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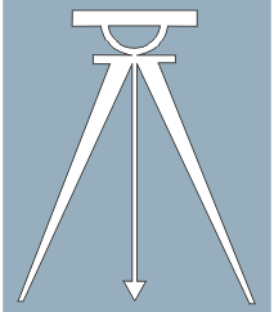
Installation—

Allied Interfaces for Milnor® Automated Laundering System Machines (Mark 5 Controls and Later) with Addendum1: BNCLDI01



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

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

Applicable Milnor® products by model number:

76028L4F	76028L4S	76028L5F	76028L5S	76028M4F	76028M4S	76028M5F
76028M5S	76028S3F	76028S3S	76028S4F	76028S4S	76028S5F	76028S5S
76028W3F	76028W3S	76028W4F	76028W4S	76028W5F	76028W5S	76032C2F
76032T2F	76032Y2F	76039L3F	76039L3S	76039L4F	76039L4S	76039M3F
76039M3S	76039M4F	76039M4S	76039S3F	76039S3S	76039S4F	76039S4S
76039S5F	76039S5S	76039W3F	76039W3S	76039W4F	76039W4S	76039W5F
76039W5S	MP2501CL	MP2501CR	MP2501L-	MP2501R-	MP2601CL	MP2601CR
MP2601L-	MP2601R-	MP2606CL	MP2606CR	MP2606L-	MP2606R-	MP1540CL
MP1540CR	MP1540L-	MP1540R-	MP1550CL	MP1550CR	MP1550L-	MP1550R-
MP1601CL	MP1601CR	MP1601LF	MP1601R-	MP1601RT	MP1602CL	MP1602CR
MP1602LF	MP1602RT	MP1603CL	MP1603CR	MP1603L-	MP1603R-	MP1604CL
MP1604CR	MP1604L-	MP1604R-	MP1A03CL	MP1A03CR	MP1A03L-	MP1A03R-
M7V4232C	M7V4232L	M7V4232R	M7V4836C	M7V4836L	M7V4836R	M7V4840C
M9S4232C	M9S4232L	M9S4232R	M9V4232C	M9V4232L	M9V4232R	M9V4840C
M9V4840L	M9V4840R	MMS4232C	MMS4232L	MMS4232R	MMV4232C	MMV4232L
MMV4232R	MXS4232C	MXS4232L	MXS4232R	MXV4232C	MXV4232L	MXV4232R
50040CS1	50040SA1	50040SB1	50040TG1	50040TS1	50040TT1	5040TS2L
5040TS2R	58040CS1	58040CT1	58040SA1	58040SB1	58040TG2	58040TS1
58040TT1	58058CS1	58058CT1	58058SA1	58058SB1	58058TG2	58058TS1
58058TT1	58080CS1	58080CT1	58080SA1	58080TG1	58080TS1	58080TT1
64058TG1	6458ATG1	6458TS1L	6458TS1R	72072TG1	CA3605CS	CA3608CS
CA3610CS	CA4005XS	CA4008CS	CA4008XS	CA4010CS	CA4010XS	CL3605CS
CL3607CS	CL3608CS	CL3608FS	CL3608MS	CL3608XS	CL3610CS	CL3610MS
CL3614MS	CL4005CS	CL4005XS	CL4008CS	CL4008FS	CL4008JS	CL4008MS
CL4008XS	CL4010CS	CL4010DH	CL4010DS	CL4010FH	CL4010FS	CL4010JS
CL4010MH	CL4010MS	CL4010XH	CL4010XS	CL4014FS	CL4014MS	CL4808MS
CL4810MS	COELF111	COELF112	COELF113	COELF121	COELF122	COSHA111
COSHA112	COSHA113	COSHA114	COSHA121	COSHA122	COSHE122	COSHJ112
COSHJH12	COSTA112	COSTA113	COSTA114	COSTA121	COSTA122	COSTA123
COSTA124	COSTE112	COSTE113	COSTE114	COSTE122	COSTE123	COSTE124
COSTQ114	COSTR112	COBUC-E-	COBUC-T-	CTLDEV16	CTLDEVM4	CTLDEVM8

Addendum

Milnor / Softrol Interface for the 68036M5K Washer-extractor with Dryell

BNCLDI01.C01 0000088961 A.5 A.6 Released

This document describes a Milnor / Softrol allied interface used in a “hands-off” laundering system where a Milnor 68036M5K washer-extractor with dryell receives from, and discharges to allied (non-Milnor) machines. The Milnor machine is controlled by a dedicated MilTouch-EX controller. The “hands-off” system is controlled by a Softrol controller. The interface passes operational signals between Milnor and Softrol in both directions. It passes batch data (formula codes) from Softrol to Milnor only.

1. Signals Summary

BNCLDI01.R02 0000089063 A.4 A.6 Released

Operational (non-numeric) Signals

Softrol Side			Milnor Side		
Function Name	**Signal Ident.**	**Signal Direction**	**Function Name**	**Connection Point (s)**	**Signal Direction**
Load/unload Ready	A201	Output	Load Allowed	3MTA4-6	Input
Load Desired	A205	Input	Load Desired	3M5-7/3M5-16	Output
Load Sequence	A202	Output	Allied Start Loading	3M4-13	Input
Begin Sequence	A207	Input	Start Loading	4M14-11/4M14-2	Output
End Sequence	A204	Output	Allied Loading Complete	3M4-16	Input
Load/unload Ready	A201	Output	Discharge Allowed	3MTA4-5	Input
Unload Desired	A206	Input	Discharge Desired	4M13-4/4M13-14	Output
Unload Sequence	A203	Output	Allied Start Discharge	3M4-17	Input
Begin Sequence	A207	Input	Start Discharge	4M14-12/4M14-3	Output
End Sequence	A204	Output	Allied Discharge Complete	3M4–15	Input
Washer Clear	A208	Input	Washer Clear	4MTA13–9 & 19	Output*
* When the washer is in the wash or load position with a known door position (either open or closed), Milnor will signal “Washer Clear”, indicating that the unloader is free to move. If the door is in an unknown position or the washer is in , A208 “Washer Clear” will not be on.					

Batch Code (numeric) Signals

Softrol Side			Milnor Side		
Function Name	**Signal Identifier**	**Signal Direction**	**Function Name**	**Connection Point (s)**	**Signal Direction**
Binary 1	Input S8–01	Output	Formula Bit 0	4MTA4–1	Input
Binary 2	Input S8–02	Output	Formula Bit 1	4MTA4–2	Input
Binary 4	Input S8–03	Output	Formula Bit 2	4MTA4–3	Input
Binary 8	Input S8–04	Output	Formula Bit 3	4MTA4–4	Input
Binary 16	Input S8–05	Output	Formula Bit 4	4MTA4–5	Input
Binary 32	Input S8–06	Output	Formula Bit 5	4MTA4–6	Input
Binary 64	Input S8–07	Output	Formula Bit 6	4MTA4–7	Input
Binary 128	Input S8–08	Output	Formula Bit 7	4MTA4–8	Input

2. Sequence of Operation

BNCLDI01.R01 0000088960 A.5 A.6 Released

Terms

Term **Definition**
Milnor The MilTouch-EX controller on the 68036M5K washer-extractor
washer The Milnor 68036M5K washer-extractor
washer safe position The washer position that is clear of allied movement: washer rear down, elbow up and locked.
Softrol The Softrol controller
loader The rail system from which the washer-extractor receives goods
unloader The shuttle conveyor to which the washer-extractor discharges goods
allied The loader and unloader (non-Milnor machines)
allied safe positions The loader and unloader positions that are clear of washer movement

Washer Loading Sequence

Device	Required Condition	Action
Softrol	loader and unloader are in allied safe positions	Softrol signals “Load/unload Ready” which makes the Milnor “Load Allowed” input.
Milnor	Milnor “Load Allowed” input made	Washer moves to load position: Rear full down, elbow down and locked, bifold door open. Milnor signals “Load Desired” which makes the Softrol “Load Desired” input.
Softrol	Softrol “Load Desired” input made	Loader moves to its discharge position. Softrol signals “Load Sequence” which makes the Milnor “Allied Start Loading” input. This state continues until loading is complete and the loader returns to the allied safe position.

Device	Required Condition	Action
Milnor	Milnor “Allied Start Loading” input made	Washer starts rotating. Milnor signals “Start Loading” which makes the Softrol “Begin Sequence” input.
Softrol	Softrol “Begin Sequence” input made	Loader discharges completely. Softrol signals “End Sequence” which makes the Milnor “Allied Loading Complete” input.
Milnor	Milnor “Allied Start Loading” and “Allied Loading Complete” inputs made.	Milnor reads formula from Formula inputs (see Operational (non-numeric) Signals). Milnor stops signaling “Load Allowed” and “Start Loading” which un-make the Softrol “Load Desired” and “Begin Sequence” inputs.
Softrol	Softrol “Load Desired” and “Begin Sequence” inputs un-made	Loader clears the washer. Softrol stops signaling “Load Sequence” and “End Sequence” which un-makes the Milnor “Allied Start Loading” and “Allied Loading Complete” inputs.
Milnor	Milnor “Allied Start Loading” and “Allied Load Complete” inputs un-made	Washer bifold door closes, washer tilts to wash position and executes the wash formula.

Washer Discharge Sequence

Device	Condition	Action
Softrol	loader and unloader are in allied safe positions	Softrol signals “Load/unload Ready” which makes the Milnor “Discharge Allowed” input.
Milnor	Milnor “Discharge Allowed” input made	Washer moves to washer safe position. Milnor signals “Discharge Desired” which makes the Softrol “Unload Desired” input.
Softrol	Washer in washer safe position. Softrol “Unload Desired” input made	Unloader moves to its receive position. Softrol signals “Unload Sequence” which makes the Milnor “Allied Start Discharge” input. This state continues until loading is complete and the unloader returns to its allied safe position.
Milnor	Milnor “Allied Start Discharge” input made	Washer tilts to unload position: Rear full up, elbow up and locked. Milnor signals “Start Discharge” which makes the Softrol “Begin Sequence” input. Washer executes the discharge sequence.
Softrol	Softrol “Begin Sequence” input made.	Unloader receives from the washer to completion. Softrol signals “End Sequence” which makes the Milnor “Allied Discharge Complete” input.

Device	Condition	Action
Milnor	Milnor “Allied Start Discharge” and “Allied Discharge Complete” inputs both made	Washer stops unloading rotation. Milnor stops signaling “Discharge Desired ”and “Start Discharge” which un-makes the Softrol “Unload Desired” and “Begin Sequence” inputs.
Softrol	Softrol “Unload Desired” and “Begin Sequence” inputs both un-made	Unloader moves to allied safe position. Softrol stops signaling “Unload Sequence” and “End Sequence” which un-makes the Milnor “Allied Start Discharge” and “Allied Discharge Complete” inputs.
Milnor	“Allied Start Discharge” and “Allied Discharge Complete” inputs both un-made	Washer tilts to the load position: Rear up, bi-fold door open, elbow down and locked. Milnor signals “Washer Clear” and “Load Desired”

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Preface

BICALC15 (Published) Book specs- Dates: 20110314 / 20110314 / 20171130 Lang: ENG01 Applic: CCL CP2 CP1 CXU CDU CSX CSW YCD

i. About Manual MTPALI01—Allied Interfaces for Milnor® Automated Laundering System Machines (Mark 5 Controls and Later)

This manual is intended for use by the technician involved in installing and troubleshooting an allied interface between a Milnor system machine and an allied (non-Milnor) device, and by those involved in the development of allied interfaces. A Milnor machine provides allied interface(s) if its control system includes inputs/outputs intended to communicate directly with allied devices.

Portions of the information provided herein are included in the reference and schematic manuals for the respective machine types.

i. 1. Scope

This manual is a comprehensive explanation of the Milnor® allied interfaces provided with the following product types used in automated laundering systems:

- 76032 CBW® (Mark 8)
- G3 CBW (Mark 9)
- Single stage press (Mark 5)
- Two stage press (Mark 5)
- Centrifugal extractor (Mark 5)
- Shuttle (Mark 5)
- COBUC (Mark 5)—shuttle for wet goods
- Dryer (Mark 5)
- The portion of the Device Master controller that supports the use of an allied dryer in a Miltrac™ system (Device Type 3).

The following product types also provide allied interfaces, but are **not** currently included in this manual. Contact Milnor Technical Support for assistance with these:

- Certain washer-extractors (when used in automated laundering system).
- Front End Loader—For a laundry that wishes to use an allied device such as a non-Milnor press in a Miltrac system, this controller provides an allied interface with greater functionality than a machine-to-machine interface can provide.
- Device Master device types other than Device Type 3. Device Master can be used to control conveyors for any of several specialized purposes. In some cases, these conveyors receive from, and/or discharge to allied devices.
- Linear COSTA and Linear COSTA Master controllers—used to control multi-cake storage conveyor(s). In some cases, these conveyors receive from, and/or discharge to allied devices.

- Shuttle Call—a relay logic controller typically used to control the sequence in which a bank of washer-extractors discharge to a Milnor shuttle. The washer-extractors may be non-Milnor.

For clarification, Discharge Sequencer (for discharge sequencing a bank of Milnor dryers), Link Master (for linking two Miltrac systems) and Vertsto (for controlling vertical cake storage conveyors) are system controllers that either do not provide for, or are not likely to be interfaced with allied devices.

i. 2. How to Identify this Manual and its Included Documents [Document BIUUUD13]

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

Use the specifications on the front cover of this manual to identify this manual or the included documents. This section tells about these specifications.

Published manual number—The primary identification number for the manual.

Specified date—The first assembly date for the machine or change about which this manual gives data.

As-of date—The company makes new manuals about items that are not new. These new manuals will include data started before this date.

Access date—The date Milnor prepared the manual for its publication.

Depth—"Detail" manuals show the maximum available data. "Synopsis" manuals show the minimum necessary data. A manual with more data goes with a synopsis manual.

Custom—A value of "n/a" here shows that this manual applies to all machines identified on the inner front cover of the manual. Other values show the laundry name and a code for the specified machine.

Applicability—Each value here shows the machines or model numbers that this manual applies to. The inner front cover shows the full list of the applicable models. If this value is "not used," this manual has a different function.

Language Code—The value here shows the language and dialect of this manual. "Eng01" shows that the manual uses United States English.

