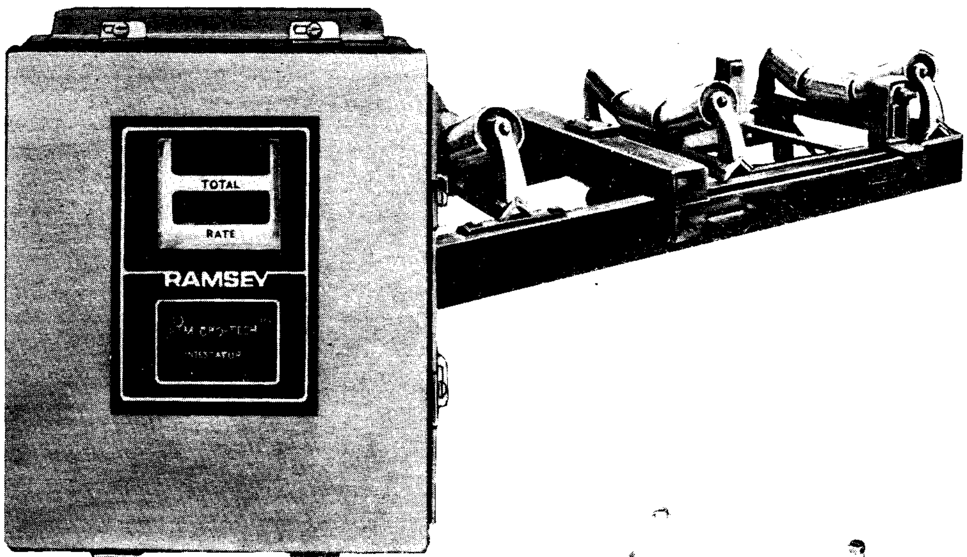
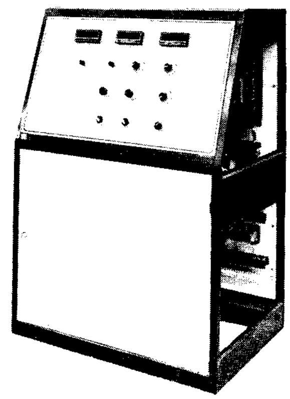
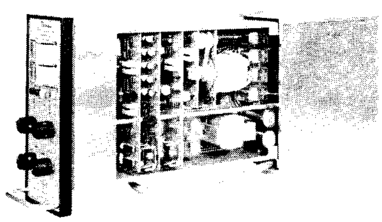
RAMSEY

Instrumentation and Automation for the Process Industries

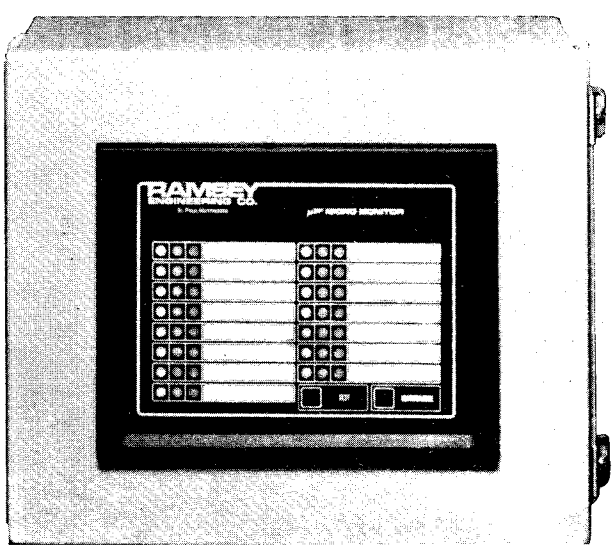
10-201

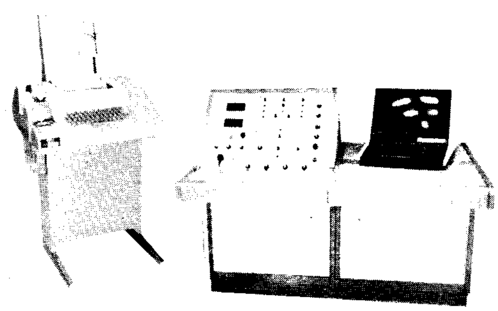






INSTALLATION, OPERATING
AND MAINTENANCE INSTRUCTIONS





Customer Manual

for Ramsey

Model 10-201

μP[R] Micro-Tech[TM]

Integrator

REC 3416

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ABOUT THIS MANUAL ...

This manual contains information on the installation, operation, and maintenance of the Ramsey Model 10-201 Micro-Tech Integrator.

Chapter 1 provides a general description of the Model 10-201 Micro-Tech Integrator and each of its parts.

Chapter 2 contains installation information. Included in this chapter is information on how to inspect, unpack, and store the Integrator prior to installation. Site selection, mounting, and wiring instructions and set-up instructions are also found in Chapter 2.

Set-up and calibration procedures are detailed in Chapter 3.

Chapter 4 discusses the Integrator operation.

Chapter 5 is devoted entirely to specifications.

The theory of operation of the Micro-Tech Integrator is detailed in Chapter 6. You should have a fair knowledge of the "how's" and "why's" after reading this chapter.

Maintenance and troubleshooting information can be found in Chapter 7.

The Appendix contains warranty information, spare parts recommendations, a return authorization form, and the electrical schematics and assembly drawings.

If, after reading this manual, you have any remaining questions, please contact your Ramsey Engineering Company representative.

**** NOTE ****

Before unpacking,

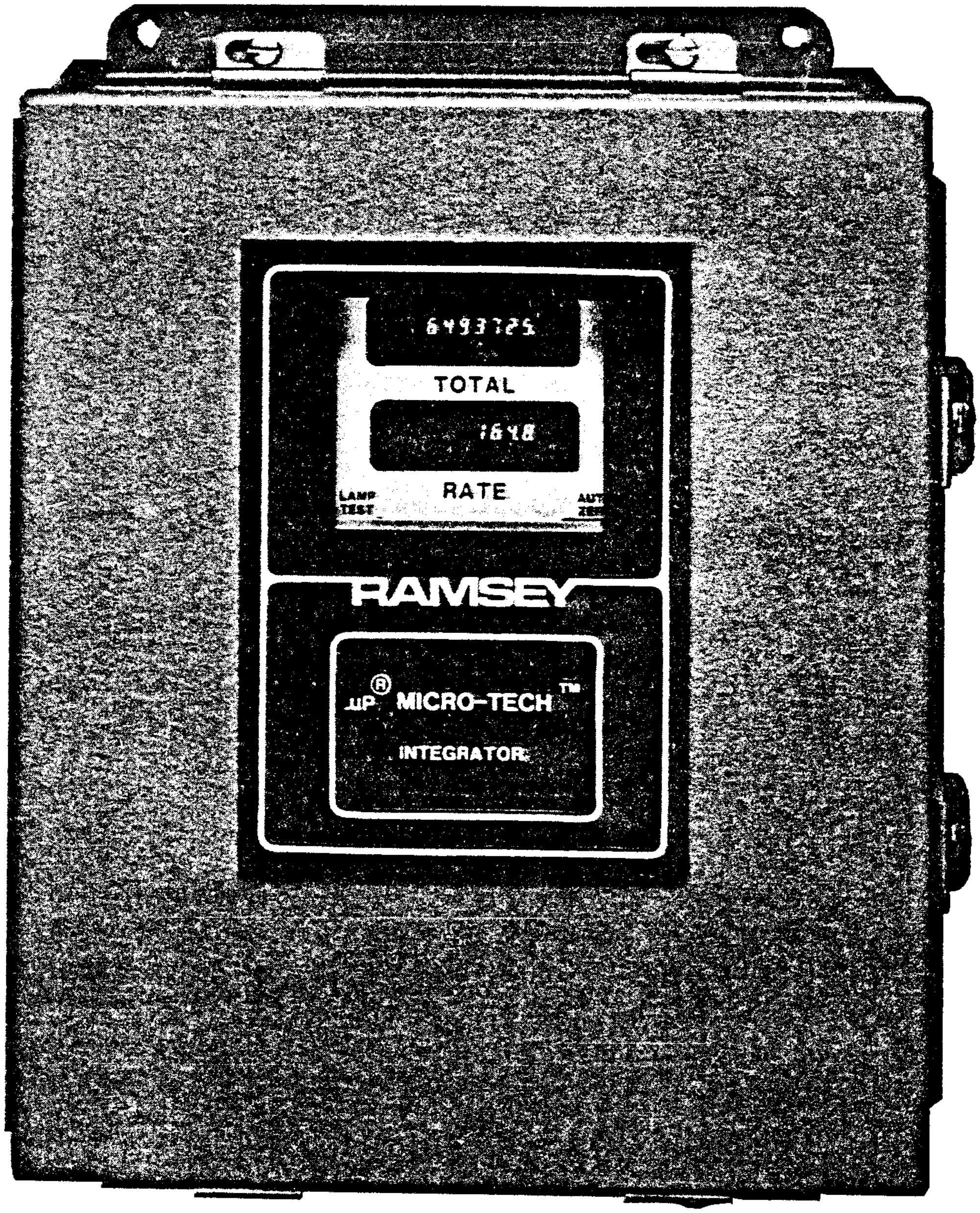
--read Section 2.1.2--

****

Before connecting and applying power,

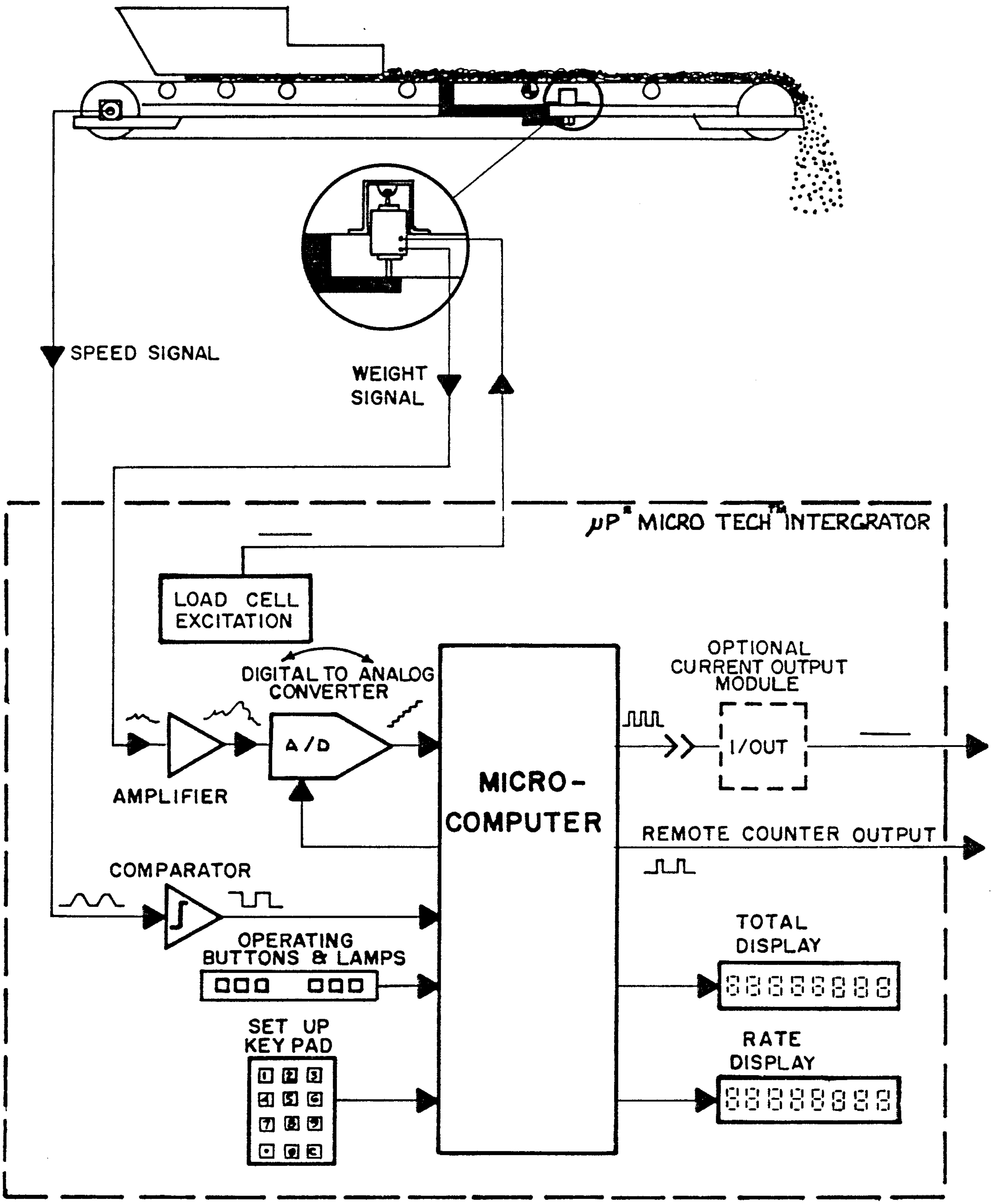
--read Chapter 2--

****



Ramsey Model 10-201 µP^R Micro-Tech^{TM} Integrator

Figure P1



Simplified System Diagram

Figure 1.0

CHAPTER 1

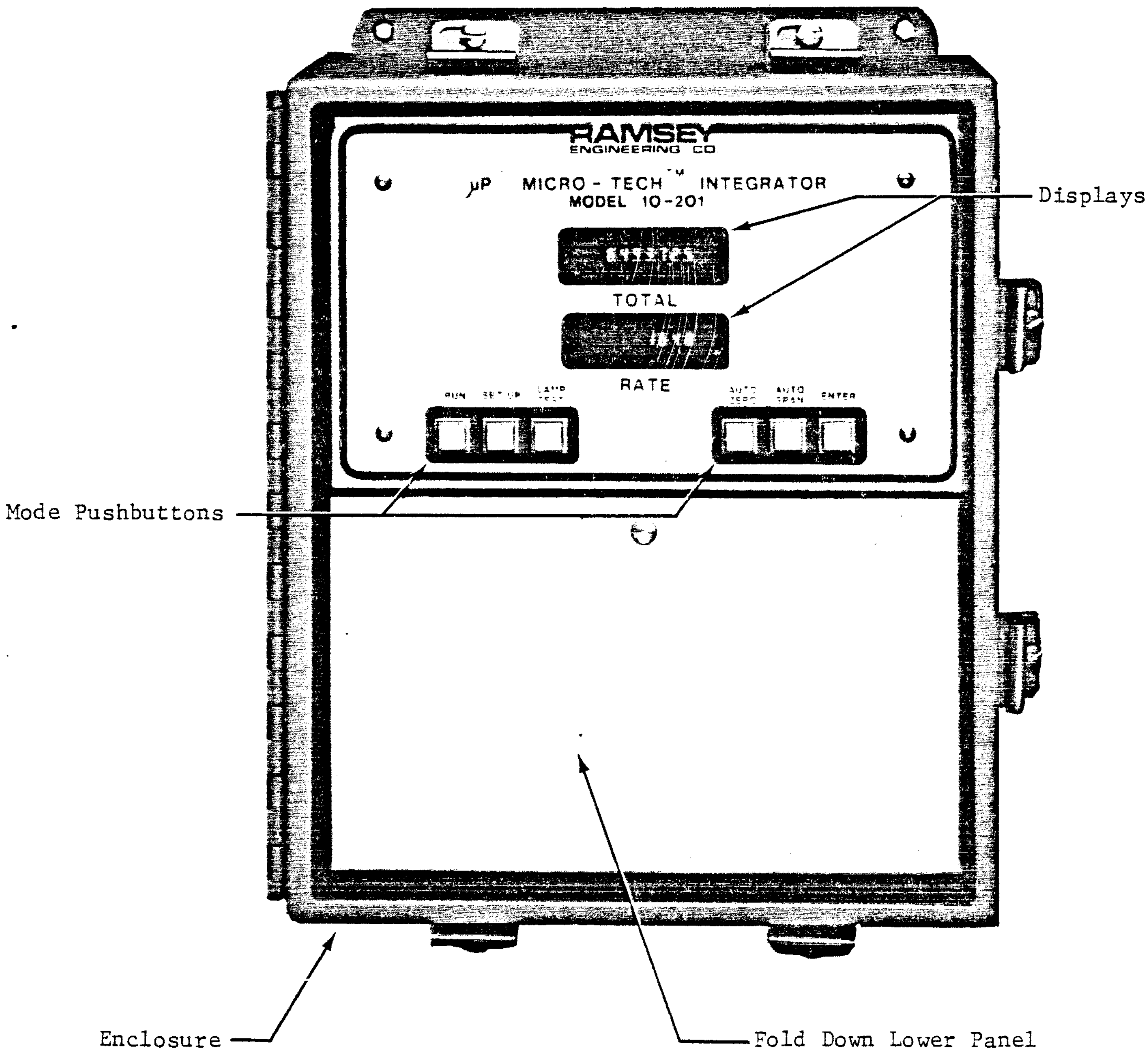
1.0 General Information

1.1 Micro-Tech Integrator

The Model 10-201 Micro-Tech Integrator is intended to be used in conjunction with a conveyor belt weigh scale and speed sensor to provide the user with an indication of rate and running total weight of the material flow on the belt (refer to the Simplified System Diagram in Figure 1.0).

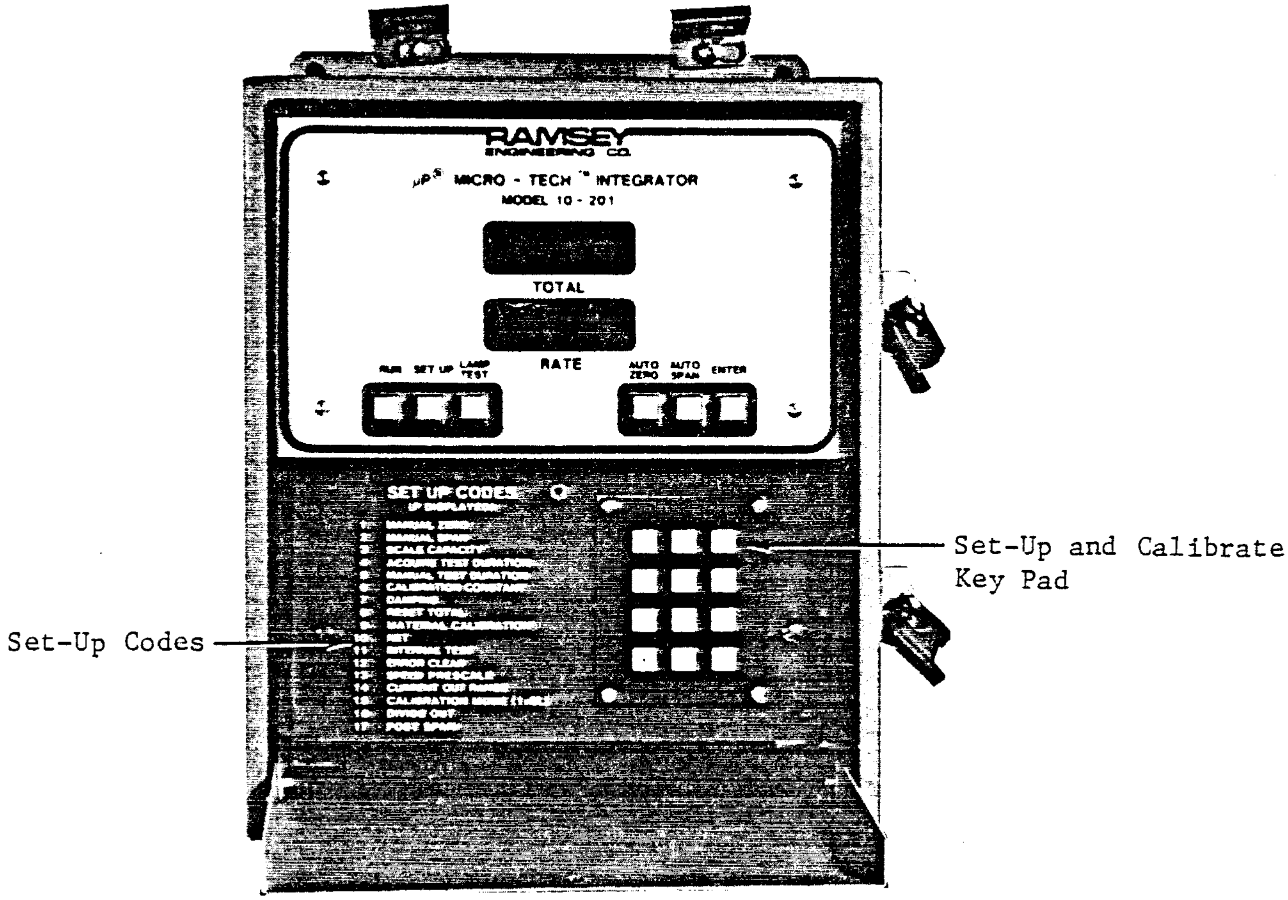
The Model 10-201 Micro-Tech Integrator amplifies and converts the analog weight and speed signals to a stable digital form. The internal microcomputer then processes these and operator inputs to produce the front panel displayed total and rate information, and also generate remote total and rate signals. Operator selected inputs include automatic span and zero calibration, displayed units selection; i.e., tons per hour and electronic calibration (no test weights!).

The operator interface consists of a front panel containing two 8-digit high visibility vacuum fluorescent displays. These display both total and rate information under normal operating conditions, and display system and calibration information when the operator selects a set-up, test, or calibration mode of operation. Also on the front panel are six lighted pushbuttons for normal system test and operation. Under the fold-down door on the lower half of the front panel is a 12-key (telephone-like) keypad for entering system parameters and for system diagnostics. The field wiring terminals and main electronic printed circuit board is accessed by opening both lower and upper front panels. Refer to Figures 1.1, 1.2, and 1.3.



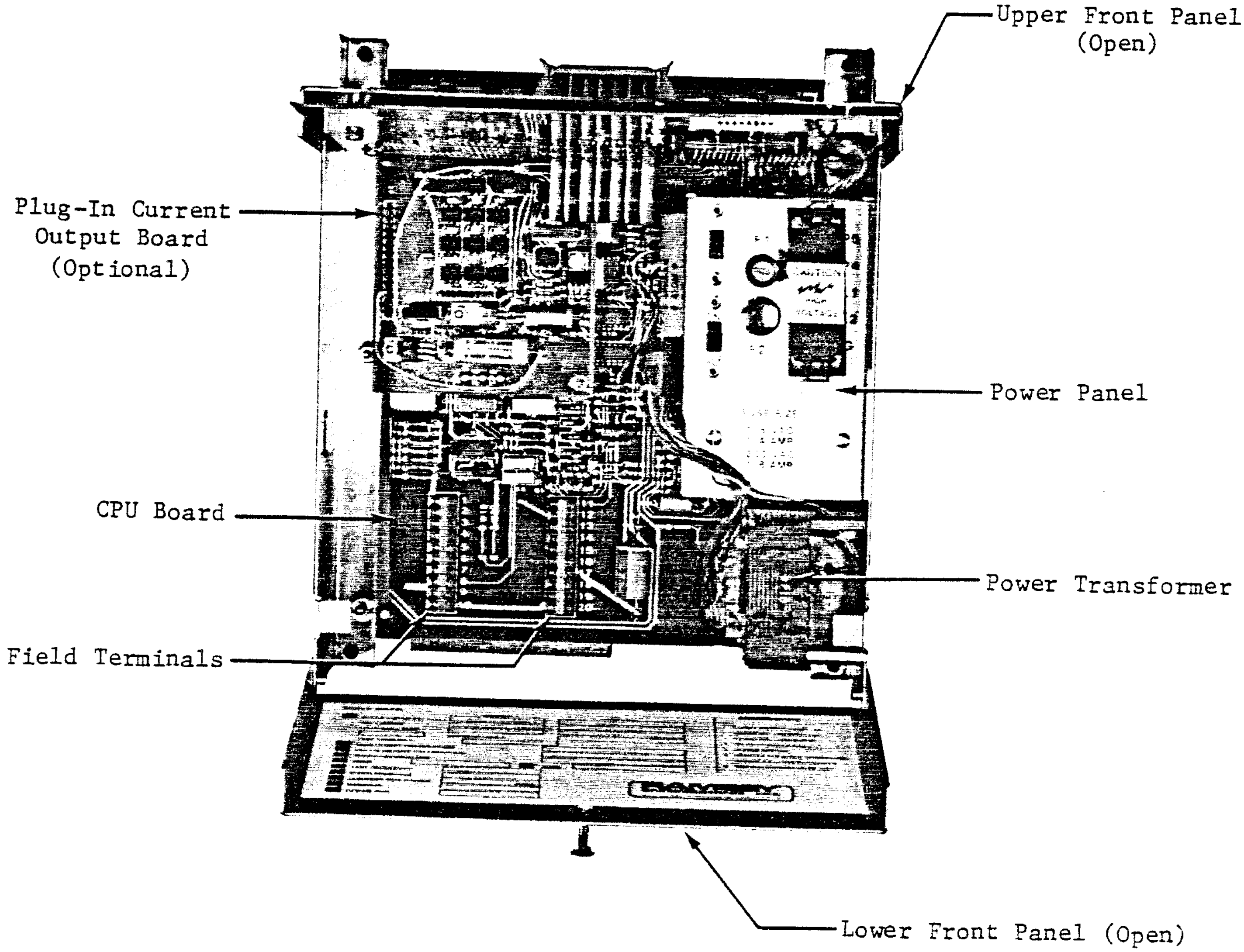
Front Panel

Figure 1.1



Front Panel - Lower Panel Open

Figure 1.2



Upper and Lower Front Panels - Open

Figure 1.3

The Model 10-201 Micro-Tech Integrator consists of a power panel, CPU (central processing unit) printed circuit board, display printed circuit board, and provisions for an optional current output (I/Out) printed circuit board, housed in a weather-tight steel enclosure.

1.2 Enclosure

The enclosure is fabricated of 14 gauge steel and conforms to the NEMA standard for Type 4 (water-tight and dust-tight) enclosures.

In addition to protecting the integrator electronic printed circuit boards from moisture and dirt, the enclosure also serves to shield the electronics from electrical noise.

1.3 CPU Board

The CPU printed circuit board is mounted at the rear of the integrator chassis. This board contains all of the electronics for processing weight, speed, and user inputs. Also on the CPU board are the microprocessor, front panel and output controls, and signal field terminations.

1.4 Power Panel

The power panel is a small metal enclosure mounted behind the upper front panel. This enclosure contains the line voltage components and functions such as the line field terminals, line filter, fuse, line voltage select and power switches. Mounted below the power panel is the line voltage isolation transformer.

1.5 Display Board

The display board is a printed circuit board mounted to the upper front panel. This board contains the total and rate displays, mode push-buttons, keypad, and the electronics for communication to and from the CPU board.

1.6 Optional Current Output (I/Out) Board

The current output board is a small printed circuit board which plugs into the CPU board. This board contains the additional electronics to provide the user with an isolated 0mA to 20mA or 4mA to 20mA current output. This output represents the flow rate of the material over the scale. This current output signal can be transmitted over long distances and used for remote rate indication or process control.

1.7 Input and Output Signals

1.7.1 Inputs

1.7.1.1 Load Cell Input

The Model 10-201 Micro-Tech Integrator accepts a strain gauge load cell output producing 3mV/V (milli-volt output per volt of excitation) full scale. For example, a load cell with a full scale output of 3mV/V and 10Vdc excitation will produce an output signal of 30mVdc under full load. Tare (no weight signal) may be from 0 to 85% of the rated load cell capacity and the net (full weight minus tare signal) must be greater than 15% of the rated load cell capability. For example, for a load cell capacity rating of 30mV, the tare signal can be from 0 to 24mV and the net signal must be greater than 4.5mV. The maximum observable input is 105% of the rated load cell capacity.

1.7.1.2 Speed Input

The speed input is jumper selectable to accept either a voltage/current pulse train or contact closure type speed transducer output. The voltage/current pulse train voltage range is from 1 to 30Vdc, with a frequency range of 0 to 1.2kHz. The contact closure voltage range is the same as the voltage/current, but the frequency range is limited to 0 to 30Hz. Power for the contact closure transducer is available through the speed sensor supply output (see Section 6.2, B).

1.7.1.3 Excitation Sense Inputs

Excitation sense inputs sense or monitor the excitation voltage supplying the load cell. The Micro-Tech Integrator uses this sense information to account for any additional or varying voltage drop in long load cell connecting wires. The excitation sense inputs are normally connected at the Micro-Tech Integrator enclosure for short (under 200 feet) load cell to enclosure distances and are connected remotely for longer distances.

1.7.1.4 R-CAL Input (electronic calibration input)

The R-CAL input allows the use of a calibration resistor to simulate a known weight input when using the electronic mode of automatic calibration.

1.7.1.5 Power Input

The power input to the Micro-Tech Integrator is switch selectable and can accept either 117 or 234Vac each with an acceptable variation of -15% to +10%. The line frequency can be either optional 50 or standard 60 Hertz, and the maximum power required is 20VA.

1.7.2 Outputs

1.7.2.1 Displays

Both total and rate information is displayed on high visibility, blue-green, vacuum fluorescent displays. These displays are visible through a window in the door of the enclosure.

1.7.2.2 Load Cell Excitation Output

The load cell excitation output supplies (excites) the load cell with a stable 10Vdc into a minimum impedance of 110 ohms.

1.7.2.3 Remote Total Counter Output

The remote total counter output is a relay contact output which is used to provide the user with a remote representation of the total display.

1.7.2.4 Current Output (optional)

The current output produced by the optional current output (I/Out) board is electrically isolated and is user selectable for either 0mA to 20mA or 4mA to 20mA output range.

CHAPTER 2

2.0 Installation

2.1 Inspection, Unpacking, and Storage

The Ramsey Model 10-201 Micro-Tech Integrator has been carefully performance tested at the factory and properly packaged for shipment.

2.1.2 Inspection and Unpacking

To be certain that there has been no shipping damage, please inspect the package carefully BEFORE opening. If there is evidence of shipping damage, immediately notify the shipping carrier.

After opening, remove any shipping material and make certain that all socketed integrated circuits are firmly inserted in their sockets and that the ribbon cable connecting the two printed circuit boards is properly seated in its connectors.

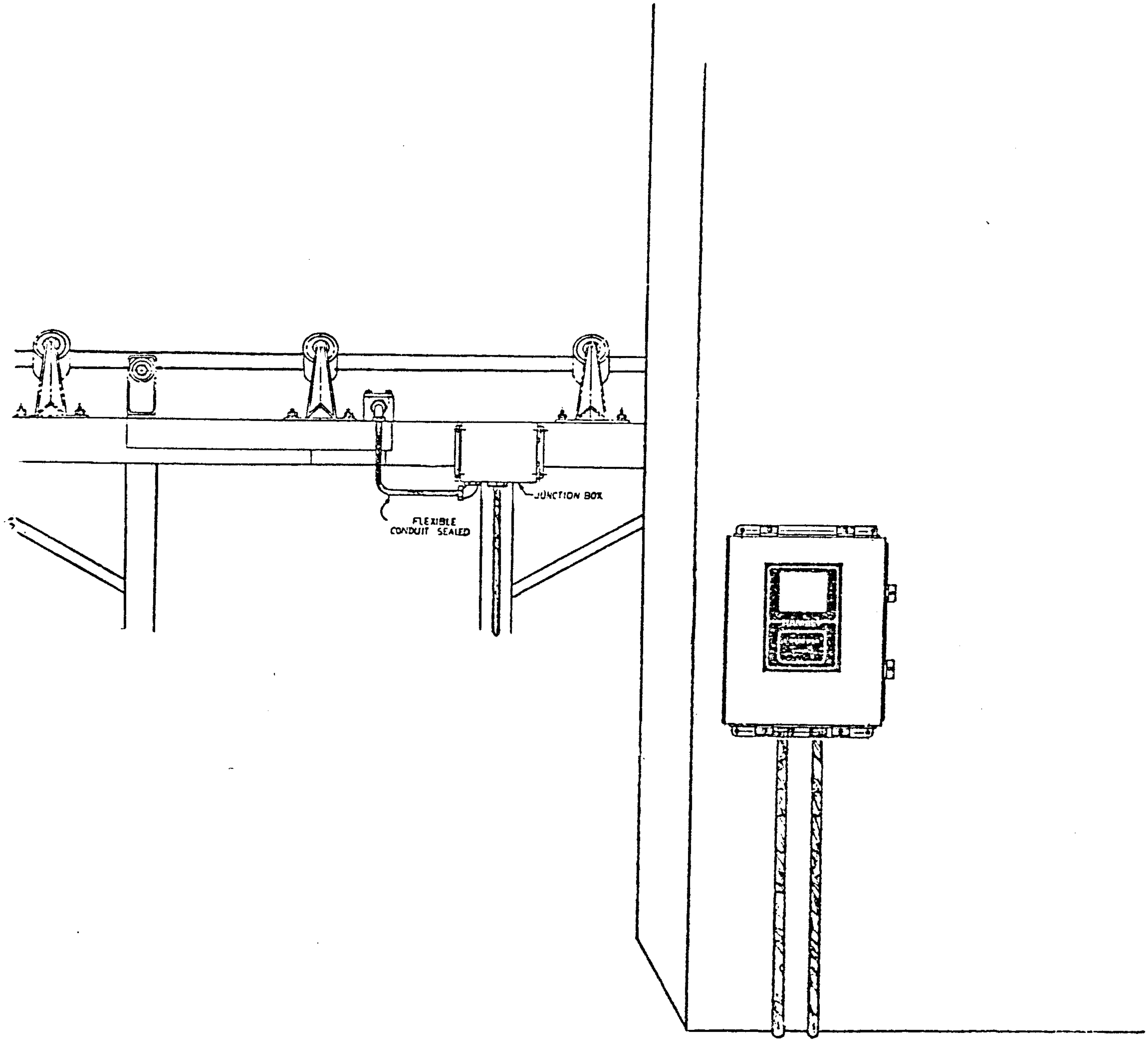
2.1.3 Storage

If you are not going to install this unit now, it can be safely stored, with the cover latches secured, between -40 and +70 degrees C. (-40 to +158 degrees F.). The unit should be protected against moisture.

2.2 Site Selection and Mounting

2.2.1 Site Selection

The Micro-Tech Integrator mounting site should be selected with care. The enclosure should be mounted as close to the load cell as possible (within 200 feet) without being exposed to excessive vibration, heat, or moisture. In a conveyor belt scale application,



Typical Installation

Figure 2.1

the ideal mounting location would be on a separate wall or beam in view of the scale (refer to Figure 2.1). In some applications, it may be necessary to mount the integrator more distant than 200 feet from the scale. In such cases, a special six-wire shielded cable is recommended for wiring the load cell and remote excitation sense lines.

2.2.2 Mounting

Mount the Micro-Tech Integrator to a rigid fixture in an area of minimum vibration. Mounting dimensions are shown in the Outline and Mounting Dimension Drawing A/11 in the Appendix. The integrator is mounted with the door hinge on the left and at a height which allows comfortable viewing of the displays and access to the front panel pushbuttons, keypad, power switch, and field wiring terminals. Conduit holes must be punched in the bottom of the enclosure to accept power and signal wires and conduit (follow local electrical codes and regulations for wire size and routing).

****

NOTE: It is recommended that the chassis be removed from the enclosure to prevent any damage during the hole punching process.

****

2.3 Wiring

Use the typical field wiring diagram shown in the Typical Field Wiring Diagram A/12 in the Appendix as a guide if you do not have a specific wiring diagram for your system. Follow your local electrical codes and regulations for wire size and routing.

Some critical wiring considerations are:

1. Check to make sure that the power is OFF.

2. Do not shorten the load cell cable supplied with the scale. The wire length is critical for load cell temperature compensation.

3. Do not route load cell or signal wires in the same conduit with power wires or any large source of electrical noise.

4. Connect shields ONLY where shown.

5. Check that all wires are tight in their connectors. This is particularly important for the load cell connections.

6. Earth ground all enclosures and conduit.

7. Never use a "megger" to check wiring.

CHAPTER 3

3.0 Calibration

The Model 10-201 µP[R] Micro-Tech is intended primarily for use as part of a nuclear or electromechanical conveyor scale. For calibration as a conveyor scale, see the conveyor scale system manual. Calibration described in this section is a bench procedure which assures proper operation of the 10-201 on a stand-alone basis.

3.1 Test Equipment Required

Following is a list of equipment (or equivalent) required for complete check-out of the Model 10-201.

3.1.1 Variable Auto Transformer 90-130V or 180-260V, 50 or 60Hz, as applicable to supply up to 20Va.

3.1.2 Digital multimeter (DMM) (2 required). 4-1/2 Digit Data Precision Model 1450 or equal.

3.1.3 Square wave generator, variable frequency. Must provide output of not less than 2vp-p or more than 30vp-p through 1000 ohms.

3.1.4 IN4728 diode, 100K 1% resistor.

3.1.5 Current source 0-20mA d-c through minimum 200 ohms.

3.1.6 Load cell simulator. BLH Model 625 or equivalent. Model 625 with Model 624 Vernier is preferred.

3.2 Set-Up Procedure

3.2.1 Connect variable auto-transformer output to power input L1, L2, GND. Set transformer to 115Vac or 230Vac in accord with the setting of the power input switch.

3.2.2 Connect the load cell simulator to terminals 1, 2, 3, 4 and 7. The following connections are appropriate to the BLH Model 625/624 simulator.

1 (+) signal
2 (-) signal
3 (+) excitation
4 (-) excitation
7 shield

3.2.3 Connect DMM to 19(-) and 20(+). Maximum current out approximately 20mA.

3.2.4 Connnect IN4728 Zener diode across terminals 15 and 16, cathode to 15. Connect frequency generator to 15 and 16. The diode limits the input to 3.3 volts. Set frequency generator to 60Hz. (50Hz for units with 50Hz power--see 3.2.7)

3.2.5 Connect 100K 1% resistor across terminals 11 and 13. This is the R-Cal resistor.

3.2.6 Place jumpers in the 10-201 in positions W1, W3, W6, W7, W9, W13, W18.

3.2.7 Note that for 60Hz operation crystal Y1 has a frequency of 3.56352MHz. For 50Hz operation, the frequency should be 2.96960 for optimal normal mode rejection ratio.

3.3 Check power supplies.

3.3.1 Connect DMM common to battery negative, connect positive to terminal 3. Power on. DMM must read +4.75 to +5.25Vdc.

3.3.2 Adjust supply voltage 87-129Vac (174 - 258V as appropriate). DMM reading should not change from original value of 3.3.1.

3.3.3 Move DMM positive lead to terminal 4. Reading must be -4.75 to -5.25Vdc. Repeat 3.3.2.

3.3.4 Power off.

3.4 Check internal operation.

3.4.1 Press and hold CLR button while turning power on. Unit should flash "HELP" and one decimal point should appear in each display.

3.4.2 Press RUN. "HELP" should disappear and be replaced by 0 in the TOTAL display and 8E and some rate value in the RATE display. RUN will light up. This step also places default constants in RAM, as listed in Table 3.1.

3.4.3 To clear the 8E, perform the following. Press SET-UP, 12, ENTER. If a number and E appear in TOTAL, press enter until TOTAL is blank.

3.4.4 PROM Identification. The following table shows the PROM identification for various configurations of the µP^{R} Micro-Tech.

	Version	
Power	Load Cell	Nuclear
50Hz	07-07-08	XX-E3-E3
60Hz	06-07-08	XX-E2-E2
XX = any number		

To read, press SET-UP, 55, ENTER. Unit will display the identification numbers as shown in the above table.

3.4.5 Press RUN. Press and hold LAMP TEST. Unit will alternately flash 8's and decimals in both displays. All buttons flash.

3.4.6 Press SET-UP, 11, ENTER. Unit will begin totalizing for about 17 seconds (20 seconds at 50Hz) and stop at 28.24 ± .02. Rate will read 6279 ± 2. This confirms that the microprocessor performs conveyor scale calculations.

3.5 Operation to simulate load cell type conveyor scale.

3.5.1 Press SET-UP, 1, ENTER, 0, ENTER. This sets ZERO to zero.

3.5.2 Press SET-UP, 16, ENTER, 10, ENTER. This sets divide out to 10.

3.5.3 Set load cell simulator (BLH) to zero. Vernier off.

3.5.4 Press SET-UP, 10, ENTER. Record number on top display (NET). This step establishes that zero input results in zero output from the A/D. Because the unit will not read a negative input, add a small increment of simulated weight (use vernier if available) with the BLH and confirm that some value appears in the upper display.

3.5.5 Set BLH to 3mV/V (vernier off). Record value of NET In upper display. Must be between 55300 and 57700. This is the acceptance tolerance (not stability) of the as built unit.

3.5.6 Record readings of NET with BLH at 2.5mV/V, 2.0mV/V, 1.5mV/V, 1.0mV/V, and 0.5mV/V. These readings represent the linearity of the unit. Each value should be within ± 16 counts of its computed value using end points of 0 and the reading obtained in 3.5.5.

3.5.7 Set BLH to 1mV/V. Press Auto Zero. Press Auto Zero again. (Second time actually initiates the procedure.) After 36 seconds, (43 seconds at 50Hz) ENTER and upper display will flash. Test is complete. Press ENTER. This establishes 1mV/V as zero for the simulated conveyor scale.

3.5.8 Set BLH to 3mV/V. Press Auto Span two times. After 36 seconds, (43 seconds at 50Hz) "ENTER" and upper display will flash. Test is complete. Press ENTER. This establishes 3mV/V as the full scale value for the simulated conveyor scale.

3.5.9 Press RUN. Unit will be totalizing. Rate display will show 2400 if 60Hz is exactly correct. If not, the percent error between 2400 and the observed rate is equal to the percent error between 60Hz and the frequency generator signal. It is convenient at this time to adjust the frequency generator to produce exactly 2400.

<u>NOTE</u>: The same procedure is appropriate using 50Hz when 50Hz power is used. 50Hz units have crystal Y1 at 2.96960MHz. 60Hz units have Y1 at 3.5635MHz.

3.5.10 Check that the output relay closes once for each ten counts accumulating in TOTAL. Contacts are across P4, P5.

3.5.11 Set BLH to 0.5mV/V. Rate display shows -600 and TOTAL counts downward. Pulse output will stop.

3.5.12 Press SET-UP, 14, ENTER. This procedure will allow current output to be calibrated for 0-20mAdc or 4-20mAdc. For 0-20mA, press 0, ENTER. For 4-20mA, press 4, ENTER.

3.5.13 With BLH at 3mV/V, adjust I-Out board for 20.0mA.

3.5.14 The following procedure checks both the current output and the speed prescale with frequency generator adjusted as in 3.5.9. To change the speed prescale, press SET-UP, 13, ENTER, desired number, ENTER.

This procedure is correct for 60Hz operation with Y1 = 3.56352MHz or 50Hz operation with Y1 = 2.96960MHz. Be sure the crystal frequency corresponds to the frequency of the power mains.

Prescale	Rate	Current Out
1	9600	22.7mA ±.1mA (overrange)
2	4800	22.7mA ±.1mA (overrange)
3	2400	20.0mA ±.03mA (calibration point)
4	1200	12.0mA ±.03mA
5	600	8.0mA ±.03mA
6	300	6.0mA ±.03mA
7	150	5.0mA ±.03mA

Return Prescale to 3.

3.5.15 Set BLH to 1mV/V to simulate no load on conveyor scale. Press SET-UP, 15, ENTER, 1, ENTER. Display will show EL to indicate electronic calibration.

3.5.16 The following procedure checks electronic calibration. Press AUTO SPAN. Upper display will show EL. Press AUTO SPAN again to initiate R-Cal. Rate will be approximately 1050. Press RUN. Return BLH to 3mV/V.

3.5.17 Be sure unit is in RUN. Adjust supply voltage slowly downward until display does not update. Note voltage. This must occur at a voltage lower than 99.45Vac (198.9Vac) and will typically be 90Vac (180Vac). Return voltage to normal 115V (230V). Switch off and on three times. Top display should count normally. Rate display should show 2400 and error 7E.

3.5.18 Set frequency generator to approximately 15Hz (12Hz for 50Hz power). Rate should read approximately 600. Return frequency to approximately 50Hz or 60Hz, as appropriate.

3.6 Miscellaneous Checks

3.6.1 Connect DMM to terminals 16(-) and 17(+). Should read 15vdc ±3vd-c.

3.6.2 Set BLH to 1mV/V. Move W9 jumper to W10. Decimal point should appear at left of RATE display. After about 18 seconds, a second decimal point should appear adjacent to the first one. Return jumper to W9. The first decimal indicates that Auto Zero Tracking is enabled. The second decimal is lit during the data acquisition period of AZT.

3.6.3 Move W7 jumper to W8. Apply 4mA to terminal 8(+) and 9(-). Press SET-UP, 10, ENTER. Upper display should read NET approximately 3800 - 4500. Return jumper to W7.

3.6.4 Check speed pulse input filter. Press SET-UP, 4, ENTER, ENTER. Top display should count speed pulses. Change frequency generator to 480Hz. Unit should still count.

3.6.5 Change jumper W6 to W5. Unit should stop counting speed pulses. Reduce frequency to 60Hz. Counting should resume. Return jumper to W6.

3.6.6 Check battery back-up. Connect DMM to pin 22 of V14, measure 4.6vd-c. Turn power off. Measure approximately 3.4vdc -0v, +.3v.

Table 3.1 Default Constants

1	ZERO	18835
2	SPAN	47791
3	SCALE CAP	2400.0
5	TEST DUR	270
6	CALCON	24
7	DAMP	2
8	N.A.	
9	N.A.	
10	N.A.	
11	N.A.	
12	N.A.	
13	PRESCALE	3
14	CURRENT	0-20
15	CALMODE - 0 (non-electronic)	
16	DIV OUT	1
17	N.A.	

N.A. = Not Applicable

Chapter 4 - Operation

This section describes the operational use of the Integrator. The scale manual describes operation within a conveyor belt scale system.

In this description, variable and constant names are spelled either with all small-case letters, capitalized, or with all capital letters depending on use. Names spelled with all small letters refer to a general concept, such as "capacity" or "total" or "tare." Names spelled with a capital followed by small-case letters refer to the proper names given to a value or register; such as "Scale Capacity" or "Cumulative Total." Names spelled with all capitals refer to the actual name of the variable, as it is found in the program; such as "CAP" or "CMOT" or "TARE". Also, switch names are spelled with all capitals.

4.1 Controls and Functions

4.1.1 Displays

The TOTAL display will display the numerical value appropriate to the integrator's present operating status (mode of function). The RATE display will always display Rate and any errors or function number.

4.1.2 Keypad

All numerical input (constants or function numbers) into the integrator is accomplished through the keypad. The "CLR" key clears the quantity being keyed in.

4.1.3 Mode Pushbuttons

The 6 mode pushbuttons are used to select the desired operating mode and enter data. Pressing a button selects the mode. (The ENTER button is functional only where noted.)

4.1.3.1 RUN:

This is the normal operating mode for the integrator. All totals are updated with counts computed from gross weight and belt travel inputs.

- Display:
  TOTAL display indicates Cumulative Total, RATE indicates Rate and any errors, if present.

- Mode Lamp:
  This run mode lamp (green) is on.

- Keypad Input:
  No inputs are expected; none are recognized.

- Operation:
  (a) Press RUN

4.1.3.2 SET-UP:

This mode allows for manual installation of constants and initial scale calibration. Integration, as in RUN, except where noted.

- Display:
  TOTAL display is blank, RATE indicates Rate and shows "ØØP" left-most.

- Mode Lamp:
  The set-up mode lamp is on.

- Keypad Input:
  The keypad is active. Enter the one or two digit number of the function desired.

- ENTER:

  Pressing the ENTER button begins the function whose number was keyed-in. If no number was keyed in, the function selected is "ØØ", (Set-Up List").

A. Set-Up Functions:

The functions are further described below:

(a) 00 - Set-Up List:

- Function:

  To display the constants which determine the scale's calibration.

- Display:

  TOTAL display will display one of the constants which determine the scale's calibration.

  RATE display will display Rate, plus the function number, followed by a "P", left-most in the display, corresponding to the number being displayed in TOTAL display. Each number is displayed for about 3 seconds. The integrator automatically returns to the Run mode.

- Mode Lamp:

  The set-up lamp is on.

- Operation:

  (a) Press SET-UP, ENTER.

  Any switch except ENTER will stop the list and enter the selected mode.

(b) 01 - Manual Zero

- Function:
  To examine and/or change the value of zero.

- Display:
  TOTAL display will display the current value of zero in non-engineering units. Indicates Rate and "01P".

