S.P.L.A.T ISA BOARD
IO-953
MANUAL

Brookhaven National Laboratory
Version 2.0 (02/12/2001)

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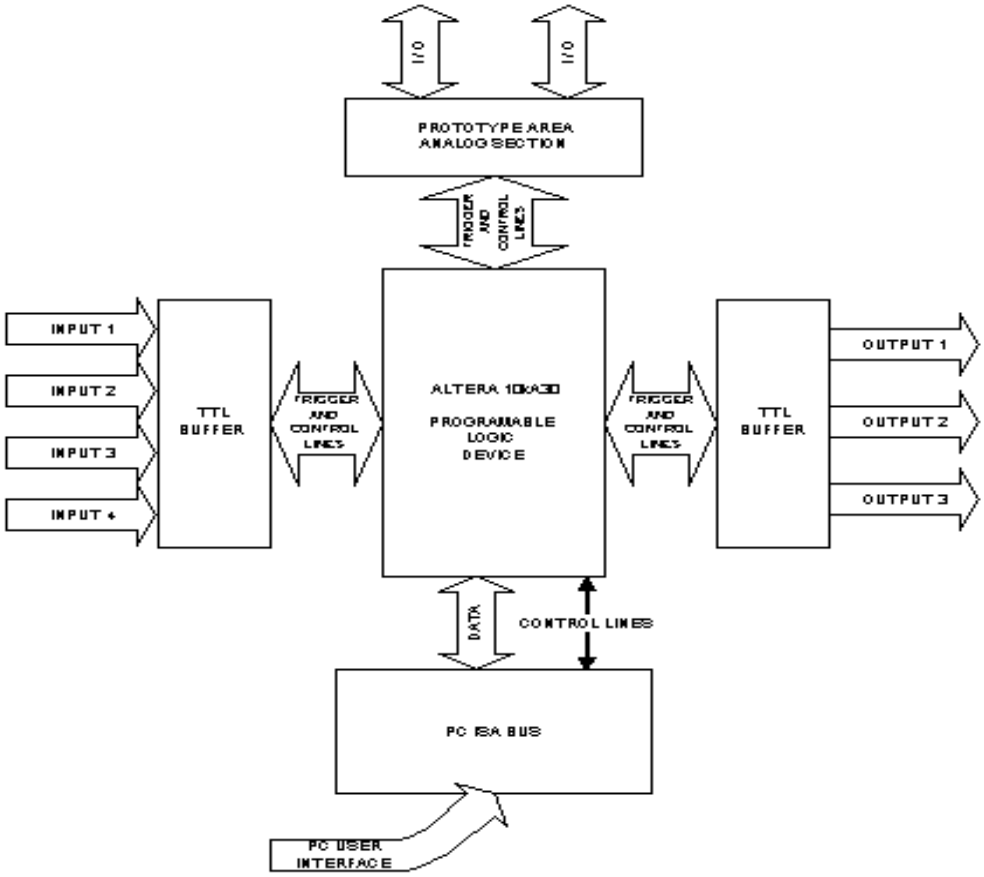
INTRODUCTION

The objective behind the SPLAT ISA board was to create a timing and control system for an aerosol particle mass spectroscopy experiment. The board will be used to measure the time of flight of particles in air to trigger an ablation laser. To accurately measure the time of flight a high-speed clock with a resolution of 25ns is used. All of the boards functions are implemented in an Altera 100KA PLD, which allows the board to be modified fairly simply. At present the PLD contains integrators, counters, multipliers and a PC ISA interface and more.

BOARD FEATURES

- **40 MHz Clock**
- **10 MHz Clock**
- **Seven I/O ports**
- **Removable Prototype Area**
- **PC ISA Interface**
- **PC Interrupt Compatible**
- **High Speed PLD**
- **VC++ Software Interface**
- **Single Event Mode**
- **Continuos Event Mode**
- **Fully controllable registers**



SPLAT ISA BOARD
Block Diagram

SPECIFICATIONS

INTEGRATORS (PMT1 & 2)
1. Threshold count 1 – 65,5360
2. Integration window 25ns – 6.4us
3. Saturation width 25ns – 6.375us

INTEGRATOR (CHANNELTRON)
1. Threshold count 1-65,5360 (wait for integration window to end)
2. Integration window 25ns-6.4s
3. Saturation width NONE

TRIGGER OUT DELAY (PMT 1 & 2)
1. delay trigger by -200ns - 1.6384ms

TRIGGER OUT DELAY (CHANNELTRON)
1. delay trigger by 0 - 1.6384ms

MULTIPLIER
1. multiplication constant. 0 - 1.99999

LASER TIME OUT DELAY
1. Trigger Rest Delay 1.6us - 104.8576ms

DIP SWITCH SETTINGS

PC I/O
Address (O = open C = Closed X= NOT USED)

	{ 1 2 3 4 5 678}
0x3c0	O O O O X XXX
0x380	O O O C X XXX
0x340	O O C O X XXX
0x300	O O C C X XXX
0x2c0	O C O O X XXX
0x280	O C O C X XXX
0x240	O C C O X XXX
0x100	C O C C X XXX
0x1c0	C O O O X XXX
0x180	C O O C X XXX
0x140	C O C O X XXX
0x100	C O C C X XXX

PC ISA REGISTERS

Board ID
BRDID 0x00

Function :
Return the board ID.

When written it clears the INTERUPT request.

WRITE

16 bit

READ

16 bit

Photo Multiplier 1&2 Threshold Setting
PMTTRS 0x02

Function :

This register controls the threshold for PMT1 and PMT2.
It sets the number of pulse counts the PMTS make before a trigger is generated.

WRITE

16 bit

READ

16 bit

Photo Multiplier 1&2 Integration window Setting
PMTWND 0x04

Function:

This register sets the Integration Windows for PMT1 and PMT2
RANGE 1-256 25ns - 6.4us
1 = 25ns
2 = 50ns
.
.
255 = 6.375us
256 = 6.400us

WRITE

8 bit

READ

8 bit

Photo Multiplier 1&2 saturation Setting
PMTSAT 0x06

Function:

This register sets the saturation setting for PMT1 and PMT2
RANGE 1-256 25ns - 6.4us
1 = 25ns
2 = 50ns
.
255 = 6.375us
256 = 6.400us

WRITE

8 bit

READ

8 bit

WAIT After PMT1 Trigger Before Allowing PMT2 to Trigger
WAIT 0x08

Function :

Wait time after PMT1 trigger is generated before allowing PMT2.
Range 50ns – 3.276ms
1 = 50ns
2 = 100ns

2 = 150ns
.

WRITE
16 bit
READ
16 bit

TIME OUT after PMT1 Triggered But no PMT2 Trigger Arrived
T2WAIT 0x0a

Function :
TIME OUT after PMT1 triggered but NO PMT2 arrives
Range 50ns – 3.276ms
1 = 50ns
2 = 100ns
2 = 150ns
.

WRITE
16 bit
READ
16 bit

Photo Multiplier trigger output delay
PMTDCNT 0x0c

Function : CHANNELTRON Delay output Trigger
Range -175ns – 1.6378ms
1 = -175ns delay
2 = -150ns delay
3 = -125ns delay
.
7 = -25ns delay
8 = 0ns delay
9 = 25ns delay
.
.

WRITE
16 bit
READ
16 bit

CHANNELTRON Threshold Setting
CHNTRS 0x0e

Function :
This register controls the threshold for PMT1 and PMT2.
It sets the number of pulse counts the PMTS make before a trigger is generated.

WRITE
16 bit
READ
16 bit

CHANNELTRON Integration window Setting
CHNWND 0x10

Function:
This register sets the Integration Windows for PMT1 and PMT2

RANGE 1-256 25ns - 6.4us
1 = 25ns
2 = 50ns
.
.
255 = 6.375us
256 = 6.400us

WRITE
8 bit

READ
8 bit

CHANNELTRON Delay output Trigger
CHNDLY 0x12

Function : CHANNELTRON Delay output Trigger
Range 0ns – 1.638ms

0 = 0
1 = 25ns
2 = 50ns
2 = 75ns
.

WRITE
16 bit

READ
16 bit

MULTIPLIER CONSTANT 1
ERR1C x14

Function : multiplier Constant
Range 0 – 1.99999

C1*4096 = 16 bit value

Example
T1 = 5430
C1= 0.98
0.98*4096 = 4014.08 (float)
reg_load -> = 4014 (16 bit) = 0x0FAE (HEX)

true result = 5321.4
mult result = 5321.293

WRITE
16 bit

READ
16 bit

MULTIPLIER CONSTANT 2
ERR2C x16

Function : multiplier Constant
Range 0 – 1.99999

C1*4096 = 16 bit value

Example
T1 = 5430
C1= 0.98

0.98*4096 = 4014.08 (float)
reg_load -> = 4014 (16 bit) = 0x0FAE (HEX)

true result = 5321.4
mult result = 5321.293

WRITE
16 bit
READ
16 bit

MULTIPLIER CONSTANT 3
ERR3C x18

Function : multiplier Constant
Range 0 – 1.99999

C1*4096 = 16 bit value
Example
T1 = 5430
C1= 0.98
0.98*4096 = 4014.08 (float)
reg_load -> = 4014 (16 bit) = 0x0FAE (HEX)

true result = 5321.4
mult result = 5321.293

WRITE
16 bit
READ
16 bit

MULTIPLIER CONSTANT 4
ERR4C x1a

Function : multiplier Constant
Range 0 – 1.99999

C1*4096 = 16 bit value
Example
T1 = 5430
C1= 0.98
0.98*4096 = 4014.08 (float)
reg_load -> = 4014 (16 bit) = 0x0FAE (HEX)

true result = 5321.4
mult result = 5321.293

WRITE
16 bit
READ
16 bit

PMT SECOND TRIGGER OUTPUT
SECTRIG 0x1c

Function :
Generate a second trigger after laser fired due to a PMT Trigger.

Time to wait after main trigger to generate second trigger.

Range 25ns – 1.638ms in 1.6us steps

0 = 25ns
1 = 50ns
2 = 100ns
.
.

WRITE
16 bit
READ
16 bit

TRIGGER reset delay
LTIMEOUT 0x1e

Function :
Wait time after the trigger is generated before restarting cycle.
Range 1.6us – 104.8576ms in 1.6us steps

0 = 1.6us
1 = 3.2us
2 = 4.8us
.
.

WRITE
16 bit
READ
16 bit

ERROR CORRECTION TIME ZONE
SMERRC 0x20

A B C D
MAP 0ns ----- SM ----- MD ----- LG ----- 6.4us
A= ERR1C B= ERR2C C= ERR3C D= ERR4C
Function :
Set time rage for end of ERR1C and start of ERR2C
Range 25ns – 6.4us in 1.6us steps

0 = 25ns
1 = 50ns
2 = 100ns
.
.

WRITE
8 bit
READ
8 bit

ERROR CORRECTION TIME ZONE
MDERRC 0x22

A B C D
MAP 0ns ----- SM ----- MD ----- LG ----- 6.4us
A= ERR1C B= ERR2C C= ERR3C D= ERR4C
Function :
Set time rage for end of ERR2C and start of ERR3C
Range 25ns – 6.4us in 1.6us steps

0 = 25ns
1 = 50ns
2 = 100ns
.
.
WRITE
8 bit
READ
8 bit

ERROR CORRECTION TIME ZONE
LGERRC 0x24

A B C D
MAP 0ns ----- SM ----- MD ----- LG ----- 6.4us
A= ERR1C B= ERR2C C= ERR3C D= ERR4C
Function :
Set time rage for end of ERR3C and start of ERR4C
Range 25ns – 6.4us in 1.6us steps

0 = 25ns
1 = 50ns
2 = 100ns
.
.
WRITE
8 bit
READ
8 bit

MEMORY WRITE LIMIT
WRLMT 0x26

Function : This register if enabled will set the number of events to be read automatically and then stop. (used to prevent memory over run) limit is 1K = 1024 = 0x400.

WRITE
10 bit
READ
10 bit

USER REGISTERS
STAR 0x28

Function : USER REGISTERS

Bit 0 :set 0 = stop run
:set 1 = run mode
Bit 1 :set 1 = single event
:set 0 = continues trigger
Bit 2 :set 0 = WRLMT disabled
:set 1 = WRLMT enabled
Bit 3 :set 0 = PMT delay disabled
:set 1 = PMT delay enable
Bit 4 :set 1 = reset board
:set 0 = Normal run
Bit 5 NONE

Bit 6 :set 1 = clr single event and wrlmt
:set 0 = re enable limits
Bit 10: if = 0 data from PMT (DATA FROM FIFO)
If = 1 data from CHANNELTRON (DATA FROM FIFO)
Bit 14: if = 0 LAST data from PMT
If = 1 data from CHANNELTRON
Bit 15: if = 1 trigger fired

WRITE
14 bit
READ
16 bit

MEMORY WRITE COUNTER
WRLMT 0x2a

Function : RETURNS the number of data written into the memory FIFO.

WRITE
NONE
READ
16 bit

MEMORY READ COUNTER
WRLMT 0x2c

Function : RETUENS the number of data read from the memory FIFO.
WRITE
NONE
READ
10 bit

EVENT DATA OUTPUT
L1CNT 0x2e
Function : READ the LAST time of flight
WRITE
NONE
READ
16 bit

EVENT DATA OUTPUT
ECNT 0x30
Function : READ the LAST # of electrons

WRITE

NONE

READ

16 bit

EVENT DATA OUTPUT FROM THE FIFO.

READOUT 0x32

Function : READ the time of flight or # of electrons

USE register STAR bit 10 to determine PMT or CHN.

WRITE

NONE

READ

16 bit

POP READ FIFO

RDNEXT 0x32

Function : Generating a write to this registers will cause the next piece of data to Be popped from the FIFO. (to read the data look at READOUT and STAR bit 10) The Read counter will automatically increment after a write to this register.

WRITE

16 bit

READ

NONE

Software Example: