



# 431 Pan and Tilt Head Technical Manual

Version 3.0  
Issue Date: 23rd October 2003

**Vinten Broadcast Ltd.**  
Western Way  
Bury St Edmunds  
Suffolk IP33 3TB  
United Kingdom

Tel: +44 (0) 1284 752121 Fax: +44 (0) 1284 757929  
Email: [contact@vinten.com](mailto:contact@vinten.com)

**Vinten Inc.**  
709 Executive Blvd.  
Valley Cottage  
New York 10989  
USA

Tel: +1 845 268 0100 Fax: +1 845 268 0113  
Email: [contact@vinten.com](mailto:contact@vinten.com)

**AMENDMENT RECORD**

Number	By whom	Description	Date
1	Ben Hannaford	Removed reference to Zoom and Focus Current Limit <b>P8 (3.3.5)</b>	7/3/2003
2	Ben Hannaford	Format change	23/10/2003
3	Ben Hannaford	Camera number setting changed <b>P7 (3.3.3)</b>	12/9/2006

# 1. TABLE OF CONTENTS

<b>1. TABLE OF CONTENTS</b>	<b>3</b>
<b>2. INTRODUCTION</b>	<b>4</b>
2.1. General.....	4
2.2. Specifications .....	4
<b>3. HANDLING AND INSTALLATION</b>	<b>6</b>
3.1. Handling .....	6
3.2. Installation .....	6
3.2.1. Mounting the Head .....	6
3.2.2. Mounting the Camera.....	6
3.3. Setting Up .....	7
3.3.1. General .....	7
3.3.2. Communications.....	7
3.3.3. Setting Camera Number.....	7
3.3.4. Switching On .....	7
3.3.5. Setting the Lens Servos .....	8
3.3.6. Remote Operation .....	8
3.4. Processor Reset.....	9
<b>4. MAINTENANCE</b>	<b>10</b>
4.1. Mechanical .....	10
4.1.1. List of Tools.....	10
4.1.2. Access .....	10
4.1.3. Fault Diagnosis .....	10
4.1.4. Replacement of Tilt Motor .....	11
4.1.5. Replacement of Pan Motor.....	11
4.1.6. Replacement of Tilt Potentiometer .....	12
4.1.7. Replacement of Pan Potentiometer.....	13
4.1.8. Helical Gear / Pinion (Pan and Tilt) .....	13
4.2. Electronic .....	13
4.2.1. General .....	13
4.2.2. Isolating a Fault.....	13
4.2.3. Control Panel .....	14
4.2.4. Processor card .....	14
<b>5. DRAWINGS</b>	<b>16</b>
5.1. 431 Head.....	16
5.2. Dual Power Supply Unit.....	16
5.3. Single Power Supply Unit .....	16
<b>6. APPENDIX A: 431 LENS INTERFACE PCB</b>	<b>17</b>
6.1. Installation .....	17
6.2. Setting Up Procedure .....	17
6.2.1. Zoom (Position Mode).....	17
6.2.2. Zoom (Velocity Mode).....	18
6.2.3. Focus (Position Mode only).....	19
6.3. Build Standard.....	19

## 2. INTRODUCTION

### 2.1. General

The type 431 pan and tilt head is specifically designed for ENG/EFP cameras where high performance is required in situations where it is necessary that the pan and tilt head is as small and unobtrusive as possible. The 431 head can be inverted for installations requiring suspended cameras. Radamec Lens Drive Modules will connect directly to the head.

#### **Applications**

Parliamentary Television

Broadcast Studios

Conference Halls

Outside Broadcasts

#### **Control Electronics**

A printed circuit card mounted in the lid of the pan and tilt head interfaces it to the control panels and power supply and controls the movements of pan, tilt, zoom and focus. On the card are analogue and digital processing circuits to provide shot storage and movement profiling as well as the power control for the servo mechanisms.

