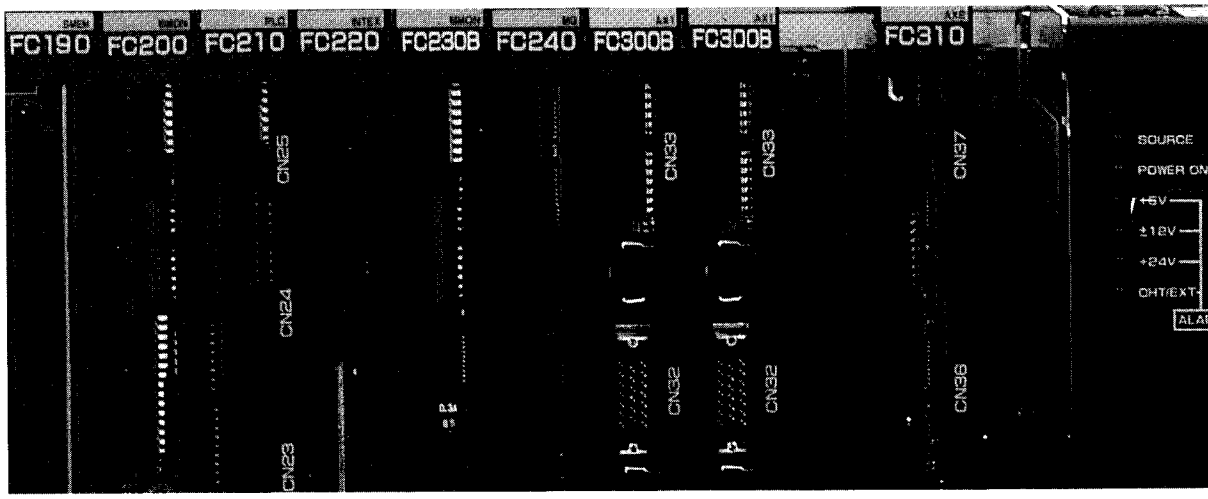
YASNAC i80M
INSTRUCTIONS

COMPUTER COMMUNICATION FUNCTION



Before initial operation read these instructions thoroughly, and retain for future reference.

YASKAWA

TOE-C843-11.33B

GENERAL DESCRIPTION

Computer communication function for YASNAC i Series provides wide-ranging communication with a host computer by adding a communication module to the CPU unit.

Since this module is equipped with a microprocessor for the purpose of communication, it can perform communication between the host computer and the NC at high speed by minimizing the effect on the motion control that is a basic performance of the NC.

It principally has the following functions.

(1) Computer Operation
Controls NC from host computer.

(2) DNC Operation
Performs continuous machining by NC program from host computer.

(3) DNC High Speed Cutting Function
Performs cutting operation for extended time by using cutting data from host computer.

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1. SPECIFICATIONS

1.1 Name and Type of Module

Communication module for YASNAC-i : JANCD-FC110

1.2 External Diagram

Dimensions in mm

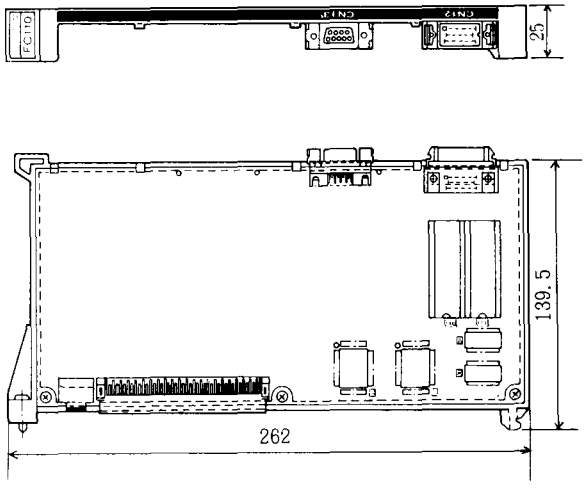


Fig. 1.1 External Diagram

1.3 Interface RS-232C or RS-422

1.4 Transmission Speed 1200, 2400, 4800, 9600, 19200, 38400 bps

1.5 Transmission Mode Half-duplex transmission system (point to point)

1.6 Synchronizing System Start-stop synchronous system

1.7 Protocol

(1) Protocol 1 RS-CS Procedure
Transmission code: ISO 7-unit or 8-unit code
Error check: Parity check
Buffer capacity: 16K bytes

(2) Protocol 2 DC Code Procedure
Transmission code: ISO 7-unit or 8-unit code
Error check: Parity check
Buffer capacity: 16K bytes

(3) Protocol 3 Communication Mode Procedure
Transmission code: ISO 7-unit or 8-unit code
Shift binary code
Error check: Sum check, parity check
Buffer capacity: 11K bytes
Receiving buffer: 8K bytes
NC control unit
Transfer buffer: 2K bytes
Receiving butter: 1K byte

2. COMMUNICATION INTERFACE

2.1 Module Mounting Position

Mount this module in the position as shown in Fig. 2.1

Dimensions in mm

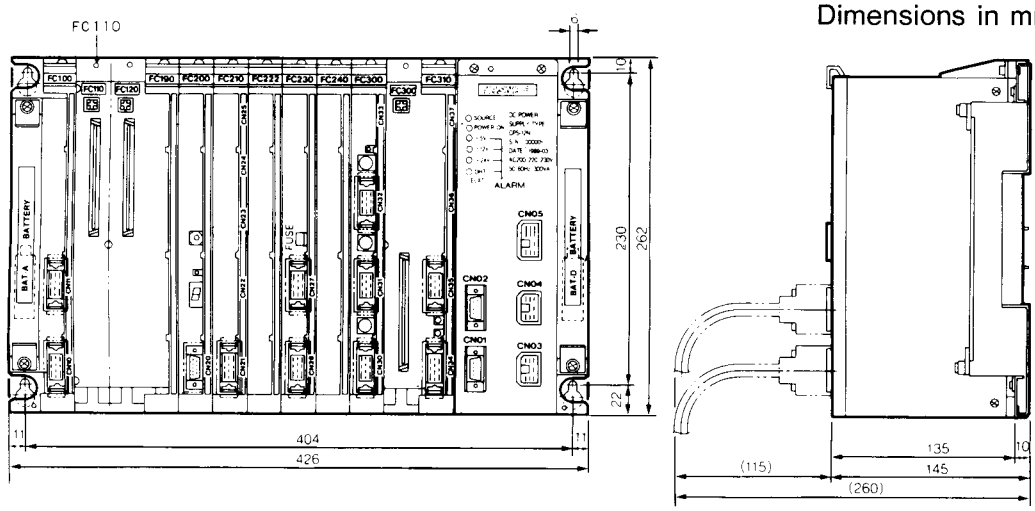


Fig. 2.1 Module Mounting Position

2.2 Selection of RS-232C or RS-422

2 types of interfaces, RS-232C and RS-422, are provided for this communication module.

Table 2.1 Perameter Setting of Interface

NC Parameter / Interface	pm0030 D6
RS-232C	0
RS-422	1

2.3 Description of Signals

FG : Frame grounding

SD : Sending data (output)

RD : Receiving data (input)

RS : Request sending (output)

This signal turns ON when starting to send out in case of transmitting the data from this module.
Note : It functions as a request receiving signal in Protocol 1.
Refer to item 3. PROTOCOL 1 for further details.

CS : Capable of sending (input)
The data can be send out from this module when this input signal is ON.

SG : Signal grounding

ER : Data terminal ready (output)
When this signal turns ON, it shows the communication module is ready for operation. If it is OFF, process the error with host computer.

DR : Data set ready (input)
When this signal turns ON, it shows that the host computer is ready for operation. If it is OFF, this module processes the error.

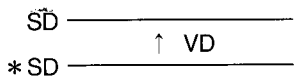
Note : In RS-422, *SD, *RD, *RS, *CS, *ER and *DR signals are also provided in addition to the above signals. These signals are the reverse of the signals explained above.

Due to difference between RS-232C and RS-422 actual signal level becomes as shown in Table 2.2.

Table 2.2 Correspondence between Signal Level and Logic

Signal Name	Logic	Function	Signal Level	
			RS232C	RS422
RD	1	Mark	Below −3V	VD < −0.2V
	0	Space	Above +3V	VD > +0.2V
SD	1	Mark	Below −3V	VD < −0.2V
	0	Space	Above +3V	VD > +0.2V
CS	0	ON (Active)	Above +3V	VD > +0.2V
	1	OFF (Disable)	Below −3V	VD < −0.2V
RS	0	ON	Above +3V	VD > +0.2V
	1	OFF	Below −3V	VD < −0.2V
DR	0	ON	Above +3V	VD > +0.2V
	1	OFF	Below −3V	VD < −0.2V
ER	0	ON	Above +3V	VD > +0.2V
	1	OFF	Below −3V	VD < −0.2V

Note : VD is the voltage that sees RS-422 with reference to *signal.



2.4 Connector Table

(1) For CN12 RS-422

Table 2.3 CN12 Connector

RS-422 MR-20RMA(HONDA)

7		13	*DR	20	FG
6		12	DR	19	
5		11	*R	18	
4	*RD	10	R	17	*SD
3	RD	9	SG2	16	SD
2	*CS	8	SG2	15	*RS
1	CS			14	RS

(2) For CN13 RS-232C

Table 2.4 CN13 Connecter

RS-232C 17LF-13092-27(DDK)

1	FG	6	DR
2	SD	7	SG2
3	RD	8	
4	RS	9	ER
5	CS		

Power supply capacity to external devices

Note: Isolation power supply +12VI 30mA } ZW1R50512
−12VI 30mA }
+5VI 500mA } ZS30505

2.5 Transmission Speed Setting

Set the transmission speed by NC parameter from the following table.

Table 2.5 Transmission Speed Setting

NC Parameter / Transmission Speed	pm0031 (RS-232C) pm0032 (RS-422)		
	D2	D1	D0
1200bps	0	0	0
2400bps	0	0	1
4800bps	0	1	0
9600bps	0	1	1
19200bps	1	0	0
38400bps	1	0	1

2.6 Transmission Frame and Parity Check Setting

Transmission frame composition and parity bit to confirm if any can be set up by NC parameter.

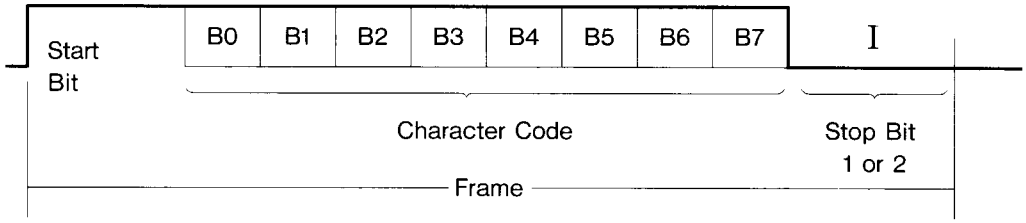


Fig. 2.2 Transmission Frame

(1) Character Code Setting

Table 2.6 Character Code Setting

NC Parameter / Character Code	pm0031: D4 (RS-232C) pm0032 : D4 (RS-422)	Recommended Setup			
		Protocol 1	Protocol 2	Protocol 3	
7 bits	0	○	○		
8 bits	1			○	

(2) Parity Check Setting for Character Code

Table 2.7 Parity Check Setting for Character Code

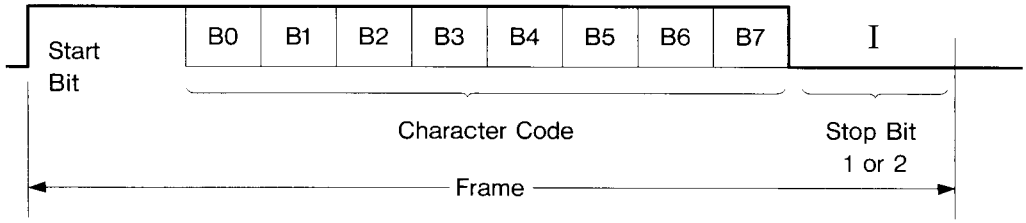
NC Parameter / Character Code	pm0031 : RS-232C pm0032 : RS-422		Recommended Setup			
	D6	D5	Protocol 1	Protocol 2	Protocol 3	
Even Number Check	0	1	○	○		
Odd Number Ckeck	1	0				
None	0	0			○	

