TMBSCOM.DLL
Termi-BUS SIO Control Library
For Win32 PC Based Controller
FunctionManual

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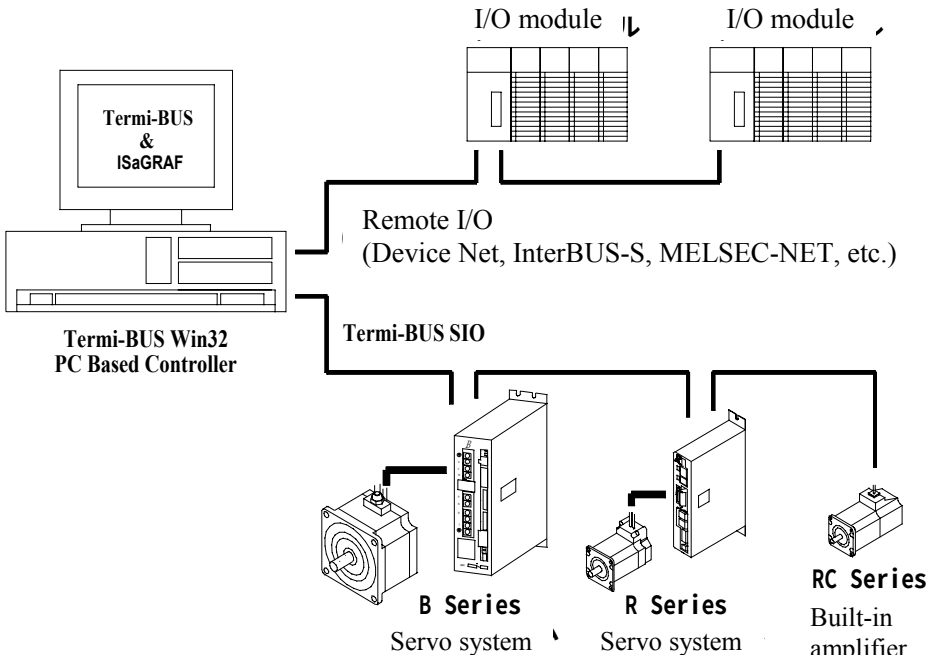
Index

This document describes based on TMBSCOM.DLL version 3.00 or later.

1. Termi-BUS for PC based controller

Because actuators in mechanical systems have own unique interfaces depending on their types, design of system and control become very complicated and the result is that users limit the use of actuators types, therefore this becomes the biggest factor of the obstacle to use best actuator for the application.
Termi-BUS is the interface between system controller and servo amplifier to make overall control with various actuators. It will allow various servo actuators to be controlled with same digital information, therefore now it is possible to choose the best actuators without over design and over specification.
PC based controller establishing FA controller on personal computer is one of best way to build flexible controller in short time by using commercial hardware and software. **Termi-BUS SIO** will give **PC based controllers** effective servo actuator functions.
Termi-BUS SIO control library can build **PC based controller** easily with the core of **Termi-BUS SIO** compatible servo system and software PLC. Because such system controllers with this need only basic hardware of PC for the execution condition, hardware cost will be minimized, and also such system can utilize commercial hardware and software and have high level of expansion ability and flexibility due to the fact that special real time operation systems for task change time reduction are not needed, and special real time expansion for standard operating systems is not needed.



2. Termi-BUS compatible servo system and TMBSCOM.DLL

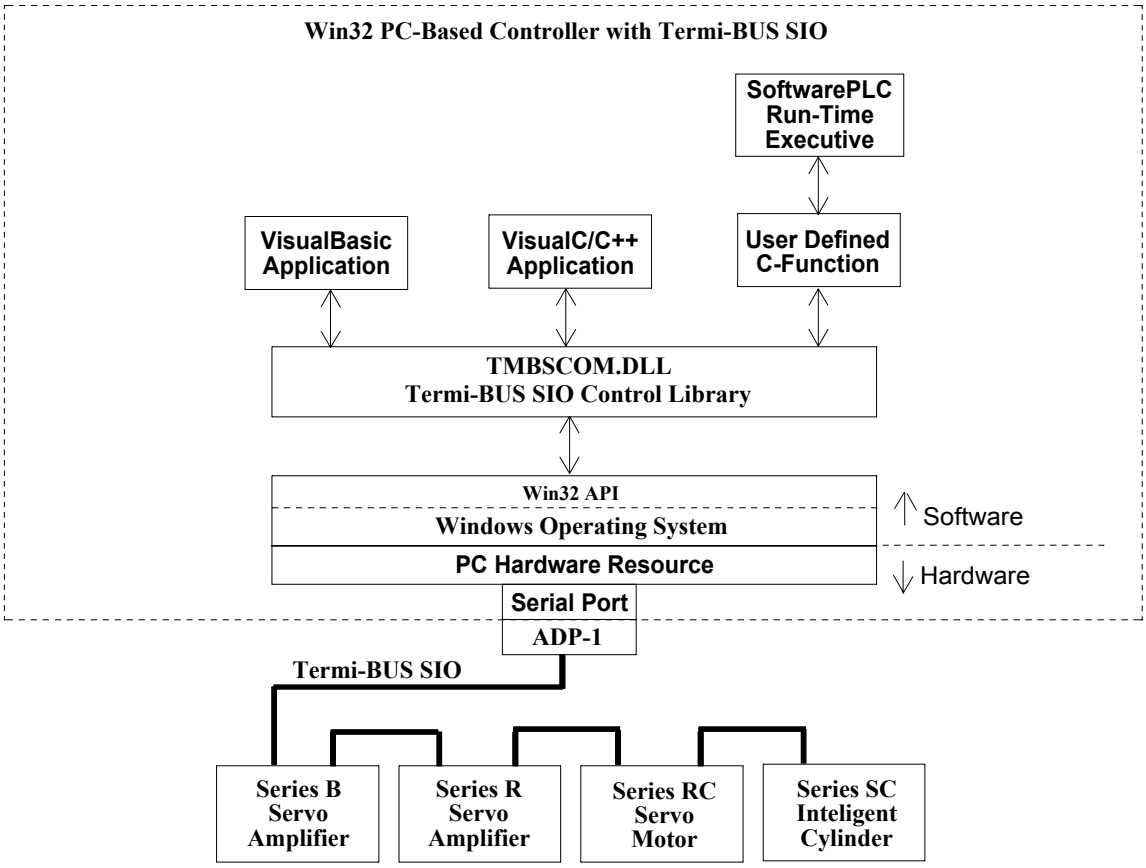
Termi-BUS compatible servo amplifier has drastically small traffic in interface between upper controller due to built-in PTP (Position To Position) motion control creation function compared with traditional interface that is always sending position increment order. Therefore **Termi-BUS** compatible system doesn't need dedicated designed hardware to interface control of servo actuator, and hardware cost will be smaller. There are 2 types of upper controller interfaces in **Termi-BUS** compatible servo system, **Termi-BUS PIO** structured with parallel I/O (DC24V) and **Termi-BUS SIO** with serial communication. **TMBSCOM.DLL** is a library software to control these servo systems through **Termi-BUS SIO** from application program on PC with 32 bit **Windows**, it will allow PC programming very easy due to its flexible function of **Termi-BUS SIO**.

2.1. Summary of Termi-BUS SIO

Termi-BUS SIO has flexible and abundant command system and effective protocol as servo actuator control dedicated interface, and it will allow system to order more flexible and higher functions compared with axes controller orders through remote I/O and PLC I/O modules. **Termi-BUS SIO** is self-adjustable synchronizing type of serial BUS interface based on EIA RS485, it can be connected directly to standard COM (serial) port of PC through **ADP-1** of RS232→RS485 converter.
Termi-BUS SIO connects dizzy chain with servo amplifiers through modular cables, and one COM port can control up to 16 axes of **Termi-BUS** compatible servo systems. **Termi-BUS SIO** interface is integrated as standard function in **Termi-BUS** compatible servo system.

2.2. Summary of TMBSCOM.DLL

TMBSCOM.DLL is a dynamic link library to utilize effectively servo control functions generated by **Termi-BUS SIO** on 32 bit **Windows** application, and there are provisions of functions corresponding to control function unit such as positioning, positioning completion confirmation, etc., therefore programmers don't need to consider detailed control of communication protocol and hardware source by using those functions.
TMBSCOM.DLL can be opened freely from regular **Windows** application made by **VisualC/C++** or **VisualBasic**, etc. same way as regular dynamic link library. If as long as software PLC is operated on 32 bit **Windows**, it can be called out from user definition C language function, etc., and high level servo control functions can be utilized easily on PLC program.



3. Features of TMBSCOM.DLL

By using functions of **TMBSCOM.DLL**, it is possible to use all functions of **Termi-BUS SIO**. These functions are to execute all communication procedure automatically such as confirmation of command-response from transmission of command to receipt of response and error recovery, therefore it is not necessary for users to consider communication procedure details of **Termi-BUS SIO**.
Once **Termi-BUS SIO** communication is established by communication establishment procedure execution function, Communication status parameter indicating communication control faults and all axes servo system movement status monitor parameter at communication establishment will be created in dynamic link library. These status parameter will be updated every time when **Termi-BUS SIO** is executed, users can read out those by rececived contents of status parameters.

3.1. Call out from VisualC/C++ Application

TMBSCOM.DLL is coming with **TBUSSIO.H** declared header file of function prototype and **TMBSCOM.LIB** file in order to linkage application of each function entry. Users will use these files to call any functions of **TMSCOM.DLL** freely from **visualC/C++** application. **TBUSSIO.H** will declare all WINAPI for those functions, therefore users can call these same way as call-out regulation of **WinewAPI** functions. Also TBUSSIO.H has designated returned value from each function, constant to pick bit information from used parameter as flag, users can these in own program freely.

3.2. Call out from VisualBasic application

TMBSCOM.DLL will be provided with files of TBUSSIO.BAS declared as public procedure function. Users can call any functions of **TMBSCOM.DLL** freely from any **VisualBasic** application by inserting these files as standard module into project. **TMBSCOM.DLL** is included returned value from each function, pubic definite parameter to choose bit information from used parameter as flag, users can use those in their program freely.

3.3. ISaGRAF use C language function library

ISaGRAF user C language function library used **TMBSCOM.DLL** is a software PLC tool to use **Termi-BUS** compatible servo system effectively. This library is provided as **ISaUSP.DLL** of object format of user C language function for **ISaGRAF**, source codes and function templates including technical memo will be provided as archive files for librarian, users don't need to make R&D work and can use these functions as any of IEC-1131-3 PLC programming language (IL, ST, LD, FBD). If user has developed own C language function, these can be integrated and rebuilt easily because **ISaGRAF** has source code set needed to rebuild C language function library.

TMBSCOM.DLL is based on the use of **ADP-1** with RS-232C/RS-485 converter, therefore please note that the system doesn't operate well in case of use of other converter than **ADP-1**.

4. TMBSCOM.DLL Function references

4.1. Each function common constant for previous definition

Following constant used in **TMBSCOM.DLL** is defined already in **TMBSCOM.H**, therefore any modules including this file can use such constant freely.

```
int WINAPI get_axes( unsigned short *axes );
int WINAPI get_sio_error( void );
int WINAPI get_tmbs_state( void );
int WINAPI get_current_baud( void );
int WINAPI get_com_errlog( void );
```

All functions of **TMBSCOM.DLL** other than above functions will send following returning value.

```
SIO_DONE        1   // Command completed without problem, or conditions has been established
SIO_ERROR       0   // Command error, or condition couldn't be established
```

4.2. Communication establishment procedure and communication status check function

4.2.1. Functions of init_tmbs_config

```
int WINAPI init_tmbs_config(
    LPCTSTR port,       // Communication port file name ( "COM1","COM2"etc. )
    int baud,           // Baud rate specification code
    int nrt,            // Command re-send max. number of times
    BOOL reset,         // TRUE if re-send number of times is over, it will return to communication
                           initialization
    BOOL automatic,     // TRUE Baud rate automatic set
    int *axes_info      // Axes components specification information
);
```

Function init_tmbs_config can make communication establishment of **Termi-BUS SIO** and detect or confirm connected axes automatically.

