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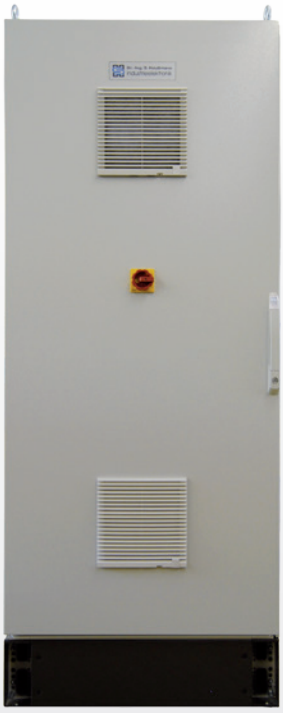
Automatic Gear Shaft Control GSW2001

Automation system for shifting and testing of vehicle gearboxes directly at the selector shaft

Automatic Gear Shaft Control GSW2001

The Automatic gear shaft control GSW2001 is an automation system for shifting and testing of vehicle gearboxes, consisting of an actuator with integrated synchronous motors and travel-sensoring system as well as the appropriate power- and signalling electronics.

The GSW2001 is used for practice-oriented gearbox shifting in stationary power train test benches and for testing of gearboxes. A variety of software for gearbox testing is available as option.



Main features

- Electronically controlled, electro-mechnical system, self learning
- 8 forward gears, 4 reverse gears, 1 idle position each can be stored in 32 data files
- Programmable path motions with travel-dependant forceand speed setting.
- Compensation of a centering error to the selector shaft
- Max. translatory setting travel: ± 30 mm (operating stroke) + 100 mm (park position)
- Max. rotatory setting angle: ± 130 °
- Max. translatory setting force: ± 1200 N
- Max. rotatory setting torque: ± 50 Nm (± 500 Nm on request)
- Max. setting speeds: 1.6 m/s referred to a virtual standard shift lever of 0.25 m lengt or 0.23 m/s for translation or 360 °/s for rotation

Benefits and advantages

- Menu-guided operation and display of shifting conditions as well as parameters by means of the delivered hand terminal HT9201
- A lot of possibilities for setting of parameters like e.g. type of gearbox, number of forward- and reverse gears, shifting modes, shifting ramps, shifting speeds, shifting forces and number of test steps.etc.
- Data files for max. 32 different gearboxes can be stored. Selection via code designation. All data files are stored in the automatic gearshift control computer. No external storage is required
- Signal exchange with an external computer via serial interface (standard: RS232) to activate a multitude of functions like e.g. selection remote-controlled/manual operation, gearbox selection, gear selection, etc.
- Distance-controlled, force-limited gearshift control with test steps for gear change operation
- Shifting force-controlled further movement for gear change operation

The coupling to the gearbox

The coupling to the gearbox

Gearbox actuation is made directly on the selector shaft by a combined linear and rotary motion. Coupling to the test unit selector shaft is made by an electric motor-driven collet adapted to the respective selector shaft contour.

The electronic cabinet

The electronic cabinet

The power and signal electronics of the GSW2001 is housed in an electronic cabinet. The synchronous motors of the actuator are fed by IGBT converters. A micro-processor system serves as a superior command for the measurement value processing.

The 3RU-19¨-rack

The 3RU-19¨-rack

The coordination of the motion sequence is made by the 19¨control unit. This rack contains a microcomputer and all required low voltage network components.

Hand terminal HT9201

The operation

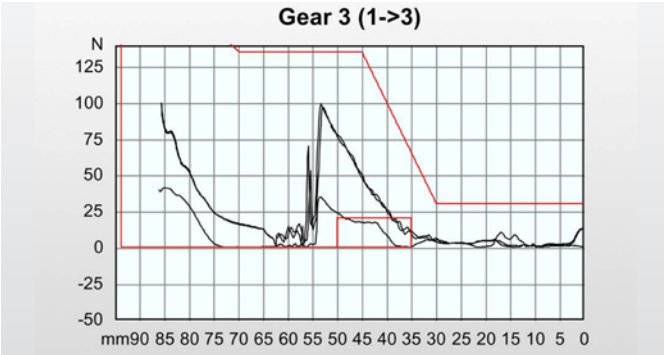
The Automatic gear shaft control GSW2001 is a self-learning system. Menu-guided setting of all relevant positions and parameters. Data files for as many as 32 different gearboxes can be stored. Operation by a hand terminal HT9201 with a large LC-display and an appropriate keyboard.