Refer to a **document** in this manual with all of the specifications shown on the front cover. Replace the published manual number with the document number.

i. 3. Trademarks [Document BIUUUD14]

i. 3.1. Trademarks of Pellerin Milnor Corporation—These words are trademarks of Pellerin Milnor Corporation:

Table 1: Trademarks

CBW®	E-P Plus®	Mentor®	MilTouch™	RinSave®
E-P Express®	ExactXtract®	Mildata®	Milnor®	Staph Guard®
E-P OneTouch®	Gear Guardian®	MilMetrix®	PulseFlow®	Visionex®
	GreenTurn™		RecircONE™	

i. 3.2. Trademarks of Other Companies—These words are trademarks of other companies:

Table 2: Trademarks

Acronis®	IBM®	Microsoft Office XP®	Microsoft Access®	Siemens®
Atlas 2000®	Microsoft Windows 2000®	Microsoft Windows NT®	Microsoft Windows XP®	Seagate Crystal Reports®
		Yaskawa®		

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BIUUUK06 (Published) Book specs- Dates: 20110314 / 20110314 / 20171130 Lang: ENG01 Applic: CCL CP2 CP1 CXU CDU CSX CSW YCD

ii. Contacting Milnor®

Your authorized Milnor dealer can assist you with any aspect of your Milnor machine and is familiar with local conditions that may be pertinent to its installation, use, or maintenance. Always contact your dealer first. Should you or your dealer need assistance from the Milnor factory, refer to Table 3 for contact information.

Table 3: Pellerin Milnor Corporation Contact Information

Purpose	Department	Telephone	FAX	E-mail/Website
Order, or enquire about replacement parts	Parts	504-467-2787	504-469-9777	parts@milnor.com
Obtain advice on installing, servicing, or using	Customer Service/ Technical Support	504-464-0163	504-469-9777	service@milnor.com www.milnor.com (Customer Service)
Learn about, request, or enroll in Milnor service seminars	Training	504-712-7725	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

Your first contact with any question should be your authorized Milnor dealer, but problems or special situations encountered in the field may require consultation with the Milnor factory. Written correspondence can be mailed to this address:

Pellerin Milnor Corporation
Post Office Box 400
Kenner, Louisiana 70063-0400
Telephone: 504-467-9591
http://www.milnor.com

— End of BIUUUK06 —

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1. About Milnor® Allied Interfaces for Automated Laundering System Machines

In most automated laundering systems, coordination and data exchange among the various machines require a sophisticated control system such as the Miltrac™ controller which can pass large amounts of data serially. However, Milnor also supports a simple form of machine-to-machine communication called an allied interface, which uses sets of on/off signals that non-Milnor (allied) equipment can readily adapt to.

1.1. When Allied Interfaces Are Used

Owner/users of automated laundering systems may wish to use an allied interface for either of two reasons:

1. To combine machines from different manufacturers. The allied interface permits a Milnor machine to be loaded by, and/or discharge to any functionally compatible non-Milnor machine that provides a similar interface (see Note 2).
2. To save cost. The allied interface can be used to interface two Milnor machines, if the additional capabilities of a Miltrac system are not needed (see Note 3).

Note 1: For information on physical alignment requirements and mechanical interfacing, refer to the machine dimensional drawings.

Note 2: Over the years, the allied interfaces offered by Milnor and other manufacturers have become more standardized. Additionally, Milnor allied interfaces provide some flexibility in working with other manufacturers and work-arounds can often be found to accommodate new requirements. In some cases, however, the needed communication cannot be accomplished without making hardware and/or software changes, at an extra cost.

Note 3: The allied interface consists of both standard and optional equipment. With the implementation of Mark 5 controls on system machines, some allied interface components such as certain output relays, which were previously extra cost, are now provided standard. However, some optional equipment is still required. Additionally, as the number of batch codes needed increases, the cost-benefit of the allied interface versus Miltrac is reduced. For more information, consult the Milnor Laundry Engineering department for a new installation or Milnor Technical Support when retrofitting an existing installation.

1.2. Definitions of Terms

device—a machine (Milnor or allied) in an automated laundering system.

allied—normally refers to a non-Milnor device, but in this context, refers to any device, Milnor or non-Milnor, that the allied interface supplied with a Milnor machine communicates with.

interface—in this context, the electrical equipment and controller functions that permit controllers on adjacent (upstream/downstream) machines in an automated laundering system to communicate.

controller—the microprocessor and related electronics, usually located on the machine, that controls machine operation. The microprocessor communicates with allied devices via input/output (I/O) boards located, along with other peripheral boards, in a separate card cage.

Mark version—a number (e.g., Mark 5) associated with a major control system redesign. On most Milnor machines, the entire control system is represented by a single mark number, which appears on the machine display when the machine is powered on. However, on the CBW®, one mark version applies to the machine's microprocessor and its related electronics and another mark version applies to the Mentor® controller, which serves as the user interface. The CBW mark versions referred to in the allied interface documentation are those for the machine microprocessor (currently Mark 8 for the 76032 CBW and Mark 9 for the G3 CBW).

batch code—a number associated with a batch of goods, identifying a characteristic of that batch such as wash formula (formula code), extracting formula (extract/press code), drying formula (dry code), customer number (customer code), goods type (goods code), and weight. The range of values available for each of these codes and the ability to pass certain codes varies with the software vintage and device type. Collectively, batch codes are also referred to as batch data or cake data.

potential-free contact ("dry" contact)—a relay contact neither used by, nor electrically connected to the device that the relay is supplied by, controlled by, and located on. The intent is for another device to use the contact in a circuit that it supplies the power for.

output—in communication between two device controllers via an allied interface, a potential-free contact on a relay operated by one device controller, intended to provide an on/off signal to the other device controller.

input—in communication between two device controllers via an allied interface, a connection point on one device through which that device's controller can receive an on/off signal from the other device's controller.

interpret relay—a relay containing potential-free contacts and operated by an output signal. Interpret relays are provided as optional equipment on the Milnor CBW® as a means of providing potential-free contacts for programmable outputs, which themselves, only provide a 120 VAC signal.

allied loading device—a device that passes batches of goods **to** (that loads) the Milnor device and for which the Milnor device provides an allied **loading** interface.

allied discharging device—a device that receives batches of goods **from** (that discharges) the Milnor device and for which the Milnor device provides an allied **discharge** interface.

numeric signal—an on/off signal representing one binary digit (1 or 0). Groups of numeric signals are used to communicate batch codes (decimal numbers) in binary.

operational signal—an on/off signal typically used to declare machine operational status.

signal enabling order—the sequence, during the operating cycle, in which the Milnor controller enables, and expects to receive operational signals.

multi-terminal—in this context, any of three types of electrical components used to make field connections to Milnor allied interface outputs and inputs. These components include terminal strips for push-on connectors, mating connectors and IEC terminal blocks.

1.3. How Allied Interfaces Work

Although the actual data handled by the allied interface will vary as required for each type of device, every allied interface uses the same general scheme, explained below. Milnor system machines provide both an allied loading interface and an allied discharge interface.

1.3.1. Basics—As of this writing, there are no official industry standards regarding communication between different manufacturers' machines. However, the following are commonly accepted conventions that Milnor conforms to. It relies on the allied device to conform to these as well:

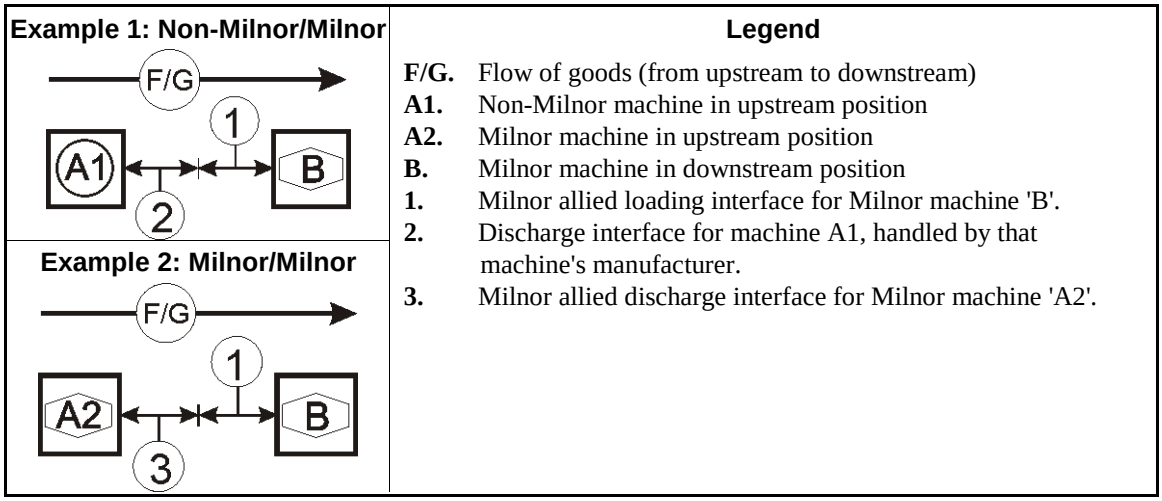
1. **dedicated, single-function, outputs/inputs** - All data is passed via two sets of circuits. Dedicated outputs on one machine connected to corresponding inputs on the other machine comprise one set and the reverse condition comprises the other set. Each circuit is dedicated to a single function and provides one on/off signal. All circuits within the set typically share a common conductor.
2. **binary encoding of batch codes** - Groups of circuits (ordered from most to least significant binary digit) are designated for passing batch codes (decimal numbers) in binary. All such

signals must be set before the receiving controller reads any of them. A separate data valid or other agreed-upon signal is used to declare when this data is valid and can be read.

3. **generic language** - The interface uses a complement of signals with generic meanings (e.g., "load desired") that permit machines to interact, even though their control logic may be otherwise, different. Refer to the document "Milnor Allied Interface Specifications and Signals" for a list of the signals Milnor provides and expects.

1.3.2. Interface Types - Loading and Discharge—As shown in Figure 1, those outputs and inputs on the Milnor machine used to communicate with an allied loading device (the adjacent upstream machine) comprise an allied loading interface. Those used to communicate with an allied discharging device (the adjacent downstream machine) comprise an allied discharge interface.

Figure 1: Two Adjacent Machines In an Automated Laundering System



Machine-to-machine wiring connects between the upstream machine's discharge interface and the downstream machine's loading interface. Although, theoretically, the lists of signals associated with the two interconnecting interfaces should match, it is likely that there will be substantial differences between the two. This results from interfaces developed at different times and the need to accommodate different manufacturers' machines and laundry conditions (e.g., a centrifugal extractor versus a press, either of which could occupy the same position in the system). These differences do not matter as long as both machines provide the core set of signals needed for this particular pair of machines.

In Figure 1, the arrowheads in both directions indicate that certain operational signals move in each direction. This is explained in more detail below.

1.3.3. Data Types - Batch and Operational—Data passing between controllers is of two general types: batch and operational. Batch data is one-directional: in a Milnor allied loading interface it only passes from allied to Milnor and in a Milnor allied discharge interface, it only passes from Milnor to allied. In other words, batch data always moves with the flow of goods. Operational data is bi-directional: in any interface, certain operational signals pass **in each direction**.

When the providers of non-Milnor equipment work with Milnor to develop an interface that passes batch codes, a point in the sequence of operational signals must be agreed-upon, when the batch data is valid and may be read by the receiving controller. If no other operational signal can be relied on for this purpose, an explicit data valid signal must be provided. Batch data signal

enabling order is irrelevant in this process, but operational signal enabling order (which includes the data valid signal, if provided) is crucial.

In both loading and discharge interfaces, the exchange of operational data requires careful coordination ("handshaking") between participating controllers. Typically, the controller can enable only one or a few operational signals (declare only one or a few operational states) before waiting for a specific response from the other controller. The sequence in which the Milnor controller sends and expects to receive specific operational signals is provided in the document "Milnor Allied Interface Specifications and Signals". If the Milnor and allied controllers do not interact according to the same sequence, erroneous batch data and machine malfunctions will likely result.

1.3.4. Data Formats - non-Numeric and Numeric—Any individual allied interface signal merely passes an on/off value (one data bit). All operational data and certain batch data (e.g., the single cake value) are non-numeric; that is, they are merely on/off (yes/no) values. However, batch codes such as the formula code are numeric (e.g., a value from 0 to 15). This data is passed via groups of signals, whose combined on/off values represent the batch code as a binary number. With these signals, not merely the individual on/off values, but also the proper ordering of the signals (e.g., from most to least significant digit) is critical and must match on the sending and receiving devices.

1.4. Field Wiring and Troubleshooting

CAUTION 2: 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 service the machine unless qualified and authorized. You must clearly understand the hazards and how to avoid them.
- Lock out and tag out power at the main machine disconnect before opening electric boxes and accessing electrical components.

The document "Milnor Allied Interface Specifications and Signals" specifies the electrical requirements for devices that connect to Milnor allied outputs and inputs. It also identifies, for each output and input, the connection point (connector, pin and wire number) to be used by allied. The types of connection points that the field technician may encounter are described in Section 1.4.1.

If the technician is familiar with the features on the Milnor controller described in Section 1.4.2, he will be able to more easily troubleshoot machine-to-machine communication problems that may arise.

1.4.1. Connection Points—Connection points on Milnor machines needed for machine-to-machine wiring are located in the low voltage control box (where the peripheral boards are located). One or more of the following types of multi-terminals (see Figure 2) will be provided for this purpose:

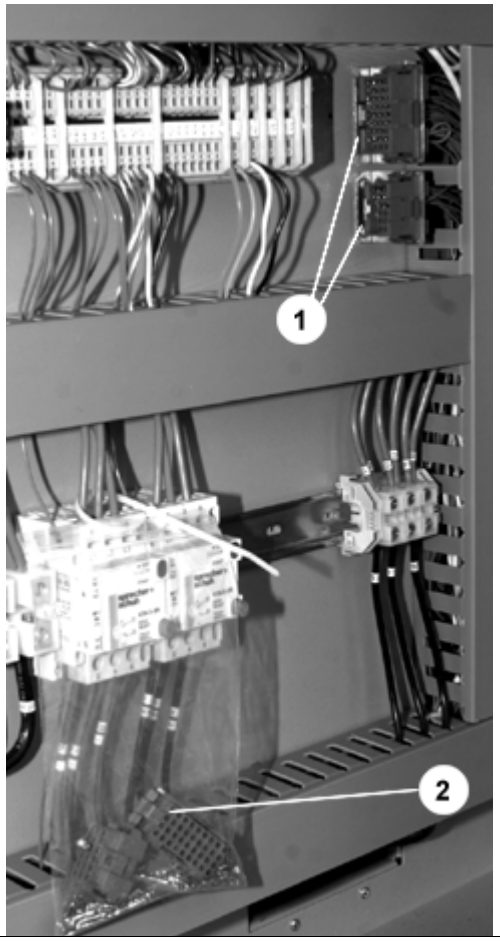
- **Terminal strip for push-on connectors**—These are used on some machines for both outputs and inputs (including common connections for inputs). A tag in the electric box identifies the terminal strips and other components. A label next to the terminal strip identifies the pins.
- **Mating connectors**—If this type is used, the machine will be supplied with one side of the connector wired, mounted, and labeled and the other side in a plastic bag for field wiring. Pin numbers are printed on the connector. On some connectors, only the corner pins are labeled. These connectors typically do not include a ground connection (see next item).

- **IEC terminal block**—These are also found on machines where mating connectors are used and provide ground connections that may be used to ground inputs. Pins on these connectors are labeled with the wire number, which for signal ground is usually wire #7 or wire #2G.

Figure 2: Types of Connectors Used With Allied Interfaces

Terminal Strip for Push-on Connectors

Mating Connectors



IEC Terminal Block

Legend

1. One side wired and mounted.
2. Other side in bag for field wiring.

1.4.1.1. Outputs—For outputs from Milnor, Milnor provides one board-mounted relay, one potential-free contact on that relay, and, except where noted otherwise, two dedicated connection points. The two connection points (normally, adjacent pins on the same connector), are internally wired to opposite sides of the relay contact. In most cases, Milnor does not assign or wire either side of the relay contact as the common.

1.4.1.2. Inputs—A single dedicated connection point (pin) is provided for each input to Milnor. This connection point has a +5VDC or +12VDC potential. When a connection is made between this pin and any valid ground (see next section), this sends an input signal to the Milnor controller. The component used to close this input circuit, usually a relay contact, is provided by allied, and

must be potential-free.

1.4.1.3. Ground (common)—For signal integrity and to protect sensitive electronic components, inputs to Milnor must use a ground connection provided for this purpose (digital signal ground). If terminal strips for push-on connectors are provided, certain pins on these terminal strips will be identified as valid ground connections. All such pins are electrically connected together. If mating connectors are provided, the ground connection will be on a separate IEC terminal block. Again, several pins are provided for this purpose. On most Milnor devices, the wire connecting all signal ground pins is identified either as wire #7 or wire #2G.

1.4.2. Milnor Controller Troubleshooting Features—Milnor system machine controllers provide for viewing the on/off status of inputs and outputs on the machine display while the machine is running. They also permit manually actuating outputs using the keypad while the machine is in manual mode (see Note 4). Refer to the machine reference manual for procedures which vary somewhat from machine to machine. The signals tables in the document "Milnor® Allied Interface Specifications and Signals" include cross-references that make it easy to identify the allied interface outputs/inputs on the display.

The output/input boards provided with Mark 4 and later (Mark 9 on the CBW), microprocessor controls used on Milnor system machines contain LED's. Each output is represented by a red LED and each input, by a green LED (see Note 4). When the LED is illuminated, the output/input is made. The signals tables in the document "Milnor Allied Interface Specifications and Signals" include crossreferences that make it easy to identify the LED's for allied interface outputs/inputs.

> **Note 4:** The outputs and inputs accessible at the machine display/keypad and represented on the output/input boards, include those for many machine functions, not just those for allied interfaces.

1.5. Tasks In Implementing an Allied Interface

The Milnor documentation needed to implement an interface are found in the machine schematic manual and include the following:

- the schematic page(s) describing the allied signal circuitry. Look for "Allied Inputs and Outputs...", "...Dry Contact Data Pass...", "Allied Interface Wiring"., etc. Often, loading interface outputs and inputs are shown together with discharge interface outputs and inputs on the same schematic pages.
- the document "Milnor Allied Interface Specifications and Signals", which includes the electrical specifications (output/input circuit requirements and limitations) and a description of the signals. The signal information is categorized by loading versus discharging interface and numeric versus non-numeric signals.

If the allied device is non-Milnor, consult the allied equipment manufacturer for equivalent documentation.

1. If the allied device is non-Milnor, verify that allied provides an interface that functions as described herein and that each interface meets the other device's specifications.
2. Verify that both the Milnor and the allied devices provide the core operational signals needed for this particular combination of machines to communicate and that they conform to the same "handshaking" scheme. Milnor Technical Support is experienced in answering these questions and designing work-arounds for minor inconsistencies. If major inconsistencies exist, hardware and/or software changes will likely be needed. Such engineering work performed by Milnor is an extra cost service.
3. Verify that both the Milnor and the allied devices provide the needed batch code signals. If not, again, look for work-arounds with the assistance of Milnor Technical Support. Otherwise, extra-cost hardware/software changes will likely be needed.

4. Verify that any optional equipment needed for an allied interface, was furnished with the machines. Typically, this comprises one or more peripheral (I/O) boards. Contact Milnor Technical Support if retrofitting is required for the Milnor machine(s).
5. If both machines provide all necessary equipment, install the machine-to-machine wiring, ensuring that corresponding inputs and outputs are properly matched up.

— End of BICALC01 —

2. Summary of Milnor® Allied Interface Capability, CBW®, COBUC, Single Stage Press, Two Stage Press, Centrifugal Extractor, Shuttle, Dryer

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 Note 6).

> **Note 5:** 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 6:** 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.

2.1. How Batch Data Travels Through a System

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 4 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.

2.2. Batch Data Signals

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 4, 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 Note 7).

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 Note 7). 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 7:** 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 4, 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 Note 8).

New customer—indicates that the batch being transferred belongs to a different customer than the previous batch (see Note 8).

> **Note 8:** 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 Note 9).

3rd (main) pressure—tells the Milnor two-stage press to use a lower than normal main bell pressure (see Note 9).

No (main) pressure—tells the Milnor two-stage press to use no main bell pressure (see Note 9).

Note 9: If the Low, 3rd, and No pressure signals are all off, the press will use standard (high) main bell pressure.

Table 4: 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.														
Single Stage Press														
Loading		16	16		256	64	16				X	X	X	
Discharge			16		256	256	16				X			
2 Stage Press														
Loading	16		16		256	64	16	409.5‡			X	X	X	X
Discharge	16		16		256	256	256				X			
‡ Reads 4096 weight values (0 to 409.5 in tenths).														
Centrifugal Extractor														
Loading		16	16		256	128	16			X	X	X	X	
Discharge	16		16		256	128	16			X	X	X		
Shuttle														
Loading			16		64		16				X	X		
Discharge			16				16					X		
COBUC														
Loading			16		64		16				X	X		
Discharge			16		64		16»					X		
Dryer														
Loading			16								X	X		
Discharge							16				X			
» Destination codes only available if optional I/O board #3 supplied.														
* Low, 3rd, and No Pressure are three separate signals.														

2.3. Operational Signals

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 5 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 pecular 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 5, 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 Note 10.

> **Note 10:** 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—tells 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 read. See Note 11.

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 Note 11.

Note 11: 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 5: Operational Functions and Available Signals

Function Type-->	**Directional Functions**				**Transfer Functions**						**Confirmation Functions**			
Function Name--> Type of Interface	**2nd level**	**Oppo-site side**	**At left**	**At right**	**Early call**	**Dis-charge desired**	**Load desired**	**Load-ing mode**	**Dis-charge al-lowed**	**Load al-lowed**	**Trans-fer not com-plete**	**Error: cancel trans-fer**	**data valid**	**trans-fer com-plete**
CBW (Tunnel)														
Loading									input: bag ready	output: start cvr. or release bag				
Dis-charge					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".													
COBUC														
Loading	input: go 2nd load posn.	‡	input: left of home	input: right of home		input: Cobuc desires load				output: desires to load		input: load-ing cancel - led	input: data valid	‡‡
Dis-charge	input: dis-charge at 2nd level	‡	input: dis-charge left	input: dis-charge right		output: desires to dis-charge	input: allied dis-charge desired		output: ready to unload	input: dis-charge allowed		input: dis-charge cancel - led	output: data valid	‡‡‡
	‡ Although the Mark 5 COBUC control provides a "discharge backwards" signal for this function, it is not needed because the COBUC can only receive and discharge forward. ‡‡ The COBUC provides a "finished loading" output. It also expects a "loading complete" input. ‡‡‡ The COBUC provides a shuttle "finished unloading" output (for allied devices) and a "finished unloading to Milnor" output (specifically for the Milnor centrifugal extractor). It also expects an "allied discharge complete" input.													
Single Stage Press														
Loading										output: press free				input: press loaded
Dis-charge						output: desires to unload				input: start dis-charge		input: don't dis-charge		

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**
2 Stage Press														
Loading										output: press free				input: press loaded
Discharge						output: desires to unload				input: allied can receive load				output: discharge complete
Centrifugal Extractor														
Loading					input: end extract		output: load desired	input: start extractor		output: extr. says load allowed				input: start cycle
Discharge						output: discharge desired				input: start discharge £				input: discharge finished
	£ There is also a "discharge allowed" input. But in this case, the function of this input is to enable/disable discharging via a manually operated switch.													
Shuttle														
Loading	input: go 2nd load posn.	input: load reverse dir.	input: left of home	input: right of home		input: desires to load shuttle	output: shuttle is empty			output: desires to receive load	output: shuttle loading	input: cancel transfer	input: data valid	†
Discharge	input: go 2nd unload posn.	input: load reverse dir.	input: left of home	input: right of home		output: desires to unload	input: desires load from shuttle		output: ready to unload	input: allowed to receive load	output: not finished unload	input: cancel transfer	output: data valid	††
	† All shuttles except the COSLIDE provide a "shuttle is loaded" output. The COSLIDE expects a "belt is loaded" input. †† The shuttle provides a shuttle "finished unloading" output. It also expects an "allied discharge complete" input.													
Dryer														
Loading							output: load desired	input: dryer loading		output: load door open				»
Discharge						output: discharge desired			input: discharge allowed					output: discharge door closed
	» The dryer expects a "dryer is loaded" input. It also provides a "load door closed" output.													

— End of BICALC13 —

3. Milnor® Allied Interface Specifications and Signals, CBW®, COBUC, Single Stage Press, Two Stage Press, Centrifugal Extractor, Shuttle, Dryer

An allied device that interfaces with the Milnor system machine equipped with Mark 5 or later microprocessor controls must meet the electrical specifications and functional requirements given in Section 3.1 "Electrical and Functional Specifications".

The "Signals..." section(s) herein identify the allied interface signals and provide related information (see Section 3.2 "How the Signals Tables Are Organized").

This document also provides useful information for troubleshooting allied interfaces:

- The **Display/code** and **Board/code** values in the signals tables, are cross-references to the output and input displays and to the output and input numbers on the I/O boards respectively. Section 3.10 "Monitoring Allied Interface Outputs and Inputs", explains how to use these cross-references.
- As an aid in working with **numeric signals**, Section 3.11 "Decimal / Binary Conversion and How It Applies to Allied Interfaces" explains how to determine, for any batch code, which value (off or on) each signal in a group should pass.

3.1. Electrical and Functional Specifications

WARNING 3: 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 service the machine unless qualified and authorized. You must clearly understand the hazards and how to avoid them.
- Lock out and tag out power at the main machine disconnect before opening electric boxes and accessing electrical components.

For inputs from Milnor (Milnor outputs), the allied device must limit circuit load to that specified in Section 3.1.1, below. For outputs to Milnor (Milnor inputs), the allied device must supply circuitry that meets the specifications in Section 3.1.2, below. The functional requirements stated in Section 3.1.3 must be met for proper coordination and data exchange between the devices.

3.1.1. Permissible Load for Milnor Outputs

—For signals from Milnor to allied (Milnor outputs/allied inputs), Milnor supplies potential-free contacts located on board-mounted relays. The signals are conducted by traces on the board having the following capacity:

- Maximum voltage: 240V
- Maximum current: 0.5 amps
- Maximum VA: 3

CAUTION 4: Risk of Damage/Malfunction—Traces on control boards may burn out, requiring board replacement, if called upon to handle heavy currents. High voltages can cause arcing across traces.

- Do not apply loads exceeding the specified capacity.
- Do not use allied interface outputs to operate motors or for any other unintended purpose. These may, however, be used to operate relays that do not exceed the specified capacity.

3.1.2. Component Requirements for Milnor Inputs—For signals from allied to Milnor (allied outputs/Milnor inputs–which connect directly to control boards and are used to ground Milnor control inputs), Milnor applies a low energy signal as follows:

- Voltage: 5VDC or 12VDC
- Minimum current: 5 milliamps

The potential-free contacts supplied by allied and the circuit wiring must be capable of faithfully carrying these low energy signals.

CAUTION 5: Risk of Bad Data—Resistance due to wire length or deteriorated contacts can mask signals. Inadequate shielding against electrical noise can trigger false signals.

- Keep wire runs as short as possible.
- Use a digital signal ground connection (wire number 2G on the CBW; wire number 7 on other Milnor devices), not merely chassis ground.
- Ground any spare wires.
- Pass all wires through a ferrite bead.
- Replace relays that have worn or corroded contacts.
- Do not run input wiring adjacent to, or in the same conduit with, any wires carrying AC. For example, do not run input and output wiring in the same conduit if AC is used to power Milnor output/allied input signals.

3.1.3. Functional Requirements

1. For numeric signals (batch codes) from allied to Milnor (allied loading interface), all signals must be properly set when the operational signal indicating this data is valid occurs. Signals must remain set for the longer of 5 seconds or through any subsequent operational signal requiring this data (see “Loading Interface non-Numeric Signals...”). Milnor will read all numeric signals during this time.
2. For numeric signals from Milnor to allied (allied discharge interface), allied must not read signals until the data valid, or other operational signal indicating data is valid occurs (see “Discharge Interface non-Numeric Signals...”).
3. Although not all the operational signals listed in the tables are necessarily required, (the signals used will vary with specific machine models and with variations in the operating cycle), those signals used, must occur in the order listed.
4. When connecting numeric signals between devices, ensure that signals are properly matched up with respect to significance (least significant-to-least significant, next least significant-to-next least significant, etc.).

3.2. How the Signals Tables Are Organized

For an allied device that loads the Milnor machine, Milnor provides an allied **loading interface**. For an allied device that receives goods from (discharges) the Milnor machine, Milnor provides an allied **discharge interface**. In both cases, some signals are used in groups to pass **numeric** values in binary and some signals are used individually to pass **non-numeric** (on/off) values. The receiving device can read the groups of numeric signals in any order as long as it reads this data during the window of time within which it is valid. However, because each signal within a group of numeric signals represents a specific digit of the binary number, the order of significance of the signals (**digit order**) must be understood and must match on sending and receiving devices. Most non-numeric signals provide operational information which must be exchanged according

to a predetermined “handshaking” scheme. Hence, the sequence in which operational signals occur (**enabling order**) is critical. Accordingly, the signal information is presented in four tables:

1. **Loading interface numeric *input* signals and digit order**—In this table, signals are depicted in digit order, that is, the way they would be read as a binary number. The rightmost **column** represents the signal that carries the least significant digit. Each adjacent **column** to the left is the signal representing the digit of next higher significance. The table is divided into **row** groups—one row group for each batch code provided. Each row group provides pertinent information for the signals used with that batch code. In an allied loading interface, all numeric signals pass from allied to Milnor and are therefore, **inputs** to Milnor.
2. **Loading interface non-numeric signals and enabling order**—In this table, each **row** represents a signal and each **column** provides pertinent information for that signal. Generally, these signals must be exchanged by the interfaced devices in the order listed. The labels given to operational signals in the schematics can vary from device to device. However, the document “Summary of Milnor Allied Interface Capability” provides generic names for these. The right-hand column of this table provides both the generic (function) name and the signal name as shown in the schematic, except where these are the same.
3. **Discharge interface numeric *output* signals and digit order**—This table is arranged the same as the “loading interface numeric...” table. However, in an allied discharge interface, all numeric signals pass from Milnor to allied and are therefore, **outputs** from Milnor.
4. **Discharge interface non-numeric signals and enabling order**—This table is arranged the same as the “loading interface non-numeric...” table. As with a loading interface, the devices need to exchange these signals in the order shown.

3.3. Signals—CBW®'s (Tunnels) with Mark 8 and Mark 9 Controls

[Document BICALC03]

This document applies to all currently manufactured CBW's. However, portions of this document specifically pertain to either the Mark 8 or the Mark 9 tunnel control system. Table 6 clarifies which types of CBW and Mentor software each control system is used with.

Table 6: Distinctions Between CBW's That Use Mark 8 Controls and Those That Use Mark 9

	Tunnel Control System	
	Mark 8	**Mark 9**
Model prefix(es)	76032	76028 and 76039
Common names	76032 CBW ("Classic")	G3 ("Generation3") CBW
Hardware type	individual modules	welded groups of modules
Mentor software provided	G2 ("Generation2")*	G3 ("Generation3")

* The predecessor to the G3 CBW was known as the G2 ("Generation2") CBW. This product had welded units like the G3 CBW, but Mark 8 wiring, like the 76032 CBW. It and the 76032 CBW used the same Mentor software, which became known as "Generation2" software. The 76032 CBW continues to use this software.

Like other Milnor® system machines, the CBW® explicitly provides several signals to be used when interfacing with allied devices. However, some of these must be enabled on the Mentor® controller *CBW Hardware Configuration* page before they will function. For the loading interface, you must enable:

- *Allied Weight* (weight)
- *Remote Soil Select* (formula code)

- *Remote Customer Select* (customer code)

For the discharge interface, you must enable *Data Pass* (all batch data outputs).

The Mentor controller also provides user-definable outputs. Additionally, Mentor controllers with G3 software (the G3 CBW) provide user-definable inputs. If a particular allied interface signal is not explicitly provided, it may be possible to define the needed output or input.

3.3.1. Explicit Allied Interface Signals

Table 7: Loading Interface Numeric Input Signals and Digit Order—CBW

Signal name on schematic (e.g., Drycode A, B, etc.)-->		**Common Conn.**	**Most Significant**		**Dedicated Connections (Binary Data Signals)**							**Least Significant**
			K	**J**	**H**	**G**	**F**	**E**	**D**	**C**	**B**	**A**
256 Formula or Goods Codes (000 - 255)	Multi-terminal	WCG			WCG	WCG	WCG	WCG	WCG	WCG	WCG	WCG
	Pin Number	9			8	7	6	5	4	3	2	1
	Wire Number	2G			EAH	EAG	EAF	EAE	EAD	EAC	EAB	EAA
	Display/code	--			View on Mentor "Direct and Standard Inputs" page.							
	Board/code	--			io2/15	io2/14	io2/13	io2/12	io2/11	io2/10	io2/9	io2/8
1000 (usable) Customer Codes (000 - 999)	Multi-terminal	WCF	WCF	WCF	WCF	WCF	WCF	WCF	WCF	WCF	WCF	WCF
	Pin Number	9	11	10	8	7	6	5	4	3	2	1
	Wire Number	2G	DAK	DAJ	DAH	DAG	DAF	DAE	DAD	DAC	DAB	DAA
	Display/code	--	View on Mentor "Direct and Standard Inputs" page.									
	Board/code	--	io1/10	io1/9	io2/7	io2/6	io2/5	io2/4	io2/3	io2/2	io2/1	io2/0
Weight (0 to 409.5 Lbs)*	Multi-terminal	WCI	WCU	WCU	WCU	WCU	WCU	WCU	WCU	WCU	WCU	WCU
	Pin Number	9	10	9	8	7	6	5	4	3	2	1
	Wire Number	2G	XX2	XX1	XXZ	XXY	XXX	XXW	XXV	XXU	XXT	XXS
	Display/code	--	Not available for viewing on Mentor screens.									
	Board/code	--	io**/9	io**/8	io**/7	io**/6	io**/5	io**/4	io**/3	io**/2	io**/1	io**/0

* A range of load weight from 0 to 409.5 lb's (in tenths of a pound) can be passed. This requires twelve signals—the ten shown in the table plus L and M. Data for L are: connector WCU, pin 11, wire XX3, Board/code io**/10. Data for L are: connector WCU, pin 12, wire XX4 Board/code io**/11.

** The position of this board is variable.

Table 8: Loading Interface non-Numeric Signals and Enabling Order—CBW (see Note 12)

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code *****	Function Name / Signal Name
	Multi-ter minal	Pin	Wire	Multi-ter minal	Pin	Wire			
Ther allied device need only ensure that the bag is ready **and the data is valid** before it issues the "load allowed / start conveyor or release bag" signal.									
Input	WCG	9	2G	WCG	11	none	***	io1/2	discharge allowed / bag ready
Output*	WCH	5	NAE	WCH	6	NAF	****	io2/4	load allowed / start conveyor or release bag**

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** This output provides potential-free contacts, but actuates during every cycle and bypasses the loading conveyor controls on the Mentor console. The console controls are designed for use with Milnor loading conveyors only and permit placing the load conveyor in "hold" to pass empty pockets in the tunnel, but they do not provide potential-free contacts.

*** Shown on the Mentor "Direct and Standard Inputs" page as "Bag Ready."

**** Shown on the Mentor "Standard Outputs" page as "Start Conveyor."

***** Applies to G3 CBW (Mark 9) only. The 76032 CBW uses Mark 8 controls which do not provide boards with LED's.

Note 12: Several allied interface inputs and outputs shown on the schematics are not usable with current production machines. These were used with the Miltron™ Rail Sequencer (Display I), which is not provided with the Mentor controller. They include the Rail Empty and Halt Rail inputs and the Rail Sequencer bit 0 through bit 3 outputs.

Table 9: Discharge Interface Numeric Output Signals and Digit Order—76032CBW (Mark 8)

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.*	Most Significant	Dedicated Connections (Binary Data Signals)								Least Significant
			J	I	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	n/a							WCIR	WCIR	WCIR	WCIR
	Pin Number	n/a							4 • 20	3 • 19	2 • 18	1 • 17
	Wire Number	n/a							DDH • DDG	DDF • DDE	DDD • DDC	DDB • DDA
	Display/code	--							Not available.			
	Board/code	--							Not available.			
4 Cooldown Codes (0 - 3)	Multi-terminal	n/a									WCIR	WCIR
	Pin Number	n/a									6 • 22	5 • 21
	Wire Number	n/a									DDM • DDL	DDK • DDJ
	Display/code	--									Not available.	
	Board/code	--									Not available.	
8 Destination Codes (0 - 7)	Multi-terminal	n/a								WCIR	WCIR	WCIR
	Pin Number	n/a								9 • 25	8 • 24	7 • 23
	Wire Number	n/a								DDT • DDS	DDR • DDO	DDP • DDN
	Display/code	--								Not available.		
	Board/code	--								Not available.		
16 Extract Codes (00-15)	Multi-terminal	n/a							WCJR	WCJR	WCJR	WCJR
	Pin Number	n/a							4 • 20	3 • 19	2 • 18	1 • 17
	Wire Number	n/a							EDH • EDG	EDF • EDE	EDD • EDC	EDB • EDA
	Display/code	--							Not available.			
	Board/code	--							Not available.			
1024 (1000 usable) Customer Codes (000-999)	Multi-terminal	n/a	WCJR	WCJR	WCJR	WCJR	WCJR	WCJR	WCJR	WCJR	WCJR	WCJR
	Pin Number	n/a	14 • 30	13 • 29	12 • 28	11 • 27	10 • 26	9 • 25	8 • 24	7 • 23	6 • 22	5 • 21
	Wire Number	n/a	ED4 • ED3	ED2 • ED1	EDZ • EDY	EDX • EDW	EDV • EDU	EDT • EDS	EDR • EDO	EDP • EDN	EDM • EDL	EDK • EDJ
	Display/code	--	Not available.									
	Board/code	--	Not available.									

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers. In this table these are listed together in the same cell, with a dot between (e.g., 1 • 17).

Table 10: Discharge Interface Numeric Output Signals and Digit Order—G3 CBW (Mark 9)

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.*	Most Significant	Dedicated Connections (Binary Data Signals)								Least Significant
			K	J	H	G	F	E	D	C	B	A
1000* Formula or Goods Codes (000 - 999)**	MTA Number	n/a	14	14	14	14	14	14	14-10 • 4-15	14-10 • 4-5	14	14
	Pin Number	n/a	10 • 18	10 • 8	10 • 17	10 • 7	10 • 16	10 • 6			4 • 14	4 • 13
	Wire Number	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Display/code	--	Not available.									
	Board/code	--	o6/21	o6/20	o6/19	o6/18	o6/17	o6/16	o6/15	o6/14	o6/13	o6/12
16 Drycodes or 16 Extract Codes (00 - 15)	Multi-terminal	n/a							WCIR	WCIR	WCIR	WCIR
	Pin Number	n/a							4 • 20	3 • 19	2 • 18	1 • 17
	Wire Number	n/a							DDH • DDG	DDF • DDE	DDD • DDC	DDB • DDA
	Display/code	--							Not available.			
	Board/code	--							o1/3	o1/2	o1/1	o1/0
4 Cooldown Codes (0 - 3)	Multi-terminal	n/a									WCIR	WCIR
	Pin Number	n/a									6 • 22	5 • 21
	Wire Number	n/a									DDM • DDL	DDK • DDJ
	Display/code	--									Not available.	
	Board/code	--									o1/5	o1/4
8 Destination Codes (0 - 7)	Multi-terminal	n/a								WCIR	WCIR	WCIR
	Pin Number	n/a								9 • 25	8 • 24	7 • 23
	Wire Number	n/a								DDT • DDS	DDR • DDQ	DDP • DDN
	Display/code	--								Not available.		
	Board/code	--								o1/8	o1/7	o1/6
256 or 1000* Customer Codes (000 - 255 or 999)**	Multi-terminal or MTA No.	WCIR**	mta14	mta14	WCIS	WCIS	WCIS	WCIS	WCIS	WCIS	WCIS	WCIS
	Pin Number	31 or 32	10 • 19	10 • 9	8	7	6	5	4	3	2	1
	Wire Number	DD5	n/a	n/a	DCH	DCG	DCF	DCE	DCD	DCC	DCB	DCA
	Display/code	--	Not available.									
	Board/code	--	o6/23	o6/22	o1/23	o1/22	o1/21	o1/20	o1/19	o1/18	o1/17	o1/16
Weight (0 to 409.5 Lbs) * @**	MTA Number	n/a	13-10 • 14-1	13	13	13	13	13	13	13	13	13
	Pin Number	n/a		9 • 19	8 • 18	7 • 17	6 • 16	5 • 15	4 • 14	3 • 13	2 • 12	1 • 11
	Wire Number	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Display/code	--	Not available.									
	Board/code	--	o6/9	o6/8	o6/7	o6/6	o6/5	o6/4	o6/3	o6/2	o6/1	o6/0

*** For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers. These are listed together in the same cell, with a dot between (e.g., 1 • 17).**

**** To provide eight Customer code signals with limited available terminals, Customer codes A through H, along with the "Start Press" and "Single Cake" signals, had to share board-level connector 1MTA14-10 (WCIR, pin 31 or 32).**

***** Requires optional extra data pass board. Currently, outputs on this board are not wired to multi-terminals in the electric box. Connections must be made directly to the pins on the board-level MTA connectors**

@ A range of load weights from 0 to 409.5 (in tenths of pounds) can be passed. This requires twelve signals–the ten shown in the table plus L and M. Data for L: connector 6MTA14, pins 2 and 11; board/code o6/10. Data for M: connector 6MTA14, pins 3 and 12; board/code o6/11.

Table 11: Discharge Interface non-Numeric Signals and Enabling Order—CBW

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code ****	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Input	WCI	9	2G	WCI	6	JAP	**	***	load allowed / press free (G2 Mentor only***)
Milnor sets all batch data (previous two tables and next six signals) before it enables the "transfer complete / start press" signal.									
Output*	WCIR	14	DD2	WCIR	30	DD1	**	o1/13	new formula
Output*	WCIR	13	DD4	WCIR	29	DD3	**	o1/12	new customer
Output*	WCIR	15	DD6	WCIR	31	DD5	**	o1/14	single cake
Output*	WCIR	11	DDX	WCIR	27	DDW	**	o1/10	low pressure
Output*	WCIR	10	DDV	WCIR	26	DDU	**	o1/9	third pressure
Output*	WCIR	12	DDZ	WCIR	28	DDY	**	o1/11	no pressure / don't main press goods *****
Output*	WCIR	16	DD8	WCIR	32	DD7	**	o1/15	transfer complete / start press

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** Not available for viewing on the Mentor screens.

*** On the G3 CBW, this input must be defined using an assignable input as explained elsewhere in this document.

**** Applies to G3 CBW (Mark 9) only. The 76032 CBW uses Mark 8 controls which do not provide boards with LED's.

***** An explicit "empty load" allied output is not provided with the CBW. However, the "don't main press goods" output may be used for this purpose. For example, in a CBW-to-Milnor extractor allied interface, this output may be connected to the extractor "empty load" input. In the "Post Wash Codes" zone of the Formula Programming Page, simply ensure that for the "pass-empty" formula, Pressure = 00.

3.3.2. **Defining Special Purpose Allied Interface Signals**—Detailed information on programmable outputs and inputs is provided in the Mentor reference manual. You should have a solid understanding of the sections on assigning functions, programming formulas, programming Generation3 inputs and outputs (G3 CBW only), and assigning interpret relays (76032 CBW only), before attempting to define outputs or inputs for allied interface use. The following information supplements those explanations with regard to allied interface signals.

Mentor controllers are normally provided with a certain number of programmable outputs (and inputs on the G3 CBW) in addition to those preprogrammed by the factory to meet the machine's anticipated requirements. Any extra outputs and inputs are available for any use including providing allied interface signals. Defining an output or input in the field involves wiring and programming it.

3.3.2.1. Wiring Programmable Outputs—Connection points for programmable outputs are available in every module electric box of the 76032 CBW and in the module section (right side) of the main control box, on the front of the G3 CBW. Connection points are on the connectors designated WCA. (Refer to the schematics to identify pins and wires.) However, programmable outputs, by themselves, do not provide the potential-free contacts normally needed for allied interface outputs. Normally, it is necessary to use the 120VAC signal provided by the programmable output to control an interpret relay that in turn, provides potential free contacts. (Refer to the interpret relay schematic page in the schematic manual.)

3.3.2.1.1. Working With Interpret Relays—Interpret relays are optional equipment. Generally, when a CBW is ordered, the purchaser only buys the number of interpret relays he knows are needed. Usually, these are for chemical supply pumps. If the need for special purpose allied interface outputs was anticipated, interpret relays should be available. Otherwise, it will be necessary to purchase and install an interpret relay for each allied interface output to be defined. (Contact

Milnor Technical Support for assistance.)

All interpret relays used on a CBW are located in one electric box regardless of the location of the programmable output used to control it. If you need an interpret relay for an allied interface output, you must consider availability and CBW type, as explained below.

3.3.2.1.1.1. 76032 CBW (Mark 8 tunnel controls and Generation2 Mentor Software)—On the 76032 CBW, the interpret relay box is located on the side of the tunnel. On these machines, interpret relays are programmatically assignable; that is, the user specifies on the Mentor *Interpret Relay Assignment* page, which programmable output he wants the interpret relay to be operated by.

3.3.2.1.1.2. G3 CBW (Mark 9 tunnel controls and Generation3 Mentor Software)—On the G3 CBW, the interpret relay box is located on the front of the tunnel, above the main control box. On the G3 CBW (G3 Mentor software), there is no software control over the association between programmable outputs and interpret relays. If additional interpret relays are purchased after the CBW is installed, these must be hard wired to their respective programmable outputs in the field.

3.3.2.1.2. Relating the Output to the Bit Number—Because implementing special purpose allied outputs involves both wiring and programming, the implementer must be able to associate the physical output (to be wired) with the correct bit number displayed on the Mentor screens. The Mentor software automatically assigns bit numbers to programmable outputs according to one of two schemes, as explained below.

3.3.2.1.2.1. 76032 CBW (Mark 8 tunnel controls and Generation2 Mentor Software)—In Generation2 Mentor software, the bit numbers for a given module apply to the outputs on the I/O board(s) provided **with that module**. A two digit bit number is assigned to each programmable output, from the first output (output 0) on the first I/O board (board #1) to the last output on the last board provided with that module. Bit numbering is sequential, beginning with 01 (i.e., output 0 on I/O board #1 on a given module is represented as output 01 on that module). Because output numbering starts over in each module, on the Mentor screen you will see bit numbers repeated several times in different module columns of the *Function Programming* and the *Formula Programming* pages. For example, you may see Bit # 05 associated with several modules, but each of these is a different output.

3.3.2.1.2.2. G3 CBW (Mark 9 Tunnel Controls and Generation3 Mentor Software)—In Generation3 Mentor software, a three digit bit number is assigned to each programmable output, from the first output (output 0) on the first I/O board (I/O board #1) to the last output on the last board on that machine, used for programmable outputs. As previously mentioned, these boards are located in the module section (right side) of the main control box on the front of the machine. Bit numbering is sequential, starting with 001 (i.e., output 0 on I/O board #1 is represented as output 001). Because bit numbering is machine-wide (not per module), a given bit number will appear only once on the Mentor *Function Programming Page* and the *Formula Programming Page*.

3.3.2.2. Wiring Inputs On the G3 CBW (Mark 8 Tunnel Controls)—Connection points for programmable inputs are available in the module section (right side) of the main control box, on the front of the G3 CBW. Connection points are on the connectors designated WCB. Refer to the schematics to identify specific pins and wire numbers.

3.3.2.3. Programming Outputs and Inputs—When you program an output or input, you assign various properties to it. Some properties, such as the Hold code are simple on/off decisions. Some, such as the Op code provide a list of values to select from. Some values, such as Output Op Code 09 “Early Call” and Input Op code 11 “Press Free” are specifically intended for use with allied interface signals. For example, if the Miltrac controller is not used, a Milnor CBW may be interfaced with a Milnor centrifugal extractor via an allied interface. In this situation,

three special purpose operational signals, two of which use the mentioned Op codes, must be defined. These signals are described below, as examples:

3.3.2.3.1. Example: "Early Call" Output—An output assigned to the last CBW module must be defined to provide the signal needed by two load interface operational inputs on the Milnor extractor. It is permissible to trigger these inputs simultaneously, (thus requiring only one programmable output on the CBW, not two). The extractor inputs include:

- "early call / end extract"
- "loading mode / start extractor"

On the left side of the Mentor *Function Programming Page*, define the function properties for the early call output as follows:

- Function name: "Early Call"
- C (Compatibility) = 0
- H (Hold Code) = not checked
- Op Code = 09 ("Early Call")
- S (Show on formula programming page) = checked

On the right side of the Mentor *Function Programming Page*, the programmable output will be represented in the *Bit* and *Init* columns for the last module. Define the module-specific properties as follows:

- Bit = the identifier number for this output (see Section 3.3.2.1.2 "Relating the Output to the Bit Number").
- Init = A

On the *Formula Programming Page*, assign On Time = 255 **for every formula** (see Note 13).

> **Note 13:** The extractor load scoop must be lowered (or the door raised) even in the case of the pass empty formula, or the extractor will not signal that it is OK for the CBW to transfer (extractor load interface operational output "load allowed / start discharge").

3.3.2.3.2. Example: "Start Extract Cycle" Output—An output assigned to the last CBW module must be defined to provide the signal needed by the "transfer complete / start cycle" input on the extractor that raises the load scoop (or lowers the door) and starts the extract cycle. On the left side of the Mentor *Function Programming Page*, define the function properties as follows:

- Function name: "Start Extract Cycle"
- C (Compatibility) = 0
- H (Hold Code) = not checked
- Op Code = 00 ("Standard Timed")
- S (Show on formula programming page) = checked

On the right side of the Mentor *Function Programming Page*, the programmable output will be represented in the *Bit* and *Init* columns for the last module. Define the module-specific properties as follows:

- Bit = the identifier number for this output (see Section 3.3.2.1.2 "Relating the Output to the Bit Number").
- Init = H

On the *Formula Programming Page*, assign On Time = 004 **for every formula** (see Note 13).

3.3.2.3.3. Example: “Extractor Free” Input (G3 CBW)—The CBW needs a signal to indicate when the extractor is free to receive a load. This is provided by the “load allowed / extractor says load allowed” output signal on the extractor. On the 76032 CBW, an explicit “press free” input is provided. But on the G3 CBW, a special input must be defined to read this signal. On the Mentor *Input Definition Page*, define this input as follows:

- Input Name = “Extractor Free”
- Op Code = 11 “Press Free”
- Bit = the identifier number for the input used (see Section 3.3.2.2 “Wiring Inputs On the G3 CBW (Mark 8 Tunnel Controls)”).

3.4. Signals—COBUC's With Mark 5 Controls [Document BICALC07]

Table 12: Loading Interface Numeric Input Signals and Digit Order—COBUC

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.	Most Significant	Dedicated Connections (Binary Data Signals)								Least Significant
			J	I	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	TBA							WCI	WCI	WCI	WCI
	Pin Number	7							O4	O3	O2	O1
	Wire Number	7							407	406	405	404
	Display/code	--							i2/D	i2/C	i2/B	i2/A
	Board/code	--							io2/3	io2/2	io2/1	io2/0
16 Destina-tion Codes (00-15)	Multi-terminal	TBA							WCI	WCI	WCI	WCI
	Pin Number	7							O8	O7	O6	O5
	Wire Number	7							411	410	409	408
	Display/code	--							i2/H	i2/G	i2/F	i2/E
	Board/code	--							io2/7	io2/6	io2/5	io2/4
64 Custo-mer Codes (00-63)	Multi-terminal	TBA					WCI	WCI	WCI	WCI	WCI	WCI
	Pin Number	7					14	13	12	11	10	O9
	Wire Number	7					427	426	425	424	423	422
	Display/code	--					i2/N	i2/M	i2/L	i2/K	i2/J	i2/I
	Board/code	--					io2/13	io2/12	io2/11	io2/10	io2/9	io2/8
16 Extract Codes (00-15)	Multi-terminal	TBA							WCI	WCI	WCI	WCI
	Pin Number	7							28	27	26	25
	Wire Number	7							431	430	429	428
	Displaycode	--							i4/O	i4/N	i4/M	i4/L
	Boardcode	--							io4/14	io4/13	io4/12	io4/11

Table 13: Loading Interface non-Numeric Signals and Enabling Order—COBUC (see Note 14)

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Input	TBA	7	7	WCI	17	415	i4/C	io4/2	2nd level / go 2nd load position
Input	TBA	7	7	WCI	15	418	i4/A	io4/0	at left / left of home
Input	TBA	7	7	WCI	16	414	i4/B	io4/1	at right / right of home
Milnor reads in the directional signals above when it receives the "discharge desired / COBUC desires load" signal below									
Input	TBA	7	7	WCI	18	416	i4/D	io4/3	discharg desired / COBUC desires load
Milnor reads in all batch data (previous table and next two signals) when it receives the "data valid" signal.									
Input	TBA	7	7	WCI	23	420	i4/J	io4/9	new customer**
Input	TBA	7	7	WCI	22	412	i4/I	io4/8	single cake
Input	TBA	7	7	WCI	21	413	i4/H	io4/7	data valid
Output*	WCO	18	433	WCO	17	432	o2/i	io4/0	load allowed / desires to load
Input	TBA	7	7	WCI	19	417	i4/E	io4/4	error: cancel transfer / loading cancelled
Output*	WCO	16	435	WCO	15	434	o2/j	io4/1	transfer complete / finished loading
Input	TBA	7	7	WCI	24	421	i4/K	io4/10	transfer complete / loading complete

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** The "new customer" input is used when it is not necessary to track batch codes electronically, but merely to ensure that different customers' goods are kept segregated. If the Milnor controller sees this input made at the appropriate time during the cycle, it will increment the customer code by one (e.g., from 07 to 08) to signal downstream devices not to combine these batches.

Note 14: Three allied interface signals shown in the schematics are concerned with semi-automatic operation, which has never been used with the COBUC. They are omitted from the table and include the “Cobuc desires to load semi-automatic” input, the “semi-auto load desired” output, and the “semi-auto finished unloading” output.

Table 14: Discharge Interface Numeric Output Signals and Digit Order—COBUC

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.*	Most Significant	Dedicated Connections (Binary Data Signals)								Least Significant
			J	I	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	n/a							WCO	WCO	WCO	WCO
	Pin Number	n/a							28 • 27	30 • 29	32 • 31	34 • 33
	Wire Number	n/a							453 • 454	451 • 452	449 • 450	447 • 448
	Display/code	--							o3/d	o3/c	o3/b	o3/a
	Board/code	--							io5/3	io5/2	io5/1	io5/0
16 Destina-tion Codes (00-15)	Multi-terminal	n/a							WCO	WCO	WCO	WCO
	Pin Number	n/a							20 • 19	22 • 21	24 • 23	26 • 25
	Wire Number	n/a							461 • 462	459 • 460	457 • 458	455 • 456
	Display/code	--							o3/h	o3/g	o3/f	o3/e
	Board/code	--							io5/7	io5/6	io5/5	io5/4

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers. In this table these are listed together in the same cell, with a dot between (e.g., C • D)

Table 15: Discharge Interface non-Numeric Signals and Enabling Order—COBUC

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Output*	WCO	O8	465	WCO	O7	466	o1/m	io2/4	discharge desired / desires to discharge
Input	TBA	7	7	WCI	36	447	i5/H	io5/7	2nd level / discharge at 2nd level
Input	TBA	7	7	WCI	35	446	i5/G	io5/6	opposite side / discharge backwards **
Input	TBA	7	7	WCI	33	444	i5/E	io5/4	at left / discharge left
Input	TBA	7	7	WCI	34	445	i5/F	io5/5	at right / discharge right
Milnor reads in the directional signals above when it receives the "load desired / allied discharge desired" cignal below.									
Input	TBA	7	7	WCI	29	440	i5/A	io5/0	load desired / allied discharge desired
Output*	WCO	O6	467	WCO	O5	468	o1/n	io2/5	discharge allowed / ready to unload
Input	TBA	7	7	WCI	30	441	i5/B	io5/1	load allowed / discharge allowed
Input	TBA	7	7	WCI	31	442	i5/C	io5/2	error: cancel transfer / discharge cancelled
Output*	WCO	10	463	WCO	O9	464	o1/k	io2/2	single cake
Milnor sets all batch data (previous table and next signal) before it enables the "data valid" signal.									
Output*	WCO	O2	471	WCO	O1	472	o1/p	io2/7	data valid
Output*	WCO	O4	469	WCO	O3	470	o1/o	io2/6	transfer complete / finished unloading ***
Output*	TBC	1	65	TBC	2	66	oi/l	io2/6	transfer complete / finished unloading to Milnor ***
Input	TBA	7	7	WCI	32	443	i5/D	io5/3	transfer complete / discharge complete

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** Although this input is provided, it is not needed with the COBUC, which can only load and discharge forward.

*** The finished unloading output is for general allied interface use. The "finished unloading to Milnor" output is specifically for the Milnor centrifugal extractor.

3.5. Signals—Single Stage Press With Mark 5 Controls [Document BICALC14]

Table 16: Loading Interface Numeric Input Signals and Digit Order—Single Stage Press

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.	Most Significant		Dedicated Connections (Binary Data Signals)							Least Significant
			K	J	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	TBA							WC2	WC2	WC2	WC2
	Pin Number	7							7	16	18	17
	Wire Number	7							232	244	243	242
	Display/code	--							i2/C	i1/p	i1/o	i1/n
	Board/code	--							io2/6	io1/15	io1/14	io1/13
16 Destina-tion Codes (00-15)	Multi-terminal	TBA							WCI	WCI	WCI	WCI
	Pin Number	7							16	15	8	7
	Wire Number	7							341	342	331	332
	Display/code	--							Not available			
	Board/code	--							io3/15	io3/14	io3/7	io3/6
256 Custo-mer Codes (000-255)	Multi-terminal	TBA			WCI	WCI	WCI	WCI	WCI	WCI	WCI	WCI
	Pin Number	7			18	17	14	13	12	11	10	9
	Wire Number	7			396	391	343	344	347	348	349	340
	Display/code	--			i2/G	i2/F	Not available					
	Board/code	--			*	*	io3/13	io3/12	io3/11	io3/10	io3/9	io3/8
64 Goods Codes (00-63)	Multi-terminal	TBA					WCI	WCI	WCI	WCI	WCI	WCI
	Pin Number	7					6	5	4	3	2	1
	Wire Number	7					333	334	337	338	339	330
	Display/code	--					Not available			i2/T	i2/S	i2/R
	Board/code	--					io3/5	io3/4	io3/3	io3/2	io3/1	io3/0
16 Extract (Press) Codes (00-15)	Multi-terminal	TBA							WC2	WC2	WC2	WC2
	Pin Number	7							4	3	2	1
	Wire Number	7							237	238	239	230
	Display/code	--							i1/t	i1/s	i1/r	i1/q
	Board/code	--							io2/3	io2/2	io2/1	io2/0
* Customer codes G and H use direct inputs on the processor board, not inputs on the peripheral boards.												

