



iPOS360x Multi-axis Motion System

v1.0E

T E C H N O S O F T

Intelligent Drives

Technical Reference

iPOS360x **Multi-axis Motion System** **Technical Reference**

P091.084.4xiPOS360x.UM.0117

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Read This First

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About This Manual

This book is a technical reference manual for the **iPOS360x Multi-axis Motion System** version **1.0E**.

Paragraph 0 shows how to quickly identify the iPOS360x Multi-axis Motion System version. If your product is version 1.0B or 1.0C, please refer to the iPOS360x Multi-axis Motion System Technical Reference Manual with p/n: P091.084.4xiPOS360x.UM.0911 (1.0B) and 0413 (1.0C). They can be requested at support@technosoftmotion.com.

Notational Conventions

This document uses the following conventions:

- iPOS** – any drive from iPOS family
- iPOS360x** – any iPOS3602 or iPOS3604 drive
- TML** – Technosoft Motion Language
- #1 - #4** – axis 1 to 4
- J110 (#1)** – connector J110 with signals for axis 1

Related Documentation

iPOS360x VX-CAN Technical Reference (part no. P091.028.iPOS360x.VX.UM.xxxx) – describes the hardware installation of the iPOS360x VX family of intelligent servo drives including the technical data, the connectors and the wiring diagrams needed for installation and an overview of the setup steps and motion programming options

iPOS360x MX-CAN Technical Reference (part no. P091.028.iPOS360x.MX.UM.xxxx) – describes the hardware installation of the iPOS360x MX family of intelligent servo drives including the technical data, the connectors and the wiring diagrams needed for installation and an overview of the setup steps and motion programming options

Help of the EasySetUp software – describes how to use **EasySetUp** to quickly setup any Technosoft drive for your application using only 2 dialogues. The output of EasySetUp is a set of setup data that can be downloaded into the drive EEPROM or saved on a PC file. At power-on, the drive is initialized with the setup data read from its EEPROM. With EasySetUp it is also possible to retrieve the complete setup information from a drive previously programmed. EasySetUp includes a firmware programmer with allows you to update your drive firmware to the latest revision. **EasySetUp can be downloaded free of charge from Technosoft web page**

Motion Programming using EasyMotion Studio (part no. P091.034.ESM.UM.xxxx) – describes how to use the EasyMotion Studio to create motion programs using in Technosoft Motion Language (TML). EasyMotion Studio platform includes **EasySetUp** for the drive/motor setup, and a **Motion Wizard** for the motion programming. The Motion Wizard provides a simple, graphical way of creating motion programs and automatically generates all the TML instructions. *With EasyMotion Studio you can fully benefit from a key advantage of Technosoft drives – their capability to execute complex motions without requiring an external motion controller, thanks to their built-in motion controller.* **A demo version of EasyMotion Studio (with EasySetUp part fully functional) can be downloaded free of charge from Technosoft web page**

iPOS CANopen Programming (part no. P091.063.iPOS.UM.xxxx) – explains how to program the iPOS drives using **CANopen** protocol and describes the associated object dictionaries for the supported profiles

TML_LIB v2.0 (part no. P091.040.v20.UM.xxxx) – explains how to program in **C, C++, C#, Visual Basic or Delphi Pascal** a motion application for the Technosoft intelligent drives using TML_LIB v2.0 motion control library for PCs. The TML_lib includes ready-to-run examples that can be executed on **Windows** or **Linux** (x86 and x64).

TML_LIB LabVIEW v2.0 (part no. P091.040.LABVIEW.v20.UM.xxxx) – explains how to program in **LabVIEW** a motion application for the Technosoft intelligent drives using TML_LIB_Labview v2.0 motion control library for PCs. The TML_Lib_LabVIEW includes over 40 ready-to-run examples.

TML_LIB S7 (part no. P091.040.S7.UM.xxxx) – explains how to program in a PLC **Siemens series S7-300 or S7-400** a motion application for the Technosoft intelligent drives using TML_LIB_S7 motion control library. The TML_LIB_S7 library is **IEC61131-3 compatible**.

TML_LIB CJ1 (part no. P091.040.CJ1.UM.xxxx) – explains how to program in a PLC **Omron series CJ1** a motion application for the Technosoft intelligent drives using TML_LIB_CJ1 motion control library for PCs. The TML_LIB_CJ1 library is **IEC61131-3 compatible**.

TML_LIB X20 (part no. P091.040.X20.UM.xxxx) – explains how to program in a B&R PLC series X20 a motion application for the Technosoft intelligent drives using TML_LIB_X20 motion control library for PCs. The TML_LIB_X20 library is **IEC61131-3 compatible**

TechnoCAN (part no. P091.063.TechnoCAN.UM.xxxx) – presents TechnoCAN protocol – an extension of the CANopen communication profile used for TML commands

If you Need Assistance ...

