MITSUBISHI
Programmable Controller

F1 , F2 SERIES

USER'S MANUAL

RS232C INTERFACE UNIT FOR MONITORING

F2 - 232GF

* Users should ensure that the details of this article are studied and understood before attempting to use the unit.

* Information concerning the programming or handling of data in the host unit is not covered.

MITSUBISHI ELECTRIC CORPORATION

INTERFACE UNIT FOR MONITORING

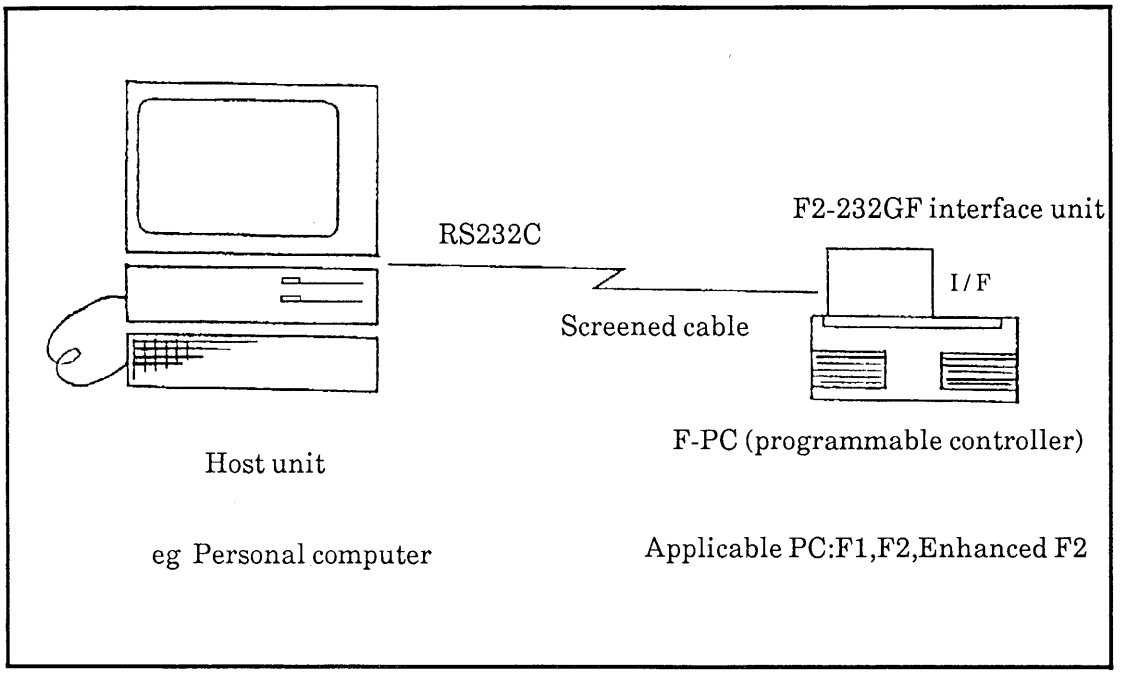
F2-232GF

INDEX

1 SPECIFICATIONS

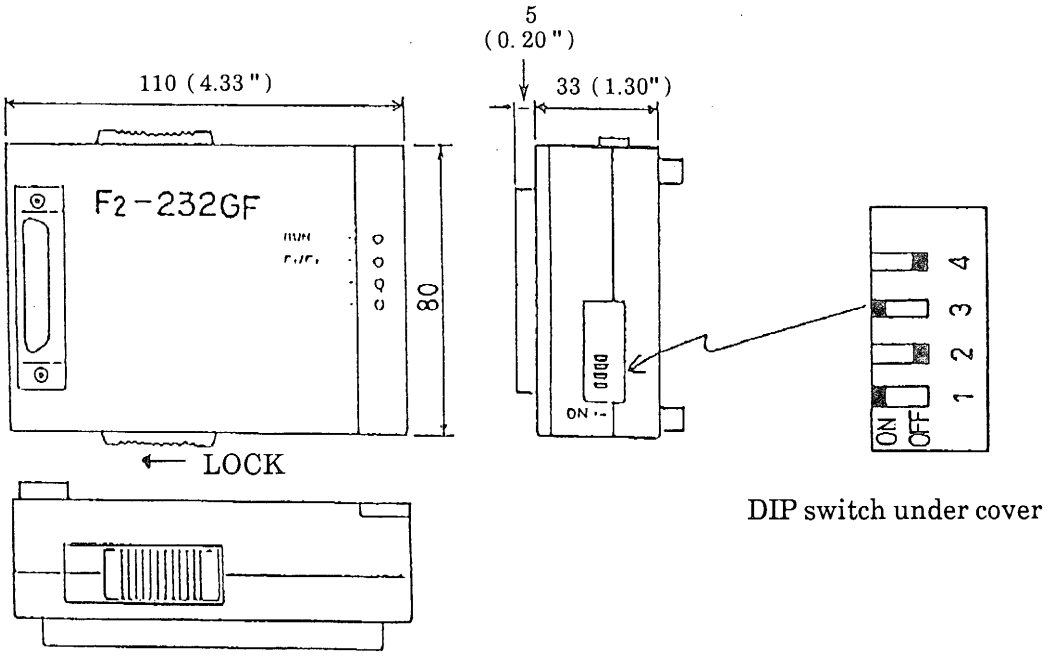
1.1 INTRODUCTION

The transmission cable to be used with the F_2-232GF interface unit and the host unit should have the specifications shown in section 1.4. This interface unit allows F_1,F_2 and Enhanced F_2 programmable controllers to be monitored by host units such as personal computers. Also it will allow bit set / reset to be made. Program constants can be changed in the RAM or EEPROM but not in the EPROM cassette area.



ITEM		SPECIFICATION
INTERFACE FORMAT		RS232C (D-SUB 25 pin connection)
TRANSFER FORMAT		Bi-direction (not simultaneously)
PROTOCOL		Specialized
TIMING		Asynchronous
BAUD RATE		9600,4800,2400,1200 bit/sec
ERROR CONTROL		Parity and sum check
DATA FORMAT	CODE	ASCII
	START	1 bit
	DATA	7 or 8 bit
	PARITY	1 bit (even or odd)
	STOP	1 bit
POWER		supplied by PC
DELAY TIME BEFORE ERROR		about 5sec
COMMUNICATION DISTANCE		Less than 15m (50ft.)

1.2 DIMENSIONS mm (inch.)



DIP switch under cover

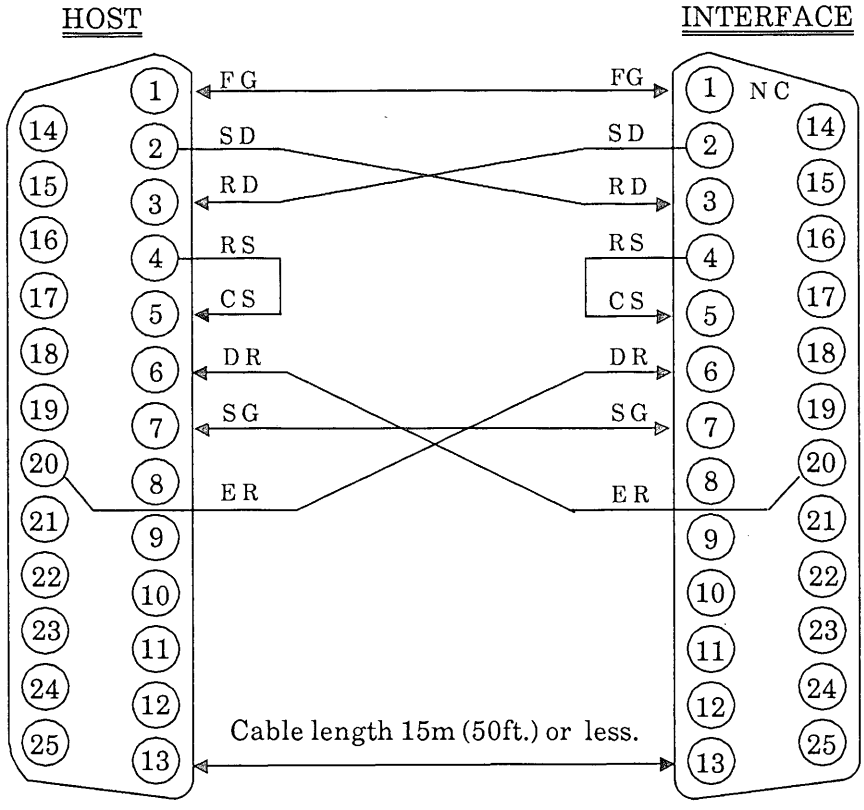
1.3 SWITCH SETTING

BAUD RATE	9600	4800	2400	1200
SW1	off	on	off	on
SW2	off	off	on	on

DATA LENGTH	7 bit	8 bit
SW3	off	on

PARITY	even	odd
SW4	off	on

1.4 CABLE PIN-OUT



PIN	SYMBOL	OBJECT	REMARK
1	FG	Frame ground	No connection on the interface side.
7	SG	Signal ground	
2	SD	Send data (TXD)	
3	RD	Receive data (RXD)	
4	RS	Request to send (RTS)	"OFF":When hardware is not ready
5	CS	Clear to send (CTS)	"OFF":Data is not sent
6	DR	Data set ready (DSR)	"ON":Data send permit
20	ER	Data terminal ready (DTR)	"ON":Ready to receive

N.B. Other pins are not connected .

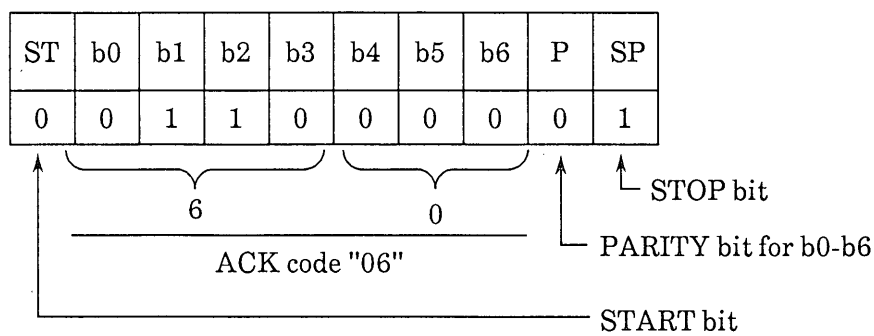
2. CONTROL CODES AND FRAME FORMATS

2.1 CONTROL CODES

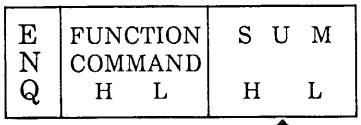
SYMBOL	NAME	ASCII CODE	REMARK
ENQ	Enquiry	05H	Sent by host only
STX	Start of text	02H	
ETX	End of text	03H	End of enquired data
ETB	End of transmission block	17H	
ACK	Acknowledge	06H	
NAK	Negative acknowledge	15H	Error acknowledge with error code
EOT	End of transmission	04H	Initializes interface unit

When EOT is received by the interface unit, it will reset itself ready for the next command. ACK code will not be sent.

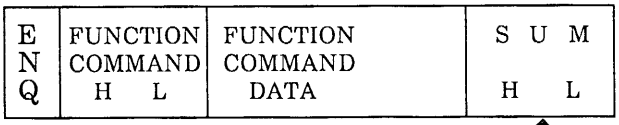
(e.g.) data length 7 bit, even parity "ACK"code



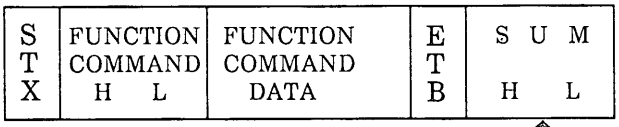
2.2 FRAME FORMAT



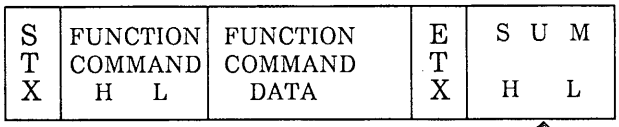
Interrogation from host.



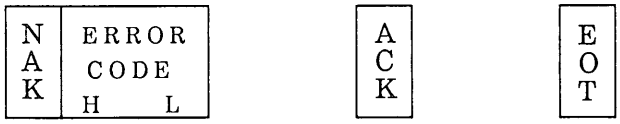
Interrogation from host with additional data.



Command and data when sent in blocks from host or interface.



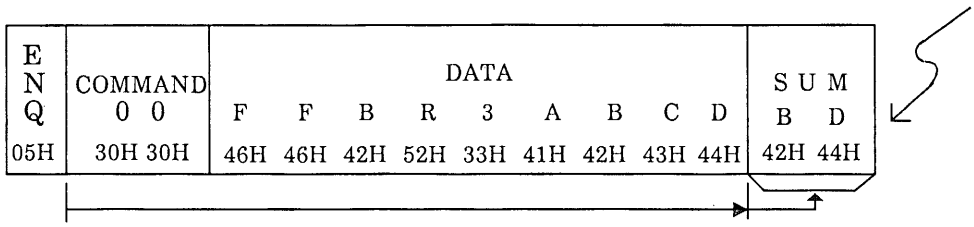
ETX indicates this as the last block of either interrogation or answer text.



Acknowledge (ACK) and end of transmission (EOT) are not accompanied by any data.
See page 10 for error code.

e.g. SUM CHECK DATA

The sum result is coded from HEX to ASCII.



$30_H + 30_H + 46_H + 46_H + 42_H + 52_H + 33_H + 41_H + 42_H + 43_H + 44_H = 2\underline{BD}_H$

SUM

NEGLECT

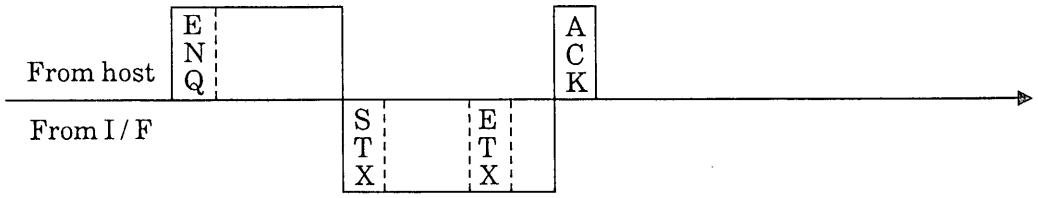
SUM $\underline{B}$ $\underline{D}$

ASCII CHAR.	0 1 2 3 4 5 6 7 8 9 ··· A B C D E F ···
ASCII CODE IN HEX	30 31 32 33 34 35 36 37 38 39 ··· 41 42 43 44 45 46 ···

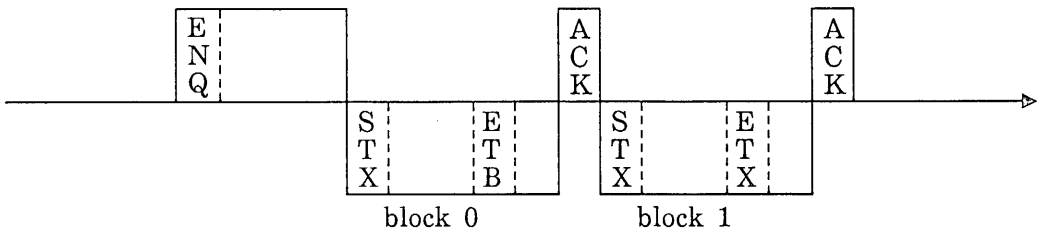
2.3 THE POSITION OF THE CONTROL CODES

[1] SIMPLE INTERROGATION

(a) SINGLE BLOCK REPLY



(b) MULTI - BLOCK REPLY

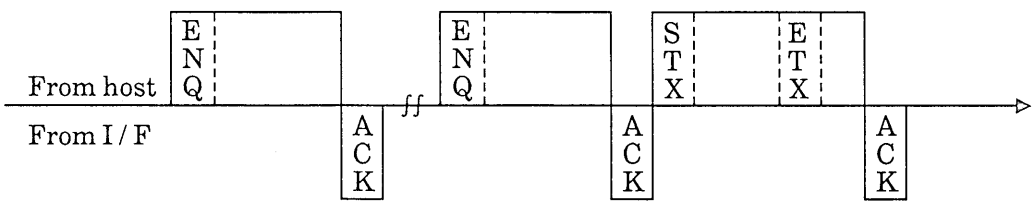


host = e.g personal computer , I/F = interface

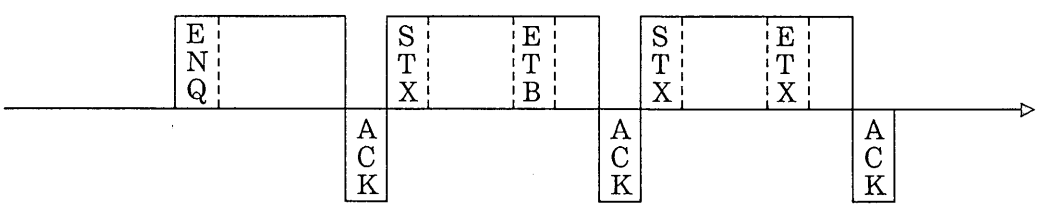
The host always initiates the communication with an enquiry ENQ and some interrogation command and data. In the simplest case(a), the interface replies with STX followed by some reply data. In case (b), the interface replies with much data, hence it is divided into blocks. ETB is end of an intermediate block. ETX is the end of the total reply text.
IMPORTANT : After the last ACK,always allow at least 1ms time for the interface unit to reset itself before sending the next ENQ interrogation.

[2] INTERROGATION WITH ADDITIONAL DATA BLOCKS

(a) SIMPLE CASE



(b) MULTI - BLOCK INTERROGATION

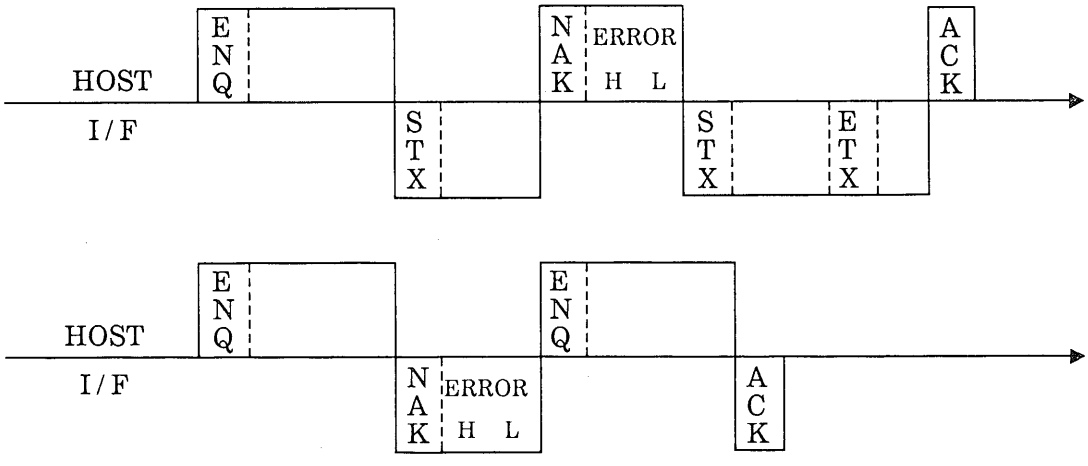


In some interrogation commands from the host, data reply from the interface is not necessary. Such commands only require the interface to store the data sent. Such data may be sent in multi-blocks.

2.4 ERROR CODES

ERROR NO.	ASCII CODE	REMARK
00_H	30_H 30_H	Sum check error
01_H	30_H 31_H	Parity error
02_H	30_H 32_H	Frame synchronization error
03_H	30_H 33_H	-
04_H	30_H 34_H	Command data error
05_H	30_H 35_H	Function command error
06_H	30_H 36_H	Commands which can not be executed during PC run.
07_H	30_H 37_H	Miscellaneous

If an error code is received, the data block is sent again. There will be further "retries" if further errors do occur.



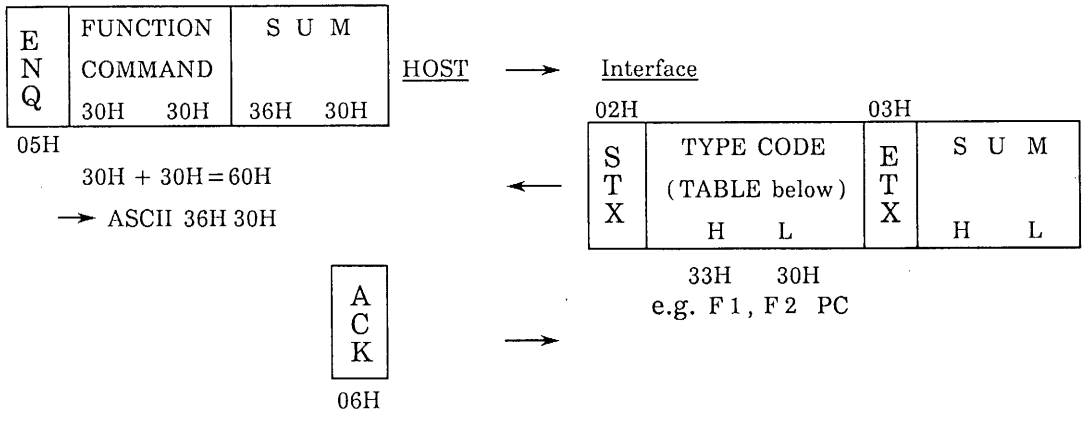
Number of "retries" for NAK is 3 times.

