INSTRUCTIONS FOR THE INSTALLATION, OPERATION AND MAINTENANCE OF THE BENTHOS MODEL 383 EDGERTON DEEP SEA HIGH INTENSITY FLASH

M-383-001 Rev. B

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1.0 INTRODUCTION

This manual furnishes instructions for the installation, operation and maintenance of the Benthos Model 383 Edgerton Deep Sea High Intensity Flash. The Flash, capable of operation at depths to 12,000 meters, has been designed for reliability and ease of operation for a variety of underwater and bottom photography applications.

The Flash is a fast recycle, high energy, variable light source, normally set to provide an output of 200 watt-seconds. Output is adjustable to a maximum of 200 watt-seconds. The Flash is powered by a Benthos Model 391 Master Battery Pack, which controls triggering of the Flash, as well as actuation of the Camera shutter and film drive.

Controls and adjustments, contained in the programmer portion of the Master Battery Pack, actuate the system, hold the system in standby condition while lowering to depth, set the interval between photo frames, and adjust the exposure (shutter speed). A system test function is also provided.

The Model 383 will put out 4,000 or more high intensity flashes before battery recharging or replacement is required. The flash duration is so short (approximately 1 millisecond) that under most conditions, photographs are sharp even if the Camera or subject is in motion.

The Model 383 Flash is normally used with the Benthos Model 372 Standard or 377 Survey Cameras and the Model 391 Master Battery Pack, providing a self-contained, programmed system. An Auxiliary Battery Pack (Model 392) is provided to assure continuous 28 VDC power for deep ocean photographic missions.

2.0 GENERAL DESCRIPTION

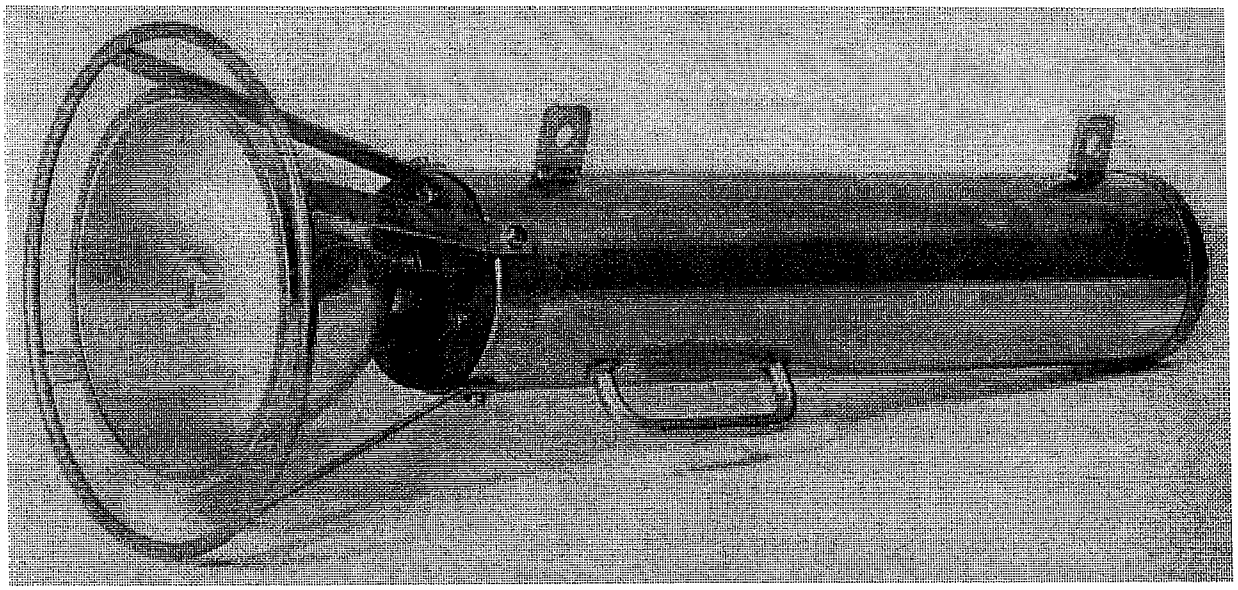
The Benthos Model 383 High Intensity Flash operates as a companion unit to the Benthos-Edgerton Deep Sea Cameras. The Flash is shown, ready for operation, in Figure 2-1 and disassembled in Figures 2-2 and 2-3.

The Model 383 delivers its 200 watt-second flash to a xenon tube supplied by four 525-microfarad, 450-volt storage capacitors wired in series parallel. The capacitors are powered by a rechargeable 28-volt nickel-cadmium Master Battery Pack (Model 391), which is contained in a separate housing. An Auxiliary Battery Pack (Model 392) is provided for power supply backup.

The capacitors are discharged through the flashtube, providing a high intensity white light of 200 watt-seconds. Light output can be adjusted with the voltage control potentiometer located on the Flash chassis printed circuit board (see Figure 2-3). This is a useful feature for close-up photos.

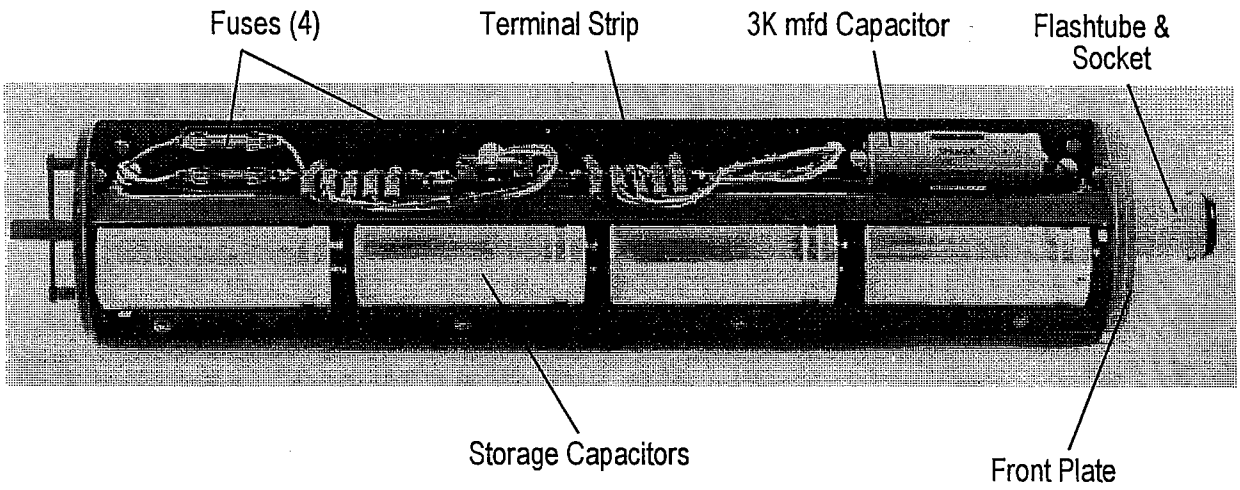
The Flash consists of two main assemblies:
1. Housing
2. Chassis

Detail drawings are included in Appendix C.



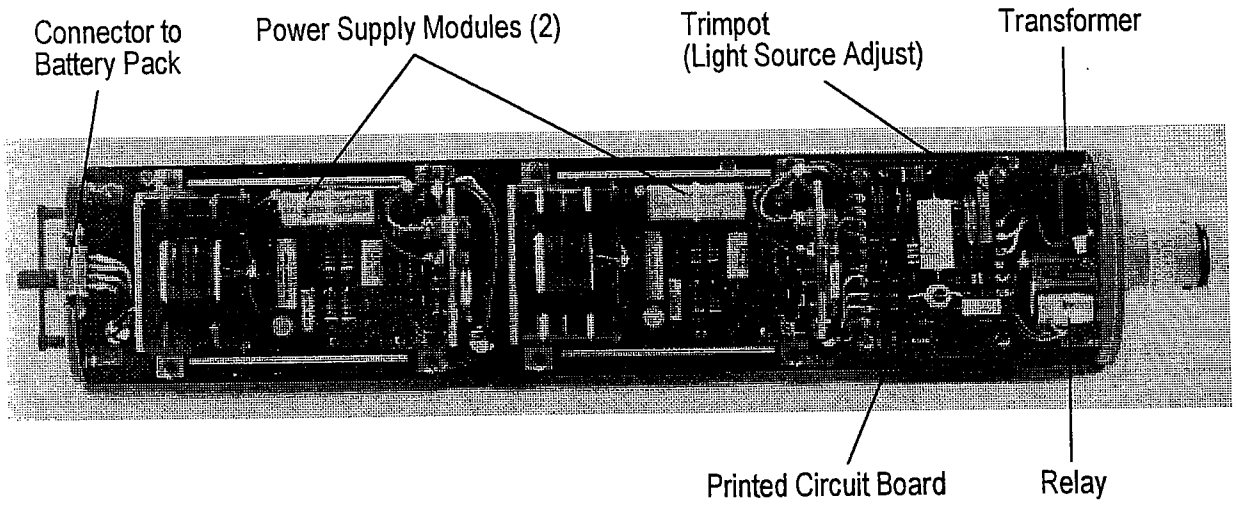
The Benthos Model 383 Edgerton Deep Sea High Intensity Flash

Figure 2-1



Model 383 Edgerton Deep Sea High Intensity Flash, Top View

Figure 2-2



Model 383 Edgerton Deep Sea High Intensity Flash, Bottom View

Figure 2-3

2.1 Housing Assembly

The Model 383 Flash housing assembly consists of a cylindrical body weldment, and front and rear end caps. The housing assembly is pressure tested to 12,000 meters at Benthos before shipment.

2.1.1 Front End Cap

The front end cap provides a pressure-proof mounting for the lamp cover and reflector (see Figure 2-1) and is permanently welded to the housing. The lamp cover is sealed by an O-ring which is mounted in a sealing ring. A clamping ring is bolted to the front end cap to pressure-proof the assembly. The reflector is mounted to the lamp cover using an adjustable hose clamp and is insulated from the glass by vinyl tape. The reflector is also attached to the end cap by a safety wire to prevent its accidental loss.

2.1.2 Housing Body

The housing body (Figure 2-1) is a stainless steel weldment providing two carry handles and two mounting pads. If, in certain situations, the handles or mounting pads are not compatible with the configuration of the user's application, they can be sawed off and the weld area filed or ground smooth.

2.2 Chassis Assembly

Figures 2-2 and 2-3 show top and bottom views of the chassis assembly. The major electrical components of the chassis are:

- the xenon flashtube
- four energy storage capacitors
- two power supply modules
- printed circuit board
- 14-pin connector
- relay
- trigger transformer
- a 3,000 mfd (30 VDC) capacitor
- four fuses
- terminal strip
- wiring.

The circuit components required for operation of the Flash (see Section 3) are contained in the power supply modules and also on the printed circuit board as shown in Figure 2-3. The PC board components include a trim potentiometer for adjusting the light source. The electrical components are identified in the schematic diagrams in Appendix C.

The xenon flashtube is inserted into the mounting socket and base located on the front plate of the chassis. The two mounting screws for the mounting socket also clamp the unused pins of the flashtube, securing it in place.

CAUTION: Due to the high voltage contained in the chassis, refer to the precautionary instructions given in Section 5.0 before handling or working on the chassis

2.3 Power Supply

Power to operate the Flash and associated Camera equipment is supplied by the Benthos Model 391 Master Battery Pack and Model 392 Auxiliary Battery Pack (see Figure 2-4).

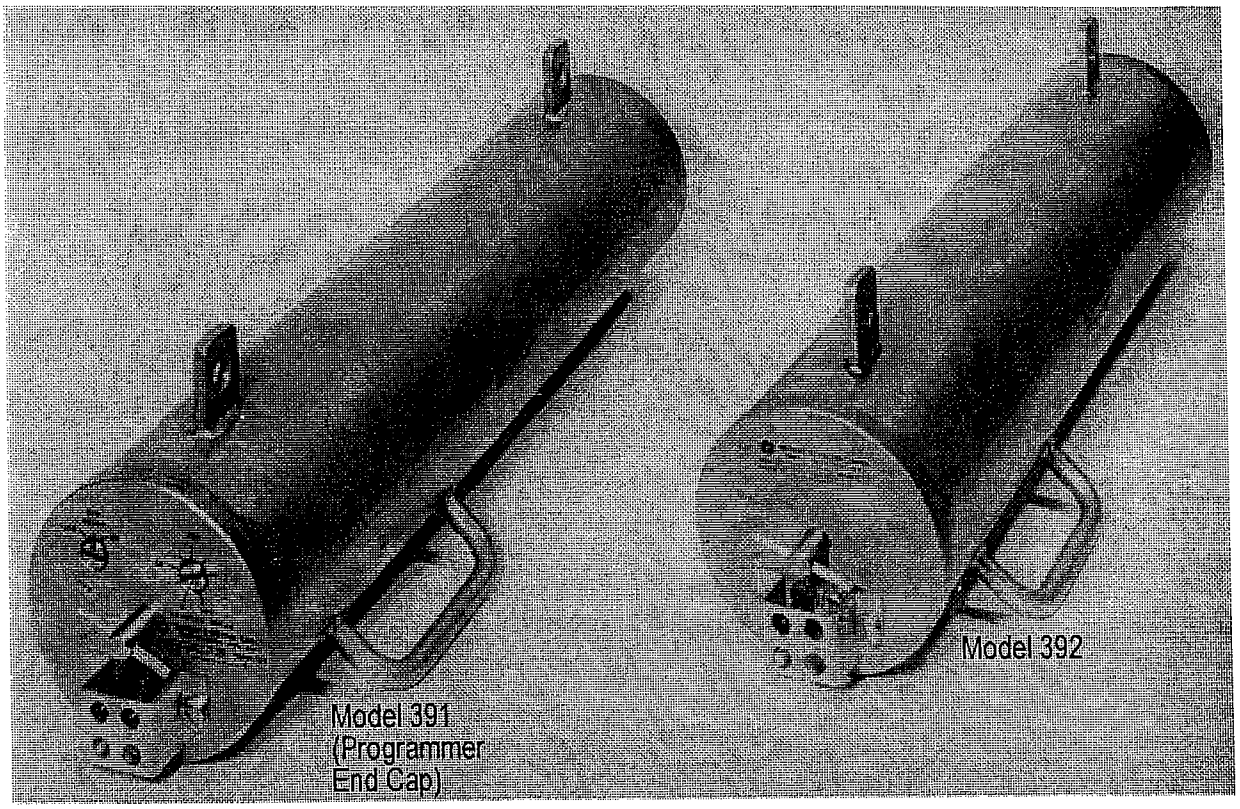
2.3.1 Master Battery Pack

The Master Battery Pack supplies 28 VDC power from 24 1.2-volt nickel-cadmium C-cell batteries assembled within a stainless steel housing which has been tested to a pressure equivalent to 12,000 meters depth. The housing contains two mounting pads and a carrying handle. The batteries are held in compression by end plates and through rods. The rear end cap of the Master Battery Pack is the "programmer" for the Camera/Flash system, containing function and adjustment controls. Identification of cable connections is identical to the Camera and Flash units.

