DMM Technology Corp.

DYN AC Servo Drive Modbus RTU Specification

[DYNMB1-BL1645-10A]

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1. Overview

The DYN2 and DYN4 servo drive supports Modbus RTU communication protocol over RS485 through the servo drive's JP2 PC Interface connector. The following servo drive mode numbers supports this Modbus RTU protocol.

- DYN2-T1B6S-00
- DYN2-TLB6S-00

- DYN4-L01B2-00
- DYN4-H01B2-00
- DYN4-T01B2-00

64 DYN servo drive nodes can be connected on a single network. The following communication formats and baud rates are supported:

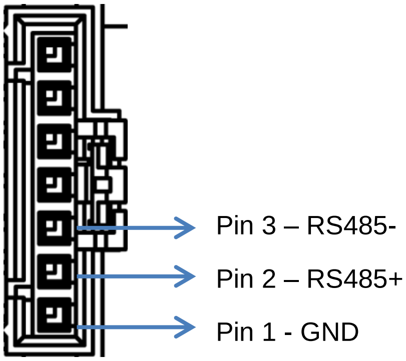
Baud Rate	Protocol
• 4800 • 9600 • 19200 • 38400 (Default) • 57600 • 115200 * Custom baud rates up to 340.8k bps can be requested	• 8-bit data, 1 start bit, no parity, two stop bits (Default) • 8-bit data, 1 start bit, odd parity, one stop bit • 8-bit data, 1 start bit, even parity, one stop bit

Please review the manual "MODBUS over serial line specification and implementation guide V1.02" from www.modbus.org for detailed communication and connection specifications.

2. Hardware Interface

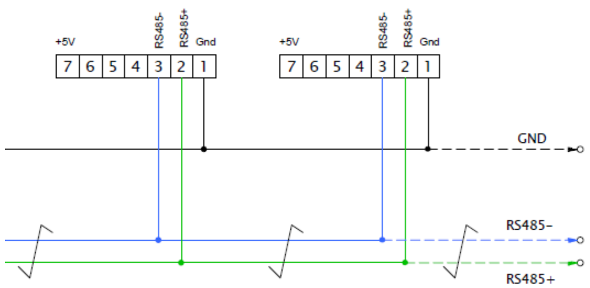
Connector

Both the DYN2 and DYN4 servo drive shares the same connection method.



Port: JP2
Connector Type: 2.54mm Pitch Rectangular
Drive Header: (Molex) 70553-0041
Plug Connector: (Molex) 50-57-9407

Use twisted pair cables for the RS485+ and RS485- lines.



Terminating Resistor

Both the DYN2 and DYN4 servo drive has internal terminating resistors (200ohm) which can be selected via jumpers on the servo drive PCB. Terminating resistors can also be connected externally on the signal lines.

Terminating Resistor Installation Instructions

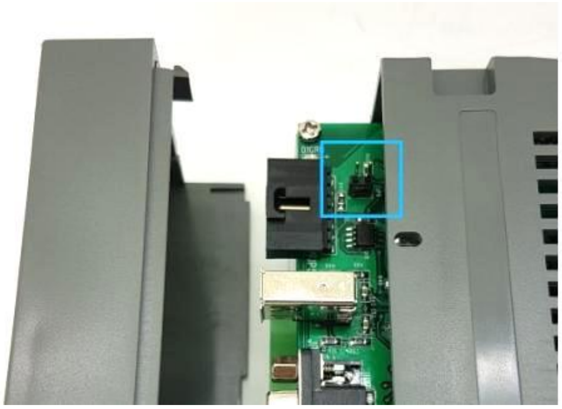
DYN2 Servo Drive:

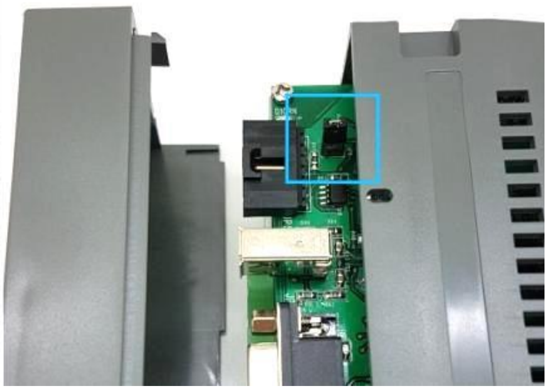
1. Power OFF servo drive and wait 5 minutes for drive to fully discharge.
2. Remove servo drive cover and locate terminating resistor jumper.

3. Inserting the jumper connects the terminating resistor. Removing the jumper disconnects the terminating resistor. By factory default, the servo drive does not have the jumper connected.

