CoroPlus® Process Control

Machine monitoring system
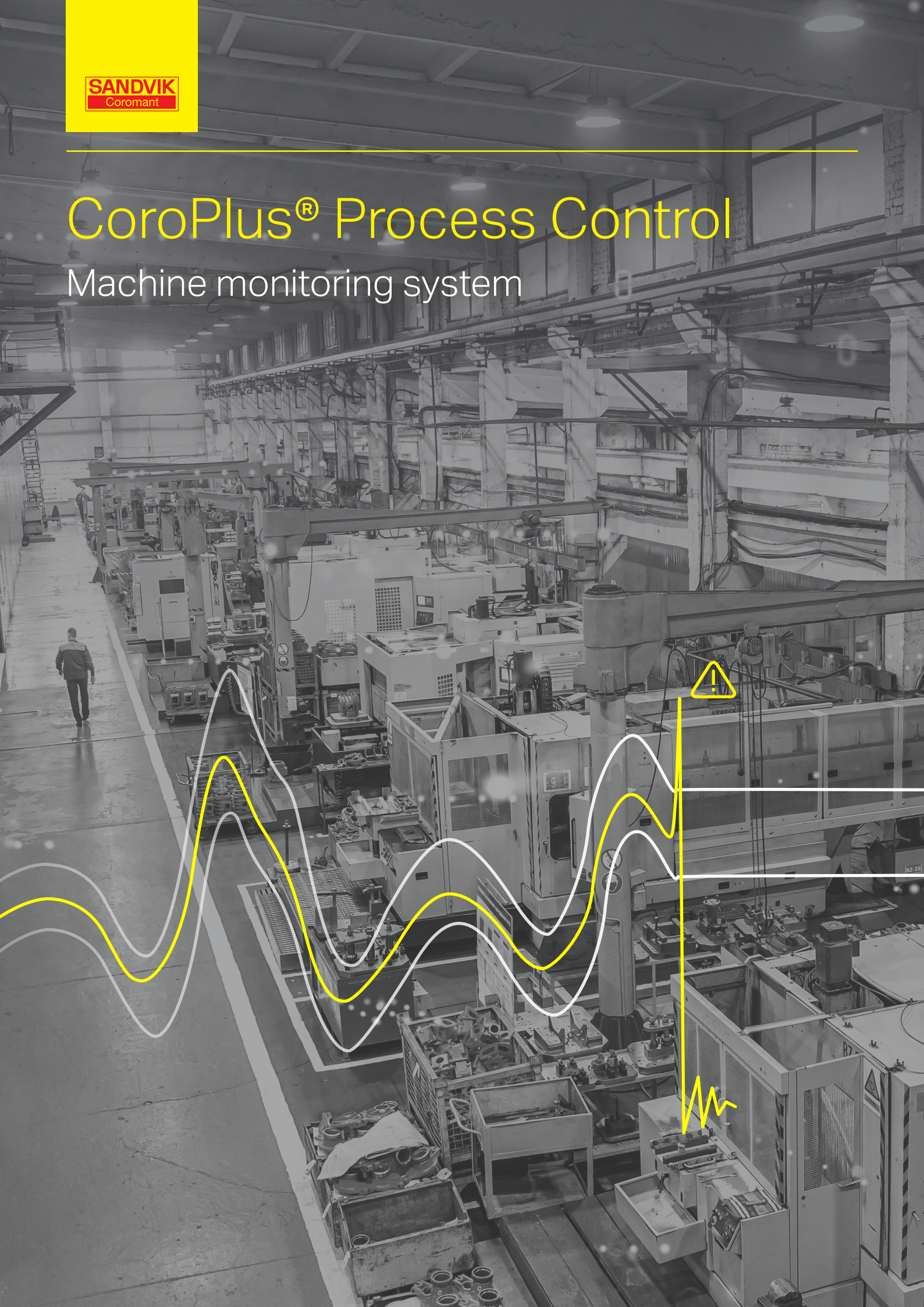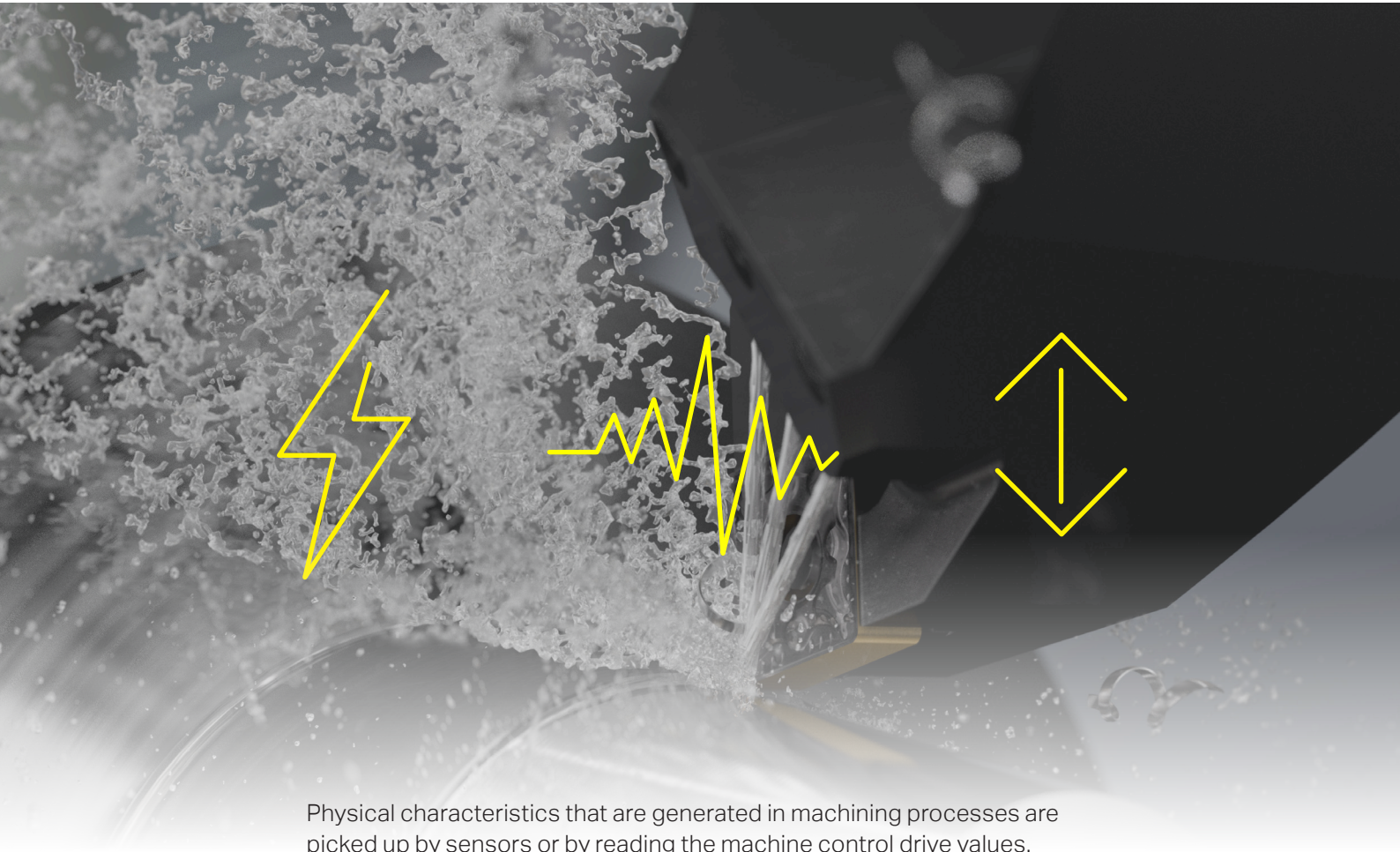
Table of contents

Detecting and acting on deviances

Physical characteristics that are generated in machining processes are picked up by sensors or by reading the machine control drive values. Analysis of the different signal inputs is performed in real-time and any deviance from expected machining process is pre-programmed in the machine logic to trigger corrective actions. Everything happens in just a few milliseconds.

The visualization of the sensor or process signals sets the prerequisite for optimizing the machining processes. CoroPlus® Process Control monitors the machining process by reviewing features depending on the enabled functions using static and/or dynamic limits. Static limits are fixed. Dynamic limits automatically and continuously adapts to different machining situations during machining
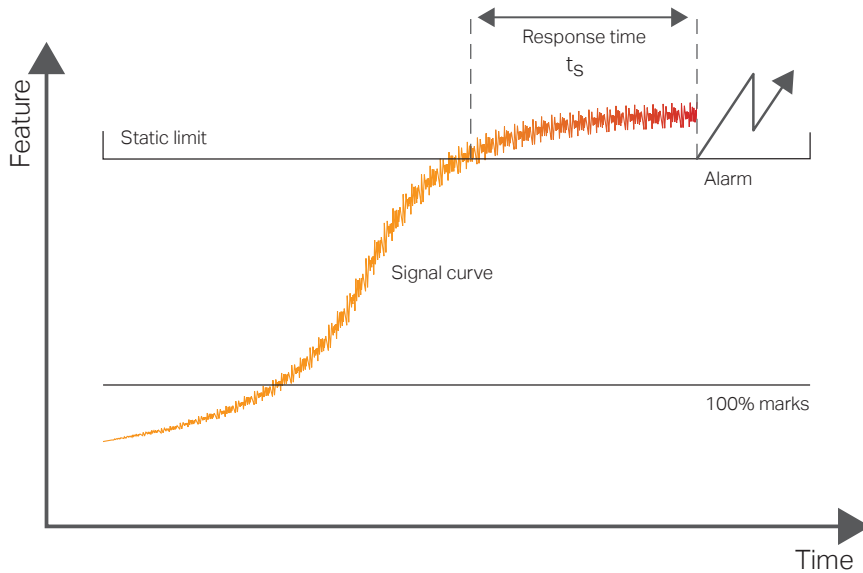
A static limit is designed around a 100% normal signal with a fixed and unchanging distance. If a feature passes a static limit, it causes an alarm after switching time t_S. The switching times are set separately for every limit during the start-up of the system by a specialist.
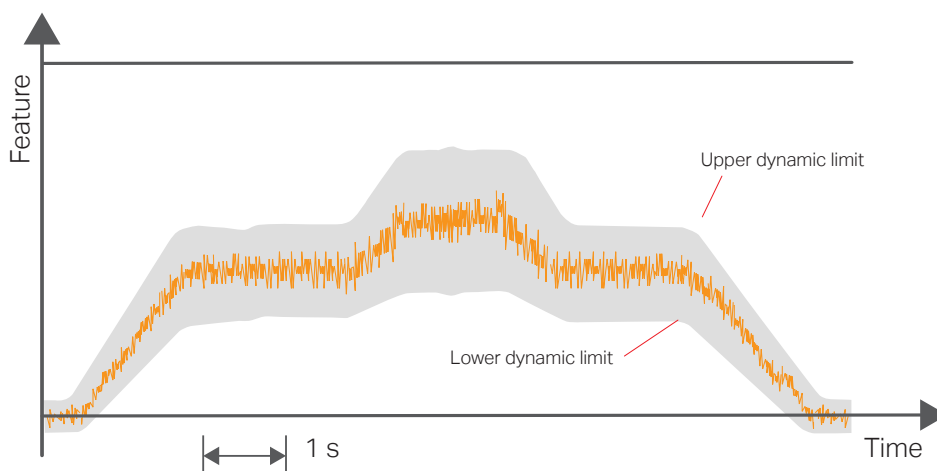
An absolute limit level is not specified for a dynamic limit. Instead, a self-setting, relative distance to the current feature is used. The upper and lower limits resulting from this go along with the feature variably and fully automatically at a corresponding distance.

The feature only passes a dynamic limit in the event of an extremely fast change. The limits are maintained at the current value. If this fast feature change is typical for breakage, a corresponding alarm is triggered. Dynamic limits offer the advantage of using sensitivities (very low, low, normal, high, very high) instead of limit distances. On the one hand, this results in significantly lower operating effort, and on the other, there is no risk of setting a value that is incorrect or too small.

Tool guard – the complete process monitoring tool box

The modularity of the process control system enables selection and activation of features based on individual needs.

Ultimately, using machine and cutting tools to their maximum potential will help:

- Increase overall workshop efficiency
- Ensure consistent component quality
- Secure machine tool investment
- Improve manufacturing economy

$\oplus$ **CoroPlus®**
Process Control

Tool breakage detection
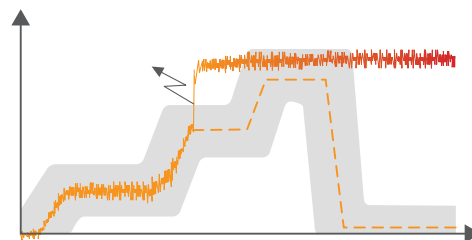
Tool breakage detection is achieved by measuring the machining process and reliably interpreting deviations in the signal as tool breakage. A tool breakage event can trigger several actions, for example stopping the machine or changing the broken tool.

Tool wear detection

Tool wear detection analyses the sensor input data over time to detect wear on a cutting tool. This allows various actions to be programmed, for example stopping the machine or changing a tool.

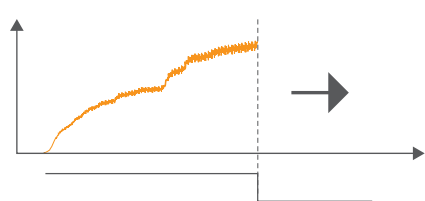## Collision detection
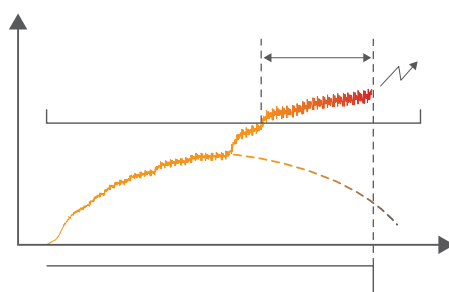
Collision detection will monitor the machining force or vibration and instantly stop machining in case of an overload.

Read more about the value of collision detection on next page.

Contact detection
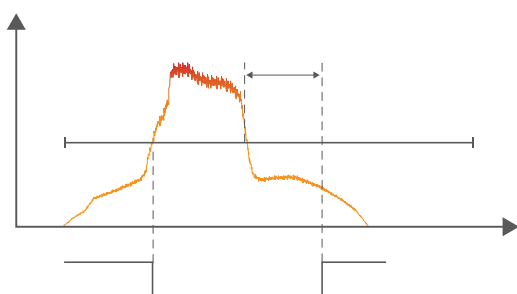
Contact detection analyses the sensor signals to determine whether or not the tool is in contact with the workpiece. The signal is transferred to the machine, which can be programmed to perform multiple different actions, for example altering the off-set.

Overcoming machine collisions

Accidents do happen

Machine collisions occur in all types of manufacturing.

Oftentimes the reason is human error due to lack of competence or experience – or just a need to push to meet the production timeline.

Mistakes simply are unavoidable.

Collisions are usually caused by fairly common distrubances in the planning and machining processes, such as manually changed clamping can being offset, basing the process simulation on a non-precise cutting tool 3D model or running the NC program untested.

Time is of the essence

In the unfortunate event of a collision, time equals money. The more time that passes between a collision to the point where the machine is stopped, lead to more costs for replacement or repair of machine parts and cutting tools.

The built-in features of a machine tool will eventually stop the machine, but it is considerably slower than a process supported by a sensor-based process control system.

