

# ITB – THROTTLE WITH INTEGRATED STEPPER MOTOR

## INSTALLATION INSTRUCTION



**ITB**   
MOTORTECH INTEGRATED THROTTLE BODY

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# 1 GENERAL INFORMATION

Prior to use, read this Installation Instruction carefully and familiarize yourself with the product. Installation and start-up should not be carried out before reading and understanding this document. Keep this Installation Instruction readily available so that you can reference it as needed.

## 1.1 What Is the Purpose of this Installation Instruction?

This Installation Instruction serves as an aid for the installation and operation of the product and supports the technical staff with all operating and maintenance tasks to be performed. Furthermore, this manual is aimed at preventing dangers to life and health of the user and third parties.

## 1.2 Who Is this Installation Instruction Targeted to?

This Installation Instruction provides a code of conduct for personnel tasked with the set-up, operation, maintenance, and repair of stationary engines. A certain level of technical knowledge with respect to the operation of stationary engines and basic knowledge of the electronic components used are necessary. Persons who are merely authorized to operate the stationary engine are to be trained by the operating company and explicitly informed of the potential hazards.

## 1.3 What Symbols Are Used in the Installation Instruction?

The following symbols are used in this manual and must be observed:



### Example

This symbol indicates examples, which point out necessary handling steps and techniques. In addition, you receive additional information from the examples, which will increase your knowledge.



### Notice

This symbol indicates important notices for the user. Follow these. In addition, this symbol is used for overviews that give you a summary of the necessary work steps.



### Warning

This symbol indicates warnings for possible risks of property damage or risks to health. Read these warning notices carefully and take the mentioned precautionary measures.



**Danger**

This symbol indicates warnings for danger to life, especially due to high voltage. Read these warning notices carefully and take the mentioned precautionary measures.

### 1.4 Which Abbreviations/Acronyms Are Used in the Operating Manual?

The following abbreviations/acronyms are used in the Installation Instruction.

Abb.	Term	Description	Explanation
CPR	Counts Per Revolution	Counter results per revolution	Unit for the resolution of encoders
HT	High temperature		Device version designed for higher temperatures of the media flowing through.
ITB	Integrated Throttle Body	Throttle with integrated stepper motor	
MICT	MOTORTECH Integrated Configuration Tool		Configuration software for MOTORTECH control units
USB	Universal Serial Bus		Serial wiring system to connect a computer to external equipment

## 2 SAFETY INSTRUCTIONS

The device is operated on a stationary engine. Please follow therefore all safety instructions of the equipment manufacturer, especially with regards to sections under high voltage. All work must be performed by trained and authorized personnel only.



### **Risk of injury!**

Turn off the engine prior to assembly and secure it from re-starting in order to avoid damage or injury.



### **Risk of injury and destruction**

The engine must be equipped with an independent emergency shutdown switch to avoid overspeed, which can cause destruction and/or injury.



### **Risk of burning!**

High temperatures may occur on the surface of the system especially on the stepper motor.

### **2.1 Proper Disposal**

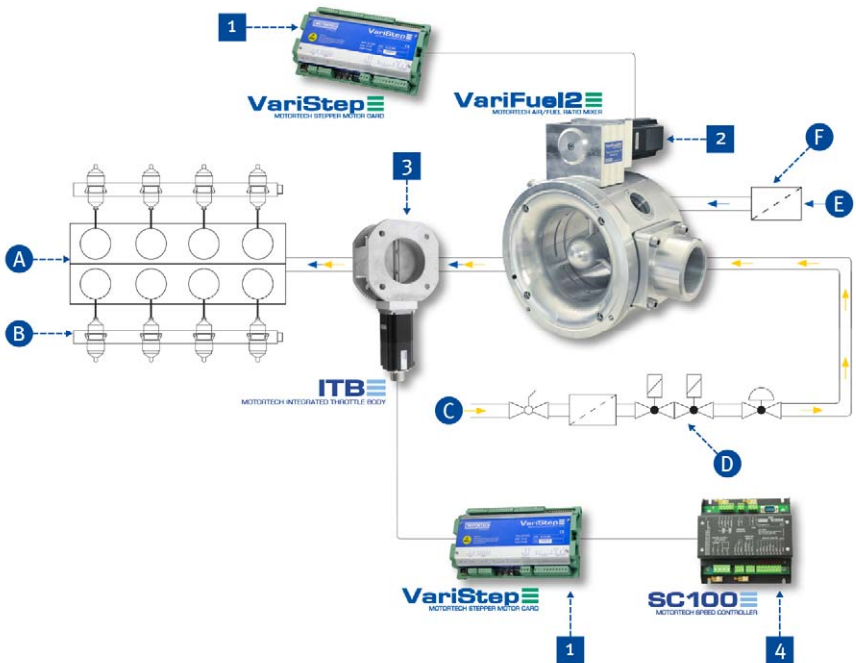
After the expiration of its service life, MOTORTECH equipment can be disposed of with other commercial waste, or it may be returned to MOTORTECH. We will ensure its environmentally friendly disposal.

## 3 INTENDED USE

### 3.1 Functional Description

The ITB throttle controls the supply of the gas-/air mixture to the gas engine. The integrated stepper motor evaluates signals from a VariStep stepper motor card and implements them in changing the opening of the throttle. The speed and power of the engine are regulated in this way.

#### System Overview (Example)



1 VariStep stepper motor cards

2 VariFuel2 gas mixer

3 ITB throttle with integrated stepper motor

4 SC100 speed control

A Engine

B Wiring rail (ignition)

C Gas supply

D Gas train

E Air supply

F Air filter

## 3 INTENDED USE

### 3.2 Applications

The ITB throttles are suitable for use on stationary gas engines. Series with different valve diameters are available for different gases and performance classes. A high temperature version (HT) can be used for operation in front of the intercooler. These permit a temperature of the medium flowing through of up to 200 °C (392 °F).

Any use other than the one described in the Installation Instruction shall be considered improper use and will result in the voiding of all warranties.



## 4 PRODUCT DESCRIPTION

### 4.1 Technical Data

The throttles have the following technical characteristics.

Feature	Value
Dimensions	See chapter <i>Overview Drawings</i> on page 11.
Weight	See following table.
Shape of device	See chapter <i>Overview Drawings</i> on page 11.
Maximum rotation angle of the throttle	80°
Chemical resistance	Water, oil, gaseous fuels
Maximum pressure	6 bar (87 psi)
Maximum temperature of media flowing through	125 °C (257 °F) (standard version) 200 °C (392 °F) (HT version)
Connection stepper motor	10-pin military connector
Permissible vibrations	5g at 20 Hz to 2000 Hz
Climatic Environmental Conditions	-20 °C to +85 °C (-4 °F to +185 °F) max. 95% humidity without condensation

### Weight

The weight depends on the type, series and diameter of the throttle.

Series	Diameter of the throttle	Type	Weight
<b>50 series</b>	42 mm (1.65")	Standard	1.7 kg (3.75 lbs)
	42 mm (1.65")	HT	1.8 kg (3.97 lbs)
<b>100 series</b>	60 mm (2.36")	Standard	2.6 kg (5.73 lbs)
	60 mm (2.36")	HT	2.7 kg (5.95 lbs)
	68 mm (2.68")	Standard	2.5 kg (5.51 lbs)
	68 mm (2.68")	HT	2.6 kg (5.73 lbs)
<b>140 series</b>	75 mm (2.95")	Standard	3.8 kg (8.38 lbs)
	75 mm (2.95")	HT	3.9 kg (8.60 lbs)
	80 mm (3.15")	Standard	3.75 kg (8.27 lbs)
	80 mm (3.15")	HT	3.85 kg (8.49 lbs)
	85 mm (3.35")	Standard	3.7 kg (8.16 lbs)
	85 mm (3.35")	HT	3.8 kg (8.38 lbs)

## 4 PRODUCT DESCRIPTION

Series	Diameter of the throttle	Type	Weight
<b>150 series</b>	90 mm (3.54")	Standard	6.3 kg (13.89 lbs)
	90 mm (3.54")	HT	6.4 kg (14.11 lbs)
	100 mm (3.94")	Standard	6.2 kg (13.67 lbs)
	100 mm (3.94")	HT	6.3 kg (13.89 lbs)
<b>200 series</b>	100 mm (3.94")	Standard	8.7 kg (19.18 lbs)
	100 mm (3.94")	HT	8.8 kg (19.40 lbs)
	110 mm (4.33")	Standard	8.2 kg (18.08 lbs)
	110 mm (4.33")	HT	8.3 kg (18.30 lbs)
	115 mm (4.53")	Standard	7.9 kg (17.42 lbs)
	115 mm (4.53")	HT	8.0 kg (17.64 lbs)

### 4.2 Digression: Control of the Stepper Motor

In the standard application, the stepper motor of the throttle is activated by the VariStep stepper motor card. For example, if you want to implement a direct activation from a master control, you receive the technical details for activation of the stepper motor in the following section.

#### Technical Data of Stepper Motors

Feature	50, 100, 140 series	150, 200 series
Design	2-phase, bipolar	2-phase, bipolar
Maximum phase current	2.8 A	6.3 A
Recommended current	2 A (full step operation mode) 2.8 A (microstep operation mode)	2.8 A (full step operation mode) 4 A (microstep operation mode)
Step width	0.9°	1.8°
Recommended control	1/16 microstep operation mode	1/16 microstep operation mode
Time to open from 0° to 80°	170 ms	310 ms
Holding torque	1.4 Nm (1.03 lb-ft)	3.2 Nm (2.40 lb-ft)

### Technical Data of the Encoder

Feature	Values for all series
Operating voltage	5 V
Type	Incremental, quadrature signal
Signal form	A, B, index; TTL-compatible
Resolution	4,096 CPR
Index position	Throttle is completely closed

You can find the assignment of the connections to the stepper motor and encoder in the section *Pole Connector Stepper Motor/Encoder* on page 22.

## 4.3 Overview Drawings



### Take military style connector into account

During planning of the installation, consider the dimensions of the military style connector on the harness (about 75 mm (2.95") on the 90° connector).

