MAINTENANCE MANUAL

PD BENCH/FLOOR SCALE SERIES

MODELS: PD-B-30, PD-B-75, PD-B-150
PD-F-75, PD-F-150, PD-F-300
PD-L-150, PD-L-300, PD-L-600
PD-XL-150, PD-XL-300, PD-XL-600

CONTENTS

1. INTRODUCTION

2. SPECIFICATIONS
   2.1 SYSTEM BLOCK DIAGRAM
   2.2 PHYSICAL LAYOUT OF ELECTRICAL CONNECTION
   2.3 GENERAL SPECIFICATIONS

3. INITIAL SETUP
   3.1 INTERNAL FUNCTION AND SETTING METHODS
   3.2 AUTO AND DEALER CALIBRATION PROCEDURES
   3.3 DISABLE CALIBRATION WITH DIP SW. (S1)
   3.4 OFFSET AND SPAN VALUE DATA
   3.5 FLOW CHART

4. TROUBLE SHOOTING
   4.1 TROUBLE SHOOTING LOOP
   4.2 PARTS AND COMPONENTS TROUBLE SHOOTING

5. ELECTRICAL CIRCUITRY
   5.1 SCHEMATICS
   5.2 PCB LAYOUT

6. BILL OF MATERIAL

7. APPENDIX

MARCH 2004

Specifications and Function Subject to Change without Notice
1. INTRODUCTION

This maintenance manual contains of certain information that may result in fraudulent use. Do not release any part of this manual to any end users or un-authorized persons.

The internal DIPS/W should be so set to prevent un-authorized settings or alternations.

Should a load cell has been replaced, make sure that the protection devices are properly set.

After servicing, it is necessary to go through all tests and procedures to ensure the scale meets all the meteorological and approval requirements.

Here are some features of the PD series

1. Zero indicator
2. Tare indicator
3. Negative value indicator
4. Subtractive tare function
5. Power on zero function
6. Manual zero function
7. Auto Power Saving Function
8. Multi Weight Unit Selectable
9. 5 x 21mm wide angle LCD digits
10. Dual power: - By built-in rechargeable battery and external AC/DC power adaptor
11. Low battery warning signal
12. Dual color charge status indicator
13. 2 Types of Calibration
14. Overload protection devices against excessive load or shock applied
15. AC/DC power adaptor and dust cover included
16. Dip Switch to prevent end-user calibration
17. Optional EL backlight and Rechargeable Power Pack
2. SPECIFICATION

2.1 SYSTEM BLOCK DIAGRAM

Description:
When an article is placed on the platter, the load of the article is applied to the load cell inside the scale.

The resistance to the excitation current in the strain gauge will then changed and the analog output signal varies.

It is amplified and digitized continuously by the A/D converter into a digital signal. Subsequently, the resulting count is processed and managed by the CPU. The CPU refers to the instructions from the keyboard, and then conveys the output data to LCD driver, which formats the data into readout on the display panels.
2.2 PHYSICAL LAYOUT OF ELECTRICAL CONNECTION

LOAD CELL

RECHARGEABLE BATTERY
6V 4Ah

MAIN BOARD

1706S-10-X

LCD

ON/ZERO  TARE  MODE  OFF

DC JACK

4 PIN CONNECTOR

LOAD CELL

RECHARGEABLE BATTERY
6V 4Ah

MAIN BOARD

1706S-10-X

LCD

ON/ZERO  TARE  MODE  OFF

DC JACK

4 PIN CONNECTOR
2.3 GENERAL SPECIFICATION

Overall View

Overall Dimension:

- **PD-B** 330 X 620 X 750 mm
- **PD-F** 425 X 720 X 850 mm
- **PD-L** 500 X 780 X 850 mm
- **PD-XL** 600 X 970 X 850 mm
### 2.3.1 Model Specifications

<table>
<thead>
<tr>
<th>Model Number</th>
<th>PD-B-30</th>
<th>PD-B-75</th>
<th>PD-B-150</th>
<th>PD-F-75</th>
<th>PD-F-150</th>
<th>PD-F-300</th>
<th>PD-L-150</th>
<th>PD-L-300</th>
<th>PD-L-600</th>
<th>PD-XL-150</th>
<th>PD-XL-300</th>
<th>PD-XL-600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>30kg</td>
<td>75kg</td>
<td>150kg</td>
<td>300kg</td>
<td>600kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External Resolution</td>
<td>0.005kg</td>
<td>0.01kg</td>
<td>0.02kg</td>
<td>0.05kg</td>
<td>0.1kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tare Range</td>
<td>Full Tare</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power on Zero Range</td>
<td>±10% F.S.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manual Zero Range</td>
<td>±2% F.S.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation Environment</td>
<td>0°C<del>40°C (32°F</del>104°F),</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-condensed. R.H. ≤ 85%</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>Normal = 0.1W Charging = 5W</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Source</td>
<td>Built-in Rechargeable Battery, or AC/DC Power Adaptor: DC9V 500mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2.3.2 Main Components Used

