INSITE PACIFIC Inc.
IMAGING SYSTEMS FOR HARSH ENVIRONMENTS

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TECHNICAL MANUAL

G E M I N I

MICROPROCESSOR CONTROLLED, SILICON INTENSIFIER TARGET (SIT), LOW LIGHT LEVEL, HIGH RESOLUTION, MONOCHROME, UNDERWATER, TV CAMERA

PUBLICATION NUMBER : GM1 - 0105 - G

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PROPRIETARY INFORMATION STATEMENT:

The material contained in this manual consists of information that is the property of INSITE PACIFIC and is intended solely for the use by purchasers of the equipment described in this manual.
INSITE PACIFIC expressly prohibits the duplication of any portion of this manual or the use thereof for any purpose other than the operation or maintenance of the equipment described in this manual without the express written permission of INSITE PACIFIC.

PRODUCT WARRANTY

INSITE PACIFIC, hereinafter referred to as the COMPANY, provides the following warranty for its products:

The COMPANY agrees to correct, either by repair or replacement, at the sole discretion of the COMPANY, any defect in material or workmanship that occurs within one year after the delivery of the equipment to the original purchaser of the equipment. This is provided that investigation and inspection by the COMPANY reveals that the equipment was used under normal operating conditions.

Exceptions and conditions of the warranty are as follows:

a. The warranty shall be void if repairs and/or modifications are made by any persons other than COMPANY employees or duly authorized COMPANY service personnel, unless such repairs are made with the prior written consent of the COMPANY.

b. In the event of a product failure and the customer fails to take prompt reasonable action to prevent further damage to the product, the COMPANY will not be held responsible for any further damage.

c. The COMPANY does not accept any liability concerning any consequential or incidental damage of any sort that occurs as the result of the operation, repair, and/or maintenance of its products.

d. This warranty shall be governed by the laws of the state of California within the United States of America.

GENERAL INFORMATION

INTRODUCTION:

This manual provides the necessary information for the operation, maintenance and servicing of this camera. A thorough understanding of this manual is essential for qualified technical personnel to repair, or make any adjustments to the operation of this camera. The manufacturer assumes no liabilities for repairs or adjustments made to this camera other than by duly authorized personnel.

The information in this manual is believed to be accurate and reliable. However no responsibility is assumed by the manufacturer, for its uses.

INSITE PACIFIC reserves the right to change or modify designs or specifications as part of its continuing product improvement.

PRODUCT DESCRIPTION:

The GEMINI is a microprocessor controlled, extremely low light level, high resolution, monochrome, underwater, TV camera. The camera employs a silicon intensifier target (SIT) camera tube which allows it to provide optimum performance at very low light levels

CAUTION: High incident light levels on a scene and/or viewing the same scene may, over a period of time, result in a permanently burned image and shortened tube life due to either target damage from photoelectrons or photocathode damage from ion bombardment.

To provide the level of sophistication required to meet the design specifications in a small space, surface mount technology has been used throughout the camera.

CUSTOMER SERVICE

This product has undergone a mechanical and electrical testing to insure that all specifications have been adhered to. Should you have any difficulty regarding the operation, maintenance or repair of this camera, please contact INSITE PACIFIC customer service department at the below address or one of its authorized service centers.

RETURN OF EQUIPMENT FROM FOREIGN LOCATIONS

In the event equipment is required to be returned to INSITE PACIFIC from foreign locations, the following information must be provided on all invoices and shipping documents.

The original purchase order should be provided on any shipping documents or declarations. The shipment is to be consigned to:

INSITE PACIFIC INC.

742 GENEVIEVE STREET, SUITE T

SOLANA BEACH, CA 92075

USA

PHONE: 858-523-0642

FAX: 858-523-0643

DECLARATION

I, _____, DECLARE THAT THE ARTICLES SPECIFIED HEREIN ARE TO THE BEST OF MY KNOWLEDGE AND BELIEF, ARE THE PRODUCT OF THE UNITED STATES AND THAT THEY WERE EXPORTED FROM THE PORT OF _____ ON OR ABOUT _____ 20____; THAT THEY ARE BEING RETURNED WITHOUT HAVING BEEN INCREASED IN VALUE OR IMPROVED IN CONDITION BY ANY PROCESS OR OTHER MEANS.

COMPREHENSIVE SPECIFICATIONS:

GEMINI: LOW LIGHT, SILICON INTENSIFIER TARGET, HIGH RESOLUTION, MONOCHROME, UNDERWATER TV CAMERA.

ELECTRICAL:

Sensor:	Silicon Intensifier Target (SIT) 1 Inch Vidicon Format	
Resolution:	700 Horizontal TV Lines Typical	
Sensitivity:	Full Performance 700 HTV lines	Usable Video > 400 HTV lines
Scene illumination (Lux):	2.5 X 10E-2	2.5 X 10E-3
Faceplate illumination (Lux):	1 X 10E-3	1X 10E-4
Automatic light Range:	6.5mm lens: ≈75,000:1 9mm lens: ≈2,500,000:1	
Signal to Noise:	Greater than 43 dB.	
Scanning System:	RS170, 60 HZ, 525 lines or CCIR, 50HZ, 625 Lines	
Video Output:	1.0 V p.p. Composite standard into 75 ohms unbalanced or 50 to 150 ohms balanced line (Twisted shielded Pair)	
Video Line Drivers:	Remotely adjustable for various types of cables. Provides full video for up to 5000 ft of RG/59U cable and usable video for up to 9000 ft.	
Gray Scale:	10 Shades of Gray	
External Sync:	Accepts negative 1.0 to 4 V p-p composite sync, with 75 ohm termination.	
SIT Tube Protection:	Ambient light sensor circuit with the 6.5mm lens helps protect SIT tube when light levels exceed safe operating limits. Complete iris closure occurs for both the 6.5mm and 9mm lenses should camera power be lost or interrupted. Full protection against loss of vertical or horizontal sweeps.	
Camera Power:	Constant Voltage Source: 17 to 30 vdc at 850 ma nominal current or Constant Current Source: 900ma to 1100 ma at 22 vdc nominal. The camera circuitry detects whether the input power is constant voltage or constant current and selects the proper mode of operation automatically.	

