

DAS650 Digital Airspeed Instrument

USER INSTRUCTION SUPPLEMENT
M/N DAS650, P/N 101-02194

*Doc. P/N: 61-101-02194
Revision H
November 7, 2014*

BARFIELD, INC.

DAS650 is Designed to be used with Barfield
Pitot-Static Test Sets (1811 Series) and other
Ground Support Test Equipment.
Not for aircraft installation.

Corporate Headquarters

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CONTACT INFORMATION

Users are requested to notify the manufacturer of any discrepancy, omission, or error found in this manual. Inquiries should include specific questions and reference the publication title, number, chapter, page, figure, paragraph, and effective date.

Please send comments to:

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REVISION RECORD

REV.	ECO #	REV. DATE	DESCRIPTION OF CHANGE
A	-	Feb/1/01	First Issue
B	260-00549	May/15/01	Revised to reflect software changes as per ECO
C	260-00582	Apr/12/02	Revised to reflect software changes per ECO including addition of power auto off feature and adjustable Leak Test Timer as well as the removal of the timer for total time instrument is in use.
D	261-000022	Jun/14/04	Revised to show tolerances in section 2 (Digital Airspeed Specifications); also stability tolerance values added to this section. Updated company logo. Updated screen graphics for digit display.
E	260-00721	Feb/20/08	New Company Logo on Pages and Figures. Company Contact info was added. Reformatted text, figures and charts. Fig. 6 wire colors were added.
F	260-00779	Apr/29/10	Recertification paragraph was added at page <i>iv</i> .
G	260-00950	Jan/10/13	Revision to update battery part number.
H	260-01060	Nov/7/14	Update Barfield logo



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LIST OF APPROVED REPAIR FACILITIES

The manufacturer of this equipment does not recommend the user to attempt any maintenance or repair. In case of malfunction, contact the manufacturer, to obtain the list of approved repair facilities worldwide, ensuring that this equipment will be serviced using proper procedures and certified instruments. A Return Maintenance Authorization (RMA) number will be assigned during this call, to keep track of the shipment and the service.

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RECERTIFICATION

Barfield Digital Airspeed Instrument, P/N 101-02194, has a one-year recertification requirement. Qualified technicians in a shop equipped with the necessary tooling, facilities, and Barfield-approved procedures must perform the maintenance required by this unit.

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BARFIELD INC.

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Form 7.5.3-13
Dated 09/01/2014, Rev. 1



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LIST OF ACRONYMS / TERMS USED

CCW.....	Counterclockwise
CW	Clockwise
EEPROM.....	Electrically Erasable Programmable Read-Only Memory
EPR.....	Engine Pressure Ratio
FS.....	Full Scale
Ft.....	Feet
F/W.....	Firmware
In-Hg	Inches of mercury
Km/hr.....	Kilometers per hour
Kts.....	Knots
LCD.....	Liquid Crystal Display
Mb	Millibar
Mb abs	Millibar absolute
MPH	Miles per hour
P/N	Part Number
Ps.....	Static Pressure
PSI	Pounds per Square Inch
PSID.....	Pounds per Square Inch Differential
Pt.....	Pitot Pressure
S/N	Serial Number

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1. GENERAL INFORMATION

1.1 Purpose

Electronic pressure sensors are far more stable, damage-resistant and more widely available than analog instruments. The DAS650 is designed as a digital, retrofit replacement for the current analog airspeed instrument found in the 1811 Pitot-Static Test Set series and equivalent testers. The fit, form and size of the DAS650 allows for easy installation into the test set.

1.2 Description

Data on the DAS650 shows on a graphic liquid crystal display (LCD). The display is backlit with an auto-shutdown timer for battery life protection. Instrument power is supplied by batteries. A keypad is used, for access to and movement through, the menu functions shown on the display. Additional keys on the keypad allow adjustment of the display contrast. The icons also serve as an indication of the battery power level, and show the two-instrument state.

1.3 Features

The DAS650 calculates and displays such aeronautical data as airspeed, MACH*, differential or Pitot* pressure, and engine pressure ratio* (EPR). It may perform an automatic static leak test or a calibration. (The DAS650 does an auto-zero of differential pressure with each power ON. This function increases airspeed accuracy by reducing offset pressure errors.)

NOTE: * Feature is available when DALT55 and DAS650 are connected as part of instrument configuration.

Units of measurement for the DAS650 are user-determined and selectable. Units for aeronautical data can be expressed in knots, kilometers per hour (English) or in miles per hour (American). Units for pressure data are available in in-Hg diff, mbars diff, PSID, in-Hg abs, mbars abs, PSIA or, the user may display both absolute (abs) and differential (diff) measurements at the same time on the screen. The user may also choose between the Aeronautical or the Pressure display.

The DAS650 allows the user to select (or define) maintenance features such as instrument serial number (S/N), manufacturer part number (P/N), configuration of single or dual instruments, time, date, password setting and enabling automatic power off.

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2. DIGITAL AIRSPEED SPECIFICATIONS