Table 17: Loading Interface non-Numeric Signals and Enabling Order—Single Stage Press

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-ter minal	Pin	Wire	Multi-ter minal	Pin	Wire			
Output*	WCY	17	312*	WCY	16	132	o1/j	o1/1	load allowed / press free
Milnor will read in all batch data (previous table and next three signals) when it receives the "transfer complete / press loaded" signal.									
Input	WCY	22	7	WCY	10	411	i1/i	io1/8	new customer
Input	WCY	25	7	WCY	13	414	i1/l	io1/11	single cake
Input	WCY	26	7	WCY	14	415	i1/m	io1/12	empty load
Input	WCY	21	7	WCY	20	386	i2/P	**	transfer complete / press loaded

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** This signal uses a direct input on the processor board, not an input on a peripheral board.

Table 18: Discharge Interface Numeric Output Signals and Digit Order—Single Stage Press

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.*	Most Significant		Dedicated Connections (Binary Data Signals)							Least Significant
			K	J	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	n/a							WCZ	WCZ	WCZ	WCZ
	Pin Number	n/a							15 • 16	13 • 14	11 • 12	9 • 10
	Wire Number	n/a							268 • 269	266 • 267	264 • 265	261 • 262
	Display/code	--							o2/T	o2/S	o2/R	o2/Q
	Board/code	--							io2/7	io2/6	io2/5	io2/4
16 Destina-tion Codes (00-15)	Multi-terminal	n/a							WCZ	WCZ	WCZ	WCZ
	Pin Number	n/a							7 • 8	5 • 6	3 • 4	1 • 2
	Wire Number	n/a							252 • 260	254 • 253	256 • 255	259 • 258
	Display/code	--							o2/P	o2/O	o2/N	o2/M
	Board/code	--							io2/3	io2/2	io2/1	io2/0
256 Customer Codes (000-255)	Multi-terminal	n/a			WCY	WCY	WCY	WCY	WCY	WCY	WCY	WCY
	Pin Number	n/a			1 • 9**	1 • 8**	1 • 7**	1 • 6**	1 • 5**	1 • 4**	1 • 3**	1 • 2**
	Wire Number	n/a			134 • 321	134 • 320	134 • 319	134 • 318	134 • 317	134 • 316	134 • 315	134 • 314
	Display/code	--			o2/L	o2/K	o2/J	o2/I	o2/H	o2/G	o2/F	o2/E
	Board/code	--			o1/23	o1/22	o1/21	o1/20	o1/19	o1/18	o1/17	o1/16
256 Goods Codes (000-255)	Multi-terminal	n/a			WCX	WCX	WCX	WCX	WCX	WCX	WCX	WCX
	Pin Number	n/a			15 • 16	13 • 14	11 • 12	9 • 10	7 • 8	5 • 6	3 • 4	1 • 2
	Wire Number	n/a			368 • 369	366 • 367	364 • 365	361 • 362	352 • 360	354 • 353	356 • 355	359 • 358
	Display/code	--			Not available							
	Board/code	--			io3/7	io3/6	io3/5	io3/4	io3/3	io3/2	io3/1	io3/0

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers. In this table these are listed together in the same cell, with a dot between (e.g., C • D)

**To provide eight customer code signals with limited available terminals, Customer codes A through H had to share pin 1.

Table 19: Discharge Interface non-Numeric Signals and Enabling Order—Single Stage Press

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Milnor will set all batch data (previous table) before it enables the "discharge desired / desires to unload" signal.									
Output*	WCY	19	313*	WCY	18	133	o1/k	o1/2	discharge desired / desires to unload
Input	WCY	23	7	WCY	11	412	i1/j	io1/9	load allowed / start discharge
* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.									

3.6. Signals—Two-Stage Press With Mark 5 Controls [Document BICALC04]

Table 20: Loading Interface Numeric Input Signals and Digit Order—Two-Stage Press

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.	Most Significant		Dedicated Connections (Binary Data Signals)							Least Significant
			K	J	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	TBA							TBA	TBA	TBA	TBA
	Pin Number	7							92	91	90	89
	Wire Number	7							92	91	90	89
	Display/code	--							i2/H	i2/G	i2/F	i2/E
	Board/code	--							io2/11	io2/10	io2/7	io2/8
16 Destina-tion Codes (00-15)	Multi-terminal	TBA							WCI	WCI	WCI	WCI
	Pin Number	7							16	15	8	7
	Wire Number	7							341	342	331	332
	Display/code	--							Not available			
	Board/code	--							io3/15	io3/14	io3/7	io3/6
256 Custo-mer Codes (000-255)	Multi-terminal	TBA			WCI	WCI	WCI	WCI	WCI	WCI	WCI	WCI
	Pin Number	7			20	19	14	13	12	11	10	9
	Wire Number	7			396	391	343	344	347	348	349	340
	Display/code	--			i2/S	i2/R	Not available					
	Board/code	--			**	**	io3/13	io3/12	io3/11	io3/10	io3/9	io3/8
64 Goods Codes (00-63)	Multi-terminal	TBA					WCI	WCI	WCI	WCI	WCI	WCI
	Pin Number	7					6	5	4	3	2	1
	Wire Number	7					333	334	337	338	339	330
	Display/code	--					Not available					
	Board/code	--					io3/5	io3/4	io3/3	io3/2	io3/1	io3/0
16 Formula Codes (00-15)	Multi-terminal	TBA							WC2	WC2	WC2	WC2
	Pin Number	7							4	3	2	1
	Wire Number	7							437	438	439	430
	Display/code	--							Not available			
	Board/code	--							io4/3	io4/2	io4/1	io4/0
Weight (0 to 409.5 lbs.*)	Multi-terminal	TBA	WC2	WC2	WC2	WC2	WC2	WC2	WC2	WC2	WC2	WC2
	Pin Number	7	14	13	12	11	10	9	8	7	6	5
	Wire Number	7	443	444	447	448	449	440	431	432	433	434
	Display/code	--	Not available									
	Board/code	--	io4/13	io4/12	io4/11	io4/10	io4/9	io4/8	io4/7	io4/6	io4/5	io4/4

* A range of load weight from 0 to 409.5 lbs (in tenths of a pound) can be passed. This requires twelve signals—the ten shown in the table plus L and M. Data for L are: connector WC2, pin 15, wire 442, Board/code io4/14. Data for M are: connector WC2, pin 16, wire 441, Board/code io4/15.

** Customer codes G and H use direct inputs on the processor board, not inputs on the peripheral boards.

Table 21: Loading Interface non-Numeric Signals and Enabling Order—Two-Stage Press

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function name / Signal Name
	Multi-ter minal	Pin	Wire	Multi-ter minal	Pin	Wire			
Output*	TBA	101	101	TBA	86	86	o1/d	io1/3	load allowed / press free
Milnor will read in all batch data (previous table and next six signals) when it receives the "transfer complete / press loaded" signal.									
Input	TBA	7	7	TBA	96	96	i1/d	io1/3	low pressure
Input	TBA	7	7	TBA	95	95	i2/T	**	third pressure
Input	TBA	7	7	TBA	88	88	i2/D	io2/7	no pressure
Input	TBA	7	7	TBA	94	94	i2/L	io2/15	empty pocket
Input	TBA	7	7	TBA	99	99	i2/J	io2/13	new customer
Input	TBA	7	7	TBA	93	93	i2/P	**	single cake
Input	TBA	7	7	TBA	97	97	i1/h	io1/7	transfer complete / press loaded
* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers. ** This signal uses a direct input on the processor board, not an input on a peripheral board.									

Table 22: Discharge Interface Numeric Output Signals and Digit Order—Two-Stage Press

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.*	Most Significant		Dedicated Connections (Binary Data Signals)							Least Significant
			K	J	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	n/a							WCD	WCD	WCD	WCD
	Pin Number	n/a							17 • 20**	19 • 20**	21 • 24**	23 • 24**
	Wire Number	n/a							162 • 164	163 • 164	166 • 167	168 • 167
	Display/code	--							Not available			
	Board/code	--							o2/15	o2/14	o2/13	o2/12
256 Destina-tion Codes (000-255)	Multi-terminal	n/a			WCZ	WCZ	WCZ	WCZ	WCZ	WCZ	WCZ	WCZ
	Pin Number	n/a			15 • 16	13 • 14	11 • 12	9 • 10	7 • 8	5 • 6	3 • 4	1 • 2
	Wire Number	n/a			468 • 469	466 • 467	464 • 465	461 • 462	452 • 460	454 • 453	456 • 455	459 • 458
	Display/code	--			Not available							
	Board/code	--			io4/7	io4/6	io4/5	io4/4	io4/3	io4/2	io4/1	io4/0
256 Customer Codes (000-255)	Multi-terminal	n/a			WCD	WCD	WCD	WCD	WCD	WCD	WCD	WCD
	Pin Number	n/a			15 • 16	13 • 14	11 • 12	9 • 10	7 • 8	5 • 6	3 • 4	1 • 2
	Wire Number	n/a			142 • 141	144 • 143	146 • 145	148 • 147	131 • 132	133 • 134	136 • 135	139 • 138
	Display/code	--			Not available							
	Board/code	--			o2/7	o2/6	o2/5	o2/4	o2/3	o2/2	o2/1	o2/0
256 Goods Codes (000-255)	Multi-terminal	n/a			WCX	WCX	WCX	WCX	WCX	WCX	WCX	WCX
	Pin Number	n/a			15 • 16	13 • 14	11 • 12	9 • 10	7 • 8	5 • 6	3 • 4	1 • 2
	Wire Number	n/a			368 • 369	366 • 367	364 • 365	361 • 362	352 • 360	354 • 353	356 • 355	359 • 358
	Display/code	--			o2/T	o2/S	o2/R	o2/Q	o2/P	o2/O	o2/N	o2/M
	Board/code	--			io3/7	io3/6	io3/5	io3/4	io3/3	io3/2	io3/1	io3/0
16 Formula Codes (00-15)	Multi-terminal	n/a							WCD	WCD	WCD	WCD
	Pin Number	n/a							25 • 26	27 • 28	29 • 30	31 • 32
	Wire Number	n/a							152 • 151	154 • 153	155 • 156	157 • 158
	Display/code	--							Not available			
	Board/code	--							o2/11	o2/10	o2/9	o2/8

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers. In this table these are listed together in the same cell, with a dot between (e.g., C • D)

**To provide four drycode signals with limited available terminals, Drycodes A and B had to share pin 24 and Drycodes C and D had to share pin 20.

Table 23: Discharge Interface non-Numeric Signals and Enabling Order—Two-Stage Press

Signal Direction	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Milnor sets all batch data (previous table and next signal) before it enables the "discharge desired / desires to unload" signal.									
Output **	2MTA14	10	none	2MTA14	6	none	--	o2/16	new customer
Output*	TBA	100	100	TBA	85	85	o1/r	o1/9	discharge desired / desires to unload
Input	TBA	7	7	TBA	87	87	i1/a	io1/0	load allowed / allied device can receive load
Output*	TBA	129	none	TBA	130	none	o2/H	o1/19	transfer complete / discharge complete

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** Although this output is available at the board, multi-terminal pins are not currently assigned or wired. Hence, the board-level MTA connector information is provided instead.

3.7. Signals—Centrifugal Extractors With Mark 5 Controls [Document BICALC05]

Table 24: Loading Interface Numeric Input Signals and Digit Order—Centrifugal Extractor

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.	Most Significant		Dedicated Connections (Binary Data Signals)							Least Significant
			J	I	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	TBA							WC2	WC2	WC2	WC2
	Pin Number	7							8	7	6	5
	Wire Number	7							231	232	233	234
	Display/code	--							i3/H	i3/G	i3/F	i3/E
	Board/code	--							io2/7	io2/6	io2/5	io2/4
16 Destina-tion Codes (00-15)	Multi-terminal	TBA							WC1	WC1	WC1	WC1
	Pin Number	7							12	11	10	9
	Wire Number	7							347	348	349	340
	Display/code	--							i4/L	i4/K	i4/J	i4/I
	Board/code	--							io3/11	io3/10	io3/9	io3/8
256 Custo-mer Codes (000-255)	Multi-terminal	TBA			WC1	WC2	WC2	WC2	WC2	WC2	WC2	WC2
	Pin Number	7			1	16	15	14	13	12	11	10
	Wire Number	7			330	241	242	243	244	247	248	249
	Display/code	--			i4/A	i3/P	i3/O	i3/N	i3/M	i3/L	i3/K	i3/J
	Board/code	--			io3/0	io2/15	io2/14	io2/13	io2/12	io2/11	io2/10	io2/9
128 Goods Codes (000-127)	Multi-terminal	TBA				WC1	WC1	WC1	WC1	WC1	WC1	WC1
	Pin Number	7				8	7	6	5	4	3	2
	Wire Number	7				331	332	333	334	337	338	339
	Display/code	--				i4/H	i4/G	i4/F	i4/E	i4/D	i4/C	i4/B
	Board/code	--				io3/7	io3/6	io3/5	io3/4	io3/3	io3/2	io3/1
16 Extract Formula Codes (00-15)	Multi-terminal	TBA							WC2	WC2	WC2	WC2
	Pin Number	7							4	3	2	1
	Wire Number	7							237	238	239	230
	Display/code	--							i3/D	i3/C	i3/B	i3/A
	Board/code	--							io2/3	io2/2	io2/1	io2/0

Table 25: Loading Interface non-Numeric Signals and Enabling Order—Centrifugal Extractor

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Although Milnor reads the batch data (previous table and next four signals) when it receives the "loading mode / start extractor" signal, these signals should be set before the "early call / end extract" signal (if used) is enabled.									
Input	TBA	7	7	WC1	13	344	i4/M	io3/12	new formula
Input	TBA	7	7	WC1	14	343	i4/N	io3/13	new customer
Input	TBA	7	7	WC1	15	342	i4/O	io3/14	empty load
Input	TBA	7	7	WC2	9	240	i3/I	io2/8	single cake
Input	TBA	7	7	TBA	71	71	i1/D	**	early call / end extract
Output*	TBA	100	100	TBA	99	99	o1/n	o1/5	load desired / extractor desires load
Input	TBA	7	7	TBA	88	88	i2/K	io1/11	loading mode / start extractor
Output*	TBA	109	109	TBA	101	101	o1/d	io1/3	load allowed / extractor says load allowed
Input	TBA	7	7	TBA	91	91	i2/L	io1/12	transfer complete / start cycle

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** This signal uses a direct input on the processor board, not an input on a peripherial board.

