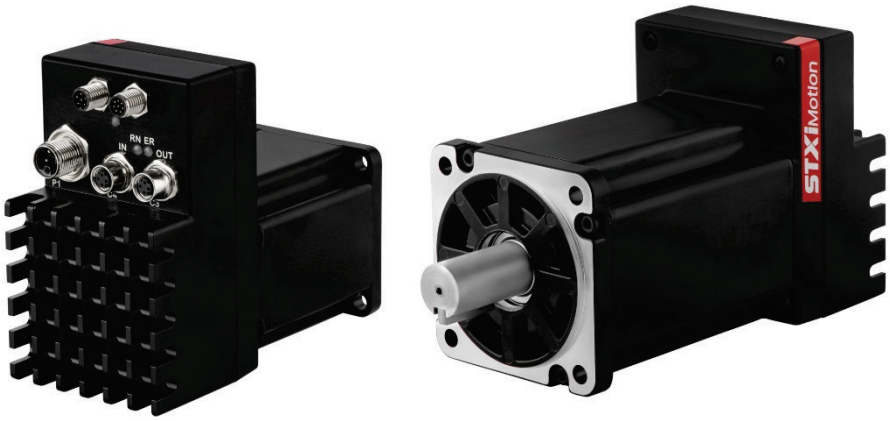
STXiMotion

TIM

Integrated Servo Motor

User Manual

ORIGINAL DOCUMENT
Manual Revision 1.3



Revision History

Manual Rev.	Date	Notes
Rev.1.3	4 Nov. 2024	Updated Ordering Info. Added Commissioning chapter. Additions and updates to Warning and Faults chapter. Reorganized content: Updated Installation chapter; added Commissioning the Drive chapter. Added note to Firmware Upgrade chapter.
Rev.1.2	18 July 2024	Updated dimensions drawings. Updated product label.
Rev.1.1	16 July 2024	Corrected descriptions for interfaces C1 and C2 in Chapter 6.
Rev.1.0/1.0a	11 July 2024	Initial release.

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Disclaimer

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Trademarks

TIM is a trademark of STXI Motion Ltd.
CANopen and CiA are registered trademarks of the CAN in Automation User's Group
EtherCAT is a registered trademark of Beckhoff Automation GmbH
Windows is a registered trademark of Microsoft Corporation

Contact Information

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CANopen Vendor-ID

Vendor-ID **0x00000513** has been registered to STXI Motion Ltd.

EtherCAT Vendor-ID

Vendor-ID **0x00000D2B** has been registered to STXI Motion Ltd.

Contents

1 Introduction

1.1 Product Description

The TIM is an integrated servo motor – consisting of motor, drive electronics, power stage and position sensor all in one unit. The TIM has digital I/Os, CANopen, EtherCAT and RS232 communication channels, and supports absolute single turn and multiturn encoders.

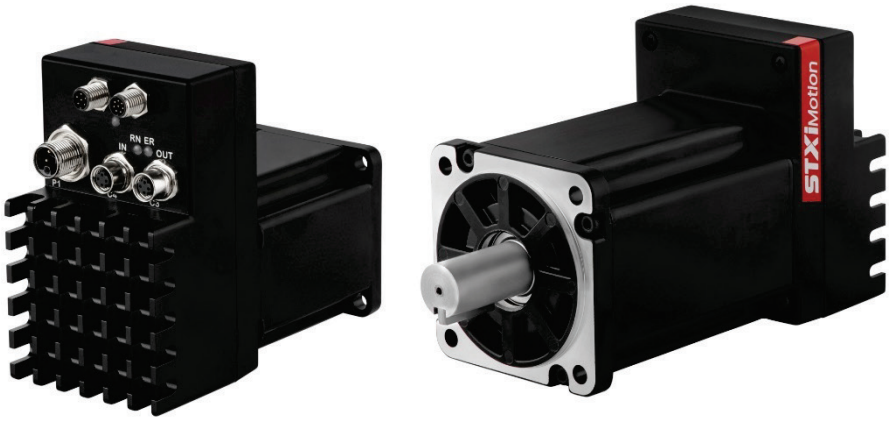


Figure 1-1 TIM integrated servo motor

1.2 Ordering Info

The following table shows the ordering options that comprise the various model numbers of the integrated servo motors in the TIM product line. To enquire about custom options, contact STXI Motion.

Table 1-1. Product Ordering Options

		IM1	-	60S	4	3	2	5	EC	20	0	00
	Integrated Servo Motor											
	Frame Size and Length											
60S	Flange 60 mm Short (200 W)											
60M	Flange 60 mm Medium (400 W)											
80S	Flange 80 mm Short (480 W)											
80M	Flange 80 mm Medium (800 W)											
	DC Bus Voltage											
2	24 VDC (60 mm motors only)											
4	48 VDC											
	Rated Speed											
3	3000											
	Shaft											
0	Smooth											
2	Keyway											
	Connector and Protection Class											
1	Connector front mounting IP54 (*upon request only*)											
5	Connector back mounting IP 54											
6	Connector top mounting IP 54											
	Communication											
CO	CANopen											
EC	EtherCAT											
	Feedback											
20	Absolute single turn 21-bit											
30	Absolute multiturn 24-bit											
	Brake											
0	No brake											
B	With brake											
	Option											
00	–											

1.3 Product Label

The product label is attached to the side of the TIM integrated servo motor.

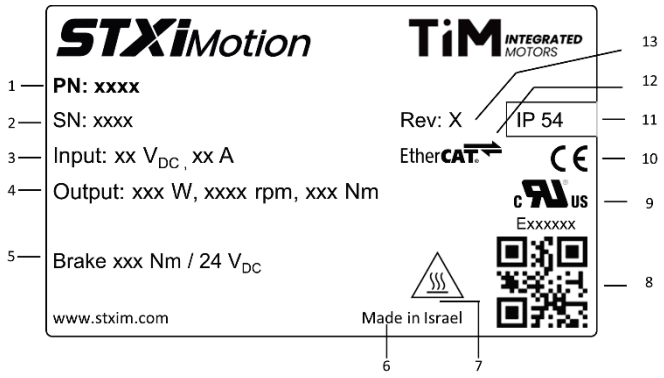


Figure 1-2. Product label on TIM

Item	Description
1	Part number
2	Product serial number
3	Nominal input
4	Nominal output
5	Brake type (if TIM has brake)
6	Country of manufacturer
7	Hot surface
8	Identification code
9	UL compliance
10	CE compliance
11	Protection class
12	Fieldbus
13	Hardware revision

1.4 Product Documentation

This documentation describes the TIM integrated servo motor.

It provides the information required for installation and configuration of the TIM.

This documentation is intended for persons who are qualified to assemble, commission, and maintain the equipment described herein.

Before you install the TIM, review the instructions in this manual. Pay particular attention to all safety instructions and warnings. Failure to follow the safety instructions may result in personal injury or equipment damage.

This manual is part of a documentation set, which consists of the following:

- TIM User Manual. Hardware installation, configuration and tuning.
- TIM EtherCAT/CANopen Reference Manual. Implementation of EtherCAT and CANopen protocol in TIM.
- TIM Motion Suite Reference Manual. Guide for graphical software interface. (*Not yet available*)
- TIM Functional Safety User Manual. (*Not yet available*)

2 Standards Compliance

The TIM has been designed and manufactured according to the standards specified in the following table. Testing and certifications are pending.

Table 2-1. Standards Compliance

Topic	Directive	Standard(s)
Thermal and Electrical Safety	EU Low Voltage Directive 2014/35/EU	EN IEC 61800-5-1
Electromagnetic Compatibility	EMC Directive 2014/30/EU	EN IEC 61800-3 EN IEC 61000-6-7
Functional Safety	Machinery Regulation EU 2023/1203	EN IEC 61508, Parts 1–7 EN IEC 61800-5-2 EN ISO 13849, Parts 1–2
RoHS	RoHS Directive 2011/65/EU	EN IEC 63000
REACH	*TBD*	*TBD*

3 Safety

3.1 Safety Symbols

The following safety symbols are used on the drive and in this manual.

Table 3-1. Safety Symbols

Symbol	Meaning	Description
	Dangerous voltage	Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.
	Caution	Indicates a hazardous situation, which, if not avoided, could result in injury or equipment damage.
	Functional earthing	Identifies a functional earthing (grounding) terminal or conductor, which serves to ensure proper functioning of electronic equipment.
	Caution, hot surface	Indicates the marked item can be hot, and should not be touched without taking care.

3.2 Safety Guidelines

- Before installing or commissioning the TIM, review all relevant product documentation.
- Install and operate the system according to the instructions in this manual.
- Only qualified personnel may perform installation, operation, service, and maintenance procedures. These persons must have sufficient technical training and knowledge to foresee and recognize potential hazards that may occur when using the product, modifying settings, and operating the mechanical, electrical, and electronic components of the entire machine system.
- All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.
- Failure to follow the safety instructions may result in personal injury or equipment damage.

3.3 Intended Use

The TIM integrated servo motor is intended for use as a component within a machine system.

- The machine builder and integrator must ensure the protection of both personnel and the complete machine system.
- The machine builder and/or integrator must perform a risk assessment in view of using the TIM integrated servo motor in the intended application. Based on the results, the appropriate safety measures must be implemented.
- The TIM integrated servo motor must be used in compliance with all applicable safety regulations and directives, and all technical specifications and requirements.
- The machine builder and the machine owner are responsible for the safety of the machine operators.
- The machine owner and the machine operator are responsible for ensuring personnel cannot enter the hazard zone while the machine is energized unless adequate functional safety mechanisms are in place.

3.4 Installation Safety

Incorrect handling of the TIM may cause personal injury and/or damage to equipment.

Perform the installation in strict compliance with product specifications and installation instructions.

Thermal Safety

- During continuous motor operation, the motor body and drive heat up.
- To prevent damage to the product, ensure the temperatures of the TIM components remain at least 5˚C below their threshold (fault) limits:
  - Drive CPU: 115˚C
  - Heat sink: 90˚C
  - Motor: 120˚C
- Motion Suite software reads and reports the temperatures of the drive CPU and the heatsink. It also reports the motor temperature if the motor has a sensor, as defined by the serial parameter **MotorTempSensor**.
- System temperature values can be read from object 2021h (sub-indices 1-6).
- Install the TIM in a manner that allows proper air flow.
- The TIM is rated for use at altitudes up to 2000 meter above sea level.

Electrical Safety

- **TIM power supply**. All connections and terminals with voltages up to 120 VDC in the TIM are equipped with safety extra-low voltage. They are protected against accidental contact in accordance with EN IEC 61800-5-1. For compliance, the TIM power supply must therefore be designed as a SELV/PELV supply (protection class III).

Warning. The use of unsuitable power supply units that are not SELV/PELV can lead to dangerously high voltages in the event of a fault.

- As part of the machine design, the machine builder must generate a hazard analysis for the machine and take appropriate measures to ensure that unforeseen movements cannot cause personal injury and/or damage to equipment.

Functional Safety (STO)

Refer to the *TIM Functional Safety User Manual. (Not yet available)*

4 Handling and Storage

4.1 Transporting

Transport the TIM integrated servo motor in its original packaging materials.

Avoid transporting the TIM in conditions which may cause strong vibrations of the drive, or impact with other objects.

4.2 Packaging

The package contains the TIM integrated servo motor only.

Upon receipt, open the package and remove all packing materials.

Check to ensure there is no visible damage to the TIM integrated servo motor. If damage is detected, notify the carrier immediately.

After unpacking, check the part number label on the product. Make sure it matches the product your ordered, and that the voltage meets your specific requirements.

Save the original box and packing materials in case you need to pack and return the product to the manufacturer.

5 Specifications

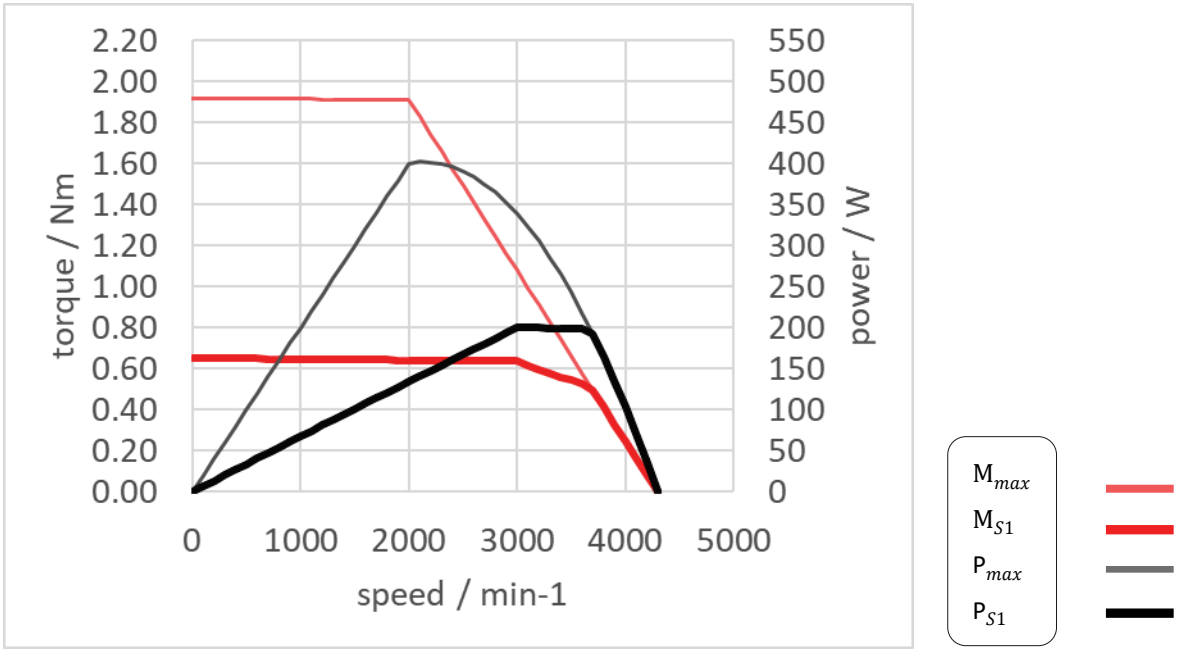
5.1 Motor Power

Table 5-1. Motor Power Specifications

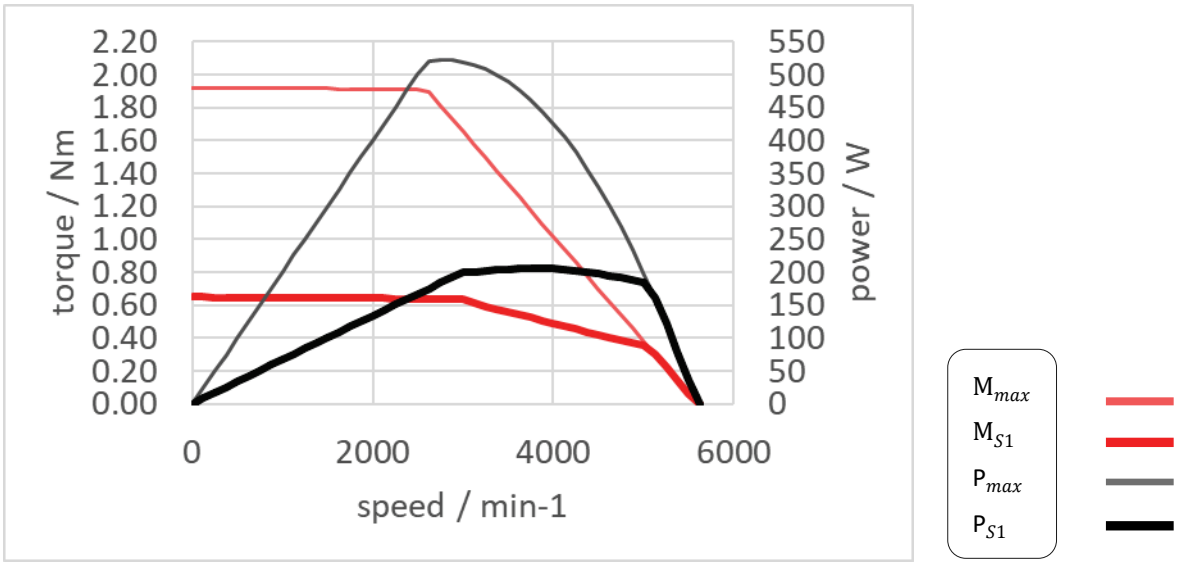
Feature	Unit	IM1-60S	IM1-60M	IM1-60S	IM1-60M	IM1-80S	IM1-80M
Input Voltage	VDC	24		48			
Flange Size	mm	60	60	60	60	80	80
Power Rating	W	200	400	200	400	480	800
Rated Current	A	11	22	6.50	12	14.60	22
Peak Current	A	32.40	66	19.50	36	46	66
Rated Torque	Nm	0.64	1.27	0.64	1.27	1.53	2.55
Peak Torque	Nm	1.92	3.81	1.92	3.81	4.60	7.60
Rated Speed	rpm	3000					
No Load Speed	rpm	4200	4200	5400	5000	5100	4800
Brake Voltage	VDC	24 ±10%					
Brake power	W	7.4				13.5	
Holding torque	Nm	1.3				4	

