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TECHNICAL MEMORANDUM

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**EG&G FILM MAGAZINE
TYPE XPH-47**

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1.0 GENERAL

The EG&G Film Magazine Type XPH-47 (Fig. 1) was designed to meet specific NC-135 program requirements for a reliable, simple and economical unit which would adapt the LC-4 camera for moving film oscilloscopic photography at film speeds suitable for the separation of oscilloscope sweep traces.

Essentially, the XPH-47 is a standard Beattie-Coleman Type 32800 magazine, redesigned for incorporation of features which would fulfill these requirements. One such feature — replacement of the original motor with a new motor having a control circuit — provides constant speed operation and consequently, reliability not achieved by other film magazines.

The XPH-47 is a self-contained unit consisting of both supply and takeup spools and a film transport mechanism. It is normally loaded in subdued light with 100 feet of 35-mm film and then placed on the camera. The magazine is removed from the camera, and the film is unloaded in a darkroom or in subdued light.

The XPH-47 can be wired for use directly on the LC-4 camera to allow magazine operation with the shutter open. If desired, with additional minor wiring changes in the LC-4 camera, film motion signals can be routed through the camera to an external control panel. The leads to the two marker lamps are wired directly to miniature coaxial connectors on the magazine and do not pass through the LC-4 camera.

A preliminary evaluation of the XPH-47 moving film magazine indicates that as a result of the design changes, the magazine more than meets established design specifications.

Specifications, features and design details of the basic XPH-47 magazine are contained in the following paragraphs.

(a) Left side view

(b) Right side view

(c) Bottom view

Fig. 1. XPH-47 magazine mounted on the LC-4 camera.

2.0 SPECIFICATIONS

Type:	Single unit including film supply, film transport, and film takeup
Film capacity:	50 feet or 100 feet of perforated 35-mm film on daylight loading spool
Operating Speed:	Variable by changing gears. Gears supplied for the following speeds: 32, 16, 8, 4, 2, 1, 1/2, 1/4, 1/8, 1/16 inches per second
Film Markers:	Two neon marker lamps at top and bottom edge of film gate
Motor:	115 v dc type with rectifier, voltage regulator, and RFI suppression
Power Requirements:	105-130 v dc, 50-800 Hz ac. Current requirements depend on film load and speed; these range from 100 ma. at minimum load to 400 ma. at maximum load and speed.
Size:	Width: 8-1/2 inches; Depth: 6 inches; Length: 6 inches
Weight:	5 pounds, 5 ounces without film load; 5 pounds, 15 ounces with full 100-ft film load

3.0 DESIGN DETAILS

3.1 Supply Spool Assembly

In the original magazine, the supply spool rotates on a fixed shaft and no indicator switch or ball detent are provided. In the XPH-47, the supply spool is held by a ball detent on a spindle which rotates as the spool plays out the film. Incorporated in the spindle is a double-throw cam operated microswitch which opens and closes once for each revolution of the supply spool. In normal operation, the switch is connected to an indicator lamp on the main camera control panel and the lamp is flashed on and off each time the spool makes one revolution. (Alternate lamps may also be used.) The rate of flashing depends on the film

motion speed and the amount of film remaining on the supply spool.

The incorporation of the microswitch feature gives the operator: (1) a positive indication that the film is moving, (2) an approximate indication of the amount of film remaining, and (3) an immediate alert that a jam, film break or film runout has occurred, in which cases, the indicator lamp would cease to flash.

3.2 Gate Assembly

After leaving the supply spool, the film passes around a cork-faced idler roller and through the film gate. The front part of this gate is the LC-4 camera plate. The film is held against the camera plate by a spring-loaded pressure plate, thus the film emulsion is held in the normal focus position for the LC-4 camera. The pressure plate includes two neon marker lamps which, when flashed by an external circuit, produce small marker spots at the center of the upper and lower edges of the 25 x 25 mm picture format. The marker lamps are used to place timing marks, trigger indications, or other data on the edge of the film.

From the film gate, the film passes around the drive sprocket and onto the takeup spool. The drive sprocket is arranged so that the film follows a straight path from the cork idler roller, through the gate and around the sprocket. The straight pull is necessary to prevent the pressure plate from being pulled open by film tension when high film speed is used. Extensive redesign of the original magazine was necessary to incorporate this feature. In addition, a new pressure plate mechanism was designed to incorporate the marker lamps and to insure accurate film location.

3.3 Takeup Spool Assembly

The takeup spool is held on a spindle by a ball detent. A standard 100-foot daylight loading spool is used for film takeup as well as for film

supply. From the drive mechanism, the spindle and spool are driven through a slip belt drive so that positive takeup is obtained regardless of the amount of film on the spool.

3.4 Motor Drive Assembly

The motor drive assembly is comprised of the original gear box and a new motor and control circuit. The gear box drives the main drive sprocket at a constant speed and drives the takeup spool through a slip belt drive. The gear box includes change gears which can be removed and replaced by unscrewing knurled nuts. The change gears supplied with the magazine permit operation at the following nominal film speeds and running times.

<u>Film Speed (in. /sec)</u>	<u>Running Time For 100-ft Film Load</u>
32	37 sec
16	75 sec
8	150 sec
4	5 min
2	10 min
1	20 min
1/2	40 min
1/4	80 min
1/8	2 hr, 40 min
1/16	5 hr, 20 min

The drive motor is a 115 v dc type, which is coupled into the gear box through a worm gear drive. The motor is driven by a voltage regulator circuit which prevents line voltage fluctuations from affecting the motor speed. The regulator circuit is fed from a bridge rectifier so that the magazine can operate from 115 v dc, 60 Hz ac, or 400 Hz ac without change. Radio frequency interference filters prevent motor brush noise from being conducted into the power leads. (See Fig. 2 for circuit diagram of the XPH-47 magazine.)

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NOTE:

Q1 - DELCO DTS 423

Q2 AND Q3 - 2N3440, RCA 40321, RCA 40327

Fig. 2. XPH-47 magazine circuit diagram.

Replacement of the motor and one pair of aluminum drive gears by stainless steel gears, the change to worm gear input, and the addition of a motor control circuit assure reliability at high operating speeds.

3.5 Film Footage Indicator Assembly

When the original magazine was mounted on the LC-4 camera, the film footage indicator, located on the bottom of the magazine, was difficult to read. On the XPH-47 magazine, the reading dial has been relocated to the rear surface of the magazine, where it is easily visible. The footage indicator mechanically shows the amount of film remaining on the supply spool by means of a follower arm, which rests on the edge of the film within the spool. As the supply is depleted, the diameter of the film decreases and the spring-loaded arm moves toward the center of the spool. Motion of the arm actuates a drum dial, which is calibrated to read the film footage remaining.

3.6 Magazine Housing

The main portions of the original magazine housing were retained; modifications were made to accommodate the relocated footage indicator, the voltage regulator, a new motor housing with RFI filters, and the new mounting plate for LC-4 camera use. On the XPH-47, space has been provided on the housing for incorporation of blue-amber flashing lamps for film motion indication and for a manual film advance pushbutton.

4.0 LC-4 MODIFICATIONS

The XPH-47 is normally wired for use directly on the LC-4 camera. It is necessary to bridge across the shutter-open interlock circuit to allow magazine operation with the shutter open. Additional minor LC-4 wiring changes may be made if it is desirable to have film motion signals pass through the camera to an external control panel. The leads to the two marker lamps go directly to miniature coaxial connectors on the magazine and do not pass through the LC-4 camera.

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