2036

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:

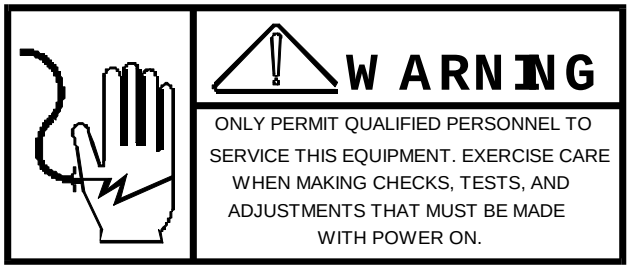
METTLER TOLEDO
Training Center
P.O. Box 1705
Columbus, Ohio 43216
(614) 438-4400

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.

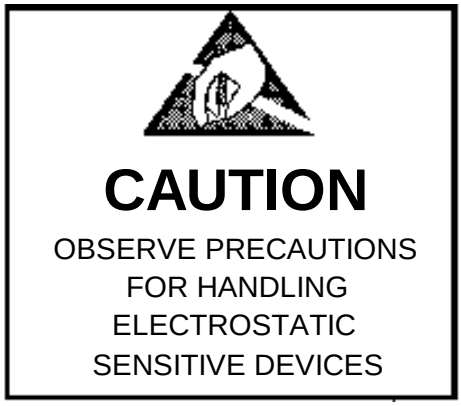
- **ALWAYS** take proper precautions when handling static sensitive devices.



- **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.

CONTENTS

1. GENERAL DESCRIPTION

The Toledo Models 2036 and 2136 are electro-mechanical, bench and portable scales which combine mechanical understructure 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.

A data output option provides the ability to transmit weight information to a printer or compatible accessory device in bit serial ASCII code, even parity, 20 mA current loop or EIA RS-232-C. The baud rate is selectable at 300, 1200, 2400,4800 or 9600 baud on demand or 2400, 4800 or 9600 baud continuous output.

FEATURES:

-- Selectable Increments and Capacities

-- Keyboard Calibration and Functional Setup

-- Displays Gross or Net Weight in either pounds (lb) or kilograms (kg).

-- Automatic pounds to kilograms switching

-- Six character 0.55” high vacuum fluorescent type display, green-blue in color

-- Automatic Zero Maintenance for weight variations less than 0.1 increment per second, (up to plus or minus 2%) of scale capacity from zero).

-- Pushbutton Zero (within plus or minus 2% of scale capacity from zero)

-- Lighted Indicator above the zero legend when scale is within plus or minus .25 increments of zero

-- Pushbutton Tare

-- Digital Filtering provides the ability to select 1, 2, 4, 8, or 16 updates to be averaged and displayed on a constant basis.

-- Analog Verification tests the load cell input circuitry.

-- Under Zero Display Blanking with a minus sign showing

-- Over Capacity Blanking at 5 increments over selected full scale capacity

-- Fabricated steel bases utilizing rugged and long lasting levers

-- Phenolic non-conductive wheels for portability (2136 only)

2. SYSTEM DESCRIPTION

2.1 The 2036/2136 consists of four (4) major blocks. These are:

1). Transformer - Steps down voltage from an A-C source to smaller magnitude voltages to be sent to the Control PCB.

2). Main PCB - Contains power supplies, scale logic, program selection switches, load cell connections and fluorescent display.

3). Keyboard - Allows operator interface for functions such as Tare, Clear, Zero lb/kg Selection, Print, Test and Setup.

4). Load Receiver

2.2 There is an optional data output K.O.P. or POD which allows a 20mA current loop or EIA RS232-C output.

2.3 Application

1). Bench and floor applications for general weighing.

2). These scales are not designed for hose-down applications. Typical examples of **misapplication** of these scales include, but are not limited to:

a). Immersions
b). Hosedown
c). Splashing liquids
d). Corrosive chemical environments

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

2.4 Performance

1). Force connection: pivot and bearing through reduction lever to cone pivot and bearing at load cell.

2). Load Cell: Toledo general purpose 25, 50, 100 & 200.

3). Platform: Slip on 12 gauge painted carbon steel.

4). Construction: fabricated, painted carbon steel base and levers.

5). Design Features -

a). Support:

2036 - four (4) adjustable feet to provide leveling capabilities
2136 - four (4) wheels for partability

b). Adjustments: shift adjustments by honing pivots

3. SPECIFICATIONS

3.1 ELECTRICAL AND PHYSICAL SPECIFICATIONS

3.1.1 ENVIRONMENT
The 2036/2136 operates from -10°C 14°F) to +40°C (104°F) at 0 to 95% relative humidity, noncondensing.

3.1.2 POWER REQUIREMENTS
The Model 2036/2136 can operate (by selection) at 120V, 220V or 240V A-C (+10% - 15%) at a line frequency from 49 to 61 Hz. Power consumption is 15 watts maximum.

CAUTION: ALL UNITS ARE SHIPPED FOR 120V A-C OPERATION.
REFER TO SECTION 4 FOR ALTERNATE VOLTAGE OPERATION.

3.1.3 U.L. AND C.S.A. STANDARDS
Materials, components, and electrical design comply with U.L. and C.S.A. standards and requirements including grounding of all meetal parts, fusing, etc.

3.1.4 FCC REGULATIONS
The 2036/2136 meets or exceeds the FCC conducted and ratiated emissions requirements.

3.1.5 RFI SPECIFICATIONS
In environments where high RFI radiation exists, special RFI protected versions of the Models 2036 and 2136 are available. Contact your local Toledo Sales representative for details.

These models have been designed to greatly reduce susceptibility to Radio Frequency Interference. The plastic indicator enclosure has been internally coated with a conductive layer and has an RFI filtered load cell connector and a screened display lens added.

3.16 APPEARANCE AND DIMENSIONS
The color of the Model 2036/2136 is charcoal black with green-blue display and gray display lens. The two piece plastic case used is 7.1" tall (18cm) x 11.8" wide (30cm) x 3" deep (7.7cm).

3.1.7 WARM UP PERIOD: 15 MINUTES

3.1.8 REPEATABILITY: .015% FULL SCALE CAPACITY

3.1.9 SHIFT: .025% FULL SCALE CAPACITY (1/2 LOAD, 1/2 DISTANCE TO EDGE)

NOTE; Scales meet or exceed H-44 accuracy of .05% of applies load plus .5 graduation with a minimum tolerance of ±1.0 graduations.

