2

MEMOBUS/Modbus Communications

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2.1 MEMOBUS/Modbus Configuration

Yaskawa drives can be controlled with a PLC using the MEMOBUS/Modbus protocol to conduct serial communications.

MEMOBUS/Modbus communication can be configured using one master (PLC) and a maximum of 31 slaves. Serial communication between master and slave are normally started by the master and the slaves respond.

The master performs serial communications with only one slave at a time. The address or node for each slave must be set beforehand so that the master can perform serial communications using that address. A slave that receives a command from the master performs the specified function and sends a response back to the master.

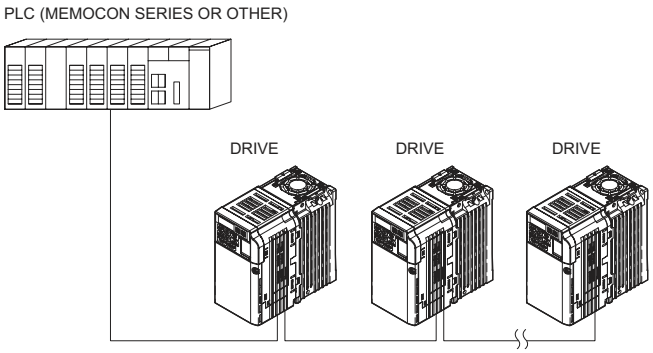


Figure 2.1 Connecting Multiple Drives to a PLC

2.2 Communication Specifications

MEMOBUS/Modbus specifications appear in the following table:

Item	Specifications	
Interface	RS-422, RS-485	
Communications Cycle	Asynchronous (Start-stop synchronization)	
Communication Parameters	Communication Speeds Available	12, 24, 48, 96, 192, 384, 576, 768, 1152 kbps
	Data length	8 bits (fixed)
	Parity	Select even, odd, or none.
	Stop bit	1 bit (fixed)
Protocol	MEMOBUS/Modbus (using RTU mode only)	
Max Number of Connections	31 drives (using RS-485)	

2.3 Communication Terminal Resistance

The MEMOBUS communication uses the following terminals: S+, S-, R+, and R-. Enable the terminating resistance by setting pin 1 of DIP switch S2 to the ON position.

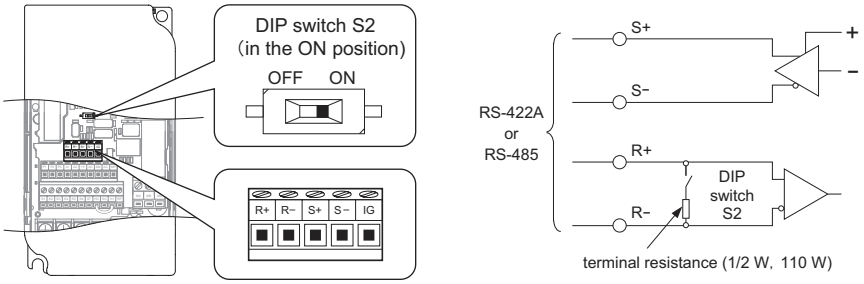


Figure 2.2 Serial Communications Terminal and DIP Switch S2

Note: Separate the communications cables from the main circuit cables and other wiring and power cables. Use shielded cables for the communications cables, and properly shielded clamps to prevent problems with noise. When using RS-485 communications, connect S+ to R+, and S- to R- as shown in the diagram below.

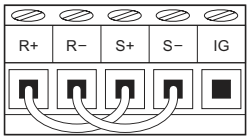


Figure 2.3 RS-485 Terminal Wiring

2.4 Connecting a PLC

Follow the instructions below to connect the drive to a PLC.

1. With the power shut off, connect the communications cable to the drive and PLC.
2. Switch the power on.
3. Set the parameters need for serial communications (H5-01 through H5-12) using the LED operator.
4. Shut the power off, waiting until the display on the LED operator goes out completely.
5. Turn the power back on.
6. The drive is now ready to begin communicating with the PLC.

