2037
2137

COUNT / WEIGH SCALES

Technical Manual

INTRODUCTION

This publication is provided solely as a guide for individuals who have received METTLER TOLEDO Technical Training in servicing the METTLER TOLEDO product.

Information regarding METTLER TOLEDO Technical Training may be obtained by writing to:

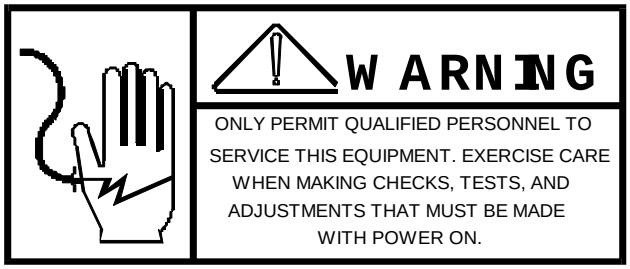
METTLER TOLEDO
Training Center
P.O. Box 1705
Columbus, Ohio 43216
(614) 438-4400

PRECAUTIONS

- **READ** this manual before operating or servicing this equipment.

- **ALWAYS REMOVE POWER** and wait at least 30 seconds **BEFORE** connecting or disconnecting any internal harnesses. Failure to observe these precautions may result in damage to, or destruction of the equipment.

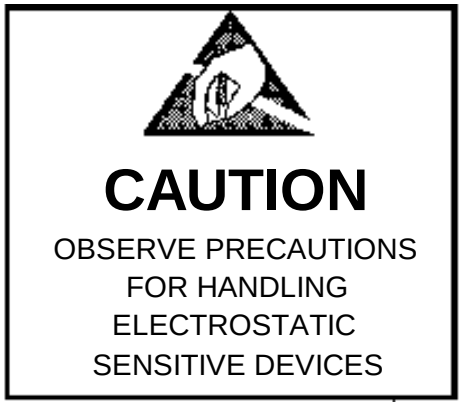
- **ALWAYS** take proper precautions when handling static sensitive devices.



- **DO NOT** connect or disconnect a load cell scale base to the equipment with power connected or damage will result.

- **SAVE** this manual for future reference.

- **DO NOT** allow untrained personnel to operate, clean, inspect, maintain, service, or tamper with this equipment.



- **ALWAYS DISCONNECT** this equipment from the power source before servicing.

- **CALL** METTLER TOLEDO for parts, information, and service.

TABLE I

CONFIGURATION, SIZES AND CAPACITIES

FACTORY NUMBER	INDICATION	INCREMENTS	LOAD CELL	L/C INITIAL	LEVER MULTIPLE	L/C PULL AT FULL SCALE	PLATFORM DIMENSION
2037-0001	100 x 0.02 lb. (50 x 0.01 kg)	5000	25 lb	8 lb	10.42	9.6 lb 10.6 lb	19-1/4”W x 20”L
2037-0002	250 x 0.05 lb (100 x 0.02 kg)	5000	50 lb	8 lb	10.42	24.0 lb 21.2 lb	19-1/4”W x 20”L
2137-0001	250 x 0.05 lb (100 x 0.02 kg)	5000	50 lb	8 lb	14.00	17.9 lb 15.7 lb	19-1/2”W x 28-1/4”L
2137-0002	500 x 0.1 lb (250 x 0.05 kg)	5000	100 lb	8 lb	14.00	35.7 lb 39.4 lb	19-1/2”W x 28-1/4”L
2137-0003	1000 x 0.2 lb (500 x 0.1 kg)	5000	200 lb	8 lb	14.00	71.4 lb 78.7 lb	19-1/2”W x 28-1/4”L

TABLE II

CONFIGURATION, SIZES AND CAPACITIES

FACTORY NUMBER	INDICATION	INCREMENTS	LOAD CELL	L/C INITIAL	LEVER MULTIPLE	L/C PULL AT FULL SCALE	PLATFORM DIMENSION
2037-0011	100 x 0.02 lb. (50 x 0.01 kg)	5000	25 lb	8 lb	10.42	9.6 lb 10.6 lb	19-1/4”W x 20”L
2037-0012	250 x 0.05 lb (100 x 0.02 kg)	5000	50 lb	8 lb	10.42	24.0 lb 21.2 lb	19-1/4”W x 20”L
2137-0011	250 x 0.05 lb (100 x 0.02 kg)	5000	50 lb	8 lb	14.00	17.9 lb 15.7 lb	19-1/2”W x 28-1/4”L
2137-0012	500 x 0.1 lb (250 x 0.05 kg)	5000	100 lb	8 lb	14.00	35.7 lb 39.4 lb	19-1/2”W x 28-1/4”L
2137-0013	1000 x 0.2 lb (500 x 0.1 kg)	5000	200 lb	8 lb	14.00	71.4 lb 78.7 lb	19-1/2”W x 28-1/4”L

The difference between the scales listed in Table I and Table II is the use of a new Printed Circuit Board (PCB).

The configurations listed are the only approved configurations for the application of this product.

NOTE: This scale may not pass requirements for the 1986 versions of Handbook 44 and should not be used in Legal for Trade applications

I. GENERAL DESCRIPTION

The Toledo model 2037 and 2137 are combination straight weigh/parts counting, electro-mechanical bench portable scales which combine mechanical under-structure with state-of-the-art electronic indication. The scales, which are designed to be both durable and accurate, are well-suited for a variety of industrial applications.

The unit is available only in ageneral purpose enclosure. The single display will show either gross weight, net weight or piece count. Recall of tare weight and Averge Piece Weight (APW) is also provided.

Weight and count information may be transmitted to a printer or compatible accessory device in bit serial ASCII code, even parity, 20mA current loop, RS-232-C or RS-422. The buad rate is selectable at 300, 1200, 2400, 4800 or 9600 baud on demand, or 1200, 2400, 4800 or 9600 buad continuous output.

A. FEATURES

- Non-volatile RAM for storage of setup parameters.
- Keyboard Calibration and Functional Setup.
- Displays weight in either pounds (lb) or kilograms (kg) switchable from the keyboard.
- Both auto tare and digital tare are standard.
- Six character 0.5” high vacuum fluorescent-type display green-blue in color.
- Any combinations of gross wight, tare weight, net weight, average piece weight and piece count may be transmitted.
- Bi-directional communications.
- Transmissions of control characters to allow expanded printing of net weight and/or piece count.
- Average Piece Weight enhancement.
- Automatic zero maintenance for weight variations less than 0.1 increments per second (up to plus or minus 2% of scale capacity from zero).
- Push-button zero (within plus or minus 2% of scale capacity from zero).
- Selectable digital filtering
- Motion detection sensitivity is selectable as either plus or minus 0.5 increment or plus or minus 3.0 increments over a period of three successive A/D updates.
- Internal resolution is one part in 500,000.
- Order independent entry of tare and sample / APW
- Ability to repeat tare and/or APW from one transaction to the next.
- Fabricated steel bases utilizing rugged and long-lasting levers.
- Phenolic non-conductive wheels for portability, (2137).

B. STATEMENT OF PERFORMANCE

The performance of any count-by weighing scale is dependent on uniformity of weight per piece, number of pieces in the sample, individual piece weight and the percent of rated load placed on the scale. In application, count accuracy is also dependent upon the ability of the operator to read and record the count information accurately.

These high resolution counting indicators significantly reduce count errors induced by the operator. In most applications, they provide better practical accuracy than either hand coutning or using mechanical techniques. Assuming proper capacity selection, count accuracy of ± one part is atainable inmany specific cases. However, the most significant variable is uniform weight of the parts to be counted. This variable is not controllable by the scale system.

C. ACCURACY CONSIDERATIONS

Counting accuracy is determined primarily by these factors:

1. Digital resolution of the sample weight.
2. Piece to piece weight variation.

Item 1 is the most frequent cause of parts counting inaccuracy because of the user's desire to count and handle the minimum number of sample pieces. For example, with a sample weight of 0.05% of full scale, sample weight resolution is ± 1 part in 250, so counting error is ± 0.4% at best. use of the 0.1% or 0.2% minimum sample weights will significantly improve counting accuracy.

Item 2 is not under control of the parts counter, but is a factor which merits serious attention by the user. The overall count accuracy can be no better than the piece to piece variation, and may be much lower if the sample is not representative of the average piece weight.

II. SYSTEM DESCRIPTION

The instrument provides 12.5 volts DC for excitation of strain gauge load cells. The output of the load cells will be a very small milli-volt signal. The unit conditions this signal, amplifies it and converts it to a digital signal in the integrator. The piece count is determined using this digital signal.

Initial and span values are automatically calculated during calibration. The standard initial range is from 0 to 15 milli-volts and the standard span range is from 10 to 30 milli-volts. With jumper W7 in the 3mV/V position, the initial range is extended to 22.5 milli-volts and span is adjustable from 15 to 45 milli-volts.

A. DESCRIPTION

The 2037/2137 consists of five major blocks. These are:

1. BASE

System of levers that transfer weight of an object to vertical pull

2. LOAD CELL

Tranduces the vertical pull from the base to a linear voltage change to send ot the Main PCB

3. MAIN PCB

Contains power supplies, scale logic, analog section, program jumpers and fluorescent display

4. TRANSFORMER

Steps down voltage from and AC source to smaller magnitude voltages to be sent to the PCB

5. KEYBOARD
The keyboard allows operator interface for functions such as tare, print, clear, lb-kg selection and calibration / setup.

B. DESIGN

1. FORCE CONNECTION
Pivot and bearing through reduction level to cone pivot and bearing at load cell

2. LOAD CELL
Toledo general purpose 25, 50, 100 and 200

3. PLATFORM
Slip on 12 guage painted carbon steel

4. CONSTRUCTION
Fabricated, painted carbon steel base and levers

5. SUPPORT
2037 - Four (4) adjustable feet to provide leveling
2137 - Four (4) wheels for portability

6. ADJUSTMENTS
Shift adjustments by honing pivots

C. APPLICATIONS

1. These scales meet NEMA 1 requirements for use in a general purpose atmosphere. They are intended for indoor appplications wherever dirt, oil or water is not a problem.

2. These scales are not designed for hose-down appplications. Typical examples of mis-application of these scales include, but are not limited to:

Immersions
Hosedown
Splashing liquids
Corrosive chemical environments

Toledo Scale manufactures other scales that are suitable for “hosedown” applications.

3. Hazardous Areas
In locations classified as hazardous by the National Electrical Code (NEC) because of combustible or explosive atmospheres, special modules are required. DO NOT USE THE 2037 AND 2137 IN THESE LOCATIONS.

4. These scales may not pass requirements for the 1986 Handbook 44 and should not be used in Legal for Trade applications.

III. SPECIFICATIONS

A. ELECTRICAL AND PHYSICAL SPECIFICATIONS

1. ENVIRONMENT

The 2037/2137 operates from -10º C (14º F) to + 40º C (104º F) at 0 to 95% relative humidity, non-condensing.

2. POWER REQUIREMENTS

The 2037/2137 can operate (by selection) at 120V, 220V or 240V AC (+10%, -15%) at a line frequency from 49 to 61.5 Hz. Power consumption is 25 watts maximum.

The line voltage must be within these specifications. The power line for the 2037/2137 must not be shared with equipment that generates line noise (such as motors, relays, heaters, etc.). If adverse power conditions exist, a power line conditioner may be required.

3. U.L. AND C.S.A. STANDARDS

Materials, components and electrical design comply with U.L. and C.S.S. standards and requirements including grounding of all metal parts, fusing, etc.

4. FCC REGULATIONS

The 2037/2137 meets or exceeds the FCC conducted and radiated emissions requirements.

5. RFI SPECIFICATIONS

The 2037/2137 has been designed to reatly reduce susceptibility to radio frequency interference. IN areas where high levels of RFI are known to exist, an optional RFI kit should be used. This kit prevents fluctuations greater than one division for the following conditions:

FIELD STRENGTH	FREQUENCIES
3 volts / meter	27, 160 and 460 Mhz
4 watts at 2 meters	27 and 460 Mhz

6. APPEARANCE AND DIMENSIONS

The color of the base and column if fog white. The platform is carbide black , while the cover and indicator aree charcoal black. The entire 2037 weights approximately 110 pounds and the 2137 weighs approximately 130 pounds.

2037 - Overall height with column and indicator: 35”.
Base dimensions: 19-1/4” wide x 20” deep x 7-3/4” high.

2137 - Overall height with column and indicator: 46-1/2”.
Base dimensions: 19-1/4” wide x 28-1/8” deep x 8” high.

