

# OPERATING AND SERVICE MANUAL

**THERMO ELECTRON**

**AC-4000 CONTROLLER**

## REVISION HISTORY

REVISION A	OCTOBER 1993
REVISION B	JANUARY 1994
REVISION C	APRIL 1994
REVISION D	FEBRUARY 1995
REVISION E	AUGUST 1995
REVISION F	NOVEMBER 1995
REVISION G	SEPTEMBER 1997
REVISION H	DECEMBER 1997
REVISION J	MAY 1998
REVISION K	FEBRUARY 2000
REVISION L	SEPTEMBER 2000
REVISION M	OCTOBER 2005

COPYRIGHT 1993, 1994, 1995, 1997, 1998, 2000 BY THERMO ELECTRON, INC

THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF THERMO. IT MAY NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THE EXPRESS WRITTEN CONSENT OF THERMO. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF THERMO. THERMO INTENDS TO AND IS MAINTAINING THE WORK AS CONFIDENTIAL INFORMATION. THERMO ALSO MAY SEEK TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. IN THE EVENT OF EITHER INADVERTENT OR DELIBERATE PUBLICATION, THERMO INTENDS TO ENFORCE ITS RIGHTS TO THIS WORK UNDER THE COPYRIGHT LAWS AS A PUBLISHED WORK. THOSE HAVING ACCESS TO THIS WORK MAY NOT COPY, USE OR DISCLOSE THE INFORMATION IN THIS WORK UNLESS EXPRESSLY AUTHORIZED BY THERMO.

### **PLEASE READ AND OBSERVE THE FOLLOWING SAFETY PRECAUTIONS FOUND THROUGHOUT THIS MANUAL.**

#### **DANGER**

FAILURE TO OBSERVE WILL CAUSE VERY SERIOUS PERSONAL INJURY OR DEATH.

#### **WARNING**

FAILURE TO OBSERVE COULD CAUSE SERIOUS PERSONAL INJURY.

#### **CAUTION**

FAILURE TO OBSERVE MAY CAUSE MINOR OR MODERATE PERSONAL INJURY  
OR DAMAGE TO THE EQUIPMENT.

# THERMO RAMSEY ICORE PRODUCTS

## AC-4000 CONTROLLER

### TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
1.0	INTRODUCTION .....	1-1
1.1	GENERAL DESCRIPTION .....	1-1
	1.1.1 Applications .....	1-1
	1.1.2 System Description .....	1-1
	1.1.3 Operation .....	1-1
	1.1.4 Features .....	1-3
1.2	OPTIONS .....	1-4
	1.2.1 15 Programmable Product Set-Ups .....	1-4
	1.2.2 Statistics (STATS) .....	1-4
	1.2.3 Multiple Diverter .....	1-4
	1.2.4 Diverter Verification .....	1-4
	1.2.5 Communications (COM) .....	1-4
1.3	WARRANTY .....	1-7
2.0	INSTALLATION .....	2-1
2.1	GENERAL .....	2-1
2.2	SAFETY PRECAUTIONS .....	2-1
	2.2.1 Occupational Safety and Health Act (OSHA) .....	2-2
2.3	STORAGE .....	2-2
2.4	UNCRATING & INSPECTION .....	2-2
2.5	EQUIPMENT LOCATION .....	2-3
2.6	INSTALLATION .....	2-4
	2.6.1 Initial Power On .....	2-4
3.0	SOFTWARE .....	3-1
4.0	MAINTENANCE .....	4-1
4.1	GENERAL .....	4-1
4.2	SERVICE & REPAIR .....	4-1

TABLE OF CONTENTS  
(continued)

CHAPTER	TITLE	PAGE
4.3	COMPONENT REPLACEMENT PROCEDURES (ELECTRICAL) . . .	4-1
4.3.1	Display Board Assembly Replacement . . . . .	4-1
4.3.2	Display Module Replacement . . . . .	4-2
4.3.3	Communication Board Replacement . . . . .	4-2
4.3.4	CPU Board Replacement . . . . .	4-4
4.3.5	Analog Board Replacement . . . . .	4-4
4.3.6	Distribution Board Replacement . . . . .	4-6
4.3.7	Front Panel Replacement . . . . .	4-8
4.3.8	Motor Speed Control Module Replacement . . . . .	4-10
4.3.9	Cold Start Procedure . . . . .	4-10
4.4	TROUBLESHOOTING . . . . .	4-11
5.0	REPLACEMENT PARTS . . . . .	5-1
5.1	GENERAL . . . . .	5-1
5.2	ORDER INFORMATION . . . . .	5-1
5.3	PARTS LIST INDEX . . . . .	5-2
5.3.1	Return Material Authorization . . . . .	5-3
6.0	AC-4000 OPTIONS . . . . .	6-1
6.1	GENERAL . . . . .	6-1
6.1.1	Swing Gate Reject System . . . . .	6-1
6.1.2	Air Bopper Reject System . . . . .	6-1
6.1.3	Air Jet Reject System . . . . .	6-2
6.1.4	Air Pusher Reject System . . . . .	6-2
6.1.5	Carrier Reject System . . . . .	6-2
6.2	VARIABLE SPEED . . . . .	6-8
6.2.1	Installation . . . . .	6-8
6.3	COMMUNICATIONS . . . . .	6-9
6.3.1	Communication Board Installation . . . . .	6-9
6.3.2	External Communication Cabling . . . . .	6-11
6.3.3	External Cabling Connections . . . . .	6-14
6.3.4	Formatted Report . . . . .	6-14



TABLE OF CONTENTS  
(continued)

<u>CHAPTER</u>	<u>TITLE</u>	<u>PAGE</u>
	6.3.5 Free Run Data .....	6-14
6.4	STATISTICS OPTION .....	6-15
	6.4.1 Installation .....	6-15
6.5	MULTIPLE PRODUCT OPTION .....	6-15
	6.5.1 Installation .....	6-15
6.6	MULTIPLE DIVERTER OPTION .....	6-16
	6.6.1 Installation .....	6-16
6.7	DIVERTER VERIFICATION OPTION .....	6-16
	6.7.1 Installation .....	6-16
6.8	MOTOR INHIBIT OPTION .....	6-17

## LIST OF ILLUSTRATIONS

<u>FIGURE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
1-1	AC-4000 Electronics .....	1-0
1-2	System Block Diagram .....	1-2
2-1	Input Power Connections .....	2-4
2-2	Analog Board .....	2-5
2-3	Distribution Board .....	2-6
4-1	Display Board Assembly/Module Replacement .....	4-3
4-2	Communication, CPU and Analog Board Replacement .....	4-5
4-3	Distribution Board Replacement .....	4-7
4-4	Distribution Board with Options .....	4-7
4-5	Front Panel Replacement .....	4-9
6-1	Communication Board Switches .....	6-11
6-2	EIA-232 Connections .....	6-12
6-3	EIA-485 Connections .....	6-13

## LIST OF TABLES

<u>TABLE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
1-1	Technical Specifications .....	1-5
4-1	Troubleshooting Procedures .....	4-12
4-2	Power Troubleshooting Procedure .....	4-17
5-1	AC-4000 Electronics (Remote or Local) .....	5-4
6-1	Swing Gate Reject System - Replaceable Parts .....	6-3
6-2	Air Bopper Reject System - Replaceable Parts .....	6-5
6-3	Air Jet Reject System - Replaceable Parts .....	6-6
6-4	Air Pusher Reject System - Replaceable Parts .....	6-7
6-5	Variable Speed Option .....	6-8
6-6	Communication Board Switch Settings .....	6-10
6-7	Communications Option Parts .....	6-11
6-8	External Cabling Connections .....	6-14

APPENDIX

LIST OF DRAWINGS

<u>TITLE</u>	<u>DRAWING NO.</u>
A/1	Field Wiring Diagram
A/3	Full Menu Tree
A/5	Comm I/Comm II Cable Assembly
A/6	Comm I/O Cable EIA-232
A/7	Comm I/O Cable EIA-485

Engineer Selected  
D07226K-V002  
C07226K-E089  
C07190K-E086  
D07190K-E087

SUPPLEMENTAL MANUALS

<u>TITLE</u>	<u>DOCUMENT NO.</u>
Minarik Adjustable Speed Control, Model MM 2300	MC-3

## PREFACE

This manual contains information necessary to install, operate, and service the Thermo AC-4000 Electronics (see Figure 1-1).

All persons concerned with the operation and servicing of the electronics should read the contents of this manual carefully and thoroughly. Keep this manual in a convenient place and refer to it often, as it is an important tool in performing proper service.

Information in this manual is presented as follows:

Chapter 1.0, INTRODUCTION, presents a brief description of the electronics' capabilities, operation, features, options specifications and warranty.

Chapter 2.0, INSTALLATION, outlines site preparation operating requirements, and installation instructions.

Chapter 3.0, OPERATION, explains the operating controls and procedures.

Chapter 4.0, MAINTENANCE, includes troubleshooting, electronic checkout, and maintenance procedures.

Chapter 5.0, REPLACEMENT PARTS, provides ordering information and replaceable parts list.

Chapter 6.0, OPTIONS, contains information about optional equipment.

The APPENDIX contains assembly, installation, and wiring drawings.

### IMPORTANT

Do not turn the equipment on or attempt to operate the electronics until you have read and understood Chapters 2.0 and 3.0. Improper operation of the electronics may result in damage to the machine.



P00151

AC-4000 ELECTRONICS  
FIGURE 1-1

## CHAPTER 1.0 INTRODUCTION

### 1.1 GENERAL DESCRIPTION

The AC-4000 Electronics System is a high accuracy machine. When combined with a weighing frame, it performs weight inspection of individual product packages in a production process or package line. The AC-4000 and a weighing frame perform these functions without interrupting product flow.

#### 1.1.1 Applications

Typical applications for the AC-4000 Electronics System are the in-motion weighing of:

Frozen food, bakery, confectionery, meat, and any canned or packaged goods.

Detergents, chemicals, pharmaceutical, and any bottled liquid products.

Manufactured products such as rubber, plastic, metal parts, multi-component parts packages, and count-by-weight packages.

#### 1.1.2 System Description

The AC-4000 Electronics System consists of:

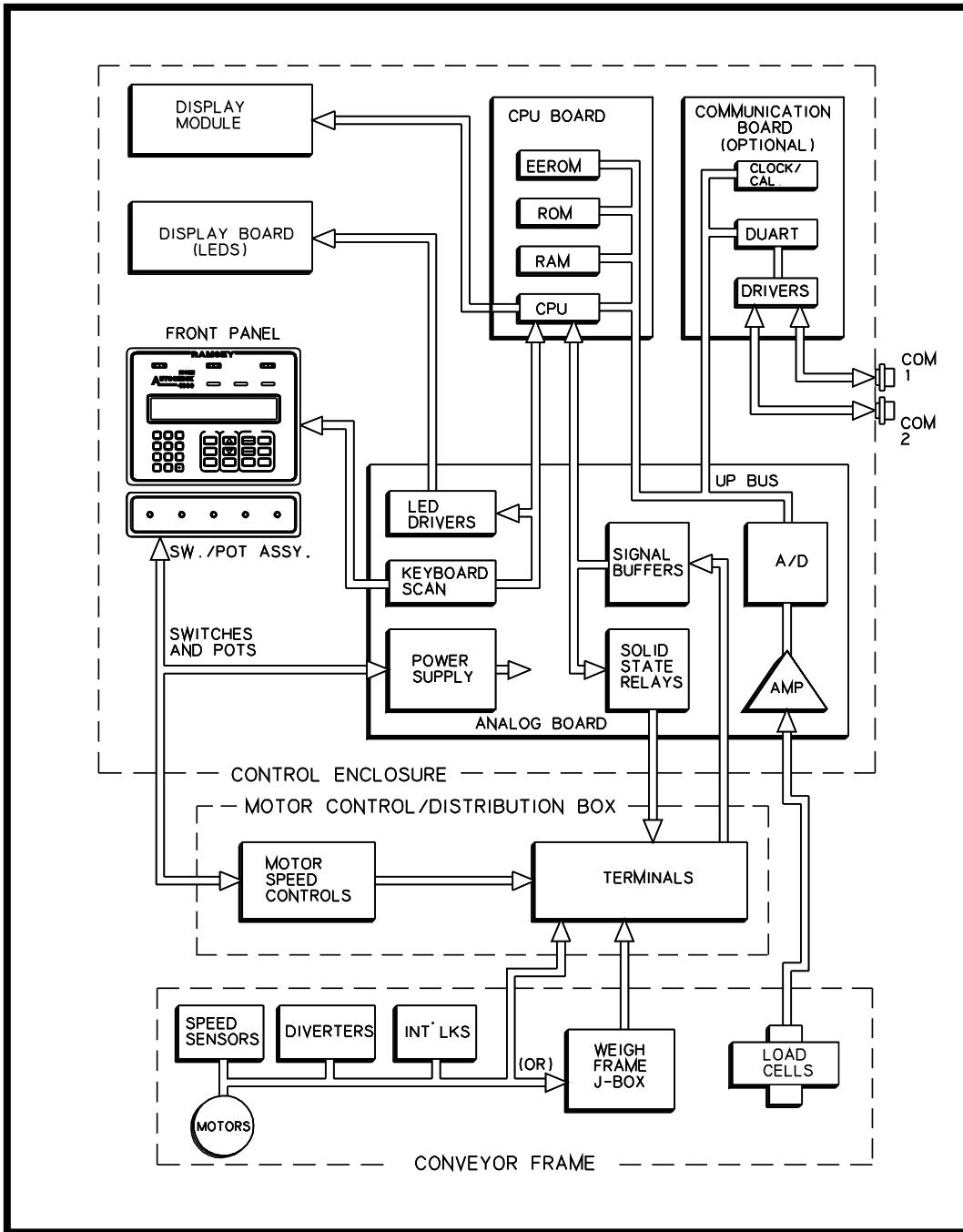
A microprocessor-based electronic system with filtering and amplification circuitry to interpret the signal from a loadcell. The electronics enclosure houses the CPU, A/D and display boards.

A front panel keypad and vacuum fluorescent display. The digital keypad is used to enter set-up parameters. The display presents weight and other statistical data to the operator.

Output signals for a reject device or alarm.

#### 1.1.3 Operation

Upon installation, certain data must be entered into the AC-4000 electronics. The AC-4000's front panel is designed to simplify set-up and operation of a machine. All data is entered digitally, using the soft keyboard buttons on the front panel. The operator is assisted in set-up by the fluorescent displays that show what data to enter.



A00435

SYSTEM BLOCK DIAGRAM  
FIGURE 1-2

During operation, the package is transported by a conveying medium (such as chains or belts) across a weightable. The loadcell supporting a weightable produces an electronic signal proportional to the package weight. As the package interrupts a beam from a photocell sensor (interlock), the gross weight of the package is computed by the AC-4000 electronics. This weight is then compared to the setpoint zone settings to determine the appropriate zone. A reject device may then be activated for off-weight packages.

The AC-4000 will display the weight class (zone) of the last package weighed, as well as the actual weight of the package in grams, kilograms, ounces or pounds. Using the front panel keyboard, the AC-4000 also will display the total number of packages in each weigh zone and the average weight of the packages in each zone.

#### **1.1.4 Features**

The AC-4000 Electronics System has the following standard features:

1. Auto Zero and Manual Zero

The electronics automatically compensate for minor buildup on the weightable by rezeroing the weightable between packages. Manual zero allows the rezeroing of the weightable at the operator's discretion.

2. Automatic Self-Diagnostics

This feature continually monitors system operation and assures that everything is operating properly. A fault relay for connection to an external alarm is provided.

3. Digital Filter Setup

During set-up, filter parameters are selected for individual products using the front panel keyboard. This exclusive feature improves the weighing accuracy by providing the best filter setting for each product.

4. Password Protection

This feature provides protection against an unauthorized change in set-up parameters and access to certain data.

5. Permanent Data Storage

An EEPROM retains set-up information and stores accumulated data.

6. 32-Bit Microprocessor

This large memory capacity increases the flexibility of the AC-4000 and allows it to handle a broader range of applications.

7. Corrosion Resistant Finish

All exposed metal parts on the AC-4000 Electronics System are either stainless steel or painted mild steel.



## **1.2 OPTIONS**

Electronics can be remote or local, and numerous options are available to transform the AC-4000 from a low-cost, basic electronics into a sophisticated tool for monitoring productivity and packaging line performance. These options include the following:

### **1.2.1 15 Programmable Product Set-Ups**

The set-up parameters for 15 products can be preset into the electronics. The AC-4000 can then be switched from one product to another in a matter of seconds.

### **1.2.2 Statistics (STATS)**

The Statistics option provides statistical information on package weights.

### **1.2.3 Multiple Diverter**

The Multiple Diverter option provides for three diverter outputs. The package can be diverted into under-weight, on-weight and over-weight categories if desired. Also can be used for No Gaps (package spacing is too close) or as an alarm actuator to signal remote locations of alarm status.

### **1.2.4 Diverter Verification**

The Diverter Verification option provides verification that packages are properly diverted. It generates an alarm if a package which should have been diverted is seen, or if one which should not have been diverted is not seen.

### **1.2.5 Communications (COM)**

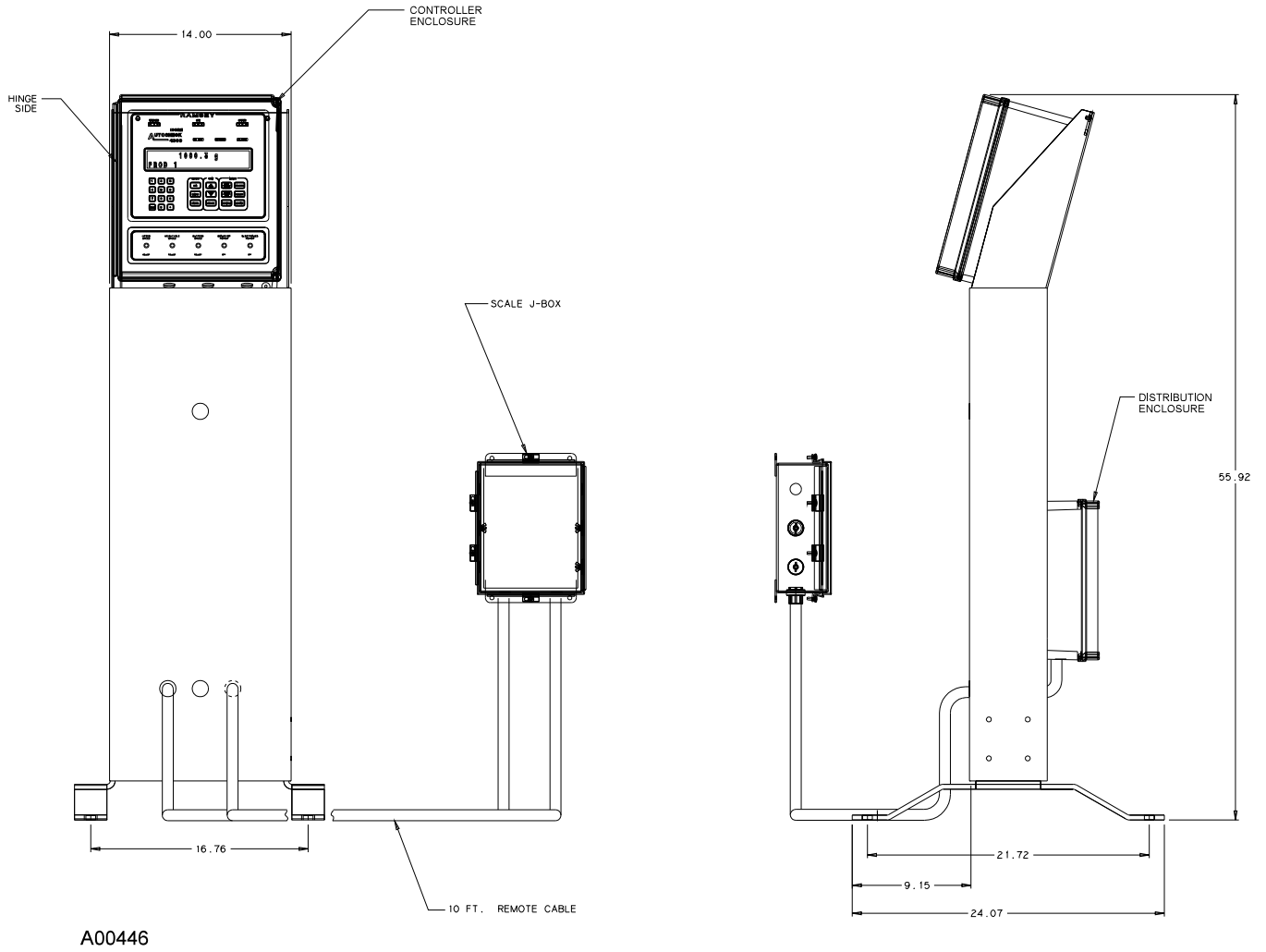
The Communication option provides for communication of weight or statistical information from the AC-4000 to a printer, CRT, or host computer. The information can be in the form of raw weight data or a formatted report, depending upon the STATS option included with the electronics.

Other optional communications capabilities are also available.

**TABLE 1-1  
TECHNICAL SPECIFICATIONS - AC-4000 ELECTRONICS**

Line Speed	20 to 350 Ft./Min. (6 to 107 m/min.)
Package Rate	To 350 PPM
Accuracy: Displayed Resolution Electrical Accuracy	$\pm 1$ , $\pm 0.1$ , or $\pm 0.01$ Units $\pm 32$ mg for 6000 gram loadcell
Zeroing	Automatic self zeroing between packages.  REZERO light turns on if an autozero cannot occur within two minutes.
Weight Zones	3 standard
Outputs	Machine comes equipped with 110 VAC output signals that may be used to drive rejects or external alarms. Any zone may be set to trigger any of the output signals. Machine includes 32 package reject memory.
Environment: Electrostatic Discharge Temperature Humidity	5000V 14° to 122° F (-10° to +50° C) 0% to 95%
Electrical: Standard	100-130/200-250 VAC, 50/60 Hz, 300 VA excluding rejecters and alarms
Neutral to Ground Maximum Voltage	140 Volt AC

**TABLE 1-1  
TECHNICAL SPECIFICATIONS - (Continued)**



### 1.3 WARRANTY

#### **THERMO ELECTRON WARRANTY**

The seller agrees, represents, and warrants that the equipment delivered hereunder shall be free from defects in material and workmanship. Such warranty shall not apply to accessories, parts, or material purchased by the seller unless they are manufactured pursuant to seller's design, but shall apply to the workmanship incorporated in the installation of such items in the complete equipment. To the extent purchased parts or accessories are covered by the manufacturer's warranty, seller shall extend such warranty to buyer.

Seller's obligation under said warranty is conditioned upon the return of the defective equipment, transportation charges prepaid, to the seller's factory in Minneapolis, Minnesota, and the submission of reasonable proof to seller prior to return of the equipment that the defect is due to a matter embraced within seller's warranty hereunder. Any such defect in material and workmanship shall be presented to seller as soon as such alleged errors or defects are discovered by purchaser and seller is given opportunity to investigate and correct alleged errors or defects and in all cases, buyer must have notified seller thereof within one (1) year after delivery, or one (1) year after installation if the installation was accomplished by the seller.

Said warranty shall not apply if the equipment shall not have been operated and maintained in accordance with seller's written instructions applicable to such equipment, or if such equipment shall have been repaired or altered or modified without seller's approval; provided, however, that the foregoing limitation of warranty insofar as it relates to repairs, alterations, or modifications, shall not be applicable to routine preventive and corrective maintenance which normally occur in the operation of the equipment.

"EXCEPT FOR THOSE WARRANTIES SPECIFICALLY CONTAINED HEREIN, SELLER DISCLAIMS ANY AND ALL WARRANTIES WITH RESPECT TO THE EQUIPMENT DELIVERED HEREUNDER, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE. THE SOLE LIABILITY OF SELLER ARISING OUT OF THE WARRANTY CONTAINED HEREIN SHALL BE EXCLUSIVELY LIMITED TO BREACH OF THOSE WARRANTIES. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF THE WARRANTIES SET OUT ABOVE SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT OF ANY DEFECTIVE ACCESSORY, PART OR MATERIAL WITH A SIMILAR ITEM FREE FROM DEFECT, AND THE CORRECTION OF ANY DEFECT IN WORKMANSHIP. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES."

#### FIELD SERVICE

Purchaser agrees to underwrite the cost of any labor required for replacement; including time, travel, and living expenses of Thermo Ramsey Field Service Engineer at closest factory base.

**THERMO ELECTRON  
501 90th Avenue N.W.  
Minneapolis, MN 55433  
Phone: (763) 783-2500  
Fax: (763) 783-2525**

## CHAPTER 2.0 INSTALLATION

### 2.1 GENERAL

The customer is responsible for initial inspection of the equipment and site preparation. It is essential that the equipment be placed on the production line in accordance with the guidelines set forth in this section. The customer must ensure that qualified personnel are available to make interconnections with other production equipment and perform work at the installation site. A Thermo Customer Service representative is available to supervise installation and verify operation as well as train personnel assigned to operate and maintain the equipment.

### 2.2 SAFETY PRECAUTIONS

#### IMPORTANT

Do not install, operate, or perform any maintenance procedures until you have read the safety precautions presented below.

1. Do not connect power to the machine or turn on the unit until you have read and understood this entire manual. The precautions and procedures presented in this manual must be followed carefully in order to prevent equipment damage and protect the operator from possible injury.
2. CAUTION! Hands and clothing must be kept away from all moving or rotating parts.
3. WARNING! Covers over the electronics, or rotating parts should always remain in place during operation. They should be removed only for maintenance procedures with the machine's power OFF. Be sure to replace all covers before resuming operation.
4. WARNING! All switches (control, motor, power, etc., as applicable) must be OFF when checking input AC electrical connections, removing or inserting printed circuit boards, or attaching voltmeters to the system.
5. Incoming voltages must be checked with a voltmeter before being connected to the machine. Pay special attention to the red tag attached to the machine that stipulates the correct input voltage for your particular unit.
6. WARNING! Extreme caution must be used in testing in, on, or around the electronics cabinet, PC boards, or modules. There are voltages in excess of 115V, 230V, or 440V in these areas. Avoid high voltage and static electricity around the printed circuit board.
7. CAUTION! Do not leave insulating material over the machine for any length of time or the machine will overheat. The specified maximum ambient temperature is not to be exceeded for more than 5 minutes.
8. Maintenance procedures should be performed only by qualified personnel and in accordance with procedures/instructions given in this manual.
9. During maintenance, a safety tag (not supplied by Thermo) should be displayed in the ON/OFF switch areas as a precaution instructing others not to operate the unit (ANSI:B157.1).
10. Only qualified electricians should be allowed to open and work in the electronics cabinets, power supply cabinets, control cabinets, or switch boxes.

11. Objects of any kind should never be placed or stored on the machine.
12. This equipment should not be operated at more than the specified production rate nor utilized in applications other than those stated in the original order. (To adapt production rates or applications, consult Thermo Products Customer Service for recommendations.)
13. All panels and doors covering the electronics must be in place and tight before conducting wash down. Damage to the electronics could result from water, moisture, or contamination in the electronics housing.
14. Harsh chemicals, caustics, disinfectants, etc., should never be added to wash down solutions.
15. Infeed and outfield conveyors and transfer assemblies should be mounted and/or positioned so clearance is maintained between moving parts. Check to ensure weighing or infeed/outfield conveyor(s) are clear of debris before turning the drive motor ON.

### **2.2.1 Occupational Safety and Health Act (OSHA)**

The Occupational Safety and Health Act clearly places the burden of compliance on the user of the equipment and the act is generalized to the extent that determination of compliance is a judgement decision on the part of the local inspection. Hence Thermo Ramsey will not be responsible for meeting the full requirements of OSHA in respect to the equipment supplied or for any penalty assessed for failure to meet the requirements, in respect to the equipment supplied, of the Occupational Safety and Health Act, as interpreted by an authorized inspector. Thermo Ramsey will use their best efforts to remedy such violation at a reasonable cost to the buyer.

## **2.3 STORAGE**

If you are not going to install the electronics system now, it can be safely stored at temperatures from -40° F (-40° C) to +158° F (+70° C). All components should be protected against moisture.

## **2.4 UNCRATING & INSPECTION**

The electronics system has been properly packaged for shipment. Inspect all packages for damage before opening as often times the carrier may be responsible for shipping damage.

1. Inspect the electronics for shipping damage.
2. Remove the poly covering from the electronics.
3. Cut the nylon shipping bands securing the electronics to pallet.
4. Lift the electronics and pedestal off the pallet.

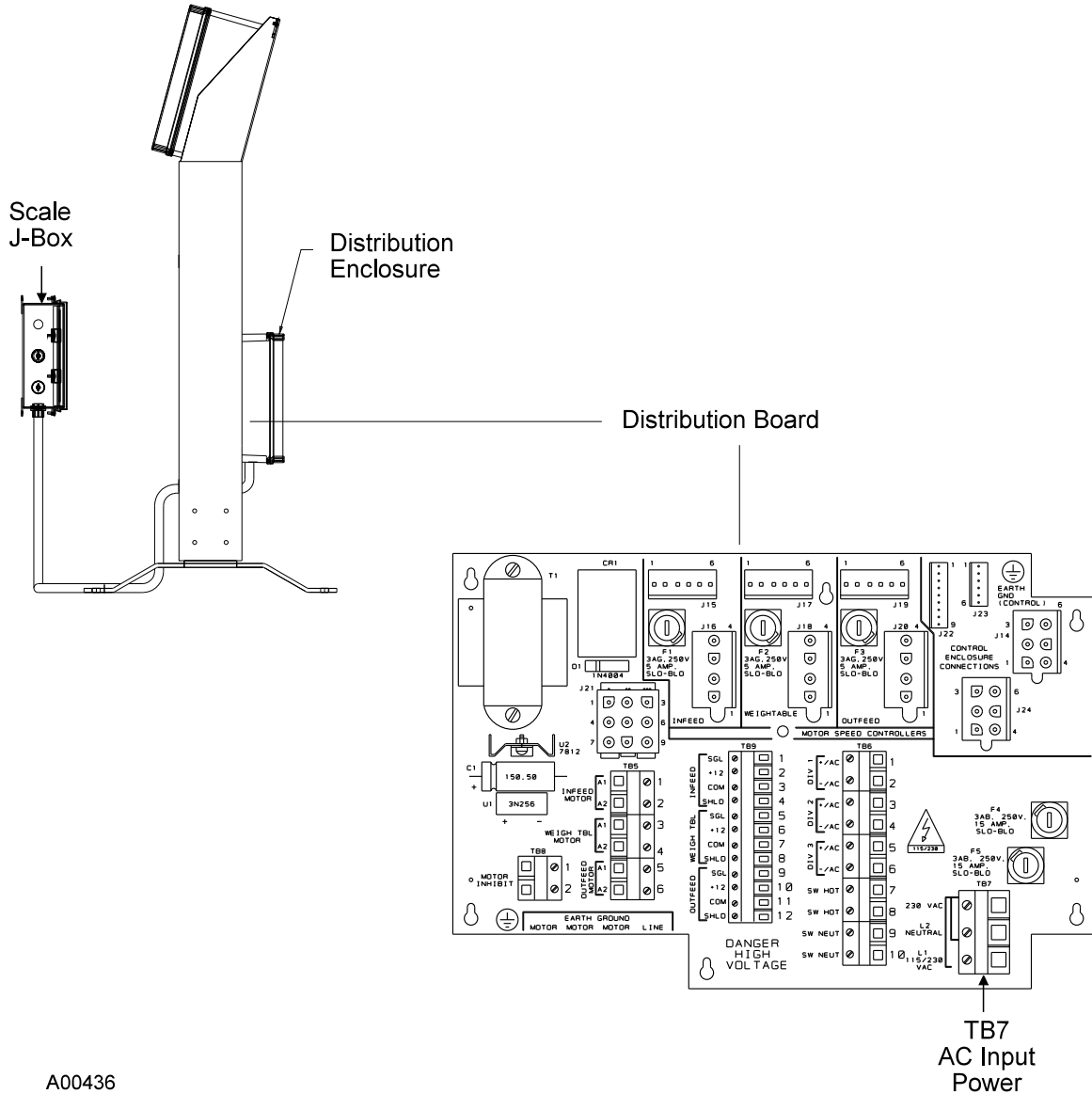
## **2.5 EQUIPMENT LOCATION**

Careful consideration should be given to the location of the electronics, as system performance is affected by its location. The following requirements must be followed.

1. The electronics should be located so maintenance personnel can easily perform cleaning and adjustment procedures, and so both the control panel and electronics enclosure rear doors are easily accessible. This requires clear space behind and in front of the machine.
2. There should be a minimum of vibration in the area. Vibrations can be conducted to a loadcell and affect weighing accuracy.
3. The electronics system is designed to operate in an environment where the temperature ranges no lower than -14° F (-10° C) nor higher than 122° F (50° C).
4. The electronics will operate in an environment where the humidity (non-condensing) ranges from 0% to 95%.

## 2.6 INSTALLATION

The procedures given below provide for installing the electronics in your production line.



A00436

INPUT POWER CONNECTIONS  
FIGURE 2-1

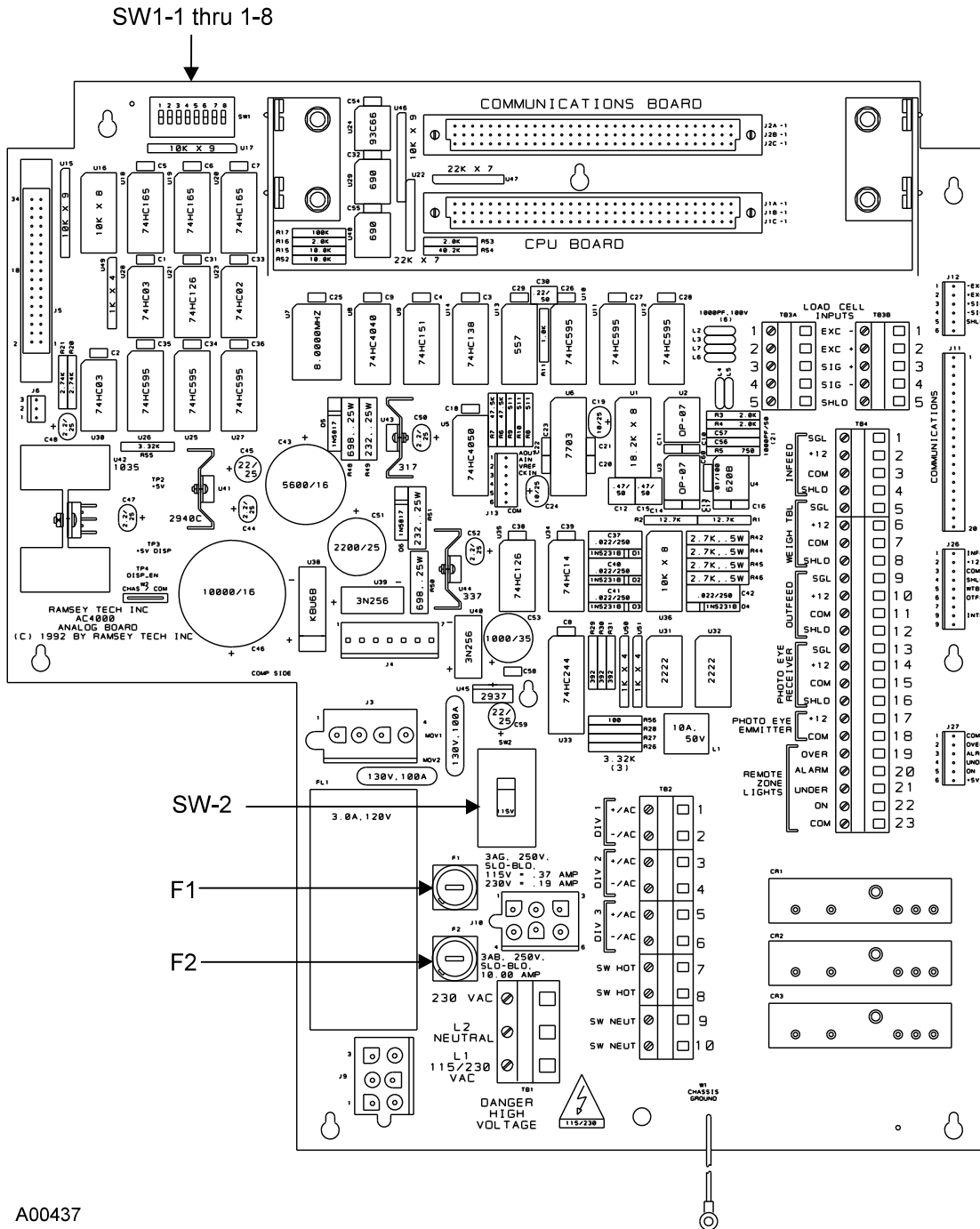
### 2.6.1 Initial Power On

The initial power on procedures describe the checks to be performed before the initial system setup procedures are performed.

1. Verify that the fuses on the Analog Board (Figure 2-2) and Distribution Board (Figure 2-3) inside the controller enclosure are correct for the AC input voltage. The following lists define the correct fuses.



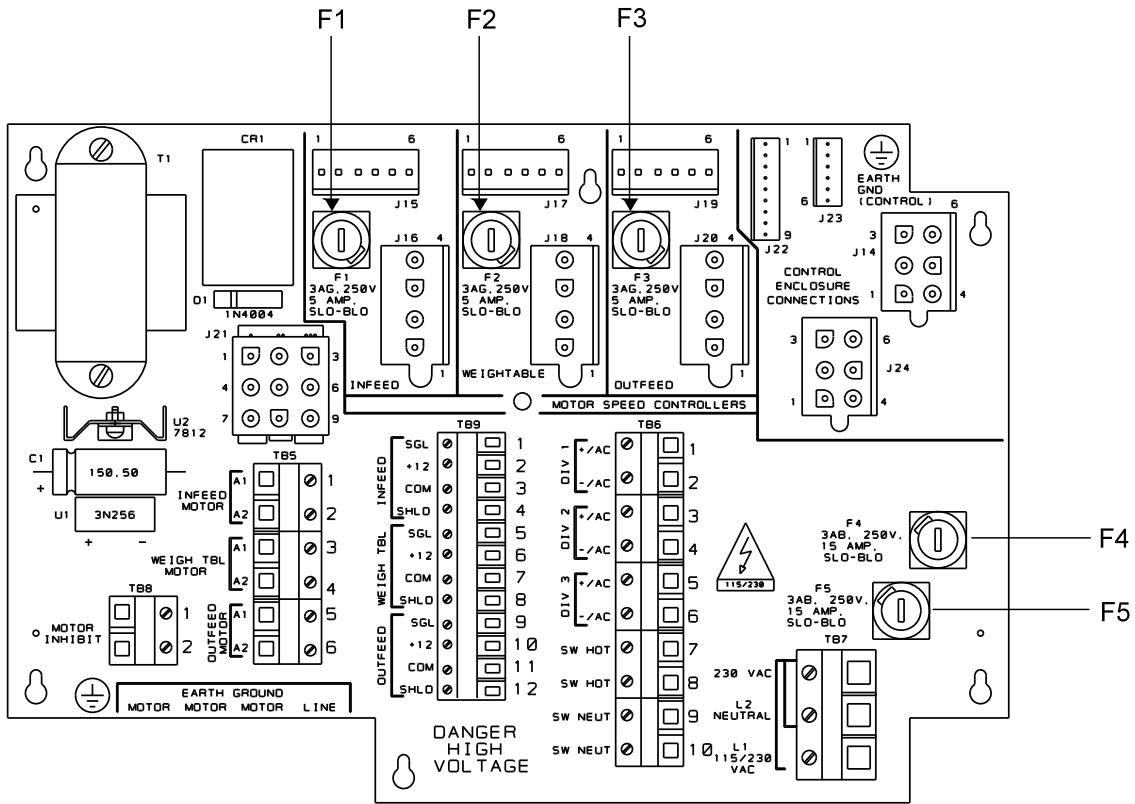
ANALOG BOARD		
FUSE	115VAC	220VAC
F1 (for electronics)	3/8A, 3AG, SB	3/16A, 3AG, SB
F2 (for line [L2])	10A, 3AB, SB	10A, 3AB, SB



A00437

ANALOG BOARD  
FIGURE 2-2

<b>DISTRIBUTION BOARD</b>	
<b>FUSE</b>	<b>115VAC/220VAC</b>
F1 (for Indeed motor)	5A, 3AG, SB
F2 (for weightable motor)	5A, 3AG, SB
F3 (for outfield motor)	5A, 3AG, SB
F4 (for line [L1])	15A, 3AB, SB
F5 (for line [L2])	15A, 3AB, SB



A00438

**DISTRIBUTION BOARD**  
**FIGURE 2-3**

2. Verify that switch SW-2 on the Analog Board is set to the correct AC input voltage.
3. Verify that the dip switches on the Analog Board are correct for your configuration. The following list defines the standard switch settings for the Analog Board, if the specific options noted are installed. (For options see Chapter 6.0.)

<b>ANALOG BOARD DIP SWITCHES</b>		
<b>SWITCH</b>	<b>POSITION</b>	<b>DESCRIPTION</b>
SW1-1	OFF/OPEN*	Optional outfield with speed sensor.
	ON/CLOSED	No outfield speed sensor.
SW1-2	OFF/OPEN	Standard weightable speed sensor.
	ON/CLOSED*	No weightable speed sensor.
SW1-3	OFF/OPEN*	Optional Indeed with speed sensor.
	ON/CLOSED	No Indeed speed sensor.
SW1-8	ON/CLOSED*	Normal Run position.
	OFF/OPEN	Remove forgotten password.
Others	OFF/OPEN	Not Used
*Standard position.		

4. Turn the front panel CONVEYOR POWER switch ON and verify that the belt (chains) are running.
5. Turn the ELECTRONICS POWER switch ON and let the electronics warm up.

This page intentionally left blank

**THERMO RAMSEY**  
**ICORE PRODUCTS**  
**AC-4000 CONTROLLER**  
  
**CHAPTER 3.0 OPERATION**  
  
**FOR**  
  
**VERSION 1.XX SOFTWARE**

This page intentionally left blank

## REVISION HISTORY

REVISION A	OCTOBER 1993
REVISION B	APRIL 1994
REVISION C	AUGUST 1995
REVISION D	OCTOBER 1995
REVISION E	MARCH 1996
REVISION F	MAY 1997
REVISION G	DECEMBER 1997
REVISION H	MAY 1998
REVISION J	AUGUST 1998
REVISION K	MARCH 1999

COPYRIGHT 1993 - 1999 BY THERMO RAMSEY

THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF THERMO RAMSEY. IT MAY NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THE EXPRESS WRITTEN CONSENT OF THERMO RAMSEY. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF THERMO RAMSEY. THERMO RAMSEY INTENDS TO AND IS MAINTAINING THE WORK AS CONFIDENTIAL INFORMATION. THERMO RAMSEY ALSO MAY SEEK TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. IN THE EVENT OF EITHER INADVERTENT OR DELIBERATE PUBLICATION, THERMO RAMSEY INTENDS TO ENFORCE ITS RIGHTS TO THIS WORK UNDER THE COPYRIGHT LAWS AS A PUBLISHED WORK. THOSE HAVING ACCESS TO THIS WORK MAY NOT COPY, USE OR DISCLOSE THE INFORMATION IN THIS WORK UNLESS EXPRESSLY AUTHORIZED BY THERMO RAMSEY.

### **PLEASE READ AND OBSERVE THE FOLLOWING SAFETY PRECAUTIONS FOUND THROUGHOUT THIS MANUAL**

#### **DANGER**

FAILURE TO OBSERVE WILL CAUSE VERY SERIOUS PERSONAL INJURY OR DEATH.

#### **WARNING**

FAILURE TO OBSERVE COULD CAUSE SERIOUS PERSONAL INJURY.

