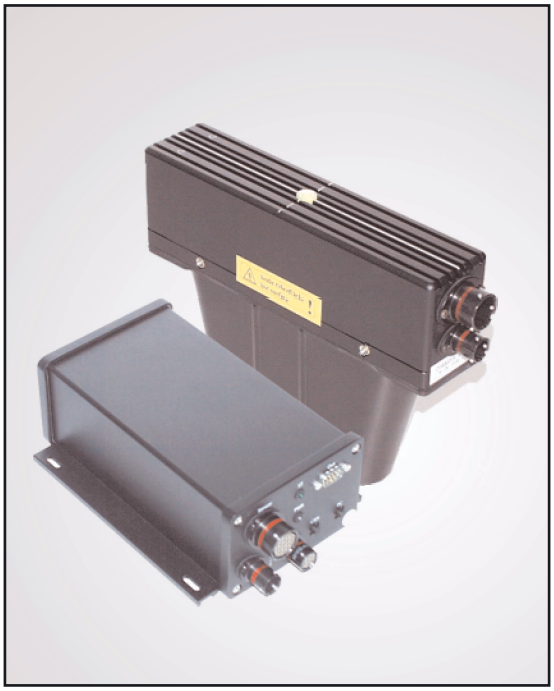
CORRSYS
DATRON
Sensorsysteme GmbH



CORREVIT® HS-CE™

Non-Contact Optical Sensor

for

slip-free measurement of longitudinal and transversal dynamics and height measurement at large operating ranges

USER MANUAL

Notes:

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General Information

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Revision

D003-50-02-04E 11/04

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Safety Instructions

Please read carefully before operating the equipment.

CORRSYS-DATRON is not responsible for damage that may occur when this system is used in any way other than that for which it is intended.

To assure safe and proper operation, all supplied equipment, components and/or accessories must be carefully transported and stored, as well as professionally installed and operated. Careful maintenance and usage in full accordance with operating instructions is imperative.

CORRSYS-DATRON equipment should be installed and operated only by qualified persons who are familiar with devices of this type.

Local regulations may not permit the operation of motor vehicles on public highways while the equipment is mounted on the exterior of the vehicle.

- Use the equipment only for intended applications. Improper application is not advised.
- Do not modify or change the equipment or its accessories in any way.
- Improper use or mounting of the equipment may affect the safety of the vehicle and/or occupants.
- The equipment must not be mounted and/or operated in any way that may compromise vehicle or and/or occupant safety.
- Equipment must be mounted firmly and securely.
- Use only original equipment, components and/or accessories included in the scope of delivery.
- Do not mount equipment, components and/or accessories near heat sources (e.g. exhaust).
- Do not use defective or damaged equipment, components and/or accessories .
- Always note correct pin assignments and operating voltages when connecting equipment to power supplies, data acquisition/evaluation systems, and/or any other applicable system or component. Equipment may be damaged if not properly connected and/or operated.
- For additional information, please call the CORRSYS-DATRON Hotline: ++49 (6441) 9282-82 or email: hotline@corrsys-datron.com.

Danger

- Use caution when exchanging sensor lamps – lamps are extremely hot, and may cause injury.
- Do not look into sensor lamps – lamps are extremely bright, and may cause eye injury.
- Sensor head can become very hot and may cause injury if power has been applied to the sensor for extended periods of time. This is especially true if the sensor is used in hot environmental conditions.

Warning

- The sensor and/or sensor components may be damaged if power is applied for extended periods, especially in hot environmental conditions.

- Disconnect power from the sensor if the vehicle is stationary for extended periods.

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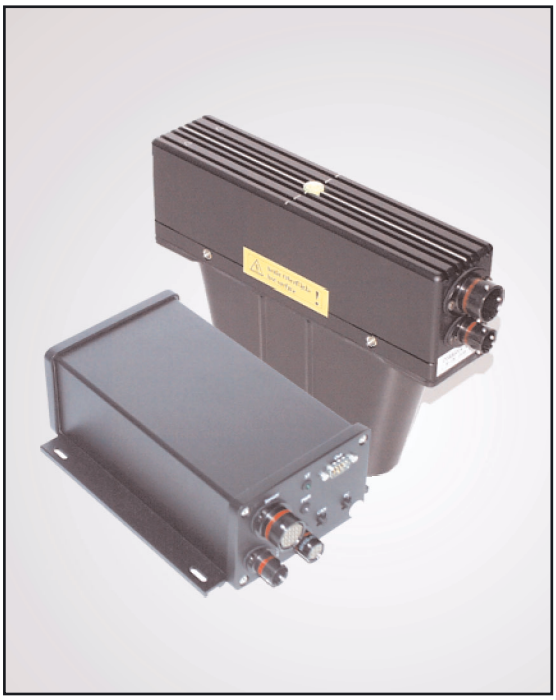
1. Overview



CORREVIT® HS-CE™

Non-Contact Optical Sensor

for

slip-free measurement of longitudinal and transversal dynamics and height measurement at large operating ranges

HS-CE longitudinal	**12787**
HS-CE transversal	**11322**

The CORREVIT® HS-CE Sensor measures the distance between the vehicle and the road surface, as well as longitudinal speed or vectorial velocity, transverse speed, and calculated drift angle.

Measurement values are provided as analog signals, ensuring that the sensor system can be connected to virtually any data acquisition system. Longitudinal, distance, and frequency-modulated signals of the measured angle or transverse speed are also available as digital outputs. CAN outputs for connection to data acquisition are also a standard feature.

The sensor is configured with the included CeCalWin Software Package using a PC, connected via standard serial interface.

Features

- Extended operating range of 400 mm ±130 mm.
- Velocity range from 0.5 kph to 350 kph.
- Programmable standardized analog and digital signal outputs using the latest processor techniques
- Fast, easy set-up and calibration with the included CeCalWin Software Package.
- Any required measurement quantity available.
- Easy operation, mounting angle correction and direct connection to PC or other evaluation systems.
- Negligible service and maintenance requirements.
- Tested and used under extreme environmental conditions.