DYN4 Servo Drive:

1. Power OFF servo drive and wait 5 minutes for drive to fully discharge.
2. Remove front cover of servo drive and locate terminating resistor jumper.





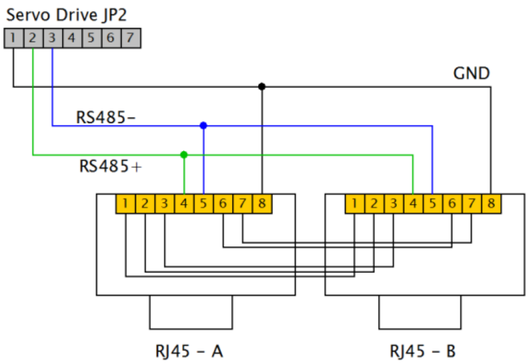
3. Inserting the jumper connects the terminating resistor. Removing the jumper disconnects the terminating resistor. By factory default, the servo drive does not have the jumper connected.

JP2 RJ45 Splitter

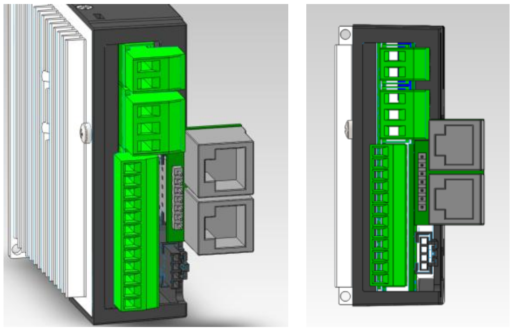
The RJ45 splitter can also be used to network multiple drives using standard RH45 modular cables and connectors. The splitter connects into either DYN2 or DYN4 JP2 ports and splits the RS485+ and RS485- signals between two RJ45 ports. The RJ45 splitter is sold separately. The pin out follows the Modbus mechanical interface standard for 2-Wire Modbus.

Part# CNJP2-RJ45SP-2

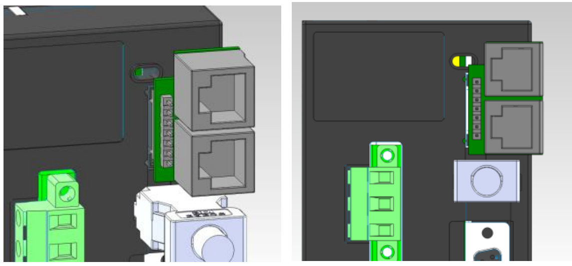
Circuit Diagram:



DYN2 Servo Drive Application:

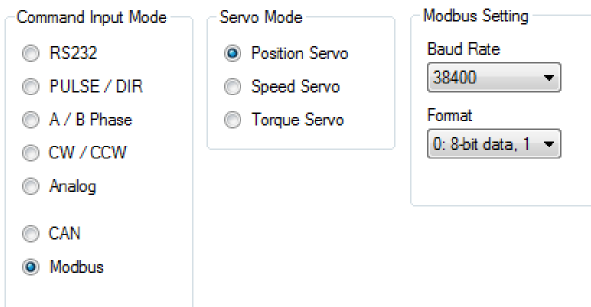


DYN4 Servo Drive Application:

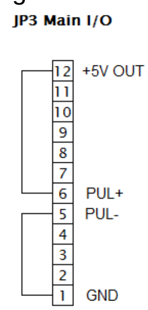


3. Servo Drive Setting

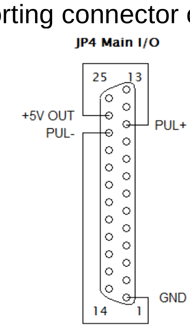
Use DMMDRV program to set and save servo drive into Modbus command input mode and Position Servo Mode. Then select the baud rate and format.



For the DYN2 servo drive, connect the Modbus shorting connector into the JP3 I/O terminal. The factory servo drive includes this Modbus shorting connector.

		Shorting connector circuit 

For the DYN4 servo drive, connect the Modbus shorting connector into the JP4 I/O terminal. The factory servo drive includes this Modbus shorting connector.

		Shorting connector circuit 

IMPORTANT

Once the servo drive is saved into Modbus command input mode and the shorting connector is connected, power OFF the drive, wait 60-seconds and power ON again to activate the Modbus mode. When the drive is in Modbus mode, the RS232 communication is stopped and the drive will not communicate with the DMMDRV program. By disconnecting the shorting connector and cycling power, the servo drive will go into RS232 mode and can be accessed via DMMDRV program. The servo drive is only in Modbus mode if the command input mode is selected as “Modbus” and the Modbus shorting connector is connected to the servo drive. Modbus mode becomes effective after power cycle.

