MCE-100

NON-TSO

MODE C ENCODER

USER'S MANUAL

Adaptive Interfaces, Inc.

2012

The MCE-100 is not certified by the FAA and is intended for use only in Homebuilt, Experimental or Ultralight aircraft. Any questions pertaining to the use of this instrument in a particular aircraft should be addressed to your local aviation authorities. It is the responsibility of the aircraft pilot to be thoroughly familiar with the operation of the MCE-100 and know its limitations. Correct installation of this instrument should be verified by a qualified avionics facility.

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INTRODUCTION

SCOPE

This manual provides specifications, operating instructions, installation instructions and calibration instructions for the MCE-100 Mode C Encoder. This manual is for use by persons who are familiar with aircraft, aircraft avionics, and general electronic principles.

DESCRIPTION

The MCE-100 Mode C Encoder is a solid state instrument that converts measured air pressure into altitude information that is presented to the user on a 5-Digit LED display and to an aircraft transponder as digitized data over 10 parallel signal lines. The MCE-100 is a standard 2-1/4 inch aircraft instrument and designed to be mounted in a standard 2-1/4 inch aircraft panel cut-out.

The MCE-100 measures static air pressure using a solid state, temperature compensated, piezoelectric pressure sensor. The output voltage of the pressure sensor is measured by a 16-bit analog-to-digital converter and a highly accurate voltage reference. Data from the analog-to-digital converter is processed by a microcomputer and displayed in 10 ft. increments as an altitude on a 5-digit LED display. Pressure Altitude data is also processed by the microcomputer and sent to digital outputs in the form of a Gillham or Gray Code for use by a transponder. Control of the MCE-100 is by a set of 4 buttons on the front panel of the instrument.

SPECIFICATIONS

Supply Voltage:	10 Vdc - 32 Vdc
Maximum Supply Current:	350 mA
Altitude Range:	-1200 ft. to 32000 ft.
Displayed Altitude Resolution:	+/- 10 ft.
Displayed Altitude Accuracy:	+/- 40 ft.
Mode C Digital Output Resolution:	+/- 100 ft.
Mode C Digital Output Accuracy:	+/- 125 ft.
Digital Output Pull-Up Voltage:	+50 Vdc Maximum
Digital Output Sink Current:	100 mA Maximum (Vce = 1.1 Vdc)
Dimensions:	H 2.40" x W 2.50" x D 2.70"
Weight:	5.5 Oz. (156 g.)
Mounting Screws:	4 ea. 6-32 x L 0.5" (Max.)
Air Fitting:	1/8 - 27 NPT Female
Upper Connector:	15-Pin DSUB Female 4-40
Lower Connector:	9-Pin DSUB Female 4-40

BUTTON FUNCTIONS

FUNC

This button is used to select and advance instrument functions for each menu level. Holding this button in for 5 seconds will cause the instrument to advance to the next menu level.

▲

▼

When the instrument is in the ALT or MC modes of the MAIN MENU, these buttons are used to adjust the brightness of the digital display when the DISPLAY BRIGHTNESS function is set to FP (Front Panel). Otherwise, these buttons perform no operations. In other functions of the MAIN MENU and MENU LEVEL 1, these buttons are used to increase or decrease values of the selected function.

AA

When the instrument is in the ALT or MC modes of the MAIN MENU, this button is used to activate and deactivate the instrument's ALTITUDE ALERT (AA) mode. When activated, ALTITUDE ALERT mode flashes the display when altitude varies more than +/- 200 ft. from the altitude at which ALTITUDE ALERT is engaged.

In all other cases, the button is used as an "Enter" button to select and retain the value or setting of the displayed function.

INDICATORS

ALT

The ALT indicator is lit when the instrument is displaying Mean Sea Level (MSL) altitude. This is an altitude based on air pressure and corrected to the local barometer.

MC

The MC indicator is lit when the instrument is displaying Mode C Altitude. This altitude is based on a standard barometer of 29.92 inHg, is displayed in 100 ft. increments, and represents the data being supplied to the transponder.

BAR

The BAR indicator is lit when the instrument is displaying the local barometer setting. This setting can be adjusted using the instrument's Up and Down buttons.

FLD

The FLD indicator is lit when the instrument is displaying the Field Altitude setting. This value is set when the aircraft is at a known altitude (usually the run-up pad) using the UP and Down buttons.

AA

The AA indicator is lit when the instrument's ALTITUDE ALERT mode is active.

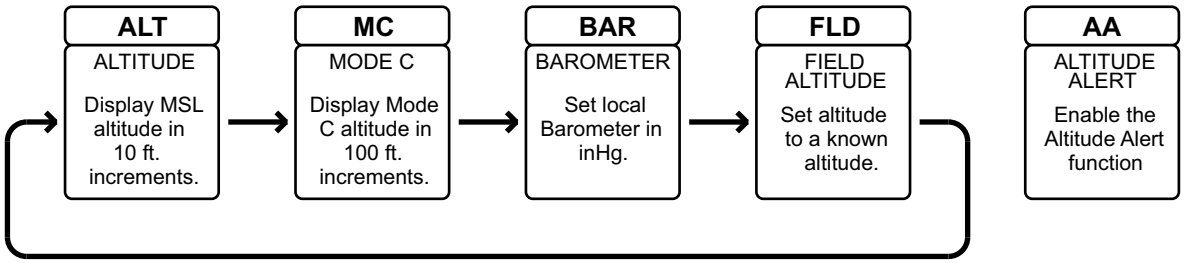
MENUS

The MCE-100 is controlled through a series of menus and functions.

The MAIN MENU (MENU LEVEL 0) allows the pilot to view MSL altitude in 10 ft. increments or the Mode C altitude in 100 ft. increments provided to the aircraft's transponder. Other functions of the MAIN MENU allow the pilot to adjust the displayed altitude by directly entering a barometer setting or by setting a known field altitude altitude before starting a flight. Also available on the MAIN MENU is the instrument's Altitude Alert (AA) function.

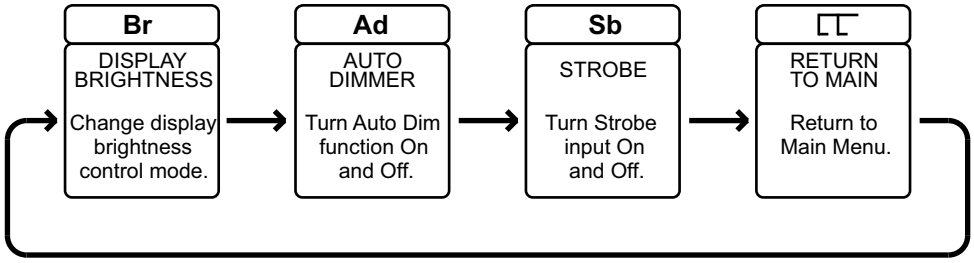
MENU LEVEL 1 is entered by pressing and holding the FUNC button for 5 seconds. When the MCE-100 is in MENU LEVEL 1, the user can change the instrument's optional settings. These settings include the digital display's BRIGHTNESS CONTROL mode, the AUTO DIM function and the use of the instrument's STOBE input signal. A RETURN function brings the instrument back to back to its normal operation mode, MAIN MENU.