AIRSPEED RANGE	0 to 650 knots														
DIFFERENTIAL PRESSURE	0 to 30 in-Hg														
ACCURACY	<table> <tr><td>20 kts</td><td>±1.0 kts</td></tr> <tr><td>50 kts</td><td>±0.5 kts</td></tr> <tr><td>100 kts</td><td>±0.3 kts</td></tr> <tr><td>200 kts</td><td>±0.2 kts</td></tr> <tr><td>400 kts</td><td>±0.2 kts</td></tr> <tr><td>650 kts</td><td>±0.2 kts</td></tr> </table>	20 kts	±1.0 kts	50 kts	±0.5 kts	100 kts	±0.3 kts	200 kts	±0.2 kts	400 kts	±0.2 kts	650 kts	±0.2 kts		
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400 kts	±0.2 kts														
650 kts	±0.2 kts														
OPERATIONAL STABILITY	<p>(12 months) sum with accuracy</p> <table> <tr><td>20 kts</td><td>±0.2 kts</td></tr> <tr><td>50 kts</td><td>±0.2 kts</td></tr> <tr><td>100 kts</td><td>±0.2 kts</td></tr> <tr><td>200 kts</td><td>±0.2 kts</td></tr> <tr><td>400 kts</td><td>±0.2 kts</td></tr> <tr><td>650 kts</td><td>±0.4 kts</td></tr> </table>	20 kts	±0.2 kts	50 kts	±0.2 kts	100 kts	±0.2 kts	200 kts	±0.2 kts	400 kts	±0.2 kts	650 kts	±0.4 kts		
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100 kts	±0.2 kts														
200 kts	±0.2 kts														
400 kts	±0.2 kts														
650 kts	±0.4 kts														
TEMPERATURE RANGE:	<p>OPERATING: -10° C to 70° C (-4° F to 158° F)</p> <p>STORAGE: -30° C to 80° C (-22° F to 176° F)</p>														
MACH	±0.005														
POWER	<table> <tr> <td>Operating Voltage:</td> <td>4.0 to 5.5 VDC</td> </tr> <tr> <td>Current Consumption</td> <td>100mA to 200mA (Depends on input voltage and the backlight ON/OFF)</td> </tr> <tr> <td>Battery Life</td> <td></td> </tr> <tr> <td>With four (4) "C" cell alkaline (P/N 101-02208)</td> <td>30 Hrs, single instrument 15 Hrs, Two instrument configuration (DALT55 & DAS650)</td> </tr> <tr> <td>With Rechargeable BP4000 NiMH (P/N 137-00009)</td> <td>34 Hrs, single instrument 17 Hrs, Two instrument configuration (DALT55 & DAS650)</td> </tr> <tr> <td>With Rechargeable BP4015 NiMH, P/N 137-00030</td> <td>30 Hrs, single instrument 15 Hrs, Two instrument configuration (DALT55 & DAS650)</td> </tr> <tr> <td></td> <td>Note: BP4000 & BP4015 have same capacity, 4.8V / 4,000 mAh</td> </tr> </table>	Operating Voltage:	4.0 to 5.5 VDC	Current Consumption	100mA to 200mA (Depends on input voltage and the backlight ON/OFF)	Battery Life		With four (4) "C" cell alkaline (P/N 101-02208)	30 Hrs, single instrument 15 Hrs, Two instrument configuration (DALT55 & DAS650)	With Rechargeable BP4000 NiMH (P/N 137-00009)	34 Hrs, single instrument 17 Hrs, Two instrument configuration (DALT55 & DAS650)	With Rechargeable BP4015 NiMH, P/N 137-00030	30 Hrs, single instrument 15 Hrs, Two instrument configuration (DALT55 & DAS650)		Note: BP4000 & BP4015 have same capacity, 4.8V / 4,000 mAh
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Accessories for the DALT55 / DAS650 Instruments	
Retrofit Kit (Order as PN: 102-02111)	Kit, Generic Rechargeable NiMH Battery Pack. Use for retrofit old analog instrument units with digital instruments
BP4015 (Order as PN: 137-00030)	Rechargeable NiMH 4.8 VDC @ 4,000 mAh. Compatible with SC3000 charger & ECP1200 embedded charger/power supply. Note: BP4015 replaces BP4010 and BP4000, same capacity. Refer to SIL 88-102-02111.
SC3000 (Order as PN: 137-00021)	Smart charger, fully charges a depleted BP4015 in less than 2 hrs. Not compatible with BP4000. Universal input (100-240 V, 50-60 Hz)

3. INSPECTION

All test sets must be recalibrated in precise time periods for their readings to remain valid.

The **DAS650** has a one-year recalibration period. During the last 30 days before the expiration of this period, a message displays at the end of the initialization sequence to remind the user that the instrument must be sent for recalibration to a Barfield Inc. approved facility.

4. INSTRUMENT DESCRIPTION

4.1 General

The **DAS650** is equipped with an easy-to-use menu-driven LCD display that assists the technician during setup and testing. Each menu gives a set of user options that are selected using cursor (arrow) keys.

4.2 Function Keys

The four (4) function keys have a fixed purpose at all times. These keys are the power ON/OFF, “+” contrast display increase, “-” contrast display decrease, and the display backlight ON/OFF.

4.3 Soft Keys

The three (3) “soft-keys” are programmable and multi-functional. The function of these keys depends on the software programming of the particular key. Each key has various functions depending on the displayed menu.

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FUNCTION KEYS

Key (s)	Location	Function
ON/OFF	Top, right of display	Powers on instrument
Backlight	Right of display	Illuminates display
“+” and “-“	Left of display	Contrast adjustment
Soft (multi-functional)	Bottom of display	Access menus and control instrument