#### **CAUTION**

FAILURE TO OBSERVE MAY CAUSE MINOR OR MODERATE PERSONAL INJURY  
OR DAMAGE TO THE EQUIPMENT.

This page intentionally left blank



**THERMO RAMSEY ICORE PRODUCTS**

**AC-4000 CONTROLLER**

**TABLE OF CONTENTS**

<u>CHAPTER</u>	<u>TITLE</u>	<u>PAGE</u>
3.0	OPERATION .....	3-1
3.1	GENERAL .....	3-1
3.2	BELT SPEED ADJUSTMENTS AND POWER SWITCHES .....	3-2
3.3	FRONT PANEL DISPLAYS .....	3-2
	3.3.1 System Status Lights .....	3-2
	3.3.2 Zone Indicators .....	3-2
	3.3.3 Message Readout .....	3-2
3.4	KEYPAD .....	3-2
	3.4.1 Numeric Keys .....	3-2
	3.4.2 Execute Keys .....	3-3
	3.4.3 View Keys .....	3-3
	3.4.4 Menu Keys .....	3-3
3.5	INITIAL SETUP PROCEDURE .....	3-9
	3.5.1 Run .....	3-9
	3.5.2 Parameter Checks .....	3-10
	3.5.3 Actual/Dev Weight Display .....	3-11
3.6	PASSWORD .....	3-12
	3.6.1 Supervisor and User Passwords .....	3-12
	3.6.2 Enter Password .....	3-12
	3.6.3 Change Supervisor Password .....	3-13
	3.6.4 Change User Password .....	3-14
	3.6.5 Password Status .....	3-14
	3.6.6 Removing a Lost Password .....	3-16
3.7.	MACHINE SETUP .....	3-19
	3.7.1 Language Selection .....	3-20
	3.7.2 Weighing Mode .....	3-20
	3.7.3 Weight Units .....	3-21
	3.7.4 Length Units .....	3-21

TABLE OF CONTENTS(continued)

<u>CHAPTER</u>	<u>TITLE</u>	<u>PAGE</u>
	3.7.5 Weight Displayed Precision . . . . .	3-22
	3.7.6 Weightable Length / On Scale Time . . . . .	3-22
	3.7.7 Interlock to Outfeed . . . . .	3-22
	3.7.8 Auto Calculate . . . . .	3-23
	3.7.9 Weightable Speed . . . . .	3-23
	3.7.10 Weightable Speed Sensor . . . . .	3-23
	3.7.11 Infeed Speed . . . . .	3-24
	3.7.12 Infeed Speed Sensor . . . . .	3-24
	3.7.13 Outfeed Speed . . . . .	3-24
	3.7.14 Outfeed Speed Sensor . . . . .	3-25
	3.7.15 Alarm Diverter . . . . .	3-25
	3.7.16 Checkweigher ID . . . . .	3-25
	3.7.17 Port A Function . . . . .	3-25
	3.7.18 Port A Baud Rate . . . . .	3-26
	3.7.19 Port A Parity . . . . .	3-26
	3.7.20 Port A Word Length . . . . .	3-26
	3.7.21 Port A Stop Bits . . . . .	3-27
	3.7.22 Port B Function . . . . .	3-27
	3.7.23 Port B Baud Rate . . . . .	3-27
	3.7.24 Port B Parity . . . . .	3-27
	3.7.25 Port B Word Length . . . . .	3-28
	3.7.26 Port B Stop Bits . . . . .	3-28
3.8	PRODUCT SETUP . . . . .	3-31
3.9	ENTERING PRODUCT DATA . . . . .	3-32
	3.9.1 Product Number . . . . .	3-32
	3.9.2 Reference Weight . . . . .	3-32
	3.9.3 Under Cutpoint . . . . .	3-32
	3.9.4 Over Cutpoint . . . . .	3-33
	3.9.5 Tare Weight . . . . .	3-33
	3.9.6 Package Length / Transition Time . . . . .	3-33
	3.9.7 Interrogate Delay . . . . .	3-34

TABLE OF CONTENTS(continued)

<u>CHAPTER</u>	<u>TITLE</u>	<u>PAGE</u>
	3.9.8 Maximum Weightable Speed .....	3-35
	3.9.9 Filter Type .....	3-35
	3.9.10 Filter Frequency .....	3-36
	3.9.11 Number of Weight Samples .....	3-36
	3.9.12 Under Weights [Diverter] .....	3-37
	3.9.13 On Weights [Diverter] .....	3-37
	3.9.14 Over Weights [Diverter] .....	3-37
	3.9.15 No Gap Diverter .....	3-38
	3.9.16 Diverter [1, 2, or 3] Delay .....	3-38
	3.9.17 Diverter [1, 2, or 3] Duration .....	3-39
	3.9.18 Diverter Verification Delay .....	3-39
3.10	SELECTING A PRODUCT FOR CHECKWEIGHING .....	3-40
3.11	SYSTEM CALIBRATION .....	3-41
	3.11.1 Zeroing the Scale .....	3-41
	3.11.2 Dynamic or Static Calibration (No_Run) .....	3-42
	3.11.3 Gray Zone .....	3-44
	3.11.4 Re-Zero Interval .....	3-45
	3.11.5 Re-Zero Count/Time .....	3-45
	3.11.6 Auto Gray Zone Test .....	3-46
3.12	GRAY ZONE - GENERAL PRINCIPLES .....	3-47
3.13	ALARM/TEST MENUS .....	3-49
	3.13.1 Alarm Displays .....	3-50
	3.13.2 Auto Zero Threshold .....	3-53
	3.13.3 Verification Learn .....	3-53
	3.13.4 Dip Switches .....	3-54
	3.13.5 Infeed Speed .....	3-55
	3.13.6 Weightable Speed .....	3-55
	3.13.7 Outfeed Speed .....	3-55
	3.13.8 Firmware Version .....	3-56
	3.13.9 Interlock Test .....	3-56
	3.13.10 Diverter Test .....	3-57

TABLE OF CONTENTS(continued)

<u>CHAPTER</u>	<u>TITLE</u>	<u>PAGE</u>
	3.13.11 Verification Test .....	3-57
	3.13.12 Comm Loopback Test .....	3-58
	3.13.13 Lamp Test .....	3-58
	3.13.14 Keyboard Test .....	3-58
	3.13.15 Live A/D Display .....	3-59
3.14	PRINT/STATS MENUS .....	3-61
	3.14.1 Print Report .....	3-62
	3.14.2 Under Weight Package Count .....	3-63
	3.14.3 On Weight Package Count .....	3-63
	3.14.4 Over Weight Package Count .....	3-63
	3.14.5 Total Accepted Count .....	3-63
	3.14.6 Total Under Weight .....	3-64
	3.14.7 Total On Weight .....	3-64
	3.14.8 Total Over Weight .....	3-64
	3.14.9 Total Accepted Weight .....	3-65
	3.14.10 Total Accepted Under Weight .....	3-65
	3.14.11 Total Accepted On Weight .....	3-65
	3.14.12 Total Accepted Over Weight .....	3-66
	3.14.13 Batch Report By .....	3-66
	3.14.14 Batch/Minutes or Count .....	3-67
	3.14.15 Report Width .....	3-67
	3.14.16 Free Run Columns .....	3-68
	3.14.17 Formatted Statistical Report .....	3-69
	3.14.18 Set Time/Date .....	3-71
	3.14.19 Product Code .....	3-71
	3.14.20 Shift Number .....	3-71
	3.14.21 Line Number .....	3-72
	3.14.22 Clear Statistics .....	3-72

## LIST OF ILLUSTRATIONS

<u>FIGURE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
3-1	AC-4000 Front Panel .....	3-1
3-2	Permanent Record for Machine Scroll .....	3-17
3-3	AC-4000 Control Setup Dimensions .....	3-18
3-4	AC-4000 Checkweigher Mode - 3 Zone .....	3-29
3-5	Permanent Record for Product Scroll .....	3-30
3-6	Analog Board Dip Switches .....	3-60
3-7	Example of Printed Report .....	3-70

## LIST OF TABLES

<u>TABLE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
3-1	Front Panel Scrolls .....	3-7
3-2	Alarm Messages .....	3-51

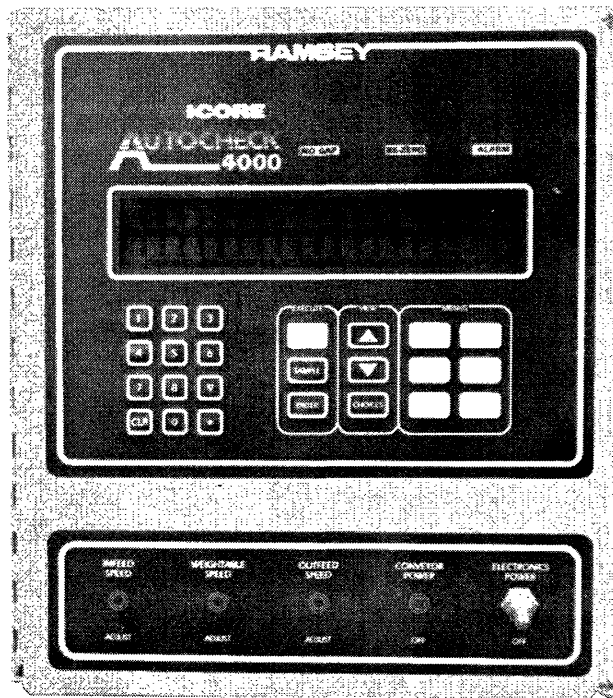
This page intentionally left blank

## CHAPTER 3.0 OPERATION

### 3.1 GENERAL

This chapter explains the AC-4000 controls and their functions. Detailed operating procedures are also included. All operations are performed from the front panel of the electronic enclosure (Figure 3-1).

The AC-4000 has been adjusted, configured, and inspected at the factory per the supplied customer data. Additional internal adjustments should not be necessary for satisfactory performance. If adjustments become necessary, then refer to the Maintenance chapter for detailed alignment and configuration procedures.



P00149

AC-4000 FRONT PANEL  
FIGURE 3-1

### 3.2 BELT SPEED ADJUSTMENTS AND POWER SWITCHES

Belt speed adjustable potentiometers are available for infeed, weightable and outfeed conveyors.

The conveyor on/off power switch controls the power to the weightable conveyor, and infeed/outfeed conveyors when installed. The electronics on/off power switch controls power to the electronics circuitry. When the electronics on/off switch is in the OFF position, data is retained in the internal memory backup.

### 3.3 FRONT PANEL DISPLAYS

The AC-4000's front panel display includes the following features:

- System status lights that show the status of the weighing process.
- Zone indicators that signify Under, On or Over weights.
- Message readout.

#### 3.3.1 System Status Lights

System status lights at the top of the panel give the operator a visual sign of specific system problems.

- **NO GAP** indicates there is insufficient spacing between packages.
- **RE-ZERO** lights when the system has been unable to zero for two minutes. It will flash when the system makes a new zero adjustment.
- **ALARM** indicates the system has a problem to report to the operator. The operator should look at the Alarm Menu for further information.

#### 3.3.2 Zone Indicators

Zone indicators are located directly above the message display. The lights are labeled **UNDER**, **ON**, and **OVER**. These lights indicate the weight zone of the last package that just crossed the weightable.

- **UNDER** lights when the package weight is less than the under cutpoint.
- **ON** lights when the package weight is greater than the under cutpoint, but less than the over cutpoint.
- **OVER** lights when the package weight is greater than the over cutpoint.

#### 3.3.3 Message Readout

The two line, twenty character message display sends alphanumeric information to the operator.

### 3.4 KEYPAD

The keypad includes twenty-four pad touch keys. The keys are arranged in four groups of keypads: Numeric, Execute, View and Menus.

#### 3.4.1 Numeric Keys

Numeric keys (0-9, decimal point, clear) allow the operator to enter new numeric values into the menus.

#### 3.4.2 Execute Keys

Execute keys (**RUN**, **SAMPLE**, and **ENTER**) provide the operator with a means to run at current settings, sample package weight, verify checkweigher accuracy, and enter changes to settings. Following is an explanation of each key.



## 1. Run

Pressing the **RUN** key puts the machine into the Run Mode if the required values have been entered before. This key operates at all times except at initial setup. After initial setup, the system continues to weigh even if the run displays are exited. If entries have been changed, these changes will take affect when the **RUN** key is pressed.

When the key is pressed, the system checks for any problems with the settings. If there are setup problems, an error message is displayed and the operator is automatically led through the menus that can correct the problem.

## 2. Sample

The sample function allows the line operators to check the checkweigher performance without stopping production. When the **SAMPLE** key is pressed, the next package is diverted to the sample diverter (diverter 1) and its measured weight will be held on the lower half of the display.

## 3. Enter

Pressing the **ENTER** key causes the system to accept changes to operator settings. It is also used to continue past informational messages that may be displayed.

To change system settings, the operator presses the numeric entry keys or the **CHOICE** key until the desired change is displayed. **ENTER** is then pressed to make the change.

**NOTE:** When making changes to system settings, be sure to press the **ENTER** key before using the up or down scroll keys. Changes will be lost if these keys are pressed before pressing **ENTER**.

### 3.4.3 View Keys

View keys (scroll up ▲, scroll down ▼, and **CHOICES**) permit the operator to look at information stored in the system. They do not change any system settings. The **CHOICES** key allows the operator to view all the possible selections for the multiple choice type menus.

### 3.4.4 Menu Keys

Menu keys allow the operator to view different categories of functions and enter values. The menu keys are **PRINT/STATS**, **CALIBRATE**, **ALARM/TEST**, **PRODUCT**, **PASSWORD**, and **MACHINE**. Some menus have selectable choices. See Menu Tree drawing D07226K-V002 in the appendix.

Not all menus shown in this document are always available. Menus may disappear either because the operator has set up the machine so they are not used, or they are part of an option that is not installed in the system. The following table shows the conditions under which menus disappear.

CONDITION	OPERATOR/OPTION
Communications	Option
Statistics	Option
Weightable speed sensor	Operator set
Infeed speed sensor	Operator set
Outfeed speed sensor	Operator set
Alarm Diverter	Operator set
Fifteen product setup	Option
Auto Calculation	Operator set
Diverter Used	Operator set
Password entered	Operator set
Three Diverter	Option

### 1. Print/Stats

The print/stats function is used to print various reports. As shown below, there are various conditions under which statistical reports are printed and reset.

CONDITION	PRINT STATISTICS	RESET STATISTICS
Operator has changed parameter.	Yes	Yes
Operator has requested print report.	Yes	No
Operator has set timed report.	Yes	No
Operator has requested clear statistics.	Yes	Yes

### 2. Calibrate

The calibration function allows the AC-4000 to be calibrated for a particular product. This function is divided into three procedures for the convenience of the operator. The following is a list of these procedures:

ZERO SCALE  
CALIBRATE  
GRAY ZONE

### 3. Alarm/Test

This feature allows the operator to troubleshoot the system. When the alarm light is turned on, the operator looks to the first menu for the error message. Error messages are logged until acknowledged, but only cleared when the condition producing the alarm is fixed.

The menus following the Alarm menu are Test menus. Test is used to check different operations of the AC-4000, such as status and zone lights, indicators, dip switch settings, firmware version, current zero level, and span value from last calibration.

#### 4. Product

The product function allows the machine to be configured to a product, or to any one of fifteen (15) different products if the Multiple Product option is installed. The product function includes creating new product information, viewing existing product information, and changing existing product information.

The following is a list of the items related to the Product key:

- A PRODUCT NUMBER
- REFERENCE WEIGHT
- UNDER CUTPOINT
- OVER CUTPOINT
- TARE WEIGHT
- B PACKAGE LENGTH / TRANSITION TIME ©
- D INTERROGATE DELAY
- MAXIMUM WEIGHTABLE SPEED
- D FILTER TYPE
- D FILTER FREQUENCY
- D NUMBER OF SAMPLES
- E UNDER WEIGHT DIVERTER
- E ON WEIGHT DIVERTER
- OVER WEIGHT DIVERTER
- E NO GAP DIVERTER
- F DIVERTER 1 DELAY
- G DIVERTER 1 DURATION
- G DIVERTER 2 DELAY
- G DIVERTER 2 DURATION
- G DIVERTER 3 DELAY
- G DIVERTER 3 DURATION

- A Scroll position only visible if Multiple Product Option is installed.
- B Scroll position only visible if Checkweigher mode is selected.
- C Scroll position only visible if Static mode is selected.
- D Scroll position only visible if Auto Calculate is set to "NO" in the Machine Scroll.
- E Scroll position only visible if Multiple Diverter Option is installed.
- F Scroll position only visible if diverter has not been assigned as an alarm, but has been assigned to a weight zone.
- G Scroll position only visible if Multiple Diverter Option is installed and diverter has not been assigned as an alarm diverter, but has been assigned to a weight zone.

5. Password

Password protection is provided to protect certain variable parameters. When password is enabled through the front panel, all scrolls may be viewed, but cannot be changed until the correct password is entered. Password consists of any combination of up to 9 numeric characters (0, 1, 2, 3, 4, 5, 6, 7, 8, 9) and the decimal point (.).

6. Machine

The machine function permits the AC-4000 electronics to be configured for compatibility with various Icore conveyor frames and customer requirements.

The following is a list of the items related to the Machine key:

	LANGUAGE SELECTION
	WEIGHING MODE
	WEIGHT UNITS
	LENGTH UNITS
	WEIGHT DISPLAYED PRECISION
A	WEIGHTABLE LENGTH / ON SCALE TIME (B)
	INTERLOCK TO OUTFEED
B	AUTO CALCULATE
B	WEIGHTABLE SPEED
C	WEIGHTABLE SPEED SENSOR
D	INFEED SPEED
D	INFEED SPEED SENSOR
	OUTFEED SPEED
E	OUTFEED SPEED SENSOR
F	ALARM DIVERTER
	CHECKWEIGHER ID
G	PORT A FUNCTION
G	PORT A BAUD RATE
G	PORT A PARITY
G	PORT A WORD LENGTH
G	PORT A STOP BITS
G	PORT B FUNCTION
G	PORT B BAUD RATE
G	PORT B PARITY
G	PORT B WORD LENGTH
G	PORT B STOP BITS
A	Scroll only visible if Checkweigher mode is selected.
B	Scroll only visible if Static mode is selected.
C	Scroll only visible if weightable speed sensor is used and Checkweigher mode is selected.
D	Scroll only visible if infeed speed sensor is used and Checkweigher mode is selected.
E	Scroll only visible if outfeed speed sensor is used and Checkweigher mode is selected.
F	Scroll only visible if the Multiple Diverter Option is installed.
G	Scroll only visible if the Communications Option is installed.

**TABLE 3-1  
FRONT PANEL SCROLLS**

DESCRIPTION	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE
<b>MACHINE MENU</b>			
Language Selection (English, Spanish, French, Italian, German)	N/A	N/A	ENGLISH
Weighing Mode (Checkweigher, Static)	N/A	N/A	CHECKWEIGHER
Weight Units (No Unit, Ounce, Pound, Gram, Kilogram)	N/A	N/A	GRAM
Length Units (Inch, Foot, Millimeter, Meters)	N/A	N/A	INCH
Weight Displayed Precision (.01, .1, 1)	N/A	N/A	.1 DIGITS
Weightable Length or On Scale Time	1.0 .02	99.0 99.0	12 INCH 12 SEC
Interlock to Outfeed	1.0	99.0	24 INCH
Auto Calculate (Yes, No)			YES
Weightable Speed (Length per Time Unit)	.1	900.0	200 FPM
Weightable Speed Sensor (Pulses per Length Unit)	.1	900.00	120
Infeed Speed	N/A	N/A	NONE
Infeed Speed Sensor	.1	900.00	120
Outfeed Speed (Length per Time Unit)	.1	900.00	200
Outfeed Speed Sensor	.1	900.00	120
Alarm Diverter (None, Diverter 3)	N/A	N/A	NONE
Checkweigher ID	0	99	0
Port A Function	N/A	N/A	NONE
Port A Baud Rate	300	19,200	9,600
Port A Parity	N/A	N/A	NONE
Port A Word Length	7	8	8 Bits
Port A Stop Bits	1	2	1 Bit
Port B Function	N/A	N/A	NONE
Port B Baud Rate	300	19,200	9,600
Port B Parity	N/A	N/A	NONE
Port B Word Length	7	8	8 Bits
Port B Stop Bits	1	2	1 Bit

DESCRIPTION	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE
<b>PRODUCT MENU</b>			
Product Number	1	15	1
Reference Weight	0	99999 g	0
Under Cutpoint	0	99999 g	0
Over Cutpoint	0	99999 g	0
Tare Weight	0	99999 g	0 g
Package Length or Transition Time	.5 .01	99.0 99.0	30 INCH 3.0 SEC
Interrogate Delay	.01	99.0	-- INCH
Maximum Weightable Speed (Length per Time Unit)	.1	900.0	200 FPM
Filter Type (Fixed, Notch, Low Pass)	N/A	N/A	FIXED
Filter Frequency	1	30	N/A
Number of Weigh Samples	1	999	10
Under Weight Diverter (No Diverter, Diverter 1, 2, or 3)	N/A	N/A	DIVERTER 1
On Weight Diverter (No Diverter, Diverter 1, 2, or 3)	N/A	N/A	NO DIVERTER
Over Weight Diverter (No Diverter, Diverter 1, 2, or 3)	N/A	N/A	NO DIVERTER
No Gap Diverter (No Diverter, Diverter 1, 2, or 3)	N/A	N/A	NO DIVERTER
Diverter 1 Delay	0.1	899.9	20 INCHES
Diverter 1 Duration	0.01	99.99	.1 sec
Diverter 2 Delay	0.1	899.9	25 INCHES
Diverter 2 Duration	0.01	99.99	.1 sec
Diverter 3 Delay	0.1	899.9	30 INCHES
Diverter 3 Duration	0.01	99.99	.1 sec
Verification Delay	0	899.9	0

**NOTE:** Weight values are displayed in grams, unit values are displayed in inches.  
Values are recalculated when other weights and/or units have been selected.

### 3.5 INITIAL SETUP PROCEDURE

Depending on actual product specifications being available at the time of final assembly and test of your AC-4000, it is possible that your machine has been fully set up at the factory. If this is the case, go through the procedures below and verify that the factors asked for are correct. If product and specifications were not available, follow these procedures in their entirety.

**NOTE:** Upon warm or cold start, a program error message will notify the operator when defective EPROMs are detected. Please contact Thermo Ramsey if this should occur.

#### 3.5.1 Run

When the **RUN** key is pressed, the system checks setup parameters for correctness, loads new running parameters, and displays the running weight information.

To view the current setup values or program initial values, the operator can first press **RUN**. Without running parameters, the operator will be directed through menus needed for a "cold start". (See the AC-4000 Menu Tree drawing in REC 3829.) Cold start menus are:

COLD START MENUS
Language Selection
Weighing Mode
Weight Units
Length Units
Weightable Length / On Scale Time
Interlock to Outfeed
Auto Calculate
Weightable Speed (without a speed sensor) Weightable Speed Sensor (with a speed sensor)
Infeed Speed (without a speed sensor) Infeed Speed Sensor (with a speed sensor)
Outfeed Speed (without a speed sensor) Outfeed Speed Sensor (with a speed sensor)
Reference Weight
Under Cutpoint
Over Cutpoint
Package Length
Interrogate Delay
Maximum Weightable Speed
Filter Type
Filter Frequency
Time / Date
Zero Scale
Calibrate

### 3.5.2 Parameter Checks

When **RUN** is pressed, several setup checks are made. If a problem is found, the following message is shown.

**RUN ERROR Press  
ENTER to correct.**

A set of menus will appear showing what scrolls have a problem. Make changes as necessary to correct the problem. Only one problem menu set will be shown at a time to help the operator determine which problem has been detected. The system will return to the run error message for each problem found until they are all resolved.

- If the interlock to outfeed length is less than the weightable length:

<u>Menu Shown:</u>	<u>Adjust:</u>
Weightable Length	Decrease
Interlock to Outfeed	Increase
  
- If interrogate delay is greater than or equal to weightable length:

<u>Menu Shown:</u>	<u>Adjust:</u>
Interrogate Delay	Decrease
Weightable Length	Increase
  
- If package length is greater than weightable length:

<u>Menu Shown:</u>	<u>Adjust:</u>
Package Length	Decrease
Weightable Length	Increase
  
- If more than one diverter delay is less than interlock to outfeed distance::

<u>Menu Shown:</u>	<u>Adjust:</u>
Interlock to Outfeed	Decrease
Diverter Delay	Increase
[1, 2, or 3] (See Note.)	
  
- If any diverter delay is less than weightable length:

<u>Menu Shown:</u>	<u>Adjust:</u>
Weightable Length	Decrease
Diverter Delay	Increase
[1, 2, or 3] (See Note.)	



**NOTE:** Two or three diverter delay menus will be shown, depending on how many were detected on the deadplate.

- If Auto Calculate is on and calculates an invalid interrogate delay or number of weight samples:

<u>Menu Shown:</u>	<u>Adjust:</u>
Weightable Length	Decrease
Auto Calculate	Choose No
Package Length	Decrease
Maximum Weightable	Decrease
Filter Frequency	Increase (only shown if filter type of "notch" is active)

### 3.5.3 Actual/Dev Weight Display

There are four different weight displays. To select one of the four weight displays, proceed as follows:

- a. Actual: (Gross Weight)

With the Product tare weight set to 0.00, press the RUN key followed by the UP arrow key.

- b. Deviation: (Gross minus Reference Weight)

With the Product tare set to 0.00, press the RUN key followed by the DOWN arrow key.

- c. NET ACT: (Gross minus Tare Weight)

With the Product tare weight set to a greater value than 0.00, press the RUN key followed by the UP arrow key.

- d. NET DEV: (Gross minus Tare minus Reference Weight)

With the Product tare weight set to a value greater than 0.00, press the RUN key followed by the DOWN arrow key.

The actual weight run display shows:

```
nnnn.nn uu tttttttt
Running tttttttt nn
```

The deviation weight run display shows:

```
snnn.nn uu tttttttt
Running tttttttt nn
```

Where: nnnn.nn = Package weights. Overrange displays asterisks (\*).

- snnn.nn = Under/Over (-/+ ) deviation weights. Overrange displays asterisks (\*).
- uu = Weight units
- tttttttt = Deviation, Actual, Net Dev, or Net Act
- ttttttt = Product (Shown when the optional 15 product setup is present.)
- nn = Current running product

### 3.6 PASSWORD

Password protection is provided to protect unauthorized changes to parameters. When password is enabled through the front panel, all scrolls may be viewed, but cannot be changed until the correct password is entered. You can create, or change your password using the Change Password Menu. Passwords consist of a combination of up to 6 numeric characters. (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and decimal point are allowed.)

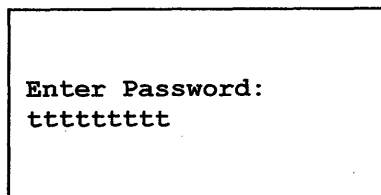
#### 3.6.1 Supervisor and User Passwords

There are two levels of password protection: a Supervisor password and a User password. The supervisor password gives the operator access to all data in the system. The user password gives the operator limited access to the system. A valid supervisor password must be entered in order to have access to the user password. If a supervisor password is active and a user password is not active, the information that is normally protected by the user password is unprotected. If prompted for a user password and the operator enters the supervisor password, the operator gain supervisor rights to all data in the system.

For more detail on what information is accessible through the user password, see the Menu/Key Definition drawing in the Appendix of this manual. The drawing notes the menus that have user level access. The other menus not noted as such are supervisor password protected when the supervisor password is active.

#### 3.6.2 Enter Password

The operator may enter a password to prevent unauthorized access to the system. This menu is not displayed until a password is installed with the change password menu.



	MINIMUM	MAXIMUM	KEYS ALLOWED
ttttttttt =	1 key	9 keys	"0 1 2 3 4 5 6 7 8 9 ."

As each character is pressed, an x appears. Press ENTER when the password has been entered. If an invalid password is entered the following message will be displayed:

```
Enter Password:  
Try Again!
```

### 3.6.3 Change Supervisor Password

The change supervisor password menu allows the changing of the supervisor password. Enter a password for the first time is considered changing the password.

```
Change supervisor  
password: tttttttt
```

tttttttt = As each character is pressed, an asterisk (\*) appears on the display. Press ENTER when the password is entered.

```
Please ENTER it  
again: tttttttt
```

tttttttt = As each character is pressed, an asterisk (\*) appears on the display. Press ENTER when the password is entered. If the two passwords agree, the following message is displayed.

```
Supervisor password  
changed.
```

If the two passwords do not agree, the following message appears. The operator should try again, making sure the two values entered are the same.

```
Try again !
```

### 3.6.4 Change User Password

The change user password menu allows the changing of the user password. Entering a password for the first time is considered changing the password. These screens are present only if a valid supervisor password is entered.

```
Change User
password: tttttttt
```

tttttttt = As each character is pressed, an asterisk (\*) appears on the display. Press ENTER when the password is entered.

```
Please ENTER it
again:  tttttttt
```

tttttttt = As each character is pressed, an asterisk (\*) appears on the display. Press ENTER when the password is entered. If the two passwords agree, the following message is displayed.

```
User password
changed.
```

If the two passwords do not agree, the following message appears. The operator should try again, making sure the two values entered are the same.

```
Try again !
```

### 3.6.5 Password Status

The password status menu is usually a display only menu. It typically displays the status of the password protection, but when the status is unprotected, the menu allows the user to select the level of password protection. This menu allows the operator to remove a password, or to turn the password protection on.

Status: Password None. (Display only)

The following screen is displayed when a password has never been entered, or when the password has been removed.

<b>Password</b> None                      Chosen	Default
---	---------

Status: Supervisor password unprotected.

This screen is displayed when a supervisor password has been correctly entered by the operator. All data in the system is unprotected until the 30 second timeout has timed out, or the operator turns protection on.

<b>Supervisor password</b> Unprotected      Chosen
---

Choices = Unprotected

Protected	Turns password protection on.
Remove	Removes ALL passwords. If selected, the status is "Password None".

Status: Supervisor password protected. (Display only)

The following screen is displayed when the operator has created a supervisor and turned on password protection. Also, this screen indicates there is no user password in the system. In this state, all supervisor data is write protected and all user data is unprotected.

<b>Supervisor password</b> Protected      Chosen
---

Status: User password protected. (Display only)

The user password protected screen is displayed when the operator has created a user password and turned password protection on. This is the highest level of password protection. All data is write protected.

<b>User password</b> Protected      Chosen
---

Status: User password unprotected.

The following screen is displayed when the user password is correctly entered by the operator. All user data in the system is unprotected until the 30 second timeout has timed out, or the operator turns protection on.

User password  
Unprotected Chosen

Choices = Unprotected

Protected Turns user password on. Status is "User password Protected.

Remove Removes user passwords. If selected, the status is "Password None".

### 3.6.6 Removing a Lost Password

**TO KEEP YOUR PASSWORD SECURE IN THE SYSTEM, THIS INFORMATION SHOULD BE REMOVED FROM THIS MANUAL AND STORED IN A SAFE PLACE.**

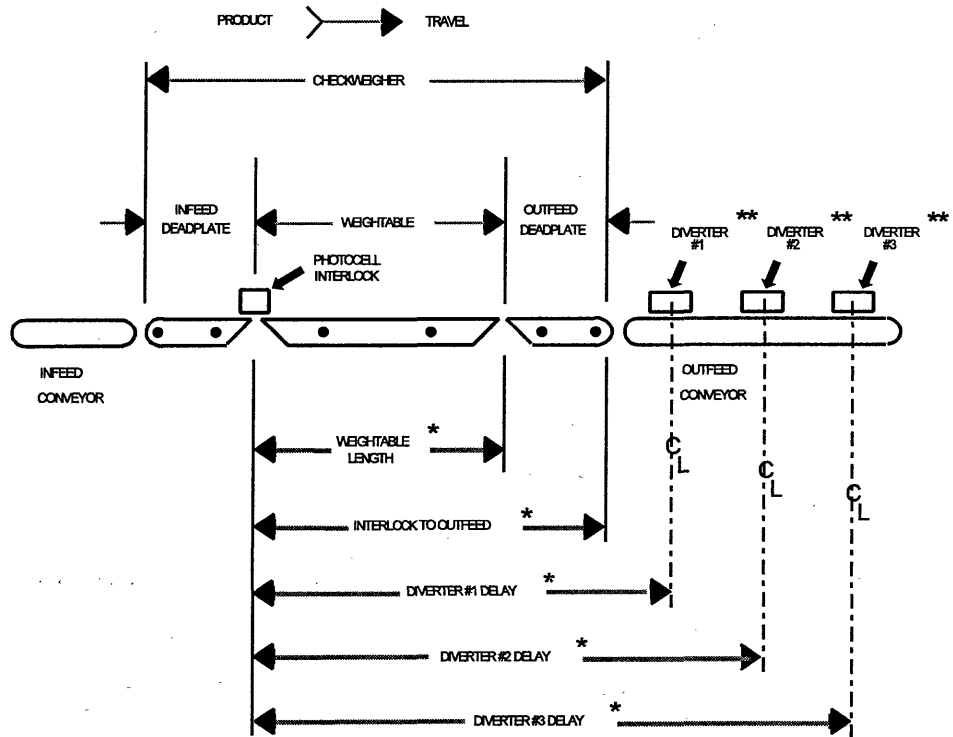
1. Turn power off to the system.
2. Open the electronics enclosure.
3. Turn dip switch SW1-8 on the Analog Board to the OFF position. See Figure 3-6 for location of dip switch.
4. Turn on the power to the system.
5. Go to the Password Access (Password Status) menu and select "Remove".
6. Turn Analog Board dip switch SW1-8 to the ON position.
7. Turn power off and then on again.
8. Close the electronics enclosure.
9. Enter a new password if protection is desired.

PERMANENT RECORD  
MACHINE SCROLL

SCROLL	
Language Selection	_____
Weighing Mode	_____
Weight Units	_____
Length Units	_____
Weight Displayed Precision	_____
Weightable Length <u>or</u> On Scale Time	_____
Interlock to Outfeed	_____
Auto Calculate	_____
Weightable Speed	_____
Weightable Speed Sensor	_____
Infeed Speed	_____
Infeed Speed Sensor	_____
Outfeed Speed	_____
Outfeed Speed Sensor	_____
Alarm Diverter	_____
Checkweigher ID	_____
Port A Function	_____
Port A Baud Rate	_____
Port A Parity	_____
Port A Word Length	_____
Port A Stop Bits	_____
Port B Function	_____
Port B Baud Rate	_____
Port B Parity	_____
Port B Word Length	_____
Port B Stop Bits	_____

PERMANENT RECORD FOR MACHINE SCROLL  
FIGURE 3-2

**Frame with Deadplates**

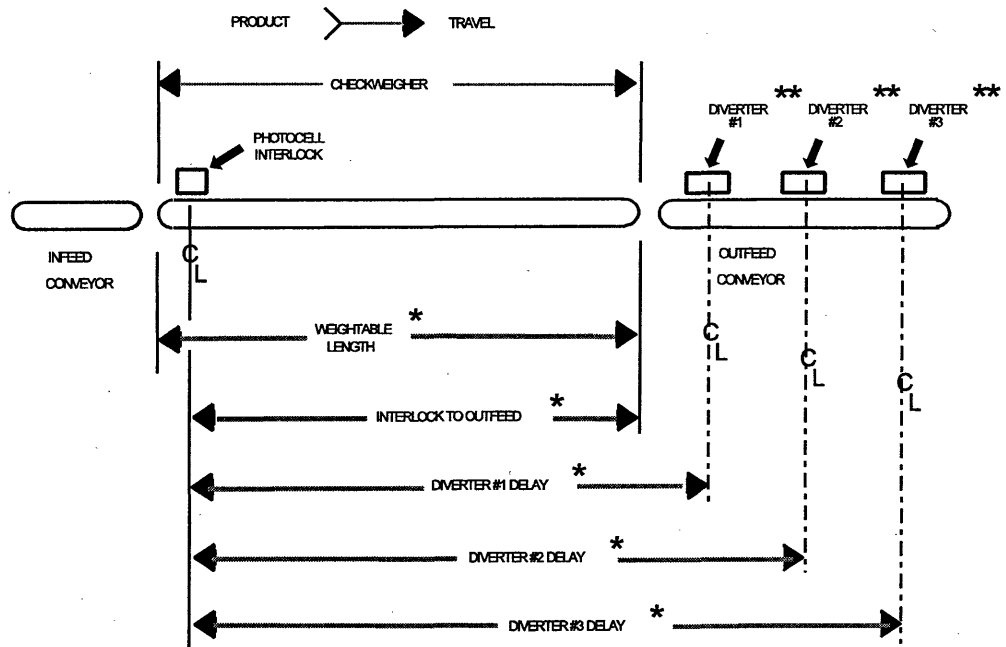


A00244

\* Entered as part of machine setup.

\*\* Entered as part of diverter durations in product setup.

**Frame without Deadplates**



A00902

\* Entered as part of machine setup.

\*\* Entered as part of diverter durations in product setup.

AC-4000 CONTROL SETUP DIMENSIONS  
FIGURE 3-3



### 3.7. MACHINE SETUP

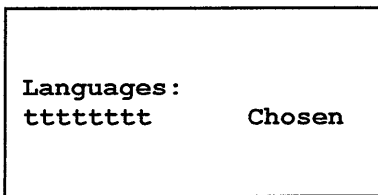
The machine function is used to configure the AC-4000 electronics with the frame assembly. This function is normally set up at the factory and verified at installation (refer to Figure 3-3). It is suggested that Machine Scroll Permanent Record (Figure 3-2) be filled out during machine setup.

**NOTE:** For Cold Start procedures, see the Component Replacement Procedures in the Maintenance Section of this manual.

	LANGUAGE SELECTION
	WEIGHING MODE
	WEIGHT UNITS
	LENGTH UNITS
	WEIGHT DISPLAYED PRECISION
A	WEIGHTABLE LENGTH / ON SCALE TIME (B)
	INTERLOCK TO OUTFEED
A	AUTO CALCULATE
C	WEIGHTABLE SPEED
C	WEIGHTABLE SPEED SENSOR
D	INFEEED SPEED
D	INFEEED SPEED SENSOR
	OUTFEED SPEED
E	OUTFEED SPEED SENSOR
F	ALARM DIVERTER
	CHECKWEIGHER ID
G	PORT A FUNCTION
G	PORT A BAUD RATE
G	PORT A PARITY
G	PORT A WORD LENGTH
G	PORT A STOP BITS
G	PORT B FUNCTION
G	PORT B BAUD RATE
G	PORT B PARITY
G	PORT B WORD LENGTH
G	PORT B STOP BITS
A	Scroll only visible if Checkweigher mode is selected.
B	Scroll only visible if Static mode is selected.
C	Scroll only visible if weightable speed sensor is used and Checkweigher mode is selected.
D	Scroll only visible if infeed speed sensor is used, Checkweigher mode is selected, and the Diverter Verification Option is not installed.
E	Scroll only visible if outfeed speed sensor is used and Checkweigher mode is selected.
F	Scroll only visible if the Multiple Diverter Option is installed.
G	Scroll only visible if the Communications Option is installed.

### 3.7.1 Language Selection

The language selection menu allows the user to select which language is used to display information on the VF display. Presently, there are two languages to choose from. The selection is always English combined with one other.



tttttttt = English/Spanish Default  
English/French Optional  
English/Italian Optional

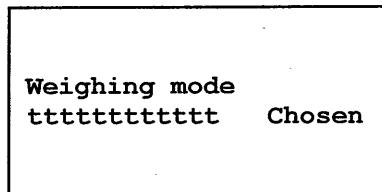
**NOTE:** There are different EPROMs for the different language selections.

### 3.7.2 Weighing Mode

The weighing mode menu permits the operator to select which weighing mode the machine is in when it takes a weight. The difference between the two modes is the type of conveyor used. If a moving chain or belt is running across the weightable, the weighing mode is dynamic Checkweigher. If no chains or belts are on the weightable, the mode is Static weigher.

In dynamic Checkweighing, a package moving across the frame breaks the interlock as it passes by. The break of interlock starts the weighing process.

In Static weighing, the package is placed on the frame and the operator triggers the weighing process by using an external device such as a switch, interlock, or PLC. The external device is connected to the interlock input of the AC-4000.



tttttttttttt = Checkweigher  
Static

When the operator selects Static mode, a number of screens that are not relevant to static weighing are removed from the system. They are listed below.

Verify Delay, Verify Test, and Verify Learn

Unit Length

Maximum Weightable Speed

Infeed Speed

Infeed Speed Sensor

Outfeed Speed

Outfeed Speed Sensor

Weightable Speed  
 Weightable Speed Sensor  
 Dynamic Calibration  
 Auto Calculation  
 Interrogate Delay: Set equal to one greater than transition time and the screen is removed.  
 Interlock to Outfeed: Set equal to one greater than On Scale Time and the screen is removed.  
 Weightable Length: Replaced with On Scale Time.  
 Package Length: Replaced with Transition Time.

Screens that are turned on when Static weighing is selected are:

Transition Time  
 On Scale Time  
 Static Calibration

### 3.7.3 Weight Units

This menu sets the units of measure the machine will weigh.

Press the **MACHINE** key. The display reads:

```

Weight units
XXXXXXXXX Chosen
  
```

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.7.4 Length Units

This menu sets the units the machine will use for menus that require a length be entered. The current length units are displayed on the screen.

```

Length units
XXXXXXXXXX Chosen
  
```

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.7.5 Weight Displayed Precision

This menu sets the precision of the weight displayed in the Run menu. The allowable entries are .01 digits, .1 digits or 1 digits.

```
Weight decimal
XXXX          Chosen
```

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.7.6 Weightable Length / On Scale Time

Dependent upon which active mode is chosen, either the weightable length menu or the on scale time menu is displayed.

#### 1. Weightable Length

This menu allows the operator to enter the weightable length of the weigh frame. This screen is not available when the weighing mode is set to Static.

```
Enter transition
time:   nnn.nn sec.
```

	MINIMUM	MAXIMUM	DEFAULT
nnn.nn =	1.0	99.0	12.0

#### 2. On Scale Time

The on scale time permits the operator to enter the time the package is on the scale. This screen is not available when the weighing mode is set to Checkweigh.

```
On scale time:
           nnn.nn sec.
```

	MINIMUM	MAXIMUM	DEFAULT
nnn.nn =	0.02	99.0	12.0

### 3.7.7 Interlock to Outfeed

This menu allows the operator to enter the length of the weighing frame from the interlock to the outfeed conveyor. Refer to Figure 3-3.

```
Interlock to
outfeed:XX.X XX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the distance from the interlock to the exit end of the outfeed conveyor.

### 3.7.8 Auto Calculate

Auto Calculate allows the operator to set whether the system should or should not automatically calculate interrogate delay and number of samples. This display is only shown if the Checkweigher mode is selected.

```
Auto calculation:
XXX          Chosen
```

"Chosen" indicates that option "XXXXX" is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.7.9 Weightable Speed

Weightable belt speed will be displayed if a speed sensor is used. The speed is the actual pulses per foot of the speed sensor. If a speed sensor is not used, the weightable speed can be measured with a tachometer and entered here. This display is only shown if the Checkweigher mode is selected.

```
Weightable speed:
XXX.XXX XX/XXX
```

The "X" indicates the current selection and units. To change the selection, press **ENTER** and use the numerical keys to enter the weightable speed.

### 3.7.10 Weightable Speed Sensor

This menu is only displayed if a weightable speed sensor is being used and the Checkweigher mode is selected. It tells the system how many pulses per unit length to expect from the sensor.

```
Weightable speed
sensor:XXX.X X/XX
```

The "X" indicates the current selection and units. To change the selection, press **ENTER** and use the numerical keys to enter the speed sensor's pulses per unit length.

### 3.7.11 Infeed Speed

Infeed belt speed is displayed on the following screen if an infeed speed sensor is used and the Checkweigher mode is selected. If no speed sensor is used, the infeed belt speed can be measured with a tachometer and entered here. This screen is not shown if the Diverter Verification option is installed.

