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Revision F
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CHRONOS

Digital Clocks / USB Chargers



FOREWORD

This manual provides information intended for use by persons who, in accordance with current regulatory requirements, are qualified to install this equipment. If further information is required, please contact:

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REVISION HISTORY

Rev	Date	Detail	Approved
A	07/15/2014	Initial release.	BAW
B	09/15/2014	Revised EQF, added DO-311A Compliance Qualification Form and provided additional limitation details (sec 2.5)	WVC
C	03/12/2015	Added Environmental Qualification Statement to Section 6.	TV
D	03/21/2016	Added Qualifications to Section 1.3.	WVC
E	10/30/2018	Updates for MOD 1 function enhancements. Revised elapsed timer to include countdown timer function. Timer reset function operates only when timer is stopped.	WVC
F	04/01/2021	Updated style and brand to meet Marketing and Engineering guidelines. Added -0, -3, -4 and -5 units and temperature probe information. Removed reference to -1 version.	DLR



SECTION 1 GENERAL DESCRIPTION

1.1 INTRODUCTION

The CH93 series, part numbers 6420093-(), is a multi-function digital clock / chronometer / voltmeter / temperature unit with multiple options for USB Charging Ports. The unit fits into a standard, rear-mounted, 2-1/4" avionics panel cutout. Power is drawn from the aircraft main bus to light a white, six digit, seven segment LED clock. The clock can display several different modes: local time, universal time, flight timers, elapsed and countdown timers and optionally, bus voltage and up to two temperature inputs. The CH93 display is daylight readable with two methods of brightness control. It can be controlled automatically using the internal photocell or manually with an external dimming bus voltage. The CH93 clock has an internal battery to maintain clock time and flight timer memory when the aircraft is not in use.

The USB Charging Ports are designed as DCPs (Dedicated Charging Ports) to industry-standard protocol per the *USB Battery Charging 1.2 Compliance Plan*. Some models also comply with the higher power requirements of *USB Power Delivery 2.0 and 3.0*. Early-generation or smaller consumer electronics typically accept one (1.0) amp during charging. However, newer electronics, such as tablets and larger devices can accept, and in some cases, require up to 3 amps to charge and operate. Unlike most dual USB chargers which provide one (1.0) amp on one port and 2.1 amps on the second port, the CH93 provides 3 amps per port. The Type A High Power (HP) USB ports provide a 5 volt output at 3 amps and the Type C Max Power USB-PD port provides 3 amps at 5, 9, 15, or 20 volts depending on the type and needs of the device. This provides enough power to charge any USB device, including the higher demand products. Refer to Section 1.4 for specific details on charging port configurations for each model. With features like short circuit protection, over-current protection, low voltage shut-down and temperature monitoring, it handles abnormal conditions safely.

1.2 PHYSICAL ATTRIBUTES

The CH93 is a single, integrated component contained in a metal enclosure, fitting into a standard 2 1/4" avionics instrument panel cutout. Two types of units are available within the series. Type 1 units have a 4-pin input connector on the rear of the unit for power, external dimming control and flight timer operation. Type 2 units have a 9-pin D-shell connector that add connections for temperature probe inputs and a countdown timer external alarm signal. The series includes versions with and without USB charging ports, located on the front of the unit below the display, and three control buttons for user interface: Mode, + (plus), and – (minus). The modes are annunciated with backlit indicators for UTC, Flight, Timer, Volts, and OAT. Refer to Figures 1.1 and 1.2 for unit dimensions.

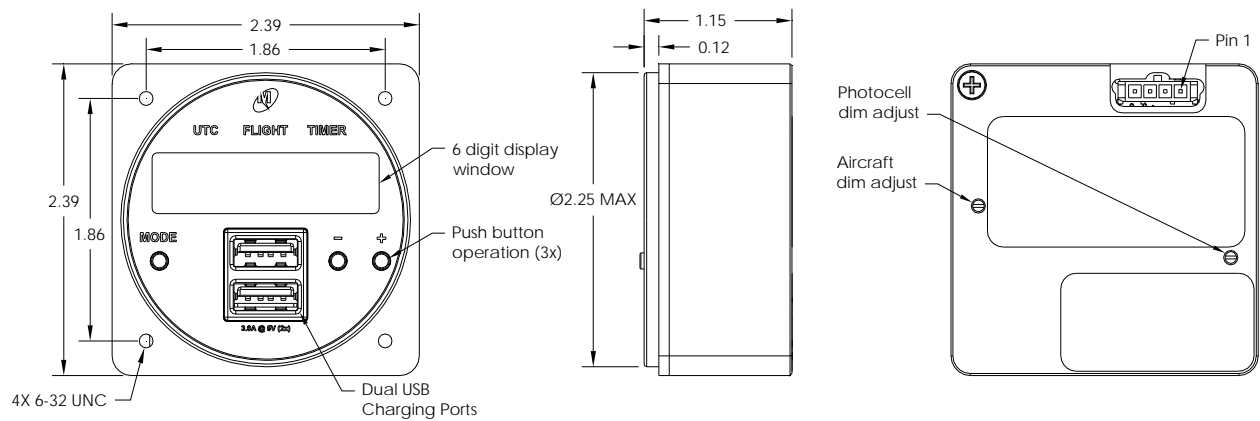


Figure 1.1
CH93 Type 1 Drawing (-2 Unit)

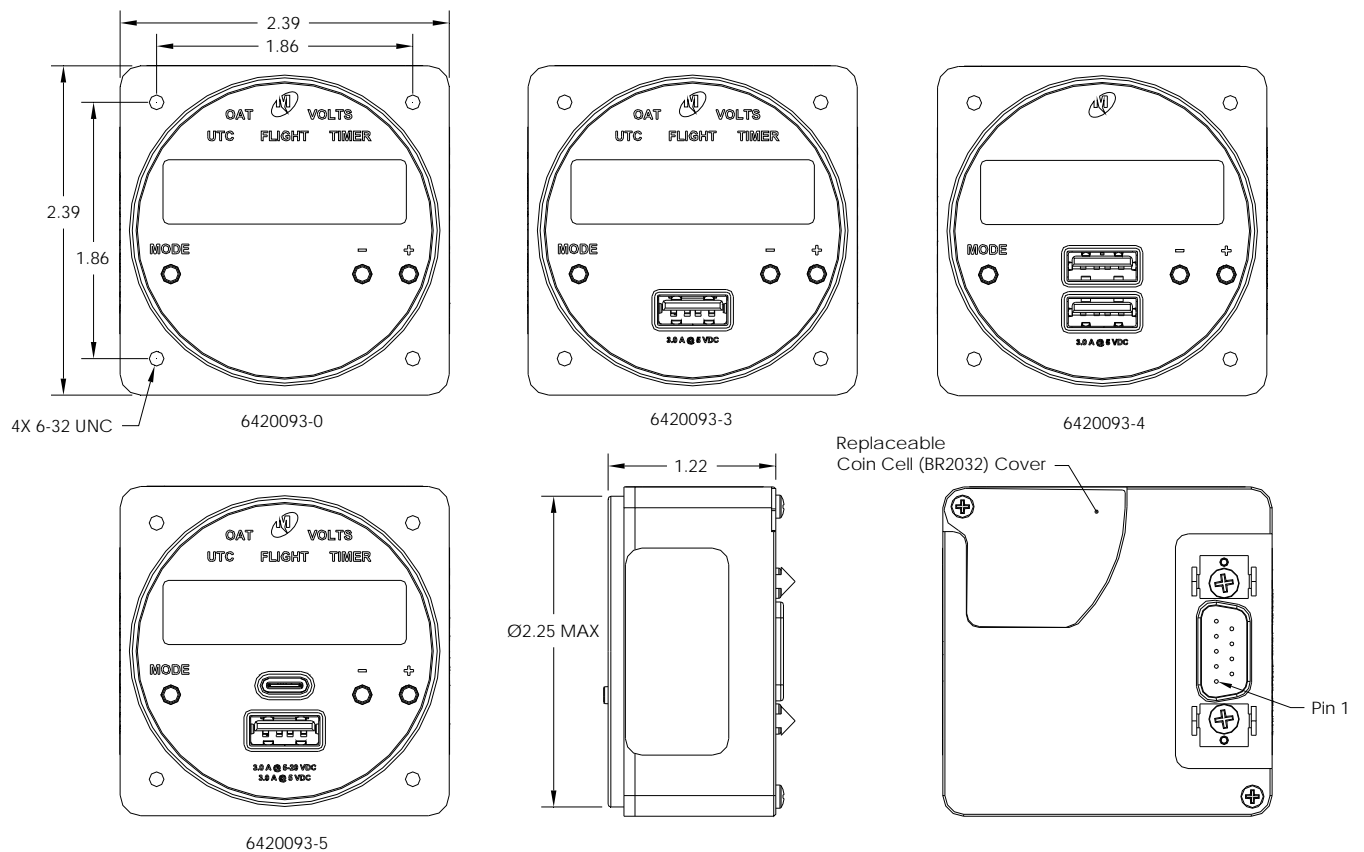


Figure 1.2
CH93 Type 2 Drawing (-0, -3, -4 and -5 Units)



1.3 MODEL AND PART NUMBER IDENTIFICATION

Chronos Models and Type			
Part Number:	Model:	Type:	USB Charging Ports:
6420093-0	CH93	Type 2	None
6420093-2	CH93HP	Type 1	Dual Type A
6420093-3	CH93HP	Type 2	Single Type A
6420093-4	CH93HP	Type 2	Dual Type A
6420093-5	CH93MAX	Type 2	Type A / Type C