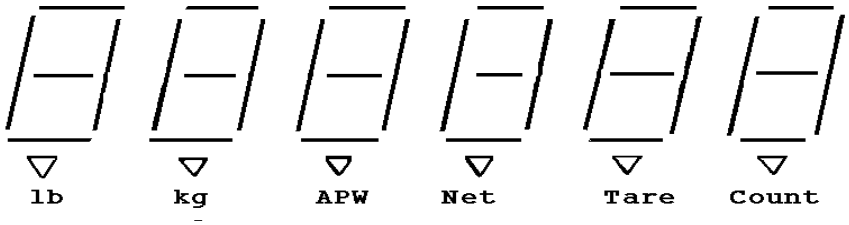
7. FUNCTIONAL SPECIFICATIONS

Save Overload Rating	Corner Loading Capacity
125% full scale capacity	100% full scale capacity
Repeatability	**Shift**
.015% full scale capacity	.025% full scale capacity (1/2 load, 1/2 distance to edge)

B. DISPLAY FORMAT

The display is a seven-segment green-blue vacuum fluorescent-type with a lighted decimal point. The display can show six digits or five digits with a minus sign. Also included are lighted descriptors to indicate lb, kg, APW, net and count arranged as shown.

There are no programming steps to select the update rate. The display update rate is dependent upon the amount of initial & span used. The larger the initial weight, the slower the update rate. This rate will vary from 2 cycles / second to 5 cycles / second.



Selectable display filtering may be used where a constant vibration or air currents cause the display to fluctuate. When display filtering is enabled, the setting time to no motion may be increased slightly.

The display will blank at 5 increments under zero and also 5 increments over the programmed full scale capacity.

APW's less than 0.1 will not show a decimal point on the display since it would appear to the left of the first digit.

C. DATA INTERFACE

All versions are capable of transmitting bit serial ASCII data at 300 to 9600 baud selectable during setup. 20mA current loop. EIA RS-232-C and EIA RS-422 are all available as standard.

1. DEMAND OPERATION

When a print command is received, either from the PRINT key or an external "Print Demand" signal, the unit will output data. (See output tables, Section VI, Part D.2.3). Transmission of a checksum character is selectable as is expanded print format. Scale motion, expanded display, under zero or over capacity operation will disable a print command.

2. CONTINUOUS OPERATION

The data is transmitted every display update, approximately 3 times each second. SE output tables, Section VI, part D.3 for format. Transmission of a checksum character is selectable in setup mode.

3. CHARACTER FORMAT

Each data byte consists of one start bit, seven data bits, one selectable* parity bit (even, odd or space) and two stop bits.

*NOTE: Units with a factory number (located on the data plate) with a "0" as the seventh digit will only have even parity and will not be selectable. These models are shown in TABLE 1 at the beginning of this technical manual.

4. DATA INPUT

Scales shown in TABLE II at the beginning of this manual have the added feature of receiving certain ASCII codes characters to duplicate keyboard functions. These functions are zeroing the scale, taring a weight, entering a sample count or APW, clearing the scale and printing. The parity and baud rate are selectable but must always be the same as the printer output selections. Once a command is received, the scale will process it within 250ms. RS232, 20mA current loop or RS-422 may be used as the means of communication for these commands.

IV. INSTALLATION INSTRUCTIONS

A. PRELIMINARY INSPECTION

The 2037 and 2137 are shipped complete in one box; however, there is some assembly required. To unpack and set up the scale, use the following procedure:

1. Check box for any signs of damage. IF DAMAGE APPEARS, MAKE A CLAIM WITH THE CARRIER IMMEDIATLEY.

2. Open the top of the box and remove the packing material. The following contents will be exposed.

   a. Indicator
   b. Load cell mounting plate with load cell attached
   c. Indicator support frame
   d. Cloth bag containing miscellaneous hardware and indicator power cord
   e. Two (2) threaded rods and one (1) steel-yard rod
   f. Four (4) wheels (2137 only)
   g. Scale base
   h. Technical Manual and Parts Catalog

3. Make sure that the scale base is stable and level before beginning the column assembly. Adjust the scale base feet is necessary to achieve this.

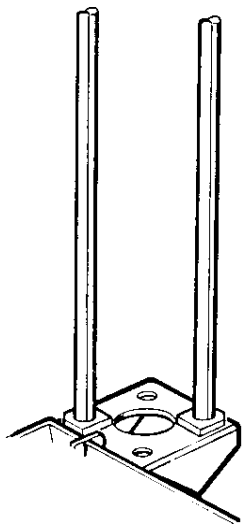
B. ASSEMBLY PROCEDURE

1. To assemble wheels to the 2137 base, notice how the base is assembled and remove the platform, spider assembly and both levers. Slide onto the axle bolt a plain washer, wheel, plain washer. Screw the axle bolt into the nut which is welded to the fame and allow just enough clearance for the wheel to turn freely. Next, place a lockwasher and nut on the axle bolt and tighten securely.

Install all four wheels using the same procedure then reassemble the levers, spider and platform to the base.

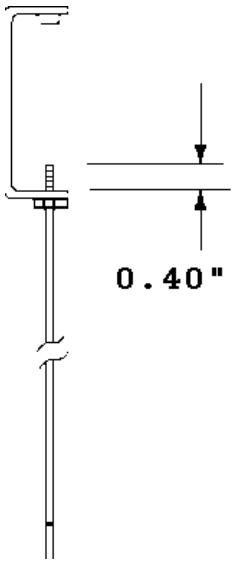
2. To attach the column, run the column plates about an inch onto the columns rods. Place the column rods into the holes on the column support plate and secure loosely with a lockwasher and nut on each rod. See Figure 1.

3. Remove top cover and load cell assembly from the column top channel. Place column top channel on top of the column and secure to the column rods with the fasteners provided.



4. Check the length of the steelyard rod assembly per Figure 2. Adjust if necessary. If the steelyard rod is not assembled, assemble per drawing and measurements in Figure 2. Install the steelyard rod assembly. Install the load cell and plate assembly. Secure the nuts and lock washers at the base of the column rods.

5. Route the load cell cable through the hole in the rear of cover and insert the grommet into this hole. Attach the cable to the load cell with the yellow wire toward the top of the load cell. Secure cable to top plate using the plastic clamp on the top plate as a strain relief.



6. Secure the top cover to the column channel. Be sure to attach ground wire to plate. Attach the indicator to the top cover with the two self-tapping screws.

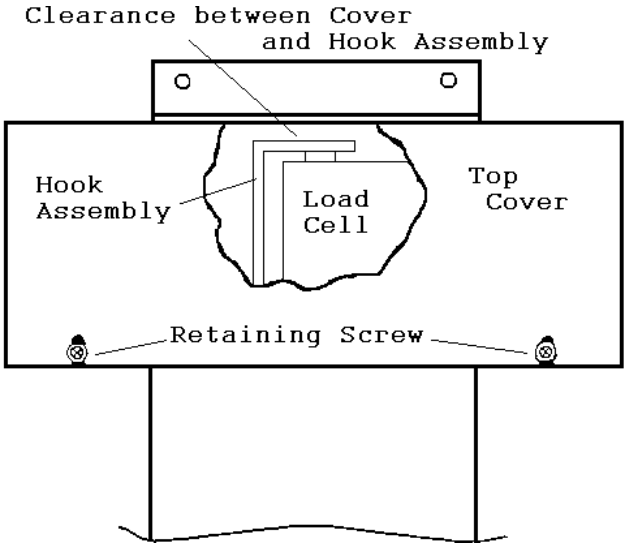
7. Adjust the top cover vertically to retain but not rub the steelyard hook assembly. If the box is pressed down as far as it will go, it may contact the hook assembly causing non-repeatability and change on the scale. See Figure 3.

If rubbing occurs, loosen the four retaining screws and lift the box assembly slightly until the scale repeats satisfactorily. Tighten the four screws to secure the top cover in this position.

8. Attach the other end of the load cell cable to the nine pin connector (J1) on the back of the indicator.

9. Open the instrument and continue the inspection, noting that all inter-connecting harnesses are securely fastened.

The unit is opened by removing the four screws from the corners of the rear cover. Be careful not to damage the keyboard harness when removing the front cover. When installing screws DO NOT over tighten.



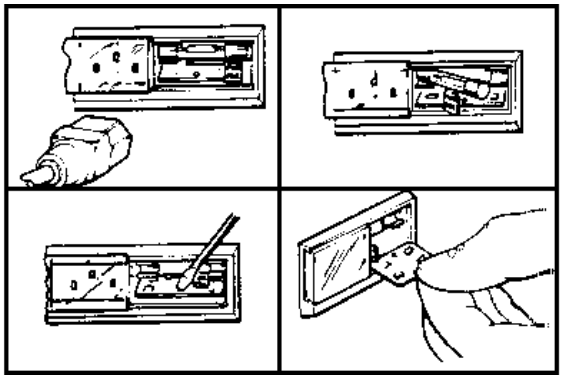
10. Locate the voltage selection PCB and verify that the voltage selected is correct for your use. An adjustment may be necessary. If the voltage is changed, the fuse may need replaced. Refer to the following fuse chart.

WARNING: BE SURE POWER IS DISCONNECTED BEFORE MAKING ANY VOLTAGE CHANGES.

The following photos will assist you in checking or changing the voltage selection. This step MUST be performed prior to applying power to the unit

1. This photo shows the line cord detached and the fuse cover moved to the left.

2. In this photo the fuse is removed by pulling the handle labeled "FUSE PULL"



3. With the fuse removed, use a small screwdriver or similar object and gently pry the card from the assembly.

4. Once you have determined the card in a readable position. A hole in the card is provided to assist removal. In the photo, the voltage selected e with Slide e.

CAUTION: CHECK TO BE SURE FUSE HAS BEEN REPLACED WITH FUSE OF CORRECT RATING. THE PROPER SLO-BLO FUSE VALUES ARE:		
OPERATION	**RATING**	**PART NUMBER**
120 V	0.5 A	112145 00A
220 V	0.25 A	095920 00A

WARNING

FOR CONTINUED PROTECTION AGAINST FIRE HAZARD, REPLACE ONLY WITH SAME TYPE AND RATING OF FUSE.

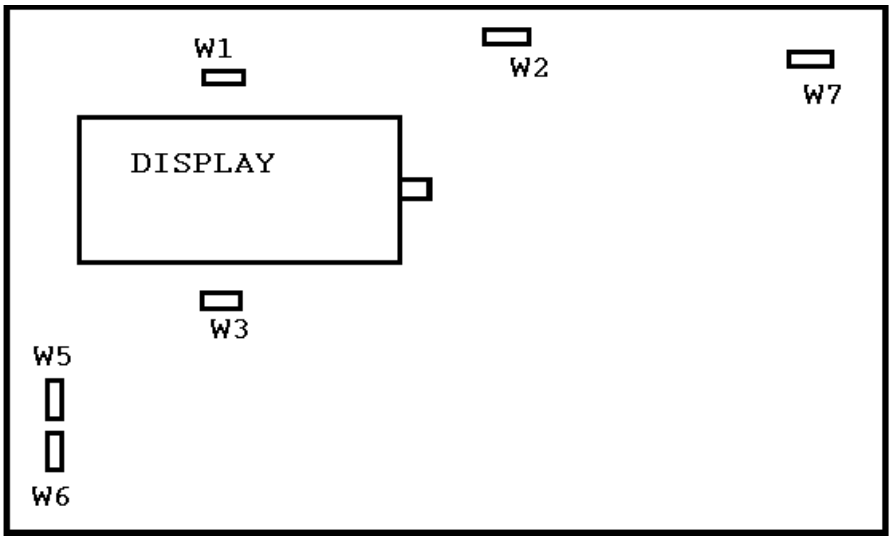
WARNING: For continued protection against shock hazard, connect to properly grounded outlet only DO NOT remove ground prong.

C. JUMPER DESCRIPTIONS

W1 - External ROM Enable
Must be in place shorting the two pins.

W2 - Store Enable
This jumper must be in place shorting the pins to access the setup mode. It must also be removed to exit the setup routine. When this jumper is referenced on the display of the unit, it will be shown as J2.

W3 - Comma
When this jumper is shorting the two pins, a comma will be displayed instead of a decimal point.



W5 - W6 - Not Used

W7 - Load Cell Output Selection
2mV/V - For use with 2mV/V load cells, this jumper should be between pin 1 and 2. The 2037/2137 uses this selection.
3mV/V - For use with 3mV/V load cells, this jumper should be between pin 2 and 3.