### 2.2. Specifications

<b>HK 431 PAN AND TILT HEAD</b>	
Overall dimensions - less camera mount	170L x 160W x 195H mm
Weight	6Kg.
Operational Travel - PAN - TILT	+/- 165 (300) degrees +/- 165 (300) degrees
Maximum payload	15Kg
Maximum speed	60 degrees / second
Minimum speed	0.1 degrees / second
Resolution	3 arc minutes
Repeatability	+/- 3 arc minutes
Mounting flange	4 x M6 equally spaced on 84mm diameter
Environment	Indoor
Temperature range	0 to 50 degrees Celsius

<b>CONTROL ELECTRONICS (INTERNAL)</b>	
Power requirement	+24 / 0 / -24 Volts DC, 200 Watts (from PSU)
Functions controlled	Pan, Tilt, Zoom, Focus
Accuracy	Pan, Tilt - 16 bits; Zoom, Focus - 12 bits
Memory capacity	600 shots; 99 Link sequences
Communications	4 ports, RS422 @ 9.6kBd
Control input	32 pin connector, power and data signals
Control outputs	2 x 10 pin connectors to RBS zoom and focus drives
External adjustments - via removable panel	camera number pan and tilt damping local / remote switch zoom and focus range, offset, local controls

<b>DUAL POWER SUPPLY UNIT FOR 431 HEADS</b>	
Overall dimensions	19 inch x 2U x 260 mm
Weight	8.5 Kg
Power input	Two versions, 220/240Vac or 110/120Vac
Power output	+25 / 0 / -25 V DC, 5A max.
Head connections	2 x 32 way sockets
Serial connections	4 x serial data input connectors looped to 4 x serial data output connectors (8 x 9 way 'D' type sockets)
Reset connection	3 way DIN socket
Indicators	Green, illuminated mains power-on switches Yellow, DC power

<b>SINGLE POWER SUPPLY UNIT FOR 431 HEADS</b>	
Overall dimensions	240mmx165mmx90mm
Weight	3.5Kg.
Power input	Two versions, 220/240Vac or 110/120Vac
Power output	+25 / 0 / -25 Vdc, 5A max
Serial connections	4 x RS422 serial connections for 2 panels, 1 cue computer, 1 CCU interface, via 4 x 9 way 'D' type sockets.
Analogue connections	1 Analogue output connector. 9 way 'D' type plug
Indicators	Green, illuminated mains power on switch. Yellow, DC power

### **3. HANDLING AND INSTALLATION**

#### **3.1. Handling**

For shipment, the head should be packed with the Pan and Tilt axes in their mid positions and the connectors protected from damage.

#### **3.2. Installation**

##### **3.2.1. Mounting the Head**

The type 431 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 6.5mm diameter clearance holes on an 84mm pitch circle diameter.

Four M6 hex. socket cap head or hexagonal head screws and lock washers will be required, the lengths being such that they do not protrude through the mounting surface by more than 10.0mm.

Offer the head up to its mounting face such that the camera will face in the desired direction at the mid travel point of its pan movement. Fit the four M6 screws and lock washers through the mounting face and into the tapped holes in the base of the head. Fully tighten them.

##### **3.2.2. Mounting the Camera**

Where the camera/lens system is supplied with its own support plate, it should be possible to attach this assembly directly to the tilt platform. However, it is possible that an intermediate plate will be required, having tapped holes positioned such 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 and height of the centre of gravity established before fitting to the pan and tilt head.

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

Connect the cables at the head end only and dress them to impose minimum drag whilst allowing full pan and tilt movement. For efficient control, it is essential that the whole load including the cables, be properly balanced about the tilt axis.

### 3.3. Setting Up

#### 3.3.1. General

The 431 head contains a Processor Card that incorporates all the digital electronics, D-A converters and servo amplifiers for the pan, tilt, zoom and focus functions with adjustments to suit different cameras and lenses. Access to user adjustments is via a removable panel located the narrow end of the head cover.

#### 3.3.2. Communications

The Processor Card drives up to four RS422 serial communications lines connected via the PSU connector. There are four, bi-colour LEDs on the card that indicate which lines are being used. A flashing green LED indicates that the card is receiving a message from a Panel whilst a flashing orange LED indicates that the card is replying to a message.

