This manual is prepared based on governing laws and regulations' requirements and relevant industrial standards. During your use of our products, if you have any question about any description in this manual, please consult the sales clerks who have sold you the products, or dial our customer service hotline, or send an inquiry email to our company's email address.

As our products are upgraded from time to time, HollySys Motor reserves the right to change any of the products and their specifications and parameters that are contained in this manual without prior notice. We remind the customers hereby to use the latest edition of the manual.

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Chapter I　Parameters

Notes: The relationships between data types and bytes.

data type	float	long int	short	int
Bytes	4	4	2	4

1.1. Game Output Parameters

Game output parameters : Game output information .

```
typedef struct      {
                    float       F32ReciveAlfaRad;     /*   Unit: Radian   */
                    float       F32ReciveBetaRad;     /*   Unit: Radian   */
                    float       F32ReciveGammaRad;    /*   Unit: Radian   */
                    float       F32ReciveXAcceG;      /*   Unit: G   */
                    float       F32ReciveYAcceG;      /*   Unit: G   */
                    float       F32ReciveZAcceG;      /*   Unit: G   */
                }DOF6_GAME_PARA;
```

Example : The coordinates XYZ in Game,as shown in the image below.

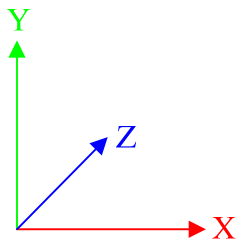

Fig1　Game universe

Taking cars as example, car rotation around the x-axis is F32ReciveAlfaRad, rotation around the y-axis is F32ReciveBetaRad, rotation around the z-axis is F32ReciveGammaRad, Linear acceleration along the x-axis is F32ReciveXAcceG, Linear acceleration along the y-axis is F32ReciveYAcceG, Linear acceleration along the z-axis is F32ReciveZAcceG. Cars in the process of movement, Linear acceleration and rotation angle is changing in real time.

注意:

1、6-DOF platform: F32ReciveAlfaRad、F32ReciveBetaRad、F32ReciveGammaRad、F32ReciveXAcceG、F32ReciveYAcceG、F32ReciveZAcceG all exists.

2、3-DOF platform and one rotating shaft: F32ReciveAlfaRad、F32ReciveBetaRad、F32ReciveGammaRad、F32ReciveYAcceG exists, the other two values should be set to zero.

3、3-DOF platform: F32ReciveAlfaRad、F32ReciveGammaRad、F32ReciveYAcceG exists, the other three values should be set to zero

The above is because the mechanical structure of the platform leads to the lack of rotation and translation of the platform in one or more directions.

1.2. Add extra Position Information

We can add extra position information on the basis of the somatosensory algorithm, parameters are as follows.

```
typedef struct      {
                    long int   I32PlayXpos;    //    X axis position information
                    long int   I32PlayYpos;    // Y axis position information
                    long int   I32PlayZpos;    // Z axis position information
                    long int   I32PlayUpos;    // U axis position information
                    long int   I32PlayVpos;    // V axis position information
                    long int   I32PlayWpos;    // W axis position information
          }DOF6_POSTION_PARA;
```

Vibration, jitter and so on can be achieved, I32PlayXpos ~ I32PlayWpos corresponding to the 1~6 axis.

1.3. Motion Cueing Parameters

Somatosensory parameters are as follows.

```
typedef struct      {
                    float      F32T1;   /*   Time factor T1   */
                    float      F32T2;   /*   Time factor T2   */
                    float      F32T3;   /*   Time factor T3   */
                    float      F32T4;   /*   Time factor T4   */
                    float      F32T5;   /*   Time factor T5   */
                    float      F32T6;   /*   Time factor T6   */
                    float      F32T7;   /*   Time factor T7   */
                    float      F32T8;   /*   Time factor T8   */

                    float      F32C1;   /*   Acceleration threshold C1   */
                    float      F32C2;   /*   Acceleration threshold C2   */
                    float      F32C3;   /*   Acceleration threshold C3   */
                    float      F32C4;   /*   Acceleration threshold C4   */
                    float      F32C5;   /*   Acceleration threshold C5   */
                    float      F32C6;   /*   Acceleration threshold C6   */
                    float      F32C7;   /*   Acceleration threshold C7   */
                    float      F32C8;   /*   Acceleration threshold C8   */

                    float      F32K1;   /*   Scaling factor K1   */
                    float      F32K2;   /*   Scaling factor K2   */
                    float      F32K3;   /*   Scaling factor K3   */
                    float      F32K4;   /*   Scaling factor K4   */
                    float      F32K5;   /*   Scaling factor K5   */
                    float      F32K6;   /*   Scaling factor K6   */
                    float      F32K7;   /*   Scaling factor K7   */
                    float      F32K8;   /*   Scaling factor K8   */
          } DOF6_CUE_PARA;
```

