

ELECTRIC DRIVE 19EP-16APK

1. PURPOSE

Electric drive 19EP-16APK (further under the text the name 'drive' is used) is intended for actuating mechanisms of the 'Konvas-Automat' (1KSR-1M, 1KSR-2M) movie cameras.

2. BASIC SPECIFICATIONS AND TOLERANCES

The name of the basic characteristics	Table 1 Specifications and Tolerances	
	Nominal	Allowable
1. The fixed shooting frequencies, fps	8,12,16,24,25,32	
2. Power supply voltage, V		
- on 8,12,16,24, 25 fps	12	11,8-16,8
- on 32 fps	12	12-16,8
3. Stabilization of the shooting frequencies	quartz	
4. Start-up time, sec		0,2-0,5
5. Maximal moment developed on the output shaft of a reducer, N·m:		
- at temperature from 0°C up to 40°C	0,06	
- at temperature from minus 30°C up to 0°C	0,08	
6. Maximal consumed current on 24 fps, 12V, A;		
- at the load moment of 0,06 N·m	3,0	
- at the load moment of 0,08 N·m	4,5	
7. Sound level during idling on 24 fps, dBA, no more	40	
8. Cyclicity of work, minutes:		
- work	6	
- pause	3	
- break after 5 cycles	30	
9. Climatic operating conditions:		
- range of working temperatures of air, °C	from minus 30 up to 40	
- range of limiting temperatures of air, °C	from minus 40 up to 50	
- maximal relative humidity of air at temperature of 25°C, %	98	
10. Overall dimensions, mm, no more:		
- electric drive	260x105x110	
- connector	550	
- case	300x205x160	
11. Weight, kg, no more:		
- electric drive	1,5	
- connector	0,25	
- case	1,2	
12. Full average service life Ts, years, not less	10	
13. Full target life Tt, years, not less	3	

INFORMATION ON TOTAL WEIGHT OF PRECIOUS MATERIALS

Gold 0,4481 gr

Silver 2,686 gr

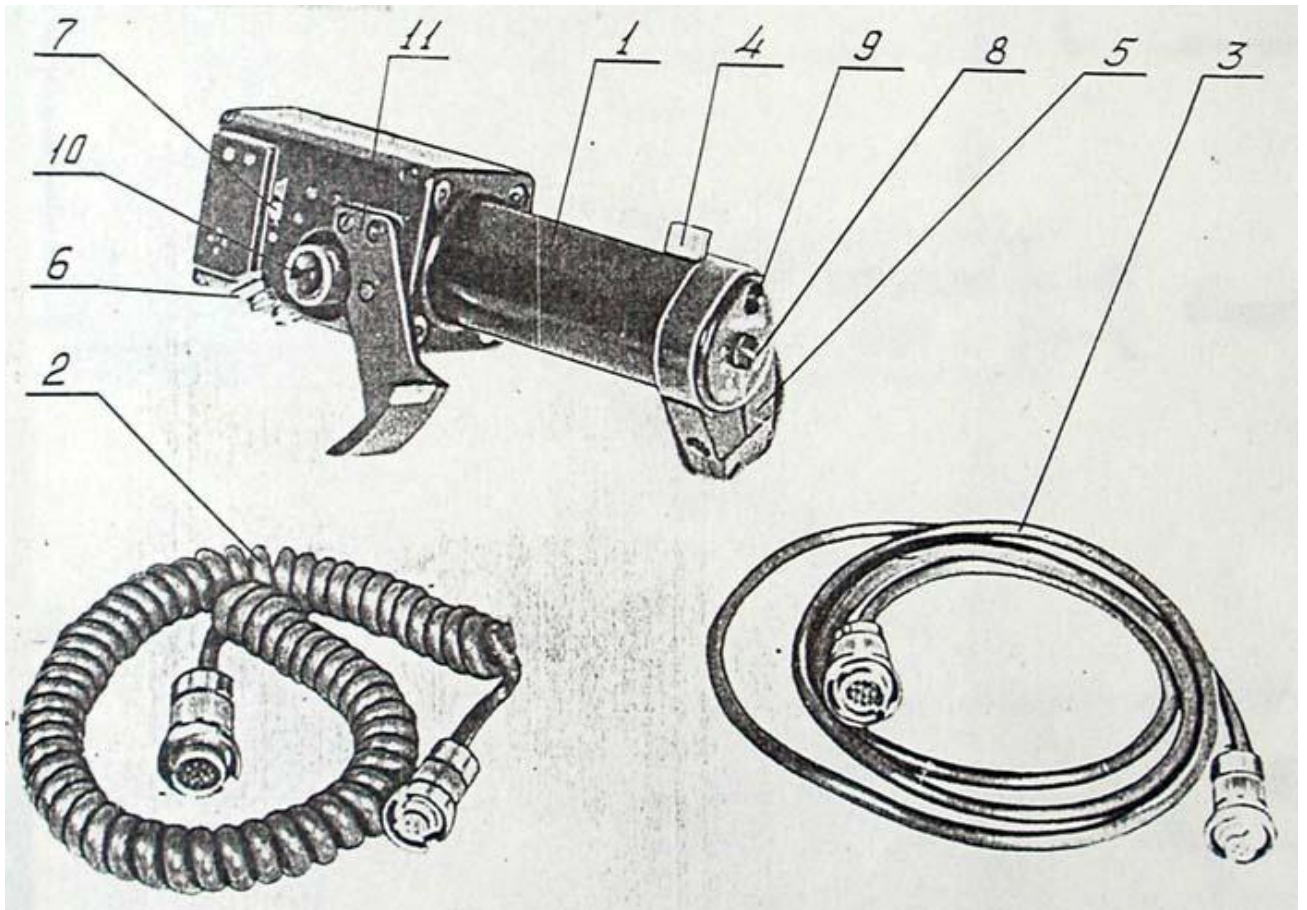
Palladium 0,0491 gr

3. COMPONENTS AND COMPLETENESS

Table 2

Designation	Name	Quantity	Overall dimensions, mm	Weight, kg	Factory number	Note
19EP-16APK.00.000	electric drive	1	260x105x110	1,5		
MKBI.434454.031	connector	2	550	0,25		Twisted
MKBI.323369.037	case	1	300x205x160	1,2		
19EP-16APK.00.000PS	passport	1				
ZIP						
AGO.481.303 TU	fuse VP1-1-5A	10				
IFMR.675100.001 TU	lamp SMN6,3-20-2	2				
The items delivered under special order at additional price						
MKBI.434454.030	connector	1	1500	0,15		
MKBI.434454.032	connector	1	1030	0,1		
MKBI.721461.001	obliquecog cylindrical wheel	1				
MKBI.303712.003	obliquecog cylindrical wheel	1				

4. DESIGN AND PRINCIPLE OF WORK



4.1. The electric drive 19EP-16APK (figure 1) consists of the following components: the electric motor with the built-in electronic control system, a twisted connector (2) and a connector (3).

4.2. Structurally, the drive represents the single unit consisting of the dc motor and printed circuit boards with controlling electric circuits (figures 4-10).

The motor is placed into a plastic casing (1) which serves as the handle during work with the movie camera. The start button (4) is located here too. For additional support of a hand, there is the collar (5) with a belt is placed on the casing.

Printed circuit boards are mounted on the cross-board which fastens to the case. There are also a plug (6) for connection of a power source, a fuse and a switch of sound indication of a non-synchronous movement (7) located on the drive case.

There is board with a shooting frequency switch (8) and the light indicator of sync lost (9) fastens at the end of the electric motor.

The drive is connected to camera gears with the half-coupling (10), and fixed by the corbel (11).

4.3. Functional and electric circuits of the drive are shown on the figures 2 and 3. The control circuit carries out function of a synchronous digital position tracking drive, that has two channels – frequency and phase. Frequency channel is intended for attain of minimal start-up time of the electric motor, and the phase channel is for attain of necessary accuracy of rotation speed stabilization.

Functionally, the drive consists of the following basic units:

- synchronization frequency generator (board MKBI.687253.008),
- unit of speed setting (board MKBI.687252.002),
- sensor and generator of feedback frequency (board MKBI.687253.009),
- converter PHASE-CODE (board MKBI.687253.010),

- converter CODE-PLM (board MKBI.687253.010),
- frequency-phase detector (board MKBI.687252.005),
- sensor and generator of the fixed stop signal (board MKBI.687253.008),
- start-up unit (board MKBI.687253.008),
- blocking logic with the generator of smooth start-up (board MKBI.687253.008),
- indicators of non-synchronous movement,
- voltage stabilizer +9V (board MKBI.667253.009),
- output amplifier stage with the executive motor.

Synchronization frequency generator forms quartz master frequency f_m which serves as reference for comparison with feedback frequency from the electric motor sensor.

Frequency of 5120 kHz from the quartz generator going to the counter ST1 (chip U11). From the counter ST1 through multiplexer DS (chip U13) the signal passes on system of tunable parts: a divider by 5 (chips U22-1, U23-1, U24-1), a divider by 3 or 4 (chips U22-2, U23-2, U25-1), a divider by 25 (chips U26, U27-1, U27-2). Depending on command from unit of the speed selection, the factor of division of the second divider is established equal to 3 on shooting frequencies of 8, 16, 32 fps, or to 4 on shooting frequencies of 12, 24, 25 fps. The "exclusive OR" element (chip U28-1) subtracts every 25th pulse on all frequencies, except for 25 fps. In result, master frequency of synchronization f_m is generated on output.

Necessary shooting frequency is set by unit of speed selection by means of switch B1. Commands from the unit of speed selection are control selection of necessary frequency from multiplexer DS, and also adjust factor of division of dividers in the synchronization frequency generator.

Sensor TS-210 of the electric motor serves as feedback sensor. The signal from this sensor going to the feedback frequency generator, and after shaping (chips U15, U16) passed to the PHASE-CODE converter. Frequency f_m from the synchronization frequency generator comes here too.

The PHASE-CODE converter made on register RS1 (chips U2, U3) transforms a phase of the feedback signal to a code by calculation of quantity of pulses from the counter ST2 (chip U1) during time between two pulses of feedback signal f_{fb} . In order to maintain stability of work of the drive, the negative feedback on a derivative realized on register RS2 (chips U4, U6) and adder M1 (chips U6, U7). From outputs of adder SM2 (chips U8, U9), the parallel code of managing frequency moves to the converter the CODE-PLM.

The CODE-PLM converter is realized on the comparator (chips U12, U14). It compares the codes of managing frequency and quartz frequency from the counter SI, and generates pulse-width code f_u which on-off time ratio depends on phase mismatch between feedback signal f_{fb} and master signal f_m . Change of value of phase mismatch is determined by change of the feeding voltage or by change of the load moment.

Converters PHASE-CODE and CODE-PLM form the phase channel of regulation.

Frequency-phase detector (FPD) is the frequency channel of regulation. FPD works in frequency and phase modes. The principle of its work is based on comparison by trigger TT2 (chip U18-2) of frequency of the master f'_m and frequency of feedback f'_{fb} , acting through the generator of short pulses SPG (chip U18-1).

If frequencies are not equal after start-up ($f'_m > f'_{fb}$, I frequency mode) there are command from triggers TT3 and TT4 (chip U19) comes to blocking logic in order to forbid passage of managing signal f_u and to open output power transistor T9.

Upon achievement of given speed, frequencies being equalized $f'_m = f'_{fb}$, and FPD switched to the phase mode. Also, special signal passes to blocking logic, allowing passage of managing signal f_u which supports speed of the motor.

Upon turning the motor off, FPD switches to II frequency mode. The drive switches to lower speed of additional turn $f'_m = f'_{at}$. Triggers TT3 and TT4 give signal to blocking logic to forbid passage of managing signal f_u and to close output power transistor T9. Speed of the motor begins to decrease.

Upon achievement of speed equal to f_{at} , FPD switches to the phase mode, and after receiving a signal from the sensor of fixed stop, through blocking logic brake transistor T8 opens. The electric motor stops in the given position.

During operating in frequency modes, FPD generates a signal of non-synchronous run, which passed to light (LED D5) and sound (microphone Gr) indicators.

The sensor of fixed stop made of photon-coupled pair: lamp L – photo diode D6. The signal from the photo diode passed to blocking logic through the signal shaper FO (chips U28-2, U28-3).

Upon a signal from start button B3, the start-up unit (chips U24-4, U23-3, U23-4, U25-2) turns the lamp L on, and permits passage of a signal fu through blocking logic. Upon switching start button B3 off, the start-up unit permits passage of the signal through blocking logic to the brake transistor T8. After a time interval determined by chain RC3 (resistor R17, condenser C11), it switches lamp L off, and closes blocking logic.

Blocking logic (chips U20-1, U29-1, U29-2, U25-4, U24-5, U24-6) collects various signals and upon a commands from the start-up unit and from FPD, passes start-up, control, or brake signal to the output amplifier stage of the electric motor. Also signal of smooth start-up being generated on the chip U25-3.

The voltage stabilizer +9V is constructed on stabilitron B3 and transistor T1. The stabilized voltage powers all control system except for the output amplifier stage.

The output amplifier stage consists of the managing transistor T9 and the brake transistor T8. Managing signal passes from blocking logic to the transistor T9 through the preliminary amplifier made of transistors T4, T7, and the brake signal comes to the transistor T8 through the preliminary amplifier made of transistors T5, T6.

5. SAFETY MEASURES

- 5.1. It is forbidden to open the drive and to make repair without disconnecting power source.
- 5.2. It is forbidden to make any switching without disconnecting power source.
- 5.3. It is forbidden to use a non-standard (home-made) electrical fuses.
- 5.4. The responsibility for observance of the safety measures is assigned to the appropriate officials.

6. PREPARATION FOR WORK AND OPERATING PROCEDURE

6.1. Adjust necessary length of a belt. To do this, pull springed overlay on the drive body through which the belt is passed, adjust necessary length of the belt, and release the overlay. Thus the pin of the overlay should enter into hole of the belt.

6.2. Mount the drive onto the movie camera. Thus marks on the output half-coupling of the drive and of the camera should match each other.

If mark on the camera is absent, mount the drive in any way.

6.3. Connect the drive to the power supply by means of a connector.

6.4. Set a necessary shooting frequency by means of the switch.

6.5. Turn the power source on.

6.6. Start the drive by pressing of the start button on the drive body.

To stop the drive, press the button once again.

6.7. Start and stop the drive once. If a shutter has not stopped in position of visioning, dismount the drive, turn output half-coupling of the drive by 180 degrees, and mount the drive back to the camera.

6.8. Monitor synchronism by means of light and sound indicators.

The light indicator works from the moment of drive start-up up to synchronous run, or during non-synchronous run.

The sound indicator works at the moment of drive start-up, during non-sync run, and upon stopping of the drive. It is possible to switch sound indicator off by means of a switch "◀".

7. MAINTENANCE SERVICE, STORAGE AND TRANSPORTATION

- 7.1. Refer to this document using the drive.
- 7.2. Check up completeness of a drive before using it.
- 7.3. Regarding influence of climatic factors, the drive should be steady against storage in conditions of group L and transportation in conditions of group ZH2 in accordance to GOST 15150-69, but at temperature down to minus 40°C.
- 7.4. The drive should be stored in warehouse in a retail container.
- 7.5. Storage of the drive near heat sources, and also its storage together with acids, alkalis or chemically active gases and the corrosion causing evaporations is not supposed.
- 7.6. The drive may be transported by all kinds of closed transport.
During transportation by air transport, the drive should be in the heated hermetically sealed compartments.
- 7.7. Protect shipping boxes from falls and impacts during loading and transportation. Observe rules of transportation.
- 7.8. Protect the boxes from moisture and heating by direct solar light during transportation.

8. POSSIBLE MALFUNCTIONS AND METHODS OF THEIR FIXING

The list of most frequent or possible malfunctions is given in table 3.

The name of malfunction, visible signs and additional attributes	Possible cause	Fix method	Note
The drive doesn't run after start button pressed	1. Burned electrical fuse.	1. Replace a fuse.	Supplied in ZIP.
	2. Broken connector.	2. Replace a connector. Repair faulty connector.	

10. MANUFACTURER'S (SUPPLIER'S) WARRANTY

- 10.1. The electric drive 19EP-16APK should be accepted by the technical control of the enterprise-manufacturer.
- 10.2. The enterprise-manufacturer guarantees conformity of the drive to requirements of specifications in case of observance of conditions of operation, transportation and the storage by the consumer.
- 10.3. Guarantee period is 18 months from the date of start using the drive, but not later than 6 months from the date of delivering it to consumer.

11. INFO ON CLAIMES

Claims for the electric drive 19EP-16APK may be presented during guarantee period and under condition of observance by the consumer of service regulations, transportation and the storage, outlined in the passport.

Data on claims should be filled in form below.

INFO ON CLAIMES

The name of a product	Date and number of the damage statement	Summary of the claim	Undertaken measures
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Post of the responsible person

signature

initials, surname

date