Published Manual Number/ECN: MATLCOSTAE/2018103A

- **Publishing System: TPAS2**
- **Access date: 03/06/2018**
- **Document ECNs: Latest**

Technical Reference

Linear Costo™ Controller

Read the separate safety manual before installing, operating, or servicing

PELLERIN MILNOR CORPORATION POST OFFICE BOX 400, KENNER, LOUISIANA 70063-0400, U.S.A.

Table of Contents
MATLCOSTAE/18103A

PELLERIN MILNOR CORPORATION
LIMITED STANDARD WARRANTY

We warrant to the original purchaser that MILNOR machines including electronic hardware/software (hereafter referred to as "equipment"), will be free from defects in material and workmanship for a period of one year from the date of shipment (unless the time period is specifically extended for certain parts pursuant to a specific MILNOR published extended warranty) from our factory with no operating hour limitation. This warranty is contingent upon the equipment being installed, operated and serviced as specified in the operating manual supplied with the equipment, and operated under normal conditions by competent operators.

Providing we receive written notification of a warranted defect within 30 days of its discovery, we will at our option repair or replace the defective part or parts, FOB our factory. We retain the right to require inspection of the parts claimed defective in our factory prior to repairing or replacing same. We will not be responsible, or in any way liable, for unauthorized repairs or service to our equipment, and this warranty shall be void if the equipment is tampered with, modified, or abused, used for purposes not intended in the design and construction of the machine, or is repaired or altered in any way without MILNOR's written consent.

Parts damaged by exposure to weather, to aggressive water, or to chemical attack are not covered by this warranty. For parts which require routine replacement due to normal wear such as gaskets, contact points, brake and clutch linings, belts, hoses, and similar parts the warranty time period is 90 days.

We reserve the right to make changes in the design and/or construction of our equipment (including purchased components) without obligation to change any equipment previously supplied.

ANY SALE OR FURNISHING OF ANY EQUIPMENT BY MILNOR IS MADE ONLY UPON THE EXPRESS UNDERSTANDING THAT MILNOR MAKES NO EXPRESSED OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE OR PURPOSE OR ANY OTHER WARRANTY IMPLIED BY LAW INCLUDING BUT NOT LIMITED TO REDHIBITION. MILNOR WILL NOT BE RESPONSIBLE FOR ANY COSTS OR DAMAGES ACTUALLY INCURRED OR REQUIRED AS A RESULT OF: THE FAILURE OF ANY OTHER PERSON OR ENTITY TO PERFORM ITS RESPONSIBILITIES, FIRE OR OTHER HAZARD, ACCIDENT, IMPROPER STORAGE, MIS-USE, NEGLECT, POWER OR ENVIRONMENTAL CONTROL MALFUNCTIONS, DAMAGE FROM LIQUIDS, OR ANY OTHER CAUSE BEYOND THE NORMAL RANGE OF USE. REGARDLESS OF HOW CAUSED, IN NO EVENT SHALL MILNOR BE LIABLE FOR SPECIAL, INDIRECT, PUNITIVE, LIQUIDATED, OR CONSEQUENTIAL COSTS OR DAMAGES, OR ANY COSTS OR DAMAGES WHATSOEVER WHICH EXCEED THE PRICE PAID TO MILNOR FOR THE EQUIPMENT IT SELLS OR FURNISHES.

THE PROVISIONS ON THIS PAGE REPRESENT THE ONLY WARRANTY FROM MILNOR AND NO OTHER WARRANTY OR CONDITIONS, STATUTORY OR OTHERWISE, SHALL BE IMPLIED.

WE NEITHER ASSUME, NOR AUTHORIZE ANY EMPLOYEE OR OTHER PERSON TO ASSUME FOR US, ANY OTHER RESPONSIBILITY AND/OR LIABILITY IN CONNECTION WITH THE SALE OR FURNISHING OF OUR EQUIPMENT TO ANY BUYER.

BIUUUD19 (Published) Book specs- Dates: 20081231 / 20081231 / 20081231 Lang: ENG01 Applic: UUU

How to Get the Necessary Repair Components

This document uses Simplified Technical English.
Learn more at http://www.asd-ste100.org.

You can get components to repair your machine from the approved supplier where you got this machine. Your supplier will usually have the necessary components in stock. You can also get components from the Milnor® factory.

Tell the supplier the machine model and serial number and this data for each necessary component:

- The component number from this manual
- The component name if known
- The necessary quantity
- The necessary transportation requirements
- If the component is an electrical component, give the schematic number if known.
- If the component is a motor or an electrical control, give the nameplate data from the used component.

To write to the Milnor factory:

Pellerin Milnor Corporation
Post Office Box 400
Kenner, LA 70063-0400
UNITED STATES

Telephone: 504-467-2787
Fax: 504-469-9777
Email: parts@milnor.com

— End of BIUUUD19 —

Trademarks

BNUUUU02.R01 0000158093 A.2 7/13/17 1:11 PM Released

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

Table 1 Trademarks

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

End of document: BNUUUU02

Commissioning 1

Important Owner/User Information—Machines with a Keypad

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

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

1. Ensure Safety of Laundry Personnel

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

2. Protect Against Data Loss

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

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

3. Customize Data

3.1. When to Customize Data

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

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

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

Table 1: Data Type and Accessibility

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

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

— End of BICM3K01 —

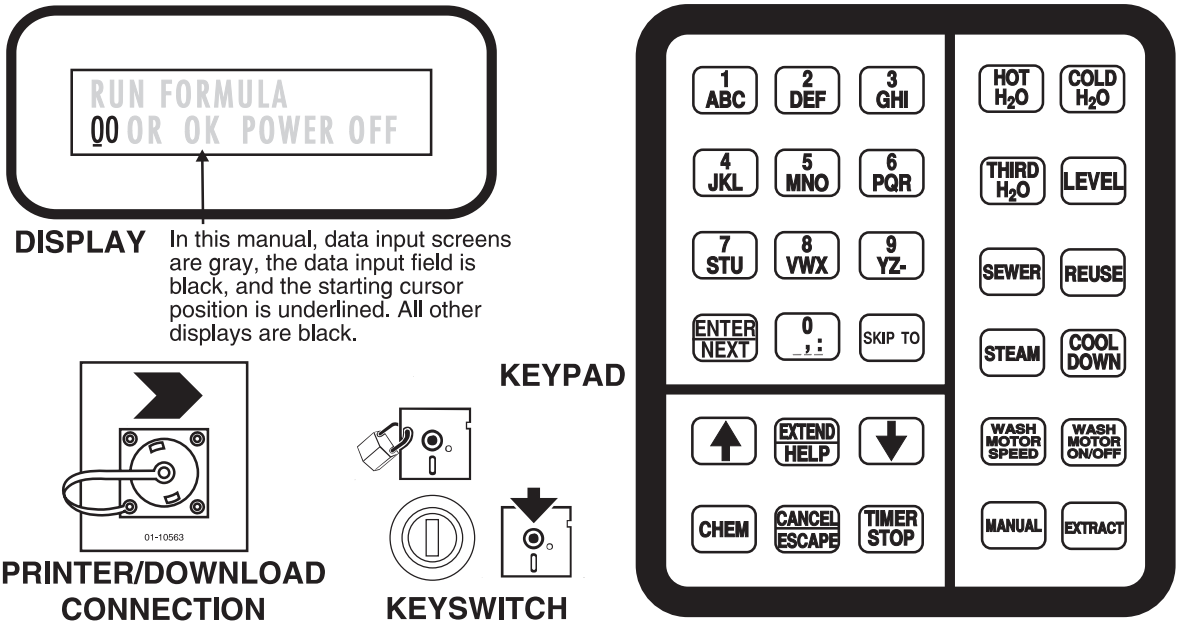
ABOUT THE USER CONTROLS— MACHINES WITH A KEYPAD