The initial values of the somatosensory parameters can be assigned by default value, These parameters are adjusted according to the dynamic effect of the platform when debugging the platform. If you want the platform to move softly, you can first increase the T1 parameter to 10~1000; reduce the K1 parameter to 0.01~0.1; increase the T4 parameter to 0.5~10 to make a

combination adjustment; otherwise, make the opposite adjustment.

1.4. Mechanical Parameters of Platform

The mechanical parameters are shown below.

```
typedef struct    {
                    // Maximum range of motion in the game
                  float     F32AlfaMaxRad;     /*   Unit: Radian   */
                  float     F32BetaMaxRad;     /*   Unit: Radian   */
                  float     F32GammaMaxRad;    /*   Unit: Radian   */
                  float     F32XAcceMaxG;      /*   Unit: Gravitational acceleration   */
                  float     F32YAcceMaxG;      /*   Unit: Gravitational acceleration   */
                  float     F32ZAcceMaxG;      /*   Unit: Gravitational acceleration   */

                    //3-DOF platform
                  float     F32TriangleHemMm;   /*   The base edge of the isosceles
                                                    triangle, Unit: Millimeter   */
                  float     F32HeightOfTriangleHemMm;   /* The height of the isosceles
                                                    triangle, Unit: Millimeter   */
                  float     F32HeightToTopMarkMm;   /* The distance from the apex of the
                                                    isosceles triangle to the center
                                                    of gravity,Unit: Millimeter   */
                    //6-DOF platform
                  float     F32StaticShortMm;   /*   The short edge of the static platform,
                                                  Unit: Millimeter   */
                  float     F32StaticDiameterMm;   /*   Diameter of the static platform,
                                                    Unit: Millimeter   */
                  float     F32MovingShortMm;   /*   The short edge of the moving
                                                    platform, Unit: Millimeter   */
                  float     F32MovingDiameterMm;   /*   Diameter of the moving platform,
                                                    Unit: Millimeter   */

                    // The amount of rotation relative to the initial coordinate
                  float     F32XAxisRotAngleDeg; /*   Coordinate rotation angle,
                                                    Unit: Degree   */

                    // The range of motion of the platform
                  float     F32PlatformAlfaMaxDeg;     /*   Alfa maximum range of motion,
                                                    Unit: Degree   */
                  float     F32PlatformBetaMaxDeg;   /* Beta maximum range of motion,
                                                    Unit: Degree   */
                  float     F32PlatformGammaMaxDeg;   /*   Gamma maximum range of
                                                    motion,Unit: Degree   */
                  float     F32PlatformXMaxMm;   /*   X maximum translational range of
                                                    motion,Unit: Millimeter   */
                  float     F32PlatformYMaxMm;   /*   Y maximum translational range of
                                                    motion,Unit: Millimeter   */
                  float     F32PlatformZMaxMm;   /*   Z maximum translational range of
                                                    motion,Unit: Millimeter   */
```

```
    // Parameters of the electric cylinder
    float       F32AccessDistanceUnitMm; /*    The stroke of the electric
                                                cylinder,Unit: Millimeter    */
    float       F32LeadDistanceUnitMm;    /* The lead of the electric cylinder,
                                                Unit: Millimeter    */
    float       F32MinLongofCylinderMm; /*    The Minimum length of the
                                            electric cylinder,Unit: Millimeter    */

    // Reduction ratio
    float       F32GearOne;    /*    Axle No. 1 Reduction ratio    */
    float       F32GearTwo;    /*    Axle No. 2 Reduction ratio    */
    float       F32GearThree;    /*    Axle No. 3 Reduction ratio    */
    float       F32GearFour;    /*    Axle No. 4 Reduction ratio    */
    float       F32GearFive;    /*    Axle No. 5 Reduction ratio    */
    float       F32GearSix;     /*    Axle No. 6 Reduction ratio    */

}DOF6_MECH_PARA;
```