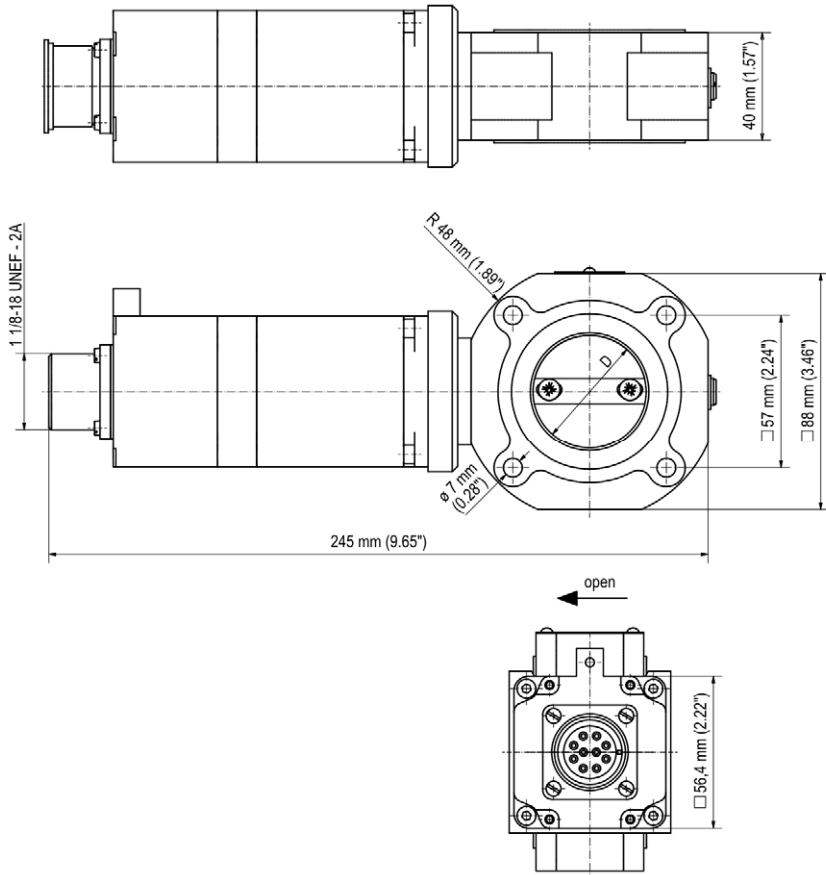
# 4 PRODUCT DESCRIPTION

## 50 series

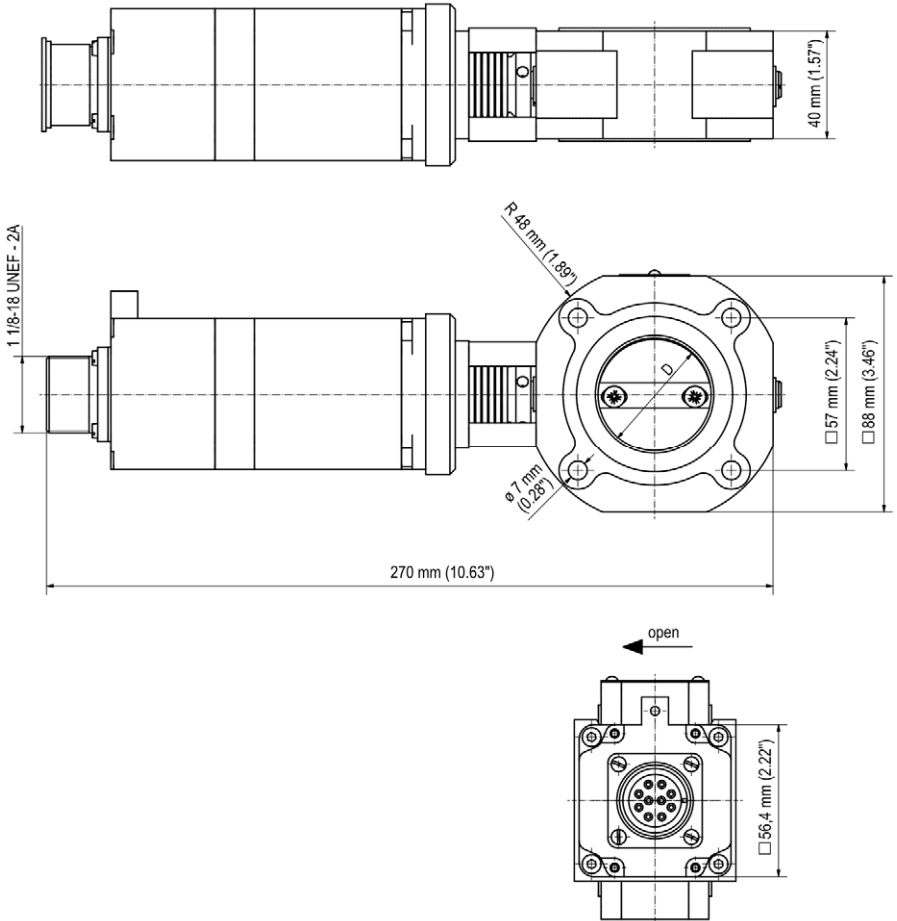
Standard diameter of the throttle (D): 42 mm (1.65")

possible diameter of the throttle: 41 mm (1.61") to 42 mm (1.65")

