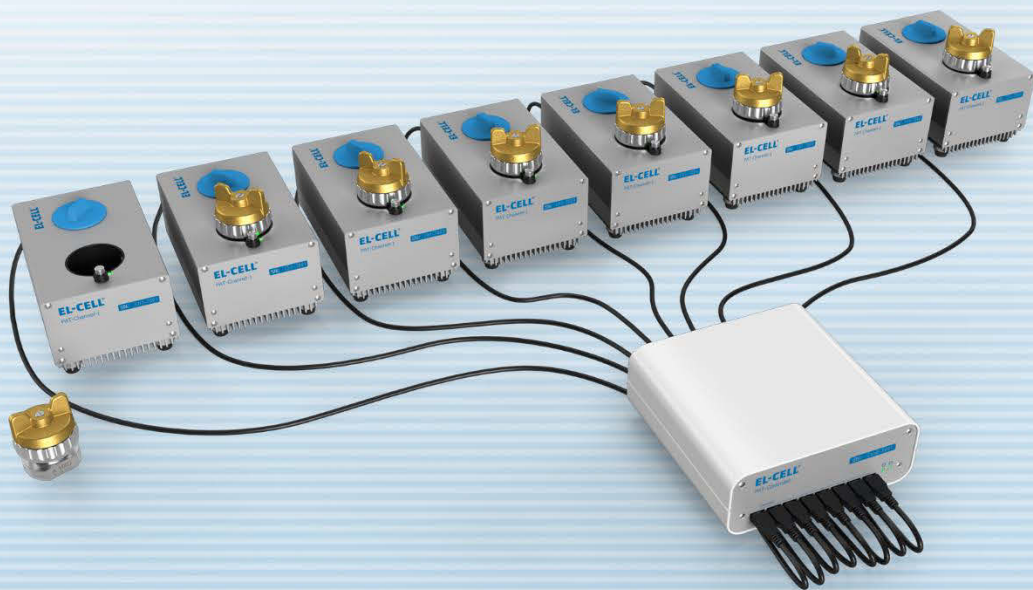


User Manual

Release 1.01

PAT-Tester-x-8

Modular battery test system with up to 8 test channels



The information in this manual has been carefully checked and believed to be accurate; however, no responsibility is assumed for inaccuracies.

EL-Cell GmbH maintains the right to make changes without further notice to products described in this manual to improve reliability, function, or design. EL-Cell GmbH does not assume any liability arising from the use or application of this product.

EL-Cell GmbH

Tempowerkring 8

21079 Hamburg - Germany

phone: +49 (0)40 790 12 737

fax: +49 (0)40 790 12 736

e-mail: info@el-cell.com

web: www.el-cell.com

Content

1 Product description 4

Included component manuals

PAT-Controller-8

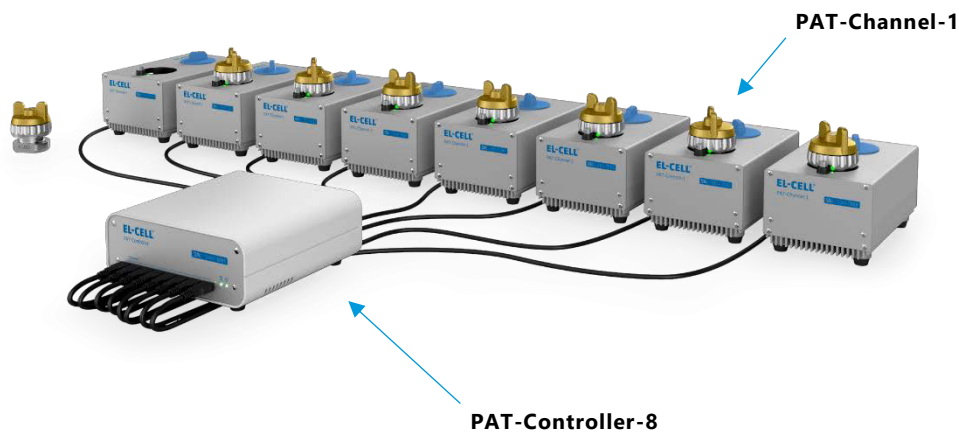
PAT-Channel-1

1 Product description

The PAT-Tester-x-8 is suited for small scale and special purpose testing. It is a modular battery tester designed for small test series and special measuring cells. The PAT-Tester-x consists of two main components, the PAT-Controller-8 and up to 8 PAT-Channel-1.

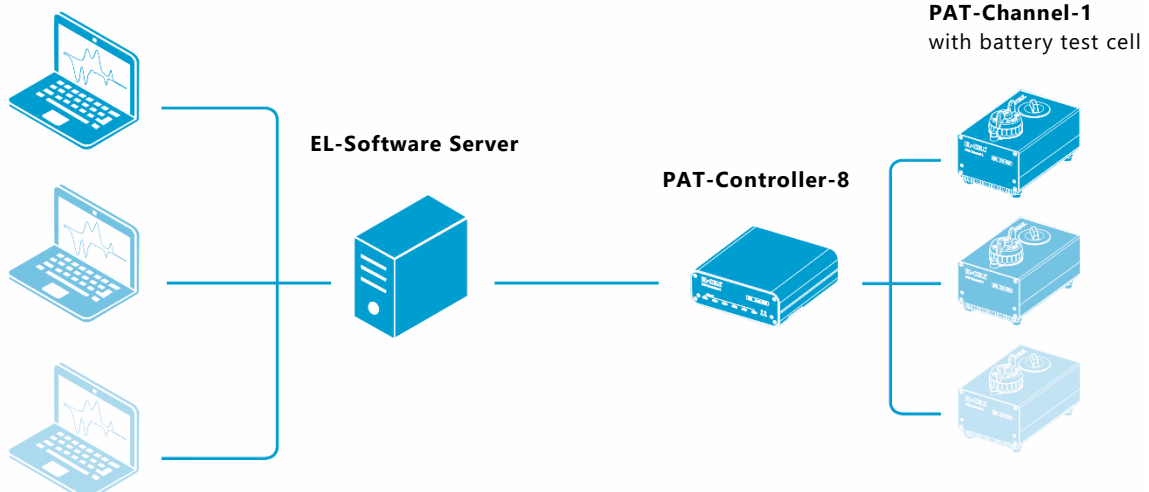
The individual test channels (PAT-Channel-1) are separate devices that can be connected as required. Each PAT-Channel-1 is a fully featured, single channel potentiostat / galvanostat/ impedance analyzer and contains a PAT docking socket for a PAT series test cell. However, it is also possible to connect other types of small battery cell or a separate PAT docking station to the PAT-Channel-1. The latter is useful for tests performed in a climatic chamber.

