UltimET Advanced Motion Controller

Hardware Manual

Version A

ETEL

THIS PAGE IS INTENTIONALLY LEFT BLANK

Table of contents

Record of revisions:

Document revisions		
Version	**Date**	**Main modifications**
Ver A	09.09.20	First version

Documentation concerning the UltimET Advanced:

- **Hardware Manual** — **Specifications and electrical interfaces**
- Operation & Software Manual — UltimET Advanced setup, operation and programming

The UltimET Advanced motion controller has been successfully tested and evaluated to meet the UL 61010-1 standard for the US Market and CAN/CSA-C22.2 No. 61010-1 for the Canadian market.

1. Introduction

This document describes the ETEL multi-axis motion controller called 'UltimET Advanced' (or "motion controller" in this document), belonging to the UltimET family and used with ETEL's AccurET digital position controllers.
The purpose of this manual is to give details regarding the electrical and mechanical specifications, installation and interfacing of the product. Detailed information concerning the setup, operation and programming is provided in the corresponding **'Operation & Software Manual'**.

1.1 Acronyms

Acronyms	Definition
CSM	Customer Software Module
EDI	ETEL Device Interface
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
I/O	Input / Output
NTC	Negative Temperature Coefficient
PCIe	Peripheral Component Interconnect express
SDK	Software Development Kit
SELV	Separated Extra-Low Voltage
SPI	Serial Peripheral Interface
TCP/IP	Transmission Control Protocol / Internet Protocol

1.2 Safety

	**The user must have read and understood this documentation as well as those listed in page 5 before carrying out any operation on this product. Please contact ETEL S.A. or authorized distributors in case of missing information or for questions regarding the installation procedure, safety or any other topic.**
	**ETEL S.A. disclaims all responsibility for accidents and damages if the safety instructions, the procedures and the usage described in the present 'Hardware Manual' are not followed (including the ones given in the manuals listed in page 5).**

- Never use the motion controller for purposes other than those described in this manual.
- A competent and trained technician must install and operate the motion controller, in accordance with all specific regulations of the respective country concerning both safety and EMC aspects.
- Troubleshooting and servicing are permitted only by ETEL's technicians and agreed distributors.
- The user must provide at anytime the appropriate protections against electrical direct contact and moving parts of the connected system. Operating the motion controller may make the motor move.
- The safety symbols placed on the motion controller or written in the manuals (page 5) must be respected.
- If the motion controller is integrated into a machine, the manufacturer of this machine must establish that it fulfills the 2014/30/EU directive on EMC before operating the controller.

	**Signals a danger of electrical shock to the operator. Can be fatal for a person.**
	**Signals a danger for the motion controller. Can be destructive for the material. A danger for the operator can result from this.**
	**Indicates electrostatic discharges (ESD), dangerous for the motion controller. The components must be handled in an ESD protected environment, only.**

1.3 Presentation

1.3.1 Working principle

The UltimET Advanced motion controller is proposed in a standalone form factor and is intended for multi-axis motion control applications. It is designed for an integration into an application rack in a way similar to the AccurET position controllers, where a single power supply unit is able to power it together with several adjacent position controllers. A dedicated modular cooling unit placed under the motion controller is also recommended.

1.3.2 Applications

Through its multiple interface capabilities, the UltimET Advanced is intended to control position controllers of the AccurET family connected via the gigabit real-time proprietary TransnET communication bus.

A number of 3.3V RS-485 programmable digital I/Os are also available. They can also be configured as a standard SPI interface.

Moreover, the UltimET Advanced provides the possibility for simultaneous TCP/IP and cabled PCIe connections to an application/commissioning host PC.

1.3.3 General operating conditions

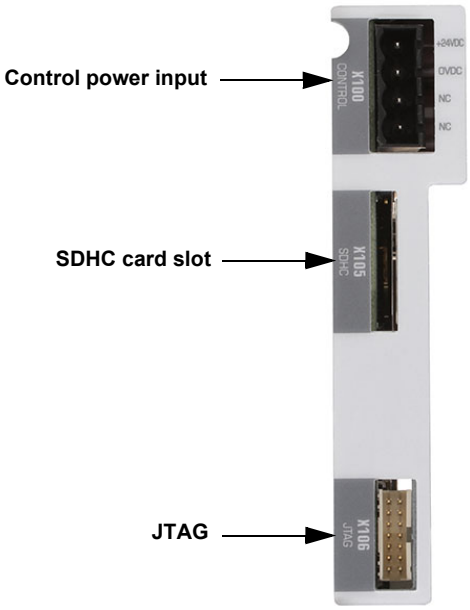
The UltimET Advanced is an open type device and must be installed in an enclosure providing electrical, mechanical and fire protection as well as adapted environment with the appropriate temperature, humidity and pollution degree 2 (refer to IEC 61010-1 and UL 61010-1 standards for more information). The UltimET Advanced is designed to operate in a non-aggressive and clean environment, with a humidity rate ranging between 10% and 85%, an altitude < 2000m (6562 ft) and a temperature ranging between +10°C (50°F) and +40°C (104°F). The controller power supply must be connected to an electrical network of overvoltage category 3 (refer to IEC 61010-1 and UL 61010-1 standards for more information) and are suitable for use on a circuit capable of delivering not more than 5000 Arms, symmetrical amperes. The power supply voltage is limited to 24 VDC ±10%. The controller's control input (X100) must be connected to a power supply device with SELV outputs (isolated secondary output). The UltimET Advanced is intended for use in the industrial environment. The UltimET Advanced is intended for indoor use in non-hazardous locations, operated by qualified personal skilled in its use. The UltimET Advanced is not designed or intended for use in the on-line air traffic control, aircraft navigation and communications as well as critical components in life support systems or in the design, construction, explosive atmosphere, operation and maintenance of any nuclear facility. All control voltages or all connections (except Mains) must fulfill requirements for Limited Voltage Circuits/ Isolated Secondary Circuits. Furthermore, UltimET Advanced has not been qualified to be installed on highly dynamic moving parts.