Applications

The CORREVIT® HS-CE Sensor is designed for use in dynamic vehicle testing applications that require highly accurate measurement of the following variables:

- Ride height
- Distance traveled
- Speed
- Longitudinal and transversal speed
- Drift angle

2. Extend of Delivery

Item	Qty.	Description
1.	(1)	HS-CE Sensor
2.	(1)	HS-CE Electronics Box
3.	(1)	Power Cable #K003-16N-12-2m
4.	(1)	Sensor to Electronics Power Cable #K003-16N-10-5m
5.	(1)	Sensor to Electronics Box Cable #K003-1J2-11-5m
6.	(1)	RS232 Serial Communication Cable #K003-15N-11-2m
7.	(1)	CAN Bus Interface Cable #K003-14N-11-2m
8.	(1)	Signal Output to 5 BNC Adapter Cable #K003-592-11-1m
9.	(1)	Signal Output to 1 BNC Adapter Cable #K008-192-10-1m
	(1)	CAN Termination Resistor Plug #K003-04N-10
10.	(2)	Halogen Lamp, 35 watt, 12V, 10°
11.	(6)	Bolts (for mounting hardware)
12.	(2)	Thumb Screws (for mounting hardware)
13.	(1)	CD-ROM with CeCalWin Software and User Manual
	(1)	Calibration Certificate ISO 9000++

Options/Accessories

- Suction Mounting Hardware
- Transport Case
- German Calibration Service Certificate (Livingston / DKD)
- Replacement Halogen Lamp 35 watt, 12V, 10°

About replacement halogen lamps

To assure optimal sensor function, use only original-equipment lamps from CORRSYS-DATRON. These lamps are specially designed and treated to withstand the demands of dynamic vehicle testing.

3. Technical Data

3.1 Specifications

Performance Specifications

Speed range:	0.5 ... 350 kph
Height measurement range:	1.5 ... 350 kph
Distance resolution:	1.9 mm
Measurement deviation - permissible variation*:	
Working range ±100 mm:	<±0.1%
Working range ±100 ... ±130 mm:	<±0,5%
Angle range:	±40°
Angle resolution :	<±0.1°
Working distance and range:	400 ± 130 mm
Height measurement resolution:	0.15 mm
Height measurement accuracy**:	±0.5 mm (±0.1% of full scale of the maximum working range - 530 mm)

Electronic Connector Output 1

Digital output 1 - distance IVI or V_L:	1 ... 1000 pulses/m
Digital output 2 - switchable:	Output as frequency
- Frequency modulated angle or transversal speed:	f center = 5 kHz
Analog output 1 - magnitude speed IVI or longitudinal speed V_L:	0 ... 10 V
Analog output 2 - transversal speed V_q:	-10 ... +10 V
Analog output 3 - angle β:	-10 ... +10 V

Electronic Connector Output 2

Analog output 1 - pitch γ (if used as part of the P&R System):	-10 ... +10 V
Analog output 2 - height h:	-10 ... +10 V
Analog output 3 - roll φ (if used as part of the P&R System):	-10 ... +10 V

CAN Bus: CAN V2.0B

System Specifications

Power requirement		11.5 ... 14.5 V; 80 W (12 V DC)
Temperature range	Operation:	- 25 ... 50° C
	Storage:	- 40 ... 85° C
	Relative Humidity:	5 ... 80% non condensing
System protection of the sensor:		IP 67
Dimensions of the sensor (l x w x h):		247 x 52 x 171 mm
Weight:		1350 g
Dimensions of the electronics (l x w x h):		212 x 144 x 76 mm
Weight:		1200 g
Shock:		50 g half-sine, 6 ms
Vibration:		10 g, 10 ... 150 Hz

A serial interface on each of the sensor electronics enables connection to PC for automatic sensor identification, set-up and function control.

* with calibration on the test surface
** with calibration on the test surface at 50 kph

3.2 Pin Assignments

3.2.1 Pin Assignment: Electronic Output 1

Cable: 9-Pin D-SUB to 5 BNC (#K003-592-11-1m)

D-SUB	Signal	Measurement Value	BNC
Pin 1	Analog 1	magnitude speed IVI, or longitudinal speed V_L	ANA1
Pin 2	Analog 2	transversal speed Vq	ANA2
Pin 3	Analog 3	angle β	ANA3
Pin 4	Analog GND		
Pin 5	n.c.		
Pin 6	n.c.		
Pin 7	Digital 1	longitudinal distance V_L, or magnitude distance IVI (pulses/m)	DIG1
Pin 8	Digital 2	angle β, or transversal speed Vq (frequency modulated)	DIG2
Pin 9	Digital GND		

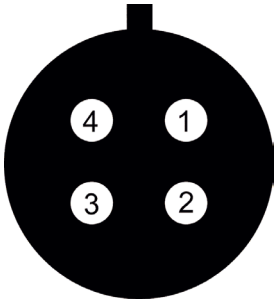
3.2.2 Pin Assignment: Electronic Output 2

Cable: 9-Pin D-SUB to 1 BNC (#K008-192-10-1m)

D-SUB	Signal	Measurement Value	BNC
Pin 1	Analog 1	pitch γ (when used with complete Pitch & Roll System)	ANA1
Pin 2	Analog 2	height h	ANA2
Pin 3	Analog 3	roll φ (when used with complete Pitch & Roll System)	ANA3
Pin 4	Analog GND		
Pin 5	n.c.		
Pin 6	n.c.		
Pin 7	n.c.		
Pin 8	n.c.		
Pin 9	n.c.		