COMMUNICATION INTERFACE:

Serial Interface:	RS232 or RS485
Protocol:	ASCII-BASED
Baud Rate:	1200, 2400, 4800, 9600,
	Selectable with auto detection

OPTICAL:

6.5mm Wide Angle Lens:

Iris:	Auto Iris, f 1.8 to f 16 (with plano-concave port)
	Auto Iris, f 1.8 to f 64 (with hemispherical port)
	Complete iris closure when camera power is turned off

Field of View:	**Hemispherical Port**	**Plano-Concave Port**
	Diagonal 110°	Diagonal 86°
	Horizontal 98°	Horizontal 73°
	Vertical 81°	Vertical 58°

Focus Range:	Fixed Focus, 6 inches (15.2 cm) to Infinity

9mm lens:

Iris:	Auto Iris, f 1.4 to f 360
	Complete iris closure when camera power is turned off
Field of View:	Diagonal 95 degrees
	Horizontal 77 degrees
	Vertical 59 degrees
Focus Range:	12 inches (30.5 cm) to Infinity, employs focus motor for remote adjustment of focus

MECHANICAL:

3,000 Meter Titanium Pressure Housing:

Refer to installation drawing for detailed information.

6,000 Meter Titanium Pressure Housing:

Refer to installation drawing for detailed information.

ENVIRONMENTAL:

Depth:	3000 meter, (10,000 ft) and 6,000 meter (20,000ft) pressure housings available.
Operating Temp:	-5°C to 40°C, (23°F to 104°F)
Storage Temp:	-20°C to 60°C, (-4°F to 140°F)

SOFTWARE CONTROLS:

- Video line driver gain and high frequency response.
- Automatic protection of SIT tube with remote over-ride capability.
- Control of all video parameters.
  (Pedestal, White clip, Gamma, etc.)
- Control of all scan functions and grid voltages.
- Saves user presets. Factory defaults selectable.
- Diagnostic mode for camera set-up and maintenance.
- Reports critical voltage, current and deflection parameters.

System Requirements for INSITE PACIFIC Camera Control Software

Operating system	**Windows 98 or later:**
Microprocessor	486 or higher
Memory	16 MB minimum recommended
Hard disc space (approximate)	2 MB available
Disk drive	One CD-ROM drive
Video adapter	VGA or higher resolution
Pointing device	Any PC compatible mouse

To Install INSITE PACIFIC Camera Control Software On Your Computer:

NOTE: Before you can install the Camera Control Software, your computer must have access to Microsoft Windows 98 or later.

1. Start Windows and close all open applications.
2. Insert Insite Pacific's Camera Control Software CD into the CD-ROM drive.

3. The software will begin installing as long as the autorun feature of the CD-ROM drive isn't disabled.

4. Should the autorun feature be disabled you will need to double click on the "**setup.exe**" file on the CD to start the software installation.

5. When prompted for the installation directory, allow the software to install in the "**C:\INSITE**" directory. Click on "**Continue**" to complete the software installation.
6. Should you need the Windows 95 version of the software please contact the factory.

Starting the Camera Control Program

1. Start the Camera Control Program by double clicking on the icon labeled "**INSITE_ V3.25 - R02**". (Note: The Orion Zoom and the Pegasus Cameras both use the same Graphic User Interface).

2. Enter your password and then click on "Okay" (Note: Passwords are "G" or "DOALL").

3. Select the serial "Port" on your computer that you've connected to your camera then click on "Start". (Note: All cameras leave the factory set to the 9600-baud rate).

4. Select the camera type that you want to communicate with and then click "Scan".

5. The camera "ID" of that particular camera type connected will come up highlighted.

6. Click on the ID number of the camera to bring up the Graphic User Interface (GUI) for that particular camera type.

G E M I N I

CAMERA ALIGNMENT PROCEDURE

MICROPROCESSOR CONTROLLED, SILICON INTENSIFIER TARGET (SIT), EXTREMELY LOW LIGHT LEVEL, HIGH RESOLUTION, MONOCHROME, UNDERWATER, TV CAMERA

PUBLICATION NUMBER : GM1 - 0109 - B

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GEMINI SIT CAMERA ALIGNMENT PROCEDURE

INTRODUCTION

This procedure assumes that the camera has been assembled properly and that all circuit boards and components do not have any faults or problems that would prevent proper alignment of the camera.
Should you not be able to obtain the correct performance as specified in this procedure, discontinue and proceed with proper troubleshooting techniques to determine the problem. To continue alignment may result in the inability to obtain optimum performance.
This alignment procedure should be followed by properly trained personnel familiar with TV camera operation. If adjustments are incorrectly made permanent damage to the SIT tube and or shortened tube life can occur.

CAUTION: High incident light levels on a scene and/or viewing the same scene may, over a period of time, result in a permanently burned image and shortened tube life due to either target damage from photoelectrons or photocathode damage from ion bombardment.

********** WARNING **********

THIS CAMERA HAS CIRCUITS WITH HIGH VOLTAGES WHICH COULD BE POTENTIALLY DANGEROUS. EXTREME CAUTION MUST BE OBSERVED BY PERSONNEL PERFORMING THESE TESTS OR BY ANY PERSONS OPERATING THE CAMERA WHEN IT IS REMOVED FROM THE PRESSURE HOUSING.

********** WARNING **********

PREVIOUSLY CALIBRATED CAMERAS

There are many controls in the camera, if improperly adjusted, will prevent a factory calibrated camera from providing a normal video output signal. If you suspect that any of these controls has been incorrectly adjusted the camera can be adjusted to the factory default settings by selecting the Factory Default Set Button on the Gemini Set Up control panel. Once a Camera has been properly aligned these settings are stored as Factory Default Settings in the cameras EEPROM (electrically erasable programmable read only memory). Should the camera still have a problem proceed with the alignment procedure.

RECOMMENDED TEST EQUIPMENT

Light Box, with minimum of (6), 25 watt, tungsten incandescent bulbs, and variable intensity control.
EIA Resolution Test Pattern 1956, or equivalent.
Light meter, to measure light levels in either foot candles or lumens.
Dual-trace oscilloscope with 100 MHZ bandwidth and 5 mv sensitivity.
Digital VOM, with min. 10 megohm input Impedance.
Video monitor, with underscan capability and min. of 800 horizontal TV lines Resolution.
7.5 Watt, 120 VA. light for high light test.
Neutral Density (ND) filters, and holder, (ND 1.0, 2.0, 3.0, & 4.0)
DC constant voltage and constant current power supply, 1 amp min. , variable output from 18 to 30vdc.
Linearity ball test chart.
Cross hatch sync generator, for 14 x 17 crosshatch pattern.
EIA gray scale test chart.
25mm focal length, 1 inch format, C mount lens, manual iris, for measuring geometric distortion.

SYSTEM SET-UP

ELECTRICAL CONNECTIONS TO THE CAMERA
The internal camera assembly (GM1-0300) may be attached to a pressure housing rear end bell (REB) which includes an underwater connector. If the camera is attached to a REB please refer to the installation drawing provided in the technical manual for proper electrical connections to the underwater connector. If a system cable is being supplied with the camera it can be connected at this time. However, use an ohmmeter and refer to the cable wiring diagram to be sure it is wired correctly. If you are connecting directly to the camera electronics Interface / Regulator PCA (901-400) please refer to the CAMERA INTERNAL WIRING DIAGRAM (GM1-0103) for proper electrical connections to the camera. Verify that each connection to the DC power supply, video monitor, computer ports and other system connections are correct for the camera you are setting up prior to applying any power to the camera.

Camera power
Prior to connecting the camera to the dc power supply turn the supply on and monitor the output voltage to be sure it is between 18.0 vdc and 30 vdc. If you are using a constant current dc power supply make sure the current regulator on the power supply is set for 1.0 amp limit.

Monitor and oscilloscope connections
Using a BNC 'T' connector loop the + Video output from the camera through channel 1 input of the oscilloscope and terminate it at the monitor. Be sure the monitor input impedance is set for 75 ohms. Place the monitor in the underscan position.
Set the oscilloscope input sensitivity to .5 volts per division and the horizontal sweep to 2 msec per division.

Light box
Place the front of the camera lens 2.75 inches (70 mm) from the center of the light box with an EIA RETMA test pattern.
Adjust the light box for 10 ft /candles measured at the front of the lens.
Make sure the lens iris is adjusted for f-16 and the camera lens cover is on.

Computer connection
Connect the camera to the RS232 "COM PORT" of the PC compatible computer. For RS485 connection a converter box will have to be placed In series with the output from your PC computer.

CAMERA HARDWARE INFORMATION

Record all of the camera hardware information required on the Factory Acceptance Data sheet.

UNDERWATER CONNECTOR WIRING

Review the Sales Order and/or the Work Order for this camera and provide the correct wiring information on the Factory Acceptance Data Sheet.

CIRCUIT BOARD PREALIGNMENT CERTIFICATION

When a new production camera has been assembled, all of the circuit boards should have been previously tested to insure there are no defects or faulty circuits that could cause the camera to malfunction or not operate to design specification. A factory test data sheet is provided with each circuit board and should accompany the camera through final and system testing. Do not proceed with the camera alignment if any of these data sheets are missing. Record the circuit board assembly numbers and attach the individual factory certification sheets to the Factory Acceptance Data Sheet.

POWER SUPPLY AND VOLTAGE REFERENCE TESTS

Note : Do not proceed with the alignment procedure until this section is completed and all voltages are correct. This step can be omitted if the camera has been previously calibrated and the likelihood of these voltages being incorrect is not suspected.

Do not remove the lens cover.
Unplug the tube socket board.
Turn on power to the camera.
Using a digital voltmeter measure the voltages referred to in the chart below. For some of these voltages there is an adjustment pot which can be adjusted to achieve the desired voltage, while for others there is no adjustment. Should you not be able to achieve the correct voltage for any of these measurements proceed with proper troubleshooting techniques to determine and correct the fault. Do not proceed with the alignment procedure until the fault has been corrected.
Record the completion of this step on the Factory Acceptance Data Sheet.

POWER SUPPLY AND VOLTAGE REFERENCE TEST CHART

VOLTAGE	RANGE	TEST POINT	ADJUSTMENT	LOCATION / FUNCTION
15 vdc	14.4-15.6	3TP35	NONE	VIDEO PROC. PCA: POWER
12 vdc	11.4-12.6	3TP39	NONE	VIDEO PROC. PCA: POWER
5 vdc	4.75-5.25	3TP40	NONE	VIDEO PROC. PCA: POWER
7.0vdc	+/- .1 vdc	5IC7 PIN7	NONE	MICROPROC. / SYNC PCA: DAC REF.
2.0vdc	+/- .1 vdc	5IC7 PIN1	NONE	MICROPROC. / SYNC PCA: DAC REF.
3.5vdc	+/- .1 vdc	3TP20	NONE	VIDEO PROC. PCA: DAC REF.
2.0vdc	+/- .1 vdc	3TP21	NONE	VIDEO PROC. PCA: DAC REF.
5.0vdc	+/- .1 vdc	2TP20	NONE	POWER / DEFLECTION PCA: DAC REF.
2.0vdc	+/- .1 vdc	2TP21	NONE	POWER / DEFLECTION PCA: DAC REF.
9.0vdc	+/- .1 vdc	3TP1	3RV1	VIDEO PREAMP , SIT TARGET
6.3vdc	6.25-6.60		NONE	SIT TUBE FILAMENT
5.12vdc	+/- .01 vdc	5TP28	5R44	MICROPROC / SYNC PCA; A/D REF.
6.5 vdc	+/- .1 vdc	5TP6	NONE	MICROPROC / SYNC PCA, SIT HVPS CONTROL
7.5 vdc	+/- .1 vdc	6J6 PIN 9	NONE	HORIZ / VERT ALIGN COIL VERT GND
-12 vdc	-11.4-12.6	3TP32	NONE	VIDEO PROC. PCA: VIDEO LINE DRIVERS

Communication Setup:

Plug in the 9 or 25 pin D sub connector to the computer COM1 or COM2 serial port.
Refer to the Installation Drawing for the camera to make sure the wires to the COM ports are connected to the correct pins on the camera rear endbell connector. If you are connecting to a test cable or system cable refer to the appropriate wiring diagram to confirm proper connection.
Turn on power to the computer
Turn on power to the camera
Initiate (double click) the INSITE Camera Control program from the Windows Program Manager.
The MAIN CAMERA SELECT PANEL will be displayed along with the SYSTEM SETUP panel shown above it.
The Communication Display window should have a green background with the following text "COM 1 is open".
The system software automatically selects the following "Defaults".

Selection	Default	Comments
Port:	COM1	Selects computer com port 1
Baud:	9600,N,8,1	Selects 9600 baud rate, N = no parity bit, 8 = 8bits/word, 1 = one stop bit
Camera Type:	GEMINI SIT	Selects camera type that computer will establish com link with
ID Code:	&	& = Global selection, software will set up com with any GEMINI Sit camera. Select numbers 1-9 to specify individual cameras to communicate with.
System Camera List	GEMINI SIT #&	Select the camera type and ID# you choose to communicate with from this menu.

Use the pull down menus adjacent to the default selections should you need to change any of the settings to be compatible with the INSITE camera you are connected too, and your computer.
Select the "Close port on minimize" box should you wish to close the com port when you minimize the INSITE Camera Control Program from the Windows menu. This will permit other applications to use the com port without having to close the Camera Control Program.
Select the "Initialize Com link". This will establish communication with any the selected camera type with the appropriate ID#.
The chosen camera should than appear on the SYSTEM SETUP panel as the Camera Type selected Along with its ID number shown in the ID window.
The Camera Type along with its ID number will also show in the Camera Type window and ID window at the bottom of the screen in the MAIN CAMERA SELECT panel.
NOTE: This information will remain there as a reminder of the camera type and ID you are communicating with, when you close the SYSTEM SETUP panel to select other panels.
The Communication Display window should have a green background with the following text "COM 1 is open".

