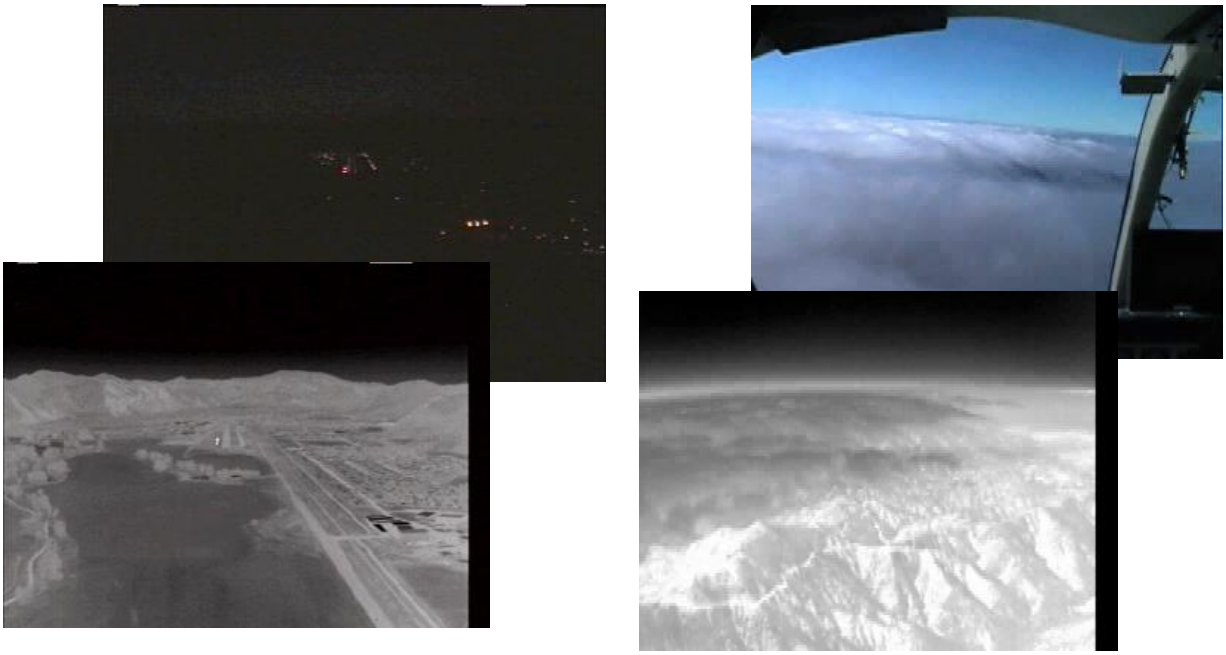
MAX VIZ®

See Clearly, Fly Safely®

Information Manual

EVS-600

See What You'll Be Missing



Max-Viz, Inc.
15940 S.W. 72nd Avenue
Portland, OR 97224

Revision History

Revision	Date	Change Description
-	7/21/2008	Production Release, same as Rev 1 except, revised export control statement, added Sensor part numbers and updated the ICD drawings.
A	11/5/2008	Removed all mention of unused NUC and Zoom Inputs. Added connection to part number 506500128 at the input connector.
B	12/08/2010	Updated the Max-Viz logo on page 1, Updated the address on this manual, and Updated Warranty Form and Customer Service form to latest revisions.
C	06/06/2011	Updated to Add Patent language on page 2, Updated logo in the header, Added email address to Section 7, Updated Warranty Form and Customer Service Form to latest revisions.

Table of Contents

1. INTRODUCTION

This document provides guidance on the installation, operation, and maintenance of the Max-Viz, Inc. Enhanced Vision System (EVS) Model 600 product.

The EVS-600 is designed to provide the flight crew with enhanced visual awareness of terrain and potential obstacles in the aircraft's forward field of view.

2. EVS-600 DESCRIPTION

The EVS-600 is comprised of a single Line Replaceable Unit, the Sensor LRU.

The Sensor LRU includes a long-wave infrared (IR) camera assembly that produces a infrared image and a low-light CMOS camera that produces a visible image. The two images are combined in the sensor electronics to produce a single fused image The horizontal field of view is 40 degrees.

The Power Supply is completely contained within the Sensor LRU.

The video display represents a thermal scene of the area in front of the aircraft and provides the flight crew with enhanced vision capability in low visibility conditions.

2.1. Equipment Identification

The EVS-600 system component is identified below.

Name	Part Number	Description
Sensor	756500047	EVS-600, Universal Mount
Sensor	756500049	EVS-600, Wing Mount
Sensor	756500053	EVS-600, Universal Mount Inverted

2.2. Electrical Characteristics

The electrical characteristics of the EVS-600 are listed below.

Characteristic	Specification
Voltage	28 VDC or 14VDC from aircraft power (9 VDC min., 32 VDC max.)
Max Current at 28 VDC	1.5 A (heaters activated)
Max Current at 14 VDC	1.0 A (heaters activated)

The EVS-600 does not require any supplemental heating or cooling from the aircraft.