Note: A timer should be set to watch how long it takes for the slave drive(s) to respond to the master. If no response is received with in a certain amount of time, the master should try resending the message.

2.5 MEMOBUS/Modbus Parameters

◆ MEMOBUS/Modbus Parameters

■ H5-01: Drive Node Address

This parameter tells the PLC what the node address is for the individual drive.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-01	Drive Node Address	Selects drive station node number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect.	0 to 20 H*	1F	425H

*If the address is set to 0, no response will be provided during communications.

For serial communciations to work, each individual slave drive must be assigned a unique node address. Setting H5-01 to any value besides 0 assigns the drive its address in the network. Slave address don't need to be assigned in sequential order, but each address needs to be unique so that no two drives have the same address. The power to the drive needs to be cycled after setting the address for the node address to take affect.

■ H5-02: Communication Speed Selection

■ H5-03: Communication Parity Selection

These parameters set the communication speed and the parity.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-02	Communication Speed Selection	Selects the baud rate for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps	0 to 8	3	426H

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-03	Communication Parity Selection	Selects the communication parity for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: No parity 1: Even parity 2: Odd parity	0 to 2	0	427H

Detailed Description

Parameters H5-02 and H5-03 should be set according to the network specifications run by the master controller. Because the power to the drive needs to be cycled in order for these parameter settings to take affect, the application will have to be stopped to change these settings.

■ H5-04: Stopping Method After Communication Error

Tells the drive how it should stop the motor when a communication error occurs.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-04	Stopping Method After Communication Error	0: Ramp to stop (decelerates according to C1-02) 1: Coast to stop 2: Fast-Stop 3: Alarm only	0 to 3	3	428H

■ H5-05: Communication Fault Detection Selection

Enables or disables the communications time-out fault (CE).

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-05	Communication Fault Detection Selection	0: Disabled - A communication loss will not cause a communication fault. 1: Enabled - If communication is lost for more than two seconds, a CE fault will occur.	0, 1	1	429H

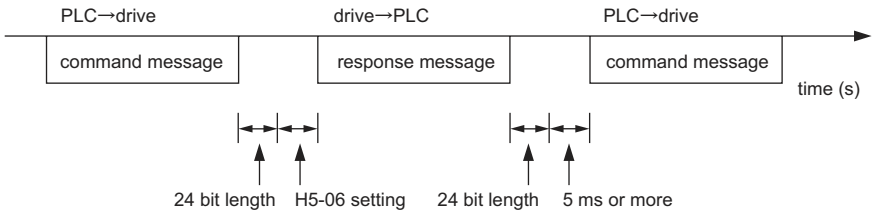
If H5-05 is set to 1, a fault will occur if the master controller does not receive a response from the drive after two seconds. The power to the drive needs to be cycled for the setting in H5-05 to take affect.

■ H5-06: Drive Transmit Wait Time

Sets how long the drive should wait to send a response after it receives data.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-06	Drive Transmit Wait Time	Set the delay time from when the drive receives data to when the drive sends data.	5 to 65	5 ms	42AH

Drive power needs to be cycled for the setting in H5-06 to take effect.



■ H5-07: RTS Control Selection

Enables ore disables RTS (“request-to-send”).

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-07	RTS Control Selection	0: Disabled - RTS is always on. 1: Enabled - RTS turns on only when sending.	0, 1	1	42BH

Disable when using RS-485, and enable this setting when using RS-422. Power to the drive needs to be cycled for any setting changes to take affect.

■ H5-09: CE Detection Time

Sets the time required to detect a communications error. Adjustment may be need when networking several drives.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-09	CE Detection Time	Sets the time required to detect a communications error. Adjustment may be need when networking several drives.	0.0 to 10.0 s	2.0 s	435H

■ H5-10: Unit Selection for MEMOBUS/Modbus Register 0025H

Selects the units used for MEMOBUS/Modbus registry 0025H (Output Voltage Reference Monitor).