D. PROGRAMMING PROCEDURE

With the set-up jumper W2 installed on the Main PCB, the unit will proceed into the setup mode. The following five keys are operational during the setup mode:

1 - Depressing this pushbutton will enable, or turn ON, the displayed programming parameter

0 - Depressing this pushbutton will disable, or turn OFF, the displayed programming parameter unless specified otherwise.

ZERO - Depressing this pushbutton will enable the programmer to back-up to the previous prompt.

CLEAR -Depressing this pushbutton will cause the unit to bypass any other programming parameters and advance to the [S FILE] prompt at the end of the programming procedure.

PRINT - The data displayed will be accepted and the routing will proceed to the next step.

STEP	DESCRIPTION	INITIAL SETUP
F1	**OPERATIONAL FUNCTIONS**	
F1.1	Auto Clear Tare	1
F1.2	Auto Clear APW	1
F1.3	APW Enhance	0
F1.4	Enable Operator Setup	0
F1.5	Expand Mode	0
F2	**UNIT FUNCTIONS**	
F2.1	Sample in Pcs./Wt.	0
F2.2	Minimum Sample	0.05
F2.3	Auto Sample Acceptance	0
F2.4	Tare Active	1
F2.5	Keyboard Tare	1
F2.6	LB/kg Switching	1
F2.7	Calibrate in Pounds	1
F2.8	Power-up Pounds	1
F2.9	Auto Zero Maintenance	1
F3	**CALIBRATION**	
F3.1	Configure Scale?	1
F3.2	Number of Increments	5000
F3.3	Increments Size	*
F3.4	Decimal Point	*
F3.5	Scale Calibration	*
F3.6	Scale Calibration	*
F3.7	Scale Calibration	*
F3.8	Scale Calibration	*
F3.9	Motion Sensitivity	1
F3.10	Digital Filtering	0
F3.11	Span Adjust	0
F3.12	Power-Up Timer	0

F4	DATA OUTPUT FUNCTIONS	
F.1	Demand Mode	1
F.2	Baud Rate	300
F.3	Checksum Enable	0
F.4	Print Key Active	1
F.5	Repeat Print	1
F.6	Remote ASCII Input	0
F.7	RS-422 Enable	0
F.8	Single Line Print	0
F.9	Print Gross	1
F.10	Print Tare	1
F.11	Print Net	1
F.12	Print Net Expanded	0
F.13	Print APW	1
F.14	Print Pieces	1
F.15	Print Pieces Expanded	0
F.16	Parity Select	EVE

Three programming steps of the 2037/2137 can be accessed without inserting the setup jumper W2 is step F1.4 is programmed as “1”. These steps are referenced as operator selectable setup parameters. To access these three steps, press the RECALL key when in the gross mode. The following steps will be accessed:

F1 Access Opertor Setup?
F1.1 Auto Clear Tare
F1.2 Auto Clear APW
F1.3 Sample Enhancement

Refer to the actual programming descriptions in the next section for a full explanation of each of these steps. Note that these operator entered functions are not saved in non-volative RAM. They will be over-written by the selections stored during normal setup in the event of a power failure.

With W2 in place on the Main PCB, proceed through the following sequence. If W2 is not in place, the setup routine cannot be accessed.

[CAL AJ] CALIBRATION ADJUST

This prompt will only occur if Step F3.11 is set to “1” and the setup mumper W2 is in place. To make an adjustment to span, answer “1” when this prompt appears. After an adjustment, the remainder of the setup will be skipped. To continue with the setup mode but not make a span adjustment answer “0”. The entire procedure is described in Part D of this Section.

[F1 ?] ACCESS OPERATIONAL FUNCTIONS?

Press:
1 - To enter into the setup of the operational parameters.
0 - To skip the programming for operational parameters and proceed to step [F2 ?].

[F1.1 1] AUTO CLEAR TARE

Press:
1- Tare will automatically clear when the scale returns to zero.
0 - Tare will be retained until the CLEAR pushbutton is depressed.

[F1.2 1] AUTO CLEAR APW

Press:
1- Average piece weight will automatically clear when the scale returns to zero.
0- Average piece weight will be retained until the CLEAR pushbutton is depressed

[F1.3 0] APW ENHANCE ENABLE

Press:
1-To activate the enhanced sample feature.
0- The unit will operate in the normal count mode.

[F1.4 0] ENABLE OPERATOR SETUP

Press:
1- To enable operator selection of steps F1.1, F1.2 and F1.3 without having to insert the setup jumper W2. This is done by pressing the RECALL key when the scale is at zero in the gross mode.
0- To disable operator selection of steps F1.1, F1.2 and F1.3. the setup mumper W2 must be inserted to change these parameters.

Note that the above operator entered funcitons are not saved in non-volatile RAM is changed when W2 is not inserted, they will be overwritten by the selections stored during normal setup i the event of a power failure

[F1.5 0] EXPANDED WEIGHT DISPLAY

Press:
1- A “1” will be displayed on the right digit of the display and the weight display will be expanded.
0- A “0” will be displayed on the right digit of the display and the display will not be expanded.

Note: The unit should not be left inthe expand mode for weighing. This should be used for instalation evaluation and troubleshooting only. Print and AZM functions will be disabled.

[F2 ?] ACCESS UNIT FUNCTIONS

Press:
1- To enter into the unit function setup routine. The display will step to [F2.1].
0- To bypass the unit function setup routine, the display will then step to [F3.?]

[F2.1 0] SAMPLE IN PCS./WT.

Press:
1- If the average piece weight is to be entered and calculated in pieces per weight unit.
0- If the average piece weight is to be entered as a decimal value.

[F2.2] MINIMUM SAMPLE SELECT
[2 0.05]

Allows selection of the percent of scale capacity that must be reached before an aveage piece weight may be calculated and a count sequence completed. The availabe percentages are 0.0%, 0.10%, 0.05% and 0.02%.
Press:
1- If the displayed number is the correct selection.
0- To cycle the display throught eh various selections. When the correct value is displayed, press 1.

[F2.3 0] AUTO SAMPLE ACCEPTANCE

Press:
1- When additional sample pieces required are to be automatically accepted.
0- When additional sample pieces are to be entered via the sample pushbutton.

[F2.4 1] TARE ACTIVE]

Press:
1- To enable tare.
0- To disable all tare functions. The display will skip to [F2.6].

[F2.5 1] KEYBOARD TARE

Press:
1- To allow a hand-entered tare via the keyboard as well as pushbutton tare.
0- to disable hand-entered tare via the keyboard. The pushbutton tare function will continue to operate.

[F2.6 1] LB/KG SWITCHING

Press:
1- To enable LB(pound) and kg(kilogram) switching via the keyboard pushbutton.
0- To disable LB/kg switching. The scale will weight in whichever mode has been selected for power up.

NOTE: LB/kg switching is disabled when both 2.7 and 2.8 are OFF>

[F2.7 1] CALIBRATE IN POUNDS

Press:
1- If the test weights to be used during calibration are avoirdupois (LB) test weights.
0- If the test weights tobe used during calibration are metric (kg) test weights.

[F2.8 1] POWER UP IN POUNDS

Press:
1- If the scale is to weigh in pounds at power up.
0- If the scale is to weigh in kilograms at power up.

[F2.9 1]

Press:
1 - To enable the atuo-zero maintenance feature. AZM will keep the unit on zero in spite of small changes in weight of up to 0.6 increments per second.
0 - To disable the auto-zero maintenance feature.

[F3 ?]

Press:
1 - To enter the calibration group of setup parameters. The setup will proceed to step [F3.1].
0 - To bypass the calibration group of parameters and the unit will proceed to step [F4 ?].

[F3.1 1]

Press:
1 - To proceed with the calibration procedure
0 - To skip calibration of the scale and proceed to Step [F3.9].

Allow a minimumof 15 minutes warm-up before attempting to calibrate. This warm-up time is required to stabliize the electronics and allow the load cells to “warm up”.

NOTE: When calibrating, the unit must remian closed or drifting will occur. Any air currents passing over the PCB will cause an error in calibration.

[F3.2] TOTAL INCREMENTS
[10000]

Press:
1 - If the number displayed is the correct number of full scale increments.
0 - If the number displayed is not the correctnumber and the display will update to the next possible selection. The valid selections are 5000, 6000, 8000, 10000, 12000, 15000, 16000 and 20000.

[F3.3 2] INCREMENT SIZE

Press:
1 - If the number displayed is the correct increment size.
0 - If the number displayed is not correct and the display will update to the next selection. Possible values are X1, X2 and X5.

[F3.4] DECIMAL POSITION
[0.002]

Press:
1 - If the position of the decimal is correct.
0 - If the position of the decimal is not correct and the display will update with the next possible selection. The valid selections are 0.001, 0.01, 0.1, 1 and 10.

[F3.5]
[E SCL] EMPTY SCALE

Remove all weight from the scale platform then press PRINT to continue.

[15 CAL] TIME OUT

The unit will count down from 15 to 0 while initial is set.

[F3.6]
[Add Ld] ADD LOAD

Place the selected test weight on the sclae platform. This should be an amount close to scale capacity. As much weight as is practical should be used. Press PRINT key to continue.

[F3.7]
[ ] TEST WEIGHT

The display will blank and the value of test weights used must be entered. Fractions or decimal weights are not accepted - only whole numbers. Press PRINT to continue after entering the weight value.

[15 CAL] TIME OUT

The unit will count down from 15to 0 while span is set.

[F3.8]
[E SCL] EMPTY SCALE

Remove the test weights then press PRINT to allow the sclae to re-check zero.

[15 CAL] TIME OUT

The unit will count down from 15 to 0 while zero is reset.

[CAL d] CALIBRATION DONE

This display will appear after calibration is complete and be displayed for approximately three seconds.

[F3.9 1] MOTION SENSITIVITY

Press:
1 - Zero, tare and print functions will be inhibited when +/- 2 increment or more of motion is detected.
0 - Zero, tare and print functions will be inhibited when +/- 1/2 increment or more of motin is detected.

[F3.10 0] DIGITAL FILTERING

Description for units from TABLE I at the beginning of this technical manual.

This step allows for selection of filtering to help compensate for constant vibration or constant air currents. A slightly slower display response may be noted if filtering is enabled.

Press:
1 - To enable digital filtering.
0 - To disable digital filtering.

Descripton for units from TABLE II at the beginning of this technical manual.

This step selects various degrees of filtering for vibration or air currents. Press the “0” key if the selection is not correct and the display willupdate with the next selection. Press th “1” key if the value displayed is the correct filtering rate. A slightly slower display response may be noted if filtering is enabled.

SELECTION	DESCRIPTION
0	No Filtering
1	Minimum Filtering
2	Medium Filtering
3	Strong Filtering

[F3.11 0] SPAN ADJUSTMENT

Press:
1 - To enter into the span adjust mode for amsll adjustments of span without total recalibration. The standard calibration must be completed to provide a referecne point beor attempting to use this step.
0 - A “0” will be displayed on the right of the display and the span adjust mode cannot be accessed.

[F3.12 0] POWER-UP TIMER

Press:
1 - The weight display will remain blank after power-up and the legend indicators will blink ntil the time-out period has elapsed. The time out is approximately 30 seconds to allow the electronics to "warm up".
0 - There will be no delay at power up before the weight display is illuminated.

[F4. ?] ACCESS DATA OUTPUT FUNCTIONS?

Press:
1 - To access the printer program setup when data output is required.
0 - To bypass the data output setup. The program will proceed to [S FILE].

[F4.1 1] DEMAND MODE

Press:
1 - A "1" will be shown on the right of the display and data output will be on demand (PRINT key).
0 - A "0" will be displayed and output will be continuous.

[F4.2] BAUD RATE SELECT
[2 0300]

Press:
1 - If the value displayed is the correct baud rate.
0 - The unit will update to another baud rate selection. The choices are 300, 1200, 2400, 4800 and 9600.

NOTE: 300 baud cannot be selected if in the continuous output mode.

[F4.3 0] CHECKSUM ENABLE

Press:
1 - A "1" will be shown on the display and a checksum character will be transmitted.
0 - A "0" will be displayed and no checksum is transmitted.

Checksum is defined as the 2's complement of the 7 low order bits of the binary sum of the 7 low order bits of all characters preceeding the checksum including STX and CR. Bit 8 of Checksum is parity of the 7 low order bits of Checksum.

[F4.4 1] PRINT KEY ACTIVE

Press:
1 - To enable the PRINT key on the 2037/2137.
0 - To disable the PRINT key. The print command must come from a remote source.

[F4.5 1] REPEAT PRINT ENABLE

1 - A "1" will be shown on the display and a repeat print will be available.
0 - A "0" will be displayed and repeat print will be inhibited.

[F4.6 0] REMOTE INPUT IN ASCII

Description for units from TABLE ! at the beginning of this technical manual.

Press:
1 - When ASCII coded character “P” is received via the receive input, a data transmission will be initiated.
0 - A pulse of approximately 300ms at the receive input will initiate a data transmission.

Description for units from TABLE II at the beginning of this technical manual.

Press:
1 - To enable the scale to receive particular ASCII characters to duplicate certain keyboard funcitons. This disables remote print using a 300ms pulse at the receive input. Reference Section VI, Part D.4 for details on the ASCII input.
0 - To disable the use of ASCII characters for remote input. A 300ms pulse at the receive input will initiate a print request.

See the Data Output Section for more details on the remote print option.

[F4.7 0] RS-422 ENABLE

Press:
1 - If RS-422 will be used as the type of data transmission from the printer port.
0 - If either 20mA current loop or RS-232 will be used as the type of data transmission from the printer port.

NOTE: If the printer output will not be used, program step F4.7 as a “0”.

[F4.8 0] SINGLE LINE OUTPUT

Press:
1 - If all the data is to be transmitted in a single line.
0 - If the data is to be output one field per line. (Multiple line)

[F4.9 1] PRINT GROSS WEIGHT

Press:
1 - If gross weight is to be transmitted.
0 - If gross weight is not to be transmitted.

[F4.10 1] PRINT TARE WEIGHT

Press:
1 - If tare weight is to be transmitted.
0 - If tare weight is not to be transmitted.

[F4.11 1] PRINT NET WEIGHT

Press:
1 - If net weight is to be transmitted.
0 - If net weight is not to be transmitted.

[F4.12 0] PRINT NET EXPANDED?

Press:
1 - A “1” will be shown on the right of the display and the net will print expanded if the printer is capable of doing so when an ASCII “SO” character is received.
0 - A “0” will be displayed and the output will not have the ASCII character “SO” to initiate an expanded print of net weight.

[F4.13 1] PRINT AVERAGE PIECE WEIGHT

Press:
1 - If APW is to be transmitted.
0 - If APW is not to be transmitted.

[F4.14 1] PRINT PIECES

Press:
1 - If piece count is to be transmitted.
0 - If piece count is not to be transmitted.

[F4.15 0] PRINT PIECES EXPANDED

Press:
1 - A “1” will be shown on the right of the display and the piece count will print expanded if the printer is capable of doing so when as ASCII “SO” character is received.
0 - A “0” will be displayed and the output will not have the ASCII character “SO” to initiate an expanded print of pieces.

[F4.16 EVE] PARITY SELECTION

NOTE: This step is only present in units shown in TABLE II at the begining of this manual and will occur only when the remote ASCII input (step [F4.6]) has been enabled. In order to change this selection, it will be necessary to program step [f4.6] as “1”.

Press:
1 - To accept the selection for parity to be used in the data input and output.
0 - To update the display with the next selection for parity. Possible selections include:

SELECTION	DESCRIPTION
non	Parity always a “0”
EVE	Even Parity
odd	Odd Parity

[S FILE] SAVE FILE?

This determines if the programming just entered is to be saved in memory or not.

Press:
1 - If the programming just completed is to be retained in memory and used again after a power down.
0 - If the programming just completed is to be used until power loss but not entered into memory for use after a power down.

[J2 OFF?] JUMPER OFF?

Remove the jumper W2 then press PRINT to exit the setup routine.

E. SPAN ADJUSTMENT

There is a feature of the 2037/2137 to allow an adjustment to span without repeating the entire calibration procedure. The procedure for using the span adjustment feature follows.

1. Before span adjust can be used the standard calibration, as specified in the setup section, must be performed. It is suggested that as much weight as is practical be used for calibration.

2. Apply known test weights to the scale and if an adjustment is necessary, proceed to the next step.

3. Install the setup jumper W2 and step through the setup until step F3.11 is displayed and enter a 1 (Yes) for that step.

4. Exit the setup routine by pressing the CLEAR key, then answering “0” (No) to [S FILE]. Remove W2 then press PRINT.

5. Install the setup jumper W2 and the display will now show [CAL AJ].

6. To make a span adjustment, answer “1” (Yes) to [CAL AJ] then enter the correct test weight value when the display blanks. All digits should be entered including those to the right of the decimal point (See Note C). Press the PRINT key to enter this value and it will exit the setup routine and go to the last step [J2 OFF]. Remove W2 then press PRINT.

7. The weight display should now show the correct weight value. This procedure may be repeated several times during a “build-up” procedure.

8. After all span adjustments are complete, re-enter the seup mode by inserting W2 and answer “0” (No) to step F3.11. Exit the setup routine by pressing the CLEAR key then answer “1” (Yes) to [S FILE]. Remove the W2 jumper and press PRINT>

NOTES:

a. This procedure will work correctly once when in the net mode. This is useful if a device to hold the test weights is required. Simply attach the holding device then press TARE. Add the test weights then follow the span adjustment procedure. After one adjustment - tare must be cleared then re-entered if required again.

b. Weights that are entered in values other than multiples of the increment size will not be accepted. For example, entering 103 pounds on the scale when the increment size is 2 pounds.

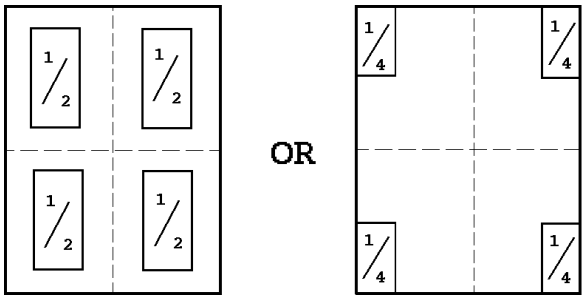
c. The entire weight value must be entered including numbers to the right of the decimal point. This is different from the standard calibration where only numbers to the left of the decimal point may be entered.

F. SHIFT TEST AND ADJUSTMENT

1. TEST

Place a half capacity test load at the center of each quarter of the platform or use a quarter capacity test load over each load pivot successively.

If a correction is not needed, proceed to the operating instructions.

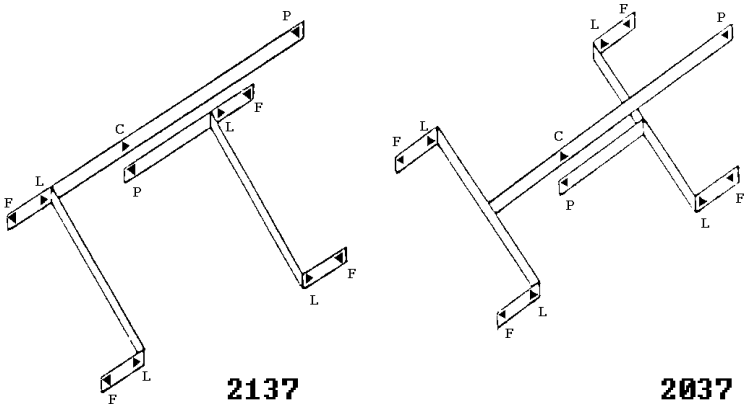


In a mechanical base, shift refers to the pivot distances of the levers. If on a lever the distances are equal, then a lever is said to have no shift error. Also, two levers which have the same ratio will have no shift error.

2. ADJUSTMENT

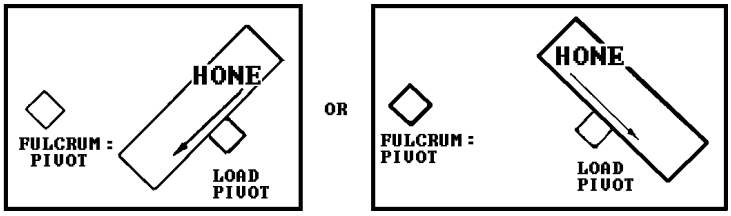
The lever illustrations of the 2137 and 2037 designate the pivots as follows.

F = Fulcrum Pivot
L = Load Pivot
P = Power Pivot
C = Center Connection



The rule is to lengthen the distance between the fulcrum and the load pivots to increase the indication. Conversely, shorten the distance between the fulcrum and the load pivots to decrease the indication. Use hone part number 085061 020 and part number 085062 020 to adjust the pivots.

Note the direction of honing. Always hone away from the load edge of the pivot.



a. Side to Side

To correct a shift error side to side on a lever, note the indication at each location and hone the load pivot as needed to correct the side to side error on either lever. Hone ONLY the load pivots to correct an error on either lever for a side to side correction.

b. Front to Back

When the indications on each load point of each lever are equal side to side and the indications of the levers are different front to back, then hone the power pivot of the short lever until the two levers are equal front to back. Do not hone the power pivot of the long lever. Increase the pivot distance from the power pivot to the fulcrum pivot on the short lever if the short lever has a higher indication than the long lever.

When the shift error is corrected, recalibrate the scale and retest the shift. Continue calibration and shift test/adjustment until no shift error is found after the scale is calibrated.

V. OPERATING INSTRUCTIONS

A. DISPLAY

The single display is used to show gross weight, net weight or piece count. Tare weights, sample quantities and average piece weights are shown during entry. Tare and APW values may also be recalled using the RECALL key.

The display can show up to six digits with a decimal point of five digits and decimal point with a minus sign. A negative six digit net weight is shown by alternate flashing of the six digits then six minus signs. Over capacity in the weight display is indicated by blanking the display at five increments over tared scale capacity. Under zero is indicated by blanking the dispaly with a minus sign showing at five increments under gross zero.

When power is applied, a display test will be initiated. This test consists of a counting sequence on all digits from number zero through number nine then illuminating all decimal points then the legend descriptors. After this sequence, the display will show the gross weight or will flash the legend descriptors for 30 seconds before displaying gross weight if the warm-up timer has been selected.

B. DISPLAY LEGENDS

The legends are printed on the display lens and are indicated by lighted descriptors directly above each legend.

LB:
The LB legend is illuminated when motion has ceased and the LB mode has been selected.

KG:
The KG legend is illuminated when motion has ceased and the KG mode has been selected.

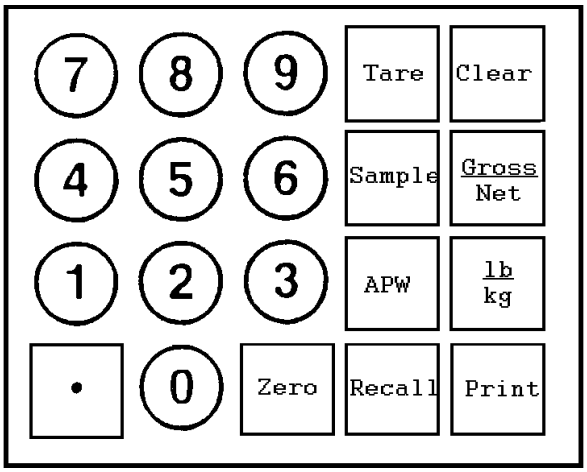
APW:
The Average Piece Weight legend will be illuminated when the APW is displayed during the recall sequence.

NET:
The NET legend, when illuminated, indicates tare has been entered and the display is showing the resulting net weight.

TARE:
The TARE legend will be illuminated when the tare value is displayed during the recall sequence.

COUNT:
The COUNT legend, when illuminated, indicates the display is showing a calculated piece count. The count will always be positive, even in the count out mode. A minus sign will not be used.

C. KEYBOARD



DIGITS 0-9:
Used to enter numeric data when required as in keyboard tare, average piece weight (APW), etc. Corresponding digits are echoed on the display.

ZERO:
Provides the ability to re-zero the scale over range of +/- 2% of the programmed full-scale capacity. After a loss of power, zero must be captured before a print or a tare command will be accepted.

PUSHBUTTON TARE:
When the TARE key is pressed with weight on the scale, and no weight motion present, the tare weight will be subtracted from the gross weight to provide a net weight display of zero. If motion is present, the tare command will be retained and performed when motion stops. If the weight is removed from the scale, the net weight will be displayed as a negative value equal to the tare value.

KEYBOARD TARE:
The instrument is equipped with a keyboard to provide ameans of entering tare weight. digital tare up to full scale capacity can be entered. The numbers entered are shown on the display. When the TARE key is pushed, the entered weight is subtracted from the gross weight on the platform and net weight is displayed. The least significant digit is always rounded up or down to agree with the weighing increment, ie. 0, 2, 4, 6, 8 for X2 increments and 0 or 5 for X5 increments. If the tare operation results in a negative six-digit net weight display, the weight display will alternate between the digits of weight and minuses in all six digit locations.