Setup Procedure

Setting into Modbus mode

1. Power ON servo drive.
2. Set Command Input Mode into “Modbus”.
3. Set Servo Mode into “Position Servo”.
4. Select Baud Rate and Format according to network requirement.
5. Press “Save All” to save above settings. At this point, the servo drive is internally still in RS232 mode. User can continue using DMMDRV for testing and tuning.
6. Power OFF servo drive. Wait 60 seconds.
7. Connect Modbus Shorting Connector to servo drive.
8. Power servo drive ON. Now, the servo drive is in Modbus mode and ready for Modbus operation. Will not communicate via RS232 and DMMDRV.

Switching back to RS232 mode

9. Power servo drive OFF. Wait 60 seconds.
10. Disconnect Modbus Shorting Connector.
11. Power servo drive ON. Servo drive is back in RS232 mode and able to communicate with DMMDRV.

4. Modbus Operation

Supported Functions:

- 0x03 Read Holding Registers
- 0x06 Write Single Register

Supported Exception Codes:

- 03 Illegal Data Value

* Read holding register only supports reading 1 register at a time

Register Definition Overview

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range	Description
40001	0	Drive ID	RW	Int16	0~63	Servo Drive ID / Node Address
40002	1	Drive Config	RW	Int16	0~127	Drive Configuration
40003	2	Drive Status	R	Int16	0~127	Drive Status
40004	3	Set ABS Origin	W	Int16	0x00 | 0xFFFF	Set Absolute Origin Zero Command
40005	4	Main Gain	RW	Int16	1~127	Main Gain parameter
40006	5	Speed Gain	RW	Int16	1~127	Speed Gain parameter
40007	6	Integration Gain	RW	Int16	1~127	Integration Gain parameter
40008	7	Torque Filter Constant	RW	Int16	1~127	Torque Filter Constant parameter
40009	8	High Speed	RW	Int16	1~127	High Speed parameter
40010	9	High Accel	RW	Int16	1~127	High Acceleration parameter
40011	a	On Position Range	RW	Int16	1~127	On Position Range parameter
40012	b	GearNumber GEAR_NUM	RW	Int16	500~16384	Gear Number parameter Electronic Gear Ratio
40013	c	LineNumber LINE_NUM	RW	Int16	500~2048	Line Number parameter Encoder Output Gear Ratio
40014	d	TBD				
40015	e	Turn_ConstSpeed	W	Int16	-2^14~2^14	Turn Constant Speed command [rpm]
40016	f	Square_Wave	W	Int16	0~4096	Square wave amplitude command
40017	10	TBD				
40018	11	Sin_Wave	W	Int16	0~4096	Sine wave amplitude command
40019	12	TBD				
40020	13	SS_Frequency	RW	Int16	0~60	Square / Sine wave frequency
40021	14	Motor Speed	R	Int16		Motor Speed [rpm]
40022	15	Go_Absolute_Pos	W	Int32	-2^27 ~ 2^27	Go absolute position – High Bytes
40023	16					Go absolute position – Low Bytes (Trigger)
40024	17	Go_Relative_Pos	W	Int32	-2^27 ~ 2^27	Go relative position – High Bytes
40025	18					Go relative position – Low Bytes (Trigger)
40026	19	Make_LinearLine	W	Int32	-2^27 ~ 2^27	Coordinated linear motion – High Bytes
40027	1a					Coordinated linear motion – Low Bytes (Trigger)
40028	1b	Make_CircularArc	W	Int32	-2^27 ~ 2^27	Coordinated circular motion – High Bytes
40029	1c					Coordinated circular motion – Low Bytes (Trigger)
40030	1d	Motor Absolute Position	R	Int32	-2^27 ~ 2^27	Motor Absolute Position – High Bytes
40031	1e					Motor Absolute Position – Low Bytes
40032	1f	Motor Torque	R	Int16	-700~700	Motor Torque
40033	20	TBD				
40034	21	TBD				
40035	22	Modbus Communication Format	RW	Int16	0~3	Modbus format
40036	23	Modbus Baud Rate	RW	Int16	0~7	Modbus Baud Rate
	0xFFFE	Diagnostic Counter	R	Int16	0~255	Diagnostic Counter

Register Definition Details

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40001	**0**	**Drive ID**	**RW**	**Int16**	**0~63**
Details					
Read/Write the servo drive ID, which corresponds to its Modbus node address. The DYN servo drive accepts addresses from 0 to 63, allowing up to 64 drive nodes to be connected on one bus. ID=0 is for broadcasting and the servo drive does not sent response or error messages.					