(3) Stop Bit Setting

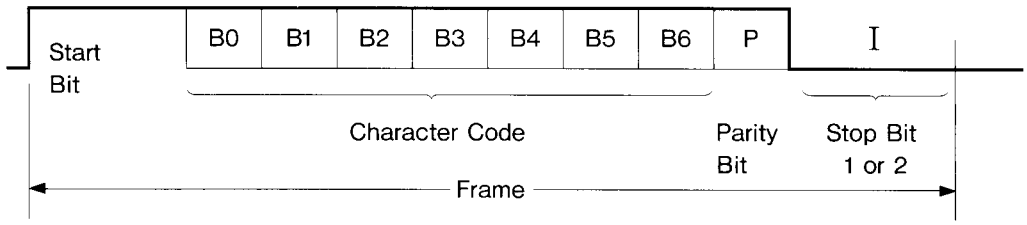
Table 2.8 Stop Bit Setting

NC Parameter / Character Code	pm0031 : D3 (RS-232C) pm0032 : D3 (RS-422)	Recommended Setup			
		Protocol 1	Protocol 2	Protocol 3	
1 bit	0				
2 bits	1	○	○	○	

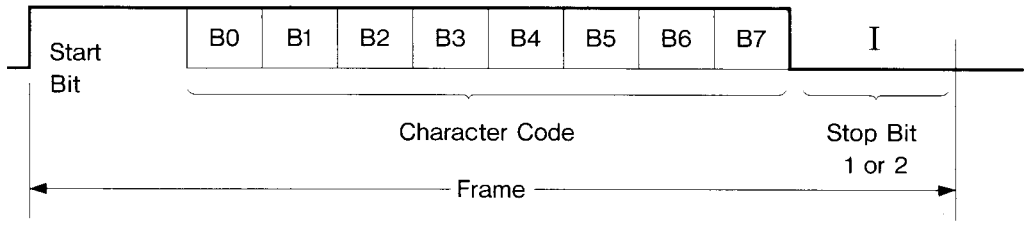
Note : The frame becomes as shown below if character is 7 bits without parity check.



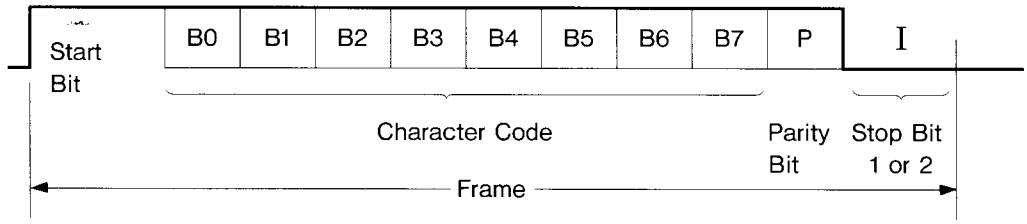
In communication module, 8th bit of character code is regarded as "0".
The frame becomes as shown below if character code is 7 bits with parity check.



In this communication module also, 8th bit of character code is regarded as "0".
The frame becomes as shown below if character code is 8 bits without parity check.



The frame becomes as shown below if character code is 8 bits with parity check.



2.7 Protocol Selection

This communication module can select the following protocols.
Set up the protocol selection with NC parameter.

Table 2.9 Protocol Selection

NC Parameter / Protocol	pm3006		
	D7	D6	D5
Protocol 1	0	0	0
Protocol 2	0	0	1
Protocol 3	0	1	0

3. PROTOCOL 1

3.1 Outline of Protocol 1

This is Protocol 1 prepared for DNC operation by the NC part program transferred from the host computer and other external equipment. For this purpose, it uses the transmission control signal "RS (request sending)" through the serial transmission line of communication module (optional) for NC unit.

3.2 Connection with Host Computer

3.2.1 RS-232C (Cable length less than 15m)

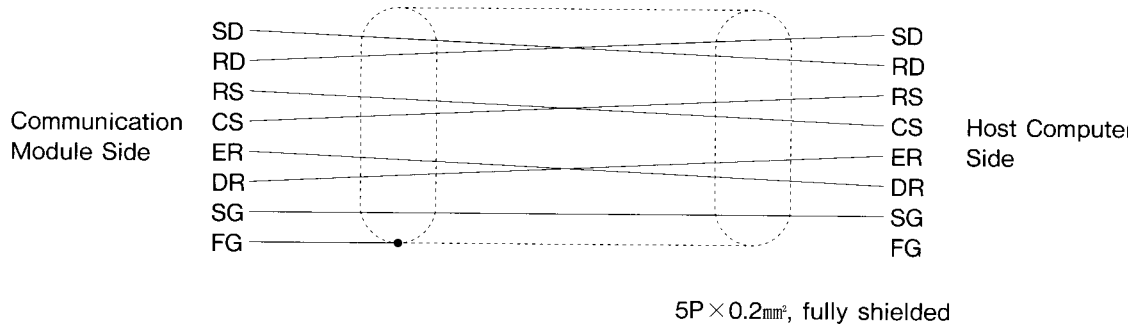


Fig. 3.1 RS232C Connection

3.2.2 RS-422 (Cable length less than 1㎞)

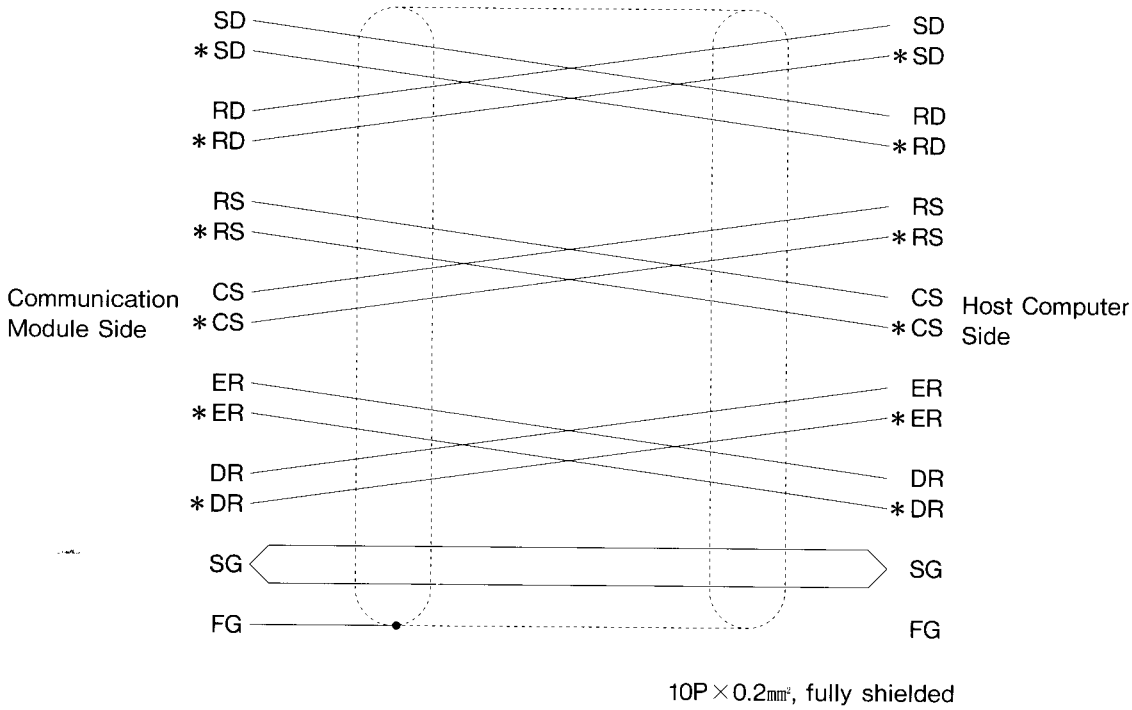


Fig. 3.2 RS-422C Connection

3.3 Transmission Format

The following format is NC part program for DNC operation.

% EOB	(NC Part Program)	M30 EOB	%

Refer to Operator's Manual of YASNAC i80M for details of NC part program format.

3.4 Operation Sequence

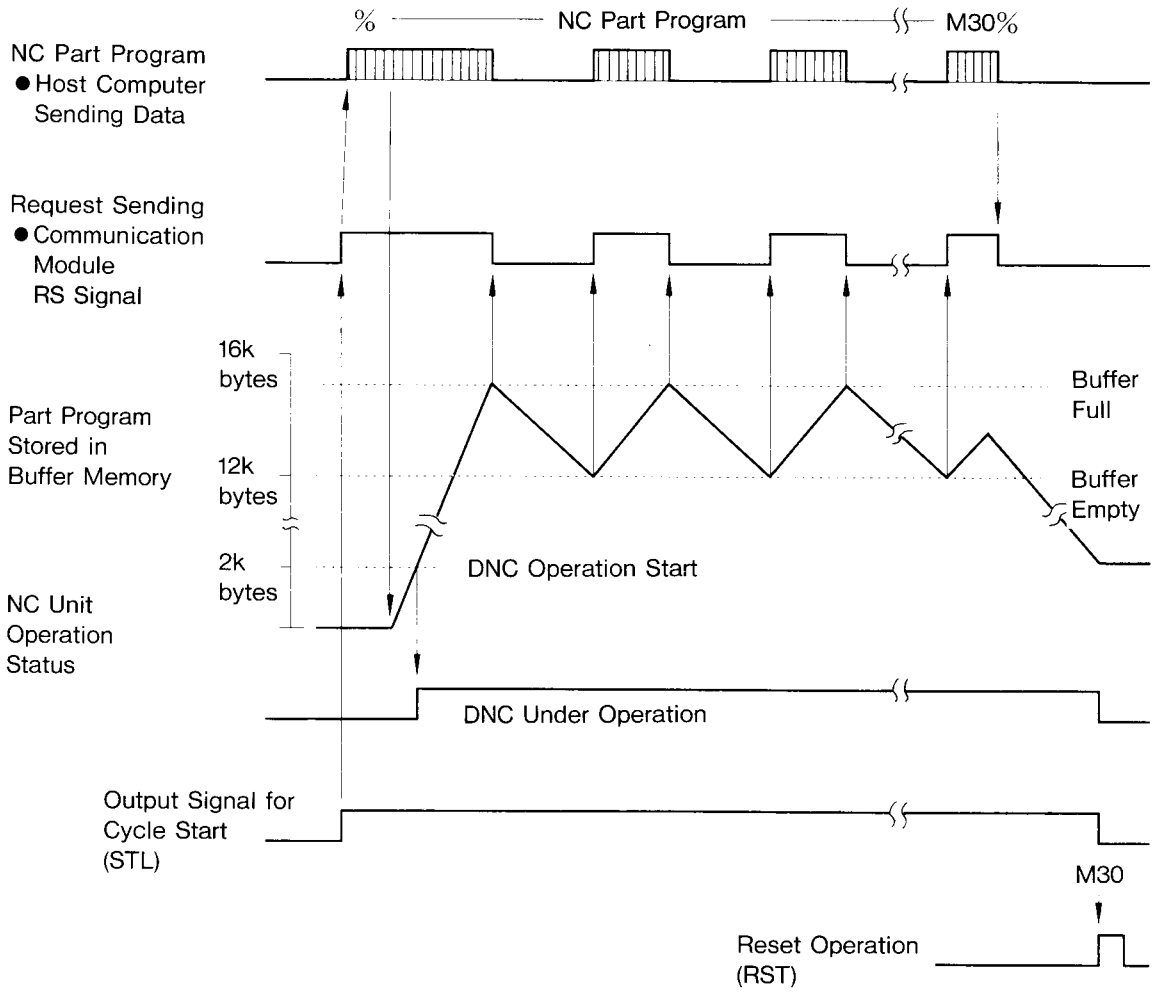


Fig. 3.3 Operation Sequence

3.5 Precautions

(1) The receiving data is disregarded until initial "%" code (or "EOB" code) is received.

(2) The part programs stored in buffer memory to start DNC operation can be made for 128/256/512 bytes by setting NC parameter.
(Refer to item 7. NC SETTINGS/PARAMETERS FOR COMMUNICATION MODULE.)

(3) If NC part program is not received for longer than 3sec. even if turning ON request sending signal during NC part program receiving mode, it is regarded as the end of the NC part program and processed in the same manner as "%" code receiving.

(4) If DNC operation is interrupted by alarm issue (at communication module or NC control unit) or by NC reset input ON during DNC operation, RS signal (request sending) turns OFF.

(5) Transmission sequence is the same as reading DC1 to RS ON and DC3 to RS OFF, respectively, in par. 4.5 "Description on Transmission Sequence." Nevertheless, "SYN" or "NAK" is not output.

