

## **Upgrading an Intensifier-Vidicon Camera to SIT-Tube Operation**

by

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This Note describes how an intensifier-vidicon (I-V) camera may be upgraded to utilize an RCA SIT (Silicon-Intensifier-Target) tube. The newer SIT tubes can provide superior performance through improved resolution and, most notably, increased sensitivity of approximately tenfold. Selection of a tube from the popular RCA 4804 16 mm SIT tube family is discussed, electrical and physical differences between the SIT and the I-V are described, and a few necessary changes to the camera are recommended.

### **Choosing the Right SIT Tube**

The C23165D or C23165E intensifier vidicon assembly can be replaced with a SIT tube from the 4804 family with only minor changes in most cameras. The 4804 is a popular 16 mm SIT tube which simultaneously optimizes resolution, lag and dark current in a camera tube of extremely high sensitivity. Four grades of 4804's are available to meet most any application requirement. These include the 4804/PRE for premium quality, the 4804/PRO for stringent blemish criteria, the 4804/SUR for general surveillance, and the 4804/SCI for relaxed blemish and testing specifications at a minimum price. The 4804/PRE/P2, 4804/PRO/P2, 4804/SUR/P2 and 4804/SCI/P2 (potted versions of above) and the C23165 have identical image section length, optical format and path length. Potted versions are recommended. Other potted versions, /P1 and /P3 are available where specifically needed. Further information on the 4804 family variants may be obtained from the 4804 family tube bulletin.

### **Differences and Changes Required**

**Physical . . . Collar Over Target Region** — The 1.615" diameter collar over the target region on the potted 4804 (P2) is longer by 0.2". A provision must therefore be made in the magnetic components assembly to accept this longer portion. This is necessary to assure target location at the proper position with respect to the magnetic fields. In some cameras, it may be necessary to remove

an electrostatic shield from the yoke to make room for the SIT tube. This will pose no problem since the 4804 (P2) has a built-in electrostatic shield. If new magnetic components are to be used, the following or their equivalent are recommended:

RCA C23175C  
Penn Tran No.1490-1  
Cleveland Electronics No.SVDA-2037-1

**Target Connection** — The 4804 (P2) target connection is made to a stud in the wall of the image section. A mating connector socket is shipped with each tube. This socket may be soldered into the camera and used for quick release from the tube, or for a more permanent connection, the stud may be unscrewed from the tube and replaced with a standard 6-32 screw to which a lead can be soldered.

**Base Socket** — There are two considerations regarding the base socket. The 4804 (P2) is approximately 0.8" shorter than the C23165, therefore, the socket leads must be long enough for the socket to reach the tube base. Also, the key pin is located on the opposite side of the tube with respect to the photocathode and target connections. This necessitates rotating the socket 180 degrees for insertion. All electrical connections are identical at the socket.

**High Voltage Connection** — High voltage is supplied to the 4804 (P2) through an AMP lead assembly, series LGH-1/2L, which mates with an AMP receptacle of the same series<sup>†</sup>. This allows quick disconnect. Permanent attachment, like the C23165, can be made by removing the connector and soldering the coaxial lead directly into the camera. If this is done, a minimum of one-inch separation must be maintained between the connection and the grounded, outside shield of the high voltage cable.

<sup>†</sup>See "Assembly LGH Leads and Receptacles"

Electrical . . . **Grid 4 Voltage** — The mesh (Grid 4) voltage of a 4804 (P2) must be limited to a maximum of 350 volts to prevent any possible shortening of tube life due to increased dark current resulting from soft x-ray bombardment of the silicon target.

**Target Voltage** — Target voltage should be set to 8 volts for optimum operation. Since the sensitivity of the 4804 (P2) is independent of target voltage, any automatic target voltage control circuitry should be deactivated.

**Photocathode Voltage** — Photocathode voltage should be limited to either  $-9$  or  $-10$  kV depending upon the maximum rating of the particular grade of 4804 (P2) being used.

**Gun Heater** — The gun heater supply must provide 6.3 volts with a current of 0.1 ampere to the 4804 (P2). The user must not attempt to operate the 4804 (P2) from a current-regulated supply which was previously providing 0.6 ampere to the C23165.

**Grid 3 Voltage** — Consideration should be given to the wall (Grid 3) voltage for optimum performance. With the RCA C23175C component, the recommended wall voltage is about 0.65 times the mesh voltage. With the Cleveland and Penn Tran components, the recommended wall voltage is between 0.8 and 0.9 times the mesh voltage.

**Automatic Signal Control** — For automatic signal control, the image section voltage of the 4804 (P2) may be varied down to  $-2.5$  kV to produce varying target gain between 1600 and about 3. A gain ratio of 1000:1 can be obtained by going to  $-2.0$  kV but with some sacrifice in resolution and image rotation. If the camera uses an RCA PF1028 power supply, the image section voltage can be varied by controlling the power supply input between about 1 and 7 volts. This control voltage can be derived by means of suitable processing of video information from the camera. In this manner, a closed gain control loop may be implemented.

The 4804 (P2) incorporates a one gigohm focus divider resistor across the image section. The current through this resistor will prevent the utilization of any automatic signal circuitry based upon changes in photocathode current. The one gigohm load for the high voltage supply will allow utilization of a relatively "soft" power supply such as the RCA PF1028.

The SIT tube sensitivity is comparable to a double-intensified-vidicon ( $I^2V$ ), but with significantly higher resolution and in an I-V package size.  $I^2V$  cameras can be changed similarly to the I-V camera so as to employ a SIT tube or an intensified-SIT (I-SIT) assembly. An I-SIT configuration, such as the RCA-C21165, can provide sensitivity great enough to achieve photoelectron-noise-limited performance.

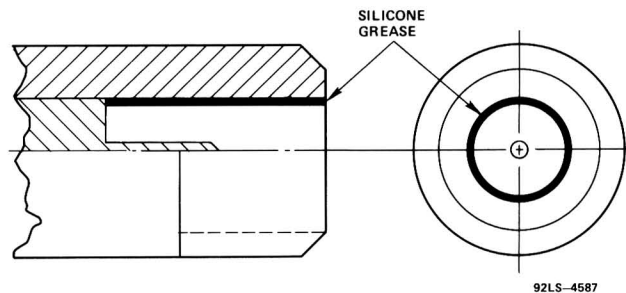
For other low-light-level applications, RCA offers a broad line of devices: 4826 (25/18 mm SIT, gateable), C21117C

(40/16 mm SIT), C21145 (40/27 mm SIT, has electronic zoom and gating), C21146 (80/27 mm SIT, has electronic zoom, gating and image motion compensation), and 35/35 mm Isocons (RCA-4807, 4827, 4828), plus a wide variety of image intensifiers. RCA Applications Engineering will be pleased to assist in the selection of the right device for a specific job.

### Assembling LGH Leads and Receptacles

For optimum high voltage coupling, the following procedure, supplied by Amp Corp., is recommended:

- Using a clean cloth saturated with toluene, clean the mating end of the "O" ring type or molded end type lead. The surface area to be cleaned should exceed the barrel depth of the mating receptacle.
- Apply a thin coating of Dow Corning High Vacuum Grease (DC-4) to the clean portion of the lead.
- Apply a generous coating of silicone grease to the inside surface of the receptacle.



**Caution:** Too much grease will prevent the lead and receptacle from fully mating.

- With a back-and-forth twisting motion, insert the lead into the receptacle until the lead end bottoms. This manner of insertion causes the silicone grease to be forced over the entire circumference of the lead and receptacle.
- With the washers and "O" ring (if applicable) in place, install the cap until the "O" ring or molded shoulder is compressed. This forms a complete seal between the top of the receptacle and lead.
- Remove all excess grease from the mated lead and receptacle with a clean cloth.

### High Voltage

The high voltages at which these tubes are operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.