3 FUNCTION COMMANDS

3.1 STATUS COMMANDS

READING OF PC TYPE — command 00H (ASCII 30_H 30_H)

RUN/STOP



ACTUAL DATA BITS SENT

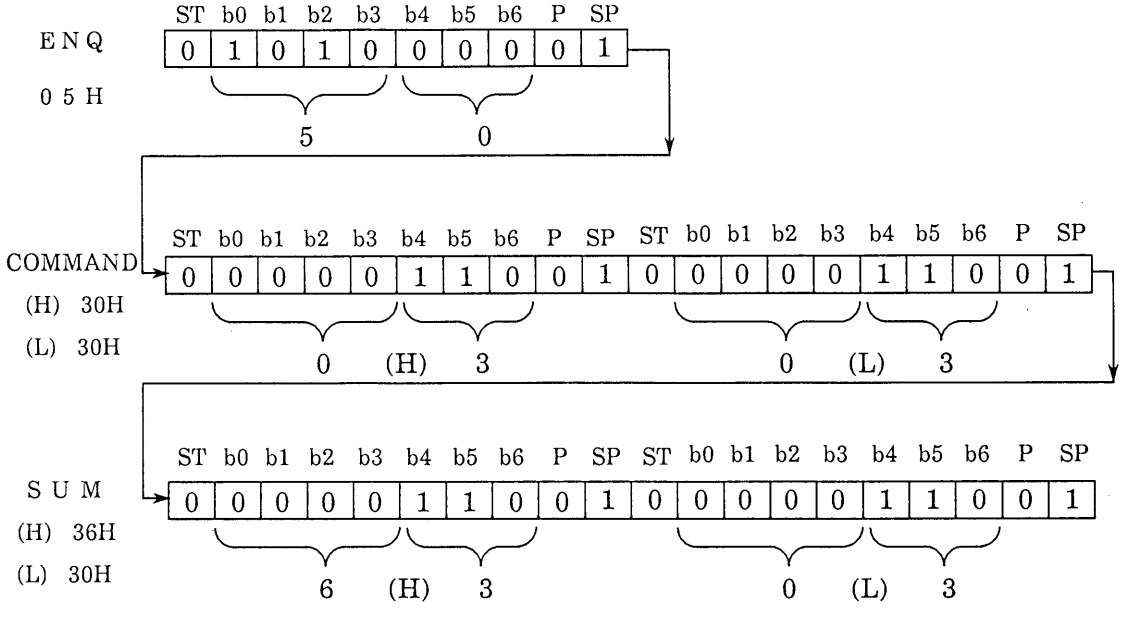


TABLE 1. REPLY FROM INTERFACE

TYPE CODE	ASCII CODE	REMARK
00_H	30_H 30_H	can not find PC type name
30_H	33_H 30_H	F_1 F_2 (1k step mode)
31_H	33_H 31_H	F_2 (2k step mode)

READING OF MODE

COMMAND 01_H (ASCII 30_H 31_H)
RUN/STOP

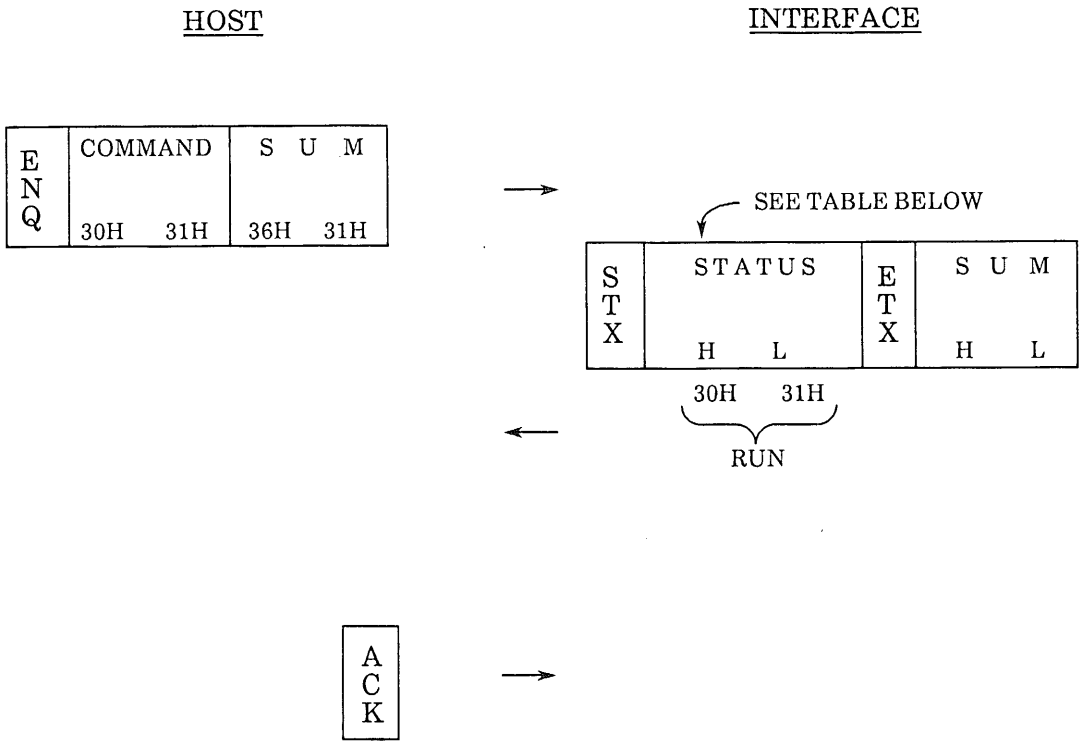


TABLE 2.MODE REPLY FROM INTERFACE

MODE	ASCII	REMARK
00_H	30_H 30_H	PC STOP
01_H	30_H 31_H	PC RUN
02_H	30_H 32_H	PC ERROR

3.2 CHANGING THE VALUE OF A CONSTANT command13_H(ASCII31_H33_H) RUN/STOP

Timer, counter and such constants in the program (RAM or EEPROM) area are applicable.

table 4 page 14

ENQ	COMMAND 31H 33H	STEP NO. 16^3 16^2 16^1 16^0	OBJECT CODE	SUM H L	→

STEP no. must be within the range of the PC.

e.g. step 0 9 5 4

ASCII 30_H 39_H 35_H 34_H

←	ACK	

NOTES

1 I/F unit do not check object code
2 ACK command will be sent after PC writing.
3 If the specified program step is not a constant, PC will not make any changes but I/F unit will still send ACK command.
If the step no is over than 999 (for 1k PC)or 1999 (for 2k F_2PC), I / F unit will send NAK command with error code.

←	NAK	ERROR 30H 37H

TABLE 4 OBJECT CODE FOR CONSTANTS

K with decimal point (45_H)

OBJECT CODE			
10^0	10^{-1}	10^1	45_H

(eg) K12.3

OBJECT CODE			
32_H	33_H	31_H	45_H

K without decimal point (46_H)

OBJECT CODE			
10^1	10^0	10^2	46_H

(eg) K123

OBJECT CODE			
32_H	33_H	31_H	46_H

NOTE : For T650-T657 timers , 001 is read as 0.01 sec. The host software must know this constant is for such timers and thus make the necessary calculations.