2.3. Physical Characteristics

The physical characteristics of the EVS-600 LRU are listed below.

Characteristic	Universal Mount	Wing Mount
Sensor		
Height:	2.51 in. (63,8 mm)	2.70 in. (68,5 mm)
Width:	3.77 in. (95,8 mm)	3.80 in. (96,4 mm)
Length:	8.69 in. (220,7 mm)	8.82 in. (224 mm)
Weight:	1.2 lbs (0,56 kg)	1.2 lbs (0,56 kg)

2.4. Export Control

Export of the EVS-600 Sensor is governed by the Commerce Department, Bureau of Industry and Security. The sensor has export classification control numbers of 6A003(b)(4).

EVS-600 commodities, technology, or software shall be exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.

3. INSTALLATION PLANNING

All installations in certified aircraft should be performed per FAA-approved installation instructions, such as an STC or service bulletin. This information is provided to assist in the design of a certified installation. It is also provided to assist in non-certified aircraft installations.

The +28 VDC or +14 VDC supply to the EVS-600 should be routed through a suitably labeled circuit breaker.

Particular attention must be taken in routing the RS-170 video coax cable through the aircraft structure to avoid potential RFI from noise items and to minimize the cable bend radii.

3.1. Interface Connections

3.1.1. Interconnect between Sensor LRU and Aircraft

The cable harness from the Sensor LRU to the aircraft can typically be fabricated from standard 22 AWG aircraft wire (e.g., M27500 twisted shielded pair). Longer cable runs require the use of heavier gauge wire, as listed in the following tables:

Wire Sizes for 28 VDC Installations

Harness Length	Recommended Wire Size	Circuit Breaker
<20 feet	22 AWG	3 amps
20 to 33 feet	20 AWG	3 amps
33 to 55 feet	18 AWG	3 amps

Wire Sizes for 14 VDC Installations

Harness Length	Recommended Wire Size	Circuit Breaker
<12.5 feet	22 AWG	3 amps
12.5 to 20 feet	20 AWG	3 amps
20 to 33 feet	18 AWG	3 amps

Connector Pin Descriptions

Pin Number	Description	Recommended Wire
1	+28 VDC or +14 VDC	22 AWG
2	Power Return	22 AWG
3	No connect	
4	No connect	
5	One end of p/n 506500128	
6	No connect	
7	No connect	
8	RS 170 Video	RG 179 (Pic Wire & Cable P/N V75268)
9	RS 170 Video Return	Coax shield/braid
10	One end of p/n 506500128	

3.1.2. Interface Connector

The connector required to fabricate a harness from a terminated end at the EVS-600 Sensor LRU to the aircraft is:

- Connector Glenair 801-007-16M7-10SA

If the harness will run through a bulkhead, ensure that the connectors have the appropriate number of pins and no wires are spliced together.

3.1.3. Interconnection Losses

The maximum video coaxial cable loss from the Power Supply/Processor to the display should not exceed 1dB.[1] There should be no cable loss limitations for RG-179 if less than 100 feet.

If more than two displays are to be connected, or if signal will be brought into the passenger cabin, the video signal from the EVS-600 should go directly to a multiple output amplified video buffer with as short of a run as feasible prior to going to the displays in order to avoid signal termination losses.

It is highly recommended to avoid routing the video coax in close proximity to electrical noise sources such as motors, generators, transmitters, etc.

Do not lace the video coax cable together (in parallel) with high current conductors, particularly AC power type wires such as 115 Vac 400 Hz or 60Hz.

3.1.4. Electrical Bonding Recommendation

If the Sensor unit is not bonded electrically via its mounting holes directly to a metal aircraft structure, then electrically bond them to the metal aircraft structure with a heavy bonding wire (or grounding braid) from one of the front mounting holes that are strapped to a copper lightning rod which is part of the EVS 600.

3.2. Recommended Installation Procedure

Do not connect the 28 VDC or 14 VDC power connector to the Sensor.

Switch "ON" the circuit breaker and the "ON/OFF" switch (if installed) to the EVS-600 system. Verify and measure the +28 VDC (or +14 VDC) between pins 1 and 2 of the mating connector. Ensure voltage within +/- 2 VDC from normal. Switch "OFF" the circuit breaker and the "ON/OFF" switch to the EVS-600 system (if installed).

Connect the RS 170 coax video cable to the display. Connect the power connector to the EVS-600 connector. Switch the input power circuit breaker and "ON/OFF" switch to "ON". After approximately a 1 minute delay observe the video image and "OK" message on the display.

[1] Note: this is a generic figure to cover all AES types and equipment configurations. If this cannot easily be achieved in any particular installation, then Max-Viz, Inc. should be contacted to determine whether a more relaxed insertion loss can be considered without decreasing system performance or raising certification issues.

At five-minute intervals the system will perform a self calibration (non-uniformity correction - NUC) and the video will momentarily go blank. This is normal. If an appropriate switch is installed, the NUC function can be manually controlled.

3.3. Installation Assistance

If you require installation assistance, and it is a certified installation, contact the type design holder. If it is a non-certified installation, contact Max-Viz, Inc. for technical support.