- Microprocessors: 89C52
- Crystal Oscillator: 7.3728MHz
- Display Device: WTN Liquid Crystal Display
- Load Cell Used: 350Ω load cell
- Load Cell Capacity: PD-B-30 = 60kg, PD-B-75, PD-F-75 = 100kg, PD-B-150, PD-F-150, PD-L-150, PD-XL-150 = 250kg, PD-F-300, PD-L-300, PD-XL-300 = 500kg, PD-L-600, PD-XL-600 = 750kg

### 2.3.3 Analog Specification

- Input sensitivity: 2mV/V
- Zero Drift: 0.02% R.O./10°C
- Zero Balance Range: ±2% of rate capacity
- Load Cell Excitation Voltage: DV5V
- A/D Conversion Speed: 5 times/second
- Internal Resolution: 30000

---

6
3. INITIAL SETUP

3.1 INTERNAL FUNCTIONS AND SETTING METHODS

INTERNAL FUNCTION TABLE

<table>
<thead>
<tr>
<th>Function</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F.1</td>
<td>Span value reading and dealer calibration</td>
</tr>
<tr>
<td>2</td>
<td>F.2</td>
<td>Full display segment and max. capacity check</td>
</tr>
<tr>
<td>3</td>
<td>F.3</td>
<td>Check offset value and scale configuration</td>
</tr>
<tr>
<td>4</td>
<td>F.4</td>
<td>Auto power off setting</td>
</tr>
</tbody>
</table>

HOW TO ENTER THE REQUIRED FUNCTION MODE

a. Turn scale off.
b. Press and hold TARE, then turn scale on. Scale displays F.1
c. Press TARE until the required function number appears.
d. Press MODE
e. Press MODE until the required setting appears.
f. Press TARE to confirm.
g. Repeat step c to f for other function setting, or
h. Press ON/ZERO to save settings and return to normal operation.

F.1 Span Value Reading and Dealer Calibration

a. Simply enter F.1 to read the A/D counts.
b. Press ON/ZERO to clear the A/D counts, apply test mass onto platter, the span value of test mass will be displayed.
c. Refer to Dealer Calibration procedures for dealer calibration.

F.2 Display Segment and Rated Capacity & Division Check

When function is entered, all segments will be displayed.
Check and make sure that no segments are missed.

F.3 Check Offset Value and Scale Configuration

a. Enter F.3, scale displays the Offset value when unloaded.
b. Apply extra load onto platter, the total internal count value will be displayed.

SELECT WEIGHT UNITS

a. Press and hold MODE until the weight unit appears.
b. To employ all (metric and pound) weight units, press MODE until lb appears. To disable pound weight unit, press MODE until kg appears.
c. Press ON/ZERO to save setting and back to normal operation status.

F.4 Auto Power Off Setting

Two modes are available: (Default=4_OFF)
0._OFF = Auto Power Off function is disabled.
4._OFF = Scale will automatically be turned off after 4 minutes
3.2 AUTO AND DEALER CALIBRATION PROCEDURES

ACCEPTABLE LOAD FOR AUTO AND DEALER CALIBRATION

<table>
<thead>
<tr>
<th>Model Number</th>
<th>External Division</th>
<th>Acceptable Auto and Dealer Calibration Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD-30</td>
<td>1/6000</td>
<td>*10kg 20kg</td>
</tr>
<tr>
<td>PD-75</td>
<td>1/7500</td>
<td>*20kg 50kg</td>
</tr>
<tr>
<td>PD-150</td>
<td>1/7500</td>
<td>*50kg 100kg</td>
</tr>
<tr>
<td>PD-300</td>
<td>1/6000</td>
<td>*100kg 200kg</td>
</tr>
<tr>
<td>PD-600</td>
<td>1/6000</td>
<td>*200kg 400kg</td>
</tr>
</tbody>
</table>

* Recommended calibration load

Dealer Calibration Procedures:

1. Turn scale off.
2. Press and hold TARE, then turn scale on.
3. Scale displays F.1
4. Press MODE
5. Scale displays offset value
6. Press ON/ZERO
7. Press TARE
8. Press ON/ZERO
9. Press TARE
10. Press ON/ZERO, scale displays an arrow at the right hand of the display. It means the scale is ready for dealer calibration. Make sure that the figure being displayed is =0 or 1, If not, press ON/ZERO again.
11. Load calibration either load as listed on above table.
12. When value displayed is stable, press MODE.
13. Wait until the scale starts down count.
14. Calibration completed and scale is ready for operation.

Note: odd weight calibration can be executed during step 11 (Min. calibration weight = 10% of rated capacity)

1. Press MODE for lasting 1 second, scale displays “00000”.
2. Enter calibration weight by pressing:
   ZERO key to increase value
   TARE key to move cursor
3. Press MODE after calibration weight is keyed in.
4. Place calibration weight onto the scale.
5. When value displayed is stable, press MODE.
6. Wait until scale displays DONE and starts down count.
7. The scale is now calibrated and ready for normal operation.
**Auto Calibration Procedures:**

1. Turn scale off
2. Press and hold MODE, then turn scale on.
3. Scale displays CAL?
4. Press MODE
5. Scale displays LOAD XXXX or XXXX
6. Apply calibration load according to above table.
7. Wait until the scale displays DONE and starts down count.
8. Calibration completed and scale is ready for operation.

**Note:** odd weight calibration can be executed during step 5
(Min. calibration weight = 10% of rated capacity)
1. Press MODE for lasting 1 second, scale displays “00000”.
2. Enter calibration weight by pressing:
   - ZERO key to increase value
   - TARE key to move cursor
3. Press MODE after calibration weight is keyed in.
4. Scale displays “YES.. LoAd..XXXX”(XXXX:calibration weight)
5. Place calibration weight as shown on the display.
6. Wait until scale displays DONE and starts down count.
7. The scale is now calibrated and ready for normal operation.

**3.3 DISABLE CALIBRATION AND AVOIRDUPOIS WEIGHT UNITS WITH DIP SW. (DIP1)**

The DIP SW. #1 is used to control calibration and avoirdupois weight units. Push this switch to ON position to disable calibration.
3.4 OFFSET AND SPAN VALUE DATA

OFFSET AND SPAN VALUE DATA TABLE

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Offset Value (Thousand)</th>
<th>Span Value (Thousand) at Various Load Applied</th>
<th>Offset Control</th>
<th>Span Control (Ohm) R1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD-30</td>
<td>10-14</td>
<td>10-15 at 10kg 20-30 at 20kg VR1 Trimmer 68K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD-75</td>
<td>10-14</td>
<td>10-15 at 20kg 25-37.5 at 50kg VR1 Trimmer 68K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD-150</td>
<td>10-14</td>
<td>10-15 at 50kg 20-30 at 100kg VR1 Trimmer 68K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD-300</td>
<td>10-14</td>
<td>10-15 at 100kg 20-30 at 200kg VR1 Trimmer 82K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD-600</td>
<td>10-14</td>
<td>10-15 at 200kg 20-30 at 400kg VR1 Trimmer 68K</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

READING OFFSET VALUE
1. Turn scale off
2. Remove all load from platter
3. Enter F.3 and read the offset value

READING SPAN VALUE
1. Turn scale off
2. Remove all load from platter
3. Enter F.1
4. Press ON/ZERO
5. Apply load to platter. Span value according to load applied will be displayed.

HOW TO ADJUST OFFSET VALUE
In case the offset value is out of range, adjust the trimmer located at VR1 on the main board to obtain correct offset value.

HOW TO ADJUST SPAN VALUE
The span value is controlled by resistor located on R1A, standard resistor value of R1A is listed on the above table. If the required span value is not attained, then change R1A resistor according to either case below:
Span value too low: Increase the resistance of R1A.
Span value too high: Decrease the resistance of R1A.
3.5 FLOW CHART
3.5.1 Auto Calibration (for end-user)

START

PRESS "MODE" & "ON/ZERO"

DISPLAY FULL SCENE

RELEASE "ON/ZERO" KEY

CALIBRATE?

DISPLAY "CAL.?"

RELEASE "MODE" KEY

"MODE"=YES "ON/ZERO" =NO

PRESS "MODE" OR "ON/ZERO" KEY

CALIBRATE?

DISPLAY "no"

DISPLAY "99999"

DISPLAY "00000"

COUNT DOWN

DISPLAY "00000"

DISPLAY "99999"

WEIGHT IS STILL ON THE PLATTER?

DISPLAY "XXXX"

"XXXX"=ASSIGNED WEIGHT

CORRECT WEIGHT ASSIGNED?

DISPLAY "DONE"

DISPLAY "99999"

DISPLAY "00000"

STANDBY FOR OPERATION

"0 kg"

"99999"
3.5.2 Function Test (for technicians only)

START

PRESS "TARE" & "ON/ZERO"

LCD PANOR-AMIC VIEW

RELEASE "ON/ZERO" KEY

RELEASE "TARE" KEY

F1

F1

"MODE" PRESS KEY?

Other

S

S

1

F2

F2

99999

COUNT DOWN

11111

00000

0.00 kg ->

STANDBY FOR OPERATION

STANDBY FOR OPERATION
1

DISPLAY "XXXX".

PRESS "ZERO" ?

CAL. LOOP

0

PRESS KEY CODE :
1, 2, 1, 2

LEGITIMATE PROCEDURE

0 ->

PUT ON THE ASSIGNED WEIGHT

DIP SW. #1 > ON?

YES

NO

YES

NO

PRESS "MODE"?

YES

WEIGHT ASSIGNED?

NO

YES

DONE

S

NOTE :
1: TARE key
2: ON/ZERO key

A/D ->0 +/- 3 counts

Key in Private Code

TEST KEYBOARD

k : key code

SWITCH OFF?

YES

END

YES

" ACCEPT Private Code

DISPLAY SPAN VALUE

j

C

xxxx: Show offset
Other "TARE" "MODE"

Press "MODE" for lasting 2 sec.

F2

Press key?

"TARE"

"MODE"

XX.XX

L.C.D PANORAMIC VIEW

"MODE"

PRESS

"TARE"

Other

S

F3

Press key?

"TARE"

"MODE"

XXXXX

XXXXX: OFFSET VALUE

Other

S

F4

F1

Press "MODE" for lasting 2 sec.

WEIGHT UNIT CHANGED:

XX.XX(kg/lb)---XX.XX(kg)
F4

F4

"TARE"

F1

"MODE"

4_off

Auto shut-off when not in use for 4 min.

S

other

PRESS KEY?

"TARE"

F1

"MODE"

0_off

No Auto shut-off

PRESS KEY?
4. TROUBLE SHOOTING
4.1 TROUBLE SHOOTING LOOP

POWER ON

NO DISPLAY
COUNT DOWN?
CHECK POWER SUPPLY, CPU, LCD, KEYBOARD

DISPLAY RANDOM FIGURE
CHECK CPU, LCD, LCD DRIVER IC

COUNTS AND THEN ZERO?
CHECK PLATTER MECHANISAM, LOAD CELL, A/D UNIT, OFFSET VALUE

OK
SHOW "00000"

OK
GHOST
PROPER READOUT?
CHECK POWER SUPPLY, LCD, LCD DRIVER IC, R34~37

INCORRECT
CORRECT READOUT?
RE-CALIBRATE THE SCALE

UNSTABLE
CHECK PLATTER MECHANISAM, LOAD CELL, A/D UNIT, BAD SOLDERING

NORMAL OPERATION
CHECK PLATTER MECHANISAM, LOAD CELL, OFFSET VALUE

OK
NORMAL OPERATION
4.2 PARTS AND COMPONENTS TROUBLE SHOOTING

4.2.1 Power Supply Checking

4.2.1.1 Relevant parts:
Main Board (1706S-10-X)
Q6 (C1061)
ZD1 (8.2V)
BR1 (W04/1A)
Q5 (A1515)
Q4 (C945)
Q8 (C945)
R14 (1.2 ohm, 1/2W)
Q9 (A733)
U9 (IC 7660)
U8 (LM358)
ZD2 (3.3V)
DC JACK (SCD-021)

Description:
1) AC Adaptor: This AC Adaptor provides power for DC9~12V, 500mA
2) Battery: Built-in Rechargeable Battery 6V/4Ah
3) How Battery is charged completely?
The charging voltage is regulated by Q6 (C1061) and ZD1 (8.2V) for about 7 volts.
The charging current will go down automatically when voltage reached. Q8 (C945) and R14 (1.2R, 1/2W) provide Over-Current protection.

4) -5V power drives analog devices (OP. amp. & A/D converter) U9 (IC 7660) is a -5volts Voltage generator.

5) +5V power drives analog and digital circuit systems. U8 (LM358) is used to generate 5volts Voltage with negative feed-back technology.

6) Auto-off: If the scale is set with 4_off mode of power saving function or under LO-BAT status, then after fixed time, CPU will release a high potential signal to draw Q4 off, therefore Q1 cuts off, the scale will be shut down immediately.

7) Low Power Detection: The Q9 (A733) is designed to detect the power level. When battery voltage is less than 5.5V, Collector pole will release a high potential signal to CPU, and then CPU will instruct LCD display to show LO-BAT symbol.

4.2.1.2 Input voltage: 5.5V or higher
Check and recharge battery if voltage less than 5.5V. Check DC-JACK or AC Adaptor if been defective.

4.2.1.3 System voltage (Vcc): 5V +/- 10%
Check that the system voltage is within 5V +/- 10%
a) less than 4.5V, the CPU may not work properly.
b) more than 6V, ghost will appear on LCD.

4.2.2 Platter Stopper Checking
The platter device shall not touch anything around itself during operation. Check that the platter is not contacted with the upper (no load) and/or lower (with load) stopper.

4.2.3 LCD Display Checking
4.2.3.1 Check that it is soldered and connected properly between LCD and driver IC (uPD7225), driver IC (uPD7225) and CPU.

4.2.3.2 Check whether LCD is broken.

4.2.4 CPU Checking
4.2.4.1 Check that all pins are seated properly into the socket.

4.2.4.2 Check that the Crystal Oscillator works.
4.2.4.3 Check the RESET is normally low.

4.2.5 A/D Unit Checking

4.2.5.1 Check that the +5V & -5V powers are correctly fed to the A/D unit.

4.2.5.2 Check that the signal output of loadcell is adequate.

4.2.5.3 Check OP. amplifiers & A/D converter (AD7135).

When no error is found with the above checking procedures, the trouble can be caused by the load cell or the PCB itself. Replace a new one could be better to identify the defectiveness.