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-10	Unit Selection for MEMOBUS/Modbus Register 0025H	0: 0.1 V units 1: 1 V units	0, 1	0	436H

■ H5-11: Communications ENTER Function Selection

Select the function for the enter command that saves parameter data to the drive.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-11	Communications ENTER Function Selection	0: Save parameter data that was edited to the drive when the enter command is given. 1: Parameter data that has been edited is saved when the enter command is given (compatible with the V7).	0, 1	1	43CH

■ H5-12: Run Command Method Selection

Determines how the Run command works when given via serial communications.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-12	Run Command Method Selection	0: FWD/STOP, REV/STOP Method 1: RUN/STOP, FWD/REV Method	0, 1	0	43DH

2.6 Related Parameters

The user can perform the following actions with MEMOBUS/Modbus communications regardless of how b1-01, b1-02, b1-15, and b1-16 are set.

- Observe drive operation from a PLC
- Reference and set parameters
- Reset faults
- Multi-function input commands

When commands are issued from the PLC to the multi-function input terminals S1 through S7, they become OR commands.

No.	Name	Description	Setting Range	Default	MEMOBUS Address	Page
b1-01	Frequency Reference Selection 1	Selects the frequency reference input source. 0: Operator 1: Terminals - Analog input terminal A1 (or terminal A2 based on parameter H3-09). 2: Serial Com 3: Option PCB 4: Pulse Input (Terminal RP)	0 to 4	1	180H	
b1-02	Run Command Selection 1	Selects the run command input source. 0: Operator - RUN and STOP keys on the operator. 1: Terminals - Contact closure on terminals S1 or S2. 2: Serial Com 3: Option PCB.	0 to 3	1	181H	
b1-15	Frequency Reference Selection 2	Selects the frequency reference input source. 0: Operator - Digital preset speed U1-01 or d1-01 to d1-17. 1: Terminals - Analog input terminal A1 (or terminal A2 based on parameter H3-09). 2: Serial Com 3: Option PCB 4: Pulse Input (Terminal RP)	0 to 4	0	1C4H	–
b1-16	Run Command Selection 2	Selects the run command input source. 0: Operator - RUN and STOP keys on the operator. 1: Terminals - Contact closure on terminals S1 or S2. 2: Serial Com 3: Option PCB	0 to 3	0	1C5H	–

2.7 Message Format

In MEMOBUS communications, the master sends commands to the slave, and the slave responds. The message format is configured for both sending and receiving as shown below, and the length of data packets depends on the command (function) content.

SLAVE ADDRESS
FUNCTION CODE
DATA
ERROR CHECK

Some space is required between messages as shown below:

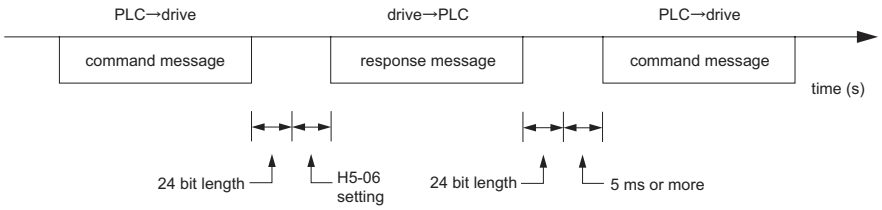


Figure 2.4 Space Between Messages

◆ Slave Address

Set the drive address between 0 and 20 in hexadecimal. If set to 0, commands from the master will be received by all slaves (the drive does not provide a response when a command has been broadcast to all slave devices).

◆ Function Code

The three types of function codes are shown in the table below.

Function Code (Hexadecimal)	Function Name	Command Message		Response Message	
		Minimum (bytes)	Maximum (bytes)	Minimum (bytes)	Maximum (bytes)
03H	Read memory contents	8	8	7	37
08H	Loopback test	8	8	8	8
10H	Write to multiple memory registers	11	41	8	8

◆ Data

Configure consecutive data by combining the memory register address (test code for a loopback address) and the data the register contains. The data length changes depending on the command details.

◆ Error Check

Errors during communication are detected using CRC-16 (cyclic redundancy check, checksum method). Calculations are performed in the following order:

1. Although the general default setting for CRC-16 calculations is 0, the default for the MEMOBUS/Modbus protocol should be set to -1 (i.e., all 16 bits equal 1).
2. Calculate CRC-16 with MSB for the final data as LSB, and the LSB for the slave address as MSB.
3. Be sure to also calculate CRC-16 relative to the response messages, and refer to that CRC-16 value in the response message.

2.8 Command/Response Message Format

Below are some examples of command and response messages.

◆ Reading Drive Memory Register Contents

The contents of the memory register are separated into higher 8 bits and lower 8 bits. A maximum of 16 drive memory registers can be read out at a time.

The following table shows message examples when reading status signals, error details, data link status, and frequency references from the slave 2 drive.

Command Message

Slave Address		02H
Function Code		03H
Starting No.	Upper	00H
	Lower	20H
Quantity	Upper	00H
	Lower	04H
CRC-16	Upper	45H
	Lower	F0H

Response Message (normal)

Slave Address		02H
Function Code		03H
Data Quantity		08H
1st storage register	Upper	00H
	Lower	65H
Next storage register	Upper	00H
	Lower	00H
Next storage register	Upper	00H
	Lower	00H
Next storage register	Upper	01H
	Lower	F4H
CRC-16	Upper	AFH
	Lower	82H

Response Message (fault)

Slave Address		02H
Function Code		83H
Error Code		03H
CRC-16	Upper	F1H
	Lower	31H

◆ Loop Back Test

The loopback test returns command messages directly as response messages without changing the contents to check the communications between the master and slave. User-defined test code and data values can be set.

The following table shows a message example when performing a loop back test with the slave 1 drive.

Command Message

Slave Address		01H
Function Code		08H
Test Code	Upper	00H
	Lower	00H
Data	Upper	A5H
	Lower	37H
CRC-16	Upper	DAH
	Lower	8DH

Response Message (normal)

Slave Address		01H
Function Code		08H
Test Code	Upper	00H
	Lower	00H
Data	Upper	A5H
	Lower	37H
CRC-16	Upper	DAH
	Lower	8DH

Response Message (fault)

Slave Address		01H
Function Code		89H
Error Code		01H
CRC-16	Upper	86H
	Lower	50H

◆ Writing to Multiple Registers

The writing of drive memory registers works similar to the reading process, i.e., the address of the first register that is to be written and the quantity of to be written registers must be set in the command message. The data to be written must be consecutive, starting from the specified address in the command message. The data order must be higher 8 bits, then lower 8 bits. The data must be in memory register address order.

The following table shows an example of a message where a forward operation has been set with a frequency reference of 60.0 Hz for the slave 1 drive.

Command Message

Slave Address		01H
Function Code		10H
Starting No.	Upper	00H
	Lower	01H
Quantity	Upper	00H
	Lower	02H

Response Message (normal)

Slave Address		01H
Function Code		10H
Starting No.	Upper	00H
	Lower	01H
Quantity	Upper	00H
	Lower	02H

Response Message (fault)

Slave Address		01H
Function Code		90H
Error Code		02H
CRC-16	Upper	CDH
	Lower	C1H

Data Quantity		04H
Starting Data	Upper	00H
	Lower	01H
Next Data	Upper	02H
	Lower	58H
CRC-16	Upper	63H
	Lower	39H

CRC-16	Upper	10H
	Lower	08H

Note: For the number of data value in the command message, take double the number of the data value.

2.9 MEMOBUS/Modbus Data Table

Table below lists all MEMOBUS/Modbus data. There are three types of data: command data, monitor data, and broadcast data.

◆ Command Data

It is possible to both read and write command data.

Note: Bits that are not used should be written as 0. Refrain from writing to reserved registers.

Register No.	Contents	
0000H	Reserved	
0001H	Operation Signals	
	bit 0	H5-12 = 0: Forward Run Command (0 = Stop, 1 = Run) H5-12 = 1: Run Command (0 = Stop, 1 = Forward Run)
	bit 1	H5-12 = 0: Reverse Run Command (0 = Stop, 1 = Run) H5-12 = 1: Forward/Reverse (0 = Stop, 1 = Reverse Run)
	bit 2	External Fault (EF0)
	bit 3	Fault Reset
	bit 4	Multi-Function Input Command 1 ComRef when set for Forward/Stop Note: If H1-01 = 40, then bit 4 becomes ComRef.
	bit 5	Multi-Function Input Command 2 ComCtrl when set for Reverse/Stop Note: If H1-02 = 42, then bit 5 becomes ComCtrl.
	bit 6	Multi-Function Input 3
	bit 7	Multi-Function Input 4
	bit 8	Multi-Function Input 5
	bit 9	Multi-Function Input 6
	bit A	Multi-Function Input 7
	bit B to bit F	Reserved
0002H	Frequency Reference	Varies by the setting units set to o1-03.
0003H	V/f Gain	
0004H-0005H	Reserved	
0006H	PID Target (0.01% signed)	
0007H	Analog Output 1 setting (10 V / 4000 H)	
0008H	Analog Output 2 setting (10 V / 4000 H)	

Register No.	Contents	
0009H	Settings for Multi-Function Digital Outputs	
	bit 0	Contact Output (terminal MA/MB-MC)
	bit 1	Photocoupler Output 1 (terminal P1-PC)
	bit 2	Photocoupler Output 2 (terminal P2-PC)
	bit 3 to bit 5	Reserved
	bit 6	Fault Contact Output Enabled (1 = enabled by bit 7)
	bit 7	Fault contact (terminal MA/MB-MC)
	bit 8 to bit F	Reserved
000AH	PO Output	1/1 Hz Setting Range: 0 to 32000
000BH-000EH	Reserved	
000FH	Control Selection Setting	
	bit 0	Reserved
	bit 1	PID Target Input
	bit 2 to bit B	Reserved
	bit C	Broadcast Data Terminal S5 Input
	bit D	Broadcast Data Terminal S6 Input
	bit E	Broadcast Data Terminal S7 Input
	bit F	Reserved

◆ Monitor Data

Monitor data is read only.

Register No.	Contents	
0020H	Drive Status	
	bit 0	During Run
	bit 1	During Reverse
	bit 2	Drive Ready
	bit 3	Fault
	bit 4	Data Setting Error
	bit 5	Multi-Function Contact Output (terminal MA/MB-MC)
	bit 6	Multi-Function Photocoupler Output 1 (terminal P1 - PC)
	bit 7	Multi-Function Photocoupler Output 2 (terminal P2 - PC)
	bit 8 to bit D	Reserved
	bit E	ComRef status
	bit F	ComCtrl status

