

RHD250 (Conrac) Electrical Part-Turn Actuator

Measurement made easy



Process optimization thanks to maximum control precision

Maintenance-free up to 10 years

For continuous positioning,
Rated torque 250 Nm (200 lbf-ft)

Electrical actuator for continuous positioning, three-point position control, or bus control

Stall-proof without the need for position- or torque-dependent shut-off

Adjustable mechanical limit stops for defined operating range

Handwheel for emergency operation

Signal and power input only via separate, microprocessor-controlled power electronics (integrated into PME120-AI)

Voltage supply: 115 V AC or 230 V AC

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1 General description

1.1 Brief description

Compact actuator for the operation of final control elements with rotary movement such as flaps, dampers, etc.

The torque is transferred via a lever-type actuator or the actuator is directly coupled to the shaft of the final control element.

The actuator is controlled using the Contract power electronic unit. This power electronic unit serves as the interface between the actuator and the control system.

During continuous positioning, the power electronic unit varies the motor torque steplessly until the actuator force and the control valve force are balanced. High response sensitivity and high positioning accuracy with short actuating times ensure excellent control quality and a long service life.

1.2 Operating principles

The actuator continuously responds to a setpoint signal. The motor is permanently under voltage (operating mode S9 – 100 % stall-proof according to IEC 60034-1 / EN 60034-1) and gently increases or reduces the torque on the electronic unit in proportion to the ΔY signal (the difference between the Y setpoint and the Y position signal).

The actuator is not subject to temperature derating, i.e., there are no restrictions, even at the maximum permissible ambient temperature. Where a state of balance exists, the actuator force and process force are equivalent and the actuator keeps the final control element in the required position.

The classification of the Contract actuator, "S9 – 100% stall-proof", in accordance with IEC 60034-1 / EN 60034-1 far exceeds the requirements for the highest class, "continuous modulation, class D", as per EN 15714-2.

The Contract actuator offers extensive process optimization capabilities thanks to its high-precision and highly dynamic operation.

1.3 Part-turn actuator

Part-turn actuators are available for rated torques between 50 Nm and 16,000 Nm (40 lbf ft to 12,000 lbf ft), and they share a common design. A motor drives a low-friction, oil-lubricated spur gearing. At the end of this gearing, a lever mounted on the output drive shaft transmits torque to the control element via a connecting rod. Since the position sensor is mounted directly on the rear end of the output drive shaft, position feedback is provided without any backlash.

This specific design in conjunction with the 3-phase asynchronous motor serves as the basis for the continuous mode of the actuator.

Mechanical limit stops, provided on the outside of the gear case, can be adjusted as needed and used to limit the travel path for swing-through butterfly valves, for instance.

The handwheel offers an optimum level of performance between handwheel forces and rotational speed, owing to the design principle of the differential gearing. Furthermore, the gear train is not interrupted, even though it is possible to adjust the handwheel at any time. This ensures maximum operational reliability.

The 3-phase asynchronous motor is equipped with a spring-loaded brake. The brake is energized in automatic mode. In the case of a fault or failure of the supply voltage, the brake will engage via the spring force and lock the control valve in the current position. This ensures reliable "Fail-Freeze" action. The brake is maintenance-free, regardless of whether the actuator is controlled via analog, bus, or step controller signals.

1.4 Analog signal and power input

For the analog signal and power input, the setpoint specification is received from the control system through a 0 ... 20 mA or 4 ... 20 mA current value. Signal monitoring is possible, should the signal deviate from pre-defined limits, the actuator will perform the set safety procedure (e. g. "Lock in last position" or "Drive to safety position"). The position feedback is also given through a 0 ... 20 mA or 4 ... 20 mA feedback signal.

There are 3 digital inputs and 3 digital outputs available in addition to the analog signal.

If a digital input is activated, it will take priority over the setpoint signal (manual mode takes priority over automatic mode).

The following digital input configurations are possible:

Configuration	Digital input 1	Digital input 2	Digital input 3
OFF	No function	No function	No function
Manual intervention	Manual mode / Automatic mode switching	Travel command in OPEN direction	Travel command in CLOSE direction
Rapid traversal	Rapid traverse mode / Automatic mode switching	Rapid traverse travel command in OPEN direction	Rapid traverse travel command in CLOSE direction
Step controller	ON / OFF step controller activation	Step controller pulses in OPEN direction	Step controller pulses in CLOSE direction

The digital output function is freely selectable for each output. The following functions are available:

Function	Description
Ready to operate	Signaling of device status
Signal end position 0%	Actuator has reached the 0% position
Signal end position 100%	Actuator has reached the 100% position
Signal limit value 1 rising	While the signal level is rising, the actuator has reached the position defined as limit value 1
Signal limit value 1 falling	While the signal level is falling, the actuator has reached the position defined as limit value 1
Signal limit value 2 rising	While the signal level is rising, the actuator has reached the position defined as limit value 2
Signal limit value 2 falling	While the signal level is falling, the actuator has reached the position defined as limit value 2
Collective failure	Drive function is no longer given. The actuator is no longer available.
Collective alarm	Parameters in the Contract interface system have adopted values, which make a failure in the near future likely. The actuator remains functional.
Local operation	The actuator is operated via the local control station (ISF)
Rapid traverse, activation + direction	Actuator is moving at rapid traverse speed in + direction (only for 2-motor version)
Rapid traverse, activation - direction	Actuator is moving at rapid traverse speed in - direction (only for 2-motor version)

1.5 Step controller operation

In the "step controller" operating mode the incoming control commands are received as pulses at digital inputs DI2 and DI3 these are upward-integrated into an internal memory. The memory uses these pulses to generate an internal setpoint which the actuator then follows.

This process is as easy on the control valve and actuator operation similar to the analog control process.

1.6 Rapid traverse mode

The actuator is operated exactly in the same operating mode as in the analog control mode. On activation of digital inputs 2 or 3, the actuator moves at twice the rated operating speed and half the torque in the corresponding direction. Just before the end position is reached, the actuator travel speed is automatically switched back to the set speed, at which the remaining distance is covered.

1.7 Speed

Contract actuators offer different speed adjustments for both directions, independently of actuator torque or actuator force.

Furthermore, a speed characteristics curve can be set with three different speed values for each direction.

The actuator speed is steplessly adapted to the rate of change in speed of the setpoint value. This ensures a highly dynamic and extremely precise control process. In order to preserve the control valve, the actuator speed is automatically reduced before the end position is reached.

1.8 Torque/Force

The torque and actuator force setting options are comparable to the speed setting options. 50 %, 75 % and 100 % of the rated output value can be selected. The power electronic unit will alter the motor control according to the selected value.

1.9 Setpoint monitoring

The setpoint can be monitored for compliance with the adjustable limit values. Should the setpoint exceed the upper limit value or fall below the lower limit value, the actuator will perform the previously defined safety action. "Lock in current Position" or "Move to pre-defined safety position" are available as safety actions.

1.10 Ambient conditions

Temperature

Different temperature versions are available, dependent on the actuator type.

The ON-period is not subject to derating, i. e. even at the maximum permissible ambient temperature, the actuator ensures maximum control precision and dynamics during an ON-period of 100 %.

Corrosion protection

The actuators and power electronics have been designed for operation in extreme ambient conditions. They satisfy the requirements of atmospheric corrosivity category C5-I (highly polluted industrial atmospheres) for protection against external corrosion in accordance with DIN EN 15714 (Electric actuators for industrial valves – Basic requirements), and EN ISO 12944-2:1998 (Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Classification of environments). Electronic cabinet modules satisfy the requirements of category C1 (low pollution) as per EN ISO 12944-2:1998 (Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Classification of environments).

Service life

Contract actuators exceed the service life requirements for the highest class D, "continuous modulation", as per DIN EN 15714 (Electric actuators for industrial valves – Basic requirements). These actuators remain maintenance-free for up to 10 years under "normal" load.

1.11 Communication

PROFIBUS DP, PROFIBUS DP/V1 or HART communication protocols are available for the purpose of digital communication.

PROFIBUS

PROFIBUS DP is an international, open fieldbus protocol which has been standardized in the fieldbus standard EN 50 170.

On a cyclic basis, the master reads the input information from the slaves and writes the output information to the slaves.

In addition to this cyclic data transfer of the process representation (e. g. setpoint and actual value), Profibus DP also provides powerful functions for diagnostics and commissioning.

PROFIBUS DP/V1 additionally offers the acyclic transfer of data for the configuration of slaves, for example.

Data traffic is monitored through the monitoring functions on the master and slave sides.

In addition to PROFIBUS data transfer, ABB Contract actuators provide two configurable digital outputs for signaling that the end position has been reached, for example.

The two configurable digital outputs can be used independently of the bus communication.

HART

Contract actuators also offer the option of using the HART communication protocol for configuration and parameterization while operation is in progress.

HART FSK communication enables simultaneous analog setpoint transmission and digital communication without additional installation. The HART signal is modulated on to the 4 ... 20 mA analog setpoint signal.

The HART protocol makes use of Frequency Shift Keying (FSK), based on the Bell 202 communication standard.

DTM

The DTM (Device Type Manager) for Contract actuators is based on FDT / DTM technology (FDT 1.2 / 1.2.1) and can either be integrated into a control system or loaded on a PC with DAT200 Asset Vision Basic. This allows you to work with the same user interface in the commissioning phase, during operation, and for servicing tasks, involving monitoring the device, setting parameters, and reading out data. Communication is based on the HART protocol or PROFIBUS communication. Reading out data from the device has no effect on the operation in progress. Newly set parameters are saved in the non-volatile memory directly upon download to the device, and become active immediately.

EDD

Similar to DTM, the EDD (Electronic Device Description) provides the option of configuring and setting device parameters through the HART communication protocol by using a handheld terminal or a control system with an integrated EDD.

2 Specifications

2.1 Actuator

	RHD250 (Contrac)
Operating mode	S9 – 100%; stall-proof acc. to IEC 60034-1/EN 60034-1
Degree of protection	IP 66 acc. to IEC 60529/EN 60529 NEMA 4X acc. to CAN/CSA22.2 No. 94
Humidity	≤ 95 % annual average; condensation not permitted
Ambient temperature	-10 ... 65 °C (15 ... 150 °F) -30 ... 50 °C (-20 ... 130 °F) -1 ... 85 °C (30 ... 185 °F) ¹⁾
Transport and storage temperature	-40 ... 70 °C (-40 ... 160 °F)
Long-term storage temperature	-30 ... 40 °C (-25 ... 105 °F)
Mounting position	any position; preferably IMB 3 acc. to IEC 60034-7 / EN 60034-7
Coating	2-layer component epoxy (RAL 9005, black)
Anti-condensation heater	Motor winding: directly from electronic unit Signal space: separate heating resistor; separately supplied or power feed from Contrac electronic unit
Electrical connection	Plug with crimp snap-in contacts or screw terminals Connecting cable for electronic unit – actuator available as an option (see ordering information for electronic unit)
Power supply for motor and sensors	Only via special electronic unit (refer to the data sheet for the electronic unit)

1) 85 °C / 185 °F — design not available for all RHD variants

	RHD250-10
Rated torque	250 Nm (200 lbf-ft), adjustable to 0.5, 0.75 or 1x rated torque
Starting torque	1.2 x rated torque (break-away torque in end positions for short time 2 x rated torque)
Rated time for 90°; adjustable	10 ... 900 s
Operating speed, adjustable	9.0 ... 0.1°/s
Operating angle	Typically 90° (min. 35°; max. 270°), see manual for reduced angle with lever and limit stop
Weight (including lever)	Approx. 45 kg (99 lb)
Associated electronic unit (data sheet)	For field installation: EBN853 ¹⁾ For rack installation: EBS852 ²⁾
Motor	MCS 71 BA
Sensors	Position and temperature sensor always available

1) Data Sheet EBN853: 10/68-8 27

2) Data Sheet EBS852: 10/68-8 24

2.2 Electronic unit

Detailed information on separate electronic units can be found in the corresponding data sheets.