#### 3.3.3. Setting Camera Number

Each Head in a system is uniquely identified so that when a camera channel is selected on the Panel, communication is established with the correct channel.

Each Head can be configured as any camera number by way of an 8-way switch (SW2) located at the front. A binary count is used to select each camera/channel number.

	1	2	3	4	5	6	7	8
<b>Cam 1</b>	OFF	ON	ON	ON	ON	ON	ON	ON
<b>Cam 2</b>	ON	OFF	ON	ON	ON	ON	ON	ON
<b>Cam 3</b>	OFF	OFF	ON	ON	ON	ON	ON	ON
<b>Cam 4</b>	ON	ON	OFF	ON	ON	ON	ON	ON
<b>Cam 5</b>	OFF	ON	OFF	ON	ON	ON	ON	ON
<b>Cam 6</b>	ON	OFF	OFF	ON	ON	ON	ON	ON
<b>Cam 7</b>	OFF	OFF	OFF	ON	ON	ON	ON	ON
<b>Cam 8</b>	ON	ON	ON	OFF	ON	ON	ON	ON

#### 3.3.4. Switching On

When the complete system is ready, set pan and tilt to their mid positions, plug in the power supply cable and the zoom and focus cables, set the LOCAL/REMOTE switch (SW 3) to the right (that is in the LOCAL position) and switch on the power supply. The head should not move but zoom and focus will take up demanded positions. Yellow and green LEDs will indicate that the head is powered.

### 3.3.5. Setting the Lens Servos

**WARNING**

**FAILURE TO PROPERLY SET UP THE LENS SERVOS MAY RESULT IN DAMAGE TO THE LENS.**

Six trim pots are located at the front of the card to enable zoom and focus to be operated and set up:

Z/L-D :	Zoom position demand	F/L-D :	Focus position demand
Z/R :	Zoom range	F/R :	Focus range
Z/OS :	Zoom offset	F/OS :	Focus offset

Operate the zoom position demand to drive zoom to a mechanical endstop. Adjust zoom range to drive back from the endstop then increase the demand to drive into the end stop. Repeat this process until the demand will no longer move zoom towards the endstop. Adjust zoom range until zoom is just clear of the endstop. Reverse the demand until the opposite endstop is reached. Adjust zoom offset so that zoom is just clear of the end stop. Zoom must be driven to each end of its range with range adjusted at one end and offset adjusted at the other end until zoom is just clear of both end stops.

Repeat this procedure for focus using the focus trim pots.

For other adjustments see Section 4 - Maintenance.

### 3.3.6. Remote Operation

Set the LOCAL/REMOTE switch (SW 3) to the right (that is in the REMOTE position). The head and lens may now be operated from a control panel.

Operate zoom and focus from end to end and check they follow the panel controls. Any delay at the ends of travel will indicate that the lens has not been set up correctly.

Operate pan and tilt slowly from and to end and check the camera/lens does not hit any obstructions and pan and tilt functions do not reach the mechanical end stops.

Pan and tilt tacho trim pots are provided at the front of the card, PAN-T and TILT-T, so that damping of these functions may be adjusted according to different payloads. Clockwise adjustment will increase damping leading to smoother operation BUT may also result in movement lagging in response to operation of the panel controls. Counter-clockwise adjustment will sharpen the response to operation of the panel controls BUT may also result in an overshoot when a function moves between preset shots. When these trim pots are correctly adjusted pan and tilt will respond immediately to the panel controls and there will be no overshoot when the camera moves between preset shots.

For other adjustments see Section 4 - Maintenance.

### **3.4. Processor Reset**

The electronic processing in the head is controlled by software. An external event can, very rarely, cause an interruption in the normal operation of the program such that the head will not respond to a control panel. A processor RESET switch (SW 1) is provided on the card in the head to restart the program.

Since the head can be mounted in an inaccessible position a second RESET switch is located on the Power Supply Unit. On the Dual Power Supply Unit there is a switch for each head powered by the unit.

Each of the RESET switches in the Dual Power Supply Unit can be operated remotely via a socket (SK C) on the rear panel. To RESET the head connected to the right hand channel of the Dual Power Supply (SK B1) connect pin 1 to pin 2 momentarily. To RESET the head connected to the left hand channel (SK B2) connect pin 3 to pin 2 momentarily.

## 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. SINCE THERE ARE NO BRAKES IN THE 431 HEAD, IT IS SAFER TO MOUNT/DISMOUNT THE CAMERA AND LENS WITH THE LENS ALREADY MOUNTED ON THE CAMERA, AND IF POSSIBLE, WITH THE HEAD POWERED ON.
2. EXCESS CURRENT CAN DAMAGE PLASTIC TRACK POTENTIOMETERS. USE ONLY OHMMETERS HAVING A SHORT CIRCUIT RATING OF LESS THAN 10mA.

### NOTE

1. NUTS AND SCREWS ARE METRIC SIZES UNLESS OTHERWISE STATED.

### 4.1. Mechanical

#### 4.1.1. List of Tools

1. Normal Workshop Tools (Hex. socket screws are metric).
2. Digital Multimeter (Short Circuit Current of resistance range must not exceed 10mA).
3. Power Supply 0 - 20V DC @ 1A.

#### 4.1.2. Access

Access to the pan and tilt mechanisms can be achieved by removing the cover secured with 4 screws.

#### 4.1.3. Fault Diagnosis

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

With the power 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.

The following can also cause Erratic and jerky operation:

1. Noisy Demand Signal. See Electronic Maintenance.
2. Noisy Position Feedback Potentiometer. Check and replace if necessary.
3. Faulty motor or tacho. Check and replace if necessary.

#### 4.1.4. Replacement of Tilt Motor

Refer to drawing 431-002-4002W(2 sheets)

1. Set the head to mid-position and note the orientation of the terminals and shaft of the Tilt potentiometer. Mark the position of the Tilt motor plate (part of the Tilt motor plate assembly, item 18) and the belt tensioner (item 20). Correct tensioning of all toothed belts is critical.
2. Disconnect the Tilt potentiometer leads at the processor card plug. Remove the two screws securing the Tilt potentiometer plate assembly (item 22). Pull the assembly out of the drive hub that is part of the intermediate shaft assembly (item 15). The small 'O' rings that drive the potentiometer shaft should remain in the hub.
3. Loosen the grub screw to remove pulley (item 10) and remove neoprene drive belt (item 31).
4. Loosen the two screws securing the belt tensioner (item 20) to release tension on the T5 belt (item 29).
5. Remove the two screws securing the T5 pulley (item 9) and pull the pulley off the shaft.
6. Disconnect the tilt motor leads at the processor card plug, remove the three screws securing the Tilt motor plate assembly (item 18) and remove the assembly. (Ease the T2.5 belt (item 27) off the small pulley).
7. On the Tilt motor plate assembly (see drawing 431-002-4008X), loosen the grub screw and remove the motor drive pulley (item 3). Remove the four slotted head screws and remove the motor from the motor plate.
8. Fit a new motor in reverse order with regard to the following points:- Carefully engage the T2.5 belt (item 27) back on to the small pulley and set the Tilt motor plate assembly back to its original position (previously marked).  
Ensure that the T5 pulley (item 9) is re-fitted squarely on the shaft. Set the T5 belt tensioner (item 20) back to its original position (previously marked).  
Before refitting the Tilt potentiometer plate assembly ensure that the head is in mid-position. Push the potentiometer shaft into the drive hub and allow the potentiometer to centralise within the small 'O' rings before final tightening of the fixing screws.
9. Replace any belt that shows signs of wear.

#### 4.1.5. Replacement of Pan Motor

Refer to drawing 431-002-4002W(2 sheets). The Tilt motor plate assembly must be removed to facilitate the removal of the pan motor plate assembly.