Speed/Torque Curves

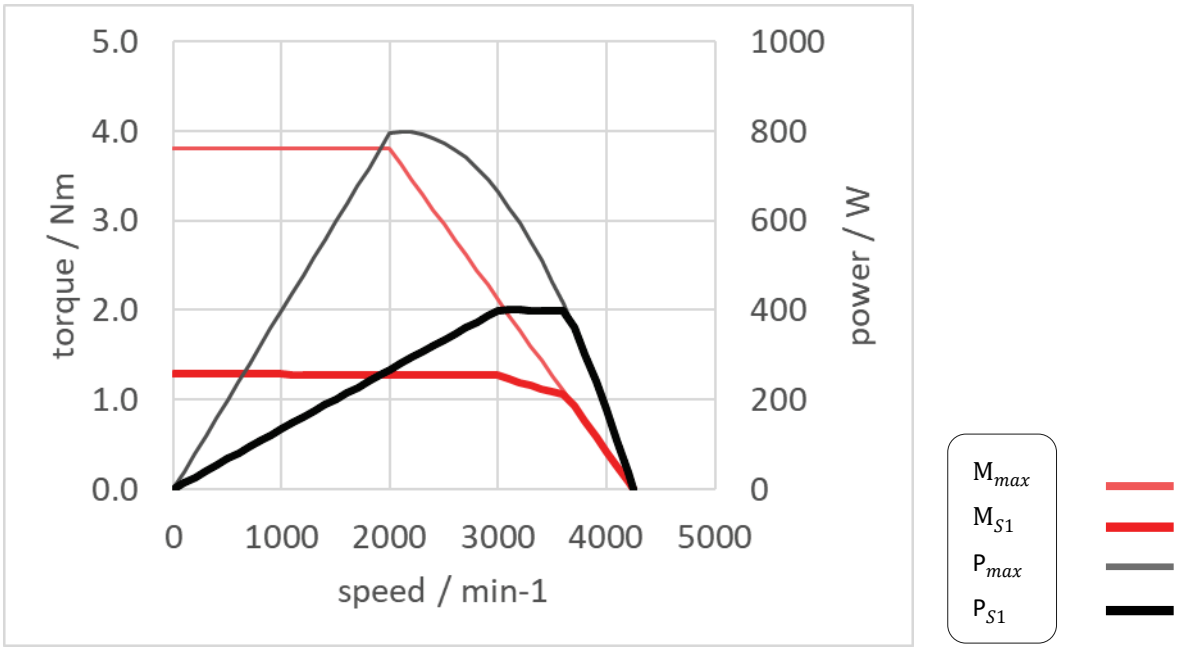
IM1-60S – 24 VDC, 200 W



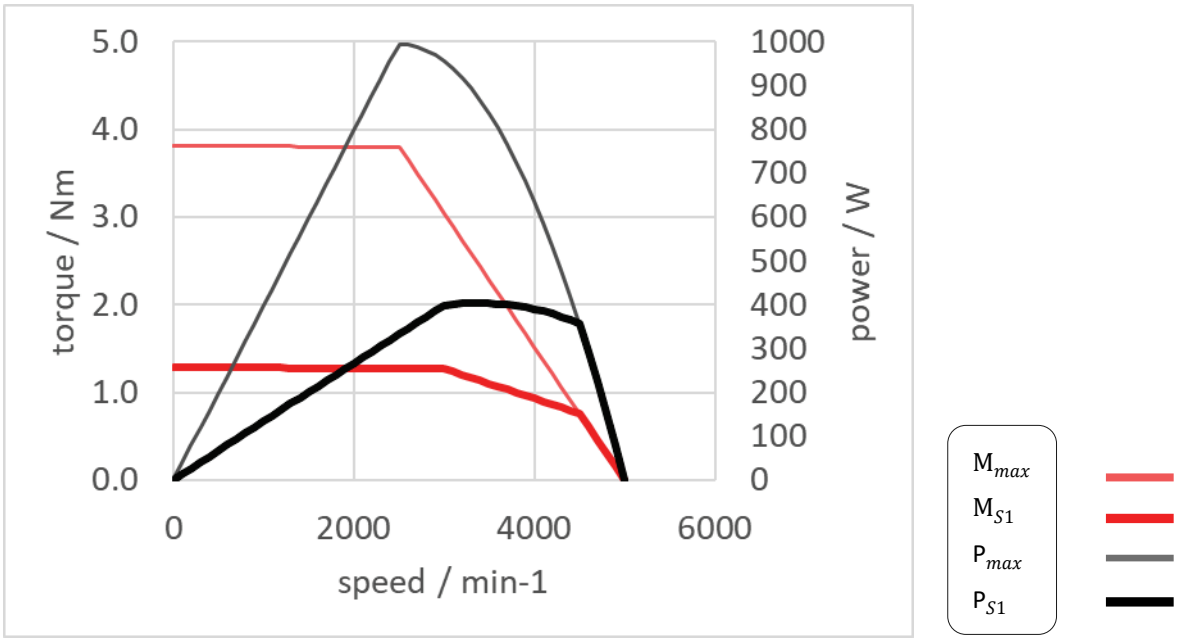
IM1-60S – 48 VDC, 200 W



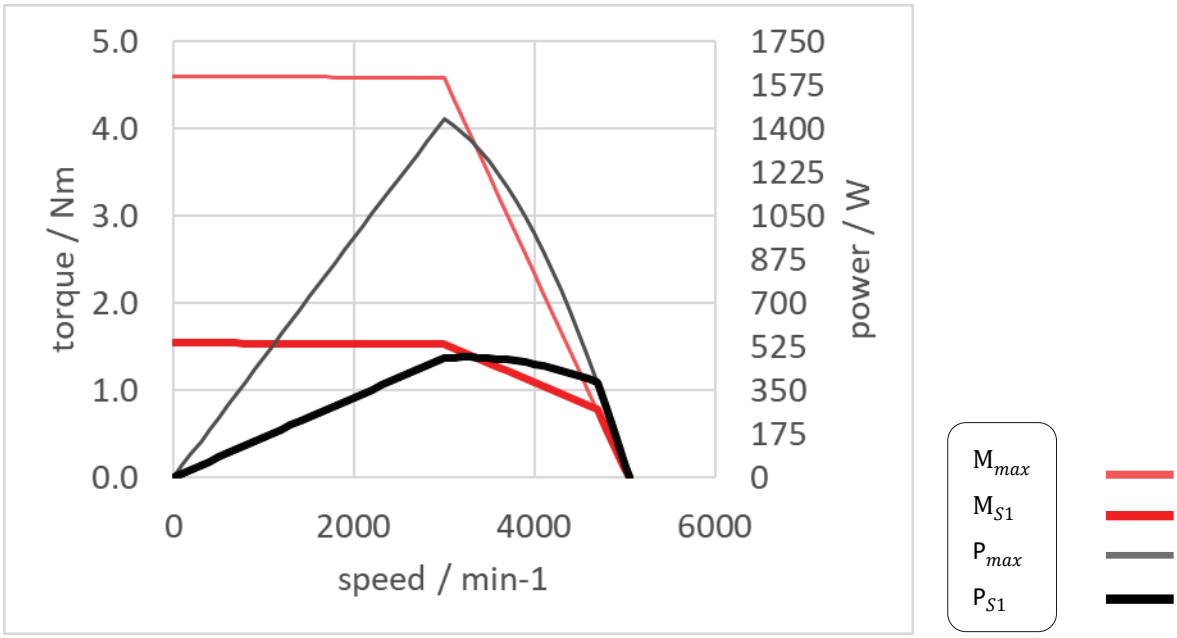
IM1-60M – 24 VDC, 400 W



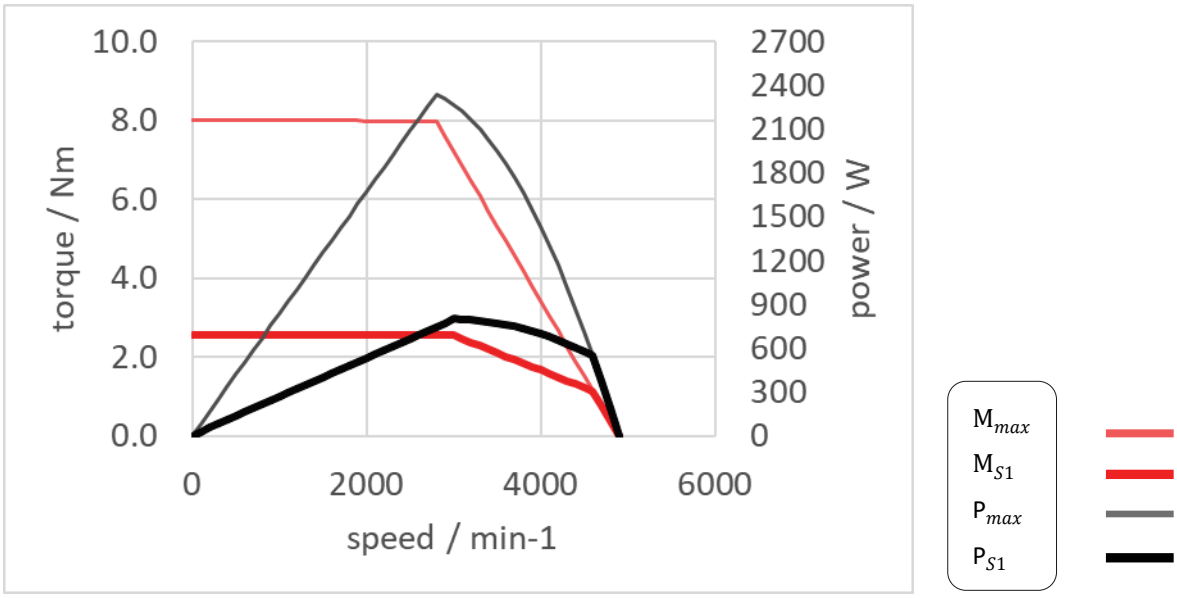
IM1-60M – 48 VDC, 400 W



IM1-80S – 48 VDC, 480 W



IM1-80M – 48VDC, 800 W



5.2 Feedback and Control

Table 5-2. Feedback and Control Specifications

Feature	Specification	
Operation Modes	Selectable	Profile position Profile velocity Homing Types: 17, 18, 19, 20, 21, 22, 23, 24, 27, 28, 37 Cyclic synchronous position
Display		LEDs
Software Tools	User Interface	Motion Suite, Windows-based
	Functions	Connection settings, Drive info, Power info, I/O configuration, Motion settings and tuning, Fault history/display
Feedback		Absolute single turn, Absolute multi turn

5.3 Inputs/Outputs

Table 5-3. Inputs/Outputs Specifications

Feature	Specification	
3x Digital Input	Signal	Configurable opto-isolated, sink/source, Types: 1 and 3
	Functions	Multi-functional, user-definable: home switch, positive limit switch, negative limit switch.
	Voltage High Level Input	30 V
	Min. High Level Input	11 V
	Max. Low Level Input	5 V
	Input Resistance	3.6 kΩ
	Max. Input Frequency	5 kHz
	Propagation Delay Time	200 µs
1x Digital Output	Signal	Configurable open collector, opto-isolated sinking output
	Functions	Multi-functional, user-definable: drive disabled, drive enabled.
	Voltage	30 V
	Max. Current	100 mA
	Min. Load Resistance	300 Ω
	Output Voltage	2 V
	Min. Propagation Delay Time	1 ms (may be longer if load current is lower)

5.4 Communication

Table 5-4. Communication Specifications

Feature	Specification
CANopen	CANopen – CiA 301 application layer and CiA 402 device profile for drives and motion control. Baud rate 10 kbps – 1 Mbps CAN ID 1 – 127 (Default 127) Heartbeat producer, SDO, PDO (dynamic mapping)
EtherCAT	CANopen over EtherCAT (CoE) – CiA 301 application layer and CiA 402 device profile for drives and motion control. Communication cycle time: up to 250 µs.
RS232	Serial communication for configuration

5.5 Mechanical

Weight

Table 5-5. TIM with Single Turn Feedback

Feature	Unit	IM1 60S	IM1 60M	IM1 80S	IM1 80M
Weight, without brake	kg	0.98	1.32	1.68	2.20
Weight, with brake	kg	1.24	1.58	2.40	2.86

Table 5-6. TIM with Absolute Multiturn Feedback

Feature	Unit	IM1 60S	IM1 60M	IM1 80S	IM1 80M
Weight, without brake	kg	1.10	1.45	1.80	2.35
Weight, with brake	kg	1.35	1.70	2.52	3.00

Dimensions

Table 5-7. TIM models IM1 60S / 60M

Part Number	Power (W)	Length (mm) with Absolute Single turn Encoder	Length (mm) Absolute Multiturn Encoder
IM1-60SX3X5XXYY000	200	104.3	124.3
IM1-60SX3X5XXYYB00	200 with brake	121.3	141.3
IM1-60MX3X5XXYY000	400	124.3	144.3
IM1-60MX3X5XXYYB00	400 with brake	141.3	161.3