```
Infeed speed:
XXX.XXX XX/XXX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the infeed belt speed.

### 3.7.12 Infeed Speed Sensor

This menu is only displayed if an infeed speed sensor is being used and the Checkweigher mode is selected. It tells the system how many pulses per unit length to expect from the sensor. This screen is not shown if the Diverter Verification option is installed.

```
Infeed speed
sensor:XXX.X X/XX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the speed sensor's pulses per unit length.

### 3.7.13 Outfeed Speed

Outfeed belt speed is displayed on the following screen if an outfeed speed sensor is used and the Checkweigher mode is selected. If no speed sensor is used, the outfeed belt speed can be measured with a tachometer and entered here.

```
Outfeed speed:
XXX.XXX XX/XXX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the outfeed belt speed.

### 3.7.14 Outfeed Speed Sensor

This menu is only displayed if an outfeed speed sensor is being used and the Checkweigher mode is selected. It tells the system how many pulses per unit length to expect from the sensor.

```
Outfeed speed
sensor:XXX.X X/XX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the speed sensor's pulses per unit length.

### 3.7.15 Alarm Diverter

The Alarm Diverter feature is displayed if the Multiple Diverter Option is installed. When the option is purchased, diverter 3 may be used to give an alarm output signal. The chosen diverter may not be used by any other diverter assignment. Its diverter 3 delay and duration menus will disappear. If the alarm light is on, this diverter output will be on.

```
Alarm diverter:
XXXXXXXXX X Chosen
```

"Chosen" indicates that option "XXXXX" is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.7.16 Checkweigher ID

This menu sets the Checkweigher ID which is printed on the statistical report. The Checkweigher ID is also used as the device address if the Multi-drop Protocol communications option is installed.

```
Checkweigher ID
nnnn
```

	MINIMUM	MAXIMUM	DEFAULT
nnnn =	0	99	0

### 3.7.17 Port A Function

This menu sets the function of communications channel A. The report interval or number of free run columns must be set in the Statistics scroll or there will be no output.

```
Port A Function
XXXXXX          Chosen
```

Choices: None, Reports, Free Run

### 3.7.18 Port A Baud Rate

This menu sets the baud rate of communications channel A.

```
Set Baud Rate A
XXXXXX          Chosen
```

Choices: 300, 600, 1200, 2400, 4800, 9600, 19200

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.7.19 Port A Parity

This menu sets the parity of communications channel A.

```
Set Parity A
XXXX          Chosen
```

Choices: None, Even, Odd

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.7.20 Port A Word Length

Transmission word length of communications channel A is set in this menu

```
Set Word Length A
X Bits          Chosen
```

Choices: 7 Bits, 8 Bits

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.



### 3.7.21 Port A Stop Bits

The number of stop bits of communications channel A is set in this menu.

```
Set Stop Bits A
X Bits          Choices
```

Choices: 1 Bit, 2 Bits

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.7.22 Port B Function

This menu sets the function of communications channel B. The number of free run columns must be set greater than zero in the Statistics scroll to get free run output.

```
Port B Function
XXXXXX          Chosen
```

Choices: None, Free Run, [(optional) Multi-Drop, Var Tare, Hayssen]

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

At most one of the choices listed inside the brackets is available if it is installed as a software option.

### 3.7.23 Port B Baud Rate

This menu sets the baud rate of communications channel B.

```
Set Baud Rate B
XXXXX          Chosen
```

Choices: 300, 600, 1200, 2400, 4800, 9600, 19200

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.7.24 Port B Parity

This menu sets the parity of communications channel B.

```
Set Parity B
XXXX          Chosen
```

Choices: None, Even, Odd

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.7.25 Port B Word Length

Transmission word length of communications channel B is set in this menu.

```
Set Word Length B
X Bits          Chosen
```

Choices: 7 Bits, 8 Bits

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

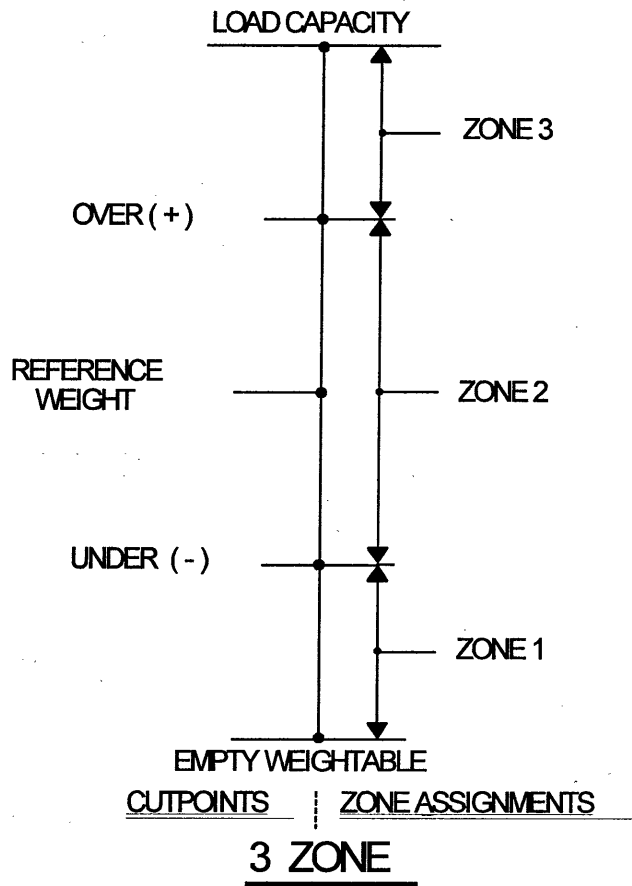
### 3.7.26 Port B Stop Bits

The number of stop bits of communications channel B is set in this menu.

```
Set Stop Bits B
X Bits          Chosen
```

Choices: 1 Bit, 2 Bits

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.



A00903

AC-4000 CHECKWEIGHER MODE  
FIGURE 3-4

**PERMANENT RECORD - PRODUCT SCROLL**

<b>SCROLL</b>	<b>PRODUCT NUMBER</b>				
Product Number					
Reference Weight					
Under Cutpoint					
Over Cutpoint					
Tare Weight					
Package Length / Transition Time					
Interrogate Delay					
Maximum Weightable Speed					
Filter Type					
Filter Frequency					
Number of Weight Samples					
Under Weight Diverter					
On Weight Diverter					
Over Weight Diverter					
No Gap Diverter					
Diverter 1 Delay					
Diverter 1 Duration					
Diverter 2 Delay					
Diverter 2 Duration					
Diverter 3 Delay					
Diverter 3 Duration					
Verification Delay					

We suggest that Product Scroll Permanent Records be filled in for each product. Make copies of this page as needed to list all products.

PERMANENT RECORD FOR PRODUCT SCROLL  
FIGURE 3-5

### 3.8 PRODUCT SETUP

Product procedures include creating new product information, and using and changing existing product information.

All product information is controlled by the **PRODUCT** key (refer to Figure 3-4). The following is a list of the items related to the **PRODUCT** key:

- A      PRODUCT NUMBER
  - REFERENCE WEIGHT
  - UNDER CUTPOINT
  - OVER CUTPOINT
  - TARE WEIGHT
  - B      PACKAGE LENGTH / TRANSITION TIME ©
  - D      INTERROGATE DELAY
  - MAXIMUM WEIGHTABLE SPEED
  - D      FILTER TYPE
  - D      FILTER FREQUENCY
  - D      NUMBER OF WEIGHT SAMPLES
  - E      UNDER WEIGHT DIVERTER
  - E      ON WEIGHT DIVERTER
  - OVER WEIGHT DIVERTER
  - E      NO GAP DIVERTER
  - F      DIVERTER 1 DELAY
  - F      DIVERTER 1 DURATION
  - G      DIVERTER 2 DELAY
  - G      DIVERTER 2 DURATION
  - G      DIVERTER 3 DELAY
  - G      DIVERTER 3 DURATION
  - H      VERIFICATION DELAY
- 
- A      Scroll only visible if Multiple Product Option is installed.
  - B      Scroll only visible if Checkweigher mode is selected.
  - C      Scroll only visible if Static mode is selected.
  - D      Scroll affected by Auto Calculate. See drawing D07226K-V002 in the appendix.
  - E      Scroll only visible if Multiple Diverter Option is installed.
  - F      Scroll only visible if diverter has not been assigned as an alarm diverter, but has been assigned to a weight zone.
  - G      Scroll only visible if Multiple Diverter Option is installed and diverter has not been assigned as an alarm diverter, but has been assigned to a weight zone.
  - H      Scroll only visible if Diverter Verification option is installed.

### 3.9 ENTERING PRODUCT DATA

Product menus are customized settings for each product being weighed. Press the **PRODUCT** key to begin. Refer to Section 3.8 for those menus that are only visible under certain conditions, and Table 3-1 for the default values.

#### 3.9.1 Product Number

The product number display is only visible when the Multiple Product option is installed. This menu allows the operator to select which product to run. With the Multiple Product option, the operator can store up to 15 product numbers.

```
Product number: XX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the product number. The system briefly shows the following display with each new product added.

```
Creating new  
product      XX
```

#### 3.9.2 Reference Weight

The target weight (units) of the package is entered in this menu. Reference weight gives the AC-4000 a basis to compare package weights and notify the operator of "over" or "under" packages.

```
Reference weight:  
XXXXX XX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the package reference weight.

#### 3.9.3 Under Cutpoint

Under cutpoint is used to set the point at which package weights are to be considered under weight. This entry is automatically subtracted from the reference weight to find the under weight cutpoint.

```
Under cutpoint:  
-   XXXXX XX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the under cutpoint weight.

### 3.9.4 Over Cutpoint

Over cutpoint is the exact opposite of under cutpoint. It is used to set the point at which package weights are to be considered over weight. This entry is added to the reference weight to find the over weight cutpoint.

```
Over cutpoint:  
+   XXXXX XX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the over cutpoint weight.

### 3.9.5 Tare Weight

Tare weight is automatically subtracted from the package weight before the cutpoints are applied. The operator should remember that extreme temperature or humidity can affect the tare weight of packaging material.

```
Tare weight:  
   XXXXX XX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the tare weight.

### 3.9.6 Package Length / Transition Time

Dependent on the active mode, the following screens appear.

#### 1. Package Length

The package length menu allows the operator to enter the package length of the product being weighed. This distance is used primarily for optimizing the auto-zeroing calculation. The screen is not available when the weighing mode is set to Static.

```

Package length:
nnn.nn

```

	MINIMUM	MAXIMUM	DEFAULT
nnn.nn =	0.5	Note	3.0

**NOTE:** See run error parameter checking.

## 2. Transition Time

The transition time menu allows the operator to enter the time it takes for the package to be placed on the weightable. The time should take into account 100 msec. settling time of the a/d filter. The screen is not available when the weighing mode is set to Checkweigher.

```

Enter transition
time:  nnn.nn sec.

```

	MINIMUM	MAXIMUM	DEFAULT
nnn.nn =	0.010	99.0	3.0

### 3.9.7 Interrogate Delay

Interrogate delay is the distance (length units) from the break of the interlock until weighing is to be started. This setting is normally auto calculated. The display is available if Auto Calculation is set to NO in the Machine menu and Checkweigher mode is active.

```

Interrogate delay:
XXXX XX

```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the delay distance.

Calculate interrogate delay using the formula below:

$$D = WL - 1.0 - \frac{(N \times 2.049 \times V)}{5000}$$

Where:

- D = Interrogate Delay in length units
- WL = Weightable Length in length units
- N = Number of samples
- V = Conveyor speed at weightable in feet per minute



### 3.9.8 Maximum Weightable Speed

This menu requires the operator to enter the maximum weightable speed. When Auto Calculation (Machine Scroll) is turned on, the value entered in this menu is used in the calculation of filter delay, number of weigh samples, interrogate delay, and filter frequency.

Maximum weightable  
speed: XXX.X XX/XXX

The "X" indicates the current selection in units per time. To change the selection, press **ENTER** and use the numerical keys to enter the maximum weightable speed.

#### With Speed Sensor

- For packaging lines with fluctuating speed, enter the maximum speed allowable on your line.

OR

- For packaging lines with fairly constant speed, enter line speed plus two percent.

For example, if your line is moving at 200 feet per minute, and that speed fluctuates  $\pm 3$  feet per minute, you would enter a maximum weightable speed of 203 feet per minute.

#### Without Speed Sensor

- Measure line speed with a tachometer. Enter line speed plus two percent.

### 3.9.9 Filter Type

Three types of filter are available to remove unwanted weighing signal(s).

Fixed: The fixed low pass filter is standard in the hardware. It has a constant 10 Hz. roll off. The fixed filter is always active, even when other filter types are chosen.

Notch: The adjustable notch filter is available in the software and can be added to the fixed. It is most useful when the scale signal has a noise source concentrated around a single frequency.

Low Pass: The adjustable low pass filter is also available in the software and can be added to the fixed filter to lower the roll off frequency below 10 Hz. It is most useful when several noise sources are present in the scale signal. If Low Pass is selected, the Number of Weight Samples menu disappears.

```
Filter type
XXXXXXXXX Chosen
```

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

**3.9.10 Filter Frequency**

**NOTE:** This selection is not available when in fixed mode.

Specifying a filter setting for the AC-4000 removes noise from the weighing signal of the weightable loadcell(s). The filter frequency display is available if Auto Calculation is set to NO in the Machine menu, and the filter type is not set to notch. Normally this setting is auto calculated.

```
Enter frequency
  XX Hz
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the cycles per second.

For low pass filters, calculate filter frequency value using the following formula:

$$F = \frac{V}{5 \times (D - 0.67P)}$$

- Where:
- F = Filter Frequency
  - V = Conveyor speed at weightable in feet per minute
  - D = Interrogate Delay in length units
  - P = Package Length in length units

For the notch filter, the filter frequency must be derived from mechanical resonance characteristics of the scale table. Consult Thermo Ramsey Technical Support for more information.

**3.9.11 Number of Weight Samples**

This menu sets the number of A/D (weigh) samples to be used in the weight calculation. The weight samples display is available if Auto Calculation is set to NO in the Machine menu. It disappears when Filter Type is set to Low Pass.

```
Number of weight
samples:      XXX
```

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the number of samples.

### 3.9.12 Under Weights [Diverter]

The under weight diverter display allows the operator to select which diverter should handle under weight packages. The display is only visible if the Multiple Diverter option is installed. Without the option, the system defaults to 1. See Table 3-1 for choices.

```
Under weights:
XXXXXXXXXXXXX Chosen
```

**NOTE:** If diverter 3 is assigned to the alarm output, it will not be displayed here.

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.9.13 On Weights [Diverter]

The on weight diverter display allows the operator to select which diverter should handle on weight packages. The display is only visible if the Multiple Diverter option is installed. Without the option, the system defaults to NO DIVERTER. See Table 3-1 for choices.

```
On weights:
XXXXXXXXXXXXX Chosen
```

**NOTE:** If diverter 3 is assigned to the alarm output, it will not be displayed here.

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.9.14 Over Weights [Diverter]

The operator selects which diverter should handle over weight packages in this display. The system default is NO DIVERTER.

```
Over weights:
XXXXXXXXXXXXX Chosen
```

**NOTE:** If diverter 3 is assigned to the alarm output, it will not be displayed here.

“Chosen” indicates that option “XXXXX” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.9.15 No Gap Diverter

#### 1. Description

This feature is designed to identify and reject, if possible, any packages which are spaced too close together.

A No Gap alarm is generated when the pitch (leading edge to leading edge) is less than weightable length. The condition can occur when two packages are on the weightable simultaneously. No Gap is normally caused by improper spacing or in some situations, where packages may be attached to each other. Also, if the package appears to be longer than the package length entered because of package skewing, the No Gap alarm will occur.

## 2. Operation

The No Gap feature in the AC-4000 allows the operator to assign "No Gap" packages to a user selected diverter.

Selection of the No Gap diverter is accomplished in the Product menus.

No Gap weights are shown as zone "X" in the "free run" print mode. Formatted reports display both "sample" and "accumulated" counts.

The No Gap counts are NOT considered in sample counts. Equally, weights of No Gap items are NOT considered in the statistical data calculations.

Note that diverter types are limited to swing gates and air jets. In this fashion, packages are "plowed" off the conveyor. Air cylinders with pusher plates cannot be used; they are likely to cause a jam since packages that are too close would not allow enough time for the air cylinder shaft to return to the inactive position.

If the Multiple Diverter option is installed, the operator can set which diverter controls improperly spaced (no gap) packages.

```
No gap diverter:  
XXXXXXXX X    Chosen
```

**NOTE:** If diverter 3 is assigned to the alarm output, it will not be displayed here.

"Chosen" indicates that option "XXXXX" is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.9.16 Diverter [1, 2, or 3] Delay

Diverter delay sets the distance for the package to travel from point of interlock break to in front of the reject device. Diverter 1 is available if it has not been assigned as an alarm diverter. (The system normally uses it as a sample diverter.) Diverters 2 and 3 appear if the Multiple Diverter option is installed, and then they too have the same restriction as Diverter 1. If the diverter is unassigned, displays for diverter 2 and 3 disappear.

```
Diverter _ delay:  
xxx.x xx
```

**NOTE:** If diverter 3 is assigned to the alarm output, it will not be displayed here.

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the distance of diverter delay.

### 3.9.17 Diverter [1, 2, or 3] Duration

Diverter duration sets the amount of "on" time of the diverter. Diverter 1 is available if it has not been assigned as an alarm diverter. (The system normally uses it as a sample diverter.) Diverters 2 and 3 appear if the Multiple Diverter option is installed, and then they too have the same restriction as Diverter 1. If the diverter is unassigned, displays for diverter 2 and 3 can disappear.

```
Diverter _ duration:
XX.XX seconds
```

**NOTE:** If diverter 3 is assigned to the alarm output, it will not be displayed here.

The "X" indicates the current selection. To change the selection, press **ENTER** and use the numerical keys to enter the on time of the diverter.

### 3.9.18 Diverter Verification Delay

If the Diverter Verification option is installed, the Diverter Verification Delay sets the distance between the weightable interlock and the verification sensor. This function confirms that a package assigned to a diverter has been diverted, or a package assigned to no diverter remains on the conveyor. If a package handling error is detected, an alarm is activated. If the entered distance is 0.0, verification is turned off.

```
Verification Delay
nnn.n
```

	MINIMUM	MAXIMUM	DEFAULT
nnn =	0.0	899.0	0.0

The entered delay must be less than 48 package pitches from the weightable interlock. If the entered delay is less than the longest delay of any assigned diverter, a run error will occur.

If the Multiple Product option is installed, at this point you can load in another product by repeating all of Section 3.9, or proceed to System Calibration.

### 3.10 SELECTING A PRODUCT FOR CHECKWEIGHING

If the Multiple Product option is installed, press the **PRODUCT** key to select a product for checkweighing. (Without the Multiple Product option, the operator must press **RUN**.) At the Product Number screen, use the numerical keys and **ENTER** key to enter the product number you desire for checkweighing.

The display will show the selected product if it has been previously calibrated.

```
Product Number XX
Now selected
```

After entering the product number, press **RUN**.

When the selected product has not been previously calibrated, the display will respond with the screen shown below. The operator should refer to the System Calibration section and calibrate the AC-4000 for the product selected before checkweighing can begin.

```
Creating new
product      XX
```

**NOTE:** Changes made to a selected product can be removed by re-entering the product number as shown below.

Press the **PRODUCT** key and enter the same number as displayed. Press **ENTER**. The display will reply with:

```
Type ENTER to
restore pn  XX
```

For example, product number 5 has been selected. After the operator presses **ENTER**, the system shows the Run screen. The operator then enters certain menus and changes the values. The system now recognizes those values but product number 5 is not running well. To return to previous product 5 values, the operator presses the **PRODUCT** key, re-enters product number 5 and presses the **ENTER** key.

The above procedure will return the values IF the operator has not selected another product before returning to product number 5. Changing to a different product stores any changes to the old product before loading the new product. Once changes are stored, they cannot be removed by this method.

### 3.11 SYSTEM CALIBRATION

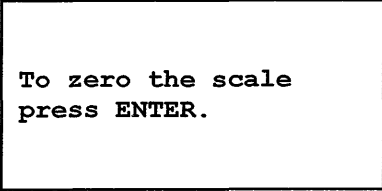
Before running any product for the first time and periodically thereafter, the system must be calibrated. Calibrating involves two steps: zeroing and spanning.

#### 3.11.1 Zeroing the Scale

This menu allows the operator to re-zero the scale. Normally, this is done when the re-zero light comes on and auto zeroing is turned off. The resulting zero can be viewed in the Test menu "Set Zero". Performing a zero also calculates a new auto zero threshold.

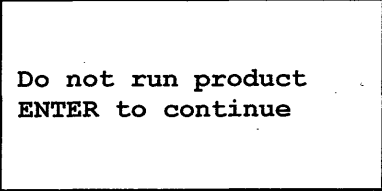
**NOTE: DO NOT RUN PRODUCT WHEN USING THIS MENU.**

Press the **CALIBRATE** key. As the operator follows the screen commands, the displays read:



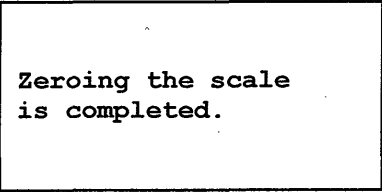
To zero the scale  
press ENTER.

Press the **ENTER** if zeroing the scale is desired. A message warns the operator that the interlock must not be triggered during zeroing. If the interlock is triggered, the zeroing calculations are restarted.



Do not run product  
ENTER to continue

When zeroing is complete, the following message is displayed.



Zeroing the scale  
is completed.

### 3.11.2 Dynamic or Static Calibration (No\_Run)

This menu will calculate a new span value. A calibration is done by taking an average a/d value and dividing by the entered calibration package weight. The resulting span can be viewed in the test menu "Set Span" if the Service password has been entered.

$$\text{SPAN} = \frac{\frac{1}{N} \sum_{1}^N A/D}{\text{CALIBRATION WEIGHT}}$$

Where:

*N* = Numbers of times the package was passed.

*A/D* = The value read from the analog to digital converter for each pass.

There are two modes of calibration: Static and Dynamic. These two modes change based on the selection of weighing mode. For more information, see the weighing mode section of this manual.

The main difference between the two calibration modes is the package presentation. In the dynamic mode, the package is passed across the scale *N* times. In the static mode, the test package is placed on the scale and when the user presses ENTER after entering the calibration package weight, the system automatically does a calibration.

Dynamic Weighing Mode:

Dynamic calibration,  
press ENTER.

Static Weighing Mode:

Static calibration,  
press ENTER.

Enter the weight of the package that will be used in the calibration passes in the next display. This entry follows the same precision entered in the Weight Displayed Precision menu (MACHINE). The allowable range for .01 digit precision is 0 to 999.99, 0 to 9999.9 for .1 digit precision, and 99999 for 1 digit precision. The default is 100.



Calibration package  
weight: XXX.XX XXX

The "X" indicates the current selection. To change the selection, use the numerical keys to enter the weight of the package and press **ENTER**.

The following message shows the number of times packages must be passed to complete calibration. A new number may be entered or the operator may immediately start passing the test package.

**NOTE: DO NOT RUN PRODUCT WHEN USING THIS MENU.**

Pass package  
XX times.

The "X" indicates the current selection. To change the selection, use the numerical keys to enter the number of passes and press **ENTER**. The minimum passes allowed is 4, maximum 99. The default value is 16.

If the system detects too much variation between passes, the following message occurs:

Bad pass, try again.

There are several conditions under which a bad pass message can occur:

1. The first package passed must be greater than 10 A/D counts above the zero level. When there is a bad pass on the first package, the machine is not sensing any weight signal from the package. A machine setup problem or a defective load cell is a likely cause.
2. Each pass after the first must be within 10 percent of the average of all previous passes. Poor package presentation is a likely cause for this problem.

Condition #1 must be satisfied before the system will allow the calibration to continue. Condition #2 will allow four bad passes before the calibration will be automatically started over.

When the system is unable to calibrate, the following message occurs:

Bad calibration,  
try again.

Bad calibration is when the sum of the passes is less than or equal to the zero level.

When the required number of good passes has occurred and a legal span value can be calculated, the display reads:

Calibration  
complete.

### 3.11.3 Gray Zone

The third feature of the Calibrate Menu is the gray zone test. It indicates the repeatability of the weighing process. A standard deviation is calculated from the weights gathered during the gray zone test. See Gray Zone - General Principles, Section 3.12, for an explanation of this feature.

**NOTE: DO NOT RUN PRODUCT WHEN USING THIS MENU.**

The first display directs the operator to start the test.

To do a gray zone,  
press ENTER.

While the operator passes packages, the screen below shows the number passed, the package weight in units, and the deviation which is multiplied by 4 (English) or 6 (Metric).

Pass package XX  
XXXXX.XX XX: XXX.XX

If there were less than 20 packages passed, the deviation is not displayed. More than 99 passes is ignored.

#### 1. Gray Zone Average Weight

This menu is viewed by pressing the down arrow from within the screen if you are executing a gray zone. It shows the average of the packages passed during the gray zone.

Gray zone average  
weight: XXXX.XX

### 3.11.4 Re-Zero Interval

This menu allows the operator to select a re-zero interval mode. This interval controls the re-zero LED on the front panel. The LED is used as a guideline to signal the operator that the system has been unable to perform an auto zero in "N" period of units. The two modes are re-zero by time or re-zero by count.

For example, the operator selects count, the re-zero count is set to 1000 and following condition occurs.

The product package pitch is shorter than the time required to do an auto-zero for an interval of 1000 packages. If this condition occurs, the re-zero LED comes on. The light stays on until there is a gap in the product flow which is equal to or greater than 1-1/2 times the time required to do an auto-zero. If this gap occurs and an auto-zero has time to complete, the re-zero LED automatically is turned off.

Another way to turn off the re-zero light is to halt all product flow and perform a zero calibration.

Rezero interval  
ttttt Chosen

ttttt Time  
ttttt Count Default

**NOTE:** If auto zero threshold is set to 0%, this screen is present.

### 3.11.5 Re-Zero Count/Time

This menu allows the operator to enter the re-zero interval. Depending on the re-zero interval mode, this interval is in either time (minutes) or count (package counts).

Rezero/ttttt  
nnnn

<pre> ttttt ttttt </pre>	<pre> Time Count </pre>	Default
--------------------------	-------------------------	---------

	MINIMUM	MAXIMUM	DEFAULT
Count nnnn =	4	9999	1000
Time nnnn =	1	240	2

**NOTE:** If auto zero threshold is set to 0%, this screen is not present.

### 3.11.6 Auto Gray Zone Test

The auto gray zone test gives an indication of the zero level noise. If the noise level is greater than the repeatability specification required for a particular application, some changes are required to the frame or the hardware to meet the specification.

```

To do an auto gray
zone press ENTER.

```

This is an informative message warning the operator that there should be no packages crossing the scale during this test.

```

Do not run product
ENTER to continue.

```

Pressing ENTER starts the auto gray zone test. The top line displays the number of simulated passed packages. The second line displays the individual simulated weights, and when the package count gets greater than 20, this line also displays the gray zone.

```

Pass packages: nn
nnnn.nn : nnnn.nn

```

The test continues until the package count becomes 99. This test can be terminated at any time by pressing any key.

### 3.12 GRAY ZONE - GENERAL PRINCIPLES

Gray zone is the amount of weight around which the checkweigher cannot determine correct weight, and is a normal problem associated with weighing objects in motion. Vibration, air currents and even unsettled package can cause a gray zone to occur. Since gray zone is constant and repeatable, it can be measured. Some of it can even be filtered out. Where weights and measures regulations are in force, gray zone should be measured.

Examples of gray zone are given here to help you understand this issue.

Assume you weigh 154 pounds (70 kg). When you stand perfectly still on your bathroom scale, it indicates that weight. But if you move, the scale shows an incorrect value. If you recorded the weights during movement, the lowest reading might be 132 pounds (60 kg) and the highest reading might be 176 pounds (80 kg). In this example, the gray zone of your scale is  $\pm 22$  pounds ( $\pm 10$  kg).

If you are using your checkweigher to comply with weights and measures regulations, it is very important to measure gray zone. Suppose your package weighs 102 grams, government regulations allow the package to weigh 96 grams, and your company policy dictates no package is to be shipped weighing more than 110 grams. If you have NO gray zone (an ideal condition NOT possible in motion weighing), you would set the reference weight to 102 grams, the over cutpoint to 8 grams, and the under cutpoint to -6 grams.

Now suppose the gray zone of the checkweigher is 4 grams ( $\pm 2$  grams). This means a package that actually weighs 100 grams might weigh 98, 99, 100, 101, or 102 grams on the checkweigher. Similarly, a package that actually weighs 96 grams could appear to weigh as low as 94 grams or as high as 98 grams on the checkweigher - all due to the external disturbances inherent in weighing something in motion - or gray zone.

If you want to insure a package is never shipped underweight, measuring gray zone is crucial. In the above example, you did not want to ship a package weighing 96 grams or lighter. If a package appears to weigh 97 grams on the checkweigher, it might actually weigh as low as 95 grams ( $\pm 2$  grams gray zone). To be sure an underweight is never accepted, the machine must be set to reject any package weighing 98 grams or lower. If a package appears to weigh 99 grams, it could actually weigh as low as 97 grams, but not lower (as long as you know the gray zone is  $\pm 2$  grams). But, if it appears to weigh 98 grams, it might actually weigh 96, so you want to reject it as an underweight.

A similar situation exists for overweights. If you want to be sure a package weighing 110 grams or more is never accepted, the checkweigher must be set to reject packages that appear to weigh more than 108 grams. This is because a package that appears to weigh 108 grams might actually weigh 110 grams.

The policy to follow to insure neither underweights nor overweights are accepted are:

- Measure the gray zone.
- Adjust each cutpoint inward (closer to the target weight) by one-half the amount of the gray zone. (For example, a 4 gram gray zone may be considered  $\pm 2$  grams, so each cutpoint is adjusted inwardly by 2 grams, or  $\frac{1}{2}$  of 4 grams.)

The earlier example can be illustrated as follows:

Machine Settings if There were No Gray Zone

Over Cutpoint _____	+8 grams
Reference Weight _____	102 grams
Under Cutpoint _____	-6 grams

Machine Settings with 4 Gram Gray Zone ( $\pm 2$  grams)

Over Cutpoint	↓ ↓ ↓	+6 grams (moved inward 2 grams)
Reference Weight		102 grams
Under Cutpoint	↑ ↑ ↑	-4 grams (moved inward 1 gram)

While it is easy to compensate for gray zone so unders and overs are always rejected, there is a cost. That is, the checkweigher will reject some good packages. For example, if a package appears to weigh 97 grams, it might actually weigh 99 grams. However, since it might as easily weigh 95 grams, the compensation adjustments described above will cause this package to be rejected. Consequently, an on-weight package might appear in the reject pile. The only way to reduce this cost is to reduce the gray zone. The best way to reduce the gray zone is to reduce machine vibration. This can be done by following the suggestions below.

- Bolt the checkweigher to a cement floor or to a slab of steel or concrete weighing at least 440 pounds (200 kg).
- Make sure no other machines are touching the checkweigher.
- Make sure the conveyor on the checkweigher is properly adjusted and lubricated (See Maintenance Section).
- Run the conveyor on the checkweigher as slow as possible to achieve proper spacing and line operation. If you use the machine for more than one product, be sure you have selected the correct product.
- Isolate the machine from wind or excessive traffic that can cause drafts.
- Insure transfers of packages on to and off the checkweigher are smooth. Each time a package comes on to the conveyor abruptly, it can cause a vibration that dramatically affects accuracy. The smoother the transfer, the less the gray zone.
- If packages need acceleration to achieve adequate spacing on the checkweigher, gray zone can be reduced by doing the acceleration on a separate conveyor (infeed conveyor) before the packages reach the checkweigher.

### 3.13 ALARM/TEST MENUS

This menu key has a dual label to alert the operator that there are two kinds of information found in the menus of this key.

The first menu shows alarm messages if there is an alarm condition. When acknowledged, the alarm light turns off, but the alarm condition is not cleared. The alarm is only cleared when the condition that produced the alarm is remedied. Test menus permit the operator to test AC-4000 functions.

The rest of the menus show various menus that either test various components of the AC-4000 system or display internally created values that might help in troubleshooting problems.

The following is a list of the menus of the **ALARM/TEST** key:

- A ALARM DISPLAYS
- A AUTO ZERO THRESHOLD
- A VERIFICATION LEARN
- A DIP SWITCHES
- B,C INFEEED SPEED
- B WEIGHTABLE SPEED
- B OUTFEED SPEED
- FIRMWARE VERSION
- INTERLOCK TEST
- DIVERTER TEST
- A VERIFICATION TEST
- D COMM LOOPBACK TEST
- LAMP TEST
- KEYBOARD TEST
- LIVE A/D DISPLAY
- A Scroll only visible if Diverter Verification Option is installed and active.
- B Scroll only visible if Checkweigher mode is selected.
- C Scroll only visible if Diverter Verification Option is not installed.
- D Scroll only visible if Communication Option is installed.

### 3.13.1 Alarm Displays

Some alarms can occur while the machine is in operation. When the alarm occurs, the alarm light is turned on. The alarm light is an indication to the operator to refer to the **ALARM/TEST** menu to check the problem.

Most error messages are logged until acknowledged by the operator. (Some alarms are self clearing.) The AC-4000 continues to attempt to weigh and reject packages. Use the optional alarm output if you wish to have an external indication of an alarm condition.

The first Alarm/Test screen displays the number of alarms present (top line) and the type of alarm (second line). The operator presses **ENTER** to acknowledge the alarm. If the machine is still in the alarm condition, the message will be re-displayed.

```
Alarms: X  
XXXXXXXXXXXXXXXXXXXX
```



**TABLE 3-2  
ALARM MESSAGES**

<b>ALARM #</b>	<b>ALARM MESSAGE</b>	<b>DESCRIPTION</b>
<b>1</b>	A/D under range	Input from the load cell is zero or less than zero. May occur when: 1. Mechanical wedging under the weightable.
<b>2</b>	A/D over range	Input from the load cell has exceeded the A/D input range. May occur when: 1. Heavy object exceeding load cell capacity is placed on the weightable.
<b>3</b>	Outfeed queue full	Too many packages on the outfeed table. May occur when: 1. There are too many packages between beginning of the outfeed and the diverter. 2. Speed sensor misadjusted or broken.
<b>4</b>	Weightbl queue full	Multipackage tracking. Too many packages on the weightable. May occur when: 1. Too many packages are between the beginning of the deadplate and the beginning of the outfeed. 2. Speed sensor misadjusted or broken.
<b>5</b>	Deadplate queue full	Excessive deadplate package control. May occur when: 1. There are too many packages between beginning of the deadplate and the deadplate diverter. 2. Speed sensor misadjusted or broken.
<b>6</b>	Printer buffer full	Attempting to output information too fast. May occur when: 1. Printer is turned off line. 2. Printing reports too often. 3. Slow printer. 4. Printer is out of paper. 5. Printer has a paper jam. 6. Low baud rate. (Communications option only)
<b>7</b>	Weighing not done	Weight sampling is being taken after the package has left the weightable. May occur when: 1. Interrogate delay is set too long. 2. Taking too many A/D samples. 3. Weightable belt speed higher than the maximum weightable speed set in Product Scroll.

<b>ALARM #</b>	<b>ALARM MESSAGE</b>	<b>DESCRIPTION</b>
<b>8</b>	Printer off line	Printer is not ready to print. May occur when: 1. Printer is turned off line. 2. Printer is out of paper. 3. Printer has a paper jam. This is a self-clearing alarm. (Communications option only)
<b>9</b>	Verify queue full	The outfeed to diverter verify sensor queue is full. 1. Too many packages between the start of the outfeed and the verify sensor. 2. Speed sensor misadjusted or broken. (Diverter Verification option only)
<b>10</b>	Package NOT verified	The package was missing at the verify sensor. 1. Package was diverted by a diverter misfiring. 2. Diverter delays are improperly set. (Diverter Verification option only)
<b>11</b>	Div 1 NOT verified	The package was present at the verify sensor and was assigned to diverter 1. 1. Diverter delay is improper. 2. Connection to Diverter 1 is broken or missing. (Diverter Verification option only)
<b>12</b>	Div 2 NOT verified	The package was present at the verify sensor and was assigned to diverter 2. 1. Diverter delay is improper. 2. Connection to Diverter 2 is broken or missing. (Diverter Verification option only)
<b>13</b>	Div 3 NOT verified	The package was present at the verify sensor and was assigned to diverter 3. 1. Diverter delay is improper. 2. Connection to Diverter 3 is broken or missing. (Diverter Verification option only)
<b>14</b>	Communications error	Communications receive buffer is full. 1. AC-4000 is receiving characters but is not in a mode that processes them. (Communications option only)
<b>15</b>	Variable tare range	Tare value received from upstream device is out of range. (Variable Tare option only)
<b>16</b>	Variable tare sync	Received tare value is out of sync. 1. Tare buffer is empty when package breaks weightable interlock. 2. Tare buffer is full when a new tare value is received. (Variable Tare option only)

### 3.13.2 Auto Zero Threshold

Auto zero threshold is the limit above which the AC-4000 stops auto zeroing. It is calculated as a percentage of the test weight used during calibration and is added to the original zero level obtained during a forced zero. If the weight remains above the auto zero threshold for more than 2 minutes, the RE-ZERO LED turns on steady. See the ZERO SCALE and CALIBRATE SCALE menus for more details.

```
Auto zero threshold:
NN %
```

NN =	MINIMUM	MAXIMUM	DEFAULT
	0%	1000%	10%

Entering 0 turns auto zero off. This takes effect immediately, pressing RUN is not required.

### 3.13.3 Verification Learn

These menus appear if the Diverter Verification option is installed and the verification delay is greater than the distance from the weightable interlock to the outfeed. These menus guide the user through a process that learns the distance between the weightable interlock and the verification sensor on the outfeed conveyor. If the verification sensor is located on the deadplate, these menus do not appear.

```
Learn verify sensor:
Press ENTER
```

Pressing ENTER goes to the next screen.

```
Do not run product.
ENTER to continue.
```

This screen is a message indicating that product run during this test will not be weighed.

```
Verify learn test:
please pass package
```

This screen appears until the system detects that a package has broken the weightable interlock.

```
Learning please wait
-- --
```

This screen appears until the system detects that a package has reached the verify sensor.

```
Distance is nnn.n uu
Please press RUN
```

If the verify learn is successful, this screen appears. The distance is measured from the leading edge of the package at the weightable interlock to the leading edge at the verify sensor. This distance is automatically installed. The operator should go the Verification Delay screen and increase the distance until verification works 100% of the time. Typically an increase of one-half package length is correct.

```
Error verifier
distance too far
```

If the learned distance is greater than the maximum, or the verify learn function detects an error, this screen appears.

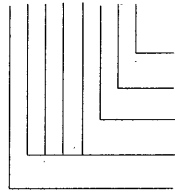
### 3.13.4 Dip Switches

This menu displays the current setting of the dip switches (Figure 3-6).

```
DIP Switch:
SW1      nnnnnnnn
```

nnnnnnnn = Binary number (1/0) that shows the current settings of the DIP switches.

SW1 = 87654321



Off/Open = Use outfeed speed sensor  
Off/Open = Use weightable speed sensor  
Off/Open = Use infeed speed sensor  
Unused  
Off/Open = Remove password

### 3.13.5 Infeed Speed

The infeed belt speed will be displayed if an infeed speed sensor is used. This display is only shown if the Checkweigher mode is selected.

```
Infeed speed:  
NNN.NNN  UU
```

NNN.NNN = current belt speed in UU units

### 3.13.6 Weightable Speed

The weightable belt speed will be displayed if a weightable speed sensor is used. This display is only shown if the Checkweigher mode is selected.

```
Weightable speed:  
NNN.NNN  UU
```

NNN.NNN = current belt speed in UU units

### 3.13.7 Outfeed Speed

The outfeed belt speed will be displayed if an outfeed speed sensor is used. This display is only shown if the Checkweigher mode is selected.

```
Outfeed speed:  
NNN.NNN  UU
```

NNN.NNN = current belt speed in UU units

### 3.13.8 Firmware Version

This menu shows which version of software is installed in the system. See drawing D07226K-V003 for a complete list of software release numbers.

```
Software version  
7226KV004-nn N.NN
```

7226KV004 = AC-4000 firmware reference number

nn = option code, identifies the installed firmware options

N.NN = Version number

If the message "\*\*\*\*UNKNOWN\*\*\*\*" is displayed, the EPROM is either bad or has been improperly programmed.

### 3.13.9 Interlock Test

This menu indicates the state of the interlock input. An object placed in front of the interlock will cause the "Blocked" message to appear.

```
Interlock test:  
Press ENTER
```

Pressing ENTER goes to the next screen.

```
Do not run packages:  
ENTER to continue
```

This is an informative message warning the operator that the interlock must not be triggered during zeroing. Packages are not being weighed during this test.

```
Interlock test:  
XXXXXX
```

XXXXXX = "Blocked" or "Unblocked"

### 3.13.10 Diverter Test

This menu will activate the diverter output for the selected diverter. The diverter will be activated for the set diverter duration time (see diverter duration menus).

```
Diverter Test:
N           Chosen
```

	MINIMUM	MAXIMUM	DEFAULT
N =1	1	1	1 Standard Machine
	1	3	1 (Multiple Diverter option)

### 3.13.11 Verification Test

These menus appear if the Diverter Verification option is installed and the verification delay is a non-zero value. They test the proper operation of the verification sensor. The menu sequence is:

```
Verify sensor test:
Press ENTER
```

Pressing ENTER goes to the next screen.

```
Do not run product.
ENTER to continue.
```

This screen is a message indicating that product run during this test will not be weighed.

```
Verify sensor test:
XXXX
```

XXXX = Blocked or Unblocked

This screen displays the result of the test.

### 3.13.12 Comm Loopback Test

This menu will only appear if the Communication Option is installed. It will output a message (alphabet) and compare it with the returned message. It will also check the hardware control lines. Press CHOICES to select the desired channel, ENTER to start the loopback test on the selected channel.

```
Comm Loop Back Test:  
Port A      Chosen
```

```
Comm Loop Back Test:  
XXXXXX
```

XXXXX =    Passed    Data was sent and received and the CTS hardware control line is OK.  
         Failed    Data sent was not received or the CTS hardware control line is bad.

### 3.13.13 Lamp Test

This tests the display by flashing two different patterns to all character cells. The two patterns are chosen such that adjacent pixels being shorted or open can be easily detected. The zone and status lights are also tested.

```
Lamp test:  
Press ENTER
```

Pressing ENTER will start the lamp test.

### 3.13.14 Keyboard Test

The front panel keys are tested in this menu.

```
Keyboard test:  
Press ENTER
```

Pressing ENTER goes to the next screen.



Press any key:  
CLR to exit

The system will stay in key test until the CLR key is pressed.

Press any key:  
XXXXXX

XXXXXX = The legend printed on the key that was pressed.

### 3.13.15 Live A/D Display

The live A/D display shows a continuous filtered A/D value.

If a filter type of Fixed or Notch is chosen, this shows the filtered value. If Low Pass is chosen for the filter type, the value is filtered by the fixed filter only. (See Section 3.9.9, Filter Type.)

Live A/D display:  
nnnnnn

	MINIMUM	MAXIMUM
nnnnnnn =	0	1048575



### 3.14 PRINT/STATS MENUS

The Print/Stats menus are available when the Communications or Statistics Options are installed. The Print key and the serial interface to a printer or computer requires the optional Communications hardware. The software will test for the serial port hardware and allow the Print option if the hardware is present.

The statistical software option will change the operation of the **PRINT/STATS** key and the type of reports that will be provided. There are various conditions under which statistical reports will be printed and reset:

CONDITION	PRINT STATISTICS	RESET STATISTICS
Operator changed parameter	Yes	Yes
Operator requests print report	Yes	No
Operator set timed report	Yes	No
Operator requests clear statistics	Yes	Yes

The following is a list of the menus of the **PRINT/STATS** key:

- A,B PRINT REPORT
- UNDER WEIGHT PACKAGE COUNT
- ON WEIGHT PACKAGE COUNT
- OVER WEIGHT PACKAGE COUNT
- TOTAL ACCEPTED COUNT
- TOTAL UNDER WEIGHT
- TOTAL ON WEIGHT
- TOTAL OVER WEIGHT
- TOTAL ACCEPTED WEIGHT
- TOTAL ACCEPTED UNDER WEIGHT
- TOTAL ACCEPTED ON WEIGHT
- TOTAL ACCEPTED OVER WEIGHT
- B BATCH REPORT BY
- B BATCH/MINUTES OR COUNT
- B REPORT WIDTH
- B FREE RUN COLUMNS
- B SET TIME/DATE
- PRODUCT CODE
- SHIFT NUMBER
- LINE NUMBER
- CLEAR STATISTICS
  
- A Scroll only visible if Comm Port A Function is set to Reports.
- B Scroll only visible if Communication Option is installed.

### 3.14.1 Print Report

The first menu allows an operator to print a report. It has no effect on the printing of a periodic report. (Available if the Communications Option is installed.)

Press **ENTER** to print  
a report.

Report format:

```
DATE: nn/nn/nnnn  
TIME: hh:mm ss * tttttttttttt *  
Product Number: nn  
  
Reference weight: nnn.nn  
Tare weight:      nnn.nn  
Under Cutpoint:  nnn.nn  
Over Cutpoint:   nnn.nn  
Under weight: nnnnnnnn packages  
On weights:     nnnnnnnn packages  
Over weights:  nnnnnnnn packages  
Total accepted weight: nnnnnnnnnnnn.nn
```

nn/nn/nnnn = mm/dd/yyyy (If set to English units).  
            dd/mm/yyyy (If set to Metric units).  
mm = month, dd = day, yyyy = year

hh:mm = hours:minutes

ss = AM or PM

tttttttttttt = Parameter changed  
                  System setting has changed that is used in the report.

- = On demand  
Operator has requested a report.
- = By time  
Report automatically generated by elapsed time.
- = Clear Stats  
Clearing of statistics was requested by operator.

### 3.14.2 Under Weight Package Count

The accumulated under weight package count since the last statistical reset is displayed on this screen.

```
Total packages under
weight: XXXXXXXX
```

### 3.14.3 On Weight Package Count

The accumulated on weight package count since the last statistical reset is shown here.

```
Total packages on
weight: XXXXXXXX
```

### 3.14.4 Over Weight Package Count

The accumulated over weight package count since the last statistical reset is displayed on this screen.

```
Total packages over
weight: XXXXXXXX
```

### 3.14.5 Total Accepted Count

The total accepted count screen displays the total of accepted weight package counts. This accumulation is the total since the last statistical reset.

```
Total accepted
count: nnnnnnnnn
```

	MINIMUM	MAXIMUM	DEFAULT
nnnnnnnnn =	0	429496729	n/a

**3.14.6 Total Under Weight**

The total weight of the under weight packages is shown here. This accumulation is the total since the last statistical reset. (Available if the Statistics Option is installed.)

Total Under weight:  
nnnnnnnnn.nn

	MINIMUM	MAXIMUM	DEFAULT
nnnnnnnnn.nn =	0.00	999999999.99	n/a

**3.14.7 Total On Weight**

The total weight of the on weight packages is shown here. This accumulation is the total since the last statistical reset. (Available if the Statistics Option is installed.)

Total On weight:  
nnnnnnnnn.nn

	MINIMUM	MAXIMUM	DEFAULT
nnnnnnnnn.nn =	0.00	999999999.99	n/a

**3.14.8 Total Over Weight**

The total weight of the over weight packages is shown here. This accumulation is the total since the last statistical reset. (Available if the Statistics Option is installed.)

Total Over weight:  
nnnnnnnnn.nn

	MINIMUM	MAXIMUM	DEFAULT
nnnnnnnnn.nn =	0.00	999999999.99	n/a

### 3.14.9 Total Accepted Weight

The total weight of the accepted weight packages is shown here. This accumulation is the total since the last statistical reset.

```
Total accepted wt:
nnnnnnnnn.nn
```

	MINIMUM	MAXIMUM	DEFAULT
nnnnnnnnn.nn =	0.00	999999999.99	n/a

### 3.14.10 Total Accepted Under Weight

This menu chooses whether the under weight count will be summed into the "Total Accepted Weight" or omitted from the accepted total.

```
Total accepted under
weight: XXXX Chosen
```

"Chosen" indicates that option "XXXXX" is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.14.11 Total Accepted On Weight

This menu chooses whether the on weight count will be summed into the Total Accepted Weight" or omitted from the accepted total.

```
Total accepted on
weight: XXXX Chosen
```

"Chosen" indicates that option "XXXXX" is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.14.12 Total Accepted Over Weight

This menu chooses whether the over weight count will be summed into the Total Accepted Weight" or omitted from the accepted total.

```
Total accepted over
weight: XXXX Chosen.
```

"Chosen" indicates that option "XXXXX" is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.14.13 Batch Report By

This menu allows the operator to select an interval that controls the automatic printing of the statistical report. The choices are report by time or report by package count. Each time the interval timer counts down to zero minutes or the package counter counts down to zero packages, a report is printed. The down timer or counter is reset to the starting value and the process starts over. This generates output only if Port A Function is set to Reports. (Available if Communications Option is installed.)

```
Batch report by
ttttt          Chosen
```

```
ttttt          Time
ttttt          Count      Default
```

**NOTE:** Selecting a new choice in this menu causes a report to be immediately printed, the statistics to be cleared, and the time/counter to be reset. When this happens, the following message appears on the display for two seconds:

```
Starting time delay
for next report
```

### 3.14.14 Batch/Minutes or Count

The batch/minutes or count menu allows the operator to enter a time in minutes or a count in package counts for the automatic printing of the batch report. (Available if the Communications Options is installed.)



```

Batch/TTTTTTT
      nnnn
  
```

```

TTTTTTT      Minutes
TTTTTTT      Count      Default
  
```

	MINIMUM	MAXIMUM	DEFAULT
Minutes nnnn =	0	480	0
Count nnnn =	0	9999	0

**NOTE:** Selecting a new value in this menu causes a report to be immediately printed, the statistics to be cleared, and the timer/counter to be reset. When this happens, the following message appears on the display for two seconds:

```

Starting time delay
for next report
  
```

If the time or count is equal to zero, the automatic printing of the batch report is turned off.

### 3.14.15 Report Width

This menu selects an 80 or 40 column printed report. The information on the reports is the same, but the format is different to fit different paper widths.

```

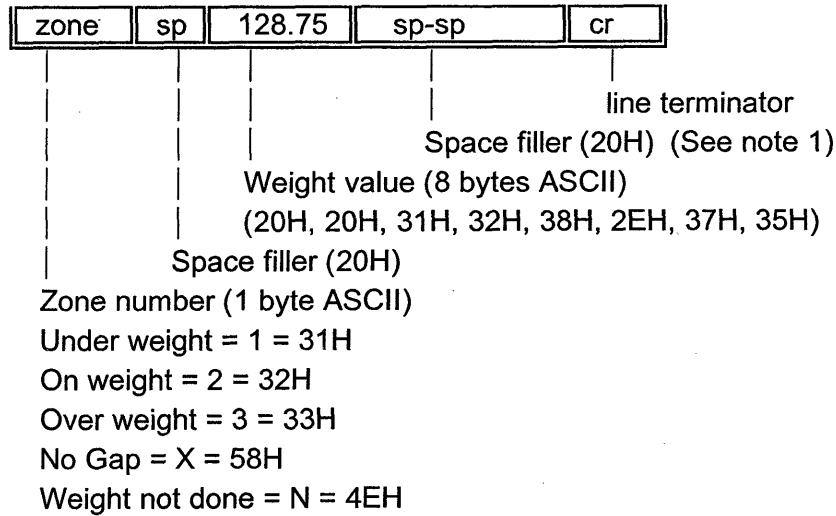
Report width
nn          Chosen
  
```

“Chosen” indicates that option “nn” is currently selected. To see other options, press the **CHOICES** key. To select the displayed option, press **ENTER**.

### 3.14.16 Free Run Columns

This output will provide the weight of each package and the zone number that was calculated by the control. The number of columns may be set from a menu (Free Run Columns). The typical use of this output is to send data to a printer or a customer supplied real-time computer port.

Free weight format (number of columns =1)



**NOTE:** If Free Run Columns is set to one, the spaces are not sent and the carriage return is sent as end of line.

If Free Run Columns is set greater than one, the above format is repeated the selected number of times with four spaces used to separate the zone weight groups. The carriage return is sent as end of line after the last zone weight group.

If Free Run Columns is set to zero, no output is generated.

Port A and/or Port B Function must be set to Free Run to get free run output from the selected communications channel.

### 3.14.17 Formatted Statistical Report

If the statistical report option is enabled, the report on the following pages can be sent out Communications Port A. (Available if the Communication and Statistics Options are installed. The 40 column report format is similar.)

#### AC-4000 PRODUCTION REPORT

Date:       nn:nn:nnnn   Time:               nn:nn

Checkweigher ID:       nnnn                   Product Code:   nnnn  
Product Number:       nnnn                   Line Number:   nnnn  
Shift Number:           nnnn

Report basis:           tttttttttttt

PRODUCT PARAMETERS:

Tare Weight:            nnn.nn g  
Reference Weight:       nnn.nn g

Under Weight Range:   (tttttt)               0.00 to           nnn.nn g  
On Weight Range:       (tttttt)               nnn.nn to  
nnn.nn g  
Over Weight Range:     (tttttt)               nnn.nn and heavier

#### SHORT TERM STATISTICS:

Sample Size:            nnnn

	Net Weight	Count
Under Weight	nnnnnnn.nn g	nnnnnnn
On Weight	nnnnnnn.nn g	nnnnnnn
Over Weight	nnnnnnn.nn g	nnnnnnn
Total Accepted:	nnnnnnn.nn g	nnnnnnn
Total Rejected:	nnnnnnn.nn g	nnnnnnn
	-----	-----
Total Production;	nnnnnnn.nn g	nnnnnnn

AC-4000 PRODUCTION REPORT - Continued

LONG TERM STATISTICS:

Data Collected since last reset:

	Net Weight	Count
Under Weight	nnnnnnn.nn g	nnnnnnn
On Weight	nnnnnnn.nn g	nnnnnnn
Over Weight	nnnnnnn.nn g	nnnnnnn
Total Accepted:	nnnnnnn.nn g	nnnnnnn
Total Rejected:	nnnnnnn.nn g	nnnnnnn
	-----	-----
Total Production:	nnnnnnn.nn g	nnnnnnn

Date =   Month/Day/Year       (If set to English units)  
          Day/Month/Year       (If set to Metric units)

nnnn =   Numeric information  
tttt =   Text information

Report basis   =   Parameter changed  
                          A system setting has changed that is used in the  
                          generating of a report.

                  =   On demand  
                          Operator has requested a report.

                  =   By time  
                          Report automatically generated by elapsed time.

                  =   By count  
                          Report automatically generated by elapsed package  
                          count.

                  =   Clear statistics  
                          Clearing of statistics was requested by the operator.

### 3.14.18 Set Time/Date

This menu allows the operator to set the real time clock. Each press of the **ENTER** key will move the cursor to the next numeric field. (Available if Communications Option is installed.)

Date/Time	tt/tt/tt:
nn:nn	nn/nn/nnnn

If entered year 'n' >= 90, the year is assumed to be '19nn'.  
Otherwise, it is assumed to be '20nn'.

Where:

- tt/tt/tt = mo/da/yr if system set to English length units
- = da/mo/yr if system set to Metric length units
- nn/nn/nnnn = Sets the month, day, and year entered in the same order as shown in the tt/tt message.
- nn:nn = Hours:Minutes (Hours are entered in 24 hour format.)

### 3.14.19 Product Code

The product code menu allows the operator to assign a numeric value to the product code for the statistical printed report. (Available if Statistics Option is installed.)

Product code
nnnn

	MINIMUM	MAXIMUM	DEFAULT
nnnn =	0	9999	0

### 3.14.20 Shift Number

The shift number menu allows the operator to assign a numeric value to the shift number for the statistical printed report. (Available if Statistics Option is installed.)

Shift number
nnnn

	MINIMUM	MAXIMUM	DEFAULT
nnnn =	0	9999	0

### 3.14.21 Line Number

The line number menu allows the operator to assign a numeric value to the line number for the statistical printed report. (Available if Statistics Option is installed.)

```
Line number
      nnnn
```

	MINIMUM	MAXIMUM	DEFAULT
nnnn =	0	9999	0

### 3.14.22 Clear Statistics

Pressing **ENTER** on the Clear Statistics menu will cause a report to be printed, and then all statistics will be cleared.

```
Press ENTER to
clear statistics.
```

```
Statistics cleared.
```

```
DATE: 09/27/1998
TIME: 11:01 AM * ON DEMAND *
Product Number:  1

Reference Weight:  500.0 g
Tare Weight:      0.0 g
Under cutpoint:   5.0 g
Over cutpoint:    5.0 g
Under weight:     345 packages
On weight:        1186 packages
Over weights:     213 packages
Total accepted weight:  700946.7
g
```

EXAMPLE OF PRINTED REPORT  
FIGURE 3-7

ICORE AC-4000  
 FACTORY INTERNAL JUMPER,  
 SETTINGS AND PROM VERSIONS

"C" NUMBER \_\_\_\_\_  
 MFG. JOB NO. \_\_\_\_\_  
 SERIAL NO. \_\_\_\_\_  
 CUSTOMER \_\_\_\_\_  
 DATE \_\_\_\_\_

CPU Board

U2 U3

EPROM  Yes  
 No

Analog Board

SW1 SW2 AC DC

1 2 3 4 5 6 7 8

On          
 Off

115 VAC  
 230 VAC

CR1    
 CR2    
 CR3

Communication Board

2 1 8 7 6 5 4 3 2 1

On  
 Off

EIA-232   
 EIA-485 4-wire   
 EIA-485 2-wire

Prepared by: \_\_\_\_\_ Date: \_\_\_\_\_

REC-QA-116

A00445

This page intentionally left blank



## **CHAPTER 4.0 MAINTENANCE**

### **4.1 GENERAL**

Your electronics system is capable of efficient and reliable operation when it is properly maintained. Cleanliness is the most important factor in keeping your electronics in good operating condition.

To assist you in servicing your electronics system, information in this section includes:

Factory service and repair information.

Removal, replacement, and adjustment procedures to assist you in solving repair problems.

Troubleshooting procedures.

### **4.2 SERVICE & REPAIR**

The maintenance information in this manual is adequate to meet your service needs. However, if you run into problems requiring technical assistance, please call (800)227-8891 toll free or (612)783-2700. In addition, Thermo Products Field Service Representatives are fully trained and available from regional offices.

Before performing any drastic modifications to this machine, refer to your warranty or contact your Thermo Products Field Service Representative.

Thermo Products has a repair center located at our plant in Minneapolis, Minnesota. Please contact our Repair Parts Representative at (612)783-2783 for assistance.

Please have available your machine model and serial number as this will expedite your service request.

When returning parts for repair, please use the Return Material Authorization form located in the parts section of this manual.

### **4.3 COMPONENT REPLACEMENT PROCEDURES (ELECTRICAL)**

#### **CAUTION**

#### **AVOID HIGH VOLTAGE AND STATIC ELECTRICITY AROUND CIRCUIT BOARDS.**

#### **4.3.1 Display Board Assembly Replacement**

To replace the Display Board, proceed as indicated below.

1. Turn off power at mains.
2. Open the electronics controller enclosure door.
3. Disconnect Display Board ribbon cable at J5 (see Figure 4-1).
4. Remove mounting hardware securing Display Board to door of enclosure.
5. Carefully lay Display Board down to gain access to front panel cable.
6. Disconnect front panel cable at Display Board connector J7.
7. Remove Display Board from enclosure.

8. Place new Display Board in enclosure with Display Board ribbon cable toward the enclosure hinge.
9. Connect front panel cable to Display Board connector J7.
10. Install new Display Board on mounting bolts.
11. Replace mounting hardware securing board to enclosure.
12. Connect Display Board ribbon cable to Display Board connector J7.
13. Close electronics controller enclosure door.
14. Apply power to electronics and verify proper operation.

#### **4.3.2 Display Module Replacement**

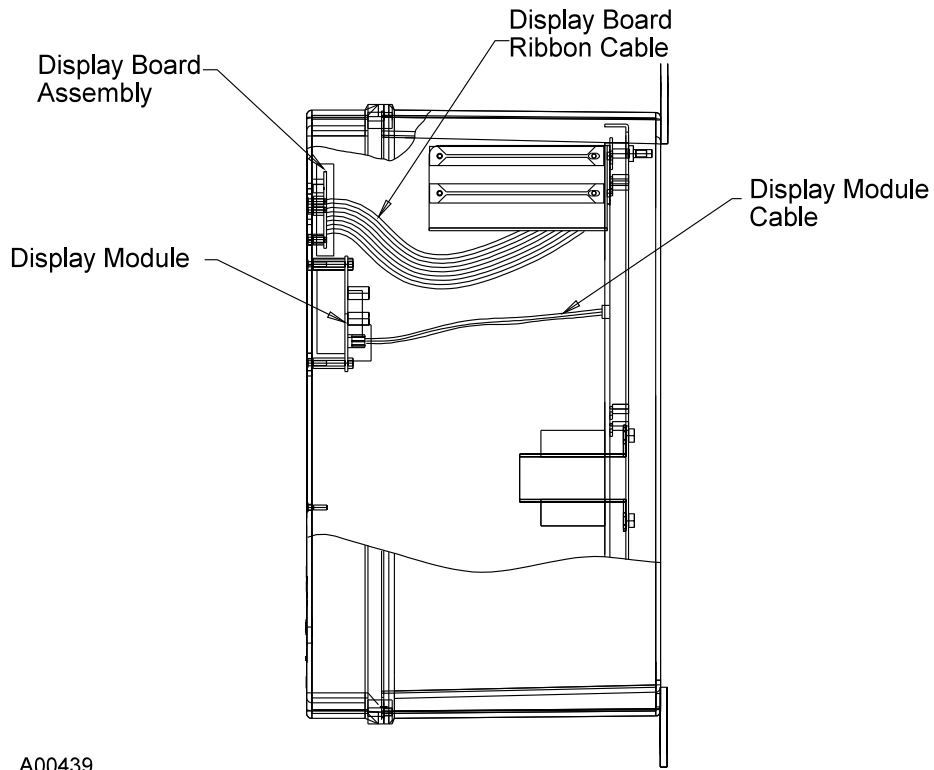
To replace the Display Module, proceed as indicated below.

1. Turn off power at mains.
2. Open the electronics controller enclosure door.
3. Remove the Display Module cable (see Figure 4-1).
4. Remove mounting hardware securing Display Module to enclosure.
5. Remove Module and place the new one on the four threaded studs.
6. Replace the mounting hardware and reconnect the Display Module cable.
7. Close and secure the electronics controller enclosure door.
8. Apply power to electronics and verify proper operation.

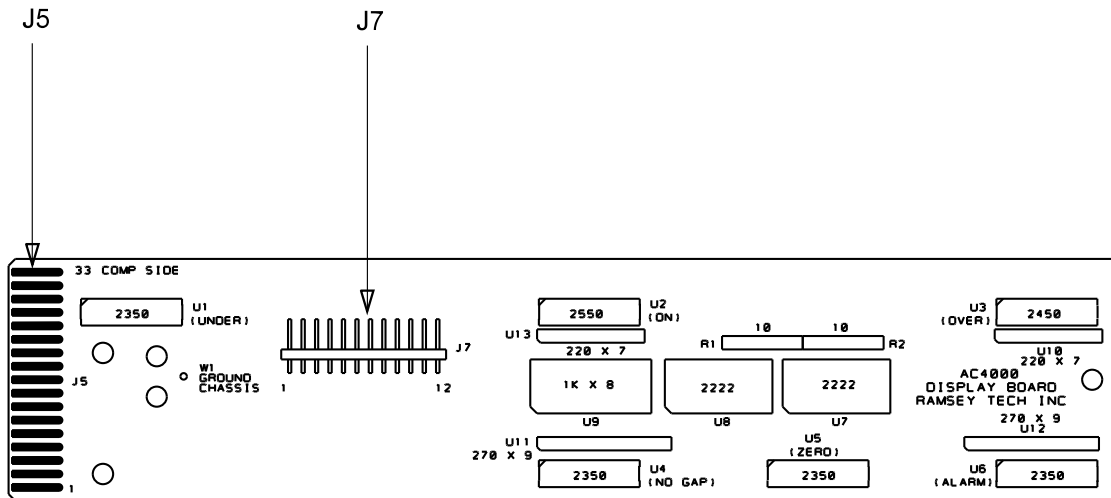
#### **4.3.3 Communication Board Replacement**

To replace the Communication Board, proceed as indicated below.

1. Turn off power at mains.
2. Open electronics controller enclosure door.
3. Locate the Communication Board (directly above the CPU Board) near the upper, back portion of the enclosure (see Figure 4-2).
4. Gently pull the Communication Board handle, extracting the board from the pin connectors.
5. Place new Communication Board in enclosure. Insure the board is in the upper slot, properly oriented and fully seated.
6. Set all switches on new Communication Board as they were positioned on old board.
7. Verify all setups. Refer to Chapter 3 of this manual for setup procedures.



A00439



A00440

DISPLAY BOARD ASSEMBLY/MODULE REPLACEMENT  
FIGURE 4-1

#### 4.3.4 CPU Board Replacement

To replace the CPU Board, proceed as indicated below.

**NOTE:** If your electronics system is operating erratically, try to capture as much setup data as possible before turning off power.

1. Turn off power at mains.
2. Open electronics controller enclosure door.
3. Locate the CPU Board (directly below the Communication Board) near the upper, back portion of the enclosure (see Figure 4-2).
4. Remove hardware securing CPU board. Gently pull the CPU card handle, extracting the board from the pin connectors.
5. Place new CPU Board in enclosure. Insure the board is in the lower slot, properly oriented and fully seated.
6. Perform a Cold Start Procedure.
7. Verify all setups. Refer to Chapter 3 for all setup procedures.

#### 4.3.5 Analog Board Replacement

To replace the Analog Board, proceed as indicated below.

1. Turn off power at mains.
2. Open electronic controller enclosure door.
3. Disconnect Analog Board cables J3, J4, J5, J6, J9, J10, J11, J26, and (see Figure 4-2).
4. Unscrew loadcell cables at TB3A and TB3B. Also unscrew all wires on TB4.
5. Remove screw and washer securing Analog Board to enclosure.
6. Remove Analog Board from enclosure.
7. Verify DIP Switch SW1-1 through SW1-8 settings on new Analog Board with old board.
8. Verify fuses.
9. Remove CPU Board and optional Communication Board from old Analog Board and place in the new Analog Board. Verify that the boards are in their proper slots and are fully seated.
10. Place new Analog Board in enclosure.
11. Secure new Analog Board to enclosure.
12. Reconnect loadcell cables to Analog Board, and reconnect wires to TB4.
13. Connect Analog Board cables J3 and J4 to CPU Board connectors J3, J4, J5, J6, J9, J10, J11, J26, and J27.
14. Perform a Cold Start Procedure.
15. Apply power to electronics and recalibrate machine. Refer to Chapter 3 for calibration procedures.



### 4.3.6 Distribution Board Replacement

To replace the Distribution Board, proceed as indicated below.

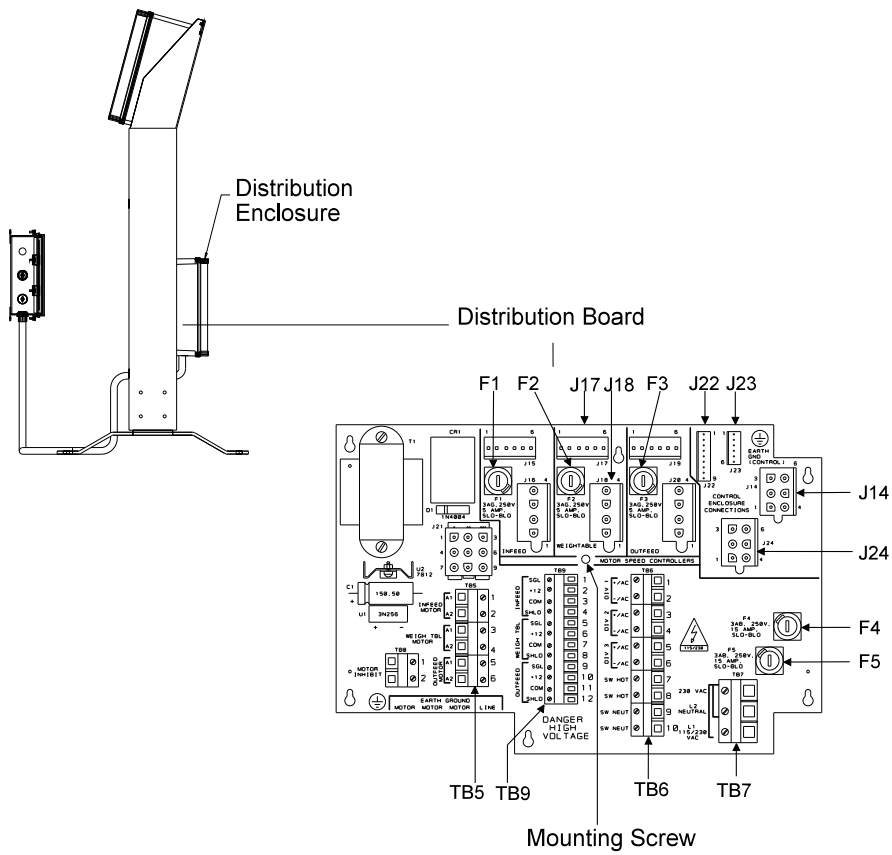
1. Turn off power at mains.
2. Open the distribution enclosure box (Figure 4-3).
3. Disconnect main AC power cable at Distribution Board terminal block TB-7.
4. Disconnect drive motor cables at Distribution Board terminal block TB-5.
5. Disconnect diverter cables at Distribution Board terminal block TB-6.
6. Disconnect speed sensor cables at Distribution Board terminal block TB-9.
7. Disconnect wiring to the distribution enclosure at J-14, J-22, J-23, and J-24.
8. Disconnect weightable motor speed control at J-17 and J-18.
9. Disconnect all option cables connected to Distribution Board (Figure 4-4). Refer to the following list.

OPTION	DISTRIBUTION BOARD CONNECTOR
INFEED SPEED CONTROL	J-15, J16
OUTFEED SPEED CONTROL	J-19, J20
MOTOR INHIBIT	TB-8

10. Remove screw securing Distribution Board to enclosure.
11. Remove Distribution Board from enclosure by sliding up and lifting out.
12. Verify that fuses on new Distribution Board are the same as old board. The following list defines the correct fuses.

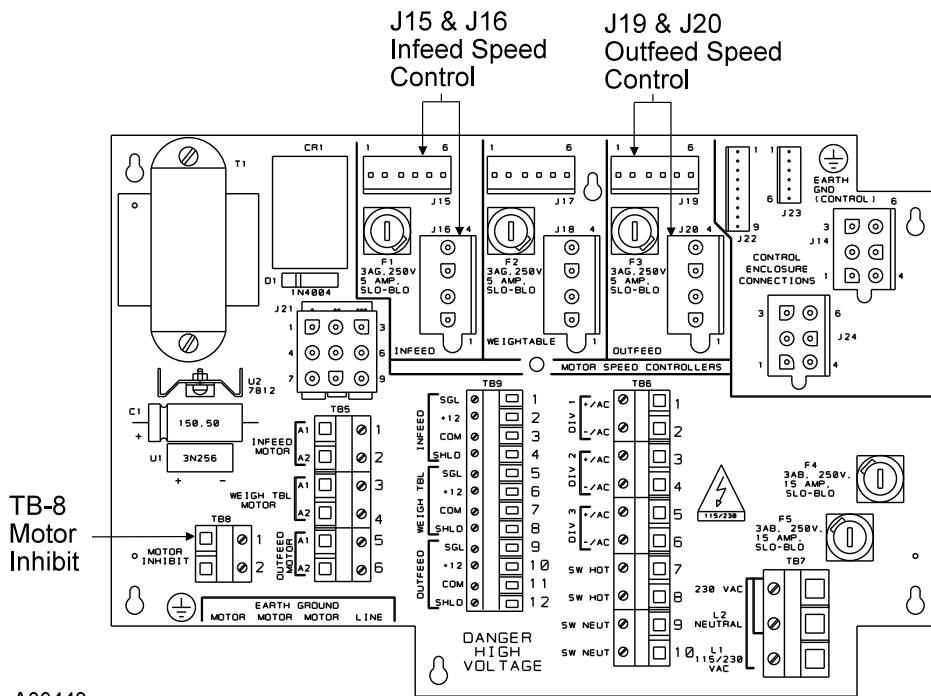
FUSE	115/220 VAC	TYPE
F1 (Infeed Motor)	5A	3AG, SB
F2 (Weightable Motor)	5A	3AG, SB
F3 (Outfeed Motor)	5A	3AG, SB
F4 (Line [L1])	15A	3AB, SB
F5 (Line [L2])	15A	3AB, SB

13. Install new Distribution Board in enclosure.
14. Replace screw securing Distribution Board to enclosure.
15. Connect all option cables installed on Distribution Board.
16. Connect weightable motor speed control at J-17 and J-18.
17. Connect wiring to the distribution enclosure at J-14, J-22, J-23, and J-24.
18. Connect speed sensor cables at Distribution Board terminal block TB-9.
19. Connect diverter cables at Distribution Board terminal block TB-5.
20. Connect drive motor cables at Distribution Board terminal block TB-5.
21. Connect main AC power cable at Distribution Board terminal block TB-7.



A00442

DISTRIBUTION BOARD REPLACEMENT  
FIGURE 4-3



A00443

DISTRIBUTION BOARD WITH OPTIONS  
FIGURE 4-4

22. Close the distribution enclosure box.
23. Apply power to electronics and verify proper operation.

#### **4.3.7 Front Panel Replacement**

To replace the controller front panel door, proceed as indicated below.

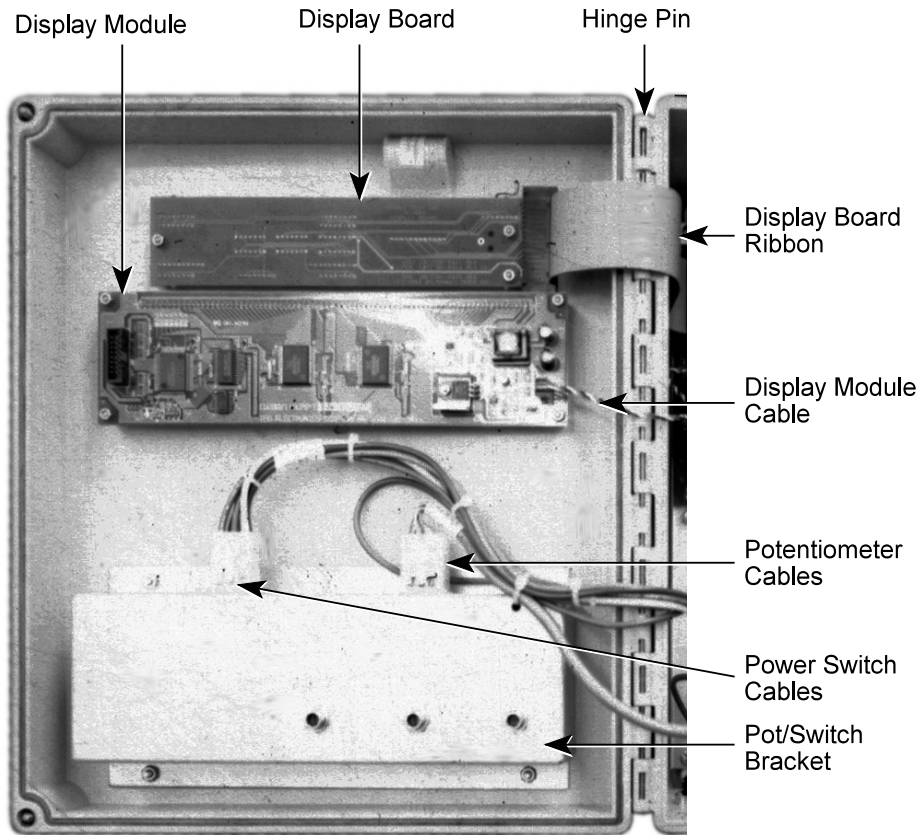
##### Fiberglass Enclosure

1. Turn off power at mains.
2. Disconnect the cables (display board, display module ribbon, and pot/switch) attached to the front door (see Figure 4-5).
3. Using a drive pin, force the hinge pin up from the bottom until it can be grasped with a pliers and removed from the controller enclosure door.
4. Remove the front panel door.
5. Remove the display board and display module from inside the front panel door.
6. Remove the nut(s) securing any externally mounted potentiometers. Also remove switch boot covers securing electronic and conveyor power switches.
7. Remove the pot/switch bracket from the inside of the door (see Figure 4-5).
8. Discard the old front panel door.
9. Fit the controller's new front panel door and insert the hinge pin.
10. Re-install all hardware in reverse order.
11. Reattach cables.
12. Close controller enclosure door.
13. Reapply power to electronics and verify proper operation.

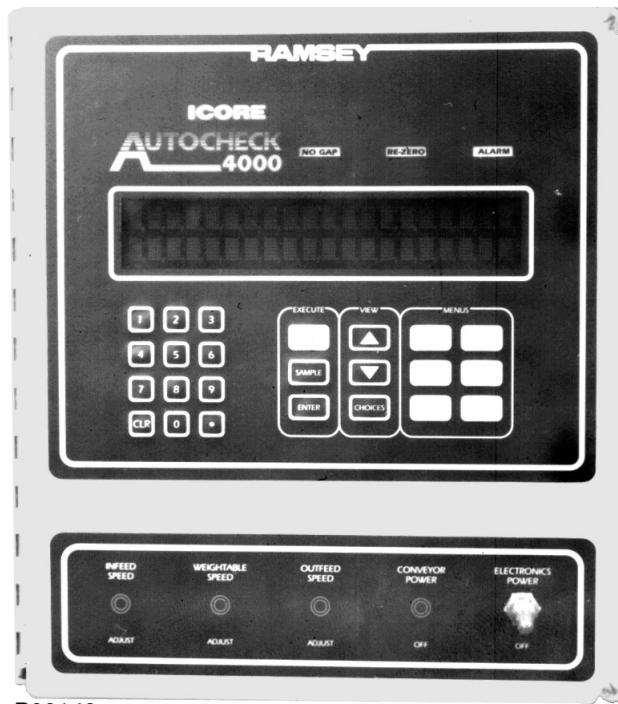
##### Stainless Steel Enclosure

1. Turn off power at mains.
2. Open the controller enclosure door (Figure 4-5).
3. Disconnect display module cable and remove display module.
4. Disconnect display board ribbon and remove display board.
5. Carefully peel front panel off enclosure. If front panel cannot be safely removed, a solvent may be used to help peel the panel off.
6. Peel protective paper off back of new front panel.
7. Mount new front panel on enclosure in same position as old panel.
8. Install display module and connect cable.
9. Install display board and connect ribbon.
10. Close controller enclosure door.
11. Apply power to electronics and verify proper operation.





A01588



P00149

FRONT PANEL REPLACEMENT  
FIGURE 4-5

### 4.3.8 Motor Speed Control Module Replacement

If you find it necessary to replace the motor speed control module, proceed as follows:

1. Turn off power at mains.
2. Open distribution enclosure door (see Figure 4-3).
3. Disconnect cable harness on motor speed control module from Distribution Board connectors J-15 and J-16, or J-17 and J-18, or J-19 and J-20.
4. Remove motor speed control module mounting screws.
5. Remove motor speed control module from enclosure.
6. Remove wiring harness from old speed control module and connect it to the new module. Set all controls (ACCEL, DECEL, MAX. SPEED, MIN. SPEED, TORQUE, and IR COMP) on new module to match old module. (See Minarik MM23000 User's Guide, Chassis Control Connections in the Appendix.) Set 115/230V switches to appropriate settings.

WIRE COLOR	BOARD CONNECTION (EXTRON OR MINARIK)
Brown	A1
Yellow	L1
Violet	L2
Red	A2

WIRE COLOR	BOARD CONNECTION	
	EXTRON	MINARIK
Orange	4	S1
Gray	2	S2
Blue	3	S3

7. Place new motor speed control module in enclosure.
8. Secure new speed control module using screws removed in step 4.
9. Connect cable harness as removed in step 3.
10. Close distribution enclosure door.
11. Apply power to electronics and verify proper operation.

### 4.3.9 Cold Start Procedure

This procedure clears the AC-4000 memory. It is recommended that this procedure be done each time a printed circuit board is changed or memory is scrambled. Thermo Ramsey also recommends all product and setup information be recorded prior to cold start. Proceed as follows:

1. Turn power switch OFF.
2. Turn power switch ON while holding down the **CLR** key.
3. Front panel display reads:

```

Memory Lost
Enter All Values

```

4. Procedure complete. Press **RUN** to re-enter the required setup information which is machine prompted. See Section 3.5, Initial Setup Procedure, for required entries.

#### 4.4 TROUBLESHOOTING

The troubleshooting procedures are listed in a logical sequence in Table 4-1 to enable maintenance personnel to make the fastest checks first. Refer to the listed symptoms and proceed to isolate the possible cause of the failure and apply the recommended corrective action. When the solution recommends replacement of a component or assembly, refer to the Replaceable Parts in Chapter 5.0. Other section references are provided where necessary. If the procedures recommended do not provide a solution to your particular problem, contact Thermo Products Technical Service for assistance.

**TABLE 4-1  
TROUBLESHOOTING PROCEDURES**

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Front panel displays blank; no lamps lit, no keyboard response.	Incorrect DC voltage	Perform power supply troubleshooting procedures, refer to Table 4-2.
	Bad Display	Replace defective Display Module, refer to Display Module Replacement Procedures in this chapter.
Front panel display blank or blinking randomly; no display response to lamp test but LED's OK.	Incorrect DC voltage	Perform power supply troubleshooting procedures, refer to Table 4-2.
	Bad Display Board or cable	Replace defective Display Module, refer to Display Module Replacement Procedures in this chapter.
	If problem persists	Replace defective Analog Board, refer to Analog Board Replacement Procedures in this chapter.
No response when one or more keys are pressed; i.e., some work and some don't.	Bad front panel	Replace defective front panel, refer to Front Panel Replacement Procedures in this chapter.
	If problem persists	Replace defective Analog Board, refer to Analog Board Replacement Procedures in this chapter.
Message "A/D Under Ranged"	Input from loadcell is zero or less.	Check for objects between loadcell and weightable.

**TABLE 4-1  
TROUBLESHOOTING PROCEDURES - Continued**

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Message "A/D Over Ranged"	Input from loadcell has exceeded A/D input range	Check for objects on weightable that exceed loadcell capacity.
Message "Outfeed Queue Full"	Too many packages on outfeed table	Decrease amount of packages between beginning of outfeed and the diverter.  Replace or adjust speed sensor.
Message "Weightable Queue Full"	Multipackage tracking. Too many packages on the weightable	Decrease amount of packages between interlock and outfeed deadplates.  Replace or adjust speed sensor.
Message "Deadplate Queue Full"	Excessive deadplate package control	Decrease amount of packages between beginning of deadplate and the outfeed.  Replace/adjust speed sensor.
Incorrect Conveyor Speed	Speed incorrectly set	Display speed on front panel and re-adjust speed potentiometer to correct speed.
	If problem persists	Check speed calibration constant and speed sensor.
Conveyor slows or stops	Product build up on drive	Clean machine.
	Timing belt broken or loose	Adjust or replace timing belt. Refer to Drive Belt Replacement and Adjustment Procedures in the weightable manual.
	Seizure of drive shaft bearings	Lubricate bearings, or if bearings are defective, refer to Chain Drive Sprocket Replacement Procedures in the weightable manual.
	Loose drive sprocket or timing gear	Retighten loose set screw on drive sprocket or motor timing gear.

**TABLE 4-1  
TROUBLESHOOTING PROCEDURES - Continued**

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
<p>Conveyor slows or stops (continued)</p> <p>Infeed, Outfeed or Weightable Conveyor stops</p> <p>Fuse 1 = Infeed                      Fuse 2 = Weightable                      Fuse 3 = Outfeed</p>	<p>Seizure of motor shaft bearings</p>	<p>Remove drive motor and rotate shaft. If motor bearings are defective, replace drive motor. Refer to Motor Replacement Procedures in the weightable manual.</p>
	<p>Blown drive motor fuse due to motor overload or jam</p>	<p>Check drive motor fuses on Distribution Board. If fuse is blown, free conveyor of jam or replace defective drive shaft bearing. Refer to Chain Drive Sprocket Replacement Procedures in the weightable manual. Install new fuses.</p>
	<p>Blown drive motor fuse due to shorted wiring</p>	<p>Using an ohmmeter, measure motor wiring isolation with respect to chassis ground. Locate short and correct wiring. Replace fuses on Distribution Board.</p>
	<p>Blown drive motor fuse due to motor armature winding</p>	<p>Measure motor armature resistance that should be 4 to 6 Ohms, if less than 4 Ohms, replace drive motor. Refer to Drive Motor Replacement Procedures in weightable manual. Replace fuses on Distribution Board.</p>
	<p>Defective motor speed control module</p>	<p>Measure output of motor speed control module. If module output is not between 45 and 90 VDC, replace defective motor speed control module. Refer to Motor Speed Control Module Replacement Procedures in the weightable manual.</p>

**TABLE 4-1  
TROUBLESHOOTING PROCEDURES - Continued**

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
No Interlocks (Use Interlock Test menu)	Dirty interlock	Clean interlock.
	Misaligned interlock or blocked path	Realign interlocks or remove blockage using visible red indicator light on receiver as an aid.
	No power	Troubleshoot wiring by checking for +12 VDC between terminals TB4-17 and TB4-18 on Junction Box Board. If voltage is incorrect, perform Power Troubleshooting checklist per Table 4-2.
	Interlocks burned out or defective	Replace defective interlock. Refer to Interlock system Replacement Procedures in the weightable manual.
	Bad Analog Board	Replace defective Analog Board. Refer to Analog Board Replacement Procedures in this chapter.
No diverter (Use Diverter Test menu)	Blown fuse	Check/replace fuse on diverter.  If fuse continues to blow, check/replace solid state relay module on Analog Board.
		Check/replace faulty diverter mechanism and/or wiring.
No diverter while running	Optional outfeed speed sensor bad	Check outfeed speed display. If zero, check/replace speed sensor and wiring.
	Analog Board bad	Check/replace Analog Board. Refer to Analog Board Replacement Procedures in this chapter.

**TABLE 4-1  
TROUBLESHOOTING PROCEDURES - Continued**

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Not weighing	Bad Interlock	Check/replace photo interlock and/or wiring.
	No speed signal	Check outfeed speed display. If zero, check/replace speed sensor.
Optional communications link inoperative.	Bad Analog Board	Check/replace Analog Board.
	Bad Communication Board or cables	Check/replace Communication Board or cables.
Weighing not done	Interrogate delay is set too long.	Reset interrogate delay.
	Taking too many A/D samples.	Decrease amount of A/D samples taken.
	Weightable belt speed is too high.	Slow weightable belt speed.
Printer buffer full	Low baud rate.	Increase baud rate.
Printer buffer full <u>or</u> printer off line	Printer needs paper.	Refill.
	Paper jam in printer.	Clear jam and reset.
	Printer is deselected.	Select printer.
	Printing reports too often.	Reduce amount of reports.
Communication Alarm	Receive buffer overflow.	Stop data transmission to AC-4000.
No gap	Packages spaced too close together	Increase package spacing or check package size for possible skewing.

**TABLE 4-2  
POWER TROUBLESHOOTING PROCEDURE**

ACTION	CORRECTIVE ACTION
<p>Measure DC Voltages at Analog Board Test Points TP2 and TP3, loadcell excitation voltage at TB3-1,2 and +12V at TB4-2. Use test connector J13-6 as common.</p> <p>Check AC Voltages at transformer connector J3:</p> <p>J3-1   HOT    - L1 J3-4   NEUTRAL - L2</p> <p>Isolate fault to single board; remove AC power, unplug the CPU Board. Reapply AC power</p> <p>Remove AC power. Unplug optional Communication Board. Reapply power.</p>	<p>If all DC Voltages are OK, perform board troubleshooting procedures, refer to Table 4-1.</p> <p>If all DC Voltages are at or near zero, check AC Voltages.</p> <p>If any one or more of DC Voltages are low or zero, isolate fault to the Analog Board or field wiring.</p> <p>If no AC Voltage, check fuses F4 and F5 on Distribution Board, and F1 and F2 on the Analog Board. Refer to Distribution Board and Analog Board Replacement Procedures in this chapter for fuse location and value.</p> <p>If fuse F4 and F5 are OK, problem exists with main AC input power. Check external power source.</p> <p>If fuse F4 or F5 on Distribution Board or fuse F1 or F2 on Analog Board are blown, replace fuse and restore power.</p> <p>If DC Voltage is OK, replace CPU Board.</p> <p>If DC Voltage is not OK, plug in CPU Board and check the Display and optional Communication Boards.</p> <p>If DC voltage is OK, replace Communication Board.</p> <p>If not OK, insert Communication Board and check Display Module.</p>



**TABLE 4-2  
POWER TROUBLESHOOTING PROCEDURE - Continued**

ACTION	CORRECTIVE ACTION
<p>Remove AC power and disconnect loadcell cables at TB3. Reapply AC power.</p> <p>Remove AC power. Disconnect speed sensor and interlock cables.</p> <p>Remove AC power and disconnect Display Module cable at J6 on CPU Board. Reapply AC power.</p>	<p>If DC Voltage is OK, replace either defective loadcell or loadcell cable. Refer to Weightable Replacement Procedures in the weightable manual.</p> <p>If DC Voltage is not OK, check speed sensor and interlocks.</p> <p>If DC voltage is OK, replace/repair speed sensor and interlock or wiring.</p> <p>If not OK, check Display Module.</p> <p>If DC Voltage is OK, replace defective Display Module or cable. Refer to Display Module Replacement Procedures in this chapter.</p> <p>If DC Voltage is not OK, replace defective Analog Board. Refer to Analog Board Replacement Procedures in this chapter.</p>

## CHAPTER 5.0 REPLACEMENT PARTS

### 5.1 GENERAL

This chapter gives information on how to order replacement parts for your AC-4000 Electronics and includes photographs and drawings with corresponding parts lists to enable you to identify parts quickly and accurately.

### 5.2 ORDER INFORMATION

For faster service when ordering parts, fax or telephone Thermo Products Parts Department. Your regional field service representative will also be happy to assist you with parts orders, but his normal scheduling time may delay shipment of your parts order.

The recommended procedure for ordering parts is as follows:

1. Determine the broken or faulty part(s).
2. Locate the part(s) in the parts list given.
3. Find the part number(s) for the item(s) needed and determine the quantity you require.
4. Write or telephone:

**Thermo Electron  
Customer Service Department  
501 90th Ave. NW  
Minneapolis, Minnesota 55433  
Fax: (763) 780-1537**

Customers A through G - (763)783-2781  
Customers H through O - (763)783-2693  
Customers P through Z - (763)783-2782  
Repair and Returns - (763)783-2783

Normal Customer Service hours are 8:00 a.m. to 4:30 p.m., Central Time.

5. With your order, list the following information:
  - Machine model and serial number
  - Purchase order number
  - Date required
  - Method of shipment preferred
  - List of parts, including part number, description and quantity

Your parts order will be handled as expeditiously as possible.

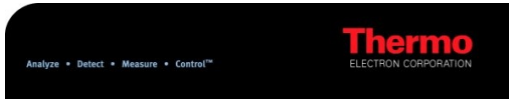
### 5.3 PARTS LIST INDEX

Parts lists are cross referenced to photographs or drawings to facilitate identification. These parts lists are indexed as follows:

#### PARTS LIST

DESCRIPTION	TABLE NO.	PAGE NO.
AC-4000 Electronics (Remote or Local)	5-1	5-4

### 5.3.1 Return Material Authorization



RMA No. R- \_\_\_\_\_

(This RMA number must be marked on all paperwork and on the outside of the package.)

Req'd By: \_\_\_\_\_

Return, Freight Prepaid to:

Date: \_\_\_\_\_

Thermo Ramsey  
501 90th Avenue N.W.  
Minneapolis, MN 55433

Customer Contact: \_\_\_\_\_

Telephone: 763 / 783-2774  
Telefax: 763 / 783-2525

Phone No.: (    ) \_\_\_\_\_  
Area Code

Bill to Customer #: \_\_\_\_\_

Ship to #: \_\_\_\_\_

Returned From:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Return To:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Description of Material Being Returned:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Describe Equipment Malfunction or Defect. If any, symptoms:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Minimum Charge:  
 Informed Customer of \$50.00 Inspection Charge Per Item

Service Requested:  
 Repair & Return       Estimate Required  
 Return for Credit

P. O. No.: \_\_\_\_\_  
Original P. O. or RTI Order No.: \_\_\_\_\_

Warranty Repair or Replacement  
Original P. O. No.: \_\_\_\_\_

Serial No.: \_\_\_\_\_  
Original Order/Job No.: \_\_\_\_\_

Return Warranty/Exchange Unit

Shipped on RTI Order No.: \_\_\_\_\_

Other: \_\_\_\_\_

Disposition/Comments: (For RTI internal use only)  
\_\_\_\_\_  
\_\_\_\_\_

**TABLE 5-1  
AC-4000 ELECTRONICS  
(Remote or Local)**

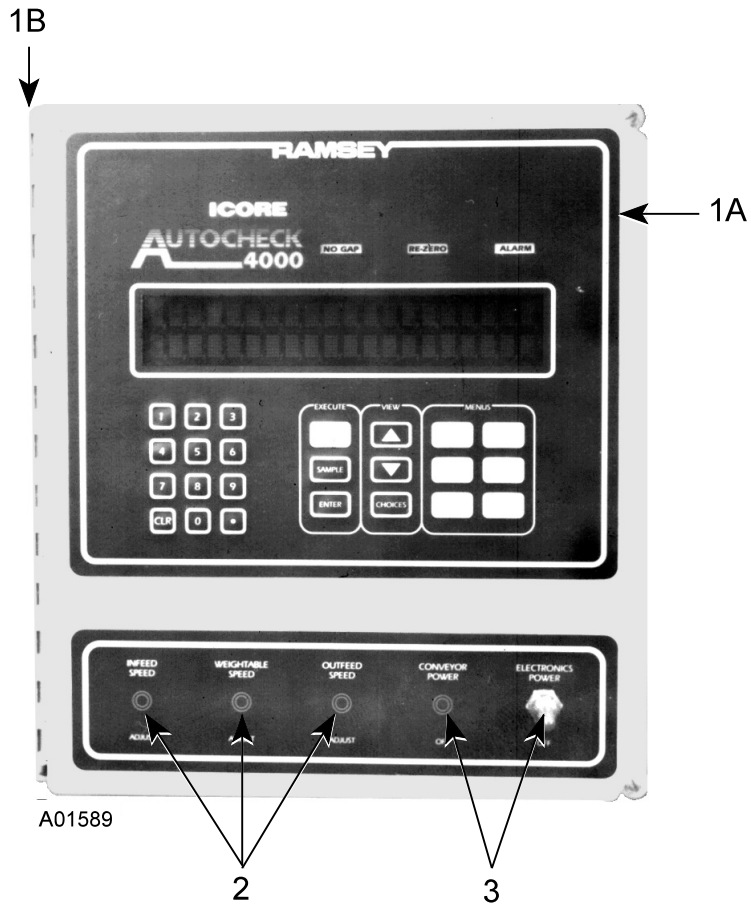
KEY	DESCRIPTION	PART NO.	QTY.
1A	Door Assembly, <u>Fiberglass</u>	045765	1
1B	Hinge Pin, Replacement	045836	1
2	Potentiometer (Indeed, Weightable, Outfield)	044727	A/R
3	Cable Assembly, Power Switch, Electronics/ Conveyor	045328	A/R
4	Display Board	043259	1
5	Cable Assembly, Analog Board/Display Board	044725	1
6	Cable Assembly, Analog Board/Display Module	044726	1
7	Display Module	042758	1
8	Communication Board	043262	1
9	CPU Board (Select applicable U2 software prom. See Section 6.0)	043253	1
10	Cable Assembly, Signal and Loadcell (for remote AC-4000 and 8000 series frames)	045326	1
11	Cable Assembly, Signal and Loadcell (for remote AC-4000 and 20, 25, 40 and 44 series frames)	045324	1
12	Cable Assembly, COM I/COM II (Optional)	044936	1

**TABLE 5-1  
AC-4000 ELECTRONICS  
(Remote or Local)**

KEY	DESCRIPTION	PART NO.	QTY.
13	Analog Board, 115V Analog Board, 230V	043256 045473	1 A/R
14	Analog Board Fuses: F1, .37 amp, Slo-Blo (for 115V) F1, .19 amp, Slo-Blo (for 230V) F2, 10.00 amp, Slo-Blo	027784 022898 022612	1 A/R 1
15	Motor Control, DC	035269	1
16	Cable Assembly, Controller Enclosure/Distribution Enclosure	044729	1
17	Distribution Board	044687	1
18	Distribution Board with Motor Inhibit	045322	A/R
19	Distribution Board Fuses: F1, F2, F3 - 5 amp, Slo-Blo F4, F5 - 15 amp, Slo-Blo	001369 045320	1 ea 1 ea
20	Cable Assembly, Motor/Rejects (for remote AC-4000 and 8000 series frames)	045325	1
21	Cable Assembly, Motor/Rejects (for remote AC-4000 and 20, 25, 40 and 44 series frames)	045323	1
22	Cable Assembly, Speed Control/Distribution Board	044718	1

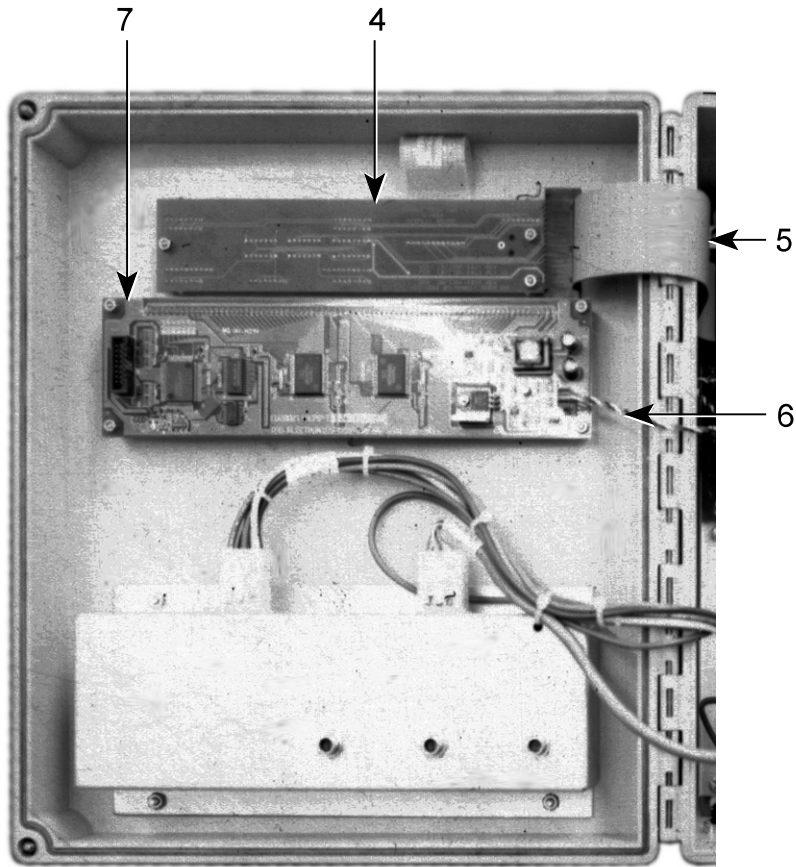
**TABLE 5-1**  
(Continued)

Controller Front Panel



**TABLE 5-1**  
(Continued)

Controller Enclosure - Left Side

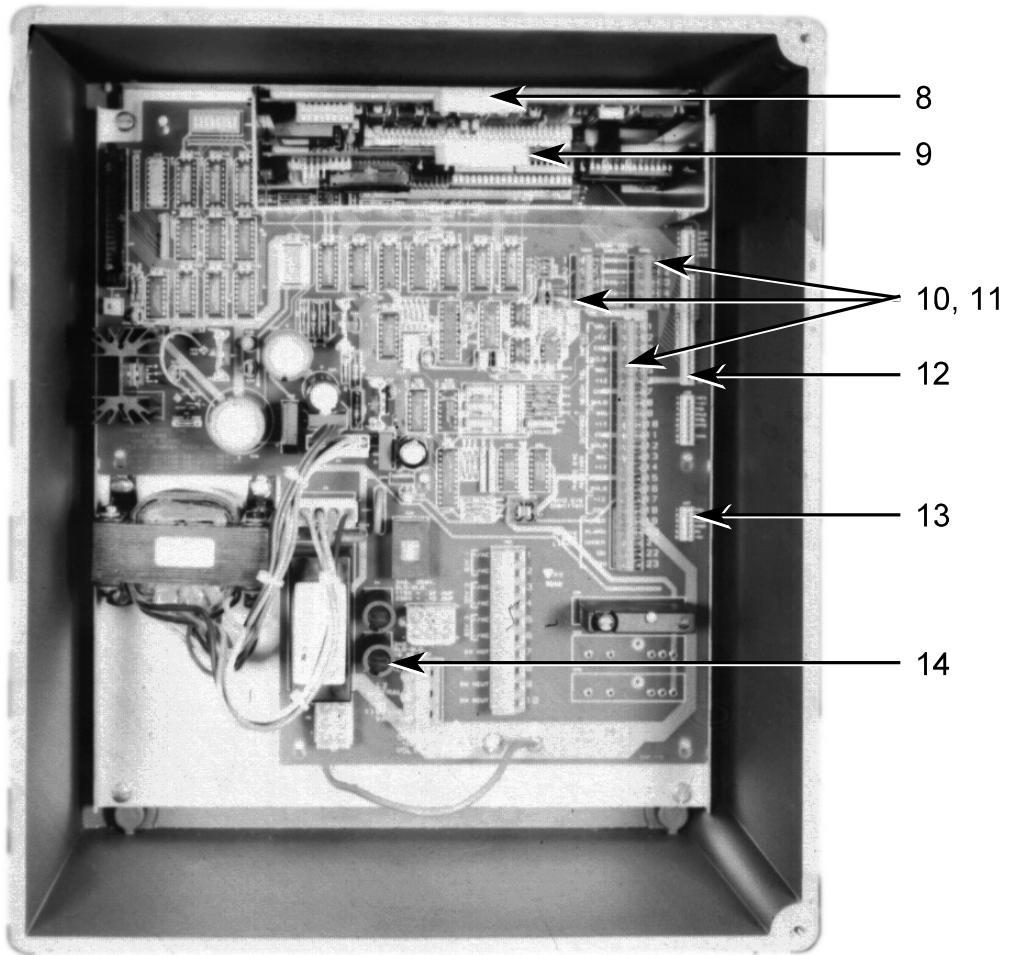


A01590



**TABLE 5-1**  
(Continued)

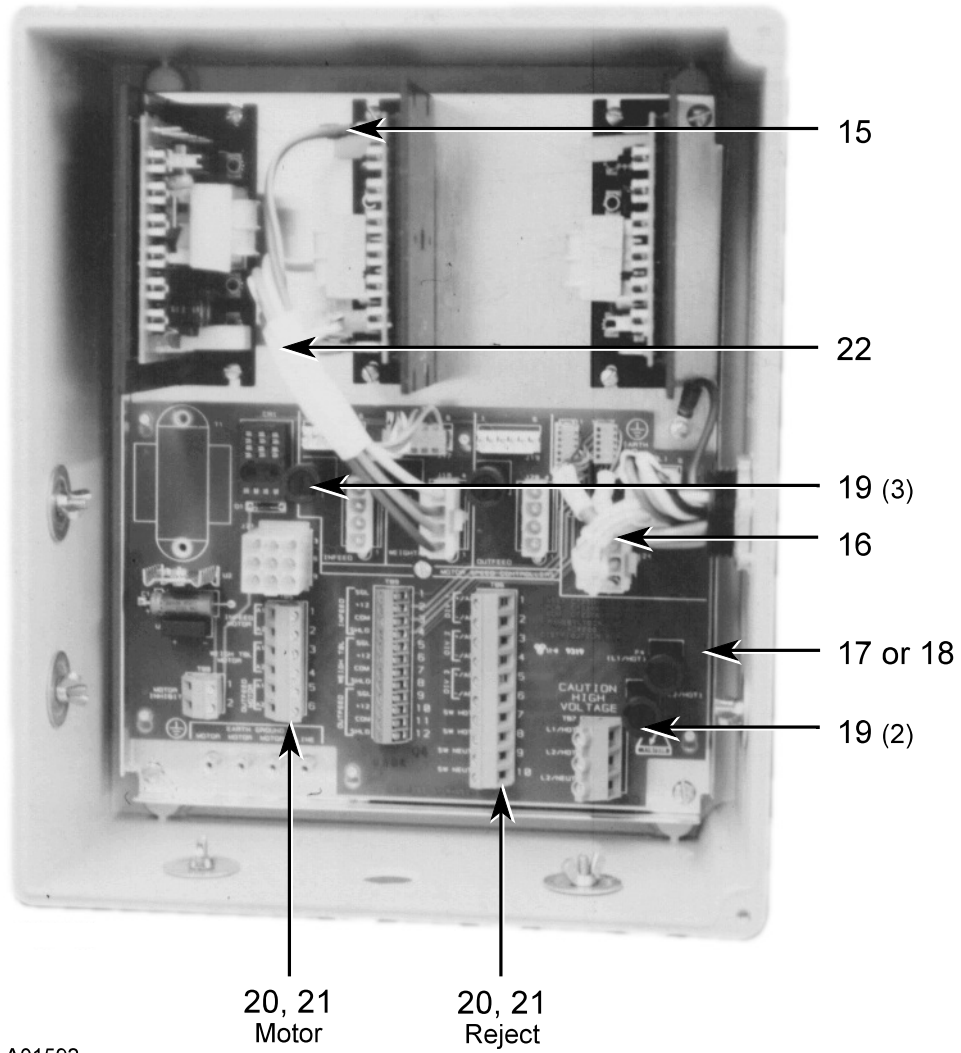
Controller Enclosure - Right Side



A01591

**TABLE 5-1**  
(Continued)

Distribution Enclosure



A01592

## **CHAPTER 6.0 AC-4000 OPTIONS**

### **6.1 GENERAL**

Five basic types of reject systems are described in the following pages. These are:

- Swing Gate Reject System
- Air Bopper Reject System
- Air Jet Reject System
- Air Pusher Reject System
- Carrier Reject System

A brief description of each system and replaceable parts with corresponding referenced drawings are provided for each type of reject system listed above.

The reject devices are controlled by the electronics of your checkweigher system and need no other inputs. Product is weighed before reaching the reject position. The timing of the reject is triggered by a photocell interlock system located upstream from the reject mechanism. As product passes the photocell (i.e., as it interrupts the interlock), a reject timing signal is sent from the checkweigher to the reject device, triggering that device to fire (reject) when product reaches the reject position.

Information presented below pertains solely to the reject systems listed above. Any other information regarding the electronics or mechanics of your system (including such adjustment procedures as reject timing or photo interlock) can be found in the Operation Chapter.

#### **6.1.1 Swing Gate Reject System**

The Swing Gate Reject System consists of an air cylinder operated paddle which, when energized, swings across the product path and diverts the product off the side of the conveyor. This paddle should be positioned as close as possible to the conveying medium but should not be in contact with the conveyor. In the rest position, the paddle should be as close as possible to the product path without actually being in the path of the product.

This reject system is designed for collapsible product containers or long rigid containers weighing up to 2 lbs. (1 Kg). The maximum allowable line speed is 100 CPM, depending upon product size and weight. The required air pressure also depends upon the product specifications and should be balanced to obtain the desired reject action.

The wearable replaceable parts are listed in Table 6-1.

#### **6.1.2 Air Bopper Reject System**

The Air Bopper Reject System consists of a polyurethane bopper plate operated by a double-acting air cylinder and a 4-way solenoid valve which provide air pressure for both the extending and retracting actions of the bopper plate. When energized, the bopper plate travels across the product path and "bops" the product off the side of the conveyor.

This reject system is designed for the high speed reject (up to 350 CPM) of smaller products (cans, bottles, and rigid boxes) weighing up to 1.5 lbs. (0.68 Kg).

The Air Bopper Reject should be mounted perpendicular to the conveying medium and as close as possible (without touching) to the product and the conveying medium. The air pressure required depends on product specifications and should be balanced to obtain the desired reject action.

The wearable replaceable parts are listed in Table 6-2.

### **6.1.3 Air Jet Reject System**

The Air Jet Reject System consists of two (2) OSHA approved air nozzles mounted on an air manifold and controlled by a solenoid valve. When energized, jets of air blow the product off the conveying medium. To avoid possible contamination of the air supply, the system's air filter and regulator assembly does not contain a lubricator. The air pressure required depends on product weight and should be adjusted to obtain the desired reject action.

This reject system is designed for rigid product containers weighing up to 2.5 lbs. (1.1 Kg) for chain conveyor applications and up to 1 lb. (0.5 Kg) for mylar belt conveyor applications. The maximum allowable line speed for this reject system is 400 CPM, depending upon product size and weight.

The wearable replaceable parts are listed in Table 6-3.

### **6.1.4 Air Pusher Reject System**

The Air Pusher Reject System consists of a stainless steel rectangular plate or an anodized aluminum round plate operated by a double acting air cylinder and a 4-way solenoid valve which provide air pressure for both the extending and the retracting actions, of the reject plate. When energized, the Air Pusher plate travels across the product path and pushes the product off the side of the conveyor.

This reject system is designed for heavier products, 5 to 40 lbs. (2.3 to 28 Kg), and slower line speeds (40 to 80 CPM). The round reject plate is used for rigid product containers. The rectangular reject plate is used for collapsible product containers.

The Air Pusher Reject should be positioned as close as possible to (without touching) the product. It should be mounted as close as possible to the conveying medium to prevent tipping the product when rejected. This height is generally about the mid-section of the product container. The air pressure required depends upon product specifications and should be balanced to obtain the desired reject action.

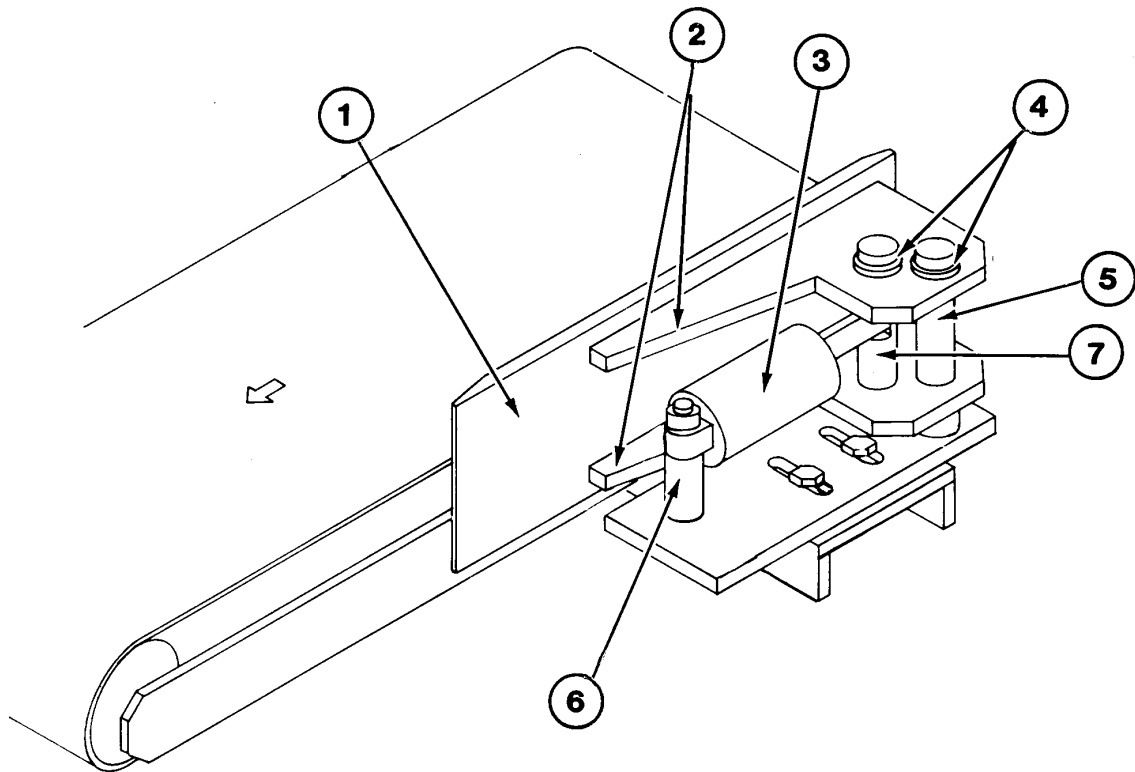
The wearable replaceable parts are presented in Table 6-4.

### **6.1.5 Carrier Reject System**

The Carrier Reject System represents the most gentle handling mechanism known for rejection applications. A series of channels (from one to five) is built into the carrier reject and signals from the checkweigher cause the carrier plaques to divert product to the desired channel. This reject system operates at any speed and handles products of any size and weight compatible with the electronics.

**TABLE 6-1  
SWING GATE REJECT SYSTEM - REPLACEABLE PARTS**

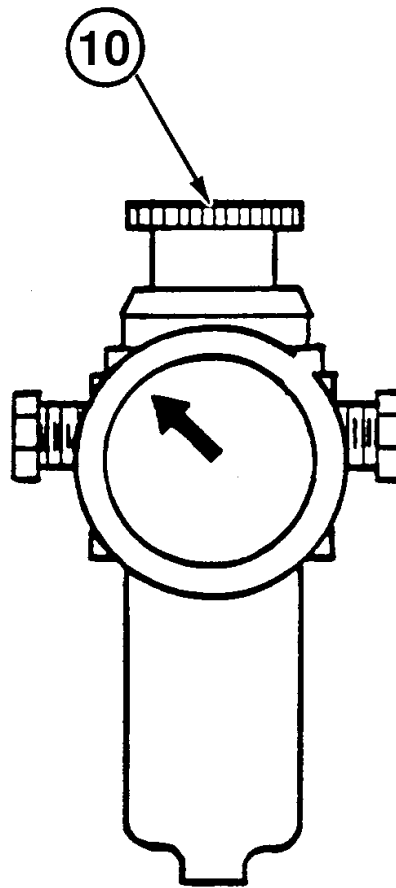
Key	Description	Part No.	Qty.
1	Paddle	032082	1
2	Gusset, Paddle	034407	2
3	Air Cylinder	025231	1
4	Bushing, Flange	027907	4
5	Pivot, Swing Gate	032549	1
6	Pivot, Cylinder	033123	1
7	Shaft, Cylinder Mount	031874	1
8	4-Way Solenoid Valve	014877	1
9	Tru-Arc Retaining Ring	027868	3



A00015

TABLE 6-1 (Continued)  
SWING GATE REJECT SYSTEM - REPLACEABLE PARTS

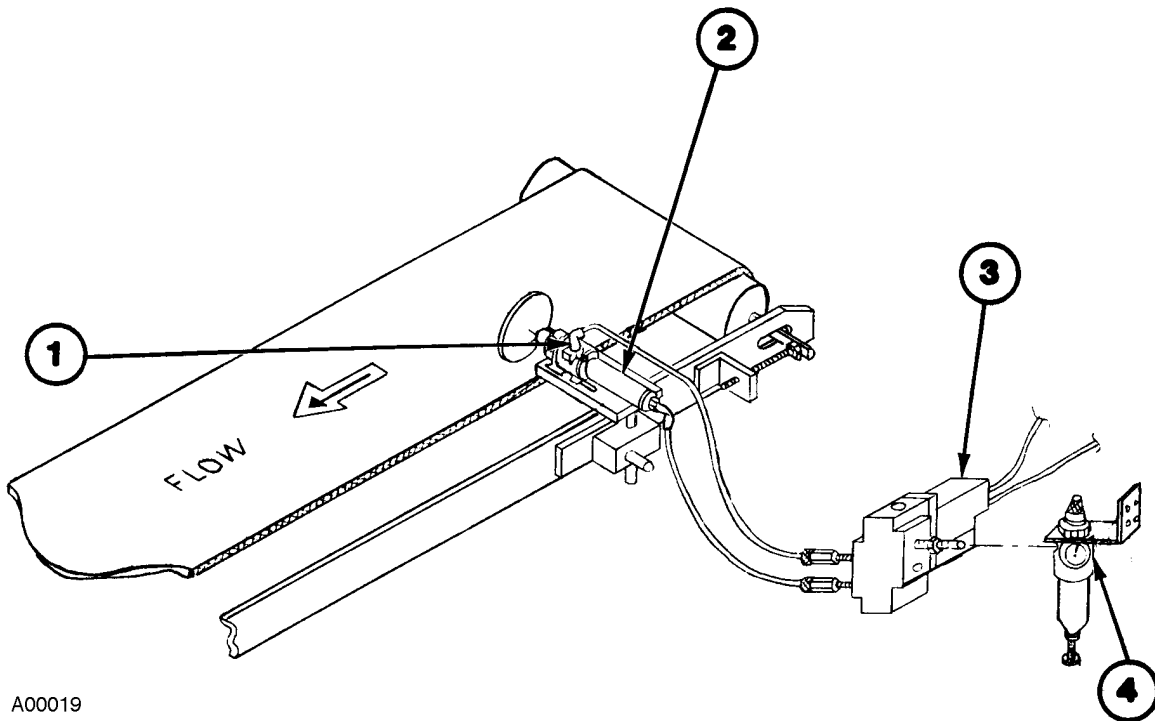
Key	Description	Part No.	Qty.
10	Air Filter Regulator, 1/4 NPT w/Gauge	026178	1



A01054

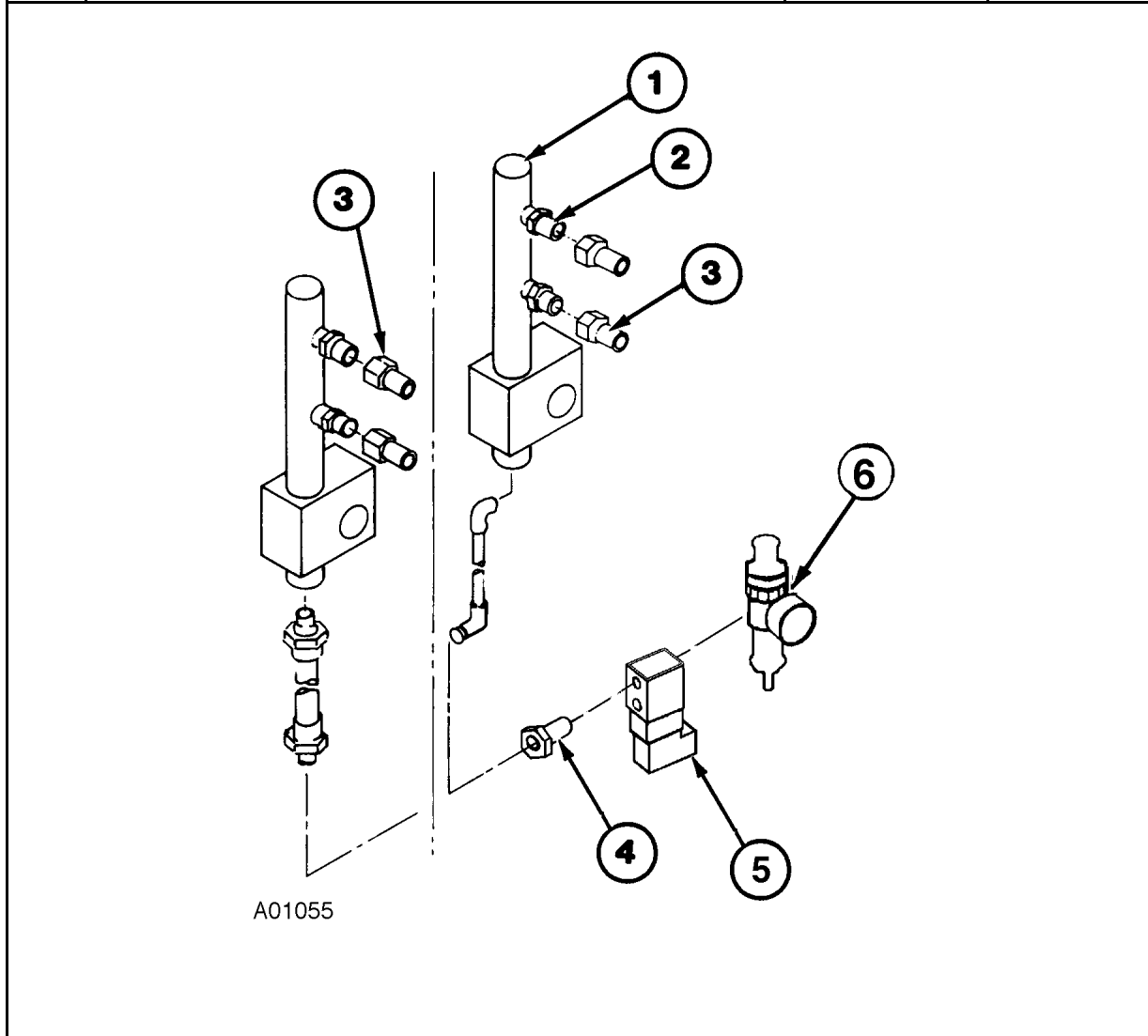
**TABLE 6-2  
AIR BOPPER REJECT SYSTEM - REPLACEABLE PARTS**

Key	Description	Part No.	Qty.
1	Bopper Plate Molding	026505	1
2	3" Stroke Air Cylinder 4" Stroke Air Cylinder 6" Stroke Air Cylinder 8" Stroke Air Cylinder	034407 014325 014326 014327	Select One
3	4-Way Valve	014877	1
4	Air Regulator/Filter Assembly w/Gauge	026178	1



**TABLE 6-3  
AIR JET REJECT SYSTEM - REPLACEABLE PARTS**

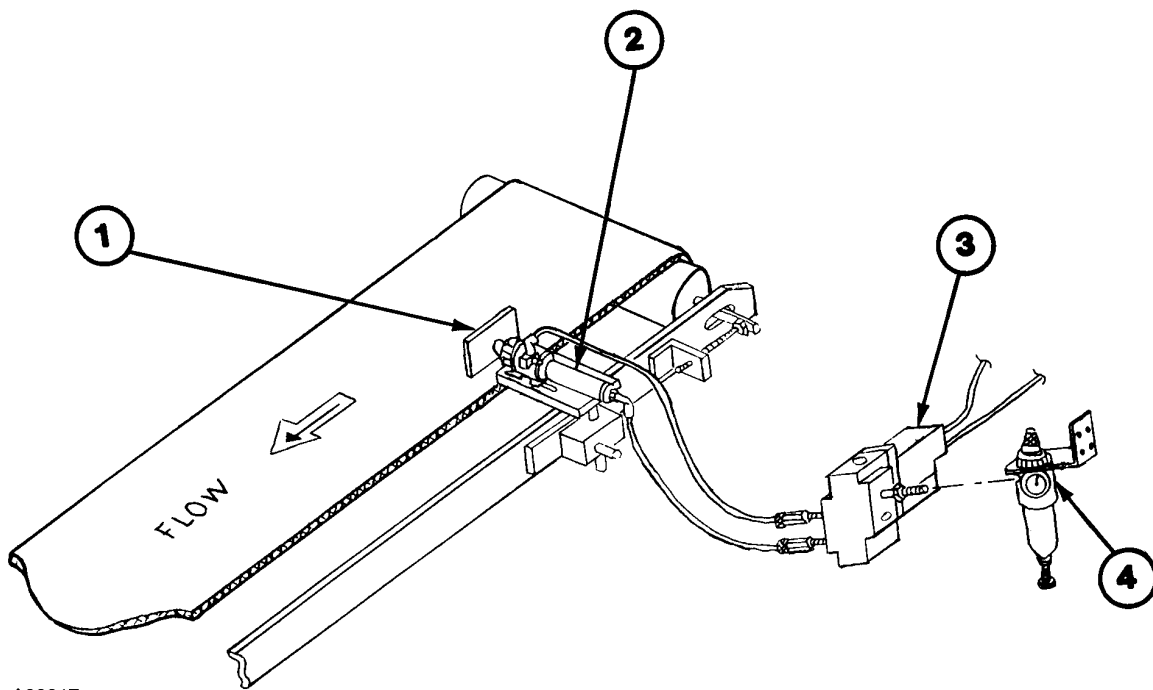
Key	Description	Part No.	Qty.
1	*Air Manifold	026936	1
2	Hex Nipple	021060	2
3	Nozzle	027659	2
4	Hex Bushing	027991	1
5	Solenoid Valve	051294	1
6	Air Regulator w/Gauge and Filter	041137	1





**TABLE 6-4  
AIR PUSHER REJECT SYSTEM - REPLACEABLE PARTS**

Key	Description	Part No.	Qty.
1	Bopper, Plate 7.0" Lg.	021506	1
2	4" Stroke Air Cylinder 6" Stroke Air Cylinder 8" Stroke Air Cylinder	014325 014326 014327	Select One
3	4-Way Valve	014877	1
4	Air Regulator/Filter Assembly w/Gauge	026178	1



## 6.2 VARIABLE SPEED

Variable speed option is provided for those applications requiring variable conveyor line speeds. With the variable speed option, you can adjust the speed of your weightable and Indeed or outfield conveyors right at the front panel. The controls are screw driver adjustable and remain wash down sealed when not in use.

### 6.2.1 Installation

To install the variable speed option proceed as follows:

1. Turn off power at mains.
2. Open the controller enclosure door.
3. Remove the switch/pot bracket from the door.
4. With a knife, cut through the hole(s) in the front panel.
5. Install the spacer onto the potentiometer(s) and tighten.
6. Insert the potentiometer(s) spacer through the front panel.
7. From the front of the panel, insert the O-ring on the spacer threads.
8. Install the jack cover and jack cover nut on the protruding spacer threads and tighten.

**TABLE 6-5  
VARIABLE SPEED OPTION PARTS**

<u>Description</u>	<u>Part No.</u>	<u>Qty.</u>
Potentiometer (Indeed, Weightable, Outfield)	044727	A/R
Power Switch (Electronics and Conveyor)	045328	A/R
Boot, Switch, Toggle	026856	A/R
Jack Cover, Sealed	034966	A/R
O-Ring, .375" x .50" x .062"	023546	A/R
Spacer	034972	A/R

## 6.3 COMMUNICATIONS

The Communications Option provides two communication channels, Port A and Port B, which are electrically identical but have different functional capabilities. This provides digital communication with external devices such as printers, terminals, or computers. Both EIA-232 and EIA-422/485 communications standards are supported on both channels. Baud rate, character size, parity, and stop bit settings can be selected from the front panel. Port A can be used to transmit formatted reports or free run data. Port B can be used to transmit free run data or for other optional functions. Several Port B software options are available and are described in the AC-4000 Communications Software Options Manual, REC 4059.

### 6.3.1 Communication Board Installation

To install the Communication Board and cable, proceed as follows:

1. Turn off power at mains.
2. Open electronics controller enclosure door.
3. The Communication Board connector is located directly above the CPU Board near the upper, back portion of the enclosure (see Figure 4-2).
4. Gently push the Communication Board onto the pin connectors using the card handle.
5. Insure the board is properly oriented and fully seated.
6. Set dip switches (shown below in Table 6-6) on the Communication Board (Figure 6-1) as needed.
7. Connect the 20 pin connector on the communications cable assembly to J11 of the Analog board.
8. Remove two of the cover plates on the bottom of the enclosure and discard. Insert the circular connectors in the holes and tighten the four hex nuts.
9. Close electronics controller enclosure door.
10. Apply power to electronics.
11. Refer to Chapter 3 of this manual for setup procedures. Also see the Menu Tree drawing for menus that are available with the Communications Option.

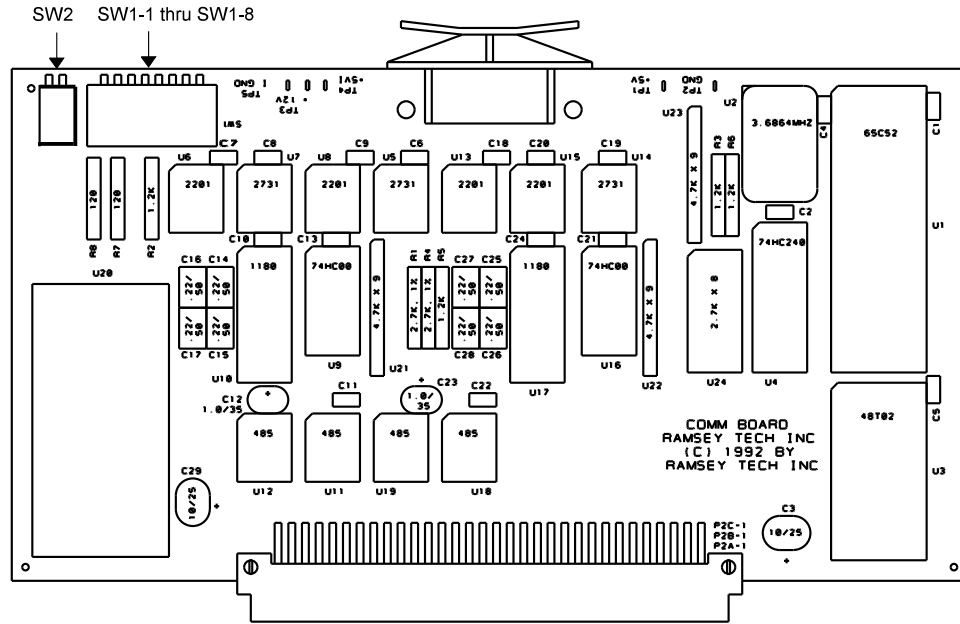
**TABLE 6-6  
COMMUNICATION BOARD SWITCH SETTINGS**

PORT A					
SWITCH SW1-1	SWITCH SW1-2	SWITCH SW1-5	SWITCH SW1-7	SWITCH SW2-1	DESCRIPTION
OFF / OPEN	OFF / OPEN	ON / CLOSED	OFF / OPEN	OFF / OPEN	EIA-232 with hardware
OFF / OPEN	ON / CLOSED	ON / CLOSED	OFF / OPEN	OFF / OPEN	EIA-232 with data leads only
ON / CLOSED	ON / CLOSED	ON / CLOSED	OFF / OPEN	OFF / OPEN	EIA-422/485 no termination
ON / CLOSED	ON / CLOSED	ON / CLOSED	ON / CLOSED	OFF / OPEN	EIA-422/485 with termination
ON / CLOSED	ON / CLOSED	OFF / OPEN	OFF / OPEN	OFF / OPEN	EIA-422/485 no termination
ON / CLOSED	ON / CLOSED	OFF / OPEN	ON / CLOSED	OFF / OPEN	EIA-422/485 with termination
ON / CLOSED	ON / CLOSED	OFF / OPEN	OFF / OPEN	ON / CLOSED	EIA-422/485 no termination
ON / CLOSED	ON / CLOSED	OFF / OPEN	ON / CLOSED	ON / CLOSED	EIA-422/485 with termination

PORT B					
SWITCH SW1-3	SWITCH SW1-4	SWITCH SW1-6	SWITCH SW1-8	SWITCH SW2-2	DESCRIPTION
OFF / OPEN	OFF / OPEN	ON / CLOSED	OFF / OPEN	OFF / OPEN	EIA-232 with hardware
OFF / OPEN	ON / CLOSED	ON / CLOSED	OFF / OPEN	OFF / OPEN	EIA-232 data leads only
ON / CLOSED	ON / CLOSED	ON / CLOSED	OFF / OPEN	OFF / OPEN	EIA-422/485 no termination
ON / CLOSED	ON / CLOSED	ON / CLOSED	ON / CLOSED	OFF / OPEN	EIA-422/485 with termination
ON / CLOSED	ON / CLOSED	OFF / OPEN	OFF / OPEN	OFF / OPEN	EIA-422/485 no termination 4-wire multidrop
ON / CLOSED	ON / CLOSED	OFF / OPEN	ON / CLOSED	OFF / OPEN	EIA-422/485 with termination 4-wire multidrop
ON / CLOSED	ON / CLOSED	OFF / OPEN	OFF / OPEN	ON / CLOSED	EIA-422/485 no termination 2-wire multidrop
ON / CLOSED	ON / CLOSED	OFF / OPEN	ON / CLOSED	ON / CLOSED	EIA-422/485 with termination 2-wire multidrop

**TABLE 6-7  
COMMUNICATIONS OPTION PARTS**

<u>Description</u>	<u>Part No.</u>	<u>Qty.</u>
