EDOC140

# EUROGAM PROJECT

---

## EUROGAM DATA ACQUISITION SYSTEM

**BGO Serial Card**
**Register Layout Specification**

---

**Edition 1.0**
**April 28, 1992**

**M.M. ALEONARD, G. BOSSON, C. DIARRA**
**P. KADIONIK, N. KARKOUR**

# BGO Serial Card Register Layout Specification

This document is aggreeded by G. BOSSON, N. KARKOUR

April 28, 1992

Here is the list of Controlable Parameters

## 1 Parameter Common to whole module

- Veto width: 8 bit DAC (1 per module) [w]
- Dead time discriminators width: 8 bit DAC (1 per module) [w]
- Sum I multiplicity width: 8 bit DAC (1 per module) [w]
- Fast trigger width (w1): 8 bit DAc (1 per module) [w]
- Validation (Sample Point) (w2): 8 bit DAC (1 per shield) [w]
- Start Readout width (w3) [r]
- PDS gate width: 8 bit Dac (1 per module) [w]
- Analogue Multiplexer control word: 16 bit (1 per module) [r/w]
- Digital Multiplexer control word: 16 bit (1 per module) [r/w]
- Voltage Inspection line Control: (1 per module) [r/w]
- CDF (Contrôle des Fenêtres) (1 per module) [r/w]
- Module Configuration Register (1 per module) [r/w]
- Test access to readout FIFO (write) (1 per module) [w]
- Test access to readout FIFO (read) (1 per module) [r]

## 2 Parameter for each of the 6 shields

- Discriminator threshold: 12 bit DAC (1 per shield) [w]
- Test generator: 12 bit DAC (1 per shield) [w]
- Channel Control Register(CCR): 11 bit register (1 per shiled) [r/w]
- ROCI ADC low threshold (3 per shield) [r/w]

- ROCI ADC Address (3 per shield) [r/w]
- ROCI ADC test read of ADC address and data (3 per shield) [r/w]
- ROCI Sliding scale enable register (1 per shield) [r/w]
- ROCI parameter readout enable/disable (1 per shield) [r/w]
- ROCI Sliding scale register (1 per shield) [r/w]
- ROCI test register (1 per shield) [w]

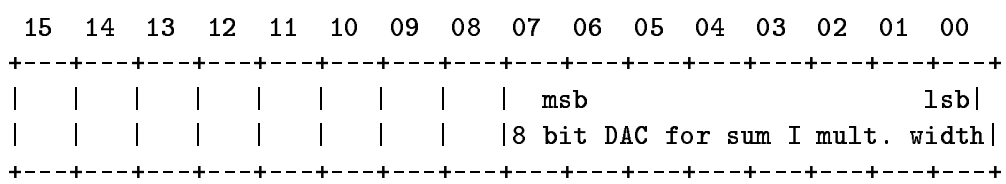
## 3 Address space Allocation

- 000-0FE Module parameters
- 100-1FE shield 1 parameters
- 200-2FE shield 2 parameters
- 300-3FE shield 3 parameters
- 400-4FE shield 4 parameters
- 500-5FE shield 5 parameters
- 600-6FE shield 6 parameters

## 4 Register layout

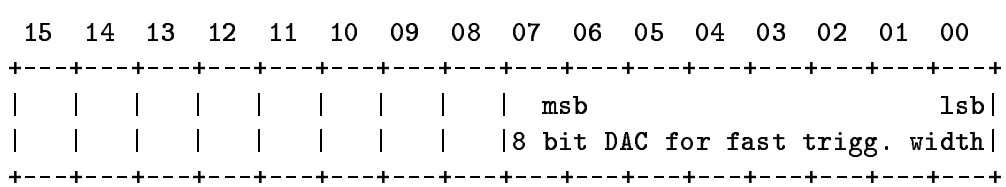
```
Name: Veto width  DAC                    Offset: @0000     write only

 15  14  13  12  11  10  09  08  07  06  05  04  03  02  01  00

+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   |   |   |   |   |   |   |   |  msb                      lsb|
|   |   |   |   |   |   |   |   |   8 bit DAC for veto width    |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
0000 = 100  ns
1111 = 1000 ns   1 bit = 4 ns


Name: Dead time discriminator width DAC    Offset: @0002   write only

 15  14  13  12  11  10  09  08  07  06  05  04  03  02  01  00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   |   |   |   |   |   |   |   |  msb                      lsb|
|   |   |   |   |   |   |   |   | 8 bit DAC for dead time width |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
0000 = 2  us
1111 = 20 us   1 bit = 80 ns
```

