



**435H
Pan and Tilt
Head
Technical Manual**

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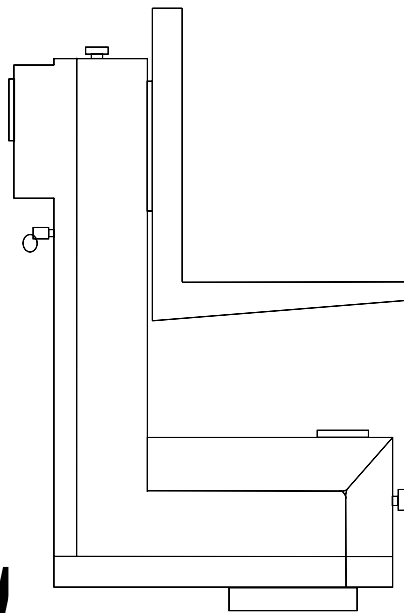
1. TABLE OF CONTENTS

	Page
1. TABLE OF CONTENTS	1
2. INTRODUCTION	2
2.1. General	2
2.2. Specifications	2
3. HANDLING & INSTALLATION	3
3.1. Handling	3
3.2. Installation	3
3.2.1. Mounting the Head	3
3.2.2. Mounting the Camera	3
3.2.3. Switching On	4
4. MAINTENANCE	5
4.1. Tools & Test Equipment	5
4.1.1. List of Tools	5
4.2. Fault Diagnosis	5
4.3. Dismantling the Head	6
4.4. Replacing a Reset Potentiometer	6
4.5. Replacing a Motor / Tacho	7
4.6. Replacing an Electro-Magnetic Clutch	7
4.7. Routine Maintenance	8
5. DRAWINGS	9
5.1. Build Standard	9

2. INTRODUCTION

2.1. General

TYPE 435 H



The 435H is one in the latest generation of pan and tilt Heads designed to support CCD Studio cameras, lenses and teleprompters. It combines high performance remote control technology with a unique system of electronic clutches enabling it to be instantly switched to a fully manual Head if programme needs demand. Adjustable fluid damping is provided as standard for both pan and tilt axes to provide a perfect feel when used manually.

The 435H head can be inverted for installations requiring suspended cameras.

APPLICATIONS

News and Current Affairs Studios

Parliaments

Manual Studio Operation

2.2. Specifications

Figures relate to both pan and tilt functions unless otherwise stated:

Mechanical travel - pan	350°
Mechanical travel - tilt	± 45°
Maximum speed	60°s ⁻¹
Minimum smooth speed	0.1°s ⁻¹
Repeatability	3 minutes of arc
Maximum payload	70 kg (154 lb)
Weight of Head	38 kg approx (83 lb)

3. HANDLING & INSTALLATION

3.1. Handling

Prior to shipment, the four mounting studs are removed from the base flange of the pan and tilt head. The head is then packed with the tilt platform in its mid-position with the locking pin in place and such that the brake knobs are protected from damage.

The brakes are left free to prevent shock loads being transmitted to the gearing should the head be roughly handled during transit.

It is recommended that this procedure be adopted should it be necessary to de-rig the head for shipment to a new site.

3.2. Installation

3.2.1. Mounting the Head

The type 435 Pan and Tilt Head may be mounted in either the upright or inverted position on a suitable surface, ceiling plate, column or pedestal, having four equally spaced 10.5mm diameter clearance holes on a 111 mm pitch circle diameter.

Fit the four mounting studs into the base flange of the Head. This can be done by locking a pair of nuts onto each stud in turn and then tightening them fully with a spanner. Studs must be fitted with their short threaded end screwed into the base flange of the head.

NOTE

WHEN NOT USING THE STUDS SUPPLIED, ENSURE THAT SCREWS USED WILL NOT BE LONGER THAN THE THICKNESS OF THE BASE. SEVERE DAMAGE TO THE MAIN BEARING CAN OCCUR IF THIS INSTRUCTION IS NOT FOLLOWED.

