360 Around View User Manual

Version 0.11
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1. 360 Around View system installation
   1.1 System Introduction
   1.1.1 Product
      This system can process 4 synchronous images input by 4 fish-eye cameras (Front/Rear/Left/Right) into 1 image which has 360 Around view. The view helps drive easily and safely.

Figure 1.1

Figure 1.2
1.1.2 Package Details

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Host</td>
<td>1</td>
<td>System core processing part</td>
</tr>
<tr>
<td>Front Camera</td>
<td>1</td>
<td>Install on the front, 170° wide-angel, high-definition, night-version lens</td>
</tr>
<tr>
<td>Rear Camera</td>
<td>1</td>
<td>Install in the rear, 170° wide-angel, high-definition, night-version lens</td>
</tr>
<tr>
<td>Left Camera</td>
<td>1</td>
<td>Install on the left, 170° wide-angel, high-definition, night-version lens</td>
</tr>
<tr>
<td>Right Camera</td>
<td>1</td>
<td>Install on the right, 170° wide-angel, high-definition, night-version lens</td>
</tr>
<tr>
<td>Extension Cord</td>
<td>4</td>
<td>Extend the camera and connect with steering control sign</td>
</tr>
<tr>
<td>Wire harness</td>
<td>1</td>
<td>Wire with reversing control, left and right sign control, video input, video switch</td>
</tr>
<tr>
<td>Remote Controller</td>
<td>1</td>
<td>Operate the 360 Around view parking system</td>
</tr>
<tr>
<td>Instruction Manual</td>
<td>1</td>
<td>User Manual</td>
</tr>
</tbody>
</table>

Sheet 1.1

1.1.3 Product parameter

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera</td>
<td>Image Sensor</td>
<td>PC1099</td>
</tr>
<tr>
<td></td>
<td>Optical Size</td>
<td>1/3 Inch</td>
</tr>
<tr>
<td></td>
<td>Pixel Pitch</td>
<td>5.0*7.4 um</td>
</tr>
<tr>
<td></td>
<td>Effective Pixel</td>
<td>720(H)*480(V) Pixel</td>
</tr>
<tr>
<td></td>
<td>Horizontal Resolution</td>
<td>580 TV Lines</td>
</tr>
<tr>
<td></td>
<td>Video Format</td>
<td>NTSC</td>
</tr>
<tr>
<td></td>
<td>Dynamic Range</td>
<td>&gt;72dB dB</td>
</tr>
<tr>
<td></td>
<td>S/N Ratio</td>
<td>&gt;48dB dB</td>
</tr>
<tr>
<td></td>
<td>Minimum illumination</td>
<td>0.1 Lux</td>
</tr>
<tr>
<td></td>
<td>View Angle</td>
<td>170 Degree(°)</td>
</tr>
<tr>
<td></td>
<td>Video output</td>
<td>1.0V@75Ω Vp-p</td>
</tr>
<tr>
<td>Host</td>
<td>Supply Voltage</td>
<td>12V Vdc</td>
</tr>
<tr>
<td></td>
<td>Voltage Range</td>
<td>8V ~ 30V Vdc</td>
</tr>
<tr>
<td></td>
<td>Consumption Current(without Camera)</td>
<td>&lt;300 @12Vdc mA</td>
</tr>
<tr>
<td></td>
<td>Video output Resolution</td>
<td>720*480 60Hz</td>
</tr>
<tr>
<td></td>
<td>Language</td>
<td>Chinese/English</td>
</tr>
<tr>
<td></td>
<td>Operation Temperature</td>
<td>-20 ~ 65 °C</td>
</tr>
<tr>
<td></td>
<td>Storage Temperature</td>
<td>-40 ~ 85 °C</td>
</tr>
</tbody>
</table>

Sheet 1.2
1.2 Installation:

1.2.1 Requirements
(1) The car DVD must be equipped with reversing video input interface, or the Car Monitor must be equipped with video input interface
(2) Enough space to install cameras
(3) 5 tapelines, 2 for 8m or longer and 3 for 5.5m or longer
(4) 4 chessboard cloth and eye-fish correction template

1.2.2 Attention
(1) The Car DVD or Monitor can work properly
(2) Carefully install
(3) All the parts should be collected well
(4) Wiring diagram is in the last page

1.2.3 Preparation
(1) chessboard cloth:

Figure 1.3

(I) Chessboard cloth dimension: 1.6M*1.2M
(II) Chessboard square dimension: 0.2M*0.2M (20cm*20cm)
(III) The chessboard cloth consists of 5*7 black and white squares (Refer to Figure 1.3)
(IV) non-reflective cloth preferred
1.3 Camera installation with square chessboard
1.3.1 Camera installation
Refer to below demonstration
After wiring the Host, Car Multimedia and Camera according to wiring diagram, start engine and adjust camera window.