MAIN MENU (MENU LEVEL 0)



Press and hold FUNC button 5 seconds to advance to MENU LEVEL 1

MENU LEVEL 1



FUNCTIONS

MAIN MENU (MENU LEVEL 0) FUNCTIONS

ALT (ALTITUDE)

DEFAULT FUNCTION

The ALT function is the normal mode of operation for the MCE-100. In this mode, the MSL (Mean Sea Level) altitude of the aircraft is displayed to the pilot. Altitude is displayed in 10 ft. increments.

As with mechanical altimeters, the MCE-100 uses air pressure to calculate altitude. Since air pressure is affected by weather conditions, a local barometer setting must be used as a correction factor to determine actual altitude from the measured pressure. This is done with the BAR function and entered as inches of mercury. A correct barometer setting is needed for an accurate altitude display.

MC (MODE C ALTITUDE)

FUNC

Press and release FUNC until the MC function is reached.

The MC (Mode C Altitude) function displays the Mode C altitude information that is being supplied to Air Traffic Control via the aircraft's transponder. Mode C altitude information is provided in 100 ft. increments and is based on a barometer setting of 29.92 inHg - standard pressure at sea level. Air Trafic Control calculates an aircraft's altitude from Mode C information provided by the aircraft's transponder and the air pressure reported for the area over which the aircraft is flying.

Unless local weather conditions consist of an air pressure of 29.92 inHg, the MC function will NOT display the aircraft's true altitude and should NOT be used as an altitude reference. The function is provided to inform the pilot of the altitude information supplied to the transponder via the digital data lines of the MCE-100.

After 30 seconds, the MCE-100 will revert from the MC function to the ALT function.

FUNCTIONS - CONT.

MAIN MENU (MENU LEVEL 0) FUNCTIONS - CONT.

BAR (BAROMETER)

FUNC	▲	AA
Press and release FUNC until MC is reached.	▼ Press UP/DOWN to change value.	Press AA button to set and store.

The BAR function allows the pilot to enter the local barometer setting using the Up and Down buttons. The local barometer pressure is based on the local weather conditions and is entered as inHg (Inches of Mercury). The barometer seting will increase or decrease in 0.01" increments every time the Up or Down button is pressed. If the Up or Down button is held, the barometer setting will increase or decrease in 0.01" increments every 0.5 second. If the Up or Down button is held for more than 10 increments, the barometer setting will start to change in 0.1" increments to speed up setting.

Once the desired barometer setting is reached, the AA button must be pressed to store (lock in) the new value. When the new value is stored, the instrument will confirm the setting by flashing all the decimal points of the display for 1 second. If the function is changed without pressing the AA button, the old barometer setting will be kept.

FLD (Field Altitude)

FUNC	▲	AA
Press and release FUNC until FLD is reached.	▼ Press UP/DOWN to change value.	Press AA button to set and store.

The FLD function allows the barometer to be set by entering a known altitude. This function can be used when the aircraft is on the ground and the exact altitude of the airfield is known, a function usually performed during run-up. Once the altitude is entered, the MCE-100 will calculate the new barometer setting.

The FLD setting will start at the current altitude reported by the ALT function and can be moved by the Up and Down buttons in 10 ft. increments. After moving 10 increments, the altitude will move by 100 ft. increments to speed the setting. To store the new setting, press the AA button.

It is strongly recommended that this function NOT be used in flight as it will probably result in an incorrect barometer setting.

FUNCTIONS - CONT.

MAIN MENU (MENU LEVEL 0) FUNCTIONS - CONT.

AA (ALTITUDE ALERT)

AA

Press once to engage, once to disengage.

The AA function assists the pilot in maintaining a constant cruising altitude while in flight. The AA function can be engaged while the MCE-100 is in the ALT or MC mode. When the AA function is engaged, the aircraft's current altitude is stored and the pilot is notified by a flashing display when the aircraft flys 200 ft. above or 200 ft. below the set altitude. The ALRM output of the lower electrical connector is also activated to drive an audio or lamp indicator when the display flashes.

To engage the AA function, press the AA button one time while flying at the desired altitude. To turn off the function, press the AA button one time again. To set a new altitude, disengage the function and engage it again at the desired altitude.

MENU LEVEL 1 FUNCTIONS

br (DISPLAY BRIGHTNESS CONTROL)

FUNC	▲ ▼	AA	FUNC	AA
Press and Hold FUNC button for 5 seconds until br function appears on the display, then release.	Use Up and Down buttons to select the brightness control mode.	Press AA button to set and store the mode.	Press and release FUNC button until the Return To Main ⊏⊐ symbol appears on the display.	Press the AA button to return to the MAIN MENU.

The brightness of the digital display and the indicator LEDs can be set to 16 different levels and be controlled in 3 different modes. These modes are as follows:

E (EXTERNAL CONTROL VOLTAGE)

An external control voltage ranging from 0V to the supply voltage is applied to pin 3 of the Lower Electrical Connector. This voltage is sampled by the MCE-100 and its ratio to the Supply Voltage is calculated into 16 levels. This allows a single potentiometer to be connected between ground and the instrument power input and used as a brightness control, its center tap used as the pin 3 input. See the ELECTRICAL CONNECTIONS section of this manual for details of the control circuit.

FP (FRONT PANEL)

When the MCE-100 is operating in the ALT or MC mode, the UP and DOWN buttons are used to set the display brightness. Also see the AUTO DIMMER function.

PH (PHOTOCELL)

The display brightness is controlled automatically by the amount of ambient light seen by the photocell on the front of the instrument.

MENU LEVEL 1 FUNCTIONS - CONT.

Ad (AUTO DIMMER FUNCTION)

FUNC	FUNC	▲ ▼	AA	FUNC	AA
Press and Hold FUNC button for 5 seconds until br function appears on the display, then release.	Press and release FUNC button until the Ad function appears on the display.	Use Up and Down buttons to turn the Ad function ON and OFF.	Press AA button to set and store the selection.	Press and release FUNC button until the Return To Main ⊏⊏ symbol appears on the display.	Press the AA button to return to the MAIN MENU.

