Pan and Tilt Decoder II
PART NO. 2207881

Add affordable Pan and Tilt control to your security cameras using the Pan and Tilt Decoder II and the DFRobot DF05BB Tilt/Pan Kit (5kg). Jameco PN 2144518 or the DAGU HI-TECH ELECTRONIC MINI PAN AND TILT KIT Jameco PN 2157870. The Pan and Tilt Decoder II uses RS485 and the Pelco-D or Pelco-P standard found on many popular security camera systems in use today. The Pan and Tilt Decoder II kit decodes these serial messages and turns them into servo motor control signals for the DFRobot DF05BB Tilt/Pan Kit or the DAGU HI-TECH ELECTRONIC MINI PAN AND TILT KIT.

Dip switches are used to set the unit to a possible 63 address combinations, so multiple units can be used together. Jumper selectable power for the servos provided either by the on-board power supply* or from an external battery or power source.

*on-board power supply capability limited. External battery should be used for higher power servos.

Time Required: 1-2 hours depending on experience
Experience Level: Intermediate

Required tools and parts:
You will NEED to program the IC and the source code (Pelco P and Pelco D) shall be available on the Jameco product page
Atmel AVR programmer (Jameco Part no. 2136788) and software
9VDC 1.0 A Power Supply (Jameco Part no. 164929)
Soldering iron and solder
Wire cutters
Needle nose pliers
Small Philips-head screwdriver
Thermal Grease (Jameco Part no. 615312)
Masking Tape (optional)
Digital Multimeter (optional)
DFRobot DF05BB Tilt/Pan Kit (optional)

Bill of Materials:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Jameco SKU</th>
<th>Component Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>151116</td>
<td>C1</td>
</tr>
<tr>
<td>1</td>
<td>93761</td>
<td>C2</td>
</tr>
<tr>
<td>1</td>
<td>15341</td>
<td>C6</td>
</tr>
<tr>
<td>1</td>
<td>35991</td>
<td>D1</td>
</tr>
<tr>
<td>1</td>
<td>248330</td>
<td>IC1</td>
</tr>
<tr>
<td>1</td>
<td>23579</td>
<td>IC2</td>
</tr>
<tr>
<td>1</td>
<td>299807</td>
<td>IC3</td>
</tr>
<tr>
<td>1</td>
<td>112300</td>
<td>SOCKET,IC,28 PIN,.300â„¢, TIN</td>
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<tr>
<td>1</td>
<td>526299</td>
<td>SOCKET,IC,8 PIN,390261-2</td>
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<tr>
<td>1</td>
<td>67812</td>
<td>ISP HEADER,LP SHROUD,10PIN,STRIGHT</td>
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<tr>
<td>1</td>
<td>101178</td>
<td>J1</td>
</tr>
<tr>
<td>4</td>
<td>109576</td>
<td>HEADER,.1&quot;ST MALE,1RW,3PIN</td>
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<tr>
<td>1</td>
<td>693901</td>
<td>LED</td>
</tr>
<tr>
<td>4</td>
<td>691104</td>
<td>R1,R9-R11</td>
</tr>
<tr>
<td>3</td>
<td>690742</td>
<td>R2,R5,R7</td>
</tr>
<tr>
<td>1</td>
<td>690718</td>
<td>R4</td>
</tr>
<tr>
<td>1</td>
<td>690857</td>
<td>R5</td>
</tr>
<tr>
<td>1</td>
<td>690646</td>
<td>R12</td>
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</table>
Step 1 - Bending of component leads

- Using the needle-nose pliers, grab the lead of the part close to the body and bend the lead 90 degrees to the part.
- Repeat the step above with the other lead, making sure to bend the lead in the same direction.

Step 2 - Diode assembly

- Locate the 1N4004 diode and form according to the technique in step 1.
- Insert the diode into the hole of the PC board for the D1 diode. Make sure to align the band of the diode with the band of the silk screened image on the PC board.
- Once inserted flush with the PC board, slightly bend the leads outward to hold the diode in place.
- Turn the PC board over and solder the leads of each diode to the PC board.
Step 3 - Proper lead trimming
-Cut the component lead just above the solder fillet.
-Do not cut into the solder joint when cutting the lead.
-Follow this process when cutting other component leads.

Step 4 - Resistor assembly 1 (P.N.691104)
-Locate the four 10K ohm resistors (Brown,Black,Orange,Gold bands) and form them according to the technique in step 1.
-Insert the 4 resistors through the holes of the PC board for R1, R9, R10 and R11. Once inserted flush with the PC board, slightly bend the leads outward to hold the resistor in place.
-Solder each resistor lead and trim them using the technique in step 3.