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

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

Electro-Mechanical Controls

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



Example Key Symbols Used in the Text

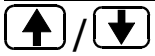
Symbology	What It Means
B 	Turn the *keyswitch* clockwise to *program* (), then press and release the *Enter/Next key*.
	Turn the *keyswitch* counterclockwise to *run* (), then press and release the *Enter/Next key*.
	Press and release the key shown.
	A slash between symbols means use either key shown. The *up* and *down arrow keys* are often shown this way (i.e., scroll up or down the menu choices).
	Typical example of a **word entry** (spells out "POLY"). In *word (alphanumeric)* data fields, press the *up* or *down arrow* key to move right or left to the next character position. Press each key until the desired character appears (e.g., press 6 PQR until "P" appears). A comma between symbols means press and release each key sequentially.
	Typical example of a **number entry** (enters the value 155). In *numeric* data fields, the cursor automatically advances to the next character position when each numeral is entered.
	A " + " between symbols means press *and hold* each key in the order shown until all keys are depressed *at the same time*, then release all keys.
hold 	Key(s) must be held depressed for the intended action to occur. Action will stop when key(s) is (are) released.
<xx> **<response>** **<password>**	This is an alternative way of depicting word and number entries when the exact values are determined by the user. <xx> means enter a two digit number. <response> means enter the value prompted for by the display. <password> means enter the password (or numeric passcode).
	Press and release the *Stop button* ( ).
B 	Press and release the *Start button* ( ).

FIGURE 1 (MSOP0235BE)
Microprocessor Interface Controls and Example Key Symbols

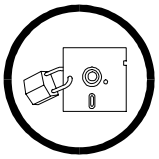
Microprocessor Interface Controls

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

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

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

⚠ CAUTION ⚠



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

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

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

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

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

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

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

Programming 2

CONFIGURE THE LINEAR COSTO

Configure decisions are accessed in the program mode (i.e., *Program/Run keyswitch* is at *program*). These decisions influence how the Linear Costo interfaces with the Miltrac "traffic cop" or with the controller for allied goods-handling devices before and after Linear Costo. Therefore, the values for these decision must match the presently installed configuration of the entire interconnected laundry system. Because configure decision are discrete to the specific machine and laundry system, they should only be changed if options are later added or removed. Although the Linear Costo is configured at the Milnor® factory, all configure decision values must be checked for accuracy at installation.

Access Configure Decisions

With Linear Costo power on, three-wire enabled, and belt not moving, display=

```
WAITING FOR LOAD OR
DISCHARGE DEVICE
```

Accesses the program mode. Display=

```
      CONFIGURE
```

Return to Run Mode From Program Mode

Repeatedly until display=

```
    TURN KEY OFF
PRESS NEXT TO EXIT
```

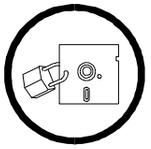
Accesses run mode. Display=

```
   INITIALIZATION
   IN PROGRESS
```

Following initialization Display=

```
WAITING FOR LOAD OR
DISCHARGE DEVICE
```

⚠ CAUTION ⚠



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

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

Enter Values for Configure Decisions

Enter Values

When the display = | CONFIGURE | ENTER/NEXT = | TOTAL STORAGE ? 1 | This is the first configure decision.

<value> **Enters the value for the current decision**, where **<value>** is the one-, two-, or three-digit number for the currently displayed decision. See the configure decisions that follow.

ENTER/NEXT **Accepts the displayed value and advances to the next decision.**

ENTER/NEXT, ENTER/NEXT, ENTER/NEXT, etc. **Advances through each decision, retaining the previously entered value.**

After advancing past the last configure decision, the display returns to the *program menu*.

Configure Decisions

Display	Range	Explanation
TOTAL STORAGE ? 1	1-8	Enter the maximum number of cakes the Linear Costo should store.
BELT CLEAR TIME SSS 000	000-255	Enter the number of seconds required to clear all the cakes off of the Linear Costo.
TIME AFTER TRAILING EDGE IN 10ths 00	00-99	Enter the number of tenths of seconds desired before the belt stops after the cake passes the load end eye when loading.
RECEIVE LEVEL ? 1	1-8	Enter the level the loading device should go to when loading the Linear Costo.
LOAD DIRECTION 0=FORWARD 1=BACK 0	0-1	Enter 0 if the belt should run forward (i.e., opposite the direction of initialization) when loading. Enter 1 if the belt should run backward (i.e., the same direction as initialization) when loading.
LOAD/UNLOAD TO SAME DEVICE? 0=NO 1=YES 0	0-1	Enter 0 if the Linear Costo cannot discharge to the device that loaded it. Enter 1 if the Linear Costo can discharge to the device that loaded it.
DISCHARGE LEVEL? 0	1-8	Enter the level the receiving device should go to when accepting goods from the Linear Costo.
OPTIMUM # OF CAKES TO UNLOAD 1	1-8	Enter the number of cakes the Linear Costo should load before it requests to discharge. Do not enter a value greater than the total belt storage. Enter 1 if the belt holds only one load. Otherwise, enter the number of loads that the receiving device can hold.