3.2.3 Pin Assignment: CAN Bus Outputs (2 Connectors)

Cable: 4-pin CAN to 9-pin D-SUB (#K003-14N-11-2m)



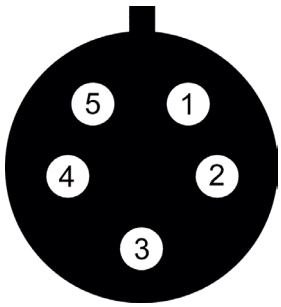
CAN connector	
Pin 1:	CAN High
Pin 2:	CAN Low
Pin 3:	n.c. (do not connect to this pin)
Pin 4:	n.c. (do not connect to this pin)
D-SUB connector	
Pin 7 - CAN High	
Pin 2 - CAN Low	

CAN output pins are connected in parallel.

NOTE: The HS-CE electronic is not equipped with a termination resistor!
If the HS-CE electronic is not connected two H-CE electronics as part of the Pitch & Roll System, plug the supplied 120 Ω termination resistor (#K003-04N-10) into the unused CAN output.

3.2.4 Pin Assignment: PC (RS 232) Outputs

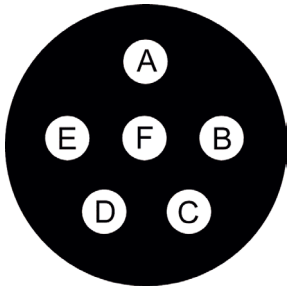
Cable: 5-pin RS-232 to 9-pin D-SUB (#K003-15N-11-2m)



RS-232 connector	
Pin 1:	TXD
Pin 2:	RXD
Pin 3:	Digital GND
Pin 4:	n.c. (do not connect to this pin)
Pin 5:	n.c. (do not connect to this pin)
D-SUB connector	
Pin 2 - TXD	
Pin 3 - RXD	
Pin 5 - Digital GND	

3.2.5 Pin Assignment: Power Connectors

Cable: 6-pin to 2 banana plugs (#K003-16N-12-2m), electronic to power supply
Cable: 6-pin to 6-pin (#K003-16N-10-5m), electronic to sensor



MIL Connector
06 10-98SN

5-pin MIL connectors	
Pins A, B, C:	Power (+12 V)
Pins D, E, F:	GND (0 V)
Banana plugs	
Red:	Power (+12 V)
Black:	GND (0 V)

3.3 Default Settings for Analog and Digital Outputs

3.3.1 Analog Output Default Settings

Electronic Output 1

Analog channel 1	25	$\frac{mV}{kph}$	Magnitude speed |V|
Analog channel 2	100	$\frac{mV}{kph}$	Transverse speed Vq
Analog channel 3	100	$\frac{mV}{°}$	Angle β

Electronic Output 2

Analog channel 1	25	$\frac{V}{°}$	Pitch γ (P+R System only)
Analog channel 2	50	$\frac{mV}{mm}$	Height
Analog channel 3	100	$\frac{mV}{°}$	Roll φ (P+R System only)

The above settings produce the following values:
100 kph = 2.5 V
200 kph = 5.0 V
300 kph = 7.5 V
400 kph = 10.0 V

With a setting of 25 mV/km/h for magnitude speed |V|, a maximum speed of 400 kph can be achieved.

All signals can be used as inputs to all common data acquisition systems.
Should any problems arise, please contact CORRSYS-DATRON.

For analog signal representation of speed, the voltage scale may be changed to between 10 and 500 mV/kph.

Use CeCalWin to change the settings.

3.3.2 Digital Output Default Settings

Calibrated CORREVIT® HS-CE sensors generate 50% duty cycle pulses on both digital outputs. Digital 1 provides a specified number of digital pulses per meter. Digital 2 supplies a frequency modulated signal for either transversal speed (default 5 kHz ± 100Hz/kph) or slip angle (default 5 kHz ± 50 Hz/deg).

Digital channel 1	340	$\frac{pulses}{m}$	Longitudinal distance (output as pulses)
Digital channel 2	50	$\frac{Hz}{°}$	Angle (output as frequency)

Use CeCalWin to change the settings.

3.4 Internal Signal Filtering

Signals may be smoothed using a moving average filter, which can be set to different time values. Note that signal detail and dynamics will decrease as the signal becomes increasingly smooth.

3.4.1 Filter Values for Speed and Slip Angle Output

- 8 ms
- 16 ms
- 32 ms
- 64 ms
- 128 ms (default setting)
- 256 ms
- 508 ms

increased signal detail and dynamics (as well as noise)
minimum signal delay

smoothest signal
maximum signal delay

Use CeCalWin to change filter settings.

