

Interface Control Document MAGNETS : CENTRALIZED INSTRUMENTATION

Interface Document: NSTXU_1-1-3_IC_106

REVISION 0

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National Spherical Torus eXperiment Upgrade

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Interface Control Document

MAGNETS: CENTRALIZED INSTRUMENTATION & CONTROL

NSTX-U-ICD-MAG-CIC-0

**Revision 0
May 16, 2019**

Change Record

Revision	Date	Description of Change
0	May 16, 2019	Initial Release

References

[1] GENERAL REQUIREMENTS DOCUMENT, NSTX-U-RQMT-GRD-001-01.

[2] SYSTEM REQUIREMENTS DOCUMENT, MAGNET SYSTEMS, NSTX-U-RQMT-SRD-002-02, March 8, 2018.

[3] SYSTEM REQUIREMENTS DOCUMENT, CENTRAL INSTRUMENTATION AND CONTROL, NSTX-U-RQMT-SRD-009-00.

1. Purpose

This document describes the various interfaces between the following subsystems: Magnets and the Centralized Instrumentation & Control . The interface locations and boundaries that connect the Magnets to the Centralized Instrumentation & Control are identified based on different interface types.

2. Scope

The Magnets consists of Inner and Outer PF and TF coils, OH Solenoid, and Bus Bars. The Central Instrumentation and Control consists of Control I/O, Plant Control and Monitoring, Timing and Synchronization System, Data I/O systems, and Data Archiving Systems. The scope of this document addresses any defined interfaces between these identified system elements.

3. Responsibilities

The interfaces are managed between the following organizations:

- Magnets
- Centralized Instrumentation & Control
- Systems Engineering and Integration

4. Interfaces

Interface requirements in the following sections are identified with a requirement number, ICD, followed by a number [ICD-MAG-CIC-X] where “X” is a sequential count beginning with 001, MAG represents Magnets, and CIC represents Centralized Instrumentation & Control. There is also a unique identifier for all interfaces in the format [#####-#####-X]. The identifier is a concatenation of two level 5 WBS values and the interface type. This is followed by an interface description and a list of references. References provide evidence pertaining to interfaces and include but are not limited to drawings, calculations, or specifications. Reference also include a reference to a paragraph that identifies the set of interface definitions.

4.1. Interface Types

The top-level interface types are defined in Table 1. Within each heading there are sub-headings to address any special sub-elements that need consideration. For example, the Mechanical has four sub-elements that need to be addressed: Structural, Spatial, Location, and Wall/Floor Penetration. For those interface types with sub-interfaces there are corresponding sub-sections.

Table 1. Interface Types

Heading	Abbreviation	Name
4.2	Me	Mechanical
4.3	Ep	Electrical Power
4.4	Si	Signal
4.5	Di	Diagnostics
4.6	Gf	Gas/Fluid
4.7	Va	Vacuum
4.8	Sw	Software
4.9	Th	Thermal
4.10	Pe	Plasma/Eddy/ Halo Current

Table 2 provides the N2 Diagram identifying all the interfaces for NSTX-U while Table 3 provides the specific details of the interface.

Table 2. N2 Diagram Interface Types.

Plasma Facing Components	Me, Th, Pe		Me, Th, Va, Pe						Me	Me	Me, Pe		Me			
	In-Vessel Structure	Me, Di, Pe			Th			Me, Th, Pe	Me		Me, Di, Pe			Di		
		Vacuum Vessel Structure			Me, Va	Me, Va	Me	Me, Th, Pe	Me	Me, Va	Me, Di, Va		Si	Di, Si		
		Va	Centerstack Structure			Va	Me, Gf	Me	Me	Me				Di		
		Me	Me, Th, Ep	Magnets			Gf	Me			Di		Si	Di		
Si		Me, Va			Heating Systems		Gf	Th		Me		Gf, Si	Si	Si	Si	
					Si, Va, Me, Sw, Gf	Vacuum Pumping System		Si	Si	Gf, Si	Si		Si, Va	Si	Si	
				Gf, Si			Coolant System	Gf				Gf, Sw	Si, Sw	Si		
	Th, Gf	Ep, Di, Th, Va	Ep, Gf, Th, Pe		Si		Si	Bakeout System						Me	Si, Me	
			Gf, Va	Gf, Va	Ep	Gf, Si			Gas Delivery System	Me	Va		Si, Sw	Si	Si	
		Gf	Si			Si, Gf, Va			Gf	Wall Conditioning System			Si, Sw	Si	Si	
		Me, Va	Me, Va	Me	Me	Gf, Si	Gf			Va, Ep	Diagnostics		Si, Sw	Si	Si	Si
				Ep	Ep	Ep	Ep	Ep	Ep	Ep	Ep	Power Systems	Si	Ep, Si	Ep, Si, Di, Gf	Ep
					Si					Me, Si	Si		Centralized Instrumentation and Control	Si, Me		
										Sw		Si	Si, Sw	Integrated Machine Operations		
								Ep							Operations & Safety Systems	
Me		Me	Me	Me	Me	Me		Me	Me	Me	Me	Me	Me	Me	Me, Ep	D-Site Locations (Test Cell)

Table 3. Callout.

Magnets	Si
	Centralized Instrumentation & Control

The remainder of this document addresses each of the interfaces. Note the template includes a paragraph heading for each interface and a table for each interface type. In the event there is no interface, the table will remain blank with a blank row.

The following paragraphs in Section 4 address each of the interfaces, and Section 5 addresses any off-project interfaces. Off-project interfaces are those external interfaces that interact with the NSTX-U system.

4.2. Mechanical Interfaces

This paragraph addresses any type of mechanical interfaces that include a structural, spatial, location dependent interfaces or areas where penetrations into a wall or floor are required. These are identified independently as interface parameters will likely be different.

4.2.1. Structural Interfaces

This identifies any interfaces between system elements that require a structural interface. This could be based on various forces placed on the system and by the system.

Identifier	Interface	References
N/A		

4.2.2. Spatial Interface

This identifies any interfaces between the system elements pertaining to spatial restrictions or constraints.

Identifier	Interface	References
N/A		

4.2.3. Location Interfaces

This identifies any interfaces between the system elements that have any particular dependencies on element location or location constraints.

Identifier	Interface	References
N/A		

4.2.4. Wall/Floor Penetration Interfaces

This identifies any interfaces between the system elements any penetrations or modifications to the wall or floor of the D-Site building.

Identifier	Interface	References
N/A		

4.3. Electrical Power Interfaces

This identifies any interfaces between the system elements requiring AC, DC, rectification or power conditioning.

Identifier	Interface	References
N/A		

4.4. Signal Interfaces

This identifies any interfaces between the system elements and signals that are used to either send or receive control information or data. It explicitly includes the type of physical interface such as Ethernet or Fiber Optic or any specific protocols.

Identifier	Interface	References
1.1.3.4- 1.6.1.1-Si	Signals from the coil current transducers on RWM coil cables are digitized.	See Paragraph 4.4.1, Drawings AE1089, 4F1005

4.4.1. RWM Transducers - CI&C

Interface Notes:

- Drawing AE1089 is currently unsigned

ICD-MAG-CIC-001: Six transducers are attached to the RWM cables as shown on the CWS RWM coils included on Drawing 4F1005. Figure 1 shows one of the transducers wrapped around the RWM cable. Drawing 1568A includes RWM coils 1, 2 & 3, while drawing 1568B includes RWM coils 4, 5, & 6 .

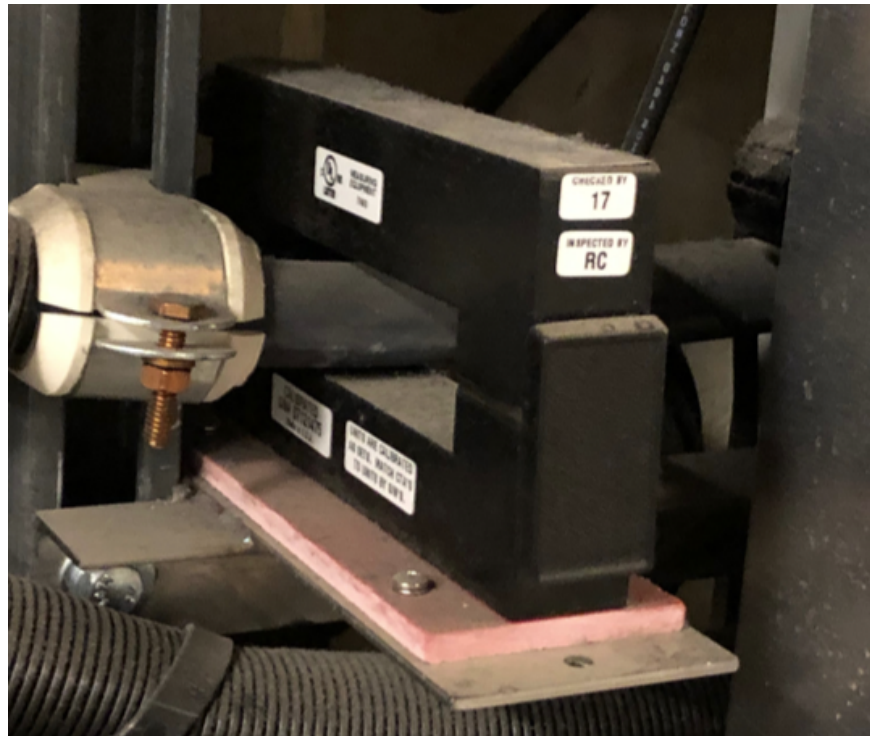


Figure 1. RWM transducer

ICD-MAG-CIC-002: The filter chassis provides the interface and the filter chassis sends data to the transient digitizer handles. These interfaces included in Rack CTC-EE-439 Crate 38 as shown In Figure 2. Note there may be other installed equipment, e.g., signal conditioners in the path of the interface.

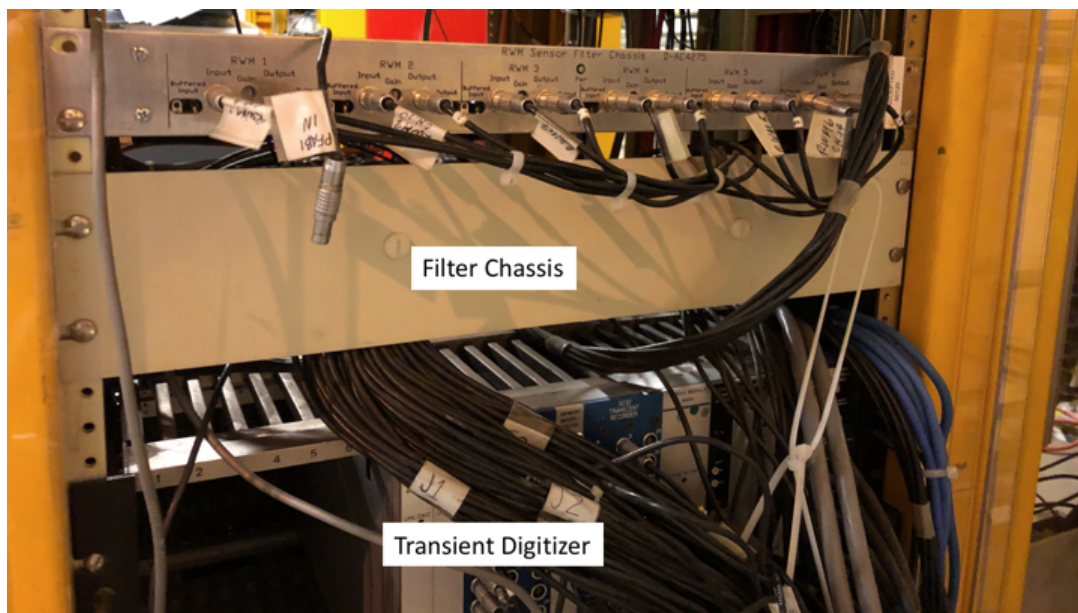


Figure 2. Rack CTC-EE-439 Crate 38

ICD-MAG-CIC-003: The physical connection uses a standard 3-pin LEMO connector.

4.5. Diagnostic Interfaces

This identifies any interfaces between the system elements with any instrumentation or diagnostic equipment to collect performance data.

Identifier	Interface	References
N/A		

4.6. Gas/Fluid Interfaces

This paragraph has two different types of interfaces: Gas and Fluid.

4.6.1. Gas Interfaces

This identifies any interfaces between the system elements that use any type of gas (e.g., He).

Identifier	Interface	References

N/A		
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4.6.2. Fluid Interfaces

This identifies any interfaces between the system elements that use any type of fluid (e.g., ionized water).

Identifier	Interface	References
N/A		

4.7. Vacuum Interfaces

This identifies any interfaces between the system elements that pertain to the Vacuum.

Identifier	Interface	References
N/A		

4.8. Software Interfaces

This identifies any interfaces between the system elements that use software that may exchange interfaces with other software components. This includes application programming interfaces (APIs) or any other exchange of information between different software applications.

Identifier	Interface	References
N/A		

4.9. Thermal Interfaces

This identifies any interfaces between the system elements that pertain to Thermal characteristics.

Identifier	Interface	References
N/A		

4.10. Plasma Interfaces

This paragraph has two different types of interfaces: Plasma and Eddy/Halo Current.

4.10.1. Plasma Interfaces

This identifies any interfaces between the system elements with the Plasma.

Identifier	Interface	References
N/A		

4.10.2. Eddy/Halo Current Interfaces

This identifies any interfaces between the system elements with the Eddy/Halo Currents.

Identifier	Interface	References
N/A		

5. Off-Project Interfaces

The off-project interfaces are components that are not specifically part of the NSTX-U system. They may include external systems and interfaces where the program has little control over the part of the interface. They are provided for completeness.

There are no external interfaces.