With the pan brake free, manually rotate the base flange to establish its mid-position, indicated by matching the red dot on the pan base with the red dot on the head casing and having set it there, lock the pan brake.

Offer up the Head to its mounting face and enter the studs into the clearance holes, such that the camera will face in the desired direction at its mid-travel point. Fit the four 3/8 nuts and lock-washers to the studs and fully tighten them.

3.2.2. Mounting the Camera

Where the camera / lens system is supplied with its own support plate, it may be possible to attach this assembly directly to the tilt platform. However, it is likely that an intermediate plate will be required, having tapped holes positioned so that the centre of gravity of the system can be brought as near as practical into line with the tilt axis, using the slots provided in the tilt platform.

It is recommended that the camera, lens and mounting plate be assembled as a unit and the approximate longitudinal position of the Centre of Gravity established before fitting to the Pan and Tilt Head. An attempt should also be made to estimate the

height of the centre of gravity of the system, including pan bar and lens controls if these are to be fitted.

Loosen the three hex-socket screws securing the tilt platform to tilt flange and raise it to bring the estimated vertical position of the camera/lens centre of gravity in line with tilt axis and tighten the three socket screws.

For efficient control, it is essential that the whole load, including the cables, be properly balanced about the tilt axis.

Connect the cables at the Head only and dress them to impose minimum drag while allowing full pan and tilt movement.

3.2.3. Switching On

With power off, remove the tilt-locking pin and transfer it to its storage position on the side of the head.

Release the pan and tilt brakes and set the pan and tilt dampers to minimum. Plug in the head cable and switch on the power.

Switch the head to Remote mode using the Local/Remote switch on the front panel of the Lens I/F Unit, which is mounted on the side of the head. Ensure that the indicator on the side of the head is illuminated confirming that the head is indeed under remote control.

A small movement may be observed in the pan and tilt head axes. If this is greater than 5 degrees in either pan or tilt, then there is a fault in the system.

Run tilt slowly from end to end and check that it does not hit its mechanical end stops. It should be noted that pan does not have a mechanical end-stop, the travel being limited electrically.

N.B. Some heads may have mechanical end-stops fitted for the pan axis.

4. MAINTENANCE

WARNING

- 1/ **REMOTELY-CONTROLLED EQUIPMENT MAY MOVE SUDDENLY AND WITHOUT PRIOR WARNING. STAND WELL CLEAR AT ALL TIMES.**
- 2/ **DANGEROUS MECHANISMS IN PAN & TILT HEAD. KEEP FINGERS WELL CLEAR.**

CAUTION

- 1/ **BEFORE MOUNTING/DEMOUNTING THE CAMERA, ENSURE THE TILT LOCKING-PIN IS ENGAGED AND PAN BRAKE IS APPLIED.**
- 2/ **PLASTIC TRACK PRECISION POTENTIOMETERS CAN BE DAMAGED BY EXCESS CURRENT. USE ONLY OHMMETERS HAVING A SHORT-CIRCUIT RATING OF LESS THAN 10mA.**
- 3/ **DO NOT ATTEMPT TO RUN THE SYSTEM UNLESS THE HEAD IS FULLY SECURED.**

NOTE

- 1/ **NUTS AND SCREWS ARE METRIC SIZES UNLESS OTHERWISE STATED.**

4.1. Tools & Test Equipment

4.1.1. List of Tools

1. Normal workshop tools (Note that nuts and screws are metric sizes unless otherwise stated).
2. Digital multi-meter (short circuit current of resistance range less than 10mA).
3. Power Supply 0-30V dc @ 2A.

4.2. Fault Diagnosis

Erratic, jerky or noisy operation, particularly in tilt, is most likely to be caused by incorrect balancing of the camera/lens system. Check and correct if necessary.