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40002	**1**	**Drive Config**	**RW**	**Int16**	**0~127**
Details					

Read/Write the servo drive Configuration. Only the lower byte is used.

Drive Configuration = b7 b6 b5 b4 b3 b2 b1 b0

		Command Input Mode
b1 b0 =	0 =	RS232 mode
	1 =	CW,CCW mode
	2 =	Pulse/Direction mode
	3 =	Analog mode
		Relative or Absolute Mode (Encoder Mode)
b2 =	0 =	Works as relative mode. Operates as incremental encoder.
	1 =	Works as absolute mode. At power up, motors moves to absolute zero or stored zero position. See *Set ABS Origin* command for details.
		Servo Mode
b4 b3 =	0 =	Position Servo Mode (default for Modbus)
	1 =	Speed Servo Mode
	2 =	Torque Servo Mode
		Servo Enable/Disable
b5 =	0 =	Servo Enabled
	1 =	Servo Disabled (Motor Free)
b7 b6 =		**Unimplemented**

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40003	**2**	**Drive Status**	**R**	**Int16**	**0~127**

Details

Reads the servo drive Status. Only the lower byte is used.

Drive Status = b7 b6 b5 b4 b3 b2 b1 b0

b0 =	0 =	On position. |Pset - Pmotor| < = OnpositionRange
	1 =	Off Position / motor busy. |Pset - Pmotor| > OnPositionRange
b1 =	0 =	Servo Enabled
	1 =	Servo Disabled / Motor Free
b4 b3 b2 =	0 =	No Alarm
	1 =	Motor lost phase alarm, |Pset - Pmotor|>8192(steps), 180(deg)
	2 =	Over current alarm
	3 =	Overheat alarm / Overpower alarm
	4 =	Error for CRC code check, refuse to accept current command
b5 =	0 =	Built in S-curve, linear, circular motion completed; waiting for next motion
	1 =	Built in S-curve, linear, circular motion is busy on current motion
b7 b6 =		Unimplemented

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40004	**3**	**Set ABS Origin**	**W**	**Int16**	**0x00 | 0xFFFF**

Details

Setting this address to 0xFFFF sets the current motor position as the absolute zero position.

When the drive is set to operate in Absolute Mode (Configuration&0x04=1), when the drive powers ON, the motor moves to the absolute zero position, then starts accepting command.

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40005	**4**	**Main Gain**	**RW**	**Int16**	**1~127**
40006	**5**	**Speed Gain**	**RW**	**Int16**	**1~127**
40007	**6**	**Integration Gain**	**RW**	**Int16**	**1~127**
40008	**7**	**Torque Filter Constant**	**RW**	**Int16**	**1~127**

Details

These registers are used to set/read the corresponding drive parameter. Since the max allowed value is 127, only the lower byte is used. Saving a 0 or any value higher than 127 into these registers returns 03 exception code.

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40009	**8**	**High Speed**	**RW**	**Int16**	**1~127**
40010	**9**	**High Accel**	**RW**	**Int16**	**1~127**
Details					

Registers used to save/read servo drive Max Speed and Max Acceleration parameters. Since the max allowed value is 127, only the lower byte is used. Saving a 0 or any value higher than 127 into these registers returns 03 exception code.

Max Speed and Max Acceleration parameters are saved into device RAM and resets back to 12 and 24 respectively when power is cycled to the servo drive. These two parameters are used to calculate the Point-to-Point S-Curve speed and acceleration – See *Section 6. Motion Reference*. The Max Acceleration parameter is also used to change the speed in Turn_Constant_Speed command.

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40011	**a**	**On Position Range**	**RW**	**Int16**	**1~127**
Details					

Register used to set/read On Position Range parameter. Max allowed value is 127 – only the lower byte is used. Saving a 0 or any value higher than 127 into this registers returns 03 exception code.

Suppose the Pset is the commanded position, and Pmotor is the real motor position, if |Pset - Pmotor|<=OnPosRange*4, then the motor is considered to be “Of Position”. Otherwise, the motor is “Off Position”.

Ex. If OnPosRange=50, then 50x4=200pulses. Encoder resolution is 65,536 so 200/65536*360=1.1degrees. Motor considered On Position if within 1.1degrees from command position.

On Position status can be monitored using I/O pins or by reading Drive Status bit 0 (Drive_Status & 0x01).

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40012	**b**	**GearNumber GEAR_NUM**	**RW**	**Int16**	**500~16384**
Details					

Register used to set/read Gear Number parameter, GEAR_NUM. Allowed value is 500~16384.