2.2.1 Supply

Supply voltage	115 V AC (94 ... 130 V) or 230 V AC (190 ... 260 V); 47.5 ... 63 Hz; 1Ph			
Current at electronic unit [A] (115 V AC/230 V AC)	RHD(E)	I_{max} at 115V 1.8 A	I_{max} at 230 V 0.9 A	$I_{pos.}$ (115 V + 230 V) approx. 40 ... 50% of I_{max}
External fuse	16 A; time-lag			

2.2.2 Conventional communication

Analog input	0 / 4 ... 20 mA; internal load EBN853, EBS852 300 Ω
Analog output	0 / 4 ... 20 mA, electrically isolated, max. load 500 Ω
3 digital inputs*, DI 1 ... DI 3	Digital 0: -3 ... 5 V or open, electrically isolated Digital 1: 12 ... 35 V, electrically isolated
3 digital outputs, DO 1 ... DO 3	Potential-free relay contact, max. 60 V, 150 mA
Digital communication	RS 232 for commissioning and service, with optional FSK / HART® or PROFIBUS DP
Default settings	See Chapter 2.3.1 "Standard configuration", page 8
Voltage output U _V	24 V, 15 mA, electrically isolated, for scanning external contacts, or similar applications
Transmitter connection (optional)	Supply for 2-wire transmitter with activated process controller in Contract
Individual settings	See data sheet 10/68-2.40 or upon request

2.2.3 PROFIBUS DP communication

PNO ID no.	0x9655 Actuators with DP/V0 communication (cyclic data traffic) 0x09EC Actuators with DP/V1 communication (cyclic and acyclic data traffic)
Communication protocol	Profibus PA profile V3.0 Class B acc. to IEC 50170 / EN 50170 (DIN 19245)
Bus cable	Twisted, shielded copper wire acc. to IEC 50170 / EN 50170
Interface	EIA-485 (RS485) acc. to IEC 50170 / EN 50170
Permissible baud rates	- 93.75 kbit/s - 187.5 kbit/s - 500 kbit/s - 1500 kbit/s Automatic baud rate detection
Bus address	0 ... 126, default address 126 Set Slave Address service is supported
Bus termination	Connectable active bus termination. Voltage supply from power electronic unit
Block types	1 AO Function Block 1 Transducer Block 1 Physical Block
Fail Save	Failsafe function is supported. Configurable function for downtime of bus communication - Lock in last position - Drive to safety position - Adjust with last effective setpoint Adjustable time delay.
Modules for cyclic communication	8 standards-compliant modules and 3 manufacturer-specific modules are available.* SP (Short) SP (Long) RCAS_IN+RCAS_OUT SP+READBACK+POS_D SP+CHECKBACK SP+READBACK+POS_D+CHECKBACK RCAS_IN+RCAS_OUT+CHECKBACK SP+RCAS_IN+READBACK+RCAS_OUT+POS_D+CHECKBACK STANDARD SP+RB+MESSEING SP+RB+ENL_DIAG
Acyclic communication	Full parameterization and configurability via Master Class 2 and DTM
Default settings	See Chapter 2.2.3 "PROFIBUS DP communication", page 7
Digital outputs, DO 1 and DO 2	In addition to the Profibus communication, there are 2 digital outputs. Potential-free relay contact, max. 60 V, 150 mA Default setting: DO 1 end position signal 0 % DO 2 end position signal 100 %
Individual settings	See data sheet 10/68-2.40 or upon request

*A full description of communication modules can be found in parameterization and configuration instructions 45/68-10

2.3 Factory default

The standard delivery scope includes metric cable entry threads with IP66 seal plugs. Optional NPT and PG adapters are available.

Unless otherwise specified by the user, the power electronic units are delivered with the following standard configuration:

The individual actuator configuration may vary from the standard setup above. This information can be displayed via the user interface.

2.3.1 Standard configuration

Parameter	Setting
Function selection:	Positioner, parameter: Setpoint
Setpoint function:	Analog setpoint
Setpoint range:	4 ... 20 mA
Setpoint characteristic:	Linear; setpoint = position value
Actual value range:	4 ... 20 mA
Rated torque/Rated force in +/- direction:	100 %
Automatic speed in +/- direction:	100 %
Action in 0 % / 100 % end position:	Keep tight with rated torque/rated force
Digital inputs:	DI 1 Manual/Automatic switching; DI 2 / DI 3 travel command +/-
Digital outputs:	DO 1 ready for operation / error message, DO 2/3 end position signal 0%/100%
Breakaway function:	Deactivated
Close Tight function:	Deactivated
Positioning loop monitoring:	Deactivated
Setpoint monitoring:	Deactivated
Error message via actual value:	Deactivated
Action after restoration of power:	Switch to Automatic
Working range of actuator:	Not set

2.3.2 PROFIBUS DP communication

Parameter	Setting
Function selection:	Positioner, parameter: Setpoint
Setpoint function:	Digital
Setpoint range:	4 ... 20 mA
Setpoint characteristic:	Linear; setpoint = position value
Actual value range:	Digital
Rated torque/Rated force in +/- direction:	100 %
Automatic speed in +/- direction:	100 %
Action in 0 % / 100 % end position:	Keep tight with rated torque/rated force
Digital outputs:	DO 1/2 end position signal 0%/100%
Breakaway function:	Deactivated
Close Tight function:	Deactivated
Positioning loop monitoring:	Deactivated
Communication monitoring:	PROFIBUS DP / V0: Activated Lock in last position PROFIBUS DP / V1: Activated After delay time has elapsed (standard configuration 5 s) Lock in last position
	Deactivated
Error message via actual value:	Switch to Automatic
Action after restoration of power:	Not set

2.4 Wire cross-sectional areas

	Crimp pins		Screw terminals (optional)	
Conductor cross-section	Motor, heater: Signals:	1.5 mm ² (16 AWG) 0.5 mm ² (20 AWG)	2.5 mm ² (14 AWG)	
Contact surface	gold-plated		Motor, signal: Heater:	gold-plated silver-plated

2.4.1 Electronic unit

EBS852

Screw terminals			
Conductor cross-section	Motor/brake	fixed:	0.08 ... 2.5 mm ² (28 ... 14 AWG)
		flexible:	0.25 ... 2.5 mm ² (24 ... 14 AWG)
	Mains	fixed:	0.5 ... 6 mm ² (20 ... 10 AWG)
		flexible:	0.5 ... 4 mm ² (20 ... 12 AWG)
	Signals	fixed:	0.2 ... 1.5 mm ² (24 ... 16 AWG)
		flexible:	0.2 ... 1.5 mm ² (24 ... 16 AWG)

