



# TRANSISTORIZED INVERTER

-INSTRUCTION MANUAL-

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Modbus Plus COMMUNICATION OPTION

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# FR-A5NM



Thank you for choosing the Mitsubishi transistorized inverter option unit. This instruction manual gives handling information and precautions for use of this equipment. Incorrect handling might cause an unexpected fault. Before using the equipment, please read this manual carefully to use the equipment to its optimum.

### **This section is specifically about safety matters**

Do not attempt to install, operate, maintain or inspect this product until you have read through this instruction manual and appended documents carefully and can use the equipment correctly. Do not use this product until you have a full knowledge of the equipment, safety information and instructions.

In this instruction manual, the safety instruction levels are classified into "WARNING" and "CAUTION".



#### **WARNING**

Assumes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.



#### **CAUTION**

Assumes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.

Note that the CAUTION level may lead to a serious consequence according to conditions. Please follow the instructions of both levels because they are important to personnel safety.

## **SAFETY INSTRUCTIONS**

### **1. Electric Shock Prevention**



#### **WARNING**

- While power is on or when the inverter is running, do not open the front cover. You may get an electric shock.
- Do not run the inverter with the front cover removed. Otherwise, you may access the exposed high-voltage terminals and charging part and get an electric shock.
- If power is off, do not remove the front cover except for wiring or periodic inspection. You may access the charged inverter circuits and get an electric shock.
- Before starting wiring or inspection, switch power off, wait for more than 10 minutes, and check for no residual voltage with a tester or the like.



#### **WARNING**

- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Always install the option unit before wiring. Otherwise, you may get an electric shock or be injured.
- Handle this option unit with dry hands to prevent an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise, you may get an electric shock.
- While power is on, do not move the station number and baud rate setting switches. Doing so can cause an electric shock.

## 2. Injury Prevention



### CAUTION

- Apply only the voltage specified in the instruction manual to each terminal to prevent burst, damage, etc.
- Ensure that the cables are connected to the correct terminals. Otherwise, burst, damage, etc. may occur.
- Always make sure that polarity is correct to prevent burst, damage, etc.
- While power is on or for some time after power-off, do not touch the inverter as it is hot and you may get burnt.

## 3. Additional instructions

Also note the following points to prevent an accidental failure, injury, electric shock, etc.:

### (1) Transportation and mounting



### CAUTION

- Do not install or operate the option unit if it is damaged or has parts missing.
- Do not stand or rest heavy objects on the product.
- Check that the mounting orientation is correct.
- Prevent screws, metal fragments or other conductive bodies or oil or other flammable substance from entering the inverter.

### (2) Test operation and adjustment



### CAUTION

- Before starting operation, confirm and adjust the parameters. A failure to do so may cause some machines to make unexpected motions.

### (3) Usage



### WARNING

- Do not modify the equipment.



### CAUTION

- When parameter clear or all parameter clear is performed, each parameter returns to the factory setting. Re-set the required parameters before starting operation.
- For prevention of damage due to static electricity, touch nearby metal before touching this product to eliminate static electricity from your body.

### (4) Maintenance, inspection and parts replacement



### CAUTION

- Do not test the equipment with a megger (measure insulation resistance).

### (5) Disposal



### CAUTION

- Treat as industrial waste.

### (6) General instruction

All illustrations given in this manual may have been drawn with covers or safety guards removed to provide in-depth description. Before starting operation of the product, always return the covers and guards into original positions as specified and operate the equipment in accordance with the manual.

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# 1. INTRODUCTION

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## 1.1 General

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Thank you for choosing this option unit for the Mitsubishi FR-A500(L)/F500(L) series transistorized inverters.

Please read this manual carefully before using this option unit. This instruction manual gives handling information and precautions for use of this product as well as the information required for the transmission of data to and from the inverter via a Modbus Plus network.

It is assumed that the reader of this manual possesses an understanding of the configuration, implementation, and operation of Modbus Plus networks. For details on the Modbus Plus network protocol and/or Modbus Plus network configuration and installation, please refer to the applicable specifications as published by Schneider Automation.

Please forward this manual to the end user.

### Modbus Plus Communications Option Unit (FR-A5NM)

This option unit lets you connect a FR-A500(L) series inverter to a network adhering to the Modbus Plus communications protocol.

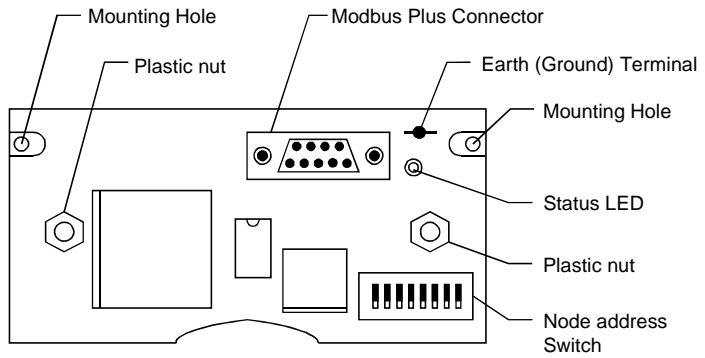
Some important features of this option unit include:

- Data rate of 1 M bps
- Support for up to 32 nodes without a repeater (64 nodes with a repeater) on a single network
- Network access to all inverter parameters
- Passed Modicon Conformance Test in March, 1999

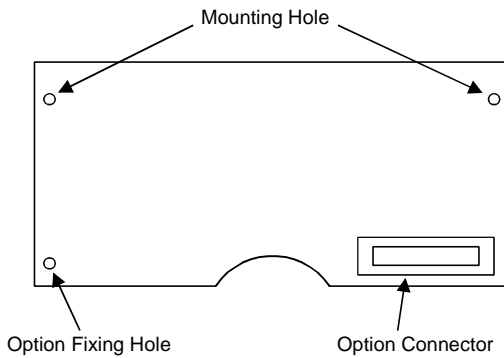
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**1.2 Structure**

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**Figure 1: Top view**



**Figure 2: Bottom view**



### **Diagnostic LED Status Indicator**

The green LED located next to the address DIP switch on the Modbus Plus option top board provides indication of communication status. The LED on the bottom board will be solid green if the option CPU acts correctly.

