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R2CP.ETH GENERATOR - MESSAGE DESCRIPTION

Software Protocol Specification

CONFIDENTIAL

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Date: 11/03/2022	**Date: 11/03/2022**	**Date: 11/03/2022**

Table of Updates

Document Revision	Date	Changes / Remarks	Affected Sections	Author
v2.0.6 and olders				Jesús Albendea
v2.0.7	13/March/15	Introduction paragraph added. Changes in the Procedure description paragraph. New messages for maximum number of procedures and data banks. Load RAD Data Bank message. Technique Mode, kV, mAs, mA, ms, maximum integration time, Focal Spot, FPS, Tracking ID and Generator Power Limit messages. Load Fluoro Data Bank message. Fluoro: kV, mA, ms, maximum integration time, PPS, ABC, High Dose, kV Scan, Q by PPS, Dose Level ID and Curve ID messages. Generator Status, Current RAD and FLUORO Parameters, Post Exposure/Post Condition, Start/Stop Exposure and Communications Inhibit Timeout messages.	Chapters 1, 2, 3, 4, 5, 6 and 7.	Aníbal Gómez
V2.0.8	13/March/15	Activate: Command field changed to Status. Values updated	Chapter 2.6	Jesús Albendea
		Allowed removed from Load RAD Data Bank ANSWER-EVENT. SET/ANSWER-EVENT share the format.	Chapter 3.1	
		Tracking/KV SCAN/MA SCAN in different bytes	Chapter 3.1	
		Tracking ID 64 → 255	Chapter 4.13	

		Load data bank: Allowed field removed from ANSWER. SET/ANSWER-EVENT have the same data fields.	Chapter 3.1	
		Allowed removed from Load Fluoro Data Bank ANSWER/EVENT. SET/ANSWER-EVENT share the format.	Chapter 5.1	
		Message to reset 5-minute fluoro alarm	Chapter 6	
		Status message simplified FL alarms added to status Generator Procedure Type redefined	Chapter 7.1	
		Current RAD Parameters: Tracking/KV SCAN/MA SCAN in different bytes. Current RAD Parameters same data fields as in RAD Data Bank	Chapter 7.2	
V2.0.9	24/April/15	Added GET message to Activate Procedure and Data Bank	Chapter 2.6	Jesús Albendea
		Remove EVENT and GET for Procedure message	Chapter 2.1	Jesús Albendea
		Remove GET for Activate Procedure	Chapter 2.6	Jesús Albendea
		Add Default Procedure and Data Bank message.	Chapter 2.7	Jesús Albendea
		Added individual messages for Current RAD DB Parameters Added individual messages for Current FL DB Parameters	Chapter 7 onwards rearranged	
		Removed Generator Power Limit from RAD Exposure Data Bank. Implemented in Current RAD Exposure Data Bank	Chapter 4.16	Jesús Albendea

		Removed Fluoro Time Reset and 5-Minute FI Alarm Reset from Fluoro Exposure Data Bank Parameters	Chapter 6.12-6.13	Jesús Albendea
		Messages for maximum number of procedures and data banks moved from Chapter 2 – Procedure to Chapter 12 – Miscellaneous	Chapter 2 – Chapter 12	Jesús Albendea
		STATUS message: Exposure Data Bank Sequence Number in Procedure added. It was removed by mistake	Chapter 12.1	Jesús Albendea
		Update All message added	Chapter 13.3	Jesús Albendea
2.1.0		Added return codes for CP function	Entire document	Jesús Albendea
		PostExposure/PostCondition - Procedure ID removed - Data Bank sequence number removed	Chapter 12.2	Jesús Albendea
		Added GET to Current Fluoro Data Bank	Chapter 9.1	Jesús Albendea
		Removed token information	Entire document	Jesús Albendea
		FPS and PPS are multiplied by 10 to be able to send values like 0.2 FPS	Chapters 3.1, 4.12, 5.1, 6.5, 7.1, 8.12, 9.1, 10,5	Jesús Albendea
2.1.1	01/09/2015	Add RAD EXPOSURE PARAMETER RANGES Add RAD EXPOSURE PARAMETER RANGES Add Minimum Integration Time	Chapter 13.4 Chapter 13.5 Chapter 3 Chapter 4 Chapter 7 Chapter 8	Jesús Albendea
	16/09/15	Add Workstation and Handswitch/Footswitch Configuration messages	Chapter 13.6 Chapter 13.7	Jesús Albendea
		Add GET codes to Activate and Default Procedure and Data Banks	Chapter 2.6 Chapter 2.7	

		Command Processed function removed for Patient Workflow messages	Chapter 2	Jesús Albendea
	22/Sep/2015	Modified cp return codes for next messages: Load RAD exposure data bank FPS Load Fluoro Data Bank Rad Maximum Integration Time Fluoro Maximum Integration Time ABC High Dose Modified description of the field AEC Density for next messages: Load RAD Exposure Data Bank AEC Density Current RAD Exposure Data Bank Current AEC Density	3.1, 4.10 4.13, 5.1, 4.7, 6.4, 6.6, 6.7, 7.1, 8.10	
		Update All moved to Patient Workflow and renamed as "Sync Up"	Chapter 13.3	Jesús Albendea
	12/11/15	Generator Procedure Type indexes rearranged: 0 – Not defined 1 – Std RAD 2 – Stitching 3 – Tomography 4 – DSI: single energy, multi energy, tomosynthesis. 5 – CINE 6 – DSA	Chapter 2.1	Jesús Albendea
	21/01/16	Added Ebox Software Version Add CP "Minimum integration time value out of range" for Load RAD Exposure Data Bank Modified max value for Current RAD Exposure Data Bank, current MS, current Minimum Integration Timer and current Max Integration time. Modified template.	Chapter 13.7 Chapter 3.1 Chapter 7.1 8.5, 8.6 and 8.7	Fco Sanchez

	25/01/16	Fixed typo	Chapter 6.2 Chapter 6.11 Chapter 13.5	Fco Sanchez
		Added Command Processed codes	Chapter 12.3 Chapter 13.5	
	28/01/16	CP for Assigned command added when Exposure Sequence Number already assigned	Chapter 2.2	Fco Sanchez
		Removed out of range CP for AEC chambers	Chapter 3.1 Chapter 4.11	
		Removed out of range CP for tracking id	Chapter 3.1 Chapter 4.14	
		Added CP when procedure type doesn't match	Chapter 3.2 Chapter 5.2	
		Added none AEC input for workstation command	Chapter 13.5 Chapter 13.6 Chapter 2.1, 2.2, 2.3, 2.4, 2.5, 3.2, 5.2	
		Fixed comments for dynamic modes status values		
		Supported procedure Id 0 for some commands		
2.1.2	05/04/16	Added exposure request phase to status message	Chapter 12.1	Jesús Albendea
		Added mA scale (63/64/65) to RAD exposure parameter ranges	Chapter 13.3	Jesús Albendea
		Removed Dynamic Mode 3 and 4 from STATUS message	Chapter 12.1	Jesús Albendea
		Added current rotor speed to STATUS message	Chapter 12.1	Jesús Albendea
		Sensitivity becomes Sensitivity / Target Dose	Chapter 3.1, 4.9, 7.1, 8.9, 12.2	Jesús Albendea
		Density field redefined	Chapter 3.1, 4.10, 7.1, 3.10, 12.2	Jesús Albendea
		Generator Procedure Type Redefined	Chapter 2.1	Jesús Albendea
2.2.0	17/03/17	Added Parasitic Capacitance Parameter	Chapter 13.8	Juan Miguel Andujar

		Added Dynamic Hardwired to HW Bus	Chapter 13.5	Juan Miguel Andujar
		Added cp return code for next messages: Load Rad Exposure Data Bank Technique Mode, KV, MAS, MA, MS ,Minimum Intergration Time, Maximum Integration Time, Focal Spot, AEC Sensitivity/Target Dose, AEC Densitiy, AEC Chambers, Tube Power Limit, FPS, Tracking ID, kV Scan, mA Scan	Chapter 3.1 Chapters 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11,4.12,4.13,4.14,4.15,4.16	
2.2.1 Rev B	18/06/18	Message Generator Status, byte 2 System Message Active, we add inhibit information	Chapter 12.1	Jesús Albendea
		Individual Patient Size message	Chapter 4.17 Chapter 0	Jesús Albendea
		Filaments ON/OFF • New message to turn filaments ON/OFF • Added filaments status in Generator Status message	Chapter 0 Chapter 12.1	Jesús Albendea
		Return code in CP message: 30 Accepted Only In Standby Replaced by: 202 Message not available	Entire document	Jesús Albendea
2.2.2 Rev C		Version document changed to Revision letter		
		MS Event data description revised	Chapter. 8.5	Lucía Maté
		Command Type added at patient size message Renumbering for Current parameters	Chapter 4.17 Chapter 7, 9	Lucía Maté
	22/11/2018	Format level number revised for section titles	All	Lucía Maté
		Included compatibility table	Chapter 1	Lucía Maté

2.2.3 Rev D	07/06/19	Add GPIO type messages	Chapter 14	Jesús Albendea
		Added new generator statuses: 7 – Waiting to Release Handswitch 8 – Shutting down	Chapter 12.1	
		Fix chapter numbering	All chapters	
		Redefine AEC related messages to support internal or external AEC reference setting	Chapters 3.1, 4.9, 4.10, 4.11, 7.1, 8.9, 8.10, 8.11	
2.2.4 Rev E		Add compatibility with old systems using image receptor sensitivity	Chapters 3.1, 4.9, 4.10, 4.11, 7.1, 8.9, 8.10, 8.11, 12.2, 13.9	
		KV scan and mA scan removed	Chapters 3.1, 4.15, 4.16, 5.1, 6.8, 6.9, 7.1 8.15, 8.16, 10.8, 10.9	
		Added AEC reference mode message	13.9	
		Added exposure counters, fluoro time, … message	13.10	
Rev F	30/04/2020	Procedure message redefined	2.1 2.6	Jesus Albendea
Rev F	30/04/2020	Load RAD Exposure DB redefined	3.1 3.3	Jesus Albendea
Rev F	30/04/2020	Removed landscape/postrait to ion chamber settings	4.19	Jesus Albendea
Rev F	30/04/2020	Tube power limit from RAD DB (DEPRECATED)	4.12	Jesus Albendea
Rev F	30/04/2020	Load FLUORO Data Bank (1) DEPRECATED	5.1	Jesus Albendea

Rev F	30/04/2020	New definition of Load FLUORO Data Bank (2)	5.3	Jesus Albendea
Rev F	30/04/2020	Fluoro mA DEPRECATED	6.2	Jesus Albendea
Rev F	30/04/2020	ABC DEPRECATED	6.6	Jesus Albendea
Rev F	30/04/2020	HIGH DOSE DEPRECATED	6.7	Jesus Albendea
Rev F	30/04/2020	Dose Leve ID DEPRECATED	6.10	Jesus Albendea
Rev F	30/04/2020	Fluoro mA, new definition	6.12	Jesus Albendea
Rev F	30/04/2020	ABC – HIGH DOSE new message	6.13	Jesus Albendea
Rev F	30/04/2020	Target LSB	6.14	Jesus Albendea
Rev F	30/04/2020	Tube Power Limit individual message	14.5	Jesus Albendea
Rev F	30/04/2020	Status message redefined	12.1 12.8	Jesus Albendea
Rev F	04/05/2020	Added Dynamic Sequence	15	Jesus Albendea
Rev F	04/05/2020	Added Image Subtraction	16	Jesus Albendea
Rev F	03/06/2020	Set mAs added CP code 4 to SET command. Not allowed in auto technique mode	4.3	Jesus Albendea
Rev F	08/06/20	Generator Status (2): Procedure status removed because it is always active. Procedure and DB Sequence number added to RAD and FL postcondition messages. New Procedure Status message added.	12.5, 12.6, 12.8, 2.7	Jesus Albendea
Rev F	09/06/20	Added Dynamic Sequence Status message	15.3	Jesus Albendea
Rev F	09/06/20	Actual Lock-In frame message redefined as Image Subtraction Status – Lock-in Frame Reached	16.3	Jesus Albendea
Rev F	18/06/20	Generator Status message, status field: 10 – Service redefined as Switching tube	12.8	Jesus Albendea

Rev F	22/06/20	Remove DB ID from current FL MA and Current ABC/High Dose event messages. mA field in Event FL MA from DB and from current corrected to 3 bytes: ID 61 and 121 Removed SET message for FL MA and ABC/High Dose	10.12 10.13 6.12	Jesus Albendea
Rev F	30/06/20	Fix byte numbering in status message	12.8	Jesus Albendea
Rev F	22/09/20	Add ABC update time message	6.16 10.16	Jesus Albendea
Rev F	22/09/20	Add Fluoro Focal Spot message	6.15 10.15	Jesus Albendea
Rev F	19/10/20	Byte 15 includes ABC / LOCK-IN/HIGH DOSE	5.3	Jesus Albendea
Rev F	19/10/20	Byte 15 includes ABC / LOCK-IN/HIGH DOSE	9.1	Jesus Albendea
Rev F	19/10/20	Byte 15 includes ABC / LOCK-IN/HIGH DOSE	9.2	Jesus Albendea
Rev F	19/10/20	Includes ABC / LOCK-IN / HIGH DOSE	10.13	Jesus Albendea
Rev F	29/10/20	Message ID's 12 and 71 added to the message table at the end of the document	17	Jesus Albendea
Rev F	03/12/20	Remove Lock In field in FL DB	6.13 10.13	Jesus Albendea
Rev F	02/03/21	New technique mode added 2P Max ms	3.1 3.3 4.1 7.1 7.2 8.1	Jesus Albendea
Rev F	02/03/21	RAD Exposure Parameter Ranges DB message added	17.1	Jesus Albendea
Rev F	02/03/21	Assign RAD Exposure Parameter Ranges DB to Procedure	17.2	Jesus Albendea

Rev F	02/03/21	RAD Exposure Parameter Scales message added	17.3	Jesus Albendea
Rev F	11/03/21	Exposure Switches Activation Devices message added	12.9	Jesus Albendea
Rev F	10/05/21	RAD Exposure Parameter Ranges DB message renamed as Exposure Parameter Ranges DB Assign RAD Exposure Parameter Ranges DB to Procedure renamed as Assign Exposure Parameter Ranges DB to Procedure	17.1 17.2	
Rev F	07/06/21	Tomosynthesis is a new generator procedure type because positioner ok signal acts as a synchronization instead of as a inhibit signal.	2.6	Jesus Albendea

TABLE OF CONTENTS

1. INTRODUCTION

This document describes the Generator R2CP message group, which is closely related to the Patient Workflow group. Some Patient Workflow messages are replied with messages from the Generator group.

