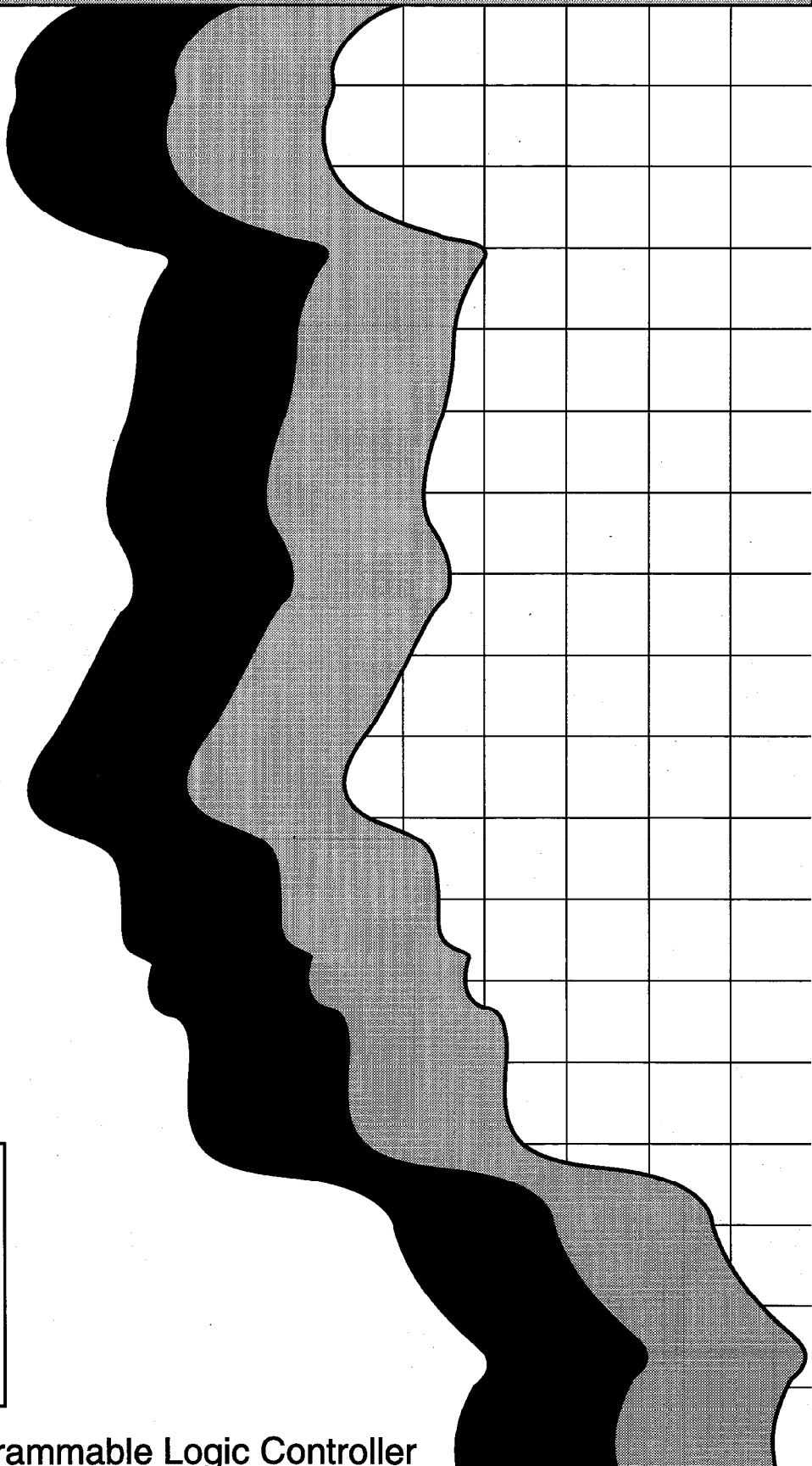


MITSUBISHI

Memory card interface module type AD59

User's Manual



Mitsubishi Programmable Logic Controller

REVISIONS

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

Print Date	*Manual Number	Revision	
Sep., 1987	IB (NA) 66141-A	First edition	
Nov., 1988	IB (NA) 66141-B	<table border="1"><tr><td data-bbox="603 405 791 439">Correction</td></tr></table> Page 1-3, 2-1, 2-6	Correction
Correction			

INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-A Series of General Purpose Programmable Controllers. Please read this manual carefully so that the equipment is used to its optimum. A copy of this manual should be forwarded to the end User.

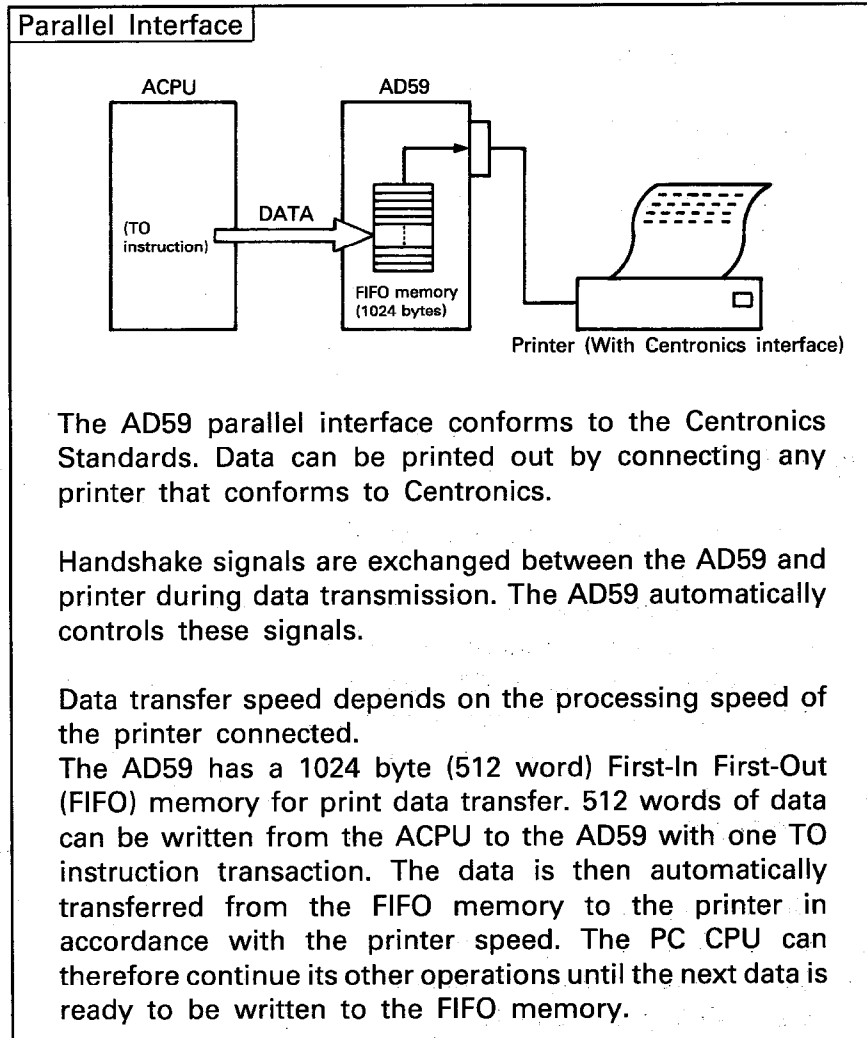
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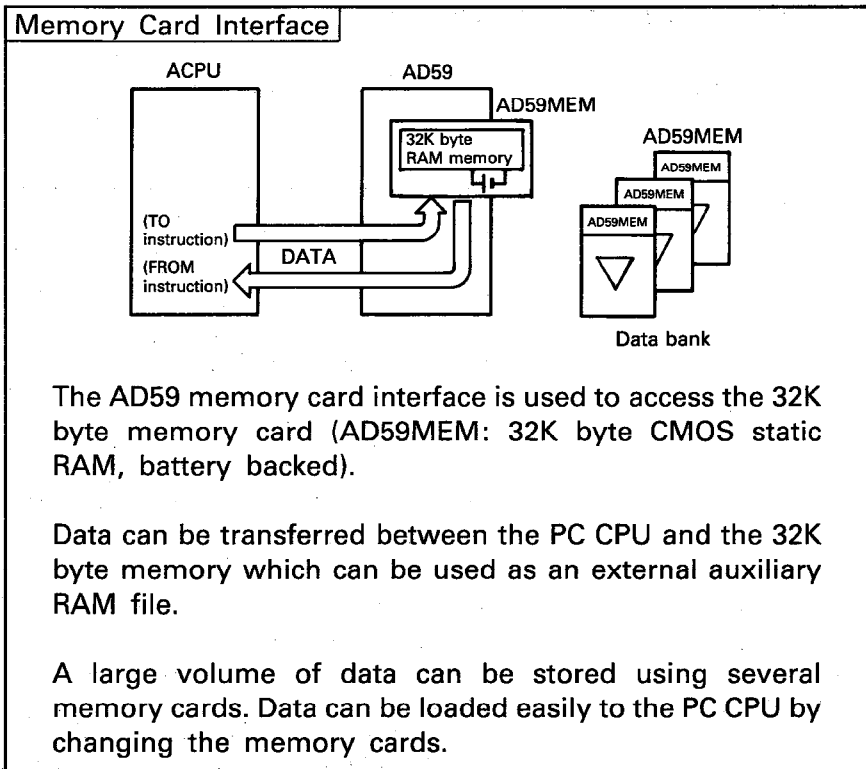
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1. INTRODUCTION

This Manual gives specifications, handling, programming procedures, etc. for the AD59 memory card/Centronics interface module.

The AD59 is equipped with one Centronics parallel interface and one memory card interface.





1.1 Notes on System Configuration

The AD59 can be used in conjunction with the following CPU units:

A1(E)CPU (P21/R21)	A1NCPU (P21/R21)
A2(E)CPU (P21/R21)	A2NCPU (P21/R21)
A3(E)CPU (P21/R21)	A3NCPU (P21/R21)
A3HCPU (P21/R21)	
AJ72P25/R25	
A0J2CPU (P23/R23)	
A0J2P25/R25	

There is no limit to the number of AD59s which can be loaded into a CPU system (except the I/O capacity of the PC CPU).

The AD59 can be loaded into any slot in the main or extension base, except the last slot of the seventh extension base.

POINT

In this manual, the AD59 I/O addresses are represented as X_n to X_{nF}, Y_(n+1) to Y_{(n+1)F}, where n depends on the AD59 I/O assignment.

Example: AD59 in slot 0

X: X00 to X0F
Y: Y10 to Y1F

Packing lists:

AD59 memory card/Centronics interface module

Description	Quantity
AD59 memory card/Centronics interface module	1
B-DS-20 dummy card	1
Parallel interface connector cap	1

AD59MEM memory card

Description	Quantity
AD59MEM memory card	1
BR2016 battery	1

REMARKS

The AD59MEM is available separately.

2. SPECIFICATIONS

2.1 General Specifications

The general specifications of AD59 are indicated in Table 2.1.