Step 5 - Resistor assembly 2 (P.N. 690742)
-Locate three of the 330 ohm resistors (Orange,Orange,Brown,Gold bands) and form them using to the technique in step 1.
-Insert the resistors through the holes of the PC board for R2, R3 and R7. Once inserted flush with the PC board, slightly bend the leads outward to hold the resistors in place.
-Solder the resistor leads and trim them using the technique in step 3.

Step 6 - Resistor assembly 3 (P.N.690718)
-Locate the 240 ohm resistor (Red,Yellow,Brown,Gold bands) and form it using the technique in step 1.
-Insert the resistor through the holes of the PC board for R4. Once inserted flush with the PC board, slightly bend the leads outward to hold the resistor in place.
-Solder the resistor leads and trim them using the technique in step 3.

Step 7 - Resistor assembly 4 (P.N.690857)
-Locate the 910 ohm resistor (White,Brown,Brown,Gold bands) and form it using to the technique in step 1.
-Insert the resistor through the holes of the PC board for R5. Once inserted flush with the PC board, slightly bend the leads outward to hold the resistor in place.
-Solder the resistor leads and trim them using the technique in step 3.

Step 8 - Resistor assembly 5 (P.N. 690646)
-Locate the 120 ohm resistor (Brown,Red,Brown,Gold bands) and form it using the technique in step 1.
-Insert the resistor through the holes of the PC board for R12. Once inserted flush with the PC board, slightly bend the leads outward to hold the resistor in place.
-Solder the resistor leads and trim them using the technique in step 3.

Step 9 - LED assembly (P.N. 693901)
-Locate the GREEN LED
-Align the flat part of the LED with the flat part of the silk screen outline on the PC board.
-Insert LED through the holes of the PC board for LED7.
-Solder each LED lead and trim them using the technique in step 3.
Step 10 - IC socket assembly (P.N's 112300 & 526299)

- Locate the 28 pin DIP chip socket and align the notch on the socket so it aligns with the notch on the silk screen outline on the PC board.
- Gently guide the pins through the holes in the board verifying each pin goes through to the other side of the board.
- As a way to hold the IC socket in place until it can be soldered, tape the socket in place using a small piece of masking tape.
- Solder each leg of the IC into place.
- Repeat the above step for the 8-pin IC3 DIP chip socket.

Step 11 - IC2 assembly (P.N. 23579)

- Bend the leads of the LM317 regulator at the tapered part of the lead 90 degrees back towards the back of the part.
- Apply a small amount of thermal grease (Jameco PN 615312) to the back of the LM317 as shown.
- Insert the regulator into the holes of the PC board for IC2. Make sure to align the regulator with the silk screened image on the PC board. Once inserted flush with the PC board, slightly bend the leads of the regulator outward to hold the part in place.
- Turn the PC board over and solder the leads of the regulator to the PC board.
Step 12 - IC2 Hardware Assembly

Note: To prevent damage to IC2, the regulator must be heatsinked if the servos are being powered from the on-board power supply (PSELECT jumper in the 2-3 position). If using servos other than those recommended, an external battery should be used with the PSELECT jumper in the 1-2 position.

-locate the screw, nut, washer and lockwasher in the kit.
-make sure the hole in the tab of IC2 aligns with the hole in the board.
-insert the screw through the bottom of the board and through the hole in IC2.
-hold the screw in place with your finger and turn the board over and assemble the washer and lockwasher onto the screw.
-assemble the nut onto the end of the screw and tighten until the lockwasher is tight.

Step 13 - C2 assembly (P.N. 93761)

-Locate the 100uF capacitor and insert it through the holes of the PC board for C2 making sure to align the negative (-) side opposite to the (+) marking on the PC board.
-Once inserted flush with the PC board, slightly bend the leads outward to hold the capacitor in place.
-Solder the capacitor leads and trim them using to the technique in step 3.
Step 14 - Capacitor assembly (P.N. 151116)

- Locate five of the 0.1uF capacitors and insert them through the holes of the PC board for C1, C3, C4, C5 and C7.
- Once inserted flush with the PC board, slightly bend the leads outward to hold the capacitors in place.
- Solder each capacitor lead and trim them using the technique in step 3.

Step 15 - C6 Capacitor assembly (P.N. 15341)

- Locate the 100pF capacitor and insert it through the holes of the PC board for C6.
- Once inserted flush with the PC board, slightly bend the leads outward to hold the part in place.
- Solder each capacitor lead and trim them using the technique in step 3.

Step 16 - ISP Connector assembly (P.N. 67812)

- Locate the 10 pin ISP header and align it with the silkscreen outline on the board.
- Make sure that the notch in the header aligns with the notch in the silk screen (towards the edge of the board).
- If needed, place a small piece of masking tape over top of the ISP header to help hold it into place.
- Turn the PC board over and solder each lead of the part into place.

Step 17 - Switch assembly (P.N's 119011 & 109171)

- Locate the RESET pushbutton and S2 sliding switch parts and align them with the silkscreen outline on the board.
- If needed, place a small piece of masking tape over top of S2 to help hold it into place.
- Turn the PC board over and solder each lead of the parts into place.