### Standard version

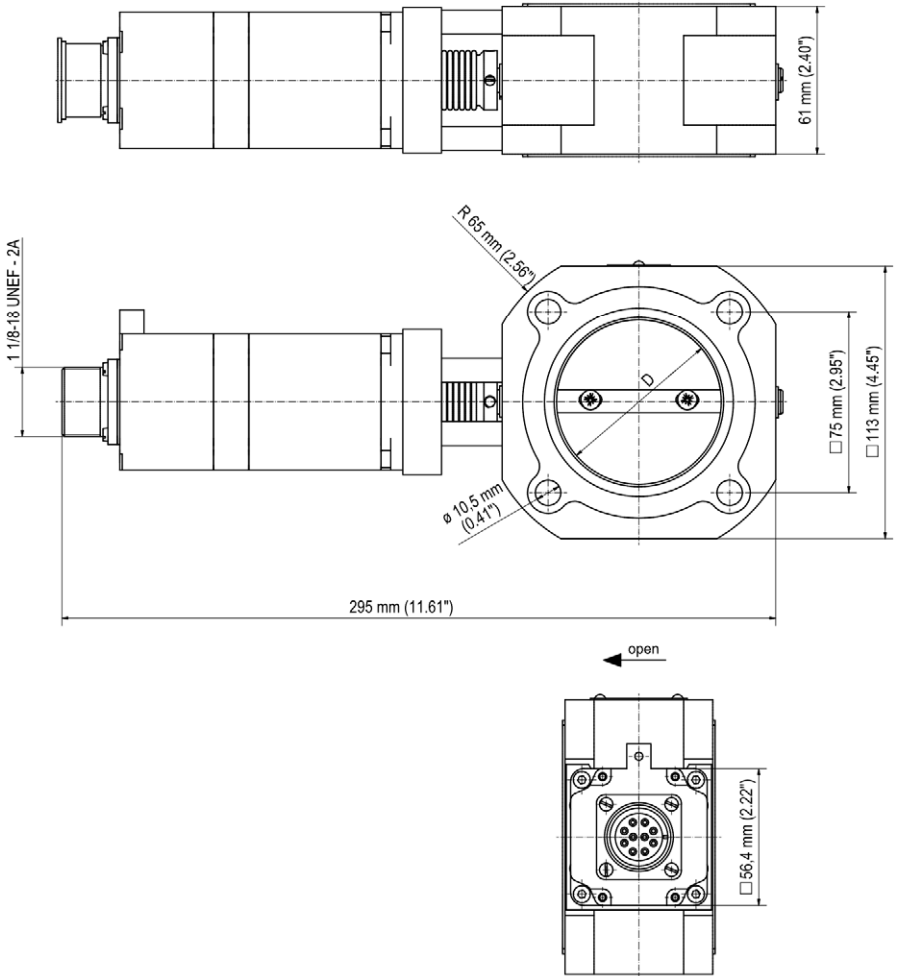


HT version





HT version

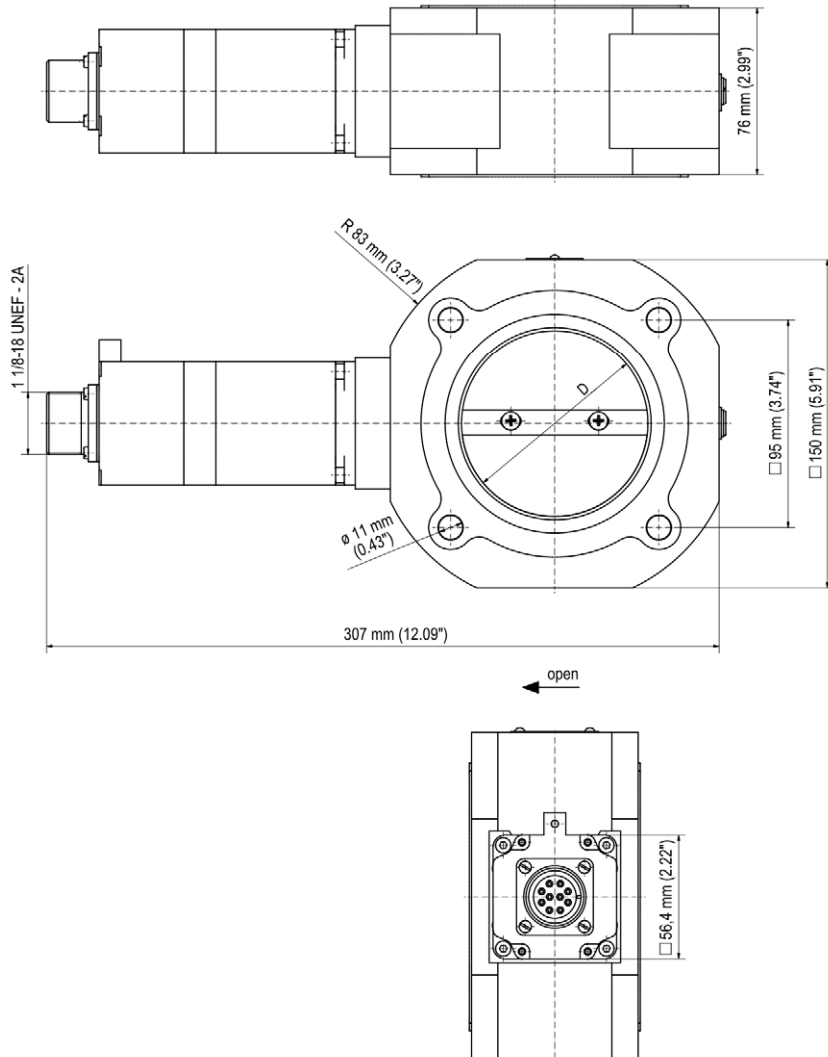


# 4 PRODUCT DESCRIPTION

## 140 series