Item	Specifications				
Operating ambient temperature	0 to 55°C				
Storage ambient temperature	-20 to 75°C				
Operating ambient humidity	10 to 90%RH, no condensation				
Storage ambient humidity	10 to 90%RH, no condensation				
Vibration resistance	Conforms to JIS C 0911	Frequency	Acceleration	Amplitude	Sweep Count
		10 to 55Hz	—	0.075mm	10 times *(1 octave/minute)
		55 to 150Hz	1g	—	
Shock resistance	Conforms to JIS C0912 (10g x 3 times in 3 directions)				
Noise durability	By noise simulator 1500Vpp noise voltage, 1 μ s noise width and 25 to 60Hz noise frequency				
Dielectric withstand voltage	500V AC for 1 minute across AC external terminals and ground				
Insulation resistance	5M Ω or larger by 500V DC insulation resistance tester across batch of AC external terminals and ground				
Operating ambience	To be free from corrosive gases. Dust should be minimal.				
Cooling method	Self-cooling				

Table 2.1 General Specifications

REMARKS

One octave marked * indicates a change from the initial frequency to double or half frequency. For example any of the changes from 10Hz to 20Hz, from 20Hz to 40Hz, from 40Hz to 20Hz, and 20Hz to 10Hz are referred to as one octave.

2. SPECIFICATIONS



2.2 Performance Specifications

Item		Specifications
Number of I/O points		32
Parallel interface	Number of channels	1
	Standards	Centronics (For data and control timing, see Appendix 1.)
	FIFO memory capacity	1024 bytes (512 words)
	Isolation	Photocoupler
	Signal level (TTL level)	Input: $V_{IH} = 2V$, $V_{IL} = 0.8V$ Output: $V_{OH} = 2.4V$, $V_{OL} = 0.5V$
Memory card interface	Memory card	One AD59MEM (CMOS, static RAM, 32K bytes) can be loaded.
	Memory capacity	Max. 32K bytes (Can be switched in units of 8K bytes)
Internal current consumption		5V DC, 0.3A
Weight kg(lb)		0.6(1.32)
Size mm(inch)		41(1.61) (H) × 132(5.2) (W) × 250(9.84) (D)

Table 2.2 AD59 Performance Specifications

Item	Specifications
Memory capacity	Max. 32K bytes (CMOS, static RAM)
Backup	BR2016 battery
Battery life	5 years
Size mm(inch)	86(3.39) (H) × 54(2.13) (W) × 3(0.12) (D)

Table 2.3 Memory Card Performance Specifications

REMARKS

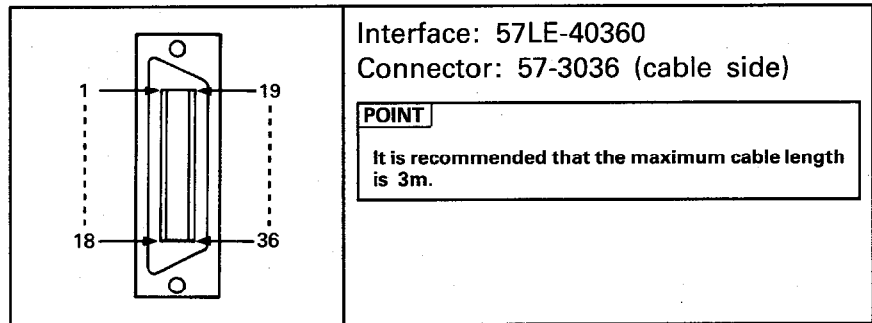
The battery is not available from Mitsubishi.

POINT

- (1) The battery must be installed in the AD59MEM before operation.
- (2) The battery storage temperature must be within the range -10°C and 60°C .

2. SPECIFICATIONS

2.3 Parallel Interface Specifications



Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	STROBE	10	ACKNLG	19	GND	28	GND
2	DATA1	11	BUSY	20	GND	29	GND
3	DATA2	12	PE	21	GND	30	GND
4	DATA3	13	SLCT	22	GND	31	INIT
5	DATA4	14	NC	23	GND	32	ERROR
6	DATA5	15	NC	24	GND	33	GND
7	DATA6	16	0V	25	GND	34	NC
8	DATA7	17	CHASIS GND	26	GND	35	NC
9	DATA8	18	NC	27	GND	36	NC

NC: No connection

【 DATA 1 to 8 】

Transmission data signal lines. The Centronics (8-bit parallel) communication uses 8 lines. DATA 1 is the least significant bit and DATA 8 the most significant bit.

DATA 1 to 8 are positive logic signal lines. 1 indicates that the voltage level is high and 0 low.

【 STROBE 】

Negative logic control line controlled by the AD59. One of the handshake lines. The AD59 transmits data on DATA 1 to 8 and concurrently sends the strobe signal (pulse) to STROBE. The strobe signal is usually high and becomes low for an instant when switched on. The printer supervises STROBE and accepts data when the voltage level changes to low. The printer can use the strobe signal as a data receiving interrupt signal.

Without STROBE, the AD59 cannot judge whether 1 byte (8 bit) data is transmitted or the same data is sent repeatedly.

【 BUSY 】

Positive logic control line controlled by the printer. One of the handshake lines. If the processing speed of the printer is higher than that of the AD59, data can be sent by the strobe signal and the printer will accept the data on receipt of the strobe signal. If data is transmitted faster than the processing speed of the printer, the next data may arrive before the printer has accepted the preceding data. In this case, BUSY is used to inform the AD59 that the printer processing the previous data. The AD59 checks BUSY to judge whether or not the next data can be transmitted.

【 ACKNLG 】 (Acknowledge)

Negative logic control line controlled by the printer. One of the handshake lines. Used to inform the AD59 that the printer has completed processing the preceding data and is ready to receive the next data. The acknowledge signal is usually high and becomes low instantaneously when switched on.

The AD59 can send the next data when the acknowledge signal is generated at the ACKNLG terminal. ACKNLG may be used instead of BUSY to judge whether data can be transmitted or not. The AD59 can use the acknowledge signal as an operation completed interrupt signal.

【 PE 】 (Paper end)

Positive logic control line controlled by the printer. PE and BUSY become high at the same time.

【 SLCT 】 (Select)

Positive logic control line controlled by the printer.

Indicates the state of the printer connection switch (ONLINE, SEL, REMOTE, etc.). High indicates that the printer is connected with the AD59. When SLCT is low, BUSY is high.

【 INIT 】 (Initialize)

Negative logic control line controlled by the AD59.

Low indicates that the printer is initialized. The initialization process depends on the printer, e.g. receiving buffer clear, tab setting reset.

【 ERROR 】

Negative logic control line controlled by the printer. Indicates that a printer error has occurred. The type of error depends on the printer.

When ERROR is low, BUSY is high.

【 0V 】

Reference voltage for all signal lines.

【 GND 】 (Ground)

Used to ground the twisted pair wires. The same voltage level as 0V.

【 CHASSIS GND 】

Used to set the AD59 and printer to the same potential by connecting their frames. Connect using twisted pair shielded wire.

2. SPECIFICATIONS

2.4 I/O Specifications

The AD59 occupies 16 inputs (X) and 16 outputs (Y) which are used as described in Tables 2.4 and 2.5.

Input Number	Application		Remarks	
Xn0	"READ" pushbutton input. Memory card read request		Pushbutton functions are allocated in the sequence program and are not processed automatically otherwise.	
Xn1	"WRITE" pushbutton input. Memory card write request			
Xn2	"PRINT START" pushbutton input. Memory card print out request			
Xn3	"PRINT STOP" pushbutton input. Memory card print stop request			
Xn4	OFF	FIFO memory is not empty.	Used to write data to the FIFO memory. Used in sequence program as interlocks. When the FIFO memory is empty, max. 1024 bytes (512 words) may be written. Xn5 is used with Y(n+1) to write data byte by byte.	
	ON	FIFO memory is empty.		
Xn5	OFF	FIFO memory is not full.		
	ON	FIFO memory is full.		
Xn6	OFF	Parallel interface ERROR terminal is high	Handshake signals for Centronics port. Need not be controlled at all times. Used for error monitoring, etc.	
	ON	Parallel interface ERROR terminal is low		
Xn7	OFF	Parallel interface BUSY terminal is high		
	ON	Parallel interface BUSY terminal is low		
Xn8	OFF	Parallel interface SLCT terminal is high		
	ON	Parallel interface SLCT terminal is low		
Xn9	OFF	AD59MEM is not loaded or memory card switch is off.		The memory card switch on the AD59 front must be set to ON when accessing the AD59MEM.
	ON	AD59MEM is loaded and memory card switch is on.		
XnA	ON	FIFO memory error (overflow)	The sum of the data entering the FIFO table and the data already in the FIFO table has exceeded 1024 bytes and the FIFO memory has been cleared. If this error has occurred, repeat the initialization program (Section 2.5) and switch off XnA.	
XnB	OFF	Parallel interface PE terminal is high	Paper end signal. OFF indicates that the printer paper has run out.	
	ON	Parallel interface PE terminal is low		
XnC	OFF	AD59MEM battery voltage is normal	ON indicates that the voltage is less than 2.5V and the battery must be changed.	
	ON	AD59MEM battery voltage low detected		
XnD to XnF	Reserved		Reserved for the AD59 and cannot be used in the user program.	

Table 2.4 Input Applications

POINT

Yn0 to YnF corresponding to Xn0 to XnF cannot be used in the program.