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Make suggestions about, or report errors in documentation.	Mail: Technosoft SA Avenue des Alpes 20 CH-2000 NEUCHATEL Switzerland

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1. Safety information

Read carefully the information presented in this chapter before carrying out the drive installation and setup! It is imperative to implement the safety instructions listed hereunder.

This information is intended to protect you, the drive and the accompanying equipment during the product operation. Incorrect handling of the drive can lead to personal injury or material damage.

Only qualified personnel may install, setup, operate and maintain the drive. A “qualified person” has the knowledge and authorization to perform tasks such as transporting, assembling, installing, commissioning and operating drives.

The following safety symbols are used in this manual:



WARNING! *SIGNALS A DANGER TO THE OPERATOR WHICH MIGHT CAUSE BODILY INJURY. MAY INCLUDE INSTRUCTIONS TO PREVENT THIS SITUATION*



CAUTION! *SIGNALS A DANGER FOR THE DRIVE WHICH MIGHT DAMAGE THE PRODUCT OR OTHER EQUIPMENT. MAY INCLUDE INSTRUCTIONS TO AVOID THIS SITUATION*



CAUTION! *INDICATES AREAS SENSITIVE TO ELECTROSTATIC DISCHARGES (ESD) WHICH REQUIRE HANDLING IN AN ESD PROTECTED ENVIRONMENT*

1.1. Warnings



WARNING! *THE VOLTAGE USED IN THE DRIVE MIGHT CAUSE ELECTRICAL SHOCKS. DO NOT TOUCH LIVE PARTS WHILE THE POWER SUPPLIES ARE ON*



WARNING! *TO AVOID ELECTRIC ARCING AND HAZARDS, NEVER CONNECT / DISCONNECT WIRES FROM THE DRIVE WHILE THE POWER SUPPLIES ARE ON*



WARNING! *THE DRIVE MAY HAVE HOT SURFACES DURING OPERATION.*



WARNING! *DURING DRIVE OPERATION, THE CONTROLLED MOTOR WILL MOVE. KEEP AWAY FROM ALL MOVING PARTS TO AVOID INJURY*

1.2. Cautions



CAUTION! THE POWER SUPPLIES CONNECTED TO THE DRIVE MUST COMPLY WITH THE PARAMETERS SPECIFIED IN THIS DOCUMENT



CAUTION! TROUBLESHOOTING AND SERVICING ARE PERMITTED ONLY FOR PERSONNEL AUTHORISED BY TECHNOSOFT



CAUTION! *THE DRIVE CONTAINS ELECTROSTATICALLY SENSITIVE COMPONENTS WHICH MAY BE DAMAGED BY INCORRECT HANDLING. THEREFORE THE DRIVE SHALL BE REMOVED FROM ITS ORIGINAL PACKAGE ONLY IN AN ESD PROTECTED ENVIRONMENT*

To prevent electrostatic damage, avoid contact with insulating materials, such as synthetic fabrics or plastic surfaces. In order to discharge static electricity build-up, place the drive on a grounded conductive surface and also ground yourself.

2. Product Overview

2.1. Introduction

The **iPOS360x Multi-axis Motion System** provides a compact, ready-to-run solution for multi-axis applications up to 4 axes. It includes the following main components:

- ☐ **iPOS360x Multi-axis Motion System** main board
- ☐ up to 4 **iPOS360x VX-CAN¹** intelligent drives

The **iPOS360x Multi-axis Motion System** main board allows you to plug in up to four iPOS360x VX-CAN drives and provides, for each one, all the necessary connectors: for the motor, the encoder feedback and the I/O signals. All the drives are connected between them via a CAN-bus link. Two CAN-bus connectors plus an optionally connectable terminal resistor ensure rapid connection to any CAN-bus network configuration. An RS-232 link offers easy access to all drives for setup and testing, using a standard PC. The **iPOS360x Multi-axis Motion System** top execution (p/n P028.002.E894) also includes an Ethernet port and an Ethernet-to-CAN adapter.

2.2. Key Features

- Compact ready-to-run solution for up to 4 axes (WxLxH): 100.3 x 98 x 37² mm
- Supply: Motor/power: +9.... +36 V_{DC}; Logic: +7.... +36 V_{DC}
- Output current:
 - iPOS3604: 4 A cont. (BLDC mode), 10 A_{PEAK}
 - iPOS3602: 2 A cont. (BLDC mode), 3.2 A_{PEAK}
- Communication: CAN-bus up to 1Mb/s, RS-232 up to 115k, and Ethernet 100 Mb/s³
- 3 possible address ranges for the 4 axes: 1-4, 22-25 or 43-46, selectable via a jumper

¹ **iPOS360x MX-CAN** drives may also be used together with their I/O board adapter, p/n P028.101.E101

² Including the iPOS360x mounted

³ Only p/n P028.002.E894 with Ethernet interface

- CAN-bus protocols: CANopen (CiA301v4.2, DSP305v2.2, DSP402v3.0) or Technosoft's TMLCAN, selectable via a jumper
- Delivery options: from one to four iPOS3602 VX-CAN or iPOS3604 VX-CAN Intelligent Servo Drives, each offering:
 - High-performance control of rotary or linear brushless, DC brushed or step motors
 - Sinusoidal (FOC) or trapezoidal (Hall-based) control of brushless motors
 - Open-loop (up to 256 μ steps/step) or closed-loop control of 2 and 3-phase steppers
 - Torque, speed or position control
 - Feedback options: incremental single-ended or RS-422 differential encoders, 1Vpp sine/cosine encoders, digital or linear Hall sensors;
 - Various modes of operation: position or speed profiles (trapezoidal or S-curve), interpolated (PT and PVT), external (pulse & direction, analogue), electronic gearing or camming (with master position sent via CANbus)
 - Powerful TML instruction set for definition / execution of motion sequences (TMLCAN protocol)
 - Standalone operation with stored motion sequences (TMLCAN protocol)
 - 5 digital inputs, 5-36V(compatible with NPN outputs): Enable, 2 limit switches, 2 general-purpose
 - 3 digital outputs, 5-36V, 0.5A: Ready, Error, 1 general-purpose
 - 2 analogue inputs 12-bit, 0-5V: Reference, Feedback or general-purpose
 - Protections to over-current, short-circuit, over- / under-voltage, I2t, control error

2.3. Identifying the board revision

Figure 1 shows how to identify the *iPOS360x Multi-axis Motion System* board version on its top side.

This manual refers to *iPOS360x Multi-axis Motion System* **version .01C**. If your board is version 1.0B, please refer to the *iPOS360x Multi-axis Motion System* Technical Reference Manual with p/n: P091.084.4xiPOS360x.UM.0911, that can be freely downloaded from Technosoft web page.

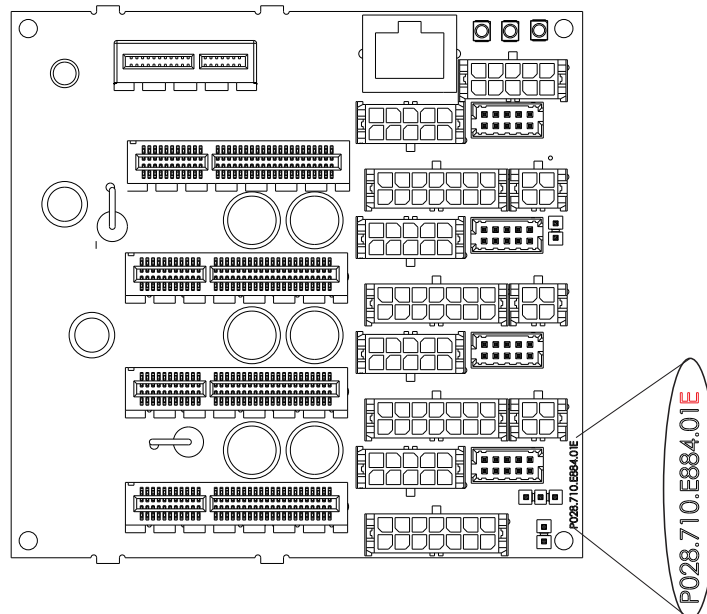


Figure 1. iPOS360x Multi-axis Motion System main board – top view with revision number

Note: The boards with the product ID P028.002.E884, do not have the Ethernet (J105) and PCI-e 1x (J100) connectors mounted.

2.4. iPOS360x Multi-axis Motion System Main Board Dimensions

All dimensions are in mm.

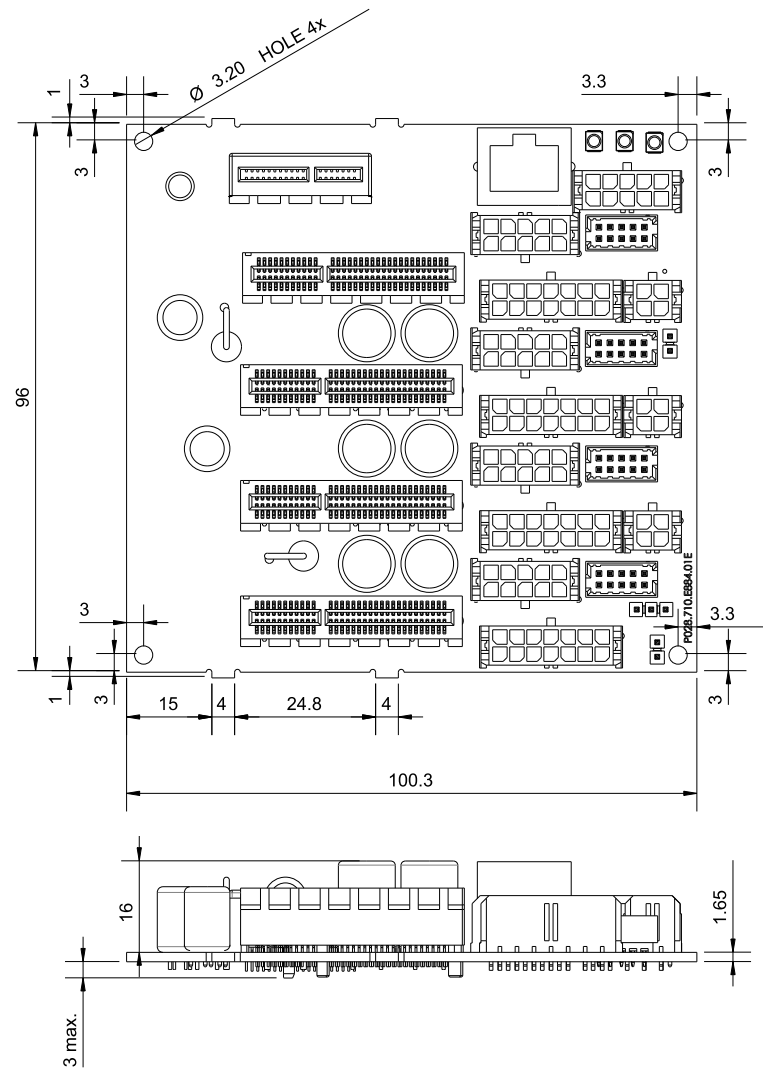


Figure 2. iPOS360x Multi-axis Motion System dimensions

3. Hardware Installation



CAUTION!

TURN OFF ALL POWER SUPPLIES BEFORE CONNECTING ANY MODULE OR CONTER CONNECTOR

3.1. iPOS360x VX-CAN Drives Mounting

Plug first **iPOS360x VX-CAN** drive into the main board connector J101 (iPOS #1). Plug the next drives into the remaining connectors J102 (iPOS #2), J103 (iPOS #3), J104 (iPOS #4).

Remark: First drive shall always be connected to J101 (iPOS #1) if RS-232 serial link is used

iPOS360x VX-CAN

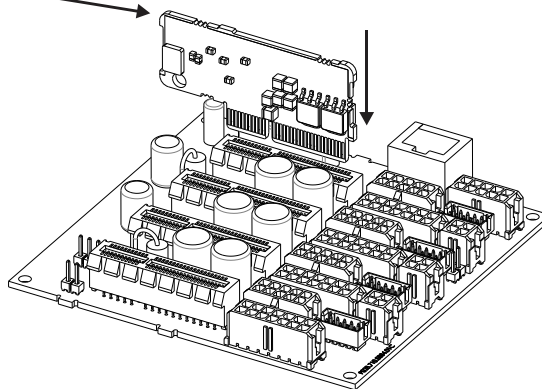


Figure 3. Installing an iPOS360x VX-CAN drive in the Multi-axis Motion System main board

3.2. Ethernet CAN Adapter Mounting¹

Plug the Ethernet CAN Adapter into the main board connector J100.

Ethernet CAN
adapter

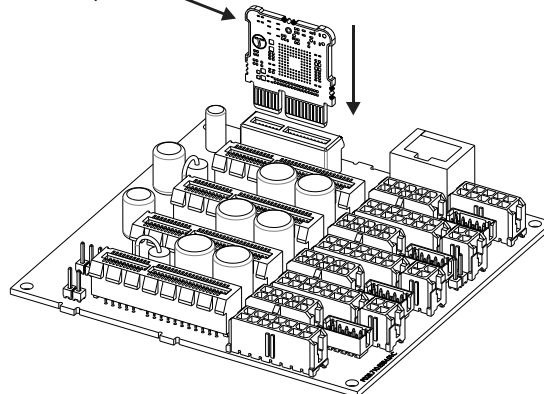


Figure 4. Installing an Ethernet CAN Adapter into the iPOS360x Multi-axis Motion System main board

¹ The Ethernet CAN adapter can be used with the iPOS360x Multi-axis Motion System main board with the product ID P028.002.E894

3.3. Connectors Layout

Figure 5 shows the top view of the iPOS360x Multi-axis Motion System main board.

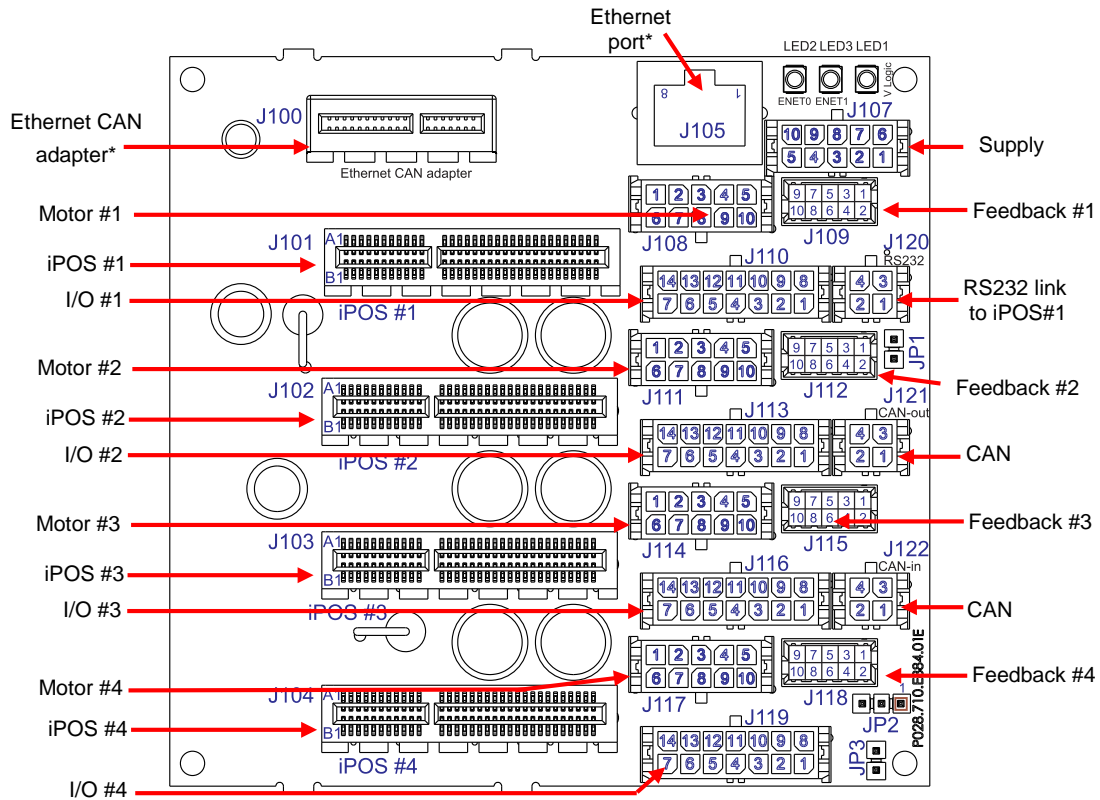


Figure 5. Top view of the iPOS360x Multi-axis Motion System main board

* The boards with the product ID P028.002.E884, do not have the Ethernet (J105) and PCI-e 1x (J100) connectors mounted.

3.4. Mating Connectors

Plastic Housing

Connector	Description	Manufacturer	Part Number
J122, J121, J120	RECEPTACLE, FREE, 4WAY, CRIMP	MOLEX	43025-0400
J119,J116,J113,J110	RECEPTACLE, FREE, 14WAY	MOLEX	43025-1400
J117, J114, J111, J107, J108	RECEPTACLE, FREE, 10WAY	MOLEX	43025-1000
J118, J115, J112, J109	HOUSING CONNECTOR 2x5 MILLIGRID	MOLEX	51110-1056

Metallic Crimp Pins

Connector	Description	Manufacturer	Part Number
J122, J121, J120, J119, J116,J113,J110, J117, J114, J111, J107, J108	CRIMP PIN, MICROFIT, 20AWG	MOLEX	43030-0007
J118, J115, J112, J109	CRIMP PIN, MILLIGRID 24-30AWG	MOLEX	50394-8400

3.5. Connectors pinout description

3.5.1. CAN Connectors – J122 & J121

Pin	Pin name	Type	Function
1	+VLOG	O	Positive terminal of the logic supply: +7 to +36VDC
2	GND	-	Ground
3	CAN-Hi	I/O	CAN-bus positive line (positive during dominant bit)
4	CAN-Lo	I/O	CAN-bus negative line (negative during dominant bit)

Remark: Put JP1 jumper to add a 120Ω terminal resistor in your CAN-bus network. Leave JP1 open if the CAN-bus network already has terminal resistors.

3.5.2. RS232 connector – J120

Pin	Pin name	Type	Function
1	TX232	O	RS-232 Data Transmission
2	-	-	Not connected
3	RX232	I	RS-232 Data Reception
4	GND	-	Ground

