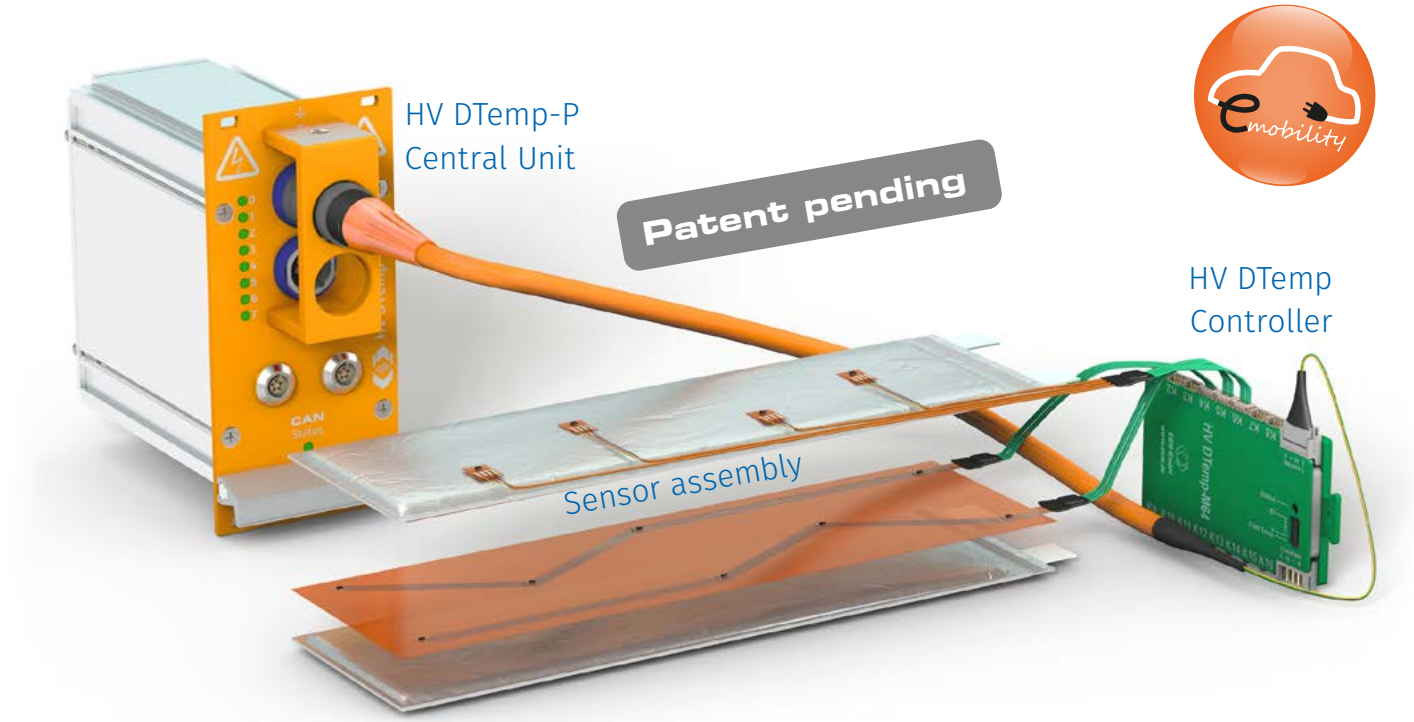
HV DTemp



System Description

The **HV DTemp measurement system** has been optimised to fulfil requirements that analogue measurement systems could not satisfy so far, particularly due to space constraints and a lack of interference resistance.

In mobile applications, the transmission of interference-sensitive analogue signals (e.g. thermal sensors) from an encapsulated HV environment proves to be difficult, especially when a high number of temperature measurement points is involved.

Thanks to a connection using only one digital cable to link the HV environment and the distributed control of up to 512 temperature measurement points, the HV DTemp measurement system is ideally suited for this purpose, in particular for the optimisation and validation of HV batteries in electric or hybrid vehicles.

Up to four temperature sensors are linked together to form an HV DTemp-4 sensor assembly. The sensors are either positioned individually on a flexible circuit or are jointly arranged on it.

Key features

CAN

HV-safe semiconductor temperature measurement system for use in confined compartments in electric vehicles, e.g. in HV batteries.