1.3.4 Transport and storage conditions

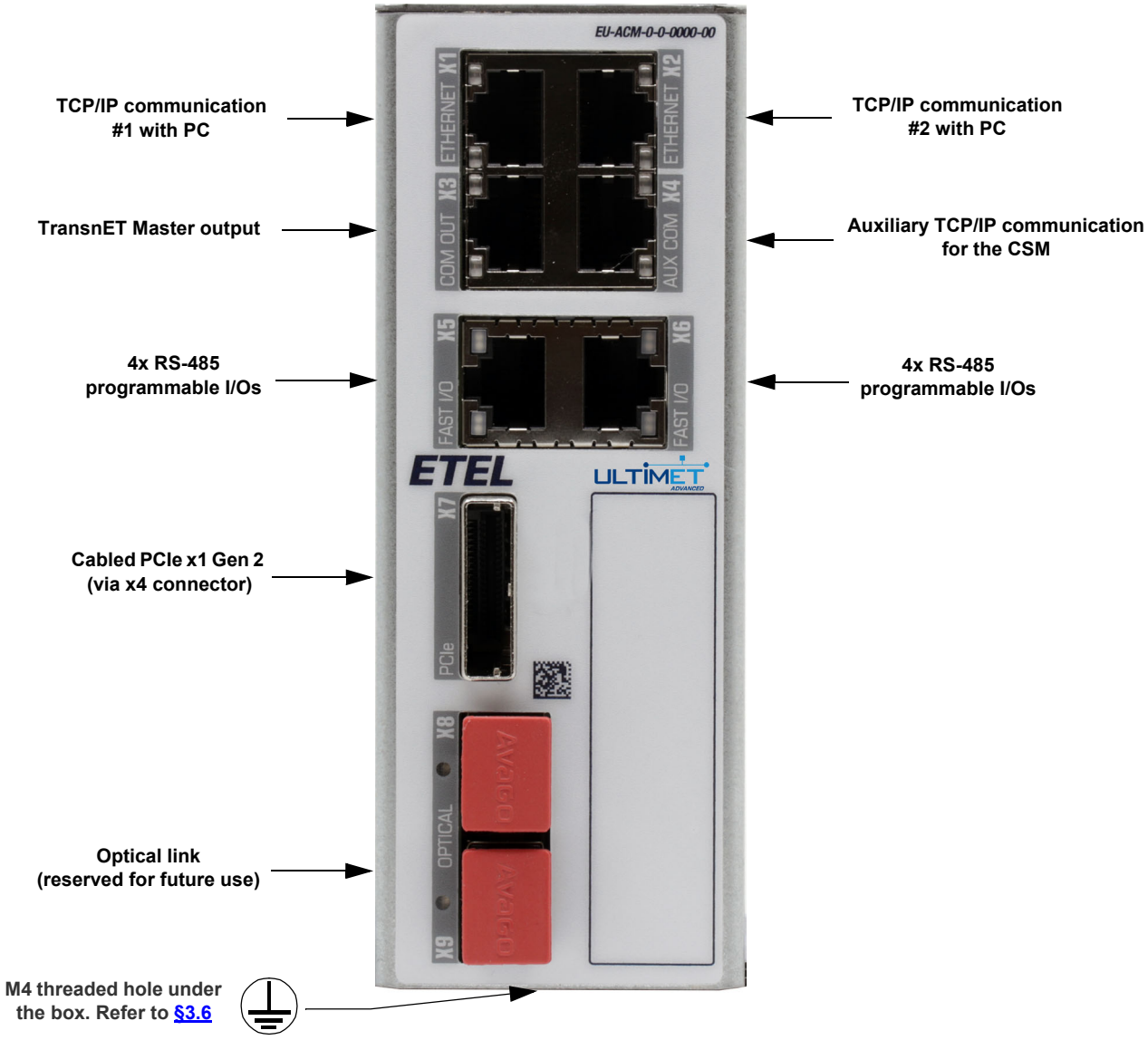
During transport and storage, the motion controller must remain inside its original packaging which provides ESD protection and has been qualified according to ISTA 1G integrity test procedure. The transport conditions must respect the class 2K3 of the IEC 60721-3-2 standard (temperature between -25°C (-13°F) and +70°C (+158°F), and humidity < 95% without condensation) and the storage conditions must respect the class 1K2 of the IEC 60721-3-1 standard (temperature between +5°C (+41°F) and +45°C (+113°F), and humidity between 5 and 85% without condensation).

1.4 Connection diagram

1.4.1 Top view

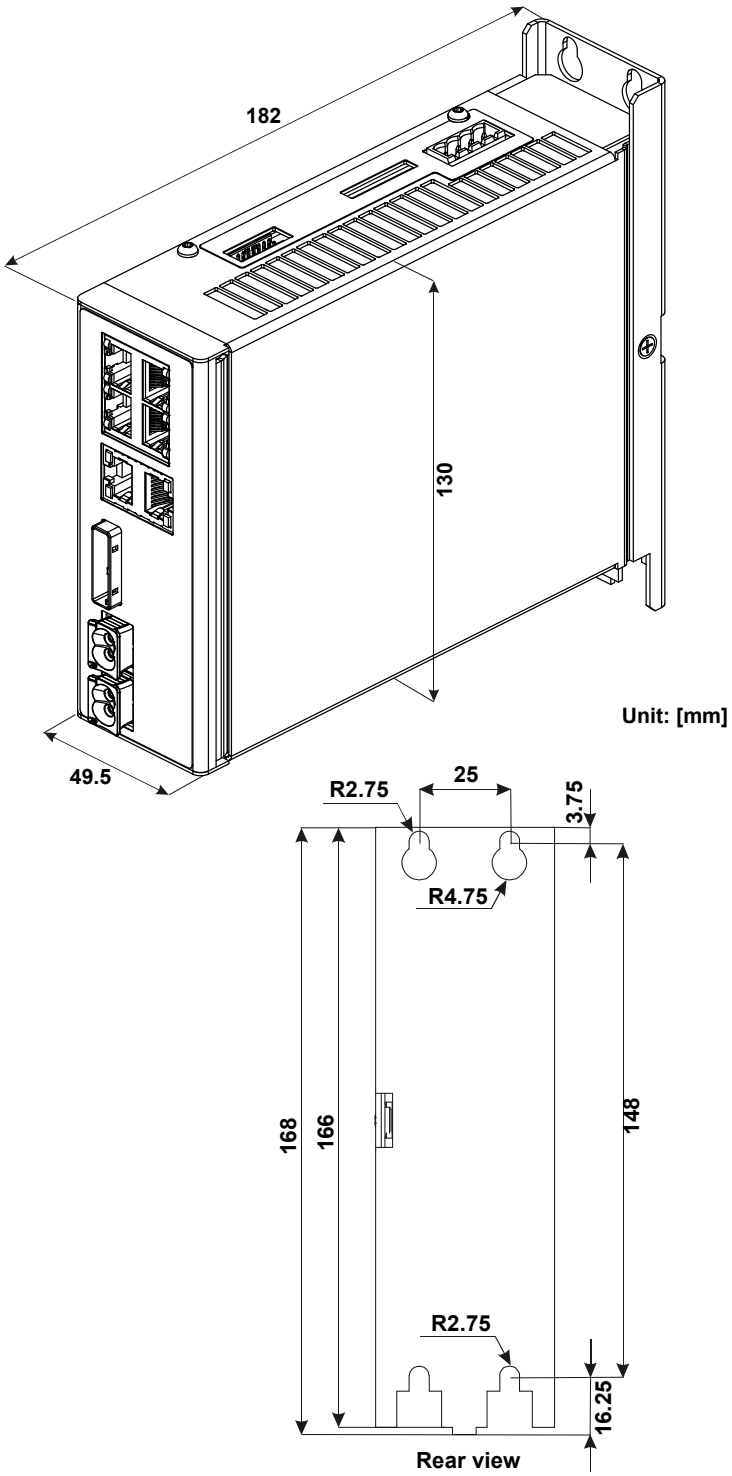


1.4.2 Front view



2. Models characteristics

2.1 Outline and dimensions



Remark: If the user uses ETEL's cooling system, the center-to-center distance between the screws at the top of the controller and the bottom screws used to fix the mounting bar is 169 mm (refer to §2.3). It is recommended to leave 100mm above and under the motion controller to guarantee a sufficient air flow.

The motion controller has been certified for safe operation in the absence of any forced ventilation up to the maximum allowed ambient temperature (+40°C / 104°F). However, ETEL strongly recommends the use of an external fan to increase product reliability. An appropriate choice could be ETEL's line of external modular cooling units, which are also compatible with the AccurET position controller family (minimum air flow of $30m^3/h$).

2.2 Ratings

POWER FEATURES		
Power input	DC voltage	24 VDC (±10%)
	Current consumption at 24 VDC	Max. 1.5 A
	Inrush current	Limited by NTC resistor
	Input one-time fuse protection	5 A fast-acting fuse (for fuse replacement, please contact an ETEL representative)

CONTROL FEATURES		
General	Control cycle	100 µs
	Processor	Quad-Core ARM Cortex-A53 @ 1.3 GHz
	Operating system	FreeRTOS for the CSM (refer to the "Operation & Software Manual" for the corresponding version)
	Motion Profiles	G-code based / Position - Velocity - Time (PVT)
Standard Interfaces	TransnET	1 Gbps
	Ethernet for host PC communication	1 Gbps
	Ethernet for commissioning	1 Gbps
	Ethernet for CSM communication	1 Gbps
	PCIe for host communication	Cabled x1, Gen 1 (2.5 Gbps), using x4 lane connector and cable
	Optical	Reserved for future use
User inputs / outputs	Digital I/O	8x RS-485 I/Os, 3.3 V, ESD-protected, non-isolated
	SPI	Standard SPI protocol available via software configuration at user-selected RS-485 I/Os (both Master and Slave SPI configurations possible)
	Analog I/O	N/A
Software support	ComET software for commissioning & monitoring	Refer to the "ComET Interface Software Communication Manual"
	EDI (DLL files for C/C++/Java/.NET)	Refer to the "EDI User's Manual"
	Firmware update	TCP/IP
User programmability	Concept	CSM running internally as a FreeRTOS application
	Development methodology	CSM is written as a C program, compiled using Xilinx SDK environment and linked to ETEL EDI libraries ported to FreeRTOS operating system. Debugging means via JTAG and TCP/IP
Weight	-	975 g

2.3 Mounting

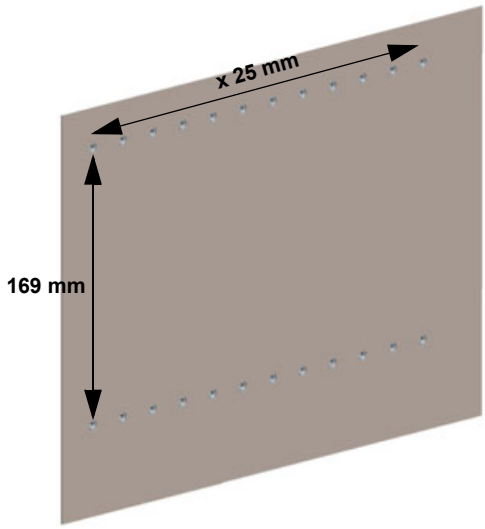
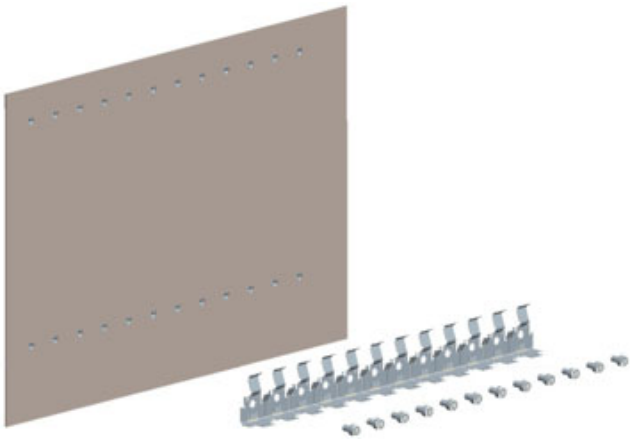
The motion controller has the following electrical safety degree: IP 20 (according to EN 60529 standard). The UltimET Advanced is an open type device and must be installed in an enclosure providing electrical, mechanical and fire protection as well as an adapted environment with the appropriate temperature, humidity and pollution degree 2 (refer to IEC 61010-1 and UL 61010-1 standards for more information).

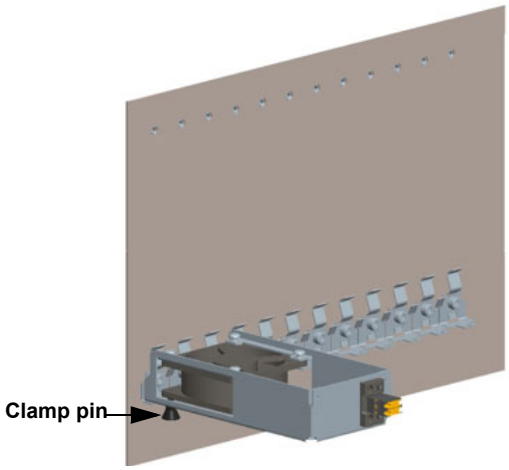
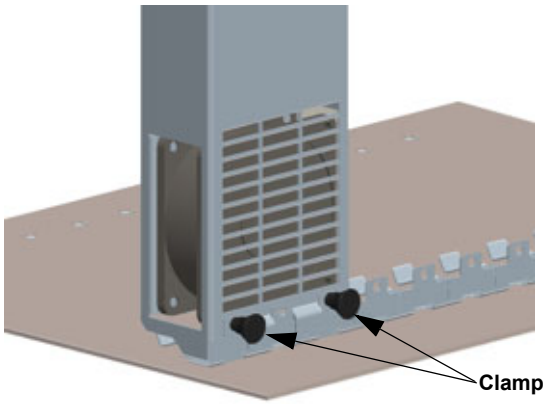
2.3.1 Hardware mounting

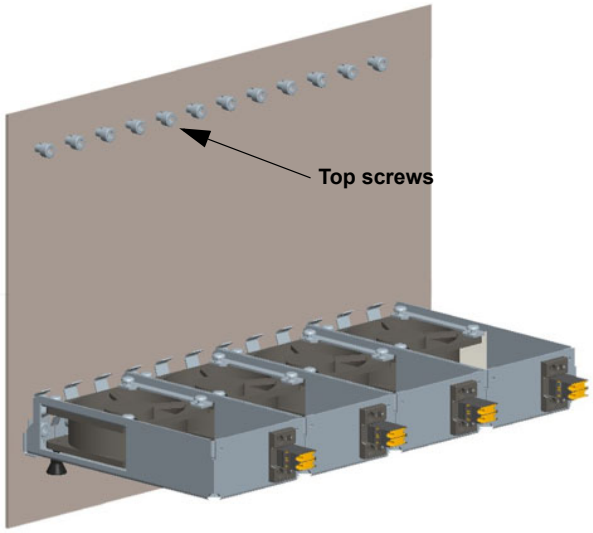
The motion controller should be protected against any splashes of liquid and any contacts with smoke and dust. It must be installed inside a closed cabinet and mounted as mentioned below. The ground must be connected prior to any other connection (refer to §3.6 for more information). It is recommended to leave 100mm above and under the motion controller to guarantee a sufficient air flow.