Maximum range of motion in the game:The maximum angle and maximum linear acceleration that an object can move around its axis in motion.F32AlfaMaxRads is the biggest angle that revolves around the X axis,F32BetaMaxRad is the biggest angle that revolves around the Y axis,F32GammaMaxRad is the biggest angle that revolves around the Z axis; You do not have to set the maximum acceleration value.

The top view of the platform with 3-DOF platform is as follows, The 3-DOF platform parameters annotation as shown below, this parameter only acts on the 3+1 platform or the 3-DOF platform.

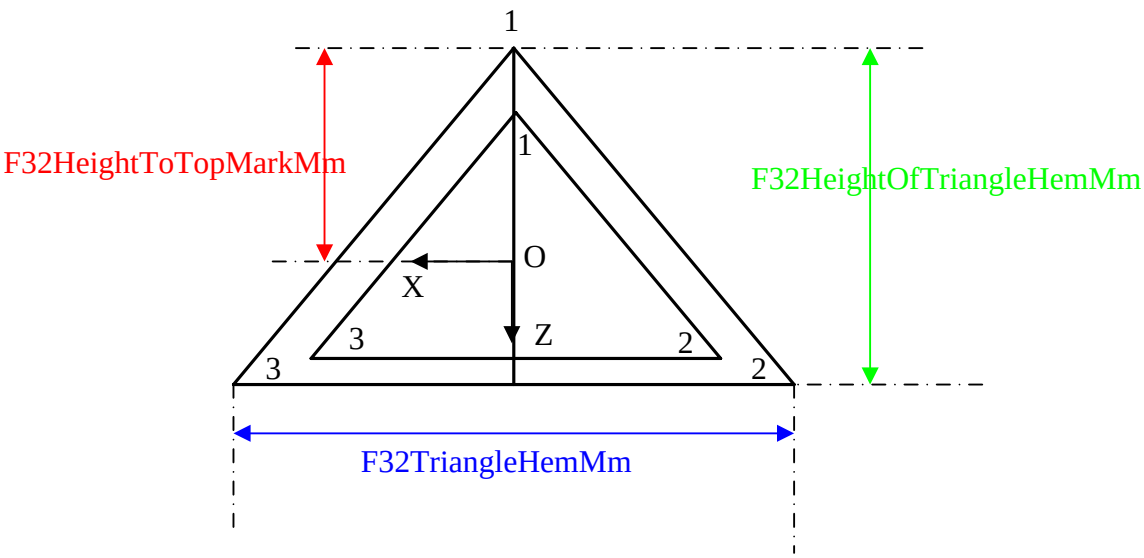

Fig. 2 The coordinate system of 3-DOF platform

The top view of the platform with 6-DOF platform is as follows, The 6-DOF platform parameters annotation as shown below, this parameter only acts on the 6-DOF platform.

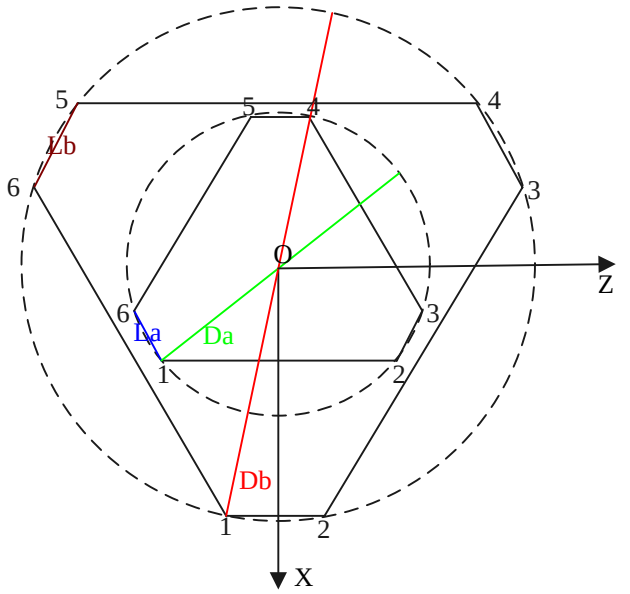

Fig. 3 The coordinate system of 6-DOF platform

As shown in the figure above,Lb is short edge of the static platform (F32StaticShortMm),Db is Diameter of the static platform (F32StaticDiameterMm),La is short edge of the moving platform(F32MovingShortMm),Da is Diameter of the moving platform (F32MovingDiameterMm).