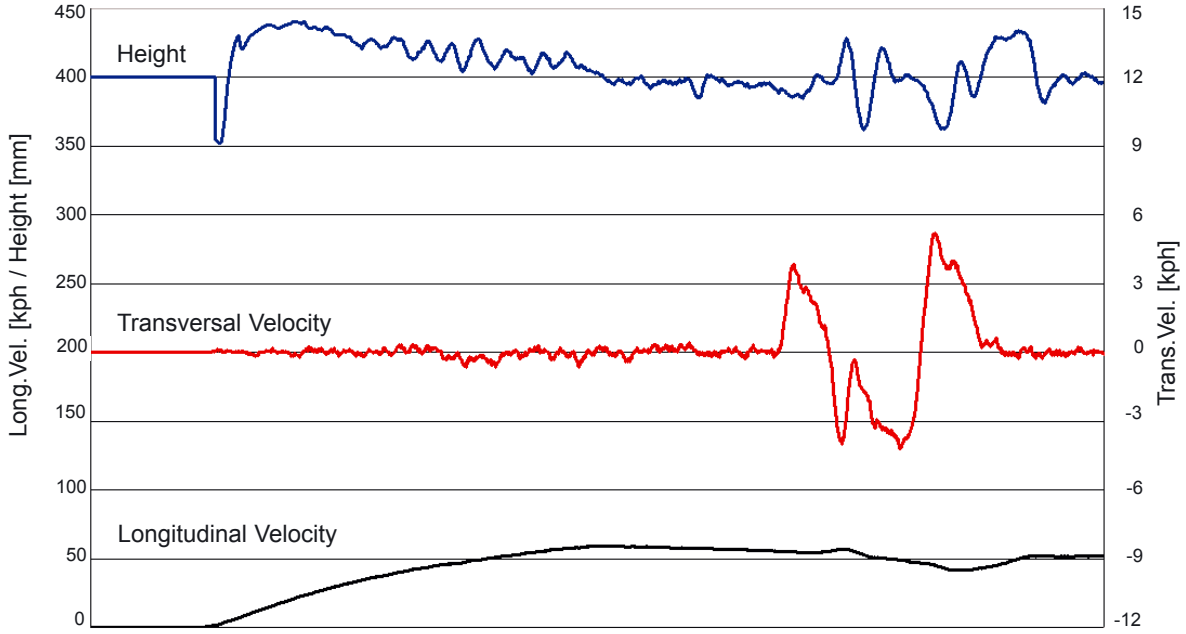
3.4.2 Filter Values for Height Output

The height signal is internally filtered.
Filter time is speed dependent and cannot be adjusted.

Speed Range [kph]	f_{3db} [Hz]
v < 3	1.5
v < 20	2
v < 31	5
v < 37.5	7.5
v < 43	10
v < 50	12.5
v < 100	15
v > 100	30

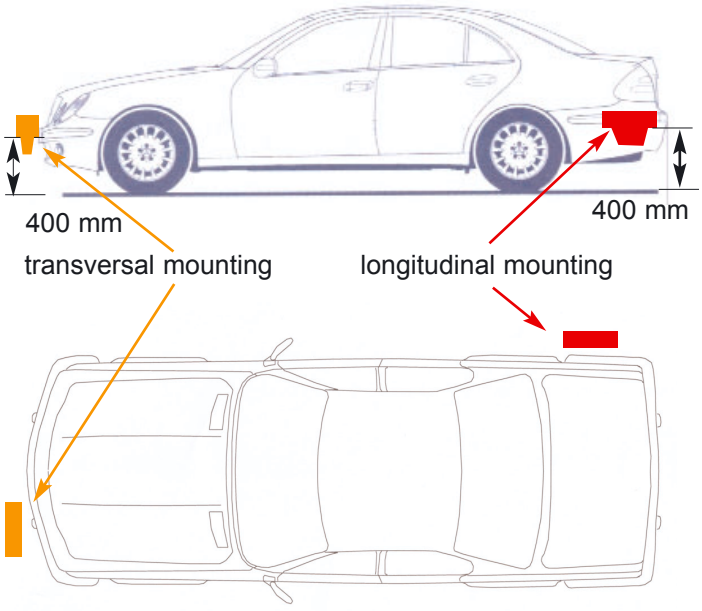
3.6 Typical Data Plot

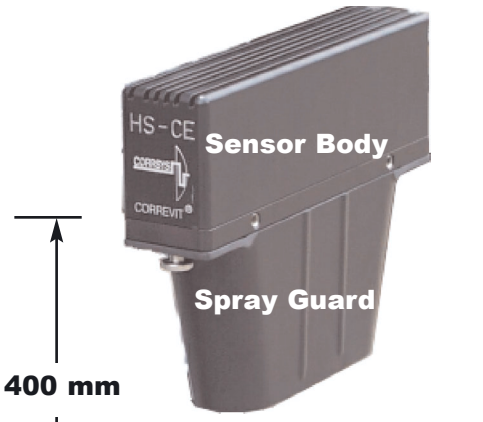
Height, Transversal Velocity & Longitudinal Velocity



4. Set-up and Connection

4.1. Mounting options

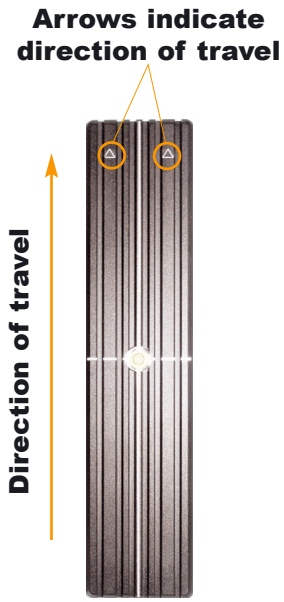


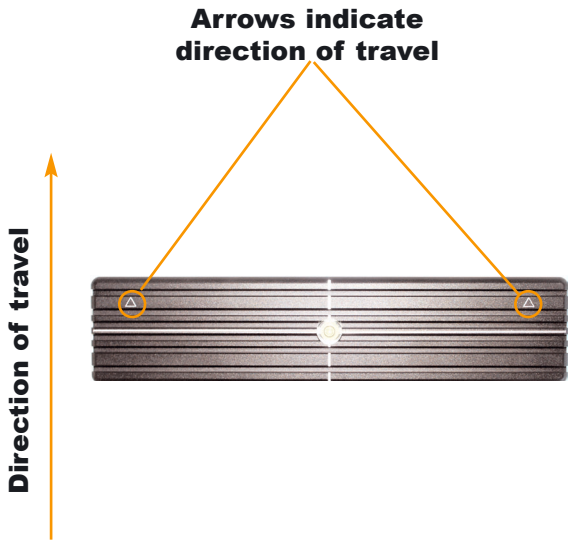


The mounting distance from the lower surface of the sensor body (not including the spray guard) to the road surface must be 400 mm.

4.2 Sensor orientation

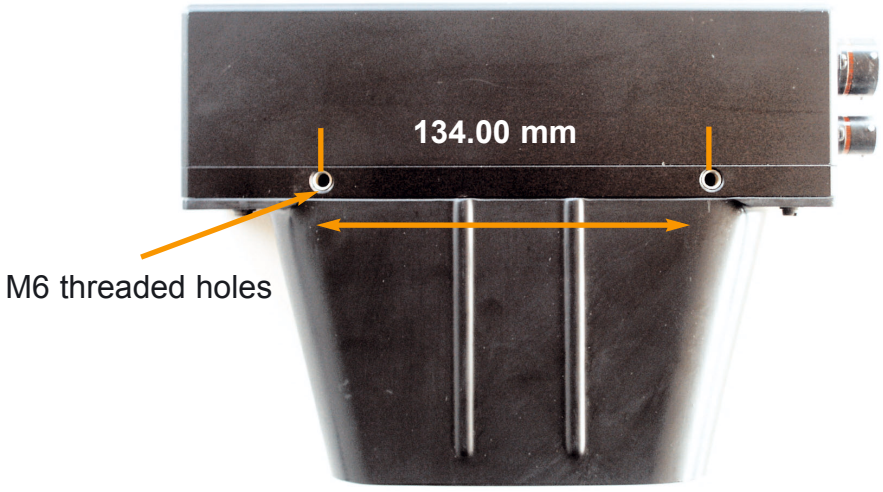
The sensor must be mounted in the orientation indicated by the arrows imprinted on the top (sensors may be ordered with either longitudinal or transversal orientation). Care should be taken to assure that the plane of the sensor orientation is closely aligned to the direction of travel.





Notice:
In wet or snowy conditions, do not mount sensors directly behind the rear wheels. This will help to prevent measurement anomalies that can be caused by spray and/or blowing snow.

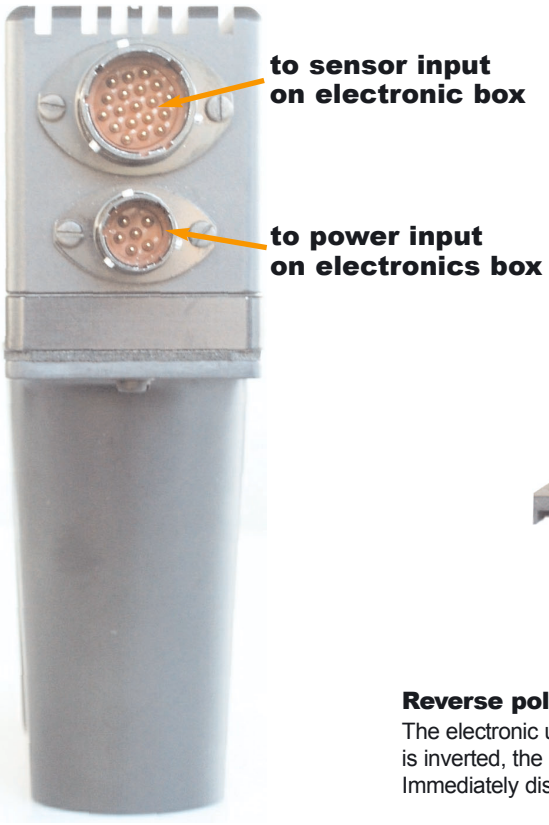
4.3 Sensor mounting jig



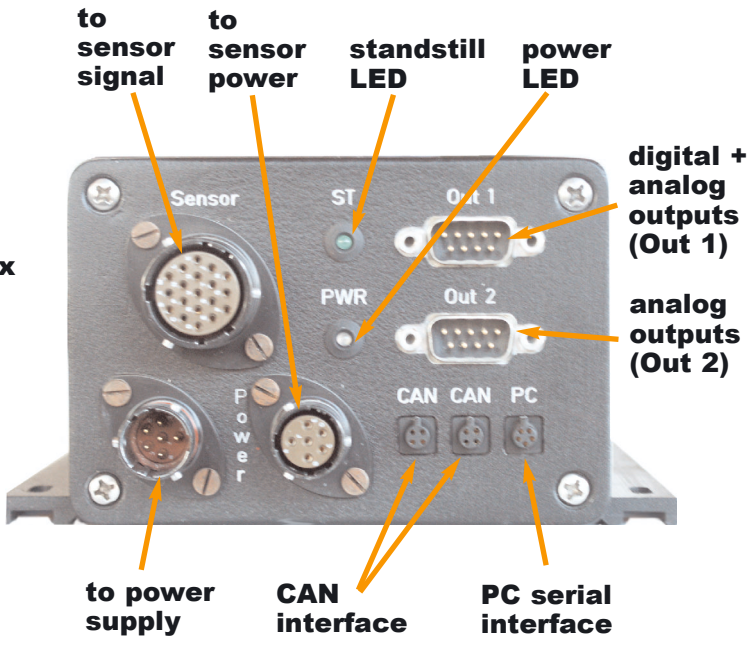
Caution:
For proper sensor mounting, use only M6 screws with a maximum thread engagement depth of 10 mm. The use of screws with thread engagement depths of greater than 10 mm can damage the sensor housing and will void the warranty!

4.4 Connecting the Sensor

Sensor Connections



Sensor Electronic Connections



Reverse polarity protection
The electronic unit is equipped with reverse polarity protection. In the event that polarity is inverted, the unit will not be damaged but the power LED will illuminate red! Immediately disconnect power from the unit and correct the power supply connection.

1. Connect the sensor to the electronic unit:

   NOTE: For easier connection, connect power cable to sensor before connecting signal cables.

   a) Connect the power input on the sensor to the power output on the electronic with 6-pin to 6-pin cable #K003-16N-10-5m.

   b) Connect signal output on the sensor to the signal input on the electronic with cable #K003-1J2-11-5m.

2. Connect the electronic to data acquisition.

   a) Connect HS-CE electronic Output 1 to data acquisition with 9-Pin D-SUB to 5 BNC cable #K003-592-11-1m.

   b) Connect HS-CE electronic Output 2 to data acquisition with 9-Pin D-SUB to 1 BNC cable #K008-192-12-1m.

   c) Connect HS-CE CAN connector to data acquisition with 4-pin CAN to 9-pin D-SUB cable #K003-14N-11-2m

   NOTE: The HS-CE electronic is not equipped with a termination resistor!
   If the HS-CE electronic is not connected to two H-CE electronics as part of a Pitch & Roll System, plug the supplied 120 Ω termination resistor (#K003-04N-10) into the unused CAN output.

