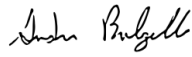
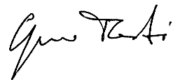
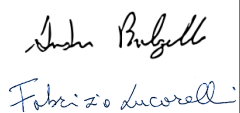
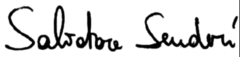




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# ASTRI Mini-Array Use Cases of the Power Management System Collector



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**Code:** ASTRI-INAF-SPE-9100-016

**Issue**

1.0

**Date:**



Nov 29, 2022

**Page:**

2/14

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		<b>ASTRI Mini-Array</b> Astrofisica con Specchi a Tecnologia Replicante Italiana					
	<b>Code:</b> ASTRI-INAF-SPE-9100-016	<b>Issue</b>	1.0	<b>Date:</b>	Nov 29, 2022	<b>Page:</b>	3/14

## Table of Contents

<b>1. Introduction</b>		<b>6</b>
1.1. Purpose		6
1.2. Scope		6
1.3. Content		6
1.4. Definitions, abbreviations and acronyms		6
<b>2. Applicable and reference documents</b>		<b>7</b>
2.1. Applicable documents		7
2.2. Reference documents		7
<b>3. Actors</b>		<b>8</b>
<b>4. Use Cases</b>		<b>9</b>
5.2. ASTRI-UC-9.1.1.6-010: The Central Control system starts the Power Management System Collector		9
5.2. ASTRI-UC-9.1.1.6-020: The Power Management System Collector acquire monitoring points and alarms		11
5.2. ASTRI-UC-9.1.1.6-030: The Central Control system shutdown the Power Management System Collector		13



## INDEX OF FIGURES & TABLES



# ASTRI Mini-Array

Astrofisica con Specchi a Tecnologia Replicante Italiana



Code: ASTRI-INAF-SPE-9100-016

Issue

1.0

Date:



Nov 29, 2022

Page:

5/14

## DOCUMENT HISTORY

Version	Date	Modification
1.0	Nov 29, 2022	First release after internal check of the ASTRI-MA software team

		<b>ASTRI Mini-Array</b> <b>Astrofisica con Specchi a Tecnologia Replicante Italiana</b>					
	<b>Code:</b> ASTRI-INAF-SPE-9100-016	<b>Issue</b>	1.0	<b>Date:</b>	Nov 29, 2022	<b>Page:</b>	6/14

## 1. Introduction

The **ASTRI Mini-Array (MA)** is an INAF project to construct and operate an experiment to study gamma-ray sources emitting at very high-energy in the TeV spectral band. The MA consists of an array of nine innovative Imaging Atmospheric Cherenkov Telescopes that are an evolution of the double-mirror ASTRI Horn telescope successfully tested since 2014 at the Serra La Nave Astronomical Station of the INAF Observatory of Catania. Each telescope will be equipped with the new version of the ASTRICAM Silicon photomultiplier Cherenkov Camera. The main scientific goal of the ASTRI Mini-Array is to perform high-energy ( $E > 1$  TeV) observations of galactic and extragalactic sources with a sensitivity better than that reachable by the other Imaging Atmospheric Cherenkov telescopes currently in operation (HESS, MAGIC, VERITAS). Furthermore, the Mini-Array will also perform Intensity Interferometry of a selected sample of bright sources. The nine telescopes will be installed at the Teide Astronomical MA System, operated by the Instituto de Astrofisica de Canarias (IAC), on Mount Teide (~2400 m a.s.l.) in Tenerife (Canary Islands, Spain). The ASTRI MA will be operated by INAF on the basis of a host agreement with IAC.

### 1.1. Purpose

This document defines the Use Cases of the Power Management System Collector (PMSC).

The Use Cases are divided into these main groups following the functional decomposition of the system:

1. PMSC Lifecycle
2. PMSC acquisition

### 1.2. Scope

The PMSC is part of the Central Control of the Supervisory Control and Data Acquisition System (SCADA), as described in [AD3].

The PMSC is a software system that acquire monitoring point and alarms from the Power Management System of ASTRI Mini-Array

### 1.3. Content



Sect 4 reports the use cases of the PMSC.

### 1.4. Definitions, abbreviations and acronyms

The definitions and abbreviations used in this document can be found in [AD8] ASTRI-MA Glossary: ASTRI-INAF-LIS-9000-001.

PMS: Power Management System

PMSC: Power Management System Collector

		<b>ASTRI Mini-Array</b> Astrofisica con Specchi a Tecnologia Replicante Italiana					
	<b>Code:</b> ASTRI-INAF-SPE-9100-016	<b>Issue</b>	1.0	<b>Date:</b>	Nov 29, 2022	<b>Page:</b>	7/14

## 2. Applicable and reference documents

### 2.1. Applicable documents

- [AD1] ASTRI-MA Management Plan: ASTRI-INAF-PLA 1000-001
- [AD2] ASTRI-MA Quality Plan: ASTRI-INAF-PLA-3000-0001
- [AD3] ASTRI-MA Top Level Software Architecture: ASTRI-INAF-DES-2100-001
- [AD4] ASTRI-MA Software Product Breakdown Structure: ASTRI-INAF-DES-2100-002
- [AD5] ASTRI-MA Data Model: ASTRI-INAF-DES-2100-003
- [AD6] ASTRI-MA Top Level Use Cases: ASTRI-INAF-SPE-2100-001
- [AD7] ASTRI-MA Software Development Plan: ASTRI-INAF-PLA-2100-002
- [AD8] ASTRI-MA Glossary: ASTRI-INAF-LIS-9000-001
- [AD8] ASTRI-MA System Engineering Management Plan: ASTRI-INAF-PLA-2100-002
- [AD9] ASTRI-MA Operation Concept: ASTRI-INAF-DES-1000-001
- [AD10] ASTRI-MA Risk Management Plan: ASTRI-INAF-PLA-1000-002
- [AD11] ASTRI Mini-Array Product Tree: ASTRI-INAF-DES-2000-001

### 2.2. Reference documents

- [RD1]



### 3. Actors

Human:

- **Operator**
- **Expert Operator**

System

- **Central Control System**
- **Monitoring System**
- **Operator HMI**

## 4. Use Cases

The list of use cases that must be developed are:

1. The Central Control system starts the Power Management System Collector
2. The Power Management System Collector acquire monitoring points and alarms
3. The Central Control system shutdown the Power Management System Collector

### 5.2. ASTRI-UC-9.1.1.6-010: The Central Control system starts the Power Management System Collector

**Summary and Scope:** This UC describes how the **Central Control System** starts and configures the PMSC.

**Authors:** Andrea Bulgarelli, Gino Tosti

**Version:** 1.0

**Trigger:** Start of the Central Control System.

**Frequency:**

**Phase:** AIT/AIV, commissioning and nominal phase.

**Assumptions:**

**Actors:** Central Control System, PMSC Manager

#### PRE-CONDITION CONSTRAINTS

- The **Central Control System** is running.

#### SCENARIOS

##### Basic Path.

1. The **Central Control System** starts the **PMSC Manager** ACS component.

**Alternate: 1a, The Expert Operator starts the PMSC manually.**

2. The **PMSC Manager** reads configurations from the configuration files.

3. The **PMSC Manager** start the **PMS Collector**

4. The **PMS Collector** connects with each assembly of the **Power Management System**

Exception: 4a, The PMS Collector cannot connets to some Power Management System assemblies (basic).  
Rejoins Main Scenario at End.

Exception: 4a, The PMS Collector cannot connets to some Power Management System assemblies (final).  
Rejoins Main Scenario at End.

5. The **Central Control System** checks that the **PMS Manager** is ready to operate and connected with all available assemblies.

Exception: 5a, The Central Control System cannot checks the PMSC status. Rejoins Main Scenario at Step 1.

Exception: 5b, The PMSC Manager cannot send feedback to the Central Control System. Rejoins Main Scenario at End.

Exception: 5c, The PMS Collector cannot connets to some Power Management System assemblies. Rejoins Main Scenario at End.

**Alternate. The PMSC is started manually**

1. The **Expert Operator** starts the **PMS Manager** ACS component.

**Exception. The PMSC Manager cannot connets to some Power Management System assemblies (basic).**

1. The **PMS Collector** excludes the assembly.

**Exception. The PMSC Manager cannot connets to some Power Management System assemblies (final).**

1. The **PMS Collector** retries the connection.
2. After N secs the **PMS Collector** sends an alarm to ACS alarm system:
  - i. notification event is received by the **Central Control System**.
  - ii. alarm is received by the **Alarm System**.
  - iii. the **Operator HMI** display the alarm to the **Operator**
3. If the assembly goes online, the **PMS Collector** notify the **Central Control System** and the **Alarm System** that the problem is solved.

**Exception. The Central Control System cannot checks the PMSC status.**

1. The **Central Control System** restart the PMSC.

**Exception. The PMSC Manager cannot send feedback to the Central Control System..**

1. The **PMSC** shutdown itself.

**POST CONDITION CONSTRAINT**

**MINIMAL GUARANTEE**

- The **PMS Collector** is running.

**SUCCESS GUARANTEE**

- The **PMS Collector** is running, configured and connection with the Power Management System

**OPEN POINTS**



## 5.2. ASTRI-UC-9.1.1.6-020: The Power Management System Collector acquire monitoring points and alarms

**Summary and Scope:** This UC describes how the **PMSC** acquire monitoring points from Power Management System and notify events, i.e. a notification that a warning condition or a critical condition (i.e. an abnormal condition or fault) has happened.

**Authors:** Andrea Bulgarelli, Gino Tosti

**Version:** 1.0

**Trigger:**

**Frequency:**

**Phase:** AIT/AIV, commissioning and nominal phase.

**Assumptions:**

**Actors:** ICTSC

### PRE-CONDITION CONSTRAINTS

- The **Power Management System** is reachable.
- The **PMSC** is running.

### SCENARIOS

#### Basic Path. Monitoring points

1. The **PMS Collector** acquires monitoring points via modbus protocol.

Exception: 1a, The **PMS Collector** cannot connects to some Power Management System assemblies. Rejoins Main Scenario at Step 1.

Exception: 2a, A **PMS** assemblee monitoring point goes outside operative ranges. Rejoins Main Scenario at Step 1.

2. The **PMS Collector** publish monitoring points to the Kafka topic *mon-collector* using the AVRO schema.

3. The **PMS Collector** fill a table with the status of all Power Management System assemblies.

4. The **Central Control System** gets the table of the status of the Power Management System assemblies from the **PMS Collector**.

5. The **Monitoring System** publish a selection of the monitoring points to the Kafka topic *mon-collector-ophmi*.

6. The **Operator** checks the selected monitoring points using the **Operator HMI**.



Alternate: 6a, The **Expert Operator** checks all monitoring points using the **Monitoring System Engineering GUI**.

#### Basic Path. Event notification

1. The **PMS Collector** acquires monitoring points via modbus protocol.

Exception: 1a, The **PMSC Manager** cannot connect to some **Power Management System** assemblies. Rejoins **Main Scenario** at End.

2. The **PMS Collector** publish notification events from warning or errors to the **Alarm System** and to the **Central Control System**.
3. The **Operator** checks the alarms using the **Operator HMI**.

Alternate: 4a, The **Expert Operator** checks the alarms using the **Alarm System Engineering GUI**.

#### Exception. The **PMSC Manager** cannot connect to some **Power Management System** assemblies.

1. The **PMS Collector** retries the connection.
2. After N secs the **PMS Collector** sends an alarm to ACS alarm system:
  - i. notification event is received by the **Central Control System**.
  - ii. alarm is received by the **Alarm System**.
  - iii. the **Operator HMI** display the alarm to the **Operator**
3. If the assembly goes online, the **PMS Collector** notify the **Central Control System** and the **Alarm System** that the problem is solved.

#### Exception. A **Power Management System** assembly monitoring point goes outside operative ranges.

1. the **PMS Collector** sends an alarm to ACS alarm system:
  - i. notification event is received by the **Central Control System**.
  - ii. alarm is received by the **Alarm System**.
  - iii. the **Operator HMI** display the alarm to the **Operator**

#### POST CONDITION CONSTRAINT

##### MINIMAL GUARANTEE

- The **PMS Collector** is running.

##### SUCCESS GUARANTEE

- The **PMS Collector** is running, configured, connected with the **Power Management System** and acquires monitoring points.

##### OPEN POINTS

## 5.2. ASTRI-UC-9.1.1.6-030: The Central Control system shutdown the Power Management System Collector

**Summary and Scope:** This UC describes how the **Central Control System** stops the PMSC.

**Authors:** Andrea Bulgarelli, Gino Tosti

**Version:** 1.0

**Trigger:**

**Frequency:**

**Phase:** AIT/AIV, commissioning and nominal phase.

**Assumptions:**

**Actors:** **Central Control System, PMSC Manager**

PRE-CONDITION CONSTRAINTS
<ul style="list-style-type: none"> <li>- The <b>Central Control System</b> is running.</li> </ul>
SCENARIOS
<p><b>Basic Path.</b></p> <ol style="list-style-type: none"> <li>1. The <b>Central Control System</b> stops the <b>PMSC Manager</b> <i>Alternate: 1a, The PMSC is stopped manually.</i></li> <li>2. The <b>Central Control System</b> checks that the <b>PMSC</b> is shutdown.</li> </ol>
<p><b>Alternate. The PMSC is stopped manually</b></p> <ol style="list-style-type: none"> <li>1. The <b>Expert Operator</b> stops the <b>PMSC</b></li> </ol>
POST CONDITION CONSTRAINT
MINIMAL GUARANTEE
<ul style="list-style-type: none"> <li>- The <b>PMSC Manager</b> is shutdown.</li> </ul>
SUCCESS GUARANTEE
<ul style="list-style-type: none"> <li>- The <b>PMSC Manager</b> is shutdown.</li> </ul>
OPEN POINTS



# ASTRI Mini-Array

Astrofisica con Specchi a Tecnologia Replicante Italiana



**Code:** ASTRI-INAF-SPE-9100-016

**Issue**

1.0

**Date:**

Nov 29, 2022

**Page:**

14/14