



**HF Controls**

**HF CONTROLS CORPORATION  
HFC-FPGA Amendment 4  
Open Item Draft Response  
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**Rev A**

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Approved By: Steve Yang

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### Revision History

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1/21/2020	A0	Jordan Mott	Initial Draft
1/22/2020	A1	Jordan Mott	Post 1/22 meeting comments
2/6/2020	A	Jordan Mott	Release

### Table of Contents

Section	Title	Page
1	SCOPE.....	4
2	CLARIFICATION FOR HFC-FPGA FCPU/X.....	4
2.1	APPLICATION PROCESSING FLOW.....	4
2.1.1	Clarification for PROGRAMMING.....	6
2.1.2	CLARIFICATION FOR SYSTEM COMMUNICATION CONFIGURATION .....	6
2.2	HFC-FPGA FCPUX CONTROLLER BOOTUP (D-20, D-22, D-64).....	7
2.3	CONTROL FPGA NORMAL OPERATION (D-22, D-14).....	8
2.3.1	TOKEN ENGINE PROCESS CYCLE (D-22, D-44, D-64) .....	8
2.3.2	F-LINK DESIGN CLARIFICATION (D-22, D-64).....	10
2.3.2.1	F-LINK DATA FLOW – (D-15).....	10
2.3.2.2	F-LINK MFM CONTROL.....	10
2.3.3	G-LINK (D-16, D-38, D-45) .....	11
2.3.4	APPLICATION PROCESSING DESIGN CLARIFICATION (D-40) .....	12
2.3.4.1	Application Defined Data movement (D-38, D-72).....	13
2.3.4.2	CQ4 Algorithm Verification.....	14
2.3.4.3	Application Defined Timer Processing.....	15
2.3.4.4	Application Defined Digital Logic Processing (D-18, D-19) .....	15
2.3.4.5	Quality Data (D-18) .....	16
2.3.5	REDUNDANCY INTERFACE – RIF (D-17).....	17
2.3.6	CONTROL/DIAGNOSTIC FPGA CLOCK DOMAINS (D-41) .....	18
2.4	DIAGNOSTIC FPGA NORMAL OPERATION (D-48).....	19
3	HFC-FPGA WATCHDOG MECHANISMS .....	21
3.1	WATCHDOG NORMAL OPERATION (D-20).....	21
3.1.1	DIAGNOSTIC FPGA EXTERNAL RESET WATCHDOG (D-9, D-11).....	21
3.1.2	DIAGNOSTIC HEARTBEAT SEQUENCE (D-7, D-12, D-49-52) .....	22
3.1.3	APPLICATION PROCESSING WATCHDOG (D-8, D-10, D-13) .....	23
3.1.4	WATCHDOG ELEMENT OPERATION TIMING DEPENDANCE (D-6) .....	24
4	HFC-FPGA G-LINK GATEWAY (D-38-39, D-46, D-59, D68-72).....	25
4.1	PROCESSOR AND FPGA NORMAL OPERATION .....	26
4.1.1	G-LINK DOWNLOAD DATA TRANSFER.....	26
4.1.2	G-LINK DATA TRANSFER – UPLOAD .....	27
4.1.3	G-LINK DOWNLOAD DATA TYPES (D-74).....	29
5	ANALOG INPUT CALIBRATION (D-73) .....	30

6	HFC-FPGA DEVICE FABRIC RESOURCE USAGE (D-60).....	32
7	DIAGNOSTIC SUMMARY .....	33
8	Appendix .....	35

**List of Figures**

Figure 1	Application Processing Flow Using OneStep.....	4
Figure 2	Platform and Application Digital Logic Interfaces.....	5
Figure 3	HFC FPGA Node Station ID Configuration .....	6
Figure 4	FCPUX System Boot Block Diagram.....	7
Figure 5	HFC FPGA Controller Startup to Normal Operation.....	8
Figure 6	FCPUX Token Engine Process Enable Sequence .....	9
Figure 7	HFC FPGA Normal Operation Process Dataflow .....	10
Figure 8	F-LINK MFM Control Flow Diagram.....	11
Figure 9	F-LINK DATA FLOW DETAIL BLOCK DIAGRAM.....	11
Figure 10	G-Link Data Flow Block Diagram .....	12
Figure 11	Application Processing Data Flow Block Diagram.....	12
Figure 12	CQ4 Block Test Block Diagram .....	15
Figure 13	Application Digital Logic Input and Output.....	16
Figure 14	RIF Data Flow Block Diagram .....	18
Figure 15	Control/Diagnostic FPGA Clock Domain Block Diagram .....	19
Figure 16	Control/Diagnostic Functional Role Block Diagram .....	20
Figure 17	FPGA Module Watchdog Block Diagram.....	21
Figure 18	External Watchdog Circuit .....	22
Figure 19	Sequence Number Diagnostic Flow .....	23
Figure 20	Application Watchdog Flow Chart .....	24
Figure 21	Interface between FPGA and CPU of HFC-FPC08 G-Link Gateway .....	26
Figure 22	G-Link Control Block Diagram .....	28
Figure 23	G-Link Control State Flow .....	29
Figure 24	Analog Input Calibration Circuit Block Diagram.....	30
Figure 25	Analog Input Correction Algorithm.....	31

**List of Tables**

Table 1	List of Configurable Hard-core Blocks Used by HFC-FPGA Platform .....	32
Table 2	Cross Reference Table .....	35

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# 1 SCOPE

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## 2 CLARIFICATION FOR HFC-FPGA FCPU/X

### 2.1 APPLICATION PROCESSING FLOW

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*Figure 1 Application Processing Flow Using OneStep*

