



LTT24 Precision Measuring Device Installation Guide

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LTT24 Precision Measuring Device Installation Guide



The multi-functional data acquisition device LTT24 combines the functionality of a Transient Recorder with 24 bit ADC and 4 MSample/s per channel with amplification functions for voltage, current, IEPE (ICP®), strain gauge, resistance, temperature, charge and more.

With all error sources consistently minimized, the full precision of the LTT24 preamp can be exploited. Distortion and noise together are as good as -119 dB and allow an ENOB (effective number of bits) of true 16 bit across a wide range of frequencies and amplitudes.

This manual will guide you through proper LTT24 device installation. In addition you will get a detailed explanation of available couplings and how to connect your sensors to the LTT24 device.

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Managing Editors

Michael Tasler David Bachert

Technical Editors

Michael Tasler Ekkehard Loesti

Software Editor

Christian Schmiedecke

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Installation

Before you start with your new LTT24, please read the following chapters carefully. Unless otherwise noted, instructions apply to all device types with any number of channels or optional features.

If your LTT24 device or parts of the accessory seem to be damaged or incomplete, please contact LTT immediately. Do not disassemble the device or the delivered power supply on your own! When using your own power supply, refer to chapter Specifications 23 for notes on power requirements.

Unpacking

Every LTT24 device comes with a set of accessories that is common to all device types. Check the following list for completeness:

- LTT 24 device
- Power supply (available in different versions) and power cord
- USB 3.0 cable A-B male/male, 1.8m
- Software as download link inclusive license and user manual

LTT 24 device, power supply and power cord and all necessary cables, software and documentation as download link



Depending on the configuration of your LTT24 device, some additional parts may be enclosed. Please check delivery note carefully for completeness.

If you have ordered additional hardware with your LTT24 device (e.g. notebook or sensors), please refer to the corresponding manuals for setup and operation.

Setup and Connections

Your LTT24 comes with an appropriate power supply. Depending on the number of channels and embedded features, 90W, 140W or 300W version is delivered.

LTT24 Precision Measuring Device Installation Guide Setup and Connections



Binder S. 693 Plug



Connect the Binder Series 693 plug of the power supply unit to the power socket of your LTT24 and the Schuko® plug to the grid. The connection to the Personal Computer (PC) can be established in different ways. Select the option you have ordered:

1. **USB 3.0:** Plug the USB cable into the (blue) USB socket of your LTT24 and to a USB 3.0 port of your computer. Be aware that using a USB 2.0 (or slower) port will result in lower data transfer rates! There is no need to install any drivers for connecting LTT24 devices! Turn on your LTT24 with the power switch at the rear.
2. **Ethernet:** At press date of this manual, ethernet option for the LTT24 is realized by a separate (19-inch or SBC) computer system. Connect this external computer system to power, USB interface with the delivered cable to the LTT24 device and ethernet interface to your local network (LAN). Please check for separate manuals or setup guides that are delivered with the external computer in order to get additional information on default IP-address, cable setup and more. Turn on the LTT24 with the power switch at the rear before you power up the external computer device.

Before installing the LTTpro software on your personal computer, please check if your LTT24 is recognized by your computer.

Devices that are connected directly to a USB port of your computer should appear as “LTT24 USB device” (mass storage) after powering up. At Microsoft Windows™ Systems you will find the LTT24 device in section disk drives of the Windows device manager.

External computer systems with ethernet interface should be checked with the ping command for responsiveness. Contact the system- or network administrator of your company in order to integrate the LTT24 ethernet interface in your LAN. If your system is secured by a firewall or your local network is setup with active port filtering, you have to allow ports 8110 (TCP), 8111 (UDP) and 8112 (UDP).

If the LTT24 is not recognized by your computer, please refer to chapter **Troubleshooting** 28 to get further

information and assistance.