- Operation:
  (a) Press SETUP, 1 , ENTER . The current zero is displayed.
  (b) If a different zero is wanted, key in that number through the keypad. The decimal point is ignored. The number being keyed in appears in TOTAL display.
  (c) Press ENTER . TOTAL display will blank for 1/2 second then the new zero in use is displayed.

(c) 02 - Manual Span

- Function:
  To examine and/or change the value of SPAN.

- Display:
  TOTAL display will display the current value of SPAN in non-engineering units. RATE display indicates Rate and "02P".

- Operation:
  (a) Press SETUP , 2 , ENTER. The current SPAN is displayed.

(b) If a different span is wanted, key in that number through the keypad. The decimal point is ignored. The number being keyed in appears in TOTAL display.

(c) Press ENTER . Display will blank for 1/2 second, then the new SPAN on use is displayed.

(d) 03 - Scale Capacity

- Function:

  To examine and/or change the value of Scale Capacity (CAP).

- Display:

  TOTAL display will display the current value of Scale Capacity. #2 indicates Rate and "03P".

- Operation:

  (a) Press SETUP , 3 , ENTER . The present Scale Capacity is displayed.

  (b) If a different Scale Capacity is wanted, key in that keypad. The number being keyed in appears in TOTAL display. 0, 1, or 2 digits may follow a decimal point.

  Note:

  The decimal point position of the Scale Capacity determines the decimal point positions of the Total and Rate displays.

For example:

Scale Capacity	Total Display	Rate Display
100	6572.	97.
100.0	6572.0	97.0
100.00	6572.00	97.0*

*Rate may or may not be displayed to the same resolution as total, depending on the setting of Scale Capacity. (1) If Scale Capacity was set with no digits to the right of the decimal, the displayed value of RATE is not affected. (2) If the integer value (digits appearing to the left of the decimal) of Capacity is 20, then RATE will be displayed left with the same number of digits to the right of the decimal, as was set in Scale Capacity. (3) If the integer value of Capacity is _ 20 but 200, and Capacity is set with 1 or 2 digits right of the decimal, then RATE will be displayed with only 1 digit right of the decimal. (4) If the integer value of capacity is _ 200, then RATE is displayed with no digits right of the decimal.

(c) Press ENTER . TOTAL display will blank for 1/2 second, then the new Scale Capacity in use is displayed.

(e) 04 - Acquire Test Duration

- Function:

  To acquire (set) a new value for Test Duration (TD) based on a timed interval or a specific amount of belt travel.

- Display:

  TOTAL display will display the acquiring belt pulse count. RATE display indicates Rate and "04P".

- Operation:

  (a) Press SET-UP, 4, ENTER. The present TD is displayed. Enter light blinks. Integration stops.

  (b) To begin a new acquisition of TD, press ENTER. The acquiring TD is displayed in TOTAL display. Enter light still flashes.

  (c) After a specific elapsed time or belt travel has occurred, press ENTER to stop the acquisition. The acquired TD remains displayed. Enter light still flashes.

  (d) Press ENTER again to install this acquired duration as the new Test Duration. TOTAL display will blank for 1/2 second, then the new TD in use is displayed. The Enter light is still flashing.

  The procedure may be repeated beginning at (b).

(f) 05 - Manual Test Duration

- Function:

  To examine and/or change the value of Test Duration (TD).

- Display:

  TOTAL display will display the present TD. RATE display indicates Rate and "05P".

- Operation:

  (a) Press SETUP , 5 , ENTER . The present TD is displayed.

  (b) If a different TD is wanted, key in that number through the keypad. The decimal point is ignored. The number being keyed in appears in TOTAL display

  (c) Press ENTER . TOTAL display will blank for 1/2 second, then the new TD in use is displayed.

(g) 06 - Calibration Constant

- Function:

  To examine and/or change the value of the Calibration Constant (CALCON).

- Display:

  TOTAL display will display the present CALCON. If electronic Auto Span is selected, "EL" will appear left-most in TOTAL display. RATE display indicates Rate and "06P".

- Operation:

  (a) Press SETUP , 6 , ENTER . The present CALCON is displayed.

  (b) If a different CALCON is wanted, key in that number through the keypad. The number being keyed in appears in TOTAL display. 0, 1, 2, or 3 digits may follow a decimal point.

(c) Press ENTER . TOTAL display will blank for 1/2 second, then the new CALCON in use is displayed.

(h) 07 - Rate Filter Damping

- Function:

  To examine and/or change the present value of Rate Filler Damping (RFD). The rate filter damping factor determines the number of weight samples (taken at 6 per second) used in "averaging" the net weight during the rate computation. Damping factors may range from 0 to 10. The value "n" used relates to the number of samples as follows:

  Number of Samples = 2^n

  Examples: n = 0 gives 1 sample (no damping)
  n = 4 gives 16 samples

  As a result, a larger damping factor provides more smoothing of the output signal. (Refer to Table A for damping factors vs. damping times.)

RFD	Time
0	0 (less than 0.6 seconds)
1	1.6 sec
2	3 sec
3	6 sec
4	13.5 sec
5	26 sec
6	53 sec
10	14.2 min

TABLE A

The damping factor has no effect on the Cumulative Total, Reset Total, remote counter relay contact closure output or any function other than the displayed rate and current output.

- Display:
  TOTAL display will display the present RFD. #2 indicates Rate and "07P".

- Operation:
  (a) Press SETUP , 7 , ENTER . The present RFD is displayed.
  (b) If a new RFD is wanted, key in that number through the keypad. The decimal point is ignored. The number being keyed in appears in TOTAL display.
  (c) Press ENTER . TOTAL display will blank for 1/2 second, then the new RFD in use is displayed.

(i) 08 - Reset Total

- Function:
  To display and/or reset the Resettable Total (RTOT).

- Display:
  TOTAL display will display Resettable Total as it is updated. RATE display indicates Rate and "08P".

- Operation:
  (a) Press SETUP , 8 , ENTER . The Resettable Total (RTOT) is displayed. Enter light blinks.

(b) To reset RTOT, press ENTER . Enter light still blinks.

(c) Step (b) may be repeated as desired.

(j) 09 - Material Calibration

- Function:

  To acquire and store a weight value from the conveyor scale for later comparison to a batch-weighed value of the same material, or for later use with Post-Span.

- Display:

  TOTAL display will display the stored Calibration Total (CALTOT) or the acquiring weight value. RATE display indicates Rate and "09P".

- Operation:

  (a) Press SETUP , 9 , ENTER . The stored CALTOT is displayed. Enter light blinks.

  (b) If a new acquisition of CALTOT is wanted, press ENTER to begin the acquisition. Normal integration <u>ceases</u> with this ENTER press. A new CALTOT is acquired at a "times 10" accuracy. Enter light still blinks.

  (c) Press ENTER to <u>stop</u> the acquisition. Enter light still blinks.

  (d) Press ENTER again to install the acquired value as the new CALTOT. Normal integration <u>resumes</u> with this ENTER press. TOTAL display will blank for 1/2 second, then the new CALTOT is displayed. The procedure may be repeated beginning with (b).

(k) 10 - Net

- Function:

  To display the present value of NET.

- Display:

  TOTAL display will display NET in non-engineering units. RATE display indicates Rate and "1ØP".

- Operation:

  (a) Press SETUP , 1 , 0 , ENTER . NET appears in TOTAL display.

(l) 11 - Internal Test:

- Function:

  To test the internal operation of the 6809 and its program. The test runs for about 30 seconds. The test cannot be stopped once it has been started.

- Display:

  TOTAL display will display an accumulating total that will stop at a specific value if the test is successful. This value of total will be 2824. RATE display should indicate 6729. The Total and Rate Display Decimal point positions depend on the Scale Capacity Decimal point position. (See Scale Capacity Set-Up Section 4.1.3.2-d.)

- Operation:

  (a) Press SET-UP, 1 , 1 , ENTER . The test is now in progress and normal integration <u>ceases</u>. The test will automatically stop after about 30 seconds. The integrator is in an idle state after the test.

(m) 12 - Error Clear

- Function:

  To clear the Error Code (ERRCD) and Error Status (ERRST) after an error has been detected.

- Display:

  TOTAL display will display any errors that occurred after the error that appears in RATE display. RATE display indicates RATE and "12P".

- Operation:

  (a) Press SETUP , 1 , 2 , ENTER . The error that appeared in RATE display before SETUP was entered has been cleared.

  (b) If any more errors are present, their number will appear, followed by a "E", in TOTAL display. (TOTAL display will be blank if no more errors are present.) The errors appear in ascending numerical order, not in the order of occurrence. The ENTER light will blank if an error appears in TOTAL display. Press ENTER to clear the displayed error.

  (c) Step (b) may be repeated as often as there are errors still appearing on TOTAL display.

(n) 13 - Speed Prescale

- Function:

  To examine and/or change the present value of Belt Speed Prescale (BSP). Belt pulses to the integrator are divided by 2 to the BSP power before entering into calculations.

- Display:

  TOTAL display will display the present value of BSP. RATE display indicates Rate and "13P".

- Operation:

  (a) Press SETUP , 1 , 3 , ENTER . The present BSP is displayed.

  (b) If a different BSP is wanted, key in that number through the keypad. The decimal point is ignored. The number being keyed in appears in TOTAL display. (Only numbers in the range 0-7 are accepted.) (2 to the 0 power divide by 1 to 2 to the 7 power divided by 128.)

  (c) Press ENTER . TOTAL display will blank for 1/2 second, then the new value of BSP in use is displayed.

  Note:

  The Belt Speed Prescale is correct if the Total Display counts at a rate of 300 - 600 counts per minute during an Acquire Test Duration (04) procedure.

(o) 14 - Current Out Range

- Function:

  To examine and/or change the present Current Output range. The available ranges are 0-20 mA and 4-20 mA.

- Display:

  TOTAL display will display the present range as "0--20" or "4--20". RATE display indicates Rate and "14P".

- Operation:
  (a) Press SETUP , 1 , 4 , ENTER . The present range is displayed.
  (b) If a different range is wanted, enter either 0 or 4. The number being keyed in appears in TOTAL display.
  (c) Press ENTER . TOTAL display will blank for 1/2 second, then the new range is displayed.

(p) 15 - Calibration Mode

The micro tech contains two independent CALCON variables--one is always active and available for view by the operator or the internal program; the other is "transparent" and cannot be viewed or changed. The selection of which CALCON is active and which is transparent is controlled by SETUP function 15, CALIBRATION MODE.

When function 15 is set to zero, the weight CALCON is active. When function 15 is set to one, the electronic cal CALCON is active. In addition, the code "EL" is displayed in the upper left display when function 15 is set to one while CALCON, CALIBRATION MODE, or AUTO SPAN are activated, thus queing the operator as to which CALCON he is using.

- Function:
  To examine and/or change the selected method of performing Auto Span. A "Ø" selects weights, a "1" selects electronic calibration using the "R-CAL" resistor.

- Operation:

  (a) Press SETUP, 1, 7, ENTER. CALTOT appears in TOTAL display.

  (b) Key in a reference weight (which will act as a CALCON). 0, 1, 2, or 3 digits may follow a decimal point.

  (c) Press ENTER to perform the recomputation and installation of SPAN. The new SPAN will be in TOTAL display. The previous value of SPAN has been lost. CALTOT has been cleared.

  The integrator is now in an idle state.

(s) 55 - Display ROM Version

- Function:

  To examine the ROM version numbers.

- Display:

  TOTAL display will display three two-digit numbers, each pair separated by a minus sign. The numbers are the version numbers of ROM's Ø, 1, and 2 from left to right. RATE display indicates Rate and "55P".

- Operation:

  (a) Press SETUP , 5 , 5 , ENTER . ROM version numbers will be displayed.

(t) 76 - Reset Cumulative Total

- Function:

  To reset the normally non-resettable Cumulative Total (CMTOT).

- Display:

  TOTAL display will display as described in "operation" below. RATE display indicates Rate and "76P".

- Operation:

  (a) Press SETUP , 7 , 6 , ENTER . All minus signs will appear in TOTAL display.

  (b) Key in the 1 to 8 digit "access code" through the keypad. The number being keyed in appears in TOTAL display. (The access code is "1853".)

  (c) Press ENTER . TOTAL display will go blank.

  (d) Press ENTER again. The Cumulative Total has now been reset. The integrator now automatically enters the RUN mode. NOTE: An incorrect or no access code will cause the integrator to exit function 76 and enter the RUN mode with CMTOT undisturbed.

4.1.3.3 Lamp Test

This mode is used to test the light-emitting diodes (LED's) that light the mode buttons and the vacuum fluorescent displays. Integration continues Lamp Test is functional only if the Integrator is in the RUN mode first.

- Display:

  Both displays will alternately blink all segments and then all decimal points. All LED's will blink on and off. All LED's should be off when the display segments are off.

- Operation:

  (a) Press LAMP TEST . Releasing the button will terminate the Lamp Test.

4.1.3.4 Auto Zero

This mode allows the automatic adjustment of the zero value to produce a zero accumulation with any weight on the scale. It is specifically intended for "zeroing out" the belt and its variations in weight over a period specified by the Test Duration (which ideally should be an integral number of belt revolutions.)

- Display:

  TOTAL display will display as described below in Operation. RATE display indicates Rate and an error code, if any.

- Operation:

  (a) Press AUTO ZERO . The Auto Zero (AZ) light will blink, TOTAL display will blank.

  (b) Press AUTO ZERO again to start test. The AZ light will be on steady. TOTAL display indicates an accumulating total in "times 10" accuracy.

  (c) The accumulation of data will terminate automatically. When this happens, the ENTER light and the total in TOTAL display will blink.

  (d) Press ENTER to perform the recomputation and installation of TARE. The new zero will be in TOTAL display. The previous value of zero has been lost.

NOTE: Pressing a different button or pressing ENTER at times other than described above will cause an early termination of Auto Zero, with no change made to zero. Data already accumulated for an auto zero will be lost.

4.1.3.5 Auto Span

The Auto Span mode allows automatic span calibration of a conveyor scale system. The Span is automatically adjusted so that for a given weight on the belt, a total accumulated over a specified test duration equals the "Calibration Constant." The weight seen by the integrator may be an actual input from a load cell or a simulated weight input using the "R-CAL" calibration resistor. (The type of weight input desired is set by Set-Up function 15.)

- Display:

  TOTAL display will display as described below in Operation. RATE display indicates Rate and an error code, if any.

- Operation:

  (a) Press AUTO SPAN . The Auto Span (AS) light will blink, TOTAL display will blank. If the R-CAL resistor has been selected ("electronic calibration"), an "EL" will appear left-most on TOTAL display.

(b) Press AUTO SPAN again to start. The AS light will be on steady. TOTAL display indicates an accumulating total in "times 10" accuracy. Again, if R-CAL has been selected, the "EL" will appear in TOTAL display. If the accumulating total exceeds 6 digits, only an "L" will appear left-most, followed by 7 digits of total.

(c) The accumulation of data will terminate automatically. When this happens, the ENTER light and the total in TOTAL display will blink.

(d) Press ENTER to perform the recomputation and installation of SPAN. The new SPAN will be in TOTAL display. The previous value of SPAN has been lost.

Pressing a button, other than ENTER, after the data acquisition has ended will cause the accumulated total (TOTAL) to be copied into CALTOT, for later use with Post-Span.

Pressing a button during the data acquisition will terminate Auto Span with no changes made to SPAN or CALTOT. Data already accumulated is lost.

CHAPTER 5

5.0 Specifications

5.1 Inputs

(a) Power Input

(1) Line voltage, switch selectable:

117Vac -15% +10%

or

234Vac -15% +10%

(2) Line frequency - 60Hz +-3Hz standard.
50Hz +-3Hz optional.

(3) Maximum power - 20VA (with optional current output board)

(4) Maximum non-destructive power input voltage - nominal (117/234Vac) +15%

(5) Fuse

117Vac input - 1/4A Slo-Blo

or

234Vac input - 1/8A Slo-Blo

U.S. AG-3 (1/4" x 1-1/4") size standard.

Metric (5mm x 20mm) size accepted using optional metric fuse carrier.

L1 (hot) line fusing standard. Second fuse for L2 (neutral) (non-U.S.) fusing optional.

(6) Power Switch

L1 (hot) line switching, SPST, slide switch standard.

L1 (hot) and L2 (neutral) line switching, (non-U.S.), DPST, slide switch optional.

(b) Weight (load cell) Input

(1) One 120 ohm or up to three 350 ohm strain gauge load cells.

(2) Nominal 3mV/V load cell full scale output.

(3) Maximum tare signal - 85% of load cell capacity.

(4) Minimum net signal - 15% of load cell capacity.

(5) Input impedance - 20K ohm typical.

(6) Maximum usable input - 31.5mV (105% of 3mV/V load cell).

(7) Maximum non-destructive input voltage - +-5V peak.

(c) Excitation Sense Input

(1) Nominal input voltage - 10Vdc (+5 and -5Vdc).

(2) Input impedance - 38K ohm typical.

(3) Maximum non-destructive input voltage - 50V peak.

(d) Speed (sensor) Input

(1) Frequency range:
Voltage or current type sensor - 0 to 1.2K Hz.
Contact closure type sensor - 0 to 30Hz.

(2) Low threshold - +1.0Vdc +-10%.

(3) High threshold - +2.0Vdc +-10%.

(4) Low or high pulse duration:
Voltage or current type sensor - 100us minimum.
Contact type input - 15ms minimum.

(5) Hysteresis - 0.8Vdc minimum.

(6) Input impedance - 6.4K ohm typical, 1.0K ohm minimum.

(7) Input source current - 0.8mA nom. at 0Vdc, decreasing linearly to 0mA nom. at +5Vdc.

(8) Maximum non-destructive input voltage - +-50V peak, continuous.

(e) R-CAL (resistor calibration) Input

(1) Resistance range - 10K ohm minimum to 1 Megohm maximum.

(2) Maximum voltage (seen by resistor) - 5.25V peak.

(f) Operator Inputs

(1) Six front panel mounted mode select lighted pushbuttons for frequently used functions:

RUN	AUTO ZERO
SET UP	AUTO SPAN
LAMP TEST	ENTER

(2) One 12-key keypad for system set-up and reconfiguration, mounted behind fold-down, lower front panel:

0-9 (numerals)
"." (decimal point)
CLR (clear)

Key actuation force - 6 oz. nominal, snap acting return.

5.2 Outputs

(a) Excitation Output

(1) Output voltage - 10Vdc +-5%.

(2) Output ripple voltage - 10mV peak to peak maximum.

(3) Minimum load impedance (operating) - 110 ohm.

(4) Output short circuit current limit - 1.5A maximum.

(5) Maximum non-destructive voltage on output - 11V peak maximum.

(b) Speed Sensor Supply Output

(1) Output voltage - +24Vdc +-20% (unregulated).

(2) Output voltage ripple - 1.0V peak to peak typical.

(3) Output current - 50mA maximum.

(c) Displays

(1) Type - vacuum fluorescent, seven segment.

(2) Number of digits - 8 digit with decimal points.

(3) Digit size - 4.5mm H x 2.3mm W.

(4) Color of illumination - blue-green.

(5) Brightness - 100 fL minimum.

(6) Life - 80,000 hr typical.

(d) Total Display

(1) Number of digits - 8 digit plus decimal points for display of total in the run mode and 7 digits plus sign and decimal points in the set-up or calibrate mode.

(2) Update rate - 6 times/second.

(e) Rate Display

(1) Number of digits - 4 digits plus decimal point and sign for display of rate. 3 digits for procedure and error information.

(2) Update rate - 6 times/second.

(See damping factor for rate.)

(f) Remote Total Contact Output

(1) Contact rating - 10A maximum at 240Vac, 3A maximum at 30Vdc.

(2) Pulse (closed) duration - 50ms +-20%.

(3) Rate - 10Hz maximum.

(4) Remote total contact output remains inactive for rates less than 2%.

(g) Current Output (optional)

(1) Output range - user selectable 0mA to 20mA or 4mA to 20mA. Representing 0 to 100% flow rate.

(2) Isolation - in accordance with ISA Standard S50.1.

(3) Resolution - 0.14% minimum.

(4) Resistive load - 800 ohm maximum.

(5) Capacitive load - no limit.

(6) Noise - 50uA peak to peak maximum.

(7) Short circuit protection - short circuit proof per ISA Standard S50.1.

(8) Maximum non-destructive voltage on output - -5V to +40V peak.

(9) Response - 0.1ms maximum to within 0.14% for any size step input.

5.3 Accuracy (system)

(a) Linearity - less than 0.05% of net non-linearity for inputs from 0 to 105% of full scale.

(b) Input conversion rate - .25/second minimum to 6/second maximum (speed input dependent).

(c) Response rate:

Time required for output (displays or current output) to settle to within 0.1% of final output for an input step change. (Note: zero damping and greater than 6Hz divided speed input.)

System - less than 0.6s (0 to 100% speed and weight step change.)

(1) Weight input - less than 0.6s (0 to 100% step change).

(2) Speed input - less than 0.32s (100% step change). 0.4s maximum for less than 6Hz divided speed input.

(d) Temperature coefficients:

(1) Zero - 0.25uV/C maximum (equal to 8.3 parts per million/^{o}C relative to full scale for 3mV/V load cell).

(2) Span - 50 parts per million/^{o}C maximum.

(3) I/Out Zero - 0.2uA/^{o}C maximum (equal to 10ppm/^{o}C relative to full scale for 20mA output).

(4) I/Out Span - 60ppm/^{o}C typical, 100ppm/^{o}C maximum.

5.4 Environmental

(a) Humidity - up to 95% RH non-condensing.

(b) Temperature:

(1) Storage - -40^{o}C to +70^{o}C (-40^{o}F to +94^{o}F) ambient.

(2) Operating - -10^{o}C to +50^{o}C (-6.2^{o}F to +122^{o}F) ambient.

(c) Vibration - designed to meet EEC Working Document III/479/78-F.

(d) RFI/EMI (Radio Frequency Interference/Electro-Magnetic Interference) - designed to meet EEC Working Document III/379/78-F and meet FCC Standard 799-555; 14686.

(e) Noise rejection (weight input):

(1) CMRR (Common Mode Rejection Ratio) - 120dB minimum at 60Hz.

(2) NMRR (Normal Mode Rejection Ratio) - 90dB minimum at 60Hz.

NOTE: Maximum common mode signal range is -5.0 to +2.3V peak.

Maximum allowable dc normal mode not to exceed 100% of full scale weight signal.

5.5 Other Specifications

(a) Power failure detection and battery back-Up.

(1) Power failure detection:

Threshold level - 80% of nominal for longer than 4ms.

(2) Battery back-Up:

(a) Type - 3.6V, Lithium, .85Ah, 1/2 AA size.

(b) Life:

(1) Storage (disconnected) - 87,600 hours typical.

(2) Operating - 8,760 hours minimum, up to 43,800 hours typical, depending on frequency and duration of power outages.

(b) Enclosure:

(1) Type - field, surface mount.

(2) Construction - 14 gauge steel, conforms to NEMA Standard for type 4 (water-tight and dust-tight) enclosures.

(3) Finish - Ramsey blue spatter vinyl paint, EXCEL# X5-1238.

(4) Size (overall) - 13.5" H x 11.0" W x 5.6" D.

(5) Weight - 8.45 kg (18.63 lb).

5.6 Operating Parameters (keypad selectable)

5.6.1 Manual zero: any integer between 0 and 65,520.

5.6.2 Manual span: any integer from 1000 to 600,000.

5.6.3 Scale capacity: any number from 0 to 194,400 (representing counts/hour), including up to 3 fractional digits.

5.6.4 Test duration: from 0 to 8,000,000 speed pulses.

5.6.5 Calibration constant: any integer between 0 and 194,400 units of totalized test weight.

5.6.6 Damping: any integer from 0 to 10 (x) representing 1.6 seconds times 2 to the (x) power. Full damping range less than 0.6 seconds to 14.2 minutes.

5.6.7 Speed prescale: any integer from 0 to 7 represents the number of times the speed pulses are divided by two. Maximum prescale divide by 128.

5.6.8 Current range: select (0) 0 to 20mA or (4) 4 to 20mA output range of optional current output.

5.6.9 Calibration mode: select (0) for test weight calibration mode or (1) for electronic (R-Cal) calibration mode.

5.6.10 Divide out: select 1, 10, or 100 to divide the total output driving the remote counter(s) by 1, 10, or 100 respectively.