Options and accessories for the Automatic Gear Shaft Control GSW2001

Force measuring equipment

Force measuring equipment

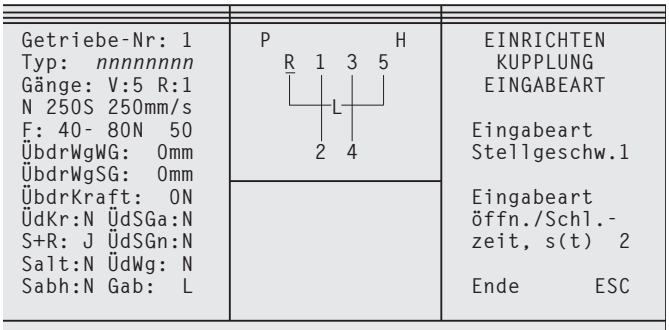
Most realistic gearshifting is feasible with the optional force measuring equipment, recognizing the rise in force at the synchronization point and a force-dependent passing-through of the synchronizing range. Furthermore actual travel and force values are output as potential free analog voltages. After gear engagement the selector shaft, even when coupled, can be regulated by means of a software function that it is free of force. Thus it is possible to detect gear jumping and shift lever vibrations.



Force- and travel measuring curve

Shifting and selector force measuring

Shifting and selector force measuring by strain gauge force sensors which are integrated in the collet of the actuator. Thus the mass inertia of the actuator can be eliminated to a large extent.



Software modules

Software modules

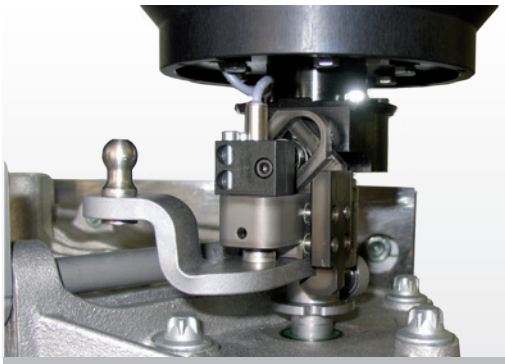
Software modules for testing of manual gearboxes, checking of double shiftings by input of a shifting gate off-set, testing for smooth operation of selector travels resp. shifting gates by force-controlled positioning of the shift lever to the selector travel resp. shifting gates and travel-controlled passing-through the selector travel resp. shifting gates, are available as options.

More options

- Software module for evaluation of synchronization incl. scratching noise detection
- Signals for clutch actuation with hydraulic or pneumatic adjusting cylinders
- Actuation of a clutch pedal via automatic clutch KA9111+
- Connection of a superior test-PC for test step presetting, evaluation and filing of test data (on request)

Accessories

GSW2001 with customized collet



GSW2001 with customized collet

GSW2001 actuator version ¨U-shape¨

GSW2001 with customized collet

Hand terminal HT9201

Data sheet for the Automatic Gear Shaft Control GSW2001

Actuator (Standard version)

Actuator with integrated synchronous motors and travel sensoring systems, all feeders led on plug connectors. Double universal joint to compensate alignment errors and axial off-sets between actuator and test unit. Electric motor-driven collet with optionally integrated force and torque measuring.	
Dimensions:	450 mm x 200 mm x 231 mm L x W x H)
Weight:	80kg
Weight incl. mounting plate:	106kg
Protection:	IP54
Max. translatorischer Shifting travel:	±30mm (operating stroke) +100mm (park position)
Max. translatorische Shifting force:	±1200N
Max. Shifting speed:	1.6 m/s referred to a virtual standard shift lever of 0.25 m length or 0.23 m/s for translation or 360 °/s for rotation
Max. rotatory setting angle:	±90 °
Max. compensation of a centering error of the selector shaft:	±0.8mm
Setting torque:	50Nm max.
Resolution and repetitive accuracy:	< ± 0.5 degrees

