HRF Software Design Document Chapter
For the
Human Research Facility
Muscle Atrophy Research and Exercise System (MARES)
Workstation Client Software

LS-71083D

3.6 HRF MUSCLE ATROPHY RESEARCH AND EXERCISE SYSTEM (MARES) RACK

3.1.6 HRF Muscle Atrophy Research and Exercise System (MARES) Workstation Client Software

3.1.6.1 System Architecture And Overview

3.1.6.1.1 Overview

The purpose of the Human Research Facility (HRF) Muscle Atrophy Research and Exercise System (MARES) Rack is to accommodate the stowage and deployment of the HRF MARES, and provide an appropriate power interface to the Space Station. The HRF MARES will be used to carry out research on muscle-skeletal, biomechanical, neuromuscular, and neurological physiology, to study the effect of microgravity on the human body, and to evaluate the effect of the countermeasures to the Space Station environment induced physiological effects. The HRF MARES Rack system consists of the HRF MARES, an HRF Portable Computer, the HRF Workstation 2 and related software. Refer to the Human Research Facility (HRF) Software Configuration Management Plan and Procedure for a list of the configuration controlled components of this system. Refer to the HRF Configuration Management System for information regarding the states and revisions of the software.

Documents relevant to this system are:

LS–71020	Software Development Plan for the Human Research Facility
LS-71020-1	Software Configuration Management Plan and Procedure for the Human Research Facility
LS–71090-2	Software Requirements Specification (SRS) for the Human Research Facility (HRF) Muscle Atrophy Research and Exercise System (MARES) Workstation Client Software

3.1.6.1.2 System-Wide Design Decisions

- The MARES Workstation Client CSCI operates in the Windows 2000 environment.
- The MARES Workstation Client CSCI will be executed from the ground, with no crew intervention.

3.1.6.1.3 Requirements

The functional requirements for the HRF MARES Workstation Client Software are specified in the following document(s):

3.1.6.1.4 System Architecture

The HRF MARES Workstation Client Software is custom-build flight software, and it consists of one Computer Software Configuration Item (CSCI). The MARES Workstation Client CSCI resides on the HRF Workstation 2, and is subdivided into three Computer Software Units (CSUs). The following paragraphs provide details of each CSCI and CSU.

3.1.7 MARES Workstation Client CSCI (HRF-MARES01U)

3.1.7.1 MARES Workstation Client CSCI Overview

The purpose of the MARES Workstation Client CSCI, HRF-MARES01U, is to accept real-time MARES data from MARES Server Software and send it to HRF Common Software for downlink. Its major input is data from the MARES Server Software.

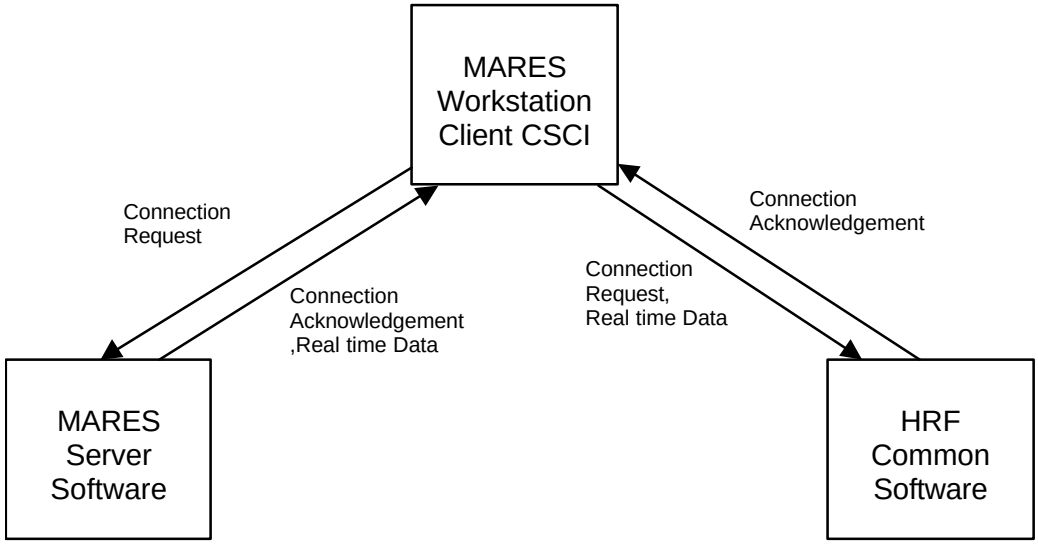

Figure 3.1.7.1-1 MARES Workstation Client Overview

3.1.7.2 CSCI-Wide Design Decisions

The programming language used for this CSCI is Visual C++ 6.0.