WAIT TO UNLOAD LESS THAN OPTIMUM 01 MIN	0-99	Enter the number of minutes the Linear Costo should wait before discharging if it carries less than the optimum number of cakes (as determined by *configure decision Optimum # of Cakes to Unload*). This prevents the *Optimum # . . . decision* from leaving post-Linear Costo devices empty.
HOLD LOADER WHEN BELT IS FULL 01 MIN	0-99	Enter the number of minutes the Linear Costo should hold the loading device if this device has more goods to discharge, but the Linear Costo is full. If the Linear Costo can discharge a cake while the loading device is held there, the Linear Costo can take another cake from the loading device. When this time runs out, the Linear Costo will allow the loading device to return home.
DISCH EYE LOADING ERROR ? 0=NO 1=YES 0	0-1	Enter 0 if the Linear Costo should not signal if the discharge-end photo-eye is blocked during loading. Enter 1 if the Linear Costo should signal an error if the discharge-end photo-eye is blocked during loading (i.e., a load is at the end of the belt and will fall off if the belt continues to move forward).
CHECK FOR PERIPHERAL FAILURE 0=NO 1=YES 0	0-1	Enter 0 if the controller should not check for input/output board malfunctions. Enter 1 if the controller should check for input/output board malfunctions. Set the value at 1 unless otherwise determined by the Milnor® factory during service procedures.
CAN THE XFER DEVICE CANCEL A TRANSFER? 0	0-1	Enter 0 if the Linear Costo discharges to a device unable to determine when it is full (e.g., dryer) and relies on the Linear Costa to end the transfer. Enter 1 if the Linear Costo discharges to a device that can determine when it is full (e.g., shuttle) and end the transfer.
MILTRAC ADDRESS 000	000-255	Enter the Miltrac address for the Linear Costo (may vary at each laundry—see Miltrac manual).
ALLIED LOADING? 0=NO 1=YES 0	0-1	Enter 0 if the load end of the shuttle interfaces with a Miltrac device. Enter 1 if the load end of the shuttle interfaces with a non-Miltrac device.

The following decision appears only if *Allied Loading = 1(yes)*.

PASS WEIGHT ? 0=NO 1=YES 0	0-1	Enter 0 if the cake weight data will not be passed with the load. Enter 1 if the cake weight data will be passed with the load. NOTE: Input/output board 04H is required to pass weight.
ALLIED DISCHARGE? 0=NO 1=YES 0	0-1	Enter 0 if the discharge end of the Linear Costo interfaces with a Miltrac device. Enter 1 if the discharge end of the Linear Costo interfaces with a non-Miltrac device.

The following decision appears only if *Allied Discharge = 1(yes)*.

COMPATIBILITY FDDCG 0=N/A 1=MATCH 00000	0-1 (each)	Enter the compatibility code desired for each type of data (0=match not required, 1=match required). F=Formula C=Customer code D=Dry code G=Goods code D=Destination code
MILDATA ADDRESS 000	000-255	Enter the Mildata address for the Linear Costo (may vary at each laundry—see Mildata® manual).

Linear Costo Configure Values

The configure values recorded in the microprocessor correspond to how this specific machine was equipped when installed, and how it operates with its interfacing devices. Changes in options on this machine or its interfacing devices may require changing these values. Record the configure values here each time they are changed, and keep this record of values and this manual in a safe place.

TOTAL STORAGE	=_____	DISCH EYE LOADING ERROR	=_____
BELT CLEAR TIME	=_____	CHECK FOR PERIPHERAL FAILURE	=_____
TIME AFTER TRAILING EDGE	=_____	XFER DEVICE CANCEL	=_____
RECEIVE LEVEL	=_____	MILTRAC ADDRESS	=_____
LOAD DIRECTION	=_____	ALLIED LOADING	=_____
LOAD/UNLOAD TO SAME DEVICE	=_____	PASS WEIGHT	=_____
DISCHARGE LEVEL	=_____	ALLIED DISCHARGE	=_____
OPTIMUM # OF CAKES	=_____	COMPATIBILITY	=_____
WAIT TO UNLOAD < OPTIMUM	=_____	MILDATA ADDRESS	=_____
HOLD LOADER	=_____		

Operating 3

RUN THE LINEAR COSTO IN AUTOMATIC

The machine's normal operating mode is fully automatic. After the machine is set for automatic operation, a new load and its batch codes passes from the loading device to the machine each time a loading device discharges. Then the machine stores the batch and waits for a signal to transfer the batch or receive another batch from the loading device.

Start the Operating Day

Be Safe—Comply with all safety instructions in this manual and on this machine.

Verify Switch Positions

Set the *Run/Program keyswitch* to *run.*

Energize Microprocessor Controller

Set the *Master switch* to *on*. The operator signal sounds and a series of displays appear.

```
COPYRIGHT PELLERIN
MILNOR 1990
```

```
ALL RIGHTS RESERVED
"LINEAR COSTO" 88100
```

```
THREE WIRE DISABLED
  PRESS START TO GO
```

Is the last display in the series.

⚠ WARNING ⚠

Machine motion can cause you to fall or become entangled in or struck by nearby objects if you stand, walk, or ride on the machine. Shuttles and conveyor belts move automatically.

☞ **Keep yourself and others off of machine.**

Energize Machine Control—Press the *Start button* to initialize for automatic operation and silence the operator signal.

Displays indicate machine actions and prompt for cake data for any position where the machine detects a load during initialization.

DOES POSITION *p* HAVE A CAKE? 0=NO 1=YES 1	Press 0, NEXT to answer no and prompt for next question. Press 1, NEXT to answer yes and enter cake data. See "Enter Cake Data" in this section.
WAITING FOR LOAD OR DISCHARGE DEVICE	The machine is ready for automatic operation.

Monitor Normal Operation

Load Operation

WAITING FOR LOAD OR DISCHARGE DEVICE	The Linear Costo is idle and waiting to be loaded. Miltrac signals to "Do Nothing."
WAITING FOR LOAD	The Linear Costo is waiting for a load with the load flag down. Miltrac signals "Get Ready To Receive."
LOADING THE BELT COMPLETE	The load end photo-eye has been blocked and cleared. The cake was loaded onto the Linear Costo.

Discharge Operation

WAITING FOR LOAD OR DISCHARGE DEVICE	The Linear Costo is idle and waiting to discharge. Miltrac signals "Do Nothing."
WAITING FOR UNLOAD DEVICE TO GET READY	The Linear Costo is waiting to discharge with the discharge flag down. Miltrac signals "Get Ready To Transfer."
UNLOADING BELT	The Linear Costo is discharging the cake.
UNLOADING BELT COMPLETE	The discharge end photo-eye has been blocked and cleared. The cake was discharged onto the receiving device.

Confirm Cake Data

When normal operation resumes following a power loss, morning start up, any error (see "LINEAR COSTO ERROR MESSAGES"), or manual intervention, the controller runs the belt(s) (i.e., initializes) to determine if any goods are on the belt(s). If the photo-eye detects goods (i.e., the photo-eye blocks), the controller prompts the user for certain information, as explained below.

To verify its photo-eye has detected goods, the controller prompts

```
DOES POSITION p HAVE
A CAKE? 0=NO 1=YES 1
```

Where *p* indicates position. Default=1(yes). See **NOTE** below.

