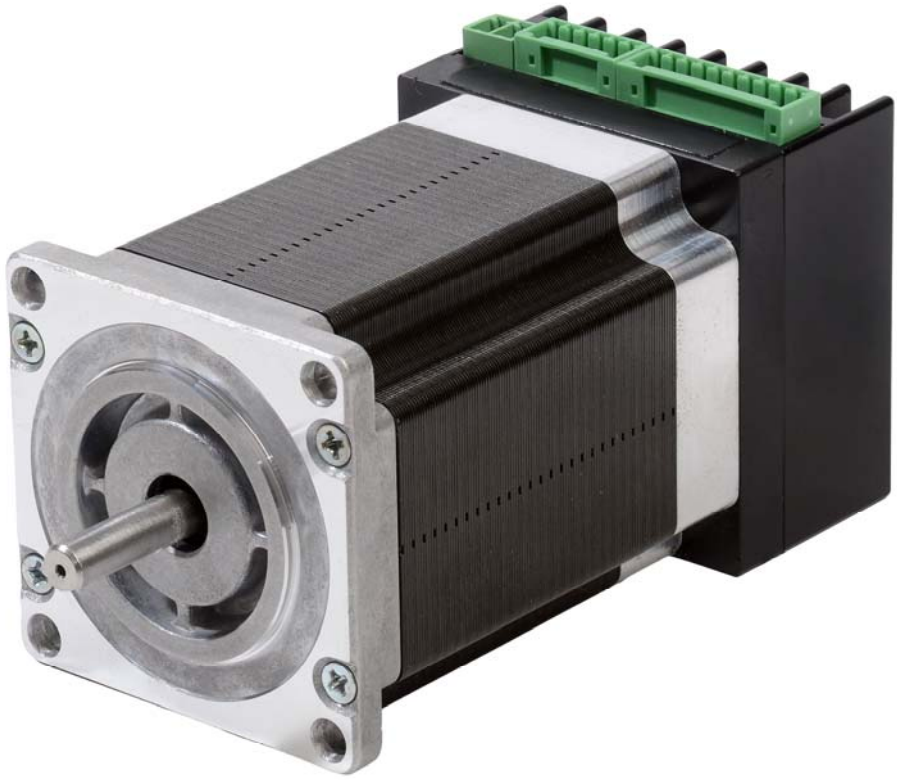

Manual

Integrated Closed-Loop Stepper Motors

S23C/ S34C

AHS Antriebstechnik GmbH
Fichtenweg 17
64319 Pfungstadt
Phone: +49 6157 9866110
Fax: +49 6157 9866112

AHS Antriebstechnik
www.AHS-Antriebstechnik.de

Previous issues:

Issue	Remarks
2014-03	Initial release
2014-08	Update for product release
2014-12	Additional stepIM models

The current issue of this manual is available online at http://www.ahs-antriebstechnik.de/home.html.

Table of contents

1 Introduction

1.1 StepIM Product Series

The stepIM is an integrated closed-loop stepper motor – a single unit comprised of motor, drive electronics and position sensor. The electronic control board is attached to the motor and includes control electronics, power stage and magnetic encoder.

The combination of an integrated stepper solution with closed-loop commutation and control provides a number of advantages for machine builders:

- Reduces cabling
- Eliminates need for cabinet
- More cost-effective than servo motors
- CANopen communication

1.2 StepIM Control Loop

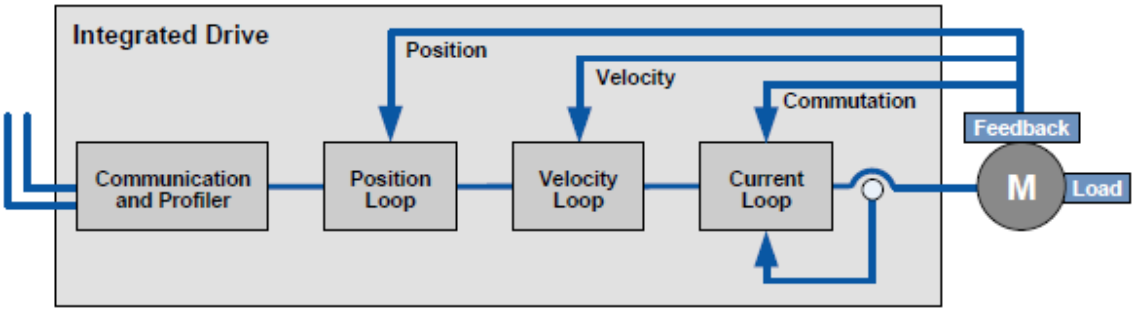

Figure 1-1. stepIM Control Loop

1.3 StepIM Hardware

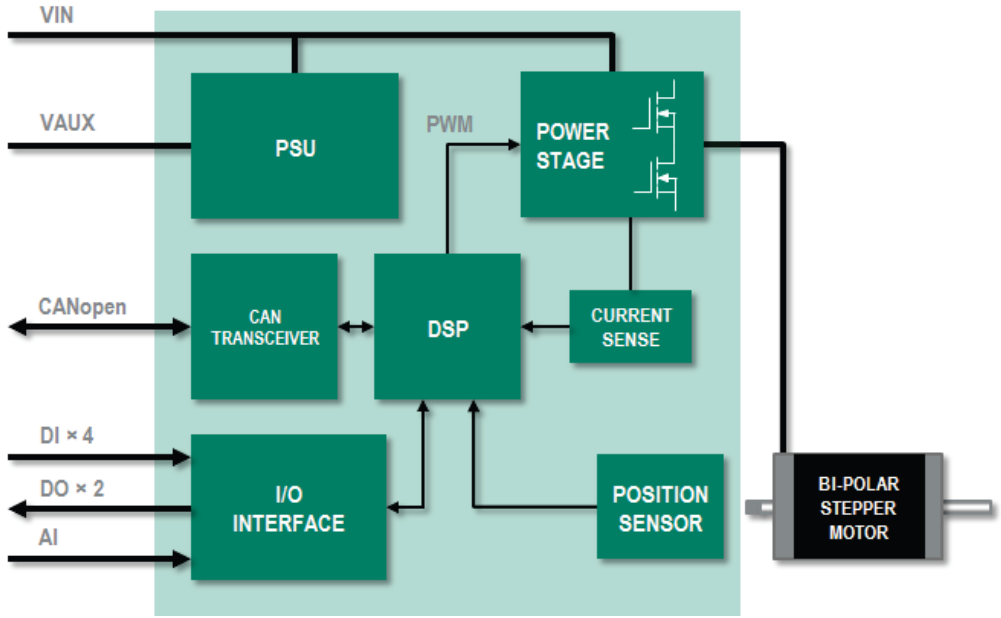

Figure 1-2. stepIM Hardware

2 Safety and Precautions

Only qualified persons may perform the installation procedures. You do not need to be an expert in motion control to install and operate the stepIM. However, you must have a basic understanding of electronics, computers, mechanics, and safety practices.

⚠ WARNING **The stepIM utilizes hazardous voltages.**
Be sure the drive is properly grounded.

Before you install the stepIM, review the safety instructions in this manual.
Failure to follow the safety instructions may result in personal injury or equipment damage.