3.1.7.3 CSCI Composition

The MARES Workstation Client CSCI is divided into three CSUs. The following paragraphs describe the composition of the CSCI.

3.1.7.4 CSCI Components and Organization

The MARES Workstation Client CSCI consists of three CSU's: the Main CSU, the MARES Interface CSU, and the Common Software Interface CSU.

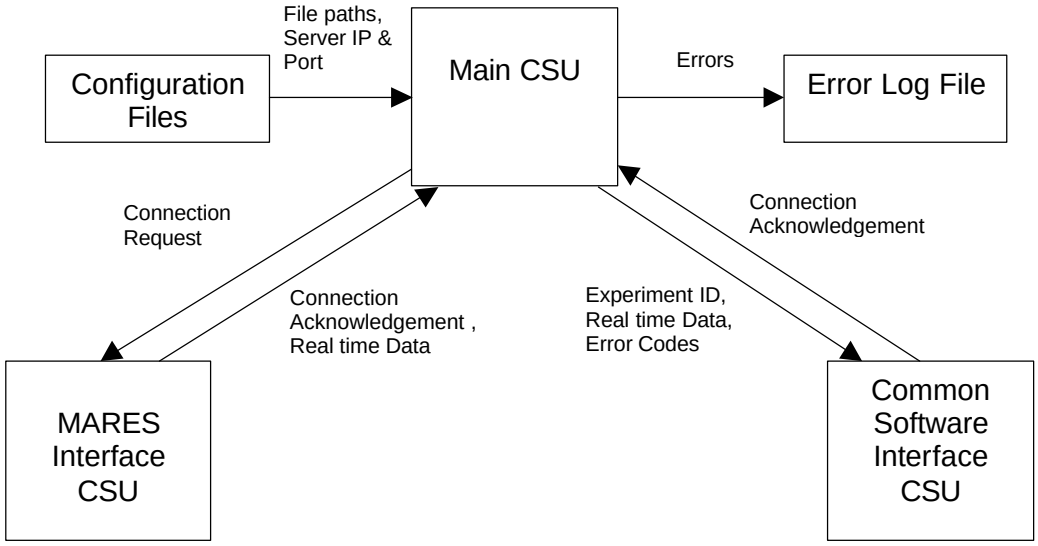

Figure 3.1.7.4-1 MARES Workstation Client CSCI Decomposition

3.1.7.5 Display CSCI Concept of Execution

The Main CSU reads in configuration file information and logs errors. The Common Software Interface CSU establishes an initial connection with HRF Common Software. The MARES Interface CSU establishes a connection with the MARES Server Software and begins receiving experiment data packets. The Main CSU parses these experiment data packets, and determines which experiment they belong to. It then requests that the Common Software Interface CSU make an additional Common Software connection to send the experiment data packets with a particular client ID. If the MARES Interface CSU cannot make a connection with the MARES Server Software, then the Main CSU will create a packet with an error code, and send it to HRF Common Software through the Common Software Interface CSU.

3.1.4.7.6 MARES Workstation Client CSCI Interface Design

The MARES Workstation Client only consists of one CSCI.

3.1.7.7 MARES Workstation Client CSCI Global Data

The MARES Workstation Client CSCI global data is described in this section.

TABLE 3.1.7.7-1 MARES WORKSTATION CLIENT CSCI GLOBAL DATA

Description	Components	Data Type	Size and Format	Units of Measurement	Range of Possible Values
MARES Server TCP/IP Address	gIPAddress	Array of characters	16	N/A	Alphanumeric characters
MARES Server TCP/IP Port	gPort	Integer	N/A	N/A	2000-9000
Name of error log file	gErrorLogFile	Array of characters	MAX_LOG_PATH	N/A	Alphanumeric characters
Time to wait in seconds for a receive from MARES Server Software	gTimeOutSec	Integer	N/A	seconds	0 – Maximum integer value

3.1.7.8 CSCI Requirements Traceability

The functional requirements for the MARES Workstation Client CSCI are identified in the table below.

TABLE 3.1.7.8-1 MARES WORKSTATION CLIENT CSCI REQUIREMENTS TRACEABILITY

Document Title	Requirement Paragraph
Software Requirements Specification (SRS) for the Human Research Facility (HRF) Muscle Atrophy Research and Exercise System (MARES) Workstation Client Software, LS-71090-2	3.3.1 a), b), c), d), e), f), g), h), i) & j)

3.1.8 Detailed Design

3.1.8.1 List of CSUs

- Main CSU – MARES Workstation Client CSCI
- MARES Interface CSU – MARES Workstation Client CSCI
- Common Software Interface CSU – MARES Workstation Client CSCI

3.1.8.2 Main CSU

The Main CSU is new development, using custom-build code. The Main CSU reads configuration file data, logs errors, parses the experiment data packets to determine which experiment they belong to, and initiates the sequence of interactions between the other CSUs.

3.1.8.2.1 CSCI Mapping

This CSU is used in the MARES Workstation Client CSCI.

3.1.8.2.2 Library Location

A library is not used.

3.1.8.2.3 CSU Design

The Main CSU handles all interaction with the user. The Main CSU is custom-build code written in Visual C++.

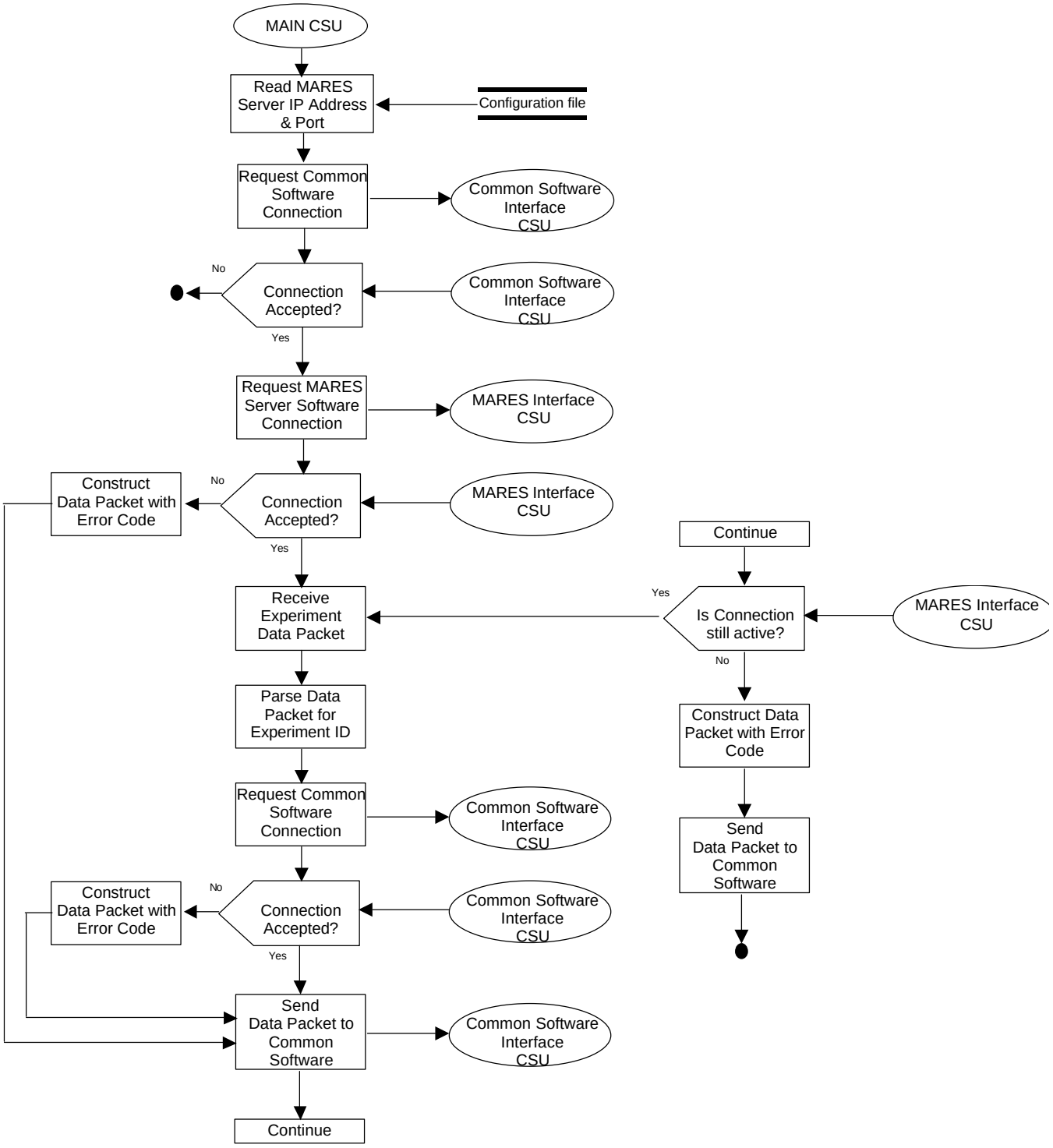

Figure 3.1.8.2.3-1 Main CSU Design

3.1.8.2.4 CSU Data

Global Data Structures/Types
None.

Local Data Structures/Types
None.

Input Data

TABLE 3.1.8.2.4-1 MAIN CSU INPUT DATA

Description	Data Type	Source
MARES IP Address	Array of Characters	Configuration File
MARES Port Number	Integer	Configuration File
Error Log File Name	Array of Characters	Configuration File
Common Software Connection	Boolean	Common Software Interface CSU
MARES Server Connection	Boolean	MARES Interface CSU
MARES Data Packet	structure	MARES Interface CSU

Output Data

TABLE 3.1.8.2.4-2 MAIN CSU OUTPUT DATA

Description	Data Type	Destination
Experiment Data Packet	Packet	Common Software Interface CSU

3.1.8.2.5 CSU Requirements Traceability

TABLE 3.1.8.2.5-1 MAIN CSU REQUIREMENTS TRACEABLILITY

Document Title	Requirement Paragraph	CSCI Identifier
Software Requirements Specification (SRS) for the Human Research Facility (HRF) Muscle Atrophy Research and Exercise System (MARES) Workstation Client Software, LS-71090-2	3.3.1 e), f), g), h), i), j) & k), 3.3.2.1.3, 3.3.5, 3.3.6, 3.3.8 a), b) & c), 3.3.9 a) & b), 3.3.10	HRF-MARES01U

3.1.8.3 MARES Interface CSU

The MARES Interface CSU is new development, using custom-build code. The MARES Interface CSU handles the connection to the MARES Server Software and receives the experiment data packets from the MARES Server Software.

3.1.8.3.1 CSCI Mapping

This CSU is used in the MARES Workstation Client CSCI.

3.1.8.3.2 Library Location

A library is not used.

3.1.8.3.3 CSU Design

The MARES Interface CSU handles connection to and data from the MARES Server Software. The MARES Interface CSU is custom-build code written in Visual C++.

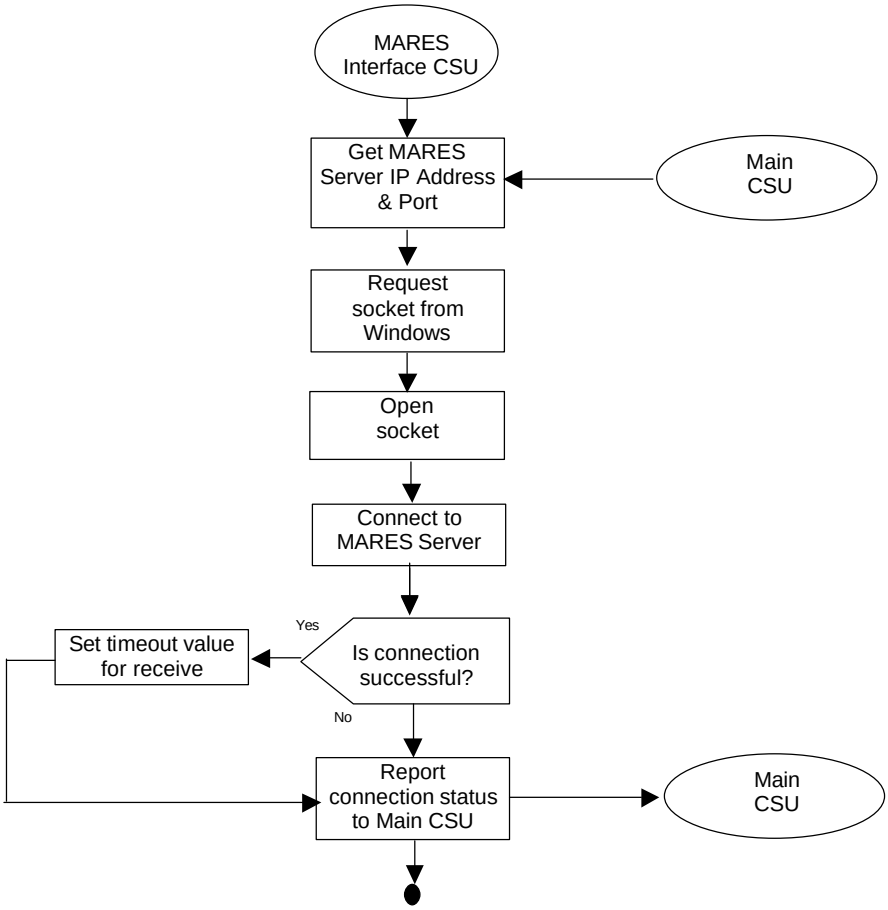

Figure 3.1.8.3.3-1 MARES Interface CSU Design

3.1.8.3.4 CSU Data

Global Data Structures/Types
None.

Local Data Structures/Types
None.

Input Data

TABLE 3.1.8.3.4-1 MARES INTERFACE CSU INPUT DATA

Description	Data Type	Source

Time to wait in seconds for a receive from MARES Server Software	Integer	Configuration File

Output Data

TABLE 3.1.8.3.4-2 MARES INTERFACE CSU OUTPUT DATA

Description	Data Type	Destination
MARES Server Connection	Boolean	Main CSU
MARES Data Packet	Structure	Main CSU

3.1.8.3.5 CSU Requirements Traceability

TABLE 3.1.8.3.5-1 MARES INTERFACE CSU REQUIREMENTS TRACEABLILITY

Document Title	Requirement Paragraph	CSCI Identifier
Software Requirements Specification (SRS) for the Human Research Facility (HRF) Muscle Atrophy Research and Exercise System (MARES) Workstation Client Software, LS-71090-2	3.3.1 a), b), c), d) & h), 3.3.2 c), 3.3.2.1.1, 3.3.2.1.2, 3.3.6, 3.3.8 a), b) & c), 3.3.9 a) & b), 3.3.10	HRF-MARES01U

3.1.8.4 Common Software Interface CSU

The Common Software Interface CSU is new development, using custom-build code. The Common Software Interface CSU handles connections to the HRF Common Software and sends the experiment data packets to HRF Common Software for real-time downlink.

3.1.8.4.1 CSCI Mapping

This CSU is used in the MARES Workstation Client CSCI.

3.1.8.4.2 Library Location

A library is not used.

3.1.8.4.3 CSU Design

The Common Software Interface CSU handles connections to and sends experiment data packets to HRF Common Software. The Common Software Interface CSU is custom-build code written in Visual C++.

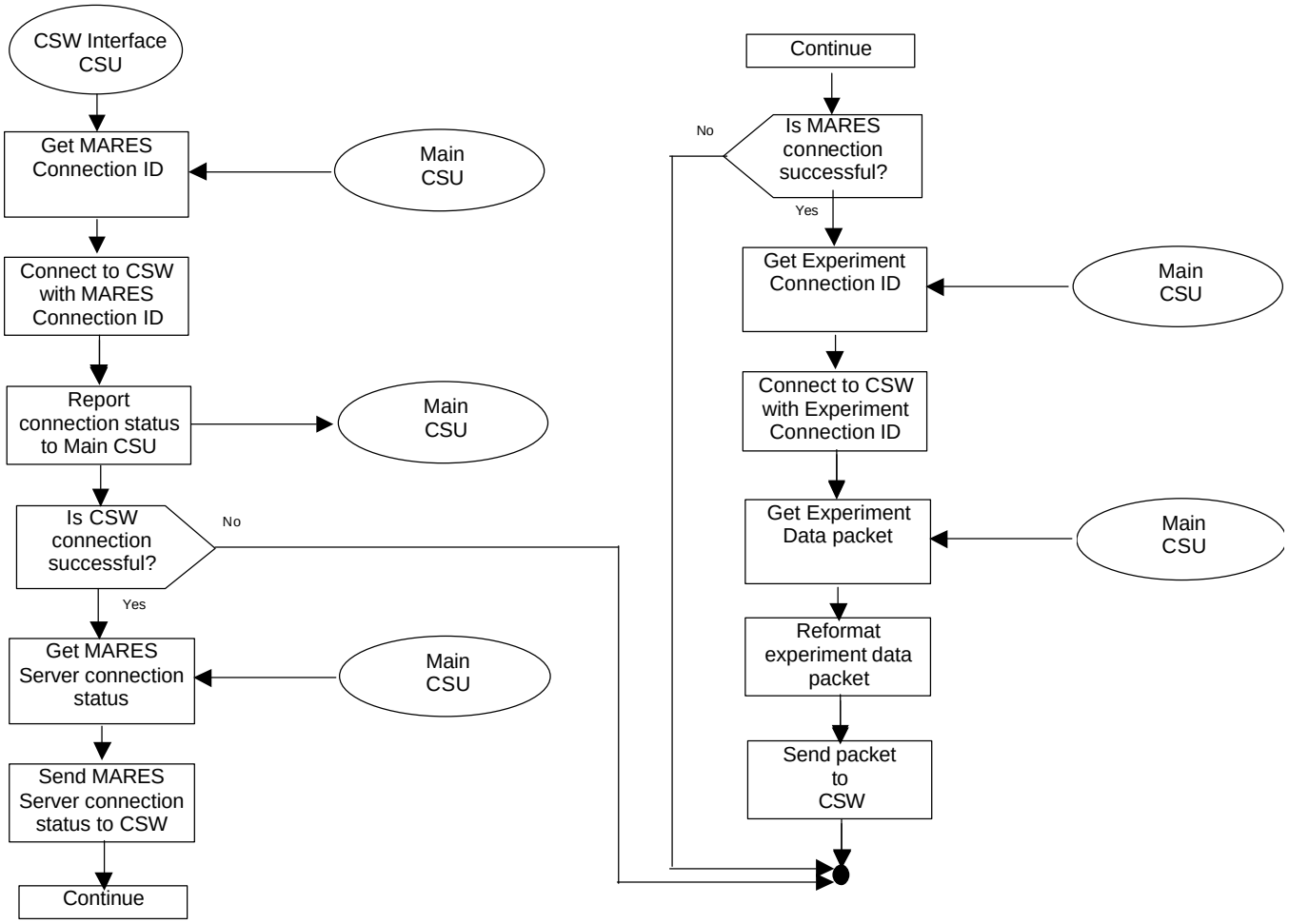

Figure 3.1.8.4.3-1 Common Software Interface CSU Design

3.1.8.4.4 CSU Data

Global Data Structures/Types
None.

Local Data Structures/Types
None.

Input Data

TABLE 3.1.8.4.4-1 COMMON SOFTWARE INTERFACE CSU INPUT DATA

Description	Data Type	Source
Common Software Connection ID	Integer	Main CSU
MARES Data Packet	structure	Main CSU

Output Data

TABLE 3.1.8.4.4-2 COMMON SOFTWARE INTERFACE CSU OUTPUT DATA

Description	Data Type	Destination
Common Software Connection	Boolean	Main CSU

3.1.8.4.5 CSU Requirements Traceability

TABLE 3.1.8.4.5-1 COMMON SOFTWARE INTERFACE CSU REQUIREMENTS TRACEABLILITY

Document Title	Requirement Paragraph	CSCI Identifier
Software Requirements Specification (SRS) for the Human Research Facility (HRF) Muscle Atrophy Research and Exercise System (MARES) Workstation Client Software, LS-71090-2	3.3.1 h), 3.3.2 a), b) & d), 3.3.2.1.1, 3.3.2.1.2, 3.3.2.1.4, 3.3.6, 3.3.8 a), b) & c), 3.3.9 a) & b), 3.3.10	HRF-MARES01U