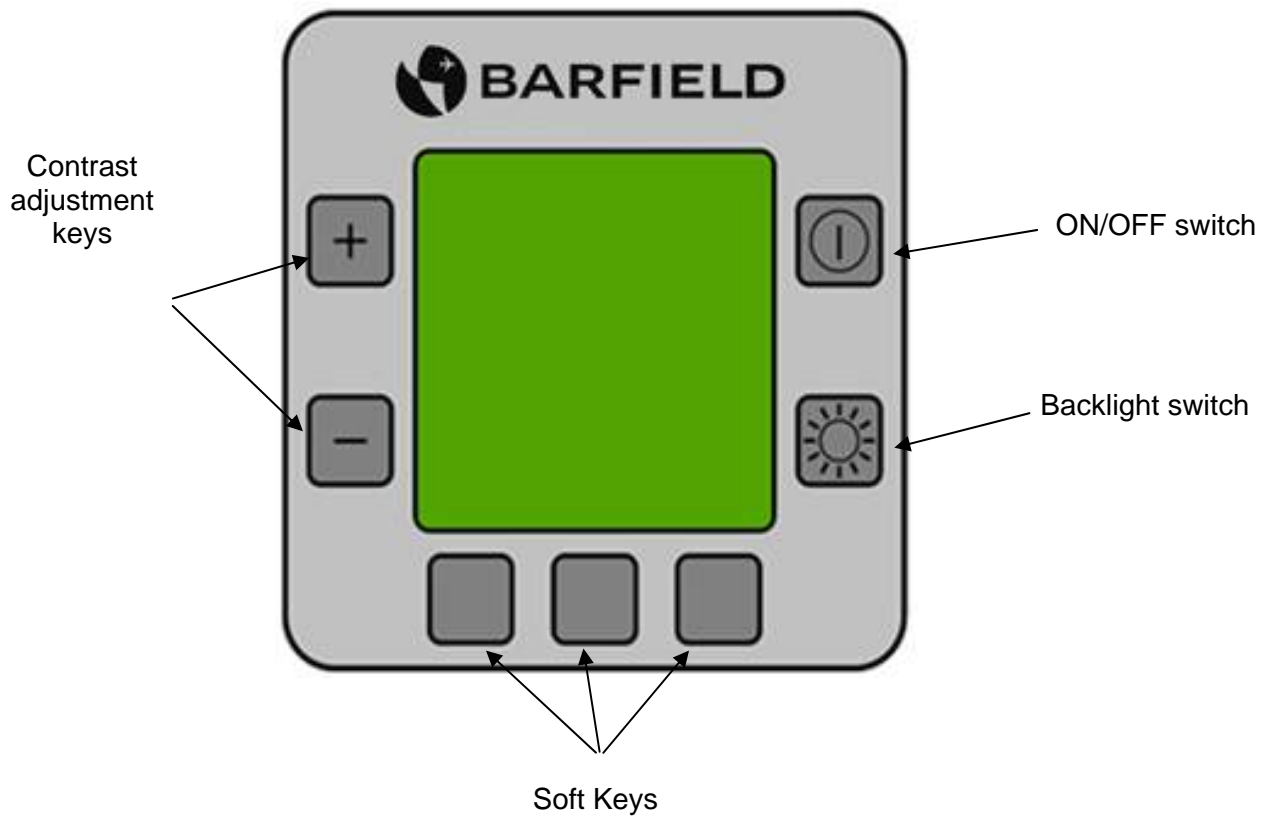


FIGURE 1 FUNCTION KEYS AND SOFT KEYS

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5. OPERATION

5.1 Powering On (Initialization)

At power on, the unit will display a message indicating if the power automatic off feature is disabled or enabled (if the auto-off is enabled, the instrument also shows the amount of time until the unit shuts off). (Note: The manufacturer's default setting is disabled.) The instrument then begins a series of initial value calculations for altitude and, if applicable, establishes the link between two instruments. Also, the date of last calibration is read. * If no errors are detected during power up, the instrument enters normal mode and the Aeronautical display appears.

NOTE: There is a delay of several seconds before start-up sequence appears and unit initializes. For two-instrument operations, turn on **DAS650** at the same time with **DALT55**. (A message appears showing the link is successful. If DAS650 is not on, the instrument displays a message that reminds the user to do so.)

* If the current date is within 30 days of the one-year anniversary of the last calibration date, a message tells the user when the next annual recalibration is due. However, if the current date is after the annual recalibration due date, the message tells the user "recalibration period exceeded".

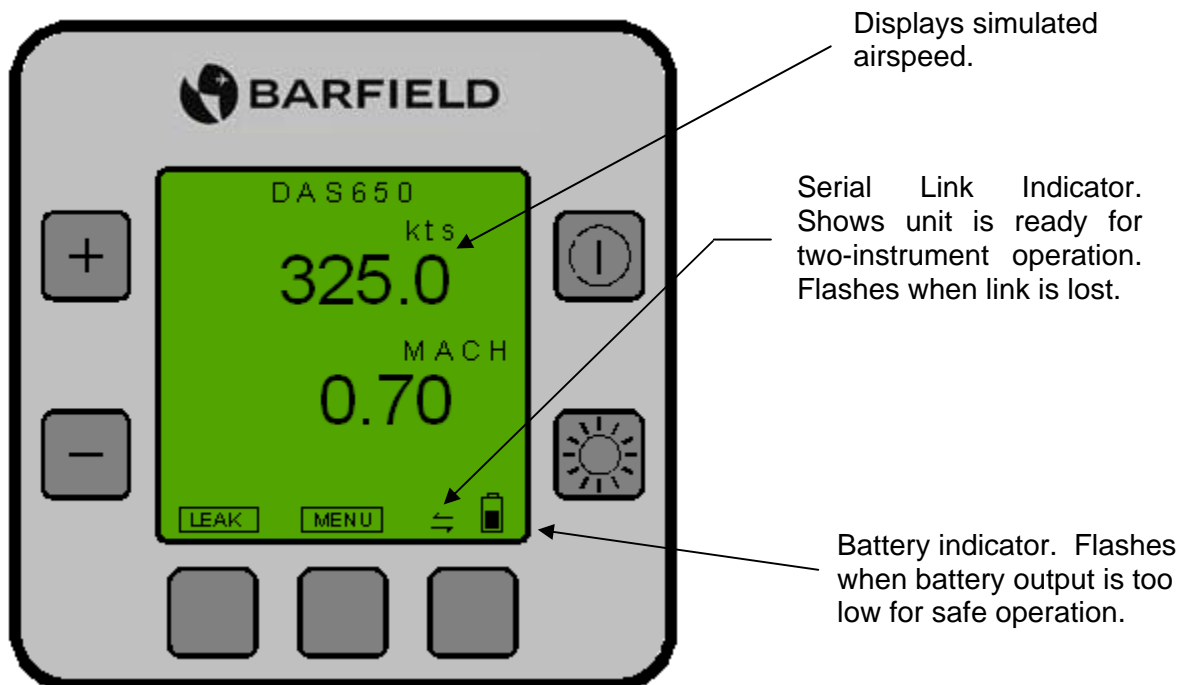


FIGURE 2 AERONAUTICAL DISPLAY

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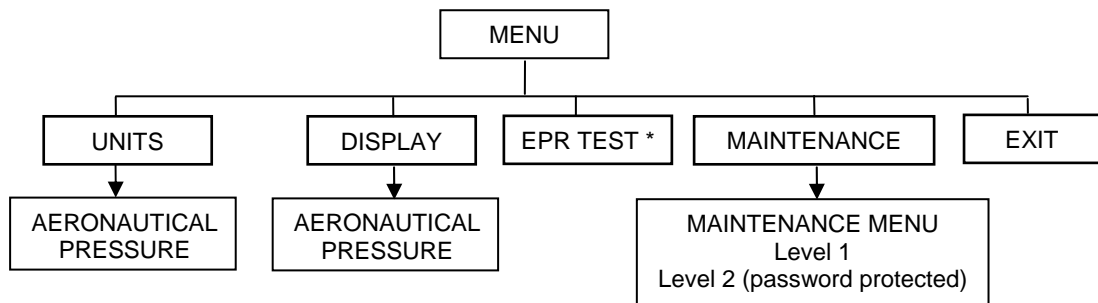
5.2 Start-up Procedure

- a. Press **ON/OFF** switch to turn on instrument.
- b. When initialization finishes, the Aeronautical display appears and shows the airspeed and MACH number if applicable.

5.3 Main Menu

Several menus allow user to access the various functions of the instrument. Primary functions of the tester are available by scrolling (using arrow keys) to the desired selection. Selecting EXIT returns the user to the previously displayed screen. (Refer to Chart 1, Main Menu)

- a. From the Aeronautical display, open the main menu by pressing **MENU** key (located at bottom of display). Press the **SEL** key to accept selection.



* accessible only in two-instrument configuration.

CHART 1 MAIN MENU

- b. Main menu options include: Units, Display, EPR Test, Maintenance, and Exit.

1) UNITS

The **DAS650** may be configured to display several units of measurement.

- After selecting AERONAUTICAL, press **CHANGE** (located bottom left corner on display). Use the arrow keys to select kts (knots), km/h, or mph as desired. Press **SAVE** to store.
- After selecting PRESSURE, press **CHANGE**. Use the arrow keys to select in-Hg diff, mbar diff, psid, in-Hg abs, mbar abs, Psia, in-Hg abs diff, mbar abs diff or Psi abs diff. Press **SAVE** to store.

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2) DISPLAY

The DISPLAY option in the main menu allows selection of two types of active display:

- **Aeronautical** display shows simulated airspeed. (If DAL55 is connected, the MACH number also displays.)
- **Pressure** display shows differential or pitot pressure. This option is controlled by type of operation and instrument configuration.

For example, in stand-alone configuration, only differential pressure (Pt – Ps) displays. In a two-instrument configuration, both pitot pressure (Pt) and differential pressure can be seen.

3) EPR TEST (Engine Pressure Ratio)

Note: EPR is only available if DAS650 and DAL55 are connected. Using the Maintenance menu in Level 1, both instruments must also be configured for the two-instrument configuration.

Selecting EPR allows user to view instrument’s calculated Pt (PT7), Ps (PT2) and EPR readings.

4) MAINTENANCE

Two submenus are available for maintenance functions such as calibration, configuring unit for two-instrument link and setting the automatic power off timer.

- **LEVEL 1** submenu contains tester general information (See Chart 2).

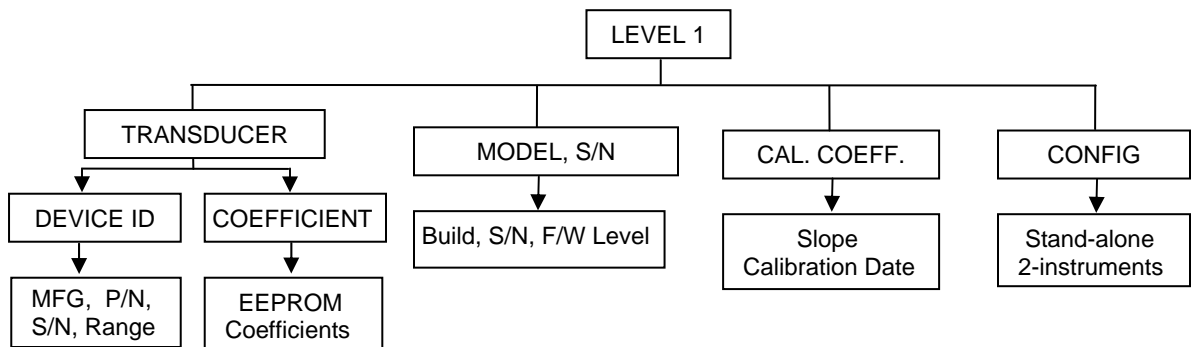


CHART 2 LEVEL 1 MAINTENANCE SUBMENU

(a) Transducer

- **Device ID:** displays the transducer’s manufacturer, P/N, S/N and range.
- **Coefficients:** displays the four (K00-K03) temperature compensation coefficients stored in the transducer’s EEPROM.

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(b) Model, S/N

Displays tester's range, firmware version, build, S/N.

(c) Cal Coeffs.

Displays linearization coefficients:

- Slope linearization
- Date last calibration was performed

(d) Config.

This option allows user to configure instrument, selecting:

- Stand-alone: **DAS650** is not communicating with **DALT55**.
- Two-instrument: **DAS650** is communicating with **DALT55**.

Note: In the two-instrument configuration, the serial link indicator shows at bottom of Aeronautical, Pressure, Leak Test and EPR Test displays. The indicator flashes when link is not functional.

Press **CHANGE**; then **SAVE** to change configuration.

- **Level 2** maintenance submenu is password-protected. User accesses calibration procedure, sets date / time and changes password and enables automatic power off.

NOTE: The initial default password is "111".

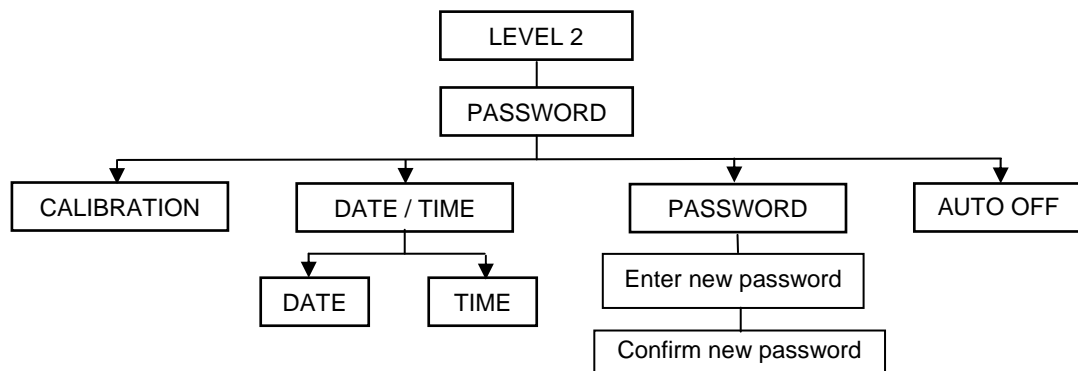


CHART 3 LEVEL 2 MAINTENANCE SUBMENU

(a) Calibration

User may perform calibration and change the units system for calibration by pressing the **UNITS** key. Continue pressing **UNITS** key to "scroll" through kts, km/h, mph, in-Hg, mb, psi screens. Press **ENTER** to store.

