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REV D
APRIL 2000

OPERATION AND MAINTENANCE MANUAL

FOR

MODEL 7122B/7133B ANTENNA CONTROL UNIT INCLUDING UNITS WITH 3 PHASE POLARIZATION MOTORS

CAUTIONARY NOTICE

Although the manufacturer has attempted to detail in this manual all areas of possible danger to personnel in connection with the use of this equipment, personnel should use caution when installing, checking out, operating, and servicing this equipment. Care should be taken to avoid electrical shock, whether the hazard is caused by design or malfunction.

The manufacturer is specifically not liable for any damage or injury arising from failure to follow the instructions contained in this manual or failure to exercise due care and caution in the installation, operation, checkout, and service of this equipment.

PROPRIETARY NOTICE

WARNING

THE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS. PERSONNEL MUST AT ALL TIMES OBSERVE SAFETY REGULATIONS.

PLEASE READ THE FOLLOWING PRECAUTIONS

This manual is intended as a general guide for trained and qualified personnel who are aware of the dangers of handling potentially hazardous electrical and electronic circuits. This manual is not intended to contain a complete statement of all safety precautions that should be observed by personnel in using this or other electronic equipment.

The installation, operation, maintenance, and service of this equipment involves risks both to personnel and equipment and must be performed only by qualified personnel exercising due care. Vertex Communications Corporation shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks.

During installation and operation of this equipment, local building codes and fire protection standards must be observed.

WARNING

ALWAYS DISCONNECT POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, GATES, PANELS, OR SHIELDS. ALWAYS USE GROUNDING STICKS AND SHORT OUT HIGH VOLTAGE POINTS BEFORE SERVICING. NEVER MAKE INTERNAL ADJUSTMENTS OR PERFORM MAINTENANCE OR SERVICE WHEN ALONE OR FATIGUED.

Do not remove, short-circuit, or tamper with interlock switches on access covers, doors, enclosures, gates, panels, or shields. Keep away from live circuits. Know your equipment and don't take chances.

WARNING

IN CASE OF EMERGENCY BE SURE THAT POWER IS DISCONNECTED.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 The Purpose of the 7122B/7133B Manual

The purpose of this manual is to provide the user with the information necessary to install and operate the Vertex Model 7122B/7133B Antenna Control Unit (ACU). This manual contains only the information related to the 7122B/7133B ACU and contains only limited information about the antenna structure or other equipment peripheral to the 7122B/7133B.

1.2 General Information about the 7122B/7133B ACU

The 7122B/7133B controller series is designed for applications requiring high reliability and low cost. The readout system provides 0.02E resolution, using brushless 2.5 KHz resolvers. The motor drive circuit provides the operator with single speed, real-time drive control.

The 7133B controls the elevation and azimuth movement of the antenna and the polarization movement of the feed horn. The 7122B controls only the elevation and azimuth movement of the antenna. Otherwise, the 7122B and the 7133B are identical.

1.2.1 System Hardware

The 7122B/7133B controller consists of the following subsystems:

- Model 7122B/7133B ACU
- Model 7122B/7133B OU
- Resolver

7122 and 7133 are Vertex's basic system model numbers. ACU is the acronym for antenna control unit, which refers to the 19-inch rack-mountable unit used in the shelter or other antenna control room. OU is the acronym for outside unit, which refers to the weather-proof cabinet typically installed near the antenna.

The ACU interfaces with starters and motors for elevation, azimuth, and polarization positioning of the antenna. The elevation, azimuth, and polarization limit interfaces are normally closed switches that open upon engagement.

1.2.1.1 7122B/7133B ACU

The primary components of the 7122B/7133B ACU are:

- Front Panel

- Power Supply
- Resolver/Digital PC Board
- Display Board Assembly
- Binary/BCD Board Assembly
- Switch PC Board Assembly

The front panel contains the POWER ON/OFF switch that controls the power to the circuit boards on the 7122B/7133B ACU.

The 7122/7133 Controller Resolver to Digital PC Board Assembly (800029) converts the analog output of the elevation, azimuth, and polarization resolvers to digital.

The 7122/7133 A, B, and C Antenna Control Unit Front PC Board (800026) contains seven-segment displays and associated circuitry for display of the elevation, azimuth, and polarization positions of the antenna.