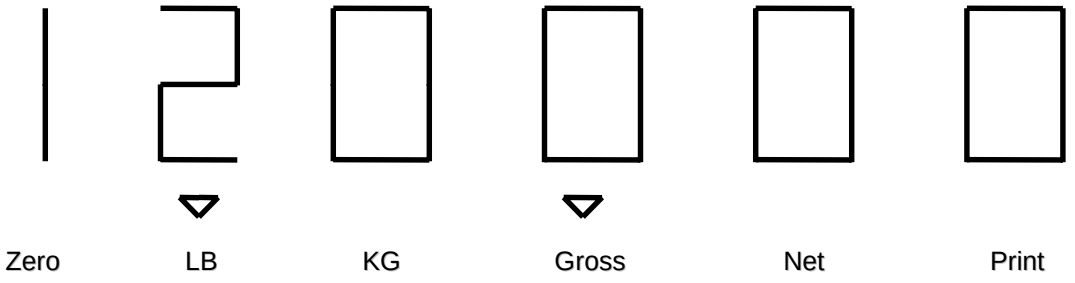
3.2 INTERNAL FUNCTIONS

The 2036/2136 contains the necessary electronics to calculate and display weight. The instrument receives the micro-volt signal from the cell, amplifies it then filters and converts it to a digital signal in the integrator.

3.3 DISPLAY FORMAT

The display is breen-blue, vacuum fluorescent, six character (6 digits or 5 digits and a minus sign) with lighted decimal point. There are lighted descriptors above the Zero, LB, KG, Gross, Net and Print Legends.

Sample display:



3.4 DATA INTERFACE

The 2036/2136 is capable of transmitting TTL logic level data at 300 to 9600 baud selectable through the keyboard. An optional data output interface PCB may be connected to allow conversion to a 20mA current loop or EIA RS-232-C output.

3.4.1 DEMAND OPERATION - 300 TO 9600 BAUD

When a print command is received,either from the Print key or an external “Print Demand” signal, the 2036/2136 will output a message formatted by setup selections throught he keyboard. (See programming procedure, Section 4.3) Transmission of a Checksum Character is selectable as is Expanded Print Format. Scale Motion, Expanded Display Mode, Under Zero or Over Capacity Operation will disable a print command.

3.4.2 CONTINUOUSOPERATION - 2400 TO 9600 BAUD

The data is transmitted every display update, approximately eight times each second. A Checksum character is always transmitted.

4. INSTALLATION INSTRUCTIONS

4.1 PRELIMINARY INSPECTION

The 2036 and 2136 are shipped complete in one box; however, there is some assembly required. To unpack 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 IMMEDIATELY.

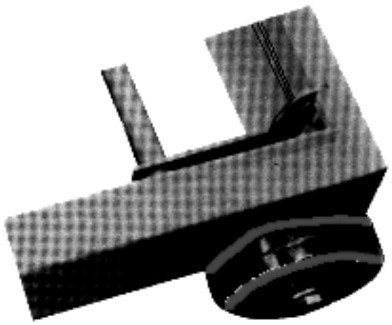
2). Open the top of the box and remove the packing material. The following contents will be exposed:

a). Indicator
b). Load cell mounting plate with load cell attached
c). Indicator support frame
d). Cloth bag containing miscellaneous harware and indicator power cord.
e). Two (2) threaded rods and one(1) steelyard rod
f). Four (4) wheels (2136 only)
g). Scale base
h). Technical manual and parts catalog

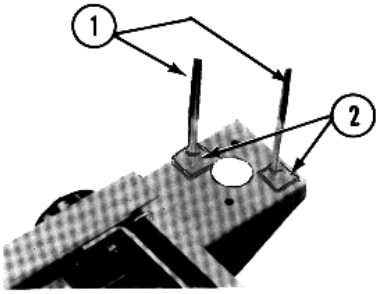
3). Make sure that the scale base is stable and level before beginning the column assembly. Adjust the scale base feet if necessary to achieve this.

4.2 ASSEMBLY PROCEDURE

1). To assemble wheels to the 2136 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 frame and allow just enough clearance for the wheel to turn freely. Next place a lockwasher and nut on the axle bolt and tighten securely.



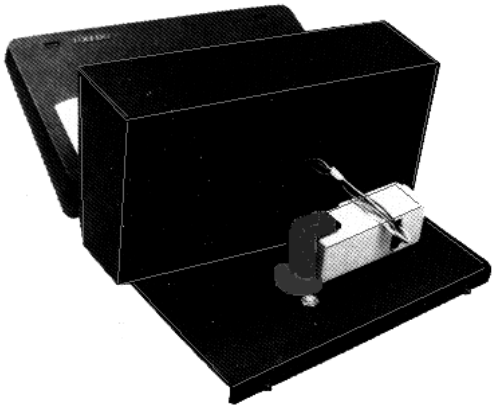
Reassemble base, levers, spider and platform.



2).To attach the column, run the column plates about an inch onto the column rods (2136 only), place the column rods into the holes on the column support plate and secure loosely with a lockwasher and nut on each rod.

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. Assemble steelyard and install. Install load cell assembly.

Secure the nuts and lockwashers at the base of the column rods.

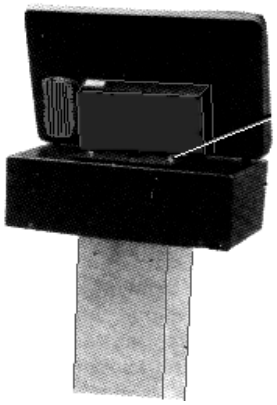


4). Route the load cell cable through the top cover and attach to load cell. Secure top cover on the column top channel. Be sure to attach ground wire to plate.

Attach the bracket to the indicator. Install the indicator on the top cover.

5). Open the instrument and continue the inspection, noting that all interconnecting harnesss are securely fastened.

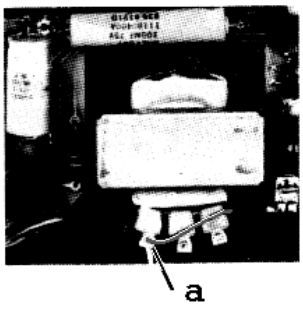
The plastic enclosure is opened by inserting a flat bladed screwdriver into the two notches into the rear cover and twisting until the catches are released. Pull the top of the front cover out until the bottom tabs clear the rear cover. Be careful not to damage the keyboard harness.