Communication Board	043262	1
Com I/Com II Cable Assembly	044936	1



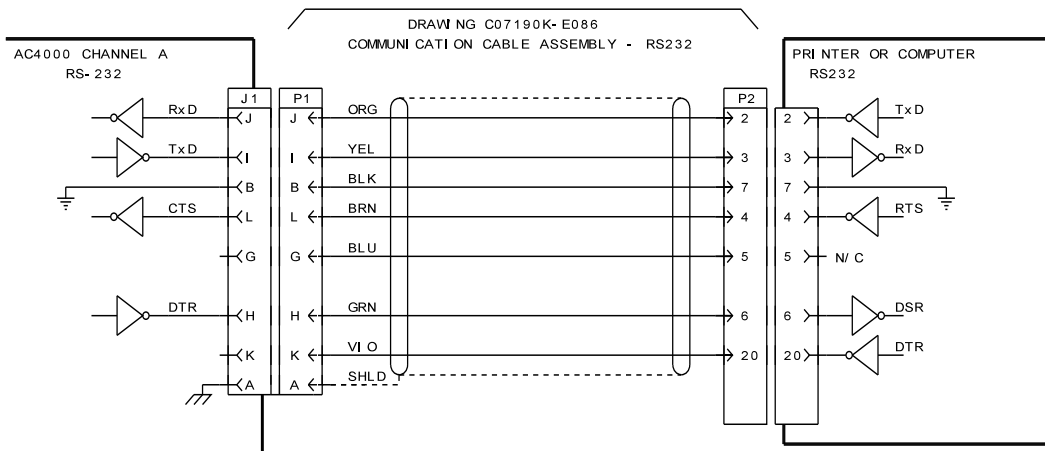
A00444

COMMUNICATION BOARD SWITCHES  
FIGURE 6-1

### 6.3.2 External Communication Cabling

This section describes the cabling necessary to connect the AC-4000 EIA-232 (Figure 6-2) and the EIA-485 (Figure 6-3) serial interface to an external device. Appendix A contains drawings showing the required cabling.

A Test Menu called "Comm Loop Back" is supplied for testing the serial interface by sending the alphabet out the selected serial channel. If the AC-4000 receives the same data it sends out, the menu indicates "PASS", otherwise it indicates "FAIL". A loopback connector should be connected instead of the external device so the data will return. If this is not done but the external device prints the alphabet, the cabling is probably working.



A00433

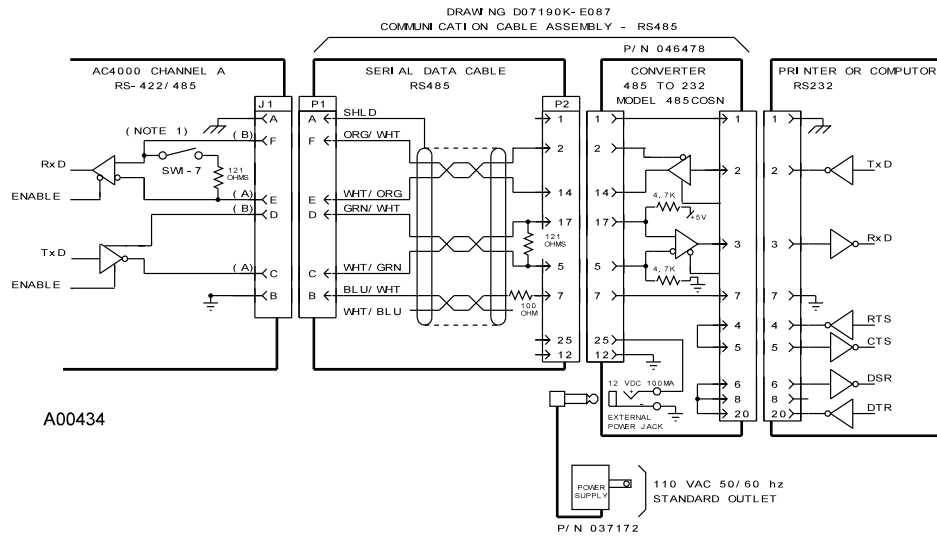
**EIA-232 CONNECTIONS**  
**FIGURE 6-2**

**EIA-232**

Typical connections are shown in Figure 6-2. In some cases, wires may need to be swapped (null modem connections). This is done by swapping wires 2-3, 4-5, and 6-20.

To make the Comm Loop Back test pass, connect a jumper wire between pins 2 and 3 of connector P2. If hardware handshaking is used, also connect pins 4-5.

If your device cannot drive the RTS line, insure the DIP switches are set to EIA-232 data leads only.



**EIA-485 CONNECTIONS**  
**FIGURE 6-3**

**EIA-485**

Figure 6-3 shows the connections typically used to connect the AC4000 EIA-485 output to an external device. The cabling shown includes a converter that changes the output back to EIA-232 before entering the device. If the device has EIA-485 capability built in, the converter can be removed and the device connected directly to connector P2.

To make the Comm Loopback Test pass, connect a jumper wire between pins 2 and 3 on the EIA-232 side of the converter. If the converter is not used, connect pins 2-5 and 14-17 of connector P2.

### 6.3.3 External Cabling Connections

A 14-pin connector, Amphenol MS3106A-20-27P, is used to connect an external communications device to the controller. A shielded cable should be used and the shield should be tied to the controller only. The connections are defined in Table 6-8 below.

**TABLE 6-8  
EXTERNAL CABLING CONNECTIONS**

MS3106A CONNECTOR PIN	FUNCTION / SIGNAL
A	Shield
B	Signal Ground
C	TxD (A/-) <span style="float: right;">△</span>
D	TxD (B/+) <span style="float: right;">EIA-422/485 4-wire</span>
E	RxD (A/-) <span style="float: right;"> </span>
F	RxD (B/+) <span style="float: right;">▽</span>
E	TxD/RxD (A/-) <span style="float: right;">EIA-422/485 2-wire</span>
F	TxD/RxD (B/+)
G	(N/C) <span style="float: right;">△</span>
H	DTR (Data Terminal Ready) <span style="float: right;"> </span>
I	TxD (Transmit Data) <span style="float: right;">EIA-232</span>
J	RxD (Receive Data) <span style="float: right;"> </span>
K	(N/C) <span style="float: right;"> </span>
L	CTS (Clear to Send) <span style="float: right;">▽</span>
M	(N/C)
N	(N/C)

### 6.3.4 Formatted Report

The AC-4000 can create a formatted report that will be sent out Port A. See Chapter 3 (REC 3830) for the report setup and format information.

### 6.3.5 Free Run Data

The AC-4000 can output free run weight data on Port A or Port B. See Chapter 3 (REC 3830) for the free run output setup and format information.



## **6.4 STATISTICS OPTION**

The Statistics Option is provided to gather information on the products being weighed. If the Communications Option is installed, a formatted report of this information can be printed.

### **6.4.1 Installation**

1. Turn off power at mains.
2. Open electronics controller enclosure door.
3. Locate the CPU Board (directly below the Communication Board) near the upper, back portion of the enclosure (see Figure 4-2).
4. Remove hardware securing CPU board. Gently pull the CPU card handle, extracting the board from the pin connectors.
5. If socket U3 is empty, insert the new Eeprom memory IC into the socket. The orientation mark is toward U1.
6. Replace CPU Board in enclosure. Insure the board is in the lower slot, properly oriented and fully seated.
7. Perform a Cold Start Procedure.
6. Verify all setups. Refer to Chapter 3 for all setup procedures. Also see the Menu Tree drawing for menus that are available with the Statistics option.

## **6.5 MULTIPLE PRODUCT OPTION**

The Multiple Product Option allows storing of setup parameters and statistical data for up to 15 different products. This information is stored in memory and the AC-4000 can be switched from one product to another in a matter of seconds by using the Product menu.

### **6.5.1 Installation**

1. Turn off power at mains.
2. Open electronics controller enclosure door.
3. Locate the CPU Board (directly below the Communication Board) near the upper, back portion of the enclosure (see Figure 4-2).
4. Remove hardware securing CPU board. Gently pull the CPU card handle, extracting the board from the pin connectors.
5. If socket U3 is empty, insert the new EEPROM memory IC into the socket. The orientation mark is toward U1.
6. Replace CPU Board in enclosure. Insure the board is in the lower slot, properly oriented and fully seated.
7. Perform a Cold Start Procedure.
8. Verify all setups. Refer to Chapter 3 for all setup procedures. Also see the Menu Tree drawing for menus that are available with the Multiple Products option.

## **6.6 MULTIPLE DIVERTER OPTION**

The Multiple Diverter Option is a combination of hardware and software that increases the number of diverter (reject) outputs from one to three. A package can be diverted into under-weight, on-weight and over-weight categories if desired. A diverter can also be used as a No Gap indicator or as an Alarm actuator.

### **6.6.1 Installation**

1. Turn off power at mains.
2. Open electronics controller enclosure door.
3. Locate the CPU Board (directly below the Communication Board) near the upper, back portion of the enclosure (see Figure 4-2).
4. Remove hardware securing CPU board. Gently pull the CPU card handle, extracting the board from the pin connectors.
5. Plug the two additional diverter modules into the sockets on the lower right of the Analog Board labeled CR2 and CR3.
6. Replace CPU Board in enclosure. Insure the board is in the lower slot, properly oriented and fully seated.
7. Perform a Cold Start Procedure.
8. Verify all setups. Refer to Chapter 3 for all setup procedures.

## **6.7 DIVERTER VERIFICATION OPTION**

The Diverter Verification Option is used to confirm that packages have been properly diverted. It confirms that a package assigned to a diverter is diverted, or, if the package is not assigned, that it remains on the conveyor. The package travels the entered distance before the AC-4000 verifies that it was handled correctly.

If a package handling error is detected, the alarm light turns on and the appropriate alarm message appears in the Alarm menu. If an alarm diverter is assigned, the alarm output goes activate until the operator manually clears the alarm.

This option requires that a verify sensor be connected to the Indeed Speed Sensor input. This option disables the Indeed speed function.

### **6.7.1 Installation**

1. Turn off power at mains.
2. Open electronics controller enclosure door.
3. Disconnect the Indeed speed sensor (if present) from terminals TB4-1 to TB4-4 on the Analog board (see Figure 4-2).
4. Connect the Verify sensor to terminals TB4-1 to TB4-4 on the Analog board, following the labels by the terminals.
5. If a photoeye is used for the verify sensor, connect the photoeye emitter to terminals TB4-17 and TB4-18, as indicated on the Analog board.
6. Perform a Cold Start Procedure.
7. Verify all setups. Refer to Chapter 3 for all setup procedures.

## 6.8 MOTOR INHIBIT OPTION

The Motor Inhibit Option permits using an external motor inhibit signal. A closed contact across TB8-1 and 2 of the distribution board allows the motors to run. Motor inhibit is not an E-Stop. See the section on the inhibit input in the motor control manual. The minimum speed setting of the motor control must be set properly or the motor may rotate at the minimum speed when the motor inhibit contact opens.

Appendix Drawing A/1  
Field Wiring Diagram

**INSERT FIELD WIRING DIAGRAM  
APPROPRIATE FOR YOUR APPLICATION**

(See Engineering Manual Request Form or  
Consult Product Engineer)

**RUN** APPLY CHANGES ENTERED BY OPERATOR TO RUNNING PRODUCT

ACTUAL WEIGHT \_\_\_\_\_  
DEVIATION WEIGHT \_\_\_\_\_

**SAMPLE** HOLD WEIGHT OF NEXT PACKAGE ON DISPLAY

**ENTER** ACCEPT CHANGES ENTERED BY OPERATOR

**PRINT STATS**

S(27)(1)	PRINT REPORT	
	UNDER WEIGHT PACKAGE COUNT	
	ON WEIGHT PACKAGE COUNT	
	OVER WEIGHT PACKAGE COUNT	
	TOTAL ACCEPTED COUNT	
(2)	TOTAL UNDER WEIGHT	
(2)	TOTAL ON WEIGHT	
(2)	TOTAL OVER WEIGHT	
	TOTAL ACCEPTED WEIGHT	
	AVERAGE WEIGHT	
	STANDARD DEVIATION	
S	AVERAGE BELOW REF	ACTIVE/INACTIVE
S	TOTAL ACCEPTED UNDER WEIGHT	SUM/OMIT
S	TOTAL ACCEPTED ON WEIGHT	SUM/OMIT
S	TOTAL ACCEPTED OVER WEIGHT	SUM/OMIT
S(1)	REPORT INTERVAL	TIME/COUNT
S(1)	BATCH/MINUTES or BATCH/COUNT	
S(1)	REPORT WIDTH	40, 80
S(1)	FREE RUN DATA COLUMNS	
S*(1)	TIME/DATE	
S(7)	PRODUCT CODE	
S(2)	SHIFT NUMBER	
S(2)	LINE NUMBER	
S	CLEAR STATISTICS	

**ALARM TEST**

S	ALARMS	
S	AUTO ZERO THRESHOLD	
+(13)	VERIFY LEARN	
	DIP SWITCH	
(3)	INFEED SPEED	
(4)	WEIGHTABLE SPEED	
(5)	OUTFEED SPEED	
	FIRMWARE VERSION	
+	INTERLOCK TEST	
+	DIVERTER TEST	
+(12)	VERIFY SENSOR TEST	
(1)	COMM LOOPBACK TEST	PORT A, PORT B
	LAMP TEST	
	KEYBOARD TEST	
	LIVE A/D DISPLAY	
(19)	DUMP A/D	
S(19)	SET ZERO	
S(19)	SET SPAN	
S(19)	EVENT TABLE	

**PASSWORD**

S(11)	ENTER PASSWORD	
S(14)	CHANGE SUPERVISOR PASSWORD	
U(14)	CHANGE USER PASSWORD	
U(11)	PASSWORD STATUS	NONE,PROTECTED,REMOVE

**CHOICES**

**CALIBRATE**

U+*	ZERO THE SCALE	
U+*	DYNAMIC CALIBRATION	
U+	MANUAL GRAY ZONE	
S	REZERO INTERVAL	TIME/COUNT
S	REZERO/TIME OR REZERO/COUNT	
U+	AUTO GRAY ZONE	

**MACHINE**

U(17)	LANGUAGE	ENGLISH,SPANISH (STANDARD)
S*	WEIGHING MODE	CHECKWEIGHER, STATIC
S*	WEIGHT UNITS	LBS,OZ,GRAMS,KG,NONE
S*	LENGTH UNITS	INCH,FOOT,MILLIMETER,METER
S*	WEIGHT DISPLAYED PRECISION	.01,.1,1
S*(15)	WEIGHTABLE LENGTH	
S*(16)	ON SCALE TIME	
S*	INTERLOCK TO OUTFEED	
S*	AUTO CALCULATE	YES,NO
S*(4)	WEIGHTABLE SPEED	
S*(4)	WEIGHTABLE SPEED SENSOR	
S*(3)	INFEED SPEED	
S*(3)	INFEED SPEED SENSOR	
S*(5)	OUTFEED SPEED	
S*(5)	OUTFEED SPEED SENSOR	
S(10)	ALARM DIVERTER	NONE,3
S(1)	CHECKWEIGHER ID	
S(1)	PORT A FUNCTION	NONE,REPORTS,FREE RUN
S(1)	BAUD RATE PORT A	300,600,1200,2400,4800,9600,19200
S(1)	PARITY PORT A	NONE,EVEN,ODD
S(1)	WORD LENGTH PORT A	7 BITS, 8 BITS
S(1)(2)	STOP BITS PORT A	
S(1)(20)	PORT B FUNCTION	NONE, FREE RUN NONE, FREE RUN, MULTI-DROP NONE, FREE RUN, VAR TARE NONE, FREE RUN, FILLER
S(1)(21)	MULTI-DROP PROTOCOL	MODBUS, ALLEN-BRADLEY
S(1)(21)(24)	ACCESS LEVEL	NONE,LEVEL 1,LEVEL 2
S(1)(22)	VAR TARE FIRST	FIRST, NOT FIRST
S(1)(22)	VAR TARE MODE	IMMEDIATE, AVERAGING
S(1)(22)	TARE DAMPING FACTOR	
S(1)(22)	SYNCHRONIZE TARES	
(1)(22)(25)	INCOMING TARE WEIGHT	
(1)(22)	CURRENT TARE WEIGHT	
S(1)	BAUD RATE PORT B	300,600,1200,2400,4800,9600,19200
S(1)	PARITY PORT B	NONE,EVEN,ODD
S(1)	WORD LENGTH PORT B	7 BITS, 8 BITS
S(1)(2)	STOP BITS PORT B	

**PRODUCT**

U(7)	PRODUCT NUMBER	
S*	REFERENCE WEIGHT	
S*	UNDER WEIGHT CUTPOINT	
S*	OVER WEIGHT CUTPOINT	
S(25)(26)	TARE WEIGHT	
S(1)(23)	FILLER TARGET WEIGHT	
S(1)(23)	FILLER LOW WEIGHT LIMIT	
S(1)(23)	FILLER HIGH WEIGHT LIMIT	
S(1)(23)	FILLER PACKAGE DELAY	
S(1)(23)	FILLER PACKAGES TO AVERAGE	
S*(15)	PACKAGE LENGTH	
S*(16)	TRANSITION TIME	
S*(8)	INTERROGATE DELAY	
S*	MAXIMUM WEIGHTABLE SPEED	
S*	FILTER TYPE	FIXED,NOTCH,LOW PASS
S*(8)	FILTER FREQUENCY	
S*(8)	NUMBER OF SAMPLES	
S(10)	UNDER WEIGHT DIVERTER	NONE,1,(10)2,3
S(10)	ON WEIGHT DIVERTER	NONE,1,(10)2,3
S	OVER WEIGHT DIVERTER	NONE,1,(10)2,3
S(10)	NO GAP DIVERTER	NONE,1,(10)2,3
S(9)	DIVERTER 1 DELAY	
S(9)	DIVERTER 1 DURATION	
S(9)(10)	DIVERTER 2 DELAY	
S(9)(10)	DIVERTER 2 DURATION	
S(6)(9)(10)	DIVERTER 3 DELAY	
S(6)(9)(10)	DIVERTER 3 DURATION	
S(12)	VERIFICATION DELAY	

**CHOICES**

IDENTIFIER	NOTE
COMM	(1) AVAILABLE IF COMMUNICATIONS OPTION IS INSTALLED.
STAT	(2) AVAILABLE IF STATISTICS OPTION IS INSTALLED.
INFEED-SEN	(3) AVAILABLE IF INFEED SPEED SENSOR IS INSTALLED.
WTBL	(4) AVAILABLE IF WEIGHTABLE OPTION IS INSTALLED.
OUTFEED-SEN	(5) AVAILABLE IF OUTFEED OPTION IS INSTALLED.
ALR-DIV	(6) AVAILABLE IF DIVERTER 3 HAS NOT BEEN ASSIGNED AS AN ALARM DIVERTER.
MULT-PROD	(7) AVAILABLE IF THE MULTIPLE PRODUCT OPTION IS INSTALLED.
AUTO-CALC	(8) SEE MENU TABLE FOR AUTO CALCULATE.
DIV-USED	(9) AVAILABLE IF DIVERTER HAS BEEN ASSIGNED TO A WEIGHT ZONE.
MULT-DIV	(10) AVAILABLE IF THE MULTIPLE DIVERTER OPTION IS INSTALLED.
PASS-ENTER	(11) AVAILABLE IF A PASSWORD HAS BEEN ENTERED.
VFY-SEN	(12) AVAILABLE IF VERIFICATION OPTION IS INSTALLED
VFY-LRN	(13) AVAILABLE IF VERIFICATION OPTION IS INSTALLED AND VERIFICATION DELAY NOT EQUAL TO ZERO.
	(14) AVAILABLE IF SUPERVISOR PASSWORD HAS BEEN ENTERED.
	(15) AVAILABLE IF CHECKWEIGHER MODE IS SET TO CHECKWEIGHER.
	(16) AVAILABLE IF CHECKWEIGHER MODE IS SET TO STATIC.
LINGO	(17) OTHER OPTIONS WILL BE MADE AVAILABLE AT LATER DATE.
	(18) AVAILABLE IF USER PASSWORD HAS BEEN CORRECTLY ENTERED.
	(19) AVAILABLE IF SERVICE PASSWORD HAS BEEN COORECTLY ENTERED.
	(20) SELECTIONS DEPEND ON WHICH PORT B COMM OPTION IS INSTALLED
NETWORK	(21) AVAILABLE IF PORT B FUNCTION IS SET TO MULTI-DROP.
VTARE	(22) AVAILABLE IF PORT B FUNCTION IS SET VARIABLE TARE.
FILLER	(23) AVAILABLE IF PORT B FUNCTION IS SET TO FILLER
	(24) AVAILABLE IF A MULTI-DROP PROTOCOL HAS BEEN SELECTED.
	(25) AVAILABLE IF VAR TARE IS SELECTED AND SET TO FIRST UNIT.
	(26) AVAILABLE IF VAR TARE IS NOT SELECTED.
	(27) AVAILABLE IF PORT A FUNCTION IS SET TO REPORTS
REQ-ENTRY	* OPERATOR WILL BE SHOWN THESE MENUS ON A COLD START.
NO-RUN	+ DO NOT RUN PRODUCT WHEN USING THIS MENU.
	S SUPERVISOR PASSWORD REQUIRED
	U USER PASSWORD REQUIRED - SUPERVISOR PASSWORD WILL OVERRIDE THE USER PASSWORD IS ACTIVATED FROM THE PASSWORD MENU.

AUTO CALCULATE MENU TABLE

AUTO CALCULATE	INTERROGATE DELAY		NUMBER OF WEIGH SAMPLES		FILTER FREQUENCY	
	ON	OFF	ON	OFF	ON	OFF
FIXED FILTER		VISIBLE		VISIBLE		
NOTCH FILTER		VISIBLE		VISIBLE	VISIBLE	VISIBLE
LOW PASS FILTER		VISIBLE				VISIBLE

CADD DATABASE: AUTOCAD

DO NOT SCALE DWG		SCALE	N/A	This document is confidential and is the property of Thermo Ramsey ("Ramsey"). It may not be copied or reproduced in any way without the expressed written consent of Ramsey. This document also is an unpublished work of Ramsey. Ramsey intends to and is maintaining the work as confidential information. Ramsey also may seek to protect this work as an unpublished copyright. In the event of either inadvertent or deliberate publication, Ramsey intends to enforce its rights to the work under the copyright laws as a published work. Those having access to this work may not copy, use or disclose the information in this work unless expressly authorized by Ramsey.	
REMOVE ALL BURRS AND UNNECESSARY SHARP EDGES		JOB NO		ENG	DATE
TOLERANCE UNLESS SPECIFIED				LM	2-3-93
.X	± .06			DWN	DATE
.XX	± .03			IEG	2-3-93
.XXX	± .01			CHK	DATE
FRACT	± 1/16			IEG	10-11-93
ANGLES	± 1/2°				
NEXT ASS'Y					
CUST ORDER NO					
CUSTOMER LOCATION					
USER LOCATION					
PART NO			DRAWING NUMBER		REV
			D07226K-V002		L

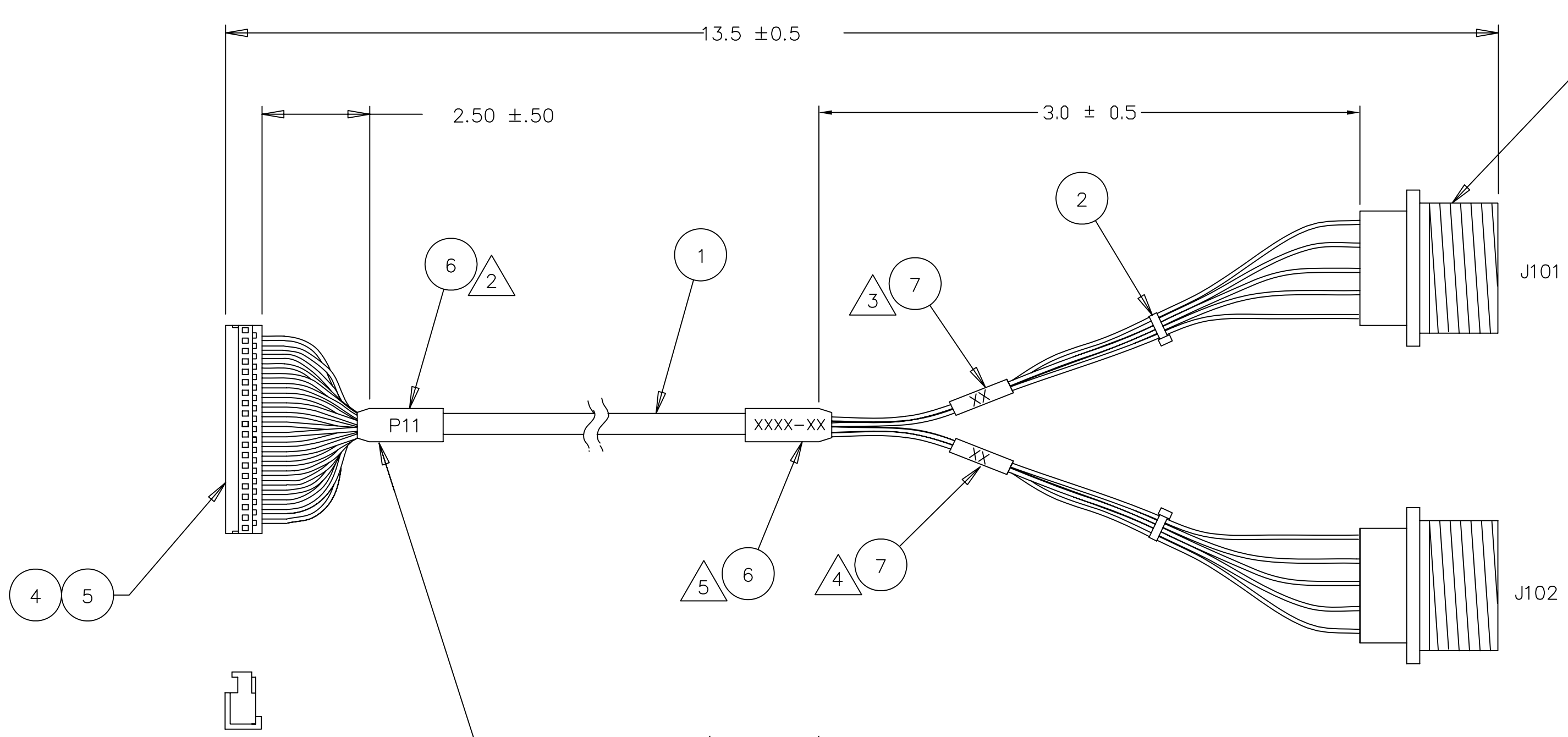
**Thermo Ramsey**  
501 - 90th Avenue N.W. • Minneapolis, MN 55433 • (763)783-2500

MENU/KEY DEFINITION  
STANDARD, AC4000

P11	SHIELD	10	BLK	A	J101
	SIG GND	9	GRN	B	
	RXD-/TXD-	8	GRN/BLK	E	
	RXD+/TXD+	7	BLU/BLK	F	
	CTS	6	WHT/BLK	L	
	DTR	5	BLU	H	
	RXD	4	WHT	J	
	TXD	3	RED	I	
	TXD-	2	ORG	C	
TXD+	1	RED/BLK	D		
CONN	SIGNAL	PIN	COLOR	PIN	CONN

P11	SHIELD	20	GRN/WHT	A	J102
	SIG COM	19	BLK/WHT	B	
	RXD-/TXD-	18	GRN/BLK/WHT	E	
	RXD+/TXD+	17	BLU/RED	F	
	CTS	16	WHT/RED/BLK	L	
	DTR	15	BLU/WHT	H	
	RXD	14	WHT/RED	J	
	TXD	13	RED/WHT	I	
	TXD-	12	ORG/RED	C	
TXD+	11	RED/GRN	D		
CONN	SIGNAL	PIN	COLOR	PIN	CONN

ITEM	PART NO	QTY	DESCRIPTION	DWG NO/SPEC
1	001113	1.12 FT	CABLE,JK1D, 257C 22AWG	CUT 13.5" LG
2	005738	2 EA	CABLE TIE, 3.88 LG (TY-WRAP)	
3	021329	2 EA	CONN,BOX RCPT,SIZE 20 14SOC	
4	041669	1 EA	CONN,HSG,20 PIN,.100,RCPT,STR	
5	041701	1 EA	CONN,STRAIN RELIEF,20 PIN,.100 RCPT	
6	038044	2 EA	MARKER,WIRE,SLV,.50 ID X 2" LG.WHT	CUT 1.00 LG (2)
7		1 EA		



CUT WIRES BLK/RED, ORG/BLK, ORG/GRN,BLK/WHT/RED, AND RED/BLK/WHT AT END OF JACKET BEFORE INSTALLING MARKERS (UNUSED) (BOTHENDS)

NOTES:

- TIE WRAP CABLE BUNDLES AS NECESSARY.
- INK STAMP OR PRINT "P11" ON ITEM #6.
- INK STAMP OR PRINT "J101" ON ITEM #7.
- INK STAMP OR PRINT "J102" ON ITEM #7
- INK STAMP OR PRINT RTI PART NO. AND CURRENT DRAWING REVISION LEVEL ON ITEM #6.

CADD DATABASE: AUTOCAD

REV	ECO NO	MICRO	DESCRIPTION	DATE	BY	APPD
E	0848		SWAP "+" & "-" ON RxD AND TxD	10/31/2005	DMO	DMO
D	0836		SOFTWARE PLATFORM CHANGE TO AUTOCAD	2-19-98	TBP	
C	0473	EMA	CORRECT NOTES 2, 3 AND 4	7-28-97	EBJ	DMO
B	8408	JAA	CHANGED LENGTH OF CABLE FROM .71 FT	7-28-97	MLL	DMO
A	7928	JAA	RELEASE TO PRODUCTION	11-23-93	IEG	DMO
PR2			PR2:CHG L OF CBL, REV ITEM 4, REV WIRE CHART ORDER	29OCT93	IEG	
PR1			PRE-PRODUCTION 1	18 AUG 93	IEG	

DO NOT SCALE DWG		SCALE 1/1	
REMOVE ALL BURRS AND UNNECESSARY SHARP EDGES		JOB NO	
TOLERANCE UNLESS SPECIFIED		ENG IEG	DATE 8-19-93
.X	± .06	DWN TGV	DATE 8-19-93
.XX	± .03	CHK IEG	DATE 16SEPT93
.XXX	± .01		
FRACT.	± 1/16		
ANGLES	± 1/2°		
NEXT ASS'Y			
CUST ORDER NO			
CUSTOMER LOCATION			
USER LOCATION			

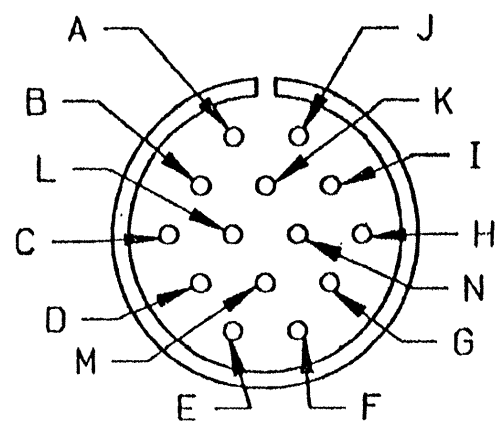
This document is confidential and is the property of Thermo Electron ("Thermo"). It may not be copied or reproduced in any way without the expressed written consent of Thermo. This document also is an unpublished work of Thermo. Thermo intends to and is maintaining the work as confidential information. Thermo also may seek to protect this work as an unpublished copyright. In the event of either inadvertent or deliberate publication, Thermo intends to enforce its rights to this work under the copyright laws as published work. Those having access to this work may not copy, use or disclose the information in this work unless expressly authorized by Thermo.

# Thermo

ELECTRON CORPORATION

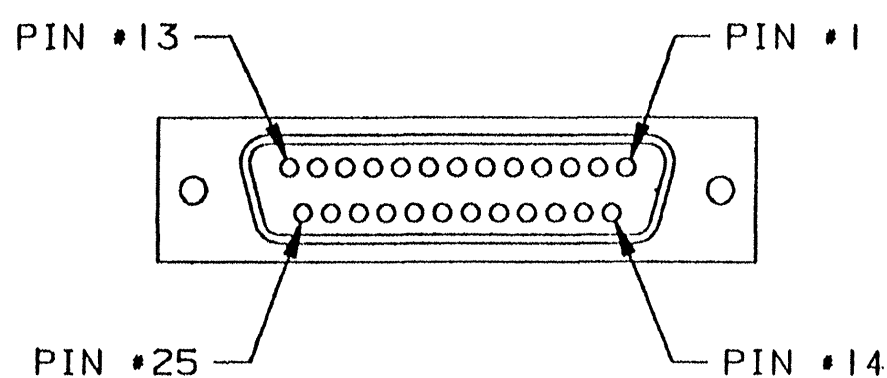
COM 1 AND 11 CABLE ASSY (OPTIONAL)  
AC4000  
CHECKWEIGHER

PART NO	DRAWING NUMBER	REV
044936	C07226K-E089	E



REAR VIEW  
(SOLDER VIEW)

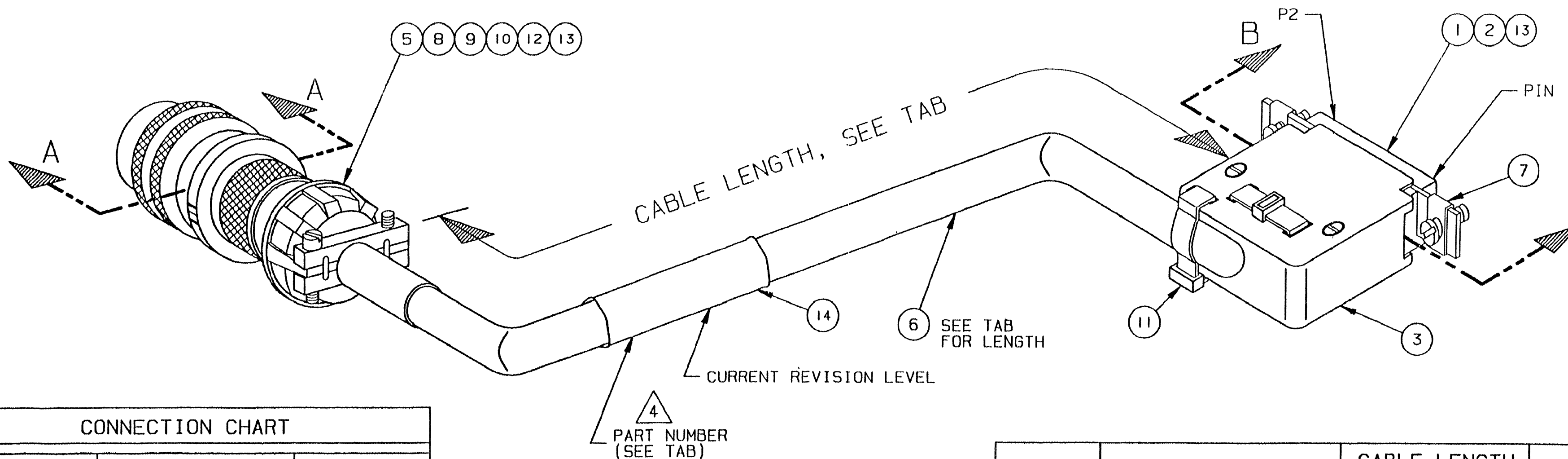
VIEW "A-A"



REAR VIEW  
(SOLDER VIEW)

VIEW "B-B"

ITEM	PART NO	QTY	DESCRIPTION	DWG NO/SPEC
1	024610	1 EA	CONN, HSG, "D", 25 POS, PLUG, STR	
2	022869	7 EA	TERM, PIN, CONN HSG, MALE, 20-24	
3	022760	1 EA	JCT SHELL, CONN, 25 PIN TYPE "D"	
4	024602	1 EA	CONN, PLUG, STR, SIZE 20 14 PIN	
5	025931	1 EA	CLAMP, CABLE, .750 ID (20 & 22)	
6	023766	SEE TAB	CABLE, SHLD, B/C 22 AWG	
7	025418	2 EA	SCR LOCK, CONN, JCT SHELL, .250, M	
8	018645	1 EA	BUSHING, CABLE CLAMP, .562 RDR	
9	017105	1 EA	BUSHING, CABLE CLAMP, .437 RDR	
10	009715	1 EA	BUSHING, CABLE CLAMP, .312 RDR	
11	005738	1 EA	CABLE TIE, 3.88" LG (TY-WRAP)	
12	026464	.10 FT	TUBING, TEF, .047 ID X .012 WALL	1.20" LG
13	006102	.10 FT	INSULATOR, HEATSHRINK, .250	1.20" LG
14	038044	1 EA	MARKER, WIRE, SLV, .50 ID X 2" LG, WHT	



CONNECTION CHART

CONNECTOR P1 P/N 024602	CONNECTOR P2 P/N 024610	COLOR
PI-A	P2-N.C.	SHEILD
PI-B	P2-7	BLACK
PI-G	P2-5	GREEN
PI-H	P2-6	BLUE
PI-I	P2-3	YELLOW
PI-J	P2-2	ORANGE
PI-K	P2-20	BROWN
PI-L	P2-4	VIOLET

NOTES:

1. CABLE LENGTH TO BE MEASURED FROM END OF CABLE CLAMP, ITEM #5, (P/N 025931) TO END OF SHELL BACK, ITEM #3, (P/N 0022760).
2. INSULATE DRAIN WIRE WITH TEFLON TUBING, ITEM #12, (P/N 026464).
3. INSULATE EXPOSED ENDS OF THE SHIELD END AT OUTER JACKET WITH HEATSHRINK TUBING, ITEM #13, (P/N 006102).
4. INK STAMP OR PRINT RTI PART NUMBER (SEE TAB), AND CURRENT REVISION LEVEL ON ITEM #14, P/N 038044.
5. DASH NUMBER EQUALS LENGTH OF CABLE IN FEET. EXAMPLE: -10 = 10 FT. CABLE. (SEE TAB FOR CABLE LENGTH)

P/N	DRAWING NUMBER	CABLE LENGTH ITEM #6, P/N 023766	E/U
046484	CO7190K-E086-10	120.00" LG	10.0 FT
046485	CO7190K-E086-15	180.00" LG	15.0 FT
046486	CO7190K-E086-20	240.00" LG	20.0 FT
046487	CO7190K-E086-25	300.00" LG	25.0 FT

DO NOT SCALE DWG REMOVE ALL BURRS AND UNNECESSARY SHARP EDGES	SCALE NONE	ENG JAB	DATE 25-APR-94
TOLERANCE UNLESS SPECIFIED	JOB NO.	DWN JAB	DATE 25-APR-94
.X .06		CHK JAB	DATE 25-APR-94
.XX .03			
.XXX .01			
FRACT. 1/16			
ANGLES 1/2°			

This document is confidential and is the property of Thermo Ramsey ("Ramsey"). It may not be copied or reproduced in any way without the expressed written consent of Ramsey. This document also is unpublished work of Ramsey. Ramsey intends to and is maintaining the work as confidential information. Ramsey also may seek to protect this work as an unpublished copyright. In the event of either inadvertent or deliberate publication, Ramsey intends to enforce its rights to this work under the copyright laws as a published work. Those having access to this work may not copy, use or disclose the information in this work unless expressly authorized by Ramsey.

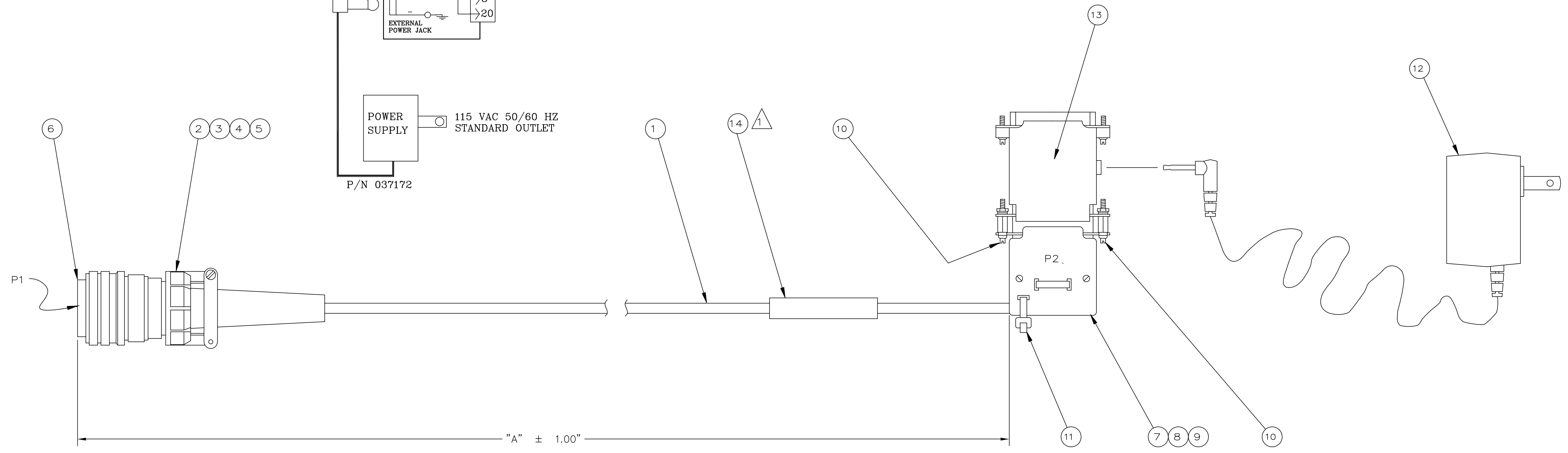
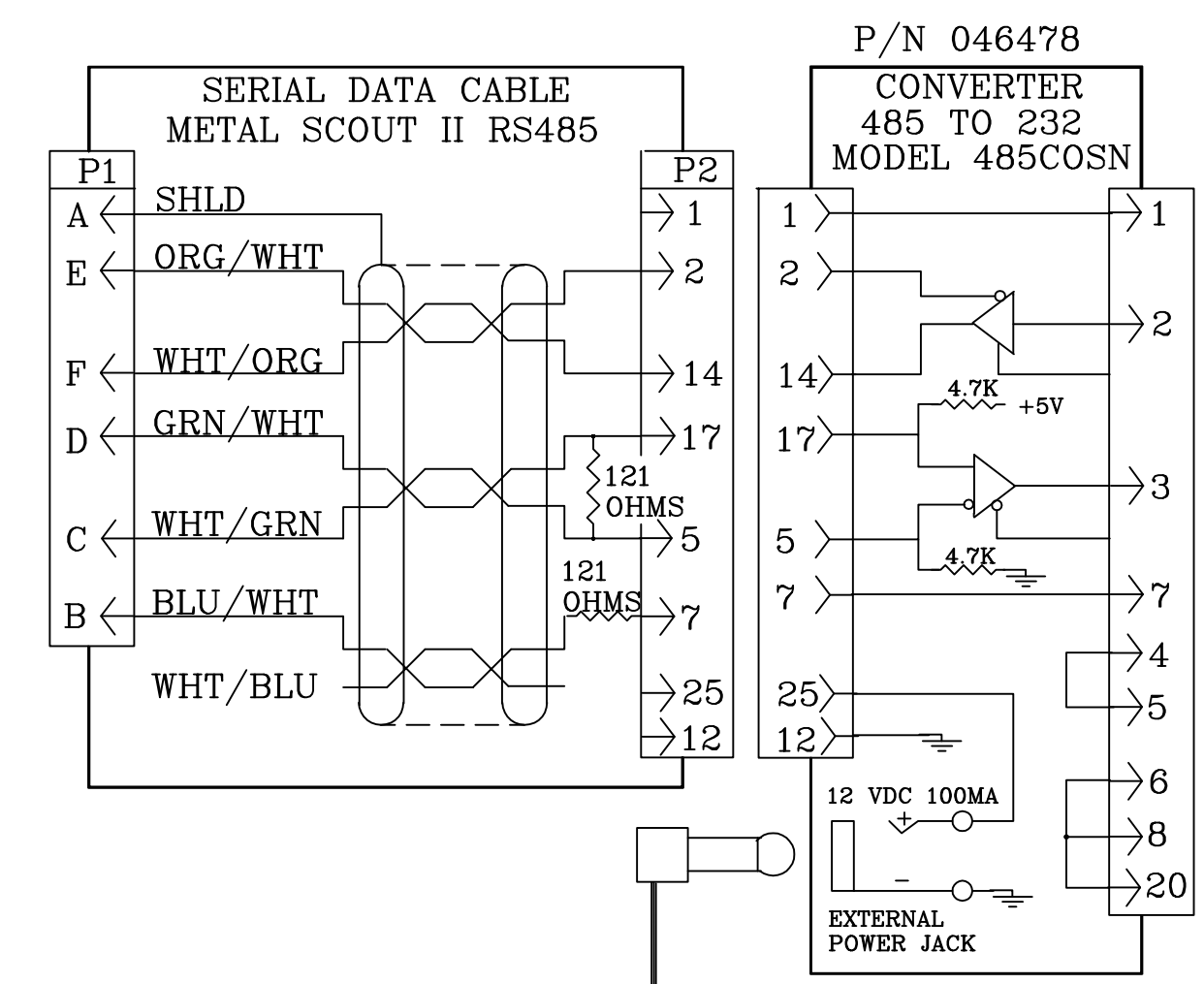
**Thermo Ramsey**  
501 - 90th Avenue N.W. • Minneapolis, MN 55433 • (763)783-2500

NEXT ASSY	
CUST ORDER NO	
CUSTOMER LOCATION	
USER LOCATION	

COMMUNICATION I/O CABLE RS 232		
PART NO	DRAWING NUMBER	REV
SEE TAB	C 07190K-E086-XX	B

REV	ECO NO	MICRO	DESCRIPTION	DATE	BY	APPD
B	8927		CORRECTED TITLE BLOCK	2-17-95	EK	JAB
A	8378		RELEASED	25-APR-94	JAB	JAB

ITEM	PART NO	QTY	DESCRIPTION	DWG NO/SPEC
1	037170	SEE TAB	CABLE,SHLD, 6/C 22 AWG	SEE TAB
2	025931	1 EA	CLAMP,CABLE,.750 ID (20&22)	
3	018645	1 EA	BUSHING,CABLE CLAMP, .562 RBR	
4	017105	1 EA	BUSHING,CABLE CLAMP, .437 RBR	
5	009715	1 EA	BUSHING,CABLE CLAMP, .312 RBR	
6	024602	1 EA	CONN,PLUG,STR,SIZE 20 14 PIN	
7	024610	1 EA	CONN,HSG,"D",25POS,PLUG,STR	
8	022869	5 EA	TERM,PIN,CONN HSG.MALR.20-24	
9	022760	1 EA	JCT SHELL,CONN,25 PIN TYPE "D"	
10	025418	2 EA	SCR LOCK,CONN,JCT SHELL,.250,M	
11	005738	1 EA	CABLE TIE, 3.88 LG (TY-WRAP)	
12	037172	1 EA	POWER SUPPLY,CONV,2-CHAN,RS422	
13	046478	1 EA	CONVERTER,TWO-CHANNEL,RS-485	
14	038044	1 EA	MARKER,WIRE,SUU,.50 ID X 2" LG WT	
15	035814	2 EA	RES, 1/8W, 1%, 121 OHM	



NOTES:

- 1 INK STAMP OR PRINT PART NUMBER AND CURRENT REVISION LEVEL OF THIS DRAWING ON ITEM 14.
- 2 INSTALL ITEM #15, BETWEEN PINS 5 AND 17 OF P2.
- 3 NON-STANDARD CABLE LENGTHS CAN BE BUILT ON SPECIAL REQUEST BY SPECIFYING THE CABLE LENGTH "A". THE MAXIMUM LENGTH IS 2000 FT. CABLE LENGTHS ABOVE 500 FT WILL REQUIRE SPECIAL ORDERING OF CABLE ITEM #1.

CADD DATABASE: AUTOCAD

DRAWING NUMBER	PART NO.	DIMENSION "A"	QTY. ITEM #1	CUT LENGTH ITEM #1
D07190K-E087-05	046483	1000 FT.	1000 FT.	1000 FT.
D07190K-E087-04	046482	500 FT.	500 FT.	500 FT.
D07190K-E087-03	046481	250 FT.	250 FT.	250 FT.
D07190K-E087-02	046480	100 FT.	100 FT.	100 FT.
D07190K-E087-01	046479	50 FT.	50 FT.	50 FT.

REV	ECO NO	MICRO	DESCRIPTION	DATE	BY	APPD
F	1265		ADD NOTE, CHANGE SOFTWARE PLATFORM	9-22-98	DK	DWC
E	0710	MPC	FIXED P1 CONNECTIONS	12-12-97	EK	DMO
D	8927	JAA	CORRECTED TITLE BLOCK	2-17-95	EK	JAB
C	8597	JAA	ADDED ELECTRICAL DIAGRAM	8-9-94	SWC	JAB
B	8407	JAA	ADDED RESISTOR	5-6-94	JAB	JAB
A	8378	JAA	RELEASED	4-26-94	JAB	JAB

DO NOT SCALE DWG	SCALE
REMOVE ALL BURRS AND UNNECESSARY SHARP EDGES	JOB NO
TOLERANCE UNLESS SPECIFIED	ENG JAB 4-26-94
.X ± .06	DATE
.XX ± .03	DWN JAB 4-26-94
.XXX ± .01	DATE
FRACT ± 1/16	CHK JAB 4-26-94
ANGLES ± 1/2°	DATE

This document is confidential and is the property of Thermo Ramsey ("Ramsey"). It may not be copied or reproduced in any way without the expressed written consent of Ramsey. This document also is an unpublished work of Ramsey. Ramsey intends to and is maintaining the work as confidential information. Ramsey also may seek to protect this work as an unpublished copyright. In the event of either inebertant or deliberate publication, Ramsey intends to enforce it's rights to the work under the copyright laws as a published work. Those having access to this work may not copy, use or disclose the information in this work unless expressly authorized by Ramsey.

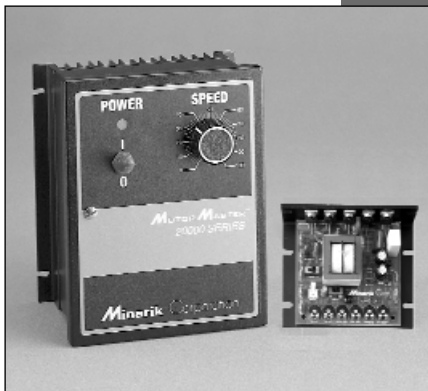
**Thermo Ramsey**  
 501 - 90th Avenue N.W. • Minneapolis, MN 55433 • (763)783-2500

COMMUNICATION I/O CABLE  
RS - 485

PART NO	DRAWING NUMBER	REV
SEE TAB	D07190K-E087	F



# MM23000 Series



SCR, Adjustable Speed Drives  
for DC Brush Motors


Copyright © 2001 by  
Minarik Corporation

All rights reserved. No part of this manual may be reproduced or transmitted in any form without written permission from Minarik Corporation. The information and technical data in this manual are subject to change without notice. Minarik Corporation and its Divisions make no warranty of any kind with respect to this material, including, but not limited to, the implied warranties of its merchantability and fitness for a given purpose. Minarik Corporation and its Divisions assume no responsibility for any errors that may appear in this manual and make no commitment to update or to keep current the information in this manual.

Printed in the United States of America.

# Safety Warnings



- This symbol  denotes an important safety tip or warning. **Please read these instructions carefully** before performing any of the procedures contained in this manual.
- **DO NOT INSTALL, REMOVE, OR REWIRE THIS EQUIPMENT WITH POWER APPLIED.** Have a qualified electrical technician install, adjust and service this equipment. Follow the National Electrical Code and all other applicable electrical and safety codes, including the provisions of the Occupational Safety and Health Act (OSHA), when installing equipment.
- Reduce the chance of an electrical fire, shock, or explosion by proper grounding, over-current protection, thermal protection, and enclosure. Follow sound maintenance procedures.



**It is possible for a drive to run at full speed as a result of a component failure.** Minarik strongly recommends the installation of a master switch in the main power input to stop the drive in an emergency.

Circuit potentials are at 115 VAC or 230 VAC above earth ground. Avoid direct contact with the printed circuit board or with circuit elements to prevent the risk of serious injury or fatality. Use a non-metallic screwdriver for adjusting the calibration trimpots. Use approved personal protective equipment and insulated tools if working on this drive with power applied.

---

# Contents

<b>Safety Warnings</b> .....	<b>i</b>
<b>Specifications</b> .....	<b>1</b>
<b>Specifications (Continued)</b> .....	<b>2</b>
Suffix Definitions .....	2
<b>Dimensions</b> .....	<b>3</b>
<b>Installation</b> .....	<b>11</b>
Chassis drives .....	11
Mounting .....	11
Wiring .....	12
Shielding guidelines .....	13
Heat sinking .....	14