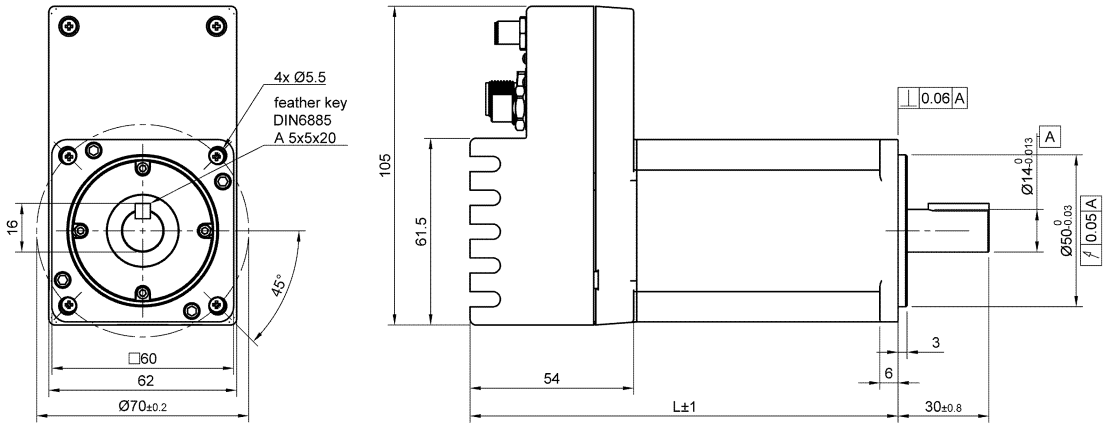


Figure 5-1. Dimensions - TIM models IM1 60S / 60M

Table 5-8. TIM models IM1 80S / 80M

Part Number	Power (W)	Length (mm) with Absolute Single turn Encoder	Length (mm) Absolute Multiturn Encoder
IM1-80SX3X5XXXX000	480	113.25	133.25
IM1-80SX3X5XXXXB00	480 with brake	143.25	163.25
IM1-80MX3X5XXXX000	800	130.25	150.25
IM1-80MX3X5XXXXB00	800 with brake	160.25	180.25

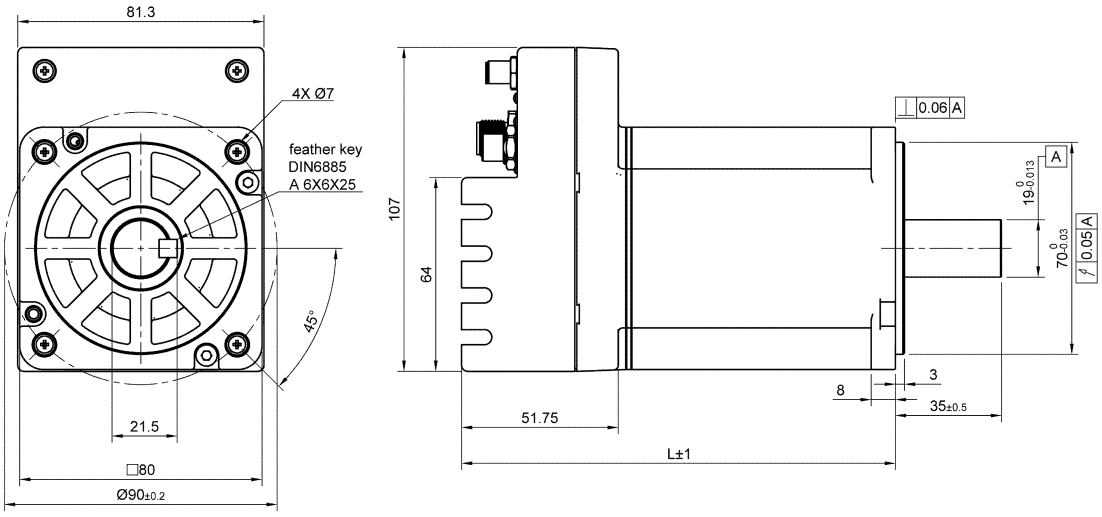


Figure 5-2. Dimensions TIM models I M1 80S / 80M

5.6 Environmental

The TIM has been designed and manufactured according to the standards specified in the following table. Testing and certifications are pending.

Table 5-9. Environmental Specifications

Feature	Specification
Environment	Ambient temperature: Operation: 0 – 40°C Storage: 0 – 70°C
	Humidity: 10 – 90%
	Altitude: <2,000 m (per EN IEC 61800-5-1)
	Vibration: 1g sine vibration from 10 Hz to 150 Hz (per EN IEC 61800-5-1)
	Shock: 5g half-sine for 30 m (per EN IEC 61800-2)
Operating Conditions	Protection class: IP54

5.7 Drive Protection

Table 5-10. Protection Specifications

Feature	Specification
Protective Functions	Overload limit, Over-voltage, Over-current, Under-voltage, Drive over-temperature, Over-speed, Velocity error, Position error, PLL lock lost, Position following error.

6 Installation

6.1 System Design

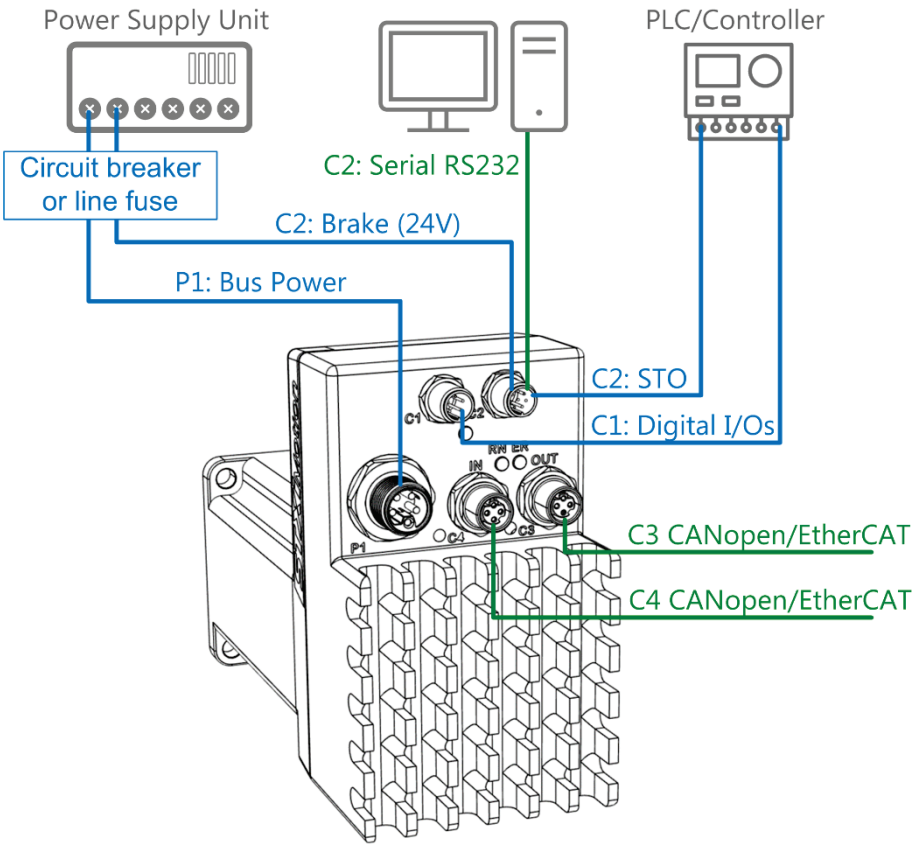


Figure 6-1 System Design

6.2 Setup Overview

Perform the following steps to install a TIM system.

1. Mount the TIM.
2. Make all wiring and cable connections, as required by your application:
   - DC bus voltage (P1)
   - CANopen/EtherCAT (C3, C4)
   - Digital inputs, digital outputs (C1)
   - Brake, STO, RS232 (C2)
3. Connect the TIM to the PLC and/or the PC (C4).
4. Power up the TIM and the PC.
5. Download and install Motion Suite for TIM on the PC, and use it to configure and test the TIM.

6.3 Wiring Guidelines

To ensure optimal performance, wire your system in accordance with the following guidelines:

- To reduce the effects of EMI, the following cables are recommended:
  - Power supply – shielded cables
  - CANopen/EtherCAT communication – twisted pairs and shielded cables
- Twisting must be maintained as close as possible to both ends of the cable.
- Shielding must be maintained at both ends of the cable.
- If connecting the power supply unit (PSU) to more than one TIM, use either a star or a bus connection, as shown in the following figures.

  When using a bus connection, be sure to select an appropriate wire gauge if minimal drive voltage is crucial.

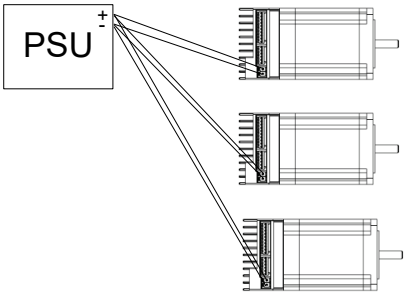


Figure 6-2. Star Connection

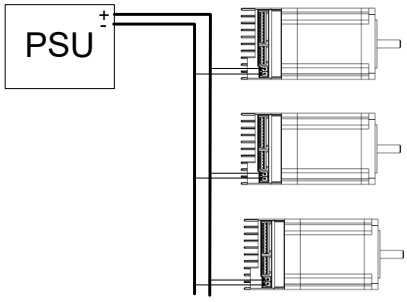


Figure 6-3. Bus Connection

Warning: *Do not daisy chain input voltage from one TIM to the next.*

6.4 Grounding

When connecting the TIM to other control equipment, be sure to follow two basic guidelines for proper functioning of the drive:

- The TIM should be grounded via functional earth ground (FE) of the voltage supply.
- Any motion controller, PLC or PC that is connected to the TIM must be grounded to the same earth ground as the TIM.

For more details, refer to the section *Electrical Safety* in Chapter 3 of this manual.

6.5 Electrical Interfaces

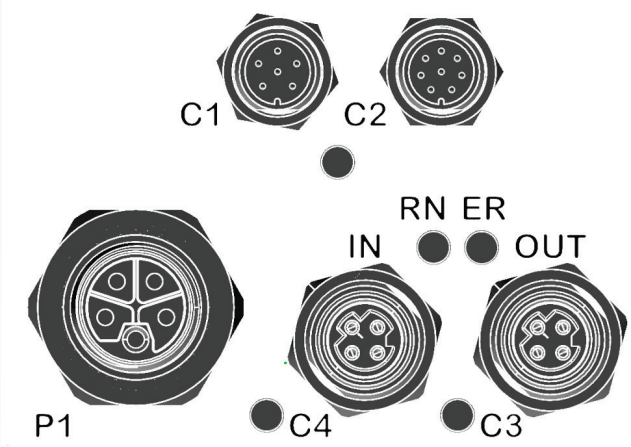


Figure 6-4 Interfaces

P1 – Power

Table 6-1. P1 Connectors

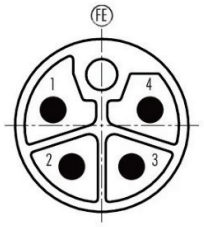
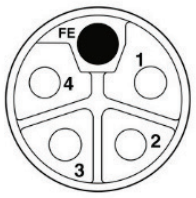
Interface	Item	Manufacturer	Manufacturer Part Number
	**Connector** M12 Male, 5-pin, L-coded	TE Connectivity	T4140L12051-000
	**Mating Cable** Power cable, 5-position, PUR, Length: 1.5 m AWG 14 or AWG 16	TE Connectivity	TE: T4151399L25-002 STXI: CBL-M1205PW-01

Table 6-2. P1 Pinout

Pin #	Signal Description
1	Vpower Power In+
2	Vpower Power In+
3	Vpower Power Ret -
4	Vpower Power Ret -
5	Functional earth (FE)

C1 – Digital I/Os

Table 6-3. C1 Connectors

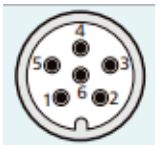
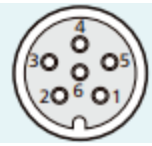
Interface	Item	Manufacturer	Manufacturer Part Number
	**Connector** M8 Male, 6-pin	Finecables	MB08MBAFF06ST
	**Mating Cable** M8 Female, Molded cable, Straight, Shielded	Finecables	FC: MA08FSAF06ST10CB14 STXI: CBL-M0806ACO-01

Table 6-4. C1 Pinout

Pin #	Signal Description
1	DIN 1
2	DIN 2
3	DIN 3
4	Out Com
5	DOUT 1
6	In Com

C2 – STO-Brake-RS232

Table 6-5. C2 Connectors

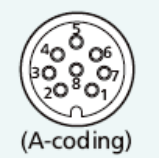
Interface	Item	Manufacturer	Manufacturer Part Number
	**Connector**. M8 Male, 8-pin	Finecables	MB08FBAFF08ST
	**Mating Cable**. M8 Female, Molded cable, Straight, Shielded	Finecables	MA08MSAF08STXXCB14 (XX = length)

Table 6-6. C2 Pinout

Pin #	Signal Description
1	STO_1
2	RS232 Rx
3	RS232 Tx
4	V_Brake
5	GND_Brake
6	STO GND
7	STO_2
8	RS232 GND

C3 – Fieldbus OUT – CANopen/EtherCAT

Table 6-7. C3 Connectors

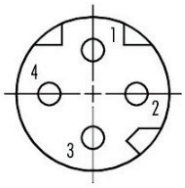
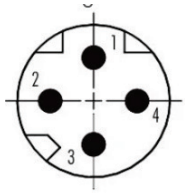
Interface	Item	Manufacturer	Manufacturer Part Number
	**Connector** M8 Female, 4-pin D-coded	Finecables	A838-CP-T0316
	**Mating Cable** M8 Male, 1 m Molded cable, Straight, Shielded, D-coded	Finecables	**M8 to M8:** FC: MA08MSDF04STx2-10CB25 STXI: CBL-M8M8ECD-001 **M8 to RJ45:** FC: MA08MSDF04ST10CB25-RJ45 STXI: CBL-M8RJ45D-001)

Table 6-8. C3 Pinout

Pin #	CANopen	EtherCAT
1	CAN_H	ECAT_OUT_Tx+
2	CAN_GND	ECAT_OUT_Rx+
3	CAN_L	ECAT_OUT_Tx-
4	CAN_GND	ECAT_OUT_Rx-

C4 – Fieldbus IN – CANopen/EtherCAT

Table 6-9. C4 Connectors

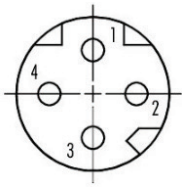
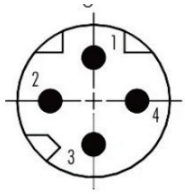
Interface	Item	Manufacturer	Manufacturer Part Number
	**Connector** M8 Female, 4-pin D-coded	Finecables	A838-CP-T0316
	**Mating Cable** M8 Male, 1 m Molded cable, Straight, Shielded, D-coded	Finecables	**M8 to M8:** FC: MA08MSDF04STx2-10CB25 STXI: CBL-M8M8ECD-001 **M8 to RJ45:** FC: MA08MSDF04ST10CB25-RJ45 STXI: CBL-M8RJ45D-001)

Table 6-10. C4 Pinout

Pin #	CANopen	EtherCAT
1	CAN_H	ECAT_OUT_Tx+
2	CAN_GND	ECAT_OUT_Rx+
3	CAN_L	ECAT_OUT_Tx-
4	CAN_GND	ECAT_OUT_Rx-

6.6 Computer System

The Motion Suite software requires Windows 10, 64-bit or higher.

The PC requires either of the following interfaces for serial communication with the TIM.

- A serial RS232 port
- A USB port with an USB-to-RS232 adaptor with ferrite bead.

To view recorded data, you need Microsoft Office Excel, or a similar spreadsheet software that supports CSV files.

6.7 Motion Suite Software

1. Download the Motion Suite installation file from the STXI Motion website or contact Technical Support.
2. Install the Motion Suite on your PC.

3. When installation is complete, start Motion Suite from the Windows Start menu or the shortcut on your desktop.

STXI Motion functionality is not available unless a TIM integrated motor is connected to and communicating with the PC.