Table 1.1

Feature Summary								
Feature	UTC Time	Local Time	Flight Timers	Elapsed Timers	Alert Output	Volts	OAT	Replaceable Battery
Type 1	Y	Y	Y	Y	N	N	N	N
Type 2	Y	Y	Y	Y	Y	Y	Y	Y

Table 1.2

1.4 TECHNICAL SPECIFICATIONS

Electrical Attributes	
Input Voltage: -0,-2,-3,-4: -5:	10 – 32 VDC 22 – 32 VDC
Input Power: -0 -2 -3 -4 -5	5 watts max; 0.3 amps @ 14 VDC / 0.15 amps @ 28 VDC 36 watts max; 2.6 amps @ 14 VDC / 1.3 amps @ 28 VDC 21 watts max; 1.5 amps @ 14 VDC / 0.75 amps @ 28 VDC 36 watts max; 2.6 amps @ 14 VDC / 1.3 amps @ 28 VDC 84 watts max; 3.0 amps @ 28 VDC
USB Output Voltage:	Type A: 5 VDC \pm 0.25 VDC per port Type C: 5, 9, 15, or 20 VDC \pm 0.25 VDC per port (auto-adjustable)
USB Output Power:	3.0 amps max per USB port (15 watts Type A; 60 watts Type C)
Efficiency:	\approx 90% nominal
Clock Accuracy:	\pm 15 seconds per month
Compatible Temp Probes: RTD: Current Sense:	500 Ω Resistor AD590 Temperature Transducer
Alarm output (Type 2 only):	Open drain ground limited to 100mA, max 32 VDC

Table 1.3



Physical Attributes	
Weight:	5.0 ounces (142 g)
Dimensions (not including connector) Type 1 Type 2	2.39 inches wide x 2.39 inches high x 1.15 inches deep (61 mm wide x 61 mm high x 29 mm deep) 2.39 inches wide x 2.39 inches high x 1.22 inches deep (61 mm wide x 61 mm high x 31 mm deep)
Charging Ports Type -0: -2,-3,-4: -5:	Not Applicable Type A USB Type A USB; Type C USB
Clock Digits:	0.360" H x 0.138" W
Connector Kit Type 1 Type 2	MCIA P/N 9018178 MCIA P/N 9018178-1
Mounting:	Rear Panel Mount

Table 1.4

Internal Battery Attributes	
Type:	Primary (non-rechargeable) coin cell; poly-carbonmonofluoride lithium
Model: Type 1 Type 2	BR2330 (factory replaceable only) BR2032 (field replaceable)
Output Voltage:	3 VDC
Capacity / Energy: Type 1 Type 2	0.255 Ah / 0.765Wh 0.190 Ah / 0.570Wh
Certification:	UL 1642 (see section 2.4)

Table 1.5

Qualifications	
Certification	FAA TSO-C71 EASA ETSO-C71
Environmental Qualification	RTCA/DO-160G (See Section 5.2)

Table 1.6



SECTION 2 PRE-INSTALLATION CONSIDERATIONS

2.1 COOLING

The CH93 will become warm when in use; however no external cooling is required. This is normal and within operational parameters. No special mounting considerations are required, although mounting to a metal surface can help dissipate any heat generated and extend the life of the product.

2.2 EQUIPMENT LOCATION

The CH93 Digital Clock / USB Charging Port is designed for a circular rear panel mount configuration, allowing for installation in a cockpit or cabin. Clearance should be provided for the input mating connector which may require an additional inch of clearance beyond the rear of the unit.

2.3 ROUTING OF CABLES

Avoid sharp bends in cabling and routing near aircraft control cables. Avoid close proximity and contact with aircraft structures, avionics equipment or other obstructions that could chafe wires during flight and cause undesirable effects.

2.4 LIMITATIONS

Environmental qualifications were verified per RTCA DO-160, Revision G in lieu of those identified within the minimum performance standards (MPS) of the TSO.

The conditions and tests for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards, specification of the article and deviations as listed above. TSO articles must have separate approval for installation in an aircraft. The article may be installed only according to 14 CFR part 43 or the applicable airworthiness requirements.

Note: Per 8300.16 job aid applicable to airplanes certified under Title 14 of the Code of Federal Regulations part 25 (Section H. Alterations or Repairs, Element H.7). (*Approval is required for* Changes to designs involving lithium batteries or battery systems except for the following cases:

1. Very small batteries or battery systems (e.g., button/coin cells) not required for safe operation of the airplane that have less than 2 watt-hours of energy and meet UL 1642, UL 2054 or International Electrotechnical Commission (IEC) 62133.

The battery in the CH93 is non-rechargeable and considered “very small”. It is less than two Watt-hours and is certified to UL 1642. No STC or coordination with the ACO is required.



2.5 MODIFICATION

This product has a nameplate that identifies the manufacturer, part number, description, certification(s) and technical specifications of the unit. It also includes the “MOD” or modification number representing notable changes in the hardware design of the unit.

Modification (MOD) 0 is the initial release of the product and is identified on the nameplate by the lack of marking on the MOD numbers 1 through 9 (i.e. 1-9 are visible). All subsequent modifications are identified on the nameplate by the marking/blacking out of that particular MOD number (i.e. for MOD 1, the number 1 is not visible and 2-9 are visible - see Figure 2.1 for examples). MODs do not have to be sequentially inclusive and may be applied independent of each other.

For additional details regarding specific changes associated with each MOD status refer to the product published Service Bulletins at www.mcico.com.

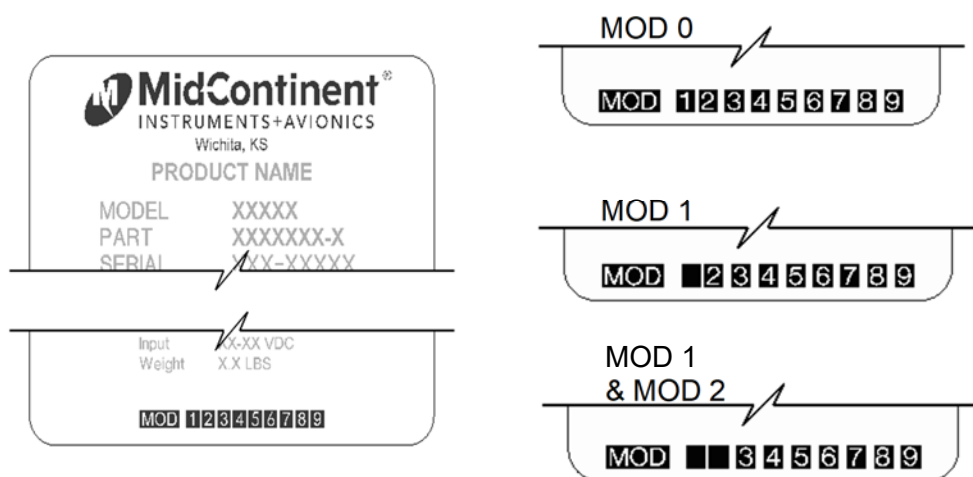


Figure 2.1
Nameplate and MOD Status Example



SECTION 3 INSTALLATION

3.1 GENERAL

This section contains interconnect diagrams, mounting dimensions and other information pertaining to the installation of the CH93 Digital Clock / Dual USB Charging Port. After installation of cabling and before installation of the equipment, ensure that power and ground are applied to the proper pins specified in Section 3.4.2, Pin Assignment Information.

3.2 PRE-INSTALLATION INSPECTION

When unpacking this equipment, make a visual inspection for evidence of any damage that may have occurred during shipment.

3.3 PARTS

3.3.1 Included Parts

- | | | |
|----|--|----------------------|
| A. | Digital Clock (with USB Charging Port(s)) | MCIA P/N 6420093-() |
| B. | Installation and Operation manual | MCIA P/N 9018205 |
| C. | Installation Kit (for Type 1) | MCIA P/N 9018178 |
| | • Mating Connector, 4-Pin | |
| | • Pins (6) (4 required, 2 spares) | |
| | • Screws (5), #6-32 x 3/8" Flat Head (4 required, 1 spare) | |
| D. | Installation Kit (for Type 2) | MCIA P/N 9018178-1 |
| | • Mating D-Sub Connector, 9-Pin | |
| | • Screws (5), #6-32 x 3/8" Flat Head (4 required, 1 spare) | |

3.3.2 Available Parts

- | | | |
|----|---|-----------------|
| A. | 500 Ω Outside Air Temperature Probe | MCIA P/N B-10-1 |
| B. | 500 Ω Cockpit/Cabin Temperature Probe | MCIA P/N B-11-1 |
| C. | Current Sense Cockpit/Cabin Temperature Probe | MCIA P/N B-11-2 |

3.3.3 Installer Supplied Parts

- | | |
|----|--|
| A. | Cable Harness Wire, See Section 3.4.1 for specifications |
| B. | Circuit Breaker Recommendations: |
| | • -0,-2,-3,-4 units: 3 amps (1.5 amp may be sufficient for 28V aircraft - as needed per system requirements) |
| | • -5 units: 5 amps for 28V aircraft |
| C. | Davtron C307PS or 655 current sense probes (if applicable). |



3.4 CABLE HARNESS

Construct the cable harness following the instructions outlined below and per Tables 3.1, 3.2 (Type 1 units) and 3.3 (Type 2 units). Refer to Section 2: Pre-Installation Considerations for routing precautions.

3.4.1 Wire Gauge Selection

Use of PTFE, ETFE, TFE, Teflon or Tefzel insulated wire is recommended for aircraft use. The wire harness should utilize 20-24 AWG stranded wire. Refer to Table 3.1 below for suggested minimum wire size.

Wire Gauge	Wire Length
20 AWG stranded wire	>35 ft.
22 AWG stranded wire	>14 ft.
24 AWG stranded wire	<14 ft.

Table 3.1
Wire Gauge and Length

Note: For Type 1 units (-2) pins should be crimped using Molex Hand Crimp Tool 63819-0000 (preferred), 63811-2800 (obsolete) or 11-01-0200 (obsolete). See the Molex Hand Crimp Tool User Manual for crimp procedures. For Type 2 units (-0,-3,-4,-5) pins should be crimped using Positronic Hand Crimp Tool 9507-0-0-0 (preferred), Daniels AFM8 (optional) or Mil P/N M22520/2-01 (optional).

3.4.2 Pin Assignment Information

See Table 3.2 for pinout definition and Figure 3.1 for pin locations on Type 1 units. Refer to Table 3.3 for pinout definition and Figure 3.2 for pin locations on Type 2 units.

Pin Number	Signal
1	Aircraft Power
2	Ground
3	Aircraft Lighting Bus
4	Flight Timer Input

Table 3.2
Power Input Connector Pinout (Type 1)

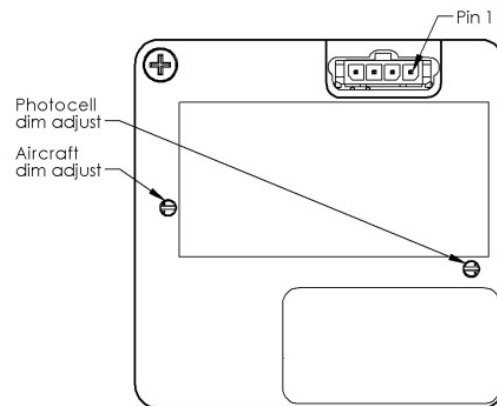


Figure 3.1
CH93 Rear View (Type 1)



Pin Number	Signal
1	Ground
2	Power Input (DC)
3	Flight Timer Input
4	RTD Temp A
5	Alarm Out
6	Current Temp Return
7	Current Temp Power
8	Aircraft Lighting Bus (DC)
9	RTD Temp B

Table 3.3
Power Input Connector Pinout (Type 2)

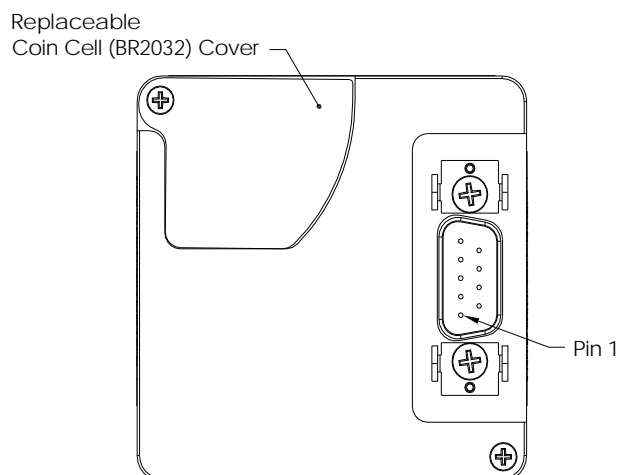


Figure 3.2
CH93 Rear View (Type 2)

3.4.3 Harness Verification



WARNING

Failure to install aircraft power and ground wires in the proper mating connector locations could damage the unit.

Once the cable harness is prepared, prior to connecting the CH93, activate the aircraft power bus and use a multimeter to verify that aircraft power and ground are supplied with appropriate voltage on the proper pins within the mating harness.

The CH93 must not be installed with input terminals reversed as this could damage the unit. Verify the correct polarity of any harness or equipment prior to connecting to the CH93.



3.5 INSTALLATION

The CH93 is rear mounted using a standard 2 ¼" panel cutout. Prepare the panel cutout as shown in Figure 3.2 below. For Type 1 units, the display dimming should be adjusted according to Section 4.4 prior to installing the unit. Mount the CH93 with #6-32 flat head screws (provided with installation kit).

NOTE: The maximum screw length used to mount the unit is 9/32" (0.280") + panel thickness on Type 1 units. Type 2 units can accommodate a screw length up to 1" in length.



Using screws longer than the recommended maximum length may damage the CH93 unit!

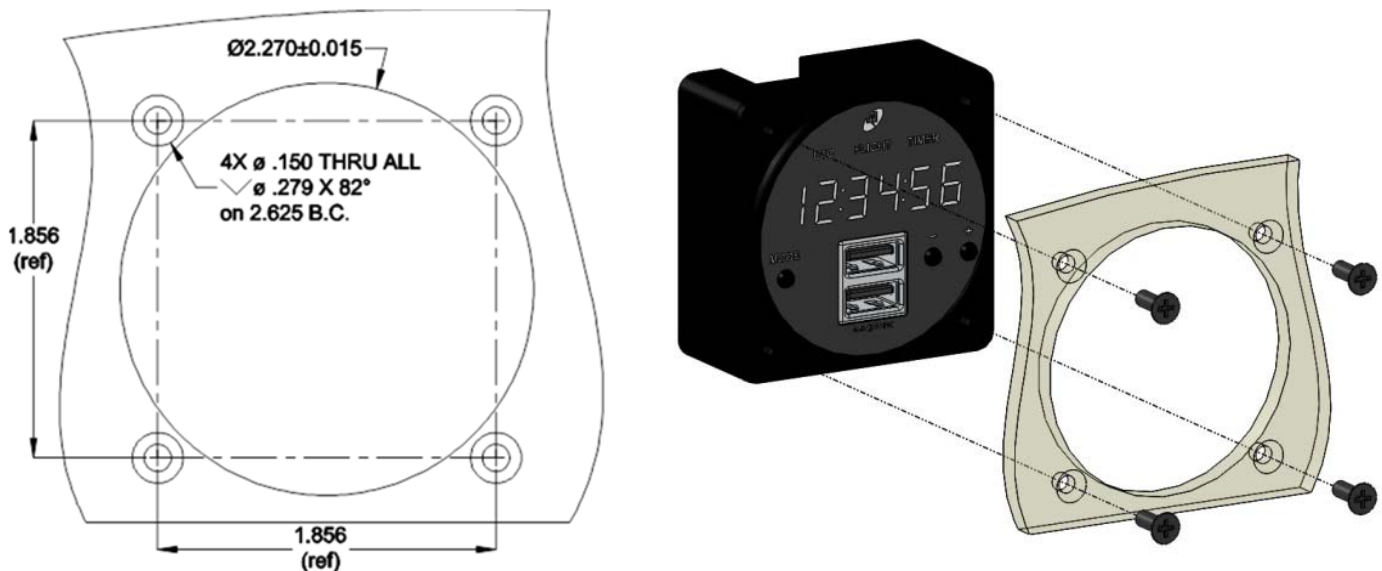


Figure 3.2
Rear Panel Mount Installation



SECTION 4 OPERATION

4.1 UNIT ARCHITECTURE

The CH93 is comprised of two functional building blocks, a USB charger and digital clock. The DC input voltage is regulated over its specified range using a DC-DC converter to power the USB charger and all clock functions. A charging port controller manages power output for the USB charging ports. An internal battery maintains clock functions (local time, universal time, flight timer) when input power is removed for up to ten years. Type 1 units require factory serviced to be replaced and Type 2 units have a field-replaceable battery. Refer to Section 5.1 for details.

The user interface is comprised of the display, three control buttons, and the mode annunciation. The display has six, seven-segment, white LED digits that are 0.360" tall and 0.138" wide. The three user interface buttons (**MODE**, **-** and **+**) are used to switch between modes of operation, set clock time, and manage timer functions for the CH93. Backlit annunciations on the front bezel indicate the current mode of operation with each mode visible only when active. When aircraft power is removed, the display clock and all annunciations will be turned off.

4.2 CLOCK AND USB PROTECTIVE FEATURES

The following features are included in the design of the CH93 and protect both the unit and any devices being charged from damage in the event of the fault conditions listed below.

4.2.1 Short Circuit Protection

The CH93 is capable of surviving a short circuit event without permanent damage. The unit enters an over-current condition so that the average current is significantly reduced and the device is protected. Removal of the short allows the unit to return to normal operation.

4.2.2 Over-Current Protection

The CH93 monitors current draw individually on each USB port. During an over-current condition the voltage is reduced. If the voltage falls below 3.8 VDC the output is turned off for a period of 12 seconds. The output is then checked for continued over-current conditions every 16 milliseconds. This condition is referred to as a hiccup mode. The device stays in this mode until the over-current condition is removed, then returns to normal operation.

4.2.3 Low Input Voltage Shutdown

If the input voltage applied to the CH93 drops below the specified minimum, the unit will shut down until the applied voltage returns to a level within the operating range.

4.2.4 Over-Temperature

If the temperature of the CH93 exceeds designed thresholds due to a fault or excessive load, the unit communicates with the USB portable device to reduce the charge current output to a 1.0 amp limit. This allows the charger to continue charging while the unit returns to a temperature within designed limits. When temperature returns to an acceptable level the unit automatically returns to normal operation.



4.3 USB OPERATION

For units with USB Charging Ports, there are single and dual Type A versions available as well as the CH93MAX dual Type A/Type C version.

The Type A USB Charging Ports convert the specified DC input voltage range to a 5 VDC output. Type C USB-PD (Power Delivery) Charging Ports convert the specified DC input voltage range specified to either 5, 9, 15, or 20 VDC. Both types employ intelligent control and use voltage signals to negotiate the maximum power (voltage and current) that each individual Personal Electronic Device (PED) allows. This provides for the fastest charging speeds possible for all devices including phones, tablets, and laptops. The output voltage and power is applied to the USB-A ports in per the *USB Battery Charging 1.2 Compliance Plan* and the USB-C/PD ports in accordance with *USB 3.1* and the *USB Power Delivery* standards, versions 2.0 and 3.0.