2. PROCEDURE AND DATA BANKS

R2CP protocol was defined as a radiological room level protocol, rather than device specific. Building blocks of this protocol are procedures which gather all the information of the different devices involved: Generator, Positioner/Collimator.

For instance, a RAD stitching procedure may be composed of the following sets of parameters:

- Two sets of exposure parameters for the generator.
- Two sets of positions for the positioner.
- Two sets of collimator FOV settings for the collimator

Sets of parameters are called generically **Data Banks**.

Procedures can be RAD or FLUORO, same data structure is used. Fields in this structure contain the following information:

- ID
- Generator Procedure Type: Defines the type of radiological procedure to be performed (see patient workflow and generator procedure related messages).
- Positioner Procedure Type: Defines the type of positioning to be performed (see patient workflow and positioner procedure related messages).
- Workstation: Defines where the detector is located and the type of interface (see patient workflow procedure and workstation configuration related messages).
- Handswitch/Footswitch: Defines the handswitch/footswitch that is initiates the procedure (see patient workflow procedure and workstation configuration related messages).
- Select from Handswitch/Footswitch: It applies to dynamic systems in which a procedure is selected based on the handswitch/footswitch pressed. If set to FALSE, Procedures are activated through Patient Workflow messages.
- Number of Exposure Data Banks ©: For a stitching procedure, after first exposure generator can automatically select next exposure data bank or wait for acquisition SW to select next one.
- Exposure Data Bank ID for Sequence Number 1..E: Keeps the list of Exposure Data Bank ID's for those defined for the procedure.

- Number of Position Data Banks (P): For a stitching procedure, after first exposure positioner can automatically select next positioner data bank or wait for acquisition SW to select next one.
- Positon Data Bank ID for Sequence Number 1..P: Keeps the list of Position Data Bank ID's for those defined for the procedure.
- Number of Collimator FOV Data Banks ©: For a stitching procedure, after first exposure positioner can automatically select next collimator FOVdata bank or wait for acquisition SW to select next one.
- Collimator FOV Data Bank ID for Sequence Number 1..C: Keeps the list of Collimator Data Bank ID's for those defined for the procedure.
- Number of Collimator Filter Data Banks ©: For a stitching procedure, after first exposure positioner can automatically select next collimator FOV data bank or wait for acquisition SW to select next one.
- Collimator Filter Data Bank ID for Sequence Number 1..C: Keeps the list of Collimator Filter Data Bank ID's for those defined for the procedure.

PROCEDURE: 1

GENERATOR PROCEDURE TYPE: STD RAD MULTIENERGY

POSITIONER PROCEDURE TYPE: POSITION LIBRARY

WORKSTATION : 1

BUTTON/PEDAL: 1

SWITCH FROM PEDAL: FALSE

NUMBER OF EXPOSURE DATA BANKS : 2

NUMBER OF POSITIONING DATA BANKS : 1

NUMBER OF COLLIMATOR FOV DATA BANKS : 1

NUMBER OF COLLIMATOR FILTER DATA BANKS : 2

RAD DATA BANK ID FOR SEQUENCE NUMBER 1: 1

RAD DATA BANK ID FOR SEQUENCE NUMBER 2: 2

POSITIONING DATA BANK ID FOR SEQUENCE NUMBER 1: xxx

COLLIMATOR FOV DATA BANK ID FOR SEQUENCE NUMBER 1: xxx

COLLIMATOR FILTER DATA BANK ID FOR SEQUENCE NUMBER 1: xxx

GENERATOR DATA BANK SEQUENCING = Activate Next Exposure Data Bank

POSITIONER DATA BANK SEQUENCING : N/A

Same Procedure data structure is used for RAD and FLUORO. Depending on the Generator Procedure Type, Exposure Data Banks will refer to RAD or FLUORO DATA BANKS.

If Auto Sequence property is set to TRUE, after each exposure in the Procedure generator will activate next Data Bank. If set to FALSE, Data Banks are activated by the acquisition SW.

	Stitching 3 exposures	**Dual Energy**	**Tomography**	**MultiRAD**
Generator Procedure Type	Std RAD	Std RAD	Tomography	MultiRAD
Positioner Procedure Type	Free Position	Position Library	Tomography	N/A
Number of Exposure Data Banks	3	2	1	1
Number of Position Data Banks	3	1	1	0
Number of Collimator FOV Data Banks	3	1	1	0
Number of Collimator Filter Data Banks	1	1	1	0

Acquisition SW will define as many procedures as needed. For instance, for a given patient it can define the following:

- MultiRAD
- Cine
- Std Fluoro
- High Fluoro

After all the exposures for a procedure have been made, generator will wait for the user to release handswitch/footswitch:

- Standard RAD – Single Shot: Wait for handswitch/footswitch to be released after the exposure.
- Dual Energy: Wait for handswitch/footswitch to be released after the second exposure.
- 3-exposure stitching: Wait for handswitch/footswitch to be released after the third exposure.

2.1 Procedure (1) (DEPRECATED)

SUBINDEX: 1

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Generator Procedure Type	0 – Not defined 1 – Std RAD 2 – Stitching 3 – Tomography 4 – Multienergy 10 – DSI: single energy, multi energy, tomosynthesis. 11 – CINE 12 – DSA 100 – Std Fluoro 101 – Boost Fluoro 102 – Roadmap Mask Fluoro 103 – Roadmap Fluoro
3	Handswitch/Footswitch ID	[1..255]
4	Activate When Handswitch/Footswitch is pressed	0, Do not Activate procedure when Footswitch/Handswitch pressed. Procedure is activated with Patient Workflow message. 1, Activate procedure when Footswitch/Handswitch pressed
5	Workstation ID	[1..255]

6	Total Number of Exposure Data Banks in Procedure	[1..255]
7	Generator Data Bank Sequencing	0 – N/A 1 – Activate next Exposure Data Bank 2 – Pause Procedure until next Exposure Data Bank is activated by a Patient Workflow message

DESCRIPTION

Generator sends this message when a new procedure has been defined with a Patient Workflow Procedure message.

2.2 Assign Exposure Data Bank to Procedure

SUBINDEX: 4

SET

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Exposure Sequence Number	[1..255]
3	Exposure Data Bank ID	[1..255]

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Exposure Sequence Number	[1..255]
3	Exposure Data Bank ID	[1..255]
4	Allowed	0 Not allowed 1 Allowed

GET

BYTE	DATA	FORMAT

1	Procedure ID	[0..255]
2	Exposure Sequence Number	[1..255]

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code…..	RETURN CODES: 0 OK 1 Procedure ID not defined (ERROR_PROC_NOT_DEFINED) 2 Procedure ID out of range 3 Procedure ID already active, assign not possible (ERROR_ASIGN_TO_CURRENT) 4 Exposure Sequence Number out of range (ERROR_ASSIGN_BAD_SEQ_NUM) 5 Exposure Data Bank ID not defined (ERROR_DB_NOT_DEFINED) 6 Exposure Data Bank ID out of range 7 Exposure DB incompatible with Procedure Type (ERROR_ASSIGN_INCORRECT_PROC TYPE) 8 Exposure Sequence Number already assigned.

GET

BYTE	DATA	FORMAT

1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES:
		0 OK
		1 Procedure ID not defined
		2 Procedure ID out of range
		3 Exposure Sequence Number out of range
		4 No Exposure DB assigned (ERROR_DB_POS_NOT_ASSIGN)

DESCRIPTION

Command used to assign an Exposure Data Bank to a Procedure.

2.3 Exposure Data Bank Acceptance

SUBINDEX: 5

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Exposure Sequence Number	[1..255]
3	Allowed	0 Not allowed 1 Allowed

GET

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Exposure Sequence Number	[1..255]

DESCRIPTION

This message indicates if parameters on the data bank are allowed. If not allowed, generator will respond also with a number of system messages indicating reason for no acceptance and system messages (warning) to instruct the user how to select correct exposure parameters, for instance:

- o Maximum generator power exceeded (it can be an inhibit if parameters are not adjusted, or just information if parameters are adjusted to avoid the inhibit).
- o Decrease RAD kV and RAD mA (user action required).
- o Maximum FL KVP reached.

GET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1..255
2	Return Code	RETURN CODES: 0 OK 1 Procedure ID not defined 2 Procedure ID out of range 3 Exposure Sequence Number out of range 4 No Exposure DB assigned (ERROR_DB_POS_NOT_ASSIGN)

2.4 Activate Procedure and Data Bank

SUBINDEX: 6

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0 .. 255]
2	Procedure Status	0 – Not Active 1 – Active 2 – Paused 3 – Finished
3	Exposure Data Bank Sequence Number	[0 .. 255] 0 – Do Not Activate Exposure Data Bank. 1 .. 255 Activate Exposure Data Bank Index

DESCRIPTION

Answer from generator for Procedure and Data Banks activation through a Patient Workflow message.

If an Image Subtraction DB and/or Dynamic Sequence DB are assigned to the procedure, they are activated too.

2.5 Default Procedure and Data Bank
SUBINDEX: 7

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0 .. 255]
2	Exposure Data Bank Sequence Number	[0 .. 255] 0 – Do Not Activate Exposure Data Bank. 1 .. 255 Activate Exposure Data Bank Index

DESCRIPTION

Answer from generator for Procedure and Data Banks activation through a Patient Workflow message.

2.6 Procedure (2)

SUBINDEX: 8

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Generator Procedure Type	0 – Not defined 1 – Std RAD 2 – Stitching 3 – Tomography 4 – Multienergy 10 – DSI: single energy, multi energy. 11 – CINE (Deprecated) 12 – DSA 13 – Tomosynthesis 100 – Std Fluoro 101 – Boost Fluoro 102 – Roadmap Mask Fluoro 103 – Roadmap Fluoro
3	Handswitch/Footswitch ID	[1..255]
4	Activate When Handswitch/Footswitch is pressed	0, Do not Activate procedure when Footswitch/Handswitch pressed. Procedure is activated with Patient Workflow message. 1, Activate procedure when Footswitch/Handswitch pressed
5	Workstation ID	[1..255]

6	Total Number of Exposure Data Banks in Procedure	[1..255]
7	Generator Data Bank Sequencing	0 – N/A 1 – Activate next Exposure Data Bank 2 – Pause Procedure until next Exposure Data Bank is activated by a Patient Workflow message
8 9	Total Number of Exposures in Procedure	0 Not defined [1..65535]

DESCRIPTION

Generator sends this message when a new procedure has been defined with a Patient Workflow Procedure message.

If Procedure definition includes Total Number of Exposures in Procedure, it affects the following functions:

- Procedure acceptance: Acceptance is calculated for the defined number of exposures.
- Procedure finished: When the number of defined exposures is made, procedure is finished and generator waits for the exposure switch to be released.
- For serial RAD, status = Exposure in Progress is sent on the first exposure and it kept until the last exposure.

