

CMS-400
Voice Checklist Management System
Install Guide

Engineering Approval:



Quality Control Approval:



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1. Introduction

Checklist errors are among the leading causes for hull-loss accidents in the aviation industry. In fact, checklist errors have been cited by the NTSB as a contributing factor in four major commercial airline crashes in a 15 month period between late 1987 and 1989.

The CMS-400 computer has been designed to reduce or eliminate many of the human limitations that are the root of checklist mistakes. It uses a microcomputer to read and manage the checklist to the pilot just like another crew member. Since a computer is managing the list, there is a greatly reduced possibility of omitted items, while at the same time, the pilot's visual workload is reduced during takeoffs and landings. Thus both safety and efficiency are improved.

2. Purpose and Scope

2.1 Purpose

The purpose of this document is to describe the installation and initial testing of the CMS-400 Voice Checklist Management System. This document applies only to the CMS-400.

2.2 Scope

This document is for use by avionics equipment and system installers and users. It may be used to support initial Type or Supplemental Type Certification Programs for installation approvals.

This document addresses the following issues relating to the installation of the CMS-400:

- Environmental
- Mechanical
- Electrical
- Initial Power Up
- Checklist Changes
- Warranty

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2.3 Applicable Documents

The following documents are referenced in the CMS-400 installation manual:

RTCA DO-160D	Environmental Conditions and Test Procedures for Airborne Equipment
CMS400-27	DO-160D Test Plan
CMS400-34	Qualification Test Report (DO-160D Results)
CMS400-7	Installation Kit
CMS400-8	Basic CMS-400 Installation
CMS400-9	CMS-400/HUCAB Installation
CMS400-10	Cartridge Checklist Outline Dimension Drawing
CMS400-11	Extended CMS400 Installation
CMS400-30	Cartridge Checklist Isometric View

3. Environmental

The CMS-400 computer and data cartridge have been designed and tested according to RTCA DO-160D. Heads Up Technologies Documents CMS400-27 and CMS400-34, as referred to in Section 2.3, provide a listing of all environmental tests performed, including temperature, vibration, and electrical tests.

4. Mechanical

The CMS400 Installation Kit, Heads Up Technologies P/N CMS400-7, contains copies of the documentation and the hardware required for complete installation of the unit. The Installation and User manuals, as well as the mating circular connector and pins are among the contents of the kit.

NOTE: This kit must be purchased separately from Heads Up Technologies.

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4.1 Selection of CMS-400 Location

The CMS-400 is a stand alone unit that can be installed in any available standard DZUS rail space. Because the primary means of communication with the pilot is by voice, it is not necessary to use prime locations such as the center of the instrument panel for the CMS-400. Rather, location in a pedestal, side console or low on the instrument panel is recommended.

4.2 Physical Dimensions

The dimensions of the CMS-400 are listed in Table 4-1. An outline dimension drawing of the unit is provided in Heads Up Technologies Drawing CMS400-10.

Table 4-1
CMS-400 Physical Dimensions and Weight

Dimension	Inches	Centimeters
height	1.88	4.78
width	5.75	14.61
depth (w/o bezel)	7.83	19.89
weight	1.9 lbs.	

As can be seen in the figure, the data cartridge is inserted into the rear of the unit and extends 1.05 inches beyond the CMS-400 housing.

5. Electrical

5.1 Overview

The CMS-400 can be installed in several configurations depending upon the requirements of the end user and the particular aircraft. In its minimum configuration, only eight (8) wires are required for operation. This section will explain the possible electrical options.

5.2 Power Requirements

Table 5.2-1 summarizes the power consumption of the CMS-400 computer.

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Table 5.2-1
CMS-400 Voltage and Current Requirements

Nominal Values

Main Power

voltage	+28 VDC
current	0.150 Amp (silent) 0.500 Amp (speaking)

Panel Lighting

5V Model **PN CMS400-1-x5**

voltage	5 V DC or AC
current	0.6 A

28V Model **PN CMS400-1-x28**

voltage	28 V DC or AC
current	0.11 A

Extreme Values

CMS-400 Computer

min. current	0.1 Amp @ 28 VDC (silent)
max. current	0.55 Amp @ 28 VDC (instantaneous at power up)
min. voltage	+18 VDC (not speaking)
max. voltage	+35 VDC

5.3 Electrical Connections

Refer to Heads Up Technologies drawings CMS400-9 and CMS400-8 for electrical wiring diagrams. This section will discuss the installation options on a feature-by-feature basis.

All wiring shall be installed per applicable sections of FAA AC-43.13-1A or later revision.

5.3.1 Power

Since the checklist is often performed before avionics have been powered, it is recommended that the CMS-400 be connected to the battery or essential bus.

The CMS-400 provides optional multiple non-isolated power inputs for added reliability, or external isolation diodes may be added for connection to multiple power buses.

5.3.1.1 Fault Protection

A 1.0 amp circuit breaker shall be installed in any available circuit panel location and connected to the appropriate bus.

Note: Failure to use the Specified circuit breaker invalidates the warranty.

5.3.2 Panel Lighting

The CMS-400 panel lighting input is a direct connection to the internal lamps of the panel. The CMS-400 ON/OFF switch or main power circuit breaker does not control the lighting. Make certain that the back lighting voltage specified on the data tag (on the CMS-400 case) corresponds to the voltage of the panel lighting bus.

5.4 Audio Options

5.4.1 Connection to Pilot/Copilot Headphone/Cockpit Audio System

The CMS-400 provides a dual 600 ohm/100 mW audio outputs that may be connected directly to pilot and/or copilot headphones or to any unused input of the existing pilot/copilot cockpit audio system. These outputs are transformer isolated, so that they may be wired to a balanced or un-balanced audio input. Shielded twisted-pair wire should be used when using a balanced configuration. Coaxial audio cable can be used when an un-balanced input is available.

The output level of these outputs is controlled by the CMS-400 volume control.

5.4.2 Connection to Pilot/Copilot Speakers

The CMS-400 also incorporates a dual 4 watt (into 8 ohms total load) audio amplifier that may be connected to pilot and/or copilot external speakers. Shielded twisted-pair wire is recommended.

The output level of these outputs is controlled by the CMS-400 volume control.

Note: Failure to use the proper impedance speakers will result in permanent damage to the audio amplifiers. Use a 4 or 8 ohm total load only.

Note: Do not connect any speaker output to the aircraft audio panel or headphones.

5.4.3 Single Pre-Amp Output

The CMS-400 provides a non-variable single 1Vp-p pre-amp output for connection to any unused cockpit audio panel input. The level of this output is not controlled by the CMS-400 volume control but is controlled by the cockpit audio panel. This output is usually used for flight conditions in conjunction with the speaker outputs for pre-flight conditions.

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5.4.4 Remote Switches

5.4.4.1 Remote "ADV" Switches (Recommended)

The CMS-400 may be controlled through the use of remote "ADV" switches so that the pilot does not have to reach to the instrument face. It is recommended that two remote "ADV" switches, one for the pilot and one for the copilot, be installed. Any normally open single-pole/single-throw momentary action switch can be used. Possible switch locations include the center pedestal, side consoles, and control wheels.

5.4.4.2 Remote "SKIP" Switches (Optional)

Remote pilot and copilot "SKIP" switches may optionally be installed. Any normally open single-pole/single throw momentary action switch can be used.

If desired, a momentary single pole/double throw switch may be used to incorporate the "ADV" and "SKIP" controls into one switch location.

5.4.5 Heads Up Cabin Briefing (Optional)

The CMS-400 may be connected to the HUCAB Heads Up Cabin Briefing System, or PBS250/400 Passenger Briefing System, (if installed) to automatically give briefings whenever the appropriate checklist is run. Refer to Table 5.3-2 for the appropriate pinouts. Refer to drawings CMS400-9 and PBS400-12 for connections.

5.4.6 Summary of Electrical Connections

Table 5.3-1 provides a list of the connector pinouts and Heads Up Technologies Drawing CMS400-8 is the accompanying installation wiring diagram for the Basic CMS-400, while Drawing Number CMS400-11 illustrates the wiring required for extended features.

Table 5.3-1
CMS-400 Circular Connector Pinout

Pin:	Function:	Note:
Lighting		
A	Panel Lighting Rtn	To Panel Lamps
B	Panel Lighting Input	To Panel Lamps
Autobrief		
C	TXD Rtn	Autobrief Signal Ground
D	TXD	Autobrief Signal Out
Remote Switches		
G	Pilot ADV Rtn	Ground

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H	Pilot ADV	Active Low
J	Copilot ADV Rtn	Ground
K	Copilot ADV	Active Low
L	Pilot SKIP Rtn	Ground
M	Pilot SKIP	Active Low
N	Copilot SKIP Rtn	Ground
P	Copilot SKIP	Active Low
Audio		
R	Pilot Audio Key Output	Active Low
S	Copilot Audio Key Output	Active Low
V	Pre-Amp Audio Rtn	Audio Ground
X	Pre-Amp Audio	20 ohms/1 Vp-p
d	Copilot 600ohm Audio Low	Balanced output
e	Copilot 600ohm Audio High	Balanced output
f	Copilot Speaker Audio Low	Audio Ground
g	Copilot Speaker Audio High	un-balanced variable
h	Pilot Speaker Audio Low	Audio Ground
i	Pilot Speaker Audio High	un-balanced variable
j	Pilot 600ohm Audio Low	Balanced variable
k	Pilot 600ohm Audio High	Balanced variable output
Power		
m, p		
r, t	Power Ground	Ground
n, q		
s, u	28 VDC Main Power	

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6. Initial Power Up

After the installation wiring has been completed and 100% continuity check performed, the CMS-400 initial power up can be performed.

- Verify a DSC20 Data Cartridge is installed in the CMS-400.
- If wiring configuration requires, power up the cockpit audio system.
- Power up the CMS-400 with volume control set to minimum. After an initial self-test, the computer will display “System Ready -- Press any key.”
- Press the “ADV” key and adjust the volume in small increments to achieve the desired audio level. A “READY” verbal response will now be heard each time the CMS-400 is powered up. If these messages are not present, double check the installation wiring, circuit breakers, and verify a DSC20 Data Cartridge is installed into the CMS-400.

Note: If the proper message is still not present, or error messages appear, call Heads Up Technologies. Do not attempt to repair unit. There are no user serviceable parts inside.

7. Checklist Data Cartridge

Note: The laminated copy of the checklist is to be used as a backup and must be stored in the cockpit.

7.1 Test Checklist for Temporary Installation

If the data tag on the Checklist Cartridge (DSC-20) is marked "Test" then the checklist contained in the cartridge memory is not the customer supplied checklist. The "Test" cartridge will allow the installer to verify the proper operation of the CMS-400. Heads Up Technologies will work with the end user to obtain his input and provide him with a replacement cartridge.

7.2 Removing/Installing Checklist Cartridge

The checklist data cartridge is shown in the Heads Up Technologies Drawing CMS400-30, "Cartridge Checklist Isometric View". The data cartridge is removed by first loosening the cartridge retainer thumb screw on the retainer bracket, rotating the bracket counter-clockwise, then pulling the cartridge from the unit. The cartridge is keyed to prevent installation in the improper orientation. Reverse the process to install.

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7.3 Changing the Checklist

Heads Up Technologies has a simple procedure for changing the CMS-400 checklist:

1) FAX requested changes to:

Heads Up Technologies
ATTN.: Customer Service
TEL (972) 980-4890
FAX (972) 980-4843

Address all correspondence:

Heads Up Technologies
2033 Chennault Drive, Suite 100
Carrollton, Texas 75006
ATTN.: Customer Service Dept.

2) Heads Up will provide an approval copy of the checklist changes to the pilot. Review, sign, and return the approval to Heads Up either by mail or by FAX.

3) Heads Up will program a new cartridge for the pilot. The checklist cartridge must be reprogrammed by Heads Up Technologies.

4) Return the old checklist cartridge to Heads Up.

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LIMITED WARRANTY

HEADS UP TECHNOLOGIES, Inc. hereby warrants that it will repair or replace, at its option, any part of the HEADS UP product with which this warranty is enclosed which proves defective by reason of improper workmanship and/or material, without charge for parts or labor, for a period of one (1) year. This warranty period commences on the date of original purchase by the buyer other than for purposes of resale, and this warranty applies only if such original purchase by the buyer was made in the United States.

To obtain service under this warranty, you must return your HEADS UP product, packaged in the original shipping container or an equivalent, to the nearest authorized service center or the dealer from whom the product was purchased. Any postage, insurance, shipping, and installation costs incurred in presenting your HEADS UP product for service are your responsibility.

The original bill of sale or other satisfactory proof of the date of the original purchase of your HEADS UP product must be made available to obtain service under this warranty.

This warranty applies only if your HEADS UP product fails to function under normal use and within the manufacturer's specifications. This warranty does not apply if the HEADS UP label or logo, or the rating or serial number, has been removed from your HEADS UP product, or if, in the sole opinion of HEADS UP, your HEADS UP product has been damaged by accident, misuse, neglect, or improper packing, shipping modification or servicing, by other than a HEADS UP authorized service center.

This Heads Up product contains static-sensitive electronic circuitry. Do not open case! This warranty will become void if you attempt to modify or adjust any internal components or the contents of any EPROM, or if you add or insert another PROM or part of any other device. Failure to adhere to installation instructions voids this warranty.

The duration of any implied warranty of merchant ability, fitness for a particular purpose, or otherwise, on your Heads Up product shall be limited to the duration of the expressed warranty set forth above. In no event shall Heads Up Technologies, Inc. or its affiliates be liable for any loss, inconvenience or damage whether direct, incidental, consequential or otherwise, or whether caused by negligence or other fault resulting from breach of any express or implied warranty of merchant ability, fitness for a particular purpose, or otherwise, with respect to your Heads Up product, except as specified herein. Some states do not allow limitations on how long an implied warranty lasts and some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations and exclusions may not apply to you.

CMS-400 CARTRIDGE AUDIO CHECKLIST SYSTEM DRAWING NUMBER: CMS400-KL-GENERIC
 DATE: 10/19/92
 REV: B
 REV. DATE: 04/26/02 5:22 PM
 FILENAME: CM4KLGEN.doc

TITLE: PART LIST FOR CMS400-7 INSTALLATION KIT
 (CMS400-KL-GENERIC)

TOTAL ITEMS LISTED: 14

ITEM NO.	HUT PART NO.	REVISION LEVEL	PART DESCRIPTION	PART QTY.
1	CMS400-KL-GENERIC	B	KIT PART LIST	1
2	CON420	-	55-PIN CONNECTOR	1
3	HDW077	-	PLACARD KIT	1
4	CMS400-4	1.1	USER MANUAL	1
5	CMS400-3	1.4	INSTALLATION MANUAL	1
6	CMS400-27QTS	1.2	ENVIRONMENTAL TEST SUMMARY	1
7	CMS400-30	C	UNIT ISOMETRIC DRAWING	1
8	CMS400-8	A	BASIC INSTALLATION DRAWING	1
9	CMS400-9	B	CMS-400/HUCAB INSTALL DWG	1
10	CMS400-11	A	EXTENDED INSTALL DRAWING	1
11	CMS400-12	-	CMS-400/PBS-400 INSTALL DWG	1
12	CMS400-13	-	EXTENDED CMS400/PBS400 DWG	1
13	CMS400-7	B	CMS-400 INSTALLATION KIT	1
14	CMS400-10	G	CARTRIDGE OUTLINE DIMENSIONS	1

Modification History:

Revision A1: Incorporated updated documents per ecn's 406, 414.

Revision A2: Updated CMS400-3 to revision 1.3.

Revision A3: Updated revisions for CMS400-4 to revision 1.1 and CMS400-27 to revision 1.2.

Revision B: Updated revisions for CMS400-3 to revision 1.4.

Prepared by:

Ken Richardson

Approved by:

Wynn Bosley

CMS-400
Environmental Qualification Test Summary

EQUIPMENT DESCRIPTION: Cartridge Checklist Management System
PART NUMBER: CMS400-1
MANUFACTURER: HEADS UP TECHNOLOGIES
ADDRESS: 2611 Westgrove, Suite 110, Carrollton, Texas, 75006

CONDITIONS	SEC/ PARA#	DESCRIPTION OF CONDUCTED TESTS
TEMPERATURE AND ALTITUDE	4.0	
LOW TEMPERATURE	4.5.1	EQUIPMENT TESTED TO CATEGORY B1
HIGH SHORT-TIME OPERATING TEMPERATURE TESTS	4.5.2	EQUIPMENT TESTED TO CATEGORY B1
HIGH OPERATING TEMPERATURE TESTS	4.5.3	EQUIPMENT TESTED TO CATEGORY B1
ALTITUDE TEST	4.6.1	EQUIPMENT TESTED TO CATEGORY D1
DECOMPRESSION TEST	4.6.2	EQUIPMENT TESTED TO CATEGORY D1
OVERPRESSURE TEST	4.6.3	EQUIPMENT TESTED TO CATEGORY D1
TEMPERATURE VARIATION	5.0	EQUIPMENT TESTED TO CATEGORY C
HUMIDITY	6.0	EQUIPMENT TESTED TO CATEGORY A
OPERATIONAL SHOCKS AND CRASH SAFETY	7.0	
OPERATIONAL SHOCK	7.2	
CRASH SAFETY	7.3	EQUIPMENT TESTED PER DO160B PARA 7.3.1
VIBRATION	8.0	SEE NOTE 1
EXPLOSION PROOFNESS	9.0	EQUIPMENT IDENTIFIED AS 'X.' NO TEST REQUIRED.
WATERPROOFNESS	10.0	EQUIPMENT IDENTIFIED AS 'X.' NO TEST REQUIRED.
FLUIDS SUSCEPTIBILITY	11.0	EQUIPMENT IDENTIFIED AS 'X.' NO TEST REQUIRED.
SAND AND DUST	12.0	EQUIPMENT IDENTIFIED AS 'X.' NO TEST REQUIRED.
FUNGUS RESISTANCE	13.0	EQUIPMENT IDENTIFIED AS 'X.' NO TEST REQUIRED.
SALT SPRAY	14.0	EQUIPMENT IDENTIFIED AS 'X.' NO TEST REQUIRED.
MAGNETIC EFFECT	15.0	EQUIPMENT TESTED TO