- ***Efficient acquisition of up to 512 temperature measurement points using one central unit to control the entire system***
- ***Only one connection cable from the HV environment to the CAN bus central unit***
- ***Miniaturized, extremely precise, robust and to a high degree interference resistant***
- ***Temperature sensors can be precisely positioned and flexibly applied, e.g. by using flexible circuits***
- ***HV-safe up to 1,000 V DC***

The design of the flexible circuit and the sensor positions can be chosen depending on the application. They can optionally be specified according to customer requirements.

The compact HV DTemp controllers are installed in a distributed manner in the HV environment. They provide the power supply for the temperature sensors and acquire up to 64 temperature signals in parallel.

At the HV DTemp-P central unit, up to eight of these HV DTemp controllers can be operated simultaneously using an internal digital measurement bus.

The power supply of all HV DTemp controllers and the transmission of the temperature measurement values from the HV environment to the HV DTemp-P central unit is performed via a single HV-safe connection cable. As a result, only one small opening is required which is why there are no issues regarding the tightness of the housing.

From the HV DTemp-P central unit to the measurement data acquisition system, the temperature measurement values are again transmitted through a single digital CAN bus cable, which also provides the power supply for all HV DTemp components.

The data transmission is performed in "free running" mode via CAN bus. The assignment of the measurement values to the corresponding CAN bus IDs is specified in a DBC file.

The DTEMPconfig software provides additional features for individual configuration, such as the selection and naming of temperature measurement points, the entry of comments, support of device firmware updates and the creation of configuration reports.

Further in-depth information can be found in our brochure **CSM HV DTemp Measurement System**.

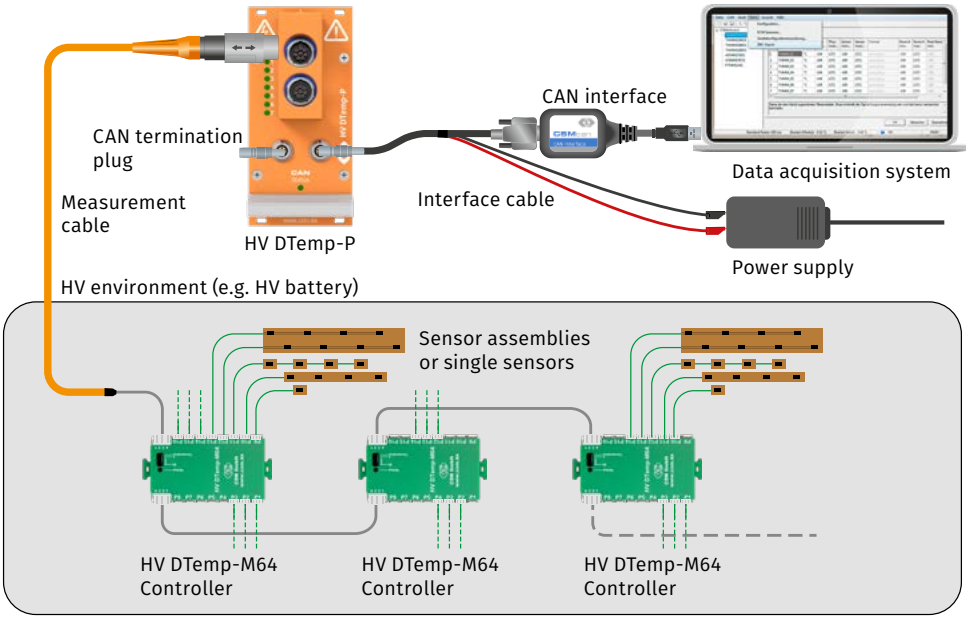


Fig. 1-1: HV DTemp measurement application

Technical Data

HV DTemp-P Central Unit

The HV DTemp-P central unit controls the entire system and is the core of every HV DTemp measurement setup. It is usually connected to the HV DTemp-Mx controllers, which are located in the HV compartment, using **a HV-safe cable**. If required, two galvanically isolated measurement chains equipped with various HV DTemp-Mx controllers can be operated from one HV DTemp-P central unit, e.g. if they are to be arranged independently of each other.

Function	control and power supply of the entire system, CAN bus user interface
Inputs	2 digital inputs for up to 8 controllers (512 measurement points) basic license: support of one HV DTemp controller

Field of application [1]	measurements in HV environments [2]
Operating voltages	up to 1,000 V DC
Routine test	test voltage [2] 3,100 V DC, performance of an isolation test at least every 12 months
Reinforced insulation [2]	
Input/input	1,000 V DC
Input/CAN	1,000 V DC
Input/power supply	1,000 V DC
Functional insulation	
CAN/power supply	designed for 12 V and 24 V supply voltages
CAN interfaces	CAN 2.0B (active), High Speed (ISO 11898-2:2016), 125 kBit/s to 1 MBit/s, up to 2 MBit/s with CSMcan interface
Configuration	specified via the supplied configuration document (DBC), or to be configured using the configuration software DTEMPconfig (optionally available), settings and configurations are stored in the module
LED indicators	
CAN	power/status
Measurement channels	status of the connected controllers
Power supply	
Minimum	6 V DC (-10 %)
Maximum	30 V DC (+10 %)
Power consumption	480 mW (without connected DTemp Mx modules)

Housing	aluminium with HV designation on the front-side (RAL2003)
Protection class	IP65
Ground connection	M6 threaded hole
Mounting	19 inch
Weight	approx. 500 g
Dimensions (w × h × d)	12 HP (approx. 61 mm) 3 U (approx. 129 mm) 100 mm (+ 25 mm protective bracket)
Connectors	
CAN/power supply	LEMO 0B, 5-pole, code G
Signal inputs	LEMO Redel 2P, 8-pole, code C (blue)
Operating and storage conditions	
Operating temperature range	-40 °C to +125 °C
Relative humidity	5 % to 95 % (non-condensing)
Operating altitude	max. 5,000 m above sea level
Pollution degree	3
Storage temperature	-40 °C to +125 °C
Conformity	CE
Device safety	EN 61010-1:2020 EN 61010-2-030:2020

[1] Please also read the CSM document "Safety Instructions HV DTemp“!

[2] EN 61010-1:2020 with EN 61010-2-030:2020

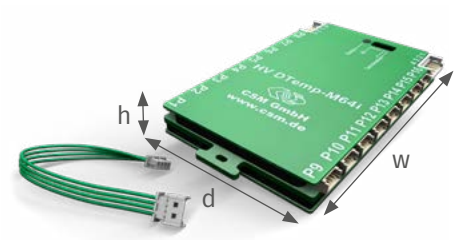
HV DTemp-Mx Controller

The HV DTemp-Mx controllers handle the addressing and power supply of the temperature sensors. The M series was introduced in order to connect semiconductor temperature sensors.

HV DTemp-Mx controllers are available as isolated and non-isolated versions, equipped with 8 or 16 ports. Depending on the controller version, up to four sensors can be connected per port. Up to eight HV DTEMP-Mx controllers can be connected to one HV DTemp-P central unit regardless of the type of controller, which allows up to 512 IC temperature sensors to be connected.

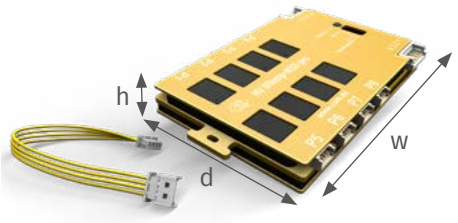
HV DTemp-M64i controller (isolated)

Function	control and grouping of up to 64 temperature measurement points
Dimensions (w × h × d)	approx. 88 mm × 10 mm × 56 mm approx. 100 mm × 10 mm × 56 mm (incl. mounting lugs)
Color	green
Inputs	16 digital ports per sensor assembly (with up to 4 sensors) sensor type: IC sensor
Measurement data rate/ send rate	1, 2, 5, 10, 20 Hz
Operating temperature range	-40 °C to +125 °C
Power supply	power supply via HV DTemp-P central unit
Galvanic isolation	
Port/bus	560 V DC
Port/power supply	560 V DC
Pollution degree	2
Routine test	test voltage[2] 840 V DC, performance of an isolation test at least every 12 months

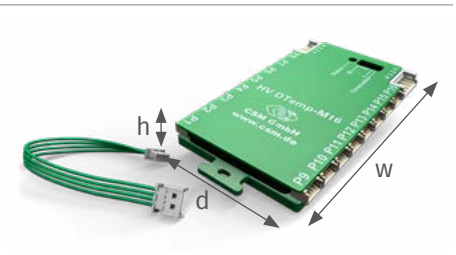


HV DTemp-M32i pro controller (isolated)