3.3 BIT DEVICE NO. FOR MONITOR command 21_H (32_H 31_H) RUN/STOP

The commands 21_H (address send) and 20_H (state request) work as a pair. Initially, command 21_H sends all the device numbers to the interface. At a later stage,command 20_H interrogates the state of these devices.

ENQ	COMMAND		STEP NO.		BLOCK SIZE		S U M		→
	32H	31H	16^1	16^0	16^1	16^0	H	L	
			1-144_D		64_D or 32_D				

(HEX) (ASCII CODE)

(eg) no.of bits 35_D → 23_H → 32_H 33_H

BLOCK SIZE 32_D → 20_H → 32_H 33_H ← ACK

Device addresses are described in table5. (next page)

STX	BLOCK No.		ADDRESS	ADDRESS	. . . .	ADDRESS	ETB	S U M	→
	H	L						H L	
	0	0_H	No.1	No.2		No.32			

(30_H 30_H) Incremented at every block.

← ACK

STX	BLOCK No.		ADDRESS	ADDRESS	ADDRESS	ETX	S U M	
	H	L					H	L
	0	0_H	No.33	No.34	No.35			
	(30_H	31_H)						

← ACK

NOTE:

1 Addresses of monitor devices will be kept in interface unit. If the I/F unit receives this 21_H command again, kept data will be lost and changed to the new monitor addresses.

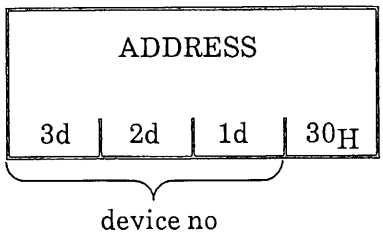
2 No. of BITS is the number of bit elements to be montored. (thus, the no. of addresses that will be sent). IT must be within 1-144_D

If 0 or over than 144_D ,then I/F unit will send NAK with error code (30_H 37_H)

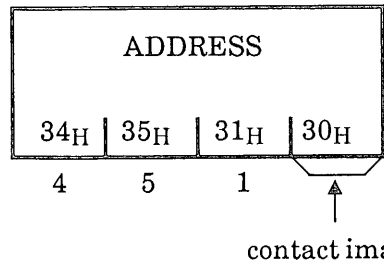
(see p.10 for error codes).

TABLE 5 MONITOR ADDRESSES

1 CONTACT IMAGES FOR X,Y,M,S & T,C ELEMENTS.

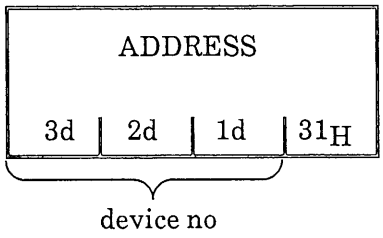


(eg) LD T451

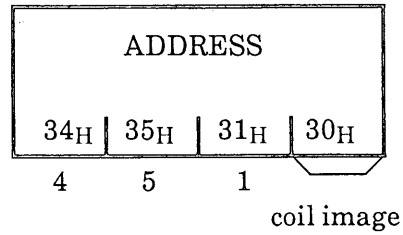


2 COIL IMAGE FOR TIMER, COUNTER & PLS M INST.

This image indicates whether the OUT T/C or PLS instruction has been driven. After the intended delay has finished their contact will change their state and these are monitored as contact images in the above shown format.

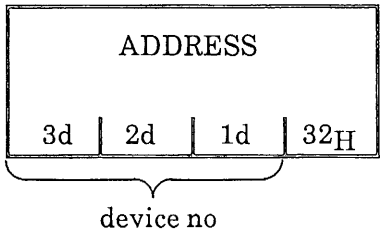


(eg) OUT T451

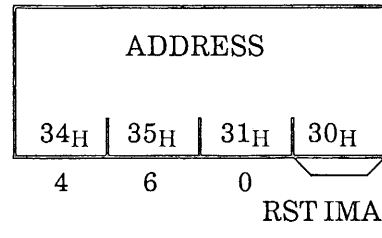


3 RST IMAGE

This image indicates whether instructions RST C, RST M have been driven.



(eg) RST C460



3.4 BIT MONITOR (1-144 points)

command 20_H (32_H 30_H)
RUN/STOP

This command is used after the 21_H command.

ENQ	COMMAND		SUM	
	32H	30H	H	L

→

See example below

STX	ON / OFF		ON / OFF		ON / OFF		...	ON / OFF		ETX	SUM	
	H	L	H	L	H	L		H	L		H	L

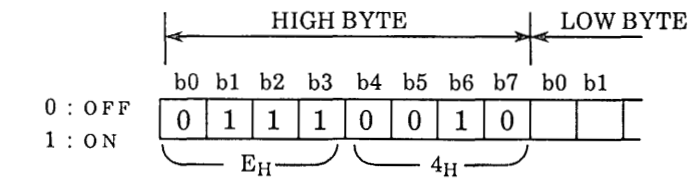
MAX. 18 Words (144 / 8 = 18)

ACK

→

TABLE 6

Example : ON / OFF INFO FOR 8 DEVICES

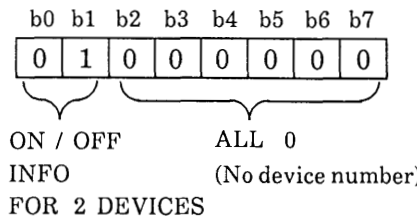


Bit b0 corresponds to the first device address sent by the 21_H command and bit b7 corresponds to the eighth address.

$4E_H \rightarrow 34_H\ 45_H$ (ASCII)

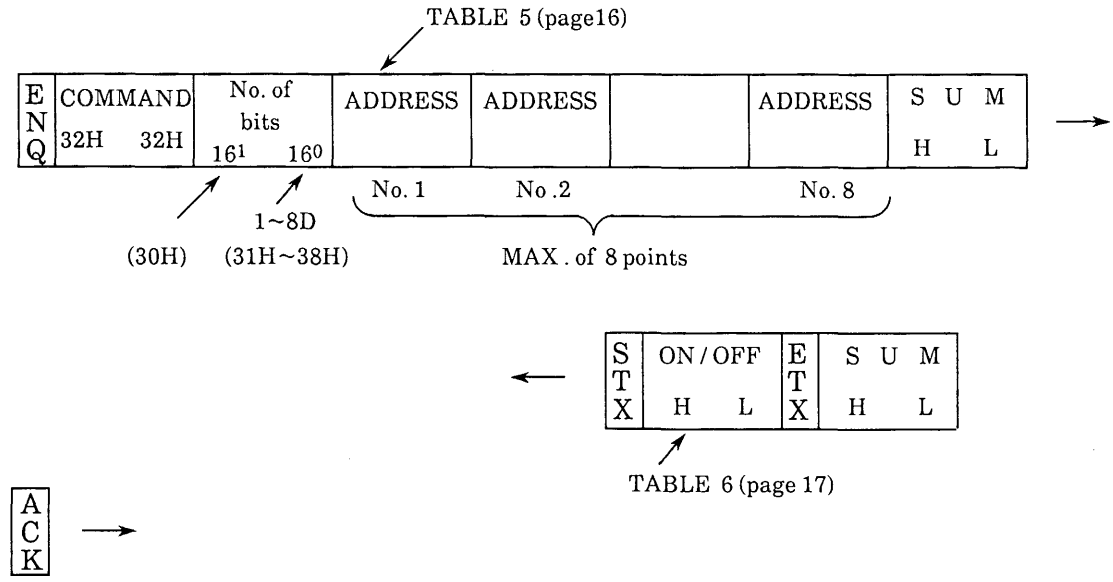
Host will receive $34_H\ 45_H$ for the above example.

eg. WHEN MONITORING ONLY 2 DEVICE .