3.5.3. I/O Connectors – J110 (I/O#1), J113 (I/O#2), J116 (I/O#3), J119 (I/O#4)

Pin	Pin name	Type	Function
1	+5V _{OUT}	O	+5V _{OUT} output supply (generated by iPOS360x drive)
2	REF	I	Analogue input, 12-bit, 0-5V. Used to read an analogue position, speed or torque reference, or used as general purpose analogue input
3	IN0	I	Digital input. General-purpose, 5-36V
4	IN4/Enable	I	Digital input. Drive enable input, 5-36V
5	IN3/LSN	I	Digital input. Negative limit switch input, 5-36V
6	OUT2/Error	O	Digital output. Drive error output, active low, 5-36V 0.5A, NPN open-collector/TTL pull-up
7	+VLOG	O	Positive terminal of the logic supply: +7 to +36VDC
8	GND	-	Ground
9	FDBK	I	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tacho), or used as general purpose analogue input
10	IN1	I	Digital input. General-purpose, 5-36V
11	IN2/LSP	I	Digital input. Positive limit switch input, 5-36V
12	OUT0	O	Digital output. General-purpose, 5-36V 0.5A, NPN open-collector/TTL pull-up
13	OUT3/Ready	O	Digital output. Drive ready output, active low, 5-36V 0.5A, NPN open-collector/TTL pull-up
14	OUT1	O	Digital output. General-purpose, 5-36V 0.5A, NPN open-collector/TTL pull-up

3.5.4. Feedback Connectors – J109 (Feedback#1), J112(Feedback#2), J115(Feedback#3), J118 (Feedback#4)

Pin	Pin name	Type	Function
1	GND	-	Ground
2	+5V _{OUT}	O	+5V _{OUT} output supply (generated by iPOS360x drive)
3	n.c / GND	-	Not connected. If AvagoTech differential quad encoders are used, you may need to connect this pin to GND. This is possible via the solder joints: SJ101 (#1), SJ102(#2), SJ103(#3), SJ104(#4). See Figure 5. for details.
4	+5V _{OUT}	O	+5V _{OUT} output supply (generated by iPOS360x drive)
5	A-/Sin-/LH1	I	Incremental encoder A- differential input, or analogue encoder Sin- differential input, or linear Hall 1 input
6	A/A+/Sin+	I	Incremental encoder A single-ended, or A+ differential input, or analogue encoder Sin+ differential input
7	B-/Cos-/LH2	I	Incremental encoder B- differential input, or analogue encoder Cos- differential input, or linear Hall 2 input
8	B/B+/Cos+	I	Incremental encoder B single-ended, or B+ differential input, or analogue encoder Cos+ differential input
9	Z-/LH3	I	Incremental encoder Z- (index) differential input, or linear Hall 3 input
10	Z/Z+	I	Incremental encoder Z (index) single-ended, or Z+ differential input

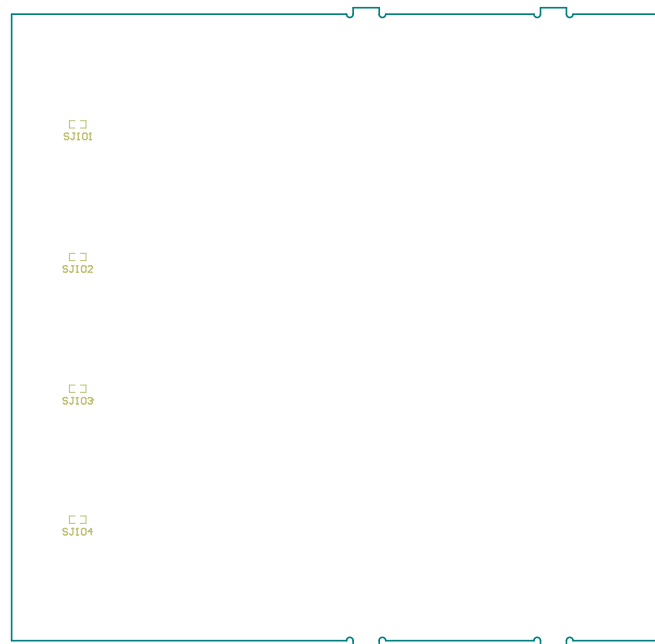


Figure 6. Back view of the iPOS360x Multi-axis Motion System main board

The solder joints are located just above the feedback connectors on the back side of the iPOS360x Multi-axis Motion System main board.

3.5.5. Motor Connectors- J108(Motor#1), J111(Motor#2), J114(Motor#3), J117(Motor#4)

Pin	Pin name	Type	Function
1	A / A+	O	Phase A for 3-phase motors Phase A+ for 2-phase steppers Motor+ for DC brushed motors
2	C / B+	O	Phase C for 3-phase motors Phase B+ for 2-phase steppers
3	Hall1	I	Hall 1 digital sensor input
4	Hall2	I	Hall 2 digital sensor input
5	Hall3	I	Hall 3 digital sensor input
6	B / A-	O	Phase B for 3-phase motors Phase A- for 2-phase steppers Motor- for DC brushed motors
7	BR / B-	O	External brake resistor Phase B- for 2-phase steppers
8	+5V _{OUT}	O	+5V _{OUT} output supply (generated by iPOS360x drive)
9	-	-	Not connected
10	GND	-	Ground

3.5.6. Supply Connector – J107

Pin	Pin name	Type	Function
1-4	+V _{MOT}	I	Positive terminal of the motor supply +V _{MOT} : +9 to +36V _{DC}
5	+V _{LOG}	I	Positive terminal of the logic supply +V _{LOG} : +7 to +36V _{DC}
6-10	GND	-	Negative return (ground)

3.5.7. Ethernet connector – J105

The J105 connector accepts a standard RJ45 Ethernet plug, compatible with IEEE802.3 100BASE-T (100Mbit/s). Accepts STP/UTP wiring.