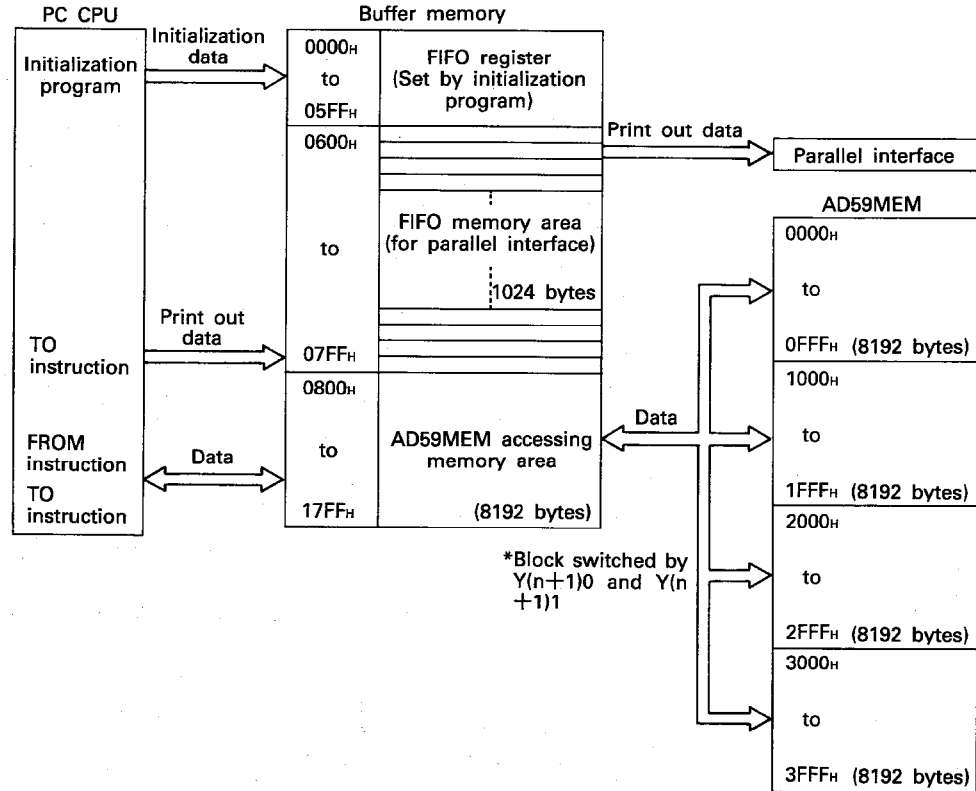
2. SPECIFICATIONS

Output Number	Application		Remarks															
Y(n+1)0 Y(n+1)1	For memory card block switching The memory card is accessed in blocks of 8K bytes. The block is selected using outputs Y(n+1)0 and Y(n+1)1.		<table border="1"> <thead> <tr> <th>Y(n+1)0</th> <th>Y(n+1)1</th> <th>Address</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>0000 to 0FFF</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>1000 to 1FFF</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>2000 to 2FFF</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>3000 to 3FFF</td> </tr> </tbody> </table> <p>The AD59MEM is accessed via the buffer memory, so the above addresses are not used in the program.</p>	Y(n+1)0	Y(n+1)1	Address	OFF	OFF	0000 to 0FFF	ON	OFF	1000 to 1FFF	OFF	ON	2000 to 2FFF	ON	ON	3000 to 3FFF
Y(n+1)0	Y(n+1)1	Address																
OFF	OFF	0000 to 0FFF																
ON	OFF	1000 to 1FFF																
OFF	ON	2000 to 2FFF																
ON	ON	3000 to 3FFF																
Y(n+1)2	OFF	BUSY LED off (AD59MEM can be loaded/unloaded)	No relation with the parallel interface BUSY signal. Data may be corrupted or lost if the AD59MEM is loaded/unloaded during a transaction. Output Y(n+1)2 may be switched on in the sequence program. This will light the BUSY LED to indicate that the AD59MEM must not be removed.															
	ON	BUSY LED on (AD59MEM should not be loaded/unloaded)																
Y(n+1)3	OFF	FIFO register initialization mode (Initialization allowed)	Before writing data to the FIFO memory, Y(n+1)3 must be switched off and the FIFO register initialized. After this, Y(n+1)3 is switched on and data written to the FIFO memory.															
	ON	FIFO mode (Data can be written to FIFO)																
Y(n+1)4	OFF	Sets parallel interface INIT terminal to high	Initializes the printer by controlling the INIT terminal. The printer is initialized when INIT is low. The INIT pulse width depends on the printer used.															
	ON	Sets parallel interface INIT terminal to low (Initialization)																
Y(n+1)5	OFF	Writes data to FIFO memory word by word.	Selects word (16 bits) or byte (8 bits). (See Section 2.5.)															
	ON	Writes data to FIFO memory byte by byte.																
Y(n+1)6	OFF	PRINT OUT LED off	Can be controlled as appropriate in the sequence program.															
	ON	PRINT OUT LED on																
Y(n+1)7 to Y(n+1)F	Reserved		Reserved for the AD59 and cannot be used in the user program.															

Table 2.5 Output Applications

2.5 Buffer Memory Specifications

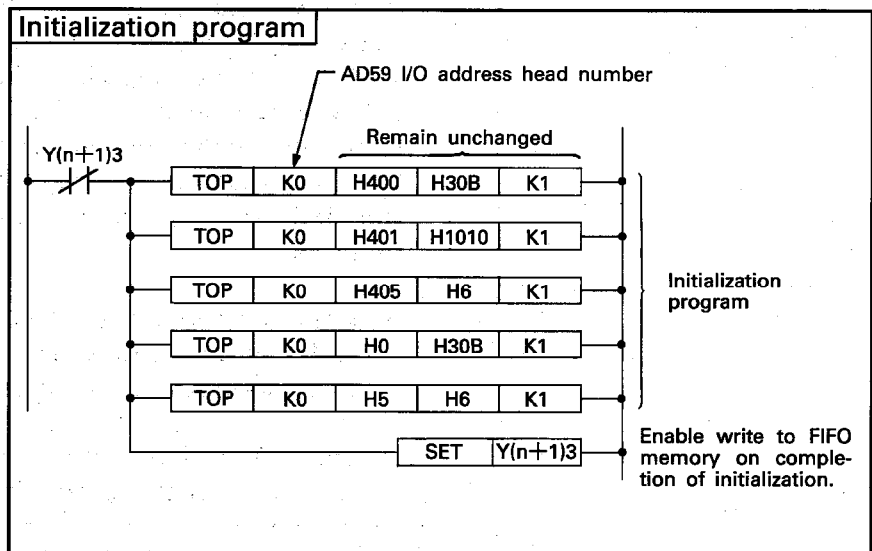
The PC CPU accesses the AD59 via the AD59 buffer memory.



(1) FIFO register

The following initialization routine is required before using the FIFO memory area.

The initialization data can only be written by the following program when $Y(n+1)3$ is off.

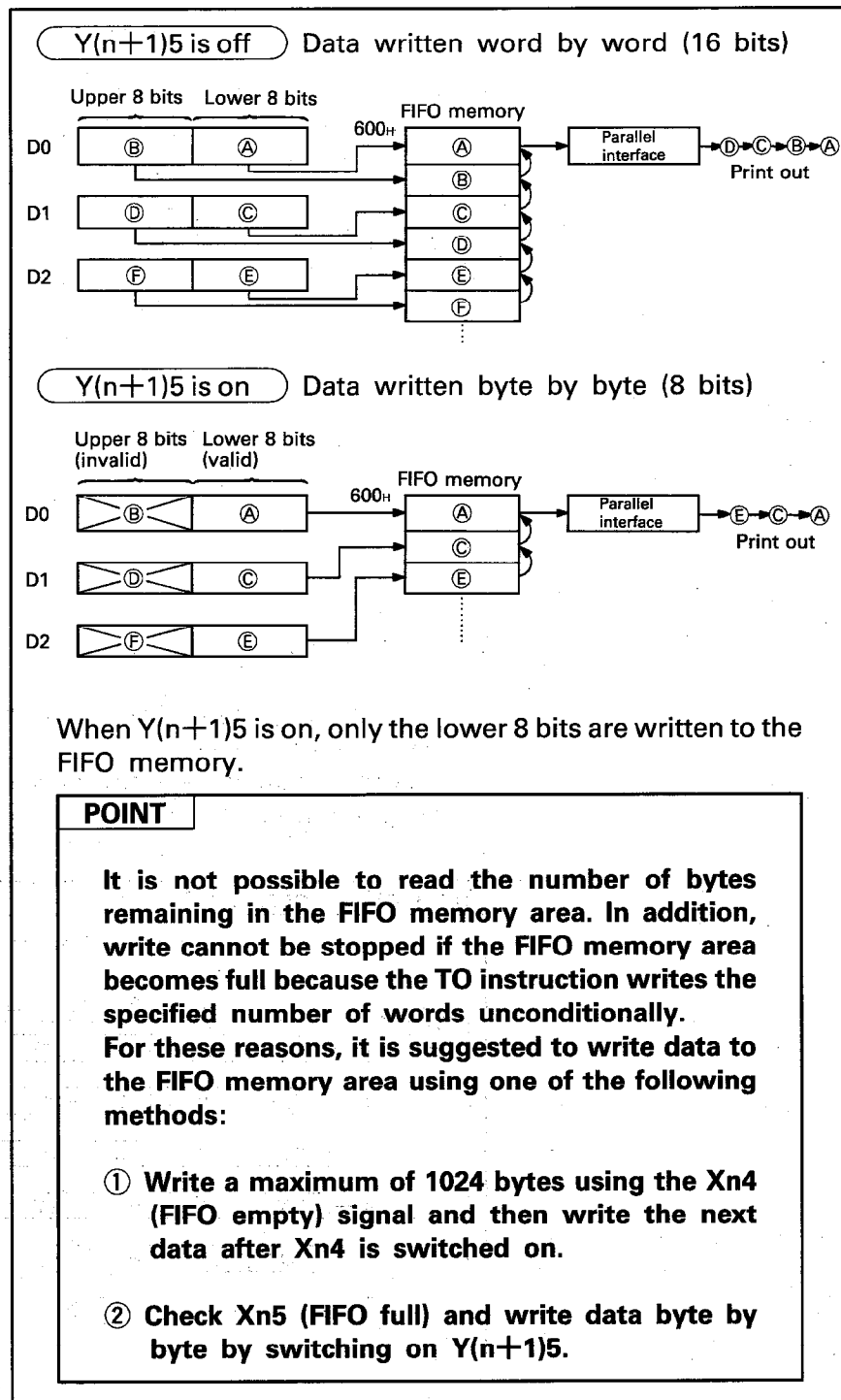


(2) FIFO memory

Print out data is written to this area (1024 bytes, buffer addresses 600_H to 7FF_H) and is automatically transferred to the printer in the order written.

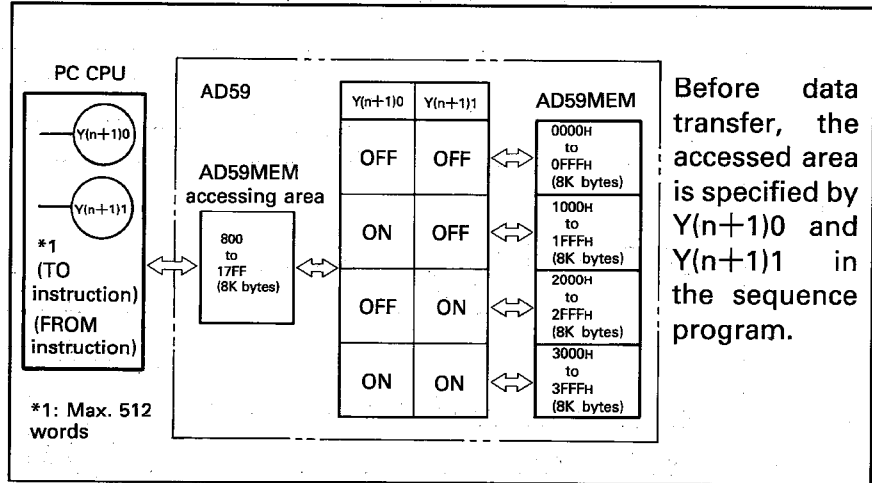
Although the parallel interface is designed for 8 bit parallel communication, data written to the buffer memory by the TO instruction is processed in batches of 16 bits.

For example, when data registers are used as the source, the data print out is processed as follows:



(3) AD59MEM accessing memory

An 8192 byte buffer memory area (800_H to 17FF_H) is used to access the AD59MEM. The block of 8K bytes actually accessed from the 32K byte memory map is determined by the states of outputs Y(n+1)0 and Y(n+1)1.