The amount of rotation relative to the initial coordinate only acts on 6-DOF platform. As shown in Figure 3,The initial coordinate of the 6-DOF platform X axis is located on the vertical bisector line of the 1 and 2 hinge of the Static platform. If you want the X axis to be on the vertical bisector of the 3 and 4 hinge points, it is equivalent to rotating the coordinate system 120 degrees counterclockwise, F32XaxisRotAngleDeg Equal to 120 degrees.

The range of motion of the platform:

For the 3-DOF platform, As shown in Figure 2, The maximum angle of rotation of the platform around the x-axis is F32PlatformAlfaMaxDeg, The maximum angle of rotation around the z-axis is F32PlatformGammaMaxDeg, The distance that is translated along the y-axis is F32PlatformYMaxMm.

For the 6-DOF platform, As shown in Figure 3, The maximum angle of rotation of the platform around the x-axis isF32PlatformAlfaMaxDeg, The maximum angle of rotation around the y-axis is F32PlatformBetaMaxDeg, The maximum angle of rotation around the z-axis is F32PlatformGammaMaxDeg, The distance that is translated along the x-axis is F32PlatformXMaxMm,The distance that is translated along the y-axis is F32PlatformYMaxMm.The distance that is translated along the z-axis is F32PlatformZMaxMm.

Parameters of the electric cylinder:

F32AccessDistanceUnitMm is the stroke of the Electric cylinder.F32LeadDistanceUnitMm is the lead of the electric cylinder.F32MinLongofCylinderMm The Minimum length of the electric cylinder.

Reduction ratio: The deceleration ratio between the motor and the electric cylinder is 1 if there is no deceleration.

1.5. Sampling Time and UDP port

UDP port and Sampling Time

```
typedef struct      {
                    float F32FlightSamplingPeriods;     /*   Sampling Time, Unit: Second    */
```

```
short     I16HostTxPort;     /*   The host sends the UDP port   */
short     I16HostRxPort;     /*   The host receives the UDP port   */
short     I16MboxTxPort;     /*   The MBOX sends the UDP port   */
short     I16MboxRxPort;     /*   The MBOX receives the UDP port   */

short     I16WhoAcceptCode ;
short     I16WhoReplyCode;
int       I16BaseDoutCode;   //   Effect output
long int  I32PlayLine;   //   Check output
}UDP_PORT_PARA;
```

F32FlightSamplingPeriods is the time interval in which the game data DOF6_GAME_PARA is updated.

I16HostTxPort、I16HostRxPort、I16MboxTxPort、I16MboxRxPort is UDP port,Details can refer to the MDBOX manual.

I16WhoAcceptCode、I16WhoReplyCode is Who recive and Who Reply, Details can refer to the MDBOX manual.

I16BaseDoutCode is Effect output,I32PlayLine is Check output, can be set to zero.

Chapter II Functions

2.1. Select the Platform Type

Choose_PlatformType(int PlatformType);

Select the type of platform you want to control, You need to call this function at the beginning.

Parameter : PlatformType. 0x00: Three DOF platform,0x01: Six DOF platform.

Return: PlatformType ID.

2.2. The Return Value of Function

Function return values are defined as follows:

0x20000000	Call_Success
0x20000001	Open_Softdog_Error
0x20000002	Id_ Softdog_Error
0x20000003	Hamc_ Softdog_Error
0x20000004	Time_ Softdog_Error

Table 1 Function Return Values

2.3. Reset Motion Cueing Parameters

DOF6_Public_CueModule_Reset();

Reset Motion Cueing Parameters,You need to call this function after Choose_PlatformType function.

Parameter:No

Return:See table 1.