2.7 Procedure Status

SUBINDEX: 9

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0 .. 255]
2	Procedure Status	0 – Not Active 1 – Active

		2 – Paused
		3 – Finished
3	Exposure Data Bank Sequence Number in Procedure	[1..255]
4 5	Number of exposures made	[0.655635] Se actualiza cuando se pausa un procedure o cuando acaba

GET

BYTE	DATA	FORMAT
1	Procedure ID	[1..255]

DESCRIPTION

Updates Procedure status. In a system with a dynamic panel, there can be more than one procedure defined, but Generator Status message only shows information about the active one.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Procedure ID not defined 2 Procedure ID out of range

3. RAD EXPOSURE DATA BANK

3.1 Load RAD Exposure Data Bank (1) (DEPRECATED)
SUBINDEX: 10

SET / ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2(1-4)	Patient Size	0: Small
		1: Medium
		2: Large
2(5-8)	Pediatric	0: Non Pediatric
		1: Pediatric
3(1-6)	Technique Mode	0: 0Point
		1: 1Point
		2: 2Point
		3: 3Point
		4: 2Point Falling load
		5: Fully Automatic
		6: 2Point max ms
3(7)	Automatic Technique Mode	0: Do not modify technique mode
		1: Modify technique mode according to parameter change
3(8)	Adjust Parameters Automatically	0: Do not modify parameters
		1: Modify parameters if not allowed

4 5	kV * 10	[20..150] * 10
6 7 8	mAs * 1000	[0.1..3200] * 1000
9 10 11	mA * 100	[1..1000] * 100
12 13 14	ms * 100	[1..20000] * 100
15 16	Minimum Integration Time (ms)	[1..20000]
17 18	Maximum Integration Time (ms)	[1..20000]
19	Focal spot	0: small 1: large 2: super small
20	AEC Sensitivity or Correction factor / AEC reference low byte	Depending on AEC Reference Mode, Byte 1 message subindex 158 Bit 1 = 0, Bit 2 = 0: Select internal AEC reference and sensitivity low/medium/high. Bit 1 = 1, Bit 2 = 0: Sensitivity correction factor. Bit 1 = 1, Bit 2 = 1: AEC reference low byte
21	AEC Density Adjustment - EI adjustment / AEC Reference high byte	Depending on AEC Reference Mode, byte 1 message subindex 158:: Bit 2 = 0: AEC Density Adjustment / EI Adjustment. Bit 2 = 1: AEC reference high byte

22	AEC Chamber off (0) / on(1) status	Bit 1: left AEC status
		
		Bit 2: center AEC status
		
		Bit 3: right AEC status
		
		Bit 4: Ion chamber orientation
		
		    0 Landscape
		
		    1 Portrait

23	Tube Power Limit (%)	[0..100]
24 25	FPS x 10	[0..1200] 0 – Single Shot
26	Tracking ID	[0..255] 0 – None
27	Available for future use	

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Command used to load a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the	1 .. 255

	SET request	
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 3 Patient size code out of range 4 Pediatric code out of range 5 Technique mode code out of range 6 Technique mode not supported 7 kVp value out of range 8 mAs value out of range 9 mA value out of range 10 ms value out of range 11 Maximum integration time value out of range 12 Focal spot code out of range 13 Focal spot not supported 14 AEC sensitivity/Dose Target code out of range 15 AEC density code out of range 16 AEC Reference out of range 17 Tube power limit out of range 18 FPS value out of range 19 Minimum integration time value out of range 20 21 Tracking not supported 22 Available for future use 23 Available for future use 24 DataBank type doesn't match 25 Available for future use 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES:

		0	OK
		1	Data Bank ID out of range
		2	Data Bank ID not defined

3.2 RAD Procedure Acceptance

SUBINDEX: 11

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Allowed	0 Not allowed 1 Allowed
3 4	Number of Exposures Allowed	[1..65535]

GET

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Check Number of Exposures Allowed	0: Do not check 1: Check

DESCRIPTION

Message used to determine if the exposures defined by the RAD Data Banks assigned to a procedure can be made given the current generator and tube heat status.

If Procedure Acceptance is requested (GET) with Check Number of Exposures Allowed = 1, generator will calculate the number of exposures that can be made with the RAD Data Banks defined for the procedure. This is particularly useful for MultiRAD applications that requires a large number of exposures to complete an acquisition run. It

is important to know if all the exposures needed can be made prior to starting the procedure, stopping the run will result in dose received by the patient and no image.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Procedure ID out of range 2 Procedure ID not defined 3 Procedure not RAD

3.3 Load RAD Exposure Data Bank (2)

SUBINDEX: 12

SET / ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Imaging System Protocol/Body Part/Organ Program Index	Index used to verify that the DB and current DB values are the ones Imaging SW / Generator console is expecting.
3(1-6)	Technique Mode	0: 0Point 1: 1Point 2: 2Point 3: 3Point 4: 2Point Falling load 5: Fully Automatic 6: 2Point max ms
3(7)	Automatic Technique Mode	0: Do not modify technique mode 1: Modify technique mode according to parameter change
3(8)	Adjust Parameters Automatically	0: Do not modify parameters 1: Modify parameters if not allowed
4 5	kV * 10	[20..150] * 10
6 7 8	mAs * 1000	[0.1..3200] * 1000

9 10 11	mA * 100	[1..1000] * 100
12 13 14	ms * 100	[1..20000] * 100
15 16	Minimum Integration Time (ms)	[1..20000]
17 18	Maximum Integration Time (ms)	[1..20000]
19	Focal spot	0: small 1: large
20	AEC Sensitivity or Correction factor / AEC reference low byte	Depending on AEC Reference Calculation (bit 22.8): - Internal: For film to select sensitivity. For digital to consider the effect of grid, collimator FOV, filter, …. - External: AEC reference calculated by the system console, usually Imaging SW.
21	AEC Density Adjustment - EI adjustment / AEC Reference high byte	Density Correction Factor
22	AEC Chamber off (0) / on(1) status AEC Reference Calculation	Bit 1: left AEC status Bit 2: center AEC status Bit 3: right AEC status Bit 8: 0 Internal 1 External, AEC reference in counts comes from an external device (Imaging SW or Service

		SW, bytes 20 and 21)
23	SPARE	
24 25	FPS x 10	[0..1200] 0 – Single Shot
26	Tracking ID	[0..255] 0 – None
27		

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Command used to load a RAD Data Bank.

Example of a film system with low, medium and high sentitivities. System calibrated for ISO 400/medium sensitivity.

Exposure with a low sensitivity ISO 200 film and +1 density

20	AEC Correction factor → we take into account sensitivity	200 → as it is calibrated for ISO 400/medium sensitivity, we have to double the AEC reference
21	AEC Density	125, +1 density means nominal AEC reference + 25%

| 22 | AEC Chamber off(0) / on(1) status | Bit 1: left AEC status
Bit 2: center AEC status
Bit 3: right AEC status |
| | **AEC Reference Calculation** | Bit 8: 0 → Generator calculates the AEC reference |

AEC REFERENCE = Regular value * 2.0 * 1.25

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 **3** 4 Pediatric code out of range 5 Technique mode code out of range 6 Technique mode not supported 7 kVp value out of range 8 mAs value out of range 9 mA value out of range 10 ms value out of range 11 Maximum integration time value out of range 12 Focal spot code out of range 13 Focal spot not supported 14 AEC sensitivity/Dose Target code out of range 15 AEC density code out of range 16 17 Tube power limit out of range 18 FPS value out of range 19 Minimum integration time value out of

		range
		20
		21 Tracking not supported
		22
		23
		24 DataBank type doesn't match
		25
		202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4. RAD EXPOSURE DATA BANK PARAMETERS

These messages allow applications to modify a single parameter. Since parameters are interrelated, there can be an ANSWER to that specific message or a few ANSWERs for the parameters affected.

4.1 Technique Mode

SUBINDEX: 20

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2(1-6)	Technique Mode	0: 0Point 1: 1Point 2: 2Point 3: 3Point 4: 2Point Falling load 5: Fully Automatic 6: 2Point max ms
2(7)	Automatic Technique Mode	0: Do not modify technique mode 1: Modify technique mode according to parameter change
2(8)	Adjust Parameters Automatically	0: Do not modify parameters 1: Modify parameters if not allowed
3	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
2(1-6)	Technique Mode	0: 0Point 1: 1Point 2: 2Point 3: 3Point 4: 2Point Falling load 5: Fully Automatic 6: 2Point max ms
2(7)	Automatic Technique Mode	0: Do not modify technique mode 1: Modify technique mode according to parameter change
2(8)	Adjust Parameters Automatically	0: Do not modify parameters 1: Modify parameters if not allowed

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets RAD Technique Mode in a RAD Data Bank.

2Point max ms is a mode in which we receive kVp and mAs and generator selects kVp, maximum allowed exposure time and resulting mA. If we receive an mAs up or down request, exposure time is kept and mA is adjusted accordingly. If ms is changed, mA will be updated accordingly to keep mAs. If mAs is changed, ms is kept.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 Technique mode code out of range 4 Technique mode not supported 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 1 OK 2 Data Bank ID out of range

		3 Data Bank ID not defined

4.2 KV

SUBINDEX: 21

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3	kV Value * 10 / Step * 10	[20..150] * 10 / [-5,-1,1,5, -0.1,0.1] * 10 (INT16)
4	Command Type	0 Set Value 1 Step

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3 4	kV Value * 10	[20..150] * 10 (INT16)

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets kVp value in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 kVp value out of range 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4.3 MAS

SUBINDEX: 22

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3 4	mAs * 1000 / Step (mAs station)	[0.1..3200] * 1000 / [-1,1] (INT24)
5	Command Type	0 Set Value 1 Step

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3 4 5	mAs * 1000	[0.1..3200] * 1000 (INT24)

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets mAs value in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 mAs value out of range 4 Not allowed in auto technique mode 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code…..	RETURN CODES:

		0	OK
		1	Data Bank ID out of range
		2	Data Bank ID not defined

4.4 MA

SUBINDEX: 23

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3 4	mA * 100 / Step (mA station)	[1..1000] * 100 / [-1,1] (INT24)
5	Command Type	0 Set Value 1 Step

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3 4 5	mA * 100	[1..1000] * 100 (INT24)

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets mA value in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 mA value out of range 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4.5 MS

SUBINDEX: 24

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3 4	ms * 100 / Step (ms station)	[1..20000] * 100 / [-1,1] (INT24)
5	Command Type	0 Set Value 1 Step

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
2 3 4	ms * 100 / Step (ms station)	[1..20000] * 100 / [-1,1] (INT24)

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets ms value in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 ms value out of range 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range

		2 Data Bank ID not defined

4.6 Minimum Integration Time

SUBINDEX: 25

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3	Miximum Integration Time Value (ms)	[1..20000]
4	Command Type	0 – Set value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3 4	Minimum Integration Time Value (ms)	[1..20000]

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets minimum integration time in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 Minimum integration time value out of range 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range

		2 Data Bank ID not defined

4.7 Maximum Integration Time

SUBINDEX: 26

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3	Maximum Integration Time Value (ms)	[1..20000]
4	Command Type	0 – Set value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3 4	Maximum Integration Time Value (ms)	[1..20000]

GET

BYTE	DATA	FORMAT

1	Data Bank ID	[1..255]

DESCRIPTION

Sets maximum integration time in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 Maximum integration time value out of range 1 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES:

		0	OK
		1	Data Bank ID out of range
		2	Data Bank ID not defined

4.8 Focal Spot

SUBINDEX: 27

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Focal Spot	0: Small 1: Large
3	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3	Focal Spot	0: Small 1: Large

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets focal spot in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 Focal spot code out of range 4 Focal spot not supported 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT

1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4.9 AEC Sensitivity or Correction Factor

SUBINDEX: 28

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	AEC Sensitivity or Correction factor	Depending on AEC Reference Mode, Byte 1 message subindex 158 Bit 1 = 0, Bit 2 = 0: Select internal AEC reference and sensitivity low/medium/high. Bit 1 = 1, Bit 2 = 0: Sensitivity correction factor.
3	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

2	Allowed	0 Not Allowed
		1 Allowed
3	AEC Sensitivity or Correction Factor	Depending on AEC Reference Mode, Byte 1 message subindex 158
		Bit 1 = 0, Bit 2 = 0: Select internal AEC reference and sensitivity low/medium/high.
		Bit 1 = 1, Bit 2 = 0: Sensitivity correction factor.

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Image receptor sensitivity or factor to multiply the AEC reference.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES:
		0 OK
		1 Data Bank ID out of range

		2 Data Bank ID not defined 3 Factor out of range 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4.10 AEC Density correction factor

SUBINDEX: 29

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	AEC Density Adjustment - EI adjustment	Depending on AEC Reference Mode, byte 1 message subindex 158:: Bit 2 = 0: AEC Density Adjustment / EI Adjustment.
3	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3	AEC Density Adjustment - EI adjustment	Density Correction Factor

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets AEC Density in a RAD Data Bank. Generator uses calibrated value for no density correction (N). Correction factor is applied according to the following formula:

AEC DAC Reference = (Calibrated Value * Correction Factor) / 100

Density range and step are room configuration values.

