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Project/WP: Systems Engineering

ICD between the E-ELT SCPs and the SCP Clients

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6.2	99	Changed from 1/2 to 3/4" (three quarter inch)

Contents

1. Introduction

1.1 Scope

[INFO-SCP/SCP-5] This document provides information about the interface characteristics of the E-ELT Service Connection Points (SCPs). It is based on and in line with the Technical Specification of the E-ELT Service Connection Points (see RD1)

1.2 Conventions and Definitions

1.2.1 Requirements and Information

[INFO-SCP/SCP-8] This document contains two types of items: requirements and information. Requirements have to be verified by the contractor while information items do not. Both types are binding items.

Requirements are identified with a requirement tag following the format [I-SCP/SCP-NNN], where NNN is a unique, non-speaking number. The letter I is intended to convey the meaning "interface requirement".

In addition, each requirement carries a verification tag suggesting the minimum verification method(s) applicable for that requirement verification (D: Design Review; A: Analysis; I: Inspection; T: Test).

Information items are identified with the tag [INFO-SCP/SCP-NNN], NNN being a unique, non-speaking number, not used in any requirement identifier. These information items, which are fully binding to this document, refer usually to context, conditions or definitions that have to be taken into consideration for all or for specific requirements.

NNN numbers do not necessarily follow a sequential order. They do not change across all versions of this document. Within this document, cross-references to an item (either requirement or information) are made by referring to the number NNN preceded by the prefix "#".

1.2.2 Abbreviations and Acronyms

[INFO-SCP/SCP-10] The following abbreviations and acronyms are used in this document:

DIN	Deutsches Institut für Normung
IP	International Protection Marking (IEC 60529)
L	Live
N	Neutral
PE	Protective Earth
SCP	Service Connection Point
TBC	To Be Confirmed
TBD	To Be Defined

1.2.3 Definitions

[I-SCP/SCP-12] / / / **Normal Power.** Electrical power supplied by the SCP to support the normal operation of the SCP client. This power source may be subject to power-shedding or interruption.

[I-SCP/SCP-13] / / / **Temporary Load.** Electrical power loads such as hand tools, temporary maintenance or test equipment that are not permanently connected to the power supply during operation.

[I-SCP/SCP-14] / / / **Permanent Load**. Electrical loads that exist permanently as a part of the SCP client.

[I-SCP/SCP-15] / / / **Power Shedding**. A strategy for managing the scenario where the available normal power is lower than its nominal value. According to this strategy some or all SCP clients within the observatory are required to reduce their "normal" electrical power consumption to a specified value.

[I-SCP/SCP-16] / / / **Safety Power**. The only source of electrical power that will remain active under all circumstances e.g. a failure of the external observatory power supply. The purpose of this power source is to supply loads that require continuous electrical supply to ensure the safety of personnel and critical equipment.

2. Related Documents

2.1 Applicable Documents

[INFO-SCP/SCP-19] The following documents, of the exact version shown, form part of this document to the extent specified herein. In the event of conflict between the documents referenced herein and the content of this document, the content of this document shall be considered as superseding.

2.1.1 ESO Documents

AD1 E-ELT Electrical and Electronic Design Requirements;
ESO-262825 Version 1
https://pdm.eso.org/kronodoc/HQ/ESO-262825/1

AD2 Components for the Instrument Cooling Circuits;
ESO-254314 Version 3
https://pdm.eso.org/kronodoc/HQ/ESO-254314/3

2.2 Reference Documents

[INFO-SCP/SCP-23] The following documents, of the exact version shown herein, are listed as background references only. They are not to be construed as a binding complement to the present document.

3. Overview

[I-SCP/SCP-25] D/ / /T The SCPs shall be standard connection points to the E-ELT Observatory service supplies (electric power, compressed air, cooling fluid, communication, safety network and time networks).

They shall be located throughout the Observatory and used to connect subsystems such as drive control units, instruments, mirror units, prefocal stations, handling tools, to Observatory infrastructure.

[I-SCP/SCP-26] D/ / /T The SCP shall comprise three separate parts: Part A (electrical power), Part B (communication), and Part C (mechanical connectors for fluids and gases). These parts will be generally installed together, but may be also installed singularly if required.

[I-SCP/SCP-27] D/ / /T

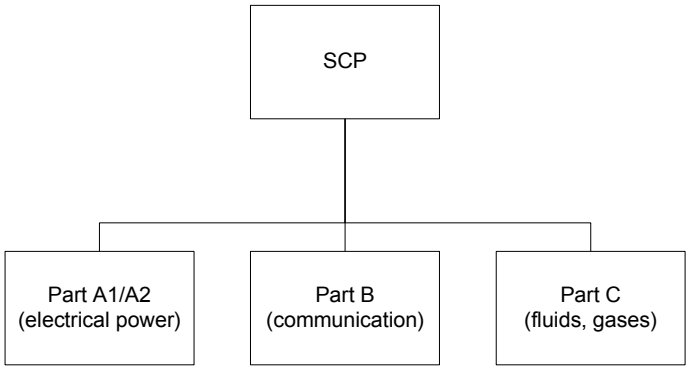


Figure 1: SCP product breakdown structure

[I-SCP/SCP-28] / / / The SCP part A shall provide "normal power" and "safety power" to the SCP clients.

[I-SCP/SCP-29] / / / The SCP part A shall be available in two different variants. SCP variant A1 shall be rated for 7.2kVA per phase and variant A2 shall be rated for 14.5kVA per phase. An SCP may be specified as variant A1 or A2 but not both. The dimension of the safety power circuit shall be the same for both A1 and A2 at 3.6kVA per phase.

[I-SCP/SCP-30] D/ / /T SCP A, B and C shall be physically separated cabinets

[I-SCP/SCP-31] D/ / /T During normal operation and for all the defined operational modes of the E-ELT, the SCP shall be used to provide power, network and fluid (coolant and gasses) to temporary loads and hosted units (i.e. SCP clients).

[I-SCP/SCP-32] D/ / /T During degraded operational modes, like during a normal (prime) power source failure, SCP shall continue to provide safety power to the ESO authorized SCP clients only.

[I-SCP/SCP-33] D/ / /T External sockets of the SCP shall only be used to supply normal power to temporary loads.

[I-SCP/SCP-34] Permanent loads shall be connected using internal power terminals exclusively.

D/ / /T

[I-SCP/SCP-35] D/ / /T Each SCP on the Nasmyth Platform shall be located at a position to be defined by ESO (location TBD) but not further than 11m from the borders of the Prefocal Station (PFS).

4. SCP Part A Characteristics

4.1 Power Requirements

[I-SCP/SCP-38] D/ / /T SCP A2 (64 A) version shall be capable to deliver up to 43.5 kVA as max demand to all its connected loads, which means up to a max of 14.5 kVA per phase.

[I-SCP/SCP-39] D/ / /T SCP A1 (32A) version shall be capable to deliver up to 21.5 kVA as max demand to all its connected loads, which means up to a max of 7.2 kVA per phase.

[I-SCP/SCP-40] D/ / /T The normal power circuit of SCP part A1 and A2, shall be based on 3-phase power scheme, 400 V a.c. line-to-line; 230 V a.c. line-to-neutral, 50 Hz.

[I-SCP/SCP-41] D/ / /T The normal power circuit of SCP part A1 and A2, shall implement a TN-S (L1, L2, L3, N and PE) earthing scheme.

[I-SCP/SCP-42] / / / The normal power circuit of SCP part A1, shall be dimensioned for a continuous rated current of 32 A per phase.

[I-SCP/SCP-43] / / / The normal power circuit of SCP part A2, shall be dimensioned for a continuous rated current of 63 A per phase.

[I-SCP/SCP-44] D/ / /T The safety power circuit of SCP part A1 and A2, shall be based on 3-Phase power scheme, 400 V a.c. line-to-line; 230 V a.c. line-to-neutral, 50 Hz.

[I-SCP/SCP-45] D/ / /T The safety power circuit of SCP part A1 and A2, shall implement a TN-S (L1, L2, L3, N and PE) earthing scheme.

[I-SCP/SCP-46] D/ / /T The safety power circuit of both SCP part A1 and A2, shall be dimensioned for a continuous rated current of 16 A per phase.

[I-SCP/SCP-47] D/ / /T Each SCP normal power feeding cable shall be connected to a separate 64 A for A2, or 32 A for A1 switched switchgear output, properly protected against overload, short circuit and earth fault (regulated type B RCD is required for this earth fault protection).

[I-SCP/SCP-48] D/ / /T Each SCP safety power feeding cable, shall be connected (only if authorized and approved) to a separate 16 A switched switchgear output, properly protected against overload, short circuit and earth fault, the last with type B RCD.

[I-SCP/SCP-49] D/ / /T Each SCP itself shall include a main switch disconnector with OFF position locking facility.

[I-SCP/SCP-50] D/ / /T The 16 A normal circuit available on the front side sockets shall be protected by a 16A MCB (preferred K type), and a 30mA type B RCD.

The proper MCB type shall be checked against the short circuit calculation.

[I-SCP/SCP-51] D/ / /T The 32A and 64A circuits respectively for SCP A1, and SCP A2 versions are assumed to be accordingly protected at switchgear level, so no local protection shall be foreseen.

4.2 Mechanical Requirements

[I-SCP/SCP-53] D/ / /T Part A (both SCP A1 and A2) shall consist of a metal box, firm and solid, with hinged front panel and reinforced attachment points to resist to earth-quake.

[I-SCP/SCP-54] D/ / /T The box shall be lockable using a universal key or special tool.

[I-SCP/SCP-55] D/ / /T The lockable power switch disconnector shall be accessible externally, and shall be located only either on the front panel or in one of the lateral sides.

[I-SCP/SCP-56] D/ / /T The lockable switch disconnector shall be always accessible regardless of the final location of the SCP.

A minimum of 50 cm shall be kept free of any parts between the lateral lockable switch and a wall or any mechanical device.

4.3 Cable Interface Requirements

[I-SCP/SCP-58] / / / All permanent live terminal connections for SCP clients shall be located inside the SCP.

[I-SCP/SCP-59] D/ / /T All cables shall enter the SCP through cable glands on the bottom surface of the cabinet.

[I-SCP/SCP-60] D/ / /T These glands shall provide strain relief, provision for the peripheral (360°) bonding of the electrical screens and environmental protection.

[I-SCP/SCP-61] D/ / /T The SCP part A1 and A2 shall provide a total of two cable glands for the 3-phase normal power output cables used to supply the SCP clients.

[I-SCP/SCP-62] D/ / /T The SCP part A1 and A2 shall provide a total of two cable glands for the 3-phase safety power output cables used to supply the SCP clients.

[I-SCP/SCP-63] D/ / /T All cable glands shall be provided with plugs to seal the entry holes when the gland is not used.

[I-SCP/SCP-64] D/ / /T The SCP part A1 and A2 shall provide internal terminals with provision for L1, L2, L3, N, PE output power cable connections.

[I-SCP/SCP-65] D/ / /T The SCP part A1 and A2 shall provide internal terminals with provision for L1, L2, L3, N, PE output safety power cable connections.

[I-SCP/SCP-66] D/ / /T A bonding bar shall be installed inside the SCP to allow connection of PE cables and shields within the SCP.

4.3.1 Electrical Interface to Permanent Loads

[I-SCP/SCP-68] D/ / /T External cable support is provided using a steel loop of cadmium plated or galvanized steel with a sectional diameter of 5 ± 1mm and minimum free opening of 15 mm diameter

[I-SCP/SCP-69] D/ / /T Safety power connection inside the SCP is made via DIN-rail mounted terminal blocks with the following cable connection capabilities:

S = 6 mm^2 for circuit with design current 16A

For both A1 and A2 SCP type

[I-SCP/SCP-70] D/ / /T Normal power connection inside the SCP is made via DIN-rail mounted terminal blocks with the following cable connection capabilities:

S = 6 mm^2 for circuit with design current 16A (A1 and A2 type)

S = 16 mm^2 for circuit with design current 32A (A1 type only)

S = 25 mm^2 for circuit with design current 64A (A2 type only)

[I-SCP/SCP-71] D/ / /T Permanent loads equipotential bonding connection is made via a 6 mm diameter brass screw terminal with nut.

4.3.2 Electrical Interface to Temporary loads

[I-SCP/SCP-73] D/ / /T 3-phase normal power socket-outlets: 1 per SCP-A

Type: panel socket-outlet 3P+N+PE, 240/415V (red type), earthing contact at 6h as per EN 60309/IEC 60309 IP54;

rated currents of normal power socket-outlets:

32 A in Part A1, 63 A in Part A2.

[I-SCP/SCP-74] D/ / /T 1-phase normal power socket-outlets: 3 per SCP-A (one per each phase)

Type: white or light grey colored panel socket-outlet; phase, neutral and earthing contact;

as per CEE-el 7/VII (DIN 49441)-IP54

rated current: 16A.

4.4 IP Protection

[I-SCP/SCP-76] D/ / /T With the door closed, the SCP Parts A1 and A2, including all socket-outlets and cable glands, shall provide a minimum protection to IP54D (as defined in IEC60529) or better.

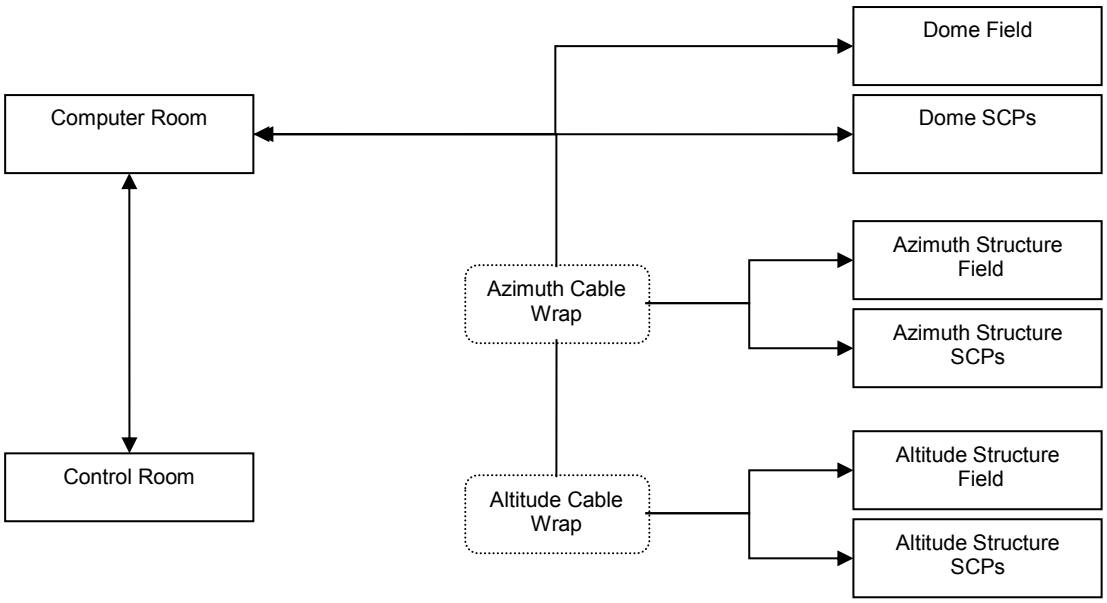
[I-SCP/SCP-77] D/ / /T With the door opened, the SCP part A1 and A2, shall provide a minimum protection of IP2x (as defined in IEC60529) or better.

5. SCP Part B Characteristics

5.1 Overview

[INFO-SCP/SCP-108] The diagram below shows the general layout of control-related fibre-optic cables between the computer room and patch panels in the field.

[INFO-SCP/SCP-110] The diagram below shows the general layout of control-related fibre-optic cables between the computer room and SCP patch panels in the field.



5.2 Mechanical Requirements

[I-SCP/SCP-80] D/ / /T — SCP B shall be a 19 ", 24 U, 1200 mm height, 800 mm width and 800 mm depth metal cabinet with plain metal hinged front and rear doors with top and bottom possible attachment points.

[I-SCP/SCP-81] D/ / /T — Both front and rear doors shall be left accessible for operation.

[I-SCP/SCP-82] D/ / /T — Both rear and front SCP B doors shall be lockable using a key or special tool.

5.3 Cable Interface Requirements

[I-SCP/SCP-112] / / / — Each SCP shall contain a fibre patch panel and cabling for at least 72 fibre strands (36 pairs). Cabling terminates at a patch panel in the SCP, and at the other end in the Computer Room.

[I-SCP/SCP-111] / / / — Fibre-optic cables between the Computer Room and all SCPs shall be single-mode (OS2 transmission standard) fibre-optic cables per AD1.

[I-SCP/SCP-113] / / / — Optical fibres shall be equipped exclusively with LC-type connectors as per AD1.

[I-SCP/SCP-114] / / / — All optical fibres shall be certified for 10Gbit/s operation according to ANSI/TI-568-C.3 as per AD1.

[I-SCP/SCP-115] / / / — Each SCP shall be able to implement the following physical layer interfaces: 100BASE-TX, 1000BASE-T or 10GBASE-T according to "Telecommunications and information exchange between systems - Local and metropolitan area networks - Part 3"; IEEE Std 802.3-2009.

[I-SCP/SCP-116] / / / — Ethernet shall be used for the data link layer.

[I-SCP/SCP-87] D/ / /T — Ethernet interfaces to SCP clients for network shall be of RJ45/GG45 type.

[I-SCP/SCP-84] D/ / /T — The Ethernet cables shall enter the cabinet through an entrance window.

[I-SCP/SCP-85] D/ / /T — SCP B cabinet shall be equipped at the cabinet entrance with cable locking devices (strain relief).

[INFO-SCP/SCP-86] — SCP B internal systems like switches patch panels etc, will be provided by ESO.

6. SCP Part C Characteristics

6.1 General

[I-SCP/SCP-90] D/ / /T SCP C shall provide two output connection points for pressurized air.

[I-SCP/SCP-91] D/ / /T SCP C shall provide one coolant supply and one coolant return connection point.

6.2 Cooling Liquid Requirements

[I-SCP/SCP-93] D/ / /T Supply temperature: The temperature of the coolant shall be nominally 8ºC below ambient, but it shall not sink below -8ºC or the external dew point (plus a given offset) whichever is higher. During day time, “ambient" is the target temperature for the enclosure air conditioning system which corresponds to the estimated temperature for the start of the forthcoming night (minus a given offset).

Return temperature: The return temperature shall be at or below the ambient temperature, i.e a maximum temperature difference (outlet - inlet) of +8ºC.

[I-SCP/SCP-94] D/ / /T Despite all precautions the danger of condensation cannot be completely ruled out and subsystems shall not suffer damage from condensing humidity.

[I-SCP/SCP-95] D/ / /T SCP C shall be designed for coolant type: water with 35% (vol.) ethylene glycol.

[I-SCP/SCP-97] D/ / /T SCP C shall be designed to supply a flow of 30 L/min at a differential pressure of 3 bar in any SCP load scenario.

[I-SCP/SCP-99] D/ / /T SCP C cooling liquid connectors: self-sealing male for output, female for return path, fluid connector according to ISO 7241-1 Series B, nominal diameter: 3/4" (three quarter inch)

[I-SCP/SCP-118] D/ / /T The SCP clients shall balance the flow inside the client with the corresponding compensation valves in order to meet the nominal client flow values. I.e no short-circuit of the SCP is allowed.

[I-SCP/SCP-119] D/ / /T The SCP clients shall not use booster devices (e.g. inline pumps) to increase the available differential pressure.

[I-SCP/SCP-120] D/ / /T The SCP clients shall maximize the efficiency in transferring their heat load to the coolant while still meeting the return temperature specified in #93.

[I-SCP/SCP-121] D/ / /T The SCP clients shall comply with the standard cooling components specified in AD2.

6.3 Compressed Air Requirements

[I-SCP/SCP-101] D/ / /T SCP C shall be designed for a supply pressure: 7-8 bars

[I-SCP/SCP-102] D/ / /T SCP C shall be equipped with replaceable filter designed to filter particles ≥ 5 µm

[I-SCP/SCP-103] D/ / /T SCP C shall be designed for oil content in air <0.01 ppm

[I-SCP/SCP-104] D/ / /T SCP C shall be designed for a relative humidity ≤10% at 20ºC at local atmospheric pressure

[I-SCP/SCP-105] D/ / /T SCP C shall be designed for a flow rate: ≤ 250 L/min peak (<5s) and ≤ 45 L/min continuous load at 1 bar and 0°C

[I-SCP/SCP-106] D/ / /T SCP C pressurized air connectors: self-sealing female connector according to DIN EN 983 and ISO 4414, compatible with ISO 6150B, nominal diameter: 1/2" (half inch)