The Front Switch PC Board (800032 - 7133B; 800050 - 7122B) contains three-position momentary on/off switches that control the elevation, azimuth, and polarization movement of the antenna.

1.2.1.2 7122B/7133B OU Drive Cabinet

The 7122B/7133B OU consist of the following major components:

- Swing-Out Panel
- MAIN POWER Circuit Breaker
- EMERGENCY STOP Switch
- 24 VDC Power Supply
- Reversing Starters
- Relay PC Board

The swing-out panel allows the operator to control antenna movement from the proximity of the antenna.

The MAIN POWER circuit breaker controls the main power and the power to the OU cabinet and the limit switches.

The EMERGENCY STOP switch, when pressed, removes power from the drive motors.

The 24 VDC power supply provides operating voltage to the 7122B/7133B OU antenna drive relay circuit board.

2.0 INSTALLATION AND INITIAL SET-UP

WARNING

Always disconnect power before opening covers, doors, enclosures, gates, panels, or shields. Never make internal adjustments or perform maintenance or service when alone or fatigued. Main power connections and grounding should be performed by qualified personnel. Keep away from live circuits; know your equipment and don't take chances. In case of emergency, be sure to disconnect power before touching equipment or personnel in contact with the equipment.

2.1 Overview

This section of the manual provides the information necessary for the installation and initial set-up of the 7122B/7133B ACU.

The system installation and set-up instructions are presented in the following general order.

- Mechanical Installation
- System Cabling
- Power-Up and Set-Up

2.2 Mechanical Installation

2.2.1 Antenna Mounted Components

Proper and complete installation of the 7122B/7133B outside unit, motors, resolvers, and limit switches is imperative for safe and accurate system operation. Refer to the mechanical drawings supplied in the drawing package separate from this manual for mechanical interface details and complete this phase of installation first.

2.2.2 Installing the 7122B/7133B ACU

Using four No. 10 screws, mount the 7122B/7133B ACU inside a standard 19-inch EIA rack. No added support is necessary.

2.3 System Cabling

Refer to Figure 2-1 for a block diagram of the 7122B/7133B Antenna Control System. The following paragraphs describe the cabling and list the connections for the 7122B/7133B. Cables must be connected from the antenna to the OU, from the OU to the 7122B/7133B ACU, and from the antenna resolvers to the ACU. Be sure the cables are connected correctly and securely because proper functioning of the system during power-up is important for the protection of the equipment and for timely completion of the installation.