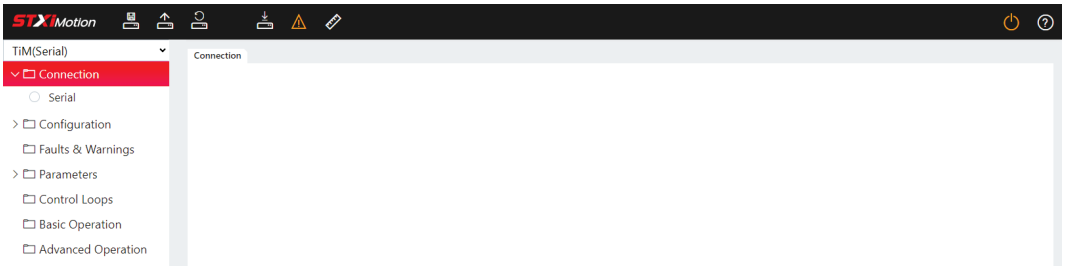


Figure 6-5 Motion Suite – not connected to drive

6.8 Fieldbus Devices (CANopen/EtherCAT)

- If using CAN protocol, an EDS (electronic data sheet) file for TIM must be loaded on the PC or PLC controller. Download the file from the STXI Motion website, or contact Technical Support.
- If using EtherCAT protocol, an ESI (EtherCAT slave information)/XML file for TIM must be loaded on the PC or PLC controller. Download the file from the STXI Motion website, or contact Technical Support.

6.9 Communication Cabling

Note

For commissioning and tuning the TIM, the PC running Motion Suite must be connected to the TIM through a serial RS232 port or a USB port with a USB-to-RS232 adaptor.

Once the drive is configured, you can then connect it to a PLC or controller over a CANopen/EtherCAT network.

Serial Cabling

A standard serial USB to RS232 adapter, shown in the following figure, is used to connect the TIM to the PC to enable communication with Motion Suite.

Figure 6-6 USB-to-RS232 adapter cable (example)

Figure 6-7 RS232/C2 connector cable (example)

Make the following cable connections. Refer to Interface C2 in section 6.5 *Electrical Interfaces*.

1. Before connecting the USB-to-RS232 adapter cable to the PC, be sure the proper device driver is installed in the PC.
2. Connect the USB-to-RS232 adapter cable to the USB port on the PC.
   The Found New Hardware Wizard will detect the device, and complete the driver installation.
3. Connect the D9 male connector on the USB-to-RS232 adapter cable to the D9 female connector on the RS232/C2 cable.
4. Connect the M8 connector on the RS232 cable to interface C2 on the TIM.
   Make sure pins 2, 3 and 8 are mated.

CANopen/EtherCAT Cabling

For fieldbus communication, use a cable with an M8 connector to connect to the TIM, and an RJ45 connector to connect to the master controller.

Figure 6-8 CANopen/EtherCAT connector cable (example)

CANopen Chain

If chaining TIM drives in a CANopen network, they can be connector in any order, with cables plugged in to either C4 or C3.

CANopen Termination

In a CANopen network, a 120Ω termination resistor is required on the last node in the chain.

To implement the termination of the CAN bus on the TIM, connect a D-coded, M8 male termination resistor plug, to connector C4/C3 on the last TIM in the chain.

EtherCAT Chain

If chaining TIM drives in an EtherCAT network, they must be connected sequentially; that is, master controller to Drive 1 In/C4 > Drive 1 Out/C3 to Drive 2/C4 In > Drive 2 Out/C3, and so forth.

6.10 Power Up

1. After completing the hardware connections and software installations, turn on power to the TIM.
2. Open Motion Suite software.
3. In the navigation menu, select Communication > **Serial.**
4. In the Communication screen, select the PC COM port that is connected to the TIM.
5. Click **Connect** to enable communication with the drive.

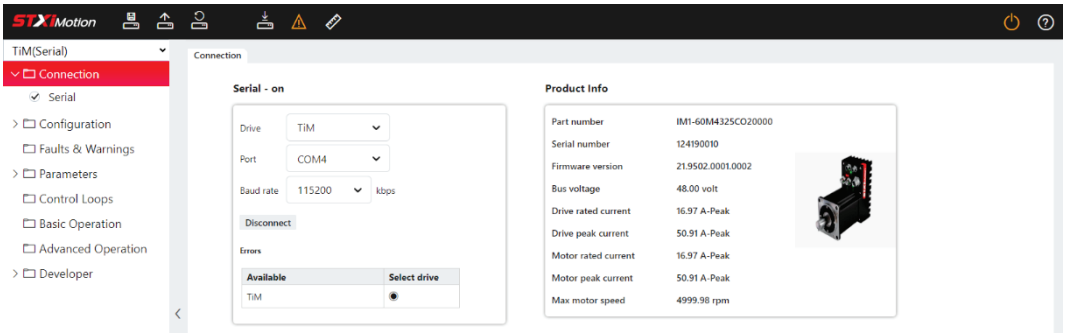


Figure 6-9 Motion Suite – connected to drive

7 Commissioning the TIM Drive

Confirm the TIM parameters and position units

Note The commissioning process does not require you to set parameters for the TIM motor, electronics or encoder. The parameters for these components are predefined in the product firmware. However, you must confirm product details before starting.

After establishing communication between the Motion Suite software and the TIM, do the following.

1. Check the details in the Product Info pane. Confirm that motor, drive, and feedback parameters match the connected TIM motor. Refer to the product label on the TIM.
2. Confirm that position units are correctly set for your application. If necessary, you can modify these settings.

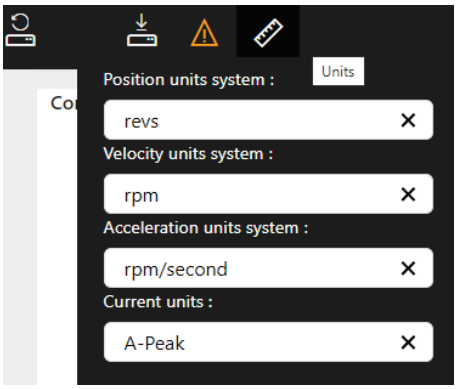


Figure 7-1 Motion Suite – position units

Test the motor response to a torque command

Note Test the motor **without a load** to confirm the motor moves in response to a torque command. After confirming proper motion, you can then add the load and/or install in your application.

To test the motor response, do the following.

1. Open the Basic Operation screen.
2. Select the Torque mode tab.
3. In the Current command field, enter **1** (A-Peak).
4. Press **Run** (or **Update**).

   Check the velocity gauge in the software. You should see a positive value.

   Check the motor. You should see it move in the positive (counter-clockwise) direction. To more easily view the actual motor motion, reduce the A-Peak value.

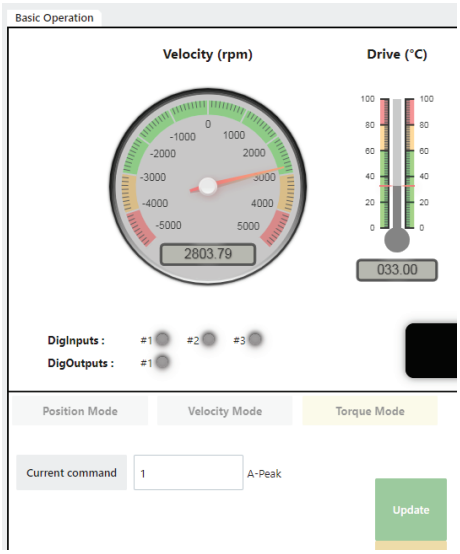


Figure 7-2 Motion Suite – torque positive motion

5. Press **Pause** to stop the motor motion.
6. In the Current command field, enter **-1** (A-Peak).
7. Press **Run** (or **Update**).

   Check the velocity gauge in the software. You should see a negative value.

   Check the motor. You should see it move in the negative (clockwise) direction. To more easily view the actual motor motion, reduce the A-Peak value.

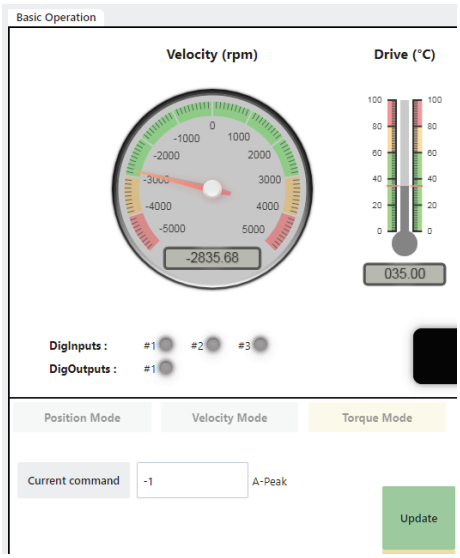


Figure 7-3 Motion Suite – torque positive motion

8. Press **Pause** to stop the motor motion.

If the motor moves as expected, you can now install the TIM in your application system or install the load on the shaft of the motor. Then proceed to tune the drive.

If there is a problem, contact STXI Motion Technical Support.

Turn off all velocity filters

Note There is no need for filters during the drive commissioning procedure.

Note Do not attempt to manipulate filter parameters unless specifically instructed to do so by STXI Motion Technical Support.

1. Open the Control Loops screen.

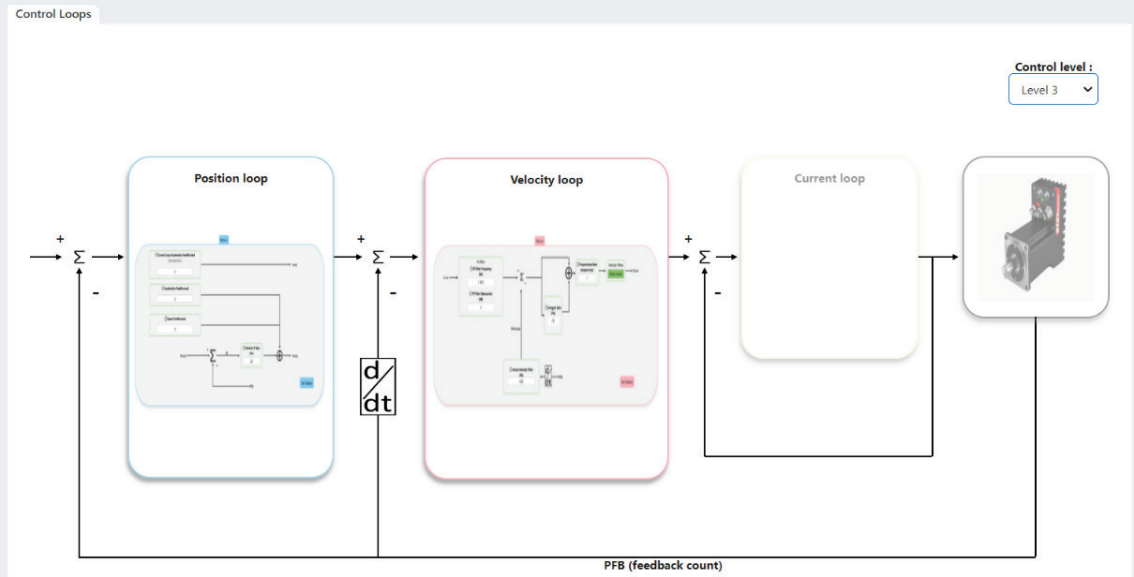


Figure 7-4 Motion Suite – Control Loops screen

2. Click on the Velocity Loop segment to enlarge the schematic dialog box.
3. Clear the option **Hide Filters**.

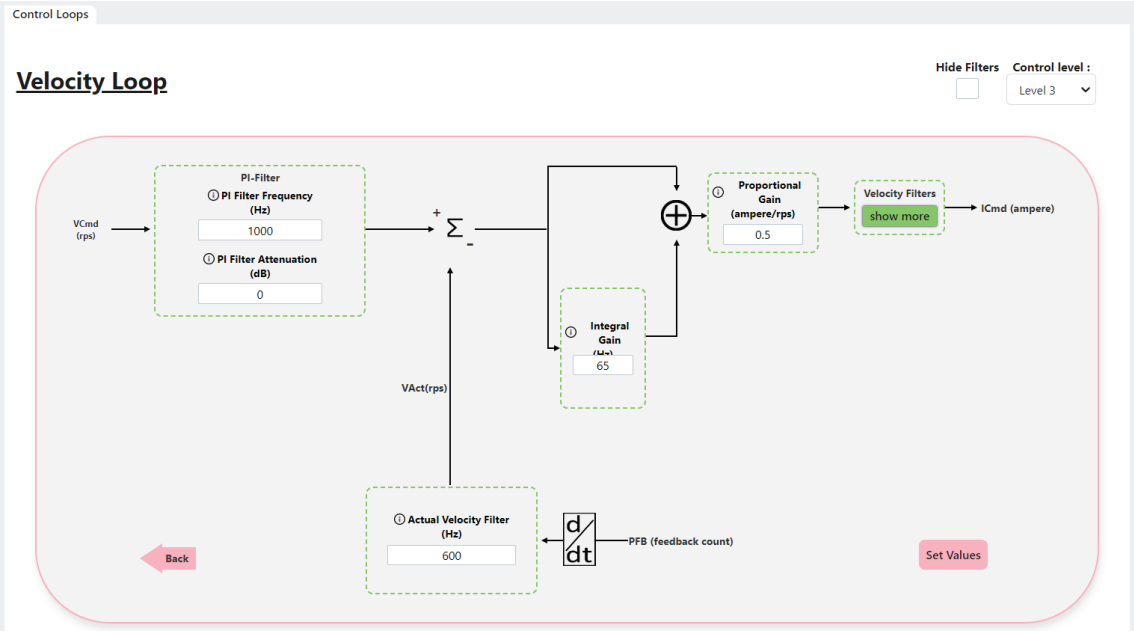


Figure 7-5 Motion Suite – Velocity Loop schematic dialog

4. In the Velocity Filters segment, press **Show More.**
5. In the Velocity Filters dialog box, select **0-None** for both Filter 1 and Filter 2 Type.

   This turns off all velocity filters.

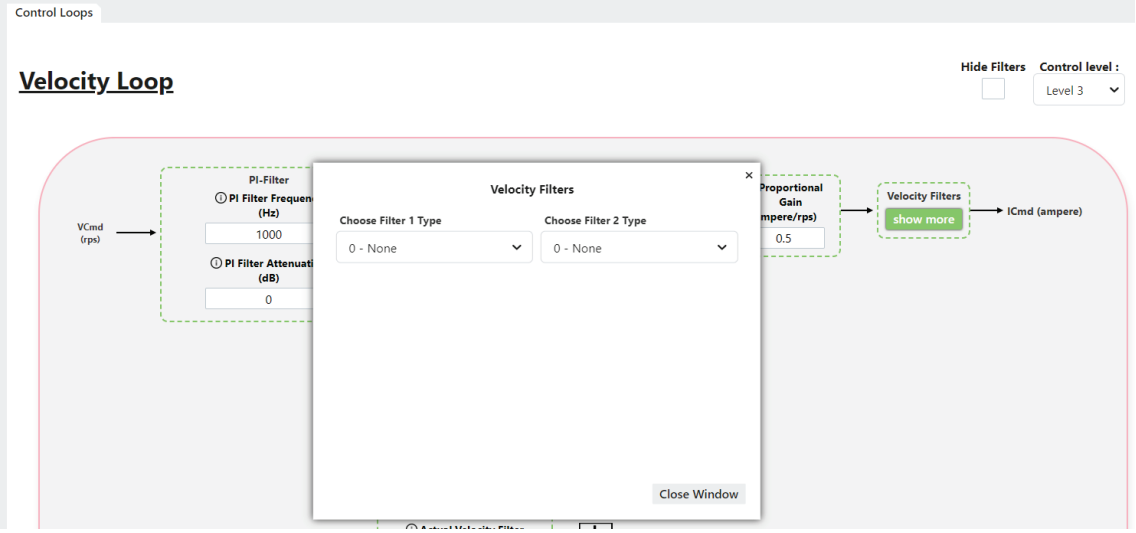


Figure 7-6 Motion Suite – Velocity Filters

Tune the gains in velocity loop

Note

The TIM system has three levels of control, which enable the user to decide whether to use minimal parameter modification, or a more complex control design. Parameter settings from Level 1 can be incorporated into Level 2, which can then be integrated into Level 3 control.