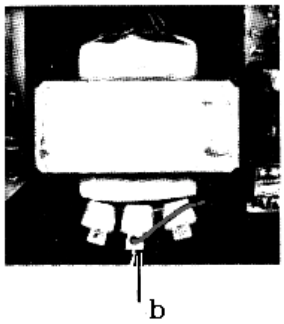
6). Check the power connection to the tranformer to insure the proper voltage has been selected for use in your area.

Be sure to reinstall space connection covers after changing the voltage selection.

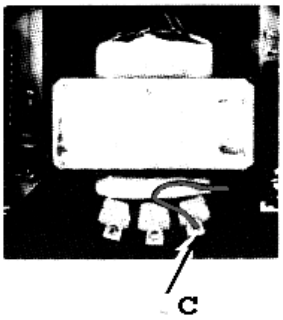
CAUTION: BE SURE POWER IS DISCONNECTED BEFORE MAKING ANY ADJUSTMENTS TO THE TRANSFORMER FOR VOLTAGE CHANGES.



a. Transformer shown connected for 120 VAC



b. Transformer shown connected for 220 VAC



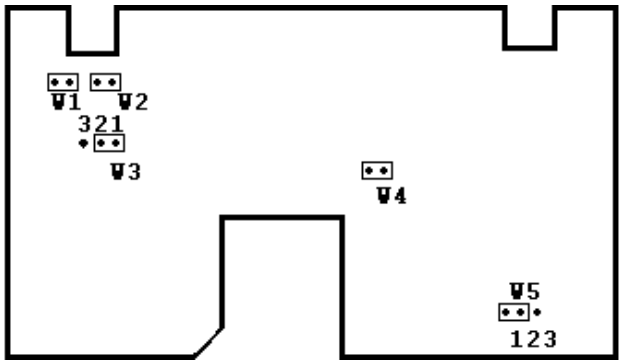
c. Transformer shown connected for 240 VAC

7). If a printer interface is to be installed, do so at this time

4.3 SET UP

4.3.1 JUMPER DESCRIPTIONS

All jumpers are in the correct position for standard operation when the unit is shipped. Check the jumper positionings to be certain they are correct for this unit's application.



W1 - External Memory

This jumper must be in place shorting the two pins for correct operation.

W2 - Calibrate Enable

IN - When this jumper is shorting the two pins, the set-up mode is accessible via the keyboard.

OUT - When this jumper is not connecting the two pins, the set-up mode cannot be accessed.

W3 - Eprom Selection

NOTE: This jumper is not present on the newer PCB's.

This jumper must be between pin 1 and pin 2 to select the proper Eprom that is used at this time.

W4 - Comma Enable

IN - When the jumper is in place shorting the pins, a comma will be displayed instead of a decimal point.

OUT - When the jumper is not whorting the pins, a decimal point will be displayed if the 8140 is programmed for one.

W5 - Load Cell Output Selection

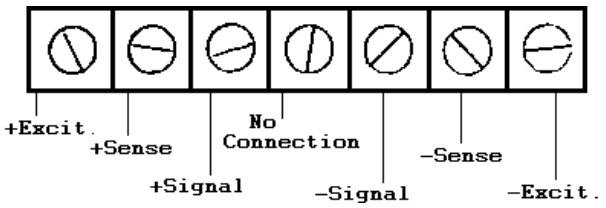
NOTE: This jumper is not presenton earlier PCB's.

2mV/ V-For use with 2mV/V load cells, this jumper should be between pin 1 and pin 2.

3mV/V-For use with 3mV/V load cells, this jumper should be between pin 2 and pin 3.

4.3.2 LOAD CELL CONNECTIONS

1). Attach the load cell cable or extension harness to the terminal strip TB1 on the Main PCB. The configuration is shown below. Be sure to attach the ground wire to the ground lug.



NOTES: There are two parts to the terminal strip. One is soldered to the PCB and the other may be removed by pulling downward for easy cable connections.

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

Allow the load cell digital instrumentation system to warm-up for a period of fifteen (15) minutes before scale calibration.

NOTE: Some Legal for Trade applications may require the removal of the Data Plate from the rear of the plastic enclosure and re-installation on the front. It should be installed on the lower left facing with nonconductive (plastic) fasteners.

4.4 PROGRAMMING PROCEDURE

This section of the technical manual deals with the programming of the operating modes and features as well as the self-calibrating procedure.

Sample displays are shown with programming prompts. Described under each sample display you will find the possible answers that the unit will accept, along with what effect this answer will have on the unit's operation.

Three keys will have the same function throughout the programming procedure. Their descriptions are:

ZERO ---- This returns the programming routine to the previous step. This key will not function during calibration or when the display shows S FILE.

CLEAR ---- When pressed, the setup routine will accept the data displayed and will go the last step which is S FILE.

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

A comparison of the keyboard functions during operational programming and normal operation is shown below.

Normal Operation

Zero	Test	Tare	Clear	lb kg	Print

Operational Programming

Previous Step	Yes 1	No 0	Exit Program	Not Used	Enter

NOTE: Jumper W2 on the Main PCB must be shorting the two pins to enter the setup mode. It is recommended that after programming, the jumper be placed on just one pin so inadvertent program changes cannot be made.

To enter the setup mode, press both the TARE and CLEAR keys, then release at the same time. The following sequence of displays will occur.

[F1 0] **EXPAND MODE**

Press: (Yes) Test - A "1" will be displayed on the right digit of the display and the weight display will be expanded.

(No) Tare - A "0" will be displayed on the right digit of the display and the display will not be expanded.

[F2 16] **DISPLAY FILTERING RATE**

Press: (Yes) Test - The number to the right of the display will be accepted as the number of averaging A/D cycles.

(No) Tare - The display will update to the next selectable filtering rate. Subsequent depressions will step through all selections which are 1, 2, 4, 8 and 16.

[F3 0] **TARE ACTIVE**

Press: (Yes) Test - A "1" will be displayed and keyboard tare will be active

(No) Tare - A "0" will be shown on the display and keyboard tare will be inhibited.