CLEAR:
When entering any data, a single depression of the CLEAR key will erase the data entered; a double depression will exit the data entry mode. When not in a counting sequence (no sample or APW has been entered) a single depression of the CLEAR key clears any tare weight that has been entered, returning the weight display to gross mode. During a counting sequence a double depression of the CLEAR key exits the counting mode and clears tare weight and APW.

SAMPLE:
The SAMPLE key is used to terminate the entry of sample piece count, and put the scale into count mode. If the sample less than the minimum required to calculate a rough APW, the count display will show “LO” for 2 seconds and then clear. The operator should place additional pieces (or remove pieces on count out sequences) on the platter and re-enter the sample count.

If the scale can calculate a rough APW but has not reached the selected minimum sample weight, the count display will show “Add n” where “n” is the number of pieces that need to be added to reach the minimum sample weight. If setup step F2.3 is programmed as a “1”, the scale will sense the weight increaseand automatically recalculate the APW and display the count. If step F2. is “0” the operator must add the exact “n” pieces and depress theSAMPLE key to advance the scale to count mode.

APW:
The APW key terminates the entry of average piece weight. The field is 6 digits maximum, plus decimal point. The scale will calculate count based on the entered APW or, as selected during setup, an entry of pieces per pound (or kilogram).

RECALL:
The RECALL key is used to examine data in memory. Sequential depressions of the RECALL key displays tare weight, net weight, average piece weight and count. The selected field will remain displayed until changed by the RECALL key or until power ,loss. When RECALL is pressed while in the gross mode, the operator setup section will be accessed. This includes setup steps F1.1, F1.2 and F1.3.

LB/KG:
When the scale is at gross zero, depressions of this key result in switching the weight display from Avoirdupois to Metric indication or the reverse.

When the scale is above gross zero, in count mode, or with tare weight entered, this key will not function.

DECIMAL POINT (.):
Used in conjunction with the numeric keys for entering tare or average piece weights.

GROSS/NET:
If the scale is in the weight mode (not count), alternte depressions of this key will switch between the display of gross weight and net weight.

PRINT:
When this key is pressed with no motion on the scale, data will be trasmitted from the JN connector according to programming in Section F4. If motion is present, this command will be retained and acted upon when motion ceases. This key can be disabled in setup.

D. OPERATING SEQUENCES

1. COUNTING OPERATION

   a. Normal Sample Mode

      i. Place empty container on platter, press TARE.
      ii. Place sample pieces on platter, enter number of pieces, press SAMPLE.
      iii. Add pieces to container, count is displayed.

   b. Normal Sample with Keyboard Tare

      i. Place sample pieces on platter, enter number of pieces, press SAMPLE.
      ii. Enter Tare Weight of container via keyboard, press TARE.
      iii. Add pieces to container, count is displayed.

   c. Count Out Sequence

      i. Place full container on scale, press TARE.
      ii. Withdraw sample pieces, enter number and press SAMPLE.
      iii. As additional pieces are removed, count of pieces withdrawn is displayed.

   d. Sample Take Out Sequence

      i. Place the full container on the scale, press TARE.
      ii. Withdraw the sample and enter number, then press SAMPLE.
      iii. Enter the container weight via the keyboard, followed by TARE. (This tare overrides the previous tare entry).
      iv. Count is then displayed.

e. Enhanced Sample Procedure:

i. Tare - Enter a digital or pushbutton tare.

ii. Sample - Place a known quantity of parts on the scale, enter this number on the keyboard and press the SAMPLE key. If the weight onthe platter is less than the minimum counts required to compute an APW, the word “LO” will appear in the display for two seconds and the sample operation terminated. If the sample is less than the sample weight minimum as determined at Setup, the sample entered is used to calculate an APW which is used to determine how many additional sample pieces are required to meet the minimum

iii. If enhamcement is enabled, the average piece weight may be updated by placing additional sample pieces on the platter. Be certain that the scale sees a motion / no-motion sequence after additional pieces have been added. If th current weight on the scale is too large the word “OVER” is displayed for two seconds after motion. If another APW enhancement is desired, remove pieces until the word “OVER” is no longer displayed after motion.

iv. Count is then displayed.

2. OPERATING ZONES

(Assumes .02%, /05%, or .1% has been selected as minimum sample)

Four distinct zones of counting exist in relation to the weight on the platter. These zones are shown in the following table and discussed more fully in the following four sections. Note that if sample enhancement is disabled, zone 3 does not exist. Note also that if the minimum sample weight is chosen as 0.0%, then zones 1 and 2 essentially do not exist and the APW computation may have a large error. A non-zero tare should be taken before using small sample weights when 0.0% is chosen to disable AZM.

ZONE	WEIGHT	CONDITION
1	Below Minimum APW Computation (Below 2 display increments)	No sampling. Display shows selected weight field.
2	2 display increments to Minimum Sample weight.	Sampling allowed. Display shows “Add n”.
3	Minimum Sample Weight to 4%. Print allowed.	Count Mode. APW Enhancement allowed. Display shows selected data field.
4	4% to Scale Capacity Print allowed.	Normal Counting Mode. No Enhancement. Display shows selected data field.

a. Below Minimum APW Computation Zone

Average piece weight (APW) cannot be accurately computed below 2 display increments. Any attempt to enter a sample piece count and press the SAMPLE key will result in the message “LO” in the count display for two seconds. The operator should add samples until the “LO” message does not result. The sample piece count may now be entered and the SAMPLE key pressed.

b. Display Increments to Minimum Sample Weight Zone

In setup the scale can be set up to permit the operator to continuously update theaverage piece weight based on larger and larger samples. A minimum APW weight, as defined in section 2.1 previously, is required for the initial calculatoin of APW. As additional pieces are placed on th escale, each time the scale sees a motion/no-motion sequence, a new APW previously established. See Seciton V, Part E for further discussion of APW

enhancement. Minimum sample weight is selected du ring Setup as 0.02%, 0.05%, 0.01% or 0.0% of scale capacity. The display shos “Add (n)”, when sample weight is below the minimum selected. (n) is calculated by using the origial sample to calculate an APW, and using this APW to calculate the maximum number of pieces allowed which will permit enhancement of the APW. If this maximum is exceeded, “OVER” will be displayed and the operator should remove parts until a motion/no-motion sequence does not result in the “OVER” display.

A manual sample acceptance mode is also selectable in the setup mode which requires an exact number of samples (n) to be added and the SAMPLE key pressed. This results in the most accurate APW.

c. May Enhance Counting Zone

From the minimum sample weight to 4% of scale capacity the scale is in full counting mode. Printing may be done as desired. The APW will be enhanced throughout this range, unless too many pieces added exceeds the number which can be reliably counted using the previous APW, the display shows “OVER” for 2 seconds, after which the count is agian displayed. If the operator wishes to continue APW enhancement pieces must be removed until each motion/no-motion sequence no longer results in an “OVER” display. APW enhancement then occurs.

If the operator ignores the “OVER” display and adds more pieces or prints,no further APW enhancement is possible for the current transaction. Once the counting weight reaches 4% of scale capacity, APW enhabcement is discontinued.

d. Normal Counting Zone

From 4% to 100% of scale capacity is the normal counting zone, during which the displayed APW will not change and no APW enhancement is done.

E. AVERAGE PIECE WEIGHT ENHANCEMENT

The initial computed value of aveage piece weight (APW) may not have the accuracy needed to reliably count large number of small pieces. This problem is inherent in a single scale parts counter, since it must have the weighing range to count large quantities of parts. To compensate for this, the APW is allowed to be enhanced constantly for up to 4% of scale capacity. In order to ensure weight of 2 display increments is required. APW;s below this value should be accurately determined on a more sensitive scale then entered via the keyboard.

APW enhancement is based on the fact that an inaccurate APW, whilenot able to count large numbers of parts, will very reliably count a small number of pieces. This count will then allow the new determination of APW based on a larger weight. Given enough enhancements the APW will become very accurate.

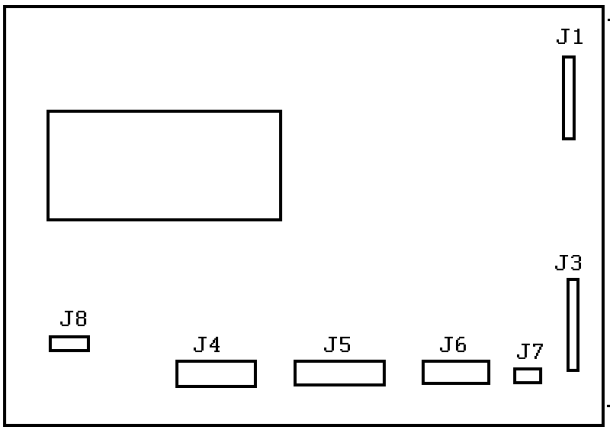
Enhancement occurs on a motion/no-motion sequence with the following two conditins satisfied:

1. Pieces must have been added (i.e., the weight must have increased).

2. The pieces added must not exceed the amount which can be counted accurately with the current APW. A display of “OVER” results when this amount is exceeded.

VI. INPUT AND OUTPUT DESCRIPTIONS

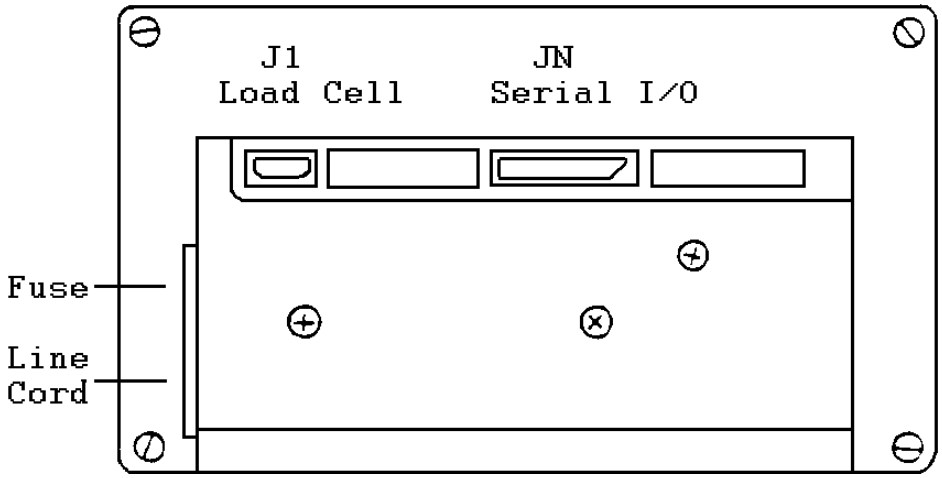
A. PRINTED CIRCUIT BOARD



J1 - Load Cell Connector
J3 - Transformer Input Connector
J4 - Not Used
J5 - Serial Input / Output Connector
J6 - Keyboard Connector
J7 - Not Used
J8 - Not Used

B. ENCLOSURE

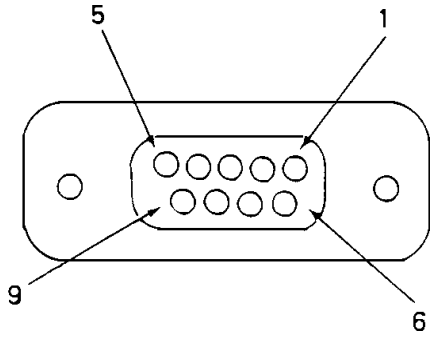
(Rear View)



C. LOAD CELL CONNECTION

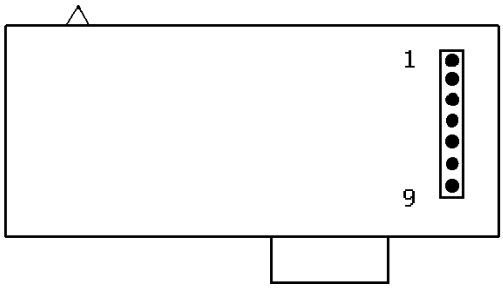
1. 2037 AND 2137 CONNECTOR

PIN	DESCRIPTION
1	+ Excitation
2	+ Sense
3	Shield
4	- Sense
5	- Excitation
7	+ Signal
8	- Signal



2. LOADCELL CONNECTION

PIN	DESCRIPTION
1	- Excitation
2	- Sense
4	+ Sense
6	- Signal
8	+ Excitation
9	+ Sense



D. PRINTER SERIAL I/O

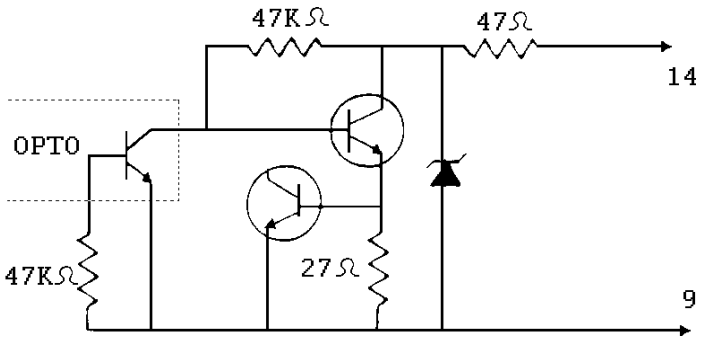
The scale can output data either continuously or upon demand depending upon setup selection. The data wil always be transmitted in an eleven bit frame consisting of:

1 - Start Bit
7 - ASCII Coded Data Bits
1 - Parity Bit
2 - Stop Bits

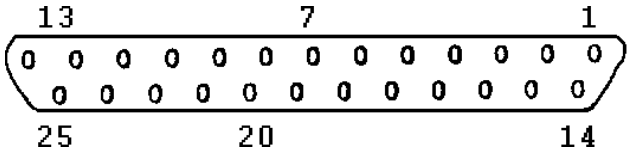
Both 20mA current loop and RS-232-C may be used at the same time; however, neither may be used with RS-422 when it is selected as the means of communication.

