

## Interface Control Document for the Pointing Monitoring Camera and Sky Quality Monitor Assembly



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**ASTRI Mini-Array**  
**Astrofisica con Specchi a Tecnologia Replicante Italiana**



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**DOCUMENT HISTORY**

Issue/Revision	Date	Modification
1.0	03/02/2019	First release
1.1	19/10/2020	Changed to comply with the general document scheme for the ASTRI Mini-Array project
1.2	19/05/2021	Changed to include updated information on the electric connector and the local control PC

## 1. Introduction

The ASTRI Mini-Array is an INAF project aimed to construct, deploy and operate a set of 9 Cherenkov telescopes of the 4 meters class at the Observatorio del Teide in Tenerife (IAC, Spain). The ASTRI Mini-Array will observe astronomical sources emitting at very high-energy in the TeV spectral band.

### 1.1. Purpose

This document is the Interface Control Document regulating the hardware interface between the ASTRI Mini-Array telescope and the PMC & SQM assembly. The PMC & SQM assembly will be designed and manufactured by the ASTRI Mini-Array team and delivered to the ASTRI Mini-Array telescope contractor.

### 1.2. Scope of the document

This document describes the interfaces (mechanical, electrical and communication) of the PMC & SQM assembly to the ASTRI telescope.

### 1.3. Content

Section 3 describes the mechanical, the electrical and the software interface between the communication hardware and the telescope.

### 1.4. Definitions and Conventions

#### 1.4.1. Abbreviations and acronyms

ASTRI	Astrofisica con Specchi a Tecnologia Replicante Italiana
IAC	Instituto de Astrofisica de Canarias
INAF	Istituto Nazionale di Astrofisica
M2	ASTRI Telescope secondary mirror
PMC	Pointing Monitoring Camera
SQM	Sky Quality Monitor
SW	Software
TBC	To Be Confirmed



### **3. Applicable and reference documents**

#### **3.1. Applicable Documents**

[AD1]

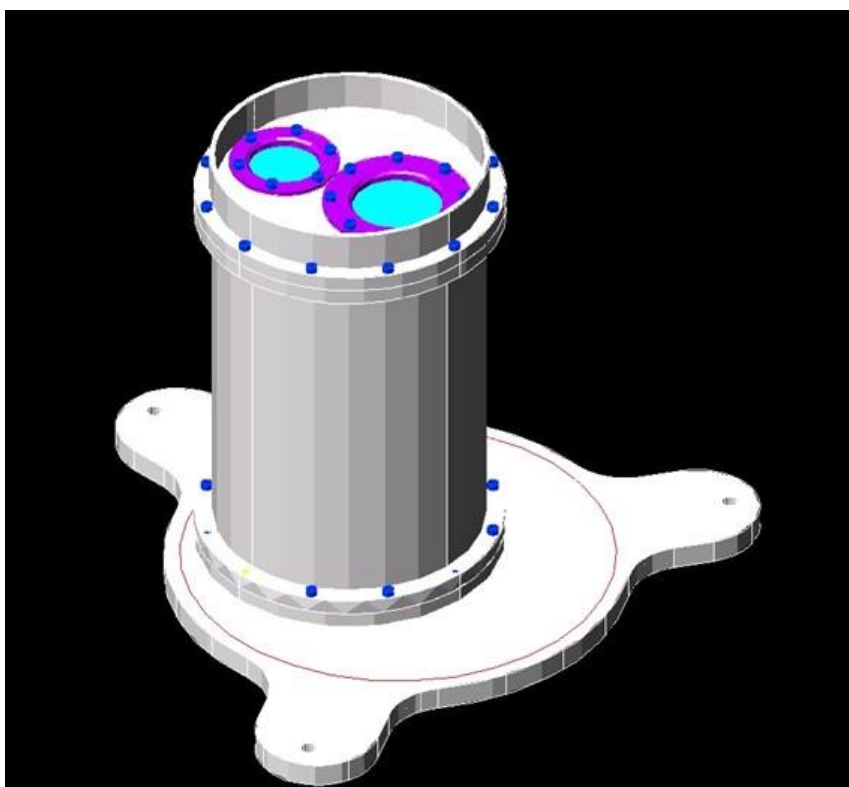
#### **3.2. Reference Documents**

[RD1]

## 4. SQM and PMC Interface Control Document

The assembly SQM (Sky Quality Monitor) and PMC (Pointing Monitoring Camera) is organised in a single cylindrical container where the two monitors are installed. Both PMC and SQM are integrated in the telescope in order to point in the same direction the structure is pointing.

