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CAN Communication for SY2 Control Option

Introduction

This document provides information on the proprietary CAN protocol used by Thomson Electrak® HD units with the SY2 control option. While connecting to the network is not required to operate units, doing so will make it possible to receive status feedback by receiving CAN messages and/or control the connected units by sending CAN messages to them. It will also make it possible to configure certain unit parameters.

Network Summary

The CAN network operates at a baud rate of 500 kbit/s by default with all messages using the standard identifier.

When one of the control leads is activated on any of the actuators connected to the bus, it will start to send out the control message. This message will use the ID 0x06. Users can optionally send this message on the network if they prefer to control the units over CAN instead of through the manual leads. More information about the properties and layout of this message can be found in "CAN Control" on page 3.

All connected units will send out a feedback message containing information about the current status of the unit. This message will use the ID 0x07. More information about the properties and layout of this message can be found in "CAN Feedback Message Properties" below.

Sending service request messages with an ID of0xA will let users configure some of the properties of connected units. Units will respond to a service request message with the service response message, which uses an ID of 0xB. In addition to the previously described messages, all connected units will send out internal communication messages. These will use IDs in the range of 0x600-0x6FF and can be ignored by the user.

CAN Feedback Message Properties

System CAN feedback can be achieved by receiving the feedback message. This 8-byte message has the ID 0x7. Every connected unit will send out the feedback message at an interval of 100 ms. While it is not possible to identify the feedback sent from a specific unit, reading the feedback message will give information about the status of the system. The feedback message will have the following layout:

Byte 0 (LSB)	Byte 1 (MSB)	Byte 2 (LSB)	Byte 3 (MSB)	Byte 4 (LSB)	Byte 5 (MSB)	Byte 6	Byte 7
Measured Position		Measured Current		Measured Speed		Motion Flags	Error Flags

The different parts of the feedback message are:

Measured Position

The measured position of the actuator. The 0.0 mm and ordered full extend stroke values represent 0 to 100% stroke, but the signaled value does not take into account any mechanical tolerances or play in the actuator. Resolution: 0.1 mm/bit, 0 offset. Size: 2 bytes.

Measured Current

How much current drawn by the motor during the active phase of the PWM duty cycle. Resolution: 0.1 A/bit, 0 offset. Size: 2 bytes

Measured Speed

The speed measured by the actuator's internal sensors. Resolution: 0.1 mm/s/bit, 0 offset. Size 2 bytes.

Motion Flags

Contains information about the current actuator motion.
Bit 0 (LSb) – Extending: 1 if currently extending, 0 otherwise.
Bit 1 – Retracting: 1 if currently retracting, 0 otherwise.
Bit2 – Saturated: 1 if the unit is moving at the maximum speed allowed by the input voltage and load, 0 otherwise.
(If this bit is continuously set on one or more units, the system will struggle to stay synchronized. During operation with the manual leads, the speed will automatically be reduced until the flag is cleared on every connected unit. The user needs to ensure that this bit will not stay activated on any unit if they are controlled by CAN messages.)
Bit 3 – Waiting: 1 if the unit is not moving because it is waiting for other units to catch up, 0 otherwise.

Error Flags

Contains information about actuator errors.

Bit 0 (LSB) – Parameter Error: This flag is used to inform the user that one of the parameters in the control message is outside the allowed ranges the specific model will allow. To prevent damage, motion is not allowed if this flag is set on any connected unit.

Bit 1 – Current Overload: This flag is used to inform the user that the last motion the actuator attempted caused an overload condition. This occurs when the actuator determines the current is above the calibrated limit if using the manual leads, or above the limit sent in the control message (see "Current Limit" table on page 3). To prevent damage, motion is not allowed if this flag is set on any connected unit. The error is cleared by either running in the opposite direction to which the units were running in when the error occurred, or by disabling the enable bit in the control message.

Bit 2 – Voltage Error: This flag is used to inform the user that the operational voltage is outside of allowable running parameters. Any motion already in progress will continue for 10 seconds if this flag is active on any connected unit. Additional movement requests will not be allowed until the operational voltage on every unit returns within the normal operating range.