To ensure enhanced cybersecurity protocols, no data is transferred from the unit to the attached device or from the device to the unit or aircraft systems. Only power and power negotiation signals are exchanged between the CH93 and the device(s) being charged.

4.4 DIMMING FUNCTIONS

The brightness control on the CH93 can use fully automatic control or a combination of external and automatic control. For fully automatic control, the internal photocell is used to adjust the brightness from minimum to maximum brightness by sensing and responding to the current ambient light conditions. For external control using a dimming bus adjustment, the brightness can be manually controlled by supplying a lighting input voltage. The lighting input voltage will be compared to the power input and will control the lighting when it is between 20-100% of the power input. A voltage equal to the aircraft bus voltage (100%) corresponds to maximum brightness. If the lighting voltage is less than 20% of the power input voltage (or off), dimming will be automatically controlled by the ambient light sensed by the photocell built into the unit.

4.4.1 Display Dimming Adjustment (Type 1 units)

To adjust the brightness range of the clock on Type 1 units for optimal daytime and night-time viewing, as well as balance amongst other panel instruments, use the two trimming potentiometers (trim pot) adjustments on the rear of the unit as shown in Figure 3.1. Set the input voltage/lighting bus to maximum and turn the “Aircraft Dim Adjust” screw to raise or lower the brightness. Next, turn the input voltage/lighting bus off in completely dark conditions and turn the “Photocell Dim Adjust” screw to raise or lower the brightness.



NOTE: For Type 1 units, the adjustment screw has a single 360° range of rotation. Exceeding its limits past the stops will damage the unit. Adjust lightly.



4.4.2 Display Dimming Adjustment (Type 2 units)

For Type 2 units, the brightness range of the clock can be adjusted before or after installation using the control buttons on the front of the unit. With the unit in either LOCAL or UTC mode, simply pressing the – or + buttons will adjust the brightness setting. The CH93 will automatically detect and adjust the brightness control method that is currently active. If the automatic photocell is active, ADJ1 is displayed. It is recommended to set the photocell adjustment level in a dark or night-time cockpit environment. If the unit is receiving a dimming input voltage, ADJ2 is displayed. If used, both should be set to the appropriate preference. Once set, the photocell and lighting bus adjustments will be saved in the clock configuration.

If the brightness of the clock needs to be increased or decreased during flight, this can be performed in either LOCAL or UTC mode using the same procedure previously described.

Refer to Figure 4.3 for detailed instructions on adjusting dimming for Type 2 units (for both photocell and lighting bus display dimming modes).



Figure 4.1
Photocell Dimming Adjustment
(-5 unit shown)



Figure 4.2
Bus Voltage Dimming Adjustment
(-5 unit shown)

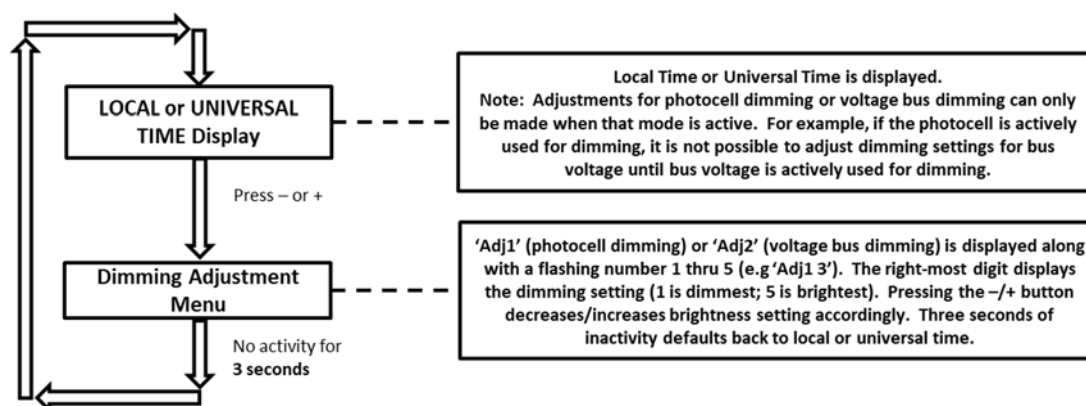


Figure 4.3
Dimming Adjustment (Type 2 units only)



4.5 OPERATIONAL MODES

The CH93 has six modes of operation representing up to nine separate functions. Each mode, when applicable, is indicated by a backlit annunciation on the display. See table 4.1 for details.

Mode	Annunciation	Functions
Local Time	(none)	Display and set local time
Universal Time	UTC	Display and set UTC time
Flight Timer	FLIGHT	Resettable and non-resettable flight timers
Timer	TIMER	Elapsed (count up) and count-down timers
Voltage*	VOLTS	Displays bus voltage
Temperature*^	OAT	Displays OAT and/or cockpit/cabin temperature

* Only available on Type 2 units

^ Requires temperature probe sensors

Table 4.1
Modes and Functions

Pressing the **MODE** button scrolls through the six different operational modes in a counter-clockwise direction on the display. Figure 4.4 depicts the overall flow of the unit modes of operation. Details for each mode are provided in the subsequent sections.

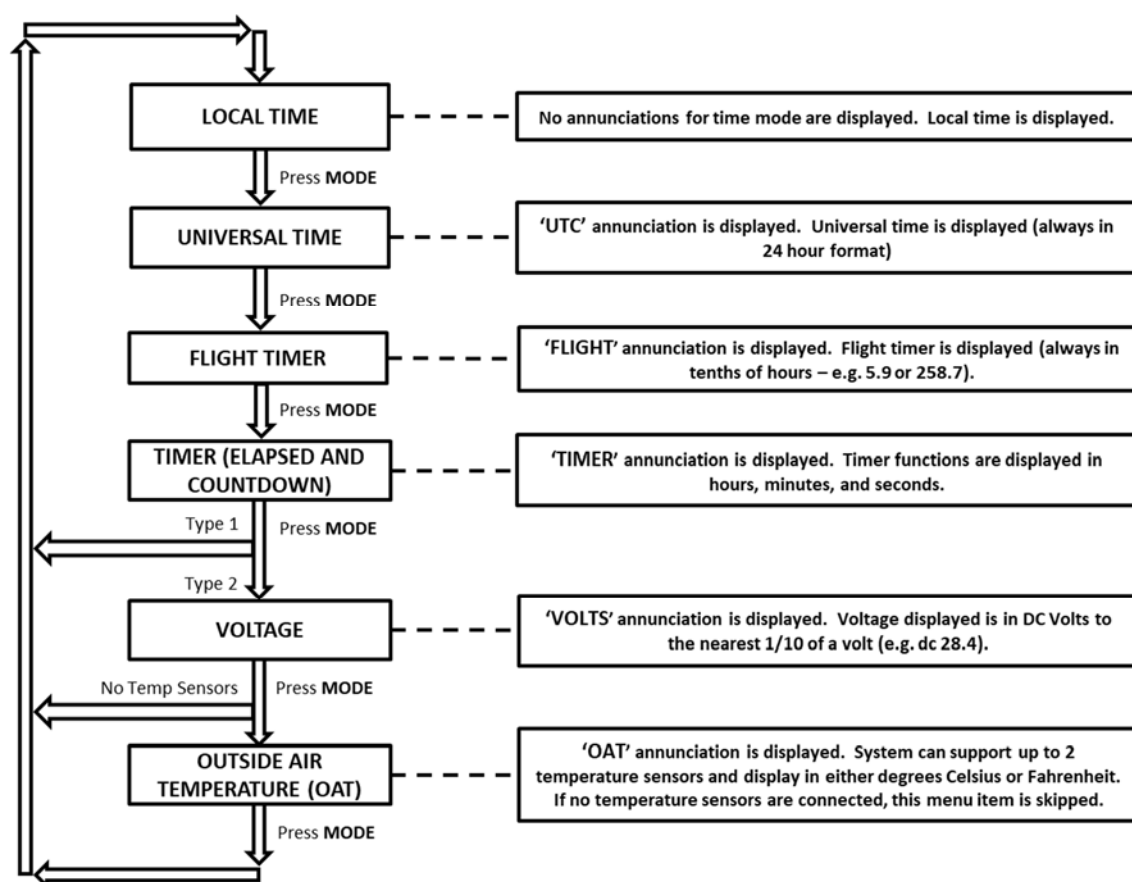


Figure 4.4
Modes of Operation



4.5.1 Local Time Mode

When power is applied to the CH93, the system defaults to Local Time mode (in this mode, there is no mode indication/annunciation; refer to Figure 4.5). Pressing and holding the **MODE** button will enter the configuration menu. The local time can be configured to display preferences for 12- or 24-hour format and to either display or hide seconds (displaying or hiding seconds setting applies to both local and UTC time). Setting hours in local time is independent of UTC time. For setting the minutes, Type 1 units apply the setting to both local and UTC time concurrently and are linked. For Type 2 units, the minutes in local time are independent of the UTC time minutes. For both unit types, the seconds are synchronized and linked between the two time modes. Refer to Figure 4.6 for detailed instructions.