Quick-disconnect terminal block (C-Q drives only) .....	15
Speed adjust potentiometer .....	16
Chassis drive connections .....	17
Power, fuse and motor connections .....	17
Voltage follower .....	23
Cased drives .....	24
Mounting (NEMA 1 enclosures) .....	24
Mounting (NEMA 12 enclosures) .....	25
Heat sinking .....	26
Line fusing .....	26
Connections .....	27
Field output connections .....	28
Current limit LED (C models only) .....	30
Current limit header block (C-H models only) .....	30
Meter header block (cased C models only) .....	30
MM23001C-Q, MM23071, and MM23072 diagnostic LEDs .....	31
Before applying power .....	32
<b>Operation</b> .....	<b>32</b>
Voltage select switches .....	33
Input voltage select (SW501) .....	33
Armature voltage select (SW502) .....	33

---

Startup	34
MM23001, MM23011, MM23071, and MM23072	34
MM23101, MM23111, MM23401, and MM23411	34
MM23201 and MM23211	35
MM23501	36
Line starting and line stopping	37
Starting and stopping methods	37
Inhibit terminals	38
Decelerating to minimum speed	39
Dynamic braking	40
<b>Calibration</b>	<b>42</b>
MINIMUM SPEED (MIN SPD)	43
MAXIMUM SPEED (MAX SPD)	43
IR COMPENSATION (IR COMP)	45
ACCELERATION (ACCEL)	47
DECELERATION (DECEL)	48
<b>Application Notes</b>	<b>49</b>
Multiple fixed speeds	49
Adjustable speeds using potentiometers in series	50
Independent adjustable speeds	51
RUN/JOG switch	52
RUN/JOG switch option #1	52
RUN/JOG switch option #2	53
Leader-follower application	54
Reversing	56
Reversing with a DIGI-LOK controller	57
Before troubleshooting	58
<b>Troubleshooting</b>	<b>58</b>
Replacement Parts	66
<b>CE Compliance</b>	<b>68</b>
Line filters	69
Armature filters	70
<b>Unconditional Warranty</b>	<b>inside back cover</b>

# Illustrations

Figure 1. MM23001 and MM23011 Dimensions . . . . .	3
Figure 2. MM23001C-Q and MM23011C-Q Dimensions . . . . .	4
Figure 3. MM23101 and MM23111 Dimensions . . . . .	5
Figure 4. MM23201 and MM23211 Dimensions . . . . .	6
Figure 5. MM23401 and MM23411 Dimensions . . . . .	7
Figure 6. MM23501 Dimensions . . . . .	8
Figure 7. MM23071 and MM23072 Dimensions . . . . .	9
Figure 8. Heat Sink Dimensions . . . . .	10
Figure 9. Quick-Disconnect Terminal Block . . . . .	15
Figure 10. Speed Adjust Potentiometer . . . . .	16
Figure 11. Chassis Drive Connections . . . . .	21
Figure 12. MM23201C-Q and MM23011C-Q Connections . . . . .	22
Figure 13. Voltage Follower Connections . . . . .	23
Figure 14. Cased Drive Connections . . . . .	29
Figure 15. Voltage Switches . . . . .	33
Figure 16. INHIBIT Terminals . . . . .	38
Figure 17. Run/Decelerate to Minimum Speed Switch . . . . .	39
Figure 18. Dynamic Brake Connection . . . . .	41
Figure 19. Recommended Torque and IR COMP Settings . . . . .	46
Figure 20. Multiple Fixed Speeds . . . . .	49
Figure 21. Adjustable Fixed Speeds Using Potentiometers in Series . . . . .	50
Figure 22. Independent Adjustable Speeds . . . . .	51

---

Figure 23. RUN/JOG Switch Connection to Inhibit Plug (Option #1)	.52
Figure 24. RUN/JOG Switch Connection to Speed Adjust Potentiometer (Option #2)	.53
Figure 25. Leader-Follower Application	.54
Figure 26. Single Speed Potentiometer Control of Multiple Drives	.55
Figure 27. Reversing Circuit Connection	.56
Figure 28. Reversing with a DLC600	.57
Figure 29. MM23000 Series Block Diagram	.62
Figure 30. MM23101, MM23111, MM23401 and MM23411 Terminal Block Connections	.63
Figure 31. MM23201 and MM23211 Terminal Block Connections	.64
Figure 32. MM23501 Terminal Block Connections	.65

# Tables

Table 1. Recommended Line Fuse Sizes	.19
Table 2. Field Output Connections	.20
Table 3. Field Output Connections	.28
Table 4. Minimum Recommended Dynamic Brake Resistor Values	.41
Table 5. Replacement Parts	.66
Table 6. Corcom® Filters	.69
Table 7. Minarik Filters	.70



# Specifications

Model	Max. Armature Current (Amps DC)	HP Range with 115 VAC Applied	HP Range with 230 VAC Applied	Style
MM23011	1.5	1/20–1/8	1/10–1/4	Chassis
MM23111				NEMA 1
MM23211				NEMA 1
MM23411				NEMA 4/4X/ 12
MM23072				Chassis
MM23001 †	5.0	1/8–1/2	1/4–1	Chassis
MM23101 ‡				NEMA 1
MM23201 ‡				NEMA 1
MM23071 †				Chassis
MM23401	10.0	1/8–1	1/4–2	NEMA 4/4X/12
MM23501				NEMA 4/4X/12

† Double maximum armature current and horsepower when drive is mounted on heat sink part number 223-0159.

‡ Double maximum armature current and horsepower when drive is mounted on heat sink part number 223-0174.

<b>AC Line Voltage</b>	115 VAC or 230 VAC $\pm 10\%$ , 50/60 Hz, single phase
<b>Armature Voltage (115 VAC Input)</b>	0–90 VDC
<b>Armature Voltage (230 VAC Input)</b>	0–180 VDC
<b>Form Factor</b>	1.37 at base speed
<b>Field Voltage (115 VAC Input)</b>	50 VDC (F1 to L1); 100 VDC (F1 to F2)
<b>Field Voltage (230 VAC Input)</b>	100 VDC (F1 to L1); 200 VDC (F1 to F2)
<b>Max. Field Current</b>	1 ADC
<b>Accel. Time Range:</b>	
for 0–90 VDC Armature Voltage	0.5–11 seconds
for 0–180 VDC Armature Voltage	0.5–22 seconds
<b>Decel. Time Range:</b>	
for 0–90 VDC Armature Voltage	coast to a stop–13 seconds
for 0–180 VDC Armature Voltage	coast to a stop–25 seconds
<b>Analog Input Voltage Range (signal must be isolated; S1 to S2):</b>	
for 0–90 VDC Armature Voltage	0–1.4 VDC
for 0–180 VDC Armature Voltage	0–2.8 VDC

# Specifications (Continued)

<b>Input Impedance (S1 to S2)</b>	100K ohms
<b>Load Regulation</b>	1% base speed or better
<b>Vibration</b>	0.5G max (0–50 Hz) 0.1G max (>50 Hz)
<b>Safety Certification</b>	UL Recognized Component, file # E132235 CSA Certified Component, file # LR41380 CE Certificate of Compliance
<b>Ambient Temp. Range (chassis drive)</b>	10°C–55°C
<b>Ambient Temp. Range (cased drive)</b>	10°C–40°C

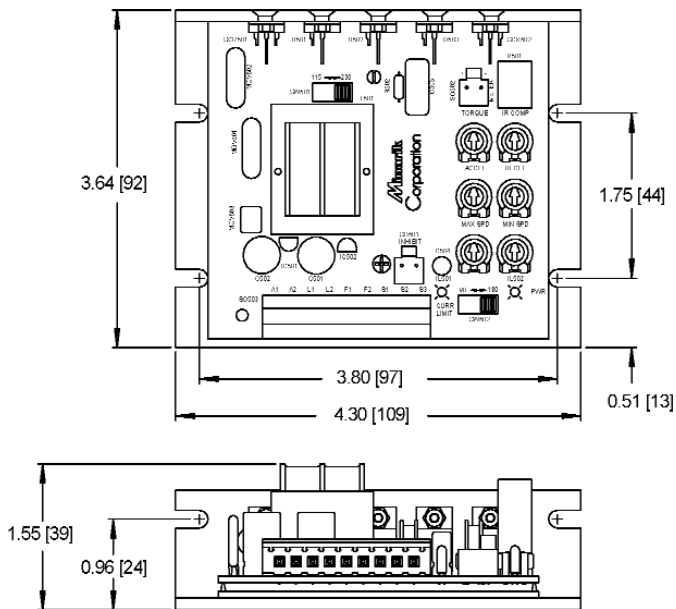
## Suffix Definitions

- A: Basic drive
- C: Basic drive with current limit LED
- C-H: Basic drive with current limit header block
- C-Q: Basic drive with current limit LED, power LED, and quick-disconnect terminal block

### *Note:*

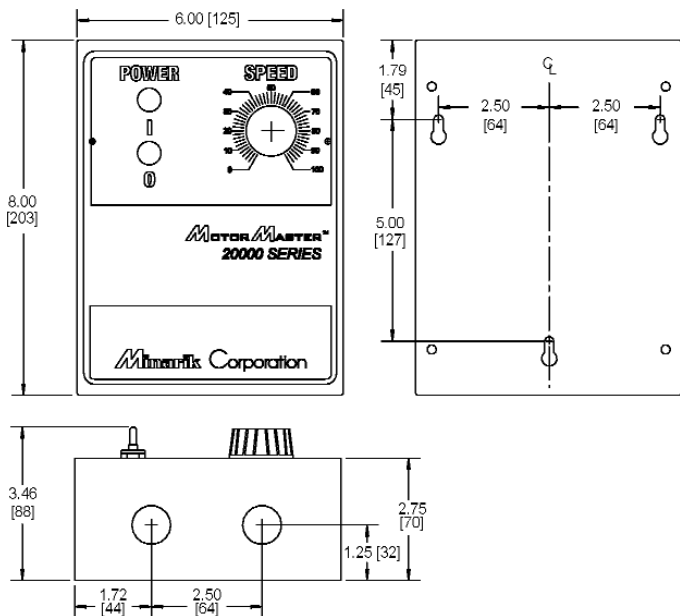
- C suffix applies to all models except MM23071 and MM23072.
- C-H and C-Q suffixes apply only to models MM23001 and MM23011.
- MM23071A and MM23072A drives include a current limit and power LED; trimmer potentiometers (trimpots) are perpendicular to the PC board.





ALL DIMENSIONS IN INCHES [MILLIMETERS]

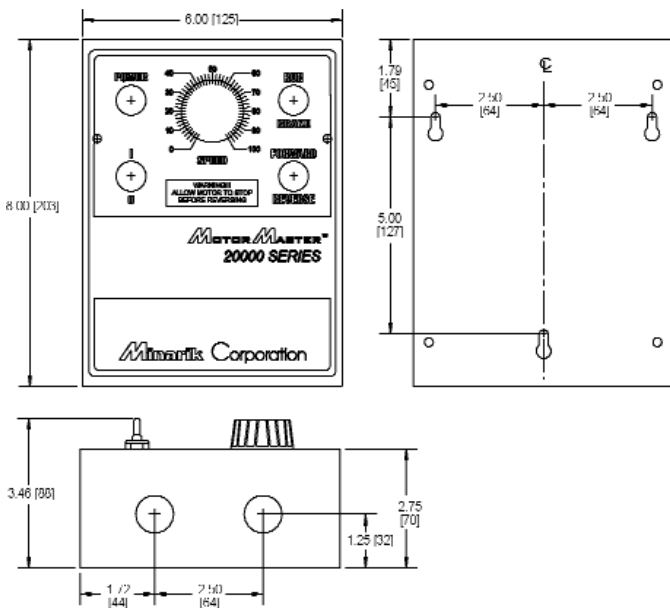
**Figure 2. MM23001C-Q and MM23011C-Q Dimensions**



TWO 0.88 [22] CONDUIT HOLES

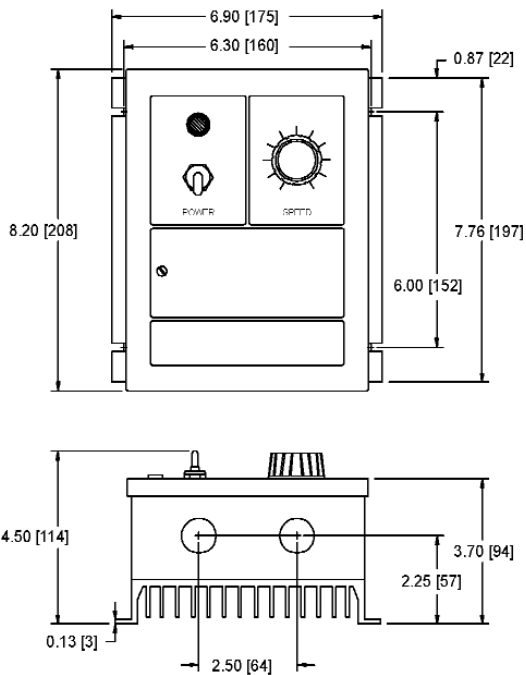
ALL DIMENSIONS IN INCHES [MILLIMETERS]

**Figure 3. MM23101 and MM23111 Dimensions**



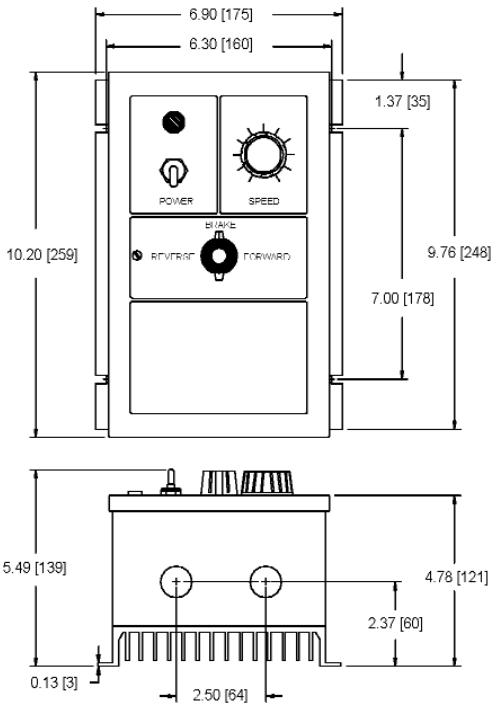
FOUR MOUNTING SLOTS 0.19 INCHES [5 MILLIMETERS] WIDE  
 TWO 0.88 [22] KNOCKOUTS  
 ALL DIMENSIONS IN INCHES [MILLIMETERS]

**Figure 4. MM23201 and MM23211 Dimensions**



FOUR MOUNTING SLOTS 0.19 INCHES [5 MILLIMETERS] WIDE  
TWO 0.88 [22] KNOCKOUTS  
ALL DIMENSIONS IN INCHES [MILLIMETERS]

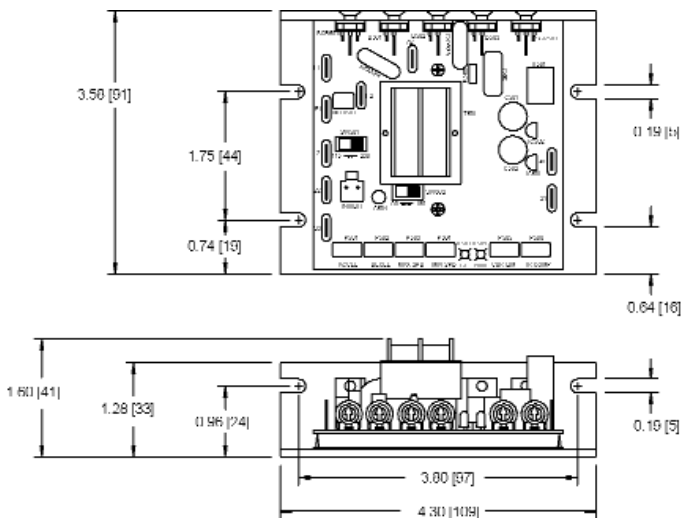
**Figure 5. MM23401 and MM23411 Dimensions**



FOUR MOUNTING SLOTS 0.19 INCHES [5 MILLIMETERS] WIDE  
TWO 0.88 [22] KNOCKOUTS  
ALL DIMENSIONS IN INCHES [MILLIMETERS]

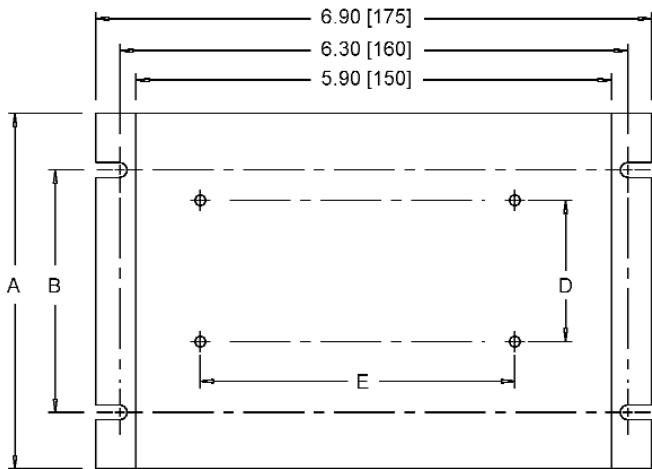
**Figure 6. MM23501 Dimensions**





ALL DIMENSIONS IN INCHES [MILLIMETERS]

**Figure 7. MM23071 and MM23072 Dimensions**



MOUNTING SLOTS 0.19 X 0.34 [5 X 9]  
 ALL DIMENSIONS IN INCHES [MILLIMETERS]

PART NO.	DIM "A"	DIM "B"	DIM "C"	DIM "D"	DIM "E"
223-0159	4.40 [112]	3.00 [76]	0.7 [18]	1.75 [44]	3.90 [100]
223-0174	7.78 [198]	6.00 [152]	0.89 [23]	6.00 [152]	5.35 [136]

Heat sinks sold separately.

**Figure 8. Heat Sink Dimensions**

# Installation



## Warning

**Do not install, rewire, or remove this control with input power applied.** Doing so may cause fire or serious injury. Make sure you have read and understood the Safety Warnings before attempting installation.

## Chassis drives

### Mounting

- Drive components are sensitive to electrostatic fields. Avoid contact with the circuit board directly. Hold drive by the chassis only.
- Protect the drive from dirt, moisture, and accidental contact.
- Provide sufficient room for access to the terminal block and calibration trim pots.
- Mount the drive away from other heat sources. Operate the drive within the specified ambient operating temperature range.
- Prevent loose connections by avoiding excessive vibration of the drive.
- Mount drive with its board in either a horizontal or vertical plane. Six 0.19 inch (5 mm) wide slots in the chassis accept #8 pan head screws. Fasten either the large base or the narrow flange of the chassis to the subplate.
- The chassis must be earth grounded. To ground the chassis, use a star washer beneath the head of at least one of the mounting screws to penetrate the anodized chassis surface and to reach bare metal.

## Wiring



### Warning



Do not install, remove, or rewire this equipment with power applied. Failure to heed this warning may result in fire, explosion, or serious injury.

Circuit potentials are at 115 or 230 VAC above ground. To prevent the risk of injury or fatality, avoid direct contact with the printed circuit board or with circuit elements.

Do not disconnect any of the motor leads from the drive unless power is removed or the drive is disabled. Opening any one motor lead may destroy the drive.

- Use 18-24 AWG wire for speed adjust potentiometer wiring. Use 14–16 AWG wire for AC line (L1, L2) and motor (A1 and A2) wiring.

## Shielding guidelines



### Warning

Under no circumstances should power and logic leads be bundled together. Induced voltage can cause unpredictable behavior in any electronic device, including motor controls.

As a general rule, Minarik recommends shielding of all conductors.

If it is not practical to shield power conductors, Minarik recommends shielding all logic-level leads. If shielding of logic leads is not practical, the user should twist all logic leads with themselves to minimize induced noise.

It may be necessary to earth ground the shielded cable. If noise is produced by devices other than the drive, ground the shield at the drive end. If noise is generated by a device on the drive, ground the shield at the end away from the drive. Do not ground both ends of the shield.

If the drive continues to pick up noise after grounding the shield, it may be necessary to add AC line filtering devices, or to mount the drive in a less noisy environment.

Logic wires from other input devices, such as motion controllers and PLL velocity controllers, must be separated from power lines in the same manner as the logic I/O on this drive.

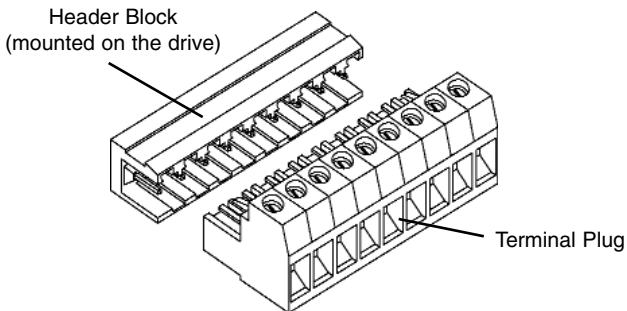
## Heat sinking

Models MM23001 and MM23071 require an additional heat sink when the continuous armature current is above 5 ADC. Use Minarik part number 223-0159. All other chassis drives have sufficient heat sinking in their basic configurations. Use a thermally conductive heat sink compound (such as Dow Corning® 340 Heat Sink Compound) between the drive chassis and heat sink surface for optimum heat transfer.

## Quick-disconnect terminal block (C-Q drives only)

The quick-disconnect terminal block, found only on C-Q drives, is composed of a 9-pin header block and 9-screw terminal plug (Figure 8). To use the quick-disconnect terminal block:

1. Carefully pull terminal plug from header block.
2. With a small flat-head screwdriver, turn terminal plug screw counterclockwise to open wire clamp.
3. Insert stripped wire into the large opening in front of the plug.
4. Turn the terminal plug screw clockwise to clamp the wire.
5. Repeat steps 2–4 for each terminal until all connections are made. Make no connections to F1 and F2 if using a permanent magnet motor.
6. Insert plug into header until securely fastened.



**Figure 9. Quick-Disconnect Terminal Block**

## Speed adjust potentiometer

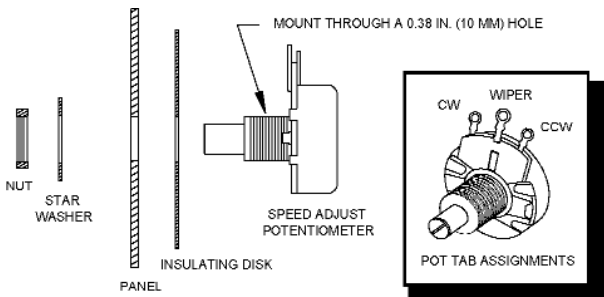


### Warning

Be sure that the potentiometer tabs do not make contact with the potentiometer enclosure. Grounding the input will cause damage to the drive.

Mount the speed adjust potentiometer through a 0.38 in. (10 mm) hole with the hardware provided (Figure 9). Install the circular insulating disk between the panel and the 10K ohm speed adjust potentiometer.

Twist the speed adjust potentiometer wire to avoid picking up unwanted electrical noise. If speed adjust potentiometer wires are longer than 18 in. (457 mm), use shielded cable. Keep speed adjust potentiometer wires separate from power leads (L1, L2, A1, A2).



**Figure 10. Speed Adjust Potentiometer**



## Chassis drive connections



### Warning

**Do not connect this equipment with power applied.** Failure to heed this directive may result in fire or serious injury.

**Minarik strongly recommends the installation of a master power switch in the voltage input line, as shown in Figure 10 (page 20).** The switch contacts should be rated at a minimum of 200% of motor nameplate current and 250 volts.

## Power, fuse and motor connections

Connect the power input leads, an external line fuse and a DC motor to TB501 on the drive's printed circuit board (PCB) as shown in Figure 10, page 20.

### Motor

Minarik drives supply motor armature voltage from A1 and A2 terminals. It is assumed throughout this manual that, when A1 is positive with respect to A2, the motor will rotate clockwise (CW) while looking at the output shaft protruding from the front of the motor. If this is opposite of the desired rotation, simply reverse the wiring of A1 and A2 with each other.

Connect a DC motor to PCB terminals A1 and A2 as shown in Figure 11, page 21. Ensure that the motor voltage rating is consistent with the drive's output voltage.

## **Power input**

Connect the AC line power leads to TB501 terminals L1 and L2, or to a double-throw, single-pole master power switch (recommended). The switch should be rated at a minimum of 250 volts and 200% of motor current. Refer to Figure 11, page 21.

## **Line fuse**

Minarik drives require an external fuse for protection. Use fast acting fuses rated for 250 VAC or higher, and approximately 150% of the maximum armature current. Fuse only the HOT leg of the AC line that connects to L1 and leave L2 unfused when the AC line voltage is 115 VAC. Table 1 (page 19) lists the recommended line fuse sizes.

Wire an external line fuse between the stop switch (if installed) and the L1 terminal on terminal board TB501. An additional line fuse should be installed on L2 if the input voltage is 230VAC. The line fuse(s) should be rated at 250 volts and 150 - 200% of maximum motor nameplate current.

**Table 1. Recommended Line Fuse Sizes**

90 VDC Motor Horsepower	180 VDC Horsepower	Max. DC Armature Current (amps)	AC Line Fuse Size (amps)
1/20	1/10	0.5	1
1/15	1/8	0.8	1.5
1/8	1/4	1.5	3
1/6	1/3	1.7	3
1/4	1/2	2.5	5
1/3	3/4	3.5	8
1/2	1	5.0	10
3/4	1 1/2	7.5	15
1	2	10	15

Minarik Corporation offers two fuse kits: part number 050-0066 (1-5A Fuse Kit) and 050-0071 (5-15A Fuse Kit).

## Field output connections



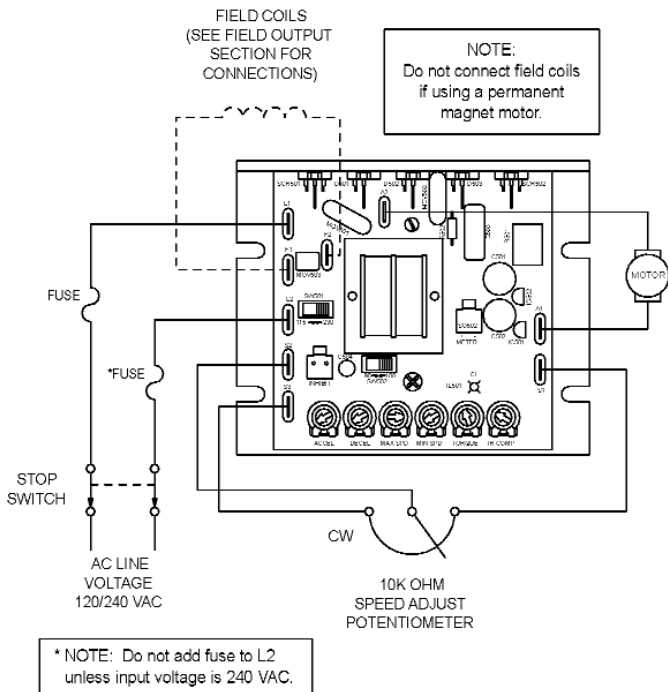
### Warning

The field output is for shunt wound motors only. Do not make any connections to F1 and F2 when using a permanent magnet motor.

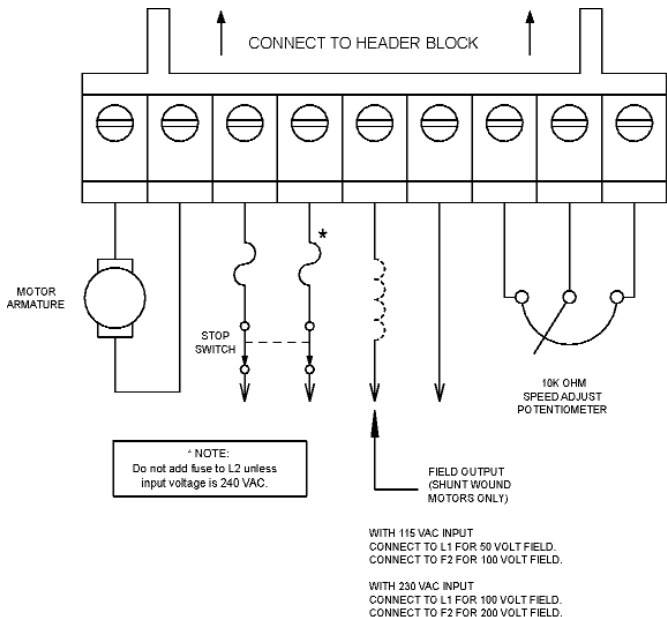
See Table 2 for field output connections. Use 18 AWG wire to connect the field output to a shunt wound motor.

**Table 2. Field Output Connections**

<b>Line Voltage (VAC)</b>	<b>Approximate Field Voltage (VDC)</b>	<b>Connect Motor Field To</b>
115	50	F1 and L1
115	100	F1 and F2
230	100	F1 and L1
230	200	F1 and F2



**Figure 11. Chassis Drive Connections**

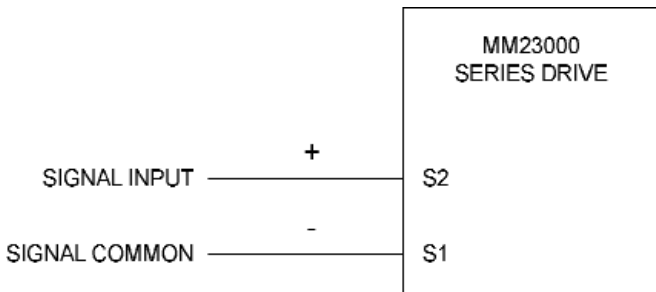


**Figure 12. MM23201C-Q and MM23011C-Q Connections**

## Voltage follower

Instead of using a speed adjust potentiometer, the drive may be wired to follow an analog input voltage signal that is isolated from earth ground (Figure 12). Connect the signal input (+) to S2. Connect the signal common (–) to S1. Make no connection to S3. A potentiometer can be used to scale the analog input voltage. An interface device, such as Minarik model PCM4, may be used to scale and isolate an analog input voltage.

With either 115 VAC or 230 VAC line voltage, an analog input voltage range of approximately 0–1.4 VDC is required to produce an armature voltage range of 0–90 VDC. With 230 VAC line voltage, an analog input voltage range of approximately 0–2.8 VDC is required to produce an armature voltage range of 0–180 VDC.



**Figure 13. Voltage Follower Connections**

## Cased drives



### Warning

**Do not install, rewire, or remove this control with input power applied.** Doing so may cause fire or serious injury. Make sure you have read and understood the Safety Warnings before attempting installation.

## Mounting (NEMA 1 enclosures)

NEMA 1 cased drives come with 0.88 inch (22 mm) conduit holes at the bottom of the case. The units may be vertically wall mounted or horizontally bench mounted using the three keyholes on the back of the case.

1. For access to the keyholes and the terminal strip, remove the two screws from the front of the case by turning them counterclockwise. Grasp the front cover and lift it straight out.
2. Install the mounting screws in the three keyholes.
3. Install conduit hardware through the conduit holes at the bottom of the case. Connect external wiring to the terminal block.
4. Reinstall the front cover. Avoid pinching any wires between the front cover and the case.
5. Replace the two screws to the front cover. Turn the screws clockwise to tighten.
6. Set the POWER switch to the OFF position before applying the AC line voltage.



## Mounting (NEMA 12 enclosures)

NEMA 12 cased drives come with two 0.88 inch (22 mm) conduit knockout holes at the bottom of the case. The units may be vertically wall mounted using the four 0.19 inch (5 mm) slotted holes on the attached heat sink. For motor loads less than 5 ADC, the drive may be bench mounted horizontally, or operated without mounting.

1. Install the mounting screws.
2. For access to the terminal strip, turn the slotted screw on the front cover counterclockwise until it is free from the case. The right side of the cover is hinged to the case. Pull the slotted screw to open the case.
3. Carefully remove the conduit knockouts by tapping them into the case and twisting them off with pliers.
4. Install conduit hardware through the 0.88 inch (22 mm) knockout holes. Connect external wiring to the terminal block.
5. Grasp the slotted screw and tilt the front cover back into place. Avoid pinching any wires between the front cover and the case.
6. Turn the slotted screw clockwise until tight to secure the front cover.
7. Set the POWER switch to the OFF position before applying the AC line voltage.

## Heat sinking

Models MM23101 and MM23201 require additional heat sinking when the continuous armature current is above 5 ADC. Use Minarik part number 223-0174. All other cased drives have sufficient heat sinking in their basic configurations. Use a thermally conductive heat sink compound (such as Dow Corning® 340 Heat Sink Compound) between the back of the drive case and heat sink surface for optimum heat transfer.

## Line fusing

15 amp line fuses are preinstalled on the cased models MM23101, MM23201, MM23401, and MM23501. 3 amp line fuses are preinstalled on the cased models MM23111, MM23211, and MM23411.

If the horsepower rating of the motor being used is less than the maximum horsepower rating of the drive, the line fuse may have to be replaced with a lower rated one. Refer to the “Recommended Line Fuse Sizes” table on page 18 to install a lower rated fuse.

## Connections



### Warning

**Do not connect this equipment with power applied.**

Failure to heed this directive may result in fire or serious injury.

**Minarik strongly recommends the installation of a master power switch in the voltage input line.** The switch contacts should be rated at a minimum of 200% of motor nameplate current and 250 volts.

## Power and motor connections

Connect the power input leads and a DC motor to TB501 as shown in Figure 13, page 28.

### Motor

Minarik drives supply motor voltage from A1 and A2 terminals. It is assumed throughout this manual that, when A1 is positive with respect to A2, the motor will rotate clockwise (CW) while looking at the output shaft protruding from the front of the motor. If this is opposite of the desired rotation, simply reverse the wiring of A1 and A2 with each other.

Connect a DC motor to PCB terminals A1 and A2 as shown in Figure 13. Ensure that the motor voltage rating is consistent with the drive's output voltage.

## Power input

Connect the AC line power leads to TB501 terminals L1 and L2, or to a double-throw, single-pole master power switch (recommended).

## Field output connections



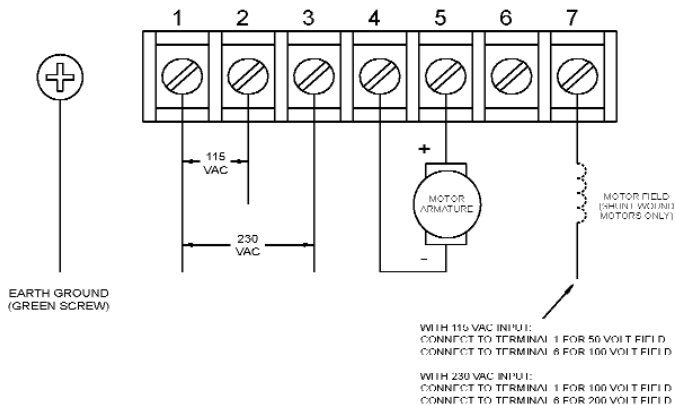
### Warning

The field output is for shunt wound motors only. Do not make any connections to F1 and F2 when using a permanent magnet motor.

See Table 3 for field output connections. Use 18 AWG wire to connect the field output to a shunt wound motor.

**Table 3. Field Output Connections**

<b>Line Voltage (VAC)</b>	<b>Approximate Field Voltage (VDC)</b>	<b>Connect Motor Field To</b>
115	50	F1 and L1
115	100	F1 and F2
230	100	F1 and L1
230	200	F1 and F2



**Figure 14. Cased Drive Connections**

## Current limit LED (**C models only**)

MM23000C series drives are equipped with a red current limit LED. The red current limit LED turns on whenever the drive reaches current limit and turns off whenever the drive is not in current limit (normal operation).

## Current limit header block (**C-H models only**)

MM23000C-H series drives are equipped with a 2-pin current limit header block. The current limit header block outputs approximately a floating 5 VDC (5 mADC) signal whenever the drive reaches current limit. The signal may be used as an input to an external device, such as an alarm or shut down circuit, that works when the drive reaches current limit.

## Meter header block (**cased C models only**)

To supply power to external devices, the *Meter* header block can supply an unregulated +9 VDC (5 mA) signal when the motor and the power supply of the drive are fully loaded. More current is available with less motor loading. *Meter* can supply an unregulated +15V (10 mA) signal in typical applications.

## **MM23001C-Q, MM23071, and MM23072 diagnostic LEDs**

Models MM23001C-Q, MM23071, and MM23072 are equipped with two diagnostic LEDs:

**Power (PWR):** Lights whenever the AC line voltage is applied to the drive.

**Current Limit (CURR LIMIT or CL):** Lights whenever the drive reaches current limit.

# Operation



## Warning

Change voltage switch settings only when the drive is disconnected from AC line voltage. Make sure both switches are set to their correct position. If the switches are improperly set to a lower voltage position, the motor will not run at full voltage and may cause damage to the transformer. If the switches are improperly set to a higher voltage position, the motor will overspeed, which may cause motor damage, or result in bodily injury or loss of life.

Dangerous voltages exist on the drive when it is powered. BE ALERT. High voltages can cause serious or fatal injury. For your safety, use personal protective equipment (PPE) when operating this drive.

If the motor or drive does not perform as described, disconnect the AC line voltage immediately. Refer to the Troubleshooting section, page 57, for further assistance.

## Before applying power

- Verify that no conductive material is present on the printed circuit board.
- Ensure that the voltage select switches are properly set.



## Voltage select switches

### Input voltage select (SW501)

Set the voltage switch SW501 to either 115V or 230V to match the AC line voltage. See Figure 14.

### Armature voltage select (SW502)

Set the voltage switch SW502 to either 90V or 180V to match the maximum armature voltage. See Figure 14.

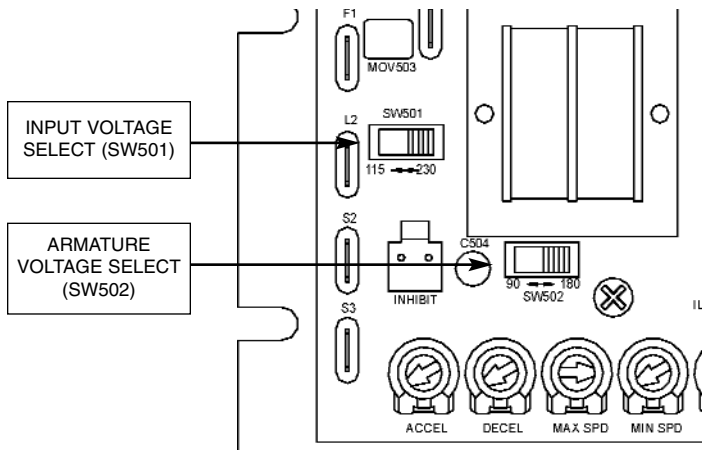


Figure 15. Voltage Switches

## Startup

### **MM23001, MM23011, MM23071, and MM23072**

1. Turn the speed adjust potentiometer full counterclockwise (CCW).
2. Apply AC line voltage.
3. Slowly advance the speed adjust potentiometer clockwise (CW). The motor slowly accelerates as the potentiometer is turned CW. Continue until the desired speed is reached.
4. Remove AC line voltage from the drive to coast the motor to a stop.

### **MM23101, MM23111, MM23401, and MM23411**

1. Set the speed adjust potentiometer to “0” (full CCW).
2. Apply AC line voltage.
3. Set the POWER switch to the ON position.
4. Slowly advance the speed adjust potentiometer clockwise (CW). The motor slowly accelerates as the potentiometer is turned CW. Continue until the desired speed is reached.
5. Set the POWER switch to the OFF position to coast the motor to a stop.

## MM23201 and MM23211



### Warning

Do not change the FORWARD / REVERSE switch while the motor is running. The motor must come to a complete stop before reversing. Changing motor direction before allowing the motor to completely stop will cause excessively high current to flow in the armature circuit, and will damage the drive and/or motor.

1. Set the RUN/BRAKE switch to the BRAKE position.
2. Set the speed adjust potentiometer to "0" (full CCW).
3. Apply AC line voltage.
4. Set the POWER switch to the ON position.
5. Set the FORWARD/REVERSE switch to the desired direction of rotation.
6. Set the RUN/BRAKE switch to the RUN position.
7. Slowly advance the speed adjust potentiometer clockwise (CW). The motor slowly accelerates as the potentiometer is turned CW. Continue until the desired speed is reached.
8. To reverse direction:
  - a. Set the RUN/BRAKE switch to the BRAKE position.
  - b. Set the FORWARD/REVERSE switch to the desired direction of rotation.
  - c. Set the RUN/BRAKE switch to the RUN position.
9. To brake the motor, set the RUN/BRAKE switch to the BRAKE position. To coast the motor to a stop, set the POWER switch to the OFF position.

**MM23501****Warning**

The motor must come to a complete stop before reversing. Changing motor direction before allowing the motor to completely stop will cause excessively high current to flow in the armature circuit, and will damage the drive and/or motor.

1. Set the FORWARD/BRAKE/REVERSE switch to the BRAKE position.
2. Set the speed adjust potentiometer to "0" (full CCW).
3. Apply AC line voltage.
4. Set the POWER switch to the ON position.
5. Set the FORWARD/BRAKE/REVERSE switch to the desired direction of rotation.
7. Slowly advance the speed adjust potentiometer clockwise (CW). The motor slowly accelerates as the potentiometer is turned CW. Continue until the desired speed is reached.
8. To reverse direction:
  - a. Set the FORWARD/BRAKE/REVERSE switch to the BRAKE position.
