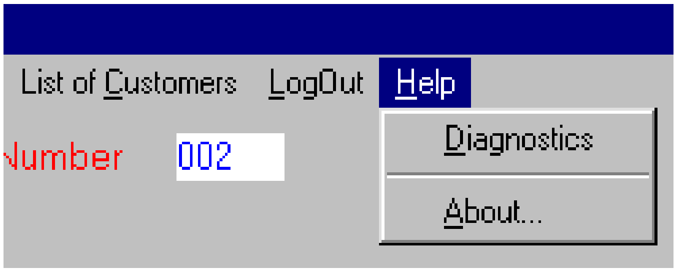


5.2.3.9 Help Menu

BNTUUO20.C51 0000242072 A.2 A.13 A.3 1/2/20 2:11 PM Released

This option (Figure 95) provides troubleshooting information regarding data communications errors, general tunnel error messages, and version information that is important when discussing problems with Milnor® personnel.

Figure 95. Help Menu



5.2.3.9.1 Diagnostics

BNTUUO20.C52 0000242070 A.2 A.13 A.4 1/2/20 2:11 PM Released

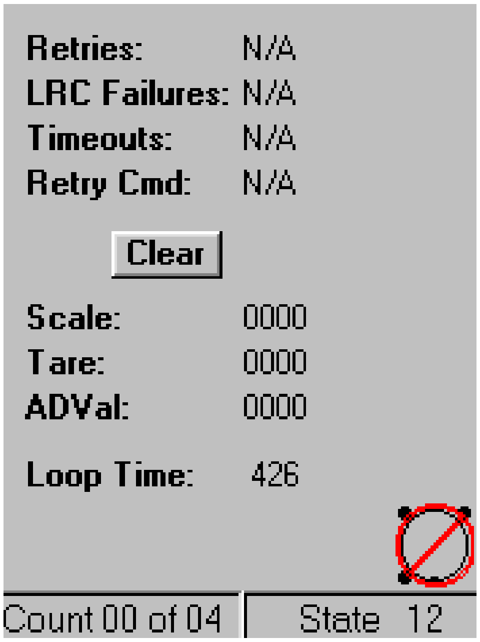
The **Diagnostics** selection displays data (Figure 96: Diagnostics Display, page 165) for troubleshooting communications errors between the Mentor® controller and the tunnel processor board.

- The **Retries** value is the number of times that Mentor® tried to communicate with the tunnel processor board. Retries may be caused by either **LRC Failures** or **Timeouts**.
  - LRC (Longitudinal Redundancy Check) errors occur when the checksum for the data transmitted between the tunnel processor board and the Mentor® controller is invalid.
  - Timeouts occur when the tunnel processor board doesn't respond at all to communications attempts by the Mentor® controller.
- The **Retry command** field is for use only by Milnor® personnel.
- The **Clear** button resets the cumulative values described above to 0.
- The Scale value is set when the load cell in the weighing device is calibrated, and is to calculate the actual weight of the goods. The Mentor® controller uses the equation below to calculate load weight:

  Load Weight = ((ADVal - Tare) x 1000) / Scale

- Tare is the detected weight of the weighing device with no load. This value is set when the weighing device is calibrated, and whenever the CONWA loading conveyor transfers.
- **ADVal** (A-to-D value) is the actual value received from the analog-to-digital board, as based on the analog voltage sent out by the load cell.
- **Loop Time** is the time in milliseconds required for the Mentor® controller to collect the information from the output timers the last time the tunnel transferred. Set the **Pause at Top Dead Center** timer to be greater than the longest time observed here.

Figure 96. Diagnostics Display

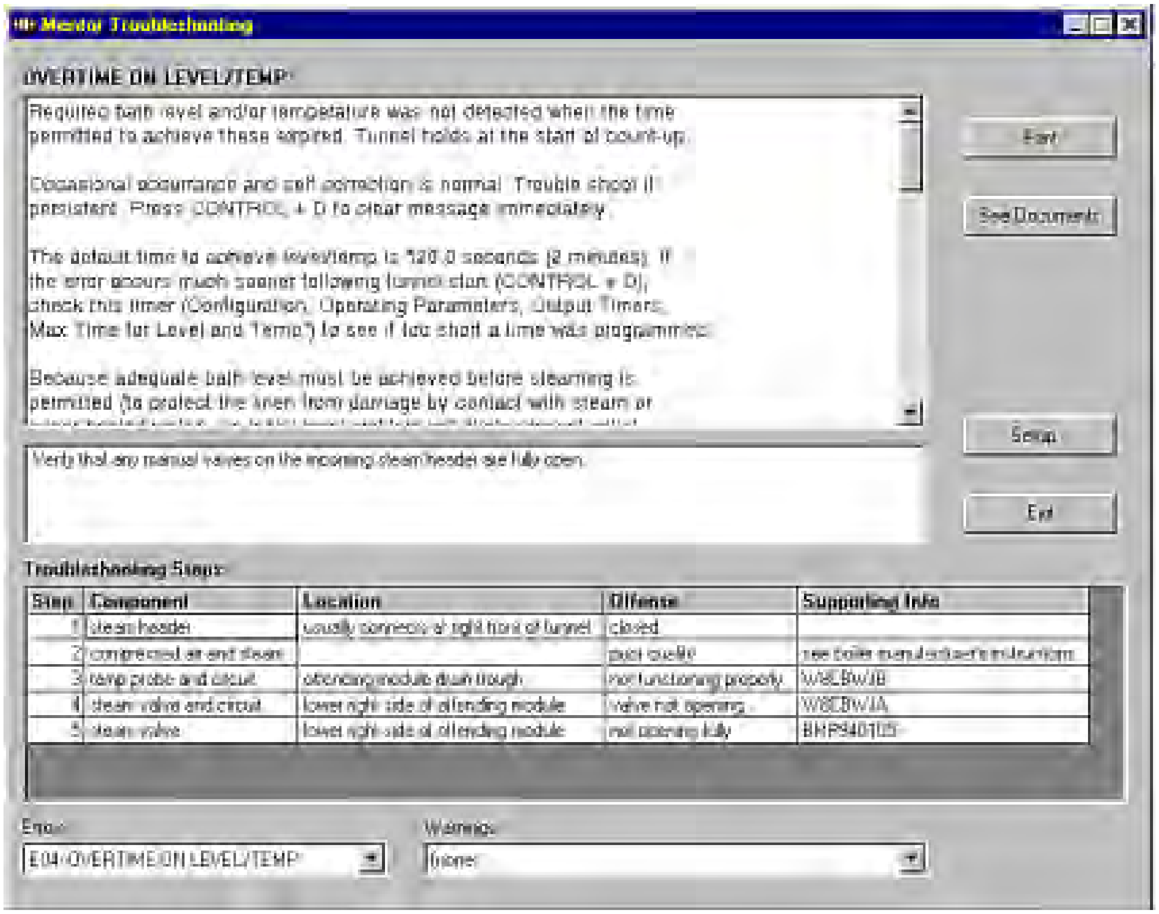


5.2.3.9.2 Troubleshooting

BNTUUO20.C53 0000242109 A.2 A.13 A.5 1/2/20 2:11 PM Released

Select this menu item to open the Mentor® online troubleshooting application, shown in Figure 97 . With the application running, select an error or warning in the lists near the bottom of the window. The upper panel of the window displays detailed information about the error or warning. See Section 6.2 : Mentor® Troubleshooting, page 196 and other documents in the Troubleshooting chapter of this manual for more details.

Figure 97. Mentor® Troubleshooting Window (Example)



The lower two panels of the **Mentor Troubleshooting** window provide the steps for troubleshooting the error (bottom panel) and a detailed description of the selected troubleshooting step in the middle panel.

Buttons for printing troubleshooting procedures, etc. are near the right side of the window.

5.2.3.9.3 Lost Password

BNTUUO20.C54 0000242107 A.2 A.13 A.4 1/2/20 2:11 PM Released

This selection (Figure 98) shows an encrypted form of the current password for the user Milnor®. This user is present on all Mentor® computers and cannot be deleted, although the password may be variable, depending on the Mentor® version. To regain access to the Mentor® software after a major incident, contact the Milnor® Customer Service department with this string. This selection is only available on Mentor® systems with software versions 20301 and later.

Figure 98. Encrypted Password Display

5.2.3.9.4 About...

BNTUUO20.C55 0000242106 A.2 A.13 A.3 1/2/20 2:11 PM Released

This menu selection displays the software product and version number, and various copyright notices. The software version number is important when communicating with Milnor® customer service representatives about your system.

Figure 99. Sample About... Screen

5.2.4 Loading System and CBW® Display Areas

BNTUUO20.C56 0000242159 A.2 A.13 A.3 1/2/20 2:11 PM Released

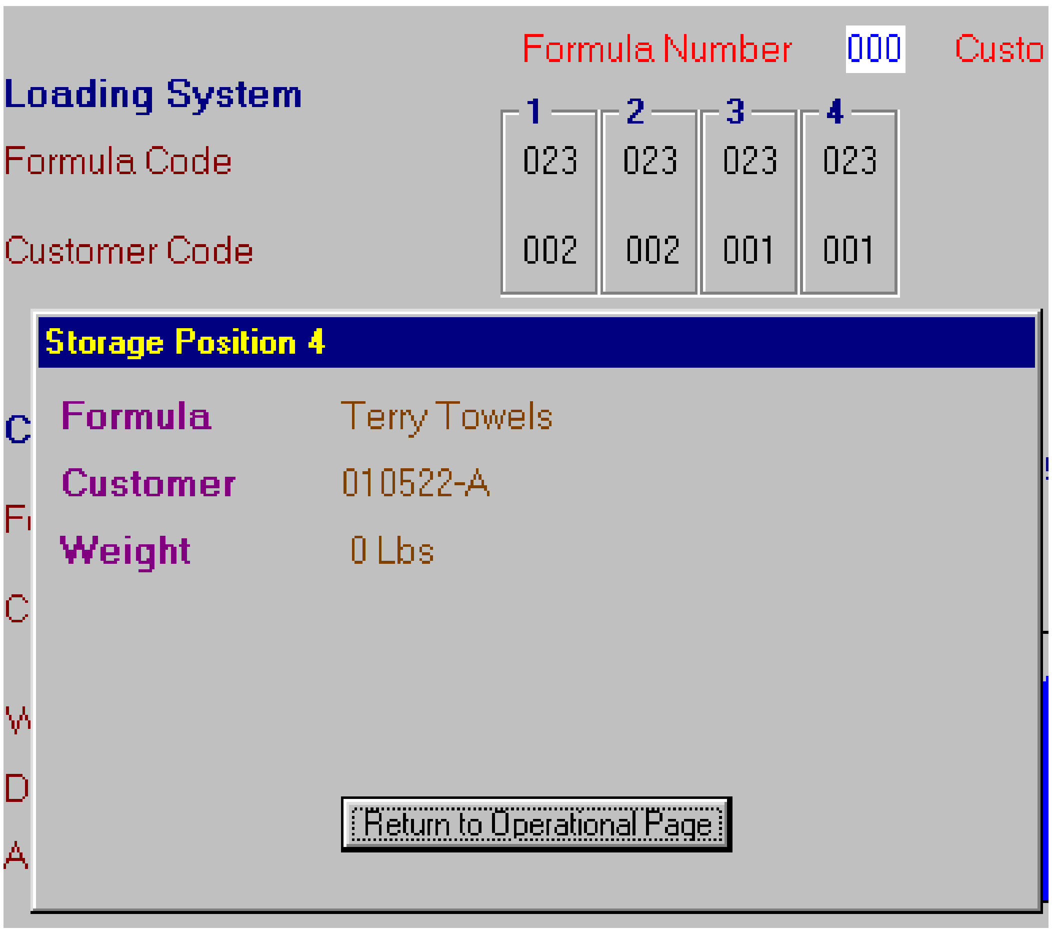
The main area of the display below the menu bar contains information about the current status of the tunnel washer and associated loading system, as well as troubleshooting and accounting information.

5.2.4.1 Loading System

BNTUUO20.C57 0000242158 A.2 A.13 A.3 1/2/20 2:11 PM Released

The loading system area (Figure 100) is a block diagram representing the storage locations (bags or conveyor pockets) of the loading system. The number of blocks in this diagram equals the number of storage positions entered in the **Hardware** selection of the **Configuration** menu.

Figure 100. Loading System Area and Details Display



Click the left mouse button in the empty area of any loading system position to view the weight of the load, as well as the formula and customer names.

5.2.4.1.1 Formula Code

BNTUUO20.C58 0000242156 A.2 A.13 A.3 1/2/20 2:11 PM Released

For each loading storage position, the top number indicates the formula code currently assigned to the load at that position. As each new batch is entered at storage location 1, the operator may enter a valid formula code for the goods. This formula code, along with all other formula codes being processed in the machine, determines how the tunnel washer operates. Available formula numbers are from 000 to 999, although numbers to which formulas have not been assigned are not valid. Note also that the Miltrac™ system is capable of handling only codes 000 through 254.

5.2.4.1.2 Customer Code

BNTUUO20.C59 0000242155 A.2 A.13 A.3 1/2/20 2:11 PM Released

For each loading storage position, the bottom number indicates the customer code currently assigned to the load at that position. As each new batch is entered at storage location 1, the operator may enter a valid customer code for the goods, to be used for accounting purposes. Customer codes numbered 000 through 999 are acceptable.

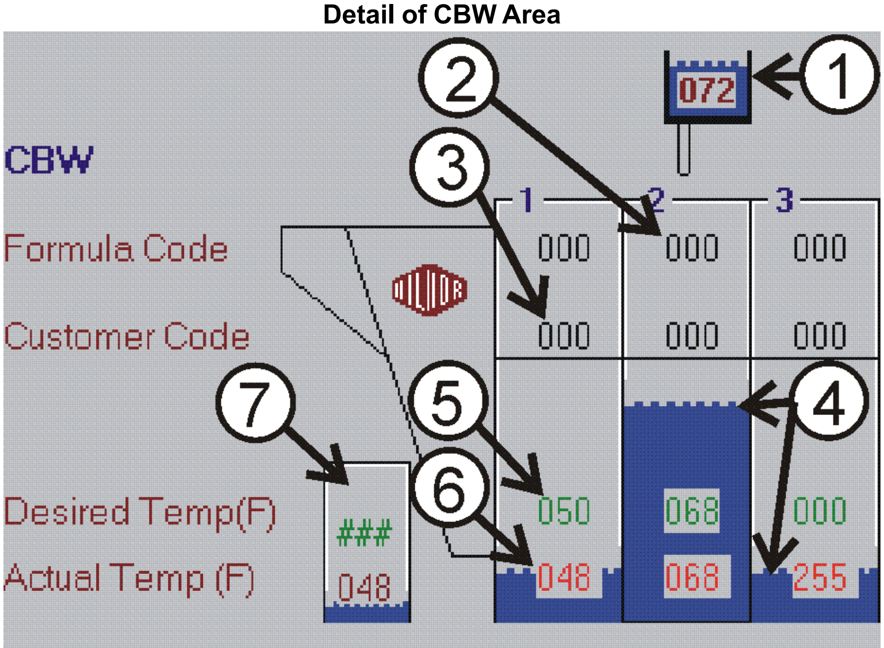
5.2.4.2 CBW®

BNTUUO20.C60 0000242605 A.2 A.13 A.5 1/2/20 2:11 PM Released

The CBW® area, detailed in Figure 101 , is a basic diagram representing the tunnel washer. The diagram displays and allows the modification of certain information about each module in the tunnel. At the top of each module is the number by which that module is known to the Mentor® controller.

Figure 101. CBW® Area

Detail of CBW Area



Legend

1. Overhead Fast Fill Tank
2. Formula Code
3. Customer Code
4. Water Level
5. Desired Temperature
6. Actual Temperature
7. Reuse Tank

5.2.4.2.1 Reuse Tank

BNTUUO20.C61 0000242604 A.2 A.13 A.3 1/2/20 2:11 PM Released

Displayed at the left end of the tunnel washer diagram (Figure 101: CBW® Area, page 169), this block displays the actual and desired temperatures of the liquor in the reuse tank unless the **Reuse Temperature** setting on the **CBW Hardware Configuration** page is set to **No Reuse Temperature**. The reuse tank stores water from the rinse zone or other sources until the water is needed to flush the next load of goods down the load chute and into the first module.

5.2.4.2.2 Modules

BNTUUO20.C62 0000242603 A.2 A.13 A.3 1/2/20 2:11 PM Released

Each module representation on the screen contains information related to certain characteristics of the contents of that module of the tunnel washer. The information is transferred from the loading device to the tunnel washer each time a new load enters the tunnel washer.

The upper two lines, above the horizontal dividing line, display the formula and customer codes currently in that module. This information moves to the next module each time the tunnel washer transfers, so the information always appears in the module containing the associated goods.

The next line is the desired temperature for the module. If the formula does not command a temperature for the current load in a particular module, the temperature number is replaced by ###. The bottom line in the tunnel diagram is a real-time display of the current temperature in each module.

The temperature fields of the operational display use four color combinations to indicate whether the tunnel is holding until temperature is first achieved, if steam is enabled in a module, etc. These combinations are described below.

Green text on gray background Temperature has been achieved once for the formula in the module, or the steam code does not stop the tunnel from counting rotations until temperature is achieved. Steam is not currently enabled for the module.

Green text on yellow background Similar to the above condition, except the steam valve for that module is currently open.

Red text on gray background Temperature has not yet been achieved for the formula in the module, or the steam code is such that reversals completed before temperature is achieved are not counted toward the number of reversals programmed. Steam is not currently enabled for the module.

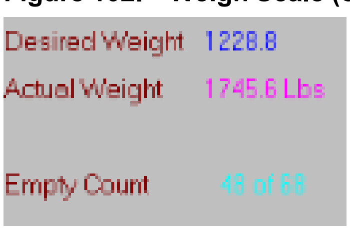
Red text on yellow background Similar to the above condition, except the steam valve for that module is currently open.

5.2.4.3 Weigh Scale (optional)

BNTUUO20.C63 0000242601 A.2 A.13 A.3 1/2/20 2:11 PM Released

If the system includes a weigh scale for accurate load sizing, the desired weight and the actual weight of the first storage position appears below the tunnel diagram. This area of the operational display is shown in Figure 102 .

Figure 102. Weigh Scale (optional)



For Mentor® software versions 97202 and later, the weight for the load currently in each module is displayed above the desired temperature field if a weighing device is present and configured.

5.2.4.4 Message Area

BNTUUO20.C64 0000242599 A.2 A.13 A.3 1/2/20 2:11 PM Released

Near the bottom of the main portion of the display is the message area, as shown in Figure 103 . Comments on the status of the tunnel system appear in this area, including error messages.

Click on the error or warning to launch the troubleshooting component of the Mentor® controller software.

Figure 103. Messages and Rotation Status Areas

5.2.4.5 Rotation Status Display

BNTUUO20.C65 0000242598 A.2 A.13 A.3 1/2/20 2:11 PM Released

Near the lower right corner of the main display is a diagram representing a view of the tunnel washer from the load end. Each rotation proximity switch is referenced on this diagram, allowing the operator to monitor tunnel rotation. As each proximity switch is triggered, its representation on the rotation status display changes from black to green. The arrow inside the symbol indicates the direction of tunnel rotation as viewed from the load end, and the arrow makes a complete rotation at tunnel transfer. When the tunnel stops, a red hash inside a circle appears over the symbol.

5.2.4.6 Status Bar

BNTUUO20.C66 0000242597 A.2 A.13 A.4 1/2/20 2:11 PM Released

The bottom line of the operational display contains various status and condition messages. At the far left of this bar is a display of the current date and time. This data is retrieved automatically from the Mentor® computer operating system and cannot be changed from within the Mentor® program.

Receive and Transfer Status boxes to the right of the time display, these boxes provide brief messages related to the tunnel.

Level box near the center of the status bar, this box indicates the status of bath liquor levels.

Temperature box located left of the level box, this area displays general information about the temperature of the bath liquor.

Count box displays the number of reversals completed and the number programmed. The programmed reversals number may also change if the **Change at Module** value of the transfer rate for the formulas is defined and takes effect.

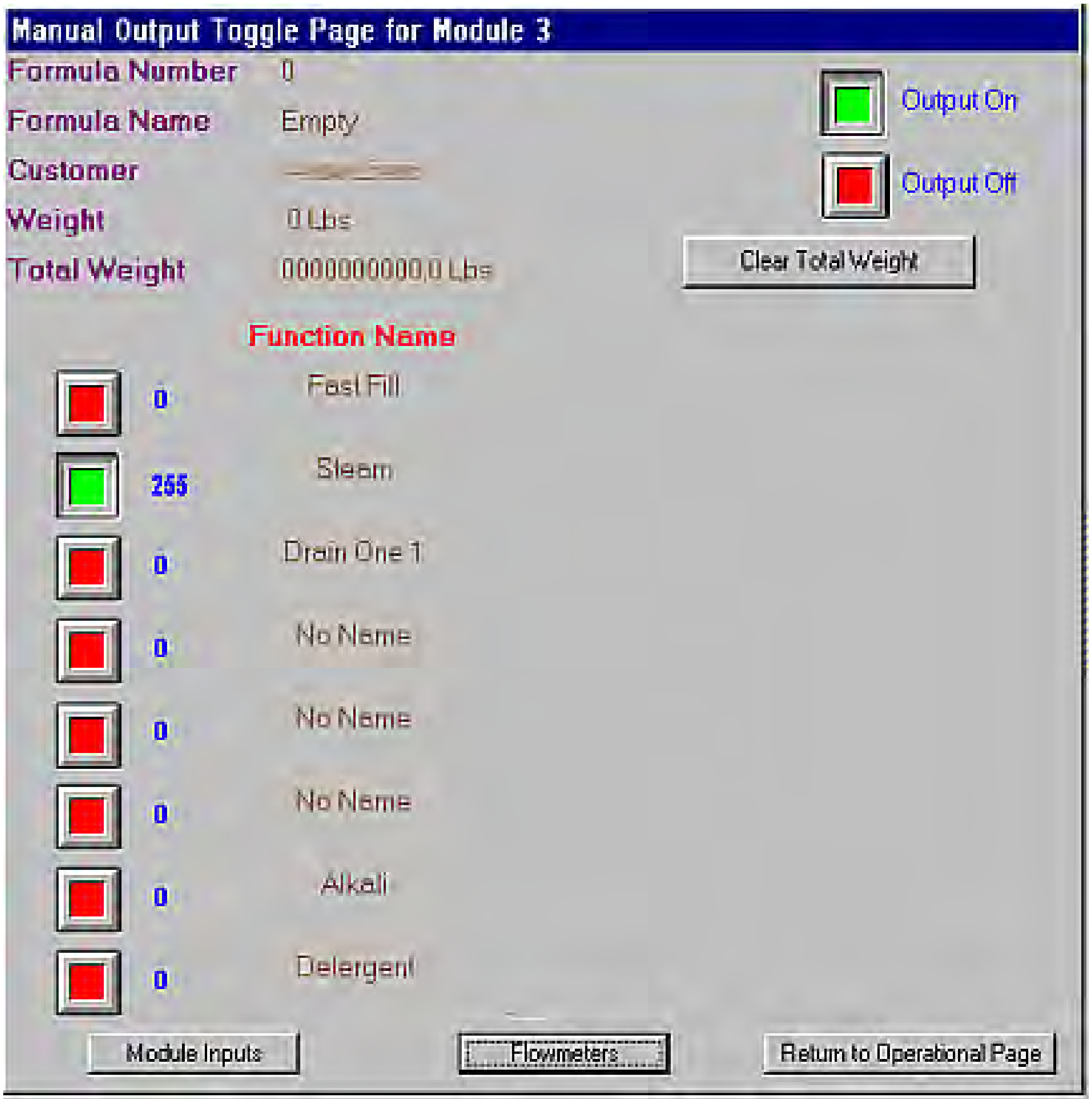
State box indicates the tunnel rotation state. This value corresponds with the rotation states shown in Figure 120: Cylinder Rotation Diagram, page 237 .

5.2.5 Manual Output Toggle Page

BNTUUO20.C67 0000242659 A.2 A.13 A.3 1/2/20 2:11 PM Released

Manual outputs for each module can be toggled on and off at the **Manual Output Toggle** page, shown in Figure 104 . Access this page by left-clicking the mouse in the top area of a tunnel module, but **not** on either the formula code or customer code displays. Note that only the outputs applicable to the selected module are displayed.

Figure 104. Manual Output Page



The upper part of this page displays the formula number and name, the customer, actual weight in the selected module (**Weight** field), and the total weight transferred out of the tunnel washer (**Total Weight** field).

The lower portion of this page displays the name and status of each output assigned to this module. The button at the left of each function name toggles the function on or off each time the left mouse button is clicked with the cursor over a button. If all safeties allow the function to be operated, clicking the mouse on a red button will cause it to turn green, and the blue 0 next to the button will change to 255, indicating that the function is operating. Enter a number between 0 and 254 for timed actuation of the output.

Across the bottom of the **Manual Output Toggle** page are three buttons for accessing module inputs, flowmeters, and for returning to the operational display.

5.2.5.1 Clear Total Weight Button

BNTUUO20.C68 0000242657 A.2 A.13 A.3 1/2/20 2:11 PM Released

Click this button to reset the total weight of goods transferred to 0.

5.2.5.2 Module Inputs Button

BNTUUO20.C69 0000242655 A.2 A.13 A.3 1/2/20 2:11 PM Released

Shown in Figure 105 , this button displays each input from this module to the tunnel microprocessor. Activated inputs are marked by a green light symbol; inputs not made are denoted by a red light. The on/off status of microprocessor inputs cannot be changed, only viewed. To return to the **Manual Output Toggle** page for the module, click the left mouse button on **Exit**, or press Alt + X on the keyboard.

Figure 105. Module Inputs Page

5.2.5.3 Flowmeters Button

BNTUUO20.C70 0000242654 A.2 A.13 A.4 1/2/20 2:11 PM Released

The **Flowmeters** button allows the operator to view, print, and clear flowmeter data for each module individually. The flowmeter data page, shown in Figure 106 , is divided into three columns. The leftmost column contains the data field. The middle and right columns display the amounts of fresh water and reuse water for the module. Values are available for programming by clicking on any valid number.

Figure 106. Flowmeter Data Page

Flowmeter data is available for all modules, but if flowmeters are present they are only wired into one module—usually module 1. Flowmeter values can only be changed in the module to which the flowmeters are wired.

Counts the number of pulses detected by the flowmeter and sent to the microprocessor. This value can be viewed, but not modified by the operator.

Counts per quantity calibration variable that allows the controller to calculate the quantity of water from the number of pulses. This value is set on the flowmeters page.

Counts per second derived by dividing the total number of counts by the number of seconds defined in **Flow Rate Sample Interval** on the **Configuration/Operating Parameters/Program Constants** page. The flow rate sample interval must be set between a minimum of 10 seconds and a maximum of 15 seconds.

Quantity per minute calculated by the controller using the run time of the tunnel washer, the number of counts, and the counts per quantity.

Total water usage measured over the period since the counters were last cleared (reset to 0), or over the life of the machine.

Clear Counters button Near the bottom of the flowmeter data page, this button allows the operator to reset the **Counts** value to 0 so new data can be collected and analyzed separately.

BNTUUO19 / 2019143 BNTUUO19 0000230269 A.5 1/2/20 2:11 PM Released

5.3 Tunnel Start-up and Shut-down

BNTUUO19.C01 0000230270 A.2 A.5 A.3 1/2/20 2:11 PM Released

5.3.1 How To Restore Water Levels and Temperatures after a Lengthy Shutdown

BNTUUO19.C02 0000230268 A.2 A.5 A.3 1/2/20 2:11 PM Released

Enable console power, then tunnel power, but do not enter the **start** command. The tunnel remains stationary, and the message “Power Failure” appears. The main water valves open, and the *Flow Splitter/Lifter* pumps are enabled. Water valves close and steam valves open when water levels reach the commanded levels. The steam valves remain open until commanded temperatures are achieved, then the steam valves close and “Level and Temp Satisfied-Press Ctrl D to Start” appears.

Stopping the water flow when correct water levels are established but before commanded temperatures are restored prevents the wasteful discharge of partially heated water.

After levels and temperatures are achieved, it may be necessary to restore chemical concentrations before processing goods. See Section 5.3.2 : How To Achieve Desired Chemical Concentrations at Start-Up, page 176 (below) for detailed information.

CAUTION: **Entanglement Hazard** — The **Ctrl-D** command starts cylinder rotation. Verify that all machine guards are in place and all personnel are well clear of the tunnel.

Ctrl-D starts cylinder rotation and normal processing. The count will be at least 20 reversals remaining for the first startup after a power failure.

Ctrl-K stops cylinder rotation and normal processing except as explained below. The Mentor® controller remembers what reversal was in progress and resumes processing at that reversal when restarted. If the CBW® was stopped with less than “count minus four reversals” remaining before transfer, the CBW® defaults to four reversals when restarted. For example, assume a formula requiring 20 reversals has only two reversals remaining when **Ctrl-K** is stopped. When the CBW® is restarted, the count will revert to four reversals remaining, rather than the two reversals that were remaining when the tunnel was stopped.

WARNING: **Do not use Ctrl-K to stop cylinder rotation.** — **Ctrl-K** will not stop cylinder rotation after the tunnel is committed to transfer. To completely stop the tunnel in an emergency, turn off power at the wall disconnect switch. Cylinder rotation can also be stopped with any of the red emergency stop buttons on the Mentor® controller console or the tunnel. However, neither of these de-energizes certain pumps or other devices on the tunnel or associated with the CBW® system.

CAUTION: **Receive Faults** — In Miltrac™ systems, after Miltrac™ acknowledges “Start Transfer” (during the last reversal), **Ctrl-K** causes a “Receive Fault” in the Milnor® press. See the explanation of error messages in the press technical manual for fault recovery.

5.3.2 How To Achieve Desired Chemical Concentrations at Start-Up

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After desired working chemical concentrations are achieved, the maintenance dose injections called for by each formula will replace the chemical depleted by the goods at each transfer. However, numerous transfers may be required before chemical concentrations achieve their normal level if chemical levels are very low or non-existent, as may occur after a shutdown. Section 5.3.2.1 : If the Tunnel Contains Goods at Start-up, page 176 and Section 5.3.2.2 : If the Tunnel is Empty of Goods at Start-up, page 176 explain how to quickly achieve normal chemical concentrations at start-up.

5.3.2.1 If the Tunnel Contains Goods at Start-up

BNTUUO19.C04 0000230542 A.2 A.5 A.4 1/2/20 2:11 PM Released

Some operators prefer to leave the tunnel full of goods overnight or over the weekend. However, the operator must consider the likelihood of linen damage if the goods remain in the bleach bath for more than a few hours. After starting tunnel cylinder rotation, use the **Inject Chemicals** menu item (**File/Inject Chemicals**) as described below to establish proper chemical concentrations.

The **Inject Chemicals** selection of the **File** menu on the *operational display* permits an operator to manually inject a quantity of chemicals equal to one, two, or three transfers for all formulas currently in the tunnel. If the corresponding goods and batch codes remained in the tunnel overnight, the operator need only inject additional chemicals using this method to achieve working concentrations. If the tunnel was empty, leaving only the “empty” formula code in each module, this method will be ineffective, as the formula for an empty pocket should not call for chemical injections.

1. From the operational display, press **Alt-F** or select **File** near the upper left corner of the screen.
2. Select **Inject Chemicals** from the drop-down menu list by hovering the mouse cursor over it or using the up and down arrow keys to move the highlight bar.
3. When the flyout menu of charges appears, select the number of chemical charges to inject into all modules to restore the desired chemical concentrations.

If three or more reversals remain before transfer, this command injects the specified number of charges of chemical and resets the rotation counter to 20.

If the tunnel is stopped, this command is stored in memory by the Mentor® controller. When **Ctrl-D** is next issued to start cylinder rotation, the Mentor® controller injects the specified number of charges.

If fewer than three reversals remain before transfer, this command does not inject chemicals.

To avoid injecting chemicals after the flyout menu appears, click the mouse on the title bar of the operational display or press **Escape** once to close each menu level.

5.3.2.2 If the Tunnel is Empty of Goods at Start-up

BNTUUO19.C05 0000230541 A.2 A.5 A.3 1/2/20 2:11 PM Released

Assuming the tunnel was emptied before shutdown as described in Section 5.3.4 : How to Empty the Tunnel Washer with XLOAD, page 177 or Section 5.3.5 : Evening Shut-down, page 177 of this document, the Mentor® controller will have in each module an empty pocket formula which commands an average temperature, but no chemicals (assuming the empty pocket formula has been properly programmed to inject no chemicals). After starting tunnel cylinder rotation, use *first dosing* (explained below) to re-establish the proper working chemical concentrations.

Used only when the tunnel was emptied of goods, first dosing, explained in detail in the document on Chemical Compatibility (contained in the reference manual), provides a special first dosing chemical quantity to be injected when and only when, for example, heavy soil goods follow light soil goods. If the tunnel is to be emptied of goods at evening shutdown, use first dosing to automatically inject the extra large doses necessary to achieve working concentrations when and only when any real formula follows the empty formula.

5.3.3 Interruptions in Normal Tunnel Washer Operation

BNTUUO19.C06 0000230554 A.2 A.5 A.3 1/2/20 2:11 PM Released

5.3.3.1 Tunnel Holds

BNTUUO19.C07 0000230553 A.2 A.5 A.3 1/2/20 2:11 PM Released

5.3.3.2 Maximum Time in Hold

BNTUUO19.C08 0000230552 A.2 A.5 A.3 1/2/20 2:11 PM Released

If the *Max Time in Hold* feature is enabled on the **Configuration/Operating Parameters/Output Timers** page, the tunnel stops and displays “Too Long in Hold” on the operational display after the specified maximum time in hold is met. The operator alarm sounds. Clear the cause of the hold, then restart the tunnel with **Ctrl-D**.

5.3.4 How to Empty the Tunnel Washer with XLOAD

BNTUUO19.C09 0000230584 A.2 A.5 A.3 1/2/20 2:11 PM Released

If this feature is desired and not wired from the factory, contact Milnor® technical support for assistance. To empty the tunnel without XLOAD, the most efficient method is to simply disable the loading system and let the tunnel continue to run without being loaded. Using this method, be sure to change the formula code and customer code to an empty code in the first module at the beginning of each transfer.

The XLOAD input (standard input 08) simplifies emptying the tunnel. When this input is made, the Mentor® controller suppresses the "start conveyor (drop bag)" output and inserts empty pockets by automatically entering the Empty formula and Empty customer codes into module 01 and permitting the tunnel to transfer. This feature eliminates the data entry on the operational display and the need to use the change code procedures as explained above. The operator merely closes input 08 via a switch and wiring provided by the customer (not by Milnor®) at the end of the day's operation and permits the CBW® system to operate until the tunnel is empty of goods. After shutdown, the operator returns the input 08 switch to its normal position for the next day's operation.

5.3.5 Evening Shut-down

BNTUUO19.C10 0000230583 A.2 A.5 A.3 1/2/20 2:11 PM Released

If goods remain in the tunnel at shutdown, the Mentor® controller will retain batch code data even with console power off, so the batch codes are synchronized with the goods remaining in the machine at the next start-up. To empty the machine, use the empty formula and empty customer codes. To facilitate emptying the tunnel with the empty formula and empty customer constants, the user may want to use standard input 08 XLOAD (see Section 5.3.4 : How to Empty the Tunnel Washer with XLOAD, page 177).

5.3.6 Emptying a Conveyor-Fed Tunnel

BNTUUO19.C11 0000230582 A.2 A.5 A.3 1/2/20 2:11 PM Released

To empty the tunnel and leave the load conveyor loaded, refer to Section 5.3.4 : How to Empty the Tunnel Washer with XLOAD, page 177 .

To empty both the load conveyor and the tunnel, stop loading the conveyor and enter the empty formula and customer codes in the first empty compartment on the conveyor. If the empty formula does not automatically permit the empty pockets to enter the tunnel, set the *Pass Empty Pockets* switch on the load conveyor to OK.

5.3.7 Emptying a Rail-Fed Tunnel

BNTUUO19.C12 0000230581 A.2 A.5 A.4 1/2/20 2:11 PM Released

Refer to Section 5.3.4 : How to Empty the Tunnel Washer with XLOAD, page 177 . Turn off the *Drop Bag* signal by checking the **Pass Empty** checkbox in the Post Wash Codes zone of the Formula Programming screen (**Programming/Formulas**), then use one of the following methods to permit empty pockets to enter the tunnel:

1. If the rail system defaults to the empty formula and empty customer when the “bag ready” signal is turned off, empty pockets will automatically enter the tunnel as it transfers. No other action is necessary.
2. If load error detection is not enabled, the Mentor® controller will permit empty pockets encoded with a “real” formula to enter the tunnel. As each empty pocket enters module 01, use the code correction procedures described in “Operational Display of Mentor®” to replace the real formula and customer codes in module 01 with the empty values.
3. If the code reading position on the rail is ahead of the position where the bag empties its contents into the load scoop (last storage position), each time the tunnel transfers, use the code correction procedures described in “Operational Display of Mentor®” to replace the real formula and/or goods and customer codes in the last storage position with the empty values.

5.3.8 Removing Power from the Mentor® Controller

BNTUUO19.C13 0000230580 A.2 A.5 A.3 1/2/20 2:11 PM Released

Ctrl-K stops cylinder rotation unless the tunnel is committed to transfer.

Shut off console power.

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5.4 Statistical Reports

BNTUUO21.C01 0000243525 A.2 B.4 A.3 1/2/20 2:11 PM Released

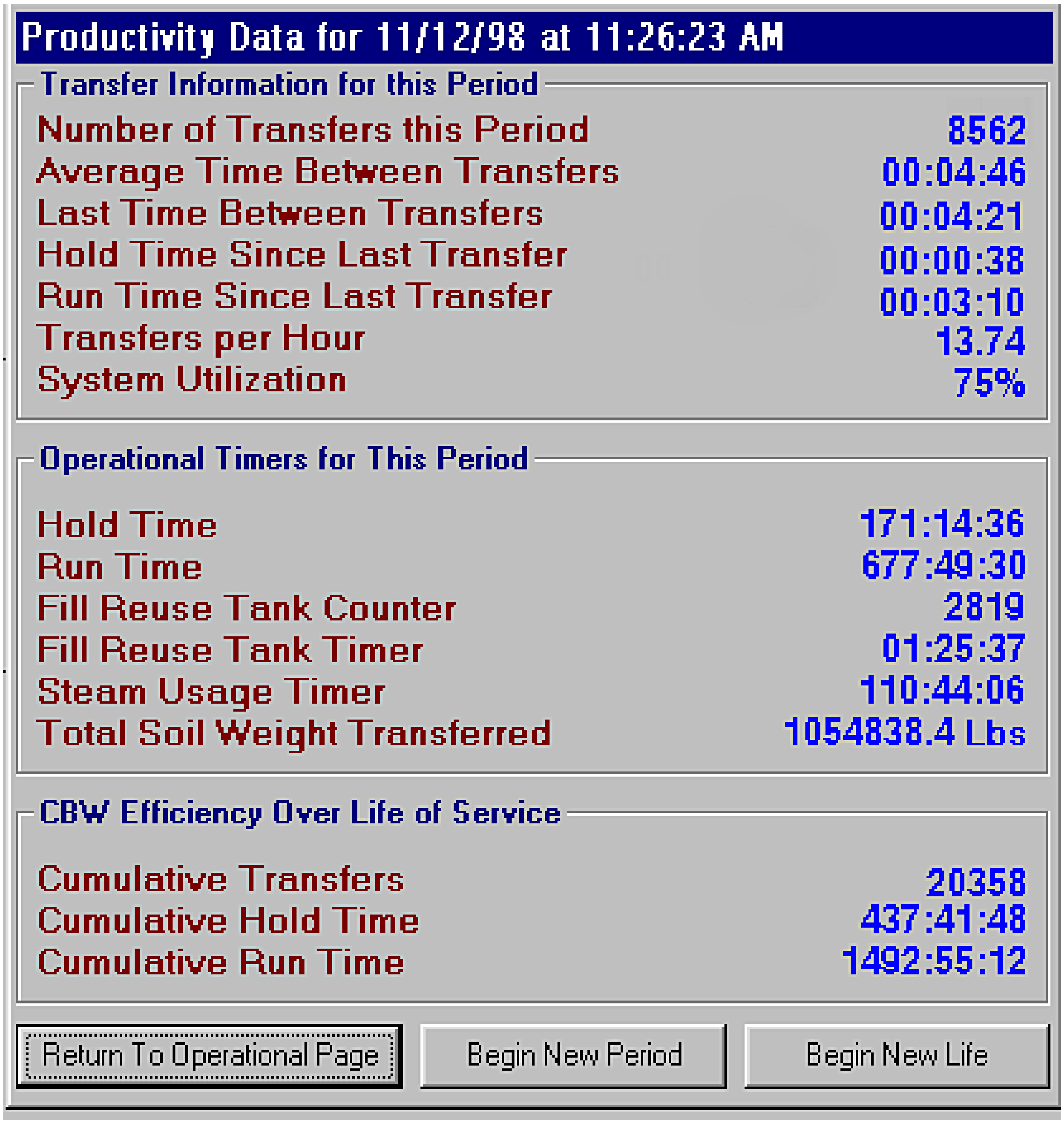
The Milnor® Mentor® controller monitors and records certain operational data continuously. By monitoring the data accumulated, management may be able to make adjustments which will increase the efficiency of the laundry.

5.4.1 Productivity Data

BNTUUO21.C02 0000243524 A.2 B.4 A.4 1/2/20 2:11 PM Released

Productivity data includes information on transfers, operational timers, and cumulative efficiency for the CBW® system. As shown in Figure 107 , the three types of data presented by this screen are segregated to make reading and interpretation easy.

Figure 107. Productivity Data Window



5.4.1.1 Title Bar

BNTUUO21.C03 0000243522 A.2 B.4 A.3 1/2/20 2:11 PM Released

The title bar of the **Productivity Data** window includes the date and time the window was accessed. Using Figure 107 as the example, this data was current as of November 12, 1998 at 11:26:23 in the morning.

5.4.1.2 Button Bar

BNTUUO21.C04 0000243521 A.2 B.4 A.3 1/2/20 2:11 PM Released

The buttons at the bottom of the **Productivity Data** window allow the user to close the window and return to the operational display, to begin a new period for data collection, or to begin a new “life” for the CBW® system.

5.4.1.2.1 Button: Return to Operational Page

BNTUUO21.C05 0000243520 A.2 B.4 A.3 1/2/20 2:11 PM Released

This button closes the **Productivity Data** window, allowing viewing of the operational display without obstruction.

5.4.1.2.2 Button: Begin New Period

BNTUUO21.C52 0000243683 A.2 B.4 A.3 1/2/20 2:11 PM Released

The **Begin New Period** button is accessible to anyone viewing the Mentor® productivity display at any time. Data for periods is not protected by a password and can be cleared at any time.

Click on this button to clear the data for the current period and begin a new one. These data include all values in the “Transfer Information for this Period” and the “Operational Timers for this Period” zones of the **Productivity Data** window.

NOTE: Data items accumulated over the life of the CBW® system, described in “CBW Efficiency Over Life of Service”, are not cleared when a new period is begun.

5.4.1.2.3 Button: Begin New Life

BNTUUO21.C07 0000243518 A.2 B.4 A.3 1/2/20 2:11 PM Released

Beginning a new life for the CBW® system clears all counters, including those which gather information across periods.

Only persons with programming rights to the Mentor® computer have access to the **Begin New Life** button. Unless a user is logged in as a programmer, the button is disabled. However, to safeguard against the loss of important data from accidental actuation of this button, print the **Productivity Data** window periodically.

Newer Mentor® software includes a **Print** button near the bottom of the window to print the contents of the window. On older version of the Mentor® software, this is accomplished by pressing the **Print Scrn** key to start Easy Print Screen™, then clicking once on the **Print** button. When Easy Print Screen™ releases control back to the keyboard, click the **Done** button to close the printing software

5.4.1.2.4 Button: Print

BNTUUO21.C08 0000243517 A.2 B.4 A.3 1/2/20 2:11 PM Released

Sends the **Productivity Data** window to the default printer attached to the Mentor® computer.

5.4.1.3 Transfer Information for this Period

BNTUUO21.C09 0000243575 A.2 B.4 A.3 1/2/20 2:11 PM Released

5.4.1.3.1 Number of Transfers this Period

BNTUUO21.C10 0000243574 A.2 B.4 A.3 1/2/20 2:11 PM Released

This field maintains a total of the number of times the tunnel transferred since it was put into service or a new period was begun. The value in this field increments at **init code D** (after tunnel starts turning after pause at top dead center) of each transfer, up to a maximum value of 65,535. Upon reaching this maximum value, the counter returns to 0 and begins again.

5.4.1.3.2 Average Time Between Transfers

BNTUUO21.C11 0000243573 A.2 B.4 A.3 1/2/20 2:11 PM Released

The average time between transfers is calculated by summing the time between all transfers, then dividing the total time by the number of transfers:

$$X = (T_1 + T_2 + T_3 + \ldots T_n) \div n$$

Where:

X = average time between transfers

T_n = time from first **init code D** to next **init code D**

n = the number of transfers in the period

5.4.1.3.3 Last Time Between Transfers

BNTUUO21.C12 0000243572 A.2 B.4 A.3 1/2/20 2:11 PM Released

The value stored in this field is the time between the most recent two transfers of the tunnel, timed from **init code D** of the first transfer to **init code D** of the second.