1. Remove the Tilt motor plate assembly as outlined in section 4.1.4
2. Remove the two lower hexagonal pillars (item 12).
3. Set the head to Pan mid-position and note the orientation of the terminals and shaft of the Pan potentiometer.
4. Disconnect the Pan potentiometer leads at the processor card plug, remove the two screws securing the Pan potentiometer plate assembly (item 21) and remove the assembly.
5. Mark the position of the Pan motor bracket (part of pan motor bracket assembly, item 17) and the T5 belt tensioner (item 19).
6. Loosen the two screws securing the tensioner (item 19) to relieve tension on the T5 belt (item 29).
7. Remove the two screws securing the T5 Pan pulley (item 9) and pull the pulley off the shaft.
8. Disconnect the Pan motor leads at the processor card plug, remove the two screws securing the Pan motor bracket assembly (item 17) and remove the assembly. (Ease the T2.5 belt (item 28) off the small pulley).
9. On the Pan motor bracket assembly (see drawing 431-002-4007X), remove the neoprene drive belt (item 10). Loosen the grub screw and remove the motor drive pulley (item 4). Remove the four slotted head screws and remove the motor from the motor bracket.
10. Fit a new motor in reverse order with regard to the following points:-  
Carefully engage the T2.5 belt (item 28) back on to the small pulley and set the Pan motor bracket assembly back to its original position (previously marked).  
Ensure that the T5 pulley (item 9) is re-fitted squarely on the shaft. Set the T5 belt tensioner (item 19) back to its original position (previously marked).  
Before re-fitting the Pan potentiometer plate assembly ensure that the head is in Pan mid-position and the potentiometer is in mid-position. Tension the potentiometer anti-backlash gear 3 to 4 teeth and secure the teeth in this position with a piece of masking tape. Engage the anti-backlash gear with the drive gear that is part of the intermediate shaft assembly (item 14). Tighten the fixing screws ensuring that a small amount of backlash is present and remove the masking tape.
11. Replace any belt that shows signs of wear.

#### **4.1.6. Replacement of Tilt Potentiometer**

Refer to drawing 431-002-4012T

1. Remove the Tilt potentiometer plate assembly (item 22) as outlined in section 4.1.4
2. Identify the electrical centre of a new potentiometer (if not already marked). Fit a new potentiometer to the mounting plate with the terminals orientated the same as the old potentiometer. Transfer the wires, complete with their plug, to the replacement potentiometer.
3. Ensure that the head is in Tilt mid-position and fit the potentiometer plate assembly as outlined in section 4.1.4.

#### 4.1.7. Replacement of Pan Potentiometer

Refer to drawing 431-002-4011T.

1. Remove the Pan potentiometer plate assembly (item 21) as outlined in section 4.1.5 (there is no need to remove any Tilt parts).
2. Loosen the gear clamp screw and remove the gear clamp and anti-backlash gear. Identify the electrical centre of a new potentiometer (if not already marked). Fit a new potentiometer to the mounting plate with the terminals orientated the same as the old potentiometer. Fit the anti-backlash gear and clamp in position (NOTE the 0.2mm dimension from the face of the gear to the underside of the mounting plate). Transfer the wires, complete with their plug, to the replacement potentiometer.
3. Ensure that the head is in Pan mid-position and fit the potentiometer plate assembly as explained in section 4.1.5.

#### 4.1.8. Helical Gears / Pinions (Pan and Tilt)

The correct mesh of the Gear / Pinion is critical to the performance of the head and is factory set. Further adjustment is NOT recommended.

## 4.2. Electronic

### 4.2.1. General

In the event of a failure of the system there are a number of simple checks that can be carried out to isolate a fault and identify the problem area.

### 4.2.2. Isolating a Fault

In normal operation, with all the heads powered on, the Control Panel continually communicates with all of the heads.