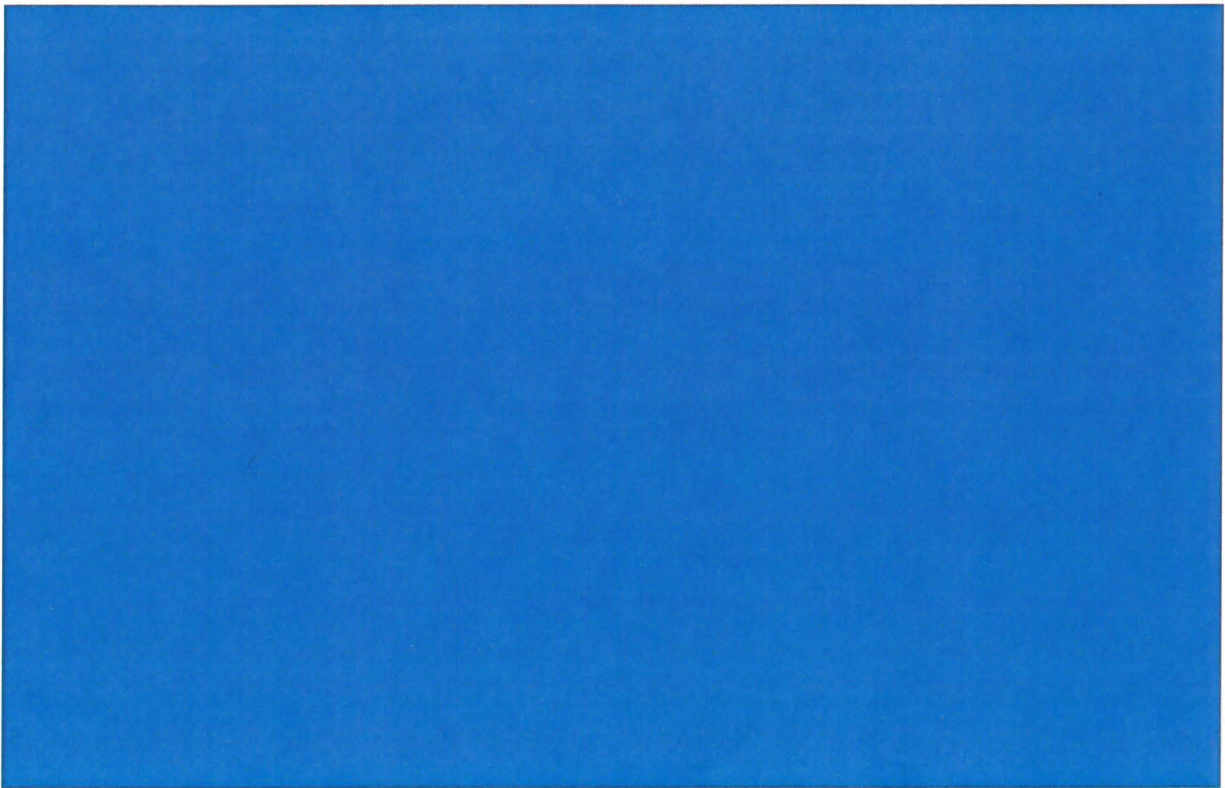
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*Figure 2 Platform and Application Digital Logic Interfaces*

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2.1.1 Clarification for PROGRAMMING

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2.1.2 CLARIFICATION FOR SYSTEM COMMUNICATION CONFIGURATION

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*Figure 3 HFC FPGA Node Station ID Configuration*

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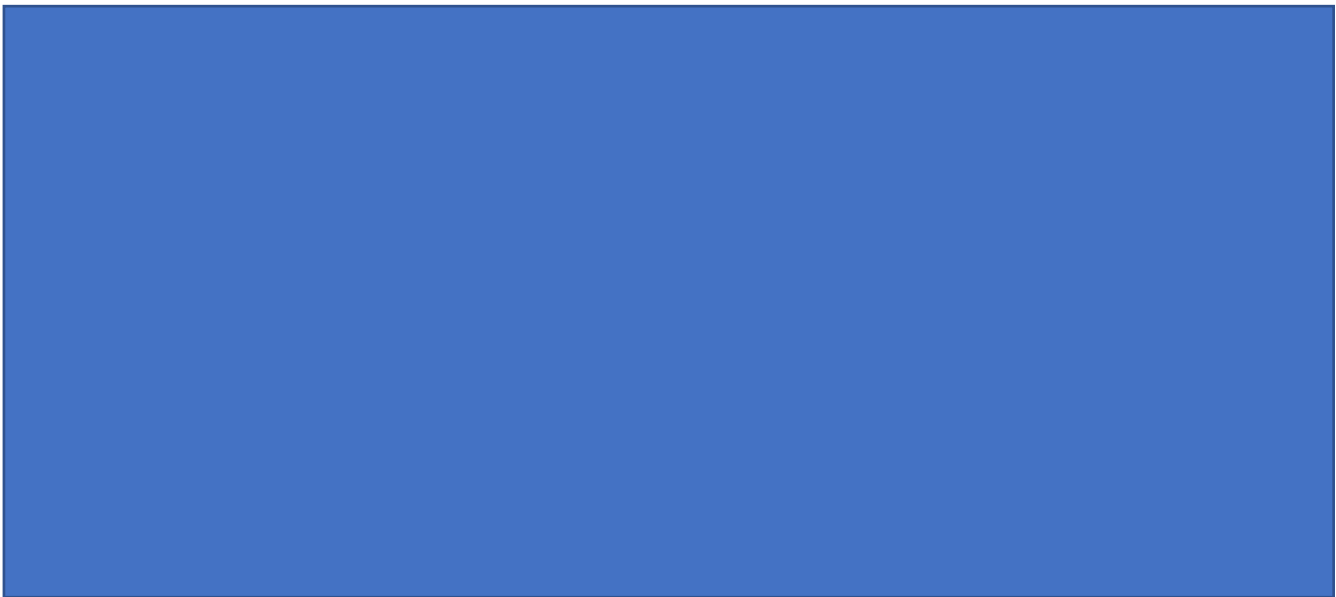
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2.2 HFC-FPGA FCPUX CONTROLLER BOOTUP (D-20, D-22, D-64)

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*Figure 4 FCPUX System Boot Block Diagram*