5.7 Operating Parameters (jumper selectable)

5.7.1 Auto Zero Tracking (jumper W10)

Continuous automatic zeroing if in the RUN mode and if the rate is less than or equal to 2% of scale capacity for a minimum of 1.5 test durations.

5.7.2 Weight Input Sensor Type (jumpers W1-W4, W7, W8, W17, and W18)

(a) Strain gauge load cell type input (ratiometeric) - jumpers W1, W3, and W7 installed.

(b) Special input (non-strain gauge load cell type), 0mA to 10mA - jumpers W2, W4, and W8 installed.

5.7.3 Excitation Sense Location (jumpers W19 and W20)

(a) Local excitation sensing (0 to 200 feet load cell integrator distance) - jumpers W19 and W20 installed [standard]).

(b) Remote excitation sensing (over 200 feet load cell integrator distance) - jumpers W19 and W20 removed, remote sense wires connected from field terminals 5 and 6 to remote located load cell junction box.

5.7.4 Speed Input Sensor Type (jumpers W5 and W6)

(a) Voltage or current type (0 to 1.2K Hz) - jumper W6 installed.

(b) Contact or vane switch type (0 to 30Hz) - jumper W5 installed.

CHAPTER 6

6.0 THEORY OF OPERATION

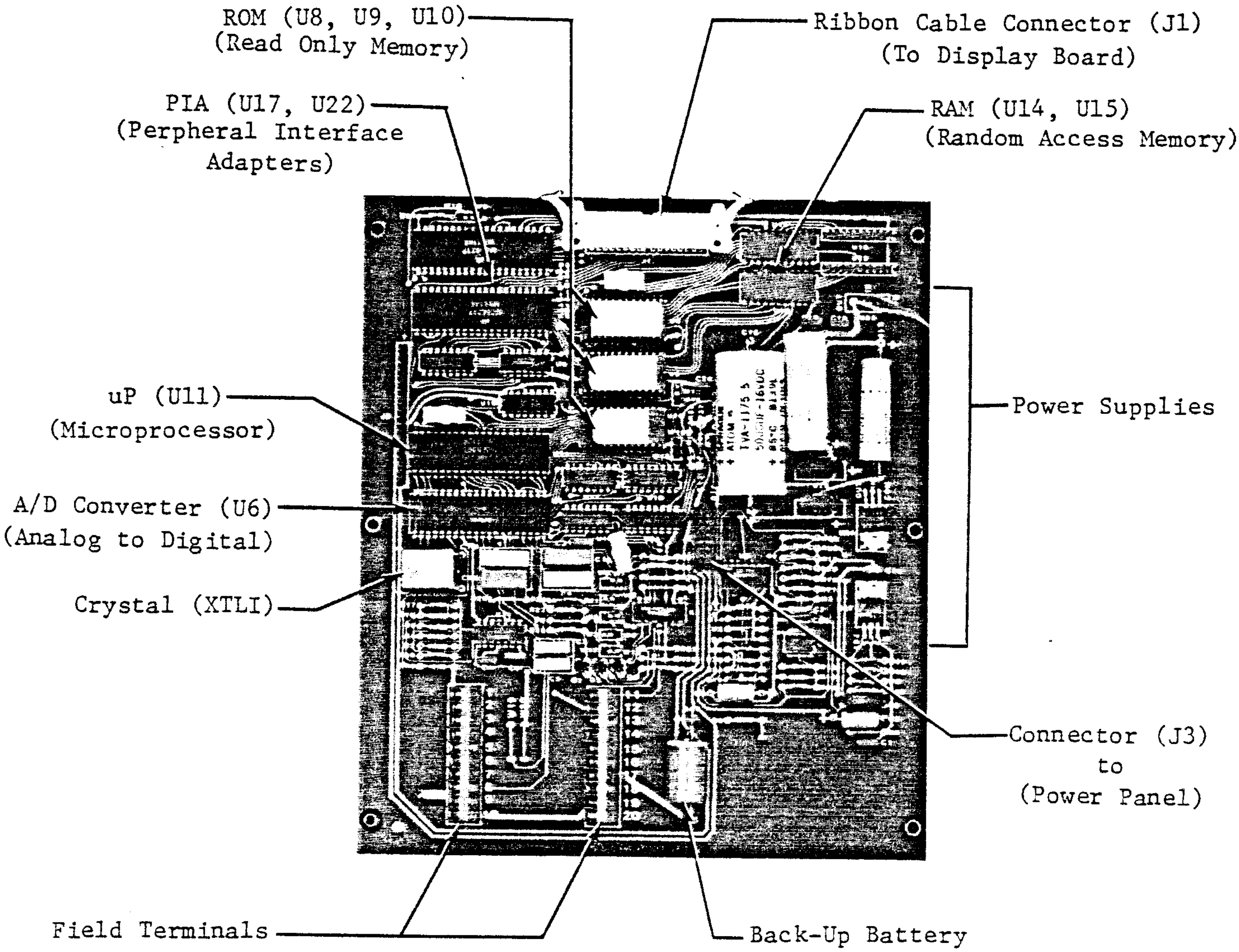
6.1 General Hardware

The Model 10-201 Micro-Tech Integrator consists of two printed circuit boards, a CPU board, display board, and a power panel. There are also provisions for an optional current output (I/Out) board. Refer to the Functional Block Diagram A/13 in the Appendix.

The CPU board is the main printed circuit board and contains all of the load cell signal processing and system control logic. Located on this board is the pre-amplifier and analog-to-digital converter for digitizing the load cell signal, and the power source to excite (power) the load cell. The CPU board also contains the micro-processor and its associated support components, the power panel connections and field terminals. Refer to Figure 6.1.1.

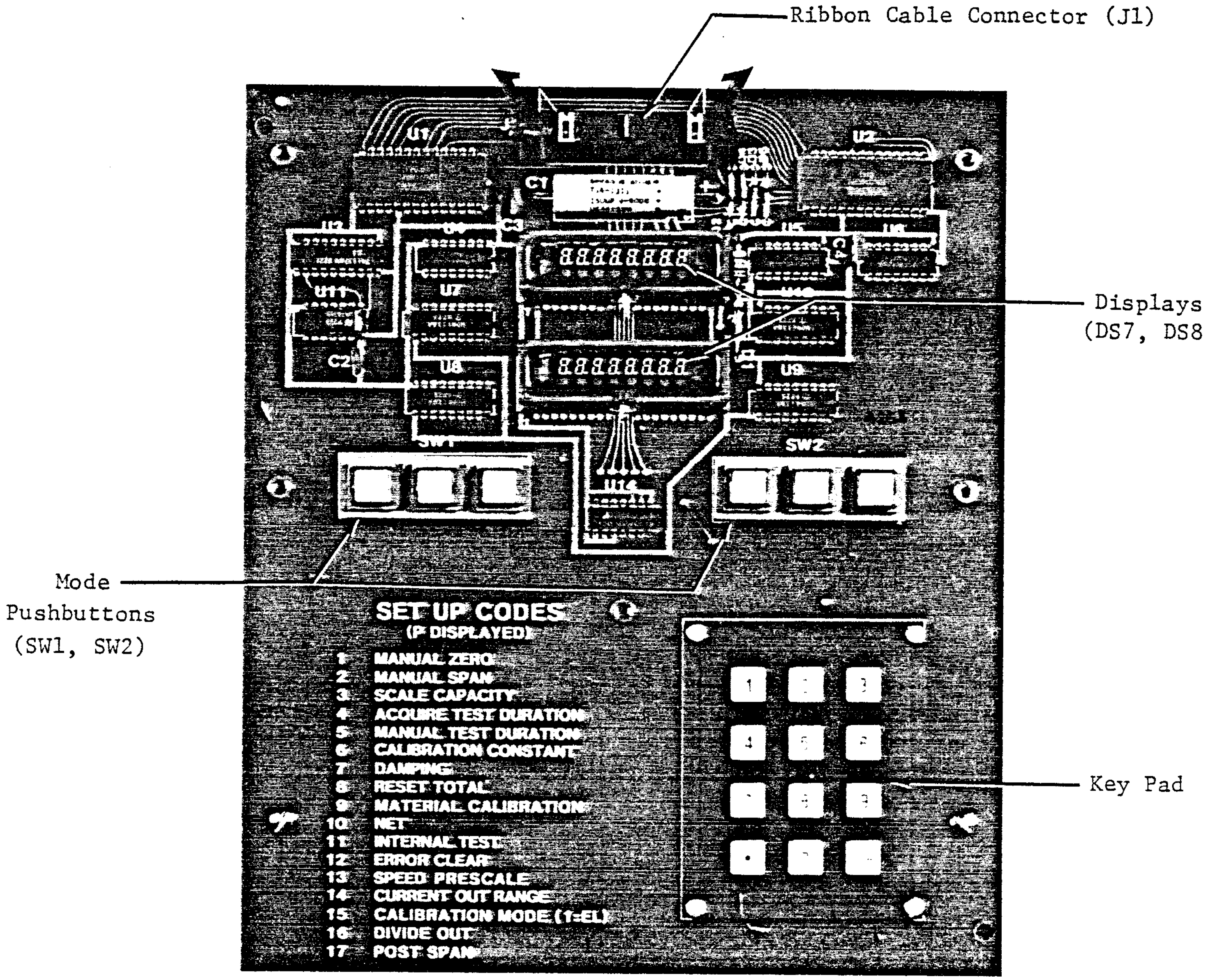
The display board contains the two front panel displays, six lighted pushbuttons, keypad, and the necessary controller/decoder integrated circuits for front panel communications to and from the CPU board. Refer to Figure 6.1.2.

The optional current output (I/Out) board contains the necessary isolated power supplies and signal electronics to produce an isolated 0 to 20 or 4 to 20 milliamp current output signal that is proportional to material flow rate. This signal is commonly used for material flow rate recordation, indication, or control. Refer to Figures 6.1.3 and 6.1.4.



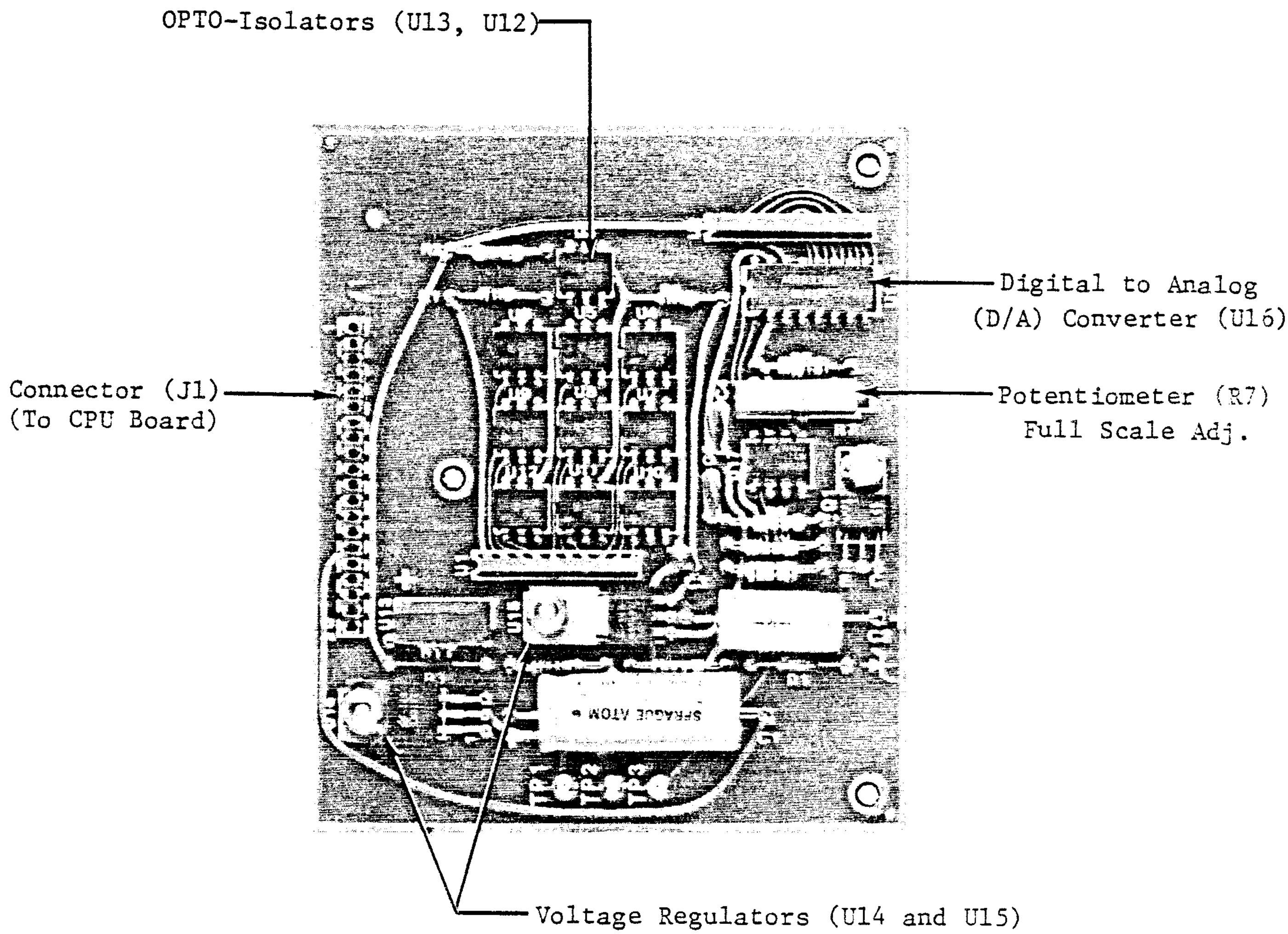
CPU Board Printed Circuit Board Assembly

Figure 6.1.1



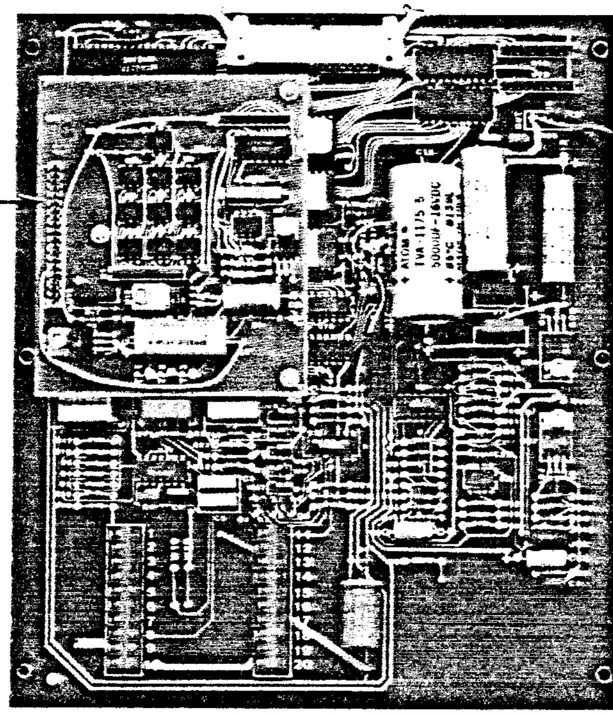
Display Board Printed Circuit Board Assembly

Figure 6.1.2



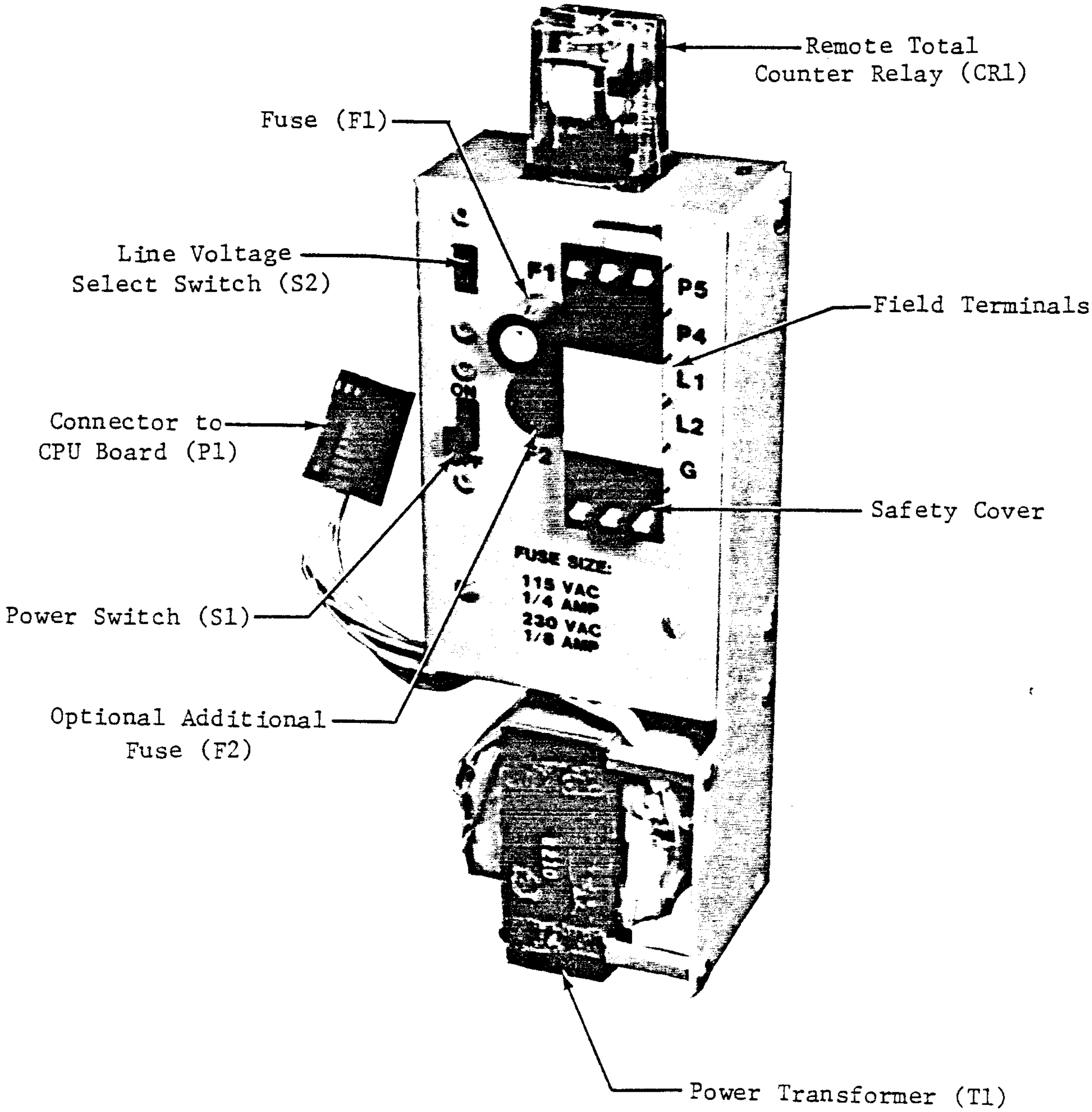
Current Output Board (Optional)
Plug-In Printed Circuit Board Assembly

Figure 6.1.3



CPU Board
Current Output Board Installed

Figure 6.1.4

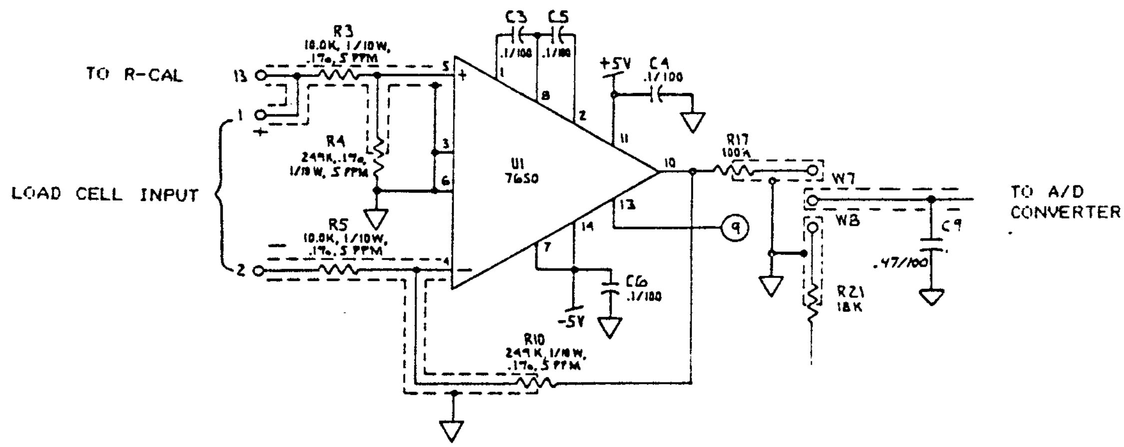


Power Panel Assembly

Figure 6.1.5

6.2 CPU Board

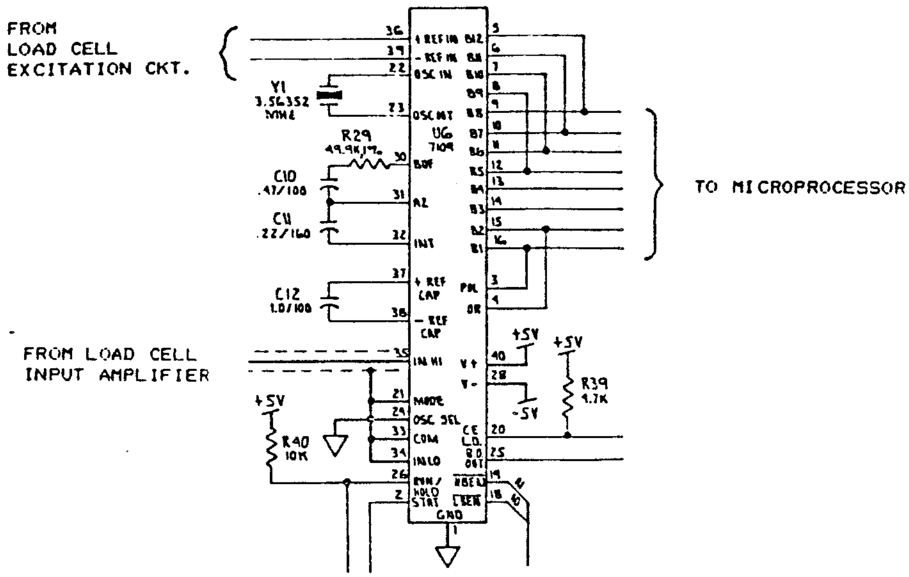
Please refer to the CPU Board Schematic A/14 in the Appendix.



Load Cell Input Amplifier

Figure 6.2

The load cell signal is amplified approximately 25 times by a chopper stabilized operational amplifier (U1). This amplifier is configured as a differential amplifier for optimum noise (common mode) reduction. The amplified signal is them filtered as it passes through a single pole low pass filter (R17 & C9). This filter dampens or filters out most of the AC components of the signal above 3.4Hz. Signals above these frequencies are generally considered noise and are most often caused by scale vibration or stray electrical signals. The amplified load cell signal along with the load cell excitation sense inputs are used by the analog to digital converter (U6).

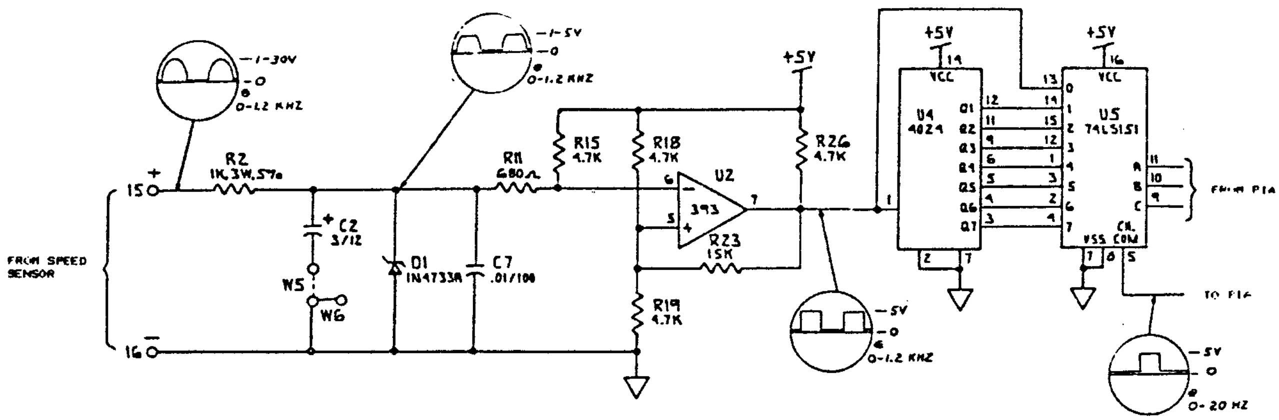


A/D (Analog to Digital) Converter

Figure 6.3

The A/D converter (U6) is a monolithic, microprocessor compatible, dual slope, analog to digital converter. The integration (slope) time is set to 1/30th of a second for maximum rejection of line frequency noise. This time is set and controlled by the quartz crystal (XTAL 1). The clock output of the A/D converter (pin 25) is used by the microprocessor (U11) for all system timing.

