

# PPDAQ Use Cases

## Table of Contents

1 DAQ Dipswitch Controls.....	7
2 Enable/Disable RS-232.....	8
2.1 Primary Actors.....	8
2.2 Details.....	8
2.3 Scenarios.....	8
2.4 Requirements.....	8
2.5 Test Plan.....	9
2.6 Relationships.....	9
3 Enable/Disable USB.....	9
3.1 Primary Actors.....	9
3.2 Details.....	9
3.3 Scenarios.....	9
3.4 Requirements.....	9
3.5 Test Plan.....	10
3.6 Relationships.....	10
4 Enable/Disable Ethernet.....	10
4.1 Primary Actors.....	10
4.2 Details.....	10
4.3 Scenarios.....	10
4.4 Requirements.....	11
4.5 Test Plan.....	13
4.6 Relationships.....	13
5 Enable/Disable Test Mode.....	13
5.1 Primary Actors.....	13
5.2 Details.....	13
5.3 Scenarios.....	13
5.4 Requirements.....	13
5.5 Relationships.....	13
6 Enable/Disable Debug Mode.....	14
6.1 Primary Actors.....	14
6.2 Details.....	14
6.3 Scenarios.....	14
6.4 Requirements.....	14
6.5 Test Plan.....	14
6.6 Relationships.....	14
7 Read DIP Switches.....	14

7.1 Details.....	15
7.2 Scenarios.....	15
7.3 Requirements.....	15
7.4 Relationships.....	15
8 PPDAQ Command Protocol.....	16
9 Send Command.....	16
9.1 Primary Actors.....	16
9.2 Details.....	16
9.3 Scenarios.....	16
9.4 Requirements.....	17
9.5 Relationships.....	17
10 Receive Acknowledgement.....	17
10.1 Primary Actors.....	18
10.2 Details.....	18
10.3 Relationships.....	18
11 RS-232 Input Stream.....	18
11.1 Details.....	18
11.2 Requirements.....	18
11.3 Relationships.....	18
12 USB Input Stream.....	18
12.1 Details.....	19
12.2 Requirements.....	19
12.3 Relationships.....	19
13 Ethernet Input Stream.....	19
13.1 Details.....	19
13.2 Requirements.....	19
13.3 Relationships.....	19
14 Command Syntax.....	20
14.1 Details.....	20
14.2 Scenarios.....	20
14.3 Requirements.....	20
14.4 Relationships.....	20
15 Process Commands.....	21
15.1 Details.....	21
15.2 Scenarios.....	21
15.3 Relationships.....	21
16 Syntax Errors.....	21
16.1 Details.....	21
16.2 Requirements.....	21
16.3 Test Plan.....	25
16.4 Relationships.....	25

17 Range Errors.....	25
17.1 Details.....	25
17.2 Requirements.....	26
17.3 Test Plan.....	40
17.4 Relationships.....	40
18 PPDAQ Commands.....	41
19 Timestamp.....	42
19.1 Primary Actors.....	42
19.2 Details.....	42
19.3 Scenarios.....	42
19.4 Requirements.....	42
19.5 Test Plan.....	42
19.6 Relationships.....	42
20 Reset.....	42
20.1 Primary Actors.....	43
20.2 Details.....	43
20.3 Scenarios.....	43
20.4 Requirements.....	43
20.5 Test Plan.....	44
20.6 Relationships.....	44
21 Version.....	44
21.1 Primary Actors.....	44
21.2 Details.....	44
21.3 Scenarios.....	44
21.4 Requirements.....	44
21.5 Test Plan.....	44
21.6 Relationships.....	45
22 Echo.....	45
22.1 Primary Actors.....	45
22.2 Details.....	45
22.3 Scenarios.....	45
22.4 Requirements.....	45
22.5 Test Plan.....	45
22.6 Relationships.....	45
23 Help.....	45
23.1 Primary Actors.....	46
23.2 Details.....	46
23.3 Scenarios.....	46
23.4 Requirements.....	46
23.5 Relationships.....	46
24 PPDIO Cmds.....	46

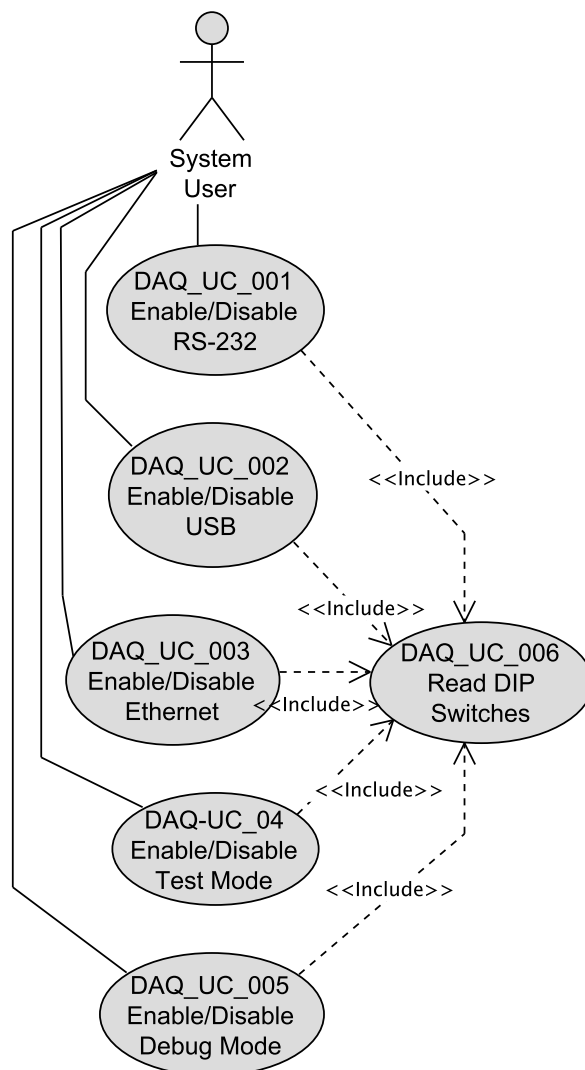
24.1 Primary Actors.....	46
24.2 Details.....	46
24.3 Scenarios.....	47
24.4 Requirements.....	47
24.5 Relationships.....	48
25 PPDIO::Polarity.....	48
25.1 Details.....	48
25.2 Scenarios.....	48
25.3 Requirements.....	50
25.4 Test Plan.....	51
25.5 Relationships.....	51
26 PPDIO::Pullup.....	51
26.1 Details.....	51
26.2 Scenarios.....	51
26.3 Requirements.....	53
26.4 Test Plan.....	54
26.5 Relationships.....	54
27 PPDIO::Boards.....	54
27.1 Details.....	54
27.2 Scenarios.....	54
27.3 Requirements.....	55
27.4 Relationships.....	55
28 PPDIO::Config.....	55
28.1 Details.....	55
28.2 Scenarios.....	55
28.3 Requirements.....	56
28.4 Test Plan.....	56
28.5 Relationships.....	56
29 PPDIO::Filter.....	56
29.1 Details.....	56
29.2 Scenarios.....	56
29.3 Requirements.....	57
29.4 Test Plan.....	58
29.5 Relationships.....	58
30 PPDIO::Debounce.....	58
30.1 Details.....	58
30.2 Scenarios.....	59
30.3 Requirements.....	59
30.4 Test Plan.....	60
30.5 Relationships.....	60
31 PPDIO::DIN.....	60

31.1 Details.....	60
31.2 Scenarios.....	60
31.3 Requirements.....	61
31.4 Test Plan.....	62
31.5 Relationships.....	62
32 PPDIO::DOUT.....	63
32.1 Details.....	63
32.2 Scenarios.....	63
32.3 Requirements.....	64
32.4 Test Plan.....	66
32.5 Relationships.....	66
33 PPDIO::Dir.....	66
33.1 Details.....	66
33.2 Scenarios.....	67
33.3 Requirements.....	67
33.4 Test Plan.....	68
33.5 Relationships.....	68
34 PPDO Cmds.....	68
34.1 Primary Actors.....	68
34.2 Details.....	68
34.3 Scenarios.....	68
34.4 Requirements.....	69
34.5 Relationships.....	69
35 PPDO::Boards.....	69
35.1 Details.....	69
35.2 Scenarios.....	69
35.3 Requirements.....	70
35.4 Test Plan.....	70
35.5 Relationships.....	70
36 PPDO::DOUT.....	71
36.1 Details.....	71
36.2 Scenarios.....	71
36.3 Requirements.....	71
36.4 Test Plan.....	72
36.5 Relationships.....	72
37 PPDO::DIN.....	72
37.1 Details.....	72
37.2 Scenarios.....	73
37.3 Requirements.....	73
37.4 Test Plan.....	74
37.5 Relationships.....	74

38 PPDO::Type.....	74
38.1 Details.....	74
38.2 Scenarios.....	74
38.3 Requirements.....	75
38.4 Test Plan.....	75
38.5 Relationships.....	75
39 PPAIO Cmds.....	75
39.1 Primary Actors.....	75
39.2 Details.....	75
39.3 Scenarios.....	76
39.4 Requirements.....	76
39.5 Relationships.....	77
40 PPAIO::Boards.....	77
40.1 Details.....	77
40.2 Scenarios.....	77
40.3 Requirements.....	78
40.4 Test Plan.....	78
40.5 Relationships.....	78
41 PPAIO::DACs.....	78
41.1 Details.....	78
41.2 Scenarios.....	78
41.3 Requirements.....	79
41.4 Test Plan.....	80
41.5 Relationships.....	80
42 PPAIO::ADCS.....	80
42.1 Details.....	80
42.2 Scenarios.....	80
42.3 Requirements.....	81
42.4 Test Plan.....	81
42.5 Relationships.....	81
43 PPAIO::Gain.....	81
43.1 Details.....	81
43.2 Scenarios.....	82
43.3 Requirements.....	82
43.4 Test Plan.....	83
43.5 Relationships.....	83
44 PPAIO::Filter.....	83
44.1 Details.....	83
44.2 Scenarios.....	83
44.3 Requirements.....	84
44.4 Test Plan.....	84

44.5 Relationships.....	84
45 PPAIO::AIN.....	84
45.1 Details.....	84
45.2 Scenarios.....	84
45.3 Requirements.....	85
45.4 Relationships.....	86
46 PPAIO::AOUT.....	86
46.1 Details.....	86
46.2 Scenarios.....	86
46.3 Requirements.....	87
46.4 Test Plan.....	87
46.5 Relationships.....	87
47 PPAIO::Type.....	88
47.1 Details.....	88
47.2 Scenarios.....	88
47.3 Requirements.....	88
47.4 Test Plan.....	89

## 1. DAQ Dipswitch Controls





## Generic PPDAQ Use Case Diagram

### 2. Enable/Disable RS-232

ID: DAQ\_UC\_001

Enabling and disabling RS-232 communications to DAQ system.

#### 2.1. Primary Actors

👤 System User

#### 2.2. Details

Level	Summary
Complexity	Low
Use Case Status	Complete
Implementation Status	Complete
Preconditions	System has booted
Post-conditions	N/A
Author	RHyde
Assumptions	N/A

#### 2.3. Scenarios

##### 2.3.1. Enable/Disable RS-232

1. During system initialization, read dip switches
2. Set global variable `serialEnabled_g` to the value of dip switch #1
  - 2.1. If `serialEnabled_g` is true start the `serialTaskInIt` task running with priority `SER_PRIO`
    - 2.1.1. `SER_PRIO`'s value must be such that `SER_PRIO` is greater than `USB_PRIO` and all the ethernet task priorities (note that a higher priority number results in a lower task priority).
  - 2.2. Else do not start `serialTaskInIt` task.

#### 2.4. Requirements

##### 2.4.1. DAQ\_SRS\_702\_000:PPDAQ RS-232 Enabled

ID: DAQ\_UC\_001.DAQ\_SRS\_702\_000

Dip switch #1 on the Netburner MOD54415 controls enabling (on) or disabling (off) the RS-232 interface to the DAQ system.

##### 2.4.2. DAQ\_SRS\_702\_001:PPDAQ RS-232 Task

ID: DAQ\_UC\_001.DAQ\_SRS\_702\_001

The PPDAQ software shall run a separate process to handle RS-232 commands if serial commands are enabled.

##### 2.4.3. DAQ\_SRS\_702\_002:PPDAQ RS-232 Task Priority

ID: DAQ\_UC\_001.DAQ\_SRS\_702\_002

The serial task (process) shall run at a lower priority than the USB and Ethernet protocol tasks.

##### 2.4.4. DAQ\_SRS\_703\_000:PPDAQ RS-232 Disabled

ID: DAQ\_UC\_001.DAQ\_SRS\_703\_000

Dip switch #1 on the Netburner MOD54415 controls enabling (on) or disabling (off) the RS-232 interface to the DAQ system.

##### 2.4.5. DAQ\_SRS\_703\_001:PPDAQ RS-232 Task not Initialized

ID: DAQ\_UC\_001.DAQ\_SRS\_703\_001

The PPDAQ software shall not start the RS-232 serial task running if the serial protocol is disabled.

##### 2.4.6. DAQ\_SRS\_723\_000:PPDAQ Read DIP Switches

ID: DAQ\_UC\_001.DAQ\_SRS\_723\_000

The PPDAQ software shall allow the host software to read the current state of the DIP switches on the Netburner MOD45515 MOD-70 evaluation board.

#### 2.4.7. DAQ\_SRS\_726\_000:PPDAQ Command Source #1

ID: DAQ\_UC\_001.DAQ\_SRS\_726\_000




The PPDAQ software shall accept commands from the UART1 serial port on the Netburner MOD45515 MOD-70 evaluation board if serial communications are enabled.

### 2.5. Test Plan

Testing Setup: DAQ\_STP\_002

Testing Configurations: N/A

### 2.6. Relationships

Relationship	From	To
 unnamed	 <a href="#">Enable/Disable RS-232</a>	 <a href="#">Read DIP Switches</a>
— unnamed	— unnamed	— unnamed

### 3. Enable/Disable USB

ID: DAQ\_UC\_002

Enabling and disabling USB communications to DAQ system.

#### 3.1. Primary Actors

 System User

#### 3.2. Details

Level	N/A
Complexity	N/A
Use Case Status	N/A
Implementation Status	N/A
Preconditions	N/A
Post-conditions	N/A
Author	N/A
Assumptions	N/A

#### 3.3. Scenarios

##### 3.3.1. Enable/Disable USB

1. During system initialization, read dip switches
2. Set global variable USBEnabled\_g to the value of dip switch #2
  - 2.1. If serialEnabled\_g is true start the usbTaskInit task running with priority USB\_PRIO
    - 2.1.1. USB\_PRIO's value must be greater than USB\_PRIO and all the ethernet task priorities (note that a higher priority number results in a lower task priority).
  - 2.2. Else do not start usbTaskInit task.

#### 3.4. Requirements

##### 3.4.1. DAQ\_SRS\_705\_000:PPDAQ USB Enabled

ID: DAQ\_UC\_002.DAQ\_SRS\_705\_000

The PPDAQ software shall activate the USB communications protocol if DIP switch #2 on the Netburner MOD45515 MOD-70 evaluation board is set to the on position.

##### 3.4.2. DAQ\_SRS\_705\_001:PPDAQ USB Task

ID: DAQ\_UC\_002.DAQ\_SRS\_705\_001

The PPDAQ software shall start a separate task running for the USB protocol if the USB communications protocol is enabled.

#### 3.4.3. DAQ\_SRS\_705\_002:PPDAQ USB Task Priority

ID: DAQ\_UC\_002.DAQ\_SRS\_705\_002

The USB task shall have a higher priority than the Ethernet and Serial protocol tasks.

#### 3.4.4. DAQ\_SRS\_706\_000:PPDAQ USB Disabled

ID: DAQ\_UC\_002.DAQ\_SRS\_706\_000

The PPDAQ software shall not activate the USB communications protocol if DIP switch #2 on the Netburner MOD45515 MOD-70 evaluation board is set to the off position.

#### 3.4.5. DAQ\_SRS\_706\_001:PPDAQ USB Task not Started

ID: DAQ\_UC\_002.DAQ\_SRS\_706\_001

The PPDAQ software shall not start the USB task if DIP switch #2 on the Netburner MOD45515 MOD-70 evaluation board is set to the off position.

#### 3.4.6. DAQ\_SRS\_727\_000:PPDAQ Command Source #2

ID: DAQ\_UC\_002.DAQ\_SRS\_727\_000

The PPDAQ software shall accept commands from the USB port on the Netburner MOD45515 MOD-70 evaluation board if USB communications are enabled.

### 3.5. Test Plan

Testing Setup: DAQ\_STP\_003

Testing Configurations: N/A

### 3.6. Relationships

Relationship	From	To
⚙️ unnamed	● <a href="#">Enable/Disable USB</a>	● <a href="#">Read DIP Switches</a>
— unnamed	— unnamed	— unnamed

### ● 4. Enable/Disable Ethernet

ID: DAQ\_UC\_003

Enabling and disabling Ethernet communications to DAQ system.

#### 4.1. Primary Actors

♀ System User

#### 4.2. Details

Level	N/A
Complexity	N/A
Use Case Status	N/A
Implementation Status	N/A
Preconditions	N/A
Post-conditions	N/A
Author	N/A
Assumptions	N/A

#### 4.3. Scenarios

##### 4.3.1. Enable/Disable Ethernet

1. During system initialization, read dip switches
2. Set global variable ethEnabled\_g to the value of dip switch #3

3. Set global variable ethMultClients\_g to the value of dip switch #4
4. Set global variable ethernetDipSw\_g to the value of dip switches #5 and #6 (#5->bit 0, #6->bit1)
5. If ethEnabled\_g is true, then:
  - 5.1. Set the Ethernet address based on the value of ethernetDipSw\_g as:
    - 5.1.1. %00: 192.168.2.70
    - 5.1.2. %01: 192.168.2.71
    - 5.1.3. %10: 192.168.2.72
    - 5.1.4. %11: 192.168.2.73
  - 5.2. If ethMultClients\_g then
    - 5.2.1. Set maxSockets to 5
  - 5.3. Else
    - 5.3.1. set maxSockets to 1
  - 5.4. Start the ethernetListenTask task with priority ETHL\_PRIO.
6. Else (if ethEnabled\_g is false)
  - 6.1. Do not start the ethernetListenTask.

#### 4.3.2. ethernetListenTask

1. Initialize an array of five descriptors with zero elements (empty descriptor slots)
2. Wait for an external connection request on Ethernet socket 0x5050
3. If a connection request is made:
  - 3.1. Search for an empty slot (array element containing zero) in the descriptor array
  - 3.2. If there are no slots available:
    - 3.2.1. Refuse connection
    - 3.2.2. Go to step 2
  - 3.3. Else if a slot is available:
    - 3.3.1. Accept connection and store its file descriptor in the available slot
    - 3.3.2. Create a new Ethernet command task associated with the new connection; the priority of the new task shall be ETH1\_PRIO...ETH5\_PRIO, selected by the index into the descriptor slot array; note that SER\_PRIO < ETHL\_PRIO < ETH1\_PRIO < ... < ETH5\_PRIO < USB\_PRIO (where smaller numbers mean the task has a higher priority in the task queue)
    - 3.3.3. Go to step 2
4. Else if the listen connection is broken, terminate listen task

#### 4.4. Requirements

##### 4.4.1. DAQ\_SRS\_708\_000:PPDAQ Ethernet IP Address

ID: DAQ\_UC\_003.DAQ\_SRS\_708\_000

The PPDAQ software shall set the Ethernet IP address to a value in the range 192.168.2.70-192.168.2.73 based on DIP switch 5-6 settings on the Netburner.

##### 4.4.2. DAQ\_SRS\_709\_000:PPDAQ Ethernet IP Address 192.168.2.70

ID: DAQ\_UC\_003.DAQ\_SRS\_709\_000

The PPDAQ software shall set the Ethernet IP address to 192.168.2.70 if the Netburner dip switches 5-6 are set to (off, off).

##### 4.4.3. DAQ\_SRS\_710\_000:PPDAQ Ethernet IP Address 192.168.2.71

ID: DAQ\_UC\_003.DAQ\_SRS\_710\_000

The PPDAQ software shall set the Ethernet IP address to 192.168.2.71 if the Netburner dip switches 5-6 are set to (on, off).

4.4.4. DAQ\_SRS\_711\_000:PPDAQ Ethernet IP Address 192.168.2.72

ID: DAQ\_UC\_003.DAQ\_SRS\_711\_000

The PPDAQ software shall set the Ethernet IP address to 192.168.2.72 if the Netburner dip switches 5-6 are set to (off, on).