NOTE: If tare is inhibited, step F5 will be skipped.

[F4 0] **TARE INTERLOCK**

Press: (Yes) Test - A "1" will be shown on the display and the inidication must be at true zero before tare can be removed. (True zero is actually ZERO minus the tare value). Previous tare msut be cleared before another tare can be entered. This also disables a weight display on power up. The display on power up will be E E E until zero has been captured.

(No) Tare - A "0" will be displayed and tare may be cleared or changed at any weight indication. Multiple tares are accepted. The 2036/2136 will also power up with a non-flashing weight display.

[F5 0] **AUTO CLEAR**

Press: (Yes) Test - A "1" will be shown on the right of the display and tare will clear automatically when indication returns to zero after settling to a no-motion condition at a weight greater than 10 increments. The CLEAR key will also function.

(No) Tare - A "0" will be displayed and tare must manually be cleared by use of the CLEAR key.

NOTE: If Tare is inhibited in Step F3, this prompt will not appear.

[F6 0] **MOTION SENSITIVITY**

Press: (Yes) Test - A "1" will be shown on the display and the Zero, Tare and Print functions will be inhibited when ±2 increments or more of motion are detected.

(No) Tare - A "0" will be shown on the display and the Zero, Tare and Print functions will be inhibited when ± 1/2 increments or more of motion are detected.

[F7 0] **POUNDS CALIBRATION**

Press: (Yes) Test - A "1" will be displayed to indicate avoirdupois (Lb) test weights will be used for calibration.

(No) Tare - A "0" will be displayed to show that kilogram (KG) test weights wil be used for calibration.

[F8 0] **POWER UP POUNDS**

Press: (Yes) Test - A "1" will be displayed and the 2036-2136 will weigh in pounds when power is applied.

(No) Tare - A "0" will be shown on the right of the display to indicate the unit will be in the kilogram mode when powered up.

[F9 0] **LB/KG SWITCHING**

Press: (Yes) Test - A "1" will be shown on the display to indicate switching between the pounds and kilogram modes is possible via the front panel keyboard.

(No) Tare - A "0" will be displayed to indicate that pound/kilogram switching is disabled.

[F10 0] **AUTO ZERO MAINTENANCE**

Press: (Yes) Test - A "1" will be shown on the display and AZM wiill operate to keep the instrument on zero to keep the instrument on zero in spite of small changes on the platform. Weight variations which occur at a rate of 0.1 increments per second or slower will be compensated. The zero pushbutton is operational.

(No) Tare - A "0" will be displayed and AZM and Zero pushbutton are disabled.

NOTE: This function is only operational with ±2% of scale capacity from analog zero.

[F11 0] **ANALOG VERIFY**

Press: (Yes) Test - A "1" will be displayed and analog verification will be active. An automatic AVOIRDUPOIS cycle will be initiated approximately every 4 hours.

(No) Tare - A "0" will be shown and analog verification will be disabled.

NOTE: If an A/V cycle fails, an error code E6 will be displayed and the 2036-2136 will be disabled until the problem is corrected.

[F12 0] **PRINTER OUTPUT**

Press: (Enter) Print - This gains access to the serial I/O programming for use with a printer or other interface.

(Exit) Clear - This skips both the printer setup and calibration procedure and proceeds to the last step of the step routine whcih is S FILE.

[1 0] **DEMAND MODE**

Press: (Yes) Test - A “1” will be shown on the right of the display and the data output will be on demand (Print key).

(No) Tare - A “0” will be displayed and the outupt will be continous.

[2 4800] **BAUD RATE**

Press: (Yes) Test - If the value displayed is the correct baud rate.

(No) Tare - The unit will update to another baud rate selection. The choices are 300, 1200, 2400, 4800 and 9600 on demand with 2400, 4800 and 9600 for continous.

[3 0] **CHECKSUM**

Press: (Yes) Test - A “1” will be shown on the display and a checksum character will be transmitted.

(No) Tare - A “0” will be displayed and no checksum is transmitted.

[4 0] **PRINTER SELECT**

Press: (Yes) Test - If the model number of the printer being used is correct. See Printer Model Chart.

(No) Tare - If the model number is not correct and the display will advance to the next selection. See Printer Model Chart.

PRINTER MODEL CHART	
Selected Number	**Printer Model**
1	307, 8806 and 8855
2	8805* (Receive only mode)
3	8805 (Smart mode)
4	8820/8830 (Ram 1)
5	8820/8830 (Rams 2 and 3)

*The receive only mode is active when certain switches in the 8805 are programmed as follows:

SWITCH	POSITION
SW2-7	ON
SW2-8	OFF
SW2-9	OF

NOTE:
The two selections for the 8805 and 8820/8830 printers are required to determine how the 2036/2136 will interpret the remote print signal. If the selected number is a 2 or 4 from the above printer model chart the signal will be interpreted as busy signal. If a code 3 or 5 is entered, the signal will be used as a print command.

[5 0] **DATA FORMAT**

Press: (Yes) Test - If the number displayed corresponds to the desired format. See Format Chart.

(No) Tare - The display will advance to the next format code. See Format Chart.

FORMAT CHART	
Selected Number	**Format Description**
0	Displayed weight only
1	Single line gross, tare and net
2	Multiple line gross, tare and net

[6 0] **EXPAND PRINT**

Press: (Yes) Test - A "1" will be shown on the right of the display and the net or gross weight (if tare has not been taken) will print expanded if the printer is capable of doing so when an ASCII SO character is received.

(No) Tare - A "0" will be displayed and the output will not have the ASCII character SO to initiate expanded print.

[CAL]CALIBRATE MODE

Press: (Exit) Clear - If calibration is not required and the setup routine will proceed to the last step which is S FILE.

(Enter) Print - If calibration is required and the 2036/2136 will continue with the configuration model.

NOTE: Error codes that may be displayed during calibration are described in the troubleshooting section of this manual.

[C1]
[5000] **TOTAL INCREMENTS**

Press: (Yes) Test - If the number displayed is the correct number of full-scale increments.

(No) Tare - If the number displayed is not the correct number and the display will update to the next possible selection. The valid selections are for 100 x .05lb and 1000 x .5 select 2000 increments. for 250 x .1 and 500 x .2 select 2500 increments.