In this way, the readout of weight would be varied because of the output voltage of loadcell and different span value, so re-calibration is necessary after this replacement.
5. ELECTRICAL CIRCUITRY

SCHEMATICS
5.2 PCB LAYOUT

1706S-10-3 TOP LAYER

1706S-10-3 BOTTOM LAYER
### 6. BILL OF MATERIAL

#### 1708S SERIES

<table>
<thead>
<tr>
<th>Parts No.</th>
<th>Description</th>
<th>Specification</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1706000010</td>
<td>P.C.B. KIT</td>
<td>1706S-10-X MAINBOARD</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A00*******</td>
<td>LOAD CELL</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>G0001FW0200</td>
<td>INDICATOR HOUSING(UPPER)</td>
<td>FW/OFW SERIES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>G0001OFW000</td>
<td>INDICATOR HOUSING(UNDER)</td>
<td>OFW SERIES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>G0003PSP000</td>
<td>INDICATOR FIX PLATE</td>
<td>PSP/OFW SERIES, U SHAPE</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>F0004OBW000</td>
<td>STEEL PILLAR(COATING)</td>
<td>OBW SERIES, L SHAPE</td>
<td>1</td>
<td>PD-B</td>
</tr>
<tr>
<td>F0004OFW000</td>
<td>STEEL PILLAR(COATING)</td>
<td>OFW SERIES, L SHAPE</td>
<td>1</td>
<td>PD-F,L,XL</td>
</tr>
<tr>
<td>G0004EC0001</td>
<td>ADJUSTABLE FEET</td>
<td>E SERIES</td>
<td>2</td>
<td>INDICATOR</td>
</tr>
<tr>
<td>A1600060400</td>
<td>RECHARGEABLE BATTERY</td>
<td>GP4-6/6V 4Ah</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A1208020351</td>
<td>BATTERY WIRE ARRAY</td>
<td>2 PIN 35cm(SINGLE HOUSING)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>F0007NBS102</td>
<td>S/S BATTERY CLAMP</td>
<td>NBS SERIES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C1W10000000</td>
<td>PANEL PC</td>
<td>200<em>78</em>2t(TRANSPARENT)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C1PD0030000</td>
<td>OVERLAY PC</td>
<td>PD SERIES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>27MFW000000</td>
<td>DUST COVER</td>
<td>FW SERIES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A0906000210</td>
<td>D.C. JACK</td>
<td>SCD-021</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A60*******</td>
<td>ADAPTOR</td>
<td>***V/9V 500mA</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A0905600401</td>
<td>CONNECTOR</td>
<td>PLT-164-P</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A0905600400</td>
<td>CONNECTOR</td>
<td>PLT-164-R</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A1204040250</td>
<td>WIRE ARRAY</td>
<td>4 PIN 25cm</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>G0005NBS000</td>
<td>RUBBER WASHER</td>
<td>ψ 27xψ 9x3mm</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