4.4.5. DAQ\_SRS\_712\_000:PPDAQ Ethernet IP Address 192.168.2.73

ID: DAQ\_UC\_003.DAQ\_SRS\_712\_000

The PPDAQ software shall set the Ethernet IP address to 192.168.2.73 if the Netburner dip switches 5-6 are set to (on, on).

4.4.6. DAQ\_SRS\_716.5\_000:PDAQ Ethernet Disabled

ID: DAQ\_UC\_003.DAQ\_SRS\_716.5\_000

The PPDAQ software shall disable Ethernet operation if the Netburner DIP switch 3 is in the off position.

4.4.7. DAQ\_SRS\_716\_000:PPDAQ Ethernet Enabled

ID: DAQ\_UC\_003.DAQ\_SRS\_716\_000

The PPDAQ software shall enable Ethernet operation if the Netburner DIP switch 3 is in the on position

4.4.8. DAQ\_SRS\_716\_001:PPDAQ Ethernet Task

ID: DAQ\_UC\_003.DAQ\_SRS\_716\_001

The Ethernet listening task shall be started if Ethernet communications are enabled.

4.4.9. DAQ\_SRS\_716\_002:PPDAQ Ethernet Task Priority

ID: DAQ\_UC\_003.DAQ\_SRS\_716\_002

The Ethernet listening task shall have a priority lower than the USB task but higher than the serial task.

4.4.10. DAQ\_SRS\_717\_000:PPDAQ Ethernet Port

ID: DAQ\_UC\_003.DAQ\_SRS\_717\_000

The PPDAQ software shall communicate via Ethernet using socket port 0x5050 (decimal 20560, "PP", for "Plantation Productions").

4.4.11. DAQ\_SRS\_718\_000:PPDAQ Ethernet Multiple Clients enabled

ID: DAQ\_UC\_003.DAQ\_SRS\_718\_000

The PPDAQ software shall allow up to 5 Ethernet clients if the Netburner DIP switch #4 is set to the on position.

4.4.12. DAQ\_SRS\_718\_001:PPDAQ Ethernet Multiple Clients Disabled

ID: DAQ\_UC\_003.DAQ\_SRS\_718\_001

The PPDAQ software shall only a single Ethernet client if the Netburner DIP switch #4 is set to the off position.

4.4.13. DAQ\_SRS\_728\_000:PPDAQ Command Source #3

ID: DAQ\_UC\_003.DAQ\_SRS\_728\_000

4.4.14. DAQ\_SRS\_737\_000:PPDAQ Maximum Ethernet Connections #1

ID: DAQ\_UC\_003.DAQ\_SRS\_737\_000

The PPDAQ software shall only recognize a single connection on the Ethernet port if the Netburner DIP switch #4 is in the off position.

4.4.15. DAQ\_SRS\_738\_000:PPDAQ Maximum Ethernet Connections #2

ID: DAQ\_UC\_003.DAQ\_SRS\_738\_000

The PPDAQ software shall only recognize up to five connections on the Ethernet port if the Netburner DIP switch #4 is in the on position.

4.4.16. DAQ\_SRS\_738\_001:PPDAQ Ethernet Command Processing Tasks

ID: DAQ\_UC\_003.DAQ\_SRS\_738\_001

The PPDAQ software shall start a new process to handle command processing for each connection.

#### 4.4.17. DAQ\_SRS\_738\_002:PPDAQ Ethernet Command Task Priorities

ID: DAQ\_UC\_003.DAQ\_SRS\_738\_002

The PPDAQ command processing tasks shall each have a different priority that is higher than the priority of the Ethernet listening task and less than the priority of the USB command task.

#### 4.5. Test Plan

Testing Setup: DAQ\_STP\_004

Testing Configurations: N/A

#### 4.6. Relationships

Relationship	From	To
unnamed	<a href="#">Enable/Disable Ethernet</a>	<a href="#">Read DIP Switches</a>
— unnamed	— unnamed	— unnamed

### 5. Enable/Disable Test Mode

ID: DAQ-UC\_04

Enabling and disabling test mode on DAQ system.

#### 5.1. Primary Actors

System User

#### 5.2. Details

Level	N/A
Complexity	N/A
Use Case Status	N/A
Implementation Status	N/A
Preconditions	N/A
Post-conditions	N/A
Author	N/A
Assumptions	N/A

#### 5.3. Scenarios

##### 5.3.1. Enable/Disable Test Mode

1. During system initialization, read dip switches
2. Set global variable unitTestMode\_g to the value of dip switch #7

#### 5.4. Requirements

##### 5.4.1. DAQ\_SRS\_719\_000:PPDAQ Unit Test Mode Enabled

ID: DAQ-UC\_04.DAQ\_SRS\_719\_000

The PPDAQ software shall operate in a special "unit test" mode if the Netburner dip switch #7 is set to the on position.




##### 5.4.2. DAQ\_SRS\_720\_000:PPDAQ Unit Test Mode Disabled

ID: DAQ-UC\_04.DAQ\_SRS\_720\_000

The PPDAQ software shall operate in the normal (non-test) mode if the Netburner dip switch #7 is set to the off position.

##### 5.4.3. DAQ\_SRS\_723\_000:PPDAQ Read DIP Switches

#### 5.5. Relationships

Relationship	From	To
 unnamed	 <a href="#">Enable/Disable Test Mode</a>	 <a href="#">Read DIP Switches</a>
— unnamed	— unnamed	— unnamed

## 6. Enable/Disable Debug Mode

ID: DAQ\_UC\_005

Enabling and disabling debug output on DAQ system.

### 6.1. Primary Actors

 System User

### 6.2. Details

Level	N/A
Complexity	N/A
Use Case Status	N/A
Implementation Status	N/A
Preconditions	N/A
Post-conditions	N/A
Author	N/A
Assumptions	N/A

### 6.3. Scenarios

#### 6.3.1. Enable/Disable Debug Mode

1. During system initialization, read dip switches
2. Set global variable debugMode\_g to the value of dip switch #8
3. Start the maintPrintf task

### 6.4. Requirements

#### 6.4.1. DAQ\_SRS\_721\_001:PPDAQ Debug Mode Enabled

ID: DAQ\_UC\_005.DAQ\_SRS\_721\_001

The PPDAQ software shall operate in a special "debug" mode if the Netburner dip switch #8 is set to the on position and USB (dip sw #2) is not enabled.

#### 6.4.2. DAQ\_SRS\_721\_002:PPDAQ Debug Mode Disabled

ID: DAQ\_UC\_005.DAQ\_SRS\_721\_002




The PPDAQ software shall operate in the normal (non-debug) mode if the Netburner dip switch #8 is set to the off position.

### 6.5. Test Plan

Testing Setup: DAQ\_STP\_002

Testing Configurations: N/A

### 6.6. Relationships

Relationship	From	To
 unnamed	 <a href="#">Enable/Disable Debug Mode</a>	 <a href="#">Read DIP Switches</a>
— unnamed	— unnamed	— unnamed

## 7. Read DIP Switches

## ID: DAQ\_UC\_006

Read the dip switches as an 8-bit value.

### 7.1. Details

Level	N/A
Complexity	N/A
Use Case Status	N/A
Implementation Status	N/A
Preconditions	N/A
Post-conditions	N/A
Author	N/A
Assumptions	N/A

### 7.2. Scenarios

#### 7.2.1. Read DIP Switches

1. Read hardware dip switches and store into global dipsw\_g variable
















### 7.3. Requirements

#### 7.3.1. DAQ\_SRS\_723\_000:PPDAQ Read DIP Switches

ID: DAQ\_UC\_006.DAQ\_SRS\_723\_000

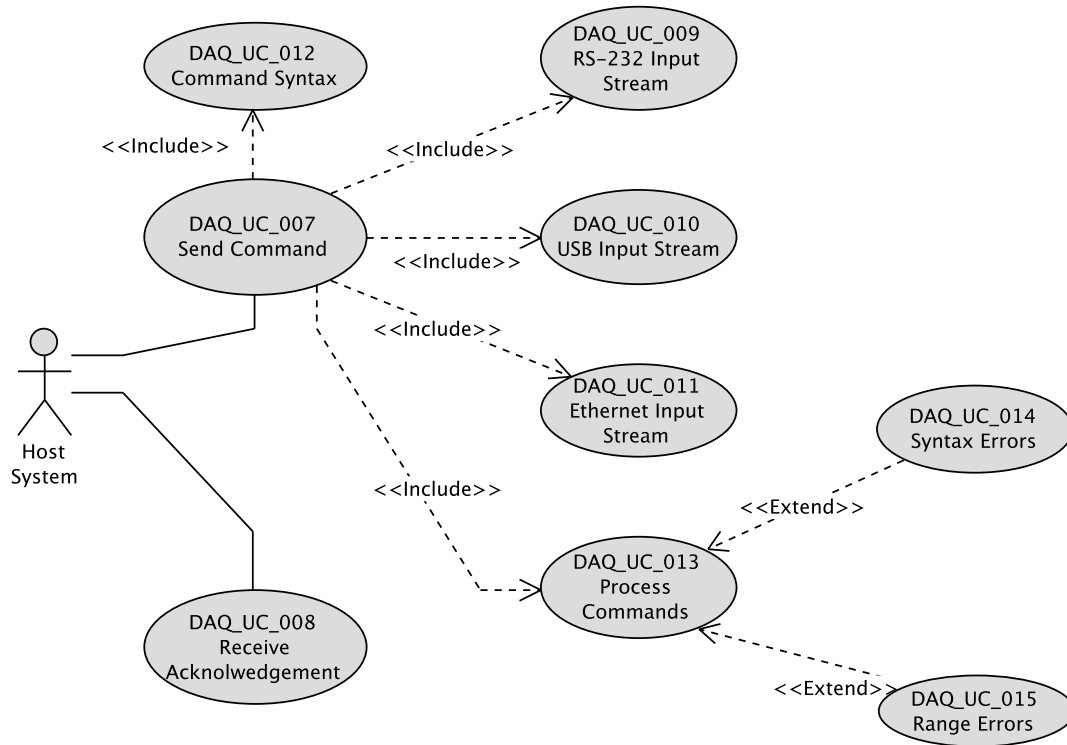
The PPDAQ software shall allow the host software to read the current state of the DIP switches on the Netburner MOD45515 MOD-70 evaluation board.

### 7.4. Relationships

Relationship	From	To
 unnamed	 <a href="#">Enable/Disable RS-232</a>	 <a href="#">Read DIP Switches</a>
 unnamed	 <a href="#">Enable/Disable USB</a>	 <a href="#">Read DIP Switches</a>
 unnamed	 <a href="#">Enable/Disable Ethernet</a>	 <a href="#">Read DIP Switches</a>
 unnamed	 <a href="#">Enable/Disable Test Mode</a>	 <a href="#">Read DIP Switches</a>
 unnamed	 <a href="#">Enable/Disable Debug Mode</a>	 <a href="#">Read DIP Switches</a>



## 8. PPDAQ Command Protocol



Description of commands the PPDAQ system supports.

### 9. Send Command

ID: DAQ\_UC\_007

The host system sends a command (via one of the input streams) to the DAQ system for processing.

#### 9.1. Primary Actors

♀ Host System

#### 9.2. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	System is running and at least one input source (RS-232, USB, or Ethernet socket) is active
Post-conditions	Command has been executed and response is available for transmission to the host.
Author	R Hyde
Assumptions	None

#### 9.3. Scenarios

##### 9.3.1. Command Acceptance

1. When a complete line of text is received from the input source, begin by separating the input line into words ("tokens")
2. Each token is separated from the others by at least one or more whitespace, end of line, or colon (":") characters.
3. If the line is blank (except for possible whitespace and colon characters) then the command processor ignores the command and reverts to waiting for characters to arrive from the input source.
4. The system compares the first word on the line against a set of known command words.

5. If a command is standalone (no subcommand or arguments):
  - 5.1. The system executes the command.
  - 5.2. The system prepares an acknowledgement string to return to the host system.
  - 5.3. End of command processing
6. The system compares the second word on the command line against a set of known subcommand words for the current "main" command.
7. The system converts all remaining arguments (third through end), if present, from hexadecimal strings to numeric form.
8. The system compares the number of actual numeric arguments against the expected number of arguments for the command/subcommand combination.
9. The system compares the value of each actual argument against the range of values allowed for that particular argument (by position).
10. The system executes the command and prepares a response/acknowledgement string to return to the host.

Extension:

- 4.a. If the command is unknown, the system prepares a "syntax error" response to return to host and command processing ends.
- 6.a. If the subcommand is unknown, the system prepares a "syntax error" response to return to host and command processing ends.
- 7.a. If a given argument is not a valid hexadecimal numeric string, the system prepares a "syntax error" response to return to host and command processing ends.
- 8.a. If the command/subcommand doesn't support the actual number of arguments supplied, the system prepares a "syntax error" response to return to host and command processing ends.
- 9.a. If the actual argument's value is out of range, the system prepares a "range error" response to return to the host and command processing ends.

## 9.4. Requirements

### 9.4.1. DAQ\_SRS\_725\_000:PPDAQ Command Protocol

ID: DAQ\_UC\_007.DAQ\_SRS\_725\_000















The PPDAQ software shall wait for a command from the host, process that command, and respond to the host.

### 9.4.2. DAQ\_SRS\_729\_000:PPDAQ Command Format

ID: DAQ\_UC\_007.DAQ\_SRS\_729\_000

The PPDAQ software shall processing commands consisting of lines of ASCII text terminated by a new-line character ('\n', 0xA, line-feed). An optional carriage return ('\r', 0xD) may precede the line feed.

## 9.5. Relationships

Relationship	From	To
 unnamed	 <a href="#">Send Command</a>	 <a href="#">RS-232 Input Stream</a>
 unnamed	 <a href="#">Send Command</a>	 <a href="#">USB Input Stream</a>
 unnamed	 <a href="#">Send Command</a>	 <a href="#">Ethernet Input Stream</a>
 unnamed	 <a href="#">Send Command</a>	 <a href="#">Command Syntax</a>
 unnamed	 <a href="#">Send Command</a>	 <a href="#">Process Commands</a>
— unnamed	— unnamed	— unnamed

## 10. Receive Acknowledgement

ID: DAQ\_UC\_008

The system collects the acknowledgement built by a command and transmits it to the host.

### 10.1. Primary Actors

♀ Host System

### 10.2. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Command has executed and has created an acknowledgement string to pass to the host system.
Post-conditions	Acknowledgement string has been transmitted to the host system.
Author	R Hyde
Assumptions	Transmission medium (RS-232, USB, or Ethernet) is functioning properly.

### 10.3. Relationships

Relationship	From	To
— unnamed	— unnamed	— unnamed

## ● 11. RS-232 Input Stream

ID: DAQ\_UC\_009

Read a stream of characters from the COM1 (RS-232) port if RS-232 command input is enabled.

### 11.1. Details

Level	Summary
Complexity	Low
Use Case Status	Complete
Implementation Status	Complete
Preconditions	N/A
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 11.2. Requirements

#### 📄 11.2.1. DAQ\_SRS\_726\_000:PPDAQ Command Source #1

ID: DAQ\_UC\_009.DAQ\_SRS\_726\_000

The PPDAQ software shall accept commands from the UART1 serial port on the Netburner MOD45515 MOD-70 evaluation board if serial communications are enabled.

### 11.3. Relationships

Relationship	From	To
📡 unnamed	● <a href="#">Send Command</a>	● <a href="#">RS-232 Input Stream</a>

## ● 12. USB Input Stream

ID: DAQ\_UC\_010

Read a stream of characters from the USB port if USB input is enabled.

### 12.1. Details

Level	Summary
Complexity	Low
Use Case Status	Complete
Implementation Status	Complete
Preconditions	N/A
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 12.2. Requirements

#### 12.2.1. DAQ\_SRS\_727\_000:PPDAQ Command Source #2

ID: DAQ\_UC\_010.DAQ\_SRS\_727\_000

The PPDAQ software shall accept commands from the USB port on the Netburner MOD45515 MOD-70 evaluation board if USB communications are enabled.

### 12.3. Relationships

Relationship	From	To
 unnamed	 <a href="#">Send Command</a>	 <a href="#">USB Input Stream</a>

## 13. Ethernet Input Stream

ID: DAQ\_UC\_011

Read a stream of characters from the Ethernet input if Ethernet communications is enabled.

Note: if multiple Ethernet ports are enabled, up to five concurrent input streams from the Ethernet are possible.

### 13.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	N/A
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A



### 13.2. Requirements

#### 13.2.1. DAQ\_SRS\_728\_000:PPDAQ Command Source #3

ID: DAQ\_UC\_011.DAQ\_SRS\_728\_000

The PPDAQ software shall accept commands from the Ethernet port on the Netburner MOD45515 MOD-70 evaluation board if Ethernet communications are enabled.

### 13.3. Relationships

Relationship	From	To
 unnamed	 <a href="#">Send Command</a>	 <a href="#">Ethernet Input Stream</a>

## 14. Command Syntax

ID: DAQ\_UC\_012

The input string syntax used by DAQ system commands.

### 14.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	None
Post-conditions	None
Author	R Hyde
Assumptions	None

### 14.2. Scenarios

#### 14.2.1. Scenario

1. Collect characters from input source (RS-232, USB, or Ethernet) and store into an input buffer associated with that input source.
2. If a backspace character appears in the input stream and there is at least one character in the buffer, delete the last input character from the buffer.
3. If a carriage return character appears in the input stream, ignore it (do not add it to the buffer).
4. When a new line character appears, pass the input line (without the new line character) to the command processor.

### 14.3. Requirements

#### 14.3.1. DAQ\_SRS\_729\_000:PPDAQ Command Format

ID: DAQ\_UC\_012.DAQ\_SRS\_729\_000

The PPDAQ software shall processing commands consisting of lines of ASCII text terminated by a new-line character ('\n', 0xA, line-feed). An optional carriage return ("\r", 0xD) may precede the line feed.

#### 14.3.2. DAQ\_SRS\_730\_000:PPDAQ Command Syntax

ID: DAQ\_UC\_012.DAQ\_SRS\_730\_000

The PPDAQ command syntax shall take the following basic form:

<command> <subcommand> <arguments>

Note: the syntax for the arguments depends on the particular command. Some commands may not allow any arguments or even subcommands, some may require a fixed number of arguments, some may allow a variable number of arguments. Whitespace (spaces or tabs) must separate commands from arguments and arguments from one another.

#### 14.3.3. DAQ\_SRS\_731\_000:PPDAQ Command Case Insensitive

ID: DAQ\_UC\_012.DAQ\_SRS\_731\_000




PPDAQ commands shall be case insensitive.

#### 14.3.4. DAQ\_SRS\_732\_000:PPDAQ Whitespace Ignored

ID: DAQ\_UC\_012.DAQ\_SRS\_732\_000

PPDAQ commands shall allow zero or more white space characters (spaces and tabs) around any command or argument.

### 14.4. Relationships

Relationship	From	To
 unnamed	 <a href="#">Send Command</a>	 <a href="#">Command Syntax</a>

## 15. Process Commands

ID: DAQ\_UC\_013

Given an array of "words" from an input line (this array is provided by DAQ\_UC\_012), the command process analyzes the command, checks for errors (syntax or range), performs the operation associated with the command.

### 15.1. Details





Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	N/A
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 15.2. Scenarios

#### 15.2.1. Scenario

1. Compare first word of command line against known commands.
- 2.

### 15.3. Relationships

Relationship	From	To
 unnamed	 <a href="#">Process Commands</a>	 <a href="#">Syntax Errors</a>
 unnamed	 <a href="#">Process Commands</a>	 <a href="#">Range Errors</a>
 unnamed	 <a href="#">Send Command</a>	 <a href="#">Process Commands</a>

## 16. Syntax Errors

ID: DAQ\_UC\_014

Generate an appropriate syntax error if a command is syntactically incorrect.

### 16.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	N/A
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 16.2. Requirements

 16.2.1. DAQ\_SRS\_\*\_012:PPDIO96 Config Response #3

ID: DAQ\_UC\_014.DAQ\_SRS\_\*\_012

The PPDIO **CONFIG** command shall return a syntax error if it is mal-formed.