2.6 AD59 Function Block

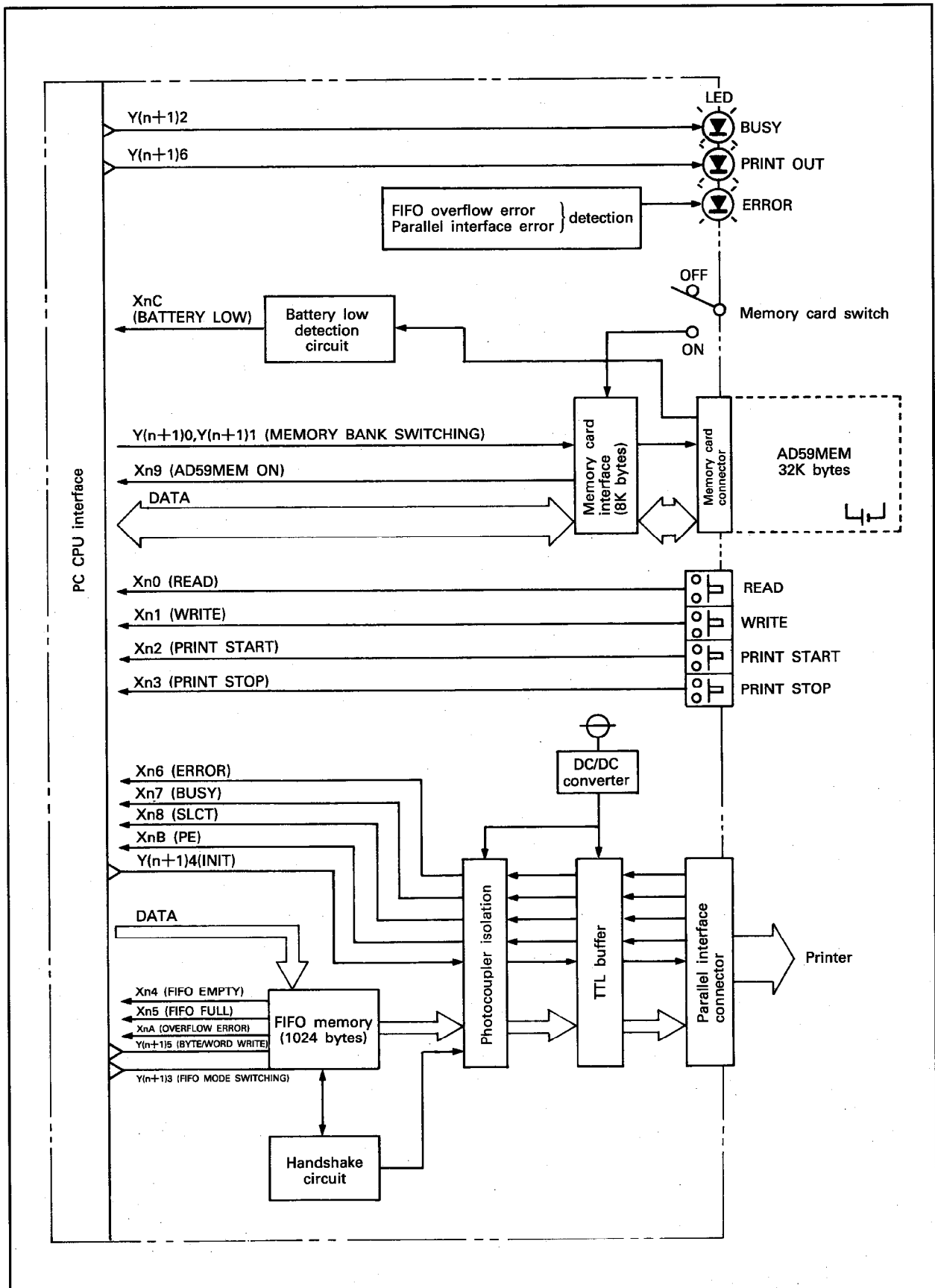


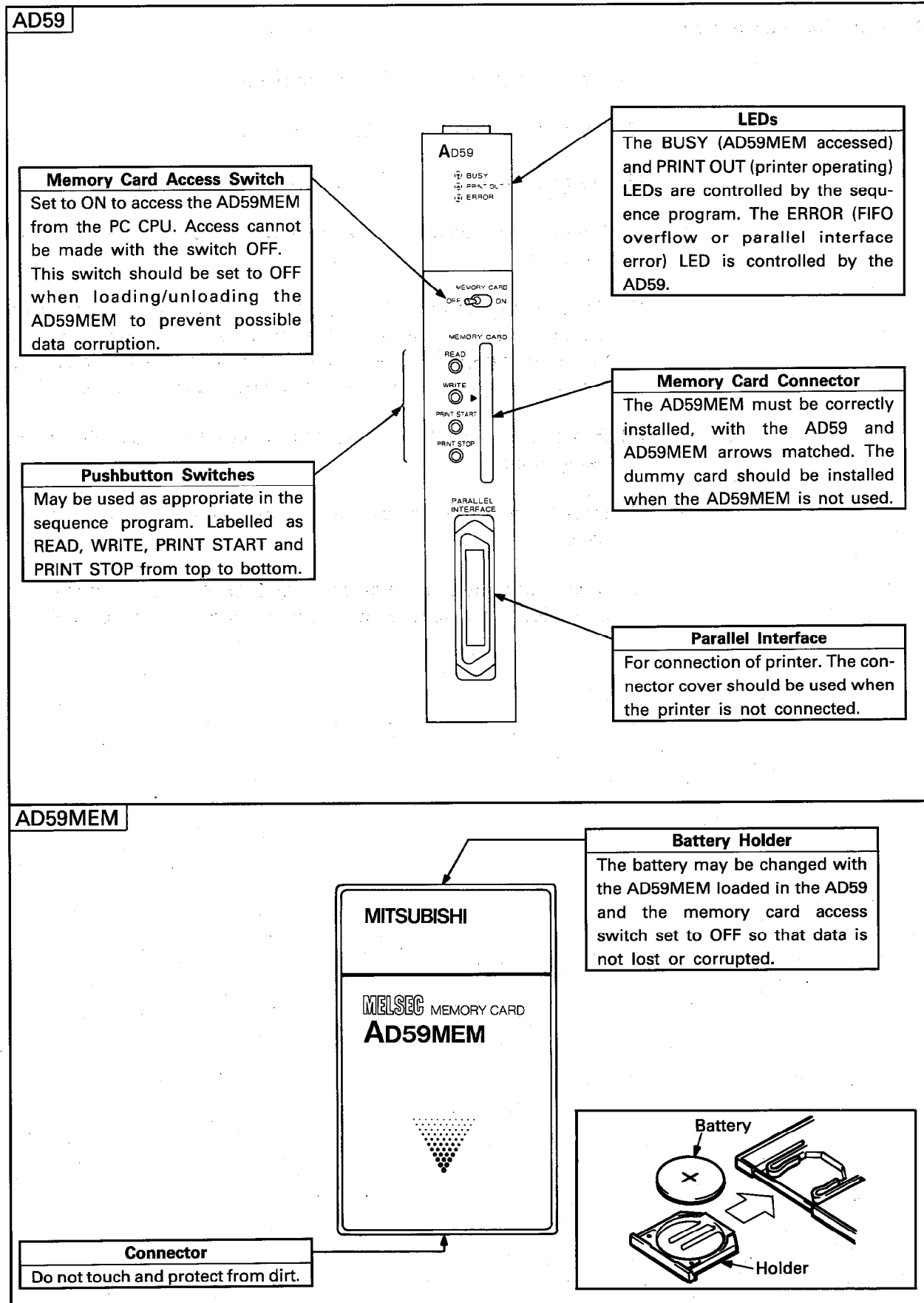
Fig. 2.1 AD59 Function Block Diagram

3. HANDLING

3.1 Handling Instructions

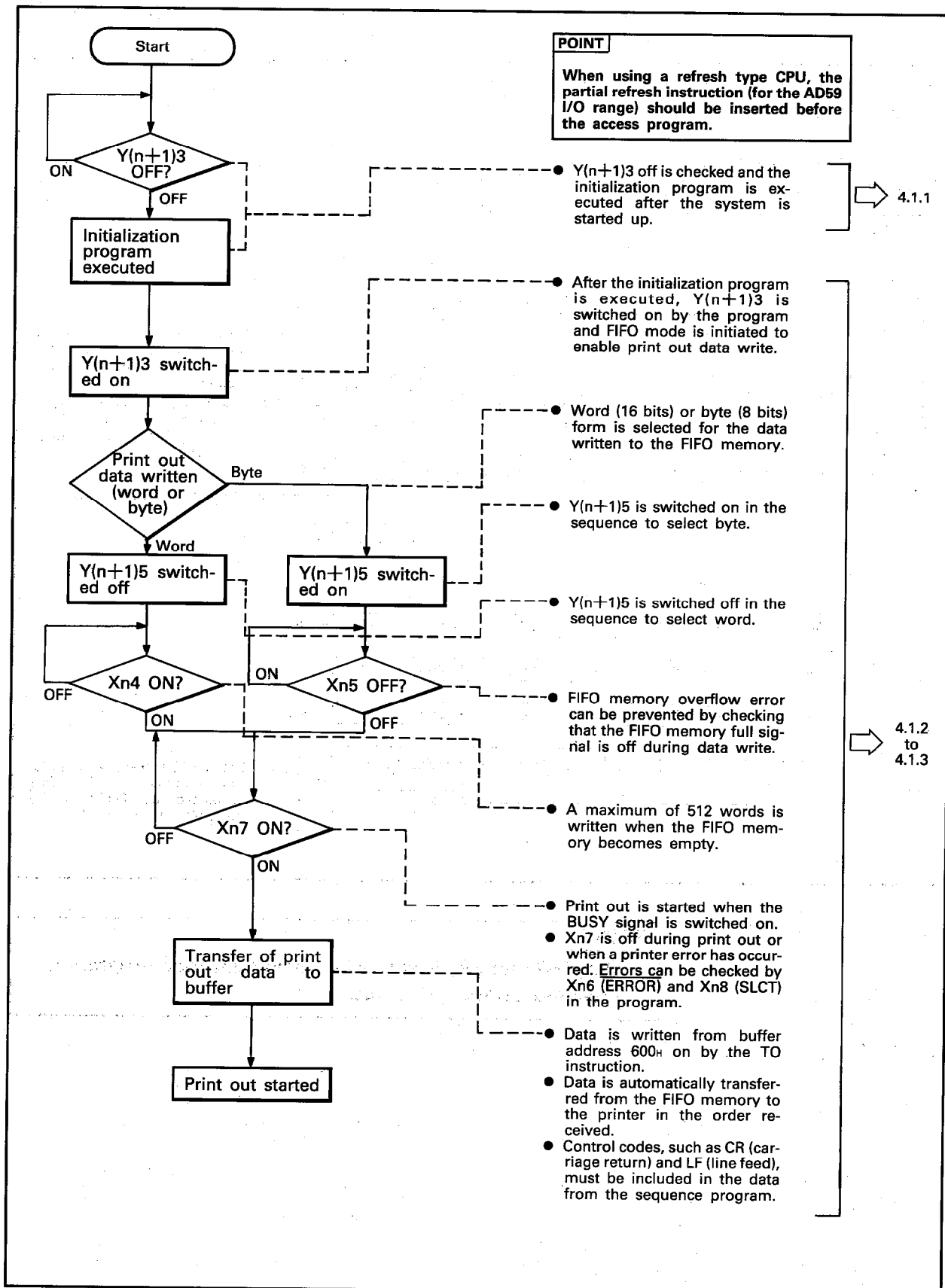
- (1) Do not subject the AD59 to impact.
- (2) Do not remove the printed circuit board.
- (3) Do not allow conductive debris to enter the unit.
- (4) Switch off PC power before loading or unloading the unit from the base.
- (5) To load the unit onto the base, hook the two lower hooks into the cut out and gently swing the unit into place. Ensure that the top latch engages. To remove the unit, press the top latch and swing the unit out before unhooking from the base unit.
- (6) Install the dummy card (B-DS-20) when the AD59MEM is not being used.
- (7) Install the connector cap when the parallel interface is not used.
- (8) It is recommended that the AD59MEM is only loaded or unloaded after setting the memory card switch to OFF.