All channels are connected to the PAT-Controller-8, which serves as the central control, storage and security point. Any number of users can access the test channels connected to the controller via LAN. The PAT-Controller-8 guarantees that measurements continue to run even if network or software components fail.



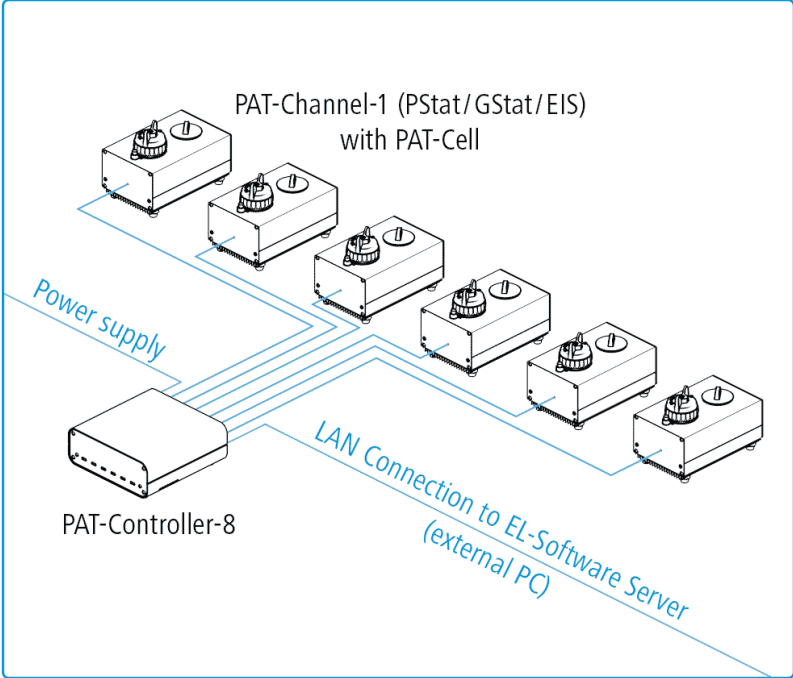
1.1 Hardware setup example

EL-Software Client

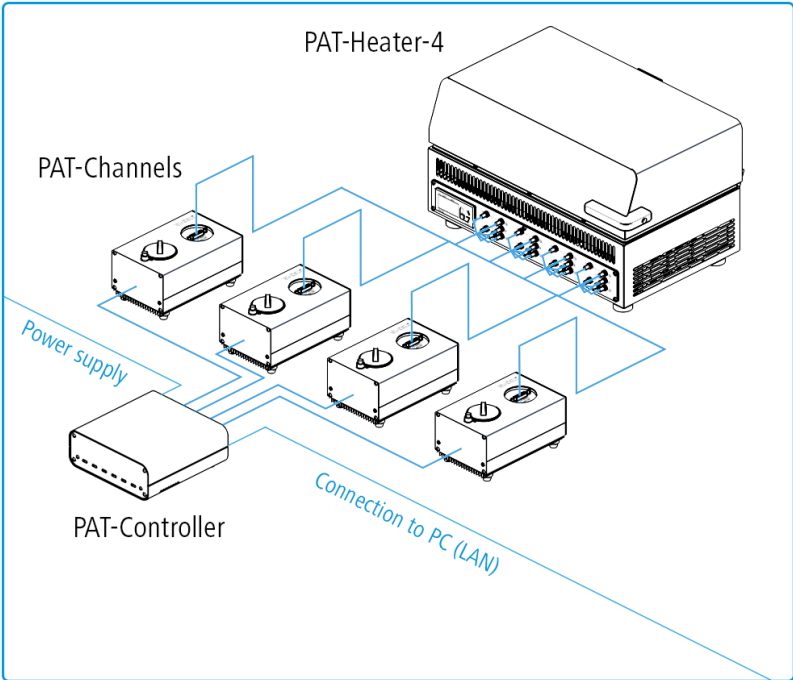


1.2 Testing setup examples

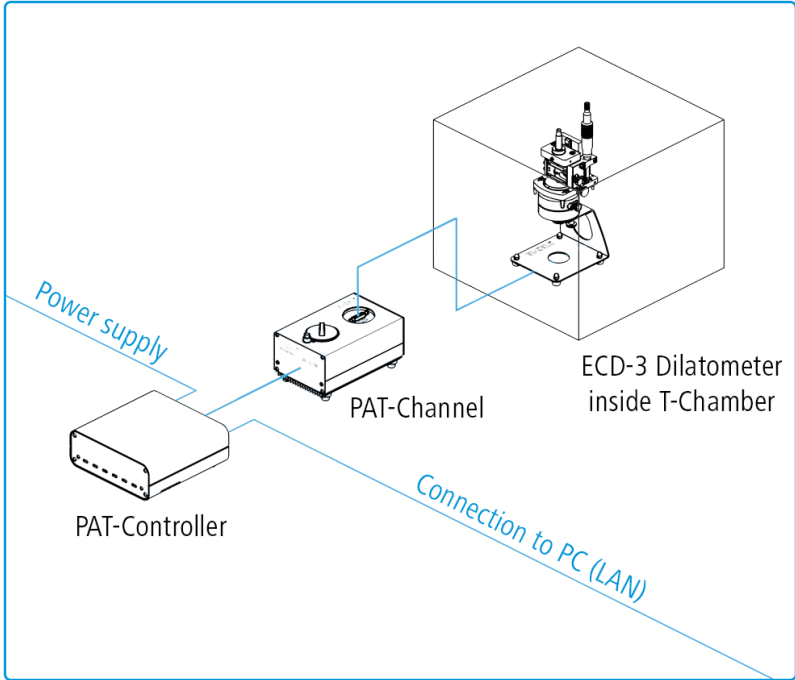
PAT-Tester-x-8 setup with 6 connected PAT-Channel running PAT-Cells



PAT-Tester-x-8 setup with a connected external PAT-Heater-4 docking station running PAT-Cell-HT test cells.



PAT-Tester-x-8 setup for running an ECD-3 dilatometer inside a temperature chamber



User Manual

Release 1.1

PAT-Controller-8

Control box for up to 8 PAT-Channel-1



The information in this manual has been carefully checked and believed to be accurate; however, no responsibility is assumed for inaccuracies.

EL-Cell GmbH maintains the right to make changes without further notice to products described in this manual to improve reliability, function, or design. EL-Cell GmbH does not assume any liability arising from the use or application of this product.

EL-Cell GmbH

Tempowerkring 8

21079 Hamburg - Germany

phone: +49 40 79012-737

fax: +49 40 79012-736

e-mail: info@el-cell.com

web: www.el-cell.com

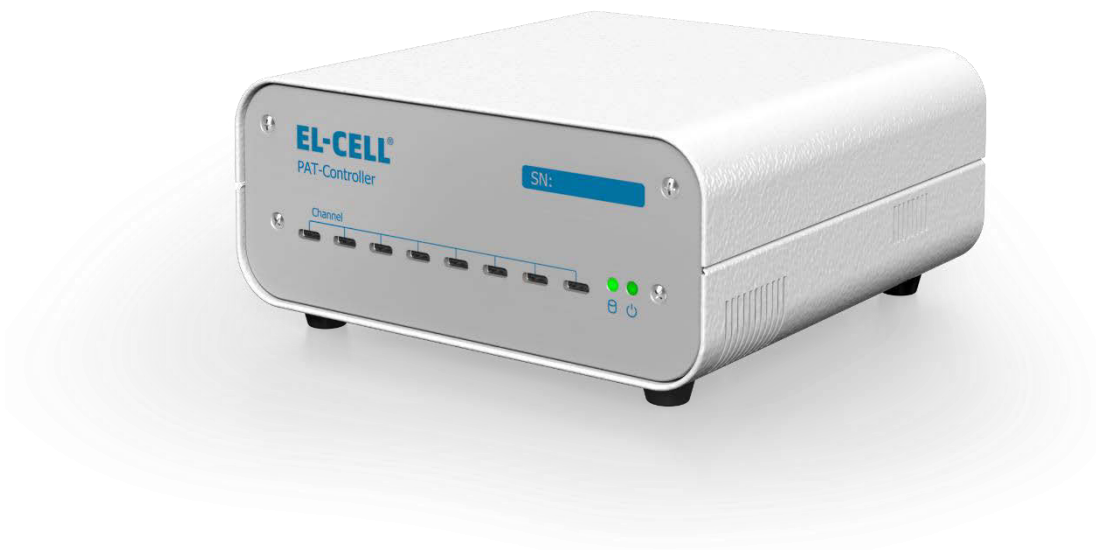
Content

1 Product description.....	4
2 Features.....	5
3 Technical data.....	5
4 Connections and display.....	6
5 Safety precautions.....	7
6 Installation.....	8
7 Cleaning.....	9
8 Unpacking.....	9
9 EC declaration of conformity.....	10
10 Technical support.....	13
11 Warranty.....	13

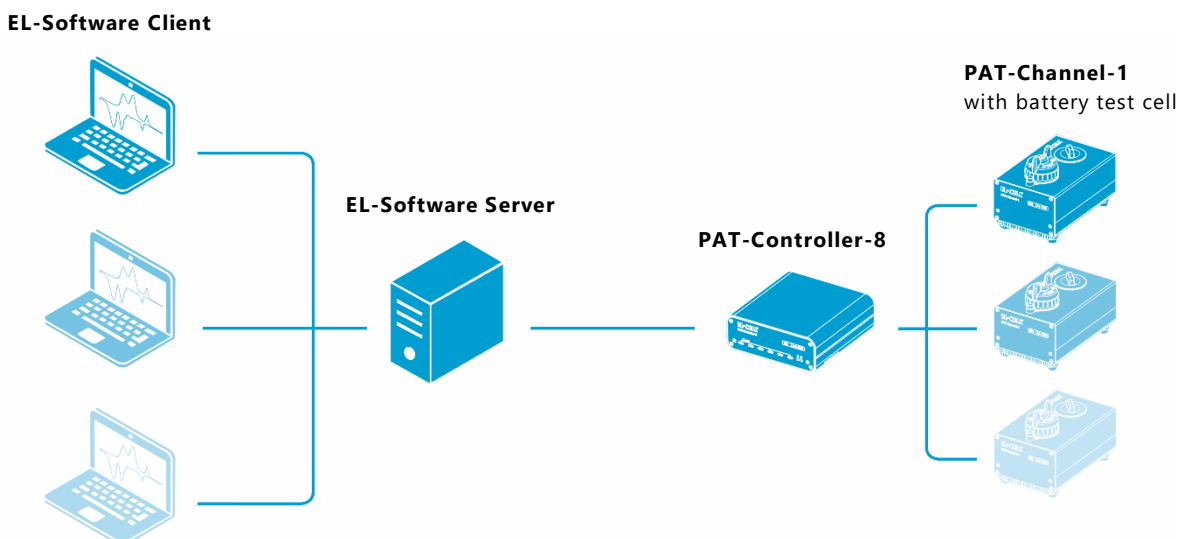
1 Product description

The PAT-Controller-8 is a core component of each PAT-Tester-x. It serves as the pivotal control, storage and security point. Any number of users can access the channels connected to the controller via LAN. The Controller guarantees that measurements continue to run even if network or software components fail.

The PAT-Controller features a built-in hard disk, a network port for server communication and USB ports for connection to up to 8 PAT-Channel-1.



Hardware setup example

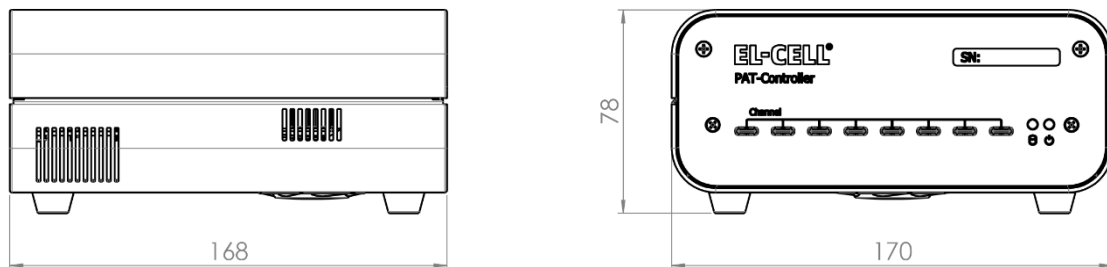


2 Features

- Internal 256 GB Solid State Disc for storing measurement data
- LAN Port (RJ45) for server connectivity
- 8 USB 2.0 Hi-Speed, type C ports for connecting PAT-Channel-1

