



<b>Publication Year</b>	2000
<b>Acceptance in OA @INAF</b>	2023-02-08T12:28:39Z
<b>Title</b>	EMCS DIAGNOSTIC PROCEDURES
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<b>Handle</b>	<a href="http://hdl.handle.net/20.500.12386/33282">http://hdl.handle.net/20.500.12386/33282</a>

**EST**

**EPIC**

**DOCUMENT TYPE:** OPERATION DOCUMENT

**TITLE:** EMCS DIAGNOSTIC PROCEDURES

**DOCUMENT No.:** EPIC-EST-OP-003 **PAGE:** 1 of II, 4

**PROJECT Ref.:** XMM EPIC

**ISSUE No.:** 1 **DATE:** February 2000

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## CHANGE RECORD

Issue	Date	Sheet	Description of Change	Release
1	February 2000	All	First Issue of the document	

## TABLE OF CONTENTS

1.	INTRODUCTION.....	1
2.	APPLICABLE DOCUMENTS.....	1
3.	DOCUMENT OVERVIEW .....	1
4.	CCD DIAGNOSTIC PROCEDURES.....	1
4.1	APPLICABLE CONDITIONS .....	1
4.2	FULL FRAME – SINGLE NODE MODE .....	2
4.3	SMALL WINDOW MODE .....	2
4.4	SMALL WINDOW – FREE RUN MODE .....	2
4.5	LARGE WINDOW MODE .....	3
4.6	LARGE WINDOW – FREE RUN MODE .....	3
4.7	FULL FRAME - DOUBLE NODE MODE .....	3
4.8	REFRESHED FRAME STORE – SINGLE NODE MODE.....	4
4.9	IMAGING FAST DIAGNOSTIC MODE .....	4
4.10	TIMING MODE .....	4

## 1. INTRODUCTION

This document reports the Command Procedures to perform the Diagnostic readouts of the EPIC MOS CCDs. For each of the applicable EMAE Sequences, the relevant command procedure for the CCD readout in Diagnostic mode is outlined.

All the below Procedures are outlined with reference to the [EMCS Command Procedure](#) document (EPIC-EST-TP-002 I.3), where the applicable command “bricks” are defined.

The content of this document will be reviewed and superseded by the next Issue of the EMCS User Manual (EPIC-EST-OP-002 I.3).

## 2. APPLICABLE DOCUMENTS

EPIC-EST-OP-001 I.2 EMCS User Manual, EST

EPIC-EST-TP-002 I.3 [Command Procedures for the EPIC MOS Camera System at S/C level](#), EST

EPIC-EST-LI-0005 I.3 [SW configuration for the EMAE unit](#), EST

## 3. DOCUMENT OVERVIEW

The following readout modes have been considered in this document:

- Full Frame – Single Node
- Small Window
- Small Window – Free Run
- Large Window
- Large Window – Free Run
- Full Frame – Double Node
- Refreshed Frame Store – Single Node
- Imaging Fast Diagnostic
- Timing

With the only exception of the Full Frame – Double Node mode, for all the above modes the CCD readout from Node 0 has been considered.

## 4. CCD Diagnostic Procedures

### 4.1 Applicable conditions

Before the execution of each of the following procedures, it is necessary that the experiment is already in the right configuration from the following point of views: EMCR Memory Load, Focal Plane thermal control, Filter Wheel synchronisation and position, CCD voltages, HBR set-up (Bright Pixel Tables, thresholds, buffer size), window size of the peripheral CCDs. Moreover, it is assumed that, for all peripheral CCDs, the EMAE Sequence *iffci10rdp\_x.seq* is used.

This means that all the operations described in the [Switch-on](#) procedure must be performed in advance, with [ES Id iffci10rdp to EMAE per](#) at step 14.

The Integration Time settings which are foreseen in these procedure are still under evaluation and they could be changed in the future.

## 4.2 Full Frame – Single Node mode

**Description:** This procedure applies when the EMAE Sequence *iffci10rdp\_0.seq* is used in the central CCD sequencer.

- Execute the [Full-Frame](#) procedure from step 1 to step 8, with [ES Id iffci10rdp to EMAE cen](#) at step 1
- Execute the [HBR1 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR3 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR4 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR5 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR6 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR7 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR8 transparent](#) and the [Enter Diagnostic FF](#) blocks

## 4.3 Small Window mode

**Description:** This procedure applies when the EMAE Sequence *iswci10rdp\_0.seq* is used in the central CCD sequencer.

- Execute the [Small Window](#) procedure from step 1 to step 8, with [ES Id iswci10rdp to EMAE](#) at step 1 and [Small Window \(Seq. I.10, 110, 0.3-2.7 sec\)](#) at step 8
- Execute the [HBR1 transparent](#) and the [Enter Diagnostic SW](#) blocks
- Execute the [HBR3 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR4 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR5 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR6 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR7 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR8 transparent](#) and the [Enter Diagnostic FF](#) blocks