When the display brightness mode of the MCE-100 is set to FP (Front Panel) control, the photocell on the front panel can be used to automatically change the brightness of the digital display when lighting conditions change. When flying from low light (ie. clouds, dawn) to bright sunlight, the AUTO DIMMER function will raise the brightness of the digital display to a set level without the need to press the UP/DOWN buttons. When flying from bright light to low light (ie. dusk), the AUTO DIMMER function will lower the brightness of digital display to a set level. After the display brightness is changed with the AUTO DIMMER function, the display brightness can still be adjusted manually with the UP and DOWN buttons.

The 2 AUTO DIMMER modes are as follows:

Ad OFF — The display brightness will stay at the level selected by the UP/DOWN buttons and will not change as lighting conditions change.

Ad On — The display brightness will raise or lower to set levels when lighting conditions change.

MENU LEVEL 1 FUNCTIONS - CONT.

Sb (STROBE INPUT FUNCTION)

FUNC	FUNC	▲ ▼	AA	FUNC	AA
Press and Hold FUNC button for 5 seconds until br function appears on the display, then release.	Press and release FUNC button until the Sb function appears on the display.	Use Up and Down buttons to turn the Sb function ON and OFF.	Press AA button to set and store the selection.	Press and release FUNC button until the Return To Main ⊏⊏ symbol appears on the display.	Press the AA button to return to the MAIN MENU.

Most altitude encoders incorporate a STROBE INPUT to enable digital outputs that are sent to a transponder. This function is used by some transponders but many other transponders do not use this function. In this case, most altitude encoders require that the STROBE INPUT be enabled by tying it to a low voltage or, more often, directly to ground. The Sb (STROBE INPUT) function of the MCE-100 tells the MCE-100 whether an enable signal (low or ground input on Pin-6 of the Upper Connector) is needed to enable the instrument's digital outputs. The Sb (STROBE INPUT) mode of the MCE-100 should be turned ON for use with transponders that require the use of a strobe signal. When the Sb (STROBE INPUT) mode of the MCE-100 is turned OFF, no enable signal is required.

The 2 STROBE INPUT modes are as follows:

Sb OFF — The digital outputs of the MCE-100 are always active. No enable input (tie to ground) is needed on the STB (STROBE) pin (Pin-6).

Sb On — The digital outputs of the MCE-100 are only active when an enable input (low or ground) is applied to the STB (STROBE) pin (Pin-6).

SPECIAL FUNCTION

Lo E (Low Voltage Warning)

The MCE-100 is designed to operate from a supply voltage of 10V to 30V. Most aircraft operate on a 12V electrical system (voltage is typically around 14V). When the supply voltage to the MCE-100 drops to 11V or lower, the instruments digital display will flash "Lo E" for 1 second every 8 seconds. This function is designed to give a pilot warning that there may be a problem with the aircraft's electrical system. The "Lo E" function is hardwired into the design of the instrument an can not be disabled.

AIR CONNECTION

To correctly measure altitude, the MCE-100 must be connected to the aircraft's static air pressure system. Normaly, the MCE-100 is connected between the aircraft's static port and the existing altimeter using a "T" fitting along the aircraft's static line. Care should be taken to ensure that moisture and condensation does not enter the MCE-100 by placing the MCE-100 above the aircraft's static port and having an adequate drain and/or moisture trap for the static line.

The MCE-100 has a standard 1/8 - 27 NPT Female air fitting within a 9/16" brass hex fitting. To prevent damage to the instrument case, two wrenches should always be used when tightening any adapter to the air fitting.

INSTRUMENT PLACEMENT

Although the MCE-100 uses a temperature compensated pressure sensor, care should be taken to place the instrument away from any hot or cold source, such as a heater or air vent. The MCE-100 will provide the most accurate information when operated in a temperature stabilized environment.

ELECTRICAL CONNECTIONS

POWER INPUT

The MCE-100 is designed to operate from a supply voltage of 10V to 32V with a maximum current draw of 350 mA. Power can be supplied to the instrument using 3 different inputs (Upper Connector Pins 8 and 14 and Lower Connector Pin 9). These 3 inputs are tied together internally through diodes to prevent reverse power being applied to the instrument and to allow all 3 inputs to be connected to different power sources. The MCE-100 will take power from the source with the highest voltage. It is recommended that the MCE-100 be powered from the avionics buss. If the A+ switched output from a transponder is used, be sure the transponder can supply 350 mA with no voltage drop.

The MCE-100 uses an internal switching voltage regulator so no extrenal components are needed when changing from a 12V to a 28V electrical system.

GROUNDS

The case of the MCE-100 is connected to the electrical ground of the instrument. Electrical ground connections are provided to the MCE-100 on pin 15 of the Upper Connector and pins 5, 6 and 7 of the Lower Connector. These pins are all connected internally on the MCE-100.

DIGITAL OUTPUTS

The digital outputs of the MCE-100 comply with the National Standard for Common System Component Characteristics for the I.F.F. Mark X (SIF) / Air Traffic Control Radar Beacon System (SIF/ATCRBS) and the International Civil Aviation Organization (ICAO) Standard Code for SSR Pressure Altitude Transmission.

The digital outputs of the MCE-100 consist of 10 open collector lines that are pulled low when active. The lines use open collector drivers that can be pulled high, with resistors, to voltages equal to or less than 50V. To function properly with a transponder, the transponder must have pull-up resistors on it's inputs.

Altitude information is presented in 100 ft. increments on the 10 lines using a Gillham Code (also called a Gray Code). This is also the code specified by the ICAO. The digital output lines are designated as: D4, A1, A2, A4, B1, B2, B4, C1, C2 and C4.

GILLHAM CODE EXAMPLE (1's are output as digital lows on the lines)

ALTITUDE	D4	A1	A2	A4	B1	B2	B4	C1	C2	C4
900	0	0	0	0	1	1	0	0	1	1
1000	0	0	0	0	1	1	0	0	1	0
1100	0	0	0	0	1	1	0	1	1	0
1200	0	0	0	0	1	1	0	1	0	0
1300	0	0	0	0	1	1	1	1	0	0

ELECTRICAL CONNECTIONS - CONT.

DIGITAL OUTPUTS - CONT.

The digital outputs of the MCE-100 are driven by a ULN2003A open collector driver chip. To function, each digital output must be pulled high with a resistive load that is provided by the transponder or pulled high externally. The resistive load can be pulled high to a voltage of 3 Vdc to 50 Vdc. The ouput voltage of each driver will increase with the amount of current that is sunk by the driver (I = 100mA : Vce = 1.1 Vdc, I = 200 mA : Vce = 1.3 Vdc). This may affect the ability of the transponder to see a logical low level so care should be taken to limit sink current to 100 mA or less. All digital outputs of the MCE-100 have 100 pF coupling capacitors placed between the outputs and ground.