3 Specifications

3.1 Dimensions and Mounting

3.1.1 StepIM Nema23

The name plate is at the side of the case.
The name plate shown in the picture belongs to the standard version of the basic device.

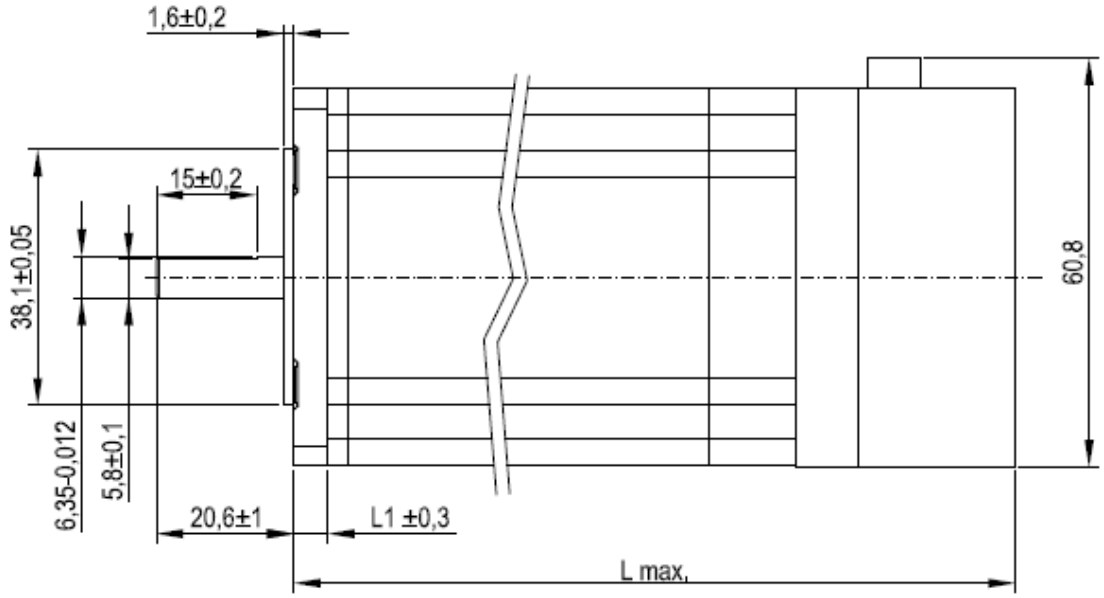

Figure 3-1. stepIM Nema 23 - Dimensions (mm)

Table 3-1. stepIM Nema 23 – Dimensions

Model	L (mm)	L1 (mm)
S23C-00-01	86	5.08
S23C-01-01	108	5.08
S23C-02-01	145	4.80

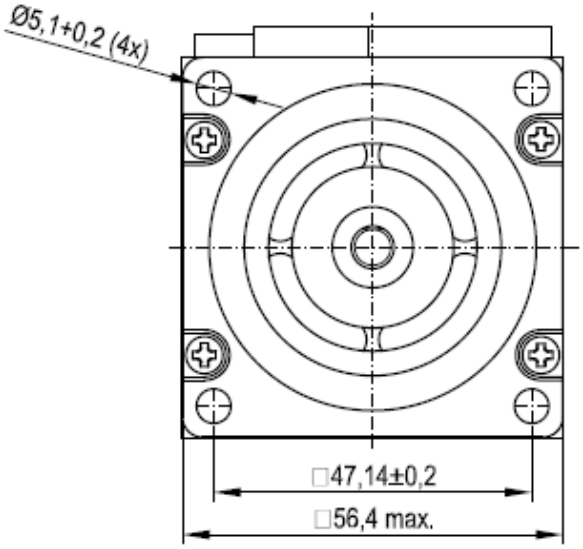

Figure 3-2. stepIM Nema 23 - Mounting (mm)

3.1.2 StepIM Nema34

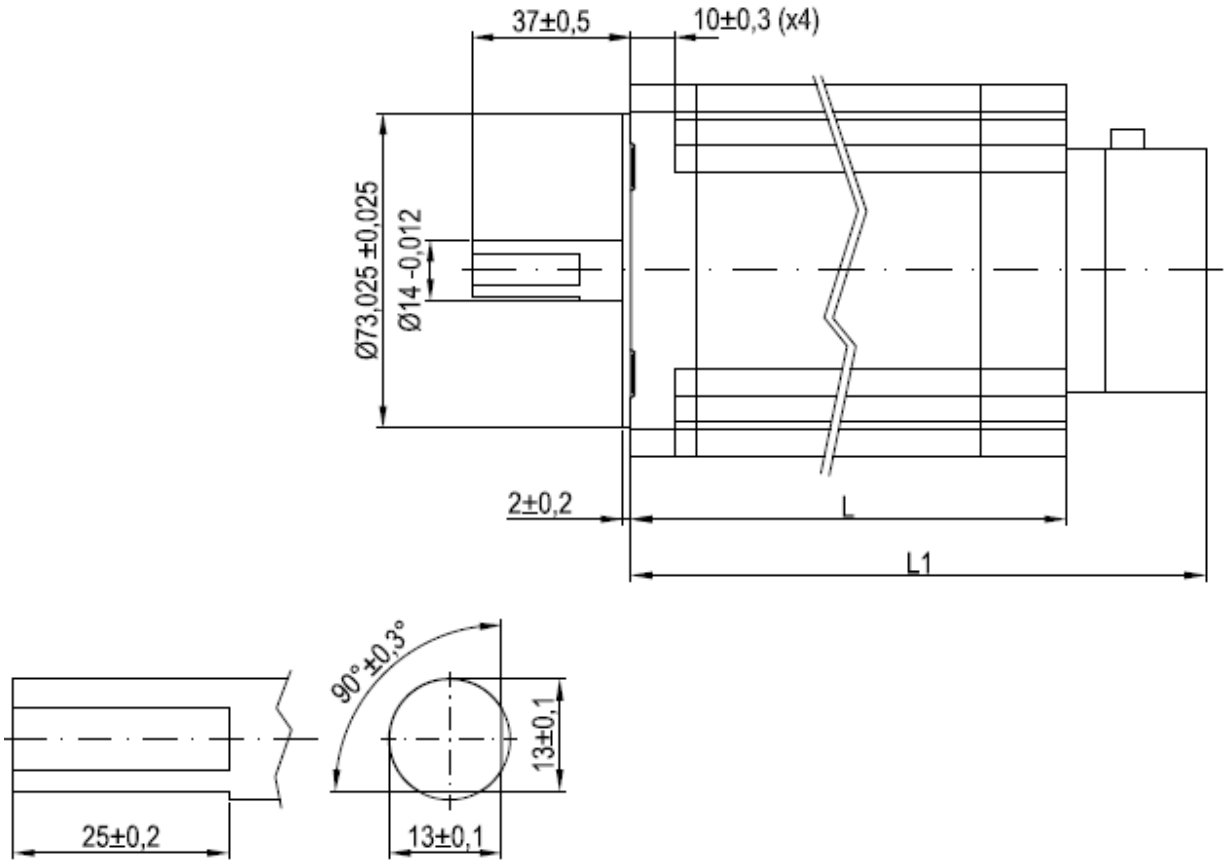

Figure 3-3. stepIM Nema 34 - Dimensions (mm)

Table 3-2. stepIM Nema 34 – Dimensions Data

Model	L (mm)	L1 (mm)
S34C-01-01	101	133.5
S34C-02-01	130.5	163

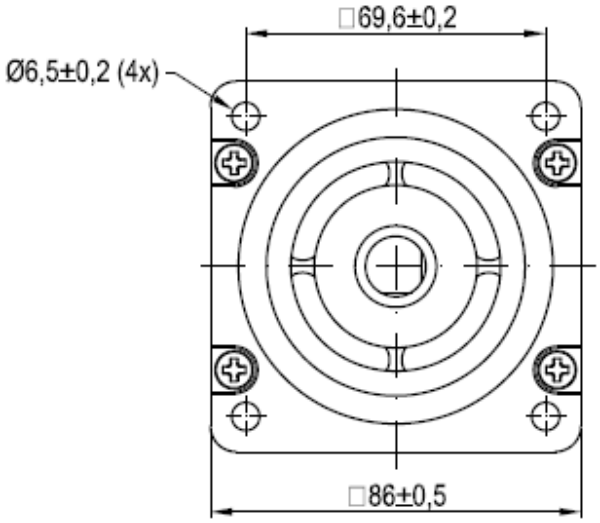

Figure 3-4. stepIM Nema 34 - Mounting (mm)

3.2 Motor and Unit Specifications

Table 3-3. Motor and Unit Specifications:

Model	Motor Type	Degrees per Full Step	Torque (Nm)	Rotor Inertia (g·cm²)	Weight (kg)
S23C-00-01	Hybrid bipolar	1.8	1.2	260	0.6
S23C-01-01			1.8	460	1.0
S23C-02-01			2.6	750	1.5
S34C-01-01*			3.4	1850	2.7
S34C-02-01*			5.4**	2750	3.8

**Supports limited time peak of 50% more torque at 7 amps*
***Under evaluation*

3.2.1 Ingress Protection (IP)

The stepIM is available with no ingress protection (IP 23).

3.2.2 Regeneration

During forced deceleration, the motor becomes a generator. The free-wheeling diodes inside the power chip rectify the sinusoidal BEMF voltage into DC current that flows back to the power supply.

Not all power supplies can handle regeneration energy. The amount of power also depends on the inertia and speed.

Since the stepIM does not have means of absorbing this energy, a suitable power supply or special accessory is required.

3.3 Power Specifications

Table 3-4. Power Specifications:

Type	Units	Value
Supply voltage range	VDC	14-48
Auxiliary supply voltage range	VDC	6-24
Maximum continuous phase current (1)	A	4.5
Maximum peak phase current (1) (2)	A	6.5

(1) Rate value will be finalized after product tests
(2) Peak current maximum duration: 2 seconds

3.3.1 Auxiliary Power Supply

The auxiliary power supply is optional. The stepIM logic voltage is derived from the bus voltage, and can work with the main bus supply only.

If auxiliary voltage is connected, it will power the stepIM digital components, allowing communication and diagnostics if bus voltage is disconnected.

3.4 I/O Specifications

3.4.1 I/O Signals

- opto-isolated digital inputs, connectivity options: sink or source
- 2 opto-isolated digital outputs
- 1 differential analog input

3.4.2 Digital Inputs/External Enable

Table 3-5. Digital Inputs / External Enable Specifications:

Item	Details
Type	Optically isolated
Maximum high level input voltage	30V
Minimum high level input voltage – VIH	11V
Maximum low level input voltage – VIL	5V
Input resistance	4.4 KΩ
Maximum input frequency	1KHz
Isolation Voltage	5000 Vrms

3.4.3 Digital Outputs

Table 3-6. Digital Outputs Specifications:

Item	Details
Type	Open collector, optically isolated
Maximum output voltage (VDDMAX)	30V
Maximum output current (ILMAX)	150 mA
Minimum load resistance	191 Ω, calculation: $\frac{V_{DDmax}-V_{Omax}}{I_{I.max}}$
Output voltage (VO)	0.25 + 8.2 x IL

3.4.4 Analog Input

Table 3-7. Analog Input Specifications:

Item	Details
Input differential voltage	±10 V
Input resistance	94 kΩ
Maximum input frequency	8KHz
Analog input resolution	12-bit

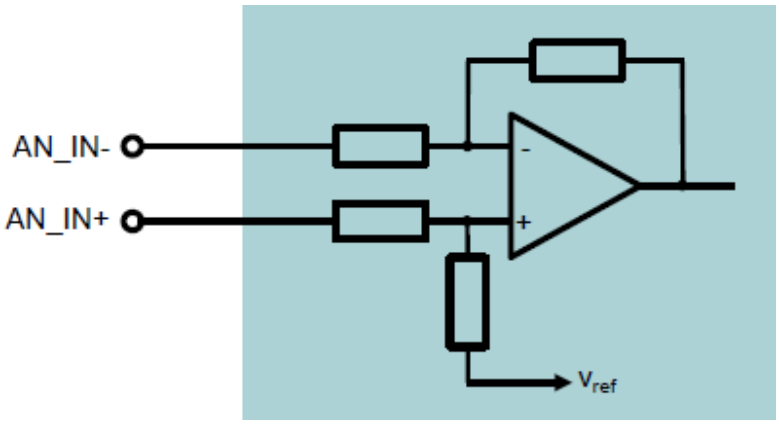

Figure 3-5. Analog Input Interface Scheme

3.5 CANopen Communication

Table 3-8. CANopen Specifications

Item	Specification	Default value
Baut rate	10Kbps - 1 Mbps	1 Mbps
CAN ID	1 126	101

3.6 Environments

Table 3-9. Environmental Specifications

Item	Specification
Operating temperature	0 to 40°C (subject to section 3.6.1)
Storage temperature	-40 to 85°C
Humidity	5 to 95%, non-condensing

3.6.1 Thermal Considerations

⚠ WARNING **Caution!** During continuous motor operation, the motor body and the power stage of the drive heat up. The drive shuts-down when its power-stage heats to 105˚C. The motor can be damaged when its winding temperature exceeds 130˚C. For precaution, use proper airflow or connect the stepIM to proper heat-sink to avoid reaching 100˚C on the stepIM heat-sink, and 120˚C on the motor body.