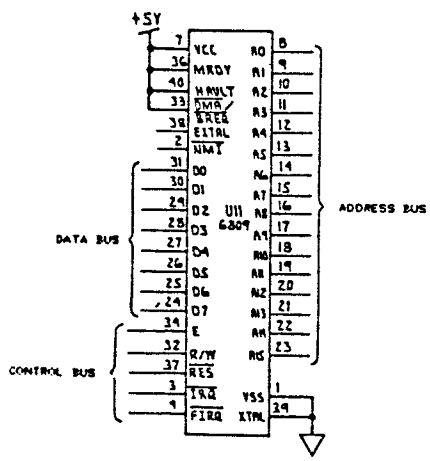
Load cell excitation sense inputs are reduced from approximately 10Vdc to about 0.43V by the voltage divider comprised of three resistors (R6, R8, and R9). This voltage is used as the reference voltage for the A/D converter (U6). Using a portion of the excitation voltage as the reference makes the system insensitive to variations in load cell excitation voltage. Full scale input to the A/D converter is twice the reference voltage or .86 volts. This provides the system with 15 percent load cell input overrange capability when using 3 millivolt per volt load cells.



Speed Sensor Input Circuit

Figure 6.4

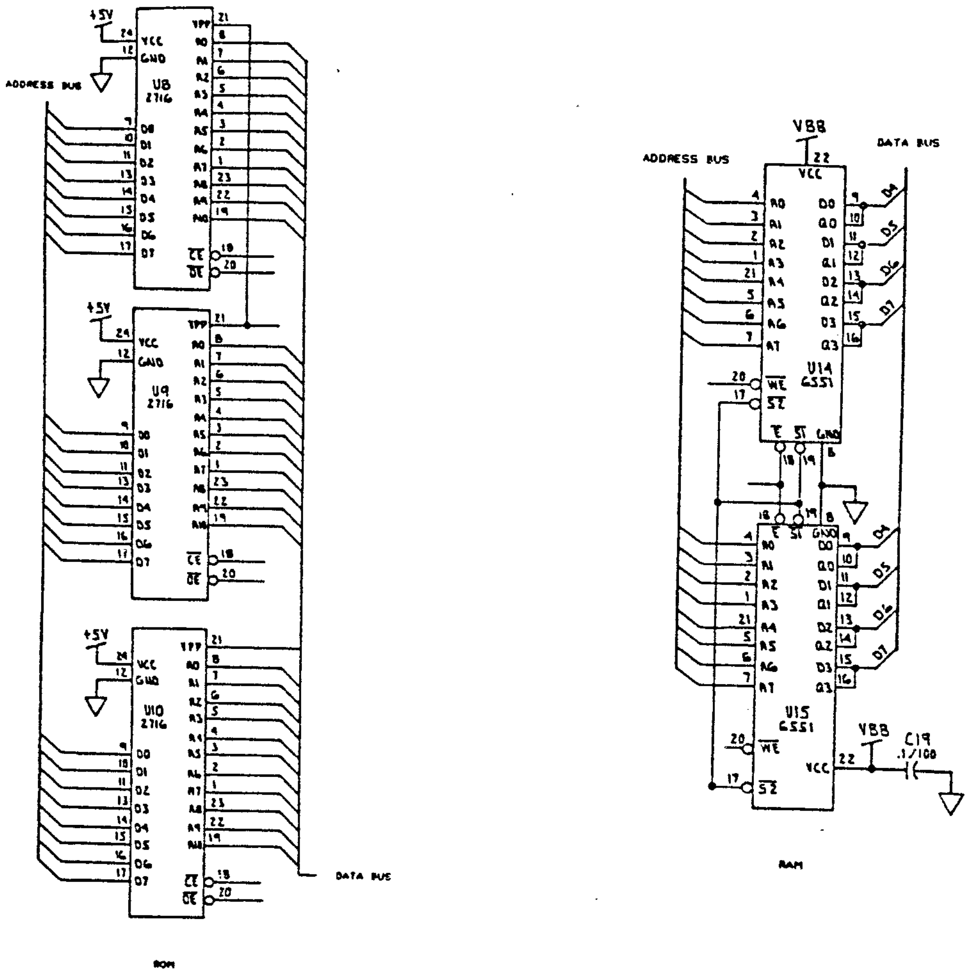
The speed signal is shaped by comparator (U2) using hysteresis. The signal is then divided by a selectable power of two, using U4 and U5, and then sent on to microprocessor (U11) by way of U7 and U22. The divide ratio is controlled by the lines PB5, PB6, and PB7 of U7.



Microprocessor

Figure 6.5

The microprocessor (U11) is a "6809" and uses an 8-bit data bus D0-D7 (pins 24-31) and a 16-bit address bus A0-A15 (pins 8-23) for communication with the A/D converter (U6), ROM (Read Only Memory) (U8-U10), RAM (Random Access Memory) (U14 and U15), and I/O (input/output) (U7 and U22).

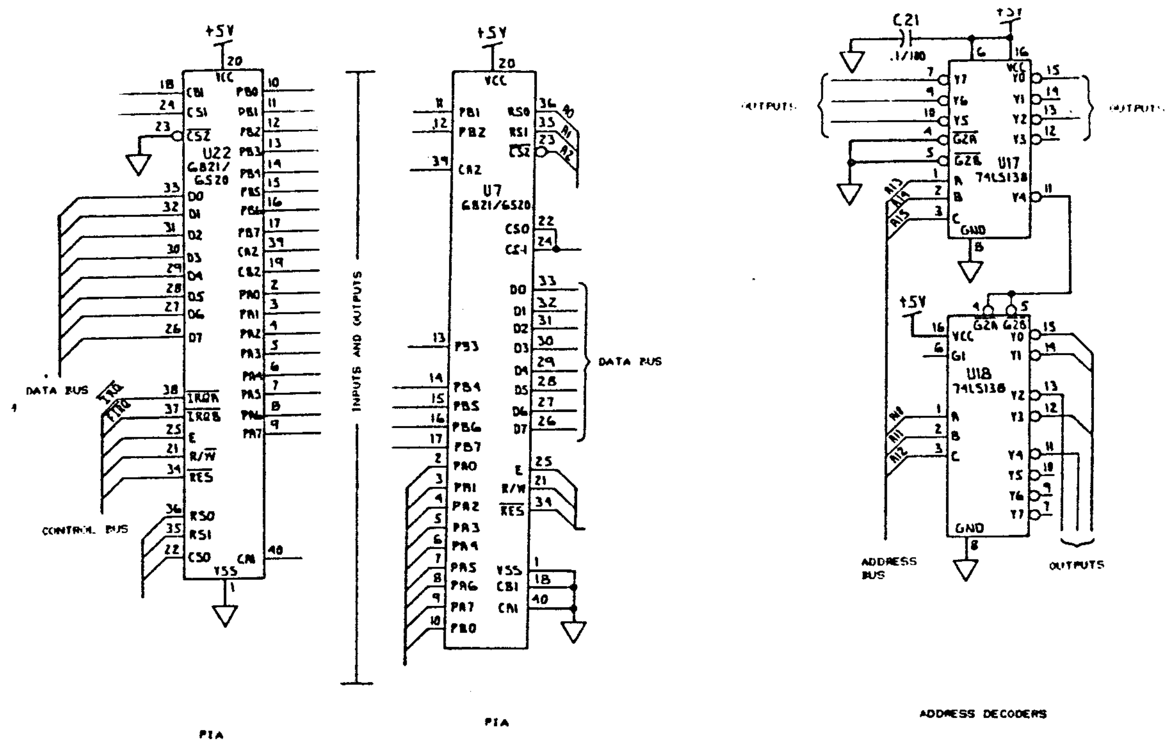


Read Only Memory (ROM) and Random Access Memory (RAM)

Figure 6.6

The ROM integrated circuits (U8-U10) are preprogrammed at the factory. They contain up to 12,000 bytes (words) of instructions and information for system operation. Data are output from each ROM on pins 9 - 11 and 13 - 17. Each ROM device is addressed using pins 1 - 8, 19, 22, and 23. The system may be configured to use either "2716" or "2732" type ROM devices by positioning option jumpers (W13, W14) and (W15, W16). Jumpers installed in positions W13 and W15 are for "2716" and W14 and W16 for "2732" type devices.

The RAM devices (U14 and U15) are continually programmable and contain storage space for up to 256 words of information. The RAM is used by the system as storage for system constants; i.e., zero, span, and for system variables such as last total or rate. The RAM devices exchange data using pins 9 - 16 and are addressed by the microprocessor (U11) through pins 1 - 7 and 21. The RAM is battery-supported and retains its information in the event of a power outage or brownout.



Peripheral Interface Adapters (PIA) and Address Decoders

Figure 6.7

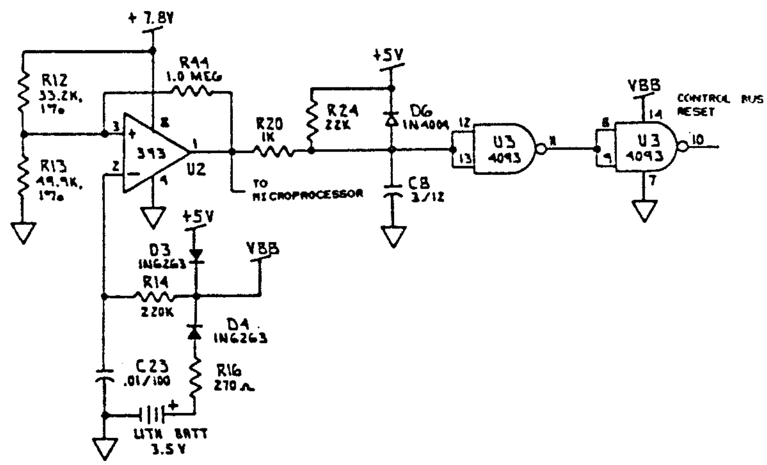
All information exchanged between the microprocessor (U1) and the ROM, RAM, A/D, and the PIA (Peripheral Interface Adapter) devices (U7 and U22) is controlled by address decoder devices (U17 and U18). U17 and U18 receive address information from the microprocessor (U11) address lines (A10 - A15) and decode the information to produce outputs (Y0-Y7). These decoder outputs in conjunction with address lines A0, A1, and A2 select system functions. Refer to the Address - Function Decode Table A/8 in the Appendix.

Peripheral Interface Adapter (PIA) devices (U7 and U22) are used to communicate with the display and I/Out (current output) boards, set the speed input divide ratio, read the jumper (W) positions, control the R-Cal and Remote Total Counter Relays, and process the interrupts generated by the speed input signal and the real time clock.

PIA (U7) communicates with A/D converter (U6) status and run controls (pins 2 and 26) and the nuclear input status (base of Q2). U7 also controls the R-Cal relay (K1)1, sets the speed input divide ratio using U5 pins 9, 10, and 11. In addition, U7 checks for any front panel mode button or keypad entry on pins 2 - 10.

PIA (U22) communicates with most of the remaining input/output signals. U22 pins 10 - 17, 19, and 39 interface with the optional current output board. Pins 2 - 9 control the total and rate displays and the indicating lights in the mode buttons. Two inputs to U22, predivided speed pin 40, and RTC (Real Time Clock) pins 18 are special in that each force the microprocessor to interrupt whatever it was doing and process the speed or RTC input. The reason for this is that both speed and RTC inputs are time related and must be processed without delay.

The microprocessor system clock signal is produced by the A/D converter using crystal (XTAL 1). This clock signal is input to the microprocessor (U11) pin 38 and is divided down to .8909MHz pin 34 to provide the internal timing functions used by the microprocessor. The .8909MHz clock signal is also input to a divider circuit (U16) pin 10. U16 produces two lower frequency clocks, 480Hz from pin 15, and 3480Hz from pin 13. The 480Hz signal is used by the weight input amplifier (U1) pin 13 and the 3480Hz clock is input to PIA (22) pin 18 and is used as the system RTC (Real Time Clock) interrupt.



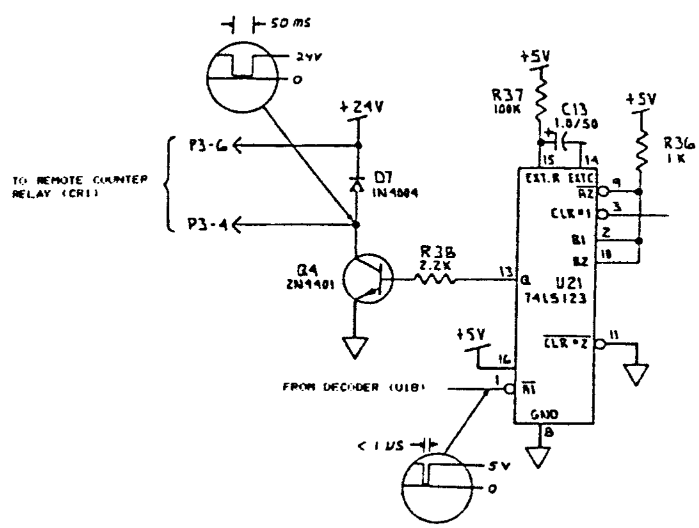
Power Fail Sensing Circuit

Figure 6.8

Power failure is detected by the comparator (U2) and its support circuitry, R12, R13, R14, and R44. The unregulated voltage on the input of the +5V regulator (U23) is compared by U2 pin 3 with the +4.7V regulated voltage appearing at diode (CR3). If U2 senses that the unregulated voltage drops below about +7.8V, its output (pin 1) goes low and interrupts the microprocessor (U11) pin 2 informing it that a power failure is occurring. The microprocessor initializes an orderly shutdown by saving all important system data.

If the output of comparator (U2) pin 1 is low for more than 4msec, as sensed by U3 pins 12 and 13, the whole system is reset. The RAM (U14 and U15) remain powered by the back-up battery and system parameters are retained. If U2 pin 1 is low for less than 4ms, the power outage was temporary and the system is not reset. In this case, the microprocessor resumes normal operation and no information is lost.

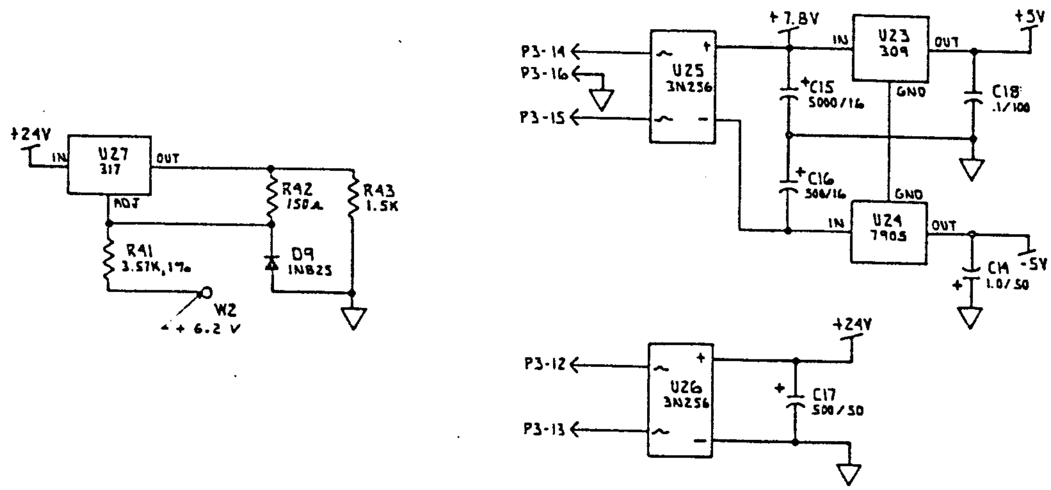
Power for the RAM devices (U14 and U15) is normally supplied by the main +5V power supply through diode (CR3) under normal line voltage conditions. When there is a power failure, power to U14 and U15 is supplied by battery (Batt 1) through diode (CR4) and resistor (R16). Diode resistor (R16) limits the current flow out of the battery to a safe level in the event of a circuit failure. Diode (CR3) prevents the battery current from flowing to the +5V supply line when there is a power failure, and allows the +5V to supply the RAM when power is okay.



Remote Total Counter Relay Driver

Figure 6.9

The Remote Total Counter Relay is controlled by timing device U21. U21 is triggered by the microprocessor on pin 1 and outputs a constant width pulse on pin 13. Resistor (R37) and capacitor (C13) set the pulse duration to about 50ms. The pulse is triggered by driver transistor (Q4), which in turn, drives the power panel mounted remote total counter relay (CR1).



CPU Board Power Supply Circuits

Figure 6.10

Power to supply all of the circuitry is transformed from the high AC line voltage to lower, safer separate AC voltages at the power panel and is connected to the CPU board through the cable connector (P3). These lower AC voltages are then used by the four main DC power supply sections, three of which are on the CPU board.

Diode bridge (U26) and capacitor (C17) produce the filtered, but unregulated +24Vdc, which supplies power for remote total counter relay (CR1), speed sensor power (terminal 17), and the reference voltage produced by voltage regulator (U27) and reference diode (D9).

Diode bridge (U25), capacitors (C15 and C16), voltage regulator (U23 and U24) form the plus and minus 5Vdc regulated supplies. U23 supplies a considerable amount of current, and in doing so, produces heat. Mounting U23 to the metal chassis effectively dissipates this heat. U23 and U24 supply all of the remaining CPU board and display board power needs with the exception of the display board and mounted displays and display drivers, and the optional plug-in circuit output board.

The display board display drivers (U7, U8, U9, and U10) are supplied with unregulated +28Vdc by diodes (CR2-CR5) and capacitor (C1). Resistor (R1) and voltage reference diode (D1) establish a reference level for the 2.8Vac, which supply both the total and rate displays (DS7 and DS8).

6.3 Display Board

The display board contains the rate and total displays, keypad, mode lighted pushbuttons, and the associated decoder-driver circuitry. The display board sends and receives information to and from the CPU board through a 34 conductor flat ribbon cable. Refer to the display board schematic A/16 in the Appendix.

The display decoder/controller integrated circuits (U1 and U2) accept display data from the microprocessor (U11) through the PIA device (U22) on the CPU board. The data is internally decoded into a form suitable for the multiplexed displays (DS7 and DS8). Drivers (U7 - U10) accept the decoded signals, translate them to +28Vdc level and drive the displays. Data for the LED's (light emitting diodes) (DS1 - DS6) mounted in the lighted pushbuttons is received and latched by latch device (U3). Driver (U11) provides the drive current for the LED's. The keypad and mode pushbuttons signals are received by the PIA (U7) pins 2 - 10 on the CPU board and sent to the microprocessor (U11).

6.4 Current Output (I/Out) Board (optional)

The current output board provides the user with an isolated current output of either 0mA to 20mA or 4mA to 20mA material flow rate signal. This board plugs onto the CPU board connector (J1). Refer to the current output board schematic A/18 in the Appendix.

A 10-bit parallel digital signal representing flow rate is sent to the I/Out board from PIA (U22) pins 10 - 17, 19, and 39 on the CPU board. These signals are electrically isolated on the I/Out board using optical isolators (U3 - U12) and are used to control a D/A (digital to analog) converter (U16). A code of 900 (1110000100 binary) on U16 pins 4 - 13 produces a current output of 20mA. This provides a 17% overrange capacity for a 4mA to 20mA output signal. The -6.2Vdc reference voltage for the D/A converter (U16) pin 15 is generated by regulator for the voltage reference diode (D1). U16 and U17, with a reference voltage of -6.2Vdc and a digital input of 900, produce +5.45Vdc at TP3 (test point 3).

The potentiometer (R7) is factory adjusted to set the full scale current output for 20mA with a 900 digital input. Amplifier (U17 pins 1 - 3) and transistor (Q1) are configured as a current sink. With a 4.98Vdc on pin 3 of U17, a current of 20mA will flow through Q1, R12, and the current output load seen between Q1 and R11.

6.5 Theory of Operation - Software

6.5.1 Introduction

This section will describe the program of instructions by which the Integrator achieves its many operating characteristics. The description will avoid the use of or need for understanding the vocabulary of "machine language" in which the program is written. Instead, the results of the 6809 micro-computer's execution of groups of these instructions and their inter-relationship to the execution of other groupings will be explained in non-specialized terms. It will be useful for the reader to refer to the Hardware Theory of Operation (Section 6.1) and the Functional Block Diagram A/13 in the Appendix. Reference to the "6809 User's Manual" may also be helpful for more comprehensive study of this topic.

In the following descriptions, the terms "6809" and "processor" are used synonymously. They refer to the micro-computer itself. The term "integrator" refers to the entire unit--the processor and its associated equipment such as analog-to-digital converter, contained within the enclosure.

In this description, variable and constant names are spelled either with all small-case letters, capitalized, or with all capital letters depending on use. Names spelled with all small letters refer to a general concept, such as "capacity" or "total" or "tare". Names spelled with a capital followed by small-case letters refer to the proper names given to a value or register;

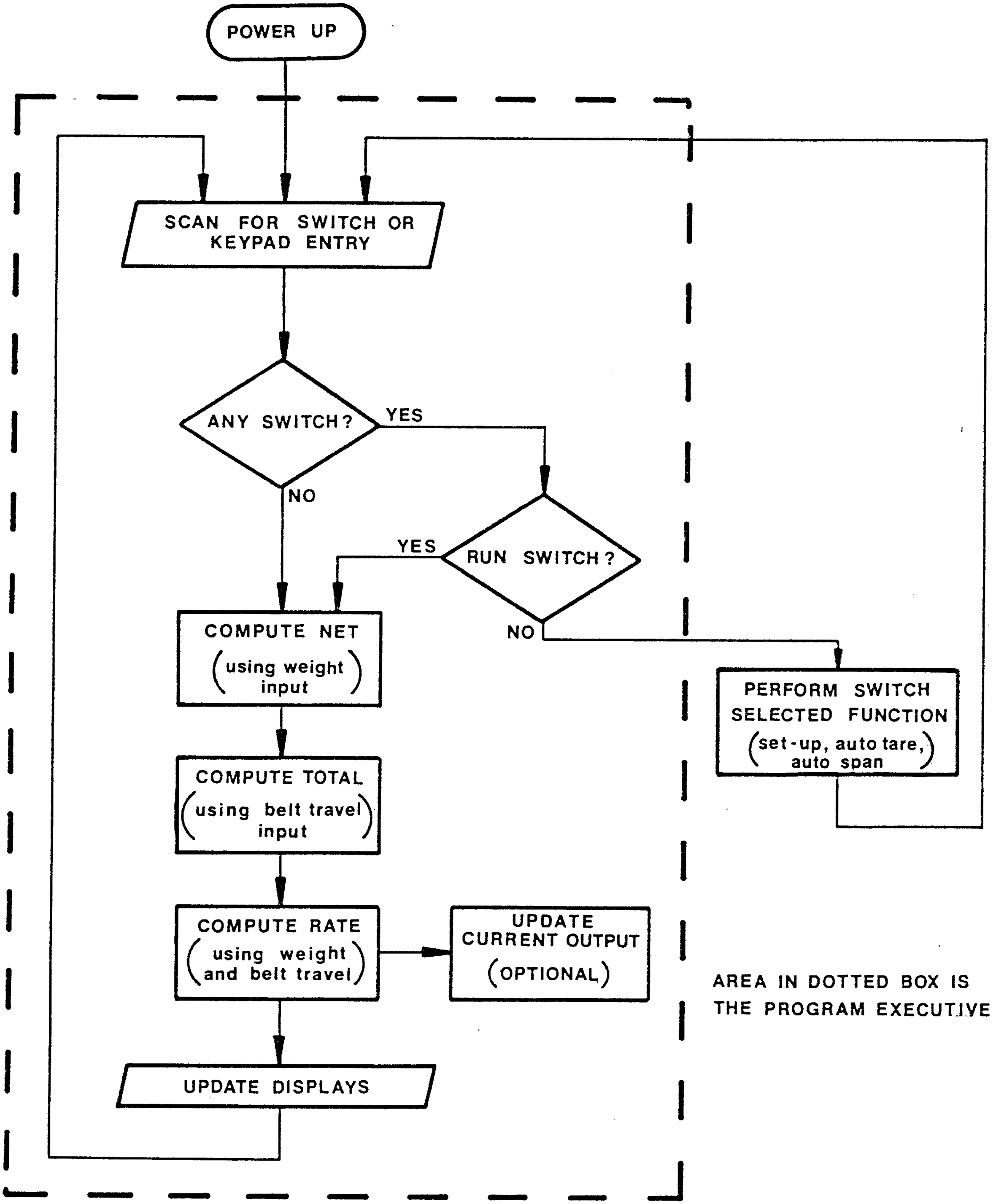
such as "Scale Capacity" or "Cumulative Total". Names spelled with all capitals refer to the actual name of the variable as it is found in the program, such as "CAP" or "CMTOT" or "TARE". Also, subroutine names and switch names are spelled with all capitals.

6.5.2 General Overview

The 6809 Micro-Computer operates by repeatedly examining its associated Read Only Memory (ROM) for an instruction word and on receipt of each, performing the action defined by that word. It repeats this activity from the time the AC power is turned on until it is turned off. There is no time when it is not executing an instruction. Each instruction word requires an average of 5 microseconds of time for its procurement from ROM and its execution; or taken another way, approximately 200,000 instruction words are procured from ROM and executed each second.

It is not important for the understanding of this description that the organization of specific groups of instructions in ROM be understood nor how the 6809 is directed from one group of instructions to another. It is important to understand that certain groups of instructions are termed subroutines and that the 6809 is directed to a subroutine by a specific instruction word and returns to take up where it left off on completion of the task described by the subroutine. In the 6809, the group of instructions termed a subroutine may contain subsidiary subroutines and they contain still more subsidiary subroutines. By this means, certain instruction groups are utilized extensively throughout all parts of the program.

One other special feature of the 6809 needs to be explained before beginning the examination of the Integrator program. This is the interrupt. On receipt of the Interrupt Signal (applied to one of three terminals on the micro-computer), the 6809 completes the instruction it is then executing and then proceeds to a certain instruction group to perform the task there described. On completion of that task, it resumes the activity that was interrupted in exactly the same manner as though no interruption had happened, except for the time lost.



Simplified Program Flowchart

Figure 6.12

6.5.3 Main Operating Program

Figure 6.12 illustrates the cyclic nature of the main operating program. Each rectangular block represents a dedicated group of instructions (which may largely consist of subroutines) which perform the named task when they are executed. Each of the diamond-shaped blocks represents a decision and program "branch point." At each branch point, the program may take one or two courses, depending on the result of the decision, which is usually the yes or no answer to the question posed for decision. Starting at the top of the diagram, the 6809 scans the switches to check for an entry. If an entry is present, the processor performs the selected procedure (further described later) and returns to scan the switches again. If no entry is present, the next action performed is to update the cumulative total, and calculate the latest value for rate. The two displays are then updated with the new total and rate. The entire process is then repeated.

The group of instructions within the dotted area is referred to as the program "executive" (EXEC). Normal operation of the integrator is in the RUN mode, carried out in EXEC. Other modes and functions (set-up, auto calibration, etc.) are performed in other subroutines of the program.

The processor is always scanning, computing, updating, or being interrupted. Even if no load is indicated or no belt travel is detected, the procedures and computations continue, with no changes resulting in total or rate. (Some computations are suppressed in certain SET-UP procedures. These are noted in the SET-UP procedure descriptions.)

6.5.4 Interrupt Handler

The interrupt handler is the name given to the instruction group dedicated to servicing the interrupt signals. The integrator receives two different interrupts--the "real-time clock" and the "belt pulse" or "speed" interrupt.

The real-time clock interrupts the processor approximately every 287uS. The interrupt is "handled" by incrementing the real-time counter (TIME).

TIME provides the integrator with a conception of the passing time, for computation of RATE.

A belt pulse interrupt occurs at varied rates, corresponding to the actual travel of the conveyor belt and the amount of pre-scale set. (Typical belt pulse rate is 10 Hz.) A belt pulse interrupt is handled by incrementing the belt pulse counter (PLCT) by one. Also, the time (from TIME) at which this latest belt pulse occurred is stored (NEW). If belt pulses are coming in faster than they can be processed, the counter will eventually overflow. The handler checks for over-flow, with each increment, and signals an error to the error handler if an overflow exists. (Keep in mind that these "counters" are actually locations in the processor's memory and not physically separate elements.)

6.5.5 Power-Up

When the hardware detects a power-up, the 6809 must accomplish several items before it can resume integration. First, the read-only memory (ROM) chips are checked for validity. If somehow the memory has degraded to alter its original contents, the 6809 will remain "hung-up" in a condition where it will do nothing--the contents of the display is arbitrary and unpredictable (from power-up), not updating, and the switches and keys have no effect. The only cure is to replace the ROM's.

If the ROM's check good, the 6809 "initializes" certain registers (memory locations) then checks the random-access memory (RAM) for validity. The RAM contains all the variables and constants used in integration. It is checked to insure that the battery has preserved these values during the time the power was off. If the RAM checks as good, the integrator begins normal operation in the RUN mode with no operator intervention required.

If the RAM fails the check, the 6809 will not integrate and the word "HELP" will flash in both displays. The first switch pressed will cause the 6809 to install its default ROM-stored constants into the RAM, report an error (8E) to the Error Handler, and begin operation in the RUN mode. This is called a "cold start." The default constants were selected within a range to allow the integrator to operate and, specifically, to produce predictable results for quality-control checks at the factory. Refer to the set-up codes and default list in the appendix.

It is possible to manually install constants (using SET-UP) outside of a range that allows normal operation, or any operation. When this occurs, one symptom is the integrator's very slow or no response to switches or keys. Generally, the only cure is to force a cold start. A cold start is forced by holding the clear key ("CLR") down while turning on the power. "HELP" will flash--press any switch. Note that all constants and variables originally in the RAM have now been replaced with the default values.

6.5.6 Compute Net

The 6809 waits for the latest digital equivalent of the analog load cell signal from the on-board analog-to-digital (A/D) converter. The A/D converter performs its conversions independent of the processor. The processor only instructs the A/D converter when to do the conversions. The digital value of load cell signal (gross weight) is checked for overflow (overflow signal from A/D) or underflow (polarity signal from A/D). If either is present, an appropriate error code is issued to the error handler. Underflowed gross weights will be forced to zero, overflowed gross weights are forced to the maximum allowable value. The valued stored in TARE is subtracted from gross weight to obtain NET.

6.5.7 Compute Cumulative Total

The value of NET just obtained represents a weight, per unit of belt travel, in non-engineering units. NET is multiplied by belt travel (belt pulse count PLCT) to form a quantity called SUBTOT. SUBTOT represents the amount of material weighed since the last calculation of total. SUBTOT is added to RCUM, a register of accumulating weight, in non-engineering units. During the last calibration or manual installation of constants, the 6809 computed a number called BOGIE which is the number of weight units in NET times belt pulses required to exactly equal one engineering unit (one pound, one kilo, one ton, one tenth of a ton, etc.).

As RCUM exceeds BOGIE, one count is added in engineering units to the accumulating total of material, in engineering units, weighed. The quantity of BOGIE is then subtracted from RCUM. The remainder stays in RCUM, which will be added to by a new SUBTOT in the next calculation of total. RCUM may contain a negative value, if, at the moment, the gross weight is less than the set TARE. As RCUM passes through zero in the negative direction, one count is subtracted from the total, and BOGIE is added to RCUM. RCUM, then, contains the fractional portion of the cumulative total.

Additions and subtractions to the total are always made to a quantity called TOTAL. TOTAL is primarily for the processor's internal use while performing Auto Zero, Auto Span, Calibration Test, etc. When the 6809 is actually "integrating", such as in the RUN mode, three other quantities, Cumulative Total (CMTOT), Resettable Total (RTOT), and Mechanical Counter Total (MCTOT) are also updated along with TOTAL. Computation of total can also be done in a "times 10" accuracy mode. This would be used for the functions Auto Zero, Auto Span, and Calibration Test. In these functions, only TOTAL is updated. Totals accumulate at the same rate, but are computed to, and displayed to, one more place behind the decimal point than usual. This increases the accuracy of the integrator's auto calibration calculations.

6.5.8 Compute Rate

After every computation of total, the 6809 computes a value for the present rate of material flow. Rate, by definition, is the quantity of material accumulated divided by the elapsed time to accumulate that quantity. Recall from the explanation of the Interrupt Handler that the time that the latest belt pulse occurred is stored in a register called NEW.

During the previous computation of cumulative total, the time of the latest belt pulse, NEW, was transferred into a register called OLD. OLD, then, is the starting time for the present computation of total and rate. Since NEW is the time of the latest belt pulse used in this present computation, the time that elapsed since the last computation is NEW-OLD. Recall, from the computation of total, that the amount of material accumulated for this present computation is in SUBTOT.

Rate (material accumulated/elapsed time) is therefore SUBTOT/(NEW-OLD). Since SUBTOT and (NEW-OLD) are in non-engineering units, this value of rate is multiplied by a scaling factor to convert it into the units of total (lb, kg, ton, etc.) per hour.

Rate and total are computed 6 times a second, belt pulses permitting. If no belt pulses are present in a given instance, the last value of computed rate remains displayed. If no belt pulses occur in a period of 4 seconds, the rate is forced to zero.

Momentary "jitters" in rate, caused by mechanical oscillations of the belt or whatever, are filtered out digitally by the processor. A number called the Rate Filter Damping Factor (RFD) sets the amount of filtering desired. The effect of various values for RFD is shown in Table A.

RFD	Time
0	0 (less than 0.6 seconds)
1	1.6 sec
2	3 sec
3	6 sec
4	13.5 sec
5	26 sec
6	53 sec
10	14.2 min

TABLE A

6.5.9 Operating Modes

The integrator operates in one of 5 modes, corresponding to 5 of the 6 switches. These modes are: RUN, SET-UP, AUTO ZERO, AUTO SPAN. A separate subroutine is associated with each mode except RUN, which is accomplished in the program executive (EXEC).

A. RUN Mode

Normal operation of the integrator is in the RUN mode. In RUN, Cumulative Total is displayed in total display. The buttons are scanned for an entry (keypad entries are ignored) before each calculation of total and rate. A button entry will send the integrator into the selected mode (entry of ENTER is also ignored at this point), described below.

B. Set-Up Mode

Set-up mode allows manual installation of various constants used in computation, examination of any of the constants, and display of variables other than Cumulative Total. Only in Set-Up is the keypad effective.

The Set-Up mode is initiated by pressing the SET-UP switch. The total display is blanked, and "ØØP" will appear left-most in the rate display. SET-UP now expects a number to be entered corresponding to the procedure (or function) desired. Digits from the keypad may be pressed, each entry causing that digit to appear just left of the "P" in the rate display. Previous digit entries are shifted left, with only the last two digits entered appearing in the display. Pressing ENTER will set the integrator's operation status (STATUS) to the two digit number that appears left of the "P". Invalid numbers will return "ØØP" to the rate display, and SET-UP expects a new procedure number entry. Detailed descriptions of each set-up procedure's usage is given in the Operation section of this manual.

6.5.10 Automatic Calibration Modes

A separate section of the program performs the two automatic calibration modes of Auto Zero and Auto Span. Much of the operation of the two is common. This common section will be described first.

When the Auto Zero (AZ) or Auto Span (AS) mode button is pushed, normal integration ceases. The total display also goes blank and the AZ or AS mode button indicator flashes. If Auto Span was pressed, and electronic calibration was selected (with Function 15), "EL" appears left-most in the total display. (Note that "EL" also remains in the total display during the display of total in the acquisition phase. The only exceptions: (1) if total goes negative, the minus sign supercedes the "EL"; (2) if total exceeds 6 digits, the "EL" will shift left to show only an "L" and 7 digits of total.) Pressing the AZ or AS mode button again will begin the acquisition of data needed to perform the selected automatic calibration mode. If the mode is Auto Span and Electronic Calibration is selected, the R-Cal relay will now close. The AZ or AS light remains on steady now. During the acquisition of data, three quantities are accumulated: TOTAL - the results of integration in a "times 10" accuracy; "SP" - the summation of the belt pulses received by the 6809 during the test; "SGP" - the summation of the product of gross weight times the belt pulses received during each measurement of gross weight. These quantities are accumulated over a previously specified amount of belt travel. (This amount of belt travel has been set by the Acquire Test Duration or Manual Test Duration functions.) Note that TOTAL is accumulating in tenths of normal units to enhance the precision of the calibration. Cumulative Total and Reset Total are not affected during Auto Zero or Auto Span.

When the specified amount of belt travel has occurred, the data accumulation phase of the function is over. At this point, the AZ or AS light, as appropriate, remains on while the ENTER indicator and the total flashes. An ENTER entry will initiate the computation of a new Zero/Span, as further described. After completion of the computation, the integrator is in an idle state.

Any mode button entry other than ENTER will cause an exit from AZ/AS with no change made to the Zero/Span. If in Auto Span, exiting at this point will cause the accumulated total (TOTAL) to be copied into the Calibration Total (CALTOT) for possible later use by Post-Span.

A. Auto Zero

Computation of a new zero uses the accumulated quantities of SP and SGP. Dividing the sum of gross times belt pulses (SGP) by the sum of belt pulses (SP) gives the average gross weight measured during the test duration period. That average gross weight is the new zero and is installed in zero and displayed in the total display. (The previous value of zero is lost.)

B. Auto Span

Computation of a new span uses the accumulated TOTAL and the previously set Calibration Constant (CALCON). CALCON represents the value of total desired for a given load integrated over the test duration period. Two CALCON's are stored, one corresponding to calibration with weights, the other for electronic calibration. (Access to which one depends which form of calibration is chosen, with Function 15.) If TOTAL is less than CALCON, SPAN must be increased, and visa versa. New SPAN equals old SPAN times CALCON divided by TOTAL. Thus, SPAN is corrected in proportion to the error in TOTAL compared to CALCON. The new SPAN is installed and displayed in the total display. The old value of SPAN is lost. BOGIE, and other values dependent on SPAN, are then recomputed.

6.5.11 Error Handler:

The Error Handler records errors reported to it from other parts of the program. Once the error is recorded, program operation continues unless the error is a "trapped error", in which case the integrator goes into an idle state.

The first error to be reported, after the last clearing of errors, is recorded in the "error code" (ERRCD). Further errors will not affect the error number in ERRCD. All errors reported will be recorded in the "error status" (ERRST). ERRST is a single 8-bit word, each bit position corresponding to a particular error number. As mentioned elsewhere, only ERRCD is shown in the rate display, if non-zero. Errors in ERRST are displayed only while in the Error Clear Function.

A. Error Codes

The various error codes, their meaning, and possible cures are:

0 - No errors present.

1 - Count Rate Overflow. Two conditions may cause this. (1) The belt pulses are entering the 6809 (after pre-scaling) too rapidly. Pre-scaling should be increased. (2) The product of Scale Capacity and SPAN is large enough so that during "times 10" integration, more than 99 counts would be added to TOTAL during a single calculation of total. The values of Scale Capacity and CALCON are unreasonably set. A change to a different unit of weight should be considered.

2 - Gross Weight Underflow. The analog signal of gross weight from the load cell has gone negative. Possibly a bad load cell.

3 - Gross Weight Overflow. The analog signal of gross weight, from the load cell, has exceeded the A/D converter's reference voltage. Possibly a bad load cell, more likely the problem is overloading of the scale.

4 - Illegal Scale Calibration. An attempt was made to recalibrate using data outside of a proper range. SPAN and/or Scale Capacity may be too large. Auto Span (non-electronic) may have been performed with no weight on belt, or CALCON not set correctly. This is a "trapped" error. (See note.)

5 - Divide Error. An arithmetic error occurred during a divide. Most likely to be caused by too large of a Scale Capacity and/or SPAN being set. This is a "trapped" error. (See note.)

6 - Remote Counter Overflow. The remote counter has lagged behind the Cumulative Total by more than 255 counts. The count rate was too high for too long or the Remote Counter Divider is not set high enough. Increase the Divider, choose another unit of weight, or reduce the scale loading.

7 - Power Failure Occurred. A power failure, or momentary power interruption, has been detected. The integrator should still be running normally, with all RAM values still valid.

8 - Default Constants Installed. All values in RAM have been reset to the "default" values used to initially check-out the integrator. This would occur with the first switch entry when a flashing "HELP" is displayed.

NOTE: Occurrence of errors normally does not stop integrator operation. "Trapped" errors, however, will stop integration and send the integrator into an idle state. Pressing any mode button (except ENTER) will exit the integrator from idle.

6.5.12 Remote Counter Output

The Remote Counter Output is a pair of terminals connected to a relay. The relay is pulsed each time Cumulative Total is increased at a rate equal to or greater than 2% of Scale Capacity. If the rate is below 2%, no counts are sent to the relay. The Remote Counter Output (RCO) may be divided by 1, 10, or 100 (i.e., 1, 10, or 100 counts in CMTOT to produce one pulse out.) Negative counts to CMTOT are not stored. The instructions to operate the RCO is contained in the time interrupt handler. Every tenth of a second, MCTOT is compared to the Remote Counter Divider (RCD). If MCTOT RCD, no pulse is produced. If MCTOT RCD, then RCD is subtracted from MCTOT and one pulse is sent to the relay. If counts are added faster than can be removed, these counts will be saved in MCTOT until the counts can be sent to the relay and be removed from MCTOT. This "buffering" is provided to accomodate momentary bursts of counts. If counts are added at an excessive rate for too long, MCTOT will overflow (at 255 counts). At each overflow, an error is reported to the Error Handler, and 256 counts of Cumulative Total are lost. (The counts are lost in MCTOT - Cumulative Total and Reset Total and never affected by any overflow condition.)

A counter called REMOTE is used to limit the maximum output count rate to 10Hz.

6.5.13 Current Output

The optional Current Output (I/Out) board is driven by 10 static (non-clocked) output lines from one of the processor's peripheral interface adapters. The output represents rate as a percentage of Scale Capacity. The board itself produces 0 mA with a zero input (output from processor) and 22.75 mA with an input value of 4095 (10 bits of 1's). The processor will scale the number it sends out so that at a rate at 100% of Scale Capacity, the I/Out board sends out 20 mA. (2.75 mA of over-range available, corresponding to a rate of 114% of Scale Capacity.) The processor will also scale the number so that at a rate of 0%, the I/Out board will produce 0 mA or 4 mA, depending on the current range set. Negative values of rate will produce a 0% output. Over-ranges of greater than 114% will produce the maximum output.

6.5.14 Arithmetic Subroutines

All of the calculations performed by the integrator use the arithmetic subroutines. The subroutines include 24-bit and 48-bit binary add, subtract, multiply, and divide, plus subroutines to convert from binary to "binary coded decimal" (BCD) and visa versa. These arithmetic routines offer resolution greatly in excess of what is required for integrating to the specified accuracy.

CHAPTER 7

7.0 Maintenance

7.1 General

CAUTION

Your Integrator has a one-year warranty covering workmanship and parts defects. Refer to the Warranty, Page A/1 in the Appendix. Check with the warranty or factory before doing any extensive maintenance or modification which may void the warranty.

The Micro-Tech Integrator is a solid state device, and as such, should require very little maintenance. The front panel can be wiped clean with a damp cloth, and if necessary, a mild detergent (never use any abrasive cleaners, especially on the display windows). As a preventative maintenance, check that all wires, plugs, and integrated circuits are tight in their connectors. Also keep the enclosure door tightly closed to prevent dirt infiltration.

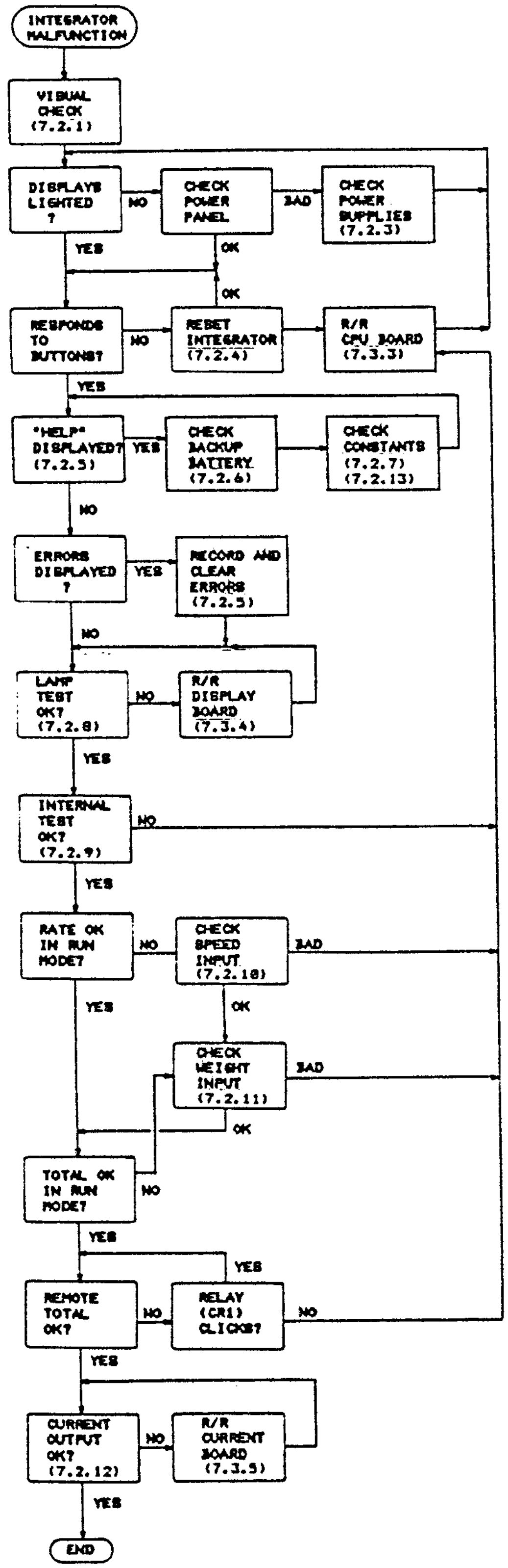
7.2 Troubleshooting

7.2.1 General Troubleshooting

More often than not, a quick visual inspection leads to the source of trouble. If a problem does develop, check the following before proceeding to more specific troubleshooting procedures:

(a) Check power.

(1) Check that the Line Voltage Selector Switch (S2) is set for the correct line voltage.
(2) Check the Fuse (F1).
(3) Power switch (S4) ON.



Troubleshooting Flowchart Trouble Isolation

Figure 7.0

(b) Check connections.

   (1) Check that all wires are tight in their field terminals. (Lightly pull to check.)
   (2) Check that the Power Panel cable and Display Board flat cable are firmly seated in their connectors.
   (3) Check that the Remote Counter Relay is secure in its socket on the Power Panel.
   (4) Check that all socketed integrated circuits are fully seated in their sockets.

(c) Check that all Operating Parameter Jumpers (J1 - J20) are correctly positioned and seated. Refer to the Operating Parameter Jumper Table A/5 and Location Layout A/5.1 in the Appendix.

If a visual inspection does not solve the problem, review Chapter 6 on Theory of Operation and proceed to the following trouble-shooting sections.

7.2.2 Troubleshooting - Problem Isolation

A systematic approach to troubleshooting is necessary in order to isolate the source of the trouble. The troubleshooting flow charts in this manual are designed to allow the user to learn what is working in the system and use this information to reveal what is not working. Figure 7.0 is a troubleshooting flow charter that should assist in isolating a problem to either the weight or speed input sensors or to one of four assemblies:

(a) Power panel.
(b) CPU printed circuit board.
(c) Display printed circuit board.
(d) Current output printed circuit board (if used).

7.2.3 Power Supply Check

Refer to the CPU Board Schematic A/14, CPU Board Assembly Drawing A/15, and the Display Board Schematic A/16 and Display Board Assembly Drawing A/15 in the Appendix.

Place the negative lead of a dc voltmeter on field terminal 16 on the CPU board and the positive lead on terminal 17. (Note: If there is a wire on terminal 17, remove it for this test.) The voltage measured between terminals 16 (com.) and 17 should be approximately +24Vdc.

The voltage measured between terminal 16 (com.) and terminal 3 should be between +4.75 and +5.25Vdc. Terminal 16 (com.) to terminal 4 should be between -4.75 and -5.25Vdc.

Move the meter leads to the capacitor (C1) on the Display Board (measure back side). Place the negative lead on the negative side of C1 and the positive lead on the positive (+ marked) side of C1. The meter should read approximately +28Vdc.

7.2.4 Reset Integrator

The Integrator can be reset by holding the CLR key while turning the power off and then on. The only time that this should be necessary is if the Integrator appears to be locked up and does not respond to the front panel mode buttons or keys, or when checking the backup battery (see Section 7.2.6). NOTE: Resetting installs default constants--normal scale constants must be installed for correct calibration.

7.2.5 Integrator Initialization ("HELP") and Error Clear

Initialization of the Integrator is necessary only when the Integrator is first installed or if there has been a power failure and backup battery failure at the same time. Both Total and Rate displays flash "HELP" when initialization is necessary.

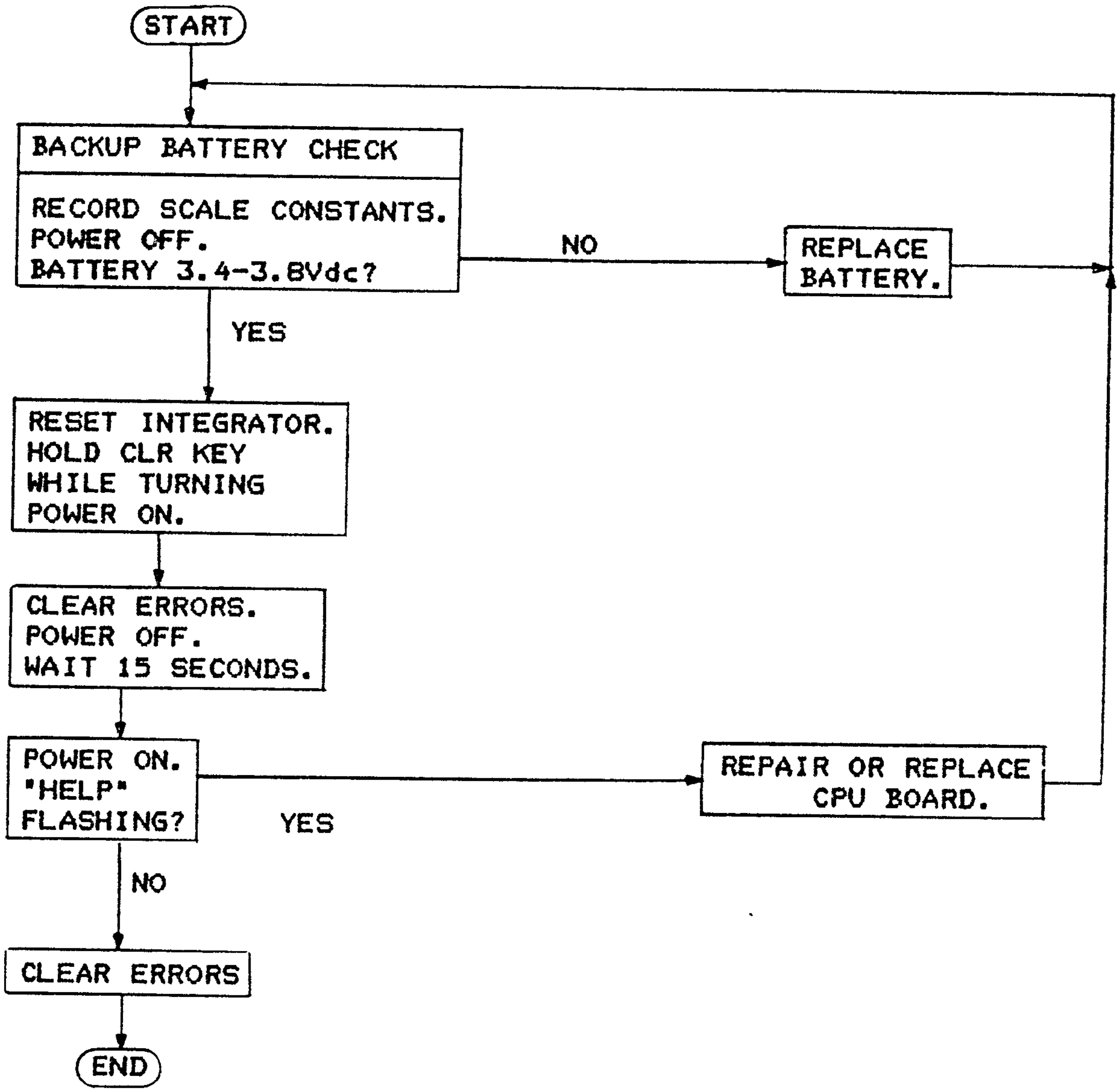
NOTE: Totalization stops when "HELP" is displayed.

Initialization consists of replacing the values of TARE, SPAN, etc. with values applicable to the installation. The default values are permanent and allow the Integrator to operate "normally" with predictable results for troubleshooting and factory quality control.

(a) Push any mode pushbutton below the displays. The total display indicates "0", which is the Cumulative Total default value. The rate display indicates the present rate in the right five digits and an error code "0BE" on the left. Error code "08E" indicates that the system has replaced all operating constants with default constants.

(b) Clear all errors (there may be more than one) by pressing the following mode pushbuttons and keypad keys:

#	Button or Key	Total Display	Rate Display
(1)	SET-UP (pushbutton)	blank	00P --
(2)	"12" (keypad)	"	12P --
(3)	ENTER (pushbutton)	XE (X=1-8) or blank	12P --



Troubleshooting Flowchart Back-Up Battery Check.

Figure 7.1

If the total display in Step #3 is blank, there was only one error (08E). If the total display indicates a 1E through 8E, there was more than one error. Push Enter until the total display remains blank, indicating all errors are cleared.

(c) The integrator is now initialized.

7.2.6 Back-Up Battery Check

Refer to Figure 7.1 showing back-up battery check flow chart. The power must be off in order to check the back-up battery. If the battery is bad, all scale constants will be lost--so please record the scale constants if you have not already done so. Turn the power switch on the power panel off. Measure the battery voltage by placing the leads of a dc volt meter directly across the battery. The battery voltage should be between 3.4 and 3.8Vdc. (Note: The voltage of this type of battery does not slowly decrease with age. Instead, the voltage remains relatively constant and drops off rapidly near its end of discharge.) Replace the battery if the voltage is not correct. Reset the integrator by pressing CLR as you turn the power on and clear any errors (8E is likely). Turn the power off and wait about 15 seconds. Turn the power back on. If "HELP" flashes in the displays, there is a fault in the CPU board back-up circuit and the CPU board must be repaired or replaced. If the displays do not flash "HELP", the back-up battery and circuit are okay.

7.2.7 Check Constants

The constants are values given to SET-UP (P) numbers that tailor the integrator to a particular installation or application. When the integrator is first initialized (see Section 7.5), the constants are automatically defaulted or changed to Default Constants. The default constants are not "correct" for any installation, but allow the integrator to "work" (refer to the Default Constants Table A/8 in the Appendix.)

The constants can be viewed automatically (scrolled) or one at a time.

(a) Power ON.

(b) Check Constants (scroll):

#	Key	Total Display	Rate Display
(1)	Set-Up	Blank	00P
(2)	"0" or NO KEY	"	00P
(3)	Enter	Constant	Constant
	--	Value*	(P#)
	--	----------	----------
	--	18835	01P
	******	47791	02P
	Auto-	2400.0	03P
	matic	270	05P
	Scroll	24	06P
	******	2	07P
	--	3	13P
	--	0--20	14P
	--	0	15P
	--	1	16P

*default constants shown.

Set-Up 0 automatically scrolls through all constants, displaying each for 3 seconds. The rate display indicates the constant P code and the total display shows the constant value. The integrator automatically returns to the RUN mode.

(c) Check constants (one at a time).

(1) Check Manual Tare Constant (1P):

#	Key	Total Display	Rate Display
(1)	Set-Up	Blank	00P
(2)	"1"	"	01P
(3)	Enter	###### (present manual tare value.)	01P

(2) Check Manual Span Constant (2P):

#	Key	Total Display	Rate Display
(1)	Set-Up	Blank	00P
(2)	"2"	"	02P
(3)	Enter	##### (present manual span value)	

Set-Up # (# = P code) causes the total display to indicate the constant value for the P code shown in the rate display.

7.2.8 Lamp Test

Pressing the LAMP TEST mode button should cause the total and rate displays to alternately flash all eights and all decimal points. At the same time, all of the mode button indicator lamps should flash on and off together. If the LAMP TEST reveals a display or mode lamp failure, replace the display board.

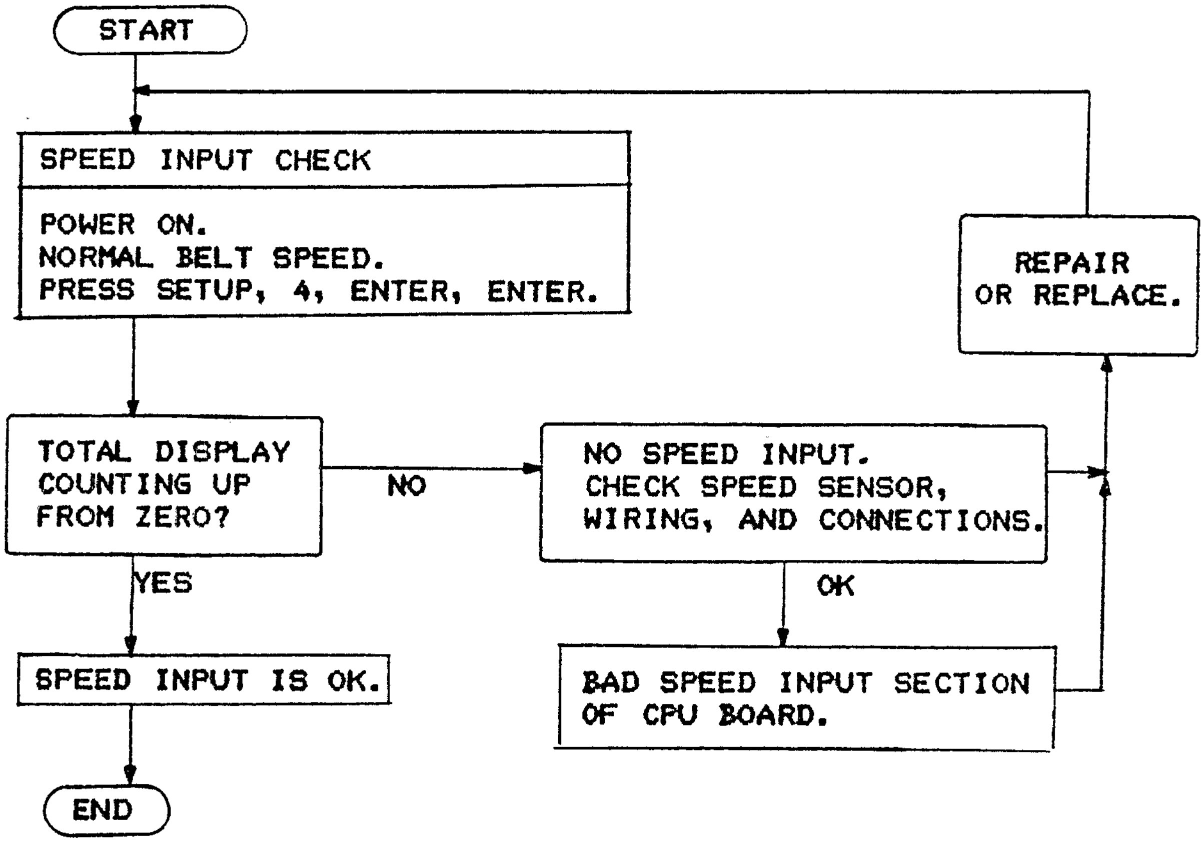
7.2.9 Internal Test

Internal Test is a built-in system diagnostic test of the microprocessor and its software (program). This test uses internal weight and speed signals and runs for about 30 seconds.

(a) Do an Internal Test:

#	Key	Total Display	Rate Display	
(1)	Set-Up	Blank	00P	--
(2)	"11"	"	11P	--
(3)	Enter	Counts up from 0 and stops at 2824	11P	Counts up and stops at 6279

Both total and rate displays will count up to specific numbers and stop. If the total display stops at 2824 and the rate display at 6279 (disregarding zeros and decimal points) the internal test was successful and the microprocessor and program are functional.



Troubleshooting Flowchart Speed Input Check

Figure 7.2

7.2.10 Speed Input Check

Refer to the Speed Input Check Flowchart in Figure 7.2. In order to check the speed input, the power must be ON and the belt running at normal speed. The speed signal is a series of pulses from the speed sensor. These speed pulses can be viewed by performing the first part of an Acquire Test Duration operation (the test duration is a certain number of speed pulses).

(a) Power ON.

(b) Normal conveyor speed.

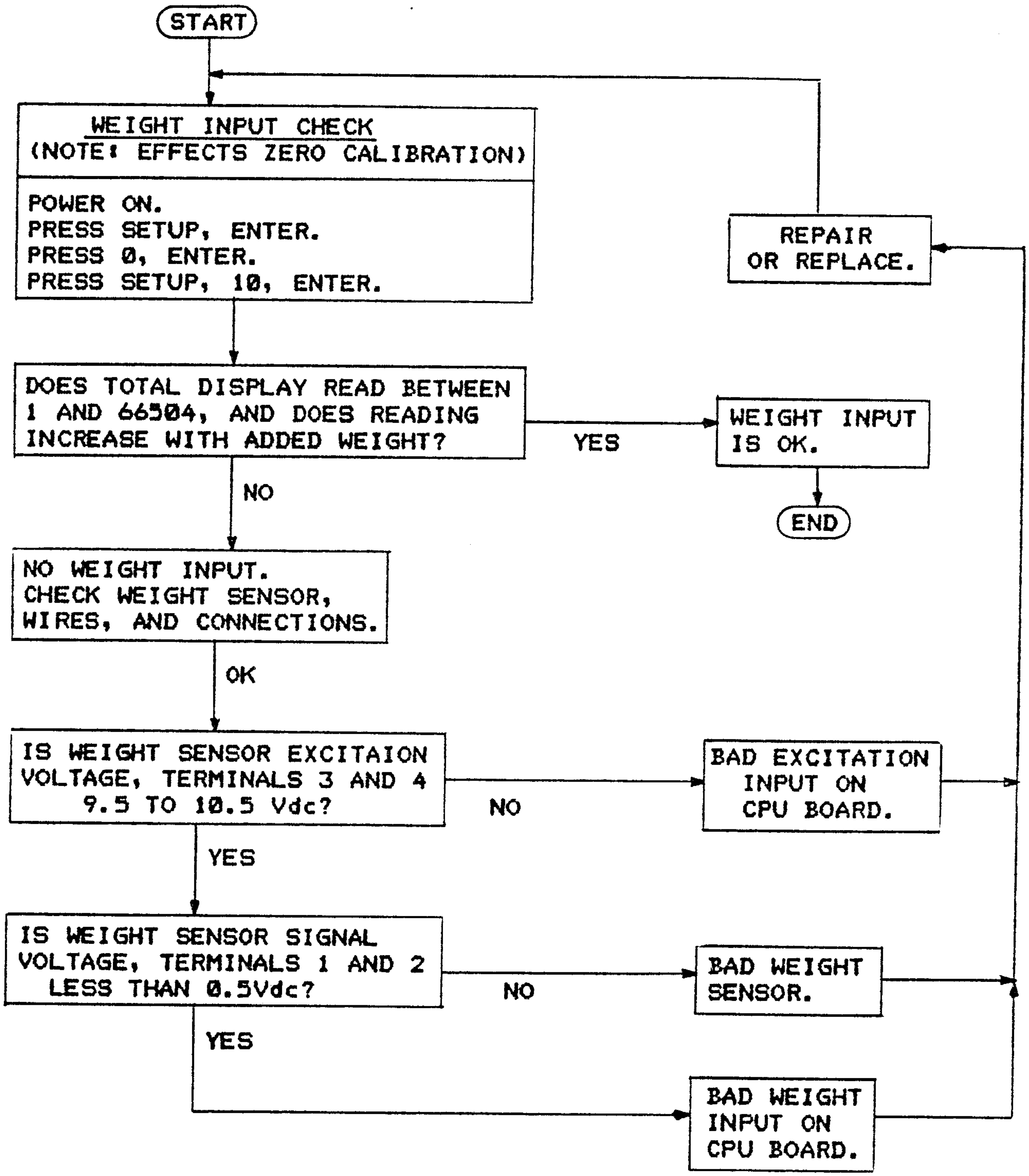
(c) Check Speed Input:

#	Key	Total Display	Rate Display
(1)	Set-Up	Blank	00P
(2)	"4"	"	04P
(3)	Enter	"	
	****Enter lamp flashes****		
(4)	Enter	Counts Up from 0	04P

If the total display is counting, speed pulses are being input and checked by the integrator. The total display not counting indicates either that the speed sensor is not producing pulses or that the speed input ;section of the CPU board is faulty, in which case, the CPU board must be replaced.

NOTE: Check for too large of speed prescale setting.

Press Set-Up to end the speed input check.



Troubleshooting Flowchart Weigh Input Check

Figure 7.3

7.2.11 Weight Input Check

Refer to the Weight Input Check Flowchart in Figure 7.3. The weight input is checked by setting the integrator zero to 0 and viewing net as indicated on the total display.

(a) Power ON.

(b) Normal conveyor speed.

(c) Empty belt.

(d) Check weight input:

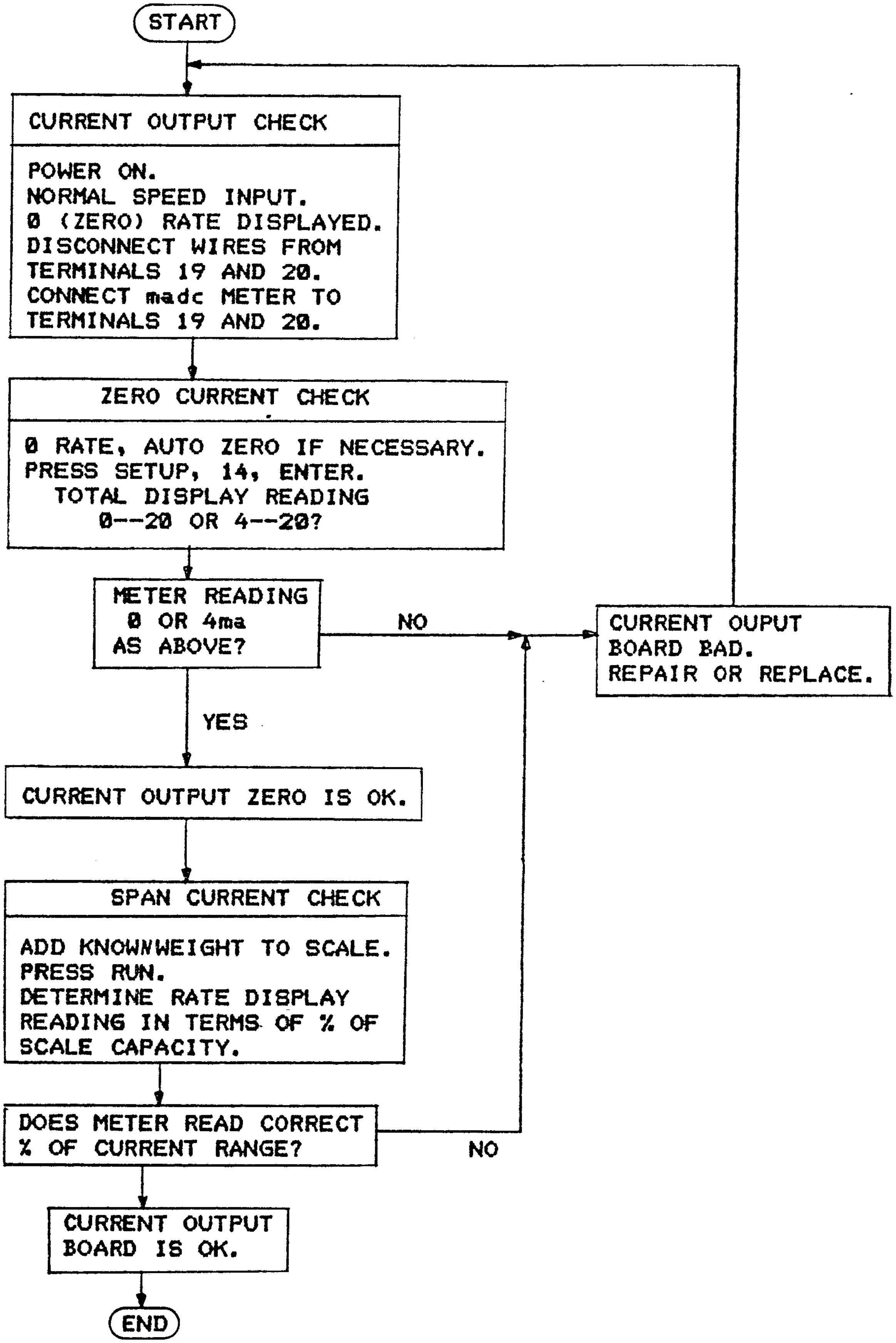
#	Key	Total Display	Rate Display
(1)	Set-Up	## (old #)	00P
(2)	"1"	"	01P
(3)	Enter	"	01P
(4)	"0"	0	01P
(5)	Enter	0 (new #)	01P
	****Manual tare is now set to 0****		
(6)	Set-Up	Blank	00P
(7)	"10"	"	10P
(8)	Enter	1 - 65504 (net)	10P

The total display indicates a number which represents the "weight" as seen by the weight input. A total display reading of 1 - 65504 indicates a correct weight input, and the number displayed will increase with added weight and decrease with weight removed. A total display reading not within 1 - 65504 indicates a weight sensor, wire, or weight input fault on the CPU board. Press Set-Up to end the weight input check.

7.2.12 Current Output Check (optional)

Refer to the Current Output Check Flowchart in Figure 7.4. The current output is checked by measuring the output at "zero" (0 or 4mA) and at a known span. The power to the integrator must be on and running at zero rate in order to check the current output zero. If the rate display is not zero, manually zero the scale or do an AUTO ZERO. Replace the wires on the current output terminals 19 and 20 with the leads of a dc milliamp meter (terminal 19 negative). Determine the current out range (0 to 20 or 4 to 20mA) set in the integrator by pressing Set-Up, 14, and Enter. The total display will indicate "0--20" for 0 to 20mA and "4--20" for 4 to 20mA range. The meter should indicate either 0 or 4mA, depending on the current range set. If the meter does not read correctly, the current output board is faulty and must be replaced.

If a current out zero check is okay, the span must be checked. Add a known weight to the scale in order to produce a known rate signal. Press RUN and determine what percent of full scale the known weight represents. For example, a reading of 10 with a scale capacity of 100 would mean that the known weight represents 10 percent of the scale capacity. The meter on the current output should indicate the same percentage of its range. If the above example is used and the current output range was 4 to 20mA, then the meter should read 10 percent of 16 (20 minus 4), or 5.6mA (1.6 plus 4). If the meter does not indicate the correct current output, repair or replace the current output board.



Troubleshooting Flowchart Current Output Check

Figure 7.4

7.2.13 Install Constants

The constants that tailor the integrator to a particular installation must be entered when the integrator is first installed or whenever the back-up battery is replaced. The design constants for a particular installation are provided by the factory or are determined by the user using the Ramsey Scale System Manual. These constants are recorded on the scale data label located on the inside of the lower front panel. A sample of the scale data label is shown on page A/9 of the Appendix.

Install constants:

(a) Power ON.

(b) Normal conveyor speed.

(c) Empty belt.

(d) Install constant values:

#	Key	Total Display	Rate Display
(1)	Set-Up	Blank	00P -----
(2)	XX (P code)	"	XXP (P code)
(3)	Enter	XXXX (old value)	XXP -----
(4)	"XXXX" (new value)	XXXX (new value)	XXP -----
(5)	Enter	XXXX (new value)	XXP -----

Repeat steps 1 through 4 for each new constant value; for example, to install a new manual zero of "17520":

#	Key	Total Display	Rate Display
(1)	Set-Up	Blank	00P -----
(2)	"1" (manual zero)	"	01P -----
(3)	Enter	XXXXX (old value)	01P -----
(4)	"17520"	17520 (new value)	01P -----
(5)	Enter	17520	01P -----

Manual zero is now "17520"

7.3 Assembly Replacement Procedures

7.3.1 Chassis

Refer to the Final Assembly Drawing on page A/23 in the Appendix.