4. OPERATION

Operationally, the EVS-600 is used as a supplemental display to enhance the view of the outside world. It uses an infrared (IR) sensor to provide an additional visual perspective. The EVS-600 is particularly effective at night, in smoke, haze, and in smog. It is also effective in some conditions of rain, snow, and fog.

EVS improves the pilot's ability to see:

- ground vehicles and other ground-based equipment/obstacles
- aircraft on taxi-ways and runways
- other traffic during takeoff, approach, and landing
- runway and taxi lights
- the runway and terrain features during climb, descent, and low altitude maneuvering

The EVS system is also valuable as an aid in ground navigation, and can be used, at the pilot's option, throughout the full mission profile. EVS use is straightforward and does not increase the pilot's workload.

Upon power-up the Sensor requires approximately 60 seconds to produce a useable image. The image generated is a monochrome (i.e., black and white) image. The hotter an object is the whiter it appears on the display. This is known as "white hot" polarity.

The display should be adjusted for optimum brightness and contrast, and readjusted only during relatively benign phases of flight or periods of low workload. The image then should be cross checked in a manner similar to other cockpit displays, using short dwell times and appropriate cockpit priorities.

To optimize the IR image the EVS system periodically recalibrates itself. The recalibration process is known as "Non-Uniformity Correction" (NUC). NUC can be observed on the display as a momentary image interruption.

The shutter closes for approximately one second during the NUC process, which happens every five minutes or when manually activated, if an appropriate switch is installed in the cockpit.

5. MAINTENANCE

The Sensor may be viewed as a sealed "black box" where no field maintenance, repair, or upgrade is performed. All such activities are conducted at Max-Viz, Inc.

To ensure your system will be covered under warranty, fill out and submit Max-Viz form 3204-00042 at the time of system installation.

If you have difficulties operating the system, first contact your authorized Max-Viz dealer for technical support. They will contact the type certificate holder, if it is a certified installation. The type certificate holder will contact Max-Viz as necessary. If it is not a certified installation, the dealer will contact Max-Viz.

If it is determined the EVS-600 must be returned for service or maintenance, Max-Viz will issue a Return Material Authorization (RMA). Fill out Max-Viz form 3204-00043, Customer Service Request, and submit it to receive a RMA. After receipt of the RMA, return the system to the address in Section 7.

A copy of the Customer Service Request Form, and Warranty Registration Form, are included at the end of this manual, but are also available at www.max-viz.com.

6. WARNINGS, CAUTIONS, AND GUIDANCE

6.1. Electromagnetic Interference

The EVS-600 system is qualified (RTCA/DO-160E) to operate in normal aircraft EMI environments. ***When installing the system, be sure that the Sensor lens is not installed in close proximity to high power EMI transmitters, such as transponders.*** High energy transmitters mounted directly in front of the germanium lens may cause video disturbance.

6.2. Germanium Window Breakage

The large window is made of Germanium. If this window is ever broken, use extreme caution when handling broken germanium shards or dust. ***Always use gloves and masks when handling broken germanium lens material.***

6.3. Germanium Lens Cleaning

In contrast to visible light energy, infrared energy typically passes through dirt or bug-debris build-up on the lens. As such, the Sensor lens requires only occasional cleaning with mild liquid soap and water or isopropyl alcohol, and a soft cloth.

Do not use abrasive cleansers or cleaning pads on the germanium lens. Abrasive cleaning can damage the lens coating. ***Do not use any cleansers with ammonia.*** Ammonia will remove the window coating.

6.4. Halo Images

Under certain circumstances, it is possible a "halo" will be seem around the image. The following sequence of events will occur:

When the heaters are first turned on, they will begin to heat the window from the outside-in.

As the window is heated, the infrared detector will not be able to compensate for the signal coming from the window, as compared to the outside view, and thus a white (hot) area will appear around the outside of the image, working its way in.

The image will re-stabilize after a Non-Uniformity Correction cycle (NUC), described below in in Section 6.8.

This process will continue, with the halo encompassing more and more of the image between NUC cycles until the window reaches a constant temperature across the surface.

After approximately 20 minutes (depending upon the temperature of the camera when the heater was turned on and the ambient operating temperature), there will be a NUC cycle that creates a clean image and the halo will no longer form.

To best prevent a halo from occuring during flight, turn the system on during preflight or run-up to stabilize the window and body heaters prior to flight and allow thermal stabilization.

6.5. Ice Effects

During in-flight use, the Sensor uses heaters to keep ice from building up over the lens. If the heaters fail and ice builds up, infrared energy will be unable to pass through the ice, and the image will begin to fade. (In this situation, ice build up may first occur around the outside of the image, and eventually close up as a circle of ice closes in over the circular lens). If the heaters fail, EVS use should be discontinued and the Sensor should be returned to the factory for service. (If the Sensor is iced over on a cold winter morning before start-up, it may take a few minutes before the ice melts off and an image appears). ***Please use caution when handling the Sensor during cold weather operation. Note: the Sensor could be warm to the touch (25 degrees Celsius).***

6.6. Image Quality and Interpretation

Independent of the operation of the Sensor, image quality is a function of target size, target temperature, background temperature, and atmospheric attenuation from particles or moisture in the air. ***As such, it is important to know that the quality of the image will appear different as these variables change.*** If the video image appears clear in the cool morning and a little "washed out" on a hot/humid summer afternoon, the difference is probably caused by changes in the infrared environment, and not from changes in the operation of the system.