3. Connect the power cable from the electronic to a CORRSYS-DATRON power distribution unit with cable #K003-16N-12-2m (6-pin to 2 banana plugs).

4. Be sure that the individual switches on each power output circuit on the power distribution unit are in the "OFF" position.

5. Start the vehicle engine and carefully connect the power distribution unit to the vehicle power supply.

6. Switch the power circuit on to send power to the sensor electronics boxes.

7. The sensor is now ready for set-up and calibration using CeCalWin Software. Connect the RS (RS 232) PC output on the electronic to a PC operating CeCalWin (see **Using the CeCalWin Software Package** for complete details). Use the 5-pin RS-232 to 9-pin D-SUB serial communication cable (#K003-15N-11-2m) to make the connection between electronic and PC.

5. Troubleshooting

When troubleshooting the HS-CE Sensor, begin by checking the following:

Cables and power supply

- Check all connections to determine that each is complete and that the system is connected to a power supply that provides voltage output within the specified range.
- Check to determine that the correct cables have been used for all connections.
- The following problems can be caused by incorrect or incomplete cable connections and/or connection to incorrect power supply voltage:
  - Output signals are not available to data acquisition and/or connected PC.
  - The sensor will not go out of standstill mode with vehicle motion.
  - Velocity and angle outputs appear to be correct, but the height signal seems incorrect or is not available.

Status LED's on sensor electronic

- If all connections are correct and no faults are present, the "PWR" (power) LED on the sensor electronic will be illuminated orange. If the "PWR" LED is red, a fault is indicated. Additionally, the green "ST" (standstill) LED will be illuminated if all connections are correct and no faults are present.
- If the "PWR" LED is red and the green "ST" LED is not illuminated, polarity has been reversed and must be corrected.
- If the "PWR" LED is orange and the green "ST" LED is not illuminated, cables may have been connected incorrectly. Check and reconnect cables as necessary.

Lamps

Check to be sure that both lamps in the sensor are illuminated. Check and replace lamps as necessary. Also be sure that connections and supply voltage are correct.

Sensor orientation

- The sensor is delivered with a user-specified operating orientation, which is indicated by arrows located on the top surface of the sensor housing. Sensors must be mounted with the arrows pointing in the direction of travel.
- Incorrect sensor orientation will cause all output signals to be incorrect.
- The height signal will not be correct when the vehicle is moving in reverse.

Operating range

If the sensor is mounted out of the recommended height range (standoff distance), it may not go out of standstill mode with vehicle motion, and no measurement signals will be output. Check and correct mounting as necessary.

Sensor lens

The sensor lens (located on the underside of the sensor housing) may occasionally become dirty, preventing proper operation. Check and clean the sensor lens regularly.

Software

- If one or more output signals appear to be incorrect, the sensor may have been set-up incorrectly via CeCalWin Software. Check all relevant settings in CeCalWin:
  - All analog voltage settings must be within range and should be conforme with the data acquisition system settings to which they are connected.
  - All digital pulse and resolution settings must be set within range and should be be conforme with the data acquisition system settings to which they are connected.
  - Check all offset values and recalibrate sensor(s) as necessary.

- If no output signals are available and all connections are correct, use the CeCalWin Test Function to determine that all outputs are fully operational. See Section 6, **Using the CeCalWin Software** Package for complete details.

- CeDapWin, an additional software package available from CORRSYS-DATRON, enables real-time monitoring of height, speed and other relevant signals with a laptop. CeDapWin can be useful for detecting errors in the measurement set-up. Contact your CORRSYS-DATRON sales office for details about obtaining CeDapWin.

Environmental conditions

The sensor may occasionally interpret heavy spray from snow or water as part of the road or track surface, producing unexplained spikes in the output signals and/or other anomalous measurement artifacts. Sensors should be mounted away from the heaviest spray areas, especially directly behind the rear wheels.

EMC interference

If the sensor starts to send output signals without vehicle motion, triggering may have been caused by excessive EMC interference from the test vehicle. To correct this condition, reset the sensor by disconnecting from power and then re-connecting, or by switching power off and then back on at the power distribution box. If the condition persists, disconnect sensor from vehicle ground and isolate them at all mounting points

If none of the above recommendations provides a solution, you may wish to contact CORRSYS-DATRON. Before doing so, please be ready to supply the following:

- A .ccw file saved from CeCalWin software to serve as an example of the problem or fault condition.

- A list of all outputs that appear to be problematic, i.e. analog, digital, CAN, RS-232.

- The serial numbers of all relevant components.

Troubleshooting CAN

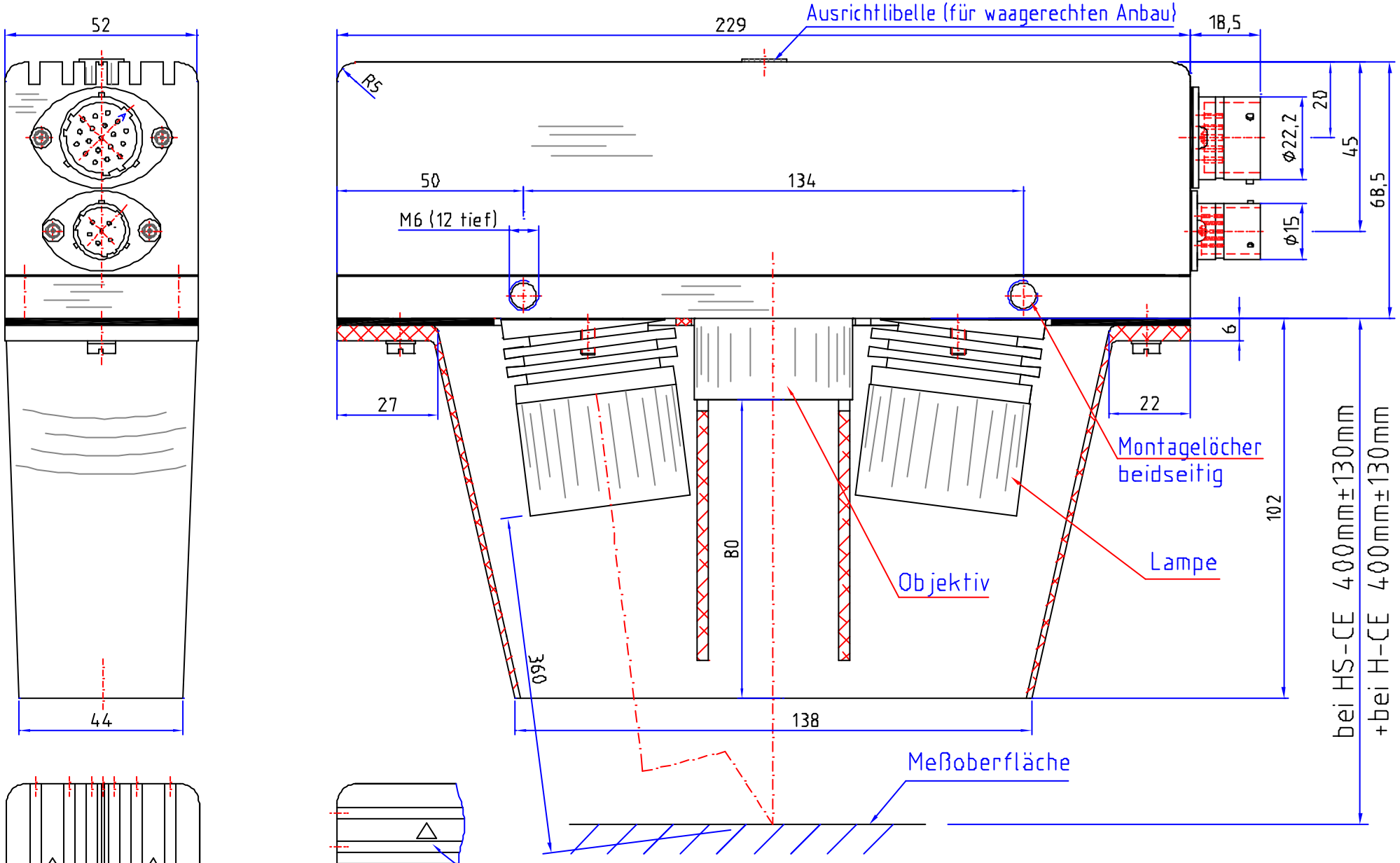
Problem: There are no messages on the CAN-bus
Check to be sure that:
- the electronic has power
- data acquisition is connected to the sensor electronic
- the correct send mode is selected
- data acquisition system and sensor electronics use the same settings for baud rate, CAN identifiers and identifier types
- if you use CANalyser or a data acquisition system with an acceptance filter, be sure the messages from the sensor are not disabled

Problem: Data received via the CAN bus appear to be incorrect
Please be sure that:
- the data acquisition system uses Intel data format for communication via CAN-bus
- the data acquisition system and sensor electronic use the same settings for the type of measured value (signed or unsigned, number of bits)

For more information about data types and how they apply to this Sensor, see the **CAN Protocol** document located in the Appendix of this manual.

CORRSYS-DATRON recommends that the .dbc file option be used to avoid problems with false data types or bit lengths. Sensor-specific .dbc files are available for download at www.corrsys-datron.com, or may also be obtained by contacting the CORRSYS-DATRON application department directly.

Problem: No height information is available on the CAN-bus.
Please be sure that:
- the electronic has power
- the electronic is connected to the sensor
- the data acquisition system uses the same settings as the sensor