Name: Sum I multiplicity width DAC  Offset: @0004  write only



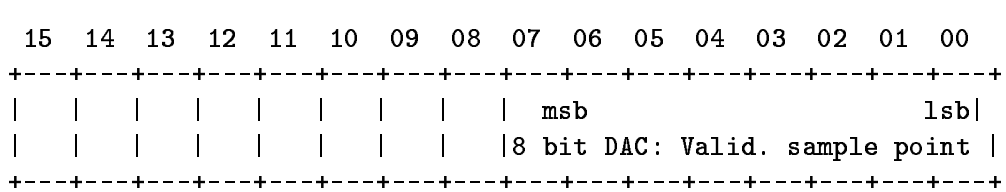

0000 = 100 ns
1111 = 1000 ns  1 bit = 4 ns

Name: Fast trigger width DAC  Offset: @0006  write only



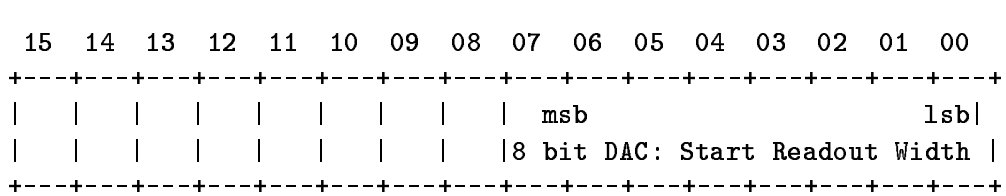

0000 = 0 us
1111 = 2 us  1 bit = 8 ns

Name: Validation Sample Point  Offset: @0008  write only



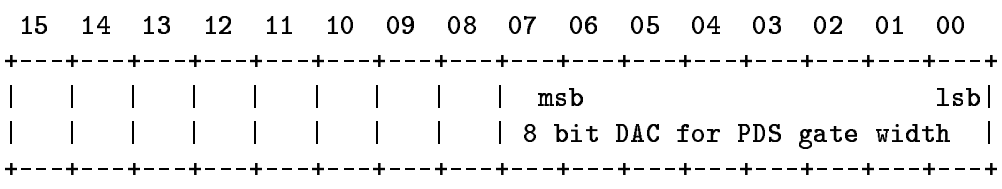

0000 = 0 us
1111 = 10 us  1 bit = 40 ns

Name: Start Readout Width  Offset: @000A  write only



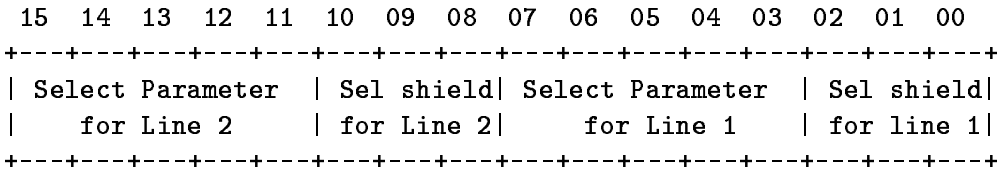

0000 = 0 us
1111 = 10 us  1 bit = 40 ns

Name: PDS gate width DAC Offset: @000C write only

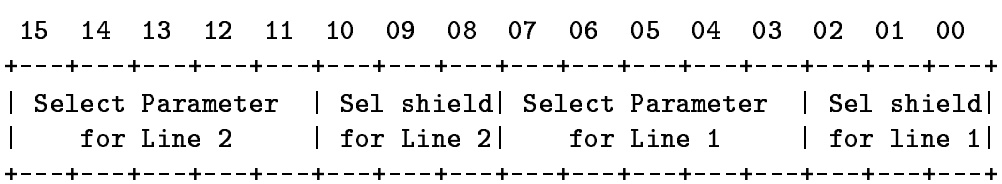



0000 = 0 us
1111 = 10 us 1 bit = 40 ns

Name: Analogue multiplexor Control Offset: @0030 read/write




Name: Digital multiplexor Control Offset: @0032 read/write



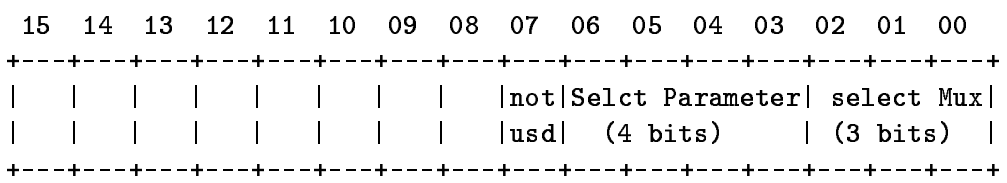
Sel shield: (for Analogue and Digital Multiplexer)

| | |
|---|---|
| 000 = disconnected from inspection line | 100 = channel 4 connected |
| 001 = channel 1 connected | 101 = channel 5 connected |
| 010 = channel 2 connected | 110 = channel 6 connected |
| 011 = channel 3 connected | 111 = not used ? |

Select Parameter: (for Analogue and Digital Multiplexer)

| Analogique | Logique | Select Parameter |
|---|---|---|
| Line Receiver BGO a | Discriminator Output BGO a | 00 |
| Line Receiver BGO b | Discriminator Output BGO b | 01 |
| Line Receiver BGO c | Discriminator Output BGO c | 02 |
| Line Receiver BGO d | Discriminator Output BGO d | 03 |
| Line Receiver BGO e | Discriminator Output BGO e | 04 |
| Line Receiver BGO f | Discriminator Output BGO f | 05 |
| Line Receiver BGO g | Discriminator Output BGO g | 06 |
| Line Receiver BGO h | Discriminator Output BGO h | 07 |