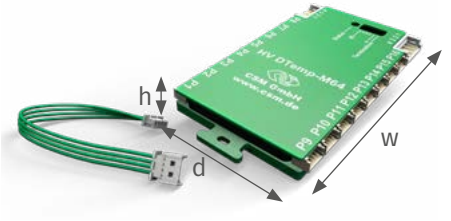
Function	control and grouping of up to 32 temperature measurement points
Dimensions (w × h × d)	approx. 80 mm × 10 mm × 56 mm approx. 92 mm × 10 mm × 56 mm (incl. mounting lugs)
Color	yellow
Inputs	8 digital ports per sensor assembly (with up to 4 sensors) sensor type: IC sensor
Measurement data rate/ send rate	1, 2, 5, 10, 20 Hz
Operating temperature range	-40 °C to +105 °C
Power supply	power supply via HV DTemp-P central unit
Galvanic isolation	
Port/bus	1,000 V DC
Port/power supply	1,000 V DC
Pollution degree	2
Routine test	test voltage[2] 1,500 V DC, performance of an isolation test at least every 12 months



HV DTemp-M16 controller

Function	control and grouping of up to 16 temperature measurement points	
Dimensions (w × h × d)	approx. 75 mm × 8 mm × 45 mm approx. 87 mm × 8 mm × 45 mm (incl. mounting lugs)	
Color	green	
Inputs	16 digital ports for one sensor each, sensor type: IC sensor	
Measurement data rate/ send rate	1, 2, 5, 10, 20 Hz	
Operating temperature range	-40 °C to +125 °C	
Power supply	power supply via HV DTemp-P central unit	
Pollution degree	2	

HV DTemp-M64 controller

Function	control and grouping of up to 64 temperature measurement points	
Dimensions (w × h × d)	approx. 75 mm × 8 mm × 45 mm approx. 87 mm × 8 mm × 45 mm (incl. mounting lugs)	
Color	green	
Inputs	16 digital ports per sensor assembly (with up to 4 sensors) sensor type: IC sensor	
Measurement data rate/ send rate	1, 2, 5, 10, 20 Hz	
Operating temperature range	-40 °C to +125 °C	
Power supply	power supply via HV DTemp-P central unit	
Pollution degree	2	

[1] Please also read the CSM document "Safety Instructions HV DTemp“!

[2] EN 61010-1:2020 with EN 61010-2-030:2020

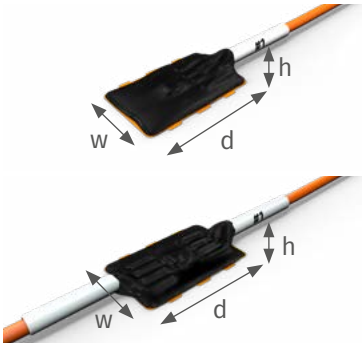
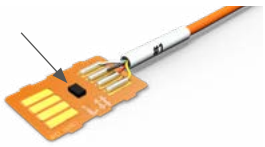
HV DTemp IC Sensors

For HV DTemp system, CSM offers various sensor types and sensor assemblies for temperature measurement. Different geometries can be used for this purpose:

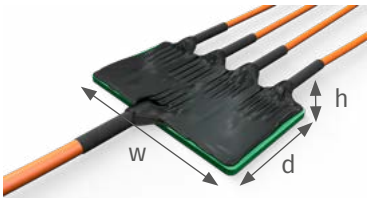
- Single sensors on flexible circuits with connection cable for direct connection to an HV DTemp controller
- Sensor assemblies consisting of up to four single sensors: connected to each other via connecting cables or by using a small distribution board
- Sensors on flexible circuits (connected to each other via printed conductors). The size and shape of the flexible circuits as well as the exact positions of the sensors is determined in accordance with the individual customer requirements.

Due to the flexibility of flexible circuits, the sensors can also be mounted on round cells.

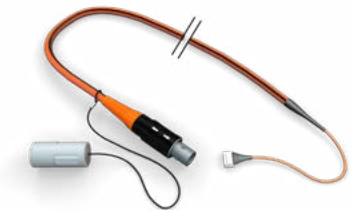
HV DTemp IC sensors (digital)

IC sensors on flexible circuits, potted	
Measurement range	-40 °C to +125 °C
Internal resolution	16 bit
Measuement uncertainty	max. ±0.1 °C (operating temperature -20 °C to +50 °C) max. ±0.15 °C (operating temperature -40 °C to +70 °C) max. ±0.2 °C (operating temperature -40 °C to +100 °C) max. ±0.25 °C (operating temperature -40 °C to +125 °C)
Calibration	calibrated by the manufacturer; metrological traceability according to NIST
Operating temperature range	-40 °C to +125 °C
Dimensions flexible circuit (w × h × d)	approx. 7 mm × 0.7 mm × 12 mm 
Dimensions sensor (w × h × d)	approx. 1.5 mm × 0.5 mm × 1 mm 

Connection cable IC sensors	The cable ends are soldered to solder pads on the flexible circuit and are also potted.
4-wire cable	
Assembly I	▸ four single wires AWG 28 with FEP (Teflon) sheath white, green, brown, yellow ▸ cable diameter of one wire: 0.7 mm ±0.1 mm ▸ incl. shield ▸ outer sheath FEP orange ▸ total cable diameter: 2.8 mm ±0.3 mm 
Assembly II	▸ four single wires AWG 36 with FEP (Teflon) sheath white, green, brown, yellow ▸ cable diameter of one wire: approx. 0.45 mm ▸ incl. shield ▸ outer sheath FEP orange ▸ total cable diameter: 1.6 mm ±0.3 mm 
1-wire cable	▸ singe wire AWG 36 with FEP (Teflon) sheath, green ▸ cable diameter: 0.42 mm ±0.05 mm
Lengths	The lengths are specified according to customer requirements
Contact protection	operating voltage up to 1,000 V DC at a temperature range from -20 °C to +130 °C

Sensor assemblies	sensor assemblies consisting of up to four single sensors: connected by means of a small distribution board or in series via connecting cables 
Dimensions distribution board (w × h × d)	approx. 30 mm × 2 mm × 17 mm 

HV DTemp Accessories

HV DTemp-P cable	connection cable between an HV DTemp-P central unit and an HV DTemp controller 
Diameter	7.2 mm ±0.2 mm
Color	orange
Contact protection	1,000 V DC

HV DTemp controller cable	connection cable between two HV DTemp controllers 
Diameter	2.8 mm ±0.3 mm
Color	orange
Contact protection	1,000 V DC (-20 °C to +130 °C)

License Model

The basic license allows the use of one HV DTemp-Mx controller (type can be freely selected) and is part of a HV DTemp-P central unit.

A license extension is required for the use of two, four or eight HV DTemp-Mx controllers at the corresponding HV DTemp-P central unit. With this extended license all HV DTemp Mx controllers can be used in any possible combination.

Product Overview

HV DTemp-P central unit		
ART1550100	HV DTemp-P central unit	TE12, R2P 8p, L0B 5p, CAN
Options		
ART1556000	HV DTemp-P optional	2 controllers
ART1556001	HV DTemp-P optional	4 controllers
ART1556002	HV DTemp-P optional	8 controllers
HV DTemp controller		
ART1551010	HV DTemp-M64i controller	WTB 4p, S4B 4p
ART1551011	HV DTemp-M32i pro controller	WTB 4p, S4B 4p
ART1551002	HV DTemp-M16 controller	WTB 4p, S4B 4p
ART1551000	HV DTemp-M64 controller	WTB 4p, S4B 4p
HV DTemp-P cable		
ART1552000	HV DTemp-P cable	CC, 2.5m, R2P 8p, S4B 4p
ART1552001	HV DTemp-P cable	CC, 5m, R2P 8p, S4B 4p
HV DTemp controller cable		
ART1553000	HV DTemp controller cable	CC, 0.5m, S4B 4p, S4B 4p
ART1553001	HV DTemp controller cable	CC, 1m, S4B 4p, S4B 4p
ART1553002	HV DTemp controller cable	CC, 2m, S4B 4p, S4B 4p
ART1553003	HV DTemp controller cable	CC, 2.5m, S4B 4p, S4B 4p
Sensors		
ART1554XXX	HV DTemp IC sensor	Customized
DTEMPconfig (config. software)		
ART1544001	DTEMPconfig	License

Shipping Content

- HV DTemp measurement system
- Configuration document (DBC)
- Documentation
- HV isolation test certificate for HV DTemp-P central unit
- HV isolation test certificate for isolated HV DTemp controller (Mxi/Mxi pro)

Maintenance

- HV isolation test according to EN 61010 at least every 12 months, see EN 61010 for scope of testing

Accessories (CAN)

- See "CAN Accessories" datasheet.

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