EBN853

Screw terminals			
Conductor cross-section	Motor/brake	fixed:	0.2 ... 6 mm ² (24 ... 10 AWG)
		flexible:	0.2 ... 4 mm ² (24 ... 12 AWG)
	Mains	fixed:	0.5 ... 6 mm ² (20 ... 10 AWG)
		flexible:	0.5 ... 4 mm ² (20 ... 12 AWG)
	Signals	fixed:	0.5 ... 4 mm ² (20 ... 12 AWG)
		flexible:	0.5 ... 2.5 mm ² (20 ... 14 AWG)

2.5 Tapped holes for cable glands

Tapped holes for cables	optional adapters*	
M20 x 1.5 (2x)	PG 16 (2x)	NPT 1/2" (2 x)
M25 x 1.5 (1 x)	PG 21 (2x)	NPT 3/4" (1 x)

* Adapter for PG or NPT thread must be ordered separately

3 Electrical connections

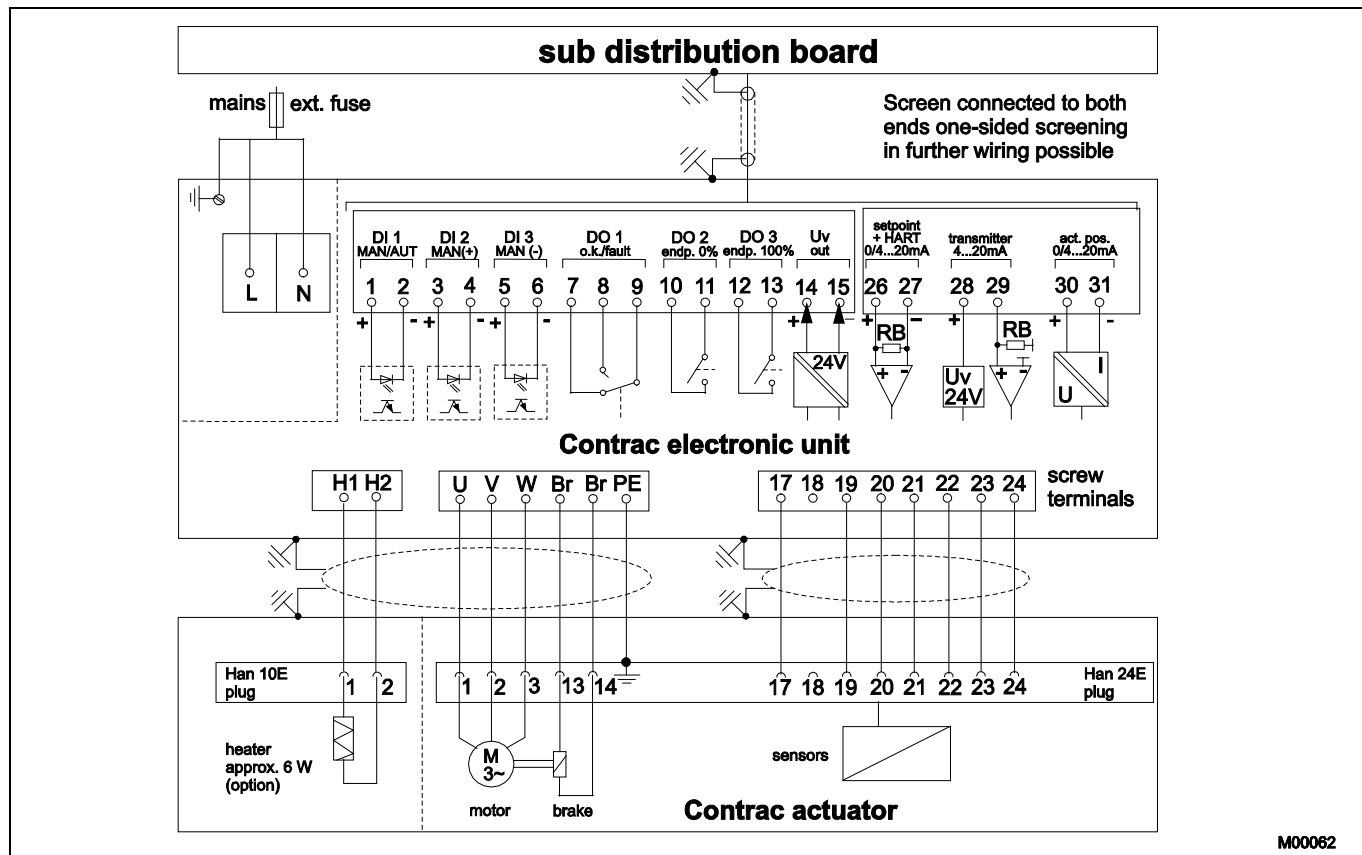
3.1 Power Electronic Unit EBN853 (Contrac)

3.1.1 Analog / Digital



IMPORTANT (NOTE)

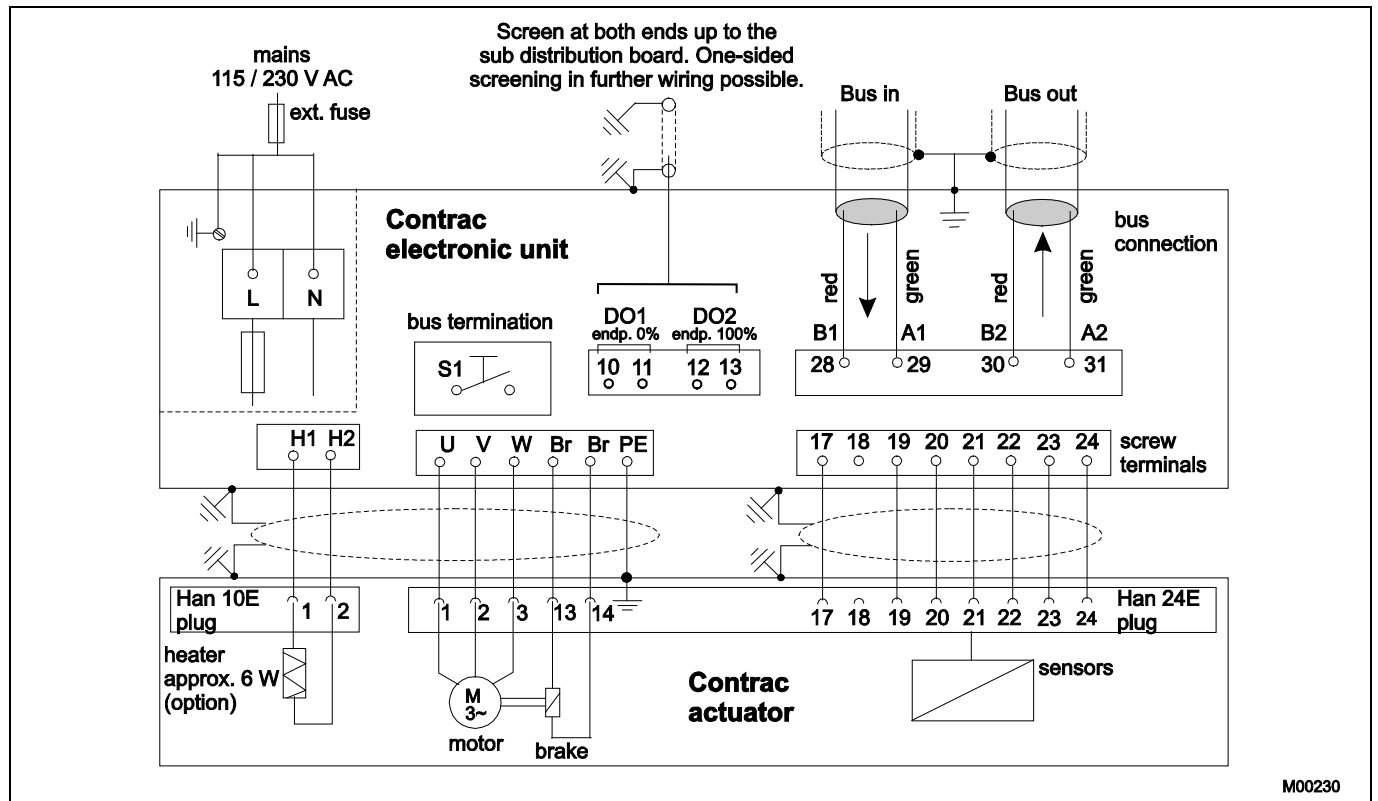
The electrical connection is provided by a plug on the actuator and the terminals on the electronic unit.



M00062

Fig. 1

3.1.2 PROFIBUS DP



M00230

Fig. 2

3.2 Power Electronic Unit EBS852 (Contrac)

3.2.1 Analog / digital



IMPORTANT (NOTE)

The electrical connection is provided by a plug on the actuator and the terminals on the electronic unit.

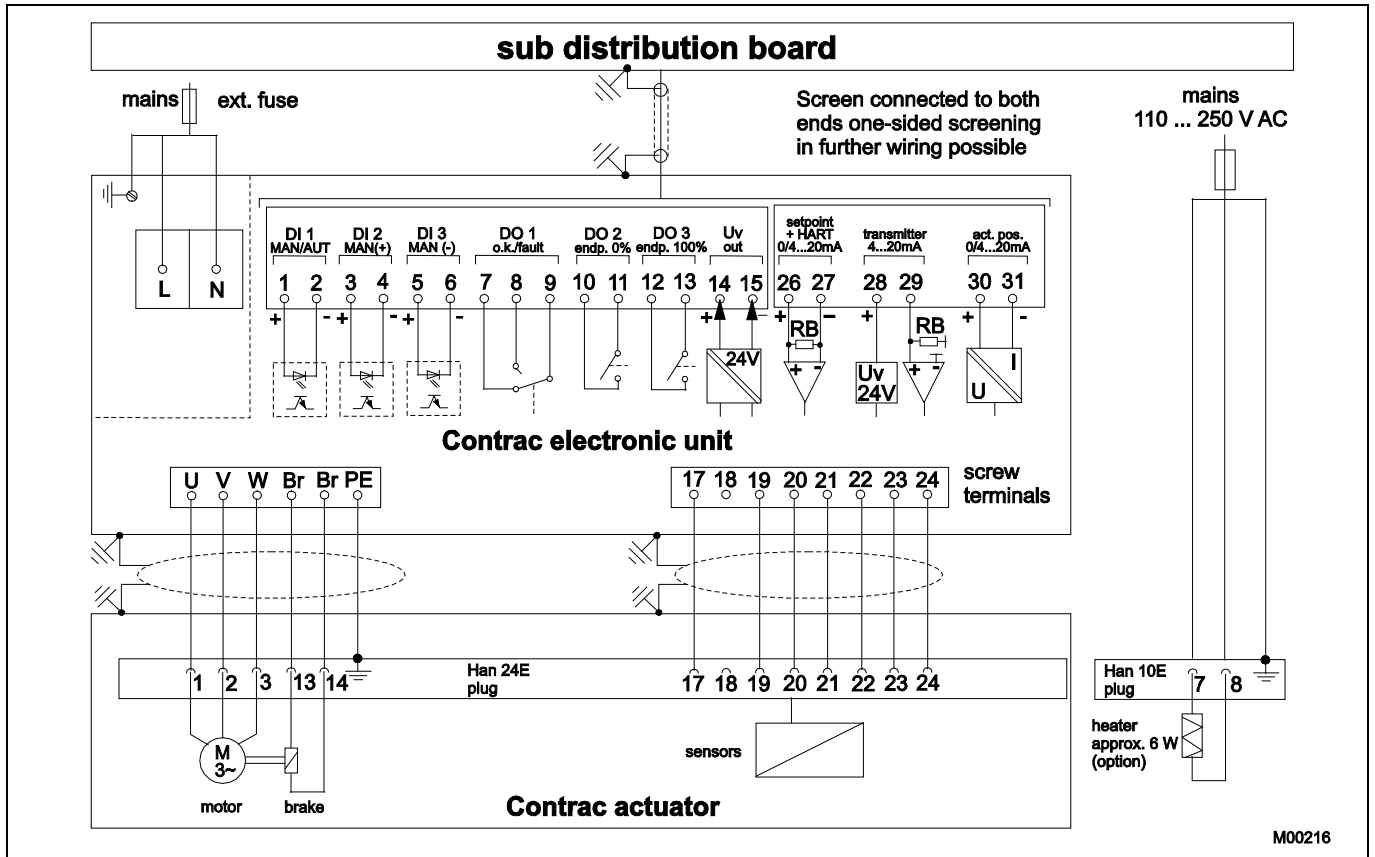
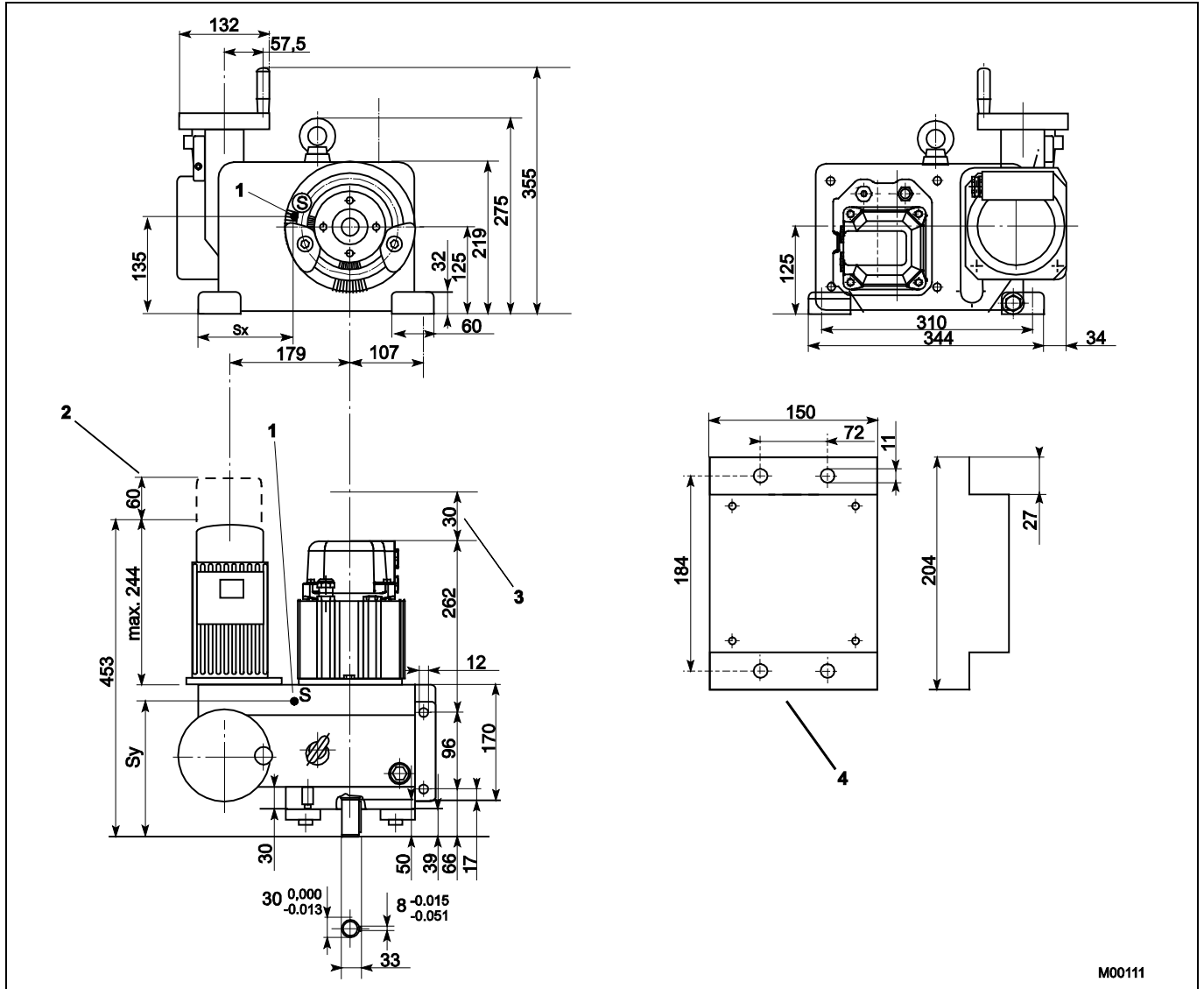