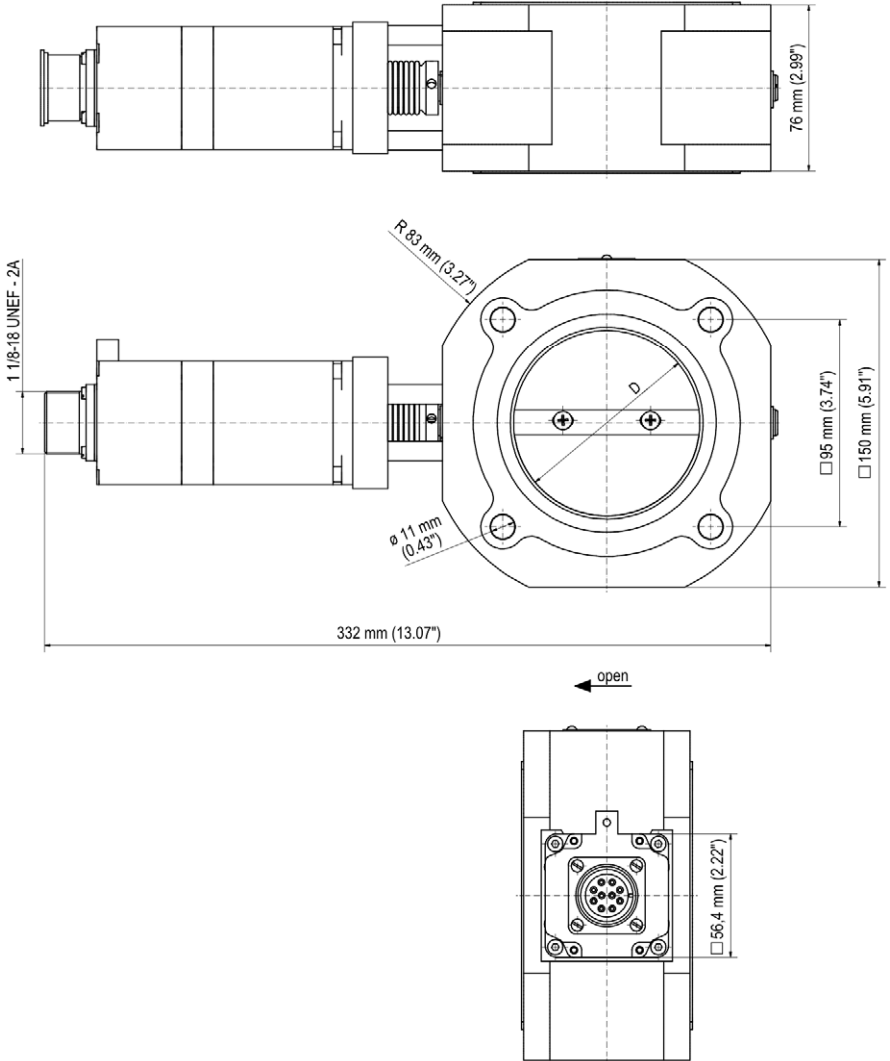
Standard diameter of the throttle (D): 75 mm (2.95"), 80 mm (3.15"), 85 mm (3.35")  
possible diameter of throttle: 73 mm (2.87") to 85 mm (3.35")

### Standard version





HT version

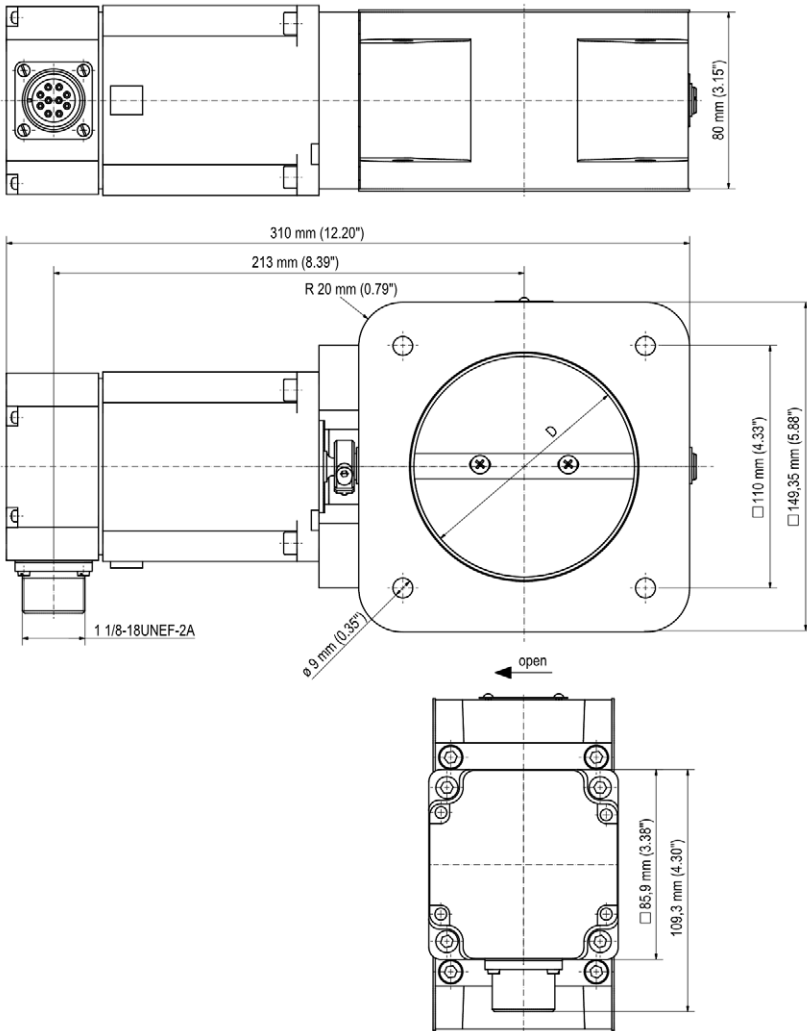


# 4 PRODUCT DESCRIPTION

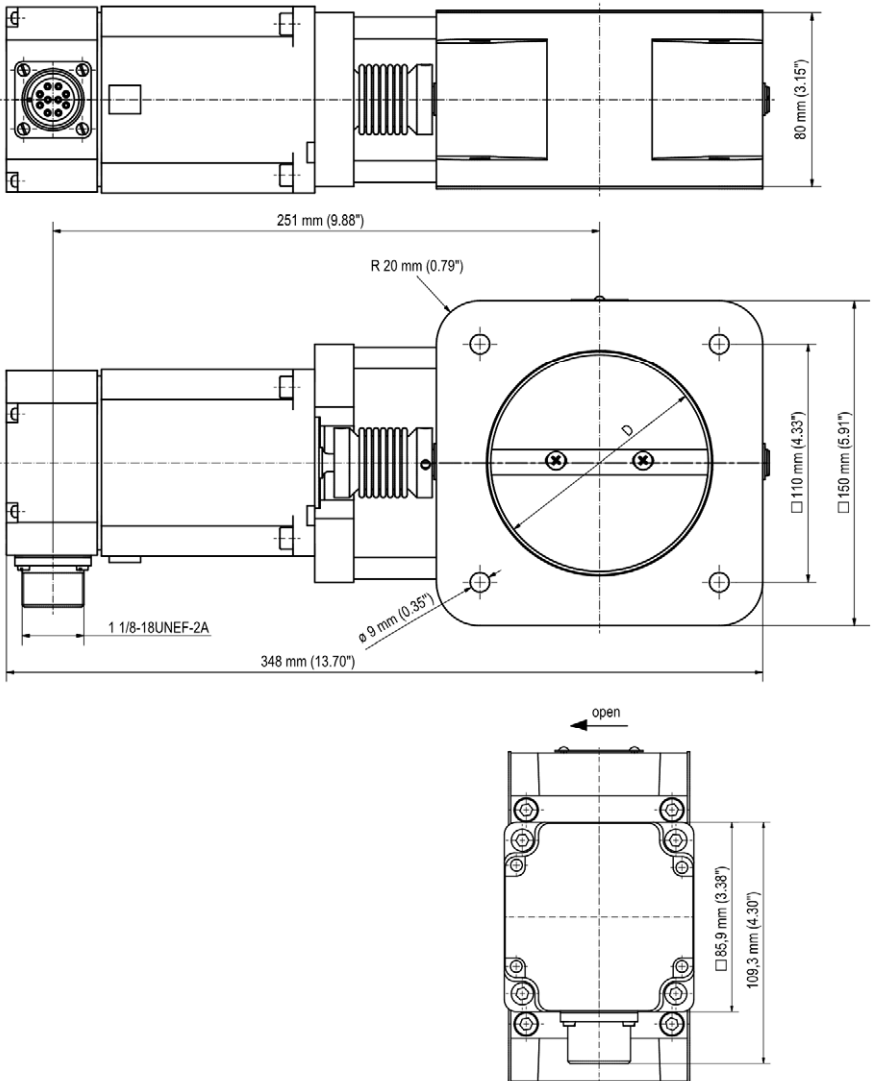
## 150 series

Standard diameter of the throttle (D): 90mm (3.54"), 100 mm (3.94")  
possible diameter of throttle: 82 mm (3.23") to 104 mm (4.09")