## 4.4 Small Window – Free Run mode

**Description:** This procedure applies when the EMAE Sequence *iswci10rdp\_0.seq* is used in the central CCD sequencer.

- Execute the [Small Window Free Run](#) procedure from step 1 to step 8, with [Free-run \(2.6 s per. CCD\)](#) at step 8
- Execute the [HBR1 transparent](#) and the [Enter Diagnostic SW](#) blocks
- Execute the [HBR3 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR4 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR5 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR6 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR7 transparent](#) and the [Enter Diagnostic FF](#) blocks

- Execute the [HBR8 transparent](#) and the [Enter Diagnostic FF](#) blocks

## 4.5 Large Window mode

**Description:** This procedure applies when the EMAE Sequence *ilwci10rdp\_0.seq* is used in the central CCD sequencer.

- Execute the [Large Window](#) procedure from step 1 to step 8, with [ES ld ilwci10rdp to EMAE](#) at step 1 and [Large Window \(Seq. I.10, 310, 0.9-2.7 sec\)](#) at step 8
- Execute the [HBR1 transparent](#) and the [Enter Diagnostic LW](#) blocks
- Execute the [HBR3 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR4 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR5 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR6 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR7 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR8 transparent](#) and the [Enter Diagnostic FF](#) blocks

## 4.6 Large Window – Free Run mode

**Description:** This procedure applies when the EMAE Sequence *ilwci10rdp\_0.seq* is used in the central CCD sequencer.

- Execute the [Small Window Free Run](#) procedure from step 1 to step 8, with [Free-run \(2.6 s per. CCD\)](#) at step 8
- Execute the [HBR1 transparent](#) and the [Enter Diagnostic LW](#) blocks
- Execute the [HBR3 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR4 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR5 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR6 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR7 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR8 transparent](#) and the [Enter Diagnostic FF](#) blocks

## 4.7 Full Frame - Double Node mode

**Description:** This procedure applies when the EMAE Sequence *iffci10rdb\_0.seq* is used in the central CCD sequencer.

- Execute the [Full Frame Double Node](#) procedure from step 1 to step 8
- Execute the [HBR1 transparent](#) and the [Enter Diagnostic DN](#) blocks
- Execute the [HBR2 transparent](#) and the [Enter Diagnostic DN](#) blocks
- Execute the [HBR3 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR4 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR5 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR6 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR7 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR8 transparent](#) and the [Enter Diagnostic FF](#) blocks

## 4.8 Refreshed Frame Store – Single Node mode

**Description:** This procedure applies when the EMAE Sequence *rfscr3rdp200.seq* is used in the central CCD sequencer.

- Execute the [Refreshed Frame Store](#) procedure from step 1 to step 8, with [Full Frame \(2.6 sec\)](#) at step 8
- Execute the [HBR1 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR3 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR4 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR5 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR6 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR7 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR8 transparent](#) and the [Enter Diagnostic FF](#) blocks

## 4.9 Imaging Fast Diagnostic mode

**Description:** This procedure applies when the EMAE Sequences *I33ci10rdp\_x.seq* are used in both the central and peripheral CCD sequencers.

- Execute the [Fast Diagnostic Setup](#) for all CCDs
- Execute the [Full-Frame](#) procedure from step 3 to step 6
- Execute the [EDU all CCDs Fast Diagnostic](#) setup.
- Execute the [HBR1 transparent](#) and the [Enter Fast Diagnostic FF](#) blocks
- Execute the [HBR3 transparent](#) and the [Enter Fast Diagnostic FF](#) blocks
- Execute the [HBR4 transparent](#) and the [Enter Fast Diagnostic FF](#) blocks
- Execute the [HBR5 transparent](#) and the [Enter Fast Diagnostic FF](#) blocks
- Execute the [HBR6 transparent](#) and the [Enter Fast Diagnostic FF](#) blocks
- Execute the [HBR7 transparent](#) and the [Enter Fast Diagnostic FF](#) blocks
- Execute the [HBR8 transparent](#) and the [Enter Fast Diagnostic FF](#) blocks

## 4.10 Timing mode

**Description:** This procedure applies when the EMAE Sequence *Tdc2\_n1\_0.seq* is used in the central CCD sequencer.

- Execute the [Timing](#) procedure from step 1 to step 8, with [ES ld tdc2\\_n1 to EMAE](#) at step 1
- Execute the [HBR1 transparent](#) and the [Enter Diagnostic Timing](#) blocks
- Execute the [HBR3 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR4 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR5 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR6 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR7 transparent](#) and the [Enter Diagnostic FF](#) blocks
- Execute the [HBR8 transparent](#) and the [Enter Diagnostic FF](#) blocks