Bit 3 – Temperature Error: This flag is used to inform the user that the measured temperature is outside of allowable running parameters. Any motion already in progress will continue for 10 seconds if this flag is active on any connected unit. Additional movement requests will not be allowed until the temperature on every unit returns within the normal operating range.

Bit 4 – Backdrive Detected: This flag is used to inform the user that the actuator has determined positional movement in the extension tube that was not commanded from the user. This can be caused by excessive static load or vibration being applied to the actuator.

Bit 5 – Message Timeout: This flag is used to inform the user that no control message has been received within 250 ms. This flag will prevent motion on all connected units if it is set on one of them.

Bit 6 – Fatal Error: This flag is used to inform the user that the actuator was unable to detect any motion while trying to run the motor, or that the position was updating in the wrong direction. To prevent damage, motion is not allowed if this flag is set on any connected unit. The error flag is cleared by either running in the opposite direction to which the units were running when the error occurred, or by disabling the enable bit in the control message.

Bit 7 (MSB) – Too Few Units Error: This flag will be set if one of the connected units detects that less than the required number of units are connected. Motion will not be allowed on any connected unit if this flag is set on any one of them. The error will be cleared when the correct amount of units are connected. Activate the manual override/reset wire or the reset bit in the control message to reset the required number of connected units.

CAN Control

System CAN control is achieved by sending the control message. This 8-byte message has the ID 0x6. This message should be sent with a transmission repetition rate of 100 ms. Each connected unit will respond to the control message, and all connected units will communicate internally with each other to achieve synchronization. The control message will have the following layout:

Byte 0 (LSB)	Byte 1 (MSB)	Byte 2 (LSB)	Byte 3 (MSB)	Byte 4 (LSB)	Byte 5 (MSB)	Byte 6	Byte 7
Target Position		Current Limit		Target Speed		Not Used	Control Bits

The different parts of the control message are:

Target Position

The target position for the next connected actuator motion. The 0.0 mm and full extend stroke values represent 0 to 100% stroke and are only relative to the actual available stroke of the individual unit. Resolution: 0.1 mm/bit, 0 offset.

Current Limit

The current at which a connected actuator will cease all motion. In the event a force is applied to one of the connected actuators that causes the motor current to exceed this settable value for more than 40 ms, all connected units will stop any current motion and activate a dynamic braking effect on the motor. This current limit does not apply during the motor-starting phase where in-rush current can be significantly higher than normal running. Setting this value to 0 will make all units use their internal calibrated current limit value, which will make the units stop at a value slightly larger than the rated load of the actuator. This calibrated value will also consider the increased current at lower temperatures.

Range: See table below:

HD12	HD24	HD48
0-25A	0-12.5A	0-6.5A

Resolution: 0.1 A/bit, 0 offset

Target Speed

Controls the target speed of the connected actuators. Units can run slower depending on synchronization requirements or system properties.

Range: See table below:

B017	B026	B045	B068	B100	B160
11-58 mm/s	6-32 mm/s	4-19 mm/s	3-14 mm/s	2-9 mm/s	1-5 mm/s

Resolution: 0.1 mm/s/bit, 0 offset.

Control Bits

Bit 0 (LSB) – Enable bit: This bit is used to enable motion from the connected actuators. If it is low (0), motion will not be allowed. This bit can be used to define the next system movement message without starting the connected units. When movement is required, this bit can be changed to high (1) and motion will begin using the values of the other objects contained in control message.

Bit 1– Override bit: This bit has the same functionality as the override/reset wire. When controlling the system through CAN messages, it will prevent movement of connected actuators and reset the number of connected units required for motion.

Control Message Example

Sending a CAN message with ID 0x6 containing the data 0xE8 0x03 0x41 0x00 0xBE 0x00 0x00 0x01 will make an actuator move to position 100 mm, at 19 mm/s, with the current limit set to 6.5A.