For a +/- 4 range, correction factors for a 25% step would be:

Density Correction	Calculation	Factor
+4	195*1.25=244	244
+3	156*1.25=195	195
+2	125*1.25=156	156
+1	100*1.25=125	125
N	100	100
-1	100/1.25=80	80
-2	80/1.25=64	64
-3	64/1.25=51	51
-4	51/1.25=41	41

For a +/- 6 range, correction factors for a 12.5% step would be:

Density Correction	Calculation	Factor
+6	180*1.125=202	202
+5	160*1.125=180	180
+4	142*1.125=160	160
+3	126*1.125=142	142
+2	112*1.125=126	126

+1	100*1.125=112	112
N	100	100
-1	100/1.125=89	89
-2	89/1.125=79	79
-3	79/1.125=70	70
-4	70/1.125=62	62
-5	62/1.125=55	55
-6	55/1.125=49	49

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 Density value out of range 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1..255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4.11 AEC Chambers (1) DEPRECATED

SUBINDEX: 30

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

2	AEC Chamber off(0) / on(1) status	Bit 1: left AEC status
		Bit 2: center AEC status
		Bit 3: right AEC status
		Bit 4: Ion chamber orientation
		   0 Lanscape
		   1 Portrait

3	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3	AEC Chamber off(0) / on(1) status	Bit 1: left AEC status Bit 2: center AEC status Bit 3: right AEC status Bit 4: Ion chamber orientation 0 Landscape 1 Portrait

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets AEC Chambers selection in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT

1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 10 Incorrect command type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4.12 Tube Power Limit (DEPRECATED)

SUBINDEX: 31

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Tube Power Limit Percentage (%)	[0-100]
3	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3	Tube Power Limit Percentage (%)	[0-100]

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets Tube Power Limit percentage in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 Tube power limit out of range 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4.13 FPS

SUBINDEX: 32

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3	FPSx10	[0..1200] 0 – Single Shot
4	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3 4	FPSx10	[0..1200] 0 – Single Shot

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets FPS in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 FPS value out of range 1 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4.14 Tracking ID

SUBINDEX: 33

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Tracking ID	[0..255] 0 – None
3	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3	Tracking ID	[0..255]

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets Tracking ID in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 4 Tracking not supported 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4.15 Available for future use

SUBINDEX: 34

4.16 Available for future use

SUBINDEX: 35

4.17 Patient Size (DEPRECATED)

SUBINDEX: 36

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Patient Size	0 Small 1 Medium 2 Large
3	Pediatric Patient	0 Adult 1 Pediatric
4		2

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Patient Size	0 Small 1 Medium 2 Large
3	Pediatric Patient	0 Adult 1 Pediatric

4	Command Type	0	Set Value

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets Patient Size in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 10 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

4.18 AEC Reference

SUBINDEX: 37

SET - ANSWER/EVENT

BYTE	DATA	FORMAT
1	**Data Bank ID**	**[1..255]**
2 **3**	**AEC REFERENCE**	**[0..65565]** Depending on AEC Reference Mode, Byte 1 message subindex 158 Bit 2 = 1: External AEC reference

GET

BYTE	DATA	FORMAT
1	**Data Bank ID**	**[1..255]**

DESCRIPTION

Sets AEC reference in a RAD Data Bank.

4.19 AEC Chambers (2)

SUBINDEX: 38

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	AEC Chamber off(0) / on(1) status	Bit 1: left AEC status Bit 2: center AEC status Bit 3: right AEC status
3	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3	AEC Chamber off(0) / on(1) status	Bit 1: left AEC status Bit 2: center AEC status Bit 3: right AEC status

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets AEC Chambers selection in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 11 Incorrect command type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255

2	Return Code	RETURN CODES:
		0 OK
		1 Data Bank ID out of range
		2 Data Bank ID not defined

5. FLUORO EXPOSURE DATA BANK

5.1 Load FLUORO Data Bank (1) (DEPRECATED)

SUBINDEX: 40

SET / ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2(1-4)	Patient Size	0: Small
		1: Medium
		2: Large
2(5-8)	Pediatric	0: Non Pediatric
		1: Pediatric
3 4	kV * 10	[40..125] * 10
5 6	mA * 100	[0.01..30] * 100
7 8 9	ms * 100	[1..1000] * 100
10 11	Maximum Integration Time (ms)	[1..1000]
12 13	PPSx10	[0..1200] 0 – Continuous
14	ABC	0 ABC OFF 1 ABC ON

15	High Dose	0 High Dose OFF 1 High Dose ON
16	Available for future use	
17	Available for future use	
18	Dose Level ID	[0..255] 0 – None
19	Curve ID	[0..255] 0 – None

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Command used to load a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES:

		0	OK
		1	Data Bank ID out of range
		2	Patient size code out of range
		3	Pediatric code out of range
		4	
		5	
		6	kVp value out of range
		7	
		8	mA value out of range
		9	ms value out of range
		10	Maximum integration time value out of range
		11	PPS value out of range
		12	Setting PPS not supported
		13	Continuous fluoroscopy not supported
		14	
		15	
		16	
		17	Dose Level ID out of range
		18	Dose Level not supported
		19	Curve ID out of range
		20	Curve not supported
		21	DataBank type doesn't match

GET

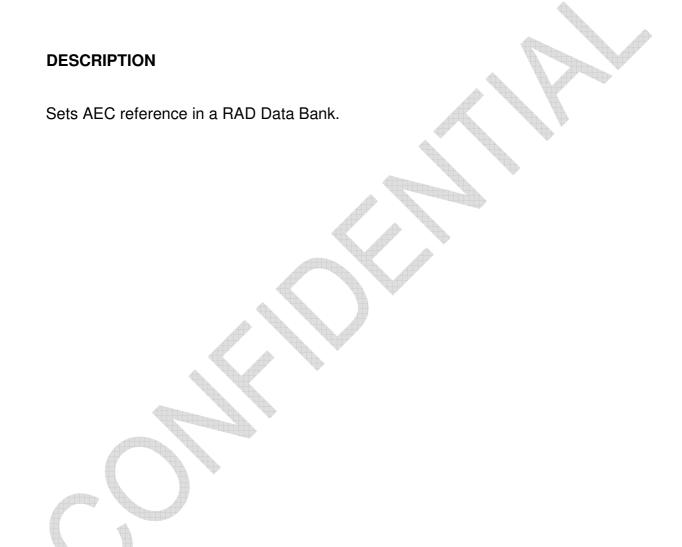| BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

5.2 FLUORO Procedure Acceptance

SUBINDEX: 41

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Allowed	0 Not allowed 1 Allowed

GET

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]

DESCRIPTION

Message defined to keep RAD and FL procedure messages consistent.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Procedure ID out of range 2 Procedure ID not defined 3 Procedure not fluoro

5.3 Load FLUORO Data Bank (2)

SUBINDEX: 42

SET / ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Imaging System Protocol/Body Part/Organ Program Index	Index used to verify that the DB and current DB values are the ones Imaging SW / Generator console is expecting.
3 4	kV * 10	[40..125] * 10
5 6 6	mA * 100	[0.01..xxx] * 100
8 9 10	ms * 100	[1..1000] * 100
11 12	Maximum Integration Time (ms)	[1..1000]
13	Focal spot	0: small 1: large
14 15	PPSx10	[0..1200] 0 – Continuous
16.1	ABC	0 ABC OFF 1 ABC ON
16.2	FL Lock-in	0 Lock-in OFF

BYTE	DATA	FORMAT
16.3	HIGH LEVEL	1 Lock-in ON 0 HIGH LEVEL OFF 1 HIGH LEVEL ON
17 18	TARGET LSB	[1..65535]
19	Curve ID / Trajectory ID	
20 21	ABC update time	Time in ms For ABC analog inteface

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Command used to load a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

		1 Data Bank ID out of range ~~2 Patient size code out of range~~ ~~3 Pediatric code out of range~~ 4 5 6 kVp value out of range 7 8 mA value out of range 9 ms value out of range 10 Maximum integration time value out of range 11 PPS value out of range 12 Setting PPS not supported 13 Continuous fluoroscopy not supported 14 15 ~~16 kV scan not supported~~ ~~17 QbyPPS not supported~~ ~~18 Dose Level ID out of range~~ ~~19 Dose Level not supported~~ 20 Curve ID out of range 21 Curve not supported 22 DataBank type doesn't match

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6. FLUORO EXPOSURE DATA BANK PARAMETERS

6.1 KV

SUBINDEX: 50

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3	kV Value * 10 / Step * 10	[40..125] * 10 / [-5,-1,1,5, -0.1,0.1] * 10 (INT16)
4	Command Type	0 Set Value 1 Step

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3 4	kV Value * 10	[40..125] * 10 (INT16)

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets FL kV value to a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 kVp value out of range 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6.2 MA (1) (DEPRECATED)

SUBINDEX: 51

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[0..255]
2 3	mA * 100	[0.01..30] * 100
4	Command Type	0 Set Value 1 Step

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[0..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3 4	mA * 100	[0.01..30] * 100

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets FL mA value to a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 mA value out of range 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6.3 MS

SUBINDEX: 52

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3 4	ms * 100 / Step (ms station)	[1..1000] * 100 / [-1,1] (INT24)
5	Command Type	0 Set Value 1 Step

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3 4 5	ms * 100	[1..1000] * 100 (INT24)

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets FL ms value (pulse width) to a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 ms value out of range 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6.4 Maximum Integration Time

SUBINDEX: 53

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3	Maximum Integration Time Value (ms)	[1..1000]
4	Command Type	0 – Set value

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3 4	Maximum Integration Time Value (ms)	[1..1000]

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets maximum integration time in a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 Maximum integration time value out of range 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code 1 Return Code 2 …..	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6.5 PPS

SUBINDEX: 54

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3	PPSx10	[0..1200] 0 – Continuous
4	Command Type	0 – Set value

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3 4	PPSx10	[0..1200] 0 – Continuous

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets PPS in a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 PPS value out of range 4 Setting PPS not supported 5 Continuous fluoroscopy not supported 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code …..	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6.6 ABC (1) (DEPRECATED)

SUBINDEX: 55

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	ABC Setting	0: ABC OFF 1: ABC ON
3	Command Type	0 Set Value

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3	ABC Setting	0: ABC OFF 1: ABC ON

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets ABC ON and OFF to a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6.7 High Dose (1) DEPRECATED

SUBINDEX: 56

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	High Dose	0: High Dose OFF 1: High Dose ON
3	Command Type	0 Set Value

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3	High Dose	0: High Dose OFF 1: High Dose ON

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets High Dose ON and OFF in a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6.8 Available for future use

SUBINDEX: 57

6.9 Available for future use

SUBINDEX: 58

6.10 Dose Level ID (DEPRECATED)

SUBINDEX: 59

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Dose Level ID	[0..255] 0 – None
3	Command Type	0 Set Value

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3	Dose Level ID	[0..255]

GET

BYTE	DATA	FORMAT

1	Data Bank ID	[1..255]

DESCRIPTION

Sets Dose Level ID in a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 Dose level ID out of range 4 Dose level not supported 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

		1 Data Bank ID out of range
		2 Data Bank ID not defined

6.11 Curve ID

SUBINDEX: 60

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Curve ID	[0..255] 0 – None
3	Command Type	0 Set Value

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3	Curve ID	[0..255] 0 – None

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets Curve ID in a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 Curve ID out of range 4 Curve not supported 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6.12 MA (2)

SUBINDEX: 61

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[0..255]
2 3 4	mA * 100	[0.01..xxx] * 100 / +-[0.01..xxx] * 100 (INT 24)
5	Command Type	0 Set Value 1 Step

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[0..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3 4 5	mA * 100	[0.01..xxx] * 100

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets FL mA value to a FL Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 mA value out of range 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6.13 ABC – HIGH DOSE (2)

SUBINDEX: 62

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[0..255]
2.1	ABC	0 ABC OFF 1 ABC ON
2.3	HIGH LEVEL	0 HIGH LEVEL OFF 1 HIGH LEVEL ON
3	Command Type	0 Set Value

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[0..255]
2	Allowed	0 – Not Allowed 1 – Allowed
3.1	ABC	0 ABC OFF 1 ABC ON
3.2	FL Lock-in	0 Lock-in OFF 1 Lock-in ON
3.3	HIGH LEVEL	0 HIGH LEVEL OFF 1 HIGH LEVEL ON

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets ABC, LOCK-IN and High Dose to a fluoro DB.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 mA value out of range 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES:

		0	OK
		1	Data Bank ID out of range
		2	Data Bank ID not defined

6.14 TARGET LSB

SUBINDEX: 63

SET - ANSWER / EVENT

BYTE	DATA	FORMAT
1	FL Bank ID	[1..255]
2 3	TARGET LSB	[0..65565]
4	Command Type	0 Set Value

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets target LSB in a FL Data Bank.