Fig. 3

4 Dimensions

4.1 Actuator

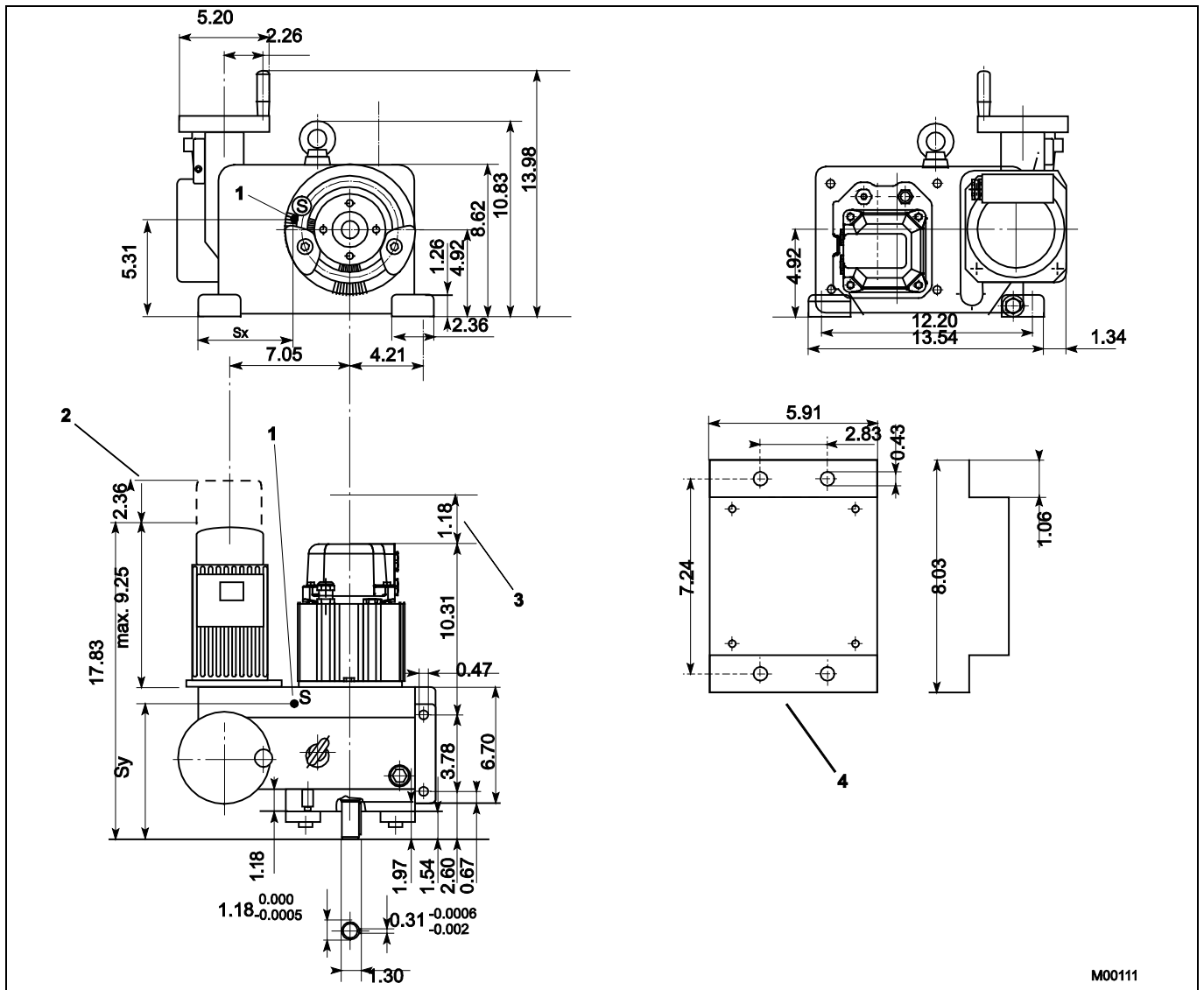


M00111

Fig. 4: Dimensions in mm

- 1 S = Center of gravity
- 2 Removal space

- 3 Space for removing the plug
- 4 Plug holder (not to scale)



M00111

Fig. 5: Dimensions in inches

- 1 S = Center of gravity
- 2 Removal space

- 3 Space for removing the plug
- 4 Plug holder (not to scale)

4.2 Lever

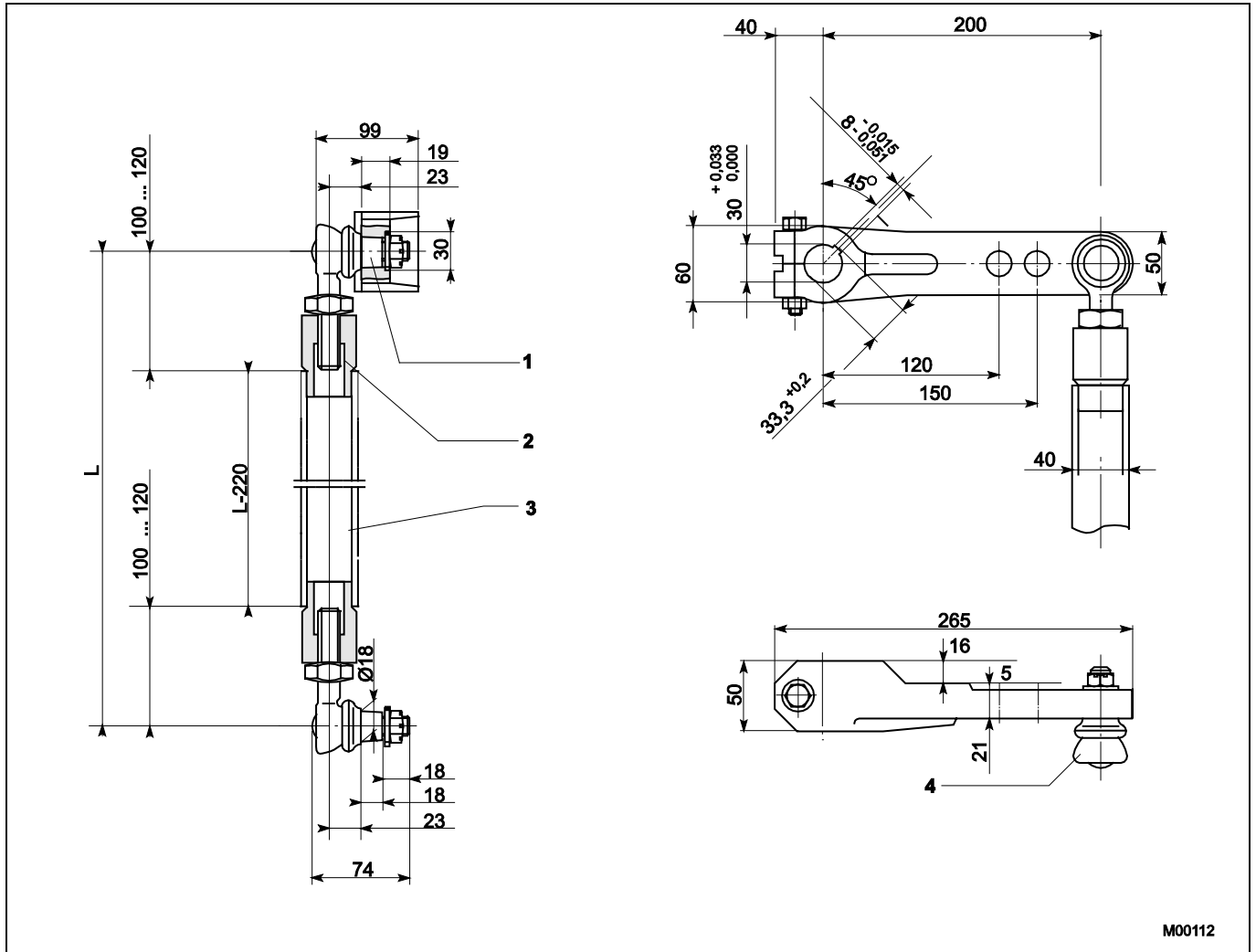
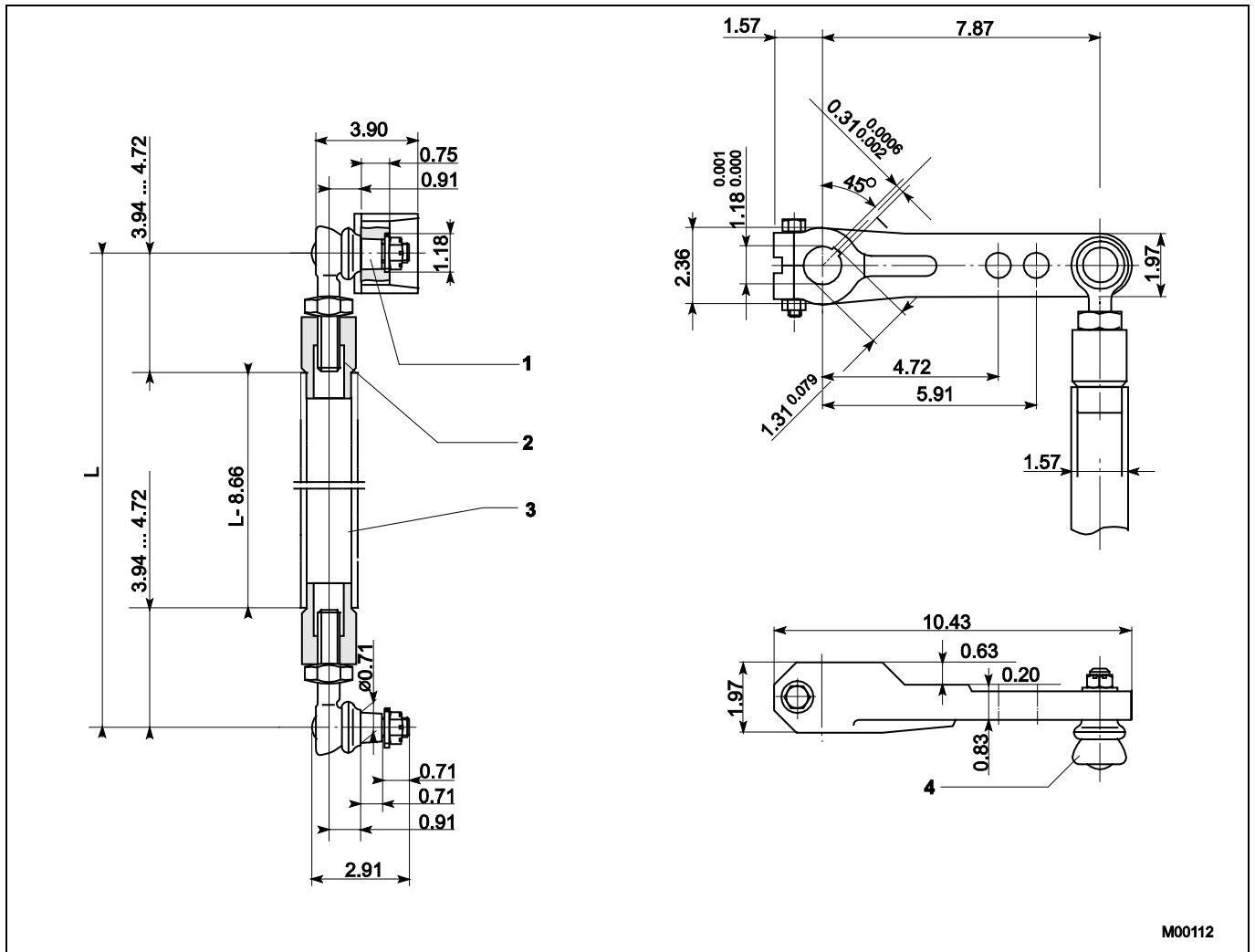


