Quick Operation Guide

of

the AMT-VME module

using AVrun software

Revision Draft 1.0C

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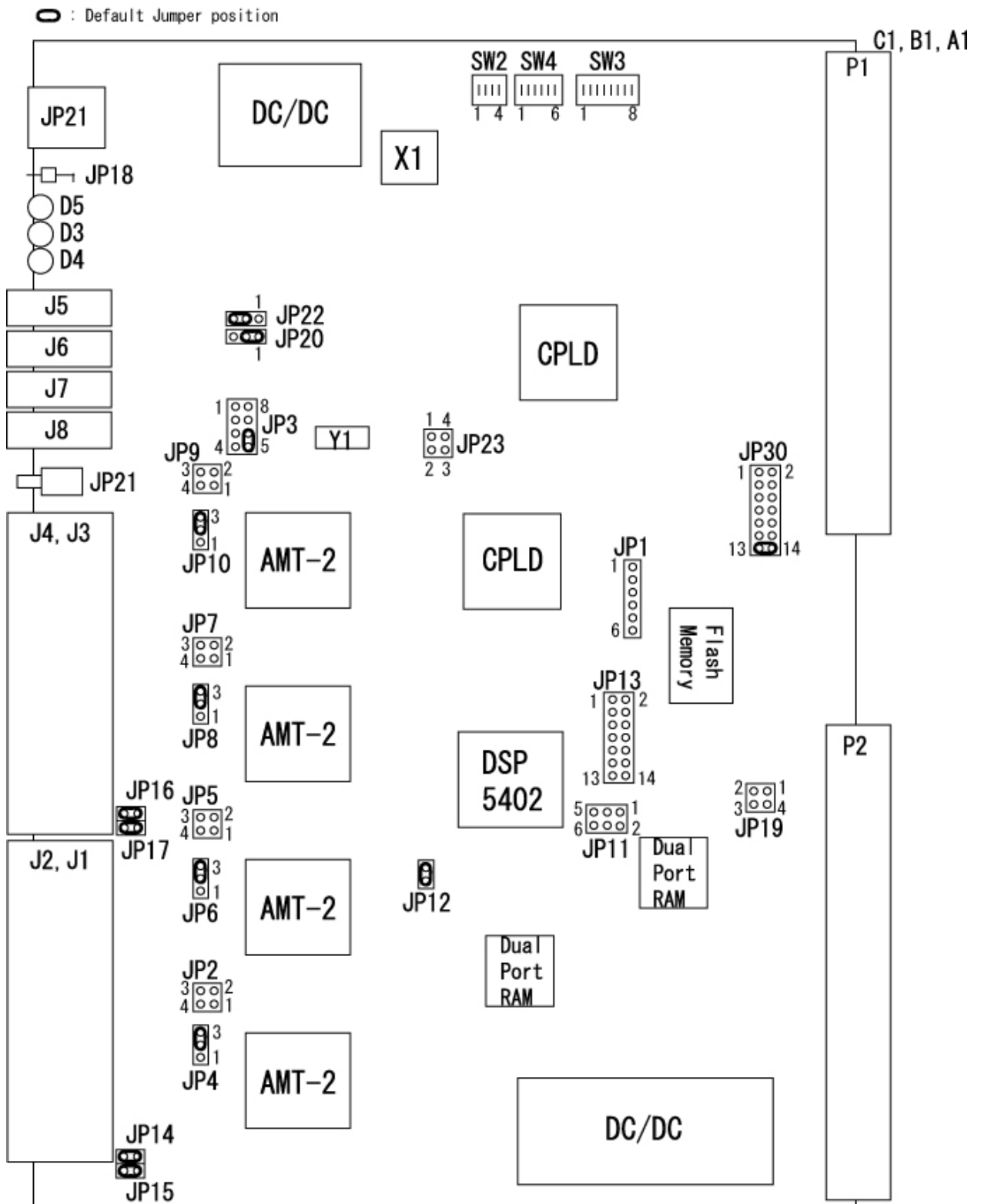
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History

```
June 13, 2003 .................First Release (Revision Draft 1.0)
June 13, 2003 ........Minor Editing English (Revision Draft 1.0A)
Nov 21, 2003 ........Fix at Dptop address(Revision Draft 1.0B)
June 29, 2005 .........Fix at Event Buffer Size(Revision Draft 1.0C)
```

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2-1. Setting Parameters

The AMT-VME module has many flexibilities due to the AMT chip's programability and the DSP software controllability. A DSP program, called **AVrun**, is prepared for the use of the majority of users. Users do **not** need to access internal registers directly. Instead users set desired conditions in a module control parameters area in a Dual Port Memory (DPM) which is accessible from the VME bus.