Cost

Crash detected by process control system

Machine stopped by feed hold

Crash detected by built in features

Emergency stop of machine motion

$

$

$

$

Insert breakage | Minor tool holder damage | Destroyed tool holder or damaged spindle | Disturbed machine geometries

Milliseconds   <5   <70   <150   <800
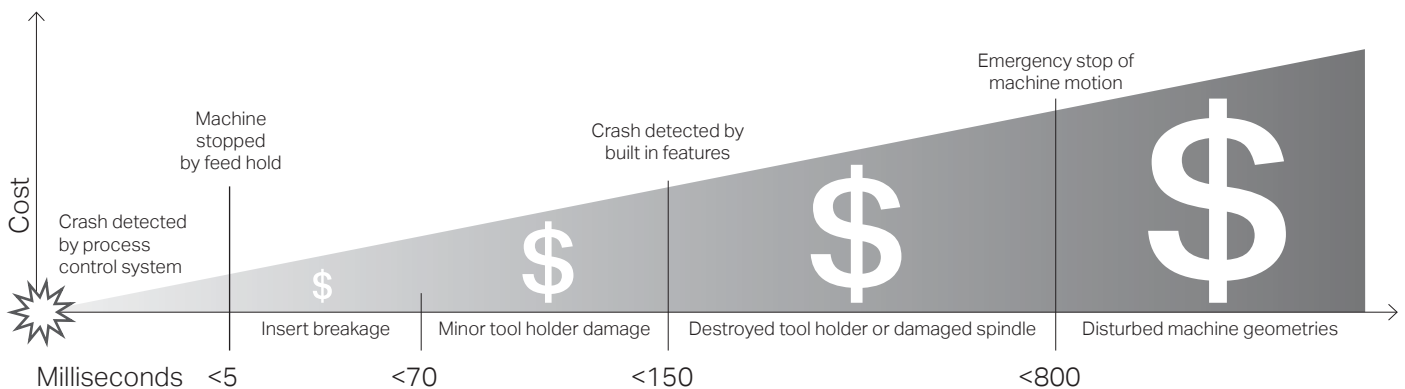
Rapid response based on sensor input

Overload limit

⚠

Machine stopped by feed hold

Collision

Machine tool vibration, measured by
CoroPlus® sensor
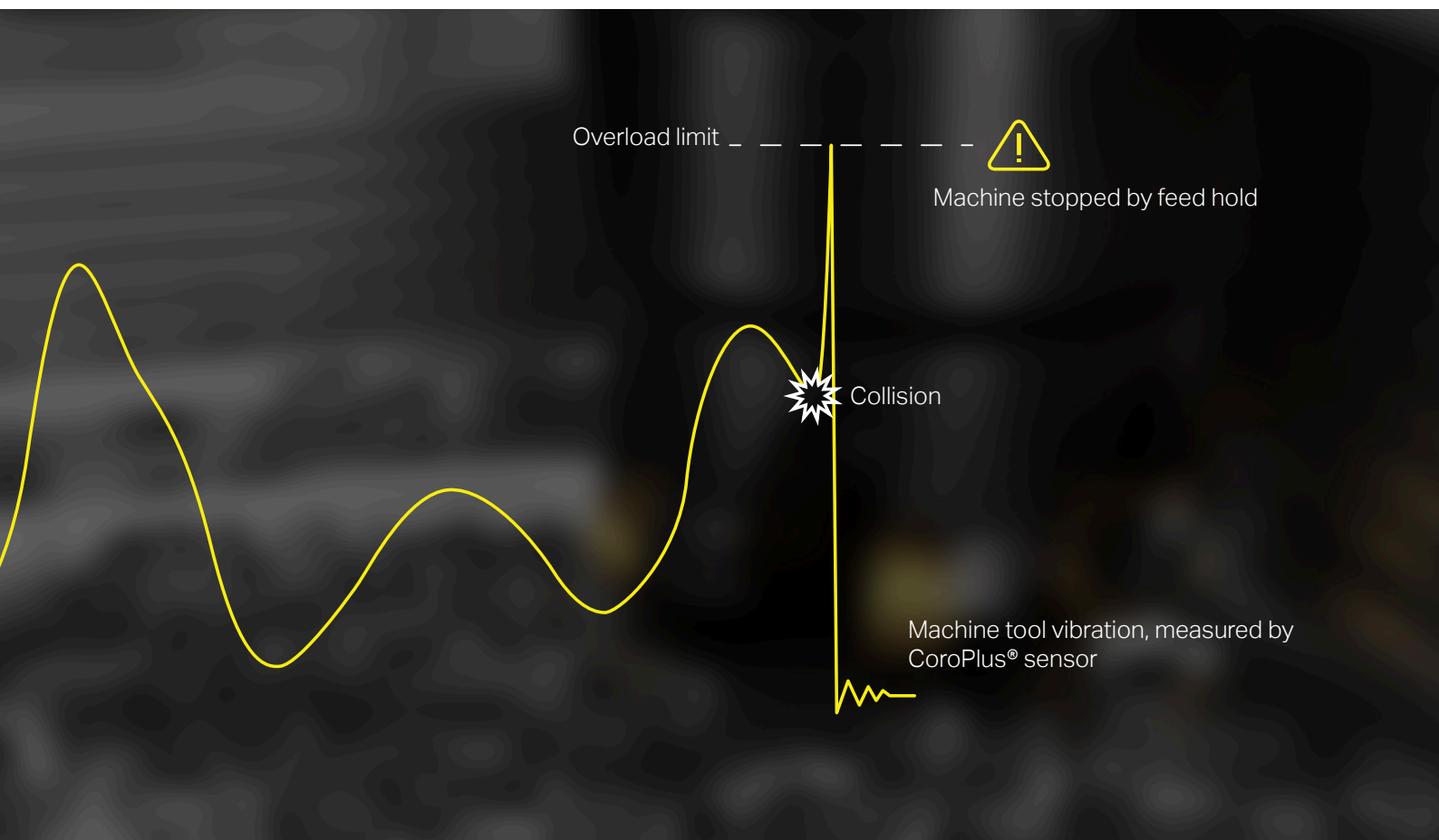
CoroPlus® Process Control will rapidly detect and stop machining in
case of a collision. The system uses highly sensitive sensors to monitor
machining vibration. A real-time monitoring device, directly connected to
the machine tool NC/PLC, instantly stops the process if the vibration level
passes a predefined overload limit.

CoroPlus® Process Control for machining centers

Collision detection

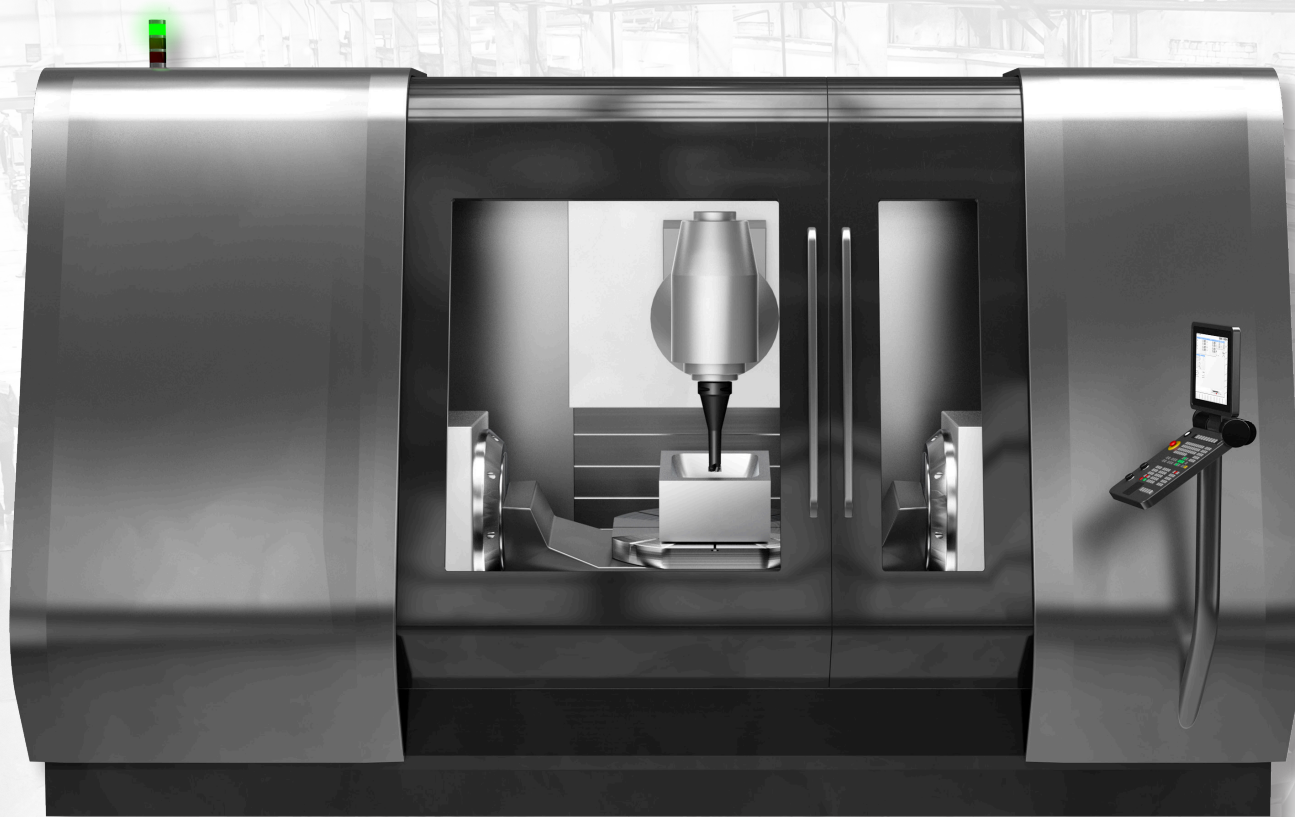| Collision detection	Tool wear detection	Contact detection	Tool breakage detection
✓			

System performance

- One-channel machine

- 4 message outputs per channel

- 8 operation cycles per channel

- 3 limits per cycle

- 1 vibration sensor

1 Vibration sensor
The vibration sensor is mounted on the spindle housing and transfers vibration signals to the RTM.

2 Real-time monitoring device
The Real Time Monitor (RTM) monitors the machining processes and connects with the machine control system.

Equipment	Ordering code
Real Time Monitor (RTM)	
With Profibus *	0.P2.RTM.PB01000
With Profinet *	0.P2.RTM.PN01000
With discreet IO (BAPSI) *	0.P2.RTM.BS01000 (also requires separate MI-parallel BAPSI module 0.MI.RTM.BAPSI)
Function level MSL 3031	0.MM.RTS.MSL3031
Vibration sensor	See Sensor chapter for sensor selection

* Select correct Real Time Monitor configuration dependent on needed machine interface.

Tool guard
With drive data from machine controller

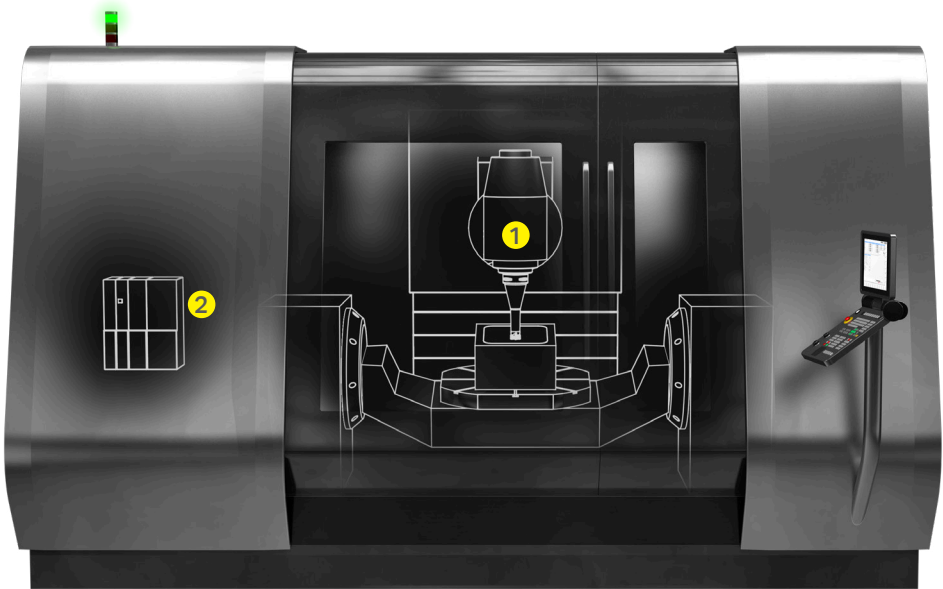| Collision detection	Tool wear detection	Contact detection	Tool breakage detection
✓	✓	✓	✓

System performance

- One-channel machine
- 7 message outputs per channel
- 250 operation cycles per channel
- 8 limits per cycle
- 1 vibration sensor
- Spindle power measurement using digital drive data
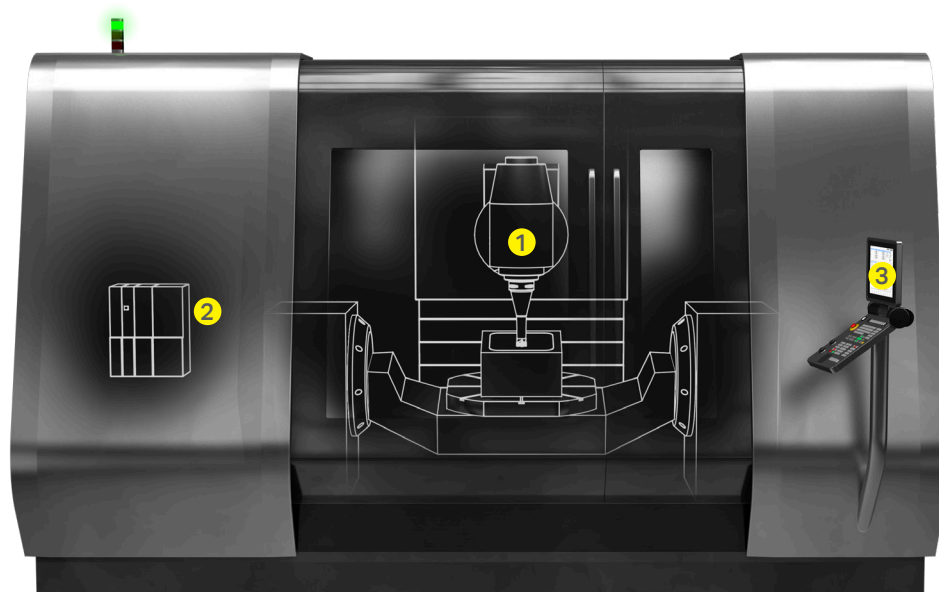
1 Vibration sensor
The vibration sensor is mounted on the spindle housing and transfers vibration signals to the RTM.

2 Real-time monitoring device
The Real Time Monitor (RTM) monitors the machining processes and connects with the machine control system.

3 User interface
The Provis 3 user interface enables configuration and visualizes the processes.

Equipment	Ordering code
Real Time Monitor (RTM)	
With Profibus *	0.P2.RTM.PB01000
With Profinet *	0.P2.RTM.PN01000
PROCUR (digital drive data)	
For Siemens control systems * * *	0.MM.RTS.MS4RROCUR
For other control systems * * *	0.MM.RTS.MS4RROALL
Provis 3 user interface	0.P3.OSM.VISNC
Required accessory:	
SI-Bus gateway CAN to Ethernet * *	0.SI.GWY.ETHER
SI-Bus gateway CAN to USB * *	0.SI.GWY.USB
Vibration sensor	See Sensor chapter for sensor selection

* Select correct Real Time Monitor configuration dependent on needed machine interface.
* * Select correct SI-Bus gateway dependent on needed interface to the machine HMI.
* * * Select correct PRUCOR configuration dependent on control system.

Tool guard
With external power measurement

Collision detection	Tool wear detection	Contact detection	Tool breakage detection
⊘	⊘	⊘	⊘

System performance

- One-channel machine
- 7 message outputs per channel
- 250 operation cycles per channel
- 8 limits per cycle
- 1 vibration sensor
- Spindle power measurement using external EPT 20 power transducer

1 Vibration sensor
The vibration sensor is mounted on the spindle housing and transfers vibration signals to the RTM.
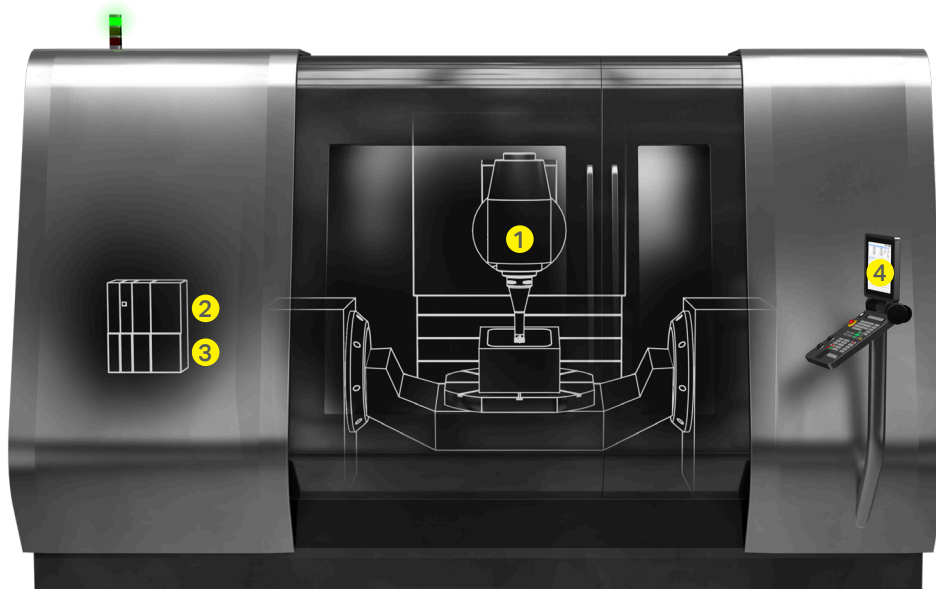
2 Real-time monitoring device
The Real Time Monitor (RTM) monitors the machining processes and connects with the machine control system.

3 Power transducer
The transducer measures the spindle power.

4 User interface
The Provis 3 user interface enables configuration and visualizes the processes.

Equipment	Ordering code
Real Time Monitor (RTM)	
With Profibus *	0.P2.RTM.PB01500
With Profinet *	0.P2.RTM.PN01500
With discreet IO (BAPSI) *	0.P2.RTM.BS01500 (also requires separate MI-parallel BAPSI module 0.MI.RTM.BAPSI)
Function level MSL 5081	0.MM.RTS.MSL5081
Provis 3 user interface	0.P3.OSM.VISNC
Required accessory:	
SI-Bus gateway CAN to Ethernet **	0.SI.GWY.ETHER
SI-Bus gateway CAN to USB **	0.SI.GWY.USB
Vibration sensor	See Sensor chapter for sensor selection
EPT 20 power transducer	0.SH.EPT.20
HC 200 C hall current converter (two per power transducer)	0.SH.EPC.HC200C

* Select correct Real Time Monitor configuration dependent on needed machine interface.
** Select correct SI-Bus gateway dependent on needed interface to the machine HMI.

CoroPlus® Process Control for turret lathes

Collision detection

Collision detection	Tool wear detection	Contact detection	Tool breakage detection

System performance

- One-channel machine
- 4 message outputs per channel
- 8 operation cycles per channel
- 3 limits per cycle
- 1 vibration sensor

1 Vibration sensor
The vibration sensor is mounted on the turret and transfers vibration signals to the RTM.

2 Real-time monitoring device
The Real Time Monitor (RTM) monitors the machining processes and connects with the machine control system.

