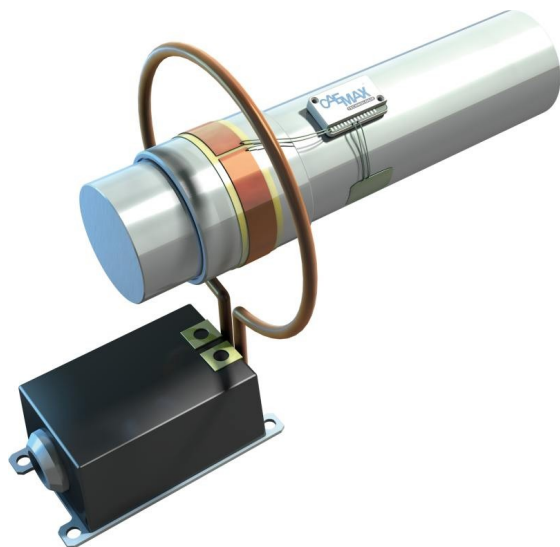


## Dx: Digital Multi-Channel Telemetry System



Instrumented shaft with signal conditioning and transmitter unit (SCT) and inductive power supply



Receiver, Control and Interface Unit (RCI)

For measurements with rotating objects, a telemetry system for wireless data transmission from the rotating device to a stationary receiver unit can be essential. With this telemetry system, a variety of measurement tasks can be performed - even with different number of channels and different channel assignment.

Due to the versatile combination of the modular system components, the setup of the whole Dx system is fast and convenient, as required for modern test engineering.

Up to 4 transmitters (SCTs) with several channels each can be operated with one receiver unit (RCI). The conditioned and digitized (16 bit) signals are then transmitted serially in the 868 MHz or 2.4 GHz band and are then available at the receiver as analog signals and CAN messages.

The power supply of the transmitters and data transmission are not coupled: The user can decide the appropriate type of power supply (battery or inductive).

The system is available in two variants:

- Dx Standard (868 MHz Band)
- Dx-HT (2.4 GHz Band respectively suited for high temperatures)

### Highlights

- Up to six analog inputs per transmitter unit: strain gauges, temperatures, analog signals, freely programmable
- Sampling rate up to 4.6 kHz (16 bit) per channel (Dx 868) respectively 5 kHz (Dx-HT)
- Synchronous data collection and processing from up to 4 transmitters (SCTs) with only one receiver unit
- Integrated standard interfaces: Analog, CAN and Ethernet
- Indication of measurement values in engineering units
- No authorization required for radio transmission
- Transmitter housing made of PEEK: heat and impact-resistant
- Plated-through soldering points
- Online monitoring of all measurement values and additional channels: transmitter temperature, power supply, signal strength

## Dx Transmitter unit (SCT)



Signal conditioning and transmitter unit (SCT)



Signal conditioning and transmitter unit (SCT) in IP67 housing

The Dx SCT contains signal processing and digitization units for up to 6 channels. Those channels can be strain gauges with bridge supply, thermocouples or voltage signals. Further additional channels (temperature, voltage supply, signal strength of the transmitter) are available. The integrated antenna transmits the digitized measurement values to the receiver unit. The devices can be supplied inductively or by battery.

### Overview of available variants

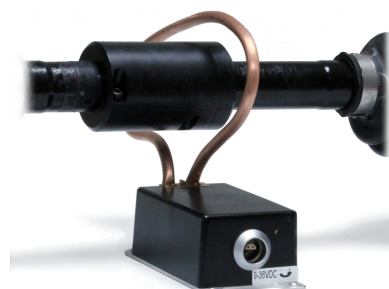
Order Code		article number
• H-TEL-CMX-DX-SCT-868	Dx signal conditioning and transmitter unit (SCT); 868 MHz band (863 - 870 MHz)	13600001
• H-TEL-CMX-DX-SCT-HT-2400	Dx signal conditioning and transmitter unit (SCT); High-temperature version up to 125 °C, 2.4 GHz band (2.40 - 2.48 GHz)	13600002
• H-TEL-CMX-DX-SCT-SA-868	Dx signal conditioning and transmitter unit (SCT) in IP67 housing with connection cable and mounting holes; 868 MHz band (863 - 870 MHz)	13600003
• H-TEL-CMX-DX-SCT-SA-2400	Dx signal conditioning and transmitter unit (SCT) in IP67 housing with connection cable and mounting holes; 2.4 GHz band (2.40 - 2.48 GHz)	13600029

### Optional accessories

#### Power supply components

• Batteries	Batteries for the SCT supply	upon request
• H-TEL-CMX-DX-SR	Ring Stator; inductive power supply via freely shapeable ring antenna	13600004
• H-TEL-CMX-DX-SR-HT	High-temperature version up to 125°C; inductive power supply via freely shapeable ring antenna	13610004
• H-TEL-CMX-DX-FS	Fixed Stator; inductive power supply via inductive head; IP 67; incl. 5 m connection cable	13600023

As data transmission and energy supply are separate with the Dx system, the ring stator can be mounted at any place along the axle. Due to a DC/DC converter integrated in the SCT transmitter, consistency of power supply is provided. Included in delivery is a 1 m copper pipe and a supply cable to banana plug for supply via an RCI. Alternative supply via any 9..32 VDC source.



- H-ZUB-CMX-TEL-KIT                      Secondary coil installation kit

13600005

As counter part for the ring stator a secondary induction coil has to be installed to the rotating shaft.

**Included accessories:** isolation tape, mu metal, copper band



### Housings to integrate SCTs

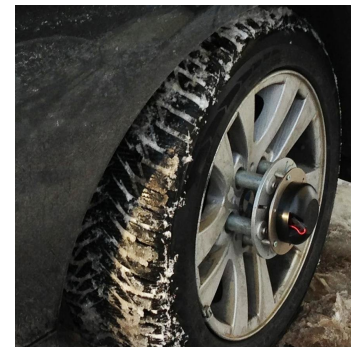
- H-TEL-CMX-DX-D1RI                      Shaft-mounted housing; inductive powered                      13600006

This type of housing consisting of 2 half shells to integrate one SCT transmitter unit, including secondary coil (inductive powered). Shaft diameter needed upon ordering; up to 50 mm shaft diameter possible (housings for diameter > 50 mm on request).

- H-TEL-CMX-DX-D1AI                      Shaft-end mounted housing; inductive power                      13600014
- Shaft-end mounted housing to integrate one SCT transmitter unit; including secondary coil (inductive powered).

- H-TEL-CMX-DX-D1AB                      Shaft-end mounted housing; Li-Ion battery                      13600007

Shaft-end mounted housing to integrate one SCT transmitter unit and Li-Ion battery for mounting on mounting adaptor for wheels (upon request, not included in delivery)



- H-TEL-CMX-DX-D1RB                      Shaft-mounted housing; Li-Ion battery

13600013

Shaft-mount-type housing consisting of **2 half shells** to integrate one SCT transmitter unit, Li-Ion battery. Shaft diameter needed upon ordering; up to 50 mm diameter possible (housings for diameter > 50 mm on request).

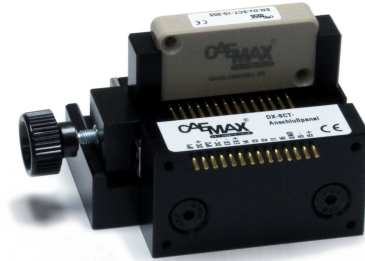
**Included accessories:** Li-Ion battery, protective cover for LEMO, LEMO plug, power adaptor with LEMO plug and a tube with sealant



### Further component

- H-TEL-CMX-DX-AP Configuration & testing panel for SCT 13600022

With the Dx connection panel, developed for convenient testing, the SCTs can be tested and programmed very quickly - without soldering.



### Optional service

- D-TEL-CMX-KAL-D1 Torque calibration on shaft 1,000 Nm 13600016  
Flat rate for the torque calibration up to 1,000 Nm for a shaft equipped with strain gauges and SCT (signal conditioning and transmitter unit) with calibration certificate and calibration log according to VDI/VDE 2646 8-step or continuous calibration left and right; two mounting positions (Attention: onetime additional charges for the mounting adaptor will apply)
- D-TEL-CMX-APP-1CH Strain gauge application on shaft 13600028  
Flat rate for equipping one shaft with strain gauges and signal conditioning and transmitter unit (SCT) for torque measurement, without calibration (without housing, without SCT).
- D-TEL-CMX-APP-1CH-KAL Strain gauge application and calibration 136000xx  
Flat rate for equipping one component with strain gauges and SCT (signal conditioning and transmitter unit) for torque measurement, (without housing, without SCT)  
Torque calibration up to 5,000 Nm with calibration certificate and calibration log according to VDI/VDE 2646 8-step or continuous calibration left and right; two mounting positions (Attention: onetime additional charges for the adapter will apply)
- D-TEL-CMX-KAL-D5 Torque calibration on shaft 5,000 Nm 13600030
- D-TEL-CMX-KAL-D10 Torque calibration on shaft 10,000 Nm 13600031  
Flat rate for the torque calibration up to 5,000 Nm or 10,000 Nm for a shaft equipped with strain gauges and SCT (signal conditioning and transmitter unit) with calibration certificate and calibration log according to VDI/VDE 2646.  
8-step or continuous calibration left and right; two mounting positions.  
(Attention: onetime additional charges for the mounting adaptor will apply)
- D-KAL-DX-SCT Calibration conditioning transmitter 13600033  
Flat rate for calibration and function test of one signal conditioning and transmitter unit (SCT) with calibration certificate.

## Dx Receiver unit (RCI)

Here, up to 4 transmitter units are synchronized and all measurement data are brought together. Due to two receiver antennas working in parallel (diversity mode) a high level of noise immunity is reached. For data output, 6 freely programmable analog outputs and a CAN interface are available.

### Overview of available variants

Order Code		article number
• H-TEL-CMX-DX-RCI-868	Receiver, Control and Interface unit (RCI) 868 MHz band (863 - 870 MHz) for 1360001, 1360003	13600010
• H-TEL-CMX-DX-RCI-HT-2400	Receiver, Control and Interface unit (RCI) 2.4 GHz band (2.40 - 2.48 GHz) for 1360002, 1360029	13600009

### Included accessories

- Ethernet cable
- Two telemetry antennas
- AC/DC power supply
- SD card (≥2 GB)
- Manual (on CD)

### Optional accessories

#### Antennas and satellite receivers as replacement for standard telemetry antennas

- |                            |  |          |
|----------------------------|--|----------|
| • TELE/CMX-DX-ANT-5m-868   | Dx flat antenna 868 MHz band<br>incl. 5 m cable, passive   | 13600008 |
| • H-TEL-CMX-DX-ANT-10m-868 | Dx flat antenna 868 MHz band<br>incl. cable 10 m, passive<br>Note: longer cable has more transmission loss | 13600018 |
| • H-TEL-CMX-DX-ANT-5m-2400 | Dx flat antenna 2.4 GHz band<br>incl. 5 m cable, passive   | 13600024 |

At hardly accessible measurement sites where the receiver can not be placed next to the transmitters, our water-proof (IP67) antennas, designed for outdoor application, may be helpful. Thus, distances of up to 10 m between receiver and transmitter can be spanned. (Note: you need two antennas for a diversity-mode)



- |                                |  |          |
|--------------------------------|--|----------|
| • H-TEL-CMX-DX-ANT-SPG-5m-868  | Dx antenna 868 MHz band for mounting on a<br>vehicle exterior mirror incl. 5 m cable | 13600017 |
| • H-TEL-CMX-DX-ANT-SPG-5m-2400 | Dx antenna 2.4 GHz band for mounting on a<br>vehicle exterior mirror incl. 5 m cable | 13600026 |

The passive vehicle antennas are attached to the wing mirrors of the vehicle by an elastic haltering system. (Note: you need two antennas for a diversity-mode)



- H-TEL-CMX-DX-ANT-RSU-10m-868      Satellite receiver 868 MHz band including signal amplifier (RSU); flat-antenna type with attached cable 10 m (digital transmission) other cable lengths upon request      13600019
- H-TEL-CMX-DX-ANT-RSU-10m-2400      Satellite receiver 2.4 GHz band including signal amplifier (RSU); flat-antenna type with attached cable 10 m (digital transmission) other cable lengths upon request (Only diversity-operation = 2 pieces necessary)      13600020

With bad transmission conditions due to reflections, shadowing etc., the standard antennas can be replaced by up to four satellite receivers.



- H-TEL-CMX-DX-RSU-YCAB      Y-cable for connection of 2 RSUs to one RCI satellite port      13600021

**Further components**

- H-TEL-CMX-DX-FRAME2      Mounting frame for one receiver unit      13500239  
Mounting frame for one receiver unit  
Optionally with protection cap for thumbwheel.



- H-ZUB-CMX-DX-CAS      Carrying case for Dx Telemetry System      13500236

The case can be used to carry:

- 1 RCI unit
- AC/DC power adaptor
- 4 SCTs
- 2 ring stators
- Antennas
- Connection cables



**Optional service**

- D-KAL-DX-RCI      Calibration Receiver, Control & Interface      13600032  
Flat rate for calibration and function test of one Receiver, Control and Interface unit (RCI) with calibration certificate.

## Technical Specs - Dx Transmitter unit (SCT)

Inputs for voltage signals in mV-range: 2 differential inputs or 4 single-end inputs		
Parameter	Value	Remarks
Measurement modes	full bridges half bridges thermocouple type J, K	up to 2 inputs up to 4 inputs up to 2 differential inputs (recommended) or up to 4 single-ended inputs
Input ranges Input voltages	$\pm 0.244$ mV/V to $\pm 1000$ mV/V $\pm 1$ mV to $\pm 4096$ mV	13 measurement ranges adjustable
Resolution	16 bit	
Accuracy	0.01% to 0.025% full scale	
Bridge supply	4.096 V (max. 40 mA)	short circuit proof; max. 2 full or 4 half bridges with 350 $\Omega$ max. 1 full or 2 half bridges with 120 $\Omega$
Antialiasing filter	Butterworth-characteristics 6th order, cut-off frequency 1/5 of sampling rate	

Inputs for voltage signals in V-range: 1 differential input and one single-ended input		
Parameter	Value	Remarks
Measurement mode	voltage measurement	one differential input and one single-ended input
Input range	$\pm 0.011$ V to $\pm 45.056$ V	13 measurement ranges adjustable
Resolution	16 bit	
Accuracy	0.01% full scale	
Antialiasing filter	Butterworth-characteristics 6th order, cut-off frequency 1/5 of sampling rate	

Additional channels		
Parameter	Value	Remarks
Voltage supply of SCT	measurement range 6 to 41.5 V	resolution 10 mV
Temperature of SCT	measurement range -30 °C to 100 °C measurement range -30 °C to 150 °C	resolution 0.034 °C Dx standard Dx HT

General		
Parameter	Value	Remarks
Power supply	inductive supply with ring stator or battery supply 8 V to 39 V	
Power consumption	<0.6 W	
Temperature range	-40 °C to +85 °C -40 °C to +125 °C	Dx standard Dx HT
Data transmission	data packages with error detection	
Transmission frequency	868 MHz 2.4 GHz	Dx standard Dx HT
Transmission power	max. +10 dBm	
Material of housing	PEEK	
Dimensions	45 x 25 x 10 mm	
Weight	approx. 14 g	

## Technical Specs - Dx Receiver unit (RCI)

Parameter	Value	Remarks
Power supply	9 to 36 V DC	
Power consumption	<5 W	
CAN output	CAN 2.0b, standard-and extended-identifiers, freely programmable up to max. 1 MBaud	according to ISO 11898, electrically isolated
Analog output	6 BNC-sockets	freely assignable to any signal, output max. $\pm 10$ V
Ethernet interface	10/100 Mbit for parametrization via web browser	
Autozero	remote controlled	optional
Transceiver	2 independent receivers operating in diversity mode	
Signal strength measurement of each SCT	-99 dB to -10 dB	resolution 8 bit
Synchronisation	synchronized sampling of 4 SCTs	
Temperature range	-20°C to +65°C	
Display	2.83 inch color display, 320 x 240 px	
Dimensions	170 x 130 x 53 mm	
Weight	approx. 0.8 kg	



The max. possible **sampling rate** of the system depends on the following parameters:

- number of SCTs
- max. number of channels per SCT.

The sampling rate is assigned to each channel of a Dx system. The additional channels *Reference Temp*, *RF\_Level* and *Supply Voltage* will be sampled with 25 Hz and will have no influence on the total aggregate sampling rate.

Sampling rates for the complete system (receiver with multiple transmitters)			
Number of		max. sampling rate per channel [Hz]	
SCTs	channels/SCT	Dx standard	Dx-HT
1	1	4600	5000
	2	2400	2400
	3	1600	1600
	4	1200	1200
	5	800	800
	6	800	800
2	1	3400	4000
	2	1800	2000
	3	1200	1200
	4	800	1000
	5	600	800
	6	600	600
3 or 4	1	1000	1200
	2	400	600
	3	200	400
	4	200	200
	5	200	200

### Power Consumption of the transmitter unit (SCT)

The power consumption of the SCT is, among other, mainly depends on the sensors connected (active / passive, strain gauge impedance), as well as from the used supply. A minimal voltage of 7 V is necessary to operate the SCTs.