4 Connections and Pinouts

4.1 Connector Locations

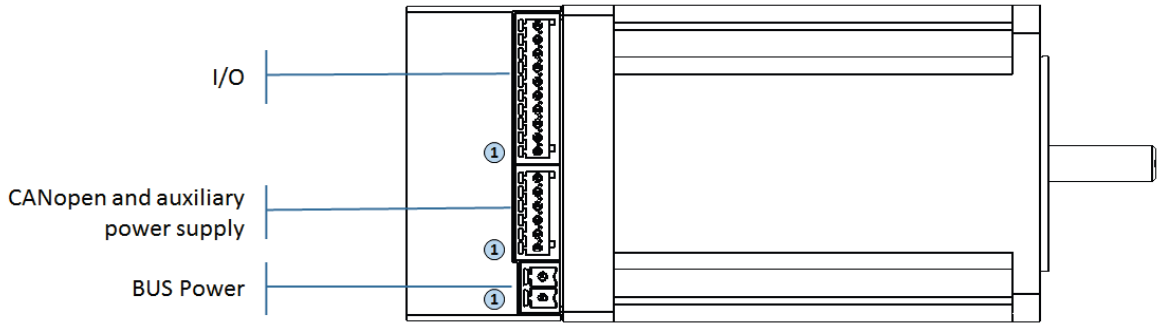

Figure 4-1. stepIM connectors (all models)

4.2 Bus Power

Table 4-1. J1 - Bus Power Interface Specifications

Connector	Phoenix Contact 1803277	
Pitch	3.81 mm	
Pinout	1	VIN
	2	VIN_RET
Mating connector	Phoenix Contact: 1851041 (spring) or Phoenix Contact: 1803578 (screw)	
Wire gauge	16 - 28 AWG	

4.3 CANopen and Auxiliary Power Supply

Table 4-2. J2 - CANopen and Auxiliary PS Interface Specifications

Connector	Phoenix Contact 1881480	
Pitch	2.5 mm	
Pinout	1	VAUX
	2	VAUX_RET
	3	NC
	4	CAN_H
	5	CAN_L
	6	CAN_GND
Mating connector	Phoenix Contact: 1881367	
Wire gauge	20 - 28 AWG	

4.4 Inputs/ Outputs

Table 4-3. J3 - Inputs/Outputs Interface Specifications

Connector	Phoenix Contact 1881529	
Pitch	2.5 mm	
Pinout	1	DIN_1
	2	DIN_2
	3	DIN_3
	4	DIN_4
	5	DIN_COM
	6	DOUT_1
	7	DOUT_2
	8	DOUT_RET
	9	AIN+
	10	AIN-
Mating connector	Phoenix Contact: 1881406	
Wire gauge	20 - 28 AWG	

5 Wiring

5.1 Wiring Guidelines

Be sure to use conductors according to the specifications in the section *Connections and Pinouts*.

- Use the shortest cable possible.
- Follow the wiring guidelines defined by the connector manufacturers.
- To reduce the effects of EMI, use twisted pairs for the following cables:
  - Power supply
  - Communication

5.2 Bus Power Supply

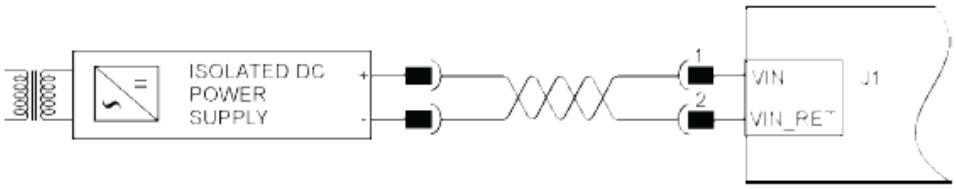

Figure 5-1. Bus Power Supply Wiring

The stepIM has two separate power supply inputs. Use twisted pair cables to reduce EMI.
When bus voltage is greater than 32 VDC, use an isolated power supply source for UL compliance.

⚠ WARNING **Warning:** No reverse polarity protection on supply input. Incorrect wiring can cause severe damage to the drive.

5.3 Auxiliary Power Supply

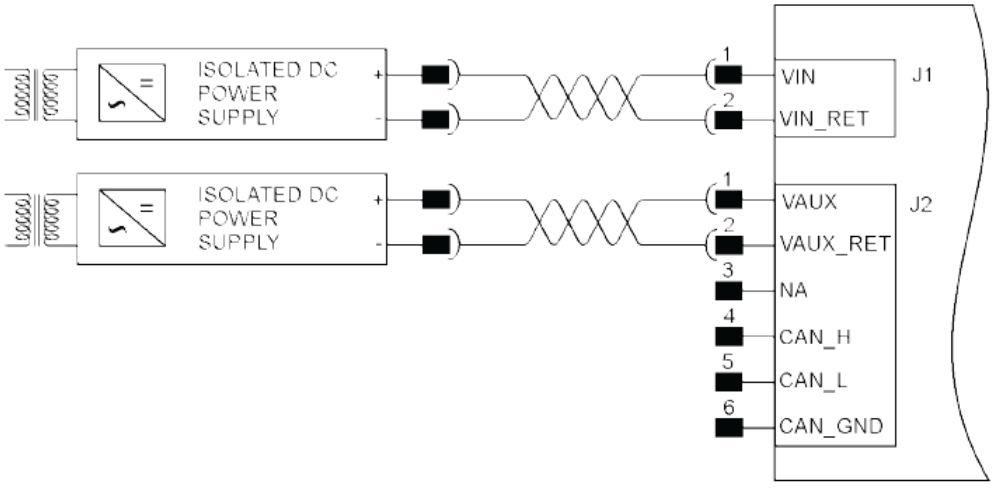

Figure 5-2. Auxiliary Power Supply Wiring

⚠ WARNING **Warning:** Use separate power supplies for the BUS and Auxiliary power supply. Do not connect the VIN+ and VAUX to the same power source.

5.4 I/ Os

5.4.1 Digital Inputs

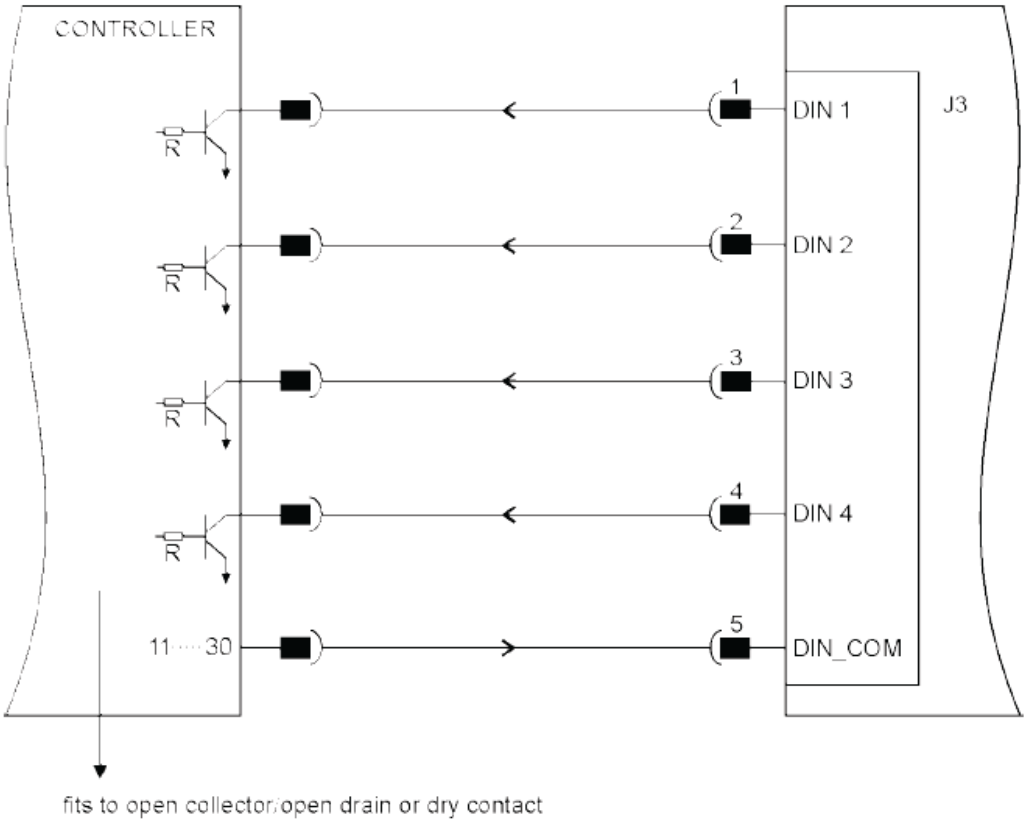

Figure 5-3. Digital Inputs Source Wiring

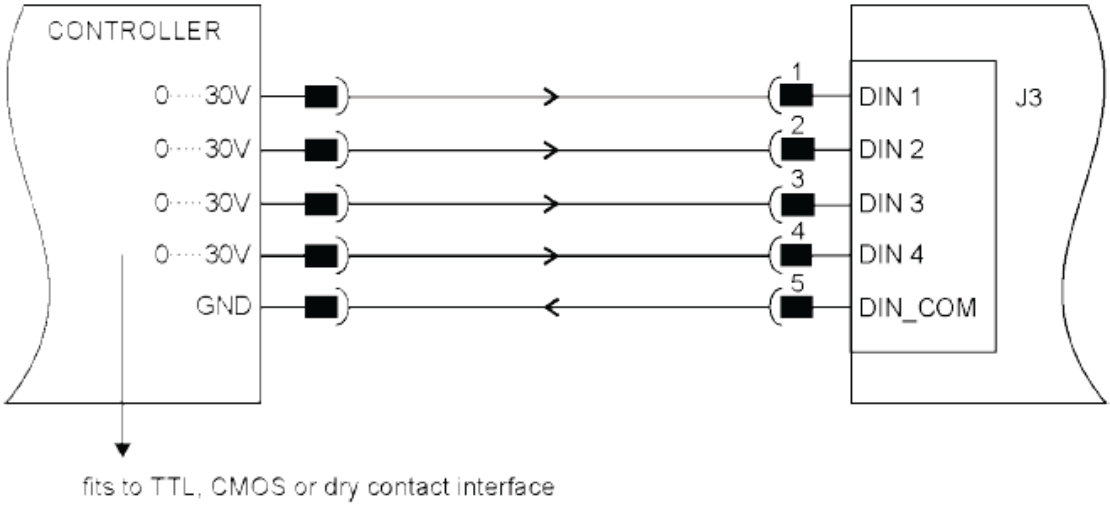

Figure 5-4. Digital Inputs Sink Wiring

The stepIM has 4 digital inputs, with 1 common port that can be used as common ground or common supply.
Follow the I/O specifications for using this interface properly.

5.4.2 Digital Outputs

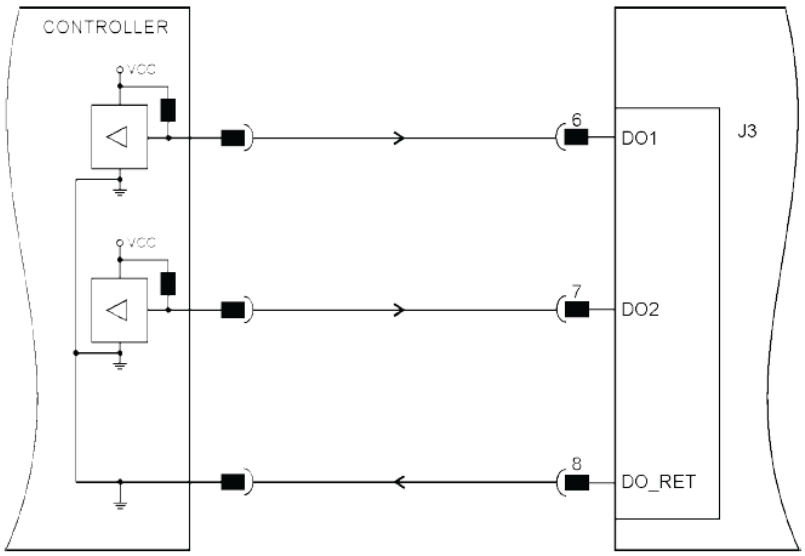

Figure 5-5. Digital Outputs Wiring

5.4.3 Analog Input

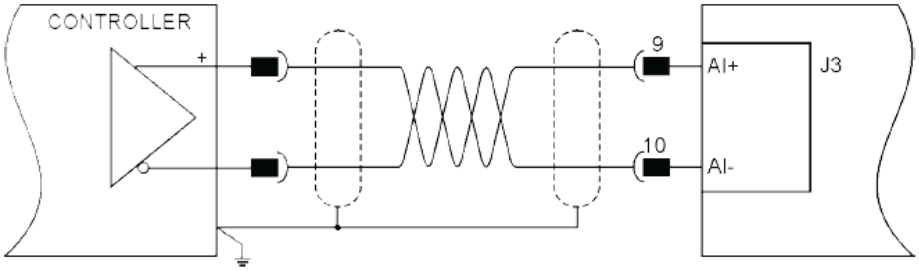

Figure 5-6. Analog Input Differential Wiring

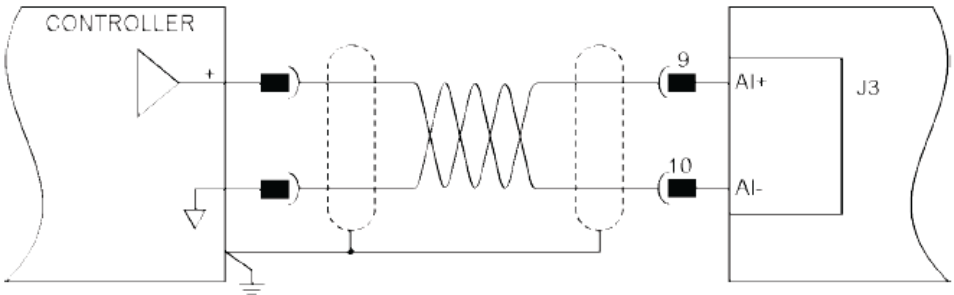

Figure 5-7. Analog Input Single Ended Wiring

The analog input can interface two kinds of analog interfaces – single ended and differential:

- Single-ended: **AN_IN-** is connected to the controller's ground and **AN_IN+** is connected to the controller's single-ended output in the range of ±10V.
- Differential: **AN_IN+** is connected to the controller's positive output and **AN_IN-** is connected to the negative output.

Use a shielded cable and twisted pair for the analog signal.