Equipment	Ordering code
Real Time Monitor (RTM)	
With Profibus *	0.P2.RTM.PB01000
With Profinet *	0.P2.RTM.PN01000
With discreet IO (BAPSI) *	0.P2.RTM.BS01000 (also requires separate MI-parallel BAPSI module 0.MI.RTM.BAPSI)
Function level MSL 3031	0.MM.RTS.MSL3031
Vibration sensor	See Sensor chapter for sensor selection

* Select correct Real Time Monitor configuration dependent on needed machine interface.

Tool guard

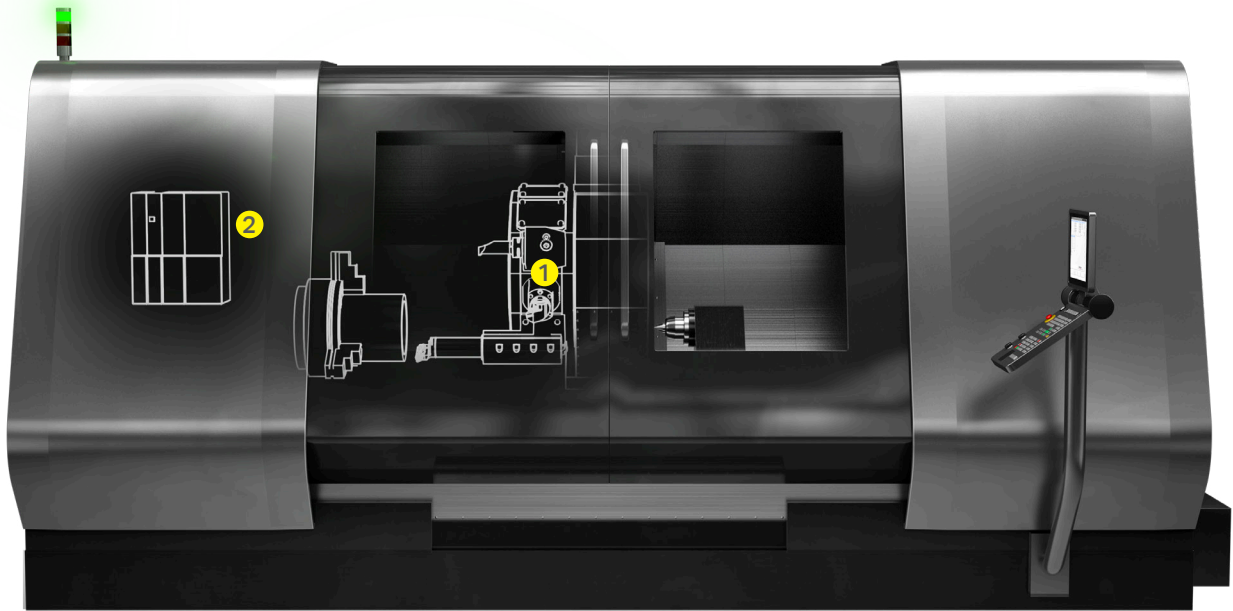| Collision detection	Tool wear detection	Contact detection	Tool breakage detection
✓	✓	✓	✓

System performance

- One-channel machine
- 7 message outputs per channel
- 250 operation cycles per channel
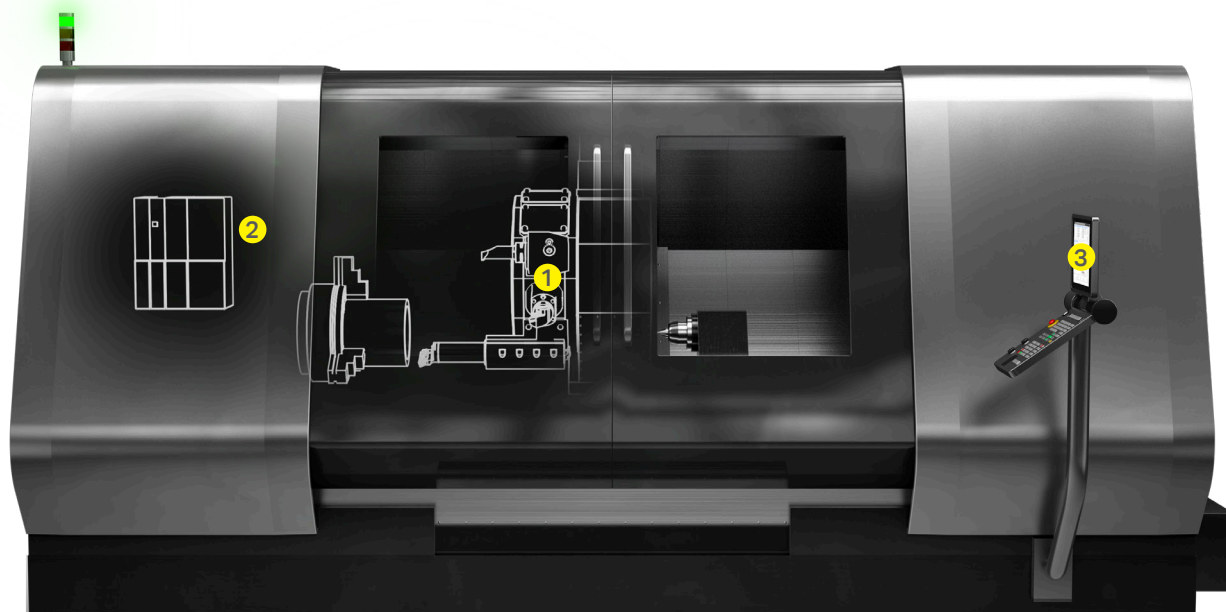- 8 limits per cycle
- 1 force sensor

1 Force sensor
The force sensor is mounted on the turret and transfers signals to the RTM.

2 Real-time monitoring device
The Real Time Monitor (RTM) monitors the machining processes and connects with the machine control system.

3 User interface
The Provis 3 user interface enables configuration and visualizes the processes.

Equipment	Ordering code
Real Time Monitor (RTM)	
With Profibus *	0.P2.RTM.PB03000
With Profinet *	0.P2.RTM.PN03000
With discreet IO (BAPSI) *	0.P2.RTM.BS03000 (also requires separate MI-parallel BAPSI module 0.MI.RTM.BAPSI
Function level MSL 5081	0.MM.RTS.MSL5081
Provis 3 user interface	0.P3.OSM.VISNC
Required accessory:	
SI-Bus gateway CAN to Ethernet * *	0.SI.GWY.ETHER
SI-Bus gateway CAN to USB * *	0.SI.GWY.USB
Force sensor	See Sensor chapter for sensor selection
1-channel charge amplifier	0.97.210.LVP1

* Select correct Real Time Monitor configuration dependent on needed machine interface.
* * Select correct SI-Bus gateway dependent on needed interface to the machine HMI.

Tool guard
With dynamic limits

Collision detection	Tool wear detection	Contact detection	Tool breakage detection
✓	✓	✓	✓

System performance

- One-channel machine
- 7 message outputs per channel
- 250 operation cycles per channel
- 8 limits per cycle
- 2 force sensors
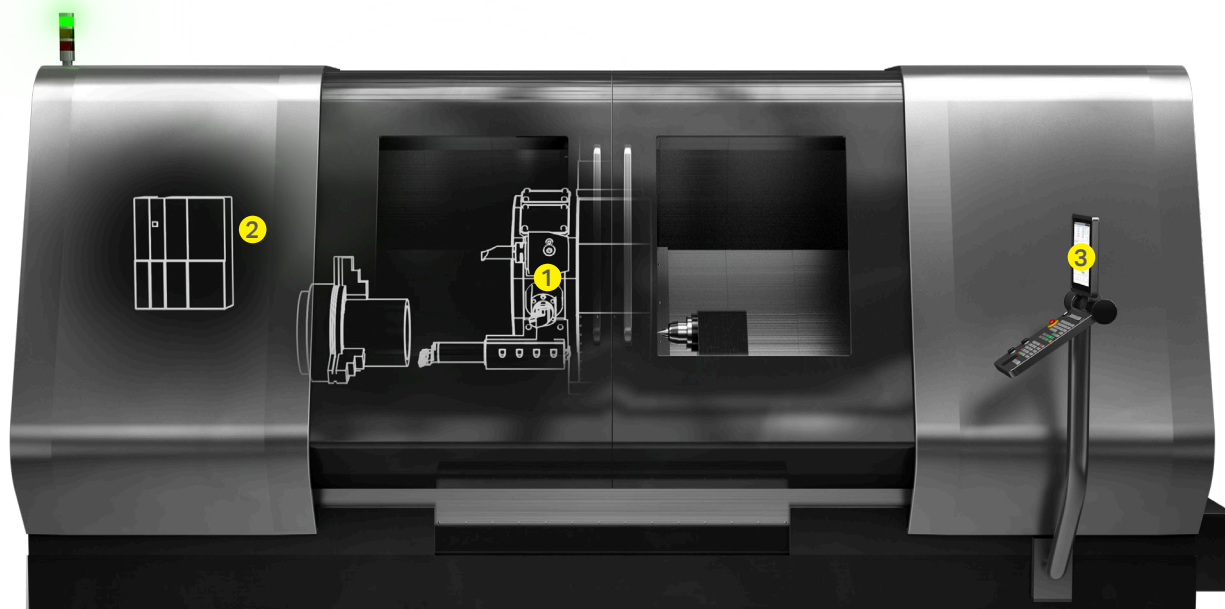- Dynamic limits

1 2 x force sensors
Two force sensors mounted on the turret transfers signals to the RTM.

2 Real-time monitoring device
The Real Time Monitor (RTM) monitors the machining processes and connects with the machine control system.

3 User interface
The Provis 3 user interface enables configuration and visualizes the processes.

Equipment	Ordering code
Real Time Monitor (RTM)	
With Profibus *	0.P2.RTM.PB02000
With Profinet *	0.P2.RTM.PN02000
With discreet IO (BAPSI) *	0.P2.RTM.BS02000 (also requires separate MI-parallel BAPSI module 0.MI.RTM.BAPSI
Function level MDL 5081	0.MM.RTS.MDL5081
Provis 3 user interface	0.P3.OSM.VISNC
Required accessory:	
SI-Bus gateway CAN to Ethernet **	0.SI.GWY.ETHER
SI-Bus gateway CAN to USB **	0.SI.GWY.USB
2 x Force sensor	See Sensor chapter for sensor selection
2-channel charge amplifier	0.97.220.LVP1

* Select correct Real Time Monitor configuration dependent on needed machine interface.
** Select correct SI-Bus gateway dependent on needed interface to the machine HMI.

Product assortment overview

VBS Sensors

Cable and connection kit

Ultra sound and vibration sensor

Cable and connection kit

Cable and connection kit

1D measuring wedge

Axial measuring dowel MDA 20

Bolt sensor KM

Power sensor

Charge amplifier

MI-Parallel BAPSI

CNC machine
control system

SP Sensor Interface

MI (machine interface)

Control and visualization

Provis 3 on touchscreen OPM21

RTM (Real Time Monitor)

CNC
HMI/PC

SI-Bus (system
interface

SI-Bus CAN gateways

Provis 3

Service offer

Contact your Sandvik Coromant representative for more information on what services are available.

Installation and support

Sandvik Coromant engineers can support in installation and set up of all required infrastructure and software, according to our agreement with you. This can include electrical wiring, positioning of sensors and PLC adaptations. The installation would be concluded with a signal and machine communication check.

After installation, our engineers and customer service will be able to assist you on site or via other channels when needed.

Commissioning and training

CoroPlus® Process Control will deliver value to your production from the start, however there are endless possibilities to explore. With the process monitoring system up and running, Sandvik Coromant offers configuration services to meet everything from basic to very specific needs.

Our engineers are also available for training of your personnel, with programs ranging from basic to advanced setup and operator training. We also offer more advanced training sessions to train users how to make and draw conclusions form process analysis based on data from the CoroPlus® Process Control system.

Modular monitoring unit

The Real Time Monitor is configured based on the specific process monitoring needs. Different sensor modules and machine interface modules are combined to build the complete Real Time Monitor unit.

Features

- Monitor up to four simultaneous sensor inputs
- Monitor static and dynamic limits
- Integrate with machine control system

Machine interface

- Profibus
- Profinet
- Discreet IO (MINI and BAPSI)

Sensor connection

- Up to 4 sensor inputs
- Vibration and ultrasound sensors
- Force sensors
- Power sensor
- Digital drive data from control system (via Profibus or Profinet)

Real Time Monitor configuration

Sensor and machine interface modules

The Real Time Monitor unit can be equipped with up to four sensor modules with ability to monitor four sensor inputs. The sensor modules are selected based on what sensor will monitor the machining process.

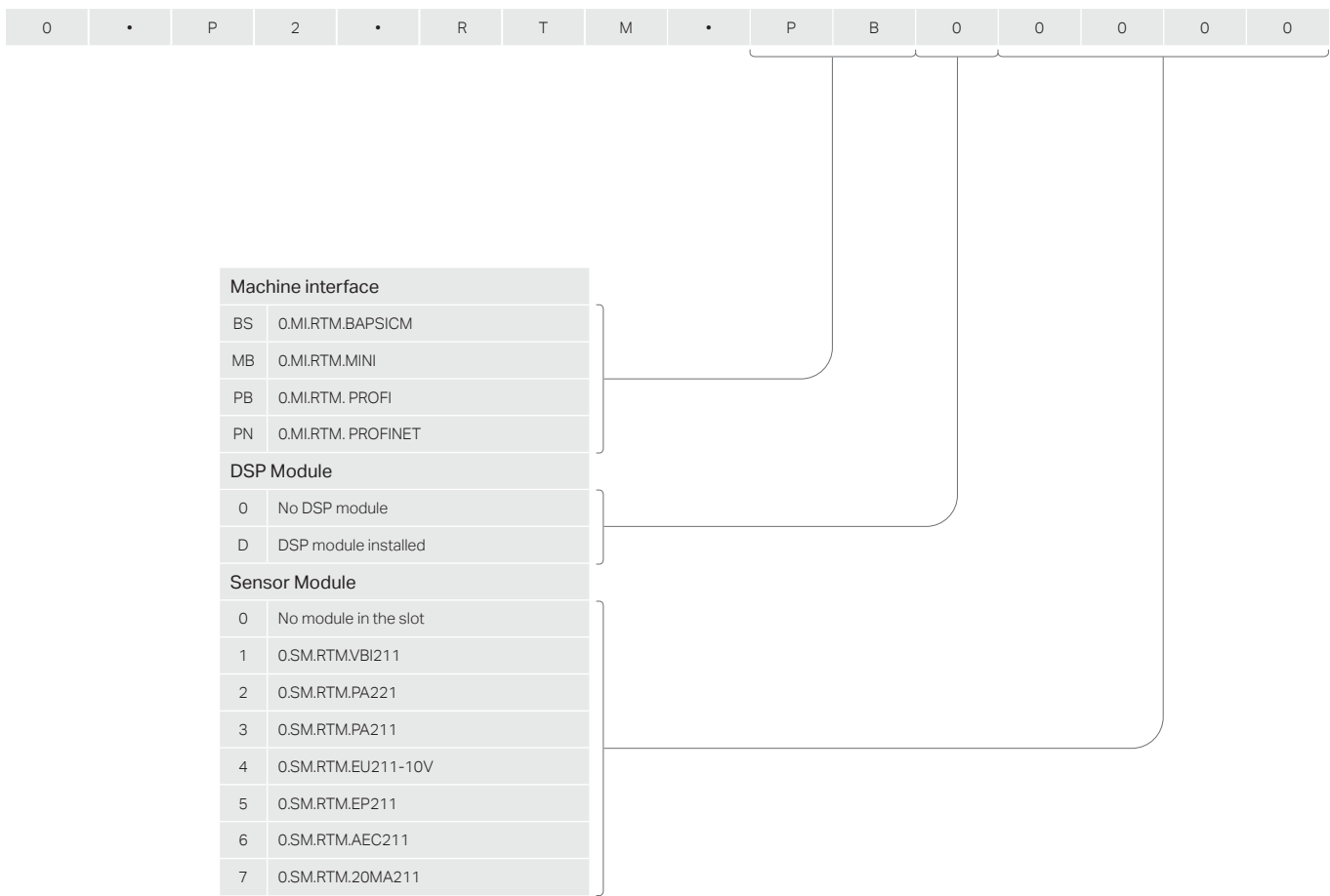| Sensor module	Inputs	Supported input sources						
		Charge amplifier	Pre-amplifier	VBS (IEPE)	AE30	EPT 20	Sensors voltage output ±10 V	Sensor current output 4 – 20 mA
0.SM.RTM.PA211	1	●	●					
0.SM.RTM.PA221	2	●	●					
0.SM.RTM.VBI211	1			●				
0.SM.RTM.AEC211	1				●			
0.SM.RTM.EP211	1					●		
0.SM.RTM.EU211-10V	1						●	
0.SM.RTM.20MA211	1							●

Machine interface modules

The Real Time Monitor unit can be integrated with the machine control system in multiple ways, including discreet IO interfaces and fieldbus systems as Profibus and Profinet.