This communication activity is displayed by four, bi-colour LEDs on the processor card. Each LED relates to one of the four serial data channels. These LEDs can be used to confirm that the head is receiving information, indicated by a GREEN pulse, or transmitting a response, indicated by an ORANGE pulse. With the system idle, i.e. no trimming or Cut/Fade operations, the LEDs will pulse GREEN-ORANGE at approximately 1-2Hz. During panel activity, however, the LED on the selected head will tend to pulse predominantly ORANGE whereas unselected heads will display predominantly GREEN. This is due to the extra volume of data exchanged between the selected head and Control Panel during trims, etc.

By examining these LEDs it is usually apparent whether a fault lies with the panel, e.g. no activity on any communication LEDs, or with a particular head if other heads show normal activity. Note that the heads will not attempt to transmit until a message is received and understood.

### 4.2.3. Control Panel

If a Control Panel does not communicate with any head and the protocol switches described later on have been checked, then the problem in all probability lies with the Panel itself or the interconnecting cable. Refer to the Panel self-test section for further information - see Control Panel Manual.

Note that due to the 'daisy chain' arrangement of the head to Panel communications it is possible that a fault in one of the link cables can cause all 'down stream' heads to appear faulty. This can be proved by swapping the suspect link cable and observing the movement of the fault.

### 4.2.4. Processor Card

If a panel appears not to be transmitting to a particular head, assuming the cabling is correct, then there is probably an internal card fault.

When just one head shows a fault then it will be necessary to check the processor card and wiring inside the head. All the digital processing, communications and DA-AD conversion are carried out on the processor card (HK 705-083-xxxx). If no faults are found in the head and connector wiring, check that the outputs of the D-A Converters follow the demands from the Control Panel. Covers can be removed and interchanged between heads by removing the four screws holding the cover in position and all the motor/tacho and position sensing potentiometer connections (PLs 3, 4, 7, 8).

Remember that swapping the covers will have the effect of swapping the head address and also any stored shots within the heads. Obviously, if the fault does not move with the card then there must be a fault within the head or cables.

If the digital/communications system appears to be functioning but still there is no head control then it could be that there is a servo system fault.

If a processor card is thought to have a servo fault there are a number of test points that can be monitored to help find the exact area at fault. The following table shows the most useful test points and their significance.

TEST POINT	DESCRIPTION	SIGNAL
1	Logic supply	0 volts
2	Logic supply	+5 volts
3	Servo supply	+15 volts
4	Servo supply	-15 volts
5	Power Amplifier supply	+25 volts
40	Power Amplifier supply	0 volts
6	Power Amplifier supply	-25 volts
7	Square wave (8 ms)	+12 volts
8	8 ms Pulse	+15 volts
9	Reference supply	+10 volts
10	Reference supply	-10 volts
11	Reference supply	+5 volts
12	Reference supply	-5 volts
13	Reference supply	+12 volts
14	Reference supply	-12 volts
16	Pan position demand	+/-10 volts
17	Pan position	+/-10 volts
22	Pan motor	+/-20 volts
23	Tilt position demand	+/-10 volts
24	Tilt position	+/-10 volts
29	Tilt motor	+/-20 volts
30	Zoom position demand	+/-10 volts
31	Zoom position	+/-10 volts
34	Zoom motor	+/-20 volts
35	Focus position demand	+/-10 volts
36	Focus position	+/-10 volts
39	Focus motor	+/-20 volts

**N.B.** Position demand signal ranges may be reduced in the configuration EPROM or by soft limits set from a Control Panel.

There are two moveable links on the card which should always be left in their factory set positions. LK 1 must be near test point 16 and LK 2 must be away from test point 26.

The following table indicates the functions of the adjustment trim pots on the card.

FUNCTION	PAN	TILT	ZOOM	FOCUS
Anti-stiction	VR 1	VR 2	-	-
Local Demand	-	-	VR 14	VR 20
Range	-	-	VR 15	VR 21
Position Offset	VR 4	VR 9	VR 16	VR 22
Position Gain	VR 5	VR 10	VR 17	VR 23
Velocity Gain	VR 7	VR 12	VR 18	VR 24
Tacho damping	VR 8	VR 13	VR 19	VR 25

No adjustment is required for trim pots VR 3, 6, 11 with the normal set-up.