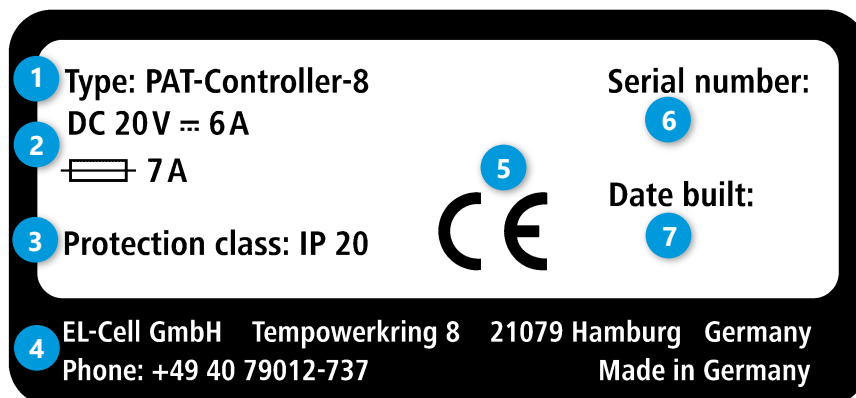
3 Technical data

- Height: 78 mm
- Length: 168 mm
- Width: 170 mm
- Weight: 1.7 kg
- Temperature operation range 0 to +40 °C
- Humidity: non-condensing



3.1 Designation (nameplate)

The nameplate provides information about the appliance model, manufacturer and technical data. It is attached to the back of the appliance.



- 1 Type designation
- 2 Operating voltage, Connection / power ratings
- 3 Protection class
- 4 Address of manufacturer
- 5 CE conformity
- 6 Serial number
- 7 Date built

4 Connections and display

Front:



1 USB 2.0 Hi-Speed, type C ports for PAT-Channel-1 connection

2 HDD-LED (yellow): Indicates hard drive (SSD) access.

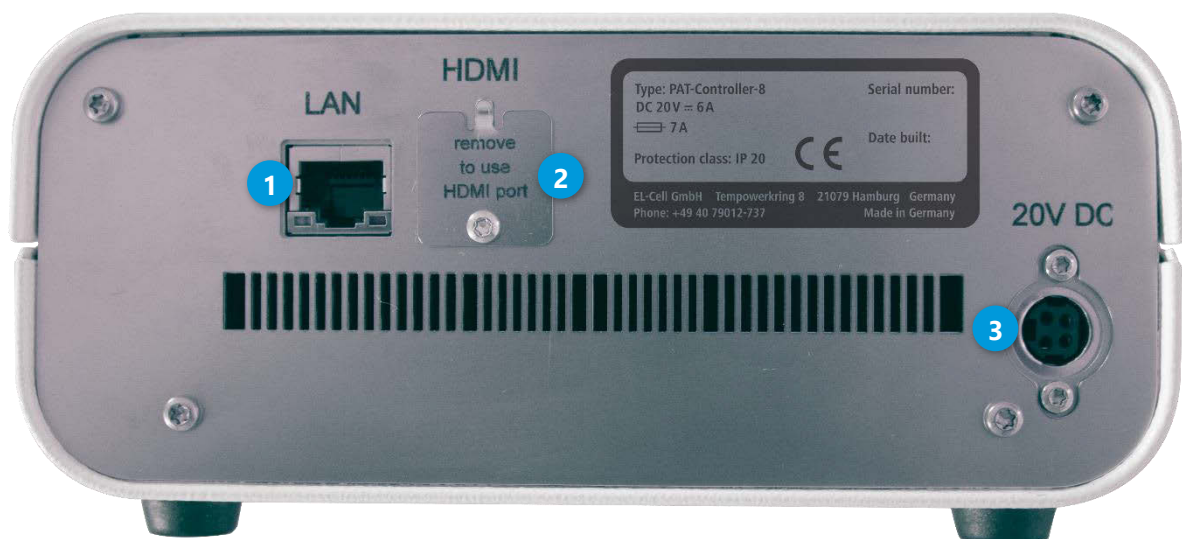
3 Power-LED (green): Indicates PAT-Controller is powered on.

Power-LED (red):) Indicates a fan fault or over-temperature fault.

After powering up the PAT-Controller, the red LED lights up for 1 second. This is the intended behaviour. If the red light stays on, this indicates a fan failure.

In case the red light comes on during operation, then this indicates an overtemperature condition, which can be the consequence of a fan fault.

Back:



1 LAN Port

2 HDMI Port (for maintenance only)

3 Power Input

5 Safety precautions



WARNING: A WARNING indicates a potential for property damage, personal injury, or death.



Do not operate the device with any cover removed.



Do not use the device in a wet environment. Protect equipment from liquid intrusion.



Do not push any objects into the air vents or openings of the device. Doing so can cause fire.



Do not operate the device beyond the allowed temperature range stated in the chapter Technical Data.



Do not attempt to service your equipment yourself. In case of technical failure contact our technical support as stated at the end of this manual.



Risk of fire or electric shock when using a mains plug adapter that is not specified. Use only the EL-Cell provided power supply approved for use with this device.

6 Installation

Note: To operate the PAT-Controller-8 you need access to an Ethernet Local Area Network (LAN). EL-Software Server (the server application of EL software) must be installed on the LAN server and EL-Software Client (the client component of EL software) on at least one client PC. The installation instructions for EL-Software can be found in the corresponding manual.

1. Place the PAT-Controller on a flat, dry and clean surface. Make sure that the fans are not covered to avoid overheating. The PAT-Controller-8 should not be operated in a glovebox.
2. Connect the provided power supply (brick) to the AC mains supply. Then plug the DC output of the power supply into the DC input of the PAT-Controller. The instrument will immediately power up once connected.
3. Connect the PAT-Controller to the network via LAN cable.
4. Follow the necessary steps to add the PAT-Controller as a new device in EL-Software (see EL-Software manual for details).
5. You can now connect PAT-Channels by plugging them into the front panel of the PAT-Controller via USB cable.

Note: Please note that the USB ports on the PAT-Controller are only for connection to PAT-Channels. Use only the special USB cables provided with the PAT-Channels.

7 Cleaning

Wipe the PAT-Controller-8 with a moist tissue. Do not use aggressive chemicals for cleaning. Protect the device from dust and moisture.

8 Unpacking

Check the contents of the packages against the list given below to verify that you have received all of the required components. Contact EL-CELL, if anything is missing or damaged.

NOTE: Damaged shipments must remain within the original packaging for freight company inspection.

List of components:

- **PAT-Controller-8**, [ECE1-00-0280-A](#)
- **Power supply GST120A20-R78**, [ELT9807](#)
- **Power cord IEC 60320 C14EURO L sw 1.5m**, [ELT9222](#)

9 EC declaration of conformity



electrochemical test equipment

EU Declaration of Conformity

Manufacturer's name and address: EL-Cell GmbH
Tempowerkring 8
21079 Hamburg
Germany

Product: PAT-Controller-8

The designated product is in conformity with the

- Low Voltage Directive (LDV) 2014/35/EU
- Electromagnetic Compatibility Directive (CEM) 2014/30/EU
- Restriction of Hazardous Substance Directive (RoHS) 2011/65/EU

and the following harmonised standards:

- Safety: IEC 61010-1
- EMC: IEC 61326

Emissions

EN 55011: Conducted Class B
EN 55011: Radiated Class A
EN 61000-3-2: Harmonic Current

Immunity

IEC 61000-4-3: EM field
IEC 61000-4-4: Burst
IEC 61000-4-5: Surge
IEC 61000-4-6: Conducted RF
IEC 61000-4-8: Magnetic Field
IEC 61000-4-11: Voltage Dip/Short Interruptions

Hamburg, 17.09.2020

Michael Hahn, CEO

This declaration certifies compliance with the above mentioned directives but does not include a property assurance.
The safety note given in the product documentation which are part of the supply, must be observed.

The products described are in conformity with the following harmonized standards:

EN 61010-1:2010	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte – Teil 1: Allgemeine Anforderungen (DIN EN 61010-1, VDE 0411-1:2011-07)
	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements (IEC 61010-1:2010 + Cor. :2011)
EN 61010-2-201:2014	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte - Teil 2-201: Besondere Anforderungen für Steuer- und Regelgeräte (DIN EN 61010-2-201:2014, VDE 0411-2-201:2014-01)
	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-201: Particular requirements for control equipment (IEC 61010-2-201:2013)
EN 61010-2-010:2015-05	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte - Teil 2-010: Besondere Anforderungen an Laborgeräte für das Erhitzen von Stoffen (DIN EN 61010-2-010:2014; VDE 0411-2-010:2015-05)
	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-201: Particular requirements for control equipment (IEC 61010-2-201:2013)
EN 61326-1:2013	Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 1: Allgemeine Anforderungen (DIN EN 61326-1:2013-07, VDE 0843-20-1:2013-07)
	EMC requirements - Part 2-3: Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning (IEC 61326-2-3:2012)

EN 61326-2-3:2013-07	<p>Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 2-3: Besondere Anforderungen - Prüfanordnung, Betriebsbedingungen und Leistungsmerkmale für Messgrößenumformer mit integrierter oder abgesetzter Signalaufbereitung</p> <p>(DIN EN 61326-2-3:2013-07, VDE 0843-20-2-3:2013-07)</p>
	<p>Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-3: Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning</p> <p>(IEC 61326-2-3:2012)</p>
EN 50581: 2013-02	<p>Technische Dokumentation zur Beurteilung von Elektro- und Elektronikgeräten hinsichtlich der Beschränkung gefährlicher Stoffe</p> <p>(DIN EN 50581; VDE 0042-12:2013-02)</p>
	<p>Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances</p>

10 Technical support

Technical support for this product is exclusively provided by EL-Cell GmbH.

EL-Cell GmbH

Tempowerkring 8

21079 Hamburg - Germany

phone: +49 40 79012-737

fax: +49 40 79012-736

e-mail: info@el-cell.com

web: www.el-cell.com

11 Warranty

For a period of one year from the date of shipment, EL-Cell GmbH (hereinafter Seller) warrants the goods to be free from defect in material and workmanship to the original purchaser. During the warranty period, Seller agrees to repair or replace defective and/or nonconforming goods or parts without charge for material or labor, or, at the Seller's option, demand return of the goods and tender repayment of the price. Buyer's exclusive remedy is repair or replacement of defective and nonconforming goods, or, at Seller's option, the repayment of the price.

Seller excludes and disclaims any liability for lost profits, personal injury, interruption of service, or for consequential incidental or special damages arising out of, resulting from, or relating in any manner to these goods.

This Limited Warranty does not cover defects, damage, or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, modification, or the attachment of improper devices to the goods. This Limited Warranty does not cover expendable items. This warranty is void when repairs are performed by a non-authorized person or service center. At Seller's option, repairs or replacements will be made on site or at the factory. If repairs or replacements are to be made at the factory, Buyer shall return the goods prepaid and bear all the risks of loss until delivered to the factory. If Seller returns the goods, they will be delivered prepaid and Seller will bear all risks of loss until delivery to Buyer. Buyer and Seller agree that this Limited Warranty shall be governed by and construed in accordance with the laws of Germany.

The warranties contained in this agreement are in lieu of all other warranties expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

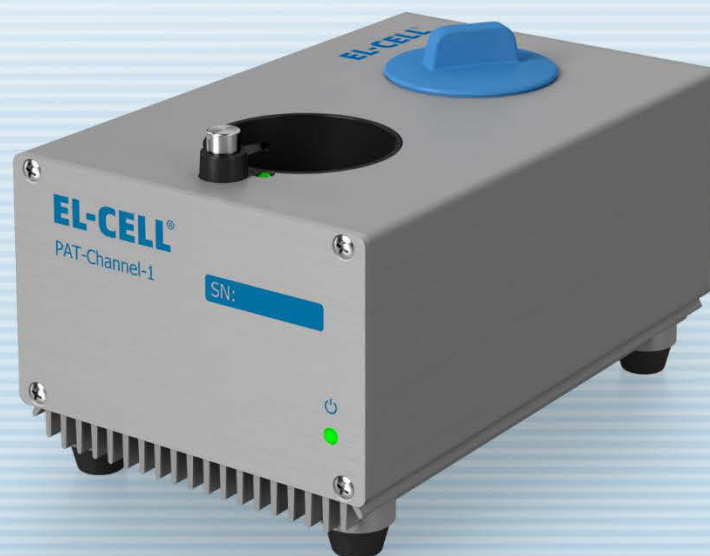
This Limited Warranty supersedes all prior proposals or representations oral or written and constitutes the entire understanding regarding the warranties made by Seller to Buyer. This Limited Warranty may not be expanded or modified except in writing signed by the parties hereto.

User Manual

Release 1.01

PAT-Channel-1

Single channel station for one test cell



The information in this manual has been carefully checked and believed to be accurate; however, no responsibility is assumed for inaccuracies.

EL-Cell GmbH maintains the right to make changes without further notice to products described in this manual to improve reliability, function, or design. EL-Cell GmbH does not assume any liability arising from the use or application of this product.

EL-Cell GmbH

Tempowerkring 8

21079 Hamburg - Germany

phone: +49 40 79012-737

fax: +49 40 79012-736

e-mail: info@el-cell.com

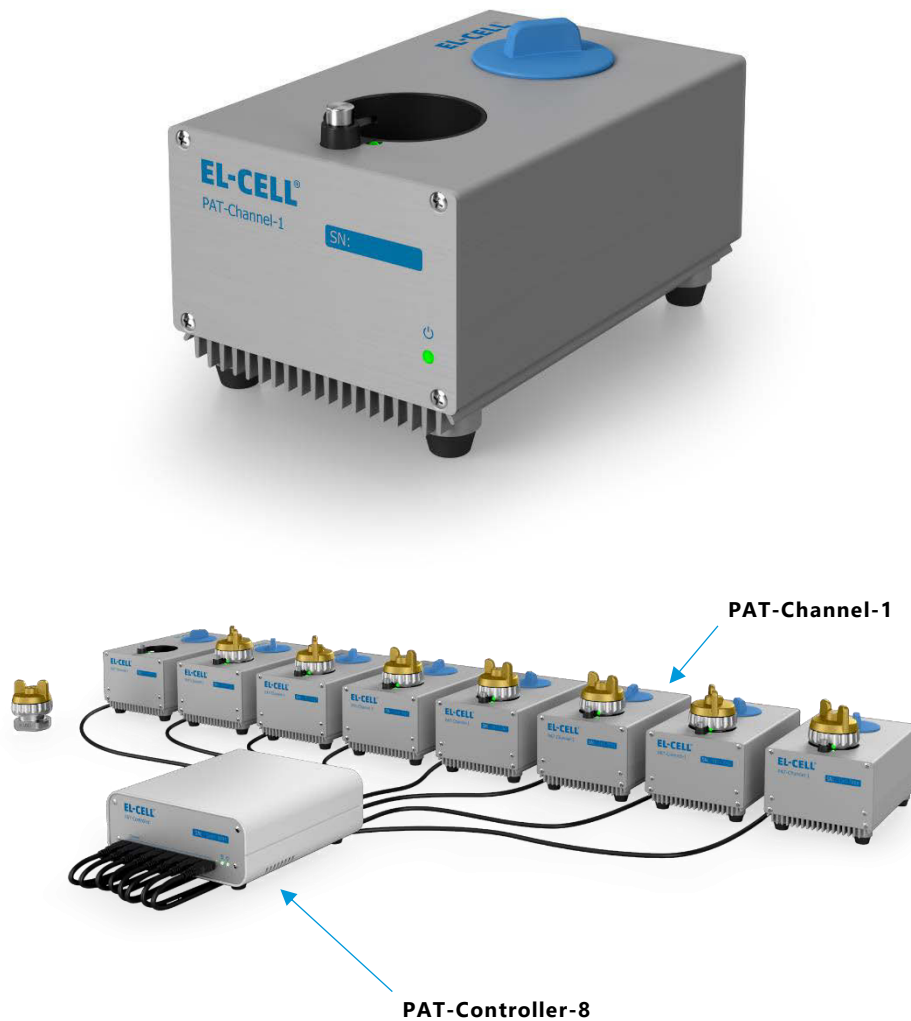
web: www.el-cell.com

Content

1 Product description.....	4
2 Features.....	5
3 Technical data.....	5
4 Specifications.....	6
5 Connections and display.....	9
6 Safety precautions.....	10
7 Installation.....	11
8 Cleaning.....	12
9 Unpacking.....	12
10 EC declaration of conformity.....	13
11 Technical support.....	16
12 Warranty.....	16

1 Product description

The PAT-Channel-1 is a fully featured, single channel potentiostat / galvanostat/ impedance analyzer which is operated in conjunction with a PAT-Controller. It has a docking socket for one PAT series test cell and external connectors to connect a test cell of a different type or a separate docking station.

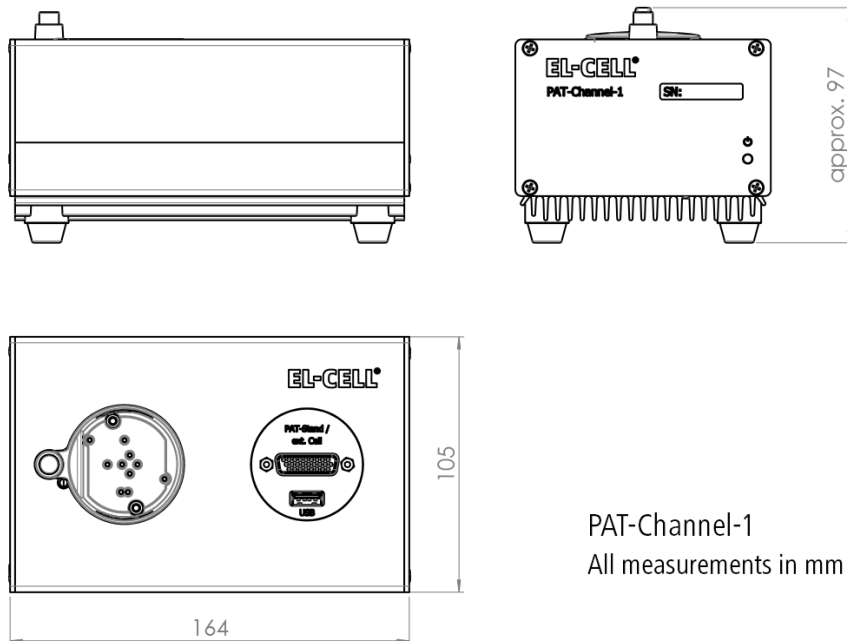


2 Features

- Fully equipped with PStat/GStat/EIS
- Voltage: +/-7 V control
- Current: +/- 100 mA
- PAT docking station
- D-Sub port for active shielded cell cable, I2C bus signals and analog input
- USB 2.0 port for additional sensor data

3 Technical data

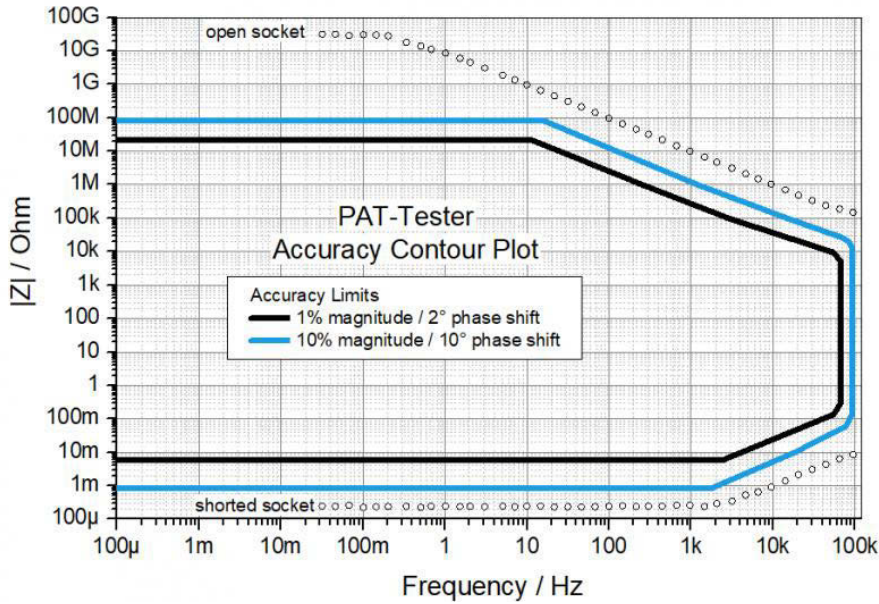
- Height: 97 mm
- Length: 164 mm
- Width: 105 mm
- Weight: 1.3 kg
- Temperature operation range -20 to +40 °C
- Humidity: non condensing



PAT-Channel-1
All measurements in mm

4 Specifications

4.1 Accuracy Contour Plot



4.2 General

# Channels per device	1
Voltage	-7 V to +7 V
Current	± 100 mA
Cell connection / Electrode connection	3 electrodes plus sense wires, connection matrix
ADC	2 x 24 Bit
DAC	1 x 18 Bit
Bandwidth ranges (Stability Factor)	500 kHz (fast) 50 kHz (medium) 5 kHz (slow)
Acquisition Time (Time Base)	1 ms

4.3 Voltage

Acquisition of ...	Full cell voltage Both half cell voltages Auxiliary voltage
Measurement Accuracy	$\pm 0.02\%$ of FSR
Control Resolution	57 μV (18 Bit)

4.4 Current

Current Ranges	± 100 mA ± 10 mA ± 1 mA ± 100 μA Autorange
Measurement Noise floor	<1 μA @ 100mA <100 nA @ 10mA <10 nA @ 1mA <1 nA @ 100 μA
Measurement Accuracy	$\pm 0.05\%$ of FSR
Control Resolution	1 nA min. (18 Bit)

4.5 Impedance (each channel)

Frequency range	100 μ Hz to 100 kHz
Impedance mode	PEIS and GEIS (simultaneous measurement of full- and half-cell impedances)
Impedance range	1 m Ω to 100 M Ω

4.6 Other

Additional Measurement (each channel)	Digital (I^2C) sensor signal, e.g. for cell temperature Analog sensor signal, e.g. for gas pressure
Calibration	Fully automatic self-calibration with internal voltage reference and three internal calibration cells
Software	EL-Software with : Experiment designer Cell and material management with database Script editor Live data monitoring Analysing and reporting capabilities
Cell Identification	PAT-Button with unique serial number stored in EEPROM

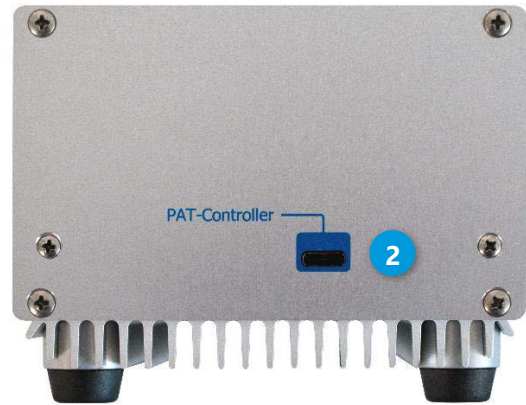
5 Connections and display

Front:



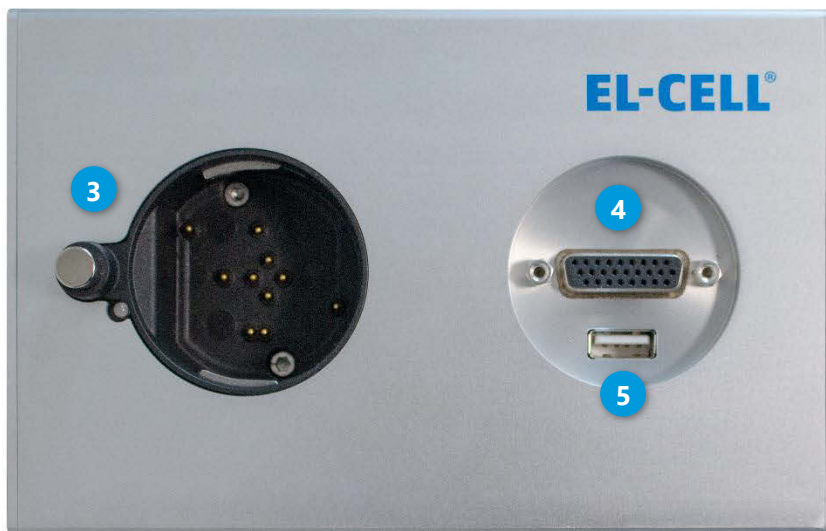
1 Power indicator

Back:



2 USB 2.0 Hi-Speed, type C connection to PAT-Controller

Top:



3 PAT Socket

4 D-Sub port

5 USB 2.0 port for additional sensor data

6 Safety precautions



WARNING: A WARNING indicates a potential for property damage, personal injury, or death.



Do not operate the device with any cover removed.



Do not use the device in a wet environment. Protect equipment from liquid intrusion.



Do not push any objects into the openings of the device.



Do not operate the device beyond the allowed temperature range stated in the chapter Technical Data.



Do not attempt to service your equipment yourself. In case of technical failure contact our technical support as stated at the end of this manual.

7 Installation

Note: To operate the PAT-Channel-1 you need a PAT-Controller connected to an Ethernet Local Area Network (LAN). EL-Software Server (the server application of EL software) must be installed on the LAN server and EL-Software Client (the client component of EL software) on at least one client PC. The installation instructions for the PAT-Controller and EL-Software can be found in separate manuals.

1. Place the PAT-Channel-1 on a flat, dry and clean surface.
2. Connect the PAT-Channel to the PAT-Controller using the supplied USB cable. The cable connects the USB port on the PAT-Channel (labeled "PAT-Controller") to one of the 8 USB ports (labeled "Channel") on the PAT Controller.
3. Insert a PAT series test cell into the PAT socket. Alternatively, connect another cell type or a PAT docking station via the D-Sub connector of the PAT-Channel and a special cable. This option can be used, for example, to operate a test cell at extreme temperatures in a climate chamber. An adapter is optionally available to test coin cells in the PAT socket.

8 Cleaning

Wipe the PAT-Channel-1 with a moist tissue. Do not use aggressive chemicals for cleaning. Protect the device from dust and moisture.

9 Unpacking

Check the contents of the packages against the list given below to verify that you have received all of the required components. Contact EL-CELL, if anything is missing or damaged.

NOTE: Damaged shipments must remain within the original packaging for freight company inspection.

List of components:

- **PAT-Channel-1**, [ECE1-00-0210-A](#)
- **USB cable 2.0, type C, 3m**, [ELT9797](#)

10 EC declaration of conformity



electrochemical test equipment

EU Declaration of Conformity

Manufacturer's name and address: EL-Cell GmbH
Tempowerkring 8
21079 Hamburg
Germany

Product: PAT-Channel-1

The designated product is in conformity with the

- Low Voltage Directive (LDV) 2014/35/EU
- Electromagnetic Compatibility Directive (CEM) 2014/30/EU
- Restriction of Hazardous Substance Directive (RoHS) 2011/65/EU

and the following harmonised standards:

- Safety: IEC 61010-1
- EMC: IEC 61326

Emissions

EN 55011: Conducted Class B
EN 55011: Radiated Class A
EN 61000-3-2: Harmonic Current

Immunity

IEC 61000-4-3: EM field
IEC 61000-4-4: Burst
IEC 61000-4-5: Surge
IEC 61000-4-6: Conducted RF
IEC 61000-4-8: Magnetic Field
IEC 61000-4-11: Voltage Dip/Short Interruptions

Hamburg, 18.09.2020

Michael Hahn, CEO

This declaration certifies compliance with the above mentioned directives but does not include a property assurance. The safety note given in the product documentation which are part of the supply, must be observed.

The products described are in conformity with the following harmonized standards:

EN 61010-1:2010	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte – Teil 1: Allgemeine Anforderungen (DIN EN 61010-1, VDE 0411-1:2011-07)
	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements (IEC 61010-1:2010 + Cor. :2011)
EN 61010-2-201:2014	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte - Teil 2-201: Besondere Anforderungen für Steuer- und Regelgeräte (DIN EN 61010-2-201:2014, VDE 0411-2-201:2014-01)
	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-201: Particular requirements for control equipment (IEC 61010-2-201:2013)
EN 61010-2-010:2015-05	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte - Teil 2-010: Besondere Anforderungen an Laborgeräte für das Erhitzen von Stoffen (DIN EN 61010-2-010:2014; VDE 0411-2-010:2015-05)
	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-201: Particular requirements for control equipment (IEC 61010-2-201:2013)
EN 61326-1:2013	Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 1: Allgemeine Anforderungen (DIN EN 61326-1:2013-07, VDE 0843-20-1:2013-07)
	EMC requirements - Part 2-3: Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning (IEC 61326-2-3:2012)

EN 61326-2-3:2013-07	<p>Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 2-3: Besondere Anforderungen - Prüfanordnung, Betriebsbedingungen und Leistungsmerkmale für Messgrößenumformer mit integrierter oder abgesetzter Signalaufbereitung</p> <p>(DIN EN 61326-2-3:2013-07, VDE 0843-20-2-3:2013-07)</p>
	<p>Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-3: Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning</p> <p>(IEC 61326-2-3:2012)</p>
EN 50581: 2013-02	<p>Technische Dokumentation zur Beurteilung von Elektro- und Elektronikgeräten hinsichtlich der Beschränkung gefährlicher Stoffe</p> <p>(DIN EN 50581; VDE 0042-12:2013-02)</p>
	<p>Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances</p>

11 Technical support

Technical support for this product is exclusively provided by EL-Cell GmbH.

EL-Cell GmbH

Tempowerkring 8

21079 Hamburg - Germany

phone: +49 40 79012-737

fax: +49 40 79012-736

e-mail: info@el-cell.com

web: www.el-cell.com

12 Warranty

For a period of one year from the date of shipment, EL-Cell GmbH (hereinafter Seller) warrants the goods to be free from defect in material and workmanship to the original purchaser. During the warranty period, Seller agrees to repair or replace defective and/or nonconforming goods or parts without charge for material or labor, or, at the Seller's option, demand return of the goods and tender repayment of the price. Buyer's exclusive remedy is repair or replacement of defective and nonconforming goods, or, at Seller's option, the repayment of the price.

Seller excludes and disclaims any liability for lost profits, personal injury, interruption of service, or for consequential incidental or special damages arising out of, resulting from, or relating in any manner to these goods.

This Limited Warranty does not cover defects, damage, or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, modification, or the attachment of improper devices to the goods. This Limited Warranty does not cover expendable items. This warranty is void when repairs are performed by a non-authorized person or service center. At Seller's option, repairs or replacements will be made on site or at the factory. If repairs or replacements are to be made at the factory, Buyer shall return the goods prepaid and bear all the risks of loss until delivered to the factory. If Seller returns the goods, they will be delivered prepaid and Seller will bear all risks of loss until delivery to Buyer. Buyer and Seller agree that this Limited Warranty shall be governed by and construed in accordance with the laws of Germany.

The warranties contained in this agreement are in lieu of all other warranties expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

This Limited Warranty supersedes all prior proposals or representations oral or written and constitutes the entire understanding regarding the warranties made by Seller to Buyer. This Limited Warranty may not be expanded or modified except in writing signed by the parties hereto.