Machine interface module	Interface type
0.MI.RTM.BAPSICM	MI-Bus Module for MI-Parallel BAPSI (discreet IO) *
0.MI.RTM.MINI	MI-Bus Module MINI (discreet IO)
0.MI.RTM. PROFI	Mi-Bus Module PROFIBUS DP
0.MI.RTM. PROFINET	Mi-Bus Module PROFINET IO

The MI-Bus module for MI-Parallel BAPSI requires at least one MI-Parallel BAPSI (0.MI.RTM.BAPSI)but can handles up to four MI-Parallel BAPSI, see Real Time Monitor accessories.

Real Time Monitor ordering codes and options

0	•	P	2	•	R	T	M	•	P	B	0	0	0	0	0

Machine interface

BS	0.MI.RTM.BAPSICM
MB	0.MI.RTM.MINI
PB	0.MI.RTM. PROFI
PN	0.MI.RTM. PROFINET

DSP Module

0	No DSP module
D	DSP module installed

Sensor Module

0	No module in the slot
1	0.SM.RTM.VBI211
2	0.SM.RTM.PA221
3	0.SM.RTM.PA211
4	0.SM.RTM.EU211-10V
5	0.SM.RTM.EP211
6	0.SM.RTM.AEC211
7	0.SM.RTM.20MA211

Functionality selection

Functionality options	MSL 30XX				MSL 50XX				MDL 50XX	
	MSL 3011	MSL 3012	MSL 3031	MSL 3032	MSL 5034	MSL 5074	MSL 5081	MSL 5082	MDL 5081	MDL 5082
Channels	1	2	1	2	4	4	1	2	1	2
Message output per channel	4	4	4	4	4	4	7	7	7	7
Cycles per channel	2	2	8	8	8	120	250	250	250	250
Maximum number of limits per cycle	2	2	3	3	4	4	8	8	8	8
Limit types										
Overload	●	●	●	●	●	●	●	●	●	●
Underload	●	●	●	●	●	●	●	●	●	●
Work over	●	●	●	●	●	●	●	●	●	●
Work under	●	●	●	●	●	●	●	●	●	●
Contact	●	●	●	●	●	●	●	●	●	●
Missing	●	●	●	●	●	●	●	●	●	●
Pattern upper					●	●	●	●	●	●
Pattern lower					●	●	●	●	●	●
Cut start					●	●	●	●	●	●
Cut end					●	●	●	●	●	●
Dynamic upper limit									●	●
Dynamic lower limit									●	●
Tool wear ***	●	●	●	●	●	●	●	●	●	●
Additional options										
Crash data recorder *	●	●	●	●			●	●	●	●
PROCUR ** (read digital drive data)	●	●	●	●	●	●	●	●	●	●

* Available for Siemens control systems only.
** Requires Profibus or Profinet connection to the machine control system.
*** Requires Profibus or Profinet connection to the machine control system and Provis 3 user interface.

Ordering code	Functionality options	Description
0.MM.RTS.MSL3011	MSL3011	MSL 30XX
0.MM.RTS.MSL3012	MSL3012	MSL 30XX
0.MM.RTS.MSL3031	MSL3031	MSL 30XX
0.MM.RTS.MSL3032	MSL3032	MSL 30XX
0.MM.RTS.MSL5034	MSL5034	MSL 50XX
0.MM.RTS.MSL5074	MSL5074	MSL 50XX
0.MM.RTS.MSL5081	MSL5081	MSL 50XX
0.MM.RTS.MSL5082	MSL5082	MSL 50XX
0.MM.RTS.MDL5081	MDL5081	MDL 50XX
0.MM.RTS.MDL5082	MDL5082	MDL 50XX

Additional options

Ordering code	Options	Description
0.MM.RTS.CDR	CDR	Crash Data Recorder
0.MM.RTS.MS4PROCUR	PROCUR	PROCUR reading digital drive data from Siemens systems
0.MM.RTS.MS4PROALL	PROCUR	PROCUR reading digital drive data from non-Siemens systems

Real Time Monitor accessories

MI-Parallel BAPSI

The MI-Parallel BAPSI is used to together with the MI-Bus module for MI-Parallel BAPSI (0.MI.RTM.BAPSICM) to offer a complete discreet IO BAPSI interface for machine communication. At least one MI-Parallel BAPSI is needed together with the 0.MI.RTM.BAPSICM MI-Bus module and can handle up to four MI-Parallel BAPSI.
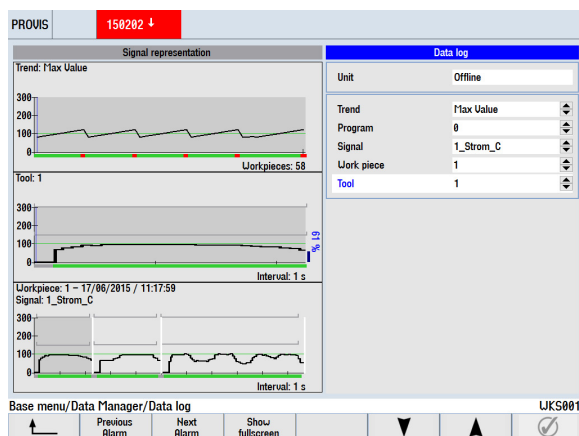
Ordering code	Description
0.MI.RTM.BAPSI	MI-Parallel BAPSI

User interface

Machining process visualization and control

The user interface enables to configure the system and visualizes the machining process.

User interface integrated on machine control

User interface on OPM21 operator module with touchscreen

Provis 3

User interface software for integration to machine control system
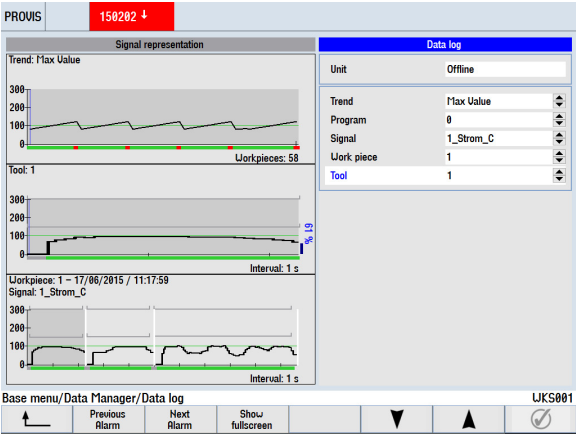
Ordering code	Description
0.P3.OSM.VISLNC	Provis 3 license for functionality option up to MSL 30XX
0.P3.OSM.VISNC	Provis 3 license for functionality option up to MSL/MDL 50XX

System requirements

Windows based systems	
Window version	Windows XP or higher
Processor	Intel or AMD dual core 1,6 GHz
RAM	1 GB
Hard disk space	1GB free space available for logging
Interfaces	USB or Ethernet see user interface accessories
SIEMENS SINUMERIK	
Operate 840D sl with PCU50 / IPC	V04.05, V04.07, V04.08
Operate 840D sl with TCU	V04.05, V04.07, V04.08

User interface accessories

SI-Bus Gateway

For connection between the Real Time Monitor unit and the machine HMI or external PC, available with different communication interfaces.

Ordering code	Description
0.SI.GWY.USB	SI-Bus Gateway CAN to USB
0.SI.GWY.ETHER	SI-Bus Gateway CAN to Ethernet
0.SI.GWY.LPTPS2P	SI-Bus Gateway CAN to LPT

OPM21 operator module with Provis 3

User interface software installed on touchscreen operator module
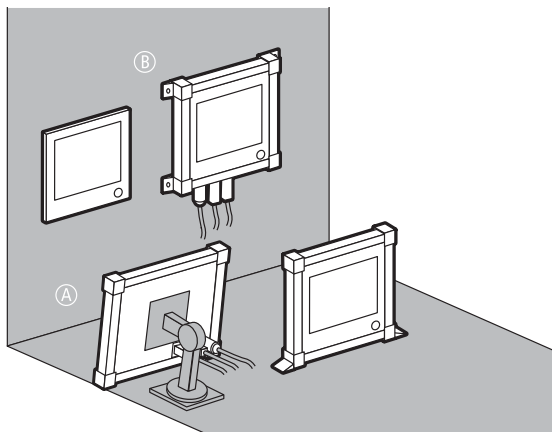
The operator module OPM 21 is available for either inset mounting or for external mounting with a protection box:

- Inset mounting: Without protection box for inset mounting in a panel.

- External mounting: With protection box for external mounting, for example on VESA compatible monitor stand or for floor/overhead or wall mounting.

  - Variant A: Connectors on the back
  - Variant B: Connectors on the base

Ordering code	Description	Protection class
0.OP.21G.M	Inset mounting	Front side IP 54, back side IP 20
0.OP.21G.MPBCAN	External mounting, variant A, with connectors on the back *	IP 54
0.OP.21G.MPBBCAN	External mounting, variant B, with connectors on the base *	IP 54
Accessories for OPM 21		
0.P3.OPM.BRVESA3D	VESA Holder for OPM21 with 3D joint	-

Includes all needed plugs and cable for power supply.
 * Includes different mounting brackets.

Technical data

Screen size / resolution	12,7″ (30,7 cm) TFT
Operating elements	Touchscreen, connection of mouse or keyboard optional
Interfaces	CAN SI-Bus (for connection to RTM), Ethernet, USB 2.0
Operating system	Windows® 7 embedded
Power supply	+12 to +26 V DC
Temperature range	Usage/operation 0 to 40 °C Storage/transport -20 to 40 °C

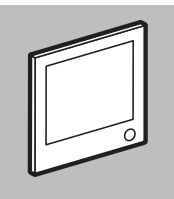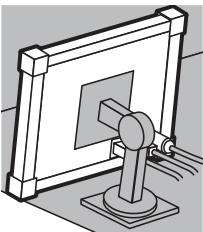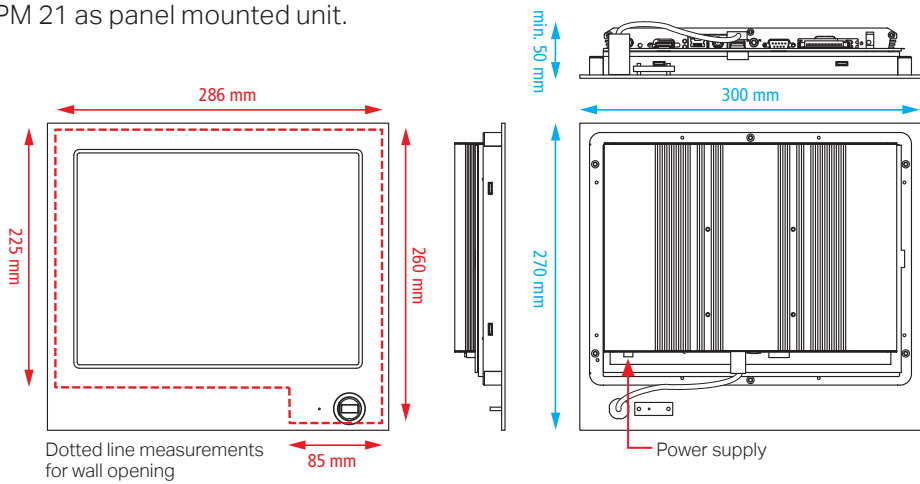# Installation guidelines

Connections

Ethernet   SI Bus   Power
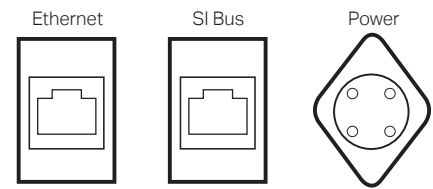
SI-Bus CAN

(RJ45 connector, can be assembled in the field, assembly instructions enclosed with the plug)

PIN	Connection
1	CAN-H
2	CAN-L
3	CAN-Gnd

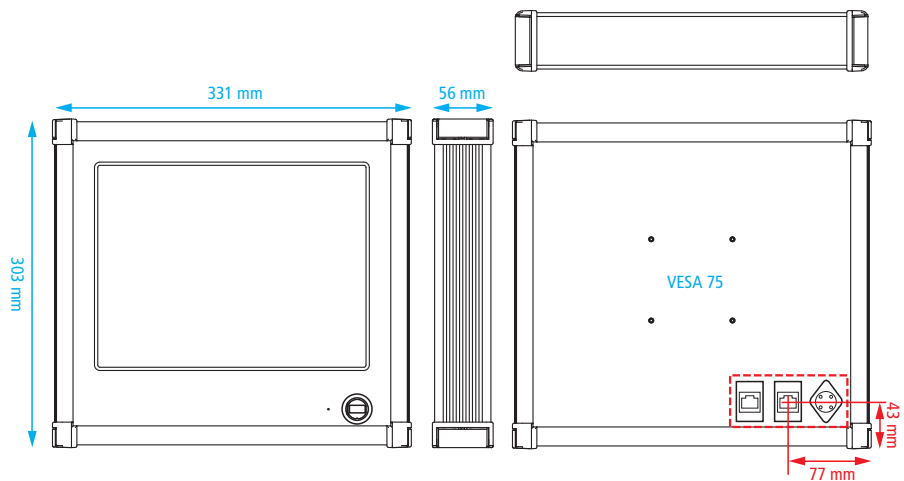## Inset mounting (Note! All measurement in mm)
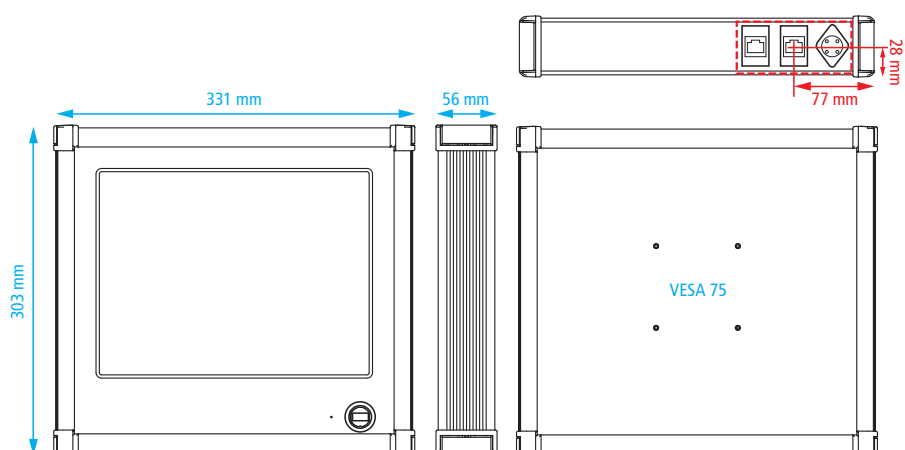
Operating module OPM 21 as panel mounted unit.

286 mm

225 mm

260 mm

Dotted line measurements for wall opening

85 mm

min. 50 mm

300 mm

270 mm

Power supply

Operating module OPM 21 in protection box with **connectors on the black plate.**

331 mm

56 mm

303 mm

VESA 75

43 mm

77 mm

Operating module OPM 21 in protection box with **connectors on the base.**

331 mm
56 mm
303 mm
28 mm
77 mm

VESA 75

Operating module OPM 21 in protection box, using brackets for floor mounting, **connectors on the black plate or on the base.**

54
30
11
4.5
352.3
368.3
331
56
308

Operating module OPM 21 in protection box, using brackets for floor mounting, **connectors on the black plate or on the base.**

56
56
1
342.2
∅5.4
303.2
279.7
361.2
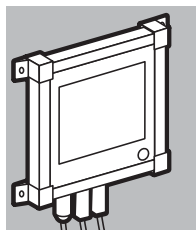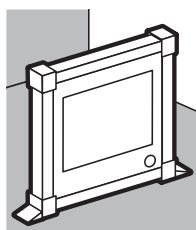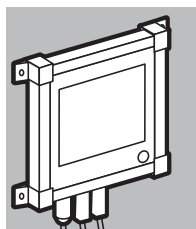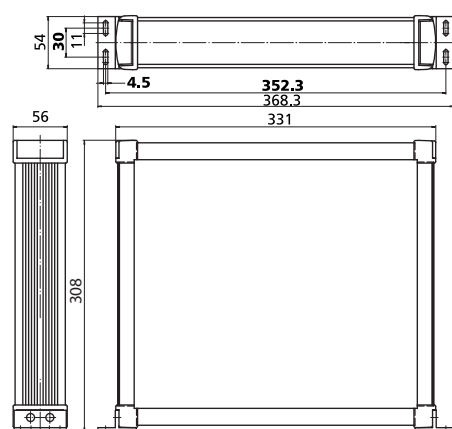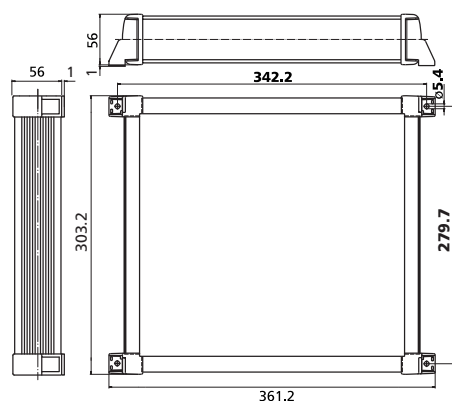
Sensors

The sensor is the part of the process control system that picks up the machining characteristics such as force, vibration and load. Different types of sensors are dedicated for specific purposes. This section acts as guide in the selection and installation of sensors.