The following describes the LED on the top board definitions.

<b>Green</b>	<b>State of system</b>
Flash every 160ms	Node is working normally. It is successfully receiving and passing the network token.
Flash every 1s	Node is in the MONITOR_OFFLINE state. It monitors the network link every 5 seconds but is not transmitting.
2 flashes, off 2s	Node is in MAC_IDLE state. This node may have a bad transmitter.
3 flashes, off 1.7s	Node is not receiving tokens. This indicates that this node is the only active node on the network or the receiver is bad.
4 flashes, off 1.4s	Duplicate node address seen.

**Table 1**

## 2. INSTALLATION


Remove the drive cover following the inverter instruction manual and install the option unit using the following procedure:

### 2.1 Pre-Installation Checks

- (1) Check the inverter type.  
You may use the option unit only with a FR-A500(L)/F500(L) series inverter. You must not use it with any other series (e.g. A200E, A200, A100, Z and F series). These other series inverters have a different option connector to prevent installation; if you force the connector, you may damage the inverter as well as the option unit.
- (2) Make sure the inverter line power is off.  
You may damage the option unit if you install it with the line power connected.

### Mounting Procedure

#### CAUTION

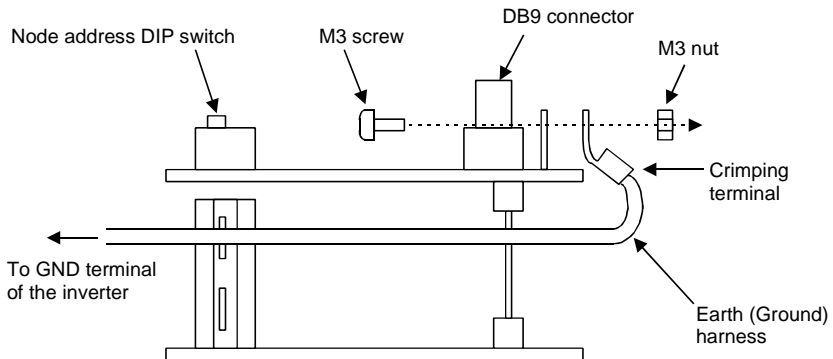
 **HAZARDOUS VOLTAGE PRESENT**  
**Always isolate power from the inverter and wait 10 minutes until the bus charge light is off to ensure the charge lamp has gone out before inserting or removing this option unit or touching the terminals.**

- (3) Insert this option unit into the inverter's **OPTION PORT# 3** only.
- (4) Carefully insert the connector of the option unit into the connector of the inverter. Use the two mounting holes and the guide hole to align the bottom board with the matching machine screw inserts and the plastic guide pin on the inverter. Make sure that the inverter option is firmly seated in the inverter and the connector is fully plugged in.  
Also be sure to fit the unit into the option fixing hook (It is available in Aug., 2000).

#### REMARKS

When you insert the option unit to the inverter, please push down the plastic nuts on the top-board. (Please refer to Figure 1)

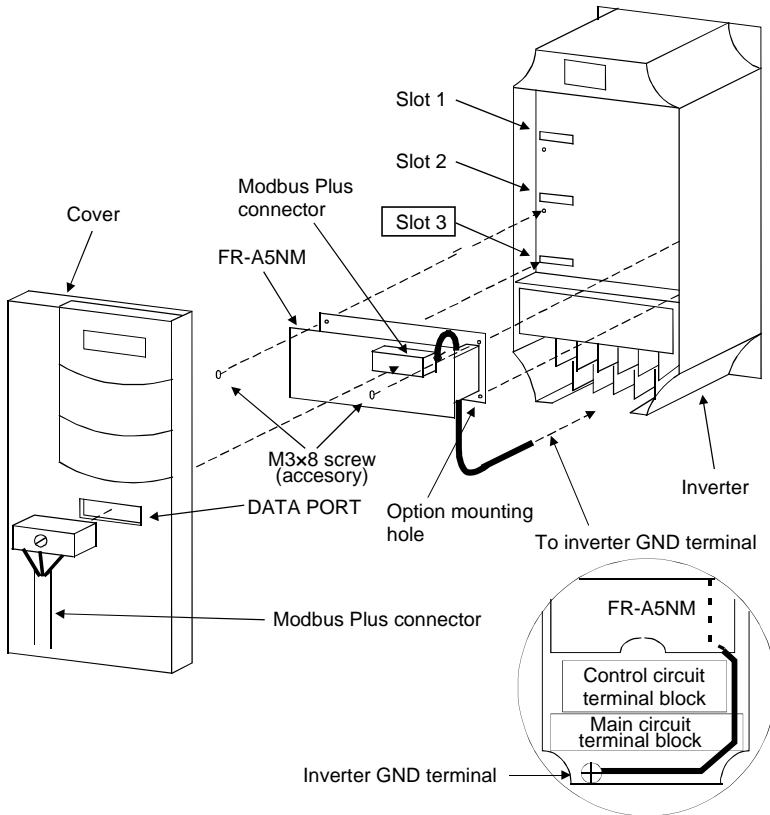
- (5) Secure the option unit to the inverter with two mounting screws. If the screw holes in the option unit do not line up with the inverter mounting holes, check that the connectors have been fitted correctly.
- (6) To ensure proper Network Grounding, connect a harness (NOT Supplied) from FR-A5NM Ground terminal to inverter Ground terminal. For ease of routing, the harness should be passed between the Top and Bottom board. (Refer to the following diagram.)  
Recommended crimping terminal : 1.25-3  
Recommended Ground harness size : 16AWG  
Torque to 0.4 - 0.7Nm