When switched to 'Local' Mode, or with the power switched off, both pan and tilt can be operated manually to determine if the problem is mechanical. If this is shown to be the case, then rectify accordingly.

Erratic and jerky operation can also be caused by the following :

1. Noisy demand signal.
2. Noisy positional feedback potentiometer. Check and replace if necessary.
3. Faulty motor or tacho. Check and replace if necessary.
4. Loose timing belt drives. Check and tighten if necessary.

4.3. Dismantling the Head

Fit the tilt locking pin, set pan to its mid position by lining up the red dots on the pan base and the main casting, and apply the pan brakes. Remove the payload so that if necessary, the head may be transferred to a suitable working area.

All adjustments and replacements on tilt (except changing the motor), can be carried out by just removing the back cover. To change the tilt motor or carry out any work on pan, the main and base castings must also be separated.

A total of twelve M5 Hex socket screws (including four which secure it to the base casting) hold the back cover in position. A further eight of these screws are used to fix the base and main castings together. However, before any castings can be separated, the brake knobs must be removed by undoing the screw at their centres. Note that removal of the load platform, after marking its position, will make the main casting easier to handle.

4.4. Replacing a Reset Potentiometer

Having gained access to the appropriate axis, replacing a reset potentiometer is the same for either pan or tilt. Set the axis being worked on to its mid position and unsolder the wires from the potentiometer terminals after having noted their coding and position. Remove the three clamps holding the potentiometer body in position.

The potentiometer may now be removed by pulling it out of the 'O' rings, which retain it in the end of the output shaft. These 'O' rings are a tight fit, so some effort may be required, but avoid pulling the potentiometer from side to side.

If either of the three 'O' rings used on each axes is seen to have remained on the potentiometer shaft, it should immediately be removed and fitted into the hole in the end of the output shaft.

NOTE

NEVER ATTEMPT TO FIT A REPLACEMENT RESET POTENTIOMETER BY PUTTING THE THREE 'O' RINGS ON ITS SHAFT. THEY MUST ALWAYS BE FITTED INTO THE HOLE IN THE END OF THE OUTPUT SHAFT BEFORE THE POTENTIOMETER IS FITTED.

Insert the shaft of the new potentiometer into the 'O' rings in the output shaft and push it home onto its mounting plate. The potentiometer spigot is not a location fit in the mounting plate so let the potentiometer centralise itself and then fit the three clamps to hold it in position.

With the axis set to its mid point, centre the potentiometer using a DVM. This is done by slipping the potentiometer shaft in the 'O' rings, until the correct setting is found. Re-solder the wires to the potentiometer terminals.

After re-assembly, the head may now be removed to service.

4.5. Replacing a Motor / Tacho

Replacing a motor / tacho is very similar for both pan and tilt. In both cases, the back cover must be removed and the main and base castings separated as described previously. Note the colour and position of the motor and tacho wires and then unsolder them from the interference suppression PCB.

The motor / tacho may now be removed together with its mounting plate or bracket after first removing the four M5 hex socket screws and washers holding it in place. Note the position of the motor terminals and then separate the motor and its plate or bracket by removing the four M4 hex. socket screws and washers.

After noting the position, the toothed pulley may be removed from the motor shaft and fitted to the shaft of the new motor / tacho.

The new motor / tacho may now be fitted to its plate or bracket and replaced in its position in the base casting of the head. Shorten the motor and tacho wires and connect them to the interference suppression PCB. In the case of tilt, pay particular attention to how the wires are tied off on the motor and ensure that the arrangement on the new motor is identical.

When replacing the pan motor / tacho, fit the belt around the pulley's and adjust the belt tension by moving the motor / tacho and its mounting plate and lock them in position by tightening the M5 hex. socket screws holding the plate in position. The tilt belt cannot be fitted or tensioned until the main and base castings are re-assembled. This re-assembly is a reversal of the procedure described previously.