3.6. Jumper Settings

Name	Function	Option	Result
JP1	CAN termination	OFF	Do not connect a CAN terminator
		ON	Connect a CAN terminator (120Ω resistor)
JP2	Selection of 3 AxisID ranges	1-2	Connect AxisID_1 input to GND
		2-3	Connect AxisID_1 input to +5Vdc
		OFF	Leave AxisID_1 input not connected
JP3	TMLCAN/CANopen	OFF	Leave AxisID_2 not connected. Set drive in TMLCAN mode
		ON	Connect AxisID_2 to GND. Set drive in CANopen mode

3.7. CAN Protocol and Axis ID Selection

The iPOS360x VX-CAN drive has 3 analogue inputs named AxisID0, AxisID1 and AxisID2 inputs used to select the CAN protocol: CANopen or Technosoft TMLCAN and the drive address or axis ID. The iPOS360x VX-CAN drive can detect up to 7 different voltage levels on these 3 inputs. On the iPOS360x Multi-axis Motion System, only 2 voltage levels can be selected via the jumpers: JP2 and JP3. All the iPOS360x boards are connected to JP3 and JP2. AxisID0 on each iPOS360x board is connected to a different voltage level by default and cannot be changed.

CAN protocol	JP3	JP2	Axis ID iPOS #1	Axis ID iPOS #2	Axis ID iPOS #3	Axis ID iPOS #4
CANopen	ON	1-2	1	2	3	4
CANopen	ON	OFF	22	23	24	25
CANopen	ON	2-3	43	44	45	46
TMLCAN	OFF	1-2	1	2	3	4
TMLCAN	OFF	OFF	22	23	24	25
TMLCAN	OFF	2-3	43	44	45	46

3.8. First Power Up

In order to setup the drives for your application, you need to communicate with them. The easiest way is via an RS-232 serial link between your PC and the **iPOS360x Multi-axis Motion System**. As serial cable you can use a standard 9-wire male to female non-inverting serial cable. If your PC has no serial port, use an RS232-USB adapter. The RS-232 link connects you with iPOS #1 (J101). Therefore, you need to have one drive plugged in J101 connector. If you have more drives, you can communicate with all of them using only the RS232 link. This is possible because iPOS #1 retransmits via CAN-bus all your commands for the other drives and returns their messages via RS232 to the PC.

Before the first power up, check the following:

1. **iPOS360x** drives mounting: they have to be fully inserted in the **iPOS360x Multi-axis Motion System** main board. If you use the RS232 communication, a drive must be inserted in J101 connector, i.e. the iPOS #1 position
2. The Ethernet CAN Adapter has to be fully inserted in the **iPOS360x Multi-axis Motion System** main board, where available.
3. Motor connections
4. Serial cable connections
5. **iPOS360x Multi-axis Motion System** jumpers: by default the system is delivered with the jumpers in the following positions:
 - a. JP1 = ON;
 - b. JP3 = OFF;
 - c. JP2 = 1-2;

Hence, the default jumper settings select the TMLCAN protocol with the following axisIDs: iPOS #1=1, iPOS #2=2, iPOS #3=3, iPOS #4=4. In order to quickly change to CANopen protocol, set JP3 = ON. The axisIDs in CANopen are the same as in TMLCAN.

6. Power on the **iPOS360x multi-axis motion system** board. The green LED from the main board lights when logic supply is ON.

3.9. Ethernet CAN Adapter configuration

The Ethernet CAN Adapter Configurator allows you to find and configure the Technosoft Ethernet CAN Adapters in a local area network (LAN). It is included in the EasySetUp/EasyMotion Studio installation packages and installed automatically. The Ethernet CAN Adapter Configurator can be launched from Windows Start menu execute: “Start | Programs | EasySetUp | Ethernet CAN Adapter Configurator” or “Start | Programs | EasyMotion Studio | Ethernet CAN Adapter Configurator” depending on which installation package was used.

The Ethernet CAN Adapter Configurator can search the LAN for Ethernet CAN Adapters presence and update their configuration settings: IP address, Subnet Mask, CAN Axis ID and CAN Baud rate.