(1) Press [power] on the remote control.

(2) Press [enter] to enter into Main Menu.

(3) Press [up], [down], shift the cursor to Around View, then press key into Password Page, press [up], [down], input password “654321”, and then press to enter the page Around View.

(4) Press [up], [down], shift cursor to Camera set, press , enter Fish-Eye interface window, then press [up], [down] to check 4 individually images collected by 4 individual cameras. Manual adjustment of cameras helps get ideal images.
1.3.2 Adjust Camera Angle
(1) Front Camera adjustment
- The car image should be in the lower part of the fish-eye picture.
- 1/3 or less space the front bumper takes in the picture (The higher position of the camera, the better. Adjust camera optical axis and the car vertical angle is between 45° - 75°), the 2 ends of the bumper must be at the same height, then fix the Camera.

(2) Rear Camera adjustment
- The car image should be in the lower part of the fish-eye picture.
- 1/3 or less space the front bumper takes in the picture (The higher position of the camera, the better. Adjust camera optical axis and the car vertical angle is between 45° - 75°), the 2 ends of the bumper must be at the same height, then fix the Camera.
(3) **Left Camera adjustment**
- The car image should be in the lower part of the fish-eye picture, and 1/2 or less space taken up.
- Car body and tires on the left side must be in the image (Adjust camera optical axis tilts to the back of car within 10°, and the side of car within 10°, make sure the front wheel and back wheel at the same height):

![Figure 1.11](image)

(4) **Right camera adjust**
- The car image should be in the lower part of the fish-eye picture, and 1/2 or less space taken up.
- Car body and tires on the right side must be in the image (Adjust camera optical axis tilts to the back of car within 10°, and the side of car within 10°, make sure the front wheel and back wheel at the same height):

![Figure 1.12](image)
1.3.3 Tapeline & Chessboard cloth

(1) Tapeline

(Ⅰ) Follow the order: Front->Rear->Left->Right to place 4 tapelines, 2 of 8m tapelines on the left and right sides, 2 of 5.5m in the front and rear.

(Ⅱ) Refer to the figure 1.9~1.12. 4 tapelines closed to the car bodywork showed in each image.

![Figure 1.13 Tapeline in front view](image1)

![Figure 1.14 Tapeline in rear view](image2)

![Figure 1.15 Tapeline on the left view](image3)

![Figure 1.16 Tapeline on the right view](image4)

(2) Chessboard cloth placement

(Ⅰ) Refer to Figure 1.13, put the chessboard cloth in front of the car, long-side closed to the tapeline in the front of the car bodywork, short-side close to the tapeline on the left of the car.

(Ⅱ) Refer to Figure 1.14, put the chessboard cloth in the rear of car, long-side closed to tapeline on the car’s back, short-side close to the tapeline on the right of the car.

(Ⅲ) Refer to Figure 1.15, put the chessboard cloth on the left of the car, long-side closed to the tapeline on the left, short-side aligns the head and the center of the left front wheel.

(Ⅳ) Refer to Figure 1.16, put the chessboard cloth on the right of the car, the long-side closed to the tapeline on the right, short-side aligns the head and the center of the right front wheel.

![Placement Picture](image5)
1.4 Around View Calibration:

1.4.1 Auto Tune:

the Around View menu, refer to Figure 1.18, input car \([\text{Length}], [\text{width}], [\text{Left and Right vertical}]\) data. Put the chessboard cloth as in chapter 1.3.3, measure the real length and width of the car, (not the data provided by manufacture, refer to Figure 1.4 for way of measurement), then shift to Auto Tune, press Enter key to start around view synthesis with the instruction as below when completed.

1.4.2 Manual Calibration

Manual calibration with remote control available if the around view synthesis is not satisfactory.

Calibration principle:
The around view are synthesized by: Fish-eye calibration -> Space projection -> 4 windows synthesis -> images display

Space projection is to adjust the location of 4 DP.

Refer to right Figure 1.19, there are 4 DP points(target points) around the front/rear/left/right window, which is adjustable to calibrate move, zoom up and down. Below different Figures 1.20 is made by calibration of DP points to display the best synthesized effect.

Manual tune:
Step1: Enter Around View menu, shift cursor to \(\text{Manual tune}\) press key ' Direction ' on remote controller. Refer to Figure 1.21.
Step 2: Shift cursor to {Front Cam} on remote controller, then enter 4 points window[Enter], refer to Figure 1.22

Figure 1.22

Step 3: In this window, press key {\(\sqrt[3]{\text{OK}}/\text{Enter}\)} on the remote controller to choose DP1→DP2→DP3→DP4→DP12→DP13→DP24→DP34→DP1234 to circle,

Then press key {\(\uparrow\) or \(\downarrow\), or \(\leftarrow\) or \(\rightarrow\)} to calibrate Up, Down, Left and Right side of the fusion line.

After that, press key {\(\text{OK/Enter}\)} to return to Manual Tune window.

Step 4: Repeat operation from Step 2~3. Shift cursor to {Rear Cam}, {Left Cam}, {Right Cam}, {Reset}, press key on remote controller to calibrate the parameter once again.

Step 5: Press key {\(\text{OK/Enter}\)} on remote controller and return to Manual Window, shift cursor on {Save}, press key {\(\text{OK/Enter}\)} on remote controller, enter Parameter window.

1.4.3 Camera Adjustment

Theoretically the camera parameter is calibrated by the manufacturer, normally there is no need to calibrate the camera. When complete synthesis process, there is an arch at the edge of the chessboard cloth image, then the camera parameters need calibrating.

Step 1: Print chessboard paper, 7*7 black and white squares, then stick on hard horizontal
Figure 1.24 (Chessboard cloth)

Step 2: In the Around View menu, shift cursor to \textcolor{red}{Camera set} (Refer Figure 1.18), press key on remote controller, then enter the Camera adjustment menu [refer to Figure 1.25]

Figure 1.25

Step 3: Align the center of square with the center of screen, 4 angles of screen with 4 angles square (refer to Figure 1.26). Press key on remote controller, then the system start calculate the center point automatically. "WinX OK" ($X = 1, 2, 3, 4$) showed around 8 seconds if they matched. "Detect Error" showed if not (Win1=Front Window / Win2=Rear Window / Win3=Left window / Win4=Right window).

PS: For "Detect Error", calibrate chessboard, align more precisely, then repeat the above steps.

Figure 1.26

Step 4: Repeat above step, press \textcolor{red}{ } or \textcolor{red}{ } to switch video for calibration, follow the order: Front->Rear->Left->Right

Step 5: Shift cursor to [Return] when completed, press key on the remote controller, back to Around View window.
2. Remote controller

Figure 2.1 There are 19 keys in use.

[1] Power:
Turn on / Off whole view output

[2] Enter:
1. Shift cursor into icon, press the key to enter
2. Manual calibration in around view, it is DP
   points (target point), from
   DP1, DP2, DP3, DP4, DP12, DP13, DP24, DP34, DP_ALL
   repeat and recycle

[3] Up
1. Shift up the cursor
2. Manual calibration in 360 whole view, shift up the DP points
3. In traveling data recorder, it’s for playing video and pause

[4] Down:
1. Shift down the cursor in the window
2. Manual calibration in 360 whole view, shift down the DP points

[5] Left
1. Shift DP points toward left in Manual tune window
2. In traveling data recorder window, it for ESC

[6] Right:
Shift the DP points toward right in Manual tune window

[7] Return:
1. Shift DP points toward left in Around View window
2. In traveling date recorder window, it’s for return to around View window

[8] Increase:
1. Increase the data for the icon which is opted by cursor
2. In Around View window, shift DP points toward right

[9] Decrease:
1. Decrease the data for the icon which is opted by cursor
2. In Around View window, shift DP points toward left

[NO]-[N9]:
Press the number needed
3. Menu
3.1 Menu page

[Main menu]:

Figure 3.1

Press key \[\text{OK}/\text{X}\] to open main menu (figure 3.2). press key \[\text{△}/\text{□}\] to set cursor on icon, press \[\text{OK}/\text{X}\] to enter.

[password page]:

Figure 3.3

In Main window, shift cursor to icon \[\text{Around View}\], press key \[\text{OK}/\text{X}\] on the remote controller, then enter Password window (Figure 3.3).

Press the number key from \[0\] ~ \[9\] or key \[\text{△}/\text{□}\], input number \[“654321”\] (Figure 3.4), then press key \[\text{OK}/\text{X}\] to enter Around View window(Figure 3.5)
[Around View window] :
All parameters for auto tune included, press ▲ & ▼ to shift cursor. (Figure 3.6)

**Car length**
Shift cursor on icon Car length, press ▼ to increase, press ▲ to decrease, number key 0-9 have the same function, unit is cm.

**Car width**
Shift cursor on icon Car width, press ▼ to increase, or press ▲ to decrease, number key 0-9 have the same function, unit is cm.

**L&R Vertical**
Shift cursor to icon L&R Vertical, press ▼ to increase or press ▲ to decrease, number key 0-9 have the same function, unit is cm.

PS: Car length, width parameter, refer to Figure 1.4

**Auto tune**
Shift cursor on icon Auto tune, press ▲ to automatic synthesis processing

**Manual tune**

**Lens Mode**
Shift cursor on icon Lens Mode, press ▲ to enter. Normally, the system has set up the fish-eye correction parameter for certain camera. When switch to another lens, input correct parameter only.

**Camera set**
Shift cursor on icon Camera Set, press ▲ to individual camera window, press ▲ & ▼ to switch front/rear/left/right display to make sure the images are normal or make fish-eye correction.

**Reset**
Shift cursor on icon Reset, press ▲ to enter reset menu(Figure 3.7).

Figure 3.7
Press ▲ & ▼ as Yes or NO, when choose YES, press ▲ to factory reset. When choose NO, press ▲ to Around View window.
Shift cursor on icon `Save`, press key \[OK/\] to `Save window` (Figure 3.8).

**Figure 3.8**

Press \[\uparrow/\downarrow\] or \[\rightarrow/\leftarrow\] to choose YES or NO, when choose YES press key \[OK/\] to save data in `Around View` menu.

When choose NO, press key \[OK/\], give up save and return to `Around View` menu.

**System window**: 
This window contains all the system data, press key \[\uparrow/\downarrow\] or \[\rightarrow/\leftarrow\] to shift cursor.

**Figure 3.9**

Shift cursor on icon `Language`, press key \[OK/\] to `language menu`, press key to choose English or Chinese, press save or return.

**Figure 3.10**

Shift cursor on icon `Image`, press key \[OK/\] to `image window`.

**Figure 3.11**

Shift cursor to icon `Horizon Center`, press key \[+/-\] to increase press \[+/-\] to decrease to move the picture toward right or left (Max 520, Min 200) preset value 360 EX: input image resolution 720 *480, image horizon center 720/2=360
Shift cursor to icon Vertical Center, press key \[+\] to increase, press key \[-\] to decrease, move up or down the picture (MAX 340, MIN 140) preset value 240 EX: input image resolution 720*480, image vertical center 480/2=240

Shift cursor on icon Horizon Zoom, press \[+\] to increase and press \[-\] to decrease to zoom up or down the image in horizon. (MAX 940 MIN 500) Preset value 720 EX: input image resolution 720*480

Shift cursor on icon Vertical Zoom, press \[+\] to increase or press \[-\] to decrease to zoom up or down the image in vertical. (Max. 640 Min. 300) Preset value 480 EX: input image resolution 720*480

Shift cursor on icon Cam Mirror, press \[OK/\] to enter

Figure 3.12

Shift cursor on icon Front Cam, press \[+\] or \[-\] to calibrate the input image as Mirror or Normal.

Shift cursor on icon Rear Cam, press \[+\] or \[-\] to calibrate the input image as Mirror or Normal.

Shift cursor on icon Left Cam, press \[+\] or \[-\] to calibrate the input image as Mirror or Normal.

Shift cursor on icon Right Cam, press \[+\] or \[-\] to calibrate the input image as Mirror or Normal.

Shift cursor on icon Cam Brightness, press \[OK/\] to enter

图3.13
Front Brightness

Shift cursor on icon Cam Brightness press OK to enter
Shift cursor on icon Front Brightness, press + to increase brightness or press - to decrease brightness for front camera (Max. 40 Min. -40) Preset value 0

Rear Brightness

Shift cursor on icon Rear Brightness, press + to increase brightness or press - to decrease brightness for rear camera (Max 40 Min -40) Preset value 0

Left Brightness

Shift cursor on icon Left Brightness, press + to increase brightness or press - to decrease brightness for left camera (Max 40 Min -40) Preset value 0

Right Brightness

Shift cursor on icon Right Brightness, press + to increase brightness or press - to decrease brightness for right camera (Max 40 Min -40) Preset value 0

[Control window]:

This window contains all the data for control, press ▲ or ▼ to shift cursor

Figure 3.14

Around view imaging delay

Shift cursor on icon Around view imaging delay, press + to increase or press - to decrease, it is to set up the turn-on delay time when car steering. (Max. 200 seconds, Min 0, step 5 seconds) Preset up 0

Power on imaging time

Shift cursor on icon Power on imaging time, press + to increase or press - to decrease, it is to set up the turn-off delay time when car steering. (Max. 20 seconds, Min 0 second, step 5 seconds) Preset up 0

Turning control

Shift cursor on icon Steering control press + to increase or press - to decrease, to adjust turning control. The Around View system would be on when the car is steering.

Emergency switch control

Shift cursor on Emergency switch control, press + to increase or press - to decrease. It is set up to turn on or off the Emergency switch control triggered by auto double flash switch.

PS. If Around View is off, press auto double flash switch once, the Around View window will be on. The Around View window will be still on when turn off double flash. Only if the double flash is turned on and off again, the Around View can be shut off.

Turning imaging style

Shift cursor on icon Steering display style, press + to increase or press - to decrease, it is change the steering image triggered by car steering switch, preset up [style 2]
Complete setup, press \[ Save \] then ESC.

[DVR setup]:

In the main menu, shift cursor to icon \[ DVR \], press \[ To Video setup window \]

In this window, press \[ To video setup menu \] press \[ or \] \[ to parameter set up. \]

Choose[Size], set up the format as HD or D1

Choose[Time], set up to turn on or off the mark of recording time, and the recording time style, i.e. time only or time & date).
Choose [Date] menu, enter date & time setup.

Press \[ \text{Alt} \] or \[ \text{Shift} \], \[ \text{Alt} \] or \[ \text{Shift} \] to setup date and time, press \[ \text{OK} \] to enter, save and ESC.

[Record Window]:

In the main menu, shift cursor on icon \text{Record}, press \[ \text{OK} \] to enter car recording window.

In this window, press \[ \text{OK} \] again to enter video recording menu, press \[ \text{Alt} \] & \[ \text{Shift} \], then press \[ \text{OK} \] to set up the telemeter.

In this window, can delete single, all or designated files, press \[ \text{Alt} \] & \[ \text{Shift} \], press \[ \text{OK} \] to choose, press \[ \text{Left} \] to return.
In this window, can protect Single, All and designated video. Press ▲ & ▼, then press ▼ to enter. Press ▼ to return.

Figure 3.26

In this window, choose [thumbnail], can preview file in the thumbnail format, press ▲ & ▼ and press ▼ to enter display window

Figure 3.27

In this window, chose [file List], display details of files press ▲ & ▼, then press ▼ to enter

Figure 3.28

In this menu, choose [Format], format all files, press ▼ to return.

[Version] :
Display the software version

Figure 3.29

Figure 3.30
Wiring instruction:
1. 4mm Diameter bullet heads are respectively connected.
2. Insert the female plug connectors of camera extension line BM4PA/B/C/D to the males plug connectors based on the colors respectively.
3. Connect the male plug connector of the the camera extension line BM4P to the left and right cameras, and link the red signal line to the reverse signal and left-and-right turning signal.
4. Connect the the wire harness with +12V tag with the the original car BAT+
5. Connect the wire harness with ACC tag with the ACC signal.
6. Connect the wire harness with GND tag with the original GND in the car or ground.
7. Connect the line of the wire harness with “reverse output” tag with the reverse output signal of vehicle display.
8. The female connector of the black 3.5mm stereo is used to insert a remote control receiver.
9. Yellow video output head is connected to the reversing video input terminal of vehicle display.