If the window has a red background and the text displayed is “Last msg not acknowledged”, than you should check to see that the camera has power and that all the cables are connected properly. You cannot proceed until you receive the message “ COM 1 is open.
Select the CAMERA INFO button.
Enter the Password assigned to your system. This can be found on the INSITE PACIFIC software disk.
Verify that the information displayed (e.g. camera lens, sync etc) is correct as indicated on the Work Order and/or Sales Order.
Select OKAY to return to the System Setup panel.
It wil read “return from cam # (n)” when there is proper communication between the camera and the computer.
If it reads “last message not acknowledged” the camera and computer are not communicating . you should than check your cables and power etc.

IRIS SETUP for 6.5mm Wide-angle lenses

Reference documents: GM1-0350A: LENS MOUNTING PLATE
PL-GM1-0350A: LENS MOUNTING PLATE

LENS SENSOR BOARD HEIGHT VERIFICATION

Verify the distance (gap) of 1mm +/- .25mm (.039” +/- .01”) between all 3 iris position sensors (located on the Lens Sensor Board) and the Iris Position Sensor Label (mounted to the rear of the Clutch Mounting Plate). If the distance is correct proceed to the next step in the procedure if incorrect the following procedure must be followed.

LENS SENSOR BOARD HEIGHT ADJUSTMENT PROCEDURE

Loosen approx. 1 turn (but do not remove) the (4) 4-40 SHC screws retaining the lens sensor PCA. Then, fit a 1/4” open-end wrench to the body of the hex standoff the Lens Sensor Board is mounted too. Turning the wrench clockwise or counterclockwise will raise or lower the standoff height. Place a feelers gauge between the lens sensors and the Position sensor Label and adjust the distance to 1mm +/- .25mm using the 1/4’ wrench. Once the distance has been correctly adjusted use the 1/4” wrench to keep the standoffs from moving while you tighten the (4) 4-40 socket head screws. Once the screws are tightened verify the distance is correct for each of the lens sensors.

IRIS POSITION SENSOR SETUP

Turn on power to the camera. The iris should drive to closed and the motor should stop. After about 20 seconds the iris should then drive to f/16 and pause briefly before resuming normal auto iris function. Press the f/16 button on the GemControl ALC Setup Panel. Verify the f/16 designator on the lens aligns (centers) on the red Dot indicator. If the lens designator aligns properly proceed to the next step in the procedure if it does not the following procedure must be followed.

IRIS POSITION SENSOR ALIGNMENT PROCEDURE:

1. Loosen the (3) slotted set screws in the (stainless steel) lens base. These are accessed between the Iris Gear and the Lens Sensor PCA with a 2mm blade-jewelers screw driver. This releases the lens body and clutch assembly. Carefully remove the lens body/clutch assembly from the lens base.

2. Loosen (3) 2-56 set screws with a 0.031 hex wrench in the Clutch Assembly to free clutch assembly from the lens. Align the f/16 notch (narrowest) in the Iris Position Sensor Label (located on the rear of the Iris Clutch Assembly) with the f16 designator on the Lens Iris Adjustment Ring. Tighten the 2-56 set screws while applying light pressure to hold the clutch squarely against the lens. Do not over tighten as these hex-sockets strip easily.

3. Set the Iris to f/16 by aligning the Iris f/16 designator with the dot indicator on the Lens Body. Again, locate the f/16 notch on the Iris Position Sensor Label (this also should align with the dot now). Align this notch with the f/16 optosensor located on the Lens Sensor PCA (at approx. 10 o'clock facing the camera with the Iris Motor oriented upward). Now, install the lens body in to the Lens Base. The F/16 notch should end up very close to the center of the f/16 optosensor. Verify lens is still set for f/16. Tighten the (3) slotted set screws in the (stainless steel) lens base.

4. Test this setup by powering up the camera. The iris should drive to closed and the motor should stop. After about 20 seconds the iris should then drive to f/16 and pause briefly before resuming normal auto iris function. Press the f/16 button on the GemControl ALC Setup Panel. Verify the f/16 designator aligns (centers) on the Dot indicator.

SYNC SELECTION

The customer sales order or the production work order will determine whether or not the camera is set up for 50 Hz CCIR or 60 Hz EIA RS170 operation.
Turn on power to the camera and observe the period of the vertical sync / blanking interval on the oscilloscope. For EIA RS170 operation the period will be 16.66 msec, or 20 msec for CCIR operation.
The sync can be selected using the chart below. If it is not correct the crystal and or jumper, located on the Microprocessor / Sync PCA, will have to be changed. Verify and record the specified sync frequency on the final test checkout.

SYNC SPECIFICATION	CRYSTAL FREQUENCY	JUMPER	SET TO
EIA RS170, 60 HZ	14.31818 MHZ	5JP9	1
CCIR, 50 HZ	14.1875 MHZ	5JP9	3

EXTERNAL SYNC TEST

Turn on power to the camera.
Adjust the horizontal sweep on the oscilloscope for 2msec/div.
Make sure that the video output from the camera is connected to channel one input of the oscilloscope.
Select channel one as the sync source for the oscilloscope sweep.
Observe the composite video on the oscilloscope.
You should be able to see one complete field of video and it should be synchronized on the oscilloscope. If it is not synchronized adjust the appropriate oscilloscope controls to stop the movement.
Connect an external sync generator with combined sync and blanking signal to channel 2 input of the oscilloscope.
Select the vertical input mode of operation on your oscilloscope that allows you to view both channel one and channel two inputs simultaneously.
You should observe that channel one (camera video) is synchronized while the input on channel 2 is not synchronized or appears to be moving in relation to channel one.
Turn power off to the camera and external sync generator.
Connect the external sync generator to the camera by looping it through the channel 2 input of the oscilloscope.
Turn on power to both the camera and external sync generator.
You should observe that both the camera and external sync generator are now synchronized with one another.
Record the completion of this step on the checkout sheet.

PREALIGNMENT SETUP MODE

This procedure should only be followed should the camera exhibit a problem or not be performing to specification.
Make sure the camera is set up in front of the test chart as described earlier in the System Setup Procedure.
From the SYSTEM SETUP panel select the “GEMINI” camera control panel.
Select the “Factory Settings” button.
From the Camera Setup Select panel, select the “load Factory Setup” button.

Note: This will load all of the original calibration factory settings for the camera into current memory. Any current settings that have either been adjusted to optimize the video for a particular application or have been incorrectly adjusted will be discarded. Therefore should you wish to save your current camera settings you must do the following. There are two (User 1 and User 2) user defined presets that can be used for saving camera presets. To save your current settings choose either the “Load User 1” or “Load User 2” button. Your current settings will than be saved to one of these locations. To recall these settings you will select either the “load User 1” or “ Load User 2” button.