5.5 CANopen

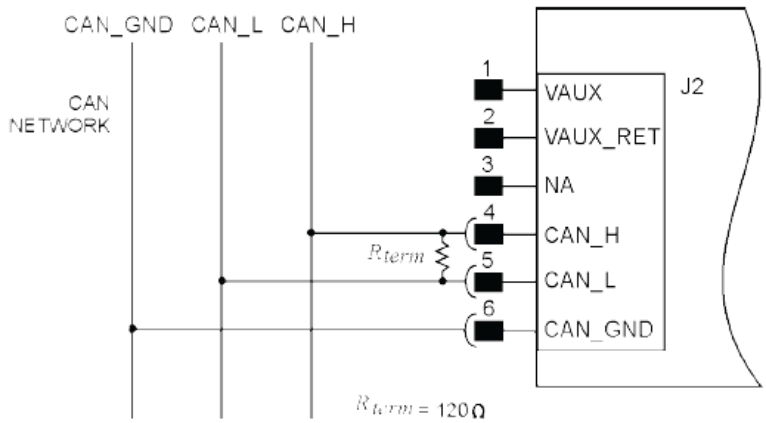

Figure 5-8. CANopen Wiring

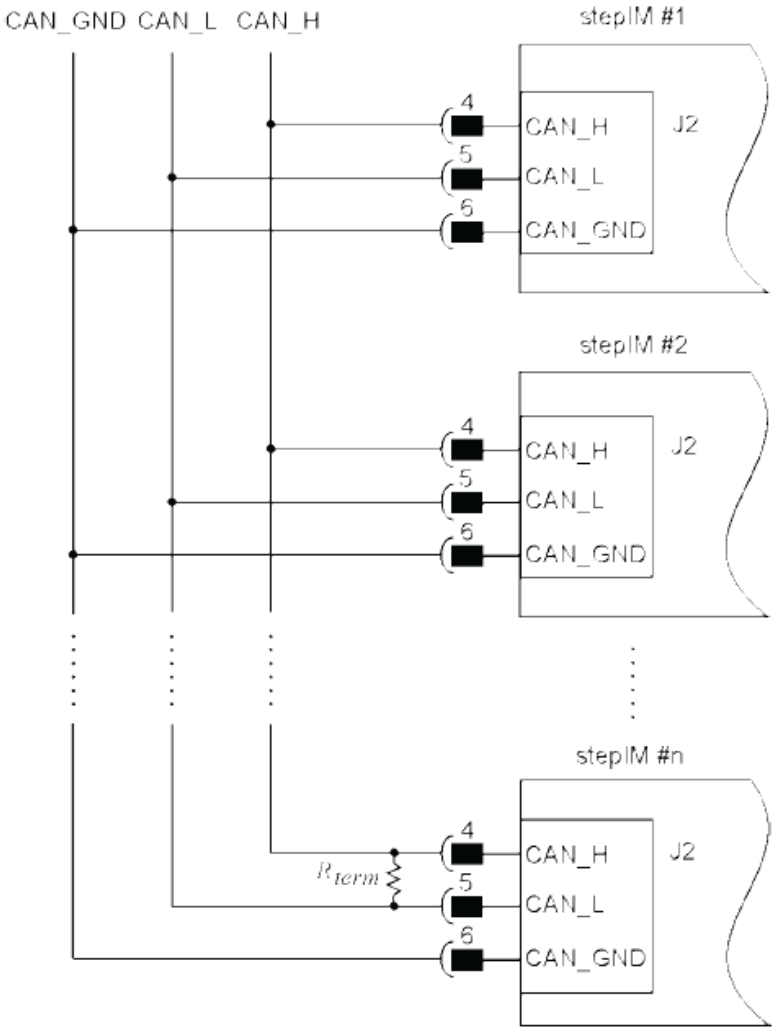

Figure 5-9. CANopen Network Wiring

In addition, use a termination resistor on the host side.

6 Communication

6.1 CANopen Communication

6.1.1 CANopen Termination

For CANopen termination, connect an external 120Ω/0.25W resistor between CAN_H and CAN_L terminals (pins 4 and 5 at connector J2).

6.1.2 CANopen Node ID

Default Node ID is 101.
Node IDs are set by object 2F1Bh.

Node ID setting procedure:
1. Write the new Node ID value to object 2F1Bh.
2. Save the new Node ID value to EEPROM (object 1010h: store parameter field).
3. Cycle the stepIM power. The new Node ID will be set upon power-up.

6.1.3 CANopen Baud Rate

In firmware versions prior to 0.0.2.12: baud rate value is fixed at 1 Mbps.

In firmware versions from 0.0.2.12:
1. Set the new baud rate value in object 2F1Fh (CANopen baud rate).
2. Save the new baud rate to EEPROM (object 1010h: store parameter field).
3. Cycle the stepIM power. The new baud rate will be set upon power-up.

7 Configurations

7.1 Drive Configurations

Drive configuration is performed by means of CANopen communication commands.

ServoStudio is a graphic user interface (GUI) provided with the stepIM to enable setup, configuration and tuning of the drive over CANopen.

ServoStudio allows you to program the drive parameters for the particular operation that the stepIM will be performing in the machine.

7.2 Drive Parameters

Drive parameters are configured by means of CANopen SDO objects. Some parameters allow on-the-fly modification while motor is in motion drive is enabled.

8 Operation

8.1 Operation Modes

The stepIM supports the following CANopen modes of operation:

1. = Profile position mode
2. = Velocity mode
3. = Profile velocity mode
4. = Profile torque mode
5. = Reserved
6. = Homing mode
8. = Cyclic synchronous position mode

8.2 Enabling the Drive

Switch modes to enable by writing to object 6040h (controlword) the following sequence:

1. 80h – Clears faults
2. 06h – Shut down command
3. 07h – Switch on command
4. 0Fh – Switch on and enable operation command

8.3 Torque Command

To initiate a torque command:

1. Change operation mode to torque mode by writing 4 to object 6060h (modes of operation).
2. Switch modes to enable (section *8.2 Enabling the Drive*)
3. Set current in the target current object 6071h.
4. Set halt bit in the control word – object 6040h (bit 8) low, and then set halt bit in the control word – object 6040h (bit 8) high to execute it.

8.4 Point-to-Point Move Command

To initiate a move command:

1. Change operation mode to profile position mode by writing 1 to object 6060h (modes of operation).
2. Switch modes to enable (section *8.2 Enabling the Drive*)
3. Set distance in object 607ah (target position).
4. Set velocity in object 6081h (profile velocity).
5. Incremental move: initiate move by writing 9Bh to object 6040h (controlword).
6. Absolute move: initiate move by writing 5Bh to object 6040h (controlword).

8.5 Synchronized Move Command

To initiate a synchronized move command:

1. Change operation mode to profile position mode by writing 8 to object 6060h (modes of operation).
2. Switch modes to enable (section *E8.2 Enabling the Drive*)
3. Set distance in object 607Ah (target position).
4. Send sync command (80h) to execute it.
5. Repeat steps (3) and (4).

The sync command should be updated at the intervals set in object 1006h (communication cycle period).

9 Recorder

9.1 General

The stepIM has an integral recorder that enables recording of up to four different objects at run time. The recorder can start the recording on command, by fault, or by evaluation of a condition.

9.2 Programming the Recorder

1. The recorder can record up to four different channels. Write the values of the CANopen indices to record in sub-indices 2 to 5 of object 2F10h (recorder channels).
2. A list of all objects that can be recorded is held in object 2F14h (recordable parameters). Set the number of points that will be recorded per channel in object 2F15h. This value must not exceed the maximum number of available points divided by the number of channels.
3. Set the sample time of the recorder in object 2F11h (recorder sample cycle). This value determines the frequency of the recording in multiples of 62.5µs.