Unit Configuration

Certain parameters of a unit can be read or adjusted by sending service messages to it. The ID of a service message sent as a request should be 0xA. A unit receiving a service message will respond with another service message with the ID 0xB. Both messages are 8 bytes long. Changing any of the available parameters may affect the synchronization properties or make units unable to push the full rated load. The user is responsible for confirming that all units with modified parameters are meeting the requirement of the specific application.

Service Message

A service message will have the following layout:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)
Service Message Type	Command Specifier	Size	Not Used	Payload			

Service Message Type

The service message type specifies the type of message. It can be decoded as follows:

Service Message Type	Value
READ_REQUEST	0x00
WRITE_REQUEST	0x01
READ_RESPONSE	0x10
WRITE_CONFIRMATION	0x11
ERROR_RESPONSE	0x13

Command Specifier

The command specifier determines which parameter should be read from or written to. See "Configurable Parameters" table on page 5 for more information about the different configurable parameters.

Size

The size specifies the size of the parameter that should be read from or written to. See "Configurable Parameters" table on page 5 for more information about the different configurable parameters.

Payload

The payload field contains the data to be read/written or, alternately, an error code in byte 4 and 5 if the message is of an error response type. The error codes are decoded as follows:

Error Code	Value
OBJECT_NOT_FOUND/INCORRECT_PASSWORD	0xFF01
WRONG_SIZE	0xFF02
INCORRECT_PERMISSION	0xFF04
WRONG_ID	0xFF08

Password

To unlock read or write access to a parameter, it is necessary to first write a password to the password parameter. The password parameter is 4 bytes long and has a command specifier of 0xFF. The passwords for the different parameters can be found in the "Configurable Parameters" table below.

Store Parameters

After updating the value of any parameter, it is necessary to save it to memory to prevent it from getting reset after a power cycle. This is done by writing any value to the store password parameter.

Configurable Parameters

The following parameters can be modified by the user:

<table>
<tr><th>Name</th><th>Command Specifier</th><th>Password</th><th>Size</th><th>Description</th></tr>
<tr><td>Soft start time</td><td>0x01</td><td>0xE5F6A7B8</td><td>2</td><td>The amount of time in millisecond units it takes for the actuator to reach full speed. This can be used to adjust the soft start.</td></tr>
<tr><td>Soft stop distance</td><td>0x02</td><td>0xE5F6A7B8</td><td>2</td><td>The distance from the target position, in 0.1 mm units, in which the actuator will begin to ramp down its speed. This can be used to adjust the soft stop.</td></tr>
<tr><td>Baud rate</td><td>0x04</td><td>0x9A8B7C6D</td><td>1</td><td>The baud rate of the actuator (default 500 kbit/s)<table><tr><th>Value</th><th>Baud Rate</th></tr><tr><td>0</td><td>1 mbit/s</td></tr><tr><td>2</td><td>500 kbit/s</td></tr><tr><td>3</td><td>250 kbit/s</td></tr><tr><td>4</td><td>125 kbit/s</td></tr></table></td></tr>
<tr><td>Timeout time</td><td>0x06</td><td>0x9A8B7C6D</td><td>2</td><td>The time in millisecond units it takes for the actuator to set the timeout error if no control message has been received</td></tr>
<tr><td>Speed</td><td>0x08</td><td>0x6B7C8D9A</td><td>2</td><td>The target speed of the unit in 0.1 mm/s units. Can be used to lower the speed when operating with the manual leads.</td></tr>
<tr><td>Password</td><td>0xFF</td><td>No password required</td><td>4</td><td>Password to unlock the other parameters</td></tr>
<tr><td>Store parameters</td><td>0xF0</td><td>No password required</td><td>4</td><td>Send this message to save any updated parameters to memory</td></tr>
</table>

Changing Parameter Example

Updating the soft start time to 500 ms is done by sending the service request messages with the following data:
0x01 0xFF 0x04 0x00 0xB8 0xA7 0xF6 0xE5 to unlock write access.
0x01 0x01 0x02 0x00 0xF4 0x01 0x00 0x00 to write 500 to the parameter.
0x02 0xF0 0x01 0x00 0x00 0x00 0x00 0x00 to store the value of all updated parameters.