(6) When DR (data set ready) signal is not used, or when DR signal is turned off to use during communication, set the pm0030 D5 parameter "DR signal checked/not checked" to "DR signal not checked."

4. PROTOCOL 2

4.1 Outline of Protocol 2

This is the protocol prepared for DNC operation by the NC part program transferred from a host computer and other external equipment. For this purpose, it uses the popular control characters (DC1,DC3) through the serial transmission line of a communication module (optional) for NC unit

4.2 Connection and Control Character

4.2.1 Connection with Host Computer

(1) RS-232C Connection (Cable length less than 15m)

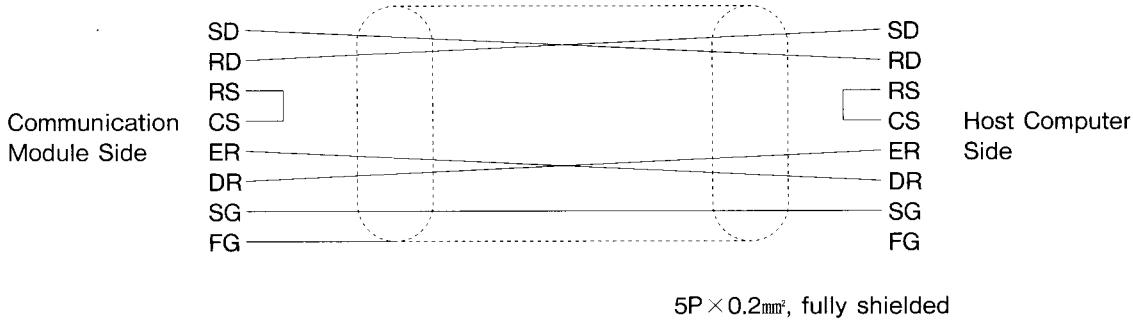


Fig. 4.1 RS-232C Connection

(2) RS-422 Connection (Cable length less than 1㎞)

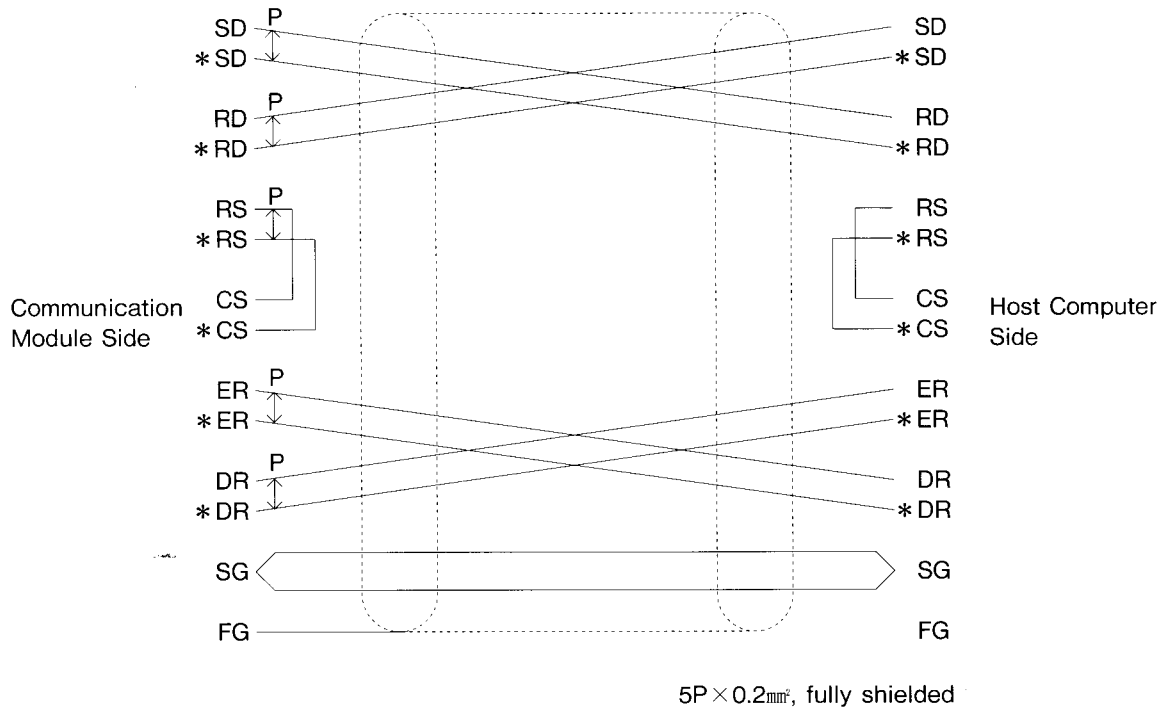


Fig. 4.2 RS-422 Connection

4.2.2 Transmission Control Character

Table 4.1 Transmission Control Character

Transmission Control Character	Code (Hexa-Decimal)	Meaning
DC1	11	Informs host computer of tranfer request of NC part program.
DC3	13	Informs host computer of tranfer interruption/end.

4.2.3 Status Information Character

Table 4.2 Status Information Character

Status Information Character	Code (Hexa-Decimal)	Meaning
NAK	15	Informs issuance of alarm during DNC operation.
SYN	16	Informs resetting during DNC operation.

Notes : 1. Set NC parameter pm3006-D4 to "1" for outputting the status information character.
2. DC1, DC3, NAK and SYN codes are expressed by a code without parity bit.
If parity bit is valid, add parity bit by difference of odd numbers and even numbers.

4.3 Transmission Format

Following format is NC part program to perform DNC operation.

%	EOB	(NC Part Program)	M30 EOB	%

Refer to YASNAC i80M Operator's Manual for details of NC part program format.

4.4 Transmission Sequence

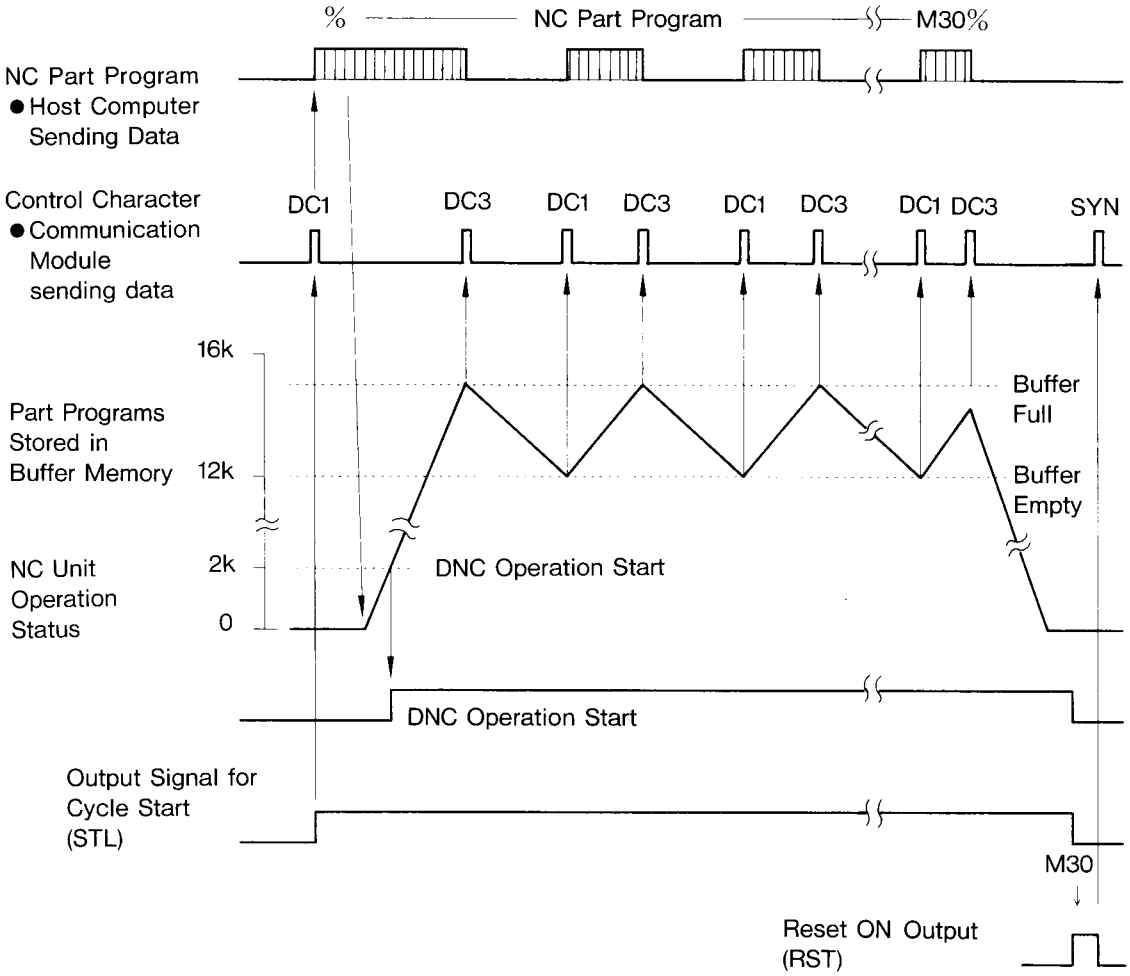


Fig. 4.3 Transmission Sequence

4.5 Description on Transmission Sequence

(1) The communication module sends "DC1" to the host computer when DNC operation start is input to NC control unit.
After receiving this character, the NC part program to operate DNC is output from the host computer side to the communication module.

(2) When NC part programs stored in the buffer memory exceed 2,000 characters, the communication module starts to transfer NC part program to NC control unit.
Then, DNC starts operation.

(3) When NC part programs stored inside the buffer memory exceed 12k characters, the communication module sends "DC3" to the host computer which requests interruption of NC part program transfer.
Then, interrupt the output of NC part program at the host computer side so as to keep it within 1K bytes.

(4) The communication module sends "DC1", when the NC control unit continues machining by DNC operation and the NC part programs stored in the buffer memory inside the communication module drop below 12K characters.
Then, restart the output of NC part program at the host computer side.

(5) Above items (3) and (4) are repeated until the end of the NC part program (receiving % code).

(6) The communication module sends "DC3" to host computer, when it receives the code "%" for the end of the NC part program.

(7) The NC control unit finishes machining by DNC operation and executes final block, "M30". After the NC control unit completes reset processing, the communication module sends to the host "SYN" computer so as to inform reset completion, followed by the completion of a series of DNC oprations.

〈Additions〉

- Received data are disregarded unitl initial "%" code (or "EOB" code) is recevied.

- The buffer stored program quantity to start DNC operation can be 128/256/512 bytes by setting NC parameter.
(Refer to par. 7. LIST OF NC SETTINGS/PARAMETERS FOR COMMUNICATION MODULE.)

- If the NC part program is not received for longer than the time set by setting parameter pm33, even if the ON request signal is sent during NC part program receiving mode, it is regarded as the end of the NC part program and is processed in the same manner as receiving a "%" code.

- If the DNC operation is interrupted by an alarm (at communication module or NC control unit) or by NC reset input ON during DNC operation, the communication module sends "DC3" to the host computer.
If NC parameter pm3006 D4=1, "NAK" code is sent if the alarm is after 1 sec. after sending "DC3". "SYN" code is send when resetting.

- When DR (data set ready) signal is not used, or when DR signal is turned off to use during communication, set the pm0030 D5 parameter "DR signal checked/not checked" to "DR signal not checked."

5. PROTOCOL 3

5.1 Outline of Protocol 3

This is the protocol prepared for:

- Computer operation
- DNC operation
- High speed machining by high speed DNC cutting function
  For these purposes, it employs intercommunication mode to exchange commands and messages between YASNAC and the host computer through a serial transmission line (RS-232C,RS-422) between the host computer and the communication module (optional) for NC unit.