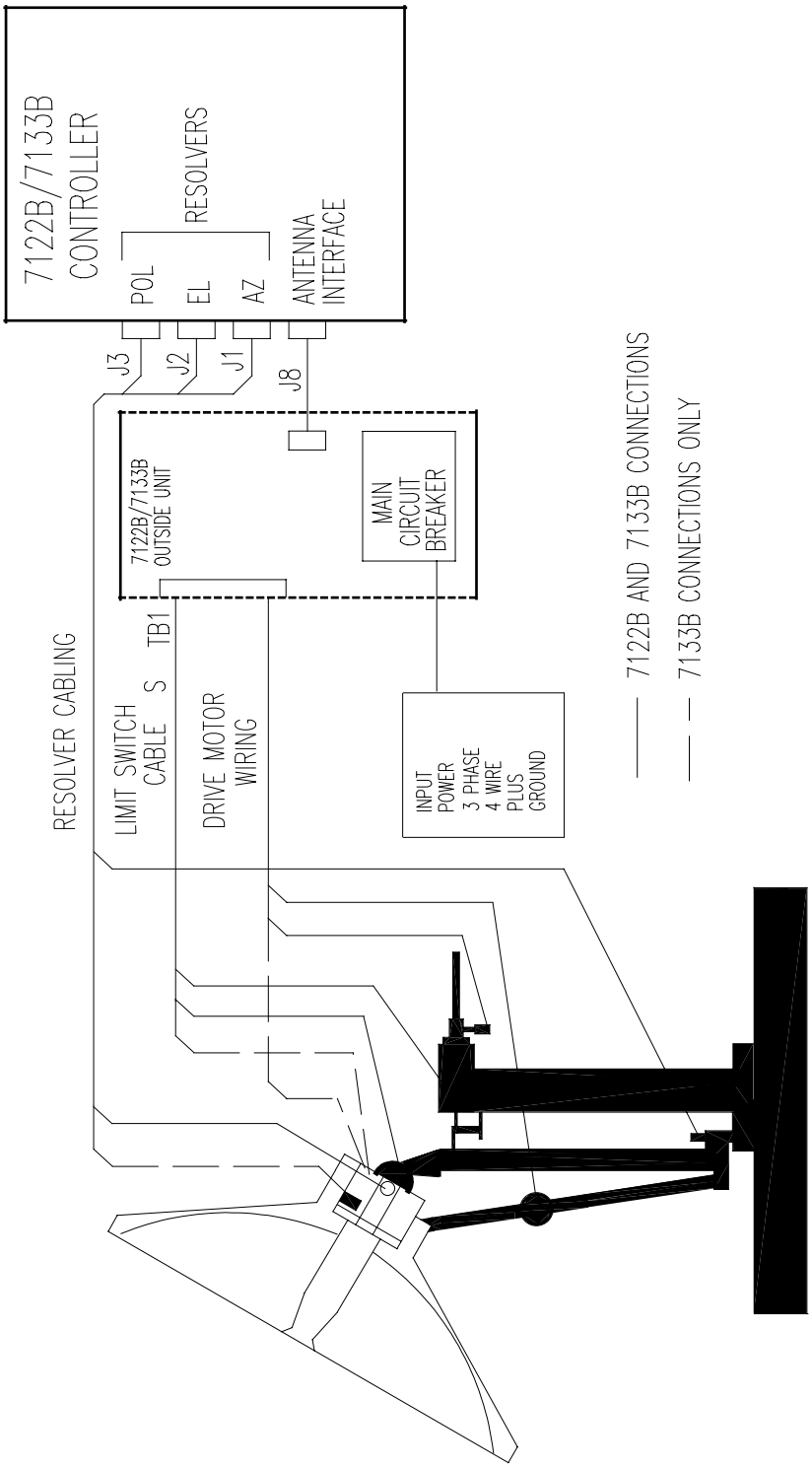

Figure 2-1. 7133B Antenna Control System Block Diagram

Table 2-1 shows the connections between the ACU and the OU.

TABLE 2-1. 7122B/7133B ACU CONNECTIONS TO 7122B/7133B OU

ACU, J8 PIN NO.	FUNCTION	OU TERMINAL STRIP
1	AZ CW COMMAND	1
2	AZ COMMON	2
3	AZ CCW COMMAND	3
4	EL UP COMMAND	4
5	EL COMMON	5
6	EL DOWN COMMAND	6
7	POL CW COMMAND	7
8	POL COMMON	8
9	POL CCW COMMAND	9
10	AZ CW LIMIT	10
11	AZ CCW LIMIT	11
12	EL UP LIMIT	12
13	EL DOWN LIMIT	13
14	POL CW LIMIT	14
15	POL CCW LIMIT	15
16	EMERGENCY STOP	16
17	GROUND	17
18	GROUND	18
19	+24V	19
20	+24V	20

The resolvers are connected as shown in Table 2-2.

TABLE 2-2. 7122B/7133B ACU RESOLVER CONNECTIONS

PIN NO.	COLOR	FUNCTION
2	Red/White	R1
8	Yellow/White	R2
9	Red	S1
5	Blue	S2
4	Black	S3
3	Yellow	S4
1,6,7		SHIELD

After installation is complete, if one or more of the resolvers is counting backward or if electrical zero is almost 180E out of phase, perform one of the following tasks.

1. Reverse S2 and S4 (SIN) leads to reverse direction without shifting electrical zero.

2. Reverse S1 and S3 (COS) leads to shift electrical zero and reverse direction.

3. Reverse R1 and R2 (REF) leads to shift electrical zero 180°. Direction remains the same.

2.4 Display Offset Adjustment

The elevation, azimuth, and polarization readout angle may be adjusted with the digital switches inside the 7122B/7133B ACU using the following procedures.