The integrator chassis can be removed from the enclosure by first turning off the power source feeding the integrator and removing all of the wires from the field terminals. Open the upper and lower front covers and remove the 4 chassis mounting screws, one in each corner. The chassis can now be lifted out of the enclosure. Reassemble in reverse order.

7.3.2 Power Panel

Refer to the Chassis Assembly Drawing on page A/22 of the Appendix. In order to remove the power panel, the chassis must be removed from the enclosure (see Chassis Section 7.3.1).

Disconnect the cable connecting the power panel to the CPU board (J3). Loosen the 2 screws (#22) attaching the power panel (#1) to the chassis side plate (#3). Remove the 4 transformer mounting screws (#18) from the chassis side of the transformer. The power panel/transformer assembly can now be removed from the chassis. Reassemble in reverse order.

7.3.3 CPU Board

Refer to the Chassis Assembly Drawing on page A/22 of the Appendix. Note: The chassis must be removed from the enclosure before the CPU board can be removed. Refer to Section 7.3.1 detailing chassis removal.

To remove the CPU board, first disconnect the power panel cable from connector J3, and unplug the flat ribbon cable from connector J1. Remove the 2 screws (#22) attaching the voltage regulator (#4). Pull the socket from the regulator pins and remove the regulator from the chassis panel. Remove the 6 screws (#5) attaching the CPU board to the chassis. The CPU board can now be removed from the chassis. Reassemble in reverse order.

7.3.4 Display Board

Refer to the Chassis Assembly Drawing on page A/22 of the Appendix. Note: The chassis does not need to be removed from the enclosure in order for display board removal.

Turn power off and unplug the flat ribbon cable from J1 on the CPU board. Remove the 4 display board mounting screws (#20) and remove the display board from the upper cover. Reassemble in reverse order.

7.3.5 Current Output Board (optional)

The Current Output Board plugs onto the pins of connector J2 of the CPU board and is held in place by 3 nylon snap-in spacers. To remove the current output board, first turn the power off and squeeze the tops of the spacers to enable the current output board to lift from the CPU board. Reassemble in reverse order.

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 St. Paul, Minnesota, and the submission of reasonable proof to seller prior to return of the equipment that the 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.

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

Said warranty shall not apply if the equipment shall not have been operated and maintained in accordance with the 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.

RETURNED MATERIAL AUTHORIZATION

NOTE: This completed form _must_ accompany shipment.

DATE: ____________________

Date of original purchase _____ / _____
month year

Customer ship Prepaid to:

RAMSEY ENGINEERING COMPANY
1853 W. County Rd. C
St. Paul, MN 55113

Return to: ____________________

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Description of returned equipment

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Model No. ____________________

Serial No. ____________________

Reason for return (Specify malfunction in detail)

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____________________ ____________________
Phone Signature Title

Complete and exact malfunction information will expedite return of unit.

Return Authorization Form

PARTS ORDERING

Ramsey maintains a complete stock of spare parts and can normally ship within one working day upon receipt of an order.

When returning parts to the factory for repair or replacement, the Return Material Authorization form should be attached to the part(s).

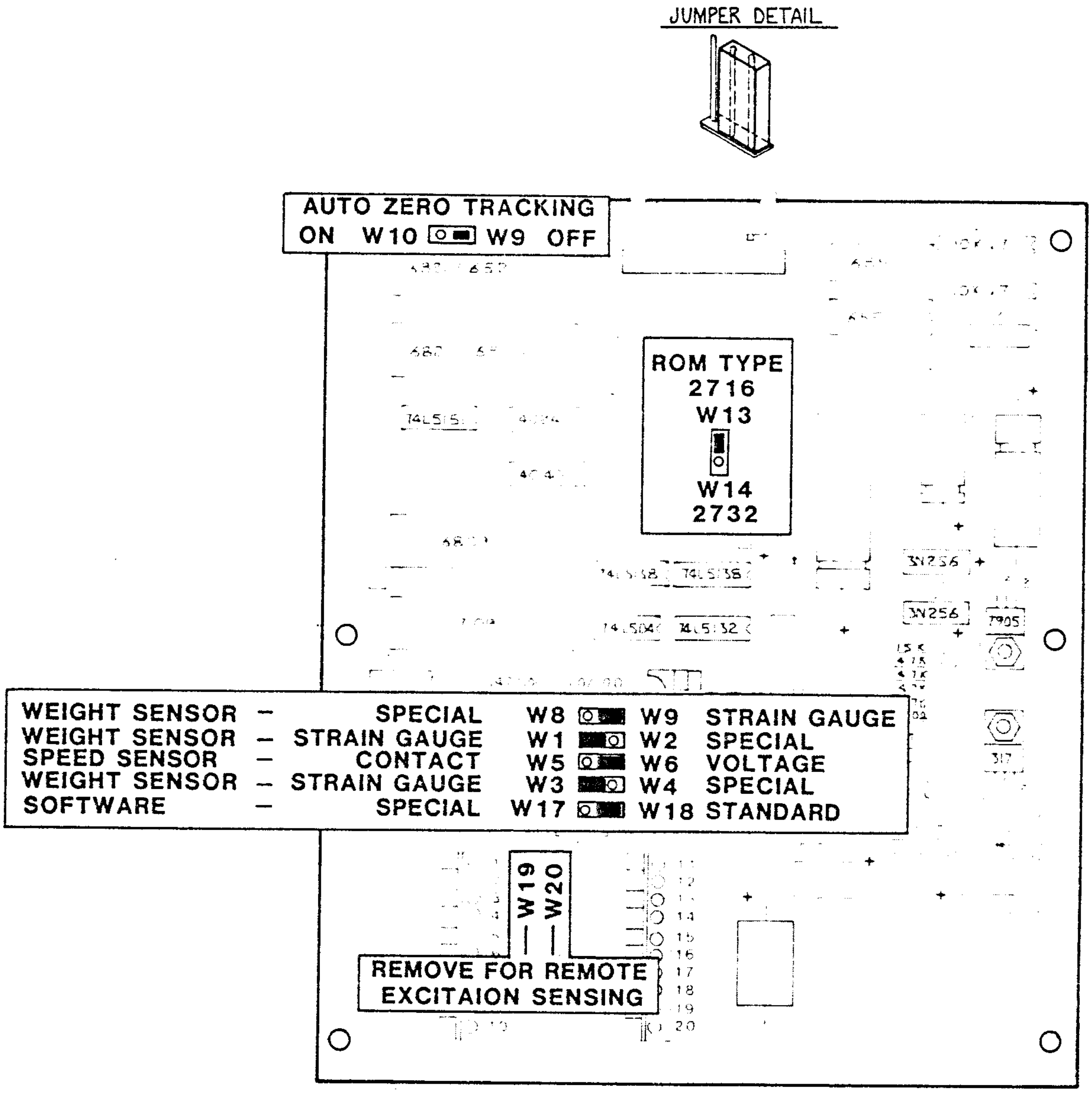
For critical applications, Ramsey suggests that the Purchaser maintain in stock the following assemblies:

Quantity	Description	Item No.
1	CPU Board D07033A-B011	8728
1	Display Board D07033A-B001	8726
1	Current Output Board D07033A-B021 (optional)	8730

Jumper Positions	Operating Parameters
W1, W3, W7	*Strain gauge load cell type weight input selected. (Strain gauge with ratiometric reference.)
W2, W4, W8	Special input (0mA to 10mA, non-ratiometric)
W6	*Voltage or current type speed sensor (0 - 1.2kHz)
W5	Contact or vane switch type speed sensor (0 - 30Hz)
W19, W20	*Local excitation sensing (under 200 ft. from load cell to integrator) with jumpers W19 and W20 installed. Remote excitation sensing (over 200 ft. from load cell to integrator) with jumpers W19 and W20 removed. Note: Special 6 conductor shielded load cell cable must be used. Consult the factory.
W9	*Auto Zero Tracking disabled. Operator assisted zeroing only.
W10	Auto Zero Tracking enabled. Continuous unassisted auto zeroing if the net weight on the scale is less than or equal to 2% of the scale capacity for at least one test duration, while the integrator is in the RUN mode.
W13	*"2716" type ROM devices installed in U8, U9, and U10 sockets. Standard.
W14	"2732" type ROM devices installed in U8, U9 sockets (U10 is always "2716".) Non-standard, special application.
W18	*Standard ROM software.
W17	Special, non-standard, ROM software.

*"standard"

Operating Parameter Jumper Table



Operating Parameter Jumper Locations

1E	Belt pulse count overflow
2E	Gross weight underflow
3E	Gross weight overflow
4E	Illegal scale calibration
5E	Divide overflow
6E	Remote mechanical under/overflow
7E	Power failure occurred
8E	Default constants installed

0 - No errors present.

1 - Count Rate Overflow. Two conditions may cause this. (1) The belt pulses are entering the 6809 (after pre-scaling) too rapidly. Pre-scaling should be increased. (2) The product of Scale Capacity and SPAN is large enough so that during "times 10" integration, more than 99 counts would be added to TOTAL during a single calculation of total. The values of Scale Capacity and CALCON are unreasonably set. A change to a different unit of weight should be considered.

2 - Gross Weight Overflow. The analog signal of gross weight from the load cell has gone negative. Possibly a bad load cell.

3 - Gross Weight Overflow. The analog signal of gross weight, from the load cell, has exceeded the A/D converter's reference voltage. Possibly a bad load cell; more likely the problem is overloading of the scale.

4 - Illegal Scale Calibration. An attempt was made to recalibrate using data outside of a proper range. SPAN and/or Scale Capacity may be too large. Auto Span (non-electronic) may have been performed with no weight on belt, or CALCON not set correctly. This is a "trapped" error. (See note.)

5 - Divide Error. An arithmetic error occurred during a divide. Most likely to be caused by too large of a Scale Capacity and/or SPAN being set. This is a "trapped" error. (See note.)

6 - Remote Counter Overflow. The remote counter has lagged behind the Cumulative Total by more than 255 counts. The count rate was too high for too long or the Remote Counter Divider is not set high enough. Increase the Divider, choose another unit of weight, or reduce the scale loading.

7 - Power Failure Occurred. A power failure, or momentary power interruption, has been detected. The integrator should still be running normally, with all RAM values still valid.

8 - Default Constants Installed. All values in RAM have been reset to the "default" values used to initially check-out the integrator. This will occur with the first switch entry when a flashing "HELP" is displayed, and in the event of a backup battery failure.

NOTE: Occurrence of errors normally does not stop integrator operation. "Trapped" errors, however, will stop integration and send the integrator into an idle state. Pressing any mode button (except ENTER) will exit the integrator from idle.

Set Up Codes	Description
ØØ SCROLL	Automatically scrolls through all constants on a three second interval per constant.
Ø1 MANUAL ZERO	Examine and/or change the value of zero. Set-Up Codes
Ø2 MANUAL SPAN	Examine and/or change the value of span.
Ø3 SCALE CAPACITY	Examine and/or change the value of full scale capacity.
Ø4 ACQUIRE TEST DURATION	Acquire test duration based on a specific amount of belt travel.
Ø5 MANUAL TEST DURATION	Examine and/or change the value of test duration.
Ø6 CALIBRATION CONSTANT	Examine and/or change the value of calibration constant. "EL" in upper display indicates electronic calibration constant in use.
Ø7 DAMPING	Examine and/or change the value of rate filter damping. Dampens only displayed rate and optional rate output.
Ø8 RESET TOTAL	Displays and/or resets the resettable total.
Ø9 MATERIAL CALIBRATION	Acquire and store actual weight from belt scale for later comparison to a batch-weighed value of the same material.
1Ø NET	Displays the net weight - gross minus tare in non-engineering units.
11 INTERNAL TEST	Test internal operation of the microprocessor.
12 ERROR CLEAR	To clear error code and error status after an error has been detected.
13 SPEED PRESCALE	Examine and/or change the value of belt speed prescale.
14 CURRENT RANGE	Examine and/or change the present current output range. 0-20 or 4-20 ma.
15 CALIBRATION MODEL	Examine and/or change the selected method of performing AUTO SPAN. Electronic calibration or weight standard.
16 DIVIDE OUT	Examine and/or change the cumulative output to remote counters by a factor of 1, 10 or 100.
17 POST SPAN	Compute and install a new Span using data acquired during a previous Material Calibration operation.

NAME	SET-UP CODE	DEFAULT VALUE	REMARKS
TARE	01	18835	Value from A/D at 1mv/v input
SPAN	02	47791	Produces Fullscale Rate for 2mv/v Input
Scale Capacity	03	2400.0	Counts/hour at 100%
Test Duration	05	270	Belt pulse count for 1/100 hour at 60 Hz, with ÷8 Prescale
CALCON	06	24.	1/100 of Scale Capacity
Rate Filter Damping	07	2	Damping so that time to stable reading = 3 sec.
Reset Total	08	0	Resettable Cumulative Weight
Material Calibration	09	0	Amount of material in last material test
Speed Prescale	13	3	Divide input speed by 2^3, or 8
Current Range	14	0	Range - 0-20mA
Calibration Mode	15	0	Auto Span using Weights or Chain
Counter Divider	16	1	Divide by 1
Post Span	17	0	Previous Material Test (09) Span Data
Cumulative Total	-	0	Non-resettable Cumulative Weight

Default Constants

Address - Function Decode Table

Address									Function	Device
A 15	A 14	A 13	A 12	A 11	A 10	A 2	A 1	A 0		
0	0	0	X	X	X	X	X	X	RAM	U14, U15
0	0	1	X	X	X	X	X	X	(not used)	
0	1	0	0	0	0	0	X	X	PIA (A/D, Keypad)	U7
0	1	0	0	0	0	1	X	X	PIA (I/Out, Display)	U22
0	1	1	X	X	X	X	X	X	(not used)	
1	0	0	0	0	0	X	X	X	Pushbutton Indicators	
1	0	0	0	0	1	X	X	X	Total Display Write	
1	0	0	0	1	0	X	0	1	A/D Read High Byte	U6
1	0	0	0	1	1	X	1	0	A/D Read Lo Byte	U6
1	0	0	0	1	1	X	X	X	Lower Display Write	
1	0	0	1	0	0	X	X	X	Remote Total Pulse	U21
1	0	1	X	X	X	X	X	X	ROM	U10
1	1	0	X	X	X	X	X	X	ROM	U9
1	1	1	X	X	X	X	X	X	ROM	U8

1 - high

2 - low

X - don't care

Address Decode Table

SCALE DATA

Code	Item	Design	Actual
3	SCALE CAPACITY		
	BELT SPEED		
	LOAD CELL SIZE		
	REVOLUTIONS =		
	TEST LENGTH =		
6	ELECTRONIC CALIBRATION =		
6	STATIC WEIGHT CALIBRATION =		
6	CHAIN CALIBRATION =		
1	ZERO		2 SPAN
5	TEST DURATION		
13	SPEED PRESCALE		
14	CURRENT OUT RANGE	-20MA	
7	DAMPING		
16	DIVIDE OUT		

ERROR/CODE

1 COUNT RATE OVERFLOW
2 GROSS WT. UNDERFLOW
3 GROSS WT. OVERFLOW
4 ILLEGAL SCALE CAL.
5 DIVIDE ERROR
6 REMOTE COUNTER OVERFLOW
7 POWER FAILURE OCCURRED
8 DEFAULT CONSTANTS INST.

RAMSEY ENGINEERING CO.
1853 W County Road C • St. Paul, Minnesota 55113 • Phone: (612) 633-5150

Scale Data Label

QUICK REFERENCE CARD
MICRO-TECH
INTEGRATOR MODEL 10-201
RAMSEY ENGINEERING COMPANY

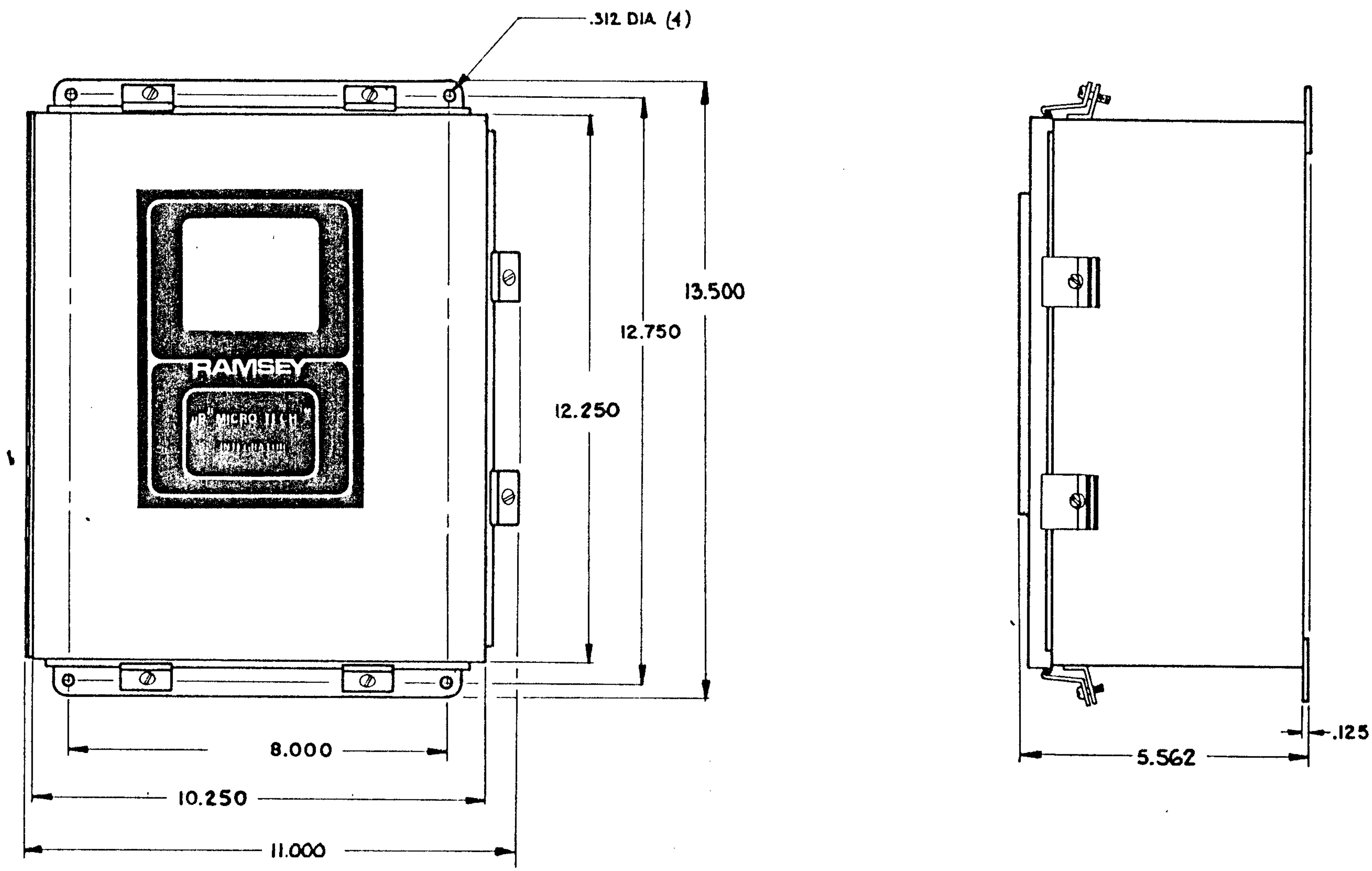
Manual Zero - Press [SET UP] [1] [ENTER]. Old zero in total display. Key in new zero, press [ENTER]. New zero in total display.

Manual Span - Press [SET UP] [2] [ENTER]. Old span in total display. Key in new span, press [ENTER]. New span in total display.

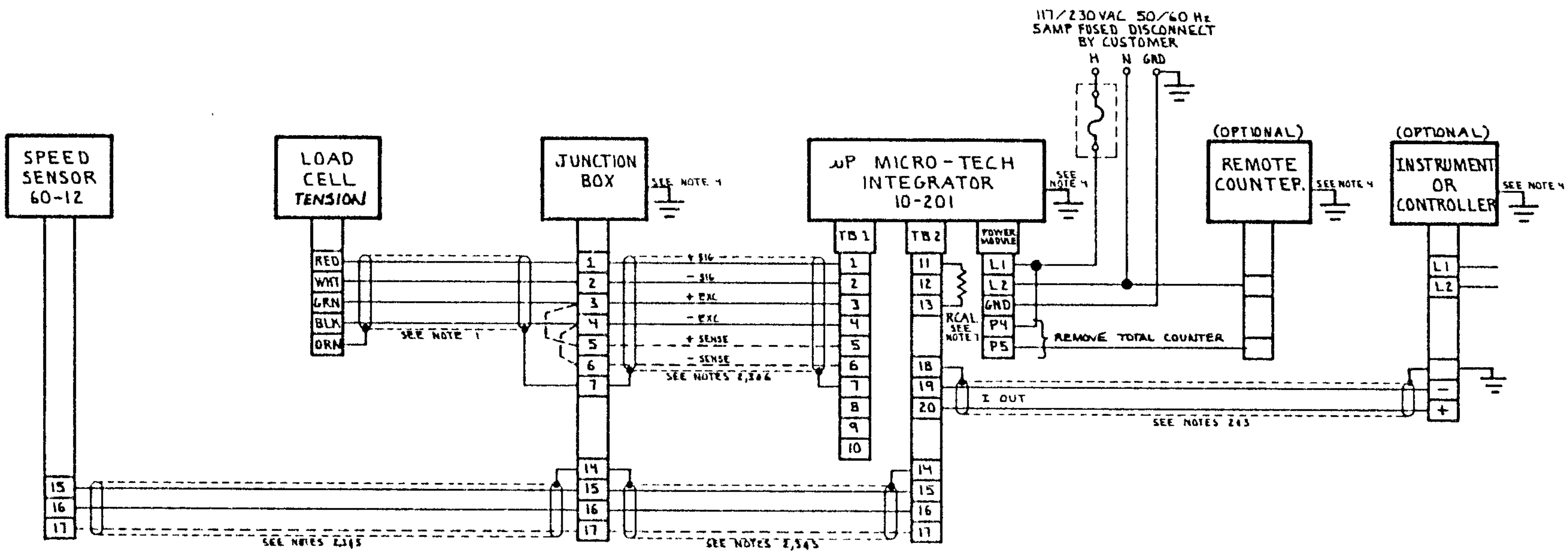
Auto Zero - Press [AUTO ZERO]. Press [AUTO ZERO] again to start. Enter light and total display flashes when finished. Press [ENTER] to compute and install new zero. New zero in total display.

Auto Span - Press [AUTO SPAN]. Press [AUTO SPAN] again to start. Enter light and total display flashes when finished. Press [ENTER] to compute and install new span. New span in total display.

Set-Up List - Press [SET UP] [ENTER]. Set-up code in rate display, stored number in total display. Three seconds for each set-up code. Automatically returns to Run when finished.



Outline and Mounting Dimensions



IMPORTANT READ ALL NOTES BEFORE WIRING SYSTEM

1. DO NOT ALTER LENTGH OF CABLE SUPPLIED WITH LOADCELL.
2. CONNECT SHIELDS ONLY WHERE INDICATED.
   CABLE: 2COND. BELDON # 8760 OR EQUIVALENT
   3COND. BELDON # 8770 OR EQUIVALENT
   4COND. BELDON # 8407 OR EQUIVALENT
   6COND. REVERE 6 COND. LOAD CELL CABLE
3. DO NOT RUN SIGNAL WIRES IN SAME CONDUIT AS POWER LINES.
4. EARTH GROUND ALL ELECTRICAL ENCLOSURES.
5. TERMINALS "17" AND 3 COND. CABLE, (NOTE 2) ARE USED WITH 60-12F SPEED SENSOR ONLY 2 COND. CABLE, (NOTE 2) IS USED OTHERWISE.
6. USE SENSE LEADS, (6 COND CABLE, NOTE 2) AND REMOVE JUMPERS "W19" & "W20" (LOCATED ON CPU BOARD) WHEN INTEGRATOR IS LOCATED OVER 200FT FROM JUNCTION BOX.
7. REFER TO MANUAL FOR "RCAL" SELECTION.

Typical Field Wiring Diagram