The following are provided for commands :

- Command for sending : 8 types
- Command for receiving : 12 types

5.2 Connection, Control Character and Packet Format

5.2.1 Connection with Host Computer

(1) RS-232C (Cable length less than 15m)

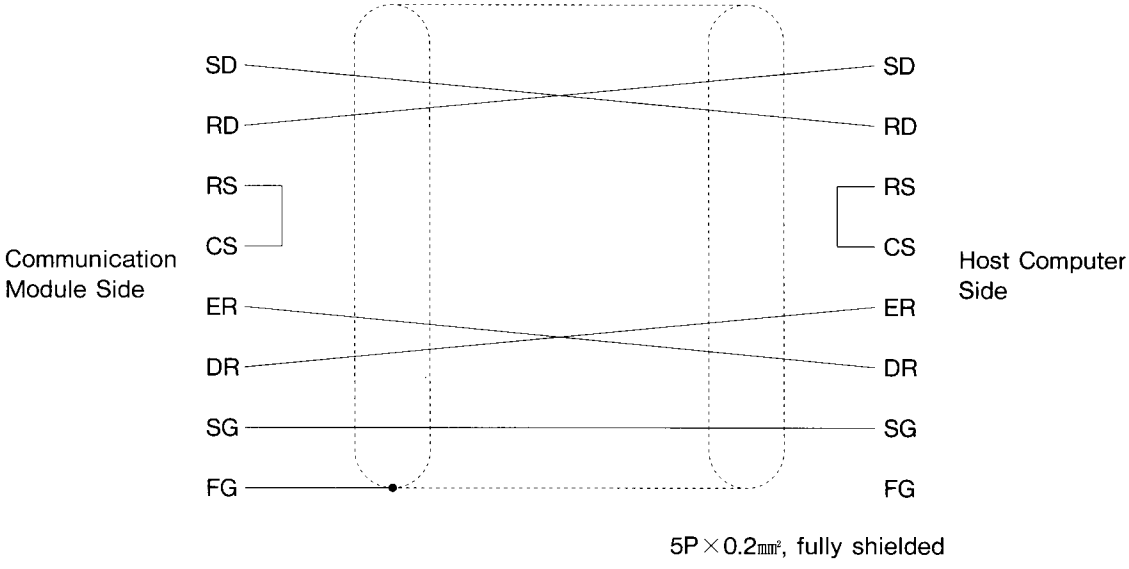


Fig. 5.1 RS-232C Connection

(2) RS-422 (Cable length less than 1km)

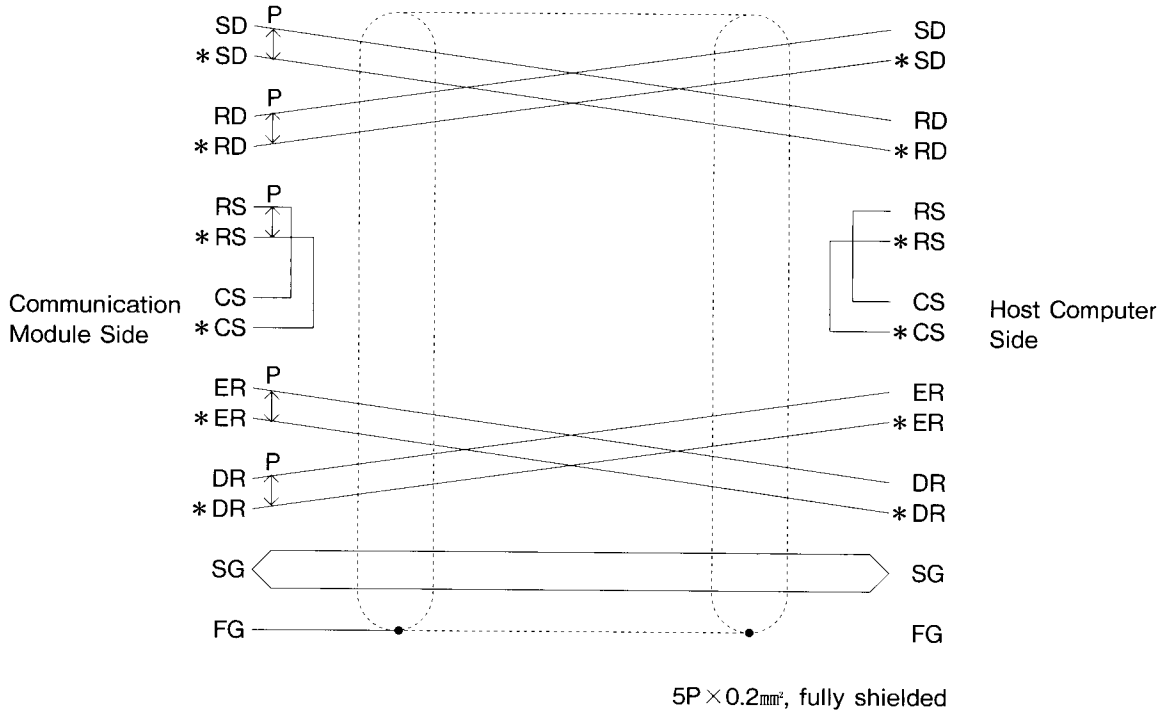


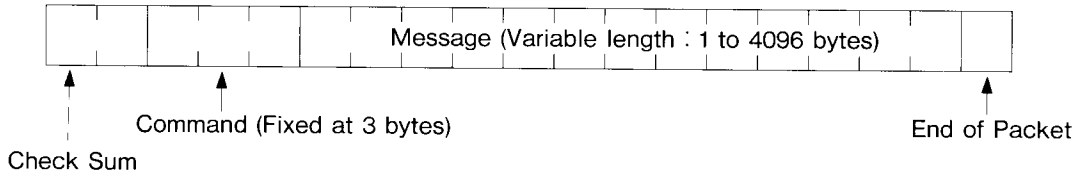
Fig. 5.2 RS-422 Connection

5.2.2 Transmission Control Character

Table 5.1 Transmission Control Character

Control Character	Code (Hexadecimal)	Meaning
EOP	0DH	End of Packet

5.2.3 Packet Format



5.2.4 Check Sum

This is 8 bits of binary sum at the lower and of the format for all the bytes from command to EOP (end of packet), as expressed by 2-character code of 2-digit hexadecimal.

5.3 Description on Commands

5.3.1 Sending Command (NC Unit Communication Module to Host Computer)

- SYN Request to initialize host computer.
- RDY Informs host computer of initializing completion of NC unit communication module and asks the host computer if it has completed initialization.
- SAT Informs host computer of sending NC unit communication module status.
- GTD Informs host computer of request for sending of machining data to NC unit side.
- RST Informs host computer of NC unit "RESET" processing completion.
- ALM Informs host computer of NC unit alarm issue during DNC opration.
- SDI Informs host computer of transfer of PC coil information.
- RTY Requests host computer to resend the command when transmission error is detected during receiving packet.

5.3.2 Receiving Command (Host Computer to NC Unit Communication Module)

- SYN Requests NC unit communication module to initialize.
  (It also informs incompletion of initialization at the host computer side at the time of power ON.)
- RDY Informs NC unit completion of host computer initialization.
- SET Informs NC unit of status change request of NC unit communication module.
  (It is also usable as acknowledgement of polling "SAT" command from NC side.)
- CLB Informs NC unit of buffer clear request for NC machining data of NC unit communication module.
- DAT Informs NC unit of sending of NC machining data.
- WAT Informs NC unit that host computer is temporarily unable to send NC machining data.
- EOD Informs NC unit of end of sending NC machining data.
- ARS Informs that host computer has received RST command sent from NC unit.
- AAL Informs that host computer has received ALM command sent from NC unit.
- SDO Informs request of host computer to write on PC coil (built inside NC unit.)
- SDI Informs request of host computer to read from PC coil (built inside NC unit.)
- RTY Requests NC unit to resend command when transmission error is detected during receiving packet at host computer.

5.3.3 Polling

If NC unit does not request sending a command for a certain time after receiving commands from the host computer, it sends SAT command and transfers the sending right to the host computer.

Polling timer is variable. Refer to par. 5.2.4. If the host computer does not need to send the command to NC side after receiving SAT command, the host computer side is requested to transfer the sending right to the communication module side by sending SET command.

5.3.4 Command Check

After sending the command, NC unit communication module receives the command from the host computer as a receiving station.

Since the command itself has its own meaning, the communication module checks the matching of the command sent previously with the receiving command.

Table 5.2 Command Check

Command Sent Previously \ Receiving Command	SYN	RDY	SET	CLB	DAT	WAT	EOD	ARS	AAL	SDO	RDI
SYN	○	Note 1									
RDY	○	○	Note 1								
SAT	Note 2	×	○	Note 4	×	×	×	×	×	○	○
GTD		×	×	×	○	○	○	×	×	○	○
RST		×	×	×	×	×	×	○	×	×	×
ALM		×	×	×	×	×	×	×	○	×	×
SDI		×	○	Note 4	Note 3			×	×	○	○

The receiving command after sending the command in the left column expects "○".

The "×" indicates a disagreement in commands and the communication module is on alarm.

Notes: 1. Resend "SYN" command and initialize again.

2. When NC unit is reset or on alarm, "SYN" command is sent to initialize communication module.
   But, the commands are regarded as disagreeing when DNC is operating.
3. The commands are regarded as disagreeing at conditions other than operation.
4. The commands are regarded as disagreeing under conditions at operation.

Communication module sends the commands as listed below after receiving a command from the host computer in accordance with NC control unit.

Table 5.3 Sending Command Communication Module

Sending Command \ Receiving Command	SYN	RDY	SET	CLB	DAT	WAT	EOD	ARS	AAL	SDO	RDI
SYN	Note 1										
RDY	○	—	—	—	—	—	—	—	—	—	—
SAT	—	○	○	○	○	—	○	○	○	○	—
GTD	—	○	○	○	○	○	—	○	○	○	—
RST	—	○	○	○	○	○	○	○	○	○	—
ALM	—	○	○	○	○	○	○	○	—	○	—
SDI	—	—	—	—	—	—	—	—	—	—	○

Note 1: SYN command is sent if communication module regards the host computer to be in error. If it receives the command normally, such command is not sent.

5.4 Message Format

Four types of messages are prepared as below :

- NC machining data
- Communication module status
- PC coil data
- Resending cause data

Correspondence of message to command is as listed below :

Table 5.4 Sending Command Message

Sending Command	Message
SYN	None
RDY	None
SAT	Status Data
GTD	
RST	——
ALM	——
SDI	PC Coil Data
RTY	Resending Request Cause Data

Table 5.5 Receiving Command Message

Receiving Command	Message
SYN	——
RDY	——
SET	Status Data (Omittable)
CLB	——
DAT	NC Machining Data
WAT	——
EOP	——
ARS	——
AAL	——
SDO	PC Coil Data
RDI	——
RTY	Resending Request Cause Data

5.4.1 NC Machining Data

These are variable length (1 to 4096 bytes) data subsequent to DAT command.

Two types of data contents are available: NC part program format and DNC high speed cutting data format.

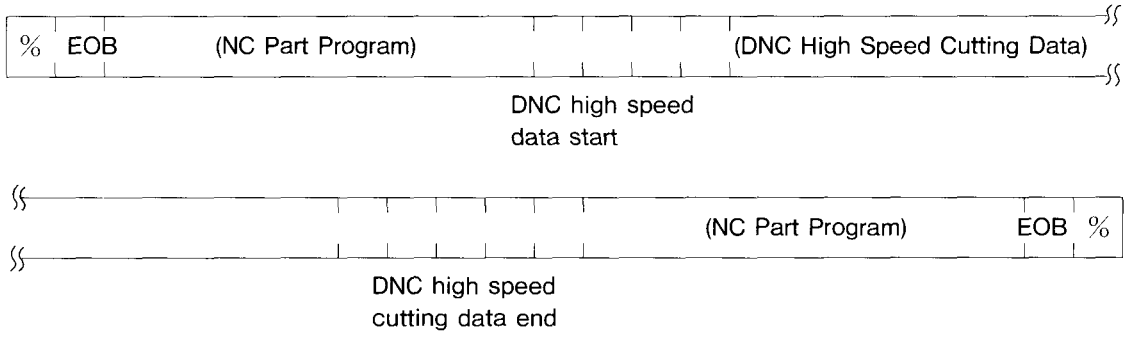


Fig. 5.4 NC Machining Data

Follow the program format of YASNAC i80M for NC part program.

Detail of DNC High Speed CUTTING Data

Data start : 3 characters + EOB (OA)

Set by NC parameter.
Set the character code that indicates start to pm3106, pm3107 or pm3108.