6.15 Focal Spot

SUBINDEX: 64

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Focal Spot	0: Small 1: Large
3	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3	Focal Spot	0: Small 1: Large

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets focal spot in a RAD Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 3 Focal spot code out of range 4 Focal spot not supported 11 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

6.16 ABC Update Time

SUBINDEX: 65

SET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 **3**	**ABC update time**	Time in ms For ABC analog interface
4	Command Type	0 Set Value

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Allowed	0 Not Allowed 1 Allowed
3 4	ABC update time	Time in ms For ABC analog interface

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Sets ABC update time in a Fluoro Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined 12 Incorrect Command Type 202 Message not available

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Data Bank ID out of range 2 Data Bank ID not defined

7. CURRENT RAD EXPOSURE DATA BANK

7.1 Current RAD Exposure Data Bank (1) DEPRECATED
SUBINDEX: 70

ANSWER - EVENT

BYTE	DATA	FORMAT
1(1-4)	Patient Size	0: Small
		1: Medium
		2: Large
1(5-8)	Pediatric	0: Non Pediatric
		1: Pediatric
2(1-6)	Technique Mode	0: 0Point
		1: 1Point
		2: 2Point
		3: 3Point
		4: 2Point Falling load
		5: Fully Automatic
		6: 2Point max ms
2(7)	Automatic Technique Mode	0: Do not modify technique mode
		1: Modify technique mode according to parameter change
2(8)	Adjust Parameters Automatically	0: Do not modify parameters
		1: Modify parameters if not allowed
3 4	kV * 10	[20..150] * 10

5 6 7	mAs * 1000	[0.1..3200] * 1000
8 9 10	mA * 100	[1..1000] * 100
11 12 13	ms * 100	[1..20000] * 100
14 15	Minimum Integration Time (ms)	[1..20000]
16 17	Maximum Integration Time (ms)	[1..20000]
18	Focal spot	0: small 1: large 2: super small
19	AEC Sensitivity or Correction factor / AEC reference low byte	Depending on AEC Reference Mode (bit 22.8) and AEC Sensitivity Adjustment Mode Bit 7 = 0, Bit 8 = 0: Select internal AEC reference and sensitivity low/medium/high. Bit 7 = 1, Bit 8 = 0: Sensitivity correction factor. Bit 7 = 1, Bit 8 = 1: AEC reference low byte
20	AEC Density Adjustment - EI adjustment / AEC Reference high byte	Density Correction Factor
21	AEC Chamber off (0) / on(1) status AEC Sensitivity Adjustment Mode	Bit 1: left AEC status Bit 2: center AEC status Bit 3: right AEC status Bit 4: Ion chamber orientation 0 Landscape 1 Portrait Bit 7:

	AEC Reference Mode	0 Legacy systems: old style sensitivity (low/medium/high) 1 New systems Bit 8: 0 Internal 1 External, AEC reference in counts comes from an external device (Imaging SW or Service SW, bytes 20 and 21)
22	Tube Power Limit (%)	[0..100]
23 24	FPSx10	[0..120] 0 – Single Shot
25	Tracking ID	[0..255] 0 – None
26	Generator Power Limit Percentage (%)	[10..100]

GET

No Data

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

7.2 Current RAD Exposure Data Bank (2)

SUBINDEX: 71

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Imaging System Protocol/Body Part/Organ Program Index	Index used to verify that the DB and current DB values are the ones Imaging SW / Generator console is expecting.
2(1-6)	Technique Mode	0: 0Point 1: 1Point 2: 2Point 3: 3Point 4: 2Point Falling load 5: Fully Automatic 6: 2Point max ms
2(7)	Automatic Technique Mode	0: Do not modify technique mode 1: Modify technique mode according to parameter change
2(8)	Adjust Parameters Automatically	0: Do not modify parameters 1: Modify parameters if not allowed
3 4	kV * 10	[20..150] * 10
5 6 7	mAs * 1000	[0.1..3200] * 1000
8 9	mA * 100	[1..1000] * 100

10		
11 12 13	ms * 100	[1..20000] * 100
14 15	Minimum Integration Time (ms)	[1..20000]
16 17	Maximum Integration Time (ms)	[1..20000]
18	Focal spot	0: small 1: large
19	AEC Sensitivity or Correction factor / AEC reference low byte	Depending on AEC Reference Calculation (bit 22.8): - Internal: For film to select sensitivity. For digital to consider the effect of grid, collimator FOV, filter, …. - External: AEC reference calculated by the system console, usually Imaging SW.
20	AEC Density Adjustment - EI adjustment / AEC Reference high byte	Density Correction Factor
21	AEC Chamber off (0) / on(1) status	Bit 1: left AEC status Bit 2: center AEC status Bit 3: right AEC status
	AEC Reference Calculation	Bit 8: 0 Internal 1 External, AEC reference in counts comes from an external device (Imaging SW or Service SW, bytes 20 and 21)
22	SPARE	
23 24	FPSx10	[0..120] 0 – Single Shot

| 25 | Tracking ID | [0..255]

0 – None |
| 26 | SPARE | |

GET

No Data

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

8. CURRENT RAD EXPOSURE DATA BANK PARAMETERS

8.1 Technique Mode

SUBINDEX: 80

ANSWER - EVENT

BYTE	DATA	FORMAT
1(1-6)	Technique Mode	0: 0Point 1: 1Point 2: 2Point 3: 3Point 4: 2Point Falling load 5: Fully Automatic 6:2Point max ms

DESCRIPTION

Current RAD Data Bank Technique Mode.

8.2 KV

SUBINDEX: 81

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	kV Value * 10	[20..150] * 10 (INT16)

DESCRIPTION

Current RAD Data Bank kVp value.

8.3 MAS

SUBINDEX: 82

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2 3	mAs * 1000	[0.1..3200] * 1000 (INT24)

DESCRIPTION

Current RAD Data Bank mAs value.

8.4 MA

SUBINDEX: 83

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2 3	mA * 100	[1..1000] * 100 (INT24)

DESCRIPTION

Current RAD Data Bank mA value.

8.5 MS

SUBINDEX: 84

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2 3	ms * 100	[1..20000] * 100

DESCRIPTION

Current RAD Data Bank ms value.

8.6 Minimum Integration Time

SUBINDEX: 85

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	Minimum Integration Time Value (ms)	[1..20000]

DESCRIPTION

Current RAD Data Bank minimum integration time value.

8.7 Maximum Integration Time

SUBINDEX: 86

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	Maximum Integration Time Value (ms)	[1..20000]

DESCRIPTION

Current RAD Data Bank maximum integration time value.

8.8 Focal Spot

SUBINDEX: 87

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Focal Spot	0: Small 1: Large

DESCRIPTION

Current RAD Data Bank focal spot value.

8.9 AEC Sensitivity or Correction Factor

SUBINDEX: 88

ANSWER - EVENT

BYTE	DATA	FORMAT
1	AEC Sensitivity or Correction factor	Depending on AEC Reference Mode (Subindex 158) Bit 7 = 0, Bit 8 = 0: Select internal AEC reference and sensitivity low/medium/high. Bit 7 = 1, Bit 8 = 0: Sensitivity correction factor.

DESCRIPTION

Factor to multiply the AEC reference.

8.10 AEC Density correction factor

SUBINDEX: 89

ANSWER - EVENT

BYTE	DATA	FORMAT
1	AEC Density	Density Correction Factor AEC Reference Mode (bit 22.8 = 0 in RAD Exposure DB

DESCRIPTION

Current RAD Data Bank AEC Density correction factor.

8.11 AEC Chambers (1) DEPRECATED

SUBINDEX: 90

ANSWER - EVENT

BYTE	DATA	FORMAT
1	AEC Chamber off(0) / on(1) status	Bit 1: left AEC status Bit 2: center AEC status Bit 3: right AEC status Bit 4: Ion chamber orientation 0 Landscape 1 Portrait

DESCRIPTION

Current RAD Data Bank AEC Chambers selection.

8.12 Tube Power Limit (DEPRECATED)

SUBINDEX: 91

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Tube Power Limit Percentage (%)	[0-100]

DESCRIPTION

Current RAD Data Bank Tuber Power Limit percentage.

8.13 FPS

SUBINDEX: 92

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	FPSx10	[0..1200] 0 – Single Shot

DESCRIPTION

Current RAD Data Bank FPS.

8.14 Tracking ID

SUBINDEX: 93

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Tracking ID	[0..255]

DESCRIPTION

Current RAD Data Bank Tracking ID.

8.15 Available for future use

SUBINDEX: 94

8.16 Available for future use

SUBINDEX: 95

8.17 Patient Size (DEPRECATED)

SUBINDEX: 96

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Patient Size	0 Small 2 Medium 3 Large
2	Pediatric Patient	0 Adult 1 Pediatric

DESCRIPTION

Current RAD Data Bank patient size

8.18 AEC Reference

SUBINDEX: 97

ANSWER/EVENT

BYTE	DATA	FORMAT
1 2	AEC REFERENCE	[0..65565]

DESCRIPTION

Current RAD DB AEC reference.

8.19 AEC Chambers (2)
SUBINDEX: 98

ANSWER - EVENT

BYTE	DATA	FORMAT
1	AEC Chamber off(0) / on(1) status	Bit 1: left AEC status Bit 2: center AEC status Bit 3: right AEC status

DESCRIPTION

Current RAD Data Bank AEC Chambers selection.

9. CURRENT FLUORO EXPOSURE DATA BANK

9.1 Current FLUORO EXPOSURE DATA BANK (1) (DEPRECATED)
SUBINDEX: 100

ANSWER - EVENT

BYTE	DATA	FORMAT
1(1-4)	Patient Size	0: Small 1: Medium 2: Large
1(5-8)	Pediatric	0: Non Pediatric 1: Pediatric
2	kV * 10	[40..125] * 10

3		
4 5	mA * 100	[0.01..30] * 100
6 7 8	ms * 100	[1..1000] * 100
9 10	Maximum Integration Time (ms)	[1..1000]
11 12	PPSx10	[1..1200] 0 – Continuous
13	ABC	0 ABC OFF 1 ABC ON
14	High Dose	0 High Dose OFF 1 High Dose ON
15	Available for future use	
16	Available for future use	
17	Dose Level ID	[1..255]
18	Curve ID	[1..255]

GET

No data

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

9.2 Current FLUORO EXPOSURE DATA BANK (2)

SUBINDEX: 101

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Imaging System Protocol/Body Part/Organ Program Index	Index used to verify that the DB and current DB values are the ones Imaging SW / Generator console is expecting.
2 3	kV * 10	[40..125] * 10
4 5 6	mA * 100	[0.01..xxx] * 100
7 8 9	ms * 100	[1..1000] * 100
10 11	Maximum Integration Time (ms)	[1..1000]
12	Focal spot	0: small 1: large
13 14	PPSx10	[0..1200] 0 – Continuous
15.1 15.2	ABC FL Lock-in	0 ABC OFF 1 ABC ON 0 Lock-in OFF 1 Lock-in ON

15.3	HIGH LEVEL	0 HIGH LEVEL OFF
		1 HIGH LEVEL ON
16	TARGET LSB	[1..65535]
17		
18	Curve ID / Trajectory ID	
19	ABC update time	Time in ms
20		For ABC analog inteface

GET

No data

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

10.CURRENT FLUORO DATA BANK PARAMETERS

10.1 KV

SUBINDEX: 110

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	kV Value * 10	[40..125] * 10 (INT16)

DESCRIPTION

Current Fl Data Bank kV value.

10.2 MA (1) DEPRECATED

SUBINDEX: 111

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	mA * 100	[0.01..30] * 100

DESCRIPTION

Current FI Data Bank mA value.

10.3 MS

SUBINDEX: 112

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2 3	ms * 100	[1..1000] * 100 (INT24)

DESCRIPTION

Current FI Data Bank ms value.

10.4 Maximum Integration Time

SUBINDEX: 113

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	Maximum Integration Time Value (ms)	[1..1000]

DESCRIPTION

Current FI Data Bank maximum integration time value.

10.5 PPS

SUBINDEX: 114

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	PPSx10	[0..1200] 0 – Continuous

DESCRIPTION

Current FI Data Bank PPS value.

10.6 ABC (1) DEPRECATED

SUBINDEX: 115

ANSWER - EVENT

BYTE	DATA	FORMAT
1	ABC Setting	0: ABC OFF 1: ABC ON

DESCRIPTION

Current FI Data Bank ABC setting.

10.7 High Dose (1) DEPRECATED

SUBINDEX: 116

ANSWER - EVENT

BYTE	DATA	FORMAT
1	High Dose	0: High Dose OFF 1: High Dose ON

DESCRIPTION

Current Fl Data Bank High Dose setting.

10.8 Available for future use

SUBINDEX: 117

10.9 Available for future use

SUBINDEX: 118

10.10 Dose Level ID (DEPRECATED)

SUBINDEX: 119

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Dose Level ID	[0..255] 0 – None

DESCRIPTION

Current Fl Data Bank Dose Level ID.