Figure 4.5
Local Time Clock Mode (-5 unit shown)

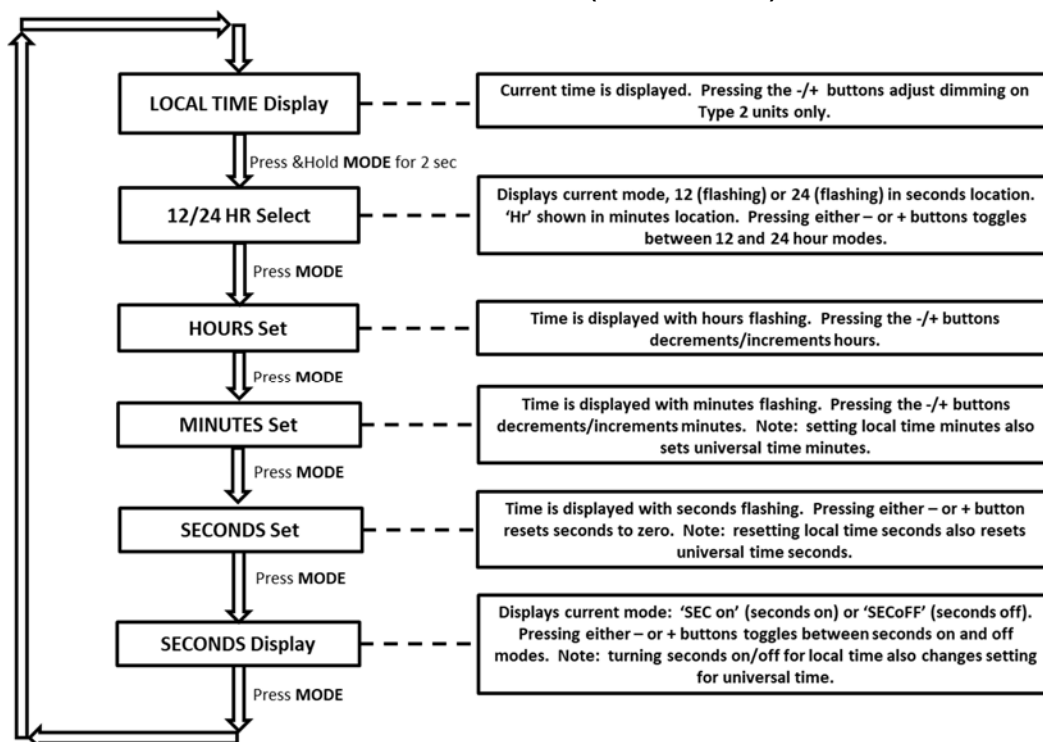


Figure 4.6
Setting Local Time



4.5.2 Universal Time Mode

When in Local Time mode, pressing the Mode button once changes the unit to Universal Time mode and the UTC annunciation will be backlit (refer to Figure 4.7). Pressing and holding the **MODE** button will enter the configuration menu. UTC time is always displayed in 24-hour format and seconds can be configured to be displayed or hidden (displaying or hiding seconds setting applies to both local and UTC time). Setting hours in UTC time is independent of local time. For setting the minutes, Type 1 units apply the setting to both local and UTC time concurrently and are linked. For Type 2 units, the minutes can be set for UTC time in 15-minute increments, independently of local time, to allow for time zones with offsets that are less than 1-hour increments. For both unit types, the seconds are synchronized and linked between the two time modes. Refer to Figure 4.8 for detailed instructions.



Figure 4.7
Universal Time Clock Mode (-5 unit shown)

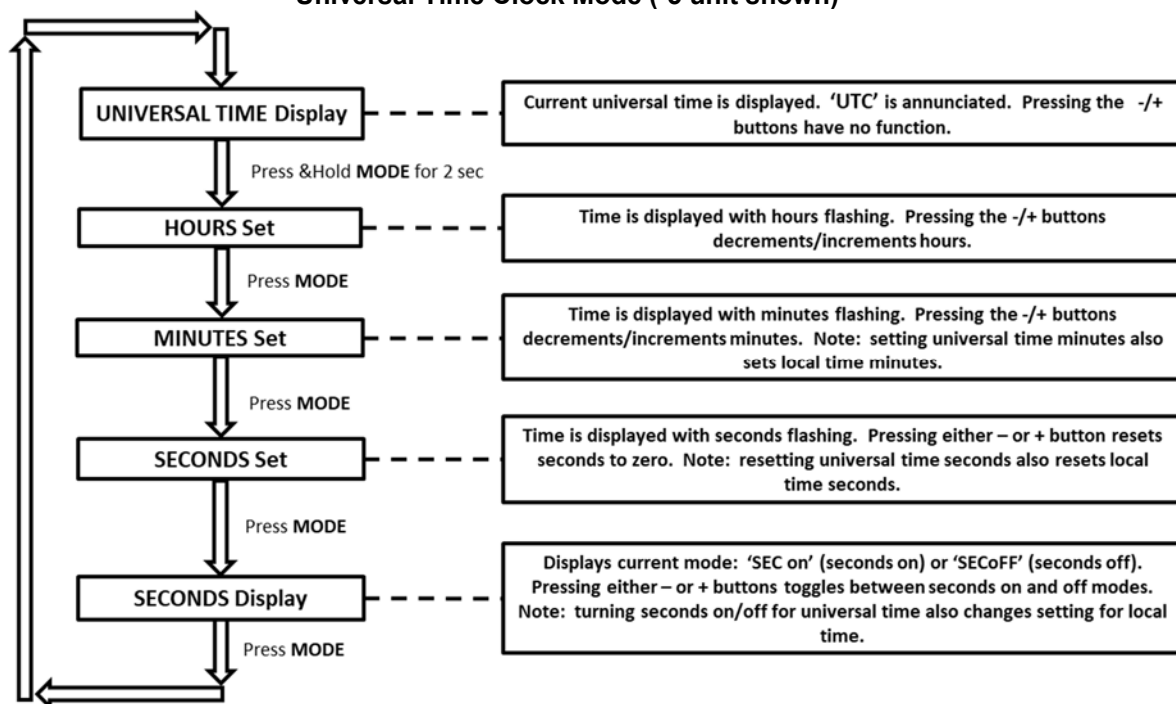


Figure 4.8
Setting Universal Time



4.5.3 Flight Timer Mode

When in UTC mode, pressing the Mode button once changes the unit to Flight Timer mode and the FLIGHT annunciation will be backlit (refer to Figure 4.9). To activate the flight timer, a ground or aircraft power signal must be supplied to the Flight Timer Enable Pin (see Tables 3.3 and 3.4). This can be provided from an event-based relay (such as engine start or weight-on-wheels) or it can be connected via jumper to the power or ground pins of the unit to activate on unit power. The decimal point will blink briefly every 2 seconds to indicate that the flight timer is active. Flight time is displayed in hours and tenths of hours up to 99999.9 hours. The flight timer maintains the accumulated time (but does not run) when power is off.

Two flight timers are available on the CH93. The default flight timer is a resettable timer. Pressing and *holding* the **MODE** button for two seconds will reset the timer. If the Flight Timer Enable signal is active, the flight timer will reset to zero and resume counting. Pressing and *holding* the – or + button will display the non-resettable flight timer for keeping total cumulative flight time. Releasing the – or + button will return the display to the resettable flight timer. Note: the non-resettable timer value can be set or reset at the factory only. Refer to Figure 4.10 for detailed instructions.



Figure 4.9

Flight Timer Mode (-5 unit shown)

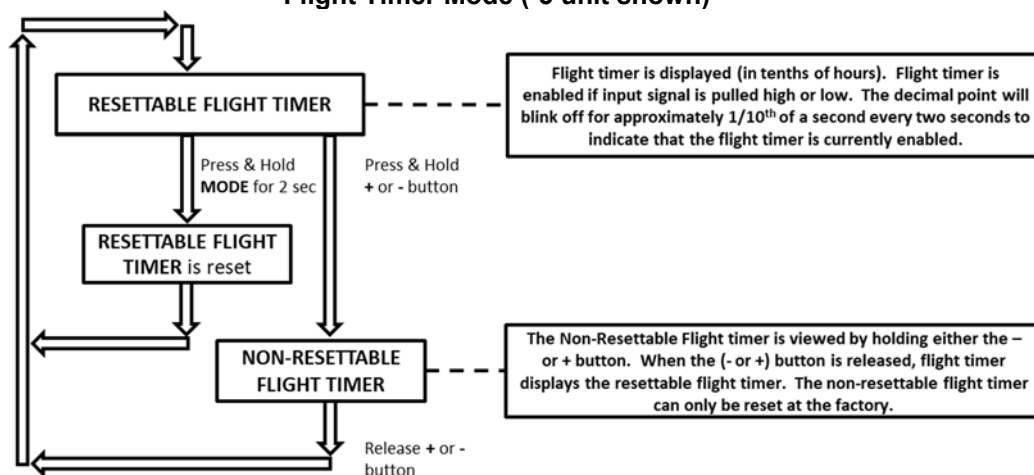


Figure 4.10
Flight Timer Operation



4.5.4 Timer Mode

When in Flight Timer mode, pressing the Mode button once changes the unit to Timer mode and the TIMER annunciation will be backlit (refer to Figure 4.11). The timer function can be operated as either an elapsed timer (stopwatch) or countdown timer, where a specific countdown time can be set. Upon power up, the CH93 remembers countdown timer setting and will default to the last displayed mode (elapsed or countdown). Once in Timer mode, pressing and holding the Mode button will allow the selection of elapsed or countdown mode. Note: When either timer is active, the user can change modes (e.g. to Local Time) and the timer will still remain active. The timer stops and resets if power is cycled or if the timer mode (elapsed vs. countdown) is changed.

4.5.4.1 Elapsed Timer

When entering Timer mode, the unit is in Elapsed Timer mode if the display shows 00:00:00 or the unit is counting up (and not blinking). The elapsed timer counts up to a maximum of 99 hours, 59 minutes, 59 seconds and then starts again at zero. Pressing the + button starts and stops the timer. Pressing the – button resets the timer only if the timer is stopped. Refer to Figure 4.12 for detailed instructions.

