



Instruction Manual

**Telemetric
Measurement System
(TMS)
Type 5190A.../5290A...**

Foreword

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1. Introduction

Thank you for choosing a Kistler quality product. Please read these operating instructions carefully so that you can make optimum use of the many features of your product.

To the extent permitted by law, Kistler accepts no liability if these operating instructions are not followed or if products other than those listed under components and accessories in chapter 8 are used.

Kistler offers a wide range of metrological products and complete solutions:

- Piezoelectric sensors for measuring pressure, force, torque, strain, acceleration, shock and vibration
- Strain gauge sensor systems for measuring force and moment
- Piezoresistive pressure sensors and transmitters, with the associated measuring amplifiers
- Associated measuring amplifiers (charge amplifiers, piezoresistive amplifiers, etc.), display devices and charge calibrators
- Electronic control, monitoring and evaluation devices as well as application-specific software for measurement technology
- Data transmission modules

Kistler also designs entire measuring systems for special applications, for example in the automotive industry, in plastics processing and in biomechanics.

Our complete catalogue provides an overview of our product range. Detailed data sheets are available for practically all products.

If you have any specific questions that remain unanswered after reading this manual, please contact Kistler Customer Service worldwide, who will also provide you with expert advice on application-specific problems.

2. Important notes

Please be sure to observe the following instructions; following them will ensure your personal safety when working with the telemetric measuring system (TMS) and guarantee long, trouble-free operation of the device.

2.1 General information

- Check all packaging of the device for transport damage. Report any damage to the transport company and the responsible Kistler representative.
- The device should only be used under the specified operating conditions; it must be protected from excessive exposure to dust and mechanical stress (shock, vibration).
- High humidity, which can lead to condensation when the temperature changes, must be avoided.

2.2 For your safety

- This appliance has been thoroughly tested and left the factory in a technically safe condition. To maintain this condition and to ensure safe operation, the user must observe the instructions and warnings contained in these operating instructions or printed on the appliance.
- Also observe the local safety regulations with regard to handling mains-powered electrical and electronic devices.
- If it can be assumed that safe operation is no longer possible, the appliance must be taken out of operation and secured against unintentional start-up.

It can be assumed that safe operation is no longer possible:

- if the appliance is visibly damaged
- if the device no longer functions
- after prolonged storage under unfavorable conditions
- after heavy transport loads

If safe operation can no longer be guaranteed according to the features listed above, the appliance must be sent to the manufacturer or the responsible representative for repair immediately.

2.3 Electromagnetic compatibility

The telemetric measuring system (TMS) consisting of the TMS base unit (type 5290A...) and the telemetric charge amplifier unit (type 5190A...) are CE-compliant and fulfil the electromagnetic compatibility (EMC) standards (see chapter 9).

2.4 Notes on handling the devices

2.4.1 Telemetric measuring system - TMS

The TMS may only be installed, operated and maintained by persons who are familiar with the device and are sufficiently qualified for their respective work.



Attention!

- Attach the TMS base unit (type 5290A...) to a fixed structure, which ensures that the device is positioned accurately in the process and allows the signal routing and power supply to be ensured by means of a Power over Ethernet (PoE) cable.
- Mount the TMS charge amplifier unit(s) (type 5190A...) on a travelling structure that ensures repeatable positioning of the device in the coupled (measuring) state.
- The gap between the ceramic surfaces of the TMS units should be 1 mm (± 0.5 mm) to ensure reliable data communication and to avoid collisions during the process.
- The protective caps for the charging connection, as well as the PoE connection, should only be removed immediately before installing the cable. The plug-in/rotary connections must be protected against the ingress of dirt and moisture.
- Some surfaces of the appliance become hot during operation. Operating heat may still be present even when the appliance is switched off.
- Product approvals, certifications and guarantees only apply to the operation of the device in combination with accessories expressly approved by Kistler.

Fig. 1: Telemetric Measurement System



All signals connected to the device must be at least double insulated from the mains voltage to minimize the risk of electric shock.

2.4.2 Electronics

- Observe the local safety regulations for handling mains-powered electrical and electronic devices.
- When opening covers or removing components, live parts may be exposed while the device is connected.
- Adjustment, maintenance and repair work on energized, open appliances must be avoided as far as possible. If such work is unavoidable, it may only be carried out by a specialist who is familiar with the risks involved. The appliance must be disconnected from the power supply before any of these work steps are carried out.

2.5 Tips for using the operating instructions

We recommend that you read the entire operating instructions. We have endeavored to design these instructions in a clear and concise manner to make it easier for you to access the information you are looking for directly.

Please keep these operating instructions in a safe place where they are always to hand.

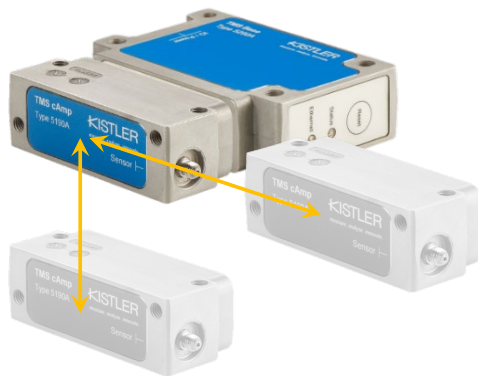
If you lose the instructions, please contact your Kistler customer service center, where you will receive a replacement immediately. All information and instructions in this manual are subject to change at any time without notice.

Symbol	Meaning
	This symbol indicates important information or a helpful tip related to the current section. Pay close attention to the details provided.
	This symbol alerts you to a potential hazard that could cause injury or damage. Proceed with caution and follow the instructions provided.
	This symbol emphasizes the importance of consulting the user manual before operating the product. Thoroughly review the instructions for safe and proper use.
	This symbol indicates that the product must not be disposed of in regular household waste. Please follow local regulations for proper disposal or recycling.
	This symbol indicates that a surface is hot and could cause burns. Avoid touching surfaces marked with this symbol until they have cooled.