CMS-400
Environmental Qualification Test Summary

		CATEGORY B
POWER INPUT	16.0	EQUIPMENT TESTED TO CATEGORY B
VOLTAGE SPIKE	17.0	EQUIPMENT TESTED TO CATEGORY A
AUDIO FREQUENCY CONDUCTED SUSCEPTIBILITY - POWER INPUTS	18.0	EQUIPMENT TESTED TO CATEGORY B
INDUCED SIGNAL SUSCEPTIBILITY	19.0	EQUIPMENT TESTED TO CATEGORY B
RADIO FREQUENCY SUSCEPTIBILITY	20.0	EQUIPMENT TESTED TO CATEGORY B
RADIO FREQUENCY EMISSION	21.0	EQUIPMENT TESTED TO CATEGORY B
REMARKS:		
<p>1. THE TEST UNIT WAS VIBRATED AT A RANDOM VIBRATION LEVEL OF 6.0 grms.</p> <p>2. THE CMS-400 SUCCESSFULLY PASSED ALL TESTING AT THE LISTED CATEGORIES.</p>		

4

3

2

1

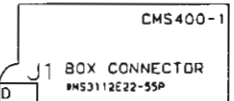
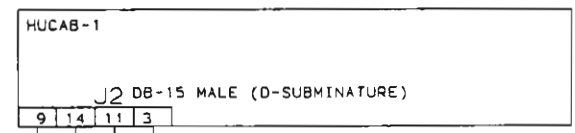
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	MISC CHANGES	03-26-97	J. HEADER

AIRCRAFT BUSES

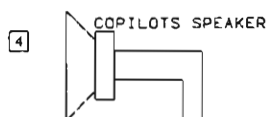
- 28V BATTERY/PE BUS
- GROUND/CHASSIS BUS
- PANEL LIGHTING BUS
- PANEL LIGHTING RETURN BUS

OPTIONAL REMOTE CONTROLS

- PILOT SKIP
- COPILOT SKIP
- PILOT ADV
- COPILOT ADV



FUNCTION	WIRE #	CONNECTOR
TXD	[HUC-04]	D
		C
		F
		E
-28VDC IN	[HUC-36]	n
GROUND	[HUC-35]	m
PANEL LIGHTING IN	[HUC-02]	B
PANEL LIGHTING RETURN	[HUC-01]	A
PILOT SKIP	[HUC-12]	M
PILOT SKIP RETURN	[HUC-11]	L
COPILOT SKIP	[HUC-14]	P
COPILOT SKIP RETURN	[HUC-13]	N
PILOT ADV	[HUC-08]	H
PILOT ADV RETURN	[HUC-07]	G
COPILOT ADV	[HUC-10]	K
COPILOT ADV RETURN	[HUC-09]	J
PILOT SPEAKER	[HUC-32]	i
SPEAKER RETURN	[HUC-31]	h
PILOT XFORMER OUT	[HUC-34]	k
XFORMER RETURN	[HUC-33]	j
COPILOT SPEAKER	[HUC-38]	p
SPEAKER RETURN	[HUC-37]	f
COPILOT XFORMER OUT	[HUC-40]	e
XFORMER RETURN	[HUC-39]	d
SHIELD GROUND		



TO PILOTS COCKPIT AUDIO HO
AMP. AUX INPUT LO

TO PILOTS COCKPIT AUDIO HO
AMP. AUX INPUT LO

NOTES UNLESS OTHERWISE SPECIFIED

- ALL WIRING TO BE INSTALLED IN ACCORDANCE WITH FAA AC-4313 CHAPTER 11 SEC 2.
- ALL WIRE TO BE MIL-22759-16-22-9, SHIELDING TO BE PER MIL-C-27500.
- CONNECTION TO BRIEFER COMPUTER FOR AUTOBRIEF FEATURE
- SPEAKER IMPEDANCE TO BE 4-8 OHMS. USE 4 OHM SPEAKERS IN NOISY COCKPITS

DMN	DATE	9/16/91
J. HEADER	DATE	9/16/91
APPROVED	DATE	9/16/91
R. BURKEY	DATE	9/16/91

HT Heads Up Technologies
2033 Chennault Ste. 100
Carrollton, Texas 75006

FBO	TITLE		
OPEN	EXTENDED CMS400 INSTALL		
USER	SIZE	UNIT SPEC	DRAWING NO
OPEN	A	OPEN	CMS400-11
AIRCRAFT TYPE	SHEET NO	REV CODE	FILENAME
OPEN	1 OF 1	A	\\INSTALL\CMS400\CMS4-11.P01

4

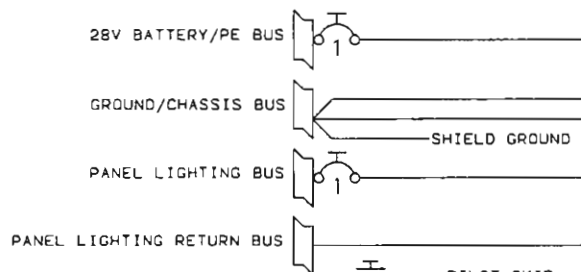
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2