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(b) Date / Time

To set date or time, use the up / down arrow keys to increase / decrease selection.)

CHANGE (Set) DATE as MM / DD / YY

CHANGE (Set) TIME as hr / min.

(c) Password

To change the password:

- Enter new password (###).
- Re-enter new password to confirm.

NOTE: Once the user is in the password screen, the unit will not allow exiting from the screen until a password is entered and saved.

(d) Auto-Off

The feature *factory setting* is “disabled”. To change the setting, use the up / down arrows to select AUTO-OFF. Press **CHANGE** key. Press **MENU** to save.

When auto-off is enabled and there are 60 seconds left before the unit shuts off, the display shows a “countdown” screen. Pressing the keys below the arrows restarts the 30-minute timer and the countdown screen disappears.

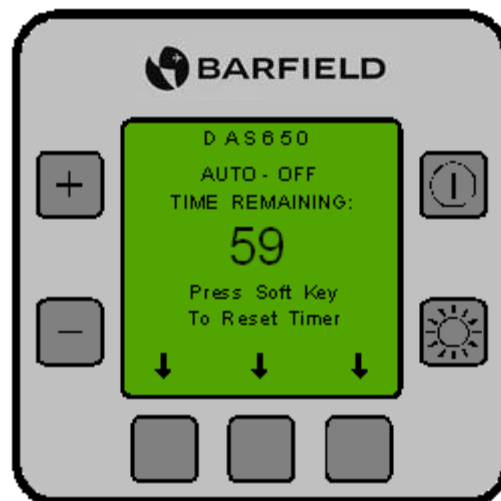


FIGURE 3 AUTO OFF COUNTDOWN DISPLAY

NOTE: Pressing any key at any time during the unit's operation will also reset the “clock” to another 30-minute time period.

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6. PITOT LEAK TEST

NOTE: Press **CANCEL** to exit leak test at any time during procedure and to return to Aeronautical display.

6.1 Pitot Pretest

NOTE: For more specific information regarding the control valves and ports refer to the Test Set Operations Manual.

The following leak test procedure is to verify the Leak Rate of the test set and hoses.

- a. Connect the pitot hose to the pitot port of the test set.
- b. Ensure the aircraft end of the hose is capped (sealed).
- c. Close the PITOT vent valve.
- d. Open the STATIC vent valve to ambient pressure.
- e. Close CROSSBLEED CONTROL valve.
- f. Close the pitot control and static control valves.
- g. If test set is equipped with an electric pump, turn PUMP **ON**. If test set does not contain an electric pump, use hand pumps on test set to supply reservoirs with 15 PSI of pressure.
- h. Slowly open PITOT CONTROL valve to get an approximate airspeed of 300 knots.
- i. When the desired altitude is reached, close PITOT CONTROL valve.
- j. To go to the Leak Test display, press the **LEAK** key on the Aeronautical display. The Leak Test display appears. To change the duration of the Leak Test, press the **ADJ** key and, using the keys below the arrows, increase (or decrease) the time from 1 to 30 minutes.

CAUTION: Do not press **START** until ready to do Leak Test. When the key is pressed, a display immediately appears with a 60-second countdown timer allowing time for stabilization of the static pressure. The actual leak test measurement begins when the timer completes the 60-second stabilization.

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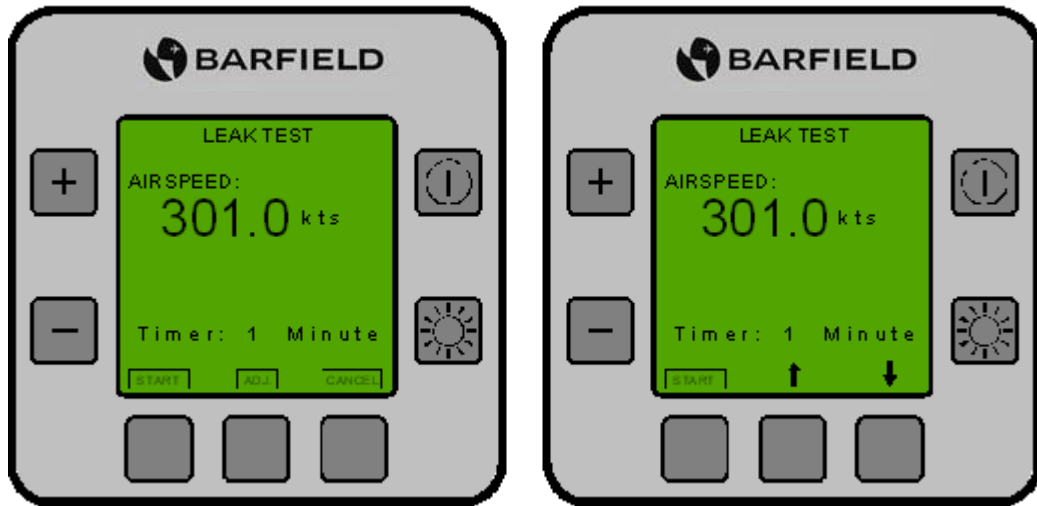


FIGURE 4 LEAK TEST DISPLAYS

- k. During the stabilization period, verify airspeed shown on display.
NOTE: A rapid decrease in airspeed (more than 5 kts/min) means presence of a leak. Stop Leak Test. (To stop test, press **CANCEL** and skip to step o.)
- l. After the 60-seconds stabilization time, the Pitot Leak Test screen shows the start of the actual leak test.
- m. Allow the LEAK Test time to reach approximately 2.00 min or more.

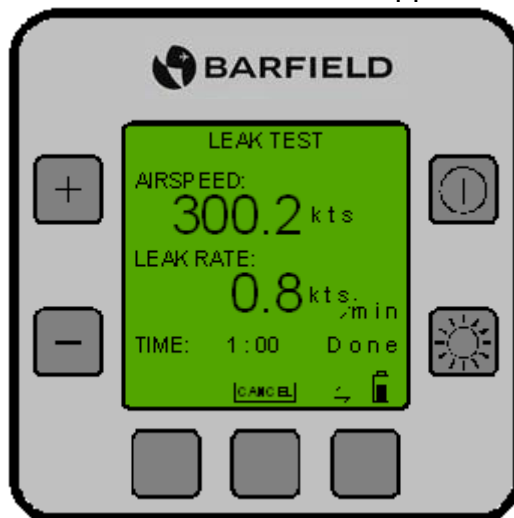


FIGURE 5 LEAK TEST COMPLETED DISPLAY

- n. Record the leak rate of the tester and hoses.

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NOTE: This recorded leak rate will be deducted from the measured aircraft leak rate. The test set must have a leak rate of **2 *kts/min*** or less.

- o. If the leak rate is more than 2 kts per minute, remove the hoses from the test set and repeat the Pitot Leak test.

NOTE: Repeating the procedure isolates the test set from the hoses. If the test set passes the procedure, the leak is located in the static hose or connector. To correct the problem, repair or replace the hoses or connectors. A repeated failure of the test set means the leak is contained within the test set and the test set should be sent to the manufacturer for repair.

- p. Slowly open the PITOT VENT valve to return to 0 kts.
- q. Remove the caps from the aircraft end of hose.

6.2 Pitot LEAK TEST

- a. Pitot System Connection

- 1) Using specified aircraft plumbing diagram, connect PITOT PORT to aircraft pitot system.

CAUTION: Ensure connections between test set and aircraft are secure. A sudden break or leak may cause severe instrument damage.

- b. Close PITOT vent valve.
- c. Open STATIC VENT valve.
- d. Close CROSSBLEED CONTROL valve.
- e. Note aircraft and test set airspeed measurements. Open PITOT CONTROL valve to desired airspeed test point (normally 300 knots).
- f. Close PITOT CONTROL valve fully when desired airspeed is reached.
- g. Perform PITOT Leak test following instructions described in section 6.1.
- h. EPR TEST

NOTE: This test must be performed with DALT55 Altitude / Vertical speed connected. Verify a two-instrument configuration is set in CONFIG option of Maintenance Level 1 submenu. (Refer to Maintenance Level-1 section of supplement.)

- 1) Connect PITOT PORT (red band) to PT7 (Hi) port of EPR transmitter to be tested.
- 2) Connect STATIC PORT (blue band) to the PT2 (Lo) port of EPR transmitter to be tested.
- 3) Select EPR TEST from the main menu. (Refer to main menu section.)

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- 4) Verify EPR Test display appears.
- 5) Set the Static (PT2) and Pitot (PT7) pressure combination to achieve desired EPR ratio.

NOTE: The EPR function of the **DAS650** allows display of the EPR ratio PT7 / PT2, also PT2 and PT7 pressures individually. Units of measure available for the PT2 and PT7 pressure display are: in-Hg, mbar and PSIA. To change the unit system, refer to Changing Units Displayed section.

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APPENDIX

INSTALLATION INSTRUCTIONS FOR:

Digital Instruments.....	Section 1
Rechargeable Battery Pack.....	Section 2
Alkaline Battery Pack.....	Section 3

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Section 1: DIGITAL INSTRUMENTS

(MOUNTING, ASSEMBLING, INSTALLATION)

1. Remove front panel from test set.
2. Remove the analog instrument (s) from panel.
3. Drill captive nuts on altimeter and airspeed mounting holes to remove threads with drill bit #28.

NOTE: Do not drill the captive nuts on the VSI instrument hole.

4. Mount Digital Instruments with 4 each, 4-40 self-locking nuts, provided.

NOTE: Digital Instruments are designed to fit into existing analog instrument holes. All plumbing connections can be performed at this time.

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Section 2: RECHARGEABLE BATTERY PACK

(MOUNTING, ASSEMBLING, INSTALLATION)

VSI (center) instrument hole installation:

NOTE: For Barfield Test Sets with 3 instruments, the battery pack base can be mounted in the VSI (center) instrument hole.

1. Mount battery pack base (Item 1, Figure 1) using the 4 (each), 6-32 x 7/8" L Phillips head screws provided (Item 4, Figure 1).

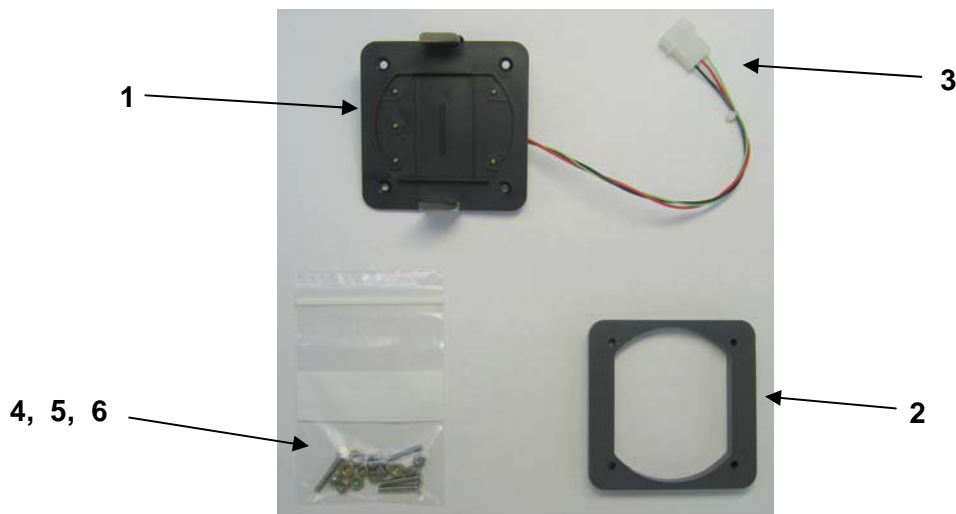


FIGURE 1

Flat panel installation:

NOTE: If mounting the battery pack base to a location other than an instrument hole, the spacer (Item 2, Figure 1) will be necessary. Using the spacer as a drill guide for the proper hole location, drill four (4) 5/32" diameter holes. Use the spacer as the reference for wires to feed through and drill a 3/16" diameter hole in the approximate center of the spacer.