### Standard version



### HT version

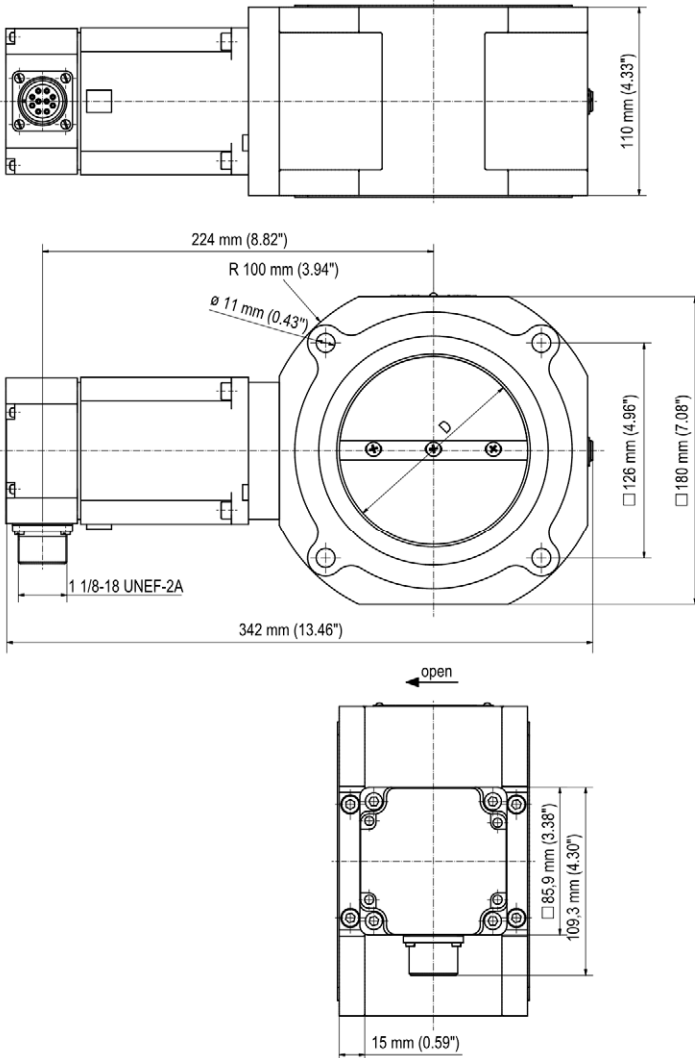


# 4 PRODUCT DESCRIPTION

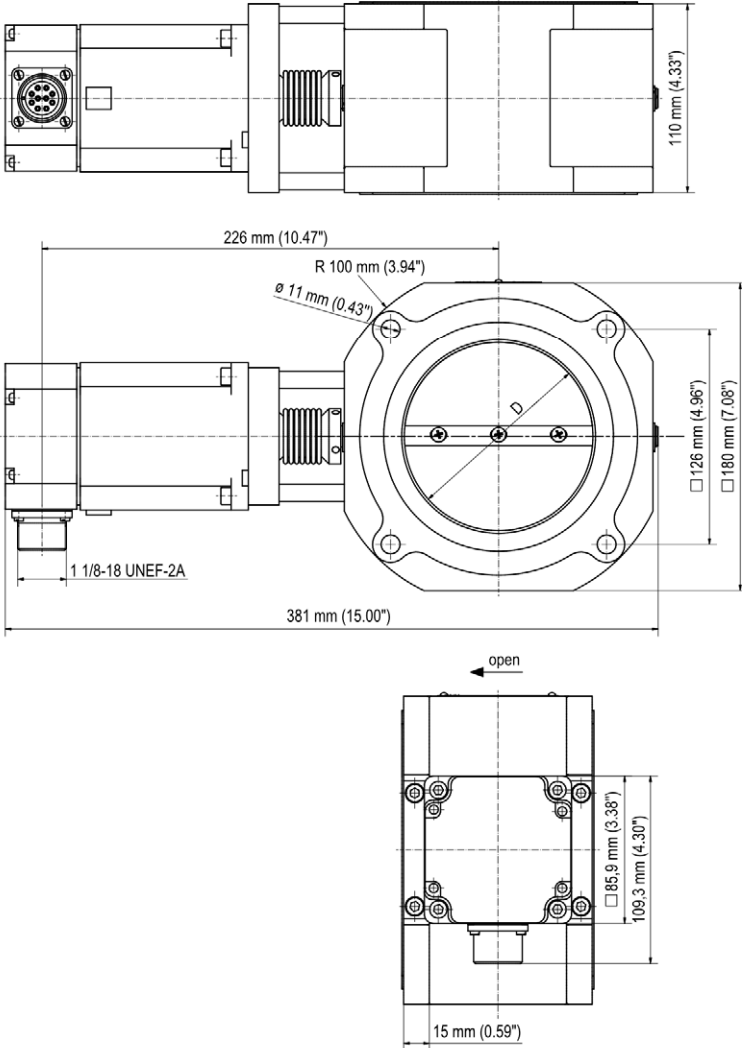
## 200 series

Standard diameter of the throttle (D): 100 mm (3.94"), 110 mm (4.33"), 115 mm (4.53")  
possible diameter of throttle: 98 mm (3.86") to 125 mm (4.92")

### Standard version



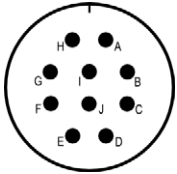
### HT version



## 5 WIRING OF THE DEVICE

### 5.1 Pole Connector Stepper Motor/Encoder

The connection of the stepper motor to the VariStep stepper motor card is carried out using the original MOTORTECH harness via the 10-pin connector on the stepper motor. The length of the connecting cable must not exceed 10 m (32’):



Pin stepper motor / encoder	Description
A	Stepper motor phase A1
B	Stepper motor phase A2
C	Stepper motor phase B1
D	Stepper motor phase B2
E	Encoder A
F	Encoder B
G	Encoder I (index)
H	Ground
I	Encoder 5 V supply voltage
J	Encoder ground

## 6 ASSEMBLY

### 6.1 Unpacking

Unpack the device taking care not to damage it, and ensure that the installation instructions are always stored with the device and are easily accessible. Check the contents for completeness and verify that the device type meets your application requirements.

#### Scope of Supply

The supply scope of the device consists of the following components:

- Throttle including stepper motor
- Two flat gaskets
- Installation Instruction

#### Required Accessories

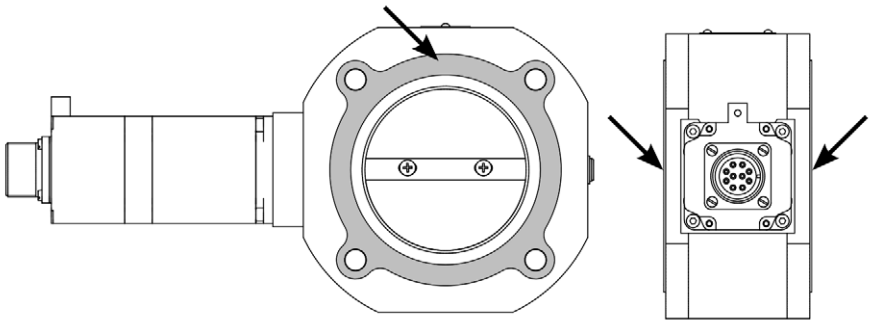
- Connection cable for connection between the throttle and stepper motor card
- VariStep stepper motor card incl. configuration software MICT and USB interface cable

### 6.2 Mounting the Device

The installation location of the throttle can be freely selected.

1. Use the flat gaskets included in delivery on both sides of the throttle (marked by arrows in the illustrations).

Example: 140 series



Exception:

If you use the mounting flange with O-ring, no additional flat gaskets may be used.

2. For the installation of the throttle between the two flanges, use four continuous screws or threaded rods (strength class 10.9 or higher).