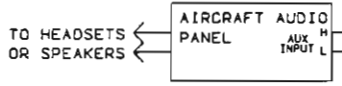
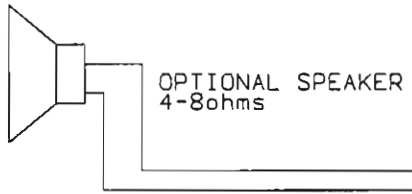
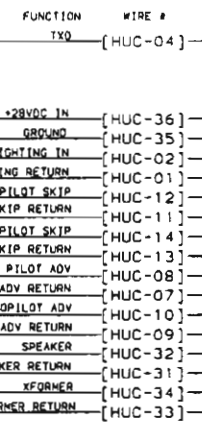
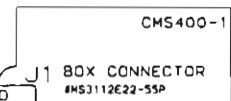
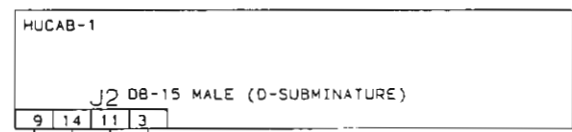
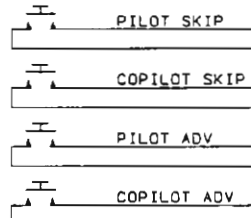
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REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	DWG NO CHANGE	1/16/91	D MURPHY
B	MISC CHANGES	03-26-97	J. HEADER

AIRCRAFT BUSES



OPTIONAL REMOTE CONTROLS

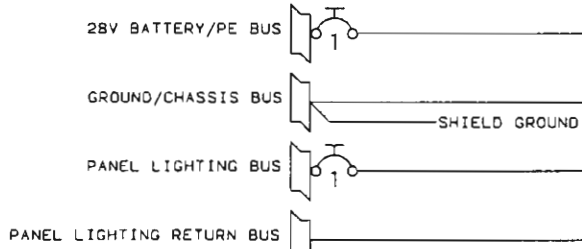


- NOTES: UNLESS OTHERWISE SPECIFIED
- ALL WIRING TO BE INSTALLED IN ACCORDANCE WITH FAA AC-4313 CHAPTER 11 SEC.2.
 - ALL WIRE TO BE MIL-22759-16-22-9. SHIELDING TO BE PER MIL-C-27500.
 - CONNECTION TO BRIEFER COMPUTER FOR AUTOBRIEF FEATURE
 - SPEAKER IMPEDANCE SHALL BE NO LESS THAN 4ohms.
 - TRANSFORMER OUTPUT CONNECTED TO 500ohm INPUT OF AIRCRAFT AUDIO PANEL (e.g. OME2, AUX, etc)

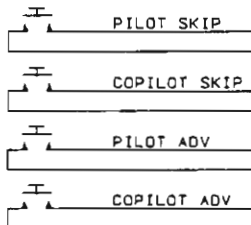
OWN J.D. Header	DATE 1/14/91	Heads Up Technologies 2033 Chennault Ste 100 Carrollton, Texas 75006	
APPROVED R. Burkholder	DATE 1/14/91	TITLE CMS-400/HUCAB INSTALLATION	
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USER OPEN	SHEET NO 1 OF 1	REV CODE B	FILENAME \\INSTALL\CMS400\CMS4-9 P01

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	MISC CHANGES	03-26-97	<i>J.D. Header</i>

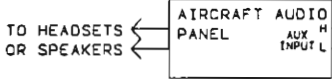
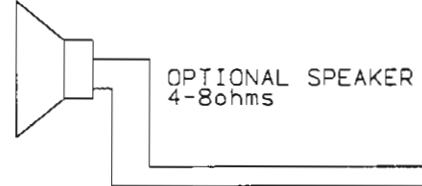
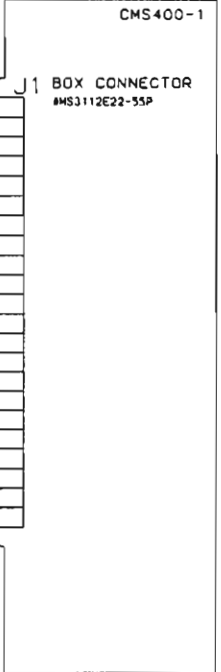
AIRCRAFT BUSES



OPTIONAL REMOTE CONTROLS



FUNCTION	WIRE #
NC	D
NC	C
NC	F
NC	E
*28VDC IN	[HUC-36]
GROUND	[HUC-35]
PANEL LIGHTING IN	[HUC-02]
PANEL LIGHTING RETURN	[HUC-01]
PILOT SKIP	[HUC-12]
PILOT SKIP RETURN	[HUC-11]
COPILOT SKIP	[HUC-14]
COPILOT SKIP RETURN	[HUC-13]
PILOT ADV	[HUC-08]
PILOT ADV RETURN	[HUC-07]
COPILOT ADV	[HUC-10]
COPILOT ADV RETURN	[HUC-09]
SPEAKER	[HUC-32]
SPEAKER RETURN	[HUC-31]
XFORMER	[HUC-34]
XFORMER RETURN	[HUC-33]



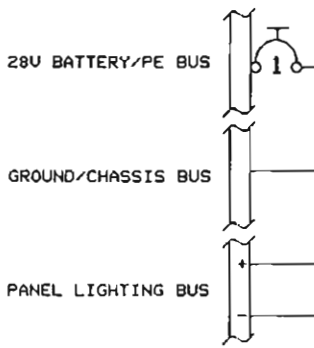
- NOTES, UNLESS OTHERWISE SPECIFIED
1. ALL WIRING TO BE INSTALLED IN ACCORDANCE WITH FAA AC-4313 CHAPTER 11 SEC.2
 2. ALL WIRE TO BE PER MIL-22759-16-22-9. SHIELDING TO BE PER MIL-C-27500.