4.5.4.2 Countdown Timer

Once the countdown mode is selected, the unit immediately allows the setting of the specific countdown time. The countdown timer can be set to a maximum of 99 hours, 59 minutes, 59 seconds. Pressing the + button will start and stop the timer. When the countdown timer reaches 00:00:00, it will enable the external alarm (ground output on pin 5; Type 2 units only) and it will begin counting up and will flash every second to indicate elapsed time since reaching zero. Pressing the – button resets the timer only if the timer is stopped and it will also reset the external alarm. The countdown timer setting is maintained when the unit is powered off. Refer to Figure 4.12 for detailed instructions.



Figure 4.11
Timer Mode (-5 unit shown)

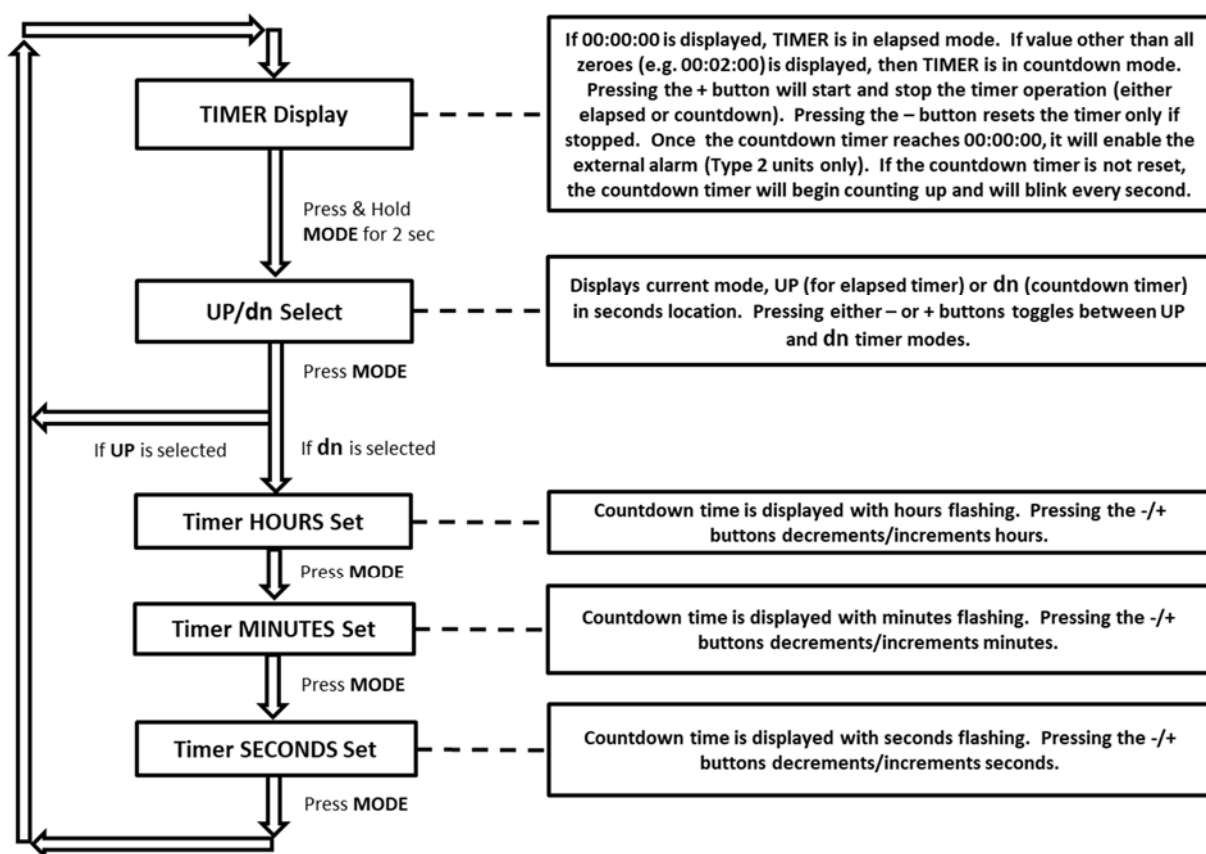


Figure 4.12
Elapsed/Countdown Timer Operation

4.5.5 Voltage

When in Timer mode, pressing the Mode button once changes the unit to Voltage mode and the VOLTS annunciation will be backlit (refer to Figure 4.13). Voltage mode is only available in CH93 Type 2 units. When in Voltage mode, the bus voltage (Volts DC (Direct Current)) is displayed to the nearest 1/10th of a volt and preceded by the “dc” label. Refer to Figure 4.13 below.



Figure 4.13
Voltage Mode (-5 unit shown)



4.5.6 Temperature Mode

When in Voltage mode, pressing the Mode button once changes the unit to Temperature mode and the OAT (Outside Air Temperature) annunciation will be backlit (refer to Figure 4.17). Temperature mode is only available in CH93 Type 2 units and requires the use of one or two temperature probes (sold separately; refer to Section 3.3 and 4.6). When a temperature probe is detected, the temperature is displayed to the nearest degree (°) in either Celsius (C) or Fahrenheit (F). If there are no temperature probes installed or detected, Temperature mode will be unavailable and the unit will transition from Voltage mode to Local mode when pressing the Mode button.

The CH93 Type 2 unit is designed to support one or two temperature inputs. One input is designed to measure and indicate Outside Air Temperature (OAT) and the other to measure and indicate inside (cockpit or cabin) air temperature. Either or both are allowable. If a temperature input is configured as OAT, the OAT annunciation will be backlit. If configured as cockpit/cabin temperature, no mode annunciation will be shown and the first digit of the display will indicate the letter “c” (Refer to Figure 4.18) When both are installed, pressing the – or + button will switch between OAT and cockpit/cabin temperature. The last viewed temperature will remain as the default view when cycling through the modes, until changed again.

To change the units of the temperature display (C or F), press and hold the **MODE** button. Refer to Figure 4.19 for detailed instructions



Figure 4.17
Temperature Mode
Outside Air Temperature (-5 unit shown)



Figure 4.18
Temperature Mode
Cockpit/Cabin Temperature (-5 unit shown)

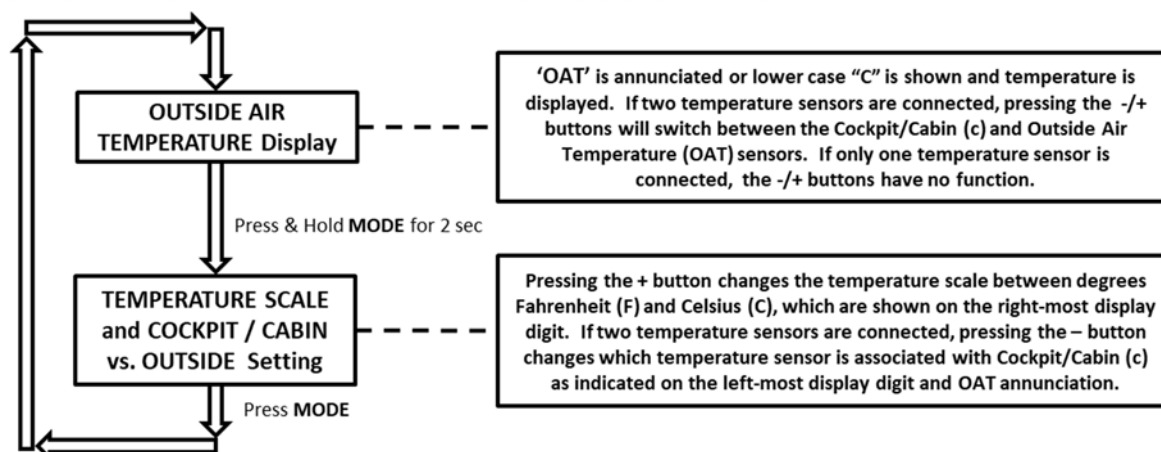


Figure 4.19
Temperature Mode Operation

4.5.6.1 Temperature Probe Configuration

The CH93 supports two different types of temperature probes; RTD and current sense devices. If only one of the above probes is connected to the CH93, the temperature display will initially appear like Figure 4.17. If two probes are connected (must be one of each type), the unit can be configured to identify one probe as Outside Air Temperature and the other as interior (cockpit/cabin) temperature.

To configure the first temperature probe, follow instructions in Figure 4.20. If two probes are connected, configure the second temperature probe similarly per instructions in Figure 4.21.