Input parameter

port:

This is a pointer into character digits including serial communication port name to be used as **Termi-BUS SIO**.
This character digit line should be valid fine name as serial communication port name.

baud:

Serial communication baud rate used in **Termi-BUS SIO** is specified.
These parameters must be one of constant already defined in **TBUSSIO.H** as below.

```
TMBS_BAUD_9600          0x04    //   9600 bps
TMBS_BAUD_19200         0x05    //  19200 bps
TMBS_BAUD_38400         0x06    //  38400 bps
TMBS_BAUD_14400         0x11    //  14400 bps
TMBS_BAUD_57600         0x13    //  57600 bps
TMBS_BAUD_115200        0x14    // 115200 bps
```

In case of specification of parameter automatic TRUE, the parameter set value j will be disregarded, and highest speed in above selections in the PC will be selected.

nrt:

This will specify re-sending maximum number of times of recovery procedure in case of communication error accident after communication establishment.
If the error is recovered within the maximum re-sending number of times, the system doesn't become communication fault. If this parameter is set to 0, the system won't do any recovery procedure.

reset:

TRUE specification will make communication initialization procedure again automatically for the case of communication error that couldn't be recovered by the recovery procedure. Such status should be managed by the application, therefore this parameter should be set to FALSE.

aurtomatic:

TRUE specification will select maximum available baud rate in the PC regardless of parameter baud set. FALSE specification will set baud rate with the set of parameter baud.

axes_info:

This is a pointer into int arrangement of 16 factors specified axes component information.
This index of arrangement is same as axis number, and factor 0 means that there is corresponding axis, -1 means that there is no corresponding axis. If any one of factors of arrangement is not –1, the system will confirm the existence of the axis only specified not –1 at initialization procedure.
For example, in case of 3 axes system with axis #0, #2 and #3, the arrangement set value of such parameter will be as follows:

```
axes_info[0] = 0;
axes_info[1] = -1;
axes_info[2] = 0;
axes_info[3] = 0;
axes_info[4] = -1;
axes_info[5] = -1;
axes_info[6] = -1;
axes_info[7] = -1;
axes_info[8] = -1;
axes_info[9] = -1;
axes_info[10] = -1;
axes_info[11] = -1;
axes_info[12] = -1;
axes_info[13] = -1;
axes_info[14] = -1;
axes_info[15] = -1;
```

If there is no corresponding axis against arrangement factor of set value other than –1, communication initialization error will occur.
If all of set value of arrangement factors are set to –1, communication establishment procedure will confirm the existence of all axes from #0 to #15, and then arrangement factors corresponding to the confirmed axes will be updated to 0. Therefore actual axes component information of the system can be given in this way that value of all arrangement factors is to be checked after communication establishment. If non of axis is confirmed its existence, communication error will occur.

Return value

After the status became normal communication establishment, SIO_DONE will be replied, and SIO_ERROR will be replied for other status. The status of SIO_ERROR is not always communication error, and SIO_ERROR is replied during communication initialization procedure execution.

4.2.2. Fuunction of init tmbs

int WINAPI init_tmbs(void);

Function of function init_tmbs is basically same as function of init_tmbs_config, but the set values corresponding to parameters of function init_tmbs_config are defined by **TBUSSIO.INI** file in directory of **Windows** (¥Windows for **Window95/98**、¥WinNT for **WindowsNT**)
Followings are definition of **TBUSSIO.INI** corresponding to the case of parameters port="COM1", baud= TMBS_BAUD_115200, nrt=2、reset=FALSE, automatic=TRUE, axes_info=#0 axis, #1 axis, #2 axis, #3 axis existence specification in function init_tmbs_config;

```
[SYSTEM]
PORT=COM1
BRSL=14
NRT=2
RESET=0
AUTOMATIC=1
AXIS=00010203
```

AXIS is defined in 2 digits of decimal system for each axis, and it cannot be operated same way as automatic all axes component information check in case of all –1 values of axes_info.

Return value

After the status became normal communication establishment, SIO_DONE will be replied, and SIO_ERROR will be replied for other status. The status of SIO_ERROR is not always communication error, and SIO_ERROR is replied during communication initialization procedure execution.

4.2.3. Function close_tmbs

int WINAPI close_tmbs(void);

This function will close all files created by TMBSCOM.DLL then end the execution of DLL.
TMBSCOM.DLL should be used for customer application software end.
When customer's application program is loading, dedicated files such as synchronizing object are created and used. When customer's application program ends, there are cases that process of call side seems to end before DLL process end event, in such case, created files in the application cannot be released and remain in the memory area even after the end of application program. Therefore TMBSCOM.DLL should be used for customer application software end.

4.2.4. Function init_sio_tbus

This function remains due to compatible function with old version.
Function init_tmbs_config should be used.

4.2.5. Function init_sio

This function remains due to compatible function with old version.
Function init_tmbs should be used.

4.2.6. Function get_tmbs_state

int WINAPI get_tmbs_state(void);

Function get_tmbs_state will give current communication status of **Termi-BUS SIO**.

Return value

This function reply one of following constant value defined in **TBUSSIO.H**.

TMBS_NO_EXIST	0	// Communication process is not starting
TMBS_INITIAL	1	// Communication initialization request waiting status
TMBS_INIT_ERROR	2	// Communication initialization error status
TMBS_OPENING	3	// Communication initialization executing status
TMBS_RUNNING	4	// Communication established status

4.2.7. Function get_current_baud

int WINAPI get_current_baud(void);

Function "get_current_baud" will give actual used baud rate set value.

Return value

This function reply one of following constant value defined in **TBUSSIO.H**

TMBS_BAUD_9600	0x04	// 9600 bps
TMBS_BAUD_19200	0x05	// 19200 bps
TMBS_BAUD_38400	0x06	// 38400 bps
TMBS_BAUD_14400	0x11	// 14400 bps
TMBS_BAUD_57600	0x13	// 57600 bps
TMBS_BAUD_115200	0x14	// 115200 bps

4.2.8. Function get_sio_error

int WINAPI get_sio_error(void);

Function "get_sio_error" will give latest communication error from just before calling this function.

Return value

This function reply one of following constant value defined in **TBUSSIO.H**

SIO_COMUSED	-1	// COM port is being used already
SIO_TIMEOUT	-2	// Re-sending number of times for error recovery is over
SIO_NOINIT	-3	// Communication order is executed before communication initialization.
SIO_INVALID_PARAM	-5	// Wrong parameter has been given
SIO_NOTSUPORT_TO	-6	// Communication time out function is not supported
SIO_NOTSUPORT_BAUD	-8	// Baud rate without support is specified
SIO_NOTSUPORT_PARA	-9	// Communication parameter update is not supported
SIO_NO_CONFIGFILE	-10	// "TBUSSIO.INI" condition set file cannot be found
SIO_COMFAILED	-12	// Serial communication port fail to be opened