5.4.1.3.4 Hold Time Since Last Transfer

BNTUUO21.C13 0000243571 A.2 B.4 A.3 1/2/20 2:11 PM Released

This field displays the time, if any, that the tunnel has been in hold since **init code D** of the last transfer.

5.4.1.3.5 Run Time Since Last Transfer

BNTUUO21.C14 0000243570 A.2 B.4 A.3 1/2/20 2:11 PM Released

This field displays the time that the tunnel has run without a hold condition since the last transfer.

5.4.1.3.6 Transfers per Hour

BNTUUO21.C15 0000243569 A.2 B.4 A.4 1/2/20 2:11 PM Released

The value in this field is calculated by dividing the number of transfers for this period by the run time of the period:

$$X = T_p \div R_p$$

Where:

X = average number of transfers per hour

T_p= number of transfers in this period

R_p= the run time of the period in hours

5.4.1.3.7 System Utilization

BNTUUO21.C16 0000243568 A.2 B.4 A.3 1/2/20 2:11 PM Released

System utilization is determined by subtracting the hold time for the period from the run time for the period, then dividing this value by the run time for the period:

$$X = (R_p - H_p) \div R_p$$

Where:

X = system utilization

R_p = run time for the period

H_p = hold time for the period

Example (units are seconds of time):

$$X = (52{,}227 - 14{,}029) \div 52{,}227 = 0.731 = 73.1\%$$

5.4.1.4 Operational Timers for This Period

BNTUUO21.C17 0000243567 A.2 B.4 A.3 1/2/20 2:11 PM Released

Operational timers log the occurrence of certain actions at the tunnel. This data is gathered from the Mentor® controller and other devices directly. The controller sums this data for display, but performs no other calculations on it. Because this zone is focused on data for a particular period, it is cleared in its entirety when a new period is begun.

5.4.1.4.1 Hold Time

BNTUUO21.C18 0000243566 A.2 B.4 A.3 1/2/20 2:11 PM Released

This cumulative timer is incremented each time the tunnel enters a hold condition. The value is displayed in hours, minutes, and seconds.

5.4.1.4.2 Run Time

BNTUUO21.C19 0000243605 A.2 B.4 A.3 1/2/20 2:11 PM Released

Run time is accumulated whenever the tunnel is operating and is not in a hold condition.

5.4.1.4.3 Fill Reuse Tank Counter

BNTUUO21.C20 0000243604 A.2 B.4 A.3 1/2/20 2:11 PM Released

This value is incremented each time make-up water is used to restore the level of the reuse tank because of the lack of reuse water from the extraction device. Frequent use of long distance compatibility to prevent contaminated water from being used to refill the reuse tank may cause additional fresh water consumption through the reuse tank.

5.4.1.4.4 Fill Reuse Tank Timer

BNTUUO21.C21 0000243603 A.2 B.4 A.3 1/2/20 2:11 PM Released

This timer accumulates the number of hours, minutes, and seconds the fresh water valve to the reuse tank is open. This timer begins incrementing each time the **Fill Reuse Tank** counter (above) is incremented.

5.4.1.4.5 Steam Usage Timer

BNTUUO21.C22 0000243602 A.2 B.4 A.3 1/2/20 2:11 PM Released

The **Steam Usage** timer begins counting whenever the steam valve to any module or tank is opened, and stops incrementing when all steam valves are closed.

5.4.1.4.6 Total Soil Weight Transferred

BNTUUO21.C23 0000243601 A.2 B.4 A.3 1/2/20 2:11 PM Released

This data is a running total of the weight of the soiled goods as they enter the tunnel. The data for individual batches making up this sum may be received from the keypad (if manually entered), or from the weighing device on the rail. This value is incremented as each batch is discharged from the tunnel.

5.4.1.4.7 Rotation Time

BNTUUO21.C24 0000243600 A.2 B.4 A.4 1/2/20 2:11 PM Released

One rotation is defined as the time required for the basket to start from **state 0B**, pass through all **non-transfer** states, and return to **state 0B**. The cylinder states are illustrated in Figure 120: Cylinder Rotation Diagram, page 237 . This value appears on machines with Mentor® software version 20201 and later and processor board software version 20301 for G1 and G2 tunnel models or software version 21301 for G3 tunnel models.

NOTE: When the Mentor® controller calculates the transfer rate during formula programming (Section 4.1.1.3 : Time (Transfer Rate) Zone, page 106 and Figure 51: Time (Transfer Rate) Zone, page 106), a fixed approximation of the rotation time is used rather than the measured time determined here.

5.4.1.5 CBW® Efficiency Over Life of Service

BNTUUO21.C25 0000243620 A.2 B.4 A.3 1/2/20 2:11 PM Released

The three values in this zone of the **Productivity Data** window are not cleared when a new period is begun. They are reset to zero only when a user with programming rights at the Mentor® controller selects **Begin New Life**.

5.4.1.5.1 Cumulative Transfers

BNTUUO21.C26 0000243619 A.2 B.4 A.3 1/2/20 2:11 PM Released

This field maintains a total of all transfers made by the tunnel since commissioning or since the **Begin New Life** button was selected. This is the sum of the values in the “Number of Transfers this Period” field.

5.4.1.5.2 Cumulative Hold Time

BNTUUO21.C27 0000243618 A.2 B.4 A.3 1/2/20 2:11 PM Released

The **cumulative hold time** is the sum of all hold times from every period since commissioning or the beginning of a new service life.

5.4.1.5.3 Cumulative Run Time

BNTUUO21.C28 0000243617 A.2 B.4 A.3 1/2/20 2:11 PM Released

This field maintains a total of all the times accumulated in the **Run Time** field of the **Operational Timers** zone since commissioning or the beginning of a new service life.

5.4.2 Accounting Data

BNTUUO21.C29 0000243616 A.2 B.4 A.3 1/2/20 2:11 PM Released

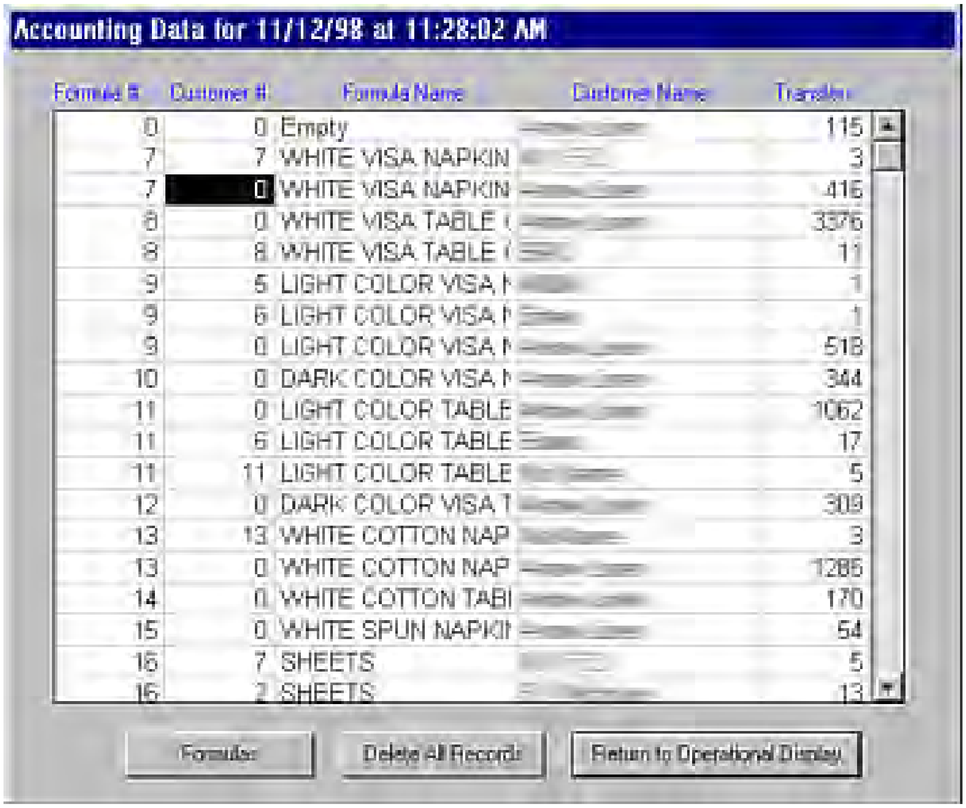
The **Accounting Data** window, shown in Figure 108: Accounting Data Window, Customer View, page 184 and Figure 109: Accounting Data Window, Formulas View, page 186 , presents data for tracking transfers by customer and formula (**Customer** view) or formula only (**Formula** view).

5.4.2.1 Customer View

BNTUUO21.C30 0000243614 A.2 B.4 A.3 1/2/20 2:11 PM Released

The customer view of the accounting data window allows management to reconcile the number of transfers of each formula to individual customers. Using Figure 108: Accounting Data Window, Customer View, page 184 for an example, formula number 9 (Light Color Visa Napkins) was used for goods from three customers. Because this view of the accounting data is sorted by the **Formula Number** field, it allows management to quickly see how many batches are produced with each formula, and what customers use each formula most frequently.

Figure 108. Accounting Data Window, Customer View



5.4.2.1.1 Title Bar

BNTUUO21.C31 0000243613 A.2 B.4 A.3 1/2/20 2:11 PM Released

The title bar of the **Accounting Data** window includes the date and time the window was accessed. Using Figure 108: Accounting Data Window, Customer View, page 184 as the example, this data was current as of November 12, 1998 at 11:28:02 in the morning. Transfers which occur while this window is being viewed are not included in the displayed count, but will be added if the window is closed and re-opened.

5.4.2.1.2 Button Bar

BNTUUO21.C32 0000243612 A.2 B.4 A.3 1/2/20 2:11 PM Released

The three buttons at the bottom of the **Accounting Data** window allow the user to view cumulative totals by formula only, to delete all records and begin data accumulation from zero, or to close the window and return to the operational display.

5.4.2.1.2.1 Button: Formulas

BNTUUO21.C33 0000243611 A.2 B.4 A.3 1/2/20 2:11 PM Released

Click once on this button to switch to the alternate view of the transfer data, as illustrated in Figure 109: Accounting Data Window, Formulas View, page 186 and described in the portion of this document related to the **Formulas** view.

5.4.2.1.2.2 Button: Delete All Records

BNTUUO21.C34 0000243642 A.2 B.4 A.3 1/2/20 2:11 PM Released

Click once on this button to delete all existing accounting data. This function might be used at the beginning of a billing period.

5.4.2.1.2.3 Button: Return to Operational Display

BNTUUO21.C35 0000243641 A.2 B.4 A.3 1/2/20 2:11 PM Released

This button closes the **Accounting Data** window, allowing viewing of the operational display without obstruction.

5.4.2.1.3 Formula Number

BNTUUO21.C36 0000243640 A.2 B.4 A.3 1/2/20 2:11 PM Released

This field lists the formula number of each formula executed since the accounting data was last cleared. This is also the field on which the formulas are sorted for display. Each horizontal line of data represents the number of times one specific formula number was executed for one customer.

NOTE: The formula number is assigned to a formula during programming, and cannot be changed. See Section 4.1 : Programming Mentor® Formulas, page 102 for more information.

5.4.2.1.4 Customer Number

BNTUUO21.C37 0000243639 A.2 B.4 A.3 1/2/20 2:11 PM Released

A customer number is assigned to each customer account to aid in production and cost accounting. The Mentor® controller maintains accounting data by customer number, not name. Any user can view (but not edit) the complete list of customers by selecting **List of Customers** from the operational display. Similarly, any user with programmer rights can view and edit the customer list by selecting **Programming/Customer Names**.

5.4.2.1.5 Formula Name

BNTUUO21.C38 0000243638 A.2 B.4 A.3 1/2/20 2:11 PM Released

Each formula is named when it is created. The list of programmed formulas is available for viewing by all users through the **List of Formulas** menu selection of the operational display. Users with programmer rights can change the name for any formula through the **Programming/Formulas** menu selection.

Because this view is designed to emphasize customers over formulas, the formula name may not be completely visible, although the Mentor® controller is maintaining all data. To view the full formula name, switch to the Formulas view (click the **Formulas** button near the bottom of the window).

5.4.2.1.6 Customer Name

BNTUUO21.C39 0000243637 A.2 B.4 A.3 1/2/20 2:11 PM Released

A customer name may be assigned to each customer account to aid in production and cost accounting. The Mentor® controller maintains accounting data by customer number, not name, so this data is for the benefit of personnel and has no effect on accounting. Any user can view (but not edit) the complete list of customers by selecting **List of Customers** from the operational display. Similarly, any user with programmer rights can view and edit the customer list by selecting **Programming/Customer Names**.

5.4.2.1.7 Transfers

BNTUUO21.C40 0000243636 A.2 B.4 A.3 1/2/20 2:11 PM Released

The transfers field maintains a cumulative total of the number of batches discharged from the tunnel washer which match both the formula number and the customer number shown in the leftmost two columns.

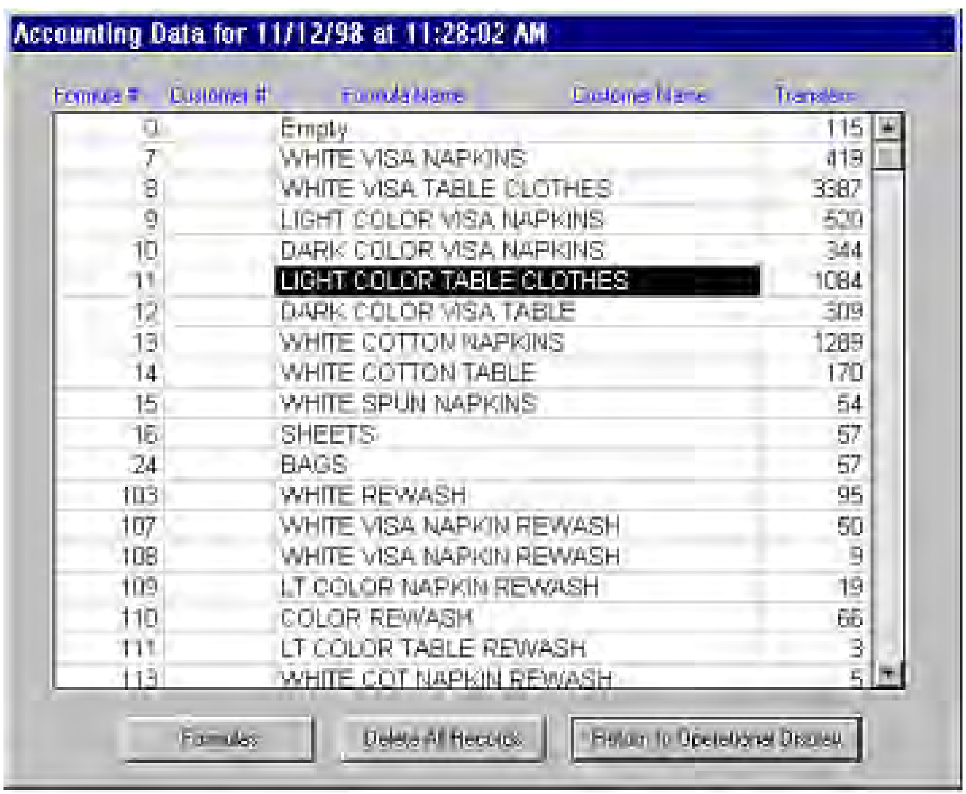
5.4.2.2 Formulas View

BNTUUO21.C41 0000243634 A.2 B.4 A.3 1/2/20 2:11 PM Released

The formulas view of the accounting data window allows management to view a summary of the number of transfers for each formula without regard to individual customers. Using Figure 109: Accounting Data Window, Formulas View, page 186 for an example, formula number 11 (Light Color Table Clothes) was used for 1084 batches of goods. Because this view does not include the customer number or name, it allows management to view the entire formula name, as well as to quickly see how many batches are produced with each formula without the need for totalling multiple customer entries.

See the part of this document describing the **Customers** view of the accounting data (above) for a complete description of each field in this window.

Figure 109. Accounting Data Window, Formulas View

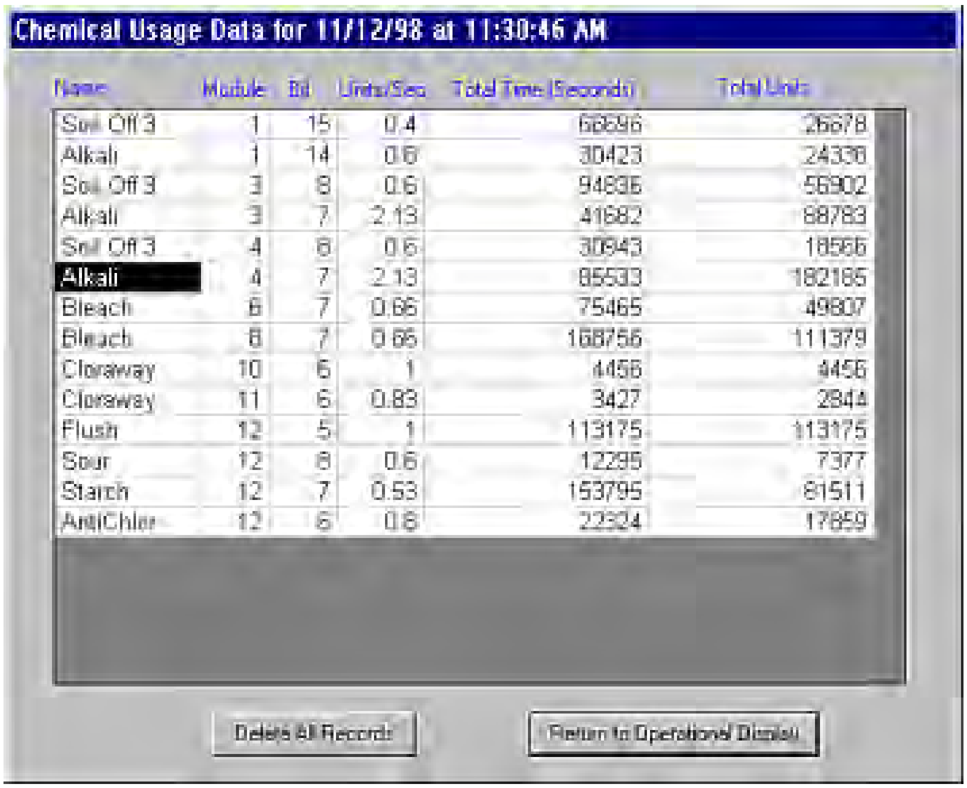


5.4.3 Chemical Usage Data

BNTUUO21.C42 0000243663 A.2 B.4 A.3 1/2/20 2:11 PM Released

Chemical usage data is maintained for the period since all records were last deleted. This data allows management to accurately track the amount of chemicals commanded by the Mentor® controller. An example of this display is shown in Figure 110 .

Figure 110. Chemical Usage Data Window


Chemical Usage Data for 11/12/98 at 11:30:46 AM

Name	Module	Bit	Units/Sec	Total Time (Seconds)	Total Units
Soil Off 3	1	15	0.4	66696	26678
Alkali	1	14	0.8	30423	24338
Soil Off 3	3	8	0.6	94836	56902
Alkali	3	7	2.13	41682	88783
Soil Off 3	4	8	0.6	30943	18566
Alkali	4	7	2.13	85533	182185
Bleach	6	7	0.66	75465	49807
Bleach	8	7	0.66	168756	111379
Cloraway	10	6	1	4456	4456
Cloraway	11	6	0.83	3427	2844
Flush	12	5	1	113175	113175
Sour	12	8	0.6	12295	7377
Starch	12	7	0.53	153795	81511
AntiChlor	12	6	0.8	22324	17859

5.4.3.1 Name

BNTUUO21.C43 0000243662 A.2 B.4 A.3 1/2/20 2:11 PM Released

This column contains the name of the chemical, as entered on the **Function Programming** page **(Programming/Functions** from the Mentor® operational display). Because certain chemicals are often commanded in more than one module, a chemical name may appear more than once in this column.

5.4.3.2 Module

BNTUUO21.C44 0000243661 A.2 B.4 A.3 1/2/20 2:11 PM Released

The **Module** column lists the module controlling this particular chemical output. All entries in this window are sorted by this column, i.e., all chemicals called for in the first module will appear at the top of the list, followed by all chemicals for the second module, etc.

5.4.3.3 Bit

BNTUUO21.C45 0000243660 A.2 B.4 A.3 1/2/20 2:11 PM Released

The **Bit** is the output (control function) actuated to inject the chemical. The module number and the bit number are combined in the form “Module:Bit” in the **Output Data** field of the **Formula Programming** page (**Programming/Formulas** from the operational display).

5.4.3.4 Units per Second (Units/Sec)

BNTUUO21.C46 0000243659 A.2 B.4 A.4 1/2/20 2:11 PM Released

This column displays the units of chemical injected for each second of time the associated chemical output bit is actuated. The chemical flow rate is calculated and entered in the **Chemical Pump Flow Rate** table, accessed through the **Configuration** menu from the operational display.

5.4.3.5 Total Time

BNTUUO21.C54 0000244271 A.2 B.4 A.3 1/2/20 2:11 PM Released

The Mentor® controller maintains a cumulative counter of the total number of seconds each chemical output is actuated. The controller recognizes outputs as chemicals from the *op code* (06) entered on the **Functions Programming** page.

5.4.3.6 Total Units

BNTUUO21.C47 0000243657 A.2 B.4 A.3 1/2/20 2:11 PM Released

The value in this column is calculated by multiplying the **Total Time** value by the **Units/Sec** value. The number displayed is the total number of units commanded by the controller since the last time the records were deleted.

5.4.4 Batch Data

BNTUUO21.C48 0000243656 A.2 B.4 A.4 1/2/20 2:11 PM Released

The **Batch Data** menu selection allows the operator to view a graph of temperature, liquor flow, and pH in each module for any batch produced in the last 30 days. This information is useful in reconstructing production histories when analyzing chemical use and production delays in the tunnel washer.

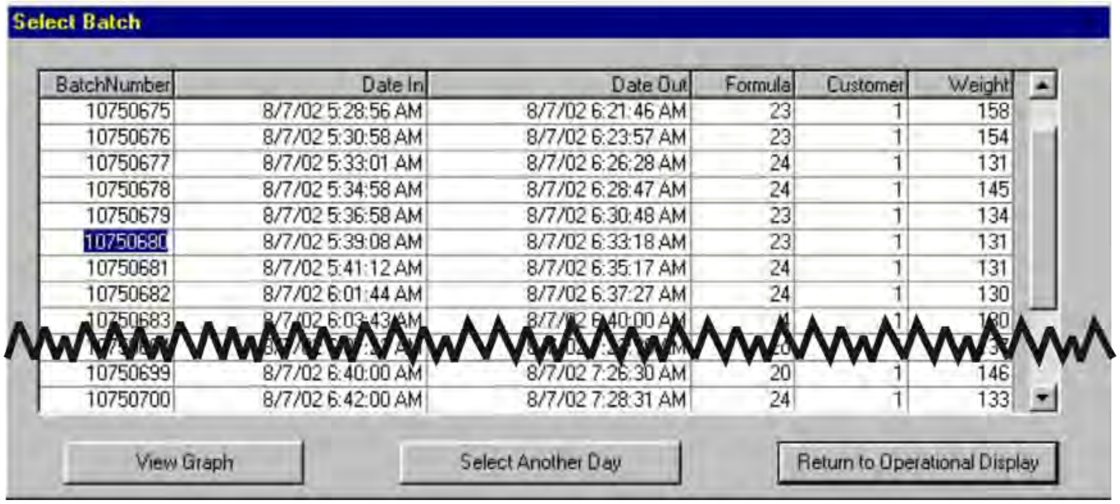
NOTICE: Batch data is collected in the units for which the Mentor® controller is configured. Changing temperature units as described in Section 2.2.1.10 : Units of Temperature, page 46 causes errors when graphing temperature and flow data collected previously.

5.4.4.1 Selecting a Batch

BNTUUO21.C49 0000243654 A.2 B.4 A.3 1/2/20 2:11 PM Released

When the **Batch Data** menu item is selected, the Mentor® controller prompts for the date on which the desired batch was processed. When a date is entered and found in the collected data, the user is presented with a screen similar to the one shown in Figure 111 .

Figure 111. Select Batch Screen



1. Click the right mouse button with the cursor on any item in a row to select the batch number at the left end of the row.
2. To view a graph similar to Figure 112: Batch Data, page 190 for the selected batch, click the **View Graph** button at the bottom of the screen.
   - Click the **Select Another Day** button to back up to the **Select Date** screen without graphing any data.
   - Click the **Return to Operational Display** button to close the **Select Batch** screen and view the **Mentor Operational** display.

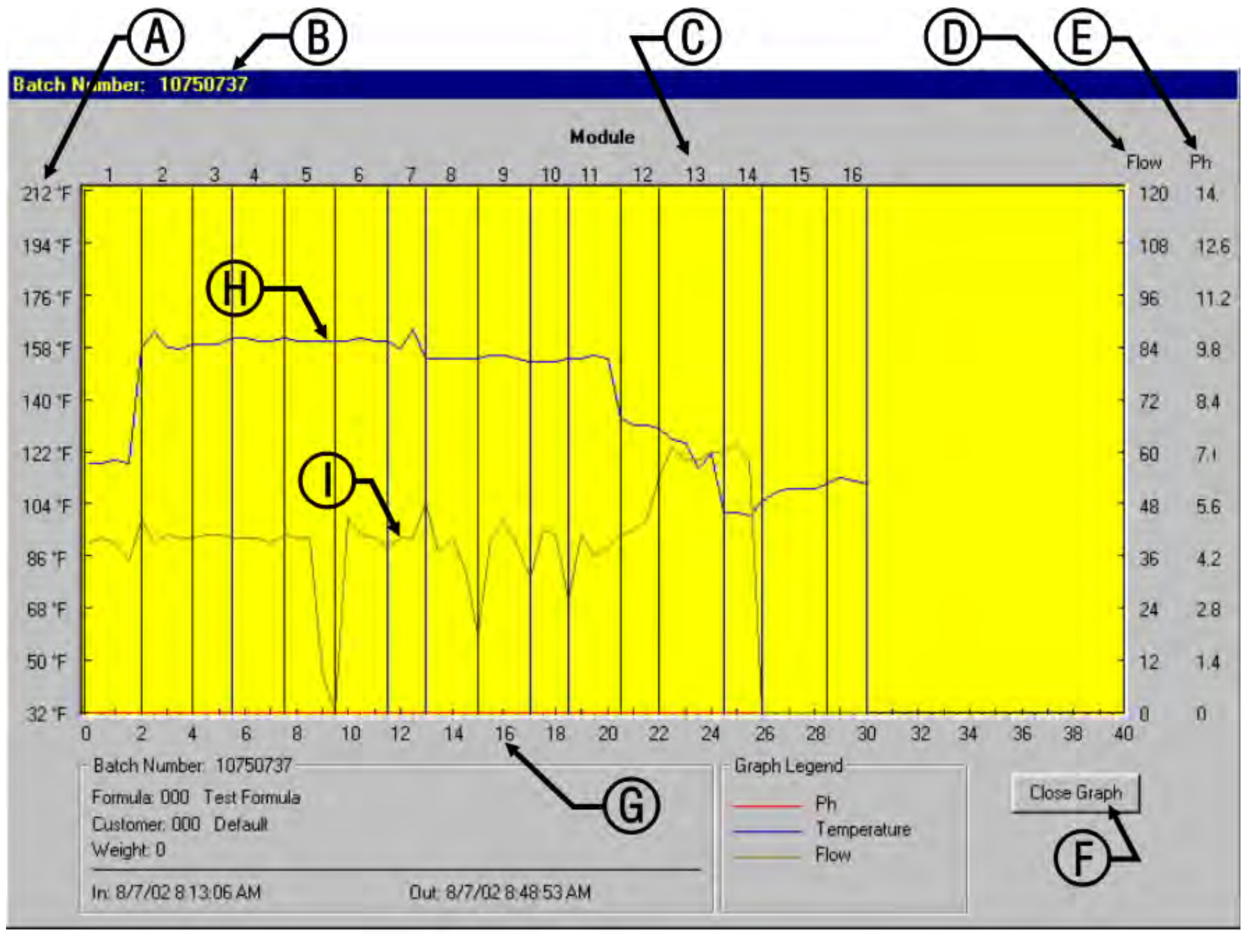
5.4.4.2 Interpreting Displayed Batch Data

BNTUUO21.C50 0000243672 A.2 B.4 A.4 1/2/20 2:11 PM Released

The graphic display for historical batch data shows up to three graphs for the selected batch on a single screen. The formula number and name, customer number and name, weight, and when the batch entered and exited the tunnel are also shown.

Figure 112. Batch Data

Typical Graph



Legend

A . . . Temperature scale
B . . . Batch number
C . . . Module number
D . . . Flow rate scale
E . . . pH scale (not used)
F . . . **Close Graph** button
G . . . Time scale
H . . . Temperature graph
I . . . Liquor flow graph

Temperature scale appears along the left side of the graph display. The range is always from the freezing point of water to the boiling point, but the temperature unit can be either Celsius or Fahrenheit, according to how the Mentor® controller is configured (see Section 2.2.1.10 : Units of Temperature, page 46).

Batch number the unique identifier for the batch displayed. This number is automatically generated by the Mentor® controller and applies to only one batch, even in a system with multiple tunnel washers.

Module number module of the CBW® washer. Each module is represented; the horizontal space attributed to the data from a module corresponds to the number of minutes the batch was in each module. A module represented by a noticeably wider space usually indicates that the tunnel entered a hold condition while the displayed batch was in the "wider" module.

Flow the liquor flow through each module, in gallons per minute or liters per minute. Collection of liquor flow data requires Bürkert modulating valves and flow meters (see Section 3.2.3.3 : Burkert Magnetic Flow Meter, page 94 and Section 3.2.4 : Burkert Valve Positioner, page 98).

pH scale not used

Close Graph button closes the graph window and returns the user to the **Select Batch** screen, shown in Figure 111: Select Batch Screen, page 189 .

Time scale minutes and half-minutes. The vertical rules on the graph indicate module boundaries, not time increments.

Temperature graph displays the liquor temperature encountered by this batch in each module.

Flow graph displays the liquor flow rate—in gallons per minute or liters per minute—measured in each module with a flow meter. Measurements in modules without flowmeters are based on the value determined when some previous batch passes through a module with a flowmeter. No flow (**0**) usually indicates a standing bath module.

5.4.5 Print I/O Reports

BNTUUO21.C51 0000243686 A.2 B.4 A.3 1/2/20 2:11 PM Released

Input and output reports provide management and maintenance personnel a convenient method for recording input and output assignments. This information can be used to quickly restore a tunnel washer to service after certain service procedures if the electronic backup is not available.

Use the procedure described in Section 8.2.2 : Programming Microprocessor Inputs, page 266 to assign Mentor® inputs for Generation3 CBW® tunnel washers.

Figure 113. Typical Mentor® Input Report

Mentor Input Report on 08/07/02 at 1:18:53 PM

Number	Name	Module	Board #	Location
1	Low Level Input	1	1	MTA 4-1
2	High Level Input	1	1	MTA 4-2
3	Low Level Input	2	1	MTA 4-3
4	High Level Input	2	1	MTA 4-4
5	Low Level Input	3	1	MTA 4-5
6		3	1	MTA 4-6
7		1	1	MTA 4-7
				MTA

Use the procedure described in Section 8.2.3 : Assigning Outputs and Functions, page 272 to assign Mentor® outputs for Generation3 CBW® tunnel washers.

Figure 114. Typical Mentor® Output Report

Mentor Output Report on 08/07/02 at 1:18:52 PM

Number	Name	Module	Board #	Common	NO
1	Standing Bath Flush	1	1	MTA 5-10	MTA 5-19
2	Flush 1	1	1	MTA 5-8	MTA 5-17
3	Flush 2	1	1	MTA 5-7	MTA 5-16
4	Fast Fill	1	1	MTA 5-4	MTA 5-14
5	Steam	1	1	MTA 5-3	MTA 5-13
6		2	1	MTA 5-2	MTA 5-12
7			1	MTA 5-1	MTA 5-11
				MTA 5-10	MTA 5-19

6 Troubleshooting

BNTUUT01 / 2019145 BNTUUT01 0000230579 A.5 1/2/20 2:11 PM Released

6.1 Summary of Error and Warning Messages

BNTUUT01.C01 0000230578 A.2 A.5 A.3 1/2/20 2:11 PM Released

The purpose of this section is to define error messages which may be encountered. Refer to the reference manual for complete troubleshooting procedures.

6.1.1 Error Messages

BNTUUT01.R02 0000230576 A.2 A.5 A.4 1/2/20 2:11 PM Released

E01 Power Failure Power up following a power loss was detected, thus the Mentor® controller always displays this error at daily start-up. Normally, no troubleshooting is required. The message clears when the tunnel is started with **Ctrl + D.**

E02 Drive System xy zz A rotation limit switch (proximity switch) input was not made within the configured time. The tunnel stops.

E03 Limit Switch xy zz Two or more of the four rotation limit switch (proximity switch) inputs were made simultaneously. This is an invalid condition which causes the tunnel to stop.

E04 Overtime on Level Temp The required bath level and/or temperature was not detected when the time permitted to achieve these parameters expired. The tunnel holds at the start of count-up. Occasional occurrence and self-correction is normal. Press **Ctrl + D** to clear immediately.

E05 Invalid Customer Code A customer number higher than 999 was received by the controller. Tunnel holds at transfer.

E06 No Bag Ready No bag was detected at the position above the load chute (the discharge position) when the tunnel desired to transfer. The tunnel holds at transfer.

E07 All Rails Empty No bags were detected on any rails in the rail system when the Mentor® rail sequencer scanned the rails. The tunnel stops. Correct the condition, then press **Ctrl + D** to restart the tunnel.

E10 Communications Failure A peripheral circuit board did not respond to the processor board. The tunnel stops. The Mentor® controller also displays "Peripheral Board xxH not Responding."

E12 Load Device Not Ready This error message applies only if no Miltrac™ loading is configured. The loading device had not yet signaled that it was ready to discharge when the tunnel was ready to transfer. The tunnel holds at transfer.

E13 Receive Device Not Ready This error message applies only if Miltrac™ Discharge Only or Miltrac™ Loading and Discharge is configured. The Miltrac™ controller had not yet signaled that it is ready to receive when the tunnel desired to transfer. The tunnel holds at transfer.

E14 Operator Hold Switch An operator-initiated hold was detected when the tunnel desired to transfer. The tunnel holds at transfer.

E15 CBW Water Level Low A bath level lower than low level was detected in one or more modules when transfer was desired. The tunnel holds at transfer.
E16 Reuse Tank Level Low A water level lower than low level was detected in the reuse tank when transfer was desired. The tunnel holds at transfer.
E17 Fill Tank Level/Temp Bath level or temperature was not satisfied in an overhead fast fill tank when transfer was desired. The tunnel holds at transfer.
E18 Check CBW Load Chute An obstruction was detected in the CBW® load chute. The tunnel holds at transfer.
E19 Press Not Free Applies only if **data pass** is enabled. The press, centrifugal extractor, or wet goods conveyor had not yet signaled that it was ready to receive when the tunnel was ready to transfer. The tunnel holds at transfer.
E20 Cleanout in Progress Applies only to workwear machines. A manual module purge was detected. The tunnel holds at transfer.
E21 Too Long to Block Eye Applies only when load fault error detection is enabled with “Max Time to Clear or Block Eye.” Goods were expected to enter the tunnel, but were not detected in the load chute during the time specified by “Max Time to Clear or Block Eye.” The tunnel holds at the start of count-up.
E22 Too Long to Clear Eye Applies only when load fault error detection is enabled with “Max Time to Clear or Block Eye.” Goods were still detected in the tunnel load chute after the time specified by “Max Time to Clear or Block Eye” expired. The tunnel holds at the start of count-up.
E23 Load Eye was Blocked Applies only when load fault error detection is enabled with “Max Time to Clear or Block Eye.” Goods were detected in the load chute during transfer when an empty pocket was expected. The tunnel holds at the start of count-up.
E24 Reuse Tank Temp Low Applies only to optional reuse steam. The temperature in the reuse tank was too low when transfer was desired. The tunnel holds at transfer.
E25 Load Not Allowed This error applies only if Miltrac™ Loading and Discharge is configured. The loading device had not yet signaled that it was ready to discharge when the tunnel desired to transfer. The tunnel holds at transfer.
E26 Loading Aborted This error applies only if Miltrac™ Loading and Discharge is configured. There are two possible causes for this error: 1) The Miltrac™ controller had not yet signaled the Mentor® controller to proceed with transfer when the tunnel desired to transfer, so the tunnel holds at transfer, or 2) the Miltrac™ controller had not yet acknowledged that transfer is complete when the Start Flush After Transfer output timer expired, so the tunnel holds at the start of count-up.
E27 Waiting for Cooldown Applies to optional reuse cooldown only. Too high a temperature was detected in the reuse tank when transfer was desired. Tunnel holds at transfer.
E28 Oil Level Low Inadequate oil was detected in the chain oiler reservoir. Tunnel holds at transfer.
E29 Air Pressure Low Insufficient pressure in the incoming compressed air line was detected when transfer was desired. Tunnel holds at transfer.
E30 Modules Not Aligned Applies to 76028 and 76039 CBW® models only. A rotational misalignment of the cylinders in adjoining units was detected. Tunnel stops.

6.1.2 Warning Messages

BNTUUT01.R03 0000230575 A.2 A.5 A.4 1/2/20 2:11 PM Released

W00 Circuit Breaker Trip in Reuse Interface Box Reuse or Flush interface box lost power. Pump will not function

W01 Reuse Pump Overload Trip A Reuse or Flush pump motor overload condition, resulting in a tripped thermal overload, was detected. Pump will not run. Troubleshooting must be done by a qualified service technician.

W02 Loading Conveyor Overload Trip A CONWA or CONLO loading conveyor drive motor overloaded, resulting in a tripped thermal overload. The conveyor will not run. Troubleshooting must be done by a qualified service technician.

W03 Load Chute Photoeye Blocked Appears if the load chute photoeye is still blocked after flushing ends. If this condition is not corrected before the tunnel desires to transfer, the error, “Check CBW Load Chute” occurs, requiring troubleshooting.

W04 Circuit Breaker Trip in Standard Output Box The standard output box lost power. These outputs will not function.

W05 Drive Motor Overload Trip in Module xx A cylinder drive motor overloaded, resulting in a tripped thermal overload. On the 76032 CBW® the motor will be on the indicated module. On a 76028 or 76039 CBW®, the motor will be on the unit that includes the indicated module. Tunnel will not run. Troubleshooting must be done by a qualified service technician.

W06 Circuit Breaker Trip in Module xx Control Box The indicated module control box lost power. Equipment on this module will not function.

W07 Manual Flush Commanded in Module xx Applies to Workwear machines only. This warning appears when a module purge is detected in the indicated module. If this condition is not corrected before the tunnel desires to transfer, the error “Cleanout in Progress” occurs, requiring troubleshooting.

W08 Circuit Breaker Trip in Module xx Rinse Zone Interface Box The rinse zone flow splitter lost power. Associated pumps will not run.

W09 Rinse Zone Flow Pump Overload Trip in Module xx A rinse zone flow pump motor overloaded, tripping a thermal overload. The pump will not run. Troubleshooting must be done by a qualified service technician.

W10 Rinse Zone Surplus Pump Overload Trip in Module xx A rinse zone surplus pump motor overloaded, tripping a thermal overload. The pump will not run. Troubleshooting must be done by a qualified service technician.

W11 Wash Water Flow Lifter Overload Trip in Module xx A wash water flow lifter pump motor overloaded, tripping a thermal overload. The pump will not run. Troubleshooting must be done by a qualified service technician.

W12 Press Pump Overload Trip This error does not apply to CBW®s originally manufactured with the Mentor® controller.

W13 Peripheral Board xxH Not Responding The controller lost communication with the peripheral board at address xxH. If this condition is not corrected before the tunnel desires to transfer, the error “Communications Error” occurs, requiring troubleshooting.

W14 Tunnel Power Off The controller detected the loss of 120VAC control circuit power. The tunnel will not run.

W15 Value for Remote Customer Code Exceeds Limit (999) Appears if the remote customer code input exceeds the maximum acceptable value of 999. If this condition is not corrected before the tunnel desires to transfer, the error “Invalid Customer Code” occurs, and troubleshooting is required.

W16 Drive Motor Contactor Failure This error applies to 76032 CBW®s only. A drive motor contactor failed to energize when it should have. Although the tunnel may continue to operate, it is extremely important to have an authorized service technician troubleshoot this warning immediately. A drive motor is likely not functioning, thus overloading and damaging other motors.

BNTUUT06 / 2019304 BNDUUI01 0000244093 B.3 1/2/20 2:11 PM Released

6.2 Mentor® Troubleshooting

BNTUUT06.C01 0000244186 A.2 B.3 A.3 1/2/20 2:11 PM Released

This document provides information on troubleshooting errors in the Mentor® tunnel washer control system.

6.2.1 The Mentor® Error Messages and Their Troubleshooting Steps

BNTUUT06.C02 0000244185 A.2 B.3 A.3 1/2/20 2:11 PM Released

Error messages indicate conditions that will immediately or soon stop the tunnel.

6.2.1.1 E01 Power Failure

BNTUUT06.C03 0000244184 A.2 B.3 A.3 1/2/20 2:11 PM Released

Power up (following a power loss) was detected. Thus Mentor® displays this error at the daily startup. No troubleshooting required. The message clears when the tunnel is started (with CONTROL + D).

6.2.1.2 E02 Drive System xy zz

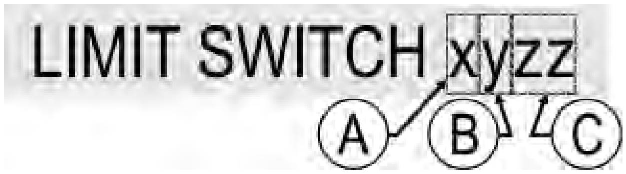
BNTUUT06.C04 0000244182 A.2 B.3 A.5 1/2/20 2:11 PM Released

A rotation limit (proximity) switch input was not made within the configured time limit. Tunnel stops. The rotation limit switches are called clockwise (CW), counterclockwise (CCW), transfer or top dead center (TDC), and safety (SAF).

1. Referring to Figure 115: Identifying the Offending Limit Switch for Error E02, page 197 , verify that a valid y code was seen (otherwise, see Section 6.2.1.3 : E03 Limit Switch xy zz, page 198) then use the zz code to determine which switch was not seen within the required time (the offending switch).
2. Determine the offending rotation limit switch. The four switches are located between certain modules, at various positions around the inter-module connection. When viewing the tunnel from the load end (in the direction of the flow of goods) the switches are located as shown in the tables following the below figure.

Figure 115. Identifying the Offending Limit Switch for Error E02

Message Format



Legend

A . . . Disregard this character
B . . . Corresponds to “Y Value” in Table 10
C . . . Corresponds to “ZZ Value” in Table 10

Table 10. Identifying the Offending Limit Switch for Error E02

Y Value	Most Recent Input	ZZ Value	Switch not Seen	ZZ Value	Switch not Seen	ZZ Value	Switch not Seen
0	none	00	TDC	07	TDC	0E	TDC
1	SAF	01	SAF	08	CCW	0F	TDC
2	TDC	02	CW	09	CCW	10	TDC
4	CW	03	CW	0A	CCW	11	TDC
8	CCW	04	CW	0B	CCW	12	CCW
other	See below note	05	CW	0C	CCW	13	CCW
		06	SAF	0D	TDC	14	CCW

NOTE: If any other code appears here, see Section 6.2.1.3 : E03 Limit Switch xy zz, page 198 .

Table 11. Rotation Limit Switch Locations

Switch	Location (viewing tunnel from load end): 76032 Models	Location (viewing tunnel from load end): 76028 and 76039 Models
CW	between mods 1 and 2, upper left	between units 1 and 2, lower right
CCW	between mods 1 and 2, upper right	between units 1 and 2, lower left
TDC	between second to last and last modules, top dead center	between units 1 and 2, upper left
SAF	between second to last and last modules, upper right	between units 1 and 2, upper right

Table 12. Error E02 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	offending limit switch or power circuit	see supporting information	not functioning or not receiving power	W8CBWSE, lines 02-09
	Hold a piece of steel under the head of the switch. If the light on the switch illuminates, proceed to step 2. If it does not illuminate, test to see if the switch is receiving power. If not, look for and repair a loose connection in the switch power circuit. If the switch is receiving power, replace the switch.			
2	switch-to-controller input circuit	see supporting information	open (loose connection)	W8CBWSE, lines 02-09
	View the offending switch input on Mentor® (Inputs and Outputs, Standard and Direct Inputs). As in step 1, hold a piece of steel under the head of the switch. If the display			

Table 12 Error E02 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
	does not show the input made, look for and repair a loose connection in the switch-to-controller wiring. Otherwise, proceed to step 3.			
3	offending switch	see error description	out of alignment	MSSMD410AE or BMP940123; MSOUCUCTAE, page 3
	With all bystanders well clear, use the Manual Jog Test switch (see MSOUCUCTAE in supporting information) to jog the cylinder counterclockwise until the target is positioned under the offending switch. If the switch status light illuminates, proceed to step 4. If not, re-align the switch. Refer only to the supporting document that applies to your tunnel model.			
4	Rotation timer	Mentor® controller	too short a time programmed	MSOPD415EE
	Verify that the applicable rotation timer (output timer) on the Mentor® display (Configuration, Rotation Timers) has the proper value. (See supporting information.) If the value is correct, the problem is probably in the I/O board or microprocessor. Consult the factory.			

6.2.1.3 E03 Limit Switch xy zz

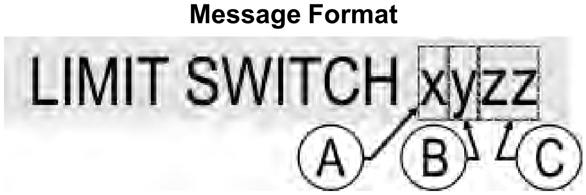
BNTUUT06.C05 0000244255 A.2 B.3 A.4 1/2/20 2:11 PM Released

Two or more of the four rotation limit (proximity) switch inputs were made simultaneously (invalid condition). Tunnel stops. The rotation limit switches are called clockwise (CW), counterclockwise (CCW), transfer or top dead center (TDC), and safety (SAF).

1. Determine from the tables below, which switches were made (code y), then which one switch should have been made (code zz = valid switch). Determine from this, the offending (invalid) switch(es)—the switch(es) that were made but should not have been.
2. Locate the offending rotation limit switch(es). The four switches are located between certain modules, at various positions around the inter-module connection. When viewing the tunnel from the load end (in the direction of the flow of goods) the switches are located as shown in the tables following the below figure.

Figure 116. Identifying the Offending Limit Switch(es) for Error E03

Message Format



Legend

A. . . Disregard this character
B. . . Corresponds to “Y Value” in Table 13
C. . . Corresponds to “ZZ Value” in Table 13

Table 13. Identifying the Offending Limit Switch(es) for Error E03

Y Value	Most Recent Input	ZZ Value	Switch not Seen	ZZ Value	Switch not Seen
3	SAF, TDC	00	CCW	0C	CW
5	CW, SAF	01	TDC	0D	CCW

Table 13 Identifying the Offending Limit Switch(es) for Error E03 (cont'd.)

Y Value	Most Recent Input	ZZ Value	Switch not Seen	ZZ Value	Switch not Seen
6	TDC, CW	02	SAF	0E	TDC
7	SAF, TDC, CW	03	CW	0F	TDC
9	SAF, CCW	04	CW	10	TDC
A	TDC, CCW	05	CW	11	TDC
B	SAF, TDC, CCW	06	CW	12	See below note
C	CW, CCW	07	SAF	13	
D	SAF, CW, CCW	08	TDC	14	
F	all four inputs	09	CCW		
other	See below note	0A	CCW		
		0B	CCW		

NOTE: If this value is displayed, see Section 6.2.1.2 : E02 Drive System xy zz, page 196 .

Table 14. Rotation Limit Switch Locations

Switch	Location (viewing tunnel from load end) 76032 Models	76028 and 76039 Models
CW	between mods 1 and 2, upper left	between units 1 and 2, lower right
CCW	between mods 1 and 2, upper right	between units 1 and 2, lower left
TDC	between second to last and last modules, top dead center	between units 1 and 2, upper left
SAF	between second to last and last modules, upper right	between units 1 and 2, upper right

Table 15. Error E03 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	offending switch (es), mounting	see error description	actuated due to damage, misalignment	MSSMD410AE or BMP940123, MSOUCUCTAE
	Verify that the target is not under the offending switch at present. If it is, with all bystanders well clear, use the Manual Jog Test switch (see MSOUCUCTAE in supporting information) to jog the cylinder counterclockwise until the target is moved away from the switch. If the status light on the switch is not illuminated, indicating that the switch is not made, proceed to step 2. If the light is illuminated, look for and repair any damage or misalignment that would cause the switch to remain made. Refer only to the supporting document that applies to your tunnel model.			
2	switch-to-controller input circuit	see supporting information	shorted to ground	W8CBWSE, lines 02-09
	View this input on Mentor® (Inputs and Outputs, Standard and Direct Inputs). If the display shows the input made, look for and repair a short in the switch-to-controller wiring. If the input is not made, the problem is probably in the microprocessor. Consult the factory.			

6.2.1.4 E04 Overtime on Level/Temp

BNTUUT06.C06 0000244290 A.2 B.3 A.5 1/2/20 2:11 PM Released

Required bath level and/or temperature was not detected when the time permitted to achieve these expired. Tunnel holds at the start of count-up. Occasional occurrence and self correction is normal. Press CONTROL + D to clear message immediately. Troubleshoot if persistent.

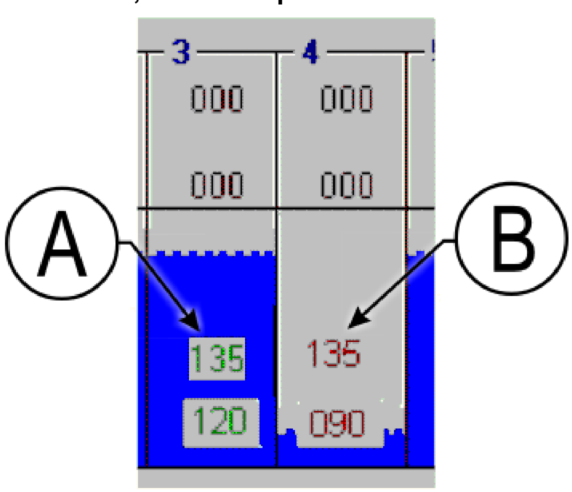
The default time to achieve level/temp is 120.0 seconds (2 minutes). If the error occurs much sooner following tunnel start (CONTROL + D), check this timer (**Configuration, Operating Parameters, Output Timers, Max Time for Level and Temp**) to see if too short a time was programmed.

Because adequate bath level must be achieved before steaming is permitted (to protect the linen from damage by contact with steam or super-heated water), an initial level problem will likely prevent initial temperature satisfaction. Thus the level problem must be corrected first.

1. Referring to Figure 117: Determining the Offending Module(s) for Error E04, page 200 , view the Mentor® Operational window to identify the offending module(s) and determine which parameter(s) (levels and/or temperatures) are not satisfied. A water line near the bottom of the module indicates that level is not achieved. Any temperature values shown in red indicate temperature was not achieved initially. If the characters are green, the module or overhead tank is not contributing to this error, even if its actual temperature is less than desired at present.
2. If any level is not yet achieved, troubleshoot this problem first. Click on the **View Another Error** button then select "CBW WATER LEVEL LOW–E15", to troubleshoot level problems.
3. If all levels are achieved, but one or more temps are not, determine the likely problem, and start troubleshooting at the corresponding step, as shown in the tables following the below figure.

Figure 117. Determining the Offending Module(s) for Error E04

Detail, Mentor® Operational Window



Legend
A. . . Initial level and temperature satisfied
B. . . Neither level nor temperature satisfied initially

Table 16. Determining Which Step to Start at for Error E04

Condition Observed	Likely Source of Problem	Start at Step
Two or more offending modules	incoming steam	1
One offending module, steam valve functioning, but no change in temp achieved	temp probe/circuit	3
One offending module and some change in temp achieved	steam valve/circuit	4

Table 17. Error E04 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	steam header	usually connects at right front of tunnel	closed	
	Verify that any manual valves on the incoming steam header are fully open.			
2	compressed air and steam		poor quality	see boiler manufacturer's instructions
	Verify that plant air pressure is normal (sufficient for air operated steam valves). Verify that the boiler is functioning properly and producing an adequate supply of "dry" steam. After attempting the other troubleshooting steps, it may be beneficial to shut the system down and clean any condensate collectors, Y-strainers (one normally located at the steam header connection point on the tunnel), etc.			
3	temp probe and circuit	offending module drain trough	not functioning properly	W8CBWJB
	If actual temperature reading is inordinately low, there is a likely open (loose connection) between the temperature probe and the Temperature A/D board. Check and repair. If the temperature reading is not inordinately low but remains relatively constant, the temp probe may be bad. Consult the Milnor® factory.			
4	steam valve and circuit	lower right side of offending module	valve not opening	W8CBWJA
	If the steam valve is functioning at all, proceed to step 5. If not, check steam valve pilot air valve-to-C-bit output wiring for a loose connection. Check pilot air valve for proper functioning. Note that because C-bit assignments are unique to each tunnel, this specific pilot air valve does not appear on the schematic listed under supporting information.			
5	steam valve	lower right side of offending module	not opening fully	BMP940105
	Observe the valve for proper functioning. If it sounds sluggish, check for low air pressure to steam valve (e.g., leaking air tube) and damaged or worn steam valve components.			

6.2.1.5 E05 Invalid Customer Code

BNTUUT06.C07 0000244320 A.2 B.3 A.3 1/2/20 2:11 PM Released

A customer number higher than 999 was received by the controller. Tunnel holds at transfer. This message is accompanied by the warning message “VALUE FOR REMOTE CUSTOMER CODE EXCEEDS LIMIT (999)”. This error only applies to remote customer code entry. The Milnor®

remote customer code entry control panel will not permit selection of an invalid code; however, this error could be the result of:

1. an input shorted to ground (see troubleshooting step 1), or
2. an allied (non-Milnor®) remote customer code entry apparatus that does permit selection of an invalid code (see step 2).

After correction, press CONTROL + D to clear the error message immediately.

Table 18. Error E05 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	remote customer code input circuits	see supporting information	shorted to ground	W8CBWSH, lines 14-17
2	allied (non-Milnor®) code input apparatus	varies	customer code above 999 entered	see allied equipment manufacturer's instructions

6.2.1.6 E06 No Bag Ready

BNTUUT06.C08 0000244319 A.2 B.3 A.3 1/2/20 2:11 PM Released

No bag was detected at the discharge position (the position above the load chute) when the tunnel desired to transfer. Tunnel holds at transfer.

If this batch was intended to be empty (the empty formula/customer batch codes were entered) the rail system can permit doing so without actually having an empty bag or a trolley present at the discharge position only if it provides another means of closing the **Bag Ready** input. See troubleshooting step 4.

After correction, press CONTROL + D to clear the error message immediately.

Table 19. Error E06 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	bag	discharge position above load chute	not present	
2	bag trolly	discharge position above load chute	not in position fully	see rail manufacturer's instructions
3	bag detector	discharge position above load chute	not functioning	see rail manufacturer's instructions
4	"Bag Ready" (Std. Input #3) circuit	see supporting information	open (loose connection)	W8CBWLD

6.2.1.7 E07 All Rails Empty

BNTUUT06.C09 0000244318 A.2 B.3 A.3 1/2/20 2:11 PM Released

No bags detected on any rails in the rail system when the Mentor® rail sequencer scanned the rails. Tunnel stops.

After correction, press CONTROL + D to restart the tunnel.

Table 20. Error E07 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	bags	feeder rails	not present	
2	bag trolley(s)	feeder rails	not in position fully	see rail manufacturer's instructions
3	bag detector(s)	feeder rails	not functioning	see rail manufacturer's instructions
4	rail sequencer	Mentor® controller	step 01 value=00	MSOPD416FE
5	"Rail Empty" (Std Input #2) circuit	see supporting information	shorted to ground	W8CBWLD

6.2.1.8 E10 Communications Failure

BNTUUT06.C11 0000244344 A.2 B.3 A.4 1/2/20 2:11 PM Released

A peripheral circuit board did not respond to the processor board. Tunnel stops

Mentor® also displays “PERIPHERAL BOARD xxH NOT RESPONDING.” On the first occurrence, attempt to restart the tunnel (CONTROL + D). On the second occurrence, note the address (xxH) of offending board.

Board Address 21H indicates a likely problem with the serial link circuit (troubleshooting step 1). This error also occurs after successfully troubleshooting any other board error. Attempt to restart.

Any other address indicates a board problem. Identify the board type in Table 21: Identifying the Board Type and Location, page 203 , and perform applicable troubleshooting steps beginning with step 2.

Table 21. Identifying the Board Type and Location

Board Type	Address (xxH)	Module on	Box In
Power Standard I/O Boards	00H=bd 00	mod 01 or first unit	Standard Output box
	80H=bd 01		
Module Standard I/O Boards	01H - 09H	mods 01 - 09	module control box
	0AH - 0FH	mods 10 - 15	
	40H - 44H	mods 16 - 20	
Module Option I/O Boards	81H - 89H	mods 01 - 09	module control box
	8AH - 8FH	mods 10 - 15	
	C0H - C4H	mods 16 - 20	
Temperature A/D Boards	21H	mods 01 - 08	module control box
	22H	mods 09 - 16	
	23H	mods 17 - 20	
Electronic Level A/D Boards	61H	mods 01 - 08	module control box
	62H	mods 09 - 15	
	63H	mods 16 - 20	
Interpret Relay 16 Output Boards	11H — 14H	specified at manufacture	module control box

Table 21 Identifying the Board Type and Location (cont'd.)

Board Type	Address (xxH)	Module on	Box In
Fast Fill Tank / Reuse / Cooldown A/D Boards	A0H	specified at manufacture	module control box
Weigh Scale A/D Board	20H	Mentor® cabinet	
Allied Interface Board	10H	usually last mod or unit	module control box

Table 22. Error E10 Troubleshooting Steps

<table>
<tr><th>Step</th><th>Component</th><th>Location</th><th>Offense</th><th>Supporting Info.</th></tr>
<tr><td rowspan="2">1</td><td>serial link wiring (shielded, twisted pair)</td><td>connects all peripheral boards</td><td>circuit open or shorted to ground</td><td>ME76CBW2AE</td></tr>
<tr><td colspan="4">Applies to board address 21H. (Proceed to step 2 for any other.) Trace the serial link (conductors SRL and SRH) throughout the system.</td></tr>
<tr><td rowspan="2">2</td><td>Function Programming window</td><td>Mentor® Controller</td><td>Nonexistent C-bit output programmed</td><td>W8CBWJB</td></tr>
<tr><td colspan="4">Applies to board addresses 01H-09H, 0AH-0FH, 40H-44H (Module Standard I/O boards) and 81H-89H, 8AH-8FH, C0H-C4H (Module Optional I/O boards). Make sure every C-bit configured on the Function Programming window is supported by an I/O board. All modules except module 1 require an optional I/O board to support more than eight C-bits on that module.</td></tr>
<tr><td rowspan="2">3</td><td>CBW® Hardware Configuration window</td><td>Mentor® Controller</td><td>Hardware spec. with no supporting board</td><td></td></tr>
<tr><td colspan="4">Make sure every hardware option configured on the CBW® Hardware configuration window is supported by the appropriate peripheral board.</td></tr>
<tr><td rowspan="2">4a</td><td>Power Standard I/O board</td><td>Standard Output box</td><td>malfunctioning board</td><td>W8CBWSGA (06-13) or W8CBWSGB (06-13)</td></tr>
<tr><td colspan="4">Applies to board addresses 00H and 80H. Check for board not seated properly, or wrong address set on DIP switch (see schematic). Otherwise, board is bad. Replace board.</td></tr>
<tr><td rowspan="2">4b</td><td>Module Standard or Optional I/O board</td><td>module control box</td><td>malfunctioning board</td><td>W8CBWJB, lines 11-12</td></tr>
<tr><td colspan="4">Applies to board addresses 01H-09H, 0AH-0FH, 40H-44H, 81H-89H, 8AH-8FH, C0H-C4H. Check for board not seated properly, or wrong address set on DIP switch (see schematic). Otherwise, board is bad. Replace board.</td></tr>
<tr><td rowspan="2">4c</td><td>Temperature A/D board</td><td>module control box</td><td>malfunctioning board</td><td>W8CBWJB, lines 11-12</td></tr>
<tr><td colspan="4">Applies to board addresses 21H, 22H, and 23H. Check for board not seated properly, or wrong address set on DIP switch (see schematic). Otherwise, board is bad. Replace board.</td></tr>
</table>

Table 22 Error E10 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
4d	Electronic Level A/D board	module control box	malfunctioning board	W8CBWEL
	Applies to board addresses 61H, 62H, and 63H. Check for board not seated properly, or wrong address set on DIP switch (see schematic). Otherwise, board is bad. Replace board.			
4e	Interpret Relay 16 Output Board	module control box	malfunctioning board	W8CBWIA
	Applies to board addresses 11H-14H. Check for board not seated properly, or wrong address set on DIP switch (see schematic). Otherwise, board is bad. Replace board.			
4f	Fast Fill Tank / Re-use Cooldown A/D board	module control box	malfunctioning board	W8CBWFT
	Applies to board address A0H. Check for board not seated properly, or wrong address set on DIP switch (see schematic). Otherwise, board is bad. Replace board.			
4g	Weigh Scale A/D board	Mentor® Cabinet	malfunctioning board	W8CBWNB, W8CBWAJ, W8CBWAW
	Applies to board address 20H. Check for board not seated properly, or wrong address set on DIP switch (see schematic). Otherwise, board is bad. Replace board.			
4h	Allied Interface board	module control box	malfunctioning board	
	Applies to board address 10H. Check for board not seated properly, or wrong address set on DIP switch. Otherwise, board is bad. Replace board.			

6.2.1.9 E12 Load Device Not Ready

BNTUUT06.C10 0000244368 A.2 B.3 A.4 1/2/20 2:11 PM Released

Applies only if no Miltrac™ loading is configured (**Configuration, Hardware**). The loading device had not yet signaled that it was ready to discharge when the tunnel was ready to transfer. The tunnel holds at transfer.

Troubleshooting steps 1 and 2 address improper loading conveyor operation that results in empty conveyor compartments. If all loading conveyor compartments contain batches, skip to step 3.

After correction, press CONTROL + D to clear the error message immediately.

Table 23. Error E12 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	loading conveyor	tunnel load end	empty–not properly manned	MSOPD466BE
	Load the conveyor. The Milnor® loading conveyor permits loading and encoding compartments that advanced while the operator is away from the machine. The operator should gauge how long this process takes and not leave the conveyor un-attended so long that all compartments become empty.			

Table 23 Error E12 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
2	loading conveyor	tunnel load end	empty compartment at discharge end	MSOPD466BE, MSOPD425DE
	If one or more compartments were skipped during loading, such that an empty compartment is now at the discharge end and compartments behind it are loaded, the empty compartment(s) cannot be backed up and loaded. Set the Pass Empty Pocket switch on the loading conveyor to the OK position, just until the next loaded compartment advances to the discharge position. Then return the Pass Empty Pocket switch to the not OK position. Every empty pocket passed to the tunnel in this manner wastes utilities, chemicals, and time. Reduce waste and ensure proper accounting of batches by re-coding any empty pockets entering the tunnel with the empty formula/customer codes.			
3	loading conveyor overload	CONLO/CONWA electric box	tripped (circuit open)	W8CBWLB
	If this error is accompanied by LOADING CONVEYOR OVERLOAD TRIP, reset the overload. Otherwise, proceed to step 4.			
4	electric power to conveyor	CONLO/CONWA electric box	not supplied	W8CBWLB
	Turn on power. If Master switch is on and Master status light is not illuminated, verify that electric power is supplied to the conveyor. If so, check the conveyor power circuit. If Master status light is on, proceed to step 5.			
5	Load Conveyor Ready input/circuit	see supporting information	circuit open	W8CBWLD
	Check this circuit. Standard input #7 (Inputs and Outputs, Standard and Direct Inputs, Load Conveyor Ready) must be made when the tunnel is ready to transfer. For example, on the Milnor® loading conveyor this error could be caused by a malfunctioning discharge-end photo eye.			

6.2.1.10 E13 Receive Device Not Ready

BNTUUT06.C12 0000244397 A.2 B.3 A.4 1/2/20 2:11 PM Released

Applies only if **Miltrac Discharge Only** or **Miltrac Loading and Discharge** is configured (**Configuration, Hardware**). Miltrac™ had not yet signaled that it is ready to receive when the tunnel desired to transfer. Tunnel holds at transfer.

Occasional occurrence and self-correction is normal. Troubleshoot if persistent. Many factors could prevent the extractor system from signaling that it is free to receive a load. Some common ones are:

- press, extractor, or wet-goods conveyor (Cobuc) power off
- controls not properly set, disabling operation
- not finished pressing a previous load
- could not discharge a previous load
- press fault condition
- circuit breaker tripped

View the Miltrac™ display to determine if receive device is responding. After correction, press CONTROL + D to clear the error message immediately.

Table 24. Error E13 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	Press, extractor or Cobuc conveyor	tunnel discharge end	not functioning	see press, extractor or Cobuc manuals
2	serial link wiring - device to Miltrac™	between device controller and Miltrac™	loose connection (circuit open)	see system cable diagram
3	serial link wiring - Mentor® to Miltrac™	between Mentor® controller and Miltrac™	loose connection (circuit open)	see system cable diagram

6.2.1.11 E14 Operator Hold Switch

BNTUUT06.C13 0000244396 A.2 B.3 A.3 1/2/20 2:11 PM Released

An operator-initiated hold was detected when the tunnel desired to transfer. Tunnel holds at transfer. After correction, press CONTROL + D to clear the error message immediately.

Table 25. Error E14 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	Run/Hold switch	Mentor® control panel	set to Hold	MSOUCUCTAE
2	Operator Hold Switch (direct input 5) circui	see supporting information	shorted to ground	W8CBWMC

6.2.1.12 E15 CBW® Water Level Low

BNTUUT06.C14 0000244395 A.2 B.3 A.4 1/2/20 2:11 PM Released

Inadequate bath level (lower than low level) was detected in one or more modules when transfer was desired. Tunnel holds at transfer. Information on the CBW® water flow system can be found in manual MATCBWTRAE.

Occasional occurrence and self-correction is normal. Troubleshoot if persistent.

CAUTION: **Malfunction Hazard** — The tunnel will jam (goods will get packed tightly into one or more modules) requiring manual dislodging if the tunnel is permitted to transfer with insufficient water level.

- Never attempt to fix a level error by disabling the level sensing apparatus.
- Before attempting to clear a jam become thoroughly familiar with, and abide by the proper procedure (see reference manual).

Prepare to troubleshoot as follows:

1. View the Operational window to identify the offending module(s).
2. View the level box on the offending module(s). If the level behind the weir plate appears to be substantially lower than the bottom of the weir opening, this is evidence of an inadequate

level and could be caused by many factors. Press the **See Documents** button now for a detailed explanation of the water flow system or proceed to step 1 to troubleshoot the more common causes.

3. If the module level does not appear to be too low, the problem is more likely with the level sensing apparatuses (troubleshooting steps 1, 2 and 8).

After correction, press CONTROL + D to clear error message immediately.

Table 26. Error E15 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	connecting hose	module level float assembly	clogged with lint	MSSMD441AE
	Purge the float tube (see supporting information).			
2	float and rod	module level float assembly	binding in float tube	MSSMD441AE
	Check for binding and adjust if necessary (see supporting information).			
3	counter-flow piping	upstream modules	clogged with lint	
	Check for and clear obstructions.			
4	drain valve	this or upstream module	leaking, not fully closed	BMP780095 or BMP940066, BMP940068
	Check for low air pressure to drain valve (e.g., leaking air tube) and damaged or worn drain valve components. Refer only to the supporting document that applies to your tunnel model.			
5	drain valve	see supporting information	open too long or won't close	W8CBWJA
	If the problem occurs only with a certain formula, or if drain valve(s) appear to remain open too long, verify that the proper on-time is programmed for the drain valve(s) on the Mentor® Programming window. A module will normally drain within 15 seconds. If the drain valve won't close, check the pilot air valve-to-C-bit output wiring for a loose connection and verify the pilot valve is functioning. Note that because C-bit assignments are unique to each tunnel, this specific pilot air valve does not appear on the schematic listed under supporting information.			
6	incoming fresh water line	upstream end of tunnel	flow restricted	
	Check for low water pressure and manual valves not fully open.			
7	metered, air operated, water inlet valve	upstream end of rinse and finish zones	not functioning properly	BMP940125, BMP920005, BMP920007, W8CBWJA
	Check for low air pressure (e.g., leaking air tube) and damage to air operated valve. Check the pilot air valve-to-C-bit output wiring for a loose connection. Verify that the pilot air valve is functioning. Note that because C-bit assignments are unique to each tunnel, this specific pilot air valve does not appear on the schematic listed under supporting information.			

Table 26 Error E15 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
8	level switch input circuit	see supporting information	open (loose connect.) or bad component	W8CBWJCA, Line 14
	Applies to level float type level sensing. (Consult factory if equipped with optional electronic level sensing.) Stop the tunnel (CONTROL + K). On the Mentor® Operational window, view the offending module inputs (click on the offending module then click the Module Inputs button) and view the "Low Water Level" input. With the tunnel stopped, manually close the level switch. If the display does not show the input made, check for and repair an open circuit or bad component.			

6.2.1.13 E16 Reuse Tank Level Low

BNTUUT06.C15 0000244394 A.2 B.3 A.4 1/2/20 2:11 PM Released

Inadequate water level (lower than low level) was detected in the reuse (flush) tank when transfer was desired. Tunnel holds at transfer. Information on the CBW® water flow system can be found in manual MATCBWTRAE.

This tank must have an adequate level to ensure proper flushing of incoming goods. Because the reuse tank is supplied with a fresh water make-up valve which supplements the water received from the flow splitter, inadequate level in this tank is abnormal and should not occur; but if it does, it may self-correct.

Observe the tank level. If it appears to be low, this could be caused by many factors. Press the **See Documents** button now for a detailed explanation of the water flow system or proceed to troubleshooting step 1 to troubleshoot the more common causes.

If the level does not appear to be low the problem is more likely with the level sensing apparatuses (steps 1, 2, and 7).

After correction, press CONTROL + D to clear the error message immediately.

Table 27. Error E16 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	connecting hose	reuse tank level float assembly	clogged with lint	MSSMD441AE
	Purge the float tube (see supporting information).			
2	float and rod	reuse tank level float assembly	binding in float tube	MSSMD441AE
	Check for binding and adjust if necessary (see supporting information).			
3	incoming fresh water line	connects to make-up valve at front of tunnel	flow restricted	
	Check for low water pressure and manual valves not fully open.			
4	reuse tank make-up water valve	mounted to front of tunnel	not functioning properly	W8CBWLA or W8CBWLF, W8CBWSA

Table 27 Error E16 Troubleshooting Steps (cont'd.)

<table>
<tr><th>Step</th><th>Component</th><th>Location</th><th>Offense</th><th>Supporting Info.</th></tr>
<tr><td></td><td colspan="4">Check for low air pressure (e.g., leaking air tube) and damage to air operated valve. Check the pilot air valve-to-standard output 15 wiring for a loose connection. Verify that the pilot air valve is functioning.</td></tr>
<tr><td rowspan="2">5</td><td>reuse tank drain valve (optional)</td><td>reuse tank</td><td>leaking or not fully closed</td><td>BMP800228</td></tr>
<tr><td colspan="4">Applies to optional reuse tank drain valve. Check for low air pressure to drain valve (e.g., leaking air tube) and damaged or worn drain valve components.</td></tr>
<tr><td rowspan="2">6</td><td>reuse tank drain valve (optional)</td><td>reuse tank</td><td>open too long or won't close</td><td>W8CBWJA</td></tr>
<tr><td colspan="4">Applies to optional reuse tank drain valve. If the problem occurs only with a certain formula, or if drain valve appears to remain open too long, verify that the drain valve is properly programmed. If the drain valve won't close, check the pilot air valve-to-C-bit output wiring for a loose connection and verify the pilot valve is functioning. Note that because C-bit assignments are unique to each tunnel, this specific pilot air valve does not appear on the schematic listed under supporting information.</td></tr>
<tr><td rowspan="2">7</td><td>reuse tank level switch input circuit</td><td>see supporting information</td><td>open (loose connect.) or bad component</td><td>W8CBWLA</td></tr>
<tr><td colspan="4">Stop the tunnel (CONTROL + K). On the Mentor® Operational window, view the "Flush Tank Low Level" input (Inputs and Outputs, Standard and Direct inputs). With the tunnel stopped, manually close the level switch. If the display does not show the input made, check for and repair an open circuit or bad component.</td></tr>
</table>

6.2.1.14 E17 Fill Tank Level/Temp

BNTUUT06.C16 0000244393 A.2 B.3 A.4 1/2/20 2:11 PM Released

Bath level or temperature was not satisfied in an overhead fast fill tank when transfer was desired. Tunnel holds at transfer. Occasional occurrence and self-correction is normal. Troubleshoot if persistent. View the Operational window to identify the offending tank and the offense (level or temperature).

After correction, press CONTROL + D to clear the error message immediately.

Table 28. Error E17 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	connecting hose	fill tank level float assembly	clogged with lint	MSSMD441AE
2	float and rod	fill tank level float assembly	binding in float tube	MSSMD441AE
3	drain valve	this tank	open or not fully closed	typically low air pressure or improper programming

Table 28 Error E17 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
4	hot and/or cold water line	this tank	flow restricted	
5	hot and/or cold water valve	this tank	not functioning properly	typically low air pressure or improper programming
6	tank level switch circuit	see supporting information	open (loose connect.) or bad component	W8CBWFT
7	tank drain valve pilot valve and circuit	see supporting information	short or bad component	W8CBWFT
8	tank water valve pilot valves and circuits	see supporting information	open (loose connect.) or bad component	W8CBWFT
9	tank steam valve and circuit	see supporting information	open (loose connect.) or bad component	W8CBWFT

6.2.1.15 E18 Check CBW® Load Chute

BNTUUT06.C17 0000244392 A.2 B.3 A.4 1/2/20 2:11 PM Released

Load chute obstruction detected. Tunnel holds at transfer.

After correction, press CONTROL + D to clear the error message immediately.

Table 29. Error E18 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	load chute photo eye	mounted in load chute	blocked	typically snagged goods or lint on lens
2	load chute photo eye	mounted in load chute	malfunctioning or not receiving power	MSSM0122AE, W8CBWLA or W8CBWLF
3	"Load Chute Eye Blocked" standard input	see supporting information	shorted to ground	W8CBWLA (5, 6, 7-19) or W8CBWLF (5, 6, 17-18)

6.2.1.16 E19 Press Not Free

BNTUUT06.C18 0000246261 A.2 B.3 A.3 1/2/20 2:11 PM Released

Applies only if **Data Pass** is enabled (**Configuration, Hardware**). The press, extractor, or wet-goods conveyor had not yet signaled that it was ready to receive when the tunnel was ready to transfer. The tunnel holds at transfer.

Occasional occurrence and self-correction is normal. Troubleshoot if persistent. Many factors could prevent the press from signaling that it is free to receive a load. Some common ones are:

1. press power off

2. controls not properly set, disabling operation
3. not finished pressing a previous load
4. could not discharge a previous load
5. press fault condition
6. circuit breaker tripped

After correction, press CONTROL + D to clear the error message immediately.

Table 30. Error E19 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	press	tunnel discharge end	not functioning	see press manufacturer's instructions
2	Last Mod. Input 14 circuit	see supporting information	open (loose connection)	W8CBWAI, lines 10-16

6.2.1.17 E20 Cleanout In Progress

BNTUUT06.C19 0000246260 A.2 B.3 A.3 1/2/20 2:11 PM Released

Applies to Workwear machines only. Manual module purge detected. Tunnel holds at transfer. Mentor® also displays “MANUAL FLUSH COMMANDED IN MODULE xx” where “xx” is the number of the offending module.

After correction, press CONTROL + D to clear the error message immediately.

Table 31. Error E20 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	Auto/Drain/Flush (manual purge) switch	left side of Module xx	switch set to Drain position	MSOUCUCTAE
2	offending Module Input 05 circuit	see supporting information	open (loose connection)	W8CBWJD, W8CBWJE

6.2.1.18 E21 Too Long to Block Eye

BNTUUT06.C20 0000246259 A.2 B.3 A.4 1/2/20 2:11 PM Released

Applies only when load fault error detection is enabled with **Max Time to Clear or Block Eye** (**Configuration, Operating Parameters, Output Timers**). Goods were expected to enter the tunnel, but were not detected in the load chute during the time specified by **Max Time to Clear or Block Eye**. Tunnel holds at the start of count-up.

It is helpful to know if the loading device discharged a batch into the tunnel (either by having seen the loading device operate or by cautiously looking through the load chute into the module).

If module 1 does not contain goods, the loading device probably did not function and the batch codes in the loading positions are now out of sync with the tunnel. Proceed to troubleshooting step 1.

NOTE: If an allied loading device is used, it is possible that an empty pocket was discharged (loading device did function) and this accounts for having no goods in module 1. However, with the Milnor® load conveyor, this would not occur since the discharge end photo eye would prevent it in this instance.

If module 1 contains goods, the loading positions remained in sync with the tunnel, and the problem is with the detection mechanisms. Proceed to step 2.

Table 32. Error E21 Troubleshooting Steps

<table>
<tr><th>Step</th><th>Component</th><th>Location</th><th>Offense</th><th>Supporting Info.</th></tr>
<tr><td rowspan="2">1</td><td>loading device</td><td>tunnel load end</td><td>did not discharge a batch into the tunnel</td><td>MSOPD466BE or rail manufacturer's instructions</td></tr>
<tr><td colspan="4">Verify that the loading device has power and controls are properly set. Any problem preventing the Milnor® loading conveyor from functioning would have occurred after Mentor® received the "Load Conveyor Ready" input (e.g., a momentary power outage). Correct the problem, check the batch codes for all loading positions, re-code the empty pocket in module 1 as such, and press CONTROL + D or the remote mounted Signal Cancel button to resume normal operation.</td></tr>
<tr><td rowspan="2">2</td><td>"Max Time to Clear or Block Loadeye" output</td><td>Configuration, Operational Parameters, Output Timers</td><td>too short a time programmed</td><td>MSOPD415EE</td></tr>
<tr><td colspan="4">All goods should pass through the load chute between 5 and 15 seconds after this time starts. Times of less than 5 seconds may expire before the first goods drop into the load chute. If this appears to be the problem, extend the time if necessary but not longer than 15 seconds because this will unnecessarily delay the start of count-up. After correction, press CONTROL + D or the remote mounted Signal Cancel button to resume operation. Otherwise proceed to step 3.</td></tr>
<tr><td rowspan="2">3</td><td>load chute photo eye</td><td>mounted in tunnel load chute</td><td>malfunctioning or not receiving power</td><td>MSSM0122AE, W8CBWLA or W8CBWLF</td></tr>
<tr><td colspan="4">Verify proper functioning. If so, proceed to step 4. If not, correct the problem and press CONTROL + D or the remote mounted Signal Cancel button to resume normal operation.</td></tr>
<tr><td rowspan="2">4</td><td>"Load Chute Eye Blocked" std. input</td><td>see supporting information</td><td>open (loose connection)</td><td>W8CBWLA or W8CBWLF</td></tr>
<tr><td colspan="4">After correcting, press CONTROL + D or the remote mounted Signal Cancel button to resume normal operation.</td></tr>
</table>

6.2.1.19 E22 Too Long to Clear Eye

Applies only when load fault error detection is enabled with **Max Time to Clear or Block Eye** (**Configuration, Operating Parameters, Output Timers**). Goods were still detected in the tunnel load chute after the time specified by **Max Time to Clear or Block Eye** expired. Tunnel holds at the start of count-up.

Typically, goods should pass through the load chute between 5 and 15 seconds after this time starts. Certain goods types may require longer times, thus requiring extending the **Max. time**.... However, consult the Milnor® factory if a max. time substantially longer than 15 seconds is needed. The resulting delay in the start of count-up will likely impair productivity.

After correction, press CONTROL + D or the remote mounted **Signal Cancel** button to resume operation. Otherwise, click on the **View Another Error** button and select **CHECK CBW LOAD CHUTE–E18** to troubleshoot load chute photo eye problems.

Table 33. Error E22 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	Max Time to Clear or Block Loadeye output	Configuration, Operational Parameters, Output Timers	too short a time programmed	MSOPD415EE
2	Flush pump	Flush (reuse) tank	not functioning properly	

6.2.1.20 E23 Load Eye Was Blocked

BNTUUT06.C22 0000246257 A.2 B.3 A.3 1/2/20 2:11 PM Released

Applies only when load fault error detection is enabled with **Max Time to Clear or Block Eye** (**Configuration, Operational Parameters, Output Timers**). Goods were detected in the load chute during transfer when an empty pocket was expected. Tunnel holds at the start of count-up.

If an actual batch, rather than an empty pocket, entered module 1 (as determined by observing the tunnel being loaded or by cautiously looking through the load chute into module 1), re-code this batch accordingly, then press CONTROL + D or the remote mounted **Signal Cancel** button to resume normal operation. Otherwise, click on the **View Another Error** button and select “CHECK CBW LOAD CHUTE–E18” to troubleshoot load chute photo eye problems.

Table 34. Error E23 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	module 1 batch codes	Mentor® Operational display	real batch improperly coded as empty	

6.2.1.21 E24 Reuse Tank Temp Low

BNTUUT06.C23 0000246256 A.2 B.3 A.3 1/2/20 2:11 PM Released

Applies to optional reuse steam only. Too low a temperature was detected in the reuse (flush) tank when transfer was desired. Tunnel holds at transfer.

View the reuse tank temperature on the Mentor® Operational window and observe the reuse tank steam valve.

- If the steam valve is functioning and the temperature display shows some change in tank temperature, the problem may be with either the incoming steam or the steam valve/circuit. Proceed to troubleshooting step 1.
- If the steam valve is not functioning, the problem is likely with the steam valve/circuit. Skip to step 3.

- If the steam valve is functioning, but there is no change in the actual temperature displayed, the problem is likely in the temp probe circuit. Skip to step 5.

Table 35. Error E24 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	steam header	usually connects at right front of tunnel	closed or flow restricted	
	Verify that any manual valves on the incoming steam header are fully open.			
2	compressed air and steam		poor quality	see boiler manufacturer's instructions
	Verify that plant air pressure is normal (sufficient for air operated steam valves). Verify that the boiler is functioning properly and producing an adequate supply of "dry" steam. After attempting the other troubleshooting steps, it may be beneficial to shut the system down and clean any condensate collectors, Y-strainers (one normally located at the steam header connection point on the tunnel), etc.			
3	steam valve and circuit	reuse tank/see supporting information	valve not opening	W8CBWJA
	If the steam valve is functioning at all, proceed to step 4. If not, check steam valve pilot air valve-to-C-bit output wiring for a loose connection. Check pilot air valve for proper functioning. Note that because C-bit assignments are unique to each tunnel, this specific pilot air valve does not appear on the schematic listed under supporting information.			
4	steam valve	reuse tank	not opening fully	
	Observe the valve for proper functioning. If it sounds sluggish, check for low air pressure to steam valve (e.g., leaking air tube) and damaged or worn steam valve components.			
5	reuse tank temp probe and circuit	reuse tank/see supporting information	not functioning properly	W8CBWFT
	If actual temperature reading is inordinately low, there is a likely open (loose connection) between the temperature probe and the Temperature A/D board. Check and repair. If the temperature reading is not inordinately low but remains relatively constant, the temp probe may be bad. Consult the Milnor® factory.			

6.2.1.22 E25 Load Not Allowed

BNTUUT06.C24 0000246255 A.2 B.3 A.3 1/2/20 2:11 PM Released

Applies only if **Miltrac Loading and Discharge** is configured (**Configuration, Hardware**). The loading device had not yet signaled (via the **Load Conveyor Ready** standard input) that it was ready to discharge when the tunnel desired to transfer. Tunnel holds at transfer. Note that a Miltrac™ system malfunction would not cause this error, but rather it would cause a “LOADING ABORTED” error.

NOTE: As of this writing, the only Miltrac™ loading device is MILRAIL™.

Table 36. Error E25 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	loading device	tunnel load end	not functioning properly	see loading device documentation
2	Load Conveyor Ready input/circuit	see supporting information	loose connection (circuit open)	W8CBWLD

6.2.1.23 E26 Loading Aborted

BNTUUT06.C25 0000246254 A.2 B.3 A.5 1/2/20 2:11 PM Released

Applies only if **Miltrac Loading and Discharge** is configured (**Configuration, Hardware**). As of this writing, the only Miltrac™ loading device is MILRAIL™. If this error appears on a non-MILRAIL™ system, the **Miltrac** configure decision is probably improperly set.

The two possible general causes and consequences are:

1. Miltrac™ had not yet signaled Mentor® to proceed with transfer when the tunnel desired to transfer. Tunnel holds at transfer.
2. Miltrac™ had not yet acknowledged that transfer is complete when the **Start Flush After Transfer** output timer (**Configuration, Operating Parameters, Output Timers**) timed out. Tunnel holds at the start of count-up.

NOTE: A malfunction of the loading device would probably not cause this error, but rather a **LOAD NOT ALLOWED** error.

Table 37. Error E26 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	Miltrac™ Controller	central control box	malfunctioned (e.g., lost power)	see Miltrac™ manual
2	serial link wiring - Miltrac™ to Mentor®	between Miltrac™ controller and Mentor®	loose connection (circuit open)	see system cable diagram
3	serial link wiring - MILRAIL™ to Miltrac™	between MIL-RAIL™ controller and Miltrac™	loose connection (circuit open)	see system cable diagram

6.2.1.24 E27 Waiting For Cooldown

BNTUUT06.C26 0000246253 A.2 B.3 A.3 1/2/20 2:11 PM Released

Applies to optional reuse cooldown only. Too high a temperature was detected in the reuse (flush) tank when transfer was desired. Tunnel holds at transfer.

View the reuse tank temperature on the Mentor® Operational window and observe the reuse tank cooldown water inlet.

- If the cooldown valve is functioning and the temperature display shows some change in tank temperature, the problem may be with either the incoming cooldown water or the the water valve/circuit. Proceed to troubleshooting step 1.

- If the cooldown valve is not functioning, the problem is likely with the cooldown water valve/circuit. Skip to step 3.
- If the cooldown valve is functioning, but there is no change in the actual temperature displayed, the problem is likely in the temp probe circuit. Skip to step 5.

Table 38. Error E27 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	Incoming water line	connects to reuse tank cooldown inlet	closed or flow restricted	
	Verify that any manual valves on the incoming cold water line are fully open.			
2	compressed air and cold water		poor quality	
	Verify that plant air pressure is normal (sufficient for air operated water valves). Verify that the incoming cold water temperature is lower than the cooldown temperature desired. This will be the desired Module 1 bath temperature for the formula currently in Module 1, or for the formula in the last storage position if module 1 currently contains the empty pocket or purge pocket formula.			
3	cooldown valve and circuit	reuse tank/see supporting information	valve not opening	W8CBWJA
	If the cooldown valve is functioning at all, proceed to step 4. If not, check cooldown valve pilot air valve-to-C-bit output wiring for a loose connection. Check pilot air valve for proper functioning. Note that because C-bit assignments are unique to each tunnel, this specific pilot air valve does not appear on the schematic listed under supporting information.			
4	cooldown valve	reuse tank	not opening fully	BMP920005, BMP920006, BMP920007
	Observe the valve for proper functioning. If it appears sluggish, check for low air pressure to air cylinder (e.g., leaking air tube) and damaged or worn air cylinder components.			
5	reuse tank temp probe and circuit	reuse tank/see supporting information	not functioning properly	W8CBWFT
	If actual temperature reading remains relatively constant, the temp probe may be bad. Consult the Milnor® factory.			

6.2.1.25 E28 Oil Level Low

BNTUUT06.C27 0000246331 A.2 B.3 A.4 1/2/20 2:11 PM Released

Inadequate oil level in the chain oiler reservoir was detected. Tunnel holds at transfer. After correction, press CONTROL + D to clear the error message immediately.

Table 39. Error E28 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	Oil	chain oiler reservoir on front of tunnel	level low	MSSMD401BE
2	"Oil Level Low" (Mod 1 input 13) circuit	see supporting information	shorted to ground	W8CBWJCA

6.2.1.26 E29 Air Pressure Low

BNTUUT06.C28 0000246330 A.2 B.3 A.3 1/2/20 2:11 PM Released

Insufficient pressure in the incoming compressed air line was detected when transfer was desired. Tunnel holds at transfer.

A minimum of 80 psi (5.62 kg/sq. cm) must be maintained in the line to ensure proper operation of all air operated apparatuses and avoid this error.

Table 40. Error E29 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	compressed air	connects at front, right, top of tunnel	below 80 psi (5.62 kg/sq. cm) pressure	
2	Air Pressure Satisfied (mod 1 input 14) circuit	see supporting information	open (loose connect.) or bad component	W8CBWJCA

6.2.1.27 E30 Modules Not Aligned

BNTUUT06.C29 0000246329 A.2 B.3 A.3 1/2/20 2:11 PM Released

Applies to 76028 and 76039 CBW models only. A rotational misalignment of the cylinders in adjoining units was detected. Tunnel stops.

The cylinders in all units must remain rotationally aligned precisely and turn in unison. The interlocked drive shafts, drive chains and sprockets maintain this alignment. Any actual misalignment is a malfunction which must be corrected before the tunnel is returned to operation.

Table 41. Error E30 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	tunnel cylinders	tunnel	not aligned	BMP940123, BMP960021
	Lock off and tag out tunnel power at the main disconnect switch, then inspect the tunnel for mis-alignment. Identify the alignment proximity switches and targets (see supporting information). Each unit has one alignment prox. switch and target. In some cases the switches/targets on adjacent units face each other and in some cases, they do not. But if the units are aligned, the distance from the alignment prox. switch to its corresponding target should be identical on each unit, no matter where the cylinders stopped in their rotation. If no mis-alignment is detected, skip to step 2. If the units are misaligned, consult the Milnor® factory. All drive components must be checked for damage, repairs performed, and the units re-aligned. Major drive components include: drive			

Table 41 Error E30 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
	chains, drive shafts and flex couplings, sprockets/keys, pulleys/keys, belts, gear reducers, motors.			
2	alignment proximity switch	see supporting information	not functioning or not receiving power	W8CBWSE
	Each unit has one alignment proximity switch. These are mounted between units, pointing toward the inter-module connection, similar to the rotation limit switches. All alignment switches are located at the same rotational angle. When viewing the front of the tunnel, the alignment switches are in the upper right quadrant, between the Safety and Counterclockwise limit switch positions. Test each alignment switch as follows: Hold a piece of steel under the head of the switch. If the light on the switch illuminates, proceed to the next switch. If it does not illuminate, test to see if the switch is receiving power. If not, look for and repair a loose connection in the switch power circuit. If the switch is receiving power, replace the switch. If all switches test OK, proceed to step 3.			
3	CBW® Alignment direct Input 11 circuit	see supporting information	open (loose connection)	W8CBWSE
	The alignment switch contacts are wired in series, such that all switches must be made simultaneously for the CBW® Alignment input (Inputs and Outputs, Direct and Standard Inputs) to be made. As in step 2, affix a piece of steel under the head of each switch, so that all switches are made simultaneously. If the display does not show this input made, look for and repair a loose connection in the switch-to-switch and switch-to-input wiring. Otherwise, proceed to step 4.			
4	alignment switches	as explained in step 2	not aligned to target	MSOUCUCTAE

6.2.2 The Mentor® Warning Messages and Their Troubleshooting Steps

BNTUUT06.C30 0000246328 A.2 B.3 A.4 1/2/20 2:11 PM Released

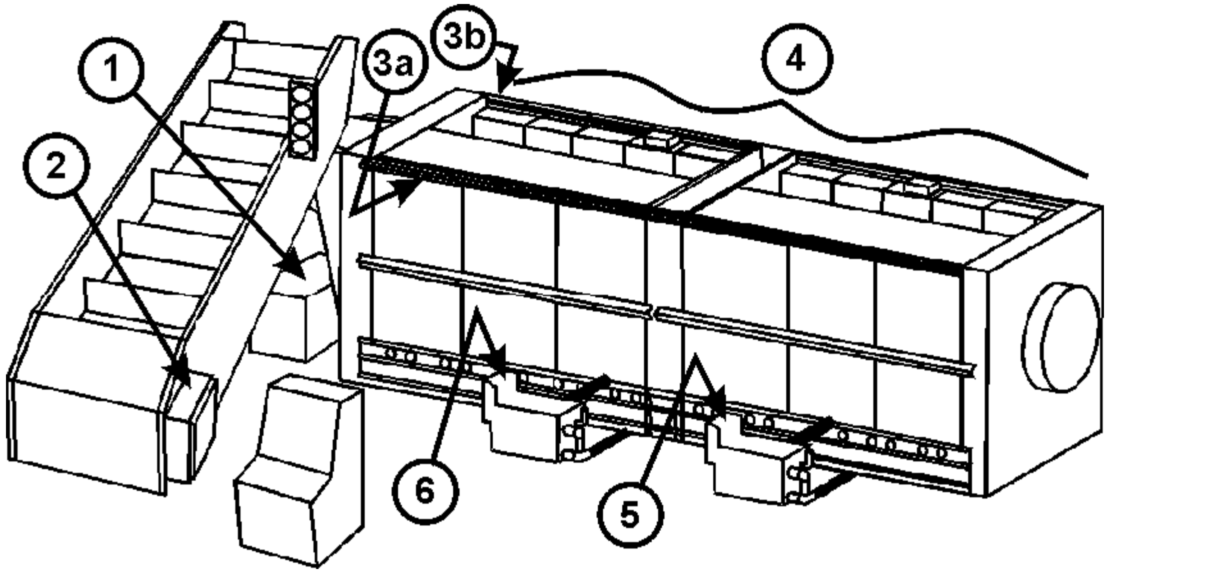
Warning messages indicate that a circuit breaker or thermal overload has tripped. Although the tunnel itself will continue to function, devices dependent on the circuit breaker or overload will cease to function. Reset switches for circuit breakers and overload locations are shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 , below. The various warning messages refer to this figure.

WARNING: Electrocution, Electric Shock, and Electrical Burn Hazards — Contact with high voltage can kill or seriously injure you. Reset switches located on the face of electric boxes are intended for operator use. However, troubleshooting involving access to thermal overloads inside electric boxes must be performed only by authorized service technicians.

- Do not access electrical components unless qualified and authorized.

Figure 118. Locating Overloads and Resets When Troubleshooting Warning Messages

Overload and Reset Locations



Legend

1 . . . Reuse (flush) tank and interface box. **Operator Reset** switch is located on face of box.
2 . . . CONWA/CONLO (loading conveyor) interface box. Thermal overload located inside box.
3a . . Standard output box - 76032 models. **Operator reset** switch located on face of box.
3b . . Standard output box - 76028 and 76039 models. **Operator reset** switch located on face of box.
4 . . . Module control boxes (76032 models) or drive contactor boxes (76028 and 76039 models). **Operator reset** switches located on face of module control boxes. Thermal overloads located inside boxes.
5 . . . Rinse zone flow splitter tank and rinse zone box. **Operator reset** switch located on face box. Thermal overload is located inside box.
6 . . . Wash zone flow lifter tank and wash zone box. Thermal overload located inside box.

6.2.2.1 W00 Circuit Breaker Trip in Reuse Interface Box

BNTUUT06.C31 0000246440 A.2 B.3 A.4 1/2/20 2:11 PM Released

Reuse (Flush) Interface box lost power. Reuse (Flush) pump will not function. Press the reset switch at the location shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 , Item 1. If this does not correct the problem, the following troubleshooting steps must be performed by an authorized service technician.

Table 42. Error W00 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	circuit breaker	see figure	tripped	
2	Flush Pump Interface circuit	see supporting information	open (loose connection) or bad component	W8CBWLA
3	CRCBF relay	Reuse (Flush) Interface box	bad; input to microprocessor shorted	W8CBWLA

6.2.2.2 W01 Reuse Pump Overload Trip

BNTUUT06.C32 0000246439 A.2 B.3 A.3 1/2/20 2:11 PM Released

A Reuse (Flush) pump motor overloaded, tripping a thermal overload (circuit breaker). Pump will not run. Troubleshooting must be done by a qualified service technician. The thermal overload is located inside the electric box at the location shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 , item 1.

- If the overload occurred immediately upon startup following maintenance, such as installation of a new pump or motor, skip to troubleshooting step 4.
- If the overload condition occurred during normal operation, but is persistent, skip to step 3.
- Otherwise, proceed to step 1.

Table 43. Error W01 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	thermal overload (circuit breaker)	Reuse (Flush) Interface box	tripped	
	If the green (upper) button, marked "1" on the thermal overload is not fully depressed, the overload is tripped. If this button is fully depressed, proceed to step 2. Otherwise, press this button. If it does not remain fully depressed, press the red (lower) button, marked "0", then press the green button.			
2	input to microprocessor	see supporting information	shorted to ground	W8CBWLA, W8CBWLF
	If the thermal overload does not appear to be tripped, test for and correct a short in the thermal overload itself, or elsewhere in the input circuit.			
3	pump motor	Reuse (Flush) tank	excessive current draw	BMP930027
	If the thermal overload trips persistently, test for and correct any problem that would cause the pump motor to draw excessive current, such as: 1) incoming voltage fluctuations, 2) excessive load on pump (e.g., clogged pump, restricted piping, closed manual valve), 3) motor or pump seizing (e.g., bad bearings), 4) motor winding deterioration (i.e., motor burning out). After correction, reset the thermal overload as in step 1.			
4	any component	Reuse (Flush) tank	improperly re-installed	BMP930027
	If the thermal overload tripped immediately after servicing (such as replacing a motor), check: 1) motor wiring/phasing, 2) Proper motor used (motors not furnished by Milnor®, even if apparently equivalent by specification, may not provide adequate power or starting torque), 3) Mechanical components properly reassembled. After correction, reset the thermal overload as in step 1.			

6.2.2.3 W02 Loading Conveyor Overload Trip

BNTUUT06.C33 0000246438 A.2 B.3 A.3 1/2/20 2:11 PM Released

A CONWA/CONLO (loading conveyor) drive motor overloaded, tripping a thermal overload (circuit breaker). Conveyor will not run. Troubleshooting must be done by a qualified service technician.

The thermal overload is located inside the CONLO/CONWA control box as shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 , item 2.

Table 44. Error W02 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	thermal overload (circuit breaker)	CONWA/CONLO Control Box	tripped	
	If the green (upper) button, marked "1" on the thermal overload is not fully depressed, the overload is tripped. If this button is fully depressed, proceed to step 2. Otherwise, press this button. If it does not remain fully depressed, press the red (lower) button, marked "0", then press the green button.			
2	input to microprocessor	see supporting information	shorted to ground	W8CBWLD
	If the thermal overload does not appear to be tripped, test for and correct a short in the thermal overload itself, or elsewhere in the input circuit.			
3	conveyor drive motor	CONWA/CONLO loading conveyor	excessive current draw	BMP820018
	If the thermal overload trips persistently, test for and correct any problem that would cause the conveyor drive motor to draw excessive current, such as: 1) incoming voltage fluctuations, 2) excessive load on motor (e.g., conveyor grossly overloaded), 3) motor seizing (e.g., broken drive component, bad motor bearing), 4) motor winding deterioration (i.e., motor burning out). After correction, reset the thermal overload as in step 1.			
4	any drive component	CONWA/CONLO loading conveyor	improperly re-installed	BMP820015, BMP820018, BMP820025, BMP820028
	If the thermal overload tripped immediately after servicing (such as replacing the motor), check: 1) motor wiring/phasing, 2) proper motor used (motors not furnished by Milnor®, even if apparently equivalent by specification, may not provide adequate power or starting torque), 3) drive components properly reassembled. After correction, reset the thermal overload as in step 1.			

6.2.2.4 W03 Load Chute Photoeye Blocked

BNTUUT06.C34 0000246437 A.2 B.3 A.3 1/2/20 2:11 PM Released

Appears if the load chute photo eye is still blocked after flushing has ended. If this condition is not corrected before the tunnel desires to transfer, the error “CHECK CBW LOAD CHUTE ”occurs, requiring troubleshooting. View this error for procedures.

6.2.2.5 W04 Circuit Breaker Trip in Standard Output Box

BNTUUT06.C35 0000246436 A.2 B.3 A.3 1/2/20 2:11 PM Released

The Standard Output box lost power. These outputs will not function. Press the reset switch on the face of the standard output box at the location shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 , item 3a or 3b. If the problem persists, the following troubleshooting steps must be performed by an authorized service technician.

Table 45. Error W04 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	circuit breaker	see above	tripped	
2	Standard Outputs circuit	see supporting information	open (loose connect.) or bad component	W8CBWSA, W8CBWMC
3	CRCBS relay	Standard Output box	bad; input to microprocessor shorted	W8CBWSA

6.2.2.6 W05 Drive Motor Overload Trip in Module xx

BNTUUT06.C36 0000246656 A.2 B.3 A.3 1/2/20 2:11 PM Released

A cylinder drive motor overloaded, tripping a thermal overload (circuit breaker). On the 76032 CBW®, the motor will be on the indicated module. On a 76028 or 76039 CBW®, the motor will be on the unit that includes the indicated module. Tunnel will not run. Troubleshooting must be done by a qualified service technician.

The thermal overload is located inside the Module box or Drive Contactor box, located as shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 , item 4.

- If the overload occurred immediately upon startup following maintenance, such as installation of a new motor, skip to troubleshooting step 4.
- If the overload condition occurred during normal operation, but is persistent, skip to step 3.
- Otherwise, proceed to step 1.

Table 46. Error W05 Troubleshooting Steps

<table>
<tr><th>Step</th><th>Component</th><th>Location</th><th>Offense</th><th>Supporting Info.</th></tr>
<tr><td rowspan="2">1</td><td>thermal overload (circuit breaker)</td><td>Module xx box or Drive box</td><td>tripped</td><td></td></tr>
<tr><td colspan="4">If the green (upper) button, marked "1" on the thermal overload is not fully depressed, the overload is tripped. If this button is fully depressed, proceed to step 2. Otherwise, press this button. If it does not remain fully depressed, press the red (lower) button, marked "0", then press the green button.</td></tr>
<tr><td rowspan="2">2</td><td>input to microprocessor</td><td>see supporting information</td><td>shorted to ground</td><td>W8CBWDB (76032 only), W8CBWJCA</td></tr>
<tr><td colspan="4">If the thermal overload does not appear to be tripped, test for and correct a short in the thermal overload itself, or elsewhere in the input circuit.</td></tr>
<tr><td rowspan="2">3</td><td>drive motor</td><td>indicated module or unit</td><td>excessive current draw</td><td>BMP810059, BMP960021, BMP940100, BMP940062</td></tr>
<tr><td colspan="4">If the thermal overload trips persistently, test for and correct any problem that would cause the cylinder drive motor to draw excessive current, such as: 1) incoming voltage fluctuations, 2) excessive load on motor (a tunnel jam is about the only condition in which too much goods could overload the drive motors), 3) motor seizing (e.g., broken</td></tr>
</table>

Table 46 Error W05 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
	drive component, bad motor bearing), 4) motor winding deterioration (i.e., motor burning out). After correction, reset the thermal overload as in step 1.			
4	any drive component	indicated module or unit	improperly re-installed	BMP810059, BMP960021, BMP940100, BMP940062
	If the thermal overload tripped immediately after servicing (such as replacing the motor), check: 1) motor wiring/phasing, 2) Proper motor used (motors not furnished by Milnor®, even if apparently equivalent by specification, may not provide adequate power or starting torque), 3) drive components properly reassembled. After correction, reset the thermal overload as in step 1.			

6.2.2.7 W06 Circuit Breaker Trip in module xx Control Box

BNTUUT06.C37 0000246655 A.2 B.3 A.3 1/2/20 2:11 PM Released

The indicated Module Control box lost power. Devices on this module will not function. Press the reset switch on the face of the indicated module control box. If the problem persists, the troubleshooting steps below must be performed by an authorized service technician.

Table 47. Error W06 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	circuit breaker	see above	tripped	
2	Module xx Outputs circuit	see supporting information	open (loose connect.) or bad component	W8CBWJA, W8CBWJCA
3	CRCB* relay	Module xx Control box	bad; input to microprocessor shorted	W8CBWJA

6.2.2.8 W07 Manual Flush Commanded in Module xx

BNTUUT06.C38 0000246654 A.2 B.3 A.3 1/2/20 2:11 PM Released

Applies to Workwear machines only. Appears when a module purge is detected in the indicated module. If this condition is not corrected before the tunnel desires to transfer, the error “CLEANOUT IN PROGRESS” occurs, requiring troubleshooting. View this error for procedures.

6.2.2.9 W08 Circuit Breaker Trip in Module xx Rinse Zone Interface Box

BNTUUT06.C39 0000246653 A.2 B.3 A.3 1/2/20 2:11 PM Released

The Rinse Zone Flow Splitter lost power. Associated pumps will not function. Press the reset switch on the face of the rinse zone interface box. If the problem persists, the troubleshooting steps below must be performed by an authorized service technician.

Table 48. Error W08 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	circuit breaker	see above	tripped	
2	Rinse Zone Control circuit	see supporting information	open (loose connect.) or bad component	W8CBWZB, W8CBWZG
3	CRCB1 relay	Rinse Zone Interface box	bad; input to microprocessor shorted	W8CBWZB, W8CBWZG

6.2.2.10 W09 Rinse Zone Flow Pump Overload Trip in Module xx

BNTUUT06.C40 0000246652 A.2 B.3 A.3 1/2/20 2:11 PM Released

A Rinse Zone Flow Pump motor overloaded, tripping a thermal overload (circuit breaker). Pump will not run. Troubleshooting must be done by a qualified service technician.

The thermal overload is located inside the electric box on the flow splitter adjacent to the indicated module as shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 , item 5.

- If the overload occurred immediately upon startup following maintenance, such as installation of a new pump or motor, skip to troubleshooting step 4.
- If the overload condition occurred during normal operation, but is persistent, skip to step 3. Otherwise, proceed to step 1.

Table 49. Error W09 Troubleshooting Steps

<table>
<tr><th>Step</th><th>Component</th><th>Location</th><th>Offense</th><th>Supporting Info.</th></tr>
<tr><td rowspan="2">1</td><td>thermal overload (circuit breaker)</td><td>Rinse Zone (flow splitter) box</td><td>tripped</td><td></td></tr>
<tr><td colspan="4">The flow pump thermal overload is the right hand of two adjacent overloads. If the green (upper) button, marked "1" on the thermal overload is not fully depressed, the overload is tripped. If this button is fully depressed, proceed to step 2. Otherwise, press this button. If it does not remain fully depressed, press the red (lower) button, marked "0", then press the green button.</td></tr>
<tr><td rowspan="2">2</td><td>input to microprocessor</td><td>see supporting information</td><td>shorted to ground</td><td>W8CBWZB, W8CBWZG</td></tr>
<tr><td colspan="4">If the thermal overload does not appear to be tripped, test for and correct a short in the thermal overload itself, or elsewhere in the input circuit.</td></tr>
<tr><td rowspan="2">3</td><td>pump motor</td><td>Rinse Zone Flow Splitter tank</td><td>excessive current draw</td><td>BMP930027</td></tr>
<tr><td colspan="4">If the thermal overload trips persistently, test for and correct any problem that would cause the pump motor to draw excessive current, such as: 1) incoming voltage fluctuations, 2) excessive load on pump (e.g., clogged pump, restricted piping, closed manual valve), 3) motor or pump seizing (e.g., bad bearings), 4) motor winding deterioration (i.e., motor burning out). After correction, reset the thermal overload as in step 1.</td></tr>
<tr><td>4</td><td>any component</td><td>Rinse Zone Flow Splitter tank</td><td>improperly re-installed</td><td>BMP930027</td></tr>
</table>

Table 49 Error W09 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
	If the thermal overload tripped immediately after servicing (such as replacing a motor), check: 1) motor wiring/phasing, 2) proper motor used (motors not furnished by Milnor®, even if apparently equivalent by specification, may not provide adequate power or starting torque), 3) mechanical components properly reassembled. After correction, reset the thermal overload as in step 1.			

6.2.2.11 W10 Rinse Zone Surplus Pump Overload Trip in Module xx

BNTUUT06.C41 0000246651 A.2 B.3 A.3 1/2/20 2:11 PM Released

A Rinse Zone Surplus Pump motor overload condition, resulting in a tripped thermal overload (circuit breaker), was detected. Pump will not run. Troubleshooting must be done by a qualified service technician.

The thermal overload is located inside the electric box on the flow splitter adjacent to the indicated module, as shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 , item 5.

- If the overload occurred immediately upon startup following maintenance, such as installation of a new pump or motor, skip to troubleshooting step 4.
- If the overload condition occurred during normal operation, but is persistent, skip to step 3.
- Otherwise, proceed to step 1.

Table 50. Error W10 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	thermal overload (circuit breaker)	Rinse Zone (flow splitter) box	tripped	
	The surplus pump thermal overload is the left hand of two adjacent overloads. If the green (upper) button, marked "1" on the thermal overload is not fully depressed, the overload is tripped. If this button is fully depressed, proceed to step 2. Otherwise, press this button. If it does not remain fully depressed, press the red (lower) button, marked "0", then press the green button.			
2	input to microprocessor	see supporting information	shorted to ground	W8CBWZB, W8CBWZG
	If the thermal overload does not appear to be tripped, test for and correct a short in the thermal overload itself, or elsewhere in the input circuit.			
3	pump motor	Rinse Zone Flow Splitter tank	excessive current draw	BMP930027
	If the thermal overload trips persistently, test for and correct any problem that would cause the pump motor to draw excessive current, such as: 1) incoming voltage fluctuations, 2) excessive load on pump (e.g., clogged pump, restricted piping, closed manual valve), 3) motor or pump seizing (e.g., bad bearings), 4) motor winding deterioration (i.e., motor burning out). After correction, reset the thermal overload as in step 1.			
4	any component	Rinse Zone Flow Splitter tank	improperly reinstalled	BMP930027

Table 50 Error W10 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
	If the thermal overload tripped immediately after servicing (such as replacing a motor), check: 1) motor wiring/phasing, 2) Proper motor used (motors not furnished by Milnor®, even if apparently equivalent by specification, may not provide adequate power or starting torque), 3) mechanical components properly reassembled. After correction, reset the thermal overload as in step 1.			

6.2.2.12 W11 Wash Water Flow Lifter Overload Trip in Module xx

BNTUUT06.C42 0000246650 A.2 B.3 A.3 1/2/20 2:11 PM Released

A Wash Water Flow Lifter pump motor overloaded, tripping a thermal overload (circuit breaker). Pump will not run. Troubleshooting must be done by a qualified service technician.

The thermal overload is located inside the electric box on the flow lifter tank adjacent to the indicated module, as shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 , item 6.

- If the overload occurred immediately upon startup following maintenance, such as installation of a new pump or motor, skip to troubleshooting step 4.
- If the overload condition occurred during normal operation, but is persistent, skip to step 3.
- Otherwise, proceed to step 1.

Table 51. Error W11 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	thermal overload (circuit breaker)	Wash Water Flow Lifter box	tripped	
	If the green (upper) button, marked "1" on the thermal overload is not fully depressed, the overload is tripped. If this button is fully depressed, proceed to step 2. Otherwise, press this button. If it does not remain fully depressed, press the red (lower) button, marked "0", then press the green button.			
2	input to microprocessor	see supporting information	shorted to ground	W8CBWZA, W8CBWZE
	If the thermal overload does not appear to be tripped, test for and correct a short in the thermal overload itself, or elsewhere in the input circuit.			
3	pump motor	Wash Water Flow Lifter tank	excessive current draw	BMP930027
	If the thermal overload trips persistently, test for and correct any problem that would cause the pump motor to draw excessive current, such as: 1) incoming voltage fluctuations, 2) excessive load on pump (e.g., clogged pump, restricted piping, closed manual valve), 3) motor or pump seizing (e.g., bad bearings), 4) motor winding deterioration (i.e., motor burning out). After correction, reset the thermal overload as in step 1.			
4	any component	Wash Water Flow Lifter tank	improperly re-installed	BMP930027

Table 51 Error W11 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
	If the thermal overload tripped immediately after servicing (such as replacing a motor), check: 1) motor wiring/phasing, 2) proper motor used (motors not furnished by Milnor®, even if apparently equivalent by specification, may not provide adequate power or starting torque), 3) Mechanical components properly reassembled. After correction, reset the thermal overload as in step 1.			

6.2.2.13 W12 Press Pump Overload Trip

BNTUUT06.C43 0000246649 A.2 B.3 A.3 1/2/20 2:11 PM Released

On line troubleshooting not available. This error not applicable to CBW®s originally manufactured with the Mentor® controller.

6.2.2.14 W13 Peripheral Board xxH Not Responding

BNTUUT06.C44 0000246648 A.2 B.3 A.3 1/2/20 2:11 PM Released

Appears if the controller loses communication with a peripheral board. If this condition is not corrected before the tunnel desires to transfer, the error “COMMUNICATIONS ERROR” occurs, requiring troubleshooting. View this error for procedures.

6.2.2.15 W14 Tunnel Power Off

BNTUUT06.C45 0000246647 A.2 B.3 A.4 1/2/20 2:11 PM Released

A loss of 120VAC control circuit power to the tunnel was detected. The tunnel will not run.

WARNING: Electrocution, Electric Shock, and Electrical Burn Hazards — Contact with high voltage can kill or seriously injure you. Loss of control circuit power does not eliminate electric power from the tunnel. High voltage is still present at the machine unless the main machine power disconnect is off.

- ▶ Do not access electrical components unless qualified and authorized.

Tunnel (CBW®) power is normally controlled by the operator at the Mentor® console. If this message appears because tunnel (CBW®) power was lost unintentionally, observe the status lights on the Mentor® console. If the **CBW Power ON** light (①) is illuminated, skip to troubleshooting step 3.

If the **CBW Power OFF** light (⓪) is illuminated, verify that bystanders are clear of the loading device and tunnel and that no other unsafe conditions exist, then attempt to return power to the tunnel by pressing the **CBW Power ON** button (①). If this does not restore power, proceed to troubleshooting step 1.

Table 52. Error W14 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	emergency stop switch	see above	depressed	
	Verify that all emergency stop switches are released (turn clockwise). These include one on the Mentor® console and four on the tunnel (one on each corner). If the tunnel is loaded by a CONWA or CONLO loading conveyor, verify that the motor disconnect			

Table 52 Error W14 Troubleshooting Steps (cont'd.)

Step	Component	Location	Offense	Supporting Info.
	rotary switch on the conveyor Control box is set to 1 (on) and that nothing is holding either of the emergency stop pull cords tight.			
2	tunnel power circuit	see supporting information	open (loose connect. or bad component)	W8CBWNA, W8CBWSD
	Test for and correct an open (e.g., loose connection or bad contact on switch) in the tunnel 3-wire (control power) circuit.			
3	CRTP+ relay	Mentor® Cabinet	bad	
	Test for and replace a bad CRTP+ relay.			
4	input to microprocessor	see supporting information	open (loose connect. or bad component)	W8CBWNA, W8CBWMC
	Test for and correct an open (e.g., loose connection, bad contact in the CRTP+ relay) in the microprocessor input circuit.			

6.2.2.16 W15 Value for Remote Customer Code Exceeds Limit (999)

BNTUUT06.C46 0000246724 A.2 B.3 A.3 1/2/20 2:11 PM Released

Appears if the remote customer code input exceeds the maximum acceptable value of 999. If this condition is not corrected before the tunnel desires to transfer, the error “INVALID CUSTOMER CODE” occurs, requiring troubleshooting. View this error for procedures.

6.2.2.17 W16 Drive Motor Contactor Failure

BNTUUT06.C47 0000246723 A.2 B.3 A.3 1/2/20 2:11 PM Released

Applies to 76032 CBW® only. The controller detected a failure of a drive motor contactor to energize during the window of time when it should have. The specific contactor (CW or CCW, and module) is not identified.

CAUTION: Machine Damage Hazard — Although the tunnel may continue to operate, drive motors can burn out if severely overloaded because not all motors are functioning.

- Have an authorized service technician troubleshoot this warning immediately.

NOTE: If a set of contactors (e.g., all odd, clockwise contactors) fails to energize due to a problem with the circuitry that controls those contactors, this will normally result in a “DRIVE SYSTEM” error. Thus, the “DRIVE MOTOR CONTACTOR FAILURE” warning will normally only result from either a single bad contactor, or a problem in the circuitry that provides input to the microprocessor.

Observe the CRWA relay in the Standard Output box then proceed as shown in Table 53: Troubleshooting Step to Start At, page 230 below. This relay should energize once during each clockwise and counter-clockwise rotation of the cylinder. The standard output box and motor contactor boxes are located as shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 .

Table 53. Troubleshooting Step to Start At

CRWA Condition Observed	Action
Energizes at CW and at CCW	Skip to troubleshooting step 3
Energizes at CW or CCW, but not both	Proceed to step 1
Does not energize at all	Skip to step 2

Table 54. Error W16 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	drive motor contactor	Module box	failed	W8CBWDA
	Using extreme caution not to touch live conductors, open one Module box at a time with the tunnel rotating and observe the contactors (closing and locking each box after observing). If any contactor is observed to be not functioning properly (chattering or not pulling in), lock off and tag out power and replace that contactor. If all contactors appear to be functioning, test for and correct a bad auxiliary contact (contact in the circuit that operates the CRWA relay) on a motor contactor.			
2	CRWA relay circuit	see supporting information	open (loose connect. or bad component)	W8CBWDA
	Test for and correct an open (loose connection) in the circuit that operates the CRWA relay or a bad CRWA relay.			
3	microprocessor input circuit	see supporting information	open (loose connect. or bad component)	W8CBWDA
	Test for and correct an open (e.g., loose connection or bad contact on the CRWA relay) in the microprocessor input circuit.			

6.2.2.18 W15 Value for Remote Customer Code Exceeds Limit (999)

BNTUUT06.C46 0000246724 A.2 B.3 A.3 1/2/20 2:11 PM Released

Appears if the remote customer code input exceeds the maximum acceptable value of 999. If this condition is not corrected before the tunnel desires to transfer, the error “INVALID CUSTOMER CODE” occurs, requiring troubleshooting. View this error for procedures.

6.2.2.19 W16 Drive Motor Contactor Failure

BNTUUT06.C47 0000246723 A.2 B.3 A.3 1/2/20 2:11 PM Released

Applies to 76032 CBW® only. The controller detected a failure of a drive motor contactor to energize during the window of time when it should have. The specific contactor (CW or CCW, and module) is not identified.

CAUTION: **Machine Damage Hazard** — Although the tunnel may continue to operate, drive motors can burn out if severely overloaded because not all motors are functioning.

- Have an authorized service technician troubleshoot this warning immediately.

NOTE: If a set of contactors (e.g., all odd, clockwise contactors) fails to energize due to a problem with the circuitry that controls those contactors, this will normally result in a "DRIVE SYSTEM" error. Thus, the "DRIVE MOTOR CONTACTOR FAILURE" warning will normally only result from either a single bad contactor, or a problem in the circuitry that provides input to the microprocessor.

Observe the CRWA relay in the Standard Output box then proceed as shown in Table 55: Troubleshooting Step to Start At, page 231 below. This relay should energize once during each clockwise and counter-clockwise rotation of the cylinder. The standard output box and motor contactor boxes are located as shown in Figure 118: Locating Overloads and Resets When Troubleshooting Warning Messages, page 220 .

Table 55. Troubleshooting Step to Start At

CRWA Condition Observed	Action
Energizes at CW and at CCW	Skip to troubleshooting step 3
Energizes at CW or CCW, but not both	Proceed to step 1
Does not energize at all	Skip to step 2

Table 56. Error W16 Troubleshooting Steps

Step	Component	Location	Offense	Supporting Info.
1	drive motor contactor	Module box	failed	W8CBWDA
	Using extreme caution not to touch live conductors, open one Module box at a time with the tunnel rotating and observe the contactors (closing and locking each box after observing). If any contactor is observed to be not functioning properly (chattering or not pulling in), lock off and tag out power and replace that contactor. If all contactors appear to be functioning, test for and correct a bad auxiliary contact (contact in the circuit that operates the CRWA relay) on a motor contactor.			
2	CRWA relay circuit	see supporting information	open (loose connect. or bad component)	W8CBWDA
	Test for and correct an open (loose connection) in the circuit that operates the CRWA relay or a bad CRWA relay.			
3	microprocessor input circuit	see supporting information	open (loose connect. or bad component)	W8CBWDA
	Test for and correct an open (e.g., loose connection or bad contact on the CRWA relay) in the microprocessor input circuit.			

BNTUUT02 / 2019146 BNTUUT02 0000230664 A.6 1/2/20 2:11 PM Released

6.3 Drive System and Limit Switch Errors

BNTUUT02.C01 0000230663 A.2 A.6 A.3 1/2/20 2:11 PM Released

The tunnel has four proximity-type limit switches to monitor rotation of the cylinder. Each of these limit switches provides a standard input to the Mentor® controller, as described in Table 57 below. Select the **Inputs and Outputs** menu from the Mentor® operational display to view the status of these switches.

Table 57. Limit Switch Identification

Common Name	Input Number	Schematic Identification
Safety limit switch	0 7	SAFETY
Top dead center limit switch	0 8	TDC
Clockwise limit switch	0 9	CWLS
Counter-clockwise limit switch	1 0	CCWLS

NOTE: Clockwise and counter-clockwise directions are identified by viewing the tunnel from the loading end, looking toward the discharge end.

6.3.1 Interpretation of Error Codes

BNTUUT02.C02 0000230662 A.2 A.6 A.5 1/2/20 2:11 PM Released

The Mentor® controller tracks the sequence of the limit switches and monitors the time between the actuation of two adjacent switches. If the controller detects a switch out of sequence, it stops the tunnel, sounds the operator signal, and displays a “Limit Switch” error. Because limit switch errors usually indicate that a switch was seen out of sequence, begin troubleshooting by looking for a failure in the limit switch wiring, then look for a failed limit switch.

If any limit switch fails to actuate within the specified time, it stops the tunnel, sounds the operator signal, and displays a “Drive System” error.

Either message is displayed with a four-digit code describing the tunnel status when the error occurred. The first character of the code represents the status of four tunnel conditions: temperature achieved, OK to transfer goods, level achieved, and load conveyor in motion. Use Table 58: Tunnel Status Codes, page 232 to interpret this code. The second character of the code (see Table 59: Limit Switch Codes, page 233) represents the status of the four limit switches, identified in Table 57: Limit Switch Identification, page 232 . The final two characters together represent the mechanical status of the machine, including motor direction and the most recent limit switch detected before the error, as described in Table 60: Machine Status Codes, page 234 .

Table 58. Tunnel Status Codes

Code	Temperature Satisfied	Transfer Allowed	Level Achieved	Load Conveyor Moving
0	No	No	No	No
1	No	Yes	No	No
2	No	No	Yes	No
3	No	Yes	Yes	No
4	Yes	No	No	No
5	Yes	Yes	No	No
6	Yes	No	Yes	No
7	Yes	Yes	Yes	No
8	No	No	No	Yes
9	No	Yes	No	Yes
A	No	No	Yes	Yes
B	Yes	No	No	Yes
C	No	Yes	Yes	Yes

Table 58 Tunnel Status Codes (cont'd.)

Code	Temperature Satisfied	Transfer Allowed	Level Achieved	Load Conveyor Moving
D	Yes	Yes	No	Yes
E	Yes	No	Yes	Yes
F	Yes	Yes	Yes	Yes

Table 59. Limit Switch Codes

Code	Valid Condition	Description
0	Yes	No proximity switches were energized or sensed a target.
1	Yes	Only the SAFETY switch was energized.
2	Yes	Only the top dead center (TDC) switch was energized.
3	No	The SAFETY and the TDC switches were energized simultaneously. No other switches were energized.
4	Yes	Only the clockwise (CWLS) switch was energized.
5	No	The CWLS and SAFETY switches were energized simultaneously. No other switches were energized.
6	No	The CWLS and SAFETY switches were energized simultaneously. No other switches were energized.
7	No	The CWLS, TDC, and SAFETY switches were energized simultaneously. The CCWLS switch was not energized.
8	Yes	Only the CCWLS switch was energized.
9	No	The CCWLS and SAFETY switches were energized simultaneously. No other switches were energized.
A	No	The CCWLS and TDC switches were energized simultaneously.
B	No	The CCWLS, TDC, and SAFETY switches were energized simultaneously.
C	No	The CCWLS and CWLS switches were energized simultaneously. No other switches were energized.
D	No	The CCWLS, CWLS, and SAFETY switches were energized simultaneously. The TDC switch was not energized.
E	No	The CCWLS, CWLS, and TDC switches were energized simultaneously. The SAFETY switch was not energized.
F	No	All four switches were energized simultaneously.
	A condition is not valid if two or more switches are energized at the same time.	

Use the information in Table 59 and Table 60 to determine which limit switch was seen last and which should have been seen next. With this information, you can determine which switch was seen out of sequence or was not seen within the specified time.

Table 60. Machine Status Codes

Code	Description
	Reversals Sequence
0 0	all motors driving baskets clockwise, having just passed switch CCWLS
0 1	all motors continuing to drive baskets clockwise, having just passed switch TDC
0 2	all motors continuing to drive baskets clockwise, having just passed SAFETY
	During 02, the controller decides whether to continue reversals, at which time it goes to code 03, or to commit to transfer, where it goes to code 0C.
0 3	all motors off, baskets coasting clockwise having just passed switch CWLS
0 4	all motors remain off for a period controlled by COAST timer; baskets coast clockwise
0 5	half of motors drive baskets counter-clockwise; other half on after delay in HALFM
0 6	all motors driving baskets counter-clockwise
0 7	all motors continue driving baskets counter-clockwise, having just passed SAFETY
0 8	all motors continue driving baskets counter-clockwise, having just passed TDC
0 9	all motors off, baskets coasting counter-clockwise having just passed switch CCWLS
0 A	all motors remain off for a period controlled by COAST timer; baskets coast counter-clockwise
0 B	half of motors drive baskets clockwise; other half on after delay in HALFM
	From state 0B, machine returns to state 00 as necessary to complete desired rotations.
	Transfer Sequence
0 C	tunnel is committed to transfer; all motors drive baskets clockwise, having just passed CWLS
0 D	all motors drive baskets clockwise, having just passed TDC
0 E	all motors off, baskets coasting clockwise, having just passed TDC
0 F	all motors remain off for a period controlled by machine timer COAST; baskets continue coasting clockwise
1 0	all motors on, driving baskets counter-clockwise for a period determined by BRAKE to stop cylinder coasting
1 1	all motors off for period controlled by PAUSE; baskets at rest
	From state 11, machine returns to state 08 to resume reversals. See explanation on resuming reversals, below.
	Start-up or Restart Sequence
1 2	all motors off; controller waiting for operator to correct error message
1 3	the start command is entered at this instant
1 4	all motors drive baskets counter-clockwise; controller looks for CCWLS and ignores all other switches
	From state 14, machine returns to state 09.

6.3.1.1 Resuming Reversals after Transferring

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After transferring goods from one module to the next, the machine resumes reversals from state 08. This is a valid action even though the motors start when the baskets are between the safety (SAFETY) and the top dead center (TDC) proximity switches. This action is valid because the TDC switch was the last switch seen by the controller, thus the TDC switch is ignored when the controller should detect it this time. Instead, the controller is looking for the counter-clockwise (CCWLS) proximity switch.

6.3.2 Testing Limit Switches

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Use the information below and the tables in this document to test the proximity switches.

1. Turn tunnel power OFF at the Mentor® controller, but leave console power ON.

   WARNING: **Entangle and Crush Hazards** — Guards, covers, and panels—Operating the machine with any guard, cover, or panel removed exposes moving components.

   ▶ Do not service the machine with power on except when explicitly called for in the service instructions. Use extreme care when working near moving components.

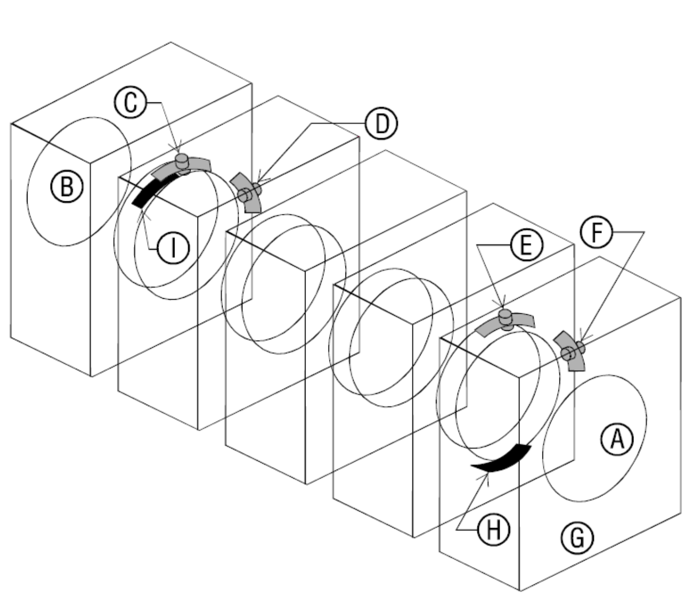
   ▶ Do not attempt unauthorized servicing, repairs, or modification.

   ▶ Know the location of the main machine disconnect and use it in an emergency to remove all electric power from the machine.

2. The LED light on a properly functioning limit switch will illuminate when a piece of steel is held near the end of the limit switch opposite the lead wire, and extinguish when the metal target is moved away. If the LED does not illuminate when the metal is near, the limit switch may be faulty, or faulty wiring is not allowing power to the switch.

Figure 119. Limit Switch and Target Locations

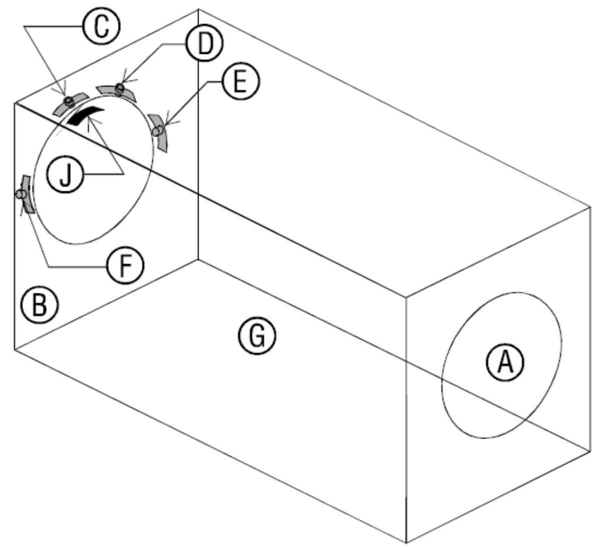
Tunnels with Individual Modules



Legend

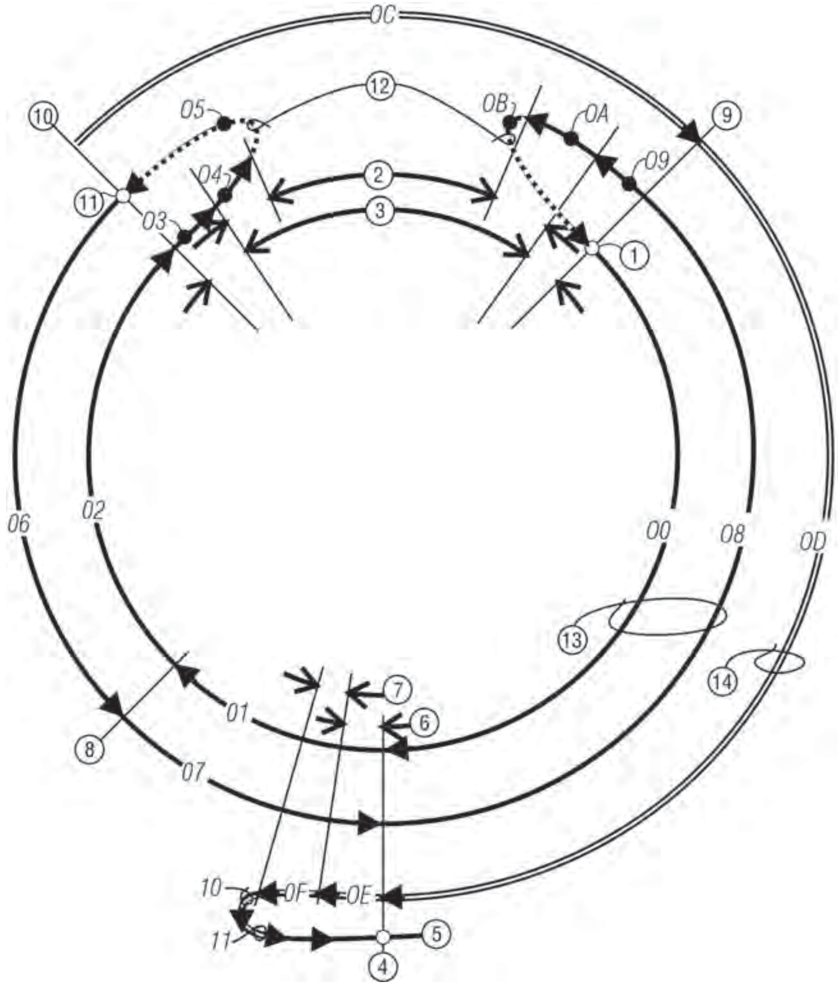
A. . . Load end of tunnel
B. . . Discharge end of tunnel
C. . . Top dead center (TDC) proximity switch
D. . . Safety (SAFETY) proximity switch
E. . . Clockwise (CWLS) proximity switch
F. . . Counter-clockwise (CCWLS) proximity switch
G. . . First module or section of tunnel
H. . . Reversals target (machines with individual modules only)
I. . . Transfer target (machines with individual modules only)
J. . . Target for all proximity switches (machines with multi-module sections only)

Limit Switch and Target Locations (cont'd.)

Tunnels with Multi-module Sections	
	

3. If the LED on the proximity switch goes off and on as the steel substitute target is removed and replaced near the end of the switch, suspect faulty wiring between the switch and the Mentor® console. Test for faulty wiring by opening the **Standard and Direct Inputs** page from the **Inputs and Outputs** menu on the Mentor® operational display. A green indicator light on the display next to the input name on the **Standard and Direct Inputs** page indicates that the input is present, while a red indicator light means that the input is not present. For the rotation proximity switches, the display should show a green light when the substitute target is held near the switch. If the light on the proximity switch operates as described in the previous step, but the display indicator does not change from red to green, suspect a loose or imperfect connection in the circuit between the proximity switch and the Mentor® console. Use the schematic wiring diagrams to trace and repair the wiring between tunnel modules, between the first tunnel module and the Mentor® console, within the console, and on the CPU board.
4. If the display indicator is red even when the light on the limit switch is illuminated, there is a short circuit between the limit switch and the Mentor® console. Refer to the schematics to trace and repair this circuit.
5. If the limit switch appears to function properly according to the **Standard and Direct Inputs** page, but the error message still appears when the machine is running, either the switches or targets are out of adjustment or the timers are incorrectly programmed.
   a. To check for proximity switches or targets out of adjustment, rotate the cylinders **clockwise as viewed from the load end** by manually turning the interconnecting drive shaft. This procedure may require two or more people. Stop at each point where a target is aligned with a switch.

Figure 120. Cylinder Rotation Diagram



Legend

1. Ignores proximity switch CCWLS
2. Coast timer
3. Internal switching
4. Top dead center proximity switch (TDC)
5. Ignores proximity switch TDC and returns to 08
6. Internal switching
7. Coast timer
8. Safety proximity switch (SAFETY)
9. Counter-clockwise proximity switch (CCWLS)
10. Clockwise proximity switch (CWLS)
11. Ignores proximity switch CWLS
12. Half-motor timer (HALFM); indicates that only one half of the motors are energized
13. Single line shows reversals sequence
14. Double line shows transfer sequence

b. If the LED on a switch does not illuminate, adjust the switch and the target so the switch properly senses the target. Ensure that the target will not strike **this or any other limit switch** during operation.

CAUTION: **Machine Damage Hazards** — Proximity switches will likely be destroyed if struck by the steel target.

▶ When adjusting either the target on any module, ensure that the target will not strike or touch any other proximity switch on that module.

c. Use the **Output Timers** page (Configuration/Operating Parameters/Output Timers) from the Mentor® operational display to check the programming of the timers. Compare the values of these timers with the sample values shown in Table 61 . The values in the table are not absolute, but will usually provide a good starting point for finer adjustments.

Table 61. Sample Values for Rotation Timers

Timer Name	Suggested Value or Range
Top dead center to SAFETY	1.5 seconds
Counter-clockwise to top dead center	6.0 seconds
Motor brake at top dead center	0.3 to 1.0 seconds
Half motor start time	0.5 seconds
Clockwise to counter-clockwise	4.5 to 6.5 seconds
Max time to start rotation	14.0 seconds
Pause at top dead center	4.0 to 5.0 seconds
Motor coast before reversal	1.5 seconds
Motor coast (anti-plug)	1.3 seconds

6. If the limit switch circuits were traced as explained in the earlier steps and no problems were found, suspect a faulty CPU processor board.

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6.4 Mentor® Hardware Replacement and Software Recovery

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This document describes the procedures for replacing inoperative computer hardware in the Mentor® control system and restoring the necessary software components to return the CBW® system to full operation. There are two solutions provided here. If the inoperative Mentor® computer is to be replaced by an existing Milnor® Mildata® computer, use Solution 1 as described in Section 6.4.2 : Solution 1: Replacing Mentor® Computer with Milnor® Mildata® Computer Hardware, page 239 . If a Milnor® Mildata® computer is not available and an off-the-shelf computer must be used as the replacement, use Solution 2 (Section 6.4.3 : Solution 2: Replacing Mentor® Computer with Off-the-Shelf Computer Hardware, page 242) to install the operating system and Mentor® software on an off-the-shelf computer.

6.4.1 Summary of Available Solutions

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6.4.1.1 Summary of Solution 1

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Perform the following steps to replace a malfunctioning Mentor® computer with a functional Mildata® computer. Each step is described in detail later in this document.

1. Install Mentor® software on the Mildata® computer.
2. Restore Mentor® programming data from the most recent accurate backup of Mentor® . This should be the last backup diskette created before the Mentor® computer failed.
3. Connect the Mildata® computer hardware in place of the Mentor® computer hardware.
4. Restart the computer. It will function as the Mentor® computer until a replacement can be commissioned.

5. Upon repair or receipt of a replacement Mentor® computer, reconfigure the Mildata® computer for Mildata® and configure the new replacement computer for Mentor®.

6.4.1.2 Summary of Solution 2

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Use this solution to replace the Mentor® computer with an off-the-shelf computer when a Mildata® computer is not available.

1. Connect the new computer hardware in place of the malfunctioning Mentor® computer hardware.
2. If the operating system is Windows® NT®(© 1981-1996 by Microsoft Corp.), configure the operating system.
3. Set up the external CD-ROM drive.
4. Install the Mentor® software on the new computer.
5. Restore Mentor® programming data from the most recent accurate backup of Mentor®. This should be the last backup diskette created before the Mentor® computer failed.
6. Restart the computer.

6.4.2 Solution 1: Replacing Mentor® Computer with Milnor® Mildata® Computer Hardware

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6.4.2.1 At the Mildata® Computer

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1. Turn on the Mildata® computer, and back up the Mentor® programmer to a blank diskette.
2. Close Mildata®, On-line Communicator, LapLink® (© 1986-1996 by Traveling Software, Inc.), and any other active applications.
3. Open Windows NT Explorer and navigate to **All Folders/Winnt/Profiles/All Users/Start Menu/Programs**.
4. In the menu bar at the top of the Explorer window, select **File/New/Folder**. Name the new folder “Copy” to create a new folder named “Copy” within the Programs folder.
5. Open the Startup folder, then click the right mouse button on the first icon (LapLink®, for example) in the right-hand window under “Contents of Startup.” When the menu drops down (also called a *flyout menu*), select **Cut**. The icon for the selected application will be ghosted (change appearance to have less visible contrast among icon colors), indicating that the application is ready to be moved to another location.
6. In the All Folders window, right-click once on the Copy folder created in step 4 above, then select **Paste** from the flyout menu.
7. Repeat steps 5 and 6 above for each file in the Startup folder (Mildata, etc.).
8. In the Windows tree view (the All Windows folder, at the left side of display), open C:, double-click the Program Files folder, then double-click the Milnor folder.
9. Select **File/New/Folder** from the menu bar, and name the new folder “Backup”.

10. Select and right-click the CBW folder, then select **Cut**.
11. Right-click the Backup folder created in step 9, and click **Paste**.
12. Click on **Start/Shut Down/Restart the Computer**, and answer **Yes** when prompted whether you want to restart the computer.

6.4.2.2 Mentor® Setup

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1. Install the Mentor® software from the Mentor® software CD. Do not confuse this CD with the Mildata® Mentor® Programmer CD.
2. Open the Windows Explorer software (Click **Start** on the bottom menu bar, then click on **Programs**, then click on **Windows Explorer**).
3. Using Windows Explorer, open the CD-ROM Drive (D:\) (on the left-hand side of the Explorer).
4. Using Windows Explorer, open the folder named “Mentor”.
5. Open the highest numbered subfolder.
6. Double click on the file named Setup.ex.
7. Click **Yes** on **Do You Want to Install?**.
8. Click **Yes** again to continue the install.
9. Click **NEXT** twice to start the install. Make sure that the software is being installed in the path **C:\Program Files\Milnor\CBW** under the name **CBW**.
10. In the Select Program Folder window, click on **Startup** under Existing Folders. Click **NEXT**.
11. Click **NEXT** again.
12. Click the **FINISH** button.
13. Shut down the computer in preparation for installing it in the Mentor® cabinet (Start/Shut Down…/Shut Down the Computer/Yes).

6.4.2.3 Hardware Connections

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1. Connect the monitor, keyboard, and mouse cables from the original computer to the replacement computer. The keyboard and mouse were originally connected together via a Y-connection to utilize only one port on the Mentor® computer. If necessary, use the Y-connection to connect the keyboard and mouse to the new computer.
2. Connect the RS232 to RS485 serial converter to the COM1 serial port of the new computer if the Mentor® software version is 97100 or later. For Mentor® versions 97000 through 97099, connect the serial converter to the COM2 serial port.

6.4.2.4 Starting Mentor® Software on the Replacement Computer

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Turn on the Mentor® computer power. The Mentor® software will start automatically.

6.4.2.5 Setting Up Users and Restoring Programmed Formulas

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1. Click on **Login**.
2. Enter “onetime” (without quotes) for the User Name, and enter “password” (without quotes) for the password. Click on **Enter**.
3. On the Mentor® operational display, select **Programming/New Users**.
4. Be sure the Programmer Rights box is checked.
5. Type a user name of your choice in the User Name box, then enter a password in the Password and Confirm Password boxes. Click on **Enter**.
6. Turn off power to the tunnel, but do not exit Mentor®.
7. On the Mentor® operational display, select **File/Restore Memory**, then click **Yes**.
8. Insert the most recent accurate Mentor® backup diskette in the floppy drive of the computer.
9. Click **OK**.
10. After the restore process is complete, remove the diskette from the floppy drive and store it in a safe place.
11. Turn on power to the tunnel and resume operation.

6.4.2.6 Restoring the Mildata® Computer to Mildata® Configuration

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1. Before disconnecting the Mildata® computer from the tunnel washer, select **File/Exit/No**. These actions will close the Mildata® program without turning off power to the computer.
2. Select **Start/Programs/Windows NT Explorer**.
3. In the left pane of the Explorer window, under All Folders, double-click **Program Files**.
4. Double-click Milnor, then double-click **CBW**.
5. Click the right mouse button (right click) on the CBW folder, then select D**elete**, and confirm the deletion.
6. Shut down the computer and make all connections to the Mildata® station.
7. Turn on the computer.
8. Double-click the Backup folder.
9. Right click on the CBW folder, then select **Cut**.
10. Double-click on the Milnor folder, right click on the Milnor folder, then click on “Paste”.
11. Right click on the Backup folder, click on **Delete**, then confirm the deletion.
12. Double-click on the Winnt folder, then double-click **Profiles/All Users/Start Menu/ Programs**.
13. Click once on the Copy folder.
14. Locate “Laplink” in the right pane of the Explorer window. Right click on “Laplink” and select **Cut**.
15. In the left pane of Explorer, right click the Startup folder, then click **Paste**.

16. Repeat steps 12 through 14 for all remaining files in the Copy folder.
17. Right click on the Copy folder, select **Delete**, then confirm the deletion.
18. Restart the computer and verify that all Mildata® programs run properly.

6.4.3 Solution 2: Replacing Mentor® Computer with Off-the-Shelf Computer Hardware

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6.4.3.1 Hardware Connections

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1. Remove the 6-inch square panel from the back of the Mentor® cabinet to access the cable connections on the rear of the Mentor® computer.
2. Disconnect the monitor, keyboard, and mouse cables from the original computer and connect them to the replacement computer. The keyboard and mouse were originally connected together via a Y-connection to utilize only one port on the Mentor® computer. If necessary, use the Y-connection to connect the keyboard and mouse to the new computer.
3. Disconnect the serial converter (RS232 to RS485 converter) from one of the serial ports (COM1 or COM2) of the original Mentor® computer. Connect the serial converter to the corresponding serial port on the new computer.
   a. For Mentor® software versions 97000 through 97007: If the Mentor® software CD includes only Mentor® versions between 97000 and 97007, the serial converter must be connected to serial port COM2. This requires that the new Mentor® computer be equipped with two serial ports.
   b. For Mentor® software versions 97100 and later: If the Mentor® software CD includes Mentor® versions 97100 or later, the serial converter must be connected to serial port COM1. This allows the new Mentor® computer to be equipped with only one serial port.

   NOTE: Milnor® has provided updated software (version 97101) to all owners of Mentor® versions 97000-97007. Please use this updated version of the Mentor® software when restoring your malfunctioning Mentor® computer (i.e., connect the serial converter to COM Port 1).

6.4.3.2 Configuration of Computer Operating System

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In rare cases of computer hardware failure within the Mentor® computer, it may be necessary to replace the hard drive and install the computer operating system on the drive. The following instructions describe in detail how to configure the Microsoft Windows 95/98 or Microsoft Windows NT operating systems for use with the Mentor® software. Complete instructions for installing the Windows software to a new hard drive are provided by the computer manufacturer or Microsoft.

6.4.3.2.1 Windows 95

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There is no special setup needed when using Windows 95 as an operating system.

6.4.3.2.2 Windows NT

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1. Upon turning on the Mentor® computer the first time, observe the lower left corner of the display. Enter the BIOS setup program when prompted. On computers supplied by Milnor®, this is accomplished by pressing Delete. Highlight the BIOS FEATURES SETUP selection and press Enter. Find ONBOARD SCSI CONTROLLER option and enable it by pressing the Page Up key until Enabled is displayed. Press the Escape key to exit this screen, then select **SAVE and EXIT Setup** and answer Yes to the question Save to CMOS & EXIT (Y/N)? The computer will re-start and load the Windows NT operating system.
2. After Windows NT starts, press Enter to log in as administrator (if displayed). Click **Start** on the bottom menu bar, then select **Programs/Administrative Tools/User Manager**. From the User Manger, select **New User**. Enter "Mentor" on the Username line, "abc" on the Password line, and "abc" on the Confirm Password line. Ensure that the Password Never Expires option is enabled (the box is checked). Click **OK** to save and exit. Close the User Manager window.
3. From the Start button, select **Settings/Control Panel**. From the Control Panel, double-click **Devices**. Find Serial Mouse Driver and click on the **Hardware Profiles** button. Disable the Serial Mouse Driver (highlight the device and click **Disable**), then click **OK** to exit this screen. Click **Close**.
4. Double-click the System icon and select **Startup/Shutdown**. Change the time to 2 seconds, then click **OK** to exit. Close the Control Panel.

6.4.3.3 External CD-ROM Setup

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NOTE: There is no need to perform the following steps to set up the external CD-ROM if using Windows 95 as an operating system. Windows 95 is a plug-and-play operating system which automatically recognizes a CD-ROM plugged into the (Centronics female) parallel port in the back of the computer at boot-up.

1. Click **Start** on the bottom menu bar, open the Settings menu, then start the Control Panel.
2. From the Control Panel, open the Devices folder.
3. Find and select the device named "Symc810."
4. Click **Startup**, set the Startup Type to **System**, and click **OK**.
5. Click **Start** and verify that the device starts.
6. Find and select the device named "CD-ROM."
7. Click **Startup**, set the Startup Type to "System" and click **OK**.
8. Click **Start** and verify that the device starts.
9. Find and select the device named "Cdfs."
10. Click **Startup**, set the Startup Type to "Disabled," and click **OK**.
11. Verify that the device starts.
12. Click the **Close** button in the Devices window.
13. Close the Control Panel.

14. Click **Start** on the bottom menu bar, then navigate to Programs/Administrative Tools/Disk Administrator.
15. Click on the CD-ROM.
16. Select **Tools/Assign Drive Letter**.
17. Assign drive letter D to the CD-ROM. Click **OK**.
18. Close the Disk Administrator.

6.4.3.4 Mentor® Setup

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1. Insert the Mentor® CD (which was sent with the Mentor® controller) into the CD-ROM drive of the new computer. If you are using a new computer that is running Windows NT and does not have a CD-ROM drive, set up the computer to acknowledge the external CD-ROM drive. The external CD-ROM drive was sent with the original Mentor® computer. The above instructions explain how to set up the external CD-ROM.
2. Open the Windows Explorer software (click the **Start** button on the bottom menu bar, then click on **Programs**, then click **Windows Explorer**).
3. Using Windows Explorer, open the CD-ROM drive (D:\) in the left pane of the Explorer window. To open a drive or folder from Windows Explorer, click once on the "+" beside the drive letter in the left pane of the Explorer window. Repeat the process to access the next level down.
4. Using Windows Explorer, open the folder named "Mentor."
5. Open the subfolder with the highest number. This insures that the current version of the software is installed later in the process.
6. Double click on the file named "Setup.ex."
7. Click **Yes** on "Do You Want to Install?"
8. Click **Yes** again to continue the installation process.
9. Click **Next** twice to start the install. Make sure that the software is being installed in the path C:\Program Files\Milnor\CBW\ under the name "CBW."
10. In the Select Program Folder window, click on **Startup** under Existing Folders. Click **Next**.
11. Click **Next** again.
12. Click the **Finish** button.
13. Restart the computer (click **Start/Shutdown** and select **Restart the Computer?**). This should restart the computer and automatically start the Mentor® software.

6.4.3.5 Restoring Backup Programming Data

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1. In Mentor®, log in as a programmer with the user name "onetime" (lowercase letters) and the password "password" (lowercase letters).
2. Insert the most recent backup diskette into the 3.5-inch floppy drive.
3. On the top Mentor® menu, click **File** and then **Restore**.

4. Click **Yes** to overwrite data. This will restore all of the data that was programmed into the Mentor® software (formula data, function data, compatibility data, user name/password data, etc.) prior to the last time a Mentor® backup was performed.

6.4.3.6 Checking Display Resolution

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If the entire Mentor® display is not visible on the screen, adjust the resolution of the display adapter. Using the bottom Windows menu bar, open Control Panel and change the Display resolution to 800X600 (Start/ Settings/ Control Panel/ Display/ Settings/ Desktop Area).

6.4.3.7 Help File Setup

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1. Log into the Mentor® as a User with programming rights, go to File and click on **Exit**.
2. When prompted, click **No** in the window stating: Shut Down the Computer.
3. Click the **Start** button on the bottom menu bar, open the Programs menu, and click on the Windows NT Explorer or Windows Explorer in Windows 95.
4. On the left-hand side of the Exploring window, click on the (D) drive. On the right-hand side of the Exploring window, click the left button of the mouse on the folder Techpub and hold the button. Drag the mouse to the left-hand side of the Exploring window to the (C) drive and release the left mouse button. This will copy all of the troubleshooting information for Mentor® to the new computer (it should take about 15 minutes).
5. After the help files have been copied to the new computer, double click on the (C) drive in the left-hand side of the Exploring window.
6. Double click on the subfolder named Techpub.
7. In the right-hand side of the Exploring window, double click on the file named Ar32e30. This will install Adobe Acrobat.
8. Click **Yes** to “Do you wish to continue?”.
9. Click **Next**.
10. Click **Yes**.
11. Under “Choose Destination Location” click the **Browse** button. Make sure that the path is C:\Acrobat3. If not, type C:\Acrobat3 in the line under Path.
12. Click **OK**, then **Next**, then **Finish**.
13. Close the Readme - Notepad window, then click **OK**.
14. Close the Exploring window.

6.4.3.8 Printer Setup

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1. Click on the **Start** button on the bottom menu bar, open the Settings menu, click on **Printers**.
2. Click the **Add Printer** icon in the Printers window.
3. Follow the steps to add a printer in the Add Printer Wizard, making sure that you select the printer to go on the available port (LPT1). When selecting the type of printer to add, insert the

printer installation disk which came with the printer, and click on the **Have Disk** button. Double-click on the folder corresponding to the operating system which you are running on the computer (i.e., NT40 for Windows NT 4.0). Select the printer file within, and click **OK**. Continue the Add Printer Wizard until finished.

4. Click on **Start** button on the bottom menu bar, click on **Shut Down**, and click on **Restart** the computer?
5. In order to use the Print Screen option, press the Print Screen key on the keyboard and answer **OK** to all the questions. This will print the current screen that you are viewing.

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6.5 How to Purge Float-tube Level Switches

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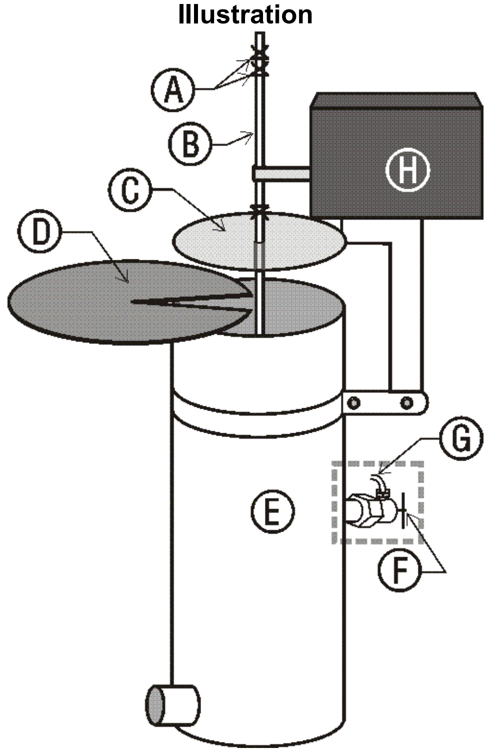
Float-tube level switches are used on Milnor® CBW® washers and washer-extractors. On some machines, these switches are fitted with a compressed air inlet and needle valve to use of air pressure to force lint from the tube into the module drain sump. A rubber purge cover is also provided. Periodically check all float tubes and purge them as explained below.

Figure 121. Float-tube Level Switch (Typical)

Illustration



Legend

A. . . Upper float switch adjusting clips (low level and safety)
B. . . Float rod
C. . . Debris shield
D. . . Rubber lint purge cover
E. . . Float tube
F. . . Air inlet needle valve (washer-extractors and G1 tunnel models only)
G. . . Compressed air line (washer-extractors and G1 tunnel models only)
H. . . Level switch assembly

1. If the float tube is fitted with a clear plastic debris shield, slide the shield up the float rod to the lower rod clip.
2. Position the rubber purge cover around the rod below the debris shield. Be careful not to damage the float rod or move the clips along the rod. If purge covers are not present, fabricate a suitable purge cover from rubber or leather.

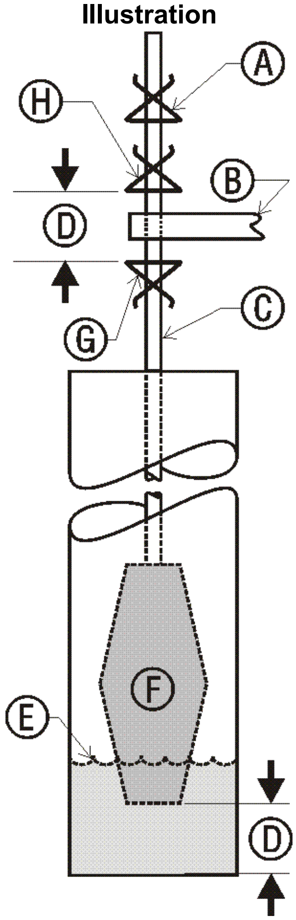
NOTE: If two rubber purge covers are provided, stack them on the float rod so the cutouts are offset by 180 degrees to reduce leaking.

3. Cover the entire opening of the float tube with the purge cover and hold it down firmly.
4. If the machine is equipped with an air inlet needle valve, turn this valve about five full turns and leave it open for about one minute to fully pressurize the level switch float tube. The pressure in the tube will force the lint out of the float tube and through the float tube piping back into a drain sump or holding tank, where it will eventually be purged.
5. Insert a water hose in the float tube if the machine is not equipped with a compressed air inlet and needle valve on the float tube. Use a shop rag or other suitable material to seal the top of the float tube around the hose. Turn the water on fully to flush the lint out of the float tube into the drain sump.
6. Return the rubber purge cover to its storage location, and slide the debris shield back into position on the float rod.

If the float must be removed to clear a large quantity of lint from the float tube, follow these guidelines in replacing the float. Refer to Figure 122 .

Figure 122. Minimum Setting Clearances

Illustration



Legend

- **A** . . . Safety clip
- **B** . . . Level switch arm
- **C** . . . Float rod
- **D** . . . Minimum 1 inch clearance (2.54cm) here
- **E** . . . Water level in float tube
- **F** . . . Level switch float
- **G** . . . High level switch clip
- **H** . . . Low level switch clip

- Use a permanent marker to mark the locations of the high level and low level clips immediately above and below the level switch arm, so the clips can be returned to their original positions.
- Maintain at least 1 inch (2.54cm) minimum clearance between the clips in the area of the float rod on which the level switch arm rides. Less clearance may result in jamming the level switch arm between the upper and lower clips.
- Never set a low level lower than 1 inch (2.54cm) above the bottom of the float tube. To be sure, drop the float all the way to the bottom of the tube, then lift it at least one inch before setting the clip **above** the level switch arm.

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6.6 How to Use the Mentor® Serial Port Test

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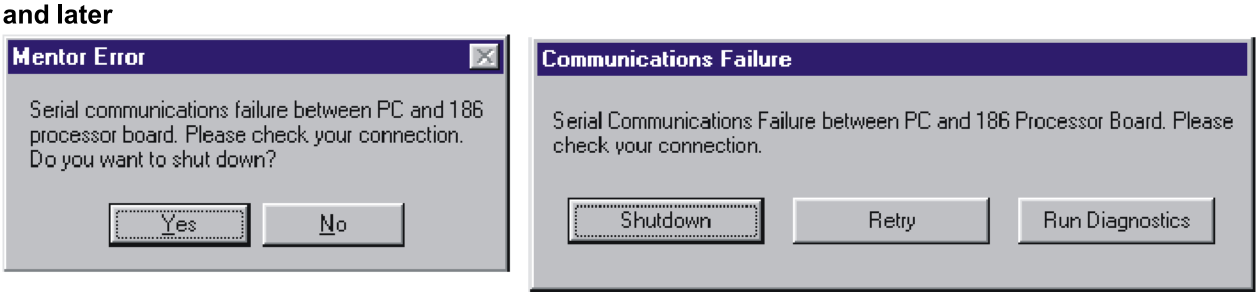
The *Serial Port Test* facility is provided standard with CBW® Mentor® controllers manufactured after July, 2001, containing Mentor® software version 20001 or later. (Display the version number of your Mentor® software by selecting **Help**, **About** on the Mentor® Operational display.) For Mentor® manufactured prior to this date and version, and not otherwise ineligible due to the restrictions explained in the below notice, it is available as Kit # KXMENTORTS.

NOTICE: Hardware Compatibility Limitation—As of this writing, this test can be performed only on machines that use the serial 186 processor board with the 16550 quad UART. This board is Milnor® part number 08BSPE1T and has been in production on Mentor® systems since September, 2000.

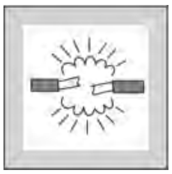
The serial port test facility consists of software that is permanently installed on the Mentor® PC, a permanently installed LED display, and both software and hardware that is temporarily installed on the processor board. The processor software and hardware are installed only for the test because this requires temporarily replacing the EPROM and serial port connections needed for normal operation.

The serial port test is a comprehensive test of all serial communication ports on the processor including communication ports for peripheral boards, Miltrac™, and the Mentor® PC. Information presented on the displays is designed to help you determine if a serial port is functioning properly. If you need to contact a Milnor® service technician for assistance, this information will help him to determine the problem.

Figure 123. Serial Communications Failure Error Message: Mentor Error message (left) used prior to Mentor software version 20001; Communications Failure message (right) used on version 20001 and later



The serial port test will typically be used in troubleshooting a serial communication failure between the Mentor® PC and the processor board located in the lower part of the Mentor® cabinet. One of the error messages (depending on software version) shown in Figure 123 appears on the Mentor® display when this failure occurs. As indicated by the error message, the error may simply be the result of a bad serial connection. First verify the integrity of the serial link from the COM 1 port on the Mentor® PC to connector MTA 29 on the processor board. If this resolves the problem, do not proceed with the *Serial Port Test*. If not, these instructions explain how to install the *Serial Port Test* software on the Mentor® PC, how to prepare the Mentor® PC and the processor board for testing, and how to perform the test.



CAUTION: **Risk of Component Damage** — Electronic components can be shorted out and destroyed if connectors are removed or installed improperly.

- Read and understand these instructions completely before performing the test.
- Disconnect electric power before removing or installing connectors.
- Do not perform this test unless qualified and authorized.

6.6.1 PC Software Installation (Mentor® versions prior to 20001)

BNTUUT04.T01 0000232305 A.2 A.7 A.5 1/2/20 2:11 PM Released

A CD ROM containing the *Serial Port Test* software and setup program is included with Kit # KXMENTORTS. A one-time installation is necessary to transfer the required files to the hard drive of the Mentor® PC. CBW® Mentor® controllers produced after July, 2001 and running Mentor® software version 20001 or later will have the *Serial Port Test* software pre-installed at the factory. If your C drive contains the file `Serial Port Test.exe`, the software has been previously installed and you may skip to Section 6.6.3 : Preparing the Mentor® PC and Processor Board for Testing, page 251 . If not, install the software as follows:

1. If Mentor® console power is not already on, apply console power (Mentor ①). The CBW® Mentor® application launches automatically on power-up.
2. With the CBW® Mentor® application running, first verify that tunnel power is off, then close the application as follows:
   a. Simultaneously press **Ctrl** + **Alt** + **Del** to access the **Task Manager**, then highlight the CBW® application and select **End Task** to close the application.
   b. Close the **Task Manager** dialog box to reveal the Windows® desktop.
3. Insert the CD labeled “Mentor® Diagnostics” into the CD drive (normally Drive D) on the Mentor® PC.
4. Select **Start**, **Run**, then on the **Run** dialog box, click **Browse** and locate the setup program at `d:\Mentor Diagnostics\20xxx\setup.exe`, where “d” represents the drive letter of your CD drive (e.g., drive D) and “20xxx” is the version number of the diagnostics software provided on the CD (e.g., 20403).
5. Click **OK** to run the setup program.
6. Once setup is complete, place a shortcut on your desktop to run the diagnostics software, as follows:

a. Minimize any running applications to reveal the Windows® desktop.

b. Right click on the desktop and select **New**, **Shortcut**.

c. On the **Create Shortcut** dialog box, click **Browse** and locate: `c:\Program Files \Milnor\Mentor Diagnostics\Serial Port Test.exe`

d. Click **Next** and in the **Select a Title for the Program** dialog box, enter “Serial Port Test”.

e. Click **Finish**.

When you are ready to run the test (after you have installed the processor software and hardware as explained in Section 6.6.3 : Preparing the Mentor® PC and Processor Board for Testing, page 251), double-click this shortcut to start the program.

NOTE: The *Mentor Diagnostics* software should remain installed on the Mentor® PC. However, should it become necessary, use the **Control Panel**, **Add/Remove Programs** utility to remove the diagnostics software.

6.6.2 Mounting the LCD Display and Reset Button (Mentor® controllers manufactured prior to August 2001)

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Mentor® controllers produced beginning in August 2001 will have the display and reset button pre-installed at the factory. For older machines, install the display and button as follows. **The following procedures must be done with the power off:**

1. Using the hardware provided, mount the bracket containing the LCD display and reset button in the Mentor® cabinet as shown on Milnor® parts drawing BMP000067, included in the kit. Schematic drawing W9CBW3ND, “Mentor® Diagnostics LCD Display”, also included in the kit, provides the wiring diagram for this installation.
2. Use the LCD display harness (p/n 10Y485LCD) to connect MTA 1 and MTA 2 to the LCD display.
3. Using the two remaining wires in the harness, connect the blue/white wire labeled “2G” to one terminal of the reset button and connect the blue/black wire labeled “1NO” to the other terminal.
4. Connect the free end of wire 2G to terminal block 2G. Install the free end of 1NO into the vacant position for pin 6 of the existing connector MTA 39 on the processor board.
5. Remove the existing connector at MTA 36 from the processor board. Remove the solitary wire LNK from pin 6 of this connector, and reconnect wire LNK to pin 6 of connector MTA 36 from the display harness, using the butt splice connection provided.
6. Install the LCD display harness to the processor board at MTA 36 and MTA 37.

6.6.3 Preparing the Mentor® PC and Processor Board for Testing

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6.6.3.1 What You Will Need

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The following components are now provided with all Mentor® systems. They are also included in Kit # KXMENTORTS:

Software EPROM (P/N WUMENDIAG) This EPROM contains the processor diagnostics software.

LCD display (P/N 08B1ELC3T) This 2-line by 20 character display permits viewing diagnostics information from the processor.

LCD display reset button (P/N 09N405PB10) This button provides an input signal to the processor to reset the error counter display to zero.

LCD display harness (P/N 10Y485LCD) These wires connect the LCD display and reset button to the processor board.

RS485 serial port harness (P/N 10Y485SPHT) These wires provide the communication link for the five RS485 serial ports on the processor board. The port at MTA 30 is designated as the *Master* port and those at MTA 32, MTA 33, MTA 34, and MTA 29 serve as *Slave 1* through *Slave 4*, respectively.

RS232 serial port cable (P/N 10C485SPT) This cable provides a direct communication link between the Mentor® PC and the processor board.

6.6.3.2 Installation

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The serial port test requires the temporary replacement of the EPROM and serial port connections used for normal operation with the test components listed in Section 6.6.3.1 : What You Will Need, page 251 . **All of the following procedures must be done with the power off**. Refer to B2TAG99014, "CBW Systems Mentor Control Panel" affixed to the inside of the Mentor® cabinet door for help in locating the EPROM and connectors referenced below. Before removing any component, be sure that it is properly labeled for reconnection and that you can recognize and replace each component when the test is concluded.

6.6.3.2.1 Turn Off Tunnel and Console Power

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Turn off tunnel power (CBW 0). Close the Mentor® program by selecting **File**, **Exit** from the Mentor® menu, or if the serial communication failure error shown in Figure 123: Serial Communications Failure Error Message: **Mentor Error** message (left) used prior to Mentor software version 20001; **Communications Failure** message (right) used on version 20001 and later, page 248 appears on the Mentor® display, select **Yes** to shut down. When the message "It is now safe to turn off your computer." appears on the Mentor® display, turn off console power (Mentor 0).

6.6.3.2.2 Install the software EPROM

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Locate and remove the Mentor® software EPROM and replace it with the *Serial Port Test* software EPROM. See Milnor® publication Section 8.12 : How to Upgrade Microprocessor EPROM

Chips, page 314 , found in the “Supplemental Information” section of your Mentor® technical reference manual, for proper procedures.

6.6.3.2.3 Install the LCD Display

BNTUUT04.C07 0000232347 A.2 A.7 A.3 1/2/20 2:11 PM Released

If the display is not yet permanently installed, see Section 6.6.2 : Mounting the LCD Display and Reset Button (Mentor® controllers manufactured prior to August 2001), page 250 .

6.6.3.2.4 Install the RS485 Serial Port Harness

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The RS485 serial port harness supplied with the kit has connectors labeled MTA 32, MTA 33, MTA 34, MTA 29, and MTA 30. Connect these to the corresponding terminals on the processor board, removing any existing connectors. The RS485 serial port harness connects all RS485 ports together using jumper wires to provide a communication link.

6.6.3.2.5 Install the RS232 Serial Port Cable

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Replace the connector at COM1 on the PC with the connector labeled COM1 from the PC-to-processor RS232 serial port cable. Connect the opposite end of the cable to the processor board at MTA 30, using connector WCY.

6.6.4 Performing the Mentor® Serial Port Test

BNTUUT04.C11 0000232376 A.2 A.7 A.4 1/2/20 2:11 PM Released

The Mentor® Serial Port Test is divided into two parts. Section 6.6.4.1 : Testing the RS485 Serial Communication Ports, page 252 describes how to test the RS485 serial communication ports on the processor board. Section 6.6.4.2 : Testing PC-to-Processor RS232 Serial Communication, page 254 describes the PC-to-Processor RS232 serial communication test. These tests can be performed separately or simultaneously, as preferred.

6.6.4.1 Testing the RS485 Serial Communication Ports

BNTUUT04.C10 0000232344 A.2 A.7 A.3 1/2/20 2:11 PM Released

6.6.4.1.1 Start the Test

BNTUUT04.C12 0000232375 A.2 A.7 A.3 1/2/20 2:11 PM Released

With the test EPROM, LCD display, and RS485 serial port harness installed, turn on console power (Mentor ①). Following the copyright and software version displays, the diagnostic display will appear on the LCD, with the test running.

The RS485 Serial Port harness establishes a direct connection with the *master* port and each of the four *slave* ports on the processor board. While the test is in progress, the master port individually polls each of the slave ports. If a slave port fails to receive data, a **receive** error occurs. If a slave port fails to transmit data, a **transmit** error occurs.

6.6.4.1.2 Observe the Display

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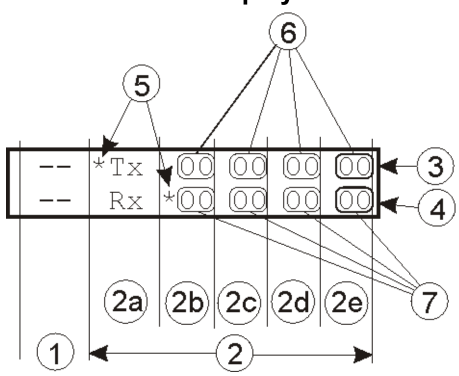
The diagnostic data shown on the LCD display during the RS485 Serial Communication Ports test is identified in Figure 124 . The area of the display pertaining to this test is partitioned into five sections: one section corresponding to the master port, and one section for each of the four slave ports. The top line of the display shows the transmit status of each port, designated by the letters “Tx”, and the bottom line of the display shows the receive status of each port, designated by the letters “Rx”.

Figure 124. The LCD Diagnostics Display

Data Displayed



Legend

1 . . . Area for displaying RS232 data (not used for this portion of test).
2 . . . RS485 data
2a . . RS485 Port 1—Master (MTA 30)
2b . . RS485 Port 2—Slave 1 (MTA 32)
2c . . RS485 Port 3—Slave 2 (MTA 33)
2d . . RS485 Port 4—Slave 3 (MTA 34)
2e . . RS485 Port 5—Slave 4 (MTA 29)
3 . . . Top line shows transmit (“Tx”) status.
4 . . . Bottom line shows receive (“Rx”) status.
5 . . . Asterisk (*) indicates data currently being passed.
6 . . . Transmit error counters.
7 . . . Receive error counters.

The asterisk (*) indicates activity for each of the ports. An asterisk that appears on the top line denotes a transmit event for the corresponding port, whereas an asterisk that appears on the bottom line denotes a receive event. A port that is functioning properly would be observed with its asterisks flashing on and off as data is being transmitted and received.

Transmit and receive error counters are provided for each of the four slave ports. The respective error counter is incremented each time an error is detected. This is particularly useful when attempting to record intermittent communication errors over a period of time. A reset button is provided which will reset the counters to zero.

NOTE: Although this test facility was designed for Mentor® systems, the RS485 test is a “stand-alone” test which can be applied to any Milnor® part number 08BSPEIT processor board regardless of the machine it is used on.

6.6.4.1.3 Interpreting the Test

BNTUUT04.C14 0000232372 A.2 A.7 B.2 5/19/20 11:52 AM Released

An RS485 port is operating properly if it displays both *transmit* and *receive* port activity (both asterisks flashing on and off), and no communication errors are detected (neither the transmit nor the receive error counters increment). If at least one slave port is operating properly, then the master port must also be operating properly. If none of the slave ports are operating properly, then the master port is likely at fault. An intermittent fault is indicated when communication errors are detected even though port activity is observed. A receive error counter increments when a slave port is not receiving data from the master port. A transmit error counter increments when the master port is not receiving data from the slave port. Table 62 lists the typical Mentor® serial port activities that would be affected by a malfunctioning RS485 port.

Table 62. Mentor® RS485 Serial Port Activities

Connector	RS485 Port #	Typical Activity
MTA30	1	none (not used in this control)
MTA32	2	Miltrac™ communication

Table 62 Mentor® RS485 Serial Port Activities (cont'd.)

Connector	RS485 Port #	Typical Activity
MTA33	3	Peripheral board communication
MTA34	4	Mildata® communication
MTA29	5	PC communication

The RS485 serial port harness connects the master port and the four slave ports in series. An examination of the wires shows that MTA 30 connects to MTA 29, MTA 29 to MTA 34, MTA 34 to MTA 33, and, finally, MTA 33 to MTA 32. Additionally, pin 1 is connected to pin 2, and pin 3 is connected to pin 4 internally on the processor board for each port. Any break in the series also breaks the connection to all ports following the break. This could result in a false indication of a port failure when all ports are tested simultaneously. If a port failure is indicated, disconnect all slave ports except MTA 29, then move the MTA 29 connector to each port one at a time. Press and release the reset button after each move to reset the error counters to zero. The error counters for the connected port should remain at zero. If the counters increment, this port is suspect. Ignore the receive error counters for the three remaining disconnected ports. These will increment merely because the ports are disconnected and, therefore, cannot receive.

When diagnosing a serial communication failure between the PC and the 186 processor board, if port 5 is not operating properly, then the processor board is likely the problem. If port 5 is operating properly then the problem must be with the PC, or the RS485-to-RS232 converter, or the serial connection. The RS232 serial port test, which follows, is used to determine if the PC is communicating properly via the RS232 serial port.

6.6.4.2 Testing PC-to-Processor RS232 Serial Communication

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6.6.4.2.1 Turn on Mentor® Console Power

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Verify that the test EPROM, LCD display, and the PC-to-processor RS232 serial port cable are properly installed. If console power is not already on, apply console power (Mentor ①). Following the copyright and software version displays, the diagnostic display will appear on the LCD.

The RS232 Serial Port cable provides a direct communication link between COM1 of the Mentor® PC and the processor board, bypassing the RS232-to-RS485 converter normally used by Mentor®.

6.6.4.2.2 Invoke the PC Diagnostics Software

BNTUUT04.C17 0000232369 A.2 A.7 A.3 1/2/20 2:11 PM Released

The procedure depends on whether your diagnostics software is integral with the Mentor® software (later Mentor® versions) or a separate program (earlier Mentor® versions).

6.6.4.2.2.1 Part of Mentor® Software (Mentor® version 20001 or later)

BNTUUT04.C18 0000232397 A.2 A.7 A.3 1/2/20 2:11 PM Released

The CBW® Mentor® application launches automatically on power up. If the CBW® Mentor® program is not already running, select **Start**, **Programs**, then select **CBW**. When the error message shown at the right of Figure 123: Serial Communications Failure Error Message: **Mentor Error** message (left) used prior to Mentor software version 20001; **Communications Failure** message (right) used on version 20001 and later, page 248 appears on the Mentor® display, select **Run**

Diagnostics. The **Mentor Diagnostics**, **Serial Port Test** window is displayed on the Mentor® screen.

6.6.4.2.2.2 Separate Program (Mentor® versions prior to 20001)

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1. If the CBW® Mentor® application is running, it must be shut down. To do so, simultaneously press **Ctrl** + **Alt** + **Del** to invoke the **Task Manager**, then highlight the CBW® application and select **End Task** to close the program.
2. Close the **Task Manager** dialog box to reveal the Windows desktop.
3. Double-click the **Serial Port Test** icon on the Windows desktop or go to the `c:\Program Files\Milnor\Mentor Diagnostics` directory and double-click on `Serial Port Test.exe` to start the program. The **Mentor Diagnostics**, **Serial Port Test** window is displayed on the desktop.

6.6.4.2.3 Start the Test

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Click the **Start** button on the **Serial Port Test** window to start the test. The caption on the button changes from **Start** to **Stop**.

While the test is in progress, random data is continuously sent, one byte at a time, from the Mentor® PC to the processor board. The processor board receives each data byte and transmits it back to the PC.

6.6.4.2.4 Observe the Serial Port Test window and the LCD display

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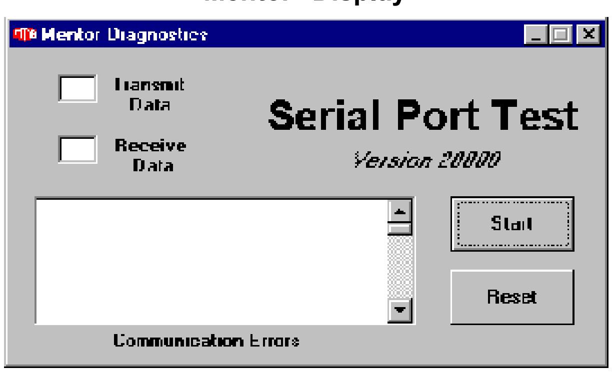
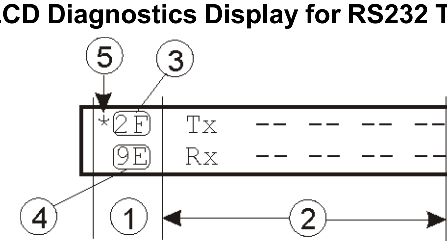
The Serial Port Test window and the LCD diagnostics display are shown in Figure 125 .

Figure 125. Displays Used in RS232 Test

Mentor Diagnostics, Serial Port Test Window on Mentor® Display



LCD Diagnostics Display for RS232 Test



Legend

1. RS232 data
2. Area for displaying RS485 data (not used for this portion of test)
3. Transmit data
4. Receive data
5. Asterisk (*) indicates data currently being passed

The value of each byte of data transmitted from and returned to the PC is displayed in the **Transmit Data** and **Receive Data** boxes, both on the **Serial Port Test** window and on the LCD display, in two-digit hexadecimal form.

On the LCD display, transmitted data is shown on the top line and received data is shown on the bottom line. Dashes appear when no data is being transmitted or received. An asterisk (*) is used to indicate port activity. A port that is functioning properly would be observed with its asterisks flashing on and off as data is being transmitted and received.

In the **Serial Port Test** window, the last 255 communication errors detected by the PC are recorded in a scrollable text box labeled **Communication Errors**. Table 63 provides a list and description of the possible error messages. To clear the **Communication Errors** text box, click the **Reset** button.

Click **Stop** on the **Serial Port Test** window to end the test.

Table 63. RS232 Error Types

Error Message Text	Description
No response on byte xx	The PC is not receiving data on the RS232 serial port, COM 1.
A break was received on byte xx	A break signal was received.
CD (RLSD) Timeout on byte xx	Change in Carrier Detect line.
CTS Timeout on byte xx	Change in Clear to Send line
DSR Timeout on byte xx	Change in Data Set Ready line. This only occurs when DSR changes from 1 to 0.
Framing Error on byte xx	The hardware detected a framing error.
Data Lost on byte xx	Port overrun. A character was not read from the hardware before the next character arrived and was lost.
Receive buffer overflow on byte xx	There is no room in the receive buffer.
Parity Error on byte xx	The hardware detected a parity error.
Transmit buffer full on byte xx	The transmit buffer was full while trying to queue a character.
Unexpected error retrieving DCB on byte xx	Unexpected error retrieving Device Control Block for the port.
Received data – yy on byte xx	The data value received did not match the value transmitted.