Temperature range actuator

Admissible range:	0 °C up to max. +50 °C (No condensing humidity allowed)

Electronics

Signalling electronics and power supply designed as 3RU-19¨ rack. Modular 3RU-19¨ IGBT converter for the actuator. Hand terminal HT9201 with LC-display and keyboard for GSW2001 operation.	
Dimensions SCR9801:	482.6 mm x 307 mm x 3 HE (L x B (without plugs) x H)
Dimensions control rack:	482.6 mm x 307 mm x 3 HE (L x B (without plugs) x H)

Temperature range electronics

Admissible range:	0 °C up to max. +70 °C (No condensing humidity allowed)
Option:	–40 °C up to +70 °C

Software

The standard software for operating the GSW2001 has the following essential features:	
- Operating modes of GSW2001:	- Setting via hand terminal HT9201 - Manual operation via hand terminal HT9201 - Remote-controlled operation via serial interface - Test functions via hand terminal HT9201
- Menu guided setting manual or motor force	
- A lot of possibilities for setting by means of parameters like type of gearbox, number of forward- and reverse gears, shifting modes, number of test steps	
- Data files for max. 32 different gearboxes can be stored	
- 8 forward gears, 4 reverse gears, 1 idle position can be stored per gearbox	

Interfaces to peripheral units

Binary signals:	Optocoupler
Analog signals:	±10V, potential free
Serial interfaces	
Type:	RS232, RS422, TTY, Profibus, CAN
Connection possibility for a second hand terminal HT9201	

Power supply

Rated voltage servo controller:	3/PE AC 380V ... 480V ±10%
Frequency servo controller:	50 ... 60 Hz
Safeguarding servo controller:	1.4kVA
Rated voltage control rack:	1/N/PE AC 230V ±10%
Frequency control rack:	50 ... 60Hz
Safeguarding control rack:	2A

Data sheet for the optional Automatic Clutch KA9111+

Actuator (Standard version)

Linear positioning unit with integrated brushless, convection cooled servomotor, absolute travel measuring system.			
Dimensions:	450 mm x 200 mm x 231 mm (L x W x H)		
Weight:	22 kg		
Protection:	IP54		
Shifting travel:	180 mm		
Shifting force (Ta ≤ 70 °C):	1500 N (static) 2000 N (temporarily: 60 sec./25% duty cycle)		
Shifting force (Ta ≤ 40 °C):	2000 N (static)		
Shifting force with FLEXBALL® cable DZ60, 1.5 m	Travel	Push forces	Pull forces
	160 mm	500 N	1250 N
	180 mm	350 N	850 N
Shifting speed:	0.64 m/s max.		
Resolution (actual travel value) and repetitive accuracy:	<± 0.05 mm		

Temperature range actuator

Admissible range for the standard version:	– 20 °C up to max. + 70 °C (No condensing humidity allowed)
Option:	– 40 °C up to max. + 70 °C

Electronics

Control and power unit as a 3RU-19¨ rack. IGBT-converter for the servomotor. LC-display and keyboard at the front panel for operation of the KA9111+. The front panel of the power and control panel is removable.	
Dimensions:	482.6 mm x 307 mm x 3 RU (L x W (without plugs) x H
Weight:	13 kg
Protection:	IP20

Temperature range electronics

Admissible range:	0 °C up to max. + 40 °C (No condensing humidity allowed)

Software

The standard software for operating the KA9111+ has the following essential features:	
- Operation of the KA9111+ with	- Analog interface - Binary inputs - Hand terminal - Serial interface (RS232) - Option: CAN (potential free)
- Manual or automatic set-up	
- Max. 32 parameter sets can be stored for the modes of operation accelerator pedal, selector lever or pedal set-point adjuster	
- Diagnostic functions	
- German, English or French language module	