Levels 1 and 2 rely on the TIM Autotuning feature, which is still in development. Therefore, the instructions for tuning the drive use Control Level 3 (L3) parameters.

To set the velocity integral gain (L3ki) and velocity proportional gain (L3kv), do the following.

1. Open the Advanced Operation screen.
2. Select the Velocity Mode tab.
3. Set Acceleration, Deceleration, and Velocity command values appropriate for your application. The values shown in the figure below should be suitable.
4. In the Tuning Parameters pane, set **L3ki** (velocity integral gain) to **0**, and set **L3kv** (velocity proportional gain) to **0.001**. Press **Set parameters**.

Note

Be sure to press **Set parameters** after modifying values in the Tuning Parameters pane. Otherwise, values will not be updated in the drive.

5. In the Recording Setup pane, do the following:

   a. Define a recording time that will be sufficient to capture the entire acceleration phase until the motor reaches a constant velocity. For example, set Gap to **16**, and Points to **2000**. Total time will automatically be set to 2 seconds.

   b. Select the parameters **Vact** and **Vcmd** to be recorded.

   c. Set the Trigger Condition to **Immediate**.

   d. Enable the option **Delete Previous Records**.

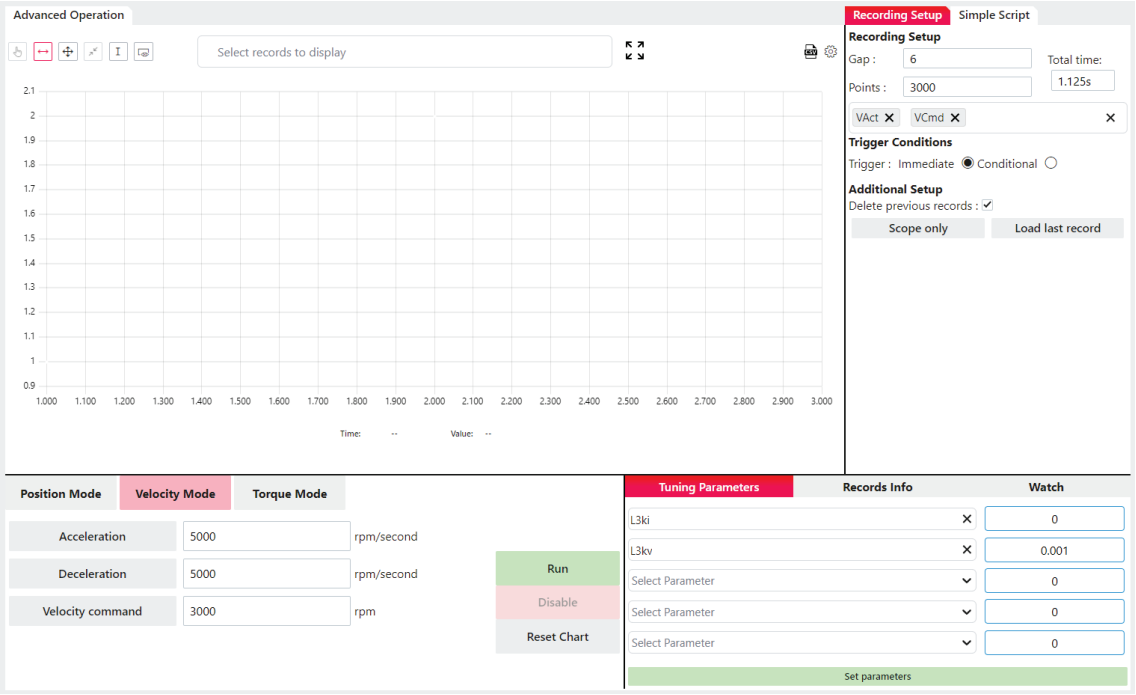


Figure 7-7 Motion Suite – Advanced Operation screen for recording

6. Press **Run**.

   Note that the motor should **not** move.

7. Wait for the velocity command to be executed, and for the recording plot to be displayed on the graph.

   You should see a half-trapezoid, representing the acceleration and target speed of the velocity command.

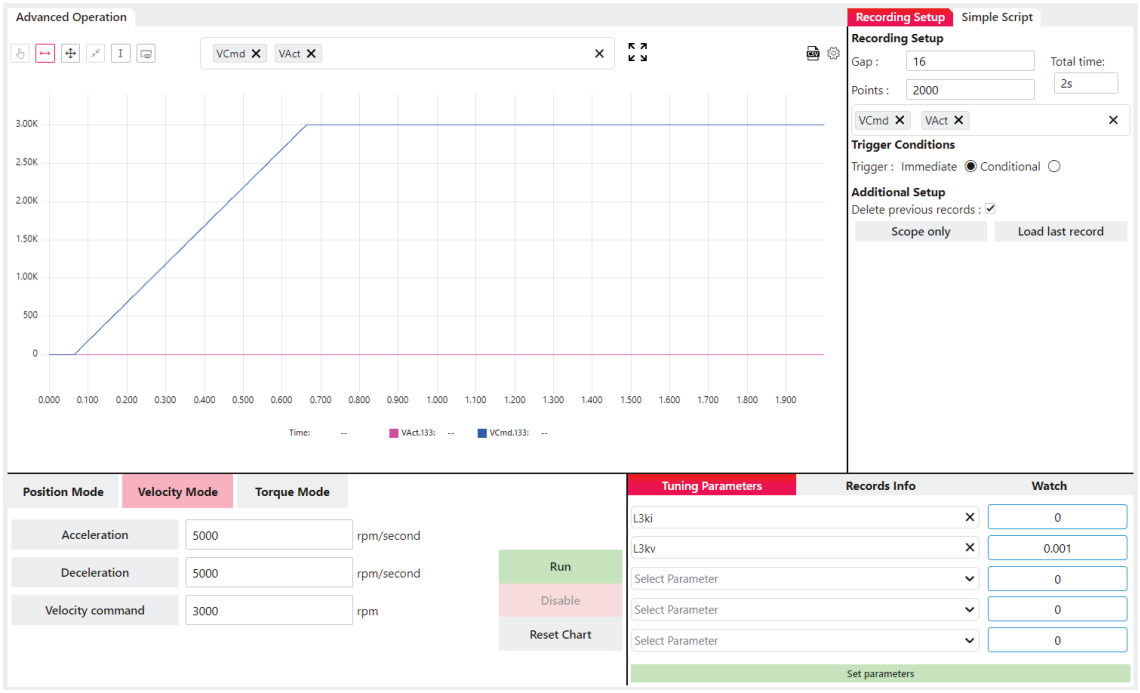


Figure 7-8 Velocity command profile

8. Leave the value of L3ki (velocity integral gain) at **0**, and do the following:

a. Gradually increase the value of L3kv (velocity proportional gain), in increments ranging between 0.5 to 1.0.

b. Press **Set parameters**.

c. Press **Run**.

d. Check the recorded plot.

e. Repeat steps **a to d** until you see that the actual velocity value closely follows the velocity command value.

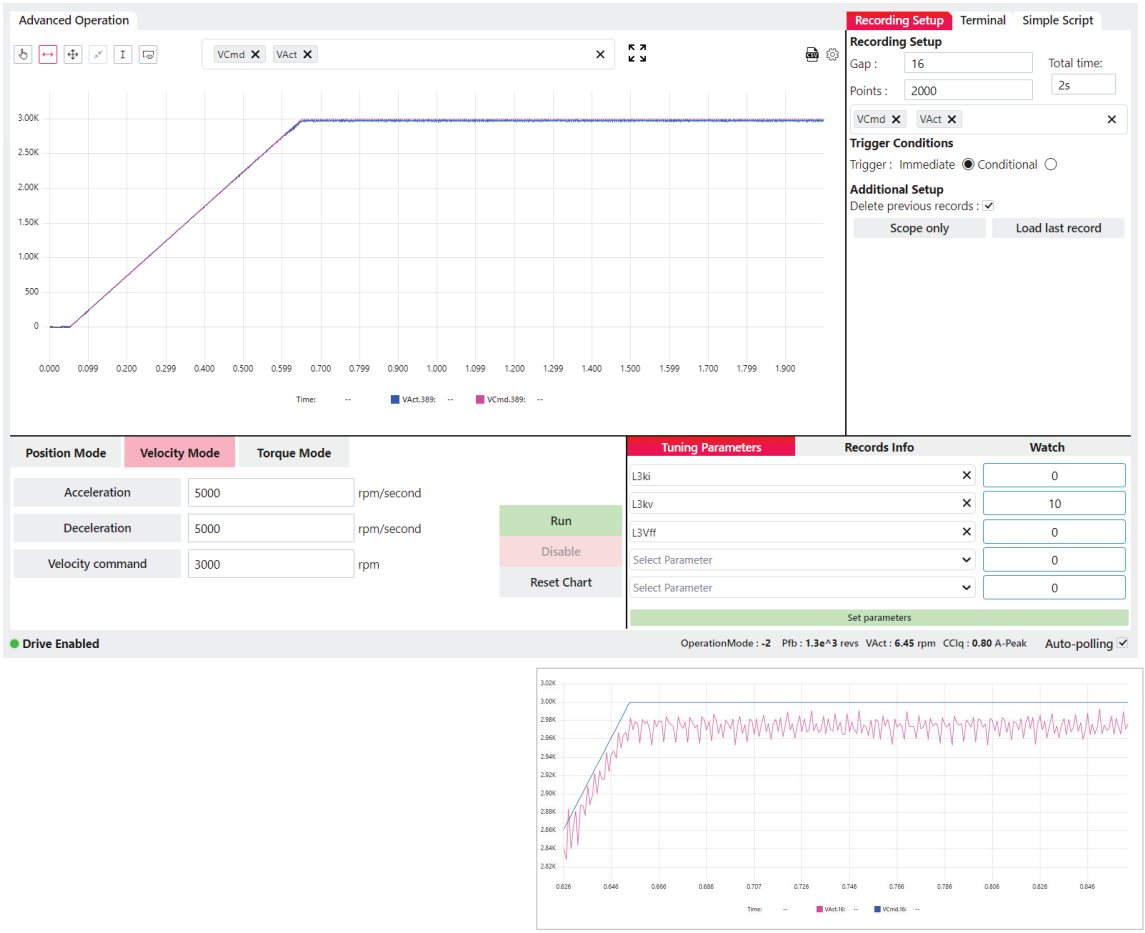


Figure 7-9 Velocity gains – preliminary tuning (inset: before tuning L3ki)

9. With the drive **enabled**, gradually increase the value of L3ki (velocity integral gain), in increments of 10, until you hear the motor making distinct crackling sounds.

   Be sure to press **Set parameters** each time you modify L3ki.

10. Once you reach this noisy motor condition, reduce the value of K3kv by half, and press **Set parameters**.

11. Press **Run**.

    In the recorded plot, you should see that the actual velocity value overlaps the velocity command value.

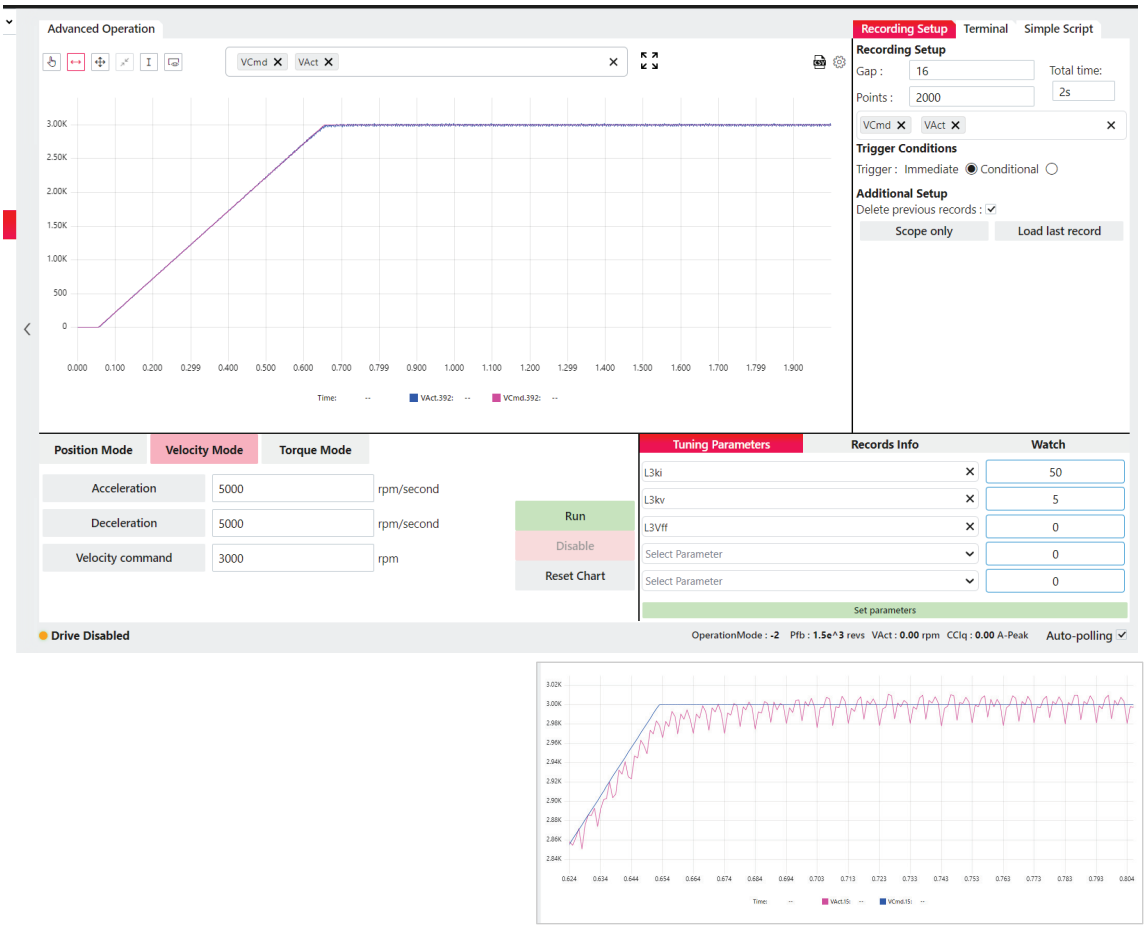


Figure 7-10 Velocity gains optimization (inset: after tuning L3ki)

12. If necessary, continue to adjust the parameters, without causing any distinct motor noise, or with as little noise as possible:

Increase the velocity integral gain (L3ki) in increments ranging between 1 and 2.

Increase the velocity proportional gain (L3kv) in increments ranging between 0.05 and 0.1.

Test the position loop

After setting the velocity gains, make sure the position profile is also a trapezoid.

To test the position control loop, execute a position command that is appropriate for your application. The values shown in the figure below should be suitable.