3. SPEAKER IMPEDANCE SHALL BE NO LESS THAN 4ohms.
4. TRANSFORMER OUTPUT CONNECTED TO 500ohm INPUT OF AIRCRAFT AUDIO PANEL (e.g., OME2, AUX, etc.)

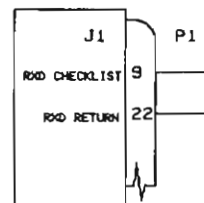
OWN J.D. Header	DATE 1/14/91	Heads Up Technologies 2033 Chennault Ste 100 Carrollton, Texas 75006	
APPROVED R Burkey	DATE 1-27-97	TITLE BASIC CMS-400 INSTALLATION	
FBO OPEN	SIZE A	UNIT SPEC OPEN	DRAWING NO CMS400-B
AIRCRAFT TYPE OPEN	SHEET NO 1 OF 1	REV CODE A	FILENAME .\INSTALL\CMS400\CMS4-B.P01

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

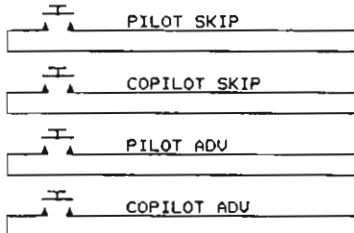
AIRCRAFT BUSES



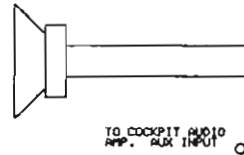
OPTIONAL PBS400-1 REMOTE COMPUTER



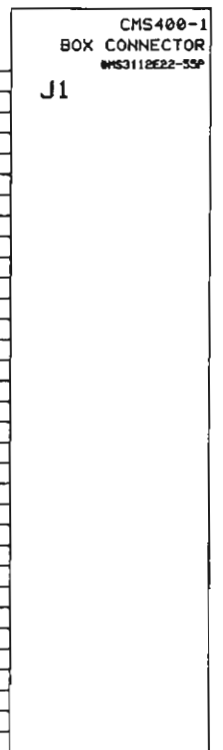
OPTIONAL REMOTE CONTROLS



4



FUNCTION	WIRE #	P1
TXD	[HUC-04]	D
TXD RETURN	[HUC-03]	C
		F
		E
*28VDC IN	[HUC-36]	n
GROUND	[HUC-35]	m
PANEL LIGHTING IN	[HUC-02]	B
PANEL LIGHTING RETURN	[HUC-01]	A
PILOT SKIP	[HUC-12]	M
PILOT SKIP RETURN	[HUC-11]	L
COPILOT SKIP	[HUC-14]	P
COPILOT SKIP RETURN	[HUC-13]	N
PILOT ADU	[HUC-08]	H
PILOT ADU RETURN	[HUC-07]	G
COPILOT ADU	[HUC-10]	K
COPILOT ADU RETURN	[HUC-09]	J
PILOT SPEAKER	[HUC-32]	i
SPEAKER RETURN	[HUC-31]	h
PILOT XFORMER OUT	[HUC-34]	k
XFORMER RETURN	[HUC-33]	j
[SHIELD GROUND]		p



OPTIONAL AUDIO OUTPUTS SEE DWG# CMS400-13

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL WIRING TO BE INSTALLED IN ACCORDANCE WITH FAA AC-4313 CHAPTER 11 SEC.2.
 2. ALL WIRE TO BE MIL-22759-16-22-9, SHIELDING TO BE PER MIL-C-27500.
- 3 CONNECTION TO BRIEFER COMPUTER FOR AUTOBRIEF FEATURE.
- 4 SPEAKER IMPEDANCE TO BE 4-8 OHMS. USE 4 OHM SPEAKERS IN NOISY COCKPITS.

DATE	DATE
APPROVED	DATE
FBO	
USER	
AIRCRAFT TYPE	

Heads Up Technologies
 2611 Westgrove Ste.110
 Carrollton, Texas 75006

STANDARD CMS400 INTERFACE WITH PBS400

SIZE	UNIT SPEC	DRAWING NO.
C	CMS400	CMS400-12

SHEET NO.	REV CODE	FILENAME
1 OF 1	NONE	CMS40012

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

AIRCRAFT BUSES

28V BATTERY/PE BUS

GROUND/CHASSIS BUS

PANEL LIGHTING BUS

OPTIONAL PBS400-1
REMOTE COMPUTER

OPTIONAL REMOTE CONTROLS

PILOT SKIP

COPILOT SKIP

PILOT ADU

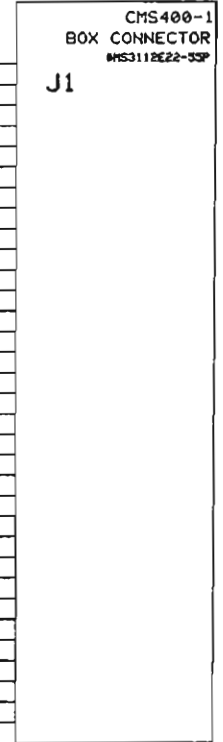
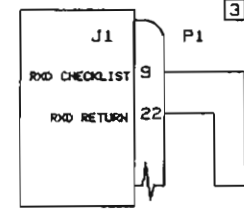
COPILOT ADU

COPILOTS SPEAKER

PILOTS SPEAKER

TO PILOTS COCKPIT AUDIO
AMP. AUX INPUT

TO COPILOTS COCKPIT AUDIO
AMP. AUX INPUT



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL WIRING TO BE INSTALLED IN ACCORDANCE WITH FAA AC-4313 CHAPTER 11 SEC.2.
2. ALL WIRE TO BE MIL-22759-16-22-9, SHIELDING TO BE PER MIL-C-27500.
- 3 CONNECTION TO BRIEFER COMPUTER FOR AUTOBRIEF FEATURE.
- 4 SPEAKER IMPEDANCE TO BE 4-8 OHMS. USE 4 OHM SPEAKERS IN NOISY COCKPITS.
- 5 JUMPER LANDING GEAR INPUTS 1,2,3 TO GEAR RETURN.