  - b. After the motor comes to a complete stop, set the FORWARD/BRAKE/REVERSE switch to the desired direction of rotation.
9. To brake the motor, set the FORWARD/BRAKE/REVERSE switch to the BRAKE position. To coast the motor to a stop, set the POWER switch to the OFF position.

## Starting and stopping methods



### Warning

Decelerating to minimum speed, dynamic braking, or coasting to a stop is recommended for frequent starts and stops. Do not use any of these methods for emergency stopping. They may not stop a drive that is malfunctioning. Removing AC line power (both L1 and L2) is the only acceptable method for emergency stopping.

For this reason, **Minarik strongly recommends installing an emergency stop switch on both the L1 and L2 inputs** (see connection diagrams on pages 20 & 21).

## Line starting and line stopping

Line starting and line stopping (applying and removing AC line voltage) is recommended for infrequent starting and stopping of a drive only. When AC line voltage is applied to the drive, the motor accelerates to the speed set by the speed adjust potentiometer. When AC line voltage is removed, the motor coasts to a stop.

## Inhibit terminals

Short the INHIBIT terminals to coast the motor to minimum speed (see Figure 15 for INHIBIT terminal location). Open the INHIBIT terminals to accelerate the motor to set speed.

Twist inhibit wires and separate them from power-carrying wires or sources of electrical noise. Use shielded cable if the inhibit wires are longer than 18 inches (46 cm). If shielded cable is used, ground only one end of the shield to earth ground. Do not ground both ends of the shield.

Minarik Corporation offers two accessory plug harnesses for connecting to the INHIBIT terminals: part number 201-0024 [inhibit plug with 18 inches (46 cm) leads]; and part number 201-0079 [inhibit plug with 36 inches (91 cm) leads].

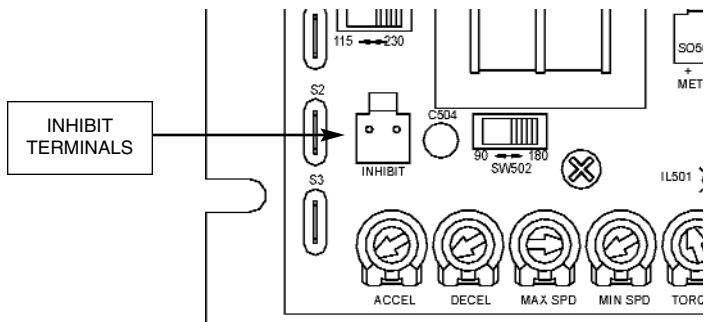
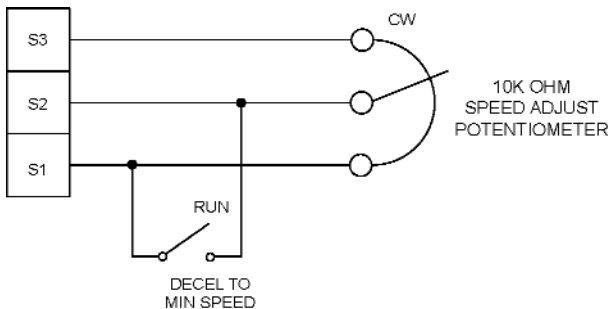


Figure 16. INHIBIT Terminals

## Decelerating to minimum speed

The switch shown in Figure 16 may be used to decelerate a motor to a minimum speed. Closing the switch between S1 and S2 decelerates the motor from set speed to a minimum speed determined by the MIN SPD trimpot setting. If the MIN SPD trimpot is set full CCW, the motor decelerates to zero speed when the switch between S1 and S2 is closed. The DECEL trimpot setting determines the rate at which the drive decelerates. By opening the switch, the motor accelerates to set speed at a rate determined by the ACCEL trimpot setting.



**Figure 17. Run/Decelerate to Minimum Speed Switch**

## Dynamic braking



### Warning

For frequent starts and stops, short the inhibit terminals, decelerate to a minimum speed, or apply a dynamic brake to the motor. Do not use any of these methods for emergency stopping. They may not stop a drive that is malfunctioning. Removing AC line power (both L1 and L2) is the only acceptable method for emergency stopping.

Frequent starting and stopping can produce high torque. This may cause damage to motors, especially gearmotors that are not properly sized for the application.

Dynamic braking may be used to rapidly stop a motor (Figure 17, page 40). For the RUN/BRAKE switch, use a two pole, two position switch rated for at least 125 VDC, 6 amps. For the dynamic brake resistor, use a 40 watt minimum, high power, wirewound resistor.

Sizing the dynamic brake resistor depends on load inertia, motor voltage, and braking time. Use a lower-value, higher-wattage dynamic brake resistor to stop a motor more rapidly. Refer to Table 4 (page 40) for recommended dynamic brake resistor sizes.

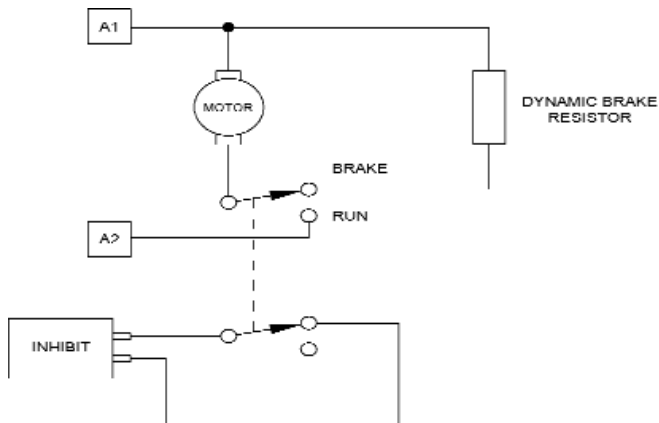
Note: Models MM23201, MM23211, and MM23501 incorporate dynamic braking in their designs.



**Table 4. Minimum Recommended Dynamic Brake Resistor Values**

Motor Armature Voltage	Dynamic Brake Resistor Value
90 VDC	15 ohms
180 VDC	30 ohms

For motors rated  $\frac{1}{17}$  horsepower and lower, a brake resistor is not necessary since the armature resistance is high enough to stop the motor without demagnetization. Replace the dynamic brake with 12-gauge wire.



**Figure 18. Dynamic Brake Connection**

# Calibration



## Warning

Dangerous voltages exist on the drive when it is powered. When possible, disconnect the voltage input from the drive before adjusting the trimpots. If the trimpots must be adjusted with power applied, use insulated tools and the appropriate personal protection equipment. BE ALERT. High voltages can cause serious or fatal injury.

MM23000-series drives have user-adjustable trimpots. Each drive is factory calibrated to its maximum current rating. Readjust the calibration trimpot settings to accommodate lower current rated motors.

All adjustments increase with CW rotation, and decrease with CCW rotation. Use a non-metallic screwdriver for calibration. Each trimpot is identified on the printed circuit board.

## MINIMUM SPEED (MIN SPD)

The MIN SPD trimpot establishes the motor speed obtained in response to the minimum input signal. It is factory set for zero speed.

To calibrate the MIN SPD pot, apply the minimum signal. Adjust the MIN SPD trimpot until the motor runs at the desired speed or is just at the threshold of rotation.

## MAXIMUM SPEED (MAX SPD)

The MAX SPD setting determines the maximum motor speed when the speed adjust potentiometer, or voltage input signal is set for maximum forward speed. It is factory set for maximum rated motor speed.

To calibrate MAX SPD:

1. Set the MAX SPD trimpot full CCW.
2. Set the speed adjust potentiometer or voltage input signal for maximum forward speed.
3. Adjust MAX SPD until the desired maximum forward speed is reached.

*Note:* Check the MIN SPD and MAX SPD adjustments after recalibrating to verify that the motor runs at the desired minimum and maximum speed.

## TORQUE



### Warning

TORQUE should be set to 150% of motor nameplate current rating. Continuous operation beyond this rating may damage the motor. If you intend to operate beyond the rating, contact your Minarik representative for assistance.

The TORQUE setting determines the maximum torque for accelerating and driving the motor. To calibrate TORQUE, refer to the recommended TORQUE settings in Figure 18 (page 45) or us the following procedure:

1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.
2. Set the TORQUE trimpot to minimum (full CCW).
3. Set the speed adjust potentiometer to maximum speed (full CW).
4. Carefully lock the motor armature. Be sure that the motor is firmly mounted.
5. Apply line power. The motor should be stopped.
6. Slowly adjust the TORQUE trimpot CW until the armature current is 150% of motor rated armature current.
7. Turn the speed adjust potentiometer CCW until the motor stops.
8. Remove line power.
9. Remove the stall from the motor.
10. Remove the ammeter in series with the motor armature if it is no longer needed.

## IR COMPENSATION (IR COMP)

The IR COMP trimpot setting determines the degree to which motor speed is held constant as the motor load changes. It is factory set for optimum motor regulation.

Use the following procedure to recalibrate the IR COMP setting:

1. Set the IR COMP trimpot to minimum (full CCW).
2. Rotate the speed adjust potentiometer until the motor runs at midspeed without load (for example, 900 RPM for an 1800 RPM motor). A hand held tachometer may be used to measure motor speed.
3. Load the motor armature to its full load armature current rating. The motor should slow down.
4. While keeping the load on the motor, rotate the IR COMP trimpot until the motor runs at the speed measured in step 2. If the motor oscillates (overcompensation), the IR COMP trimpot may be set too high (CW). Turn the IR COMP trimpot CCW to stabilize the motor.
5. Unload the motor.

See Figure 18, for recommended IR COMP settings.

MODELS MM23011, MM23111, MM23211, MM23072, and MM23411



MODELS MM23001, MM23071, MM23101, MM23201, MM23401, and MM23501



**Figure 19. Recommended Torque and IR COMP Settings  
(actual settings may vary with each application)**

## ACCELERATION (ACCEL)

The ACCEL setting determines the time the motor takes to ramp to a higher speed. See Specifications on page 1 for approximate acceleration times. ACCEL is factory set for the fastest acceleration time (full CCW).

To set the acceleration time:

1. Set the speed adjust potentiometer full CCW. The motor should run at minimum speed.
2. Turn the speed adjust potentiometer full CW and measure the time it takes the motor to go from minimum to maximum speed.
3. If the time measured in step 2 is not the desired acceleration time, turn the ACCEL trimpot CW for a slower acceleration time, or CCW for a faster acceleration time. Repeat steps 1 through 3 until the acceleration time is correct.

## DECELERATION (DECEL)

The DECEL setting determines the time the motor takes to ramp to a lower speed. See Specifications on page 1 for approximate deceleration times. DECEL is factory set for the fastest deceleration time (full CCW).

To set the deceleration time:

1. Set the speed adjust potentiometer full CW. The motor should run at maximum speed.
2. Turn the speed adjust potentiometer full CCW and measure the time it takes the motor to go from maximum to minimum speed.
3. If the time measured in step 2 is not the desired deceleration time, turn the DECEL trimpot CW for a slower deceleration time, or CCW for a faster deceleration time. Repeat steps 1 through 3 until the deceleration time is correct.



# Application Notes

## Multiple fixed speeds

Replace the speed adjust potentiometer with series resistors with a total series resistance of 10K ohms (Figure 19). Add a single pole, multi-position switch with the correct number of positions for the desired number of fixed speeds.

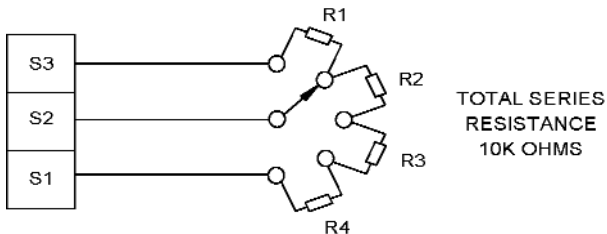
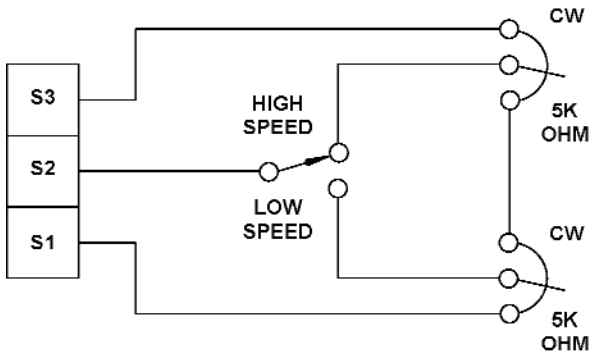


Figure 20. Multiple Fixed Speeds

## Adjustable speeds using potentiometers in series

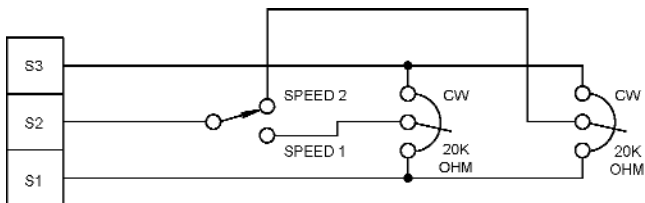
Replace the speed adjust potentiometer with a single pole, multi-position switch, and two or more potentiometers in series, with a total series resistance of 10K ohms. Figure 20 shows a connection for fixed high and low speed adjust potentiometers.



**Figure 21. Adjustable Fixed Speeds Using Potentiometers in Series**

## Independent adjustable speeds

Replace the speed adjust potentiometer with a single pole, multi-position switch, and two or more potentiometers in parallel, with a total parallel resistance of 10K ohms. Figure 21 shows the connection of two independent speed adjust potentiometers that can be mounted at two separate operating stations.



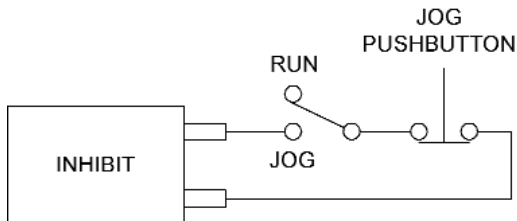
**Figure 22. Independent Adjustable Speeds**

## RUN/JOG switch

### RUN/JOG switch option #1

Using a RUN/JOG switch is recommended in applications where quick stopping is not needed and frequent jogging is required. Use a single pole, two position switch for the RUN/JOG switch, and a single pole, normally closed, momentary operated pushbutton for the JOG pushbutton.

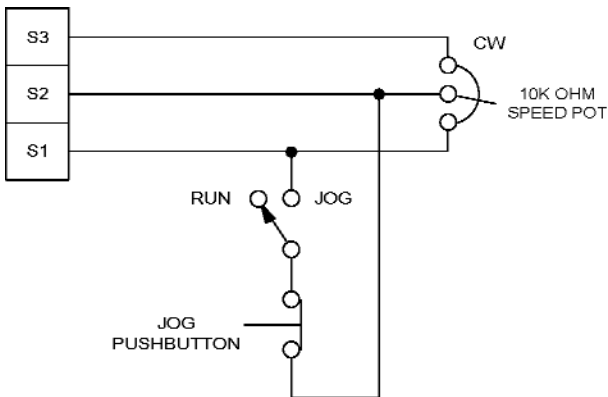
In the first wiring option, connect the RUN/JOG switch and JOG pushbutton to the inhibit plug as shown in Figure 22. The motor coasts to a stop when the RUN/JOG switch is set to JOG. Press the JOG pushbutton to jog the motor. Return the RUN/JOG switch to RUN for normal operation.



**Figure 23. RUN/JOG Switch Connection to Inhibit Plug (Option #1)**

## RUN/JOG switch option #2

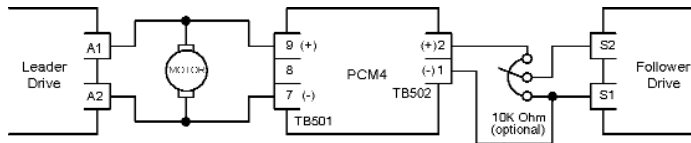
In the second wiring option, connect the RUN/JOG switch and the JOG pushbutton as shown in the Figure 23. When the RUN/JOG switch is set to JOG, the motor decelerates to minimum speed (minimum speed is determined by the MIN SPD trimpot setting). Press the JOG pushbutton to jog the motor. Return the RUN/JOG switch to RUN for normal operation.



**Figure 24. RUN/JOG Switch Connection to Speed Adjust Potentiometer (Option #2)**

## Leader-follower application

In this application, use a PCM4 to monitor the speed of the leader motor (Figure 24). The PCM4 isolates the leader motor from the follower drive, and outputs a voltage proportional to the leader motor armature voltage. The follower drive uses this voltage reference to set the speed of the follower motor. An optional ratio potentiometer may be used to scale the PCM4 output voltage.



**Figure 25. Leader-Follower Application**

## Single speed potentiometer control of multiple drives

Multiple drives can be controlled with a single speed adjust potentiometer using a PCM4 at the input of each drive to provide isolation (Figure 25). Optional ratio potentiometers can be used to scale the PCM4 output voltage, allowing independent control of each drive.

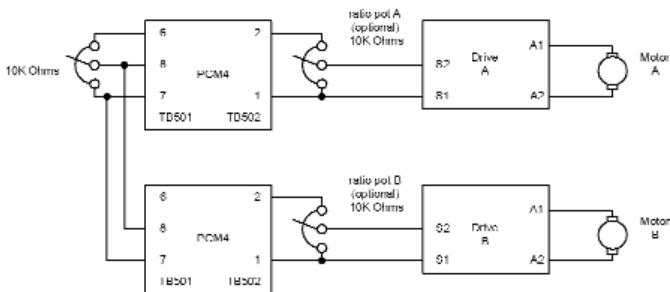
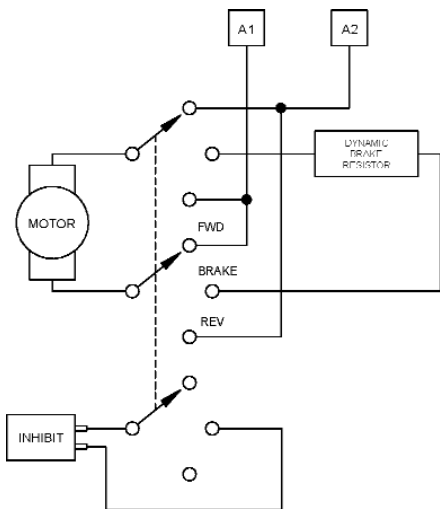


Figure 26. Single Speed Potentiometer Control of Multiple Drives

## Reversing

A dynamic brake may be used when reversing the motor direction (Figure 26). Use a three pole, three position switch rated for at least the maximum DC armature voltage and maximum braking current. Wait for the motor to stop completely before switching it to either the forward or reverse direction. See the Dynamic braking section, page 39, for recommended dynamic brake resistor sizes

*Note:* Model MM23501 is equipped with this reversing feature.



**Figure 27. Reversing Circuit Connection**





# Troubleshooting



## Warning

Dangerous voltages exist on the drive when it is powered. When possible, disconnect the drive while troubleshooting. High voltages can cause serious or fatal injury.

## Before troubleshooting

Perform the following steps before starting any procedure in this section:

1. Disconnect AC line voltage from the drive.
2. Check the drive closely for damaged components.
3. Check that no conductive or other foreign material has become lodged on the printed circuit board.
4. Verify that every connection is correct and in good condition.
5. Verify that there are no short circuits or grounded connections.
6. Check that the voltage selection switch settings match the AC line and output voltages.
7. Check that the drive's rated armature and field outputs are consistent with the motor ratings.

For additional assistance, contact your local Minarik Distributor, or the factory direct at:

Tel.: 1-800-MINARIK (646-2745) or Fax: 1-800-394-6334

<b>Problem</b>	<b>Possible Causes</b>	<b>Suggested Solutions</b>
Line fuse blows.	<ol style="list-style-type: none"><li>1. Line fuse is the wrong size.</li><li>2. Motor cable or armature is shorted to ground.</li><li>3. Nuisance tripping caused by a combination of ambient conditions and high-current spikes (i.e. reversing).</li></ol>	<ol style="list-style-type: none"><li>1. Check that the line fuse is correct for the motor size.</li><li>2. Check motor cable and armature for shorts.</li><li>3. Add a blower to cool the drive components; decrease TORQUE settings, or resize motor and drive for actual load demand, or check for incorrectly aligned mechanical components or “jams”. See page 43 for information on adjusting the TORQUE trimpot.</li></ol>

<b>Problem</b>	<b>Possible Causes</b>	<b>Suggested Solutions</b>
Line fuse does not blow, but the motor does not run.	<ol style="list-style-type: none"> <li>1. Speed adjust pot or speed reference voltage is set to zero speed.</li> <li>2. INHIBIT terminals are jumpered.</li> <li>3. S2 is shorted to S1.</li> <li>4. Drive is in current limit.</li> <li>5. Drive is not receiving AC line voltage.</li> <li>6. Motor is not connected.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase the speed adjust pot or speed reference voltage setting.</li> <li>2. Remove jumper from the INHIBIT terminals.</li> <li>3. Remove short.</li> <li>4. Verify that motor is not jammed. Increase TORQUE setting if they are set too low. See page 43.</li> <li>5. Apply AC line voltage to L1 and L2.</li> <li>6. Connect motor to A1 and A2.</li> </ol>
Motor does not stop when the speed adjust potentiometer is full CCW.	MIN SPD setting is too high.	Calibrate MIN SPD. See page 42.
Motor runs in the opposite direction (non-reversing drives).	Motor connections to A1 and A2 are reversed.	Reverse connections to A1 and A2.

<b>Problem</b>	<b>Possible Causes</b>	<b>Suggested Solutions</b>
Motor runs too fast.	<ol style="list-style-type: none"> <li>1. MAX SPD and MIN SPD are set too high.</li> <li>2. Motor field connections are loose (shunt wound motors only).</li> </ol>	<ol style="list-style-type: none"> <li>1. Calibrate MAX SPD and MIN SPD. See page 42.</li> <li>2. Check motor field connections.</li> </ol>
Motor will not reach the desired speed.	<ol style="list-style-type: none"> <li>1. MAX SPD setting is too low.</li> <li>2. IR COMP setting is too low.</li> <li>3. TORQUE setting is too low.</li> <li>4. Motor is overloaded.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase MAX SPD setting. See page 42.</li> <li>2. Increase IR COMP setting. See page 44.</li> <li>3. Increase TORQUE setting. See page 43.</li> <li>4. Check motor load. Resize the motor and drive if necessary.</li> </ol>
Motor pulsates or surges under load.	<ol style="list-style-type: none"> <li>1. IR COMP is set too high.</li> <li>2. Motor bouncing in and out of current limit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the IR COMP setting slightly CCW until the motor speed stabilizes. See page 44.</li> <li>2. Make sure motor is not undersized for load; adjust TORQUE trimpot CW. See page 43.</li> </ol>

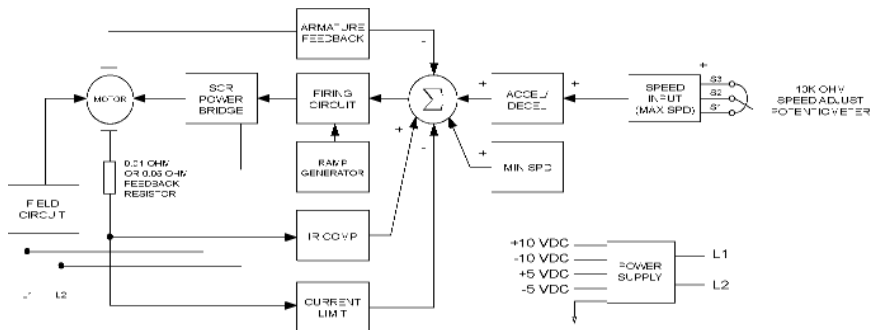


Figure 29. MM23000 Series Block Diagram

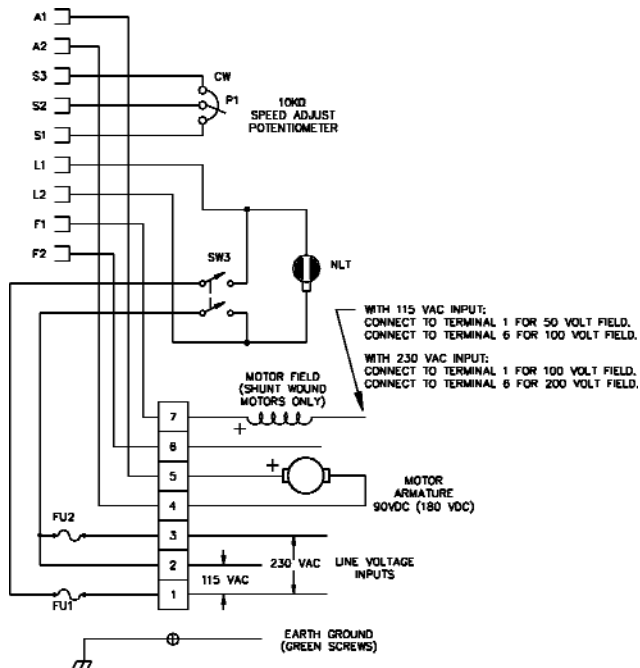


Figure 30. MM23101, MM23111, MM23401 and MM23411 Terminal Block Connections





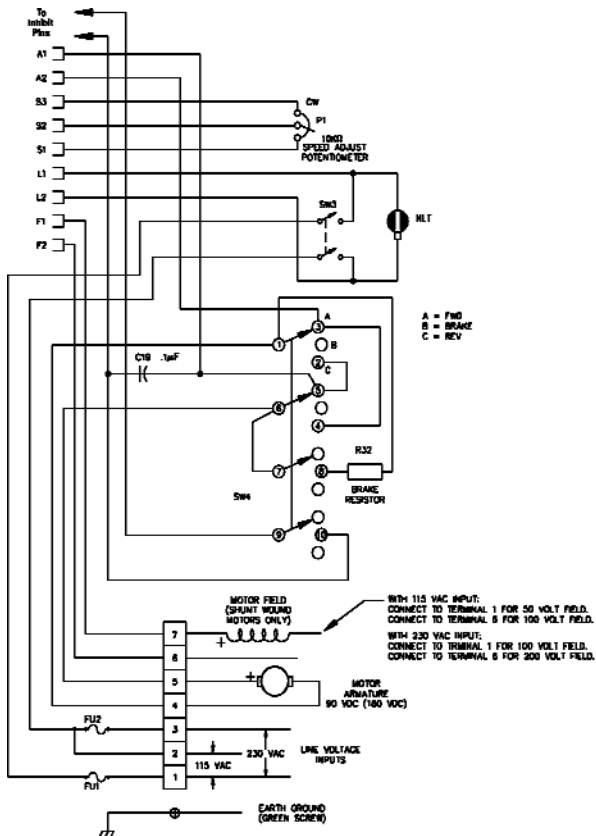


Figure 32. MM23501 Terminal Block Connections

## Replacement Parts

Replacement parts are available from Minarik Corporation and its distributors for this drive series.

**Table 5. Replacement Parts**

<b>Model No.</b>	<b>Symbol</b>	<b>Description</b>	<b>Minarik P/N</b>
<b>MM23001 and</b>	SCR501, 502	800 V, 20 A SCR	072-0043
<b>MM23071</b>	D501-503	800 V, 20 A Diode	071-0039
	R501	0.01 OHM, 5 W Resistor	032-0129
	T501	3FD-224-001 Transformer	230-0083
		10K $\Omega$ potentiometer kit	202-0031
<b>MM23011</b>	Same as MM23001 except:		
	SCR501, 502	600 V, 8 A SCR	072-0024
	D501-503	600 V, 3 A Diode	071-0007
	R501	0.05 OHM, 5W Resistor	032-0089
<b>MM23101</b>	Same as MM23001 except potentiometer kit, and including:		
		Case Bottom	223-0170
		Case Cover	223-0169
		240V Pilot Light	040-0043
		10K OHM, 5W Potentiometer	120-0009
		Knob	140-0013
		DPST Power Switch	080-0037
		15 A, 3AB Fuse	050-0018
<b>MM23111</b>	Same as MM23011 except potentiometer kit. Same as MM23101 except fuse. Include:		
		3 A, 3AG Fuse	050-0021
<b>MM23201</b>	Same as MM23101 except case cover, and including:		
		Case Cover	223-0168
		40 OHM, 40W Resistor	032-0076
	SW4	DPST Run/Brake Switch	080-0037
	SW5	DPST FWD/REV Switch	080-0037

**Table 5. Replacement Parts (continued)**

<b>Model No.</b>	<b>Symbol</b>	<b>Description</b>	<b>Minarik P/N</b>
<b>MM23211</b>	Same as MM23011 except potentiometer kit. Same as MM23201 except fuse. Include:		
		20K $\Omega$ , 10W Resistor	032-0043
		3 A, 3AG Fuse	050-0021
<b>MM23411</b>	Same as MM23011 except potentiometer kit, and including:		
		Knob	140-0013
		240V Pilot Light	040-0043
		DPST Power Switch	080-0037
		Power Switch Boot	155-0078
		10K OHM, 1/2 W Potentiometer	120-0009
		3A 3AG Fuse	050-0021
		Heat Sink	223-0182
	Case	223-0104	
<b>MM23401</b>	Same as MM23001 except pot kit. Same parts as MM23411 (knob,.....case) except fuse, and including:		
		15 A, 3AB Fuse	050-0018
<b>MM23501</b>	Same as MM23401 except heat sink and case, and including:		
		Heat Sink	223-0183
		Case	223-0106
		20 OHM, 40 W Resistor	032-0062
		FWD/BRAKE/REV Switch	081-0037
		Knob	140-0014
<b>MM23072</b>	Same as MM23071 except:		
	R501	0.05 OHM, 5W Resistor	032-0089
<b>MM23001C-Q</b>	Same as MM23001 including:		
	SO503	Quick-Disconnect Header Block	164-0211
		Quick-Disconnect Plug	160-0095

# CE Compliance

Minarik Corporation hereby certifies that its MM23000 series drives have been approved to bear the “CE” mark provided the conditions of approval have been met by the end user.

The MM23000 series has been tested to the following test specifications:

**EN55011:1991 (emissions), and  
EN50082-1:1992 (immunity)**

Compliance allows Minarik’s MM23000 series to bear the CE mark.

The end user, as described herein, falls into one of two categories:

1. The Consumer will deploy a stand-alone unit as an integral, yet external, portion of the machine being operated.
2. The Original Equipment Manufacturer (OEM) will implement the product as a component of the machine being manufactured.

In addition to EMI/RFI safeguards inherent in the MM23000 series’ design, external filtering is required.

## Line filters

Minarik requires the Corcom<sup>®</sup> line filters listed below.

**Table 6. Corcom<sup>®</sup> Filters**

<b>Nameplate Current of Motor Wired to the Drive</b>	<b>Corcom<sup>®</sup> Filter Part Number</b>
0 to 4 amps	6VV1
4.1 to 13 amps	20VV1

If the exact line filter is not available, the specifications are as follows:

L = (1.73 + 0.03) milliHenries.

C = (0.27 + 0.54) microFarads (X); 0.0055 microFarads (Y).

R = 330Kohms.

Rated current: 1.4 times maximum DC motor current.

Filter type: Balanced 2-section.

The line filters should be wired to the AC line within 0.25 meters of the drive. The ground connection from the line filter must be wired to solid earth ground (resistance less than 500 ohms); not machine ground. This is very important!

If the end-user is using a CE-approved motor, the correct line filter listed above is all that is necessary to meet the EMC directives listed herein.

## Armature filters

If the end-user is not using a CE-approved motor, a second filter on the armature must be used. It is Minarik's CEXXMM. XX = rated current of the filter. Minarik Filters are listed below.

**Table 7. Minarik Filters**

Nameplate Current of Motor Wired to the Drive	Minarik Filter Part Number
0 to 4 amps	CE4MM
4.1 to 13 amps	CE20MM

The filters listed above are Real-Pole Balanced-Pi 3-pole filters. If the exact filter is not available, the specifications are as follows:

$L \text{ \& } L1 = 2 * (0.8) \text{ milliHenries.}$

$C \text{ \& } C1 = 2 * (0.1) \text{ microFarads @ 400W VDC.}$

$Rin = 0.1 \text{ ohm; } Rout = 1.2 \text{ ohm.}$

The filters listed above must be wired to the DC output of the drive, as close to the drive as possible.

The end user must use the filters listed in this section to comply with CE. The OEM may choose to provide alternative filtering that encompasses the Minarik drive and other electronics within the same panel.

The OEM has this liberty because CE is a machinery directive. Whether or not every component in the OEM's machinery meets CE, the OEM must still submit his machine for CE approval.

Thus, no component must necessarily meet CE within the machine, as long as the OEM takes the necessary steps to guarantee the machine does meet CE. By the same token, even if every component in the OEM's machine does meet CE, the machine will not necessarily meet CE as a machine.

Using CE-approved wiring practices (like proper shielding) and the filters listed in this section help the drive meet EN55011 (1991 emissions standard) and EN50082-1 (1992 immunity standard).

# NOTES



# NOTES

# NOTES

# Unconditional Warranty

**A. Warranty** - Minarik Corporation (referred to as “the Corporation”) warrants that its products will be free from defects in workmanship and material for twelve (12) months or 3,000 hours, whichever comes first, from date of manufacture thereof. Within this warranty period, the Corporation will repair or replace, at its sole discretion, such products that are returned to Minarik Corporation, 901 East Thompson Avenue, Glendale, CA 91201-2011 USA.

This warranty applies only to standard catalog products, and does not apply to specials. Any returns for special controls will be evaluated on a case-by-case basis. The Corporation is not responsible for removal, installation, or any other incidental expenses incurred in shipping the product to and from the repair point.

**B. Disclaimer** - The provisions of Paragraph A are the Corporation's sole obligation and exclude all other warranties of merchantability for use, express or implied. The Corporation further disclaims any responsibility whatsoever to the customer or to any other person for injury to the person or damage or loss of property of value caused by any product that has been subject to misuse, negligence, or accident, or misapplied or modified by unauthorized persons or improperly installed.

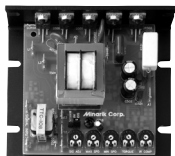
**C. Limitations of Liability** - In the event of any claim for breach of any of the Corporation's obligations, whether express or implied, and particularly of any other claim or breach of warranty contained in Paragraph A, or of any other warranties, express or implied, or claim of liability that might, despite Paragraph B, be decided against the Corporation by lawful authority, the Corporation shall under no circumstances be liable for any consequential damages, losses, or expense arising in connection with the use of, or inability to use, the Corporation's product for any purpose whatsoever.

An adjustment made under warranty does not void the warranty, nor does it imply an extension of the original 12-month warranty period. Products serviced and/or parts replaced on a no-charge basis during the warranty period carry the unexpired portion of the original warranty only.

If for any reason any of the foregoing provisions shall be ineffective, the Corporation's liability for damages arising out of its manufacture or sale of equipment, or use thereof, whether such liability is based on warranty, contract, negligence, strict liability in tort, or otherwise, shall not in any event exceed the full purchase price of such equipment.

Any action against the Corporation based upon any liability or obligation arising hereunder or under any law applicable to the sale of equipment or the use thereof, must be commenced within one year after the cause of such action arises.

## Other drives from Minarik Corporation:



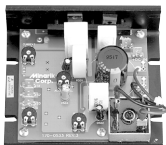
**PCM20000 Series**



**DLC600**



**MM-PCM Series**



**XP Series  
(AC or DC Input)**



901 E Thompson Avenue  
Glendale, CA 91201-2011  
Tel.: 1-800-MINARIK (646-2745)

Fax: 1-800-394-6334

[www.minarikcorp.com](http://www.minarikcorp.com)

Document number 250-0091, Revision 5

Printed in the U.S.A – 10/01

North America \$12.00, Outside North America \$15.00