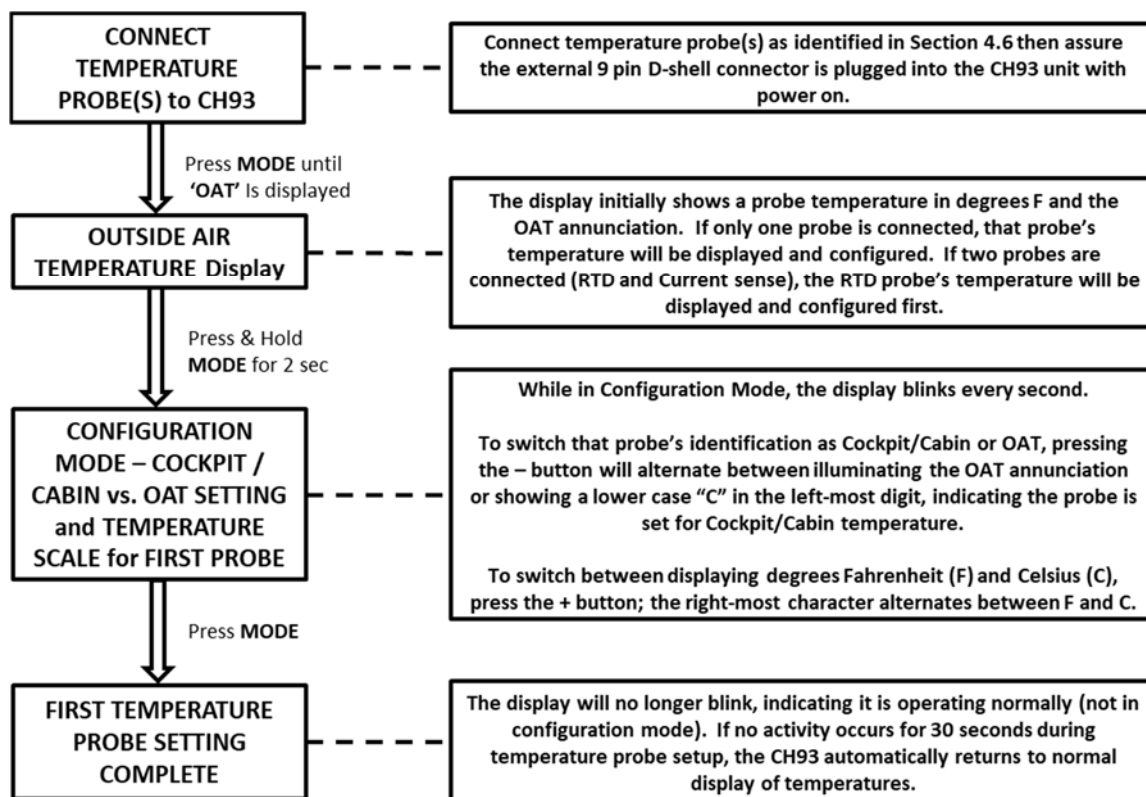


Figure 4.20
Temperature Sensor Configuration
(First Temperature Probe)

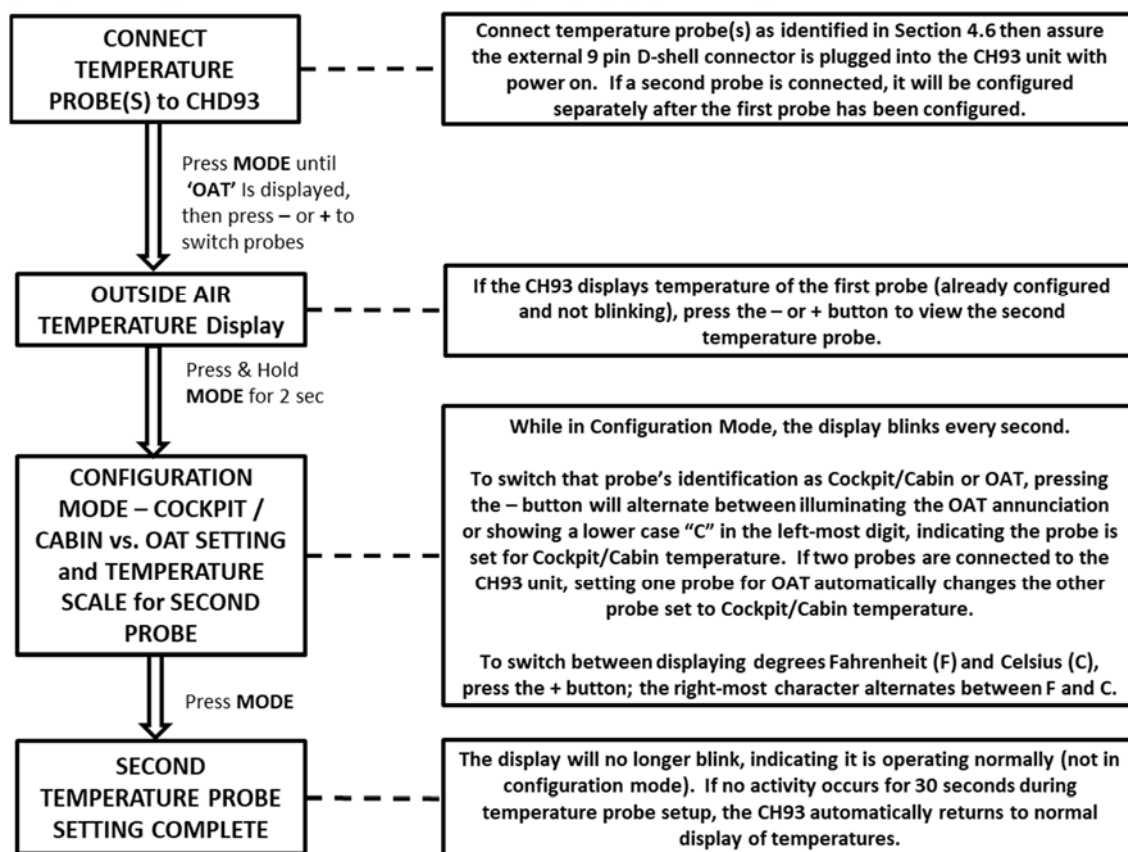


Figure 4.21
Temperature Sensor Configuration
(Second Temperature Probe)



4.5.6.2 Uninstalling Temperature Probes

To uninstall (un-configure) a temperature probe(s), follow instructions per Figure 4.22.

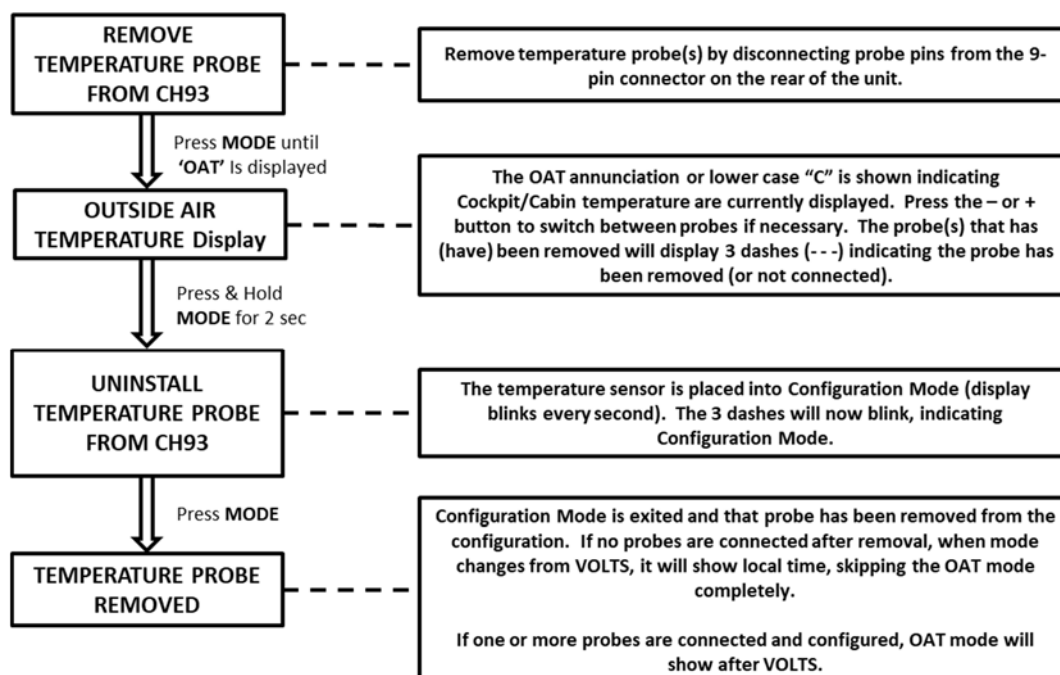


Figure 4.22
Temperature Sensor Configuration
(Uninstalling Temperature Probes)

4.5.7 Display Test Mode

To test the CH93 display, press and hold both +/- buttons for 2 seconds. After 2 seconds all display segments and annunciators will be activated until the + and - buttons are released. Refer to Figure 4.23.



Figure 4.23
Display Test Mode (-5 unit shown)



4.6 TEMPERATURE PROBE INSTALLATION

The CH93 (Type 2) supports two types of temperature probes: an RTD (Resistance Temperature Detector; 500 Ω) and a Temperature Transducer (current sense device; AD590). This section describes compatible probes available for installation for the CH93 Type 2 unit. Either may be used (if only one) or one of each type.

4.6.1 RTD Probes

To install either of the RTD-style probes for OAT or cockpit/cabin temperature, connect to pins 4 and 9 (no polarity required) of the mating connector of the CH93 per the instructions below.

4.6.1.1 OAT RTD Probe

The MCIA p/n B-10-1 is a 13-inch long Outside Air Temperature RTD Probe furnished with a 6 pin connector and mating socket connector kit. The probe mounts in a 5/16" diameter hole through the aircraft skin. Use 22 gauge wire to create a harness that connects the probe's mating connector to the CH93 mating 9-pin d-sub connector. Refer below to Figure 4.14 for pinout connection to the CH93 unit. Refer to Figure 4.24.