0, ENTER/NEXT **(No) Tells the controller that there are no goods for this position.**

```
WAIT FOR LOAD AND
DISCHARGE DEVICE
```

If all goods positions are answered No (see **NOTE**), then the Linear Costo is ready to be loaded.

or

1 ABC, ENTER/NEXT or ENTER/NEXT **(Yes) Tells the controller that goods are still on the Linear Costo and prompts**

```
ENTER FORMULA
FOR POSITION 0   XXX
```

Where XXX is the wash formula. Change number if necessary.

ENTER/NEXT **Accepts the displayed formula number,** and the controller prompts for confirmation of additional information: extract code, dry code, destination, customer, goods code, weight, cake number, and single cake information.

When all cake data is entered, the normal power up sequence resumes.

NOTE: If the Linear Costo has more than one goods position per belt, the controller prompts for batch codes for each goods position on the belt until *0 (No)* is entered.

View Data on the Display During Operation

Cake data (batch codes), inputs, outputs, and Miltrac commands can be viewed while the Linear Costo is operating (i.e., the three wire is enabled). All this data is useful for troubleshooting, but cake information is also useful for determining the status of individual batches.

Access, Scroll, and Exit the Data Menu

When display= `WAITING FOR LOAD OR DISCHARGE DEVICE`

2 DEF — Displays one of the five types of data each time it is pressed, or scrolls through all menu choices if held depressed. Pressing 2 DEF with cake data displayed returns to the normal run display.

View Miltrac Commands

2 DEF displays

```
DLLCDCLSDSRSTSLL
 0 0 0 0 0 0 0 0
```

DL (Discharge Level)—the level at which the Linear Costo tells the receiving device to receive goods.

LC (Load End Command)—what the Miltrac system is telling the Linear Costo to do at its load end.

0 Do nothing
1 Get ready to receive
2 Get ready to receive right
3 Get ready to receive left
4 Start receiving
5 Finished receiving
6 You are finsihed receiving (Do Not Hold)

DC (Discharge End Command)—what the Miltrac system is telling the Linear Costo to do at its discharge end.

0 Do nothing
1 Get ready to discharge
2 Get ready to discharge right
3 Get ready to discharge left
4 Start discharging
5 You are finished discharging
6 You are finished discharging (Do Not Hold)

LS (Load End Status)—what the Linear Costo is telling the Miltrac system about its load end.

0 Cannot do anything
1 Want to receive
2 Ready to receive
3 I am finished receiving
4 I am finished receiving (Do Not Hold)

DS (Discharge End Status)—what the Linear Costo is telling the Miltrac system about its discharge end.

0 Cannot do anything
1 Want to discharge
2 Ready to discharge
3 I am finsished discharging
4 I am finished discharging (Do Not Hold)

RS (Linear Costo Receive State)—for factory use only

TS (Linear Costo Transfer State)—for factory use only

LL (Load Level)—the level where the Linear Costo tells the loading device to discharge goods.

View Cake Position Status

2 DEF displays

```
POSITION  0123   <-- Cake position
LOADED=1  0000   <-- Status:
                     0=Position not loaded with a cake
                     1=Position loaded with a cake
```

View Inputs

2 DEF Displays first 16 inputs (1: A-P). Located on first 16/8 board.

```
(1) ABCDEFGHIJKLMNOP
    -+-+-+-+-+-+-+-+
```

"+" = input energized
"-" = input not energized

SKIP TO Displays second 16 inputs (2:A-P). Located on 2nd 16/8 board.

SKIP TO Displays third 16 inputs (3:A-P). Located on 3rd 16/8 board.

SKIP TO Displays fourth 16 inputs (4:A-P). Located on 4th 16/8 board.

SKIP TO Displays fifth 16 inputs (5:A-P). Not currently used.

Page 1: First 16 Inputs (standard)			Page 2: Second 16 Inputs (optional)	
Display Code	**Input Name**	**Connector/Pin**	**Input Name**	**Connector/Pin**
A	Load eye end	1MTA3-10	Goods code in bit 0	2MTA3-10
B	Discharge end eye	1MTA3-9	Goods code in bit 1	2MTA3-9
C	Not used	1MTA3-8	Goods code in bit 2	2MTA3-8
D	Not used	1MTA3-7	Goods code in bit 3	2MTA3-7
E	Not used	1MTA3-4	Goods code in bit 4	2MTA3-4
F	Not used	1MTA3-3	Goods code in bit 5	2MTA3-3
G	Not used	1MTA3-2	Goods code in bit 6	2MTA3-2
H	Not used	1MTA3-1	Goods code in bit 7	2MTA3-1
I	Not used	1MTA4-10	Customer code in bit 0	2MTA4-10
J	Not used	1MTA4-9	Customer code in bit 1	2MTA4-9
K	Not used	1MTA4-8	Customer code in bit 2	2MTA4-8
L	Unload Device ready	1MTA4-7	Customer code in bit 3	2MTA4-7
M	System Discharge OK	1MTA4-4	Customer code in bit 4	2MTA4-4
N	Load allowed	1MTA4-3	Customer code in bit 5	2MTA4-3
O	Discharege allowed	1MTA4-2	Customer code in bit 6	2MTA4-2
P	Three wire	1MTA4-1	Customer code in bit 7	2MTA4-1

Page 3: First 16 Inputs (optional)			Page 4: Second 16 Inputs (optional)	
Display Code	**Input Name**	**Connector/Pin**	**Input Name**	**Connector/Pin**
A	Drycode bit 0	3MTA3-10	Weight in bit 0	4MTA3-10
B	Drycode bit 1	3MTA3-9	Weight in bit 1	4MTA3-9
C	Drycode bit 2	3MTA3-8	Weight in bit 2	4MTA3-8
D	Drycode bit 3	3MTA3-7	Weight in bit 3	4MTA3-7
E	Destination code bit 0	3MTA3-4	Weight in bit 4	4MTA3-4
F	Destination code bit 1	3MTA3-3	Weight in bit 5	4MTA3-3
G	Destination code bit 2	3MTA3-2	Weight in bit 6	4MTA3-2
H	Destination code bit 3	3MTA3-1	Weight in bit 7	4MTA3-1
I	Get ready to load	3MTA4-10	Not used	4MTA4-10
J	Start loading	3MTA4-9	Not used	4MTA4-9
K	Get ready to discharge	3MTA4-8	Not used	4MTA4-8
L	Start discharge	3MTA4-7	Not used	4MTA4-7
M	Not used	3MTA4-4	Not used	4MTA4-4
N	Not used	3MTA4-3	Not used	4MTA4-3
O	Not used	3MTA4-2	Not used	4MTA4-2
P	Allied Transfer Cancelled	3MTA4-1	Not used	4MTA4-1

View Outputs

2 DEF — Displays first 16 outputs (1: a-p). Located on first 16/8 board.

```
(1) abcdefghijklmnop
    -+-+-+-+-+-+-+-+
```

"+" = output energized
"-" = output not energized

SKIP TO — Displays second 16 outputs (1: a-p). Located on second16/8 board.