Move pulse data per unit time (4ms)

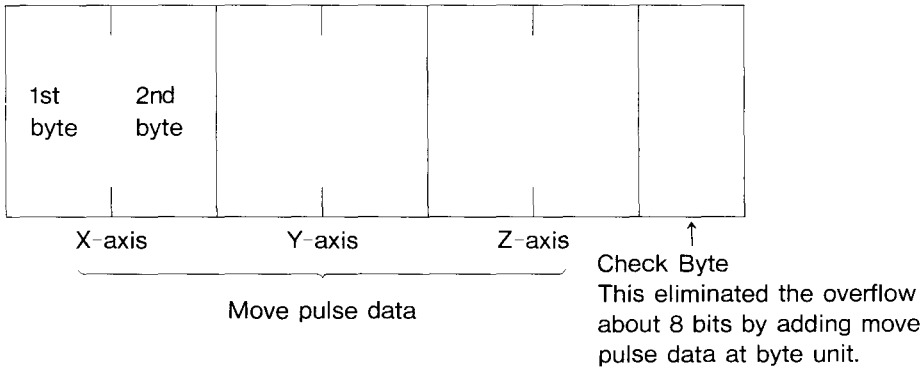


Fig. 5.5 DNC High Speed Cutting Data Format

Move pulse data is quoted as shift binary data and it expanded the 14-bit binary data to 16 bits.

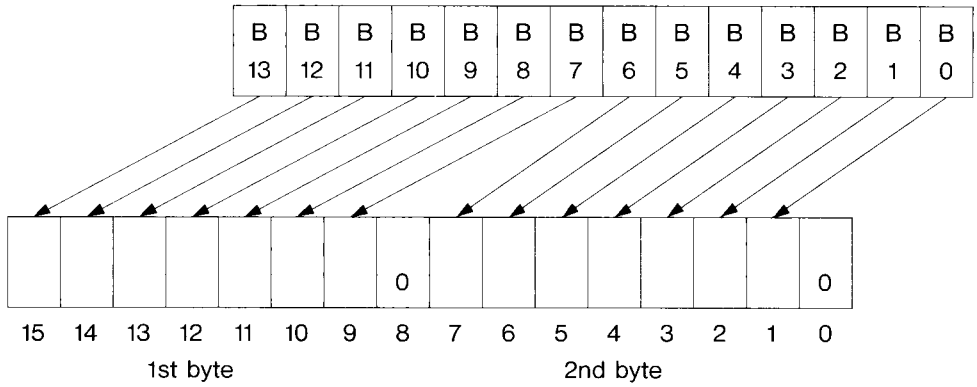


Fig. 5.6 X-axis Move Pulse Data

If NC has adding axis, 4th axis and 5th axis can be added by the NC parameter (pm1200) which specifies DNC high speed cutting axis.

High Speed Cutting Data Format for 4th Axis (pm1200=4)

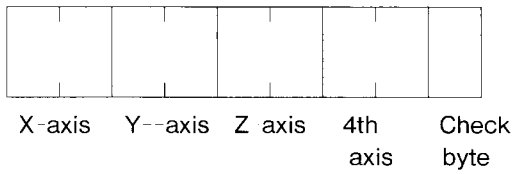
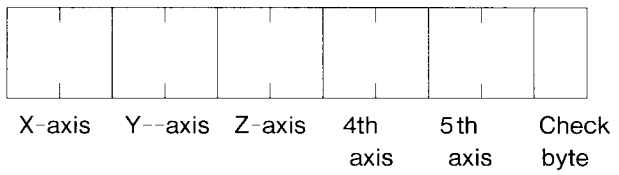


Fig. 5.7 High Speed Cutting Data Format for 4th Axis

High Speed Cutting Data Format for 5th Axis (pm1200=5)



Data End : Continous 7 NULL codes, but 9 codes for 4th axis and 11 codes for 5th axis.

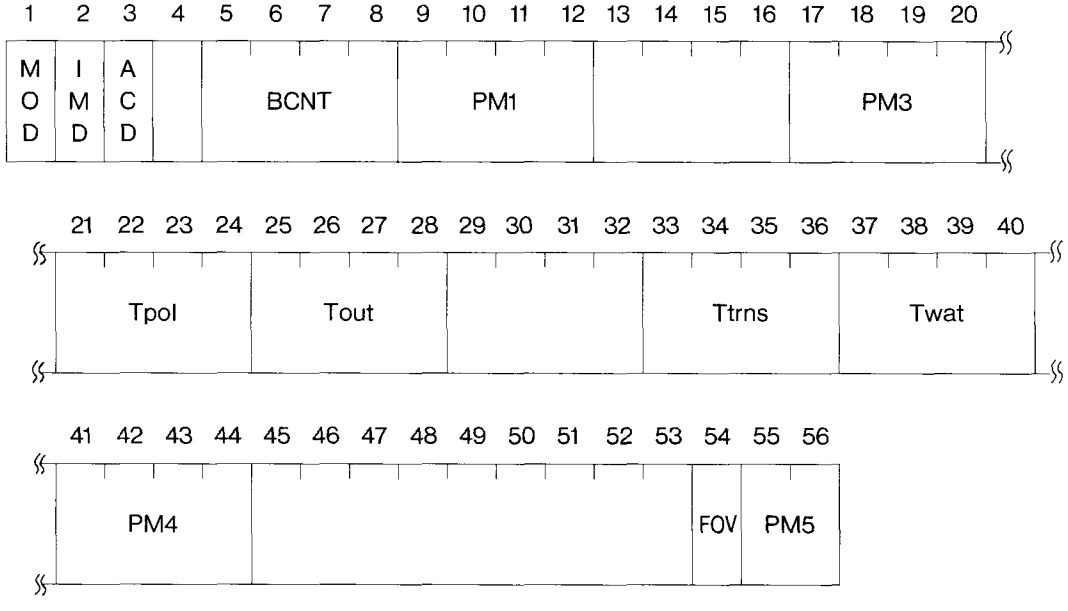
Fig. 5.8 High Speed Cutting Data Format for 5th Axis

5.4.2 Status Data

This is status data for the communication module and is 54-byte-length data subsequent to command in the left column that has meaning by byte position.

Table 5.6 Status Data Command

Sending/Receiving	Command	Applicaton
NC unit to Host Computer	SAT GTD	Data to inform the status of communication module to host computer
Host Computer to NC unit	SET	Status data so that the host computer can specify the status of the communication module.



MOD : Tape run device

IMD : Internal mode for communication module

ACD : Alarm code of communication module

BCNT : Communication module receiving buffer character

PM1, PM3, Tpol, Tout, Ttrns, Twat, PM4, FOV, PM5: Parameter/timer for controlling communication module

Note : If the status data sent from host computer exceeds 55 bytes, NC unit disregards those bytes above 57 bytes.
If it is below 57 bytes, only the timer and parameter provided by the data are set up.

Fig. 5.9 Status Data Format

Table 5.7 Detail of Status Data

Name	Byte Position	Sending Command (SAT, GTD)	Receiving Command (SET)	Remarks
MOD	1	Character code numerals to inform the input device for tape running of NC unit 1 : DNC interface 2 : PTR	Character code numerals to specify the input device for NC tape running 1 : DNC interface 2 : PTR "0" if not specified.	Specified selection during DNC running is disregarded. Receiving command is also disregarded when setting "2", NC parameter pm3006, DO=1.
IMD	2	Character code numerals to inform the internal status of communication module 0 : Unfinished status 1 : Reset status 2 : Time out 3 : Alarm status	———	
ACD	3	Character codes to inform the element code at alarm status of communication status 0 : NC alarm 1 : Time out 2 : DR line error 3 : Packet length error 4 : 51 error 5 : DR signal error 6 : Check sum error 7 : 8 : Diagnostic error	———	
—	4	Space code	———	
BCNT	5 to 8	Character code of hexa-decimal number in 4 digits to inform number of charac-ters stored in buffer of communication module	———	
PM1	9 to 12	Character code of hexa-decimal 4 digits to inform numerals of setting number of by tes of GTD command buffer parameter : Minimum empty area for DNC interface receiving buffer at the time of sending GTD command	Character code of hexa-decimal 4 digits that specifies the numerals to be set to GTD command buffer parameter	Setting at the time of initializing com-munication module "2000" (bytes)
	13 to 16	"0" code × 4	———	

Table 5.7 Detail of Status Data (Cont'd)

Name	Byte Position	Sending Command (SAT, GTD)	Receiving Command (SET)	Remarks
PM3	17 to 20	Character code of hexadecimal 4 digits that informs numeral of parameter to set times resending requests at the time of detecting transmission error	Character code of hexadecimal 4 digits that specifies numerals to be set to parameter for times of resending requests	Setting at the time of initializing communication module "10" (times)
TPOL	21 to 24	Character code of hexadecimal 4 digits to inform the numerals of polling timer : It sets the time until SAT command is sent after receiving command.	Character code of hexadecimal 4 digits that specifies the numerals to be set to polling timer	Setting at the time of initializing communication module "5" (seconds)
TOUT	25 to 28	Character code of hexadecimal 4 digits to inform the numerals of time out detect timer : Timer to specify the allowable timer until receiving the command after sending the command	Character code of hexadecimal 4 digits that specifies the numerals to be set to time out detect timer	Setting at the time of initializing communication module "20" (seconds)
	29 to 32	"0" code × 4	———	
TX	33 to 36	Character code of hexadecimal 4 digits to inform the numerals of command sending timer : Interval timer until sending the command after receiving the command	Character code of hexadecimal 4 digits that specifies the numeral to be set to command sending timer	Setting at the time of initializing communication module "100" (msec) But, it causes error within one clock, since it is counted up by 8ms real time clock.
TWAT	37 to 40	Character code of hexadecimal 4 digits to inform the numerals of Wait timer for requesting NC machining data : Timer up to resending GTD command after receiving WAT command	Character code of hexadecimal 4 digits that specifies the numerals to be set to Wait timer for requesting NC machining data.	Setting at the time of initializing communication module
PM4	41 to 44	Character code of hexadecimal 4 digits to inform the numerals of control system of communication module 16 types of P0 to P15 P0 : 0 fixed (buffer clear by NC reset) P1 : 0 fixed (8 units by ISO code) P2 : 0 (polling time unit at second) 1 (polling time unit at 0.1 second) P3 : 1 fixed (add status data to GTD as message)	Character code of hexadecimal 4 digits to set the numerals of communication module control system 16 type of P0 to P15 P2 : 0 (polling time unit at second) 1 (polling time unit at 0.1 second)	
	45 to 54	"0" code × 9	———	
FOV	54	NC cutting override DO=0, D1 to D5=0 to 200%, binary D7=1		
	55, 56	Protocol 3−1 : Mode data	0 : Protocol 3-1 not provided 1 : Protocol 3-1 provided	

Those SET commands showing "———" indicate to be disregard at the communication module side.

5.4.3 PC Coil Data

These are 2-byte fixed data to indicate the information of 1 channel (8 bits) for PC coil by hexadecimal 2 digits.

Sending Command (SDI)
Sends the present status of coil set by NC unit parameter (pm3440)

Receiving Command (SDO)
Writes the receiving data to the coil set by NC unit parameter (pm3441)

(Example) The command to write "00010010" to pm7100 from host computer

Check sum	S	D	0	1	2	EOP

However, "7100" has to be set up to NC unit parameter pm3441 in advance.

Note : 3rd byte and on are disregarded if receiving PC coil data exceeds 3 bytes.

5.4.4 Resending Cause Data

Character code data of 1 byte subsequent to RTY command
"1" Check sum error
"2" Error other than above

Note : It can be omitted when resending request is made from host computer.
If receiving data from host computer exceeds 2 bytes, 2nd byte and on are disregarded.

5.5 Transmission Procedure

5.5.1 Power Application Sequence

NC unit

"SYN" Command	Trigger
· Informs initializing request to host computer	· At power ON · At communication time out · At exceeding number of retrys

"RDY" Command	Trigger
· Inform com pletion of communicaton module initi- alization	· Activates at completion of initialization by receiving "SYN" command

"SAT" Command	Trigger
Informs sending of communica- tion module status	· Activates when sending command from NC unit side is absent even if a certain time elapses after receiving command from host computer

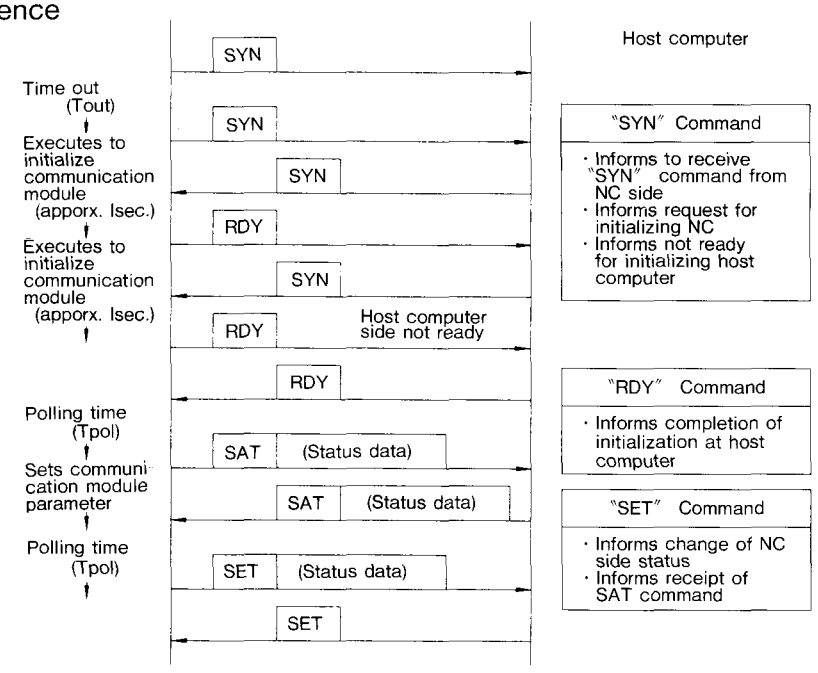


Fig. 5.10 Transmission Procedure at Power Application Sequence

5.5.2 DNC Operation

NC unit

"GTD" Command	Trigger
Informs request for transfer of machining data	· Activates during NC side operation with buffer empty

"RST" Command	Trigger
Inform comple- tion of NC unit resetting	· Activates at resetting NC unit Note : It is not sent when NC unit is on alarm.