Step 18 - Connector assembly (P.N.109576)

- Locate the four 3-pin headers and align them with the RANGE, PSELECT SRV1 and SRV2 silkscreen outlines on the board.
- If needed, place a small piece of masking tape over top of the 3pin headers to help hold it into the place.
- Turn the PC board over and solder each lead of the parts into place.
- Locate the two 2-position terminal blocks and align them with the BATT and RS485 silkscreen outlines on the board making sure the openings are towards the edge of the board.
- Locate the J1 power connector and align it with the J1 silkscreen outline on the board
- If needed, place a small piece of masking tape over top of the terminal blocks and J1 to help hold it into the place.
- Turn the PC board over and solder each lead of the parts into place.
Step 19 - S1 Switch assembly (P.N. 38826)

- Locate the 6 position DIP switch and remove the protective tape covering the top of the switches. (note: switches come shipped in the "ON" position).
- Align switch 1 with position 1 on the silkscreen outline on the board.
- If needed, place a small piece of masking tape over the top of the switch to help hold it into the place.
- Turn the PC board over and solder each lead of the switch into place.

Step 20 - IC Insertion (P.N's 248330 & 299807)

- Align the notch of IC1 with the notch on the socket on the PC board.
- Guide the pins of IC1 into the socket making sure all pins are aligned in the socket and then push the chip into place.
- Repeat the step above with IC3.
**Step 21 - Initial check-out**

Check assembly:
- Verify all parts are assembled and all leads are soldered and trimmed.
- check to make sure there are no solder shorts
- Verify that parts with polarity are properly installed
- Verify that the IC's are correctly aligned and all pins are in the sockets.
- if using the DFRobot DF05BB Tilt/Pan Kit or the DAGU HI-TECH ELECTRONIC MINI PAN AND TILT KIT sold by Jameco and not using an external battery, then place a jumper across pins 2-3 of the PSELECT header. This will enable the on-board power supply to supply power to the servos. If using an external battery, place the jumper across pins 1-2 of the PSELECT header.

(optional)
- take an ohm meter or DVM set to ohms and measure the resistance from the center pin to the other 2 pins of IC2. All readings should be higher than 200 ohms.

- plug the 9VDC wallwart into the J1 jack.

**Step 22 - Programming**

The firmware is written for the Atmega8 chip (IC1) which is used as the controller in the PTZ Servo Decoder. It was written in C and compiled using WINAVR which is a set of the GNU C open source software development tools for the Atmel AVR series of RISC microprocessors hosted on the Windows platform.

Youâ€™ll need an Atmel AVR programmer to program this kit. This can be found on the Jameco website (Jameco Part no. 2136788). You'll also need the Atmel Studio software which you can download for free at http://www.atmel.com/tools/ATMELSTUDIO.aspx. You donâ€™t have to get a programmer if you already have an Atmel AVR programmer, but your programmer will require a 10-pin AVR-standard ISP connector.

Youâ€™ll also need the Intel .hex files for the Pelco-P or Pelco-D which will be available on the Jameco website along with the C source code.

- Plug in the 10-pin AVR ISP connector from the AVR Programmer into the ISP connector on the board. Make sure to align the notch in the cable with the notch in the connector. Switch the S2 switch ON. Note: the green LED7 status LED will not be lit until after IC1 is programmed.
- Start up the AVR Studio software on your computer. On the top menu bar go to the “Tools” selection and scroll down to the “Program AVR” selection and choose “Connect” and select the programmer platform you are using from the list.
- Click on the “Connect” button and this will bring up the Programming window.
- From the “Device” selection, choose “ATmega8”
- Make sure the “Erase Device Before Programming” and “Verify Device After Programming” Programming Mode check boxes are checked.
- Click on the square box to the right of the “Input HEX File” line to open the file for loading.
- Click the correct firmware file from the directory and select “Open” to load it. Use the PtZServo-P.hex file for the Pelco-P format or the PtZServo-D.hex file for the Pelco-D format.
- Click on the “Fuses” tab and select the 8MHz clock option.
- Click on the “Program” button to download the firmware to the board.
- If programming was successful you should see the message “Leaving Programming Mode... OK!” in the bottom message window and green status LED7 on the board should be lit.
- Switch the S2 switch OFF and remove the programming cable from the ISP connector on the board. (Note: leaving the programming cable connected while running the servos may cause the board to reset.)
- Switch the S1 dip switches to the desired address. (Note: these switches are in the binary format, position 1,2,4,8,16 and 32. To select address 5 set dip switch 1 and 3 to ON. Address is only read at power-up.)
- Align the BROWN wire of the PAN servo motor cable to pin 1 of the SRV1 connector on the board. Connect the TILT servo motor cable to the SRV2 connector the same way.