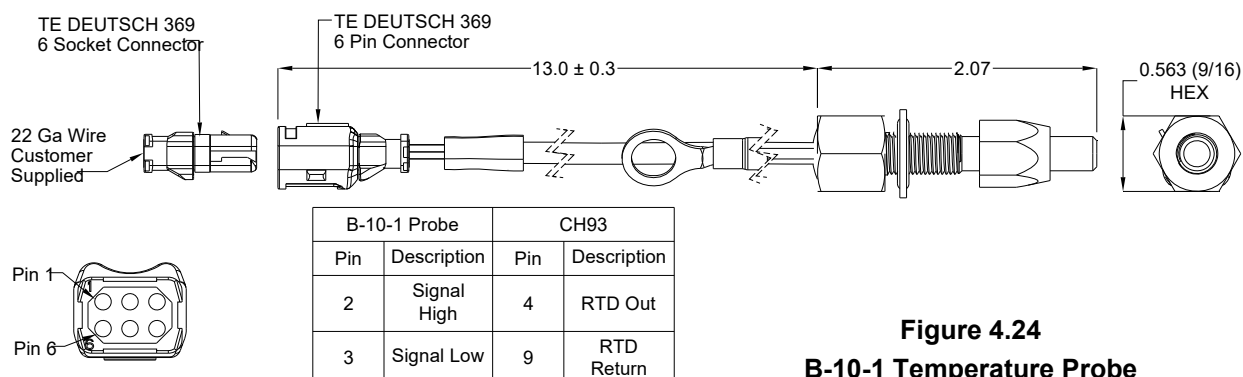


Figure 4.24
B-10-1 Temperature Probe

4.6.1.2 Interior RTD Temperature Probe

The MCIA p/n B-11-1 is a 120-inch long (10 foot) Cockpit/Cabin Temperature RTD Probe that mounts by either a #8 (or smaller) screw or cable tie to any interior location. To connect the B-11-1 probe to the CH93 unit, remove excess cable length from the probe, strip ends, and connect to the CH93 mating 9-pin d-sub connector. Refer to Figure 4.25.

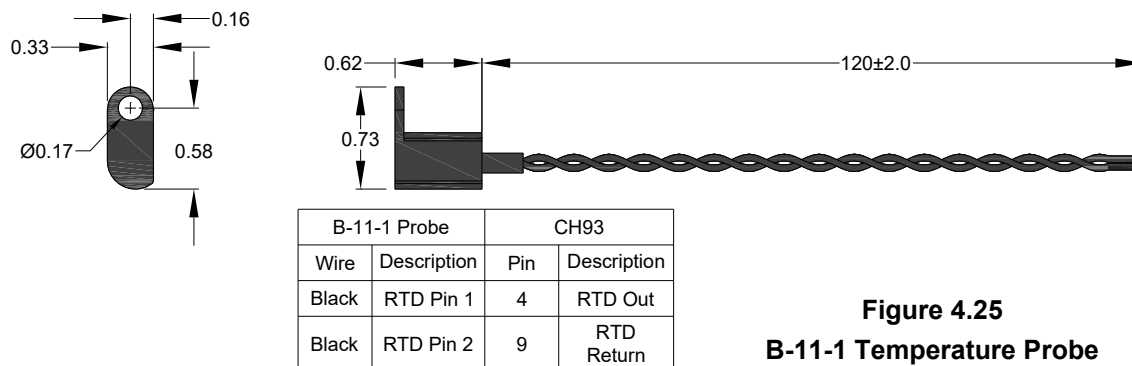


Figure 4.25
B-11-1 Temperature Probe



4.6.2 Transducer Probes

To install any of the Transducer-style probes for OAT or interior temperature, connect pins 6 and 7 (polarity required) to the mating connector of the CH93 per the instructions below.

4.6.2.1 OAT Transducer Probes

The CH93 is compatible with the following OAT Transducer Probes:
(not available through MCIA)

- Davtron p/n C307PS
- Davtron p/n 655

To install these probes, connect the power line to pin 7 and the return line to pin 6 of the CH93 mating 9-pin d-sub connector.

4.6.2.2 Interior Transducer Probe

The MCIA p/n B-11-2 is a 120-inch long (10 foot) Cockpit/Cabin Interior Temperature Current Sense Transducer Probe that mounts by either a #8 (or smaller) screw or cable tie to any interior location. To connect the B-11-2 probe to the CH93 unit, remove excess cable length from the probe, strip ends, and connect to the CH93 mating 9-pin d-sub connector as follows: Black wire to pin 6 (Return) and Red wire to pin 7 (Power).

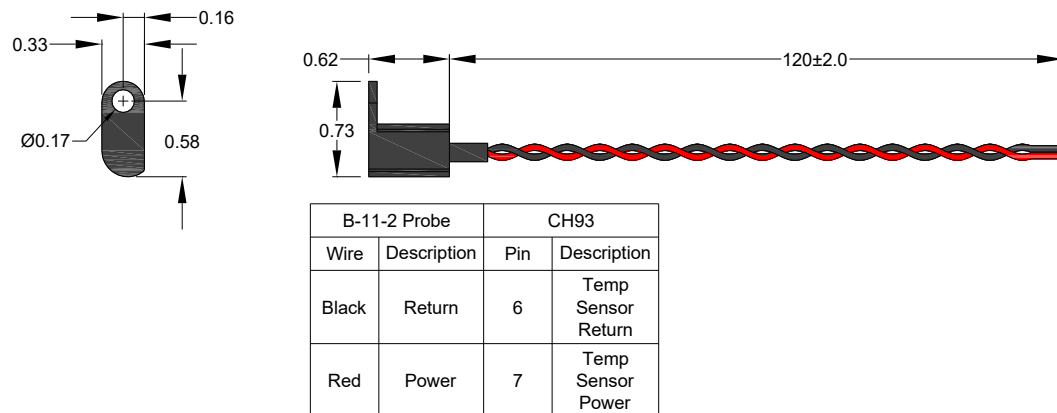


Figure 4.26
B-11-2 Temperature Probe



SECTION 5 CONFORMANCE

5.1 INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

No periodic scheduled maintenance or calibration is necessary for continued airworthiness of the CH93 Digital Clock / Dual USB Charging Port.

If the unit fails to perform to specifications, the unit must be removed and serviced by Mid-Continent Instruments and Avionics or their authorized designee.

If the unit fails to maintain local or UTC time upon power-up, the internal battery must be replaced per the instructions below.

Type 1 units: Remove unit from service and return to Mid-Continent Instruments and Avionics for battery replacement.

Type 2 units: Remove unit from the panel and loosen the screw retaining the battery cover door on the rear of the unit. Rotate the battery door counter-clockwise and carefully remove the battery with a non-conductive flat blade object on the side with the battery holder notch. Replace with a new battery of the same type (BR 2032; compliant with UL 1642).

Verify time remains set after a power cycle and return to service.

Refer to Figure 5.1 below for battery replacement.

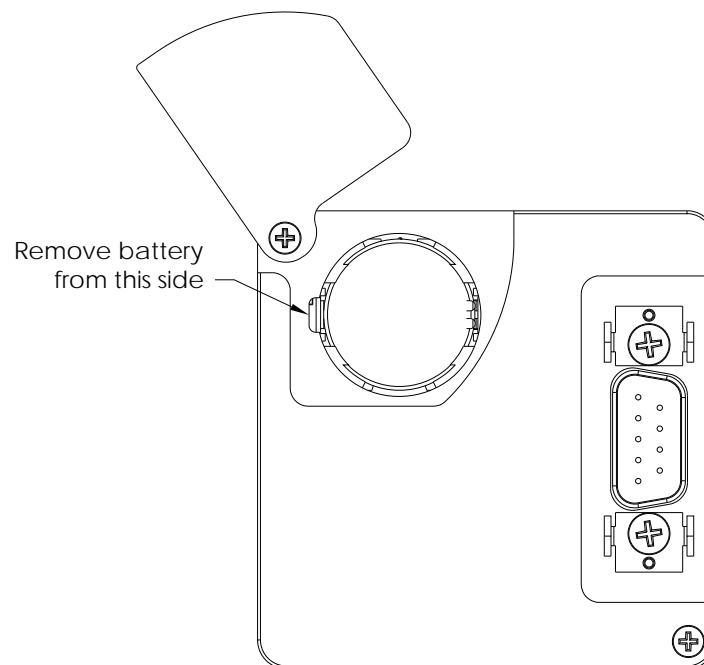


Figure 5.1
Battery (coin cell) Removal
(Type 2 units only)



5.2 ENVIRONMENTAL QUALIFICATION STATEMENT

MODEL NUMBER: CH93 Series **PART NUMBER:** 6420093-()
DESCRIPTION: Digital Clock/USB Charging Port **CERTIFICATION:** FAA TSO-C71
MANUFACTURER: Mid-Continent Instrument Co., Inc.
ADDRESS: 9400 E. 34th St. North, Wichita, KS 67226, USA.
SPECIFICATION: Test Specification (TS) 509 Test Data Sheet (TDS) 509 and 093
STANDARD: RTCA DO-160, Rev G, dated 12/08/2010

CONDITIONS	SECTION	DESCRIPTION OF TEST
Temperature and Altitude	4	Category F1
Temperature Variation	5	Category S2
Humidity	6	Category B
Operational Shock and Crash Safety	7	Category B
Vibration	8	Fixed Wing: Category R, Curves C & C1 Rotorcraft: Category U, Curve G
Explosion	9	Category X
Waterproofness	10	Category X
Fluids	11	Category X
Sand and Dust	12	Category X
Fungus	13	Category X
Salt Fog	14	Category X
Magnetic Effect	15	Category Y
Power Input	16	Category B(XX)
Voltage Spike	17	Category B
Audio Frequency Conducted Susceptibility	18	Category R
Induced Signal Susceptibility	19	Category X
Radio Frequency Susceptibility	20	Category X
Emission of Radio Freq Energy	21	Category M
Lightning Induced Transient Susceptibility	22	Category X
Lightning Direct Effects	23	Category X
Icing	24	Category X
ESD	25	Category A
Fire, Flammability	26	Category X

REMARKS:

- Section 4: Category F1 with excursions as declared by the manufacturer: Operating Low Temperature performed at Short-time Low Temperature set point of -40C.
- Section 8: Vibration was performed per Cat R, Curves C & C1 for fixed-wing aircraft and per Cat U, Curve G for helicopter using the same test article.