[C2 5] **INCREMENT SIZE**

Press: (Yes) Test - If the number displayed is the correct increment size.

(No) Tare - If the number displayed is not correct and the display will updateto the next selection. For 250 x .1 select 1. For 500 x .2 select 2. For 200 x .05 and 1000 x .5 select 5.

[C3]
[0.01] **DECIMAL POSITION**

Press: (Yes) Test - If the position of the decimal is correct.

(No) Tare - If the position of the decimal is not correct and the display will update with the next possible selection. The valid selections are for 100 x .05 select .01. For 250 x .1, 500 x .2 and 1000 x .5 select .1.

NOTE: If the selectinof Full Scale Increments and Increment Size results in an invalid scale capacity, program returns to Step C1 (Full Scale Increments display).

If the Clear button is pressed while Full Scale Increments, Increment Size numtiplier of Decimal Point position are on the display, the currently entered values for these variables are lost.

[E SCL] **EMPTY SCALE**

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

[10 SEC] **TEN SECONDS**

There will be a 10 second wait while the instrument sets initial.

[Add Ld] **ADD LOAD**

Place full capacity test Load on the platform. Press Print to continue.

[00000] **TEST WEIGHT**

Enter value of the Test Load (full capacity). Fractional or decimal weights are not accepted - only whole numbers. The blank digit to the left will be entered first

Press: (No) Tare - To increment the blanked digit by one until the correct value is displayed for that position.

(Yes) Test - To shift the weight selection to the next position to the right after a correct value has been selected. A blank digit is entered as a 0.

(Enter) Print - To enter the netire displayas the value of test weights used. Any blank digit will be entered as a 0.

[10 SEC] **TEN SECONDS**
There will be a 10 second wait while zero is rechecked.

[E SCL] **EMPTY SCALE**
Remove the test weights then press Print to allow the 2036/2136 to recheck zero.

[10 SEC] **TEN SECONDS**
There will be a 10 second wait while zero is rechecked.

[CAL d] **CALIBRATION DONE**
This display will appear after calibration is complete and be displayed for approximately three seconds.

[S FILE] **SAVE FILE?**
This determines if the programming just entered is to be saved in memory or not.

Print: (Yes) Test - If the programming just completed is to be retained in memory and used again after a power down.

(No) Tare - If the programming just completed is to be used until power loss but not entered into memory for use after a power down.

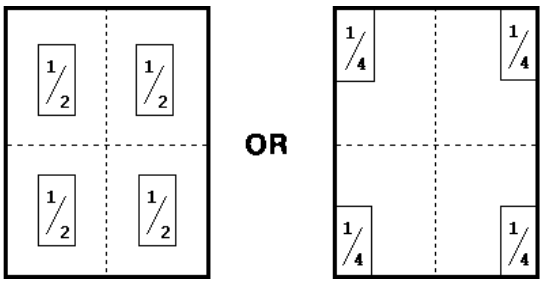
(Exit) Clear - If the programming changes just made are to be disregarded and the previously stored setup used.

5. SHIFT TEST AND ADJUSTMENT

5.1 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 instrucitons.

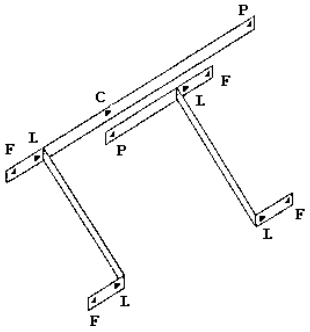
In a mechanical base, shift refers to the pivot distances of the levers. If on a lever the distances are equal, then a lever is said to have no shift error. Also, two levers which have the same ratio will have no shift error. Also, two levers which have the same ratio will have no shift error.

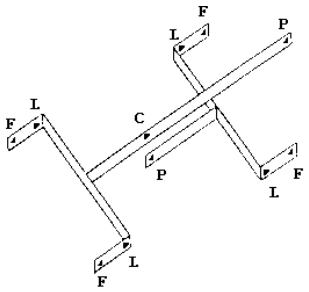


5.2 ADJUSTMENT

The lever illustrations of the 2136 and 2036 designate the pivots as follows.

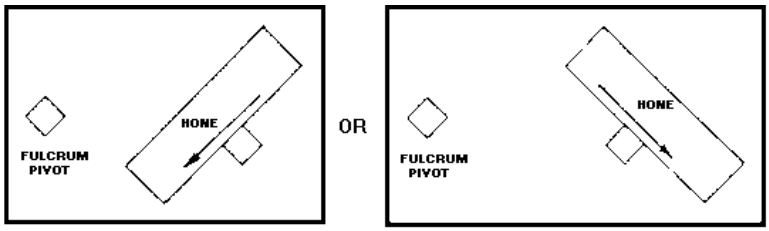
F = Fulcrum Pivot
L = Load Pivot
P = Power Pivot
C = Center Connection





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.



TO LENGTHEN THE DISTANCE

TO SHORTEN THE DISTANCE

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 ofthe 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.

5. OPERATING INSTRUCTIONS

5.1 DISPLAY

The display shows the digital resultant of the analog signal from the load cell(s). The display blanks at overcapacity and also blanks, except for the minus (-) sign, at undercapacity.

5.2 LEGENDS

The 2036/2136 illuminates a pointer above the proper legend for the status of the display. The printed legends are:

1. ZERO
Will be illuminated when the instrument is within ±.25 increments of the zero increment and there is no motion.

2. LB
Will be lit when motion has ceased and the LB mode has been selected.

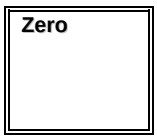
3. KG
This is illuminated when there is no motion and the KG mode has been selected.

4. GROSS
When lit, this indicates no tare has been taken.

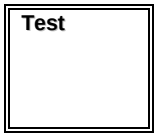
5. NET
When illuminated indicates tare has been entered.

6. PRINT
This will light during data transmission to a printer in demand output mode or, when the “PRINT” key is depressed in continuous mode.

5.3 KEYBOARD

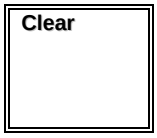


1. ZERO KEY
This key provides re-zeroing of the scale over a range of ±2%of scale capacity from zero. A setup selection permits disabling the pushbutton Zero and Automatic Zero Maintenance.
The zero key must be depressed for approximately 2 seconds to initiate this function.