Page 1: First 16 Outputs			Page 2: Second 16 Outputs	
Display Code	**Output Name**	**Connector/Pin**	**Output Name**	**Connector/Pin**
a	Run belt forward	1MTA5-9,8	Drycode out bit 0	3MTA5-9,8
b	Run belt rearward	1MTA5-6,5	Drycode out bit 1	3MTA5-6,5
c	Signal	1MTA5-4,3	Drycode out bit 2	3MTA5-4,3
d	Load Flag Down	1MTA5-2,6-10	Drycode out bit 3	3MTA5-2,6-10
e	Unload Priority	1MTA6-2,1	Destination code out bit 0	3MTA6-2,1
f	Not used	1MTA6-4,5	Destination code out bit 1	3MTA6-4,5
g	Not used	1MTA6-6,7	Destination code out bit 2	3MTA6-6,7
h	Discharge flag down	1MTA6-8,9	Destination code out bit 3	3MTA6-8,9
i	Not used	2MTA5-9,8	Not used	4MTA5-9,8
j	Want to receive	2MTA5-6,5	Not used	4MTA5-6,5
k	Ready to receive	2MTA5-4,3	Not used	4MTA5-4,3
l	Finished receiving	2MTA5-2,6-10	Not used	4MTA5-2,6-10
m	Not used	2MTA6-2,1	Not used	4MTA6-2,1
n	Want to discharge	2MTA6-4,5	Not used	4MTA6-4,5
o	Ready to discharge	2MTA6-6,7	Not used	4MTA6-6,7
p	Finished discharge	2MTA6-8,9	Not used	4MTA6-8,9

View Cake Data

2 DEF displays

```
CAKE FM DC DS CC  GC
 01  00 00 00 000 00
```

CAKE—Cake postion; the first position (01) starts at the discharge end of the belt.
FM—Formula for the cake position
DC—Dry Code for the cake position
DS—Destination Code for the cake position
CC—Customer Code for the cake positon
GC—Goods Code for the cake position

Interruptions in Normal Operation

Holds Ahead of the Linear Costo—Anytime the flow of goods onto the Linear Costo stops (as might be caused by a hold condition in the loading device), the Linear Costo remains at *Waiting For Load Or Discharge Device*. When the flow of goods resumes, the Linear Costo resumes operation without manual intervention.

Holds Behind the Linear Costo—Anytime the Linear Costo desires to discharge but cannot because the receiving device (e.g., dryer) is not ready, the Linear Costo waits and displays *Waiting For Load Or Discharge Device*. As soon as the receiving device is available, the transfer occurs, and normal operation resumes without manual intervention.

Power Loss or Three-Wire Disabled Condition—If the Linear Costo loses power or the three-wire circuit drops out (as will occur if an emergency stop switch is pressed), the Linear Costo stops immediately. The Linear Costo resumes operation, as explained in "Restore Power" in this section, as soon as the power or three-wire circuit connection is restored, regardless of how long the Linear Costo was stopped. See NOTE below.

NOTE: It is not usually necessary to load or unload the Linear Costo before returning it on-line with the controller. Upon restoring power, the Linear Costo initializes and resumes normal automatic operation. It automatically synchronizes with its interfacing devices (e.g., press, dryer), providing the Linear Costo was not in the middle of loading or receiving goods at power loss. See "Restore Power" in this section.

Restore Power

The intervention required to return the Linear Costo on-line depends on which of the following conditions occurred:

- Power was lost or the three-wire was disabled other than during transfer.
- Power was lost or the three-wire was disabled during transfer.

If Power Was Lost or the Three-Wire was Disabled Other Than During Transfer

When the *Master switch* is set at *on* or the power is restored, the power up sequence appears, then the display =

THREE WIRE DISABLED PUSH START TO GO

The control power is energized, but not machine power.
Press the *Start button*.

⚠ WARNING ⚠

Machine motion can cause you to fall or become entangled in or struck by near-by objects if you stand, walk, or ride on the machine. Shuttles and conveyor belts move automatically.

☞ **Keep yourself and others off of machine.**

INITIALIZATION IN PROGRESS	The three-wire circuit is armed, the alarm is silenced, and the machine is energized.

The Linear Costo may prompt for cake data. The Linear Costo resumes normal operation. See “Monitor Normal Operation.”

If Power Was Lost or the Three-Wire Was Disabled During Transfer—A power loss or three-wire disabled condition may occur when a transfer was in progress leaving goods partially on the Linear Costo and partially on the loading or receiving device. Use the following procedure to ensure that all goods are transferred to either the Linear Costo or the loading or receiving device.

When the *Master switch* is set at *on* or the power is restored, the power up sequence appears, then the display =

THREE WIRE DISABLED PUSH START TO GO	The control power is energized, but not machine power.

⚠ CAUTION ⚠

Goods extending past the end of a conveyor belt after a power loss or three-wire disabled condition can catch on machinery during machine movement, causing damage to goods or machinery. These goods must be moved either onto the Linear Costo or onto the transferring device before the Linear Costo is permitted to move automatically.

1. Taking all safety precautions, move the goods either completely onto the Linear Costo or completely onto the transferring device, ensuring that any goods on the Linear Costo are not hanging over the edge of the belt where they can catch on machinery.
2. Correct the malfunction that caused the three-wire disabled condition.

⚠ WARNING ⚠

Machine motion can cause you to fall or become entangled in or struck by nearby objects if you stand, walk, or ride on the machine. Shuttles and conveyor belts move automatically.

☞ **Keep yourself and others off of machine.**

3. Press the *Start button,* and the Linear Costo resumes normal operation.

OPERATE THE LINEAR COSTO MANUALLY AND TEST THE OUTPUTS

The Linear Costo can be operated manually from the controls through the manual menu accessible at the controller. By actuating outputs in manual, most microprocessor outputs can be tested.

Access the Manual Menu

	When the display=	WAITING FOR LOADING OR RECEIVING DEVICE	This is the *run mode*. It is possible to enter *manual mode* from other displays, but Milnor® recommends using this display.
1 ABC	Accesses *manual mode*	TURN OUTPUT ON 1	Allows operator to test outputs or operate the Linear Costo manually.
ENTER NEXT	Accesses the manual menu	RETURN TO RUN MODE 01 OFF	
0 _,: , 2 DEF	Accesses *Run Belt Forward* output	RUN BELT FORWARD 02 OFF	Allows operator to run the belt forward by pressing ENTER NEXT to turn the output *on* and *off*.

Following is a complete list of outputs/manual functions that can be accessed through the manual mode.