A properly mounted sensor will ensure that the signal is correct and will secure that the process control system will operate according to need. When installing a new system, or making changes to an existing one, make sure to follow instructions meticulously. Contact a Sandvik Coromant representative with any questions.
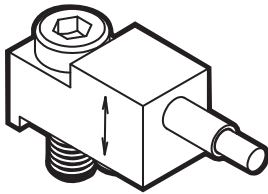
Acceleration sensors
In IEPE technology

The VBS acceleration sensors are used to monitor the machining process and machine components and are especially designed for detecting dynamic collisions in the machining system.
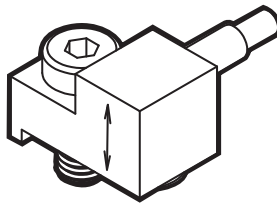
The VBS sensors comes in different shape and mounting possibilities to cover a wide range of implementations.

Screw mounting, M8 thread

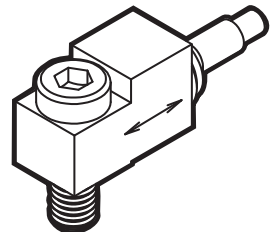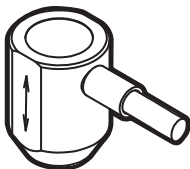VBS 50 AR   VBS 50 AT   VBS 50 RR

Adhesive mounting

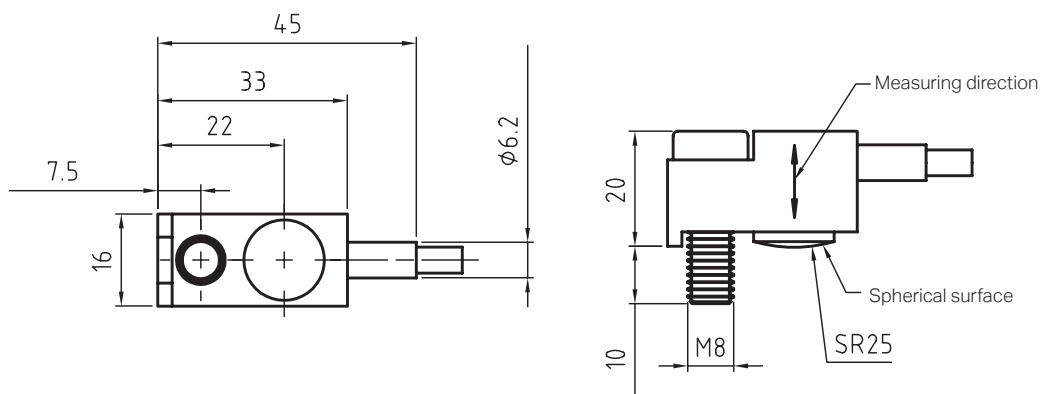VBS 50 Epoxy CR   VBS 50 Epoxy CA   VBS 50 Micro A   VBS 50 Micro R

VBS 50-100-500 AR

Acceleration sensor with measuring direction axial to the bolt and cable radial to the bolt.

(All measurements in mm)

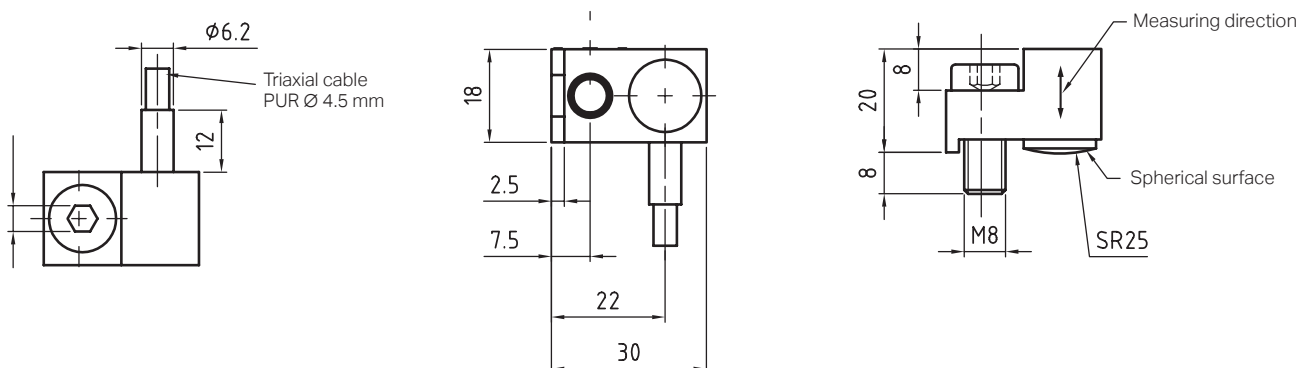| Ordering code | Sensitivity (±20%) * | | | Measurement range | | | Cable length (m) | Male connector (M12) |
	50 mV/g	100 mV/g	500 mV/g	±100 g	±50 g	±10 g		
0.SH.VBS.050AR03	●			●			3	
0.SH.VBS.050AR10	●			●			10	
0.SH.VBS.050AR15	●			●			15	
0.SH.VBS.050AR20	●			●			20	
0.SH.VBS.050AR30	●			●			30	
0.SH.VBS.050AR03C	●			●			3	●
0.SH.VBS.050AR10C	●			●			10	●
0.SH.VBS.050AR15C	●			●			15	●
0.SH.VBS.050AR20C	●			●			20	●
0.SH.VBS.050AR30C	●			●			30	●
0.SH.VBS.100AR03		●			●		3	
0.SH.VBS.100AR10		●			●		10	
0.SH.VBS.100AR15		●			●		15	
0.SH.VBS.100AR20		●			●		20	
0.SH.VBS.100AR03C		●			●		3	●
0.SH.VBS.100AR10C		●			●		10	●
0.SH.VBS.100AR15C		●			●		15	●
0.SH.VBS.100AR20C		●			●		20	●
0.SH.VBS.500AR10			●			●	10	
0.SH.VBS.500AR10C			●			●	10	●

The sensor is delivered with calibration data sheet.

Technical data

Performance		Electrical characteristics		Environmental conditions		Physical connectors	
Frequency range	0.1 to 10,000 Hz	Excitation voltage	18 to 28 VDC	Overload limit (shock)	7,000 g peak	Cable	Triaxial, shielded cable
Internal filter	Low pass 10 kHz 2nd order	Constant current excitation	2 to 20 mA	Enclosure rating	IP 67	Cable jacket	PUR, 4.5 mm
Resonant frequency	> 20 kHz	Output bias voltage	8 to 12 VDC	Temperature range	-50 °C to +70 °C (-60 °F to 160 °F)	Bending radius	25 mm
-	-	Case insulation	$> 10^5\ \Omega$	-	-	Screw mounting	M8
-	-	-	-	-	-	Fastening torque	12 Nm

VBS 50 AT

Acceleration sensor with measuring direction axial to the bolt and cable tangential to the bolt.

(All measurements in mm)

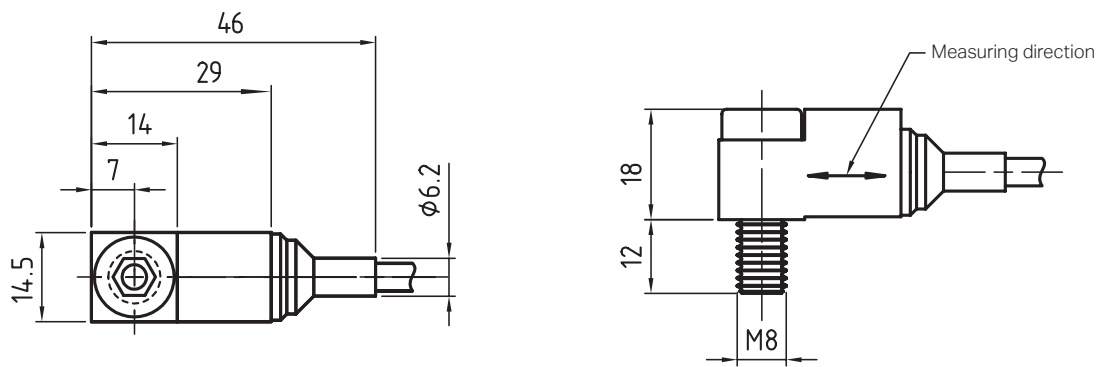| Ordering code	Sensitivity (±20%) *			Measurement range			Cable length (m)	Male connector (M12)
	50 mV/g			±100 g				
0.SH.VBS.050AT03	●			●			3	
0.SH.VBS.050AT12	●			●			12	
0.SH.VBS.050AT03C	●			●			3	●
0.SH.VBS.050AT12C	●			●			12	●

The sensor is delivered with calibration data sheet.

Technical data

Performance		Electrical characteristics		Environmental conditions		Physical connectors	
Frequency range	0.1 to 10,000 Hz	Excitation voltage	18 to 28 VDC	Overload limit (shock)	7,000 g peak	Cable	Triaxial, shielded cable
Internal filter	Low pass 10 kHz 2nd order	Constant current excitation	2 to 20 mA	Enclosure rating	IP 67	Cable jacket	PUR, 4.5 mm
Resonant frequency	> 20 kHz	Output bias voltage	8 to 12 VDC	Temperature range	-50 °C to +70 °C (-60 °F to 160 °F)	Bending radius	25 mm
-	-	Case insulation	$> 10^5 \, \Omega$	-	-	Screw mounting	M8
-	-	-	-	-	-	Fastening torque	12 Nm

VBS 50-100 RR

Acceleration sensor with measuring direction and cable radial to the bolt.

Measuring direction

(All measurements in mm)

Ordering code	Sensitivity (±20%) *			Measurement range			Cable length (m)	Male connector (M12)
	50 mV/g	100 mV/g		±100 g	±50 g			
0.SH.VBS.050RR10	●			●			10	
0.SH.VBS.050RR15	●			●			15	
0.SH.VBS.050RR20	●			●			20	
0.SH.VBS.050RR10C	●			●			10	●
0.SH.VBS.050RR15C	●			●			15	●
0.SH.VBS.050RR15C	●			●			20	●
0.SH.VBS.100RR10		●			●		10	
0.SH.VBS.100RR10C		●			●		10	●

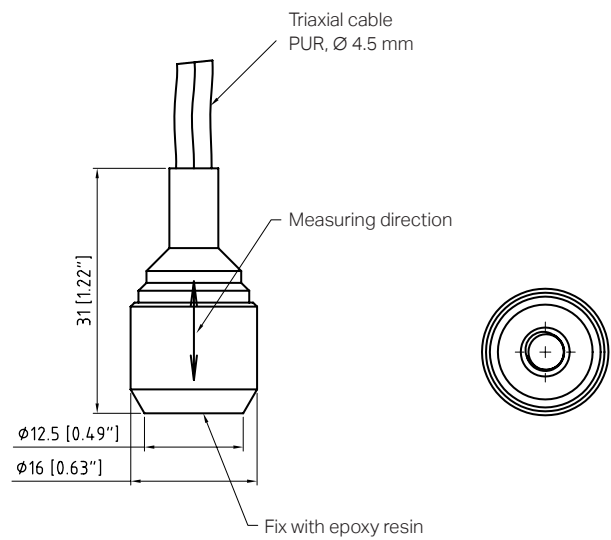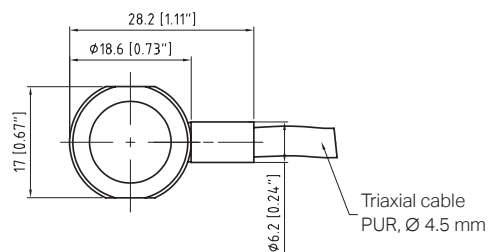The sensor is delivered with calibration data sheet.

Technical data

Performance		Electrical characteristics		Environmental conditions		Physical connectors	
Frequency range	0.1 to 10,000 Hz	Excitation voltage	18 to 28 VDC	Overload limit (shock)	7,000 g peak	Cable	Triaxial, shielded cable
Internal filter	Low pass 10 kHz 2nd order	Constant current excitation	2 to 20 mA	Enclosure rating	IP 67	Cable jacket	PUR, 4.5 mm
Resonant frequency	> 20 kHz	Output bias voltage	8 to 12 VDC	Temperature range	-50 °C to +70 °C (-60 °F to 160 °F)	Bending radius	25 mm
-	-	Case insulation	> 10^5 Ω	-	-	Screw mounting	M8
-	-	-	-	-	-	Fastening torque	12 Nm

VBS Epoxy CA

Acceleration sensor with measuring direction and cable axial to the sensor.

Triaxial cable
PUR, Ø 4.5 mm

Measuring direction

31 [1.22"]

ø12.5 [0.49"]

ø16 [0.63"]

Fix with epoxy resin

(All measurements in mm)

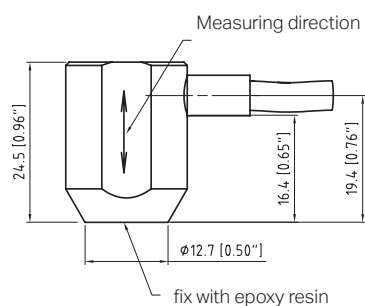| Ordering code	Sensitivity (±20%) *			Measurement range			Cable length (m)	Male connector (M12)
	50 mV/g	100 mV/g		±100 g	±50 g			
0.SH.VBS.050EPCA03	●			●			3	
0.SH.VBS.050EPCA03C	●			●			3	●
0.SH.VBS.100EPCA03		●			●		3	
0.SH.VBS.100EPCA03C		●			●		3	●

The sensor is delivered with calibration data sheet.

Technical data

Performance		Electrical characteristics		Environmental conditions		Physical connectors	
Frequency range	0.1 to 10,000 Hz	Excitation voltage	18 to 28 VDC	Overload limit (shock)	7,000 g peak	Cable	Triaxial, shielded cable
Internal filter	Low pass 10 kHz 2nd order	Constant current excitation	2 to 20 mA	Enclosure rating	IP 67	Cable jacket	PUR, 4.5 mm
Resonant frequency	> 25 kHz	Output bias voltage	8 to 12 VDC	Temperature range	-50 °C to +70 °C (-60 °F to 160 °F)	Bending radius	25 mm
-	-	Case insulation	$> 10^5\ \Omega$	-	-	Mounting	2-Component epoxy resin adhesive

VBS Epoxy CR

Acceleration sensor with measuring direction axial to the sensor and cable radial to the sensor.

Measuring direction
24.5 [0.96"]
16.4 [0.65"]
19.4 [0.76"]
Ø12.7 [0.50"]
fix with epoxy resin

28.2 [1.11"]
Ø18.6 [0.73"]
17 [0.67"]
Ø6.2 [0.24"]
Triaxial cable PUR, Ø 4.5 mm

(All measurements in mm)

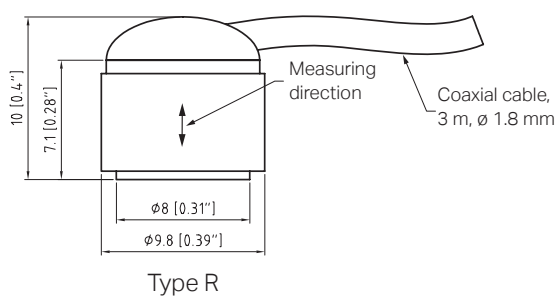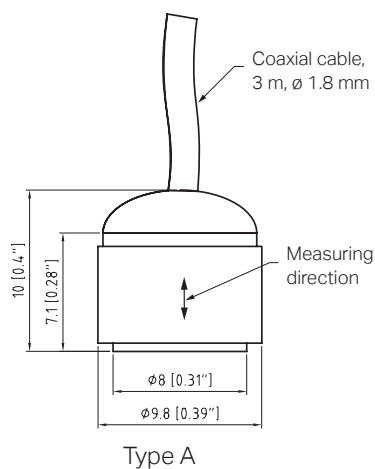| Ordering code	Sensitivity (±20%) *			Measurement range			Cable length (m)	Male connector (M12)
	50 mV/g	100 mV/g		±100 g	±50 g			
0.SH.VBS.050EPCR03	●			●			3	
0.SH.VBS.050EPCR10	●			●			10	
0.SH.VBS.050EPCR15	●			●			15	
0.SH.VBS.050EPCR20	●			●			20	
0.SH.VBS.050EPCR03C	●			●			3	●
0.SH.VBS.050EPCR10C	●			●			10	●
0.SH.VBS.050EPCR15C	●			●			15	●
0.SH.VBS.050EPCR20C	●			●			20	●
0.SH.VBS.100EPCR03		●			●		3	
0.SH.VBS.100EPCR15		●			●		15	
0.SH.VBS.100EPCR03C		●			●		3	●
0.SH.VBS.100EPCR15C		●			●		15	●

*The sensor is delivered with calibration data sheet

Technical data

Performance		Electrical characteristics		Environmental conditions		Physical connectors	
Frequency range	0.1 to 10,000 Hz	Excitation voltage	18 to 28 VDC	Overload limit (shock)	7,000 g peak	Cable	Coaxial, shielded
Internal filter	Low pass 10 kHz 2nd order	Constant current excitation	2 to 20 mA	Enclosure rating	IP 67	Cable jacket	PUR, 4.5 mm
Resonant frequency	> 25 kHz	Output bias voltage	8 to 12 VDC	Temperature range	-50 °C to +70 °C (-60 °F to 160 °F)	Bending radius	25 mm
-	-	Case insulation	> 10^5 Ω	-	-	Mounting	2-Component epoxy resin adhesive

VBS Micro

Acceleration sensor with measuring direction axial to the sensor and cable axial or radial to the sensor.

Coaxial cable,
3 m, ø 1.8 mm

Measuring
direction

10 [0.4''] 7.1 [0.28'']

ø8 [0.31'']
ø9.8 [0.39'']

Type A

Measuring
direction

Coaxial cable,
3 m, ø 1.8 mm

10 [0.4''] 7.1 [0.28'']

ø8 [0.31'']
ø9.8 [0.39'']

Type R

(All measurements in mm)

Ordering code	Sensitivity (±20%) *			Measurement range			Cable length (m)	Type
	50 mV/g	100 mV/g	500 mV/g	±100 g	±50 g	±10 g		
0.SH.VBS.050MICA	●			●			3	A
0.SH.VBS.050MICR	●			●			3	R
0.SH.VBS.100MICA		●			●		3	A
0.SH.VBS.100MICR		●			●		3	R
0.SH.VBS.500MICR			●			●	3	R

The sensor is delivered with calibration data sheet.

Technical data

Performance		Electrical characteristics		Environmental conditions		Physical connectors	
Frequency range	0.1 to 10,000 Hz	Excitation voltage	18 to 28 VDC	Overload limit (shock)	7,000 g peak	Cable	Coaxial, shielded
Internal filter	Low pass 10 kHz 2nd order	Constant current excitation	2 to 20 mA	Enclosure rating	IP 67	Cable jacket	PUR, 1.8 mm
Resonant frequency	> 25 kHz	Output bias voltage	8 to 12 VDC	Temperature range	-50 °C to +70 °C (-60 °F to 160 °F)	Bending radius	10 mm
-	-	Case insulation	$> 10^5 \ \Omega$	-	-	Mounting	2-Component epoxy resin adhesive

Installation guidelines

Sensor connection example

Fix the cable to the machine using cable claps. Take extra caution to make sure that the area close to the sensor is securely fixed to eliminate vibration.

See VBS accessories for optional connection system. The total cable length between sensor and sensor module on the RTM unit should not exceed 50 meters.

| 1 | S1 | ICP Signal |
| 2 | S2 | ICP GND |
| 3 | S3 | Screen |

Connection example:

VBS 50 for
CoroPlus Process control
VBI sensor box

VBS 50 Micro

Plug or terminal box provided by customer

1	S1	ICP Signal
2	S2	ICP GND
3	S3	Screen

Connection example:

VBS 50 Micro for
CoroPlus Process control
VBI sensor box
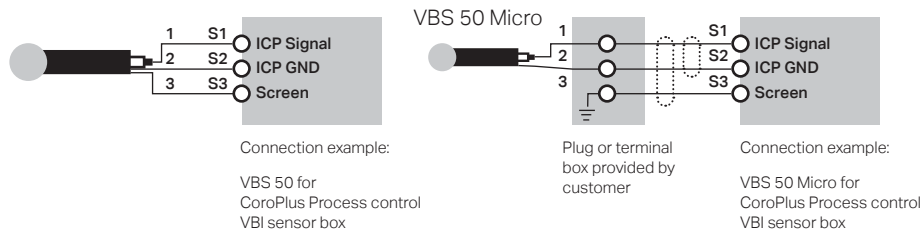
Sensor mounting

VBS AR/AT/RR:
Use M8 screw with fastening torque 12Nm to mount the VBS AR/AT/RR sensors to the machine.

VBS Epoxy CR/Epoxy CA/Micro A/Micro R:
Use epoxy resin (permanent bonding) or cyan acrylate (fast, detachable bonding) to mount the VBS Epoxy CR/Epoxy CA/Micro A/Micro R sensors to the machine. In its ideal position, the sensor's side walls do not touch the drill hole.

! Bond only the ceramic base plate of the sensor to the surface machine surface.

! If the drill hole is sealed or potted, use a soft grouting agent.
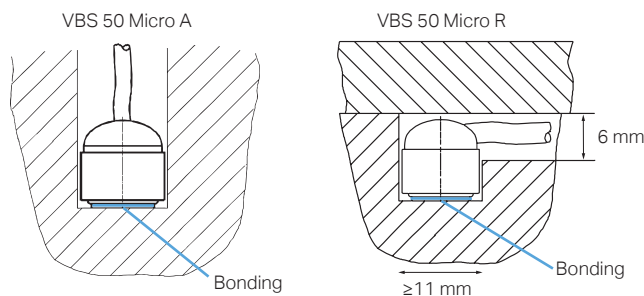
VBS 50 Micro A

VBS 50 Micro R

6 mm

Bonding

Bonding

≥11 mm

Cooling and lubrications

Use alcohol-based cleaning fluids to clean the sensor, cable and protection hose.

! Never use acetone-containing agents to clean the sensor, cable and protection hose.

! Cooling lubricant must be allowed to drain from installed sensors and cables. Other installations must be absolutely avoided.

## Extension and connection cords to monitoring system for VBS sensors
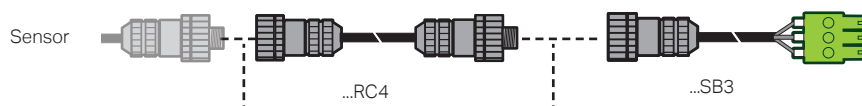
Ordering code	Cable length (m)	Connector 1	Connector 2
0.CP.VBS.RP4-RC4-05	5	4 pole female M12	4 pole male M12
0.CP.VBS.RP4-RC4-08	8	4 pole female M12	4 pole male M12
0.CP.VBS.RP4-RC4-10	10	4 pole female M12	4 pole male M12
0.CP.VBS.RP4-RC4-15	15	4 pole female M12	4 pole male M12
0.CP.VBS.RP4-RC4-20	20	4 pole female M12	4 pole male M12
0.CP.VBS.RP4-RC4-30	30	4 pole female M12	4 pole male M12
0.CP.VBS.RP4-RC4-40	40	4 pole female M12	4 pole male M12
0.CP.VBS.RP4-SB3-05	5	4 pole female M12	3 pole screw block
0.CP.VBS.RP4-SB3-10	10	4 pole female M12	3 pole screw block
0.CP.VBS.RP4-SB3-13	13	4 pole female M12	3 pole screw block
0.CP.VBS.RP4-SB3-20	20	4 pole female M12	3 pole screw block
0.CP.VBS.RP4-SB3-24	24	4 pole female M12	3 pole screw block
0.CP.VBS.RP4-SB3-25	25	4 pole female M12	3 pole screw block
0.CP.VBS.RP4-SB3-30	30	4 pole female M12	3 pole screw block

Triaxial cord for VBS sensors

Ordering code	Cable length (m)	Description
0.CA.SPC.TRIAXPUR	Length by the meter	Triaxial cable, double shielded in black PUR, qualified for drag chain use

Connectors
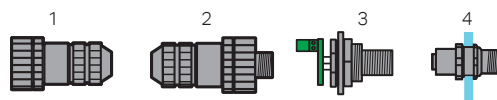
Ordering code	Type	Description
0.CL.VBS.RP4	1	4 pole female M12
0.CL.VBS.RC4	2	4 pole male M12
0.CL.VBS.RC4-JSH2F	3	4 pole male M12 for wall mounting
0.CL.VBS.RC4RP4WFT	4	Wall feed through for 4 pole round connectors (male to female) M12

Two-component adhesive

Two-component high-strength adhesive epoxy resin for fastening of VBS sensors VBS Epoxy CA/CR and VBS Micro.

Ordering code	Description
0.SH.AAG.EPOXY.27G	2C Epoxide resin glue, Two-compartment syringe, 27 g

Magnetic clamp

Magnetic fitting for flexible fitting of the sensor to workpieces, tools, holders or machine parts.

Ordering code	Description
0.SH.AAS.MC50	Magnetic clamp type MC 50 with M8 bolt

Acoustic emission and vibration sensor

Piezoelectric AE sensor technology

The AE acoustic emission and vibration sensor are well suited for measuring vibration-induced oscillations up to the ultrasonic range in machine components.
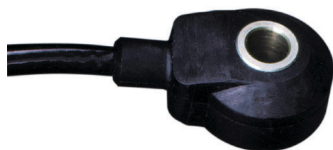
The AE sensors come in two protection class versions.

Type O: IP67 with plastic housing and PUR cable jacket.

Type S: IP68 with protective housing and metal braided protection hose PX9.
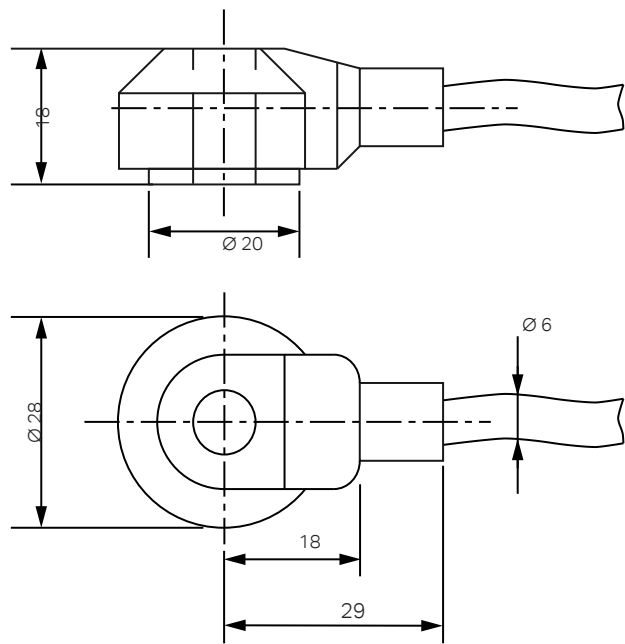
Both versions are mounted to the machine equipment with an M6 screw.

AE 30, Type O   AE 30, Type S

AE 30, Type O

Plastic housing with PUR cable jacke

AE 30, Type S

With protective housing and metal braided protection hose PX 9

Protection hose PX 9
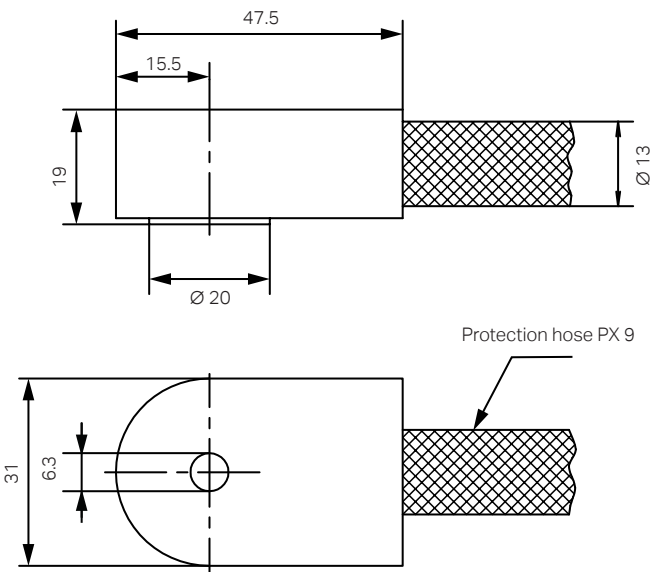
Ordering code	Cable length (m)	Type	Male connector (M12)
0.17.129.AEO1M	850	O	
0.17.129.AEORC4-1M	850	O	●
0.17.130.AES1M	850	S	
0.17.130.AESRC4-1M	850	S	●

Technical data

Performance		Protection class		Environmental conditions		Physical connectors	
Supply	±15 V DC, ±10%	Type O	IP67, salts mist, industrial atmosphere, oil, low-pollution coolant proof	Temperature range	5 °C to +60 °C (40 °F to 140 °F)	Screw mounting	M6
Output	RMS signal, o to 10 VDC	Type S	IP68, same as Type O, also aggressive cooling lubricants, chip protection				
Frequency range	100 to 80,000 Hz						

Installation guidelines
Sensor connection

Connect the AE30 sensor using the best suited of two different methods:

1) Use screw connection set to mount the sensor with the cable entering on a change amplifier.

2) Use 4 pole round connector and associated connection system to attach the cable.

See Accessories for AE 30 sensors for associated connection system. The total cable length between sensor and sensor module on the RTM unit should not exceed 50 meters.

Sensor mounting

Use an M6 x 30 screw to mount the AE 30 sensor on a plane, bright metal surface.
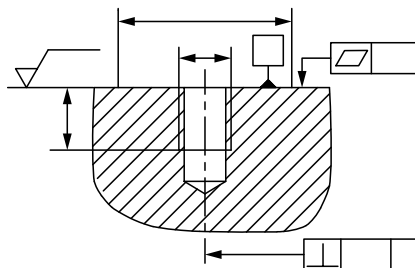
Cooling and lubrications

Use alcohol-based cleaning fluids to clean the sensor, cable and protection hose.

! Never use acetone-containing agents to clean the sensor, cable and protection hose.

! Cooling lubricant must be allowed to drain from installed sensors and cables. Other installations must be absolutely avoided.

Accessories and Extension cords for AE 30 sensors
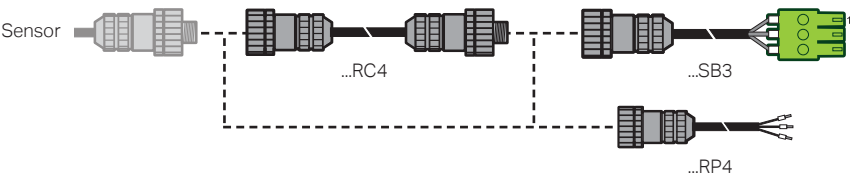
Ordering code	Cable length (m)	Connector 1	Connector 2
0.CP.AE3.RP4-RC4-10	10	4 pole female M12	4 pole male M12
0.CP.AE3.RP4-SB3-10	10	4 pole female M12	3 pole screw block
0.CP.AE3.RP4-SB3-15	15	4 pole female M12	3 pole screw block
0.CP.AE3.RP4-5	5	4 pole female M12	Terminal sleeves
0.CP.AE3.RP4-10	10	4 pole female M12	Terminal sleeves
0.CP.AE3.RP4-15	15	4 pole female M12	Terminal sleeves

Triaxial cord for VBS sensors

Ordering code	Cable length (m)	Description
0.CA.LICY02X05	Length by the meter	LiCY 2 x 0,5 mm² PUR

Connectors
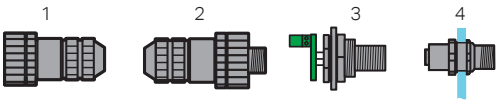
Ordering code	Type	Description
0.CL.VBS.RP4	1	4 pole female M12
0.CL.VBS.RC4	2	4 pole male M12
0.CL.VBS.RC4-JSH2F	3	4 pole male M12 for wall mounting
0.CL.VBS.RC4RP4WFT	4	Wall feed through for 4 pole round connectors (male to female) M12

Magnetic clamp

Magnetic fitting for flexible fitting of the sensor to workpieces, tools, holders or machine parts.

Measurements for AE 30 Type O (in parentheses for AE 30 Type S)
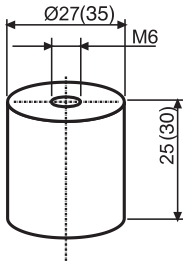
Ordering code	Type for AE sensor	Type
0.19.403.HM27	O	HM 27-M6
0.19.403.HM35	S	HM 35-M6

Force sensors

Piezoelectric force sensor technology

The force sensors are used to monitor the machine process and machine components and are good for detecting dull collisions in the machining system.

The force sensors come in many different shapes and mounting possibilities to cover a wide range of implementations
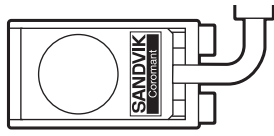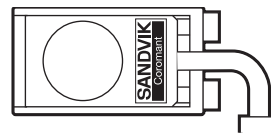
Measuring wedge
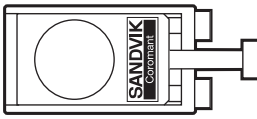
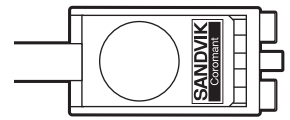| Type AG	Type AL	Type AR	Type IG
Cable outside, straight	Cable outside, left	Cable outside, left	Cable inside

Axial measuring dowel
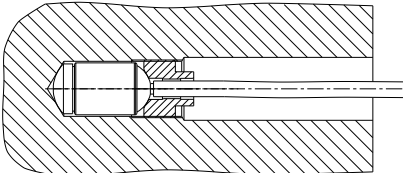
MDA 20 ST	MDA 20 PT	MDA 20 PST
Spherical, cable topside	Plane, cable topside	Plane with joint, cable topside
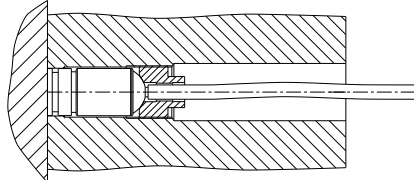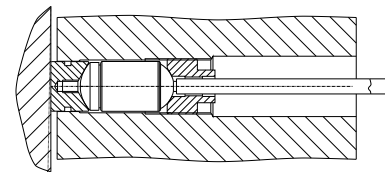
Bolt sensors
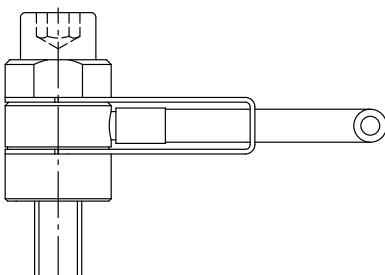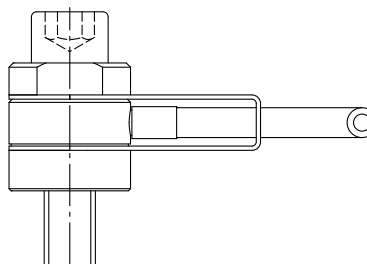
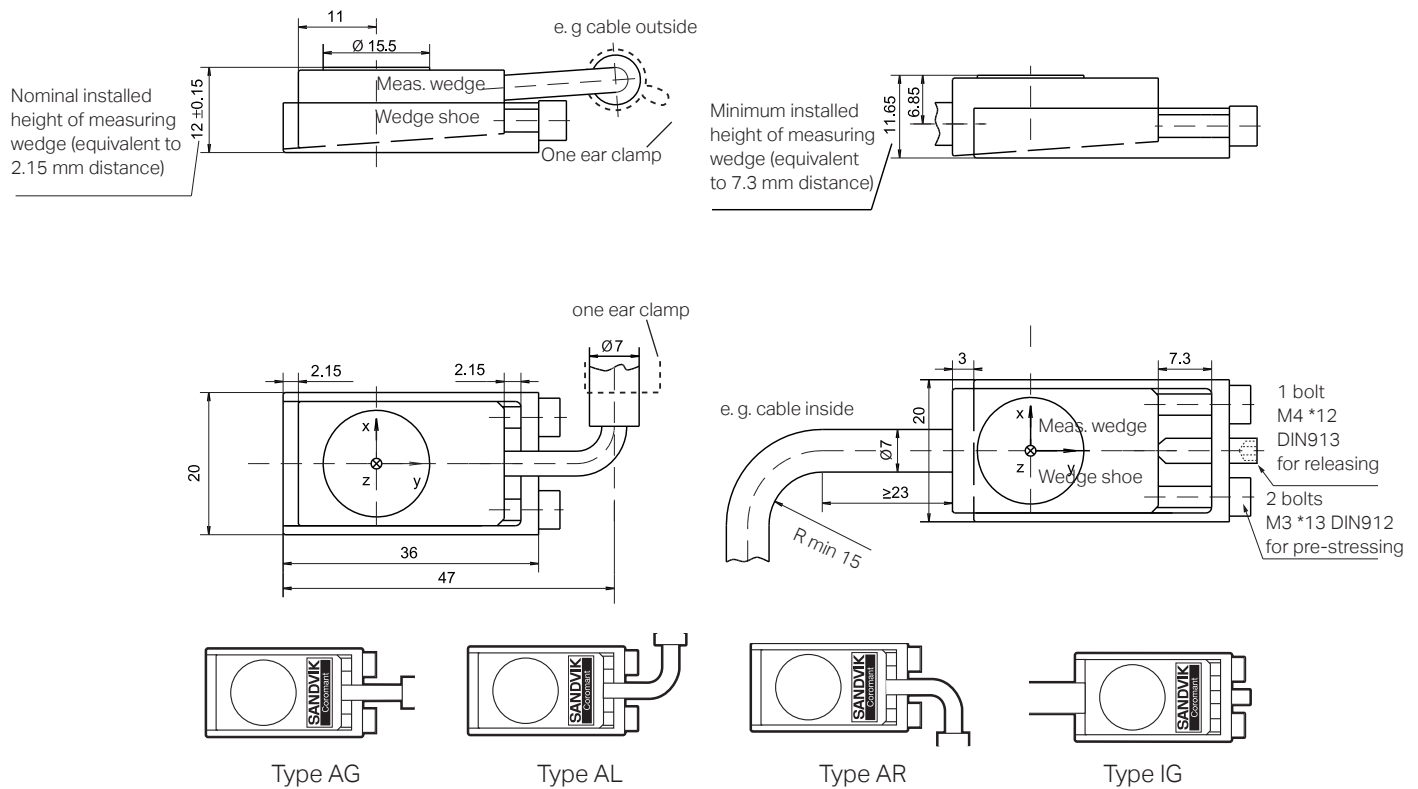| KM 10	KM 12	KM 16
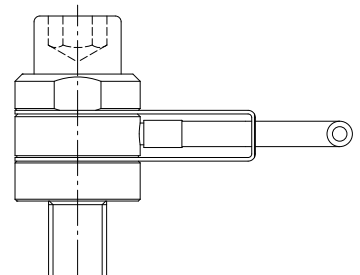
Measuring wedge

Measuring wedge with different cable mounts for installation in pocket.

Nominal installed height of measuring wedge (equivalent to 2.15 mm distance)

Meas. wedge
Wedge shoe
One ear clamp
e. g cable outside

Minimum installed height of measuring wedge (equivalent to 7.3 mm distance)

one ear clamp

e. g. cable inside

R min 15

Meas. wedge
Wedge shoe

1 bolt M4 *12 DIN913 for releasing

2 bolts M3 *13 DIN912 for pre-stressing

Type AG   Type AL   Type AR   Type IG

(All measurements in mm)

Ordering code	Cable length (m)	Type
0.11.032.1DKMAG	2	AG
0.11.032.1DKMAL	2	AL
0.11.032.1DKMAR	2	AR
0.11.033.1DKMIG	2	IG
0.11.032.1DKMAG05	5	AG
0.11.032.1DKMAL05	5	AL
0.11.032.1DKMAR05	5	AR
0.11.033.1DKMIG05	5	IG

Technical data

Performance		Protection class		Environmental conditions	
Sensitivity	0-4.2pC/N	Enclosure rating	IP68 oil- and coolant-proof	Cable	Coaxial, shielded
Measurement range	-7.5 to +7.5 kN (pre-load: 10 kN) * 0 to 15 kN (Pre-load: 3 kN)	Temperature range	-50 to 80 °C (-58 to 176 °F)	Protective sleeve	PU, Ø7 mm
Reponses threshold	< 0.01 N ≙ 0.01nm ≙ 0.0012µε			Bending radius	15 mm
Fastening torque	ca. 1.7 Nm *				
(pre-stress screws)	(allowed max. 1.9 Nm)				

* Recommended, with pre-stress torque the wedge measures stress as well as relief of the appropriate machine part
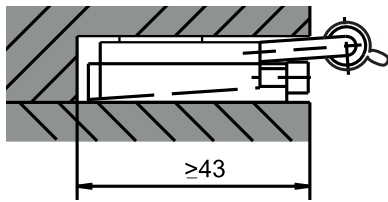
Installation guidelines

Sensor cable

It is recommended to keep the sensor cable as short as possible for ease of handling and to prevent damage to the cable.

In case of high mechanical stress in the working chamber (e.g. due to hot chips), an additional metal protection hose for the sensor cable with a length of 1.3 m is recommended, see order code 0.20.805.PHPU4M and protection hoses under the accessories section.

Measuring wedge (cable outside, left):   Tolerance I:
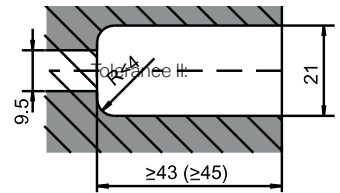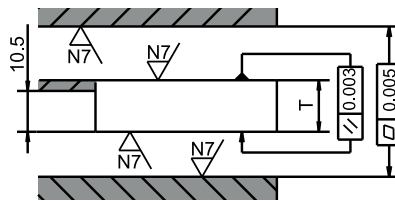
All dimensions in mm. All dimensions given in brackets ( ) refer to a measuring element projecting the maximum distance.

Due to the force bypass measuring principle, forces acting on the structure of the machine or fixture can be much larger than forces acting or measured on the sensor fitting point.

Cooling and lubrications

Use alcohol-based cleaning fluids to clean the sensor, cable and protection hose.

! Never use acetone-containing agents to clean the sensor, cable and protection hose.

! Cooling lubricant must be allowed to drain from installed sensors and cables. Other installations must be absolutely avoided.

Axial Measuring Dowel
MDA 20

The Axial Measuring Dowel is a piezoelectric force sensor that measures forces in longitudinal direction proportional to the load on the installed machine components.
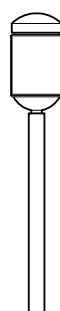
MDA 20 ST   MDA 20 PT   MDA 20 PST   MDA 20 SB

Ordering code	Cable length (m)	Type
0.SH.MDA.20PST	3	MDA 20 PST
0.SH.MDA.20PT	3	MDA 20 PT
0.SH.MDA.20SB	3	MDA 20 SB
0.SH.MDA.20ST	3	MDA 20 ST
0.SH.MDA.20PST05	5	MDA 20 PST
0.SH.MDA.20PT05	5	MDA 20 PT
0.SH.MDA.20SB05	5	MDA 20 SB
0.SH.MDA.20ST05	5	MDA 20 ST

Sensor is delivered with pressure screw or pressure piece/adjusting screw, connection set for cable entry on charge amplifier.

Technical data

Performance		Environmental conditions		Physical connectors	
Sensitivity	-4 pC/N	Protection class	IP68, resistant to most oils and coolants	Cable	Coaxial, shielded
Measurement range	Fz = 0 – 15 kN -7.5 to +7.5 kN	Temperature range	-30 to +120 °C -22 to +176 °F	Protective sleeve	PU, Ø7 mm
	Preloaded with a tightening torque of 12-15 Nm	Housing	Chrome-nickel steel	Bending radius	15 mm

All technical data apply to the fitting location at 100% force transmission. The measuring wedges are corrosion resistant.

Installation guidelines

Sensor cable

It is recommended to keep the sensor cable as short as possible for ease of handling and to prevent damage to the cable.

In case of high mechanical stress in the working chamber (e.g. due to hot chips), an additional metal protection hose for the sensor cable with a length of 1.3 m is recommended, see order code 0.CH.XXX.PHPU4M13 and protection hoses under the accessories section.
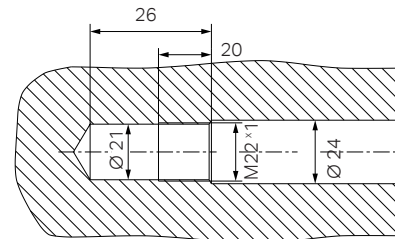
Sensor mounting

All involved surfaces must be clean. The protective hose of the sensor must be secured in the area of the cable outlet in such a way that mechanical loads are not transferred to the sensor.
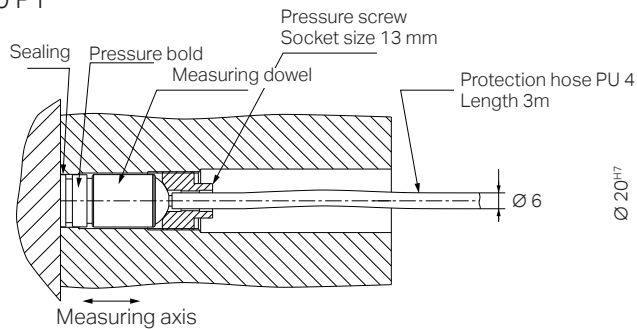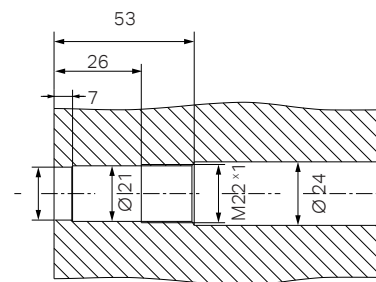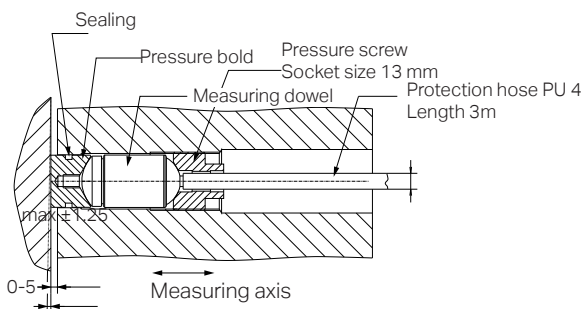
MDA 20 ST
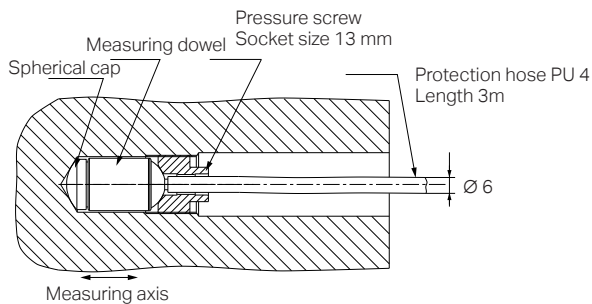
Example of dowel hole and fitting

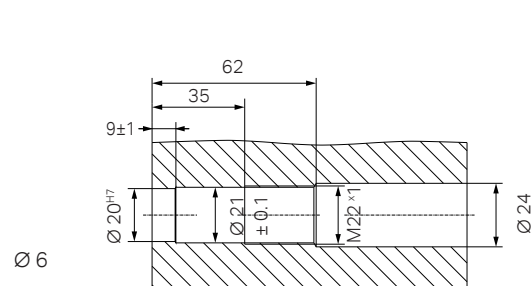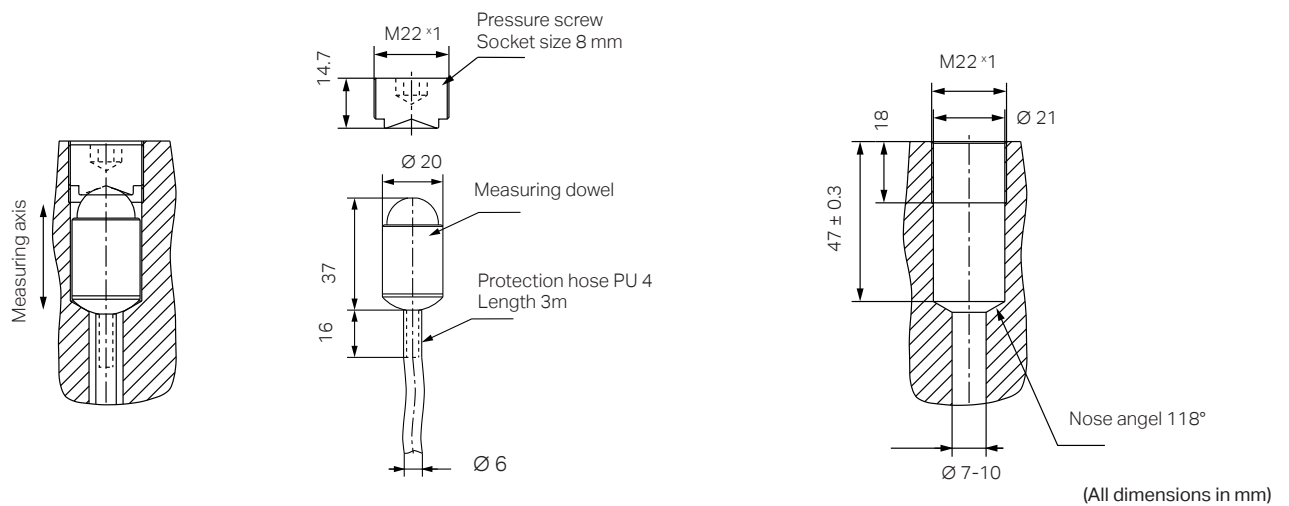### MDA 20 PT

Example of dowel hole and fitting

MDA 20 PST

Example of dowel hole and fitting

Example of dowel hole and fitting

M22 ×1
14.7
Pressure screw
Socket size 8 mm

Ø 20
Measuring dowel

37
16

Protection hose PU 4
Length 3m

Ø 6

Measuring axis

M22 ×1
18
Ø 21
47 ± 0.3

Ø 7-10
Nose angel 118°

(All dimensions in mm)

Cooling and lubrications

Use alcohol-based cleaning fluids to clean the sensor, cable and protection hose.
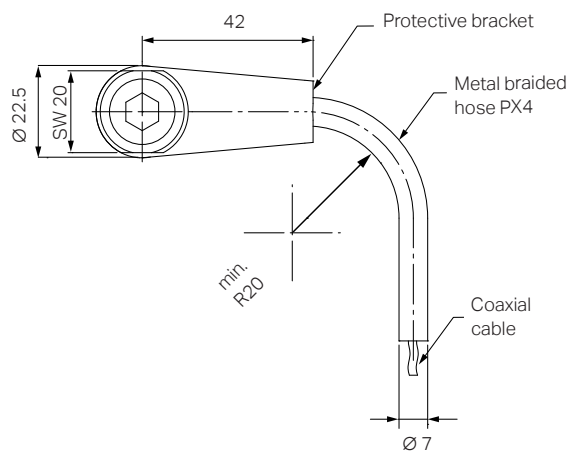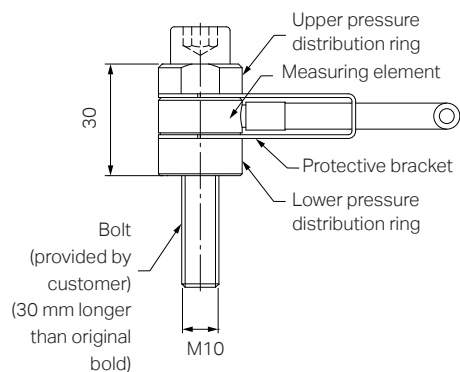
! Never use acetone-containing agents to clean the sensor, cable and protection hose.

! Cooling lubricant must be allowed to drain from installed sensors and cables. Other installations must be absolutely avoided.
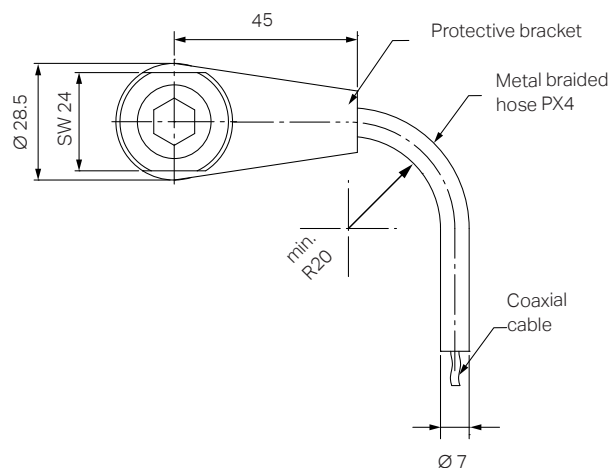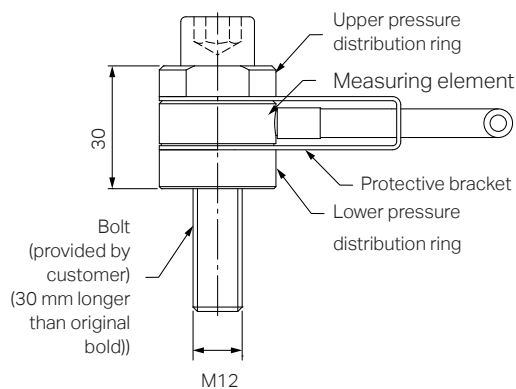
Bolt sensor KM

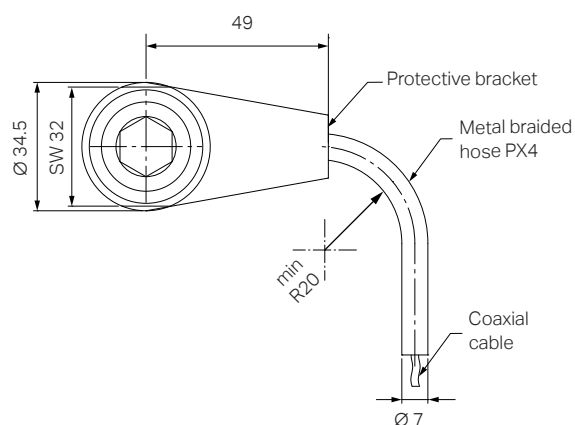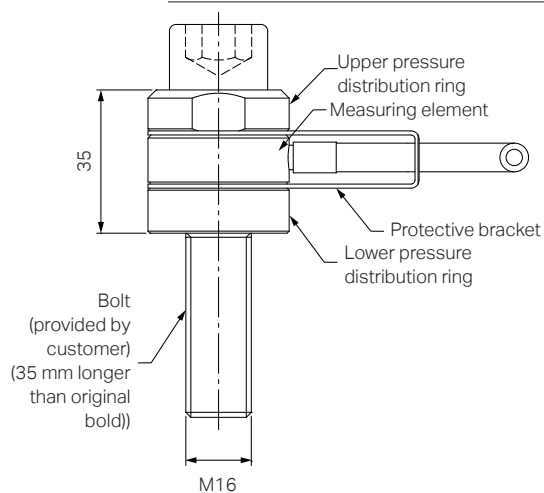Piezoelectric force sensor technology.

KM 10

Upper pressure distribution ring
Measuring element
Protective bracket
Lower pressure distribution ring
30
Bolt (provided by customer) (30 mm longer than original bold)
M10

42
Protective bracket
Ø 22.5
SW 20
min. R20
Metal braided hose PX4
Coaxial cable
Ø 7

KM 12

Upper pressure distribution ring
Measuring element
Protective bracket
Lower pressure distribution ring
30
Bolt (provided by customer) (30 mm longer than original bold))
M12

45
Protective bracket
Ø 28.5
SW 24
min. R20
Metal braided hose PX4
Coaxial cable
Ø 7

KM 16

Upper pressure distribution ring
Measuring element
Protective bracket
Lower pressure distribution ring
35
Bolt (provided by customer) (35 mm longer than original bold))
M16

49
Protective bracket
Ø 34.5
SW 32
min. R20
Metal braided hose PX4
Coaxial cable
Ø 7

Ordering code	Cable length (m)	Bolt size (mm)	Measuring range f_z	Max. permissible axial force f_z
0.SH.BSK.M1003	3	M10	0–50 kN	60 kN
0.SH.BSK.M1203	3	M12	0–100 kN	120 kN
0.SH.BSK.M1603	3	M16	1–140 kN	160 kN

The sensors are delivered with pressure distribution rings, protective bracket, screw accessories for cable installation on the charge amplifier and 2 cable clamps with screws.

Technical data

Performance		Environmental conditions	
Sensitivity	≈ -4,3 pC/N	Protection class	IP68, resistant to most oils and coolants
		Temperature range	-40 to +120 °C

Installation guidelines

Sensor mounting

Important: The sensor may only be installed including both of its pressure distribution rings.

Secure cable outlet against twisting during installation: When tightening the bolt sensor, be careful not to twist or load the cable outlet. Use a spanner of the appropriate size to secure the upper pressure distribution ring when tightening the bold.

Do not exceed the measuring range of the sensor: The tightening torque of the bolt depends on the specifications of the machine manufacturer, whereby the maximum measuring range of the bolt sensor listed in the table must not be exceeded.

Use cover plate as protection against temperature fluctuations: In order to avoid temperature drift of the measured signal the sensor must be protected by metal cover plates from direct coolant contact, metal chips, etc.

Secure protection hose: The protective hose must be fixed to the machine in at least two places in the area of the sensor so that no forces can be transferred from the protective hose to the measuring element. It is essential to ensure a twist free installation.

Example of a turret mounting

It is recommended to replace the two bolts with bolt sensors KM that are closest to the revolver plate or respectively to the tool position.
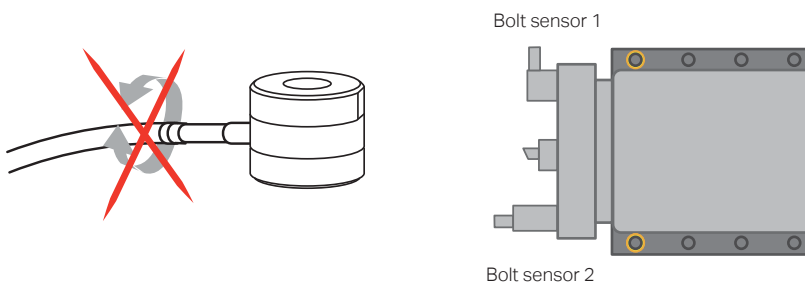
Bolt sensor 1

Bolt sensor 2

Cooling and lubrications

Use alcohol-based cleaning fluids to clean the sensor, cable and protection hose.

! Never use acetone-containing agents to clean the sensor, cable and protection hose.

! Cooling lubricant must be allowed to drain from installed sensors and cables. Other installations must be absolutely avoided.

Accessories for force sensors
Charge amplifier

Type N = Normal protection box

Type C = Compact protection box

Ordering code	Cable length (m)	Type
0.97.210.LVP1	1	C
0.97.211.LVP1	1	N
0.97.220.LVP1	2	C
0.97.221.LVP1	2	N
0.97.230.LVP1	3	C
0.97.231.LVP1	3	N
0.97.241.LVP1	4	N

Installation guidelines

Electrical installation

Both the charge amplifier and the force sensors work with a very low charge and a high insulation resistance ($10^{14}\Omega$) is used. The high insulation resistance applies to all components on the charge path, it covers the charge amplifier module and especially the charge cable terminal block and the range capacitor socket as well as the sensor charge cable.

It is important to maintain cleanliness at all times in this area, as each particle of dirt can interfere with the insulation resistance and thus badly impair functions. Therefore, make sure that hands as well as tools are completely clean when connecting the charge amplifier. If any cleaning is necessary isopropyl alcohol is recommended.

Mounting

Always install the charge amplifier outside the area of cooling lubrications and chips.

Make sure that the area of installation is clean before installation or opening the change amplifier.

The housing cover has a seal that must be checked for damage before closing the housing and replaced if necessary. The housing must be properly closed so that no particles can penetrate the housing and impair the function of the charge amplifier.

Power measurements

Hall current converters technology

Power measurement indicates the load or overload status of a motor or a drive. Monitoring power can ensure efficient protection for the motor or drive.

The power is proportional to the torque at the motor or drive shaft. Power measurement as compared to direct torque measurement is easier to fit or retrofit.
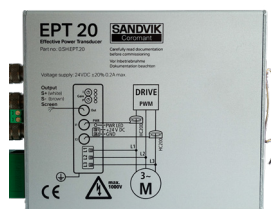
EPT 20   HC 200 C

EPT 20

Effective Power Transducer

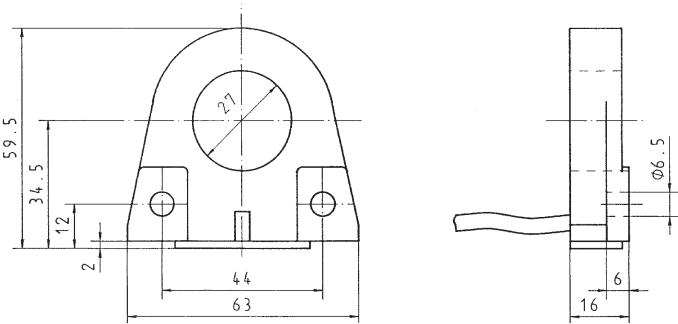| Ordering code	
0.SH.EPT.20 *	

Delivered with power connector, output connector with 2 m cable, 3 x voltage measuring cable 2 m.
 *Note: Two Hall Current Converter (0.SH.EPC.HC200C) is needed for one EPT 20 unit ordered separately.

Technical data

Performance		Environmental conditions	
Voltage supply	+24V DC ±20%	Temperature range	-0 to +70 °C (+32 to +150°F)
Voltage measuring range	100 to 600 V		
Current measuring range	0 to 300 A		
Reaction time	≤ 10 ms		
Resolution	From 0,4 mW In real life: drill breakage detection from a drill diameter of 2 mm in aluminum or drill output > 0.4% of rated motor output		
Measuring ranges	100 mW to 150kW (adjustable)		

HC 200 C

Current converter

| Ordering code	Cable length (m)
0.SH.EPC.HC200C	2

Delivered with connecter for connection to the EPT 20 effective power transducer.

Technical data

Performance	
Temperature range	-25 to +85 °C (-15 to +170°F)

Installation guidelines

The power sensor is connected directly to the motor's supply cables as illustrated by the figure below. The power sensor is delivered with detailed installation manual and user guide.
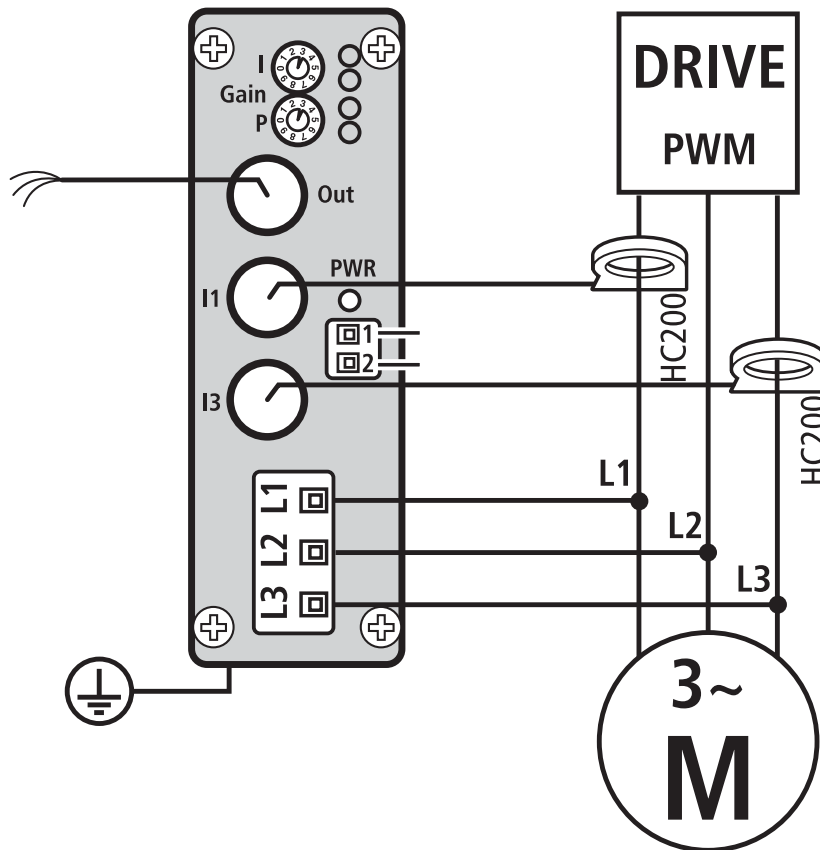
For safety reasons, always switch off the machine at the main switch before installing the sensor. You should also respect any discharge times of the control's voltage supply.

General accessories

Machine interface bus cables

Ordering code	Type	Cable length (m)	Connectors
0.CP.MIB.PROFIN02	PROFINET	2	RJ45
0.CP.MIB.PROFIN05	PROFINET	3	RJ45
0.CA.SPC.TP2X64S	PROFIBUS	Length by the meter	Open ended

Machine interface bus cable accessories

Ordering code	Description
0.CL.PRO.FIBUSCA	PROFIBUS connector (m), cable 90º angular

System interface bus cables

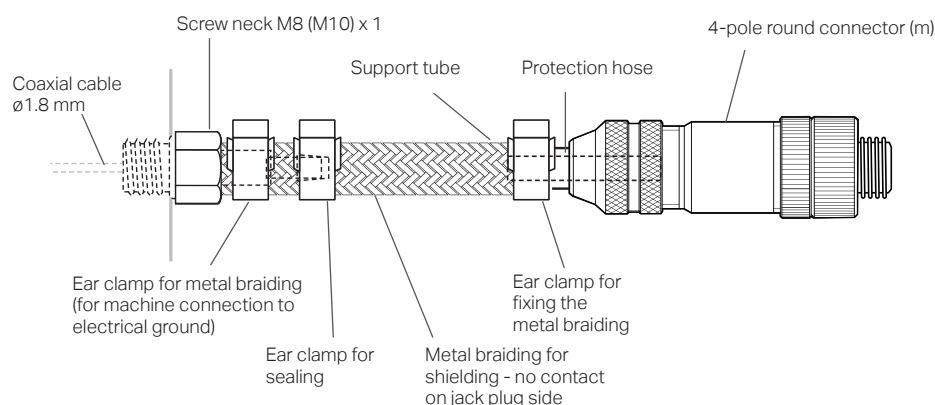| Ordering code	Length (m)	Description
0.CP.SIB.ETHER-03	3	Ethernet cable with Rj45 connector cat. 6, violet color
0.CP.SIB.ETHER-05	5	Ethernet cable with Rj45 connector cat. 6, violet color
0.CP.SIB.ETHER-10	10	Ethernet cable with Rj45 connector cat. 6, violet color
0.CP.SIB.ETHER-15	15	Ethernet cable with Rj45 connector cat. 6, violet color

Cables

Ordering code	Length (m)	Description
0.CA.SPC.TP4X25SU	Length by the meter	Twisted Pair Cable 4 x 0.25 mm², shield, in purple PUR, cable carrier proof
0.CA.SPC.TP6X25SU	Length by the meter	Twisted Pair Cable 6 x 0.25 mm², shield, in gray PUR, cable carrier proof
0.CA.LIC.Y08X05	Length by the meter	Cable LiCY 8 x 0.5 mm² PUR

Cable protective hose

Ordering code	Length (m)	Suitable for sensor	Description
0.20.805.PHPX6	Length by the meter	VBS AR, VBS RR, VBS AT, VBS Epoxy	Metal braiding rubber hose
0.CH.XXX.PHPU4M13	1.3	VBS AR, VBS RR, VBS AT, VBS Epoxy, Measuring Wedge, MDA 20	Metal protection hose

Cable protective hose for VBS micro sensors

Protective hose for built in VBS micro sensor including 4-pole round male connector.

System interface bus cables

Ordering code	Length (m)	Screw neck
0.CL.VBS.M08HRC4-02	2	M8
0.CL.VBS.M08HRC4/35	0.35	M8
0.CL.VBS.M10HRC4-02	2	M10

Delivery: Protection hose with metal braiding, screw neck, support tube, M12 round connector (m), 3 1-ear clamps with inserts (08.3RER).

Technical data

Performance		Environmental conditions	
Protection hose	PUR – with metal braiding	Protection class	IP67 (when plugged in)
Diameter	4 (inside), 7.5 (outside)	Permitted temperature	-30 to 70°C (-22 to 158°F)
Min. bending radius	30 mm static		

Siemens licenses

Ordering code	Description	Siemens number
0.OS.RTL.S840DSL	Sinumerik 828D/840D SL Sinumerik integrate run myHMI / 3GL	6FC5800-0AP65-0YB0
0.SH.TSL.2SASIEPAMS	Sinumerik 810D/810DE/840D/840DE analysis of internal drive values	6FC5251-0AB17-0AA0
0.SH.TSL.SA16SIE	Sinumerik 810D/810DE/840D/840DE synchronous operations level 2	6FC5251-0AD05-0AA0
0.SH.TSL.SA256SIESL	Sinumerik 840D SL synchronized actions step 2	6FC5251-0AM36-0YB0
00.SH.TSL.XSASIE28L	Sinumerik 828D analysis of internal drives basic	6FC5800-0AS53-0YB0
0.SH.TSL.XSASIESL	Sinumerik 840D SL evolution internal drive variables	6FC5800-0AM41-0YB0

Note: Siemens licenses cannot be reused or re-utilized or be returned against credit.

SANDVIK
Coromant