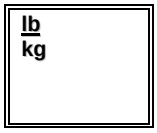


2. TEST KEY
Pressing and releasing the test key will cause the display to blank and then sequentially light each segment of all digits and each discriptor. These results show that all drivers and displays operate in both OFF and ON conditions.

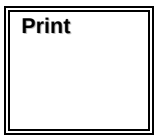
3. TARE KEY
When the Tare key is depressed with weight on the scale, and no weight motion present, the tare weight will be subtracted from the gross weight to provide a net weight display of zero. If the weight is removed from the scale, the tare weight will be displayed as a negative value.



4. CLEAR KEY
Tare may be cleared by the use of the Clear key or automatically by the use of Automatic Clear. Automatic Clear may be enabled in setup mode.



5. LB/KG KEY
An alternate action pushbutton is provided for pounds/kilogram selection. When switching, the increment size will be adjusted and the decimal point will be shifted, if required. The instrument can be locked into the LB or KG mode by a setup selection which disables the LB/KG key.



6. PRINT KEY
A Print key is provided to initiate a print cycle to an external device. The format of the print is programmed by keyboard setup selection.

6. PREVENTIVE MAINTENANCE

The Model 2036/2136 Digital Indicator is designed to require a minimum of maintenance and service. This section provides instructions and procedures for maintenance of the indicator, as well as a troubleshooting guide to aid in problem analysis.

6.1 REQUIRED TOOLS AND SUPPLIES

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

Volt-Ohm Meter	Load Cell Simulator (PN 100865 00A)
Cleaning Cloth	Static Bag
Static Wrist Strap	

6.2 MAINTENANCE SCHEDULE

The frequency at which normal maintenance (cleaning and inspection) should be performed, when installed in a clean office environment, should be once a year. However, if the unit is subjected to a dusty or dirty environment the frequency should be increased as required.

6.3 CLEANING

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

6.4 TROUBLESHOOTING

1. PROCEDURE

a. If operational difficulties are encountered, obtain as much information as possible regarding the particular trouble, as this may eliminate a lengthy, 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 circuits, power supply connections or fuse failure.

c. Use the electrical inter-connecting diagram as an aid to locating trouble causes. This diagram 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 2036/2136 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 “VELOSTAT” STATIC BAG FOR BOTH THE NEW AND DEFECTIVE PCB.

e. To verify the problem, as being in the removed PCB, reinstall 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 (From No. TM008140 100, Section 4, Part C) for proper programming. Do not autoatically 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 are displayed by the 2036/2136 when one of the following malfunctions occur:

ERROR CODES		
ERROR	**CAUSE**	**CORRECTIVE MEASURE**
E1	ROM Error	Try Power Down / Replace Main PCB
E2	RAM Error	Try Power Down / Replace Main PCB
E3	NOVRAM Error	Try Power Down / Replace Main PCB
E4	Print Fault	Check Printer / Format
E5	Display Verify Error	Replace Main PCB
E6	Analog Verify Error	Recalibrate
E8	Scale in Motion	Waits Unit Motion Stops
E9	Illegal Configuration	Reconfigure Increment Size
E10	Calibration Error	Recalibrate
E11	Calibration Error	Recalibrate
E12	Over Capacity	Reconfigure
E13	Low Capacity	Reconfigure
EA	Insufficient Test Weight	Use More Test Weights / Try Again

3. TESTING THE POWER SUPPLY VOLTAGES

NOTE: ALL UNITS ARE SHIPPED FOR 120 VAC OPERATION. REFER TO SECTION IV FOR ALTERNATIVE VOLTAGE OPERATION.

1. Transformer Voltages

These voltages are average voltages for 117 volt A-C power line.

FROM	TO	VOLTAGE (with J3 connected)	VOLTAGE (with J3 disconnected)
J3 - 2	J3 - 1	20.6 VAC	22.2 VAC
J3 - 4	J3 - 1	21.0 VAC	22.1 VAC
J3 - 5	J3 - 6	1.55 VAC	1.75 VAC
J3 - 7	J3 - 6	1.55 VAC	1.75 VAC
J3 - 8	J3 - 9	10.2 VAC	10.8 VAC

A tolerance of ±10% of these values is acceptable.

2. Regulated 5V Supply

This can be measured at J2 (printer output) between Pin 7 (Ground) and Pin 10 (+5V). The voltage should be 5V +0.15 volts with a maximum ripple of 0.01V p-p.

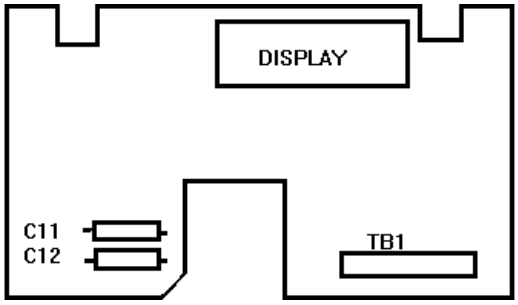
3. Excitation

This voltage can be measured at the load cell terminal block TB1. There should be +7.5* volts between terminals 1 and 4 and -7.5* volts between terminals 4 and 7.

* The load cell excitation voltage is gated and therefore, cannot be measured accurately with a digital or analog voltmeter since they generally measure average volts. The voltages you actually see will be:

SIGNAL	TB1 CONNECTION	A-C VOLTAGE	METER READING
+ Excitation	1 - 4	7.5V p-p	+3.75VDC ±2VDC
- Excitation	4 - 7	7.5V p-p	-3.75VDC ±2VDC

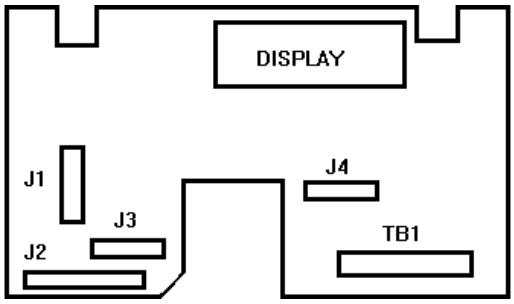
4. ±15 Volt Supplies
These regulated voltages can be measured at their respective filter capacitors. If out of tolerance, replace the Main PCB.