All digital outputs are on the 15-pin Upper Connector and are in the same pin locations as most other manufactrurers' altitude encoders. Pin numbers for the digital outputs are as follows: D4 Pin-1, A1 Pin-2, A2 Pin-3, A4 Pin-4, B1 Pin-5, B2 Pin-9, B4 Pin-10, C1 Pin-11, C2 Pin 13, C4 Pin-12.

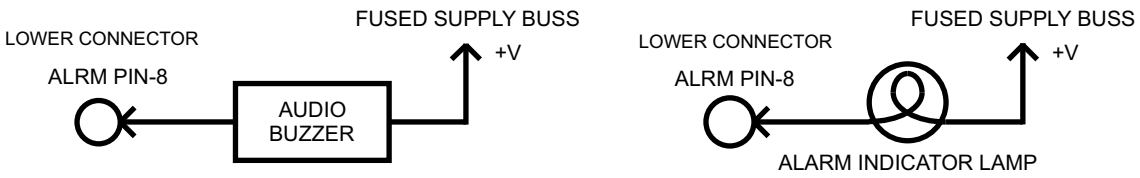
STROBE INPUT

The Strobe Input (Pin-6 of the Upper Connector) is used by some transponders to control the digital outputs of altitude encoders. When this function is used, the transponder will drive the input to a logical low (<= 1.2 Vdc) to enable the encoder output lines. Most transponders do not use this function and require that the encoder output lines are active at all times. This can be accomplished in two ways with the MCE-100. The Strobe (Sb) function can be turned off with the front panel controls or Pin-6 of the Upper Connector can be tied to ground.

The Strobe Input is pulled high internally to +5 Vdc by a 100k ohm resistor and protected by 2 Schottky diodes and a 1000 ohm series resistor. The input is also decoupled by a 100 pF capacitor placed between the input and ground.

ALARM OUTPUT

The Alarm Output is on Pin-8 of the Lower Connector. This output is used with the AA (Altitude Alert) function to drive a warning lamp or audio alarm. The output uses an open collector transistor that can sink up to 300 mA. The pull-up voltage of the load can be 40 Vdc or less. The output is decoupled by a 100 pF capacitor to ground.



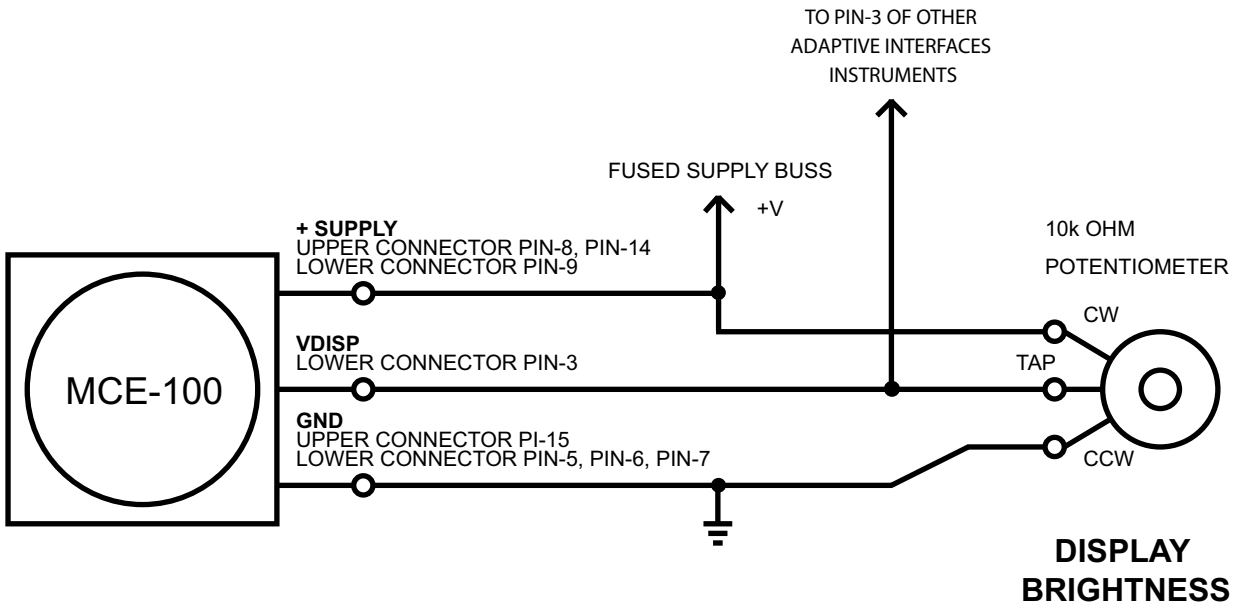
ELECTRICAL CONNECTIONS - CONT.

DISPLAY BRIGHTNESS CONTROL INPUT (VDISP)

The brightness of the digital display and indicator LEDs can be contolled by an external voltage applied to Pin-3 of the Lower Connector when the brightness control mode is set to "E" (See MENU LEVEL 1 FUNCTIONS). In this mode, the display brightness is set by the ratio of the voltage at VDISP to the Supply Voltage. This way, a single potentiometer can be placed between ground and the supply voltage with its center tap wired to the VDISP input. Changes or fluctuations of the supply voltage (as can happen when lights and avionics are switched on and off) will not affect the brightness of the display. The display brightness can be set to 16 different levels. The display brightness is limited to 16 levels by the instrument's display driver chip.

To use this function, a linear potentiometer, valued between 10k ohms and 20k ohms, is placed between the instrument supply and ground. The center tap of the potentiometer is wired directly to Pin-3 of the Lower Connector. The input resistance of this input is 200k ohms and the input is protected by Schottky diodes. A single potentiometer can be used to control several Adaptive Interfaces instruments. It is suggested that this input not be connected to existing dimmer controls on the panel as the display brightness is usually the opposite of that desired for nighttime instrument lighting (bright in sunlight - dim at night).

WIRING EXAMPLE



ELECTRICAL CONNECTIONS - CONT.

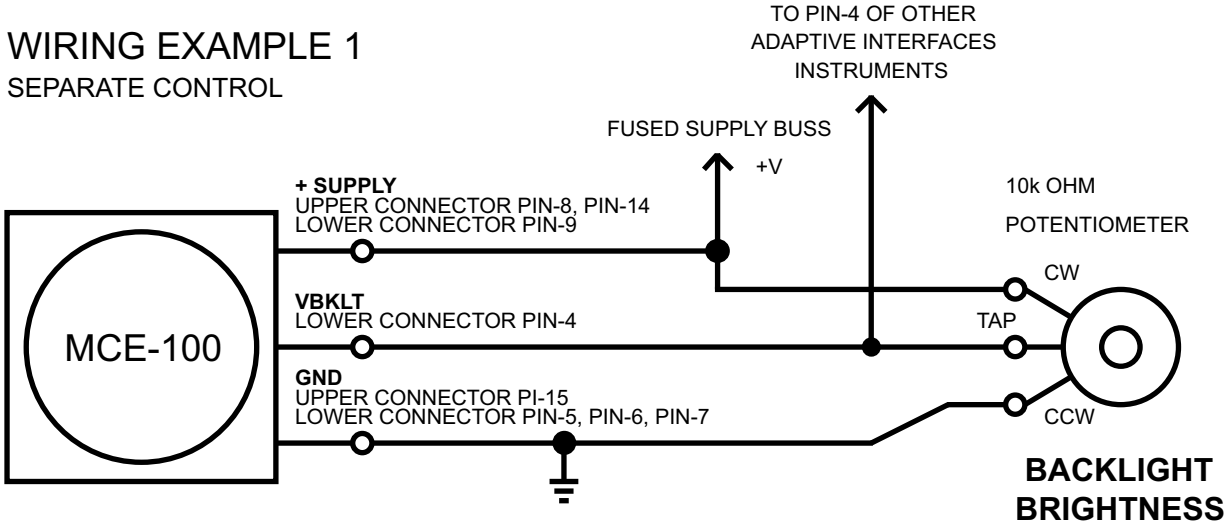
BACKLIGHT BRIGHTNESS CONTROL INPUT (VBKLT)

The MCE-100 has an integrated, white LED backlight for its front panel graphics. The only way to control the brightness of the backlight is to apply a control voltage to Pin-4 of the Lower Connector (VBKLT). The backlight brightness can be set to 256 levels by the ratio of the voltage at VBKLT to the Supply Voltage. This way, a single potentiometer can be placed between ground and the supply voltage with its center tap wired to the VBKLT input. Changes or fluctuations of the supply voltage (as can happen when lights and avionics are switched on and off) will not affect the brightness of the backlight.

To use this function, a linear potentiometer, valued between 10k ohms and 20k ohms, is placed between the instrument supply and ground. The center tap of the potentiometer is wired directly to Pin-4 of the Lower Connector. The input resistance of this input is 200k ohms and the input is protected by Schottky diodes. A single potentiometer can be used to control several Adaptive Interfaces instruments. The VBKLT input can also be wired into the existing panel lighting circuit.

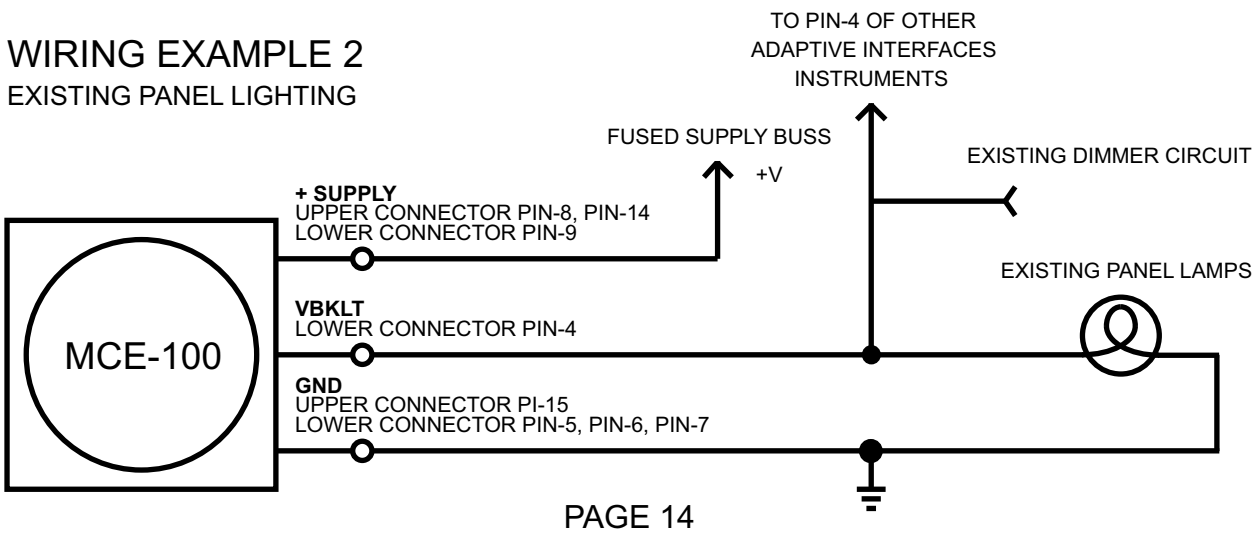
WIRING EXAMPLE 1

SEPARATE CONTROL



WIRING EXAMPLE 2

EXISTING PANEL LIGHTING



CALIBRATION AND VERIFICATION

The pressure sensor of the MCE-100 is calibrated at 10 precise pressures found within the altitude range of -1200 ft. to 32700 ft. using N.I.S.T. traceable standards. These 10 calibration values are set at the factory and can not be changed. A second calibration stage, consisting of 2 set points, is available to a qualified avionics facility. By setting data points at Pressure Altitudes of 0 ft. and 30k ft., a correction table is created within the instrument to maintain pressure accuracy over time.

For redundancy and safety (in case of the loss of the aircraft electrical system), the MCE-100 should used as an encoder along with a primary, mechanical altimeter. If used as an encoder, the MCE-100 should be calibrated against the primary altimeter and its output must correspond to the primary altimeter within +/- 125 ft. (per FAA requirements).

If, however, the MCE-100 is to be used as a primary altimeter, it should be calibrated with a N.I.S.T. traceable pitot/static test set or N.I.S.T. traceable pressure standards.

CALIBRATION SET POINTS

In the case of the MCE-100 being used as an encoder and secondary altimeter and in the case of the MCE-100 being used as a primary altimeter, calibration is perfomed by setting data points at Pressure Altitudes of 0 ft. and 30,000 ft. To set these data points, the MCE-100 must be placed into a higher menu level (MENU LEVEL 2).

SET POINT FOR 0 FT.

MENU LEVEL 1

FUNC

Press and Hold FUNC button for 5 seconds until br function appears on the display, then release.

AA

Press AA button to set the 0 ft. calibration point.

MENU LEVEL 2

FUNC

Press and Hold FUNC button for 5 seconds until CAL 0 function appears on the display, then release.

FUNC

Press and release FUNC button until the Return Level 1 ⌐ or ⌐⌐ Return To Main symbol appears.

Apply 0 Ft. pressure to the MCE-100

AA

Press the AA button to return to MENU LEVEL 1 or the MAIN MENU.

CALIBRATION AND VERIFICATION - CONT.

SET POINT FOR 30k FT.

MENU LEVEL 1

FUNC

Press and Hold FUNC button for 5 seconds until br function appears on the display, then release.

MENU LEVEL 2

FUNC

Press and Hold FUNC button for 5 seconds until CAL 0 function appears on the display, then release.

FUNC

Press and release FUNC button until the CAL 30 function appears on the display.

Apply 30k Ft. pressure to the MCE-100

AA

Press AA button to set the 30k ft. calibration point.

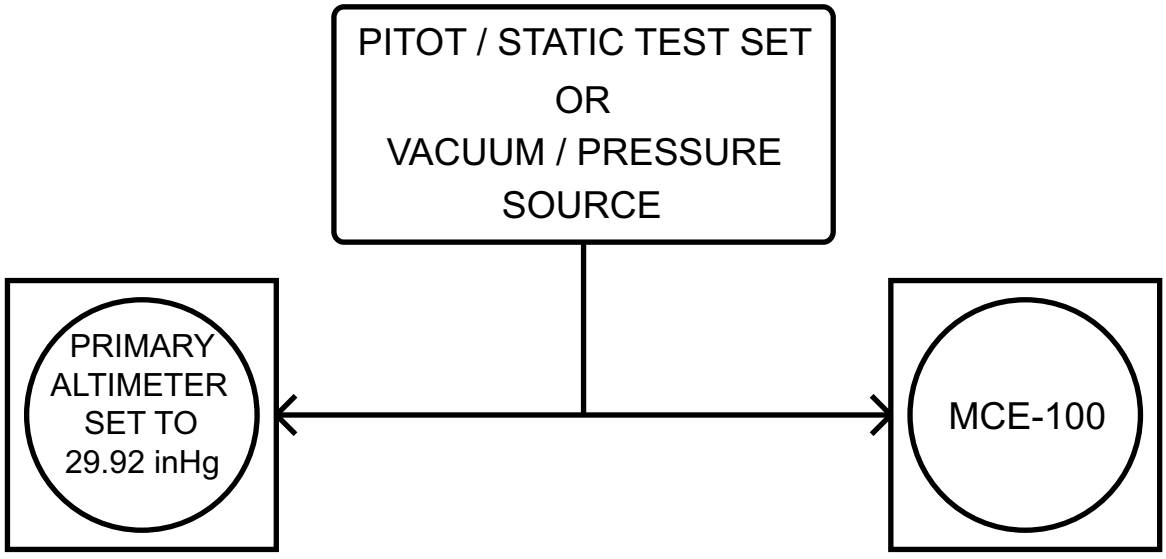
FUNC

Press and release FUNC button until the Return Level 1 ⌐ or ⌐⌐ Return To Main symbol appears.

AA

Press the AA button to return to MENU LEVEL 1 or the MAIN MENU.

AS AN ENCODER - CALIBRATION TO A PRIMARY ALTIMETER



TEST SETUP 1

CALIBRATION AND VERIFICATION - CONT.

AS AN ENCODER - CALIBRATION TO A PRIMARY ALTIMETER

1) Connect the MCE-100, Primary Altimeter, and Pitot/Static Test Set or Vacuum/Pressure Source as shown in Test Setup 1.

2) Be sure the Primary Altimeter's barometer setting is 29.92 inHg.

3) Apply power to the MCE-100 and Test Set/Source and allow at least a 10 minute warmup time.

4) Apply a pressure to the system that corresponds to an altitude of 0 ft. (101.33 kPa) and adjust the pressure so that the Primary Altimeter reads exactly 0 ft.

5) Perform the 0 ft. Set Point procedure on the MCE-100.

6) Apply a pressure to the system that corresponds to an altitude of 30,000 ft. (30.07 kPa) and adjust the pressure so that the Primary Altimeter reads exactly 30,000 ft.

7) Perform the 30k ft. Set Point procedure on the MCE-100.

NOTE - Always perform both the 0 ft. and 30k ft. set point procedures.

This procedure can take place within the aircraft or on a test bench.
If done on a test bench, the MCE-100 supply voltage should be +14 Vdc.

AS AN ENCODER -
VERIFICATION AND CORRESPONDENCE TO PRIMARY ALTIMETER

The FAA requires that an altitude encoder correspond to a Primary Altimeter within +/- 125 ft. (Advisary Circular 43-6B). This correspondence can be verified at various altitudes by sweeping a test pressure up and down about altitude transition points of the encoder and recording the altitude of the Primary Altimeter. Because the altitude encoder reports in 100 ft. increments, transition points are at +/- 50 ft. to any given altitude (Example: At 1200 ft., the transition points are 1150 ft. and 1250 ft.).

1) Connect the MCE-100, Primary Altimeter, and Pitot/Static Test Set or Vacuum/Pressure Source as shown in Test Setup 1. Be sure the test set is capable of sweeping pressure up and down about a point.

CALIBRATION AND VERIFICATION - CONT.

AS AN ENCODER (CONT.) -
VERIFICATION AND CORRESPONDENCE TO PRIMARY ALTIMETER

2) Be sure the Primary Altimeter's barometer setting is 29.92 inHg.

3) Apply power to the MCE-100 and Test Set/Source and allow at least a 10 minute warmup time.

4) Place the MCE-100 in "MC" mode. As the MCE-100 will only stay in the "MC" mode for 30 seconds without a button press, enabling and disabling the "AA" function will help the MCE-100 stay in the "MC" mode during the test and will not affect the test results.

5) Slowly sweep the pressure down so that the Primary Altimeter goes from -100 ft. to +100 ft.. Record the altitude reported by the Primary Altimeter at the points where the MCE-100 transitions from -100 ft. to 0 ft. and from 0 ft. to +100 ft..

6) The Primary Altimeter should be at -50 ft. +/- 125 ft. when the MCE-100 transitions from -100 ft. to 0 ft. and at +50 ft. +/- 125 ft. when the MCE-100 transitions from 0 ft. to +100 ft.. If not, the MCE-100 will need to be recalibrated.

7) Slowly sweep the pressure up so that the Primary Altimeter goes from +100 ft. to -100 ft.. Record the altitude reported by the Primary Altimeter at the points where the MCE-100 transitions from +100 ft. to 0 ft. and from 0 ft. to -100 ft..

8) The Primary Altimeter should be at +50 ft. +/- 125 ft. when the MCE-100 transitions from +100 ft. to 0 ft. and at -50 ft. +/- 125 ft. when the MCE-100 transitions from 0 ft. to -100 ft.. If not, the MCE-100 will need to be recalibrated.

9) Slowly sweep the pressure down so that the Primary Altimeter goes from 29900 ft. to 30100 ft.. Record the altitude reported by the Primary Altimeter at the points where the MCE-100 transitions from 29900 ft. to 30000 ft. and from 30000 ft. to 31000 ft..

CALIBRATION AND VERIFICATION - CONT.