4.2.9. Actual procedures of communication establishment and notes

Other functions in TMBSCOM.DLL than Communication establishment procedure function and function of "get_tmbs_state" shouldn't be called before communication establishment of Termi-BUS SIO (until communication establishment execution function reply with SIO_DONE as return value) by using communication establishment procedure execution function (function init_tmbs_config, function init_tmbs, function init_sio_tbus, function init_sio).
Followings are C language image of actual communication establishment execution program using communication establishment procedure execution function or communication status check function.

```
while ( init_tmbs( ) != SIO_DONE )
{
    Sleep( 5 );    // Anothor thread may need the time slice.

    if ( get_tmbs_state( ) == TMBS_INIT_ERROR )
    {
        // Hard Luck!! some axes may not exist.
        break;
    }
}

if ( get_tmbs_state( ) == TMBS_RUNNING )
    // OK!! the communication is established.
```

4.3. Motor movement order function and movement completion confirmation function

4.3.1. Function of move point (position number specification indirect PTP movement order)

```
int WINAPI move_point(
    int axis,          // Execution objective axis number
    int point          // PTP movement order position data number
);
```

PTP movement order data memorized in EEPROM memory area of servo amplifier/motor inside is to be loaded to execution area, and then PTP movement is to be executed. Because PTP movement order data of each position will be batch loaded into execution area including profile parameters such as speed, acceleration, etc., therefore all of these data should be written in EEPROM memory area by **TBVST** or **CTA** prior to the movement order execution. This function can only order push force movement of **R**, **RC** and **SC** series.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.3.2. Funnction "move_abs" (Absolute positioning order PTP movement order)

```
int WINAPI move_abs(
    int axis,          // Axis number
    long position      // Target position in absolute coordinate system
);
```

It will position to target position in absolute coordinate system. Data values remained in execution area will be used for movement profile parameter of function execution such as speed/acceleration, etc.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.3.3. FUNCTION OF move_inc (incremental movement distance specify PTP movement order)

```
int WINAPI move_inc(
    int axis,          // Axis number
    long distance    // Incremental movement distance
);
```

Target position will be the position with current position plus relative distance. Data values remained in execution area will be used for movement profile parameter of function execution such as speed/acceleration, etc.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.3.4. Fuunction “move_org” (Homing movement order)

```
void move_org(
    int axis          // Execution objective axis number
    int mode         // Pattern specify code of homing movement
);
```

This will make homing movement according to pattern specified based on parameter mode. Homing movement pattern specified mode is as follows:

mode=00H

Servomotor doesn’t move, and the current position will be set to 0.
This pattern is default for absolute encoder, if other pattern is set, the new pattern will be executed.

mode=01H (RC series with encoder 2ch type cannot select this.)

Servomotor will rotate clockwise at slow speed and stop at the position of encoder marker (Cch). This position is to be set to 0.

mode=02H (Invalid for encoder 2ch type of RC series)

Servomotor will rotate counter clockwise at slow speed and stop at the position of encoder marker (Cch). This position is to be set to 0.

mode=03H (Invalid for RC series)

Servomotor will rotate clockwise at slow speed by the procedure indicated by figure 1, and then detect edge of stroke limit signal (**Termi-BUS PIO** *INH+), and then rotate counter clockwise at slow speed and stop at the position of encoder marker (Cch). This position is to be set to 0.

mode=04H (Invalid for RC series)

Servomotor will rotate counter clockwise at slow speed by the procedure indicated by figure 6, and then detect edge of stroke limit signal (**Termi-BUS PIO** *INH-), and then rotate clockwise at slow speed and stop at the position of encoder marker (Cch). This position is to be set to 0.

mode=05H (Invalid for RC series)

Servomotor will rotate clockwise at slow speed by the procedure indicated by figure 5, and then

detect edge of stroke limit signal (**Termi-BUS PIO** *INH+), and then stop. This position is to be set to 0.

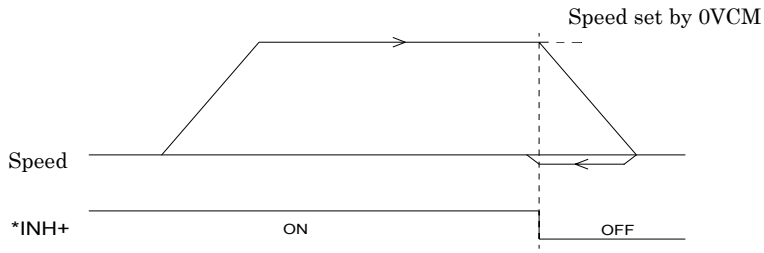


Figure 1. Clockwise *INH+ edge detect sequence

mode=06H (Invalid for RC series)

Servomotor will rotate counter clockwise at slow speed by the procedure indicated by figure 6, and then detect edge of stroke limit signal (**Termi-BUS PIO** *INH-), and then stop. This position is to be set to 0.

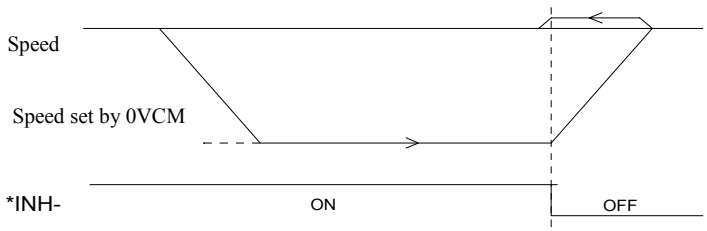


Figure 2. Counter clock *INH- edge detect sequence

mode=07H (Valid only for R/RC series)

Servomotor is set in the status with current limitation of set by parameter ODPW, and then servomotor is to move and collide at the speed of parameter OVCM clockwise to the mechanical stopper. Servomotor will then return from the position by 2 counter of encoder feedback, this position is to set to 0 of coordinate. In case of no collision detection within set time of parameter OTIM, it will be in alarm (BEH) condition.

mode=08H (Valid only for R/RC series)

Servomotor is set in the status with current limitation of set by parameter ODPW, and then servomotor is to move and collide at the speed of parameter OVCM counter clockwise to the mechanical stopper. Servomotor will then return from the position by 2 counter of encoder feedback, this position is to set to 0 of coordinate. In case of no collision detection within set time of parameter OTIM, it will be in alarm (BEH) condition.

mode=09H (Valid only for R/RC series)

Servomotor is set in the status with current limitation of set by parameter ODPW, and then servomotor is to move and collide at the speed of parameter OVCM clockwise to the mechanical stopper. Servomotor will then return from the position at slow speed to encoder marker (Cch) and stop, this position is to set to 0 of coordinate. In case of no collision detection within set time of parameter OTIM, it will be in alarm (BEH) condition.

mode=0AH (Valid only for R/RC series)

Servomotor is set in the status with current limitation of set by parameter ODPW, and then servomotor is to move and collide at the speed of parameter OVCM counter clockwise to the mechanical stopper. Servomotor will then return from the position at slow speed to encoder

marker (Cch) and stop, this position is to set to 0 of coordinate. In case of no collision detection within set time of parameter OTIM, it will be in alarm (BEH) condition.