1. Remove the top cover and locate the six 8-bit digital DIP switches (four on the 7122B) on the binary/BCD board, mounted to the left side of the chassis.

2. The offset switches are labeled AZ (S1 and S2), EL (S3 and S4), and POL (S5 and S6). Switches 1 and 2 are not used on DIP switches S1, S3, and S5. Switch 3 on DIP switches S1, S3, and S5 controls the most significant bit (180°) and switch 8 or DIP switches S2, S4, and S6 controls the least significant bit (0.022°). Set the switches to obtain the desired display angles.

3. To intentionally blank an axis, set the 16 switches as follows: (MSB)1010101010101010(LSB)

4. Replace the top cover.

3.0 OPERATION

3.1 7122B/7133B ACU

The front panel controls of the 7122B/7133B ACU are shown in the following table.

7122B/7133B ACU CONTROLS AND INDICATORS	
CONTROL OR INDICATOR	**FUNCTION**
POWER ON/OFF Switch	Provides power for the ACU.
AZIMUTH, POLARIZATION, and ELEVATION Indicator	7-segment displays indicate the azimuth, polarization, and elevation angle of the antenna.
LIMITS AZ CW/CCW, POL CW/CCW, and EL UP/EL DOWN Indicators	LEDs illuminate if the respective limit switch is activated.
EMERGENCY Indicator	LED illuminates if the Emergency Stop Switch is activated.
AZ CW/CCW Switch	Momentary switch provides jog control of the antenna azimuth drive motor.
POL CW/CCW Switch	Momentary switch provides jog control of the polarization drive motor (feed tube rotation).
EL UP/DOWN Switch	Momentary switch provides jog control of the antenna elevation drive motor.

3.2 7122B/7133B OU

The 7122B/7133B OU is a self-contained motor drive unit that can operate the antenna drive motor without using the 7122B/7133B ACU. However, the 7122B/7133B OU has no display to show the antenna position.

3.2.1 7122B/7133B OU Controls

The following table shows the functions of the controls on the 7122B/7133B OU.

7122B/7133B OU CONTROLS	
CONTROL	**FUNCTION**
MAIN POWER Circuit Breaker	Controls power to the elevation, azimuth, and polarization motors, the limit switches, and the 7122B/7133B ACU.
MAINT/REMOTE Switch	In the REMOTE position only the 7122B/7133B ACU controls antenna movement. In the MAINT position only the 7122B/7133B OU controls antenna movement.
EMERGENCY STOP Switch	Located on the side of the OU. The push button must be pulled outward before the ACU or OU can be used to control the movement of the antenna. Pressing this button removes the control voltage to the motor contactor.
EL UP/DOWN Switch	Momentary contact switch that controls the elevation movement of the antenna.
POL CW/CCW Switch	Momentary contact switch that controls the polarization movement of the feed tube.
AZ CW/CCW Switch	Momentary contact switch that controls the azimuth movement of the antenna.

4.0 ACCEPTANCE TEST PROCEDURE

4.1 Preliminary Information

This test procedure is intended to serve as the final proof of performance document for the 7122B/7133B ACU, subsequent to field installation and set-up. Prior to the performance of these tests, the system must have been installed and adjusted as described in Section 2.0 of this manual. Motor rotation direction should be normalized and limit stops should be set.

4.2.1 Maintenance Mode

1. On the 7122B/7133B OU set the MAIN POWER circuit breaker to ON. _____(Check)

2. Verify that the EMERGENCY STOP button is in the out position. _____(Check)

3. Set the MAINT/REMOTE switch to MAINT. _____(Check)

4. Using the EL UP/DOWN switch, drive the antenna and verify correct directional movement of the antenna. _____(Check)

5. Using the EL UP/DOWN switch, drive the antenna UP and verify that the limit switch stops the movement of the antenna. _____(Check)

6. Using the EL UP/DOWN switch, drive the antenna DOWN and verify that the limit switch stops the movement of the antenna. _____(Check)

7. Using the AZ CW/CCW switch, drive the antenna and verify correct directional movement of the antenna. _____(Check)

8. Using the AZ CW/CCW switch, drive the antenna CW and verify that the limit switch stops the movement of the antenna. _____(Check)