Fig. 6: Dimensions in mm

- 1 Cone 1 : 10
- 2 Welding bushings are included in delivery
- 3 Connection pipe 1 1/4" EN 10255/ISO 65 or 1 1/4 inch schedule 80 pipe. Size "L" acc. to requirements. The pipe is not included in delivery.

- 4 Angular deflection of ball and socket joint:
 Pointing towards the actuator: max. 3°
 Pointing away from the actuator: max. 10°

M00112



M00112

Fig. 7: Dimensions in inches

- 1 Cone 1 : 10
- 2 Welding bushings are included in delivery
- 3 Connection pipe 1 1/4" EN 10255/ISO 65 or 1 1/4 inch schedule 80 pipe. Size "L" acc. to requirements. The pipe is not included in delivery.

- 4 Angular deflection of ball and socket joint:
 Pointing towards the actuator: max. 3°
 Pointing away from the actuator: max. 10°

5 Ordering information

5.1 Electrical Part-Turn Actuator RHD250 (Contract)

	Main ordering information					Additional ordering information
	Version number	1 - 6	7-10	11-13	14-16	
RHD250 Part-Turn Actuator, rated torque 250 Nm (200 ft-lbs) (adjustable to 50 % / 75 % / 100 %)	V68151	XXXX	XXX	XXX	XXX	XXX
Rated Pos. Speed 9.0°/s (adjustable to 9.0 ... 0.1°/s)		0110				
Mechanical Connection						
Shaft with key				370		
Lever set, standard design (consists of lever, 2 ball-and-socket joints and 2 welding bushings)				496		
Lever set, US design (consists of lever, 2 ball-and-socket joints and 2 US welding bushings)				374		
Electrical Connection						
Plug (24-pole) complete, crimped					277	
Plug (24-pole) complete, terminals					278	
Plug bottom part covered				1)	279	
Ambient Temperature Range						
-10 ... 65 °C (15 ... 150 °F)						344
-30 ... 50 °C (-20 ... 125 °F)						341
-1 ... 85 °C (30 ... 185 °F)						349
Electrical Connection Thread						
Set NPT adapter (junction metric / NPT thread)						680
Set PG adapter (junction metric / PG thread)						681
Anti-condensation Heater						
Anti-condensation Heater						360
Identification on Data Label						
Alphanumeric, max. 32 characters						294
Data Label with US Units						
Data label with US units						253
Accessories: Plug Cover						
Cover for male plug (24 pole)						337
Accessories: Plug Holder						
Plug holder						338
Factory Certificate 2.1 acc. to EN 10204						
Factory Certificate 2.1 acc. to EN 10204						291
Certificate 3.1 acc. to EN 10204						
Certificate 3.1 acc. to EN 10204						292
Operating Instruction						
German						Z1D
English						Z1E
Portuguese						Z1P
Italian						Z1I
French						Z1F

1) Female plug with cables to be ordered with electronic unit.

Accessories	Order number
RHD(E) Adapter Plate for Part-Turn Actuators, Type AP1	789189

Notes

Notes

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