#### 16.2.2. DAQ\_SRS\_1000\_000:PPAIO FILTER Response #2

ID: DAQ\_UC\_014.DAQ\_SRS\_1000\_000

If the "ppaio FILTER *board port filter*" contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command\_line* \n

#### 16.2.3. DAQ\_SRS\_1021\_000:PPAIO AOUT Response #7

ID: DAQ\_UC\_014.DAQ\_SRS\_1021\_000

In response to a "ppaio aout *board xxx0 xxx1 xxx2 xxx3*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

#### 16.2.4. DAQ\_SRS\_1026\_000:PPAIO AOUT Response #12

ID: DAQ\_UC\_014.DAQ\_SRS\_1026\_000

In response to a "ppaio aout *board port xxxx*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

#### 16.2.5. DAQ\_SRS\_1027\_000:PPAIO AOUT Response #13

ID: DAQ\_UC\_014.DAQ\_SRS\_1027\_000

In response to a "ppaio aout *board port value*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

#### 16.2.6. DAQ\_SRS\_1032\_000:PPAIO AOUT Response #4

ID: DAQ\_UC\_014.DAQ\_SRS\_1032\_000

In response to a "ppaio type *board port se\_de*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

#### 16.2.7. DAQ\_SRS\_1034\_000:PPAIO Mal-Formed Command

ID: DAQ\_UC\_014.DAQ\_SRS\_1034\_000

If a "ppaio" command is not handled by any of the other requirements, the software shall respond with the following error acknowledgement:

Error: syntax: *command\_line* \n

#### 16.2.8. DAQ\_SRS\_787\_000:PPDIO96 Boards Response #3

ID: DAQ\_UC\_014.DAQ\_SRS\_787\_000

The PPDIO **boards** command shall return "Error: syntax: *command\_line*" if the command is otherwise syntactically incorrect.

#### 16.2.9. DAQ\_SRS\_791\_000:PPDIO96 DIR Response #2

ID: DAQ\_UC\_014.DAQ\_SRS\_791\_000

If the "ppdio dir *board bank io*" contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command\_line* \n

#### 16.2.10. DAQ\_SRS\_798\_000:PPDIO96 PULLUP Response #2

ID: DAQ\_UC\_014.DAQ\_SRS\_798\_000

If the "ppdio pullup *board bank bit pullup*" contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command line* \n

16.2.11. DAQ\_SRS\_801.9\_011:PPDIO96 PULLUP #4 Response #11

ID: DAQ\_UC\_014.DAQ\_SRS\_801.9\_011

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command line* \n

16.2.12. DAQ\_SRS\_805\_000:PPDIO96 POLARITY Response #2

ID: DAQ\_UC\_014.DAQ\_SRS\_805\_000

If the "ppdio pol *board bank bit polarity*" contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command line* \n

16.2.13. DAQ\_SRS\_810.6\_001:PPDIO96 POLARITY #2 Response #2

ID: DAQ\_UC\_014.DAQ\_SRS\_810.6\_001

If the "ppdio pol *board bank polarity*" contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command line* \n

16.2.14. DAQ\_SRS\_810.9\_011:PPDIO96 POLARITY #4 Response #11

ID: DAQ\_UC\_014.DAQ\_SRS\_810.9\_011

If the "ppdio polarity *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command line* \n

16.2.15. DAQ\_SRS\_814\_000:PPDIO96 FILTER Response #2

ID: DAQ\_UC\_014.DAQ\_SRS\_814\_000

If the "ppdio filter *board bank bit filter*" contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command line* \n

16.2.16. DAQ\_SRS\_822\_000:PPDIO96 DEBOUNCE Response #2

ID: DAQ\_UC\_014.DAQ\_SRS\_822\_000

If the "ppdio debounce *board bank bit value*" contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command line* \n

16.2.17. DAQ\_SRS\_834\_004:PPDIO96 DIN Response #4

ID: DAQ\_UC\_014.DAQ\_SRS\_834\_004

If the "ppdio din *board bank bit*" contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command line* \n

16.2.18. DAQ\_SRS\_845\_000:PPDIO96 DOUT Response #7

ID: DAQ\_UC\_014.DAQ\_SRS\_845\_000



In response to a "ppdio dout *board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.19. DAQ\_SRS\_850\_000:PPDIO96 DOUT Response #12

ID: DAQ\_UC\_014.DAQ\_SRS\_850\_000

In response to a "ppdio dout *board bank xxx*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.20. DAQ\_SRS\_856\_000:PPDIO96 DOUT Response #17

ID: DAQ\_UC\_014.DAQ\_SRS\_856\_000

In response to a "ppdio dout *board bank bit value*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.21. DAQ\_SRS\_857\_000:PPDIO96 Mal-Formed Command

ID: DAQ\_UC\_014.DAQ\_SRS\_857\_000

If a "ppdio" command is not handled by any of the other requirements, the software shall respond with the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.22. DAQ\_SRS\_914\_000:PPDO BOARDS Command Response #3

ID: DAQ\_UC\_014.DAQ\_SRS\_914\_000

If the "ppdo boards *boards*" command is mal-formed, then the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.23. DAQ\_SRS\_920\_000:PPDO DOUT #1 Response #4

ID: DAQ\_UC\_014.DAQ\_SRS\_920\_000

In response to a "ppdo dout *board xxxx*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.24. DAQ\_SRS\_920\_001:PPDO DOUT #2 Response #5

ID: DAQ\_UC\_014.DAQ\_SRS\_920\_001

In response to a "ppdo dout *board bits xxxx*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.25. DAQ\_SRS\_924\_000:PPDO DIN Response #3

ID: DAQ\_UC\_014.DAQ\_SRS\_924\_000

In response to a "ppdo din *board bits*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.26. DAQ\_SRS\_928\_000:PPDO DIN Response #6

ID: DAQ\_UC\_014.DAQ\_SRS\_928\_000

In response to a "ppdo din *board*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.27. DAQ\_SRS\_932\_000:PPDO TYPE Response #3

ID: DAQ\_UC\_014.DAQ\_SRS\_932\_000

In response to a "ppdo type *board*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.28. DAQ\_SRS\_937\_000:PPDO TYPE Response #7

ID: DAQ\_UC\_014.DAQ\_SRS\_937\_000

In response to a "ppdo type *boardr type*" command where the command is mal-formed, the software shall return the following error acknowledgement:

Error: syntax: *command\_line* \n

16.2.29. DAQ\_SRS\_989\_000:PPAIO Boards Response #3

ID: DAQ\_UC\_014.DAQ\_SRS\_989\_000

The PPAIO **boards** command shall return "Error: syntax: *command\_line*" if the command is otherwise syntactically incorrect.

16.2.30. DAQ\_SRS\_989\_006:PPAIO DACS Response #4

ID: DAQ\_UC\_014.DAQ\_SRS\_989\_006

The "**ppaio dacs board dacs**" command shall return a syntax error it cannot otherwise parse the command.

16.2.31. DAQ\_SRS\_993\_000:PPAIO Gain Response #2

ID: DAQ\_UC\_014.DAQ\_SRS\_993\_000

If the "ppaio gain *board port gain*" contains a syntax error (other than a value out of range), then the software shall return the following response:

Error: syntax: *command\_line* \n

### 16.3. Test Plan

Testing Setup: DAQ\_STP\_005

DAQ\_STP\_009

DAQ\_STP\_010

DAQ\_STP\_011

DAQ\_STP\_012

Testing Configurations: N/A

### 16.4. Relationships

Relationship	From	To
«E» unnamed	<a href="#">Process Commands</a>	<a href="#">Syntax Errors</a>

## 17. Range Errors

ID: DAQ\_UC\_015

Generate an appropriate range error if an argument's value is out of range.

### 17.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	N/A

Post-conditions N/A

Author R Hyde

Assumptions N/A

## 17.2. Requirements

### 17.2.1. DAQ\_SRS\_1001\_000:PPAIO FILTER Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_1001\_000

If the "ppaio FILTER *board port filter*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

### 17.2.2. DAQ\_SRS\_1002\_000:PPAIO FILTER Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_1002\_000

If the "ppaio FILTER *board port filter*" contains a *port* value that is out of range (not in 0-F), then the software shall return the following response:

Error: range: *command line* \n

### 17.2.3. DAQ\_SRS\_1003\_000:PPAIO FILTER Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_1003\_000

If the "ppaio FILTER *board port filter*" contains a *port* value that odd and is part of a double-ended analog input channel, then the software shall return the following response:

Error: range: *command line* \n

### 17.2.4. DAQ\_SRS\_1004\_000:PPAIO FILTER Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_1004\_000

If the "ppaio FILTER *board port filter*" contains a *filter* value that is out of range (not in 0..5), then the software shall return the following response:

Error: range: *command line* \n

### 17.2.5. DAQ\_SRS\_1010\_001:PPAIO AIN Response #2a

ID: DAQ\_UC\_015.DAQ\_SRS\_1010\_001

In response to a "ppaio ain *board*" command, where *board* is outside the range zero through the number of installed boards minus one, the system shall return the error:

Error: range: *command line* \n

### 17.2.6. DAQ\_SRS\_1011\_001:PPAIO AIN Response #3a

ID: DAQ\_UC\_015.DAQ\_SRS\_1011\_001

In response to a "ppaio ain *board port*" command, where *board* is outside the range zero through the number of installed boards minus one, the system shall return the error:

Error: range: *command line* \n

### 17.2.7. DAQ\_SRS\_1011\_002:PPAIO AIN Response #3b

ID: DAQ\_UC\_015.DAQ\_SRS\_1011\_002

In response to a "ppaio ain *board port*" command, where *port* is outside the range 0-F, the system shall return the error:

Error: range: *command line* \n

### 17.2.8. DAQ\_SRS\_1011\_003:PPAIO AIN Response #3c

ID: DAQ\_UC\_015.DAQ\_SRS\_1011\_003

In response to a "ppaio ain *board port*" command, where *port* is odd and is set up for double-ended operation, the system shall return the error:

Error: range: *command\_line* \n

17.2.9. DAQ\_SRS\_1019\_000:PPAIO AOUT Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_1019\_000

In response to a "ppaio aout *board xxx0 xxx1 ... xxx3*" command where the *board* value is outside the range 0..(# installed boards minus one), the software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.10. DAQ\_SRS\_1020\_000:PPAIO AOUT Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_1020\_000

In response to a "ppaio aout *board xxx0 xxx1 ... xxx3*" command where one or more of the hexadecimal values are out of range (0-FFFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.11. DAQ\_SRS\_1020\_001:PPAIO AOUT Response #6a

ID: DAQ\_UC\_015.DAQ\_SRS\_1020\_001

In response to a "ppaio aout *board xxx0 xxx1 ... xxx3*" command where *xxx0* is out of range (0-FFFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.12. DAQ\_SRS\_1020\_002:PPAIO AOUT Response #6b

ID: DAQ\_UC\_015.DAQ\_SRS\_1020\_002

In response to a "ppaio aout *board xxx0 xxx1 ... xxx3*" command where *xxx1* is out of range (0-FFFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.13. DAQ\_SRS\_1020\_003:PPAIO AOUT Response #6c

ID: DAQ\_UC\_015.DAQ\_SRS\_1020\_003

In response to a "ppaio aout *board xxx0 xxx1 ... xxx35*" command where *xxx2* is out of range (0-FFFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.14. DAQ\_SRS\_1020\_004:PPAIO AOUT Response #6d

ID: DAQ\_UC\_015.DAQ\_SRS\_1020\_004

In response to a "ppaio aout *board xxx0 xxx1 ... xxx3*" command where *xxx3* is out of range (0-FFFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.15. DAQ\_SRS\_1023\_000:PPAIO AOUT Response #9

ID: DAQ\_UC\_015.DAQ\_SRS\_1023\_000

In response to a "ppaio aout *board port xxxx*" command where the *board* value is outside the range 1..8, the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.16. DAQ\_SRS\_1024\_000:PPAIO AOUT Response #10

ID: DAQ\_UC\_015.DAQ\_SRS\_1024\_000

In response to a "ppaio aout *board port xxxx*" command where the *port* value is outside the range 0..F, the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.17. DAQ\_SRS\_1024\_001:PPAIO AOUT Response #10a

ID: DAQ\_UC\_015.DAQ\_SRS\_1024\_001

In response to a "ppaio aout *board port xxxx*" command where the *port* value is odd and that particular port is not single-ended, the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.18. DAQ\_SRS\_1025\_000:PPAIO AOUT Response #11

ID: DAQ\_UC\_015.DAQ\_SRS\_1025\_000

In response to a "ppaio aout *board port xxxx*" command where the hexadecimal output value is out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.19. DAQ\_SRS\_1029\_000:PPAIO TYPE Response #1

ID: DAQ\_UC\_015.DAQ\_SRS\_1029\_000

In response to a "ppaio type *board port se\_de*" command where the hexadecimal *board* value is out of range (0-7), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.20. DAQ\_SRS\_1030\_000:PPAIO TYPE Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_1030\_000

In response to a "ppaio type *board port se\_de*" command where the hexadecimal *port* value is out of range (0-F), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.21. DAQ\_SRS\_1031\_000:PPAIO TYPE Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_1031\_000

In response to a "ppaio type *board port se\_de*" command where the hexadecimal *se\_de* value is out of range (0-1), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.22. DAQ\_SRS\_786\_000:PPDIO96 Boards Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_786\_000

The PPDIO **boards** command shall return "Error: range: *command\_line*" if the *boards* argument is outside the range 0-6.

17.2.23. DAQ\_SRS\_792\_000:PPDIO96 DIR Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_792\_000

If the "ppdio dir *board bank io*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command\_line* \n

17.2.24. DAQ\_SRS\_793\_000:PPDIO96 DIR Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_793\_000

If the "ppdio dir *board bank io*" contains a *bank* value that is out of range (not in 0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.25. DAQ\_SRS\_794\_000:PPDIO96 DIR Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_794\_000

If the "ppdio dir *board bank io*" contains an *io* value that is out of range (not zero or one), then the software shall return the following response:

Error: range: *command line* \n

17.2.26. DAQ\_SRS\_799\_000:PPDIO96 PULLUP Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_799\_000

If the "ppdio pullup *board bank bit pullup*" contains a *board* value that is out of range (0 or a value greater than the number of previously specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.27. DAQ\_SRS\_800\_000:PPDIO96 PULLUP Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_800\_000

If the "ppdio pullup *board bank bit pullup*" contains a *bank* value that is out of range (not in 0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.28. DAQ\_SRS\_801.6\_001:PPDIO96 PULLUP #2 Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_801.6\_001

If the "ppdio pullup *board bank value*" contains a *board* value that is out of range (0 or a value greater than the number of previously specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.29. DAQ\_SRS\_801.6\_002:PPDIO96 PULLUP #2 Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_801.6\_002

If the "ppdio pullup *board bank value*" contains a *bank* value that is out of range (0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.30. DAQ\_SRS\_801.6\_003:PPDIO96 PULLUP #2 Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_801.6\_003

If the "ppdio pullup *board bank value*" contains a *value* value that is out of range (0..fff), then the software shall return the following response:

Error: range: *command line* \n

17.2.31. DAQ\_SRS\_801.8\_001:PPDIO96 PULLUP #3 Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_801.8\_001

If the "ppdio pullup *board bank*" contains a *board* value that is out of range (0 or a value greater than the number of previously specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.32. DAQ\_SRS\_801.8\_002:PPDIO96 PULLUP #3 Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_801.8\_002

If the "ppdio pullup *board bank*" contains a *bank* value that is out of range (0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.33. DAQ\_SRS\_801.9\_002:PPDIO96 PULLUP #4 Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_801.9\_002

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *board* value that is out of range (0 or a value greater than the number of previously specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.34. DAQ\_SRS\_801.9\_003:PPDIO96 PULLUP #4 Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_801.9\_003

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu0* value that is out of range (0 or a value greater than 0xFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.35. DAQ\_SRS\_801.9\_004:PPDIO96 PULLUP #4 Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_801.9\_004

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu1* value that is out of range (0 or a value greater than 0xFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.36. DAQ\_SRS\_801.9\_005:PPDIO96 PULLUP #4 Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_801.9\_005

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu2* value that is out of range (0 or a value greater than 0xFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.37. DAQ\_SRS\_801.9\_006:PPDIO96 PULLUP #4 Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_801.9\_006

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu3* value that is out of range (0 or a value greater than 0xFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.38. DAQ\_SRS\_801.9\_007:PPDIO96 PULLUP #4 Response #7

ID: DAQ\_UC\_015.DAQ\_SRS\_801.9\_007

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu4* value that is out of range (0 or a value greater than 0xFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.39. DAQ\_SRS\_801.9\_008:PPDIO96 PULLUP #4 Response #8

ID: DAQ\_UC\_015.DAQ\_SRS\_801.9\_008

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu5* value that is out of range (0 or a value greater than 0xFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.40. DAQ\_SRS\_801.9\_009:PPDIO96 PULLUP #4 Response #9

ID: DAQ\_UC\_015.DAQ\_SRS\_801.9\_009

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu6* value that is out of range (0 or a value greater than 0xFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.41. DAQ\_SRS\_801.9\_010:PPDIO96 PULLUP #4 Response #10

ID: DAQ\_UC\_015.DAQ\_SRS\_801.9\_010

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu7* value that is out of range (0 or a value greater than 0xFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.42. DAQ\_SRS\_801\_000:PPDIO96 PULLUP Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_801\_000

If the "ppdio pullup *board bank bit pullup*" contains a *bit* value that is out of range (not in 0..B), then the software shall return the following response:

Error: range: *command line* \n

17.2.43. DAQ\_SRS\_801\_001:PPDIO96 PULLUP Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_801\_001

If the "ppdio pullup *board bank bit pullup*" contains a *pullup* value that is out of range (not in 0..1), then the software shall return the following response:

Error: range: *command line* \n

17.2.44. DAQ\_SRS\_806\_000:PPDIO96 POLARITY Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_806\_000

If the "ppdio polarity *board bank bit polarity*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.45. DAQ\_SRS\_807\_000:PPDIO96 POLARITY Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_807\_000

If the "ppdio polarity *board bank bit polarity*" contains a *bank* value that is out of range (not in 0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.46. DAQ\_SRS\_808\_000:PPDIO96 POLARITY Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_808\_000

If the "ppdio polarity *board bank bit polarity*" contains a *bit* value that is out of range (not in 0..B), then the software shall return the following response:

Error: range: *command line* \n

17.2.47. DAQ\_SRS\_809\_000:PPDIO96 POLARITY Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_809\_000

If the "ppdio polarity *board bank bit polarity*" contains a *polarity* value that is out of range (not zero or one), then the software shall return the following response:



Error: range: *command line* \n

17.2.48. DAQ\_SRS\_810.6\_002:PPDIO96 POLARITY #2 Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_810.6\_002

If the "ppdio polarity *board bank polarity*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.49. DAQ\_SRS\_810.6\_003:PPDIO96 POLARITY #2 Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_810.6\_003

If the "ppdio polarity *board bank polarity*" contains a *bank* value that is out of range (not in 0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.50. DAQ\_SRS\_810.6\_004:PPDIO96 POLARITY #2 Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_810.6\_004

If the "ppdio polarity *board bank polarity*" contains a *polarity* value that is out of range (not in 0..fff), then the software shall return the following response:

Error: range: *command line* \n

17.2.51. DAQ\_SRS\_810.8\_001:PPDIO96 POLARITY #3 Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_810.8\_001

If the "ppdio polarity *board bank* " contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.52. DAQ\_SRS\_810.8\_002:PPDIO96 POLARITY #3 Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_810.8\_002

If the "ppdio polarity *board bank* " contains a *bank* value that is out of range (not in 0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.53. DAQ\_SRS\_810.9\_002:PPDIO96 POLARITY #4 Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_810.9\_002

If the "ppdio polarity *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *board* value that is out of range (0 or a value greater than the number of previously specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.54. DAQ\_SRS\_810.9\_003:PPDIO96 POLARITY #4 Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_810.9\_003

If the "ppdio polarity *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu0* value that is out of range (0 or a value greater than 0xFFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.55. DAQ\_SRS\_810.9\_004:PPDIO96 POLARITY #4 Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_810.9\_004

If the "ppdio polarity *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu1* value that is out of range (0 or a value greater than 0xFFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.56. DAQ\_SRS\_810.9\_005:PPDIO96 POLARITY #4 Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_810.9\_005

If the "ppdio polarity *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu2* value that is out of range (0 or a value greater than 0xFFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.57. DAQ\_SRS\_810.9\_006:PPDIO96 POLARITY #4 Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_810.9\_006

If the "ppdio polarity *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu3* value that is out of range (0 or a value greater than 0xFFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.58. DAQ\_SRS\_810.9\_007:PPDIO96 POLARITY #4 Response #7

ID: DAQ\_UC\_015.DAQ\_SRS\_810.9\_007

If the "ppdio polarity *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu4* value that is out of range (0 or a value greater than 0xFFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.59. DAQ\_SRS\_810.9\_008:PPDIO96 POLARITY #4 Response #8

ID: DAQ\_UC\_015.DAQ\_SRS\_810.9\_008

If the "ppdio polarity *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu5* value that is out of range (0 or a value greater than 0xFFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.60. DAQ\_SRS\_810.9\_009:PPDIO96 POLARITY #4 Response #9

ID: DAQ\_UC\_015.DAQ\_SRS\_810.9\_009

If the "ppdio polarity *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu6* value that is out of range (0 or a value greater than 0xFFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.61. DAQ\_SRS\_810.9\_010:PPDIO96 POLARITY #4 Response #10

ID: DAQ\_UC\_015.DAQ\_SRS\_810.9\_010

If the "ppdio polarity *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command contains a *pu7* value that is out of range (0 or a value greater than 0xFFFF), then the software shall return the following response:

Error: range: *command line* \n

17.2.62. DAQ\_SRS\_815\_000:PPDIO96 FILTER Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_815\_000

If the "ppdio filter *board bank bit filter*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.63. DAQ\_SRS\_816\_000:PPDIO96 FILTER Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_816\_000

If the "ppdio filter *board bank bit filter*" contains a *bank* value that is out of range (not in 0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.64. DAQ\_SRS\_817\_000:PPDIO96 FILTER Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_817\_000

If the "ppdio filter *board bank bit filter*" contains a *bit* value that is out of range (not in 0..B), then the software shall return the following response:

Error: range: *command line* \n

17.2.65. DAQ\_SRS\_818.6\_001:PPDIO96 FILTER #2 Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_818.6\_001

If the "ppdio filter *board bank bit*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.66. DAQ\_SRS\_818.6\_002:PPDIO96 FILTER #2 Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_818.6\_002

If the "ppdio filter *board bank bit*" contains a *bank* value that is out of range (not in 0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.67. DAQ\_SRS\_818.6\_003:PPDIO96 FILTER #2 Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_818.6\_003

If the "ppdio filter *board bank bit*" contains a *bit* value that is out of range (not in 0..B), then the software shall return the following response:

Error: range: *command line* \n

17.2.68. DAQ\_SRS\_818\_000:PPDIO96 FILTER Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_818\_000

If the "ppdio filter *board bank bit filter*" contains a *filter* value that is out of range (not in 0-4), then the software shall return the following response:

Error: range: *command line* \n

17.2.69. DAQ\_SRS\_823\_000:PPDIO96 DEBOUNCE Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_823\_000

If the "ppdio debounce *board bank bit value*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.70. DAQ\_SRS\_824\_000:PPDIO96 DEBOUNCE Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_824\_000

If the "ppdio debounce *board bank bit value*" contains a *bank* value that is out of range (not in 0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.71. DAQ\_SRS\_825\_000:PPDIO96 DEBOUNCE Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_825\_000

If the "ppdio debounce *board bank bit value*" contains a *bit* value that is out of range (not in 0..B), then the software shall return the following response:

Error: range: *command line* \n

17.2.72. DAQ\_SRS\_825\_001:PPDIO96 DEBOUNCE Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_825\_001

If the "ppdio debounce *board bank bit value*" contains a *value* value that is out of range (not in 0..28 [40 decimal]), then the software shall return the following response:

Error: range: *command line* \n

17.2.73. DAQ\_SRS\_833\_002:PPDIO96 DIN Response #2b

ID: DAQ\_UC\_015.DAQ\_SRS\_833\_002

If the "ppdio din *board*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.74. DAQ\_SRS\_834\_002:PPDIO96 DIN Response #3b

ID: DAQ\_UC\_015.DAQ\_SRS\_834\_002

If the "ppdio din *board bank*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.75. DAQ\_SRS\_834\_003:PPDIO96 DIN Response #3c

ID: DAQ\_UC\_015.DAQ\_SRS\_834\_003

If the "ppdio din *board bank*" contains a *bank* value that is out of range (not in 0-7), then the software shall return the following response:

Error: range: *command line* \n

17.2.76. DAQ\_SRS\_834\_005:PPDIO96 DIN Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_834\_005

If the "ppdio din *board bank bit*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.77. DAQ\_SRS\_834\_006:PPDIO96 DIN Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_834\_006

If the "ppdio din *board bank bit*" contains a *bank* value that is out of range (not in 0..7), then the software shall return the following response:

Error: range: *command line* \n

17.2.78. DAQ\_SRS\_834\_007:PPDIO96 DIN Response #7

ID: DAQ\_UC\_015.DAQ\_SRS\_834\_007

If the "ppdio din *board bank bit*" contains a *bit* value that is out of range (not in 0..B), then the software shall return the following response:

Error: range: *command\_line* \n

17.2.79. DAQ\_SRS\_843\_000:PPDIO96 DOUT Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_843\_000

In response to a "ppdio dout *board xxx0 xxx1 ... xxx7*" command where the *board* value is outside the range 1..6, the software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.80. DAQ\_SRS\_844\_000:PPDIO96 DOUT Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_844\_000

In response to a "ppdio dout *board xxx0 xxx1 ... xxx7*" command where one or more of the hexadecimal values are out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.81. DAQ\_SRS\_844\_001:PPDIO96 DOUT Response #6a

ID: DAQ\_UC\_015.DAQ\_SRS\_844\_001

In response to a "ppdio dout *board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7*" command where *xxx0* is out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.82. DAQ\_SRS\_844\_002:PPDIO96 DOUT Response #6b

ID: DAQ\_UC\_015.DAQ\_SRS\_844\_002

In response to a "ppdio dout *board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7*" command where *xxx1* is out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.83. DAQ\_SRS\_844\_003:PPDIO96 DOUT Response #6c

ID: DAQ\_UC\_015.DAQ\_SRS\_844\_003

In response to a "ppdio dout *board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7*" command where *xxx2* is out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.84. DAQ\_SRS\_844\_004:PPDIO96 DOUT Response #6d

ID: DAQ\_UC\_015.DAQ\_SRS\_844\_004

In response to a "ppdio dout *board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7*" command where *xxx3* is out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.85. DAQ\_SRS\_844\_005:PPDIO96 DOUT Response #6e

ID: DAQ\_UC\_015.DAQ\_SRS\_844\_005

In response to a "ppdio dout *board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7*" command where *xxx4* is out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.86. DAQ\_SRS\_844\_006:PPDIO96 DOUT Response #6f

ID: DAQ\_UC\_015.DAQ\_SRS\_844\_006

In response to a "ppdio dout *board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7*" command where *xxx5* is out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.87. DAQ\_SRS\_844\_007:PPDIO96 DOUT Response #6g

ID: DAQ\_UC\_015.DAQ\_SRS\_844\_007

In response to a "ppdio dout *board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7*" command where *xxx6* is out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.88. DAQ\_SRS\_844\_008:PPDIO96 DOUT Response #6h

ID: DAQ\_UC\_015.DAQ\_SRS\_844\_008

In response to a "ppdio dout *board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7*" command where *xxx7* is out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.89. DAQ\_SRS\_847\_000:PPDIO96 DOUT Response #9

ID: DAQ\_UC\_015.DAQ\_SRS\_847\_000

In response to a "ppdio dout *board bank xxx*" command where the *board* value is outside the range 1..6, the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.90. DAQ\_SRS\_848\_000:PPDIO96 DOUT Response #10

ID: DAQ\_UC\_015.DAQ\_SRS\_848\_000

In response to a "ppdio dout *board bank xxx*" command where the *bank* value is outside the range 0..7, the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.91. DAQ\_SRS\_849\_000:PPDIO96 DOUT Response #11

ID: DAQ\_UC\_015.DAQ\_SRS\_849\_000

In response to a "ppdio dout *board bank xxx*" command where the hexadecimal output value is out of range (0-FFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.92. DAQ\_SRS\_852\_000:PPDIO96 DOUT Response #14

ID: DAQ\_UC\_015.DAQ\_SRS\_852\_000

In response to a "ppdio dout *board bank bit value*" command where the *board* value is outside the range 1..6, the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.93. DAQ\_SRS\_853\_000:PPDIO96 DOUT Response #15

ID: DAQ\_UC\_015.DAQ\_SRS\_853\_000

In response to a "ppdio dout *board bank bit value*" command where the *bank* value is outside the range 0..7, the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.94. DAQ\_SRS\_854\_000:PPDIO96 DOUT Response #15

ID: DAQ\_UC\_015.DAQ\_SRS\_854\_000

In response to a "ppdio dout *board bank bit value*" command where the *bit* value is outside the range 0..B, the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.95. DAQ\_SRS\_855\_000:PPDIO96 DOUT Response #16

ID: DAQ\_UC\_015.DAQ\_SRS\_855\_000

In response to a "ppdio dout *board bank bit value*" command where the hexadecimal output value (*bit*) is out of range (0-1), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.96. DAQ\_SRS\_913\_000:PPDO BOARDS Command Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_913\_000

If the "**ppdo** boards *boards*" *boards* argument is out of range (1-10) then the software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.97. DAQ\_SRS\_918\_000:PPDO DOUT #1 Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_918\_000

In response to a "ppdo dout *board xxxx*" command where the *board* value is out of range (1-#boards), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.98. DAQ\_SRS\_918\_001:PPDO DOUT #2 Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_918\_001

In response to a "ppdo dout *board bit xxxx*" command where the *board* value is out of range (1-#boards), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.99. DAQ\_SRS\_919\_000:PPDO DOUT #1 Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_919\_000

In response to a "ppdo dout *board xxxx*" command where the hexadecimal *xxxx* value is out of range (0-FFFF), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.100. DAQ\_SRS\_919\_001:PPDO DOUT #2 Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_919\_001

In response to a "ppdo dout *board bits xxxx*" command where the hexadecimal *bits* value is out of range (0-F), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.101. DAQ\_SRS\_919\_002:PPDO DOUT #2 Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_919\_002

In response to a "ppdo dout *board bits xxxx*" command where the hexadecimal *xxxx* value is out of range (0-1), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.102. DAQ\_SRS\_923\_000:PPDO DIN Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_923\_000

In response to a "ppdo din *board bits*" command where the hexadecimal *board* value is out of range (1-10) the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.103. DAQ\_SRS\_923\_001:PPDO DIN Response #2a

ID: DAQ\_UC\_015.DAQ\_SRS\_923\_001

In response to a "ppdo din *board bits*" command where the hexadecimal *bits* value is out of range (0-F), the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.104. DAQ\_SRS\_927\_000:PPDO DIN Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_927\_000

In response to a "ppdo din *board*" command where the hexadecimal *board* value is out of range (1-10) the PPDAQ software shall return the following error acknowledgement:

Error: range: *command\_line* \n

17.2.105. DAQ\_SRS\_931\_000:PPDO TYPE Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_931\_000

In response to a "ppdo type *board*" command where the board number is outside the range 1-10, the software shall return the following response:

Error: range: *command\_line* \n

17.2.106. DAQ\_SRS\_935\_000:PPDO TYPE Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_935\_000

In response to a "ppdo type *board type*" command where the board number is outside the range 1-10, the software shall return the following response:

Error: range: *command\_line* \n

17.2.107. DAQ\_SRS\_936\_000:PPDO TYPE Response #6

ID: DAQ\_UC\_015.REQ086

In response to a "ppdo type *board type*" command where the type number is outside the range 1-3, the software shall return the following response:

Error: range: *command\_line* \n

17.2.108. DAQ\_SRS\_988\_000:PPAIO Boards Response #2

ID: DAQ\_UC\_015.DAQ\_SRS\_988\_000

The PPAIO **boards** command shall return "Error: range: *command\_line*" if the *boards* argument is out of the range 1..8.

17.2.109. DAQ\_SRS\_994\_000:PPAIO Gain Response #3

ID: DAQ\_UC\_015.DAQ\_SRS\_994\_000



If the "ppaio gain *board port gain*" contains a *board* value that is out of range (0 or a value greater than the number of specified boards), then the software shall return the following response:

Error: range: *command line* \n

17.2.110. DAQ\_SRS\_995\_000:PPAIO Gain Response #4

ID: DAQ\_UC\_015.DAQ\_SRS\_995\_000

If the "ppaio gain *board port gain*" contains a *port* value that is out of range (not in 0-F), then the software shall return the following response:

Error: range: *command line* \n

17.2.111. DAQ\_SRS\_996\_000:PPAIO Gain Response #5

ID: DAQ\_UC\_015.DAQ\_SRS\_996\_000

If the "ppaio gain *board port gain*" contains a *port* value that odd and is part of a double-ended analog input channel, then the software shall return the following response:

Error: range: *command line* \n

17.2.112. DAQ\_SRS\_997\_000:PPAIO Gain Response #6

ID: DAQ\_UC\_015.DAQ\_SRS\_997\_000

If the "ppaio gain *board port gain*" contains a *gain* value that is out of range (not in 0-4), then the software shall return the following response:

Error: range: *command line* \n

### 17.3. Test Plan

Testing Setup: DAQ\_STP\_005

DAQ\_STP\_006

DAQ\_STP\_007

DAQ\_STP\_008

DAQ\_STP\_009




DAQ\_STP\_010

DAQ\_STP\_011

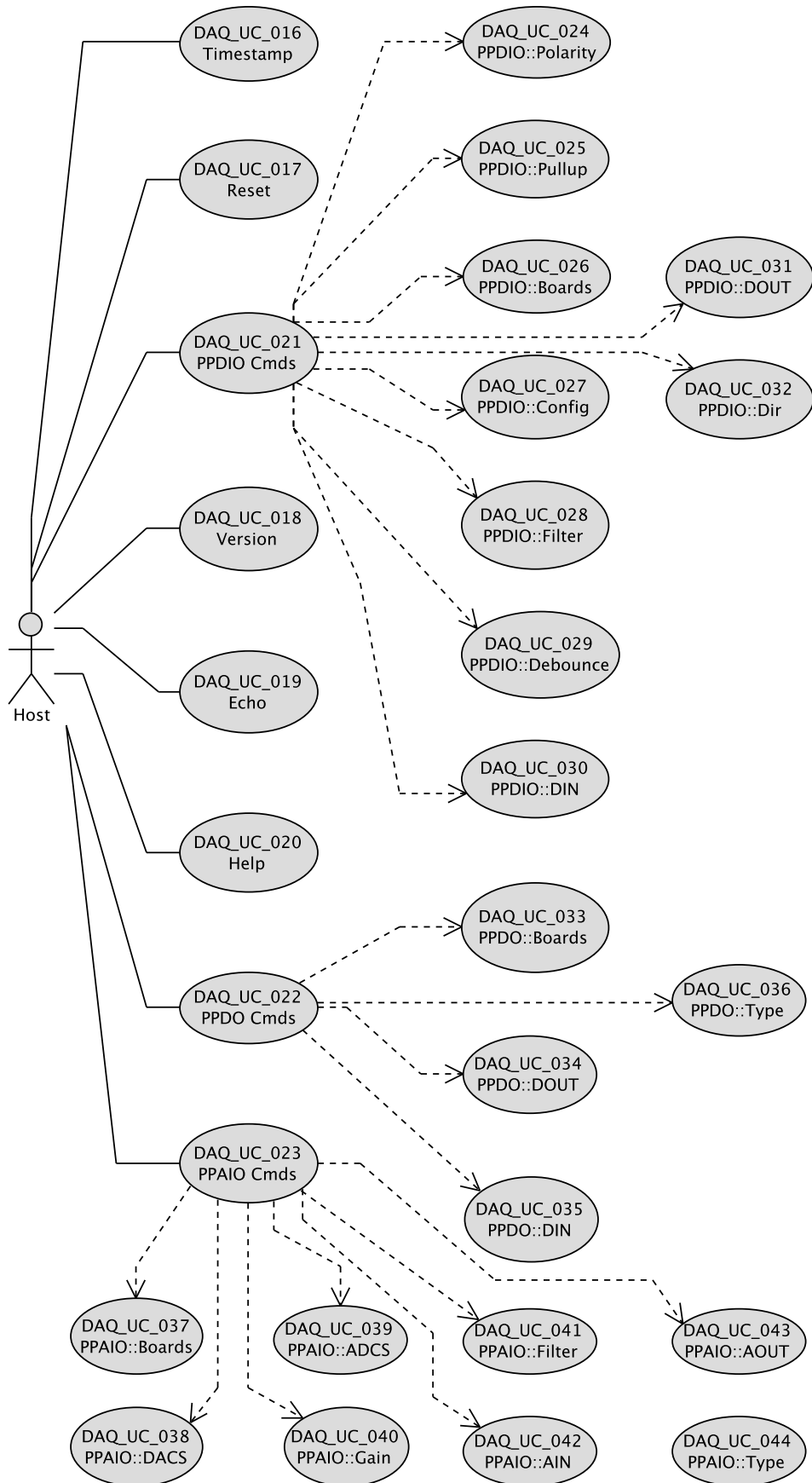
DAQ\_STP\_012

Testing Configurations: N/A

### 17.4. Relationships

Relationship	From	To
 unnamed	 <a href="#">Process Commands</a>	 <a href="#">Range Errors</a>

## 18. PPDAQ Commands



DAQ\_IF commands the host system can send to a DAQ system.

## 19. Timestamp

ID: DAQ\_UC\_016

Command to return a timestamp code.

### 19.1. Primary Actors

♀ Host

### 19.2. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Timestamp counter has been initialized to zero at boot time.
Post-conditions	N/A
Author	R Hyde
Assumptions	Timestamp counter is maintained in memory as a 32-bit unsigned integer.

### 19.3. Scenarios

#### 19.3.1. Scenario

1. Retrieve the current timestamp counter.
2. Convert timestamp counter integer to a hexadecimal string of characters.
3. Generate the acknowledgement string "timestamp xxxx\n" where "xxxx" is the hexadecimal representation of the timestamp counter.
4. Return the acknowledgement string to host.

### 19.4. Requirements

#### 19.4.1. DAQ\_SRS\_\*\_001:PPDAQ Timestamp Command Syntax

ID: DAQ\_UC\_016.DAQ\_SRS\_\*\_001

The PPDAQ **timestamp** command shall take the following form:

timestamp\n

#### 19.4.2. DAQ\_SRS\_\*\_002:PPDAQ Timestamp Command Response

ID: DAQ\_UC\_016.DAQ\_SRS\_\*\_002

The PPDAQ **timestamp** command shall return the following response:

timestamp xxxx\n

where xxxx is a 32-bit unsigned integer that increases by one (except for 32-bit wraparound) every 25 to 100 msec.

### 19.5. Test Plan

Testing Setup: DAQ\_STP\_005

Testing Configurations: N/A

### 19.6. Relationships

Relationship	From	To
— unnamed	— unnamed	— unnamed

## 20. Reset

ID: DAQ\_UC\_017

## Reset command

### 20.1. Primary Actors

👤 Host

### 20.2. Details

Level	Summary
Complexity	Low
Use Case Status	Complete
Implementation Status	Complete
Preconditions	DAQ reset line is programmed high
Post-conditions	Pulsing the reset line low for 350 msec does the following: <ul style="list-style-type: none"><li>• Reset the watchdog timeout latch</li><li>• Reset all the MCP23S17 I/O expansion chips on the PPDIO96 boards (see the MCP23S17 data sheet for the implications of a reset).</li><li>• Clear all the PPSSR-16 and PPRELAY-12 output bits (set the relays to the open/fail-safe condition).</li></ul>
Author	N/A
Assumptions	N/A

### 20.3. Scenarios

#### 20.3.1. Scenario

1. During initialization, the system programs the DAQ reset line high
2. Upon receipt of the reset command (no operands or subcommands) the system programs the DAQ reset line low.
3. The system executes a 350 msec delay
4. The system programs the DAQ reset line high.
5. The system returns the command line to the host as the command acknowledgement.

### 20.4. Requirements

#### 20.4.1. DAQ\_SRS\_744\_000:PPDAQ Reset Command Syntax

ID: DAQ\_UC\_017.DAQ\_SRS\_744\_000

The PPDAQ **reset** command shall take the following form:

```
reset\n
```

#### 20.4.2. DAQ\_SRS\_744\_001:PPDAQ Reset Pulse Operation

ID: DAQ\_UC\_017.REQ002DAQ\_SRS\_744\_001

The PPDAQ **reset** command shall send a 350msec pulse on the DAQ reset line.

In the existing design, a reset pulse will:

- Reset the watchdog timeout latch
- Reset all the MCP23S17 I/O expansion chips on the PPDIO96 boards (see the MCP23S17 data sheet for the implications of a reset).
- Clear all the PPSSR-16 and PPRELAY-12 output bits (set the relays to the open/fail-safe condition).

#### 20.4.3. DAQ\_SRS\_744\_002:PPDAQ Reset Command Operation

ID: DAQ\_UC\_017.DAQ\_SRS\_744\_002

The PPDAQ **reset** command shall modify the in-memory objects (for any PPDIO96, PPRelay-12, and PPSSR-16 boards) to reflect the state of the hardware after a reset command.

#### 20.4.4. DAQ\_SRS\_746\_000:PPDAQ Reset Response

ID: DAQ\_UC\_017.DAQ\_SRS\_746\_000

The PPDAQ software shall respond to the **reset** command by returning the command line sent to it.

## 20.5. Test Plan

Testing Setup: DAQ\_STP\_004

Testing Configurations: N/A

## 20.6. Relationships

Relationship	From	To
— unnamed	— unnamed	— unnamed

## 21. Version

ID: DAQ\_UC\_018

Return the current software revision to the host

### 21.1. Primary Actors

♀ Host

### 21.2. Details

Level	Summary
Complexity	Low
Use Case Status	Complete
Implementation Status	Complete
Preconditions	System has encoded the current major and minor release/version numbers in memory.
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 21.3. Scenarios

#### 21.3.1. Scenario

1. Create an acknowledgement string of the form ""DAQ:xx.yy\n" where "xx" is the system software major version number and "yy" is the system software minor version number.
2. Return the acknowledgement string to the host.

### 21.4. Requirements

#### 21.4.1. DAQ\_SRS\_745\_000:PPDAQ Version Command Syntax

ID: DAQ\_UC\_018.DAQ\_SRS\_745\_000

The PPDAQ **version** command shall take the following form:

version\n

#### 21.4.2. DAQ\_SRS\_747\_000:PPDAQ Version Response

ID: DAQ\_UC\_018.DAQ\_SRS\_747\_000

The PPDAQ **version** command shall return a string of the form:

PPDAQ:xx.yy\n

Where "xx" is a major version number and "yy" is a minor version number.

## 21.5. Test Plan

Testing Setup: DAQ\_STP\_004

Testing Configurations: N/A

## 21.6. Relationships

Relationship	From	To
— unnamed	— unnamed	— unnamed

## 22. Echo

ID: DAQ\_UC\_019

Echo command (and response) - used to synchronize after an error condition.

### 22.1. Primary Actors

♀ Host

### 22.2. Details

Level	Summary
Complexity	Low
Use Case Status	Complete
Implementation Status	Complete
Preconditions	N/A
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 22.3. Scenarios

#### 22.3.1. Scenario

1. Return command line as the acknowledgement.

### 22.4. Requirements

#### 22.4.1. DAQ\_SRS\_748\_000:PPDAQ Echo Command Syntax

ID: DAQ\_UC\_019.DAQ\_SRS\_748\_000

The PPDAQ **echo** command shall take the following form:

```
echo\n
```

#### 22.4.2. DAQ\_SRS\_749\_000:PPDAQ Echo Response

ID: DAQ\_UC\_019.DAQ\_SRS\_749\_000

The PPDAQ software shall respond to the **echo** command by returning the command line sent to it.

Note: main use of the echo command is to provide a "cleanup" command. If the command processor gets out of sync, sending an echo command and then waiting until you retrieve the corresponding echo can clean up the communication channel.

### 22.5. Test Plan

Testing Setup: DAQ\_STP\_004

Testing Configurations: N/A

### 22.6. Relationships

Relationship	From	To
— unnamed	— unnamed	— unnamed

## 23. Help

ID: DAQ\_UC\_020

Help command for interactive command usage.

### 23.1. Primary Actors

♀ Host

### 23.2. Details

Level	Summary
Complexity	Low
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Length of help string fits within the buffer used to transmit to the host
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 23.3. Scenarios

#### 23.3.1. Scenario

1. Return a (large) string as the command acknowledgement containing help information.

### 23.4. Requirements

#### 23.4.1. DAQ\_SRS\_750\_000:PPDAQ Help Command Syntax

ID: DAQ\_UC\_020.DAQ\_SRS\_750\_000

The PPDAQ **help** command shall take the following form:

```
help\n
```

#### 23.4.2. DAQ\_SRS\_751\_000:PPDAQ Help Response

ID: DAQ\_UC\_020.DAQ\_SRS\_751\_000

The PPDAQ software shall respond to the **help** command by returning a string containing several lines of text containing a help message (contents of the help message is undefined by the requirements, to be determined later).

Note: the **help** command is intended for interactive usage via a terminal program, not by host software. Largely, it is intended for system testing and debugging purposes.

### 23.5. Relationships

Relationship	From	To
— unnamed	— unnamed	— unnamed

## 24. PPDIO Cmds

ID: DAQ\_UC\_021

Placeholder for PPDIO commands.

### 24.1. Primary Actors

♀ Host

### 24.2. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Received a command line that begins with the word/command "PPDIO"

Post-conditions Command returns acknowledgement string for transmission back to host (could be an error acknowledgement).

Author R Hyde

Assumptions N/A

## 24.3. Scenarios

### 24.3.1. Scenario

1. Extract second "word" from the command line (sub-command)
2. **if** subcommand is "polarity"
  - 2.1. execute PPDIO POLARITY command**end if**
3. **if** subcommand is "pullup"
  - 3.1. Execute PPDIO PULLUP command**end if**
4. **if** subcommand is "boards"
  - 4.1. Execute PPDIO BOARDS command**end if**
5. **if** subcommand is "config"
  - 5.1. Execute PPDIO CONFIG command**end if**
6. **if** subcommand is "filter"
  - 6.1. Execute PPDIO FILTER command**end if**
7. **if** subcommand is "debounce"
  - 7.1. Execute PPDIO DEBOUNCE command**end if**
8. **if** subcommand is "din"
  - 8.1. Execute PPDIO DIN command**end if**
9. **if** subcommand is "dout"
  - 9.1. Execute PPDIO DOUT command**end if**
10. **if** subcommand is "dir"
  - 10.1. Execute PPDIO DIR command**end if**
11. Else return syntax error.

## 24.4. Requirements

### 24.4.1. DAQ\_SRS\_783\_000:PPDAQ PPDIO96-Specific Commands

ID: DAQ\_UC\_021.DAQ\_SRS\_783\_000

The PPDAQ commands specific to the PPDIO96 board shall use the following syntax:

```
ppdio <command> <optional arguments> \n
```



Note: PPDIO commands follow the requirements specified in [DAQ\_SRS\_730\_000] , [DAQ\_SRS\_731\_000] , and [DAQ\_SRS\_732\_000] .

## 24.5. Relationships

Relationship	From	To
⚙️ unnamed	● <a href="#">PPDIO Cnds</a>	● <a href="#">PPDIO::Polarity</a>
⚙️ unnamed	● <a href="#">PPDIO Cnds</a>	● <a href="#">PPDIO::Pullup</a>
⚙️ unnamed	● <a href="#">PPDIO Cnds</a>	● <a href="#">PPDIO::Boards</a>
⚙️ unnamed	● <a href="#">PPDIO Cnds</a>	● <a href="#">PPDIO::DOUT</a>
⚙️ unnamed	● <a href="#">PPDIO Cnds</a>	● <a href="#">PPDIO::Dir</a>
⚙️ unnamed	● <a href="#">PPDIO Cnds</a>	● <a href="#">PPDIO::Config</a>
⚙️ unnamed	● <a href="#">PPDIO Cnds</a>	● <a href="#">PPDIO::Filter</a>
⚙️ unnamed	● <a href="#">PPDIO Cnds</a>	● <a href="#">PPDIO::Debounce</a>
⚙️ unnamed	● <a href="#">PPDIO Cnds</a>	● <a href="#">PPDIO::DIN</a>
— unnamed	— unnamed	— unnamed

## ● 25. PPDIO::Polarity

ID: DAQ\_UC\_024

PPDIO POLARITY commands.

### 25.1. Details

Level	User
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default polarity is 1 (active high)
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 25.2. Scenarios

#### 25.2.1. Scenario

1. **if** there are four valid numeric operands (board, bank, bit, polarity) after "PPDIO POLARITY"
  - 1.1. Set the specified (board, bank, bit)'s polarity to the value of the fourth argument (0:active low, 1:active high)
  - 1.2. Return the command line as the acknowledgement

**end if**
2. **if** there are three valid numeric operands (board, bank, polarity) after "PPDIO POLARITY"
  - 2.1. Set the specified (board, bank)'s polarity to the 12 bits specified by the third (polarity) argument
  - 2.2. Return the command line as the acknowledgement

**end if**
3. **if** there are two valid numeric operands (board, bank) after "PPDIO POLARITY"
  - 3.1. Return the polarities of the 12 bits specified by (board, bank) as the acknowledgement

end if

4. if there are nine valid numeric operands (board, pol0, pol1, pol2, pol3, pol4, pol5, pol6, pol7 ) after "PPDIO POLARITY"

4.1. Set the 8 bank polarities on (board) to the 12-bit values specified by pol0..pol7

end if

5. else return a syntax error as the acknowledgement (see DAQ\_UC\_015)

Extension:

1.a.

1. if board is outside the range 1..boards

1.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

2. if bank is outside the range 0..7

2.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

3. if bit is outside the range 0..11 (0xb)

3.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

4. if polarity is outside the range 0..1

4.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

2.a.

1. if board is outside the range 1..boards

1.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

2. if bank is outside the range 0..7

2.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

3. if polarity is outside the range 0..fff

3.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

3.a.

1. if board is outside the range 1..boards

1.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

2. if bank is outside the range 0..7

2.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

4.a.

1. if board is outside the range 1..boards

1.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

2. if any of pol0..pol7 are outside the range 0..fff

2.1. Return a range error as the acknowledgement (see DAQ\_UC\_014)

end if

## 25.3. Requirements

### 25.3.1. DAQ\_SRS\_802\_000:PPDIO96 POLARITY Command

ID: DAQ\_UC\_024.DAQ\_SRS\_802\_000

The PPDIO polarity (**polarity**) command shall accept the following syntax:

ppdio polarity *board bank bit polarity*

where *board* is a board number in the range 1..6, *bank* is a bank number in the range 0..7, *bit* is a hexadecimal number in the range 0..B, and *polarity* is either 0 (active low) or 1 (active high).

### 25.3.2. DAQ\_SRS\_803\_000:PPDIO96 Default Polarity

ID: DAQ\_UC\_024.DAQ\_SRS\_803\_000

The system shall default to active high polarity (non-inverting) for all input bits on the PPDIO96.

### 25.3.3. DAQ\_SRS\_804\_000:PPDIO96 POLARITY Response #1a

ID: DAQ\_UC\_024.DAQ\_SRS\_804\_000

If the "ppdio polarity *board bank bit polarity*" command is syntactically correct, then the software shall return the command line as the response.

### 25.3.4. DAQ\_SRS\_804\_001:PPDIO96 POLARITY Response #1b

ID: DAQ\_UC\_024.DAQ\_SRS\_804\_001

If the "ppdio polarity *board bank bit 0*" command is syntactically correct, then the software shall set the polarity of the specified bit to active-low (inverting).

### 25.3.5. DAQ\_SRS\_804\_002:PPDIO96 POLARITY Response #1c

ID: DAQ\_UC\_024.DAQ\_SRS\_804\_002

If the "ppdio polarity *board bank bit 1*" command is syntactically correct, then the software shall set the polarity of the specified bit to active-high (non-inverting).

### 25.3.6. DAQ\_SRS\_810.5\_000:PPDIO96 POLARITY Command #2

ID: DAQ\_UC\_024.DAQ\_SRS\_810.5\_000

The PPDIO polarity (**polarity**) command shall accept the following syntax:

ppdio polarity *board bank polarity*

where *board* is a board number in the range 1..6, *bank* is a bank number in the range 0..7, and *polarity* is a 12-bit hexadecimal number in the range 0..FFF.

### 25.3.7. DAQ\_SRS\_810.6\_000.5:PPDIO96 POLARITY #2 Response #1b

ID: DAQ\_UC\_024.DAQ\_SRS\_810.6\_000.5

If the "ppdio polarity *board bank polarity*" command is syntactically correct, then the software shall set the 12 bits of the specified (*board, bank*) to the polarity specified by the 12-bit value *polarity*.

### 25.3.8. DAQ\_SRS\_810.6\_000:PPDIO96 POLARITY #2 Response #1a

ID: DAQ\_UC\_024.DAQ\_SRS\_810.6\_000

If the "ppdio polarity *board bank polarity*" command is syntactically correct, then the software shall return the command line as the response.

### 25.3.9. DAQ\_SRS\_810.7\_000:PPDIO96 POLARITY Command #3

ID: DAQ\_UC\_024.DAQ\_SRS\_810.7\_000

The PPDIO polarity (**polarity**) command shall accept the following syntax:

## ppdio polarity *board bank*

where *board* is a board number in the range 1..6 and *bank* is a bank number in the range 0..7.

25.3.10. DAQ\_SRS\_810.8\_000:PPDIO96 POLARITY #3 Response #1

ID: DAQ\_UC\_024.DAQ\_SRS\_810.8\_000

25.3.11. DAQ\_SRS\_810.9\_000:PPDIO96 POLARITY Command #4

ID: DAQ\_UC\_024.DAQ\_SRS\_810.9\_000

The PPDIO polarity (**polarity**) command shall accept the following syntax:

```
ppdio pullup board pol 0 pol 1 pol 2 pol 3 pol 4 pol 5 pol 6 pol 7
```

where *board* is a board number in the range 1..6 and *pol<sub>n</sub>* is a value in the range 0..FFF.

25.3.12. DAQ\_SRS\_810.9\_001:PPDIO96 POLARITY #4 Response #1

ID: DAQ\_UC\_024.DAQ\_SRS\_810.9\_001

If the "ppdio polarity *board pol 0 pol 1 pol 2 pol 3 pol 4 pol 5 pol 6 pol 7*" command is syntactically correct, then the software shall return the command line as the response.




## 25.4. Test Plan

Testing Setup: DAQ\_STP\_006

DAQ\_STP\_007

Testing Configurations: N/A

## 25.5. Relationships

Relationship	From	To
 unnamed	 PPDIO Cmds	 PPDIO::Polarity

## 26. PPDIO::Pullup

ID: DAQ\_UC\_025

PPDIO PULLUP commands

### 26.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default pullup is 0 (no pullup)
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 26.2. Scenarios

#### 26.2.1. Scenario

- if there are four valid numeric parameters (board, bank, bit, pullup) after "PPDIO PULLUP"
  - 1.1. Program the specified (board, bank, bit)'s pullup as on (1) or off (0) based on the value of the fourth parameter
  - 1.2. Return the command line as the acknowledgement

end if
- if there are three valid numeric parameters (board, bank, pullup) after "PPDIO PULLUP"

2.1. Program the 12 (board, bank) bits pullups using the 12-bit bit array value specified as the third parameter

2.2. Return the command line as the acknowledgement.

end if

3. if there are two valid numeric parameters (board, bank) after "PPDIO PULLUP"

3.1. Return a 12-bit "current pullup bit array" value as the acknowledgement.

end if

4. if there are nine valid numeric parameters (board, pu0, pu1, pu2, pu3, pu4, pu5, pu6, pu7) after "PPDIO PULLUP"

4.1. Program the eight banks on the board using the eight 12-bit bit arrays (pu0..pu7).

4.2. Return the command line as the acknowledgement.

end if

5. Else syntax error (see DAQ\_UC\_014)

Extension:

1.a.

1. if the board parameter is outside the range 1..boards

1.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

2. if the bank parameter is outside the range 0..7

2.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

3. if the bit parameter is outside the range 0..11 (0..0xb)

3.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

4. if the pullup parameter is outside the range 0..1

4.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

2.a.

1. if the board parameter is outside the range 1..boards

1.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

2. if the bank parameter is outside the range 0..7

2.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

3. if the pullup parameter is outside the range 0..fff

3.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

4.a.

1. if the board argument is outside the range 1..boards

1.1. Return range error as acknowledgement (see DAQ\_UC\_015)

end if

- 2. if any of pu0..pu7 are outside the range 0..fff
    - 2.1. Return range error as acknowledgement (see DAQ\_UC\_015)
- end if

## 26.3. Requirements

### 26.3.1. DAQ\_SRS\_795\_000:PPDIO96 PULLUP Command

ID: DAQ\_UC\_025.DAQ\_SRS\_795\_000

The PPDIO pull-up resistor (**pullup**) command shall accept the following syntax:

```
ppdio pullup board bank bit pullup
```

where *board* is a board number in the range 1..6, *bank* is a bank number in the range 0..7, *bit* is a hexadecimal number in the range 0..B, and *pullup* is either 0 (no pullup) or 1 (insert pullup resistor).

### 26.3.2. DAQ\_SRS\_797\_000:PPDIO96 PULLUP Response #1a

ID: DAQ\_UC\_025.DAQ\_SRS\_797\_000

If the "ppdio pullup *board bank bit 0*" command is syntactically correct, then the software shall return the command line as the response and turn off the specified pullup resistor.

### 26.3.3. DAQ\_SRS\_797\_001:PPDIO96 PULLUP Response #1b

ID: DAQ\_UC\_025.DAQ\_SRS\_797\_001

If the "ppdio pullup *board bank bit 1*" command is syntactically correct, then the software shall return the command line as the response and turn on the specified pullup resistor.

### 26.3.4. DAQ\_SRS\_801.5\_000:PPDIO96 PULLUP Command #2

ID: DAQ\_UC\_025.DAQ\_SRS\_801.5\_000

The PPDIO pull-up resistor (**pullup**) command shall accept the following syntax:

```
ppdio pullup board bank value
```

where *board* is a board number in the range 1..6, *bank* is a bank number in the range 0..7, and *value* is a hexadecimal number in the range 0..FFF.

### 26.3.5. DAQ\_SRS\_801.6\_000.5:PPDIO96 PULLUP #2 Response #1b

ID: DAQ\_UC\_025.DAQ\_SRS\_801.6\_000.5

If the "ppdio pullup *board bank value*" command is syntactically correct, then the software shall set the pullup resistors based on the *value* argument (value is 12 bits, one bit for each pullup resistor in the bank).

### 26.3.6. DAQ\_SRS\_801.6\_000:PPDIO96 PULLUP #2 Response #1a

ID: DAQ\_UC\_025.DAQ\_SRS\_801.6\_000

If the "ppdio pullup *board bank value*" command is syntactically correct, then the software shall return the command line as the response.

### 26.3.7. DAQ\_SRS\_801.7\_000:PPDIO96 PULLUP Command #3

ID: DAQ\_UC\_025.DAQ\_SRS\_801.7\_000

The PPDIO pull-up resistor (**pullup**) command shall accept the following syntax:

```
ppdio pullup board bank
```

where *board* is a board number in the range 1..6 and *bank* is a bank number in the range 0..7.

### 26.3.8. DAQ\_SRS\_801.8\_000:PPDIO96 PULLUP #3 Response #1

ID: DAQ\_UC\_025.DAQ\_SRS\_801.8\_000

If the "ppdio pullup *board bank*" command is syntactically correct, then the software shall return "ppdio pul: xxx" as the response (where 'xxx' is the 12-bit hexadecimal representation of the pullup resistor setting).

### 26.3.9. DAQ\_SRS\_801.9\_000:PPDIO96 PULLUP Command #4

ID: DAQ\_UC\_025.DAQ\_SRS\_801.9\_000

The PPDIO pull-up resistor (**pullup**) command shall accept the following syntax:

```
ppdio pullup board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7
```

where *board* is a board number in the range 1..6 and *pu<sub>n</sub>* is a value in the range 0..FFF.

### 26.3.10. DAQ\_SRS\_801.9\_001;PPDIO96 PULLUP #4 Response #1

ID: DAQ\_UC\_025.DAQ\_SRS\_801.9\_001

If the "ppdio pullup *board pu0 pu1 pu2 pu3 pu4 pu5 pu6 pu7*" command is syntactically correct, then the software shall return the command line as the response.

#### 26.4. Test Plan

Testing Setup: DAQ\_STP\_005

Testing Configurations: N/A

#### 26.5. Relationships

Relationship	From	To
↳ unnamed	PPDIO Cmds	PPDIO::Pullup

## 27. PPDIO::Boards

ID: DAQ\_UC\_026

PPDIO BOARDS command

### 27.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default # of PPDIO96 boards is 0.
Post-conditions	If no error, system is set up to handle specified number of PPDIO96 digital I/O boards.
Author	R Hyde
Assumptions	N/A

### 27.2. Scenarios

#### 27.2.1. Scenario

1. **if** there are no additional arguments after "PPDIO BOARDS"
  - 1.1. Return an acknowledgement string specifying the number of configured boards in the system.**end if**
2. **if** there is a single hexadecimal/numeric argument after "PPDIO BOARDS" and that value is in the range 0-6
  - 2.1. Initialize the system to accept the specified number of PPDIO96 boards.
  - 2.2. Return the command line as the acknowledgement.**end if**
3. Else return error as command acknowledgement (see DAQ\_UC\_014).

Extension:

- 2.a. If number of boards argument is greater than 6, return a range error as the command acknowledgement (see DAQ\_UC\_015).

## 27.3. Requirements

### 27.3.1. DAQ\_SRS\_784\_000:PPDIO96 Boards Command

ID: DAQ\_UC\_026.DAQ\_SRS\_784\_000

The PPDIO **boards** command shall accept the following syntax:

```
ppdio boards boards
```

where *boards* is an integer in the range 0-6 specifying the number of installed PPDIO96 boards.

### 27.3.2. DAQ\_SRS\_785\_000:PPDIO96 Boards Response #1

ID: DAQ\_UC\_026.DAQ\_SRS\_785\_000

The PPDIO **boards** command shall return the command line as its response if the command is valid.

### 27.3.3. DAQ\_SRS\_787.5\_000:PPDIO96 Boards Command #2

ID: DAQ\_UC\_026.DAQ\_SRS\_787.5\_000

The PPDIO **boards** command shall accept the following syntax:

```
ppdio boards
```

Note that this command has no arguments.

### 27.3.4. DAQ\_SRS\_787.6\_000:PPDIO96 Boards #2 Response




ID: DAQ\_UC\_026.DAQ\_SRS\_787.6\_000

The PPDIO **boards** command, with no arguments, shall return the following response:

```
ppdio boards: x
```

where *x* is the number of PPDIO96 boards currently programmed into the system (that is, the number of boards specified by the last "ppdio boards <*boards*>" command that had the numeric argument).

## 27.4. Relationships

Relationship	From	To
 unnamed	 <a href="#">PPDIO Cmds</a>	 <a href="#">PPDIO::Boards</a>

## 28. PPDIO::Config

ID: DAQ\_UC\_027

PPDIO CONFIG command

### 28.1. Details

Level	N/A
Complexity	N/A
Use Case Status	N/A
Implementation Status	N/A
Preconditions	N/A
Post-conditions	N/A
Author	N/A
Assumptions	N/A

### 28.2. Scenarios

#### 28.2.1. Scenario

1. **if** there is a single numeric operand (board) following "PPDIO CONFIG"

1.1. Reset the specified PPDIO96 board (programmed initialization)



1.2. Return the command line as the acknowledgement

end if

2. else return a syntax error as the acknowledgement (see DAQ\_UC\_014)

Extension:

1.a.

1. if the board operand is outside the range 1..boards

1.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

## 28.3. Requirements

### 28.3.1. DAQ\_SRS\_\*\_009:PPDIO96 Config Command

ID: DAQ\_UC\_027.DAQ\_SRS\_\*\_009

The PPDIO96 **CONFIG** command shall return the following response:

config: *board*\n

where *board* is a value in the range 1..6, specifying the board to configure.

### 28.3.2. DAQ\_SRS\_\*\_010:PPDIO96 Config Response

ID: DAQ\_UC\_027.DAQ\_SRS\_\*\_010

The PPDAQ software shall respond to a correct **config** command by returning the command line sent to it.

## 28.4. Test Plan

Testing Setup: DAQ\_STP\_010

Testing Configurations: N/A

## 28.5. Relationships

Relationship	From	To
unnamed	PPDIO Cmds	PPDIO::Config

## 29. PPDIO::Filter

ID: DAQ\_UC\_028

PPDIO FILTER command

### 29.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default filter is 0 (most recent)
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 29.2. Scenarios

#### 29.2.1. Scenario

1. if there are four valid numeric arguments (board, bank, bit, filter) after "PPDIO FILTER"

1.1. Set the internal (board, bank, bit) filtering value to "filter"

1.2. Return the command line as the acknowledgement

end if

2. if there are three valid numeric arguments (board, bank, bit) after "PPDIO FILTER"

2.1. Return the filter value for (board, bank, bit) as the command acknowledgement

end if

3.

Extension:

1.a.

1. if board value is outside range 1..boards

1.1. Return range error as acknowledgement (see DAQ\_UC\_015)

end if

2. if bank is outside the range 0..7

2.1. Return range error as acknowledgement (see DAQ\_UC\_015)

end if

3. if bit is outside the range 0..11 (0xb)

3.1. Return range error as acknowledgement (see DAQ\_UC\_015)

end if

4. if filter is outside the range 0..4

4.1. Return range error as acknowledgement (see DAQ\_UC\_015)

end if

2.a.

1. if board value is outside range 1..boards

1.1. Return range error as acknowledgement (see DAQ\_UC\_015)

end if

2. if bank is outside the range 0..7

2.1. Return range error as acknowledgement (see DAQ\_UC\_015)

end if

3. if bit is outside the range 0..11 (0xb)

3.1. Return range error as acknowledgement (see DAQ\_UC\_015)

end if

## 29.3. Requirements

### 29.3.1. DAQ\_SRS\_811\_000:PPDIO96 FILTER Command

ID: DAQ\_UC\_028.DAQ\_SRS\_811\_000

The PPDIO filter (**filter**) command shall accept the following syntax:

`ppdio filter board bank bit filter`

where *board* is a board number in the range 1..6, *bank* is a bank number in the range 0..7, *bit* is a hexadecimal number in the range 0..B, and *filter* is one of the following values:

0. Most recent
1. First

2. Vote
3. Loser
4. Debounce

### 29.3.2. DAQ\_SRS\_812\_000:PPDIO96 Default Filter State

ID: DAQ\_UC\_028.DAQ\_SRS\_812\_000

The system shall default to the "most recent" filter state for all PPDIO96 input bits.

### 29.3.3. DAQ\_SRS\_813\_000:PPDIO96 FILTER Response #1

ID: DAQ\_UC\_028.DAQ\_SRS\_813\_000

If the "ppdio filter *board bank bit filter*" command is syntactically correct, then the software shall return the command line as the response.

### 29.3.4. DAQ\_SRS\_813\_001:PPDIO96 FILTER Response #1a

ID: DAQ\_UC\_028.DAQ\_SRS\_813\_001

If the "ppdio filter *board bank bit filter*" command is syntactically correct, then the software shall set the filter state for the specified (*board, bank, bit*) to *filter*.

### 29.3.5. DAQ\_SRS\_818.5\_000:PPDIO96 FILTER Command #2

ID: DAQ\_UC\_028.DAQ\_SRS\_818.5\_000

The PPDIO filter (**filter**) command shall accept the following syntax:

```
ppdio filter board bank bit
```

where *board* is a board number in the range 1..6, *bank* is a bank number in the range 0..7, and *bit* is a hexadecimal number in the range 0..B.

### 29.3.6. DAQ\_SRS\_818.6\_000:PPDIO96 FILTER #2 Response #1

ID: DAQ\_UC\_028.DAQ\_SRS\_818.6\_000

If the "ppdio filter *board bank bit*" command returns the current filter value for the specified (board, bank bit):

```
ppdio fltr: filter
```

## 29.4. Test Plan

Testing Setup: DAQ\_STP\_008

Testing Configurations: N/A

## 29.5. Relationships

Relationship	From	To
unnamed	PPDIO Cmds	PPDIO::Filter

## 30. PPDIO::Debounce

ID: DAQ\_UC\_029

PPDIO DEBOUNCE command

### 30.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default debounce time is 0 (no debouncing).
Post-conditions	N/A
Author	R Hyde

Assumptions

N/A

## 30.2. Scenarios

### 30.2.1. Scenario

1. **if** there are four valid numeric arguments (board, bank, bit, value) after "PPDIO DEBOUNCE"
  - 1.1. Set the debounce state for (board, bank, bit) to "value"
  - 1.2. Return the command line as the acknowledgement**end if**
2. **if** there are three valid numeric arguments (board, bank, bit) after "PPDIO DEBOUNCE"
  - 2.1. Return the debounce state for (board, bank, bit) as the acknowledgement**end if**
3. **else** return syntax error as the acknowledgement (see DAQ\_UC\_01

Extension:

- 1.a.
  1. **if** board is outside the range 0..boards
    - 1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**
  2. **if** bank is outside the range 0..7
    - 2.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**
  3. **if** bit is outside the range 0..11 (0xb)
    - 3.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**
  4. **if** value is outside the range 0..39 (0x27)
    - 4.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**
- 2.a.
  1. **if** board is outside the range 0..boards
    - 1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**
  2. **if** bank is outside the range 0..7
    - 2.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**
  3. **if** bit is outside the range 0..11 (0xb)
    - 3.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**

## 30.3. Requirements

### 30.3.1. DAQ\_SRS\_819.5\_000:PPDIO96 DEBOUNCE Command #2

ID: DAQ\_UC\_029.DAQ\_SRS\_819.5\_000

The PPDAQ software shall accept the following syntax:

ppdio debounce *board bank bit*

where *board* is a board number in the range 1..6, *bank* is a bank number in the range 0..7, and *bit* is a hexadecimal bit number in the range 0..B.

### 30.3.2. DAQ\_SRS\_819\_000:PPDIO96 DEBOUNCE Command

ID: DAQ\_UC\_029.DAQ\_SRS\_819\_000

The PPDAQ software shall accept the following syntax:

```
ppdio debounce board bank bit value
```

where *board* is a board number in the range 1..6, *bank* is a bank number in the range 0..7, *bit* is a hexadecimal bit number in the range 0..0xB, and *value* is a debounce time in the range 0..0x27.

### 30.3.3. DAQ\_SRS\_820\_000:PPDIO96 DEBOUNCE #2 Response

ID: DAQ\_UC\_029.DAQ\_SRS\_820\_000

If the "ppdio DEBOUNCE *board bank bit*" command is syntactically correct, then the software shall return the following line as the response:

```
ppdio DEBOUNCE: debounce
```

where "*debounce*" is a hexadecimal number (1-0x27, without the 0x prefix) holding the debounce count for the selected bit.

### 30.3.4. DAQ\_SRS\_821\_000:PPDIO96 DEBOUNCE Response #1

ID: DAQ\_UC\_029.DAQ\_SRS\_821\_000




If the "ppdio debounce *board bank bit value*" command is syntactically correct, then the software shall return the command line as the response.

## 30.4. Test Plan

Testing Setup: DAQ\_STP\_009

Testing Configurations: N/A

## 30.5. Relationships

Relationship	From	To
 unnamed	 PPDIO Cmds	 PPDIO::Debounce

## 31. PPDIO::DIN

ID: DAQ\_UC\_030

PPDIO DIN command

### 31.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	N/A
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 31.2. Scenarios

#### 31.2.1. Scenario

1. if there is a single numeric argument after "PPDIO DIN"

1.1. Read all (96) input bits on (board) and return the result as the acknowledgement

end if

2. if there are two numeric arguments after "PPDIO DIN"

2.1. Read the 12 input bits for (board, bank) and return the result as the acknowledgement

end if

3. if there are three numeric arguments after "PPDIO DIN"

3.1. Read the input bit at (board, bank, bit) and return the result as the acknowledgement

end if

4. else return syntax error (see DAQ\_UC\_0014)

Extension:

1.a.

1. if board is outside the range 0..boards

1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)

end if

2.a.

1. if board is outside the range 0..boards

1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)

end if

2. if bank is outside the range 0..7

2.1. Return range error as the acknowledgement (see DAQ\_UC\_015)

end if

3.a.

1. if board is outside the range 0..boards

1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)

end if

2. if bank is outside the range 0..7

2.1. Return range error as the acknowledgement (see DAQ\_UC\_015)

end if

3. if bit is outside the range 0..11 (0xb)

3.1. e DAQ\_UC\_015)

3.2. Return range error as the acknowledgement (see DAQ\_UC\_015)

end if

### 31.3. Requirements

#### 31.3.1. DAQ\_SRS\_827\_000:PPDIO96 DIN Command #2

ID: DAQ\_UC\_030.DAQ\_SRS\_827\_000

The PPDIO digital data input (**din**) command shall accept the following syntax:

```
ppdio din board
```

where the *board* argument is a number in the range 1..6. This reads all the input bits on the specified board.

#### 31.3.2. DAQ\_SRS\_828\_000:PPDIO96 DIN Command #3

ID: DAQ\_UC\_030.DAQ\_SRS\_828\_000

The PPDIO digital data input (**din**) command shall accept the following syntax:

```
ppdio din board bank
```

where the *board* argument is a number in the range 1..6 and the *bank* argument is a number in the range 0..7. This reads all the 12 input bits on the specified (board, bank).

■ 31.3.3. DAQ\_SRS\_829\_000:PPDIO96 DIN Command #4

ID: DAQ\_UC\_030.DAQ\_SRS\_829\_000

The PPDIO digital data input (**din**) command shall accept the following syntax:

```
ppdio din board bank bit
```

where the *board* argument is a number in the range 1..6, the *bank* argument is a number in the range 0..7, and the *bit* argument is a hexadecimal number in the range 0..B (with no leading radix characters). This reads the bit specified by (board, bank, bit).

■ 31.3.4. DAQ\_SRS\_830\_000:PPDIO96 DIN Response Bits #1

ID: DAQ\_UC\_030.DAQ\_SRS\_830\_000

When returning digital input data in response to a PPDIO96 **din** command, the software shall return the bit value as appropriate for each bit's filter type (most recent, first, vote, loser, debounce).

■ 31.3.5. DAQ\_SRS\_831\_000:PPDIO96 DIN Response Bits #2

ID: DAQ\_UC\_030.DAQ\_SRS\_831\_000

When returning digital input data in response to a PPDIO96 **din** command, the software shall return the bit value as appropriate for each bit's polarity setting (active low/high).

Note: Active low polarity will invert the signal received on the input port, active high polarity returns the received signal as-is.

■ 31.3.6. DAQ\_SRS\_833\_000:PPDIO96 DIN Response #2

ID: DAQ\_UC\_030.DAQ\_SRS\_833\_000

In response to a "ppdio din *board*" command, the PPDAQ software shall return the following response:

```
ppdio din: xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7
```

where xxx represents a 3-digit (12-bit) hexadecimal number.

Note: xxx represents a 12-bit value. Bit zero of this number corresponds to the L.O. bit in the associated bank of bits and bit 11 of this number corresponds to the H.O. bit in the associated bank of bits.

■ 31.3.7. DAQ\_SRS\_833\_001:PPDIO96 DIN Response #2a

ID: DAQ\_UC\_030.DAQ\_SRS\_833\_001

If a particular bank is programmed as output bits rather than input bits, the DIN command shall return zeros those 12 bits.

■ 31.3.8. DAQ\_SRS\_834\_001:PPDIO96 DIN Response #3a

ID: DAQ\_UC\_030.DAQ\_SRS\_834\_001

If a particular bank is programmed as output bits rather than input bits, the DIN command shall return zeros for those 12 bits.

31.4. Test Plan

Testing Setup: DAQ\_STP\_006

Testing Configurations: N/A

31.5. Relationships

Relationship	From	To
↳ unnamed	● <a href="#">PPDIO Cmds</a>	● <a href="#">PPDIO::DIN</a>

## ● 32. PPDIO::DOUT

ID: DAQ\_UC\_031

PPDIO DOUT command

### 32.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default DOUT bit values are 0.
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 32.2. Scenarios

#### 32.2.1. Scenario

1. **if** nine valid numeric operands (board, out0, out1, out2, out3, out4, out5, out6, out7) follow "PPDIO DOUT"

1.1. Write the eight 12-bit out $n$  values to the eight banks

1.2. Return the command line as the acknowledgement

**end if**

2. **if** three valid numeric operands (board, bank, value) follow "PPDIO DOUT"

2.1. Write the 12-bit value to (board, bank)

2.2. Return the command line as the acknowledgement

**end if**

3. **if** four valid numeric operands (board, bank, bit, value) follow "PPDIO DOUT"

3.1. Write the single bit value to (board, bank, bit)

**end if**

4. **if** two valid numeric operands (board, bank) follow "PPDIO DOUT"

4.1. **if** (board, bank) is initialized as an input port

4.1.1. return 0 (12 bits of zeros) as the command acknowledgement

**end if**

4.2. Return the last-written 12-bit values for (board, bank) as the acknowledgement

**end if**

5. **else** return syntax error as the command acknowledgement (see DAQ\_UC\_014)

Extension:

1.a.

1. **if** board is outside the range 0..boards

1.1. Return range error as the acknowledgement

**end if**



2. **if** any of out0..out7 are outside the range 0..fff

2.1.

**end if**

2.a.

1. **if** board is outside the range 0..boards

1.1. Return range error as the acknowledgement

**end if**

2. **if** bank is outside the range 0..7

2.1. Return range error as the acknowledgement

**end if**

3. **if** value is outside the range 0..fff

3.1. Return range error as the acknowledgement

**end if**

3.a.

1. **if** board is outside the range 0..boards

1.1. Return range error as the acknowledgement

**end if**

2. **if** bank is outside the range 0..7

2.1. Return range error as the acknowledgement

**end if**

3. **if** bit is outside the range 0..11 (0xb)

3.1. Return range error as the acknowledgement

**end if**

4. **if** value is outside the range 0..1

4.1. Return range error as the acknowledgement

**end if**

4.a.

1. **if** board is outside the range 0..boards

1.1. Return range error as the acknowledgement

**end if**

2. **if** bank is outside the range 0..7

2.1. Return range error as the acknowledgement

**end if**

## 32.3. Requirements

### 32.3.1. DAQ\_SRS\_836\_000:PPDIO96 DOUT Command #2

ID: DAQ\_UC\_031.DAQ\_SRS\_836\_000

The PPDIO digital data output (**dout**) command shall accept the following syntax:

```
ppdio dout board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7
```

where the *board* argument is a number in the range 1..6. This writes all the output bits to the specified board.

Note: this command always has nine numeric arguments. The argument count is how the software differentiates this command from other DOUT commands.

#### 32.3.2. DAQ\_SRS\_837\_000:PPDIO96 DOUT Command #3

ID: DAQ\_UC\_031.DAQ\_SRS\_837\_000

The PPDIO digital data output (**dout**) command shall accept the following syntax:

```
ppdio dout board bank xxx
```

where the *board* argument is a number in the range 1..6, the *bank* argument is a number in the range 0..7, and *xxx* is a 12-bit hexadecimal value (3 hex digits). This writes the 12 output bits to the specified (board, bank).

Note: if (board,bank) is set up as an input port, the software ignores the write operation.

Note: this command always has three numeric arguments. The argument count is how the software differentiates this command from other DOUT commands.

#### 32.3.3. DAQ\_SRS\_838.5\_000:PPDIO96 DOUT Command #5

ID: DAQ\_UC\_031.DAQ\_SRS\_838.5\_000

The PPDIO digital data output (**dout**) command shall accept the following syntax:

```
ppdio dout board bank
```

where the *board* argument is a number in the range 1..6 and the *bank* argument is a number in the range 0..7. This returns the 12-bit value last written to (board, bank).

Note: if (board,bank) is set up as an input port, the command returns zero bits.

Note: this command always has two numeric arguments. The argument count is how the software differentiates this command from other DOUT commands.

#### 32.3.4. DAQ\_SRS\_838\_000:PPDIO96 DOUT Command #4

ID: DAQ\_UC\_031.DAQ\_SRS\_838\_000

The PPDIO digital data output (**dout**) command shall accept the following syntax:

```
ppdio dout board bank bit value
```

where the *board* argument is a number in the range 1..6, the *bank* argument is a number in the range 0..7, and the *bit* argument is a hexadecimal number in the range 0..B (with no leading radix characters), the *value* argument is zero or one. This command writes the specified bit to the output.

Note: if (board,bank) is set up as an input port, the software ignores the write operation.

Note: this command always has four numeric arguments. The argument count is how the software differentiates this command from other DOUT commands.

#### 32.3.5. DAQ\_SRS\_842\_000:PPDIO96 DOUT Response #4a

ID: DAQ\_UC\_031.DAQ\_SRS\_842\_000

In response to a valid "ppdio dout *board xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7*" command, the PPDAQ software shall return the command line as the acknowledgement.

#### 32.3.6. DAQ\_SRS\_842\_001:PPDIO96 DOUT Response #4b

ID: DAQ\_UC\_031.DAQ\_SRS\_842\_001

In response to a valid "ppdio dout *board* xxx0 xxx1 xxx2 xxx3 xxx4 xxx5 xxx6 xxx7" command, the PPDAQ software shall write the specified values to the eight banks on the PPDI096 board. (if the banks are programmed as outputs, the bits shall appear on the bank output pins.)

### 32.3.7. DAQ\_SRS\_846\_000:PPDI096 DOUT Response #8a

ID: DAQ\_UC\_031.DAQ\_SRS\_846\_000

In response to a valid "ppdio dout *board bank xxx*" command, the PPDAQ software shall return the command line as the acknowledgement.

### 32.3.8. DAQ\_SRS\_846\_001:PPDI096 DOUT Response #8b

ID: DAQ\_UC\_031.DAQ\_SRS\_846\_001

In response to a valid "ppdio dout *board bank xxx*" command, the PPDAQ software shall write the 12-bit value (*xxx*) to the specified (*board, bank*).

### 32.3.9. DAQ\_SRS\_851\_000:PPDI096 DOUT Response #13a

ID: DAQ\_UC\_031.DAQ\_SRS\_851\_000

In response to a valid "ppdio dout *board bank bit value*" command, the PPDAQ software shall return the command line as the acknowledgement.

### 32.3.10. DAQ\_SRS\_851\_001:PPDI096 DOUT Response #13b

ID: DAQ\_UC\_031.DAQ\_SRS\_851\_001

In response to a valid "ppdio dout *board bank bit value*" command, the PPDAQ software shall write the specified *value* (0/1) to (*board, bank, bit*).

### 32.3.11. DAQ\_SRS\_856.5\_000:PPDI096 DOUT Response #18

ID: DAQ\_UC\_031.DAQ\_SRS\_856.5\_000

In response to a "ppdio dout *board bank* " command the software shall return the following response:

```
ppdio dout: xxx \n
```




where "xxx" represents the last 12 bits written to the specified bank.

## 32.4. Test Plan

Testing Setup: DAQ\_STP\_010

Testing Configurations: N/A

## 32.5. Relationships

Relationship	From	To
 unnamed	 PPDIO Cmds	 PPDIO::DOUT

## 33. PPDIO::Dir

ID: DAQ\_UC\_032

PPDIO DIR command

### 33.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default data direction is 0 (input)
Post-conditions	N/A
Author	R Hyde

Assumptions

N/A

## 33.2. Scenarios

### 33.2.1. Scenario

1. **if** there are only two numeric arguments after "DIR"

1.1. Return an acknowledgement specifying the data direction for the specified (board,bank)

**end if**

2. **if** there are three numeric arguments after "DIR"

2.1. Program the specified set of 12 bits on the PPDIO96 (board,bank) as inputs or outputs as per the third argument.

2.2. Return the command line as the acknowledgement.

**end if**

3. Else return a syntax error as per DAQ\_UC\_014.

Extension:

1.a.

1. **if** the first argument is out of range (1..#boards)

1.1. Return a range error as acknowledgement, as per DAQ\_UC\_015

**end if**

2. **if** the second argument is out of range (0..11)

2.1. Return a range error as acknowledgement, as per DAQ\_UC\_015

**end if**

2.a.

1. **if** the first argument is out of range (1..#boards)

1.1. Return a range error as acknowledgement, as per DAQ\_UC\_015

**end if**

2. **if** the second argument is out of range (0..11)

2.1. Return a range error as acknowledgement, as per DAQ\_UC\_015

**end if**

3. **if** the third argument is out of range (0..1)

3.1. Return a range error as acknowledgement, as per DAQ\_UC\_015

**end if**

## 33.3. Requirements

### 33.3.1. DAQ\_SRS\_788\_000:PPDIO96 DIR Command

ID: DAQ\_UC\_032.DAQ\_SRS\_788\_000

The PPDIO data direction (**dir**) command shall accept the following syntax:

```
ppdio dir board bank io
```

where *board* is a board number in the range 1..6, *bank* is a bank number in the range 0..7, and *io* is either 0 (inputs) or 1 (outputs).

### 33.3.2. DAQ\_SRS\_789\_000:PPDIO96 Default Data Direction

ID: DAQ\_UC\_032.DAQ\_SRS\_789\_000

The system shall default to all input bits on the PPDIO96.

### 33.3.3. DAQ\_SRS\_790\_000:PPDIO96 DIR Response #1

ID: DAQ\_UC\_032.DAQ\_SRS\_790\_000

If the "ppdio dir board bank io" command is syntactically correct, then the software shall return the command line as the response.

33.3.4. DAQ\_SRS\_790\_001:PPDIO96 DIR Response #1a

ID: DAQ\_UC\_032.DAQ\_SRS\_790\_001

If the "ppdio dir board bank 0" command is syntactically correct, then the software shall set the (board, bank) direction to input.

33.3.5. DAQ\_SRS\_790\_002:PPDIO96 DIR Response #1b

ID: DAQ\_UC\_032.DAQ\_SRS\_790\_002

If the "ppdio dir board bank 1" command is syntactically correct, then the software shall set the (board, bank) direction to output.

33.3.6. DAQ\_SRS\_794.5\_000:PPDIO96 DIR Command #2

ID: DAQ\_UC\_032.DAQ\_SRS\_794.5\_000

DAQ\_SRS\_794.5\_000

33.3.7. DAQ\_SRS\_794.6\_000:PPDIO96 DIR #2 Response

ID: DAQ\_UC\_032.DAQ\_SRS\_794.6\_000

If the "ppdio dir board bank" command is syntactically correct, then the software shall return "ppdio dir: io" as the response, where io is the current data direction programmed for that bank (0 or 1).

33.4. Test Plan

Testing Setup: DAQ\_STP\_005

Testing Configurations: N/A

33.5. Relationships

Relationship	From	To
unnamed	PPDIO Cmds	PPDIO::Dir

34. PPDO Cmds

ID: DAQ\_UC\_022

Placeholder for PPDO commands.

34.1. Primary Actors

Host

34.2. Details

Level	N/A
Complexity	N/A
Use Case Status	N/A
Implementation Status	N/A
Preconditions	N/A
Post-conditions	N/A
Author	N/A
Assumptions	N/A

34.3. Scenarios

34.3.1. Scenario

1. Extract second word from PPDO command
2. if second word is "boards"

2.1. Execute "PPDO BOARDS" command

end if

3. if second word is "dout"

3.1. Execute the "PPDO DOUT" command

end if

4. if second word is "type"

4.1. Execute the "PPDO TYPE" command

end if

5. else return syntax error as response (see DAQ\_UC\_0014)

## 34.4. Requirements

### 34.4.1. DAQ\_SRS\_910\_000:PPDO-Specific Commands

ID: DAQ\_UC\_022.DAQ\_SRS\_910\_000

The PPDAQ commands specific to the serial output boards shall use the following syntax:

```
ppdo <commands> <optional arguments> \n
```

Note: PPDO commands follow the requirements specified in [DAQ\_SRS\_730\_000] , [DAQ\_SRS\_731\_000] , and [DAQ\_SRS\_732\_000] .

## 34.5. Relationships

Relationship	From	To
⋈ unnamed	<a href="#">PPDO Cmds</a>	<a href="#">PPDO::Boards</a>
⋈ unnamed	<a href="#">PPDO Cmds</a>	<a href="#">PPDO::DOUT</a>
⋈ unnamed	<a href="#">PPDO Cmds</a>	<a href="#">PPDO::DIN</a>
⋈ unnamed	<a href="#">PPDO Cmds</a>	<a href="#">PPDO::Type</a>
— unnamed	— unnamed	— unnamed

## 35. PPDO::Boards

ID: DAQ\_UC\_033

PPDO BOARDS command

### 35.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default number of boards is zero.
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

## 35.2. Scenarios

### 35.2.1. Scenario

1. if there is a single valid numeric argument (boards) after "PPDO BOARDS"

- 1.1. Initialize the number of PPDO boards to the specified value
- 1.2. **if** boards is greater than the previous number of boards (default is zero boards)
  - 1.2.1. Initialize the type of the board to zero (no board)
 

**end if**
- 1.3. Return the command line as the acknowledgement
 

**end if**
2. **if** there are no arguments after "PPDO BOARDS"
  - 2.1. Return the current number of installed PPDO boards as the acknowledgement
 

**end if**
3. else return syntax error as the acknowledgement (see DAQ\_UC\_014)

Extension:

- 1.a.
  1. **if** boards is outside the range 0..10 (0xa)
    - 1.1. Return range error as the acknowledgement
 

**end if**

### 35.3. Requirements

#### 35.3.1. DAQ\_SRS\_911\_000:PPDO BOARDS Command

ID: DAQ\_UC\_033.DAQ\_SRS\_911\_000

The "**ppdo boards**" command shall have the following syntax:

```
ppdout boards boards
```

where *boards* is a hexadecimal value specifying the number of PPSSR-16 and PPRELAY-12 boards (combined) connected to the DAQIF board. Note that PPDO-48 boards consume three board slots, so the *boards* value must include "number of PPDO-48 boards" times three.

#### 35.3.2. DAQ\_SRS\_912\_000:PPDO BOARDS Command Response #1

ID: DAQ\_UC\_033.DAQ\_SRS\_912\_000

A valid "**ppdo boards** *boards*" command shall return the command line as its acknowledgement.

#### 35.3.3. DAQ\_SRS\_914\_001:PPDO BOARDS Command #2

ID: DAQ\_UC\_033.DAQ\_SRS\_914\_001

The "**ppdo boards**" command shall have the following syntax:

```
ppdout boards
```

#### 35.3.4. DAQ\_SRS\_914\_002:PPDO BOARDS #2 Command Response #1

ID: DAQ\_UC\_033.DAQ\_SRS\_914\_002




A valid "**ppdo boards**" command shall return "ppdo boards: xx" as its acknowledgement, where "xx" is the hexadecimal representation of the number of boards specified by the last "ppdo boards xxx" command.

### 35.4. Test Plan

Testing Setup: DAQ\_STP\_011

Testing Configurations: N/A

### 35.5. Relationships

Relationship	From	To
 unnamed	 <a href="#">PPDO Cmds</a>	 <a href="#">PPDO::Boards</a>

## 36. PPDO::DOUT

ID: DAQ\_UC\_034

PPDO DOUT command

### 36.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default DOUT bits are all zero
Post-conditions	N/A
Author	N/A
Assumptions	N/A

### 36.2. Scenarios

#### 36.2.1. Scenario

1. **if** there are two valid numeric arguments (board, value) after "PPDO DOUT"
  - 1.1. Store the 16-bit value in the output slot for "board" (for later output to the board)
  - 1.2. Return the command line as the acknowledgement**end if**
2. **if** there are three valid numeric arguments (board, bit, value) after "PPDO DOUT"
  - 2.1. Store the 1-bit value in the output slot for (board, bit) (for later output to the board)
  - 2.2. Return the command line as the acknowledgement**end if**
3. **else** return syntax error as the acknowledgement (see DAQ\_UC\_0014)

Extension:

- 1.a.
  1. **if** board is outside the range 1..boards
    - 1.1. Return range error as the acknowledgement**end if**
  2. Note: value can't be outside the range 0..ffff. It's a syntax error rather than a range error if this is the case.
- 2.a.
  1. **if** board is outside the range 1..boards
    - 1.1. Return range error as the acknowledgement**end if**
  2. **if** bit is outside the range 0..15 (0xf)
    - 2.1. Return range error as the acknowledgement**end if**
  3. **if** value is outside the range 0..1
    - 3.1. Return range error as the acknowledgement**end if**

### 36.3. Requirements



### 36.3.1. DAQ\_SRS\_915\_000:PPDO DOUT Command #1

ID: DAQ\_UC\_034.DAQ\_SRS\_915\_000

The PPDO digital data output (**dout**) command shall accept the following syntax:

```
ppdo dout board xxxx
```

where *board* is a serial output board number (board #1 is the board connected directly to the DAQIF board) and *xxxx* represents a 4-digit (16-bit) hexadecimal number.

Note: remember, the PPDO-48 board consumes three board slots each with 16 bits (banks 0&1, 2&3, and 4&5).

### 36.3.2. DAQ\_SRS\_916\_000:PPDO DOUT Command #2

ID: DAQ\_UC\_034.DAQ\_SRS\_916\_000

The PPDO digital data output (**dout**) command shall accept the following syntax:

```
ppdo dout board bit x
```

where *board* is a serial output board number (board #1 is the board connected directly to the DAQIF board), *bit* is a bit index on that board (0-F), and *x* is either zero or one.

Note: remember, the PPDO-48 board consumes three board slots each with 16 bits (banks 0&1, 2&3, and 4&5).

Note: the PPDAQ software will differentiate the two *dout* commands based on the number of arguments.

### 36.3.3. DAQ\_SRS\_917\_000:PPDO DOUT #1 Response #1

ID: DAQ\_UC\_034.DAQ\_SRS\_917\_000

In response to a syntactically correct "ppdo dout *board xxxx*" command, the PPDAQ software shall return the command line as the acknowledgement.

### 36.3.4. DAQ\_SRS\_917\_001:PPDO DOUT #2 Response #1

ID: DAQ\_UC\_034.DAQ\_SRS\_917\_001

In response to a syntactically correct "ppdo dout *board bit xxxx*" command, the PPDAQ software shall return the command line as the acknowledgement.

## 36.4. Test Plan

Testing Setup: DAQ\_STP\_011

Testing Configurations: N/A

## 36.5. Relationships

Relationship	From	To
unnamed	PPDO Cmds	PPDO::DOUT

## 37. PPDO::DIN

ID: DAQ\_UC\_035

PPDO DIN command

### 37.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete

Preconditions	N/A
Post-conditions	N/A
Author	N/A
Assumptions	N/A

## 37.2. Scenarios

### 37.2.1. Scenario

1. **if** there are two valid numeric operands (board, bits) after "PPDO DIN"
  - 1.1. Return the last value written to the DOUT slot (board, bit) as the acknowledgement**end if**
2. **if** there is a single valid numeric operand (board) after "PPDO DIN"
  - 2.1. Return the last 16 bits written to the PPDO slot for board as the acknowledgement**end if**
3. **else** return a syntax error as the acknowledgement (see DAQ\_UC\_014)

## 37.3. Requirements

### 37.3.1. DAQ\_SRS\_921\_000:PPDO DIN Command #1

ID: DAQ\_UC\_035.DAQ\_SRS\_921\_000

The PPDO digital data input (**din**) command shall accept the following syntax:

`ppdo din board bit`

where *board* is a serial output board number (board #1 is the board connected directly to the DAQIF board) and *bit* is a hexadecimal value in the range 0-F.

Note: remember, the PPDO-48 board consumes three consecutive board slots each with 16 bits (banks 0&1, 2&3, and 4&5).

### 37.3.2. DAQ\_SRS\_922\_000:PPDO DIN Response #1

ID: DAQ\_UC\_035.DAQ\_SRS\_922\_000

In response to a valid "ppdo din *board bits* " command the PPDAQ software shall return the following response:

`ppdo din: bit \n`

where *bit* is a 0/1 value representing the last value written to that board and bit.

### 37.3.3. DAQ\_SRS\_925\_000:PPDO DIN Command #2

ID: DAQ\_UC\_035.DAQ\_SRS\_925\_000

The PPDO digital data input (**din**) command shall accept the following syntax:

`ppdo din board`

where *board* is a serial output board number (board #1 is the board connected directly to the DAQIF board).

Note: the PPDAQ software will differentiate the two "ppdo din" commands based on the number of arguments.

### 37.3.4. DAQ\_SRS\_926\_00:PPDO DIN Response #4

ID: DAQ\_UC\_035.DAQ\_SRS\_926\_00

In response to a valid "ppdo din *board* " command the PPDAQ software shall return the following response:

ppdo din: *bits* \n

where *bits* is the last value (16 bits) written to that particular board.

### 37.4. Test Plan

Testing Setup: DAQ\_STP\_011

Testing Configurations: N/A

### 37.5. Relationships

Relationship	From	To
unnamed	PPDO Cmds	PPDO::DIN

## 38. PPDO::Type

ID: DAQ\_UC\_036

PPDO TYPE command

### 38.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default type is zero (no board)
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 38.2. Scenarios

#### 38.2.1. Scenario

1. **if** a single valid numeric argument (board) follows "PPDO TYPE"
    - 1.1. Return the type for the specified PPDO board as the acknowledgement**end if**
  2. **if** two valid numeric arguments (board, type) follow "PPDO TYPE"
    - 2.1. Set the internal type for the specified board
    - 2.2. Return the command line as the acknowledgement**end if**
  3. **else** return syntax error as acknowledgement (see DAQ\_UC\_014)
- Extension:
- 1.a.
    1. **if** board value is outside the range 0..boards
      - 1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**
  - 2.a.
    1. **if** board value is outside the range 0..boards
      - 1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**

2. if type is outside the range 1..3

2.1. Return range error as the acknowledgement (see DAQ\_UC\_015)

end if

### 38.3. Requirements

#### 38.3.1. DAQ\_SRS\_929\_000:PPDO TYPE Command #1

ID: DAQ\_UC\_036.DAQ\_SRS\_929\_000

The PPDO type (**type**) command shall accept the following syntax:

```
ppdo type board
```

where *board* is a serial output board number (board #1 is the board connected directly to the DAQIF board).

#### 38.3.2. DAQ\_SRS\_930\_000:PPDO TYPE Response #1

ID: DAQ\_UC\_036.DAQ\_SRS\_930\_000

In response to a valid "ppdo type *board*" command the PPDAQ software shall return the following response:

```
ppdo type: type \n
```

where *type* is 0 (no board installed), 1 (PPRELAY-12 board installed), 2 (PPSSR-16 board installed), or 3 (PPDO-48 board installed).

Note: remember, the PPDO-48 board consumes three consecutive board slots (banks 0&1, 2&3, and 4&5); application software must set the type to 3 for each of the three consecutive board slots.

#### 38.3.3. DAQ\_SRS\_933\_000:PPDO TYPE Command #2

ID: DAQ\_UC\_036.REQ003

#### 38.3.4. DAQ\_SRS\_934\_000:PPDO TYPE Response #4

ID: DAQ\_UC\_036.DAQ\_SRS\_934\_000




In response to a valid "ppdo type *board type*" command the PPDAQ software shall return the command line as the acknowledgement.

### 38.4. Test Plan

Testing Setup: DAQ\_STP\_011

Testing Configurations: N/A

### 38.5. Relationships

Relationship	From	To
 unnamed	 <a href="#">PPDO Cmds</a>	 <a href="#">PPDO::Type</a>

### 39. PPAIO Cmds

ID: DAQ\_UC\_023

Placeholder for PPAIO commands.

#### 39.1. Primary Actors

 Host

#### 39.2. Details

Level	N/A
-------	-----

Complexity	N/A
Use Case Status	N/A
Implementation Status	N/A
Preconditions	N/A
Post-conditions	N/A
Author	N/A
Assumptions	N/A

### 39.3. Scenarios

#### 39.3.1. Scenario

1. Extract second word (subcommand) from command line
2. **if** subcommand is "boards"
  - 2.1. Execute PPAIO BOARDS command**end if**
3. **if** subcommand is "dacs"
  - 3.1. Execute PPAIO DACS command**end if**
4. **if** subcommand is "adcs"
  - 4.1. Execute PPAIO ADCS command**end if**
5. **if** subcommand is "gain"
  - 5.1. Execute PPAIO GAIN command**end if**
6. **if** subcommand is "filter"
  - 6.1. Execute PPAIO FILTER command**end if**
7. **if** subcommand is "ain"
  - 7.1. Execute PPAIO AIN command**end if**
8. **if** subcommand is "aout"
  - 8.1. Execute PPAIO AOUT command**end if**
9. **if** subcommand is "type"
  - 9.1. Execute PPAIO TYPE command**end if**
10. else return syntax error as acknowledgement (see DAQ\_UC\_014)

### 39.4. Requirements

#### 39.4.1. DAQ\_SRS\_985\_000:PPAIO-Specific Commands

ID: DAQ\_UC\_023.DAQ\_SRS\_985\_000

The PPDAQ commands specific to the serial output boards shall use the following syntax:

```
ppaio <commands> <optional arguments> \n
```

Note: PPAIO commands follow the requirements specified in [DAQ\_SRS\_730\_000] , [DAQ\_SRS\_731\_000] , and [DAQ\_SRS\_732\_000] .

### 39.5. Relationships

Relationship	From	To
unnamed	PPAIO Cmds	PPAIO::Boards
unnamed	PPAIO Cmds	PPAIO::DACS
unnamed	PPAIO Cmds	PPAIO::ADCS
unnamed	PPAIO Cmds	PPAIO::Gain
unnamed	PPAIO Cmds	PPAIO::Filter
unnamed	PPAIO Cmds	PPAIO::AIN
unnamed	PPAIO Cmds	PPAIO::AOUT
unnamed	unnamed	unnamed

## 40. PPAIO::Boards

ID: DAQ\_UC\_037

PPAIO BOARDS command

### 40.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default is zero boards in the system.
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 40.2. Scenarios

#### 40.2.1. Scenario

1. **if** a single valid numeric operand (boards) follows "PPAIO BOARDS"
  - 1.1. Set the internal PPAIO board count to the specified value
  - 1.2. Return command line as acknowledgement

**end if**
2. **if** no operands follow "PPAIO BOARDS"
  - 2.1. Return the current number of PPAIO boards as the acknowledgement

**end if**
3. **else** return syntax error as the acknowledgement (see DAQ\_UC\_014)

Extension:

- 1.a.
  1. **if** boards value is outside the range 0..8

1.1. Return range error as the acknowledgement

end if

### 40.3. Requirements

#### 40.3.1. DAQ\_SRS\_986\_000:PPAIO Boards Command

ID: DAQ\_UC\_037.REQ001

#### 40.3.2. DAQ\_SRS\_987\_000:PPAIO Boards Response #1

ID: DAQ\_UC\_037.DAQ\_SRS\_987\_000

The PPAIO **boards** command shall return the command line as its response if the command is valid.

#### 40.3.3. DAQ\_SRS\_989\_001:PPAIO Boards Command #2

ID: DAQ\_UC\_037.DAQ\_SRS\_989\_001

The PPAIO **boards** command shall accept the following syntax:

```
ppaio boards
```

#### 40.3.4. DAQ\_SRS\_989\_002:PPAIO Boards #2 Response #1

ID: DAQ\_UC\_037.DAQ\_SRS\_989\_002

The PPAIO **boards** command shall return "ppaio boards: x" where 'x' is a value in the range 0-8 specifying the number of PPAIO-16/4 boards installed in the system.

### 40.4. Test Plan

Testing Setup: DAQ\_STP\_012

Testing Configurations: N/A

### 40.5. Relationships

Relationship	From	To
unnamed	PPAIO Cmds	PPAIO::Boards

## 41. PPAIO::DACS

ID: DAQ\_UC\_038

PPAIO DACS command

### 41.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default DACS value is 0xf (all D/A ports active)
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 41.2. Scenarios

#### 41.2.1. Scenario

1. if two valid numeric arguments (board, bitmap) follows "PPAIO DACS"

1.1. Store away the 4-bit bitmap for the selected board

1.2. Return the command line as the acknowledgement

end if

2. **if** a single valid numeric argument (*board*) follows the "PPAIO DACS" command
  - 2.1. Return the 16-bit bitmap value for the selected board as the acknowledgement
- end if**
3. **else** return a syntax error as the acknowledgement (see DAQ\_UC\_014)

Extension:

- 1.a.
  1. **if** the board argument is outside the range 1..*boards*
    - 1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)
  - end if**
  2. **if** *bitmap* is outside the range 0-f
    - 2.1. Return range error as the acknowledgement (see DAQ\_UC\_015)
  - end if**
- 2.a.
  1. **if** the board argument is outside the range 1..*boards*
    - 1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)
  - end if**

### 41.3. Requirements

#### 41.3.1. DAQ\_SRS\_986\_001:PPAIO DACs Command

ID: DAQ\_UC\_038.DAQ\_SRS\_986\_001

The PPAIO **dacs** command shall accept the following syntax:

`ppaio dacs board`

where *boards* is an integer in the range 0-8 specifying the board whose DAC bitmap the command shall return.

#### 41.3.2. DAQ\_SRS\_986\_003:PPAIO DACs Command #2

ID: DAQ\_UC\_038.DAQ\_SRS\_986\_003

The PPAIO **dacs** command shall accept the following syntax:

`ppaio dacs board dacBM`

where *boards* is an integer in the range 0-8 specifying the board to set the DAC bitmap for and *dacBM* is a 4-bit bitmap (value in the range 0-0xf) specify active DACs on the specified board.

#### 41.3.3. DAQ\_SRS\_989\_003:PPAIO DACS Response #1

ID: DAQ\_UC\_038.DAQ\_SRS\_989\_003

The "**ppaio dacs *board***" command shall return "ppaio dacs: x" where 'x' is a hexadecimal value in the range 0-0xf specifying a bitmap of active DAC modules on the board (bit<sub>n</sub>=1 implies that DAC BoB #n is active).

#### 41.3.4. DAQ\_SRS\_989\_004:PPAIO DACS Response #2

ID: DAQ\_UC\_038.DAQ\_SRS\_989\_004

The "**ppaio dacs *board dacs***" command shall return the command line if *board* is in the range 0-"number\_of\_specified\_PPAIO-16/4\_boards" and *dacs* is in the range 0-0xf.

#### 41.3.5. DAQ\_SRS\_989\_011:PPAIO Default DACs Bitmap

ID: DAQ\_UC\_038.DAQ\_SRS\_989\_011






The “**ppaio boards board**” command shall set the DACS default bitmap to 0xf (all DACs active) for all PPAIO-16/4 boards.

#### 41.4. Test Plan

Testing Setup: DAQ\_STP\_012

Testing Configurations: N/A

#### 41.5. Relationships

Relationship	From	To
 unnamed	 PPAIO Cmds	 PPAIO::DACS

### 42. PPAIO::ADCS

ID: DAQ\_UC\_039

PPAIO ADCS command

#### 42.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default bitmap setting is 0xf (all modules active)
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

#### 42.2. Scenarios

##### 42.2.1. Scenario

1. **if** two valid numeric arguments (board, bitmap) follows "PPAIO ADCS"
  - 1.1. Store away the 4-bit bitmap for the selected board
  - 1.2. Return the command line as the acknowledgement**end if**
2. **if** a single valid numeric argument (board) follows the "PPAIO ADCS" command
  - 2.1. Return the 16-bit bitmap value for the selected board as the acknowledgement**end if**
3. **else** return a syntax error as the acknowledgement (see DAQ\_UC\_014)

Extension:

- 1.a.
  1. **if** the board argument is outside the range 1..boards
    - 1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**
  2. **if** bitmap is outside the range 0-f
    - 2.1. Return range error as the acknowledgement (see DAQ\_UC\_015)**end if**
- 2.a.
  1. **if** the board argument is outside the range 1..boards

1.1. Return range error as the acknowledgement (see DAQ\_UC\_015)

end if

### 42.3. Requirements

#### 42.3.1. DAQ\_SRS\_986\_002:PPAIO ADCs Command

ID: DAQ\_UC\_039.DAQ\_SRS\_986\_002

The PPAIO **adcs** command shall accept the following syntax:

```
ppaio adcs board
```

where *boards* is an integer in the range 0-8 specifying the board whose DAC bitmap the command shall return.

#### 42.3.2. DAQ\_SRS\_986\_004:PPAIO ADCs Command #2

ID: DAQ\_UC\_039.DAQ\_SRS\_986\_004

The PPAIO **adcs** command shall accept the following syntax:

```
ppaio adcs board adcBM
```

where *boards* is an integer in the range 0-8 specifying the board to set the DAC bitmap for and *adcBM* is a 4-bit bitmap (value in the range 0-0xf) specify active ADC modules on the specified board.

Note: each Adafruit ADS1115 breakout board module has two differential ADCs or four single-ended ADCs.

#### 42.3.3. DAQ\_SRS\_989\_007:PPAIO ADCS Response #1

ID: DAQ\_UC\_039.DAQ\_SRS\_989\_007

The “**ppaio adcs board**” command, assuming *board* is in the range one to “number\_of\_specified\_PPAIO-16/4\_boards”, shall return “ppaio adcs: x” where ‘x’ is a hexadecimal value in the range 0-0xf specifying a bitmap of active ADC modules on the board (bit<sub>n</sub>=1 implies that ADC BoB #n is active).

#### 42.3.4. DAQ\_SRS\_989\_010:PPAIO ADCS Response #4

ID: DAQ\_UC\_039.DAQ\_SRS\_989\_010

The “**ppaio adcs board adcs**” command shall return the command line if *board* and *adcs* are both within range.

#### 42.3.5. DAQ\_SRS\_989\_012:PPAIO Default ADCs Bitmap

ID: DAQ\_UC\_039.DAQ\_SRS\_989\_012




The “**ppaio boards board**” command shall set the ADCs default bitmap to 0xf (all ADCs active) for all PPAIO-16/4 boards.

### 42.4. Test Plan

Testing Setup: DAQ\_STP\_012

Testing Configurations: N/A

### 42.5. Relationships

Relationship	From	To
 unnamed	 PPAIO Cmds	 PPAIO::ADCS

### 43. PPAIO::Gain

ID: DAQ\_UC\_040

PPAIO GAIN command

#### 43.1. Details

Level	Summary
-------	---------

Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default gain for all ports is 1 ( $\pm 4.096V$ ).
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

## 43.2. Scenarios

### 43.2.1. Scenario

1. **if** there are three valid numeric operands (board, port, gain) after "PPAIO GAIN"
  - 1.1. Write the appropriate gain setting to (board, port)
  - 1.2. Return the command line as the acknowledgement**end if**
2. **else** return syntax error as the acknowledgement (see DAQ\_UC\_014)

Extension:

- 1.a.
  1. **if** board is not in the range 1..boards
    - 1.1. Return range error as acknowledgement (see DAQ\_UC\_015)**end if**
  2. **if** port is not in the range 0..15 (0xf)
    - 2.1. Return range error as acknowledgement (see DAQ\_UC\_015)**end if**
  3. **if** gain is not in the range 0..4
    - 3.1. Return range error as acknowledgement (see DAQ\_UC\_015)**end if**

## 43.3. Requirements

### 43.3.1. DAQ\_SRS\_990\_000:PPAIO Gain Command

ID: DAQ\_UC\_040.DAQ\_SRS\_990\_000

The PPAIO **gain** command shall accept the following syntax:

`ppaio gain board port gain`

where *board* is an integer in the range 1..8 specifying the specific PPAIO board, *port* is a hexadecimal value in the range 0-F specifying the particular port on the board, and *gain* is a value in the range 0-4 representing one of the following gain adjustments:

- |    |              |
|----|--------------|
| 0: | $\pm 6.144V$ |
| 1: | $\pm 4.096V$ |
| 2: | $\pm 2.048V$ |
| 3: | $\pm 1.024V$ |
| 4: | $\pm 0.512V$ |

### 43.3.2. DAQ\_SRS\_991\_000:PPAIO Default Gain

ID: DAQ\_UC\_040.DAQ\_SRS\_991\_000

Until otherwise reprogrammed, the PPDAQ software shall use a gain of 1 (4.096V) as the default gain for all ADC channels.

### 43.3.3. DAQ\_SRS\_992\_000:PPAIO Gain Response #1

ID: DAQ\_UC\_040.DAQ\_SRS\_992\_000




If the "ppaio gain *board port gain*" command is syntactically correct, then the software shall return the command line as the response.

#### 43.4. Test Plan

Testing Setup: DAQ\_STP\_012

Testing Configurations: N/A

#### 43.5. Relationships

Relationship	From	To
 unnamed	 <a href="#">PPAIO Cmds</a>	 <a href="#">PPAIO::Gain</a>

### 44. PPAIO::Filter

ID: DAQ\_UC\_041

PPAIO FILTER command

#### 44.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default filter value is 0 (most recent)
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

#### 44.2. Scenarios

##### 44.2.1. Scenario

1. **if** there are three valid numeric arguments (board, port, filter) after "PPAIO FILTER"

1.1. Set the internal filter value for (board, port) to filter.

1.2. Return the command line as the acknowledgement

**end if**

2. **else** return a syntax error as acknowledgement (see DAQ\_UC\_014)

Extension:

1.a.

1. **if** board is outside the range 0..boards

1.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

**end if**

2. **if** port is outside the range 0..15 (0xf)

2.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

**end if**

3. **if** filter is outside the range 0..5

3.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

## 44.3. Requirements

### 44.3.1. DAQ\_SRS\_998\_000:PPAIO FILTER Command

ID: DAQ\_UC\_041.DAQ\_SRS\_998\_000

The PPAIO filter (**filter**) command shall accept the following syntax:

```
ppaio FILTER board port filter
```

where *board* is a board number in the range 1..8, *port* is a port number in the range 0-F, and *f* *ilter* is one of the following values:

- 0: Most recent reading
- 1: First reading in history list
- 2: Maximum
- 3: Minimum
- 4: Mean
- 5: Median

### 44.3.2. DAQ\_SRS\_999\_000:PPAIO FILTER Response #1

ID: DAQ\_UC\_041.DAQ\_SRS\_999\_000




If the "ppaio FILTER *board port filter*" command is syntactically correct, then the software shall return the command line as the response.

## 44.4. Test Plan

Testing Setup: DAQ\_STP\_012

Testing Configurations: N/A

## 44.5. Relationships

Relationship	From	To
 unnamed	 <a href="#">PPAIO Cmds</a>	 <a href="#">PPAIO::Filter</a>

## 45. PPAIO::AIN

ID: DAQ\_UC\_042

PPAIO AIN command

### 45.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	N/A
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 45.2. Scenarios

#### 45.2.1. Scenario

1. **if** a single valid numeric operand (board) appears after "PPAIO AIN"

1.1. Read all ADC values from an internal buffer and convert to hexadecimal strings

1.2. Return hexadecimal strings (16, one for each ADC) as the acknowledgement

end if

2. if two valid numeric operands (board, port) appear after "PPAIO AIN"

2.1. Read the ADC value from the internal buffer and convert to a hexadecimal string

2.2. Return hexadecimal string as the acknowledgement

end if

3. else return syntax error as the acknowledgement string

Extension:

1.a.

1. if the board operand is outside the range 1..boards

1.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

2.a.

1. if the board operand is outside the range 1..boards

1.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

2. if the port value is outside the range 0..15 (0xf)

2.1. Return a range error as the acknowledgement (see DAQ\_UC\_015)

end if

### 45.3. Requirements

#### 45.3.1. DAQ\_SRS\_1006\_000:PPAIO AIN Command #2

ID: DAQ\_UC\_042.DAQ\_SRS\_1006\_000

The PPAIO analog data input (**ain**) command shall accept the following syntax:

```
ppaio ain board
```

where the *board* argument is a number in the range 1..8. This reads all the input ports on the specified board.

#### 45.3.2. DAQ\_SRS\_1007\_000:PPAIO AIN Command #3

ID: DAQ\_UC\_042.DAQ\_SRS\_1007\_000

The PPAIO analog data input (**ain**) command shall accept the following syntax:

```
ppaio ain board port
```

where the *board* argument is a number in the range 1..8 and *port* is a number in the range 0..7. This the specified input port.

#### 45.3.3. DAQ\_SRS\_1008\_000:PPAIO AIN Response Value

ID: DAQ\_UC\_042.DAQ\_SRS\_1008\_000

When returning digital input data in response to a PPAIO **ain** command, the software shall return the ADC port value (16-bit hexadecimal value representing a two's complement signed number) as appropriate for each bit's filter type (most recent, first, minimum, maximum, mean, or median).

#### 45.3.4. DAQ\_SRS\_1010\_000:PPAIO AIN Response #2

ID: DAQ\_UC\_042.DAQ\_SRS\_1010\_000




In response to a "ppaio ain *board*" command, the PPDAQ software shall return the following response:

AIN: xxxx<sub>0</sub> xxxx<sub>2</sub> ... xxxx<sub>15</sub>

where xxxx represents a 4-digit (16-bit) hexadecimal number.

Note: Values corresponding to odd port numbers of a double-ended input pair are undefined.

## 45.4. Relationships

Relationship	From	To
 unnamed	 <a href="#">PPAIO Cmds</a>	 <a href="#">PPAIO::AIN</a>

## 46. PPAIO::AOUT

ID: DAQ\_UC\_043

PPAIO AOUT command

### 46.1. Details

Level	Summary
Complexity	Medium
Use Case Status	Complete
Implementation Status	Complete
Preconditions	N/A
Post-conditions	Data stored in AOUT buffers will eventually be written to DAC channels on PPAIO-16/4 board.
Author	R Hyde
Assumptions	N/A

### 46.2. Scenarios

#### 46.2.1. Scenario

1. **if** there are five valid numeric operands (board, aout0, aout1, aout2, aout3) after "PPAIO AOUT"
  - 1.1. Store the aout0..aout3 values into an internal buffer for (board), for output to the DACs
  - 1.2. Return the command line as the acknowledgement**end if**
2. **if** there are three valid numeric operands (board, port, value) after the "PPAIO AOUT"
  - 2.1. Store value into (board, port) internal buffer for output to the DAC
  - 2.2. Return command line as the acknowledgement**end if**
3. **else** return syntax error as acknowledgement (see DAQ\_UC\_014)

Extension:

- 1.a.
  1. **if** board is outside range 1..boards
    - 1.1. Return range error as acknowledgement (see DAQ\_UC\_015)**end if**
  2. **if** any of aout0..aout3 are outside the range 0..fff
    - 2.1. Return range error as acknowledgement (see DAQ\_UC\_015)**end if**

2.a.

1. **if** board is outside range 1..boards
  - 1.1. Return range error as acknowledgement (see DAQ\_UC\_015)**end if**
2. **if** port is outside the range 0..3
  - 2.1. Return range error as acknowledgement (see DAQ\_UC\_015)**end if**
3. **if** value is outside the range 0..fff
  - 3.1. Return range error as acknowledgement (see DAQ\_UC\_015)**end if**

## 46.3. Requirements

### 46.3.1. DAQ\_SRS\_1013\_000:PPAIO AOUT Command #2

ID: DAQ\_UC\_043.DAQ\_SRS\_1013\_000

The PPAIO analog data output (**aout**) command shall accept the following syntax:

```
ppaio aout board xxxx0 xxxx1 xxxx2 xxxx3
```

where the *board* argument is a number in the range 0..7. This writes all the output bits to the specified board.

Note: this command always has five numeric arguments. The argument count is how the software differentiates this command from other AOUT commands.

### 46.3.2. DAQ\_SRS\_1014\_000:PPAIO AOUT Command #3

ID: DAQ\_UC\_043.DAQ\_SRS\_1014\_000

The PPAIO analog data output (**aout**) command shall accept the following syntax:

```
ppaio aout board port xxxx
```

where the *board* argument is a number in the range 0..7, the *port* argument is a number in the range 0..3, and xxxx is a 16-bit hexadecimal value (4 hex digits). This writes the 4 output values to the specified (board, port).

Note: this command always has three numeric arguments. The argument count is how the software differentiates this command from other AOUT commands.

### 46.3.3. DAQ\_SRS\_1018\_000:PPAIO AOUT Response #4

ID: DAQ\_UC\_043.DAQ\_SRS\_1018\_000

In response to a valid "ppaio aout *board* xxx0 xxx1 xxx2 xxx3" command, the PPDAQ software shall return the command line as the acknowledgement.

### 46.3.4. DAQ\_SRS\_1022\_000:PPAIO AOUT Response #8

ID: DAQ\_UC\_043.DAQ\_SRS\_1022\_000




DAQ\_SRS\_1022\_000

## 46.4. Test Plan

Testing Setup: DAQ\_STP\_012

Testing Configurations: N/A

## 46.5. Relationships

Relationship	From	To
 unnamed	 PPAIO Cmds	 PPAIO::AOUT



## 47. PPAIO::Type

ID: DAQ\_UC\_044

PPAIO TYPE command

### 47.1. Details

Level	Summary
Complexity	Low
Use Case Status	Complete
Implementation Status	Complete
Preconditions	Default type setting for all ports is 0 (single-ended)
Post-conditions	N/A
Author	R Hyde
Assumptions	N/A

### 47.2. Scenarios

#### 47.2.1. Scenario

1. **if** three valid numeric operands (board, port, value) follow "PPAIO TYPE"
  - 1.1. Set the internal (board, port) type to value
  - 1.2. Return command line as acknowledgement**end if**
2. **else** return syntax error as acknowledgement (see DAQ\_UC\_014)

Extension:

- 1.a.
  1. **if** board is outside the range 1..boards
    - 1.1. Return a range error as acknowledgement (see DAQ\_UC\_015)**end if**
  2. **if** port is outside the range 0..3
    - 2.1. Return a range error as acknowledgement (see DAQ\_UC\_015)**end if**
  3. **if** valid is outside the range 0..1
    - 3.1. Return a range error as acknowledgement (see DAQ\_UC\_015)**end if**

### 47.3. Requirements

#### 47.3.1. DAQ\_SRS\_1028\_000:PPAIO TYPE Command #1

ID: DAQ\_UC\_044.DAQ\_SRS\_1028\_000

The PPAIO **type** command shall accept the following syntax:

```
ppaio type board port se_de
```

where the *board* argument is a number in the range 0..7, the *port* argument is a number in the range 0..F, and *se\_de* is either zero (single-ended) or 1 (double-ended/differential).

Note: The type is always written to the even/odd pair (because setting one port single- or double-ended always affects the even/odd pair).

#### 47.3.2. DAQ\_SRS\_1033\_000:PPAIO TYPE Response #5

ID: DAQ\_UC\_044.DAQ\_SRS\_1033\_000

In response to a "ppaio type *board port se\_de*" command where the command is valid, the software shall return the following acknowledgement:

```
ppaio type: x \n
```

where 'x' is '0' or '1' representing single-ended operation or double-ended operation, respectively.

47.4. Test Plan

Testing Setup: DAQ\_STP\_012

Testing Configurations: N/A