**Figure 3 : Earth (Ground) harness connection**

## **INSTALLATION**

- (7) Set the node address before replacing the cover onto the inverter.  
(Refer to page 7 for node address setting.)
- (8) Next remove the option data port insert from the inverter cover. Then replace the inverter cover, while making sure that the Modbus Plus connector is aligned with the option data port window. Connect the Modbus Plus cable to the inverter by plugging DB9-style male connector into DB9-style female connector of the option unit, which should be visible in the option port window.
- (9) Please consult and adhere to standard Modbus Plus documentation and specifications on the wiring and installation of Modbus Plus network hardware, as provided by Schneider Automation.



**Figure 4 : Installation**

## 2.2 Node address setting

- (1) Make sure that the inverter power is off and the option unit is mounted in the inverter. Connect the Modbus Plus cable you created to the network.
- (2) When setting the Modbus Plus address on the option board, use the following table. Refer to page 2 for the address switch location.

### REMARKS

A switch setting of 1 indicates the On position, and a switch setting of 0 indicates the Off position.

**Table 2 : Node address setting**

Decimal Address	Switch Positions							
	1	2	3	4	5	6	7	8
3	1	0	1	1	1	1	1	1
4	0	0	1	1	1	1	1	1
5	1	1	0	1	1	1	1	1
6	0	1	0	1	1	1	1	1
7	1	0	0	1	1	1	1	1
8	0	0	0	1	1	1	1	1
9	1	1	1	0	1	1	1	1
10	0	1	1	0	1	1	1	1
11	1	0	1	0	1	1	1	1
12	0	0	1	0	1	1	1	1
13	1	1	0	0	1	1	1	1
14	0	1	0	0	1	1	1	1
15	1	0	0	0	1	1	1	1
16	0	0	0	0	1	1	1	1
17	1	1	1	1	0	1	1	1
18	0	1	1	1	0	1	1	1
19	1	0	1	1	0	1	1	1
20	0	0	1	1	0	1	1	1
21	1	1	0	1	0	1	1	1
22	0	1	0	1	0	1	1	1
23	1	0	0	1	0	1	1	1
24	0	0	0	1	0	1	1	1
25	1	1	1	0	0	1	1	1
26	0	1	1	0	0	1	1	1
27	1	0	1	0	0	1	1	1

# INSTALLATION

Decimal Address	Switch Positions							
	1	2	3	4	5	6	7	8
28	0	0	1	0	0	1	1	1
29	1	1	0	0	0	1	1	1
30	0	1	0	0	0	1	1	1
31	1	0	0	0	0	1	1	1
32	0	0	0	0	0	1	1	1
33	1	1	1	1	1	0	1	1
34	0	1	1	1	1	0	1	1
35	1	0	1	1	1	0	1	1
36	0	0	1	1	1	0	1	1
37	1	1	0	1	1	0	1	1
38	0	1	0	1	1	0	1	1
39	1	0	0	1	1	0	1	1
40	0	0	0	1	1	0	1	1
41	1	1	1	0	1	0	1	1
42	0	1	1	0	1	0	1	1
43	1	0	1	0	1	0	1	1
44	0	0	1	0	1	0	1	1
45	1	1	0	0	1	0	1	1
46	0	1	0	0	1	0	1	1
47	1	0	0	0	1	0	1	1
48	0	0	0	0	1	0	1	1
49	1	1	1	1	0	0	1	1
50	0	1	1	1	0	0	1	1
51	1	0	1	1	0	0	1	1
52	0	0	1	1	0	0	1	1
53	1	1	0	1	0	0	1	1
54	0	1	0	1	0	0	1	1
55	1	0	0	1	0	0	1	1
56	0	0	0	1	0	0	1	1
57	1	1	1	0	0	0	1	1
58	0	1	1	0	0	0	1	1
59	1	0	1	0	0	0	1	1
60	0	0	1	0	0	0	1	1
61	1	1	0	0	0	0	1	1
62	0	1	0	0	0	0	1	1
63	1	0	0	0	0	0	1	1

**Alternate method for setting the switch:**

- i. To set the node address to be nn, first subtract 1 from it.
- ii. Convert the result (nn-1) into hexadecimal XXh.
- iii. Then span it into binary format, padding with 0's in the front 00fedcba.
- iv. Finally, take the complement 11nmlkji, if a bit is 0, set the switch to Off position; if a bit is 1, set the switch to On position.

**REMARKS**

The first two leading position switches are not used.

For example, to set the node address to 30, do the following:

- a. Convert the result  $29=30-1$  into 1Dh
- b. Span into 8-bit format 00011101
- c. Take the complement 11100010
- d. Set 8 positions according to c



**Figure 5 : Node address switch**

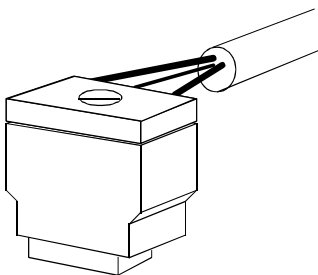
### **2.3 Communication cable**

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When making a cable for the Modbus Plus protocol, make sure that each end of the cable is terminated with the A5MBKT185 terminator connectors. For nodes between the termination points, use the in-line connectors (A5MBKT085). The cable should be a Modbus Plus standard cable (490NAA271xxF).

Connect a wire from the ground terminal on the FR-A5NM to the inverter Chassis to ensure proper grounding of the option board.  
Makers of DB9 connectors, Schneider Automation:

- End Connector Part#: AS-MBKT-185 (light gray)
- Inline Connector Part#: AS-MBKT-085 (dark gray)



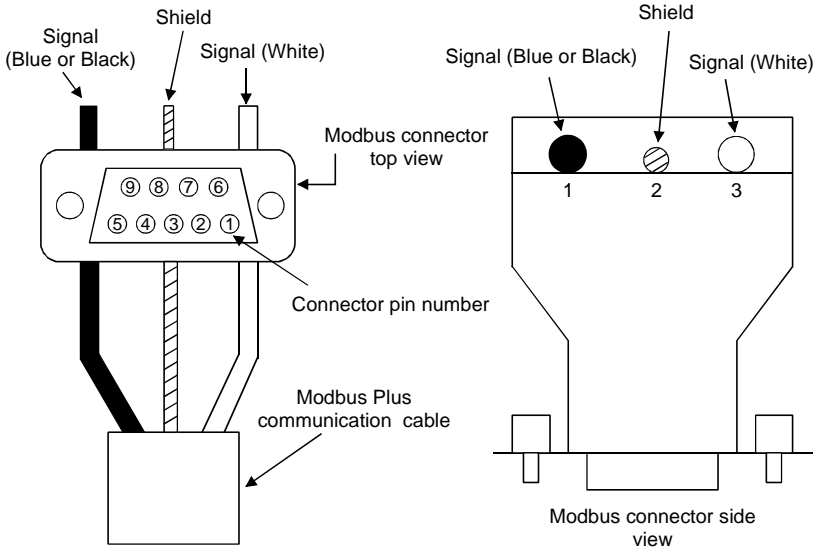
**Figure 6 : Modbus connector**



Please connect Modbus connector and the communication cable following the table.

Connector pin number	Communication cable
1 (Signal)	Signal (Blue or Black)
2 (Shield)	Shield
3 (Signal)	Signal (White)

(\* ) Another connector pins are not used



**Figure 7 : Communication cable connection**

## 3. OPERATION

The operation of the inverter changes slightly when you install this option unit, as described below.

### 3.1 Operating Modes

In the PU operating mode, a Parameter Unit (PU) controls the inverter. In the External-operating mode, the inverter is controlled by external signals connected to the inverter's terminal block. In the Network (computer link) operating mode, the inverter is controlled by commands from a Modbus Plus master.

### 3.2 Selecting the Operating Mode

The following conditions must also be met before you can change the operating mode:

- The inverter is stopped.
- The forward and reverse commands are off.

The following table describes the actions required to change the operating mode.

Mode Change	Action Required
Ext Operation → PU Operation	Select the PU operation mode from the operation panel or press PU key on the parameter unit.
PU Operation → Ext Operation	Select the EXT operation mode from the operation panel or press EXT key on the parameter unit.
Ext Operation → Net Operation	Modbus Plus master writes a 0014h to Register 40010.
Net Operation → Ext Operation	Modbus Plus master writes a 0010h to Register 40010.

For all other mode changes, please refer to the *Inverter Instruction Manual*.

Pr. 340 allows you to select the Network operating mode on power-up and after a drive reset. Once the Network operating mode is initiated, there must be Modbus Plus activity at least once every 3 seconds. If the option unit does not sense valid Modbus Plus activity for 3 seconds or more, the inverter performs an option module alarm stop (E.OP3), and you must reset the inverter to clear this fault.

### 3.3 Functions Available in the Operating Modes

The functions available to the drive depend on the operating mode.

The following table indicates the command types available according to the operating mode.

Control Type	Command Type	Net	Ext	PU
Modbus Plus	Operating Command	Yes(*1)	No	No
	Output Frequency Setting	Yes(*1)	No	No
	Monitor	Yes	Yes	Yes
	Parameter Write	Yes(*2)	No(*2)	No(*2)
	Parameter Read	Yes	Yes	Yes
	Inverter Reset	Yes(*3)	No	No
External Terminals	Operating Command	Yes(*1)	Yes	No
	Output Frequency Setting	Yes(*1)	Yes	No
	Inverter Reset	Yes	Yes	Yes

\*1 Depends on the value of Pr. 338 and Pr. 339.

\*2 Depends on the value set in Pr. 77.

Refer to the Inverter Instruction Manual for further information.

\*3 If a network communication error has occurred, a manual resewill be required.

## 4. ACCESSING DRIVE DATA

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- (1) This option unit acts as a Modbus Plus slave to a PLC or equivalent controller acting as a Modbus Plus master.

This means that the option unit:

- Acknowledges messages received
- Transmits messages at the request of a network master.

- (2) The option unit can also act as a Modbus Plus slave to a Modbus Plus master that can read the drive's I/O values, as well as configure the drive itself.
- (3) The option unit cannot send messages on its own, and it has no bus access rights. It also cannot simultaneously act as a slave to network master and as a lead drive (master) to follower drives (slaves).
- (4) This option unit does not support any other manufacturer-specific messages or parameters.
- (5) The Modbus Plus network is designed to allow individual devices to be taken off-line without affecting the other devices on the network. For example, if an inverter exists on a Modbus Plus network consisting of a master and 1 or more other slave devices, deactivating or disabling the master will not result in a Modbus Plus network error; therefore, the inverter will not experience a fault and will continue to run based upon the last valid command received.