1. In the Advanced Operation screen, select the Position Mode tab.

a. Keep the same Acceleration, Deceleration, and Velocity command values that you used in Velocity Mode.

b. Set the Position command value.

c. Enable the option for **Incremental** position.

2. Press **Run**.

The recorded plot should be a trapezoid that represents the motion profile.

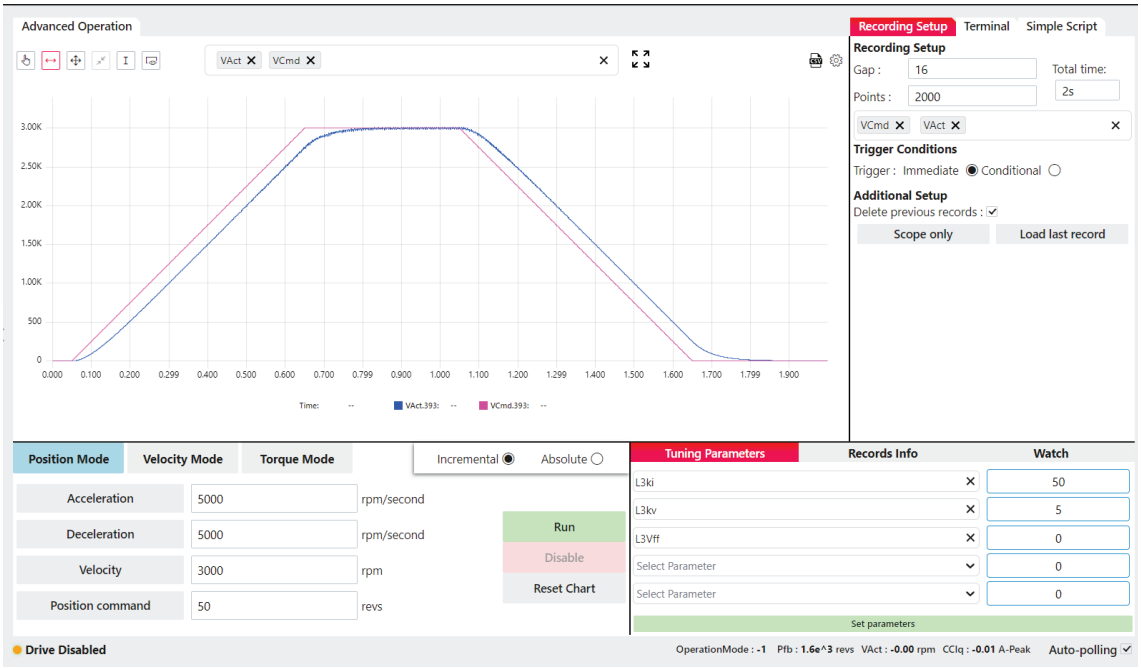


Figure 7-11 Position motion profile

Optimize the position error

1. In the Recording Setup pane, delete parameters Vcmd and Vact.

   Select the parameter **Pe** (position error) to be recorded.

2. Press **Run**.

   The recorded plot should be a trapezoid that represents the position error.

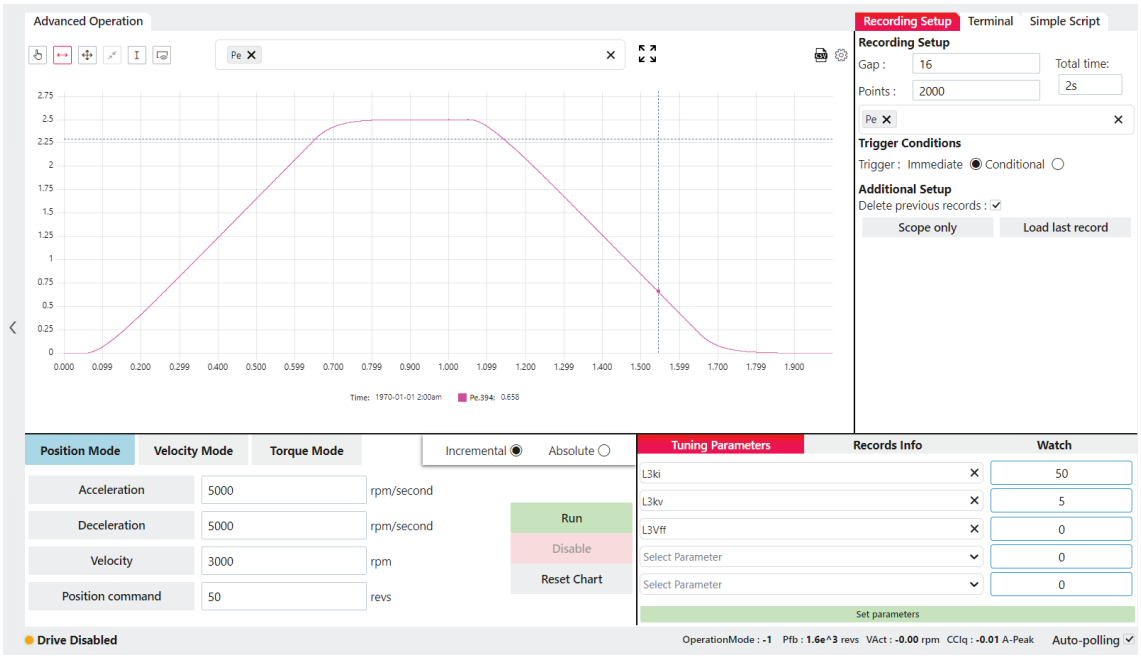


Figure 7-12 Position error profile

3. To reduce the position error and achieve optimal following of the motion profile, add velocity feedforward to the control loop.

   a. In the Tuning Parameters pane, add the parameter **L3Vff** (Velocity Feedforward).

   b. Set the value of L3Vff to **1**, and press **Set parameters**.

   c. Press **Run**.

   The recorded plot of the position error should resemble the one in the following figure.

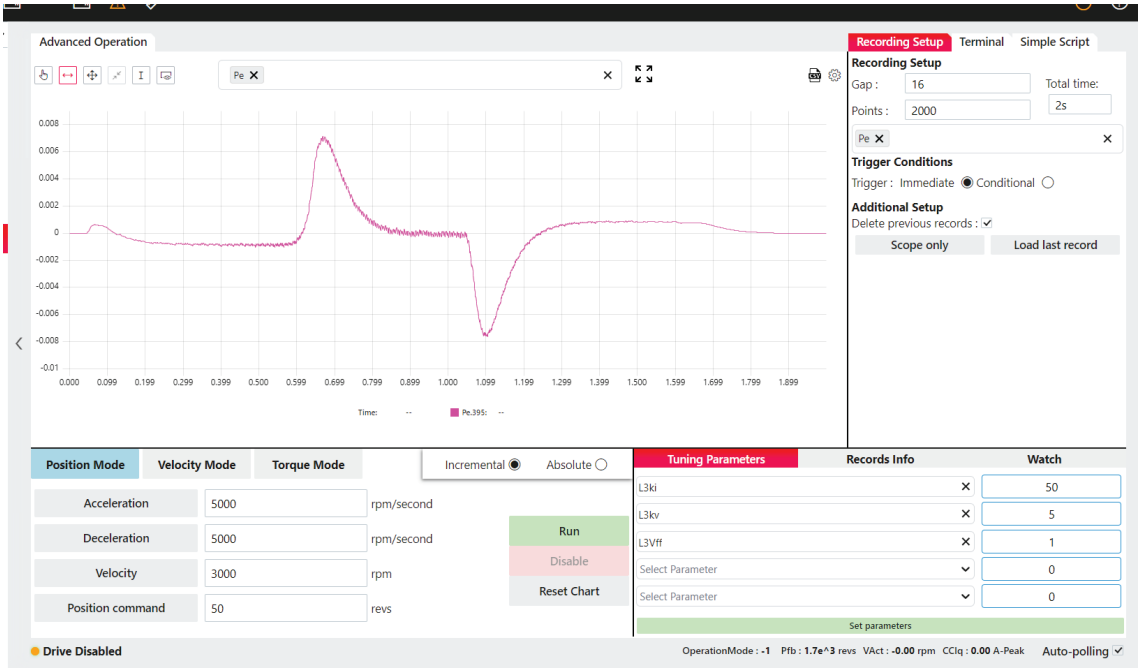


Figure 7-13 Optimization of position error, with velocity feedforward

If the plot displays a velocity ripple, as shown in the following figure, contact STXI Motion Technical Support.

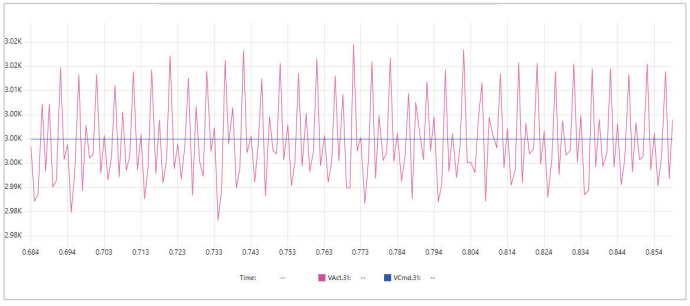


Figure 7-14 Velocity ripple

Save the control parameters to the drive

When you are satisfied with the results of tuning, press the **Save to drive** button in the toolbar.

8 Network Communication

8.1 CANopen Network

CANopen Network Management

CANopen network nodes and states are controlled by network management (NMT) messages. The following diagram shows the network states and transitions.

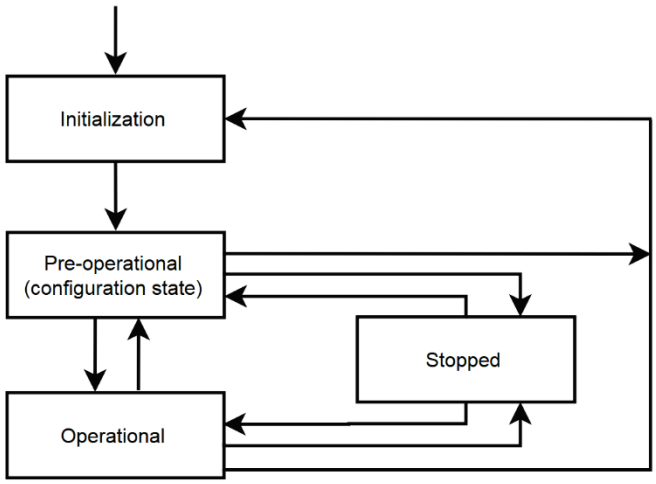


Figure 8-1. CANopen Network Management (NMT) States

- **Pre-operational state**. This state is used primarily for configuration of the CANopen device; therefore, the exchange of process date via PDOs is not possible in this state, and the device cannot be enabled in this state.
- **Operation state**. In this state the transmission of process data via PDOs is possible. This is the only state in which a device can be enabled.
- **Stopped**. A node cannot transmit or receive any other messages in this state. A device cannot be enabled when in this state.

CANopen Node ID

The default node ID for the TIM is **CAN-ID:127.**

To modify the node ID, use the serial parameter **CanNodeID.**

Note: *A CANopen/EtherCAT object is not yet implemented for Node ID.*

1. Save the new node ID in the TIM.
2. Cycle power to the drive.
3. The new node ID will be set upon power-up.

CANopen Baud Rate

The default baud rate for the TIM is 1000 kbps.

Possible baud rates in CANopen are: 125, 250, 500, 1000.

To modify the baud rate, use the **serial** parameter **CanBaudRate**.

Note: *A CANopen/EtherCAT object is not yet implemented for Baud Rate.*

1. Save the new baud rate in the TIM.
2. Cycle power to the drive.
3. The new baud rate will be set upon power-up.

8.2 EtherCAT Network

EtherCAT Address

During the start-up phase, the EtherCAT master device sends an auto-addressing telegram to the slave devices – each slave receives an address and auto-increments the address to the next higher number for the following slave. The EtherCAT master then continues to query each EtherCAT slave for details about its properties.

All addressing is performed by the EtherCAT master device according to the EtherCAT standard; there are no address settings for the user to manipulate.

EtherCAT Network Management

EtherCAT network nodes and states are controlled by network management (NMT) messages. The following diagram shows the network states and transitions.

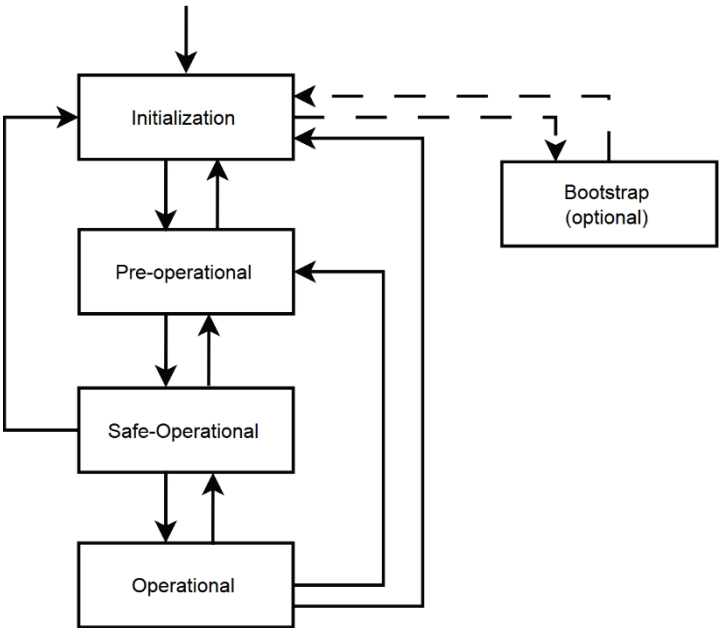


Figure 8-2. EtherCAT Network Management (NMT) States

- **Init**. No communication on the application layer is available. The master has access only to the DL-information registers.
- **Pre-operational.** Mailbox communication on the application layer available, but no process data communication available
- **Safe-operational**. Mailbox communication on the application layer, process (input) data communication available. In SafeOp only inputs are evaluated; outputs are kept in 'safe' state.
- **Operational**. Process data inputs and outputs are valid.
- **Bootstrap**. Optional but recommended if firmware updates are required. No process data communication. Communication only via mailbox on Application Layer. Special mailbox configuration is possible, e.g. larger mailbox size. In this state the FoE protocol is usually used for firmware download

9 Motor Brake Control

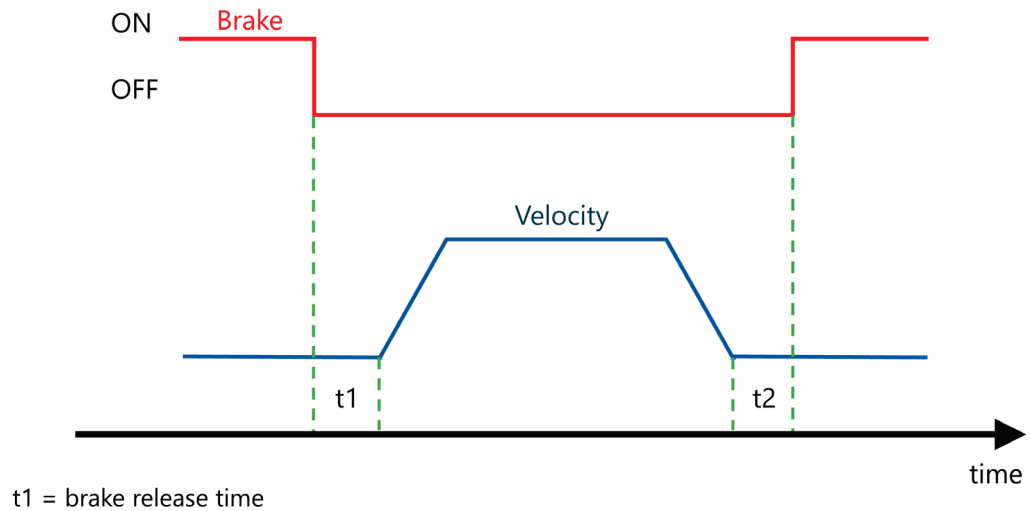
9.1 Holding Brake

The TIM can be supplied with or without a holding brake. It is not possible to retrofit the holding brake.