CAUTION: Use care drilling. Damage may result to existing hardware and components behind the panel.

2. Feed battery pack base harness leads (Item 3, Figure 1). If required, disassemble the connector (Item 7, Figure 1) attached (as supplied) to feed wires through the 3/16" diameter center hole. Re-attach the connector. (Refer to Figure 2.)

CAUTION: Use care when locating the base. Battery pack must not interfere with top covers, miscellaneous items, storage compartments, etc.

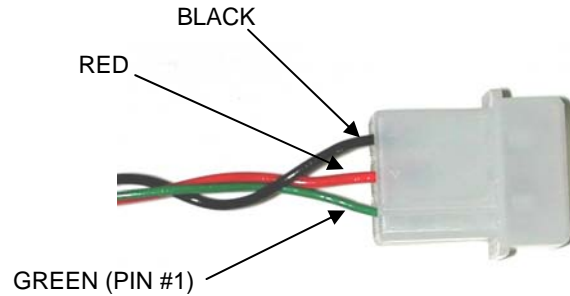


FIGURE 2

3. Connect the wire harness (Item 1, Figure 3) to digital instrument(s) and battery pack base harness. (Item 2, Figure 3).
4. Reattach panel to test set. Insert rechargeable battery pack (Item 3, Figure 3) and snap onto mounting base. Ensure Battery pack is inserted properly into base.

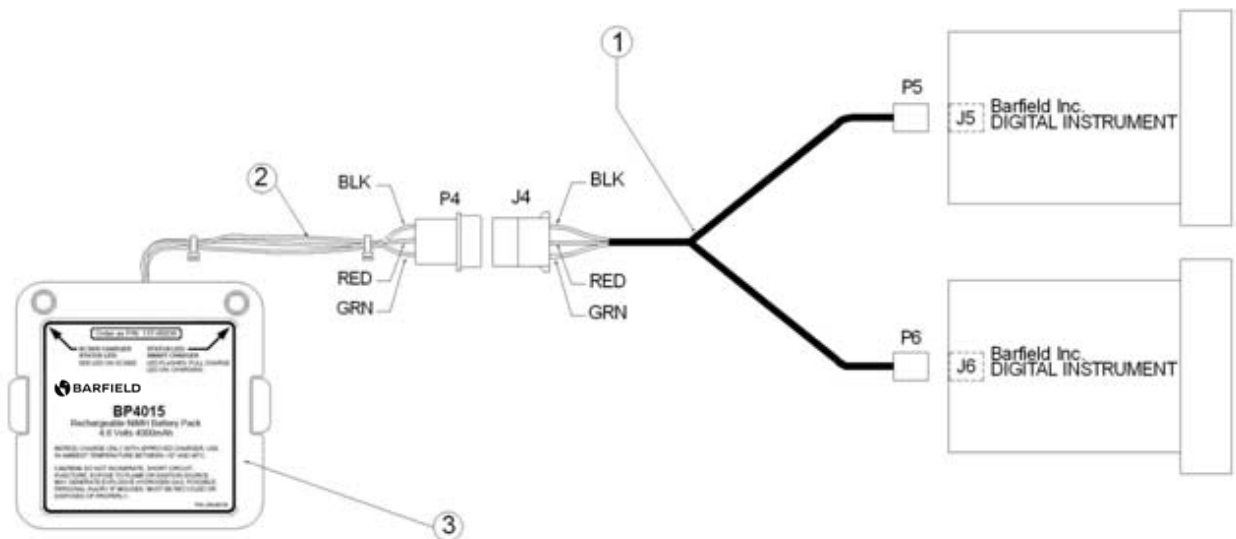


FIGURE 3

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Section 3: ALKALINE BATTERY PACK

(MOUNTING, ASSEMBLING, INSTALLATION)

1. Mount battery pack base (Item 1, Figure 4) on test set panel with the 4 (each), 6-32 x ½ L flat head screws and 4 (each) 6-32 self-locking nuts provided.

NOTE: For Barfield Test Sets, battery pack base mounts in the same location as the correction cards. Remove the clear polycarbonate cover and correction cards from the panel.

2. Using the attached drill template for proper hole location (refer to Figure 6), drill base mounting holes (C holes) and harness feed through A & B holes.

CAUTION: Use care when drilling. Damage may result to existing hardware and components behind the panel.

3. Feed battery pack base harness leads (Item 2, Figure 4), without the connector (Item 3, Figure 4) attached (as supplied) through center holes (A & B). Re-attach connector.

4. Connect wire harness (Item 4, Figure 5) to digital instrument(s) and battery pack base harness. (Refer to Figure 5.)

5. Re-attach panel to test set.

6. Insert alkaline batteries into battery pack (Item 5, Figure 5) and snap onto mounting base.

NOTE: Battery pack is keyed for proper insertion into base.

CAUTION: Use care when locating the mounting base. Battery pack must not interfere with top covers, miscellaneous items, storage compartments etc.