9. Using the AZ CW/CCW switch, drive the antenna CCW and verify that the limit switch stops the movement of the antenna. _____(Check)

10. Using the POL CW/CCW switch, drive the feed horn and verify correct directional movement of the feed horn. _____(Check)

11. Using the POL CW/CCW switch, drive the feed horn CW and verify that the limit switch stops the movement of the feed horn. _____(Check)

12. Using the POL CW/CCW switch, drive the feed horn CCW and verify that the limit switch stops the movement of the feed horn. _____(Check)

4.2.2 Remote Mode

1. Set the MAINT/REMOTE switch on the 7122B/7133B OU to REMOTE. _____(Check)

2. From the 7122B/7133B ACU drive the antenna in elevation and verify correct directional movement of the antenna. _____(Check)

3. Drive the antenna UP and verify that the limit switch stops the movement of the antenna. _____(Check)

4. Drive the antenna DOWN and verify that the limit switch stops the movement of the antenna. _____(Check)

5. From the 7122B/7133B ACU drive the antenna in azimuth and verify correct directional movement of the antenna. _____(Check)

6. Drive the antenna CW and verify that the limit switch stops the movement of the antenna. _____(Check)

7. Drive the antenna CCW and verify that the limit switch stops the movement of the antenna. _____(Check)

8. From the 7122B/7133B ACU drive the feed horn and verify correct directional movement of the feed horn. _____(Check)

9. Drive the feed horn CW and verify that the limit switch stops the movement of the feed horn. _____(Check)

10. Drive the feed horn CCW and verify that the limit switch stops the movement of the feed horn. _____(Check)

5.0 RECOMMENDED SPARES

The following tables list the recommended spares for the 7122B/7133B ACU and Drive Cabinet.

7122B/7133B ACU RECOMMENDED SPARES		
QTY	**DESCRIPTION**	**VERTEX PART NO.**
1	Circuit Breaker, 1A	CCB007
1	Power Supply +5, –12 VDC	CPS004
1	PCB, Display	BBB035
1	PCB, Resolver/Digital	BBB056
1	PCB, Binary/BCD	BBB057
1	PCB, Switch	BBB042

7122B/7133B DRIVE UNIT RECOMMENDED SPARES		
QTY	**DESCRIPTION**	**VERTEX PART NO.**
1	Circuit Breaker, 3-Pole, 20A	CCB074
1	Circuit Breaker, 3-Pole, 6A	CCB092
1	Circuit Breaker, 3-Pole, 2A	CCB081
1	Circuit Breaker, 1-Pole, 1A	CCB076
1	Reversing Contactor	CPC056
1	Relay, Thermal Overload 4.0A	BRL125
1	Relay, Thermal Overload 1.6A	BRL126
1	Power Supply, 24 VDC	CPS002
1	PCB, Relay	800057-01
1	PCB, Switch	800057-02

6.0 ENGINEERING DRAWINGS

The following list shows the engineering drawings provided in this section.

200000 Binary-BCD Board Schematic

201023 Drive Unit (3 PH POL) 208-240 VAC 3 Phase, 7133B Custom

201027 Antenna Drive Unit 208-220-240 VAC 3 Phase, 7133B Series 2

800020 7122B Outside Unit Top Assembly and Wiring Diagram

800026 7122/7133 A, B, and C Antenna Control Unit Front PC Board Layout

800029 7122/7133 Controller Resolver to Digital PC Board Assembly

800032 Model 7133A/7133B Front Switch PC Board Layouts and Assemblies

800034 Model 7122/7133 Antenna Controller Binary to BCD PC Board Assembly

800050 Model 7122A/7122B Front Switch PC Board Layouts and Assemblies

800057 Model 7133B OU Drive Unit Relay and Switch PC Board Assemblies

800151 Model 7122B Drive OU Relay and Switch PC Board Assemblies

800153 Model 7122B Antenna Control Unit Assembly and Wiring Diagram

800455 Model 7133B Antenna Control Unit 120/220-240 VAC, 1PH STD

800631 Antenna Drive Unit 380-415 VAC, 3 Phase Model 7133B

APPENDIX A - ACRONYMS AND ABBREVIATIONS

The following is a list of acronyms and abbreviations that are used by Vertex Control Systems and may appear in this manual.