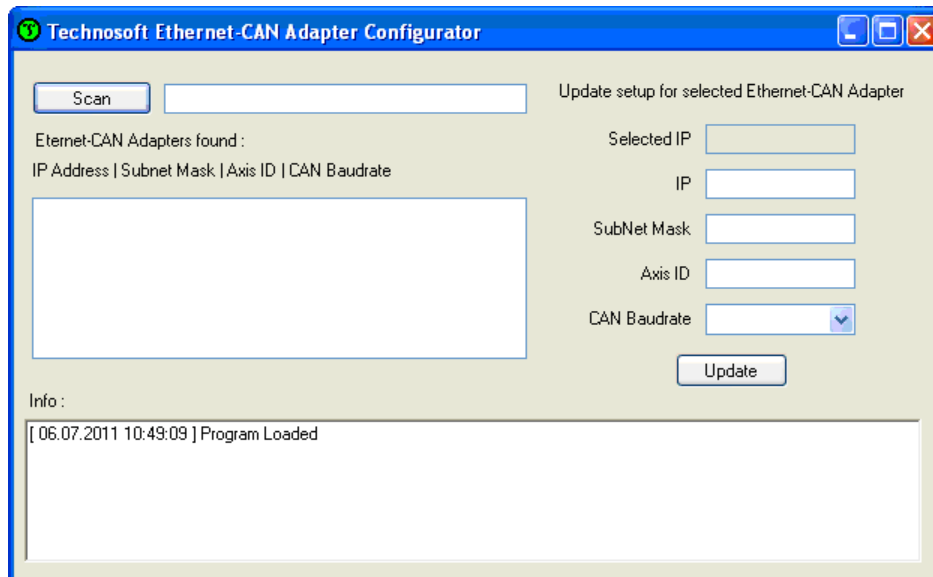


Figure 7. Technosoft Ethernet CAN Adapter Configurator

3.9.1. Searching for the Ethernet CAN Adapters

Before starting Ethernet CAN Adapter Configurator, the communication from EasySetUp / EasyMotion Studio must be switched off with the **Communication | Work Offline** menu command.

Press the **Scan** button to search for the Ethernet CAN Adapters connected in the LAN i.e. powered and with an active Ethernet link. The Ethernet CAN Adaptors present, will reply with their configuration settings and will be listed using the following format:

IP Address | Subnet Mask | Adapter Axis ID | CAN Baudrate

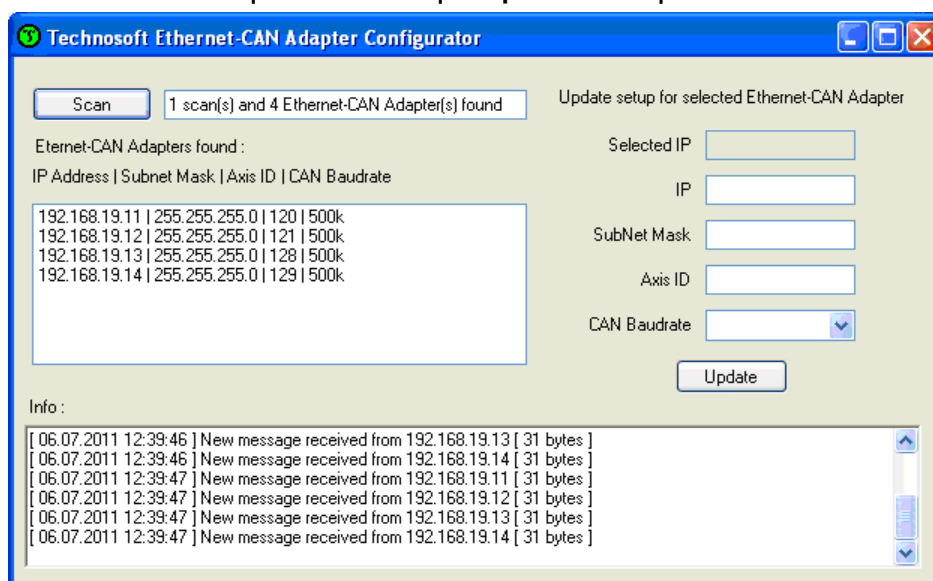


Figure 8. List of found devices example

3.9.2. Changing the configuration settings of an Ethernet CAN Adapter

Select an adaptor from the list of devices found. The configuration settings of the adapter will be displayed on the right side of the dialogue, where they can be modified.

The default configuration settings of an Ethernet CAN Adapter are:

- IP Address: 192.168.19.11
- Subnet mask: 255.255.255.0
- CAN baud rate: 500kb
- Adapter Axis ID: 120

After changing the configuration settings, press the **Update** button. The new settings will be sent to the selected Ethernet CAN Adapter and stored in its internal non-volatile memory.

Notes:

- The Ethernet CAN Adapter supports only a static IP configuration.
- The Axis ID of the adapter must be different from the Axis IDs assigned to the drives/motors.
- The Axis ID of the adapter must match the one set in the Communication Setup dialog from EasySetUp/EasyMotion Studio.



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