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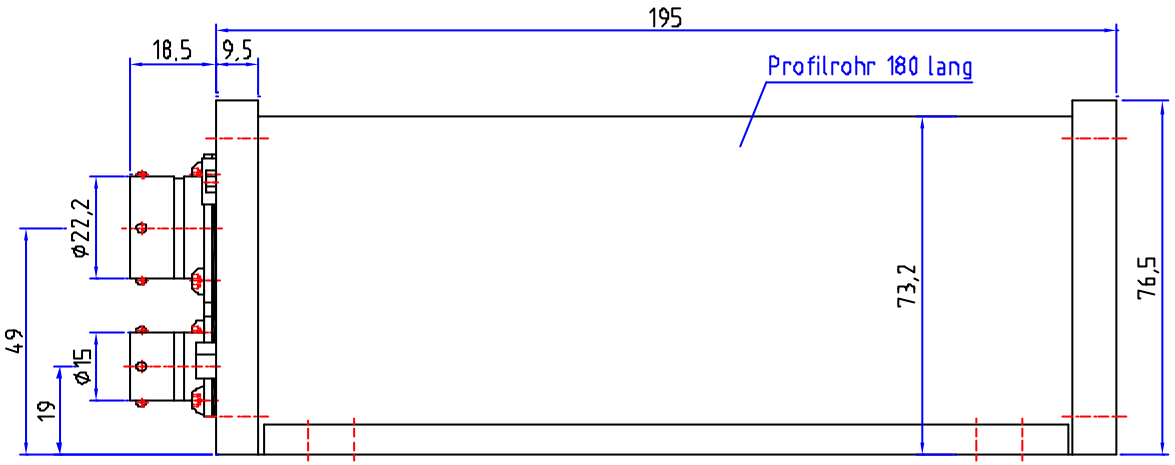
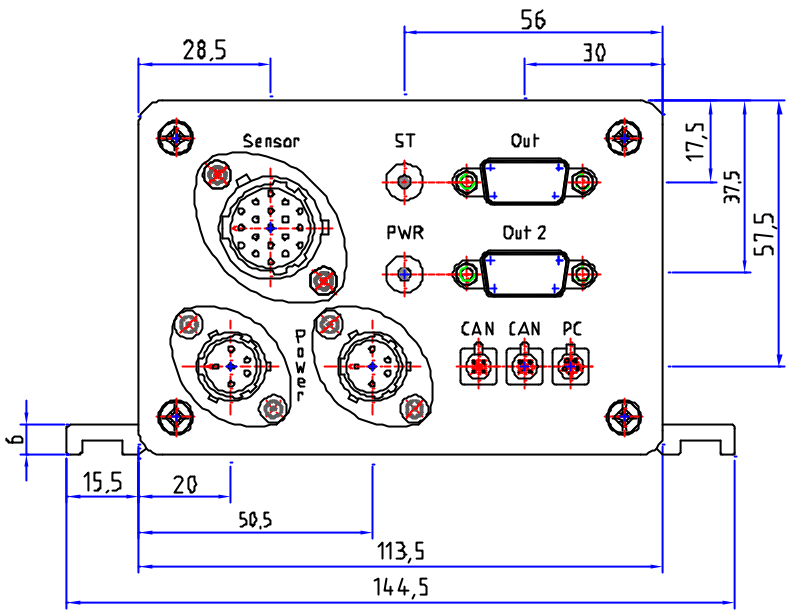
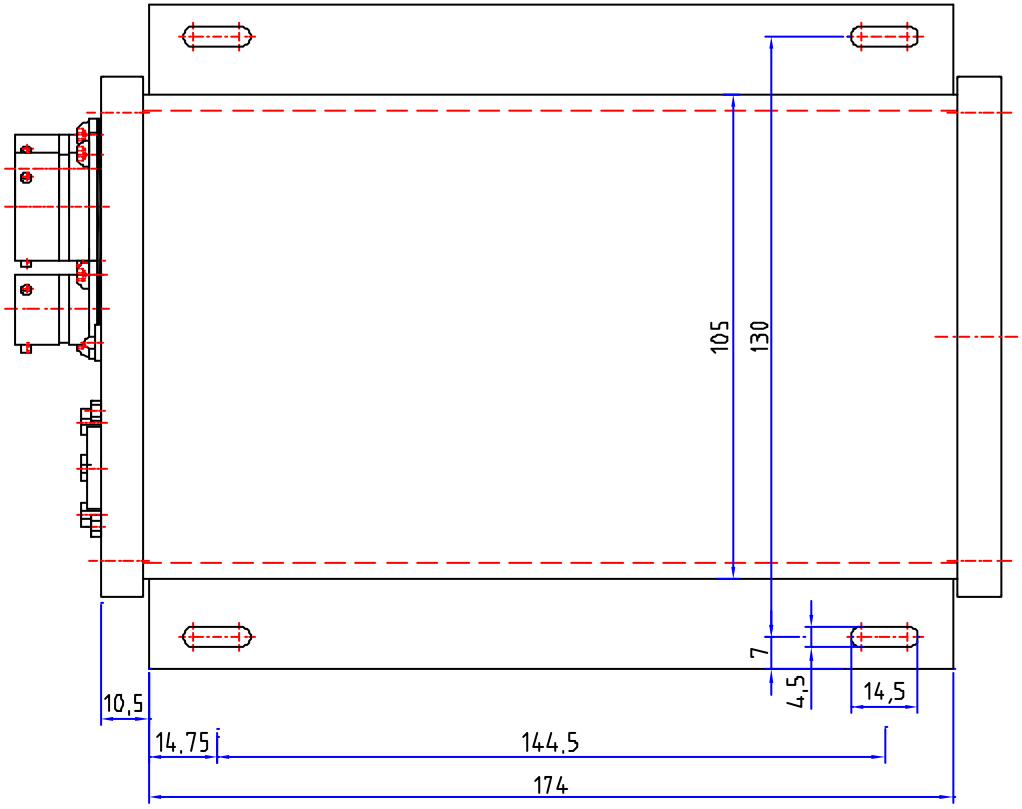
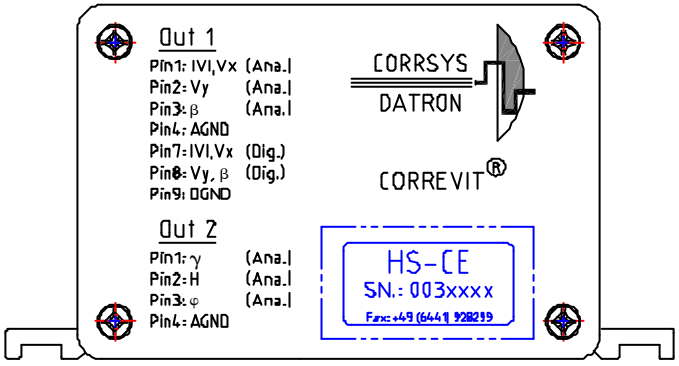
				Gepr.	16.12.2002	Kaul			
				Norm			M003-80-00-0-00		Blatt — Blätter
Zust.	Änderung	Datum	Name	Ursprung			Ersatz für:		Ersatz durch:







Seitenansicht
von rechts



(Verwendungsbereich)				(Zul. Abw.)		(Oberfl.)	Maßstab 1:1 (1:1,13 angepaßt)				(Gewicht)
AutoCAD LT 2000							(Werkstoff, Halbzeug) (Rohteil-Nr.) (Modell- oder Gesenk-Nr.) Aluminium-Gehäuse				
					Datum	Name	Elektronikgehäuse-kpl. für HS-CE Sensor Verkaufszeichnung				
				Bearb.	16.12.2002	Weigl					
				Gepr.	16.12.2002	M. Dürr					
				Norm							
				CORRSYS DATRON Sensorsysteme GmbH			M008-81-00-0-00			Blatt	
Zust.	Änderung	Datum	Name	Ursprung			Ersatz für:			Ersatz durch:	Blätter