NOTE: In Table 63 , “xx” represents the data byte (2-digit, hexadecimal value) transmitted from the PC and which is displayed in the **Transmit Data** text box. “yy” represents the data byte received by the PC (when different from “xx”) which is displayed in the **Receive Data** text box.

6.6.4.2.5 Interpreting the Test

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The RS232 serial communication is operating properly if the **Serial Port Test** window on the Mentor® display shows data being transmitted and received, and no communication errors are displayed. **Transmit Data** and **Receive Data** values change rapidly as the PC sends and receives random data. Likewise, the LCD diagnostics display would also show rapidly changing data as the 186 processor receives data from and transmits data back to the PC.

A communications failure is indicated when an error message is displayed in the **Communication Errors** text box on the **Serial Port Test** window. The **Transmit Data** value remains fixed because the PC will re-transmit the same data value until it receives a valid response. For example, the message “No response on byte xx” indicates that the PC is not receiving data. This message would be displayed if the RS232 serial port cable was disconnected. The characters “xx” represent the data value (in hexadecimal form) transmitted from the PC. The PC expects to receive the same data value back in response. If the PC receives a different value, the error message “Received data - yy on byte xx” is displayed, where “xx” represents the expected data value and “yy” represents the actual received data value.

If a communication failure is indicated, determine if the problem is within the PC. To do so, locate the six-pin connector consisting of a jumper wire from pin 1 to pin 2. Disconnect the RS232 serial port cable from connector WCY at the processor board and connect the jumper to the cable in its place. The DB9 connector at the opposite end of the cable remains connected to COM1 on the PC. Start the serial port test. In this case, a communication failure indicates a problem with the RS232 serial port on the PC. A successful test indicates the PC is operating properly.

Normally, COM1 (RS232 serial port) on the Mentor® PC is connected to MTA 29 (RS485 serial port) on the processor through an RS232-to-RS485 converter. If the error message shown in Figure 123: Serial Communications Failure Error Message: **Mentor Error** message (left) used prior to Mentor software version 20001; **Communications Failure** message (right) used on version 20001 and later, page 248 appears and both the PC and the processor are determined to be operating properly, then the problem must be with the RS232-to-RS485 converter or the serial connection.

7 Important Safety Considerations

7.1 Minimizing Risks in Entering the Tunnel

7.1.1 About Tunnel Jams and How to Prevent Them

The Milnor® CBW® tunnel washer will not jam if the following conditions exist:

1. **Correct water levels are maintained.**
2. **All loads are sized correctly.**
3. **Correct cylinder rotation is maintained.**

7.1.1.1 Correct Water Levels

Immediately after each transfer, the Mentor® controller verifies that the water levels are correct in each module that monitors water levels. Countdown does not start unless all the monitored levels are correct. Also, immediately before each transfer, the Mentor® controller again reads all the monitored levels and prevents transfer if any level is not correct. Water levels are always monitored in the first module, in each module with a drain valve, and in each module that does not (or may not) receive its water from, or send its water to, its adjacent module. Depending on the specific water flow and the number of modules, additional water level monitors may be installed at the factory.

The tunnel will jam if it transfers without enough water in each module.

Do not attempt to “fix” a low water level condition by holding the float lever up mechanically or by merely readjusting the level switch. (With float-type level switches, cutting off the float rod above the two top clips will discourage readjusting.) Instead, check for logical reasons for loss of water flow (shut off water valves or pumps, lint-blocked pumps or strainers, etc.).

Make sure the float tube connection is not blocked with lint, as this can cause the Mentor® controller to think the water level is correct when it is not. Periodically purge each float tube connection with air as explained in *How to Purge Float-tube Type Level Switches* in the service manual.

Weir boxes must be checked periodically for lint build-up. If the water flow through the weir box is reduced, wash quality will diminish, the blocked module may overflow opposite the flow of incoming water, and the water level may become too low for a safe transfer in any modules that depend upon water from the blocked module.

Water levels are controlled by weirs as explained in Using the Water Flow Features of the Milnor Continuous Batch Washer in manual MATCBWTRAE. This section also explains how to set the level switches.

7.1.1.2 Correct Load Sizes

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Because the Milnor® CBW® tunnel washer is usually able to transfer occasional loads much larger than its rated capacity, the load sizes actually employed are generally dictated by the capability of the extracting equipment (press or centrifugal) and the material-handling equipment after the tunnel.

However, exceptions to this rule include—but are not necessarily limited to—"stiff jeans" or similar products that do not readily absorb water, certain new goods, and goods that are lightweight yet bulky (e.g., micro-filament 100% polyester barrier goods), etc. The load sizes for such goods must be reduced proportionately, similar to the proportional reduction that must be observed in washers and washer-extractors.

Multiple or repeated over-size loads can cause jams. Monitor and frequently recalibrate the load-sizing method in your plant. The tunnel can often handle a **single** "double-size" load (usually caused by a rail or loading conveyor malfunction) without incident—although a fault will likely occur in the press or centrifugal extractor. However, repeated multiple loads will cause a jam, especially in tunnels with date codes prior to Mildate 88297 (December 15, 1988). This is less likely (but not impossible) with tunnels manufactured on or after this date because newer machines have a photo-eye in the load scoop to prevent transfer when the entire load has not flushed into the first module.

Jams can also be caused by insufficient wet-down or flushing water in the first module. Check the reuse water flush pump, the level switch setting in the first module, and the minimum commanded time for the flush valve to remain open. This minimum time is controlled by output timer CRST2.

7.1.1.3 Correct Cylinder Rotation

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Although unlikely, it is conceivable that one or more of the four rotation-control proximity switches might malfunction, or the proximity switch or its target might become maladjusted causing a jam. However, the Mentor® controller is programmed to recognize an error if any of the four proximity switches is not seen, or seen in an incorrect order, or if the time to transit from each switch to the next varies from the standards commanded in output timers Top Dead Center to Safety, Counter-clockwise to Top Dead Center, and Clockwise to Counter-clockwise in the Mentor® software. Moreover, a separate, non-computer, electromagnetic "watch dog timer" in the controller will stop the tunnel if the machine rotates too long in the transfer direction. (Jams usually do not occur if the tunnel rotates continuously in the non-transfer direction.)

7.1.2 Clearing Tunnel Jams Safely and Efficiently

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7.1.2.1 Guidelines for Management

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1. A tunnel jam, no matter how minor, incapacitates the tunnel and requires entering the machine to service it.
2. **A competent supervisor must be present outside of the tunnel at all times.** The supervisor must use these methods to track the status and location of each worker and the progress of the jam-clearing operation:

a. Establish a distress signal, such as banging five times (international danger signal) on the cylinder wall, to be used by any worker who runs into trouble.

b. Frequently talk through the module vent on top of each module to each worker inside the tunnel.

DANGER: **Prepare thoroughly** — Do not enter the tunnel until all safety hazards are eliminated. Supervisor must be present outside the tunnel at all times. Potential safety hazards include, but are not necessarily limited to the conditions stated in the following safety statements.

DANGER: **Panic and Isolation Hazards** — Confined space, dampness, heat, odor, darkness, etc. can induce panic. **Workers cannot be readily evacuated.**

- Take measures to minimize adverse working conditions.
- Permit only smaller, agile, completely healthy, non-claustrophobic workers to enter the tunnel.

DANGER: **Chemical Burn Hazards** — If not thoroughly purged, flushed, cooled, and drained, modules may contain toxic substances that can burn your skin or eyes.

- Before permitting anyone to enter, thoroughly purge, flush, cool, and drain the tunnel as explained in this document.

DANGER: **Poison and Suffocation Hazards** — If not thoroughly purged, flushed, cooled, and drained, modules may contain toxic gases that can kill or injure you if inhaled.

- Test for and purge gases.
- Ventilate tunnel continuously.

DANGER: **Burn and Heat Prostration Hazards** — If modules are not thoroughly purged, flushed, cooled, and drained, cylinder surfaces, goods, and bath may be hot enough to burn you on contact. You can become ill while working in a hot tunnel.

- Do not enter the tunnel unless all goods and surfaces are cool.

DANGER: **Biological Hazards** — Even if thoroughly purged, flushed, cooled, and drained, modules may contain disease organisms carried in with the goods.

- Never enter the tunnel with open wounds.
- Beware of sharp objects carried in with the goods.

DANGER: **Electrocution Hazard** — Use only air or battery powered tools and lights.

- Never attempt to illuminate the tunnel by carrying in any non-battery powered electrical devices.
- Never carry in plug-in tools.

DANGER: **Crush Hazard** — Unless electrically disabled and mechanically restrained, tunnel cylinder can rotate without warning, entrapping and even crushing you.

- Lock main fusible disconnect and Mentor® fusible disconnect in OFF position.
- Use wood or metal restraints held by C-clamps to block chain drives on both sides of the small sprocket, so an off-center weight distribution in the cylinder will not cause it to drift or turn by itself in either direction. See Figure 127: Blocking the Cylinders, page 262 .

DANGER: **Other Unknown Hazards** — There may be additional hazards, perhaps (but not necessarily) peculiar to a particular installation, that are unknown as of this writing. It is solely the responsibility of the owner/user to recognize and cope with any such hazards.

7.1.2.2 What to Do Before Entering the Tunnel

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1. **Disable all hot water and chemical feeds to the tunnel.**
2. **Provide natural light and ventilation to each module.** Remove any vent covers or vent piping, etc. on the top of each module to provide natural light and ventilation inside each module. Open all weir box covers. These measures will provide ventilation and communication benefits and a means to monitor any odors in each module. See Item 7 below.
3. **Drain, purge, flush, and cool the tunnel.**
   a. First drain each module completely, including **both** sides of **each** drain trough in **each** module. A pipe plug in the bottom of each drain trough is provided for this purpose when the module has no drain valves (or only one drain valve). If the tunnel has been in service a long time, the pipe plug drains may be blocked with sediment. If water does not come out, use a screwdriver or small rod to penetrate the blockage.

      Drain any overhead tanks that can feed the tunnel.
   b. Reinstall the pipe plugs (hand tight), and close the module drain valves.
   c. Flush the tunnel with **cold** water, ensuring **every** module is sufficiently flushed. (If necessary, use water hoses directed into each weir box to accomplish this.) The tunnel and its contents must be totally flushed and cooled. All chemicals in the water and goods must be completely removed before anyone can be allowed to enter the tunnel. (Permitting the tunnel to turn normally—**without transferring**—should expedite this process without worsening the jam; but **the tunnel must not transfer**.) Place the TUNNEL RUN-HOLD switch on the controller at HOLD to command the tunnel not to transfer. Now start the

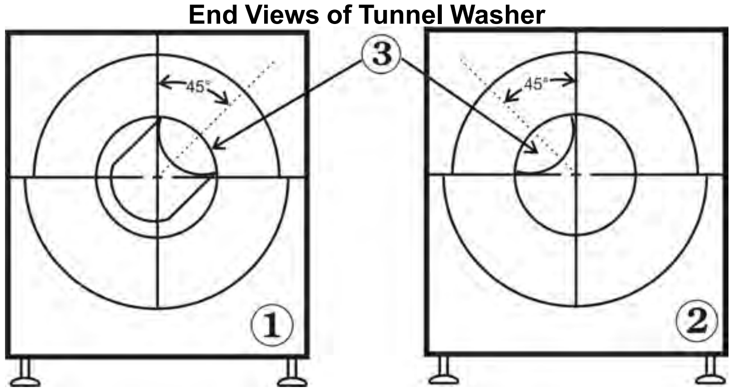
tunnel in the normal way and observe that it reverses normally. **Stop the tunnel at once if it turns only in one direction!**

d. Once the goods are cold and all chemicals have been purged from every module, again drain **both** sides of **each** drain trough in **each** module per Item 3.a above. Ensure each module is **fully** drained and totally empty of all water before entering the tunnel. No water must remain standing in any module. If any drain valve or module overflow is connected directly to a sewer without a “P-trap,” special ventilation measures must be employed so that sewer gases cannot enter the tunnel. These ventilation measures can vary depending upon local conditions and are solely the responsibility of the owner/user.

4. **Position the cylinder for easiest transit**, as shown in Figure 126 .

Figure 126. Positioning the Cylinders

End Views of Tunnel Washer

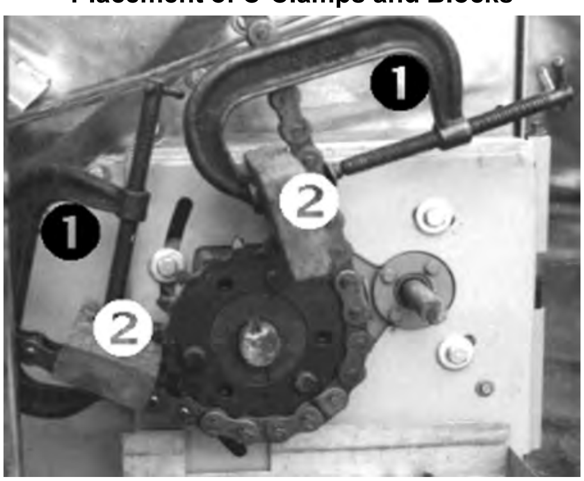


Legend
1. View from loading end
2. View from discharge end
3. Closed end of transfer scoop

5. **Restrain the tunnel chain drives so the tunnel cannot drift or turn by itself in either direction.** See Figure 127 .

Figure 127. Blocking the Cylinders

Placement of C-Clamps and Blocks



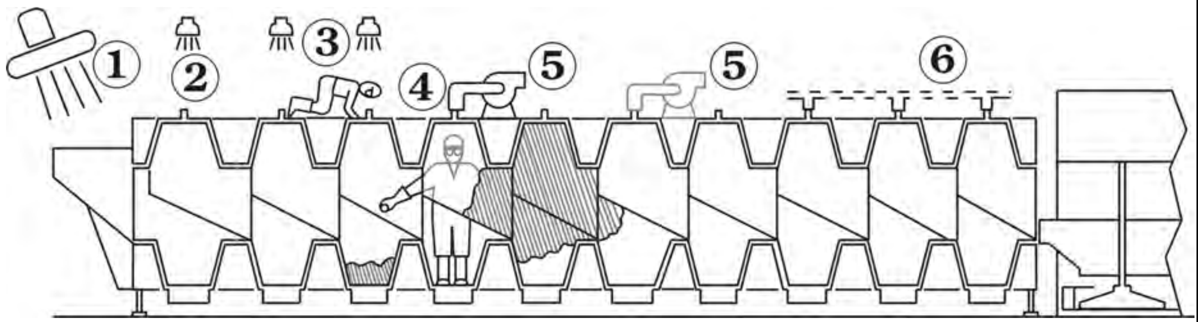
Legend
1. C-clamps securing wood blocks to chain
2. Wood blocks wedged between sprocket and chain (both sides)

6. **Disable main electrical power to the tunnel, to the Mentor®, and to all appropriate electrically operated devices (e.g., the press, etc.) directly before and after the tunnel.** Open (disconnect), lock open, and tag all electrical services to the above indicated devices.

7. **Provide additional lighting and ventilation for the worker(s) who will enter.** See Figure 128 .

Figure 128. Safety in Clearing Tunnel Jams

Location of Personnel and Equipment



Legend

1. Direct a powerful fan (with guards) into the end(s) of the tunnel that workers will enter.
2. If necessary, install lighting directed into vents to illuminate tunnel interior.
3. Frequently communicate with workers through vents.
4. Workers carry in flashlights for additional illumination.
5. If necessary, install blower with inlet side connected to vent to induce a draft. Use one blower on the side (s) of the jam that will be worked.
6. Remove vent piping as necessary.

7.1.2.3 Which End of the Tunnel to Enter

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Generally, one should enter the loading end because the jammed goods will be less tightly packed at that end. However, exceptions to this general rule should be considered in the following situations:

1. The goods are dropped into the tunnel from the floor above via a tall drop chute with no quickly accessible or convenient means to enter and exit the drop chute at the level of the loading chute on the tunnel. (Without a convenient means to enter and exit the drop chute, it may be impossible to climb out.)
2. The jam is much nearer the discharge end.
3. The jam is so tightly packed that it becomes necessary to clear it from both sides.

7.1.2.4 Clearing the Jam

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1. Because the goods will likely be less tightly jammed toward the loading end, it is usually better to pull the jammed goods, piece by piece, toward the loading end. However, it may be necessary to station workers on both sides of the jam to clear it from both sides at the same time. In extreme cases, it may save time to cut away some of the jammed goods—but the cost of doing this must be weighed against the benefit of returning the tunnel to service sooner. If cutting is required, use retractable utility knives, and caution all workers to use extreme care to avoid injury.
2. Additional workers may need to be stationed in other modules to pass the goods along.

3. If the jam is to be cleared by simply spreading the goods among the empty cylinders, remember that the wet, compacted goods will appear to be a smaller load than they actually are. To prevent another jam, never re-start the tunnel with a larger-than-standard load in any module, and always be sure the correct water levels exist in every module before restarting.

7.1.2.5 Which End of the Tunnel to Exit

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It is generally believed that the shortest way out is the best. However, some prefer to exit through the discharge end.

7.1.2.6 Safety Procedures if the Tunnel Must be Entered and/or Exited from the Discharge End

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1. **For a Milnor® Press**—Place the **bell and the pre-press tamper full down**. Turn the air off and **actually disconnect the air line** to the press so, even if the air line shut-off valve should leak, there is no chance of the tamper rising without warning.
2. **For a single Milnor® Centrifugal Extractor**—Tilt the cylinder full up, and install the factory-supplied safety stands securely so the cylinder cannot come down.
3. **For a Milnor® COBUK Conveyor**—Move the conveyor well away from the tunnel.
4. **For any non-Milnor® Device**—Use good judgment, and follow the manufacturer's recommendation

After completing the above procedures, **completely disable electrical service to the device** as previously explained.

7.1.3 Electric Welding Inside the Tunnel

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1. Because safety regulations vary at different localities, it is solely the responsibility of the owner/user to establish safe working procedures by using good common sense and by adhering to all safety standards and regulations.
2. There must be absolutely no water or goods in the cylinder to be welded. The inside of the cylinder must be completely dry and absolutely empty of all goods and water. The welder must not stand in water or on wet goods.
   a. If the tunnel is modular in design, it is best to separate the modules.
   b. If the tunnel has multiple modules welded together, it is absolutely necessary to remove the top before sending a welder inside.
3. The cylinder to be welded must be **securely grounded to the grounding point on the welding machine**.
4. The welder must wear dry, non-conducting protective clothing and shoes.
5. Adequate ventilation is an absolute necessity.

8 Supplemental Information

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8.1 Electrical Connections for the PulseFlow® Devices

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The PulseFlow® tunnel washer requires one high-speed digital-to-analog board for each two pumps. The machine also requires one high-speed 8-output/16-input board.

- The PulseFlow® pumps are numbered according to the c-bits assignments. The pump that is controlled by the c-bit with the lowest number is Pump 1.
- For each pump, one digital-to-analog output controls the inverter, and one high-speed input is the counter for the flow meter.

Table 64. Flow Meter Inputs (8-output/16-input Board at 81H)

Device	Connection
Pump 1	MTA4-1
Pump 2	MTA4-2
Pump 3	MTA4-3
Pump 4	MTA4-4
Flush Pump	MTA4-18

Table 65. Inverter Outputs (Digital-to-Analog Boards at 31H and 32H)

Device	Connection
Pump 1	Board 31H MTA43–3
Pump 2	Board 31HMTA43–1
Pump 3	Board 32H MTA43–3
Pump 4	Board 32H MTA43–1
Common	MTA43–6,7,8,9,10

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8.2 Programming Generation3 Mentor® Inputs and Outputs

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The Generation3 Mentor® controller provides flexibility in monitoring and controlling Milnor® tunnel systems with the addition of programmable inputs and outputs. With this feature, any tunnel washer device can be wired to any available microprocessor input or output relay, respectively, then named and configured with the Mentor® controller software.

This document describes the processes of programming inputs and outputs through software, and also provides some rudimentary knowledge on correlating inputs and outputs to hardware descriptions and microprocessor names.

8.2.1 Quick Reference to Peripheral Boards

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Table 66. Summary of Board Information for Generation3 Tunnel Systems

Board Type	Application in System	Board Address Setting		Outputs	Inputs
		SW1	SW2		
8-output/16-input	Standard Board “A”	0	0		
	Board 1	1	0	1–8	1–16
	Board 2	2	0	9–16	17–32
	Board 3	3	0	17–24	33–48
	Standard Board “B”	8	0		
	Allied weight	F	4		
24-output	Board 0 (Allied)	0	1		
	Board 1	1	1	121–144	
	Board 2	2	1	145–168	
	Board 3	3	1	169–192	
	Board 4	4	1	193–216	
Analog-to-Digital	Temperature in modules 1–8	1	2		
	Temperature in modules 9–16	2	2		
	Temperature in overhead fill tank and reuse tank cooldown	0	A		
	Weighing conveyor	0	2		

8.2.2 Programming Microprocessor Inputs

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Inputs are electrical signals from sensing devices in the tunnel system which are sent through the Mentor® controller to the microprocessor. Each input signal is either on or off. The on/off status of the input causes the microprocessor to perform some action, usually posting a message on the display that a condition has occurred.

8.2.2.1 Inputs Definition Page

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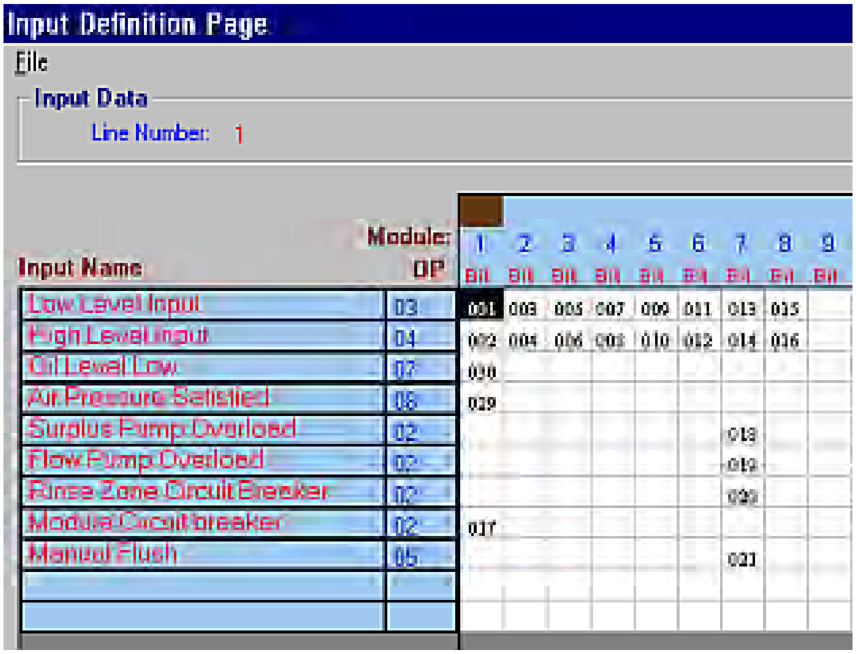
The inputs definition page is the user interface between the input devices (module level switches, oil and air pressure sensors, motor overloads, etc.) and the Mentor® microprocessor. This page, shown in Figure 129 , allows human language presentation of electrical signals from the input devices to the microprocessor.

An example of how microprocessor inputs are used can be drawn from the Low Level Input shown in Figure 129 . Access the **Input Definition page** by selecting **Inputs** from the

Programming menu on the Mentor® operational display. You must be logged in with programmer rights to view or change any configuration or programming data.

Figure 129. Typical Inputs Definition Page



8.2.2.1.1 Input Name

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The first column in the table is the name of the input. This field is open to the user's discretion, as the text entered here appears on the Mentor® display when the input is made. This use of input names in status messages greatly simplifies customization of such messages with regard to language, specific wording, etc.

8.2.2.1.2 Module Number

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The **Module** row of the **Input Definition** page is important only in that it displays the number of the module in which a particular bit represents a type of input. As shown in the example figure (Figure 129), a single type of input, e.g., **Low Level Input**, may be used in several modules.

8.2.2.1.3 OP

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The second column (OP) of the **Input Definition** page is the operational code for the input. This code controls how the input is interpreted by the microprocessor. For example, when an input with an op code of 01 is made, the name of the input is displayed in the Mentor® status bar and the tunnel goes into hold. Conversely, making an input with an op code of 02 simply displays the name of the input in the Mentor® status bar; the tunnel will not enter a hold condition based solely on the status of this type of input. A more detailed explanation of input operational codes is provided in Section 8.2.2.2 : Op Codes for Inputs, page 268 .

8.2.2.1.4 Bit

BNTUUT05.C08 0000232575 A.2 A.5 A.3 1/2/20 2:11 PM Released

Depending on hardware, each input may be monitored in one or more tunnel modules. For example, to determine whether low level is achieved in several modules, the level switches on each module can provide inputs to the microprocessor. By wiring the level switch from the module to be monitored to the designated pin on an MTA connector and configuring the proper operational code, the Mentor® controller will be able to tell when low level is achieved in the desired module. A complete explanation of the process of matching bits from this display to specific hardware and wiring locations is in Section 8.2.2.3 : Correlating Input Sensing Devices with the Mentor® Controller, page 269 .

8.2.2.2 Op Codes for Inputs

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8.2.2.2.1 01: Warning, Signal ON

BNTUUT05.C10 0000232573 A.2 A.5 A.3 1/2/20 2:11 PM Released

This is a warning input that displays the text of the warning in the warning line of the operational display and turns on the signal relay to alert the operator of the error condition. Inputs coded with this op code will initiate a hold condition in the tunnel when made.

8.2.2.2.2 02: Warning without Signal

BNTUUT05.C11 0000232572 A.2 A.5 A.3 1/2/20 2:11 PM Released

This is a warning input that displays the text of the warning in the warning line of the operational display. Inputs coded with this op code will not initiate a hold code.

8.2.2.2.3 03: Low Level Input

BNTUUT05.C12 0000232571 A.2 A.5 A.3 1/2/20 2:11 PM Released

Inputs with this op code signify that low level has been achieved in a module when made. Usually, an input with this op code is assigned to each module of the tunnel.

8.2.2.2.4 04: High Level Input

BNTUUT05.C13 0000232593 A.2 A.5 A.3 1/2/20 2:11 PM Released

Inputs with this op code signify that high level has been achieved in a module when made. In most cases an input with this op code is assigned to the first and last module of the tunnel.

8.2.2.2.5 05: Workwear

BNTUUT05.C14 0000232592 A.2 A.5 A.3 1/2/20 2:11 PM Released

This input op code is not currently used.

8.2.2.2.6 07: Oil Level

BNTUUT05.C15 0000232591 A.2 A.5 A.3 1/2/20 2:11 PM Released

This input signifies that the level of the oil for the chain oiler is low when the input is made. This input must be configured for proper operation. An “Oil Level Low” error will appear on the operational display when this input is made.

8.2.2.2.7 08: Air Pressure

BNTUUT05.C16 0000232590 A.2 A.5 A.3 1/2/20 2:11 PM Released

This input signifies that the air pressure is satisfactory when the input is made. This input must be configured for proper operation. An "Air Pressure Low" error will appear on the operational display when this input is made.

8.2.2.2.8 09: Fill Tank, Low Level

BNTUUT05.C17 0000232589 A.2 A.5 A.3 1/2/20 2:11 PM Released

This input signifies that low level has been achieved in an overhead fill tank when made. In most cases one input with this op code is assigned to each module filled from an overhead tank.

8.2.2.2.9 10: Fill Tank, High Level

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This input signifies that high level has been achieved in a fill tank when made. In most cases one input with this op code is assigned to each module filled from an overhead tank.

8.2.2.2.10 11: Press Free

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This input is only enabled when *Data Pass* is configured. This input must be made for the tunnel to transfer. The tunnel will enter a hold condition if this input is not made at transfer. If *Data Pass* is configured, this input must exist for proper operation. This input is usually assigned to the last module of the tunnel.

8.2.2.3 Correlating Input Sensing Devices with the Mentor® Controller

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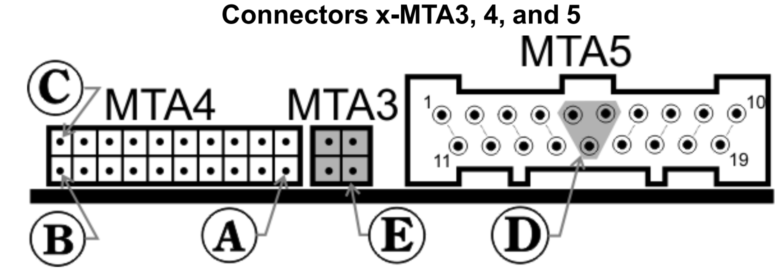
A microprocessor input signal can be thought of as an electrical circuit in which the device being monitored is a switch. When the device, such as a level switch, closes, the input is made. This signals the microprocessor that an action has occurred, at which time the microprocessor may execute certain functions through outputs and/or send a message to the display. Depending on the operational code for the input, its normal state may be either made or not made, as described in Section 8.2.2.2 : Op Codes for Inputs, page 268 .

Inputs from devices in the tunnel system enter the Mentor® system through MTA3 and MTA4 of an 8 output/16 input board, as illustrated in Figure 130 . Each input number on each board is permanently associated with a particular pin on that board, as described in Table 67 .

Figure 130. Inputs and Outputs on 8 Output/16 Input Board

Connectors x-MTA3, 4, and 5



Legend

A. . . Pin 1 on x-MTA4
B. . . Pin 10 on x-MTA4
C. . . Pin 20 on x-MTA4
D. . . Pins 5, 6, and 15 on x-MTA5 (not used)
E. . . x-MTA3 used only for flow meter inputs

Table 67. Inputs per 8 Output/16 Input Board

Pin Number	Application or Input Number	Pin Number	Application or Input Number
MTA3 (Flow Meter Inputs to Microprocessor)			
1	Flow Meter	3	not used
2	Ground	4	Ground
MTA4 (Standard Microprocessor Inputs)			
4–1	0	4–11	8
4–2	1	4–12	9
4–3	2	4–13	10
4–4	3	4–14	11
4–5	4	4–15	12
4–6	5	4–16 (examples)	13 (examples)
4–7	6	4–17	14
4–8	7	4–18	15
4–9	not used	4–19	not used
4–10	Ground	4–20	+12 Volys DC

See the following examples (Section 8.2.2.3.1 : Input Example 1: Low Level Input for Module 7, page 270 and Section 8.2.2.3.2 : Input Example 2: Tunnel Air Pressure Satisfied, page 271) to better understand the relationship between devices and specific pins on 8 output/16 input boards. Note that both examples make use of pin 16, but that the pins are on two different 8 output/16 input boards, known to the processor by their respective addresses. These addresses are set via two rotary switches on each board, as described in Section 8.2.4 : Determining Board Addresses, page 276 .

8.2.2.3.1 Input Example 1: Low Level Input for Module 7

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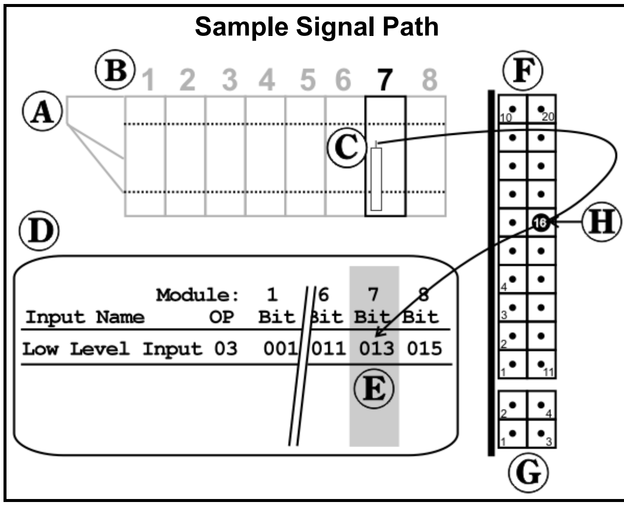
In this example (see Figure 131: Graphic of Input Example 1, page 271), we assume that the seventh module of the tunnel washer is equipped with a level switch controlling whether the input is made or not made. When the level switch is above low level, the input is made. The status line on the Mentor® operational display shows “Low Level Input.”

Figure 131. Graphic of Input Example 1



Legend

- **A. . .** Tunnel washer
- **B. . .** Tunnel module numbers
- **C. . .** Level switch on module 7
- **D. . .** Mentor® Inputs display
- **E. . .** Low Level input in module 7
- **F. . .** MTA4 on 8 output/16 input board
- **G. . .** MTA3 on 8 output/16 input board
- **H. . .** Pin 4-16 (Input 13) on first 8 output/16 input board (board address is 1H)

8.2.2.3.2 Input Example 2: Tunnel Air Pressure Satisfied

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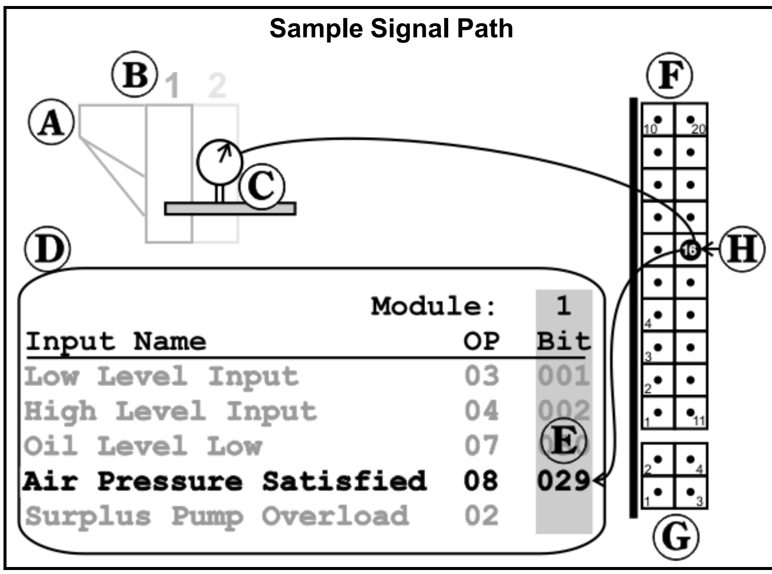
In this example (Figure 132: Graphic of Input Example 2, page 271), we assume an air pressure switch is used to tell the microprocessor whether there is sufficient air pressure for the tunnel to operate. Because air pressure is usually monitored at only one position on the tunnel washer, only one input is required. For convenience, this input is usually assigned to the first module of the tunnel.

Figure 132. Graphic of Input Example 2



Legend

- **A. . .** Tunnel washer
- **B. . .** Module 1
- **C. . .** Compressed air inlet and pressure gauge with sending unit
- **D. . .** Mentor® Inputs display
- **E. . .** Air Pressure Achieved input
- **F. . .** MTA4 on 8 output/16 input board
- **G. . .** MTA3 on 8 output/16 input board
- **H. . .** Pin 4-16 (Input 13) on second 8 output/16 input board (board address is 2H)

8.2.3 Assigning Outputs and Functions

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8.2.3.1 Function Page

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The **Function Programming** page is described in detail in the manual section entitled “Assigning Functions” (see Table of Contents). For Generation3 Mentor®control systems, the procedure for assigning outputs and functions changes only to the degree that each function and module pair is assigned a unique bit number. This part of this document describes how devices which act on microprocessor outputs are correlated with the correct peripheral board and pin on that board.

As shown in Figure 133: Typical Function Page, page 273 , each function is represented by a row on the **Function Programming** page, and each module is represented by two columns (Bit and Init). The intersection of the module information (column) and the function (row) contains the output number and operational code of the function.

By convention of the Milnor® factory, functions are usually assigned in this order:

1. Steam functions for all modules are assigned to the first available output relays.
2. Fast fill functions are assigned to the next available output relays.
3. Drain functions are assigned to immediately follow fast fill functions.
4. Other options are assigned to the remaining output relays, using additional output boards if necessary.
5. Chemicals are usually assigned to a separate board to isolate them from other functions.

Outputs are numbered sequentially, with output 001 corresponding to the first output on the first 8 output/16 input board (address 1H). When this output is energized, the red light emitting diode labelled “0” on the edge of the board illuminates.

Figure 133. Typical Function Page

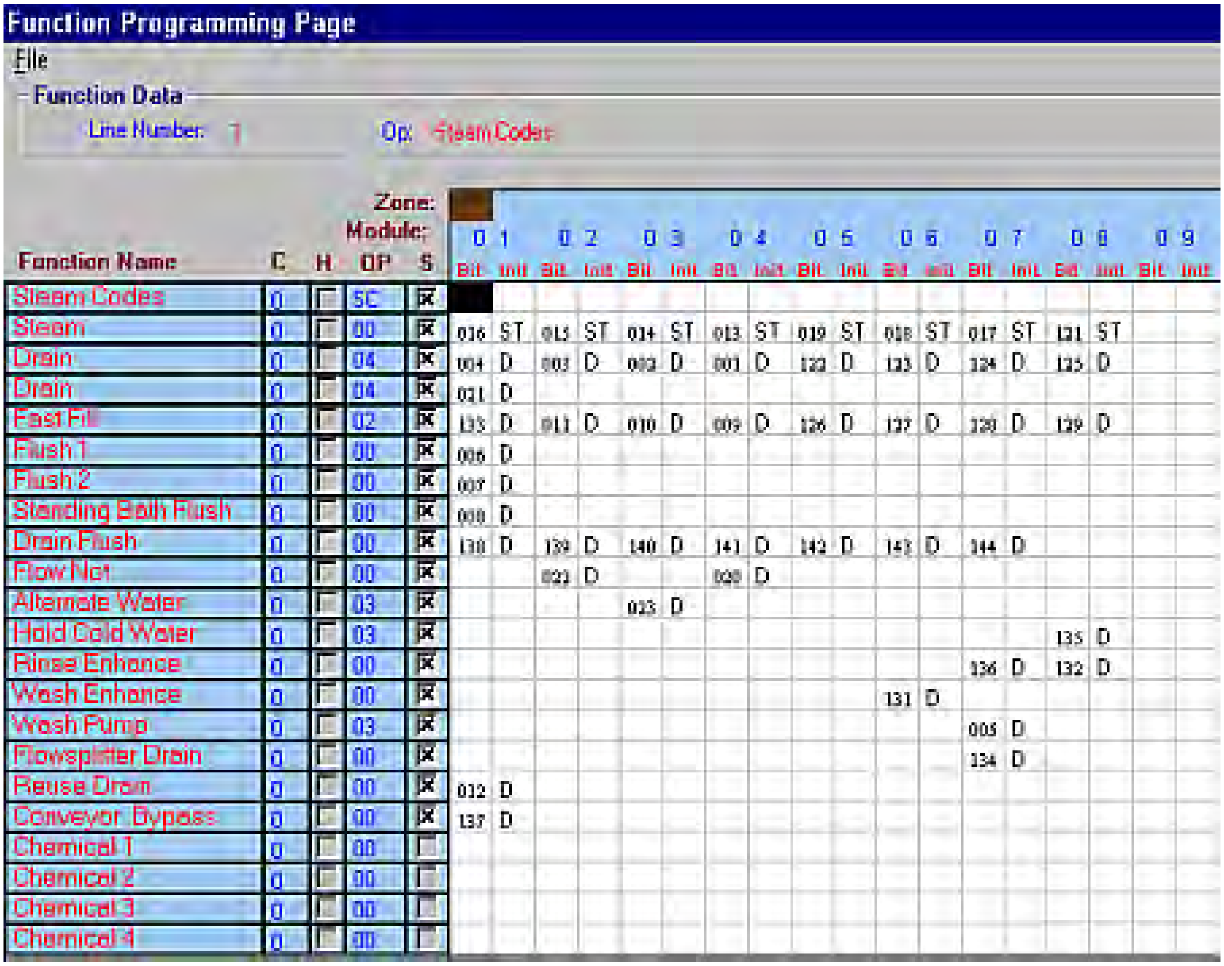

Table 68. Mentor® 98xxx Output Assignments: 8 Output/16 Input Boards

Board Address	First Output	Last Output
1H	1	8
2H	9	16
3H	17	24
4H	25	32
5H	33	40
6H	41	48
7H	49	56
8H	57	64
9H	65	72
AH	73	80
BH	81	88
CH	89	96
DH	97	104
EH	105	112
FH	113	120

When all available outputs on the 8 output/16 input boards are assigned, 24 output boards are used for additional functions. Also, a single 24 output board is usually dedicated to chemical supplies, so that chemical signals remain somewhat isolated from other components. The available addresses for these boards are listed in Table 69 below.

Table 69. Mentor® 98xxx Output Assignments: 24 Output Boards

Board Address	First Output	Last Output
11H	121	144
12H	145	168
13H	169	192
14H	193	216
15H	217	240
16H	241	264
17H	265	288
18H	289	312
19H	313	336
1AH	337	360
1BH	361	384
1CH	385	408
1DH	409	432
1EH	433	456
1FH	457	480

8.2.3.2 Correlating Devices to Functions

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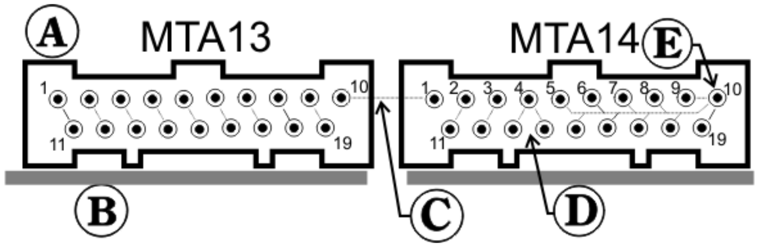
Each output relay provides a common and a normally open pin on the edge of the board on which it occurs. For 8 output/16 input boards, the arrangement of outputs is shown in Figure 130: Inputs and Outputs on 8 Output/16 Input Board, page 269 . On these boards, MTA3 is dedicated to microprocessor inputs for optional flowmeters. MTA4 provides inputs to the microprocessor from non-flowmeter devices (described in Section 8.2.2.3 : Correlating Input Sensing Devices with the Mentor® Controller, page 269). MTA5 provides outputs on pins 1 through 4, 7 through 10, 11 through 14, and 16 through 19.

For 24 output boards, see the arrangement in Figure 134 . In matching functions to pins in MTA13 and MTA14 of each 24 output board, use the following guidelines:

1. Output 0 (the first output per board) spans pins MTA13-1 and MTA13-11
2. All outputs on MTA13 have the normally open pin on the row nearest the circuit board and the common pin on the row farthest from the circuit board.
3. Output 9 spans across the two MTA connectors, from MTA13-10 to MTA14-1.
4. On MTA14, outputs 14 through 23 (the last 10 outputs) use pin 10 as common. See Figure 134 for details.

Figure 134. Outputs on 24-Output Board

Connectors x-MTA13 and x-MTA14



Legend

A. . . Thin lines connect common and normally open pins. The common pin is to the left unless otherwise noted (see legend items D and E below).

B. . . Circuit board shown for reference only.

C. . . Output 9 crosses MTA13 and MTA14

D. . . Pin MTA14-4 is shared as common between output 12 (MTA14-13) and output 13 (MTA14-14)

E. . . Pin MTA14-10 is shared as common among outputs 14 (MTA14-5) through 23 (MTA14-19)

8.2.3.2.1 Outputs Example 1: Adding a Module Drain Valve

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For the first example of assigning an output from the microprocessor to a device on the tunnel, assume a second drain has been added to the first module of the tunnel. The signal to open the drain must travel from the desired pins on an 8 output/16 input board or a 24 output board. For this example, only 8 output/16 input boards will be used.

1. Output 5 (MTA5-3 and MTA5-13) on the third 8 output/16 input board (address 3H) is found available.
2. Wire from the device to the selected output, as specified above.
3. Create the new function for the second drain valve in module 1. Depending on the function added, this procedure may include programming an operational code, hold code, compatibility code, etc.
4. Following procedures at the Mentor® controller similar to those described in Section 8.2.2.1 : Inputs Definition Page, page 266 , assign the selected output bit to the function. In this example (shown in Figure 133: Typical Function Page, page 273), this is bit 021. This number represents the fifth output on the third 8 output/16 input board.

8.2.3.2.2 Outputs Example 2: Configuring a Steam Valve Output

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Assume the bit for the steam valve on module 7 was lost and must be restored.

1. Trace the wire from the steam valve back through all intermediate components to the MTA connector on the 8 output/16 input board.
2. Verify the board address where this connector attaches. If our example system is similar to that shown in Figure 133: Typical Function Page, page 273 , this board will have address 3H. See Section 8.2.4 : Determining Board Addresses, page 276 for how to interpret rotary switch settings to board addresses.
3. Verify the pins occupied by this device. According to our example, pins MTA5-2 and MTA5-12 are used here.

4. From the address of the board (3H) and the pins on that board occupied by the device (MTA5-2 and MTA5-12), we can determine that the correct bit code for the steam valve on module 7 of our tunnel is 017.