An artistic view of the assembly is shown in Figure 1.



*Figure 1. SQM/PMC assembly*

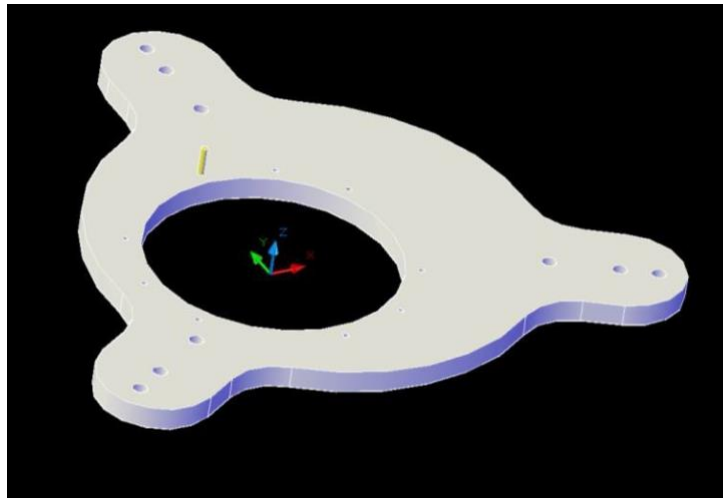
### 4.1. SQM/PMC Mechanical Interface

The assembly will be integrated on the M2 back structure. The mounting frame, shown in Figure 2, is mounted on the M2 Support Structure.

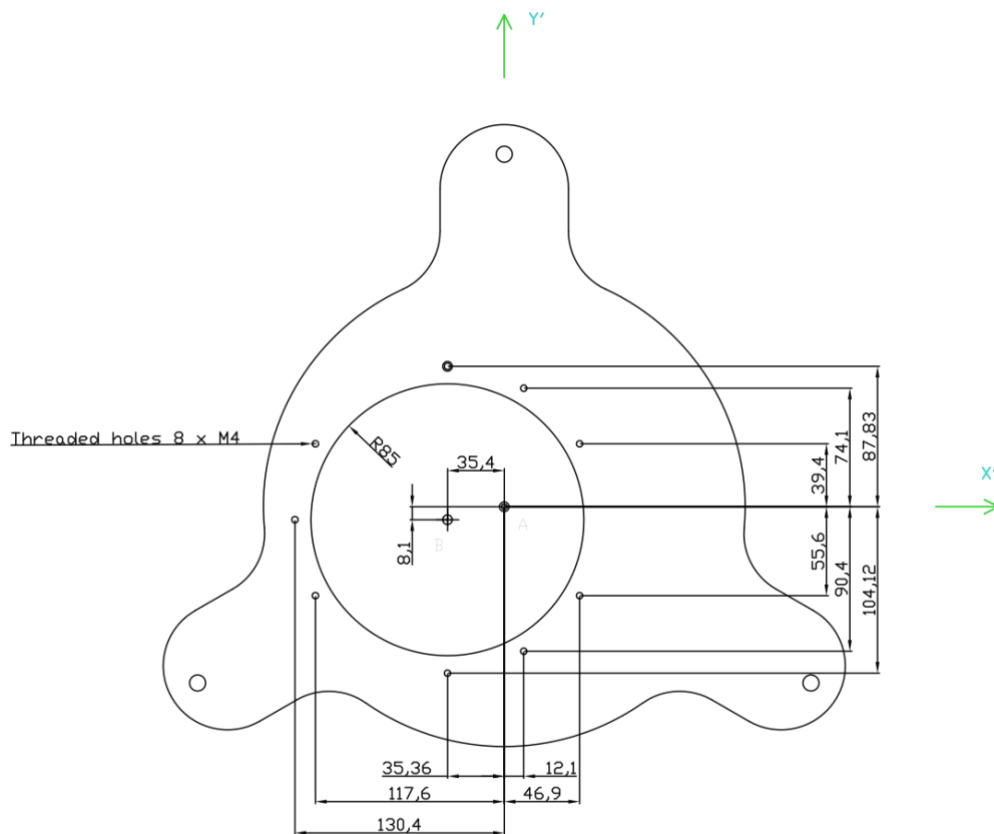
Three holes Ø10 mm in diameter, positioned 120° from each other on a radius of 220.5 mm are the fixing points of the frame.

Figure 2 shows the requested position of the three holes (indicated with E, F, and G in Figure 3) to be drilled on the M2 Support Structure.

In order to have the desired match between the two frames in correspondence with the holes the M2 Support Structure shall be milled on a 30 mm diameter in order to have the requested planarity. The three pads, where the SQM/PMC frame will be mounted, shall be maintained perpendicular to Z axis.



UPPER VIEW



A : telescope optical axis

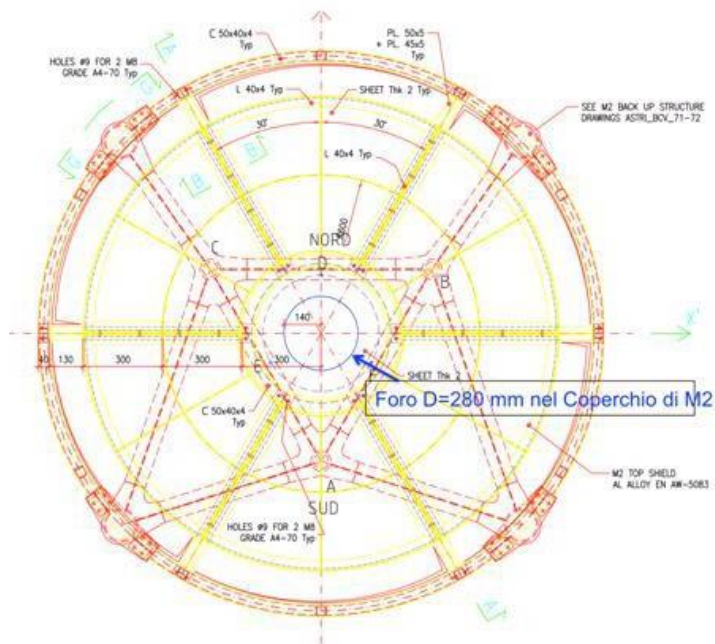
B : PMC assembly axis

Figure 2. SQM/PMC Interface Flange

Technical drawing of a circular structure, likely a dome or a large container, showing internal components and structural details. The drawing includes the following elements:

- Internal Components:** Three circular components labeled A, B, and C, each with a central point and radial lines.
- Structural Details:**
  - TUBE 60x40x4:** Dimensions for the main structural tubes.
  - PL. Thk 6:** Plate thickness specifications.
  - THREAD HOLE FOR 2 M8 GRADE A4-70:** Specifications for the holes used to secure the components.
  - Typ:** Typical or standard dimensions.
- Orientation:** A compass rose indicates North (NORD) and South (SUD).
- Dimensions:** Various dimensions are provided, including radii (R1000, R2000, R3000) and angles (e.g., 120°, 60°).
- Labels:** Numerous labels (A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z) are used to identify specific points and components.

Finally, in order to mount the SQM/PMC assembly, the M2 Shield has to be modified. The suggested modification is to have a circular aperture on the M2 Shield of a diameter of 280mm. The proposed solution is shown in Figure 4.



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*Table 1. Mechanical characteristics of the PMC/SQM assembly*

Max envelope	TBC	
Max Weight	< 7 Kg	Including the interface flange
Center of Gravity (CoG)	TBC	

#### 4.2. SQM/PMC Electrical Interface

In the SQM/PMC assembly there are three independent power lines, one (24V) for the PMC, one (5V) for the SQM, and a third one (24V) for a heater that can be switched on in case of mist formation on the optical windows.

The selected connector (Figure 5) is an Amphenol Limited, 62GB 14 Way Flange Mount MIL Spec Circular Connector Receptacle, Pin Contacts, Shell Size 12, Bayonet. Identification codes and the link to on-line information are available in Table 2.



