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Revision History

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Rev.** |  | **Date** |  | **Initials** |  | **Description** |
| 0.1 |  | 28-Apr-2009 |  | KK |  | Initial draft |
| 0.2 |  | 01-Sep-2009 |  | DAT |  | Added Signatures and References sections |
| A |  | 16-Oct-2009 |  | DAT |  | Initial Release |
| A.1 |  | 23-May-2019 |  | KW |  | Reference back to System Controller SRS for device support  Include support Motor Table and Serial Number RS485 commands for MDUs |
| A.2 |  | 10-Jun-2019 |  | DAT |  | Additional updates to support Motor Tables from the MDU |
| A.3 |  | 06-Aug-2019 |  | KW |  | Formatting |
| B |  | 25-Sep-2019 |  | DAT |  | Update to Revision B, content is identical to Revision A.3 |

Glossary

EIP Earnings Improvement acronym referring to this hardware configuration

DSC Digital Signal Controller

MDUs Motor Drive Units

SRS Software Requirement Specification

References

15000721 – DYONICS II EIP Inter Controller Protocol

15000286 – DYONICS II RS485 Accessory Protocol

15000695 – DYONICS II EIP System Controller SRS

Table of Contents

[1 Overview 3](#_Toc15997595)

[2 Software Requirements 3](#_Toc15997596)

[2.1 Software Upgrade Interface 3](#_Toc15997597)

[2.2 System Controller Interface 3](#_Toc15997598)

[2.3 Motor Port Interfaces 3](#_Toc15997601)

[2.3.1 Motor Types 3](#_Toc15997602)

[2.3.2 Motor Functions 3](#_Toc15997605)

[2.4 Accessory Port Interfaces 3](#_Toc15997606)

[2.4.1 Digital I/O 4](#_Toc15997607)

[2.4.2 Analog Input 4](#_Toc15997608)

[2.4.3 HallBus Inputs 4](#_Toc15997609)

[2.4.4 Peripheral Serial Interface 4](#_Toc15997610)

# Overview

The field reprogrammable Motor Controller Software is a primary element in an arthroscopic powered resection design that is responsible for simultaneously controlling two low voltage DC motors. The Motor Controller Software communicates control and parametric data bi-directionally with a System Controller in response to the needs of the upper level application software contained in the System Controller. Additionally, the Motor Controller possess a variety of I/O channels for communicating with legacy and new accessory devices currently used or planned for arthroscopic powered resection or access. The EIP is a cost driven trimmed down DII Control Unit with all performance maintained in a non-platform based design.

# Software Requirements

The requirements for the Motor Controller Software are divided into four major sections, i.e., the Software Upgrade Interface, the System Software Interface, the Motor Port Interfaces and the Accessory Port Interfaces.

## Software Upgrade Interface

1. The Motor Controller Software shall provide a user accessible software upgrade interface.
2. The Motor Controller Software shall protect against corrupted upgrade software installations.
3. The Motor Controller Software shall recover from interrupted software upgrade installations.

## System Controller Interface

1. The Motor Controller Software shall communicate variable length control and parametric data packets bi-directionally to a System Controller via a custom parallel data bus and DYONICS II EIP Inter Controller Protocol (15000721).
2. The Motor Controller Software shall support Motor Parametric Data from the System Controller via the System Controller Interface.

## Motor Port Interfaces

1. The Motor Controller Software shall provide two simultaneously operable motor control ports.
2. Both ports should become electrically hot only when attempting to run a motor.
3. Both ports should provide short circuit protection to prevent smoking components.
4. Both ports should detect and report motor operational faults.
5. The Motor Controller Software shall reset with the motor ports disabled if it loses communication with the System Controller.
6. The Motor Controller Software shall support digital communications to MDUs via the RS485 Accessory Protocol (15000286).

### Motor Types

The Motor Controller Software shall independently control brushless and brush type 24 VDC motors in either port.

### Motor Functions

1. Motors shall operate in forward, reverse, oscillate and profile mode.
2. The Motor Controller Software shall be capable of tracking the output shaft position of a motor.
3. The Motor Controller Software shall be capable of stopping a motor on a specific position.
4. The Motor Controller Software shall provide for closed loop motor velocity control.
5. The Motor Controller Software shall provide for closed loop motor position control.
6. The Motor Controller Software shall allow for open loop motor operation.
7. The Motor Controller Software shall be capable of torque limiting the output of the motors.
8. The Motor Controller Software shall accept position data from the motors or encoders.

## Accessory Port Interfaces

I/O channels shall connect to various external accessory devices, and the Motor Controller Software shall maintain state and parametric information from these devices accessible to the System Controller.

### Digital I/O

1. The Motor Controller shall contain sufficient digital input lines to support the requirements of legacy shaver motor drive units (MDUs), powered instruments and footswitches supported by the System Controller (SRS 15000695), and maintain this state data accessible to the System Controller.
2. The Motor Controller shall provide the means to control some spare digital outputs for future use.

### Analog Input

The Motor Controller shall provide both external analog data for accessory device status, and internal analog data for system temperature status.

#### External

1. Motor current shall be measured for each motor port and made accessible to the System Controller.
2. Footswitch analog pedal position shall be measured and made accessible to the System Controller.
3. Powered instrument analog trigger position shall be measured and made accessible to the System Controller.

#### Internal

1. Motor Controller on-board temperature shall be measured and made accessible to the System Controller.
2. DSC (microprocessor) temperature shall be measured and made accessible to the System Controller.

### HallBus Inputs

The Motor Controller Software shall provide support for a multiplexed two-wire hall-effect device.

#### Legacy Product Support

The Motor Controller Software shall support the HallBus requirements for all relevant motor drive units and footswitches supported by the System Controller (SRS 15000695).

### Peripheral Serial Interface

The Motor Controller shall support packet based RS-485 requests and responses as defined by the DYONICS II RS485 Accessory Protocol (15000286) for communicating with devices such as MDUs and footswitches:

1. The Motor Controller shall relay the standard (8-bit request / 10-bit response) commands from the System Controller to the device and make accessible the responses back to the System Controller.
2. The Motor Controller shall relay the Program Page command from the System Controller to the device and make accessible the responses back to the System Controller.
3. The Motor Controller shall relay the Motor Table request from the System Controller, update the internal Motor Parametric Data of the Motor Port Interface with the response from the MDU and make the information accessible to the System Controller.
4. The Motor Controller shall relay the Serial Number request from the System Controller and make accessible the response back to the System Controller.