6.7. Nitrogen Added to Sensor

The Sensor is sealed at the factory and filled with nitrogen to eliminate moisture. If the Sensor is opened, the nitrogen will be lost. ***Do not open the Sensor during system installation or maintenance, warranty is void if opened.***

6.8. Non-Uniformity Correction (NUC)

The Sensor hosts a 320 x 240 pixel sensor array. At five-minute intervals the system automatically performs a Non-Uniformity Correction (NUC), where an internal shutter assembly closes, to give the array a standard temperature target for array correction and re-calibration. ***During the NUC cycle, the video image is interrupted for approximately one second.***

6.9. Video Signal Interruption/ Improper Display Settings

If the video signal is ever completely interrupted, the display may appear as a solid field (e.g., gray, white, or blue, etc.) and the message "no video" may appear, depending on the display, to indicate a video failure.
Please also note: if the brightness and contrast settings on the video display are not set properly, the image will be degraded, or possibly even displayed as solid black or solid

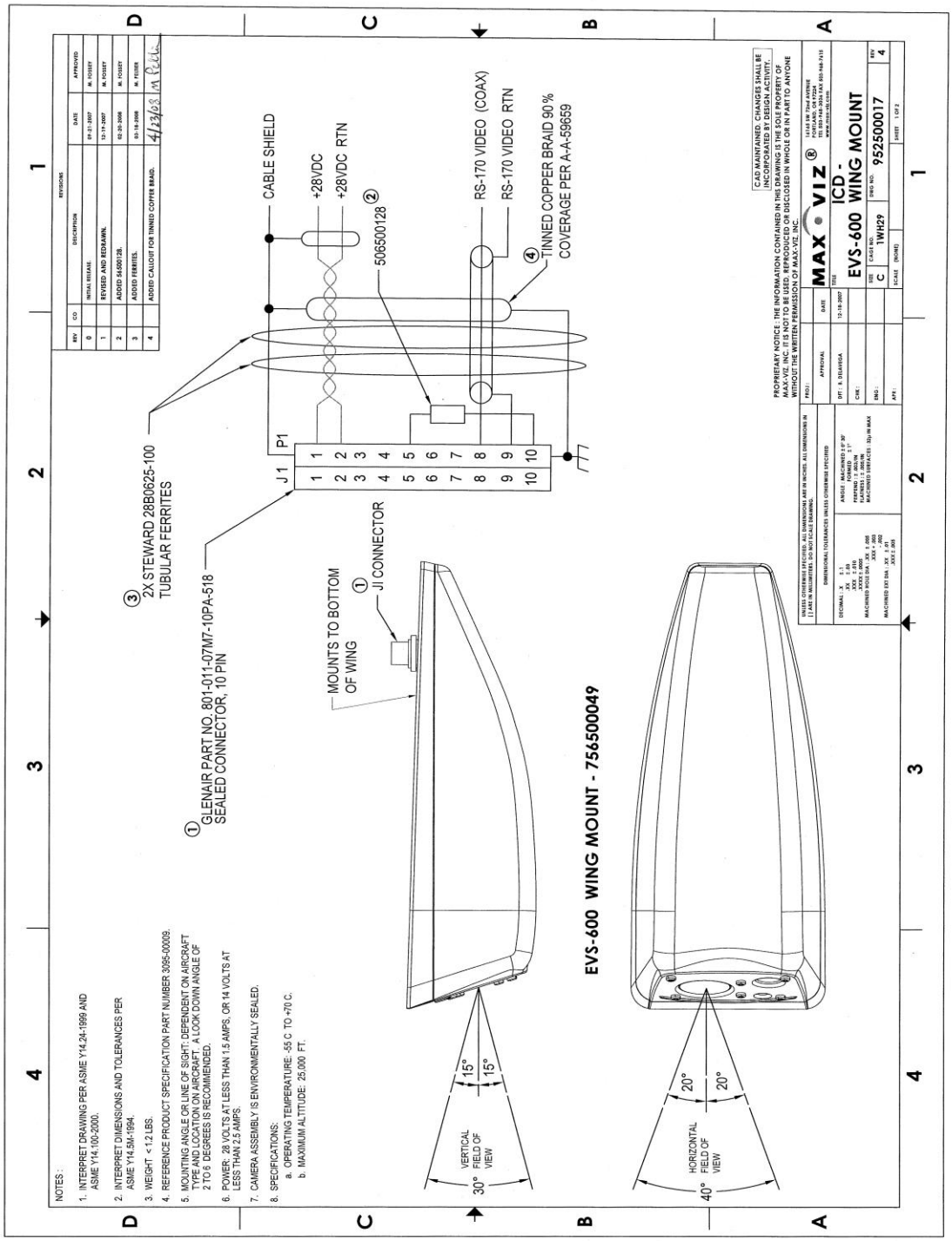
white. ***Following initial power-up of the system, always adjust brightness and contrast settings to obtain the best image.***