9.3 Triggering the Recorder

The recorder has three triggers types (object 2F12h, sub-index 1: recorder trigger):

- **Immediate**. The recording will start as soon as the recorder has started (object 2F16h: recorder start).

- **By condition object**. The recording will start as soon as the recorder has started (object 2F16h: recorder start) and the condition has been met. The condition consists of three elements:
  - Condition object (object 2F12h, sub-index 2: recorder condition channel index): the object index of the inspected condition.
  - Condition value (object 2F12h, sub-index 3: recorder condition value): the value that must be passed by the condition object in order to trigger the recorder
  - Condition comparator (object 2F12h, sub-index 4: recorder condition comparator): the passing direction of the value (rising edge or falling edge).

- **By fault**. The recording will start as soon as the recorder has started (object 2F16h: recorder start) and a fault has occurred. The trigger consists of one element:
  - Recorder buffer location (object 2F12h, sub-index 5): the position of the trigger in the recorder results buffer (i.e., all points preceding this value were recorded before the condition occurred).

9.4 Starting the Recorder

To start the recorder, write 1 to object 2F16h (recorder start).
Writing 0 cancels recording if it is in progress.

9.5 Retrieving the Results

Once the recorder has finished successfully (object 20E6h: record done indicator), the recorder results buffer can be retrieved from object 2F18h (recorder results).

To retrieve the results:

1. Reset the buffer index by writing 1 to object 2F18h, sub-index 1 (reset results index).
2. Read object 2F18h sub-index 2 to retrieve each point's value. On each read operation the buffer is automatically advanced to the next point and the next point is retrieved.
   Repeat reading this object according to the value of 2F13h (recorder total number of points).

If more than a single channel was recorded, the recorded points are arranged as follows:

<1st channel 1st point>
<2nd channel 1st point>
<3rd channel 1st point>
<1st channel 2nd point>
<2nd channel 2nd point>
<3rd channel 2nd point>
.
.
.
.
.
<1st channel last point>
<2nd channel last point>
<3rd channel last point>

10 Firmware Upgrade

10.1 Firmware Upgrade via ServoStudio

10.1.1 Preparation

Contact technical support for the required firmware file.
Important: Before upgrading the firmware, do the following:

1. Backup the drive parameters since parameter settings may be lost during the upgrade. After the upgrade is completed, the parameters can be reloaded/restored.
   To backup parameters from ServoStudio, go the **Backup & Restore** screen, and click the **Backup** button.
2. Read the release note or other documentation supplied with the new firmware.

10.1.2 Upgrade Procedure

1. From the ServoStudio **Drive Information** screen, click **Download Firmware**.
   The **Firmware Upgrade** dialog box opens, and allows you to download the firmware file to the drive over CANopen.

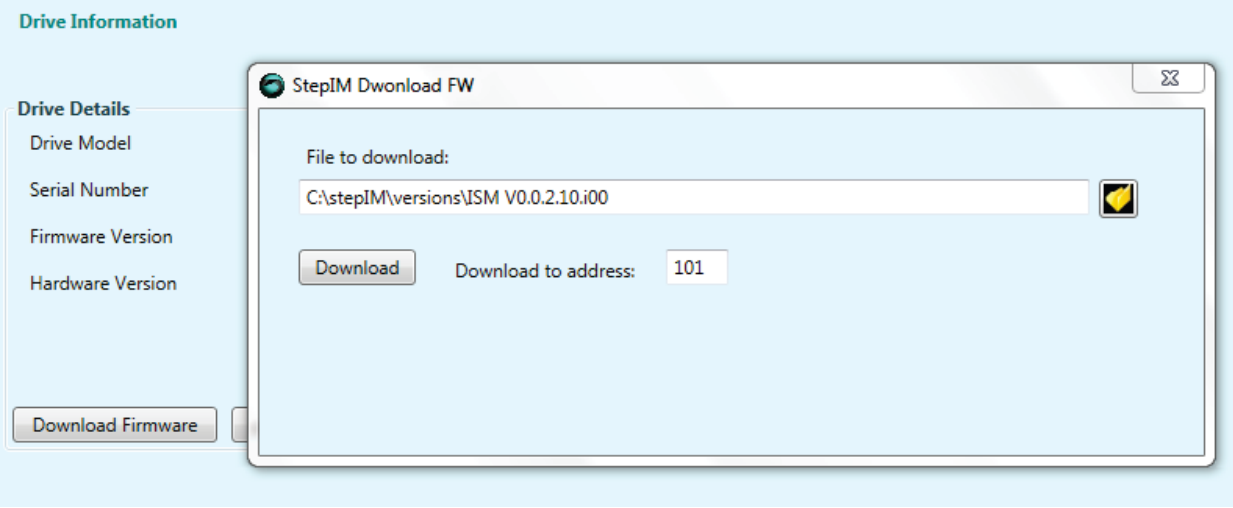

Figure 10-1. Firmware Upgrade Interface

2. Set the address of the stepIM unit to upgrade, browse to and select the firmware file, and press **Download**.

During the firmware upgrade process, the stepIM red LED is steadily-lit.

10.1.3 Resuming Operation

1. Go to the ServoStudio **Drive Info** screen in ServoStudio, and check the drive firmware version to verify that the new firmware has been loaded.

2. To restore values to the drive parameters, go the ServoStudio **Backup & Restore** screen, and click the **Restore** button.

3. Check the version release notes, and set any parameters that may have been added to the new version.

4. Save the parameters to the non-volatile parameter memory: either via object 1010h (store parameter field), or click the **Save** button on the ServoStudio toolbar.

10.1.4 Boot Mode

If the firmware loading process has been interrupted, or the firmware is corrupted, the stepIM red LED will continue flashing after power-up.

When the stepIM is in boot mode, firmware upgrade works via the ServoStudio as described in the section *Upgrade Procedure*.

10.2 Firmware Upgrade Protocol

Firmware upgrade over CANopen communication is done by the bootloader. During the boot of the stepIM, the controller can access the bootloader and start the firmware upgrade procedure.

The stepIM bootloader supports a minimal set of CANopen objects to enable the firmware upgrade procedure. The bootloader is stored in a protected section of the product's flash memory, and saves the new firmware to its allocated flash sectors.

After power-up, the drive is in boot mode for about 3 seconds. During this brief interval, a CANopen access to the drive prevents it from starting the firmware, and the drive can accept a firmware upgrade.

The following CANopen objects are used in the firmware upgrade procedure:

1000h – Device type
2000h – Main program
2001h sub-index 1 – Flash ready
2001h sub-index 2 – Erase flash
2002h - Unlock bootloader (only in bootloader versions 2.3 and newer)
2800h – Domain transfer

Note: Except for object 1000h, these objects are unique to the stepIM bootloader, and do not exist in the product firmware.

10.2.1 Firmware Upgrade Procedure

CAN ID during firmware upgrade:

1. Bootloader versions prior to 0.0.2.3: During the boot, the CAN ID of the stepIM is 127.

2. Bootloader versions 0.0.2.3 and newer: During the boot, the CAN ID of the stepIM is the last drive address that was set to the drive, or CAN ID 101 if the address has not been changed.