8.2.4 Determining Board Addresses

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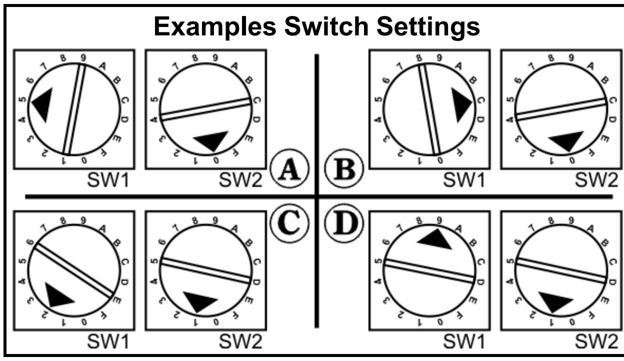
The microprocessor communicates with all peripheral boards via a serial link. Each peripheral board is known to the microprocessor by an address that is unique within the system. The address for most peripheral boards is determined by the setting of two rotary switches on the board.

To find the rotary switches on 8 output/16 input and 24 output boards, hold the board with the components facing you and the light emitting diodes and connectors facing to the left. The two rotary switches are located in the upper left corner of the board.

Figure 135. Sample Addresses from Rotary Switches



Legend

A. . . Board at address 5H
B. . . Board at address CH
C. . . Board at address 12H
D. . . Board at address 19H

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8.3 Press Water to Rinse Zone Summary

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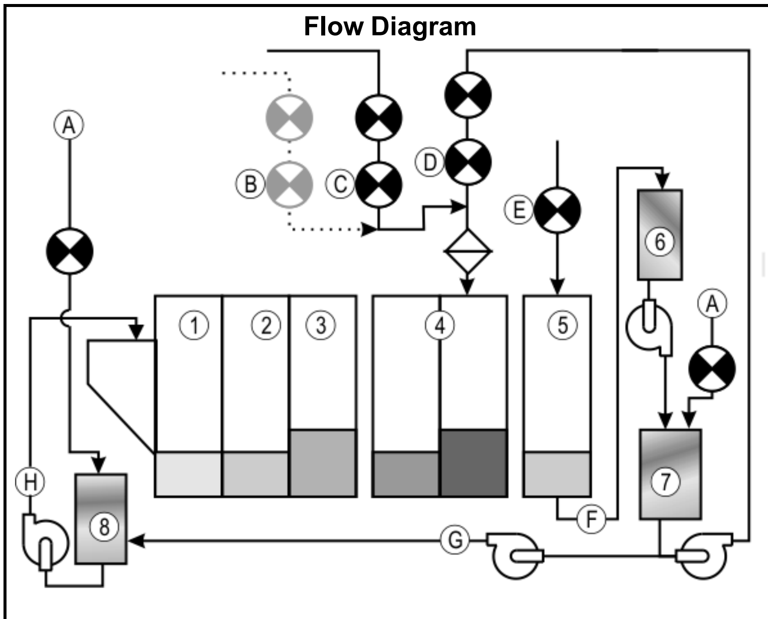
This document provides an overview of the Milnor® Press Water to Rinse Zone (PWR) option in a CBW® system.

The PWR tank stores water extracted by the press or centrifugal extractor which would otherwise flow to the sewer. Water from the PWR tank flushes goods into the first module, maintains water flow in the rinse zone, and maintains the desired water level in the last module. Figure 136 illustrates how water from the PWR tank is distributed through the tunnel washer.

Figure 136. PWR Flow



Legend

1. . . Tunnel washer module 1
2. . . Tunnel washer module 2
3. . . Tunnel washer module 3
4. . . Tunnel washer rinse zone
5. . . Tunnel washer last module
6. . . Extraction tank
7. . . PWR tank
8. . . Flush tank
A. . . Cold fresh water
B. . . Fresh water to rinse zone (G4 models only)
C. . . Tempered fresh water to rinse zone
D. . . PWR tank water to rinse zone
E. . . Fresh water make-up in last module
F. . . Weir overflow from last module
G. . . PWR tank water to flush tank
H. . . Flush tank water to module 1

NOTE: Use the guidelines below as a starting point for establishing values to get the most efficiency from the PWR tank. Adjust only one variable at a time when making any adjustment, and allow the tunnel washer time to return to equilibrium before making another adjustment.

Fresh water make-up (Figure 136 , Item A) These valves individually provide fresh water to the flush tank and the PWR tank if the tank is near empty.

G4 fresh water to rinse zone (G4 models only, see Item B of Figure 136) For G4 models with modulating valves, the standard **fresh water to rinse zone** valve (Item C) is set at a fixed flow rate; this valve modulates to control total flow of fresh water into the zone.

Fresh water to rinse zone (Figure 136 , Item C) Set this valve to make up the remainder of the desired flow into the rinse zone. If the tunnel washer is equipped with optional modulating valves, this valve flows the non-modulating proportion of the total flow into the zone.

PWR tank to rinse zone (Figure 136 , Item D) Set this valve to a fixed flow rate (measured as **percent open**) of 40 to 60 percent of the total water flowing into the rinse zone.

Make-up water for last module (Figure 136 , Item E) Admits fresh water if level in the last module is low.

PWR tank to flush tank (Figure 136 , Item G) This valve diverts water from the PWR tank to the flush tank if the PWR tank level is high.

Flush tank to module 1 (Figure 136 , Item H) The CBW® system uses water from the flush tank to wet goods in the load chute.

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8.4 Generation3 CBW® System Chemical Injection

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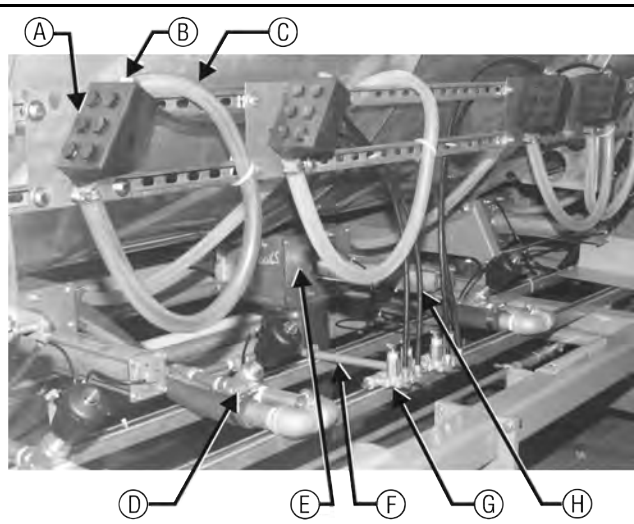
The typical chemical injection system employed on Milnor® G3 model tunnel washers connects to the drain sumps on the tunnel. Tubing from the chemical supply system (e.g., peristaltic pump system) connects to the black plastic injection box through 1/2-inch NPT fittings. When a chemical is desired by the Mentor® CBW® controller, a programmable function of the controller signals the chemical supply system to deliver concentrated chemical to the injection box. These components and others in this system are identified in Figure 137 .

Either during the chemical injection or immediately after it finishes, the Mentor® controller activates one of the air-operated water valves on the flushing water valve manifold. When the valve opens, water (preferably tempered) from the main header flows into the top of the chemical injection box, diluting the chemical concentrate and flushing it through the chemical delivery tube to the tunnel drain sump.

Figure 137. Components of the Chemical Injection System



Legend

A. . . Chemical injection box
B. . . Flushing water inlet
C. . . Chemical delivery tube (to tunnel drain sump)
D. . . Fast fill water valve
E. . . Drain sump
F. . . Flushing water manifold supply pipe
G. . . Flushing water valve manifold
H. . . Flushing water supply line

8.4.1 Mechanical Connections

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There are two type of connections to the chemical injection box on the tunnel washer: the flushing water inlet and the six chemical concentrate inlets. The flushing water inlet is a 1/2-inch NPT insert in the chemical injection box. As assembled at the Milnor® factory, flexible plastic tubing with compression fittings serves as the flushing water supply line, connecting the flushing water valve manifold to the chemical injection box.

The chemical concentrate inlets, also 1/2-inch NPT inserts, are in the side of the chemical injection box. These inserts are plugged at the Milnor® factory. When connecting tubes from the chemical supply system to the chemical injection box, always use appropriate fittings and sealants to prevent leaks.

The outlet from the bottom of the chemical injection box is sized to fit inside the 1-inch nominal flexible tubing used for chemical delivery to the tunnel washer. The chemical delivery tubing is attached over the box outlet and the drain sump fittings with appropriately sized screw-type hose clamps.

Periodically inspect for leaks all tubing and piping that contacts with chemicals, whether concentrated or diluted.

8.4.2 Configuration and Programming

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While the Mentor® controller software was configured and programmed at the Milnor® factory according to the information available when the tunnel was manufactured, the types of goods processed and other factors may suggest that the programming be modified for more efficient operation.

The illustrations of Mentor® displays in this document are **examples only**. The values presented here will probably be incorrect for your application.

8.4.2.1 Configuring the Controller

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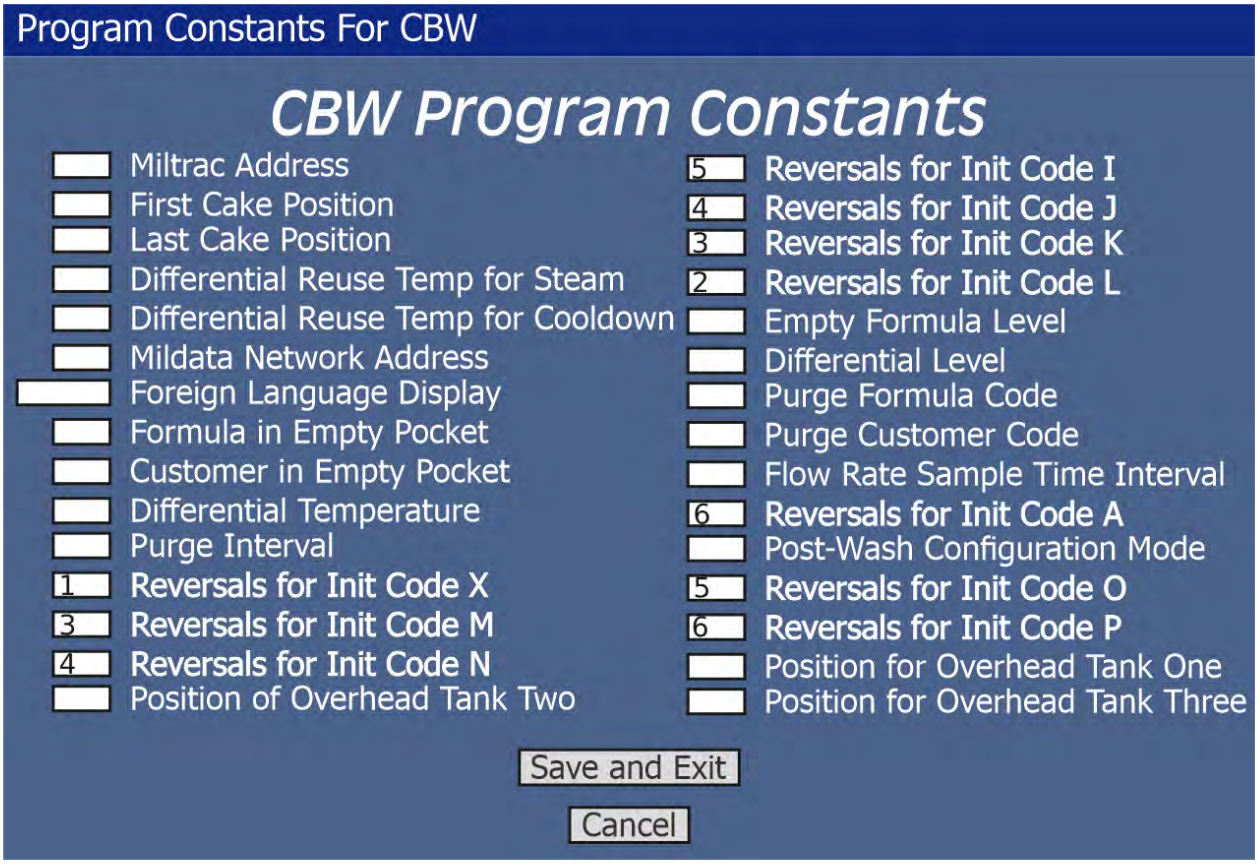
The tunnel chemical injection system depends on flushing the chemical injection boxes with water to deliver the chemical to the tunnel washer and to prevent chemical damage to machine components.

The chemical injection box is usually flushed while the chemical is injecting, or shortly after the chemical injection time expires. The time in the cycle when an event such as a chemical injection or a flush occurs is controlled by programming an **initialization code** (init code) for each event.

To flush the box **while** the chemical is injecting, the flush function and the chemical injection function start at the same time. It is important in this situation that the flush valve remain open long enough to flush **all** the chemical completely through the chemical delivery tube and into the tunnel washer. Chemical remaining in the delivery tube after the flush ends is not available to the goods for which it was intended, and it might damage subsequent goods.

To flush the box **after the injection ends**, select an init code which delays the start of the flush until the chemical injection is complete. As a general rule, allow about 10 seconds for each reversal (one clockwise and one counter-clockwise rotation) of the tunnel washer. According to this guideline, a flush beginning after a 30-second chemical injection ends should start about three reversals after the chemical injection begins (30 seconds divided by 10 seconds per reversal equals 3 reversals). Select an init code from the “CBW® Program Constants” page (shown in Figure 138) to satisfy this requirement. If a suitable init code is not already configured, refer to “Configuring the Mentor® Controller” in this manual to configure an unused init code.

Figure 138. Sample CBW Program Constants page



8.4.2.2 Programming Functions

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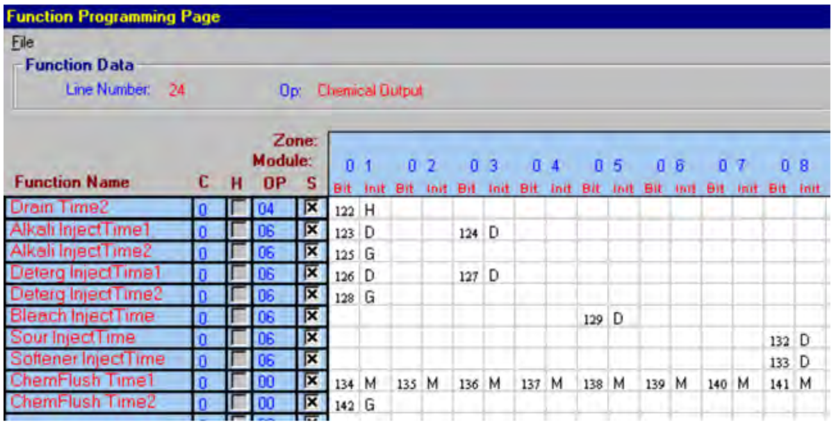
A function (output relay) must be assigned to each chemical injection and subsequent flush in each module, as shown in the example in Figure 139 . Because the example system shown here allows injecting and flushing alkali into module 1 two times and into module 3 one time, four functions (using six outputs) handle all alkali injections.

If all information about chemical injections was available when the tunnel washer was manufactured, this page was programmed before the machine was delivered. If chemical requirements changed after manufacture, modify this page as necessary to match the new requirements. Consult your chemical supplier or the Milnor® factory if you need help.

Figure 139. Function Programming Page (Example)



The sample “Function Programming” page (Figure 139) provides for two separate alkali injections and two separate detergent injections in the first module for each cycle, with all four injections followed by flush operations. Alkali and detergent can both be injected and flushed one time per cycle into module 3. Bleach can be injected and flushed into module 5 one time per cycle, and sour and softener can each be injected once per cycle into module 8. The functions programmed for each chemical and flush in each module are shown in Table 70 .

Table 70. Sample Chemical Function Assignments

Function Name	Output (Bit)	When (Init)	Module	Description
Drain Time2	122	G	1	allows draining module 1 at the midpoint of the cycle, usually to remove insoluble soils from the drain sump
Alkali InjectTime1	123	D	1	allows alkali injection when tunnel starts turning after the pause at top dead center
	124		3	
Alkali InjectTime2	125	G	1	allows alkali injection at the midpoint of the cycle, after Drain Time2 expires and the drain closes
Detergent InjectTime1	126	D	1	allows detergent injection when tunnel starts turning after the pause at top dead center
	127		3	
Detergent InjectTime2	128	G	1	allows detergent injection at the midpoint of the cycle, after Drain Time2 expires and the drain closes
Bleach InjectTime	129	D	5	allows bleach injection when the tunnel starts turning after the pause at top dead center
Sour InjectTime	132	D	8	allows sour injection when the tunnel starts turning after the pause at top dead center
Softener InjectTime	133	D	8	allows softener injection when the tunnel starts turning after the pause at top dead center

Table 70 Sample Chemical Function Assignments (cont'd.)

Function Name	Output (Bit)	When (Init)	Module	Description
ChemFlush Time1	134–141	M	1–8	allows flushing the chemical injection box on each module at a pre-determined number of reversals after transfer
ChemFlush Time2	142	G	1	allows flushing the chemical injection box on module 1 at the midpoint of the cycle

8.4.2.3 Programming Formulas

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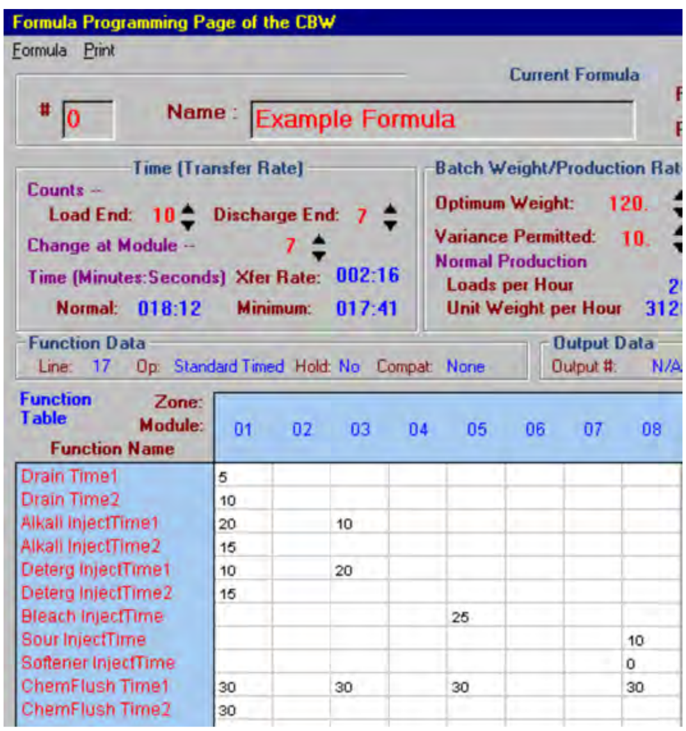
Figure 140 illustrates the chemical portion of a simple wash formula in a typical CBW washer of eight modules. In this example, there is a partial drain (five seconds) of the first module at the midpoint of the cycle. This drain eliminates the insoluble soils that settled out of the goods, but also washes away some of the chemicals. To restore the proper chemistry, alkali and detergent are again injected and flushed into the first module at the midpoint of the cycle. Because the timer does not advance during the time the drain is open, the chemical dosage will be accurate.

Figure 140. Formula Programming Page (Example)



Note that the chemical flush times in the example are programmed for 30 seconds. Carefully observe your machine during a chemical injection and corresponding chemical box flush to ensure that all the chemical is flushed out of the tubing. Consider also that momentary drops in water pressure in the main header (the source of the flushing water) may necessitate longer flush times to clear all chemical from the tubing.

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8.5 Milnor® Electronic Chemical System Interface for CBW® Systems

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8.5.1 Scope of this Document

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This document describes the technical characteristics and operation of the **Milnor Electronic Chemical System Interface** (MECSI). This information is for use by a qualified, knowledgeable programmer in creating a chemical injection system compatible with the MECSI.

Information regarding hardware connections and Microsoft Windows settings, especially the creation of a local area network, is beyond the scope of this document. Refer to the chapter entitled “PC Networking” in manual MTYCUI01 “On-Site Control Connections for Milnor® Automated Laundering System Machines and Controllers” and the appropriate Microsoft documentation for this information.

8.5.2 What is the Milnor Electronic Chemical System Interface?

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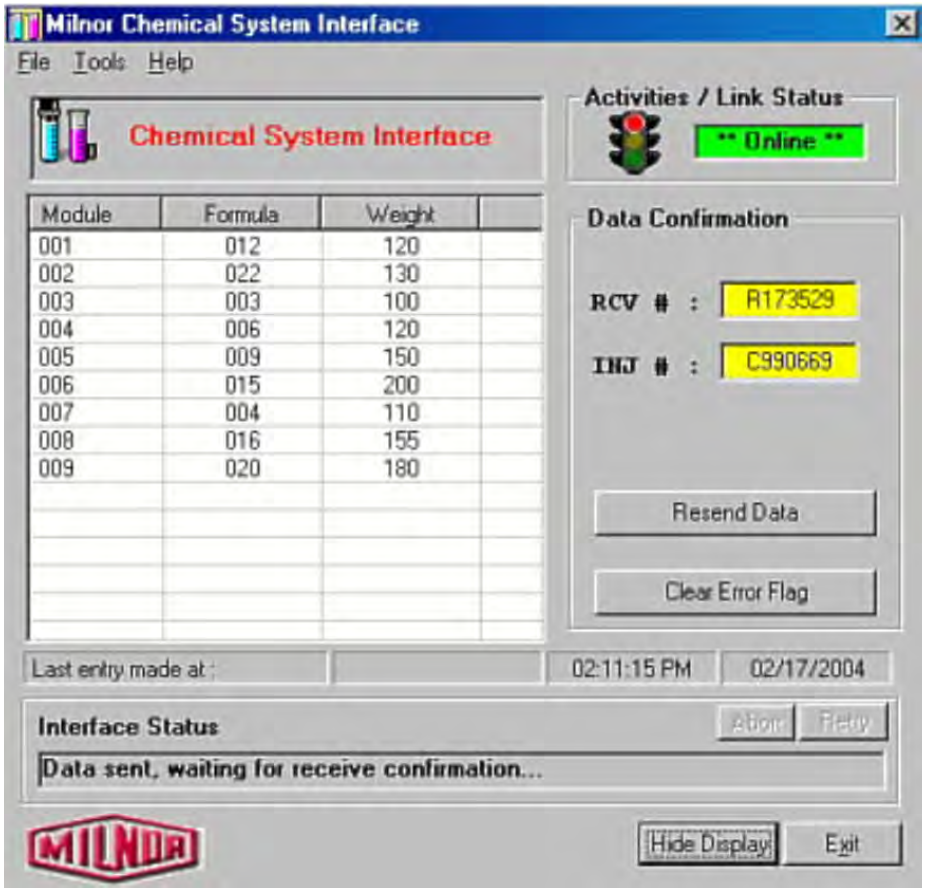
The objective of the MECSI is to establish peer-to-peer communications between the Milnor® Mentor® CBW® controller software and any third-party software used to control the chemical system. The Mentor® software is the **client**, and the chemical software is the **server**. The data format of the Mentor® controller is described in Section 8.5.5 : Definition of the Data Format, page 287 .

The MECSI handles communications between the Milnor® Mentor® controller for Continuous Batch Washer systems and Windows-based chemical supply systems supplied by others. The interface uses the Windows Sockets (WinSock) protocol over a local area network to send batch information from the Mentor® controller to the chemical supply system, to handle all additional data exchange, and to monitor communications between the two systems. By employing the WinSock protocol, the MECSI provides standardization and reduces the number of dry contacts required.

When the MECSI is operating, it is normally represented by an icon in the Windows **Start** bar. Click on the icon to display the monitor window, shown in Figure 141 .

Figure 141. MECSI Monitor Window



8.5.3 Operational Summary

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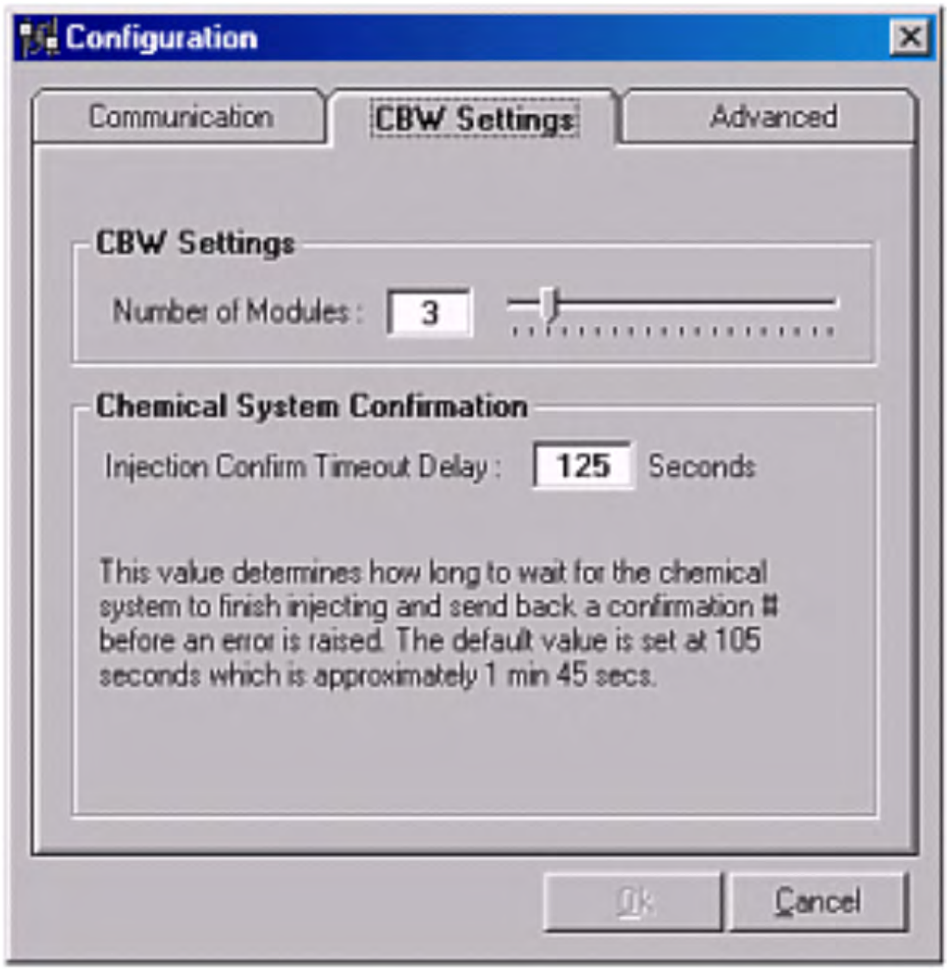
1. Each time the tunnel washer transfers, the MECSI sends formatted data to the chemical system.
2. The chemical system must confirm receipt of the data within three seconds by sending the **Data Receive Confirmation** code back to the MECSI.
   a. If three seconds expires before the chemical system responds with the proper **Data Receive Confirmation** code, the MECSI sends the data a second time.
   b. If the chemical system fails to confirm the second data transmission attempt within three seconds, the MECSI signals a communication error and puts the tunnel washer in a hold condition.
3. The chemical system must confirm that the injection is complete within the configured **Injection Confirm Timeout Delay** time (see Figure 142: CBW Settings Tab, page 285) by sending the **Chemical Injection Confirmation** code back to the MECSI.
   a. If the configured time expires before the chemical system responds with the proper **Chemical Injection Confirmation** code, the MECSI signals an injection error and puts the tunnel washer in a hold condition.

b. If the chemical system responds with any negative value for the **Chemical Injection Confirmation** code, the MECSI signals an error and puts the tunnel washer in a hold condition until it receives the correct code.

4. If the chemical system responds with the same **Chemical Injection Confirmation** as it received from the MECSI, the MECSI waits to repeat the process at the next tunnel transfer.

Figure 142. CBW Settings Tab



8.5.4 Communication Between Devices

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If the MECSI is configured, it attempts to establish a WinSock connection to the chemical system when the interface system starts. If the first connection attempt fails, the MECSI tries to connect every 10 seconds for a maximum of one minute. If the connection isn't established within this time, the MECSI signals a connection error and puts the tunnel washer in a hold condition until the error is resolved.

Table 71. Milnor® Interface WinSock Settings

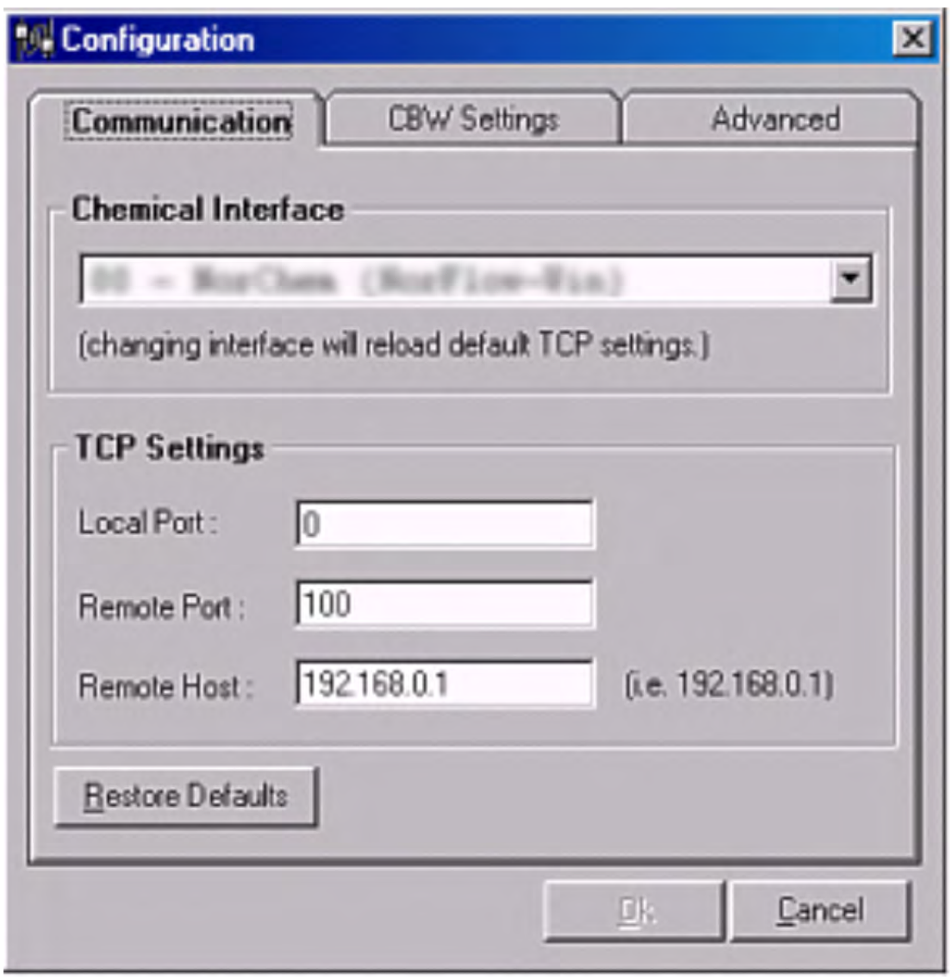
WinSock Property	Socket	TCP Protocol Settings	Description
LocalPort	0	recommended	0 = automatically assign port
RemotePort	100	user-definable	chemical system listen port
RemoteHost	192.168.0.1	user-definable	chemical system IP address

Table 72. Chemical System WinSock Settings

Protocol	Socket	TCP Protocol	Description
ListenPort	100	user-definable	default to port 100 to listen for connection request

NOTICE: The **RemotePort** in the MECSI and the **ListenPort** of the chemical system must use the same settings. Use the Communication tab of the MECSI (Figure 143) to configure this information.

Figure 143. Communication Tab



If the WinSock connection with the chemical system fails, the MECSI signals an error and attempts to restore the connection. The alarm resets immediately when the connection is restored, and batch information is sent the next time the tunnel washer transfers.

8.5.5 Definition of the Data Format

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The **Milnor Electronic Chemical System Interface** uses the WinSock connection to send **string** data from the tunnel washer to the chemical system. Batch data is transmitted to the chemical system at each tunnel washer transfer. Each communication block contains comma-delimited data for all tunnel washer modules and **confirmation code** numbers (**Data Received** and **Chemical Injected**).

Table 73. Example Data String

M01	**12**	**108**	**,**	**M02**	**08**	**099**	**,**	**R472396,**	**C325907**
Maa	**bb**	**ccc**	**,**	**Maa**	**bb**	**ccc**	**,**	**Rdddddd,**	**Ceeeeee**
Module number	Formula number	Load weight	Batch delimiter	Module number	Formula number	Load weight	Batch delimiter	Data Received Confirmation code	Chemical Injected Confirmation code

Maa The module number data component comprises the alphabetic character **M** followed by the two-digit number of the tunnel washer module which just received the batch. Values less than 10 are zero-padded to two characters (e.g., M05).

bb the two-digit formula number used to process this batch in the tunnel washer. Values less than 10 are zero-padded to two characters (e.g., 03).

ccc the three-digit weight of the batch. Values less than 100 are zero-padded to three characters (e.g., 099).

Rdddddd The **Data Received** confirmation code comprises the alphabetic character **R** followed by a six-digit random number generated by the MECSI. The chemical injection system must return this value within three seconds of receiving the data string from the MECSI.

Ceeeeee The **Chemical Injected** confirmation code comprises the alphabetic character **C** followed by a six-digit random number generated by the MECSI. The chemical injection system must return this value within the **Injection Confirm Timeout Delay** configured in the MECSI.

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8.6 Milnor® Electronic Rail System Interface for CBW® Systems

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8.6.1 Scope of this Document

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This document describes the technical characteristics and operation of the **Milnor Electronic Rail System Interface** (MERSI). This information will help a qualified, knowledgeable programmer to create a rail control system compatible with the MERSI.

Information regarding hardware connections and Microsoft Windows settings, especially the creation of a local area network, is beyond the scope of this document. Refer to the chapter entitled “PC Networking” in manual MTYCUI01 “On-Site Control Connections for Milnor Automated Laundering System Machines and Controllers” and the appropriate Microsoft documentation for this information.

8.6.2 What is the Milnor Electronic Rail System Interface?

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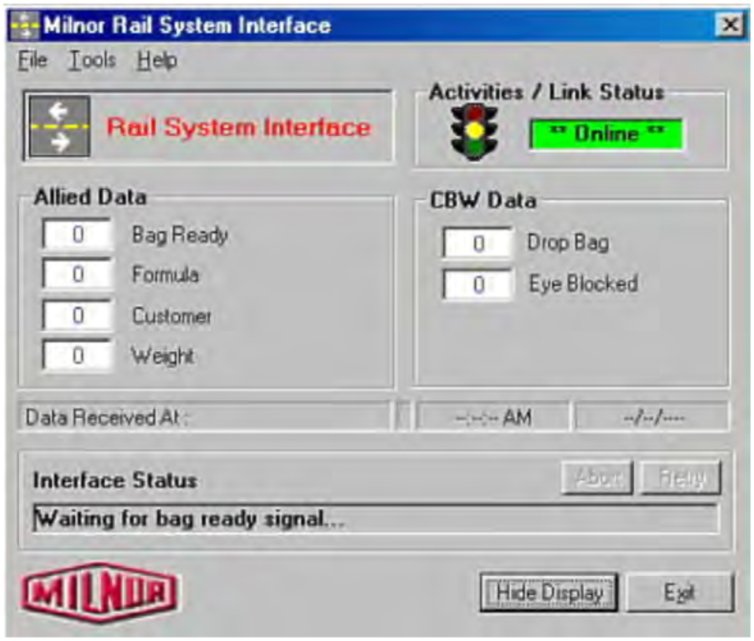
The MERSI acts as a communication agent between a Milnor® Mentor® CBW® controller software and a third-party rail system. The interface retrieves load information from the rail system and passes it to the Mentor® controller using Microsoft NetDDE protocol. Microsoft `NetDDE.exe` and `DDEShare.exe` are used to establish the DDE communications over the local area network.

The MERSI is enabled by selecting the **Electronic Chemical Interface** option on the Mentor® **Hardware Configuration** screen, then re-starting the Mentor® computer. The application will start automatically. When the MERSI is operating, it is normally represented by an icon in the Windows task bar. Double-click on the icon to display the monitor window, shown in Figure 144
.

Figure 144. MERSI Monitor Window



8.6.3 Operational Summary

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NetDDE protocol is used to establish a peer-to-peer connection between the MERSI and the rail system software. Pre-defined DDE items within a topic pass data between the MERSI and the rail system.

Data such as formula number, customer number, and batch weight can be passed to the MERSI from the rail system. The MERSI receives the load data, passes them to the Milnor® Mentor® CBW® controller, then signals the rail system to process the next batch. After signalling the rail system, the MERSI waits for the rail system to send more data.

1. The rail system software loads new data for formula, customer, and weight into the specified topic object.
2. After loading the data, the rail software should pause three to five seconds, then signal the MERSI that there is a **Bag Ready**. This signal also serves as the **Data Valid** signal.
3. When the MERSI receives the **Bag Ready** signal, it signals the rail system to **Drop Bag**. The duration of the signal is approximately three seconds.
4. When the rail system receives the **Drop Bag** signal, it responds by opening the sling to drop the batch.
5. The MERSI signals **Eye Blocked** when the batch blocks the load chute photoeye on the tunnel washer. At this signal, the rail system clears the **Bag Ready** signal and sends the empty bag away. The **Formula**, **Customer**, and **Weight** data are not cleared between loads.
6. The MERSI clears the **Eye Blocked** signal and the process repeats.

8.6.4 Communication Between Devices

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If the MERSI is configured, it automatically attempts to connect to the rail system when the MERSI loads. If the first connection attempt fails, the MERSI tries to connect every 10 seconds for a maximum of one minute. If the connection isn't established within this time, the MERSI signals a connection error and puts the tunnel washer in a hold condition until the error is resolved.

If the NetDDE connection with the rail system fails, the MERSI signals an error and attempts to restore the connection. The alarm resets immediately when the connection is restored, and batch information is sent the next time the tunnel washer transfers.

8.6.5 Definition of the Data Format

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The **Milnor Electronic Rail System Interface** uses Microsoft NetDDE to facilitate communication between the tunnel washer and the rail system. Batch data is considered valid when the **Bag Ready** signal is present.

The default DDE **application** is `CWSERV`, and the default DDE **topic name** is `POINT`. These items can be changed through the MERSI user interface. The DDE **items** are described in Table 74 .

Table 74. DDE Item Names for MERSI

Item Name	Data Source	Description	Valid Data
T*_UNLD	Milnor®	Drop bag	0 – 1
T*_REC		Eye blocked	
T*_SRDY	rail system	Bag ready and all data valid	
T*_SC		Formula	000–999
T*_CUST		Customer	
T*_WT		Weight	
* = number for tunnel washer (e.g., first tunnel is T1, second is T2)			

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8.7 Construction of External Serial Link Cables

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This document provides information for on-site fabrication of certain types of serial communication cables. An individual machine can be connected to certain makes and models of serial printer (see related note below) using the printer cable described in Section 8.7.2.2 : Connecting a Machine to a Printer for “Print Data”, page 293 . Programmable data can be transferred between compatible machines or between a machine and a Milnor® *serial memory storage device* (see related note below), using the download cables described in Section 8.7.2.3 : Connecting Two or More Machines for Machine-to-machine Transfer, page 294 and Section 8.7.2.4 : Connecting a Machine to a Serial Memory Storage Device, page 295 respectively. These cable(s) connect to the cabinet-mounted 9-pin DIN type receptacle shown in Figure 145: 9-Pin DIN Connector Pin Identification (from wire entry side of connectors), page 292 and may be installed temporarily or permanently, as appropriate.

If the machine is connected to a Mildata® or Drynet (dryer/shuttle controller) network (see related note below), downloading is more likely to be handled by these products. Document BICCUC01, available from the Milnor® Parts Department, 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: The currently approved printers and printer configuration settings are provided in Section 8.9 : Printer Requirements and Settings, page 301 . A pre-assembled machine-to-printer cable similar to the cable described here, is available from Milnor® (P/N 10YMK2PNTR).

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

NOTE: 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.

8.7.1 Pin Identification

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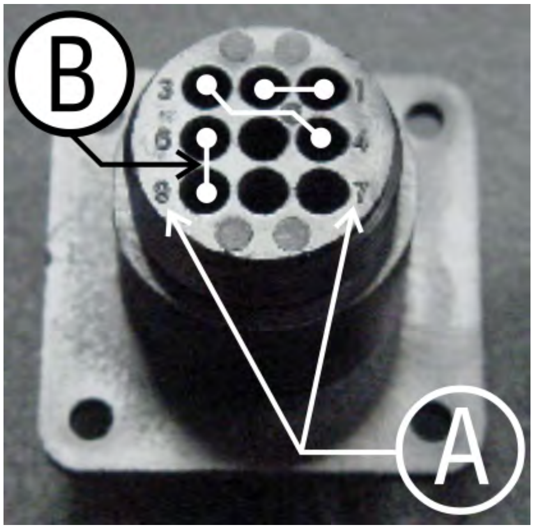
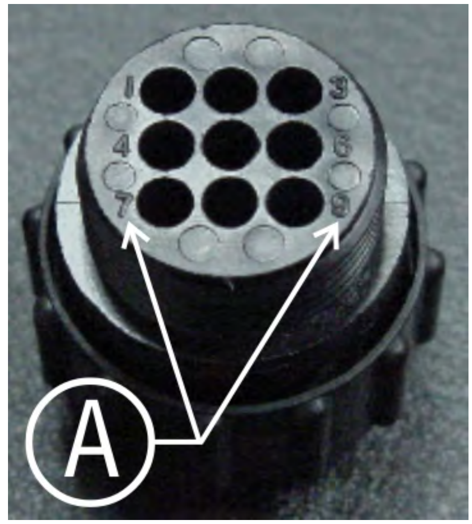
The download and printing functions use different data communication lines, but the DIN receptacle on the machine contains all of the pins used for either function. Figure 145: 9-Pin DIN Connector Pin Identification (from wire entry side of connectors), page 292 illustrates the DIN receptacle (which 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 75: External Serial Link Pin Assignments, page 292 shows the function of each pin.

Figure 145. 9-Pin DIN Connector Pin Identification (from wire entry side of connectors)

Receptacle (uses male pins)	Plug (uses female pin sockets)
	

Legend

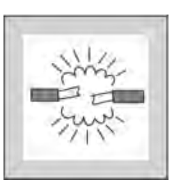
A... Pin numbers molded into parts

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

Table 75. External Serial Link Pin Assignments

Pin Number	Function	Receptacle Wiring (inside electrical enclosure)	
		Wire Number	Color Code
1, 2	Serial low	DLL	Blue and black
3, 4	Serial high	DLH	Blue and red
5	Clear to send (used for printing only)	CTS	Blue and orange
6, 9	Electronic ground	2G	Blue and white
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: **Risk of damage to electronic components** — Pin 8 is only used to supply +5VDC power to the download box and will damage components in both devices if not properly connected



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

8.7.2 How to Wire the Cables

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

8.7.2.1 Cable Specifications

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

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

8.7.2.2 Connecting a Machine to a Printer for “Print Data”

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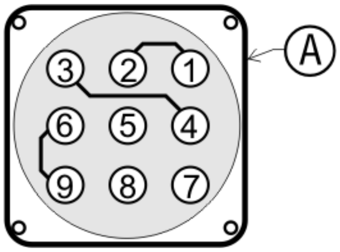
Many Milnor® microprocessor-controlled machines allow permanent or temporary connection of a serial printer for generating printed copies of formulas or status reports during operation. Figure 146: Wiring Diagram for Cable to Connect a Machine to a Printer, page 294 shows how to wire the machine-to-printer cable. Milnor® has tested and approved certain printers for this application (see previous note).

Figure 146. Wiring Diagram for Cable to Connect a Machine to a Printer

Receptacle



Legend

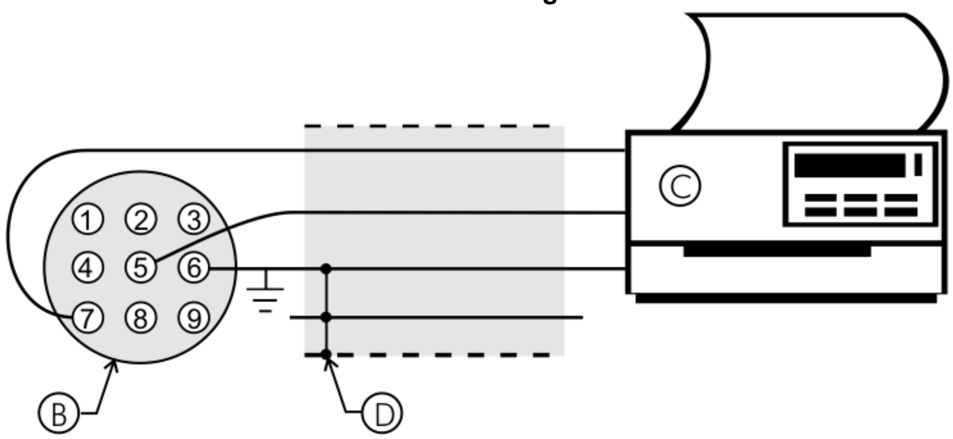
A . . . Receptacle (with male pins). Pin functions are as follows: **5**=Clear to send (CTS); **7**=Transmit data (TXD); **6&9**=Ground. This application only uses Pin 6; **1&2**=Not used in this application; **3&4**=Not used in this application; **8**=Not used in this application. See previous, related caution statement.