3.2 Nomenclature



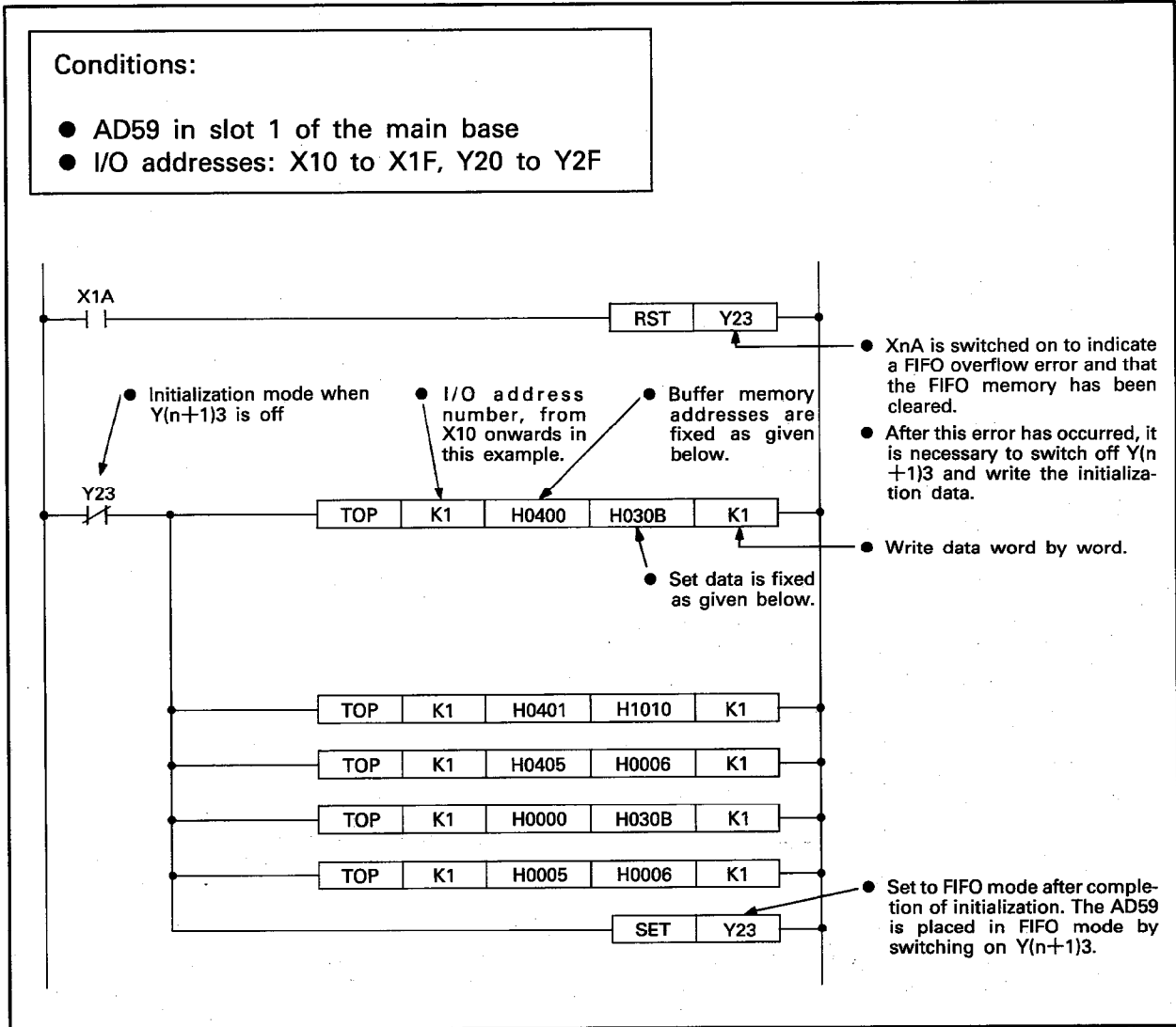
4. PROGRAMMING

4.1 Programming for Parallel Interface Control



4.1.1 Initialization program

The initialization program should be executed before writing print out data to the FIFO memory. The following program must be used.

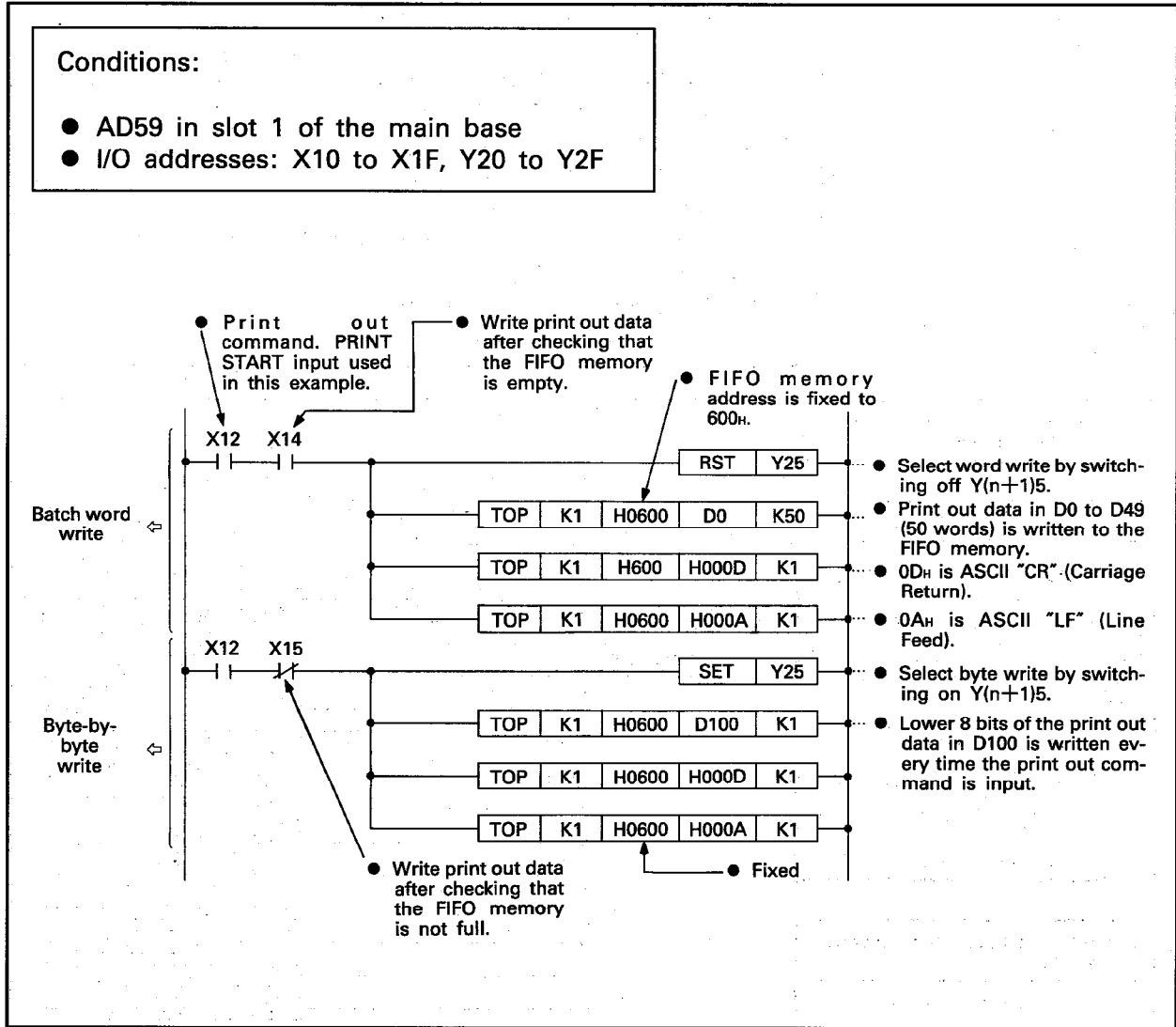


POINT

The FIFO memory is cleared if the initialization program is executed during print out.

4.1.2 Print out data write program

This program is executed after the initialization program. Print out data may be written word by word ($Y(n+1)5=OFF$) or byte by byte ($Y(n+1)5=ON$). (See Section 2.5 (2).) Both programs are shown below.



POINT

- Data can be written in batches if either (word or byte) form is used.
- Up to 1024 bytes (512 words) maximum may be written by one transaction.
- If more than 1024 bytes are written, an overflow error occurs and the FIFO memory is cleared. In this case, the initialization program must be executed.
- The print out data must be converted into ASCII before it is transferred to the printer.

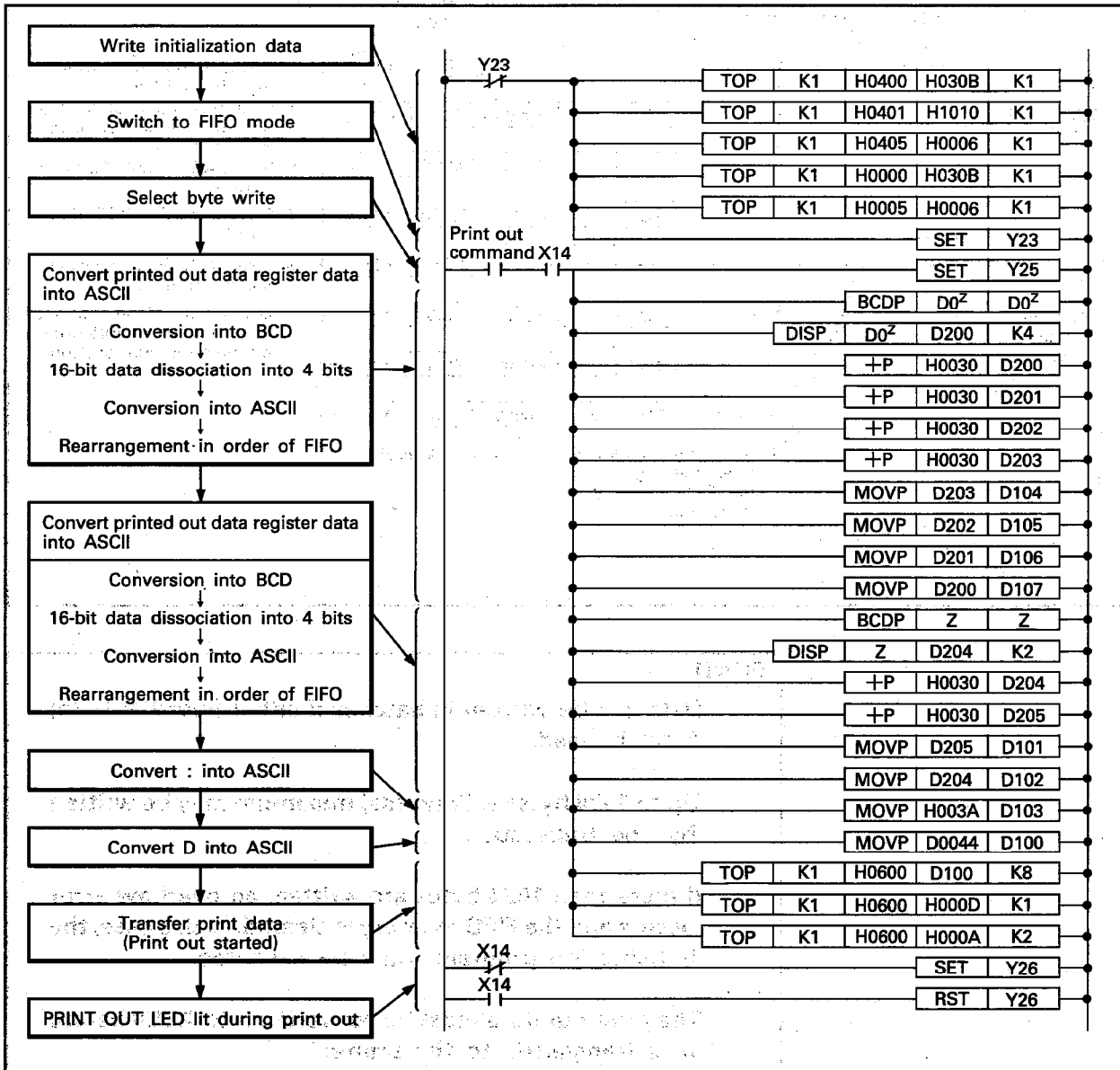
4.1.3 Application program example

Conditions:

- ① AD59 in slot 1 of the main base
- ② I/O addresses: X10 to X1F, Y20 to Y2F
- ③ With Dn data being logged, the specified data register data is printed out on alternate lines when the print out command is given.
- ④ Data register numbers are specified by the index register Z.
- ⑤ Data registers used: D00 to D99
- ⑥ Data register data: 0000 to 9999

(Print out example)

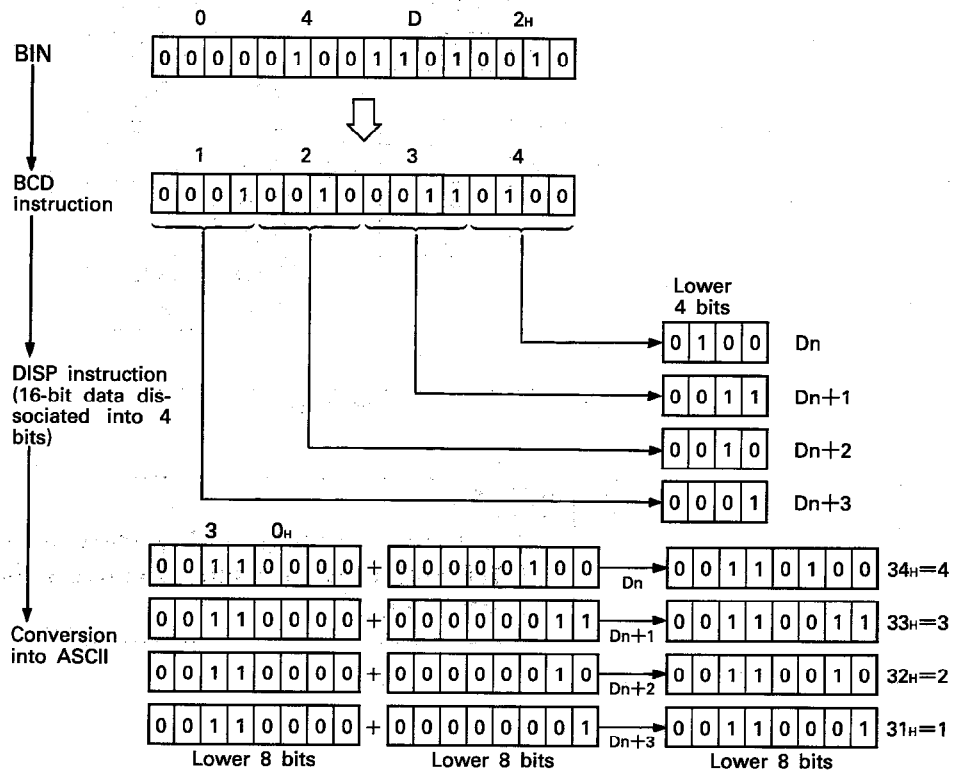
D00 : 1234
 D01 : 0999
 D02 : 3456
 D03 : 8652



(1) Conversion of data register content into ASCII

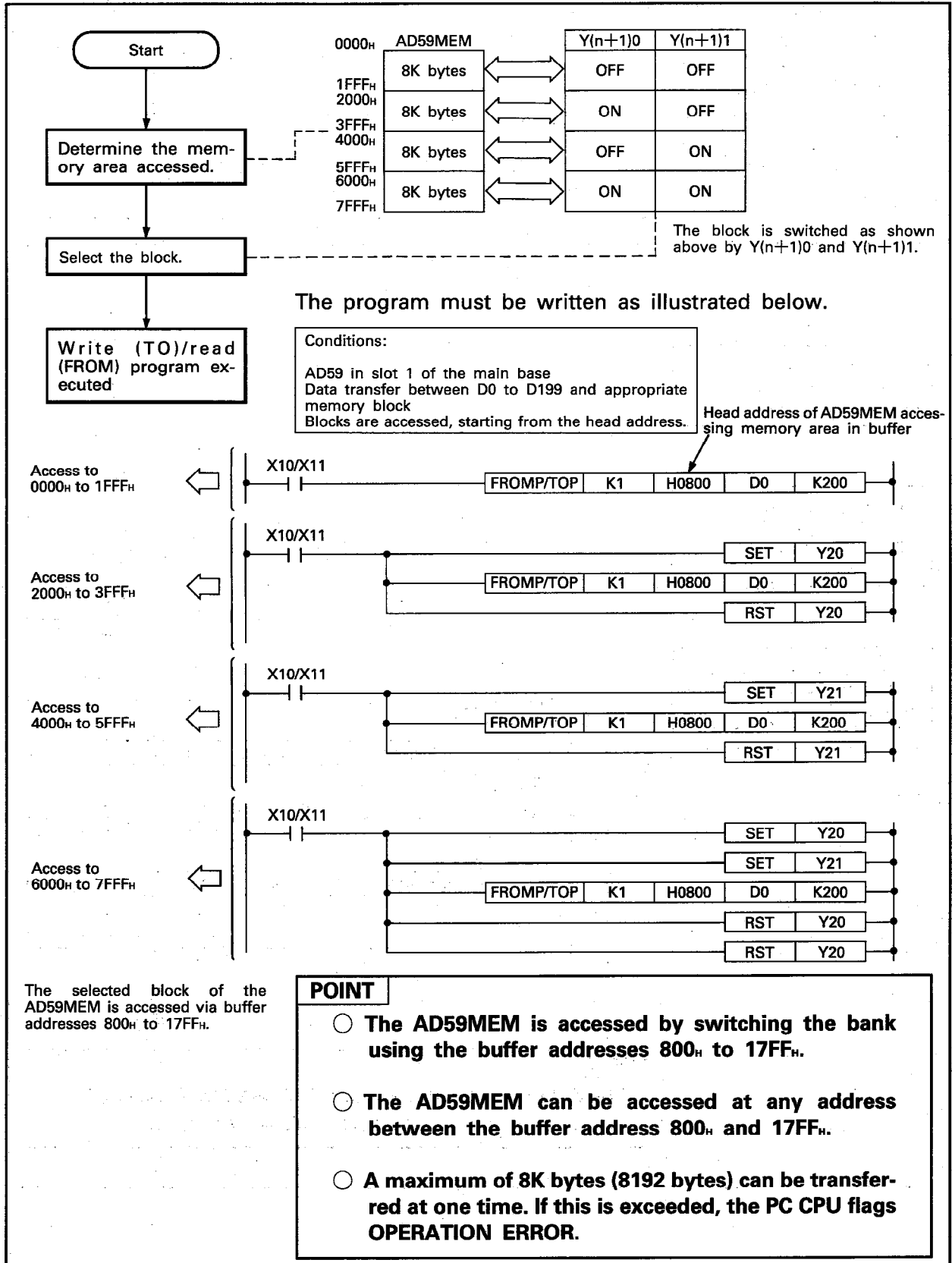
The PC CPU handles data as binary. It is therefore necessary to convert print out data from BIN to ASCII.

Example: To convert data register content 1234 into ASCII



4.2 Programming for AD59MEM Control

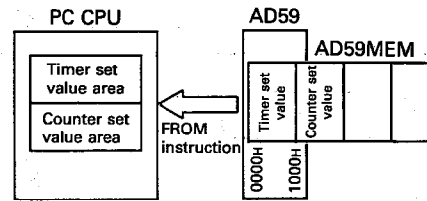
The AD59MEM is accessed by the TO (write) and FROM (read) instructions.



4.2.1 Application program example 1

Conditions:

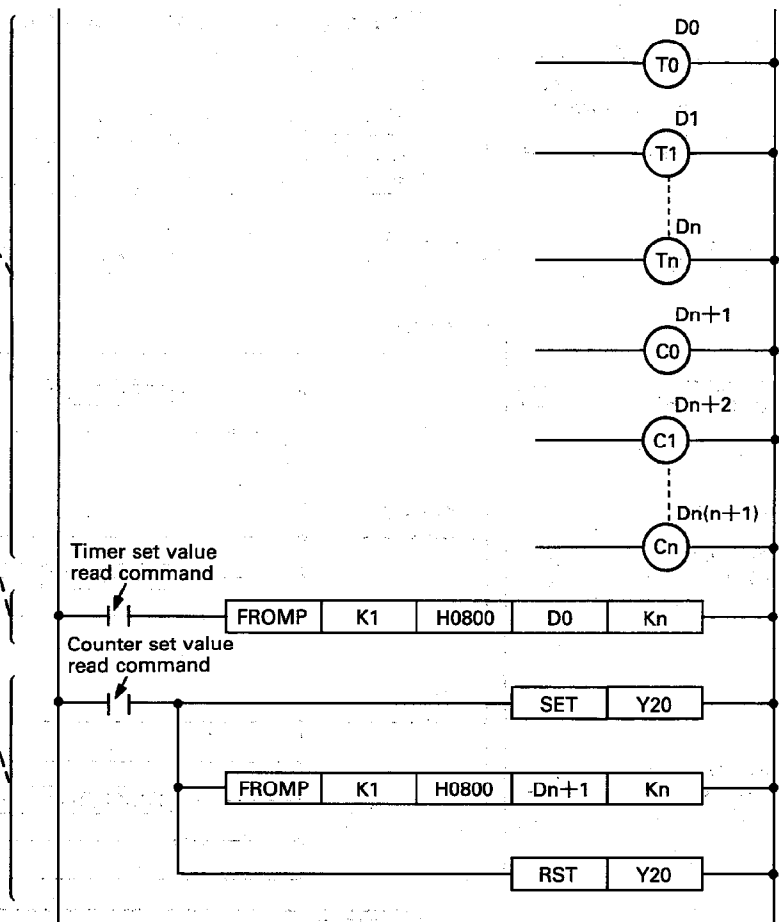
- ① AD59 in slot 1 of the main base
- ② I/O addresses: X10 to X1F, Y20 to Y2F
- ③ The AD59MEM stores timer and counter settings for use in the sequence program. These are called and used according to the process being controlled.
- ④ The AD59MEM stores timer set values at and after address 0000_H and counter set values at and after address 1000_H.



Timer and counter set values are stored in data registers in the sequence program.

To change timer set values, read the values from the AD59MEM with Y20 and Y21 off.

To change counter set values switch on Y20, change the memory block, and read the values from the AD59MEM.