With the tilt belt fitted around its pulley's, tensioning is achieved by moving the motor / tacho up and down on its bracket and finally tightening the M4 hex. socket screws which hold it to its bracket. The belt is correctly tensioned when there is approximately 3mm (pan) or 4mm (tilt) of lateral movement of the belt at the mid point between the pulleys.

After re-assembly, the head may now be returned to service.

4.6. Replacing an Electro-Magnetic Clutch

When replacing an electromagnetic clutch on a type 435 or type 435H Pan and Tilt Head, no special gauges are required to set up the clutch gap. However, it is most important not to remove the spacer collar from its axis - either in pan or tilt. This collar has been adjusted on assembly to ensure the correct clutch gap is achieved on its particular axis.

Having gained access to the head, replacing either a pan or tilt clutch is a very similar procedure, except that the pan clutch wires must be disconnected from the clutch drive PCB while the tilt wires must be disconnected from the terminal block. It should be noted that these wires are not polarised.

Loosen the arm locating the clutch coil, and swing it out of the way. Undo the four grub-screws (two M5 and two M4) holding the clutch body to the shaft and pull the complete rotor / coil assembly off the shaft. Remove the clutch armature by undoing the three slotted screws holding it to the pulley. Do not remove the spacer collar on the shaft. carefully remove any grub-screw burrs from the shaft with a fine file.

Fit the new clutch armature plate to the pulley with the three slotted screws, or new ones if provided. Slide the new clutch rotor / coil assembly onto the shaft so that it is

against the spacer collar. Holding the ring of the coil at the coil end of the assembly, tighten the two M5 grub-screws while ensuring that there is minimum end float, but also ensuring that the coil is free to rotate on the shaft. Next the two M4 grub-screws should be tightened and if the coil tends to bind, repeat the tightening procedure until a satisfactory result is obtained.

Before fitting the coil locating arm, carefully squeeze the arms of the coil lug together to reduce the free movement between the lug and the locating pin in the arm. On the final assembly, the arm may be rotated slightly until the pin is at a point in the lug where rotational movement of the coil is almost imperceptible. Note however, that there must be a tiny amount of slack or manual operation of the head will not be smooth.

The air gap between the rotor and the armature should be 0.2mm. It remains to re-connect the clutch wires as appropriate and after re-assembly, the head may be returned to service.

4.7. Routine Maintenance

The bearings are greased for life with Rocol MTS 1000, but the occasional application of a little light grease such as Alvania, to the teeth of the timing belts will help to ensure quiet operation. Ensure that no grease contaminates the clutches.

It may eventually be necessary to replace motor or tacho brushes, but this will only be after a very long period of service.

Should any undue noise or vibration occur, it should be investigated immediately.

5. DRAWINGS

5.1. Build Standard

TYPE 435H PAN + TILT HEAD (HK 435-103-0001)

The type 435H heavy duty (70kg) P+T Head with increased damping is based on the HK 435-101-0002DA build standard and contains the following sub assemblies:

Suppression P.C.B.	:	HK 707-182-0003
Clutch P.C.B.	:	HK 707-423-0002
(P / T brake clamp	:	HK 435-103-4001)

The drawings for the Head and its sub-assemblies are:

TITLE	DRAWING TYPE	DRAWING NUMBER	ISSUE
Type 435H P+T Head	Gen. Assembly	HK 435-103-0001W (2)	C
Type 435H P+T Head	Connections	HK 435-001-2002W	E
Suppression P.C.B.	PCB Assembly	HK 707-182-0003Y	A
Suppression P.C.B.	PCB Circuit	HK 707-182-2003Y	A
Clutch Drive P.C.B.	PCB Assembly	HK 707-423-0002T	C
Clutch Drive P.C.B.	PCB Circuit	HK 707-423-2002T	B

NOTES

1. Drawings in parenthesis in the Build Standard (Section 5.1) are not included in this Manual.
2. All drawings are photo-reduced to A3 size for inclusion in the Technical Manual. The exception is those drawings, which do not photo-reduce well.