10.11 Curve ID

SUBINDEX: 120

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Curve ID	[0..255] 0 – None

DESCRIPTION

Current Fl Data Bank Curve ID.

10.12 MA (2)

SUBINDEX: 121

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2 3	mA * 100	[0.01..xxx] * 100

DESCRIPTION

Current FL DB mA value

10.13 ABC – HIGH DOSE (2)

SUBINDEX: 122

ANSWER – EVENT

BYTE	DATA	FORMAT
1.1	ABC	0 ABC OFF 1 ABC ON
1.3	HIGH LEVEL	0 HIGH LEVEL OFF 1 HIGH LEVEL ON

DESCRIPTION

Current FL DB ABC, LOCK-IN and HIGH DOSE settings.

10.14 TARGET LSB

SUBINDEX: 123

ANSWER / EVENT

BYTE	DATA	FORMAT
1 2	TARGET LSB	[0..65565]

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Target LSB from current FL Data Bank.

10.15 Focal Spot

SUBINDEX: 124

EVENT

BYTE	DATA	FORMAT
1	Focal Spot	0: Small 1: Large

GET

No data.

DESCRIPTION

Focal spot in current Fluoro Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

10.16 ABC Update Time

SUBINDEX: 125

EVENT

BYTE	DATA	FORMAT
1 2	ABC update time	Time in ms For ABC analog interface

GET

No data.

DESCRIPTION

ABC update time from current Fluoro Data Bank.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT

1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

11.OTHER GENERATOR FUNCTIONS

11.1 Fluoro Time Reset

SUBINDEX: 130

SET / ANSWER - EVENT

No data

DESCRIPTION

Resets fluoro time.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Function not supported

11.25-Minute Fluoro Alarm Reset

SUBINDEX: 131

SET / ANSWER - EVENT

No data

DESCRIPTION

Resets 5-minute fluoro alarm.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Function not supported

11.3 Generator Power Limit

SUBINDEX: 132

SET

BYTE	DATA	FORMAT
1	Generator Power Limit Percentage (%) / Step (Percentage station)	[10..100] / [-1,1] (INT8)
2	Command Type	0 Set Value 1 Step

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Allowed	0 Not Allowed 1 Allowed
2	Generator Power Limit Percentage (%)	[10..100]

GET

No Data

DESCRIPTION

Sets Generator Power Limit.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Power Limit value out of range 10 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code 1	RETURN CODES: 0 OK

11.4 Enable Filaments

SUBINDEX: 133

SET

BYTE	DATA	FORMAT
1	Filaments status	0 Filaments disabled 1 Filaments enabled

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Filaments status	0 Filaments disabled 1 Filaments enabled

GET

No Data

DESCRIPTION

Sets the filaments ON and OFF.

There is a dip switch on the generator, this message will only be considered if dip switch is set to enable filaments.

Dip switch	R2CP message	Filaments
ON	OFF	OFF
ON	ON	ON

OFF	OFF	OFF
OFF	ON	OFF

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Filaments OFF by HW 11 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code 1	RETURN CODES: 0 OK

11.5 Tube Power Limit

SUBINDEX: 134

SET

BYTE	DATA	FORMAT
1	Tube ID	1 Tube 1 2 Tube 2
2	Tube Power Limit Percentage (%) / Step (Percentage station)	[10..100] / [-1,1] (INT8)
3	Command Type	0 Set Value 1 Step

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Allowed	0 Not Allowed 1 Allowed
2	Tube ID	1 Tube 1 2 Tube 2
3	Tube Power Limit Percentage (%)	[10..100]

GET

No Data

DESCRIPTION

IIS0008SPRO Rev. F   168/237

Sets Tube Power Limit

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 10 Tube Power Limit value out of range 11 Incorrect tube 12 Tube not supported 12 Incorrect Command Type

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

12. STATUS AND EXPOSURE MANAGEMENT

12.1 Generator Status (1) DEPRECATED

SUBINDEX: 140

ANSWER - EVENT

BYTE	DATA	FORMAT
1.0-1.6	Status	[1..255] 1 – Initialization 2 – Standby 3 – Preparation 4 – Ready 5 – Exposure Request (not applicable for direct, tomography and tomosynthesis) 6 – Exposure in Progress 7– Waiting to Release Handswitch 8 – Shutting down 9 – Error 10 – Service
2.0 – 2.3	System Message Active	0 – Not active 1 – Active
2.4 – 2.7	System Message Active → Inhibit	0 – No inhibit 1 – Inhibit
3	Procedure ID	[0..255] 0 – Default Procedure 1..255 – Application specific procedures
4	Procedure Status	0 – Not Active 1 – Active 2 – Paused

		3 – Finished
5	Exposure Data Bank Sequence Number in Procedure	[1..255]
6 7	FI Time Seconds	[1..65565]
8(1-4)	5-minute fluoro alarm	0 – Alarm off 1 – 5-minute alarm ON
8(5-8)	10-minute fluoro without releasing handswitch/footswitch	0 – Alarm off 1 – 9-minute alarm ON 2 – 10-minute alarm ON
9	Accumulated anode HU %	[0..100]
10	Accumulated housing HU %	[0..100]
11	Generator HU %	[0..100]
12(1)	RAD Preparation signal status	0 – Not Active 1 – Active
12(2)	RAD Exposure signal status	0 – Not Active 1 – Active
12(3)	FLUORO signal status	0 – Not Active 1 – Active
12(8)	Filaments status	0 – Filaments OFF 1 – Filaments ON
13(1)	Dynamic Mode 1 Signal Status	0 – Not Active 1 – Active
13(2)	Dynamic Mode 2 Signal Status	0 – Not Active 1 – Active
14	Current Rotor speed	0 – Stopped 1 – Low Speed 2 -- High Speed

GET

No data

DESCRIPTION

Generator provides information about its current internal status and if a transition to a different status is in progress.

If Status=2, Status transition from=2 and Status transition to=3, it means that generator is preparing to make an exposure after prep signal has been pressed.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

12.2 Post Exposure / Post Condition (1) DEPRECATED

SUBINDEX: 141

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	kV * 10	[20..150] * 10
3 4 5	mA * 100	[1..1000] * 100
6 7 8	ms * 100	[1..16000] * 100
9 10 11	mAs * 1000	[0.1..3200] * 1000
12	Focal spot	0: small 1: large
13	AEC Sensitivity or Correction factor / AEC reference low byte	Depending on AEC Reference Mode (bit 22.8) and AEC Sensitivity Adjustment Mode Bit 7 = 0, Bit 8 = 0: Select internal AEC reference and sensitivity low/medium/high. Bit 7 = 1, Bit 8 = 0: Sensitivity correction factor. Bit 7 = 1, Bit 8 = 1: AEC reference low byte
14	AEC Chamber off (0) / on(1) status	Bit 1: left AEC status Bit 2: center AEC status Bit 3: right AEC status Bit 4: Ion chamber orientation 0 Landscape

	AEC Sensitivity Adjustment Mode AEC Reference Mode	1 Portrait Bit 7: 0 Legacy systems: old style sensitivity (low/medium/high) 1 New systems Bit 8: 0 Internal 1 External, AEC reference in counts comes from an external device (Imaging SW or Service SW, bytes 20 and 21)
15	AEC Density Adjustment - EI adjustment / AEC Reference high byte	Depending on AEC Reference Mode (bit 22.8): Bit 8 = 0: AEC Density Adjustment / EI Adjustment. Bit 8 = 1: AEC reference high byte
16	RAD End of Exposure Reason	0: Not started 1: Finished ok, no AEC 2: Finished ok, AEC 3: AEC backup timer reached. 4: Finished user aborted (handswitch released) 5: Finished aborted with error 6: Finished aborted before ready 7: Finished aborted panel not ready timeout 8: Finished inhibit aborted (positioner inhibit, door open, …)

GET

No data

DESCRIPTION

Actual exposure parameters. For standard RAD applications Exposure Number = 0 always refers to last exposure.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 No exposure made

12.3 Start / Stop Exposure

SUBINDEX: 142

SET

BYTE	DATA	FORMAT
1	Request	0 – Stop Exposure 1 – Start Exposure

DESCRIPTION

Message to initiate or to stop an exposure. Exposure will start if handswitch is pressed and all conditions to start exposure are met: no inhibits and anode and filament ready.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Feature not supported by the detector interface 2 Request Value out of range

12.4 Communications Inhibit Timeout

SUBINDEX: 143

SET

BYTE	DATA	FORMAT
1	Communications Timeout	0: Not active 1-255: Active, Timeout in seconds.
2	Source Node Number ID	[1..255]

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Communications Timeout	0: Not active 1-255: Active, Timeout in seconds.
2	Link Status	0: Connection lost 1: Connection ok
3	Source Node Number ID	[1..255]

GET

No Data

DESCRIPTION

This message is used to set and manage a communications timeout on the generator.

It is used to make sure that exposures are enabled and disabled when main generator console determines, which is usually when a patient is open and a procedure is selected for flat panel or when a direct workstation is selected.

This message works as a keep alive message at application level.

Generator console will start sending this message at specified intervals, setting communications timeout with a longer time. Generator will send an answer message to let generator console know that communications are ok.

If this message is not received by the generator within the timeout defined, exposures will be disabled and it will send answer with Link status = Connection lost with the same timeout interval. When communications are reestablished, generator console can start sending this message again and enable exposures if needed.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

12.5 RAD Post Exposure / RAD Post Condition (2)

SUBINDEX: 144

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	Exposure number	[0..65535]
3	Procedure ID	[0..255] 0 – Default Procedure 1..255 – Application specific procedures
4	Exposure Data Bank Sequence Number in Procedure	[1..255]
5 6	kV * 10	[20..150] * 10
7 8 9	mA * 100	[1..1000] * 100
10 11 12	ms * 100	[1..16000] * 100
13 14 15	mAs * 1000	[0.1..3200] * 1000
16	Focal spot	0: small 1: large
17	AEC Sensitivity or Correction factor / AEC reference low byte	Depending on AEC Reference Calculation (bit 22.8): - Internal: For film to select sensitivity. For

		digital to consider the effect of grid, collimator FOV, filter, ….
		- External: AEC reference calculated by the system console, usually Imaging SW.
18	AEC Density Adjustment - EI adjustment / AEC Reference high byte	Density Correction Factor
19	AEC Chamber off (0) / on(1) status	Bit 1: left AEC status
		Bit 2: center AEC status
		Bit 3: right AEC status
	AEC Reference Calculation	Bit 8:
		0 Internal
		1 External, AEC reference in counts comes from an external device (Imaging SW or Service SW, bytes 20 and 21)
20	RAD End of Exposure Reason	0:Not started
		1:Finished ok, no AEC
		2:Finished ok, AEC
		3:AEC backup timer reached.
		4:Finished user aborted (handswitch released)
		5:Finished aborted with error
		6:Finished aborted before ready
		7:Finished aborted panel not ready timeout
		8:Finished inhibit aborted (positioner inhibit, door open, …)
		9 Exposed out of detector acquisition window
21	ION CHAMBER ROTATION	0 – Unknown

		1 – 0º
		2 – 90º
		3 – 180º
		4 – 270

GET

No data

DESCRIPTION

Actual exposure parameters. Generator only keeps last exposure values, GET would only apply to last exposure made.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 No exposure made **2 Exposure number requested does not match last exposure**

12.6 FL Post Exposure / FL Post Condition
SUBINDEX: 145

ANSWER - EVENT

BYTE	DATA	FORMAT
1 2	Exposure number	[0..65565]
3	Procedure ID	[0..255] 0 – Default Procedure 1..255 – Application specific procedures
4	Exposure Data Bank Sequence Number in Procedure	[1..255]
5 6	kV * 10	[20..150] * 10
7 8 9	mA * 100	[1..1000] * 100
10 11 12	ms * 100	[1..16000] * 100
13	Focal spot	0: small 1: large
14	FL End of Exposure Reason	0: Not started 1: Aborted 2: Finished ok 4 Exposed out of detector acquisition window

GET

No data required

DESCRIPTION

Actual exposure parameters.