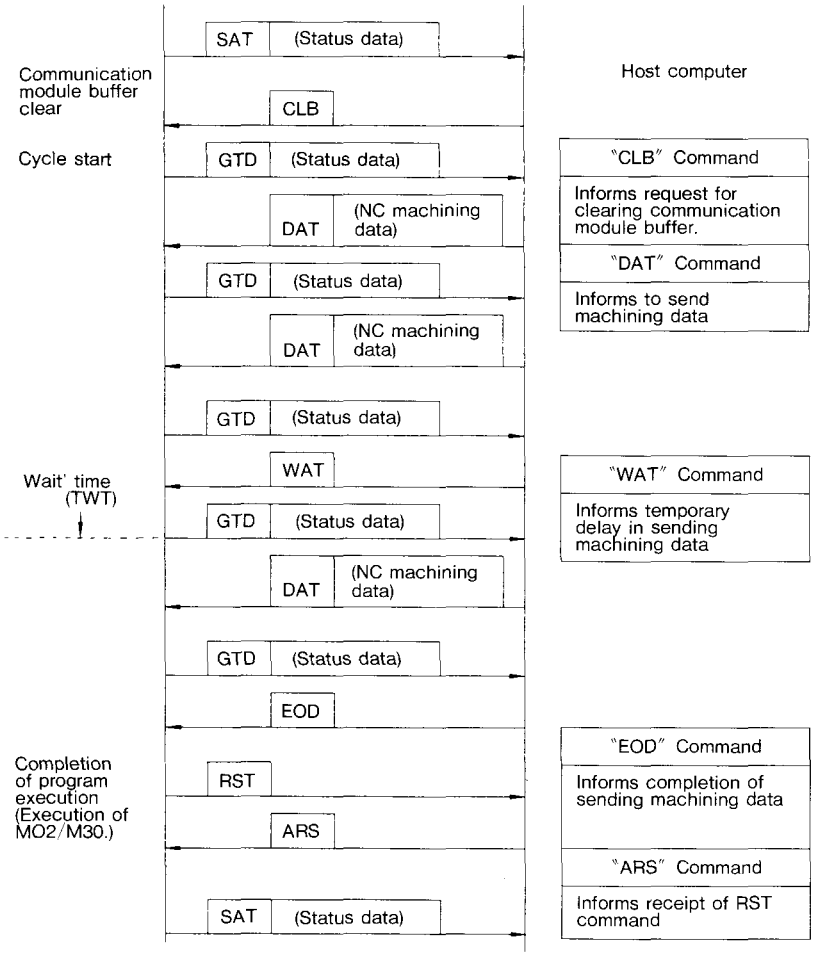


Fig. 5.11 Transmission Procedure at DNC Operation

5.5.3 Interruption by Alarm during DNC Operation

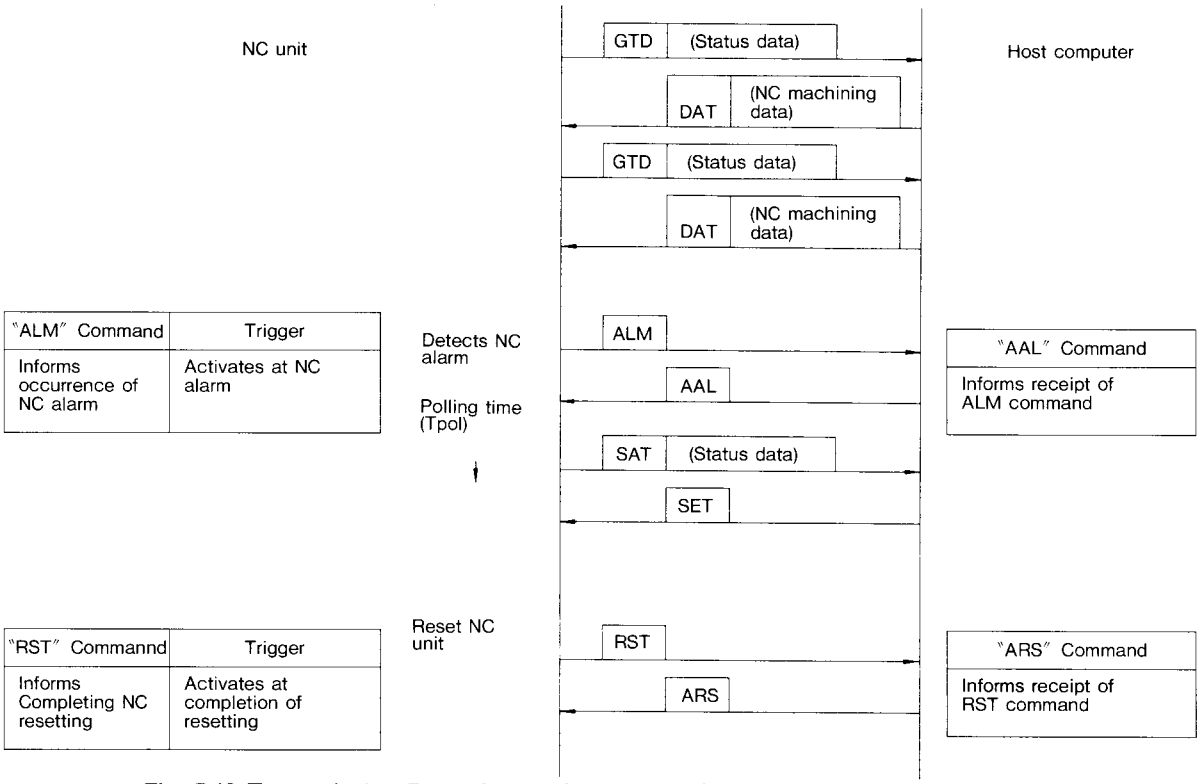


Fig. 5.12 Transmission Procedure at Interruption by Alarm during DNC Operation

5.5.4 Computer Operation (PC coil reading/writing)

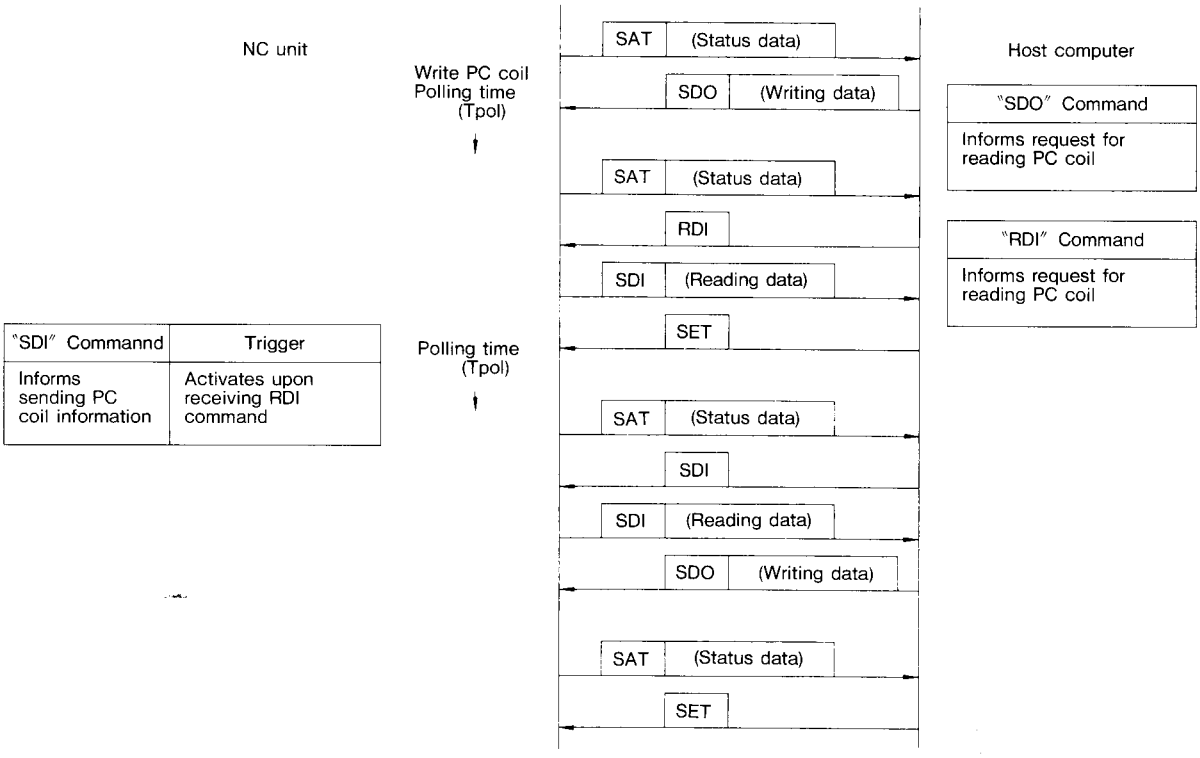


Fig. 5.13 Transmission Procedure at Computer Operation (PC coil reading/writing)

5.5.5 Computer Operation (DNC operation start by PC coil control)

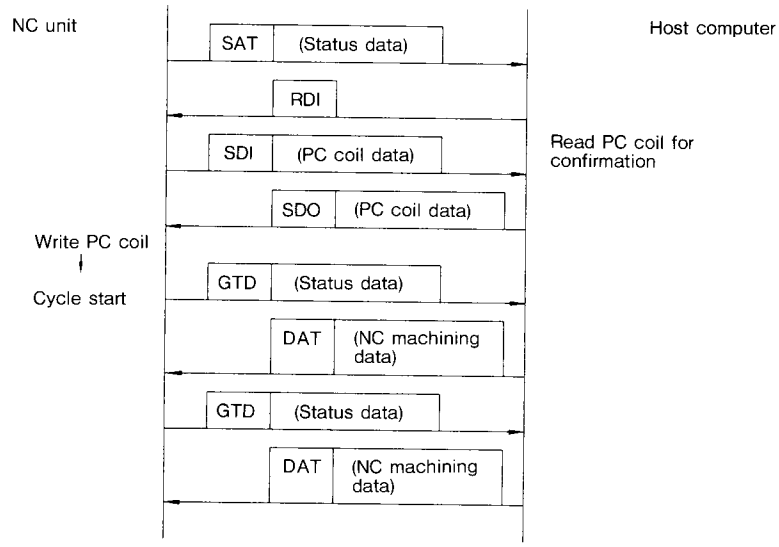


Fig. 5.14 Computer Operation at DNC Operation Start by PC Coil Control

5.6 Error Detection at Host Computer

Communication module regards the host computer to be in error in the following cases :

- Time Out
  When characters are not received from host computer in a certain time after sending command from NC unit, this is regarded as a host computer error and the communication module enters into alarm status by sending a SYN command.
  Time Out detect time can be set from the host computer with SET command.

- Transmission Error
  If transmission error is detected at the time of receiving command, RTY command is sent for resending request.
  However, if transmission error occurs even by requesting for a certain time, the host computer is regarded as being in error and the communication module enters into alarm status by sending a SYN command.
  Times of resending requests can be set from the host computer with SET command.

- Packet Length Error
  If the data length of message cannot be stored in the buffer of the communication module at the time of receiving the command, the host computer is regarded as being in error and the communication module enters into alarm status by sending SYN command.