7. MAX-VIZ, INC. CONTACT INFORMATION

Max-Viz, Inc.
15940 SW 72nd Avenue
Portland, OR 97224
USA
Office: (503) 968-3036
Fax: (503) 968-7615
Email: customer.service@max-viz.com
www.max-viz.com

Appendix A

1. Interface Control Drawing: 952500017, "ICD - EVS-600 Wing Mount"
2. Interface Control Drawing: 952500018, "ICD - EVS-600 Universal Mount"
3. Form 3204-00042, "Warranty Registration Form"
4. Form 3204-00043, "Customer Service Request Form"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CABLE SHIELD
+28VDC
+28VDC RTN
506500128
RS-170 VIDEO (COAX)
RS-170 VIDEO RTN
TINNED COPPER BRAID 90 % COVERAGE PER A-A-59659
2X STEWARD 28B0625-100 TUBULAR FERRITES
GLENAIR PART NO. 801-011-07M7-10PA-518 SEALED CONNECTOR, 10 PIN
MOUNTS TO BOTTOM OF WING
J1 CONNECTOR
P1
VERTICAL FIELD OF VIEW
30°
15°
15°
HORIZONTAL FIELD OF VIEW
40°
20°
20°
NOTES :
1. INTERPRET DRAWING PER ASME Y14.24-1999 AND ASME Y14.100-2000.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. WEIGHT : < 1.2 LBS.
4. REFERENCE PRODUCT SPECIFICATION PART NUMBER 3095-00009.
5. MOUNTING ANGLE OR LINE OF SIGHT: DEPENDENT ON AIRCRAFT TYPE AND LOCATION ON AIRCRAFT. A LOOK DOWN ANGLE OF 2 TO 6 DEGREES IS RECOMMENDED.
6. POWER: 28 VOLTS AT LESS THAN 1.5 AMPS, OR 14 VOLTS AT LESS THAN 2.5 AMPS.
7. CAMERA ASSEMBLY IS ENVIRONMENTALLY SEALED.
8. SPECIFICATIONS:
a. OPERATING TEMPERATURE: -55 C TO +70 C.
b. MAXIMUM ALTITUDE: 25,000 FT.
REVISIONS
REV | CO | DESCRIPTION | DATE | APPROVED
0 | | INITIAL RELEASE. | 01-31-2007 | M. YOSSEF
1 | | REVISED AND REDRAWN. | 12-19-2007 | M. YOSSEF