B . . . Plug (with female pin sockets)

C . . . Approved serial printer (see previous note)

D . . . Tie shield and spare conductor(s) on this end of cable to ground. Leave unconnected on other end.

Cable Wiring



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

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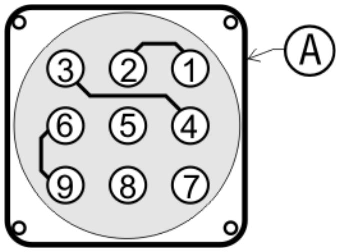
Figure 147: Wiring Diagram for Cable to Connect Two or More Machines, page 295 shows how to wire a cable to connect a bank of identical machines (the Figure 147: Wiring Diagram for Cable to Connect Two or More Machines, page 295 example shows connections for four machines) so that data programmed on 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 147. Wiring Diagram for Cable to Connect Two or More Machines

Receptacle On Each Machine



Legend

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

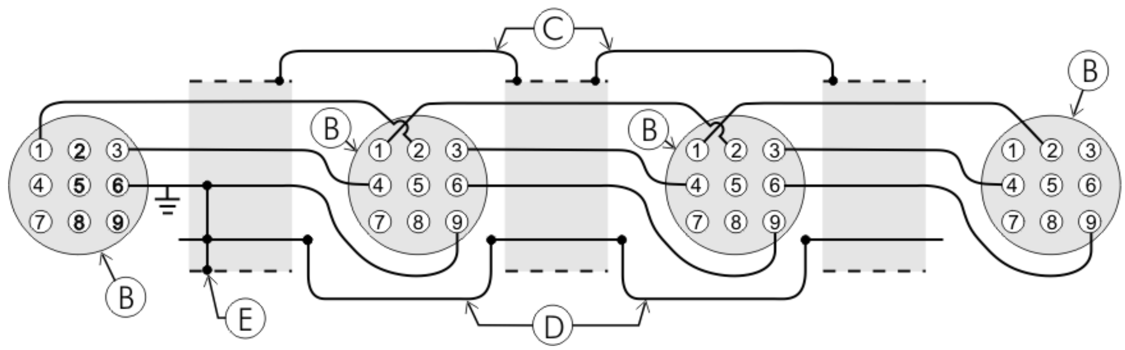
B. . . Plug on cable (with female pin sockets)

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

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

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

Cable Wiring



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

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

8.7.2.4 Connecting a Machine to a Serial Memory Storage Device

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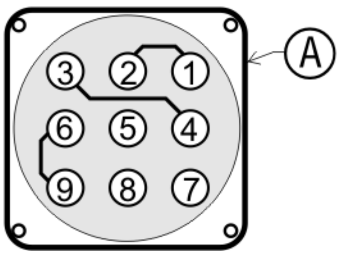
The cable used with the serial memory storage device (download box) available from Milnor®, see previous note, is permanently attached to the storage device. Cable fabrication, as shown in Figure 148: Wiring Diagram for Cable to Connect a Machine to a Serial Memory Storage Device, page 296 , is not required except for replacing a damaged cable. The memory storage device is the only application in which the power conductor (Pin 8) is used.

Figure 148. Wiring Diagram for Cable to Connect a Machine to a Serial Memory Storage Device

Receptacle



Legend

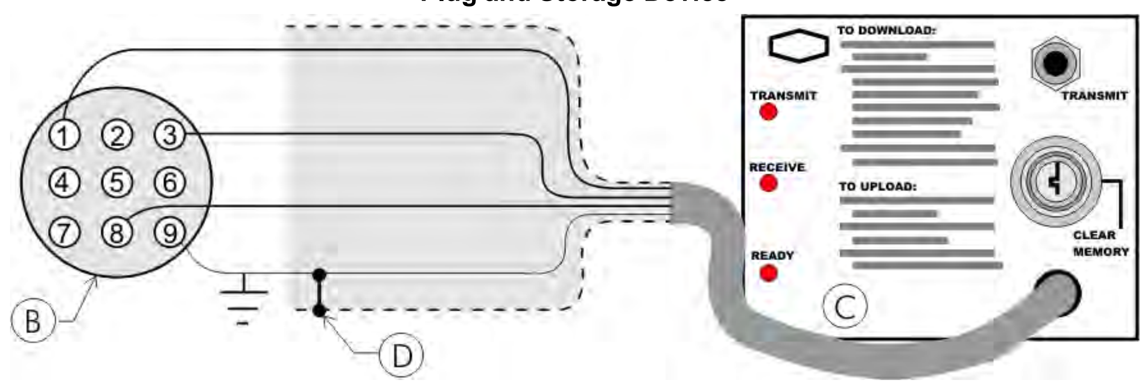
A. . . Receptacle on machine (with male pins). Pin functions are as follows: **1&2**=Serial low. This application only uses Pin 1; **3&4**=Serial high; This application only uses Pin 3. **6&9**=Ground. This application only uses Pin 9. **5&7**=Not used in this application **8**=+5VDC. Provides power to memory storage device.

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

C. . . Memory storage device (front panel may be different)

D. . . Tie shield on this end of cable to ground. Leave unconnected on other end.

Plug and Storage Device



The download device may be used with CBW®s with the serial Miltron controller. On newer CBW®s with the Mentor® controller (and assuming Mildata® is not used), data is downloaded to/ from a diskette on the Mentor® PC.

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8.8 Summary of Milnor® Allied Interface Capability, CBW®

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A Milnor® system machine may need to load from, or discharge to a non-Milnor® machine. This document summarizes allied interface capability for the Milnor® system machine equipped with Mark 5 microprocessor or later controls, as of this writing (see below note).

NOTE: Refer to the document “About Milnor® Allied Interfaces for Automated Laundering System Machines” for a general explanation of allied interfaces. Refer to “Milnor® Allied Interface Specifications and Signals” for technical information needed to implement an allied interface.

NOTE: The allied interfaces offered by Milnor® are continually evolving and the available signals can vary from one software version (date code) to another. Milnor® Tehnical Support can assist in determining data-passing capacities for specific software versions.

8.8.1 How Batch Data Travels Through a System

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The types and ranges of batch codes that the devices within an automated laundering system can handle depend on both the individual device controller and the means of communication used to pass this data from device to device. Generally, allied interfaces provide less capacity then the Miltrac™ controller because they are much more limited by hardware constraints and are developed on an as-needed basis. You will notice in Table 76: Batch Data-passing Capacity for Milnor® Allied Interfaces, page 299 that certain types of codes and code ranges do not carry over from device to device, or even from the loading to the discharge interface within the same device. Keep in mind that both down stream and upstream of a given allied interface, data will most likely be passed not via an allied interface, but rather, by the Miltrac™ controller or a similar system controller supplied by another equipment manufacturer. As of this writing, Miltrac™ is capable of passing the following codes and code ranges throughout the entire system (among all Miltrac™ devices): 256 formula codes, 16 press/extract codes, 16 dry codes, 256 goods code, 1000 customer codes, 64 destination codes, 1000 weight values, 256 cake numbers, and the following flags: single cake, empty load, low pressure, third pressure, no pressure.

8.8.2 Batch Data Signals

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This section summarizes the types and number of batch codes for which, as of this writing, batch data allied interface signals are available. As shown in Table 76: Batch Data-passing Capacity for Milnor® Allied Interfaces, page 299 , the signals that carry batch data are divided into two general categories, those that pass multi-digit batch codes (e.g., drycode) in binary, and must therefore, function in groups and those that pass a single on/off value (e.g., the “new customer” code).

Both the need for, and the specific use that any type of batch code serves can vary significantly from one installation to another. Signals traditionally used for certain batch codes can sometimes be adapted to new types of batch data. The following are the batch codes traditionally associated with allied interfaces and their traditional definitions.

Formula code identifies the wash formula used in the tunnel. Although in some systems, the wash formula may affect post-wash processing, formula codes are passed to post-wash devices primarily for accounting and record-keeping purposes (see below note).

Extract code Sometimes called press code, this identifies the extract formula, if a Milnor® centrifugal extractor is used, or the press formula, if a Milnor® single stage press is used (see below note). Extract codes do not apply to the Milnor® two-stage press which does not have formulas as such, but can be made to vary the pressure of the main bell via the Low, 3rd, and No Pressure (on/off) signals.

NOTE: Although formula code and extract code are technically different things, they can be thought of as the same by programming the Milnor® centrifugal extractor or single stage press so that the proper extract formula is invoked by a formula code of the same number. For example, program extract code 05 so that it is the proper extraction process for batches processed with formula code 05. Then simply pass the formula code to the extractor or single stage press as the extract code.

Dry code identifies the drying formula to be used in the drying or conditioning equipment.

Cooldown code identifies the cooldown procedure to be used in the dryer.

Customer code identifies the customer (commercial laundry) or department (institutional laundry) the batch belongs to.

Goods code in older Milnor® CBW®'s (with Miltron controllers), identifies a subset of a general class of goods. All batches conforming to the general class are processed using the same wash formula. But each specific goods code within that class causes variations in processing, essentially extending the range of available wash formulas. Although in some systems, the goods code may affect post-wash processing, goods codes are passed to post-wash devices primarily for accounting and record-keeping purposes.

Destination code identifies a storage location within the laundry to send the load.

Weight the dry, soiled weight of a batch, as measured by a weighing device, such as a weighing type load conveyor, upstream of the tunnel. Although in some systems, weight may affect post-wash processing, weights are passed to post-wash devices primarily for accounting and record-keeping purposes.

Cake Number in older Milnor® CBW®'s (with Miltron controllers), this is an identification number associated with each batch. The Miltron automatically assigns the numbers 000 to 255 in sequence and starts over at 255. As indicated in Table 76: Batch Data-passing Capacity for Milnor® Allied Interfaces, page 299 , allied signals are not currently available on any machine for passing this code.

New formula indicates that the batch being transferred was processed using a different formula than the previous batch (see below note).

New customer indicates that the batch being transferred belongs to a different customer than the previous batch (see below note).

NOTE: The intent of both of these signals is to provide a means of segregating batches with different formula, goods, and/or customer codes, in post-dry. They are typically used in systems that are not capable of passing (or do not need to pass) formula, goods, or customer codes. Depending on the specific situation, the signal would be actuated by the washer whenever the formula, goods, and/or customer code changes. In the Milnor® dryer controller, the “new customer” signal causes the customer code to increment by one (e.g., from 07 to 08). In such a system, the value of the customer code is irrelevant, but changing it signals downstream devices not to combine these loads.

Single cake also called “small load” or “little load”, this signal tells a shuttle to deliver, and a multi-cake dryer to accept this cake (load) by itself. This is usually done when the cake that follows belongs to a different customer and the goods should not be intermingled.

Empty load also called “empty pocket” or “pass-empty”, this signal tells the receiving device that it will not receive any goods with the batch data it is receiving. Empty pockets are sometimes used in the tunnel to perform a cleaning process or to segregate goods from incompatible baths.

Low (main) pressure tells the Milnor® two-stage press to use the lowest main bell pressure (see below note).

3rd (main) pressure tells the Milnor® two-stage press to use a lower than normal main bell pressure (see below note).

No (main) pressure tells the Milnor® two-stage press to use no main bell pressure (see below note).

NOTE: If the Low, 3rd, and No pressure signals are all off, the press will use standard (high) main bell pressure.

Table 76. Batch Data-passing Capacity for Milnor® Allied Interfaces

Data Format–>	Numeric: Groups of signals pass multi-digit batch codes in binary (number of available batch codes shown)									Non-Numeric: One signal passes a single on/off value (X indicates signal is available)				
Code Name–> Type of Interface	Formula code	Press/Extract code	Dry code	Cool down code	Customer code	Goods code	destination code	weight (tenths of units)	Cake number	New formula	New customer	Single cake	Empty load	Low, 3rd, No pressure*
CBW® (Tunnel)														
Loading	256††				1000	256††		409.5†						
Discharge 7632CBW®		16	16	4	1000		8			X	X	X		X
Discharge G3 CBW®	1000 ††@	16†††	16†††	4	256 or 1000 @	1000 ††@	8	409.5 †@		X	X	X		X

† Passes 4096 weight values (0 to 409.5 in tenths)

†† Formula codes or Goods codes, but not both.

††† 16 Drycodes or 16 Extract codes, but not both.

@ Requires optional extra data-pass board.

* Low, 3rd, and No Pressure are three separate signals.

8.8.3 Operational Signals

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A set of generic functions can be defined that encompasses most operational information that might be needed for any interface. The generic functions are helpful in understanding interfacing in general, even though it is usually possible to successfully interface any two specific machines using only a few of these functions. Table 77: Operational Functions and Available Signals, page 301 lists the generic functions and which corresponding signals are actually provided on the device(s).

The generic functions only describe the general purpose for a signal. A given signal may have a more specific meaning peculiar to the device. The signal names are taken from the schematics (may be abbreviated) and may vary from device to device. As shown in Table 77: Operational Functions and Available Signals, page 301 , the generic functions can be grouped into three categories: *directional functions*, *transfer functions*, and *confirmation functions*.

Directional functions apply specifically to communication with the shuttle or COBUC and tell the shuttle / COBUC where it must travel to align with the device it will receive from or discharge to. These are all inputs to the shuttle / COBUC and include the following:

2nd level The shuttle/COBUC must elevate to the higher of two possible levels. 2nd level is usually referred to in the documentation as “level 1” (the first level is level 0).

opposite side The shuttle must run its belt(s) backwards because the device it is receiving from or discharging to is on the opposite side of the rail from normal. See below note.

NOTE: Although the Mark 5 COBUC controls provide a signal for this function, it is not needed because the COBUC can only receive and discharge forward.

at left The shuttle/COBUC must traverse leftward.

at right The shuttle/COBUC must traverse rightward.

Transfer functions either declare that the device is now in a certain state with respect to transfer, or request that the other device achieve a certain state. The transfer functions include:

early call applies only to communication between the tunnel and a Milnor® centrifugal extractor. This function tells the extractor to end the current cycle in preparation for transfer if minimum extract time has elapsed. The Milnor® extractor input is called *end extract*.

discharge desired There are actually two possible functions: 1) *Allied discharge desired* (loading interface input) which tells the Milnor® device that the allied loading device is or soon will be ready to send a batch to it, and 2) *Milnor discharge desired* (discharge interface output) which tells the allied discharge device that the Milnor® device is or soon will be ready to send a batch to it.

load desired There are actually two possible functions: 1) *Milnor load desired* (loading interface output), which tells the allied loading device that the Milnor® device is or soon will be ready to receive a batch from it, and 2) *allied load desired* (discharge interface input), which tells the Milnor® device that the allied discharge device is or soon will be ready to receive a batch from it.

loading mode tells the receiving device to perform the actions that facilitate receiving. In the centrifugal extractor, the input is called *start extractor* and causes the load door to open or the load chute to lower, and the cylinder to turn. In the dryer, the input is called dryer is *loading* and causes the load door to open and the cylinder to turn.

discharge allowed There are actually two possible functions: 1) *allied discharge allowed* (loading interface input), which tells the Milnor® device that the allied loading device can now send, and 2) *Milnor discharge allowed* (discharging interface output), which tells the allied discharge device that the Milnor® device can now send.

load allowed There are actually two possible functions: 1) *Milnor load allowed* (loading interface output), which tells the allied loading device to begin sending, and 2) *allied load allowed* (discharge interface input), which tells the Milnor® device to begin sending.

Confirmation functions provide information on the completion status of transfer and include the following:

transfer not completed not an error condition (see below) but simply the inverse of *transfer completed*.

error: cancel transfer says that an illegal condition was detected when transfer was attempted and to stop the transfer. Currently, this function is only provided as an allied output/Milnor® input signal.

data valid the Milnor® device (in a loading interface) or the allied discharge device (in a discharge interface) that batch data are set and should now be ready. See below note.

transfer completed says that all goods have been transferred. The signal usually passes from discharging device to receiving device. Hence, this is usually an input signal in a loading interface and an output signal in a discharging interface. However, the Milnor® shuttle is also capable, via the belt photoeyes, of detecting when it has received a complete load. So if needed, it can communicate this information (in the opposite direction) to the loading device. The signal name varies, depending on the device and type of interface. See below note.

NOTE: In most cases, an explicit **data valid** signal is not needed because another operational signal serves this purpose. Where the **data valid** signal is not provided, the various tables of non-numeric signals in the document “Milnor® Allied Interface Specifications and Signals” indicate which signal should be used for this purpose.

Table 77. Operational Functions and Available Signals

Function Type–>	Directional Functions				Transfer Functions						Confirmation Functions			
Function Name–> Type of Interface	2nd level	Opposite side	At left	At right	Early call	Discharge desired	Load desired	Loading mode	Discharge allowed	Load allowed	Transfer not complete	Error: cancel transfer	data valid	transfer complete
CBW® (Tunnel)														
Loading									input: bag ready	output: start cvr. or release bag				
Discharge					output: early call*					input: press free**				***

* The CBW® "early call" output, which is used when the CBW® is interfaced with a Milnor® centrifugal extractor via an allied interface, must be user-defined (as explained in the document "Signals—CBW®'s (Tunnels) with Mark 8 and Mark 9 Controls". It is not explicitly provided.

** On the G3 CBW®, the "press free" input must be user-defined as eplained in the document "Signals—CBW®'s (Tunnels) with Mark 8 and Mark 9 Controls".

*** For most situations, the CBW® provides a "start press" output. When the CBW® is interfaced with a Milnor® centrifugal extractor, a special "start extract cycle" output must be user defined, as explained in the document "Signals—CBW®'s (Tunnels) with Mark 8 and Mark 9 Controls".

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8.9 Printer Requirements and Settings

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

8.9.1 Cable Requirements

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

Table 78. 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

8.9.2 Configuring the Citizen GSX-190 Printer

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Table 79: Required Settings for Citizen GSX-190 Printer, page 302 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 79. 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 inch		Paper out	Enable
	Front 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

8.9.3 Configuring the Epson LX300 Printer

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

Table 80. 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		

8.9.4 Previous Printer Models

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

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8.10 Requirements and Settings for Printers Used with Milnor® Controllers

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Until early 2001, Epson LX300 and Okidata ML184T printers were provided by Milnor® for printing from microprocessor controlled machines with printing functions. These printers replaced the Epson LX810 and the Epson LX800, which were shipped earlier. Refer to Milnor® document MSSM0251AE for information on these older printer models. This document supplements the user's guides for the Epson LX300 and the Okidata ML184T.

TIP: Because of the many differences among printer makes and models, Milnor® cannot ensure suitability or troubleshoot printers other than the Epson LX300 or other **approved** models used with the required interface cable.

8.10.1 Cable Requirements

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

Table 81. Cable Requirements for Printers Connected to Milnor® Devices

Part Number	Description
10MK2PNTR	100-formula washer-extractor, dryer, extractor, and Miltron (CBW®) controllers
10YCBWPNTR	Non-serial Miltron (CBW®) controller
08MPSERCBL	Mentor® (CBW®) and Mildata® controllers

8.10.2 Required Settings

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All printers shipped by Milnor® are configured to operate correctly with Milnor® equipment. If the printer is replaced or loses its configuration, refer to the user's guide to reconfigure the printer with the following values:

Table 82. Required Settings for Printers Connected to Milnor® Devices

Parameter	Value	Parameter	Value
Character spacing	10 cpi	Tractor	Single
Shape of zero	0	Interface	Serial
Skip over perforation	Off	Bit rate	9600 bps
Character table	PC 437	Parity	Even

Table 82 Required Settings for Printers Connected to Milnor® Devices (cont'd.)

Parameter	Value	Parameter	Value
Auto line feed	Off	Data length	8 bits
Page length	11 inches	ETX/ACT	On
Auto tear-off	Off		

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8.11 Hardware Components of Serial Microprocessor Controllers

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8.11.1 General

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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.**

8.11.2 Microprocessor Components

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

8.11.2.1 Keypad or Keyboard

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

8.11.2.2 Keyswitch

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

CAUTION: **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.

8.11.2.3 Display

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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 Display This type of display is identified by dark green characters on a lighter 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.

8.11.2.4 Power Supply

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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.

8.11.2.4.1 Control Console Power Supply

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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.

8.11.2.4.2 Tunnel Power Supply

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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.

8.11.2.5 Central Processing Unit (CPU) Board

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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.

8.11.2.6 Memory Expansion Board

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Increases memory space available to the processor. This board is used with 8088 CPU boards in some applications.

8.11.2.7 Battery

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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.

8.11.2.8 Opto-Isolator Board

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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.

8.11.2.9 Input/Output Board

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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 8.11.4 : Assigning Board Addresses, page 312 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.

8.11.2.10 Output Board

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A 24-output board contains 24 output relays identical to those described in Section 8.11.2.9 : Input/Output Board, page 306 .

8.11.2.11 Analog to Digital Convertor Board

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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 8.11.4 : Assigning Board Addresses, page 312). This board also has convenient test points that can be used to test voltage to the board.

8.11.2.12 Resistor Boards

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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.

8.11.2.13 Temperature Probe

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Thermistor temperature probes are temperature-sensitive resistors through which the resistance value changes with respect to the temperature of the surrounding medium (usually bath liquor). This type of device is used in washer-extractors, textile machines, and tunnel washers.

8.11.2.14 Weigh Scale Interface Board

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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.

8.11.2.15 8 Output/16 Input Chemical Flow Meter Board

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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.

8.11.3 Serial Communications Port

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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 Section 8.13 : Construction of External Serial Link Cables, page 321 , if applicable.

Table 83. Board Application by Device (Part A)

Device		CPU	Input/Output	Output	Analog to Digital	Digital to Analog	CRT	Opto-isolator	Temperature Sensing Resistor	Gas Valve Resistor	Steam Valve (4–20mA)	Thermocouple Signal Conditioner	Chemical Flow Meter	Rotation Safety	Weight Scale Interface
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

Table 83 Board Application by Device (Part A) (cont'd.)

Device	CPU	Input/Output	Output	Analog to Digital	Digital to Analog	CRT	Opto-isolator	Temperature Sensing Resistor	Gas Valve Resistor	Steam Valve (4–20mA)	Thermocouple Signal Conditioner	Chemical Flow Meter	Rotation Safety	Weight Scale Interface

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 84. Board Application by Device (Part B)

Device		CPU	Input/Output	Output	Analog to Digital	Digital to Analog	CRT	Opto-isolator	Temperature Sensing Resistor	Gas Valve Resistor	Steam Valve (4–20mA)	Thermocouple Signal Conditioner	Chemical Flow Meter	Rotation Safety	Weight Scale Interface
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

Table 84 Board Application by Device (Part B) (cont'd.)

Device	CPU	Input/Output	Output	Analog to Digital	Digital to Analog	CRT	Opto-isolator	Temperature Sensing Resistor	Gas Valve Resistor	Steam Valve (4–20mA)	Thermocouple Signal Conditioner	Chemical Flow Meter	Rotation Safety	Weight Scale Interface
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													

8.11.4 Assigning Board Addresses

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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 85. Rotary Switch Settings

Board		Washer-Extractor	VERTSTO	Extractor	Two-Stage Press	One-Stage Press	Linear COSTO	Textile	Dryer	Device Master	COBUC	COSHA
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.

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8.12 How to Upgrade Microprocessor EPROM Chips

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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.

8.12.1 How to Change EPROMs

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WARNING: **Electrocution and Electrical Burn Hazards** — Contact with electric power can kill or seriously injure you. Electric power is present inside the cabinetry unless the main machine power disconnect is off.

- Do not attempt unauthorized servicing, repairs, or modification.
- Abide by the current OSHA lockout/tagout standard when lockout/tagout is called for in the service instructions. Outside the USA, abide by the OSHA standard in the absence of any other overriding standard

8.12.1.1 Remove and Replace EPROM Chips

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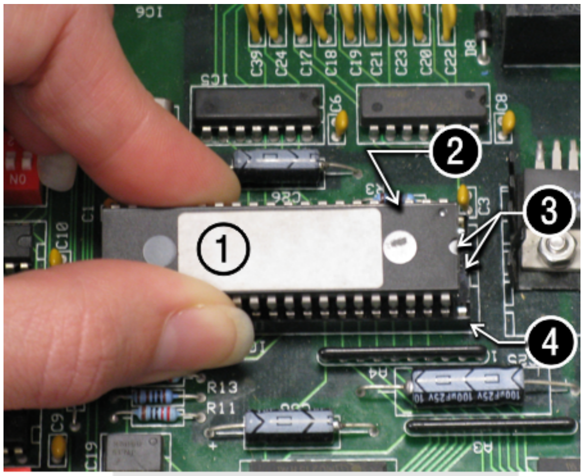
1. Make sure all power to the machine is off.
2. Locate the chips as described in Section 8.12.2 : Location of EPROM Chips, page 315 . Note the orientation of the chips as shown in the figure(s) below.
3. Use a chip removal tool or another small flat tool to carefully remove each EPROM chip from its 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 149 . 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 149. EPROM Chip Identification and Installation

EPROM Chip and Socket



Legend

1. Label—shows the software version and date code
2. EPROM chip
3. Key notch
4. EPROM socket

CAUTION: **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.

8.12.1.2 Verify Proper EPROM Chip Installation

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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, **immediately** turn the machine off and verify that the chips are correctly oriented in the sockets.

8.12.2 Location of EPROM Chips

BNCUUM01.C05 0000220354 A.2 A.7 A.4 1/2/20 1:30 PM Released

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 86. 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—	

Table 86 Processor Boards and Applications (cont'd.)

Processor Part Number	Typical Machine Applications	Comments
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)	

8.12.2.1 8085 Processor Boards (except Coin Machines)

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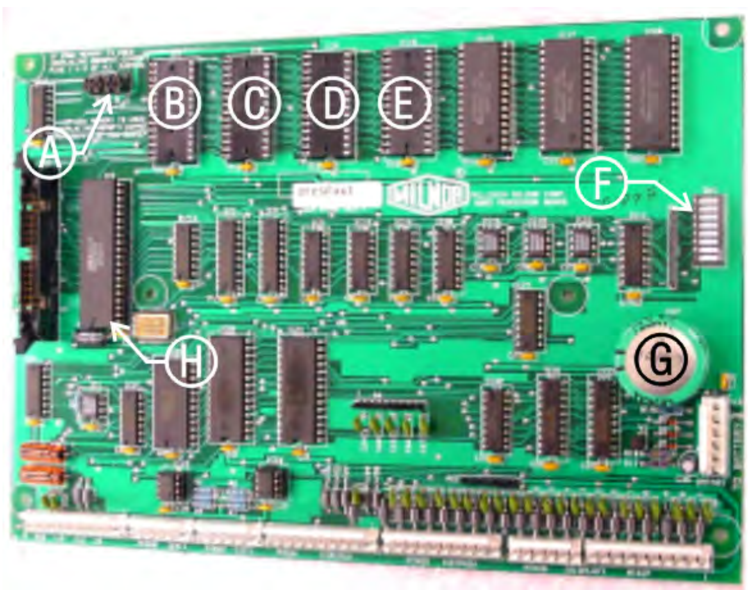
See Figure 152: 8085 Processor Boards (Except Coin Machine), page 318 . Install EPROM #1 at the end of the row nearest the corner of the board, then #2, #3, and #4. Chip #4 goes next to the two chips soldered to the board. See Figure 151: Where to Check Processor Board Voltages, page 317 for where to check for proper voltages.

Figure 150. Replacement Processor Board

<table>
<tr><td>

08BSPAA_



</td><td>

Legend

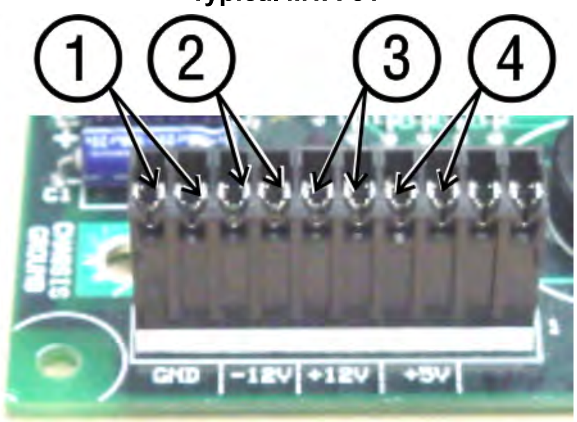
A. . . Jumpers for setting EPROM capacity
B. . . EPROM socket 1
C. . . EPROM socket 2
D. . . EPROM socket 3
E. . . EPROM socket 4
F. . . DIP switch
G. . . Capacitor
H. . . Microprocessor

</td></tr>
</table>

Figure 151. Where to Check Processor Board Voltages

<table>
<tr><td>

Typical MTA-31



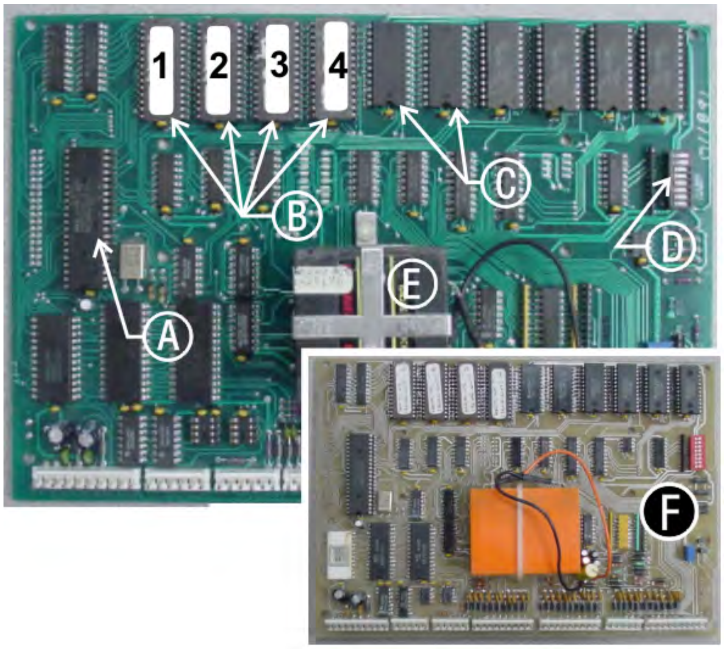
</td><td>

Legend

1. Ground (Earth)
2. Negative 12VDC
3. Positive 12VDC
4. Positive 5VDC

</td></tr>
</table>

Figure 152. 8085 Processor Boards (Except Coin Machine)

Typical 08BSP_ and 08BSPx_ Processor Boards	Legend
	**A. . .** 8085 microprocessor chip **B. . .** EPROMs **C. . .** Soldered chips **D. . .** DIP switch **E. . .** Battery **F. . .** 08BSPB_ processor board

8.12.2.2 8088 Processor Boards without Memory Expansion Board

BNCUUM01.C07 0000220349 A.2 A.7 A.3 1/2/20 1:30 PM Released

See Table 87: EPROM Locations for 8088 Processor Applications, page 319 and Figure 154: 8088 Processor Board and Optional Memory Expansion Board, page 319 . If the set consists of only one EPROM, install it in socket A of Figure 154 . 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 153. Typical 8088 Processor Board without Memory Expansion Board

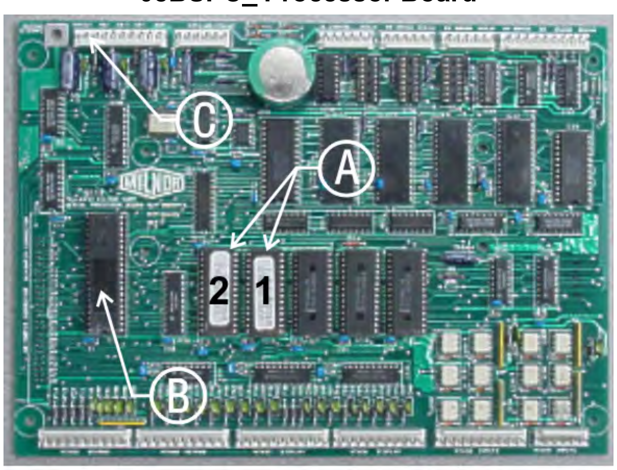
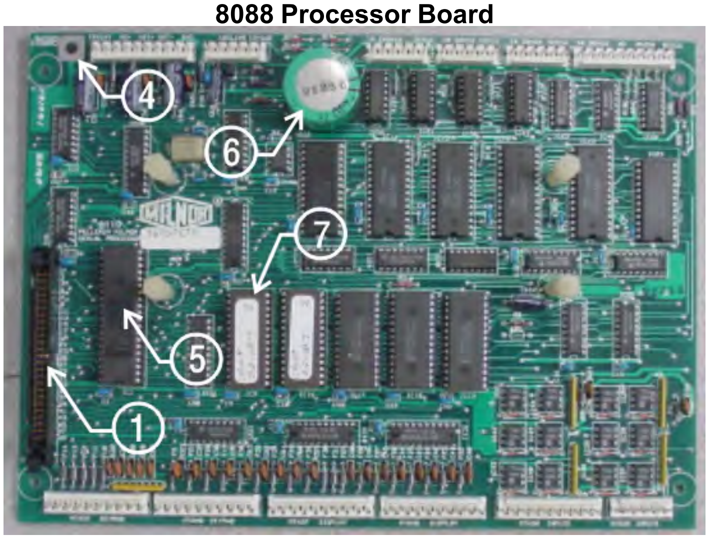
08BSPC_ Processor Board	Legend
	**A. . .** EPROMs **B. . .** 8088 processor chip **C. . .** MTA31 for voltage verification

Table 87. EPROM Locations for 8088 Processor Applications

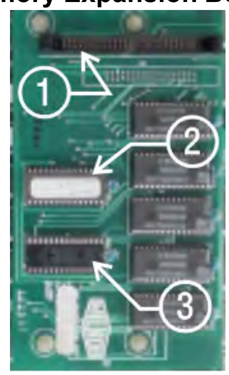
	EPROM Location by Socket			
EPROMS in Set	**A**	**B**	**IC-1**	**IC-2**
4 chips	4	3	2	1
3 chips	3	2	1	—
2 chips	2	1	—	—
1 chip	1	—	—	—

Figure 154. 8088 Processor Board and Optional Memory Expansion Board

8088 Processor Board



Memory Expansion Board



Legend

1. Connector, memory board to processor board
2. Socket IC1
3. Socket IC2
4. Chassis ground
5. 8088 microprocessor chip
6. Capacitor
7. Highest numbered EPROM

8.12.2.3 8088 Processor Boards with Memory Expansion Board

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See Table 87: EPROM Locations for 8088 Processor Applications, page 319 and Figure 154: 8088 Processor Board and Optional Memory Expansion Board, page 319 . 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.

8.12.2.4 80186 Processor Boards

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This processor board (see Figure 155: 08BSPET 80186 Processor Board, page 320) 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.

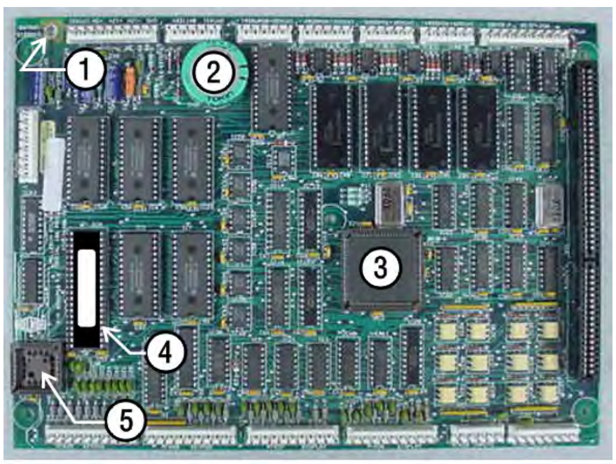
TIP: For maximum reliability and to minimize the chances of the processor board resetting due to low voltage, adjust the power supply voltage for 80186 processors to 5.10 VDC at the processor board.

There are three major revisions of this board, all of which have Milnor® part numbers starting with “08BSPE”. If the seventh character is a “1” (one), the board is a later version with a single four-channel communications chip. If the seventh character of the part number is any 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 (shown in Figure 157: 08BSPE2T 80186 Processor Board, page 321) 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.

Figure 155. 08BSPET 80186 Processor Board

Overview

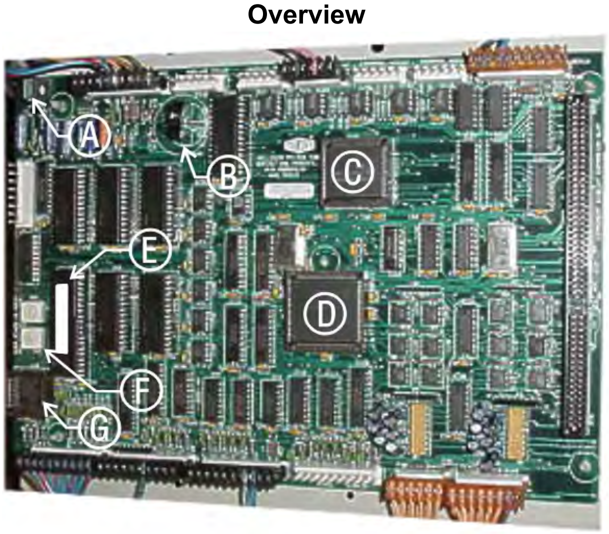


Legend

1. Chassis ground
2. Capacitor
3. 80186 microprocessor chip
4. EPROM in socket IC-2
5. ROM socket (empty except in Japan)

Figure 156. 08BSPE1T 80186 Processor Board

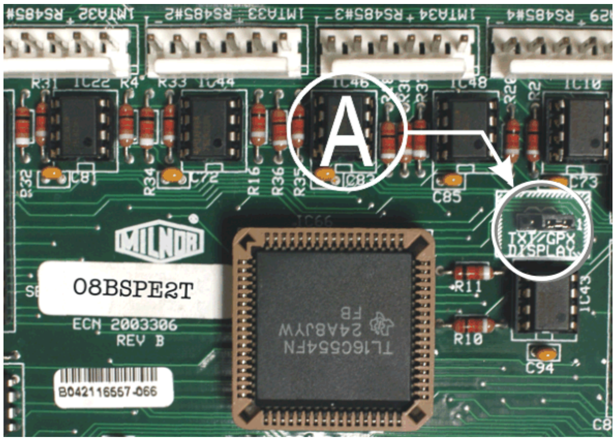
Overview



Legend

A . . . Chassis ground
B . . . Capacitor
C . . . Quad-UART chip
D . . . 80186 microprocessor
E . . . EPROM
F . . . Rotary DIP switches for keypad
G . . . ROM socket (empty except in Japan)

Figure 157. 08BSPE2T 80186 Processor Board

Detail	Legend
	**A. . .** Jumper for selecting display type

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8.13 Construction of External Serial Link Cables

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This document provides information for on-site fabrication of certain types of serial communication cables. Programmable data can be transferred between compatible machines or between a machine and a Milnor® *serial memory storage device* (see related note below), using the download cables described in Section 8.13.2.2 : Connecting Two or More Machines for Machine-to-machine Transfer, page 323 and Section 8.13.2.3 : Connecting a Machine to a Serial Memory Storage Device, page 324 respectively. These cable(s) connect to the cabinet-mounted 9-pin DIN type receptacle shown in Figure 158: 9-Pin DIN Connector Pin Identification (from wire entry side of connectors), page 322 and may be installed temporarily or permanently, as appropriate.

NOTE: The currently approved printers and printer configuration settings are provided in Section 8.9 : Printer Requirements and Settings, page 301 . A pre-assembled machine-to-printer cable similar to the cable described here, is available from Milnor (P/N 10YMK2PNTR).

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

8.13.1 Pin Identification

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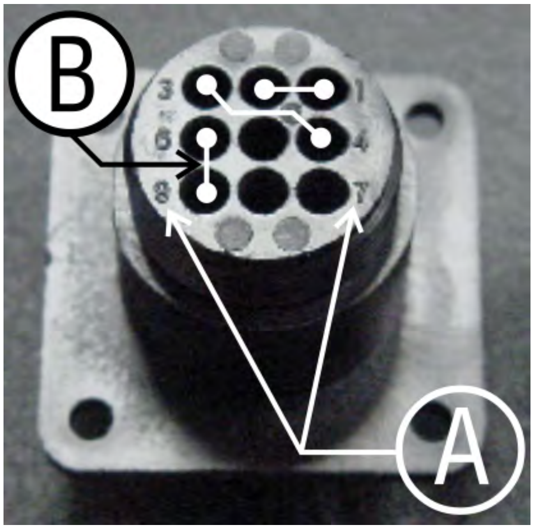
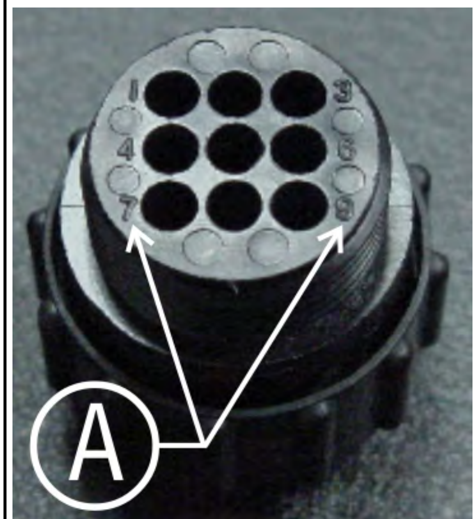
Figure 158: 9-Pin DIN Connector Pin Identification (from wire entry side of connectors), page 322 illustrates the DIN receptacle (which uses male pins) and the mating plug (which uses female pin sockets), each viewed from the **wire entry** side. The receptacle is normally installed and wired at the Milnor factory. The plug and female pin sockets for customer use are provided in a

bag inside the electric box. Table 88: External Serial Link Pin Assignments, page 322 shows the function of each pin.

Figure 158. 9-Pin DIN Connector Pin Identification (from wire entry side of connectors)

Receptacle (uses male pins)	Plug (uses female pin sockets)
	

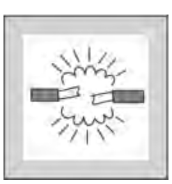
Legend

A. . . Pin numbers molded into parts
B. . . Heavy white lines terminated with dots indicate pins normally connected together at the Milnor factory

Table 88. External Serial Link Pin Assignments

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

CAUTION:



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

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

8.13.2 How to Wire the Cables

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

8.13.2.1 Cable Specifications

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

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

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

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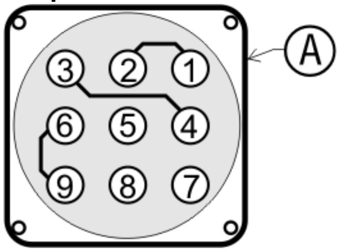
Figure 159: Wiring Diagram for Cable to Connect Two or More Machines, page 324 shows how to wire a cable to connect a bank of identical machines (the Figure 159: Wiring Diagram for Cable to Connect Two or More Machines, page 324 example shows connections for four machines) so that data programmed on 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 159. Wiring Diagram for Cable to Connect Two or More Machines

Receptacle On Each Machine



Legend

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

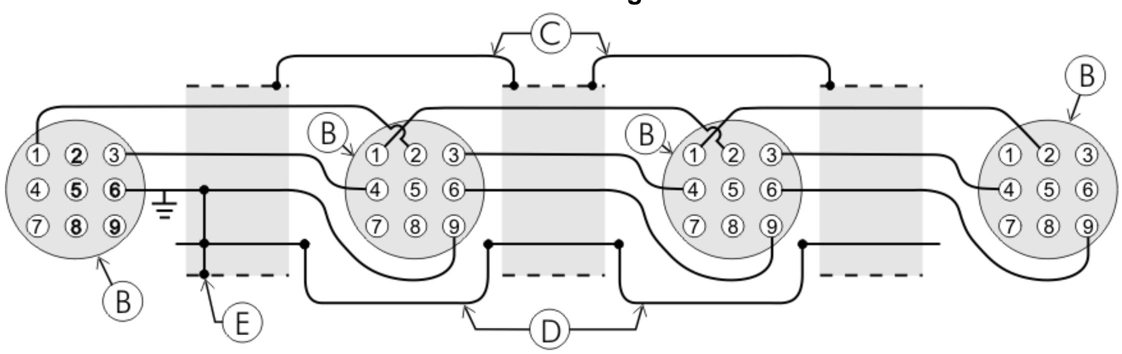
B . . . Plug on cable (with female pin sockets)

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

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

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

Cable Wiring



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

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

8.13.2.3 Connecting a Machine to a Serial Memory Storage Device

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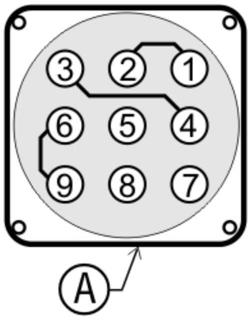
The cable used with the serial memory storage device (download box) available from Milnor, see related note in Section 8.13 : Construction of External Serial Link Cables, page 321 , is permanently attached to the storage device. Cable fabrication, as shown in Figure 160: Wiring Diagram for Cable to Connect a Machine to a Serial Memory Storage Device, page 325 , 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 160. Wiring Diagram for Cable to Connect a Machine to a Serial Memory Storage Device

Receptacle



Legend

A . . . Receptacle on machine (with male pins). Pin functions are as follows: **1&2**=Serial low. This application only uses Pin 1; **3&4**=Serial high. This application only uses Pin 3; **6&9**=Ground. This application only uses Pin 9; **5&7**=Not used in this application; **8**=+5VDC. Provides power to memory storage device.

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

C . . . Memory storage device (front panel may be different)

D . . . Tie shield on this end of cable to ground. Leave unconnected on other end.

Plug and Storage Device