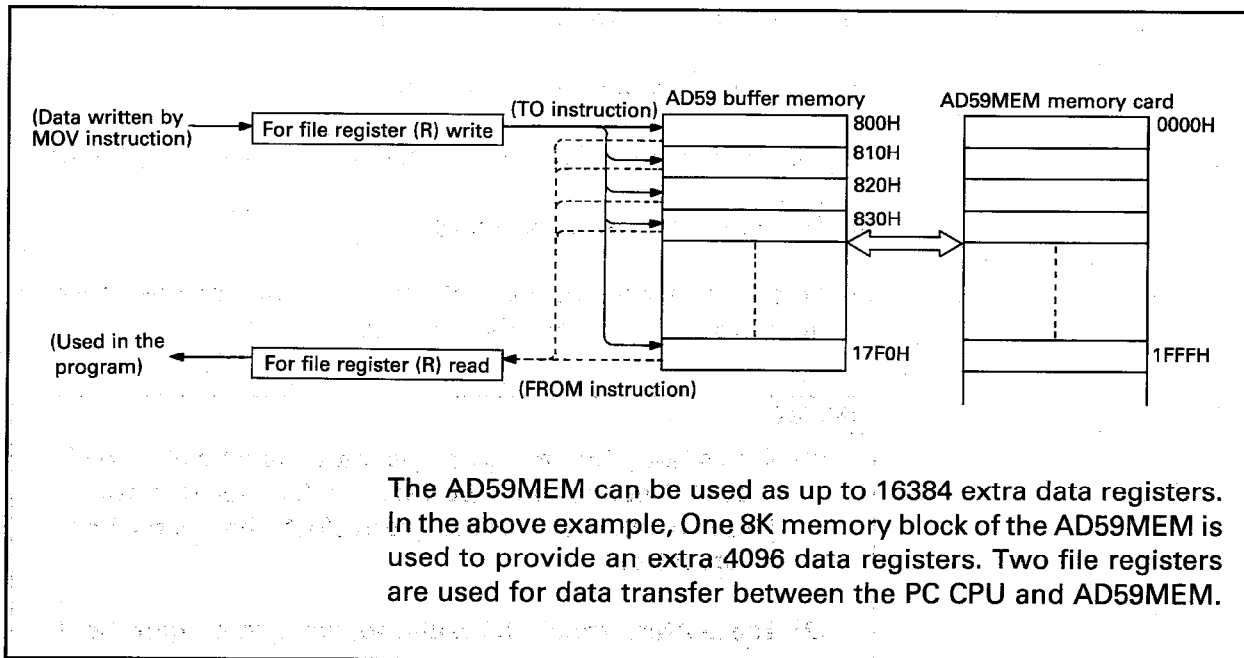


POINT

The data must be stored on the AD59MEM using the TO instruction prior to using the above program.

4.2.2 AD59MEM application example

The AD59MEM has 32K byte capacity which can be used as required, e.g. timer/counter set value change in Section 4.2.1. The following example shows the AD59MEM used as an extension data register area.



5. MAINTENANCE

5.1 Unit Storage

The AD59 should be stored in the following environments:

- (1) Ambient temperature -10 to 75°C .
- (2) Ambient humidity 10 to 90%RH.
- (3) No condensation (e.g. due to sudden temperature changes).
- (4) No direct exposure to sunlight.
- (5) Free from excessive amounts of conductive powder such as dust, iron filings, oil mist, salt, etc.

POINT

- | |
|---|
| <ol style="list-style-type: none">(1) A two hour "warming up" period should be allowed if the AD59 has not been powered up for over 12 months. This is to allow the electrolyte in electrolytic capacitors to stabilize.(2) The battery should be replaced every three months if the unit is not powered up to maintain memory card data.(3) The battery must be stored between -10 and 60°C. |
|---|

5.2 Battery Change**5.2.1 Battery change frequency**

When the AD59MEM backup battery voltage drops, the battery error signal to the PC CPU is switched on. The battery will continue to support the RAM for about seven days (168 hours) more and, if it is not replaced, data will then be lost or corrupted.

Guide for preventive maintenance

	Guaranteed Value (Minimum)	Actual Value (Typical)
Battery backup	3 years	5 years
After battery error	7 days (168 hours)	—————

Batteries unused for more than five years should not be used.

REMARKS

Battery handling:

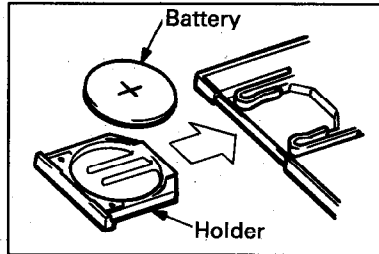
- (1) Do not short.
- (2) Do not disassemble.
- (3) Do not burn.
- (4) Do not heat.
- (5) Do not measure voltage with an analog voltmeter.

POINT

The battery voltage drops if the AD59MEM is loaded in the powered up AD59. In this case, the AD59MEM data is not corrupted.

5.2.2 Changing the battery

Memory data may be retained in the RAM during battery changes by loading the AD59MEM into a powered-up AD59 unit. The internal circuitry will retain the data while the battery is changed.



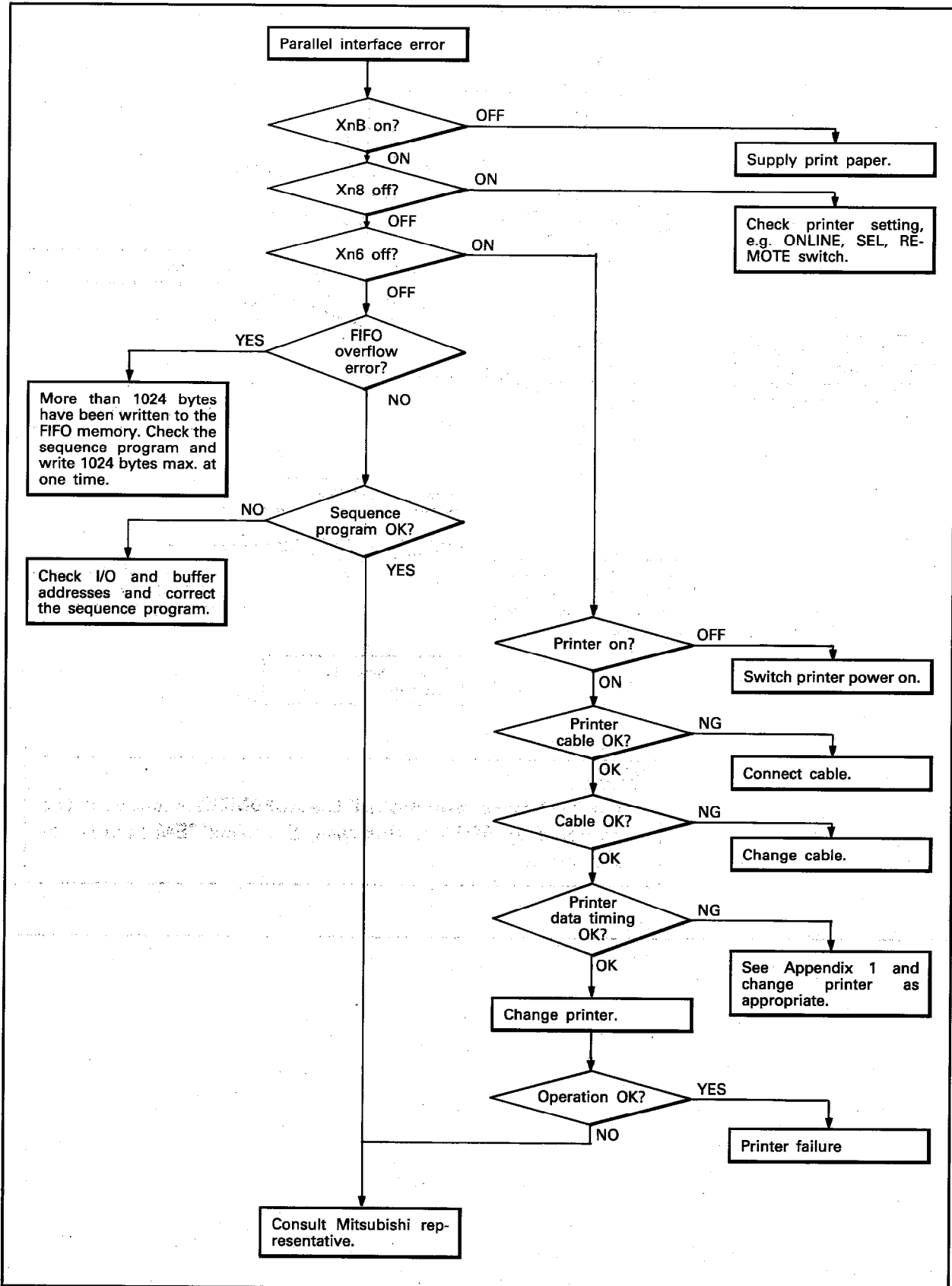
Battery access

POINT

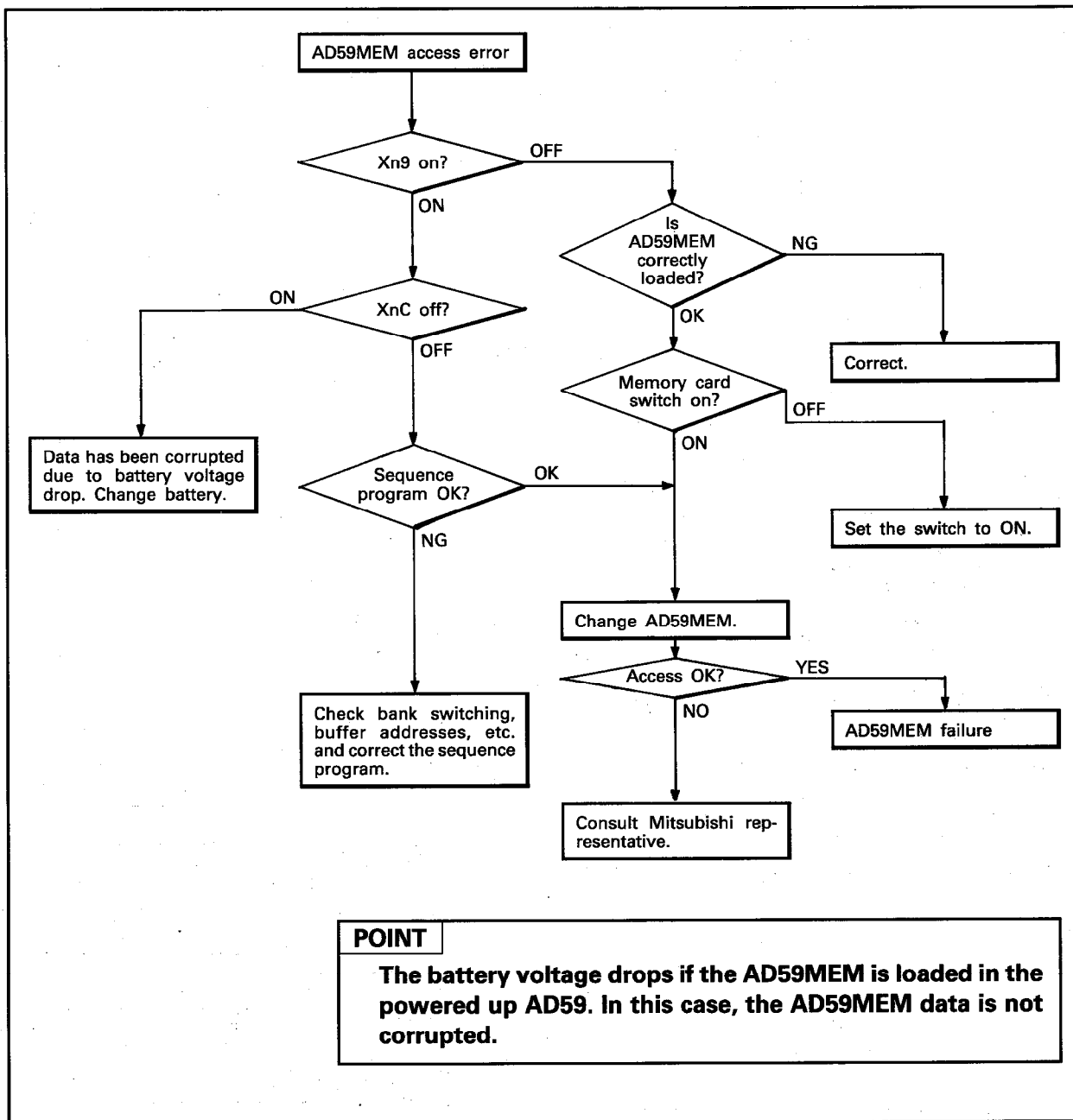
Data may be lost or corrupted if the AD59MEM is not loaded in a powered up AD59 during battery change.