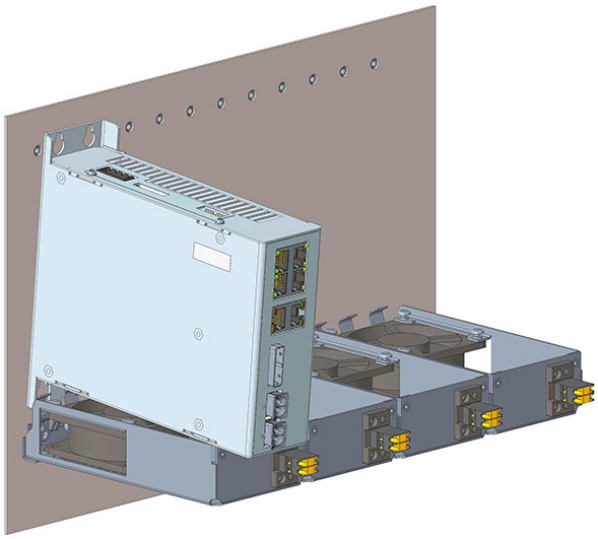
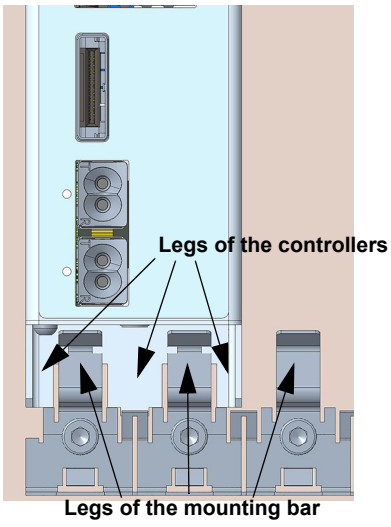
There are three different ways to attach the motion controller depending on the installation condition:

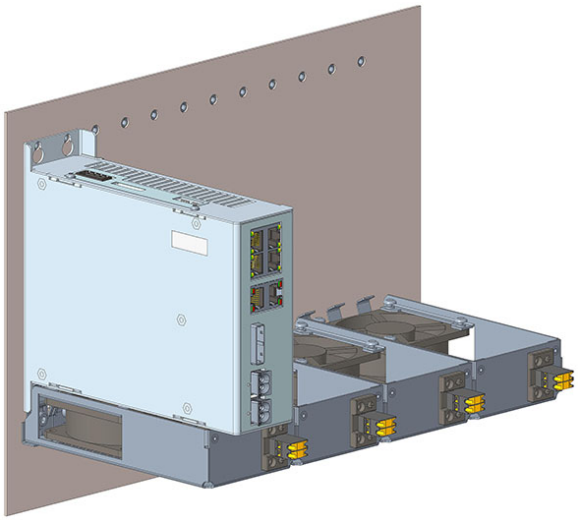
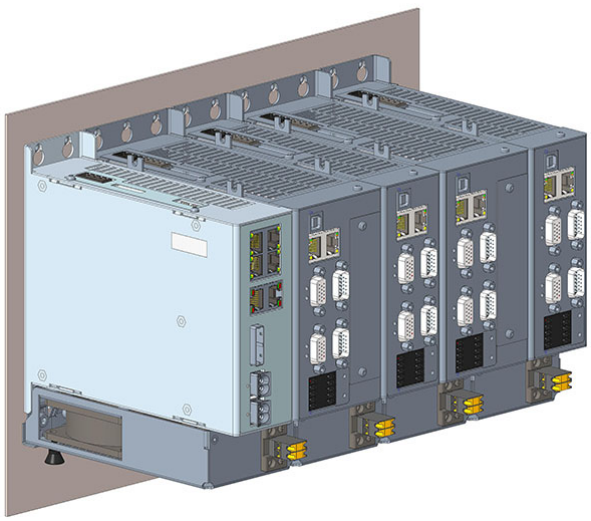
- An ETEL cooling system is required: in that case, the procedure described hereafter must be followed.
- The user does not require an ETEL cooling system nor the mounting bar. In that case, only 4 screws are needed to attach the motion controller. Refer to §2.1 for more information.
- The user does not need ETEL's cooling system but still wants to use the mounting bar. In that case, the step 1 and 2 of the procedure mentioned below must be followed (refer also to §2.1 for more information).

Step 1	Step 2
	
The drilling must be realized. The center-to-center distance between the screws at the top of the controller and the bottom screws used to attach the mounting bar is 169 mm. The pitch between each screw belonging to the same row is 25 mm.	Fasten the mounting bar with M5 screws

Step 3	
	 Bottom view
Put the fans in position and attach them with the black clamp pins (2 per fan)	

Step 4

Screw, half way, the top screws

Step 5
 
Put the motion controller as mentioned above. The legs at the bottom of the motion controller must be inserted between each leg of the mounting bar.

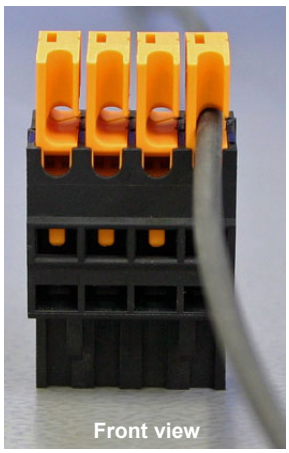
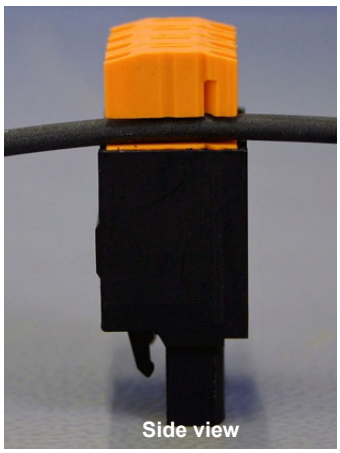
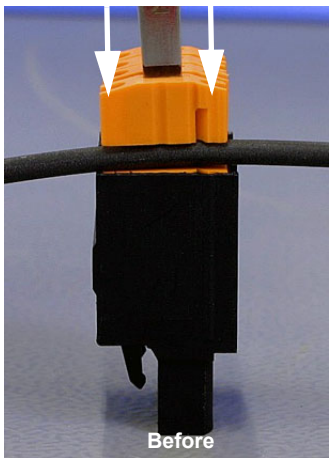
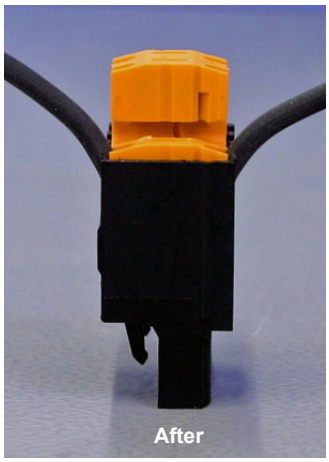
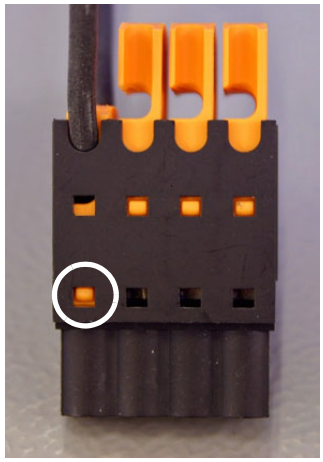
Step 6	Step 7
	
Push the motion controller against the back panel, then against the fan and finish to screw the top screws.	Proceed as mentioned in step 5 and 6 to put the position controllers.

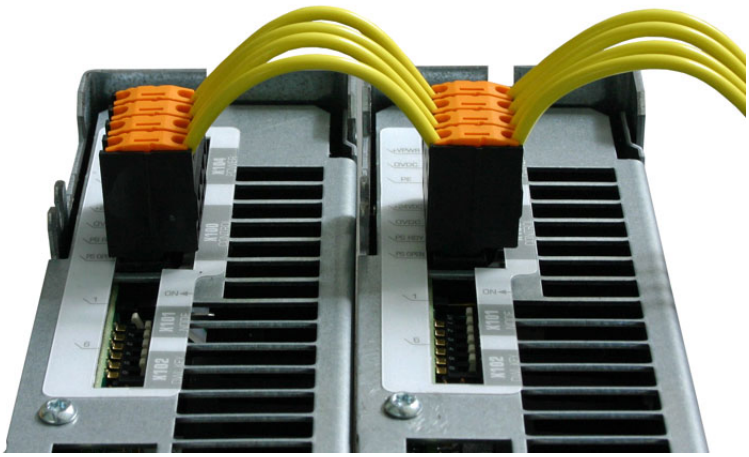
Remark: The mounting bar and ETEL's fans are identical whatever the product (AccurET modular or UltimET Advanced).

2.3.2 Fan power and control input wiring

All connectors corresponding to the power input voltage of the fans as well as the control voltage of the motion controller (going to the top of each connected controllers) are connected all together with the type of connector delivered by ETEL. These connectors are self-strip connectors and can be ordered separately (it is also delivered with the "Starting kit"). The user must correctly size the power supply according to the number of position controllers connected together with the UltimET Advanced.

Here is the procedure to manufacture the wiring:

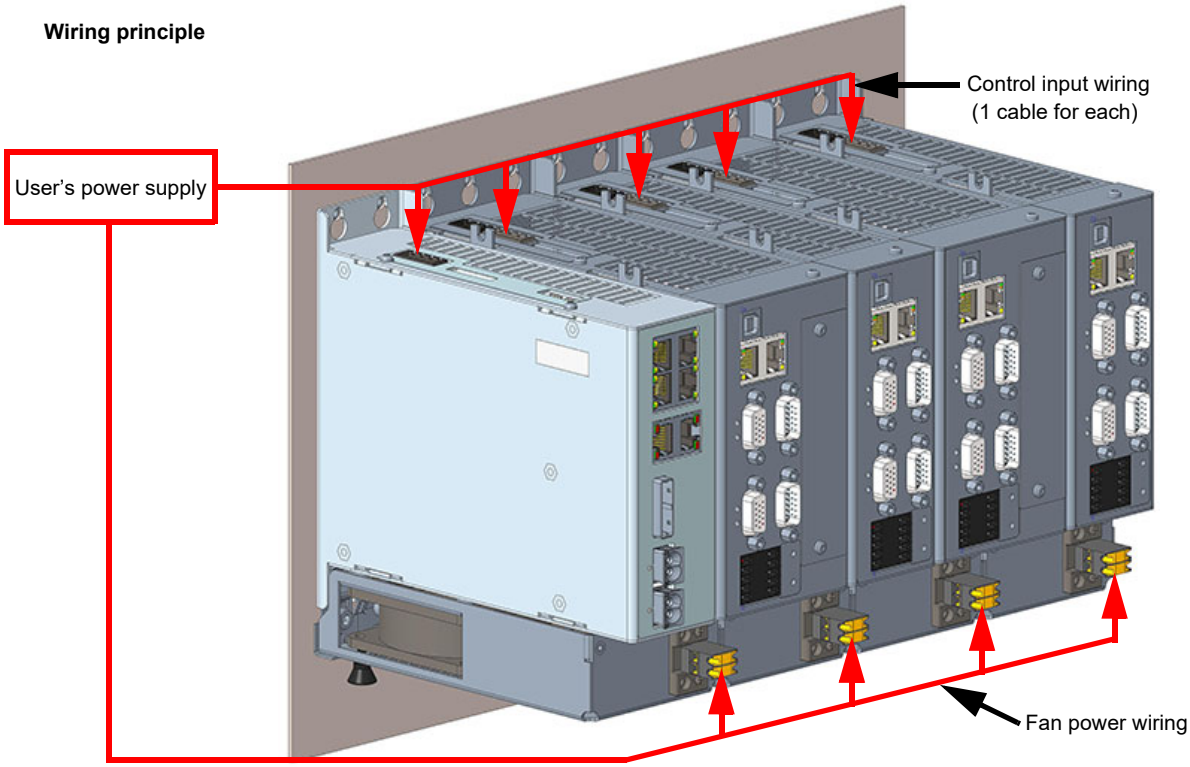
 	1) Insert the cable in the slot. **Caution: Use only wire with a section from 0.5mm^2 (AWG 20) to 1mm^2 (AWG 18).**
 	2) Push down the upper part (orange) with a screwdriver for example. **Caution: It is forbidden to realize this operation with the connector plug on the controller. It must be done before plugging it into the controller.** **Be careful, not to get your finger caught when pushing down.**
	3) To check if the upper part has been pushed enough, the orange pin must be visible in the black cut-out. 4) Repeat the steps 1 to 3 for the other wires. 2 wires are needed per control input connector and 2 for the fan power connector. 5) Repeat the steps 1 to 4 for the other connectors. There are as many control input connectors as controllers. The number of fan power connectors depends on the width of the fan (refer to §2.4.3). 6) The wires after the last connector must be cut short.



Here is an example with two controllers. Even if the UltimET Advanced requires only 2 wires (refer to §3.3.1), it may be more convenient to connect the 4 cables as required for the AccurETs.

Caution: the length of the wires between 2 connectors must take into account the length lost inside the connector and the fact that the distance may change depending on the controller's width.

Wiring principle



2.4 Ordering information

Here is the ordering information describing the meaning of each digit present on each product:

2.4.1 Motion controller

E	U	-	A	C	M	-	0	-	0	-	0	0	0	0	-	0	0

Family code:
EU = Electronics UltimET motion controller

Product type / Technology:
A = Advanced

Control:
C = With interpolation (synchronized & interpolated movement)

Format:
M = Modular format (box)

Reserved

Reserved

External I/O connectivity:
0 = No external I/O available

Reserved

Standard:
0 = UL compliant

Reserved

Hardware revision:
00 = Standard product

2.4.2 Cooling unit

EA	-	CU	M	-	125	-	BT	-	0	0

Family code:
EA = Electronics AccurET

Product type / technology:
CU = Cooling Unit

Format:
M = modular

Size:
75 = 75mm
100 = 100mm
125 = 125mm

Type:
BT = Bottom to Top air flow (default)
TB = Top to Bottom air flow (performances 25% lower compared to BT)

Reserved

Reserved

Remark: ETEL's fans are identical whatever the ETEL product (AccurET modular or UltimET Advanced).

2.4.3 Mounting bar

EA	-	MB	M	-	300	-	0	0

Family code:
EA = Electronics AccurET

Product type / technology:
MB = Mounting Bar

Product type:
M = modular

Size:
300 = 300mm

Reserved

Reserved

Remark: The mounting bar is identical whatever the ETEL product (AccurET modular or UltimET Advanced).

2.4.4 Starting kits

EU	-	STK	-	ACM	-	00

Family code:
EU = Electronics UltimET motion controller

Product type / technology:
STK = Starting Kit

Format:
ACM = UltimET Advanced

Kit type:
00 = Kit with PCIe interfacing hardware
01 = Kit without PCIe interfacing hardware

- The basic “Starting kit” without a PCIe interface includes:

Description	Quantity
JTAG programming cable through USB port: Digilent JTAG-HS3 and additional 3 m USB cable	1
TransnET / Ethernet cable of 30 cm and 3 m	1
SD card of 1GB	1
Connector for the Control input: Phoenix Contact MSTBA 2.5/4-G BK (plastic)	1

- The full “Starting kit” contains in addition:

Description	Quantity
PCIe x4 Gen 2 host board for PC: One Stop Systems, P/N OSS-PCIe-HIB25-x4-H/T	1
PCIe cable: One Stop Systems, P/N OSS-PCIe-CBL-x1-x4-3m (3m)	1

3. Electrical interface

This chapter describes the pin assignment for every connector. More detailed explanations for proper connections are given in each section.

Here is the list of the groups of connectors, according to their function:
- Communication connectors (refer to §3.1).
- Input / Output connectors (refer to §3.2).
- Power connectors (refer to §3.3).
- SDHC card slot (refer to §3.4).
- Development / Debug connector (refer to §3.5).

Remark: In the next paragraphs, connectors with male pins are indicated with the • symbol (full), and female pins are represented with the o symbol (empty).

	**Always connect the ground prior to any other connection.**
	**All the connectors must be handled in an ESD protected environment, only.**
	**Low voltage and data signals are not insulated from Protective Earth (PE).** **This product was tested according to IEC 61000-6-2 and IEC 61000-6-4: Electromagnetic compatibility (EMC) Generic standards - Immunity and emission for industrial environments. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.**

3.1 Communication connectors

	**Low voltage and data signals are not insulated from Protective Earth (PE).**
	**The communication connectors must be handled in an ESD protected environment, only.**

3.1.1 Ethernet (connectors X1 and X2)

These connectors (standard 1Gbps Ethernet interface), identified by «ETHERNET» on the front panel, are used to directly connect the motion controller to a host PC or Ethernet switch.

Remark: The RJ-45 cable must meet the following characteristics: 1:1 shielded SF/UTP, category 5e 8p8c. The length of each Ethernet cable must not exceed 100m.

3.1.2 TransnET output (connector X3)

The TransnET output, identified by «COM OUT» (COMmunication OUTput) on the front panel, is used to connect the output cable of ETEL's TransnET communication bus. The UltimET Advanced controller operates as a TransnET master. Since only one master is allowed, all remaining devices connected to the TransnET communication bus must be AccurET slaves.

Remark: The RJ-45 cable must meet the following characteristics: 1:1 shielded SF/UTP, category 5e 8p8c. The cumulated length of all TransnET cables must not exceed 100m.

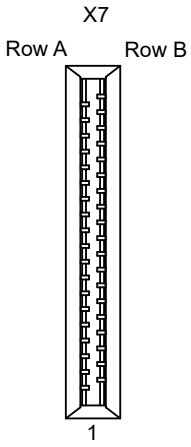
3.1.3 Ethernet for Customer Software Module (connector X4)

This connector (standard 1Gbps Ethernet interface), identified by «AUX COM» (AUXiliary COMmunication) on the front panel, can be used arbitrarily in the CSM for any Ethernet-based communication to an external device/ PC (including for debugging purposes).

Remark: The RJ-45 cable must meet the following characteristics: 1:1 shielded SF/UTP, category 5e 8p8c. The length of each Ethernet cable must not exceed 100m.

3.1.4 PCIe (connector X7)

This input, identified by «PCIe» on the front panel, is a standard cabled PCIe x4 interface used to connect the UltimET Advanced to a host PC. Since only lane #1 on the connector is used, the resulting configuration corresponds effectively to a PCIe x1 interface. The supported speed standard on this interface is Gen 2 (2.5 Gbps). The "Starting kit" (ordered separately) includes a PCIe x4 cable, as well as a matching adapter card for the host PC (refer to §2.4.4 for more information).

Molex 38 pin iPass P/N 75586-0011 (PCIe ×4 connector)							
Power Input	**Pin #**	**Signal**	**Function**		**Pin #**	**Signal**	**Function**
	A1	GND	Ground		B1	GND	Ground
	A2	PETp(0)	Transmit pair (+)		B2	PERp(0)	Receive pair (+)
	A3	PETn(0)	Transmit pair (–)		B3	PERn(0)	Receive pair (–)
	A4	GND	Ground		B4	GND	Ground
	A5	PETp(1)	Not connected		B5	PERp(1)	Not connected
	A6	PETn(1)	Not connected		B6	PERn(1)	Not connected
	A7	GND	Ground		B7	GND	Ground
	A8	PETp(2)	Not connected		B8	PERp(2)	Not connected
	A9	PETn(2)	Not connected		B9	PERn(2)	Not connected
	A10	GND	Ground		B10	GND	Ground
	A11	PETp(3)	Not connected		B11	PERp(3)	Not connected
	A12	PETn(3)	Not connected		B12	PERn(3)	Not connected
	A13	GND	Ground		B13	GND	Ground
	A14	CREFCLKp	Clock 100 MHz		B14	3.3V active cable power	Not connected
	A15	CREFCLKn	Clock 100 MHz		B15	3.3V active cable power	Not connected
	A16	GND	Ground		B16	GND active cable power	Not connected
	A17	SB_RTN	Ground return for isolated circuits		B17	GND active cable power	Not connected
	A18	CPRSNT#	Cable present		B18	CWAKE#	Not connected
	A19	CPWRON	Cable Power On		B19	CPERST#	Cable reset

3.2 Input / Output connectors

	**Low voltage and data signals are not insulated from Protective Earth (PE).** **The RS-485 I/Os are NOT galvanically isolated.**
	**The I/O connectors must be handled in an ESD protected environment, only.**

3.2.1 Digital RS-485 I/O with SPI capability (connectors X5 and X6)

These fast digital I/Os, identified by «FAST I/O» on the front panel, can be used for synchronization, position capture, external triggering, etc. The physical interface is composed of 3.3V, RS-485 differential pairs, wired to the connector similarly to a standard RJ-45 Ethernet 1:1 8p8c UTP cable. The pins are capable of a maximum data rate of 40 Mbps (depending on the length and the quality of the cables). The direction (input or output) is software programmable.
It is also possible to configure a standard 4-wire SPI protocol over these I/Os in both master and slave configurations. Any I/O can be programmatically assigned to any of the SPI functions lines (MOSI, MISO, SCLK, SS).

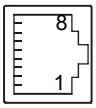
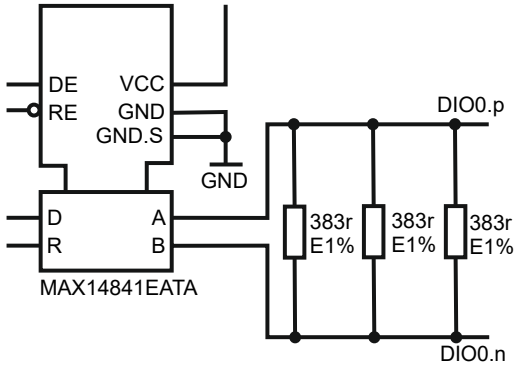
Only the hardware interface of the I/Os is considered here. Refer to the corresponding “Operation & Software Manual” chapter for more information about their use.

The commutation times of the above-mentioned inputs and outputs are as follows:

	Status	Typical	Maximum	Unit
Outputs	0 => 1	12	20	ns
	1 => 0	12	20	ns
Inputs	0 => 1	-	25	ns
	1 => 0	-	25	ns

Remark: The above-mentioned times takes only the hardware into account.

RJ-45, 8 pins, female

Fast I / O	Pin #	Signal	Function	Interface
X5 & X6 			X5	
	1	FDIO1+	Fast digital I/O 1 (RS-485 +)	
	2	FDIO1-	Fast digital I/O 1 (RS-485 -)	
	3	FDIO3+	Fast digital I/O 3 (RS-485 +)	
	4	FDIO2+	Fast digital I/O 2 (RS-485 +)	
	5	FDIO2-	Fast digital I/O 2 (RS-485 -)	
	6	FDIO3-	Fast digital I/O 3 (RS-485 -)	
	7	FDIO4+	Fast digital I/O 4 (RS-485 +)	
	8	FDIO4-	Fast digital I/O 4 (RS-485 -)	
			X6	
	1	FDIO5+	Fast digital I/O 5 (RS-485 +)	
	2	FDIO5-	Fast digital I/O 5 (RS-485 -)	
	3	FDIO7+	Fast digital I/O 7 (RS-485 +)	
	4	FDIO6+	Fast digital I/O 6 (RS-485 +)	
	5	FDIO6-	Fast digital I/O 6 (RS-485 -)	
	6	FDIO7-	Fast digital I/O 7 (RS-485 -)	
	7	FDIO8+	Fast digital I/O 8 (RS-485 +)	
	8	FDIO8-	Fast digital I/O 8 (RS-485 -)	

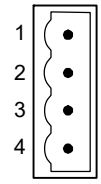
3.2.2 Optical (connectors X8 and X9)

These connectors are reserved for future use.

3.3 Power connectors

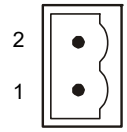
	**Always connect the ground prior to any other connection.**
	**The power connectors must be handled in an ESD protected environment only.**

3.3.1 Control power input (connector X100)

Phoenix Contact MSTBA 2.5/4-G BK (plastic connector)			
Control	**Pin #**	**Signal**	**Function**
X100 	1	+24 VDC	Control power input (24 VDC (±10%))
	2	0 VDC	Control power input (0 VDC). Also connected to the metal housing
	3	NC	Internally not connected. Any connection is harmless for the UltimET Advanced.
	4	NC	Internally not connected. Any connection is harmless for the UltimET Advanced.

Remark: To ensure proper operation of the controller, it is recommended to wait for at least 15 seconds between two consecutive ON or OFF cycles (15 seconds minimum for the OFF state when ON/OFF/ON cycle and 15 seconds minimum for the ON state when OFF/ON/OFF).
The control power input shall be supplied by an isolated power supply with SELV outputs (isolated secondary output), rated 24 VDC (±10%). The controller power supply must be connected to an electrical network of overvoltage category 3 (refer to IEC 61010-1 and UL 61010-1 standards for more information).
The control power input connector is located on the top of the motion controller.
The associated connector can be ordered separately or one is already included in the “Starting kit” (refer to §2.4.4). If not, be sure to use a connector compatible with the above-mentioned one.

3.3.2 Fan power input

Phoenix Contact DFK-MSTB 2.5/2-G BK (plastic connector)			
Power input	**Pin #**	**Signal**	**Function**
	2	0 VDC	Supply input (0 VDC)
	1	+24 VDC	Supply input (24 VDC (±10%))

Remark: This connector is present on ETEL’s optional external modular cooling unit.
The current requirement according to the fan’s width is as follows: 0.2A for the 75mm, 0.3A for the 100mm and 0.5A for the 125mm.

3.4 SDHC card slot (connector X105)

This SDHC card slot, identified by «SDHC» on the top panel, is intended to accept a standard-size SDHC card which can be used for any data storage need of the CSM.

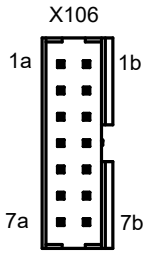
The integrated SD controller is compatible with version 2.0 of the SD and SDIO specifications, supporting SDHC cards up to 32 GB at high-speed bus mode (read/write rate of max. 5 MB/s).

Remark: ETEL recommends the use of industrial-grade SD cards in SLC technology such as the Swissbit S-455 products range.

3.5 Development / Debug (connector X106)

This connector, identified by «JTAG» on the top panel, allows the user to develop and debug their CSM via a standard JTAG connection. This JTAG interface allows a direct connection to any development tool that uses a standard Xilinx 14-pin connector, such as:

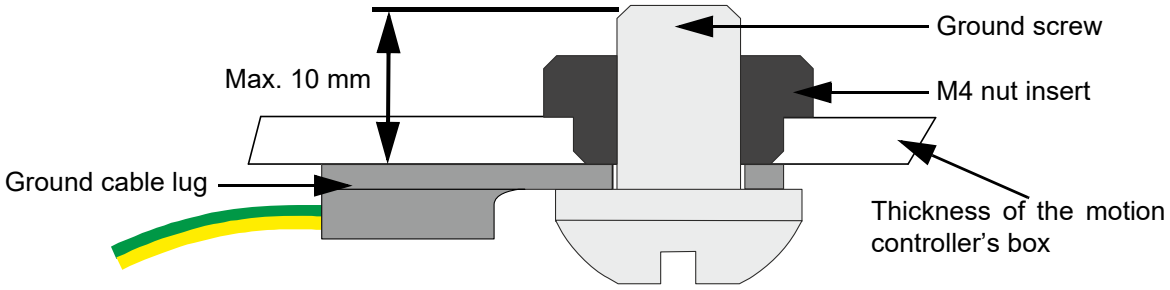
- Digilent JTAG-HS3 (recommended)
- Xilinx® Platform Cable USB II
- ARM® DSTREAM

FCI 98464-F61-14ULF, header 2 row x 7 pins, 2x2 mm, right-angled, THT							
JTAG	**Pin #**	**Signal**	**Function**		**Pin #**	**Signal**	**Function**
	1a	GND	Ground		1b	VREF (+3.3V)	Voltage reference
	2a	GND	Ground		2b	TMS	Test Mode Select
	3a	GND	Ground		3b	TCK	Test ClocK
	4a	GND	Ground		4b	TDO	Test Data Out
	5a	GND	Ground		5b	TDI	Test Data In
	6a	GND	Ground		6b	NC	Not connected
	7a	GND	Ground		7b	SRST_N	Test reset

3.6 Ground connection

The ground connection of the motion controller is realized via the 0 VDC pin of the control input (X100 connector). The metal housing of the product is galvanically connected to the same ground.