- DR Error
  If DR signal OFF is detected during transmission, it is considered to be a host computer error, and the communication module enters into alarm status by sending a SYN command.

However, if the communication module is not ready, the line is regarded as "not operational" and the communication module is kept in a non-operational status.

5.7 Communication Module Status Transition Diagram

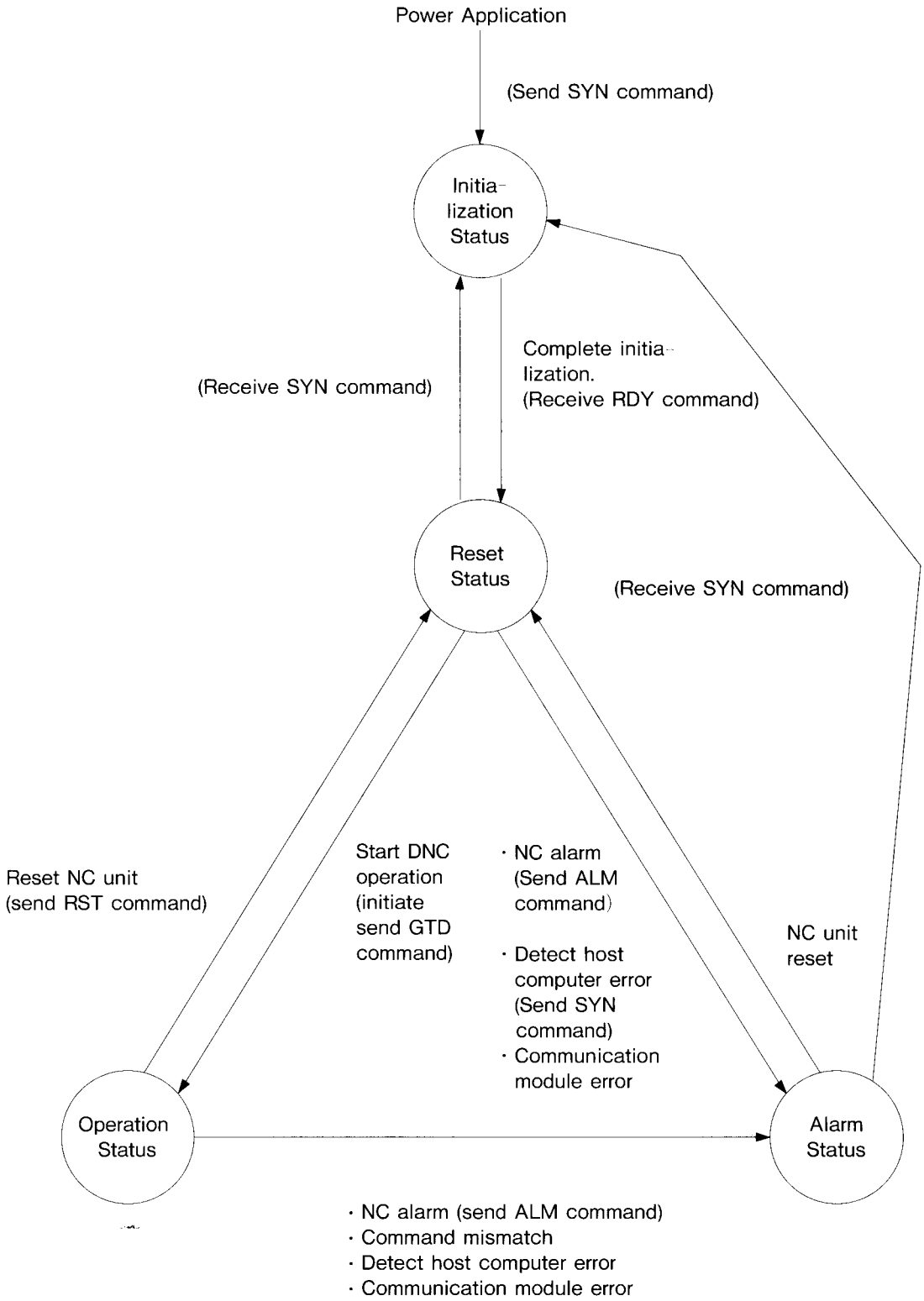


Fig. 5.15 Communication Module State Transition

5.8 Supplementary Description on NC Operation by DNC High Speed Cutting Data

- Data start is transferred to NC unit by converting to internal code of internal processing which NC unit can decode inside the communication module.
- Idle time from end of pulse distribution of part program by NC format to the start of pulse distribution by DNC high speed cutting data requires processing time of 1 block maximum (40ms max. in normal mode).
  The idle time unitl restart of pulse distribution of part program by NC format after completing pulse distribution by DNC high speed cutting data is the same.
- Execution of normal machining NC program is interrupted during distrubution of DNC high speed cutting data pulse.
- Pulse distribution stops when feedhold and interlock are input from PC.
- Feedrate override is disregarded.
- Cutting feed maximum speed clamp is disregarded.
- An alarm will be initiated if DNC high speed cutting data is specified during radius compensation, canned cycle or user macro mode.
- During DNC high speed cutting data manual movement is not compensated for even if the manual absolute switch is ON and if manual mode is selected during distribution of DNC high speed cutting data pulse to interrupt the pulse distribution and then the pulse distribution is resumed.
  (During DNC high speed cutting data, operation is the same as manual absolute switch OFF. Manual movement amount is compensated for at the time of executing NC language.)
- When DR (data set ready) signal is not used, or when DR signal is turned off to use during communication, set the pm0030 D5 parameter "DR signal checked/not checked" to "DR signal not checked."

6. PROTOCOL 3-1

This protocol is an expanded type of protocol 3, and makes a packet for high-speed transfer format at NC machining data transfer requiring high-speed information transfer. At the same time, communication efficiency has been improved by an all duplex-communication.

When DNC operation is performed by using protocol 3-1, the relation with protocol 3 is as shown below :

Communication Start

↓ Protocol 3

DNC Operation Start

↓ Protocol 3-1

- DNC Operation NC Machining Data

Completion of Transfer

- DNC Operation Suspension
- Communication Error Detection

↓ Protocol 3-1

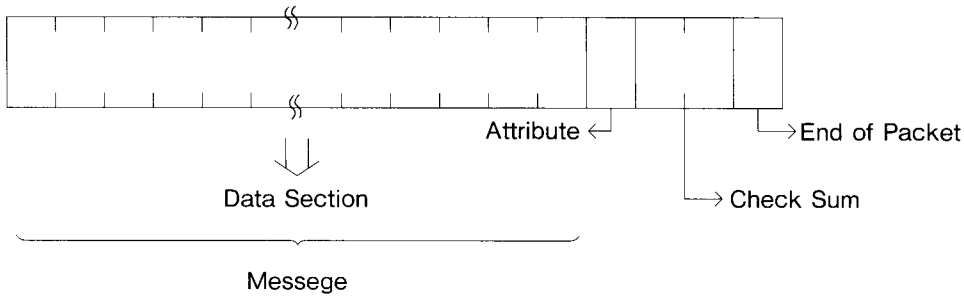
When protocol 3-1 is used, it is necessary to set the protocol 3-1 NC machining data packet length by the protocol 3 SET command status data PM5 (55th or 56th byte) before DNC operation.

6.1 Control Character and Packet Format

Character code in eight units is used in protocol 3-1.

(CN Parameter pm6067, pm6068 D4=1)

Packet Format



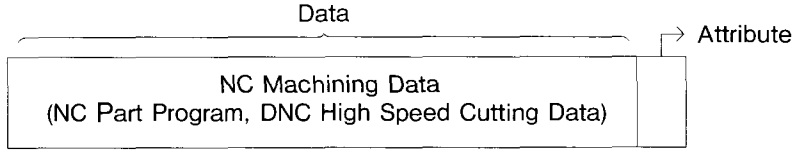
· Message Data Section
Data area for NC machining data (host computer→NC; data length fixed by PM5) control code (host computer←NC; data length 1 byte)

· Message Attribute Section
Area for attribute information (transmission order No., etc.) added to message data

· Check Sum
Obtained by adding each byte up to message data or attribute in the units of 1 byte, omitting overflow exceeding 8 bits and expressing the resultant added 8 bits in hexadecimal representation ASCII code 2 bytes.

6.2 Details of Message Section

NC machining data (host computer→NC)



6.2.1 Data Section

The data length is fixed to 256 × N (1,2,4,8) bytes.
The value of N is set by the 55th or 56th byte among "SET" command comunication module status data of protocol 3 which is executed before protocol 3-1.

6.2.2 Attribute Section

One-byte information indicating attribute of NC machining data sent from the host computer.

Attribute	Quantity	Contents
NC Machining Data Packet Transmission Order No.	30H to 39H	Indicates NC machining data transmission order sent from host computer. 30→31→···39→30→31··· →Transmission order
NC Machining Data Ineffective	80H to FEH	Indicates dummy NC machining data packet transmision.
NC Machining Data Transmission Completed	FFH	Indicateds completion of a serial NC machining data transmission.

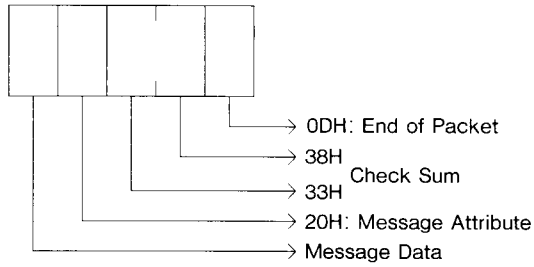
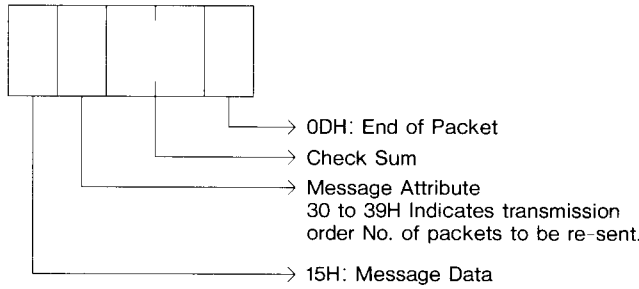
6.2.3 Supplement of NC Machining Data

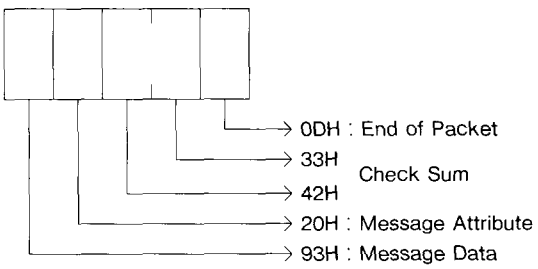
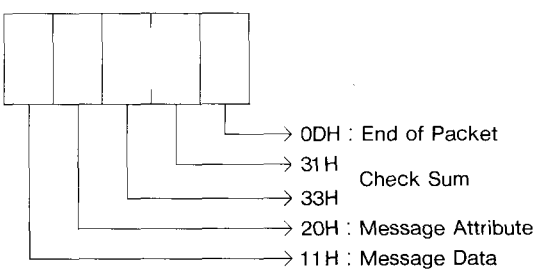
1. NC part program is in accordance with protocol 3.
2. Since NC machining data packet data length is fixed, the following items differ from protocol 3 at communication, concerning DNC high-speed cutting information.

Item	Protocol 3-1	Protocol 3
· Data start · Data end · Moving pulse data per unit time	Information may be overlapped in two packets.	Information is collected in one packet.