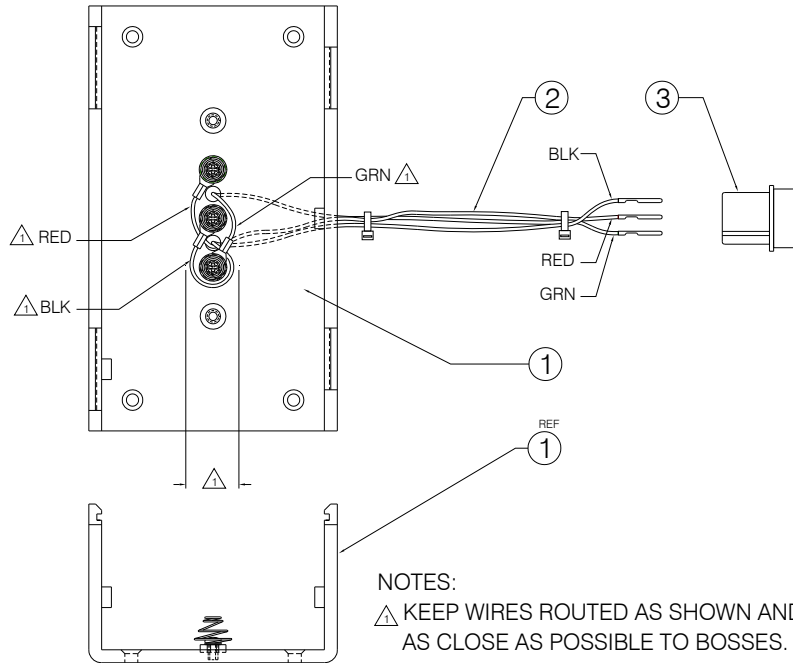


FIGURE 4

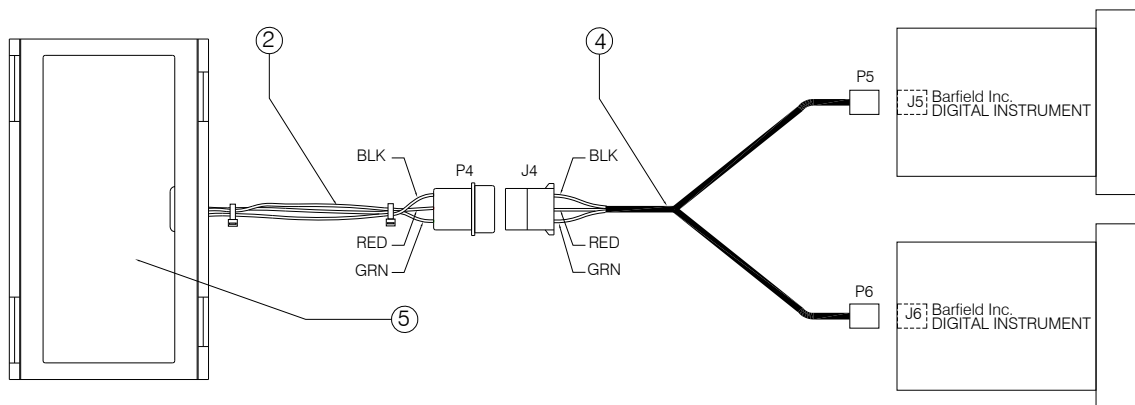


FIGURE 5

APPENDIX: INSTALLATION INSTRUCTIONS

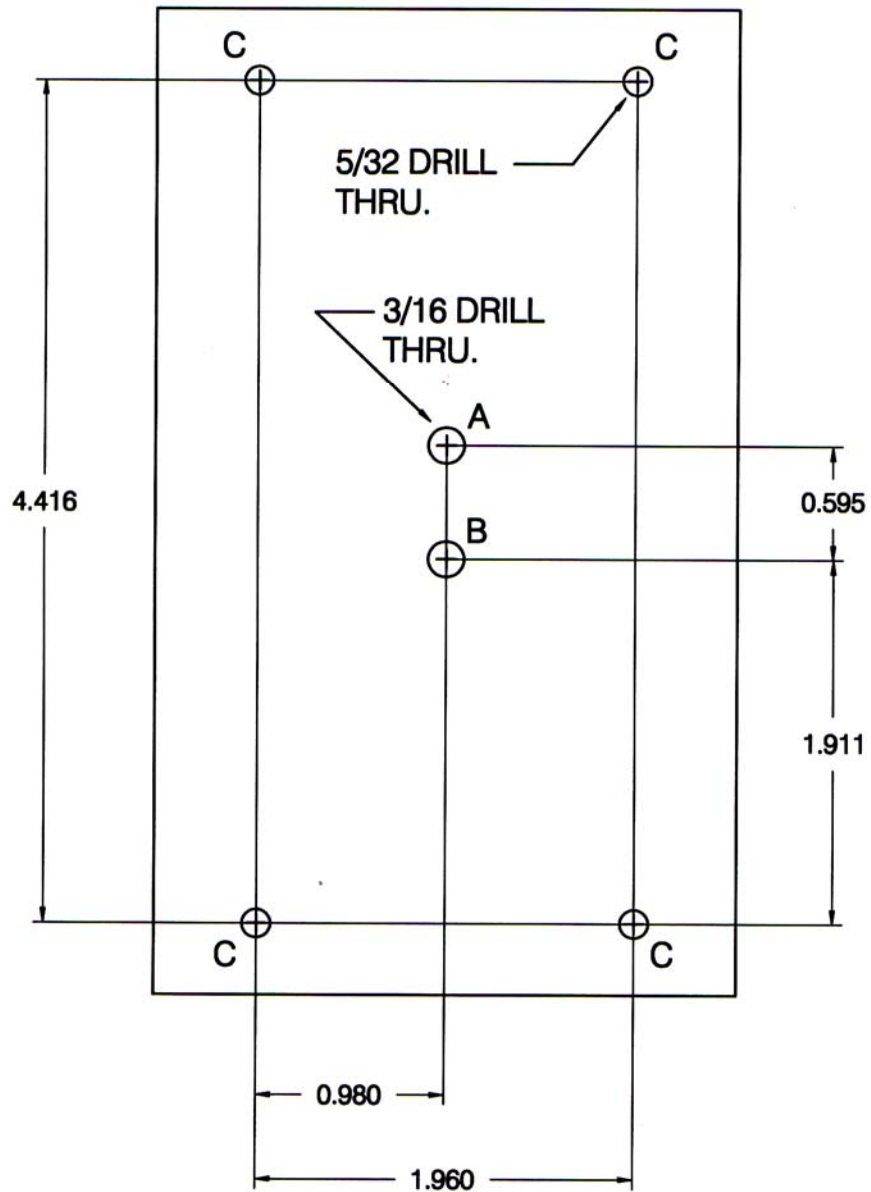


FIGURE 6