AS AN ENCODER (CONT.) -
VERIFICATION AND CORRESPONDENCE TO PRIMARY ALTIMETER

10) The Primary Altimeter should be at 29950 ft. +/- 125 ft. when the MCE-100 transitions from 29000 ft. to 30000 ft. and at 30050 ft. +/- 125 ft. when the MCE-100 transitions from 30000 ft. to 31100 ft.. If not, the MCE-100 will need to be recalibrated.

11) Slowly sweep the pressure up so that the Primary Altimeter goes from 30100 ft. to 29500 ft.. Record the altitude reported by the Primary Altimeter at the points where the MCE-100 transitions from 30100 ft. to 30000 ft. and 30000 ft. to 29500 ft..

12) The Primary Altimeter should be at 30050 ft. +/- 125 ft. when the MCE-100 transitions from 31000 ft. to 30000 ft. and at 29950 ft. +/- 125 ft. when the MCE-100 transitions from 30000 ft. to 29900 ft.. If not, the MCE-100 will need to be recalibrated.

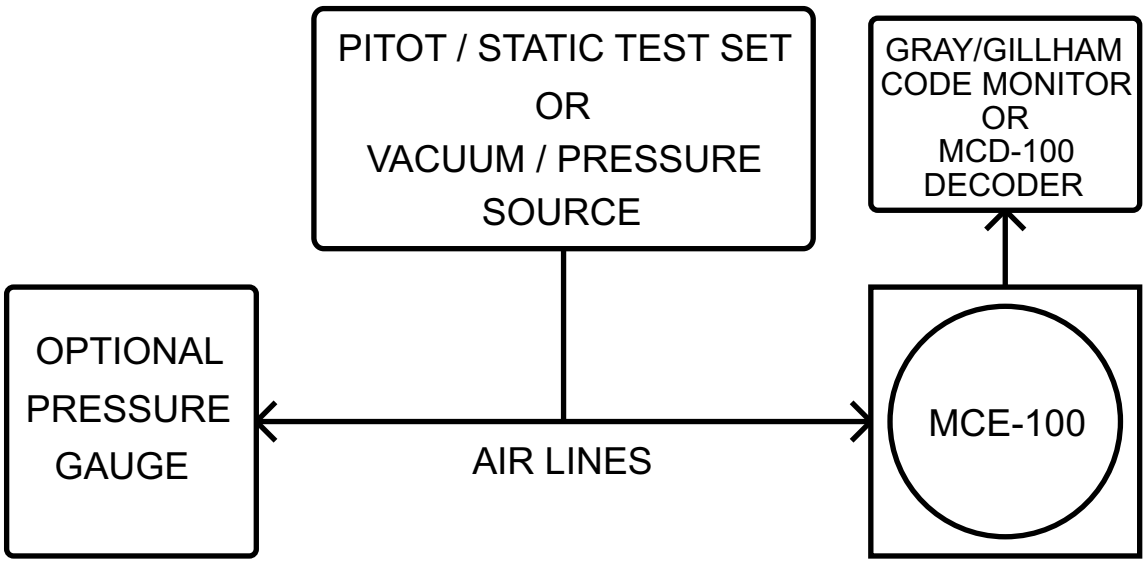
13) Repeat steps 9 to 12 at various altitudes between -1100 ft. and 32000 ft.. The selection of these altitudes is at the discretion of the avionics technician. If the MCE-100 is shown to be out of the +/- 125 ft. tolerance at any altitude after performing the calibration procedure, it will need to be returned to Adaptive Interfaces for repair and/or recalibration of the pressure sensor. Be sure to verify the accuracy of the Primary Altimeter before determining the status of the MCE-100.

This procedure can take place within the aircraft or on a test bench.

If done on a test bench, the MCE-100 supply voltage should be +14 Vdc.

CALIBRATION AND VERIFICATION - CONT.

AS A STANDALONE PRIMARY ALTIMETER - CALIBRATION



TEST SETUP 2

1) Connect the MCE-100, Pitot/Static Test Set or Vacuum/Pressure Source and Pressure Gauge (if used) as shown in Test Setup 2.

2) Apply power to the MCE-100, Test Set/Source and Pressure Gauge (if used) and allow at least a 10 minute warmup time.

3) Apply a pressure to the system that corresponds to an altitude of 0 ft. (101.33 kPa).

4) Perform the 0 ft. Set Point procedure on the MCE-100.

5) Apply a pressure to the system that corresponds to an altitude of 30,000 ft. (30.07 kPa).

6) Perform the 30k ft. Set Point procedure on the MCE-100.

NOTE - Always perform both the 0 ft. and 30k ft. set point procedures.

This procedure can take place within the aircraft or on a test bench.
If done on a test bench, the MCE-100 supply voltage should be +14 Vdc.

CALIBRATION AND VERIFICATION - CONT.

AS A STANDALONE PRIMARY ALTIMETER - VERIFICATION

1) Connect the MCE-100 and Pitot/Static Test Set or Vaccum / Pressure and Pressure Gauge as shown in Test Setup 2. Be sure the test set is capable of sweeping pressure up and down about a point.

2) Be sure the MCE-100 barometer setting (BAR) is 29.92 inHg.

3) Apply power to the MCE-100, Test Set/Source and Pressure Gauge and allow at least a 10 minute warmup time.

4) Set the Pitot/Static Test Set or Vacuum/Pressure Source to output a pressure of 101.33 kPa (0 ft.). Verify this pressure with a Pressure Gauge if the accuracy of the Test Set or Source is in question.

5) Verify that the MCE-100 reports an altitude of 0 ft. +/- 40 ft. in the "ALT" mode. If the altitude is beyond the +/- 40 ft. limits, recalibration of the MCE-100 should be performed.

6) Using a Gray/Gillham code monitor or Mode C Decoder, verify that the digital outputs of the MCE-100 represent an altitude of 0 ft. If the MCE-100 is being tested with a transponder test set, verify that the Mode C pulses are correct for an altitude of 0 ft..

7) Slowly sweep the pressure down so that the MCE-100 display reads from -100 ft. to 100 ft.. Verify that the digital outputs transition from -100 ft. to 0 ft. when the "ALT" display reads -50 ft. and that the digital outputs transition from 0 ft. to 100 ft. when the display reads 50 ft..

8) Slowly sweep the pressure up so that the MCE-100 display reads from 100 ft. to -100 ft.. Verify that the digital outputs transition from 100 ft. to 0 ft. when the "ALT" display reads 50 ft. and that the digital outputs transition from 0 ft. to -100 ft. when the display reads -50 ft..

9) Set the Pitot/Static Test Set or Vacuum/Pressure Source to output a pressure of 30.07 kPa (30,000 ft.). Verify this pressure with a Pressure Gauge if the accuracy of the Test Set or Source is in question.

10) Verify that the MCE-100 reports an altitude of 30,000 ft. +/- 40 ft. in the "ALT" mode. If the altitude is beyond the +/- 40 ft. limits, recalibration of the MCE-100 should be performed.

