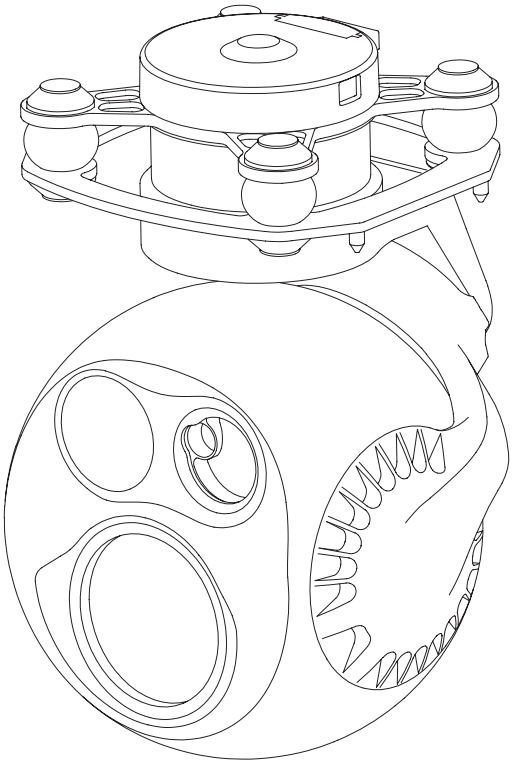
V1.0

2024.03

# D-90DE

## User Manual



# Using this Manual – Legend

 Important

 Tips

 Explanation

# Revision History

| Date | Document Version |
| --- | --- |
| 2024.03.04 | V1.0 |

## Caution

1. When not in use, store the D-90 in the package box. The recommended storage environment is a relative humidity less than 40% at a temperature of 20±5° C. If the lenses fog up. The water vapor will usually dissipate after turning on the device for a while.
2. Do not place the product under direct sunlight, in areas with poor ventilation, or near a heat source such as a heater.
3. Do not frequently power on/off the product. After it is turned off, wait at least 30 seconds before turning back on, otherwise the product life will be affected.
4. Make sure the pod port and pod surface are free from any liquid before installation.
5. Make sure the pod is securely installed onto the aircraft, the microSD card slot cover is clean and firmly in place.
6. Make sure the pod surface is dry before opening the microSD card slot cover.
7. Do not plug or unplug the microSD card during use.
8. Do not touch the surface of the camera lenses and keep it away from hard objects. As doing so may lead to blurred images and affect the imaging quality.
9. Clean the surface of the camera lenses with a soft, dry, clean cloth. Do not use alkaline detergents.
10. When not receiving valid carrier INS data, the yaw shaft of the pod will drift about 15 degrees per hour because of the earth rotation. To make sure the pod attitude corrects, it is necessary to transmit valid carrier INS data, usually the GNSS should be positioning.

# Catalog

# Introduction

## Synopsis

The D-90DE equips with a high accuracy 3-axis nonorthogonal gombal, a wide-angle camera and a 30x hybrid zoom camera. User can quickly switch to a highly magnified zoom camera view after recognizing a target in a wide camera view. Thanks to the laser range finder, the D-90DE can provide the location of a target and the distance to it that improves working efficiency.

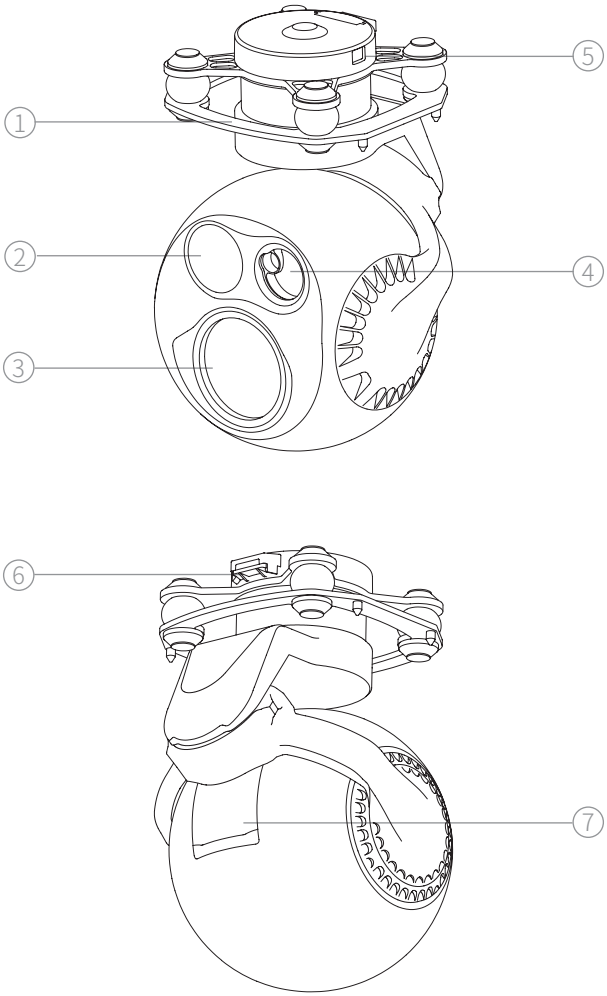
The D-90DE have AI multi-object detection and tracking function. The gimble camera can intelligently identify the persons and vehicles in the image, and constantly track one of them.

The D-90DE can be mounted tool-lessly onto multiple carriers, whether downward or upward. With the GCU and the Dragonfly software, user can watch the image from the camera and control the pod real-timely on a computer.

## Characteristics

- Features AI multi-object detection and tracking, which can constantly track one of the persons and vehicles intelligently identified in the image.
- Combination of wide-angle camera and 30x hybrid zoom camera, which can quickly switch between overall and detailed view.
- Laser range finder provides the location of a target and the distance to it.
- Low-profile spherical shape and 3-axis nonorthogonal mechanical stabilized structure, minimize the gyration radius and the wind resistance of the pod. The D-90DE is able to spin continually around its yaw axis.
- With the GCU, the D-90DE supports network, UART and S.BUS control. The GCU supports both private protocol and MAVLink protocol.
- Thanks to the Dual-IMU complementary algorithms with IMU temperature control and carrier AHRS fusion, the D-90DE provides a stabilization accuracy at ±0.01° .
- Can be mounted onto multiple carriers, whether downward or upward.
- With the GCU and the Dragonfly software, user can watch the image and control the pod without protocol ducking.
- Screen supports overlaying OSD information such as latitude, longitude and altitude. Image supports shooting point coordinate EXIF save. Video stream supports SEI stacking.
- 14~53 VDC wide voltage input.

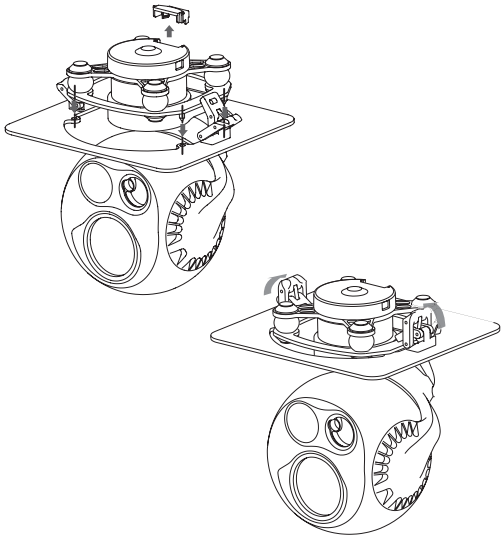
# Overview




1. Damping Platform
2. Wide Camera
3. Zoom Camera
4. Laser Range Finder
5. Update Port
6. Control Port
7. MicroSD Card Slot

# Installation

1. Remove the control port protector.
2. Align and insert the 4 pins into the locating holes of the mount platform. Press down the lock catch to fix the pod. The pod can be also fixed with screws through the holes on the damping platform.
3. Plug the pod control cable into the control port and install the port protector back.



⚠ While upward mounted or mounted at carriers with large vibration or impact, the pod should be fixed with screws nor the quick-release locks.

⚠ Gently plug or unplug the cable. Avoid hardly pull the cable.

⚠ Avoid squash the cable while installing the port protector.

⚠ Ensure the microSD card slot cover is firmly in place to prevent dust or moisture entering during usage or storage.

⚠ The pod heats while operating. Please ensure the device good cooling.

The MicroSD card should be configured as HDD-FAT32 mode.