*Figure 5. Amphenol Limited, 62GB 14 Way Flange Mount MIL Spec Circular Connector Receptacle, Pin Contacts, Shell Size 12, Bayonet Connector*

*Table 2. Amphenol Limited, 62GB 14 Way Flange Mount MIL Spec Circular Connector Receptacle, Pin Contacts, Shell Size 12, Bayonet Connector details*

Link	<a href="https://it.rs-online.com/web/p/connettori-circolari-militari/8139749/">https://it.rs-online.com/web/p/connettori-circolari-militari/8139749/</a>
RS Code	813-9749
Man. Code	62GB-50T12-14PN

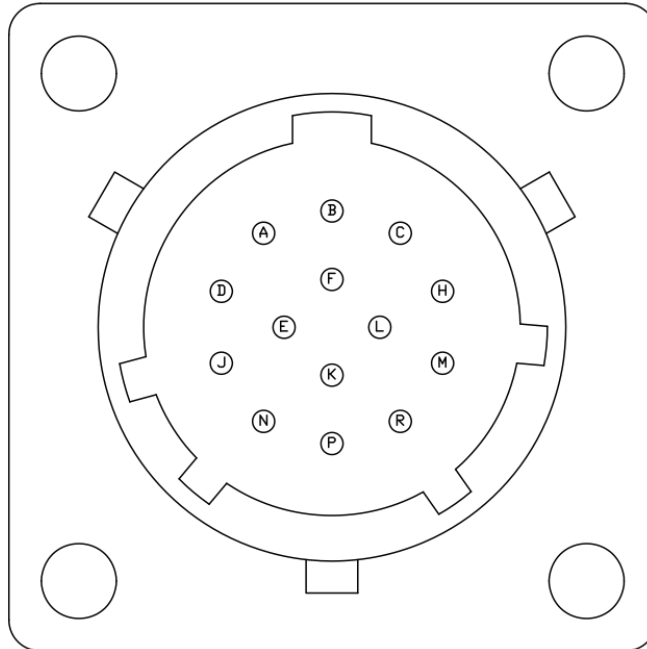
The corresponding female connector (which will be provided) is the Amphenol Limited, 62GB 14 Way Cable Mount MIL Spec Circular Connector Plug, Socket Contacts, Shell Size 12, Bayonet which is shown in Figure 6 and whose details are available in Table 3.



*Figure 6. Amphenol Limited, 62GB 14 Way Cable Mount MIL Spec Circular Connector Plug, Socket Contacts, Shell Size 12, Bayonet corresponding to the male connector mounted on the PMC/SQM assembly plate.*

*Table 3. Amphenol Limited, 62GB 14 Way Cable Mount MIL Spec Circular Connector Plug, Socket Contacts, Shell Size 12, Bayonet Connector details*

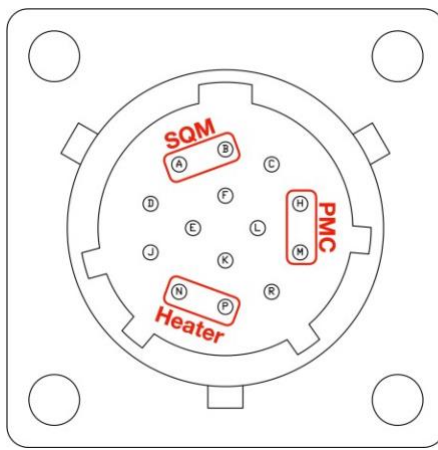
Link	<a href="https://it.rs-online.com/web/p/connettori-circolari-militari/8139847/">https://it.rs-online.com/web/p/connettori-circolari-militari/8139847/</a>
RS Code	813-9847
Man. Code	62GB-56T12-14SN



*Figure 7. Pin naming scheme for the Amphenol panel mount male Connector (Amphenol Limited, 62GB 14 Way Flange Mount MIL Spec Circular Connector Receptacle, Pin Contacts, Shell Size 12, Bayonet)*

Table 4 lists the pin out for the power connector.

*Table 4. Pin out of the Amphenol connector*

Pin	Signal	Note	
A	+5 Volt	SQM Power	
B	Ground	SQM Grounding	
C	Spare		
D	Spare		
E	Spare		
F	Spare		
H	+24 Volt	PMC Power	
J	Spare		

K	Spare		
L	Spare		
M	Ground	PMC Grounding	
N	Ground	Heater Return	
P	+24 Volt	Heater	
R	Spare		

The power budget is shown in 5.

*Table 5. Power Budget for the PMC/SQM assembly*

Device	Volt	Current	Power
SQM	Min 5 Max 6	0,3 A	1,8 W
PMC	Min 12 max 24	0,21 A max	< 2,5 W
Heater	24 V	2 A	50 W
			<b>P totale max +10%margin 58 W</b>

#### 4.3. SQM/PMC Communication interface

Both PMC and SQM are connected directly to the Telescope Switch or the Local Control PC and there is no SW interface between the assembly and the telescope structure.

Each SQM and PMC subsystem needs an Ethernet connection. The selected connectors are the Amphenol, Female Cat5e RJ45 Panel Mount Connector shown in Figure 8. Figure 9 shows the corresponding cable mount connector (provided) and Table 6 lists the Amphenol Cat5e RJ45 details not for the Panel and Cable mount connectors.

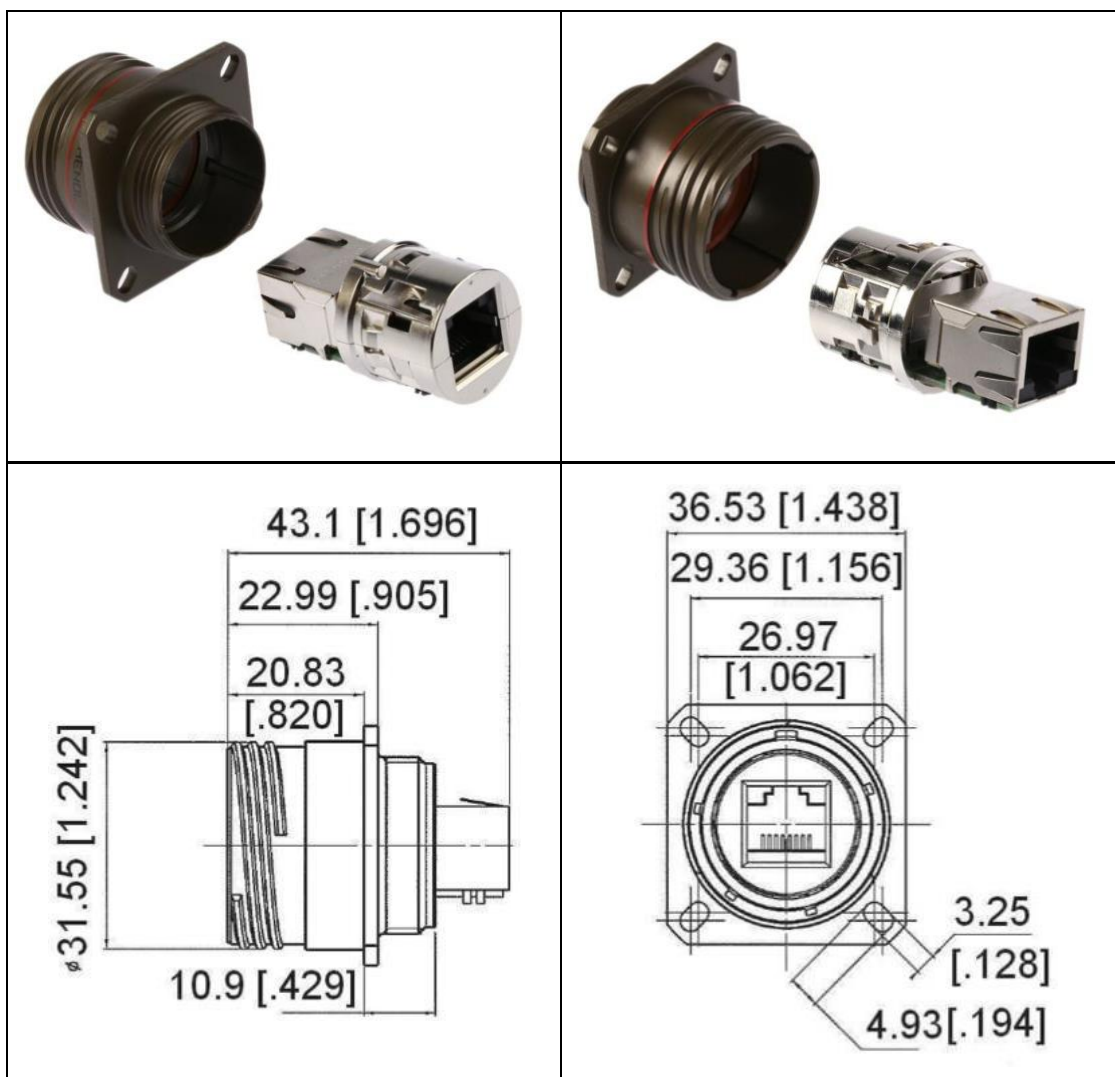


Figure 8. Receptacle Connector on Camera Assembly for Ethernet connection

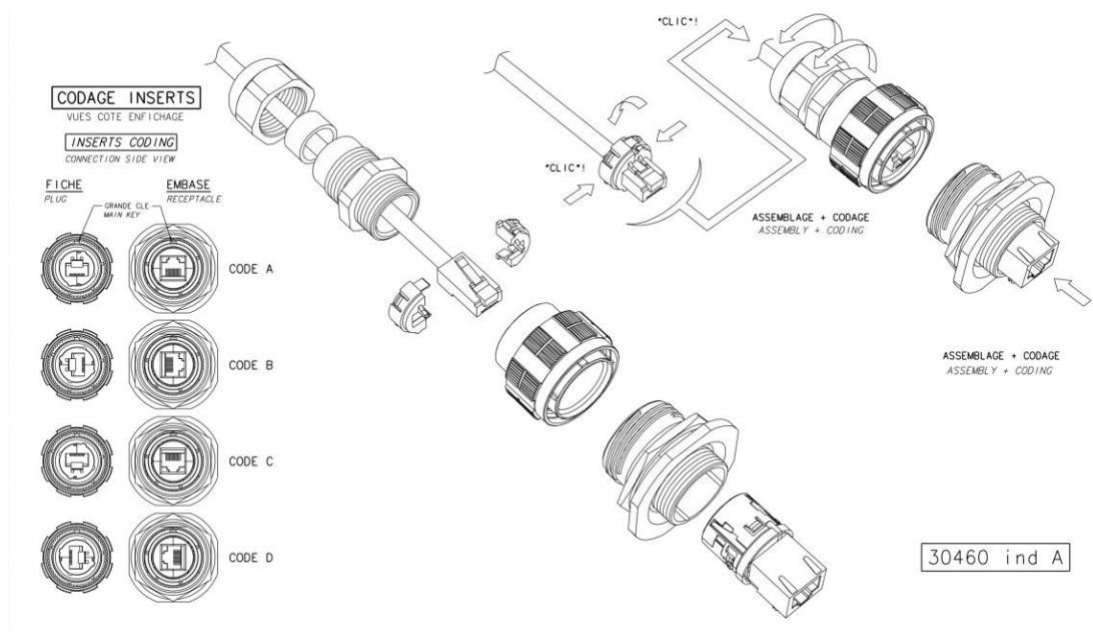


Figure 9. Cable side connector for the Cat5b RJ45 Ethernet connection

*Table 6. Details of Cat5b RJ45 Ethernet connector*

Connector	RS Code	Man. Code	Link
Panel	447-9999	RJF TV 21G	<a href="https://it.rs-online.com/web/p/connettori-ether-net/4479999/">https://it.rs-online.com/web/p/connettori-ether-net/4479999/</a>
Cable	447-9961	RJF TV 6G	<a href="https://it.rs-online.com/web/p/connettori-ether-net/4479961/">https://it.rs-online.com/web/p/connettori-ether-net/4479961/</a>

Figure 10 shows the Amphenol Cat5b RJ45 assembly procedure for the Panel and Cable connectors with a cable.



*Figure 10. Amphenol Cat5b RJ45 assembly procedure for the Panel and Cable connectors with a cable*

A picture of the endplate of the PMC/SQM assembly with the connectors is shown in Figure 11. Two RJ45 connectors are present with labels in the image indicating which one is relative to the PMC and which one is dedicated to the SQM. Only one power connector (62GB-50T12-14PN) will be present. The second corresponding hole will be closed with a cap.