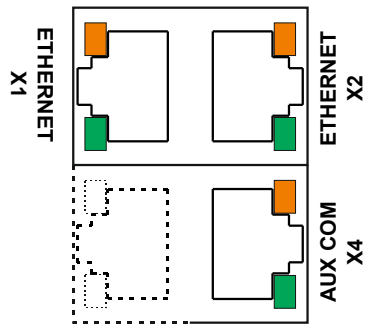
Remark: If the ETEL cooling unit (refer to §2.4.2) is not used, it is possible to connect an additional ground cable to the M4 threaded hole present under the motion controller. It does not replace the one on the X100 connector which is compulsory. In this case, the length of the screw (not provided) must not exceed 10 mm from the external surface of the controller box.



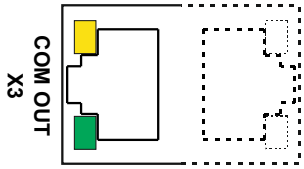
3.7 LEDs meaning

The different LEDs present on the motion controller have the following meaning:

3.7.1 Ethernet communication status

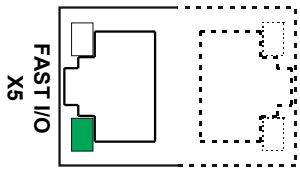
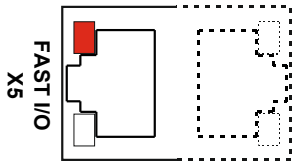
Ethernet LEDs	Meaning
	Orange/Green LEDs are OFF => no Ethernet link Green LED is ON or blinking => link established at 1 Gbps Orange LED is blinking => Activity is running on the Ethernet

3.7.2 TransnET communication status

TransnET LEDs	Meaning
	Yellow LEDs is ON => Link established at 1 Gbps Green LEDs is ON => TransnET data is running

3.7.3 Fast I/O status

The LEDs on the “FAST I/O” (connector X5) show the status of the controller.

FAST I/O LEDs	Meaning
	Green LED is ON or blinking => Normal operation
	Red LED is ON or blinking => The motion controller is in ERROR state

3.7.4 User LEDs

The LEDs on the FAST I/O (connector X6) are available for user purposes. Refer to the corresponding “Operation & Software Manual” chapter for more information.

4. Service and support

For any inquiry regarding technical, commercial and service information relating to ETEL S.A. products, please contact your ETEL S.A. representative:

HEADQUARTER / SWITZERLAND	BELGIUM	CHINA
ETEL S.A. **Zone industrielle** **CH-2112 Môtiers** **Phone: +41 (0)32 862 01 00** **E-mail: etel@etel.ch** **http://www.etel.ch**	**HEIDENHAIN nv/sa** Pamelse Klei 47 1760 Roosdaal Phone: +32 54 34 31 58 E-mail: sales@heidenhain.be	**DR. JOHANNES HEIDENHAIN (CHINA) Co., Ltd** No. 6, Tian Wei San Jie, Area A, Beijing Tianzhu Airport, Industrial Zone Shunyi District, Beijing 101312 Phone: +86 400 619 6060 E-mail: sales@heidenhain.com.cn
CZECH Republic	**FRANCE**	**GERMANY**
HEIDENHAIN s.r.o. Dolnomecholupská 12b 102 00 Praha 10 - Hostivar Phone: +420 272 658 131 E-mail:heidenhain@heidenhain.cz	**HEIDENHAIN FRANCE SARL** 2 avenue de la cristallerie 92310 Sèvres Phone: +33 (0)1 41 14 30 09 E-mail: sales@heidenhain.fr	**DR. JOHANNES HEIDENHAIN GmbH** Technisches Büro Südwest II Verkauf ETEL S.A. Schillgasse 14 78661 Dietingen Phone: +49 (0)741 17453-0 E-mail: tbsw.etel@heidenhain.de
GREAT-BRITAIN	**ISRAEL (Representative)**	**ITALY**
HEIDENHAIN (GB) Ltd. 200 London Road, Burgess Hill, West Sussex RH 15 9RD Phone: +44 (0)1444 247711 E-mail: sales@heidenhain.co.uk	**MEDITAL COMOTECH Ltd.** 36 Shacham St., P.O.B 7772, Petach Tikva Israel 4951729 Phone: +972 3 923 3323 E-mail: comotech@medital.co.il	**ETEL S.A.** Piazza della Repubblica 11 28050 Pombia Phone: +39 0321 958 965 E-mail: etel@etelsa.it
JAPAN	**KOREA**	**SINGAPORE**
HEIDENHAIN K.K. Hulic Kojimachi Bldg. 9F 3-2 Kojimachi, Chiyoda-ku Tokyo - 102-0083 Phone: +81 3 3234 7781 E-mail: sales@heidenhain.co.jp	**HEIDENHAIN KOREA Ltd.** 75, Jeonpa-ro 24beon-gil, Manan-gu, Anyang-si Gyeonggi-do, 14087, Korea Phone: + 82 31-380-5304 E-mail: etelsales@heidenhain.co.kr	**HEIDENHAIN PACIFIC PTE. LTD** 51 Ubi Crescent, Singapore 408593 Phone: +65 6749 3238 E-mail: info@heidenhain.com.sg
SPAIN (Representative)	**SWEDEN**	**SWITZERLAND**
Farresa Electronica, S.A. C/ Les Corts, 36 bajos ES-08028 Barcelona Phone: +34 93 409 24 91 E-mail: farresa@farresa.es	**HEIDENHAIN Scandinavia AB** Storsätragränd 5 127 39 Skärholmen Phone: +468 531 93 350 E-mail: sales@heidenhain.se	**ETEL S.A.** Zone industrielle CH-2112 Môtiers Phone: +41 (0)32 862 01 33 E-mail: sales@etelsa.ch
TAIWAN	**THE NETHERLANDS**	**UNITED STATES**
HEIDENHAIN CO., LTD. No. 29, 33rd road, Taichung Industrial Park Taichung 40768, Taiwan, R.O.C. Phone: +886 4 2358 8977 E-mail: info@heidenhain.tw	**HEIDENHAIN NEDERLAND B.V.** Copernicuslaan 34 6716 BM Ede Phone: +31 (0)318 581800 E-mail: verkoop@heidenhain.nl	**HEIDENHAIN CORPORATION** 333 E. State Parkway Schaumburg, IL 60173 Phone: +1 847 490 1191 E-mail: info@heidenhain.com

The technical hotline, based in ETEL S.A.'s headquarters, can be reached by:

- Phone: +41 (0)32 862 01 12.
- Fax: +41 (0)32 862 01 01.
- E-mail: support@etel.ch.

Please refer to your corresponding ETEL S.A. representative for more information about the technical documentation. ETEL S.A. organizes training courses for customers on request, including theoretical presentations of our products and practical demonstrations at our facilities.