## 5. PARAMETER DEFINITIONS

Depending upon which Modbus Plus master device is being used, data registers may be referenced using a 5-digit(4nnnn) or 6-digit(40nnnn) format. For convenience, this manual uses the 5-digit format. When using the 6-digit format, the last 4 digits of the register remain the same and a zero is inserted between the numeral 4 and the 4-digit register number(nnnn).

The Modbus Plus option card generates error codes when inappropriate operations occur. These codes are stored in register 40020(9C54h)

If a write occurs to the inverter while the inverter is in EXT mode, a 41h will exist in register 40020. If a write occurs to the Real Time Monitor or the Alarm History, 42h will exist in register 40020. 43h will exist in register 40020 if an out of range value is written to any parameter. See more error code listings in the table below:

### Error Codes for FR-A5NM

Error codes for FR-A5NM are stored in Extended Error Code Register 40020.

Code	Definition	Explanation
01h	Unsupported Task (*1, 2, 3)	You request an unsupported Task.
03h	Invalid Register	You use an undefined register.
04h	DPR Read Failure	You cannot read such data from Dual Port RAM.
05h	Write Cmd Failure	You cannot write data to this register.
41h	Mode Error	e.g. You try to write to the register 41000(Pr. 0) while inverter is running.
42h	Instruction Error	e.g. You try to write to Real Time Monitor because it is read only.
43h	Data Range Error	You try to write an out of range data to this register.

\*1 Writing invalid data to Op Mode Register 40010 is not allowed and answered "01 unsupported task" in the Error Code Register 40020.

\*2 Access to undefined Registers in A5NM is answered "01 unsupported task" in the Error Register 40020.

\*3 Reading invalid Monitor data, writing to Pr. 77, Pr. 79 are answered "01 unsupported task" in the Error Register 40020.

## **PARAMETER DEFINITIONS**

Read out data:

FFFEh means No parameter.

FFFDh means parameter Not Available.

Any register that does not appear in any entry of the following tables is considered Reserved.

Examples for reading from and writing to parameters:

<b>Operation</b>	<b>Communication Function</b>
Read Parameter 0	Read from Register 41000
Start running forward	Write a 2 to Register 40009
Stop the drive from running	Write a 0 to Register 40009
Enable Net Mode	Write a 14h to Register 40010
Enable EXT Mode	Write a 10h to Register 40010

## 5.1 Input to Inverter From Modbus Plus Network (Control Input Command)

To change the inverter Control Input Cmd, write the word value to Register 40009.

The following table describes the bit-map for the inverter Ctrl Input Cmd word value.

Write a value to register 40009 to give an operation command to the inverter. The bit-map values of the control instructions to the inverter are listed in the following table.

Bit	Definition (Signal)	Terminal
0	Not used and always set to 0	—
1	1 = Forward rotation (STF signal)	STF
2	1 = Reverse rotation (STR signal)	STR
3	1 = Low speed operation (RL signal) *1	RL
4	1 = Middle speed operation (RM signal) *1	RM
5	1 = High speed operation (RH signal) *1	RH
6	1 = Jog operation selection (JOG signal) *1	JOG
7	1 = Second function selection (RT signal) *1	RT
8	1 = Current input selection (AU signal) *1	AU
9	1 = Instantaneous power failure restart selection (CS signal) *1	CS
10	1 = Output stop (MRS signal)	—
11 to 15	Not used and always set to 0	—

\*1 These are factory-set signals. Input signals can be switched by Pr. 180 to Pr. 186 (input terminal function selection). Refer to the inverter manual for details of input terminal function selection.

## 5.2 Output From Inverter to Modbus Plus Network (Inverter Status)

To check the inverter status, read the word out from Register 40009 or 40019.

The following table describes the bit-map for the inverter status word.

Bit	Definition		
	Inverter Status 1 (40009)	Inverter Status 2 (40019)	Terminal
0	1 = Inverter running (RUN signal)	1 = Forward running	—
1	1 = Forward running	1 = Reverse running	—
2	1 = Reverse running	1 = Inverter running (RUN signal) *1	RUN
3	1 = Up to frequency (SU signal)	1 = Up to frequency (SU signal) *1	SU
4	1 = Overload alarm (OL signal)	1 = Instantaneous power failure or under voltage (IPF signal) *1	IPF
5	1 = Instantaneous power failure or under voltage (IPF signal)	1 = Overload alarm (OL signal) *1	OL
6	1 = Frequency detection (FU signal)	1 = Frequency detection (FU signal) *1	FU
7	1 = Alarm output (ABC signal)	1 = Alarm output (ABC signal) *1	ABC
8 to 14	Not used		—
15	1 = Alarm output (ABC signal inversion)	Not used	

\*1 These are factory-set signals. Output signals can be switched by Pr. 190 to Pr. 195 (output terminal function selection). Refer to the inverter manual for details of output terminal function selection.



### 5.3 System Environment Variable (SEV) Interface

Inverter Reg	Definition	Access (*1)	WriteVal
40001	UsrClrValSett	WO	0000h
40002	Inverter Reset (*2)	WO	XXXXh
40003	PrClr	WO	965Ah
40004	PrAllClr	WO	99AAh
40005	PrUsrClr	WO	5A55h
40006	PrClr (*3)	WO	5A96h
40007	PrAllClr (*3)	WO	AA99h
40008	PrUsrClr (*3)	WO	555Ah
40009	Inverter Status 1/CtrlInpCmd (*4)	R/W	00XXh/ 0XXXh
40010	OpMode / Inverter Config	R/W	(*5)
40013	f Sett Val	R/W	ffggh
40014	Runng f (RAM) (*6)	R/W	ffggh
40015	Runng f (E <sup>2</sup> PROM) (*6)	WO	ffggh
40019	Inverter Status 2 (*7)	RO	—

\*1 Regarding access

WO ..... Only writing is enabled (reading is disabled)

RO ..... Only reading is enabled (writing is disabled)

R/W ..... Both reading and writing are enabled

\*2 Writing any value to the parameter 40002 resets the inverter.

