

RDBE External Interface

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Table of Contents

1OVERVIEW.....	4
2RDBE SERVER VSI-S BASE COMMAND SET.....	4
2.1INITIALIZATION.....	4
2.1.1DBE_PERSONALITY – SET / GET THE DBE FPGA BIT CODE PERSONALITY.....	4
2.1.2BC_MODES – SET / GET THE DBE FPGA BIT CODE MODE.....	5
2.2TIMING.....	5
2.2.1DBE_CLOCK_SET – SPECIFY THE CLOCK PARAMETERS	5
2.2.2DBE_DOT – GET THE DATA OBSERVABLE TIME (DOT) CLOCK INFORMATION (QUERY ONLY)	6
2.2.3DBE_DOT_SET – SET THE DOT CLOCK ON NEXT 1PPS TIC.....	6
2.2.4DBE_DOT_INC – INCREMENT THE DOT CLOCK.....	7
2.3GENERAL COMMANDS.....	7
2.3.1STATUS – GET SYSTEM STATUS (QUERY ONLY).....	7
2.3.2DBE_SW_VERSION – GET THE DBE COMMAND / CONTROL SOFTWARE VERSION NUMBERS (QUERY ONLY).....	8
2.4DATA MODE.....	8
2.4.1DATA COMMUNICATION COMMANDS.....	8
2.4.2DBE_IFCONFIG – SET / GET DBE 10G NETWORK INTERFACE CONFIGURATION.....	8
2.4.3DBE_ARP – SET / GET THE IP TO MAC ADDRESS RESOLUTION ...	9
2.4.4DBE_TID2ADDR – SET / GET THE THREAD ID ASSOCIATION RESOLUTION TO EITHER DESTINATION IP OR MAC ADDRESS	9
2.5PACKET FORMAT COMMANDS.....	10
2.5.1DATA_FORMAT – SET / GET DATA TRANSMISSION MODE.....	10
2.5.2PACKET – SET / GET PACKET TRANSMISSION CRITERIA.....	10
2.6DATA TRANSFER.....	12
2.6.1DATA_XFER – SEND A VALID DATA STREAM OUT OF THE DBE ON/OFF.	12
2.7APPLICATION COMMANDS?.....	13
2.7.1QUANTIZE_SEED – SET / GET CHANNEL QUANTIZATION SEED. .	13
2.7.2QUANTIZE – GET PRESENT CHANNEL QUANTIZATION DATA (QUERY ONLY).....	13
2.7.3CMD – SET / GET TEMPLATE.....	13

1 **OVERVIEW**

This document describes the externally visible VSI-S compatible commands recognized by the RDBE server software running on the Roach board.

2 **RDBE SERVER VSI-S BASE COMMAND SET**

The DBE version 2 system has functionality that was once located in the Mark5 unit but that has now been moved to the generating source. The specified command set reflects this utilizing commands that were previously issued to the Mark5B system. In addition newer commands are required to add support for features that previously did not exist for communicating to the Mark5C recording system. The command set will be presented as set of commands and queries separated into 4 main categories: Initialization, Timing, General and Data Mode, that were presented in the DBE Software Command Requirement Document Memo. From the external application perspective, the RDBE software recognize the following commands:

Command	Description	Comment
rdbe_personality	set / get the DBE FPGA bit code personality	
mode	set / get data transmission mode	
rdbe_clock_set	set – set the clock parameters	
rdbe_DOT	Get the Data Observable Time (DOT) clock information (query only)	
rdbe_DOT_set	set the DOT clock on next 1pps tic	
rdbe_DOT_inc	Increment the DOT clock	
status	get system status (query only)	
rdbe_sw_version	get the software version information from the DAS	
rdbe_ifconfig	set / get DBE 10G network interface configuration	
rdbe_tid2addr	set / get the channel ID association resolution to either IP or MAC address	
rdbe_arp	set / get the IP to MAC address resolution	
packet	set / get packet transmission criteria	
data_xfer	send a valid data stream out of the DBE ON/OFF	
data_format	Set the packet format mode to either the Mark5C native mode or Mark5B compatibility mode	
quantize_seed	set / get the seed for the gain settings	
quantize_<chid>	Get channel quantization values - Query	

2.1 **INITIALIZATION**

2.1.1 **db_e_personality – set / get the DBE FPGA bit code personality**

Command: → db_e_personality = <type> : [<location>] ;
← !db_e_personality = <return code>;

Query: → db_e_personality?;
← !db_e_personality ? <return code>: <type> : <version> ;;

Purpose: Specify the FPGA bit code personality. The personality will support the two primary operating modes of the DDS, the poly phase filter bank (PFB) or the baseband converter (BBC).

Settable Parameters:

Parameter	type	allowed Values	Comments
type	char	BBC PFBG PFBA	BBC bit code type PFB Geodetic bit code type PFB Astronomy bit code type
location	char		file and system path (see Note 1)

Notes:

1. There will be a default location and file name of the bit code load. If there is another location that the bit code should be loaded from it should be specified here, along with the filename

2.1.2 bc_modes – set / get the DBE FPGA bit code mode

Command: → bc_modes = <type> : <location>] ;
← !bc_modes = <return code>;

Query: → bc_modes? ;
← !bc_modes ? <return code>: <type> : <version> ;

Purpose: Depending on the implementation of the FPGA bit code this is an optional command to provide additional information to further determine the appropriate bit code to load.

Settable Parameters:

Parameter	type	allowed Values	Comments
type	char	BBC PFBG PFBA	BBC bit code type PFB Geodetic bit code type PFB Astronomy bit code type
location	char		file and system path (see Note 1)

2.2 TIMING

Since functionality of the Mark5B has been transferred to the DBE, a set of commands from the Mark5B will be renamed, “dbe_cmd”, but the functionality essentially the same. Those commands are listed here.

2.2.1 dbe_clock_set – Specify the clock parameters

Command: → dbe_clock_set = <clock freq> : <clock source > : [<clock-generator freq>] ;

← !dbe_clock_set = <return code>;

Query: → dbe_clock_set?;

← !dbe_clock_set ? <return code>: <clock freq> : <clock

source> : [<clock-generator freq>];

Purpose: To specify the dbe’s clocking source driving the DAS.

Settable Parameters:

Parameter	type	allowed Values	Comments
clock freq			
clock source	ascii	ext/int	The default is external 1pps, but if tvgr this should be int.
clock-freq generator			

clock Monitor Only Parameters:

Parameter	type	allowed Values	Comments

Notes:

2.2.2 db_e_DOT - Get the Data Observable Time (DOT) clock information (query only)

Query: → db_e_dot?;
 ← !db_e_dot ? <return code> : <current DOT reading> : <sync status> : <FHG status> : <current OS time> : <DOT-OS difference>;
Purpose: Get the DOT clock information

Monitor Only Parameters:

Parameter	type	allowed Values	Comments
current DOT reading	time		Current value of DOT clock.
sync status	char	not_synced syncerr_eq_0 syncerr_le_3 syncerr_gt_3	'not_synced' - DOT 1pps generator has not yet been sync'ed. See Note 1. 'syncerr_eq_0' - DOT 1pps tick is exactly coincident with selected external 1pps tick. See Note 2. 'syncerr_le_3' - DOT 1pps tick within +/-2 clock cycles of selected external 1pps tick. 'syncerr_gt_3' - DOT 1pps tick more +/-3 clock cycles from selected external 1pps tick
FHG status	char	FHG_off FHG_on	'FHG_off' - Frame Header Generator is not running (<current DOT reading> is software estimate) 'FHG_on' - FHG is running (<current DOT reading> is read from hardware FHG). See Note 3.
current OS time	time		Corresponding OS time
DOT-OS difference	time		<current DOT reading> minus <current OS time>

Notes:

2.2.3 db_e_dot_set - set the DOT clock on next 1pps tick

Command: → db_e_dot_set = <time > : [<option >] ;
 ← !db_e_dot_set = <return code>;
Query: → db_e_dot_set?;
 ← !db_e_dot_set? <return code>: <time> : <option> : <time offset>;
Purpose: Set the initial value of the DBE's DOT clock on the next tick of the selected 1pps source.

Settable Parameters:

Parameter	type	allowed Values	Comments
time	time	null time	DOT Clock can only be set to an integer second value. See Note 1. If null the dot clock is set according to the current OS time.
option	char	null force	If "force", 1pps generator will be re-synced even though the DOT_synced status indicates it is not already sync'ed

Monitor Only Parameters:

Parameter	type	allowed Values	Comments
time	time		includes all inferred higher order time that was not explicitly in the command value.
option	char		
time offset	time		estimated interval

Notes:

1. The <time> value should be set according to the vdif reference epoch, regardless of Mark5B or vdif formatted data. For Mark5B formatted data, the vdif reference time will be added to the that is set. For Mark5B

2.2.4 db_e_dot_inc - Increment the DOT clock

Command: → db_e_dot_inc = <inc > ;
 ← !db_e_dot_inc = <return code>;

Query: → db_e_dot_inc? ;
 ← !db_e_dot_inc ? <return code>: <inc> ;

Purpose: Increment the DOT clock time by a specified number of seconds

Settable Parameters:

Parameter	type	allowed Values	Comments
inc	int		Number of seconds to increment DOT clock (may be positive or negative). >0 will advance the DOT clock setting; <0 will retard the DOT clock setting

Monitor Only Parameters:

Parameter	type	allowed Values	Comments
inc	int		

Notes:

1. The DOT_inc command should be used to adjust an error in the DOT clock only after the DOT clock has been synchronized to an external 1pps tick with the 'DOT_set' command.

2.3 GENERAL COMMANDS

The general commands and queries features associated with the general setup of the DDS. They focus on the digital channel-gain mode, the channel gains, ADC sample statistics and channel sample statistics. These commands are further separated between the DBEV2 and the VDBE general commands.

2.3.1 status - get system status (query only)

Query: → status? ;
 ← !status ? <return code>: <status word> ;

Purpose: Get general system status

Monitor Only Parameters:

Parameter	type	Bit Value	Comments
Status word	hex	0x0001	Bit 0 – system ready Bit 1 – error messages pending Bit 2 – system command has control of FPGA Bit 3- ‘delayed completion’ commands pending Bit 4- ‘delayed completion’ queries pending Bit 5- Bit 6- Transmitting data marked data Bit 7- Transmitting data marked invalid

2.3.2 DBE_sw_version – Get the DBE command / control software version numbers (query only)

Query: → dbe_sw_version?;
← !dbe_sw_version ? <return code>: <DBE application version> : <HAL Library version> : [<OS / Kernel version>];

Purpose: To determine the version of software application and supporting software running on the DAS.

Monitor Only Parameters:

Parameter	type	Comments
DBE application version	ascii	The version number of the DBE command and control application
HAL Library version	ascii	The version of the HAL library the DBE application was compiled against
OS/Kernel version	ascii	Distribution and kernel version of Linux running on the DAS

2.4 DATA MODE

The commands associated with the data-mode configuration provide the application the ability to set and query the data transport parameters. This includes all parameters configuring the 10G Ethernet interface within the FPGA, the destination MAC addresses, and the specific packet formats, e.g. Mark5C or Mark5B emulation mode, and enable the transfer of valid data.

2.4.1 Data Communication Commands

The Data Communication Commands focus on the ability to configure the network interface and all associated data communication parameters.

2.4.2 db_e_ifconfig – set / get DBE 10G network interface configuration

Command: → db_e_ifconfig = <state> : <MTU> : <mode> : <IP address>;
← !db_e_ifconfig = <return code>;

Query: → db_e_ifconfig?;
← !db_e_ifconfig ? <return code>: <state> : <MTU> : <mode > : <IP address> : <TX Packets> : <TX Errors> : <TX Dropped> : <TX_Overrun> : <txqueuelen> ;

Purpose: Set interface type and enable or get status of the FPGA 10G network interface.

Settable Parameters:

Parameter	type	allowed Values	Comments
state	char	up down	causes the interface to be enabled causes the interface to be disabled
MTU	int	64 <= mtu <= 9000	Maximum packet size to accept default = 9000
mode	int	2 4	Layer 2 transmission (No IP /UDP headers) Layer 4 transmission (standard UDP/IP header used)
IP address	ascii		IPv4 address to be assigned to this interface

Monitor Only Parameters:

Parameter	type	allowed Values	Comments
state	char	NA	interface status (up/down)
MTU	int	NA	maximum packet size the interface will send
mode	int	NA	Layer 2 or Layer 4 transmission
IP address	ascii	NA	if mode is 4, then the IP address assigned to the interface
TX Packets	int	NA	The number of packets transmitted
TX Errors	int	NA	The number of transmission errors detected
TX Dropped	int	NA	The number of packets dropped
TX Overrun	int	NA	The numbers of packets dropped due to the tx queue length overflowing
txqueulen	int	NA	The transmission queue length

2.4.3

db_e_arp – set / get the IP to MAC address resolution

Command: → db_e_arp = <IP1>: <MAC1> : [<IP2>]: [<MAC2 >]: ... ;
← !db_e_arp = <return code>;

Query: → db_e_arp?;
← !db_e_arp? <return code>:<IP1>:<MAC1>:[<IP2>]:[<MAC2
>]: ...;

Purpose: This command is supported since the 10GE interface is presently unidirectional in our design and cannot respond to ARP queries. This is equivalent to running on Linux the arp command. This command is only valid for layer 4 data transport on the 10GE.

Settable Parameters:

Parameter	type	allowed Values	Comments
IP1	ascii	xx.xx.xx.xx	This is the destination IPv4 address
MAC1	ASCII	00.00.00.00.00	IP1 MAC address to be used in data transmission ¹

Notes:

1. If the DBE is connected directly to the recording device, e.g. Mark5C, the MAC address will be the Conduants 10GE MAC address. If the connection between the DBE and the MARK5C has any switches or routers in the path, then the MAC1 address has to be the MAC address of the port that the DBE is connected directly to, e.g. switches 10GE port address.

2.4.4

db_e_tid2addr – set / get the thread ID association resolution to either destination IP or MAC address

Command: → deb_tid2addr = <tid_id>:<IP1>: [<tid_id>]: [<IP2>]: ... ;
← !db_e_tid2addr = <return code>;

Query: → db_e_tid2addr?;

← !dbe_tid2addr? <return code>:<tid_id>:<IP1> :[<tidid >] : [<IP2>]:...;

Purpose: This command is a method to specify the thread ID to a destination IP address resolution and is primarily for the VDIF packet format. Up to 16 MAC or IP address must be supported.

Settable Parameters:

Parameter	type	allowed Values	Comments
IP	ascii	xx.xx.xx.xx	This is the destination IPv4 address
thread_id	ascii	00 - 1024	can be a single channel identifier or specified as a range separated by a hyphen, e.g. 0-7 (See note 1)

Notes:

1. The thread_id can be a single value, e.g. 0 for channel id 0, or specified as a **continuous** range of channels, e.g. 0-7 for thread IDs 0 through 7.

2.5 PACKET FORMAT COMMANDS

2.5.1 data_format - set / get data transmission mode

Command: → data_format = <data mode> : <data submode1 > : [<data submode2>];

← !data_format = <return code>;

Query: → data_format?;

← !data_format ? <return code>: <data mode> : <data submode1 >:[<data submode2>];

Purpose: Set the packet format mode to either the Mark5C native mode or Mark5B compatibility mode.

Settable Parameters:

Parameter	type	allowed Values	Comments
payload	char	vdif mark5B tvgvdif tvg5b	transmit using vdif (Mark5C profile) (note 1) transmit in Mark5B format transmit TVG data in Mark5C profile format transmit TVG data in Mark5B format
data submode1	int hex	>0 != 0x0	(vdif) number of channels (Mark5B) bit-stream mask
data submode2	int	1 2 4 8 16	(vdif) decimation ratio (Mark5B) NA

Notes:

1. For the vdif format (replacement for Mark5C formats) the parameters required to completely specify the setup of a scan are split between the commands **data_format**, **packet** and **car_cache** or UDP/IP. The parameters set by **packet** and **car_cache** are lower-level and are used by the FPGA to determine the transmission criteria and the respective destination of the packets. The parameters set by mode are used in the generation of the scans data formats.