GEAR_NUM used to calculate the Point-to-Point S-Curve speed and acceleration – See *Section 6. Motion Reference*.

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40013	**c**	**LineNumber LINE_NUM**	**RW**	**Int16**	**500~2048**
Details					

* This parameter is only applicable for the DYN4 servo drive.

Register used to set/read Line Number parameter, LINE_NUM. Allowed value is 500~2048. LINE_NUM x 4 = number of pulses per motor revolution (ppr) from DYN4 JP5 encoder output.

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40015	**e**	**Turn_ConstSpeed**	**W**	**Int16**	**-2^14~2^14**
Details					
Command to turn motor at constant speed. Setting this register immediately turns the motor at register stored value in rpm. Positive command turns motor in CW direction, negative command turns motor in CCW direction.					

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40016	**f**	**Square_Wave**	**W**	**Int16**	**0~4096**
Details					
Sets built-in Square Wave motion amplitude. 1024 = 45degree, 2048 = 90degree, 4096 = 180degree amplitude. Motion begins when register is set, and SS_Frequency register is not zero.					

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40018	**11**	**Sin_Wave**	**W**	**Int16**	**0~4096**
Details					
Sets built-in Sine Wave motion amplitude. 1024 = 45degree, 2048 = 90degree, 4096 = 180degree amplitude. Motion begins when register is set, and SS_Frequency register is not zero.					

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40020	**13**	**SS_Frequency**	**RW**	**Int16**	**0~60**
Details					
Sets built-in Square/Sine Wave motion frequency. Units in Hertz. Register value resets to zero when drive powered OFF.					

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40021	**14**	**Motor Speed**	**R**	**Int16**	
Details					
Register contains motor speed in [rpm].					

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40022	**15 (High Bytes)**	**Go_Absolute_Pos**	**W**	**Int32**	**-2^27 ~ 2^27**
40023	**16 (Low Bytes)**				

Details

Move Absolute Position command. Value of two registers combined is total movement distance. Positive command turns motor in CW direction, negative command turns motor in CCW direction. Higher register (Low Bytes) is motion start trigger.

In order to maintain data reliability, always set both high bytes and low bytes together. Do not set low bytes without setting high bytes. See *Section 6. Motion Reference* for motion profile calculation.

Example:

- Move motor to 4,726,140 absolute position.
- 4,726,140 = 0x00481D7C.
- Send 0x0048 to register address 0x15. Drive stores 0x0048 as Go Absolute Position high bytes. Does not run command.
- Send 0x1D7C to register address 0x16. Drive stores 0x1D7C as Go Absolute Position low bytes. Combines value with high bytes, checks to see if command is within allowed range and runs command.

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40024	**17 (High Bytes)**	**Go_Relative_Pos**	**W**	**Int32**	**-2^27 ~ 2^27**
40025	**18 (Low Bytes)**				

Details

Move Relative Position command. Value of two registers combined is total movement distance. Positive command turns motor in CW direction, negative command turns motor in CCW direction. Higher register (Low Bytes) is motion start trigger.

In order to maintain data reliability, always set both high bytes and low bytes together. Do not set low bytes without setting high bytes. See *Section 6. Motion Reference* for motion profile calculation.

Example:

- Move motor -15,898 relative position.
- -15,898 = 0xFFFFC1E6.
- Send 0xFFFF to register address 0x15. Drive stores 0xFFFF as Go Relative Position high bytes. Does not run command.
- Send 0xC1E6 to register address 0x16. Drive stores 0xC1E6 as Go Relative Position low bytes. Combines value with high bytes, checks to see if command is within allowed range and runs command.

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40026	**19 (High Bytes)**	**Make_LinearLine**	**W**	**Int32**	**-2^27 ~ 2^27**
40027	**1a (Low Bytes)**				
Details					
See *Section 7. Coordinated Linear Motion Reference*.					

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40028	**1b (High Bytes)**	**Make_CircularArc**	**W**	**Int32**	**-2^27 ~ 2^27**
40029	**1c (Low Bytes)**				
Details					
See *Section 8. Coordinated Circular Motion Reference*.					

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40030	**1d (High Bytes)**	**Motor Absolute Position**	**R**	**Int32**	**-2^27 ~ 2^27**
40031	**1e (Low Bytes)**				
Details					

These registers contain the absolute position of the motor. Make sure to always read the high bytes (0x1d) first, then the low bytes (0x1e). Read low bytes after high bytes as soon as possible to maintain best position reference. The absolute position is the stored position when the high bytes are read.

Timing / Position Synchronization Example:

Time [ms]	Motor Position [pts]	Operation
0	69514	
25	75201	0x1d register read command sent. Servo drive stores current position 75201 = 0x000125C1 and returns high bytes 0x0001
50	85218	0x1e register read command sent. Servo drive returns stored position low bytes 0x25C1
75	98521	
…		
125	129921	0x1d register read command sent. Servo drive stores current position 129921 = 0x0001FB81 and returns high bytes 0x0001
150	148759	0x1e register read command sent. Servo drive returns stored position low bytes 0xFB81
175	160258	

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40032	**1f**	**Motor Torque**	**R**	**Int16**	**-700~700**
Details					
Register contains the reference value of instantaneous output current from servo drive to motor. 700=peak output current of servo drive. Value is positive when current/torque is applied in CCW direction. Example: - Servo drive used = DYN4-H01B2. Peak output current = 20A - Servo motor used = 11A-DHT-A6HK1. Torque coefficient = 0.774Nm/A - Motor Torque read value = 0xFF63 = -157 - 157 / 700 = 0.224 * 20A = 4.48A - 4.48A * 0.774Nm/A = 3.47Nm applied in CW direction since reading is negative					

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40035	**22**	**Modbus Communication Format**	**RW**	**Int16**	**0~3**
Details					

Register used to read/write Modbus communication format. Only the lower byte is used.

Modbus communication format = b7 b6 b5 b4 b3 b2 b1 b0

b1 b0 = 0 = 8-bit data, 1 start bit, no parity, two stop bits (Default)
1 = 8-bit data, 1 start bit, odd parity, one stop bit
2 = 8-bit data, 1 start bit, even parity, one stop bit

b7~b2 = Unimplemented

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
40036	**23**	**Modbus Baud Rate**	**RW**	**Int16**	**0~7**
Details					

Register used to read/write Modbus baud rate. Only the lower byte is used. Baud rate can be configured for custom applications up to 340.8k bps.

Modbus baud rate = b7 b6 b5 b4 b3 b2 b1 b0

b2 b1 b0 = 0 = 4800
1 = 9600
2 = 19200
3 = 38400 (Default)
4 = 57600
5 = 115200
6 = Custom 1
7 = Custom 2

b7~b3 = Unimplemented

Register# (Modbus Decimal)	Modbus Address# [hex]	Register Map	Access	Data Type	Data Range
	0xFFFE	**Diagnostic Counter**	**R**	**Int16**	**0~255**
Details					

Drive internal unsigned 8-bit counter used for testing and diagnostics. Register value increments by 1 each time it is read. Rolls back to 0 after 255.

5. Operation Examples

Example 1. Read Servo Drive Status

Request		Response	
Function	03	Function	0x03
Starting Address High	0x00	Byte Count	0x02
Starting Address Low	0x02	Register value Hi	0x00
Quantity of registers High	0x00	Register value Lo	0x21
Quantity of registers Low	0x01		

Drive Status = 0x21 = Off Position / motor busy. |Pset - Pmotor| > OnPositionRange
Built in S-curve, linear, circular motion is busy on current motion

Example 2. Move absolute position

Move to absolute position 12,947,521 = 0x00C59041 (32-bit)
High Bytes = 0x00C5
Low Bytes = 0x9041

Command 1:

Request		Response	
Function	06	Function	06
Starting Address High	0x00	Starting Address High	0x00
Starting Address Low	0x15	Starting Address Low	0x15
Register Value High	0x00	Register Value High	0x00
Register Value Low	0xC5	Register Value Low	0xC5

Command 2:

Request		Response	
Function	06	Function	06
Starting Address High	0x00	Starting Address High	0x00
Starting Address Low	0x16	Starting Address Low	0x16
Register Value High	0x90	Register Value High	0x90
Register Value Low	0x41	Register Value Low	0x41

Servo drive runs motion after Command 2 is received.

Example 3. Read absolute position

Command 1:

Request		Response	
Function	03	Function	0x03
Starting Address High	0x00	Byte Count	0x02
Starting Address Low	0x1d	Register value Hi	0xFF
Quantity of registers High	0x00	Register value Lo	0x23
Quantity of registers Low	0x01		

Command 2:

Request		Response	
Function	03	Function	0x03
Starting Address High	0x00	Byte Count	0x02
Starting Address Low	0x1e	Register value Hi	0x11
Quantity of registers High	0x00	Register value Lo	0x8B
Quantity of registers Low	0x01		

Register 1d = Absolute Position High bytes = 0xFF23 = INT16 ABS_Pos16_H
Register 1e = Absolute Position Low bytes = 0x118B = INT16 ABS_Pos16_L

```
INT32 ABS_Pos32 = ABS_Pos16_H & 0x0000FFFF;
ABS_Pos32<<=16;
ABS_Pos32 = ABS_Pos32 | ABS_Pos16_L;       // ABS_Pos_32 = 32-bit absolute motor position
```

* Note: For client/master devices that do not allow 32-bit data bit manipulation, copy the two 16-bit ABS_Pos16_H and ABS_Pos16_L data into two separate 32-bit Integer data types. The multiply the data containing ABS_Pos16_H by 65536 (shift left by 16) and add data containing ABS_Pos16_L.

Example without 32-bit data bit-manipulation:

```
INT32 ABS_Pos32_H, ABS_Pos32_L;
ABS_Pos32_H = ABS_Pos16_H & 0x0000FFFF;
ABS_Pos32_L = ABS_Pos16_L & 0x0000FFFF;
ABS_Pos32 = ABS_Pos32_H*65536 + ABS_Pos32_L;    // ABS_Pos_32 = 32-bit absolute motor position
```

Example 4. Move constant speed

Target motor speed = 4520rpm
Target motor direction = CCW
Command data = -4520 = 0xEE58

Request		Response	
Function	06	Function	06
Starting Address High	0x00	Starting Address High	0x00
Starting Address Low	0x0e	Starting Address Low	0x0e
Register Value High	0xEE	Register Value High	0xEE
Register Value Low	0x58	Register Value Low	0x58

Servo drive rotates motor at 4520rpm in CCW direction as soon as command received.

Example 5. 3-Axis Coordinated Linear Motion

X axis drive ID = 0
Y axis drive ID = 1
Z axis drive ID = 2
Set all 3 axis GEAR_NUM to 4096

Starting Coordinate = (547,201,1498)
Target Coordinate = (1058,-5180,84750)
Travel Distance = (511,-5381,83252)
Travel Distance (32bit) = (0x000001FF,0xFFFFEAFB,0x00014534)
Target Feed Rate = 300rpm – *FeedRate* = 300/1.526 = 196 = 0xC5

Command 1:

Request	
Function	06
Starting Address High	0x00
Starting Address Low	0x19
Register Value High	0x00
Register Value Low	0x00

Command 2:

Request	
Function	06
Starting Address High	0x00
Starting Address Low	0x1a
Register Value High	0x01
Register Value Low	0xFF

Command 3:

Request	
Function	06
Starting Address High	0x00
Starting Address Low	0x19
Register Value High	0xFF
Register Value Low	0xFF

Command 4:

Request	
Function	06
Starting Address High	0x00
Starting Address Low	0x1a
Register Value High	0xEA
Register Value Low	0xFB

Command 5:

Request	
Function	06
Starting Address High	0x00
Starting Address Low	0x19
Register Value High	0x00
Register Value Low	0x01

Command 6:

Request	
Function	06
Starting Address High	0x00
Starting Address Low	0x1a
Register Value High	0x45
Register Value Low	0x34

Command 7:

Request	
Function	06
Starting Address High	0x00
Starting Address Low	0x19
Register Value High	0x00
Register Value Low	0x00

Command 8:

Request	
Function	06
Starting Address High	0x00
Starting Address Low	0x1a
Register Value High	0x00
Register Value Low	0xC5

All 3 servo drive axis begins interpolated linear motion after 8th command received.

6. Point-to-Point Motion Reference

The Max Acceleration, Max Speed, and Gear Number parameters used for generating the Point-to-Point S-Curve. The DYN servo drive also applies a smoothing filter to the acceleration profile to generate best S-Curve performance. This Point-to-Point motion reference is applicable to both Go_Absolute _Pos and Go_Relative_Pos commands.

The S-Curve profile is calculated as the following,

$$\text{Gear Ratio} = \frac{4096}{GEAR\_NUM}$$

$$\text{Maximum Motor Acceleration [rpm/s]} = \text{MaxAcl} * 635.78 * \text{Gear Ratio}$$

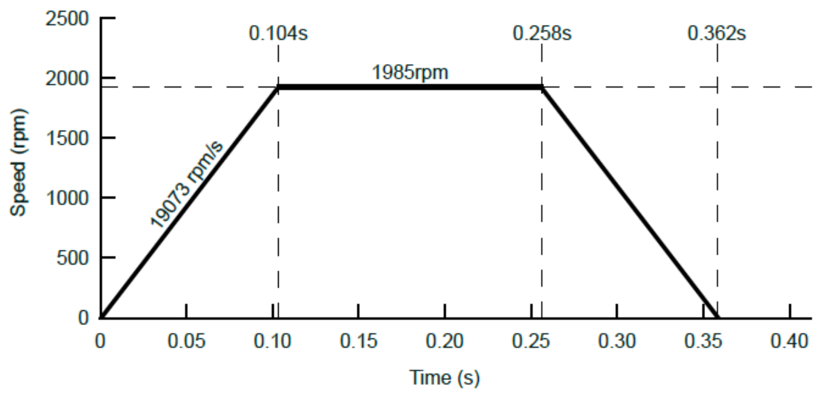
$$\text{Motor Movement Position} = \text{Command Position} * \text{Gear Ratio} * 4$$