Table 26: Discharge Interface Numeric Output Signals and Digit Order—Centrifugal Extractor

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.*	Most Significant		Dedicated Connections (Binary Data Signals)							Least Significant
			J	I	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	n/a							WCZ	WCZ	WCZ	WCZ
	Pin Number	n/a							7 • 8	5 • 6	3 • 4	1 • 2
	Wire Number	n/a							452 • 460	454 • 453	456 • 455	459 • 458
	Display/code	--							o3/d	o3/c	o3/b	o3/a
	Board/code	--							io2/3	io2/2	io2/1	io2/0
16 Destina-tion Codes (00-15)	Multi-terminal	n/a							WCD	WCD	WCD	WCD
	Pin Number	n/a							21** • 22	21** • 24	25 • 26	27 • 28
	Wire Number	n/a							267 • 274	267 • 275	268 • 276	269 • 277
	Display/code	--							o4/n	o4/m	o4/l	o4/k
	Board/code	--							o2/13	o2/12	o2/11	o2/10
256 Customer Codes (000-255)	Mulit-terminal	n/a			WCX	WCX	WCX	WCX	WCX	WCX	WCX	WCX
	Pin Number	n/a			15 • 16	13 • 14	11 • 12	9 • 10	7 • 8	5 • 6	3 • 4	1 • 2
	Wire Number	n/a			368 • 369	366 • 367	364 • 365	361 • 362	352 • 360	354 • 353	356 • 355	359 • 358
	Display/code	--			o3/p	o3/o	o3/n	o3/m	o3/l	o3/k	o3/j	o3/i
	Board/code	--			io3/7	io3/6	io3/5	io3/4	io3/3	io3/2	io3/1	io3/0
128 Goods Codes (000-127)	Mulit-terminal	n/a				WCD	WCD	WCD	WCD	WCD	WCD	WCD
	Pin Number	n/a				31 • 32	15 • 16	13 • 14	11 • 12	9 • 10	7 • 8	5 • 6
	Wire Number	n/a				271 • 279	257 • 265	256 • 264	255 • 263	254 • 262	253 • 261	252 • 260
	Display/code	--				o4/i	o4/h	o4/g	o4/f	o4/e	o4/d	o4/c
	Board/code	--				o2/8	o2/7	o2/6	o2/5	o2/4	o2/3	o2/2
16 Formula Codes (00-15)	Mulit-terminal	n/a							WCZ	WCZ	WCZ	WCZ
	Pin Number	n/a							15 • 16	13 • 14	11 • 12	9 • 10
	Wire Number	n/a							468 • 469	466 • 467	464 • 465	461 • 462
	Display/code	--							o3/h	o3/g	o3/f	o3/e
	Board/code	--							io2/7	io2/6	io2/5	io2/4

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers. In this table these are listed together in the same cell, with a dot between (e.g., C • D)

** To provide 4 destination signals with limited available terminals, Destination Codes C and D had to share pin 21.

Table 27: Discharge Interface non-Numeric Signals and Enabling Order—Centrifugal Extractor

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Input	TBA	7	7	TBA	94	94	i2/P	io1/15	(no function name) / discharge allowed***
Output*	TBA	96	96	TBA	95	95	o1/h	io1/7	discharge desired / discharge desired
Milnor sets all batch data (previous table and next three signals) before it enables the "transfer complete / discharge finished" signal.									
Output*	WCD	3	251	WCD	4	259	o4/b	o2/1	new formula
Output*	WCD	29	270	WCD	30	278	o4/j	o2/9	new customer
Output*	WCD	1	250	WCD	2	258	o4/a	o2/0	single cake
Input	TBA	7	7	TBA	76	76	i1/J	**	load allowed / start discharge
Output*	TBA	98	98	TBA	97	97	o1/p	o1/7	transfer complete / discharge finished
* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers. ** This signal uses a direct input on the processor board, not an input on a peripherial board. *** The function of this input is to inable/disable discharging via a manually operated switch. This is not the "discharge allowed" function.									

3.8. Signals—Shuttles With Mark 5 Controls [Document BICALC06]

Table 28: Loading Interface Numeric Input Signals and Digit Order—Shuttle

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.	Most Significant	Dedicated Connections (Binary Data Signals)								Least Significant
			J	I	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	TBK							TBI	TBI	TBI	TBI
	Pin Number	G							D	C	B	A
	Wire Number	7							403	402	401	400
	Display/code	--							i3/D	i3/C	i3/B	i3/A
	Board/code	--							io3/3	io3/1	io3/2	io3/0
16 Destina-tion Codes (00-15)	Multi-terminal	TBK							TBI	TBI	TBI	TBI
	Pin Number	H							H	G	F	E
	Wire Number	7							411	410	409	408
	Display/code	--							i3/H	i3/G	i3/F	i3/E
	Board/code	--							io3/7	io3/6	io3/5	io3/4
64 Custo-mer Codes (00-63)	Multi-terminal	TBG					TBJ	TBJ	TBJ	TBJ	TBJ	TBJ
	Pin Number	1 or 2					F	E	D	C	B	A
	Wire Number	7					443	442	441	440	439	438
	Display/code	--					i4/F	i4/E	i4/D	i4/C	i4/B	i4/A
	Board/code	--					io4/5	io4/4	io4/3	io4/2	io4/1	io4/0

Table 29: Loading Interface non-Numeric Signals and Enabling Order—Shuttle

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Input	TBJ	Q	7	TBG	8	452	i4/O	io4/14	2nd level / go 2nd load position
Input	TBG	5	7	TBJ	J	446	i4/I	io4/8	opposite side / load reverse direction
Input	TBG	7	7	TBJ	G	444	i4/G	io4/6	at left / left of home
Input	TBG	5	7	TBJ	H	445	i4/H	io4/7	at right / right of home
Milnor reads in the directional signals above when it receives the "discharge desired / desires to load shuttle" signal below.									
Input	TBL	G	7	TBI	R	419	i3/P	io3/15	discharge desired / desires to load shuttle
Output*	TBE	2	470	TBE	1	471	o3/i	io6/o	load desired / shuttle is empty
Milnor reads in all batch data (previous table and next two signals) when it receives the "data valid" signal.									
Input	TBL	G	7	TBJ	R	453	i4/P	io4/15	new customer**
Input	TBL	G	7	TBI	J	412	i3/I	io3/8	single cake
Input	TBL	G	7	TBI	K	413	i3/J	io3/9	data valid
Output*	TBI	T	420	TBI	S	421	o2/c	io3/2	load allowed / shuttle desires to receive load
Output*	TBJ	X	458	TBJ	W	459	o1/k	io2/2	transfer not complete / shuttle is loading
Input	TBG	6	7	TBJ	N	450	i4/M	io4/12	error: cancel transfer / cancel transfer
Output*	TBI	X	424	TBI	W	425	o2/h	io3/7	transfer complete / shuttle is loaded (not COSLIDE) ***
If the shuttle can take another cake, the applicable signals shown in this table are repeated here.									
Input	TBG	7	7	TBJ	K	447	i4/J	io4/9	transfer complete / belt is loaded (COSLIDE)

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** The "new customer" input is used when it is not necessary to track batch codes electronically, but merely to ensure that different customers' goods are kept segregated. If the Milnor controller sees this input made at the appropriate time during the cycle, it will increment the customer codes by one (e.g., from 07 to 08) to signal downstream devices not to combine these batches.

*** The duration of this output is controlled by the "Allied Loading Completed Delay" configure decision.

Table 30: Discharge Interface Numeric Output Signals and Digit Order—Shuttle

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.*	Most Significant	Dedicated Connections (Binary Data Signals)							Least Significant
			J	I	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	n/a							TBK	TBK	TBK	TBI
	Pin Number	n/a							E • F	C • D	A • B	1 • 2
	Wire Number	n/a							436 • 437	434 • 435	432 • 433	430 • 431
	Display/code	--							o2/b	o2/a	o2/g	o2/f
	Board/code	--							io3/1	io3/0	io3/6	io3/5
16 Destina-tion Codes (00-15)	Multi-terminal	n/a							TBL	TBL	TBL	TBJ
	Pin Number	n/a							E • F	C • D	A • B	1 • 2
	Wire Number	n/a							468 • 469	466 • 467	464 • 465	462 • 463
	Display/code	--							o2/j	o2/i	o2/o	o2/n
	Board/code	--							io4/1	io4/0	io4/4	io4/5

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers. In this table these are listed together in the same cell, with a dot between (e.g., C • D)

Table 31: Discharge Interface non-Numeric Signals and Enabling Order—Shuttle

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Output*	TBI	V	422	TBI	U	423	o2/d	io3/3	discharge desired / desires to unload
Input	TBL	H	7	TBI	M	415	i3/L	io3/11	2nd level / go 2nd unload position
Input	TBL	G	7	TBI	L	414	i3/K	io3/10	opposite side / load reverse direction
Input	TBL	H	7	TBI	Q	418	i3/O	io3/14	at left / left of home
Input	TBL	H	7	TBJ	L	448	i4/K	io4/10	at right / right of home
Milnor reads in the directional signals above when it receives the "load desired / machine desires load from shuttle" signal below.									
Input	TBL	H	7	TBI	N	416	i3/M	io3/12	load desired / machine desires load from shuttle **
Output*	TBJ	V	456	TBJ	U	457	o2/l	io4/3	discharge allowed / ready to unload
Input	TBG	1	7	TBI	P	417	i3/N	io3/13	load allowed / machine allowed to receive load from shuttle **
Output*	TBK	K	426	TBK	J	427	o2/p	io4/7	transfer not complete / not finished unloading
Input	TBG	8	7	TBJ	P	451	i4/N	io4/13	error: cancel transfer / cancel transfer
Milnor sets all batch data (previous table and next signal) before it enables the "data valid" signal.									
Output*	TBJ	Z	460	TBJ	Y	461	o2/m	io4/4	single cake
Output*	TBJ	T	454	TBJ	S	455	o2/k	io4/2	data valid
Output*	TBI	Z	428	TBI	Y	429	o2/e	io3/4	transfer complete / shuttle is finished unloading
Input	TBG	1	7	TBJ	M	449	i4/L	io4/11	transfer complete / allied discharge complete

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** These inputs must remain on until transfer is complete.

3.9. Signals—Dryers With Mark 5 Controls [Document BICALC08]

Table 32: Loading Interface Numeric Input Signals and Digit Order—Dryer

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.	Most Significant	Dedicated Connections (Binary Data Signals)								Least Significant
			J	I	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	TBX							TBX	TBX	TBX	TBX
	Pin Number	7							4	3	2	1
	Wire Number	7							171	170	169	168
	Display/code	--							i1/L	i1/J	i1/F	i1/E
	Board/code	--							*	*	*	*
* This signal uses a direct input on the microprocessor board, not an input on the peripherial board.												

Table 33: Loading Interface non-Numeric Signals and Enabling Order—Dryer

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Output*	TBA	159	159	TBA	162	162	o1/d	io1/3	load desired
Although Milnor reads all batch data (previous table and next two signals) when it receives the "transfer complete / dryer is loaded" signal, all batch data should be set before the "loading mode / dryer is loading" signal is enabled.									
Input	TBX	7	7	TBX	5	167	i1/K	**	single cake / little load
Input	TBX	7	7	TBX	6	166	i1/I	**	new customer / new customer ***
Input	TBA	7	7	TBA	143	143	i2/G	io1/6	loading mode / dryer is loading ****
Output*	TBA	92	92	TBA	93	93	o1/g	o1/12	load allowed / load door open *****
Input	TBA	7	7	TBA	141	141	i2/I	io1/8	transfer complete / dryer is loaded
Output*	TBA	93	93	TBA	94	94	o2/d	io2/2	(no function name) / load door closed ******

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** This signal uses a direct input on the microprocessor board, not an input on the peripherial board.

*** The "new customer" input is used when it is not necessary to track batch codes electronically, but merely to ensure that different customers' goods are kept segregated. If the Milnor controller sees this input made at the appropriate time during the cycle, it will increment the customer codes by one (e.g., from 07 to 08) to signal downstream devices not to combine these batches.

**** If the Dryer is loaded by a dedicated loading device, this input may be jumpered to set it permanently on.

***** When a single freestanding Dryer is loaded with pressed cakes via an allied loading conveyor or shuttle capable of automatic operation, it is recommended to connect the following Milnor outputs in series: "Loading allowed / load door open" (TBA92/TBA93) and "Transfer complete / discharge door closed" (TBA164/TBA165 - in discharge interface). This confirms that the discharge door is fully closed before loading starts.

****** This output was implemented for use with the Milnor COELD dedicated elevating loading conveyor. It may be used to release the shuttle; however, it remains on for the duration of the cycle.

Table 34: Discharge Interface Numeric Output Signals and Digit Order—Dryer (see Note 15)

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn.	Most Significant	Dedicated Connections (Binary Data Signals)							Least Significant
			J	I	H	G	F	E	D	C	B	A
16 Destination Codes (00 - 15)	Multi-terminal	n/a							3MTA5*			
	Pin Number	n/a							4 • 14	7 • 16	8 • 17	9 • 18
	Wire Number	n/a							none	none	none	none
	Display/code	--							not available			
	Board/code	--							io3/4	io3/3	io3/2	io3/1
* A standard multi-terminal pin assignment is not currently established for these outputs. Hence, the board level (MTA) connector and pins are shown in this case.												

Note 15: The destination code output signals shown are only available if optional I/O board #3 is supplied. This remotely mounted board also provides two operational signals: "discharge desired" on 3MTA5, pins 1 and 11, and "data valid" on 3MTA5, pins 2 and 12.

Table 35: Discharge Interface non-Numeric Signals and Enabling Order—Dryer (see Note 15)

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Output*	TBA	158	158	TBA	161	161	--	io2/0	discharge desired
Input	TBA	7	7	TBA	140	140	i2/H	io1/7	discharge allowed
Milnor will set all batch data (previous table and next signal) before it enables the "transfer complete / discharge door closed" signal.									
Output*	TBA	160	160	TBA	163	163	o1/e	io1/4	new customer
Output*	TBA	164	164	TBA	165	165	o2/g	io2/2	transfer complete / discharge door closed **
* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers. ** This output remains on for the duration of the cycle.									

3.10. Monitoring Allied Interface Outputs and Inputs

The status of outputs and inputs can be monitored on the machine display while the machine is in operation, as explained in the machine reference manual (see Note 16 and Note 17). Beginning with Mark 4 controls (Mark 9 on the CBW), output and input status can also be monitored on the I/O boards. These boards contain LED's—one green LED for each input and one red LED for each output (see Note 18). When the LED is illuminated, the circuit is made.

Note 16: It is also possible to actuate certain outputs for testing, as explained in the reference manual. However, the “Display/code” values in the tables herein, refer only to the displays used to view outputs/inputs.

Note 17: The outputs and inputs available for viewing on the display include some (but not all) allied interface signals as well as signals for many other functions. See the reference manual for a listing of all outputs and inputs that can be monitored during operation.

Note 18: Almost all allied interface outputs and inputs are passed via the I/O boards (peripheral boards) and are therefore, represented by LED's on the boards. A few, however, are passed directly via the processor board (direct outputs/inputs). The processor board does not contain LED's.

3.10.1. Identifying Outputs and Inputs on the Display Pages

—On CBW's, some allied inputs are available for viewing on the Mentor *Direct and Standard Inputs* page (as indicated in the signals tables). It is fairly easy to identify signals on the Mentor because the signal names are displayed.

