

Hardware Manual

TP50 / TP80 / TP130 / TP350 Revision E



Keep all manuals belonging to this product during its life span. Pass all manuals to future owners and users of this product. This English version is the original version of the product manual.

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1 Safety Information

The user must have read and understood this documentation before carrying out any operation on Triamec Motion AG hardware. Please contact Triamec Motion AG in case of missing information or doubt regarding the installation procedures, safety or any other issue.



Caution Triamec Motion AG disclaims all responsibility to possible industrial accidents and material damages if the procedures & safety instructions described in this manual are not followed.

- Never use the device for purposes other than those described in this manual.
- The device must be installed by trained personnel only and in accordance with applicable regulations of the respective country concerning both safety and EMC aspects.
- Troubleshooting and servicing are permitted only by Triamec Motion AG technicians.
- The safety symbols placed on the device or written in this manual must be respected.
- If this device is integrated into a machine, the manufacturer of this machine must ensure that it fulfills the 2004/108EC directive on EMC before operating the system.



Danger To avoid electric arcing and hazards to personnel and electrical contacts, never connect/disconnect the device while the power source is on.



Danger Power cables can carry a high voltage, even when the motor is not in motion. Disconnect the hardware from all voltage sources before it is disassembled for servicing.

After shutting off the power and removing the power source from the equipment, wait at least 10 minutes before touching or disconnecting parts of the equipment that are normally loaded with electrical charges (such as capacitors or contacts). Measuring the electrical contact points with a meter before touching the equipment is recommended.



Caution The device contains hot surfaces and electrically-charged components during operation.



Caution The maximum AC power supply connected to this hardware must comply with the parameters outlined in this guide.

In a one phase configuration, never connect the phase without the corresponding neutral wire.



Caution Read the paragraph Overvoltage on possible mechanical damage that may occur if an external brake resistor is missing or improperly dimensioned.

2 Product Description

The TP50, TP80, TP130 and TP350 devices complement the TSD80, TSD130, and TSD350 drive series.

TP devices contain:

- A three phase rectifier, in-rush current limiter
- A large capacitance to recuperate motion energy
- An internal brake resistor or an optional connector for an external brake resistor to limit the DC-Bus voltage
- DC-Bus output connectors for up to four drives
- Connectors for two cooling fans
- Status output and Status LED

The devices also include the following protective functions:

- Energy dissipation by internal or external brake resistor
- Short circuit protection of brake resistor (internal and external)
- Short circuit protection on DC-Bus on power up
- Input overvoltage protection on power up. The device will actively limit the DC-bus voltage using the brake resistor but will not supply- current in this state
- Over temperature of the device
- Phase fail detection (3-phase supplies only)



Caution TP devices have no voltage transformation built-in! Refer to Chapter 3.2 for the allowed input voltage range. In most cases an external transformer or SMPS is needed in between main supply and TP.

2.1.1 Internal or external brake

All power supplies can be ordered with an internal brake resistor (standard) or a connector for an external brake resistor (order code BRK).

2.1.2 Phase Fail Detection

The power supplies can be ordered in two variants:

- TPXXX: This is the standard variant which accepts 3-phase AC input, single phase AC input and DC input.
- TPXXX-3PH: This variant accepts 3-phase AC input only and is equipped with a phase fail detection. In case of a phase fail, the output 'Status Out'(J9) is switched off and the LED's will indicate a 'One AC-Line missing' failure.

Single phase AC input is not recommended as this cause higher voltage ripples on the DC bus compared to 3-phase AC input or DC input.

2.2 Block Diagram

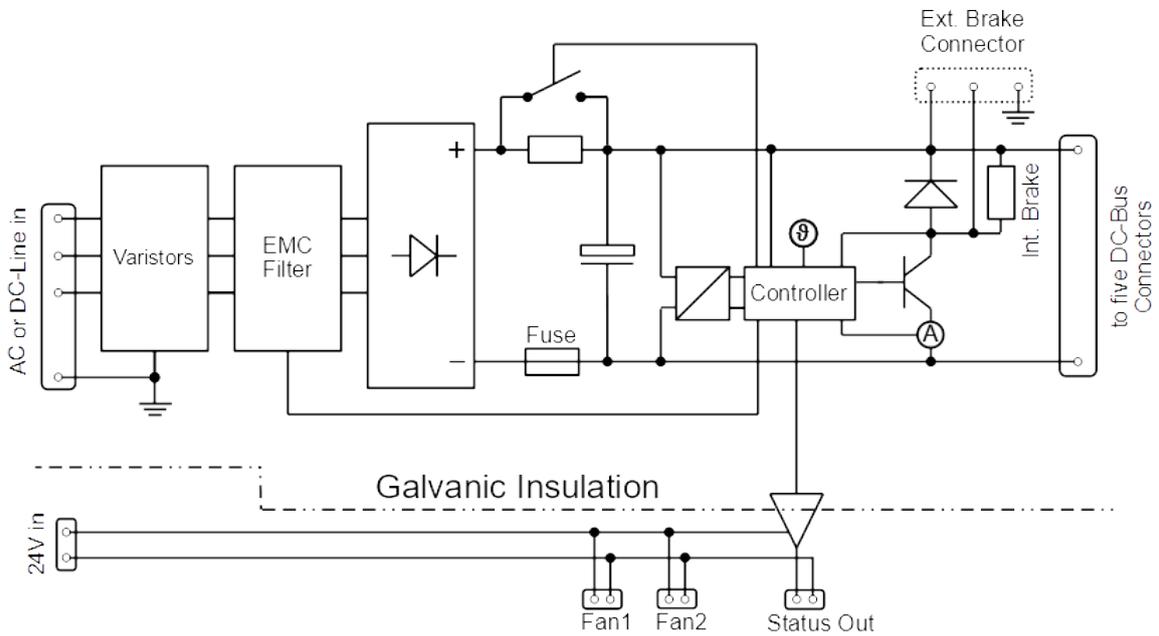


Figure 1: Block Diagram, Remark: As of hardware revision E5, there is no longer a fuse installed

3 Technical Specifications

3.1 Environmental Conditions

3.1.1 Transport and storage conditions

During the transport and the storage, the device must remain inside their original packaging which complies with the ESD standard.

- The transport conditions must respect the class 2K3 of the IEC 60721-3-2 standard (temperature between -25°C (-13°F) and $+70^{\circ}\text{C}$ ($+158^{\circ}\text{C}$), and humidity $<95\%$ without condensation) and
- the storage conditions must respect the class 1K2 of the IEC 60721-3-1 standard (temperature between $+5^{\circ}\text{C}$ ($+41^{\circ}\text{F}$) and $+45^{\circ}\text{C}$ ($+113^{\circ}\text{F}$), and humidity between 5 and 85% without condensation). If either storing for more than two years or at temperatures higher than 35°C , observe the reforming procedure as shown under „Capacitor reforming“.

3.1.2 General Operating conditions

The device has the following electrical safety degree: IP 20 (according to EN 60529 standard).

The power supplies are designed to operate in a non-aggressive and clean environment, with a (non-condensing) humidity ranging between 5% and 85%, an altitude $< 2000\text{m}$ (6562 ft), and a temperature ranging between $+5^{\circ}\text{C}$ (50°F) and $+40^{\circ}\text{C}$ (104°F).

The electronics must be in an enclosure respecting a pollution degree of 2 (refer to UL 508C and EN 61800-5-1 standards for more information). They are not designed or intended for use in the on-line control of air traffic, aircraft navigation and communications, explosive atmosphere, as well as critical components in life support systems or in the design, construction, operation and maintenance of any nuclear facility.

3.2 Electrical Specifications

All the specifications are given for an ambient temperature ranging from +10°C (50°F) to +40°C (104°F).

		TP50	TP80	TP130	TP350	
3-phase or (1-phase) AC-Line input	3-phase AC voltage (L-L)	31...35 ±10%	44...56 ±10%	44...86 ±10%	44...230 ±10%	VAC
	1-phase AC voltage	31...35 ±10%	44...56 ±10%	44...86 ±10%	44...230 ±10%	VAC
	Nominal frequency	50-60				Hz
	Nominal maximum AC current I_{VN}	22				Arms
	Required external fuse maximum	20, e.g. Hager NBN320				Arms
	Power factor correction	no				
Transformer	Requirements	Isolating transformer required			None, Auto-transformer allowed	
DC-Line input	Input voltage DC	44...50 ±10%	62...80 ±10%	62...122 ±10%	62...325 ±10%	VDC
	Nominal maximum DC current I_{VN}	14				A
	Required external fuse maximum	16				A
Line input	Internal DC-bus fuse (fast)	30				Arms
	In-rush limiter	250				Ohm
	Insulation test voltage ¹	360				VDC
DC-Bus output	DC voltage nominal	50	80	122	325	VDC
	DC voltage maximum	59	93	142	380	VDC
	Max current (sum)	14				A
	continuous	20				A
	pulse 30s	25				A
	pulse 2s					A
Capacitance	DC-bus capacitance	7.5 ±20%			2.8 ±20%	mF
Internal brake resistor	Brake-point U_{Brake}	57 ±2%	90 ±2%	137.5 ±2%	375 ±2%	V
	Adiabatic dissipation energy E_A	5000				J
	Continuous power P_C	50 (requires cooling)				W
	Resistance	7			18	Ohm
Ext. brake resistor ²	Min resistance	2.5	4	6.5	17	Ohm
Status/Fan supply ³	Voltage	24 VDC ±20%				V
	Current	Sum of Fan and Status out current				A
Fan 1, Fan 2 ⁴	Direct connection	24V, 1A				
Status out ⁴	High-Side switch	24V on/off, 30mA				

1 Limited by an internal arrestor circuit.

2 If an external brake resistor is used, it has the same brake-point U_{Brake} as if the internal brake resistor is used

3 The Status/Fan supply is galvanically isolated from the internal logic power. It is used only for the fans and the Status out.

4 The fan and status outputs are galvanically connected to the 24V Status/Fan supply.



Caution Before running an Insulation test or voltage test on a machine, disconnect all connectors from Triamec drives.

Caution Mains input voltage drops at maximum load on the Dc-Bus side may break the internal fuse⁵ due to capacitor recharging. Consult Triamec on how to avoid this problem.

3.3 AC-Line

The device must be connected to an electrical AC network

- of overvoltage category 3 (refer to EN 61800-5-1 and UL 840 standards for more information)
- capable of delivering not more than 40kArms, symmetrical amperes (prospective current according to EN 60269-1).
- The network must be a TN-C-S with center earth or similar. In these cases, a transformer with common center (not insulating) is sufficient. An IT-net with phase on earth requires an isolating transformer. The same applies, if the network supplies more than 400VAC+15%, due to arrestor limits if only one of three lines is connected and due to double isolation requirements. In this case, a transformer with common center is not allowed.
- For TSD80-1x and TSD130-10 an isolating transformer is required (see manual of TSD)

3.4 DC-Line

It's also possible to operate the device with an electrical DC network.

3.5 Discharge Currents



Caution Discharge currents (EN 50178, IEC 60755). If the primary side contains a residual current device (RCD) for the protection of personnel against electric shock, this device must be of type B according to EN 50178. Otherwise, alternative protection must be enforced, such as insulation from the environment by double isolation or using an isolation transformer.

⁵ As of hardware revision E5, there is no longer a fuse installed

3.6 EN 61800-5-1

The TP devices conform to EN 61800-5-1 (2008), overvoltage category III. Safe electrical separation according to EN 61800 is guaranteed between the power circuit and 24V and Earth.

3.7 EN 61800-3

The interference suppression filter in this device complies to EN 61800-3 C2 under the following conditions.

- Guidelines for proper grounding and shielding of the TP must be applied.
- Guidelines for proper grounding and shielding of the respective drive hardware manual must be applied.
- Restrictions regarding EMC, stated in the drive hardware manual, are mandatory.

With some setups, a single stage line EMC filter or an insulated transformer between mains and TP might be required. For good EMC behavior it is important to have a low impedance Earth-connection running in parallel with the AC-Line connected to the J6. Furthermore, the AC-Line should be routed apart from motor cables.

3.8 Overvoltage

A system of a motor coupled with a load has a certain amount of energy. This energy is mainly kinetic when the load is moving or rotating. While stopping these loads, the energy must either be stored or dissipated. The same applies during moves where gravitational energy or spring energy is involved.

The drives recuperate this energy back to the TP and the bridge voltage rises.

3.8.1 Internal Brake Capability

The following measures are provided device internally to store and dissipate energy. The internal capacitors can store a certain amount of energy

$$E_C = 0.5 * C * (U^2 - U_{dcSupply}^2)$$

Since the maximum voltage is given, the energy stored is defined by the rectified supply voltage $U_{dcSupply}$. See technical electrical specification sheet.

Above U_{Brake} , the brake (internal or external) will be activated to dissipate energy. The internal resistor can dissipate a short term energy E_A but only a small continuous power P_C . If high mechanical energy is

involved the internal brake resistor might reach its thermal limit. It will turn off and the DC-bus voltage might increase further until the drives turn off. Then the axis does not stop and might cause mechanical damage.

This failure is avoided by using an external brake resistor or reducing the deceleration of the drives. Slower stopping reduces the load on the brake resistor.

3.8.2 External Brake Resistor

The optional external brake resistor must be dimensioned properly to account for the amount of energy to be dissipated in the axis system.

It is recommended to use a resistor that is protected against over-temperature. Contact manufacturer for dimensioning.

3.8.3 Overvoltage Protection

If the external braking resistor is not dimensioned correctly, the DC-Bus voltage may exceed the maximum DC voltage level. The TP indicates this by switching the Status output to OV. If the voltage further increases and reaches the internal limit of the drives, they will protect themselves by turning off their semiconductor switches. The axis is not decelerated anymore and the voltage will not increase any further. However, turning off the drives during fast motion leaves the axis at the original speed. The axis might crash into its end-limits, which might cause significant damage to the mechanical system.

Therefore it is important to choose a well dimensioned braking resistor. Also, the Status output signal and the overvoltage error message of the drives may be used by the control system for damage prevention.

3.9 LED Diagnostics and Status

There is a green and a red LED for diagnostics. The green LED indicates the DC-Bus voltage. Steady on means the voltage is in its normal range. Flashing short means the voltage is too low and flashing long means the voltage is too high. The red LED indicates any caution or error.

	Green LED	Red LED	Status Output
No line power	off	off	0V
Charging DC-Bus	flashing short	off	0V
Ready	on	off	24V
One AC-Line missing (3-Phase Mode only)	[according to device state]	flashing short	0V
Line disturbance check (20ms)	on	on	24V
Line disturbance (1s)	on	on	0V
Discharging DC-Bus	flashing short	off	0V
Brake active	[according to device state]	on	24V
Overvoltage	flashing long	on	0V
Brake open	[according to device state]	flashing 1 times then pause	0V
Brake short (*)	[according to device state]	flashing 2 times then pause	0V
Over-temperature	[according to device state]	flashing 3 times then pause	0V
Internal error	[according to device state]	flashing 4 times then pause	0V

(*) cleared after restarting the device

Flashing short: On for 0.2s / Off for 0.2s

Flashing long: On for 0.8s / Off for 0.8s

4 Mounting and Wiring

The device 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.

4.1 Mechanical Specifications

Weight: 2.3kg

Dimensions:

Width 68 mm
Height 205 mm
Depth 181mm, 184 mm as of revision E5

Recommended distance for the mounting screws is 195mm.

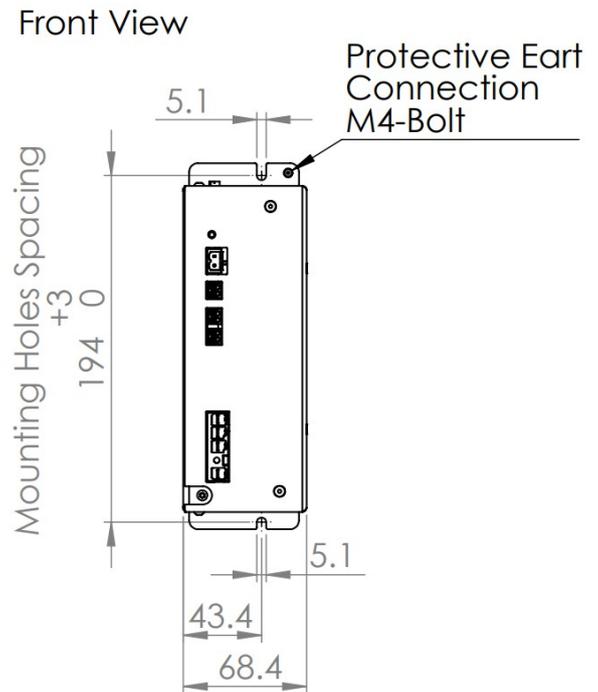


Figure 2: TP mounting dimensions

4.2 Cooling

The maximum allowable ambient temperature is 40°C. A minimum air speed of 3m/s is required at maximum current.

4.3 Brake resistor

Use only resistors with thermal shutdown protection. The use of an undersized power and energy withstand capability resistor might cause damage to the system. See section 3.8 for dimensioning.



Caution The cables connected to the external brake resistor must be shielded.

4.4 Capacitor reforming



Caution If the device has been stored without power for more than two years after shipment or after last time use, the internal capacitors require reforming. The same applies if storing above 35°C for more than one month without power.

Reforming instructions:

Add a resistor 470Ω/5W into each of the three phase power wires. Apply power for half an hour without enabling the drives. Then shut down and disconnect the device for 4 hours, remove the resistors and the TP is ready to use ⁶.

4.5 Wiring and Connectors

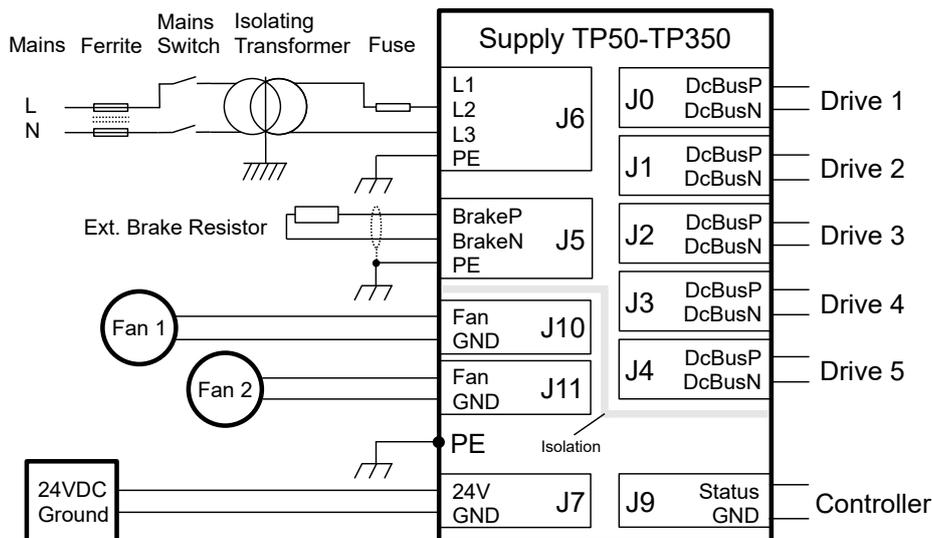


Figure 3: TP connections in case of 1 phase AC supply configuration

⁶ See JIS C 5101-4 clause 4.1 for details.

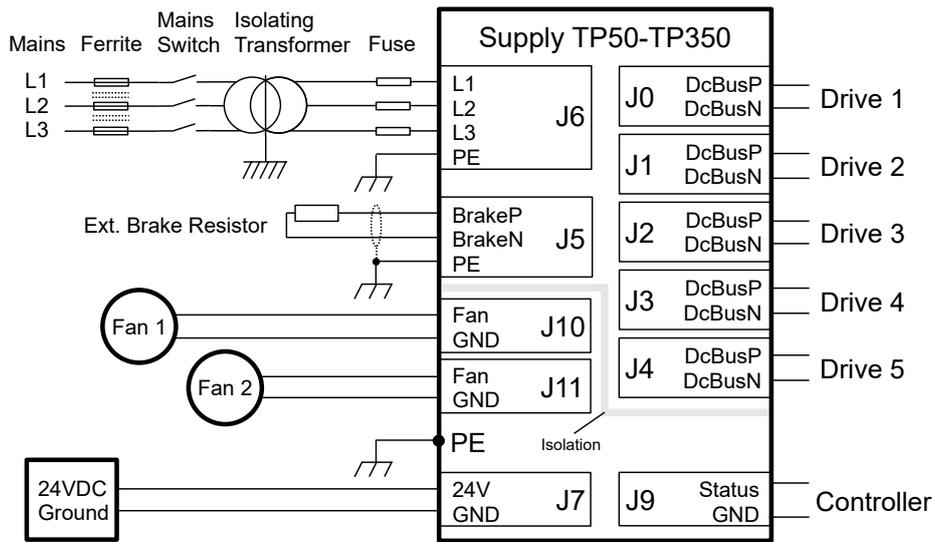


Figure 4: TP connections in case of 3 phase AC supply configuration

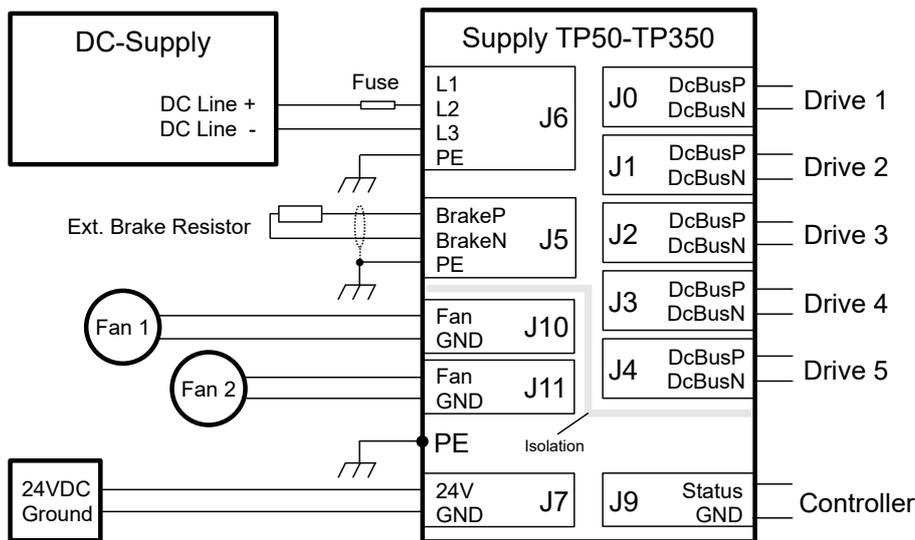


Figure 5: TP connections in case of DC supply configuration

	Dir.	Name	Mating Connector Type	Cross-section
J0-J4	out	DC-Bus	Würth Elektronik 691 348 400 002	1.5mm ² min, 2.5mm ² typ
J5	out	External brake res.	Würth Elektronik 691 348 400 003	1.5mm ² min, 2.5mm ² typ
J6	in	AC-Line or DC-Line in	Weidmüller 1156750000	1.5mm ² min, 2.5mm ² typ
J7	in	Status/Fan supply	Weidmüller 1013430000, 2 pin, 5.08mm pitch	(or similar)
J9	out	Status Out	Weidmüller 1615670000, 2 pin, 3.5mm pitch	(or similar)
J10 / J11	out	Fan 1, Fan 2	Weidmüller 1615670000, 2 pin, 3.5mm pitch	(or similar)
PE		Protective Earth	M5 (Front or top right corner of the housing)	Same or larger than AC-Line

In case of DC-line or 1 phase AC configuration, DC Line + and DC Line -, or P and N wires shall be connected to input L2/L3.

The following measures must be taken to ensure personal safety and EMC requirements

- There must be two connections to earth. Each must have at least the same diameter as the AC-Line wires.



Danger

Always connect first the protective earth (PE) to the dedicated screw in the housing!

Must!



Caution

In a one phase configuration, never connect the phase L without the corresponding neutral N. This might cause damage to the high voltage protection circuit.

5 Appendix

5.1 Warranty Information

The products covered in this manual are warranted to be free of defects in material and workmanship and conform to the specifications stated either within this document or in the product catalog description. All *Triamec Motion AG* products are warranted for a period of 12 months from the time of installation, or 18 months from time of shipment, whichever comes first. No other warranties, expressed or implied – and including a warranty of merchantability and fitness for a particular purpose – extend beyond this warranty.

5.2 Service

We are committed to quality customer service. In order to serve in the most effective way, please contact the Customer Support at *Triamec Motion AG*.

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References

The documents referenced in this manual.

[1] “Grounding Instructions”, AN144_GroundingInstructions_EP002.pdf, Triamec Motion AG, 2022

Revision History

Version	Date	Editor	Comment
001	2016-04-12	lh	First edit
002	2017-04-20	ab	Added DC-mode description
003	2018-09-25	lh	Added TP130 device
004	2019-10-09	lh	Added resistance value of internal brake resistor
005	2021-01-21	re	Clarify isolation transformer and update naming
006	2021-06-02	bl	Added order number of mating Weidmüller connectors
007	2021-11-18	re	Clarify and simplify. New address
008	2022-08-08	sm, ms	Update to newest CD, new owner ms, add service chapter, content update
009	2022-08-23	sm	Bugfix: File Header on Page 1 was missing in previous release.
010	2023-01-06	ab	Merged electrical specification tables, correct DC-line and int. brake resistor values, adjust TP130 brake-point, dimensions adapted
011	2024-01-04	ab	Changed connector designation to Mating Connector Type, added weight

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