ODPW, OVCM, OTIM are common parameter in EEPROM memory area inside of servo amplifier and motor, and these data should be set prior to the operation by **TBVST** or **CTA**.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.3.5. Function "move_rotate" (unlimited revolution movement order)

```
int WINAPI move_rotate(
    int axis,          // Execution objective axis axis number
    int dir,           // Revolution direction   0=clockwise, 1=counter clockwise
    int vcmd,          // Speed order value
    int acmd           // Acceleration order value
);
```

This function will keep objective axis moving at ordered speed/acceleration to ordered direction. This may be used for main axis revolution. This function will update movement profile parameter of execution area with value of vcmd and acmd.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned

4.3.8. Function “move_jog” (JOG movement order)

```
int WINAPI move_jog(
      int axis,          // Execution objective axis axis number
      long distance    // JOG order movement distance of repeat cycle
);
```

This function will order Servo amplifier/amplifier to execute JOG movement. Movement speed of JOG order will be decided automatically based on internal calculation.

((distance * 60) / (delta_T * motor_1rev)) [r/min]

Please note:
delta_T : an interval between previous signal receipt and this signal receipt of JOG movement order [sec]
motor_1rev : Movement distance per one revolution of motor

The maximum value of above delta_T is 0.1 [sec], in order to make continuous JOG movement, it is necessary to execute JOG movement order function with shorter cycle of interval than 0.1 [sec]. And the maximum distance of movement distance order value “distance” will be the maximum distance with maximum revolution speed of servo system in 0.1 [sec]. Therefore motor will stop within 0.1 sec from the start of last JOG movement function order execution.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned

4.3.9. Function ”check_pfin” (positioning completed status acquirement)

```
int WINAPI check_pfin(
      int axis          // objective axis number
);
```

This function will acquire positioning completed status (**PFIN** of **Termi-BUS PIO**) of objective axis. This function will find the completion status by servo system movement status monitor parameter in dynamic link library, therefore function “check_status” should be used together to repeat to check.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned

4.3.10. Funnction “check_status (Servo system internal status polling)

```
int WINAPI check_status(
      int axis          // objective axis number
);
```

This function will acquire internal status of objective axis and store into servo system movement status monitor parameter in dynamic library. This function is to acquire internal status of servo amplifier/motor, and it doesn’t order any actual movement at all.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.3.11. Function “follow_position” (Current position follow up/Immediate stop)

```
int WINAPI follow_position(
      int axis          // objective axis number
);
```

This function is to follow up current position value at function execution from target position in absolute coordinate. If the objective axis is moving, this function will stop the axis immediately and then move to the above position.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.3.12. Notes of axes movement order

Following indicates C language image of 2 axes reciprocation movement execution program using PTP movement order function in absolute position.

```
int ax0_err , ax1_err;

while( FOREVER )
{
      ax0_err = move_abs( 0, 2000 )      // Ax#0 start to 2000;
      ax1_err = move_abs( 1, 1500 )      // Ax#1 start to 1500;

      if ( ( ax0_err == SIO_ERROR) || ( ax1_err == SIO_ERROR) )
            break;      // Hard Luck!! failed.

      while ( FOREVER )
      {
            if ( ( check_status( 0 ) == SIO_DONE ) && ( check_status( 1 ) == SIO_DONE ) )
            {
                  if ( ( check_pfin( 0 ) == SIO_DONE ) && ( check_pfin( 1 ) == SIO_DONE ) )
                        break;    // Move complete
            }
            Sleep( 5 );    // Anothor thread may need the time slice.
      }

      ax0_err = move_abs( 0, 0 )      // Ax#0 return to 0;
      ax1_err = move_abs( 1, 0 )      // Ax#1 return to 0;

      if ( ( ax0_err == SIO_ERROR) || ( ax1_err == SIO_ERROR) )
            break;      // Hard Luck!! failed.

      while ( FOREVER )
      {
            if ( ( check_status( 0 ) == SIO_DONE ) && ( check_status( 1 ) == SIO_DONE ) )
            {
                  if ( ( get_pfin( 0 ) == SIO_DONE ) && ( get_pfin( 1 ) == SIO_DONE ) )
                        break;
            }
            Sleep( 5 );    // Anothor thread may need the time slice.
      }
}
```

4.4. Servo system status change function

4.4.1. Function of “write_position” (Current position direct set)

```
int WINAPI write_position(
    int axis,          // objective axis number
    long position    // current position in absolute coordinate system
);
```

This function is to update current position value in absolute coordinate system to value of “position”. This function is used to shift absolute position coordinate system, this doesn’t make any movement of motor.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.4.2. Function of “set_son” (Servo ON order)

```
int WINAPI set_son(
    int axis          // objective axis number
);
```

This function is to make servo amplifier status to servo ON status. However, servo ON can be set only when SON input of Termi-BUS PIO in servo amplifier of objective axis should be ON. (For RC, SC series, it means that main power is turned ON.)

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.4.3. Function of “set_soff” (Servo OFF order)

```
int WINAPI set_soff(
    int axis          // objective axis number
);
```

This function is to make servo amplifier status to servo OFF status.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.4.4. Function of ”reset_alarm” (Servo amplifier alarm reset)

```
int WINAPI reset_alarm(
    int axis          // axis number
);
```

This function is to reset alarm status of servo amplifier.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.5. Motor movement parameter change functions

4.5.1. Function of "write_velocity" (speed/acceleration order set)

```
int WINAPI write_velocity(
      int axis,          // objective axis number
      int vcmd,          // speed order value
      int acmd           // acceleration order value
);
```

This function is to set speed and acceleration order values at PTP movement. This function will update movement profile parameters in execution data area to values of vcmd and acmd, therefore those new values of movement profile parameters will be used for axes movement order afterward.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.5.2. Function of "select_svparm" (servo gain parameter selection)

```
int WINAPI select_svparm(
      int axis,          // axis number
      int gain_sel,      // Selection of "at movement" or "at stop" 0=at movement, 1= at stop
      int svparm         // servo gain parameter
);
```

This function is to update servo gain parameter at movement or at stop for the objective axis to the value of svparm. This function will overwrite servo gain parameter in execution data area, therefore this new servo gain parameter will be used for axes movement order afterward.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.5.3. Function of "write_trqlim" (Electrical current limit value set)

```
int WINAPI write_trqlim(
      int axis,          // objective axis number
      int l_dynamic,     // current limit value at stop
      int l_static       // current limit value at movement
);
```