| Line Receiver BGO i | Discriminator Output BGO i | 08 |
| Line Receiver BGO j | Discriminator Output BGO j | 09 |
| TAC output | Start TAC | 10 |
| Shaping filter output | Fast Tigger in | 11 |
| Peak detector output | PDS GATE | 12 |
| Test generator output | Fast Trigger Sample Point | 13 |
| BGO j input | Validation Sample point | 14 |
| BGO i input | Local Trigger gate 3 | 15 |
| BGO h input | Dead time discriminator Gate | 16 |
| BGO g input | OR (discriminator output) | 17 |
| BGO f input | Discriminator veto | 18 |
| BGO e input | Validation Ack | 19 |
| BGO d input | Encode commande | 20 |
| BGO c input | Validation in | 21 |
| BGO b input | INHIBIT | 22 |
| BGO a input | Reset Local trigger | 23 |

Name: Voltage Inspection Line Control  Offset: @0034  read/write




Select Mux = 1 or 2

| Select Parameter (4 bits) | Select Mux (3bits) | Parameter |
|---|---|---|
| 0 | 1 | DAC output: Fast Trigger Width |
| 1 | 1 | DAC output: SUM I Multiplicity |
| 2 | 1 | DAC output: Dead Time Discriminator Width |
| 3 | 1 | DAC output: Veto Width |
| 4 | 1 | DAC output: Test Generator Shield 6 |
| 5 | 1 | DAC output: Test Generator Shield 5 |
| 6 | 1 | DAC output: Test Generator Shield 4 |
| 7 | 1 | DAC output: Test Generator Shield 3 |
| 8 | 1 | DAC output: Test Generator Shield 2 |
| 9 | 1 | DAC output: Test Generator Shield 1 |
| 10 | 1 | DAC output: Discriminator threshold Shield 6 |
| 11 | 1 | DAC output: Discriminator threshold Shield 5 |
| 12 | 1 | DAC output: Discriminator threshold Shield 4 |
| 13 | 1 | DAC output: Discriminator threshold Shield 3 |
| 14 | 1 | DAC output: Discriminator threshold Shield 2 |
| 15 | 1 | DAC output: Discriminator threshold Shield 1 |
| 16, 17 | | unused |

| Select Parameter (4 bits) | Select Mux (3bits) | Parameter |
|---|---|---|
| 28 | 2 | Voltage measurement (Alim) +24 volts (not yet implemented) |
| 18 | 2 | Voltage measurement (Alim) -24 volts |
| 19 | 2 | Voltage measurement (Alim) -12 volts |
| 20 | 2 | Voltage measurement (Alim) -6 volts |
| 21 | 2 | Voltage measurement (Alim) -5.2 volts |
| 22 | 2 | Voltage measurement (Alim) -2 volts |
| 23 | 2 | Voltage measurement (Alim) +3 volts Reg |
| 24 | 2 | Voltage measurement (Alim) +5 volts ADC |
| 25 | 2 | Voltage measurement (Alim) +5 volts |
| 26 | 2 | Voltage measurement (Alim) +6 volts |
| 27 | 2 | Voltage measurement (Alim) +12 volts |
| 29 | 2 | DAC output: PDS Gate Width |
| 30 | 2 | DAC output: Start Readout Width |
| 31 | 2 | DAC output: Validation Sample Point |

**Note about parameter 18 to 28:** After measurement, each voltage must be multiplied bye 10 because all the voltages are divided by 10 before they are measured. The voltages are divided by 10 because one can't drawn more than 12 vots through the multiplexer lines.

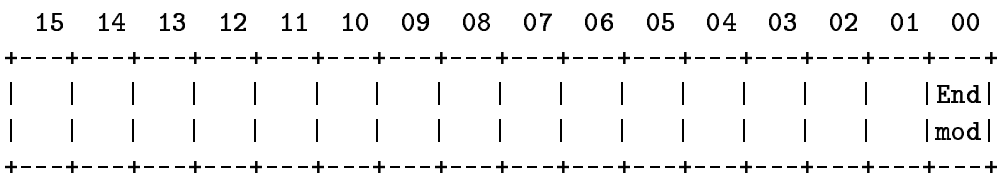
Note: For the definitive version of the BGO card, only the voltage +24 and -24 will be divided per 2 before the voltage measurement. The other voltages will not be divided.

Name: Controle des fenetres Offset: @0036 read/write
(will be implemented later)

| 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | on/off |

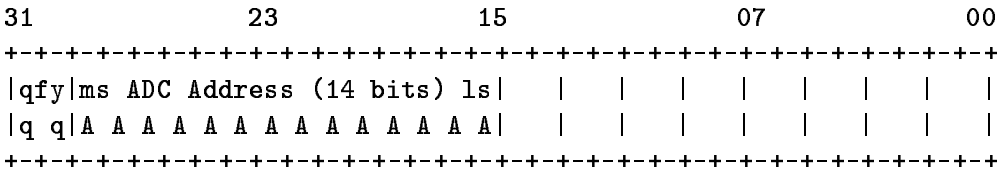
(1=on, 0=off)

Name: Module Configuration Offset: @0038 read/write
Register



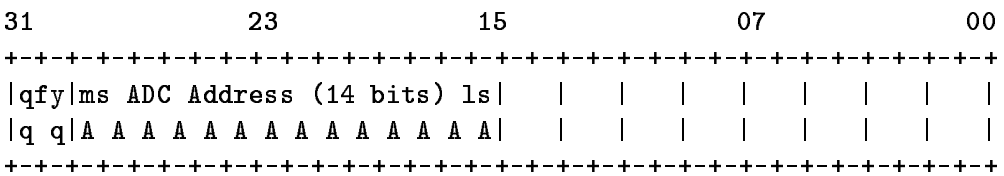

End mod = 1 (if last module)
End mod = 0 (if not last module)

Name: Test Write to readout FIFO Offset: @003C write only




D00-D31 may be written

Name: Test Read to readout FIFO Offset: @003C read only




Read byte: D00-D31

```
Name: Discriminator threshold DAC      Offset: @0100 (shield 1) write only
                                               @0200 (shield 2)
                                               @0300 (shield 3)
                                               @0400 (shield 4)
                                               @0500 (shield 5)
                                               @0600 (shield 6)

 15  14  13  12  11  10  09  08  07  06  05  04  03  02  01  00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   |   |   |   | msb                                       lsb|
|   |   |   |   | 12 bit DAC for Discriminator threshold       |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
0000 = 0 volts
1111 = 5 volts    1 bit = 3 mv
```

**Note:** There is a divider (by 10) after the DAC. So, the value to be written in the DAC must be multiplied by 10 before writing it. Here is the effective range (after the division):

```
0000 = 0 volts
1111 = 0.5 volts    1 bit = 0.3 mv
```

**exemple:** to get 100 mv as the threshold one will write 1000 mv (1 volt) in the DAC.
But for the "Mesure de tension" operation the measurement is done before the value is divided: the measured value is the value written in the DAC.

```
Name: Test generator DAC              Offset: @0102 (shield 1) write only
                                              @0202 (shield 2)
                                              @0302 (shield 3)
                                              @0402 (shield 4)
                                              @0502 (shield 5)
                                              @0602 (shield 6)

 15  14  13  12  11  10  09  08  07  06  05  04  03  02  01  00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   |   |   |   | msb                                       lsb|
|   |   |   |   | 12 bit DAC for Test Generator                |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
0000 = 0 volts
1111 = 5 volts    1 bit = 3 mv
```

```
Name: Channel Control Register        Offset: @0120 (shield 1) read/write
            (CCR)                               @0220 (shield 2)
                                                @0320 (shield 3)
                                                @0420 (shield 4)
                                                @0520 (shield 5)
                                                @0620 (shield 6)

 15  14  13  12  11  10  09  08  07  06  05  04  03  02  01  00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   |   |   |   |   |ON/|ON/|ON/|ON/|ON/|ON/|ON/|ON/|ON/|ON/|ON/|
|   |   |   |   |   |OFF|OFF|OFF|OFF|OFF|OFF|OFF|OFF|OFF|OFF|OFF|
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

Shield Disable/Enable                       (bit 10) 1=disabled,   0=enabled

important: bit 0 to 10 allocation

1) Test mode: using Test Generator.

BG0a Disable/Enable                         (bit  0) 0=enabled,    1=disabled
BG0b Disable/Enable                         (bit  1) 0=enabled,    1=disabled
BG0c Disable/Enable                         (bit  2) 0=enabled,    1=disabled
BG0d Disable/Enable                         (bit  3) 0=enabled,    1=disabled
BG0e Disable/Enable                         (bit  4) 0=enabled,    1=disabled
BG0f Disable/Enable                         (bit  5) 0=enabled,    1=disabled
BG0g Disable/Enable                         (bit  6) 0=enabled,    1=disabled
BG0h Disable/Enable                         (bit  7) 0=enabled,    1=disabled
BG0i Disable/Enable                         (bit  8) 0=enabled,    1=disabled
BG0j Disable/Enable                         (bit  9) 0=enabled,    1=disabled

2) Normal mode: in normal mode, both bit 0 to bit 9 are set to 1 (i.e all channel
                disabled)


Name: ROCI ADC low threshold     Offset: @0140 (shield 1)  read/write
      (Pattern)                          @0240 (shield 2)
                                         @0340 (shield 3)
                                         @0440 (shield 4)
                                         @0540 (shield 5)
                                         @0640 (shield 6)
31               23              15              07              00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Pattern ADC Lower Threshold   |                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
```

```
Name: ROCI ADC low trheshold          Offset: @0144 (shield 1)  read/write
      (TAC ADC)                               @0244 (shield 2)
                                              @0344 (shield 3)
                                              @0444 (shield 4)
                                              @0544 (shield 5)
                                              @0644 (shield 6)
31               23             15              07             00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| TAC ADC Lower Threshold       |                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

Name: ROCI ADC  low threshold    Offset: @0148 (shield 1)  read/write
      (Energy Shield)                    @0248 (shield 2)
                                         @0348 (shield 3)
                                         @0484 (shield 4)
                                         @0548 (shield 5)
                                         @0648 (shield 6)

31               23             15              07             00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Energy Shield lower threshold |                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

Name: ROCI ADC Address      Offset: @0150 (shield 1)  write only
      (Pattern)                    @0250 (shield 2)
                                   @0350 (shield 3)
                                   @0450 (shield 4)
                                   @0550 (shield 5)
                                   @0650 (shield 6)

31 30          23                  15 .......................00
+-+-+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| | |ROCI Patrn ADC Address (14bits)|                           |
|q|q|-----------+-------------------|                           |
| | |Item(6bits)| Group(8bits)      |                           |
+-+-+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
```

```
Name: ROCI ADC Address       Offset: @0154 (shield 1)  write only
      (TAC ADC)                      @0254 (shield 2)
                                     @0354 (shield 3)
                                     @0454 (shield 4)
                                     @0554 (shield 5)
                                     @0654 (shield 6)

31 30          23                  15 .......................00
+-+-+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| | |ROCI TAC ADC Address (14 bits) |                           |
|q|q|-----------+-------------------|                           |
| | |Item(6bits)| Group(8bits)      |                           |
+-+-+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+


Name: ROCI ADC Address           Offset: @0158 (shield 1)  write only
      (Energy ADC)                       @0258 (shield 2)
                                         @0358 (shield 3)
                                         @0458 (shield 4)
                                         @0558 (shield 5)
                                         @0658 (shield 6)

31 30          23                  15 .......................00
+-+-+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| | |  Energy ADC Address (14 bits) |                           |
|q|q|-----------+-------------------|                           |
| | |Item(6bits)| Group(8bits)      |                           |
+-+-+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+


Name: ROCI Test Read         Offset: @0160 (shield 1)  read only
       Pattern                       @0260 (shield 2)
                                     @0360 (shield 3)
                                     @0460 (shield 4)
                                     @0560 (shield 5)
                                     @0660 (shield 6)

31                              15    12                  03  00
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|qfy|ms ADC Address (14 bits) ls| 3   |   Pattern  data   |  3  |
|q q|A A A A A A A A A A A A A A|bits |D D D D D D D D D D|bits |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

10 Pattern bits: D00-D09
bits D10 to D15 not used
```

```
Name: ROCI Test Read          Offset: @0164 (shield 1)  read only
     (TAC ADC)                        @0264 (shield 2)
                                      @0364 (shield 3)
                                      @0464 (shield 4)
                                      @0564 (shield 5)
                                      @0664 (shield 6)

31              23              15               07              00
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|qfy|ms ADC Address (14 bits) ls|ms  TAC  ADC  data word      ls|
|q q|A A A A A A A A A A A A A A|0 0 0 D D D D D D D D D D D D|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

Name: ROCI Test Read          Offset: @0168 (shield 1)  read only
      (ENERGY ADC)                    @0268 (shield 2)
                                      @0368 (shield 3)
                                      @0468 (shield 4)
                                      @0568 (shield 5)
                                      @0668 (shield 6)

31              23              15               07              00
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|qfy|ms ADC Address (14 bits) ls|ms   Energy ADC data word    ls|
|q q|A A A A A A A A A A A A A A|0 0 0 D D D D D D D D D D D D|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

Name: ROCI Sliding scale      Offset: @0170 (shield 1)  read/write
      Enable Register                 @0270 (shield 2)
                                      @0370 (shield 3)
                                      @0470 (shield 4)
                                      @0570 (shield 5)
                                      @0670 (shield 6)

31                                          19  18  17  16  15 ..... 00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+----------+
|   |   |   |   |   |   |   |   |   |   |   |   |   |ENE|TAC|PAT|          |
|   |   |   |   |   |   |   |   |   |   |   |   |   |RGY|   |TER|          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+----------+
bit 16 (Pattern readout enable) must be set to 0.
```

```
Name: ROCI Parameter Readout    Offset: @0174 (shield 1)  read/write
      Enable Register                   @0274 (shield 2)
                                        @0374 (shield 3)
                                        @0474 (shield 4)
                                        @0574 (shield 5)
                                        @0674 (shield 6)
31                                                 19  18  17  16  15 ..... 00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+----------+
|   |   |   |   |   |   |   |   |   |   |   |   |   |ENE|TAC|PAT|          |
|   |   |   |   |   |   |   |   |   |   |   |   |   |RGY|   |TER|          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+----------+


Name: ROCI Sliding scale     Offset: @0178 (shield 1)  read only
      Register                      @0278 (shield 2)
                                    @0378 (shield 3)
                                    @0478 (shield 4)
                                    @0578 (shield 5)
                                    @0678 (shield 6)

31                              15                                  00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| msb       (16 bits)        lsb|                                   |
|Sliding Scale register for ROCI|                                   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+


Name: ROCI test              Offset: @017C (shield 1)  write only
      Register                      @027C (shield 2)
                                    @037C (shield 3)
                                    @047C (shield 4)
                                    @057C (shield 5)
                                    @067C (shield 6)

31                              15                                  00
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| msb       (16 bits)        lsb|                                   |
|        ROCI Test register     |                                   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
```