#### 1706S-10-X MAINBOARD

<table>
<thead>
<tr>
<th>Parts No.</th>
<th>Description</th>
<th>Specification</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>E0706000010</td>
<td>P.C.B.</td>
<td>1706S-10-X</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A0208072250</td>
<td>I.C.</td>
<td>UPD7225G</td>
<td>1</td>
<td>U1</td>
</tr>
<tr>
<td>A0202093461</td>
<td>I.C.</td>
<td>93C46</td>
<td>1</td>
<td>U4</td>
</tr>
<tr>
<td>A0203071350</td>
<td>I.C.</td>
<td>7135(TI)</td>
<td>1</td>
<td>U7</td>
</tr>
<tr>
<td>A0203076600</td>
<td>I.C.</td>
<td>7660</td>
<td>1</td>
<td>U9</td>
</tr>
<tr>
<td>A0204744520</td>
<td>I.C.</td>
<td>74HC4520AP</td>
<td>1</td>
<td>U6</td>
</tr>
<tr>
<td>A0206000074</td>
<td>I.C.</td>
<td>OF07CP (AD)</td>
<td>2</td>
<td>U3,5</td>
</tr>
<tr>
<td>A0206003580</td>
<td>I.C.</td>
<td>LM358N</td>
<td>1</td>
<td>U8</td>
</tr>
<tr>
<td>A0201089521</td>
<td>I.C.</td>
<td>89CS2</td>
<td>1</td>
<td>U2</td>
</tr>
<tr>
<td>A0102000281</td>
<td>L.C.D.</td>
<td>UTN-G281JV-W</td>
<td>1</td>
<td>LCD1</td>
</tr>
<tr>
<td>A0300000040</td>
<td>I.C. SOCKET</td>
<td>40 PIN</td>
<td>1</td>
<td>U2</td>
</tr>
<tr>
<td>A0401007330</td>
<td>TRANSISTOR</td>
<td>A733</td>
<td>2</td>
<td>Q7,9</td>
</tr>
<tr>
<td>A0401009450</td>
<td>TRANSISTOR</td>
<td>2SC945</td>
<td>3</td>
<td>Q3,4,8</td>
</tr>
<tr>
<td>A0401015150</td>
<td>TRANSISTOR</td>
<td>A1515</td>
<td>2</td>
<td>Q2,5</td>
</tr>
<tr>
<td>A0401010610</td>
<td>TRANSISTOR</td>
<td>C1061C OR D880</td>
<td>1</td>
<td>Q6</td>
</tr>
<tr>
<td>A0501004148</td>
<td>DIODE</td>
<td>1N4148</td>
<td>2</td>
<td>D1,2</td>
</tr>
<tr>
<td>A0502000001</td>
<td>BRIDGE RECTIFIER</td>
<td>W04(1A)</td>
<td>1</td>
<td>BR1</td>
</tr>
<tr>
<td>A0503020033</td>
<td>ZENER DIODE</td>
<td>1/2W 3V3(3C2)</td>
<td>1</td>
<td>ZD2</td>
</tr>
<tr>
<td>A0503020082</td>
<td>ZENER DIODE</td>
<td>1/2W 8V2(9A3)</td>
<td>1</td>
<td>ZD1</td>
</tr>
<tr>
<td>A0625050000</td>
<td>L.E.D.</td>
<td>ROUND, 5mm, (RED,GREEN)</td>
<td>1</td>
<td>LED1</td>
</tr>
<tr>
<td>A0701106017</td>
<td>CAPACITOR (EC)</td>
<td>10uF/16V (SS TYPE)</td>
<td>6</td>
<td>C20,22-24</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35-36</td>
</tr>
<tr>
<td>A0701108016</td>
<td>CAPACITOR (EC)</td>
<td>1000uF/16V</td>
<td>1</td>
<td>C17</td>
</tr>
<tr>
<td>A0701477016</td>
<td>CAPACITOR (EC)</td>
<td>470uF/16V</td>
<td>1</td>
<td>C19</td>
</tr>
<tr>
<td>A0702105035</td>
<td>CAPACITOR (TC)</td>
<td>1uF/35V (105L)</td>
<td>1</td>
<td>C37</td>
</tr>
<tr>
<td>A0702106016</td>
<td>CAPACITOR (TC)</td>
<td>10uF/16V (106F)</td>
<td>2</td>
<td>C15,21</td>
</tr>
<tr>
<td>A0713105063</td>
<td>POLYESTER FILM CAPACITOR (MEF)</td>
<td>1uF/63V (105)</td>
<td>3</td>
<td>C11-13</td>
</tr>
<tr>
<td>A0713224101</td>
<td>POLYESTER FILM CAPACITOR (MEF)</td>
<td>0.22uF/100V (224)</td>
<td>2</td>
<td>C9,10</td>
</tr>
<tr>
<td>A0710224101</td>
<td>POLYESTER FILM CAPACITOR (MPF)</td>
<td>0.22uF/100V (224)</td>
<td>1</td>
<td>C14</td>
</tr>
<tr>
<td>A0720103101</td>
<td>POLYESTER FILM CAPACITOR (PEI)</td>
<td>0.01uF/100V (103J)</td>
<td>1</td>
<td>C8</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Value</td>
<td>Qty</td>
<td>Notes</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------------</td>
<td>--------</td>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>A0730104050</td>
<td>CAPACITOR (MLC) 104Z</td>
<td></td>
<td>21</td>
<td>C1-7,16, 18,25-30, 32,38-42</td>
</tr>
<tr>
<td>A0740020050</td>
<td>CERAMIC CAPACITOR (CC) 20pF</td>
<td></td>
<td>2</td>
<td>C33,34</td>
</tr>
<tr>
<td>A0801001203</td>
<td>TRIMMER 3006P-001-203 (20K)</td>
<td></td>
<td>1</td>
<td>VR1</td>
</tr>
<tr>
<td>A0802047309</td>
<td>RESISTOR NETWORK 47K OHM 9 PIN</td>
<td></td>
<td>1</td>
<td>NR1</td>
</tr>
<tr>
<td>A0803042002</td>
<td>METAL FILM RESISTOR (10PPM) 20K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R10</td>
</tr>
<tr>
<td>A0803042201</td>
<td>METAL FILM RESISTOR (10PPM) 2.2K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R9</td>
</tr>
<tr>
<td>A0804041003</td>
<td>METAL FILM RESISTOR 100K OHM 1/4W</td>
<td></td>
<td>6</td>
<td>R2-6</td>
</tr>
<tr>
<td>A0804041503</td>
<td>METAL FILM RESISTOR 150K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R39</td>
</tr>
<tr>
<td>A0804045003</td>
<td>METAL FILM RESISTOR 500K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R40</td>
</tr>
<tr>
<td>A0804046802</td>
<td>METAL FILM RESISTOR 68K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R3</td>
</tr>
<tr>
<td>A5005000110</td>
<td>JUMPER</td>
<td></td>
<td>1</td>
<td>R8</td>
</tr>
<tr>
<td>A0805021020</td>
<td>CARBON FILE RESISTOR 1.2 OHM 1/2W</td>
<td></td>
<td>1</td>
<td>R14</td>
</tr>
<tr>
<td>A0805021101</td>
<td>CARBON FILE RESISTOR 100 OHM 1/2W</td>
<td></td>
<td>1</td>
<td>R12</td>
</tr>
<tr>
<td>A0805041102</td>
<td>CARBON FILM RESISTOR 1K OHM 1/4W</td>
<td></td>
<td>2</td>
<td>R22,31</td>
</tr>
<tr>
<td>A0805041103</td>
<td>CARBON FILM RESISTOR 10K OHM 1/4W</td>
<td></td>
<td>6</td>
<td>R17,24,30, 34-36</td>
</tr>
<tr>
<td>A0805041104</td>
<td>CARBON FILM RESISTOR 100K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R20</td>
</tr>
<tr>
<td>A0805041153</td>
<td>CARBON FILE RESISTOR 15K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R15</td>
</tr>
<tr>
<td>A0805041183</td>
<td>CARBON FILE RESISTOR 18K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R37</td>
</tr>
<tr>
<td>A0805041221</td>
<td>CARBON FILE RESISTOR 220 OHM 1/4W</td>
<td></td>
<td>2</td>
<td>R13,23</td>
</tr>
<tr>
<td>A0805041223</td>
<td>CARBON FILE RESISTOR 22K OHM 1/4W</td>
<td></td>
<td>2</td>
<td>R21,41</td>
</tr>
<tr>
<td>A0805041334</td>
<td>CARBON FILM RESISTOR 330K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R33</td>
</tr>
<tr>
<td>A0805041471</td>
<td>CARBON FILE RESISTOR 470 OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R16</td>
</tr>
<tr>
<td>A0805041472</td>
<td>CARBON FILE RESISTOR 4.7K OHM 1/4W</td>
<td></td>
<td>7</td>
<td>R18,19,25, 26,32,38, 42</td>
</tr>
<tr>
<td>A0902010020</td>
<td>CONNECTOR</td>
<td>2 PIN WAFER,PITCH=3.9mm</td>
<td>2</td>
<td>J1,2</td>
</tr>
<tr>
<td>A1100273728</td>
<td>CRYSTAL 7.3728 MHz</td>
<td></td>
<td>1</td>
<td>X1</td>
</tr>
<tr>
<td>A1306000003</td>
<td>TACT SW KPT-1104B</td>
<td></td>
<td>4</td>
<td>SW1-4</td>
</tr>
<tr>
<td>A1500000004</td>
<td>BUZZER OBO-15210</td>
<td></td>
<td>1</td>
<td>B21</td>
</tr>
<tr>
<td>A5004000002</td>
<td>HEAT SINK MB-204-20</td>
<td></td>
<td>1</td>
<td>Q6</td>
</tr>
<tr>
<td>Z0011000308</td>
<td>SCREW(FLAT HEAD) M3*8</td>
<td></td>
<td>1</td>
<td>Q6</td>
</tr>
<tr>
<td>Z0016000003</td>
<td>NUT M3</td>
<td></td>
<td>1</td>
<td>Q6</td>
</tr>
</tbody>
</table>

**EL BACKLIGHT OPTION**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Value</th>
<th>Qty</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0401009450</td>
<td>TRANSISTOR 2SC945</td>
<td></td>
<td>1</td>
<td>Q1</td>
</tr>
<tr>
<td>A0805041102</td>
<td>CARBON FILM RESISTOR 1K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R28</td>
</tr>
<tr>
<td>A0805041334</td>
<td>CARBON FILM RESISTOR 330K OHM 1/4W</td>
<td></td>
<td>1</td>
<td>R29</td>
</tr>
<tr>
<td>A1400000004</td>
<td>BACKLIGHT(EL) 103.5*40mm(BL-8036)</td>
<td></td>
<td>1</td>
<td>EL1</td>
</tr>
<tr>
<td>A1401005000</td>
<td>INVERTER 5V/90cm²</td>
<td></td>
<td>1</td>
<td>IN1</td>
</tr>
</tbody>
</table>

==================================================================================================
7. APPENDIX

Features
- Compatible with MCS-51™ Products
- 8 Kbytes of In-System Reprogrammable Flash Memory
- Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 MHz
- Three-Level Program Memory Lock
- 256 x 8-Bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-Bit Timer/Counters
- Eight Interrupt Sources
- Programmable Serial Channel
- Low Power Idle and Power Down Modes

Description
The AT89C52 is a low power, high-performance CMOS 8-bit microcontroller with 8 Kbytes of Flash programmable and erasable read-only memory (PEROM). The device is manufactured using Atmel's high density non-volatile memory technology and is compatible with the industry standard 80C51 and 80C52 instruction set and pinout. The in-circuit Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcontroller which provides a highly flexible and cost effective solution to many embedded control applications.

The AT89C52 provides the following standard features: 8 Kbytes of Flash, 256 bytes of RAM, 32 I/O lines, three 16-bit timer/counters, a six vector two level interrupt architecture, a full duplex serial port, on-chip oscillator and clock circuitry. In addition, the AT89C52 is

Pin Configurations

8-Bit Microcontroller with 8 Kbytes Flash

(continues)
AT89C52

Block Diagram
4½ Digit, BCD Output, A/D Converter

The Intersil ICL7135 precision A/D converter, with its multiplexed BCD output and digit drivers, combines dual-slope conversion reliability with 1 in 20,000 count accuracy and is ideally suited for the visual display DVM/DPM market. The 2.0000V full scale capability, auto-zero, and auto-polarity are combined with true ratiometric operation, almost ideal differential linearity and true differential input. All necessary active devices are contained on a single CMOS IC, with the exception of display drivers, reference, and a clock.

The ICL7135 brings together an unprecedented combination of high accuracy, versatility, and true economy. It features auto-zero to less than 10 V, zero drift of less than 1 V/ºC, input bias current of 10pA (Max), and rollover error of less than one count. The versatility of multiplexed BCD outputs is increased by the addition of several pins which allow it to operate in more sophisticated systems. These include STR, OVERRANGE, UNDERRANGE, R UN/HOLD and BUSY lines, making it possible to interface the circuit to a microprocessor or UART.

Features

• Accuracy Guaranteed to 1 Count Over Entire 20000 Counts (2.0000V Full Scale)
• Guaranteed Zero Reading for 0V Input
• 1pA Typical Input Leakage Current
• True Differential Input
• True Polarity at Zero Count for Precise Null Detection
• Single Reference Voltage Required
• Overrange and Underrange Signals Available for Auto-Range Capability
• All Outputs TTL Compatible
• Blinking Outputs Gives Visual Indication of Oerrange
• Six Auxiliary Inputs/Outputs are Available for Interfacing to UART's, Microprocessors or Other Circuitry
• Multiplexed BCD Outputs

Ordering Information

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TEMP. RANGE (ºC)</th>
<th>PACKAGE</th>
<th>PKG. NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICL7135CPI</td>
<td>0 to 70</td>
<td>28 Ld PDIP</td>
<td>28.6</td>
</tr>
</tbody>
</table>

Pinout
Typical Application Schematic

ICL7135

SET V_REF = 1.000V

V_REF IN

ANALOG GND

100k

0.47 F

1 F

100K

1 F

100k

SIGNAL INPUT

-5V

+5V

ICL7135

CLOCK IN

120kHz

0V

ANODE DRIVER TRANSISTORS

-19999

DISPLAY

SEVEN SEG. DECODE


**Description**

The µPD7225 is an intelligent peripheral device designed to interface most microprocessors with a wide variety of alphanumeric LCDs. It can directly drive any static or multiplexed LCD containing up to 4 backplanes and up to 32 segments and is easily cascaded for larger LCD applications. The µPD7225 communicates with a host microprocessor through an 8-bit serial interface. It includes a 7-segment numeric and a 14-segment alphanumeric LCD decoder to reduce system software requirements. The µPD7225 is manufactured with a low power consumption CMOS process allowing use of a single power supply between 2.7 V and 5.5 V. It is available in a space-saving 52-pin plastic flat package.

**Features**

- Single-chip LCD controller with direct LCD drive
- Low-cost serial interface to most microprocessors
- Compatible with:
  - 7-segment numeric LCD configurations up to 16 digits
  - 14-segment alphanumeric LCD configurations up to 8 characters
- Selectable LCD drive configuration:
  - Static, bi-plexed, tri-plexed, or quad-plexed
- 32-segment drivers
- Cascadable for larger LCD applications
- Selectable 1 LCD bias voltage configuration:
  - Static, 1/2 or 1/3
- Hardware logic blocks reduce system software requirements:
  - 8-bit serial interface
  - Two 32 x 4-bit static RAMs for display data and blinking data storage
  - Programmable segment decoding capability:
    - 16-character, 7-segment numeric decoder
    - 64-character, 14-segment USASCII alphanumeric decoder
  - Programmable segment blinking capability
  - Automatic synchronization of segment drivers with sequentially multiplexed backplane drivers
- Single power supply, variable from 2.7 V to 5.5 V
- Low power consumption CMOS technology
- Extended -40°C to +85°C temperature range available

**Ordering Information**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package Type</th>
<th>Max Frequency of Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>µPD7225G-00</td>
<td>52-pin plastic miniat</td>
<td>1 MHz</td>
</tr>
</tbody>
</table>

**Pin Configuration**

**Pin Identification**

<table>
<thead>
<tr>
<th>No.</th>
<th>Symbol</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CLK</td>
<td>System clock output</td>
</tr>
<tr>
<td>2</td>
<td>SYNE</td>
<td>Synchronization port</td>
</tr>
<tr>
<td>3-5</td>
<td>V_LCD</td>
<td>LCD bias voltage supply inputs</td>
</tr>
<tr>
<td></td>
<td>CLCD</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>VSS</td>
<td>Ground</td>
</tr>
<tr>
<td>7, 33</td>
<td>VDD</td>
<td>Power</td>
</tr>
<tr>
<td>8</td>
<td>SCK</td>
<td>Serial clock input</td>
</tr>
<tr>
<td>9</td>
<td>SI</td>
<td>Serial input</td>
</tr>
<tr>
<td>10</td>
<td>CS</td>
<td>Chip select</td>
</tr>
<tr>
<td>11</td>
<td>BUSY</td>
<td>Busy output</td>
</tr>
<tr>
<td>12</td>
<td>C/D</td>
<td>Command or data select input</td>
</tr>
<tr>
<td>13</td>
<td>RESET</td>
<td>Reset input</td>
</tr>
<tr>
<td>14</td>
<td>NC</td>
<td>No connection</td>
</tr>
<tr>
<td>15-16</td>
<td>COM5-COM6</td>
<td>LCD backplane driver outputs</td>
</tr>
<tr>
<td>17-32, 34-36</td>
<td>S5-S36</td>
<td>LCD segment driver outputs</td>
</tr>
<tr>
<td>52</td>
<td>CL1</td>
<td>System clock input</td>
</tr>
</tbody>
</table>