3.5 IMMEDIATE ADDRESS BIT MONITOR 1-8 points command 22_H(32_H 32_H)
RUN/STOP

This bit monitor command sends the address of the monitor device and causes the interface to interrogate the PC and reply immediately to the host.



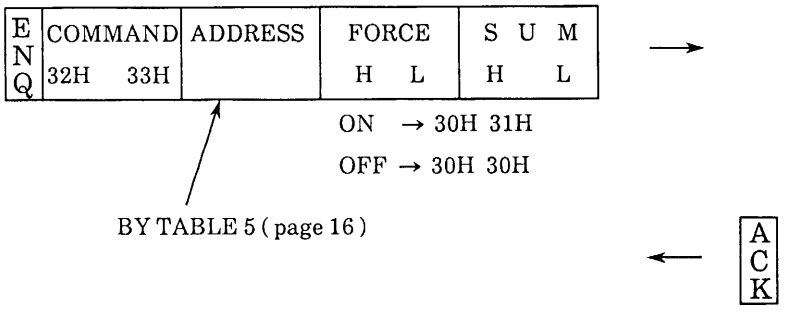
NOTE:

1 No. of bits and no. of addresses sent must be the same.If not then the I/F unit will send NAK with error code (30_H 37_H) (page10 for error codes)

2 Contact or coil image of counters and such elements are differentiated by the address format. See page 16 for address format.

3.6 FORCE ON / OFF

COMMAND 23_H (32_H 33_H)
RUN/STOP



When timers and counters are forced on, their current value is forced to zero and their contacts are forced on. When they are forced off, the current value is reset to the pre-set value and the contacts are opened.

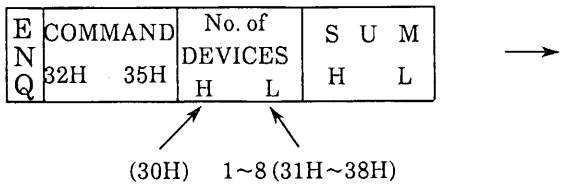
AFFECTED DEVICES

STOP: all X,Y,M,S,T,C

RUN : 1 All X
2 All Y,M,S,T,C
But it needs an OUT instruction of the relevant element.
I/F unit do not check this.

3.7 DEVICE ADDRESS FOR DATA MONITOR(T,C,D) command25$_H$ (32$_H$ 35$_H$) RUN / STOP

ELEMENTS: Timer, counter & data register.
This command (25$_H$) sends the monitor device addresses only. Command 24$_H$ requests and receives the monitored data.



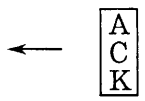
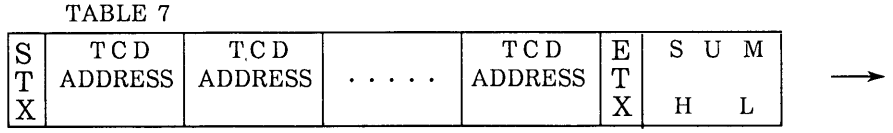
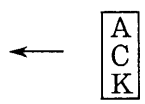


TABLE 7





note:

1 T,C,D address will be kept in I/F unit. If the I/F unit receive this 25$_H$ command again, kept data will be changed to the new T,C,D addresses.

2 No. of devices must be 1-8 . If 0 or more than 8 ,then NAK with error code (30$_H$ 37$_H$) is sent. (see page 10 for NAK format)

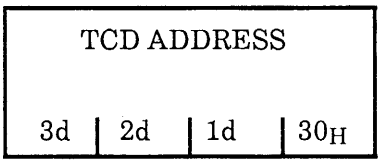
3 Do not mix the following three types of addresses :

* current value registers of timer or counter.
* setting value register of timer or counter.
* data register

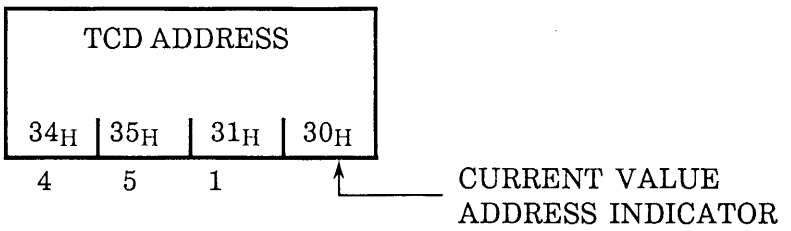
Mixing the current value register addresses of timers and counters is valid. This also applies to setting value registers.