NOTE: Generator will probably need to keep the values for the exposures between two updates of image grey level or for the last second which is equal to the PPS selected.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 No exposure made 2 Exposure number requested does not match last exposure

12.7 Reset Exposure Counter
SUBINDEX: 146

SET

No data

DESCRIPTION

Resets exposure counter, typically when a patient is open.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK, counter reset to 0 1 Not OK

12.8 Generator Status (2)

SUBINDEX: 147

ANSWER - EVENT

BYTE	DATA	FORMAT
1.0-1.6	Status	[1..255] 1 – Initialization 2 – Standby 3 – Preparation 4 – Ready 5 – Exposure Request (not applicable for direct, tomography and tomosynthesis) 6 – Exposure in Progress 7– Waiting to Release Handswitch 8 – Shutting down 9 – Error 10 – Switching tube
2.0 – 2.3	System Message Active	0 – Not active 1 – Active
2.4 – 2.7	System Message Active → Inhibit	0 – No inhibit 1 – Inhibit
3	Procedure ID	[0..255] 0 – Default Procedure 1..255 – Application specific procedures
4	Exposure Type	0 – None 1 – Single Shot 2 – Serial RAD 3 – Continuous FL 4 – Continuous FL - HLC

		5 – Pulsed FL
		6 – Pulsed FL - HLC
5	Exposure Data Bank Sequence Number in Procedure	[1..255]
6 7	Fl Time Seconds	[1..65565]
8.1	5-minute fluoro alarm	0 – Alarm OFF 1 – Alarm ON
8.2	5-minute fluoro warning	0 – Warning OFF 1 – Warning ON
8.3	Spare	0 – 1 –
8.4	Lock in frame reached	0 – Not reached 1 – Reached
8.5	10-minute fluoro alarm	0 – Alarm OFF 1 – Alarm ON
8.6	10-minute fluoro warning	0 – Warning OFF 1 – Warning ON
8.7	Spare	0 – 1 –
8.8	High Level Fluoro	0 – High Level Fluoro OFF 1 – High Level Fluoro ON
9	Accumulated anode HU %	[0..100]
10	Accumulated housing HU %	[0..100]
11	Generator HU %	[0..100]

12.1	RAD Preparation signal status	0 – Not Active 1 – Active
12.2	RAD Exposure signal status	0 – Not Active 1 – Active
12.3	FLUORO signal status	0 – Not Active 1 – Active
12.8	Filaments status	0 – Filaments OFF 1 – Filaments ON
13.1	Dynamic Mode 1 Signal Status	0 – Not Active 1 – Active
13.2	Dynamic Mode 2 Signal Status	0 – Not Active 1 – Active
14	Current Rotor speed	0 – Stopped 1 – Low Speed 2 -- High Speed

GET

No data

DESCRIPTION

Generator provides information about its current internal status and if a transition to a different status is in progress.

If Status=2, Status transition from=2 and Status transition to=3, it means that generator is preparing to make an exposure after prep signal has been pressed.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

13.MISCELLANEOUS (1)

13.1 Maximum Number of Procedures

SUBINDEX: 150

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Maximum number of Procedures	[1 .. 255]

GET

No Data

DESCRIPTION

Information about the maximum number of procedures available.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

13.2 Maximum Number of Data Banks

SUBINDEX: 151

ANSWER - EVENT

BYTE	DATA	FORMAT
1	Maximum number of Data Banks	[1 .. 255]

GET

No Data

DESCRIPTION

Information about the maximum number of data banks available.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0　OK

13.3 RAD EXPOSURE PARAMETER RANGES

SUBINDEX: 152

ANSWER – EVENT

BYTE	DATA	FORMAT
1 2	Min kV * 10	[20..150] * 10
3 4	Max kV * 10	[20..150] * 10
5 6 7	Min mAs * 1000	[0.1..3200] * 1000
8 9 10	Max mAs * 1000	[0.1..3200] * 1000
11 12 13	Min mA * 100	[1..1000] * 100
14 15 16	Max mA * 100	[1..1000] * 100
17 18 19	Min ms * 100	[1..20000] * 100
20 21 22	Max ms * 100	[1..20000] * 100
23	mA scale	(63/64/65)

GET

No data.

DESCRIPTION

This message contains the information about the RAD exposure parameter ranges.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

13.4 FLUORO EXPOSURE PARAMETER RANGES

SUBINDEX: 153

ANSWER – EVENT

BYTE	DATA	FORMAT
1 2	Min kV * 10	[40..125] * 10
3 4	Max kV * 10	[40..125] * 10
5 6 7	Min mA * 100	[0.01..30] * 100
8 9 10	Max mA * 100	[0.01..30] * 100

GET

No data.

DESCRIPTION

This message contains the information about the FLUORO exposure parameter ranges.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT

1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

13.5 WORKSTATION

SUBINDEX: 154

SET/ANSWER – EVENT

BYTE	DATA	FORMAT
1	Workstation ID	1..255
2	Generator ID	1..255
3	Tube	1,2
4	Positioner ID	0..255
5	Synchronization Interface Type	0 – Direct Mode, No synchronization: Film, CR, Autotrigger detector. 1 – Software Synchronization 2 – Hardware Synchronization Connected to Generator 3 – Hardware Synchronization Connected to HW Bus 4 - Dynamic Hardware Synchronization TO HW Bus
6	Image Receptor Index	0..4 If connected to HW bus, it indicates index local to table or

		wallstand.
		If connected directly to generator, it indicates index related to generator.
7	Ion Chamber Connected to	0 – No AEC 1 – Generator 2 – eBox
8	AEC Input	0..4 0 – None

GET

BYTE	DATA	FORMAT
1	Workstation ID	1..255

DESCRIPTION

This message contains the information required by a generator to configure a workstation. It is available for generators that do not support XML configuration files.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

		1 Workstation ID out of range
		2 Tube out of range
		3 Synchronization Interface Type out of range
		4 Image Receptor out of range
		5 Io Chamber connection out of range
		6 AEC input out of range

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Workstation ID out of range

13.6 HANDSWITCH/FOOTSWITCH CONFIGURATION

SUBINDEX: 155

SET / ANSWER – EVENT

BYTE	DATA	FORMAT
1	Handswitch/Footswitch ID	[1..255]
2.1	PREP RAD	0 Don't care / 1 Care for handswitch/footswitch activation
2.2	EXP RAD	0 Don't care / 1 Care for handswitch/footswitch activation
2.3	FL	0 Don't care / 1 Care for handswitch/footswitch activation
3.1	Dynamic Mode 1 Mask	0 Don't care / 1 Care
3.2	Dynamic Mode 2 Mask	0 Don't care / 1 Care
3.3	Dynamic Mode 3 Mask	0 Don't care / 1 Care
3.4	Dynamic Mode 4 Mask	0 Don't care / 1 Care
3.5	Dynamic Mode 1 Status	0 Signal should not be active for pedal activation 1 Signal should be active for pedal activation
3.6	Dynamic Mode 2 Status	0 Signal should not be active for pedal activation 1 Signal should be active for pedal activation

3.7	Dynamic Mode 3 Status	0 Signal should not be active for pedal activation 1 Signal should be active for pedal activation
3.8	Dynamic Mode 4 Status	0 Signal should not be active for pedal activation 1 Signal should be active for pedal activation

GET

No data.

DESCRIPTION

This message contains the information required by a generator to configure handswitches/footswitches. It is available for generators that do not support XML configuration files.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Handswitch/Footswitch ID out of range

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

13.7 EBOX SW VERSION

SUBINDEX: 156

SET / ANSWER – EVENT

BYTE	DATA	FORMAT
1	Version	[0 .. 255]
2	Revision	[0 .. 255]
3	Sub revision	[0 .. 255]
4	Board Type	0 Ebox 1 HwBus Interface

GET

No data.

DESCRIPTION

This message contains the information required by a generator to know what software version is running in Ebox Device when exists.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

13.8 Parasitic Capacitance Parameter

SUBINDEX: 157

ANSWER

BYTE	DATA	FORMAT
1 2 3 4	Parasitic Capacitance * 100	[0…65535] * 100

GET

No data.

DESCRIPTION

This message contains the information required to know the current parasitic Capacitance.

13.9 AEC Reference Mode

SUBINDEX: 158

SET / ANSWER – EVENT

BYTE	DATA	FORMAT
1	AEC Reference Mode	Bit 1: 0 Legacy systems: old style sensitivity (low/medium/high) 1 New systems with Sensitivity correction factor Bit 2: 0 Internal

		1 External, AEC reference in counts comes from an external device

GET

No data.

DESCRIPTION

This message configures the way the AEC is handled by the generator.

Bit 1	Bit 2	
0	0	**Default value.** AEC internal reference. Sensitivity can be Low/Medium/High values (0, 1, 2)
1	0	AEC internal reference Sensitivity is calculated with a correction factor (%) that multiplies the calibrated reference value.
X	1	AEC external reference Generator console or imaging system calculate the AEC reference

For AEC internal reference, density/EI adjustment is always set through a correction factor (%) that multiplies the calibrated reference value.

13.10 EXPOSURE COUNTERS

SUBINDEX: 159

ANSWER

BYTE	DATA	FORMAT
1	Tube ID	1, 2
2	Command	0 RAD exposures 1 RAD energy (joules) 2 RAD mAs 3 Filament excited ime (seconds) 4 Fluoro time (seconds) 5 Fluoro energy (joules)
3 4 5 6	Small focal spot data	
7 8 9 10	Large focal spot data	

GET

BYTE	DATA	FORMAT
1	Tube ID	1, 2
2	Command	0 RAD exposures 1 RAD energy (joules) 2 RAD mAs 3 Filament excited ime (seconds) 4 Fluoro time (seconds) 5 Fluoro energy (joules)

DESCRIPTION

This message requests generator different counters linked to generator usage

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Tube not supported 2 Tube ID out of range 3 Command ID out of range

14. General Purpose Input Output

14.1 Digital Inputs

SUBINDEX: 160

ANSWER/EVENT

BYTE	DATA	FORMAT
1 2	Digital inputs mask	Mask in hexadecimal indicating the inputs whose value is received Digital input 1 to 16
3 4	Digital inputs value	Digital inputs value

GET

BYTE	DATA	FORMAT
1 2	Digital inputs mask	Mask in hexadecimal indicating the inputs whose value is requested

DESCRIPTION

This message is used to request the value of the digital inputs (GET), to receive the Response, and also to receive an event when digital input is configured to inform about transitions.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT

1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

Examples:

- Request the status of the digital inputs 2 and 12

Digital Input	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mask bits	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Hex value		0				8				0				2		

  - GET: 0x0802
  - ANSWER, only digital input 2 is active:
    - 1,2 Mask: 0x0802
    - 3,4 Digital input value: 0x0002
- Digital input 13 is configured to inform about 0 → 1 transitions
  - EVENT
    - 1, 2 Mask: 0x1000
    - 3 4 Digital input value: 0x1000

15. Dynamic Sequence

15.1 Load Dynamic Sequence DB

SUBINDEX: 170

SET / ANSWER - EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	#stages	[1..255]
3	Stage 1 #frames	[1..255]
4 5	Stage 1 FPSx10	[0..1200]
6	Stage 2 #frames	[1..255]
7 8	Stage 2 FPSx10	[0..1200]
……..		
N-2	Stage J #frames	0 → Keep exposing until pedal is released 1..255]
N-1 N	Stage J FPSx10	[0..1200]

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Message to read (GET) or write (SET) parameters for a Dynamic Sequence Data Bank.

In a Dynamic Sequence we define different stages with predefined frame rates and duration that can be used for fluoro or serial RAD.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 101 Frame out of range 102 Duration out of range

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 101 Not OK.

15.2 Assign Dynamic Sequence DB to Procedure

SUBINDEX: 171

SET

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Dynamic Sequence Data Bank ID	[1..255]

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Dynamic Sequence Data Bank ID	[1..255]
3	Allowed	0 Not allowed 1 Allowed

GET

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code…..	RETURN CODES: 0 OK 1 Procedure ID not defined (ERROR_PROC_NOT_DEFINED) 2 Procedure ID out of range 3 Procedure ID already active, assign not possible (ERROR_ASIGN_TO_CURRENT) 4 Dynamic Sequence DB Number out of range (ERROR_ASSIGN_BAD_SEQ_NUM) 5 Dynamic Sequence Bank ID not defined (ERROR_DB_NOT_DEFINED) 6 Dynamic Sequence Data Bank ID out of range 7 Dynamic Sequence DB incompatible with Procedure Type (ERROR_ASSIGN_INCORRECT_PROC TYPE)

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255

2	Return Code	RETURN CODES:
		0 OK
		1 Procedure ID not defined
		2 Procedure ID out of range 3 4 No Dynamic Sequence DB assigned (ERROR_DB_POS_NOT_ASSIGN)

DESCRIPTION

Command used to assign a Dynamic Sequence Data Bank to a Procedure.

15.3 Dynamic Sequence Status
SUBINDEX: 172

ANSWER-EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2	Current stage	[1..255]
3 4	Number of frames made	[1..255]

GET

BYTE	DATA	FORMAT

1	Data Bank ID	[1..255]

DESCRIPTION

Message that informs about Dynamic Sequence progress.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 1 OK

16. Exposure Lock In

Exposure Lock In refers to a feature used in Fluoro and RAD procedures to lock exposure after ABC or AEC have regulated. With fluoro we stop ABC regulation and with RAD we keep exposure time achieved with the last AEC exposure.

It is particularly suitable for Fluoro Roadmap Mask and DSA, but can also be used for regular Fluoro and serial RAD procedures.