\*3 Communication parameter (Pr. 117 to Pr. 124, Pr. 331 to Pr. 342) are not cleared.

\*4 For read values of inverter status and write values of control input command, refer to page 17, 18.

\*5 For read values of operation mode and inverter setting, refer to the table below.

Operation Mode	Read Value	Write Value
External operation mode	0000h	0010h
PU operation mode	0001h	0011h
External jog mode	0002h	—
PU jog mode	0003h	—
Net mode	0004h	0014h
Combined mode	0005h	—
Programmed operation mode	0006h	—

Programmed operation mode is displayed only for the FR- A500(L) series.

\*6 Writing to Register 40014 or 40015 can be read out from Register 40014.

\*7 For read values of inverter status 2, refer to page 18.

## PARAMETER DEFINITIONS

### 5.4 Using the Modsoft MSTR Block

The MSTR control register usage is as follows:

PLC Register	Register Value	Value Base	Description
n	1,2	decimal	Commands MSTR function: 1 = write; 2 = read
n+1	xxxx	hexadecimal	MSTR function error code
n+2	1	decimal	Number of registers to be written/read to /from the inverter
n+3	rrrr	decimal	Specifies the inverter register to write/read to/from. Value represents an offset starting w/register 40000 (i.e. 1 = 40001; 49 = 40049).
n+4, 5, 6, 7	node number	decimal	Routing registers contain Modbus Plus nodes for communication routing. The first register following the register containing the inverter node number must contain a 1 value. Remaining routing registers must contain a 0 value.

### 5.5 Real-Time Monitor

Register	Definition	Minimum Setting Increments (A500, F500)	Minimum Setting Increments (A500L, F500L)
40201	RTM01 Outp f	0.01Hz	0.01Hz
40202	RTM02 Outp I	0.01A	0.1A
40203	RTM03 Outp V	0.1V	0.1V
40205	RTM05 f Sett Val	0.01Hz	0.01Hz
40206	RTM06 Runng Spd	1r/min	1r/min
40207	RTM07 Motor Torq	0.1%	0.1%
40208	RTM08 Convtrr Outp V	0.1V	0.1V
40209	RTM09 Regen Brake Duty	0.1%	0.1%
40210	RTM10 Electr Overcur Protectn Load Factr	0.1%	0.1%
40211	RTM11 Outp I Peak	0.01A	0.1A
40212	RTM12 Converter Peak Outp V	0.1V	0.1V
40213	RTM13 Inverter Input Power	0.01kW	0.1kW
40214	RTM14 Inverter Output Power	0.01kW	0.1kW

Register	Definition	Minimum Setting Increments (A500, F500)	Minimum Setting Increments (A500L, F500L)
40215	RTM15 Inp Termnl Status (*1)	—	—
40216	RTM16 Outp Termnl Status (*2)	—	—
40217	RTM17 Load Meter	0.1%	0.1%
40218	RTM18 Motor Excitatn I	0.01A	0.1A
40219	RTM19 Positive Pulse	—	—
40220	RTM20 Cumulative Energ t	1h	1h
40222	RTM22 Orientatn Status	—	—
40223	RTM23 Actl Op t	1h	1h
40224	RTM24 Motor Load Factr	0.1%	0.1%
40225	RTM25 Cumulative Powr	1kWh	1kWh

\*1 Bit-Map for Register 40215

Input Terminal Monitor:

15..12	11	10	9	8	7	6
0	CS	RES	STOP	MRS	JOG	RH

5	4	3	2	1	0
RM	RL	RT	AU	STR	STF

\*2 Bit-Map for Register 40216

Outp Terminal Monitor:



15..6	5	4	3	2	1	0
0	Relay	FU	OL	IPF	SU	RUN

The bit-wise data here reflect Pr. 190 to 195; if assignments for terminals are changed, the bit-map may not be the same.

**REMARKS**

Modbus Plus is a single command machine. Only one command can be sent to the FR-A5NM at a single time. Multiple commands to a single slave is NOT supported. Please send one command for each terminal assignment.

## 5.6 Input/Output Terminal Assignment

 <b>CAUTION</b>
 <b>Input/output terminal assignment functions depend upon programmed functions such as brake sequences</b>

## 5.7 Operation When an Alarm Occurs

The following table shows the behavior of the inverter and network when an alarm occurs:

<b>Fault Type</b>	<b>Item</b>	<b>Net</b>	<b>Ext</b>	<b>PU</b>
Inverter (*2)	Inverter Operation	Stop	Stop	Stop
	Network Comm.	Continue	Continue	Continue
Modbus Plus Comm. (*3)	Inverter Operation	Stop	Continue	Continue
	Network Comm	Continue (*1)	Continue (*1)	Continue (*1)

\*1 Depends on the type of communication fault.

\*2 For example, E.OP3, E.OC3.

\*3 For example, Slow blinking LED

## 5.8 Alarm History

Register	Definition
40501	Alarm 1 (*1)
40502	Alarm 2
40503	Alarm 3
40504	Alarm 4
40505	Alarm 5
40506	Alarm 6
40507	Alarm 7
40508	Alarm 8

\*1 Writing any value to parameter 40501 resets the alarm history buffer for all alarms. All other entries in this table are read only.