## 5. DRAWINGS

### 5.1. 431 Pan and Tilt Head (HK 431-002-0001)

The type 431 P+T Head contains the following sub-assemblies :

Lid Assembly	: HK 431-002-4001
Case Assembly	: HK 431-002-4002
PCB Sub-plate Assembly	: HK 431-002-4013
Head Control Processor PCB	: HK 705-083-0001

TITLE	DRAWING TYPE	DRAWING NUMBER	ISSUE
431 Pan and Tilt Head	Gen. Assembly	HK431-002-0001W	A
431 Pan and Tilt Head	Connections	HK431-002-2001X	B
Lid Assembly	Sub-assembly	HK431-002-4001W	B
Case Assembly	Sub-assembly	HK431-002-4002W(2)	B
Pan Motor Bracket	Sub-assembly	HK431-002-4007X	A
Tilt Motor Plate	Sub-assembly	HK431-002-4008X	A
Pot. Plate (Pan)	Sub-assembly	HK431-002-4011T	A
Pot. Plate (Tilt)	Sub-assembly	HK431-002-4012T	1
PCB Sub-plate assy.	Sub-assembly	HK431-002-4013X	B
Control Processor PCB	Gen. Assembly	HK705-083-0001W	E
Control Processor PCB	Circuit	HK705-083-2001W(3)	E

### 5.2. Dual Power Supply Unit (HK 195-111-0001/2)

The -0001 version = 220V/240V, whilst the -0002 version = 110V.

TITLE	DRAWING TYPE	DRAWING NUMBER	ISSUE
Dual 431 Head PSU	Gen. Assembly	HK195-111-0001/2W	D
Dual 431 Head PSU	Connections	HK195-111-2001/2W	E

### 5.3. Single Power Supply Unit (HK 195-116-0003)

TITLE	DRAWING TYPE	DRAWING NUMBER	ISSUE
Single 431 Head PSU	Gen. Assembly	HK195-116-0003W	B
Single 431 Head PSU	Connections	HK195-116-2003W	B

## 6. APPENDIX A: 431 LENS INTERFACE PCB.

### 6.1. Installation

- 1) The 431 Lens Interface pcb is an add-on, installed on the Processor pcb inside the head, to enable the head to interface to lens built-in zoom and focus drives. It will not drive a lens iris.
- 2) The Interface pcb is mounted, with M3 screws and extension pillars, to two pillars that fix ICs 50 and 51 on the Processor pcb assembly after 16-way SK 5 and 3-way SK 10 have been disconnected.
- 3) Connect SK 5 to PL 2 on the Interface pcb and leave PL 10 disconnected. Use 16- way ribbon cable to connect PL 5 on the Processor pcb to PL 1 on the Interface pcb and use 3-way cable to connect PL10 on the Processor pcb to PL 3 on the Interface pcb.
- 4) Connect the 431 head to the lens with the Adaptor cable supplied for the particular lens type.
- 5) Apply power to the 431 head.

### 6.2. Setting Up Procedure

#### NOTE

The range of the zoom and focus position demands are normally factory set between +2.5v and +7.5v when measured at TP5 (zoom) and TP3 (focus). SW2/3 is normally set to the OFF position. Closing this switch links the lens ground to the robotic system ground. It may be necessary to close SW2/3 to achieve stability between the two grounds.

Two trim pots are located at the front of the processor pcb to enable zoom and focus to be operated and set up.

Z/L-D :      Zoom position demand      F/L-D :      Focus position demand

Set the Local/Remote switch to Local and the Zoom and Focus position demands to mid-range before operating.

#### **6.2.1. Zoom (Position Mode)**

- 1) On the Interface pcb set SW1/2 to the P position.
- 2) Adjust VR6 so that the voltage at TP6 is set to -5.00 volts.
- 3) Move zoom to one end of its mechanical travel using the zoom position demand. Adjust VR1 to drive away from the end of travel then increase the demand to drive into the end of travel. Repeat this procedure until the demand is at its end and zoom is at one end of its mechanical travel. Reverse

the demand until the opposite end of travel is reached. If any offset adjustment is required this is achieved by adjusting VR6. When correctly setup zoom will just reach each end of its mechanical travel when the demand is moved from end to end.

- 4) Set the Local/Remote switch to Remote and check zoom just reaches each end of its mechanical travel when driven end to end from the Control Panel. Adjust VR1 and VR6 again, if necessary, so that zoom reaches each end of its mechanical travel under remote control.

### **6.2.2. Zoom (Velocity Mode)**

- 1) Adjust VR6 so that the voltage at TP6 is set to -5.00 volts.
- 2) On the Interface pcb set SW1/2 to the V position. Set switches SW2/1 and SW2/2 to OFF. Adjust VR6 if necessary to minimise zoom drifting. Adjust VR3 and VR4 fully CCW (counterclockwise).
- 3) Set switch SW2/2 to ON. If zoom runs off to an end-stop set switch SW1/1 to its opposite position (A or B).
- 4) Move zoom to one end of its mechanical travel using the zoom position demand. Adjust VR5 to drive away from the end of travel then increase the demand to drive into the end of travel. Repeat this procedure until the demand is at its end and zoom is at one end of its mechanical travel. Adjusting VR4 CW will increase the speed of movement. Reverse the demand until the opposite end of travel is reached. If any offset adjustment is required this is achieved by adjusting VR6. When correctly setup zoom will just reach each end of its mechanical travel when the demand is moved from end to end.
- 5) Set the Local/Remote switch to Remote.
- 6) At the Control Panel store two shots just short of the two end-stops with 10 second fade times.
- 7) Adjust VR4 fully CCW. Movement will be sluggish at this stage when recalling the end to end shots.
- 8) Switch SW2/1 ON. (Leave SW2/2 ON)
- 9) Starting with VR3 fully CCW, adjust VR3 slowly CW until a small amount of reverse movement is visible at the ends of zoom movements when recalling the end to end shots. (This must be done whilst carefully observing the camera picture). Now adjust VR3 carefully CCW until this reverse creep is eliminated. ( If VR3 is adjusted too far CCW, zoom will initially end too short and then creep forward on to shot. If VR3 is adjusted too far CW, then zoom will go too far and then creep back. A small degree of creeping forward is in fact desirable to ensure that the much less acceptable reverse creep is avoided.)

- 10) Re-adjust VR4 CW just sufficient to ensure that repeatability is satisfactory (by observation of the camera picture).

### **6.2.3. Focus (Positon Mode only)**

- 1) Adjust VR7 so that the voltage at TP7 is set to -5.00 volts.
- 2) Move focus to one end of its mechanical travel using the focus position demand. Adjust VR2 to drive away from the end of travel then increase the demand to drive into the end of travel. Repeat this procedure until the demand is at its end and focus is at one end of its mechanical travel. Reverse the demand until the opposite end of travel is reached. If any offset adjustment is required this is achieved by adjusting VR7. When correctly setup focus will just reach each end of its mechanical travel when the demand is moved from end to end.
- 3) Set the Local/Remote switch to Remote and check focus just reaches each end of its mechanical travel when driven end to end from the Control Panel. Adjust VR2 and VR7 again, if necessary, so that focus reaches each end of its mechanical travel under remote control.

## **6.3. Build Standard**

Studio Lens Interface PCB:

HK 707-501-0001

The drawings for the Lens I/F pcb are :

<b>TITLE</b>	<b>DRAWING TYPE</b>	<b>DRAWING NUMBER</b>	<b>ISSUE</b>
Lens Interface pcb	Gen. Assembly	HK 707-501-0001T	A
Lens Interface pcb	Connections	HK 707-501-2001T	A
431 Head	Connections	HK 431-002-2002X	A