6. TROUBLESHOOTING

6.1 Parallel Interface Operation Fault



6.2 AD59MEM Access Fault

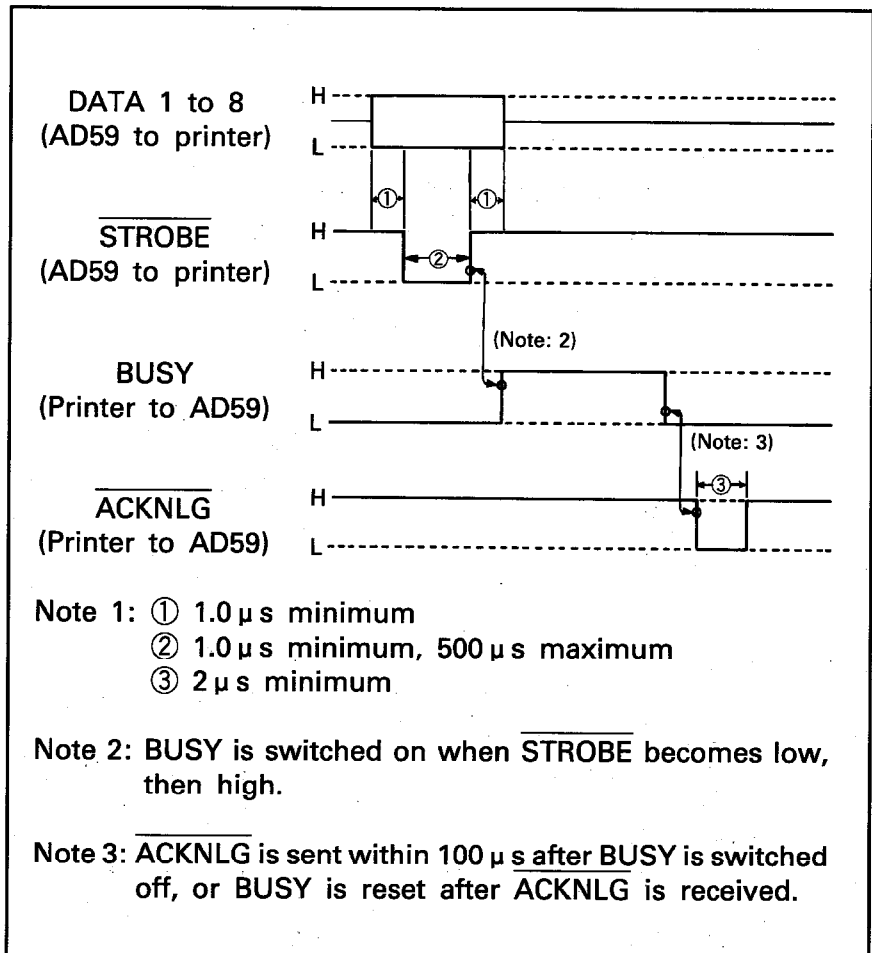


POINT
 The battery voltage drops if the AD59MEM is loaded in the powered up AD59. In this case, the AD59MEM data is not corrupted.

APPENDICES

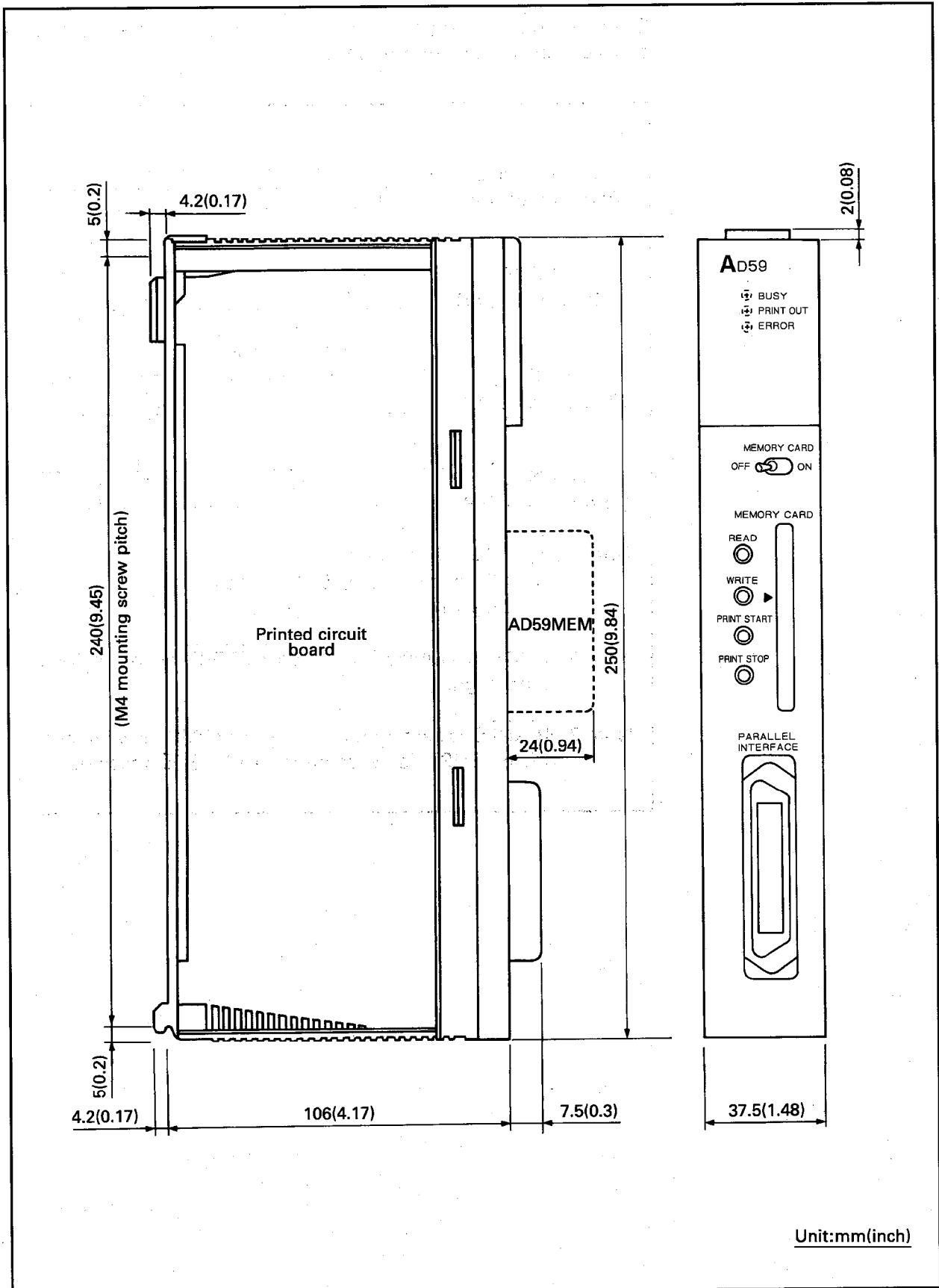
Appendix 1 Data and Control Signal Timing

Check the data timing of the printer used against the AD59 data and control signal timings shown below.

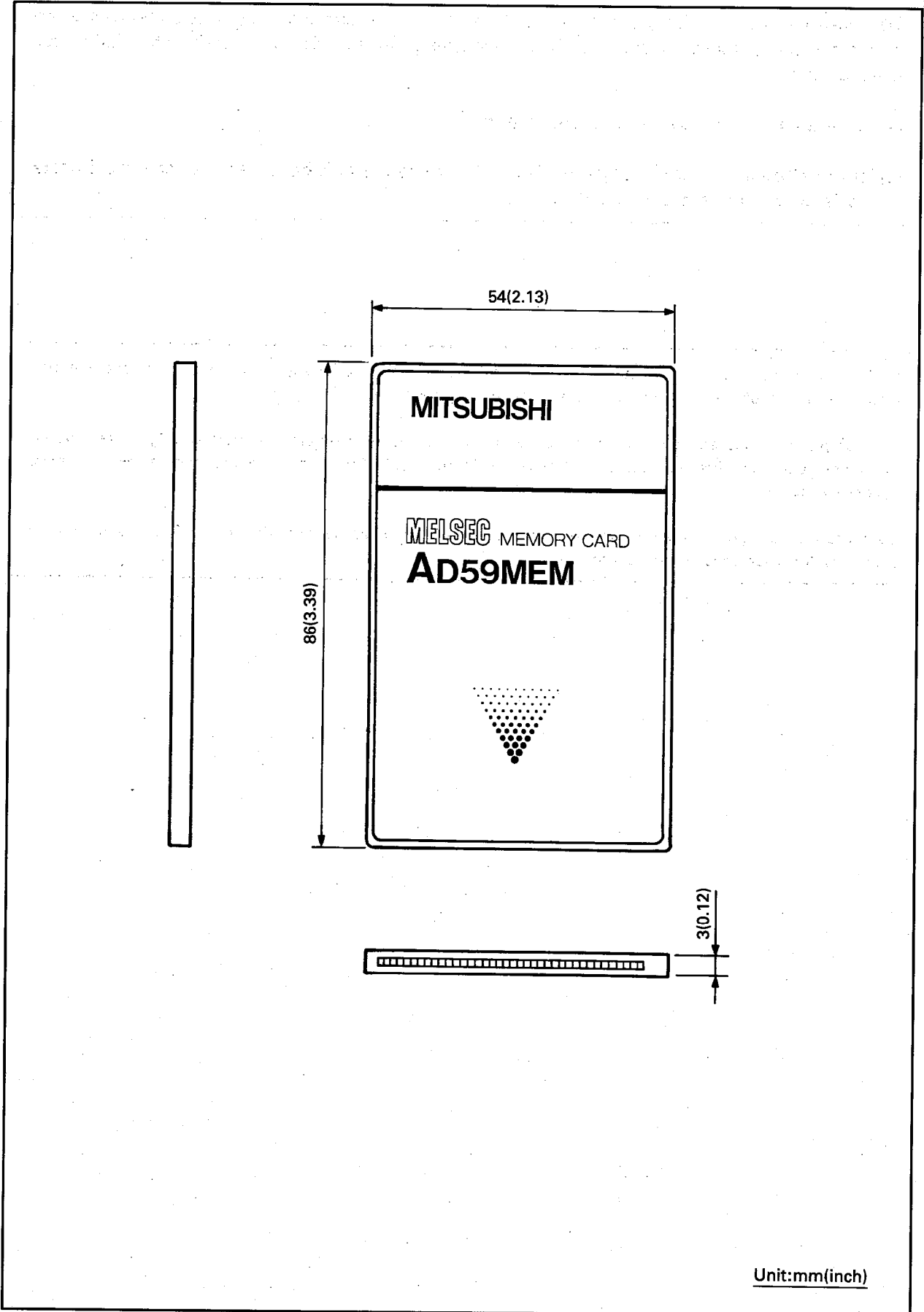


Appendix 2 External Dimensions

(1) AD59 diagram



(2) AD59MEM diagram



Unit:mm(inch)

IMPORTANT

The components on the printed circuit boards will be damaged by static electricity, so avoid handling them directly. If it is necessary to handle them take the following precautions.

- (1) Ground human body and work bench.**
- (2) Do not touch the conductive areas of the printed circuit board and its electrical parts with any non-grounded tools etc.**

Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.

All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.

Owing to the very great variety in possible applications of this equipment, you must satisfy yourself as to its suitability for your specific application.

Memory card interface module type AD59

User's Manual

MODEL	AD59-USERS-E
MODEL CODE	13J629
IB(NA)66141-B(8811)MEE	

 **MITSUBISHI ELECTRIC CORPORATION**

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