DATE	10/16/92
APPROVED	R.B. 10/19/92
FBO	OPEN
USER	OPEN
AIRCRAFT TYPE	OPEN

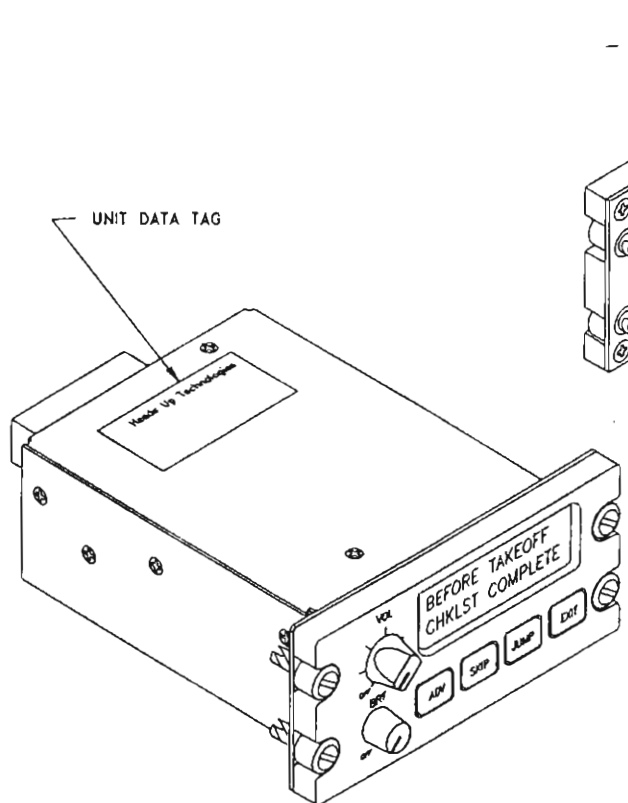
Heads Up Technologies
 2611 Westgrove Ste.110
 Carrollton, Texas 75006

EXTENDED CMS400 INTERFACE WITH PBS400

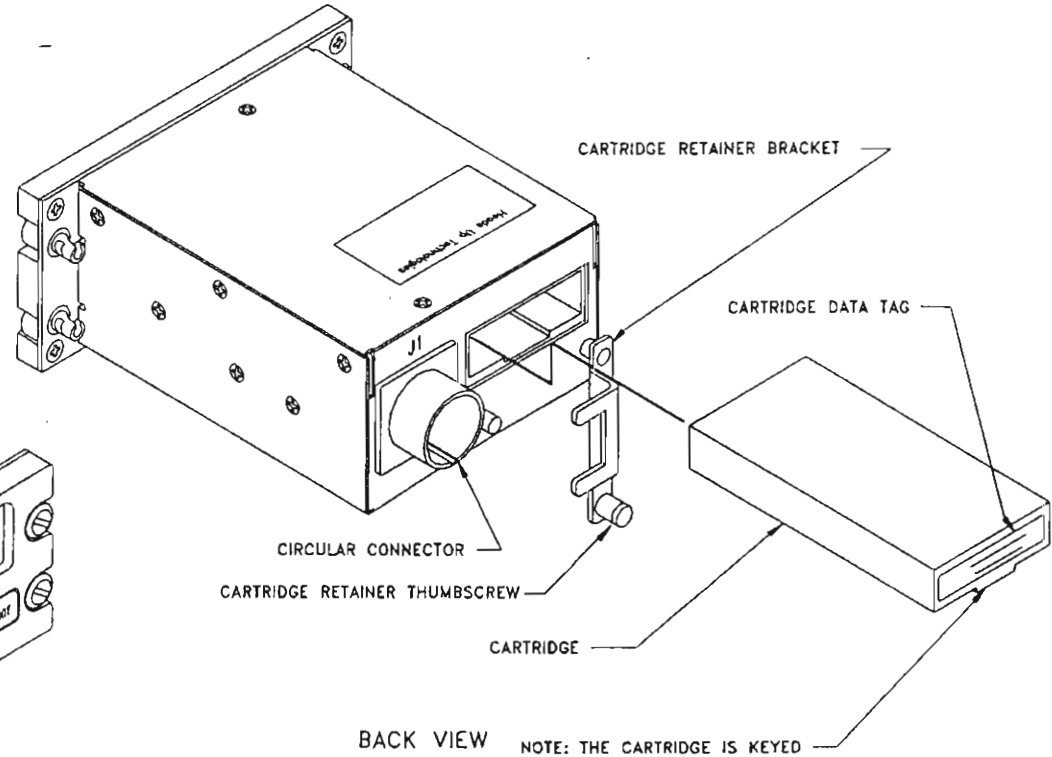
SIZE	UNIT SPEC	DRAWING NO.
C	CMS400	CMS400-13
SHEET NO.	REV CODE	FILENAME
1 OF 1	NONE	CMS40013

NOTES: UNLESS OTHERWISE SPECIFIED:

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ENGINEERING CHANGES	9/10/90	DJM
B	ADDED BRACKET TO BACK VIEW CHANGED PART NUMBER	1/16/91	DJM
C	CORRECTED THE PICTORIALS AND ADDED SIGNATURES	3/14/91	DJM



FRONT VIEW



BACK VIEW

NOTE: THE CARTRIDGE IS KEYED

SEQ NO	PROCESS	ADDITIONAL	NOTES

QTY	ITEM NO	PART NUMBER	DESCRIPTION	SPECIFICATION	NOTES
PARTS LIST					
6/23/90 D. Murphy		<ul style="list-style-type: none"> INCLUDE FINISHES SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: <ul style="list-style-type: none"> FRACTIONS: ±.005 DECIMALS: ±.005 ANGLES: ±.05 2 PLACE DECIMALS: ±.01 MISFIRE! BEARING FOR 1000-8-1000 REMOVE ALL BURRS AND SHARP EDGES CONCENTRICITY MATCHED DIMENSIONS .010 P.M. FUNCTIONAL LOTS AND APPROV. PROCESSES FUNCTIONAL TO TOI BY OI 		DATE: 6/23/90 CHECKED: D. MURPHY DATE: 6/23/90 DRAWN: D. MURPHY DATE: 6/23/90 APPROVED: E. MARSHAW DATE: 7/23/90 RELEASED: E. MARSHAW DATE: 3/14/91	
CMS400-1		HOLE DIMETER TOLERANCE		HEADS UP TECHNOLOGIES 2811 W. UNIVERSITY BLVD. SUITE 110 CORPUS CHRISTI, TX 78408 (512) 407-1121	
NEXT ASSY		(SIGNATURES ON FILE)		CARTRIDGE CHECKLIST ISOMETRIC VIEW SHEET: C FILENAME: P:\ACAD\ULAYOUT \C\ULISTS DRAWING NO: CMS400-30	
		CONTRACT: NOT APPLICABLE		SCALE: NONE	
		PROJECT: NOT APPLICABLE		REV. C	

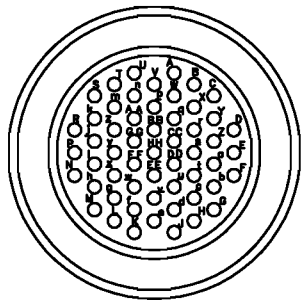
CMS400-30
 112
 A
 B
 C
 A

NOTES: UNLESS OTHERWISE SPECIFIED:

1. THE CONNECTOR CONFORMS TO MIL-C-26482, SERIES 1.
2. DESCRIPTION: MS3116, STRAIGHT PLUG
SHELL SIZE: 22
NUMBER OF PINS: 55
CONTACT TYPE: SOCKET, CRIMP

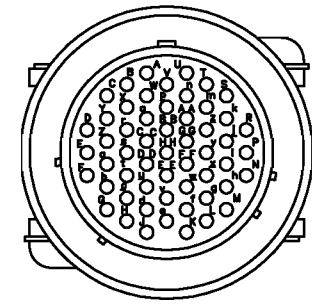
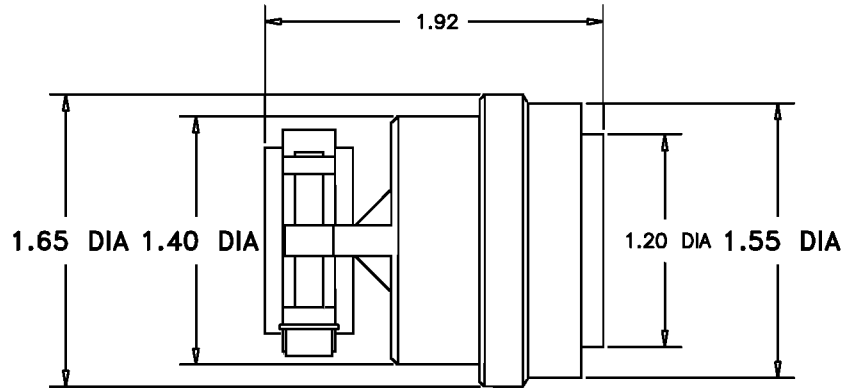
3. THE CONNECTOR BACK SHELL HAS BEEN OMITTED FOR CLARITY.
4. FONT: WHITE LETTERS ON BLACK BACKGROUND, HELVETICA MEDIUM PT SIZE 8.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADDED PLACARDS AND CRIMP SOCKETS TO DRAWING.	6/16/93	D. MURPHY
B	ADDED BOM	6/25/02	K.RICHARDS

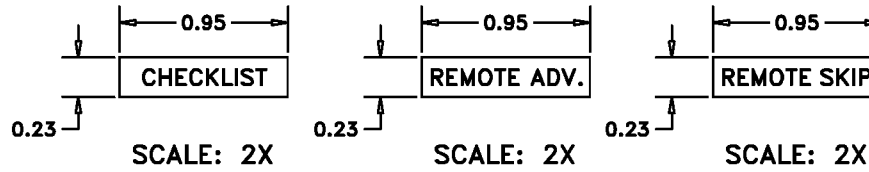


BACK VIEW

3



FRONT VIEW



PLACARDS
QTY: 1 EACH

4

SOCKET, CRIMP
QTY 55

QTY	ITEM NO	PART NUMBER	DESCRIPTION	SPECIFICATION	NOTES
1	5	CMS400-3	INSTALLATION MANUAL		
1	4	CMS400-4	USER MANUAL		
1	3	HDW077	PLACARD KIT		
1	2	CON420	55-PIN CONNECTOR		
1	1	CMS400-KL-GENERIC	CMS-400 INSTALLATION KIT		

PARTS LIST		HEADS UP TECHNOLOGIES	
<p>UNLESS OTHERWISE SPECIFIED:</p> <ul style="list-style-type: none"> • DIMENSIONS ARE IN INCHES • FINISH: POLISH • TOLERANCES UNLESS OTHERWISE SPECIFIED: • SURFACE FINISH: RA 1.6 • DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED • DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED • DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED • DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED 	<p>DATE: 2/21/01</p> <p>DATE: 2/21/01</p> <p>DATE: 2/21/01</p> <p>DATE: 2/21/01</p> <p>DATE: 2/21/01</p>	<p>Head Up Technologies</p> <p>2811 Westgate, Suite 110</p> <p>Carrollton, TX 75006 (514) 497-1191</p>	<p>CMS-400 INSTALLATION KIT</p>
<p>CMS 400</p> <p>USED ON</p>	<p>CMS400-11D</p> <p>NEXT ASSY</p>	<p>FILENAME: CMS400-7.DWG</p> <p>SIZE: 11.0</p> <p>DATE: 2/21/01</p>	<p>DRAWING NO: CMS400-7</p> <p>SHEET NO: 1</p>

CAD GENERATED DRAWING

CMS400-7

SEQ NO	PROCESS	ADDITIONAL	NOTES