This function is to set electrical current limit value of servomotor at movement and at stop. This function will overwrite current limit parameter in execution data area, therefore this new current limit value will be used for axes movement order afterward.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.5.4. Function of “write_inpos” (positioning completion detection width set)

```
int WINAPI write_inpos(
      int axis,          // objective axis number
      long width         // positioning completion detection width
);
```

This function is to set tolerance value of difference between target position to detect movement completion and current position to the value of “width”. This function will overwrite positioning completion detection width parameter in execution data area, therefore this new positioning completion detection width value will be used for axes movement order afterward.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.5.5. Function of “write_fzone” (zone output +side border value set)

```
int WINAPI write_fzone(
      int axis,          // objective axis number
      long zone          // clockwise zone border value
);
```

This function is to set + side border value of zone output to the value of “zone”.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.5.6. Function of “write_rzone” (zone output – side border value set)

```
int WINAPI write_rzone(
      int axis,          // objective axis number
      long zone          // counter clockwise zone border value
);
```

This function is to set - side border value of zone output to the value of “zone”.

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.6. Servo system internal status check function

4.6.1. Function of “check_run” (servo system RUUN status acquirement)

```
int WINAPI check_run(
    int axis          // objective axis number
);
```

Return value

If servo system is in RUN status, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.6.2. Function of “check_son” (servo ON/OFF status acquirement)

```
int WINAPI check_son(
      int axis          // objective axis number
```

);

Return value

If servo system is in servo ON status, SIO_DONE is returned, for servo OFF status, SIO_ERROR will be returned.

4.6.3. Function of "check_alrm" (alarm status acquirement)

```
int WINAPI check_alrm(
      int axis          // objective axis number
);
```

Return value

If servo system is in alarm status, SIO_DONE is returned, for normal status, SIO_ERROR will be returned.

4.6.4. Function of "check_org" (homing completion status acquirement)

```
int WINAPI check_org(
      int axis          // objective axis number
);
```

Return value

If servo system is in homed status, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.6.5. Function of "get_status" (servo system internal status acquirement)

```
int WINAPI get_status(
      int axis,             // objective axis number
      char *param       // pointer of servo system internal status data storage area
);
```

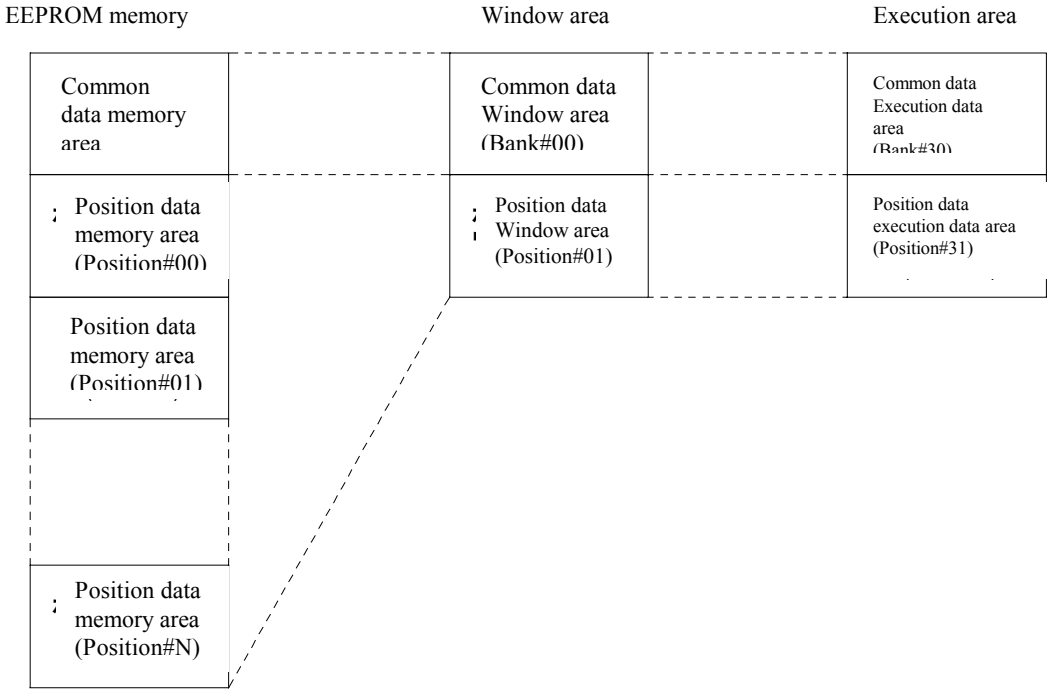
This function is to acquire all internal status of servo amplifier/motor for the objective axis from servo system movement status monitor parameters in dynamic link library acquired by execution of "check_status" function or other communicational functions, and then store this into char arrangement indicated by parameter of "param".

Return value

After execution objective axis receives normal order, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.7. Virtual memory space access function in Servo amplifier/motor

Servo amplifier/motor compatible with **Termini-BUS SIO** has EEPROM memory area to memorize axis control order data, and this area is connected with axis control execution data area inside of servo amplifier/motor through Window area that can be written and read freely. EEPROM memory area access function can write and read EEPROM memory area. These operations can be done through Window area.



Normally, data edit and memory of EEPROM memory area will be done by **Termi-BUS Tools** or **CTA**, therefore it is not necessary to data transfer by using EEPROM memory area access function in sequence program. In case of using virtual memory space access function explained later, please refer "**4.8. Notes of COMPACK structure body and virtual memory space**" to get information about structure of virtual memory space and its use.

4.7.1. Random access read out function from virtual memory space

```
int WINAPI read_svmem(
      int axis,         // objective axis number
      int address,      // virtual memory space address of read out data
      long *dst         // pointer to read out data storage area
);
```

This function is to read out specified data by address from virtual memory space inside of servo amplifier, and then write into the area specified by pointer "dst".

Return value

After successful read out, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.7.2. Random access read out function from virtual memory space

```
int WINAPI write_svmem(
      int axis,              // objective axis number
      int address,           // write to address in virtual memory space
      const long *src        // pointer of write to data storage area
);
```

This function is to write specified data by pointer “src” into specified area on virtual memory space inside of servo amplifier by “address”.