A Memory map of the DPM is shown in the Appendix. Each parameter and control sequence is described below.

2-1-1. Run Status

```
Bit31           (not used)
Bit30~28        width select (wselect) (default = 0)
                          Set width resolution and range in dedge=3 mode.
                          resolution of the width=0.78125*2^(wselect)
                          max. width range=resolution*256
Bit27~8         (not used)
Bit7            measurement control
                          1/0 = Trigger measurement/Normal measurement
Bit6~5          use (or not use) subtract offset (dsuboff)
                          0 = do not subtract (default)
                          1 = test mode (reserved)
                          2 = subtract using offset table
                          3 = test mode (reserved)
Bit4~3          hit signal's edge detection (dedge)
                          0 = rising edge detect mode (default)
                          1 = rising and falling edge detect mode
                          2 = falling edge detect mode
                          3 = rising edge and width detect mode
Bit2            Common Start/Stop
                          0 = Common Start Mode
                          1 = Common Stop Mode (default)
Bit1            Measurement control
                          0 = measurement stop (default)
                          1 = measurement start
Bit0            (not used)
```

2-1-2. Time Range Count (dcount 12 bit) (default = 0x07EA(50us))

```
Recording time = 25ns * dcount value
Example) When,
        dcount = 0x02FA
        Recording time = 0x02FA(762d) * 25ns = 19050ns (about 19us)
```
(Note)
```
In Trigger Mode, maximum value of dcount is 0x07EA(50us).
In Normal Mode, maximum value of dcount is 0x0FFE(100us).
In Normal Mode, max recording time is 100us.  But stored event data (also
garbage data between stop and start) is not rejected.
```

2-1-3. Module ID

5 bit arbitrary number. Included in event header. **(default 0)**

2-1-4. CH_Enable (63~0 ch)

This parameter uses two 32-bit words. Each bit corresponds to an input channel. Input signal from disabled channels are not measured.
#63(MSB) - #0(LSB) **(default all'1')**
        0 = disable
        1 = enable
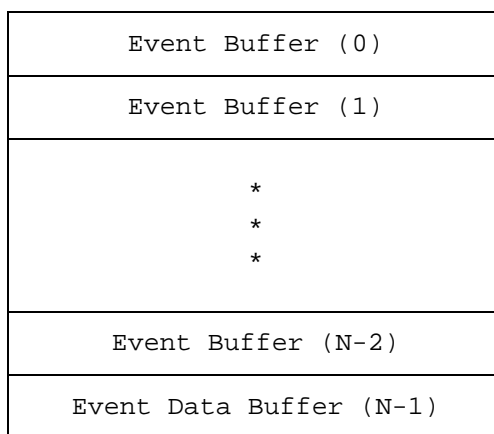Example) 0xF00000 means ch 63~59 are enabled.

2-1-6. Number of Partitions (12 bit)

Event buffer area can be divided into several partitions. This allows concurrent measurement and data readout, and reduced dead time.

Bit No.	D15 ~ D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Num of Parti	not use	2048	1024	512	256	128	64	32	16	8	4	2	1

default = 0x001

a) When all bits are cleared (Number of Partitions = 0x0000), this is same as 0x0001.
b) If multiple bits are set, only Most Significant Bit (MSB) setting is effective.
c) When this register set to 0x0001, act as single buffer, other settings act as multi buffer.
d) An example of multiple buffer partitioning is shown below.

```
┌─────────────────────────────┐
│      Event Buffer (0)        │
├─────────────────────────────┤
│      Event Buffer (1)        │
├─────────────────────────────┤
│                             │
│             *               │
│             *               │
│             *               │
│                             │
├─────────────────────────────┤
│     Event Buffer (N-2)       │
├─────────────────────────────┤
│   Event Data Buffer (N-1)    │
└─────────────────────────────┘
```

N = Number of Partitions

The buffer area is equally divided, so all partitions have the same size. If the data size of an event is lager than the buffer size, an OVR bit in error report word is set and data beyond the buffer size are discarded.