CAPACITOR	OPERATING VOLTAGE
C11	14.75 VDC ± 0.25 VDC
C12	15.1 VDC ± 0.25 VDC

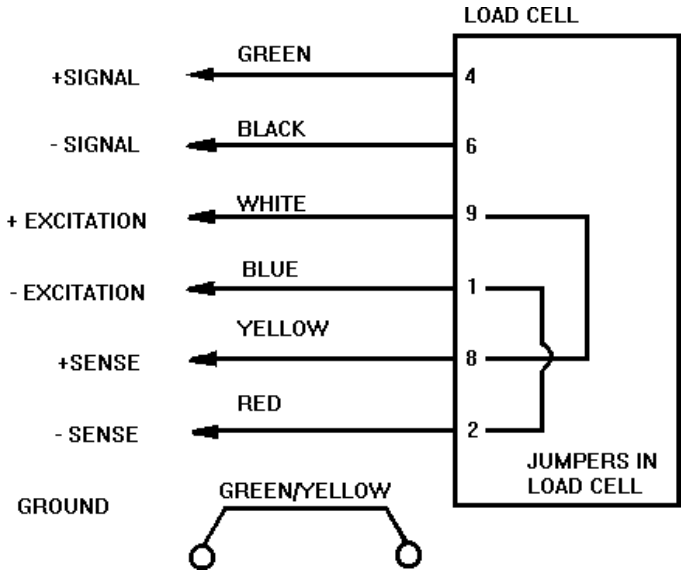
7. INPUT AND OUTPUT CONNECTIONS

7.1 MAIN PRINTED CIRCUIT BOARD



CONNECTOR	DESCRIPTION
J1	Manufacturing Use Only
J2	Serial I/O
J3	Transformer Input
J4	Analog Output
TB1	Load Cell Terminal Block

7.2 LOAD CELL CONNECTIONS



7.3 PRINTER AND SERIAL I/O

The standard 2036/2136 does not contain the circuitry required to interface to a Toledo printer. In order to obtain a data output signal, a Printer Pod mut be installed. To install this option, the round plastic plug on the left side of the enclosure should be removed. The Printer Pod Cable should be routed inside the enclosure and plugged into the J2 Connector on the lower left side of the Main PCB.

1. SERIAL INPUT AND OUTPUT DESCRIPTIONS

Signal Name	2036 / 2136	301 307 J9	8805 J1	8806 J7	8620 8830 J25	8855 J1
Chassis Ground TxD (RS-232-C) RxD (RS-232-C)	1 2 3	*	*	*	*	*
RTS (RS-232-C) CTS (RS-232-C) DSR (RS-232-C)	4 ** 5 ** 6					
Logic Ground + Print (20mA) 20mA Transmit - - Print (20mA)	7 8 9 10	 6	 24 26 19	 11 16 22	 15 16 14	 3
Not Used Not Used Not Used	11 12 13					
20mA Transmit + 20mA Supply (+12V) + Print (20mA)	14 ** 15 ** 16					
20mA Supply (-12V) - Print (20mA) Logic Ground	17 18 19					
DTR (RS-232-C) 20mA Supply (-12V) Logic Ground	20 21 22	 7	 28	 18	 18	 22
Logic Ground Not Used Not Used Not Used	23 24 25					
Jumper shown is in printer end of interconnecting cable.				12 ⌝ 23 ⌟	9 ⌝ 19 ⌟	
* Denotes shield connection ** Jumper is in 2036/2136 end of interconnecting cable.						

2. SIGNAL DESCRIPTIONS

RTS (Request to Send) - The output line will normally be at - 12VDC. After the 2036/2136 has been requested to send data, this line will pulse to +12VDC for approximately 500ms. When in the demand mode, the motion detect parameters must be met before this output signal will change.

CTS (Clear to Send) - This input signal can be used to control when the 2036/2136 is able to transmit data. If this line is held to -12VDC the 2036/2136 will have a not clear to send signal and will not be able to send data. This line does not need to be held to +12VDC to allow a data transmission but it can be if desired.

DSR (Data Set Ready) - This input line may be pulsed to 0VDC or lower (-15VDC minimum) for approximately 300ms 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.

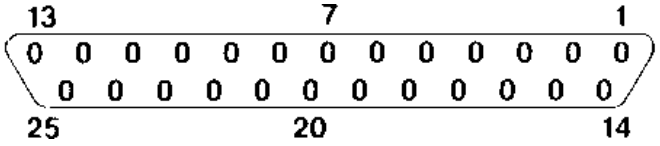
DTR (Data Terminal Ready) - This output signal will go to +12VDC while the 2036/2136 unit powered ON.

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

3. INTERCONNECTING CABLES

PRINTER	LENGTH	SERVICE PART NO.	SALES PART NO.
301 / 307	6' 20'	A119714 00A A119715 00A	0900-0191 0900-0199
8805	6' 20'	A119716 00A A119717 00A	0900-0200 0900-0201
8806	6' 20'	115544 00A 115545 00A	0900-0136 0900-0137
8810 / 8820 / 8830	6' 20'	A11970 00A A119721 00A	0900-0195 0900-0196
8855	6' 20'	A119722 00A A119723 00A	0900-0197 0900-0198