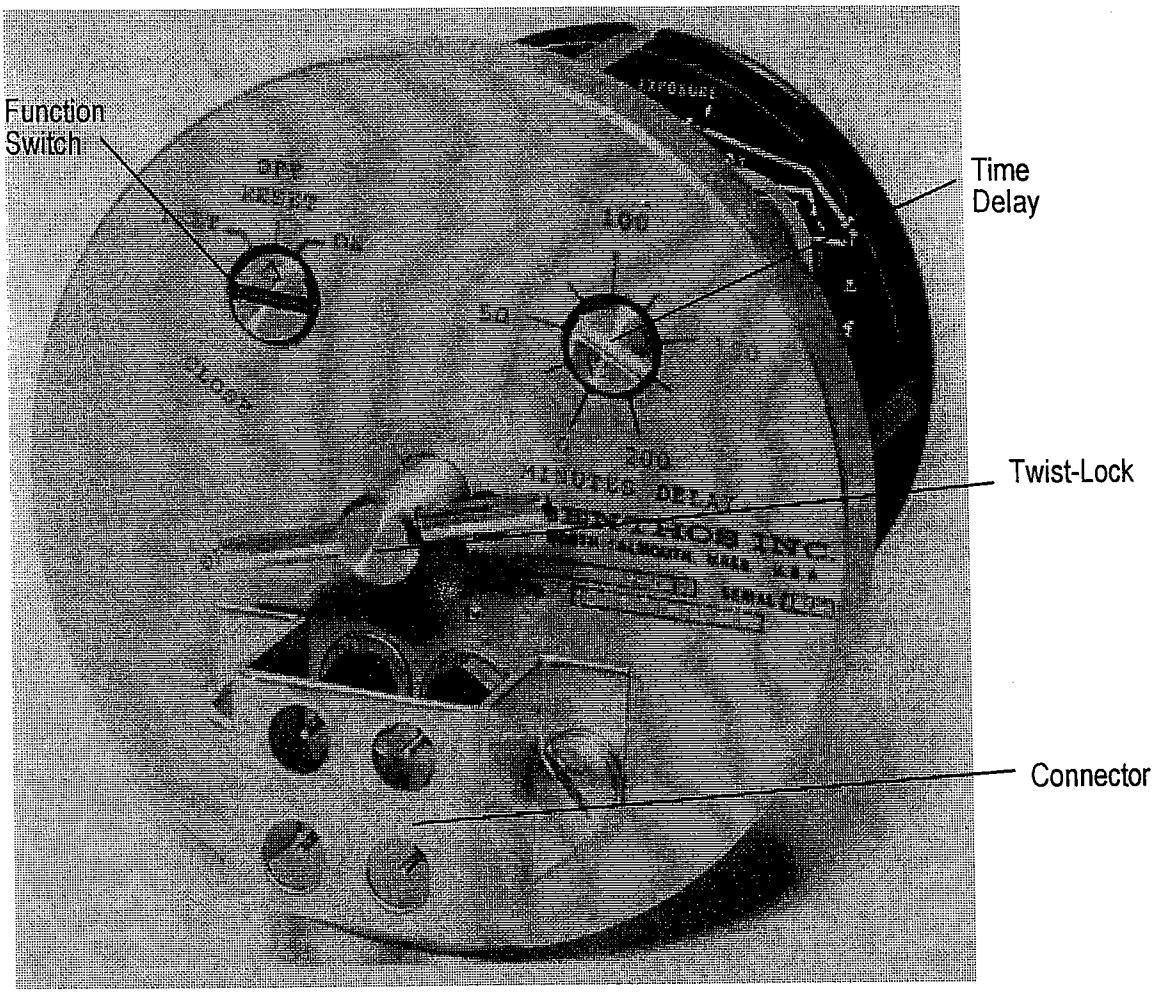
The programmer end cap (see Figures 2-5 and 2-6) contains the two external controls operating TEST--OFF/RESET--ON and MINUTES DELAY functions, a printed circuit board mounting two potentiometers for adjustment of exposure (shutter speed) and frame interval, a switch linked to the TEST--OFF/RESET--ON function, potentiometer for the MINUTES DELAY function, and a 14-pin male connector which mates the internal battery assembly and external cable connections. The programmer end cap forms the rear closure portion of the housing assembly and is also pressure tested to 12,000 meters. The Benthos "twist-lock" closure system locks the end cap to the housing.

The programmer end cap contains two O-rings, one forming a radial seal inside the housing and the other forming a face seal on the end of the housing. As the housing is lowered into the sea, a metal-to-metal seal occurs between the end of the housing tube and the end cap on the annular area inside the face seal O-ring.

Mounted on the outside of the end cap is a stainless steel "connector protector" which prevents damage to the cable harness and provides common (ungrounded negative), trigger or "sync", battery, and programmer leads to the cable harness.

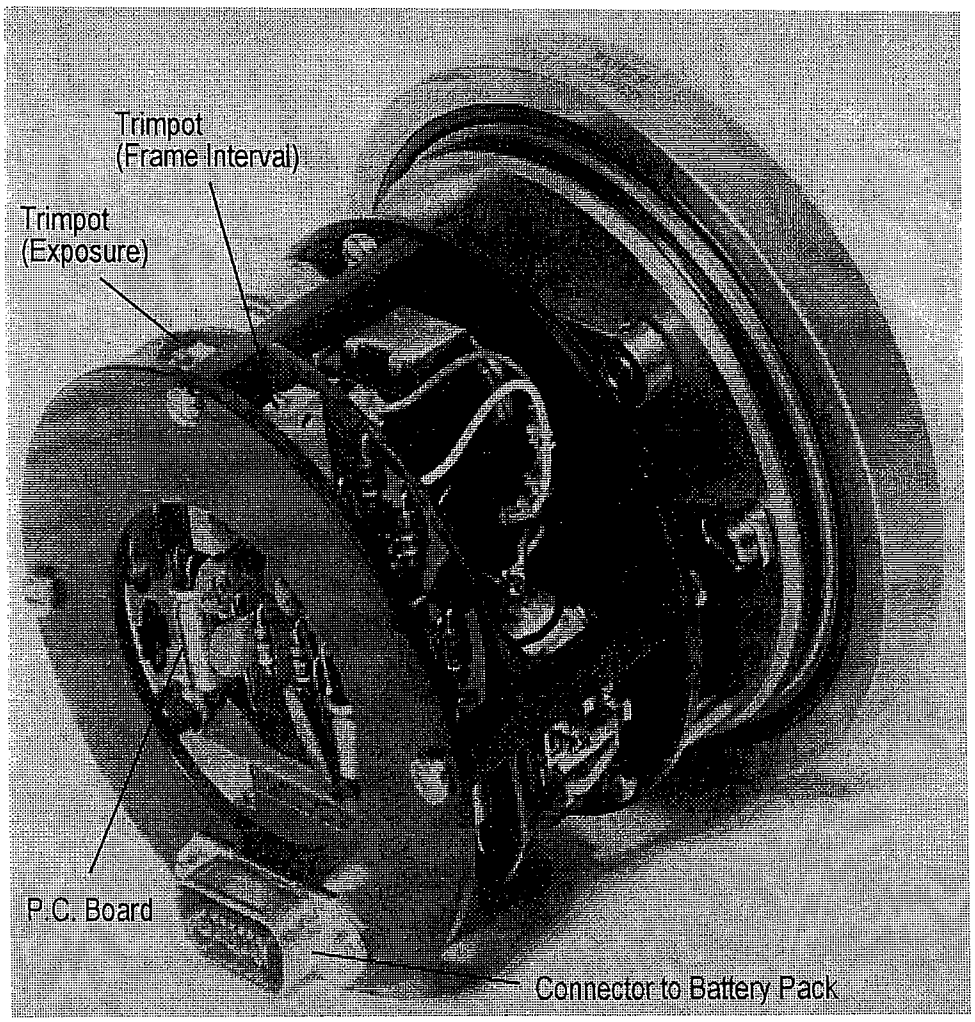


The Benthos Model 391 Master Battery Pack and
Model 392 Auxiliary Battery Pack
Figure 2-4



Programmer End Cap Assembly of Master Battery Pack, External View

Figure 2-5



Programmer End Cap Assembly of Master Battery Pack, Internal View

Figure 2-6

2.3.2 Auxiliary Battery Pack

A Benthos Model 392 Auxiliary Battery Pack (Figure 2-4) is provided to assure a constant source of 28 VDC power when a camera system is operating at great depth.

The Auxiliary Battery Pack consists of 24 1.2-volt nickel-cadmium batteries assembled within a pressure tested housing in the same way as described for the Master Battery Pack. The housing contains a rear end cap with twist-lock closure and cable connections identified in the same manner as the Camera, Flash and Master Battery Pack.

2.4 Cable Harness

The cable harness is made up of four insulated 6 foot (2 meter) long cables with rubber caps at each end for making the connections between Flash, Camera, Battery Packs and Bottom Finding Pinger. Each cable is coded by means of knobs on the end caps for proper attachment to the numbered connector pins (see Figures 2-5 and 4-2).

2.5 Spares Kits

Spare parts kits are available for servicing the Model 383 Flash and companion Battery Packs at sea. The kits contain electrical and mechanical replacements parts. Parts lists describing the spares provided are included in Appendix C. Spare parts kits should be available aboard ship for all deep sea missions.

2.6 Specifications

Depth Rating:	12,000 meters
Power Source:	Benthos Model 391 Master Battery Pack and 392 Auxiliary Battery Pack each providing 28 VDC - cadmium rechargeable batteries (24 Gould 1.2 volt, No. 4 - OSCL, connected in series)
Capacitance:	525 microfarads; 800 volts; 200 watt-seconds
Number of Flashes:	Approximately 2,000 per battery pack
Flash Duration:	Approximately 1 millisecond
Recycle Time:	Less than 3 seconds with fully charged battery
Spectrum of Light Output:	White. Essentially the same spectrum as sunlight
External Materials:	
Housing:	Hardened 17-4PH stainless steel
Lamp Cover:	Annealed glass
Lamp Cover Retainer:	PVC Plastic

Dimensions:

Flash:	69 cm (27 5/8 inches) long by 12.2 cm (4 7/8 inches) diameter
Battery Packs:	59.5 cm (23 13/16 inches) long by 12.2. cm (4 7/8 inches) diameter

Weight:

Flash:	in air:	21 kg; 46 pounds
	in water:	15 kg; 33 pounds
Battery Packs:	in air:	26 kg: 58 pounds
	in water:	20 kg, 45 pounds.

3.0 THEORY OF OPERATION

The Model 383 High Intensity Flash consists of a xenon flashtube and electronics mounted on a chassis contained in the housing assembly. The Flash is powered from 28 VDC Master and Auxiliary Battery Packs. The Master Battery Pack contains a programmer which provides function switches and adjustments to control the Camera/Flash system. Schematic diagrams are shown in Drawings C-383-12, C-391-10 and B-380-177 in Appendix C.

3.1 Flash

The Flash chassis consists basically of:

- a capacitor bank which stores the energy for each Flash
- power supply modules which convert the 28 VDC to the necessary 800 VDC
- a P.C. board which controls the voltage on the capacitor bank and supplies the trigger pulse to fire the Flash.

Upon application of power, C15 is charged to 28 VDC by the "P" line from the programmer through diode D13 and R29. This in turn biases the amplifier Q2 and Q3 ON by way of R22. The amplifier provides a ground path for the coil of relay L2, activating it. With the relay closed, voltage is fed to the power supplies which begin to charge the capacitor bank C17, C18, C20 and C21. The output of the power supplies is a maximum of ±400 VDC relative to ground. As the negative potential on the capacitor bank increases, the voltage across the neon light (signal light A230) also increases. This voltage is a constant proportion of the total negative voltage determined by the voltage divider formed by R28 with R26 and potentiometer R27. When the potential across the neon light reaches approximately 65 VDC, it turns on, pulling the base of Q3 to ground (it can not go negative due to D12), thus turning off the amplifier Q2 and Q3 and with it, the power supply. The neon light will now stay on until the voltage across it drops to approximately 55 VDC which will happen when either:

1. the Flash is fired and capacitors C17, C18, C20 and C21 are discharged, or
2. the capacitors self-discharge to a level where the divider voltage can no longer hold the neon light on. In this way, the capacitor bank voltage is maintained when there are very long intervals between firings.

As the power supply charges the capacitor bank C17, C18, C20 and C21 to ±400 volts, it also charges capacitor C19 to approximately 270 volts, achieved by the voltage divider formed by R24 and R25 with respect to the +400 volt tap on the capacitor bank and ground. In order to trigger the Flash, C21 is discharged (by turning on the silicon controlled rectifier Q5) into the primary of the trigger transformer T1 which generates a high voltage spike which is applied to the trigger of the flashtube, causing the tube to fire. Capacitor C16 is normally held discharged by transistor Q4 which is biased on by way of the voltage present at C15 through R18 and zener diode D11. When the sync line is grounded, the base of Q4 is pulled to common through D11, R17 and D8, turning Q4 off. This allows current to flow through R20 to charge capacitor C16 as well as triggering the silicon controlled rectifier Q5. Thus a high-voltage trigger pulse is generated each time the sync is grounded.

3.2 Programmer

The programmer end cap controls the timing interval between pictures, the exposure (shutter speed), the delay before the system begins to operate (for deactivation during lowering), as well as the necessary switching for operating, resetting and testing the system.

When switch S1, accessible from the outside of the end cap, is switched to the ON position, power is supplied to the logic circuit on the PC board as well as the rest of the end cap assembly. As soon as power is applied, capacitors C2 and C3 are charged by way of resistor R2 and the "delay" potentiometer R1 (also accessible from the outside of the end cap). When the voltage at pin 13 of IC1 reaches the threshold of IC1 (approximately 2/3 supply voltage), they are discharged and the cycle repeats. Thus these components, in conjunction with IC1, form an oscillator whose frequency over a range is controlled by the delay potentiometer R1. IC1 is a programmable timer and counts the oscillations of the time base. After 255 counts (when IC1 is wired as in this application) the output (pins 1 - 8 and 10) goes high, initiating operation of the system by triggering IC2. Once IC2 is triggered, it runs in an astable mode with a frequency that is controlled by R8, C8 and the "interval" potentiometer R7 located on the PC board. Like the preceding stage, IC2 counts the oscillations, but in this case the output goes high after every 192 counts, since the counter IC2 is programmed differently from IC1.

On the negative-going edge of each output from IC2, IC3 is triggered, which is used in a monostable mode. Upon triggering, IC3's output (pin 3) goes high for a period of time determined by the R-C network formed by R12, C12 and the "exposure" potentiometer R11 located on the PC board. With pin 3 high, transistor QL is biased on, providing a ground path for the relay coil L1 and activating it. When L1 is activated, the P3 terminal on the end cap is switched from +28 volts to ground. This transition triggers the Camera and controls the operation of the whole system. The "P" line is also connected to the strobe, but as a source of power for the logic circuit and not as a trigger. Capacitor C15 holds the logic supply voltage up during the grounded period of the "P" line.

When S1 is switched to the TEST position, it not only provides power for the system, but bypasses the delay timing stage and puts the system into immediate operation. It does this by providing an instant trigger for IC2 (pin 11) instead of the trigger coming from the output of IC1.

By moving the jumper on the PC board to the "R" (remote) position, both the delay and the interval sections of the timing circuit can be bypassed. In this mode, IC3 is triggered by the grounding of pin 3 of the PC board connector. In Model 391 programmers wired with the remote option, pin 3 of the PC board connector is wired to the 4 (S) joy connector on the end cap (on programmers without the option there is no 4 (S) connector). With the jumper in the remote position, manual triggering is thus achieved by grounding the 4 (S) terminal (see Figure 4-2). When the jumper is in the automatic position, the 4 (S) terminal is not used and should be capped with one of the dummy connectors supplied.

When the first two timing stages of the programmer are bypassed for remote trigger, the shutter speed will still be controlled by IC3 and can thus be adjusted with the "exposure" potentiometer R11.

The Model 391 Master Battery Pack also supplies the necessary power to operate the Camera/Flash system. The supply voltage is switched by S1 in the end cap from which it provides the rest of the system with power.

4.0 INSTALLATION AND PREPARATION

4.1 Unpacking

When the Model 383 High Intensity Flash and power supplies are received, examine the exterior of the shipping container for damage. Carefully remove the equipment and verify the packing list. The standard equipment furnished with each Flash consists of:

- Flash:
  a. Housing assembly with reflector and lamp cover
  b. Chassis assembly
  c. Rear end cap
- Master Battery Pack:
  a. Housing assembly
  b. Programmer end cap
  c. Battery assembly
- Auxiliary Battery Pack:
  a. Housing assembly
  b. Battery assembly
  c. Rear end cap
- Four female underwater connectors with leads approximately 2 meters (6 feet) long.
- Instruction manual

Should there be any damage or missing items, immediately file a damage claim with the carrier. Forward a copy of the claim to Benthos, Inc. and make arrangements for repair or replacement. Do not return any equipment without written instructions from Benthos.

4.2 Tools and Equipment Required

Assembly, disassembly, adjustments, settings and parts replacement for the Flash and Battery Packs can be made with standard tools and equipment. Test equipment should include:

- a suitable voltmeter for checking battery voltage and the presence of voltage on the flashtube
- an ohmmeter to perform a cable harness check.

A "hotsplicer" is useful for cable splices but Scotchfill and plastic electrical tape (#88) can be used. Detailed information is given in Section 4.6.

A supply of silicone grease should be available for use with O-ring seals. Acetone, distilled water and cottons swabs are required for proper cleaning of flashtubes.

4.3 Inspection and Checkout

The Flash should be given a complete visual inspection and operational check. Refer to Section 5 for operating instructions.

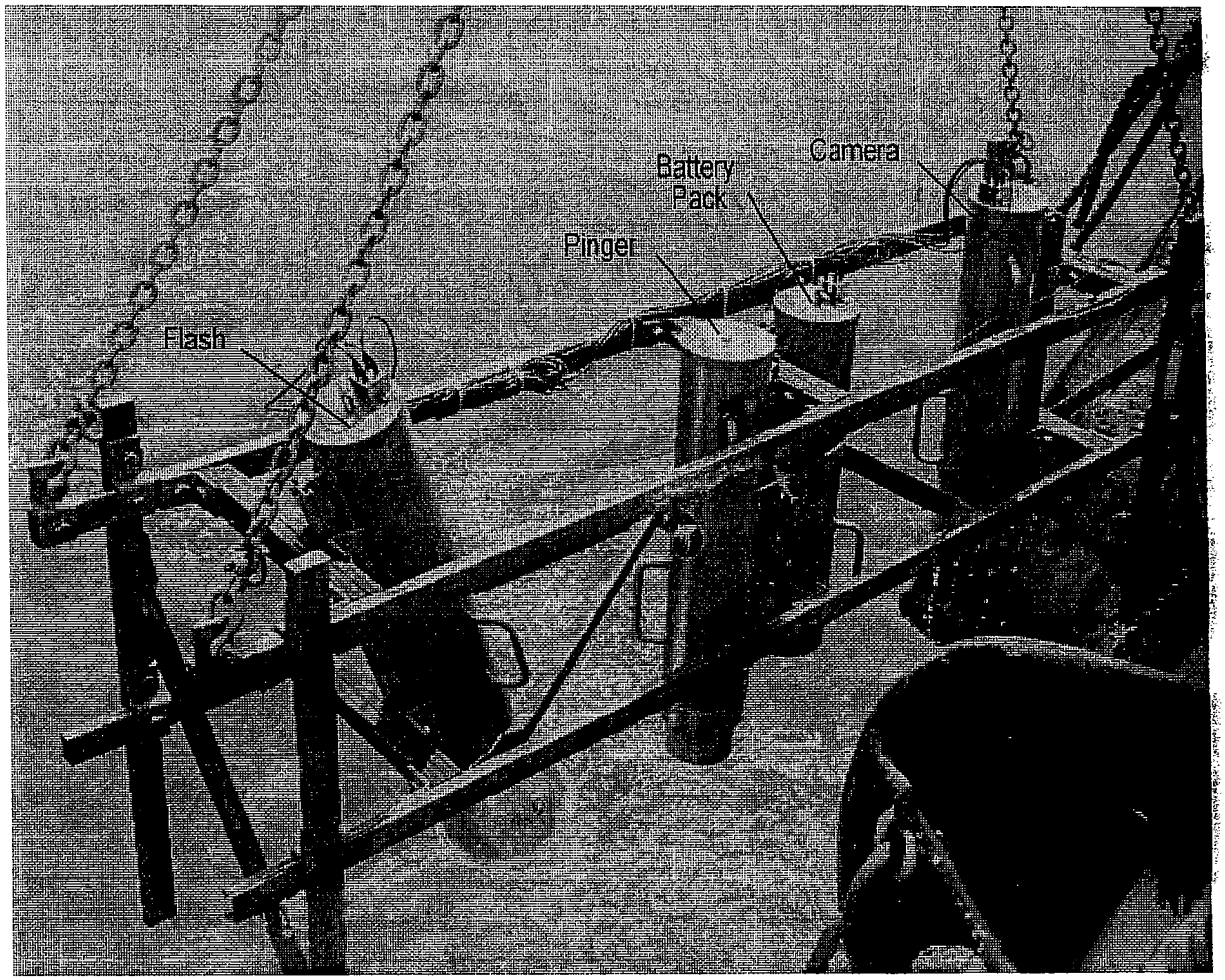
It is good practice the check the Battery Pack voltage before use. The Master or Auxiliary Battery Packs should be recharged when their voltage measures less than 24 VDC under load. Special care should be taken of the end cap closure O-rings to insure that they are always lubricated, clean and properly seated (see Section 6.1.1). Observe precautions given in Section 5 due to the presence of high voltage in the chassis.

4.4 Mounting

The outline dimensions of the Model 383 Flash are given in the specifications (see Section 2.6). The Flash can best be mounted by means of the two pads welded to the housing body. Use two stainless steel bolts, ½ inch in diameter, with stainless steel lock nuts. The removable end caps should never be allowed to rest against anything when mounted since this may affect their seal. It is also desirable to have adequate clearance at the rear of the Flash housing so that the battery pack and chassis assembly can be removed without having to dismount the housing.

The Camera and Flash should be positioned so that their axes intersect at the distance that the Camera lens is in focus in water. Normally the Camera and Flash are placed as far apart as practical in order to reduce "flare back" due to light scattering and to enhance shadows. A typical mounting arrangement is shown in Figure 4-1.

A variety of mounting frame designs have been used; however, the most successful ones are as heavy duty as can be handled by the surface ship. After the Camera and Flash positions on the frame are determined, the Battery Packs can be mounted and the cable harness installed and secured to the frame.



Benthos Model 372 Camera, Model 383 Flash and Model 2216 Pinger mounted on Type 397 Framework

Figure 4-1

4.5 Cable Connections

A stainless steel "connector protector" is located on the removable programmer end cap to prevent damage to the connector pins. The four connector pins are numbered and lettered as shown in Figure 4-2.

Each mating female connector is number coded to identify it. Each of these connectors has either 1 or 4 knobs on it to identify which connector it goes to. The female connectors in the spare parts kit all have 10 knobs on them (2 rows of 5). When installing one of these spares, be sure to carefully cut off the excess knobs to identify the connector.

Figure 4-2 also shows the interconnection of the Flash with a Camera, Battery Packs and a Pinger. Several precautions should be observed during initial installation or during subsequent mounting and cable interconnections:

a. Each time the cables are connected to the Flash or Battery Packs, they should be cleaned and lightly lubricated with fresh silicone grease.

b. The underwater connectors should always be mated in air rather than underwater. Any unused underwater connectors must be capped or plugged with rubber caps and plugs provided.

c. The cables used to connect the Flash, Camera and Battery Packs should be carefully taped or tied away from areas where they could be damaged.

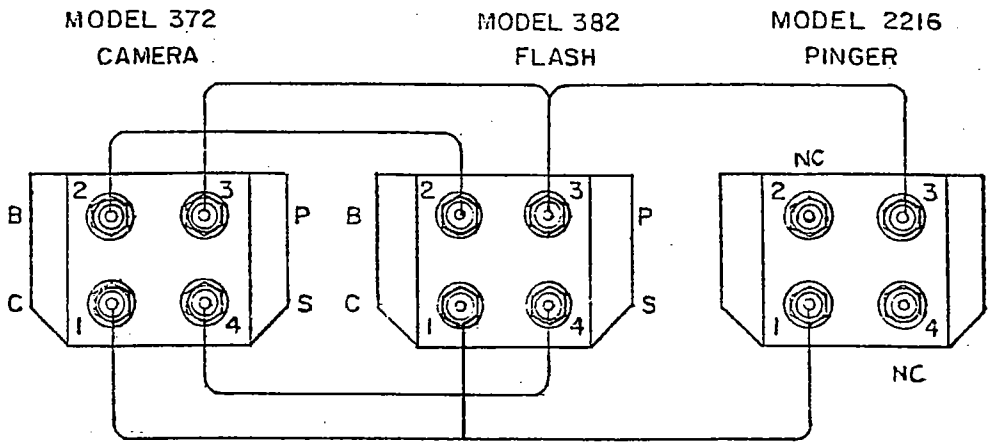
d. It is best not to unplug the underwater connectors from the end cap every time it is removed from the housing to unload or install the Flash chassis or to remove or install the Master Battery Pack programmer. The underwater cable harness should have enough slack in it near the equipment so that it is not necessary to unplug the connectors to remove the end caps. The end caps should be replaced quickly to keep moisture and dirt out of the housings.

4.6 Cable Harness Check

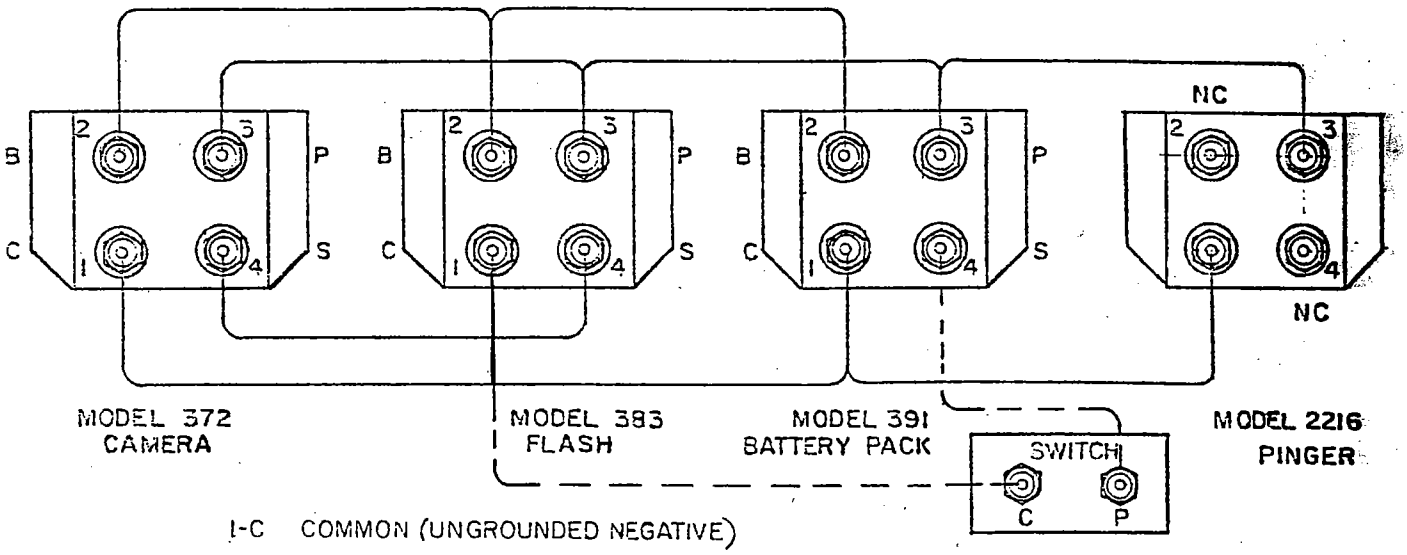
To check the integrity of the connector cables, each connector except one should be plugged or capped. The cables should then be submerged in salt water (preferably for several hours at pressure) except for the one unplugged connector. An ohmmeter is used to test the resistance between the unplugged connector and the salt water as shown in Figure 4-3.

If the resistance is greater than 2 megohms, the cable harness is considered to be good. If the resistance is less than 2 megohms, the harness is questionable. If the resistance is less than 20,000 ohms, the system may not operate. An ohmmeter may be used to make an inspection along the cable harness to find the location of a fault.

a. STANDARD SYSTEM (WITH MODEL 382 FLASH)



b. OPTIONAL SYSTEM (WITH MODEL 383 FLASH AND MODEL 391 BATTERY PACK).



1-C COMMON (UNGROUNDED NEGATIVE)

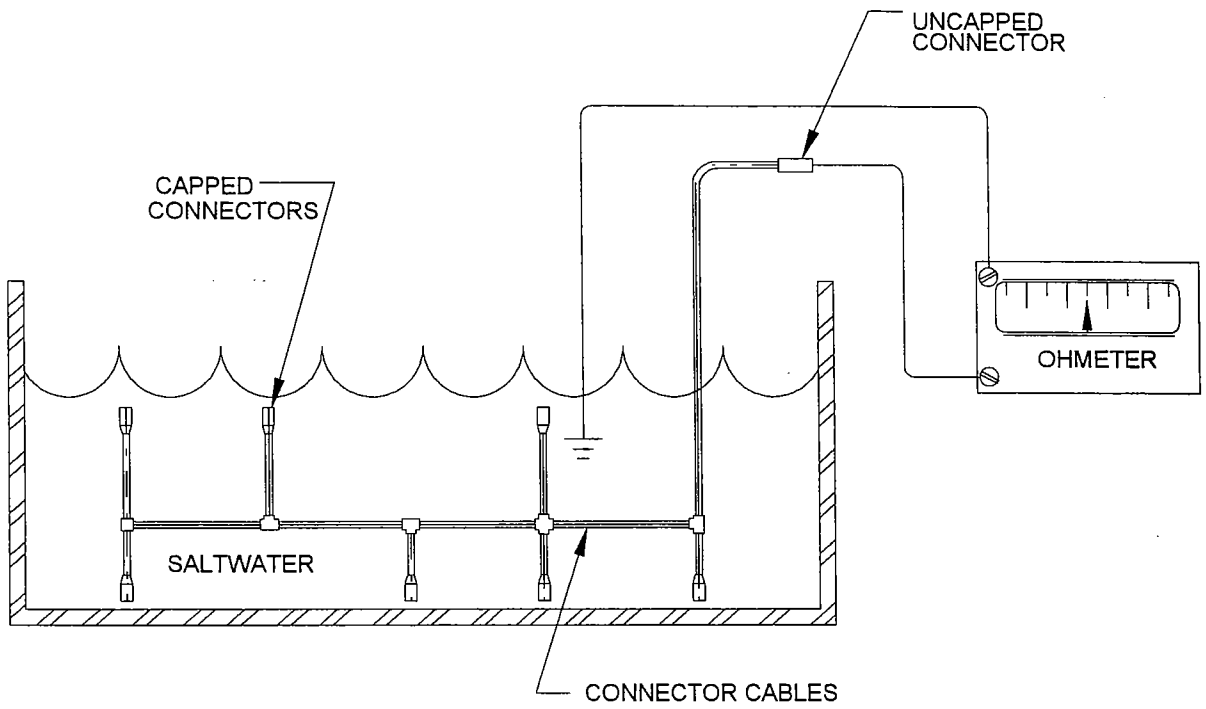
2-B EXTERNAL BATTERY (OPTIONAL)

3-P EXTERNAL PROGRAMMER

4-S SYNC TO FLASH

NC = NOT CONNECTED

FIGURE 4-2 Interconnections for Single Camera Systems using Model 383 High Intensity Flash



Set-up for Wiring Harness Check

Figure 4-3

New wire or connectors may be spliced into the cable harness by soldering the wires together and then covering them with molded neoprene rubber, using a portable rubber vulcanizing machine such as the "Hotsplicer".* Be sure that the rubber vulcanizes well to the insulation of the wires. Another method of insulating the soldered splice is to cover it with Scotchfill ** and wrap it with narrow strips of #88 electrical tape, tightly stretched and wrapped well around the soldered joint and along the insulation of each wire for about 1 inch (2.5 cm). The completed splice should be checked in salt water for leakage as described above.

* A manufacturer of these machines is:

Joy Technologies, Inc.
338 South Broadway
New Philadelphia, Ohio 44663 U.S.A.
Telephone: 216-339-1111

** Scotchfill is a product of 3M Corporation and is available from local suppliers.

5.0 OPERATION

The following sections describe the operating controls and adjustments for the Model 383 Flash.

WARNING

High voltages are present within the Flash chassis assembly. The TEST--OFF/RESET--ON switch on the end cap should be turned to the OFF/RESET position before turning the twist-lock handle to remove the end cap and chassis. Even so, residual charge on the capacitors will still be present and care should be exercised when handling the chassis assembly.

5.1 Controls and Adjustments

The Model 383 Flash is prepared for operation by means of two external function switches and by two internal trim potentiometers located on the programmer end cap of the Master Battery Pack. A third trim pot is located on the Flash chassis printed circuit board. See Figure 5-1.

5.1.1 External Controls

Two external controls are located on the programmer end cap. They provide TEST--OFF/RESET--ON and MINUTES DELAY (0-200 minutes) settings. With the first control, the system can be turned ON and OFF. The second control sets the delay time, which holds the system in a standby state while lowering to depth. To operate, set the desired delay time and then turn the system to ON. This will expose one film frame, after which the system will go into a standby state until the delay time has elapsed. It is possible to restart the delay by simply turning the system to OFF/RESET, waiting a few seconds and then turning it back on.

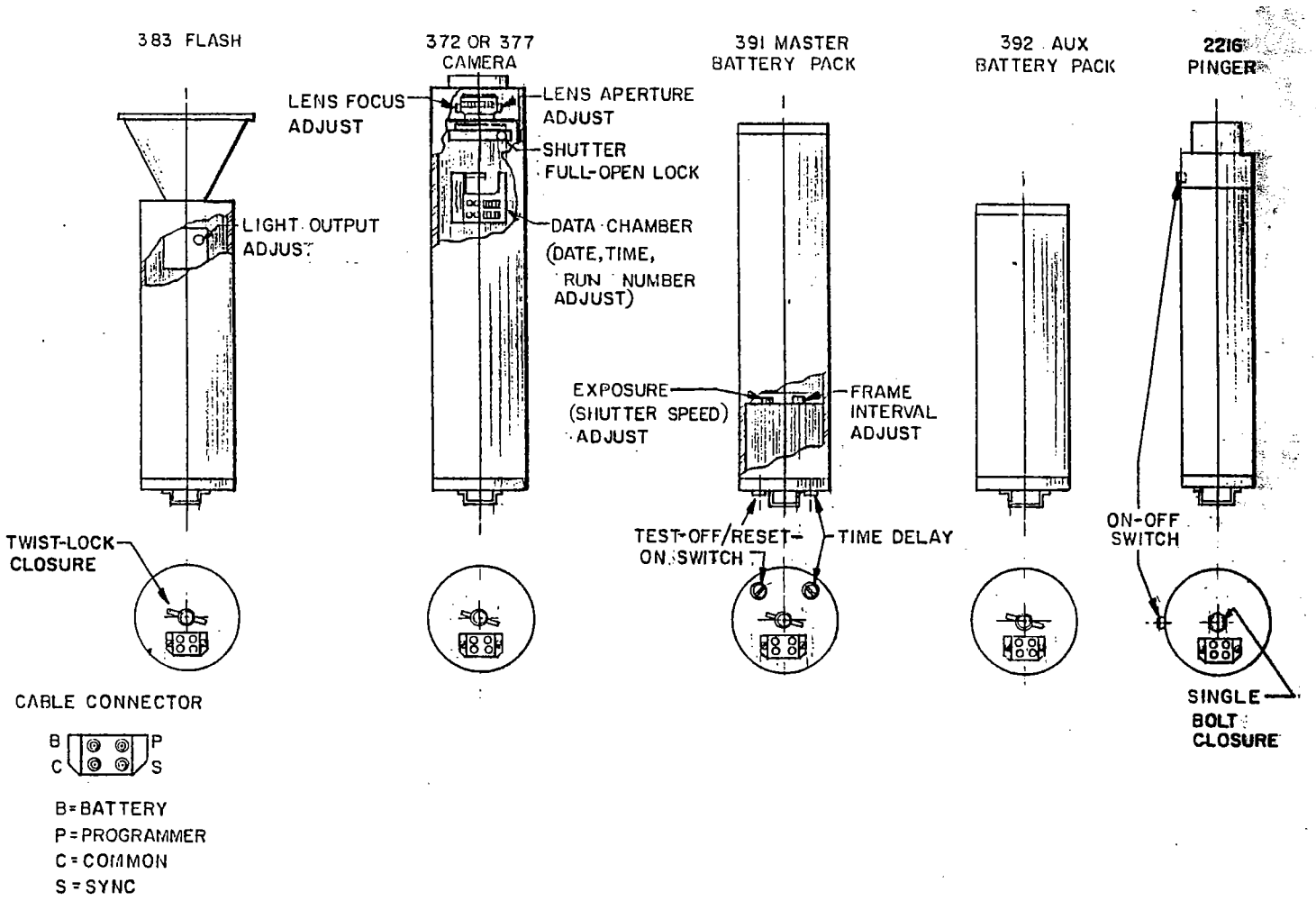


FIGURE 5-1 Operating Controls, Adjustments and Interconnections for Model 372 or 377 Camera used with Model 383 High Intensity Flash

To test the system without waiting for the delay, turn the switch on the programmer end cap to TEST, which bypasses the delay function and puts the system into immediate operation. This option is useful when setting the frame interval and exposure (shutter speed), as well as when testing system operation.

5.1.2 Trim Potentiometers

Two of the internally mounted trim potentiometers are located on the programmer end cap PC board. They allow the interval between film frames and the exposure (shutter speed) to be reset. The potentiometers are marked interval and exposure (on back of PC board) to designate their functions. Both of these functions operate by simply turning the potentiometers until the desired frame interval and/or exposure times are achieved. The TEST--OFF/RESET--ON switch should be turned to TEST when the potentiometers are adjusted.

5.1.2.1 Exposure (Shutter Speed) Adjustment

The exposure (shutter speed) adjustment is set at 50 ms (1/20 second) at Benthos. It can be adjusted in the range of 40 ms (1/25 second) to 400 ms (2/5 second). The shutter speed adjustment can be monitored with an oscilloscope connected to the end cap. Disconnect the "sync" (S) lead and monitor the adjustment relative to common. (Refer to the wiring diagram C-383-7 in Appendix C.) Normally the supply voltage (28 VDC) will appear at that point. When the shutter contacts close, this terminal will go to ground. Monitoring this point tells the length of time that the shutter is fully open.

5.1.2.2 Light Source Adjustment

The third trim potentiometer is located on the Flash chassis assembly PC board and adjusts the xenon light source up to a maximum output of 250 watt-seconds. The trimpot has been preset to 200 watt-seconds at Benthos and, under most circumstances, would not need to be readjusted. The trimpot controls the voltage to which the capacitor bank is charged, thus varying the energy output. The voltage is read across the HV- (brown) and HV+ (red) terminals on the printed circuit board and should be 800 V for a 200 watt-second output.

WARNING

Extreme care should be taken when making this adjustment since high voltages are present. Do not short any terminals on printed circuit boards as damage to the unit may result.

5.2 Loading Flash Chassis Assembly

5.2.1 Inspection and Checkout

Before loading the chassis assembly into the Flash housing, the following checks should be made:

a. The Flash reflector is properly positioned and clamped. Safety wire is in place.

b. The flashtube and lamp cover are secure and clean.

c. Air in the housing has been displaced with inert liquefied gas. See Section 6.1.1.1.

d. The light source has been adjusted to the desired level (250 watt-second maximum) by means of the trim potentiometer located on the chassis PC board.

5.2.2 Loading Procedure

The following steps are used to load the chassis into the Flash housing.

a. Insert the chassis into the housing, using care not to strike the flashtube against the housing body.

b. Rotate the chassis until the alignment pin on the front of the flashtube mounting plate seats in the front end cap.

c. Connect cable harness, checking the knobs on the rubber caps to be sure correct cable is united with connector pin. (Cable with three knobs goes to pin 3, etc.)

5.3 Loading Master Battery Pack

5.3.1 Inspection and Checkout

Before loading the Master Battery Pack, the following checks should be made:

a. Check programmer end cap O-ring seals for condition and cleanliness. Lightly lubricate with silicone grease as described in Section 6.1.1.

b. Check battery pack for voltage level (24-volt minimum level required). Recharging procedure is given in Section 6.2.1

c. Be sure that the exposure (shutter speed) and frame interval settings have been adjusted to the desired settings via the two trim potentiometers on the programmer end cap PC board.

5.3.2 Loading Procedure

The following steps are used to load the Master Battery Pack into its housing:

a. Insert the battery pack, rotating it until the locating pin is seated.

b. Seat the programmer rear end cap so that the 14-pin connector mates with the battery pack connector. Turn the twist-lock handle to the CLOSE position. Pull on the handle to be sure proper closure of the programmer end cap has taken place.

c. Check the system by turning switch to ON. If the flash and/or Camera does not trigger, check the cable connections or other possible sources of malfunctions given in the troubleshooting procedures (Section 6.4).

d. Set the time delay control to the desired position (0 to 200 minutes). The time delay interval can be restarted by turning the function switch to OFF/RESET, resetting the time delay to the desired minutes, waiting a few seconds, and then returning the function switch to the ON position.

e. Turn the TEST--OFF/RESET--ON switch to the ON position.

5.4 Unloading Flash Chassis and Battery Packs

After a mission has been completed, the Flash chassis and the battery packs should be removed from their housing and checked for condition. Maintenance procedures are given in Sections 6.1 and 6.2. If flooding has occurred in any of the units, refer to Section 6.3.

CAUTION

Do not stand directly in back of the rear end caps of the Flash, Battery Packs or Cameras when turning the twist-lock handle to open their housings. If for some reason leakage has occurred under pressure, a housing may contain water and high-pressure air.

The procedure for opening the Master Battery Pack housing is as follows:

a. Place the battery pack on a work surface where it is prevented from rolling. Turn the TEST--OFF/RESET--ON switch to OFF/RESET.

b. Unlock the programmer end cap by turning the twist-lock handle to OPEN, and withdraw the end cap.

6.0 MAINTENANCE

The high-voltage WARNING given in Section 5 should be carefully observed before removing the Model 383 High Intensity Flash chassis assembly from the housing assembly for inspection and maintenance. The TEST--OFF/RESET--ON switch on the Master Battery Pack programmer end cap should first be turned to the OFF/RESET position.

The following sections describe the requirements for periodic checks and preventive maintenance of the Flash housing and chassis assemblies, and the battery packs. Steps to be followed if the Flash or battery packs become flooded, and procedures for troubleshooting are given in Sections 6.3 and 6.4. Replacement of components and parts can be made with standard tools and procedures by referring to the diagrams, assembly drawings and parts lists included in Appendix C.

6.1 Preventive Maintenance (Flash)

Although the housing of Benthos-Edgerton flash units are made of a good grade of stainless steel (17-4PH), they will tarnish and corrode somewhat in sea water. Corrosion can be greatly reduced by spraying the housings lightly with silicone oil before each exposure to sea water or salt spray, and rinsing in fresh water after each operation.

Corrosion of the housings is also affected by other nearby metals. If the housings are mounted on or next to metal that is more noble than stainless steel, corrosion of the housings will be increased. Mounting the housings near less noble metal such as mild steel or zinc will help protect the housings.

6.1.1 Housing Assembly

6.1.1.1 Use of Liquefied Gas

Each time the Flash is installed in its housing, the air in the housing should be displaced with an inert liquefied gas. This will reduce the possibility of corrosion and deterioration by elimination of oxygen. It also reduces the possibility of condensation of moisture in the Flash when it is in the cold water of the deep ocean by elimination of water vapor. One of the most convenient ways of doing this is to put a small amount of liquefied gas into the housing before it is closed. This is best done with an inert gas that is heavier than air, installed with the housing open in a vertical position. Immediately after the liquefied gas has evaporated, the Flash chassis is inserted in the housing and the end cap installed. The gas should also be applied before the flash is put in storage. Suggested products and suppliers are listed in Appendix B.

6.1.1.2 Front End Cap Seal

The rubber O-ring used to seal the front end cap of the housing assembly should not require maintenance or replacement. Each housing assembly is tested at Benthos to 12,000 meters (17,000 psi) before shipment.

6.1.1.3 Rear End Cap Seal

The O-rings used to seal the rear end cap and housing may deteriorate in time. The two large O-rings on the end cap forming radial face seals should be removed periodically. The O-rings and their grooves should be cleaned and inspected. Each O-ring should be lightly stretched to reveal hidden cracks which can be caused by ozone in the air. If there is any doubt about the reliability of an O-ring, it should be replaced. Replacement O-rings should be made of neoprene. The O-rings may be lightly lubricated with silicone grease as an aid in pressing the end cap in place. Over-lubricating the O-rings can create a hazard because the grease will pick up flakes of paint or rust which may prevent proper sealing.

6.1.1.4 Reflector Mounting and Adjustment

Several layers of vinyl plastic tape should be placed around the lamp cover to distribute stresses when the reflector hose clamp is tightened. The position of the reflector on the lamp cover is a critical factor in determining proper light display. To eliminate "hot spots" and obtain even distribution, set the reflector by observing the light pattern on a plain background in a dark area.

6.1.1.5 Lamp Cover

The lamp cover should be free of grease or dirt. It should not be handled. If contamination is observed, wipe the lamp cover clean with acetone and cottons swabs, and again with distilled water.

6.1.2 Chassis Assembly

6.1.2.1 Flashtubes

The operation of flashtubes with fingerprints, grease or dirt on their surface may result in reduced performance and shortened service life. Therefore, use care when handling or installing flashtubes. If the flashtube becomes dirty or has been touched, clean it with a cotton swab moistened with pure acetone and then with another cotton swab wetted with distilled water. Dry the tube carefully with a clean cloth or with cotton.

CAUTION

Do not operate the Flash out of its housing in flammable or explosive atmosphere.

Avoid careless or rough handling of the flashtube.

Abrasions and scratches could result in shattering of the tube.

6.2 Preventive Maintenance

6.2.1 Battery Packs

Under normal conditions, the Model 391 Master Battery Pack and Model 392 Auxiliary Battery Pack are usable for up to 4,000 exposures (when used with the Benthos Model 377 Survey Camera). The battery packs should be recharged when the voltage measures 24 volts under load (running the system). When the Flash is not in use, the battery pack should be removed for storage.

A fully discharged battery pack should be charged at the rate of 500 ma for twelve hours. If a battery pack is not fully discharged, it should be allowed to charge for a period of time proportional to its condition; i.e., if it is only halfway discharged, charge for six hours. The battery packs are designed to accept up to a 100% overcharge (though it is not recommended as a common practice). If a battery pack has not been used in a while but was charged after the last use, it can be trickle-charged at the rate of 50 ma for a few hours to freshen it up. When the battery voltage gets down to about 24 volts or under, consider it fully discharged.

WARNING

Do not charge battery while it is installed in the housing or is otherwise connected to the flash. Due to potential hydrogen off-gassing during the charging process, adequate ventilation must be available to the battery pack to eliminate the danger of an explosion.

The PC board in the Master Battery Pack programmer end cap can be removed for inspection or replacement by unscrewing the knurled locating pin, removing the space post and withdrawing the board. Component inspection, checkout and replacement can be performed using standard procedures (refer to troubleshooting procedures, Section 6-4). The two trim potentiometers on the programmer end cap PC board are adjusted for shutter speed and frame interval as described in Section 5.1.2.

Electrical contacts on the function switches should be checked for tightness. The external cable connectors should be checked for contamination of pins. The 14-pin internal connectors should also be checked for cleanliness and security of wiring. The three 5-amp fuses should also be inspected.

6.3 Flooding

If the Flash or battery packs should become flooded, there is a possibility of pressure buildup inside the housing. Remove the housing end cap in the manner described in Section 5.4, using care not to stand directly behind the end cap as the twist-lock handle is turned to the OPEN position.

6.3.1 Inspecting and Servicing Flash Chassis

Withdraw the Flash chassis assembly from the housing and remove the flashtube. Visually inspect the chassis components for evidence of water damage. Rinse the chassis assembly in fresh water. Remove moisture by wiping or with compressed air. The chassis can also be dried by rinsing in alcohol if available. Dry completely, using a warming source if available. Perform a circuit check.

In general, the four 525 storage capacitors (C17, C18, C20 and C21) should be replaced if the Flash has been flooded, particularly if flooding occurred under pressure. Although the resistors and diodes on the component board tend to withstand pressure and moisture, they should be checked and replaced if necessary. If the Flash was exposed to pressure flooding, the capacitors on the component board and the silicon controlled rectifier should be closely inspected and replaced if visibly damaged.

After inspection, testing and replacement of suspect components, the Flash should be tested. If it fails to operate properly, troubleshoot the Flash as outlined in Section 6.4.

6.3.2 Inspecting and Servicing Battery Packs

Remove the battery assembly, rinse the battery pack housing body and end cap in fresh water and dry them thoroughly. Remove the end cap face seal and radial O-rings and clean the grooves. Install new, lightly lubricated O-rings.

Test the housing assembly in a pressure vessel or by lowering it to a depth of 100 feet or more. After retrieving the housing assembly, carefully remove the programmer end cap (Master Battery Pack) and examine the inner surfaces to determine any further leak problem. Wetness in an area of the housing end cap will usually reveal the location of the problem. Replace any faulty O-rings (see Section 6.1.1) or connectors. Follow the same procedure for the Auxiliary Battery Pack.

Before returning a battery pack to operation, replace the battery assembly with a new unit.

6.4 Troubleshooting

Troubleshooting information for locating and correcting possible malfunctions in the Flash or Battery Packs is provided in the following table. The information given in this table should be used in conjunction with the illustrations in previous sections, and with the schematic diagrams, assembly drawings and parts lists included in Appendix C.

TROUBLESHOOTING CHART

TABLE 6-1

Difficulty	Possible Cause	Corrective Action
Unit does not flash.	Battery voltage low.	Recharge battery
	Flashtube wet or broken.	Dry or replace
	Loose connections.	Repair
	Camera sync. circuit not operating.	Short pins 1 and 4 on Flash. If unit fires, the problem is in the Camera or cable harness.
	Defective Flashtube.	Replace
	Blown fuses(s).	Replace
No trigger pulse to flashtube.	Pulse transformer T1 wet, open or shorted.	Replace
	Capacitors C21, C16 defective.	Replace
	SCR (Q4) defective.	Replace
	Transistor (Q4) defective.	Replace
	Resistors R24 and R25 open or shorted.	Replace
	Diode D8 or D11 defective.	Replace
	Resistor R20, R18 or R17 defective.	Replace
	No high voltage.	See below
No high voltage in light source (anode/cathode of flashtube 800V).	Capacitors C17, C18, C20 or C21 shorted or open.	Replace
	Defective power supply.	Replace
	Defective voltage control circuit.	See below
	Bad connections.	Replace
	Defective diodes D15 or D17.	Repair
Defective voltage control circuit.	Defective relay L2.	Replace
	Defective Darlington Amplifier (Q2 or Q3).	Repair
	No voltage on base of Q3.	Find cause and repair
	Blow fuse F2 or F3.	Replace
Defective programmer.	Defective relay L2.	Replace
	Defective timer board.	Replace
	Defective switch S1.	Replace
	Defective potentiometer R1.	Replace
	Bad connections or connectors.	Replace

APPENDICES

APPENDIX A

INTERCONNECTIONS FOR STEREO CAMERA SYSTEM

The accompanying diagrams illustrate the cable connections to be made when two (or more) cameras, flashes and battery packs are assembled on a mounting framework to achieve a stereo photographic system. A camera position pinger is used in a stereo system and its connections are shown in the diagrams.

Stereo systems are based on the use of either the Model 372 Standard or 377 Survey Cameras with either the Model 382 Standard or 383 High Intensity Flash units, as well as a Model 2216 Bottom Finding Pinger. Figure A-1 shows the interconnection of a pair of Model 372 or 377 Cameras with a Model 382 Flash and Model 2216 Pinger. The Model 382 Flash is a variable light source with a 100 watt-second maximum output. This Flash contains both a Model 389 28 VDC Battery Pack, which supplies power to the Camera, and a programmer.

Figure A-2 shows a pair of Model 372 or 377 Cameras connected to a pair of Model 383 Flash units. This combination requires the addition of a Model 391 Master Power Pack and a Model 392 Auxiliary Power Pack. The Bottom Finding Pinger is again added.

The Model 383 Flash is a fast recycle, high energy unit capable of supplying flashes at 200 watt-seconds. Recycle time is approximately three seconds. The Power Packs, containing nickel-cadmium batteries, deliver 28 volts DC to the Flash units. The Model 391 Master Battery Pack provides programming and power for the system, while the Model 392 provides an auxiliary power source.

The Benthos Model 2216 Bottom Finding Deep Sea Pinger accurately positions a suspended camera system close to the ocean floor. A 12 kHz ping is emitted at precisely 1 second intervals. A shipboard recorder or oscilloscope indicates the exact position of the camera system above the ocean floor at any depth. The Pinger is wired to skip a ping whenever the camera takes a picture so that operation can be monitored from shipboard. Operation of the Pinger is described in detail by Data Sheet No. 2216.

A Deep Sea Compass (Model 395) is also available from Benthos so that the orientation of bottom features such as ripple marks and rock outcrops can be determined relative to magnetic north. The vane on the compass lines up with the current and shows the general current direction relative to the camera system.

The suggested mounting framework is the Benthos Type 397 which is furnished in kit form for assembly by the user. Several models are available to mount the instruments comprising a stereo system. Each rail of the framework is slotted along its entire length so that the units can be positioned where most convenient. The framework is designed to accept the mounting pads of all Benthos Deep Sea Cameras, Flashes and accessory camera system equipment.

1-C COMMON (–)

2-B BATTERY (+)

3-P PROGRAMMER (PULSE)

4-S SYNC (SHUTTER)

NC=NOT CONNECTED

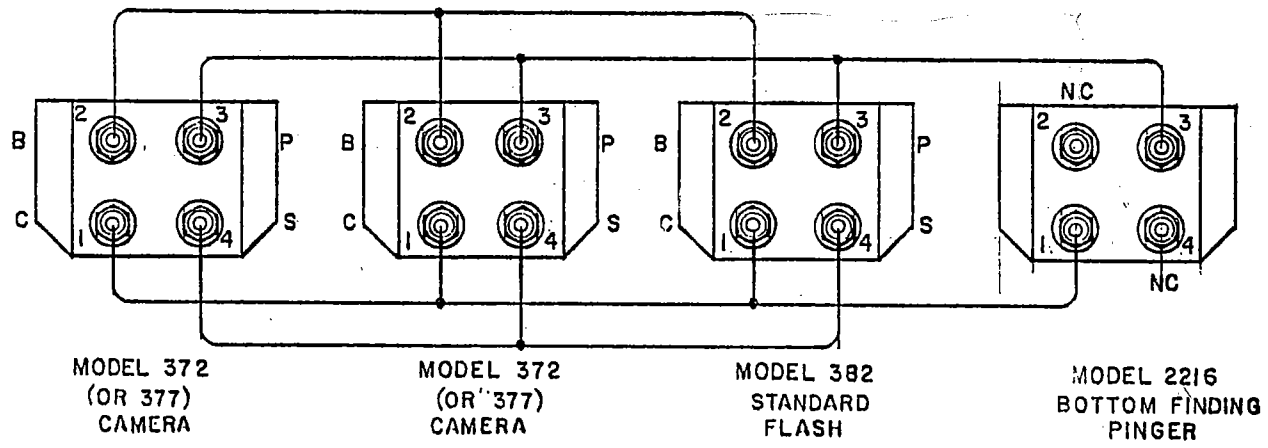


FIGURE A-1 Interconnections for Stereo Camera Systems using Model 382 Standard Flash

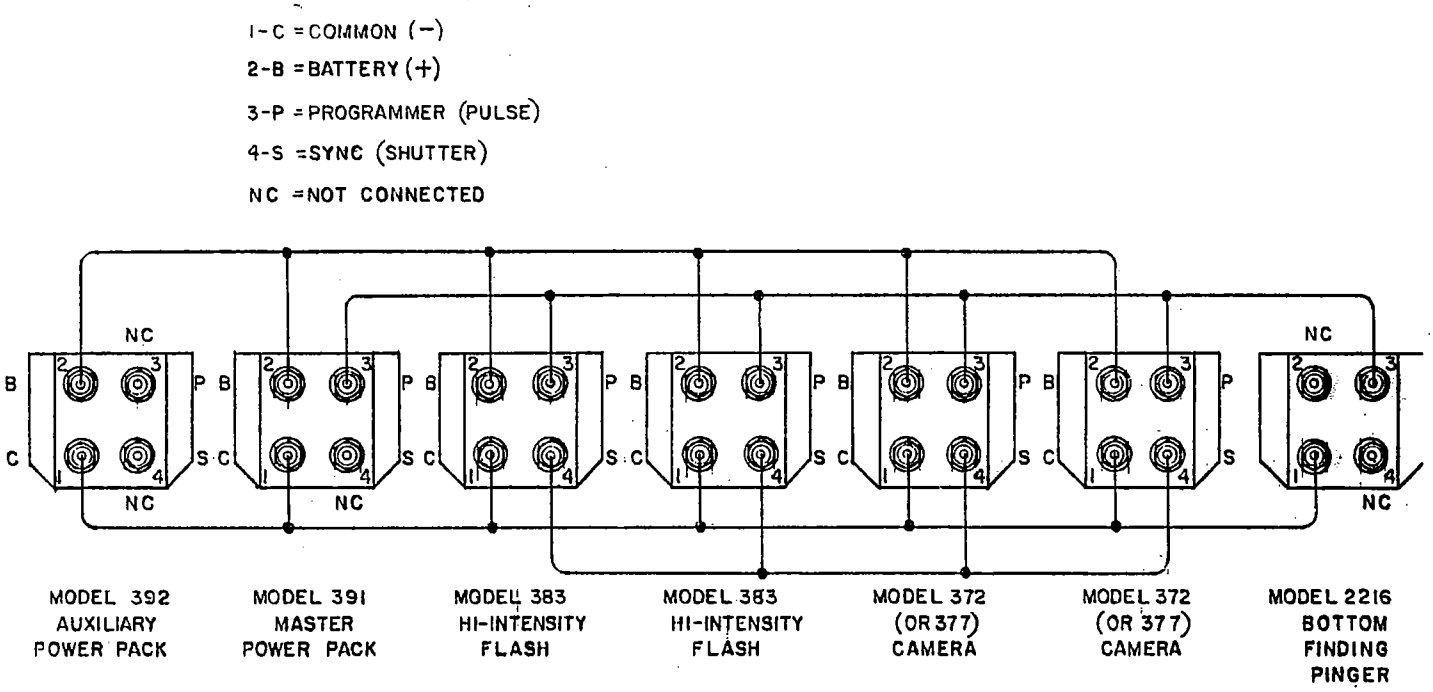


FIGURE A-2 Interconnections for Stereo Camera Systems using Model 383 High Intensity Flash

APPENDIX B

LIQUEFIED GAS PRODUCTS

The following are some of the liquefied gases available to displace air in the camera housing during use and storage. They are listed in order of their increasing environmental effect with regard to the problem of ozone depletion. We welcome suggestions for other appropriate gases that are readily available and environmentally safe. The desired properties are inert, dry, heavier than air, non-toxic, non-flammable and easily available.

SAFE:

BOTTLED NITROGEN - Available from welder's suppliers in 80cu. ft. and larger bottles

HCFC-22 BASED PRODUCTS (DICHLORODIFLUOROMETHANE):

GENETRON 22
Allied Signal
Special Chemicals Division
Morristown, New Jersey
201-455-2000

DUST OFF
Falcon Safety Products
Branchburg, New Jersey
908-707-4900

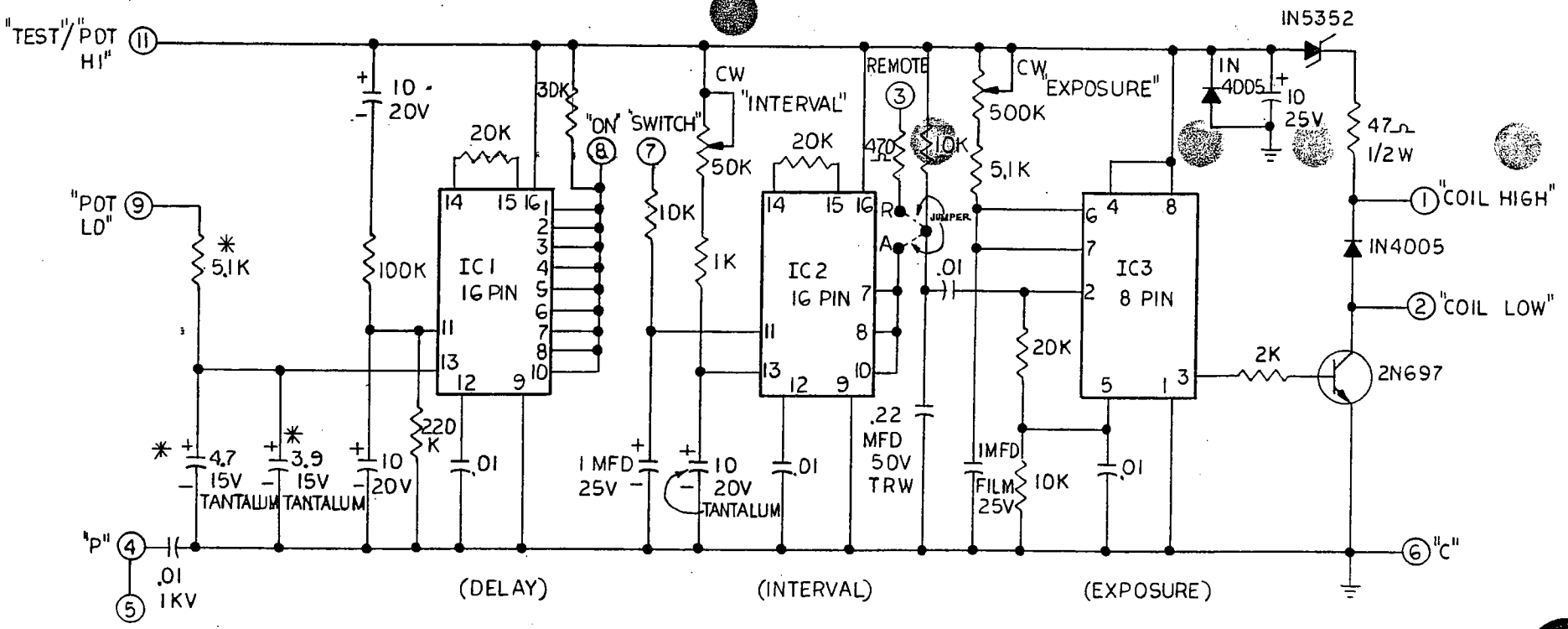
AERO-DUSTER
Miller-Stephenson Chemical Company
Danbury, Connecticut
1-800-992-2424

APPENDIX C

DRAWINGS AND PARTS LISTS

Housing Assembly for Model 383	D-383-6 + BOM
Flash Assembly Layout	D-383-5 + PL
Wiring Diagram for Model 383 High Intensity Flash	C-383-7
Chassis Wiring Diagram for Model 391 Programmer End Cap	B-391-8
Chassis Wiring Diagram for Model 392 Auxiliary Battery Pack	A-392-3
Schematic Diagram for Model 383 High Intensity Flash	C-383-12
Schematic Diagram for Model 391 Programmer End Cap	C-391-10
Schematic for Flash P.C. Board Model 383 High Intensity Flash	B-383-4
Programmer Board Schematic for Model 391 Master Battery Pack	B-380-177
Model 383 High Intensity Flash Spare Parts Kit	D-383-SPK
Model 391 Spare Parts Kit	D-391-SPK
Model 392 Spare Parts Kit	D-392-SPK

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.

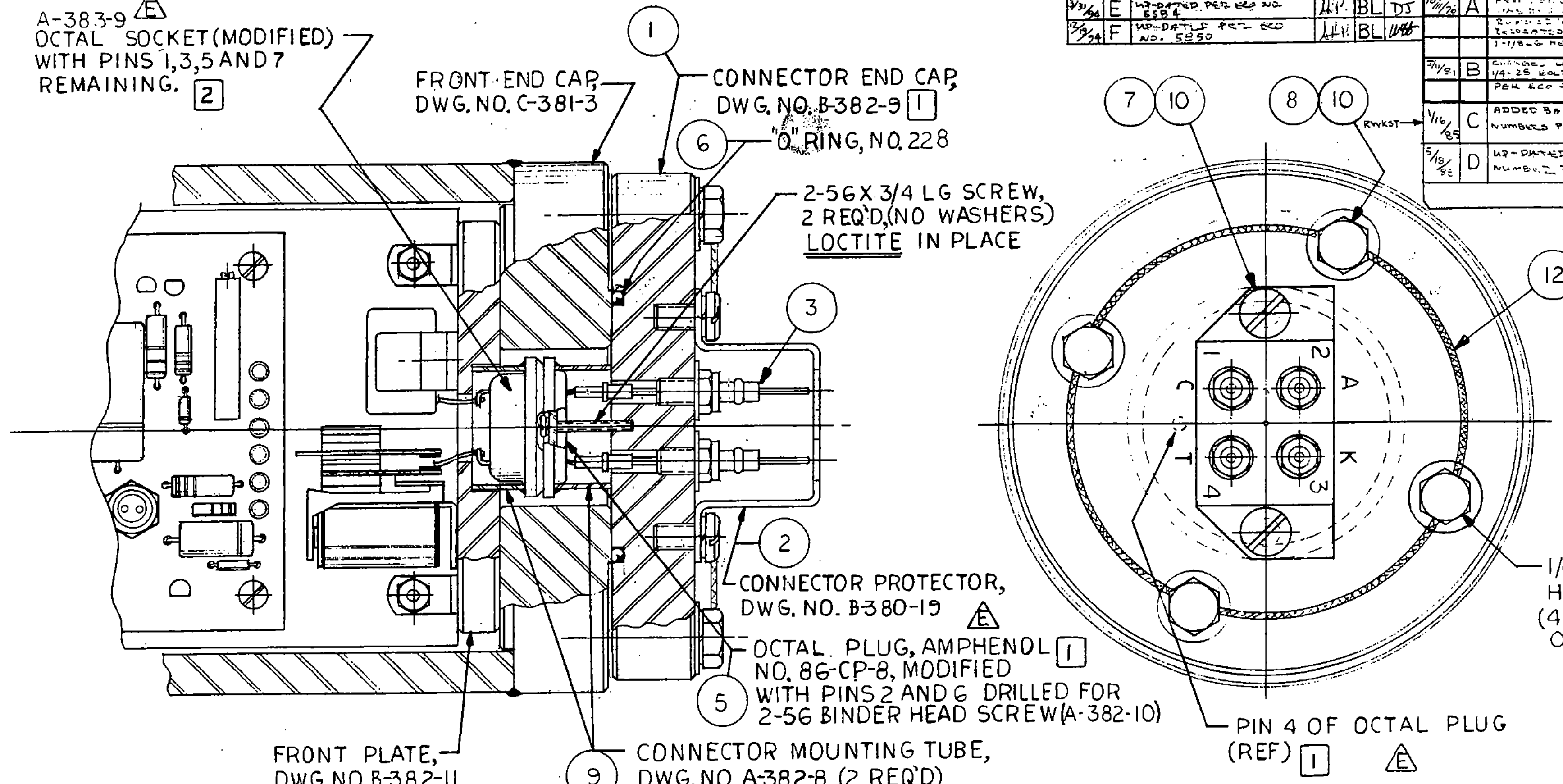


NOTES:

1. * DENOTES DELAY TRIM ADJUST.
2. ◯ DENOTES WINCHESTER CONNECTOR PIN NUMBER.

TOLERANCES (EXCEPT AS NOTED) DECIMAL ± FRACTIONAL ± ANGULAR ± BREAK ALL SHARP EDGES EXCEPT AS NOTED	BENTHOS, Inc. NORTH FALMOUTH, MASS. 02556 U.S.A. Telephone (617) 563-5917 Telex 94-0884	DRAWN BY B. Simpkins CHECKED BY WDy APPROVED BY GH
	TITLE PROGRAMMER BOARD SCHEMATIC (LP)	
	DATE 16 NOV 77 SCALE NONE	DRAWING NUMBER B-380-177 REVISION

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
3/31/94	E	UP-DATED PER ECO NO. 5584	[illegible]	BL	DJ
12/13/94	F	UP-DATED PER ECO NO. 5850	[illegible]	BL	[illegible]
10/11/76	A	[illegible] C-381-3 [illegible] C-381-10, [illegible] RELOCATED (4) 1/4-28 X 1-1/8-G HEX HEAD BOLTS,	[illegible]	BL	[illegible]
7/11/81	B	CHANGED LENGTH OF 1/4-28 BOLT (WAS 1 1/8) PER ECO = 1033	[illegible]	JD	[illegible]
1/16/85	C	ADDED BALLOON ITEM NUMBERS PER ECO = 2496	[illegible]	BL	[illegible]
5/15/92	D	UP-DATED PER ECO NUMBER 3469		BL	DJ



NOTES: E

1. INSTALL OCTAL PLUG ON HOUSING WITH PIN 4 POINTING TOWARDS LOCATING PIN HOLE.
2. E GLUE OCTAL SOCKET ON CHASSIS WITH PIN 4 POINTING TOWARDS LOCATING PIN AT THE (TOP VIEW SIDE OF CHASSIS).
3. PUT LOCATING PIN IN HOLE AT <u>TOP</u> OF CHASSIS. (A-382-11)

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TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ± ~		SCALE FULL	CHECKED BY: WDM; DRAWN BY B. [illegible]; APPROVED BY
FRACTIONAL ± ~	TITLE END CAP ASSEMBLY FOR MODEL 383/382 REMOTE FLASH HOUSING		
ANGULAR ± ~	DATE 8 SEPT 75	DRAWING NUMBER B-382-10	REV F

AS OF 09/12/95

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3820 STANDARD FLASH

B-382-10 OPCODE: 0 REV: F ASSY,END CAP,382,383 REMOTE
MODEL:
ECO NO: 5850
DATE OF LAST ECO: 12/19/94

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	USE UME
B-382-9	END CAP,CONN,382 REM FLASH	0	C	1	1.000	1.000	EA9
B-380-19	PROTECTOR,CONN	1		2	1.000	1.000	EA9
B-380-293	CONN ASSY,MALE BULKHEAD	0	A	3	4.000	1.000	EA9
0403-006	CONN,CAMB #450-0016-01-03,1S	0		4	4.000	1.000	EA9
A-382-10	MOD,PLUG,382 REM FLASH	0	C	5	1.000	1.000	EA9
0204-228	RING,O,2-1/4 X 1/8	0		6	1.000	1.000	EA9
0128-451	SCREW,BNDRHD,18-8,1/4-28 X 1/2	0		7	2.000	1.000	EA9
A-380-230-1	BOLT,HEX,316,1/4-28 X 1-1/4	0	A	8	4.000	1.000	EA9
A-382-8	TUBE,CONNECTING MTG	0	A	9	1.000	1.000	EA9
0144-031	WASHER,SPLIT LK,18-8,1/4 X.031	0		10	6.000	1.000	EA9
0801-001	WIRE,.032 DIA,SAFETY,SS	0		12	.000	1.000	RL9

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3830 HIGH INTENSITY FLASH

D-383-6 OPCODE: 0 REV: U ASSY,HOUSING,383
MODEL:
ECO NO: 6130
DATE OF LAST ECO: 08/17/95

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	USE UME
C-383-1	WELDMENT,HSG,383	0	F	1	1.000	1.000	EA9
C-383-9	REFLECTOR,382 & 383 FLASH	0	B	3	1.000	1.000	EA9
C-381-1-2	COVER,LAMP,6"LONG	0		4	1.000	1.000	EA9
B-381-13	RING,SEALING	0	B	5	1.000	1.000	EA9
A-381-17	LANYARD,FLASH REFLECTOR	0		6	.000	1.000	EA9
B-381-14	RING,CLAMP	0	C	7	1.000	1.000	EA9
0203-032	CLAMP,HOSE,300,M32.	1		8	1.000	1.000	EA9
0903-005	TAPE,BLACK ELEC.,3/4" X 66'	0		9	.000	1.000	RL9
0143-019	WASHER,FLAT,18-8,#6,3/8X.032	0		10	1.000	1.000	EA9
0144-019	WASHER,SPLIT LOCK,18-8,#6X.031	0		11	1.000	1.000	EA9
0128-262	SCREW,PH MACH,18-8,6-32 X 1/2	0		12	1.000	1.000	EA9
0198-005	BOLT,HEX,316,1/4-28 X 1-1/2	0		13	4.000	1.000	EA9
0144-031	WASHER,SPLIT LK,18-8,1/4 X.031	0		14	8.000	1.000	EA9
0143-031	WASHER,FLAT,18-8,1/4X5/8X.050	0		15	12.000	1.000	EA9
0904-023	LABEL,BENTHOS MYLAR,12X3	0		16	2.000	1.000	EA9
0118-033	SCREW,HEXCAP,18-8,1/4-28 X 5/8	0		17	4.000	1.000	EA9
C-383-8	GUARD,REFLECTOR	0	A	18	1.000	1.000	EA9
0204-330	RING,O,2-1/8 X 3/16	0		19	1.000	1.000	EA9
0801-001	WIRE,.032 DIA,SAFETY,SS	0		20	.000	1.000	RL9
0801-005	WIRE,NYLON COATED LEADER	0		21	.000	1.000	FT9
0198-019	BOLT,HEX,316,1/4-28 X 3/4	0		22	4.000	1.000	EA9
TR.HOUSING	TRAVELLER,HOUSING ASSY	0	A	23	.000	1.000	EA9

Reference Designation		Quantity	Description	Drawing or Part No.	Item No.
		REF.	D3835RH-PS		82
-1		REF.	WIRING DIAGRAM (STANDARD)	C-383-14	81
		REF.	WIRING DIAGRAM (REMOTE HEAD OPTION)	C-383-22	80
		15	TERMINAL, NO. 10 STUD, CRIMP	0423-015	79
-2		4	CAPACITOR, 2400 MF, 360 V	0522-021	78
-2		1	RESISTOR, 1 MEG, 1 WATT, 5% C.C.	0512-068	77
-2		2	DIODE, IN5399	0505-007	76
		REF.	SCHEMATIC FOR 600 W.S. OPTION	C-383-24	75
-2		1	9 POSITION TERMINAL STRIP	0423-122	74
-2		1	5 POSITION TERMINAL STRIP	0423-101	73
-2		1	INSULATOR TERMINAL STRIP	A-383-10-1	72
-2		1	INSULATOR TERMINAL STRIP	A-383-10-2	71
-2		REF.	WIRING DIAGRAM (300 W.S./600 W.S. SELECT)	C-383-23	70
-2		1	BASE PLATE SUPPORT	D-383-4-2	69
		12	FLAT WASHER, NO. 6, 1/4 O.D.	0143-018	68
		27	NO. 6 CRIMP LUG	0423-010	67
		AR	SCOTCH ELECTRICAL TAPE, NO. 33, 3/4" WIDE	0903-005	66
		2	SCREW, FLATHEAD, 6-32 X 3/8 LG.	0125-153	65
		10	SCREW, PAN HEAD, 6-32 X 5/16 LG.	0128-256	64
					63

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Drwg. No. D-383-5(-RH)PL-2 -1

Rev. F

		8	NO. 6-32 X 9/16 LG. FLAT HEAD SCREW	0125-148	62
		AR	EPOXY		61
		4	NO. 3-48 X 7/16 LG. FLAT HEAD SCREW	0125-076	60
		3	NO. 6-32 X 5/8 LG. FLAT HEAD SCREW	0125-157	59
					58
					57
					56
		10	NO. 6-32 HEX NUT	0100-007	55
		10	NO. 6-32 X 7/16 LG. FLAT HEAD SCREW	0125-155	54
		2	NO. 6-32 X 1" LG. PAN HEAD SCREW	0128-274	53
					52
					51
					50
					49
		4	NO. 6-32 X 3/4 LG. PAN HEAD SCREW	0128-268	48
		20	NO. 6-32 FLEX NUT	0104-019	47
		2	NO. 6-32 X 3/16 LG. PAN HEAD SCREW	0128-250	46
		2	CAMBION INSULATED STANDOFF #1945-1	0423-005	45
		1	CAPACITOR CLIP AUGAT NO. 6020-6A	0412-004	44
		1	P.C. BOARD INSULATOR	A-383-11	43
		1	END CAP GUIDE PIN	A-383-13	42
		1	PRINTED CIRCUIT BOARD ASSEMBLY	C-383-6	41
		2	FUSEBLOCK, LITTLEFUSE, NO. 357002	0412-103	40
	-1	2	TERMINAL STRIP, 5 LUG DOUBLE CINCH #5-140	0423-101	39
	-1	2	TERMINAL STRIP INSULATOR	A-383-10	38
		1	FUSE, 10 A, LITTLEFUSE NO. 313010	0501-002	37
		1	FUSE, 2 A, SB LITTLEFUSE NO. 313002	0501-003	36
					35
		16	NO. 6 WASHER, FLAT	0143-019	34
		57	NO. 6 LOCKWASHER	0144-019	33
					32
		4	PCB MOUNTING SPACERS	A-383-8	31
		8	NO. 10-32 X 5/16 · CAPACITOR TERM SCREW	0128-352	30
					29
		1	CAPACITOR, SPRAGE, NO. 39D, 3000 MFD, 30V	0522-002	28
		1	RELAY CONTACTOR, P. BRUMFIELD, NO. MB3D	0500-003	27
		2	FUSE, 5A, SB LITTLEFUSE, NO. 313005	0501-004	26
Reference Designation		**Quantity**	**Description**	**Drawing or Part No.**	**Item No.**

BENTHOS
NORTH FALMOUTH, MASS. 02556
U.S.A. TEL. 617-563-5917

Drwg. No. D-383-5(-RH)PL-2 -1 **Rev.** F

Sym.	Revisions	Date
A	Redrawn sheets 2 & 3 Per ECO # 2248	2/13/84
B	CHANGED PART NO. OF ITEM 24. PER ECO # 2567	7/17/85
C	UP-DATED PER ECO No. 4559 TAM	12/4/91
D	UP-DATED PER ECO NUMBER 4688 TAM	4/10/92
E	UP-DATED PER ECO No. 4721 TAM	5/19/92
F	UP-DATED PER ECO No. 5250 BT	10/4/93

Reference Designation		Quantity	Description	Drawing or Part No.	Item No.
					25
		2	STROBE POWER SUPPLY ASSY.	C-380-182-2	24
F -1		4	Capacitor 525 MFD, 450V, Sprague	0523-001	23
		1	Benthos Label, 13/16 X 2-1/2 Lg. Aluminum	0904-004	22
					21
		1	Mounting Socket, Modified	A-383-9	20
					19
		1	Socket Mounting Tube, Remote Head	A-382-8	18
		1	No. 10 Flat Washer	0143-025	17
		1	No. 10 Split Lockwasher	0144-025	16
		1	Locating Pin, Remote Head	A-382-11	15
		1	Front Plate, Remote Head	B-382-11	14
		2	No. 4 Split Lockwasher	0144-013	13
		2	No. 4-40 X 5/16 Long Panhead Screw	0128-156	12
		1	Connector, Male Amphenol 57-10140	A-382-19	11
		7	Danger High Voltage Label	0904-007	10
		3	No. 6-32 X 9/16 Long Panhead Screw	0128-263	9
F		4	No. 6-32 X 7/16 Long Panhead Screw	0128-260	8
		2	Handle Spacer	A-383-5	7
		1	Handle	A-383-3	6
		6	RIGHT ANGLE BRACKET MODIFICATION	A-382-25	5
		1	Back Plate	B-383-2	4
		1	Capacitor Bracket	C-383-3	3
F -1		1	Base Plate Support	D-383-4-1	2
		1	Base Plate	D-383-3	1

BENTHOS
NORTH FALMOUTH, MASS. 02556
U.S.A. TEL. 617-563-5917

Next Assy.

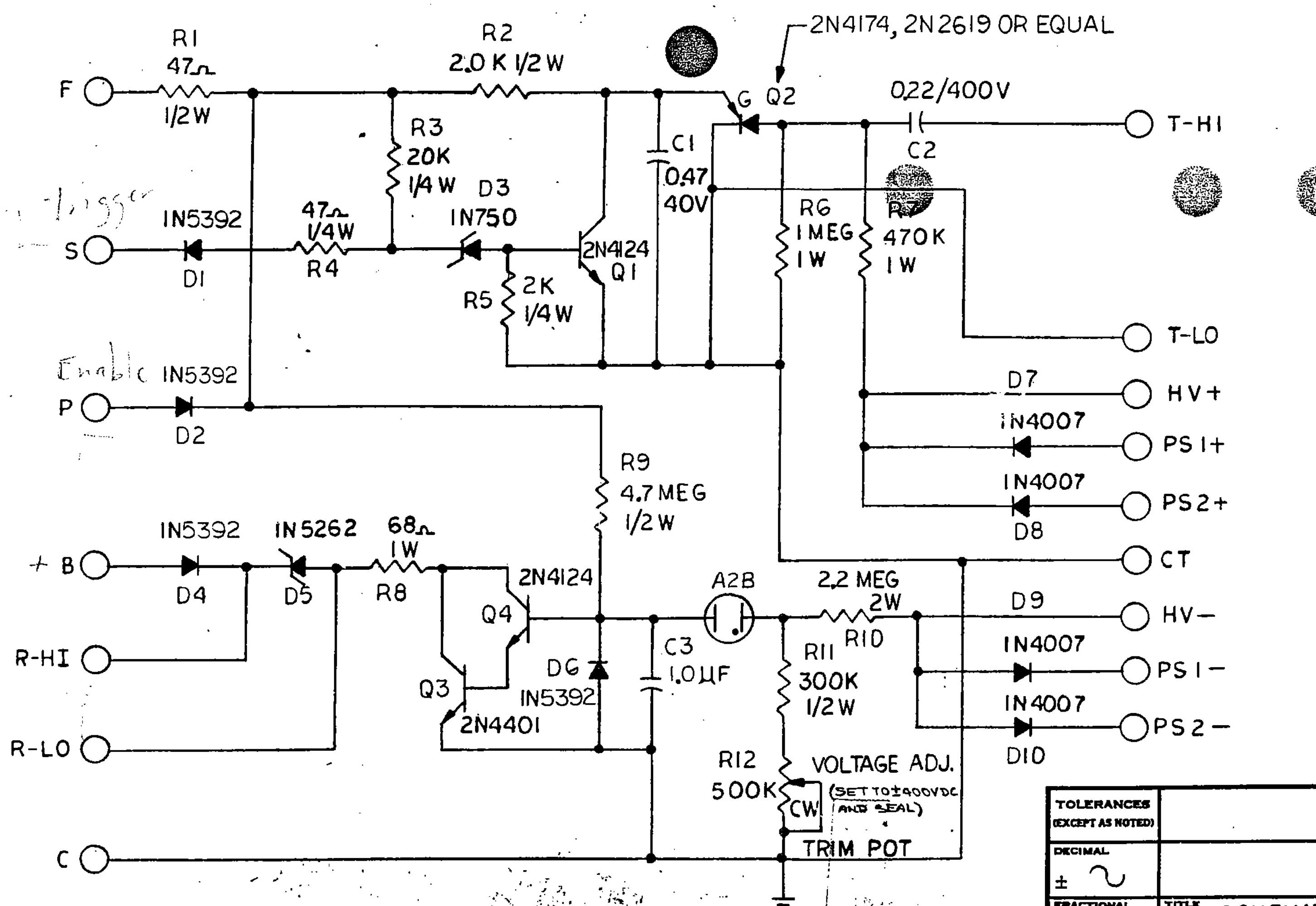
Dr. J. Doucette Date 31 Dec 80

Chk. m

Title
Model 383 Hi-Intensity Flash with Remote Head, Chassis Assembly -1 = 2 SELECT OPT.

Drwg. No. D-383-5(-RH)PL-2 -1 Rev. F

Sheet 1 of 3



DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
8/2/74	A	30K RES WAS 10K 2N4123 WAS 2N4124 [illegible]	[illegible]	BL	[illegible]
10/29/74	B	2 MEG WAS 510K, 470K WAS 30K, 2.2 MEG WAS 2 MEG	GH	BL	WDM
11/25/75	C	CHANGED PER ECR DATED 11/21/75	GH	BL	WDM
4/22/76	D	2.0K 1/2W WAS 2.2K 1/2 W	GH	BL	WPM
5/27/76	E	ADDED 47Ω, 1/2W RESISTOR PER ECO NO. 0126	GH	BL	WPM
11/5/76	F	TRANSISTOR 2N4124 WAS 2N2124	GH	BL	[illegible]
8/6/80	G	ADDED COMPONENT DESIGNATIONS PER ECO NUMBER 0677	DH	BL	[illegible]
1/22/81	H	CHANGED NEON BULB (WAS SYLVANIA A060) PER ECO # 0858	DH	JD	WSM
5/12/81	J	1N5392 WAS 1N4002. PER ECO # 1010.	DH	NB	[illegible]
7/[illegible]/87	K	UP-DATED PER ECO NUMBER 3089	WDM	BL	
10/26/92	L	UP-DATED PER ECO NO. 4868	JM	BL	JM

PROPRIETARY INFORMATION
DISCLOSURE ONLY TO PERSONS AUTHORIZED BY BENTHOS, INC.

TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ± ~		SCALE: NONE	CHECKED BY: / DRAWN BY: B. Lampkin / APPROVED BY: GH
FRACTIONAL ± ~	TITLE: SCHEMATIC FOR FLASH P.C. BOARD MODEL 383 HIGH INTENSITY FLASH		
ANGULAR ± ~	DATE: 29 MAY 74	DRAWING NUMBER: B-383-4	REV. L

APPENDIX D

INSTRUCTIONS FOR THE OPERATION AND MAINTENANCE OF THE BENTHOS MODEL 382 RH AND 383 RH REMOTE HEAD OPTION

NOTE

This manual is a supplement to the standard manual for a Model 382 or Model 383 Flash and describes the differences between a standard Flash and a remote head Flash.

TABLE OF CONTENTS

1.0 INTRODUCTION

Both the Model 382 and 383 strobes are available in a remote head configuration. This option separates the flash head from the electronics housing, allowing greater flexibility for mounting and easier optimization of lighting patterns. A second remote flash head can be added if more balanced lighting is required. The output power will then be divided between the two heads.

2.0 GENERAL DESCRIPTION

The front of the strobe electronics housing has a connector end cap mounted in place of the flash tube and lamp cover on a standard strobe. The remote flash head is a unit, connected to the end cap by electrical cables.

2.1 Connector End Cap

The connector end cap is mounted to the front of the flash housing by means of four safety wired bolts and is sealed by means of a face seal O-ring. This end cap provides the pressure proof mounting for the four external connectors to the remote head and an internal connector to interface with the electronic chassis. A protective guard is mounted over the external connectors.

2.2 Remote Flash Head

The remote flash head is comprised of a xenon flash tube mounted within a pressure proof glass lamp cover, a mounting socket, trigger transformer and electrical connectors, all mounted on a stainless steel base. The flash tube is inserted into a mounting socket and base located on the front of the remote head. The two mounting screws for the socket also clamp the unused pins of the flash tube, securing it in place. The trigger transformer is located within the base, under the flash tube socket. A large circular reflector is clamped to the lamp cover and is protected by a reflector guard. At the back of the base is a combination connector guard and mounting bracket. Mating connectors are supplied for connecting the remote head to the front end cap on the strobe housing.

2.3 Specifications

Remote Head

Length:	11½ inches (29.2 cm)
Diameter:	10¾ inches (27.3 cm)
Weight in air:	6.5 lbs. (2.9 kg)
Weight in water:	4.8 lbs. (2.2 kg)
Reflector:	Parabolic with nominal 75° coverage
Depth Rating:	12,000 meters (39,370 feet)

3.0 OPERATION

3.1 Circuit Description

The remote flash head operates exactly the same as the standard strobe. The trigger transformer is mounted in the remote head so the high voltage spike which triggers the flash tube does not travel through the connecting cables.

3.2 Preparation for Operation

3.2.1 Reflector Position

The remote head is supplied with a reflector that is secured to the lamp cover by a hose clamp. The position of the reflector on the lamp cover will modify the light coverage somewhat from its nominal 75° coverage. This can best be optimized by trying different positions while running the unit in a darkened room, projecting the flash against a flat surface.

3.2.2 Cable Connectors

WARNING

Care should be exercised when connecting or disconnecting remote head cable connectors, as high voltages may be present.

Both the front end cap and the remote flash head are stamped with the letters C (common), A (anode), K (cathode) and T (trigger). The connector protectors are numbered 1 (common), 2 (anode), 3 (cathode) and 4 (trigger) in order to allow easy interconnection by number coding the mating connectors. Each female connector has molded rubber knobs on it. Cut off the required number of knobs to identify each female connector and connect 1 to 1, 2 to 2, etc. The connectors should always be mated in air, not underwater. A thin coating of silicone grease on the male bulkhead connectors will make connections easier. The cables should be taped or tied away from areas where they could be damaged. If dual remote heads are used with one strobe electronics unit, the connecting cables are teed and connections are made in the same manner. Molded tee cables are available from Benthos or may be field spliced or hotspliced in the normal fashion.

3.2.3 Mounting

The unit may be mounted in any convenient manner utilizing the connector protector mounting holes.

4.0 REPAIR AND MAINTENANCE

The following sections describe the requirements for preventive maintenance and repair. Replacement of components and parts can be made with standard tools and procedures by referring to the drawings and parts lists in this manual.

4.1 Preventive Maintenance

After each use in salt water, the strobe and remote head should be washed with fresh water to reduce the possibility of corrosion. This is particularly needed before the flash is put into storage. The aluminum reflector should be replaced when it shows signs of corrosion. The lamp cover should be kept free of grease and dirt by careful cleaning.

4.2 Flash Tubes

If replacement of the flash tube becomes necessary, the new tube must be kept absolutely clean. Even fingerprints can affect the life and performance of a flash tube. A dirty tube should be cleaned with acetone and a cotton swab, and then with distilled water on a second swab. Dry the tube carefully with a clean cloth before use.

5.0 DRAWINGS AND PARTS LISTS

Outline Drawing, Remote Flash Head	C-382-13
Remote Flash Head Assembly	C-382-10 + BOM
End Cap Assembly	B-382-10 + BOM
Wiring Diagram for Model 382 Flash with Remote Flash Head	C-382-14
or	
Wiring Diagram for Model 383 Flash with Remote Flash Head	C-383-14

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3820 STANDARD FLASH

C-382-10 OPCODE: 0 REV: U ASSY,REMOTE HEAD,380-RH
MODEL:
ECO NO: 4612
DATE OF LAST ECO: 02/05/92

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	USE UME
B-382-15	END CAP,REMOTE FLASH	0	E	1	1.000	1.000	EA9
B-398-2	BRACKET, CONN GUARD MTG	0	B	2	2.000	1.000	EA9
C-381-1-3	COVER,LAMP	0		3	1.000	1.000	EA9
A-398-2	RETAINER,RING,LAMP COVER	0	H	4	1.000	1.000	EA9
A-382-5	BASE, FLASH TUBE MTG	0		5	1.000	1.000	EA9
A-382-9	TUBE,SOCKET&TRANSFORMER MNTING	0	A	6	1.000	1.000	EA9
C-383-9	REFLECTOR,382 & 383 FLASH	0	B	7	1.000	1.000	EA9
C-382-12	GUARD,REFLECTOR,REMOTE FLASH	0	C	8	1.000	1.000	EA9
A-383-9	MOD,SOCKET,MTG	0	B	9	1.000	1.000	EA9
0204-225	RING,O,1-7/8 X 1/8	1		10	1.000	1.000	EA9
B-380-293	CONN ASSY,MALE BULKHEAD	0	A	11	4.000	1.000	EA9
0801-001	WIRE,.032 DIA,SAFETY,SS	0		12	.000	1.000	RL9
0508-001	TRANSFORMER,TRIGGER,VE20-3	0		13	1.000	1.000	EA9
0144-031	WASHER,SPLIT LK,18-8,1/4 X.031	0		14	10.000	1.000	EA9
0143-031	WASHER,FLAT,18-8,1/4X5/8X.050	0		15	12.000	1.000	EA9
0104-031	NUT,FLEX LOCK,18-8,1/4-20	0		16	2.000	1.000	EA9
0128-407	SCREW,PH MACH,18-8,1/4-20X 5/8	0		17	2.000	1.000	EA9
0128-451	SCREW,BNDRHD,18-8,1/4-28 X 1/2	0		18	2.000	1.000	EA9
0118-032	SCREW,HEXCAP,18-8,1/4-28 X 1/2	0		19	4.000	1.000	EA9
0198-018	BOLT,HEX,316,1/4-28 X 1	0		20	4.000	1.000	EA9
0144-019	WASHER,SPLIT LOCK,18-8,#6X.031	0		21	4.000	1.000	EA9
0143-019	WASHER,FLAT,18-8,#6,3/8X.032	0		22	4.000	1.000	EA9
0128-268	SCREW,PH MACH,18-8,6-32 X 3/4	0		23	1.000	1.000	EA9
0128-256	SCREW,BNDRHD,18-8,6-32 X 5/16	0		24	2.000	1.000	EA9
0128-153	SCREW,PH MACH,18-8,4-40 X 1/4	0		25	2.000	1.000	EA9
0144-013	WASHER,SPLIT LOCK,300,#4X .025	0		26	2.000	1.000	EA9
0203-032	CLAMP,HOSE,300,M32.	1		27	1.000	1.000	EA9
0903-005	TAPE,BLACK ELEC.,3/4" X 66'	0		28	.000	1.000	RL9
0516-101	TUBE,FLASH #SFT291	0		29	1.000	1.000	EA9
0801-005	WIRE,NYLON COATED LEADER	0		30	.000	1.000	FT9
0128-259	SCREW,PH MACH,18-8,6-32 X 3/8	0		31	1.000	1.000	EA9
0900-003	CEMENT,PVC SOLV,SOS MO54191	0		32	.000	1.000	EA9
0242-001	SLEEVE,COMPRESSION, A-7	0		33	4.000	1.000	EA9
0904-003	LABEL,BENTHOS,3/4X3	0		34	1.000	1.000	EA9
0405-045	CONN,DOUBLE END/REF C-380-86	1		35	2.000	1.000	EA9
0403-006	CONN,CAMB #450-0016-01-03,1S	0		36	4.000	1.000	EA9
TP.C38210	TEST PROCEDURE,REMOTE FLASH HD	0	A	38	.000	1.000	EA9
IP.REMFLHHED	INSPECTION PROC,REMOTE FLASHHD	0	A	39	.000	1.000	EA9
PS.C38210	PROCESS SHEET,REMOTE FLASH HD	0	A	40	.000	1.000	EA9
TR.RMTFLHHED	TRAVELLER,REMOTE FLASH HEAD	0	A	41	.000	1.000	EA9

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3910 MASTER POWER PACK

D-391-SPK OPCODE: 4 REV: R SPK,POWER PACK,391
MODEL:
ECO NO: 3515
DATE OF LAST ECO: 10/18/88

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	USE UME
C-391-6-LP	PCB,PROGRAMMER,LOW POWER	0	M	1	1.000	1.000	EA9
0204-243	RING,O,4-1/8 X 1/8	1		2	1.000	1.000	EA9
0204-240	RING-O,3-3/4 X 1/8,#2-240,70	0		3	1.000	1.000	EA9
0204-010	RING,O,1/4 X 1/16,#2-010,70,BN	0		4	6.000	1.000	EA9
A-391-10	CONN,PREWIRED,391	0	B	5	1.000	1.000	EA9
A-390-15	CONN,PREWIRED,390	0		6	1.000	1.000	EA9
0403-001	CONN,WINCH #WD11S	0		7	1.000	1.000	EA9
A-391-9	MOD,SHAFT,POT	0	A	8	1.000	1.000	EA9
0503-001	SWITCH,CUTLER HAMMER#8820K16	0		9	1.000	1.000	EA9
0500-001	RELAY,24V,PB #KA11DY,DPDT	0		10	1.000	1.000	EA9
0412-103	BLOCK,LITTELFUSE#357002	0		11	1.000	1.000	EA9
0501-004	FUSE,5A,#313005/MDL5	1		12	5.000	1.000	EA9
B-380-293	CONN ASSY,MALE BULKHEAD	0	A	13	4.000	1.000	EA9
0401-101	BATTERY,GOULD 4.0 SCL,NICAD-D	1		14	3.000	1.000	EA9
A-380-165	WASHER,BULKHD CONN FEEDTHRU	0	B	15	4.000	1.000	EA9
0403-006	CONN,CAMB #450-0016-01-03,1S	0		16	3.000	1.000	EA9
0405-045	CONN,DOUBLE END/REF C-380-86	1		17	2.000	1.000	EA9
0206-009	RING,O,7/32X1/16,90 DURO BUNA	0		18	4.000	1.000	EA9
0212-001	BOX,PLASTIC McMAST #6755A16	0		22	1.000	1.000	EA9
0138-039	PIN,ROLL, 420, 3/32X1-1/8	0		23	1.000	1.000	EA9
0138-070	PIN,ROLL, 420, 3/16X1/2	0		24	2.000	1.000	EA9
0138-025	PIN,ROLL, 420, 3/32X1/2	0		25	1.000	1.000	EA9
IP.SPK	INSPECTION PROCEDURE,SPK	0	B	26	.000	1.000	EA9

AS OF 09/12/95

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3920 AUXILARY POWER PACK

D-392-SPK OPCODE: 4 REV: L SPK,POWER PACK,392
MODEL:
ECO NO: 3515
DATE OF LAST ECO: 10/18/88

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	SELE UME
0204-243	RING,O,4-1/8 X 1/8	1		1	1.000	1.000	EA9
0204-240	RING-O,3-3/4 X 1/8,#2-240,70	0		2	1.000	1.000	EA9
0204-010	RING,O,1/4 X 1/16,#2-010,70,BN	0		3	2.000	1.000	EA9
0412-103	BLOCK,LITTELFUSE#357002	0		4	1.000	1.000	EA9
0501-002	FUSE,10A,LTLFUSE 313010	0		5	5.000	1.000	EA9
B-380-293	CONN ASSY,MALE BULKHEAD	0	A	6	2.000	1.000	EA9
A-392-4	CONN,PREWIRED ENDCAP,392	0		7	1.000	1.000	EA9
A-390-15	CONN,PREWIRED,390	0		8	1.000	1.000	EA9
0405-045	CONN,DOUBLE END/REF C-380-86	1		9	1.000	1.000	EA9
0403-006	CONN,CAMB #450-0016-01-03,1S	0		10	2.000	1.000	EA9
0401-101	BATTERY,GOULD 4.0 SCL,NICAD-D	1		11	3.000	1.000	EA9
0143-031	WASHER,FLAT,18-8,1/4X5/8X.050	0		12	2.000	1.000	EA9
0206-009	RING,O,7/32X1/16,90 DURO BUNA	0		13	4.000	1.000	EA9
A-380-30	BOLT,HEX,1/4-28	0	C	14	2.000	1.000	EA9
0212-001	BOX,PLASTIC McMAST #6755A16	0		16	1.000	1.000	EA9
0138-039	PIN,ROLL, 420, 3/32X1-1/8	0		17	1.000	1.000	EA9
0138-070	PIN,ROLL, 420, 3/16X1/2	0		18	2.000	1.000	EA9
0138-020	PIN,ROLL, 420, 3/32X5/16	0		19	1.000	1.000	EA9
A-380-165	WASHER,BULKHD CONN FEEDTHRU	0	B	20	4.000	1.000	EA9
IP.SPK	INSPECTION PROCEDURE,SPK	0	B	21	.000	1.000	EA9

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3830 HIGH INTENSITY FLASH

D-383-SPK OPCODE: 4 REV: S SPK,383
MODEL:
ECO NO: 4721
DATE OF LAST ECO: 05/28/92

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	USE UME
C-381-1-2	COVER,LAMP,6"LONG	0		1	1.000	1.000	EA9
B-381-13	RING,SEALING	0	B	2	1.000	1.000	EA9
B-381-14	RING,CLAMP	0	C	3	1.000	1.000	EA9
C-383-9	REFLECTOR,382 & 383 FLASH	0	B	4	1.000	1.000	EA9
0203-032	CLAMP,HOSE,300,M32.	1		5	1.000	1.000	EA9
0204-243	RING,O,4-1/8 X 1/8	1		6	1.000	1.000	EA9
0204-240	RING-O,3-3/4 X 1/8,#2-240,70	0		7	1.000	1.000	EA9
0204-010	RING,O,1/4 X 1/16,#2-010,70,BN	0		8	2.000	1.000	EA9
B-380-293	CONN ASSY,MALE BULKHEAD	0	A	9	4.000	1.000	EA9
0403-006	CONN,CAMB #450-0016-01-03,1S	0		10	4.000	1.000	EA9
A-383-14	CONN,PREWIRED ENDCAP,383	0		11	1.000	1.000	EA9
0801-001	WIRE,.032 DIA,SAFETY,SS	0		12	2.000	1.000	RL9
C-383-6	PCB,383 FLASH	1	T	13	1.000	1.000	EA9
0522-002	CAPACITOR,3000MF,30V,ELECTRO	0		14	1.000	1.000	EA9
0508-001	TRANSFORMER,TRIGGER,VE20-3	0		15	1.000	1.000	EA9
C-380-182-2	ASSY,STROBE POWER SUPPLY	0	C	16	1.000	1.000	EA9
0516-101	TUBE,FLASH #SFT291	0		17	1.000	1.000	EA9
A-382-19	CONN,PREWIRE CHASS,382,383	0		18	1.000	1.000	EA9
0523-001	CAPACITOR,525MFD,450V,ELECTRO	0		19	2.000	1.000	EA9
0500-003	RELAY,24VDC,P&B #MB83D	0		20	1.000	1.000	EA9
0212-002	BOX,PLASTIC McMAST#6755A13	0		22	1.000	1.000	EA9
0501-004	FUSE,5A,#313005/MDL5	1		23	10.000	1.000	EA9
0501-003	FUSE,2A,LITTELFUSE #313002	1		24	5.000	1.000	EA9
0501-002	FUSE,10A,LTLFUSE 313010	0		25	5.000	1.000	EA9
0405-045	CONN,DOUBLE END/REF C-380-86	1		26	2.000	1.000	EA9
0204-330	RING,O,2-1/8 X 3/16	0		27	1.000	1.000	EA9
0138-020	PIN,ROLL, 420, 3/32X5/16	0		28	1.000	1.000	EA9
0138-070	PIN,ROLL, 420, 3/16X1/2	0		29	2.000	1.000	EA9
0138-039	PIN,ROLL, 420, 3/32X1-1/8	0		30	1.000	1.000	EA9
A-380-165	WASHER,BULKHD CONN FEEDTHRU	0	B	31	4.000	1.000	EA9
0206-009	RING,O,7/32X1/16,90 DURO BUNA	0		33	4.000	1.000	EA9
IP.SPK	INSPECTION PROCEDURE,SPK	0	B	34	.000	1.000	EA9