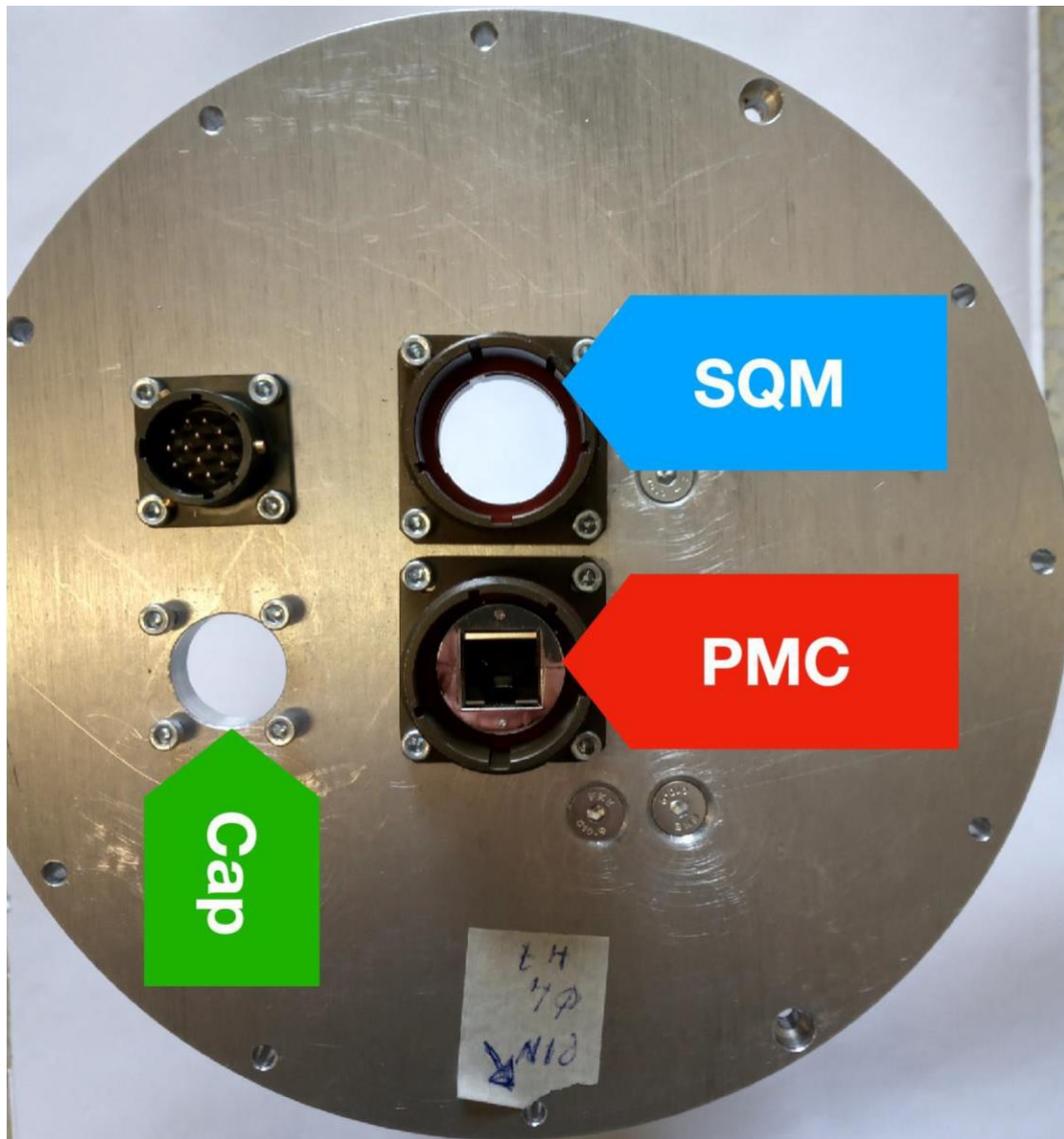


Figure 11. PMC/SQM assembly container endcap with connectors.

#### 4.4. Local Control PC mechanical Interface

The local Control PC for the PMC and the SQM (Figure 12) will be hosted in the telescope service cabinet through a din rail mechanical adapter. Table 7 shows its mechanical dimensions

Figure 12. Local Control PC



Table 7. Local Control PC Dimensions

Size:	128x156x47 mm <sup>3</sup>
Mass:	1.15 kg

#### 4.5. Local Control PC electrical Interface

The Local Control PC is powered through a 12 V power jack connected to a AC-DC converter provided by the manufacturer.

Table 8. Local Control PC AC-DC specifications

	Input	Output
<b>Voltage</b>	120-240 V (50/60 Hz)	12 V
<b>Max Current</b>	1 A	3 A

#### 4.6. Local Control PC communication interface

During normal operations the Local Control PC is only connected to Ethernet, in particular to the PMC and the Local Ethernet Switch through RJ45 Connectors.