The single stage press, two stage press, centrifugal extractor, shuttle, COBUC, and dryer use a two or four line by 20 character LCD display (see Note 19). On these devices, each output or input is represented by a character (lower or upper case letter) on the top line and a plus (+) or minus (-) sign under the character indicating the on/off status of the signal. The outputs and inputs span several display pages. Each page is accessed via the keypad and the procedures for doing so are explained in the reference manual. The “Display/code” values listed in the tables herein tell you which display page and character represent the indicated signal, as shown in the following example:

i2/H

Where:

i = **input** display page (o = **output** display page)

2 = the second in a series of input display pages. See the reference manual for the keystrokes used to access each display page in the series. Note that in some software such as the centrifugal extractor, page numbering begins with 0 (zero); that is, the first page is page #0. Hence, on software such as the extractor, i2 = inputs page #1 (the second inputs page).

H = This input is represented by the character "H" on the display.

Note 19: When the Milnor Dryer/Shuttle Controller is provided for a new installation, the LCD displays are omitted from the controllers for any shuttle(s) and dryer(s) also provided. In this case, inputs and outputs may be viewed on the monitor supplied with the shuttle/dryer controller. As with the CBW Mentor controller, it is easy to identify signals because the signal names are displayed.

3.10.2. Identifying Output and Input LED's On the I/O Boards (all except 76032 CBW)

—Two types of output/input peripheral boards are used in conjunction with the allied interfaces covered herein. Their designations and capacities are:

1. **BO24-x**—contains 24 outputs (and no inputs). x is "1", "2", etc. indicating the first, second, etc. such board in this machine.
2. **BIO-x**—contains 16 inputs and 8 outputs. x is "1", "2", etc. indicating the first, second, etc. such board in this machine.

For all except the CBW, the peripheral boards are located in the low voltage electric box. The arrangement and combination of these boards within the card cage varies with the machine type and optional equipment provided. For the G3 CBW (Mark 9), the boards that support the explicit allied interface signals are located in the card cage in the left (Standard Output) section of the main control box.

A tag located in the electric box identifies the boards that may be provided and shows the position of each board in the card cage. Each 24 output board has a set of red LED's (numbered 0 through 23). Each 16/8 I/O board has two sets of LED's—a red set for the outputs (numbered 0 through 7) and a green set for the inputs (numbered 0 through 15). The "Board/code" values listed in the tables herein tell you which board and output or input number represent the indicated signal, as in the following example:

io2/5

Where:

io2 = the 16/8 I/O board designated "BIO-2". (Other examples: io1=BIO-1, o1=BO24-1, o2=BO24-2)

5 = input #5, if this signal is an input or output #5 if this signal is an output.

3.11. Decimal / Binary Conversion and How It Applies to Allied Interfaces

Batch codes (decimal numbers) are converted to binary by the sending controller, then passed via the numeric signals to the receiving controller, where they must be converted back to decimal numbers. For example, if an interface provides for passing 16 drycodes, then to pass drycode 14

(binary 1110), drycode signals D, C, B, and A (from most to least significant) must be on, on, on, and off respectively, during the “data valid” window.

Table 36 “Numeric Signal Decimal and Binary Values” shows, for the first 16 decimal numbers (e.g., drycodes 00 through 15), the corresponding binary numbers and which numeric signal carries each binary digit. This table's columns correspond to, and align with the columns in each table of numeric signals herein. For higher numbers, use the “Decimal Value of Signal” values in this table to convert between decimal and binary as explained herein.

Table 36: Numeric Signal Decimal and Binary Values

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Decimal Value of Group	Most Significant	Binary Data Signals							Least Significant
			J or K or 9	I or J or 8	H or 7	G or 6	F or 5	E or 4	D or 3	C or 2	B or 1	A or 0
Decimal Value of Signal-->			**512**	**256**	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
The number of data signals required for typical ranges of batch codes are as follows:		0							0	0	0	0
		1							0	0	0	1
		2							0	0	1	0
		3							0	0	1	1
		4							0	1	0	0
Code Range	Signals Required	5							0	1	0	1
		6							0	1	1	0
00-15	A-D	7							0	1	1	1
00-31	A-E	8							1	0	0	0
00-63	A-F	9							1	0	0	1
000-127	A-G	10							1	0	1	0
000-255	A-H	11							1	0	1	1
000-511	A-I or J	12							1	1	0	0
0000-1023	A-J or K	13							1	1	0	1
		14							1	1	1	0
		15							1	1	1	1

For brevity, this table shows only the binary numbers for decimals 0 - 15 (e.g., decimal 7 = binary 0111).

Use the "Decimal Value of Signal" values above, to convert between decimal and binary, for any decimal number between 16 and 1023.

See explanations of decimal / binary conversion herein.

For convenience, an example and explanations of converting between decimal and binary follow. Many other examples and explanations can be found in mathematics texts, on the Internet, etc. Also, some pocket calculators and many computer programs are available for converting between decimal and binary.

Note 20: In Table 37, which follows, the “Decimal value of binary 1 in this position” is the same as “Decimal Value of Signal” in Table 36.

Table 37: Decimal Values for Binary Digit 1 In the First Ten Positions

Significance of digit	**most**									**least**	
Position of digit	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
Decimal value of binary 1 in this position	**512**	**256**	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**	
Example binary number	1	0	0	1	0	1	1	0	1	0	
Decimal value carried down for this example	512	0	0	64	0	16	8	0	2	0	= 602

3.11.1. Converting Decimal to Binary—Referring to Table 37, if you want to convert decimal number 602 to binary, use the “Decimal value of binary 1 in this position” values, as follows:

512 = highest value not exceeding 602.
602 – 512 = 90
64 = highest value not exceeding 90.
90 – 64 = 26
16 = highest value not exceeding 26.
26 – 16 = 10
8 = highest value not exceeding 10.
10 – 8 = 2
2 = highest value not exceeding 2.
2 – 2 = 0

In the above arithmetic, you used the decimal values 512, 64, 16, 8, and 2. You did not use 256, 128, 32, 4, and 1. Placing a 1 in the position for each decimal value used and a 0 (zero) in each position not used, yields 1001011010. Hence, decimal 602 = binary 1001011010.

3.11.2. Converting Binary to Decimal—Referring to Table 37, if you want to convert binary to decimal, simply sum the decimal values corresponding to the 1's in each position of the binary number. Keep in mind that while a 1 in any position has a certain positive decimal value, a 0 (zero) in any position has the decimal value 0 (zero). The conversion for binary 1001011010 looks like this:

512 + 0 + 0 + 64 + 0 + 16 + 8 + 0 + 2 + 0 = 602

Hence, binary 1001011010 = decimal 602.

— End of BICALC02 —

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4. Device Master™ Allied Dryer Interface

The role of Device Master in a Milnor® automated laundering system is to represent an allied (non-Milnor) device as a Milnor device to Milnor's Miltrac™ system controller. The seven generic device types currently defined by the PC Device Master software accommodate a variety of allied equipment. One device type is Type 3, Allied Dryer (see manual MTYCDR01, "Technical Reference—Using the Device Master Controller"). This generic type, along with the Device Master inputs and outputs described herein, comprise the Device Master allied dryer interface, and provide better control of an allied dryer than can be achieved otherwise.

This document summarizes the Device Master allied dryer interface signals available and identifies them in the Device Master circuitry. These signals have the same electrical and functional specifications as stated in document BICALC02, "Milnor Allied Interface Specifications and Signals..." in manual MTPALI01 "Installation—Allied Interfaces..."

4.1. What the Device Master Allied Dryer Interface Does

Milnor shuttles provide an allied discharge interface (see document BICALC02, "Milnor Allied Interface Specifications and Signals...") that can be used to electrically interface the shuttle with an allied dryer. However, because this interface is independent of Miltrac, Miltrac functionality is unavailable to the allied dryer. For example, Miltrac cannot sequence the loading of an allied dryer within a bank of dryers in a Miltrac system. Device Master device Type 3, Allied Dryer solves this problem by permitting an allied dryer to appear to, and be handled by Miltrac as a Milnor dryer.

For discharge to a belt, Device Master device Type 3 also provides a means of interfacing an allied dryer with a dryer discharge conveyor. Milnor does not offer a dedicated belt controller with an allied loading interface to perform this function.

4.2. Summary of Device Master Allied Dryer Signals

The Device Master allied dryer interface passes only the batch data needed for dryer processing. This currently includes four binary outputs which provide for 16 drycodes and one output to signal a partial (single cake) load. There is no need to pass batch data for down-stream devices (if any). This is handled by Miltrac.

Table 38 lists the operational signals passing between Device Master and the allied dryer and relates them to the generic functions described in document BICALC13, "Summary of Milnor Allied Interface Capability..." in manual MTPALI01 "Installation—Allied Interfaces..." The operational signals have meanings similar to those of the allied interfaces that this interface can be used in place of (such as a Milnor shuttle discharge interface). However, the words "input" and "output" in the following tables refer to the Device Master controller, as opposed to the Milnor machine controller (such as a shuttle controller) that would otherwise provide the interface.

Table 38: Operational Functions and Available Signals

Function Type-->	Directional Functions				Transfer Functions						Confirmation Functions			
Function Name--> / Physical 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
Device Master Allied Dryer Interface														
Shuttle to Dryer							input: dryer desires a load	output: dryer allowed to load		input: load door open*			output: dryer loaded	input: load door closed
Dryer to Conveyor						input: dryer desires dischg			output: dryer allowed to dischg		input: discharge door open			output: discharge door closed
* All batch data outputs close at this time, as well.														

4.3. Signals—Device Master Allied Dryer Interface

The signals tables provided herein are organized much the same as those in "Milnor Allied Interface Specifications and Signals..." in manual MTPALI01 "Installation—Allied Interfaces..." However, with Device Master, the various interface functions (such as load desired) can be considered either a loading or a discharge function, depending on whether they are viewed from the standpoint of the allied device (which Device Master represents) or the Milnor device it is physically intefaced with. To avoid confusion resulting from this ambiguity, Device Master interfaces are not identified as to "loading" or "discharge" the way Milnor machine allied interfaces (and their "signals" tables) are.

As with machine interfaces, some Device Master signals pass **numeric** values in binary and others are used individually to pass **non-numeric** (on/off) values. The receiving device can read the groups of numeric signals in any order as long as it reads this data during the window of time within which it is valid. However, because each signal within a group of numeric signals represents a specific digit of the binary number, the order of significance of the signals (**digit order**) must be understood and must match on sending and receiving devices. Most non-numeric signals provide operational information which must be exchanged according to a predetermined "handshaking" scheme. Hence, the sequence in which operational signals occur (**enabling order**) is critical. Accordingly, the signal information is presented in two tables:

1. **Numeric signals and digit order**—In this table, signals are depicted in digit order; that is, the way they would be read as a binary number. The rightmost **column** represents the signal that carries the least significant digit. Each adjacent **column** to the left is the signal representing the digit of next higher significance. The table is divided into **row** groups—one row group for each batch code provided. Each row group provides pertinent information for the signals used with that batch code.
2. **Non-numeric signals and enabling order**—In this table, each **row** represents a signal and each **column** provides pertinent information for that signal. Generally, these signals must be exchanged by the interfaced devices in the order listed. The labels given to operational signals in the schematics can vary from device to device. However, the document "Summary of Milnor Allied Interface Capability" provides generic names for these. The right-hand column of this table provides both the generic (function) name and the signal name as shown in the schematic, except where these are the same.

Table 39: Numeric Signals and Digit Order—Device Master Allied Dryer Interface

Signal name on schematic (e.g., Drycode A, B, etc.)-->		Common Conn. *	Most Significant		Dedicated Connections (Binary Data Signals)							Least Significant
			K	J	H	G	F	E	D	C	B	A
16 Drycodes (00 - 15)	Multi-terminal	n/a							TBK	TBK	TBK	TBK
	Pin Number	n/a							U • V	S • T	Q • R	L • M
	Wire Number	n/a							AAU • AAV	AAS • AAT	AAQ • AAR	AAL • AAM
	Display/code	--							**	**	**	**
	Board/code***	--							io_/6	io_/5	io_/4	io_/3

* For outputs from Device Master, Milnor does not normally assign either pin of the potential-free contace as the common. Hence, both pins have unique pin and wire numbers. In this table, these are listed together in the same cell with a dot between (e.g., U • V).

** The PC Device Master software provides an intuitive "Device Inputs and Outputs" window for viewing input/output status. See manual MTYCDR01, "Technical Reference—Using the Device Master Controller"

*** The underscore in the third character position of the board/code (e.g., io_/6) represents the board number and depends on the device number of the dryer within Device Master (which can support up to eight devices, numbered 0 through 7). For devices 0 though 7, the boards are numbered 6, 7, 8, 9, A, B,C, and D respectively. Hence, device 4 uses Device Master board A (e.g., ioA/6).

Table 40: Non-Numeric Signals and Enabling Order—Device Master Allied Dryer Interface

Signal Direc-tion	Common Connection*			Dedicated Connection			Display / code	Board / code ***	Function Name / Signal Name
	Multi-terminal	Pin	Wire	Multi-terminal	Pin	Wire			
Input	2G	2G	2G	TBK	B	AAB	**	io_/1	load desired / dryer desires a load
Output*	TBK	W	AAW	TBK	Y	AAY	**	io_/0	loading mode / dryer allowed to load
Input	2G	2G	2G	TBK	C	AAC	**	io_/2	load allowed / load door open
Output*	TBK	X	AAX	TBK	Z	AAZ	**	io_/1	transfer complete / dryer loaded****
Input	2G	2G	2G	TBK	D	AAD	**	io_/3	transfer complete / load door closed****
Output*	TBK	N	AAN	TBK	P	AAP	**	io_/7	single cake / partial load****
Input	2G	2G	2G	TBK	E	AAE	**	io_/4	discharge desired / dryer desires discharge
Output*	TBK	H	AAH	TBK	J	AAJ	**	io_/2	discharge allowed / dryer allowed to discharge
Input	2G	2G	2G	TBK	F	AAF	**	io_/5	transfer not complete / discharge door open
Input	2G	2G	2G	TBK	G	AAG	**	io_/6	transfer complete / discharge door closed

* For outputs from Milnor, Milnor does not normally assign either pin of the potential-free contact as the common. Hence, both pins have unique pin and wire numbers.

** The PC Device Master software provides an intuitive "Device Inputs and Outputs" window for viewing input/output status. See manual MTYCDR01, "Technical Reference—Using the Device Master Controller"

*** The underscore in the third character position of the board/code (e.g., io_/6) represents the board number and depends on the device number of the dryer within Device Master (which can support up to eight devices, numbered 0 through 7). For devices 0 though 7, the boards are numbered 6, 7, 8, 9, A, B,C, and D respectively. Hence, device 4 uses Device Master board A (e.g., ioA/6).

**** The batch data outputs are set when Device Master receives the "load door open" input. The "dryer loaded" output may be used by the allied dryer as a data valid signal to indicate that batch data may now be read. When Device Master receives the "load door closed" input, it "turns off" the batch data signals.

— End of BICALC16 —