The brake works according the closed-circuit current principle, and opens when voltage of 24 VDC ±10% is supplied.

If the power supply is interrupted, as in an emergency stop or a power outage, the brake stops the motor shaft rotation.

When using the holding brake, the TIM requires a separate 24 VDC power supply at connector C2, pins 4 and 5 (refer to section *Electrical Interfaces*).



t1 = brake release time
t2 = brake pull-in time

Figure 9-1.

Table 9-1. 60 mm flange Motor Brake Specifications

Voltage	VDC	24 ±10%
Power	W	7.4
Static Torque min.	Nm	1.3
Resistance	Ω	78 ±10%
Release Voltage	V	> 1
Pull-in Voltage	V	≤ 16.8
Release time	ms	30
Pull-in time	ms	50

Table 9-2. 80 mm Flange Motor Brake Specifications

Voltage	VDC	24 ±10%
Power	W	13.5
Static Torque min.	Nm	4.0
Resistance	Ω	42.7 ±10%
Release Voltage	V	> 1.2
Pull-in Voltage	V	≤ 16.8
Release time	ms	30
Pull-in time	ms	60

Note In vertical axis applications, it is necessary to implement additional safety measures, such as, but not only, mechanical interlocks, redundant brakes.

9.2 Manual Brake Disengagement

There are no specific commands that allow the user to explicitly disengage/engage the brake on the TIM.

During maintenance, however, the user might need to release the brake and move the motor. For such a purpose, use the following procedure:

1. Disable the drive.
2. Use the serial parameter **BrakeSupport**, or the CANopen object **0x210F**.

   Define the parameter/object value as:

   0: No brake on TIM.

   The brake is considered disengaged; the motor can be moved.

   1: TIM has brake.

   The brake is controlled by the drive.
   When the drive is disabled, the brake is engaged; the motor cannot be moved.
   When the drive is enabled, the brake is disengaged; the motor can be moved.

The parameter value can be modified only when the drive is disabled.

The parameter value is stored in the drive's non-volatile (flash) memory.

10 Digital Inputs and Outputs

The digital inputs and outputs can be configured in the Motion Suite software.

In the navigation menu, select Communication > **Configuration** > **IO config**.

10.1 Serial

The **Digital Inputs** tab enables you to configure functionality and polarity of the digital inputs, and to monitor the state of the digital inputs.

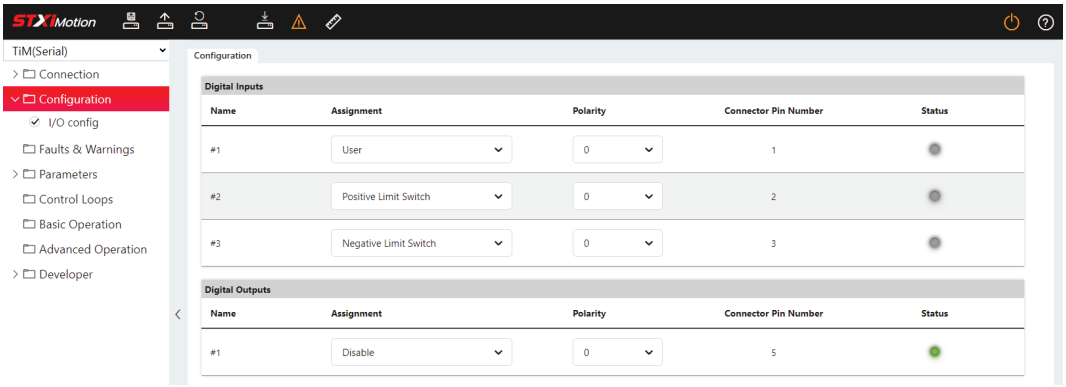


Figure 10-1 Motion Suite – IO configuration

Digital Inputs

Element	Description	Serial Parameters
Name	Identifies the specific input.	
Assignment	Defines the functionality of the digital input. 1 = User defined 2 = Position limit 3 = Negative limit 4 = Home switch	DigInput1Assign DigInput2Assign DigInput3Assign
Polarity	Defines the polarity of a digital input. 0 = Not inverted 1 = Inverted As a result of inversion, the Status graphic element in the software changes color.	DigInput1Polarity DigInput2Polarity DigInput3Polarity
Connector Pin Number	Indicates the pin number of the input on interface C1.	
Status	A graphic element that toggles between green and gray to reflect the on and off states of the actual input.	DigInput1 DigInput2 DigInput3

Digital Outputs

The **Digital Inputs** pane enables you to configure functionality and polarity of the digital output, and to monitor the state of the digital output.

Element	Description	Serial Parameters
Name	Identifies the specific output.	
Assignment	Defines the functionality of the digital output. 0 = Not used 1 = User defined 2 = Drive disabled 3 = Drive enabled	Out1Assign
Polarity	Defines the polarity of a digital output. 0 = Not inverted 1 = Inverted As a result of inversion, the Status graphic element in the software changes color.	Out1Polarity
Connector Pin Number	Indicates the pin number of the output on interface C1.	
Status	A graphic element that toggles between green and gray to reflect the on and off states of the actual output.	DigOutput1

10.2 CANopen/EtherCAT

Input and output functionality is implemented in the TIM according to the CAN standard.

- Object 60FDh – Inputs
- Object 60FE – Outputs

Note: *Object 60FD (digital inputs) not yet implemented for EtherCAT*.

Note: *Object 60FE (digital outputs) not yet implemented for CANopen*.

Digital Inputs – CANopen

Object 60FDh is organized bit-wise.

Bit	Field	Bit Value	Definition
0	Negative limit switch	0 1	Negative limit switch not reached Negative limit switch reached
1	Positive limit switch	0 1	Negative limit switch not reached Negative limit switch reached
2	Home switch	0 1	Home switch not reached Home limit switch reached
3	Reserved/Interlock	0	Not applicable
4–15	–		Not applicable
16-31	Manufacturer-specific: bit 16 – digital input 1 bit 17 – digital input 2 bit 18 – digital input 3	0 1	Function is not activated Function is activated

Digital Outputs - EtherCAT

Object 60FEh is organized bit-wise.

The object includes sub-indices.

	Field	Bit Value	Definition
Sub-index 01	Set brake	0 1	Switch off / do not set brake Switch on / set brake
Sub-index 01	Reserved	0	Reserved
Sub-index 01	Manufacturer-specific	0 1	Switch off Switch on
Sub-index 02	Each bit	0 1	Disable output Enable outputs

11 Firmware Upgrade

Firmware Upgrade via RS232/Motion Suite

Drive firmware is downloaded to drive through a serial connection and the Motion Suite software.

Note Firmware download over CAN or EtherCAT is not yet supported.

Preparation

1. Download the required firmware file from the STXI Motion website, or contact Technical Support. The firmware file has the extension **bHex** or **Hex**.
2. Read the release note or other documentation supplied with the new firmware.
3. Before upgrading the firmware, it is recommended that you backup the drive parameters, since parameter settings may be modified during the upgrade process. After the upgrade is completed, the parameters can be restored.

   To backup parameters from drive:

   a. Open Motion Suite.

   b. In the navigation menu, select **Parameters**.

   c. At the top of the Parameters screen, select **Export Parameters**.

      Export Parameters saves all the parameters in the drive to a CSV file, and automatically downloads the file to the **Download** folder on your PC. You can rename the file and store it in any other location on your PC.

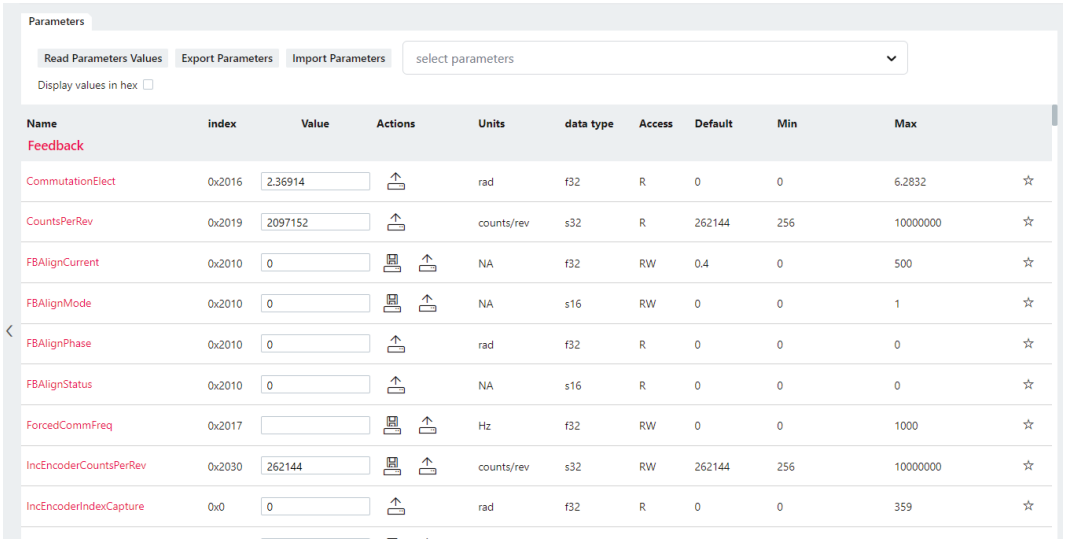


Figure 11-1 Motion Suite – Parameters

Procedure

1. Before downloading firmware to the TIM, make sure the drive is disabled.
2. From the Motion Suite toolbar, select **Download Firmware**. 
3. At the prompt, Select **Load File**.
4. Browse to and select the new firmware file, and click **Open**.
5. Select **Download**.

   Downloading the firmware file to the drive takes 1–2 minutes.

Resuming Operation

1. Confirm that the new firmware has been downloaded to drive. Open the Motion Suite Connections screen, and check the Firmware version displayed in the Product Info pane:

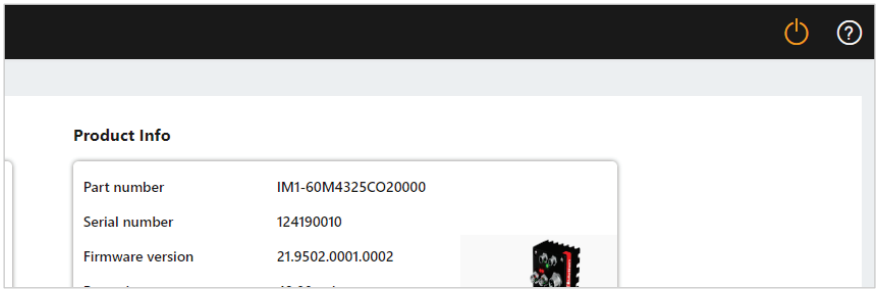


Figure 11-2 Motion Suite – Firmware version

2. Restore the saved parameters to the drive.
   a. At the top of the Parameters screen, select **Import Parameters**.
   b. At the prompt, select **Upload file**.
   c. Browse to and select (Open) the CSV file you saved on your PC.
   d. At the prompt, select **Import Parameters**.
3. Check the version release notes.
4. Set any parameters that may have been added in the new version.

Note If the fault message **Corrupted Parameters** is displayed after the firmware upgrade, press the **Save to drive** button in the toolbar. 

12 Troubleshooting

12.1 LEDs

One tri-color LED serves as a drive status indicator.

Four LEDs serve as fieldbus indicators.

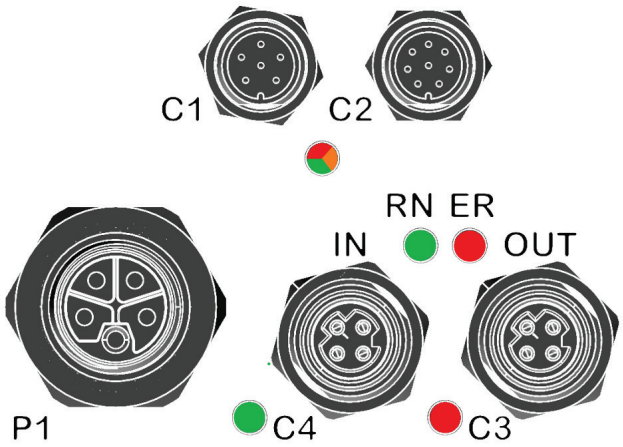


Figure 12-1 Communication and Drive Status Indicator LEDs

Link Activity Status – LEDs C4 and C3 – EtherCAT only

Color	LED state	Description
Green (C4) Red (C3)	Off	No link
	Blinking	Link and activity
	On	Link without activity

Drive Status – Tri-colored LED – CANopen and EtherCAT

Power Up (boot)

Color	LED state	Description
Green	Blinking	Immediately after power up. Evaluating checksum of the application firmware.
Orange	Blinking	Immediately after power up. Evaluating checksum of a new (recently downloaded) application firmware within a backup sector.
Orange	Blinking (other)	Immediately after power up and before application firmware starts running. Indicates a reprogramming sequence after firmware download.
Orange	Flashing	Application firmware checksum failure. Drive requires repair. (1s on > 1s off > 1s on > 1s off > 1s on > 3s off.)

Operational

Color	LED state	Description
Green	On	The TIM is enabled. No faults.
Green	Flashing	The TIM is disabled. No faults. (1000 ms on, 1000 ms off).
Red	On	A fault has been detected and needs attention. The LED remains lit until the error is resolved.
Red	Flashing	STO disconnected. (1000 ms on, 1000 ms off).
Red	Blinking	STO one channel diagnostic fault. (300 ms on, 300 ms off).
Red/Orange	Blinking	Watchdog. (300 ms red, 300 ms orange)

Run Status – RN – CANopen

Color	LED State	Slave State	CANopen Description
Green	On	Operational	The device is in Operational state.
Green	Blinking	Pre-operational	The device is in Pre-operational state.
Green	Single flash	Stopped	The device is in Stopped state.

Error Status – ER – CANopen

Color	LED State	Error Name	CANopen Description
Red	Off	No error	The device is in working condition
Red	On	Bus off	The CAN controller is bus off
Red	Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames).
Red	Double flash	Error control event	A guard event (NMT-slave or NMT-master) or a heartbeat event (heartbeat consumer) has occurred.

Run Status – RN – EtherCAT

Color	LED State	Slave State	EtherCAT Definition
Green	On	Operational	The device is in Operational state.
Green	Off	Initialization	The device is in Initialization state.
Green	Blinking	Pre-operational	The device is in Pre-operational state.
Green	Single flash	Safe-operational	The device is in Safe-operational state.

Error Status – ER – EtherCAT

Color	LED State	Error Name	EtherCAT Definition
Red	Off	No error	EtherCAT communication of the device is in working condition.
Red	On	Application controller failure	A critical communication or application controller error has occurred.
Red	Single flash	Local Error	Slave device application has changed the EtherCAT state autonomously due to local error (Error Indicator bit is set to 1 in AL Status register.) *Unsolicited state change*.
Red	Double flash	Process data watchdog timeout/ EtherCAT watchdog timeout	An application watchdog timeout has occurred.
Red	Blinking	Invalid Configuration	General configuration error
Red	Flickering	Booting error	Booting error was detected. Init state reached, but Error Indicator bit is set to 1 in AL Status register.