01 Return to Run Mode	08 Relay (06)	15 Want to Discharge	22 Destination Bit 0
02 Run Belt Forward	09 Relay (07)	16 Ready to Discharge	23 Destination Bit 1
03 Run Belt Rearward	10 Relay (08)	17 Finished Discharge	24 Destination Bit 2
04 Signal	11 Want to Load	18 Drycode Bit 0	25 Destination Bit 3
05 Put Flag Down	12 Ready to Load	19 Drycode Bit 1	
06 Relay (04)	13 Finished Loading	20 Drycode Bit 2	
07 Relay (05)	14 Relay (12)	21 Drycode Bit 3	

For Quick Return to *Run Mode* From *Manual Mode*

ENTER NEXT	Turns *off* any output that is *on*.	RUN BELT FORWARD 02 OFF	
0 _,: , 1 ABC	Accesses first manual menu selection.	RETURN TO RUN MODE 01 OFF	
ENTER NEXT	Returns to *run mode*.	WAITING FOR LOADING OR RECEIVING DEVICE	Linear Costo is ready for normal automatic operation.

Operate Manual Functions

01=Return to Run Mode

When the display=

```
RETURN TO RUN MODE
01 OFF
```

ENTER/NEXT =

```
WAITING FOR LOADING
OR RECEIVING DEVICE
```

Linear Costo ready for normal automatic operation.

02=Run Belt Forward

0, 2 DEF

```
RUN BELT FORWARD
02 OFF
```

ENTER/NEXT

Activates relay K0 on input/output board 1, causing the belt to run forward.

03=Run Belt Rearward

0, 3 GHI

```
RUN BELT REARWARD
03 OFF
```

ENTER/NEXT

Activates relay K1 on input/output board 1, causing the belt to run rearward.

04=Signal

0, 4 JKL

```
SIGNAL
04 OFF
```

ENTER/NEXT

Activates relay K2 on input/output board 1, activating the operator signal.

05=Put Flag Down

0, 5 MNO

```
PUT FLAG DOWN
05 OFF
```

ENTER/NEXT

Activates relay K3 on input/output board 1, causing the Linear Costo to extend its target for the loading device.

06=Relay (04)

0, 6 PQR

```
RELAY (04)
06  OFF
```

ENTER/NEXT

Activates relay K4 on input/output board 1, signaling unload priority.

07=Relay (05)

0, 7 STU

```
RELAY (05)
07 OFF
```

ENTER/NEXT

Activates relay K5 on input/output board 1.

08=Relay (06)

0, 8 VWX

```
RELAY (06)
08 OFF
```

ENTER/NEXT

Activates relay K6 on input/output board 1.

09=Relay (07)

0, 9 YZ

```
RELAY (07)
09 OFF
```

ENTER NEXT

Activates relay K7 on input/output board 1, causing the Linear Costo to extend its target for the receiving device.

NOTE: Remaining relays available only if allied loading or allied discharge option installed.

10=Relay (08)

1 ABC, 0

```
RELAY (08)
10 OFF
```

ENTER NEXT

Activates relay K0 on input/output board 2.

11=Want To Load

1 ABC, 1 ABC

```
WANT TO LOAD
11 OFF
```

ENTER NEXT

Activates relay K1 on input/output board 2, signaling the loading device that the Linear Costo wants to load.

12=Ready To Load

1 ABC, 2 DEF

```
READY TO LOAD
12 OFF
```

ENTER NEXT

Activates relay K2 on input/output board 2, signaling the loading device that the Linear Costo is ready to load.

13=Finished Loading

1 ABC, 3 GHI

```
FINISHED LOADING
13 OFF
```

ENTER NEXT

Activates relay K3 on input/output board 2, signaling the loading device that the Linear Costo is finished loading.

14= Relay (12)

1 ABC, 4 JKL

```
RELAY (12)
14 OFF
```

ENTER NEXT

Activates relay K4 on input/output board 2.

15=Want To Discharge

1 ABC, 5 MNO

```
WANT TO DISCHARGE
15 OFF
```

ENTER NEXT

Activates relay K5 on input/output board 2, signaling the receiving device that the Linear Costo wants to discharge.

16=Ready To Discharge

1 ABC, 6 PQR

```
READY TO DISCHARGE
16 OFF
```

ENTER NEXT

Activates relay K6 on input/output board 2, signaling the receiving device that the Linear Costo is ready to discharge.

17=Finished Discharge

1 ABC, 7 STU

```
FINISHED DISCHARGE
17 OFF
```

ENTER NEXT

Activates relay K7 on input/output board 2, signaling the receiving device that the Linear Costo is finished discharging.

The following four outputs pass drycode data to an allied receiving device in 4-bit binary format where bit 0 is the least significant bit and bit 3 is the most significant bit:

18=Drycode Bit0

1 ABC, 8 VWX

```
DRYCODE BIT0
18 OFF
```

ENTER NEXT

Activates relay K0 on input/output board 3.

19=Drycode Bit1

1 ABC, 9 YZ-

```
DRYCODE BIT1
19 OFF
```

ENTER NEXT

Activates relay K1 on input/output board 3.

20=Drycode Bit2

2 DEF, 0 _,:

```
DRYCODE BIT2
20 OFF
```

ENTER NEXT

Activates relay K2 on input/output board 3.

21=Drycode Bit3

2 DEF, 1 ABC

```
DRYCODE BIT3
21 OFF
```

ENTER NEXT

Activates relay K3 on input/output board 3.

The following four outputs pass drycode data to an allied receiving device in 4-bit binary format where bit 0 is the least significant bit and bit 3 is the most significant bit:

22=Destination Bit0

2 DEF, 2 DEF

```
DESTINATION BIT0
22 OFF
```

ENTER NEXT

Activates relay K4 on input/output board 3.

23=Destination Bit1

2 DEF, 3 GHI

```
DESTINATION BIT1
23 OFF
```

ENTER NEXT

Activates relay K5 on input/output board 3.

24=Destination Bit2

2 DEF, 4 JKL

```
DESTINATION BIT2
24 OFF
```

ENTER NEXT Activates relay K6 on input/output board 3.

25=Destination Bit3

2 DEF, 5 MNO

```
DESTINATION BIT3
25 OFF
```

ENTER NEXT Activates relay K7 on input/output board 3.

Discharging a Cake

5 MNO + 8 VWX + ENTER NEXT Overrides the configured *Wait to Unload Less Than Optimum* time, allowing the Linear Costo to discharge when the belt holds less than the configured *Optimum Number of Cakes*. This function can be performed irrespective of the message on the display.

Troubleshooting 4

LINEAR COSTO ERROR MESSAGES

The following messages can result from an error condition (e.g., improper procedure, component failure, mechanical malfunction) or while correcting an error condition.

The following errors can usually be corrected at the operator controls.