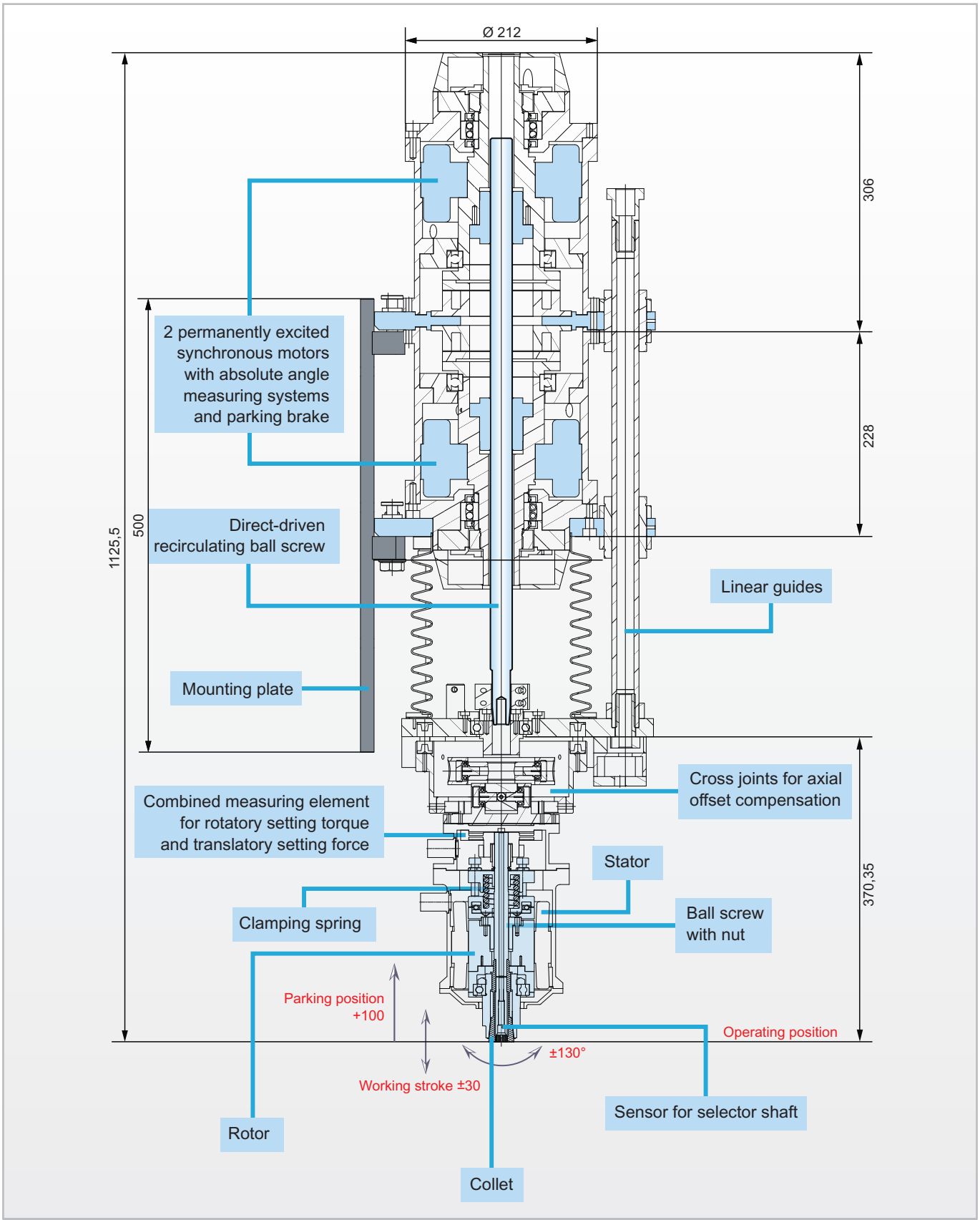
Interfaces to peripheral units

Binary signals	
Relay contact outputs:	50 V/100 mA
Optocoupler inputs:	15 V up to 24 V
Plug-in connection:	Phoenix MC 1.5/16-STF-3.81
Analog intefaces	
Analog outputs:	0 up to ± 10 V/max. 5 mA
Analog inputs:	0 up to 10 V/> 20 kΩ (each potential free)
Plug-in connection:	Phoenix MC 1.5/16-STF-3.81
Serial interfaces	
Type:	RS232 (potential free)
Plug-in connection:	D-Sub-9
External connection for hand terminal	
Type:	RS422
Plug-in connection:	D-Sub-15
Connections for Miniterminal MT1	
Plug-in connection:	Push-Pull