12.2 Warnings and Faults

The following tables list the warnings and faults issued through serial communication.

For EtherCAT/CAN error codes and bitmasks, refer to object **603Fh** (Error Code) and object **2032h** (Fault word) in the *TIM EtherCAT/ CANopen User Manual*.

Warnings

Warnings are not considered faults and do not disable operation. The system automatically clears the warning state when the condition that generated the warning no longer exists.

Fault ID#	Serial String	Description
0	No User Enable	Drive is Disabled. Indicates the user enable command (serial command **En** or the relevant bits in fieldbus control word) is missing.
43	Drive Overload Warning	This warning is issued when the drive's overload current (serial command **DriveOverLoadI**) is slightly above drive's peak current (serial command **DriveIPeak**), and there is no Drive Overload fault
45	Motor Overload Warning	This warning is issued when the motor's overload current (serial command **MotorOverLoadI**) is slightly above motor's peak current (serial command **MotorIPeak**), and there is not Motor Overload fault.
46	Drive Over Temp Warning	This warning is issued when the measured drive temperature (serial command **DriveTemp**) reaches 5°C below the drive temperature threshold (serial command **DriveTempThreshold**); that is, 5°C before the drive temperature fault occurs.
56	Drive Under Voltage Warning	The warning is issued when the measured bus voltage (serial command **BusVoltageSense**) drops to within 2V of the undervoltage threshold (serial command **UnderVoltageThreshold**); that is 2V before the undervoltage fault occurs.
58	Heatsink Over Temp Warning	The warning is issued when the measured heatsink temperature (serial command **HeatSinkTemp**) reaches 5°C below the heatsink temperature threshold (serial command **HeatsinkTempThreshold**); that is, 5°C before the heatsink temperature fault occurs.
63	STO Not Active Warning	This warning is issued when STO voltage is removed while the drive is enabled.

Fault ID#	Serial String	Description
71	Motor Over Temp Warning	The warning is issued when the measured motor temperature (serial command **MotorTemp**) reaches 5°C below the motor temperature threshold (serial command **MotorTempThreshold**); that is, 5°C before the motor temperature fault occurs.

Faults

Faults occur when settings or conditions may adversely affect TIM operation or damage the drive.

Faults automatically disable the drive, and the fault status is indicated by LEDs and/or software messages.

The drive fault status is generally latched, and the drive cannot be enabled until the fault status is explicitly cleared. The fault status cannot be cleared until the fault condition no longer exists.

Fault ID#	Serial String	Description	TIM Response
1	Current Offsets Invalid	This fault is in effect until the drive completes the offset compensation calculation for the A2D converters, which sample the motor phase U, V and W currents.	Immediate disable
7	Overload Design Failed	This fault occurs in two instances: ▪ If the drive is enabled and the drive's peak current (serial command **DriveIPeak**) is equal to or below the drive's rated current (serial command **DriveIRated**). ▪ This fault occurs if the drive is enabled and the motor's peak current (serial command **MotorIPeak**) is equal to or below the motor's rated current (serial command **MotorIRated**).	Immediate disable
15	Invalid Halls State	This fault is applicable to motors with an incremental encoder and Hall sensor feedback. This fault occurs when the three Hall switches are all either logically high or logically low, which are invalid Hall states.	Immediate disable

Fault ID#	Serial String	Description	TIM Response
16	Invalid Halls Switch	This fault is applicable to motors with an incremental encoder and Hall sensor feedback. This fault occurs when an invalid Hall switch is detected.	Immediate disable
22	Manufacturer Info Read Error	This fault indicates that reading manufacturer data from non-volatile memory has failed. This fault cannot be cleared by the **Clearfaults** command. Try clearing the fault by power cycling the drive. If the fault persists, contact STXI Motion Technical Support.	Immediate disable
23	Manufacturer Info Write Error	This fault indicates that writing manufacturer data to non-volatile memory or erasing manufacturer data from non-volatile memory has failed. This fault cannot be cleared by the **Clearfaults** command. Try clearing the fault by power cycling the drive. If the fault persists, contact STXI Motion Technical Support.	Immediate disable
24	PWM Driver Error	This fault occurs in several instances: ▪ If the gate driver type could not be read from the manufacturer data in non-volatile memory (serial command **GateDriveType**). ▪ If the gate driver type is unknown to the firmware (serial command **GateDriveType**). ▪ If configuration of the gate driver (e.g., via SPI interface) has failed. This fault cannot be cleared by the **Clearfaults** command. Try clearing the fault by power cycling the drive. If the fault persists, contact STXI Motion Technical Support.	Immediate disable
25	Fieldbus Sync Loss	This fault occurs if the drive loses synchronization with the fieldbus master during enable. Refer to object 210Bh PLL Information Parameters.	Immediate controlled stop

Fault ID#	Serial String	Description	TIM Response
26	Corrupted Parameters File	This fault occurs if the loading of parameter data from the flash memory fails due to a missing file, a corrupted file, or unknown/invalid data content. The fault can be cleared by saving the parameter (serial command **SaveParams 1**).	Immediate disable
27	Motor Over Speed	This fault occurs if the drive is enabled and the actual velocity (serial command **VAct**) briefly exceeds the overspeed threshold (5 consecutive samples). The overspeed threshold is the minimum of the user overspeed setting (serial command **Overspeed**), and 1.2 times the maximum motor speed (serial command **MotorSpeed**).	Immediate disable
28	Drive Over Current	This fault occurs if the CPU reads a momentary or latched over-current hardware indication on a dedicated CPU input pin. At least 1 second should elapse from the time over-current fault was detected until there is an attempt to clear it. Only 3 over-current fault clears are allowed. The fourth over-current fault cannot be cleared. Try clearing the fault by power cycling the drive.	Immediate disable
29	Drive Over Voltage	This fault occurs in two instances. ▪ If the measured bus voltage (serial command **BusVoltageSense**) exceeds the overvoltage threshold (serial command **OverVoltageThreshold**). **OverVoltageThreshold** is the minimum of: ♦ General TIM maximum voltage rating of the drive (hardware-dependent). ♦ 1.5 times the motor voltage (serial command **MotorVoltage**). ♦ 1.75 times the TIM drive voltage (serial command **Vbus**). ▪ By a hardware signal (if that feature is enabled).	Immediate disable

Fault ID#	Serial String	Description	TIM Response
30	Drive Over Temp	This fault occurs if the measured drive temperature (serial command **DriveTemp**) exceeds the drive temperature threshold (serial command **DriveTempThreshold**).	Immediate controlled stop
31	Motor Over Temp	This fault occurs if the motor has a temperature sensor, and the measured motor temperature (serial command **MotorTemp**) exceeds the motor temperature threshold (serial command **MotorTempThreshold**).	Immediate controlled stop
32	PE Max Exceeded	This fault occurs if the drive is enabled and the following error of the position loop (serial command **Pe**) exceeds the user-defined following error threshold (serial command **PeMax**). A **PeMax** value of 0 deactivates this fault. Tuning the control loops will affect generation of this fault.	Immediate controlled stop
33	MT6835 Enc Over Speed Reached	This fault occurs when, for 3 consecutive cycles of 62.5 µs (3 x 62.5 µs), the MT6835 feedback device reports a **Rotation Overspeed Warning** in it STATUS register. This error is reported by the feedback device itself. The maximum rotation speed of the MT6835 feedback device is 120,000 rpm. This fault cannot be cleared by the **Clearfaults** command. Try clearing the fault by power cycling the drive. If the fault persists, contact STXI Motion Technical Support.	Immediate disable

Fault ID#	Serial String	Description	TIM Response
34	MT6835 Enc Weak Magnetic Field	This fault occurs when, for 3 consecutive MTS cycles of 62.5 µs (3 x 62.5 µs), the MT6835 feedback device reports a **Weak Magnetic Field Warning** in it STATUS register. This error is reported by the feedback device itself. This fault cannot be cleared by the **Clearfaults** command. Try clearing the fault by power cycling the drive. If the fault persists, contact STXI Motion Technical Support.	Immediate disable
35	MT6835 Enc No Communication	This fault occurs when, for 3 consecutive MTS cycles of 62.5 µs (3 x 62.5 µs), the CPU reads 0xFFFF,FFFF from the MT6835 feedback device. This is due to a missing connection to the feedback device.	Immediate disable
36	MT6835 Enc CRC Failed	This fault occurs when, for 3 consecutive MTS cycles of 62.5 µs (3 x 62.5 µs), the CPU detects a CRC error of the data received from the MT6835 feedback device.	Immediate disable
37	EE Emulator Error	This fault occurs if a file erasure fails.	Immediate disable
39	Drive Under Voltage	The fault occurs if the measured bus voltage (serial command **BusVoltageSense**) reaches or drops below the undervoltage threshold (serial command **UnderVoltageThreshold**) for 3 samples.	Immediate controlled stop
42	Drive Overload	This faults occurs if the command to the current controller (serial command **Icmd**) is saturated by the drive's overload current (serial command **DriveOverLoadI**), and this fault is enabled (serial command **OverloadMode** = 0).	Immediate disable

Fault ID#	Serial String	Description	TIM Response
44	Motor Overload	This fault occurs if the command to the current controller (serial command **Icmd**) is saturated by the motor's overload current (serial command **MotorOverLoadI**), and this fault is enabled (serial command **OverloadMode** = 0).	Immediate disable
54	MT6835 Enc Under Voltage	This fault occurs when, for 3 consecutive MTS cycles of 62.5 µs (3 x 62.5 µs), the MT6835 feedback device reports a **Weak Under Voltage Warning** in its STATUS register. This error is reported by the feedback device itself. This fault cannot be cleared by the **Clearfaults** command. Try clearing the fault by power cycling the drive. If the fault persists, contact STXI Motion Technical Support.	Immediate disable
57	Heatsink Over Temp	This fault occurs when the measured heatsink temperature (serial command **HeatSinkTemp**) exceeds the heatsink temperature threshold (serial command **HeatsinkTempThreshold**).	Immediate controlled stop
59	Authorization Key Is Missing	The error occurs if the product did not receive an authorization key during the production process. Contact STXI Motion Technical Support.	Immediate disable

Fault ID#	Serial String	Description	TIM Response
60	Motor Brake Fault	This fault occurs in the following instances: ▪ Brake overcurrent. The brake current is 1.5 times greater than the brake peak current, where the brake peak current equals brake voltage (serial command **BrakeVoltage**), divided by the brake resistance (serial command **BrakeResistance**), for brake types (serial command **BrakeType**) 1 or 2. ▪ The actual brake state (engaged or disengaged) does not match the commanded state, for brake type (serial command **BrakeType**) 1 or 2. ▪ Hardware brake fault indication, for brake type (serial command **BrakeType**) 0.	Immediate disable
61	Heatsink Temp Sensor Fault	This fault occurs if communication with the heatsink temperature sensor fails. In this case, the displayed heatsink temperature will exceed 1000°C.	Immediate controlled stop
62	STO Not Active Fault	This fault occurs if STO voltage is removed while the drive is enabled.	Immediate disable
64	STO Channel 1 Diagnostic Fault	This fault occurs if the diagnostics of STO channel 1 detects a failure in this channel; for example, the diagnostic momentarily asserts STO channel 1, but the hardware feedback indicates that STO channel 1 is not asserted. If the diagnostics of both STO channel 1 and STO channel 2 fail, the drive will reset itself. Contact STXI Motion Technical Support.	Immediate controlled stop
65	STO Channel 2 Diagnostic Fault	This fault occurs if the diagnostics of STO channel 1 detects a failure in this channel; for example, the diagnostic momentarily asserts STO channel 2, but the hardware feedback indicates that STO channel 2 is not asserted. If the diagnostics of both STO channel 1 and STO channel 2 fail, the drive will reset itself. Contact STXI Motion Technical Support.	Immediate controlled stop

Fault ID#	Serial String	Description	TIM Response
66	BiSS Config Failed	This fault occurs if initialization of the BiSS encoder fails.	Immediate disable
67	BiSS Communication Fault	The fault occurs if there are consecutive communication failures (CRC, watchdog, timeout) with the BiSS encoder.	Immediate disable
68	BiSS Feedback Alarm	This fault occurs if the BiSS encoder sets its alarm bit (encoder temperature sensor) too high.	Immediate disable
69	Biss Feedback Warning Bit is Set	This fault occurs when the BiSS encoder sets it warning bit. All BiSS encoder warning bits are OR'ed together.	Immediate disable
70	CAN Init Failed	This fault occurs if the BiSS encoder set a warning bit in its telegram.	Immediate disable
72	Motor Temp Sensor Fault	This fault occurs if initialization of the CAN module fails.	Immediate controlled stop
73	Invalid Drive Peak Current	The fault occurs if the drive peak current (serial command **DriveIPeak**) exceeds 1000 A. Contact STXI Motion Technical Support.	Immediate disable
74	Invalid Drive Rated Current	The fault occurs if the drive rated current (serial command **DriveIRated**) exceeds 1000 A. Contact STXI Motion Technical Support.	Immediate disable
75	Personality Info Invalid	This fault occurs if either the digital board EEPROM or the power board EEPROM was not completely initialized with proper values during production process. Contact STXI Motion Technical Support.	Immediate disable
76	CAN Baud Rate Changed	This fault occurs if the CAN baud rate was modified (serial command **CanBaudRate**) after the CAN module was initialized. This fault cannot be cleared. The fault disappears after Save (serial command **SaveParams 1**) and power cycle after the new baud rate is applied.	Immediate disable

Fault ID#	Serial String	Description	TIM Response
77	Unknown Flash Size	This fault occurs if the digital board EEPROM does not contain a valid value for the digital board QSPI flash size. The serial command **FlashSize** reads that flash-size value out of the EEPROM and the error is raised in case that the flash size was not yet programmed to the EEPROM (value -1 is returned). Contact STXI Motion Technical Support.	Immediate disable
78	No Remote Enable	This fault occurs if the functionality of one of the digital inputs is assigned to mode 5 (serial command **DigInput1Assign** or **DigInput2Assign** or **DigInput3Assign**), and the input is at low level.	None (special case)
79	Consumer 1 Heartbeat Fault	CANopen. This fault occurs if heartbeat 1 is defined and no heartbeat is detected within the designated time (heartbeat period).	Immediate controlled stop
80	Consumer 2 Heartbeat Fault	CANopen. This fault occurs if heartbeat 2 is defined and no heartbeat is detected within the designated time (heartbeat period).	Immediate controlled stop
81	Feedback Extrapolations Limit	This fault occurs if two or more consecutive feedback interpolations were performed (feedback interpolation is performed when a communication-based feedback device experiences a communication error, such as timing or CRC.	Immediate disable
82	Ethercat PHY Write Fault	This fault occurs when a write command to the PHY's register is executed, and the value that is read from the register is not equal to the value that is written. This fault can be cleared.	Immediate disable

Fault ID#	Serial String	Description	TIM Response
83	Fieldbus Connection Loss Fault	This fault occurs for an EtherCAT drive if the EtherCAT slave stack code reports a Sync Manager Watchdog error in the EtherCAT state machine register AL Status (ESC registers 0x130 and 0x134) and the drive is in the enabled state. This condition may occur, for example, when unplugging the EtherCAT cable.	Immediate controlled stop
84	Encoder Power Failure	This fault occurs when the encoder power supply fails.	Immediate disable
85	PWM driver power supply failure	This fault occures when the PWM driver power supply fails.	Immediate disable

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