LOADING ERROR PRESS SIGNAL CANCEL

Miltrac cancelled the loading (receiving) transfer in progress.
RECOVERY: Check the loading device and correct errors found there. Press the *Signal Cancel button*, and enter cake data to resume operation.

DISCH DEV CANCELLED PRESS SIGNAL CANCEL

Miltrac cancelled the discharging transfer in progress.
RECOVERY: Check the receiving device and correct errors found there. Press the *Signal Cancel button* and enter cake data to resume operation.

WRONG DATA ENTERED PRESS SIGNAL CANCEL

After discharging, the photo-eye detected a cake where a cake should not be or did not detect a cake where one should be.
RECOVERY: Ensure the photo-eye is operating properly. Press the *Signal Cancel button*, and enter cake data to resume operation.

DISCH EYE BLOCKED PRESS SIGNAL CANCEL

The discharge photo-eye detected goods at the discharge end during loading. This error appears only if *Discharge Eye Loading Error configure decision* value = 1.
RECOVERY: Ensure the photo-eye is operating properly. Press the *Signal Cancel button* and enter cake data to resume operation.

ALLIED XFER CANCEL PRESS SIGNAL CANCEL

Allied transfer cancelled with loading or discharging in progress.
RECOVERY: Check the allied device for error messages. Correct any error in the device. Press the *Signal Cancel button* and enter cake data to resume operation.

The following error usually requires accessing program data and procedures in this manual.

BOARD xx HAS FAILED PRESS SIGNAL CANCEL

Connectors are loose or improperly placed on a newly installed board, incorrect voltage is being received by the board, the machine is configured for an option not available (e.g., pass data), or a board was installed that is configured for an option not on the machine, or the board failed. This error appears only if *Check for Peripheral Failure configure decision* value = 1.
RECOVERY: Ensure the connectors are tight and the correct voltage is present at the peripheral boards. Press the *Signal Cancel button* to reset the controller and access the program menu. Review configure decisions to ensure that the required peripheral boards are provided for all configured options. If everything is configured correctly, replace the failed board. Automatic operation can resume when the problem is resolved.

Supplemental Information 5

Memory Download Box Applications

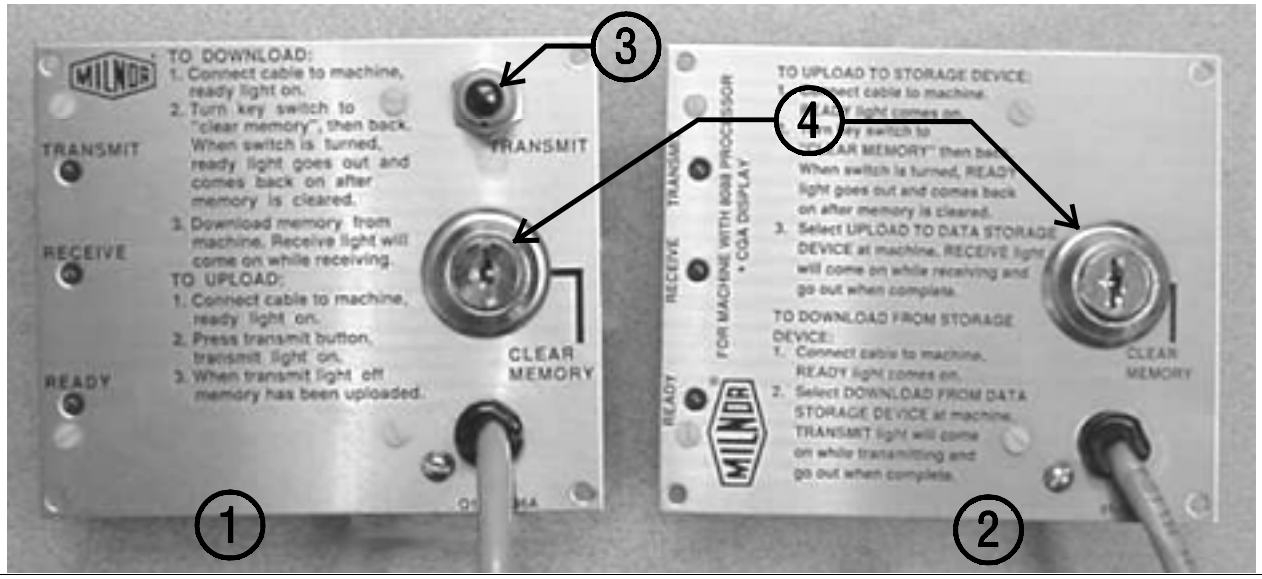
Document..... BICUDC01
Specified Date..... 20010807
As-of Date..... 20010807
Access Date..... 20010807

Applicability..... YUD CUD
Language Code..... ENG01

The memory download box is used to store configuration and formula data for most current models of Milnor® machines. Two types of download boxes (Figure 1) are available: one with a *Transmit* button on the front panel, and one without the button. The *Transmit* button is not required for machines—usually CBW® controllers and similar devices—which are capable of initiating the data transfer.

Figure 1: Download Box Identification

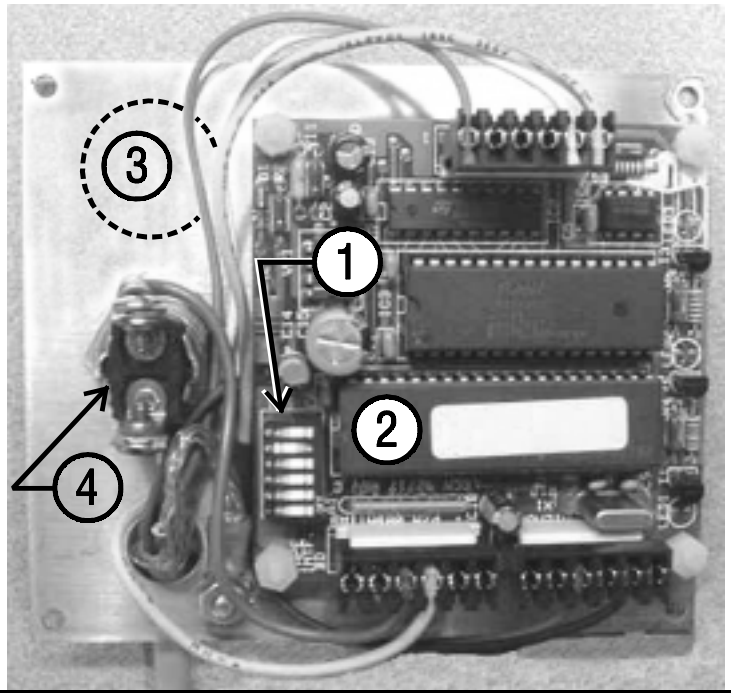
Faceplate Comparison



Legend

1. Download box **with** *Transmit button*
2. Download box **without** *Transmit button*
3. *Transmit button*
4. Key switch

Figure 2: Rear View of Circuit Board

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

Supplement 1

Interpreting the DIP Switch Settings

Use the following codes and their definitions to set the DIP switch positions for the equipment, as shown in Table 1.

A. All switch positions are OFF.

B. Switch position 4 is ON; all other switch positions are OFF.

C. Switch position 5 is ON; all other switch positions are OFF.

D. Switch positions 1 and 5 are ON; all other switch positions are OFF.

Note 1: If necessary, a memory download box with the *Transmit* button may be used to store configuration and formula data from any machine that's capable of downloading. When using a button-equipped download box to store data from one of the devices listed in Table 1 as requiring the *Transmit* button, ignore the button. The download will begin when commanded from the device control panel.

Table 1: DIP Switch Positions

Processor Board	Software Version	DIP Switch Setting
Uses Memory Download Box WITH Transmit Button		
Washer-extractor Models		
8088	All	C
80186	98000-98003	C
	98004-99004	not supported
	99005-9900B	D
	20000-20003	D
FxW, FxP, and FxS Washer-extractor models		
8088	All	C
80186	98000-98003	C
	98004-98009	not supported
	9800A-9800H	D
	20000-2000B	D
Textile and Dye Machine Models		
8088	All	C
80186	95000-95305M	C
	95305N-95306	D
	20000-20004	D
Dryer Models		
8088	All	C
80186	All	C
Centrifugal Extractor Models		
8088	All	C
80186	All	C
Single-station Press Models		
8088	All	C

Processor Board	Software Version	DIP Switch Setting
Uses Memory Download Box WITHOUT Transmit Button		
Miltron Controller for CBW System		
8088	All	A
80186	All	B
Miltrac		
8088	All	A
80186	All	B
Milrail Rail Controller		
8088	All	A
80186	All	B
Device Master		
8085	All	not supported
8088	All	not supported
80186	94000-94017	not supported
	94018	B
	20000-present	B
Linear Costo Master		
8085	All	not supported
8088	All	not supported
80186	94000-94011	not supported
	20000-present	B

Key:

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

— End of BICUDC01 —

NOTICE

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

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

If your machine uses printed circuit boards containing one DIP switch, refer to MSFDA401**D**E to set the address on replacement boards. If your machine uses printed circuit boards containing rotary switches, refer to MSFDA401**E**E.

BMP970004/97071

Hardware Components of Serial Microprocessor Controllers

1. General

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

2. Microprocessor Components

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2.16. Signal Conditioner for Thermocouple—Amplifies and filters the output from a thermocouple so an analog to digital board can convert the signal to digital values for the microprocessor.

2.17. Rotation Safety Board—Used in dryers. Reads rotational safety proximity switch to confirm that the basket is turning.

2.18. Temperature Probe—Two types of temperature probes are used, depending on equipment type:

Thermistor temperature probe—a temperature-sensitive resistor whose resistance value changes with respect to temperature; uses include washer-extractors, textile machines, and tunnel systems.

Thermocouple temperature probe—a closed loop of two dissimilar metals which produces a voltage with respect to the change in temperature between the two junctions. Thermocouples are used in dryers.

2.19. Weigh Scale Interface Board—In the electrical circuit, this device is between the weighing conveyor (CONWA) load cell and the weighing conveyor analog to digital board. It filters and interprets the signals from the conveyor load cell to the analog to digital board.

2.20. 4-20mA Output Board—Used on newer textile machines and steam dryers with temperature control. See Section 2.15 "Resistor Boards" in this document.

2.21. 8 Output/16 Input Chemical Flow Meter Board—This board is used with the metered chemical injection option on textile machines. Eight outputs and eight counters respectively are assigned to chemical valves and chemical flow meters. Two of the counters are non-isolated direct inputs to the microprocessor on this board and are capable of counting pulses of 0 to 5VDC at a frequency of up to 10kHz. The remaining six counters are optically isolated from the peripheral board microprocessor and are capable of counting pulses from 0 to 12VDC at a frequency up to 150 Hz.

3. Serial Communications Port

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

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

Table 1: Board Application by Device (Part A)

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

Table 2: Board Application by Device (Part B)

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

4. Assigning Board Addresses

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

Table 3: Rotary Switch Settings

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.

— End of BICMDF01 —

INTERFACING MILNOR LINEAR COSTOS WITH ALLIED SYSTEMS

Milnor® Linear Costos can be supplied with potential-free contacts to permit interfacing with allied loading and unloading systems, including electromechanical (relay-oriented) systems, to pass the batch codes listed in "Table of Batch Codes" in this section. For all signals *to* Milnor®, the allied equipment must provide potential-free contacts capable of faithfully conducting low energy signals of 5 to 150 milliamps at 5VDC to 12VDC. These signals ground a Milnor® computer input and go directly into the computer. Therefore, never run them adjacent to, or in the same conduit with any other wires. For all signals *from* Milnor®, Milnor® provides potential-free contacts capable of conducting up to a maximum of 3VA at up to a maximum of 120VAC. Only use these signals to close 120VAC interface relays (a source of 120VAC is available for this purpose (see schematic manual)), and do not use them to directly energize any device consuming more current (3VA) or requiring a higher voltage (120VAC) than stipulated.

⚠ CAUTION ⚠

All Milnor® signals are conducted by "traces" on the computer boards. These traces may burn out if called upon to handle heavy currents. Thus, they must never be connected to a load greater than 3VA at 120VAC (a maximum of .125 amperes at a maximum of 120VAC). Heavier loads may burn out the traces and ruin expensive computer boards.

When the Miltrac system controls the Linear Costo for loading and discharging goods, the Linear Costo receives and sends the Linear Costo codes and batch codes (cake data) through the Miltrac serial link. When the Linear Costo is manually loaded and Miltrac controls discharging, the operator must use the Remote Formula Entry controls (see the description of controls in the operator manual) to indicate the batch codes associated with the loaded goods.

When the Linear Costo is automatically operated using the Miltrac system for loading or discharging, but not both, or when the Linear Costo is fully operated by an allied system, the Miltrac interface is as described above. Allied interface details are given in the schematic manual.

Table of Batch Codes

Code	Number of Codes Available When Passed Via		Consequences
	MILTRAC	Data Pass	
Dry code	16	16	Invokes desired dry cycle.
Destination	64	16	Routes goods to desired after-dry destination.
Formula	256	N/A	Identifies formula code assigned to these goods.
Extractor	16	N/A	Identifies extractor code assigned to these goods.
Customer	1000	N/A	Identifies customer code assigned to these goods.
Goods	256	N/A	Identifies goods code assigned to these goods.
Weight	999	N/A	Identifies weight code assigned to these goods.
Cake Number	256	N/A	Identifies cake number assigned to these goods.