Return value

After successful writing, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.7.3. Servo system movement parameter write function

```
int WINAPI write_param(
    int axis,                  // objective axis number
    const COMPACK *src    // pointer into COMPACK structure body with writing data
);
```

This function is to write movement parameters at once written in specified COMPACK structure body by pointer “src” in common data memory area of EEPROM memory area inside of servo amplifier. COMPACK structure body is the structured body indicated as below, please refer “**4.8. Notes of COMPACK structure body and virtual memory space**” for its usage.

```
typedef struct {
    int address[32];     // Offset value arrangement in bank of virtual address (value –1 means to skip
                            process)
    long data[32];        // data arrangement
} COMPACK;
```

Return value

After successful writing, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.7.4. Servo system movement parameter read out function

```
int WINAPI read_param(
    int axis,              // objective axis number
    COMPACK *dst      // pointer into COMPACK structure body to read out to
);
```

This function is to read out movement parameters at once memorized in common data memory area of EEPROM memory area inside of servo amplifier, and then to write in specified COMPACK structure body by pointer “dst”. COMPACK structure body is the structured body indicated as below, please refer “**4.8. Notes of COMPACK structure body and virtual memory space**” for its usage.

```
typedef struct {
    int address[32];     // Offset value arrangement in bank of virtual address (value –1 means to skip
                            process)
    long data[32];        // data arrangement
} COMPACK;
```

Return value

After successful read out, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.7.5. PTP movement order data write function

```
int WINAPI write_point(
    int axis,                   // objective axis number
    int point,                  // point number
    const COMPACK *src    // pointer into COMPACK structure body with written data
);
```

This function is to write PTP movement order data at once written in specified COMPACK structure body by pointer "src" into corresponding position data memory area to specified position by "point" in EEPROM memory area inside of servo amplifier. COMPACK structure body is the structured body indicated as below, please refer "**4.8. Notes of COMPACK structure body and virtual memory space**" for its usage.

```
typedef struct {
    int address[32];    // Offset value arrangement in bank of virtual address (value –1 means to skip
                           process)
    long data[32];      // data arrangement
} COMPACK;
```

Return value

After successful writing, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.7.6. PTP movement order data read out function

```
int WINAPI read_point(
    int axis,               // objective axis number
    point,                  // position number
    COMPACK *dst      // pointer into COMPACK structure body read out to
);
```

This function is to read out PTP movement order data at once memorized in corresponding position data memory area to position number specified by "point" in EEPROM memory area inside of servo amplifier, and then to write in specified COMPACK structure body by pointer "dst". COMPACK structure body is the structured body indicated as below, please refer "**4.8. Notes of COMPACK structure body and virtual memory space**" for its usage.

```
typedef struct {
    int address[32];    // Offset value arrangement in bank of virtual address (value –1 means to skip
                           process)
    long data[32];      // data arrangement
} COMPACK;
```

Return value

After successful read out, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.7.7. Servo system movement parameter load function

```
int WINAPI load_param(
    int axis        // objective axis number
);
```

This function is to load movement parameters memorized in common data memory area of EEPROM memory area inside of servo amplifier into execution area at once via Window area. After execution of this function, the system will move following movement parameters memorized in EEPROM memory area. Respective parameters in Window area and execution area will be loaded automatically with memorized values in EEPROM memory area after the power is turned ON. Therefore it is not necessary to load movement parameters by using this function, and this function should be used only for initialization and/or update of movement parameters in EEPROM memory area. It is necessary to write movement parameters into EEPROM memory area prior to the operation by **Termi-BUS Tools** or **CTA**.

Return value

After successful loading, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.7.8. Servo system movement parameter save function

```
int WINAPI save_param(
    int axis        // objective axis number
);
```

This function is to save movement parameters memorized in common data memory area of execution area into EEPROM memory area inside of servo amplifier at once via Window area. This function should be used in case when movement parameters updated during execution must be written into EEPROM memory area as they are.

Return value

After successful save, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.7.9. PTP order data save function

```
int WINAPI save_point(
    int axis,       // objective axis number
    int point       // position number
);
```

This function is to save current PTP order data memorized in position data memory area of execution area into EEPROM memory area inside of servo amplifier at once via Window area. This function should be used in case when PTP order data updated during execution must be written into EEPROM memory area as they are.

Return value

After successful save, SIO_DONE is returned, for other status, SIO_ERROR will be returned.

4.7.10. Memory initialization function of servo amplifier

```
int WINAPI reset_memory(
    int axis        // objective axis number
);
```

This function is to make servo system movement parameter and position data in Window area and execution area to default value. Set default values are fixed values depending on the model, they are not values in EEPROM memory area. Execution of “reset_memory” function will update status parameters of objective axis on global memory to new values.

4.8. Notes of COMPACK structure body and virtual memory space

Virtual memory space in servo amplifier/motor is divided into SWORD arrangement of 32 factors all named bank. COMPACK structure body is to make these banks batch operation able, there are 2 groups of arrangements with 32 factors as indicated as below.

```
typedef struct {
    int address[32];    // Offset value arrangement in bank of virtual address (value –1 means to skip
                           process)
    long data[32];      // data arrangement
} COMPACK;
```

COMPACK structure body handles 2 factors of address and data as a pair, one number i has address [i] and data [i] and it means one factor in bank with offset address and data in bank. Item of "address" with –1 value is disregarded, therefore this enables to partial data pick up and/or partial writing in bank.

Following is data structure of virtual memory space including bank 0 (servo system movement parameter), bank 1 (PTP movement order data) and status monitor area. It is value that virtual address in the following list is deducted by base address (top item address of its bank) of bank for offset address in bank that specifies address field in COMPACK structure body.

Common parameter Window area Bank 0 (COM0)

Virtual address (HEX)	Symbol	Items	Model
00000000	CNTM	Absolute position coordinate range + side maximum value	
00000001	CNTL	Absolute position coordinate range - side maximum value	
00000002	LIMM	Software stroke limit value + side	
00000003	LIML	Software stroke limit value - side	
00000004	ZONM	Zone border value + side	
00000005	ZONL	Zone border value - side	
00000006	ORG	Homing pattern selection code Bit 0~3: Homing pattern selection code Bit 7: Short cut control valid specify bit (1=valid)	
00000007	PHSP	Motor energizing phase signal detection operation parameter Bit 0~6: Energizing phase signal detection operation start delay time specify code Unit: 1ms Bit 7: Energizing phase signal detection movement direction specify bit 0/1: = Clockwise / Counter-clockwise	R/RC
00000008	FPIO	PIO function set flag Bit 0: 0 / 1 = PFIN / INP Bit 4: 1 = CSTR invalid Bit 5: 1 = INH + invalid Bit 6: 1 = INH - invalid Bit 7: 1 = ILK invalid	
00000009	BRSL	SIO communication speed selection code	
0000000A	OVCM	Homing speed order Unit: 0.2rpm	
0000000B	OACC	Homing acceleration order Unit: 0.1r/min/ms	
0000000C	RTIM	Slave transmitter activation minimum delay time parameter Unit: 1ms	
0000000D	INP	In position width default value	