2 | | ADDED 506500128. | 02-20-2008 | M. YOSSEF
3 | | ADDED FERRITES. | 03-19-2008 | M. YOSSEF
4 | | ADDED CALLOUT FOR TINNED COPPER BRAID. | 4/23/08 | M. Yossef
PROPRIETARY NOTICE : THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF MAX-VIZ, INC. IT IS NOT TO BE USED, REPRODUCED OR DISCLOSED IN WHOLE OR IN PART TO ANYONE WITHOUT THE WRITTEN PERMISSION OF MAX-VIZ, INC.
CAD MAINFRAMES. CHANGES SHALL BE INCORPORATED BY DESIGN ACTIVITY.
MAX VIZ
ICD - EVS-600 WING MOUNT
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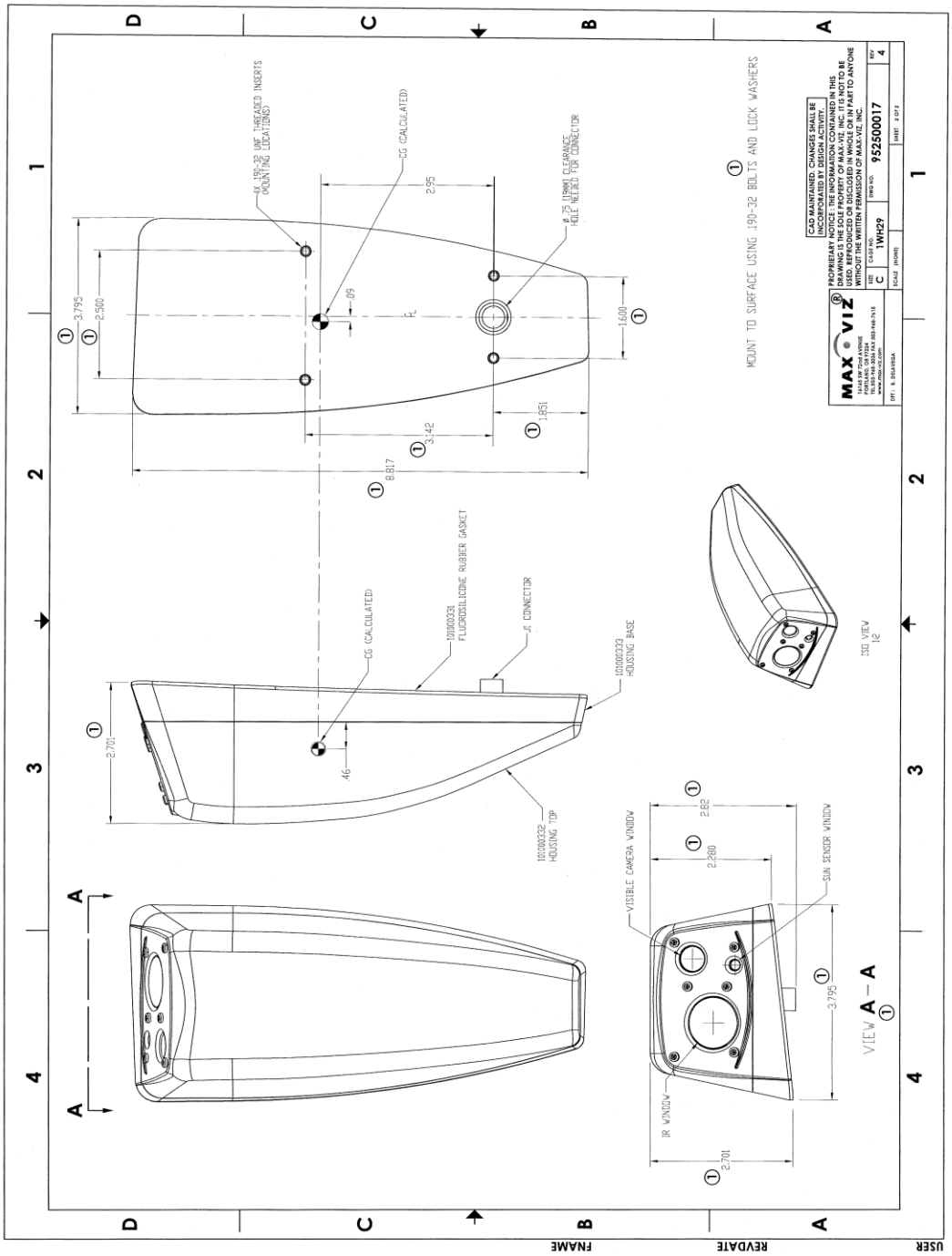
SCALE (NONE) | SHEET 1 OF 2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Ø.75 (19MM) CLEARANCE HOLE NEEDED FOR CONNECTOR
MOUNT TO SURFACE USING .190-32 BOLTS AND LOCK WASHERS
3.795
2.500
.09
1.600
1.851
3.42
8.817
CG (CALCULATED)
1019003331 FLUOROSILICONE RUBBER GASKET
J1 CONNECTOR
1010003333 HOUSING BASE
2.701
.46
1010003332 HOUSING TOP
ISO VIEW 12
VISIBLE CAMERA WINDOW
SUN SENSOR WINDOW
IR WINDOW
2.82
2.280
3.795
2.701
VIEW A-A
CAD MAINTAINED. CHANGES SHALL BE INCORPORATED BY DESIGN ACTIVITY.
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MAX • VIZ
SIZE C
CAGE NO. 1WH29
DWG NO. 952500017
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SHEET 2 OF 2
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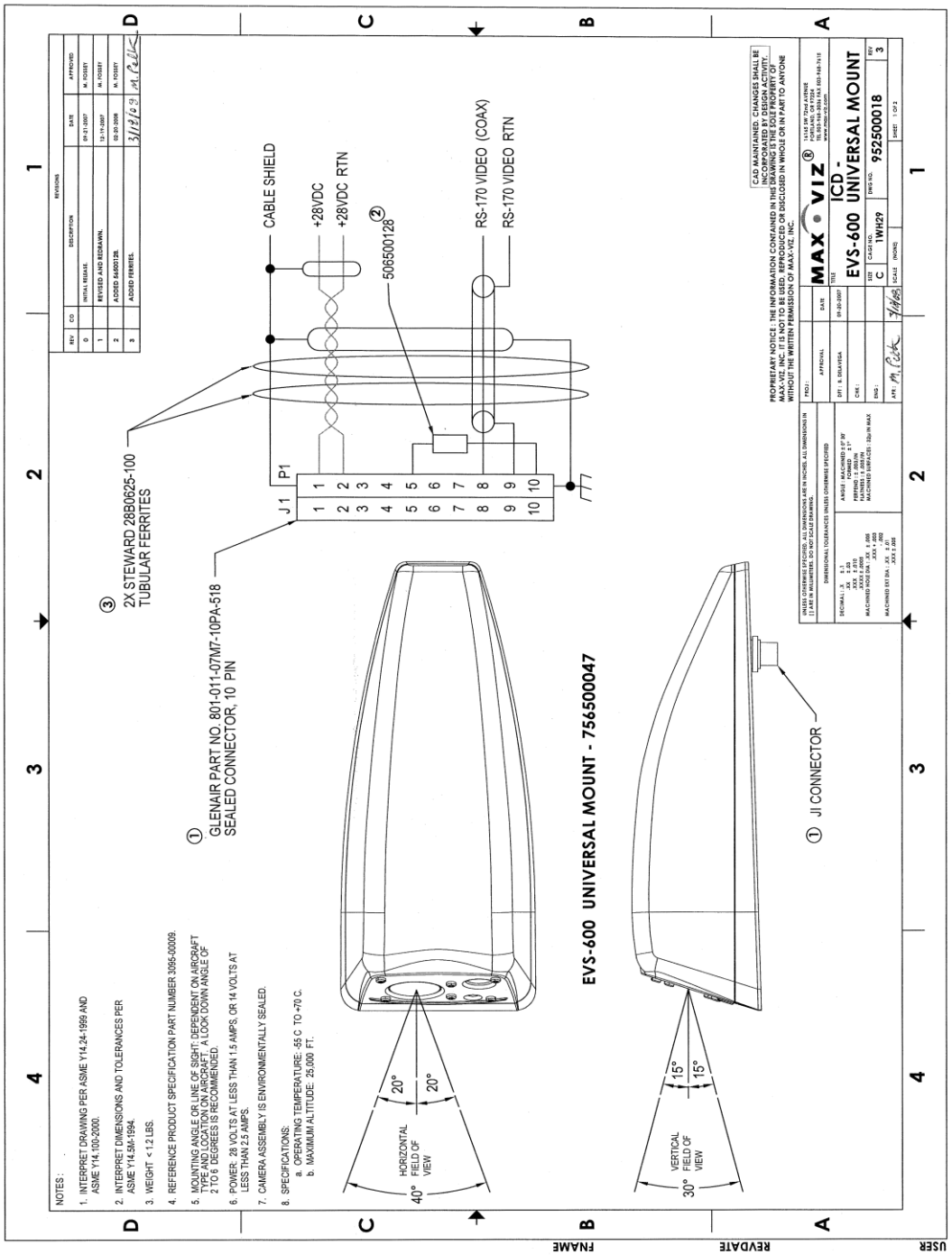
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REV CO DESCRIPTION DATE APPROVED
0 INITIAL RELEASE 09-21-2007 M. FOSSEY
1 REVISED AND REDRAWN. 12-19-2007 M. FOSSEY
