Instruction Manual

Evaluation Instrument

CoMo Torque Type 4700B…

Firmware from V5.00

CE

4700B_002-574e-08.12

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Foreword

This instruction manual applies to the Evaluation Instrument ControlMonitor CoMo Torque, Type 4700B… for Torque Sensors.

The instruction manual must be kept on hand for future use, and must be available at the site of implementation of the NC joining system, as needed.

The specifications in this manual can change at any time without prior notification. Kistler reserves the right to improve and to change the product for the purpose of technical progress without the obligation to inform persons and organizations as the result of such changes.

The HyperTerminal® PC application described in this manual is a product of Microsoft®.

Original language of these operating instructions: German

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1. Introduction

We thank you for your decision to purchase a quality Kistler product. Please read through this Instruction Manual carefully in order to make best use of the versatile features of your product.

To the extent permitted by law Kistler does not accept any liability if this instruction manual is not followed or products other than those listed under Accessories are used.

Kistler offers a wide range of products for use in measuring technology:

- Piezoelectric sensors for measuring force, torque, strain, pressure, acceleration, shock, vibration and acoustic-emission
- Strain gage sensor systems for measuring force and torque
- Piezoresistive pressure sensors and transmitters
- Signal conditioners, indicators and calibrators
- Electronic control and monitoring systems as well as software for specific measurement applications
- Data transmission modules (telemetry)
- Electromechanical NC joining modules and force-displacement monitors
- Test stand systems for electric motors and gear units for laboratory, manufacturing, and quality assurance

Kistler also develops and produces measuring solutions for the application fields engines, vehicles, manufacturing, plastics and biomechanics sectors.

Our product and application brochures will provide you with an overview of our product range. Detailed data sheets are available for almost all products.

If you need additional help beyond what can be found either on-line or in this manual, please contact Kistlers extensive support organization.

This product is a CoMo Torque Type 4700B… Evaluation Instrument for Torque and Force Sensors.

Torque sensors with speed and angle of rotation outputs as well as force sensors can be connected directly to this tabletop unit. Sensors based on the strain gage measurement method without their own amplifier as well as sensors with normalized voltage or frequency outputs have direct connections on the Type 4700B.… instrument.

The evaluation instrument provides passive strain gage sensors with a unipolar voltage of 5 V. The 6-conductor technique is used to compensate voltage drops over the supply lines as a result of so-called Sense connections. This means the Type 4700B… instrument is able to record and to evaluate measured values more precisely. As well as bipolar, analog measurement signals in the ±5 V or ±10 V range, a torque-equivalent frequency with definable offset and frequency deviation can also be recorded.

For better evaluation of units such as electrical or combustion engines, gearboxes, compressors, fans, crank assemblies, etc., the input torque and the speed of the mechanical power must be specified. The Type 4700B… instrument accomplishes this by calculating the performance from the measured parameters and displaying the result.

The functionality of the evaluation instrument extends from monitoring functions, through trigger options, assignable analog outputs, digital input and outputs, up to serial interfaces such as the RS-232C and the USB port.

1.1 Features

- Supply of the torque sensor or force sensor.
- Determination of the torque or force signal as an analog voltage (mV/V, V) or frequency.
- Determination of the speed and angle of rotation (quadrature).
- Measured value conversion between input and output (functionality as a measured value amplifier).
- Simultaneous display of torque/force, speed/angle of rotation, revolution counter reading and mechanical power.
- Software and hardware trigger functions for saving a measurement graph.
- Limit value monitoring of 3 measurement parameters.
- Min./max. memory for each measured and calculated parameter.
- Data transfer via RS-232C interface or USB port.
- Firmware update via the USB port.

2. Important Notes

You must heed the following notes; these are provided for your personal safety when working with the Evaluation Instrument, Type 4700B… and ensure long, trouble free operation.

2.1 For Your Safety

The unit left the factory in a safe and perfect condition. To maintain this condition and to ensure hazard-free operation, the notes and warning comments in this instruction manual and on the unit must be heeded.

Also adhere to the local safety regulations which govern the handling of electrical and electronic devices.

If it can be assumed that hazard-free operation of the instrument is no longer possible, it must be taken out of operation and secured against accidental operation.

Safe operation is not possible,
if the device has visible damage,
if the device does not function correctly, after extended storage in unfavourable conditions, after heavy transport loads.

If, after the above listed attributes, a safe operation is no longer guaranteed, then the device must be returned immediately for repair to the responsible Kistler sales company or representative.

When opening covers or removing parts, live parts can be exposed, as long as the device is connected to power.

Service and repair work on live parts, opened devices are not permitted. However, if such work is unavoidable, it should only be carried out by trained personnel, who are familiar with the associated risks.

Any disconnection of the protective earth inside or outside of the device or removing the protective earth connection can lead to the device causing risk. An intentional disconnection is not allowed!
The mains plug must only be inserted into a socket with protective contact. The protective effect must not be removed by an extension cord without protective earth connection.
Defective fuses must only be replaced by the appropriate types with the specified rated current (see Chapter 9.2). The use of "repaired" fuses or short circuiting of the fuse holder is not permitted.

2.2 Unpacking

Check all instrument packaging for damage in transit. Notify the shipping company and the responsible Kistler Sales Company or representative of any such damage.

Please check the shipment before beginning with the setup of the instrument system. If any part is missing, please contact the responsible Kistler Sales Company or representative.

2.3 Transport and Storage

If the device must be transported or stored for an extended time, the following safety precautions must be taken:

- The temperature should be in the range between –10 and 70 °C.
- The sensor connections must be covered with a dust cap.
- The surroundings should be as dry as possible and free of vibrations.
- Store the device so that there is not pressure on either the front or rear plates.
- The device, as long as it is not being used, should be stored in the original packaging if possible.

2.4 Intended Operation

The device must be installed so that the mains switch and the power cable connected at the power connection socket, located on the rear plate of the device, are not restricted and can be accessed at any time.

Only operate the device in dry areas and at altitudes ≤ 2000 m. The operating temperature range (nominal temperature range) is 10 – 40 °C. The maximum relative humidity can be 80 % at temperatures up to 31 °C, linearly decreasing to 50 % at 40 °C.

2.5 Service

The outside of the device is normally cleaned with a soft, non-woven dusting cloth.

The display itself must only be cleaned with a small amount of water or suitable glass cleaner. This should then be polished with a dry, clean and lint-free cloth. Cleaning liquid must never get into the device. The use of alcohol and solvents must be avoided and can damage the display and surfaces.

2.6 Mains Voltage

Before switching on for the first time, make sure that the specified operating voltage range is in agreement with the applied mains voltage. The mains voltage may fluctuate between 90 – 264 VAC and 50 – 60 Hz. The device is suitable for a mains environment of overvoltage category II and contamination level 2.

No inadequately measured mains cable must be used (operating voltage 250 VAC, current carrying capacity ≥ 10 A, with grounding conductor pin).

2.7 Replacing the Fuse

To replace the fuse of the mains connection socket on the rear of the device, proceed as follows:

- First remove the device from the mains and switch off (switch on 0 position).
- Carefully pry up the safety latch with a narrow, blunt object and remove the fuse holder including the fuse.
- Replace the fuse with a suitable type (see chapter 9.2).
- Push the fuse holder back in and lock it.

2.8 Electromagnetic Compatibility (EMC)

The evaluation instrument, CoMo Torque Type 4700B… is designed to be CE-compliant. This instrument fulfills safety engineering requirements with respect to electromagnetic compatibility in accordance with EN 61000-6-2 (noise immunity) and EN 61000-6-4 (noise immunity in the industrial sector).

The respective conformity declaration is enclosed in the annex to this instruction manual.

2.9 Tips for Using the Instruction Manual

NOTE

Report any transport damage to the freight forwarder and to Kistler Lorch GmbH.

Keep this instruction manual in a secure location where it is available at all times. If the manual is lost, please contact the responsible Kistler Sales Company or representative and ask for a replacement.

Instrument modifications (rebuilds, retrofits, etc.) normally also result in changes to the instruction manual. In this event, inquire into the updating options for your documentation from the responsible Kistler Sales Company or representative.

2.10 Disposal Instructions for Electronic Devices

Do not discard old electronic instruments in municipal trash. For disposal at end of life, please return this product to an authorized local electronic waste disposal service or contact the nearest Kistler Instrument sales office for return instructions.

2.11 Nomenclature Used

Here you will find explanations of the nomenclature and abbreviations used in this instruction manual:

Active sensor	Torque sensor with active electronics.
DMS	Resistance strain gage.
Passive sensor	Torque or force sensor without active electronics. Strain gage signal is fed out directly.
Control signal	This signal is used to test active or passive torque sensors (controlled self-test).
Condition 0	Logic condition of a digital input. The voltage level range for this is <0.8 V.
Condition 1	Logic condition of a digital input. The voltage level range for this is <3.5 V.
Condition z	Open (electronic) switch of a digital output without electrical level or reference.

3. Basic Information about the Instrument

3.1 Instrument Versions

The complete type identification of the evaluation instrument comprises the basic type identification Type 4700B… plus further digits:

Ordering Key

Type 4700BP0 ☐

Analog BNC-output

Without	**00**
For voltage	**UA**
For current	**IA**
For voltage a. speed/rotation angle	**UN**

Order Example: **Type 4700BP0UN**

ControlMonitoring CoMo Torque, evaluation instrument for torque sensors **Type 4700BP0**, analog BNC-output **UN**: for voltage and speed/rotation angle

3.2 Accessories Supplied

The evaluation instrument, Type 4700B… is supplied with:

Included Accessories	Type/Art. No.
• Power connector	KSM006309
• 9 pin null modem cable	KSM009720
• USB cable	KSM030552
• CD with software SensorTool Type 4706A	KSM026397

3.3 Accessories (optional)

• Power connector US, Japan	KSM018529
• Power connector UK	KSM031930
• Type 4700B... – analog output connection cable, 5 m	KSM020521
• Connection cable analog, 2,5 m, 12 pin for Type 4700B... to Type 4503A..., 4504B... and 4510B...	KSM186420-2,5
• Connection cable frequency, 2,5 m, 12 pin for Type 4700B... to Type 4503A..., 4504B... and 4510B...	KSM186430-2,5
• Connection cable analog, 2,5 m, 12 pin for Type 4700B... to Type 4502A..., 4520A...	KSM185380-2,5
• Connection cable analog, 2,5 m, 6 pin for Type 4700B... to Type 4501A... Q/R (respectively force)	KSM185350-2,5
• Connection cable strain gage with angle, 2,5 m, 12 pin for Type 4700B... to Type 4501A... QA	KSM185370-2,5

See data sheet KSM_000-615 for other cables.

3.4 Firmware Update

The firmware of the Evaluation Instrument Type 4700B… can be updated via the USB interface. The PC application Update Application and the corresponding update file is used for this purpose.

The PC application and the firmware can be found on the enclosed CD which is included with the delivery of Type 4700B… .

The CD with the latest version of the firmware can be ordered from the Kistler sales company or representative, please quote Type 4706A.

4. Basics

4.1 Torque Sensors

In practice, torque sensors measure the torque with the aid of strain gages. The strain gages are applied to the torsion section and undergo a change in impedance that depends on the torque.

This causes a voltage change that is proportional to the change in impedance and that either reaches the Evaluation Instrument, Type 4700B… directly or is conditioned with the aid of an internal amplifier in the torque sensor.

Type 4501A…

Commutator ring torque sensor (passive sensor)
Type 4501A…

Torque sensors of Type 4501A... work according to the strain gage principle and provide an analog output signal in mV/V. Optionally, there is an integrated angle/speed measurement available. The Type 4501A… is optimized for usage in screw technology. The versions with square shaft or hexagonal shaft fit directly onto the outputs of the assembly tools for screws and nuts.

Typical applications are the testing of stationary screw spindles or torque measurement with hand-guided assembly tools for screws and nuts.

The versions with round shaft ends can be used wherever torque is to be measured sporadically or at low speed.

Type 4502A…

Mini-Smart torque sensor (active sensor)
Type 4502A…

Torque sensors of Type 4502A... work according to the DMS principle. The torque signal is transferred without physical contact from the rotating shaft using frequency modulation and is conditioned as a 0 ... ±5 VDC analog signal. Optionally, there is an integrated angle/ speed measurement available.

The Type 4502A… with rotating measurement shaft is not only suitable for the dynamic determination of tightening and release torques in screw fitting and assembly technology, but also for quality control in production and in the laboratory.

Type 4503A…

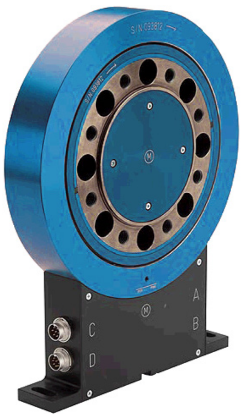
Dual-range torque sensor (active sensor)
Type 4503A…

Torque sensors of Type 4503A... with integrated speed sensor work according to the strain gage principle. An integrated, digital measured value preprocessor generates analog or digital output signals.

The version with a second measurement range (option) is suitable for applications with high peak torque and medium operating torque. A torque sensor with a single measurement range must be selected to withstand the peak torque. As a result, however, this would be somewhat over-dimensioned for measuring the actual operating torque of interest.

The dual-range sensor of Type 4503A… offers the principle of measurement range switching here, where both the peak torque and the operating torque can be measured with sufficient accuracy.

Typical fields of application include the testing of electrical motors, coefficient of friction measurement on gearboxes or spindle drives, or the testing of generators or the power measurement of drive units.



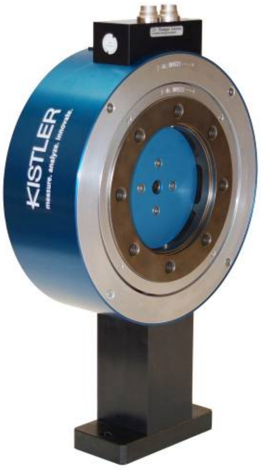
Type 4504B…

Torque measurement flange (active sensor)
Type 4504B…

Torque measurement flanges of Type 4504B... work according to the strain gage principle. The integrated, digital measured value preprocessor generates analog or digital output signals that are transferred without physical contact. The rotor runs without bearings and, as a result, does not cause wear to the stator ring.

The short flange-to-flange solution allows the measurement flange to be integrated cost-effectively in the drive train while also saving space. The speed recording is fully integrated in the sensor.

Because of its construction, the torque measurement flange Type 4504B... is suitable for test bench technology and is used, for example, for combustion engines, gearboxes, rollers, wheel load, electrical motors and pump test stands.



Type 4510B…

Dual-Range torque measuring flange (active sensor)
Type 4510B...

Torque measuring flanges Type 4510B… measure torque by strain gages. The digital measuring values are transmitted contactless from rotor to stator. There are analog and digital output signals available for evaluation.

Due to the design with clamp set the measuring flange may be mounted directly on the shaft of the infeed drive.

The optional dual range version is predestinated for applications with high peak torque and medium average operating torque. A single range torque sensor should be selected for withstanding the peak torque. For measuring the average operating torque it would therefore be oversized.

The 4510B… can be used in gear box test rigs, wheel load simulation, engine test rigs and in other applications in research and development.

Type 4520A…

Basic Line torque sensor (active sensor)
Type 4520A…

Torque sensors Type 4520A... operate on the strain gage principle and supply an analog output signal that is transmitted without contact.

The robust Type 4520A... for measuring torque on rotating shafts offers particularly good value for money and is recommended primarily as an entry-level solution for torque measurement. Frequency modulation is used to transmit the torque signal from the rotating shaft without contact and convert it into an analog signal. The speed signal at 60 pulses/rev. is available as TTL signal level.

Type 4520A… is suitable for static and dynamic measurement of torques in assembly and for quality control in production and the laboratory.

Type 4550A…
Type 4541A...

KiTorq System torque measurement flange (active sensor) Type 4550A… and Type 4541A…

Torque measurement flanges of Type 4550A... (KiTorq Rotor) and Type 4541A… (KiTorq Stator) work according to the strain gage principle. The digitized measured signals are transferred without physical contact to the fixed evaluation unit (stator). Analog and digital output signals will be generated. The rotor runs without bearings and is wear-free.

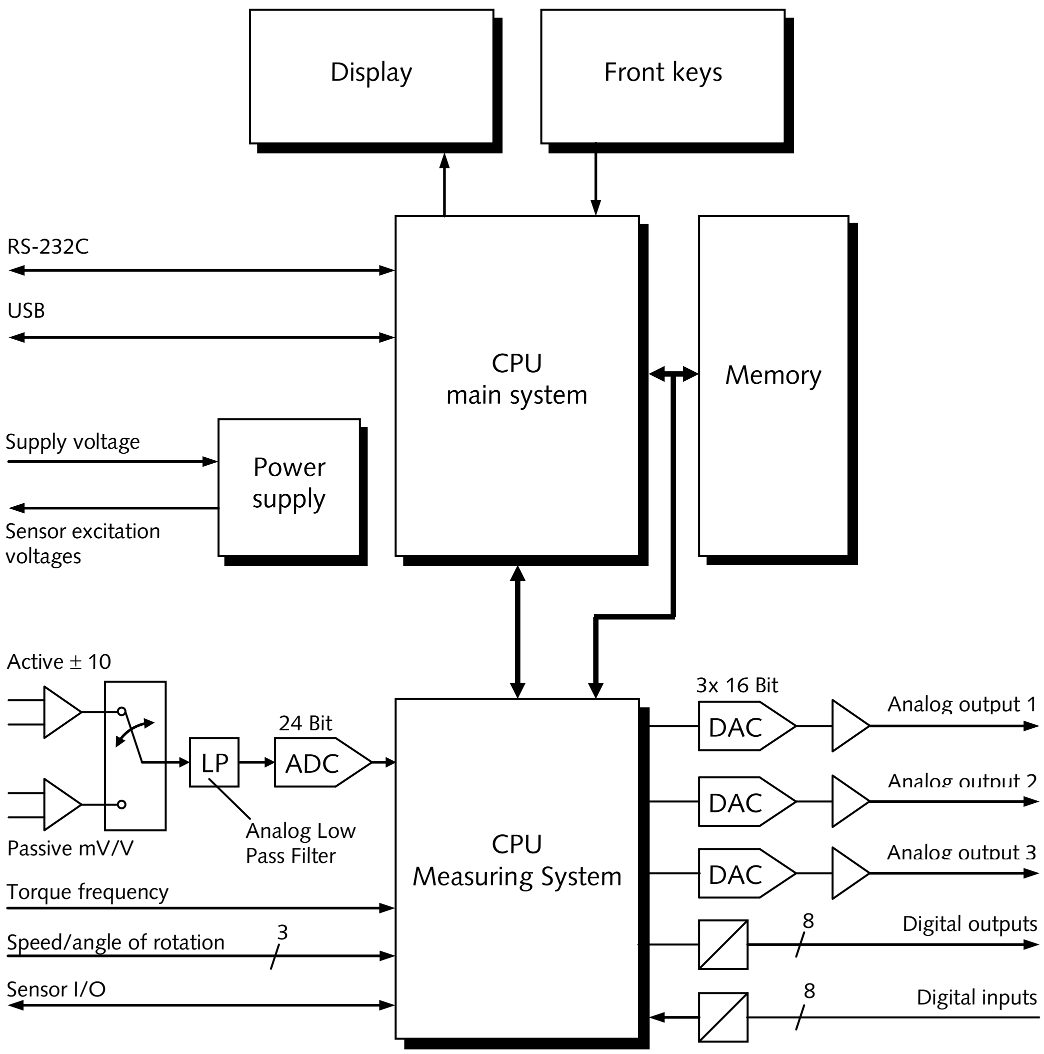
The short flange-to-flange solution allows the measurement flange to be integrated cost-effectively in the drive train while also saving space. The speed recording is fully integrated in the sensor.

The KiTorq System is applicable with its construction for applications in test bench technology, especially for electrical motors, gearboxes, pump test stands and combustion engines.

5. Instrument Description

5.1 Architecture

In the following the most important internal components of device architecture.



5.2 Internal Measured Value Buffer

The internal measured value buffer serves to store the recorded measured values of an initiated measurement. This is particularly useful if an adequately high sampling rate seems necessary (up to 10 kHz, e.g. for recording the tightening torque of a power screwdriver or the bending torque of a torque wrench).

Up to 5 000 successive measured value packets can be stored in the measured value buffer. It is then possible to transfer the recorded contents to the target system (e.g. PC).

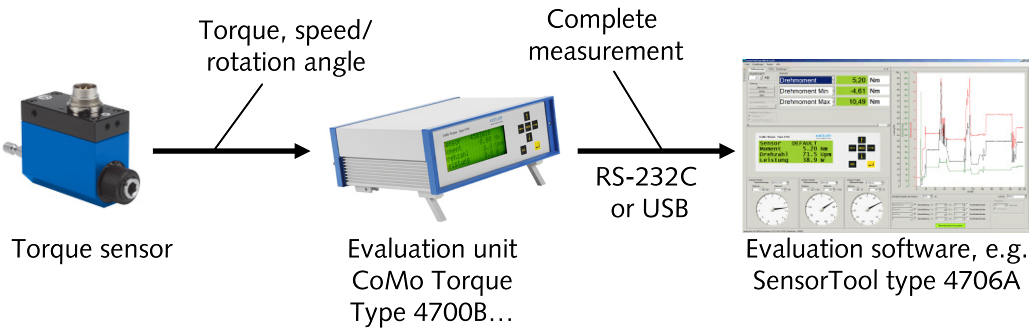
Individual measured value packet

An individual measured value packet always contains the following measured value variables:

1. Torque
2. Speed
3. Rotation angle
4. Rotation counter reading
5. Mechanical power

A trigger condition must be met to store successive measured value packets (measurement curve). The trigger condition is dependent on a threshold being reached, the defined condition of a digital input or manual triggering with a key. These conditions can be set in the menu system.

A new measured value storage operation overwrites the previously saved values. It is therefore only possible for a continuous measurement curve to be saved in the measured value buffer.



5.3 Front and Rear View

The operating keys and the backlit 4x20 character display of the Evaluation Instrument CoMo Torque, Type 4700B… are on the front panel. All connection plugs and socket are mounted on the rear.

Front view CoMo Torque

Back view CoMo Torque Type 4700B…
Without analog BNC-output

Type 4700BP0**00**

Back view CoMo Torque Type 4700B…
Analog BNC-output for voltage and for current

Type 4700BP0**UA or** Type 4700BP0**IA**

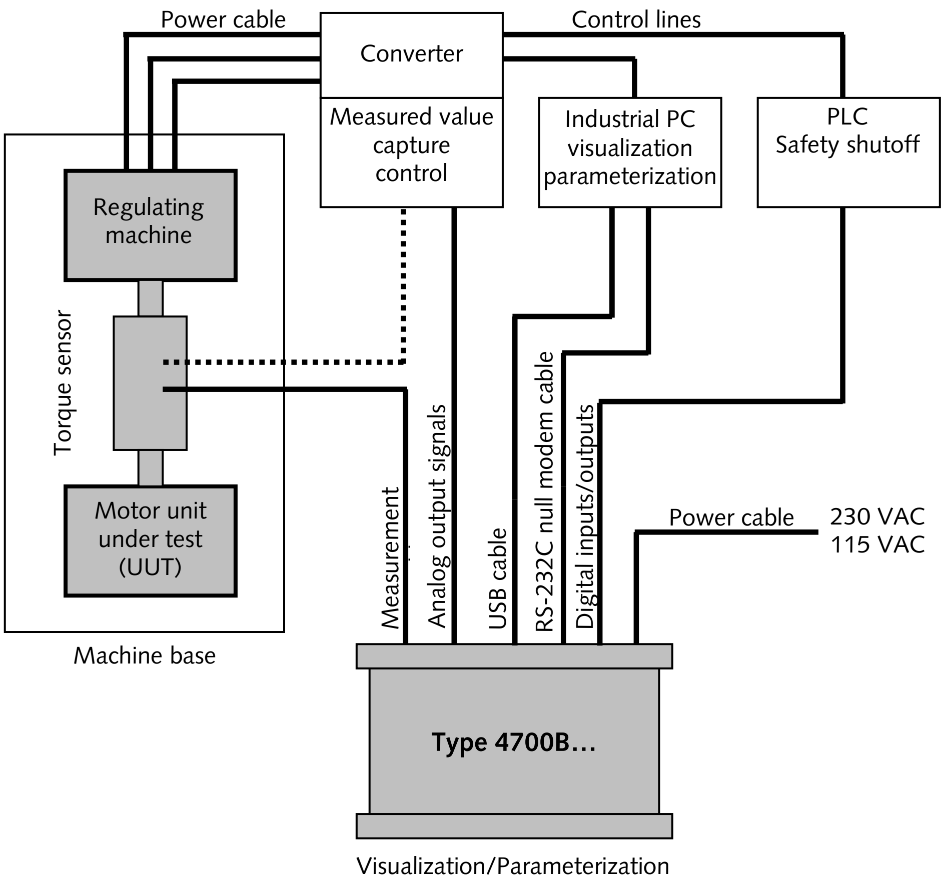
Back view CoMo Torque Type 4700B…
Analog BNC-output for voltage or for current, or as well as foe voltage and speed /rotation angle

Type 4700BP0**UA or** Type 4700BP0**IA or** Type 4700BP0**UN**

6. Connection Description

6.1.1 Cabling

The Evaluation Instrument, Type 4700B… is suitable for integration in existing systems. The following figure shows a typical application of motor testing:

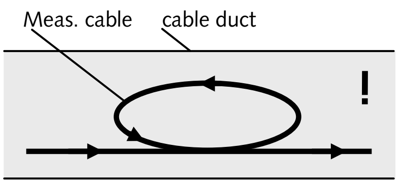


Electrically isolated sensor supply
The torque sensor can be supplied by the Type 4700B… instrument. This results in electrical isolation between the digital inputs and outputs that are often connected with the operating ground of the programmable logic controller (PLC).

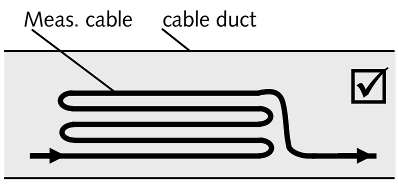
Measured value conversion for passive sensors
If the torque signal is to be used for control or regulation purposes, this can be carried out with the analog outputs of the Evaluation Instrument, Type 4700B…. This can be particularly advantageous with a passive sensor (mV/V signals) (works as a measured value amplifier).

Generating a tacho signal from the speed
The speed recorded and measured by the Type 4700B… instrument can be converted into a voltage parameter with an analog output. This output voltage is proportional to the speed/angle of rotation (tacho signal).

Cable shield, laying the measurement cable
In general, use shielded cable. Do not place parallel to power lines or control lines.
Do not place near strong electromagnetic fields, e.g., transformers, welding equipment, contactors, motors, etc..
If this cannot be avoided, place the measuring cables in an earthed steel conduit.
Avoid cables that are too long. If this is not possible, do not wind up the extra length as a closed cable ring, so that induction surfaces are held as small as possible!



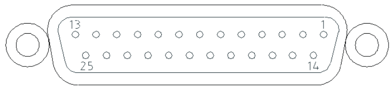
Danger of induction on the measurement signal as a result of electromagnetic fields



Effective inductive surfaces are reduced by bifilar laying

External control signals
Digital signal states can be generated via the digital input and output signals of the evaluation instrument, Type 4700B… (e.g. if limit values are exceeded). It is also possible to detect digital input signals of a PLC via the serial interface of the Type 4700B… instrument.

6.1.2 Sensor Connector

Type 4700B… 25 pin female D-SUB	Torque sensors					Description
	Type 4504B… Type 4503A… Type 4510B…	S 0160 (360 Imp.)	Type 4502A… Type 4520A…	Type 4501A… without angle (0143SD) Q version	Type 4501A… with angle (0143SD) QA version	SENSOR 
1				2	B	Bridge supply +5 V
2				2	B	Sense +
3				4	C	Bridge signal +
4	$C^{(U)}$	$C^{(U)}$	C			Torque + (active sensor)
5						–12 V
6						Counter 1 (zero pulse)
7		H	H		F	+5 V
8					E	GND (+5 V)
9	L					TXD *
10	B					RXD *
11						+12 V
12	K	K	K			Active control signal / Reset ** (TTL output for active sensors)
13	F	F	F			+24 V
14				1	A	Bridge supply 0V
15				1	A	Sense –
16				5	D	Bridge signal –
17	$D^{(U)}$	$D^{(U)}$	D			Torque – (active sensor)
18	H	B	B		G	Counter 2 (leading angle/speed)
19		G	G		H	Counter 3 (lagging angle)
20	$C^{(f)}$	$C^{(f)}$				Counter 4 (torque active sensor with frequency)
21	A					GND (±12 V)
22	E	A	A			GND TTL output
23				6	K	Passive control signal (output for passive sensors)
24	$D^{(f)}$	$D^{(f)}$, E	E		J	GND (counter)
25	M	M	M	3	M	GND (+24 V)

*** Torque sensor with voltage or frequency output:**
A torque sensor with voltage output is connected to connection pins $C^{(U)}$ and $D^{(U)}$. A torque sensor with frequency output is connected to pins $C^{(f)}$ and $D^{(f)}$.

The digital connection to the Type 4503A… and Type 4504B… is made via the RS-232C TXD and RXD interface to the sensor connector.

**** Piezo reset for ICAM – Industrial Charge Amplifier Type 5073A…:**
If an external ICAM charge amplifier Type 5073A… is connected, the control signal is used for the Piezo reset (to clear the charge/for grounding).

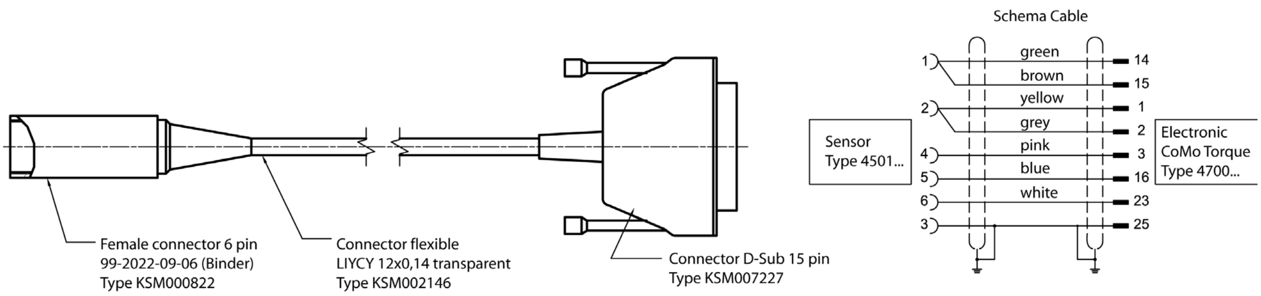
ICAM Industrial charge amplifier Type 5073A…

6.1.3 Sensor Type 4501A…

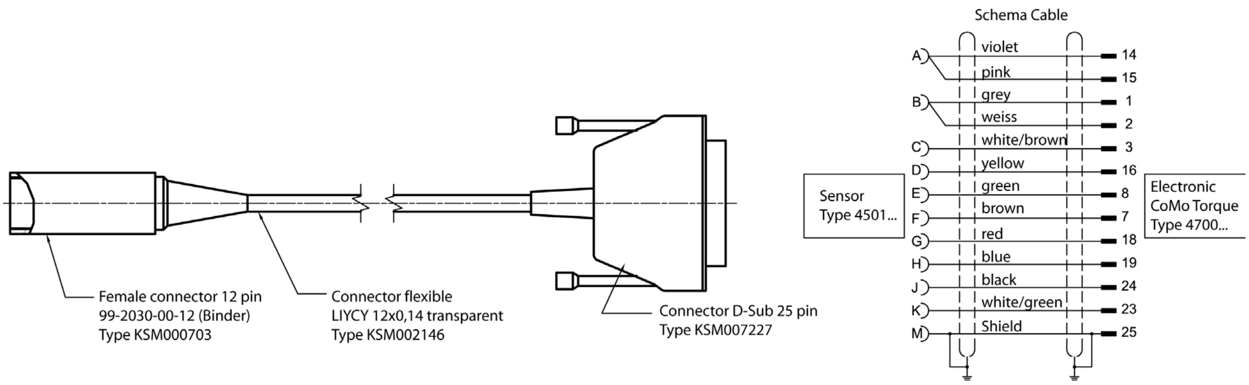
The Type 4501A… sensor is supplied with a unipolar DC voltage of +5 V by the Type 4700B… Evaluation Instrument. To compensate for voltage drops due to long feed lines, the use of Sense connections is recommended. The control signal is used for function control and detunes the strain gage bridge on the torsion shaft of the sensor.

The following prefabricated cables can be used:

Technical Data		Type KSM185350-2,5
Connecting cable		analog
Connector		6 pin for Type 4700B… to Type 4501A… Q/R (force)
Length	m	2,5



Technical Data		Type KSM185370-2,5
Connecting cable		Strain gage with angle
Connector		12 pin for Type 4700B… to Type 4501A… QA
Length	m	2,5

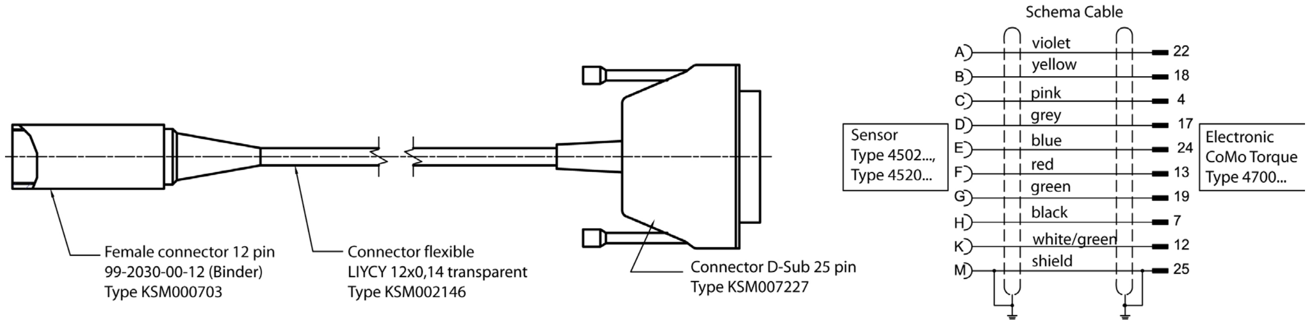


6.1.4 Sensor Type 4502A… and Type 4520A…

The Type 4502A… and Type 4520A… is supplied with a unipolar DC voltage of +24 V by the Type 4700B… Evaluation Instrument. The control signal is used for function control and is triggered by an active signal with TTL level.

The following prefabricated cable can be used:

Technical Data		Type KSM185380-2,5
Connecting cable		analog
Connector		12 pin for Type 4700B… to Type 4502A… and Type 4520A…
Length	m	2,5

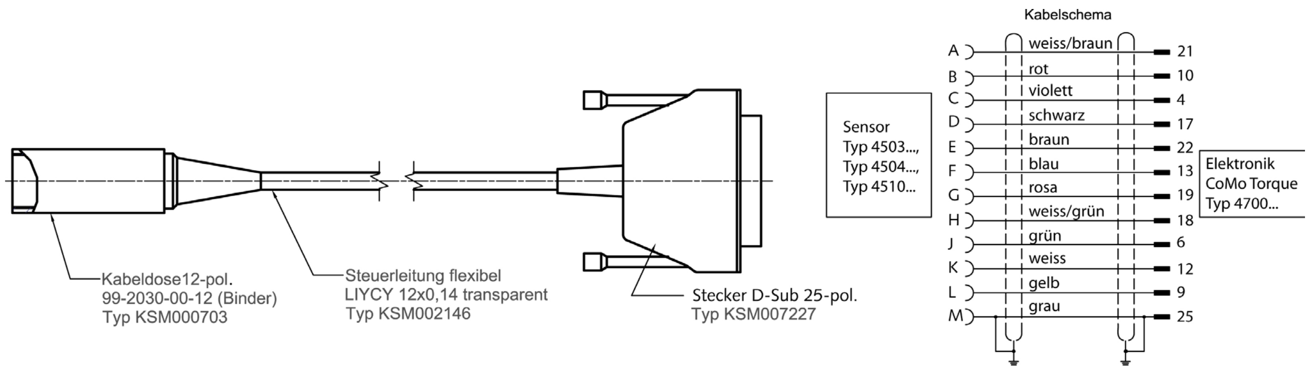


6.1.5 Sensor Type 4503A…, Type 4504B…, Type 4510B…

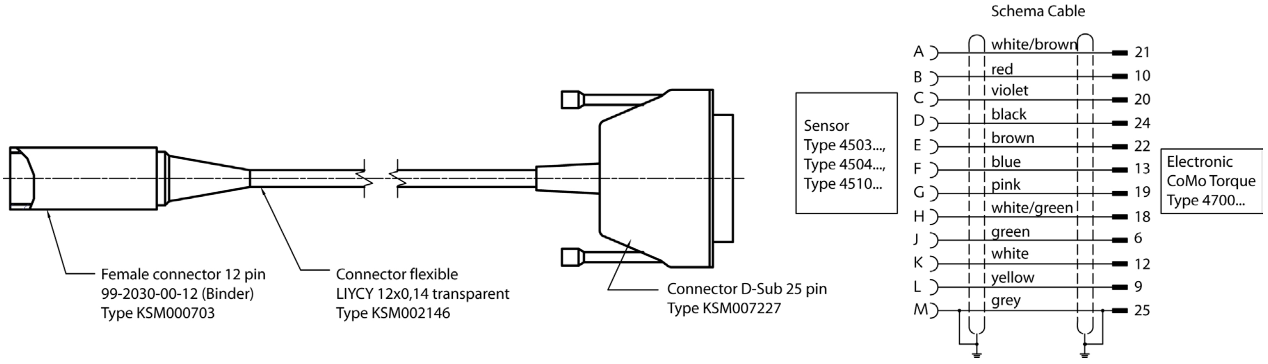
The torque sensor Type 4503A…, Type 4504B… and Type 4510B... is supplied with a unipolar DC voltage of +24 V by the CoMo Torque Type 4700B… evaluation instrument. The control signal is used for function control and is triggered by an active signal with TTL level.

The following prefabricated cable can be used:

Technical Data		Type KSM186420-2,5
Connecting cable		analog
Connector		12 pin for Type 4700B… to Type 4503A…, 4504B… and to Type 4510B…
Length	m	2,5



Technical Data		Type KSM186430-2,5
Connecting cable		Frequency
Connector		12 pin for Type 4700B… to Type 4503A…, 4504B… and to Type 4510B…
Length	m	2,5



NOTE

Connection cable for voltage / frequency output
The connection cables for torque sensors with voltage or frequency output are different!

6.1.6 ICAM – Industrial Charge Amplifier Type 5073A…

The charge amplifier Type 5073A… is loaded via the loading and analysis system Type 4700B… with a unipolar DC voltage of +24 V. The control signal is used for clearing the load/grounding and is triggered with an active signal with TTL level.

The following, pre-assembled cable can be used:

Technical Data		Type KSM310500-2,5
Connector		15 pin for Type 4700B… to Type 5073A…
Length	m	2,5

NOTE

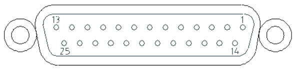
Clearing the charge/grounding the charge amplifier
For the loading and analysis system Type 4700B a Piezo reset is carried out … in measurement mode by pressing the ESC key or, alternatively, in the **Zero point** submenu.

6.1.7 Voltage Outputs

Type 4700B… 9 pin female D-SUB	Description ANALOG OUT			
	1st channel	2nd channel	3rd channel	Non assigned connections
1	U_{A1}			
2				n.a.
3				n.a.
4				n.a.
5		U_{A2}		
6	GND_{A1}			
7			U_{A3}	
8			GND_{A3}	
9		GND_{A2}		

n.a.: Not assigned, do not connect.

6.1.8 Digital Inputs and Outputs

Type 4700B… 25 pin female D-SUB	Description DIGITAL IN/OUT 	
	Digital inputs	Digital outputs
1		GND_{OUT}
2		Output 1
3		Output 3
4		Output 5
5		Output 7
6		GND_{OUT}
7	+24 V (80 mA)*	
8	GND_{INP}	
9	Input 2	
10	Input 4	
11	Input 6	
12	Input 8	
13	GND_{INP}	
14		GND_{OUT}
15		Output 2
16		Output 4
17		Output 6
18		Output 8
19		GND_{OUT}
20	GND_{INP}	
21	Input 1	
22	Input 3	
23	Input 5	
24	Input 7	
25	GND_{INP}	

NOTE

*** Internal +24V voltage source:**
An electrically isolated 24 V voltage source is provided for the digital inputs (PIN 7, max. 80 mA). The relevant ground potential is GND_{INP} (Pin 8, 13, 20 and 25).

NOTE

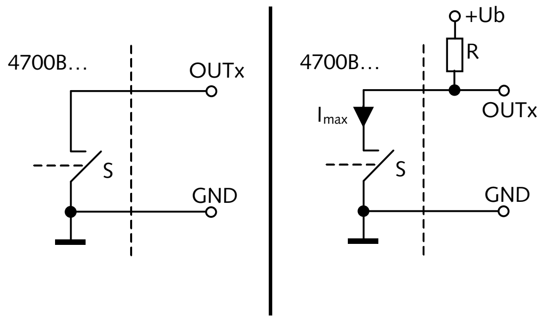
Digital input states, optocoupler
An optocoupler is present on each digital input. The inputs are electrically isolated from the other parts of the circuits of the Type 4700B.... evaluation instrument.

Logic state 1 or High: 3,5 … 30 V
Logic state 0 or Low: ≤0,8 V

Digital output states, electronic relay
An electronic semiconductor relay is available for each digital output. These are electrically isolated from the other parts of the circuits of the Type 4700B... instrument.

Logic state z or high-impedance: Relay opened
Logic state 0 or Low: Relay closed

An open semiconductor relay does not have any unique logic level (state z for this reason). By connecting an external pull-up resistor R, the logic state 1 or High is created. The pull-up resistor is not part of the Type 4700B… instrument.



With R, state z becomes state 1.

The pull-up resistor R is connected to a voltage source; this connection can be made on Pin 7 of the internal 24 V voltage source of the evaluation instrument Type 4700B…

The maximum current consumption I_{max} of each digital output is 100 mA. The resistor must be dimensioned accordingly:

$$R_{\min} = \frac{U_b}{I_{\max}}$$

Calculation example:

U_b = +24 V (e.g. Pin 7 on Type 4700B…), $I_{\max}$ = 100 mA, this results in a good approximation:

$$R_{\min} = \frac{U_b}{I_{\max}} = \frac{24V}{100mA} = 240\Omega_{\min}$$ with open output.

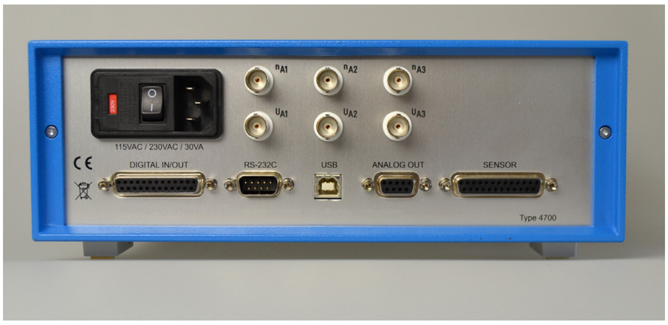
On $R_{\min}$ there is a maximum power loss $P_{\max}$ of:

$$P_{\max} = I^2_{\max} \cdot R_{\min} = (100mA)^2 \cdot 240\Omega = 2{,}4W$$!

Limitation of the power loss on the pull-up resistor
A resistor value of, for example, 1 kΩ should be selected; this mainly depends, however, on the input resistance of the external evaluation circuit (e.g. digital PLC input).

6.1.9 Optional BNC Outputs

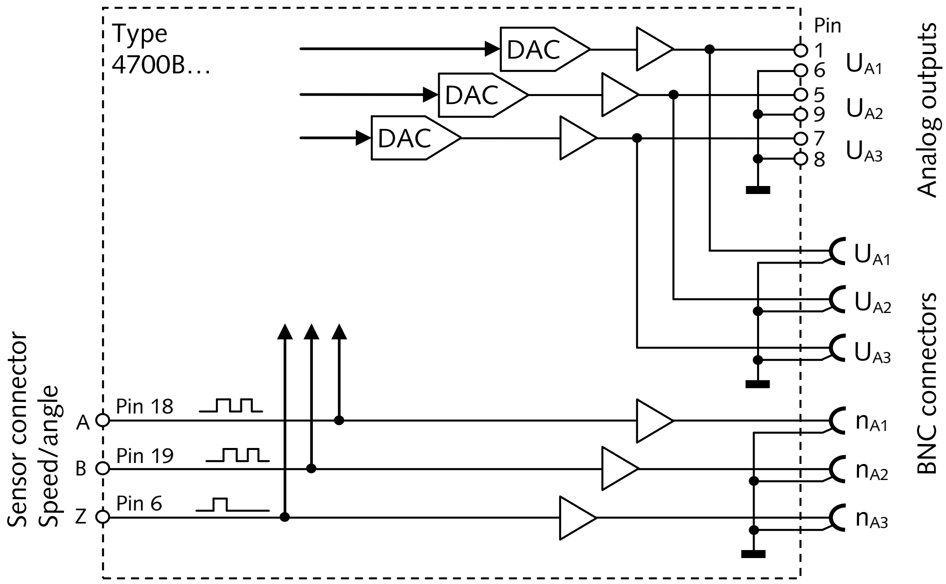
The evaluation instrument Type 4700B… can be equipped with optional BNC sockets. These are connected to the analog outputs and, depending on the extension version, to the physical speed/angle of rotation pulses (buffered with driver circuits) from the connected sensor.



The following assignments are made for the BNC sockets:

n_{A1}	Leading angle/speed (TTL, 100 mA max.),
n_{A2}	Lagging angle (TTL, 100 mA max.),
n_{A3}	Zero pulse (TTL, 100 mA max.),
U_{A1}	Analog output 1,
U_{A2}	Analog output 2,
U_{A3}	Analog output 3.

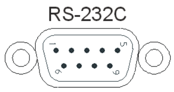
The following block circuit diagram clearly shows the internal electrical circuits of the BNC sockets.



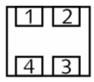
6.1.10 RS-232C Interface

A null modem RS-232C cable (crossed cable) is used between the PC and Type 4700B… instrument. The interface works according to the following conditions:

1 start bit,
8 data bits,
1 stop bit,
no parity.

Type 4700B… 9 pin male D-SUB	Description 	Description Non assigned connections
1		not assigned
2	RXD	
3	TXD	
4		not assigned
5	GND	
6		not assigned
7		not assigned
8		not assigned
9		not assigned

6.1.11 USB Interface

Type 4700B… USB 2.0 Standard, Type B	Description 
1	U_{USB}*
2	DATA -
3	DATA +
4	GND_{USB}

NOTE

*** USB Interface:**
The Type 4700B… instrument is not supplied via the U_{USB} connection of the USB port. The PC detects whether the evaluation instrument CoMo Torque, Type 4700B… is connected via this line.

7. Menu Guidance

7.1 Operating the Instrument

The evaluation instrument CoMo Torque, Type 4700B… is operated from a menu. A total of 7 keys are provided for navigation.

The main menu can always be selected with the MENU key. The Enter key ↵ is used to call up the submenu selected with the four arrow keys as well to confirm a change to a parameter.

The ESC key is used to discard a change to the parameter or to exit the menu item again. The individual menu items and the menu structure are explained in more detail in the following section.

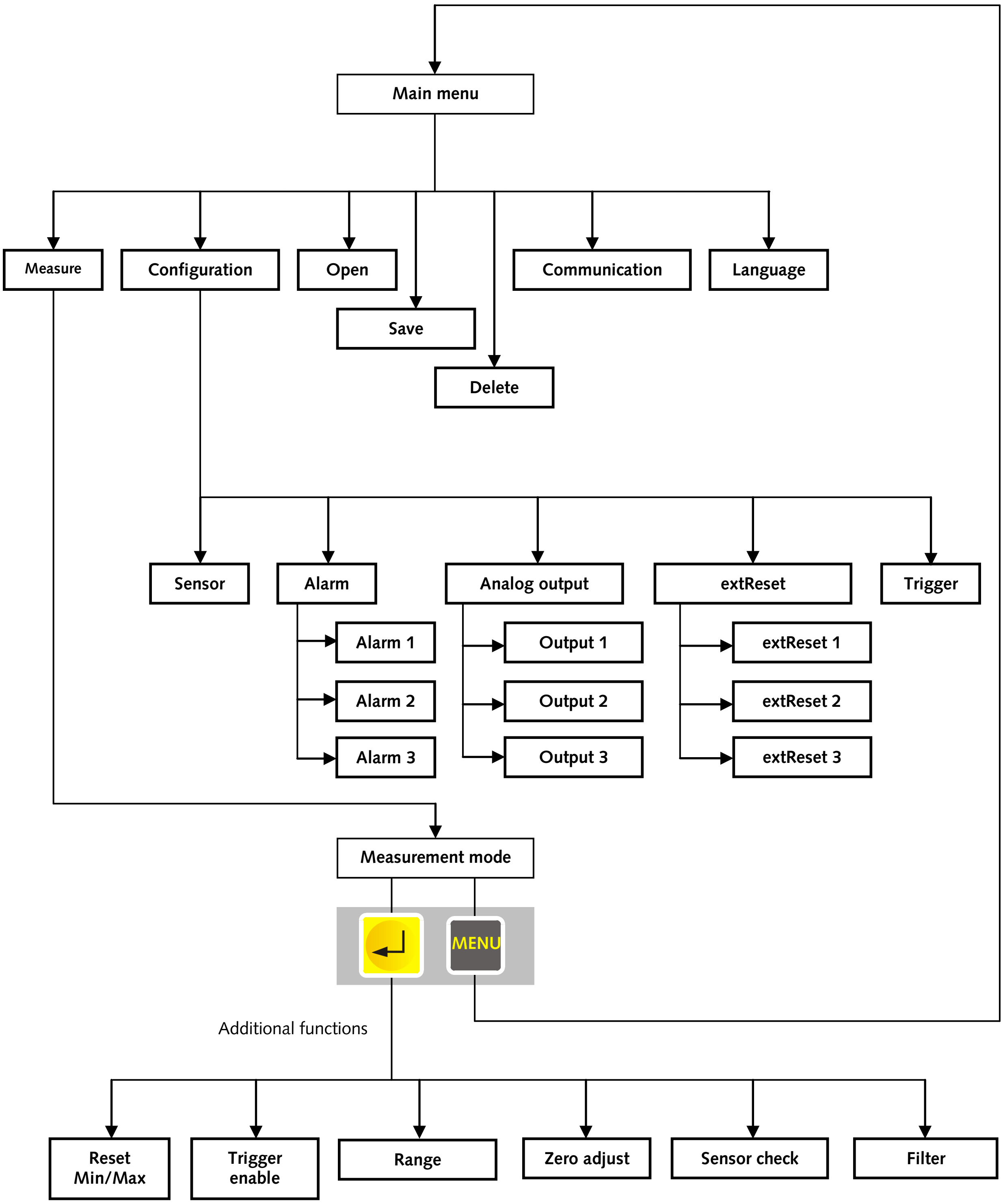
7.2 Welcome Screen

Type 4700
CoMo Torque
Firmware V4.93

When the evaluation instrument, Type 4700B… is switched on, the model identification and the firmware version number are displayed for a few seconds.

The display then switches into measurement mode.

7.3 Menu Structure



7.4 Main Menu

▸	Measure	↓
	Configuration	↕
	Open	↕
	Save	↑
	Delete	
	Communication	
	Language	

The main menu consists of a number of entries. Only four lines are visible on the display. Arrows on the right side of the menu show whether it is possible to navigate further in the menu by scrolling downwards, downwards and upwards, or just upwards. The selected menu item is indicated by an arrow ▸ on the left side.

7.5 Measurement Mode

The **Measure** menu is not a submenu in the real sense, but rather the measurement mode for the parameters:

Sensor	4700B
Torque	0,0000 N·m
Speed	0 1/min
Power	0,0 W

- Torque/Force
- Speed/Angle
- Revolution counter
- Mechanical power

In this mode, the correct values of the current measurements with the desired units are shown on the display.

7.6 Configuration Menu

All significant settings for the evaluation instrument Type 4700B… are made in the **Configuration** menu:

▸	Sensor
	Alarm
	Analog output
	ExtReset
	Trigger

- Sensor configuration,
- Threshold observations (alarms),
- Signal conversions (analog output),
- External reset options of Min./Max., buffer (ExtReset),
- Trigger conditions for the internal measured value buffer.

7.6.1 Sensor Submenu

The CoMo Torque Type 4700B… is parameterized in the **Sensor** menu using a connected torque or force sensor. Assignments between the output voltage/frequency and applied rated torque or rated force of a sensor are configured in this menu.

When connecting a dual-range sensor (e.g. Type 4503A…), it is possible to define two nominal ranges of use (1st and 2nd range).

The number of pulses of speed sensors as well as other settings for the display in measurement mode (number of decimal places, additional measurement parameters, etc.) are also specified in this menu. The various setting options are shown and explained in detail in the following section:

▸	**Sign.Kind**	**+/-10V**
	Unit	N·m

In **Sign.Kind**, a choice can be made between **Bridge** , **±10 V**, **Freq.** and **5073A**.

ICAM industrial charge amplifier Type 5073A…

In this menu item, the user chooses a passive or active sensor. An active sensor with voltage output (0 … ±10 V) is selected with **±10V**. Sensors with a torque-equivalent frequency output are selected with **Freq.**. A passive sensor contains a strain gage bridge without its own measured value amplifier. This is selected with **Bridge**. If connecting an ICAM – industrial charge amplifier Type 5073A…, the selection **5073A** should be used (measuring range ±0 … 10 V).

Depending on which function is activated, the diagram and the subsequent setting options change to the present display.

	Sign.Kind	±10 V
▸	**Unit**	**N·m**

A choice can be made between the following units for the signal type in **Unit**:

Metric units:

kN·m N·m N·cm N·mm ⇒ torque sensor
kN N ⇒ force sensor

Imperial units:

lbft	(pound force feet)	⇒ torque sensor
lbin	(pound force inches)	⇒ torque sensor
ozin	(ounce-force inches)	⇒ torque sensor
lbf	(pound force)	⇒ force sensor

It is possible to differentiate between a torque and a force sensor by the units. The factors for calculating the mechanical power are automatically taken into account.

Setting example: **Passive sensor**

Measurement range: 200 N·m
Sensitivity: ±1 mV/V

▸	**Sign.Kind**	**Bridge**
	Unit	N·m
	Range	200,0 N·m
	Sens.	1,000 mV/V
	Dec. Pt.	###.###

If the **Bridge** measurement type is activated, the sensitivity of the strain gage bridge of a passive sensor appears behind the abbreviation **Sens**.

In conjunction with the selected **Range**, the conversion of mV/V into the selected **Unit** of the sensor is carried out automatically.

The number or decimal places after the decimal point for displaying the torque or force signal can be defined in **Dec.Pt.**. A definition of **##.####**, for example, means that 4 decimal points are displayed for the respective display range.

Setting example: **Active dual-range sensor with voltage output**

1st meas. range: 200 N·m, ± 10.004 V
2nd meas. range: 20 N·m, ± 9.997 V

▸	**Sign.Kind**	**±10 V**
	Unit	Nm
	1. Range	200,0 Nm
	Nominal	10,004 V
	Dec. Pt.	####.##
	2. Range	20 Nm
	Nominal	9,997 V
	Dec. Pt.	###.###
	Selection	Button
	Output	---

An active sensor with normalized torque-equivalent voltage output is selected with **±10 V**. In this case, the **Nominal** abbreviation appears for the 1st and 2nd measurement range (**1. Range** and **2. Range**).

This means sensors with an output voltage of ±0 … 10 V can be connected.

NOTE

Dual-range sensor, e.g. Type 4503A…
A dual-range sensor is integrated in the Type 4700B… instrument where the nominal range (1:1) is defined for the 1st measurement range **1.Range** and the extended range, i.e. smaller measurement range, is defined for the 2nd measurement range **2.Range**. The respective nominal values are indicated in the relevant sections. An option is available for each range to specify its own decimal places. These are taken into consideration for the display in measurement mode.

NOTE

Deactivating the 2nd measurement range:
If the 2nd measurement range cannot/should not be used, the value 0 is entered for **2.Range**. The relevant specifications for the nominal value and decimal places are automatically hidden.

NOTE

Switch-over of the measuring range by key actuation or digital input
The measuring range can be switched over in the additional Measuring range menu (1st range to the 2nd range or vice versa). To this purpose the **Button** option is defined for **Selection**.

	2. Range	20 N·m
	Nominal	9,997 V
	Dec.Pt.	###.###
▸	**Selection**	**IN1**
	LogicIn	0→1
	Output	---

If the measuring range is to be selected via a digital input, this is possible by definition of the options **IN1** to **IN8** in **Selection**.

The necessary digital change in status for the selected input is defined with **LogicIn**. The options **0→1** or **1→0** are available to this purpose.

Switchover of the measuring range with a digital input and the key in the additional Measuring range menu is not permissible.

NOTE

Signalling of the measuring range with digital output
The selected measuring range can be displayed with a digital output. This is possible by selection of **OUT1** to **OUT8** in **Output**. If the parameter --- is set, no digital output is defined for signalling.

	2. Range	20 N·m
	Nominal	9,997 V
	Dec.Pt.	###.###
	Selection	IN1
	LogicIn	0→1
▸	**Output**	**OUT1**
	LogicOut	z→0

The original status of the digital output depending on the active measuring range is defined in **LogicOut**. The following options are possible:

0→z

1st measuring range (nominal range)	status 0 (closed)
2nd measuring range (smaller range)	status z (open)

z→0

1st measuring range (nominal range)	status z (open)
2nd measuring range (smaller range)	status 0 (closed)

Setting example: **Active dual-range sensor with frequency output**

1st meas. range: 200 N·m, 100 kHz ±40 kHz
2nd meas. range: 20 N·m, 100 kHz ±39,99 kHz

▸	**Sign.Kind**	**Freq.**
	Unit	N·m
	1. Range	200,0 N·m
	FreqOffs	100,00 kHz
	Nominal	40,00 kHz
	Dec. Pt.	####.##
	2. Range	20 N·m
	FreqOffs	100,00 kHz
	Nominal	39,99 kHz
	Dec. Pt.	###.###
	Selection	Button
	Output	---

If, however, the **Freq.** measurement type is selected as the **Sign.Kind**, the **FreqOffs** line is inserted which can be used to define a frequency offset.

The value entered for **FreqOffs** and **Nominal** (frequency deviation) is always made in kHz.

▸	**Type**	**Speed**
	Puls/rot	60
	Direction	cw
	Dec. Pt.	#####.#

The options of **Speed**, **Angle** or **---** are available under **Type**. In this case, the speed or angle parameter is added to the measurement mode. The number of pulses per revolution/rotation (0 … +9999) can be specified under **Puls/Rot**.

The direction of rotation of the sensor can be defined in **Direction**. Here, a signed evaluation of the speed/angle/

counter and the mechanical power is carried out (considered as positively signed with the selection **cw** (clockwise) and negatively signed with the selection **ccw** (counter clockwise)).

NOTE

Maximum speed:
The maximum input frequency that can be evaluated for recording the speed parameter is 300 kHz.

The maximum permitted input speed based on the pulses per revolution can be calculated as follows:

$$n_{max} = \frac{f_{max}}{z} \cdot 60 \quad [n_{max}] = \min^{-1}$$

here
n_{max} is the maximum speed searched for in $\min^{-1}$, f_{max} = 300 kHz and z is the user-defined pulses per revolution.

Example:

360 pulses per revolution are defined. The maximum permitted input speed n_{max} is:

$$n_{max} = \frac{300000 Hz}{360} \cdot 60 = 50000 \quad \min^{-1}.$$

NOTE

Angular resolution in ¼ degrees:
If the sensor has two tracks, each displaced by 90 °, for the angle recording, the instrument evaluates the angle with the quadrature process. If 2 decimal places are defined for displaying the **Dec.Pt**. angle (####.##), an angle display is made in ¼ (0,25) degree steps in the measurement mode.

▸	**Type**	**Angle**
	Puls/rot	360
	Direction	cw
	Dec. Pt.	####.##

NOTE

Simultaneous measurement of speed and angle
In the Type 4700B… instrument, the speed and angle parameters as well as the counter reading are always recorded simultaneously and permanently, independently of the selection in Type.

NOTE

Displaying the counter reading and its tare
The counter reading is proportional to the angle. For every 360 ° degrees, the counter reading changes by a value of 1.

This results in the following relationship:

$$z = \frac{\alpha}{360°}$$, where

z is the counter reading and α is the angle.

Examples:

Angle	Counter reading
0 °	0,0
180 °	0,5
360 °	1,0
720 °	2,0
…	…

The counter reading can be tared separately from the angle, see the **Zero Adjust** or **Reset Min/Max** submenu for this.

▸	**Add. Displ.**	**Power**
	Unit	W
	Dec. Pt.	####.##

For the 4th line in the measurement mode, an additional parameter can be displayed next to the torque/force signal and the speed or the angle.

This is carried out in **Add.Displ.** depending on the previous settings. The following options can be selected:

---	no additional parameters
To.Min	minimum torque
To.Max	maximum torque
Fo.Min	minimum force
Fo.Max	maximum force
Sp.Min	minimum speed
Sp.Max	maximum speed
An.Min	minimum angle
An.Max	maximum angle
Counter	revolution counter
C.Min	minimum counter reading
C.Max	maximum counter reading
Pow.	mechanical power
P.Min	minimum power
P.Max	maximum power
LPF	cutoff frequency of the lowpass filter

With the ...**Min** and ...**Max** options, the continuous Min./Max. memory is read and displayed for the selected parameter. The cutoff frequency of a low pass filter can be defined in the **Filter** submenu in the measurement mode.

The power is calculated in the Type 4700B… instrument with the following formula:

$$P_{mech} = M \cdot \omega = M \cdot 2 \cdot \pi \cdot \frac{n}{60} \quad , \quad \text{where}$$

P_{mech} is the mechanical power in W,

M is the torque in N·m and n is the speed in min^{-1}.

NOTE

Calculating the mech. power in HP (horse power):
If the **lbft**, **lbin** or **ozin** units have been defined, the mechanical power is automatically calculated in HP.

7.6.2 Alarm Submenu

Up to three different parameters can be monitored at the same time in the Type 4700B… instrument. Alarm states are generated when freely-definable thresholds are undercut or exceeded. These are indicated by the measured value display flashing in the measurement mode and by a defined logical status change of the digital outputs.

▸	**Type**	**Norm**

The **Norm** (Normal), **Hold** (saving alarm status) and **---** (no monitoring) options are available under **Type**.
Normal monitoring means that the alarm state is only triggered as long as the threshold is undercut or exceeded. In the case of hold monitoring, a triggered alarm can only be reset by a freely-defined digital input.

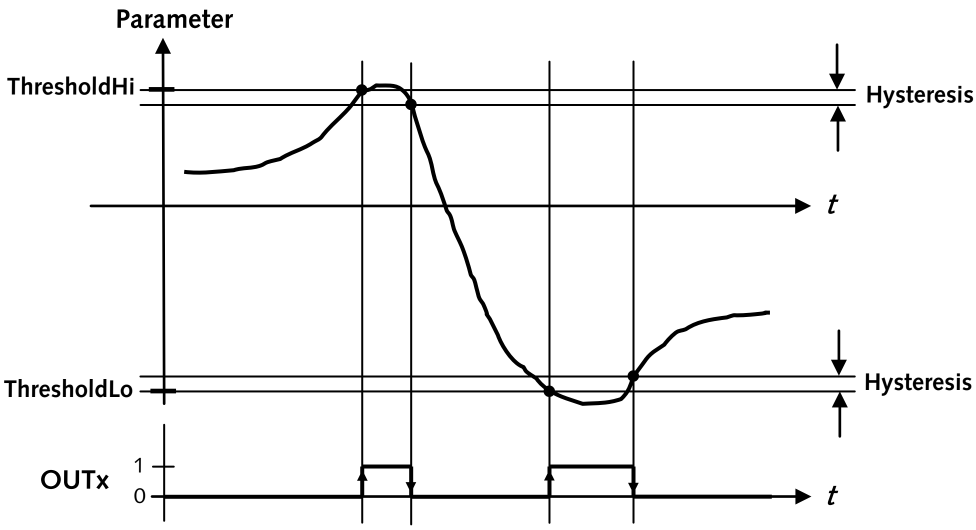
▸	**Source**	**Torque**

The parameters to be monitored can be defined with **Source**:

Torque	torque
Force	force
Speed	speed
Angle	angle
Counter	counter reading
Power	mechanical power

▸	**Thr. Lo.**	**-10,000 N·m**
	Thr. Hi.	10,000 N·m
	Hyst.	0,010 N·m

The lower threshold value is parameterized with **Thr.Lo.** and the upper threshold value can be specified with **Thr.Hi.**. Optionally, a hysteresis can be defined for each threshold by selecting the **Hyst.** menu option.



▸	**Enable**	**In1**
	LogicIn	0→1

With **Enable**, a digital input **In1** … **In8** is selected and can be used to specifically activate or deactivate the monitoring in order to drive to a valid range first (from 0 to target value), for example. A triggered and saved alarm state (through **Type** → **Hold**) can also be reset again here.

The **Button** can also be selected with **Enable**. A triggered and saved alarm state can then be reset in the measurement mode by pressing the left arrow key.

If the Enable function is not desired, select the **---** option under **Enable**.

The digital switch state is defined in **LogicIn** to specify whether the monitoring should be enabled or the triggered and saved alarm state should be reset when the state changes from **0→1** or **1→0**.

Targeted enable of alarm function monitoring
For example, the definition 0→1 in LogicIn means that alarm function monitoring is enabled or reset in the digital switch state 1.

A digital output **OUT1** … **OUT8** that switches to the desired direction when an alarm state is triggered in accordance with **LogicOut** is defined in the **Output** menu item. If the alarm process is not to influence any digital output, select the **---** option in **Output**.

The following settings are possible in **LogicOut**:

z→0 from high-impedance state to state 0,
0→z from state 0 to high-impedance state.

7.6.3 Analog Output Submenu

Every recorded or calculated parameter can be reproduced in a scaled form on an analog output. The Type 4700B… instrument acts as a measured value amplifier as a result.

▸	**Output 1**
	Output 2
	Output 3

The structure of the **Analog Output** submenu is divided into the **Output 1**, **Output 2** and **Output 3** submenu items. For each analog output, there is an option to independently set up different configurations.

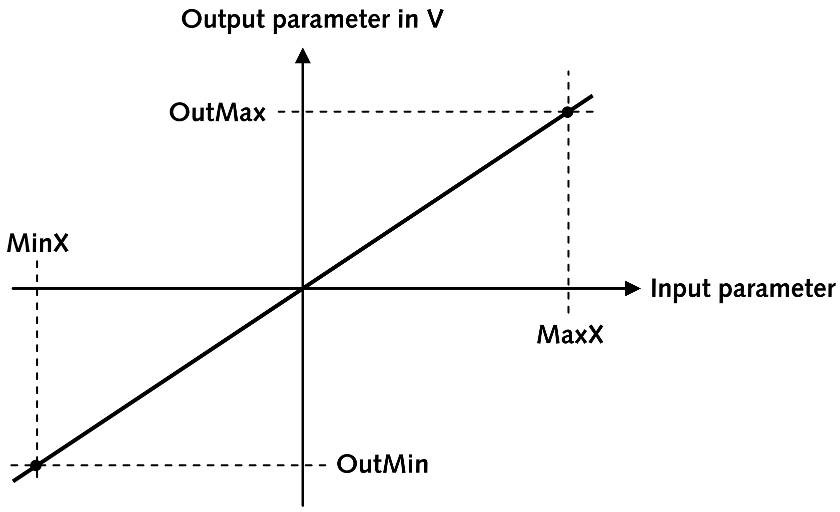
▸	**Source**	**Torque**
	MinX	–5,000 N·m
	MaxX	5,000 N·m
	OutMin	–10,000 V
	OutMax	10,000 V

The parameter to be converted is defined in the **Source** menu item:

---	analog output deactivated,
Torque	torque,
Speed	speed,
Angle	angle,
Counter	counter reading,
Power	mechanical power.

The input value is scaled in **MinX** and **MaxX**. The assignments of the output voltage values are defined in **OutMin** and **OutMax**.

The following schematic diagram shows the linear relationship between the input and output parameters for each analog output.



The maximum definable output voltage value is +10 V and the minimum value is –10 V.

NOTE

Dual-range sensor (e.g. 4503A…)
If there is an extended (i.e. smaller) measuring range, an additional pair of values can be added for scaling the input values. This is performed in 2.MinX and 2.MaxX. The output voltage values in OutMin and OutMax are equally valid for the nominal and extended measuring range.

	1. MinX	–5,000 N·m
	1. MaxX	5,000 N·m
▸	**2. MinX**	**–0,500 N·m**
	2. MaxX	0,500 N·m
	OutMin	–10,000 V
	OutMax	10,000 V

NOTE

Value range transgression
If the value range is exceeded during the measurement, the output voltages remain at their maximum (+11 V) or minimum values (–11 V) until the input parameters return to the defined value range again.

NOTE

Detection of the direction of rotation
If the speed parameter is portrayed by an analog output, the detection of the direction of rotation can be realized by a change in sign of the output voltage. Prerequisite for detection of the direction of rotation is that the speed is fed by means of 2 tracks shifted with respect to one another.

Configuration example:

MinX = 0 min^{-1} with OutMin = 0 V
MaxX = 20 000 min^{-1} with OutMax = 10 V

During the measurement –10 V would appear on the analog output at –20 000 min^{-1} (opposite direction of rotation).

7.6.4 External Reset Submenu (Value Memory Reset via Dig. Inputs)

The evaluation instrument Type 4700B… contains minimum and maximum memory for each recorded parameter and calculated value (e.g. mechanical power).

These are continuously updated during operation while the measurement is taking place. These memories as well as the measured value of the current angle and counter reading can be reset in the additional **Reset Min/Max** menu or via external digital input states.

▸	**ExtReset 1**
	ExtReset 2
	ExtReset 3

Three configurations, **ExtReset 1**, **ExtReset 2** and **ExtReset 3**, are available for this in the **ExtReset** submenu. This means that a maximum of three different parameters can be reset by external input states.

▸	**ExtReset**	**To.Min**

The corresponding measured value memory is defined under **ExtReset**:

---	no measured value memory,
All	all measured value memories,
To.Min	minimum torque,
To.Max	maximum torque,
Sp.Min	minimum speed,
Sp.Max	maximum speed,
Angle	angle,
An.Min	minimum angle,
An.Max	maximum angle,
Counter	actual counter reading,
C.Min	minimum counter reading,
C.Max	maximum counter reading,
P.Min	minimum mechanical power,
P.Max	maximum mechanical power.

▸	**Input**	**In1**
	LogicIn	0→1

An external digital input **In1** … **In8** is defined in **Input**. The logic state change on which a memory reset is carried out is selected under **LogicIn**.

Example:

0□1 means that a reset should be carried out when the state changes from 0 to 1.

Trigger submenu (trigger condition for measured value storage)

Before the internal measured value buffer of the evaluation device type 4700B… can be used, the trigger condition parameters must be set.

‣	**Mode**	**on**
	Source	Torque
	Threshold	3,000 N·m
	Direction	over
	Time	3,0 s
	Measured values	5 000

If the trigger condition is met, measured value storage is triggered. The created measured value packets can then be communicated to the outside via the port.

The general function of the measured value buffer is activated or deactivated with Mode. The following options can be selected:

on	The measured value storage function is enabled
---	The measured value storage function is disabled

NOTE

Disabling of the measured value storage function
If the function of the measured value buffer is not used, in Mode select the --- option (disabled). As a result other functions of the device are not negatively affected if a trigger condition is accidentally initiated.

NOTE

Measured value storage and restrictions
During trigger monitoring activity and measured value storage, the following functions are temporarily not available:

Analog outputs
Alarm monitoring and digital outputs
Average value filter
Measurement range switchover

The function of the measured value buffer remains inactive with a torque sensor with torque-equivalent frequency output.

	Mode	on
‣	**Source**	**Torque**
	Threshold	3,000 N·m
	Direction	over
	Time	3,0 s
	Measured values	5 000

Source defines on which input variable the trigger condition should depend.

The following options can be selected:

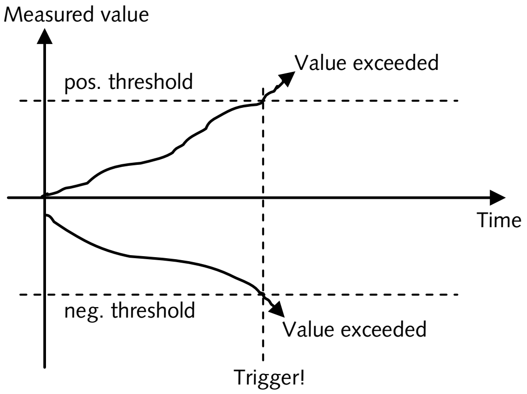
Torque	Torque
Speed	Speed
Angle	Angle
Counter	Rotation counter reading
Power	Mechanical power
IN1 … IN8	digital input 1 … 8
Key	Key actuation in the additional functions menu

	Mode	on
	Source	Torque
▸	**Threshold**	**3,000 N·m**
	Direction	over
	Time	3,0 s
	Measured values	5 000

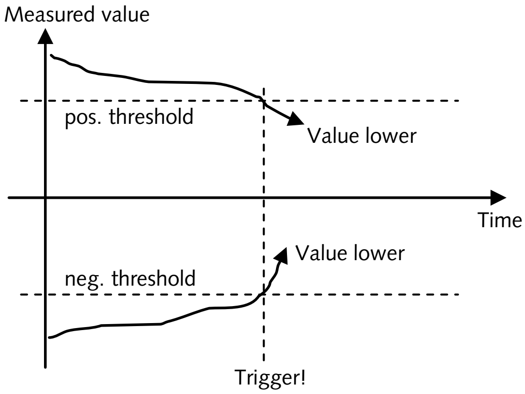
When a measurement variable is defined, trigger monitoring is initiated depending on a programmable threshold. This value is defined with the Threshold option. The unit is automatically added and depends on the defined measurement variable and the sensor settings.

The direction of threshold passage is defined with Direction and is shown in the diagram below.

Higher than threshold (direction: **over**)



Lower than threshold (direction **below**)



Example:

If the torque measured value exceeds a value of 0.5 N·m, the trigger condition should be met and therefore measured value storage initiated. Therefore the option Torque should be selected as Source, the value 0.5 for Threshold and the option over for Direction.

	Mode	on
	Source	Torque
	Threshold	3,000 N·m
	Direction	over
▸	**Time**	**3,0 s**
	Measured values	5 000

The storage time when measured value storage is triggered is defined with the Time option. The number of measured value packets in measured value storage can be set with Measured values.

NOTE

Storage time
The storage time cannot be below 0,5 s and not exceed 7 200 s (i.e. 2 hours).

Number of measured value packets
A minimum of 10 and a maximum of 5 000 measured value packets can be recorded during measured value storage in the evaluation device Type 4700B… . When the evaluation device is switched off, the stored measured values are lost.

Sampling rate during measured value storage
The sampling rate is automatically calculated by the evaluation device Type 4700B… on the basis of the set storage time and the number of the measured value packets.

$$f_{Sample} = \frac{n_{packets}}{t_{Storage}}$$ whereby

f_{Sample} is the sampling rate,

$n_{packets}$ is the measured value packets,

$t_{Storage}$ is the storage time.

Example:

The storage time is set to 0,5 s, and 5 000 measured value packets should be stored. The sampling rate in the equation above is therefore 10 kHz.

Time interval during measured value storage
The time interval (time stamp) as well as the sampling rate are automatically calculated by the evaluation device Type 4700B… .

$$t_{Slice} = \frac{1}{f_{Sample}}$$, whereby t_{Slice} is the time interval.

Example:

At a sampling rate of 10 kHz the interval between each measuring point is 100 µs.
If the option IN1 … IN8 is selected as Source, another option is available instead of the threshold.

	Mode	on
	Source	In1
▸	**Logic**	**0→1**
	Time	3,0 s
	Measured values	5 000

The necessary change in condition for initiation of measured value storage is defined with Logic. The following options can be selected:

0→1 Measured value storage with logic condition 1
1→0 Measured value storage with logic condition 0

	Mode	on
▸	**Source**	**Key**
	Time	3,0 s
	Measured values	5 000

If measured value storage should be triggered manually, it is possible to define the option Key as Source.

NOTE

Initiation of trigger monitoring/measured value storage
Trigger monitoring depends on the set Source option.

Additional functions menu

	Reset Min/Max	|
▸	**Trigger release**	|
	Measurement range	|
	Zero point	↓

Measurement mode

Sensor	4700B	**TA**
Torque	0,0000 N·m	
Speed	0 rev/min	
Power	0,0 W	

Torque
Speed
Angle
Counter
Power

Selection of the **Trigger release** option in the additional functions. The symbol **TA** *(trigger armed)* then appears at the top left of the display for trigger monitoring. If the trigger condition is met (e.g. threshold value exceeded), measured value storage then starts immediately. Trigger monitoring must then be performed again manually (**Trigger release**).

IN1…IN8

If a digital input is defined, measured value storage can be started immediately by the corresponding change in condition of the digital input.

Key

In this option, trigger monitoring of a measured variable or of a digital input is not available. Measured value storage is initiated immediately with selection of the **Start trigger** option in the additional functions.

7.7 Open Menu (Load Parameter Set)

▸	**Open**

An existing parameter set (all configurations) from the internal memory of the Evaluation Instrument, Type 4700B… can be opened with the **Open** menu function.

▸	**DEFAULT**
	4502A250Q
	4503A50
	4504B1000

The **DEFAULT** parameter set in which the factory settings are stored is used as the default setting. The identification of the loaded parameter set is shown on the first line of the measurement mode.

7.8 Save Menu (to Save a Parameter Set)

▸	Save

In the Save menu function, a parameter set is saved to the nonvolatile internal memory of the Type 4700B... instrument; this parameter set is defined with a name (all available characters allowed). A maximum of 20 parameter sets can be stored.

▸	<New>
	DEFAULT
	4502A250Q
	4503A50
	4504B1000

A new parameter set is created by selecting <New>. The name must then be defined.

4502A250Q
Overwrite?
▸ Yes ◂

If the desired name of the parameter set already exists, a confirmation prompt appears before the overwrite (Yes or No).

The identification of the saved parameter set is shown on the first line of the measurement mode.

7.9 Delete Menu (to Delete a Parameter Set)

▸	Delete

An existing parameter set is deleted from the internal memory of the Type 4700B… instrument with the Delete menu function.

4502A250Q
Delete?
▸ no ◂

A confirmation is requested for this (yes or no). The delete is irrevocable and cannot be undone.

Communication Menu

The **Communication** menu contains the settings of the RS-232C and USB port.

▸	Port	RS232

The type of port is defined with the **Port** option. The following options can be selected:

RS232	RS-232C port
USB	USB port

NOTE

USB port and its use
The USB port is only available for the SensorTool type 4706A PC application and the CoMo Torque firmware update software (Update Application). No other USB settings are necessary.

▸	Baudrate	115200

The transmission speed is defined in bits/second; the following settings are available in **Baudrate**:

4800
9600
19200
38400
57600
115200
230400

▸	Termination	CRLF

Each ASCII command over the serial interface ends with a so-called end character (a termination). This termination is used to correctly interpret the end of a command character string. The following termination options are available with the **Termination** option:

		ASCII code
;	semicolon	59_{dec}
CRLF	carriage return & line feed	13_{dec} & 10_{dec}
LFCR	line feed & carriage return	10_{dec} & 13_{dec}
CR	carriage return	13_{dec}
LF	line feed	10_{dec}

The communication settings are immediately saved as nonvolatile in the Type 4700B… instrument on exiting the **Communication** submenu.

NOTE

Kistler SensorTool PC application
A baud rate range of 38400 to 115200 bits/second must be set for communicating with the Kistler SensorTool PC application. The required termination is CRLF.

7.9.1 Automatic Sending

With the **Auto Send** option the RS-232C communication is able to send measured values automatically. The following settings are available:

▸	Auto Send	Yes

Yes automatic sending activated,
No measured values are only sent when the respective command is activated.

▸	Format	Torque

The data content can be defined with **Format**:

Torque torque,
To.Min minimum torque,
To.Max maximum torque,
Speed speed,
Sp.Min minimum speed,
Sp.Max maximum speed,
Angle angle,
An.Min minimum angle,
An.Max maximum angle,
Counter counter reading,
C.Min minimum counter reading,
C.Max maximum counter reading,
Output mechanical output,
P.Min minimum power,
P.Max maximum power,

M+n+P Torque, speed and mechanical output, separated by the vertical separating character **|** ($7C_{Hex}$, 124_{10}), example:

<M>|<n>|<P><CR><LF>

4703A Protocol as for the electric force measuring instrument Type 4703A… (formerly model STM 702), whereby the following table applies:

Byte	ASCII-Character	Meaning
1	B N	Meas. value without taring Tared measured value
2	<Space> –	positive measured value negative measured value
3 … 8*	<Meas. value>	Measured value
9 … 10*	<Termination>	The terminating characters depend on the **Termination** menu item, e.g. **CRLF**

* The number of bytes for the measured value or termination is variable.

As an example, a measured value 5,000856 N·m with tared zero point and the setting **4703B**:
N 5.000856<CR><LF>

If necessary, an index can be added before each automatically sent measured value package. To this purpose the counter reading is incremented from zero to 1, 2 etc.
The highest counter reading is 2^{32}-1 (4294967295), followed by an overflow after which the index starts again at 0. The index and the corresponding measured value are separated by a vertical separating character **|** ($7C_{Hex}$, 124_{10}).

▸	**Index**	**Yes**

Indexing is controlled with **Index** with the settings **Yes** (activated) and **No** (deactivated).

Example for automatic sending of torque values with the termination **CRLF**, but without indexing:

1st measured value:	`5.005787<CR><LF>`
2nd measured value:	`5.006022<CR><LF>`
3rd measured value:	`5.007122<CR><LF>`

…

and with indexing:

1st measured value:	`0|5.005787<CR><LF>`
2nd measured value:	`1|5.006022<CR><LF>`
3rd measured value:	`2|5.007122<CR><LF>`

…

▸	**Interval**	**100ms**

The time between each sent measured value package is defined with **Interval**.
The following settings are available to this purpose:

10s	10 seconds,
5s	5 seconds,
1s	1 second,
500ms	500 milliseconds,
100ms	100 milliseconds,
50ms	50 milliseconds,
10ms	10 milliseconds.

The communication settings are immediately saved as nonvolatile in the Type 4700B… instrument on exiting the **Communication** submenu.

NOTE

PC Application Kistler SensorTool Type 4706A
Automatic sending of measured values must be deactivated for use of the SensorTool PC Application tool (Option Auto Send toNo).

7.10 Language Menu

▸	**English**
	German
	Francais
	Italian
	Spanish

This menu provides the option of defining the display language of the Type 4700B… instrument.

The following languages are supported:

English	Englisch,
German	Deutsch,
Francais	Französisch,
Italian	Italienisch,
Spanish	Spanisch.

After selecting the language, the instrument automatically returns to the main menu. The language selection is immediately saved as nonvolatile in the Type 4700B… instrument.

7.11 Additional Functions

7.11.1 Reset Min/Max Submenu (to Delete Value Memory)

▸	**Reset All**	
	To.Min	–9,998 N·m
	To.Max	11,623 N·m
	Sp.Min	–1002,67 1/min
	Sp.Max	980,78 1/min
	An.Min	–6766.25 °
	An.Max	1290,75 °
	Angle	230,00 °
	C.Min	–67,5
	C.Max	80,9
	Counter	31,2
	P.Min	1049,78 W
	P.Max	1183,76 W

The option to manually delete the value memory is available in the **Reset Min/Max** submenu. The following memories can be reset:

Reset All	all value memories
To.Min	minimum torque
To.Max	maximum torque
Sp.Min	minimum speed
Sp.Max	maximum speed
An.Min	minimum angle
An.Max	maximum angle
Angle	angle
C.Min	minimum counter reading
C.Max	maximum counter reading
Counter	actual counter reading
P.Min	minimum mechanical power
P.Max	maximum mechanical power

Select the respective position with the arrow keys and confirm the reset with the Enter key ↵.

7.11.2 Measurement Range Submenu

Sensor Range	
--	
Range	10,00 N·m
Torque	0,01 N·m

The measurement range of a connected dual-range sensor can be switched over in the **Range** submenu.

The measurement range is switched over by pressing the Enter key ↵. The Type 4700B… instrument transfers a corresponding command to the dual-range sensor via the sensor cable. This causes the measurement range to switch over. The sensor configuration in the Type 4700B… instrument determines the nominal measurement range end value and decimal points in the measurement mode.

Sensor	**4503A ***
Torque	**0,002 N·m**
Speed	**0,00 rev/min**
Power	**0,00 W**

The active measurement range is displayed under **Range**. If the extended range (2nd measurement range) is active, a star (*) is displayed in measurement mode.

The ESC key is used to exit the **Range** submenu, and the user returns to the additional functions.

NOTE

Measurement range switchover
The measurement range can only be switched over if a dual-range sensor is used. This is possible with a Type 4503A… and Type 4504A… in particular. It is also mandatory to define the measurement range end value of the extended range in the sensor configuration that must not be equal to zero.

When switched on, the Type 4700B… instrument is basically switched to the nominal range (1st measurement range).

Term assignments:

Nominal range (1st measurement range): e.g. 10 N·m.
Extended range (2nd measurement range): e.g. 1 N·m.

NOTE

Zero point taring
If necessary, the zero point can be retared after the measurement range switchover (Additional functions → Zero Adjust submenu).

7.11.3 Zero Adjust Submenu

▸	**Torque**	**0,002 N·m**
	Angle	0,00 °
	Counter	0,00 rev

The **Zero Adjust** submenu is used to set current measured values, such as torque/force, the measured angle value or the counter reading, to the value of zero.

For this, the respective measured value is selected with the arrow keys and the renewed zero point shift (taring) is confirmed with the Enter key ↵.

The zero point shift of the angle measured value or the counter reading has the same effect as the reset in the **Reset Min/Max** submenu.

The ESC key is used to exit the **Zero Adjust** submenu when the user is returned to the additional functions.

NOTE

Saving the zero point shift (taring)
The zero point shift is lost when the Type 4700B… instrument is switched off and on again. If this taring is to remain saved as nonvolatile, however, this can be achieved by saving the parameter set (Main menu → **Save** submenu).

7.11.4 Sensor Check Submenu

Sensor Check	
--	
Torque	10,00 N·m
Signal	5,000 V

The **Sensor Check** submenu is used to put the sensor into a defined state. By pressing the Enter key ↵, an active or passive sensor causes the strain gage bridge to become unbalanced in order to test the sensor.

This test mode remains active until the Enter key ↵ is released again. The display shows both the normalized torque value and the tared voltage/frequency value.

NOTE

Kistler torque sensors with sensor check functionality
The following sensors contain the sensor check function:

Type 4501A… passive sensor
Type 4502A… active sensor
Type 4503A… active dual-range sensor
Type 4504A… active sensor
Type 4510B… active sensor
Type 4520A… active sensor

Sensor check voltage level on the sensor connector
Activation of the sensor check affects the output pins of the sensor connector as follows:

Active sensors (Pin 12, ground reference PIN 22)

Control signal inactive (normal operating condition)	active control signal (↵ pressed)
0 V	+5 V

Passive sensors (Pin 23, ground reference PIN 14)

Control signal inactive (normal operating condition)	active control signal (↵ pressed)
+2,5 V (bridge supply middle)	0 V

7.11.5 Filter Submenu

In the submenu **Filter** there are filter functions available for torque/force and speed measurement values. Following filter functions are available:

Analog low pass filter 2nd order
This low pass filter can be used by analog input values (passive or active sensors). This filter is not usable for sensors with frequency outputs based on torque.

Moving average filter for torque/force
Instead of low pass filter, this moving average filter can be used for analog and sensors with frequency outputs based on torque.

Moving average filter for speed
Speed measured values can be damped with the moving average function (e.g. for minimization of speed fluctuations).

Filtering of mechanical power
The mechanical power can also be affected by the filter functions because the power calculation depends on torque and speed.

▸	Torque	
	Speed	

In the **Torque** submenu low pass filter or moving average filter for torque/force can be defined.

▸	Low-pass	50 Hz
	Averaging	off

The following cutoff frequencies (-6 dB) are available for the torque signal:

0,1Hz	0,1 Hz
0,2Hz	0,2 Hz
0,5Hz	0,5 Hz
1Hz	1 Hz
2Hz	2 Hz
5Hz	5 Hz
10Hz	10 Hz
20Hz	20 Hz
50Hz	50 Hz
60Hz	60 Hz
100Hz	100 Hz
120Hz	120 Hz
200Hz	200 Hz
500Hz	500 Hz
1000kHz	1000 kHz
off	no low pass active (cutoff frequency 10 kHz)

▸	Low-pass	off
	Averaging	64

Instead of analog low pass filter, a moving average filter can be defined in following depths:

2	depth 2
4	depth 4
8	depth 8
16	depth 16
32	depth 32
64	depth 64
128	depth 128
256	depth 256
512	depth 512
1024	depth 1024
off	moving average filter deactivated

NOTE

Low pass filter/moving averaging
If activating moving average filter, the analog low pass filter will be deactivated automatically.

	Torque	
▸	Speed	

With the submenu **Speed** moving average filter can be defined for speed measured values.

▸	**Averaging**	**16**

Following depths are available:

2 depth 2
4 depth 4
8 depth 8
16 depth 16
32 depth 32
64 depth 64
128 depth 128
256 depth 256
512 depth 512
off moving average filter deactivated

NOTE

Effects of the filter functions
The measured value display and the analog outputs are directly affected by the filter functions.

8. Interface Commands (RS-232C)

Communication between the Type 4700B… instrument and an operating PC is possible over the RS-232C interface. The ASCII commands to be used are based on the SCPI standard (standard commands for programmable instruments) in order to achieve the most straightforward and easy to understand method of communication.

An **RS-232C null modem cable** is used for the connection between the Type 4700B instrument and operating PC. The RS-232C interface works in accordance with the following conditions:

4 800 … 230 400 bits/second (adjustable),
8 data bits,
1 stop bit,
no parity,
no flow control.

Each ASCII command contains an ASCII character string followed by a termination. See also the chapter on **Communication menu**. The following chapters list and describe commands where the terminating character strings are omitted for purposes of clarity.

8.1 Conventions and Syntax

The Evaluation Instrument, Type 4700B… only responds over the RS-232C interface when it receives a command from the requester (i.e. PC: **Master**, Type 4700B…: **Slave**).

A response (acknowledgment) is always sent by the Type 4700B… instrument even if only configurations are transmitted by the requester.

Only ASCII commands are sent by the requester. Terminating characters must always be appended at the end of these commands. The Type 4700B… instrument communicates the same termination to the requester. Terminating characters can be defined in the **Communication** submenu of the Type 4700B… instrument.

Syntax example for determining the torque with the termination **CRLF**:

Requester:	**MEAS:TORQ?***<CR><LF>*
Type 4700B… responds:	**120.089***<CR><LF>*

Upper and lower case are not differentiated. The command interpreter of the Type 4700B… instrument also ignores any leading spaces and spaces within the commands.

Examples:

Typical	**MEAS:TORQ?***<CR><LF>*
Identical to	**MEAS :torq ?** *<CR><LF>*
Identical to	**MeaS :Torq?***<CR><LF>*

Syntax and conventions
The end of a command chain must always be made with a termination (e.g. **<CR><LF>**).

A command for a request ends with a question mark (?), e.g. **MEAS:TORQ?<CR><LF>**.

The numerical value of zero **(0)** is sent back as a confirmation following successful transfer of a configuration.

Example:

Requester:	**ROUT:TORQ:ACTI***<CR><LF>*
Type 4700B… responds:	**0***<CR><LF>*

Commas in floating-point numbers are defined in decimal point form (e.g. 9.998).

If a command is not accepted for various reasons, the evaluation Instrument CoMo Torque Type 4700B… returns a negative error value.

Example of an incorrectly written command:

Requester:	**MEA:TORQ?***<CR><LF>*
Type 4700B… responds:	**ERR-100***<CR><LF>*

Error values and their meanings can be found in the chapter on **Error messages**.

For reasons of clarity, the terminating characters are omitted in the following *(e.g. <CR><LF>)*.

8.2 Command Glossary

The command strings follow the structure of an instrument and are separated by separators (:). Each command string has a maximum of four ASCII characters. The most important command strings are listed and assigned with their meaning in the following table:

Code	Meaning	Translation
ACTI	ACTIve	Active branch
ADD	ADDitional	Additional
ALER	ALERt	Alarming
ALL	ALL	All
ANA	ANAlog	Analog branch
ANG	ANGle	Angle
ARM	ARMing	Arming
ASR	AlertStatusRegister	alert event register
AUTO	AUTOmatic	Automatic
AVER	AVERage	(moving) average
BRID	BRIDge	Bridge branch
BUFF	BUFFer	Memory range
CALC	CALCulate	Calculation unit
CCW	Counter Clock Wise	Counterclockwise
CENT	CENTer	Center
CLE	CLEar	Delete
CLSE	CLoSE	Close
CONT	CONTrol	Control signal
COUN	COUNter	Counter (status)
CW	Clock Wise	Clockwise
DEL	DELete	Delete file
DIG	DIGital	Digital
DIR	DIRectory / DIRection	File directory/direction
DISP	DISPlay	Display
DOWN	DOWN	Down
DPT	Decimal PoinT	Decimal point
ENA	ENAble	Activated
ENG	ENGlish	English
ENTR	ENTeR	Enter key
ERST	External ReSeT	External reset
ESC	ESCape	Cancel
ESR	EventStatusRegister	Event register
EXT	EXTended	Extended
FILE	FILE	File
FILT	FILTer	Filter
FOFF	Frequency OFFset	Frequency offset
FRA	FRAncais	French
FREQ	FREQuency	Frequency measurement branch
GER	GERman	German
HIGH	HIGH	Logic state 1
HOLD	HOLD	Saved mode
HYST	HYSTeresis	Hysteresis
Code	**Meaning**	**Translation**
IDN	IDeNtification	Identification

INP	INPut	Input
KEY	KEY	Key on the front panel
LANG	LANGuage	Language
LEFT	LEFT	Left
LOAD	LOAD	Load
LOW	LOW	Logic state 2
LPFT	Low Pass FilTer	Low pass filter
MAX	MAXimum	Maximum
MaxX	X MAXimum	X maximum
MAXY	Y MAXimum	Y maximum
MEAS	MEASure	Measure
MEM	MEMory	Memory
MENU	MENU	Menu
MIN	MINimum	Minimum
MinX	X MINimum	X minimum
MINY	Y MINimum	Y minimum
MODE	MODE	Mode
MULT	MULTiplicate	Range multiplicator
NOM	NOMinal	nominal
NONE	NONE	None
Norm	NORM	Normal mode
OFF	OFF	Off
ON	ON	On
OPEN	OPEN	Open
OUTP	OUTPut	Output
POST	POST	After
POW	POWer	Mechanical power
PRE	PRE	Before
PULS	PULSe	Pulse
RANG	RANGe	Range
RFRH	ReFResH	Refresh
RGHT	RiGHT	Right
ROUT	ROUTe	Measurement routing
SAVE	SAVE	Save
SECN	SECoNd	Second
SENS	SENSe	Sensing unit
SOUR	SOURce	Source
SPE	SPEed	Speed
STAT	STATus	Status
TARE	TARE	Zero point shift
TARG	TARGet	Target
TEMP	TEMPerature	Temperature
THR	THReshold	Threshold
TIME	TIME	Time
TORQ	TORQue	Torque
TRAC	TRACe	Volatile memory
TRIG	TRIGger	Trigger
UNIT	UNIT	Unit
UP	UP	Up

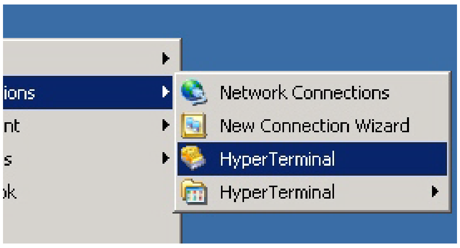
8.3 Error Messages

The Evaluation Instrument, Type 4700B… transfers a negative error value (**ERR-xxx**) over the RS-232C interface if a command has not been accepted for various reasons (see the following table).

Error value of the Type 4700B… instrument	**Error description**	**Remedy**
ERR–100	Command not understood.	Check command syntax. Send the command again as Type 4700A… instrument may be busy.
ERR–101	"**?**" has not been appended to a request.	Add "**?**" to the request.
ERR–104	Calculation steps led to an overflow.	Check calculation variables (company-internal use).
ERR–105	Error when accessing the nonvolatile memory.	Rewrite the memory, Notify Kistler.
ERR–106	Access to protected memory.	Remove memory protection (company-internal use).
ERR–108	Transferred character string too long.	Shorten character string (company-internal use).
ERR–109	Transferred numerical value invalid.	Check numerical value (company-internal use).

8.4 HyperTerminal®

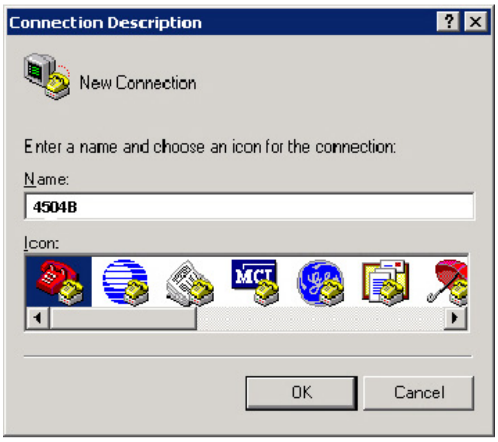
Basic communication over the RS-232C interface is possible with the HyperTerminal® from Microsoft®. The commands are entered manually, sent to the Type 4700B… instrument and output again on the PC screen as acknowledged.



With the aid of the HyperTerminal®, it is possible to set up a simple means of communication for the initial installation or for service functions.

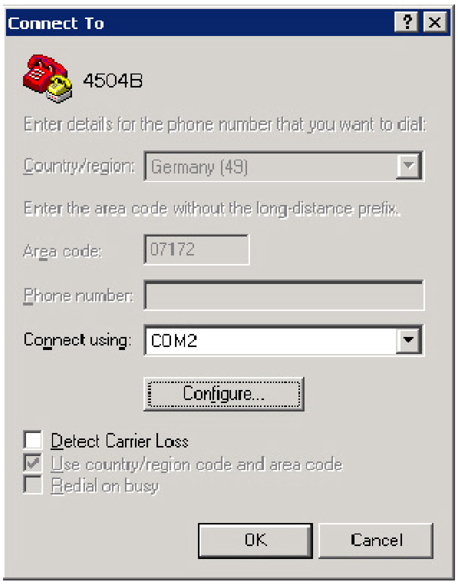
The configuration in the Type 4700B… instrument and of the HyperTerminal® is explained in more detail in the following example.

The HyperTerminal® is started from the start group of the Windows® PC.



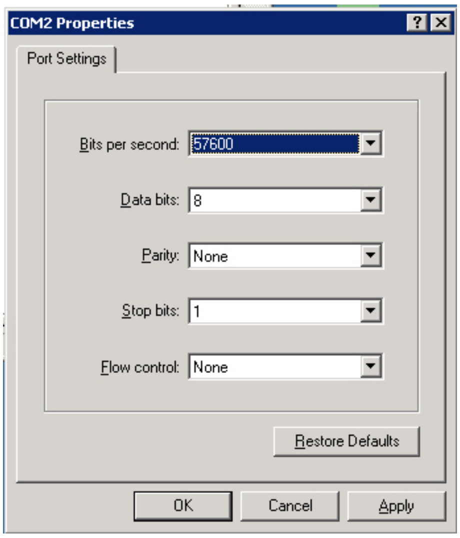
HyperTerminal® recommends a new connection. The name must be defined, e.g. **4700B**, in order to identify the connection. The HyperTerminal® setting can be saved later on the desktop; any icon can be selected for this.

The entry is confirmed with the **OK** button.



The connection to the serial RS-232C interface is then defined, e.g. **COM2**.

The configurations are confirmed with the **OK** button.



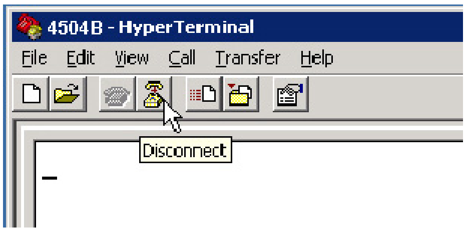
The properties of the COM port are defined as follows:

115 200 bits per second
8 data bits
no parity
1 stop bit
no flow control

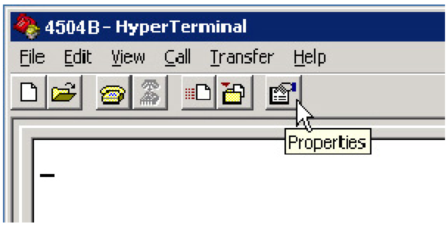
The following configurations should be selected in the Type 4700B… instrument (**Communication** submenu):

Baud rate = **115200** bits/second
Termination = **CRLF** (*carriage return & line feed*)

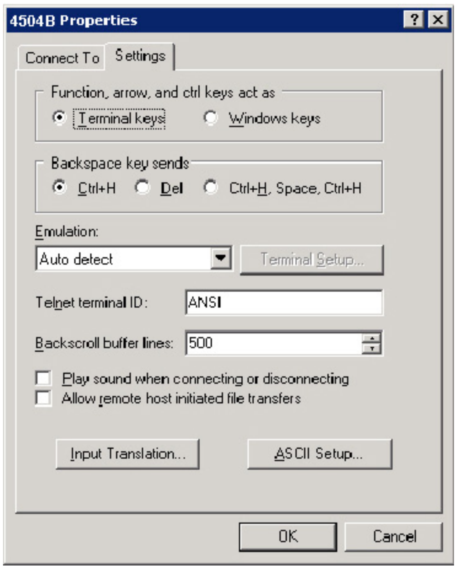
RS-232C cable and transmission speed
The definition of the transmission speed (baud rate) depends on the length and quality of the RS-232C cable. In an emergency, the transmission speed in the Type 4700B… instrument and operating PC must be decreased.



The connection between the HyperTerminal and Type 4700B… instrument is disconnected by pressing the **Hangup** symbol as the terminal settings need to be made first (alternatively with menu item **Call** → **Disconnect**).

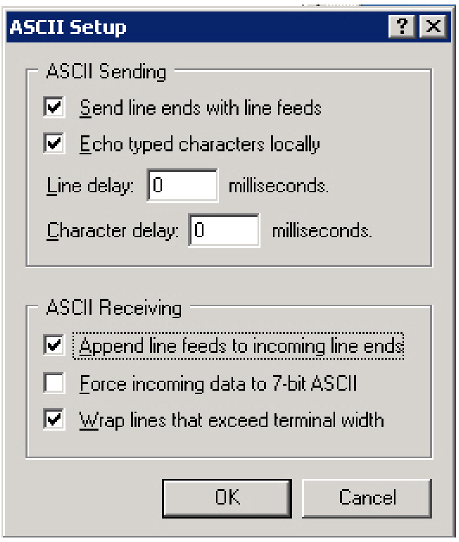


The window with the COM port and terminal settings is opened with the **Properties** symbol (alternatively with menu item **File** → **Properties**).



Then click the **Settings** tab in the **Properties** window. The following settings must be made and mostly correspond to the default settings:

Allocation of function keys:	Terminal
Back key sends:	CTRL+H
Emulation:	Auto-Detect.
Telnet terminal detection:	ANSI
Lines in image buffer:	500

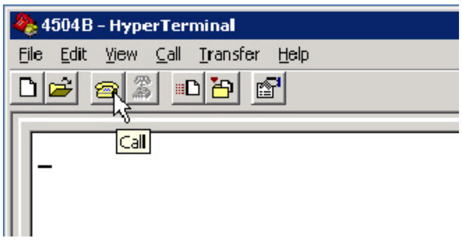


The window for defining the sent and received ASCII characters is opened by pressing the **ASCII configuration** button. The following settings should be made:

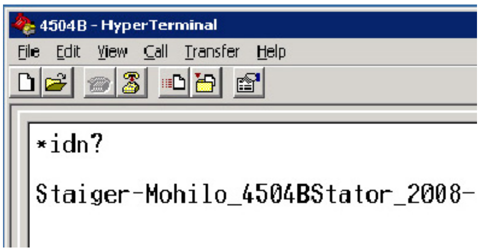
Sent lines end with line feed
Output entered characters locally (local echo)
Append line feed at line end when received
Wrap excessive lines in the terminal window

The settings are confirmed with the **OK** button.

The **Properties** window is also closed by pressing the **OK** button.



The connection to the Type 4700B… instrument can now be established by pressing the **Call** symbol  (or, alternatively, menu item **Call → Call**).



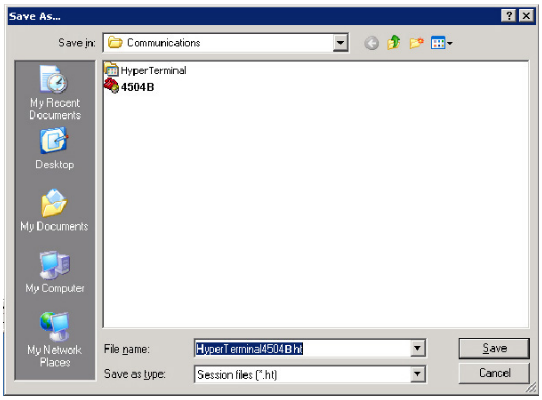
The identification command ***idn?** is entered with the keyboard and confirmed with the Enter key in order to test the connection.

The evaluation instrument, Type 4700B… responds with the character identification string.

Command conventions and useful entry aids
Upper and lower case are not differentiated, i.e. case insensitive. Spaces are also ignored. Star symbols (*) that also need to be entered for special commands in the SCPI standard can be omitted. For example, *IDN? is identical to IDN?.

The backspace key can be used for deleting individual characters in order to correct incorrectly entered commands.

The last command sent from the evaluation unit Type 4700B… instrument is displayed again on the HyperTerminal® by entering the exclamation mark (**!**, key Shift+1).



The settings of the HyperTerminal® can be saved on the desktop of the PC. This means the HyperTerminal® can be accessed quickly and easily in the future.

To do this, open the Save window in the HyperTerminal® with the menu item **File → Save under…**.

To do this, select the **Desktop** save location and save the **4700B.ht** file by pressing the **Save** button.

The corresponding icon then appears on the desktop; click on this at any time to start the HyperTerminal® again with the previously saved settings.

8.5 System

8.5.1 Identification (*IDN?)

***IDN?**

The Evaluation Instrument, Type 4700B… is identified with this command. The following ASCII identification is given as the response:

Staiger-Mohilo_4700B_vvvv_yyyy-mm-dd

where:

Staiger-Mohilo	Manufacturer Kistler Lorch GmbH (once Dr. Staiger, Mohilo + Co. GmbH)
4700B	Instrument ID
vvvv	Version number in format Vx.xx
yyyy-mm-dd	Date in the order year-month-day

Syntax example:

*IDN?
Staiger-Mohilo_4700B_V4.93_2010-05-12

8.5.2 Event Status Register (*ESR?)

***ESR?**

The event status register is read with this command. The contents show the internal states of the Type 4700B… instrument.

Empty bit fields of the ESR register are not allocated and have the value 0. When the Type 4700B… instrument is in the switched on state, the ESR register is deleted and then the PON bit (power on) is set.

	ESR register							
Bit	D7	D6	D5	D4	D3	D2	D1	D0
Event	**PON**	**NSE**	**CME**	**EXE**	**SC**	**ALE**	**RNG**	**OPC**
Weighting	128 (2^7)	64 (2^6)	32 (2^5)	16 (2^4)	8 (2^3)	4 (2^2)	2 (2^1)	1 (2^0)
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Assignment:

0 Event bit is not set
1 Event bit is set

Event bits:

PON **Switched on state (*power on*)**
This bit is set as soon as the Type 4700B… instrument is in measurement mode.

NSE **Changed configuration data (*new settings*)**
This bit is set as soon as configurations are made in the Type 4700B… instrument in a menu or over an interface (e.g. another sensor type, etc.).

EXE ***Execution error***
This bit is set if an inadmissible command has been transferred to the Type 4700B… instrument.

SC ***Sensor check***

This bit is set if a sensor check functionality to a connected sensor was switched on (colloquial: calibration signal).

ALE *Alert occurred*
This bit is set if a user defined threshold was exceeded, e.g. torque or speed.

RNG *Measurement range*
This bit is set if extended (smaller) measurement range was activated.

OPC *Operation complete*
This bit is set when a command has been successfully completed or the trigger process ends.

The output of the ESR register is made in decimal format (0_{dec} … 255_{dec}). The set bits are deleted based on the determination of the ESR register.

Syntax example:

***ESR?**
129 (PON and OPC bit set)

8.5.3 Alert Status Register (ASR?)

ASR?

The alert status register is read with this command. The contents show the internal affected threshold states of the Type 4700B… instrument.

Empty bit fields of the ASR register are not allocated and have the value 0. When the Type 4700B… instrument is in the switched on state, the ASR register is deleted.

	ASR register							
Bit	D7	D6	D5	D4	D3	D2	D1	D0
Event	**M**	**N**	**A**	**C**	**P**	---	---	---
Weighting	128 (2^7)	64 (2^6)	32 (2^5)	16 (2^4)	8 (2^3)	4 (2^2)	2 (2^1)	1 (2^0)
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Assignment:
0 Event bit is not set
1 Event bit is set

Event bits:

M *Torque/Force*
This bit is set if torque or force threshold was exceeded.

N *Speed*
This bit is set if speed threshold was exceeded.

A *Angle*
This bit is set if angle threshold was exceeded.

C *Counter*
This bit is set if counter value threshold was exceeded.

P *Mechanical power*
This bit is set if calculated mechanical power threshold was exceeded.

The output of the ASR register is made in decimal format (0_{dec} … 255_{dec}). The set bits are deleted based on the determination of the ASR register.

Syntax example:

ASR?
136 (M and P bit set)

8.5.4 Trigger status register (TSR?)

TSR?

This command is used to output the (trigger status register). The displayed content includes internal conditions regarding the measured value buffer and trigger conditions of type 4700B… .

Empty bit fields of the TSR register are not assigned and contain the value 0. When type 4700B… is switched on, the content of the TSR register is deleted.

	TSR register							
Bit	D7	D6	D5	D4	D3	D2	D1	D0
Event	**A**	**E**	**F**	**C**	---	---	---	---
Weighting	128 (2^7)	64 (2^6)	32 (2^5)	16 (2^4)	8 (2^3)	4 (2^2)	2 (2^1)	1 (2^0)
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Assignment:

0 Event bit is not set
1 Event bit is set

Event bits:

A **Trigger monitoring** (*armed*)
As soon as trigger monitoring is armed, this bit is set. If the bit is set, measured value storage can be initiated when the trigger condition (e.g. exceeded threshold value) is met.

E **Measured value storage initiated?**
(established)
This bit is set as soon as measured value storage is initiated when a trigger condition is met.

F **Measured value storage finished?**
(finished)
If the measured value storage is finished (time elapsed), this bit is set.

C **Measured value contents available?**
(contents)
If measured value packets are available in the buffer which can be transferred externally through the port, this bit is set.

8.6 Measuring

8.6.1 Determining Measured Values (MEAS)

MEAS:<function>?
MEAS:ALL?

Individual measured values can be determined with the MEAS command group. The following parameters are available:

<Function> =

TORQ	torque (or force)
TORQ:MIN	minimum torque
TORQ:MAX	maximum torque
SPE	speed
SPE:MIN	minimum speed
SPE:MAX	maximum speed
ANG	angle
ANG:MIN	minimum angle
ANG:MAX	maximum angle
COUN	counter reading
COUN:MIN	minimum counter reading
COUN:MAX	maximum counter reading
POW	mechanical power
POW:MIN	minimum mechanical power
POW:MAX	maximum mechanical power

The measured value is transferred as a decimal floating-point number. The associated unit for the torque can be determined with **SENS:UNIT?**. The unit for the mechanical power is determined with **CALC:POW:UNIT?**. The speed parameter is always assigned the unit rev/min and angle is always assigned the unit degree.

Syntax examples:
MEAS:TORQ?
56.556
MEAS:ANG?
100.25

With **MEAS:ALL?**, all relevant parameters can be transferred in one go. The sequence is made up as follows:

<torque>|<speed>|<angle>|<counter>|<power>

<torque> torque/force
<speed> speed
<angle> angle
<counter> counter reading
<power> mechanical power

The vertical separator or pipe (|) represents ASCII code 124_{dec} ($7C_{Hex}$).

Syntax example:

MEAS:ALL?
10.554|890.67|334.25|1901.34|984.379

8.6.2 Determining Digital Input States (INP:DIG)

INP:DIG?

The digital input states can be determined with the **INP:DIG?** command. The return value is output as a decimal number (0 … 255).

	Digital input port							
Bit	In8	In7	In6	In5	In4	In3	In2	In1
Weighting	128 (2^7)	64 (2^6)	32 (2^5)	16 (2^4)	8 (2^3)	4 (2^2)	2 (2^1)	1 (2^0)
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Syntax example:

INP:DIG?
144 (In8 and In5: state 1, remaining: state 0)

8.6.3 Determining Digital Output States (OUTP:DIG)

OUTP:DIG?

The digital output states can be determined with the **OUTP:DIG?** command. The return value is output as a decimal number (0 … 255).

	Digital output port							
Bit	In8	In7	In6	In5	In4	In3	In2	In1
Weighting	128 (2^7)	64 (2^6)	32 (2^5)	16 (2^4)	8 (2^3)	4 (2^2)	2 (2^1)	1 (2^0)
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Syntax example:

OUTP:DIG?
5 (In3 and In1: state 1, remaining: state 0)

8.6.4 Deleting Peak Value Memory (TRAC)

TRAC:<Function>:CLE

The internal min./max. memory can be reset (deleted) with this command group. The following memories are available:

<Function> =

ALL	all min./max. memories
TORQ:MIN	minimum torque
TORQ:MAX	maximum torque
SPE:MIN	minimum torque
SPE:MAX	maximum torque
ANG:MIN	minimum angle
ANG:MAX	maximum angle
COUN:MIN	minimum counter reading
COUN:MAX	maximum counter reading
POW:MIN	minimum mechanical power
POW:MAX	maximum mechanical power

Syntax examples:

TRAC:ALL:CLE
0 (all min./max. memories deleted)
TRAC:TORQ:MIN:CLE
0 (minimum torque only deleted)

8.6.5 Dual-Range Sensor: Switching Over the Measurement Range (INP:GAIN:MULT)

INP:GAIN:MULT:ON
INP:GAIN:MULT:OFF
INP:GAIN:MULT:STAT?

If a dual range sensor (Type 4503A…) is connected to Type 4700B… instrument, the extended (i.e. smaller) measurement range can be selected with the **INP:GAIN:MULT:ON** command.

The nominal range is selected with **INP:GAIN:MULT:OFF**

INP:GAIN:MULT:STAT? is used to determine whether the extended measurement range is active (response **ON**). If the nominal range is active, the Type 4700B… instrument responds with the **OFF** character string.

Syntax examples:

INP:GAIN:MULT:ON
0 (extended meas. range)

INP:GAIN:MULT:STAT?
ON (extended meas. range active)

INP:GAIN:MULT:OFF
0 (nominal meas. range)

INP:GAIN:MULT:STAT?
OFF (nominal meas. range active)

8.6.6 Control Signal (INP:CONT)

INP:CONT:ON
INP:CONT:OFF
INP:CONT:STAT?

The control signal (for the functional test of the connected sensor) is activated with **INP:CONT:ON**. The control signal is deactivated again by **INP:CONT:OFF**.

INP:CONT:STAT? is used to determine whether the control signal is currently active (response **ON**). If the control signal is deactivated, the Type 4700B… instrument responds with the **OFF** character string.

NOTE

Control signal
The sensor must be equipped for this. The following torque sensors have this functionality:
Type 4501A…
Type 4502A…
Type 4503A…
Type 4504B…
Type 4510B…
Type 4520A…

8.6.7 Torque/Force Zero Point Shift (CALC:TARE:TORQ)

CALC:TARE:TORQ:AUTO
CALC:TARE:TORQ:ON
CALC:TARE:TORQ:OFF
CALC:TARE:TORQ:STAT?

A zero point shift (taring) is possible for the torque or force parameter.

The torque signal is tared (set to zero) with **CALC:TARE:TORQ:AUTO**. The taring is activated with **CALC:TARE:TORQ:ON** and deactivated with **CALC:TARE:TORQ:OFF**.

CALC:TARE:TORQ:STAT? is used to determine whether the zero point shift is currently active (response **ON**). If the zero point shift is deactivated, the Type 4700B… instrument responds with the **OFF** character string.

Syntax examples:

CALC:TARE:TORQ:AUTO (torque tared)
0
CALC:TARE:TORQ:ON (activates taring)
0
CALC:TARE:TORQ:STAT?
ON

8.6.8 Angular Zero Point Shift (CALC:TARE:ANG)

CALC:TARE:ANG:AUTO
CALC:TARE:ANG:ON
CALC:TARE:ANG:OFF
CALC:TARE:ANG:STAT?

A zero point shift (taring) is possible for the angle parameter.

The angle signal is tared with **CALC:TARE:ANG:AUTO** (set to zero). The taring is activated with **CALC:TARE:ANG:ON** and deactivated by **CALC:TARE:ANG:OFF**.

CALC:TARE:ANG:STAT? is used to determine whether the zero point shift is currently active (response **ON**). If the zero point shift is deactivated, the Type 4700B… instrument responds with the **OFF** character string.

Syntax examples:

CALC:TARE:TORQ:AUTO	(torque tared)
0	
CALC:TARE:TORQ:ON	(activates taring)
0	
CALC:TARE:TORQ:STAT?	
ON	

8.6.9 Torque/Force Low Pass Filter (INP:FILT)

INP:FILT<cutOffFreq>
INP:FILT:ON
INP:FILT:OFF
INP:FILT:STAT?

The analog torque/force measurement branch has a 2nd order, analog low pass input filter. This can be selected in **INP:FILT<cutOffFreq>**.

The low pass filter is activated with **INP:FILT:ON**. The low pass filter is deactivated with **INP:FILT:OFF**.

INP:FILT:STAT? is used to determine whether the low pass filter is currently active (response **ON**). If the low pass filter is deactivated, the Type 4700B… instrument responds with the character string **OFF**.

<cutOffFreq> =

0.1	0,1 Hz
0.2	0,2 Hz
0.5	0,5 Hz
1	1 Hz
2	2 Hz

5	5 Hz
10	10 Hz
20	20 Hz
50	50 Hz
60	60 Hz
100	100 Hz
120	120 Hz
200	200 Hz
500	5 kHz
1000	1 kHz

Syntax examples:

INP:FILT10	(filter frequency 10 Hz)
0	
INP:FILT?	
10	
INP:FILT:ON	(filter activated)
0	
INP:FILT:STAT?	
ON	

NOTE:

Sensors with frequency output
The analog low pass filter will be deactivated if a sensor with frequency output is connected.

8.6.10 Torque/Force Averaging Filter (INP:AVER:TORQ)

INP:AVER:TORQ<averageDepth>
INP:AVER:TORQ:ON
INP:AVER:TORQ:OFF
INP:AVER:TORQ:STAT?

The moving average filter can be defined for torque or force measurements. The depth can be selected in **INP:AVER:TORQ<averageDepth>**.

The moving average filter is activated with **INP:AVER:TORQ:ON**. The moving average filter is deactivated with **INP:AVER:TORQ:OFF**.

INP:AVER:TORQ:STAT? is used to determine whether the moving average filter is currently active (response **ON**). If the moving average filter is deactivated, the Type 4700B… instrument responds with the character string **OFF**.

<averageDepth> =

2
4
8
16
32
64
128

256
512
1024

Syntax examples:

INP:AVER:TORQ32 (Moving average depth to 32)
0
INP:AVER:TORQ?
32
INP:AVER:TORQ:ON (Moving average activated)
0
INP:AVER:TORQ:STAT?
ON

NOTE

Moving average and low pass filter function
The analog low pass filter will be deactivated, if moving average filter for torque or force is parameterized and activated.

8.6.11 Speed Averaging Filter (INP:AVER:SPE)

INP:AVER:SPE<averageDepth>
INP:AVER:SPE:ON
INP:AVER:SPE:OFF
INP:AVER:SPE:STAT?

The moving average filter can be defined for speed measurements. The depth can be selected in **INP:AVER:SPE <averageDepth>**.

The moving average filter is activated with **INP:AVER:SPE:ON**. The moving average filter is deactivated with **INP:AVER:SPE:OFF**.

INP:AVER:SPE:STAT? is used to determine whether the moving average filter is currently active (response **ON**). If the moving average filter is deactivated, the Type 4700B… instrument responds with the character string **OFF**.

<averageDepth> =

2
4
8
16
32
64
128
256
512

Syntax examples:
INP:AVER:SPE64 (Moving average depth to 64)

0
INP:AVER:SPE?
64
INP:AVER:SPE:ON (Moving average activated)
0
INP:AVER:SPE:STAT?
ON

8.7 Sensor Configuration

It is possible to remotely control the Evaluation Instrument, Type 4700B… fully over the RS-232C interface. All configurations in the menus can also be set up via this interface.

8.7.1 Torque Measurement Channel (ROUT:TORQ)

ROUT:TORQ:ACTI
ROUT:TORQ:BRID
ROUT:TORQ:FREQ
ROUT:TORQ:ICAM
ROUT:TORQ?
ROUT:TORQ<route>

The physical measurement channel of the torque measurement can be defined with this command group. **ROUT:TORQ:ACTI** switches to the ±10 V measurement mode (active sensor). **ROUT:TORQ:FREQ** is used for a torque sensor with frequency output. A passive sensor with DMS output is connected to the Type 4700B… instrument when **ROUT:TORQ:BRID** is specified.

Is an ICAM – Indutrial Charge Amplifier Type 5073A… connected, then **ROUT:TORQ:ICAM** should be used.
The measurement channel can also be defined in the form of a number:

<route> =

0	±10 V measurement mode (active sensor)
1	passive sensor with strain gage output
2	torque sensor with frequency output
3	ICAM – Charge Amplifier Type 5073A…

ROUT:TORQ? can be used to determine the corresponding number which represents the measurement channel.

Syntax examples:
ROUT:TORQ1 (sensor with strain gage output)
0
ROUT:TORQ?
1 (strain gage channel determined)

8.7.2 Unit of the Force/Torque Parameter (SENS:UNIT)

SENS:UNIT:<unit>
SENS:UNIT?

The force or torque parameter unit can be defined with **SENS:UNIT:<unit>**. The following units are available:

<unit> =

N	N
KN	kN
LBF	lbf (pound force)
NMM	N·mm
NCM	N·cm
NM	N·m
KNM	kN·m
LBFT	lbf-ft (pound force feet)
LBIN	lbf-in (pound force inches)
OZIN	oz-in (ounce-force inches)

The **SENS:UNIT?** command is used to determine the unit defined in the Type 4700B… instrument. The unit is transferred as a character string (e.g. **NM**).

Syntax examples:

SENS:UNIT:NCM
0
SENS:UNIT?
Ncm

NOTE

Imperial units and mechanical power
The mechanical power unit depends on the units used for the torque. If the units LBFT, LBIN and OZIN are used, HP **(horse power)** is automatically assigned to the mechanical power.

NOTE

Dual-range sensor
The defined unit is applicable for both measurement ranges.

8.7.3 Nominal Measurement Range (SENS:RANG)

SENS:RANG<range>
SENS:RANG?

The nominal measurement range of the torque parameter is defined with this command. **SENS:RANG?** can be used to determine the defined value in the Type 4700B… instrument.

<range> = floating-point number.

Syntax examples:

SENS:UNIT:NM
0
SENS:RANG100.00 (nominal meas. range 100 N·m
0
SENS:RANG?
100

8.7.4 Extended Measurement Range (SENS:EXT:RANG)

SENS:EXT:RANG<range>
SENS:EXT:RANG:NONE
SENS:EXT:RANG?

The extended (i.e. smaller) measurement range of the torque parameters can be defined with this command. This is particularly useful with a dual-range sensor of Type 4503A… . **SENS:EXT:RANG?** can be used to determine the defined value in the Type 4700B… instrument.

If the extended measurement range does not appear necessary, this can be shown with **SENS:EXT:RANG0** or **SENS:EXT:RANG:NONE**.

<range> = floating-point number

Syntax examples:

SENS:UNIT:NM
0
SENS:EXT:RANG10.00 (extended meas. range 10 N·m
0
SENS:EXT:RANG?
10
SENS:EXT:RANG:NONE (no extended measurement range
0
SENS:EXT:RANG?

8.7.5 Nominal Characteristic Value of Force/Torque (SENS:NOM)

SENS:NOM<nominal>
SENS:NOM?

The characteristic value of an active sensor or the sensitivity of a passive sensor is defined with **SENS:NOM<nominal>**.

The characteristic value of a sensor with analog output is normalized in Volts. The normalization is in kHz for the frequency parameter. The sensitivity of a passive sensor is specified in mV/V.

<nominal> = floating-point number in V, kHz or mV/V

Syntax examples:

ROUT:ACTI	(active sensor voltage)
0	
SENS:NOM9.998	(characteristic voltage 9,998 V)
0	
SENS:NOM?	
9.998	
ROUT:FREQ	(active sensor frequency)
0	
SENS:NOM40.005	(characteristic freq. 40,005 kHz)
0	
ROUT:BRID	(DMS passive sensor)
0	
SENS:NOM1.999	(sensitivity 1,999 mV/V)
0	

8.7.6 Extended Characteristic Value of Force/Torque (SENS:EXT:NOM)

SENS:EXT:NOM<nominal>
SENS:EXT:NOM?

The characteristic value of the extended (i.e. smaller) measurement range of an active sensor or the sensitivity of a passive sensor is defined with **SENS:EXT:NOM<nominal>**.

The characteristic value of a sensor with analog output is normalized in Volts. The normalization is in kHz for the frequency parameter.

A second measurement range is not supported for the passive strain gage sensor.

<nominal> = floating-point number in V or kHz.

Syntax examples:

ROUT:ACTI	(active sensor voltage)
0	
SENS:EXT:NOM9.995	(characteristic voltage 9,998 V)
0	
SENS:EXT:NOM?	
9.998	

ROUT:FREQ	(active sensor frequency)
0	
SENS:EXT:NOM40.010	(characteristic freq. 40,010 kHz)
0	

8.7.7 Frequency Offset of Force/Torque (SENS:FOFF)

SENS:FOFF<freqOffset>
SENS:FOFF?

The frequency offset of a torque sensor with frequency output is defined with **SENS:FOFF<freqOffset>**. The output frequency at zero torque corresponds to the frequency offset in kHz.

SENS:FOFF? determines the frequency offset.

Example on Type 4503A… or Type 4504B… with frequency output:

0 N·m: 100 kHz

<freqOffset> = floating-point number in kHz.

Syntax examples:

SENS:FOFF100.003	(frequency offset 100,003 kHz)
0	
0	
SENS:FOFF?	
100.003	

8.7.8 Extended frequency Offset of Force/Torque (SENS:EXT:FOFF)

SENS:EXT:FOFF<freqOffset>
SENS:EXT:FOFF?

The frequency offset of the extended (i.e. smaller) measurement range of a dual-range sensor with frequency output is defined with **SENS:EXT:FOFF<freqOffset>**. The output frequency at zero torque corresponds to the frequency offset in kHz.

SENS:EXT:FOFF? is used to determine the frequency offset.

Example of a Type 4503A… (0260DM) with frequency output:

0 N·m: 100 kHz

<freqOffset> = floating-point number in kHz.

Syntax examples:

SENS:FOFF100.010 (frequency offset 100.010 kHz)
0
SENS:FOFF?
100.010

8.7.9 Measurement Range Selection (SENS:EXT:ENA…)

SENS:EXT:ENA<selection>
SENS:EXT:ENA?
SENS:EXT:ENA:DIR<direction>
SENS:EXT:ENA:DIR?

It is possible to switch between the nominal and the extended measuring range from the Measuring range additional menu or via a digital input. This is defined with **SENS:EXT:ENA<selection>**.

The following options are possible to this purpose:

<selection> =

0	ENTER key in the Measuring range additional menu,
{1,2,…,8}	digital input 1 … 8.

With **SENS:EXT:ENA?** it is possible to determine the type of measuring range selection.

The logical digital input status for changing the measuring range is defined with **SENS:EXT:ENA:DIR<direction>**:

<direction> =

0	Extended measuring range with status 0 (1→0)
1	Extended measuring range with status 1 (0→1)

With **SENS:EXT:ENA:DIR?** the digital input status is determined for switching the measuring range.

Syntax examples:

SENS:EXT:ENA0	(button)
0	
SENS:EXT:ENA3	(digital input 3)
0	
SENS:EXT:ENA?	
3	(Response: digital input 3)
SENS:EXT:ENA:DIR1	(extended measuring range with status from 0 to 1)
0	
SENS:EXT:ENA:DIR?	
1	(Response: state 1)

8.7.10 Measurement Range at Digital Output (SENS:EXT:OUTP…)

SENS:EXT:OUTP<digOutput>
SENS:EXT:OUTP?
SENS:EXT:OUTP:DIR<direction>
SENS:EXT:OUTP:DIR?

The active measuring range can be displayed as a logical status on a digital output. The command **SENS:EXT:OUTP<digOutput>** is available to this purpose:

<digOutput> =

0	no digital output
{1,2,…,8}	digital output 1…8

With **SENS:EXT:OUTP?** it is possible to determine whether a digital output is assigned to the measuring range status, and if yes, which output.

The type of digital output status can be defined with **SENS:EXT:OUTP:DIR<direction>**. The following options are available to this purpose:

<direction> =

0	Nominal measuring range:	Status 1
	Extended measuring range:	Status 0
1	Nominal measuring range:	Status 0
	Extended measuring range:	Status 1

With **SENS:EXT:OUTP:DIR?** it is determined which output status was defined for the extended measuring range.

Syntax examples:

SENS:EXT:OUTP0	(no digital output defined)
0	
SENS:EXT:OUTP5	(digital output 5)
0	
SENS:EXT:OUTP?	
5	
SENS:EXT:OUTP:DIR1	(output status 0 for nominal measuring range and status 1 for the extended range)
0	
SENS:EXT:OUTP:DIR?	
1	(Response: Status 1 in the extended measuring range)

8.7.11 Number of Speed Sensor Pulses (SENS:PULS)

SENS:PULS<pulsesPerRev>
SENS:PULS?

The number of speed sensor pulses per revolution is defined with the **SENS:PULS<pulsesPerRev**> command. This parameter is used in the Type 4700B… instrument to calculate the speed or angle or the counter reading.

SENS:PULS? can be used to determine the defined pulses.

<pulsesPerRev> = {1|2|…|4095}.

Syntax examples:

SENS:PULS720	(720 pulses per revolution)
0	
SENS:PULS?	
720	

8.7.12 Direction of Rotation of a Speed Sensor (SENS:DIR)

SENS:DIR:CW
SENS:DIR:CCW
SENS:DIR<direction>
SENS:DIR?

The direction of rotation of a speed sensor is defined with **SENS:DIR:CW** (right-rotating, i.e. clockwise) or **SENS:DIR:CCW** (left-rotating, i.e. counterclockwise). This defines the preferential direction (positive reading).

It is also possible to configure the direction of rotation in the form of a number. **SENS:DIR?** can be used to determine the selected direction of rotation of the Type 4700B… instrument.

<direction> =

0	right-rotating (*clockwise*)
1	left-rotating (*counter clockwise*)

Syntax examples:

SENS:DIR:CW	(right-rotating)
0	
SENS:DIR?	
0	
SENS:DIR:CCW	(left-rotating)
0	
SENS:DIR?	
1	
SENS:DIR0	(0 □-rotating)
0	
SENS:DIR?	
0	

NOTE

Reversal of the direction of rotation
The sign of the speed and angle parameter as well as the counting of the counter reading can be determined with **SENS:DIR:CW** and **SENS:DIR:CCW**.

8.7.13 Mechanical Power Unit (CALC:POW:UNIT)

CALC:POW:UNIT:<unit>
CALC:POW:UNIT?

The unit of mechanical power can be defined with **CALC:POW:UNIT:<unit>**. The following units are available:

<unit> =

W	W
KW	kW
MW	MW

The unit can be determined with **CALC:POW:UNIT?**. The return is made in the form of a character string.

NOTE

HP imperial unit (horsepower)
For the **LBFT, LBIN** and **OZIN** torque units, **HP** is automatically defined for the mechanical power.

Syntax examples:

CALC:POW:UNIT:W	(power in W)
0	
CALC:POW:UNIT?	
W	
SENS:UNIT:LBFT	(torque in lb-ft)
0	
CALC:POW:UNIT?	
HP	(power autom. in HP)

8.8 Alarm

Every parameter in the Type 4700B… instrument can be monitored. It is possible to generate alarm states when limit values are undercut or exceeded.

8.8.1 Alert Mode (ALER:MODE)

ALER:MODE:NORM<ch>
ALER:MODE:HOLD<ch>
ALER:MODE:OFF<ch>
ALER:MODE<ch>;<mode>
ALER:MODE<ch>?

The parameter monitoring of the alarm channel can be explicitly activated with **ALER:MODE:NORM<ch>**.

If a limit value is exceeded, the alarm state can remain triggered until a digital input releases it again. In this case, the **ALER:MODE:HOLD<ch>** command is used for the configuration.

The monitoring for the respective channel is deactivated with **ALER:MODE:OFF<ch>**.

<ch> = {1|2|3} alarm channel number.

The alert mode can also be configured in numerical form, the **ALER:MODE<ch>;<mode>** command is used for this.

<mode> =

0	parameter monitoring deactivated (**NONE**),
1	monitoring activated (**NORM**),
2	monitoring with saved mode activated (**HOLD**).

ALER:MODE<ch>? is used to determine the configuration of the respective alert channel.

Syntax examples:

ALER:MODE:NORM1	(active, normal mode)
0	
ALER:MODE1?	
1	

8.8.2 Parameters to Be Monitored (ALER:SOUR)

ALER:SOUR:<source><ch>
ALER:SOUR<ch>;<sourceNo>
ALER:SOUR<ch>?

The **ALER:SOUR:<source><ch>** command is used to define the parameter to be monitored.

<source> =

TORQ	torque
SPE	speed
ANG	angle
COUN	counter reading
POWER	mechanical power

<ch> = {1|2|3} alarm channel number

The parameter to be monitored can be defined as a numerical value with the **ALER:SOUR<ch>;<sourceNo>** command:

<sourceNo> =

1	torque
2	speed
3	angle
4	counter reading
5	mechanical power

ALER:SOUR<ch>? is used to determine the monitoring parameter as a numerical value.

Syntax examples:

ALER:SOUR:TORQ1	(torque)
0	
ALER:SOUR1?	
1	

8.8.3 Limit Values (ALER:THR)

ALER:THR:HIGH<ch>;<value>
ALER:THR:HIGH<ch>?
ALER:THR:LOW<ch>;<value>
ALER:THR:LOW<ch>?

The upper limit value is defined with **ALER:THR:HIGH<ch>;<value>**. The lower limit value can be set with **ALER:THR:LOW<ch>;<value>**.

<ch> = {1|2|3} alarm channel number
<value> = floating-point number

The determination of the upper limit value is made with **ALER:THR:HIGH<ch>?** and the lower limit value with **ALER:THR:LOW<ch>?**.

Syntax example of a torque sensor with limits to be monitored of –80 N·m and +100 N·m using the alarm monitoring of the 1st channel:

ALER:THR:HIGH1;100
0
ALER:THR:LOW1;-80
0

ALER:THR:HIGH1?
100
ALER:THR:LOW1?
-80

8.8.4 Hysteresis (ALER:HYST)

ALER:HYST<ch>;<value>
ALER:HYST<ch>?

The hysteresis of each limit value is defined with **ALER:HYST<ch>;<value>**.

<ch> = {1|2|3} alarm channel number.

<value> = floating-point number.

The determination of the defined hysteresis is made with **ALER:HYST<ch>?**.

Syntax example of a torque sensor with limits to be monitored of –80 N·m and +100 N·m and a defined hysteresis of 0,1 N·m (alarm monitoring of 1st channel):

ALER:HYST1;0.1
0
ALER:HYST1?

0.1

8.8.5 Control Unit/Enable (ALER:ENA)

ALER:ENA<ch>;<input>
ALER:ENA<ch>?
ALER:ENA:DIR:LOW<ch>
ALER:ENA:DIR:HIGH<ch>
ALER:ENA:DIR<ch>;<state>
ALER:ENA:DIR<ch>?

The monitoring can be explicitly controlled with **ALER:ENA<ch>;<input>**. It is possible to enable the alarm monitoring with a digital input or to reset it again if an alarm state has been triggered and held (**HOLD** mode).

<ch> = {1|2|3} alarm channel number

<input> = {1|2|3|4|5|6|7|8} digital input

The digital input is determined with the **ALER:ENA<ch>?** command.

The required state change of a digital input for monitoring/resetting can be defined with **ALER:ENA:DIR:LOW<ch>** (change from 1 to 0) or **ALER:ENA:DIR:HIGH<ch>** (change from 0 to 1). It is also possible to define this configuration numerically (**ALER:ENA:DIR<ch>;<state>**):

<state> =

0	required state change from 1 to 0
1	required state change from 0 to 1

ALER:ENA:DIR<ch>? enables the required state change of a digital input to be determined. The return is made as a numerical value.

Syntax examples for alarm channel number 1:

ALER:ENA1;5	(digital input no. 5)
0	
ALER:ENA1?	
5	
ALER:ENA:DIR:HIGH	(state change 0 → 1)
0	
ALER:ENA:DIR1?	
1	

8.8.6 Digital Output (ALER:OUTP)

ALER:OUTP:NONE<ch>
ALER:OUTP<ch>;<output>
ALER:OUTP<ch>?
ALER:OUTP:DIR:OPEN<ch>
ALER:OUTP:DIR:CLSE<ch>
ALER:OUTP:DIR<ch>;<state>
ALER:OUTP:DIR<ch>?

It is possible to influence a digital output by a triggered alarm state. The digital output is specified with **ALER:OUTP<ch>;<output>**. If no digital output is to be assigned, the **ALER:OUTP:NONE<ch>** command is responsible.

<ch> = {1|2|3} alarm channel number

<output> = {1|2|3|4|5|6|7|8} digital output

The assigned digital output is determined with **ALER:OUTP<ch>?**. If no digital output is defined, a response of zero (**0**) is issued.

The state change of the digital output when an alarm is triggered can be set with the command **ALER:OUTP:DIR:OPEN<ch>** (electronic relay opened, high-impedance state z) or the command **ALER:OUTP:DIR:CLSE<ch>** (electronic relay closed, state 0).

The numerical assignment of the state change is made with **ALER:OUTP:DIR<ch>;<state>**:

<state> =

0	electronic relay closed, state 0
1	electronic relay opened, state z

The assigned state change can be determined with **ALER:OUTP:DIR<ch>?**.

Syntax examples for alarm channel number 1:

ALER:OUTP1;6	(digital output no. 6)
0	
ALER:OUTP1?	
6	
ALER:OUTP:DIR:CLSE1	(alarm: relay closed)
0	
ALER:OUTP:DIR1?	
0	

8.9 Analog Output

8.9.1 Parameter Assignment (OUTP:ANA:SOUR)

OUTP:ANA:SOUR:NONE<ch>
OUTP:ANA:SOUR:<source><ch>
OUTP:ANA:SOUR<ch>?
OUTP:ANA:SOUR<ch>;<sourceNo>

A parameter is assigned to the analog output; this is carried out with the **OUTP:ANA:SOUR:<source><ch>** command. The following selection options are available:

<ch> = {1|2|3} channel number of the analog output

<source> =

TORQ	torque
SPE	speed
ANG	angle
COUN	counter reading
POW	mechanical power

The analog output is deactivated with **OUTP:ANA:SOUR:NONE<ch>**.

The parameters can also be determined as a numerical value (**OUTP:ANA:SOUR<ch>;<sourceNo>**):

<sourceNo> =

0	analog output deactivated
1	torque
2	speed
3	angle
4	counter reading
5	mechanical power

The corresponding parameters can be determined as a numerical value with **OUTP:ANA:SOUR<ch>?**.

NOTE

Parameter assignment
The **OUTP:ANA:SOUR:TORQ1** command is identical to the numerical specification **OUTP:ANA:SOUR1;1** and assigns the torque parameter (numerical value 1) to the analog output 1.

Syntax examples:

OUTP:ANA:SOUR:TORQ1	(analog output 1: torque parameter)
0	
OUTP:ANA:SOUR1?	(request for output 1)

1	(response 1: torque)
OUTP:ANA:SOUR:SPE2	(analog output 2: speed parameter)
0	
OUTP:ANA:SOUR2?	(request for output 2)
2	(response 2: speed)
OUTP:ANA:SOUR:NONE3	(analog output 3: deactivated)
0	
OUTP:ANA:SOUR3?	(request for output 3)
0	(response 0: deactivated)

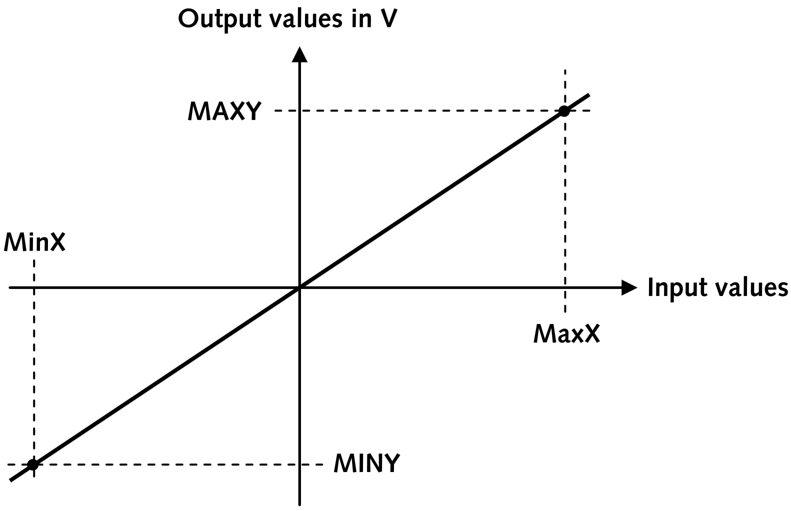
8.9.2 Scaling (OUTP:ANA:...)

OUTP:ANA:MINX<ch>;<value>
OUTP:ANA:MINX<ch>?
OUTP:ANA:MAXX<ch>;<value>
OUTP:ANA:MAXX<ch>?

OUTP:ANA:EXT:MINX<ch>;<value>
OUTP:ANA:EXT:MINX<ch>?
OUTP:ANA:EXT:MAXX<ch>;<value>
OUTP:ANA:EXT:MAXX<ch>?

OUTP:ANA:MINY<ch>;<value>
OUTP:ANA:MINY<ch>?
OUTP:ANA:MAXY<ch>;<value>
OUTP:ANA:MAXY<ch>?

The relationship between the parameter value and output voltage value is required for the linear scaling of the analog output. These are specified in the form of coordinates.



<ch> = {1|2|3} channel number of the analog output
<value> = floating-point number

NOTE

Units of the input and output values
The units of the input values are based on the parameter assigned to the analog output and its defined units. The output value is always scaled in V.

NOTE

Dual-range sensor (e.g. 4503A...)
If the extended (i.e. smaller) measuring range is available, an additional pair of values can be assigned for the extended range with **OUTP:ANA:EXT:MINX <ch>;<value>** and **OUTP:ANA:EXT:MAXX <ch>; <value>.**

Scaling example for the 1st analog output, starting from a torque measured value assigned with a unit of N·m:

Minimum input parameter (1st range): –500 N·m
Maximum input parameter (1st range): +500 N·m
Minimum input parameter (2nd range): –50 N·m
Maximum input parameter (2nd range): +50 N·m
Minimum output parameter (both ranges): –10 V
Maximum output parameter (both ranges): +10 V

Corresponding syntax example:

OUTP:ANA:MINX1;-500 (min. torque –500 N □m)
0
OUTP:ANA:MAXX1;500 (max. torque 500 N □m)
0

OUTP:ANA:EXT:MINX1;-50 (2nd range: min. torque –50 N·m)
0
OUTP:ANA:EXT:MAXX1;50(2nd range: max. torque 50 N·m)
0

OUTP:ANA:MINY1;-10 (–10V at –500 N □m and –50 N□m 2nd range)
0
OUTP:ANA:MAXY1;10 (10V at 500 N □and 50 N□m 2nd range)
0

OUTP:ANA:MINX1?
-500
OUTP:ANA:MAXX1?
500

OUTP:ANA:EXT:MINX1?
-50
OUTP:ANA:EXT:MAXX1?
50

OUTP:ANA:MINY1?
-10
OUTP:ANA:MAXY1?
10

8.10 External Reset

8.10.1 Parameter (TRAC:ERST:TARG)

TRAC:ERST:TARG:<target><ch>
TRAC:ERST:TARG<ch>;<targetNo>
TRAC:ERST:TARG<ch>?

It is possible to reset a value memory (e.g. Min./Max. memory) with a digital input. The **TRAC:ERST:TARG:<target><ch>** command defines the respective target parameter.

<ch> = {1|2|3} channel number of the external reset

<target> =

NONE	no external reset
ALL	all value memories are reset
TORQ:{MIN|MAX}	min./max. torque/force
SPE:{MIN|MAX}	min./max. speed
ANG	present angle
ANG:{MIN|MAX}	min./max. angle
COUN	present counter reading
COUN:{MIN|MAX}	min./max. counter reading
POW:{MIN|MAX}	min./max. mechanical power

The target parameters can also be defined numerically: (**TRAC:ERST:TARG<ch>;<targetNo>**):

<targetNo> =

0	no external reset
1	all value memories are reset
2	min. torque
3	max. torque
4	min. speed
5	max. speed
6	present angle
7	min. angle
8	max. angle
9	present counter reading
10	min. counter reading
11	max. counter reading
12	min. mechanical power
13	max. mechanical power

The **TRAC:ERST:TARG<ch>?** command is used to determine the target parameter in numerical form.

Syntax examples:

TRAC:ERST:TARG:TORQ:MIN1 (channel 1: min. torque)
0
TRAC:ERST:TARG1?
2

TRAC:ERST:TARG:SPE:MAX2 (channel 2: max. speed)
0
TRAC:ERST:TARG2?
5

TRAC:ERST:TARG:POW:MAX3 (channel 3: max. power)
0
TRAC:ERST:TARG3?
13

8.10.2 Digital Input (TRAC:ERST:INP)

TRAC:ERST:INP<ch>;<input>
TRAC:ERST:INP<ch>?
TRAC:ERST:INP:DIR:LOW<ch>
TRAC:ERST:INP:DIR:HIGH<ch>
TRAC:ERST:INP:DIR<ch>;<state>
TRAC:ERST:INP:DIR<ch>?

The digital input is defined with **TRAC:ERST:INP<ch>;<input>**; this can be used to trigger an external reset. The determination of the digital input is made with the **TRAC:ERST:INP<ch>?** command.

<ch> = {1|2|3} channel number of the external reset

<input> = {1|2|3|4|5|6|7|8} digital input

The required state change of the digital input can be set with **TRAC:ERST:INP:DIR:LOW<ch>** (change from 1 to 0) or with **TRAC:ERST:INP:DIR:HIGH<ch>** (change from 0 to 1).

A numerical definition is also possible (**TRAC:ERST:INP:DIR<ch>;<state>**):

<state> =

0 required state change from 1 to 0
1 required state change from 0 to 1

The required state change can be determined in numerical norm with **TRAC:ERST:INP:DIR<ch>?**.

Syntax examples:

TRAC:ERST:INP1;2 (channel 1: dig. input 2)
0
TRAC:ERST:INP1?`
2
TRAC:ERST:INP:DIR:LOW1 (reset on 1□0)
0
TRAC:ERST:INP:DIR1?
0

TRAC:ERST:INP2;5 (channel 2: dig. input 5)
0
TRAC:ERST:INP2?
5
TRAC:ERST:INP:DIR:HIGH2 (reset on 0 □1)
0
TRAC:ERST:INP:DIR2?
1

8.11 Trigger and Measured Value Buffer

8.11.1 Number of Measured Value Packets (TRIG:VAL)

TRIG:VAL<packets>
TRIG:VAL?

The depth of the measured value buffer or the number of the measured value packets to be saved can be defined with the **TRIG:VAL<packets>** command. Each individual measured value packet contains the variables torque, speed, angle, the rotation counter reading and the mechanical power.

<packets> = {10|11|…|5000} Number of measured value packets

The defined packets are determined with the **TRIG:VAL?** command.

Syntax examples:

TRIG:VAL2000 (2000 measured value packets)
0
TRIG:VAL?
2000

8.11.2 Storage Time (TRIG:TIME)

TRIG:TIME<time>
TRIG:TIME?

The measured values are saved immediately after a trigger condition. The corresponding storage time is defined with the **TRIG:TIME<time>** command.

<time> = {0.5|…|7200.0} storage time standardized in s.

The **TRIG:TIME?** command provides information on the programmed storage time.

Syntax examples:

TRIG:TIME10 (10 s storage time)
0
TRIG:TIME?
10

8.11.3 Trigger Source (TRIG:SOUR)

TRIG:SOUR<source>
TRIG:SOUR?
TRIG:SOUR:INP<digInput>
TRIG:SOUR:INP?

To initiate storage of the measured value, triggering must take place. A trigger is initiated when a threshold value of a specific measured variable is exceeded, a key is pressed or the condition of a digital input is changed. To this purpose it is recommended to define a trigger source. This is performed with the **TRIG:SOUR<source>** command.

<source> =

:TORQ	Torque
:SPE	Speed
:ANG	Angle
:COUN	Rotation counter reading
:POW	Mechanical power
:KEY	Menu item **Start trigger** in the additional menu

The trigger source can also be defined as a numeric value.

<source> =

0	Torque
1	Speed
2	Angle
3	Rotation counter reading
4	Mechanical power
5	Menu item **Start trigger** in the additional menu
6	Digital input 1
7	Digital input 2
8	Digital input 3
9	Digital input 4
10	Digital input 5
11	Digital input 6
12	Digital input 7
13	Digital input 8

As an alternative it is also possible to use the **TRIG:SOUR:INP<digInput>** command to define a digital input as a trigger source.

<digInput> = {1|2|…|8}   digital input

The source of a trigger condition is determined with the **TRIG:SOUR?** command or **TRIG:SOUR:INP?**.

Syntax examples:

TRIG:SOUR:SPE	(Trigger source speed)
0	
TRIG:SOUR?	
1	(Num. value for speed)
TRIG:SOUR5	(Trigger source key actuation)
0	
TRIG:SOUR?	
5	
TRIG:SOUR:INP3	(Trigger source dig. input 3)
0	
TRIG:SOUR:INP?	
3	(dig. input 3)
TRIG:SOUR?	
8	(Num. value for dig. input 3, determined with TRIG:SOUR?)

8.11.4 Trigger Threshold (TRIG:THR)

TRIG:THR<threshold>
TRIG:THR?

In addition to the trigger source, the trigger threshold may be required as a trigger condition if a measured variable is defined as a source. If the trigger threshold is exceeded, triggering is initiated. The trigger threshold is programmed with the **TRIG:THR<threshold>** command.

<threshold> = Floating point number standardized for the respective measured variable source

The **TRIG:THR?** command is used for determining the trigger threshold.

Syntax examples:

TRIG:SOUR:TORQ (Torque trigger source)

0	
TRIG:THR155.3	(155.3 N·m trigger threshold if N·m is defined as a unit)
0	
TRIG:THR?	
155.3	(155.3 N·m)

8.11.5 Value Above or Below (TRIG:THR:DIR)

TRIG:THR:DIR<direction>
TRIG:THR:DIR?

If a measured variable is defined as a trigger source and a corresponding trigger threshold is defined, it is recommended to state the direction of threshold passage (value above or below threshold). The **TRIG:THR:DIR<direction>** command is used to this purpose.

<direction> =

:HIGH	Trigger if value higher than threshold
:LOW	Trigger if value lower than threshold

The information can also be given as a numeric value.

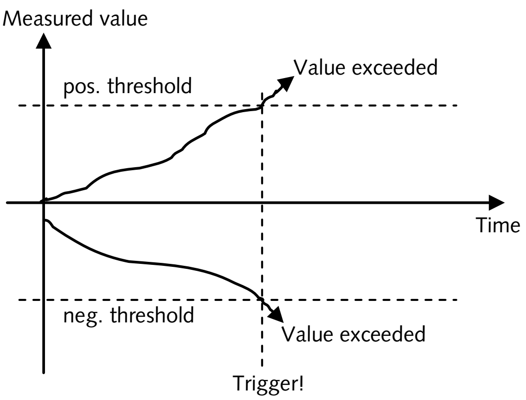
<direction> =

1	Trigger if value too high
0	Trigger if value too low

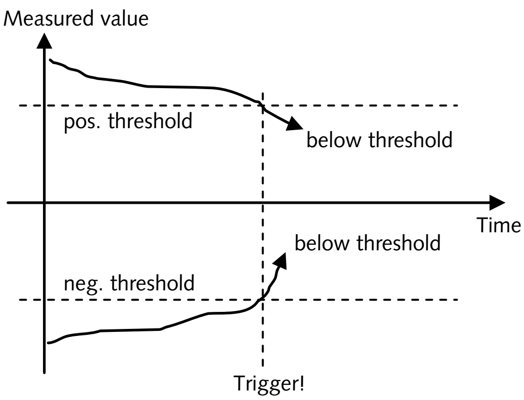
The type of threshold passage is determined with the **TRIG:THR:DIR?** command.

High and low value definition can be determined from the following diagrams.

Higher than threshold (TRIG:THR:DIR:HIGH)



Lower than threshold (TRIG:THR:DIR:LOW)



Syntax examples:

TRIG:THR:DIR:HIGH	(Trigger if value exceeded)
0	
TRIG:THR?	
1	(Value exceeded)

8.11.6 Change in Condition with Dig. Input (TRIG:ENA:DIR)

TRIG:ENA:DIR<direction>
TRIG:ENA:DIR?

If a digital input was defined for the trigger source, the **TRIG:ENA:DIR<direction>** command can be used to state the necessary change in condition for the trigger condition.

<direction> =

:HIGH	Trigger when change of condition 0→1
:LOW	Trigger when change of condition 1→0

The change of condition can also be stated numerically.

<direction> =

1	Trigger if change of condition 0→1
0	Trigger if change of condition 1→0

The defined change of condition can be determined with the **TRIG:ENA:DIR?** command.

Syntax examples:

TRIG:ENA:DIR:HIGH (change of condition 0 □1)
0
TRIG:ENA:DIR?
1

8.11.7 Arm/Disarm Trigger Monitoring (TRIG:ARM)

TRIG:ARM<arming>
TRIG:ARM?

Trigger monitoring can be armed and disarmed with the **TRIG:ARM<arming>** command. If trigger monitoring is activated, the threshold passage, the change in condition of the digital input or the key actuation is evaluated for the trigger condition to save a measurement curve.

NOTE

Repeated trigger monitoring after storage of a measured value
When a measured value is stored, trigger monitoring must be rearmed. Repeated storage of a measured value is only then possible.

<arming> =

:ON Trigger monitoring activated.

:OFF Trigger monitoring deactivated.
Measured value storage cannot be initiated.

The trigger monitoring definition can also be numeric.

<arming> =

1 Trigger monitoring activated
0 Trigger monitoring deactivated

Trigger monitoring is determined with the **TRIG:ARM?** command.

Syntax examples:

TRIG:ARM:ON (Trigger monitoring activated)
0
TRIG:ARM?
1

TRIG:ARM0 (Trigger monitoring deactivated)
0
TRIG:ARM?
0

8.11.8 Permit / Block Measured Value Storage (TRIG:MODE)

TRIG:MODE<mode>
TRIG:MODE?

Measured value storage and its trigger condition can be generally permitted or blocked with the **TRIG:MODE<mode>** command. Blocking is recommended if measured value storage is not required as a function.

<mode> =

:ON	Permit measured value storage
:OFF	Block measured value storage

The measured value storage definition can also be numeric.

<mode> =

1	Permit measured value storage
0	Block measured value storage

The **TRIG:MODE?** command can be used to find out if measured value storage is permitted or blocked.

Syntax examples:

TRIG:MDOE:ON (Measured value storage permitted)
0
TRIG:MODE?
1

TRIG:MODE0 (Block measured value storage as function)
0
TRIG:MODE?
0

8.11.9 Initiate Measured Value Storage Immediately (TRIG:INIT)

TRIG:INIT

Measured value storage can be directly initiated with the **TRIG:INIT** command independently of defined trigger conditions.

Syntax example:

TRIG:INIT (Triggering is initiated immediately)
0

8.11.10 Read out Measured Value Buffer (TRAC:BUFF)

TRAC:BUFF?
TRAC:BUFF:UNIT<measurand>?
TRAC:BUFF<offsetAddr>;<noOfPackets>?

The **TRAC:BUFF?** command is used to output the stored measured value variables and the number of the measured value packets. The units of the respective measured value variables are of interest for assigning the measured values. The **TRAC:BUFF:UNIT<measurand>?** command is provided to determine these.

The measured value packets themselves can be transferred with the **TRAC:BUFF<offsetAddr>;<noOfPackets>?** command as a continuous data chain to the PC.

<measurand> =

:TORQ	Torque unit
:POW	Unit of mechanical power

<offsetAddr> = {0|1|…|4999} Packet address

<noOfPackets> = {1|2|…|5000} Measured value packets

Content of a measured packet and number of measured value packets

The content of a measured value packet can include the following variables:

TORQ	Torque
SPE	Speed
ANG	Angle
COUN	Rotation counter reading
POW	Mechanical power

The type of measured variable, the sequence and the number of measured value packets is transferred with the **TRAC:BUFF?** command. Each information carrier is separated by a separator **|** ($0x7C_{Hex}$ or 124_{10}). An example is given below:

TORQ|SPE|ANG|COUN|POW|5000

List of the variables in a packet	Number of measured value packets in the measured

Measured value packets in the data chain
Each measured value in a measured value packet is separated by a separator | ($0x7C_{Hex}$ or 124_{10}). A measured value packet is terminated with # ($0x23_{Hex}$ or 35_{10}).

As an example, 2 measured value packets are transferred with the **TRAC:BUFF0;2?** command:

0.0000|-2.937935|0|0|0|0#**0.0006**|-2.937105|0|0|0|0#

Packet no. 0	Packet no. 1
(1st measured value)	(2nd measured value)

The time stamp (standardized in s) is always at the beginning of a measured value packet. In the example above, the difference between both subsequent time stamps of the measured value packets can be taken to calculate a sampling rate of 0,0006 s (= 600 µs). The measuring rate was therefore approx. 1,67 kHz when the value was stored.

Syntax examples:

1. Determine the type of measured value variable and the number of the measured value packets in the measured value buffer:

TRAC:BUFF?
TORQ|SPE|ANG|COUN|POW|3000

2. Determine the unit of the torque measured variable for interpretation of the measured values:

TRAC:BUFF:UNIT:TORQ?
Nm

3. Determine the unit of the mechanical power for interpretation of the measured values:

TRAC:BUFF:UNIT:POW?
W

4. Fetch measured value packets from the beginning of the trigger event (address zero) until the end of recording (all measured value packages, i.e. 3 000):

TRAC:BUFF0;3000?
0.0000|-2.937935|0|0|0|0#0.0006|-2.937105|0|0|0|0#…
…**1.7988|-2.940522|0|0|0|0#1.7994|-2.939863|0|0|0|0#**

8.12 Menu and Display

8.12.1 Keyboard Control (MENU:KEY)

The keys on the front panel of the Evaluation Instrument, Type 4700B… can be operated remotely over the RS-232C interface. The following commands simulate a key press:

MENU:KEY:UP	(upwards arrow key)
MENU:KEY:DOWN	(downwards arrow key)
MENU:KEY:RGHT	(arrow key to the right)
MENU:KEY:LEFT	(arrow key to the left)
MENU:KEY:ESC	(ESC key)
MENU:KEY:ENTR	(ENTER key)
MENU:KEY:ENTR:ON	(ENTER permanently pressed)
MENU:KEY:ENTR:OFF	(ENTER released again)
MENU:KEY:MENU	(MENU key)

Syntax examples:

MENU:KEY:UP	(1x upwards arrow key)
0	

NOTE

Permanently pressing the ENTER key
The control is triggered in the **control signal** menu by keeping the ENTER key pressed on the front panel of the Type 4700B… instrument. The control is inactive once the key is released again.

This can also take place with the **MENU:KEY:ENTR:ON** command (**ENTER** key permanently pressed). The key is released again with **MENU:KEY:ENTR:OFF**

8.12.2 Defining the Menu Language (MENU:DISP:LANG)

MENU:DISP:LANG:GER
MENU:DISP:LANG:ENG
MENU:DISP:LANG:FRA
MENU:DISP:LANG<language>
MENU:DISP:LANG?

The menu language can be defined with this command group:

MENU:DISP:LANG:GER	German
MENU:DISP:LANG:ENG	English
MENU:DISP:LANG:FRA	French

It is also possible to define the language numerically with **MENU:DISP:LANG<language>**:

<language> =

0	German
1	English
2	French

The language is numerically determined with **MENU:DISP:LANG?**.

The selected language is immediately saved in the Type 4700B… instrument as nonvolatile.

8.12.3 Additional Measured Value Display (MENU:DISP:ADD)

An additional parameter can be displayed on the 4th line of the measurement mode. The following commands are available for this:

MENU:DISP:ADD:NONE	(no display)
MENU:DISP:ADD:TORQ:MIN	(min. torque)
MENU:DISP:ADD:TORQ:MAX	(max. torque)
MENU:DISP:ADD:SPE:MIN	(minimum speed)
MENU:DISP:ADD:SPE:MAX	(maximum speed)
MENU:DISP:ADD:ANG:MIN	(minimum angle)
MENU:DISP:ADD:ANG:MAX	(maximum angle)
MENU:DISP:ADD:COUN	(counter reading)
MENU:DISP:ADD:COUN:MIN	(min. counter reading)
MENU:DISP:ADD:COUN:MAX	(max. counter reading)
MENU:DISP:ADD:POW	(mechanical power)
MENU:DISP:ADD:POW:MIN	(minimum power)
MENU:DISP:ADD:POW:MAX	(maximum power)
MENU:DISP:ADD:LPFT	(torque low pass filter)

It is also possible to define the additional parameter as a numeric value (**MENU:DISP:ADD<additional>**):

<additional> =

0	no display
1	min. torque
2	max. torque
3	min. speed
4	max. speed
5	min. angle
6	max. angle
7	counter reading
8	min. counter reading
9	max. counter reading
10	mechanical power
11	min. power
12	max. power
13	torque low pass filter value

MENU:DISP:ADD? can be used to determine the parameters as a numerical value.

Syntax examples:

MENU:DISP:ADD:SPE:MAX	(max. speed)
0	
MENU:DISP:ADD?	
4	
MENU:DISP:ADD10	(mechanical power)
0	

8.12.4 Refreshing the Contents of the Display (MENU:DISP:RFRH)

MENU:DISP:RFRH

If configurations were made over the serial interface, these are only visible on the display when a key on the front panel is pressed or the **MENU:DISP:RFRH** command has been transferred to the Type 4700B… instrument.
It is enough to refresh the display just once at the end of the configuration settings.

Syntax examples:

SENS:UNIT:NM	(torque units in N□m)
0	
SENS:RANG100.0	(measurement range 100 N □m)
0	
MENU:DISP:RFRH	(display refreshed)
0	

8.12.5 Speed or Angle Parameters in Measurement Mode (MENU:DISP:SECN)

MENU:DISP:SECN:NONE
MENU:DISP:SECN:SPE
MENU:DISP:SECN:ANG
MENU:DISP:SECN<display>
MENU:DISP:SECN?

Alternatively, the speed parameter (**MENU:DISP:SECN:SPE**) or angle parameter (**MENU:DISP:SECN:ANG**) can be shown on the 2nd line of the display.

If neither of these parameter types should appear in the measurement mode, the **MENU:DISP:SECN:NONE** is responsible for this.

It is also possible to carry out the definition with **MENU:DISP:SECN<display>**:

<display> =

0	no parameter
1	speed

2 angle

MENU:DISP:SECN? can be used to determine the parameters as a numerical value.

Syntax examples:

MENU:DISP:SECN:SPE (speed in measurement mode)
0

8.12.6 Decimal Points for Torque/Force (MENU:DISP:DPT:TORQ)

MENU:DISP:DPT:TORQ<dpt>
MENU:DISP:DPT:TORQ?

The decimal points of the torque or force parameter of the nominal measurement range can be defined with **MENU:DISP:DPT:TORQ<dpt>**. The effects are visible in measurement mode.

<dpt> = {0|1|2|3|4}

No decimal places are defined for the torque or the force with **MENU:DISP:DPT:TORQ0**.

Syntax examples:

MENU:DISP:DPT:TORQ3 (3 decimal points)
0
MENU:DISP:DPT:TORQ?
3

8.12.7 Decimal Pts. of Torque/Force, 2nd Meas. Range (MENU:DISP:DPT:EXT:TORQ)

MENU:DISP:DPT:EXT:TORQ<dpt>
MENU:DISP:DPT:EXT:TORQ?

The decimal points of the torque or force parameter of the extended (i.e. smaller) measurement range can be defined with **MENU:DISP:DPT:EXT:TORQ<dpt>**. The effects are visible in measurement mode.

<dpt> = {0|1|2|3|4}

No decimal points are defined for the torque or the force with **MENU:DISP:DPT:EXT :TORQ0**.

Syntax examples:

MENU:DISP:DPT:EXT:TORQ3 (3 decimal points)
0
MENU:DISP:DPT:EXT:TORQ?
3

8.12.8 Decimal Points of Speed/Angle (MENU:DISP:DPT:SECN)

MENU:DISP:DPT:SECN<dpt>
MENU:DISP:DPT:SECN?

The decimal points of the speed or angle parameters can be defined with **MENU:DISP:DPT:SECN<dpt>**. The effects are visible in measurement mode.

<dpt> = {0|1|2|3|4}

No decimal points for the speed or the angle is defined with **MENU:DISP:DPT:SECN0**.

Syntax examples:

MENU:DISP:DPT:SECN2 (2 decimal points)
0
MENU:DISP:DPT:SECN?
2

8.12.9 Decimal Points of the Additional Display (MENU:DISP:DPT:ADD)

MENU:DISP:DPT:ADD:<source><dpt>
MENU:DISP:DPT:ADD:<source>?

The decimal points of the additional parameters on the 4th line of the measurement mode can be defined with **MENU:DISP:DPT:ADD:<source><dpt>**. The following parameters are influenced with this command:

<source> =

POW	mechanical power
TORQ	torque/force
COUN	counter reading

<dpt> = {0|1|2|3|4}

No decimal places for the additional parameters is defined with **MENU:DISP:DPT:ADD:<source>0**.

NOTE

Speed/Angle as additional parameters on the 4th line. The **MENU:DISP:DPT:SECN<dpt>** command is used for this.

Syntax examples:

MENU:DISP:DPT:ADD:POW2 (2 decimal points)
0
MENU:DISP:DPT:ADD:POW?
2

9. Technical Data

9.1 Power Connection Socket

Power connector type		EN/IEC 60320/C13
Supply voltage	VAC	100 … 240
Supply voltage tolerance	%	–10, +10
Power frequency	Hz	50 … 60
Power consumption	VA	≈50

9.2 Fuse

Type		IEC 60127-2
Dimension	mm	5 x 20
Current	mA	400
Voltage	V	250
Characteristic		Time-delayed / slow; high breaking capacity (H, with sand filling)
Reference source		Littelfuse 215.400P

9.3 Additional Data

General

Measuring rate	kHz	≤10
Limit frequency	kHz	≤1
Accuracy	% f.s.	<±0,05
Min./max. peak detection	ms	1
Reaction on threshold exceeding	ms	1
Operating temperature range (rated temperature range)	°C	10 … 40
Service temperature range	°C	0 … 40
Storage temperature range	°C	-10 … 70
Measured value storage		ring buffer for up to 5 000 measured values
Input power	VAC	100 ... 240
	Hz	50 ... 60
Housing material		Aluminum
Dimensions		
width	mm	260
height	HE	2
Weight	kg	≈2

Display

4x20 character-LC display	max. 7-digit per value
Keyboard	membrane keypad 7 keys
Menu language	German/English/French/Italian/Spanish

Sensor Inputs

Torque and force transducer strain gage full bridge 4-/6-conductor techniques	mV/V	0,5 ... 3,5
Supply	V	5 (50 mA)
Torque transducer	VDC	±5
	VDC	±10
Frequency	kHz	≤300
Supply	V	24 (500 mA)
Speed input	kHz	TTL ≤300
Angle of rotation input	kHz	TTL ≤300

Control Signals, Analog Output, Interface

8 digital logic I/O signal each		
output signal		open collector
input signal		TTL or 24 VDC
Analog output 1:		
torque/load	VDC	±10
with update rate	kHz	10
Analog output 2:		
torque/speed/angle	VDC	±10
with update ratek	Hz	1
Analog output 3:		
mechanical rating	VDC	±10
with update rate	kHz	1
Interface		USB 2.0 RS-232C
Communication port	kbps	≈115

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