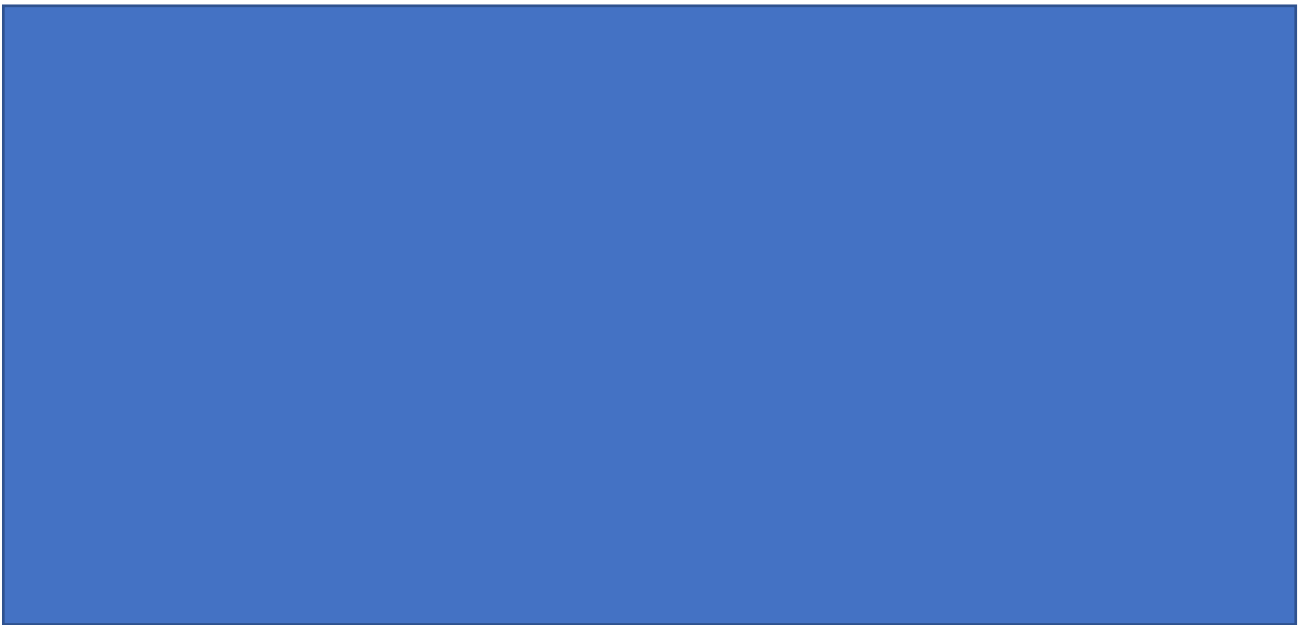
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*Figure 5 HFC FPGA Controller Startup to Normal Operation*

2.3 CONTROL FPGA NORMAL OPERATION (D-22, D-14)

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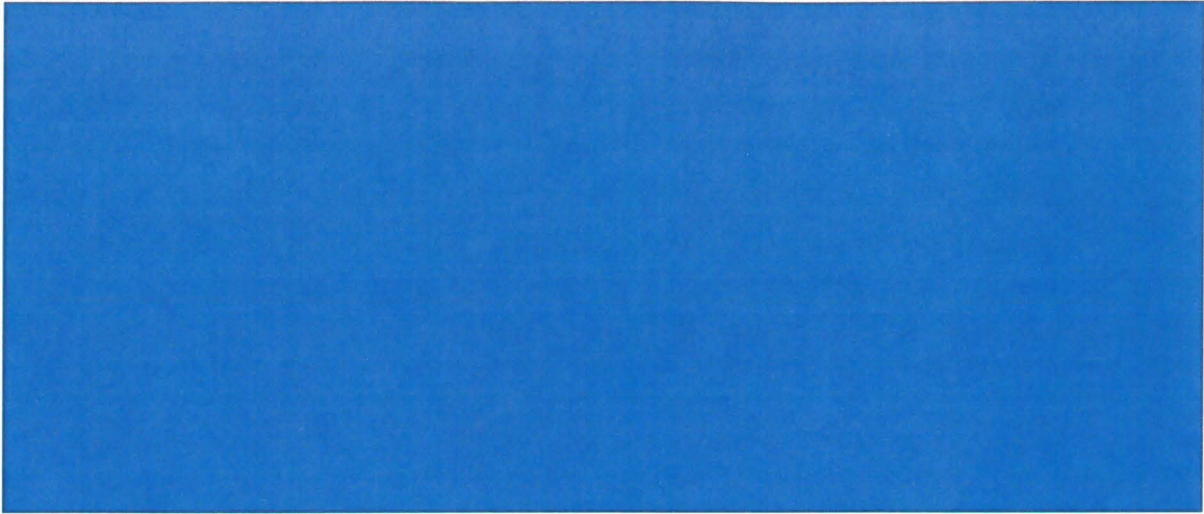
2.3.1 TOKEN ENGINE PROCESS CYCLE (D-22, D-44, D-64)

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*Figure 6 FCPUX Token Engine Process Enable Sequence*

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*Figure 7 HFC FPGA Normal Operation Process Dataflow*

2.3.2 F-LINK DESIGN CLARIFICATION (D-22, D-64)

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2.3.2.1 *F-LINK DATA FLOW – (D-15)*

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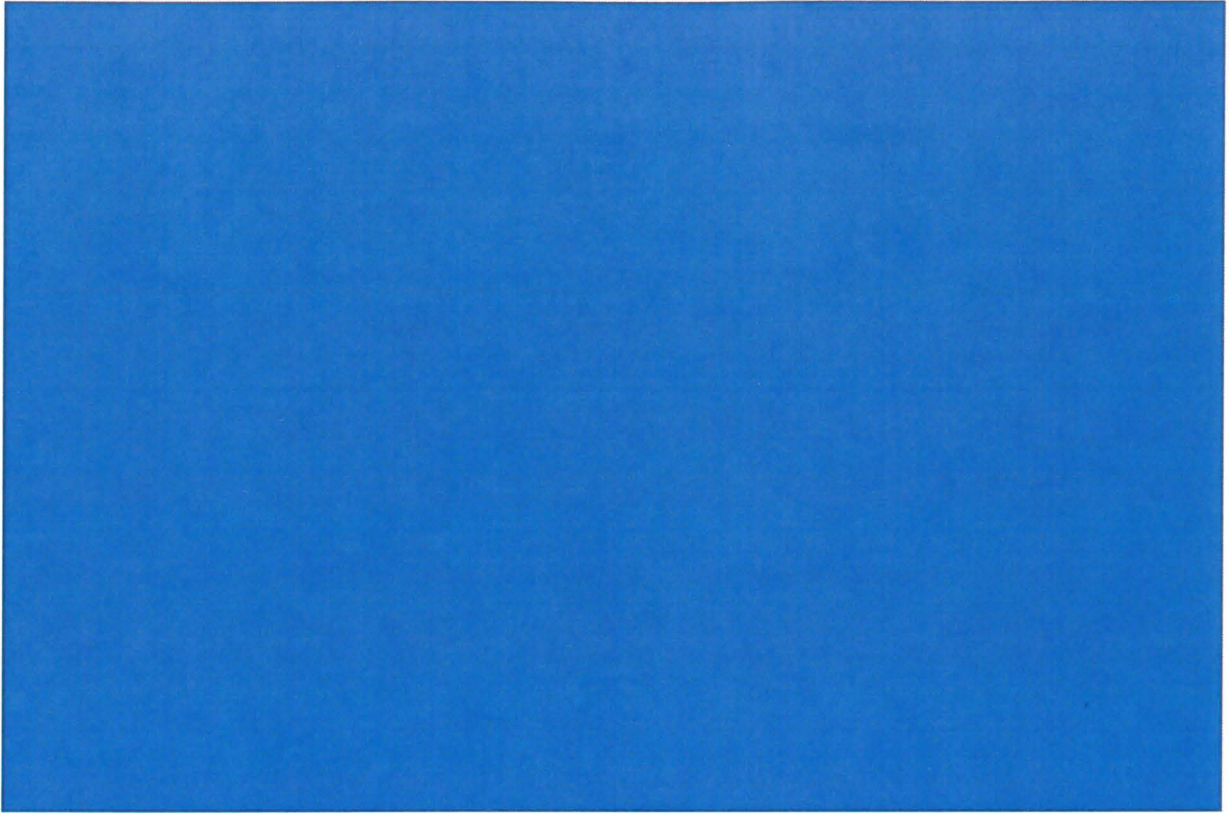
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2.3.2.2 *F-LINK MFM CONTROL*

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*Figure 8 F-LINK MFM Control Flow Diagram*



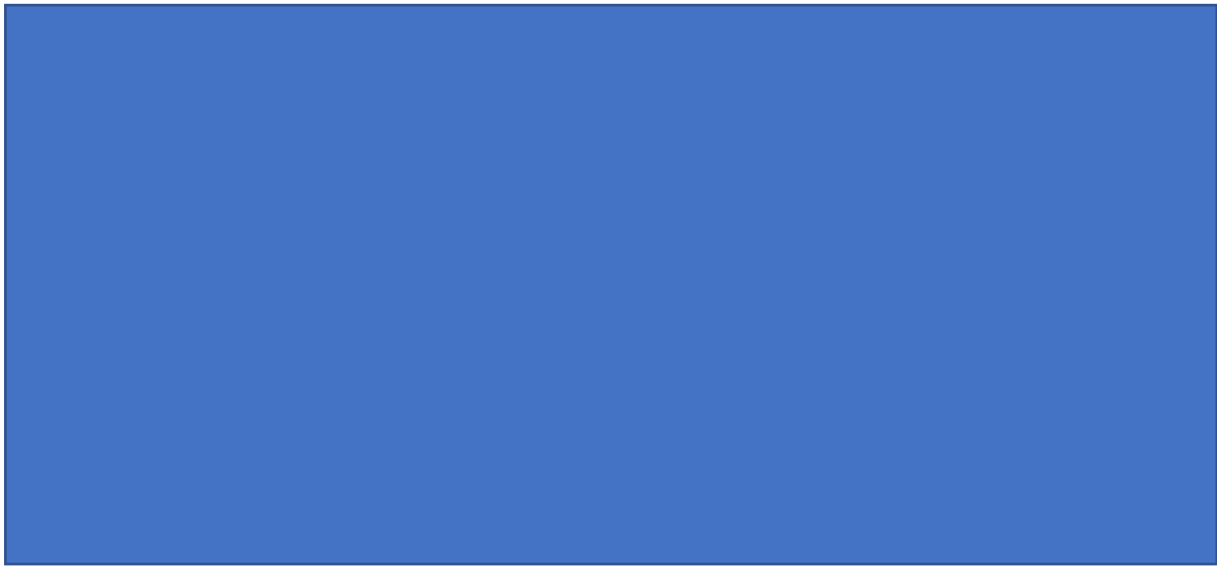
*Figure 9 F-LINK DATA FLOW DETAIL BLOCK DIAGRAM*

2.3.3 G-LINK (D-16, D-38, D-45)

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*Figure 10 G-Link Data Flow Block Diagram*

2.3.4 APPLICATION PROCESSING DESIGN CLARIFICATION (D-40)

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*Figure 11 Application Processing Data Flow Block Diagram*

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2.3.4.1 *Application Defined Data movement (D-38, D-72)*

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2.3.4.2 CQ4 Algorithm Verification

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*Figure 12 CQ4 Block Test Block Diagram*

2.3.4.3 *Application Defined Timer Processing*

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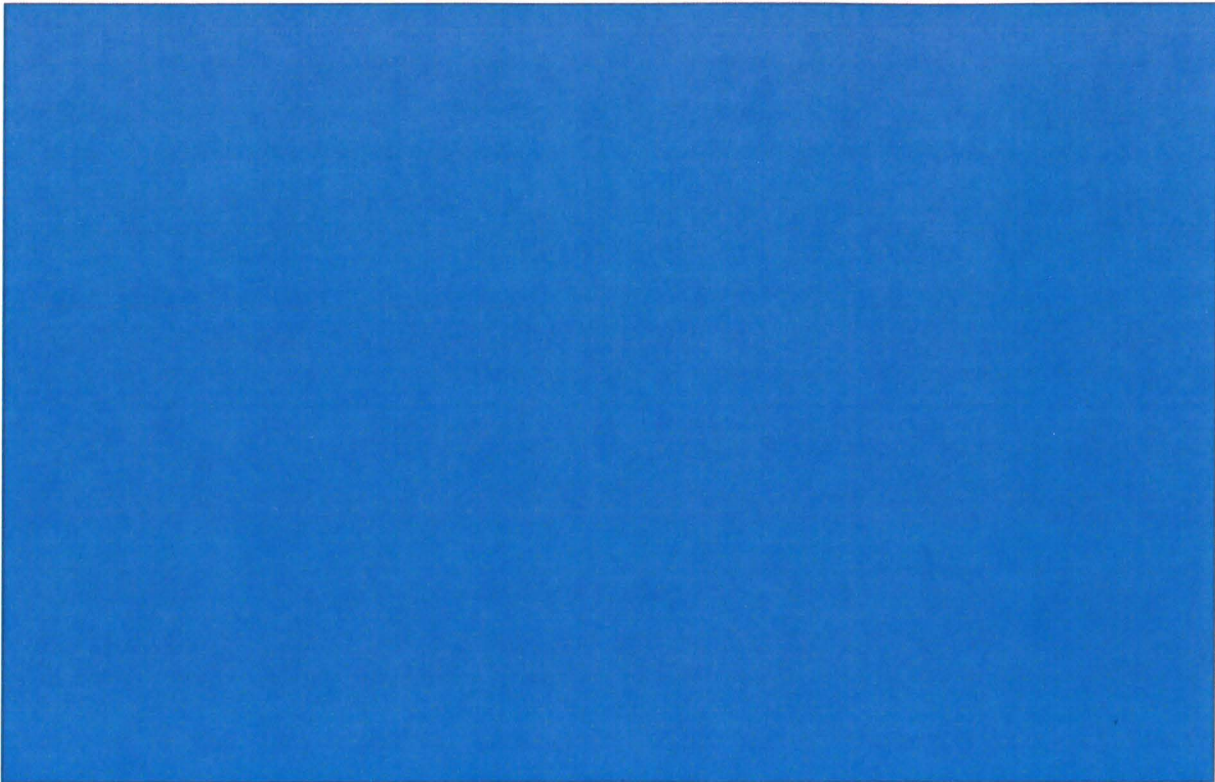
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2.3.4.4 *Application Defined Digital Logic Processing (D-18, D-19)*

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*Figure 13 Application Digital Logic Input and Output*

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2.3.4.5      *Quality Data (D-18)*

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2.3.5 REDUNDANCY INTERFACE – RIF (D-17)

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*Figure 14 RIF Data Flow Block Diagram*

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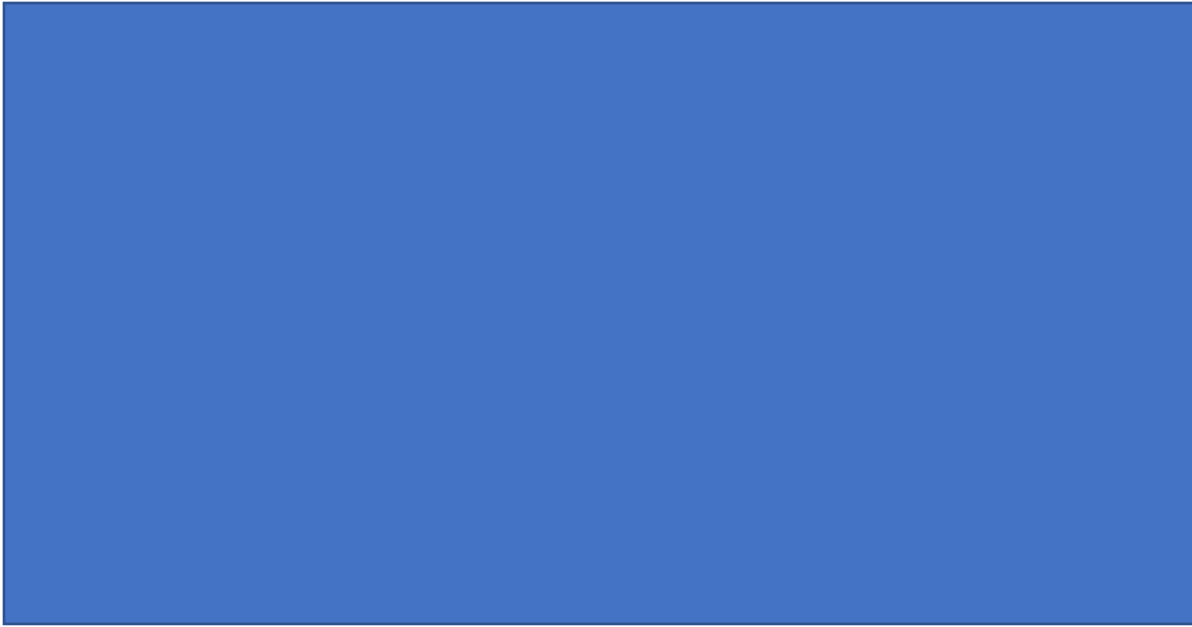
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2.3.6 CONTROL/DIAGNOSTIC FPGA CLOCK DOMAINS (D-41)

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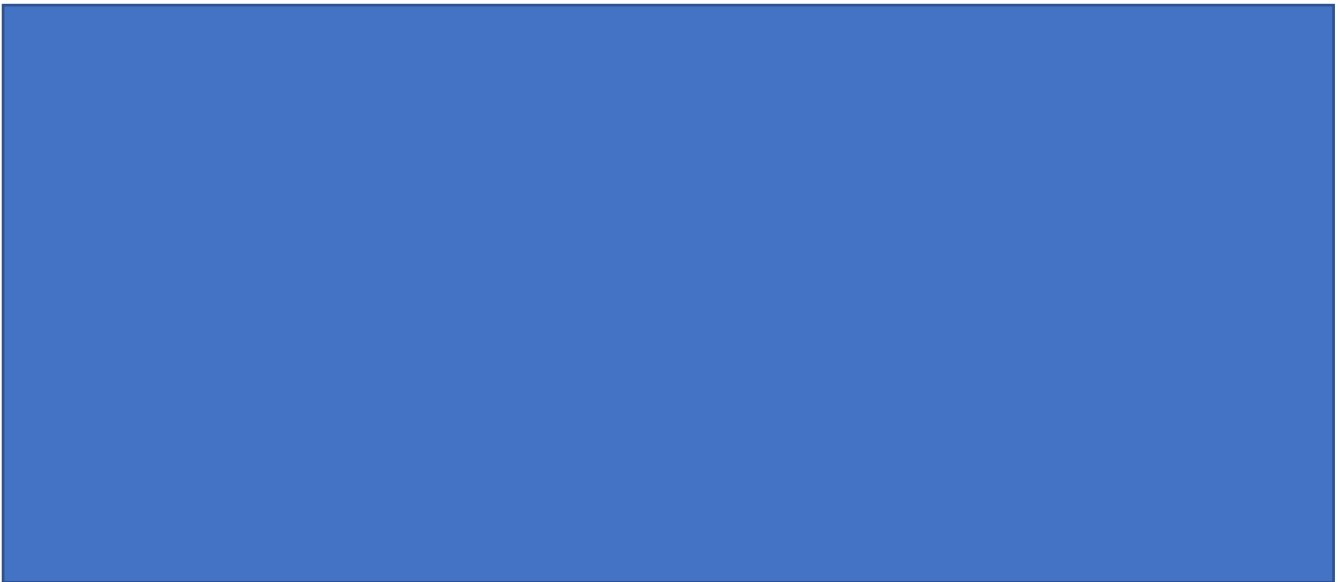


*Figure 15 Control/Diagnostic FPGA Clock Domain Block Diagram*

2.4 DIAGNOSTIC FPGA NORMAL OPERATION (D-48)

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*Figure 16 Control/Diagnostic Functional Role Block Diagram*

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### 3 HFC-FPGA WATCHDOG MECHANISMS

#### 3.1 WATCHDOG NORMAL OPERATION (D-20)

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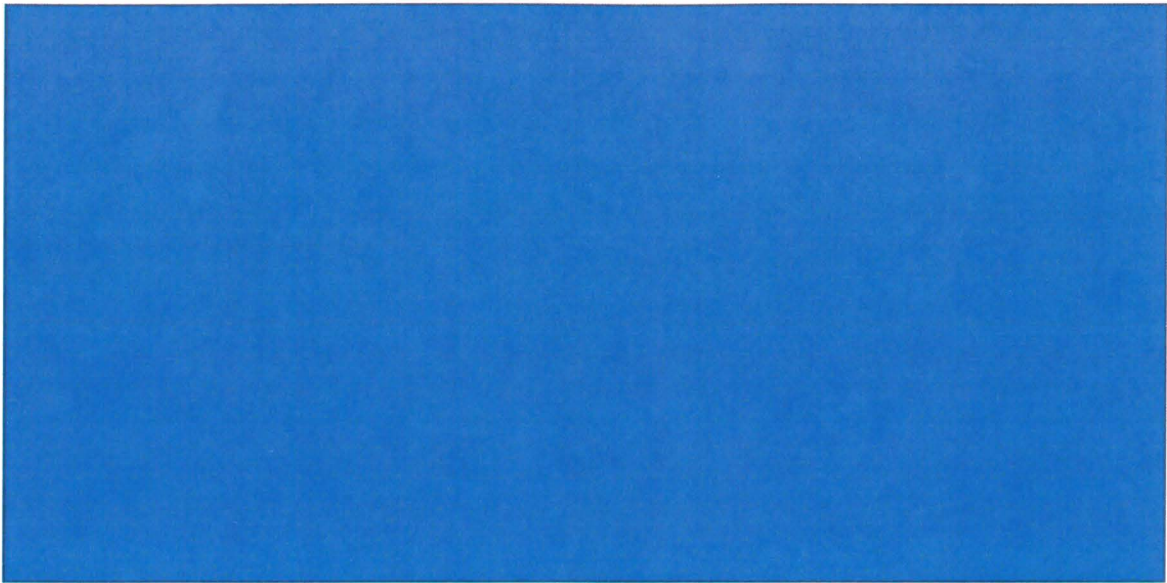
*Figure 17 FPGA Module Watchdog Block Diagram*

#### 3.1.1 DIAGNOSTIC FPGA EXTERNAL RESET WATCHDOG (D-9, D-11)

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*Figure 18 External Watchdog Circuit*

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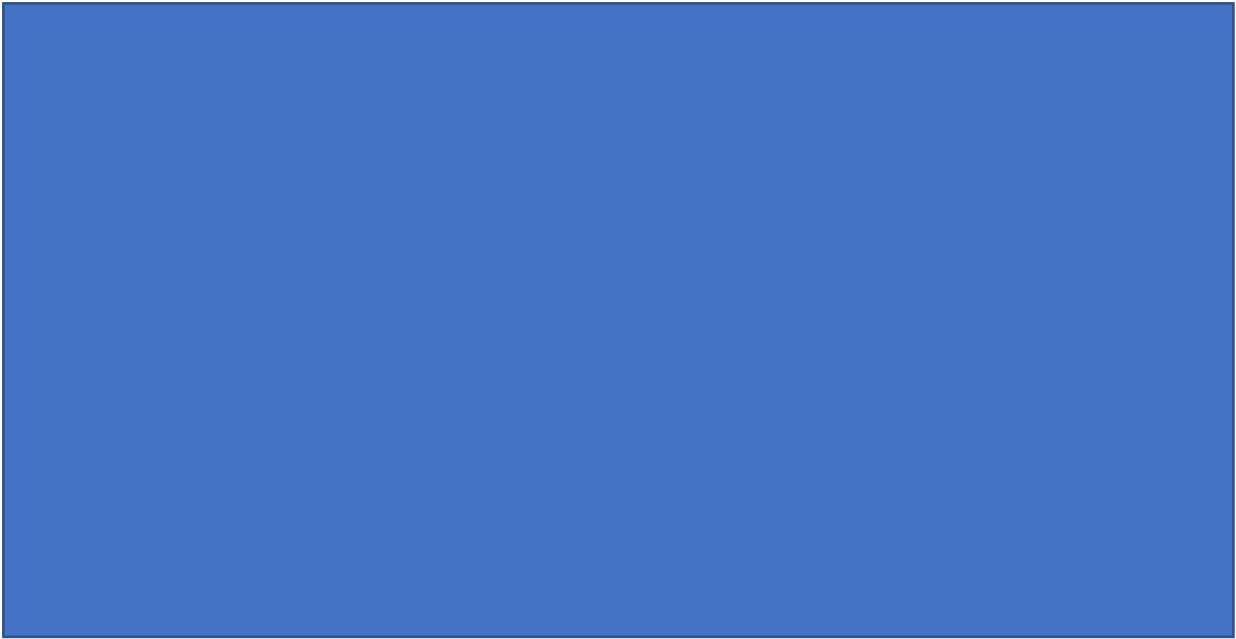
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3.1.2 DIAGNOSTIC HEARTBEAT SEQUENCE (D-7, D-12, D-49-52)