2 ADDED SA600126. 02-20-2008 M. FOSSEY
3 ADDED FERRITES. 3/19/09 M. FOSSEY
③ 2X STEWARD 28B0625-100 TUBULAR FERRITES
① GLENAIR PART NO. 801-011-07M7-10PA-518 SEALED CONNECTOR, 10 PIN
J1 P1
CABLE SHIELD
+28VDC
+28VDC RTN
② 506500128
RS-170 VIDEO (COAX)
RS-170 VIDEO RTN
① J1 CONNECTOR
EVS-600 UNIVERSAL MOUNT - 756500047
HORIZONTAL FIELD OF VIEW
40°
20°
20°
VERTICAL FIELD OF VIEW
30°
15°
15°
PROPRIETARY NOTICE : THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF MAX-VIZ, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF MAX-VIZ, INC. IS PROHIBITED.
CAD MAINTAINED. CHANGES SHALL BE INCORPORATED BY DESIGN ACTIVITY. NOT TO BE REPRODUCED OR DISCLOSED IN WHOLE OR IN PART TO ANYONE
MAX • VIZ®
ICD - EVS-600 UNIVERSAL MOUNT
DWG NO. 952500018
REV 3
SIZE C
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SHEET 1 OF 1
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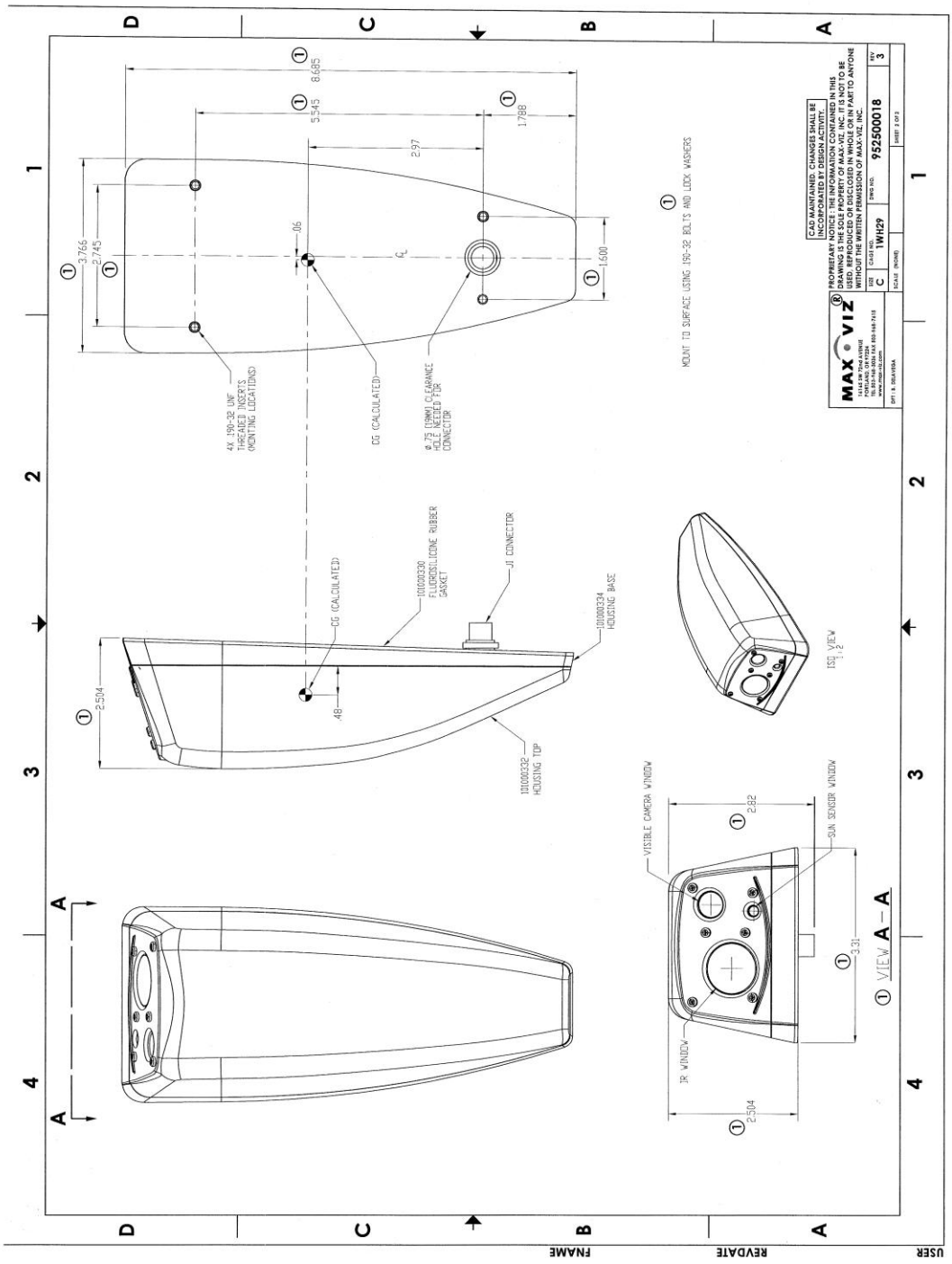
FNAME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4X .190-32 UNF THREADED INSERTS (MOUNTING LOCATIONS)
CG (CALCULATED)
Ø.75 (19MM) CLEARANCE HOLE NEEDED FOR CONNECTOR
MOUNT TO SURFACE USING 190-32 BOLTS AND LOCK WASHERS
J1 CONNECTOR
1010000330 FLUOROSILICONE RUBBER GASKET
1010000334 HOUSING BASE
1010000332 HOUSING TOP
2.504
.48
ISO VIEW
VISIBLE CAMERA WINDOW
SUN SENSOR WINDOW
IR WINDOW
2.82
3.31
2.504
VIEW A-A
MAX • VIZ
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SIZE C
CAGE CODE 1WH29
DWG NO. 952500018
REV 3
SCALE NONE
SHEET 2 OF 2
DEPT. A ENGINEERING
D
C
B
A
1
2
3
4
FNAME
REVDATE
USER