3. General system description

3.1 Intended use of the telemetric measuring system - TMS

The telemetric measuring system (TMS) can be used to record single-channel piezoelectric measuring signals. This is possible in various measurement and process monitoring applications, especially on moving structures such as tool turrets, multi-spindle machines, robots or assembly lines.



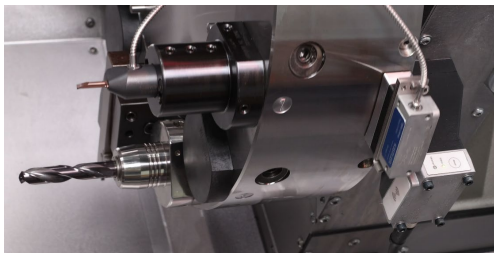
The TMS charge amplifier unit is mounted directly on the moving structure near the piezoelectric sensor. The TMS base unit, on the other hand, is attached to a fixed structure. The ceramic surfaces of the TMS base unit and a TMS charge amplifier unit are positioned in the same direction by means of a movement (rotation or linear process). In this position, the charge amplifier unit is supplied with power wirelessly. This allows the raw measurement signal from the connected piezoelectric sensor (charge) to be converted into a voltage signal. This signal is in turn digitized, transmitted telemetrically to the base unit and is then available either as a ± 10 V signal or as an Ethernet data stream for the data analysis.

The compact design favors the integration of piezoelectric measurement technology in a wide range of production and assembly processes. The robust housing and the encapsulation of the internal electronic components allow applications in exposed areas, such as the machine room.

This device features an IP67 ingress protection rating, making it ideal for robust indoor industrial applications. The IP67 standard ensures that the device is completely dust-tight (6), preventing any ingress of particulate matter that could compromise performance in factory or workshop settings. Additionally, it offers protection against temporary immersion in water up to 1 meter for 30 minutes (7), guarding against accidental spills or cleaning procedures commonly encountered in industrial environments. This combination of dust and water protection makes it a reliable choice for demanding indoor industrial operations.

Fig. 2: Traversing paths of the TMS

3.1.1 Application example



The telemetric measuring system (TMS) can be used in the machining sector for monitoring cutting forces on machine tools with turrets or multi-spindle machines. In the application, the sensory tool holders (with integrated SlimLine sensor) are connected to the TMS charge amplifier unit via a charging cable suitable for the machine room. Several sensory tool holders, each with a charge amplifier unit, can be installed on the turret. The tool in use is coupled wirelessly and is therefore in measuring mode. The analogue measurement signal from the TMS base unit is then transmitted by cable from the machine room and is available either as a voltage signal or Ethernet data stream for monitoring the cutting force data. The TMS therefore makes an important contribution to:

- Optimization of turning processes
- Monitoring of series production processes
- Wear monitoring of tools
- Detection of tool breakages

3.2 Components of the measuring system

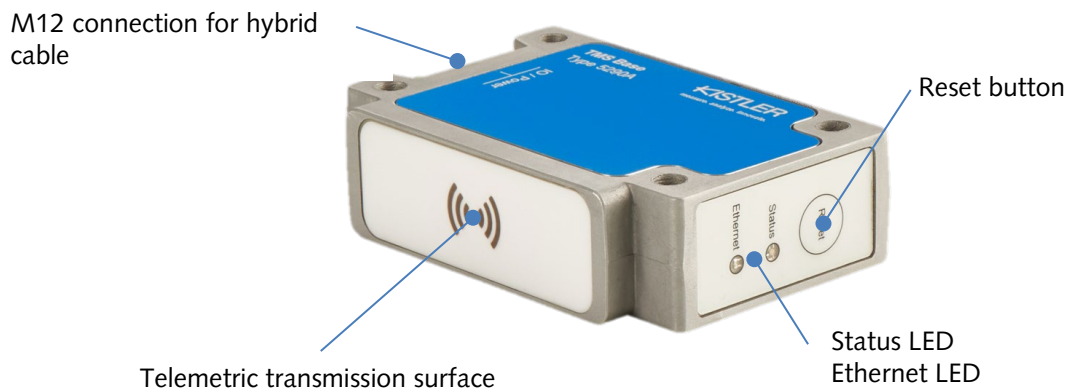
In addition to the two TMS components, the measuring system consists of various connection components. These are listed in the following table:

Piezoelectric sensor	Connection cable for piezoelectric sensors	TMS Charge amplifier unit	TMS Base unit	Hybrid cable	Y-Splitter	Network cable (PoE)	PoE Switch	Process Monitoring unit
	Various	5190A... 	5290A... 			 I/O cable (optional) 	Measuring signal Trigger Control signals	

The charge signal from a piezoelectric sensor is fed into the system by the TMS-LV module and transmitted wirelessly via the TMS. The hybrid cable supplies the TMS with power on the one hand and ensures communication with third-party devices on the other.

3.2.1 TMS Base unit (Type 5290A...)

The TMS base unit is the centerpiece of the TMS, combining the central functionalities of the system in a compact design. The base unit has a hardware user interface that has been reduced to the essentials, consisting of a reset button and two status LEDs for displaying the operating status.



3.2.2 TMS Charge amplifier unit (Type 5190A...)

The TMS charge amplifier unit is used to convert the charge signal into a digital data stream, which is then transmitted to the TMS base unit via the telemetric transmission surface.



4. Installation and commissioning

4.1 Important notes

The TMS consisting of 5190A... and 5290A... is a precision instrument that requires careful handling. Therefore, please observe the following instructions:

- When installing the two TMS components on moving machine elements, it must be ensured that no collision can occur.
- The protective caps on the charge input of the 5190A... and the protective cap on the M12 connector of the 5290A... must first be removed immediately before installing the respective cable to prevent the ingress of liquids / moisture.
- Avoid touching the surface of the housing directly during operation, as the surface can heat up.



Do not touch the surface to avoid burns. Allow the appliance to cool down completely before cleaning or transporting it.

4.2 Installation of the TMS

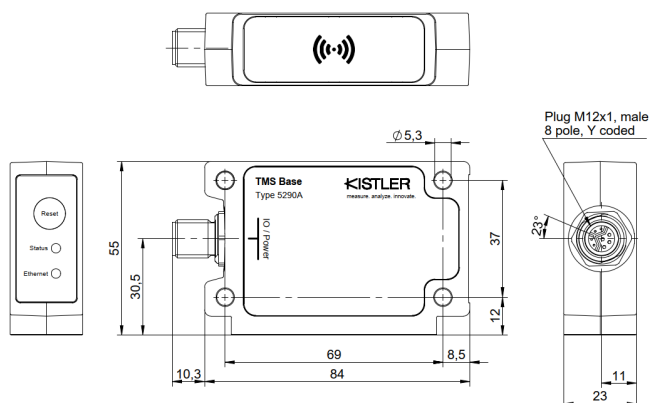
4.2.1 Mounting the TMS base unit

Both TMS components have a hole pattern for flexible mounting on a wide variety of machine and system elements. In some cases, machine-specific adaptations may be necessary in order to position the two elements in relation to each other with repeat accuracy and precision. The following illustration shows an example of the installation on a turret of a machine tool including a customized adaptation



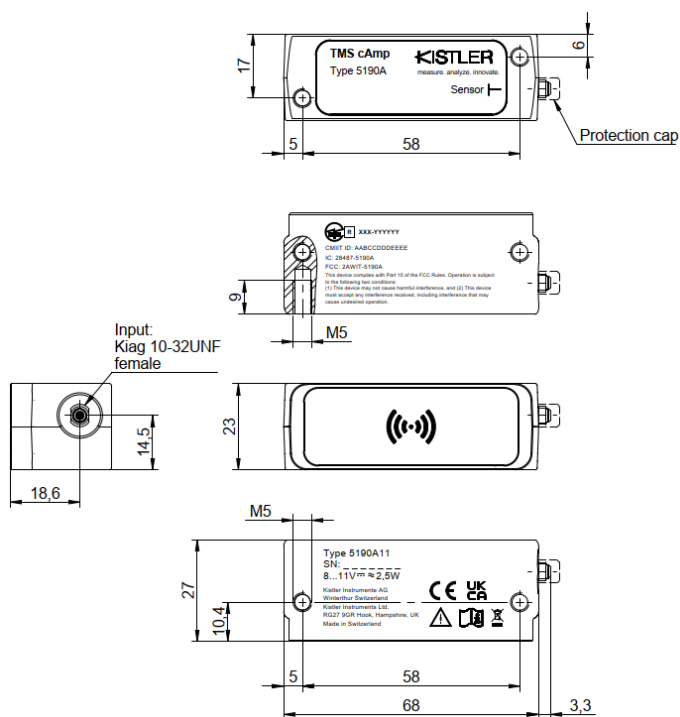
The TMS base unit has through-holes for mounting on a flat surface using (4x) M5 screws. The base unit must be mounted on a stationary machine element from which a cable-connected signal can be routed to an evaluation unit.

The TMS base unit must be fixed to an grounded surface or, if this is not possible, earthed with a separate earthing cable.

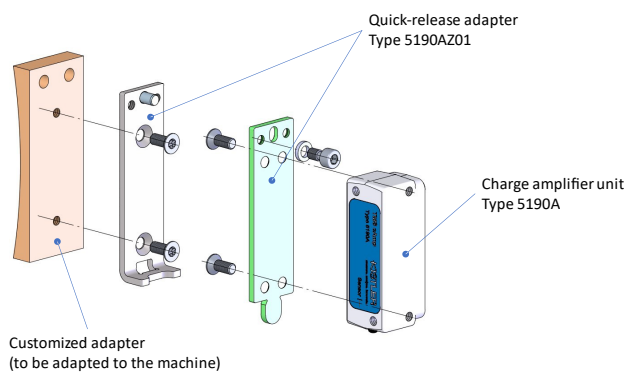


4.2.2 Mounting the TMS charge amplifier unit

The TMS charge amplifier unit should ideally be placed close to the sensor and can be positioned on the travelling unit. For mounting, it has (2x) M5 through threaded holes in a vertical direction on the one hand, and (2x) M5 x 9 mm blind threaded holes on the side of the blue cover on the other, which allow the device to be mounted in different orientations.

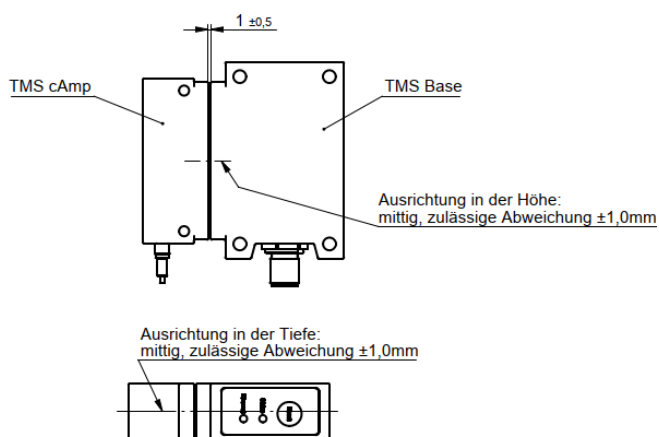


For applications in which the charge amplifier unit has to be removed / fitted regularly. A quick-release adapter set is optionally available. Two adapter plates are attached between the machine-specific interface (orange) and the TMS. The system can be loosened / tightened using this system with a single M5 x 10 screw. Two M5 threaded holes at a distance of 50 mm are sufficient on the machine adapter side



4.2.3 Alignment of the TMS

The quality and stability of the system's data transmission is highly dependent on how accurately the hardware is positioned and how accurately it is installed. For ideal operation, the telemetric transmission surfaces of the two components must overlap as much as possible. The ideal gap between the components should be 1 mm. Deviations from these positioning tolerances can cause the wireless communication to be unstable and measurement data or energy cannot be transmitted.



It is recommend to check the signal strength and transmission quality in the web user interface after installation.

4.2.4 Connecting the TMS



The TMS can be connected to 24V control and measurement electronics using an I/O cable.

The cable is configured as follows:

Wire colour	Signal
White	Reference / GND
Blue	Analogue Out $\pm 10V$
Brown	Measuring range
Black	Reset/Measure

5. Operation

5.1 Operating and display elements

The TMS base unit has a minimalist status display directly on the housing with two LEDs.



The two LEDs have three and one colour respectively. The possible device statuses are displayed using various patterns. The possible statuses and their respective LED patterns are listed below.

LED	LED Pattern	Device status
Status	No light	Device is without power/switched off.
	Yellow flashing at 1Hz	The TMS base unit identifies a TMS LV unit within range.
	Yellow flashing at 3Hz	An identification command was sent to the system.
	Glowing yellow	The TMS base unit is currently being updated.
	Flashing blue	The data connection between the TMS base unit and the TMS LV unit is established, the system is ready to measure (reset).
	Glowing blue	The system is in active measurement (measurement mode).
	Flashing red at 1Hz	System error on the side of the TMS Charge Amplifier unit.
	Flashing red at 3Hz	System error on the side of the TMS base unit.
	Glowing red	A force outside the permissible measuring range has been measured (overload). The measuring accuracy of the system may be impaired.
Ethernet	No light	No Ethernet connection to a control system.
	Flashing green	Ethernet connection to a control system is active
	Glowing green	Ethernet connection to a control system available without activity.

5.2 Measurement mode

5.2.1 Measure/Reset

To record measurement data, the system must be in measurement mode. To be able to make configuration adjustments, the system must be in reset mode.

5.2.2 Measuring range

The user has the option of configuring two different measuring ranges between 48 pC and 140 000 pC. The system then uses an accuracy that is optimized for the measuring range and scales the ± 10 V output signal accordingly.

This setting is made for each charge amplifier unit and stored persistently in it.

5.2.3 Analog output signal

The analog output voltage can be set using two parameters

- Voltage at Zero
- Voltage at User Range

in the range ± 10 V.

The following operating states, in which no measurement is possible, are also coded on the output signal:

- In the error state of the system, +11 V is output.
- In the state without a coupled TMS charge amplification unit, -11 V is output.

5.2.4 Control of the system

The system can be controlled either via hardware or software. This setting can be defined individually for both control parameters (measure/reset, measuring range switching):

- **API / User Interface** for control via Web User Interface or REST-API. In this configuration, the system does not respond to physical control signals.

Each charge amplifier unit starts automatically in the measuring range that was activated the last time it was coupled, regardless of which digital control commands were sent to the system while other charge amplifier units were coupled.

- **Hardware interface** for control via control signals (see also chapter 4.2.4) In this configuration, the system does not respond to digital control commands.

- **Default setting**

Pin	0 V	24 V
Measure/Reset	Reset	Measure
Range	Low	High

- **Inverted Hardware Signal**

Pin	0 V	24 V
Measure/Reset	Measure	Reset
Range	High	Low

5.2.5 Coupling

The system can only provide measurement data if a charge amplifier unit is coupled. The system is ready to measure within 260ms after the physical coupling of the two modules.

All configuration parameters of the connected charge amplifier unit can be modified via the base unit. If several charge amplifier units are used, each charge amplifier unit must be coupled and configured individually.

Control commands that are sent to the system while no charge amplifier unit is connected are discarded. If the hardware interface is activated, the status of the control lines is adopted during coupling.

The quality of the coupling can be read out via the digital interface (see chapter 5.4) and should be checked during commissioning and in the event of irregular measurements. The following parameters are available:

- **Signal Quality** defines the quality of the signal received by the base unit
- **Power Reserve** defines the supply voltage received at the charge amplifier unit

If these values deteriorate, the alignment of the modules to each other must be checked and any foreign bodies in the coupling path must be removed.

5.2.6 Factory Reset

The factory reset function resets all configuration parameters of the base unit to the factory settings. This function has no influence on calibration parameters or any coupled charge amplifier units.

To perform the factory reset, the system must be briefly disconnected from the power supply and, after restarting, the factory reset button must be pressed briefly 5 times in succession within 2 minutes.

5.2.7 Low pass filter

Optionally, a low-pass filter can be activated to filter the output signal accordingly.

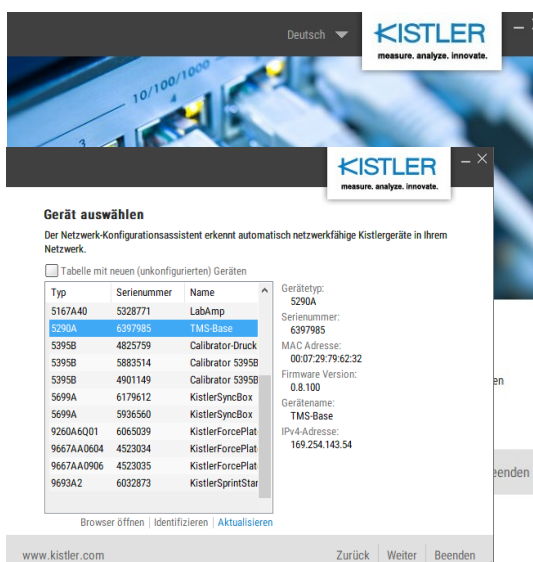
5.3 Access to the web user interface

The TMS network connection is made via the hybrid cable or the Power Over Ethernet cable (see chapter 8). If the device is connected to the same network, the web user interface can be accessed. The web user interface is primarily used to configure and maintain the measuring chain.



It is not possible to access the Web User Interface with more than one computer at the same time.

When connecting to the device for the first time, it is recommended to find the device using the “IP Setup Wizard” tool from Kistler. The tool can be downloaded from the Kistler website.



The figure shows the start screen of the network configuration wizard. The “Network configuration wizard” button can be used to generate a list of all Kistler devices available in the network.

A device of type 5290A including all relevant device information for access should now be visible in the tabular view. By selecting the device and pressing the “Open browser” button, the web user interface can be opened directly in the standard browser.

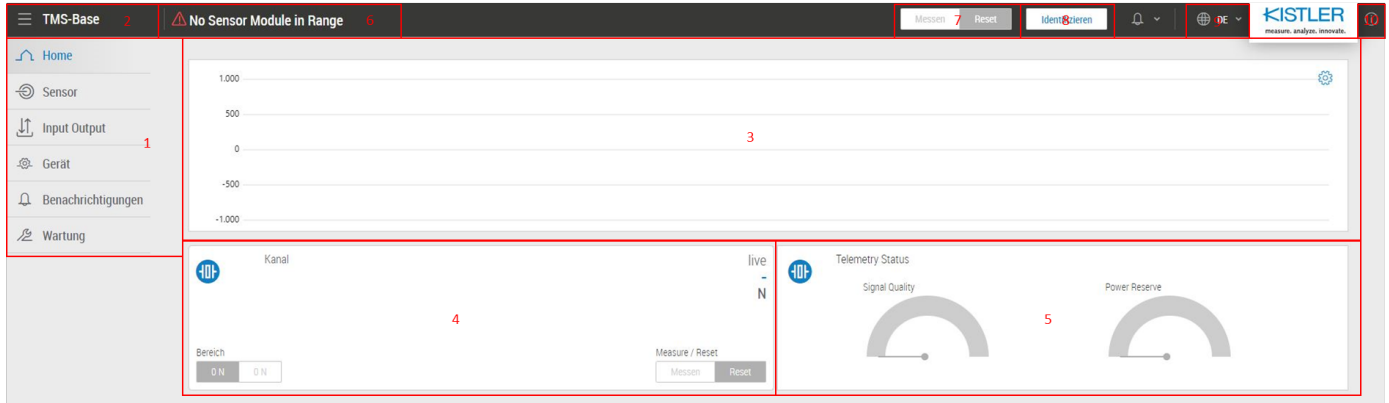
The “Identify” button offers the option of flashing the status LED of the device (yellow) in order to visually verify the selected hardware.

The Refresh button starts a new search query for all Kistler devices in the network.

The device configuration can also be opened using the selection and the “Next” button. This is primarily used to configure a DHCP or static IP address.

TMS Menu– «Home» overview

When accessing the web user interface and after accepting the license agreements, the home view is displayed, which is structured as follows



1. User menu overview
2. Button to expand/collapse the user menu overview and name of the TMS Base module
3. Live view for measurement data (graph)
4. Live view for the measuring channel (absolute value and information), as well as configuration of the measuring range and measuring mode
5. Connection status of the telemetry
6. name of the connected TMS-LV module and error messages
7. Current status and option to switch between measuring mode and reset
8. Manual identification of a TMS-LV module
9. Language selection
10. General information

5.4 TMS Menu– «Sensor» configuration

As soon as a TMS Charge Amplifier module is coupled with the TMS base unit and is not in measurement mode, the sensor data is read out and displayed in the “Sensor” view. The currently active parameters are displayed on the sensor channel page; these can be edited in the configuration and then transferred.

Sensor Channel	
Seitennummer	6420841
Device Type	5190
Physical Range 1	50
Physical Range 2	500
Physical Unit	N
Sensitivität Bereich 1	-2.400000095367432
Sensitivität Bereich 2	-2.400000095367432

Konfiguration	
Sensor Channel Configuration	
Seitennummer	6420841
Sensitivität Bereich 1	-2.4000000954 pC/N
Physical Range 1	50 N
Sensitivität Bereich 2	-2.4000000954 pC/N
Physical Range 2	500 N
Physical Unit	N
Rückgängig Übernehmen	

Sensor channel configuration:

The serial number and two measuring ranges (with sensitivity and force range with variable unit) can be configured for the TMS-LV module. The device has the supports the following measuring range:

- $\pm 48 \dots 140\,000\text{pC}$

The two user measuring ranges can be freely configured in the area. The device ensures that the lowest possible signal-to-noise ratio is achieved for the respective range.

Configuration TMS modules:

In the TMS Module user menu, only the name of the base unit can be configured, which helps to clearly identify the existing devices in the network.

5.5 TMS Menu– «Input Output» configuration

The TMS Input / Output configuration interface is used to define the control signals for measurement mode and reset. By default, both Measure and Reset are carried out manually via the user interface. If an IO cable is connected and a corresponding signal transmitter is available, Measure and Reset can be controlled via the hardware. It is also possible to invert the expected control signal.

As an output, the TMS has the option of an Ethernet data stream on the one hand and a voltage signal in the range of ± 10 V on the other.

The screenshot shows the TMS Base web interface. The top navigation bar includes 'TMS-Base', a status message 'No Sensor Module in Range', and buttons for 'Measure', 'Reset', and 'Identifizieren'. The left sidebar contains navigation links: 'Home', 'Sensor', 'Input Output' (highlighted), 'Gerät', 'Benachrichtigungen', and 'Wartung'. The main content area displays the 'Input / Output' configuration table.

Input / Output	
Measure/Reset Control Mode	API / User Interface
Inverted Hardware Signal	False
Range Control Mode	API / User Interface
Inverted Hardware Signal	False
Voltage at Zero	0
Voltage at User Range	10
Low-pass Filter Frequency	10 Hz
Low-pass Filter Enabled	False

On the right, a 'Konfiguration' dialog is open, showing the 'Input/Output Configuration' settings. It includes options for 'Measure/Reset Control Mode' and 'Range Control Mode', both set to 'API / User Interface'. There are checkboxes for 'Inverted Hardware Signal'. Below these are input fields for 'Voltage at Zero' (0 V) and 'Voltage at User Range' (10 V). At the bottom of the dialog are buttons for 'Rückgängig' and 'Übernehmen'.

5.6 TMS Menu– «Device» configuration

The screenshot shows the KISTLER TMS-Base web interface. The top navigation bar includes 'TMS-Base', a status message 'No Sensor Module in Range', and buttons for 'Identifizieren', 'Benachrichtigungen', and 'DE'. The left sidebar contains navigation links: Home, Sensor, Input Output, **Gerät** (selected), Netzwerk, Datum Uhrzeit, Benachrichtigungen, and Wartung.

The main content area is titled 'Gerät' and displays the following device information:

Gerätename	TMS-Base
Gerätebeschreibung	1-Channel Telemetric Measuring System
Gerätetyp	5290A
Hersteller	Kistler Instrumente AG
Seriennummer	6397985
Hardware Version	

On the right side, there is a 'Grundeinstellung' (Basic Settings) panel with an 'Import/Export' button. It contains input fields for 'GeräteName *' (filled with 'TMS-Base') and 'Gerätebeschreibung' (filled with '1-Channel Telemetric Measuring System'). Below these fields are buttons for 'Rückgängig' (Reset) and 'Übernehmen' (Apply).

5.7 TMS Menu – «Maintenance»

The maintenance view provides the relevant system information on the device status. This view can also be used to restart the TMS base module, reset it to the factory settings or install a firmware update.

5.8 Software updates

Kistler may from time to time develop upgrades or updates to the in-built software.

This device allows firmware upgrades by the customer. Please contact Kistler Customer Service to check the possibility of upgrading your device to the latest firmware.

Proper operation requires that the software on the TMS Base Unit and TMS Charge Amplifier Unit are in a compatible state.

Kistler disclaims any liability for direct or consequential damage caused by products that operate with integrated software and have not been updated with the latest software supplied.

6. Maintenance

6.1 Cleaning and storage

Keep the measuring electronics clean and protect the electrode from excessive dirt and moisture.

If the device becomes dirty, clean it. Only use a clean, soft, lint-free cloth for cleaning. If necessary, moisten the cloth with water or pure alcohol. Do not use any other liquids; these can damage the adhesive points.

6.2 Recalibration of the devices

The TMS must be recalibrated after an uncontrolled overload, for example. This recalibration must be carried out at the manufacturer's factory. In this case, please contact the responsible Kistler representative.

Our products can be recalibrated or tested using the same procedure as before initial delivery. All records are kept and are available to our customers so that calibrations and repairs of our products can be fully traced.

Quality management systems, such as ISO 9001, require documentation and periodic recalibration of measuring equipment.

Kistler recommends such a recalibration at least every 2 years.

6.3 Checking for visible damage

Please observe the following instructions for maintaining your TMS:

- Check the TMS for obvious damage before each use. Do not operate a damaged device!
- Refer all repairs to the manufacturer.

6.4 In the event of a defective TMS

If your TMS is defective, please observe the following instructions:

- Contact the responsible Kistler representative and notify them of the delivery of the defective device.
- Send the defective TMS in its original packaging to the Kistler representative.
- Enclose a detailed description of the defect and the accompanying circumstances with the TMS.
- Describe the measurement process during which the defect occurred.
- If a major repair is necessary, you will receive a cost estimate.
- Kistler will endeavor to repair your TMS in the shortest possible time and at minimum cost, and to return it to you in as-new condition

7. Technical data

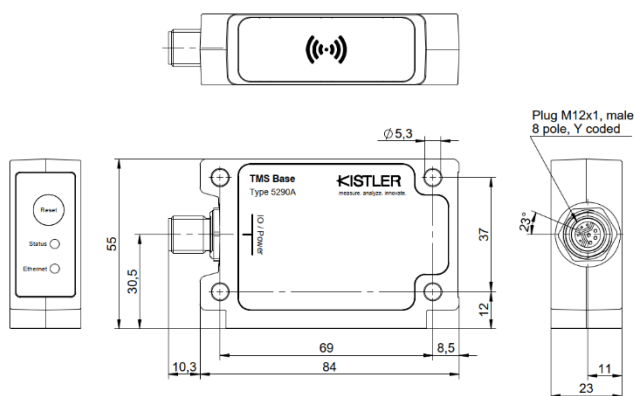
7.1 TMS Base unit (Type 5290A...)

Analog output		
Nominal output range	V	±10
Valid measured values	V	±10
System in error mode	V	+11
.. No measuring module coupled	V	-11
Output impedance	Ω	<10
Output low-pass filter	kHz	10
DAC resolution	Bit	16
Output noise system (1 Hz ... 10 kHz, all ranges)	mVrms	<0.3
Digital inputs (reset / measure, range switching)		
Voltage level	VDC	18 ... 30
Logic "0" according to IEC 61131-2	VDC	< 5
Logic "1" according to IEC 61131-2	VDC	> 15
Digital low-pass filter		
Order		2 (IIR)
Cutoff frequency	Hz	Off 10, 20, 50, 100, 200, 500, 1000, 2000, 5000
Ethernet interface (PoE)		
Data rate	MBit	100
Sampling rate	Sps	100 1 000 5 000 10 000 25 000
Power consumption (typ.)	W	4.5
Power Supply		PoE 802.3af
Plug-Type		M12 Y-Coded
LED – Ethernet		
Activity		Flashing yellow
LED – Status		
Measurement mode		Blue static
Reset		Flashing blue
Overload		Red static
Error sensor module		Red flashing 1Hz
Base unit error		Red flashing 3Hz
No sensor coupled		Yellow static
No firmware loaded		
Device identification		Yellow flashing 3Hz
Start up - communication to the sensor is established		Yellow flashing 1Hz
Factory reset button		
Resetting option		2 minutes from device start
Perform a reset		Press the button 5 times within a period of 10 seconds.

Telemetry interface		
Energy transmission power	W	2
Frequency range	kHz	114 ... 130
H-field value of NFC data transmission at 13.56 MHz (at a distance of 10 m)	dBuA/m	<-40
Specifications		
Dimensions B x H x T	mm	55 x 94 x 23
Protection class (IEC 60529)	IP	67
Operating temperature	°C	-20 ... 65
Storage temperature	°C	-40 ... 85

7.1.1 Device specifications

The following diagram shows the relevant specification dimensions of the TMS base unit.

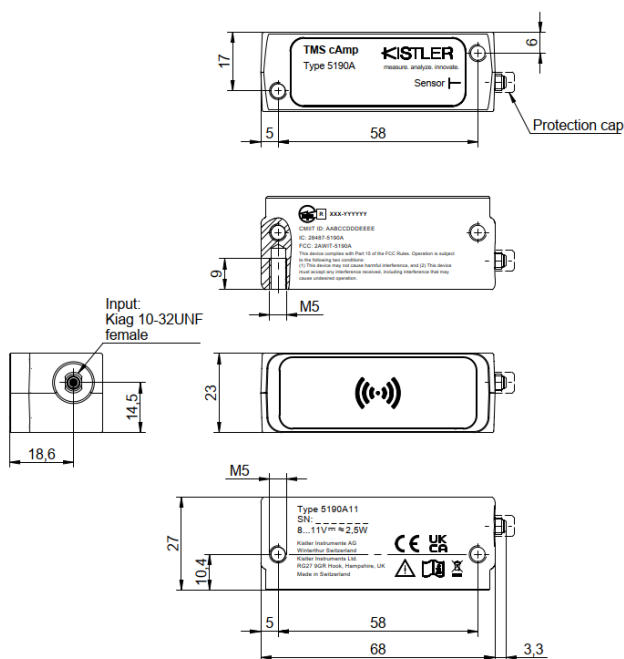


7.2 TMS Charge Amplifier unit (Type 5190A...)

Charge Amplifier		
Number of channels		1
Input connector		KIAG 10-32
Measuring range	pC	±48 ... 140.000
Measurement uncertainty	%FSO	< ± 0.6
Input-related noise (typically with bandwidth = 1Hz ... 10kHz)	pC _{pp}	Range 1 < 0.5 Range 2 < 5 Range 3 < 50
Overload capacity to nominal force	%	> 20
Frequency range (-3dB)	Hz	0.1 ... 5 000
Drift at -20°C to 65°C (typ.)	pC/s	<±0.2
Reset / Measure jump	pC	< ±2
ADC resolution	Bit	24
ADC sampling rate	kSps	35
Telemetry interface		
Power consumption	W	< 0.6
Coupling process duration	ms	< 260
Signal runtime	μs	<350
Response time control signals (typ.)	ms	10
Specifications		
Protection class (IEC 60529)	IP	67
Operating temperature	°C	-20 ... 65
Storage temperature	°C	-40 ... 85
Dimensions W x H x D	mm	27 x 71 x 23

7.2.1 Device specifications

The following diagram shows the relevant specification dimensions of the TMS charge amplifier unit.



8. Accessories

8.1 Hybrid cable

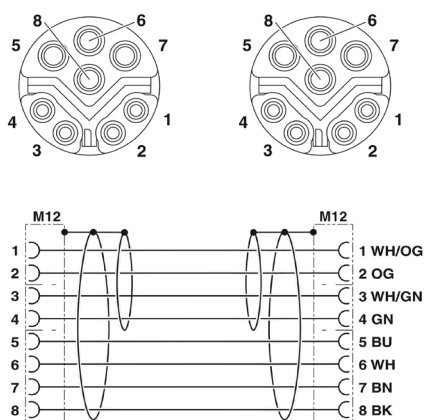
The hybrid cable 1200A263... is used for the power supply and data communication of the TMS Base Unit (type 5290A...). For environments that require IP67, it is recommended that the cable is long enough to be routed out of the environment (e.g. into a control cabinet). The other components for power supply and communication of the device can then be accommodated there.

Both the TMS base unit (type 5290A...) and the Y-distributor to be attached to the hybrid cable have a male connector, so make sure to use the female version of the cable. The designation SF stands for Straight-Female and refers to both cable ends.



Hybrid cable (PoE + signal)	Type / Mat. no.
Hybrid cable 3 m	1200A263SF3
Hybrid cable 5 m	1200A263SF5
Hybrid cable 10 m	1200A263SF10

The following graphic shows the pin assignment from the M12 plugs.



8.2 Y-Distributor

The Y-distributor (type 1700A...) serves as a splitter between voltage and communication, which is fed to the hybrid cable via the PoE Ethernet cable, and the analog signals, which can also be fed to the hybrid cable via the Y-distributor.

On the hybrid cable side, the Y-distributor has an M12 8-pin straight male connector with Y-coding. On the opposite side, there is an M12 8-pin female connector with D-coding for the Ethernet cable and an M12 8-pin male connector with A-coding for the I/O cable.

If the I/O cable connection is not used, it can be closed using the cover (type 1700A139Z1).



Y-distributor (PoE / signal)	Type / Mat. no.
Y-distributor	1700A139
Sealing cap (without I/O cable)	1700A139Z1

8.3 I/O cable

The I/O cable is used on the one hand to output the analog measurement signals (as a $\pm 10\text{V}$ voltage signal) or for external switching of the Measure / Reset. The TMS can therefore be connected to 24V control and measurement electronics using an I/O cable.

The cable is configured as follows:

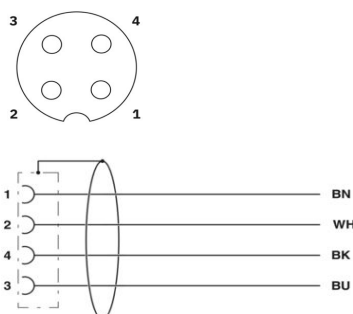
Wire colour	Signal
White (WH)	Reference / GND
Blue (BU)	Analogue Out $\pm 10\text{V}$
Brown (BN)	Measuring range
Black (BK)	Reset/Measure

It must be ensured that the shielding is connected in any case to ensure the compliant operating conditions of the device.



I/O cable (analog signal cable)	Type / Mat. no.
I/O cable 3 m	1700A129A3
I/O cable 5 m	1700A129A5
I/O cable 10 m	1700A129A10

The following graphic shows the pin assignment from the M12 plug, 4-pin, D-coded to the open ends.



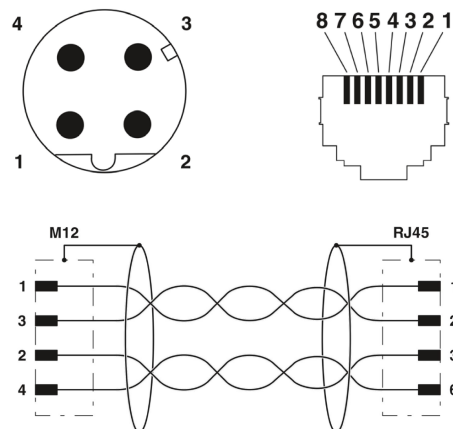
8.4 Ethernet cable

The Ethernet cable is a Power over Ethernet-capable cable. It supplies the TMS base unit (type 5290A...) with power indirectly via Y-distributors and hybrid cables and also ensures data communication between the device and the network. The device allows either Ethernet streaming or analog data output.



Ethernet cable (PoE)	Type / Mat. no.
Ethernet cable 3 m	1200A195A3
Ethernet cable 5 m	1200A195A5
Ethernet cable 10 m	1200A195A10

The following graphic shows the pin assignment from the M12 plug, 4-pin, D-coded to the Ethernet (RJ45) plug.



8.5 PoE injector

The PoE injector serves as a power source and network switch for the TMS (type 5290A...), the switch has 2 RJ45 connections and a PoE port in which the Ethernet cable can be attached.

The built-in transformer is designed for voltages from 12 VDC to 48 VDC and allows integration into control cabinets or other installations close to the measuring chain. Mounting is facilitated by the interface to wall or top-hat rails.



PoE injector	Type / Mat. no.
PoE injector	5795AD1

9. Appendix

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10. Declaration of conformity

10.1 CE (Europe)

Hereby, Kistler Instrumente AG declares that the radio equipment types 5190A... and 5290A are in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following Internet address:

www.kistler.com > About us > Certificates and product compliance > Product compliance

10.2 UKCA (UK)

Hereby, Kistler Instrumente AG declares that the radio equipment types 5190A... and 5290A... are in compliance with Directive UK SI 2017 Nr. 1206. The full text of the UK declaration of conformity is available at the following Internet address:

www.kistler.com > About us > Certificates and product compliance > Product compliance

10.3 FCC (USA)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help



Changes or modifications not expressly approved by Kistler Instrumente AG for compliance could void the user's authority to use the equipment.

10.4 IC (Kanada)

10.4.1 Canada Compliance Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license exempt RSS(s). Operation is subject to the following two conditions:

- This device may not cause interference
- This device must accept any interference, including interference that may cause undesired operation of the device

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be chosen in such a way that the equivalent isotropically radiated power (e.i.r.p.) is not more than that is necessary for successful communication.

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

10.4.2 Canada Déclaration de Conformité

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- L'appareil ne doit pas produire de brouillage
- L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

Conformément aux réglementations d'Industry Canada, cet émetteur radio ne peut fonctionner qu'à l'aide d'une antenne dont le type et le gain maximal (ou minimal) ont été approuvés pour cet émetteur par Industry Canada. Pour réduire le risque d'interférences avec d'autres utilisateurs, il faut choisir le type d'antenne et son gain de telle sorte que la puissance isotrope rayonnée équivalente (p.i.r.e) ne soit pas supérieure à celle requise pour obtenir une communication satisfaisante.

Cet équipement respecte les limites d'exposition aux rayonnements IC RSS-102 définies pour un environnement non contrôlé. Il doit être installé et utilisé en maintenant une distance minimum de 20cm entre le radiateur et votre corps.

10.5 Others

The conformity for countries with other national regulations has to be approved prior to use and operation.