## 5.9 Alarm Numbers vs. Alarm Definitions

#	Definition	#	Definition	#	Definition	#	Definition
10	OC1	80	GF	D1	Osd	F3	E3
11	OC2	81	LF	D2	ECT	F4	E4
12	OC3	90	OHT	D3	Od	F5	E5
20	OV1	A0	OPT	D4	ECA	F6	E6
21	OV2	A1	OP1	D5	Mb1	F7	E7
22	OV3	A2	OP2	D6	Mb2	F8	E8
30	THT	A3	OP3	D7	Mb3	F9	E9
31	THM	B0	PE	D8	Mb4	FA	E10
40	FIN	B1	PUE	D9	Mb5	FB	E11
41	FAN	B2	RET	DA	Mb6	FC	E12
50	IPF	C0	CPU	DB	Mb7	FD	E13
51	UVT	C1	CTE	F0	E0	FE	E14
60	OLT	C2	P24	F1	E1	FF	E15
70	BE	D0	OS	F2	E2		

Please refer to the *Inverter Instruction Manual* for an explanation of Alarm Definitions.

**5.10 A500(L) PARAMETERS**

**5.10.1 Normal Parameter Area**

You can use the Register to make parameter settings from the network. The last three digits of Register are the parameter number.

Standard parameter examples are introduced below. Refer to the examples and make parameter settings.

For the parameter data and details, refer to the inverter and option manuals.

Pr	Reg	Definition	Range		Factory setting
			Decimal	Hex	
Pr. 0	41000	Torque Boost	0-30	0-12C	6% / 4% / 3% / 2%
Pr. 1	41001	Maximum frequency	0-120	0-2EE0	120Hz
Pr. 2	41002	Minimum frequency	0-120	0-2EE0	0Hz
Pr. 3	41003	Base frequency	0-400	0-9C40	60Hz
Pr. 4	41004	Multi-speed setting (high speed)	0-400	0-9C40	60Hz
Pr. 5	41005	Multi-speed setting (middle speed)	0-400	0-9C40	30Hz
Pr. 6	41006	Multi-speed setting (low speed)	0-400	0-9C40	10Hz
⋮	⋮	⋮	⋮	⋮	⋮

**REMARKS**

1. Pr. 77 (41077) is Read-Only from MBP, it cannot be written from network.
2. Pr. 79 (41079) is Read-Only from MBP, it cannot be written from network.  
Pr. 79 = 6 is switch over mode.

**5.11 900f Parameter Area**

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<b>Parameter</b>	<b>Register</b>	<b>Definition</b>
Pr. 902	41902	Pr. 902f Frequency Setting Voltage Bias (frequency)
Pr. 903	41903	Frequency Setting Voltage Gain (frequency)
Pr. 904	41904	Frequency Setting Current Bias (frequency)
Pr. 905	41905	Frequency Setting Current Gain (frequency)

**5.12 900% Parameter Area**

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<b>Parameter</b>	<b>Register</b>	<b>Definition</b>
Pr. 902	42092	Frequency Setting Voltage Bias (%)
Pr. 903	42093	Frequency Setting Voltage Gain (%)
Pr. 904	42094	Frequency Setting Current Bias (%)
Pr. 905	42095	Frequency Setting Current Gain (%)

**5.13 Programmed Operation : Setting Time**

Parameter	Register	Definition
Pr. 200	41200	Program time unit (Min/Sec) Select
Pr. 201	41201	Program Setting 1 (t)
Pr. 202	41202	Program Setting 2 (t)
Pr. 203	41203	Program Setting 3 (t)
Pr. 204	41204	Program Setting 4 (t)
Pr. 205	41205	Program Setting 5 (t)
Pr. 206	41206	Program Setting 6 (t)
Pr. 207	41207	Program Setting 7 (t)
Pr. 208	41208	Program Setting 8 (t)
Pr. 209	41209	Program Setting 9 (t)
Pr. 210	41210	Program Setting 10 (t)
Pr. 211	41211	Program Setting 11 (t)
Pr. 212	41212	Program Setting 12 (t)
Pr. 213	41213	Program Setting 13 (t)
Pr. 214	41214	Program Setting 14 (t)
Pr. 215	41215	Program Setting 15 (t)
Pr. 216	41216	Program Setting 16 (t)
Pr. 217	41217	Program Setting 17 (t)
Pr. 218	41218	Program Setting 18 (t)
Pr. 219	41219	Program Setting 19 (t)
Pr. 220	41220	Program Setting 20 (t)
Pr. 221	41221	Program Setting 21 (t)
Pr. 222	41222	Program Setting 22 (t)
Pr. 223	41223	Program Setting 23 (t)
Pr. 224	41224	Program Setting 24 (t)
Pr. 225	41225	Program Setting 25 (t)
Pr. 226	41226	Program Setting 26 (t)
Pr. 227	41227	Program Setting 27 (t)
Pr. 228	41228	Program Setting 28 (t)
Pr. 229	41229	Program Setting 29 (t)
Pr. 230	41230	Program Setting 30 (t)
Pr. 231	41231	Time Of Day

<Time setting method>

ex. To enter a time of 10 minutes 20 seconds (Pr. 200 = 0):