TABLE 7 T,C,D MONITOR ADDRESSES

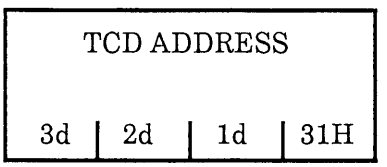
1 TIMER COUNTER T,C CURRENT REGISTER



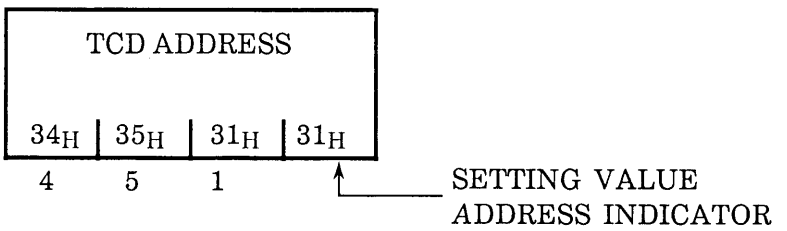
(eg) T451 current value register



2 T,C SETTING VALUE REGISTER
D DATA REGISTER



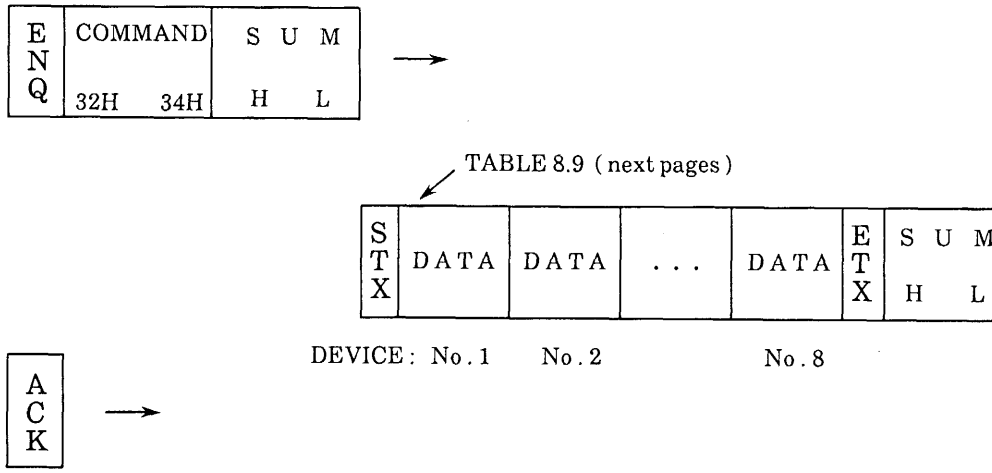
(eg) T451 setting value register



3.8 DATA MONITOR

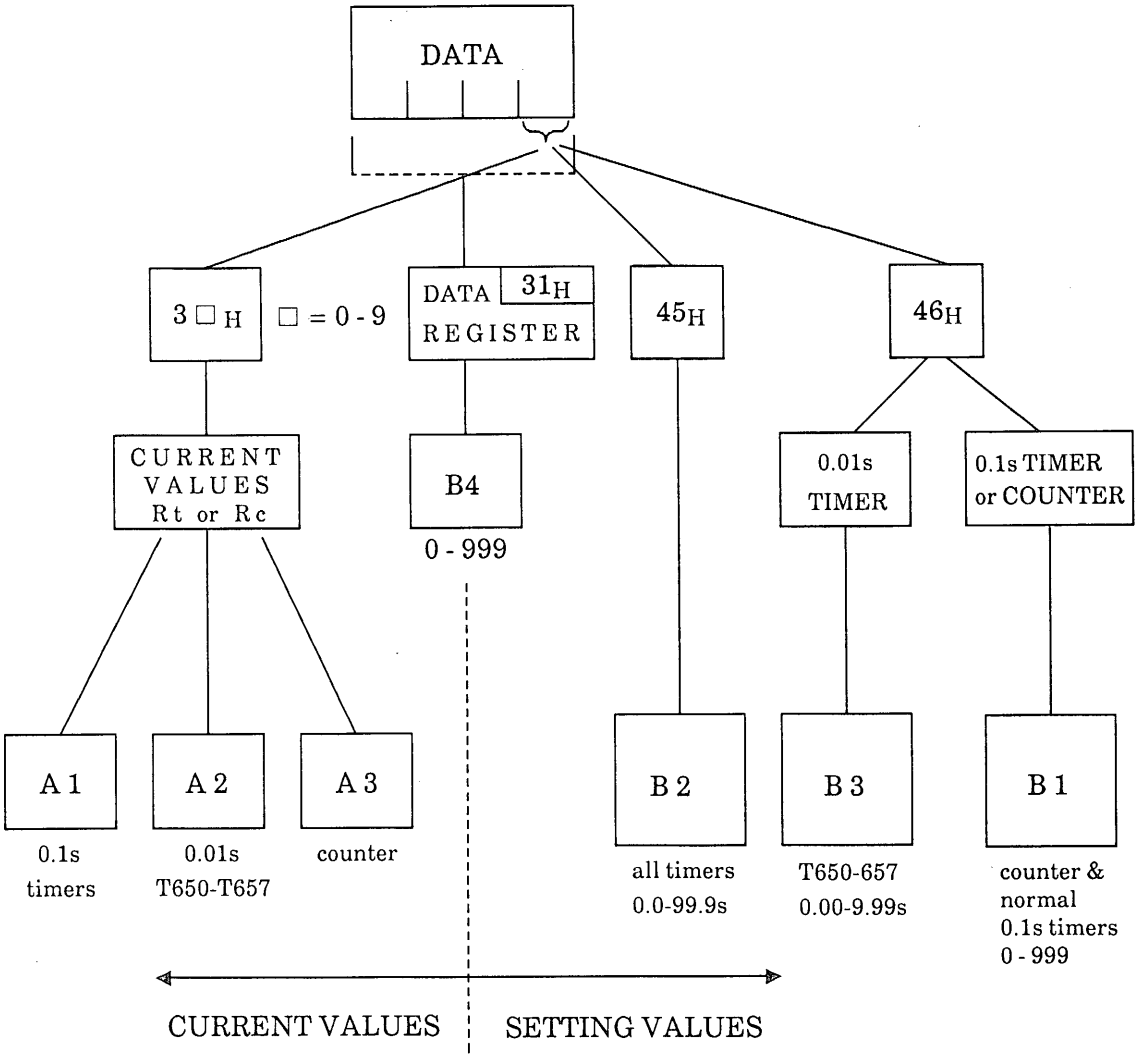
command 24_H (32_H 34_H)
RUN/STOP

This command is used after the 25_H command



The requested data is sent in correspondence to the addresses sent by command 25_H

DATA FORMAT DEFINITION TREE



Data replied from the interface in response to the Data monitor command 24_H can be in various formats depending on what kind of device it corresponds to (i.e. counter, timer or register). Hence, in order to interpret this data correctly, the host must know whether it is a value of a timer, counter or otherwise.

The rightmost number of the DATA code provides some aid to which device this data belongs. As shown by the above tree, it is not unique and the data can only be interpreted if the device it corresponds to is already known.

Use the correct format from A1-A3, B1-B4 by using the above tree. These format are explained in the next two pages.

TABLE 8 T,C CURRENT VALUE

Data from different devices are sent in different formats.
The host unit must know which data corresponds to which device in order to interpret or scale the data correctly.

A1 0.1s TIMER (T50-57,T450-457,T550-557)

Data interpretation format

DATA			
10^2	10^1	10^0	10^{-1}

(eg)123sec

DATA			
31_H	32_H	33_H	30_H
1	2	3	0

A2 0.01s TIMER (T650 - 657)

Data interpretation format

DATA			
10^1	10^0	10^{-1}	10^{-2}

(eg)1.23sec

DATA			
30_H	31_H	32_H	33_H
0	1	2	3

A3 COUNTER

Data interpretation format

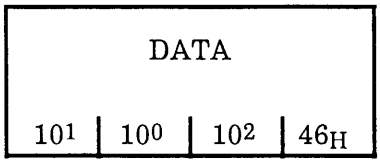
DATA			
10^2	10^1	10^0	0

(eg)123

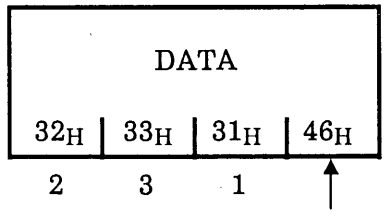
DATA			
31_H	32_H	33_H	30_H
1	2	3	0

TABLE 9 T,C SETTING VALUE
DATA REGISTER VALUE

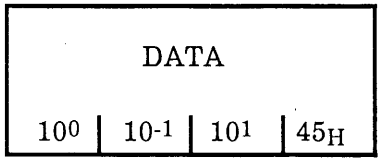
B1 0 - 999 sec TIMER
0 - 999 COUNTER



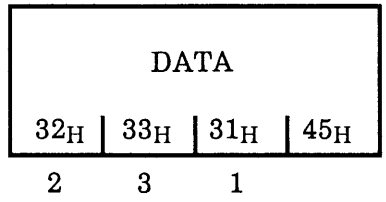
(eg)123.