CALIBRATION AND VERIFICATION - CONT.

AS A STANDALONE PRIMARY ALTIMETER - VERIFICATION

11) Using a Gray/Gillham code monitor, Mode C Decoder or Transponder Test Set, verify that the digital outputs of the MCE-100 represent an altitude of 30,000 ft..

12) Slowly sweep the pressure down so that the MCE-100 display reads from 29,900 ft. to 31,000 ft.. Verify that the digital outputs transition from 29,900 ft. to 30,000 ft. when the "ALT" display reads 29950 ft. and that the digital outputs transition from 30,000 ft. to 31,000 ft. when the display reads 30,050 ft..

13) Slowly sweep the pressure up so that the MCE-100 display reads from 31,900 ft. to 29,000 ft.. Verify that the digital outputs transition from 31,000 ft. to 30,000 ft. when the "ALT" display reads 31550 ft. and that the digital outputs transition from 30,000 ft. to 29,000 ft. when the display reads 29,950 ft..

14) Repeat steps 9 to 11 at various altitudes between -1100 ft. and 32000 ft.. The selection of these altitudes is at the discretion of the avionics technician. If the MCE-100 is shown to be out of the +/- 40 ft. tolerance at any altitude after performing the calibration procedure, it will need to be returned to Adaptive Interfaces for repair and/or recalibration of the pressure sensor.

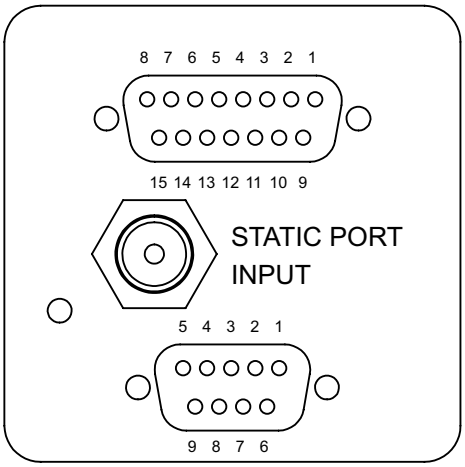
15) Repeat steps 12 and 13 at various altitudes between -1100 ft. and 32,000 ft. to verify that the digital outputs are correct and transition at the 50 ft. points. The selection of these altitudes is at the discretion of avionics technician.

This procedure can take place within the aircraft or on a test bench. If done on a test bench, the MCE-100 supply voltage should be +14 Vdc.

MCE-100 BACK PANEL

UPPER CONNECTOR

1) D4	4) A4	7) N/C	10) B4	13) C2
2) A1	5) B1	8) +12 Vdc B	11) C1	14) +12 Vdc A
3) A2	6) STB (STROBE)	9) B2	12) C4	15) GND (GROUND)



LOWER CONNECTOR

1) N/C
2) N/C
3) VDISP (DISPLAY BRIGHTNESS CONTROL VOLTAGE INPUT)
4) VBKLT (BACKLIGHT BRIGHTNESS CONTROL VOLTAGE INPUT)
5) GND (GROUND)
6) GND (GROUND)
7) GND (GROUND)
8) ALRM (ALARM OUTPUT - OPEN COLLECTOR)
9) +12 Vdc C

COMMON TRANSPONDER CONNECTIONS

MCE-100

MCE-100 UPPER CONNECTOR

SIGNAL	D4	A1	A2	A4	B1	B2	B4	C1	C2	C4	STROBE
PIN	1	2	3	4	5	9	10	11	13	12	6

MODEL	CONNECTOR										
ARC (CESSNA) RT359A, RT459A, RT859A		10	14	13	15	19	17	16	21	18	20	11
BECKER ATC 2000	J4204	23	16	15	14	17	19	18	22	21	20	(1)
BECKER ATC 3401	P8	23	16	15	14	17	19	18	22	21	20	(1)
BECKER ATC 4401	P1	20	1	2	3	14	15	16	17	18	19	(1)
BENDIX TR541A, TR641A, TR641B		(2)	A	B	C	D	E	F	H	J	K	(1)
BENDIX TPR-660, TPR-2060, TPR-2061		(2)	4	6	8	9	10	11	3	5	7	(1)
CESSNA RT359A, RT459A, RT859A		10	14	13	15	19	17	16	21	18	20	11
COLLINS TDR-950, TDR-950L		(2)	12	10	7	6	5	4	8	11	9	(1)
EDO-AIRE RT-777		15	7	5	3	12	13	14	8	6	4	2
GARMIN GTX 320	P102	18	3	5	6	9	11	12	10	4	7	(1)
GARMIN GTX 320A, GTX 327	P3271	18	3	5	6	9	11	12	10	4	7	(1)
GENAVE BETA 5000		3	4	5	6	7	8	9	10	11	12	3
KING KT 75		(2)	6	7	8	9	10	11	12	13	14	5
KING KT 76, KT 78	P1	(2)	6	7	9	4	1	2	3	8	10	12
KING KT 76A, KT 76C, KT 87A, KT 79	P1	8	M	K	J	E	C	B	D	L	H	(1)
MICROAIR T2000		21	9	10	11	12	13	17	18	19	20	(1)
NARCO AT5, AT6, AT6A		(2)	2	4	8	9	10	11	1	3	5	12
NARCO AT50, AT50A (3)	P101	(2)	7	6	8	12	10	9	14	11	13	5
NARCO AT 150, AT 155	P101	(2)	7	6	8	12	10	9	14	11	13	(1)
NARCO AT 165	P101	(2)	7	6	8	12	10	9	14	11	13	(1)
NARCO AT 165C	P900	(2)	14	13	15	19	17	16	21	18	20	(1)
RADAIR 250		15	7	6	13	9	10	11	14	16	12	19
TERRA TRT250, TRT250D		9	5	17	16	15	2	14	3	4	18	(1)
UPS APOLLO SL70		35	13	31	12	33	14	32	16	34	15	(1)
WILCOX 1014A		(2)	k	c	W	T	L	D	P	f	Z	(1)

(1) This transponder does not have a strobe output and does not use the strobe function. Disable the strobe function of the MCE-100 by tying Pin-6 of the Upper Connector to common ground or by setting the "Sb" function to OFF in MENU LEVEL 1.

(2) This transponder does not use the D4 input. Leave the D4 (Pin-1 of the Upper Connector) output of the MCE-100 unconnected.

(3) Unmodified versions of the Narco AT50A can be unstable with some altitude encoders. Be sure the AT50A is modified in accordance with Narco Service Bulletin AT-50A-5.

This connection list is provided only as an information reference. Adaptive Interfaces does not guaranty the accuracy of this information. Always refer to the transponder manufacturer's technical manual for electrical connections.