2.5.2 Packet - set / get packet transmission criteria

Command: → packet = <DPOFST> : <DFOFST > : <length>: <PSN Mode>: <PSNOFST>;

← !packet = <return code>;

Query: → packet?;

← !packet ? <return code>: <DPOFST> : <DFOFST > : <length>: <PSN Mode>: <PSNOFST>;

Purpose:

Settable Parameters:

Parameter	type	allowed Values	Comments
DPOFST	int	≥ 0	payload byte offset from the beginning of the payload to first recorded data
DFOFST	int	≥ 0	payload byte offset to beginning of recording
length	int	≥ 0	number of bytes to record per packet (note 1)
PSN Mode	int	0 1 2	Packet Serial Number (PSN) monitor mode (note 2)
PSNOFST	int	≥ 0	payload byte offset from beginning of payload to PSN (PSN = 1 2)

Notes:

1. The length of the data to be recorded must be a multiple of 64 bits
2. PSN-Monitor mode 0 will cause the PSN not to be written into the data. PSN Monitor mode 1 enables the PSN to be written at byte position offset PSNOFST. PSN-monitor mode 2 will can be used by Mark5B emulation mode to cause invalid packets from being recorded at the destination when the most significant bit is set, when the msb is not set, the data is valid and must be recorded.

2.6 DATA TRANSFER

The data transfer commands will diverge from earlier version of Mark5A and Mark5B. The change comes based upon the fact that the DBE will now know when to send data. It is not recording or playing data so a new command is created to meet the needs of the existing system.

2.6.1 **data_xfer – send a valid data stream out of the DBE ON/OFF.**

Command: → data_xfer = < state > : < ts > : [<te>] : [<delta>] ;
← !data_xfer = <return code>;

Query: → data_xfer?;
← !data_xfer ? <return code>: <state> : <time> : <errors>:

Purpose:

Settable Parameters:

Parameter	type	allowed Values	Comments
state	char	on off	Transmission of data should begin at ts cease transmission of data
ts	time		Start time of valid data on 1pps boundary
te	time		End time of valid data on 1pps boundary
delta	time		Duration of valid data (note 1)

Monitor Only Parameters:

Parameter	type	allowed Values	Comments
status	char	on off waiting	Normal conditions On has been issued but the start time has not arrived yet
time	time		The present time
error			???? (note 2)

Notes:

1. The parameter delta can be used instead of the end time, or the end time can be specified, since one implies the other.
2. Not sure of the error conditions that should be flagged here. Need to think about this.

2.7 APPLICATION COMMANDS?

The data transfer commands will diverge from earlier version of Mark5A and Mark5B. The change comes based upon the fact that the DBE will now know when to send data. It is not recording or playing data so a new command is created to meet the needs of the existing system.

2.7.1 **quantize_seed - set / get channel quantization seed**

Command: → quantize = <seed> ;
 ← !quantize = <return code>;

Query: → quantize?
 ← !quantize ? <return code>: <seed> ;

Purpose:

Settable Parameters:

Parameter	type	allowed Values	Comments
seed	int	0 - 0xffffffff	seed value for the per channel gain

Monitor Only Parameters:

Parameter	type	allowed Values	Comments
seed	int		present seed value used ¹

Notes:

1. The seed value or first guess. If the seed value is not set, the dbe will assign a default value as the good first guess.

2.7.2 **quantize - get present channel quantization data (query only)**

Query: → quantize[<chid>]?;
 ← !quantize[<chid>] = <return code>: <time> :
 <amp_real> : <amp_img>:<phase>:

Purpose: The correction factor that has been applied to the specific channels gain to get optimum state counts. Corrections form a single channel ID can be requested, or with no channel id specified all channels values are presented. The time when these values were applied is also presented. Please note that the format has the command name with optional fields.

Monitor Only Parameters:

Parameter	type	allowed Values	Comments
time	char	on off waiting	Normal conditions On has been issued but the start time has not arrived yet
amp	int		Real part of amplitude
amp	int		Imaginary portion of amplitude
phase	int		Phase angle

2.7.3 **Cmd - set / get template**

Command: → cmd = <> : <> : <> ;
 ← !cmd = <return code>;

Query: → cmd?;
 ← !cmd = <return code>: <> : <> ;;

Purpose:

Settable Parameters:

Parameter	type	allowed Values	Comments

Monitor Only Parameters:

Parameter	type	allowed Values	Comments