Example:

Set parameter	Output
Gear_Num = 4096 MaxSpd = 48 MaxAcl = 30 Command Position = 140,000	Gear Ratio = 1 Maximum Motor Speed = 1985 rpm Maximum Motor Acceleration = 19073 rpm/s Motor Movement Position = 560,000 positions

S-Curve:

Acceleration Time = 0.104 s
Distance During Acceleration = 1.72 rev
Constant Speed Travel Time = 0.154 s
Total S-Curve Time = 0.362 s



7. Coordinated Linear Motion Reference

The coordinated linear motion can be run in 3 axis, X/Y/Z. In order to run this command, the system must reserve 4 ID node addresses, including 0,1,2 and 127. No other node on the Modbus network may have these addresses.

X axis must be set to ID=0, Y axis set to ID=1 and Z axis set to ID=2. Set all 3 drives GEAR_NUM parameter to 4096.

Suppose the motor's current coordinates is at (X0,Y0,Z0) and the target coordinates is (X1,Y1,Z1).

Using ID address of 127 (0x7F), send the following 4 Make_LinearLine commands. Make sure to send the high bytes (0x19) first, then the low bytes (0x1a). Since the command is being accepted by all 3 drives, the drives do not send response messages.

Command 1	Data = Distance of X1-X0
Command 2	Data = Distance of Y1-Y0
Command 3	Data = Distance of Z1-Z0
Command 4	*FeedRate* = 1~127. Movement speed = 1.526* *FeedRate* [rpm]

If moving within a 2-axis plane, set the third axis travel distance to zero. Higher Feed Rate can be achieve by setting lower GEAR_NUM setting. All 3 drives begin motion after 4th command received.

8. Coordinated Circular Motion Reference

The coordinated circular motion can be run in 3 axis, X/Y/Z. In order to run this command, the system must reserve 4 ID node addresses, including 0,1,2 and 127. No other node on the Modbus network may have these addresses. The circular motion can only be run on one plane between Drive 0 and Drive 1.

Set all 3 drives to ID=0,1 and 2. The circular motion can only be run on one plane between Drive 0 and Drive 1. Set all 3 drives GEAR_NUM parameter to 4096.

Suppose the motor's current coordinates is at (X0,Y0) and the target coordinates is (X1,Y1) and the circle center is at (XC,YC).

Using ID address of 127 (0x7F), send the following 5 Make_CircularArc commands. Make sure to send the high bytes (0x1b) first, then the low bytes (0x1c). Since the command is being accepted by all 3 drives, the drives do not send response messages.

Command 1	X0 - Xc
Command 2	Y0 - Yc
Command 3	X1 - Xc
Command 4	Y1 - Yc
Command 5	16-bit data High byte = PlaneNumber = 0,1,2. the 0 for X-Y plane,1 for Z-X and 2 for Y-Z. Low byte = Feed Rate = -127~127. If Feed Rate is positive, it will make arc in CW orientation. Negative makes arc in CCW orientation.

After drives 0,1,2 receives the above five commands, they will begin circular coordinated motion from (X0,Y0) to (X1,Y1). If Feed Rate>0, the path is CW orientation, CCW orientation. Movement speed = 1.526* *FeedRate* [rpm]

Suppose R0 = Sqrt((X0-Xc)*(X0-Xc) + (Y0-Yc)*(Y0-Yc))
R1 = Sqrt((X1-Xc)*(X1-Xc) + (Y1-Yc)*(Y1-Yc))

Make sure the difference of R0 and R1 is less or equal to 1, otherwise the drive cannot find the final position of circular arc during circular motion.

Sqrt((X0-X1)*(X0-X1) + (Y0-Y1)*(Y0-Y1)) > 4, means this function cannot be used to make a whole circle, in order to make a whole circle, this function must be run twice consecutively.

The radius of any circle path should must be less than 134217727:

-134217728 =< X0,Y0,X1,Y1,Xc,Yc <= 134217727

Oval paths can be achieved by setting different GEA_NUM values for Drive 0 and Drive 1.

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