2.4. Parameter Transfer

DOF6_Public_UserCueParaTranfer(DOF6_SYS_PARA *p);

All parameters passed to the dynamic - link library.

Parameter: Struct DOF6_SYS_PARA

Return:See table 1.

2.5. Mechanical Parameter Initialization

DOF6_Public_MechModule_InitCalc ();

Calculation of coordinates and median height of the Platform.

Parameter:No

Return:See table 1.

2.6. Open UDP Port

Public_OpenMboxUdpPort();
Open UDP port.
Parameter:No
Return:See table 1.

2.7. Special Effects Output

Public_DoOutControl(short BaseDoutCode, short ExtDoutCode);
Send Special Effects Output via UDP port, it can realize special effects such as wind, spray, water spray, flash, etc.
Parameter:BaseDoutCode is Basic Digital Output,ExtDoutCode is Expanded Digital Output.
Relation between bit setting and DO channel is as shown in the table below:

B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
DO12	DO11	DO10	DO9	DO8	DO7	DO6	DO5	DO4	DO3	DO2	DO1

Example: when the user wants to DO1 and DO4's output, BaseDoutCode is set as 9.

Bit	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
DO	DO12	DO11	DO10	DO9	DO8	DO7	DO6	DO5	DO4	DO3	DO2	DO1
Binary	0	0	0	0	0	0	0	0	1	0	0	1
Decimal	9											

Return:No.

2.8. Motion Cueing Algorithm

DOF6_Public_Cue2Inverse_Solution(DOF6_GAME_PARA *p, DOF6_POSTION_PARA *q, int PositonEnable);
Send data control platform movement through the UDP port.
Parameter:
1. DOF6_GAME_PARA *p is the game parameter that is refreshed in real time.
2. DOF6_POSTION_PARA *q is the special position pulse number of six cylinders.
3. PositonEnable:Select whether to superimpose special effects DOF6_POSTION_PARA *q,if PositonEnable equal to 1,superimposed DOF6_POSTION_PARA *q,if PositonEnable equal to 0, do not superimposed DOF6_POSTION_PARA *q.

Return:See table 1.

2.9. Reset Platform

Public_ResetPlatform();
Send data control platform reset via UDP port.
Parameter:No
Return:See table 1.

2.10. Platform Goto Middle Position

Public_GoMiddlePlatform(long int GoMiddleTimeMs);

Send data control platform going middle position via UDP port.

Parameter :GoMiddleTimeMs is the time the platform reaches the median height, Units are milliseconds.

Return:See table 1.

2.11. Platform Goto Zero Position

Public_GoZeroPlatform(long int GoZeroTimeMs);

Send data control platform going zero position via UDP port.

Parameter : GoZeroTimeMs is the time the platform reaches the zero position, Units are milliseconds.

Return:See table 1.

2.12. Close UDP Port

Public_CloseMboxUdpPort();

Close UDP port.

Parameter:No

Return:See table 1.

2.13. Function Calling Sequence

1. Calling Choose_PlatformType(int PlatformType) select the type of control platform, then calling DOF6_Public_CueModule_Reset() reset Motion Cueing Parameters.

2. Assigning all parameters in the DOF6_SYS_PARA structure, and the assignment process needs to be evaluated according to the actual conditions of the platform.

3. Calling DOF6_Public_UserCueParaTranfer(DOF6_SYS_PARA *p) transfer structural parameters.

4. Calling DOF6_Public_MechModule_InitCa() initialize the mechanical parameters.

5. Calling Public_OpenMboxUdpPort() open UDP port.

6. Calling Public_GoMiddlePlatform(long int GoMiddleTimeMs) control platform going middle position.

7. Calling Public_DoOutControl(short BaseDoutCode, short ExtDoutCode) control special effects, If you have no special effects output, you cannot call the function.

8. Calling DOF6_Public_Cue2Inverse_Solution(DOF6_GAME_PARA*p,DOF6_POSTION_PARA*q,int PositonEnable) control platform movement. This function needs to update the parameter DOF6_GAME_PARA at regular intervals. This function can be put into the timer and the data controling platform movement will be sent regularly.

9. Program shutdown Calling Public_GoZeroPlatform(long int GoZeroTimeMs) control platform going middle position, Calling Public_CloseMboxUdpPort() close UDP port.