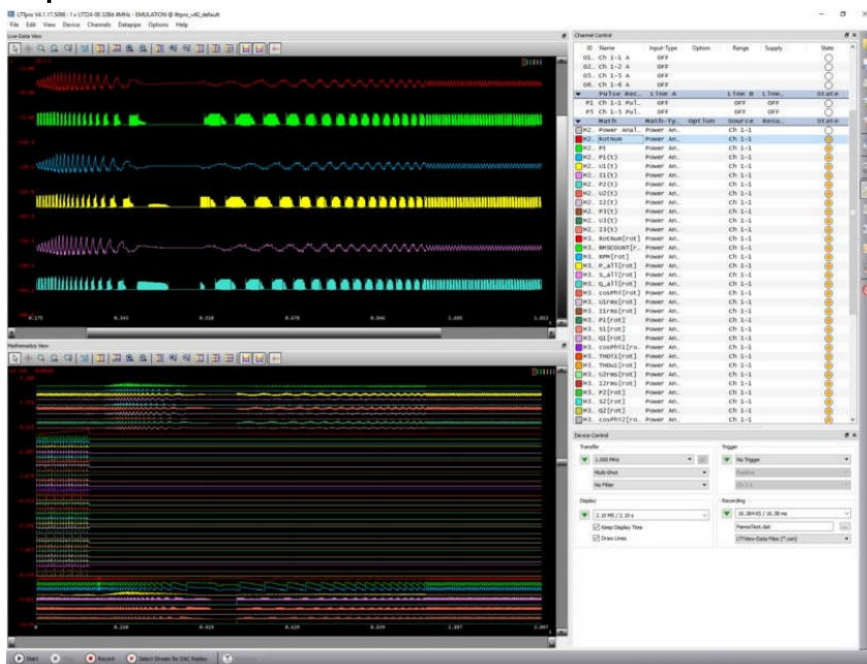
Software

The LTTpro software for your LTT24 device running under Microsoft Windows™ is available as a download link. You should always install the latest version of the software that comes with your device even if you have already installed a previous version of LTTpro on your computer.

If you want to explore yourself with the LTTpro software before installation, you will get the complete software manual (in Adobe Portable Document Format – you need additional software to open PDF files!) via the download link.

After installation it is also possible to run LTTpro software in device emulation mode without real devices attached. All software controls can be explored, a signal is simulated and essential workflow can be exercised without a real device.

LTTpro software in device emulation mode



LTTpro is also available for Linux operating system. Due to the multitude of Linux distributions on the market, it is not possible to supply a standard setup for LTTpro on that operating system. If you want to run LTTpro on Linux, please contact LTT software development for binaries and instructions.

If you want to implement LTT24 device(s) in your own measurement or analysis product you can use ltt2api libraries for complete control and data handling on our devices. Visit our website (www.tasler.de) or contact our software support to get further information on ltt2api.

Operation

The modular concept of the LTT24 allows different (hardware) configuration with each channel. While all channels implement VOLT and CURRENT coupling, other features like IEPE, STRAIN GAUGE or CHARGE are optional and can be ordered individually.

In order to achieve most flexibility, each channel of an LTT24 comes with an 8-pole DIN socket in addition to a conventional BNC jack. In the following chapters we will describe the pin assignment of the different couplings – please read them carefully because there are very important notes on safety precautions and range limits.

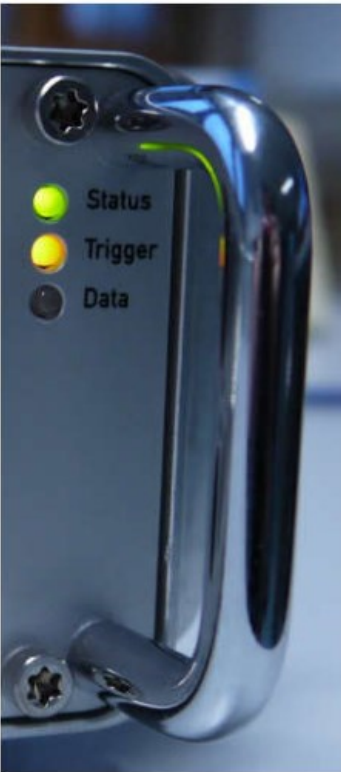
While each channel has individual LEDs for socket selection and active supply, the LTT24 also comes with three global LEDs for common status information:

- **Status:** green signals device powered up and running in normal condition, red indicates error
- **Trigger:** off signals no trigger, orange signals waiting for trigger, green signals fired trigger
- **Data:** off signals no data, green (blinking) signals data transfer, red signals error condition

Normal Device Operation



Waiting for Trigger



Trigger was fired



With small display sizes in LTTpro a lot of small packets are transferred from LTT24 to your personal computer resulting in a heavily flushing Data LED. With higher data rates (large display sizes) the Data LED seems to remain permanently on.

If Data LED turns red in constant intervals, the combination of sample clock, active channels and display size exceeds available RAM buffer – not all data will be recorded or transferred to your computer.

If Status LED turns red, a severe error condition has reached. Turn off device immediately and check for proper environment conditions.

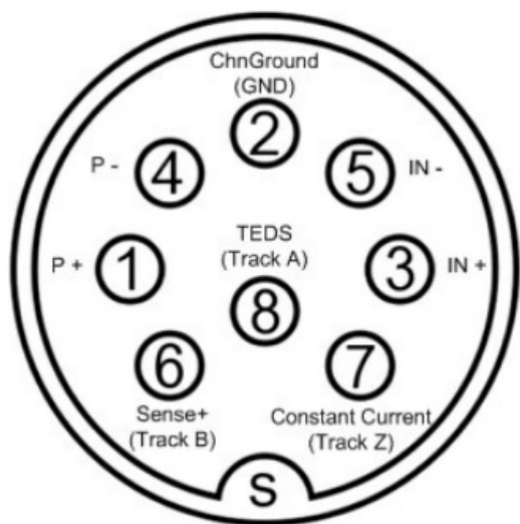
Overview

The default hardware configuration of an LTT24 channel has a DIN socket and a BNC jack with the following pin assignment. See the following chapters for a description of the different sensor types and measurement applications.

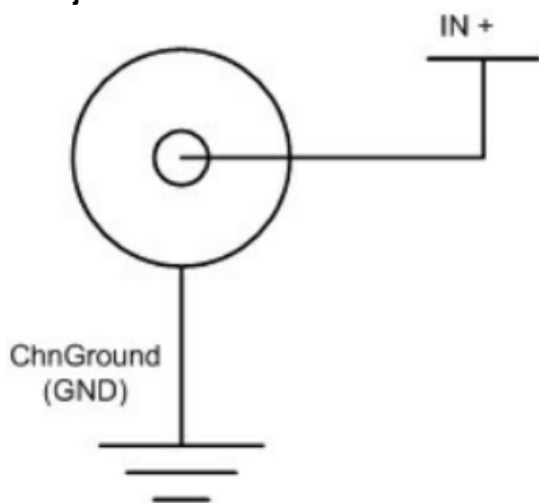
Pin Name Description

1. P+ Positive Supply
2. GND Channel Ground
3. IN+ Positive Input
4. P- Negative Supply
5. IN- Negative Input
6. S+ Sense+ (Track A with Pulse Option)
7. CC Constant Current (Track Zero with Pulse Option)
8. TEDS TEDS (Track A with Pulse Option)

LTT24 DIN socket (front view)



BNC jack



Keep in mind that not all signals are available with all configurations. Several signals depend on hardware or firmware features, e.g. Track A, B and Z are available only with pulse recognition option.

Note that even if IN+ signal of BNC jack goes to the same signal path as PIN 3 of the DIN socket and ChnGround is same as PIN 2 of the DIN socket, only one interface (DIN or BNC) is available at a time.

Caution: Channels that come with Pulse Recognition or DACout option have ChnGround and Pin 2 shorted all the time!

Couplings (Sensor Types)

This chapter describes all available couplings composite to their connection diagram. While Single Ended (SE) operation affects both interfaces, all other couplings will describe only DIN socket. The following couplings will be described:

- Single Ended (SE) Operation 13
- Differential Ended (DE) Operation 14
- IEPE (ICP™) 15
- STRAIN GAUGE: Quarterbridge
- STRAIN GAUGE: Halfbridge
- STRAIN GAUGE: Fullbridge 18

You will see activity of DIN socket or BNC jack at the channel LEDs. Green LED signals channel activity, orange LED signals active supply.

DIN IN active



BNC IN active



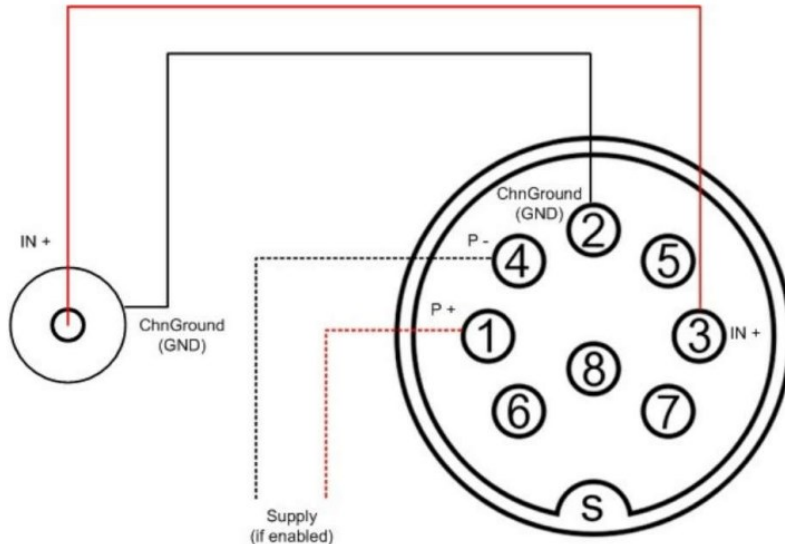
Single Ended (SE) Operation

Single Ended (SE) measurement can be realized on both, BNC jack and DIN socket with the following

couplings:

- VOLT SE (AC, DC)
- IEPE (ICP®)
- CHARGE SE
- CURRENT

SE pin assignment



In CURRENT coupling, the measuring input is bridged with a 5.1Ω shunt resistor.

Caution: The 5.1Ω shunt resistor in CURRENT operation can damage inappropriate sources or sensors. Make sure that attached source is able to drive low-impedance devices.

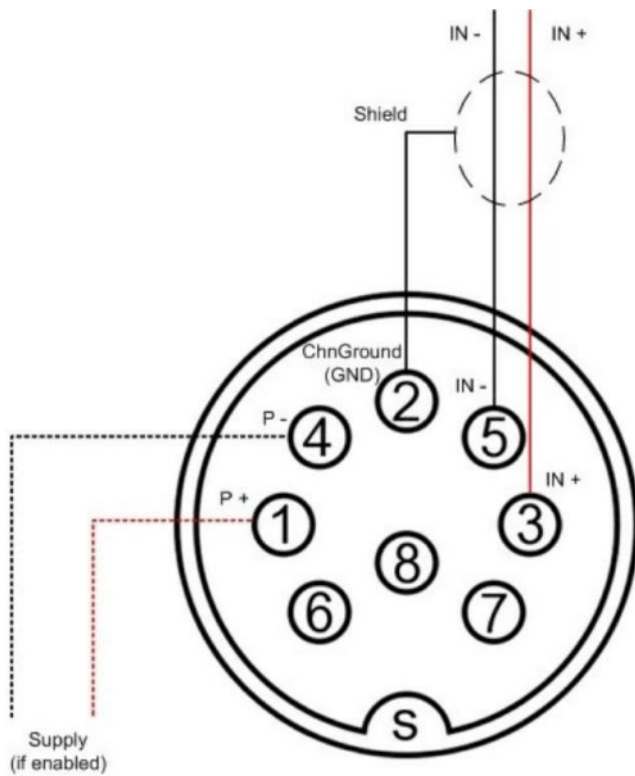
Caution: In CURRENT operation (AC and DC), currents above ±200 mA will heat up the 5.1Ω shunt resistor and will eventually damage the amplifier!

Differential Ended (DE) Operation

Differential Ended (DE) measurement with DIN socket:

- VOLT (DE)
- CHARGE (DE)

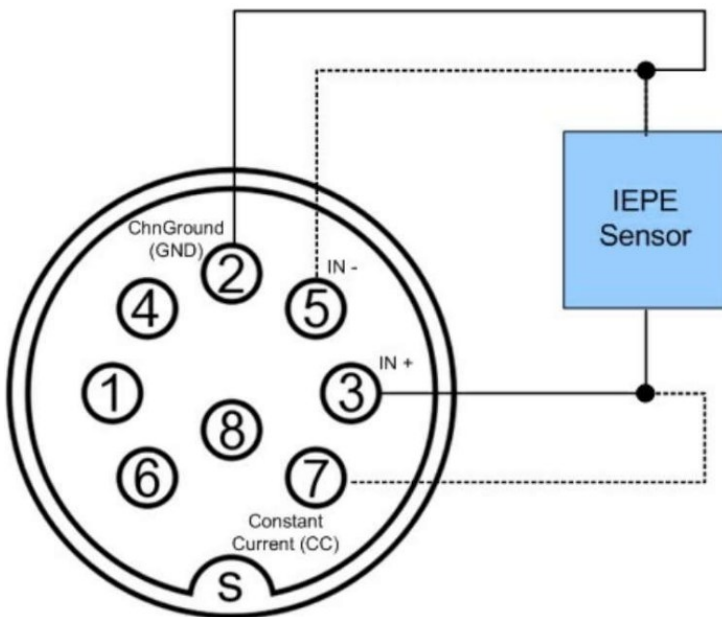
DE pin assignment



IEPE (ICP™)

Pin assignment for IEPE (ICP™) measurement. Normally, IEPE sensors are attached with 2- wires. Depending on 2-wire, 3-wire or 4-wire measurement the dotted lines have to be used.

IEPE pin assignment



The above circuit can also be used for temperature sensors, current driven (quarterbridge) strain gauges and more.

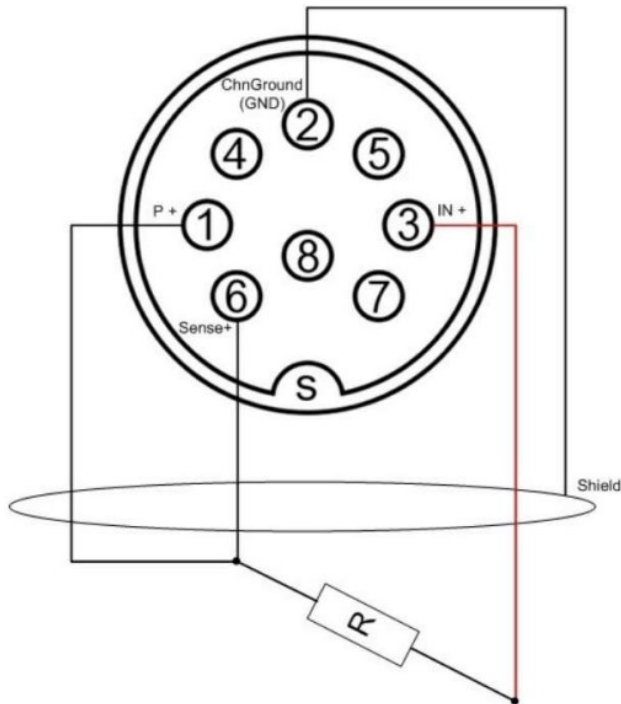
You can determine cable impedance by changing from 4-wire to 3-wire to 2-wire operation:

- **2-wire:** Constant Current (CC) is internally bridged to IN+, IN- is bridged to ChnGround (GND)
- **3-wire:** IN- is bridged to ChnGround (GND), Constant Current has to be connected
- **4-wire:** ChnGround and Constant Current have to be connected in addition to IN+ and IN

STRAIN GAUGE: Quarterbridge

Quarterbridge strain gauge pin assignment. By default, a 120 Ω or 350 Ω resistor is used. Supply range of the bridge is 0 .. 5V if not otherwise ordered.

Quarterbridge pin assignment



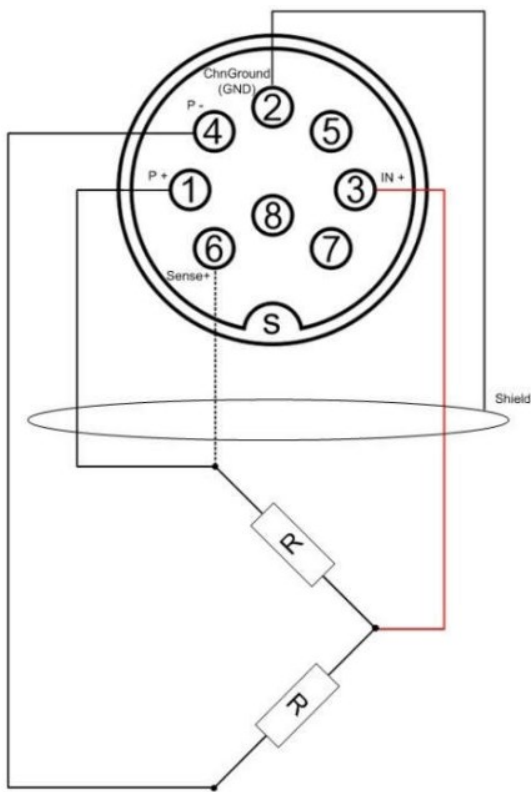
Note: Quarterbridge always uses Sense+ line! In 2-wire operation, connect Sense+ with P+ as close as possible to the strain gauge.

Caution: No further resistors are allowed with Quarterbridge coupling!

STRAIN GAUGE: Halfbridge

When using strain gauges in halfbridge mode, supply voltage range is 0V to 10V with a maximum of 90mA. Sense+ line can be used if needed and has to be selected within LTTpro software.

Halfbridge pin assignment



You should look out for same cable length and same cable impedance on $P+$, $P-$ and (optional) $Sense+$. Signal quality will also be improved by twisting the cables.

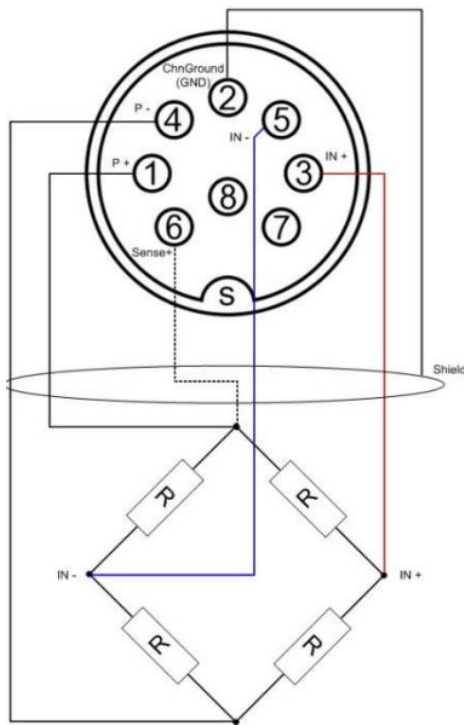
Note: You should avoid to use coax cable for $P+$ and $P-$ because cable cross-section of coax cable for shield is different to those of center.

Sensors with 5 wires (including $Sense-$): Keep the $Sense-$ unattached. **Caution:** be aware of the antenna effect on open wires!

STRAIN GAUGE: Fullbridge

Supply voltage range is 0V .. 10V with a maximum of 90mA. $Sense+$ line can be used if needed and has to be selected in LTTpro software.

Fullbridge pin assignement



Fullbridge will work with any bridge impedances. You should pay attention to matching cable length and impedance of P+, P- and (optional) Sense+. Signal quality will also be improved by twisting the cables, in addition to halfbridge mode you should also twist IN+ and IN- cables.

You should avoid to use coax cable for P+ and P- because cable cross-section of coax cable for shield is different to those of center.

Sensors with 6 wires (including Sense-): Keep the Sense- unattached. Caution: be aware of the antenna effect on open wires!

Optional Features

The basic LTT24 configuration consists of a 4-, 8- or 16-channel housing with a selectable number of default (VOLT/CURRENT) channels. In addition to that, you can order several channel and device features in compliance with your requirements. Explore the next sections to get to know available features and extensions.

Extended Channel Features

Each channel of an LTT24 can have its own capabilities. Along with the documents of your LTT24 you will get a Release Report that indicates the configuration of every channel. LTTpro software is aware of those features and offers only available options.

IEPE

This feature will support a wide range of IEPE (ICP®) sensors. With a supply current from 500µA up to 10mA (SE and DE), this feature enables most available sensors on the market. The available compliance voltage is 19V.

Select IEPE AC as Input-Type for selected channel(s) in LTTpro software. Option defines single ended or differential-ended operation and selects DIN (SE, SE-3-wire, DE-4-wire) or BNC-jack (SE BNC). Range can be defined from ±250mV to ±50V. The desired constant supply current gets selected in steps of 500µA by software.

STRAIN GAUGE

Strain gauge option enables your LTT24 to control quarter-, half- and fullbridge strain gauges with different options. See **Couplings (Sensor Types)** 12 section for assistance on pin assignment on your desired strain-gauge type.

Bridge options (SE,DE,Sense etc.), input-range and supply is controlled by LTTpro software. Quarterbridges can be supplied with 0.5V to 5V, Half- and Fullbridges can be supplied with 1.0V to 10V. Higher supply options are available.

Internal Harddisk

If you have ordered your LTT24 with optional internal hard disk, the limitations of recording to a computer hard disk are mostly eliminated. Especially with higher sample clocks ($> 1\text{MHz}$) and a lot of active channels, direct recording to the hard disk of an attached computer system could be risky as data transfer over USB or ethernet may vary.

Note: The maximum continuous data throughput to the internal SSD depends strongly on the type of SSD used inside the LTT24. Also it depends on the temperature of the SSD and the number of performed write cycles to the SSD. At time of manufacturing of each individual LTT24, the most modern SSD with the highest performance grade is used that is available within the given mechanical dimensions at that time.

Today's highest performance SSDs are built with two different types of flash memory within one single SSD:

a) the first type is a very high speed flash memory with limited storage density. b) the second type is a very high density flash memory with limited speed. During idle times of the SSD it performs automatic internal copy procedures to clear as much high speed flash memory as possible by copying sectors from the high speed flash to the high density flash.

The high speed flash memory of these SSDs is fast enough to handle the maximum LTT24 data rate of 256 MB/s (that is when 16 channels are turned on at maximum sample rate of 4 MS/s/Ch).

Once the high speed flash memory of the SSD is filled up, the sustained data rate drop down to the performance limit of the high density flash, which is considerably less than 256 MB/s (with nowadays SSDs). Unless new SSDs will be available in future, it is important to know that the free high speed flash memory size depends strongly on the SSD idle time before you start a measurement. If the high speed flash memory is completely free, it will last for about 9 minutes of full speed data recording. In general it is possible to record at least 2-3 minutes of full speed data before the SSD slows down and forces the LTT24 recording to stop.

With the internal hard disk option a recording gets saved internally to the LTT24 disk and may get replayed later to screen or to disk on an attached computer with LTTpro. See softwaremanual for further instructions.

Basic hard disk feature consists of a 64 GB (~64.000.000.000 bytes) Solid State Disk (SSD), other capacities up to 1000 GB are available. Even higher capacities will be available in future.

Note: Device internal recording is configured and started with LTTpro software. An active recording will continue within LTT24 device even if computer connection (USB or Ethernet) is broken, for example by a blast test or similar.

Accumulator

Accumulators will keep your LTT24 alive even if the normal power supply fails or is interrupted.

The accumulators in your LTT24 are lithium polymer (LiPo) based and not intended for replacement. Charge of LTT24 internal accumulators is done automatically with delivered power supply.

Caution: Never open the device in order to change or upgrade the internal accumulators of the LTT24!

Specifications

Technical Specifications

Data Recording

RAM	32MByte/channel (512MByte RAM with 16 channels)
Interface to PC	USB 3.0, USB 2.0, Gigabit Ethernet
Recording media	Internal RAM, external PC hard disk, optional internal SSD

Data Transfer Rate

PC (with Gigabit LAN)	60 MByte/s
PC (with USB)	USB2.0: 35 MByte/s; USB3.0: 170MByte/s
Internal SSD	256MByte/s over up to 3 minutes depending on available S SD.

Input Characteristics

No. of channels per device	4, 8, 12, 16, ..., 32
Synchronisation of several devices	yes
Max. sample rate per channel	4 MSample/s/ch
Max. Bandwidth per channel	DC – 1.6MHz
Quantization	24bit
External Quantisation Clock	yes
Impedance	1M Ω , 10pF
Connector	BNC, DIN
Input Protection	$\pm 17.5V$ @ range $\pm 250mV$, $\pm 5V$ $\pm 175V$ @ range $\pm 10V$, $50V$ $\pm 220V$ @ range $\pm 100V$, $200V$
Galvanic Isolation	$\pm 200V$
Range	$\pm 250mV$, $5V$, $50V$ (optional $\pm 200V$)
Input dividers	(1:10), (optional 1:100)
Coupling	Single-Ended (AC/DC), Differential (AC/DC)
Dynamic range	118dB @ 5kHz Sample/s (gain 1) 109dB @ 125kHz Sample/s (gain 1) 94dB @ 4MHz Sample/s (gain 1)
Inter-channel phase difference	0°
Crosstalk	-120dB or less (DC – 200kHz)
Filter	Analog 1.6MHz low pass filter. Digital: selectable.

Output Characteristics

No. of channels per device	4, 8, 12, 16, ..., 64
Synchronization of several devices	yes
Analog output: max. DAC rate	2MSample/s
Max. Bandwidth per channel	DC – 500kHz
Quantization	16bit (optional 18 oder 20)
Impedance	100 Ω
Connector	BNC
Galvanic Isolation	no
Output range	$\pm 5V$ (optional $\pm 10V$, $\pm 250mV$)
Coupling	DC
DC offset	digital
Dynamic range	100dB
Inter-channel phase difference	0°

Signal Conditioning

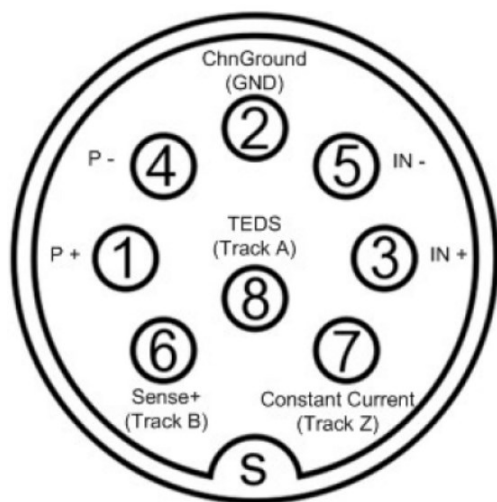
StrainGauge (optional)	Full-, Half-, Quarter-Bridge Sense, no Sense, Const. Voltage 0 ... 10V Const. Current 0 ... 25mA Shunt calibration
IEPE (ICP®)	DC / AC
Current	± 0 ... 50mA Single-Ended: AC / DC; Differential: DC
Charge	1mV/pC, 11mV/pC Range: ± 5nC, ± 100pC High-pass: 0.15 Hz; 1.5Hz; 15Hz Auto charge Clear; manual Clear
TEDS (optional)	yes
Puls input	Signal input +/-30V Time resolution 1ns (1GHz) Direction detection Zero marker
Digital inputs (optional)	TTL
Error detection	IEPE (ICP®): Cable short/break; Charge: limit; Signal Out-Of-Range, Strain-Gauge: (Signal+Sense+Power) Short and Open detection

Operation Conditions

Power Supply	12-16VDC (absolute max. rating 10 – 35VDC) 100 – 240VAC with external power supply
Environmental Temperature	+10°C to +40°C Extended temp. range 0°C to +50°C on request
Operation System	Windows XP / Vista / 7 / Linux and others

DIN socket pin assignment

When looking from the front of the LTT24 device, the DIN socket has the following pin assignment:



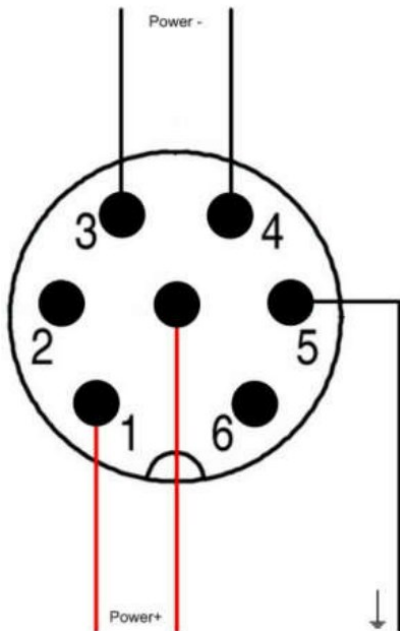
Note: Pin assignment may vary with different options. For example, pulse recognition feature excludes TEDS, and, depending on further options, also Sense+ and Constant Current.

With a pre-configured DIN cable (LTT order no. 91-24-025), use the following color assignment:

Color	Signal	Pin	Twist
White	Signal IN+	3	2 & 3
Green, Brown, Violet	Ground	2	
Yellow	Signal IN-	5	2 & 5
Pink	Sensor Supply P+ (+12V)	1	
Gray	Sense+	6	1 & 6
Red	Sensor Supply P- (-12V)	4	
Blue	TEDS	8	4 & 8
Black	Constant Current	7	2 & 7

Binder Series 693 power plug

When using your own power supply for LTT24 devices, use a Binder series 693 plug with the following pin assignment. Numbers are plotted from rear as looking to an open plug from behind:



Note: Due to power supply compatibility to former LTT devices, the center pin of the Binder plug is NOT connected to ground!

Minimum power requirements:

- 4-channels: 60 Watt
- 8-channels: 120 Watt
- 16-channels: 240 Watt

Valid input voltage: 10 Volt ... 35 Volt

Troubleshooting

The LTT24 device is designed for easy handling and a non-problematic workflow. However, if problems occur while connecting your LTT24 device with your computer or network, read the following section carefully. If you

have problems concerning the LTTpro software, please explore the LTTpro manual for assistance.

Problems with computer connection

All LTT24 devices come generally with an USB 3.0 interface. If connected directly to your computer system, no device driver or extra software packet is necessary for device communication. Check the following solutions if you have problems with the link from LTT24 device to your computer.

- **Device is visible in device manager but inaccessible by software:**

LTT24 devices that are connected directly to your computer system with USB 3.0 interface are handled like a hard disk by the operation system. For maximum flexibility and performance, you have to start the software with administrator privileges. In Microsoft Windows™ this is realized by starting the software from the context-menu “Run as administrator ...”. In Linux distributions, your account has to be in the “disk” group for full access to the LTT24 device.

- **My company does not allow administrator access for employees:**

When installing the LTTpro software, an additional small installation packet named “LTTROADService.exe” is copied to the LTTpro path. This packet contains a connection service for the LTTpro software and has to be installed once by a user with administrator privileges. After installing the service, select LTTROAD-service as operation mode in LTTpro and the software can be started without administrator privileges in the future. Be aware that due to the additional software layer of the service, data transfer rate is decreased to ~80% of original speed when using LTTROADservice! Please execute LTTROAD-Config.exe once at every Windows user-account that wants to access the LTT system.

- **The LTT24 device is still inaccessible, regardless of the above mentioned procedures:**

Check your computer system or ask your companies system/network administrator for existing firewall- or security-solutions. LTT24 devices appear as “mass storage device”, such as an USBstick or a hard drive. Some third-party security solutions restrict access to those devices or block access at all. At the moment, we know about problems with the following software security solutions:

- Cisco™ Security Agent® (no access to LTT24 device)
- WinMagic™ SecureDoc® (corrupted data)

Most security systems allow to define a “white-list” containing exceptions for their security rules. Contact your administrator to add LTTpro and the LTT24 device interface as an exception and your system should work.

- **Ethernet connection to LTT24 device can not be established:**

LTT24 devices with ethernet interface come with an external computer system. The IPaddress and the subnet-mask of that external computer system has to match your local area network (LAN) settings, regardless if you work with a single computer or a complex network. A software (“LTTFWUpdate”) is supplied for changing the network settings of the delivered external computer system. Ask your network administrator for assistance if you have problems with the network setup.

- **Data transfer rates are lower than expected:**

Transferred data rate from LTT24 device to computer system depends on three factors: interfacetype, transfer-mode and display-size of data-blocks:

- In “Multi-Shot” transfer-mode, the measurement is restarted after the preset display-size. With small display-sizes, the possible transfer rate is limited to the I/O subsystem of the used operation system. Always use higher display-sizes (>64KS) if you do not need the resolution of lower ones.
- With USB 2.0 interface, data transfer rate is limited to ~35MB/s due to interface specifications and protocol overhead. Use USB 3.0 interface for higher data-rates if available.
- When using the LTTROAD-service, the data rate will not exceed ~80% of the possible speed when working in

direct mode. Use “Physical Disk” operation mode in LTTpro software if possible.

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Documents / Resources

	<p> LTT LTT24 Precision Measuring Device [pdf] Installation Guide LTT24 Precision Measuring Device, LTT24, Precision Measuring Device, Measuring Device, Device </p>
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References

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[High Speed Messungen | Messtechnik von Labortechnik Tasler](#)