At this point you will either have a good video picture or the camera will exhibit a problem.
Should the camera appear to have a normal video picture you can either terminate this test or continue to the resolution and sensitivity test to see if the picture quality has degraded.
Should the camera not be functioning correctly you should than select the “Diagnostic” panel.
Compare all of the readings shown on this panel with the factory readings supplied with the camera. Make sure you the camera serial number and the data sheet serial numbers are the same.
In some instances the readings may not be exactly the same.
This does not necessarily mean there is a problem.
The chart below shows the range of nominal values for all of these settings.
Should any of the readings not be identical to the factory data sheet, compare them to the readings in the chart below to see if they are still within the nominal range.
should any readings be outside the nominal range, you should if at all possible contact the factory for advice on how to proceed.
Should this not be a viable option, proceed to the section in the procedure that explains how to adjust the setting that is incorrect.

ALIGNMENT SETUP CHART

CONTROL / ADJUSTMENT	NOMINAL RANGE	ADJUST SLIDER OR SETTING TO:
G-1 Control Grid - Beam	25 +/- 2 vdc	ADJUST FOR MINIMUM BLOOMING ON TEST PATTERN
G-2 Accelerator Grid	285 +/- 2 vdc	ADJUST FOR 285 vdc
G-3 Focus Grid	315 +/- 2 vdc	ADJUST FOR 315 vdc note G3 = 0.65 x G4
G-4 Mesh Grid	485 +/- 2 vdc	ADJUST FOR 485 vdc
PL Iris Video Level (preprocessor)		
HH Intensifier - High Volt Power Supply Drive		
G0 Heater Voltage		No Adjustment
MF Magnetic Focus Current	109 +/- 1 ma	Adjust for best resolution on monitor
HA Horizontal Alignment Current	-25 to +25 ma	Adjust for even distribution of beam landing
VA Vertical Alignment Current	-25 to +25 ma	Adjust for even distribution of beam landing
G1 Grid 1 Regulator Control Voltage	200 - 235 vdc	No adjustment
G5 15 vdc Regulated Power Supply	15 +/- .3 vdc	No adjustment
G7 2.50 Volt Reference	2.50 +/- .1 vdc	No adjustment
P7 7.50 Volt Virtual Ground	7.50 +/- .2 vdc	No adjustment
VL AGC Video Level - Post Processor		
AG Video Processor Gain Control		
VO Video Output Level (Line Amp)		
HF High Frequency Control (Line Amp)		
HZ Horizontal Size Drive (Flyback)	102 +/- 3 vdc	Adjust for full raster width, when aligned with test pattern
HC Horizontal Centering Drive	4.10 to 4.60 vdc	
VZ Vertical Size Drive	750 to 950 mv	
VC Vertical Centering Drive	5.60 to 6.2 vdc	

G-1 BEAM (GRID) ADJUSTMENT

The G-1 beam control will have the most impact on whether or not you will see a video picture. If you do not initially see video but have a raster, you will want to adjust G-1 (BEAM). This is assuming that all of the other prealignment setup values are within the parameters specified on the chart. In order for there to be an electron beam present to scan the target G-1 will typically be in the range of -23 to -27 vdc. IF the voltage is too negative (-70 vdc) the Grid will not allow electrons to leave the cathode and there will be no electron scan and therefore no video.
If you do not have video, start by moving the G-1 slider to approx. -70 vdc than gradually reduce the voltage. At approx. -45 vdc the picture will turn negative (white areas in the scene will be black and black areas white) than as you continue to reduce the voltage the picture should turn positive and provide normal video. It will most likely be defocused and not sharp but this is typical. Continue to reduce the -voltage until all of the “blooming” areas are discharged. Blooming occurs when the electron beam is not strong enough to discharge all of the high light areas of the image. The horizontal and vertical centering sliders (not the Alignment sliders) may have to be slightly adjusted to keep the image centered while you are making this adjustment.
Record the completion of this step on the checkout sheet.

MAGNETIC FOCUS ADJUSTMENT

While observing the resolution test chart adjust the magnetic focus slider for the sharpest resolution on the TV monitor. This is typically done by using the resolution wedges that converge toward the center of the test chart. The most accurate adjustment is one that allows you to see the 4 converging black and white lines as separate and distinct lines, as far down the chart toward the center as possible.
Record the completion of this step on the checkout sheet.

MECHANICAL LENS FOCUS (IN AIR)

The following focus procedure adjusts the lens mechanically for the sharpest image with the camera positioned at a distance (2.75 inches) from the test pattern so that the test pattern completely fills the active area of the sit tube. The focus will be readjusted later on in the procedure to acquire the 7 inches to infinity focus provided by the lens.
Loosen the (2), 4-40 set screws that secure the lens mounting ring to the lens mounting plate. This will allow the lens to be rotated.
Position the front of the lens 2.75 inches (70mm) in front of the test pattern.
Adjust the light box for 100 ft/candles.
Place an ND-3 filter in front of the lens.
Turn the iris to f-2.
NOTE: At this f-stop the depth off focus for the lens will be very shallow. This will allow you to easily adjust the lens focus for the sharpest image.
Turn on camera power and remove the lens cover.
While observing the resolution on the test pattern slowly rotate the lens clock-wise or ccw until the highest resolution is obtained.
Readjust the magnetic focus again to be sure it has been optimized.
Rotate the lens again CW or CCW to be sure mechanical focus is correct.
Tighten the 2 set screws on the lens mounting plate while observing the resolution chart. Make sure the focus does not change while you are tightening the screws.
Turn power off to the camera.
Remove the ND-3 filter from the lens, and put the lens cover on.
Adjust the iris for F-16.
NOTE: THE LENS WILL BE MECHANICALLY REFOCUSED FOR OPERATION IN WATER BEHIND THE GLASS HEMISPHERICAL WINDOW LATER ON IN THE PROCEDURE.
Record the completion of this step on the checkout sheet.

DEFLECTION YOKE ALIGNMENT

The vertical and horizontal deflection coils located within the deflection yoke will have to be rotated to permit the electron beam to properly scan the active target area of the SIT tube.
Before adjusting the yoke make sure the horizontal axis of the Camera and the test chart are within 5 degrees of one another.
The camera internal assembly will have to be horizontal to within 3 degrees of the bench surface. The test pattern will also have to be positioned within 3 degrees of the bench surface.
To see the active scan area of the SIT tube the horizontal and vertical deflection will have to be adjusted to overscan the active area of the tube.
Adjust the vertical and Horiz size and centering control sliders to center the overscanned image in the center of the raster display on the monitor. These adjustments will interact with themselves so you may have to go back and forth between them to achieve the desired results.
The monitor contrast and brightness controls will have to be adjusted to see the active area of the SIT tube.
Make sure the camera is held securely in a fixture and cannot move and be damaged.

********** WARNING **********

DO NOT USE EXCESSIVE FORCE TO MAKE THIS ADJUSTMENT. IF THE YOKE DOES NOT MOVE EASILY. CORRECT THE OBSTRUCTION BEFORE PROCEEDING. OTHERWISE YOU CAN DAMAGE THE SIT TUBE.

********** WARNING **********

Loosen the two socket 2-56 screw that secure the yoke retaining ring.
Using a small plastic or nylon flat blade screw driver leverage the screwdriver against the side of the yoke housing and the adjacent gear tooth on the yoke adjustment gear and apply a slight amount of lateral pressure against the gear. This will cause the yoke to rotate either cw or ccw depending on which edge of the yoke housing you anchored the screw driver against. As you rotate the gear observe the edges of the active area of the edges of the sit tube in relation to the edge of the monitor scan . Rotate the yoke so that the monitor scan edges (both vertical and Horiz) are parallel to the active scan area edges of the sit tube.
Turn power off to the camera.
Apply Blue 242 Locktite to the 2 yoke retaining screws and tighten.
Record the completion of this step on the checkout sheet.

VERTICAL AND HORIZONTAL ALIGNMENT COILS

Turn on power to the camera and remove the lens cap.
While observing the test chart, turn down the target voltage (3RV1) on the video processor board, until the image starts to bloom over about 1/2 of the picture. Blooming occurs when the electron beam is not strong enough to discharge the high light areas of the image.
Alternately adjust the horizontal and vertical alignment sliders until the blooming is symmetrical around the center of the picture. Slowly turn up the target voltage back to its correct voltage of 10.0 vdc while observing the picture to be sure the blooming remains symmetrical.
Record the completion of this step on the checkout sheet.

OPTICAL ALIGNMENT OF SIT TUBE AND LENS

The optical centerline of the Sit tube and the lens must be aligned so that the image from the scene is not shifted vertically or horizontally as it passes through the lens and is presented to the SIT tube. Otherwise the image plane will be off axis and the camera will be seeing objects at an angle.
The camera assembly must be precisely placed in front of the resolution test pattern to properly align the optical axis. The center of the lens and the center of the test pattern must be aligned vertically and horizontally and positioned the same distance from a common reference point. The lens of the camera must also be positioned horizontally so that the center of the lens lines up with the center of the test pattern. The camera length must also be perpendicular to the face of the test pattern.
Once the above has been accomplished you can begin optical alignment.
Turn on the power to the camera.
If the centerline of the camera is aligned with the center of the test chart the image on the monitor will show the test pattern in the center of the target mask.
The horizontal and vertical size and centers sliders may have to be adjusted to see the full Target Mask.
If it is correct you do not need to make the following adjustments and can continue to the next step in the procedure.
The following alignment of the SIT tube is only necessary if the tube has been replaced.
There are (4) 8-32 x .5 inch spring plunger screws that are used to orient the SIT tube in the X-Y axis.
There are (4) 6-32 socket head set screw and (4) 6-32 x .5 inch spring plunger screws that lock the assembly into place once the alignment has been completed.
These screws must be loosened in order for you to be able to adjust the 8-32 spring plunger screws. Rotate these screws approx. 3 turns ccw to loosen them.
Slowly loosen the 8-32 spring plunger screws 1/2 turn ccw while observing the test pattern. You should start to see the test pattern shift or move in the x-y axis. By applying combinations of loosening and tightening of these screws you should be able to maneuver the test pattern so that it is centered on the TV monitor. Once you have completed this the (4) 8-32 spring plungers should all be reasonably tight.
DO NOT APPLY EXCESSIVE FORCE TO THESE SCREWS OR DAMAGE TO THE ASSEMBLY COULD RESULT.
Now tighten the (4) 6-32 socket head screws and the (4) 6-32 spring plunger screws. Observe the monitor while doing this. These screws should not effect the optical alignment of the

camera. If these screws are excessively tightened they can effect the optical alignment of the tube.
Record the completion of this step on the checkout sheet.

VERTICAL AND HORIZONTAL SIZING AND CENTERING

Turn on camera power and remove the lens cover.
Adjust the horizontal and vertical sliders to overscan the Target mask.
To view the target mask in relation to the edge of the monitor raster the monitor must be set for underscan.
Adjustment of the monitors brightness and contrast controls will usually enhance the ability to see the target mask in relation to the monitor raster.
Center the target mask within the monitor raster by adjusting the vertical and horizontal centering sliders. Center the test pattern within the target mask by physically orienting the camera.

Adjust the horizontal and vertical size sliders until the boarder of the test pattern (arrows) just touch the edges of the raster. If the arrows on one side touch the edges of the raster before the opposite side touches, DO NOT MOVE EITHER THE CAMERA OR THE TEST PATTERN TO COMPENSATE FOR THIS. Instead adjust the horizontal and vertical centering sliders until all edges of the raster touch simultaneously.
DO NOT CONFUSE THE HORIZONTAL AND VERTICAL CENTERING CONTROLS WITH THE HORIZONTAL AND VERTICAL ALIGNMENT CONTROLS. THEY ARE DIFFERENT ADJUSTMENTS.
Adjust the horizontal and vertical size and centering controls until you obtain a picture that is completely centered within the monitor raster and all the edges of the test pattern are coincident with the edges of the raster on the monitor. Since these adjustments interact with one another you will have to go back and forth between them to achieve the desired results.
Record the completion of this step on the checkout sheet.

REPEAT THE ALIGNMENT OF THE VERTICAL AND HORIZ ALIGNMENT COILS

You will have to readjust the vertical and horizontal centering sliders if you made any adjustment to the alignment coils.
Put lens cover on lens and turn off camera power.
Record the completion of this step on the checkout sheet.

AUTOMATIC LIGHT CONTROL (ALC) ADJUSTMENTS

Make sure lens cover is on.
Adjust light box for 100 ft/candles measured from the front of the camera lens.
Select the underscan mode of operation for the monitor.
Turn on camera power.
Using the computer interface check to make sure the following controls are set as follows.

CONTROL	SETTING	GEMINI CONTROL PANEL
AGC	OFF	VIDEO SET UP PANEL
PEDESTAL	PRESET	VIDEO SET UP PANEL
WHITE CLIP	PRESET	VIDEO SET UP PANEL
GAMMA	1.0	VIDEO SET UP PANEL
VIDEO LONG LINE COMPENSATION	OFF	LONG LINE AMP PANEL

Using your computer select the Auto Light Control Panel.
Remove lens cap and place an ND 1.0 filter on the lens.
Make sure the arrows on the test pattern are properly aligned with the edges of the camera raster.
Refer to the SIT HVPS information recorded on the checkout sheet.
Select the “INTENSIFIER MAX” control and adjust the DC voltage for the value shown on the High Voltage Power Supply data sheet that corresponds to 10KV.

F-64 SET

Select the F-64, IRIS SELECT, control setting.
The iris position indicator (red dot) on the lens should be lined up with the F-64 set point on the lens.
If the iris is not set to f-64 you must first loosen the two set screws

Using the mouse or keyboard select the ALC HOLD button.

********** WARNING **********

The “ALC HOLD” button prevents the iris and intensifier from responding to changes in scene illumination. Do not expose the camera to excessive light levels while you are in this mode of operation or you can damage the SIT tube.

********** WARNING **********

From the IRIS SELECT command select the F-16 iris setting.
Using the oscilloscope monitor the composite video output from the camera.
Adjust the “Intensifier Operating Point” control for 1.2 +/- .02 V P-P composite video.

Turn the camera power supply off.
Replace the iris drive gear and tighten the set screws.
Record the completion of this step on the checkout sheet.

Manually adjust the iris to f-16. This is done by hand by turning the clutch mount, located on the lens, until the f-16 setting on the lens is aligned with the red dot on the lens.

BLACK LEVEL ADJUSTMENT

Make sure the camera is still properly aligned to the test pattern.
Turn on camera power.
Observe video output from camera on oscilloscope.
Place a black piece (black reference) of paper at the far right hand side of the test pattern. This piece of paper should be the height of the test pattern and take up approximately 20% of the picture. Adjust the black level slider, while looking at the oscilloscope, so that the most negative excursions of the video (black) are measured to be 50 to 70 mv above the blanking level. See Drawing below.
Record the completion of this step on the checkout sheet.

VIDEO OUTPUT LEVEL ADJUSTMENT

Turn on camera power.
Observe the composite video signal from the camera on the oscilloscope.
Adjust the video output level slider for a sync amplitude of .4vp-p
Record the completion of this step on the checkout sheet.

CAMERA LIGHT SENSITIVITY AND RESOLUTION TESTS

Set up the camera in front of the test pattern.
Adjust the light box for 100 ft/candles at the lens.
Place an ND 1.0 filter in front of the lens.
Turn on camera power.
Be sure the arrows of the test pattern are correctly aligned to the edges of the monitor raster.
Record the resolution and shades of gray on the check out sheet as the following Neutral Density filters are placed in front of the lens.
The chart below shows the minimum acceptable limits for each ND filter. These minimums must be met in order for the camera to pass final Quality Assurance acceptance.
Record the completion of this step on the checkout sheet.

RESOLUTION AND SHADES OF GRAY ACCEPTANCE CHART

ND FILTER	RESOLUTION	SHADES GRAY	IRIS	HVPS
ND 0.0	≥ 600 HTVL		F16	
ND 1.0	≥ 600 HTVL		F1.8	
ND 2.0	≥ 600 HTVL			
ND 3.0	≥ 600 HTVL			
ND 4.0	≥ 550 HTVL			
ND 5.0	≥ 500 HTVL			
ND 6.0	≥ 400 HTVL			

VIDEO LONG LINE AMPLIFIER TESTS

The video long line amplifiers have the capability of providing sufficient high frequency and voltage compensation for RG59/U cables in excess of 5000 ft. Typically compensation is not required until you reach 1000 ft for RG59/U cable.
Loop the video output from the camera through the 5000 foot RG59/U test cable fixture. This fixture should have video switches that allow you to select from 0 ft to 5000 ft of cable in 1000 ft increments.
Set up the camera in front of the test pattern.
Adjust the light box for 100 ft/candles at the lens.
Place an ND 1.0 filter in front of the lens.
Turn on camera power.
Be sure the arrows of the test pattern are correctly aligned to the edges of the monitor raster.
Adjust the oscilloscope for 10 usec/div sweep. This should allow you to see one horizontal sync pulse along with one line of video on the oscilloscope.
The drawing below shows a properly compensated video signal as compared with an under and over compensated video signal.
Record the resolution and shades of gray on the check out sheet as the following cable lengths are selected from the chart below.
Record the completion of this step on the checkout sheet.

VIDEO LONG LINE AMPLIFIER COMPENSATION CHART

RG59/U CABLE LENGTH	RESOLUTION	SHADES OF GRAY
0 FT	≥ 600 HTVL	≥ 10
1000 FT	≥ 600 HTVL	
2000 FT	≥ 600 HTVL	
3000 FT	≥ 600 HTVL	
4000 FT	≥ 600 HTVL	
5000 FT	≥ 600 HTVL	

LIFE TEST

This test is intended to verify stability of components and locate any possible defective components, that may ultimately fail, prior to shipping the camera.
Install the camera into its pressure housing.
Connect the system cable, monitor and power supply to the camera.
Turn on power to the camera.
Set the camera up in front of the test pattern so that the arrows on the test pattern touch the edges of the raster.
Place a cover over the camera window that allows no light to enter the camera.
This is important so that an image is not burned into the SIT tube.
Check the camera at the end of a 24 hour period and verify that the operational performance has not changed.
Record completion of this step on the check out sheet.

TEMPERATURE TEST

Place the camera internal electronics assembly inside of a temperature chamber capable of providing temperature ranges of -5 degrees C and 50 degrees C (23 deg F to 122 deg F).
Connect the cables, camera power supply, and monitor to the camera to allow you to remotely observe the operation of the camera while it is in the temperature chamber.
Make sure there is sufficient lighting in the chamber to allow 10 to 100 ft candles illumination of the test pattern.
Place a test pattern in the chamber and properly align the camera to the chart.

********** WARNING **********

TO PREVENT POSSIBLE IMAGE BURN OF THE SIT TUBE MAKE SURE THE CAMERA LENS IS COVERED DURING THESE TESTS EXCEPT WHEN YOU ARE TAKING MEASUREMENTS TO EVALUATE PERFORMANCE.

********** WARNING **********

TEMPERATURE TEST PROCEDURE

Adjust the temperature chamber for -5 degrees C.
Allow the camera to operate at -5 deg C for one hour.
Remove the lens cover.
Adjust the illumination level to approx. 5 ft/candles.
The resolution of the camera should not have decreased by more than 50 HTV lines.
You should have the same number of shades of gray.
The vertical and horizontal sizing and centering should not have changed by more than 10%.
Turn the illumination level up to 100 ft candles and observe that the lens iris closes to F-16
Turn power off to the camera and observe that the iris closes.
Let the camera sit for 1 minute.
Turn on camera power and observe that the camera resumes normal operation.
Record the completion of this step on the checkout sheet.
Place the lens cover back on the lens.
Adjust the temperature chamber for 50 degrees C.
Allow the camera to operate at 50 deg C for one hour.
Remove the lens cover.
Adjust the illumination level to approx. 5 ft/candles.
The resolution of the camera should not have decreased by more than 50 HTV lines.
You should have the same number of shades of gray.
The vertical and horizontal sizing and centering should not have changed by more than 10%.
Turn the illumination level up to 100 ft candles and observe that the lens iris closes to F-16
Turn power off to the camera and observe that the iris closes.
Let the camera sit for 1 minute.
Turn on camera power and observe that the camera resumes normal operation.
Record the completion of this step on the checkout sheet.
Place the lens cover back on the lens.
Record the completion of this step on the checkout sheet.

OPTICAL FOCUS IN WATER

Place the lens cover on the camera.
Loosen the two set screws that hold the iris drive gear and remove the gear.
Unplug the Iris motor connector.
Manually set the iris to f1.2.
Loosen the two set screws that mount the lens to the C mount adapter.
Warning avoid exposure of camera to high light levels during these tests.
Place the front of the camera lens 6.0 inches from the test pattern.
Adjust the light box for 10 ft/candles at the front of the lens.
Place an ND 1.0 filter in front of the lens.
Turn on camera power and remove the lens cover.
Pre set the in water focus by rotating the lens cw and ccw until the test pattern is in sharp focus on the monitor.
Turn off camera power.
Place the corrected window lens adapter on the front of the lens.
Place the camera behind the corrected window of the test tank and push the camera gently against the inside of the corrected window until it touches.
Place the underwater test chart in the tank and set it for a distance of 7 inches from the front of the corrected window.
Turn on camera power.
Rotate the lens slightly cw and ccw and make sure that the test chart is focused on the monitor.
Move the Test pattern to a distance of 7 ft from the front of the lens and verify that it is still in sharp focus.
Slight adjustment of the lens focus may be necessary to achieve focus at both distances.
Turn off camera power.
Tighten the two set screws that hold the lens into the C mount.
Replace the iris drive gear and tighten the two set screws.
Plug the iris motor connector back in.
Record the completion of this step on the checkout sheet.

FOCUS SETUP for 6.5mm Wide-angle lenses

Reference documents:
GM1-0350A: LENS MOUNTING PLATE
PL-GM1-0350A: LENS MOUNTING PLATE

INITIAL FOCUS SETTING

After the camera calibration has been completed and the camera is ready to be installed in the housing the in water focus must be set. This done by setting the distance from the faceplate of the SIT tube to the lens mount base using a 0.001 resolution depth gauge (included on most calipers). This is done as follows:

1. Loosen the (3) slotted set screws in the (stainless steel) lens base. These are accessed between the Iris Gear and the Lens Sensor PCA with a 2mm blade-jewelers screw driver. This releases the lens body and clutch assembly. Carefully remove the lens body/clutch assembly from the lens base.

2. Loosen the (2) 6-32 set screws in the Lens Mounting Plate with a 0.062 hex wrench. This allows the (stainless steel) Lens Base and attached (brass, threaded) C-mount adapter ring to rotate. Measure the distance from the outermost surface of the Lens Base to the SIT tube faceplate. BE EXTREMELY CAREFUL NOT TO SCRATCH THE FACEPLATE WITH THE DEPTH GAUGE. Set the distance to 0.895 (this approx. 12") Rotate clockwise to decrease the distance to the faceplate.

3. Apply light even pressure to the Lens Base while tightening the 6-32 set screws in the Lens Mounting Plate (to maintain parallelism between faceplate and lens mounting surface.

5. Now, install the lens body in to the Lens Base. Tighten the (3) slotted set screws in the (stainless steel) lens base. Initial focus is now set.

6. To test the focus setting place the front of the lens 4.75 inches from the test chart. Adjust the light box for 10 ft candles illumination measured from the front of the lens. Put an ND 2 filter in front of the lens. This will cause the iris to open and provide the narrowest depth of field. The resolution of the test chart should be sharp if the focus has been set properly.

AUTO INPUT POWER SELECT TEST

These tests will verify that the cameras input power selection circuits operate properly when the camera main input power supply varies from 18 to 30 vdc constant voltage, or changes to a constant current source of from 850 to 1000 ma.
Adjust the light box for 10 ft/candles illumination.
Adjust the Camera input power supply for constant voltage at 18vdc.
Turn on power to the camera.
Position the camera in front of the test pattern so that the arrows on the chart touch the edges of the monitor raster.
While observing the video on the monitor, gradually increase the camera supply voltage in 1 volt increments until you reach 30vdc.
There should not be a noticeable change in performance of the camera during this test.
Turn off camera power.
Change the camera input power supply to provide 800ma constant current.
Turn on power to the camera.
While observing the video on the monitor, gradually increase the camera supply current to 1.0 amps.
There should not be a noticeable change in performance of the camera during this test.
Record the completion of this step on the checkout sheet.

FINAL PRODUCTION INSPECTION AND QUALITY ASSURANCE APPROVAL

Remove all circuit boards from the camera. Do a complete through inspection of the circuit boards to make sure there are no cold solder joints and no loose components.
Inspect all of the internal assemblies to be sure all appropriate screws and hardware have been installed and if required locktite has been applied.
Submit the disassembled camera and circuit boards along with the checkout data sheet to quality control for inspection.
Quality control shall do a complete physical inspection of all circuit boards and mechanical assemblies to insure all solder connections and all mechanical assemblies have been properly done.
Once quality control has approved the inspection of the camera it shall be reassembled for final testing.
Quality control shall witness the resolution, sensitivity and shades of gray testing as defined in this procedure.
The completion of this step shall be signed off by the quality assurance inspector.

ASSEMBLY INTO PRESSURE HOUSING AND SOAK TEST

Check the work order or sales order to determine the pressure housing the camera is to be assembled into.
An approved pressure certification sheet must accompany the pressure housing.
Do not assemble the camera into a pressure housing that has not been certified.
Make sure the underwater connector is properly protected by either a dummy plug or cap prior to putting the housing into the test tank.
Once the camera has been properly assembled into the pressure housing, place the camera into the low pressure soak tank.
The camera shall remain in the tank for a minimum of 8 hours.
Remove the camera from the test tank.
Dry the camera housing off and remove the protective cover from the underwater connector.

ELECTRICAL ISOLATION TEST

Using a VOM measure the electrical isolation of the camera housing to all of the electrical connections of the underwater connector.
This can be done by pressing one of the meter leads against the housing while individually touching the other lead to all of the other connections.
This can be done easily if the camera is titanium or stainless steel and is not anodized.
The isolation for each connection should be greater than 10megohm.
Record the completion of this step on the checkout sheet.