6.3 Message for Control (Host Computer←NC)

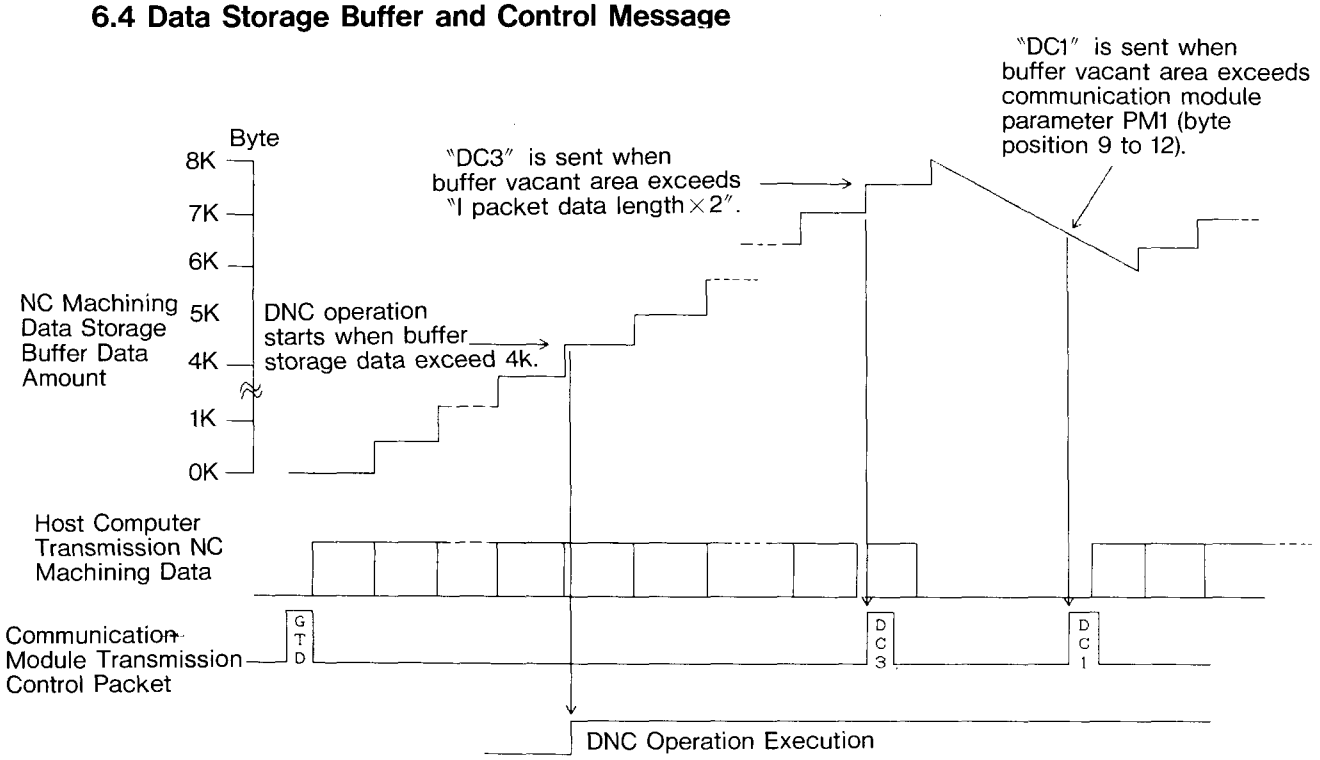
These are four types of packets to send control characters from the NC unit to the host computer. Each message is composed as shown below.

Packet Name	Details of Contents and Format
Data Send Cancel Request (CAN)	Requests to cancel DNC operation by protocol 3-1. 
Resend Request (NAK)	Requests resending to host computer when NC machining data error packet received. 

Send Stop Request (DC3)	Requests temporary stop of NC machining data send to host computer when data storage buffer vacant area is lower than the specified value at NC machining data receiving. 
Send Restart Request (DC1)	Requests NC machining data sending restart to host computer when communication module data storage buffer vacant exceeds the specified value after send stop request (DC3) output. 

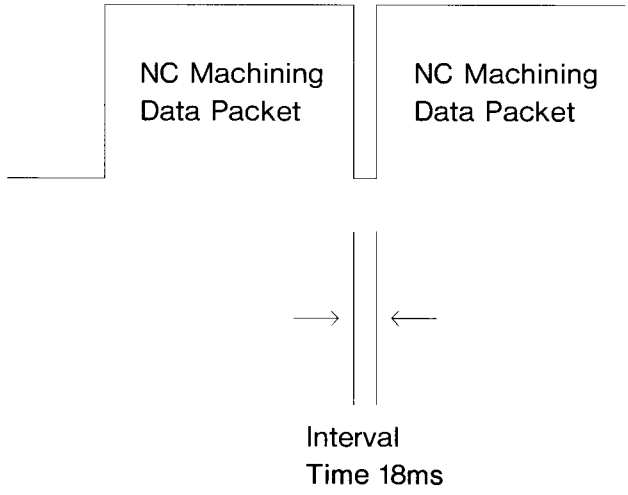
Note : The above examples are provided when NC machining data length is 0.5 k-byte.

6.4 Data Storage Buffer and Control Message

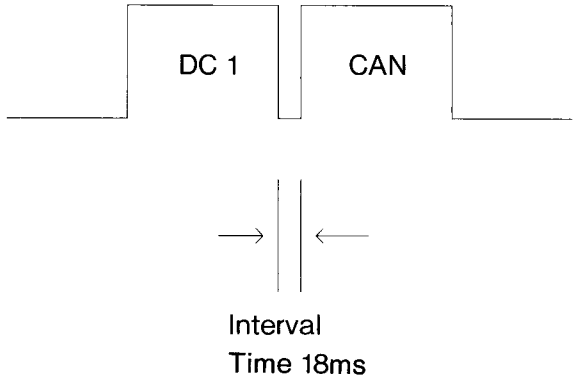


6.5 Limitation on Packet Communication

· Host Computer to NC
Interval time exceeding 8ms is needed until the next NC machining data packet is sent after an NC machining data packet was sent.



· NC to Host Computer
Interval time exceeding 8ms is provided when control packets sent from the communication module are overlapped.



7. NC SETTINGS/PARAMETERS FOR COMMUNICATION MODULE

Table 7.1 NC Settings/Parameters for Communication Module

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Description</th><th colspan="3">Protocol</th></tr>
<tr><th>1</th><th>2</th><th>3</th></tr>
<tr><td>pm0030</td><td>D5 : 0=DR signal disregarded 1=DR signal employed

D6 : Specify communication module device
0=RS-232C 1=RS-422

D7 : Specify NC tape operation device
0=PTR (FC200 circuit board serial port)
1=Communication module</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>pm0031</td><td>Specify communication module RS-232C format D0, D1, D2: Set baud rate
<table><tr><th></th><th>D2</th><th>D1</th><th>D0</th></tr><tr><td>1200</td><td>0</td><td>0</td><td>0</td></tr><tr><td>2400</td><td>0</td><td>0</td><td>1</td></tr><tr><td>4800</td><td>0</td><td>1</td><td>0</td></tr><tr><td>9600</td><td>0</td><td>1</td><td>1</td></tr><tr><td>19200</td><td>1</td><td>0</td><td>0</td></tr><tr><td>38400</td><td>1</td><td>0</td><td>1</td></tr></table>D3: Set stop bit 0=1 bit 1=2 bits
D4: Set character bit 0=7bits 1=8 bits
D5, D6: Set parity check
D5=1 Even number check
D6=1 Odd number check
D5=D6=0 Parity check absent</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>pm0032</td><td>Specify communication module RS-422 format
(Bit composition is same as pm0031)</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>pm3006</td><td>Set NC function for communication module.
D0: Classify tape operation device.
0=I/O input specification
(#30160 1 : DNC/0 : PTR)
1=Setting specification
(pm0030 D7 1 : DNC/0 : PTR)
D1: Specify communication module error disposal.
0=NC at alarm
1=NC not at alarm</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td></td><td>D2, D3, D4: Specify protocol 1 and 2 operation status.
D2 and D3: Buffer storage amount for DNC operation start
<table><tr><th></th><th>D3</th><th>D2</th></tr><tr><td>128bytes</td><td>0</td><td>1</td></tr><tr><td>256bytes</td><td>1</td><td>0</td></tr><tr><td>512bytes</td><td>1</td><td>1</td></tr><tr><td>2048bytes</td><td>0</td><td>0</td></tr></table>D4: Specify status information character.
0=Not sending 1=Sending</td><td>○</td><td>○</td><td>×</td></tr>
</table>

Table 7.1 NC Settings/Parameters for Communication Module (Cont'd)

No.	Description	Protocol 1	Protocol 2	Protocol 3
pm3006	D5,D6,D7 : Specify communication module protocol Protocol 1: D7=0, D6=0, D5=0 Protocol 2: D7=0, D6=0, D5=1 Protocol 3: D7=0, D6=1, D5=0 Protocol 4: D7=0, D6=1, D5=1	○	○	○
pm3106 pm3107 pm3108	Specify DNC high speed cutting data start character.	×	×	○
pm1200	Specify number of axes for DNC high speed cutting data. 3=3 axes 4=4 axes 5=5 axes	×	×	○
pm3440 pm3441	Specify "RD1" command PC coil number (Setting range : 7000 to 7999) Specify "SDO" command PC coil number (Setting range : 7000 to 7999)	×	×	○
pm4167	Specify DNC high-speed cutting multi-segment. 1=1ms 2=2ms 4=4ms	×	×	○
pm3007	D6 : when pm3006 D1=1 1 : Does not output only TIME OUT ERROR. 0 : Normal D7 : Specify DAT binary data 150 bytes (15 segments) buffering function after WAT command. 1 : Buffering 0 : No buffering	×	×	○
Setting pm33	Protocol 2 Receiving interruption timer (1S to 5S)	×	○	×

Notes : 1. If setting a number other than setting range (7000 to 7999) to parameter for sending command (SDI) and receiving command (SDI), the number below 6999 is written/read to 7000 and the number above 8000 is written/read to 7999.
2. O: Effective
3. Perform initialization or power OFF except for pm0030 D7 (communication module device specification) if setting value for setting or parameter changes.

ADDITONAL EXPLANATION

Related Parameters

pm0004 D6 : ISO code "EOB" output setting
0 "EOB" output as "LF", "CR"
1 "EOB" output as "LF"

8. COMMUNICATION MODULE DIAGNOSTIC FUNCTION AND NC CONTROL UNIT ERROR PROCESSING

8.1 Communication Module Diagnostic Function at System Operation

- Memory Check
  Performs memory check at the time that power is turned ON and the system operation.
- Watchdog
  Checks to ensure that the communication module processor operates normally by NC side processor.

If an error is detected by above diagnostic function, the communication module enters into alarm status.

8.2 NC Control Unit Error Processing

If the communication module detects an error or the NC control unit detects an error in the communication module, the NC unit displays the cause of the alarm on the operation panel and the NC unit enters into an alarm status.

Table 8.1 Alarm Code and Message

Alarm Cause	Alarm Cause	Message
DNC Time Out	1000	DNC TIME-OUT
DR Line Error	1001	DNC DR-LINE ERROR
Packet Length Error	1002	DNC PACKET LENGTH ERROR
DNC 51 Error	1009	DNC 51 ERROR
Check Sum Error	1004	DNC CHECK SUM ERROR
Command Error	1005	DNC COMMAND ERROR
(Reserved)	(166)	
DNC Communication Module Diagnostic Error	1007	DNC ROM CHECK ERROR
High Speed Cutting Mode Error	1006	DNC HISPEED MODE ERROR
DNC CPU Error	1008	DNC CPU ERROR

Notes 1. NC unit can be free from alarm status even at the time of the communication module error by setting NC parameter pm3006 D1=1.
By this setting, NC operation is available by memory even if the communication module shuts down.

2. If the communication module is not ready without setting by NC parameter pm3006, as mentioned in par. 7, line is regarded as unestablished and the NC unit does not enter into alarm status even at occurrence of error.

9. STORAGE TO MEMORY INSIDE NC

It can store an NC part program, offset data, setting/parameter data transferred from the host computer through the serial transmission line of the communication module into the NC part program memory of YASNAC.

9.1 NC Part Program Storage

9.1.1 Storage Operation of Part Program Tape with Program No.

NC Part Program Format

·····% ; 01234 ; G92XOYO ———— M30 ; %·····

Note : " ; " = EOB code (OAH)

Fig. 9.1 NC Part Program Format with Program No.

Operation Procedure
Refer to "I/O Verification Job" in the YASNAC i80M Operator's Manual.

9.2 Storage of Offset Data and Setting/Parameter Data

9.2.1 Storage Operation of Tool Offset Data to Offset Memory

Tool Offset Data Format

·····% ; H01X1000 ; H02X2000 ; H03X3000 ; ——— ; %···

Note : " ; " =EOB code (OAH)

Fig. 9.2 Tool Offset Data Format

Opetration Procedure
Refer to "I/O Verification Job" in the YASNAC i80M Operator's Manual.

9.2.2 Storage Operation of Setting/Parameter Data to Memory
Setting/Parameter Data Format

·····% ; N6000X128 ; N6001X5 ; N6002 ; ——— ; %·····

Note : " ; " =EOB code (OAH)

Fig. 9.3 Setting/Parameter Data Format

Operation Procedure
Refer to "I/O Verification Job" in the YASNAC i80M Operator's Manual.

YASNAC i80M
INSTRUCTIONS

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