## 6 ASSEMBLY

Depending on the thread used, observe the following tightening torques (for strength class 10.9):

- M6: 14 Nm  $\pm$  1 Nm (10.3 lb-ft  $\pm$  0.7 lb-ft)
- M8: 34 Nm  $\pm$  2 Nm (25.1 lb-ft  $\pm$  1.5 lb-ft)
- M10: 70 Nm  $\pm$  3 Nm (51.6 lb-ft  $\pm$  2.2 lb-ft)

### 6.3 Connecting the Device



#### Risk of damage!

Please observe the following procedure when connecting the stepper motor to the VariStep stepper motor card:

1. Configure the VariStep stepper motor card for the desired ITB throttle (see section *External device* in the operating manual for the VariStep stepper motor card).
2. Separate the stepper motor card from the power supply.
3. Connect the stepper motor of the throttle to the stepper motor card.
4. Connect the VariStep stepper motor card again to the power supply.
  - ▶ Now, the stepper motor card will initiate a reference run. The throttle is ready for operation.



#### Follow operating manuals

Follow the operating manual during connection and start up for the VariStep stepper motor card and for the connected speed control.

1. Connect the harness with the military style connector to the stepper motor of the ITB throttle.
2. Connect the open end of the harness with the connector for stepper motor and encoder to the stepper motor card. For this, read the operating manual on the VariStep stepper motor card.
3. Connect the speed control to the VariStep stepper motor card.
4. Connect the VariStep stepper motor card to the power supply.
  - ▶ The stepper motor card will initiate a reference run. If the stepper motor card is in automatic mode, the signals of the connected speed controller are then carried out. If the stepper motor card is in manual mode, the throttle stays in the closed position.



## 7 DISTURBANCES



### Observe error messages in MICT

If malfunctions occur, observe in general the error messages in MICT. These can help you to narrow down the errors. For this, also read the corresponding sections in the operating manual on the VariStep stepper motor card.

#### Problem:

Throttle does not move although corresponding signals are sent from the stepper motor card. You can recognize this problem by the fact that the groove on the axis of the throttle does not move in the event of corresponding signals.

#### Possible Causes and Solutions:

##### Cause 1:

The wiring between the VariStep stepper motor card and ITB throttle is defective.

##### Solution 1:

Check the connection harness and the connections to the stepper motor card. For this, also read the corresponding sections in the operating manual on the VariStep stepper motor card.

##### Cause 2:

The VariStep stepper motor card was incorrectly configured.

##### Solution 2:

Check the configuration via the MICT. Observe the error messages displayed. For this, also read the corresponding sections in the operating manual on the VariStep stepper motor card.

##### Cause 3:

The stepper motor is defective.

##### Solution 3:

The ITB throttle has to be replaced. Please contact your MOTORTECH contact person.

##### Cause 4:

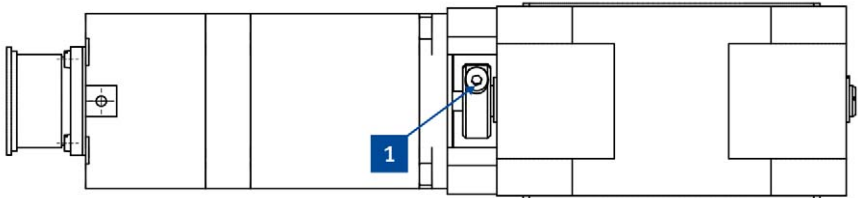
The connection between stepper motor and the axis of the throttle has loosened.

## 7 DISTURBANCES


### Solution 4:

Proceed as follows:

1. Dismantle the throttle, if necessary, from the intake section.
2. Loosen the attachment screw **1** of the clamping ring.



3. Trigger a reference run via the VariStep stepper motor card in manual mode, for example via the two buttons on the VariStep stepper motor card or via the MICT. For this, read the operating manual on the VariStep stepper motor card.
  - ▶ The stepper motor is now in the closed position.
4. Close the throttle by hand until a gap of 0.1 mm (0.004") remains open. For this, use a corresponding gauge role.

Position of the axis in the closed position: 

The groove on the axis of the throttle corresponds to the position of the throttle.
5. Re-tighten the attachment screw.
6. Re-install the throttle (see *Mounting the Device* on page 23).

## 8 MAINTENANCE

### 8.1 Customer Service Information

You can reach our customer service during business hours at the following phone and fax number, or by e-mail:

Phone: +49 5141 93 99 0  
Fax: +49 5141 93 99 99  
Email: [service@motortech.de](mailto:service@motortech.de)

### 8.2 Returning Equipment for Repair / Inspection

To return the device for repair and inspection, obtain a return form and return number from MOTORTECH.

Fill out the return form completely. The completely filled out return form guarantees fast, uncomplicated processing of your repair order.

Send the device and the return form to one of the two addresses below or to the nearest MOTORTECH representative:

#### MOTORTECH GmbH

Hogrevestr. 21-23  
29223 Celle  
Germany  
Phone: +49 5141 93 99 0  
Telefax: +49 5141 93 99 98  
[www.motortech.de](http://www.motortech.de)  
[motortech@motortech.de](mailto:motortech@motortech.de)

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[info@motortechamericas.com](mailto:info@motortechamericas.com)

### 8.3 Instructions for Packaging the Equipment

For return shipment, equipment should be packaged as follows:

- Use packaging material that does not damage the equipment surfaces.
- Wrap the equipment with sturdy materials and stabilize it inside the packaging.
- Use sturdy adhesive film to seal the packaging.

### 8.4 Spare Parts and Accessories

For spare parts and accessories, please refer to our current Product Guide, which is available for you to download on the Internet at [www.motortech.de](http://www.motortech.de).

## Original MOTORTECH Accessories for Stationary Gas Engines

As a supplier, MOTORTECH develops, produces and distributes accessories as well as spare and wearing parts for nearly all kinds of stationary gas engines worldwide: Ignition control and monitoring, industrial spark plugs and high tension leads, wiring systems and gas regulation– from detonation to speed control and complete gas engine management. On-site support and special training courses complete our service.



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