2.9 MEMOBUS/Modbus Data Table

Register No.	Contents	
0021H	Fault Contents 1	
	bit 0	oC, GF: Overcurrent or Ground Fault
	bit 1	oV: DC Bus Overvoltage
	bit 2	oL2: Drive Overload
	bit 3	oH1, oH2: Overheat Fault
	bit 4	rH, rr: Braking Resistor Fault
	bit 5	Reserved
	bit 6	FbL, FbH: PID Feedback Fault
	bit 7	EF0 to 7: External Fault
	bit 8	CPF□□: Hardware Fault (includes OFx)
	bit 9	oL1, oL3, oL4, UL3, UL4: Motor Overload/Overtorque 1 or 2, Undertorque 1 or 2
	bit A	PGo, oS, dEv: PG Disconnect, Overspeed, Speed Deviation
	bit B	Uv1: DC Bus Undervoltage
	bit C	Uv1, Uv2, Uv3: DC Bus Undervoltage, Control Power Supply Fault, Inrush Prevention Circuit Fault
	bit D	PF, LF: Input/Output Phase Loss
	bit E	CE, bUS: Communication Loss
	bit F	oPr: Operator Disconnected
0022H	Data Link Status	
	bit 0	Writing Data
	bit 1	Reserved
	bit 2	Reserved
	bit 3	Upper/Lower Limit Error
	bit 4	Data Integrity Error
	bit 5	Writing to EEPROM
	bit 6 to bit F	Reserved
0023H	Frequency Reference (U1-01)	
0024H	Output Frequency (U1-02)	
0025H	Output Voltage Reference (U1-06), units: 1/0.1 V Note: Switch between setting units using parameter H5-10.	
0026H	Output Current (U1-03), units: 10/1 A	
0027H	Output Power (U1-08)	
0028H	Torque Reference (U1-09)	

Register No.	Contents	
0029H	Fault Contents 2	
	bit 0	SC: Load Short Circuit
	bit 1	GF: Ground Fault
	bit 2	PF: DC Bus Voltage Fault
	bit 3	LF: Output Phase Loss
	bit 4	rH: Braking Resistor Overheat
	bit 5 to bit F	Reserved
002AH	Alarm Contents1	
	bit 0 to bit 1	Reserved
	bit 2	EF: Simultaneous Forward and Reverse Run Commands
	bit 3	bb: Drive Baseblock
	bit 4	oL3: Overtorque 1
	bit 5	oH: Heatsink Overheat
	bit 6	oV: DC Bus Overvoltage
	bit 7	Uv: DC Bus Undervoltage
	bit 8	Reserved
	bit 9	CE: Communications Error
	bit A	bUS: Option Error
	bit B	UL3: Undertorque 1
	bit C	oH2: Drive Overheat Prealarm
	bit D	FbL, FbH: PID Feeback Alarm
	bit E	Reserved
	bit F	CALL: Waiting for Communications
002BH	Input Terminal Status (U1-10)	
	bit 0	Terminal S1 Closed
	bit 1	Terminal S2 Closed
	bit 2	Terminal S3 Closed
	bit 3	Terminal S4 Closed
	bit 4	Terminal S5 Closed
	bit 5	Terminal S6 Closed
	bit 6	Terminal S7 Closed
	bit 7 to bit F	Reserved

2.9 MEMOBUS/Modbus Data Table

Register No.	Contents	
002CH	Drive Status 2	
	bit 0	During Run
	bit 1	Zero Speed
	bit 2	Speed Agree
	bit 3	User Speed Agree
	bit 4	Frequency Detection 1
	bit 5	Frequency Detection 2
	bit 6	Drive Ready
	bit 7	During Undervoltage
	bit 8	During Baseblock
	bit 9	Frequency Reference from Operator Keypad
	bit A	Run Command from Operator Keypad
	bit B	Over/Undertorque 1, 2
	bit C	Frequency Reference Loss
	bit D	During Fault Restart
	bit E	Fault
	bit F	Communication Timeout
002DH	Output Terminal Status (U1-11)	
	bit 0	Multi-Function Contact Output (terminal MA/MB-MC)
	bit 1	Multi-Function Photocoupler Output 1 (terminal P1 - PC)
	bit 2	Multi-Function Photocoupler Output 2 (terminal P2 - PC)
	bit 3 - 6	Reserved
	bit 7	Fault Contact (terminal MA/MB-MC)
	bit 8 to bit F	Reserved
002EH	Reserved	
002FH	Frequency Reference Bias (UP2, DOWN2) 1000/100%	
0030H	Reserved	
0031H	DC Bus Voltage (U1-07)	
0032H	Torque Monitor (units: 1/1%)	
0033H	Reserved	
0034H	Product Code 1 [ASCII] V O	
0035H	Product Code 2 [ASCII] A O	
0036H	Reserved	
0037H	Reserved	
0038H	PID Feedback (100% / max. output frequency; 1/0.1% resolution; not signed)	
0039H	PID Input (100% / max. output frequency; 1/0.1% resolution; signed)	
003AH	PID Output (100% / max. output frequency; 1/0.1% resolution; signed)	

Register No.	Contents	
003B to 003CH	Reserved	
003DH	Communications Error Contents*	
	bit 0	CRC Error
	bit 1	Data Length Error
	bit 2	Reserved
	bit 3	Parity Error
	bit 4	Overrun Error
	bit 5	Framing Error
	bit 6	Timeout
	bit 7 to bit F	Reserved
003EH	Output Frequency	Revolutions per Minute
003FH	Output Frequency	0.01% Units

*The contents of a communication error are saved until fault is reset.

◆ Broadcast Messages

Data can be written from the controller to all slave devices at the same time.

The slave address in a broadcast command message must be set to 00H. All slaves will receive the message, but will not respond.

Register No.	Contents	
0001H	Digital Input Command	
	bit 0	Forward Run (0: Stop 1: Run)
	bit 1	Direction Command (0: Forward, 1: Reverse)
	bit 2, 3	Reserved
	bit 4	External Fault (set by H1-01)
	bit 5	Fault Reset (set by H1-02)
	bit 6 to bit B	Reserved
	bit C	Multi-Function Contact Input S5
	bit D	Multi-Function Contact Input S6
	bit E	Multi-Function Contact Input S7
	bit F	Reserved
0002H	Frequency Reference	30000/100%

Note: See the following page for information on Enter Command Data (0900H, 0910H).

2.10 Enter Command

When writing parameters to the drive from the PLC using MEMOBUS/Modbus communication, the parameters are temporarily stored in the parameter data area of the drive. To enable these parameters in the parameter data area, the Enter command must be used.

There are two types of Enter commands: Enter commands that enable parameter data in RAM only (changes are lost when the drive is shut off), and Enter commands that write data into the EEPROM (non-volatile memory) of the drive and enable the data in RAM at the same time.

The following table shows the Enter command data. The Enter command is enabled by writing 0 to register number 0900H or 0910H.

Register No.	Description
0900H	Saves parameter data to EEPROM
0910H	Updates parameter data to RAM without saving to EEPROM

Note: Because the EEPROM can be written to a maximum of 100,000 times, refrain from writing to the EEPROM too often. The ENTER command registers are write-only. Consequently, if these registers are read, then the register address will be invalid (Error code: 02H). An ENTER command is not required if reference or broadcast data are sent to the drive.

◆ ENTER Command Settings when Upgrading the Drive

To transfer parameter settings from an earlier Yaskawa model drive to V1000, parameter H5-11 needs to be set in accordance with how the Enter command functions in the older drive.

If upgrading from a G7 or F7 series drive to V1000, set parameter H5-11 to 0.

If upgrading from a V7 series drive to V1000, set parameter H5-11 to 1.

No.	Name	Description	Setting	Default	Control Mode			Addr. Hex
					VF	OLV	PM	
H5-11	Communications ENTER Function Selection	Select the function for the enter command that saves parameter data to the drive. 0: Save parameter data that was edited to the drive when the enter command is given. 1: Parameter data that has been edited is saved when the enter command is given (compatible with the V7).	0.1	1	□	□	□	43CH

Note: Option cards are designed for a specific model, and are not compatible between drives.