HB = 10 = 0Ah, LB = 20 = 14h -> Register value : 0A14h



**5.14 Programmed Operation : Setting Rotation Direction**

<b>Parameter</b>	<b>Register</b>	<b>Definition</b>
Pr. 201	42001	Program Setting 1 (D)
Pr. 202	42002	Program Setting 2 (D)
Pr. 203	42003	Program Setting 3 (D)
Pr. 204	42004	Program Setting 4 (D)
Pr. 205	42005	Program Setting 5 (D)
Pr. 206	42006	Program Setting 6 (D)
Pr. 207	42007	Program Setting 7 (D)
Pr. 208	42008	Program Setting 8 (D)
Pr. 209	42009	Program Setting 9 (D)
Pr. 210	42010	Program Setting 10 (D)
Pr. 211	42011	Program Setting 11 (D)
Pr. 212	42012	Program Setting 12 (D)
Pr. 213	42013	Program Setting 13 (D)
Pr. 214	42014	Program Setting 14 (D)
Pr. 215	42015	Program Setting 15 (D)
Pr. 216	42016	Program Setting 16 (D)
Pr. 217	42017	Program Setting 17 (D)
Pr. 218	42018	Program Setting 18 (D)
Pr. 219	42019	Program Setting 19 (D)
Pr. 220	42020	Program Setting 20 (D)
Pr. 221	42021	Program Setting 21 (D)
Pr. 222	42022	Program Setting 22 (D)
Pr. 223	42023	Program Setting 23 (D)
Pr. 224	42024	Program Setting 24 (D)
Pr. 225	42025	Program Setting 25 (D)
Pr. 226	42026	Program Setting 26 (D)
Pr. 227	42027	Program Setting 27 (D)
Pr. 228	42028	Program Setting 28 (D)
Pr. 229	42029	Program Setting 29 (D)
Pr. 230	42030	Program Setting 30 (D)

**5.15 Programmed Operation : Frequency Setting**

<b>Parameter</b>	<b>Register</b>	<b>Definition</b>
Pr. 201	42031	Program Setting 1 (f)
Pr. 202	42032	Program Setting 2 (f)
Pr. 203	42033	Program Setting 3 (f)
Pr. 204	42034	Program Setting 4 (f)
Pr. 205	42035	Program Setting 5 (f)
Pr. 206	42036	Program Setting 6 (f)
Pr. 207	42037	Program Setting 7 (f)
Pr. 208	42038	Program Setting 8 (f)
Pr. 209	42039	Program Setting 9 (f)
Pr. 210	42040	Program Setting 10 (f)
Pr. 211	42041	Program Setting 11 (f)
Pr. 212	42042	Program Setting 12 (f)
Pr. 213	42043	Program Setting 13 (f)
Pr. 214	42044	Program Setting 14 (f)
Pr. 215	42045	Program Setting 15 (f)
Pr. 216	42046	Program Setting 16 (f)
Pr. 217	42047	Program Setting 17 (f)
Pr. 218	42048	Program Setting 18 (f)
Pr. 219	42049	Program Setting 19 (f)
Pr. 220	42050	Program Setting 20 (f)
Pr. 221	42051	Program Setting 21 (f)
Pr. 222	42052	Program Setting 22 (f)
Pr. 223	42053	Program Setting 23 (f)
Pr. 224	42054	Program Setting 24 (f)
Pr. 225	42055	Program Setting 25 (f)
Pr. 226	42056	Program Setting 26 (f)
Pr. 227	42057	Program Setting 27 (f)
Pr. 228	42058	Program Setting 28 (f)
Pr. 229	42059	Program Setting 29 (f)
Pr. 230	42060	Program Setting 30 (f)

## 6. SPECIFICATIONS

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<b>Current Consumption</b>	From inverter drive:300 mA typ. @5 Vdc Provided to Modbus Plus network:100 mA @5 Vdc
<b>Backplane Isolation</b>	500 Vdc min.
<b>Supported Data Rates</b>	<= 450 m: 1 M bps, no repeater; <= 1800 m: 1 M bps, repeaters Maximum distance between nodes is 450 meters.
<b>Operating Temperature</b>	-10 to 50 °C
<b>Storage Temperature (*1)</b>	-20 to 65 °C
<b>Relative Humidity</b>	<= 90% @50 °C, non-condensing
<b>Dimensions</b>	96 x 49 x 33 mm

\*1 This refers to a short period of time such as during transportation.

## Appendix A. Other Option-Specific parameters

The following table identifies option-specific parameters which are used for the A5NM.

Pr. #	Function	Setting Range	Minimum Increment	Default Setting
338	Operation control command source	0, 1	1	0
339	Speed command source	0, 1	1	0
340	Link start-up mode selection	0, 1, 2*	1	0

\* Pr.340 "link startup mode selection" can be switched from the PU in any operation mode.

### A. Definition for Pr. 338 and Pr. 339

Control Source Selection		Function													
Pr. 338	Pr. 339	STF	STR	STOP	JOG	RT	2	4	1	RH, RM, RL	AU	RES	MRS	OH	CS
0	0	Net	Net	Net	-	Net	Net	Net	Net	Net	-	Both	Both	Ext	Ext
0	1	Net	Net	Net	-	Net	Ext	Ext	Ext	Ext	Ext	Both	Both	Ext	Ext
1	0	Ext	Ext	Ext	Ext	Ext	Net	Net	Net	Net	-	Both	Ext	Ext	Ext
1	1	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext

Ext : Control is via input to external terminal

Net : Control is via Modbus Plus.

Both : Control is via either external terminal or Modbus Plus.

'-' : Control is via neither external nor Modbus Plus.

### B. Definition for Pr. 340

The operation mode at power on and at restoration from instantaneous power failure can be selected.

Value	Mode at Power On or After Reset
0	Inverter operates in the external operation mode.
1	Inverter operates in the network operation mode.
2	Inverter operates in the network operation mode. After instantaneous power failure, however, the inverter will resume the same operation state which was in before the instantaneous power feilure occurrence.

# MEMO

## REVISIONS

\*The manual number is given on the bottom left of the back cover.

<b>Print Date</b>	<b>*Manual Number</b>	<b>Revision</b>
Mar., 2003	IB(NA)-0600137E-A	First edition
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