00000000E	VCMD	Speed order default value Unit: 0.2 rpm	
00000000F	ACMD	Acceleration order default value Unit: 0.1 r/min/ms	
000000010	SPOW	Electrical current limitation default value for positioning stop	
000000011	DPOW	Electrical current limitation default value during movement	
000000012	PLG0	Servo gain number default value	
000000013	MXAC	Maximum acceleration specify flag default value	R/RC
000000014	CPAC	CP control mode acceleration constant (reservation for future expansion)	B/R
000000015	PSWT	Special specification (reservation)	
		Reservation for future expansion	
000000018	ZRMK	Homing prohibition flag (B series absolute model only)	B
000000019	ODPW	Homing current limitation value	R/RC
00000001A	OTIM	Homing time out value Unit: 1ms	R/RC
00000001B	PLG1	Servo gain number default value for positioning stop	B
00000001C	PLJL	Servo gain table selection switch by load inertia 0 = Light load inertia 1 = Middle load inertia 2 = Heavy load inertia	B
00000001D	FLSL	Type selection flag for current order filter 0 = Primary low pass filter 1 = band elimination filter 0 = Light load inertia	B
00000001E	FLFC	LP cut off frequency/BEF central frequency of current order	B
00000001F		Total write number of times in EEPROM memory area (Area A)	

Position data window area bank 1 (PNT1)

Address (HEX)	Symbol	Data	Models
000004000	PCMD	Absolute position coordinate target positioning stop	
000004001	FLGP	Axis movement parameter default / Position data selection flag Position data valid Bit 7: In position width Bit 6: Speed, acceleration, ultimate acceleration Bit 5: Electrical current limitation value Bit 4: Servo gain number	
000004002		Reservation for future expansion	
000004003	INP	In position width / Push force maximum pushing depth	
000004004	VCMD	Speed order Unit: 0.2 rpm	
000004005	ACMD	Acceleration order Unit: 0.1 r/min/ms	
000004006	SPOW	Electrical current limitation value for positioning stop / Electrical current limitation value for push movement	
000004007	DPOW	Electrical current limitation value during movement	
000004008	PLG0	Servo gain number value	
000004009	MXAC	Ultimate acceleration specify flag Bit 0: 1 = Ultimate acceleration	R/RC
000004011	PLG1	Servo gain number of positioning stop	B
00000041F		Total write number of times in EEPROM memory area (Area A)	

Amplifier / Motor type monitor Bank 26 (TYPE)

Address (HEX)	Symbol	Data	Models
00006800	ROM	Model code and ROM version code	
00006801	S／N	Serial number	RC
00006802	AMP1	Servo amplifier model name character digits, Number 1 group 4 characters	
00006803	AMP2	Servo amplifier model name character digits, Number 2 group 4 characters	
00006804	AMP3	Servo amplifier model name character digits, Number 3 group 4 characters	
00006805		Reservation	
00006806	MOT1	Servo motor model name character digits, Number 1 group 4 characters	
00006807	MOT2	Servo motor model name character digits, Number 2 group 4 characters	
00006808	MOT3	Servo motor model name character digits, Number 3 group 4 characters	
00006809		Reservation	

Monitor relating data bank 27 (MONI)

Address (HEX)	Symbol	Data	Models
00006C00	A_FL	Flag of analog monitor (Note 1)	R
00006C01	A_AD	Address of analog monitor (fixed value 7401) (Note 1)	R
00006C02	H_DT	Trace data specify address	B/RC
00006C03	H_SC	Sampling distance for trace data Set value n : (n+1)*500μs	B/RC
00006C04	H_WR	Maximum written address for trace data All area write completion when top bit is 1	B/RC
00006C05	H_BY	Trace data type BYTE = 1, WORD = 2, LWORD = 4	B/RC

(Note 1) Dyadic uses only, please do not use this.

Storage area for trace data

Address (HEX)	Symbol	Data	Models
10000000		First data	
10000001		2nd data	
.		.	
********		Last data	

Alarm monitor area bank 28 (ALRM)

Address (HEX)	Symbol	Data	Models
00007000	WARN	Final detected warning code	
00007001	HYS0	Final detected alarm code	
00007002	HYS1	Preceding detected alarm code one time before last	
00007003	HYS2	Preceding detected alarm code 2 times before last	
00007004	HYS3	Preceding detected alarm code 3 times before last	
00007005	HYS4	Preceding detected alarm code 4 times before last	
00007006	HYS5	Preceding detected alarm code 5 times before last	
00007007	HYS6	Preceding detected alarm code 6 times before last	
00007008	HYS7	Preceding detected alarm code 7 times before last	
00007009	ARMA	Data address where execution was something wrong.	

Internal status monitor area bank 29 (STAT)

Address (HEX)	Symbol	Data	Models
00007400	PNOW	Absolute position counter current position	
00007401	VNOW	Current speed monitor	
00007402		Reservation for future expansion	
00007403	STAT	Internal status flag	
00007404	ALRM	Current alarm/Warning code	
00007405	PI	PIO input port monitor	B/R
00007406	PO	PIO output port monitor	
00007407	SW	Status monitor of SW1 (Rotary), SW2 (DIP) Bit 4~7: 4 bit status of SW1 (Axis number) Bit 3: 6 of SW2 (1 / 0 = ON / OFF) Bit 2: 5 of SW2 (1 / 0 = ON / OFF) Bit 1: 4 of SW2 (1 / 0 = ON / OFF) Bit 0: 3 of SW2 (1 / 0 = ON / OFF)	B/R
00007408	STA2	Bit 0: Homing flag 1 = Homing is in execution	
00007409	WADR	**W**rite to address counter by 4 command	
0000740A	ROM	Model code and ROM version	
0000740B	A／D0	Analog value for inspection	R/RC
0000740C	A／D1	Analog value for inspection	R/RC
0000740D	A／D2	Analog value for inspection	R/RC
00007412	OLLV	Current value of over load detection, Output alarm for 78H or greater	
00007413	LVPK	Peak hold value of over load detection level	
00007414	ICMD	Internal electrical current order value (torque order value) 100/Current rating	B
00007415	PNTM	Current position number monitor (0~255)	B