■ H5-11 and the Enter Command

H5-11 Settings	H5-11 = 0	H5-11 = 1
Drive being replaced	G7, F7	V7
How parameter settings are enabled	When the ENTER key is pressed	As soon as the value is changed
Upper/Lower limit check	Determined by related parameters	Single upper/lower limit
Default value of related parameters	Not affected	Determines the default values of related parameters
Error when setting multiple parameters	Data is accepted even if one setting is invalid	Error occurs if one setting is invalid
Operation when saving several parameter settings at once	Allows all valid settings to be saved	No data is written if a single piece of data is invalid

2.11 Error Codes

A list of MEMOBUS/Modbus errors appears below.

When an error occurs, remove whatever it was that caused the error and restart communications.

Error Code	Error Name Cause
01H	Function Code Error
	• Attempted to set a function code from a PLC other than 03H, 08H, and 10H.
02H	Register Number Error
	• None of the register numbers exist. • Attempted to send a broadcast message that did not start with 0001H or 0002H.
03H	Bit Count Error
	• Read data or write data is greater than 16 bits. • While the number of bits in the write data message is not ???
21H	Data Setting Error
	• Control data or parameter write data is outside the allowable setting range. • Attempted to write a contradictory parameter setting.
22H	Write Mode Error
	• Attempted to write while the drive was operating to a parameter that cannot be written to during run. • During an EEPROM data error (CPF06), the PLC attempted to write to a parameter other than A1-00 to -05, E1-03, or o2-04. • Attempted to write to read-only data.
23H	DC Bus Undervoltage Write Error
	• Attempted to write from the PLC during an undervoltage fault (Uv1). • Attempted to execute and Enter command from the PLC during Uv1.
24H	Write Error During Parameter Process
	• PLC attempted writing to the drive while the drive was processing parameter data.

2.12 Slave Not Responding

In the following situations the slave drive will ignore the command message sent from the master, and not send a response message:

- When a communications error (overrun, framing, parity or CRC-16) is detected in the command message.
- When the slave address in the command message and the slave address in the drive do not match (remember to set the slave address for the drive using H5-01).
- When the gap between two blocks (8 bit) of a message exceeds 24 bits.
- When the command message data length is invalid.

Note: If the slave address specified in the command message is 00H, all slaves execute the write function, but do not return response messages to the master.

◆ Application Notes

Set the time that the master device should wait for the slave to respond after a command message has been sent. If a response is not received within the specified time, the message can be sent again.

2.13 Self-Diagnostics

The drive has a built-in self-diagnosing function of the serial communication interface circuits. To perform the self-diagnosis function use the following procedure.

1. Turn on the power to the drive.
2. Set terminal S7 for the communications test mode (H1-07 = 67).
3. Turn off the power to the drive.
4. With the power off, wire the drive as shown in the illustration below.

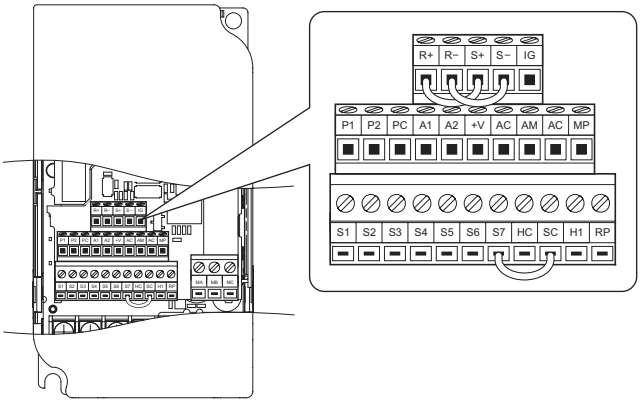


Figure 2.5 Terminal Connections for Communication Self-Diagnostics

5. The last slave in the series should have DIP switch 2 placed to the ON position in order to enable terminal resistance.
6. Turn the power to the drive back on.
   The DIP switch setting takes affect after the drive is turned on again.

During normal operation, the drive will display PASS. This indicates that the communications test mode is operating normally.
When a fault occurs, the drive will display CE on the keypad screen. Once the output contact closes, the “Drive Ready” signal will open.