1. GENERAL DESCRIPTION

a. Description of Transmit Opto
The transmit current loop will be normally conducting when connected. That is, ther will be approximately 20mA in the loop when the loop is completed. When data is transmitted, the current will be turned off and on.



Schematic of 20mA transmit current loop used.



The 2037/2137 use a 25 pin connector numbered as shown.

b. Handshaking Signal Descriptions

CTS (Clear to Send) - This input signal can be used to control when the unit is able to transmit data. If this pin is held to - 12VDC the scale will have a not clear to send signal and will not be able to send the next line of data. CTS does not need to be held to +12VDC to allow a data transmission but it can be if desired. If this line is held not clear to send longer than 2-1/2 seconds after receiving a print command or between lines of output, the transmission will be aborted. This signal is not active in the continuous mode.

DSR (Data Set Ready) - This input line can be pulsed to 0VDC of approximetely 300 ms to initiate a data transmission. If the output is in the continuous mode, bit 3 in status word C for “print button pushed” will change. This method may not operate consistently at a distance greater than 25 feet.

DTR (Data Terminal Ready) - This output signal will go to +12VDC while the unit is powered ON.

NOTE: Where a 12 volt level is stated in the handshaking descriptions, a voltage level from 3 to 15 volts is acceptable. Toledo Scale normally uses a 12 volt level for its equipment.

c. Printer I/O Connector (JN)

---------- * **PRINTER * ----------**

SIGNAL NAME	JN PINS		307	8804 * 8806 8860 *	8840	8855
Logic Ground	1					
TxD (RS-232-C)	2				3	
RxD (RS-232-C)	3					
Not Used	4**					
CTS (RS-232-C)	5**					
DSR (RS-232-C)	6					
Logic Ground	7				7	
+Print (20mA)	8			11		
20mA Transmit -	9		6	16		3
- Print (20mA)	10			22		
RS422 (A)	11					
RS422 (B)	12					
Not Used	13					
20mA Transmit+	14**					
20mA Supply (+22V)	15**					
+Print (20mA)	16					
20mA Supply (-22V)	17					
- Print (20mA)	18					
Logic Ground	19					
DTR (RS-232-C)	20					
20mA Supply (-22V)	21					
Logic Ground	22		7	18		22
Logic Ground	23					
Not Used	24					
Not Used	25					
Jumper shown is in printer end of interconnecting cable.				12] 23]		

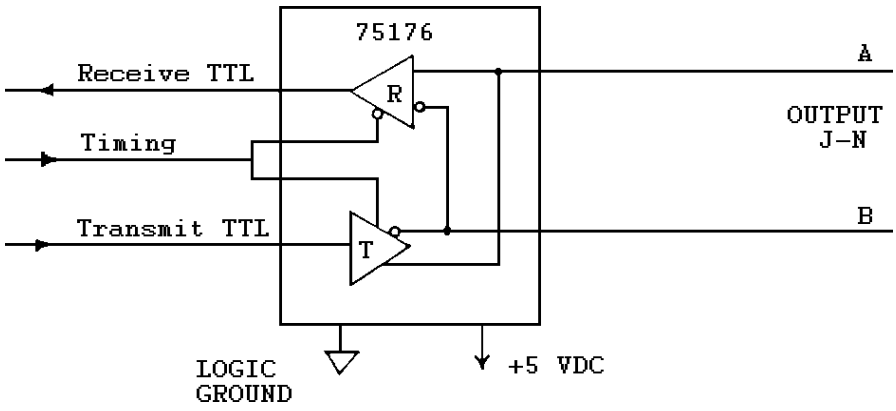
* The adaptor plug included with the printer must be used

** Jumper is in 2037/2137 end of interconnecting cable.

NOTE: Data transmitted from the printer port is 11 bit ASCII coded - one start bit, seven data bits, one parity bit and two stop bits.

d. Interface Notes on RS-422

The wiring configuration used on the 2037/2137 for RS-422 can be referred to as a “two-wire” scheme. That is, the data ouput is totally container on only two wires. The following schematic shows how it utilizes RS-422.



Interface to a “four-wire” scheme may be possible by connection of all “A: lines together and all “B” lines together provided the receiving device is in the receive or tri-state mode when not sending data.

2. DEMAND OPERATION

In this mode the scale will output data, in a format selected during setup, only when a print command is received. This print command may be ginven in one of four ways. Described next are the four different methods including any notes pertaining to each. The third and fourth methods are selectable in setup.

a. Remote Print Descriptions

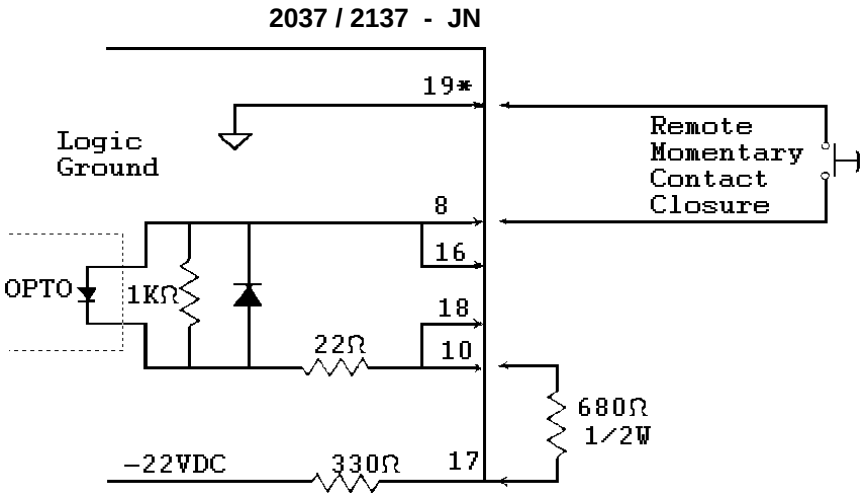
i. Pressing the PRINT key on the front of the keyboard. The PRINT key can be disabled in the setup mode to prevent unauthorized or accidental activation.

ii. Applying ground (0 vDC) to the DSR line for approximately 300 milliseconds then releasing. This method may not operate consistently at distances greater than 25 feet.

iii. Transmitting an ASCII coded “P” to the receive port. The capital letter “P” may be sent to the RS-232 receive line (RxD) or to the 20mA receive opto to initiate a print. The character must be in an eleven bit frame with one start bit, seven ASCII data bits, one parity bit and two stop bits. No other formats will be accepted. Setup step [F4.6] must be programmed as a “1”.

iv. Pulsing the receive line for 300 milliseconds. This can be done by applying -12vDC to the RS-232 receiveline (RxD) or applying 20mA to the 20mA current loop receive opto for approximately 300ms then releasing. This method is how the 8806 transmits its print request to the 2037/2137. Setup step [F4.6] must be programmed as a “0”.

The circuit shown below is an example how to use the receive opto for a remote print command from a switch or relay contact. The resistor must be added to limit the current and the print loop or damage to the circuit board may result. The remote switch may be a maximum of 2000 feet from the scale and shielded twisted pair cable shoudl be used. Groung the shield of the cable to the chassis.



** In electrically noisy environments, it is suggested that chassis ground also be connected here.*

b. Repeat Print

The operation of the repeat print function is the same in both the weigh and count mode.

i. Repeat Print Disable

When repeat print is turn OFF, only one print is permitted after weight is applied to the scale. Additional print requests are ignored until the scale returns to gross zero or until the CLEAR key is pressed twice. The recall function remain active throughout the sequence.

ii. Repeat Print Enabled

When repeat print is turned ON, the weight or coutn display will lock after a print request. Repeated prints of this information are available using the PRINT key. The recall sequence is inhibited. If pieces are added to the scale (or removed in the count down mode) in an amount greater than one display increment, the sclae will unlock the display when motion ceases. The RECALL key will then become active and a print of the new values is possible. After a print, the display willlock and multiple prints of these values are possible.

c. Demand Mode Data Formats

During setup, the format of the demand mode output is selectable as either single or multiple line. Both of these selections are described next.

i. Single Line Output

The unit can transmit any or all of its fields on a single line. The data will always be sent in the following order:

Gross - Tare - Net - APW - Pieces

The net weight and piece count can also have the “SO” character added to indicate expanded print. In order to print all fields on a single lnie, the receiving device msut be capable of printing, up to 68 characters on a line. The format and number of characters in each field are shown below.

STX	X	X	X	X	X	X	X	sp	Lk	Bg	sp	X	X	X	X	X	X	X	sp	Lk	Bg	sp	T	R

SO	*	X	X	X	X	X	X	X	sp	Lk	Bg	sp	N	E	T	Sl	sp	X	X	X	X	X	X	X	X

sp	Lk	Bg	sp	A	P	W	sp	SO	X	X	X	X	X	X	sp	P	C	S	Sl	CR	CKS	LF

STX - Start of Text Character
sp - Space Character
X - Numeric data, minus sign or space
* - Space or minus sign
CR - Carriage Return Character
CKS - Optional Checksum Character
LF - Line Feed Character
SO - Optional Shift Out Character for expanded print
SI - Optional Shift In Character to end expanded print

The scale will not output a comma in place of a decimal point.

The scale will not output leading zeroes. Non-signigicant leading zeroes are transmitted as spaces.

If a particular field is selected not to print, all following fields will be shifted left accordingly.

ii. Multiple Line Output

The five fields sent from the scale can each be sent on a separate line if the multiple line output is selected in setup. The data will always be sent in the following order:

Gross - Tare - Net - APW - Pieces

The net weight and piece count can also have the “SO” character added to indicate expanded print. The exact format and number of characters in each field are shown below.

STX	sp	X	X	X	X	X	X	X	sp	Lk	Bg	CR	CKS	LF

sp	X	X	X	X	X	X	X	sp	Lk	Bg	sp	T	R	CR	CKS	LF

SO	*	X	X	X	X	X	X	X	sp	Lk	Bg	sp	N	E	T	SI	CR	CKS	LF

sp	X	X	X	X	X	X	X	sp	Lk	Bg	sp	A	P	W	CR	CKS	LF

SO	sp	sp	X	X	X	X	X	X	sp	P	C	S	SI	CR	CKS	LF

STX - Start of Text Character
sp - Space Character
X - Numeric data, minus sign or space
* - Space or minus sign
CR - Carriage Return Character
CKS - Optional Checksum Character
LF - Line Feed Character
SO - Optional Shift Out Character for expanded print
SI - Optional Shift In Character to end expanded print

The scale will not output a comma in place of a decimal point.

The scale will not output leading zeroes. Non-significant leading zeroes are transmitted as spaces.

If a particular field is selected not to print, all following fields will be shifted up accordingly.

3. CONTINUOUS OPERATION

In this mode, the scale continuously transmits count and/or weight data. Bit six of Status Word C will indicate if bytes eleven through sixteen ar count digits or weight digits. Non-significant digits are transmitted as spaces. If the continuous mode is selected, there is only one format for whcih the data may be configured. The only option is the addition of a checksum character if required. The format is:

CHARACTER NUMBER:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
START OF TEXT	STATUS WORD A	STATUS WORD B	STATUS WORD C	INDICATED WEIGHT VALUE						TARE OR COUNT VALUE						CARRIAGE RETURN	CHECKSUM
				MSD					LSD	MSD					LSD		

SEE NOTE

Start of text character is always the first character sent.

Carriage return character always follows the least significant digit of the tare weight.

Selectable Checksum Character

STATUS WORD A DEFINITION

	DECIMAL POINT OR DUMMY ZERO LOCATION							
BIT NO.	NOT USED	X0	X	X	XX	XXX	XXXX	NOT USED
0	0	1	0	1	0	1	0	1
1	0	0	1	1	0	0	1	1
2	0	0	0	0	1	1	1	1

	INCREMENT SIZE		
	COUNT BY 1	COUNT BY 2	COUNT BY 5
3	1	0	1
4	0	1	1

5	ALWAYS A 1
6	ALWAYS A 0
7	EVEN PARITY

STATUS WORD B DEFINITION

BIT NO.	OPERATING PARAMETERS
0	Gross Mode = 0 / Net Mode = 1
1	Positive Weight = 0 / Negative Weight = 1
2	In Range = 0 / Overcapacity = 1
3	No Motion = 0 / In Motion = 1
4	Lb Mode = 0 / kg Mode = 1
5	Always a 1
6	Normal = 0 / Power Up = 1
7	Parity Bit

STATUS WORD C DEFINITION

BIT NO.	OPERATING PARAMETERS
0	Always a 0
1	Always a 0
2	Always a 0
3	Normal = 0 / Print Button Pushed = 1
4	Normal = 0 / Display Expanded By 10 = 1
5	Always a 1
6	Count = 0 / Weight = 1
7	Parity Bit

4. REMOTE INPUT COMMANDS

All units with a factory number from TABLE II (see the Factory Number Guide at the beginning of this manual) have the added feature of receiving certain ASCII coded characters to duplicate keyboard functions. These functions are zeroing the scale, taring a weight, entering a sample count or APW, clearing the scale and printing. The parity and baud rate are selectable but must always be the same as the printer output selections. RS-232, 20mA current loop or RS-422 may be used as the means of communication for these commands.

The format of the commands must always be in an 11bit frame. This format consists of:

1 Start bit 1 Parity bit
7 Data bits 2 Stop bits

Once a command is received, the scale will process it within 250ms. If another command is received before the previous one has been processed, it will be ignored along with all further transmissions until the next valid command is received. All invalid characters are ignored.

The external commands that will be recognized are described next with descriptions when required. The brackets < > are for clarity only and must be not be transmitted. All letters sent must be capital letters. The input data is free format with a maximum number of digits as noted. A decimal point is needed only if data interpretation requires it. Leading zeroes are not required (“0.12” may be enterered as “.12”) the ASCII Carriage Return Character <CR> is used to terminate a command.

COMMAND FORMAT	DESCRIPTION
< Z > < CR >	Zero the scale if within +/- 2% of capacity from zero
< T > < CR >	Tare the scale to net zero.
< T > < XXX.XX > < CR >	Enter the digital value transmitted as the tare value for the scale. From 1 to 5 digits (plus decimal point) may be transmitted. Keyboard tare must be enabled.
< C > < CR >	Clear the scale to the home position.
< S > < XXX > < CR>	Enter the sample coutn transmitted. Sample pieces must be on the scale.
< A > < X.XXXXX > < CR >	Enter the value transmitted (up to 6 digits plus decimal point) as either the APW or PCS/wt depending upon setup step [F2.1].
< P > < CR >	Print command. Data output must be enabled.

ASCII CHAR.	DECIMAL	HEX	76543210	ASCII CHAR.	DECIMAL	HEX	76543210
NULL	0	00	00000000	@	64	40	01000000
SOH	1	01	00000001	A	65	41	01000001

STX	2	02	00000010	B	66	42	01000010
ETX	3	03	00000011	C	67	43	01000011
EOT	4	04	00000100	D	68	44	01000100
ENQ	5	05	00000101	E	69	45	01000101
ACK	6	06	00000110	F	70	46	01000110
BELL	7	07	00000111	G	71	47	01000111
BACKSPACE	8	08	00001000	H	72	48	01001000
TAB	9	09	00001001	I	73	49	01001001
LineFeed	10	0A	00001010	J	74	4A	01001010
Vert. Tab	11	0B	00001011	K	75	4B	01001011
Form Feed	12	0C	00001100	L	76	4C	01001100
Carr.Return	13	0D	00001101	M	77	4D	01001101
Shift Out	14	0E	00001110	N	78	4E	01001110
Shift In	15	0F	00001111	O	79	4F	01001111
Data Link Esc	16	10	00010000	P	80	50	01010000
DC1	17	11	000010001	Q	81	51	01010001
DC2	18	12	00010010	R	82	52	01010010
DC3	19	13	00010011	S	83	53	01010011
DC4	20	14	00010100	T	84	54	01010100
NAK	21	15	00010101	U	85	55	01010101
SYNCH IDLE	22	16	00010110	V	86	56	01010110
End Trans. Block	23	17	00010111	W	87	57	01010111
CANCEL	24	18	00011000	X	88	58	01011000
End Of Medium	25	19	00011001	Y	89	59	01011001
SUBSTITUTE	26	1A	00011010	Z	90	5A	01011010
ESCAPE	27	1B	00011011	[	91	5B	01011011
FS (Cursor Right)	28	1C	00011100	\	92	5C	01011100
GS (Cursor Left)	29	1D	00011101	]	93	5D	01011101
RS (Cursor Up)	30	1E	00011110	^	94	5E	01011110
US (Cursor Down)	31	1F	00011111	_	95	5F	01011111
SPACE	32	20	00100000	`	96	60	01100000
!	33	21	00100001	a	97	61	01100001
"	34	22	00100010	b	98	62	01100010
#	35	23	00100011	c	99	63	01100011
$	36	24	00100100	d	100	64	01100100
%	37	25	00100101	e	101	65	01100101
&	38	26	00100110	f	102	66	01100110
'	39	27	00100111	g	103	67	01100111
(	40	28	00101000	h	104	68	01101000
)	41	29	00101001	i	105	69	01101001
*	42	2A	00101010	j	106	6A	01101010
+	43	2B	00101011	k	107	6B	01101011
,	44	2C	00101100	l	108	6C	01101100
-	45	2D	00101101	m	109	6D	01101101
.	46	2E	00101110	n	110	6E	01101110
/	47	2F	00101111	o	111	6F	01101111
0	48	30	00110000	p	112	70	01110000
1	49	31	00110001	q	113	71	01110001
2	50	32	00110010	r	114	72	01110010
3	51	33	00110011	s	115	73	01110011
4	52	34	00110100	t	116	74	01110100
5	53	35	00110101	u	117	75	01110101
6	54	36	00110110	v	118	76	01110110
7	55	37	00110111	w	119	77	01110111
8	56	38	00111000	x	120	78	01111000
9	57	39	00111001	y	121	79	01111001
:	58	3A	00111010	z	122	7A	01111010
;	59	3B	00111011	{	123	7B	01111011
<	60	3C	00111100	|	124	7C	01111100
=	61	3D	00111101	}	125	7D	01111101
>	62	3E	00111110	~	126	7E	01111110
?	63	3F	00111111		127	7F	01111111

VII. PREVENTIVE MAINTENANCE

The 2037/2137 is designed to require a minimum of maintenance and service. This section provides instructions and procedures for maintenance of the indicator, as well as troubleshooting guide to aid in problem analysis.

A. REQUIRED TOOLS AND SUPPLIES

The following items are recommended for proper maintenance and repairs. Comman hand tools are also required:

Volt-Ohm Meter
Load Cell Simulator (PN 100866 00A)
Cleaning Cloth
Static Bag
Static Wrist

B. CLEANING

Clean the keyboard and covers with a soft clean cloth that has been dampened with a mild window-type cleaner. **DO NOT USE ANY TYPE OF INDUSTRIAL SOLVENT. DO NOT SPRAY CLEANER DIRECTLY ON THE UNIT.**

C. TROULBESHOOTING

1. PROCEDURE

a. If operational difficulties are encountered, obtain as much information as possible regarding the particular trouble, as this may eliminate a lenghty, detailed checkout procedure.

b. Check fuses, primary power lines, external circuit elements and related wiring for possible defects. Failures and malfunctions often may be traced to simple causes such as loose or improper power supply connecitons or fuse failure.

c. Use the electrical inter-connecting diagram as an aid to locating trouble causes. Part 3 of this section contains various voltage measurements that are average for normal operation. Use instrument probes carefully to avoid causing short circuits and damaging circuit components.

d. Malfunctions in the unit are best located by substitution. A printed circuit board believed to be defective may be checked by replacing it with a known good PCB, and then observing whether the problem is corrected.

WHEN HANDLING A PCB, USE A STATIC BAG FOR BOTH THE NEW AND DEFECTIVE PCB.

e. To verify the problem, as being in the removed PCB, replace the defective PCB and retest. This simple test will eliminate the possibility of having replaced a good PCB because of a loose or poor connection.

Be sure to consult the technical manual for proper programming. Do not automatically program the replacement PCB like the suspected faulty PCB as the problem may be a programming error.

Exchange PCB's or sub-assemblies are available from your authorized Toledo Scale representative. These assemblies are repaired and tested at various Toledo Scale factories.

2. ERROR CODES

Error codes will be displayed when certain malfunctions are detected. The following chart describes each error code and also gives some suggestions for corrective measures.

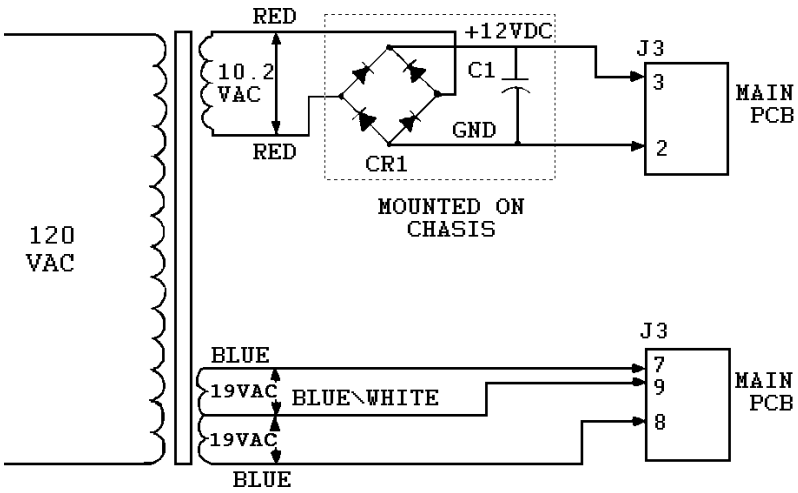
ERROR CODE	DESCRIPTION	CORRECTIVE MEASURES
E1	ROM Error	1. Try power down / wait / power up. 2. Replace Main PCB.
E2	RAM Error	1. Try power down / wait / power up. 2. Replace Main PCB.
E3	NOVRAM Error	1. Try power down / wait / power up. 2. Replace Main PCB.
E4	Printer Error	A signal was received from the printer indicating a failure.
E5	Overcount Error	The computed piece count was seven digits or more and therefore not displayable.
CAL E1	Scale in Motion	Detected during calibration
CAL E2	Calibration Error	1. Try to recalibrate 2. Replace Main PCB
CAL E3	Calibration Error	1. Try to recalibrate 2. Replace Main PCB
CAL E4	Scale Over Capacity	Reduce test weights
CAL E5	Capacity Error	Microvolt build too small
CAL E6	Illegal test weight value entered	Use a test weight less than 125% of full scale.

3. TESTING POWER SUPPLY VOLTAGES

a. Transformer Voltages

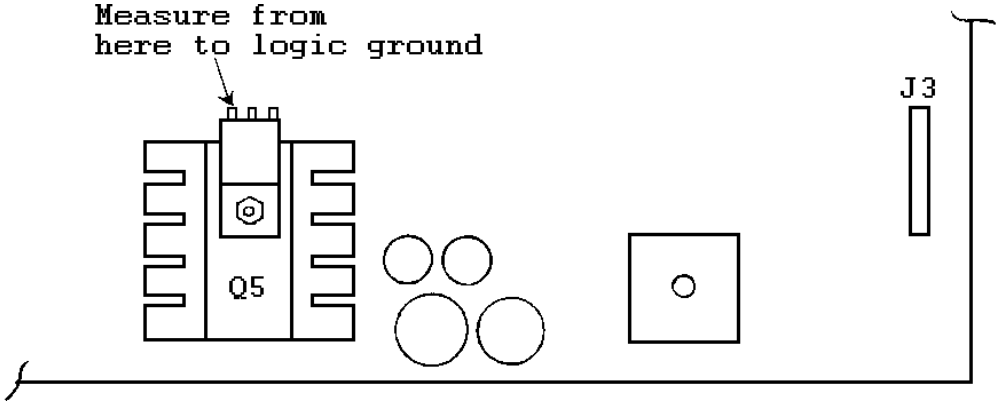
MEASUREMENT		AC VOLTAGE	
FROM	TO	MINIMUM	MAXIMUM
CR1 - AC	CR1 - AC	9.9	12.0
J3-7	J3-9	18.4	19.3
J3-8	J3-9	18.4	19.3
J3-7	J3-8	36.8	38.6

These voltages are the limits for a 120 VAC power line. They will vary with the AC input and are acceptable from -15% to +10% corresponding to 102 VAC up to a 132 VAC power line.



b. Regulated +5 Volt Supply
The +5 volt DC supply can be checked at the five volt regulator Q5. The tolerance for this voltage is shown below. This voltage is derived formt he 10-volt AC supply. If the +5 volt supply is out of tolerance, and the 10-volt AC supply is satisfactory, replace the Main PCB.

OPERATING VOLTAGE	DC VOLTAGE		MAXIMUM AC RIPPLE
	MINIMUM	MAXIMUM	
+5 VDC	+4.9	+5.3	0.1 V RMS



3.3 Load Cell Excitation
This voltage can be measured at the load cell connection on the Main PCB. The voltage is measured between pin 1 and pin 9 of the J1 connector. The excitation voltage is produced from the AC voltage measured at J3 between pins 7 and 8 on the Main PCB.

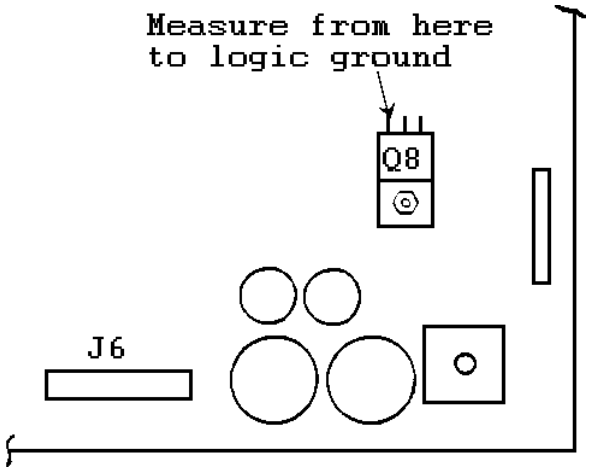
The excitation voltage is not gated so the voltage you will read with a voltmeter will be the actual 12.5 volts DC.

3.4 +15 Volt Supply

The 2037/2137 use a 15 volt DC supply to produce the operating voltages for the analog section. This voltage can be checked where shown below on the Main PCB. If this voltage is out of specification, the Main PCB must be replaced.

VOLTAGE	MEASUREMENT LOCATION	ACTUAL MEASUREMENT MINIMUM	MAXIMUM
+15	Q8	+ 14.25	+ 15.75

The AC ripple voltage should be less than 0.1 V RMS.



3.5 Regulated ±22 Volt Supplies

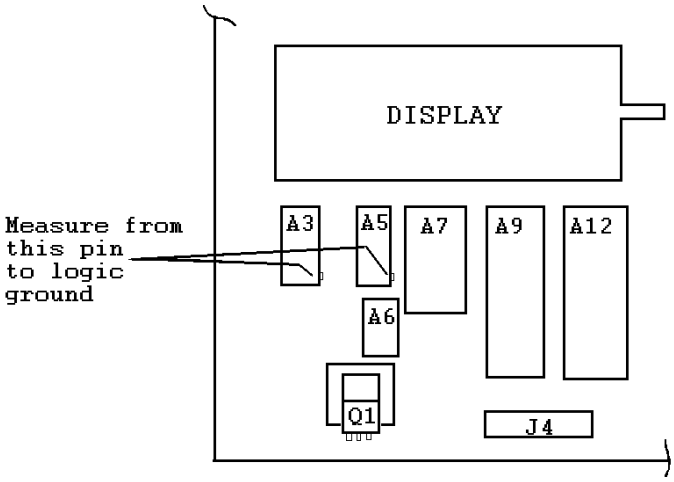
These voltages are used as the 20mA current loop supply on the JN connector. They can be checked on this connector at the pins shown in the following chart.

VOLTAGE	CONNECTOR PINS	DC VOLTAGE MINIMUM	MAXIMUM
+ 22	15 TO 22	20.5	23.5
- 22	17 TO 22	- 23.5	- 20.5

3.6 Display Voltage

The display is powered by a 39 volt DC supply. If this voltage is not present, the display will remian blank. If no voltage is found, replace the Main PCB.

Measure the voltage between pin 10 and logic ground of A3 and A5. It should be between 37.5 VDC and 40.5 VDC. This DC voltage is derived from the 22 VAC voltage measured at J3 between pins 7 and 9.



VIII. GENERAL INFORMATION

A. RECOMMENDED SPARE PARTS

It is recommended that these spare parts be kept in stock in order to keep downtime to minimum. The items are available through your local Authorized Toledo Scale Service Representative.

In addition to the items listed below, it is also recommended that a parts catalog be ordered so that items no listed may be properly identified for correct and prompt delivery. The Parts Catalog number is PC002037 I00.

1. UNIT FROM TABLE 1
(at beginning of manual)

DESCRIPTION	PART NUMBER	QTY.
Keyboard Assembly	127892 00A	1
Main PCB	* 127875 00A	1
Fuse (0.5A Slo-Blo)	112145 00A	5
* PCB may have revision level.		

NOTE: The Main PCB (#127875 00A) listed in the chart above is being replaced with the Main PCB (#127902 00A) in the chart below. The Main PCB #127875 00A is no longer available from Toledo Scale Company.

2. UNIT FROM TABLE II
(at beginning of manual)

DESCRIPTION	PART NUMBER	QTY.
Keyboard Assembly	127892 00A	1
Main PCB	* 127902 00A	1
Fuse (0.5A Slo-Blo)	112145 00A	5
* PCB may have revision level.		

B. CABLES AND MATING CONNECTORS

1. PRINTER INTERCONNECT CABLES

PRINTER	LENGTH	PART NO.	FACTORY NO.
307	6’ 20’	A119714 00A A119715 00A	0900-0191-0000 0900-0199-0000
8804* 8806 8860*	6’ 20’	A115544 00A A115545 00A	0900-0136-0000 0900-0137-0000
8840	6’	128220 00A	0900-0214-0000
8855	6’ 20’	B119722 00A B119723 00A	0900-0197-0000 0900-0198-0000

*Adaptor plug included with printer must be used.

2. MATING CONNECTORS

CONNECTOR	DESCRIPTION	MATING PART NUMBERS	FACTORY NUMBER
Load Cell *	Male Plug and Clamp KOP	125819 00A	0917-0117
Serial I/O	Male Plug	108187 00A	--------
	Cable Clamp	125389 00A	--------
	Contact Pins	107189 00A	--------
	Grommet	125842 00A	--------
	Complete Kit	128881 00A	0917-0144

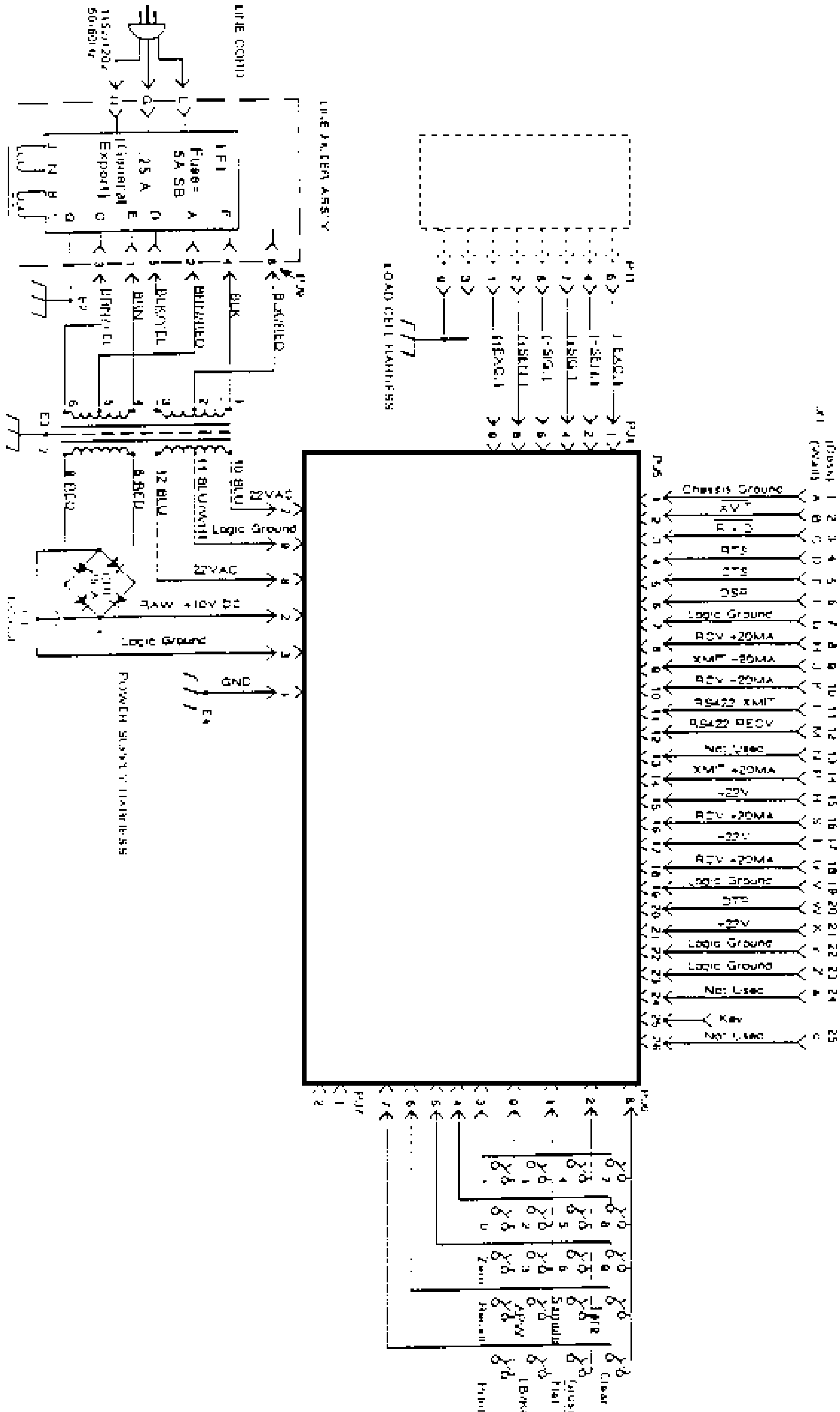
C. ACCESSORIES

MODEL 2037

DESCRIPTION	PART NUMBER	FACTORY NUMBER
RFI Kit of Parts	125347 00A	0917-0110
Stand with Wheels	A116396 00A	0924-0021
Stainless Steel Platter	118996 00A	0906-0109
Laundry Pan, 10” sides - 5” front	116526 00A	0906-0086
Laundry Pan, 9” sides - 1” front	116561 00A	0906-0087

MODEL 2137

DESCRIPTION	PART NUMBER	FACTORY NUMBER
RFI Kit of Parts	125347 00A	0917-0110
Aluminum Pan, 9” sides - 3” front	116523 00A	0906-0088


LINE CORD
LINE FILTER ASSY
LOAD CELL HARNESS
POWER SUPPLY HARNESS
22VAC
Logic Ground
22VAC
RAW +10V DC
Logic Ground
GND
Chassis Ground
RTS
CTS
DSR
Logic Ground
RCV +20MA
XMIT -20MA
RCV -20MA
RS422 XMIT
RS422 RECV
Not Used
XMIT +20MA
+22V
RCV +20MA
-22V
RCV +20MA
Logic Ground
DTR
+22V
Logic Ground
Logic Ground
Not Used
Key
Not Used
Zero
Clear
Print