2-1-7. Pcount (Parameter Counter) (32 bit)

This parameter is used for start/stop control and initiate new parameter setting and measurement from a VME master.

2-1-8. Icount (16 bit)

Icount and Scount are used to handshake data transfer between an AMT-VME module and a VME master module.
When AMT-VME measures and stores an event data into the DPM, Scount is incremented by the module. On the other hand, the master module must increment the Icount when a readout of event data is finished.

Icount is a signed 16-bit value.
The method of incrementing Icount is somewhat different between single buffer and multi buffer.

```
<single buffer>
      After reading data, increment Scount value.
<multi buffer>
      After reading data, point to next buffer number.
      *) Icount is within {0 ~ (Number of Partitions-1)}
```

2-1-9. Scount (16 bit)

Scount is a signed 16-bit value.
The method of incrementing Scount also some differs between single buffer and multi buffer.

```
<single buffer>
      After storing data in the DPM, Scount is incremented.
<multi buffer>
      After storing data in the DPM, point to next buffer number.
      *) Scount is within {0 ~ (Number of Partitions-1)}
```

2-2. Control Sequence (Single Buffer)

Please refer to the Sequence Image (Timing Diagram) on the following page.

(1) Set operation Parameters
    a) Set RunStatus, TimeRangeCount, etc…
    b) Set Number of Partitions.

(2) Start Measurement
    c) Write `1` to measurement control bit (bit1) of RunStatus.
        (Example) RunStatus = 0x00000002
    d) Increment Pcount (Parameter Counter)
        (Example) Pcount = 0x00000001
    e) LED D4 on Front Panel lights when you update Runstatus and Pcount.
       This lighted LED means "Ready for measurement".
       Scounter is automatically cleared to zero.)

(3) Store Data
    f) When the AMT-VME module finishes storing a new event, Scounter is
       automatically incremented, and front panel LED D4 will go off.

(4) Read Data
    g) Read data from the event buffer area at VME address $xxx72000 ~ $xxx7DFFE
    h) After reading the event, increment Icount value.
            (note) You must increment by the same value as Scount.

repeat (3) (4)

(5) Stop Measurement
    i) write '0' into measurement control bit of Runstatus.

<caution>

  **If you change the Pcount value during measurement, new parameters are
set and a new measurement will start.
  We recommend stopping measurement before changing parameters and
Pcount.**