A	Amperes
AC	Alternating Current
ACS	Antenna Control System
ACU	Antenna Control Unit
A/D	Analog-to-Digital
ADU	Antenna Drive Unit
AGC	Automatic Gain Control
AOS	Acquisition of Star
ASCII	American Standard Code for Information Interchange
ASSY	Assembly
AST	Adaptive Steptrack
AZ	Azimuth
BCD	Binary Coded Decimal
BDC	Block Downconverter
BIT	Built-In Test
BW	Bandwidth
CCW	Counterclockwise
CFE	Customer-Furnished Equipment
COM	Common
CPU	Central Processing Unit
CR	Carriage return
CRLF	Carriage return/line feed
CW	Clockwise
dB	Decibel
dBm	Decibel referred to 1 milliwatt
DC	Direct Current
deg	Degrees
DMM	Digital Multimeter
DOS	Disk Operating System
EIA	Electronic Industries Association
EIC	Encoder Input Circuit
EL	Elevation
EPROM	Erasable Programmable Read-Only Memory
E STOP	Emergency stop

FLT	Fault
FSM	Finite State Machine
FWD	Forward
GHz	Gigahertz
GND	ground
HB	High Byte
HP	horsepower
Hz	Hertz
I/O	Input/Output
IC	Integrated Circuit
IEC	International Electrotechnical Commission
IEE	Institute of Electrical Engineers
IEEE	Institute of Electrical and Electronic Engineers
IF	Intermediate Frequency
ISIO	Intelligent Serial Input/Output
km	Kilometer
LB	Low Byte
LED	Light-Emitting Diode
LNA	Low Noise Amplifier
LOS	Loss of Signal (Loss of Star)
LSB	Least Significant Bit
LSI	Large Scale Integration
LT	Long-term
M	Meter
M&C	Monitor and Control
mA	Milliamperes
mb	Multibody (propagator)
MHz	Megahertz
ms	Millisecond
N/A	Not applicable
NEC	National Electrical Code
NEMA	National Electrical Manufactures Association
NORAD	North American Air Defense Command
NVRAM	Nonvolatile Read-Only Memory
O&M	Operations and Maintenance
OPT	Orbit Prediction Tracking

PC	Printed circuit
PCB	Printed-Circuit Board
PH	Phase
PLL	Phase-Lock Loss
PMCU	Portable Maintenance Control Unit
POL	Polarization
p-p	Peak-to-peak
PROG	Program
PROM	Programmable Read-Only Memory
RAM	Random Access Memory
RC	Resistance-capacitance
RDC	Resolver-to-Digital Converter
REV	Reverse
RF	Radio Frequency
RFI	Radio Frequency Interference
RMS	Root mean square
ROM	Read-Only Memory
rpm	Revolutions per minute
sec	Second
SPST	Single-Pole Single-Throw
ST	Short-term
STD	Standard
2b	Two-body (propagator)
TBT	Tracking Band Translator
TBU	Test Bed Unit
TEE	True Equinox and Equator
TT&C	Telemetry, Tracking, and Control
UTC	Coordinated Universal Time
V	Volts

APPENDIX B - TECHNICAL SUPPORT

If you have any questions or problems that are not addressed by the manual, there are several ways to contact our technical support team.

1. Phone us at (903) 295-1480.

2. Email us at ***support@vcsd.com.***

3. Make copies of the following Technical Inquiry form and fax us your questions at (903) 295-1479.

4. Contact us on our web site at ***www.vcsd.com.***

Vertex RSI™ A TriPoint Global Company **Technical Inquiry**	**FAX (903) 295-1479**	
CUSTOMER NAME:	**SITE:**	
CONTACT:	**PHONE:**	**EXT:**
FAX:	**EMAIL:**	

EQUIPMENT: ***(INCLUDE MODEL, NAME, AND SERIAL NUMBER OF ALL PERTINENT EQUIPMENT)*** **S/N:**

1. Model: _____

2. Model: _____

3. Model: _____

4. Model: _____

OTHER EQUIPMENT

TECHNICAL QUESTION/PROBLEM:

VCSD RESPONSE:

VCSD TROUBLESHOOTER	DATE	TIME	REF. NO.