

Telescope Mechanics

TITLE

CG-Set Interface Requirements

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Gran Telescopio de Canarias, S.A.

Instituto de Astrofísica de Canarias

Vía Láctea s/n

38200 - LA LAGUNA, TENERIFE, Islas Canarias

Tfno +34 922 315 031 Fax +34 922 315 032

Centro Común de Astrofísica de La Palma

Cuesta de San José s/n

38712 BREÑA BAJA, LA PALMA, Islas Canarias

Tfno +34 922 425 720 Fax +34 922 425 725

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Approval control

Prepared by	Germán Prieto Engineer of Development Group	Signed in the original copy
Revised by	Benjamin Siegel Engineer of Development Group	Signed in the original copy
Approved by	Germán Prieto Engineer of Development Group Javier Castro Head of Development Group Luis Alberto Rodríguez Head of Operations Group	Signed in the original copy Signed in the original copy Signed in the original copy
Authorized by	Romano Corradi General Director Date:	Signed in the original copy



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Changes record

Issue	Date	Section	Change code	Brief description
1.A	22/06/17	All	All	First version

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Configuration items

Code	Name

Interfaces

Interface Code	Element 1	Element 2	Name
I-AG-AG-017	AG-CG-AG-200	AG-CG-AG-100	AG Mechanics Assembly - Cassegrain AG Instrument
I-AG-AG-018	AG-CG-AG-251	AG-CG-AG-252	Cassegrain AG Arm Structure - Cassegrain AG Pick-off mirror
I-CS-CW-002	CS-AS-CG-200	CW-PL	Cassegrain Local Control- Power & Lighting
I-CS-CW-003	CS-EC-PC	CW-AV-CS	Primary Mirror Cell Cabinets - Cooling System
I-CW-TL-030	TL-IR-CG	CW-AV-CS	Cassegrain Rotator - Cooling System
I-CW-TL-031	TL-IR-CG	CW-GS-CA	Cassegrain Rotator - Compressed Air
I-SE-TL-013	SE-CG-LF	TL-IR-CG	Cassegrain Lifting Systems- Cassegrain rotator
I-CS-CS-015	CS-AS-CG-200	CS-AS-CG-100	Cass. Local Control - Cassegrain Remote Control
I-CS-CS-016	CS-IS-CG	CS-IS-MA	Cass. Local ISS – ISS Master
I-TL-CS-015	CS-EC-PC	TL-TB-PC	Primary Mirror Cell Cabinets - Primary Mirror Cell
I-TL-TL-001	TL-IR-CG	TL-TB-PC	Cassegrain Rotator - Primary Mirror Cell

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Applicable documents

N°	Document title	Code	Issue
A1	CG-Set – Science Instrument Interface	DCI/TELE/0062-R	1.A
A2	Cassegrain Focal Station Envelopes	DR/GTC/002	1.H
A3	Cassegrain Rotator – Telescope Tube	DR/I-TL-TL-001/000	1.A
A4	CG-Set – Cassegrain lifting system	DR/I-SE-TL-013/000	1.A
A5	AG Instrument – Probe Arm Linear Stage	DR/I-AG-AG-017/000	1.A
A6	AG Pick-Off Mirror unit – Probe Arm	DR/I-AG-AG-018/000	1.A
A7	Science Instrument – Cassegrain Transport Cart	DR/I-IN-SE-002/002	1.A

Reference documents

N°	Document title	Code	Issue
R1	Cassegrain Set (CG-Set) Preliminary Design	RPT/TELE/0442-R	1.A
R2	Cassegrain Set Specifications	ESP/TELE/0216-R	1.A

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List of acronyms and abbreviations

AG	Acquisition and Guiding
CG-Set	Set formed by Instrument Rotator, AG-Mechanics, Electronics Cabinet and Support Elements
COG	Centre Of Gravity
FE	Finite Elements
FEM	Finite Elements Model
GCS	GTC Control System
GTC	Gran Telescopio Canarias
ISS	Interlock and Safety System
LCU	Local Control Unit
LISS	Local Interlock and Safety System
PLC	Programmable Logic Controller
POM	Pick-Off Mirror
TBC	To Be Confirmed
TBD	To Be Defined



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1 INTRODUCTION

1.1 Summary

The GC-Set consists of Instrument Rotator, AG Mechanics, Electronics Enclosure, with the Local Control System, and the Support Elements. This document describes the interface requirements of the GC-Set with the rest of the GTC, more specifically with:

- The Telescope Tube structure and the lifting system.
- The Science Instrument
- The AG optics (Instrument + Pick off Mirror)
- The GTC Control System
- The GTC Interlock and Safety System
- GTC Electricity, Air and Water supplies

For a brief description of the GTC see the Introduction chapter in R2.

1.2 Requirements and guidelines

“Shall” is used for requirements no matter how stable they are, whereas “should” is reserved for guidelines. Requirements are mandatory and guidelines are not mandatory, although their fulfilment should be strongly pursued.

1.3 Verification deliverables

Requirements and guidelines verification is mandatory as long as a Verification Deliverable is specified. Verification Deliverables are documents or section of documents demonstrating design or product compliance with the corresponding requirement at the different Project review milestones through the Design and Product Phases.

Verification Deliverables expected at Design Phase are mostly specifically addressed (trade-offs, analysis or calculations). When referred as design “Description and justification” justification of the requirement compliance is required as well (by any of the mentioned methods or e.g. rationale for a component choice). Requirements whose fulfilment can be straight forward demonstrated with a mere “Description” of the corresponding aspect of the design are referred as such in the Verification deliverables paragraphs

During the Product Phase, the kind of written justification expected to show compliance is specified rather than a particular test or analysis (with exceptions). Specific test, analysis, etc... shall be proposed by the contractor within the verification matrix/verification plan, unless otherwise required. When “Inspection Report” is required compliance shall be visually or manually verified and certified in a written manner with the signature of the vericator. Inspection and/or Test Reports can be grouped in one or several documents, as desired.

1.4 Unstable and undefined requirements

Unstable or undefined requirements are identified by “TBC” or “TBD” respectively.

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1.5 Requirements code

Requirements are numbered with the last code in the upper level title (between quotes) before the Requirement. The coding is RQ/EC/NNN where:

“RQ” is fixed and means Specification.

“EC” is the Configuration Element code (GTC Product Tree) to which the Requirement applies.

“NNN” is the Requirement number (used for the document chapter hierarchy).

In the example, bellow, all requirements hanging from 5.2 have the code SP/TL-IR-CR/... The “Instrument Rotator Concept” Shall have the code SP/TL-IR-CR/5.2.1.1.

5. 2 Instrument Rotator (SP/TL-IR-CR/NNN)

5.2.1 Functional Requirements

5.2.1.1 Instrument Rotator Concept

In the case two codes appear between quotes, there shall be two identical requirements with different codes.

2 DEFINITIONS

Definitions on section 3 of the Specification document R2 apply.

3 SCOPE

The Requirements in this document apply to the Interfaces between the GC-Set and the rest of the GTC listed in the section “Interfaces” in page 4.

The GC-Set Product Tree and some of other GTC subsystems interfacing with it are shown in a tree shape in R2.

The GTC subsystems interfacing with the GC-Set are:

- The Primary Mirror Cell of the Telescope Tube, at the Rotator attachment flange: sections 4 and 7.
- The AG (Acquisition and Guiding) Instrument: section 10.
- The POM (Pick-Off-Mirror) Unit: section 10.
- The Scientific Instruments: section 7.
- The Cassegrain Lifting System: section 5.
- The GCS (GTC Control System): section 14.
- The ISS (GTC Interlock and Safety System): section 15.
- The GTC services (electrical power, cooling water, compressed air): sections 8, 11 and 9.

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4 CG SET ROTATOR- SCIENCE INSTRUMENT

4.1.1 Interface with the Science Instrument

Interface of the Instrument Rotator with the Science instrument shall be as defined A1, unless otherwise agreed with GRANTECAN¹.

Verification Deliverables

See A1.

5 CG-SET ROTATOR–LIFTING SYSTEM (RQ/I-SE-TL-013/NNN)

5.1 CG-Set Attachment points for lifting

Attachment points location at the Rotator and at the Instrument dummy shall comply with drawing A4.

There shall be a hole of dimensions TBD beside each Rotator lifting point allowing the lifting chain passing through to attach and lift down the Science Instrument bellow.

Verification Deliverables

Design Phase 3D Model, drawings.

Product Phase: Inspection report.

6 CG SET ROTATOR - TELESCOPE TUBE (RQ/I-TL-TL-001/NNN)

6.1 Reference Temperature

The reference temperature for all the dimensions and tolerances, unless otherwise specified, shall be 8.5°C. This affects all drawings and metrology reports requiring possible extrapolations.

Verification Deliverables

Design phase: All drawings must specify the reference temperature.

Product phase: Metrology reports shall specify measurement temperature, measurements and extrapolated dimensions.

¹ The envelope might be slightly modified in certain areas if justified by a substantial improvement in the design, e.g. the static part of the rotator bearing.

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6.2 Dimensional envelope

The CG-Set Rotator and AG Mechanics shall be kept within the envelope defined in drawing A2 unless otherwise agreed with GRANTECAN².

Verification Deliverables

Design phase: 3D Model, drawings

Product phase: Inspection report, metrology report

6.3 Attachment of the Instrument Rotator to the Telescope Tube

The attachment of the Instrument Rotator to the Telescope Tube shall be thorough the attachment flange specified in A3.

The Telescope flange flexibility shall be taken into account for deformation analysis (see FE model in R1).

Verification Deliverables

Design phase: 3D Model, drawings. Design Document (FE analysis).

Product phase: Inspection report. Metrology reports

7 CG SET ELECTRONICS ENCLOSURE – TELESCOPE TUBE (RQ/I-TL-CS-015/NNN)

7.1 Electronics Enclosure dimensional envelope

The Electronics Enclosure envelope shall be as defined in drawing A2. External wall connection panel envelope is TBC depending on the final location at the Enclosure.

Verification Deliverables

Design phase: 3D Model, drawings.

Design phase: Inspection report.

7.2 Maximum mass

The enclosure + cooling system + electronics shall weight less than 250 kg.

Verification Deliverables

Design phase: Design Document (enclosure and electronics mass budget).

Product Phase: Test report (Weight test)

² The envelope might be slightly modified in certain areas if justified by a substantial improvement in the design, e.g. the static part of the rotator bearing.

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7.3 Electronics Enclosure Attachment to the Telescope structure

The Electronics Cabinet shall be provided with silent blocks at four attachment points. The interface part between silent blocks and Telescope Tube is within scope.

The interface plane shall be parallel to the base panels of the Enclosure. The attachment shall be made with bolts at points TBD.

The silent block choice shall take into account the different possible orientations with respect to gravity, as defined in R2.

Verification Deliverables

Design phase: Design document (Silent blocks choice justification). 3D model.

Component List

Product phase: Inspection.

7.4 Cabling length between Enclosure and AG chain connection panel

The cables between the Electronics Enclosure and the AG chain connection panel shall be 6m (TBC, depending on the final location of the cable entrance at the Enclosure wall).

Verification Deliverables

Design phase: Cable and connector list.

Design phase: Inspection report.

8 CG SET INSTRUMENT ROTATOR – GTC COOLING SYSTEM (RQ/I-CW-TL-030/NNN)

8.1 Cooling water circuit V at Cassegrain focal station

There is coolant available at location with the following specification:

- Coolant (35% glycol water)
- Temperature: variable, -2°C bellow ambient temperature
- Working Pressure: 5 bar
- Allowed average coolant temperature rise 4°C.
- Allowed pressure drop: 0,4 bar

The design of the CG-Set shall comply with the previous data.

Verification Deliverables

Design phase: Design document (thermal calculations, heat exchanger choice, cooling circuit materials)

Product phase: Test report (pressure test)

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8.2 Cooling water connexion to CG-Set

The interface with the GTC cooling system shall be at in the +Y (Cassegrain Coordinate System) outer part of the Rotator³. The connector type shall be TBD.

Verification Deliverables

Design phase: 3D Model, Component List.

Product phase: Inspection.

9 CG SET ELECTRONICS ENCLOSURE – GTC COOLING SYSTEM (RQ/I-CS-CW-003/NNN)

9.1 Cooling water circuit IV at Cassegrain focal station

There is coolant available at location with the following specification:

- Coolant (35% glycol water)
- Flow- 8 l/min.
- Temperature: 5°C
- Working Pressure: 5 bar
- Allowed average coolant temperature rise 4°C.
- Allowed pressure drop: 0,4 bar

The design of the cabinet cooling system shall comply with the previous data.

Verification Deliverables

Design phase: Design document (thermal calculations, heat exchanger choice, cooling circuit materials)

Product phase: Test report (pressure test)

9.2 Cooling water connexion to the Electronics Cabinet

The interface with the GTC cooling system shall be at location TBD at the Cabinet. The connectors type shall be TBD.

Verification Deliverables

Design phase: 3D Model, Component List.

Product phase: Inspection.

³ This is the lower part of the rotator when the Tube is horizontal. This is chosen to minimize the effects of a potential leak

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10 CG SET – GTC ELECTRICAL POWER (RQ/II-CS-CW-002/NNN)

10.1 Electrical supply at Cassegrain focal station

GRANTECAN shall provide 2 kinds of electrical power at location with the following specification:

- “Clean” Power Supply (Mains through transformer, backed up by a generator)
 - 400V, 50 Hz, 3 phase + neutral + PE
 - Maximum power ($\cos\alpha$ 0,85): 3200 W.
- UPS Power Supply (Uninterrupted Power Supply)
 - 230V, 50 Hz, 3 phase + neutral + PE
 - Maximum power ($\cos\alpha$ 0,85): 770 W.

Verification Deliverables

Design phase: Design document (description, power budget)

Product phase: Inspection

10.2 Power connection

The interface with the GTC electrical power net shall be at the Electronics Enclosure wall panel (TBC) with Military connectors type like ITT/Cannon series (e.g. CA3100E16-10SYB and CA3100E16-10PYB).

Verification Deliverables

Design phase: Design Document (Enclosure external panel description).

Product phase: Inspection.

10.3 Earthing at GTC

The GTC electrical installation is of the TN-S type. There are 2 kinds of earthing at the GTC.

- Protective Earthing (PE), within the power supply cord. Connected at the beginning of the installation to the transformer earth.
- "Structural grounding". There are specific earthing bolts available for “direct earthing”. These points are bonded to the Telescope metallic structure and connected to the GTC ground mat bellow the building through wide section wiring. The CG-Set shall provide an adequate earthing connection for this aim. GRANTECAN is responsible for the connection between this structural grounding point and the general structural grounding.
- Earthing ways should have a star like connection, avoiding loops.

Verification Deliverables

Design phase: Design document (Description), electrical drawings.

Product phase: Inspection report.

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10.4 Electrical protections coordination

Electrical protections at CG-Set shall be in adequate hierarchy with regard to the GTC ones upstream⁴.

Verification Deliverables

Design phase: Design Document (description and justification), electrical drawings

Product phase: Inspection.

11 CG SET – GTC COMPRESSED AIR (RQ/I-CW-TL-031/NNN)

11.1 Compressed air at Cassegrain focal station

There is compressed air available at location with the following specification:

- Clean Instrumentation air (particles bellow 0,01 μ , dew point -70°C)
- Flow- 60l/min (TBC)
- Working Pressure: 6 bar (TBC)

The design shall comply with the previous data.

Verification Deliverables

Design phase: Design document (description and justification)

Product phase: Test report (pressure test)

11.2 Compressed air connectors

The interface with the GTC compressed air system shall be at the Electronics Enclosure external wall panel (TBC). The connector type shall be TBD.

Verification Deliverables

Design phase: Component List.

Product phase: Inspection.

12 CG SET – PICK-OFF MIRROR (RQ/I-AG-AG-018/NNN)

12.1.1 Reference Temperature

The reference temperature for all the dimensions and tolerances, unless otherwise specified, shall be 8.5°C. This affects all drawings and metrology reports requiring possible extrapolations.

Verification Deliverables

⁴ Please, ask Grantecan personnel about the upstream electrical protection

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Design phase: All drawings must specify the reference temperature.

Product phase: Metrology reports shall specify measurement temperature, measurements and extrapolated dimensions.

12.1.2 POM unit envelope

The CG-Set design shall respect the POM unit envelope defined in drawing A6.

Verification Deliverables

Design phase: 3D Model, drawings.

Product phase: Inspection report.

12.1.3 POM unit attachment

The POM Unit shall be attached to the end of the Probe Arm at the surface defined in drawing A6. The position and orientation of the POM with regard to the GTC optical axis and the Pupil is defined in A6⁵.

Verification Deliverables

Design phase: 3D Model, manufacturing drawings.

Product phase: Inspection report. Metrology report. POM unit mounting repeatability

12.1.4 POM unit mass

The design shall consider a mass of 0,5 kg for the POM unit.

Verification Deliverables

Design phase: FEM, 3D model.

Product phase: inspection report

13 CG SET - AG INSTRUMENT (RQ/I-AG-AG-017/NNN)

13.1 Reference Temperature

The reference temperature for all the dimensions and tolerances, unless otherwise specified, shall be 8.5°C. This affects all drawings and metrology reports requiring possible extrapolations.

Verification Deliverables

Design phase: All drawings must specify the reference temperature.

⁵ The position of the POM has been decided at preliminary design but may be modified if deemed necessary in further steps and if the modification is agreed with Grantecan.

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Product phase: Metrology reports shall specify measurement temperature, measurements and extrapolated dimensions.

13.2 Probe Arm – AG Instrument

13.2.1 AG Instrument envelope

The Probe Arm design shall respect the AG Instrument envelope defined in drawing A5 for the whole Linear Stage range.

Verification Deliverables

Design phase: 3D Model.

Product phase: Inspection report.

13.2.2 AG Instrument attachment

The AG Instrument shall be attached to the upper surface of the Probe Arm linear stage as defined in drawing A5. The position of the AG Instrument and orientation of the AG optical axis is defined in A5 too⁶. The linear stage movement shall be parallel to the AG optical axis.

The tolerances for the position and orientation of the AG Instrument and, therefore, the Probe Arm linear stage, as well as the repeatability, shall be determined as a part of the relative lateral position error budget.

Verification Deliverables

Design phase: 3D Model, manufacturing drawings.

Product phase: Inspection report. Metrology report. Test report Linear table contribution to relative lateral Probe Arm error

13.2.3 AG Instrument mass

The design of the CG-Set shall have into account a mass of 5 kg for the AG Instrument. The cog. position, as defined in drawing A5. The AG instrument may be considered rigid regarding mechanical calculations.

Verification Deliverables

Design phase: FEM, 3D model.

Product phase: Test Report (functionality and performance of linear table shall be tested with the dummy mass in the worst-case position).

⁶ The position of the AG Instrument has been decided at preliminary design but may be modified if deemed necessary in further steps and if the modification is agreed with Grantecan

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13.3 AG Mechanics – AG Instrument electronics

13.3.1 Electronics mass and electronics attachment

The electronics mass is 2 kg (TBC). Electronics attachment to the box shall be TBD.

Verification Deliverables

Design phase: FEM, 3D model.

Product phase: Inspection report.

13.3.2 DC power cable end at AG Instrument

The cable coming from the 24 DC power supply (see R2) in the Electronics Enclosure shall be left unconnected at the at the AG Instrument electronics box location with 1m excess length. Each single conductor shall be provided with insulated cable ends.

Verification Deliverables

Design phase: Cable and connector list

Product phase: Inspection report

13.3.3 FO cable connector at AG Instrument end

The FO cable required in R2 shall end at the AG Instrument end with a Duplex LC connector.

Verification Deliverables

Design phase: Cable and Connector list and layout

Product phase: Inspection report

13.3.4 Cable routing between the AG Instrument and AG Instrument Electronics Box

The AG mechanics shall provide the routing of the cables (out of scope) connecting the AG Instrument with the AG Instrument Electronic Box. These cables are a 24V DC power cable and a USB3.0 communication cable (detailed cable definition is TBD)

Verification Deliverables

Design phase: 3D model, drawings

Product phase: Inspection report

14 CG SET – GTC CONTROL SYSTEM (RQ/I-CS-CS-015/NNN)

14.1 Physical interface

14.1.1 Motion control CANopen communications

- Interface Location: At each drive (see Fig. 1).

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- Bus: CAN
- Connectors: the drives shall have a CAN bus connection. The interface shall be the connector available at each drive

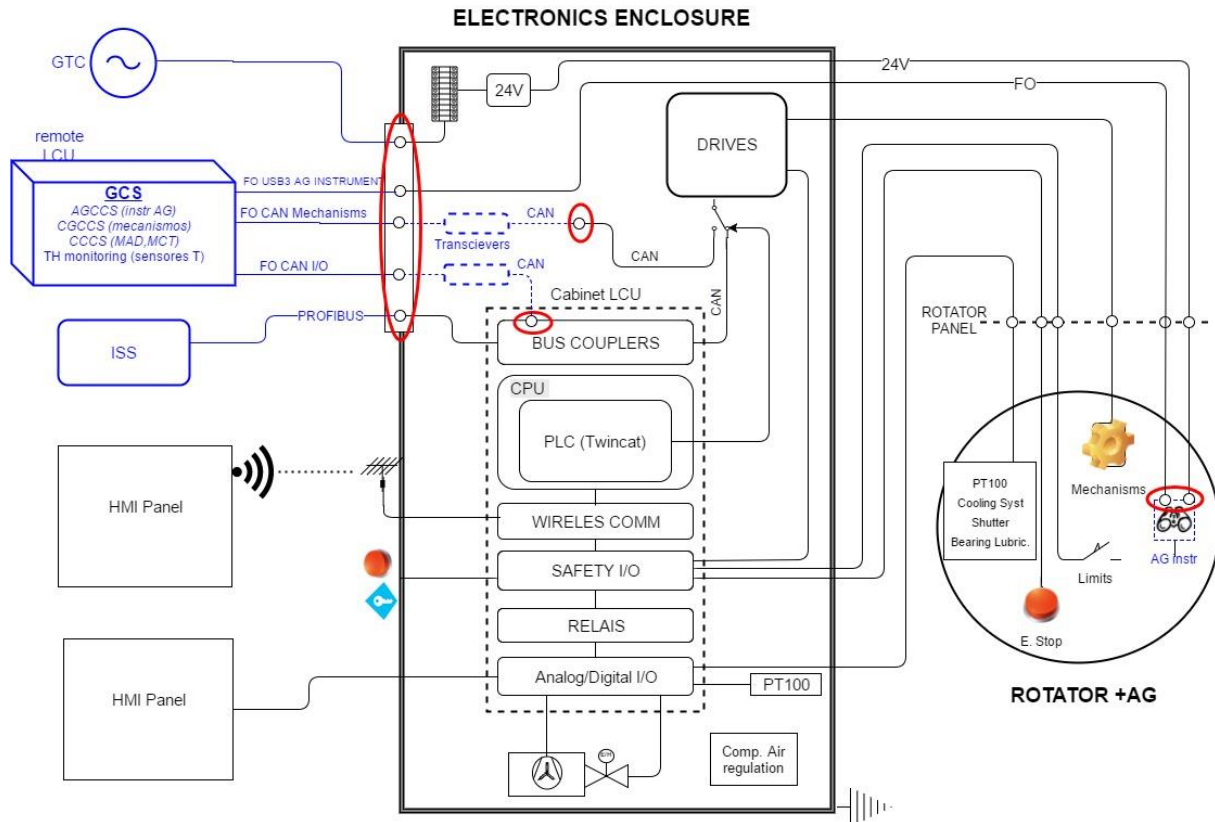


Fig. 1 - CG-Set HW Control Architecture. In blue, out of scope of GC-Set Tender. In Red Interface with other GTC subsystems

Verification Deliverables

Design phase: Design document (Electronics Cabinet schematics).

Product Phase: Inspection report.

14.1.2 Cabinet LCU CANopen communications

I/O CANopen communications physical interface needed for the CANopen signals defined in 14.1 shall be as follows:

- Location: at the Cabinet LCU (see Fig. 1)
- Bus: CAN
- Connectors: TBD (depending on the one provided by the Cabinet LCU CAN interface module)

Verification Deliverables

Design phase: Design document (Electronics Cabinet schematics).

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Product Phase: Inspection report. NOTE: GRANTECAN shall test this interface as part of the Factory Acceptance connecting its own device to the Cabinet LCU through a CAN bus.

14.1.3 Provisions for Transceivers

CAN bus communication with GCS is done through FO link. GRANTECAN shall provide Transceivers at both ends of the FO (see Fig. 1). There shall be space in the electronics cabinet reserved for mounting and connecting the FO CAN transceivers in a DIN rail. The envelope to be reserved is:

- 150 mm depth (perpendicular to the mounting panel).
- 200mm height (parallel to the mounting panel perpendicular to the rail).
- 100mm width (parallel to the rail).

At the Enclosure external wall connection panel there shall be two FO panel connectors. The connectors shall be type SC (TBC) two sided.

Verification Deliverables

Design phase: Design document (Electronics Cabinet internal layout).

Product Phase: Inspection report.

14.1.4 AG Instrument FO cable connector at the Electronics Enclosure

The FO cable required in R2 shall end at the at the Electronics Enclosure wall panel a Duplex ST connector (see Fig. 1).

Verification Deliverables

Design phase: Cable and Connector list and layout

Product phase: Inspection report

14.2 Logical interface

14.2.1 Motion Control

Communication between the GCS and each of the motor drives shall be as follows:

- Protocol: CANOpen DS402.
- Signals: out of scope
- Drives configuration:
 - The drive configurations shall allow to work with user units:
 - Rotary devices (Rotator, AG turn table, AG arm)
 - Position: degrees
 - Velocity: degrees/second
 - Acceleration: degrees/second²
 - Lineal devices (AG Instrument focusing linear table)

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- Position: mm
- Velocity: mm/second
- Acceleration: mm/second²
- CAN bus baud rate configuration: 500 kbaud.
- CAN bus node addresses from high priority to low priority: Rotator, AG turn table, AG arm, AG instrument focusing linear table, PLC.

Verification Deliverables

Product Phase: Inspection report (drives configuration).

14.2.2 Start-up system

Communication between the GCS and Cabinet LCU for Start-up functionality shall be as follows:

- Protocol: CANOpen DS401.
- Signals:

Signals from GCS to the start-up system:

- Groups 1 to N⁷ switch on (default all groups switch on at once)
- Groups 1 to N switch off
- Group n switch on ($n \geq 1$ & $n \leq N$)
- Group n switch off ($n \geq 1$ & $n \leq N$)

Signals from the start-up system to GCS:

- State (on/off) of group n ($n \geq 1$ & $n \leq N$)
- Communication errors

For a summary of the corresponding CANOpen objects/parameters description see 14.2.7.

Verification Deliverables

Design phase: Design document (Control Architecture and functional description).

Product Phase: NOTE: GRANTECAN shall test this interface as part of the Factory Acceptance connecting its own device to the Cabinet LCU through the CAN bus

14.2.3 Enclosure temperature control

Communication between the GCS and the Cabinet LCU for Enclosure Temperature Control functionality shall be as follows:

- Protocol: CANOpen DS401.
- Signals:

⁷ being N the number of any of the groups defined in **R1**

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Signals from GCS to Cabinet LCU:

- Enable/disable control loop (default enabled)
- ON/OFF fan (default ON)
- Open/close solenoid valve (in case control loop is disabled, default closed)
- Set Temperature threshold value (default 20°C)
- Set hysteresis value (default 4°C)

Signals from the Cabinet LCU system to GCS:

- Enclosure Door state (open/closed)
- Control loop state
- Fan relays state
- Solenoid valve relays state
- Actual temperature threshold setting
- Actual temperature value
- Actual hysteresis setting
- Actual water flux value
- Communication errors

For a summary of the corresponding CANOpen objects/parameters description see 14.2.7.

Verification Deliverables

Design phase: Design document (Control Architecture and functional description).

Product Phase: NOTE: GRANTECAN shall test this interface as part of the Factory Acceptance connecting its own device to the Cabinet LCU through a CAN bus.

14.2.4 Rotator Motor temperature monitoring

Communication between the GCS and the Cabinet LCU for Rotator Motor Temperature monitoring functionality shall be as follows:

- Protocol: CANopen 401 DS401
- Signals:

From the cabinet LCU to the GCS:

- Temperature sensor N
- Error messages

For a summary of the corresponding CANOpen objects/parameters description see 14.2.7.

Verification Deliverables

Design phase: Design document (Control Architecture and functional description).

Product Phase: NOTE: GRANTECAN shall test this interface as part of the Factory Acceptance connecting its own device to the Cabinet LCU through a CAN bus

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14.2.5 Structural temperature monitoring

Communication between the GCS and the Cabinet LCU for Structural Temperature monitoring functionality shall be as follows:

- Protocol: CANopen 401 DS401

- Signals:

From the cabinet LCU to the GCS:

- Temperature sensor N
- Error messages

For a summary of the corresponding CANOpen objects/parameters description see 14.2.7.

Verification Deliverables

Design phase: Design document (Control Architecture and functional description).

Product Phase: NOTE: GRANTECAN shall test this interface as part of the Factory Acceptance connecting its own device to the Cabinet LCU through a CAN bus

14.2.6 Operation mode monitoring

Communication between the GCS and the Cabinet LCU for the Operation Mode Monitoring functionality shall be as follows:

- Protocol: CANOpen DS401.

- Signals:

From the cabinet LCU to the GCS:

- Active Operation mode
- Communication errors

For a summary of the corresponding CANOpen objects/parameters description see 14.2.7.

Verification Deliverables

Design phase: Design document (Control Architecture and functional description).

Product Phase: NOTE: GRANTECAN shall test this interface as part of the Factory Acceptance connecting its own device to the Cabinet LCU through a CAN bus

14.2.7 Parameter description

Each of these parameters shall constitute an object within the dictionary of CANOpen which is accessed by a 16-bit index and an 8-bit sub-index, according to the CANOpen DS401 standard, for digital and analogue input/output.

Parameter / Object	Function	Description
SetGroups	Start-up system	Set on/off groups
GetGroups	Start-up system	Get status of groups



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SetAutoStartUp	Start-up system	Enables or disables the automatic start-up
GetAutoStartUp	Start-up system	Indicates whether the automatic start-up is activated
SetControlLoop	Enclosure temperature control	Enables or disables local temperature control
GetControlLoop	Enclosure temperature control	Indicates whether the local temperature control is on or off
GetEnclosureDoorState	Enclosure temperature control	Indicates whether the Enclosure Door state is open or close
SetRelais	Enclosure temperature control	Enables or disables the solenoid valve relays and fans
GetRelais	Enclosure temperature control	Indicates whether the solenoid valve relays and fans are activated
SetHysteresis	Enclosure temperature control	Sets the hysteresis value (0.0 °C – 6.0 °C)
GetHysteresis	Enclosure temperature control	Hysteresis value (0.0 °C – 6.0 °C)
SetTemperatureThreshold	Enclosure temperature control	Sets the temperature demand (5.0 °C - 30.0 °C)
GetTemperatureThreshold	Enclosure temperature control	Temperature demand value (5.0 °C - 30.0 °C)
GetMaximumTemperature	Enclosure temperature control	Maximum temperature value of the 3 sensors (10.0 °C - 50.0 °C)
GetActualTemperature1	Enclosure temperature control	Temperature value of sensor 1 (10.0 °C - 50.0 °C)
GetActualTemperature2	Enclosure temperature control	Temperature value of sensor 2 (10.0 °C - 50.0 °C)
GetActualTemperature3	Enclosure temperature control	Temperature value of sensor 3 (10.0 °C - 50.0 °C)
GetTempUpperSetting	Enclosure temperature control	Activation value of the cooling system (10.0 °C - 50.0 °C)
GetTempLowerSetting	Enclosure temperature control	Deactivation value of the cooling system (10.0 °C - 50.0 °C)
GetWaterFlux	Enclosure temperature control	Water flow rate (1.0 l/min - 10.0 l/min)

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GetOperationMode	Operation mode monitoring	Indicates the operation mode: Remote or Local
GetError	All	Indicates if there has been any communication error with the modules (TBC)

Verification Deliverables

Design phase: Design document (Mapping between functional description and CAN objects).

Product Phase: NOTE: GRANTECAN shall test this interface as part of the Factory Acceptance connecting its own device to the Cabinet LCU through a CAN bus

15 CG SET – GTC INTERLOCK & SAFETY SYSTEM (RQ/I-CS-CS-016/NNN)

15.1 Physical and Logical Interface

Communication between the ISS and ISSL (Cassegrain Local ISS) shall be as follows:

- Interface Location: At the Enclosure external wall panel
- Bus: PROFIBUS
- Connectors: TBD
- Protocol: PROFISAFE
- Signals (all digital):
 - From ISS to LISS (expected CG-Set reaction when signal is active hereafter described):
 - Emergency stop for Rotator, AG Mechanics and Probe Arm (TBC depending on Safety assessment)
 - Emergency general power switch off (TBC depending on Safety assessment)
 - Close central shutter
 - Any other signals TBD corresponding to safety functions derived from the Safety assessment (acknowledgements, etc..., to be agreed with GRANTECAN)
 - From ISSL to ISS:
 - Cassegrain Emergency stop
 - Cassegrain Emergency general power switch off
 - Central shutter closed (Y/N)
 - Brakes callipers pressurized (Y/N)
 - Operation mode Local (Y/N)
 - Any other signals TBD corresponding to safety functions derived from the Safety assessment (limits, etc..., to be agreed with GRANTECAN)

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Switch off signal from the ISS shall be fail safe, i.e. mechanisms shall be switched off when connection with the ISS is lost. Some system shall be deployed to bypass this fact when the GC-Set is working autonomously before being connected to the ISS.

Verification Deliverables

Design phase: Design document (local safety interfaces description, Electronics Cabinet schematics)

Product phase: Test report (signal communication)