16.1 Lock-In DB

SUBINDEX: 180

SET / ANSWER

BYTE	DATA	FORMAT
1	Lock In DB ID	[1..255]
2	Auto Lock-in Enabled	0 Not enabled 1 Enabled
3	Auto Lock-in time seconds*10	[1..255] 0.1 seconds – 25.5 seconds

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Message to read (GET) or write (SET) parameters for a Lock-In Data Bank.

Auto Lock-in Enabled is related to ABC in Roadmapping fluoro and to AEC in DSA. It can also be uses for non image subtraction procedures.

For Roadmapping fluoro lock-in is reached when lock-in frame is met or when ABC regulation is done if this occurs before lock-in frame.

If roadmapping fluoro is performed with continuous fluoroscopy, frame number is defined for 30 PPS.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 10 Lock-in time out of range

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 10 Not OK.

16.2 Assign Lock In DB to Procedure

SUBINDEX: 181

SET

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Lock In Data Bank ID	[1..255]

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	Lock In Data Bank ID	[1..255]
3	Allowed	0 Not allowed 1 Allowed

GET

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code…..	RETURN CODES: 0 OK 1 Procedure ID not defined (ERROR_PROC_NOT_DEFINED) 2 Procedure ID out of range 3 Procedure ID already active, assign not possible (ERROR_ASIGN_TO_CURRENT) 4 Image Subtraction DB Number out of range (ERROR_ASSIGN_BAD_SEQ_NUM) 5 Image Subtraction Bank ID not defined (ERROR_DB_NOT_DEFINED) 6 Image Subtraction Data Bank ID out of range 7 Image Subraction DB incompatible with Procedure Type (ERROR_ASSIGN_INCORRECT_PROC TYPE)

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 1 Procedure ID not defined

		2	Procedure ID out of range
		3	
		4	No Image Subtraction DB assigned (ERROR_DB_POS_NOT_ASSIGN)

DESCRIPTION

Command used to assign an Image Subtraction Bank to a Procedure. Depending on the procedure type it is assigned to, it refers to DSA or Roadmap Fluoro.

16.3 Lock-in Frame Reached

SUBINDEX: 182

ANSWER-EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[1..255]
2	Lock-in frame reached	[0..255] 0 Lock-in Frame not reached 1..255 Actual lock-in frame reached

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

Message sent by the generator when the generator reaches lock-in frame defined by the procedure.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK 101 Image Subtraction DB not loaded 102 No DSA or Roadmapping procedure defined.

16.4 Injector

SUBINDEX: 183

SET

BYTE	DATA	FORMAT
1	Injector	0 – Stop 1 – Prepare 2 – Inject

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Injector Drive status	0 – Stopped 1 – Ready 2 – Running

GET

No data

DESCRIPTION

Imaging SW provides information about its current internal status.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

17. MISCELLANEOUS (2)

17.1 EXPOSURE PARAMETER RANGES DB

SUBINDEX: 190

SET / ANSWER – EVENT

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]
2 3	Min kV * 10	[20..150] * 10 0xFF: range limit not applicable, keep current one
4 5	Max kV * 10	[20..150] * 10 0xFF: range limit not applicable, keep current one
6 7 8	Min mAs * 1000	[0.1..3200] * 1000 0xFF: range limit not applicable, keep current one
9 10 11	Max mAs * 1000	[0.1..3200] * 1000 0xFF: range limit not applicable, keep current one
12 13 14	Min mA * 100	[1..1000] * 100 0xFF: range limit not applicable, keep current one
15	Max mA * 100	[1..1000] * 100

BYTE	DATA	FORMAT
16 17		0xFF: range limit not applicable, keep current one
18 19 20	Min ms * 100	[1..20000] * 100 0xFF: range limit not applicable, keep current one
21 22 23	Max ms * 100	[1..20000] * 100 0xFF: range limit not applicable, keep current one
24	Fixed focal spot	0: small 1: large 0xFF: not applicable
25 26	Min FPS x 10	[0..1200] 0 – Single Shot 0xFF: range limit not applicable, keep current one
27 28	Max FPS x 10	[0..1200] 0 – Single Shot 0xFF: range limit not applicable, keep current one

GET

BYTE	DATA	FORMAT
1	Data Bank ID	[1..255]

DESCRIPTION

This message contains the information about the RAD exposure parameter ranges to be assigned to a procedure.

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

17.2 Assign Exposure Parameter Ranges DB to Procedure

SUBINDEX: 191

SET

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	RAD Exposure Parameter Ranges DB ID	[1..255]

ANSWER – EVENT

BYTE	DATA	FORMAT
1	Procedure ID	[0..255]
2	RAD Exposure Parameter Ranges DB ID	[1..255]
3	Allowed	0 Not allowed 1 Allowed

GET

BYTE	DATA	FORMAT

1	Procedure ID	[0..255]

COMMAND PROCESSED FUNCTION RETURN CODES

SET

BYTE	DATA	FORMAT
1	SEQ Number for the SET request	1 .. 255
2	Return Code…..	RETURN CODES: 0 OK 1 Procedure ID not defined (ERROR_PROC_NOT_DEFINED) 2 Procedure ID out of range 3 Procedure ID already active, assign not possible (ERROR_ASIGN_TO_CURRENT)

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

		1	Procedure ID not defined
		2	Procedure ID out of range
		3	
		4	RAD Exposure Parameter Ranges DB assigned (ERROR_DB_POS_NOT_ASSIGN)

DESCRIPTION

Command used to assign an Exposure Parameter Ranges DB to a procedure.

17.3 RAD EXPOSURE PARAMETER SCALES

SUBINDEX: 192

ANSWER – EVENT

BYTE	DATA	FORMAT
1	kVp Scale	0 R10' 1 R20' 2 Linear
2	mAs Scale	0 R10' 1 R20' 2 Linear
3	mA Scale	0 R10' 1 R20' 2 Linear

4	ms Scale	0	R10'
		1	R20'
		2	Linear

GET

No data.

DESCRIPTION

This message contains the information about the RAD exposure parameter scales.

COMMAND PROCESSED FUNCTION RETURN CODES

GET

BYTE	DATA	FORMAT
1	SEQ Number for the GET request	1 .. 255
2	Return Code	RETURN CODES: 0 OK

18.MESSAGE INDEX TABLE

GENERATOR GROUP INDEX 0x20		
GROUP	**SUBINDEX**	**DESCRIPTION**
PROCEDURE AND DATA BANK	1	PROCEDURE (1) (DEPRECATED)
	2	CLEAR PROCEDURE
	3	CLEAR ALL PROCEDURES
	4	ASSIGN EXPOSURE DATA BANK TO PROCEDURE
	5	EXPOSURE DATA BANK ACCEPTANCE
	6	ACTIVATE PROCEDURE AND DATA BANK
	7	DEFAULT PROCEDURE AND DATA BANK
	8	PROCEDURE (2)
	9	PROCEDURE STATUS
RAD EXPOSURE DATA BANK	10	LOAD RAD DATA BANK (1) (DEPRECATED)
	11	RAD PROCEDURE ACCEPTANCE
	12	LOAD RAD DATA BANK (2)
	13	
	14	
	15	
	16	
	17	
	18	
	19	
RAD EXPOSURE DATA BANK	20	TECHNIQUE MODE

PARAMETERS		
	21	KVP
	22	MAS
	23	MA
	24	MS
	25	MINIMUM INTEGRATION TIME
	26	MAXIMUM INTEGRATION TIME
	27	FOCAL SPOT
	28	AEC SENSITIVITY or CORRECTION FACTOR
	29	AEC DENSITY CORRECTION FACTOR
	30	AEC CHAMBERS (1) DEPRECATED
	31	TUBE POWER LIMIT DEPRECATED
	32	FPS
	33	TRACKING ID
	34	Available for future use
	35	Available for future use
	36	PATIENT SIZE
	37	AEC REFERENCE
	38	AEC CHAMBERS (2)
	39	
FLUORO DATA BANK	40	LOAD FLUORO DATA BANK (1) DEPRECATED
	41	FLUORO PROCEDURE ACCEPTANCE
	42	LOAD FLUORO DATA BANK (2)
	43	
	44	
	45	
	46	

	47	
	48	
	49	
FLUORO EXPOSURE PARAMETER	50	KVP
	51	MA (1) (DEPRECATED)
	52	MS
	53	MAXIMUM INTEGRATION TIME
	54	PPS
	55	ABC (1) DEPRECATED
	56	HIGH DOSE (1) DEPRECATED
	57	Available for future use
	58	Available for future use
	59	DOSE LEVEL ID (1) DEPRECATED
	60	CURVE ID
	61	MA (2)
	62	ABC – HIGH DOSE (2)
	63	TARGE LSB
	64	FOCAL SPOT
	65	ABC UPDATE TIME
	66	
	67	
	68	
	69	
CURRENT RAD EXPOSURE DATA BANK	70	CURRENT RAD EXPOSURE DATA BANK (1) DEPRECATED
	71	CURRENT RAD EXPOSURE DATA BANK (2)
	72	

	73	
	74	
	75	
	76	
	77	
	78	
	79	
CURRENT RAD EXPOSURE DATA BANK PARAMETERS	80	TECHNIQUE MODE
	81	KVP
	82	MAS
	83	MA
	84	MS
	85	MINIMUM INTEGRATION TIME
	86	MAXIMUM INTEGRATION TIME
	87	FOCAL SPOT
	88	AEC SENSITIVITY or CORRECTION FACTOR
	89	AEC DENSITY CORRECTION FACTOR
	90	AEC CHAMBERS (1) DEPRECATED
	91	TUBE POWER LIMIT
	92	FPS
	93	TRACKING ID
	94	Available for future use
	95	Available for future use
	96	PATIENT SIZE
	97	AEC REFERENCE
	98	AEC CHAMBERS (2)
	99	

CURRENT FLUORO EXPOSURE DATA BANK	100	CURRENT FLUORO EXPOSURE DATA BANK (1) DEPRECATED
	101	CURRENT FLUORO EXPOSURE DATA BANK (2)
	102	
	103	
	104	
	105	
	106	
	107	
	108	
	109	
CURRENT FLUORO EXPOSURE DATA BANK PARAMETERS	110	KVP
	111	MA (1) DEPRECATED
	112	MS
	113	MAXIMUM INTEGRATION TIME
	114	PPS
	115	ABC (1) DEPRECATED
	116	HIGH DOSE (1) DEPRECATED
	117	Available for future use
	118	Available for future use
	119	DOSE LEVEL ID
	120	CURVE ID
	121	MA (2)
	122	ABC – HIGH DOSE (2)
	123	TARGET LSB
	124	FOCAL SPOT
	125	ABC UPDATE TIME

	126	
	127	
	128	
	129	
OTHER GENERATOR FUNCTIONS	130	FLUORO TIME RESET
	131	5-MINUTE FLUORO ALARM RESET
	132	GENERATOR POWER LIMIT
	133	FILAMENTS ON/OFF
	134	TUBE POWER LIMIT
	135	
	136	
	137	
	138	
	139	
STATUS AND EXPOSURE MANAGEMENT	140	GENERATOR STATUS (1) DEPRECATED
	141	POST EXPOSURE / POST CONDITION (1) DEPRECATED
	142	START/STOP EXPOSURE
	143	COMMUNICATIONS INHIBIT TIMEOUT
	144	RAD POST EXPOSURE / POST CONDITION (2)
	145	FL POST EXPOSURE / POST CONDITION
	146	RESET EXPOSURE COUNTER
	147	GENERATOR STATUS (2)
	148	
	149	
MISCELLANEOUS	150	MAXIMUM NUMBER OF PROCEDURES
	151	MAXIMUM NUMBER OF DATA BANKS

	152	RAD EXPOSURE PARAMETER RANGES
	153	FLUORO EXPOSURE PARAMETER RANGES
	154	WORKSTATION
	155	HANDSWITCH/FOOTSWITCH CONFIGURATION
	156	EBOX SOFTWARE VERSION
	157	PARASITIC CAPACITANCE PARAMETER
	158	AEC REFERENCE MODE
	159	EXPOSURE COUNTERS
General Purpose Input Output	160	DIGITAL INPUTS
	161	
	162	
	163	
	164	
	165	
	166	
	167	
	168	
	169	
DYNAMIC SEQUENCE	**170**	LOAD DYNAMIC SEQUENCE DB
	171	ASSIGN DYNAMIC SEQUENCE DB TO PROCEDURE
	172	
	173	
	174	
	175	
	176	
	177	
	178	

	179	
IMAGE SUBTRACTION	180	LOCK-IN DB
	181	ASSIGN LOCK-IN DB TO PROCEDURE
	182	LOCK-IN FRAME REACHED
	183	INJECTOR
	184	
	185	
	186	
	187	
	188	
	189	
MISCELLANOUS (2)	**190**	Exposure Parameter Ranges DB
	191	Assign Exposure Parameter Ranges DB to Procedure
	192	RAD EXPOSURE PARAMETER SCALES
	193	
	194	
	195	
	196	
	197	
	198	
	199	