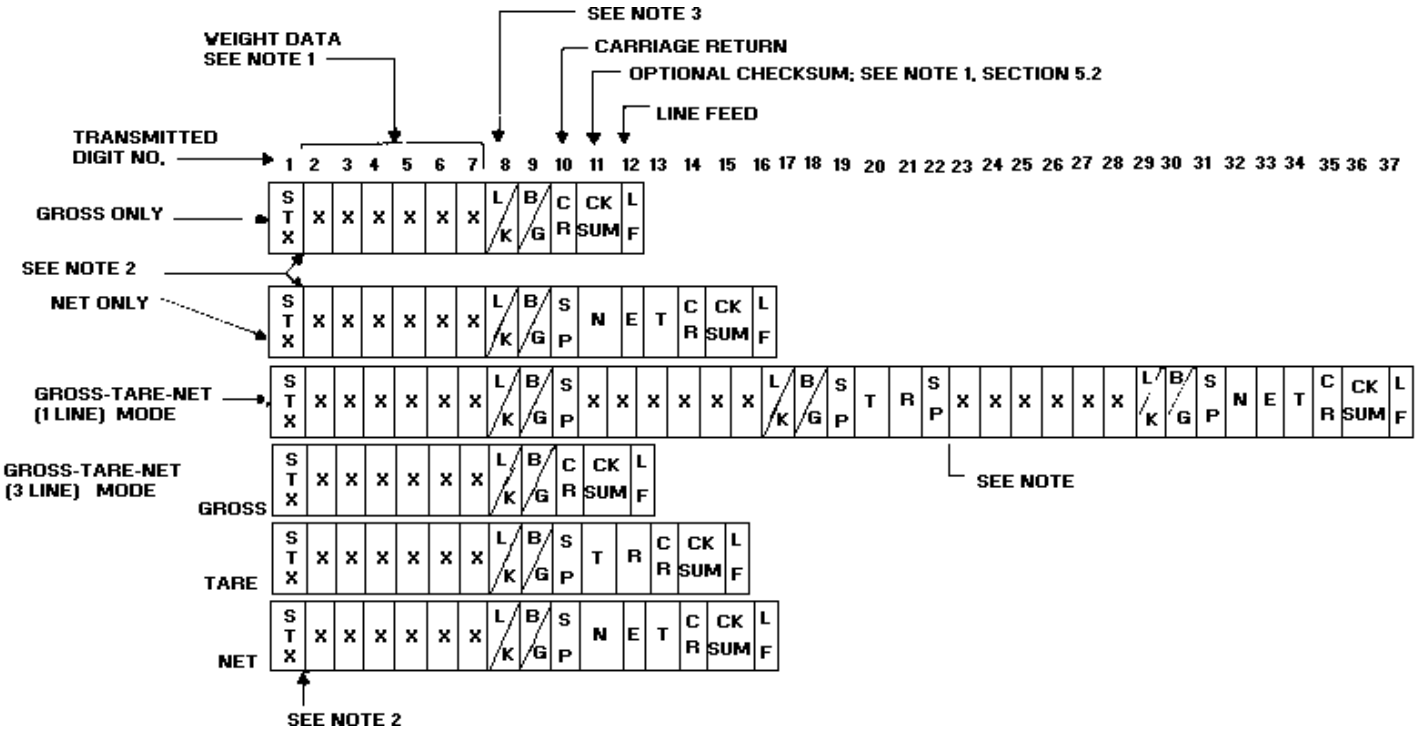
4. PRINTER POD CONNECTOR PIN LOCATION



5. DATA OUTPUT TABLES

1. Demand Output

ALL DATA SENT IS 11 BIT ASCII (1 START BIT, 7 DATA BITS, 1 EVEN PARITY BIT, 2 STOP BITS) DATA IS SENT ONCE EACH TIME PRINT BUTTON ON FRONT MODULE IS PRESSED.



1. AN EXTRA BYTE IS INSERTED IN THE FORMAT WHEN A DECIMAL POINT IS REQUIRED.

2. IF EXPANDED PRINTING IS SELECTED AN “SO” CHARACTER (HEX E) IS INSERTED AT THIS POINT. ALL FOLLOWING CHARACTERS ARE SHIFTED RIGHT 1 LOCATION.

3. A SPACE IS TRANSMITTED IN POUNDS MODE BUT NOT IN KG MODE.

2. Continuous Output

DATA IS 11 BIT ASCII (1 START BIT, 7 DATA BITS, I EVEN PARITY BIT, 2 STOP BITS)

BIT NO	S TX	STATUS WORD 'A' X 10	1	.X	.XX	.XXX	.XXXX	STATUS WORD 'B'	STATUS WORD 'C'	SP ACE	NUMERIC DATA 0-9 0	1	2	3	4	5	6	7	8	9	CR
0	0	1	0	1	0	1	0	NET MODE = 1	ALWAYS 0	0	0	1	0	1	0	1	0	1	0	1	1
1	1	0	1	1	0	0	1	NEGATIVE DATA = 1	ALWAYS 0	0	0	0	1	1	0	0	1	1	0	0	0
2	0	0	0	0	1	1	1	OVER CAP=1 NORMAL=0	ALWAYS 0	0	0	0	0	0	1	1	1	1	0	0	1
3	0	X1 =1 X2=0 X5=1						MOTION=1 NO MOTION=0	PRINT BUTTON PUSHED = 1	0	0	0	0	0	0	0	0	0	1	1	1
4	0	X1=0 X2=1 X5=1						LB = 0 KG = 1	EXPANDED DATA = 1	0											0
5	0	ALWAYS 1						ALWAYS 1	ALWAYS 1	1					ALWAYS 1						0
6	0	ALWAYS 0						POWER UP = 1	ALWAYS 0	0					ALWAYS 0						0
7	1	EVEN PARITY						EVEN PARITY	EVEN PARITY	1	0	1	1	0	1	0	0	1	1	0	1

Transmitted Digit No.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
STX	SW A	SW B	SW C	X	X	X	X	X	X	X	X	X	X	X	X	CR	CK SUM

MSD LSD MSD LSD

DATA

Start text character

is always the first character sent.

INDICATED WEIGHT

TARE WEIGHT

Checksum Character

Carriage Return Character always follows the least significant digit of the tare weight.

(Checksum is defined as the 2/s complement of the 7 low order bits of the binery 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.)

6. ASCII CHARACTER CHART

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

7.4 ANALOG OUTPUT

The connector J4 on the Main PCB is the analog output. This output is isolated with a 10K metal film resistor. The pin configuration is:

PIN NO.	DESCRIPTION
J4 - 1	+22 VDC
J4 - 2	-22 VDC
J4 - 3	Analog Ground
J4 - 4	Keyed
J4 - 5	0-10 VDC Analog Output

7.5 PARTS LISTING

1. RECOMMENDED SPARE PARTS

Keyboard	125634 00A
Main PCB	122751 00A
L/C Extension Harness	125765 00A

2. MATING CONNECTORS

MATING CONNECTORS FOR 2036/2136 I/O		
TYPE	**DESCRIPTION**	**DESK**
Load Cell 7 Pin	Connector Clamp	117661 00A 117662 00A
Load Cell 9 Pin	Assembly Connector Clamp	125819 00A 117599 00A 117600 009
Serial I/O	Plug Clamp Pins	107187 00A 107188 00A 107189 00A

3. PRINTER INTERFACE

Printer Interface Pod 122809 00A

7.6 INTERCONNECTING DIAGRAM