# Configuring & Updating Firmware

⚠ Ensure the gimbal and the GCU have both been updated to the latest firmware before use. Otherwise, usage may be affected.

⚠ Ensure the diver of the config module is installed on the computer before configuring or updating the firmware.

⚠ Before configuring, the computer should be set to a static IP address, which is in the same network segment with the GCU and the camera (without IP address conflicts). The default IP address of the GCU and the camera are 192.168.144.121 and 192.168.144.108.

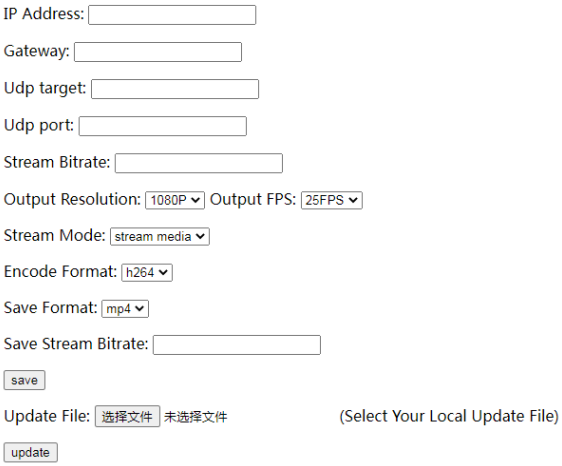
⚠ Do not power off the device while updating the firmware. Restart the device once firmware update is complete.

## Camera Configuring & Firmware Updating

Camera Configuring

1. Connect the pod and the GCU with the pod control cable. Connect the computer and ETH port of the GCU with the network conversion module. Power on the devices.
2. Visit http://192.168.144.108/cgi-bin/config on the computer (if the IP address of the camera has been changed, the IP address in the URL should be replaced with the current camera IP address).
3. Configure the camera in the web page, and click"save"to save the configuration.
4. Restart the pod to enable the configurations to take effect.

⚠ It is not able to read current configurations of the camera in this page.



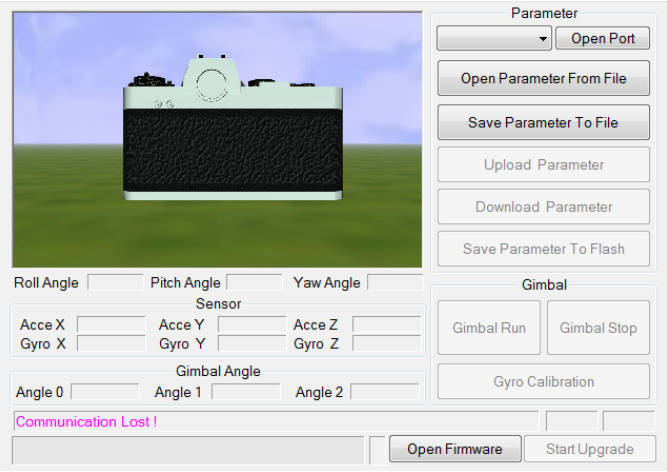

- IP Address / Gateway
  Camera IP Address / Camera Gateway.
- Udp target / Udp port
  Should be configured while the stream is in UDP mode.
- Stream Bitrate
  Image transfer rate, which is in the unit of bps. The higher the stream bitrate, the clearer the transferred image, yet the higher request to the bandwidth of the image transmission system.The recommended range is [2048~8192].
- Output Resolution / Output FPS
  Default as 1080P / 25FPS
- Stream Mode
  Stream Media / UDP / GB/T28181. Default as Stream Media. The Stream Media is RTSP mode. UDP mode and GB/T28181 mode is unavailable temporarily.
- Encode Format
  H.264 / H.265. Default as H.264.
- Save Format
  Default as MP4.
- Save Stream Bitrate
  Image storage rate, which is in the unit of bps. The higher the storage bitrate, the clearer the storage image, yet the higher request to the storage rate of the MicroSD card.The recommended range is [2048~9216].

Camera Firmware Updating

Select the firmware, click "update" and wait for updating completing. If the updating failed, please retry on another computer.

## Gimbal Updating Firmware

1. Connect the pod and the GCU with the pod control cable. Connect the computer and the gimbal update port with the config module. Power on the devices.
2. Run GimbalConfig software. Choose the COM port corresponding to the config module. Click "Open Firmware" , choose the firmware file, click "Start Upgrade" and wait for the updating complete.




## Real-time Vedio Playing

Example as camera IP address 192.168.144.108:
Stream address: rtsp://192.168.144.108/554

# Appendix 1 Specifications

| | | |
|---|---|---|
| **General** | | |
| Product Name | D-90DE | |
| Dimensions | Pod: 96.4 x 96 x 147mm<br>GCU: 45.4 x 40 x 13.5mm | |
| Weight | Pod: 576g<br>GCU: 18.6g | |
| Operating Voltage | 14 ~ 53 VDC | |
| Power | Pod: 10.5W(AVG, ranging off) / 55W(Stall, ranging on)<br>GCU: 1.8W | |
| Mounting | Downward / Upward | |
| Target Positioning Accuracy[1] | Horizonal Error：1.8m<br>Vertical Error：0.7m @ Horizonal Distance：105m<br>Relative Height：75m | |
| | Horizonal Error：17.4m<br>Vertical Error：6.7m @ Horizonal Distance：513m<br>Relative Height：119m | |
| | Horizonal Error：33.8m<br>Vertical Error：13.7m @ Horizonal Distance：1003m<br>Relative Height：246m | |
| **Gimbal** | | |
| Gimbal Type | 3-axis Nonorthogonal Mechanical Stabilization | |
| Angular Accuracy | ±0.01° | |
| Controllable Range | Pitch: -150°～ +50° , Yaw: ±360° constantly | |
| Max Controllable Speed | Pitch: ±200° /s, Yaw:±200° /s | |
| **Zoom Camera** | | |
| Image Sensor | 1/2.8'' CMOS; Effective Pixels: 2.07M | |
| Lens | Focal Length: 4.7~47mm<br>HFOV: 61.3°～ 6.8°<br>VFOV: 36.9°～ 3.9°<br>DFOV: 68.4°～ 7.8° | |
| Resolution | 1920 x 1080 | |
| Pixel Pitch | 2.9μm | |
| Optical Zoom Rate | 10x | |
| Equivalent Digital Zoom Rate | 3x | |
| Min Illumination | Night Vision off: 0.01Lux / F1.6;<br>Night Vision on: 0.0015Lux / F1.6 | |
| Object Detection Distance | EN62676-4:2015 | Person[2]: 709m;<br>Light vehicle[3]: 932m<br>Large vehicle[4]: 1986m |
| | Johnson Criteria | Person: 8103m<br>Light vehicle: 24851m<br>Large vehicle: 52943m |

| | | |
|---|---|---|
| Object Identification Distance | EN62676-4:2015 | Person: 142m<br>Light vehicle: 187m<br>Large vehicle: 397m |
| | Johnson Criteria | Person: 2026m<br>Light vehicle: 6213m<br>Large vehicle: 13236m |
| Object Verification Distance | EN62676-4:2015 | Person: 71m<br>Light vehicle: 93m<br>Large vehicle: 199m |
| | Johnson Criteria | Person: 1013m<br>Light vehicle: 3106m<br>Large vehicle: 6618m |
| **Wide Camera** | | |
| Thermal Sensor | 1/2.8” CMOS; Effective Pixels: 2.07M | |
| Lens | Focal Length: 5.1mm<br>HFOV: 71.4°<br>VFOV: 44.0°<br>DFOV: 79.6° | |
| Resolution | 1920 x 1080 | |
| Pixel Pitch | 2.9μm | |
| **Laser Range Finder** | | |
| Wavelength | 905nm | |
| Max Laser Power | 1mW | |
| Beam Angle | 3.5mrad | |
| Beam Diameter | 0.35m@100m | |
| Laser Safety | Class 1M（IEC 60825-1:2014） | |
| Measurement Accuracy | ±1.0m | |
| Measurement Range | 5-1200m ( ϕ12m vertical surface with 20% reflectivity) | |
| **AI Multi-object Detection & Tracking** | | |
| Object Size | 16x16 ~ 128x128 px | |
| Object Identification Delay | ＜ 40ms | |
| Tracking Speed | ±32 px / field | |
| Tracking Deviation Refresh Rate | 30Hz | |
| Tracking Deviation Output Delay | ⩽ 5ms | |

| Image & Video | |
|---|---|
| Image Format | JPEG |
| Maximum Image Resolution | 1920 x 1080 |
| EXIF | Shooting point coordinate |
| Video Format | MP4 |
| Maximum Video Resolution | 1080P@25fps |
| Stream Encode Format | H.264, H.265 |
| Stream Network Protocol | RTSP |
| **Storage** | |
| Supported SD Cards | Supports a Speed Class 10 MicroSD card with a capacity of up to 256GB |
| Supported File System | HDD-FAT32 |
| **Environment** | |
| Operating Temperature | -20°C～ 50°C |
| Storage Temperature | -40°C～ 60°C |
| Operating Humidity | ⩽ 85%RH（Non-condensing） |

[1] Measured by pod mounted on a dual antenna RTK positioned multicopter drone to a known coordinate point. The target positioning accuracy is influenced by carrier’ s positioning and orientation accuracy, angle between the direction of pod mounted and the heading of carrier, slant range, gradient of measurement line and air quality. The data is for reference only.

[2] Reference dimension of person: 1.8x0.5m. Critical dimension under Johnson criteria is 0.75m.

[3] Reference dimension of light vehicle: 4.2x1.8m. Critical dimension under Johnson criteria is 2.3m.

[4] Reference dimension of large vehicle: 6.0x4.0m. Critical dimension under Johnson criteria is 4.9m.

# Appendix 2 SEI Data Structure

```
typedef struct // 64 bytes. Little-endian byte order. Byte alignment
{
    uint8_t head[2]; // Header [0xEE, 0x16]
    struct
    {
        uint8_t rng_trig:1; // Ranging trigger flag
        uint8_t_pip_state:3; // Pic-in-Pic Statue
                        0-Zoom camera (main)+Wide camera (sub);
                        1-Wide camera;
                        2-Wide camera (main)+ Zoom camera (sub);
                        3-Zoom camera
        uint8_t data_valid:1; //Validity flag of carrier's coordinate, carrier's attitude
                        and camera's attitude
        uint8_t tgt_valid:1; //Validity flag of target's coordinate
        uint8_t reserved:2; // Reserved flag
    } flag;
    int32_t uav_lon; // Longitude of carrier. [-180° , 180° ). Resolution 1e-7deg
    int32_t uav_lat; // Latitude of carrier. [-90° , 90° ]. Resolution1e-7deg
    int32_t uav_alt; // Altitude of carrier. Resolution 1mm
    int32_t uav_hgt; // Relative height of carrier. Resolution 1mm
    int16_t uav_phi; // Roll angle of carrier. [-180° , 180° ). Resolution 0.01deg
    int16_t uav_the; // Pitch angle of carrier. [-90° , 90° ]. Resolution 0.01deg
    uint16_t uav_psi; // Yaw angle of carrier. [0° , 360° ). Resolution 0.01deg
    int16_t cam_phi; // Roll angle of camera. [-90° , 90° ]. Resolution 0.01deg
    int16_t cam_the; // Pitch angle of camera. [-180° , 180° ). Resolution 0.01deg
    uint16_t cam_psi; // Yaw angle of camera. [0° , 360° ). Resolution 0.01deg
    uint16_t cam1_zoom; // Zoom rate of zoom camera. Resolution 0.01x
    uint16_t cam2_zoom; // Zoom rate of wide camera. Resolution 0.01x
    uint16_t rng_dist; // Distance from target. Resolution 0.1m (Invalid, 0)
    uint16_t gnss_week; //GNSS week
    uint32_t gnss_itow; //GNSS microsecond. Resolution 1ms
    int32_t tgt_lon; // Longitude of target. [-180° , 180° ). Resolution 1e-7deg  (Invalid, 0)
    int32_t tgt_lat; // Latitude of target. [-90° , 90° ]. Resolution 1e-7deg (Invalid, 0)
    int32_t tgt_alt; // Altitude of target. Resolution 1mm (Invalid, 0)
    uint16_t cam1_fl1x; // Focal length of zoom camera at 1x. Resolution 0.01mm
    uint16_t cam2_f1x; // Focal length of wide camera at 1x. Resolution 0.01mm
    uint8_t reserved[4]; // Reserved
    uint8_t check_sum; // Checksum
} SdSei_t;
```