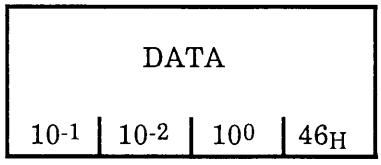
B2 0.0-99.9 sec TIMER (including T650-657)



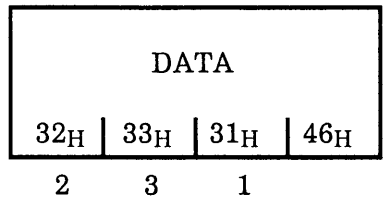
(eg)12.3



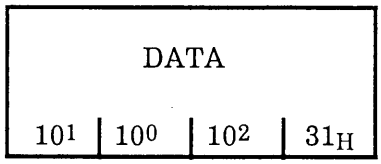
B3 0.00-9.99 sec TIMER (T650-657 only)



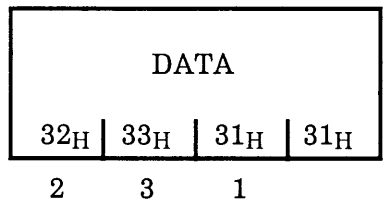
(eg)1.23



B4 DATA REGISTER 0-999

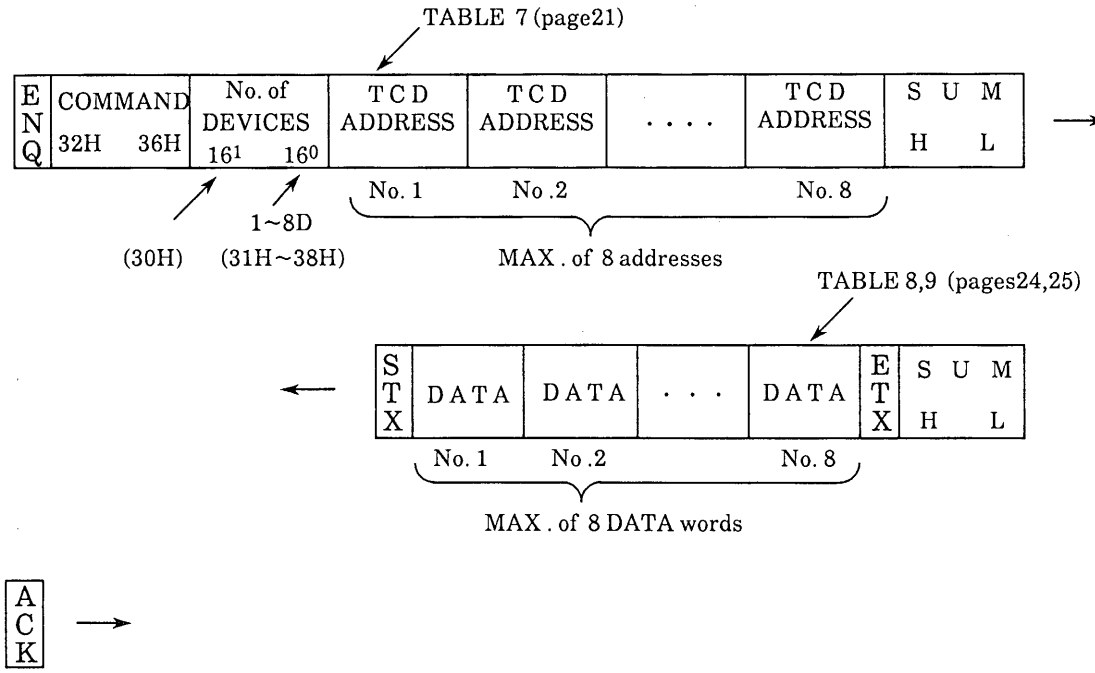


(eg)123



As in table 8, the host unit must know which data corresponds to which timer or counter in order to interpret the data correctly. Also it must expect the data type to correspond with exactly which data format to use.

3.9 IMMEDIATE ADDRESS DATA MONITOR command 26_H (32_H 36_H) RUN/STOP



NOTE:

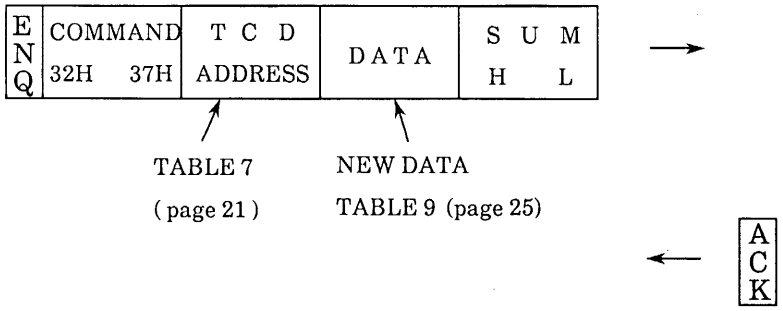
1 Applicable elements are:

Timer,counter current value registers.
Timer,counter setting value registers.
Data registers.

2 The T,C,D addresses can be a mixture of different types. (e.g. current value with setting value or data registers).

3.10 DATA WRITING

command 27_H (32_H 37_H)
RUN/STOP



NOTE:

1 Timer & Counters (T,C) setting value and Data Register (D) are applicable. (Note that the F_1 - pc has not setting value registers for T&C.)

2 Data of T,C current value register can not be changed.

3.11 WAITING TIME

command 30H (33H 30H)
RUN/STOP

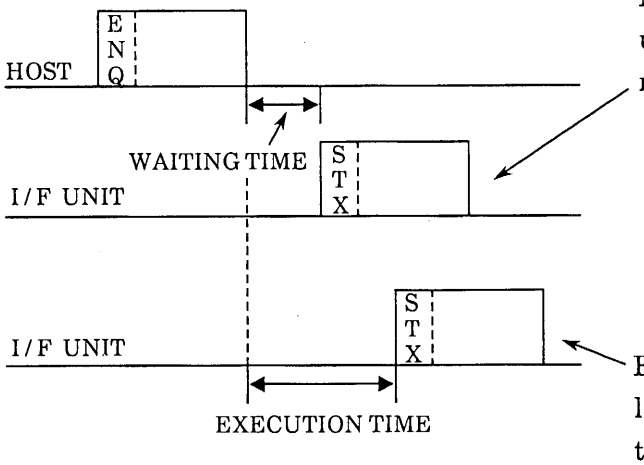
This command asks the interface to delay its response for a specified time.

ENQ	COMMAND 33H 30H	TIME H L	SUM H L

→

← ACK

TIME	CODE	ASCII
0	00_H	30_H 30_H
10ms	01_H	30_H 31_H
20ms	02_H	30_H 32_H
"	"	"
"	"	"
100ms	$0A_H$	30_H 41_H



Normally the host is busy, so the I/F unit waits a while for the host to be ready before making the answer.

Execution time of the I/F may be longer than the required waiting time.

4 APPENDIX

4.1 FUNCTION COMMAND

4.2 FUNCTION COMMAND DATA LIST

COMMAND DATA	PAGE	REMARK
ERROR	10	
PC TYPE	11	e.g. F_1
STATUS	12	RUN, STOP or ERROR
BLOCK SIZE	15	64 or 32
BLOCK No.	15	Incremented at every block
OBJECT CODE	13,14	K constant in program
STEP No.	13	Step no.
No. of BITS	15,18	bit monitor size
ADDRESS	16	bit device no.
ON/OFF	17	bit on/off info
FORCE	19	to ON or to OFF
No. of DEVICES	20	data monitor
T,C,D ADDRESS	20,21	address for monitor
DATA	22－25	T,C,D contents
TIME	28	waiting time

MEMO

MEMO

MITSUBISHI ELECTRIC CORPORATION
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Effective DEC. 1989
The specifications and designs are subject to change without notice.

JY992D18501A
HI - IB - 026 - A 8912 (SEN) (A1)