Power supply

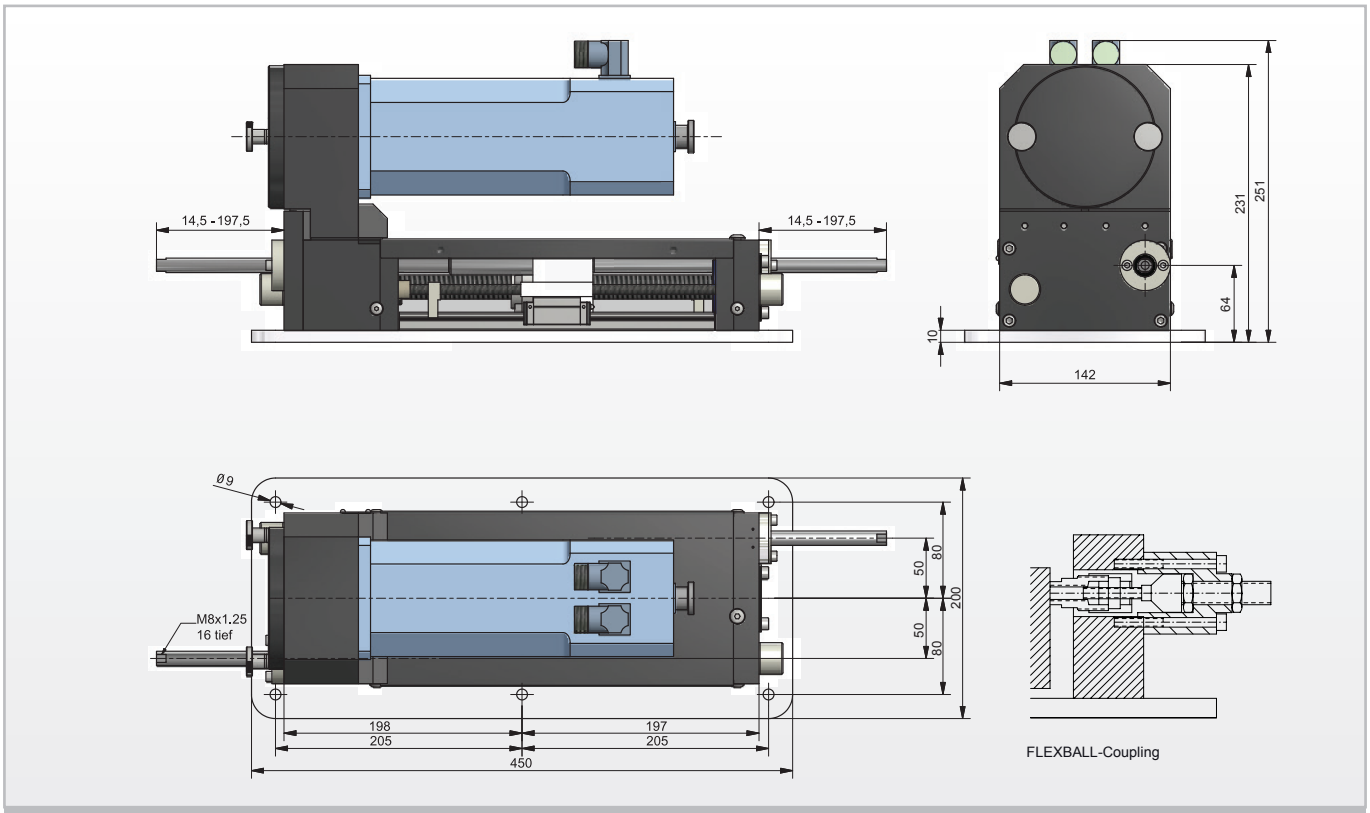
Rated voltage:	3/PE AC 380 V ... 480 V ± 10 %
Frequency:	50 ... 60 Hz
Installed load:	1.4 kVA
Plug-in connection:	6-poles connector pair

Dimensions for the Automatic Gear Shaft Control GSW2001



Actuator

Dimensions for the optional Automatic Clutch KA9111+



Actuator standard version with optional steel rod

Order information for the Automatic Gear Shaft Control GSW2001

1. Gear Shaft Control GSW2001

	Order information
1.1	Automatic gearbox selector shaft GSW2001 in standard version incl. front panel and hand terminal HT9201, all plug connector pairs and connection cables between control rack and converter unit inside an electronic cabinet (without electronic cabinet), incl. GSx-release box, incl. initial set up of GSW2001 at place of customer and instruction of operating staff (max. 3 working days without travel expenses)

2. Options:

	Order information
2.1	Force- and travel measuring equipment for GSW2001 incl. software module
2.2	Signals for clutch actuation with hydraulic or pneumatic adjusting cylinders
2.3	Software-Modul 1 - Checking of double shiftings - Testing for easy operation of selector travels and shifting gates (Force- and travel measuring equipment required)
2.4	Software-Modul 4 - Evaluation synchronization - Scratching noise detector (Force- and travel measuring equipment required)
2.5	Software-Modul - For tabular conversion to mechanical gear positions (16 forward-/4 rear gears, 2 neutral positions)
2.6	Gear position signals (3 bit binary coded)
2.7	Potential free interface type RS232
2.8	Potential free interface type RS422
2.9	Potential free interface type TTY
2.10	Field bus connection Profibus
2.11	Field bus connection CAN

3. Accessories:

	Order information
3.1	External second hand terminal HT9201 incl. connection cable, 3 m and connector
3.2	Electronic cabinet (Schroff, RAL7035) incl. installation and commissioning of GSW2001 components
3.3	Electronic cabinet (Rittal, RAL7035) incl. installation and commissioning of GSW2001 components
3.4	Installation and commissioning of components of GSW2001 in a special cabinet requested or made available by the customer (cabinet not included)
3.5	Air/Air-cooling unit incl. mounting into an electronic cabinet for increased ambient temperature range from 0 °C up to +55 °C

3.6	Air/Water-cooling unit incl. mounting into an electronic cabinet for increased ambient temperature range from 0 °C up to +55 °C
3.7	Superior test bench computer incl. software package

4. Cables:

	Order information
4.1	Connection cable between electronic cabinet and actuator of GSW2001 version with force-/position measurement, length 20 m
4.2	Connection cable between electronic cabinet and actuator of GSW2001 version with force-/position measurement, customized length

5. Service:

	Order information
5.1	Installation and commissioning of GSW2001 at the place of application incl. instruction of the operating staff of max. 3 persons (without travel expenses)

Order information for the optional Automatic Clutch KA9111+

1. Automatic Clutch KA9111+

	Order information
1.1	Automatic clutch actuator KA9111+ for GSW2001, without inserts and mechanical coupling elements, incl. all connector pairs and connection cables inside an electronic cabinet, (only in combination with GSW2001), incl. Installation and commissioning of at the place of application (without travel expenses)

2. Options:

	Order information
2.1	Force- and travel measuring equipment for KA9111+ incl. software module

3. Accessories:

	Order information
3.1	Steel rod with insert for version without force measuring, 180 mm travel
3.2	Steel rod with insert for version with force measuring, 180 mm travel
3.3	FLEXBALL® cable insert for version without force measuring
3.4	FLEXBALL® cable insert for version with force measurement
3.5	FLEXBALL® cable type DZ60, 1.5 m, 180 mm travel
3.6	FLEXBALL® cable type DZ60, customized length
3.7	Miniterminal MT1 incl. connection cable, 1.5 m and connector
3.8	Hand terminal HT9201 incl. connection cable, 3 m and connector
3.9	One hand grease press. incl. grease filling (370 g) for the extended temperature range standard temperature – 40 °C ... + 70 °C
3.10	Grease refill tube (370 g) for the temperature range – 40 °C up to + 70 °C

4. Cables:

	Order information
4.1	Connection cable set between control rack and actuator, length 15 m
4.2	Connection cable set between control rack and actuator, length 20 m
4.3	Connection cable set between control rack and actuator, customized length

5. Service:

	Order information
5.1	Installation and commissioning of KA9111+ into electronic cabinet (electronic cabinet not included)

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