Communication Timing Image during measurement sequence (Single Buffer)
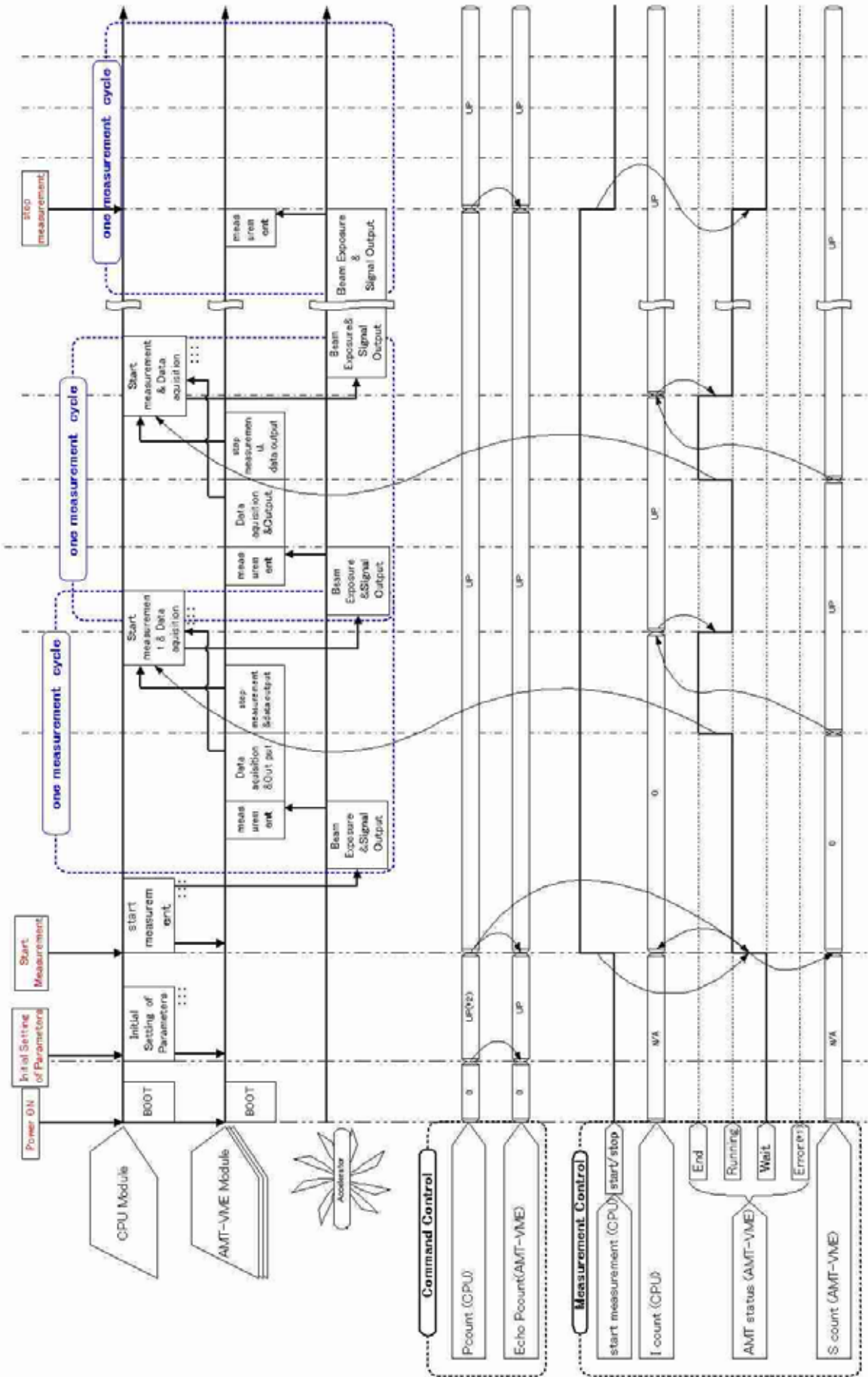
(*1)······If DSP detect error condition. AMT-Status turn error level on . (*2)······You must increment Pcounter after you s

2-3. Sequence (Multi Buffer)

Please refer to the Sequence Image (Timing Diagram) on the following page.

(1) Setting Measurement Parameters
        a) Set RunStatus, TimeRangeCount, etc…
        b) Set Number of partitions.
            (Example) Number of partitions = 0x00000004 (4 partitions)

(2) Start Measurement
        c) Write `1` to measurement control bit(bit1) of RunStatus.
            (Example) RunStatus = 0x00000002
        d) Increment Pcount (Parameter Counter)
            (Example) Pcount = 0x00000001
        e) LED D4 on front panel lights when you update Runstatus and Pcount.
           This lighted LED means "Ready for measurement".

(3) Store Data
        f) When the AMT-VME module finishes storing a new event, Scounter is
           automatically incremented, and LED D4 will go off when a buffer
   is filled by the event.

(4) Read Data
        g) Read data pointed by Icounter.
            (Example)
            Number of Partition = 4, Icount = 2
            Icounter=0   VMEaddress=$xxx72000~$xxx74FFE (DSPaddress $9000~$A7FF)
            Icounter=1   VMEaddress=$xxx75000~$xxx77FFE (DSPaddress $A800~$BFFF)
    Read----->Icounter=2   VMEaddress=$xxx78000~$xxx7AFFE (DSPaddress $C000~$D7FF)
            Icounter=3   VMEaddress=$xxx7B000~$xxx7DFFE (DSPaddress $D800~$EFFF)
             (note) 1) Scount counts up "0 -> 1 -> 2 -> 3 -> 0 -> 1......".
                       and after reading data, Icounter is incremented.
                    2) Icount **does not** overtake Scount.
                    3) Icount is already masked by ("Number Of Partitions" - 1).
                      So, at your program, Icount is not necessary ring counter.
                    4) When the buffer is empty and full, the Scount and Icount are same
                      value. So you have to check a "AMT Status".
                     Buffer is Empty: AMT Status is Running(1).
                     Buffer is Full : AMT Status is End(2).

repeat (3) (4)

(5) Stop of Measurement
        h) write '0' into measurement control of Runstatus.

<caution>

**If you change Pcount's value during measurement, new parameters are set
and new measurement will start.**
We recommend stopping measurement before changing parameters and Pcount.
(In multi buffer mode, start address of store is $9000.)

Communication Timing Image during measurement sequence (Multi Buffer)
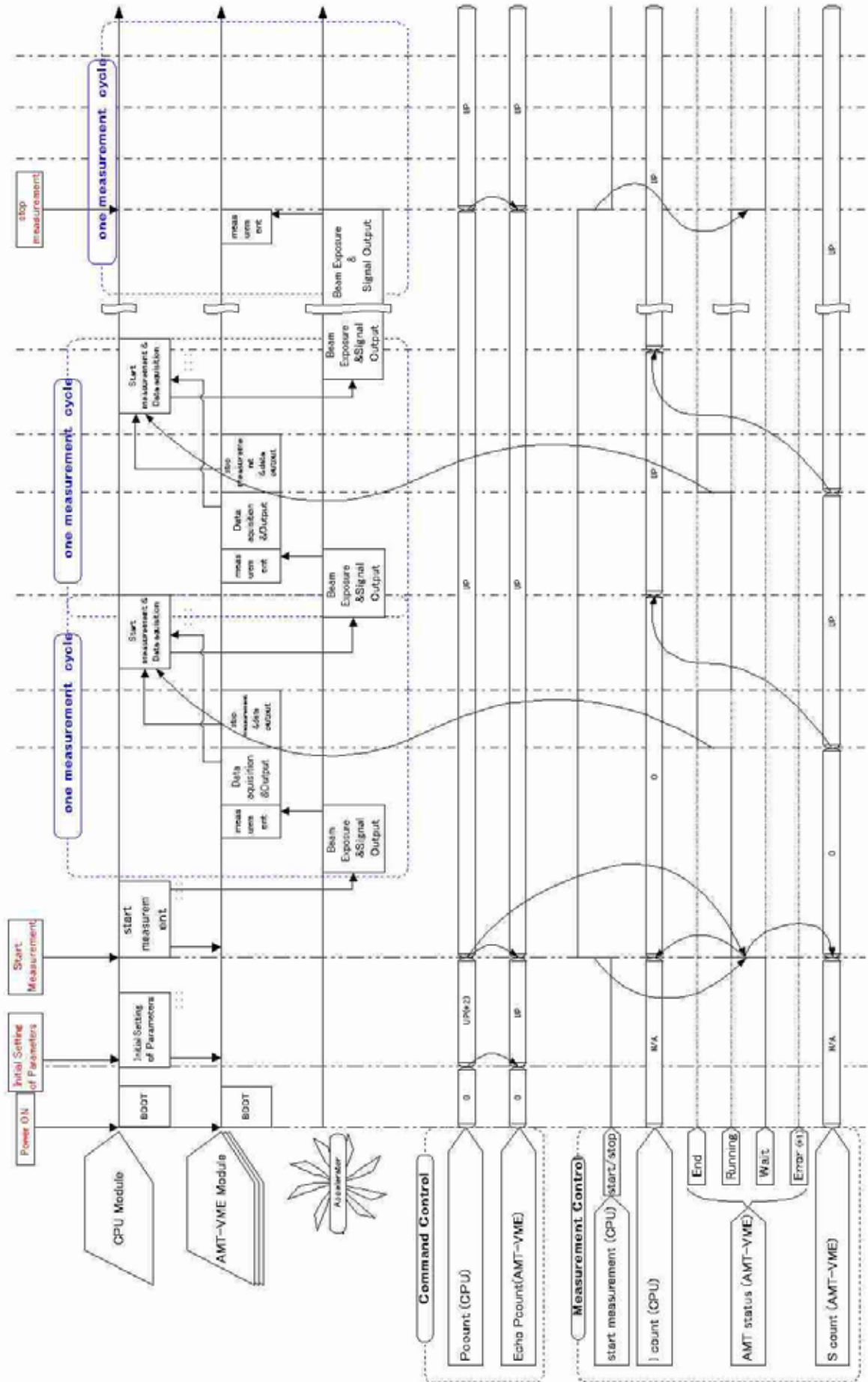
(*1)······If DSP detect error condition. AMT-Status turn error level on . (*2)······You must increment Pcounter after you set

Appendix

A) DP Memory map

DSP Add	VME add	31 contents 0	Direction
$8F80	DPtop	Module Control parameters (8Dword)	VME=> 1)
		(Reserved)	
$8FA0	+$0040	Offset table (64word)	VME=> 1)
		(Reserved)	
$8FF0	+$00E0	AMT Board Monitor Data (3DWord)	<= AMT
		(Reserved)	
$9000 $EFFF	+$0100	Event buffer (Fix length Max12KDWord)	<=AMT

Dptop = VME_BASE address +$60000+ $11F00

(ex)if VME_BASE address is $00800000, Dptop is $00871F00

B) Module Control parameter   (VME => AMT)

DSP Add	VME add	31 contents 0
$ 8F80	DPtop	Pcount (*1) Parameter counter:16bit
$ 8F82	+$0004	RunStatus (bitmap)
$ 8F84	+$0008	Time range count (dcount 12bit) Rec time = 25ns x dcount
$ 8F86	+$000C	Module ID(5bit)
$ 8F88	+$0010	CH_Enable(#31(MSB) #0(LSB))
$ 8F8A	+$0014	CH_Enable(#63(MSB) #32(LSB))
$ 8F8C	+$0018	Number of partitions (12bit)
$ 8F8E	+$001C	Icount (Input counter: 16bit)

C) Offset table   (VME => AMT)

When Offset compensation is assigned with RunStatus's Bit 5-6,
the DSP calculates DATA compensation according to the table below.

DSP Add	VME add	31 contents 0	
$ 8FA0	Dptop +$0040	Offset ch#0 16bit signed	Offset ch#1 16bit signed
$ 8FA2	+$0044	Offset ch#2 16bit signed	Offset ch#3 16bit signed
$ 8FDE	+$007C	Offset ch#62 16bit signed	Offset ch#63 16bit signed

D) AMT Board Monitor Data   (AMT =>VME)

DSP Add	VME add	31 contents 0
$ 8FF0	Dptop +$00E0	EchoPcount (16bit copy of Parameter counter
$ 8FF2	+$00E4	AMT Status 0:wait 1:running 2:end(when multi buff mode) -1:error
$ 8FF4	+$00E8	Scount (Save counter: 16bit)

E) Event buffer (AMT =>VME variable length)

DSP Add	VME add	31 content 0
$ 9000	Dptop +$0100	Event Buffer(0)
		Event Buffer (1)
		Event Buffer (n)
$EFFF	$BFFC	

Point with Scount

Point with Icount

Recoding Data Block

31   contents   0
Recording data Status
Common start/stop time
Hit data× n
Error Report (if exists)
End of data
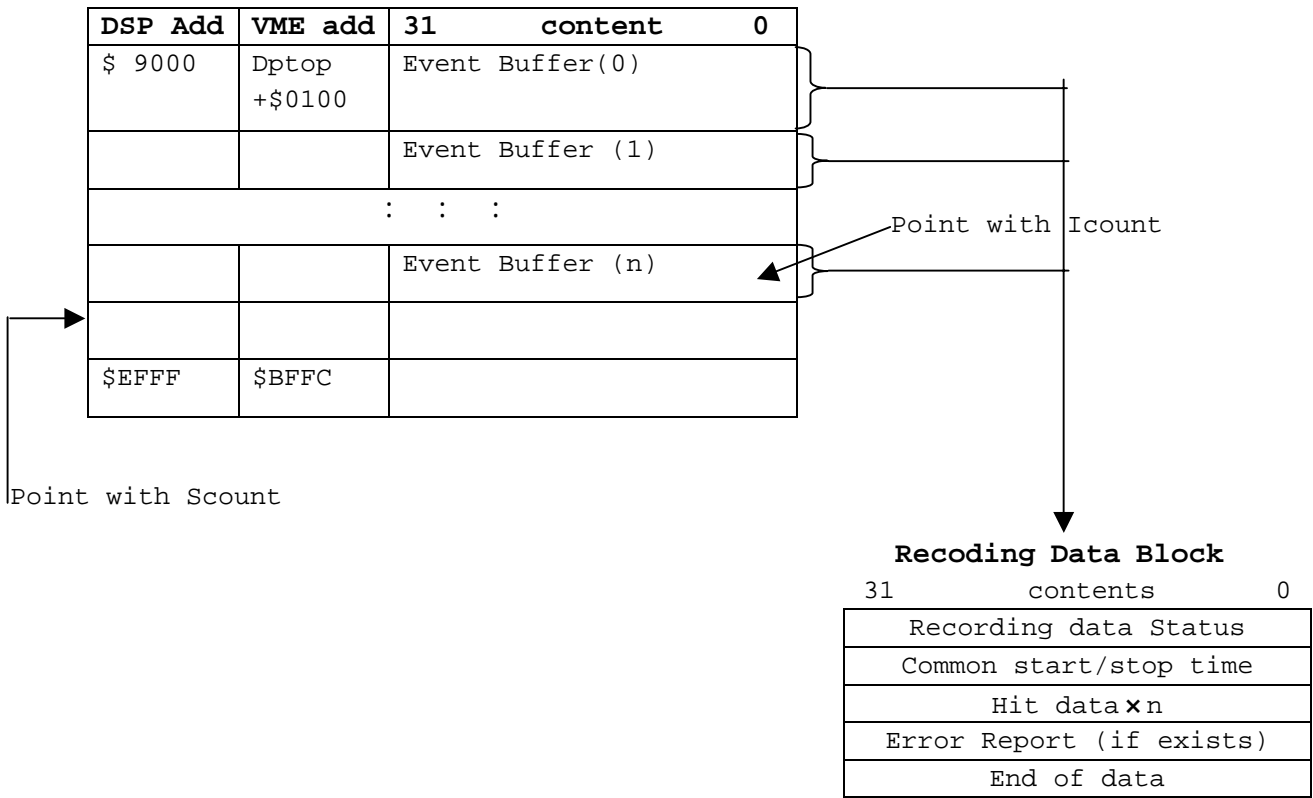
F) Recording data Status

D31			D28												D16
1	0	1	Total # of recording data (tntotal) (include header & footer unit:DWord)												

D15															D0
Event #															

G) Common start/stop time

D31			D28		D24	D23	D22 D20	D19 D18	D17	D16
1	1	0	Module ID			0	Width select	Edge detection	MC (*1)	Common start/ stop time

D15															D0
Common start/stop time (17bit)															

(*1)   measurement control

H) Hit data

D31			D28			D25					D20	D19			D16
0	0	0	F/R			CH#(6bit 0-63)						HIT time data			

F/R: Edge direction Falling (=1)/Rising (=0)

CH#: Refer Appendix A (Module Ch# assignment)

D15															D0
HIT time data (20bit offset from common start/stop timing)															

I) Error Report (if any)

D31			D28			D24	D23					D18	D17	D16
0	1	1	Module ID				Unused						OVR	ERR

D15		D13													D0
AMT#		AMT Error Flag (Refer AMT1&2 User's Manual § 2.10)													

J) End of data

D31															D16
End of data ($5555)															

D15															D0
Event #															

K) Ch# assignment

AMT#	Ch#(Chip)	Ch#(Module)
AMT0	#0 to #23	#0 to #23
AMT1	#0 to #23	#24 to #47
AMT2	#0 to #15	#48 to #63
AMT3	#0, #1	Start, Stop