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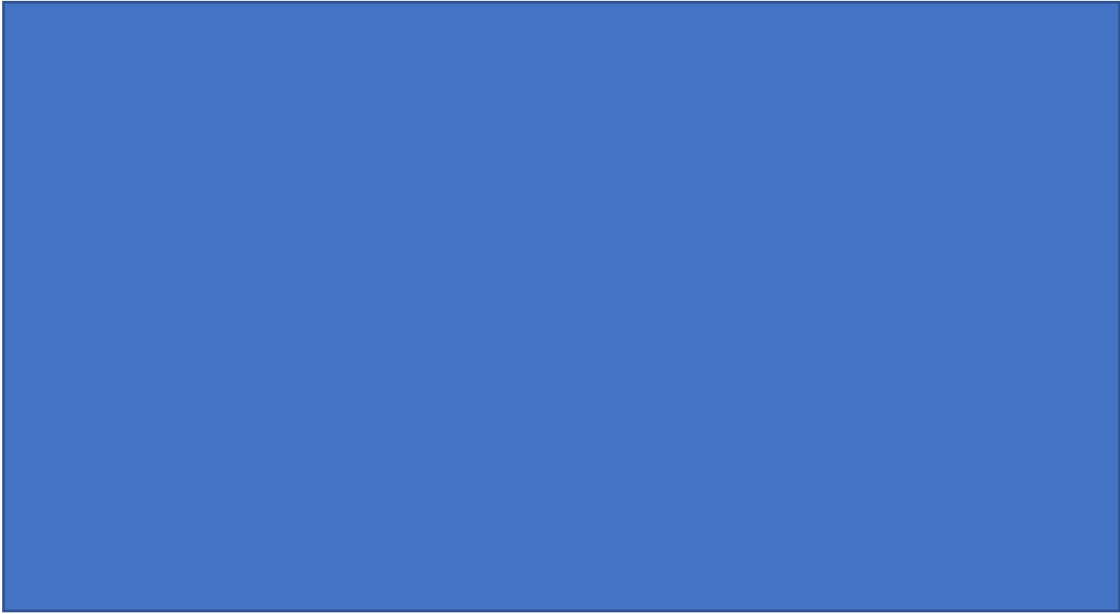
*Figure 19 Sequence Number Diagnostic Flow*

3.1.3 APPLICATION PROCESSING WATCHDOG (D-8, D-10, D-13)

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*Figure 20 Application Watchdog Flow Chart*

3.1.4 WATCHDOG ELEMENT OPERATION TIMING DEPENDANCE (D-6)

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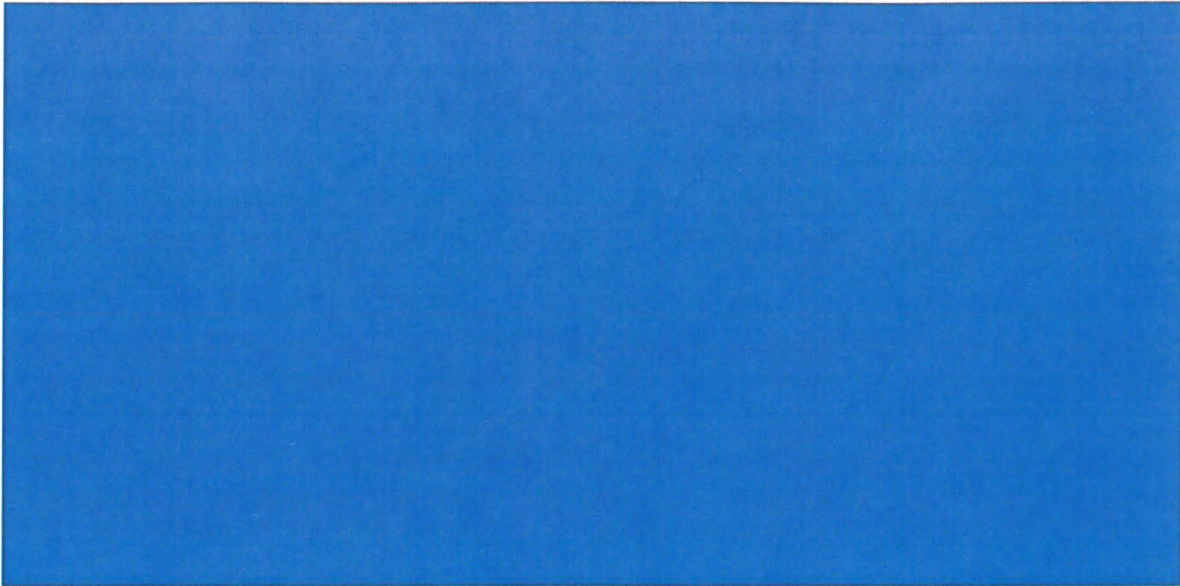
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4 HFC-FPGA G-LINK GATEWAY (D-38-39, D-46, D-59, D68-72)

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*Figure 21 Interface between FPGA and CPU of HFC-FPC08 G-Link Gateway*

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4.1 PROCESSOR AND FPGA NORMAL OPERATION

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4.1.1 G-LINK DOWNLOAD DATA TRANSFER

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4.1.2 G-LINK DATA TRANSFER – UPLOAD

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*Figure 22 G-Link Control Block Diagram*

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*Figure 23 G-Link Control State Flow*

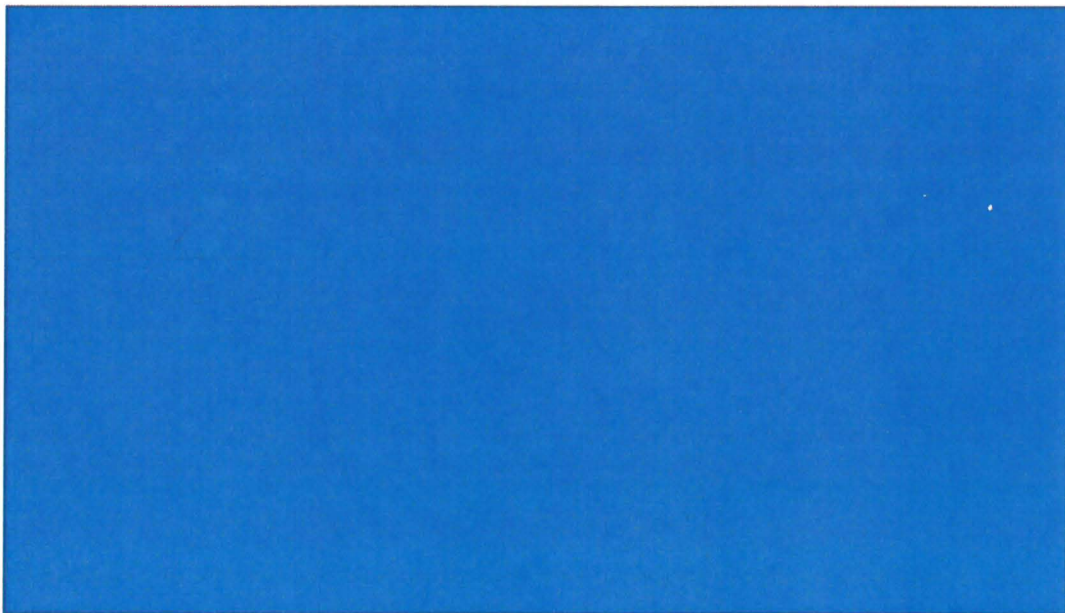
4.1.3 G-LINK DOWNLOAD DATA TYPES (D-74)

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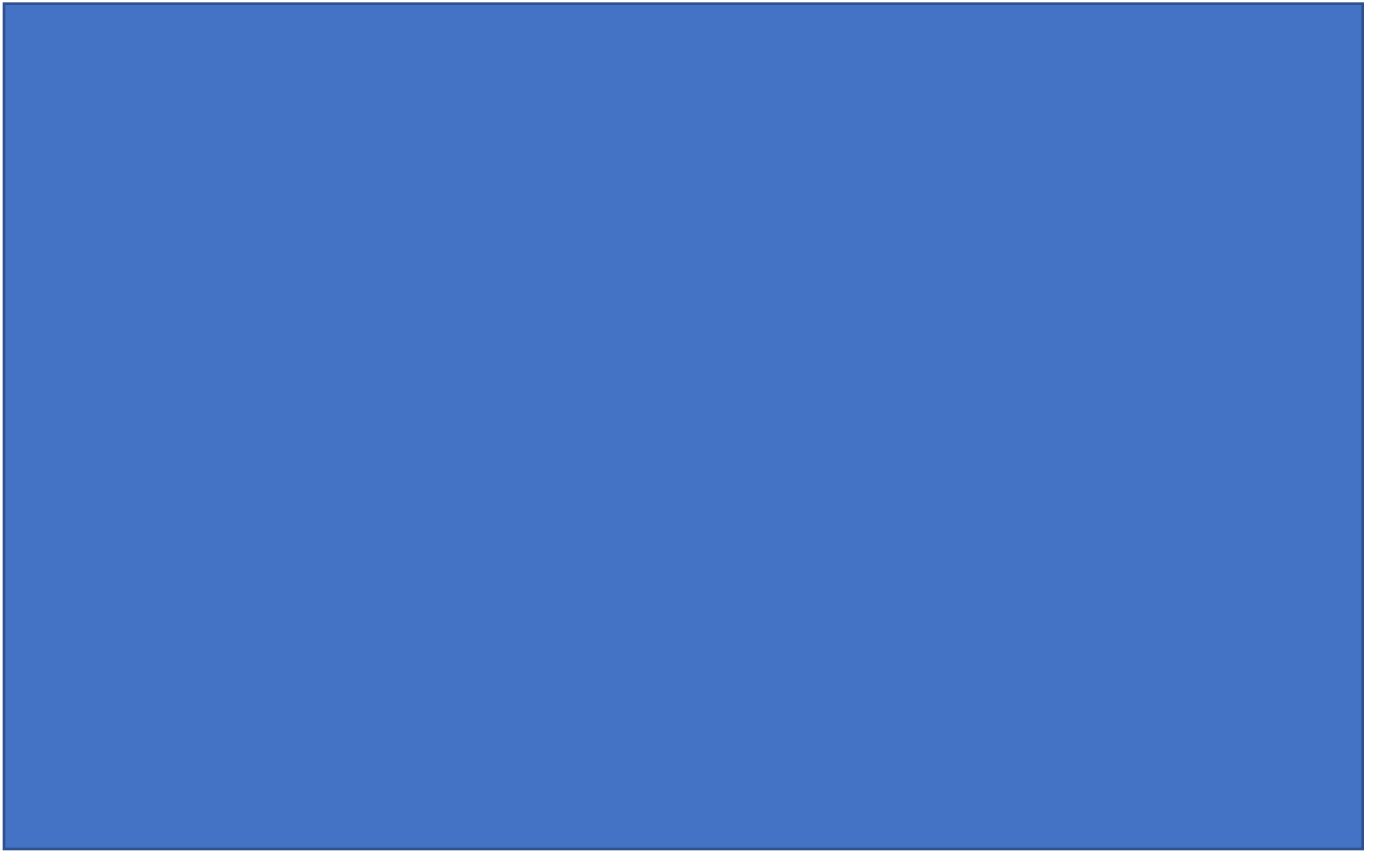
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## ANALOG INPUT CALIBRATION (D-73)



*Figure 24 Analog Input Calibration Circuit Block Diagram*

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*Figure 25 Analog Input Correction Algorithm*

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## HFC-FPGA DEVICE FABRIC RESOURCE USAGE (D-60)

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*Table 1 List of Configurable Hard-core Blocks Used by HFC-FPGA Platform*



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**7**                    **DIAGNOSTIC SUMMARY**  
(D-6, D-10, D-20, D-27, D-47, D-49, D-50, D-62, D-63, D-51)

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8 Appendix  
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*Table 2 Cross Reference Table*