Perform the following steps to upgrade the firmware:

1. Power up the drive.
   - Bootloader versions prior to 2.3: within the first 5 seconds after powerup, access the drive at CAN ID 127 by reading the value of object 1000h.
   - Firmware versions 2.3 and newer: within the first 3 seconds after power-up, write 0x6E65706F (“open”) to object 2002h.

2. Erase the flash memory by writing value 1 to object 2001h sub-index 2.
   - Wait 10 to 20 seconds; the drive hangs during the flash erase.

3. Read the value from object 2001h sub-index 1.
   - If the value of 2001h sub-index 1 is not 0, this indicates a problem with the flash erase. Repeat the procedure from step 2. If the problem persists, contact technical support.
   - When the value of 2001h sub-index 1 is 0, continue to the next step.

4. Send the firmware file via object 2800h.

5. When the file send is done, read the value of object 2000h.
   - If the value of object 2000h is not 0, this indicates that firmware send failed. Repeat the procedure from step 2. If the problem persists, contact technical support.
   - If the value of object 2000h is 0, the firmware upgrade is successful. Restart the drive.

The following table shows the return values from erase and programming:

Desription	Name	Value
Success	SUCCESS	0
Erase and programming errors	CSM_LOCKED	10
	REVID_INVALID	11
	ADDR_INVALID	12
Erase specific errors	NO_SECTOR_SPECIFIED	20
	FAIL_PRECONDITION	21
	FAIL_ERASE	22
	FAIL_COMPACT	23
	FAIL_PRECOMPACT	24
Programming specific errors	FAIL_PROGRAM	30
	FAIL_ZERO_BIT_ERROR	31
	FAIL_VERIFY	40

11 Troubleshooting

11.1 LEDs

The stepIM has green and red LED indicators.

Table 11-1. LED Indicators

Color	Function
Green	**Flashing** – The drive is operational and ready to be enabled. No faults. **ON** – The drive is enabled. No faults.
Red	**ON** – A fault has been detected and needs attention. The LED remains ON until the error is resolved. **Flashing** – o Within the first 3 seconds after power-up: the drive is in boot mode. o During firmware running: a fault that was detected no longer exists, but has not yet been cleared.

11.2 Built-in Protection

When a drive fault occurs, the fault is automatically latched and the drive is disabled. Faults must be explicitly cleared before the drive can be enabled.

11.3 Faults

The following table lists the fault (emergency error) codes. When an illegal state occurs in the drive, the stepIM sends the code to the master device as object 603Fh (error code). Whenever the value of 603Fh is not 0, there is a fault in the drive.

The CANopen state machine enters Fault mode, and the stepIM cannot be enabled.

Table 11-2. Faults

Error code	Name	Description	Action required
2214h	Over-current	Hardware or software over-current was detected. The maximum current value is set at object 2036h.	Check the current loop parameters (IGP 2007h, IGI 2006h). Increase maximum current value (object 2036h) or reduce the current saturation value (object 6073h).
2310h	I2T limit	Energy usage is higher than the I2T limit value (object 2034h). The value of I2T value (object 2033h) is greater than the value of I2T limit value (object 2034h).	Check the parameter values in the control loops. Check the demanded velocity (object 6081h), acceleration (object 6083h) and deceleration (object 6084h) and motor load. Increase I2T limit value (object 2034h) if needed, or set it to 0 to disable this functionality.

Error code	Name	Description	Action required
3110h	Over-voltage	Bus voltage exceeds the value that is set at the over-voltage fault level (object 20A1h).	Check the bus power voltage (object 0790h). Increase the value of object 20A1h.
3120h	Under-voltage	Bus voltage is lower than the value that is set at the under-voltage fault level (object 20CFh).	Check the bus power voltage (object 0790h). Reduce the value of the undervoltage fault level (object 20CFh).
4310h	Over-temperature	The temperature of the drive is higher than 90°C (194°F) or lower than -30°C (-22°F), or the temperature sensor has a malfunction.	Check the drive measured temperature, at object 2044h. Reduce the load on the drive.
5530h	EEPROM fault	One of the following faults occurred: Checksum error while loading parameters. EEPROM read fault: The drive firmware could not access the EEPROM during LOAD (object 1011h). EEPROM write fault: The drive firmware could not access the EEPROM during SAVE (object 1010h).	Use the command object 1011h to reload the parameters from the EEPROM. Reset the drive, and try again. The EEPROM might be damaged and the drive requires service.
7122h	Reserved	-	-
7310h	Over-speed	Actual speed exceeds the velocity over speed value (object 606Ch).	Check the velocity-loop parameters (VGI 2026h and VGP 2027h). Increase velocity over speed (object 2F0Ah), or reduce the velocity limit (object 20EEh).
8400h	Velocity error	The difference between the velocity command and the actual velocity is greater than the value that is set in maximum velocity error (object 2F08h).	Check the parameter values in the control loops. Check the demanded velocity (object 6081h), acceleration (object 6083h) and deceleration (object 6084h). Increase the value of the maximum velocity error (object 2F08h). If needed, or set it to 0 to disable this functionality.
8611h	Position error	The difference between the position command and the actual position is greater than the value that is set in maximum position error (object 6065h)	Check the parameter values in the control loops. Check the demanded velocity (object 6081h), acceleration (object 6083h) and deceleration (object 6084h). Increase the value of the position error maximum (object 6065h) if needed.

Error code	Name	Description	Action required
F001h	Acceleration / deceleration violation	The motor acceleration or deceleration is greater than the value of the maximum acceleration (object 60C5h).	Check control loops parameters. Check the demanded velocity, acceleration and deceleration. Or, increase the value of the maximum acceleration object 60C5h, or set it to 0 to disable this functionality.
FF00h	Position command error	The difference between two sequential position commands is greater than the value of the maximum position derivative (object 2F0Bh). Note: Interpolated mode only.	Check motion controller configuration. Check the demanded velocity (object 6081h), acceleration (object 6083h) and deceleration (object 6084h). Or, increase the value of the maximum position derivative (object 2F0Bh), or set it to 0 to disable this functionality.
FF03h	PLL lock lost	In synchronous motion the drive PLL on Sync has failed.	Check CAN sync cycle parameter (object 60C2h) and increase it if needed.
FF04h	Power stage fault	Power stage generated a fault due to over or under voltage, over current or over temperature.	Check that drive operating condition are within the specification of the product.
FF05h	Magnet missing	Magnetic encoder has failed.	Try to reboot the product. If the fault persists, drive will need to be serviced.

12 Ordering code

TSP10 Type code

S	2	3	C	-	0	0	-	0	1

Drive Series
Integrated Stepper

NEMA 23 stepper motor… 23
NEMA 34 stepper motor… 34

CANopen..... C
EtherCAT (upcoming)..... E

Without brake.....…..... 0

Length short*..... 0
Length medium.... 1
Length large..... 2
**Frame Size 23 only*

Degree of protection IP 23..... 0
Degree of protection IP 67..... 6

Shaft single flat*..... 1
Shaft double flat**.... 2
Shaft key*..... 3
**Frame Size 23 only*
***Frame Size 34 only*