

<b>APPLICATION NOTE</b>	<b>FECA-AN-183</b>
<b>FRENIC-Ace Modbus Communications</b>	

<b>Inverter type</b>	FRENIC-Ace
<b>Software version</b>	All
<b>Required options</b>	None
<b>Related documentation</b>	FRENIC-Ace User's Manual, RS-485 User's Manual

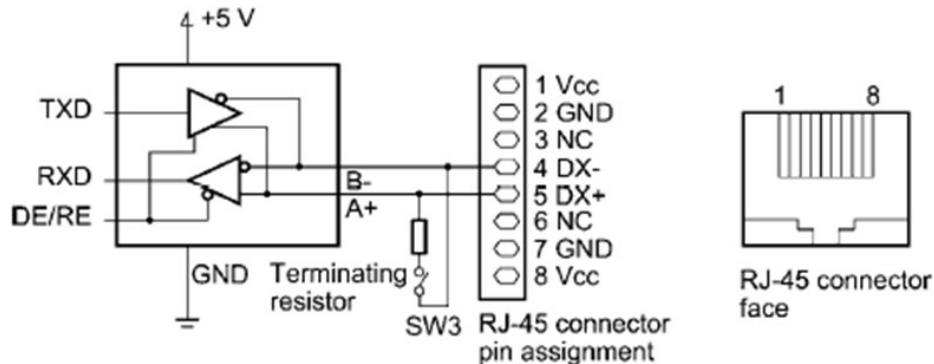
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<b>Revision</b>	None

### Introduction

The Modbus communications protocol was designed specifically for industrial applications and is one of the most widely used standards in the industry. The FRENIC-Ace supports Modbus RTU serial communications as a standard feature via the RS485 ports. The Ace is also capable of Modbus over Ethernet via the OPC-PRT option card. This document will focus primarily on RS485 Modbus RTU communications, but much of the information applies to both.

### Connection

It is possible to utilize either the RJ45 connector (port 1) on the front of the drive, or the DX+/DX- terminals (port 2) for Modbus communications. Wiring to the DX+/DX- terminals is recommended as the RJ45 jack is typically reserved for keypad use.



### Configuration

In order to enable Modbus RTU communications you will need to configure the relevant function codes on the drive. The critical function codes are H30 (command source,) y20 (or y10) (protocol selection,) and function codes y11 through y16 (or y01 through y06) (RS485 settings.)

### Command Source Setting (H30)

Function code H30 determines the source of the run and frequency commands. If you only need to monitor the drive via Modbus, you can leave H30 at the default setting of 0. If you wish to operate the drive via Modbus RTU you will need to choose the appropriate H30 setting:

H30 Setting	Frequency Command	Run Command
0	F01/C30	F02
1	RS-485 (Port 1)	F02
2	F01/C30	RS-485 (Port 1)
3	RS-485 (Port 1)	RS-485 (Port 1)
4	RS-485 (Port 2)	F02
5	RS-485 (Port 2)	RS-485 (Port 1)
6	F01/C30	RS-485 (Port 2)
7	RS-485 (Port 1)	RS-485 (Port 2)
8	RS-485 (Port 2)	RS-485 (Port 2)

**Communication Settings (y codes)**

<b>Function Code</b>	<b>Name</b>	<b>Setting Range</b>	<b>Default Setting</b>
y01/y11	Station Address	0 - 255	1
y04/y14	Baud Rate	0: 2400bps 1: 4800bps 2: 9600bps 3: 19200bps 4: 38400bps	3
y05/y15	Data Length	0: 8bit 1: 7bit	0
y06/y16	Parity Check	0: None (2 stop bits) 1: Even Parity (1 stop bit) 2: Odd Parity (1 stop bit) 3: None (1 stop bit)	0
y10/y20	Protocol Selection	<b>0: Modbus RTU</b> 1: FRENIC-Loader 2: Fuji General Purpose	1/0

**Modbus Function Codes**

Modbus “function codes” should not be confused with the drive function code settings. A Modbus function code (FC) is a command sent by the Modbus master. The FRENIC-Ace supports the following Modbus FCs:

- 1: Read Coil Status (80 coils maximum)
- 3: Read Holding Registers (100 registers maximum)
- 5: Force Single Coil
- 6: Preset Single Register
- 8: Diagnostics
- 15: Force Multiple Coils (16 coils maximum)
- 16: Preset Multiple Registers (100 registers maximum)

**Modbus Registers**

The Modbus registers are organized by drive function code group. The hi-byte of the register address is determined by its function code group as shown in the table below; the low byte is determined by the drive function code number.

Group	Hi-byte	Group	Hi-byte	Group	Hi-byte
F	00h	r	0Ah	W	0Fh
E	01h	S	07h	X	10h
C	02h	o	06h	Z	11h
P	03h	M	08h		
H	04h	J	0Dh		
A	05h	d	13h		
B	12h	y	0Eh		

**Modbus Registers (Example)**

Chapter 5 of the RS485 User’s Manual lists all available function codes by function. The S group (command) and M group (monitor) are of particular interest. Function code S05 (frequency reference), for example, allows you to set the reference frequency of the drive. Referencing the chart above, we can see that the hi-byte of the S group is 07h. The low-byte is 05 (decimal,) or 05h (hexadecimal.) This results in a holding register address of 0705h or 1797 decimal. Writing to this address allows us to set the drives reference frequency.

### Data Format

Chapter 5.2 of the RS485 User’s Manual describes the data formats used for the function code data. We can see that S05 from the previous example has a data format of 22 (positive decimal, resolution 0.01Hz). Writing 3000 to register S05 would result in setting the reference frequency to 30.00Hz.

### Data Format (Example)

Function code S06 (operation command) allows us to command the drive to run and/or activate the x terminal functions. Referencing chapter 5.2 of the RS485 User’s Manual, we can see that S06 has a data format number of 14. The individual bits of this register each control a discrete binary function as shown in the table below.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RST	XR	XF	-	EN	X9	X8	X7	X6	X5	X4	X3	X2	X1	REV	FWD
Alarm Reset	General Purpose Input	Not Used		EN	General-purpose Input								Run Command		

(Data Format 14)

Referencing this table, we can see that bit 3 controls the X2 function. In order to activate the assigned X2 function you would write 0000 0000 0000 1000 (binary) to S06 (holding register 0706h.)

*Note: the drive must be configured to receive an operation command via RS485 (by setting H30 appropriately) in order to operate via S06 commands.*

### Additional Resources

The RS485 Communications Manual is full of valuable reference material including function code listings and data format descriptions. The FRENIC-Ace User’s Manual contains an overview of RS485 communications as well as detailed function code descriptions. Additionally, there is a Modbus register cross reference available from Fuji Electric that allows you to quickly convert function codes to Modbus register addresses and determine their data format.