

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

Brookhaven National Laboratory
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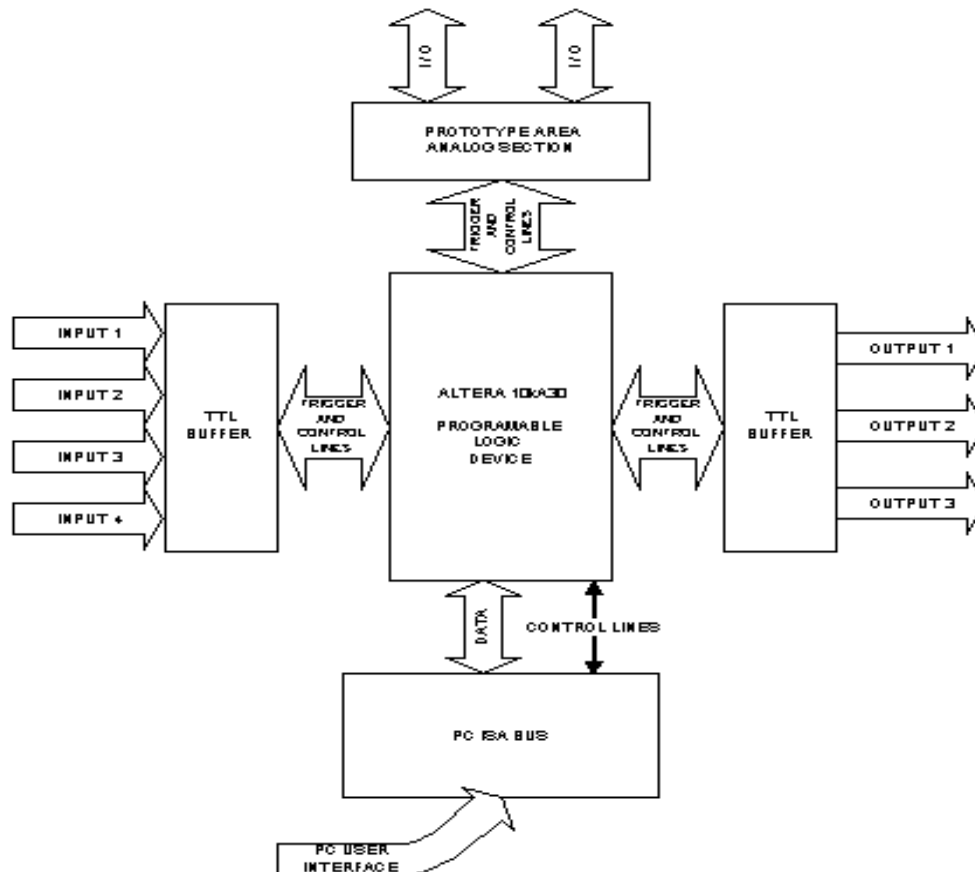
BY Jack Fried (email jfried@bnl.gov)
Web page (<http://www.inst.bnl.gov/~jfried>)

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
- Continuous 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 INTERRUPT 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

$C1 \times 4096 = 16 \text{ bit value}$

Example

T1 = 5430

C1 = 0.98

$0.98 \times 4096 = 4014.08 \text{ (float)}$
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

$C1 \times 4096 = 16 \text{ bit value}$

Example

T1 = 5430

C1 = 0.98

$0.98 \times 4096 = 4014.08$ (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

$C1 \times 4096 = 16$ bit value

Example

T1 = 5430

C1 = 0.98

$0.98 \times 4096 = 4014.08$ (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

$C1 \times 4096 = 16$ bit value

Example

T1 = 5430

C1 = 0.98

$0.98 \times 4096 = 4014.08$ (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 range 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 range 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: