Rugged Servo Drives & Control Systems for Extreme Environments

CAN Command Protocol

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Revision History

Version	Date	Items Changed
A		Initial Release
B	1/19/06	Updated to current template format
C	4/11/06	Update to reflect recent loop input control changes
D	4/12/16	Add Command Mode A and B to command packet
E	10/7/16	Corrected command-enable.
F	9/14/18	Updated to new style guide, logo, copyright, warranty disclaimer and Non-ITAR/EAR legends

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1 Purpose

This document describes the software requirements of the CAN protocol for ESI Motion servo drives and servo drive modules. This command interface can be used for general control of ESI Motion Servo drives and for status reporting during common operation.

2 Background

ESI Motion servo drives, modules and control systems are a complete ruggedized, off-the-shelf motor control solution which include ESI's rugged controller and power driver boards, an integrated EMI filter, military-grade submersible case, controller software, and user-friendly GUI. These systems are ideal for military, aviation, automotive or other heavy industrial applications operating in outdoor, high temperature, high vibration, or other extreme environmental conditions.

3 Support Information

- ESI Motion Controller User Manual, document number 100266

4 HiDS CAN Interface Overview

The HiDS menu system contains an Index, Pages and Objects.

4.1 Body

The Body follows the Header. In this implementation there is only one command packet defined and only one status packet defined. The only common attribute between the command and response message body is the message-body length of 8 bytes.

4.2 Command Packet

The Command Packet is received by the ESI Motion servo drive. The servo drive command supplies the motor current or velocity command and other necessary information to enable or disable the drive. The body of the command is shown below:

Note - all bytes shown below are in the order of transmission (Byte 0 is transmitted first)

Signal name	Byte	Bit	Size (bits)	Data Type	Coding
Motor Enable A	0	0	1	unsigned	0=motor disabled 1=motor enabled
Motor Enable B	0	1	1	unsigned	0=motor disabled 1=motor enabled
Clear all errors	0	2	1	unsigned	0=unused 1=clear all present errors
Command Mode A	0	Bit3-4	2	unsigned	0 – Torque Mode 1 – Velocity Mode 2 – Position Mode
Command Mode B	0	Bit5-6	2	unsigned	0 – Torque Mode 1 – Velocity Mode 2 – Position Mode
Unused	0	7	1	n/a	Unused; should be zero
Command Motor A	1-2	B[15.0]	16	Signed	Command Mode and Scaling defined via HiDS Mode 0 – Current Command Mode 1 – Velocity Command Mode 2 – Position Command
Command Motor B	3-4	B[15.0]	16	Signed	Command Mode and Scaling defined via HiDS Mode 0 – Current Command Mode 1 – Velocity Command Mode 2 – Position Command
Unused	5-7	B[23.0]	24	n/a	Unused; should be zero

4.2.1 Example

For example, to enable both motors, with a +1 Amp MotorA command and a -1 Amp MotorB command, the 8-byte packet contents would be:

03 E8 03 FC 00 00 00

4.3 Status Packet

The Status Packet is transmitted by the servo drive. As with the Command Packet, within each byte, bit7 is transmitted first and bit0 is transmitted last.

The Status Packet provides the run-time and error information about the drive. The body of the status is shown below:

Signal name	Byte	Bit	Size (bits)	Data Type	Coding
Motor Enabled A	0	Bit0	1	Unsigned	0 - Motor Disabled 1 - Motor Enabled
Motor Enabled B	0	Bit1	1	Unsigned	0 - Motor Disabled 1 - Motor Enabled
Error Condition Motor A	0	Bit2	1	Unsigned	0 – No Errors 1 – An Error Occurred
Error Condition Motor B	0	Bit3	1	Unsigned	0 – No Errors 1 – An Error Occurred
Error-Overvoltage	0	Bit4	1	Unsigned	0 – No Error 1 – Over Voltage Error
Error-Undervoltage	0	Bit5	1	Unsigned	0 – No Error 1 – Under Voltage Error
Error-PrechargeV	0	Bit6	1	Unsigned	0 – No Error 1 – Precharge Error
Reserved	0	Bit7	1	NA	Reserved
Feedback Motor A	1-2	B[15..0]	16	Signed	Command Mode and Scaling defined via HiDS Mode 0 – Current Command Mode 1 – Velocity Command Mode 2 – Position Command
Feedback Motor B	3-4	B[15..0]	16	Signed	Command Mode and Scaling defined via HiDS Mode 0 – Current Command Mode 1 – Velocity Command Mode 2 – Position Command
Motor A Error-Overcurrent	5	Bit0	1	Unsigned	0 – No Error 1 – Over Current Error
Motor A Error-LossOfFeedback	5	Bit1	1	Unsigned	0 – No Error 1 – Loss Of Feedback Error

Signal name	Byte	Bit	Size (bits)	Data Type	Coding
Motor A Error-Overspeed	5	Bit2	1	Unsigned	0 – No Error 1 – Over Speed Error
Motor A Error-MotorTemp	5	Bit3	1	Unsigned	0 – No Error 1 – Motor Temperature Error
Motor A Error-IGBTTemp	5	Bit4	1	Unsigned	0 – No Error 1 – IGBT Temperature Error
Motor A Error-I2T	5	Bit5	1	Unsigned	0 – No Error 1 – I2T Error
Motor A Error-BridgeFault	5	Bit6	1	NA	0 – No Error 1 – Bridge Fault Error
Reserved	5	Bit7	1	NA	Reserved
Motor B Error-Overcurrent	6	Bit0	1	Unsigned	0 – No Error 1 – Over Current Error
Motor B Error-LossOfFeedback	6	Bit1	1	Unsigned	0 – No Error 1 – Loss Of Feedback Error
Motor B Error-Overspeed	6	Bit2	1	Unsigned	0 – No Error 1 – Over Speed Error
Motor B Error-MotorTemp	6	Bit3	1	Unsigned	0 – No Error 1 – Motor Temperature Error
Motor B Error-IGBTTemp	6	Bit4	1	Unsigned	0 – No Error 1 – IGBT Temperature Error
Motor B Error-I2T	6	Bit5	1	Unsigned	0 – No Error 1 – I2T Error
Motor B Error-BridgeFault	6	Bit6	1	NA	0 – No Error 1 – Bridge Fault Error
Reserved	6	Bit7	1	NA	Reserved
Reserved	7	B[7..0]	8	NA	Reserved

4.4 HiDS Configuration Variables

The HIDS tool is used to configure the CAN interface. The following sections define the modifiable parameters.

4.4.1 Enabling the CAN Interface

The CAN control interface can be enabled by selecting the "CAN Command" as one of the two input-source selections for the desired control-loop (there are independent source-inputs for the torque, velocity and position loops). These options can be found under the "Loop Gains" tab in HiDS under the active control loop.

The CAN status interface is enabled if the CAN Command is selected as an input source.

The CAN command (received) packet ID (address) is settable via variable CANCommandMsgId. The default address is 0x250 (592d).

The CAN status (transmitted) packet ID (address) is settable via variable CANFeedbackMsgId. The default address is 0x260 (608d).

4.4.2 Command Mode

The command can be set for each axis independently. The valid modes are as follows:

- 0 – Torque
- 1 – Velocity
- 2 – Position

CommandModeA and CommandModeB are used to select the command mode for Motor A and Motor B respectively.

4.4.3 Command Scaling

Each motor includes three variables for Command Scaling - one for torque, velocity and position mode. The three variables are as follows:

- CommandCurrentScaleX
- CommandVelocityScaleX
- CommandPositionScaleX

The "X" is ether A or B for Motor A or Motor B. Note these variables are common between the RS422 and CAN interfaces.

If CommandCurrentScaleX = 0.001, the range is -32.768 to +32.767 amps.
If CommandVelocityScaleX = 1, the range is -32,768 to +32,767 RPM.
If CommandPositionScaleX = 0.000191753, the range is -2π to +2π radians.

The scale above is the same as the resolution. Software uses the following equation to determine the drive command:

Command = (Signed 16-Bit CAN Input) * Command Scale

4.4.4 Response Rate

The response rate is set by the variable CANResponseRate_ms. The units are milliseconds between packets.

4.4.5 Bit Rate

The CAN bit rate can be set via the HIDS variable CanXAddresses.BitRate.

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