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Warranty Registration Form

Please complete this form and return to:

Max-Viz, Inc.

Attn: Customer Service

15940 SW 72nd Avenue, Portland, Oregon 97224 USA

Phone: 503-968-3036 Fax: 503-968-7615

Email: **customer.service@max-viz.com**

www.max-viz.com

Registered Owner Information		**Installing Agent**	
Name:		Name:	
Address:		Address:	
Country:		Work Order:	
Phone:		Phone:	
Fax:		Fax:	
Contact Name:		Contact Name:	
Email:		Email:	
Operator (if other than owner):			
Aircraft Information			
Manufacturer:		Reg. No:	
Model No.:		Serial No:	
Warranty Start Date: (mm/dd/yy)		**Aircraft Hours:**	
Installation Date: (mm/dd/yy)		**Aircraft Hours:**	
Max-Viz Product Information			
Model No:		Serial No:	
Model No:		Serial No:	
Model No:		Serial No:	

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Customer Service Request Form / Return Material Authorization

Please complete this form and return to:

Max-Viz, Inc.

Attn: Customer Service

15940 SW 72nd Avenue, Portland, Oregon 97224 USA

Phone: 503-968-3036 Fax: 503-968-7615

Email: **customer.service@max-viz.com**

www.max-viz.com

RMA#		PO#	

Registered Owner Information		**Completion Center**	
Name		Name	
Address		Address	
Country		Work Order	
Contact Name		Contact Name	
Phone or Fax		Phone or Fax	
E-mail		E-mail	

Operator (if other than owner):	

Aircraft Information

Manufacturer		Reg. No.	
Model No.		Serial No.	
		Aircraft Hours	

Description of Service

EVS Model No.	Serial No.	Date:

Description of Service Requested or Problem to be Fixed: