Actuators 2000X series

Operation Manual

EDP no.: 011-003-993 EN

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1 Read This Chapter First

Please read this chapter carefully **before starting up this unit**. It contains information on the following:

- The structure of this operating manual
- Important chapters to read for learning about proper operation
- Legal information
- Operating personnel requirements

1.1 Read This Chapter First

This operating manual has been written with the following intentions:

- Readers are to include all those who work with and on the unit, especially the operating and maintenance personnel.
- Information is provided on the intended use of the unit as well as its operation and features.
- Information is organized such that the reader first encounters the basics needed in day-to-day operation. The relevant basic chapters are:
  - Chapter 5: Installation and Setup
  - The chapter describing the operation of the respective actuator: chapter 8, chapter 9 or chapter 10
  - Chapter 11: Maintenance
- Information is organized such that it is quick and easy to find with the help of:
  - Table of contents
  - Index
  - Chapter contents at start of each chapter

WARNING

We expressly inform you that you are obliged to read this operating manual before starting operation with the unit and to work with the unit according to the instructions provided herein. Using the unit as intended will avoid injury to persons and damage to property. To eliminate the risk of injury or damage, it is extremely important that the operating personnel are authorized and qualified to work with the unit.

We cannot accept liability for damage caused by improper use that could have been avoided.

Before beginning to work with the unit, you should read the following basic chapters and sections:

- Chapter 4: Delivery and Handling
- Chapter 5: Installation and Setup
- The chapter describing the operation of your actuator.

1.2 Availability of This Operating Manual

Always keep this operating manual close at hand in the operating area.

1.3 Copyright

Actuators of the 2000X series
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The actuators of the 2000X series and this operating manual are protected by copyright. Reproduction of any part of the machine will lead to prosecution. All rights to this operating manual are reserved, including any form of reproduction, whether by means of photocopying, printing, translation or through storage on a data medium. Reproduction or reprinting of this operating manual, even in an abridged form, requires the written consent of BRANSON Ultrasonics.

This operating manual contains the most exact product description possible; nonetheless, specific characteristics or operating results are not guaranteed. Prior to publication, this operating manual was thoroughly checked for possible errors. However, the publishers assume no liability, whether explicit or implicit, for any damage resulting from the use of this operating manual. We are always grateful for information concerning errors, as well as any criticism and suggestions you may have to improve this operating manual!

Unless otherwise stated, the technical status upon joint delivery of the product and the operating manual by BRANSON Ultrasonics is authoritative. We reserve the right to make technical changes without prior notice. Previous operating manuals are then no longer valid.

The BRANSON Ultrasonics General Conditions of Sale and Delivery apply.

Do you have questions? Or problems with installation and startup? Call us! We will be glad to help you!

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Dietzenbach, 8. March 2012

1.4 Product Liability, Intended Use, and Warranty

We guarantee that the product is free of faults as stated in our advertisements, in the product information we have published, and in this operating manual. Any other product properties are not guaranteed. We do not accept responsibility for the profitability or proper functioning of the unit when used for purposes other than those described in chapter 2.4.

Claims for damages are generally excluded, except after proof of intended, gross negligence on the part of BRANSON Ultrasonics or the absence of guaranteed product properties. In particular, we do not accept responsibility for cases where the welding machine is used for purposes for which it is not intended as defined in this operating manual. We are not liable for the consequences of unintended use involving using units in surroundings or with control systems that are not suited for the welding machines or do not comply with standard engineering practice.

Moreover, we decline any liability for damages to welding and automation systems caused by product malfunctions or errors in the operating manual.

We are not responsible for the violation of patents and other rights of third parties outside of the Federal Republic of Germany. We are not liable for damages due to inappropriate handling as defined in this operating manual. We explicitly exclude liability for profit loss, particularly owing to consequential damage resulting from non-compliance with safety regulations and warnings. We are not liable for consequences caused by accessories which are not supplied or certified by BRANSON Ultrasonics; this especially includes tools from other manufacturers.

BRANSON welding systems are designed for a long service life. They are designed in accordance with standard engineering practice and each function is tested separately prior to delivery. The electrical construction complies with current standards and regulations, see chapter 2.11. BRANSON Ultrasonics continually conducts product and market analyses for further development and improvement. Should malfunctions or failures occur despite these preventive measures, please contact the customer service at BRANSON. We guarantee that immediate and suitable measures for repairing any damage will be provided.

1.5 Warranty Terms

We hereby guarantee the trouble-free operation of the units in accordance with this operating manual for a period of 36 months following the delivery date on the delivery notice. If the system is operated in multiple shifts, the warranty period is reduced accordingly, to either 18 or 12 months. Special conditions apply to wear parts such as horns and fixtures. Similarly converters are excluded from the guarantee if they are used for applications involving ground detect.

The warranty period begins on the date the machine is delivered to the buyer, regardless of the actual initial startup date. The warranty is valid only for units that have been installed and operated as described in this operating manual and as instructed by employees of BRANSON Ultrasonics. Free repair work requires proof of adherence to the operating manual regarding storage, transport, installation, startup, and operation.

A unit may only be modified by the customer or a third party after having consulted with and received written consent from BRANSON Ultrasonics. Disregard of these terms annuls the warranty and BRANSON Ultrasonics will not accept responsibility for any property damage, personal injury, or other resulting damage.

Furthermore, BRANSON Ultrasonics will not accept responsibility for defects caused by the use of damaged or malfunctioning equipment in the vicinity of the welding machine or by the use of accessories not supplied by BRANSON Ultrasonics. Tools manufactured by other firms must be individually tested and approved by BRANSON Ultrasonics in order to maintain the warranty.

Furthermore the BRANSON Ultrasonics General Conditions of Sale and Delivery apply.

If you have questions regarding the scope of the warranty, please contact your BRANSON representative or the BRANSON customer service department.

1.6 Requirements for Operating and Maintenance Personnel

It is required that:

- Operating personnel are trained to operate the unit safely.
- Operating personnel
  - set up,
  - maintain,
  - and repair

  the unit in such a way that it does not pose any hazard for persons, environment or objects.

Other imperative prerequisites to performing work on the unit are:

- Possession of the required expert knowledge
- Reading and understanding of this operating manual

2 Safety Instructions and Service

This chapter describes the safety symbols used in the manual and on the products, and provides additional safety information regarding ultrasonic welding. Furthermore it informs you how you can contact BRANSON in the event of questions.

2.1 Safety and Warning Notes

2.1.1 Symbols Used in This Manual

Chapter 2.1.1 and chapter 2.1.2 inform you on recurring signs in the operating manual. These signs provide you with a quick overview.

Observe the following safety signs and instructions that can be found in this operating manual. They warn you of hazards and their consequences.

DANGER

Dangerous situation that could result in personal injury and/or serious damage to the unit.

WARNING

Possibly dangerous situation that could result in minor to medium injuries and damage to the unit.

NOTE

Tips on usage and other important or useful information and instructions.

2.1.2 Symbols Used on the Product

In the case of sensitive or dangerous elements, customary symbols warn the user. The symbols located on the rear of the 2000X series actuators are described in fig. 2-1 and fig. 2-2. The warning signs located on the front of the actuator are described in fig. 2-3 and fig. 2-4.

Fig. 2-1 Safety signs on the rear of the 2000X series actuators

Fig. 2-2 Connections on 2000X series actuators

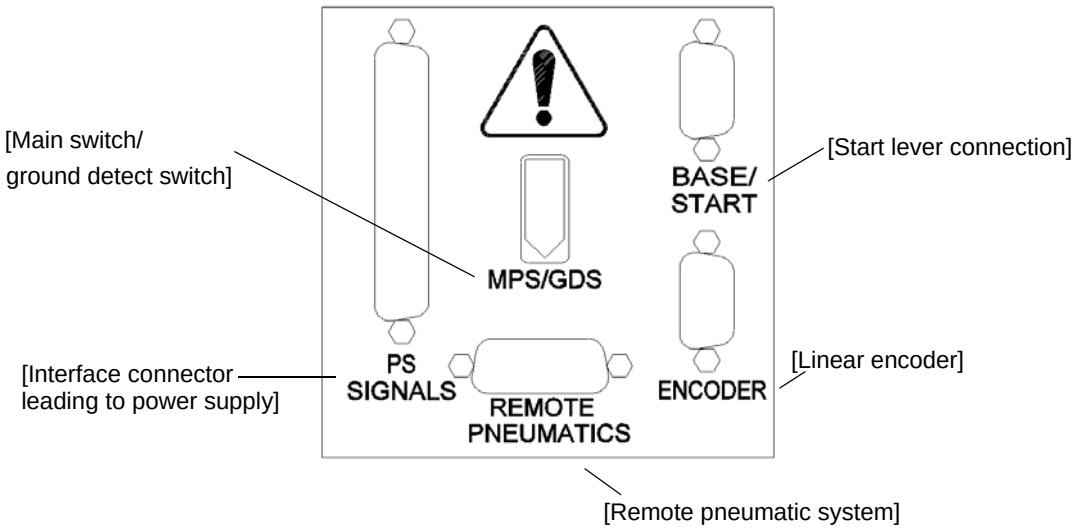
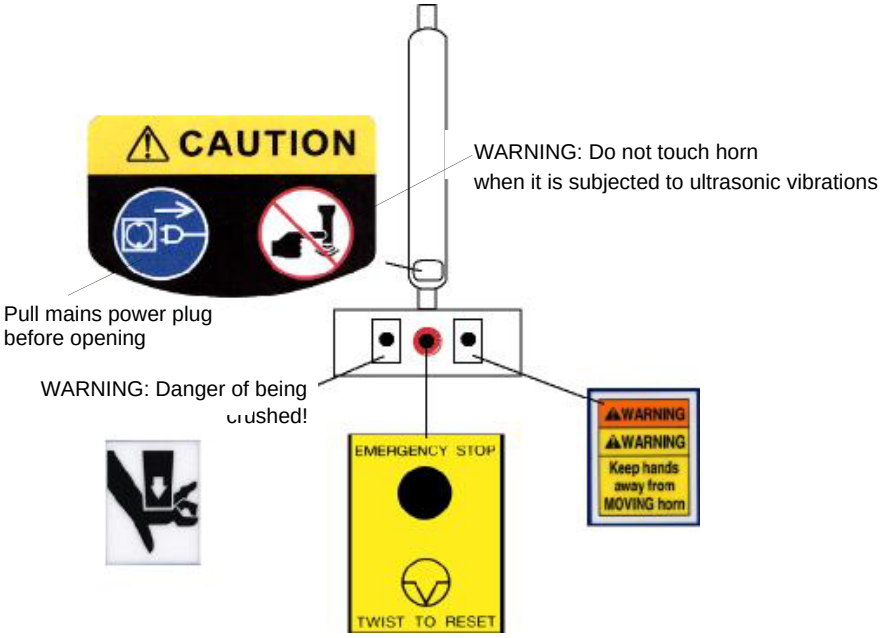


Fig. 2-3 Warning signs on 2000X series actuators - compressed air supply

Fig. 2-4 Safety signs on the front of the actuator



Tab. 2-1 Safety signs on BRANSON units

Pictogram	Explanation
	Warning against hazardous locations
	Warning against dangerous exposure to electricity
	Pull mains power plug before opening
	Do **not** operate unit with two persons

2.2 Operating Personnel: Authorized Personnel

DANGER

Only authorized personnel may carry out installation and maintenance work on the unit!
Improper operation and maintenance of the unit may be hazardous to persons, objects, and the environment.

Authorized personnel:

- Are operating personnel who have been specially instructed and trained to **operate the unit**.
- For **setup, maintenance and installation work** are the trained specialist personnel of the owner/operator and the manufacturer.
- Must all be familiar with the safety equipment and regulations and have read the relevant operating manuals.

2.3 Sources of Danger Specific to Ultrasonic Technology

Always observe the following general instructions when using ultrasonic technology:

DANGER

Never place your hands between the horn and weld part fixture. Danger of being crushed!
Do not touch the horn while it is being subjected to ultrasonic vibrations. Risk of burns!

DANGER

Do not operate the unit when the case covers of the power supplies have been removed. Risk of lethal exposure to high voltage!

Make sure that no other persons are exposed to the hazards mentioned above, for instance if additional personnel assists in setting up or carrying out maintenance work on the unit.

Make sure that the mains power switch is set to OFF before you connect any electrical cables.

The power supply may only be connected to a grounded power source, to prevent danger of an electrical shock.

Power supplies generate high voltage. Before you start work at the power supply module, take the following steps:
- Switch off the power supply.
- Disconnect the device from the mains power.
- Wait at least 2 minutes for the capacitors to discharge.

There is live high voltage within the power supply. Never operate the unit without its case cover.
The device-specific ground is not directly connected to the protective ground. Therefore you should employ only ungrounded, battery-operated multimeters. Other testing devices could cause electric shocks.

WARNING

Only start the ultrasonic vibrations (i.e., press the TEST button, press both palm buttons, or send an external start signal) when the HF cable and converter are connected to it.

Avoid direct contact between the horn and metal while the horn is subjected to ultrasonic vibrations. This can destroy the unit.

In the descriptions of each activity, you are informed of other possible sources of danger.

Furthermore observe the following general safety instructions:

WARNING

If the HF cable or the converter has not been connected, it is impermissible to start the welding cycle.

Before performing maintenance tasks on the power supply, observe the following safety instructions:

DANGER

Before you set a DIL switch, you have to make sure that the mains power has been disconnected.

Do not reach underneath the horn. Downward force (pressure) and ultrasonic vibrations can cause injuries.

When you use larger horns, avoid situations in which fingers can get clamped between the horn and the weld part fixture.

Keep in mind that the actuator is subject to a “pre-load” if the pressure display (on the front panel) is lit.

NOTE

The following factors can influence the volume and frequency of noises generated during ultrasonic processes:
- Type of application
- Size, form and composition of the material to be welded
- Form and material of the weld part fixture
- Welding parameters
- Design of the welding tools
During the welding process, some weld parts vibrate within the audible frequency range. Some or all of these factors can cause an unpleasant noise level. In such cases, personal protective equipment has to be issued to the operating personnel.
See chapter 2.9.

2.4 Intended Use of the Unit

The power supplies and the 2000X series actuators are components of an ultrasonic welding system. They have been designed for a wide range of welding and processing applications.

Intended use is defined as usage of the unit as described in the operating manual.

The owner/operator is responsible for carrying out the work required to connect the welding system to a third-party system, such as a PLC.

The specifications of the order, as well as the order confirmation, are binding for the owner/operator. Using the unit in any other ways or in ways which go beyond those specified here are considered to be unintended use.

Using the 2000X series actuators other than intended may cause damage to them or any other connected systems. Furthermore there is the danger of injury and consequential damage. The owner/operator accepts full responsibility for any modifications made independently to the unit's hardware or software.

2.5 Scope of Validity of the Operating Manual

This manual is valid for the entire system. Additional safety regulations for the components used in the system are not made ineffective by these instructions.

2.6 Safety Features on the Unit

The power supplies and the 2000X series actuators are equipped with software-controlled electronics. It ensures that system operation is safe for the operating personnel. Start and EMERGENCY STOP buttons have been equipped, to prevent an unintended system start.

DANGER

It is prohibited to remove, bridge, or deactivate the safety features during production. Some of the safety features listed below may be deactivated, but only once higher-level safety systems have been implemented.

2.6.1 EMERGENCY STOP Impact Button on the Press Unit

NOTE

In case of danger, hit the EMERGENCY STOP impact button on the press unit or on the sound insulation cabin. The ultrasonic power supply and press unit switch off immediately.

Do not use the EMERGENCY STOP impact button to switch off the regular operation of power supply and press unit.

The EMERGENCY STOP button must always be easily accessible.

2.6.2 Two-Hand Operation (Palm Buttons)

You can only trigger the welding process by simultaneously pressing both START palm buttons.

2.6.3 System Protection Monitor (SPM)

SPM (System Protection Monitor) is an electronic monitoring system in the ultrasonic power supply. The SPM stops ultrasonic activity during power supply overload, and when system components are wrong or defective.

2.6.4 Disconnecting the Mains Supply

The mains power plug serves as the main switch and disconnects the control computer from power.

2.7 Safety Checks

NOTE

Check the safety features at the intervals specified by the employer's liability insurance association!

2.8 Safety During Maintenance and Installation

2.8.1 Work on Electrically Live Components

DANGER

Only persons authorized for the tasks are to carry out maintenance and installation work.

DANGER

Never assume that a circuit is not live - always check, for safety's sake! Touching live components can cause extremely serious or even lethal burns as well as internal injuries from electric shock.

You may only perform work on live components if this is expressly specified.

The mains switch is still live, even after the control computer has been switched off.

When working, always observe the relevant safety norms.

2.8.2 Installation and Maintenance Work

If this manual instructs you to remove safety features for installation or maintenance work, it is imperative to replace them after you have finished work. Only remove safety features if it is necessary. This applies especially to covers and ground cables.

DANGER

Prior to installation and maintenance work, proceed as follows to switch off the unit:

Switch off the power for all system components:
- Switch off the units.
- Pull the mains plug.
- Secure the mains plug from being reconnected.

Switch off the pneumatic system:
- Unplug the pneumatic connection.
- Ventilate lines and valves using the pressure control valve on the press unit.

NOTE

Any other dangers involved in performing tasks with and on the unit are described along with these tasks.

2.9 Emissions

Due to the wide range of applications and operating locations, it is not possible to provide generally valid specifications on the sound pressure levels. We recommend that you measure and log the sound pressure levels before starting production.

Should the measured sound pressure levels exceed the permitted momentary or permanent levels, then appropriate sound insulation measures are necessary, such as a sound insulation cabin or hearing protection!

NOTE

The required sound insulation features might not be part of the standard delivery.

BRANSON sound insulation cabins fulfill the special requirements of ultrasonic technology and have been specially developed for applications where the weld part generates audible sound waves.

Furthermore processing some types of plastics can generate poisonous vapors, gases or other emissions, which pose a hazard to the health of the operating personnel. Workplaces where such materials are processed have to be well-ventilated. If you are processing such materials, contact your supplier for information on recommended safety measures.

WARNING

Many of the processed materials, for example PVC, pose a hazard to the health of the operator or could cause corrosion and other damage to the units. Make sure that there is good ventilation and adhere to the safety measures.

2.10 Workplace Setup

To ensure safe operation of the ultrasonic welding machine, the measures for setting up the workplace are described in chapter 5.

2.11 Manufacturer's Note on Electromagnetic Compatibility

BRANSON's 2000X series actuators and the converter are controlled and supplied with current by means of the appropriate ultrasonic power supply from the 2000X series.

Observe the following when installing and operating the device:

- Only connect the system to an electric socket that is correctly grounded and use the power cable provided for this purpose.
- Never operate the unit without its case or appropriate case covers. These reduce operational noise, protect the device against dust, and serve as screens against electromagnetic radiation.
- Do not modify the standard cables.
  Other technical modifications, especially to the interfaces, are only to be carried out by qualified personnel who are able to verify whether the modifications comply with interference suppression provisions.
- Only use accessories and spare parts made by BRANSON Ultrasonics.

2.12 Sales and Delivery Conditions

The excerpts from the sales and delivery conditions (see the back of the invoice) contain important stipulations regarding the product liability for the BRANSON ultrasonic welding machine. The points listed mainly address delivery, shipment and the duration of the warranty. If you have any questions, please read the back of the invoice that is included with the system. It lists all sales and delivery conditions.
Or contact your BRANSON representative.

The BRANSON Ultrasonics General Conditions of Sale and Delivery apply.

3 Introduction

The 2000X series actuators have been designed for use with a 2000X series power supply manufactured by BRANSON. This chapter gives an overview of the various types and the equipped features.

3.1 Overview of the Actuators

This section provides an overview of the actuators and their equipped technical features.

Tab. 3-1 Overview of the Actuators

Functional differences		**Actuator Designation/Description**		
	Remote pneumatic system required (rp, see fig. 3-1)			With integrated pneumatic system
	Stroke 50 mm	Stroke 100 mm	Stroke 150 mm	
Mechanical triggering of ultrasonic vibrations		**ao** = actuator open (actuator without pneumatic system)	**aol** = actuator open long stroke (Actuator without pneumatic system, with long stroke)	**ae** = actuator enclosed (actuator with pneumatic system)
S Beam Load cell + linear encoder	**aodm (aod Micro)** = actuator open distance micro (actuator without pneumatic system with linear encoder)	**aod** = actuator open distance (actuator without pneumatic system with linear encoder)	**aodl** = actuator open distance long stroke (actuator without pneumatic system, with long stroke and linear encoder)	**aed** = actuator enclosed distance (actuator with pneumatic system and linear encoder)
S- Beam Load cell + linear encoder + proportional valve				**aef** = actuator enclosed force (actuator with pneumatic system, linear encoder and proportional valve)
S- Beam Load cell + linear encoder + proportional valve in combination with 2000X mc net	aomc Micro = actuator open micro + 2000X mc net (actuator without pneumatic system in combination with 2000X mc net)	aomc = actuator open + 2000 mc net (actuator without pneumatic system in combination with 2000 mc net)		**aemc** = actuator enclosed + 2000 mc net (actuator in combination with 2000 mc net)

The actuators have been designed for all frequencies. In the case of 30 kHz and 40 kHz, you have to use an adapter for mechanical adjustment.

Tab. 3-2 Technical equipment of the pneumatic systems of the actuators

Equipment Pneumatic system	**Type of actuator**										
	ao	**aol**	**aod**	**aodl**	**aodm**	**aomc**	**aomc Micro**	**ae**	**aed**	**aef**	**aemc**
Cylinder 1.5	x	x	x	x	x		x	x	x		
Cylinder 2.0	x	x	x	x		x		x	x	x	x
Cylinder 2.5	x	x	x	x				x	x		
Cylinder 3.0	x	x	x	x		x		x	x	x	x
Cylinder 3.2	x	x	x	x				x	x		
Stroke 50 mm					x		x				
Stroke 100 mm	x		x			x		x	x	x	x
Stroke 150 mm		x		x							
Valve for converter cooling	x	x	x	x	x		x	x	x	x	x
Switch valve for the stroke								x	x	x	x
Proportional valve for force control							x			x	x
Manual control valve for downspeed								x	x		
Manual pressure regulator/work pressure display								x	x		
Pneumatic display/system pressure						x				x	x
Remote pneumatic system	x	x	x	x	x	x	x				
Pressure recording (work pressure)			x	x	x		x		x		
Pressure recording (reference pressure)						x				x	x
Damper for return stroke	x	x	x	x	x	x	x	x	x	x	x

The remote pneumatic system, rp, is equipped with

- Converter cooling system
- Switch valve for the stroke
- Manual control valve for downspeed
- Manual pressure regulator/work pressure display

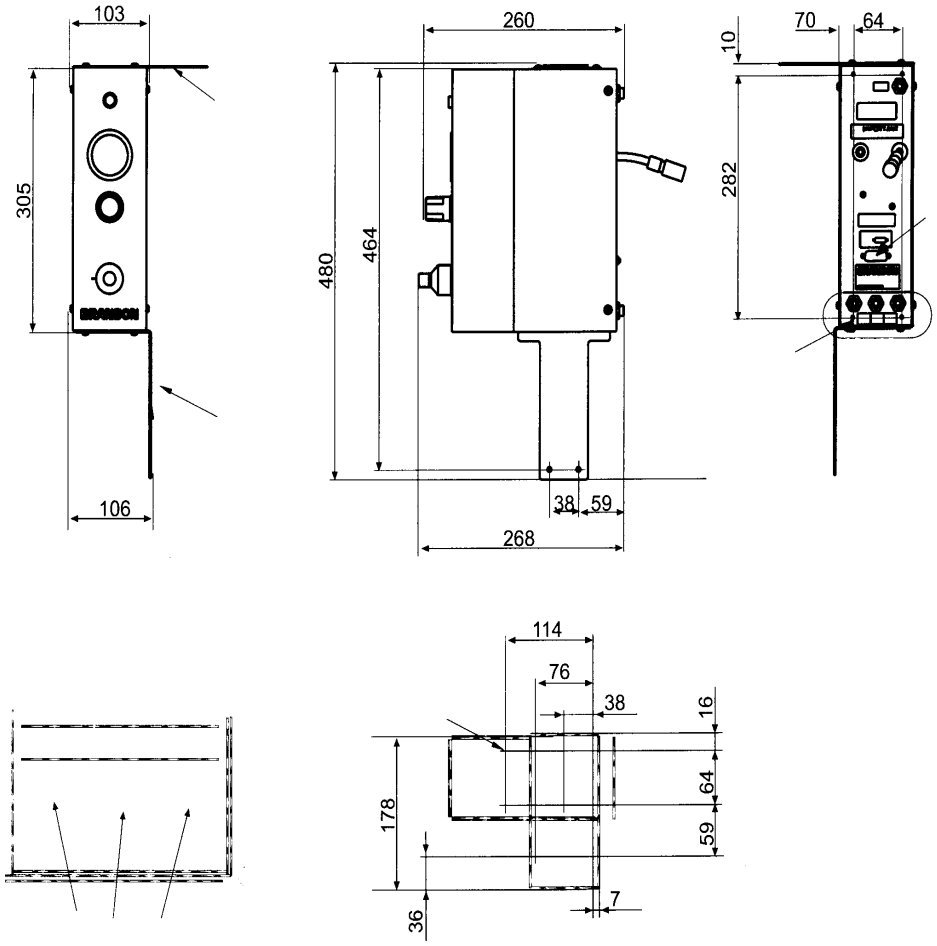
For more information on the remote pneumatic system, also see fig. 3-1.

Tab. 3-3 Technical equipment of the actuators (except pneumatic systems)

Other equipment	**Type of actuator**										
	ao	**aol**	**aod**	**aodl**	**aodm**	**aomc**	**aomc Micro**	**ae**	**aed**	**aef**	**aemc**
Linear encoder			x	x	x	x	x		x	x	x
Mechanical depth stop	x	x	x	x	x	x	x	x	x	x	x
Converter case closed	x	x	x	x		x	x	x	x	x	x
ULS/fork light barriers	x	x	x	x	x	x	x	x	x	x	x
Mechanical trigger system	x	x						x			
Load cell			x	x	x	x	x		x	x	x
Interface “AE/AO”	x	x						x			
Interface “AED/AOD”			x	x	x				x		
Interface “AEF”										x	
Interface “AEMC”						x	x				x
Display 24 V operating voltage	x	x	x	x	x	x	x	x	x	x	x

The following illustrations provide an overview of the control elements and dimensions of the various actuators.

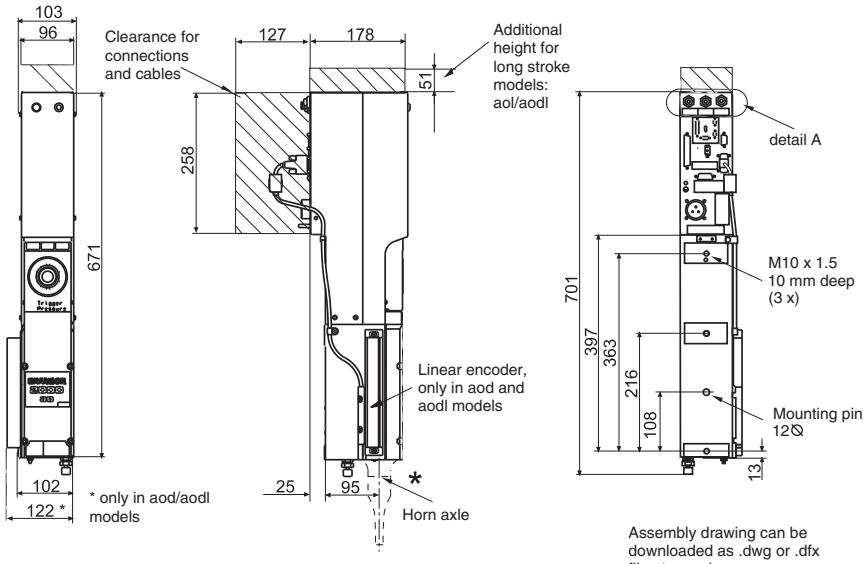
Fig. 3-1 Remote pneumatic model, rp



NOTE

The remote pneumatic system, rp, is sold separately. This applies to the following actuators: ao, aol, aod and aodl.

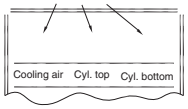
Fig. 3-2 Actuator models: ao, aod, aol, aodl



Assembly drawing can be downloaded as .dwg or .dfx file at www.branson-plasticsjoin.com, under "Information".

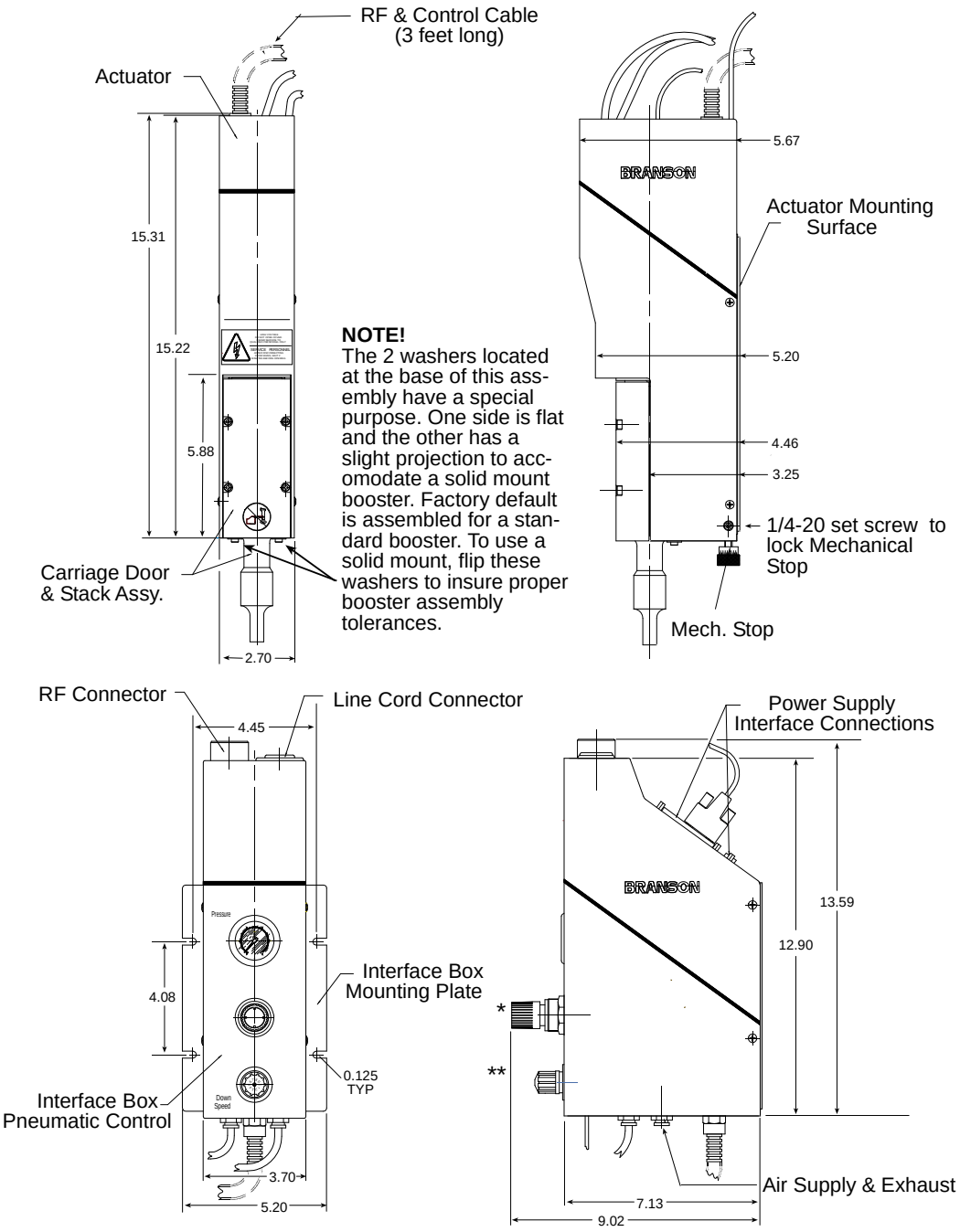
*	Frequency			
	20 kHz	30 kHz	40 kHz	
	5 - 70	33 - 39	17 - 24	These lengths are approximate and depend on the booster gain, horn construction, material and calibration. All horn dimensions are valid for $\lambda/2$
	127 - 140	75 - 96	64 - 70	

Hose connections 1/4"



View A

Fig. 3-3 Actuator model: aodm, part 1



* = pneumatic system
** = downspeed

Note: The aomc Micro is not equipped with these control elements!

Fig. 3-4 Actuator model: aodm, part 2

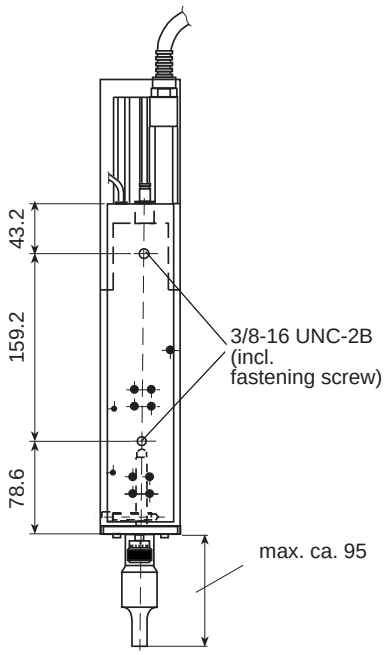
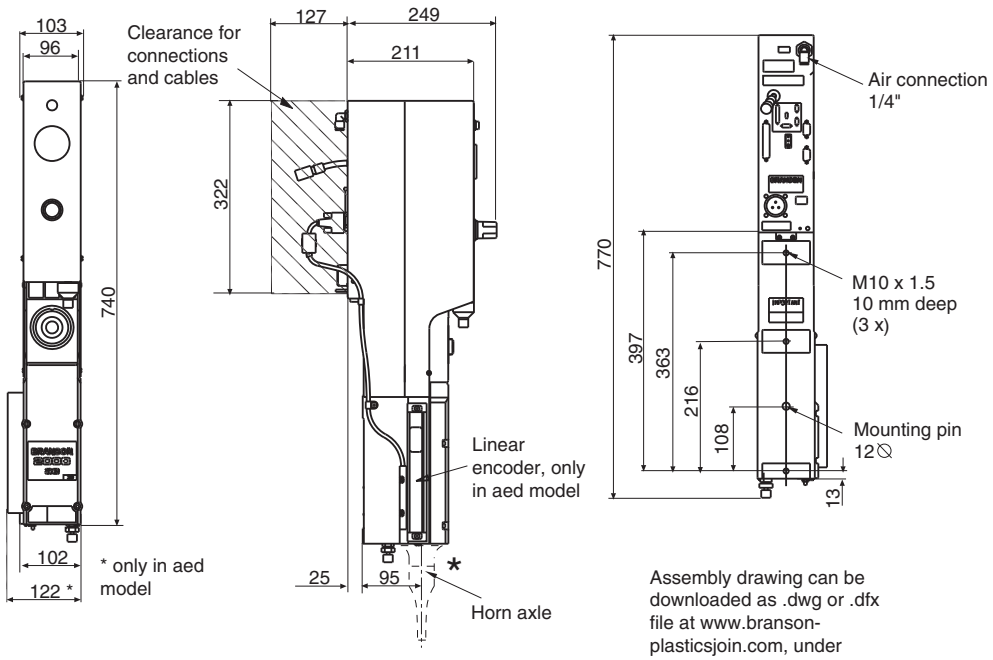
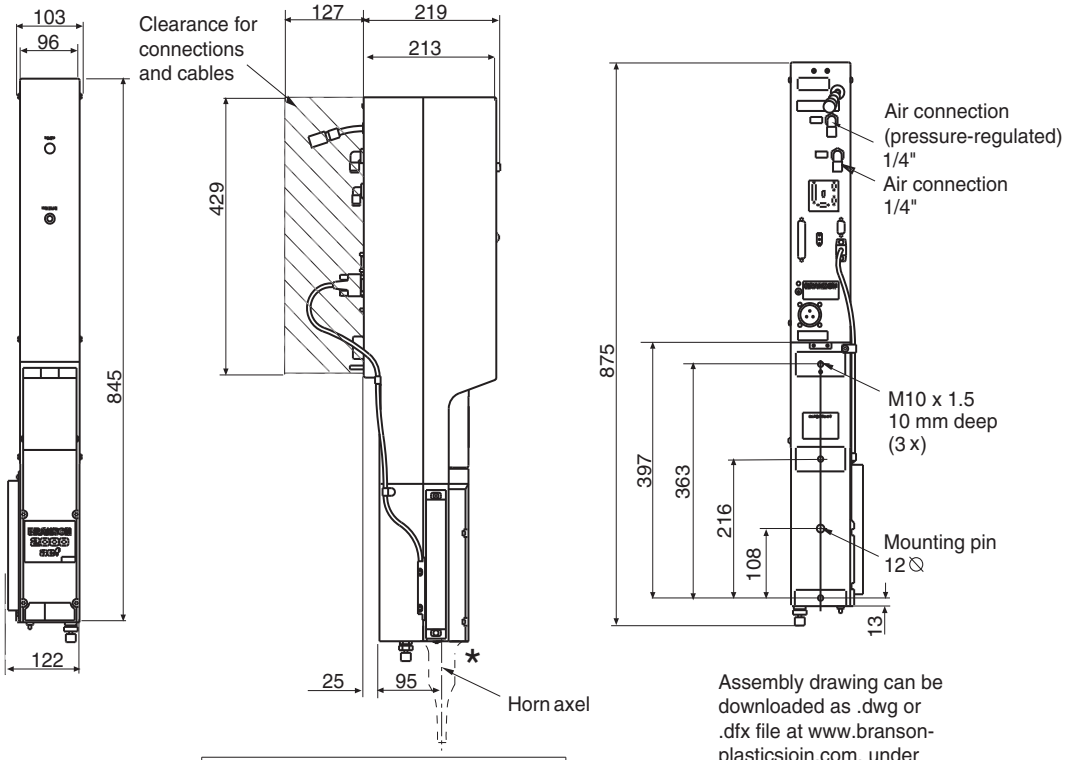


Fig. 3-5 Actuator models: ae and aed



*	Frequency			
	20 kHz	30 kHz	40 kHz	
	53 - 70	33 - 39	17 - 24	These lengths are approximate and depend on the booster gain, horn construction, material and calibration. All horn dimensions are valid for $\lambda/2$
	127 - 140	75 - 96	64 - 70	

Fig. 3-6 Actuator model: aef/aemc



*	Frequency			
	20 kHz	30 kHz	40 kHz	
	53 - 70	33 - 39	17 - 24	These lengths are approximate and depend on the booster gain, horn construction, material and calibration. All horn dimensions are valid for λ/2
	127 - 140	75 - 96	64 - 70	

Operating manuals on the actuators

The following documentation is available for 2000X series power supplies that are compatible to 2000X series actuators:

Actuator ao/aol

- Operating manual - 2000X t power supply (EDP no. 011-003-992-US)
- Operating manual - 2000X ea power supply (EDP no. 011-003-991-US)

Actuator aod/aodl/aodm

- Operating manual - 2000X dt power supply (EDP no. 011-003-990-US)

Actuator ae

- Operating manual - 2000X t power supply (EDP no. 011-003-992-US)
- Operating manual - 2000X ea power supply (EDP no. 011-003-991-US)

Actuator aed

- Operating manual - 2000X dt power supply (EDP no. 011-003-990-US)

Actuator aef

- Operating manual - 2000X f tpower supply (EDP no. 011-003-989-US)

Actuator aemc/aomc/aomc Micro

- Operating manual - 2000 b/bdc power supply (EDP no. 011-003-971)
- Operating manual - 2000 mc net (EDP no. 011-003-973)

3.2 Installation Options

There are various possible ways to install the actuators:

- Standard installation as actuator with connector between the column and actuator, and with ergonomic base plate. In the operating manual, this version is also described as actuator with base plate; see fig. 3-8.
- Installation using an adapter (support) between the actuator and the round column with flange. This is possible with and without base plate. In the operating manual, this version is also described as actuator with flange. For more information, refer to chapter 4.3.1 and chapter 4.3.2.
- In special machines, installation directly at the support or a suitable device. Please pay attention to the length of the screws; you have to take care not to use too long screws, as this would damage the actuator. In the operating manual, this version is also described as actuator without welding stand.
- Installation at the square column, as needed. This is possible with or without base plate.
- The Micro actuator is installed with or without base plate, as needed. Two fastening bolts and a T-wrench are included in the scope of delivery. Only use 3/8"-16 x 5/8" screws. Otherwise the actuator could be damaged!

In the case of the square column, the pneumatic system is within the square column. There are differences between the ae, aed and aef models.

- ae and aed: Air filter and slide valve, On and Off for supply air
- aef: When switching on the air supply for the first time:
  - Soft start valve for slowly building up the system pressure
  - Precision regulator for reference pressure
  - 2 filters for better air treatment This is necessary due to the proportional valve.

Fig. 3-8 shows a BRANSON 2000X series adapter-mounted actuator that has been installed on a column. The whole unit is mounted on an ergonomic base plate.

Fig. 3-7 View of right side of an actuator, round column

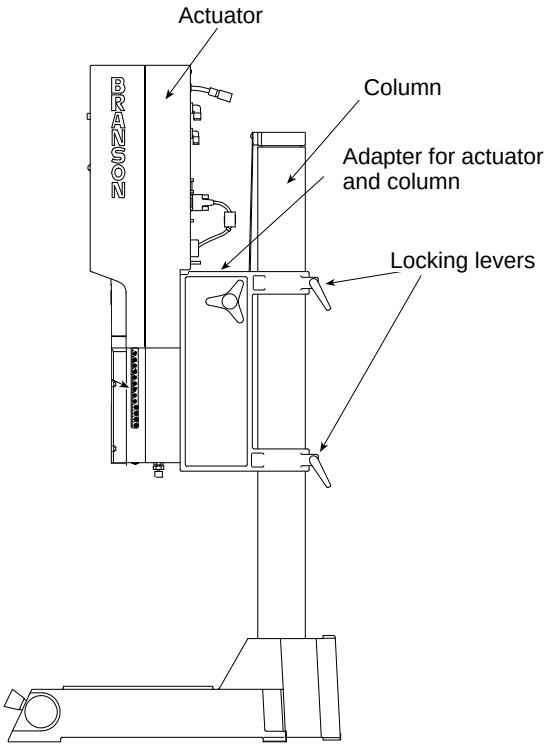
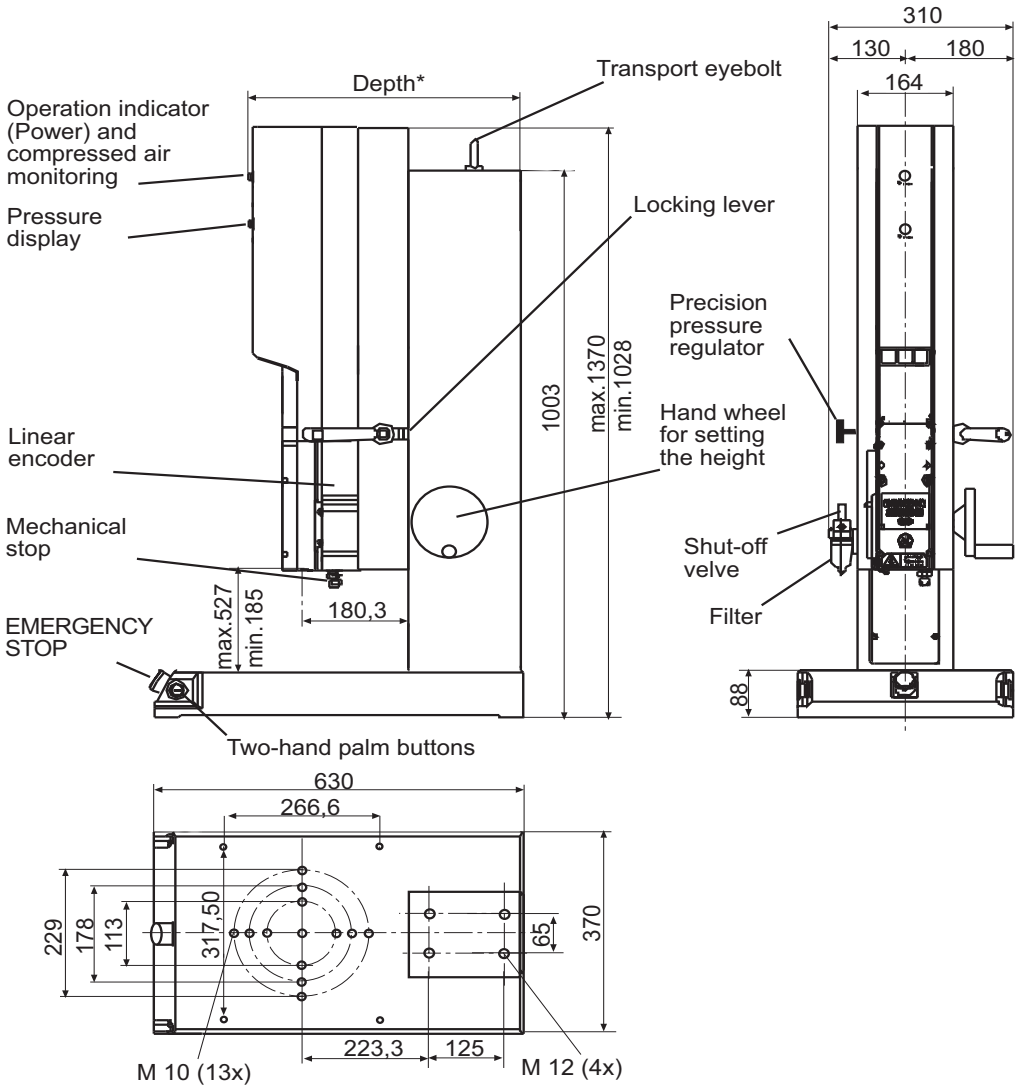


Fig. 3-8 2000X series press units: ae, aed, aef and aemc; rectangular column



Pay attention to the different dimensions of the various actuators.

Tab. 3-4 Depth and height dimensions

	ae/aed	aef/aemc
Depth	501	470
Height 1	925	1028
Height 2	1267	1370

For the aef actuator you need a 5 µm particle filter and a 0.3 µm coalescence filter.

3.3 Component Descriptions

The actuator carriage

The carriage of the actuator is driven by a double-acting air cylinder. It is mounted on a linear ball-bearing slide. The slide system is based on eight sets of preloaded, **permanently lubricated** bearings and provides consistent, precise movement and positioning, and a long service life.

Actuator adapter

Attach the adapter of the actuator to the column. You can use the adapter of the actuator to adjust the height of the actuator case above the weld part fixture. The height is adjusted to adapt to the respective application or to make service tasks easier.

Base plate of the actuator

Designation	Description
Start switches (two-hand palm buttons)	You start the operating cycle at the power supply, via the actuator, when you press these buttons simultaneously.
EMERGENCY STOP impact button	This button causes the operating cycle to be interrupted by means of the power supply, and the carriage returns. Turn the switch to reset it.
Start cable	Connect the base plate with the START connection on the actuator.

Pneumatic system

The pneumatic system is integrated into the steel casing of the actuator, or in the case of the ao/aod actuators, in the actuator and the remote pneumatic control unit. The system consists of a primary solenoid valve, a cooling solenoid valve, an air cylinder, a pressure regulator, a proportional valve (not in the case of the ao/aod) and a pressure sensor. The downspeed velocity can be adjusted at the front panel of the power supply by means of a knob, or in the case of the ao/aod actuators, at the front panel of the remote pneumatic control unit, by means of a knob. The upspeed is factory-set. You cannot adapt it.

Triggering ultrasonic vibrations

In the 2000X series, some actuators are equipped with mechanical triggering of ultrasonic vibrations, and some with a load cell:

Triggering of ultrasonic vibrations	Actuator
mechanical	ao, ae, aol
by means of load cell	aod, aodl, aodm, aed, aef, aemc, aomc, aomc Micro

Dynamic triggering of ultrasonic vibrations (mechanical triggering)

For many welding applications, you have to build up a force that acts on the weld part, before the ultrasonic vibrations can be triggered. The steps of the actuator during the welding process are as follows:

1. The actuator moves down for the welding process.
2. After it makes contact with the weld part, a force builds up.
3. When the springs are compressed to a specified degree, the trigger switch activates the ultrasonic vibrations, depending on the pressure.
4. The ultrasonic vibrations plasticize the material.
5. The counterpressure that the material exerts on the horn becomes less. To balance this pressure loss, the springs in the trigger packet relax. Thus the welding pressure stays approximately the same.

Dynamic triggering of ultrasonic vibrations, by means of the load cell

1. The actuator moves down for the welding process.
2. After it makes contact with the weld part, a force builds up.
3. The S- Beam Load cell measures the force exerted on the weld part, to trigger ultrasonic vibrations and record the welding parameters. With the load cell, it is ensured that pressure is exerted onto the weld part before the ultrasonic vibrations are triggered.
4. When the S- Beam Load cell detects contact with the part, a start signal is sent to the power supply. The welding starts. Afterwards the actuator holds itself in position, and the time measurement starts.
5. As soon as the plastic starts to melt, the S- Beam Load cell ensures an even, efficient transfer of ultrasonic energy onto the weld part. To maintain the contact between the horn and weld part, the S- Beam Load cell ensures that the pressure is maintained, by means of dynamic follow-through.

Linear encoder of the actuators

The linear encoder measures the distance traveled by the horn. Depending on the power supply settings, the linear encoder can enable either collapse distance or absolute distance welding. It can also:

- Recognize unfavorable setup controllers.
- Monitor the welding quality.
- Reduce the cycle time by generating a signal for releasing the actuator, before the horn moves back completely.

Limit switch

The optical upper limit switch (ULS), signals the control circuits in the power supply that the carriage has reached the upper limit stop and is ready for another operating cycle. In the power supply, the ULS signal is used for various control functions. Examples:

- **Indexing control:** In automated systems, the linear encoder generates an “Actuator Clear” signal at a preset distance along the travel of the horn. This signal can be used to trigger a safety interlock switch, controlling movement of the material handling equipment (indexing) before the horn is fully retracted.
- **Electronic pretrigger:** Power supplies of the 2000X series can use the ULS signal to activate the ultrasonic vibrations before the horn touches the weld part. Pretriggering is used with large or difficult-to-start horns and in specialized applications.
- **Ground detect switch-off:** As soon as the base plate/weld part fixture and the horn make contact, the ultrasonic vibrations stop. This function is used for cutting and sealing film and textiles, to protect the tool.

Mechanical stop

The mechanical stop limits the downward travel of the horn. To prevent equipment damage, adjust the stop so that the horn will not contact the fixture when no weld part is in place. There is an indicator on the right side showing the position of the mechanical stop. The mechanical stop cannot be used to limit the welding distance! It only serves to protect the welding system.

WARNING

Do not loosen the hexagonal screws (top). You might damage the mechanical stop!

NOTE

Clockwise rotation lengthens the column distance, counterclockwise rotation shortens the column distance. Each rotation changes the column distance by approx. 1 mm.

4 Delivery and Handling

4.1 Transport and Handling

Ambient conditions

The 2000X series ao is made of cast materials and electro-pneumatic components that move the ultrasonic tool within the ultrasonic welding system and control the welding process. Many of the components can be damaged if the unit falls, or if it is transported or handled improperly.

When transporting the actuator, please observe the following guidelines:

Tab. 4-1 Ambient specifications

Criterion	**Permissible range**
Humidity	0% to 90%, non-condensing
Storage/transport temperature	-25 °C to +70 °C for 24 hours (-13 °F to +158 °F)
Shock/vibrations (transport)	60 g shock/0.5 g and (3 - 100 Hz) vibration as prescribed by ASTM (American Society For Testing and Materials) 3332-88 and 3580-90

4.2 Delivery

BRANSON actuators are carefully inspected and packaged prior to shipment. Carefully check the actuator upon delivery:

- Directly after delivery, check whether the actuator has been damaged during transport.
- Check the delivery note to see if the delivery is complete. Keep in mind that some components might be packaged together with other components.
- Check whether assembled components have become loose during transport, and tighten the respective screws, if necessary.
- Examine the control elements, displays and the surface for signs of damage.

Keep the packing materials, the pallets and the distance blocks, in case the unit has to be shipped back at a later time.

NOTE

If you find any damage caused by the transport on the unit or transport packing, immediately inform the freight agency.

WARNING

The actuator and the power supply are heavy. You might need the help of additional employees to lift, unpack or install it. Lifting platforms or hoisting equipment might be required.

4.3 Unpacking the Actuator

The assembly groups of the actuator are delivered in protective packing. The booster, converter and tool for the actuator are usually contained in the shipping packing.

Actuators are always shipped as part of one of the following components, and have to be unpacked in different ways. These assembly groups differ where the packing materials and the supplied components are concerned.

NOTE

Remote pneumatic control units for the aod and ao actuators are supplied in a separate crate.

- **Welding stand (actuator with base plate):** A welding stand consisting of an actuator with base plate is supplied on a wooden pallet with a cardboard cover.
- **Welding stand (actuator with flange):** A welding stand consisting of an actuator with flange is supplied on a wooden pallet with a cardboard cover.
- **Actuator (without welding stand):** Actuators without welding stand are shipped in a stable cardboard box with protective foam packing.

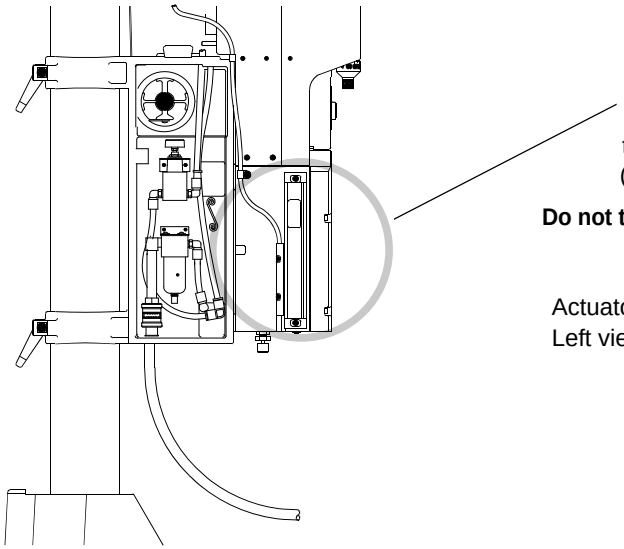
WARNING

The linear encoder at the left of the actuator is very sensitive. Never use the linear encoder as handle, avoid bumps and do not subject it to any load.

The welding stand or actuator is heavy and is shipped in protective packing. The tool for the actuator is packaged together with the actuator. The booster, converter and other parts, depending on the order, are contained in the shipping packing.

- The welding stands are supplied on a wooden pallet with a cardboard cover.
- Actuators without welding stand are shipped in a stable cardboard box with protective foam packing.

Fig. 4-1 The linear encoder



Linear encoder
at the left of
the 2000X series actuator
(not in ae and ao models)

Do not touch, do not subject to bumps, never use as handle.

Actuator in welding stands
Left view

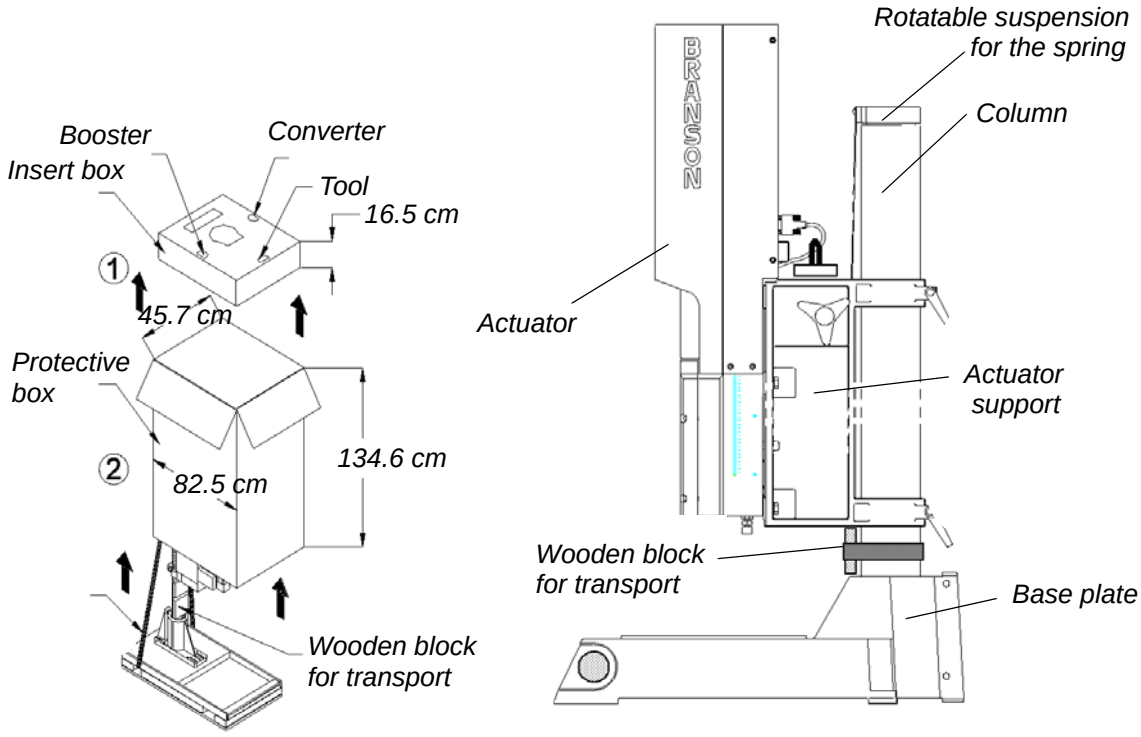
Unpack the BRANSON actuator as described in the appropriate set of instructions in the following text, depending on the model:

4.3.1 Welding stand: Actuator with base plate

WARNING

Pay attention to the arrows with the labeling “This End Up” and the instruction “Open Top First”. The packing can only be removed in an upright position.

Fig. 4-2 Unpacking the welding stand (actuator with base plate); right view of the welding stand



1. Take the transport packing to a position close to the installation site and place it on the floor.
2. Open the top of the packing. Remove the top insert box, which might contain a booster, converter and tools.
3. Remove the clips at the bottom of the protective box. Lift the protective box off the pallet.

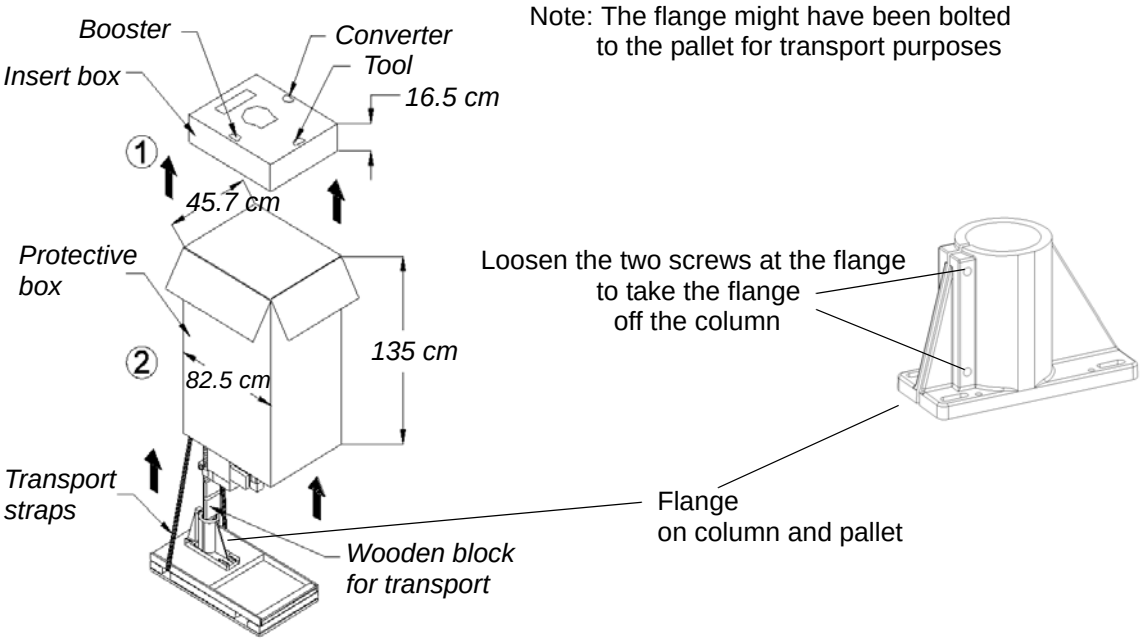
WARNING

The column and the connector between the actuator and the column are subject to the tension of the compensation spring. Do not try to dismount the column from the welding stand. The column holder always has to be screwed tight. To adjust height settings, loosen the clamps slowly and carefully, so that you maintain control over the movements. Hold the welding stand, to prevent sudden movements or injuries.

4. Cut the two packing straps that have been wound around the base plate and the pallet. At the rear base plate, break off the two wooden blocks that protect the base plate against sliding on the pallet.
5. Now you can position the welding stand at the desired location by sliding it off the pallet. To position the assembly group by means of a crane, there is a transport eyelet on the welding stand.
6. Remove the wooden block that is located between the base plate and the connector for the actuator and column, by carefully releasing the two locking levers. It is permitted for the actuator to lift up slightly, however, you have to prevent sudden jarring movements. Cut the adhesive tape at the wooden block. TIGHTEN THE LOCKING LEVER AGAIN.
7. Take the tool and other parts (converter, booster, etc.) that might be included in the shipment out of the insert box. Keep the packing materials.

4.3.2 Welding stand: Actuator with flange

Fig. 4-3 Unpacking the welding stand (actuator with flange); flange illustrated separately



WARNING

Pay attention to the arrows with the labeling “This End Up” and the instruction “Open Top First”. The packing can only be removed in an upright position.

1. Take the transport packing to a position close to the installation site and place it on the floor.
2. Cut the two vertical packing straps and open the box at the top. Remove the top insert box, which might contain a booster, converter and tools. Put the insert box aside.

3. Remove the clips at the bottom of the protective box. Lift the protective box off the pallet. Fold up the box until it is flat and place it next to the pallet. Use the pallet as surface on which to place the welding stand.

WARNING

The unit can tilt over. Ensure that it stays stable by using the transport eyelet or by asking another person for assistance.

4. Cut the transport straps that keep the column holder on the pallet.

WARNING

The column and the connector between the actuator and the column are subject to the tension of the compensation spring. Do not try to dismount the column from the welding stand. The column holder always has to be screwed tight. To adjust height settings, loosen the clamps slowly and carefully, so that you maintain control over the movements. Hold the welding stand, to prevent sudden movements or injuries.

5. Remove the wooden block(s) between the plate and the support by carefully releasing the two locking levers. The welding stand will lift up slightly. Cut the adhesive tape at the wooden block. TIGHTEN THE LOCKING LEVER AGAIN.
6. Loosen the two screws that are used to attach the column to the flange.
7. Lift the actuator and the column from the pallet. Carefully place the welding stand on its right side (NOT ON THE LEFT SIDE; THE LINEAR ENCODER IS ON THE LEFT SIDE; this does not apply to the ae and ao actuators).
8. Remove the flange from the pallet. Put the flange aside. Some flanges have been attached to the pallet from above.
9. Take the converter, booster and tool out of the insert box. Store the packing materials and the wooden blocks for future use.

For information on installing the welding stand (actuator with flange) - refer to chapter 5.3.3.

4.3.3 Actuator Without Welding Stand

The actuator without welding stand is delivered in completely assembled condition. You can install it immediately.

Take the transport packing to a position close to the installation site and place it on the floor.

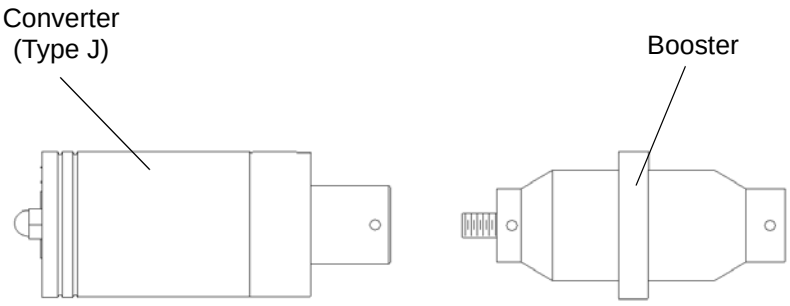
10. Open the top of the box, remove the insert box at the top, and put it aside.
11. The tool, assembly screws, converter and/or booster are delivered with the actuator, in separate boxes. Unpack the converter, booster and tool.

Keep the packing materials.

NOTE

If ordered, the packing also contains the converter and/or booster.

Fig. 4-4 Ultrasonic converter (type J for applications without welding stand) and booster



4.3.4 Wiring

The power supply and actuator are connected by two cables: the interface cable for the actuator and the HF cable. For automated systems, you additionally need a J911 start cable and a user interface cable. The cable types and lengths are listed on your invoice.

Tab. 4-2 Cable list

101-241-203	Interface for actuator J925 (2.5 m)
101-241-204	Interface for actuator J925 (4.5 m)
101-241-205	Interface for actuator J925 (7.5 m)
101-241-206	Interface for actuator J925 (15 m)
011-004-041	Interface for actuator J925S (7.5 m)
011-003-070	2 JWP01 cables, only for the aemc actuator
101-240-072	J911 start cable (7.5 m), only for operation without base plate
101-240-176	HF cable (2.5 m), J931C
101-240-177	HF cable (4.5 m), J931C
101-240-178	HF cable (7.5 m), J931C Note: Only for 20 kHz systems
101-240-199	HF cable (15 m), J931C Note: Only for 20 kHz systems and only aef
101-240-199	HF cable (15 m), J931C
101-240-179	HF cable (2.5 m), J934C
101-240-188	HF cable (4.5 m), J934C
101-240-182	HF cable (6 m), J934C
100-246-320	Metal contact cable aef
100-246-630	Metal contact cable
100-143-043	Printer, 2 m

5 Installation and Setup

5.1 Installation Requirements

This chapter has been written as support for the assembly personnel and provides information on the initial installation of your new 2000X series welding system.

5.1.1 Ambient specifications

Criterion	Permissible range
Humidity	30% to 95%, non-condensing
Ambient temperature (operating)	+5 °C to +50 °C (+41 °F to 122 °F)
Storage/transport temperature	-25 °C to +55 °C (-13 °F to +131 °F) For 24 hours up to +70 °C (+158 °F)

5.1.2 Dimensions of the actuators

For information on the dimensions, refer to the illustrations provided subsequently. It contains approximate dimensions. The exact dimensions vary from version to version. See:

- Dimensional drawing of the ae and aed actuators fig. 5-1
- Dimensional drawing of the aef and aemc actuators fig. 5-2
- Dimensional drawing of the square column for the ae, aed, aef and aemc actuators fig. 5-3
- Dimensional drawing of the ao/aod actuator fig. 5-4
- Dimensional drawing of the aodm/aomc actuator fig. 5-5 and fig. 5-6

Fig. 5-1 Dimensional drawing of the ae/aed actuator

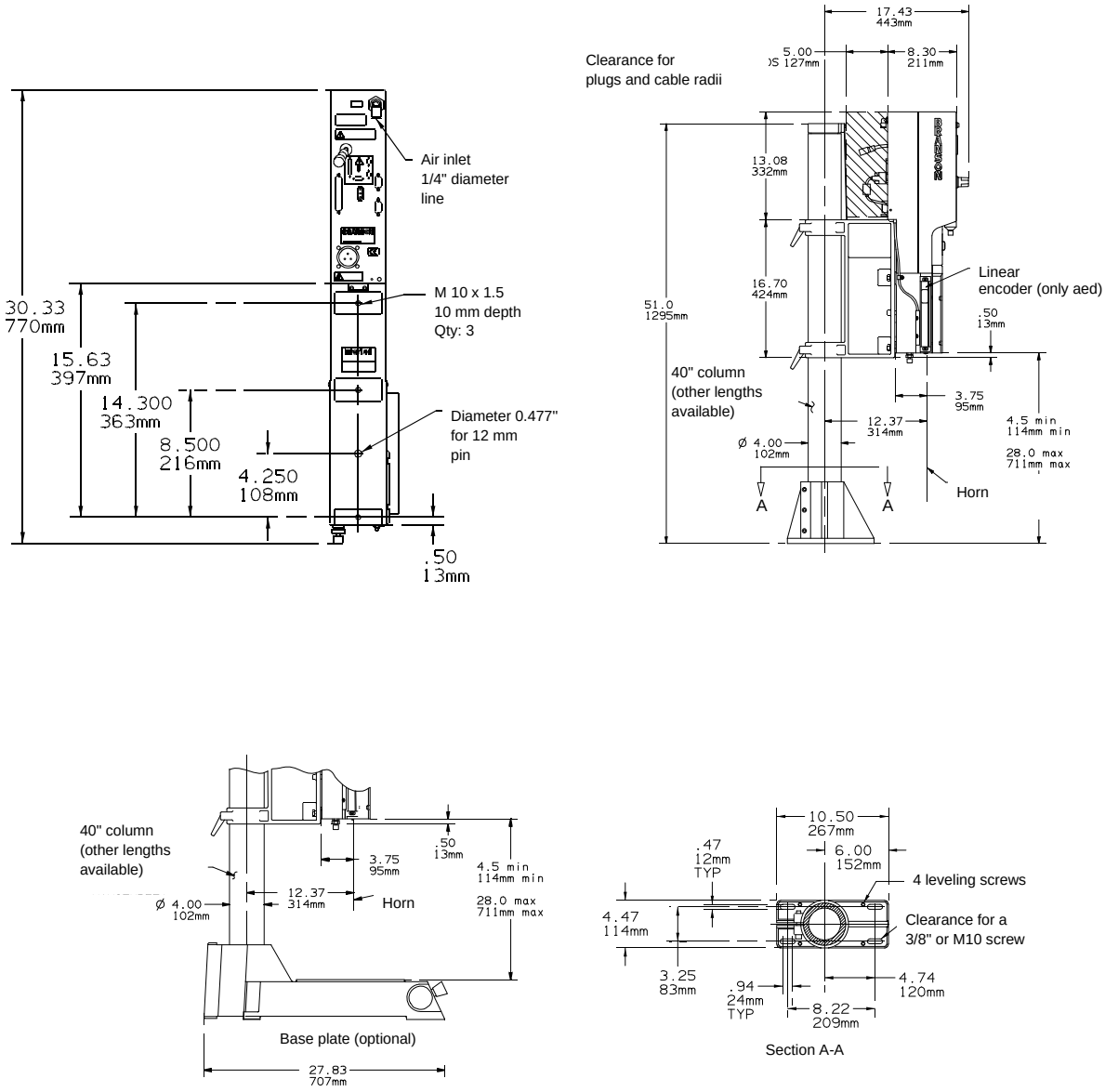
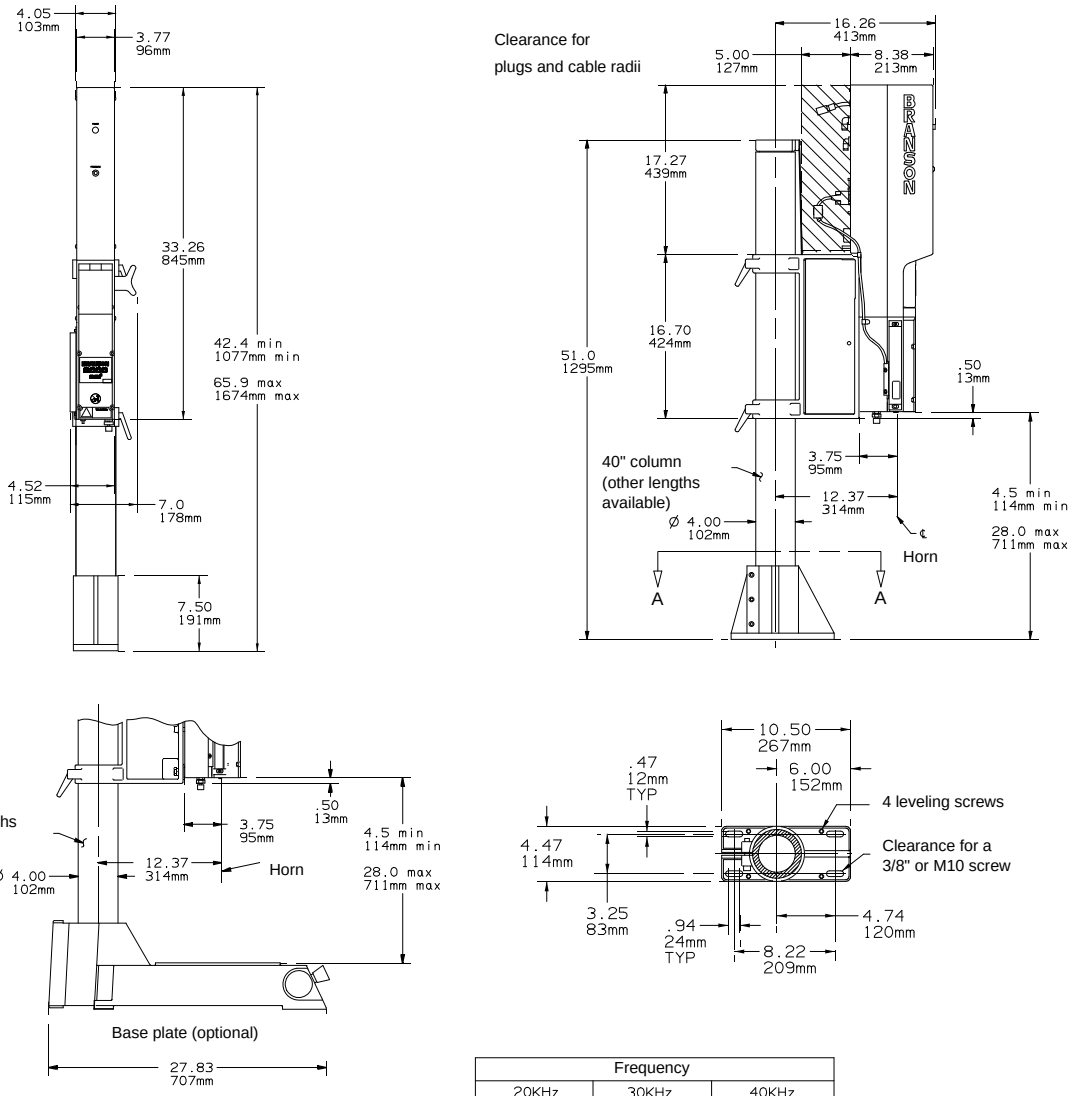


Fig. 5-2 Dimensional drawing of the aef/aemc actuator



	Frequency			
	20KHz	30KHz	40KHz	
	2.12 (54 mm) to 2.75 (70 mm)	1.30 (33 mm) to 1.54 (39 mm)	0.69 (18 mm) to 0.94 (24 mm)	The dimensions are approximate because of the different possible booster and horn designs, as well as the materials and tuning. All horn dimensions for horn with half wavelength. Observe the settings and the tool change specifications!
	5 (127 mm) to 5.50 (140 mm)	2.97 (75 mm) to 3.80 (97 mm)	2.5 (64 mm) to 2.75 (70 mm)	

For further information, refer to Fig. 4.18.

THE WIDTH AND LENGTH OF THE HORN DEPENDS ON THE DESIGN

Fig. 5-3 Square column at the ae, aed, aef and aemc actuators

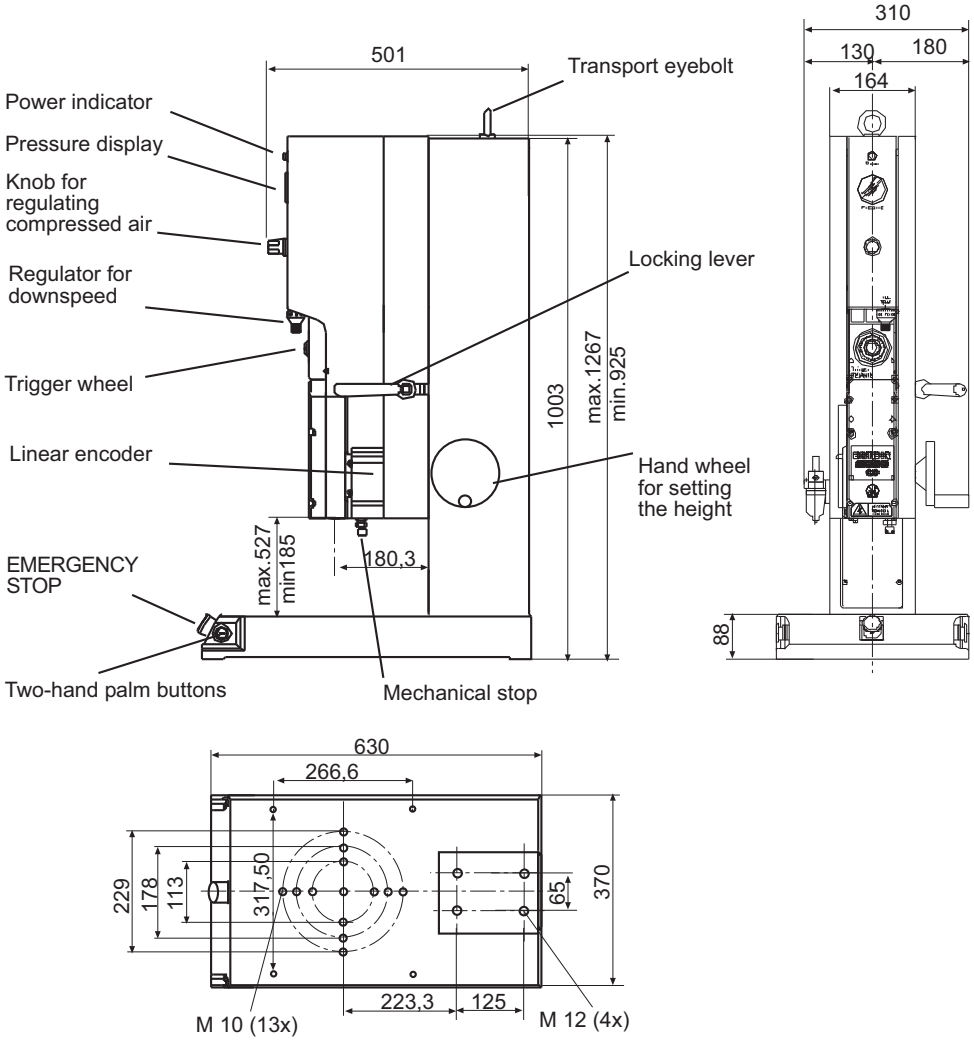


Fig. 5-4 Dimensional drawing of the ao/aod actuator

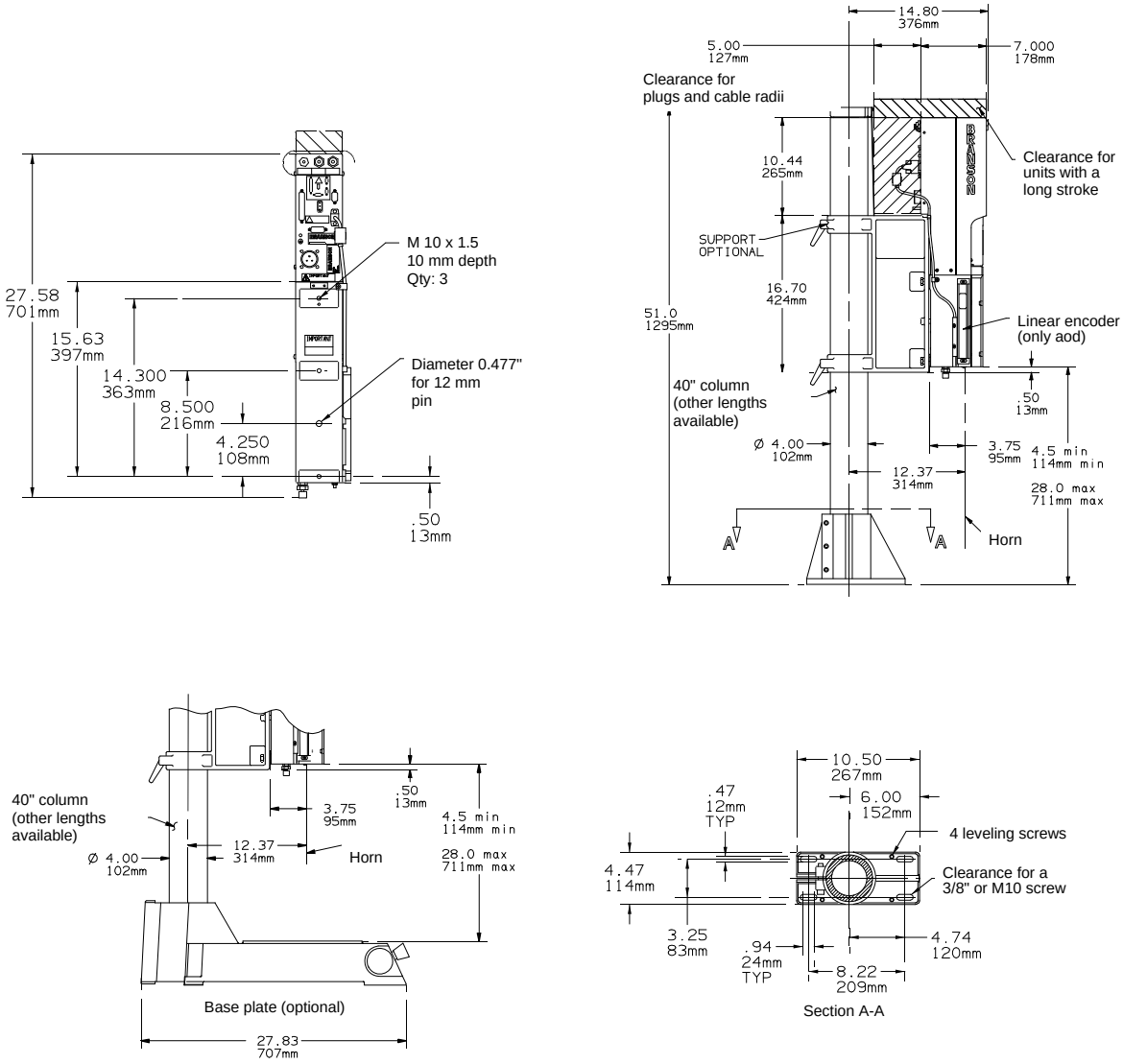
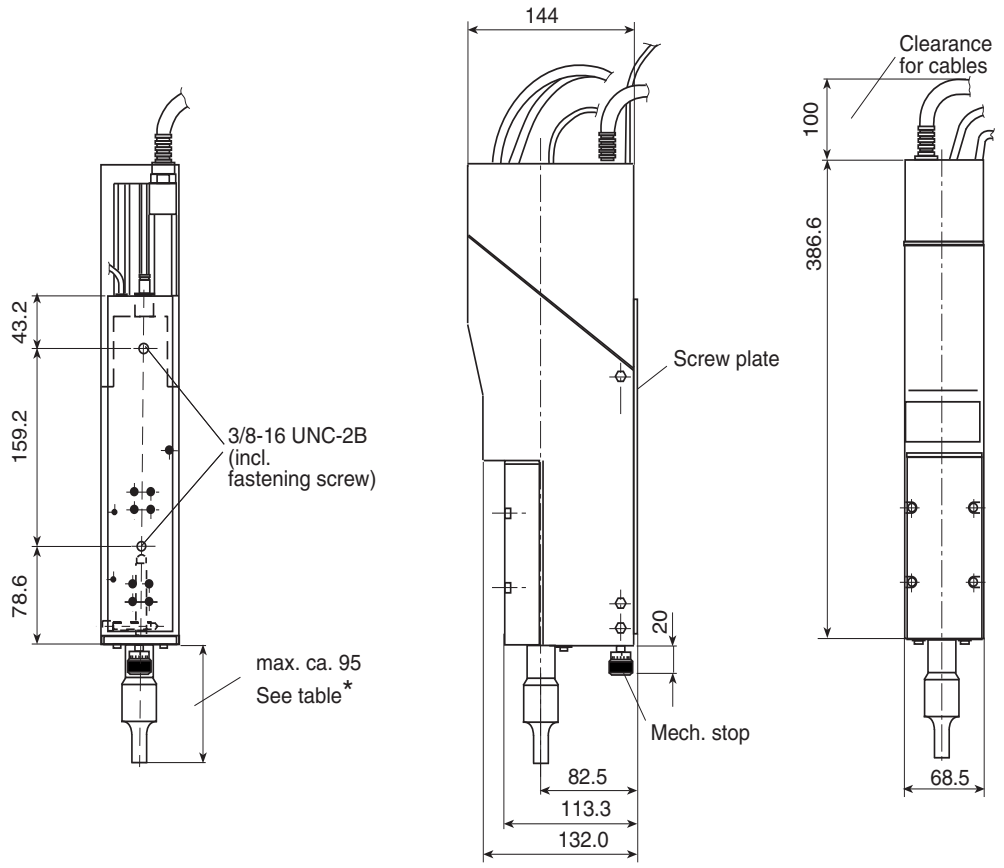


Fig. 5-5 Dimensional drawing of aodm/aomc actuator Part 1



* Table

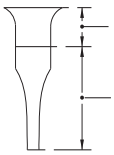
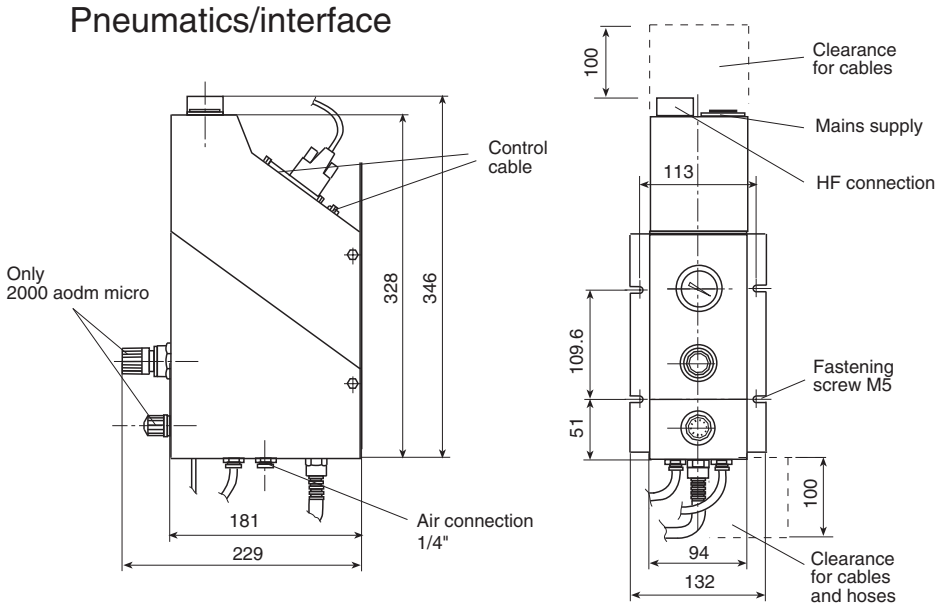
	Frequency	
	40 kHz	
	17 - 24 64 - 70	These lengths are approximate and depend on the booster gain, horn construction, material and calibration. All horn dimensions are valid for $\lambda/2$.

Fig. 5-6 Dimensional drawing of aodm/aomc actuator Part 2



Technical Specifications

		2000 aodm	2000 aomc
Cylinder size:	mm	38	38
Rated pressure	bar	6.9	6
Max. permissible pressure:	bar	7	7
Max. closing force:	N	620	540
Dynamic triggering range:	N	22 - 620	22 - 540
Stroke/work area:	mm	50/5 - 45	
Weight:	kg	8	
Supply voltage:	V/Hz	230/50	
Long connection cable			
Pneumatics/interface - actuator unit:	cm	ca. 90	

Fig. 5-7 2000X aef Pneumatic Schematic

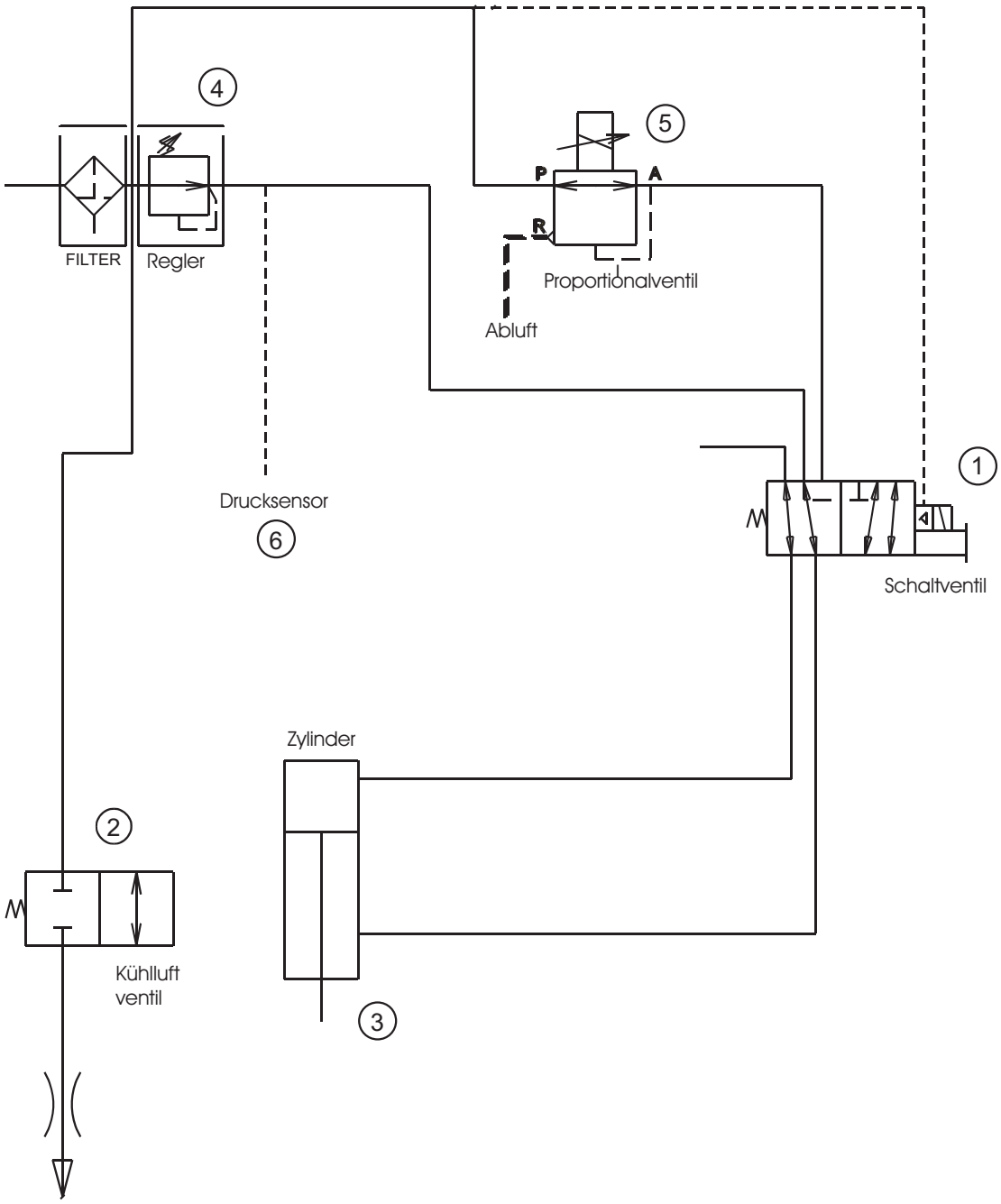


Fig. 5-8 2000X aed, ae and aod Pneumatic Schematic

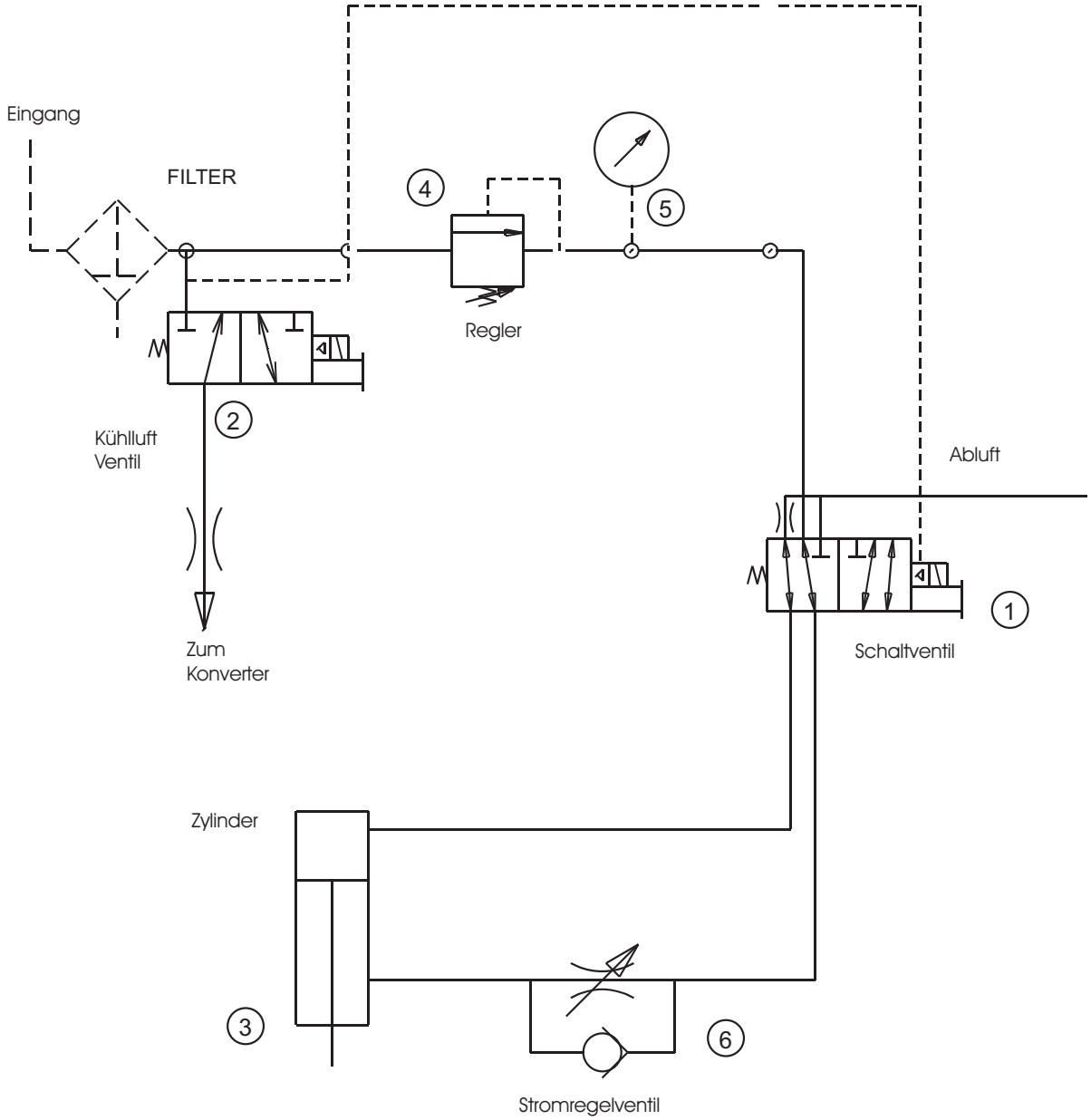


Fig. 5-9 Block diagram of the ae actuator

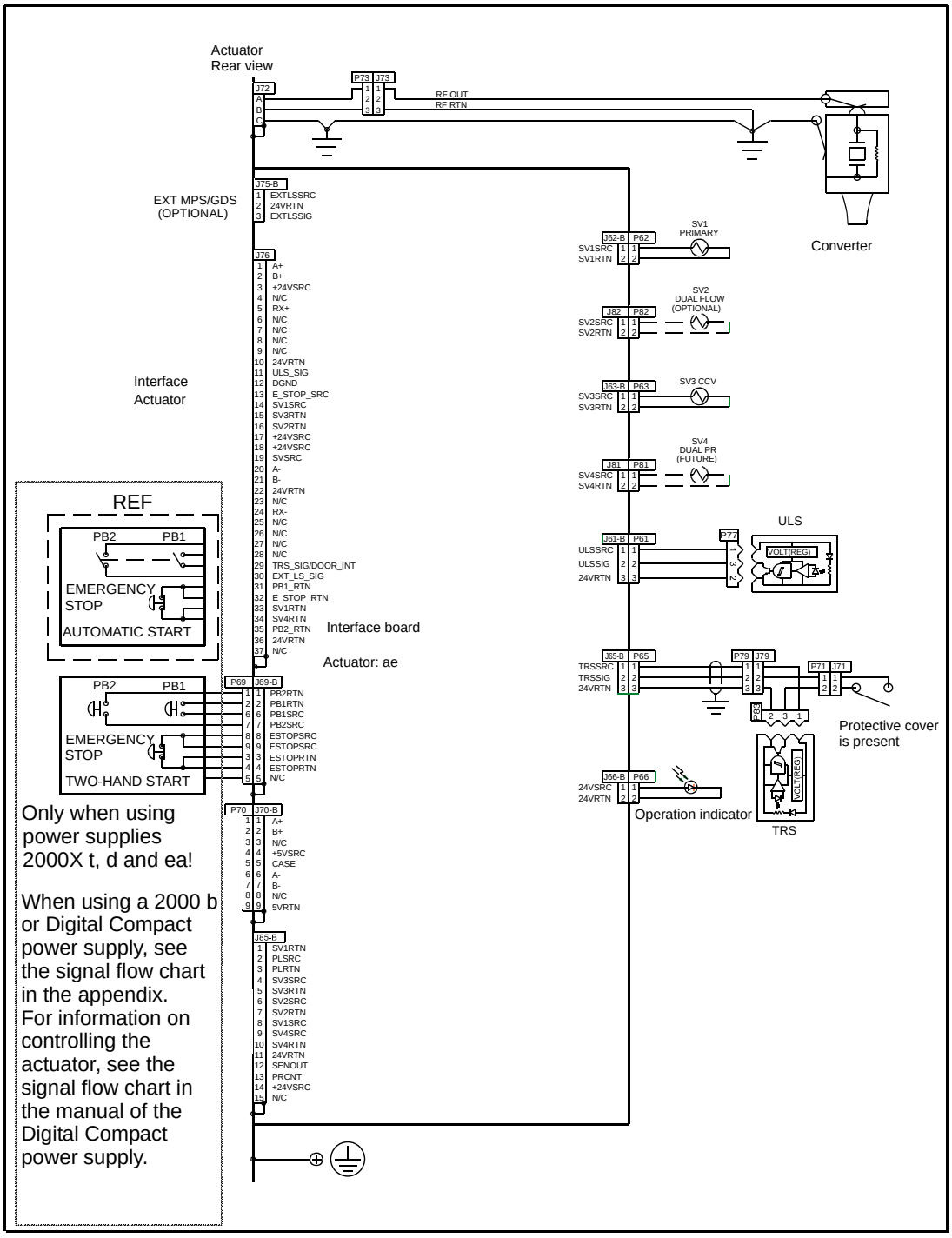


Fig. 5-10 Block diagram of the aemc actuators

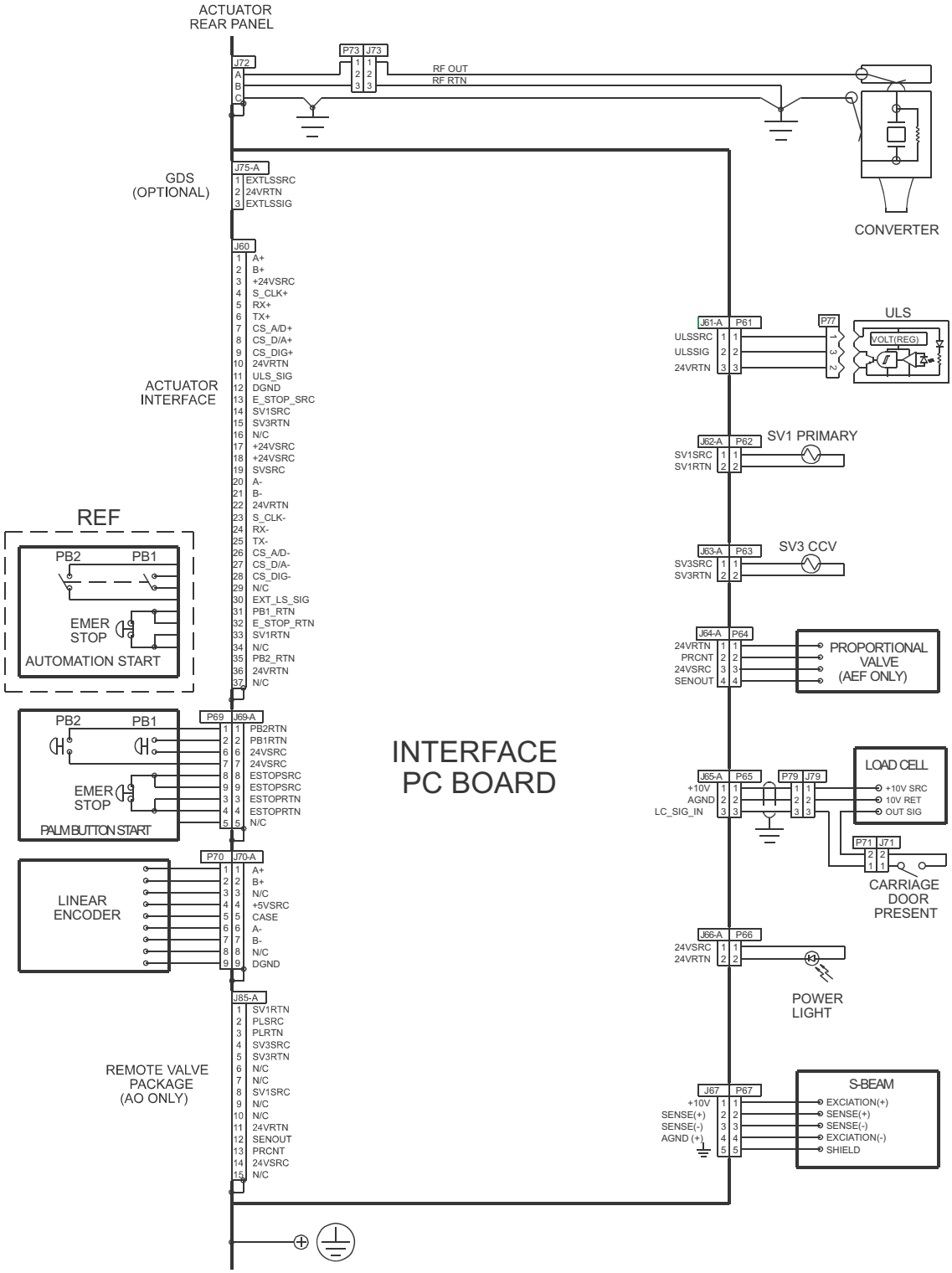


Fig. 5-11 Block diagram of the aed and aef actuators

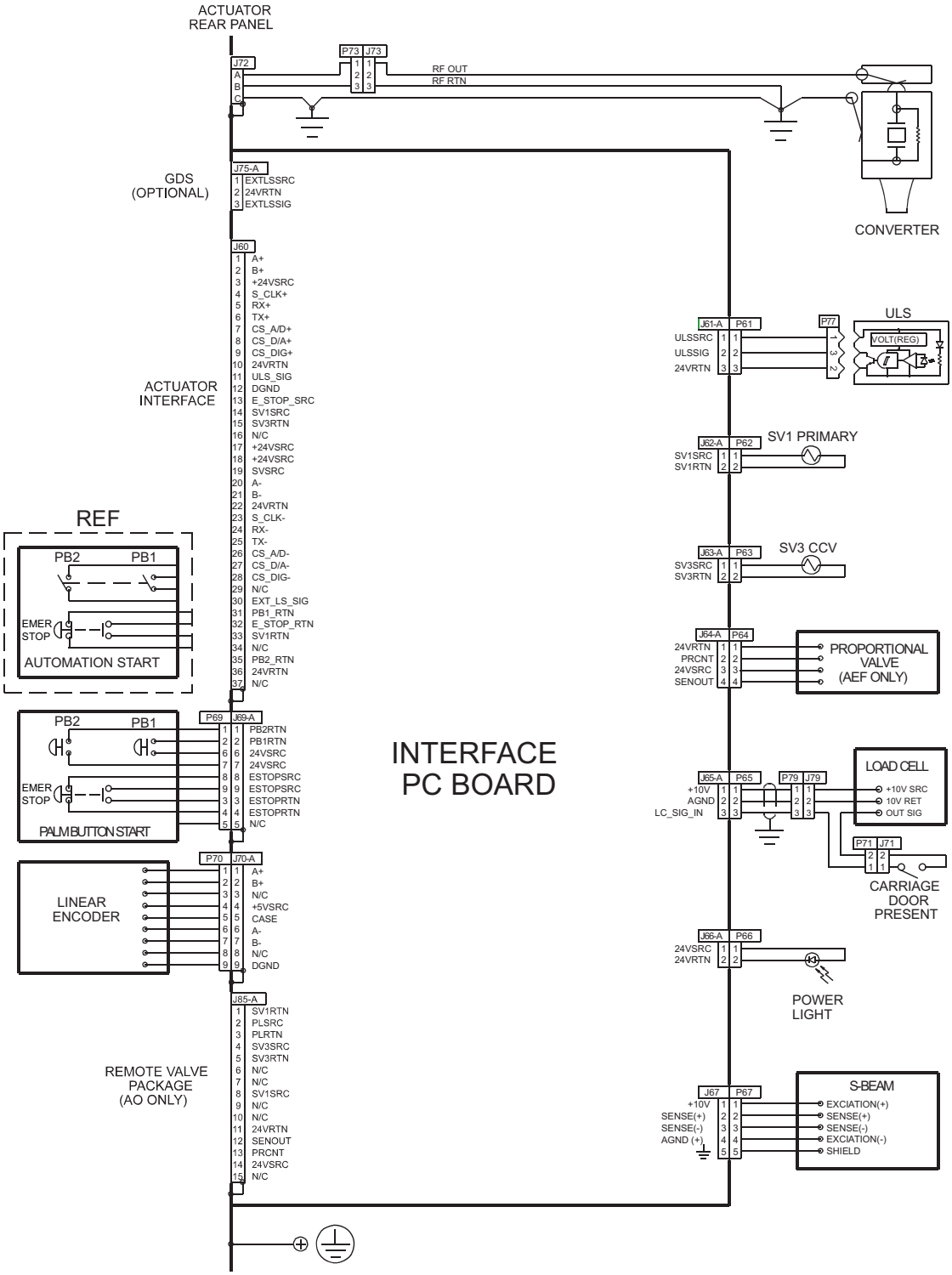


Fig. 5-12 Block diagram of the ao/aol actuator

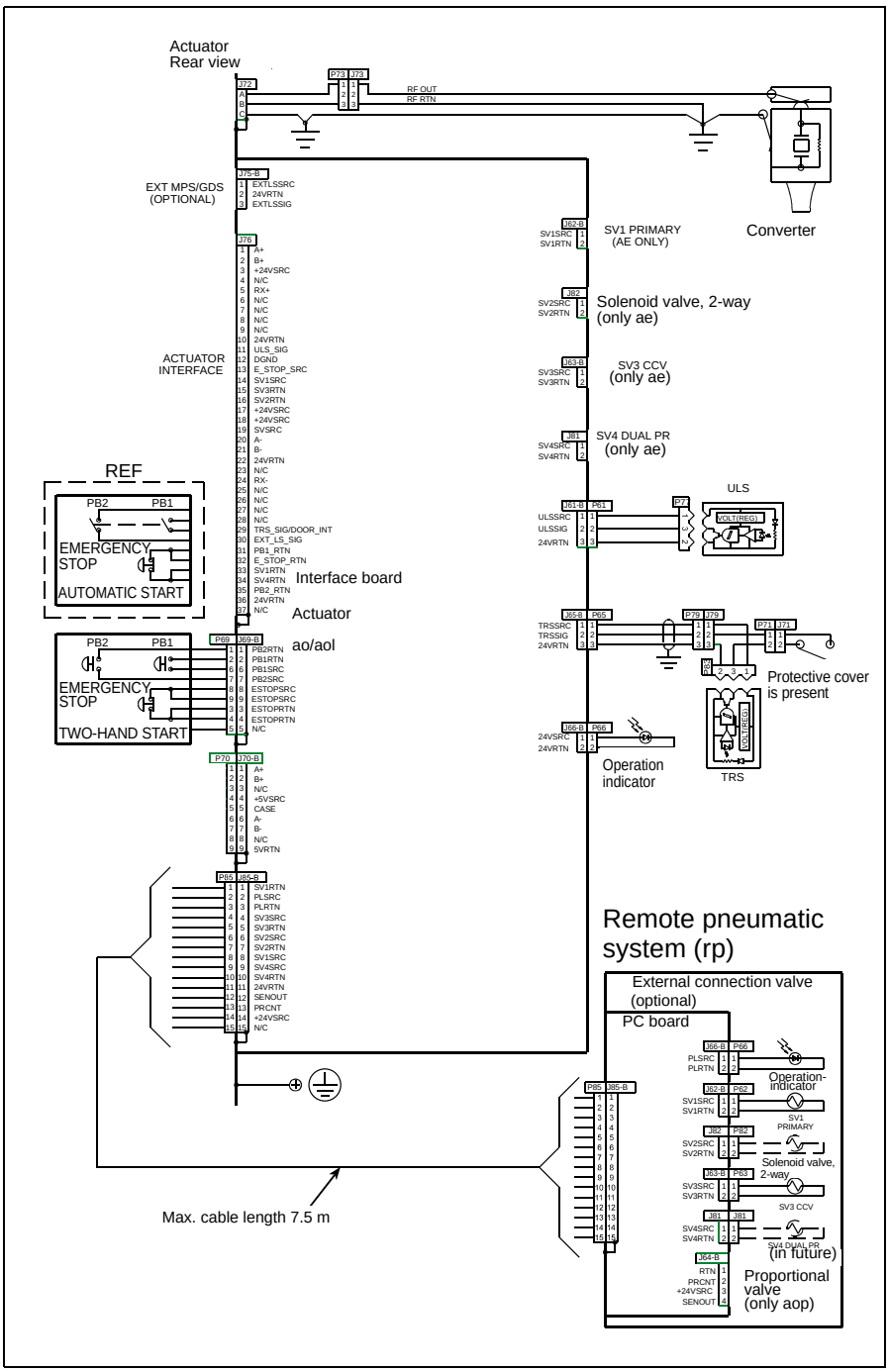
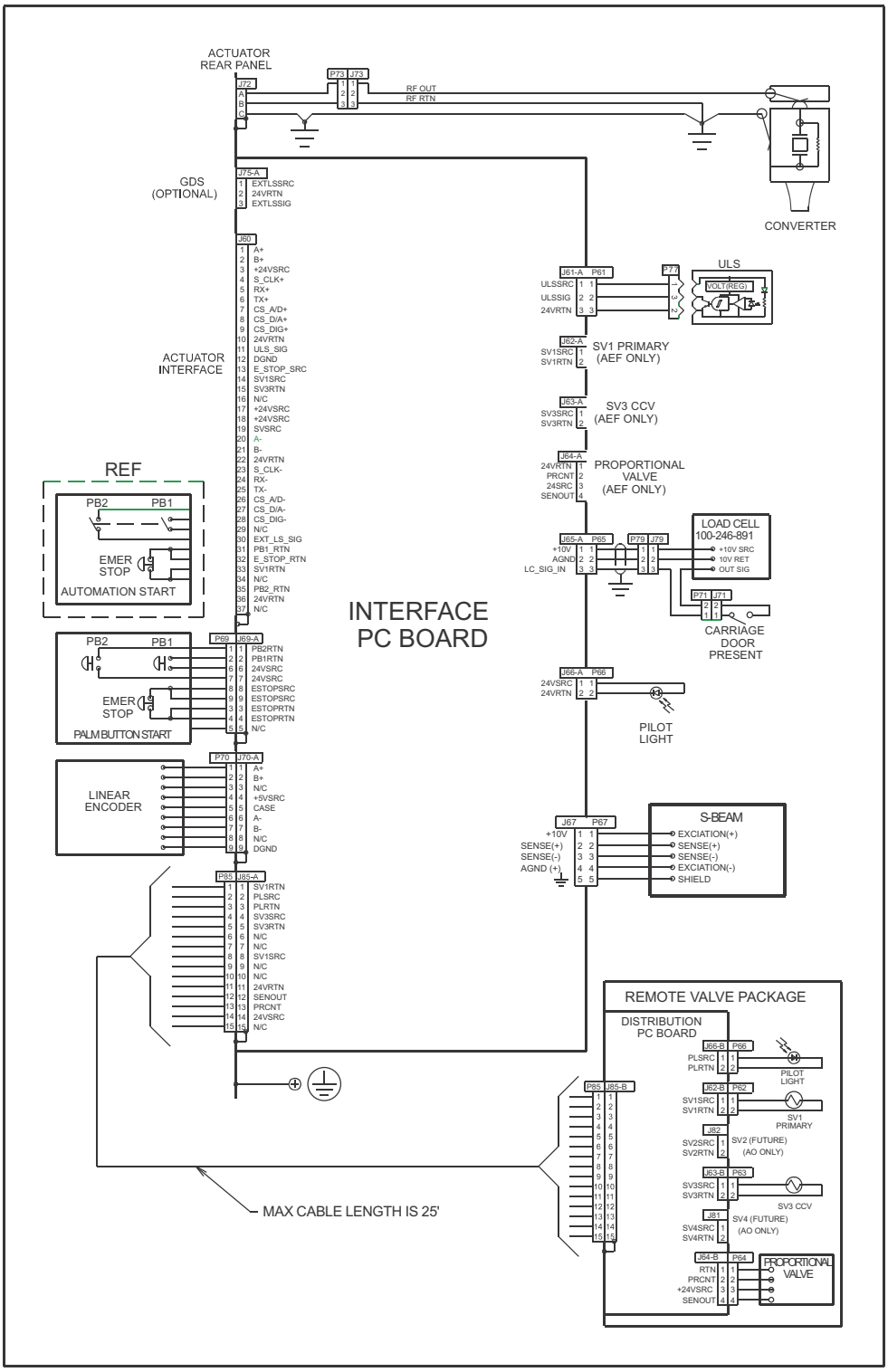


Fig. 5-13 Block diagram of the aod, aodl, aomc, aodm and aomc Micro actuators



5.2 General Conditions for Connecting the Actuators to the Round and Square Column

Compressed air supply

Three pressure values play a role where the actuators are concerned:

- System pressure: the pressure that is required for connecting the actuator. For all actuators of the 2000X series, this pressure value is max. 100 psi (~ 7 bar).
- Working pressure: the pressure set for the welding process. For all actuators of the 2000X series, this pressure value is 0 to 100 psi.
- Reference pressure: Pressure recording of the work range for the f and mc models. The f and mc models use counterpressure, therefore a constant pressure that is continuously monitored during the pressure recording is necessary. You can specify a fixed pressure value, namely 60 or 80 psi. The pressure display and the feedback message can be viewed at the power supply. BRANSON presets the reference pressure to 80 psi.

The supplied process air has to be “clean (filtered to 5 µm), dry and free of oil” and has to have a controlled max. pressure of 100 psi (689 kPa, 6.89 bar). Depending on the application, the actuator needs a min. pressure of 70 or 90 psi (4.82 or 6.3 bar). Welding stands are equipped with an air filter that is switched in series. The compressed air components for actuators without a welding stand can be ordered from BRANSON. A rapid-acting connector is recommended. If necessary, use a shut-off mechanism for the air supply.

Air filter

For the actuator without welding stand, you need a separate air filter for protection against particles (5 µm or larger). BRANSON can provide these air filters.

If a welding stand is not mounted vertically, you have to install the respective air filters in such a way that the curved part of the relevant case is facing downward and the air flows horizontally through the filters. For this purpose, you might have to reroute the existing lines on the site. The two air filters are each attached to a holder with two screws. The holder in turn is attached to a connector between the actuator and column, and to the on-site pipeline.

General information on the compressed air line and connections

No external lines are attached to the actuators ex works. However, the actuators are equipped with compressed air connections for lines with an exterior diameter of 5/16". When connecting an actuator, or when routing lines for a new air filter position, you have to use lines with an exterior diameter of 5/16" and connections with a rated load capacity of

more than 100 psi (100 psi = 6.89 bar). Use 5/16" Imperial Eastman Poly-Flo lines, SMC T0806 lines (aef), or similar lines, as well as matching connections.

Compressed air connections for the ao, aod, aol, aodl, and aodm actuators

The compressed air connections for these actuators are “Cylinder top”, “Cylinder bottom”, and “Cooling”. The remote pneumatic system, rp, contains the main air supply as well as the three compressed air connections leading to the actuator.

DANGER

You have to supply the ao, aod and aol actuators with filtered cooling air from the external controller unit or from the customer-supplied compressed air system. If you neglect to cool the system appropriately, your warranty becomes void! If you have questions, please contact your BRANSON representative.

Use an air filter that is suitable for at least 100 psi (= 6.89 bar) and can remove particles with a size of 5 µm or larger.

Only for the aod actuator: The remote pneumatic system, rp, can be positioned up to 7.5 m from the actuator.

In the case of 15 kHz applications, you can place the power supply up to 7.5 m away from the actuator:

- 15 m for 20 kHz applications,
- 6 m for 30 kHz applications and
- 4.5 m for 40 kHz applications.

Compressed air connections for the ae and aed actuators

The actuators are supplied with compressed air via the compressed air connection at the top rear, by means of plastic compressed air lines. For actuators without a welding stand, use an air filter that is suitable for at least 100 psi (= 6.89 bar) and can filter out particles with a size of 5 µm or larger.

Compressed air connections for the aef, aemc, aomc and aomc Micro actuators

You need dry, clean air that has been filtered to 5 µm, with a pressure of 100 psi (= 6.89 bar), for the actuators. With the pneumatic control unit, which is located within the support of the aef actuator, or is at a remote location in the case of non-vertical alignments, the factory air is filtered to 0.3 µm (coalescence filter).

5.3 Installation Steps

DANGER

This unit is heavy. There is danger of getting crushed during setup or when configuring settings. Keep away from moving parts and only release the locking lever when expressly instructed to do so.

WARNING

If you do not align the welding stand vertically, you have to remove the air filter at the connector between the actuator and the column, realign it and connect it. If you neglect to do so, both the air filter and the actuator could fall out!

5.3.1 Installation Site

You can mount the actuator or the welding stand in various positions. The welding stand with base plate is frequently operated manually by means of the start switch at the base plate. Therefore you should place the welding stand on a safe and ergonomic work bench, at a height of approx. 75 to 90 cm, so that you can either sit or stand while working. Welding stands with a flange are frequently used in automatic systems; you can equip them manually or automatically. This information applies to round and square columns.

DANGER

During rotations around the column axle, the welding stand could possibly tilt over if it is not secured properly. The work surface on which the welding stand is mounted has to be stable enough to support it. It also has to be secured against tilting during adjustment of settings or during setup tasks.

5.3.2 Setting Up the Welding Stand: Actuator with Base Plate

For information on unpacking, refer to chapter 4.3.1.

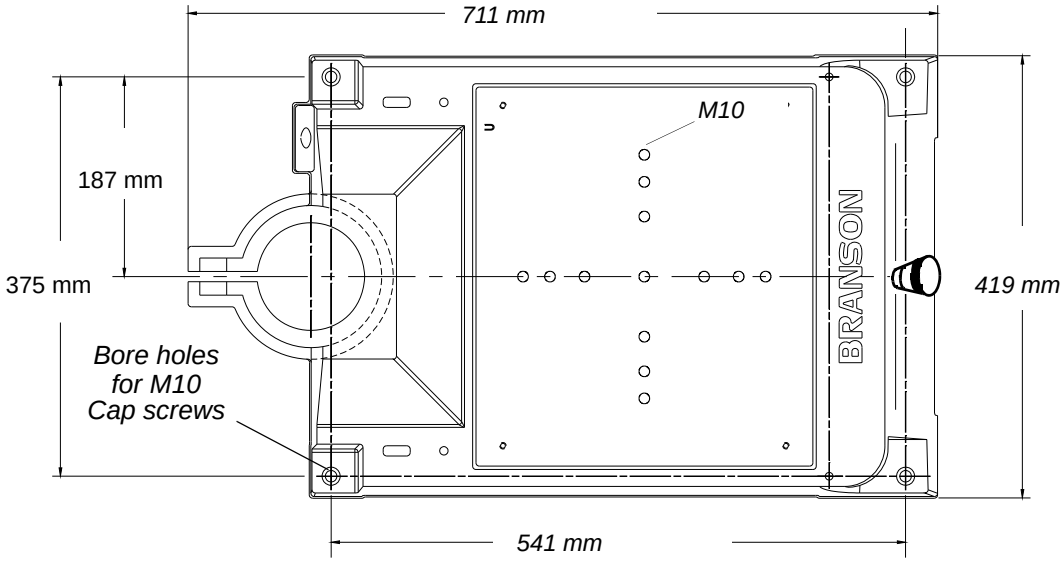
To prevent tilting or undesired movements, you have to bolt the base plate to the work bench. There are four bore holes for the 3/8" or M10 screws on the corners of the cast part. To prevent surface damage (scoring), use flat washers. See fig. 5-14.

WARNING

To protect the actuator against tilting or undesired movement, you have to bolt the base plate to the work surface with four screws.

1. Make sure that there are no obstacles at the top and no crush or friction points exist. Keep in mind that, in its extended state, the actuator is higher than the welding stand, and the connections are uncovered.
2. Attach the base plate with four hexagon socket screws (not included in the scope of supply), 3/8" inch (US system) or M10 (metric system). To prevent surface damage (scoring), use flat washers. To prevent the screws from becoming loose due to vibrations and movements, use self-locking nuts with plastic rings.
3. Connect the compressed air supply at the air hose of the welding stand (3/8 NPT male connection at the hose). A rapid-acting connector is recommended. If necessary, use a shut-off mechanism for the air supply.
4. Make sure that the control cables (HF cables) for the limit stop and start switch have been connected to the plug connections **at the rear of the actuator** by means of the fastening bolts.
5. Make sure that the linear encoder has been connected **to the rear of the actuator**. This applies to the following actuators: aod, aodl, aed, aef, aemc, aodm/aomc and aomc Micro.

Fig. 5-14 Dimensions of the base plate for the round column



The square column connection differs from that of the round column. In the case of the square column, the cables are already at the welding stand. You only have to connect the cables, see fig. 3-8.

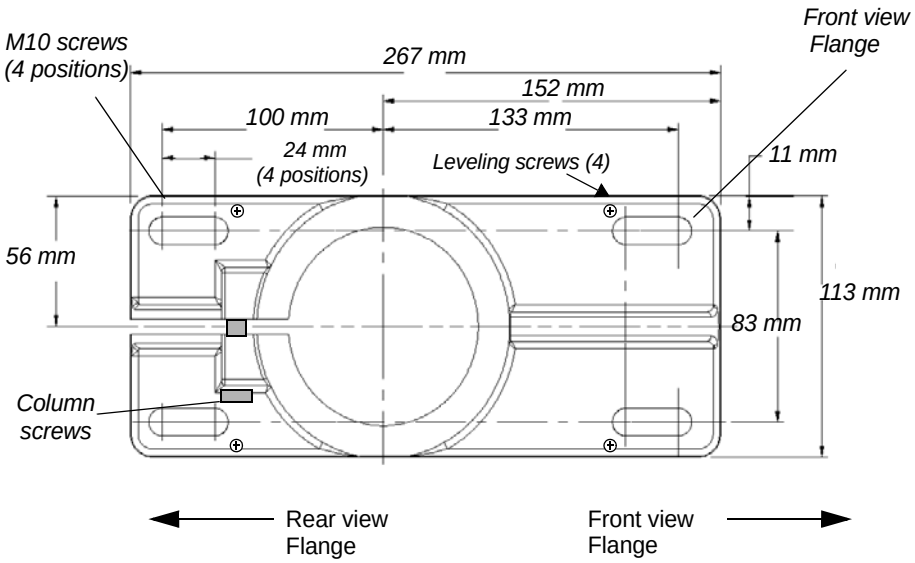
5.3.3 Setting Up the Welding Stand: Actuator with Flange

When you unpacked the unit, you took the flange off the welding stand, see chapter 4.3.2. Select an installation site for the flange, making sure the location can support the column and actuator. Make sure that you have all accessories and tools needed for the assembly ready. There are four bore holes for the 3/8" or M10 screws on the corners of the cast part. To prevent surface damage (scoring), use flat washers.

WARNING

The fronts of the flange and the actuator have to face in the same direction. The screws for the flange are located on the back of the flange. See fig. 5-15.

Fig. 5-15 Positions of the assembly screws for the flange (welding stand with flange)



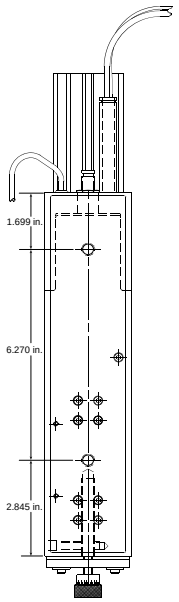
1. Place the flange in position at the installation site. Make sure that there are no obstacles at the top or the sides that could hinder the normal operation or use of the system.

WARNING

Mount the flange onto the work surface by means of the four screws (3/8 inch or M10 shank) and flat washers (small parts not included in scope of supply).

2. Carefully lift the actuator and column and mount the column on the flange. Align the flat side of the rotatable suspension for the spring with the upper front side of the actuator. Tighten both screws on the flange.
3. Connect the compressed air supply at the air hose of the welding stand (3/8 NPT male connection at the hose). A rapid-acting connector is recommended. If necessary, use a shut-off mechanism for the air supply.
4. Use the leveling screws for the fine adjustment of the system. Use a 3/16" Allen wrench for the 3/8"-16 x 3/4" leveling screws.
5. Make sure that the control cables (HF cables) for the limit stop and start switch have been connected to the plug connections **at the rear of the actuator** by means of the fastening bolts.
6. Make sure that the linear encoder has been connected **to the rear of the actuator** by means of the HF cable. This applies to the following actuators: aod, aodl, aed, aef and aemc.

Fig. 5-16 Position of the assembly screws for the column (aodm)



5.3.4 Actuator Without Welding Stand

For information on unpacking, refer to chapter 4.3.3.

The actuator without welding stand is intended for customer-specific installations. It is positioned by means of a guide pin and secured with three metric screws.

1. Lift the actuator out of the box. Carefully place the unit on the right side (NOT on the side on which the linear encoder is located; this does not apply to ae and ao actuators).
2. It is recommended that you use a guide pin. It is not included in the scope of supply. If you need a guide pin, use a stable metal pin, with a diameter of 12 mm. It must not protrude more than 0.40 inch (10 mm) into the actuator.

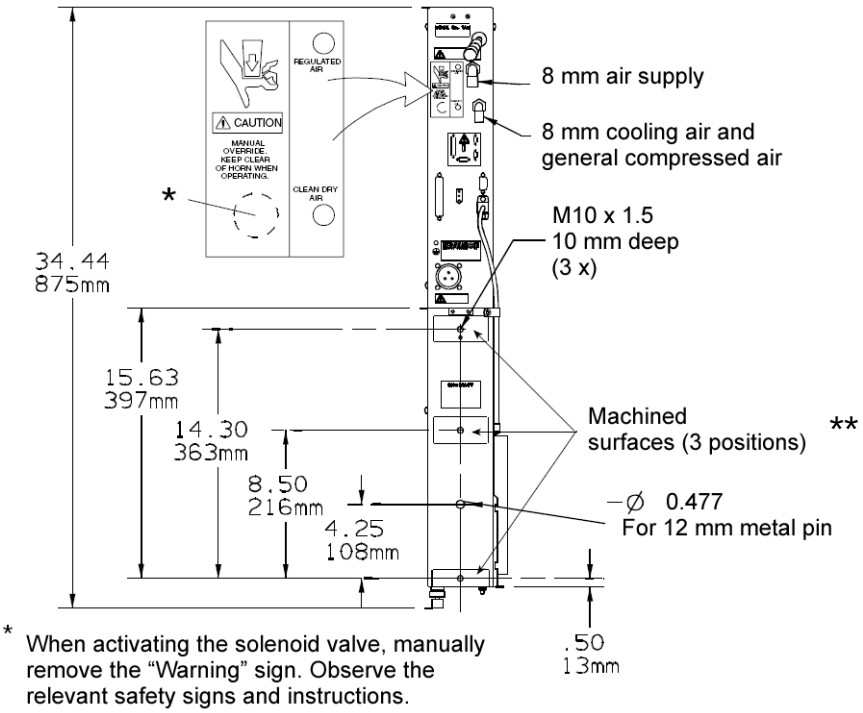
WARNING

The support screws for the actuator of the 2000X series are metric M10 x 1.5 threaded screws with a length of 25 mm. The customer-specific conditions on-site are decisive, because the support pin and the assembly screws may not protrude more than 10 mm (0.40 inch) into the actuator, else there is a risk of the actuator getting blocked or damaged.

WARNING

DO NOT use the M10 x 1.25 assembly screws of the 900 series. They have a different thread pitch. Therefore you cannot use these assembly screws for the 2000X series!

Fig. 5-17 Rear view of the actuator, assembly area, positions of the screws and the guide pin



** These three tool receptacle surfaces have a planarity of 0.004 inch (0.1 mm) with a tolerance range of 16 x 3.5 inch (410 x 90 mm). The surface onto which you mount the actuator has to have the same planar tolerance.

1. Position the actuator on the carrier, and secure it with the supplied metric screws.

WARNING

If you use other screws, make sure that they protrude at least 0.25 inch (6 mm) into the bore hole of the case, but not more than 0.40 inch (10 mm).

WARNING

Synthetic compressed air lubricants that contain silicone or WD-40 can cause damage and malfunctions at the actuator, due to the solvents contained in these lubricants. The supplied process air has to be clean (filtered to 5 µm), dry and oil-free, see chapter 5.2.

5.3.5 Connecting the Power Supply and Actuator

In the case of BRANSON's 2000X series actuator, there are two electric connections between the power supply and the actuator: the HF cable and the interface cable for the actuator. A 37-pin interface cable is used for transmitting power and control signals between the ultrasonic power supply and the BRANSON actuator. The cable is routed from the rear of the power supply to the rear of the actuator.

To enable the “Ground detect” mode, in which the ultrasonic vibrations are switched off when the horn contacts the electrically insulated weld part fixture or the anvil, the following is required: Connect one end of the BRANSON cable with EDP no. 100-246-630 to the MPS/GDS plug socket on the rear of the actuator, and the other end to the insulated weld part fixture or anvil.

In the case of the aod actuator, it is possible that there are other connections leading to the actuator and power supply than those shown in fig. 5-19, but the connections described here are the standard connections.

In the case of the actuators used in combination with square columns, the cables illustrated in fig. 5-19 are located in the square column. Connect the cables as illustrated in fig. 5-19.

Fig. 5-18 Electrical connections between the 2000X series power supply, the ao/aol actuator, and the remote pneumatic kit

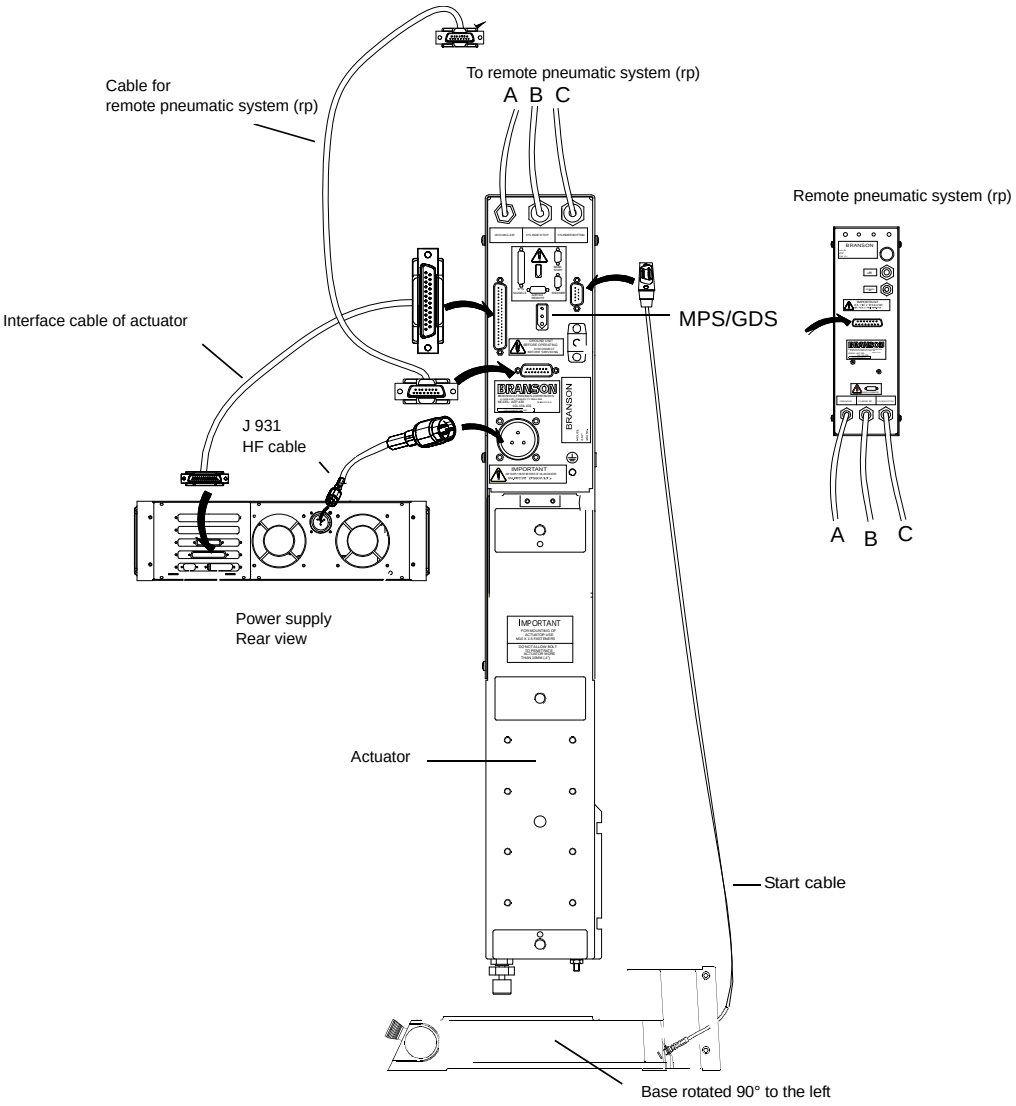
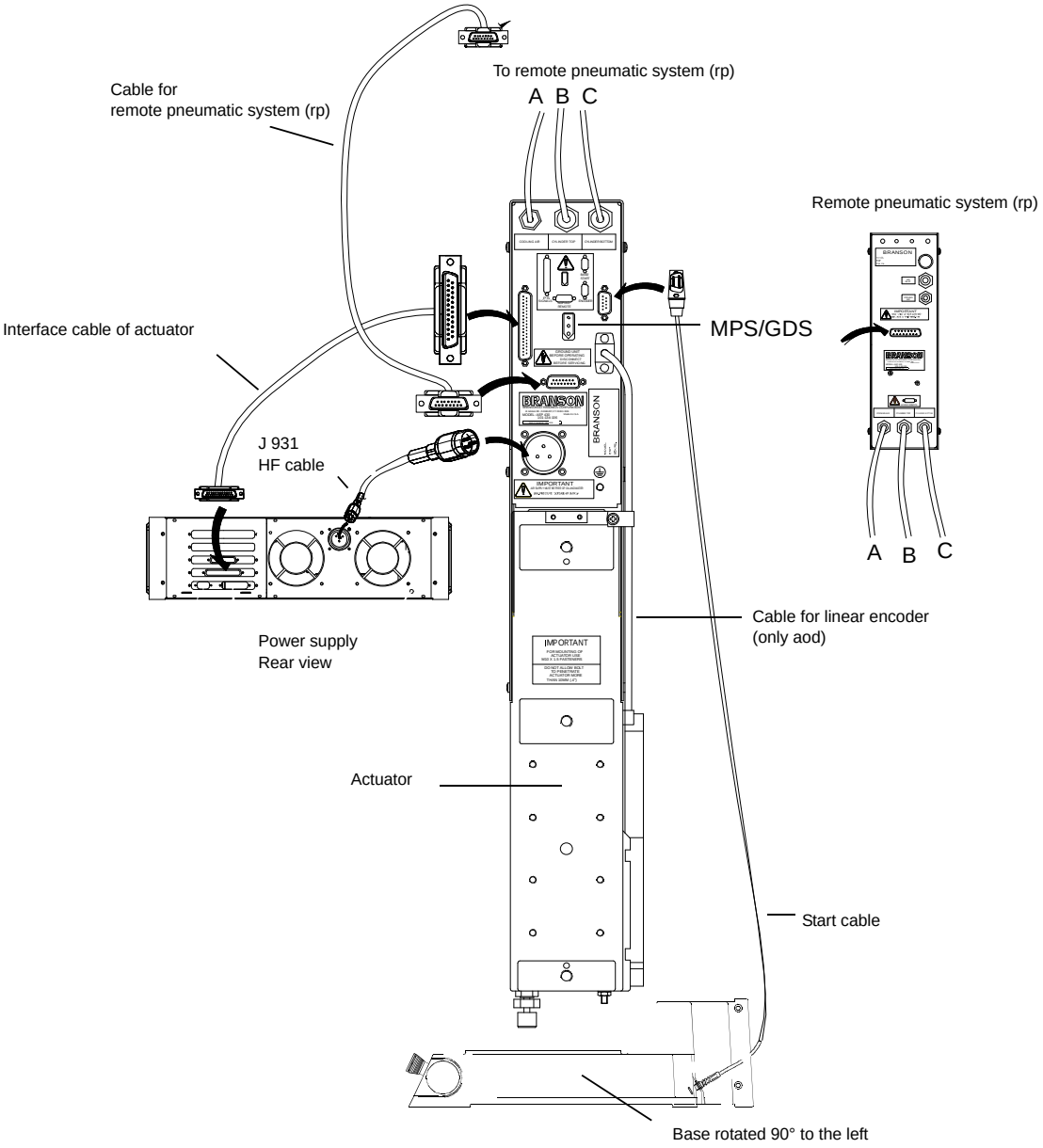


Fig. 5-19 Electrical connections between the power supply, the aod, aodl, or aomc actuator, and the external remote pneumatic kit



The aodm/aomc Micro actuators

NOTE

Please keep in mind that the pneumatic system and the actuator are two components that are connected by cables!

The actuator is permanently connected to the pneumatic unit by means of cables and air hoses. Therefore the possible positioning of the pneumatic system relative to the actuator is limited (cable length approx. 80 cm).

The compressed air supply is prepared by means of a pneumatics panel and connected to the pneumatic system.

WARNING

By means of the precision controller on the pneumatics panel, set the reference pressure to 80 psi. When the reference pressure is not 80 psi ± 3 psi, the compressed air will not be constant and the system will not start!

Position the pneumatics panel as close as possible to the pneumatic system. Fasten the actuator with 3/8-16 UNC-2B screws. The screws must not be screwed more than 10 mm into the actuator. For information on the electronic and pneumatic connections, see the illustrations.

aodm Micro actuator

Fig. 5-20 Electrical connections between the power supply and the aodm actuator

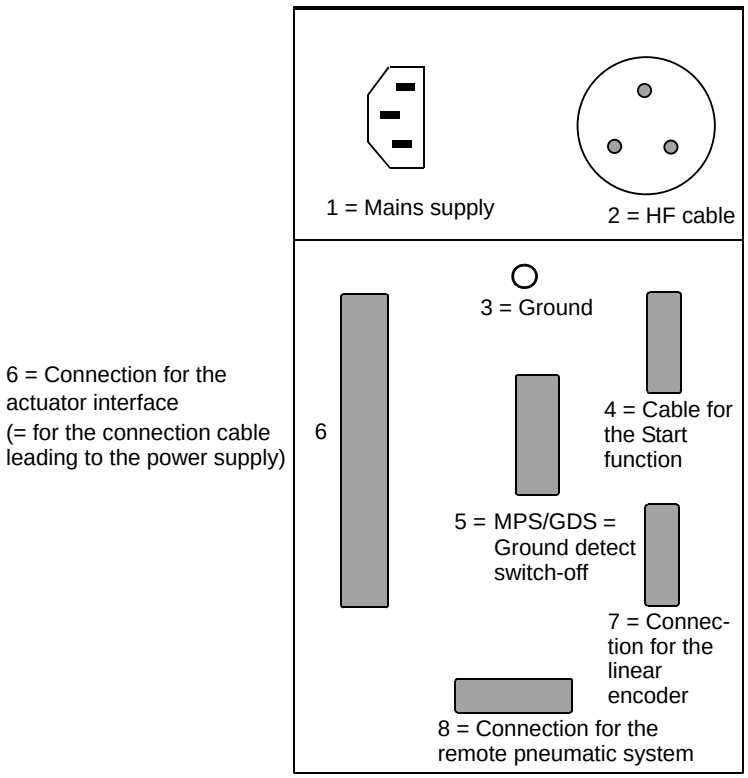


Fig. 5-21 Pneumatic system (aodm) from below

aomc Micro actuator

You need this pneumatic panel for the aomc actuator, and also for the aemc and aef actuators, if these two actuators do not have columns.

Fig. 5-22 Pneumatic panel

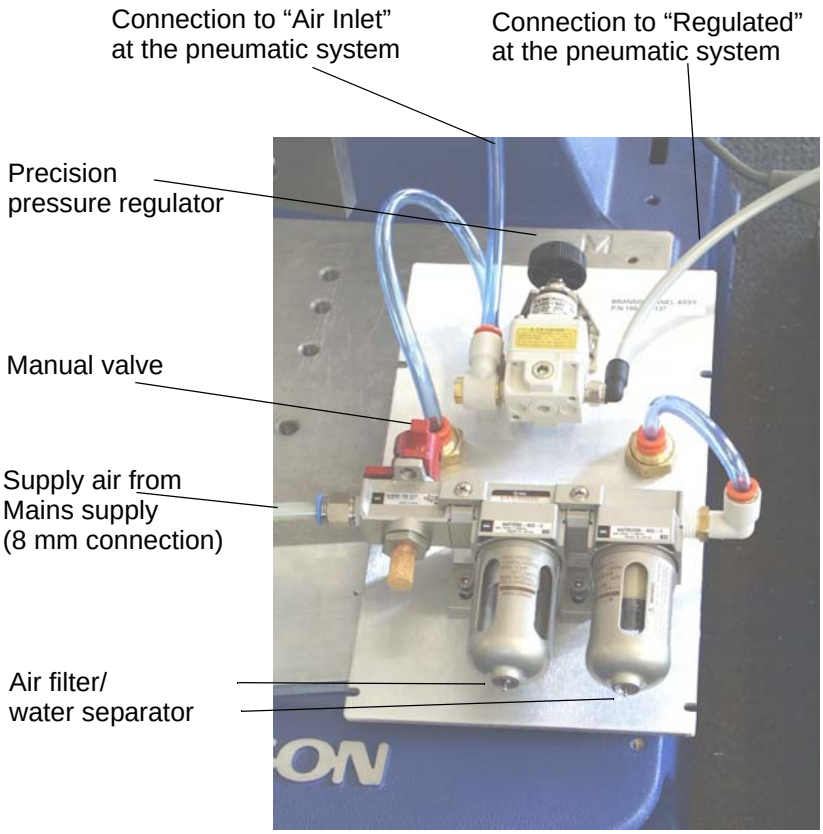
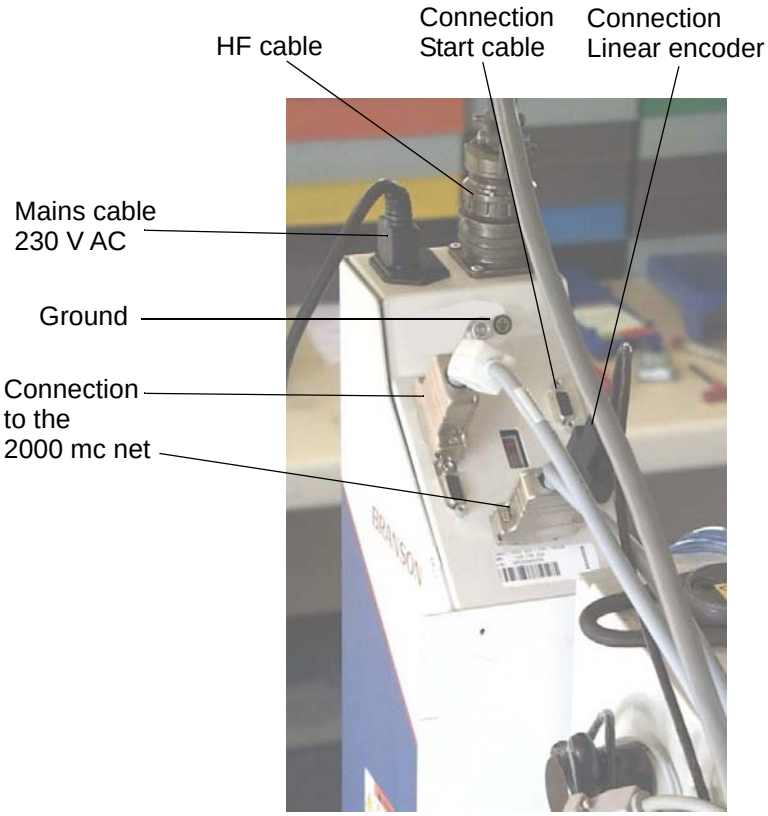


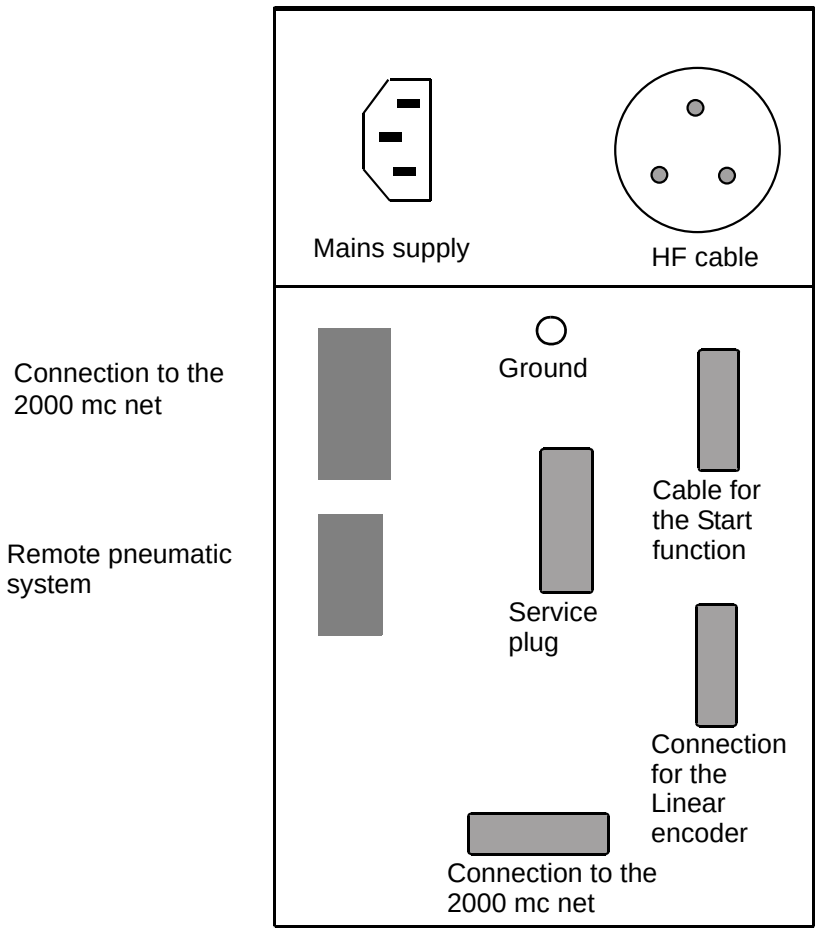
Fig. 5-23 Electrical connections between the 2000 mc net control computer and the aomc micro-actuator



WARNING

Connect a ground conductor to the case of the pneumatic system, to ensure that the system is grounded properly!

Fig. 5-24 Electrical connections between the power supply and the aomc Micro actuator



For a bottom view of the pneumatic system and its connections, see fig. 5-21.

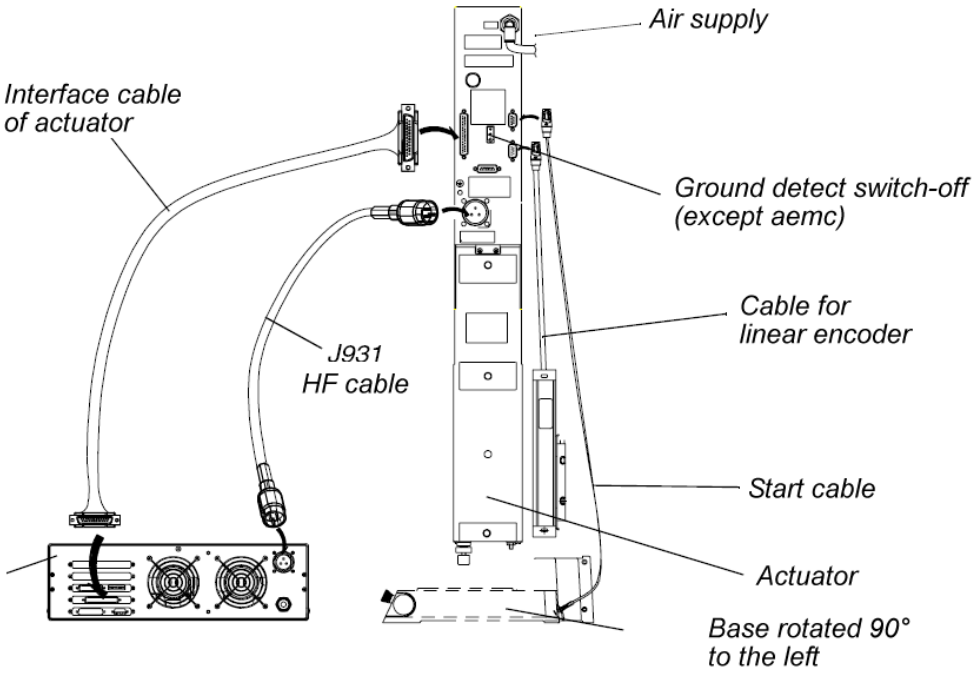
Fig. 5-25 Pneumatic unit of the aomc Micro from below

Supply air from “Regulated” inlet of pneumatics panel (reference pressure)

Supply air from “Air Inlet” of pneumatics panel

ae actuators

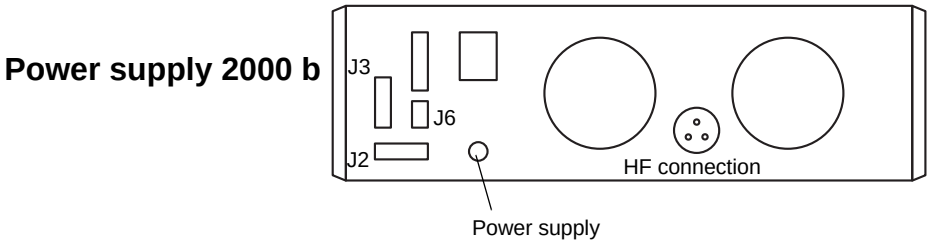
Fig. 5-26 Electrical connections between the power supply and the ae, aed and aef actuators

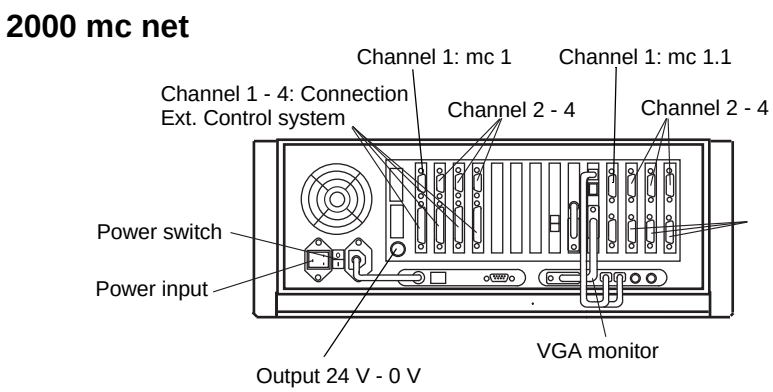


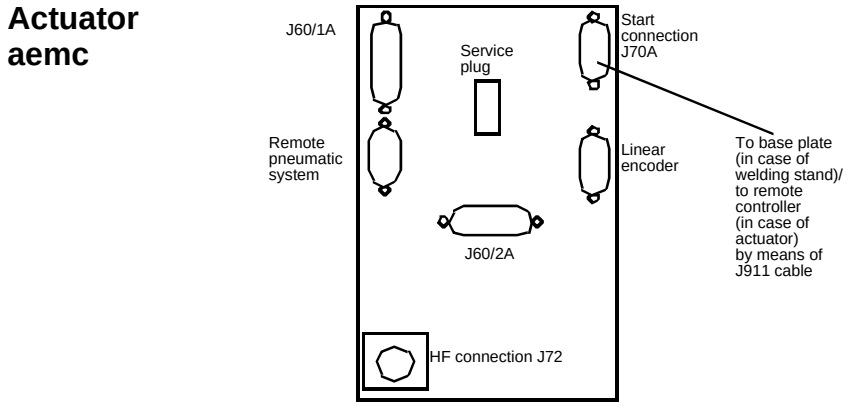
NOTE

Please note that the aemc actuator has different cables and a different interface. The cables are routed to the 2000 mc net.

Fig. 5-27 Electrical connections between the power supply and the aemc actuator







Tab. 5-1 Cable connections between the power supply, 2000 mc net and the aemc actuator

Designation of the respective plug in brackets		
2000 b (J1) **2000 b** (J2, J3, J6)	<- J931C -> <- JMC1.4 ->	**aemc actuator** (J72) **2000 mc net** (mc1)
2000 mc net (mc1.1) **2000 mc net** (mc1.2) **2000 mc net** (mc1)	<- JWP01 -> <- JWP01 -> <- J971 ->	**aemc actuator** (J60/1A) **aemc actuator** (J60/2A) **Ext. controller** e.g. PLC
aemc actuator (J70A)	<- J911 ->	**Ext. controller** e.g. PLC

5.3.6 Start switch connection (automated)

NOTE

For additional information on the automation, refer to appendix E of the power supply's manual.

A BRANSON actuator requires two start switches and an EMERGENCY STOP switch. Welding stands that have base plates are equipped with these switches, in other words they have been installed and connected at the factory. If, however, you use an actuator with flange or actuator without welding stand, you have to install the start switches (buttons) and EMERGENCY STOP switch as follows:

Fig. 5-28 Two-hand start - Start button connections (for aed and aef actuators)

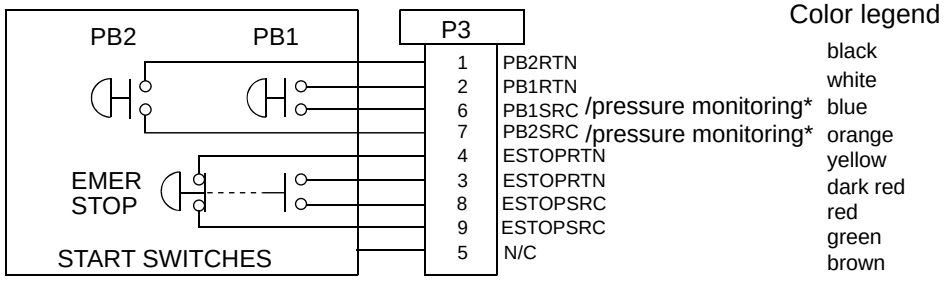
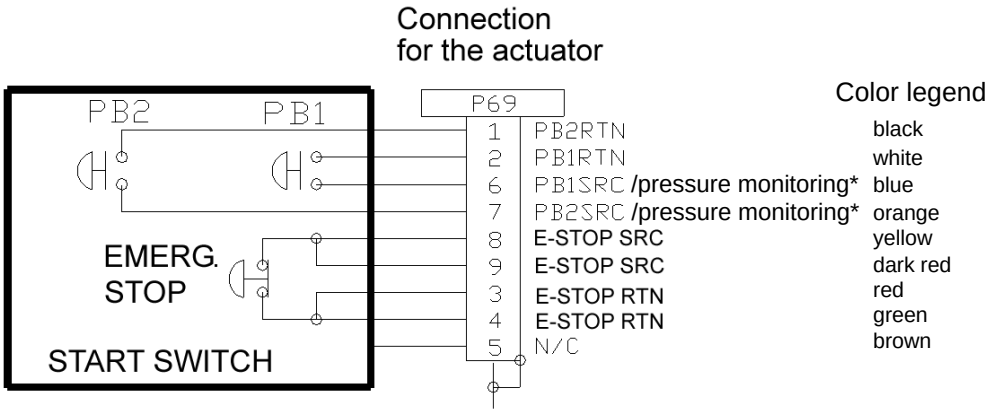


Fig. 5-29 Two-hand start - Start button connections (for all actuators except aed and aef)



* The pressure monitoring information only applies to the aemc actuator. If you connect the start inputs of the aemc actuator directly to the PLC, you should use pins 6 and 7 for pressure monitoring.

NOTE

Semiconductor components can be used instead of mechanical start switches if their leakage current is not more than 7 mA.

BASE/START is the DB-9 plug socket at the rear of the actuator. For the cable, you need a male DB-9 plug (Sub-D plug).

PB1 and PB2 (palm button 1 and 2), are normally open start switches of the two-hand start function. To start the welding cycle, you have to press the two start buttons simultaneously. If you do not press both start buttons within 200 milliseconds, the error message “Start Sc Time” appears. No restart is required. However, for the next cycle you have to press the buttons simultaneously, to prevent another error message. Also see the note above.

EMER STOP is an emergency stop switch with two contacts,one normally closed and the other normally open.

5.3.7 Operating the aemc and aomc Actuators in Combination with a PLC

Take the PLC signal, monitor it and link it with the start signal to monitor the reference pressure.

You start the welding cycle by means of the 9-pin plug at the actuator. To have complete control over the welding system, connect the pins as follows:

PIN 1: Input: Start/two-hand palm buttons
PIN 2: Input: Start/two-hand palm buttons

You can address these two inputs by means of corresponding outputs on a PLC. In this case, the plant safety is achieved by means of the machine control.

PIN 6/7: Output/reference pressure OK

This output should be monitored by the PLC. The reference pressure has to be OK at the start (24 V).

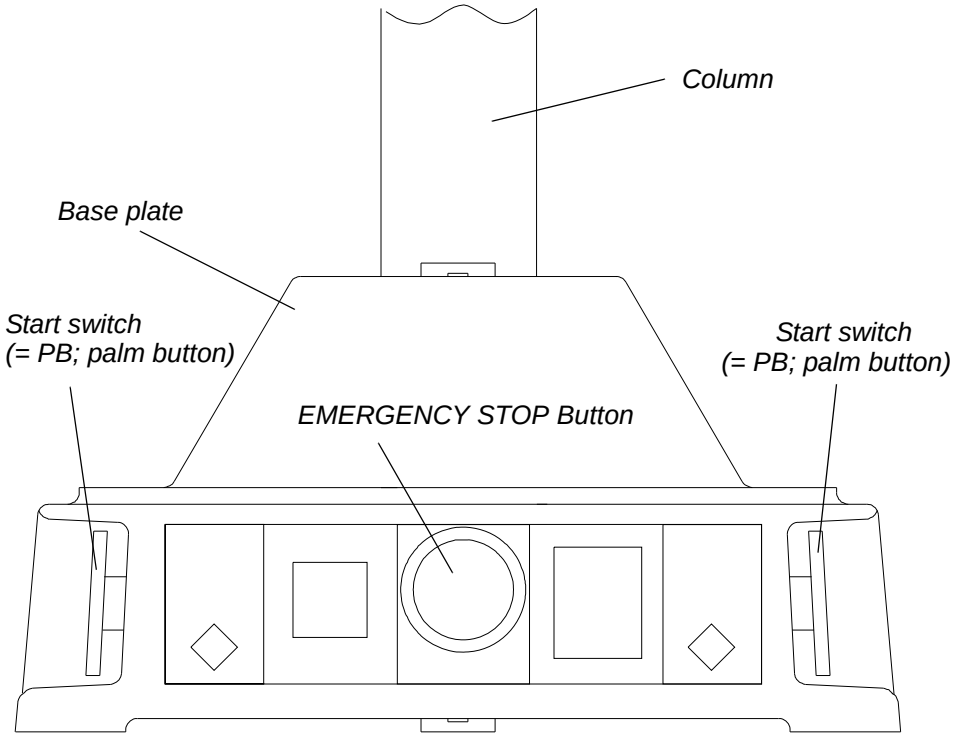
PIN 3/4 and PIN 8/9: These pins are intended for the EMERGENCY STOP of the welding system. This function can be activated by means of the machine control, to forward an Emergency Stop signal to the welding system. Whether an Emergency Stop state also acts on the welding system depends on the manufacturer of the complete system.

5.4 Protective and Safety Equipment

5.4.1 EMERGENCY STOP Button

If you have pressed the EMERGENCY STOP palm button at the actuator to stop a welding process, turn the button to reset it. The welding unit does not work as long as the button is pressed. Subsequently press the RESET button on the power supply. If the system is running in automatic mode, you can use the external reset function that is connected with your user interface.

Fig. 5-30 Actuator, EMERGENCY STOP button



If you have triggered the EMERGENCY STOP signal from the user interface, reset the EMERGENCY STOP state to put the system back into operation.

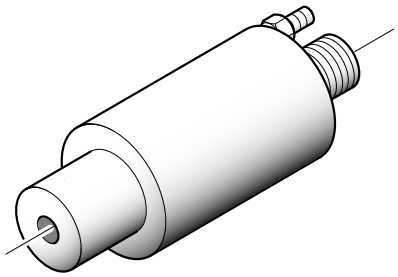
WARNING

The emergency stop should be engaged prior to removing the door.

5.5 Stack Components

Converter

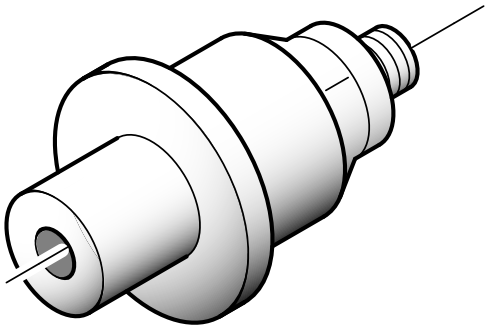
Fig. 5-31 Converter



The converter is integrated into the actuator and is part of the stack. The electrical ultrasonic energy generated by the power supply is conducted to the converter (also called transducer). Thus the high-frequency electrical vibrations are converted to mechanical vibrations with the same frequency. Piezoelectric ceramic elements are the core elements of the converter. When subjected to alternating current, these elements alternately expand and contract. Thus more than 90% of the electrical energy is converted to mechanical energy.

Booster

Fig. 5-32 Booster



Successful operation of an ultrasonic assembly largely depends on the amplitude of the movements at the front face of the horn. The amplitude is a function of the shape of the horn, which is in turn largely determined by the size and the shape of the parts to be welded. The booster can be used as a mechanical transformer with which the amplitude of the vibrations that the horn applies to the weld parts can be increased or decreased.

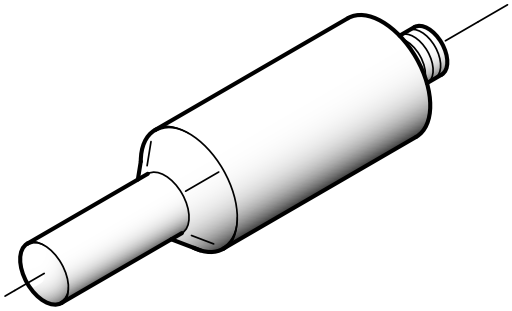
The booster is a mechanical adapter made of aluminium or titanium, with a length that corresponds to half of the wave length. It is part of the ultrasonic stack and acts as the connection between the converter and the horn. Furthermore the booster provides a pressure point, which is needed for a rigid connection between the elements of the stack.

Boosters are designed in such a way that they vibrate at the same frequency as the respective converter with which they are used. They are usually positioned at nodes of vibration (minimal vibration) of the axial movement. Thus the energy loss is reduced to a minimum and the transmission of vibrations to the actuator is prevented.

The stack is delivered as a completely assembled unit. The text that follows first describes the stack components, and subsequently the assembly of the stack.

Horn

Fig. 5-33 Horn



The horn is selected or manufactured in accordance with the respective application. Horns are normally metal sections with a length that is equal to half the wavelength, and are used to apply the necessary force and vibrations evenly to the weld parts that are to be joined. The horn transmits ultrasonic vibrations from the converter to the weld part. The horn is attached to the booster and forms part of the ultrasonic stack.

Depending on the profile, horns are described as stepped, tapered, exponential, bar or catenoid. The shape of the horn determines the amplitude at the horn's front face. Depending on the application, horns can be made of titanium alloys, aluminium or steel. Titanium alloys are the best choice in the manufacturing of horns, thanks to the high strength and low losses. Aluminium horns are usually chrome or nickel-plated or hard-coated, to reduce wear. Steel horns are suitable for low amplitudes that need high hardness values, for example during inserting.

5.6 Assembling the Stack

The explanations that follow concern maintenance and repairs.

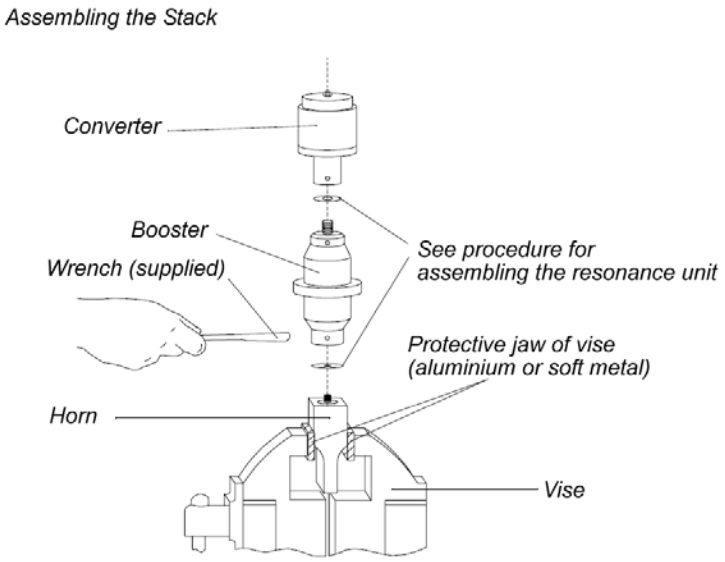
WARNING

The following steps have to be taken by a person who is responsible for the setup. If necessary, you can clamp most square or rectangular horns in a vise with soft jaws (brass or aluminium). NEVER attempt to install or remove a horn by clamping the converter case or the booster's locking ring in a vise.

WARNING

Do not use silicone grease for Mylar washers. Only use 1 (one) Mylar washer, with the correct inner and outer diameter, for each joint.

Fig. 5-34 Assembling the stack



Torque table for the stack

NOTE

We recommend that you use a BRANSON torque wrench or an equivalent wrench.

Tab. 5-2 Tools

Tool	EDP no.
20 kHz torque wrench	101-063-617
40 kHz torque wrench	101-063-618
20 kHz screw wrench	201-118-019
30 kHz screw wrench	201-118-033
40 kHz screw wrench	201-118-024
Silicon grease	101-053-002

Tab. 5-3 Torque values for the screws at the booster and horn

Used with	Screw size	Torque	EDP No.
15 kHz (only aed, ae)	½" x 20 x 1-1/4"	450 in-lb (50 Nm)	100-098-123
20 kHz	½" x 20 x 1-1/2"	450 in-lb (50 Nm)	100-098-370
20 kHz	3/8" x 24 x 1"	290 in-lb (32 Nm)	100-098-123
30 kHz*	M8 x 1.25	70 in-lb (8 Nm)	100-298-170
40 kHz*	½" x 20 x 1-1/4"	450 in-lb (50 Nm)	100-098-790

* Apply a drop of Loctite 290 to the screw. Tighten and allow to dry for 30 minutes prior to use.

5.6.1 Procedure for 20 kHz Systems

Step	Procedure
1	Clean the mating surfaces of the converter, booster and horn. Remove all foreign objects from the tapped bore.
2	Insert and tighten the screw at the top of the booster. Torque 50 Nm. If the screw is too dry, apply 1 or 2 drops of light lubricant before you screw it in.
3	Use only one Mylar washer, suitable for the screw size, for each joint.
4	Mount the converter to the booster and the booster to the horn. Torque 24 Nm.

5.6.2 Procedure for 30 kHz Systems

Step	Procedure
1	Clean the mating surfaces of the converter, booster and horn. Remove all foreign objects from the tapped bore.
2	Apply a few drops of Loctite® 290 (or equal) to the screws of the booster and the horn.
3	Insert and tighten the screw at the top of the booster, with a torque of 32 Nm, and allow it to dry for 30 min.
4	Insert and tighten the screw at the top of the horn, with a torque of 32 Nm, and allow it to dry for 30 min.
5	Use only one Mylar washer (suitable for the screw size), for each joint.
6	Screw the converter onto the booster. Torque 21 Nm.

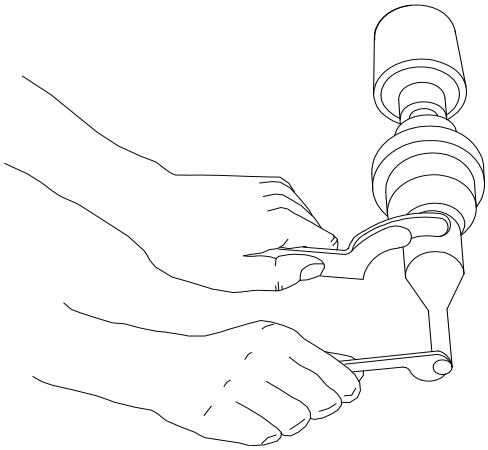
5.6.3 Procedure for 40 kHz Systems

Step	Procedure
1	Clean the mating surfaces of the converter, booster and horn. Remove all foreign objects from the tapped bore.
2	Apply a few drops of Loctite® 290 or equal to the screws of the booster and the horn.
3	Insert and tighten the screw at the top of the booster, with a torque of 8 Nm, and allow it to dry for 30 min.
4	Insert and tighten the screw at the top of the horn, with a torque of 8 Nm, and allow it to dry for 30 min.
5	Apply a thin film of silicon grease to all joints - *however not on the screw or the tip.*
6	Screw the converter onto the booster.
7	Torque 10 Nm, for aef actuator: Torque 8 Nm.
8	Slide the booster/converter unit into the adapter sleeve. Unscrew the ring nut of the adapter sleeve until it is loose.
9	Screw the booster onto the horn.
10	Repeat step 7.
11	Use the supplied wrench to tighten the ring nut of the adapter sleeve.
11a	Tighten the ring nut of the adapter sleeve. This only applies to the ao actuator.

5.6.4 Connecting the Tip with the Horn

1. Clean the mating surfaces of the horn and the tip. Remove foreign particles from the screw and the tapped bore.
2. By hand, attach the tip to the horn. Dry-mount the two components. Do not use any lubricants.
3. Use the hook wrench and an open-ended wrench (see fig. 5-35) to tighten the tip in accordance with the torque specifications in table 4.8:

Fig. 5-35 Connecting the tip with the horn



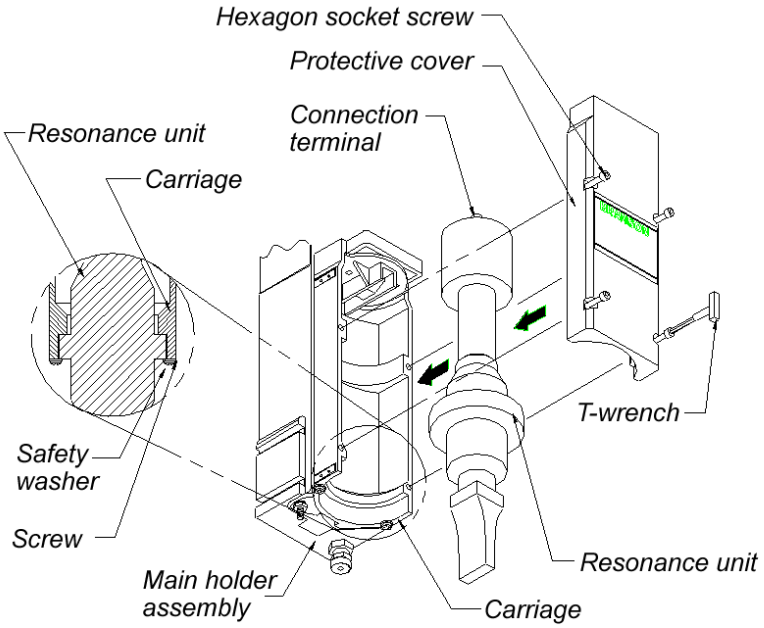
Tab. 5-4 Torque values for connecting the tip and horn

Thread of tip	**Torque**
1/4-28	12 Nm
3/8-24	20 Nm

5.7 Installing the Stack in the Actuator

5.7.1 20-kHz Unit

Fig. 5-36 Installing a 20 kHz stack into a BRANSON actuator

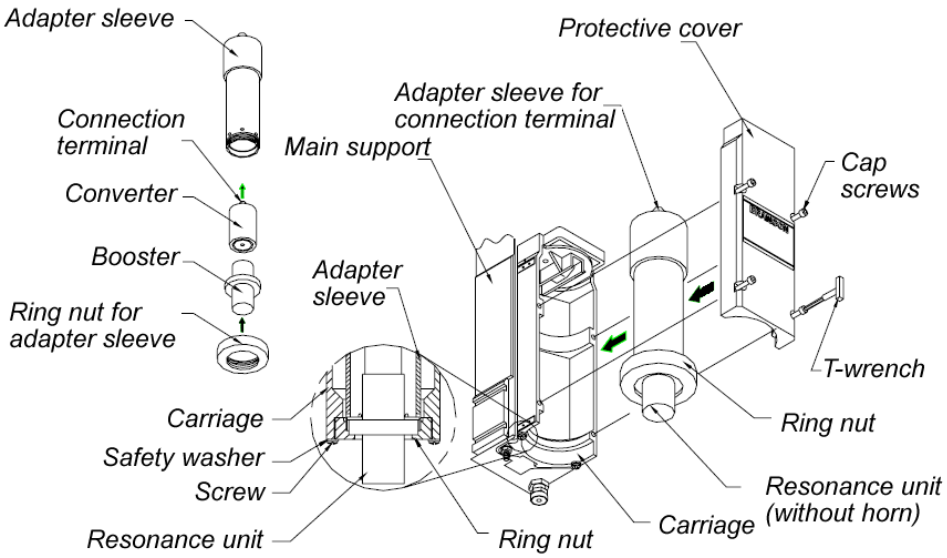


To install the stack, proceed as follows:

1. Make sure that the current supply is disconnected, by pulling the mains plug.
2. Loosen the four screws of the protective cover.
3. Pull off the protective cover whilst holding it straight, and put it aside.
4. Take the stack and align the ring on the booster above the retainer disk in the carriage. Firmly push the unit into place, with the acorn nut on the top of the converter making contact with the contactor in the top of the carriage.
5. Reinstall the protective cover by means of the four screws.
6. Realign the horn by turning it, if necessary. Tighten the protective cover to a torque of 5 Nm, to secure the screw.

5.7.2 30 kHz and 40 kHz Stacks

Fig. 5-37 Installing a 40 kHz stack into a BRANSON actuator



First assemble the stack and then proceed as follows:

1. Make sure that the current supply is disconnected, by pulling the mains plug.
2. Attach the converter/booster to the adapter.
3. Loosen the four screws of the protective cover.
4. Pull off the protective cover whilst holding it straight, and put it aside.

WARNING

Do not attempt to clamp the adapter in a vise. This might warp or damage it.

1. Take the assembled adapter and align the ring on the booster above the retainer disk in the carriage. Firmly push the adapter into place, with the acorn nut on the top of the converter making contact with the contactor in the top of the carriage.

2. Reinstall the protective cover with the four screws.

WARNING

Make sure that the screws are only hand-tightened (approx. 2 Nm)! There are two possible dangers:
1. The thread could be torn.
2. The wall could be pressed into the cover flap.

3. Realign the horn by turning it, if necessary. Tighten the protective cover to a torque of 2 Nm, to secure the screw.

NOTE

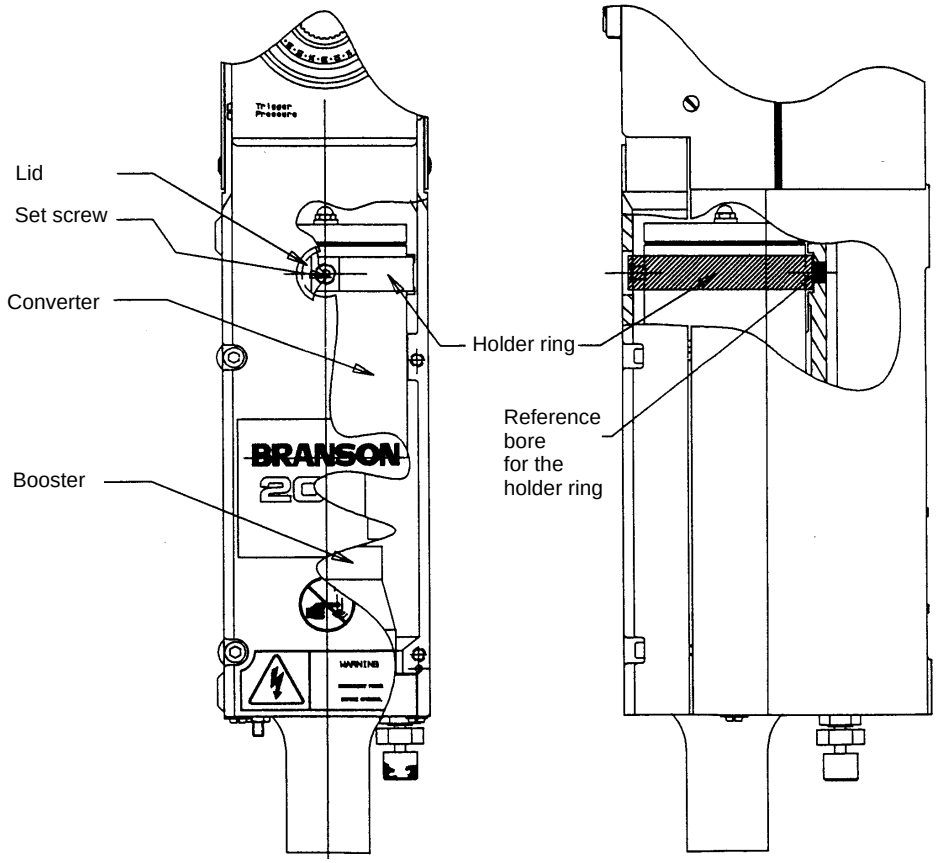
Branson recommends using the CA-30-Converter instead of the CJ-30 converter with the sleeve assembly.

5.8 Tool Change System (Not For the Micro Actuators)

If you want to weld several products with one actuator, it is recommended that you use the tool change system to quickly switch between converters and boosters.

The tool change system has EDP no. 159-063-665.
The tool change system with ring has EDP no. 159-063-665.

Fig. 5-38 Parts of the tool change system



- Loosen the four screws of the cover at the front of the actuator.
- Remove the cover.

WARNING

The stack can be heavy. Make sure that it does not fall out of the tool change system uncontrolled when you remove the cover!

- Take the stack out of the tool receptacle.
- Put the holder ring over the converter.
- The holder ring has a convex part that fits into the bore hole in the tool receptacle. Insert the stack into the tool receptacle in such a way that you fit the convex part of the holder ring into the bore hole of the tool receptacle. Ensure that it is fitting tightly.
- Loosely screw the cover onto the front of the actuator.
- Align the horn to your tool.
- Screw the cover tight.
- Tighten the holder ring through the hole in the cover.

5.9 Mounting the Weld Part Fixture on the BRANSON Base Plate

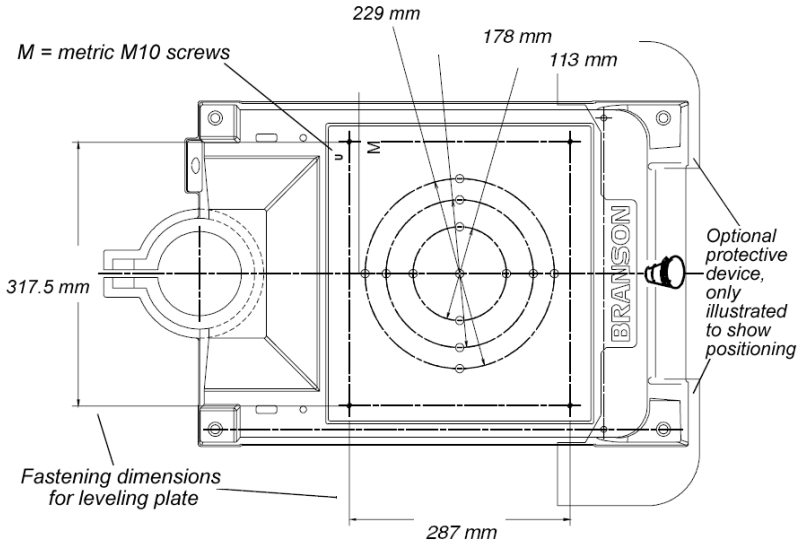
Small parts and bore holes

The base plate is equipped with bore holes for the weld part fixture. There are also bore holes for the optional leveling plate. The threads have been designed for M10-1.5 screws and are designated by an “M” on the base plate. The bore holes are arranged in three concentric circles with dimensions as shown below.

WARNING

The base plate consists of cast material. If the screws are pulled too tight, the tapped bore holes can be damaged. Only tighten the screws to the point where the weld part fixture cannot move any more.

Fig. 5-39 Mounting circles on the base plate



The optional protective device, EDP no. 101-063-550, is sometimes needed for very big horns. Here it is only shown for positioning purposes. It protrudes a few centimeters beyond the base plate on both sides and protects the user of the welding unit against crushing fingers or hands between the base plate and tool.

5.10 Checking the Installation

1. Open the air supply.
2. Make sure that there are no leaks in the air supply system.
3. Switch on the power supply. The power supply starts with the self-test.
4. If the power supply displays an alarm message, you can find the relevant description, cause and solution in Chapter 7 of the power supply's operating manual. If the power supply does not display an alarm, or displays the “Ready” status, continue with the next step.
5. Calibrate the actuator - except the ao and ae actuators - as described in the operating manual of your power supply. Make sure that there is at least 2 cm clearance between the horn and the weld part.
6. Press the **Test** button at the power supply.
7. If the power supply issues an alarm at this time, look for the description thereof in the maintenance section in Chapter 7 of the power supply operating manual. If no alarm messages are displayed, continue with the next step.
8. Put a test part in the weld part fixture.
9. Press the **Horn Down** button and then keep both start buttons pressed. The horn moves downwards, towards the weld part fixture. This is done to test if the compressed air system is working.
10. Press the **Horn Down** button again. The horn moves back. The system is now fully functional. You can configure it for your applications.

Principally the following applies: If the power supply does not issue any alarms and the actuator moves up and down correctly, the ultrasonic welding unit is ready to weld.

5.11 Do You Have Questions?

We are happy that you chose our product and will be glad to be assistance if you have questions! If you need support for your 2000X series products, please contact your BRANSON representative.

6 Technical Specifications

Requirements

The 2000X series actuators require compressed air. For operation and cooling, the supplied air has to have a min. pressure of 70 or 90 psi.
70 psi = 4.8 bar
90 psi = 6.2 bar
100 psi = 6.9 bar
However, for some applications a min. pressure of up to 100 psi might be necessary. The following table contains the required ambient conditions for the ultrasonic welding system.

Criterion	**Permissible range**
Humidity	30% to 95%, non-condensing
Ambient temperature	+5 °C to +50 °C
Storage/transport temperature	-25 °C to +55 °C (+70 °C for 24 hours)
Operating Altitude	Up to 1000 m
IP Rating	2X

All electric inputs are intended for connections with the power supply.

Actuator ratings

The following tables contain the actuator ratings.

Tab. 6-1 Max. weld force at 100 psi (690 kPa) and 95 mm stroke. The aodm and aomc Micro have a stroke of 50 mm.

Cylinder	ao, aod, ae, aed	aef, aemc	aodm, aomc
1.5 inch 38 mm	135 lb 600 N		620 / 540 N* * at 60 psi
2.0 inch 50 mm	269 lb 1190 N	269 lb 1190 N	
2.5 inch 63 mm	441 lb 1960 N		
3.0 inch 76 mm	651 lb 2890 N	651 lb 2890 N	
3.25 inch 82 mm	772 lb 3430 N		

Tab. 6-2 dynamic trigger force

Actuator	Cylinder size	aodm	aef,aed,ae	aod, ao
Dynamic trigger force	1,5 inch(38 mm) 2,0 inch (50 mm)	22 N bis 620 N	22N to max. force	66N bis 800N
	2,5 inch(63 mm) 3,0 inch (76 mm) 3,25 inch (82 mm)		44N to max. force	66N bis 800N

Tab. 6-3 Max. speed for rapid motion mode, in combination with power supplies of the 2000X series

	ao, ae, aod, aed, aef, aemc
Down- and upspeed	max. 203.2 mm per second at 88.9 mm stroke, 90 psi (= 6.2 bar) (all cylinder sizes)

Tab. 6-4 Max. and min. stroke

	ao, ae, aod, aed, aef, aemc	**aodm, aomc**
Min. stroke	3 mm	3 mm
Max. stroke	95 mm for a cylinder with 100 mm stroke	45 mm for a cylinder with 50 mm stroke

7 Control Elements and Displays

First you are provided with an overview of the control elements and displays at the actuators. Subsequently a short description is provided.

Tab. 7-1 Overview of control elements and displays

Control element/display	**Actuator**						
	ao (rp needed)	**Remote pneumatic system (rp)**	**aod (remote pneumatic system (rp) needed)/ aodm (rigid connection with the pneumatic unit)**	**ae Actuators**	**aed**	**aef/aemc/ aomc**	**aomc Micro**
Pressure display	x		x	x	x	x	
Operation indicator lamp	x	x	x	x	x	x (only aef)	
Pressure regulator		x		x	x		
Control: downspeed		x			x		
Manometer		x		x	x		
Stroke display			x	x	x	x	
Control: pressure triggering				x	x		
Mechanical stop	x		x	x	x	x	x
Load cell			x		x	x	x

Descriptions of control elements and displays

- **Pressure display:** Indicates whether the actuator contains compressed air.
- **Operation indicator lamp:** Indicates whether the actuator and power supply are on.
  Actuator aed and aef only: A blinking operation indicator lamp indicates a safety alarm.

- **Pressure regulator:** Regulates the compressed air that acts on the cylinder, range between 35 - 700 kPa (0.3 - 7 bar)
  To adjust setting: Pull.
  To lock setting: Press the regulator.
- **Downspeed control:** With the downspeed switch you can control the downspeed and the force that acts on the part to be welded.
- **Manometer:** Shows the air pressure value that acts on the cylinder, in two stages from 35 to 700 kPa.
- **Stroke display:** A fast method for determining the relative column distance of the carriage during a welding cycle. A scale indicates the collapse distance.
- **Pressure triggering control:** Here you can select the pressure for the dynamic triggering, calibration is done from 1 to 24 in half-steps (48 markings), that correspond to a force range of 67 to 890 N for the stronger force units and 32 to 890 N for the weaker force units. For more information on the load cell, refer to chapter 3.3.
- **Mechanical stop:** Limits the column distance to prevent the horn from making contact with the weld part fixture if no weld part has been inserted. Each rotation of the screw corrects the stop by approx. 1 mm (0.04"). A lock nut prevents the setting of the stop from changing due to vibrations. To make the column distance longer, turn the screw clockwise.

NOTE

The mechanical stop is not intended for controlling the welding process.

WARNING

If the screw for the mechanical stop is turned too far, it could fall out.

- Load cell: Shows the force acting on the weld part during the welding process. By using the load cell, you can specify the trigger point for activating the ultrasonic vibrations, and can generate a force/distance diagram of the operating cycle. For more information on the load cell, refer to chapter 3.3.

8 Operating the ao and ae Actuators

8.1 Control Elements of the ao and ae Actuators

This text section describes the execution of a welding cycle by means of the 2000X ao actuator. For more information on configuring and changing settings, refer to the operating manual of the power supply.

DANGER

When setting and operating the actuator, pay attention to the following:
Do not reach underneath the horn.
Downward force (pressure) and ultrasonic vibrations can cause injuries.

Plastic parts can vibrate in the audible frequency range during the welding process. To prevent injuries, wear hearing protection.
A vibrating horn must not make contact with a metal plate or a weld part fixture made of metal.

The 2000X ao and ae actuators are controlled by the power supply. The actuator sends operating cycle data (trigger force etc.), status information and alarm information to the power supply. For information on configuration, testing, setup and operation, refer to the operating manual of the 2000X series power supply.

DANGER

When you use larger horns, avoid situations in which fingers can get clamped between the horn and the weld part fixture. If you need optional protective equipment, please contact BRANSON.

8.2 Basic Configuration of the ao and ae Actuators

The actuator is always controlled by means of the power supply; however, the actuator itself also controls some functions. This includes the following functions:

- Compressed air
- Regulated compressed air and manometer at the remote pneumatic control unit
- Control of the downspeed at the remote pneumatic control unit
- Mechanical stop
- Position and height of the actuator with regard to the weld part fixture (horn path)
- EMERGENCY STOP button at the base plate, and as an EMERGENCY STOP signal from the user interface in the case of automated systems

Each of these functions influences the operation of the actuator.

8.2.1 Regulated Compressed Air and Manometer

Compressed air is fed to the pressure regulator in the actuator. The regulator is a snap-in pushbutton that prevents unintentional changes to the compressed air settings.

DANGER

If you depressurize the system or activate the drain valve, the actuator might move to a lower position, as the higher position requires constant compressed air. Always keep your hands clear of the area below the horn or other areas where there is danger of getting crushed. Lock the horn in place with a piece of wood or another soft material, to prevent the tool from getting damaged.

DANGER

Set the pressure regulator to zero before you connect or disconnect the compressed air supply. If you supply the actuator with compressed air with a regulated max. pressure of more than 100 psi (690 kPa), there is danger of personal injury or permanent damage to the units!

To set a lower pressure, first turn the pressure regulator knob counterclockwise. If some parts of the unit have not been connected properly, a lower pressure prevents the actuator from suddenly being triggered. Typical setting values are between 20 - 25 psi (= 1.38 - 1.725 bar) for new or untested devices.

8.2.2 Compressed Air Supply

The compressed air supply has to be on and the compressed air regulator has to supply the actuator with pressure. To ensure reliable actuator operation, the compressed air may not drop below a value of 35 psi (2.4 bar). The supplied air is also used to provide the converter with cooling air.

In the case of applications that require a higher welding pressure, the compressed air supply can have an influence on the welding results.

NOTE

The pressure of the air supplied by the compressed air system has to exceed the max. pressure required for the system. The capacity of the compressed air system has to be suitable for all systems connected to it. To ensure a constant air flow, you might have to use an accumulator.

8.2.3 Controlling the Downspeed

The speed of the horn is controlled by means of the downspeed controller. If the controller for the downspeed has been set to zero, the actuator does not move.

NOTE

For the initial setup, set the downspeed controller to a low valve, between 5 and 15. To do so, use an adjusting screw at the control button for the downspeed.

8.2.4 Dynamic Triggering

The dynamic triggering mechanism should initially be set to a value between 1 and 5.

8.2.5 Alignment and Height - ao and ae Actuators (Horn Path)

The horn carriage moves up and down in the rails of the actuator. You can change the position of the actuator at the column. When selecting the distance between the horn and the weld part fixture, make sure that there is sufficient space for servicing tasks (replacing parts, etc.).

- The min. column distance may not be less than 3.175 mm.
- The absolute column distance traveled before touching the weld part may not be more than 95 mm.

Constant welding results are best achieved with column distances of more than 6.35 mm, because in the case of shorter welding distances, as well as during the respective force build-up on the weld part, other components of the welding system can hinder the welding process.

8.2.6 Mechanical Stop

The mechanical stop affects the amount of downward travel the actuator is allowed to have, up to the full stroke length of the unit. The multi-turn knurled knob to the right of the stack, on the bottom of the actuator, is the mechanical Stop adjustment. On the right of the actuator, there is a display with a user-definable scale for the mechanical stop.

The mechanical stop prevents the horn from touching the weld part fixture if no weld part is present. It is not a precision measuring unit. Therefore you should **NOT** use the mechanical stop as a means to limit the welding distance in the collapse distance or absolute distance modes. You can also use the part detection function to monitor the min. distance between the horn and the weld part fixture.

Initially set the mechanical stop to a horn travel distance of at least 6.35 mm; however all distances that lie within the absolute column distance is suitable.

Setting the mechanical stop

DANGER

If you depressurize the system or activate the drain valve, the actuator might move to a lower position, as the higher position requires constant compressed air. Always keep your hands clear of the area below the horn or other areas where there is danger of getting crushed. Lock the horn in place with a piece of wood or another soft material, to prevent the tool from getting damaged.

1. Activate the manual drain valve and manually move the carriage down until the horn is positioned directly above the weld part fixture.
2. If the horn does not reach the weld part fixture, and has not moved down 100 mm, remove the lock nut and turn the adjusting nut for the stop clockwise until the carriage is in the desired position. If the horn reaches the desired position before touching the mechanical stop, turn the nut counterclockwise, until the stop touches the carriage.
3. Check the height of the horn and make changes to the stop, if necessary.
4. After correctly setting the stop, tighten the lock nut. The lock nut prevents the adjusting nut from being maladjusted during operation, due to vibrations.
5. Insert a weld part, reset the drain valve and perform a test weld.
6. Check whether the full force can be built up between the horn and weld parts. If not, you have to change the setting of the mechanical stop.

NOTE

Due to dynamic follow-through, do not weld in the last 6.35 mm of stroke.

8.2.7 EMERGENCY STOP Button

With the EMERGENCY STOP button, you interrupt the operation of the actuator, the current welding process stops immediately and the horn moves back. Pressing the EMERGENCY STOP button does NOT switch off the mains power! At the power supply you can specify that an audible signal is given each time the EMERGENCY STOP button is pressed. If you switch the system to EMERGENCY STOP, a message appears on the display at the front panel of the power supply. To reset the system, turn the EMERGENCY STOP button.

8.3 Operating the ao and ae Actuators

For more detailed information on the control elements of the 2000X ao and 2000X ae actuators, refer to chapter 7. To operate the ao and ae actuators:

1. If your application has been analyzed by the BRANSON application laboratory, refer to the respective laboratory report for the settings. Else follow the instructions in the operating manual of the 2000X series power supply.
2. Set the mechanical stop to a position that prevents the horn from contacting the weld part fixture. For the relevant information, refer to chapter 8.2.6.
3. In the case of an actuator with base plate, make sure that the EMERGENCY STOP button is not active. In the case of actuators without BRANSON base plate, make sure that the EMERGENCY STOP button of the respective signal source is not active.
4. When the weld part has been inserted, press both start switches (two-hand palm buttons) simultaneously, or activate the start mechanism.
5. The horn moves down and touches the weld part.
6. A force builds up between the horn and the weld part. This force activates the trigger switch.
7. The ultrasonic vibrations start. The power display on the power supply indicates the load, it is normally between 25 and 100%. You can now release the start buttons.
8. The ultrasonic vibrations stop and the horn continue to apply a closing force to the weld part for the duration of the time specified by you as hold time.
9. After completion of the holding cycle, the horn automatically moves back. Thereafter you can remove the weld part from the weld part fixture.
10. Weld several weld parts with the basic configuration to check the results.

If the achieved welding quality does not match your requirements, you can modify the settings based on the results that were achieved, and the values measured by the power gages. Between test welds, only change one setting at a time, until you have achieved a weld with max. strength within as short a time as possible.

9 Operating the aod, aed and aodm Actuators

9.1 Control Elements of the aod, aed and aodm Actuators

This text section describes the execution of a welding cycle by means of the 2000X aod actuator. For more information on configuring and changing settings, refer to the operating manual of the power supply.

DANGER

When setting and operating the actuator, pay attention to the following:
Do not reach underneath the horn. Downward force (pressure) and ultrasonic vibrations can cause injuries.

Plastic parts can vibrate in the audible frequency range during the welding process. To prevent injuries, wear hearing protection.
A vibrating horn must not make contact with a metal plate or a weld part fixture made of metal.

The 2000X aod, aed and aodm actuators are controlled by the power supply. The actuator sends operating cycle data (speed, force, etc.), status information and alarm information to the power supply. The power supply in turn sends operating parameters to the actuator. These parameters determine when the welding cycles start and stop. During setup, the power supply constantly receives distance, force and pressure data from the actuator. For information on configuration, testing, setup and operation, refer to the operating manual of the 2000X series power supply.

DANGER

When you use larger horns, avoid situations in which fingers can get clamped between the horn and the weld part fixture. If you need optional protective equipment, please contact BRANSON.

9.2 Basic Configuration of the aod, aed and aodm Actuators

The actuator is always controlled by means of the power supply; however, the actuator itself also controls some functions. This includes the following functions:

- Compressed air
- Regulated compressed air and manometer
- Controlling the downspeed
- Mechanical stop
- Position and height of the actuator with regard to the weld part fixture (horn path)
- EMERGENCY STOP button at the base plate, and as an EMERGENCY STOP signal from the user interface in the case of automated systems

Each of these functions influences the operation of the actuator.

9.2.1 Regulated Compressed Air and Manometer

Compressed air is fed to the pressure regulator in the actuator. The regulator is a snap-in pushbutton that prevents unintentional changes to the compressed air settings.

DANGER

If you depressurize the system or activate the drain valve, the actuator might move to a lower position, as the higher position requires constant compressed air. Always keep your hands clear of the area below the horn or other areas where there is danger of getting crushed. Lock the horn in place with a piece of wood or another soft material, to prevent the tool from getting damaged.

DANGER

Set the pressure regulator to zero before you connect or disconnect the compressed air supply. If you supply the actuator with compressed air with a regulated max. pressure of more than 100 psi (690 kPa), there is danger of personal injury or permanent damage to the units!

To set a lower pressure, first turn the pressure regulator knob counter-clockwise. If some parts of the unit have not been connected properly, a lower pressure prevents the actuator from suddenly being triggered. Typical setting values are between 20-25 psi (= 1.38 - 1.725 bar) for new or untested devices.

9.2.2 Compressed Air Supply

The compressed air supply has to be on and the compressed air regulator has to supply the actuator with pressure. To ensure reliable actuator operation, the compressed air may not drop below a value of 35 psi (2.4 bar). The supplied air is also used to provide the converter with cooling air.

In the case of applications that require a higher welding pressure, the compressed air supply can have an influence on the welding results.

NOTE

The pressure of the air supplied by the compressed air system has to exceed the max. pressure required for the system. The capacity of the compressed air system has to be suitable for all systems connected to it. To ensure a constant air flow, you might have to use an accumulator.

9.2.3 Controlling the Downspeed

The speed of the horn is controlled by means of the downspeed controller. If the controller for the downspeed has been set to zero, the actuator does not move.

NOTE

For the initial setup, set the downspeed controller to a low valve, between 5 and 15. To do so, use an adjusting screw at the control button for the downspeed.

9.2.4 Alignment and Height (Horn Path)

The horn carriage moves up and down in the guide rails of the actuator. You can change the position of the actuator at the column. When selecting the distance between the horn and the weld part fixture, make sure that there is sufficient space for servicing tasks (replacing parts, etc.).

- The min. column distance may not be less than 3.175 mm.
- The absolute column distance traveled before touching the weld part may not be more than 95 mm.

Constant welding results are best achieved with column distances of more than 6.35 mm, because in the case of shorter welding distances, as well as during the respective force build-up on the weld part, other components of the welding system can hinder the welding process.

9.2.5 Mechanical Stop

The mechanical stop affects the amount of downward travel the actuator is allowed to have, up to the full stroke length of the unit.

DANGER

At the aodm actuator, the mechanical stop is set by locking an Allen screw. To prevent the thread from being destroyed, you have to loosen the Allen screws.

The multi-turn knurled knob to the right of the stack, on the bottom of the actuator, is the mechanical stop adjustment. On the right of the actuator, there is a display with a user-definable scale for the mechanical stop.

The mechanical stop prevents the horn from touching the weld part fixture if no weld part is present. It is not a precision measuring unit. Therefore you should **NOT** use the mechanical stop as a means to limit the welding distance in the collapse distance or absolute distance modes. You can also use the part detection function to monitor the min. distance between the horn and the weld part fixture.

Initially set the mechanical stop to a horn travel distance of at least 6.35 mm; however all distances that lie within the absolute column distance is suitable.

Setting the mechanical stop

DANGER

If you depressurize the system or activate the drain valve, the actuator might move to a lower position, as the higher position requires constant compressed air. Always keep your hands clear of the area below the horn or other areas where there is danger of getting crushed. Lock the horn in place with a piece of wood or another soft material, to prevent the tool from getting damaged.

1. Activate the manual drain valve and manually move the carriage down until the horn is positioned directly above the weld part fixture.
2. If the horn does not reach the weld part fixture, and has not moved down 100 mm, remove the lock nut and turn the adjusting nut for the stop clockwise until the carriage is in the desired position.
   If the horn reaches the desired position before touching the mechanical stop, turn the nut counterclockwise, until the stop touches the carriage.
3. Check the height of the horn and make changes to the stop, if necessary.
4. After correctly setting the stop, tighten the lock nut. The lock nut prevents the adjusting nuts from being maladjusted during operation, due to vibrations.
5. Insert a weld part, reset the drain valve and perform a test weld.
6. Check whether the full force can be built up between the horn and weld parts. If not, you have to change the setting of the mechanical stop.

NOTE

Due to dynamic follow-through, do not weld in the last 6.35 mm of stroke.

9.2.6 EMERGENCY STOP button

With the EMERGENCY STOP button, you interrupt the operation of the actuator, the current welding process stops immediately and the horn moves back. Pressing the EMERGENCY STOP button does NOT switch off the mains power! At the power supply you can specify that an audible signal is given each time the EMERGENCY STOP button is pressed. If you switch the system to EMERGENCY STOP, a message appears on the display at the front panel of the power supply. To reset the system, turn the EMERGENCY STOP button.

9.2.7 Safety Circuit Alarms

Actuator aed only: The Safety Control System within the actuator constantly monitors the system's safety related components for correct operation. When this system detects a fault condition, operation is interrupted and the system immediately goes to a safe state. A blinking of the power indicator light is used to signal a safety system alarm.

Use the following procedure to troubleshoot safety circuit alarms:

1. Verify that the 9-pin base cable is properly connected to the start connector located on the back of the actuator.
2. Power down and then power up the power supply to reset the system.
3. If the alarm persists, call Branson Support.

9.3 Operating the aod, aed and aodm Actuators

For more detailed information on the control elements of the 2000X aod, aed and aodm actuators, refer to chapter 7. To operate the aod, aed and aodm actuators:

1. If your application has been analyzed by the BRANSON application laboratory, refer to the respective laboratory report for the settings. Else follow the instructions in the operating manual of the 2000X series power supply.
2. Set the mechanical stop to a position that prevents the horn from contacting the weld part fixture. For the relevant information, refer to chapter 9.2.5.
3. In the case of an actuator with base plate, make sure that the EMERGENCY STOP button is not active.
   In the case of actuators without BRANSON base plate, make sure that the EMERGENCY STOP button of the respective signal source is not active.
4. When the weld part has been inserted, press both start switches (two-hand palm buttons) simultaneously, or activate the start mechanism.
5. The horn moves down and touches the weld part.
6. A force builds up between the horn and the weld part. This force activates the load cell.
7. The ultrasonic vibrations start. The power display on the power supply indicates the load, it is normally between 25 and 100%. You can now release the start buttons.
8. The ultrasonic vibrations stop and the horn continue to apply a closing force to the weld part for the duration of the time specified by you as hold time.
9. After completion of the holding cycle, the horn automatically moves back. Thereafter you can remove the weld part from the weld part fixture.
10. Weld several weld parts with the basic configuration to check the results.

If the achieved welding quality does not match your requirements, you can modify the settings based on the results that were achieved, and the values measured by the power gages. Between test welds, only change one setting at a time, until you have achieved a weld with max. strength within as short a time as possible.

10 Operating the aef, aemc and aomc Actuators

WARNING

The 2000 aemc and 2000 aomc actuators are operated by means of the 2000 mc net control computer. Read and adhere to the instructions in the operating manual of the 2000 mc net control computer, EDP no. 011-003-973! Furthermore the information in this chapter applies to the 2000 aemc and 2000 aomc actuators.

10.1 Control Elements of the aef, aemc and aomc Actuators

This text section describes the execution of a welding cycle by means of the 2000X aef, 2000 aemc and 2000 aomc actuators. For more information on configuring and changing settings, refer to the operating manual of the power supply, or, in the case of the 2000 aemc and 2000 aomc actuators, in the operating manual of the 2000 mc net control computer, EDP no. 011-003-973

DANGER

When setting and operating the actuator, pay attention to the following:
Do not reach underneath the horn. Downward force (pressure) and ultrasonic vibrations can cause injuries.
Plastic parts can vibrate in the audible frequency range during the welding process. To prevent injuries, wear hearing protection. A vibrating horn must not make contact with a metal plate or a weld part fixture made of metal.

The 2000X aef actuator is controlled by means of the power supply; the 2000 aemc and 2000 aomc by means of the 2000 mc net control computer.

The actuator sends operating cycle data (speed, force, etc.), status information and alarm information to the power supply. The power supply in turn sends operating parameters to the actuator. These parameters determine when the welding cycles start and stop. During setup, the power supply constantly receives distance, force and pressure data from the actuator. For information on configuration, testing, setup and operation, refer to the operating manual of the 2000X series power supply. In the case of the 2000 aemc and 2000 aomc actuators, please also read and observe the instructions in the operating manual of the 2000 mc net control computer.

DANGER

When you use larger horns, avoid situations in which fingers can get clamped between the horn and the weld part fixture. If you need optional protective equipment, please contact BRANSON +49 (0) 6074 497 - 784.

10.2 Basic Configuration of the aef, aemc and aomc Actuators

The aef actuator is always controlled by means of the power supply; however, the actuator itself also controls some functions. The aemc and aomc actuators are always controlled by means of the 2000 mc net control computer, however, the actuator itself also controls some functions.

This includes the following functions:

- System pressure setting: 60 or 80 psi, factory setting is 60 psi. 60 psi = 414 kPa, approx. 4.14 bar; 80 psi = 552 kPa, approx. 5.52 bar.
- Mechanical stop
- Position and height of the actuator with regard to the weld part fixture (horn path)
- EMERGENCY STOP button at the base plate, and as an EMERGENCY STOP signal from the user interface in the case of automated systems

Each of these functions influences the operation of the actuator.

10.2.1 Regulated Compressed Air and Compressed Air Display

The compressed air is fed to the pressure regulator by means of a drain valve. You can set the pressure with the regulator. The pressure sensor at the front panel of the aef actuator shows the compressed air supply that is present.

If you switch off the compressed air, e.g. by means of the drain valve, the actuator “relaxes”.

DANGER

If you depressurize the system or activate the drain valve, the actuator might move to a lower position, as the higher position requires constant compressed air. Always keep your hands clear of the area below the horn or other areas where there is danger of getting crushed. Lock the horn in place with a piece of wood or another soft material, to prevent the tool from getting damaged.

WARNING

To prevent damage to the interior components of the actuator, do not supply the actuator with electrical energy as long as the pressure sensor at the front panel of the actuator does not indicate that there is pressure. Non-observance of this warning can cause damage to the interior components.

The factory pressure setting of 60 psi is the required value for almost all applications (= 414 kPa, 4.14 bar)**.** The aef actuator has been equipped with a soft start valve that prevents sudden, jarring tool movements when you first apply pressure to the system.

If the required forces do not build up at a system pressure of 60 psi, you might have to increase the system pressure to 80 psi (= 552 kPa, 5.52 bar). To change the pressure, move down the horn and read the pressure. Set the regulator to 80 psi ± 3 psi.

DANGER

If you supply the actuator with compressed air with a regulated max. pressure of more than 100 psi (690 kPa), there is danger of personal injury or permanent damage to the units!

NOTE

**Only set the system pressure to the following values:
60 psi ± 3 psi or 80 psi ± 3 psi. All other values cause an alarm.
To delete an alarm, move the horn down and reset the regulator.**

10.2.2 Compressed Air Supply

Switch on the compressed air supply, and supply the compressed air regulator of the actuator with pressure. To ensure reliable operation of the actuator, set the pressure as follows:

- In the case of 80 psi operation (= 552 kPa, 5.52 bar), use compressed air with 90 psi (= 621 kPa, 6.21 bar).
- In the case of 60 psi operation (= 414 kPa, 4.14 bar), use compressed air with 70 psi (= 483 kPa, 4.83 bar).

The supplied air is also used to supply the converter with cooling air.

In the case of applications that require a higher welding pressure, the compressed air supply can have an influence on the welding results.

NOTE

The pressure of the air supplied by the compressed air system has to exceed the max. pressure required for the system. The capacity of the compressed air system has to be suitable for all systems connected to it. To ensure a constant air flow, you might have to use an accumulator.

WARNING

You may only switch on the electrical energy supply if the compressed air display at the front panel of the actuator indicates that there is system pressure present.

10.2.3 Controlling the Downspeed

The speed of the horn is controlled by means of the downspeed controller. The control function is performed by means of a proportional valve, which you can set by means of the control elements of the ultrasonic power supply. The start setting for the downspeed should be 20 to 25%. You can reduce the downspeed by reducing the percentage setting. If the downspeed is set to 0%, the actuator does not move down.

10.2.4 Dynamic Triggering

The dynamic triggering mechanism is used to determine which value the force applied to the weld part has to achieve before the ultrasonic vibrations are triggered. If the value of this setting is low, only a low force is required. If the value is high, a high force is required. In the default settings, a low value has been specified for the dynamic trigger.

10.2.5 Alignment and Height (Horn Path)

The horn carriage moves up and down in the guide rails of the actuator. You can change the position of the actuator at the column. When selecting the distance between the horn and the weld part fixture, make sure that there is sufficient space for servicing tasks (replacing parts, etc.).

- The min. column distance may not be less than 1/8" (3.175 mm).
- The absolute column distance traveled before touching the weld part may not be more than 3 3/4" (95 mm).

Constant welding results are achieved with column distances of more than 1/4" (6.35 mm). In the case of shorter welding distances, as well as during the respective force build-up on the weld part, other components of the welding system can hinder the welding process.

10.2.6 Mechanical Stop

The mechanical stop affects the amount of downward travel the actuator is allowed to have, up to the full stroke length of the unit. The multi-turn knurled knob to the right of the stack, on the bottom of the actuator, is the mechanical stop adjustment. On the right of the actuator, there is a display with a user-definable scale for the mechanical stop.

The mechanical stop prevents the horn from touching the weld part fixture if no weld part is present. It is not a precision measuring unit. Therefore you should **NOT** use the mechanical stop as a means to limit the welding distance in the collapse distance or absolute distance modes. You can also use the part detection function to monitor the min. distance between the horn and the weld part fixture.

Initially set the mechanical stop to a horn travel distance of at least 1/8" (3.175 mm); however all distances that lie within the absolute column distance is suitable.

Setting the mechanical stop

DANGER

If you depressurize the system or activate the drain valve, the actuator might move to a lower position, as the higher position requires constant compressed air. Always keep your hands clear of the area below the horn or other areas where there is danger of getting crushed. Lock the horn in place with a piece of wood or another soft material, to prevent the tool from getting damaged.

1. Activate the manual drain valve and manually move the carriage down until the horn is positioned directly above the weld part fixture.
2. If the horn does not reach the weld part fixture, and has not moved down 4" (100 mm), remove the lock nut and turn the adjusting nut for the stop clockwise until the carriage is in the desired position. If the horn reaches the desired position before touching the mechanical stop, turn the nut counterclockwise, until the stop touches the carriage.
3. Check the height of the horn and make changes to the stop, if necessary.
4. After correctly setting the stop, tighten the lock nut. The lock nut prevents the adjusting nuts from being maladjusted during operation, due to vibrations.
5. Insert a weld part, reset the drain valve and perform a test weld.

6. Check whether the full force can be built up between the horn and weld parts. If not, you have to change the setting of the mechanical stop.

NOTE

Due to dynamic follow-through, do not weld in the last 6.35 mm of stroke.

10.2.7 EMERGENCY STOP Button

With the EMERGENCY STOP button, you interrupt the operation of the actuator, the current welding process stops immediately and the horn moves back. Pressing the EMERGENCY STOP button does NOT switch off the mains power! At the power supply you can specify that an audible signal is given each time the EMERGENCY STOP button is pressed. If you switch the system to EMERGENCY STOP, a message appears on the display at the front panel of the power supply. To reset the system, turn the EMERGENCY STOP button.

10.2.8 Safety Circuit Alarms

Actuator aef only: The Safety Control System within the actuator constantly monitors the system's safety related components for correct operation. When this system detects a fault condition, operation is interrupted and the system immediately goes to a safe state. A blinking of the power indicator light is used to signal a safety system alarm.

Use the following procedure to troubleshoot safety circuit alarms:

1. Verify that the 9-pin base cable is properly connected to the start connector located on the back of the actuator.
2. Power down and then power up the power supply to reset the system.
3. If the alarm persists, call Branson Support.

10.3 Operating the aef, aemc and aomc Actuators

For more detailed information on the control elements of the aef, aemc and aomd actuators, refer to chapter 7.

To operate the aef actuator:

1. If your application has been analyzed by the BRANSON application laboratory, refer to the respective laboratory report for the settings. Else follow the instructions in the operating manual of the 2000X series power supply.
2. Set the mechanical stop to a position that prevents the horn from contacting the weld part fixture. For the relevant information, refer to chapter 10.2.6.
3. In the case of an actuator with base plate, make sure that the EMERGENCY STOP button is not active.
   In the case of actuators without BRANSON base plate, make sure that the EMERGENCY STOP button of the respective signal source is not active.
4. When the weld part has been inserted, press both start switches (two-hand palm buttons) simultaneously, or activate the start mechanism.
5. The horn moves down and touches the weld part.
6. A force builds up between the horn and the weld part. This force activates the load cell.
7. The ultrasonic vibrations start. The power display on the power supply indicates the load, it is normally between 25 and 100%. You can now release the start buttons.
8. The ultrasonic vibrations stop and the horn continue to apply a closing force to the weld part for the duration of the time specified by you as hold time.
9. After completion of the holding cycle, the horn automatically moves back. Thereafter you can remove the weld part from the weld part fixture.
10. Weld several weld parts with the basic configuration to check the results.

If the achieved welding quality does not match your requirements, you can modify the settings based on the results that were achieved, and the values measured by the power gages. Between test welds, only change one setting at a time, until you have achieved a weld with max. strength within as short a time as possible.

11 Maintenance

WARNING

The devices have to be serviced once a year, else the warranty becomes void.

11.1 Calibration

This product does not have to be calibrated regularly. However, if your application does need regular calibration, for example because specific regulations have to be complied with, please contact your BRANSON representative.

11.2 Maintenance

DANGER

Only authorized personnel may carry out installation and maintenance work on the unit!
Improper operation and maintenance of the unit may be hazardous to persons, objects, and the environment.

WARNING

Prior to performing any maintenance tasks, read and observe the safety instructions in chapter 2.1 and chapter 2.3!

The following preventative measures lengthen the service life of BRANSON's 2000 series units.

11.2.1 Regularly Cleaning the Units

At regular intervals, disconnect the ultrasonic power supply from the mains power, take off the cover and remove dust and other foreign objects that have accumulated. Remove particles that are clinging to the circuit boards, air inlets and outlets. Disconnect the compressed air lines from the compressed air supply at the actuator, open the air filter and clean the filter and the case with mild soap and water. You can clean the outside of the unit with a damp sponge or cloth and a solution of mild soap and water. Make sure that no cleaning solution penetrates into the case. To prevent oxidation in environments with high humidity, cover exposed steel surfaces such as handles, hardware and the main column with a thin film of oil, for example WD-40, if necessary.

11.2.2 Renewing the Stack (Converter, Booster and Horn)

If the mating surfaces are in a good condition, the stack components work with highest efficiency. In the case of 20 and 30 kHz products, you have to install BRANSON Mylar® washers between the horn and the booster, as well as between the horn and converter. Replace the washers if they are worn or perforated. Check the stack and Mylar® washers every three months.

Stacks where silicon grease is used, for example some 20 kHz installations and all 40 kHz products, have to be renewed regularly to prevent vibration fretting. Every two weeks, check stacks that have been smeared with silicon grease for corrosion. Depending on experience gathered with specific stacks, the inspection intervals can be shorter or longer. The BRANSON operating manuals contain precise details on renewing the mating surfaces.

NOTE

If the mating surfaces between the converter, booster and horn are uneven or corroded, or if they do not make contact well, the performance of the unit is considerably diminished. If the mating surfaces do not make contact properly, part of the power output is lost and the tuning process becomes more difficult. More noise and heat is generated, and there is danger of damaging the converter.

Renewing the mating surfaces:

1. Remove the stack from the actuator.
2. Take apart the stack, which consists of converter, booster and horn.

Observe the following rules: If you have to disassemble a stack, always use the correct wrench and a matching vise with soft clamping jaws when removing the horn or booster. To assemble, reverse the disassembly steps.

WARNING

NEVER attempt to remove a horn or booster by clamping the converter case or the booster's locking ring in a vise.

NOTE

To remove square or rectangular horns, or horns that cannot be removed by other means, use a vise with soft clamping jaws and perform the steps described in chapter 5.6 in the reverse order.

3. Wipe the surfaces with a clean cloth or paper wipe.
4. Examine all mating surfaces. Mating surfaces that show signs of corrosion or black, hard deposits have to renewed.
5. If the mating surfaces are in a good condition, proceed with step 13.
6. If necessary, remove all horn screws.
7. Use adhesive tape to attach a clean emery cloth, with a grit of 400 or finer, on an even, smooth surface, for example a glass plate.
8. Hold the component that you wish to renew at its lower end, and carefully lap the component by rubbing it over the emery cloth in one direction. Do not apply any pressure; the weight of the component provides enough pressure.
9. Lap the component across the emery cloth again. Turn the component one third of a rotation and lap it across the cloth twice.

NOTE

Only lap the component across the cloth twice per position. Lap it across the cloth the same amount of times at each position.

10. Turn the component another third of a rotation and repeat the procedure (lapping).
11. Again examine the mating surfaces and repeat steps 8, 9 and 10 until the surfaces are clean and smooth. For each component to be renewed, repeating the procedure above 2 or 3 times should be sufficient.
12. Clean the tapped bore with a clean cloth or paper wipe.

13. If the screw has been removed, replace it with a new one. Tighten the 3/8-24 screws to a torque of 32.77 Nm. Tighten the ½-20 screws to a torque of 50.84 Nm and the M8 x 1-1/4 screws to a torque of 7.9 Nm.

NOTE

We recommend that you use a BRANSON torque wrench or an equivalent wrench. EDP no. 101-063-617 for 20 kHz systems and 101-063-618 for 40 kHz systems.

WARNING

If you do not adhere to the prescribed torques, the screw could become loose or break, which would cause a system overload. It is recommended that you use a BRANSON torque wrench or an equivalent wrench.

14. Reassemble the stack in accordance with the instructions in chapter 5.6 of this operating manual, and reinstall it in the actuator.

11.2.3 Scheduled Component Replacements

The service life of some components depends on the number of cycles that the unit has completed, or the operating hours. Refer to table 11-1 for the average number of cycles used for determining the appropriate time to replace a component. The operating temperature also influences the service life of the components. The higher the temperature, the lower the number of possible cycles or operating hours. The specifications in the following table is based on an operating temperature of 22 to 24 °C.

The service life of the pneumatic components is influenced by the quality of the supplied compressed air. All BRANSON systems need dry, clean (normal) compressed shop air. Oil particles or humidity in the air shortens the service life of the parts. The values in the table are based on an air supply of average quality.

Tab. 11-1 Exchanging Components

After 20 million cycles	Start button at base plate
	Air cylinder
	Proportional valve
After 40 million cycles	Solenoid valves
	Pressure regulator
	Air filter
	Hydraulic restrictor
	Cooling valve

For your information:

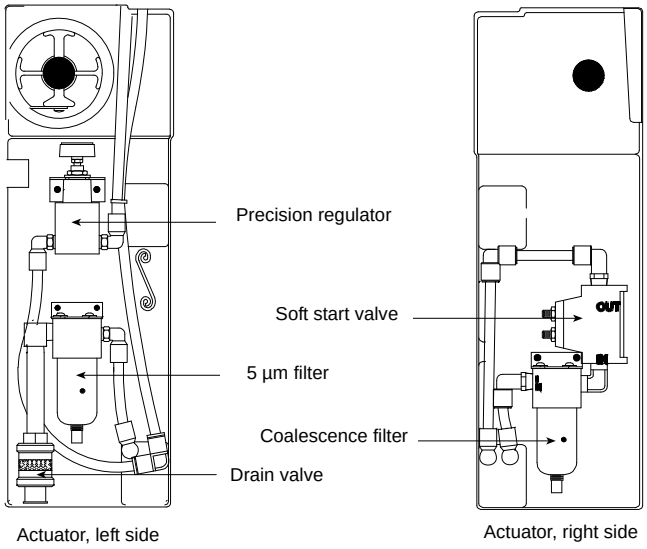
1. If a system performs 60 welds per minute, for 8 hours per day, 5 days per week, 50 weeks per year, a cycle count of 7.2 million and an operating time of 2000 hours are achieved.
2. If the same system is used 24 hours per day, 5 days per week, 50 weeks per year, it will have completed 21.6 million cycles and 6000 operating hours.
3. Running the system 365 days per year, 24 hours per day, means 31.5 million cycles in 8760 hours.

Please take note that parts replaced during maintenance are subject to normal wear and tear. There is no guaranty on these parts.

WARNING

Before you can exchange the filter elements, you have to make sure that the filter case is OK. To prevent an air supply failure, you have to insert the 5 µm filter and the coalescence filter into the respective case. See fig. 11-1.

Fig. 11-1 Component layout



For information on positioning the filter at the square column, see fig. 3-8.

11.3 Parts lists

The following table lists the components and replacement parts that are available for the 2000 series actuators.

NOTE

When ordering cylinders, please pay attention to the diameter specifications at the protective cover of the actuator.

11.3.1 Accessories and Replacement Parts for the ao Actuator

Tab. 11-2 Accessories for the ao actuator

Description	EDP no.
ao actuator with cylinder with 1.5 inch (38.1 mm) diameter	101-134-157
ao actuator with cylinder with 2 inch (50.8 mm) diameter	101-134-134
ao actuator with cylinder with 2.5 inch (63.5 mm) diameter	101-134-272
ao actuator with cylinder with 3 inch (76.2 mm) diameter	101-134-274
aol actuator with cylinder with 2.5 inch (63.5 mm) diameter	101-134-273
aol actuator with cylinder with 3 inch (76.2 mm) diameter	101-134-275
Remote pneumatic control unit (RP)	101-134-108
Remote pneumatic control unit (low force) for 1.5 inch (38.1 mm) and 2 inch (50.8 mm) diameter	101-134-1350
RP actuator mount kit [mount kit for attaching the RP (remote pneumatic control unit) on the left or right of the actuator]	101-063-1351
Encoder kit	101-063-552
Clean air kit	101-063-551
AE/AO drain valve	100-246-952
Ball of the leveling plate, adapts the 2000 M plate to the inch plate	100-298-076
Metric leveling plate	101-063-444
Actuator converter CJ20 in the actuator	101-135-059
Actuator converter CA30	159-134-114
30 kHz adapter for CA30	100-087-283
Actuator converter 4TJ in the actuator	101-135-041
40 kHz adapter (as for 900)	100-246-612
Base plate, 6.35 mm, fixture	100-246-1038
Flange, 12.7 mm, fixture	100-246-1344

Description	EDP no.
Ergonomic base plate, 102 mm, metric, black	100-246-1311
Flange, 2000 for 102 mm round column	101-063-583
102 mm adapter, light grey	100-246-1035
Round column, 122 mm, 1200 mm x 6.35 mm wall thickness	100-028-021
Round column, 122 mm, 1016 mm x 6.35 mm wall thickness	100-028-017
Round column, 122 mm, 1016 mm x 12.7 mm wall thickness (optional)	100-028-011
Round column, 183 mm, 1016 mm x 12.7 mm wall thickness (optional)	100-028-012
Adapter, 6.35 mm wall thickness	100-094-159
Adapter, 12.7 mm wall thickness	100-094-102
900 series boosters, 1/2-20 input, 1/2-20 output	
Black (Ti), amplification 1:2.5	101-149-120
Silver (Ti), amplification 1:2	101-149-121
Gold (Ti), amplification 1:1.5	101-149-122
Green (Ti), amplification 1:1	101-149-123
Purple (Ti), amplification 1:0.6	101-149-060
Silver (Al), amplification 1:2	101-149-053
Gold (Al), amplification 1:1.5	101-149-052
Green (Al), amplification 1:1	101-149-051
Purple (Al), amplification 1:0.6	101-149-055
Solid mount boosters - 20 kHz - 1/2-20 input, 1/2-20 output	
Black (Ti), amplification 1:2.5	101-149-099
Silver (Ti), amplification 1:2	101-149-098
Gold (Ti), amplification 1:1.5	101-149-097
Green (Ti), amplification 1:1	101-149-096
Purple (Ti), amplification 1:0.6	101-149-095
Booster 30 kHz	
Black (Ti), amplification 1:2.5	159-149-120
Silver (Ti), amplification 1:2.0	159-149-121
Gold (Ti), amplification 1:1.5	159-149-122
Green (Ti), amplification 1:1.0	159-149-123

Description	EDP no.
Booster - 40 kHz (same as XL: 8 mm)	
Black (Ti), amplification 1:2.5	101-149-084
Silver (Ti), amplification 1:2.0	101-149-083
Gold (Ti), amplification 1:1.5	101-149-086
Green (Ti), amplification 1:1	101-149-085
Black (Al), amplification 1:2.5	101-149-082
Silver (Al), amplification 1:2.0	101-149-081
Gold (Al), amplification 1:1.5	101-149-080
Green (Al), amplification 1:1	101-149-079
Purple (Al), amplification 1:0.6	101-149-087
Solid mount boosters - 40 kHz (same as XL: 8 mm)	
Black (Ti), amplification 1:2.5	109-041-174
Silver (Ti), amplification 1:2.0	109-041-175
Gold (Ti), amplification 1:1.5	109-041-176
Green (Ti), amplification 1:1.0	109-041-177
Purple (Ti), amplification 1:0.6	109-041-178

Tab. 11-3 Replacement Parts for the ao Actuator

Description	EDP no.
HF cable set	100-246-1282
TRS HF cable set (only with dynamic trigger)	100-246-923
HF cable set, aol/aodl	100-246-1003
HF contact block	100-246-909
HF connection plug	100-246-932
Switch at the protective cover	100-246-890
Dynamic trigger kit	100-246-697
Valve for converter cooling	100-246-896
Solenoid valve	100-246-901
Regulator for the downspeed (flow control) for cylinder diameters of 2.5 inch (63.5 mm) and 3 inch (76.2 mm) cylinder diameter	100-246-1309
Regulator for downspeed (flow control, low force), for 1.5 inch (38.1 mm) and 2 inch (50.8 mm) cylinder diameter	100-246-1310
2000 ao distributor	102-242-277
Upper limit switch kit	100-241-181

Operation indicator kit	100-246-924
2000 series carriage	100-018-039
TRS Harness	100-246-1283
Air cylinder AE/AO - 1.5 inch (38.1 mm) diameter	100-246-600
Air cylinder AE/AO - 2 inch (50.8 mm) diameter	100-246-778
Air cylinder AE/AO - 2.5 inch (63.5 mm) diameter	100-246-562
Air cylinder AE/AO - 3 inch (76.2 mm) diameter	100-246-559
Air cylinder AE/AO - 82.6 mm diameter	100-246-935
Air cylinder AOL/AODL - 2 inch (50.8 mm) diameter	100-246-926
Air cylinder AOL/AODL - 3 inch (76.2 mm) diameter	100-246-934
Protective cover (plastic)	100-037-026
Protective cover (metal)	100-037-025
Cover - AO/AOD actuator	100-032-357
Damper at limit stop	100-013-018
Bolt kit M6 x 6	200-298-102
Return spring	100-095-139
Regulator kit	100-246-553
Manometer kit	100-246-554
HF connection plug kit	100-246-932
Light barrier - upper limit stop	200-099-190
Slide bearing	200-003-080
Pin	200-078-146
Transport eyebolt	200-298-027
Carriage	100-018-039
Screw at the protective cover	100-298-242
Contact block	100-246-909
Ground spring	100-095-024
Sub-D plug	200-063-195
Start switch	200-099-236
EMERGENCY STOP button	200-099-237
Mechanical stop	
Threaded rod	100-089-066
Slot nut	100-006-197
Sliding film	100-062-105
Pressure spring	200-095-138
Washer #8	200-114-013
Washer M6	200-114-114
Limit screw of mechanical stop	100-073-187
Counternut of mechanical stop	100-073-188
Setting screw of the mechanical stop	100-064-054

11.3.2 Accessories and Replacement Parts for the ae Actuator

Tab. 11-4 Accessories for the ae actuator

Description	EDP no.
ae actuator with 1.5 inch (38.1 mm) diameter	101-134-156
ae actuator with 2 inch (50.8 mm) diameter	101-134-124
ae actuator with 2.5 inch (63.5 mm) diameter	101-134-121
ae actuator with 3 inch (76.2 mm) diameter	101-134-104
Protective panel for large horns	101-063-550
Encoder kit	101-063-552
Clean air kit	101-063-551
AE/AO drain valve	100-246-952
Ball of the leveling plate, adapts the 2000 M plate to the inch plate	100-298-076
Metric leveling plate	101-063-444
Converter CJ20 in the actuator	101-135-059
Converter CA30	159-134-114
Converter 4TJ (in actuator)	101-135-041
40 kHz adapter (as for 900)	100-246-612
Base plate, 12.7 mm, fixture	100-246-1314
Flange, 12.7 mm, fixture	100-246-1344
Ergonomic base plate, 102 mm, metric, black	100-246-1311
Flange, 2000 for 102 mm round column	101-063-583
102 mm adapter, light grey	100-246-1035
Round column, 122 mm, 1200 mm x 6.35 mm wall thickness	100-028-021
Round column, 122 mm, 1016 mm x 6.35 mm wall thickness	100-028-017
Round column, 122 mm, 1016 mm x 12.7 mm wall thickness (optional)	100-028-011
Round column, 183 mm, 1016 mm x 12.7 mm wall thickness (optional)	100-028-012
Adapter, 6.35 mm wall thickness	100-094-159
Adapter, 12.7 mm wall thickness	100-094-102
900 series booster: See information on ao actuator, table 11-2	

Tab. 11-5 Replacement Parts for the ae Actuator

Description	EDP no.
HF cable set	100-246-1282

HF contact block	100-246-909
HF connection plug	100-246-932
Linear encoder	100-143-161
Slide bearing	200-003-080
Threaded rod	100-089-066
Switch at the protective cover	100-246-890
Dynamic triggering	100-246-697
Valve for converter cooling	100-246-896
Solenoid valve	100-246-901
Regulator for the downspeed (flow control) for cylinder diameters of 1.5 inch (38.1 mm) and 2 inch (50.8 mm) cylinder diameter	100-246-1310
Regulator for the downspeed (flow control) for cylinder diameters of 2.5 inch (63.5 mm) and 3 inch (76.2 mm) cylinder diameter	100-246-1309
Distributor kit	100-242-277
Upper limit switch kit	100-241-181
Operation indicator kit	100-246-924
2000 series carriage	100-018-039
Air cylinder AE/AO - 1.5 inch (38.1 mm) diameter	100-246-600
Air cylinder AE/AO - 2 inch (50.8 mm) diameter	100-246-778
Air cylinder AE/AO - 2.5 inch (63.5 mm) diameter	100-246-562
Air cylinder AE/AO - 3 inch (76.2 mm) diameter	100-246-559
Air cylinder AE/AO - 3.25 inch (82.6 mm) diameter	100-246-859
Protective cover (plastic)	100-037-026
Protective cover (metal)	100-037-035
Cover AE/AED actuator, right	100-032-444
Cover AE/AED actuator, left	100-032-445
Pin	200-078-146
Screw at the protective cover	100-098-242
Ground spring	100-095-024
Start plug	200-099-236
EMERGENCY STOP button	200-099-237
Damper at limit stop	200-013-018
Bolt kit M6 x 6	200-298-102
Return spring	100-095-139
Regulator kit	100-246-553
Manometer kit	100-246-554
HF connection plug kit	100-246-932
Light barrier - upper limit stop	200-099-190
Mechanical stop	
Threaded rod	100-089-066

Slot nut	100-006-197
Sliding film	100-062-105
Pressure spring	200-095-138
Washer #8	200-114-013
Washer M6	200-114-114
Limit screw of mechanical stop	100-073-187
Counternut of mechanical stop	100-073-188
Setting screw of the mechanical stop	100-064-054

11.3.3 Accessories and Replacement Parts for the aod, aodl and aomc Actuators

Tab. 11-6 Accessories for the aod, aodl and aomc actuators

Description	EDP no.
aod actuator with 2 inch (50.8) diameter	101-134-146
aod actuator with 2.5 inch (63.5 mm) diameter	101-134-145
aod actuator with 3 inch (76.2 mm) diameter	101-134-144
aodl actuator with 2.5 inch (63.5 mm) diameter	101-134-273
aodl actuator with 3 inch (76.2 mm) diameter	101-134-275
RP package (requires PLA and J924 cable)	101-134-108
RP actuator mount kit [mount kit for attaching the RP (remote pneumatic control unit) on the left or right of the actuator]	101-063-547
Protective panel for large horns	101-063-550
Remote pneumatic control unit	101-134-108
Remote pneumatic control unit (low force) for 1.5 inch (38.1 mm) and 2 inch (50.8 mm) diameter	101-134-182
Encoder kit	101-063-552
Clean air kit	101-063-551
AE/AO drain valve	100-246-952
Ball of the leveling plate, adapts the 2000 M plate to the inch plate	100-298-076
Metric leveling plate	101-063-444
Converter CJ20 in the actuator	101-135-059
Converter CA30	159-134-114
Converter 4TJ in the actuator	101-135-041
40 kHz adapter (as for 900)	100-246-612
Base plate, 6.35 mm, fixture	100-246-1314
Stand (stroke), 6.35 mm, fixture	100-246-1344
Ergonomic base plate, 102 mm, metric, black	100-246-1311
Flange, 2000 for 102 mm round column	101-063-583
102 mm adapter, light grey	100-246-1035
Round column, 122 mm, 1200 mm x 6.35 mm wall thickness	100-028-021
Round column, 122 mm, 1016 mm x 6.35 mm wall thickness	100-028-017
Round column, 122 mm, 1016 mm x 12.7 mm wall thickness (optional)	100-028-011
Round column, 183 mm, 1016 mm x 12.7 mm wall thickness (optional)	100-028-012
Adapter, 6.35 mm wall thickness	100-094-159
Adapter, 12.7 mm wall thickness	100-094-102
900 series boosters, see information on ao actuator, table 11-2	

Description	EDP no.
Solid mount boosters - 40 kHz (same as XL: 8 mm)	
Black (Ti), amplification 1:2.5	109-041-174
Silver (Ti), amplification 1:2.0	109-041-175
Gold (Ti), amplification 1:1.5	109-041-176
Green (Ti), amplification 1:1.0	109-041-177
Purple (Ti), amplification 1:0.6	109-041-178

Tab. 11-7 Replacement parts for the aod, aodl and aomc actuators

Description	EDP no.
Linear encoder	100-143-161
HF cable set	100-246-1282
HF cable set, aol/aodl	100-246-1003
HF contact block	100-246-909
HF connection plug	100-246-932
Switch at the protective cover	100-246-1276
S-Beam Load Cell Assembly	100-246-891
Valve for converter cooling	100-246-896
Solenoid valve	100-246-901
Regulator for the downspeed (flow control) for cylinder diameters of 2.5 inch (63.5 mm) and 3 inch (76.2 mm) cylinder diameter	100-246-1309
Regulator for the downspeed (flow control, low force) for cylinder diameters of 1.5 inch (38.1 mm) and 2 inch (50.8 mm) cylinder diameter	100-246-1310
Interface kit	102-242-388
Upper limit switch kit	100-241-181
Operation indicator kit	100-246-924
2000X series carriage	100-018-039
Air cylinder AED/AOD - 1.5 inch (38.1 mm) diameter	100-246-859
Air cylinder AED/AOD - 2 inch (50.8 mm) diameter	100-246-858
Air cylinder AED/AOD - 2.5 inch (63.5 mm) diameter	100-246-576
Air cylinder AED/AOD - 3 inch (76.2 mm) diameter	100-246-573
Air cylinder AED/AOD - 82.6 mm diameter	100-246-935
Air cylinder AOL/AODL - 2.5 inch (63.5 mm) diameter	100-246-926
Air cylinder AOL/AODL - 3 inch (76.2 mm) diameter	100-246-934
Protective cover (plastic)	100-037-026
Protective cover (metal)	100-037-035
Cover - AO/AOD actuator	100-032-357
Damper at limit stop	200-013-018
Bolt kit M6 x 6	200-298-102

Return spring	100-095-139
Regulator kit	100-095-152
Manometer kit	100-246-553
HF connection plug kit	100-246-554
Light barrier - upper limit stop	200-099-190
Slide bearing	200-003-080
Pin	200-078-146
Transport eyebolt	200-298-027
Carriage	100-018-039
Protective cover	100-037-026
Screw at the protective cover	100-298-242
Ground spring	100-095-024
Sub-D plug	200-063-195
Start plug	200-099-236
EMERGENCY STOP button	200-099-237
Mechanical stop	
Threaded rod	100-089-066
Slot nut	100-006-197
Sliding film	100-062-105
Pressure spring	200-095-138
Washer #8	200-114-013
Washer M6	200-114-114
Limit screw of mechanical stop	100-073-187
Counternut of mechanical stop	100-073-188
Setting screw of the mechanical stop	100-064-054

11.3.4 Replacement Parts for the aomc Actuator

Tab. 11-8 Replacement parts of the 40 kHz aomc Micro actuator EDP no. 011 005 100

Part	EDP no.
Upper limit switch	149-246-1195
Force sensor	209-143-148
Return spring	109-095-162
Carriage	109-018-037
Damper	209-013-021
HF contact block	149-246-1132
Cylinder	149-246-1183
Linear encoder (without contact)	109-143-147
Manometer	149-246-1192
Solenoid valve	011-003-401
Interface cable	011-004-020
Measuring amplifier	209-250-005
Door at the carriage	109-037-033
HF wiring harness	149-246-1188
Mechanical limit stop	109-089-067
Proportional valve	100-246-921
Fuse holder	200-050-018
0.5 A fuse	200-049-003

11.3.5 Accessories and Replacement Parts for the ad Actuator

Tab. 11-9 Accessories for the aed actuator

Description	EDP no.
aed actuator with 1.5 inch (38 mm) diameter	101-134-252
aed actuator with 2 inch (50.8 mm) diameter	101-134-253
aed actuator with 2.5 inch (63.5 mm) diameter	101-134-256
aed actuator with 3 inch (76.2 mm) diameter	101-134-259
Protective panel for large horns	101-063-550
Encoder kit	101-063-552
Clean air kit	101-063-551
AE/AO drain valve	100-246-952
Ball of the leveling plate, adapts the 2000 M plate to the inch plate	100-298-076
Metric leveling plate	101-063-444
Converter CJ20 in the actuator	101-135-059
Converter CA30	159-134-114
Converter 4TJ in the actuator	101-135-041
40 kHz adapter (as for 900)	100-246-612
Base plate, 12.7 mm, fixture	100-246-1314
Flange, 12.7 mm, fixture	100-246-1344
Ergonomic base plate, 102 mm, metric, black	100-246-1311
Flange, 2000 for 102 mm round column	101-063-583
102 mm adapter, light grey	100-246-1035
Round column, 122 mm, 1200 mm x 6.35 mm wall thickness	100-028-021
Round column, 122 mm, 1016 mm x 6.35 mm wall thickness	100-028-017
Round column, 122 mm, 1016 mm x 12.7 mm wall thickness (optional)	100-028-011
Round column, 183 mm, 1016 mm x 12.7 mm wall thickness (optional)	100-028-012
Adapter, 6.35 mm wall thickness	100-094-159
Adapter, 12.7 mm wall thickness	100-094-102
900 series boosters, see information on ao actuator, table 11-2	

Tab. 11-10 Replacement parts for the aed actuator

Description	**EDP no.**
Linear encoder	100-143-161
HF cable set	100-246-1282
HF contact block	100-246-909
HF connection plug	100-246-932
Switch at the protective cover	100-246-890
Screw at the protective cover	100-298-242
S-Beam Load Cell Assembly	100-246-1276
Valve for converter cooling	100-246-896
Solenoid valve	100-246-901
Regulator for downspeed (flow control)	100-246-1310
Interface kit	102-242-619
Upper limit switch kit	100-241-181
Operation indicator kit	100-246-924
2000 series carriage	100-018-039
TRS Harness	100-246-1283
Air cylinder AED/AOD - 1.5 inch (38.1 mm) diameter	100-246-859
Air cylinder AED/AOD - 2 inch (50.8 mm) diameter	100-246-858
Air cylinder AED/AOD - 2.5 inch (63.5 mm) diameter	100-246-576
Air cylinder AED/AOD - 3 inch (76.2 mm) diameter	100-246-573
Air cylinder AED/AOD - 82.6 mm diameter	100-246-859
Protective cover (metal)	100-037-035
Cover AE/AED actuator	100-032-444
Cover AE/AED actuator	100-032-445
Slide bearing	200-003-080
Pin	200-078-146
Transport eyebolt	200-298-027
Carriage	100-018-039
Ground spring	100-095-024
Sub-D plug	200-063-195
Start plug	200-099-236
EMERGENCY STOP button	200-099-237
Damper at limit stop	200-013-018
Bolt kit M6 x 6	200-298-102
Return spring	100-095-139
Regulator kit	100-246-553
Manometer kit	100-246-554
HF connection plug kit	100-246-932
Light barrier - upper limit stop	200-099-190

Tab. 11-10 Replacement parts for the aed actuator

Description	**EDP no.**
Mechanical stop	
Threaded rod	100-089-066
Slot nut	100-006-197
Sliding film	100-062-105
Pressure spring	200-095-138
Washer #8	200-114-013
Washer M6	200-114-114
Limit screw of mechanical stop	100-073-187
Counternut of mechanical stop	100-073-188
Setting screw of the mechanical stop	100-064-054

11.3.6 Accessories and Replacement Parts for the ae and aemc Actuators

Tab. 11-11 Accessories for the aef and aemc actuators

Description	EDP no.
aef actuator with 2 inch (50.8 mm) diameter	101-134-126
aef actuator with 3 inch (76.2 mm) diameter	101-134-106
Encoder kit	101-063-552
Clean air kit	101-063-551
Ball of the leveling plate, adapts the 2000 M plate to the inch plate	100-298-076
Metric leveling plate	101-063-444
Converter CJ20 in the actuator	101-135-059
Converter CA30	159-134-114
Converter 4TJ in the actuator	101-135-041
40 kHz adapter (as for 900)	100-246-612
Base plate, 6.35 mm, fixture	100-246-929
Flange, 12.7 mm, fixture	100-246-1062
Ergonomic base plate, 102 mm, metric, black	100-246-1311
Flange, 2000 for 102 mm round column	101-063-583
102 mm adapter, light grey	100-246-1035
Round column, 122 mm, 1200 mm x 6.35 mm wall thickness	100-028-021
Round column, 122 mm, 1016 mm x 6.35 mm wall thickness	100-028-017
Round column, 122 mm, 1016 mm x 12.7 mm wall thickness (optional)	100-028-011
Round column, 183 mm, 1016 mm x 12.7 mm wall thickness (optional)	100-028-012
Adapter, 12.7 mm wall thickness	100-094-102
900 series boosters, see information on ao actuator, table 11-2	

Tab. 11-12 Replacement parts for the aef and aemc actuators

Description	EDP no.
Linear encoder	100-143-161
HF cable set	100-246-1282
HF contact block	100-246-909
HF connection plug	100-246-932
Switch at the protective cover	100-246-890
Screw at the protective cover	100-098-242
S-Beam Load Cell Assembly	100-246-1276
Valve for converter cooling	100-246-896
Solenoid valve	100-246-901
Proportional valve	100-246-920
Delay valve for aef/aof	100-246-908
Delay valve [drain valve]	200-113-077
Interface	102-242-279
Upper limit switch kit	100-241-181
Operation indicator kit	100-246-924
Air cylinder aef - 2 inch (50.8 mm) diameter	100-246-1129
Air cylinder aef - 3 inch (76.2 mm) diameter	100-246-1130
Protective cover (metal)	100-037-035
Cover, aef actuator	100-032-356
Pin	200-078-146
Transport eyebolt	200-298-027
Carriage	100-018-039
Ground spring	100-095-024
Sub-D plug	200-063-195
Start plug	200-099-236
EMERGENCY STOP kit	101-063-497
Damper at limit stop	100-013-019
Bolt kit M6 x 6	200-298-102
Return spring	100-095-139
Manometer	100-246-903
HF connection plug kit	100-246-932P
Light barrier - upper limit stop	200-099-190
Proportional valve	200-113-076
Proportional valve	100-246-921
Pressure regulator	200-083-024
Soft start valve	200-113-078
Filter case, 5 µm filter, SMC	NAF2000-NO2-C*
Filter case, coalescence filter, SMC	NAFM2000-NO2-C*
Coalescence filter element, SMC	630611*

Coalescence filter element, Watt	F501H*
Filter, 5 µm particle, SMC	1129116A*
Filter, 5 µm particle, Watt	EK504VY*
Mechanical stop	
Threaded rod	100-089-066
Slot nut	100-006-197
Sliding film	100-062-105
Pressure spring	200-095-138
Washer #8	200-114-013
Washer M6	200-114-114
Limit screw of mechanical stop	100-073-187
Counternut of mechanical stop	100-073-188
Setting screw of the mechanical stop	100-064-054

* = Article with part number of the original manufacturer

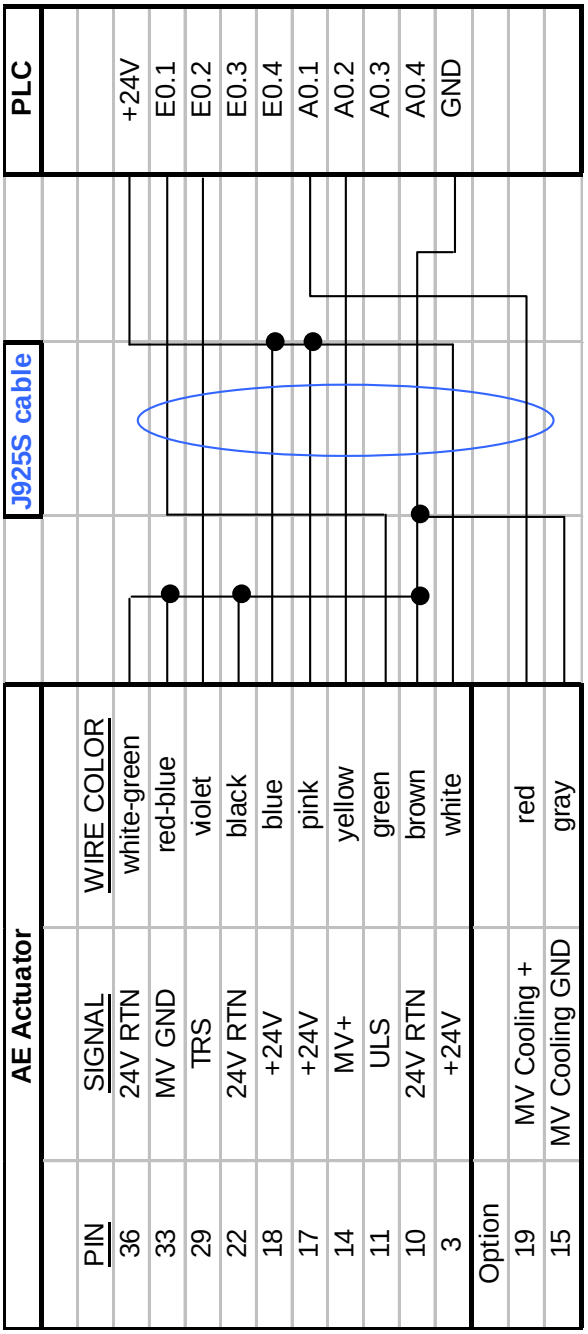
11.3.7 Accessories and Replacement Parts for the aodm Actuator

Tab. 11-13 Spare parts list

Description	EDP No.
Guide carriage with guide rail	109-003-085
Upper limit switch	149-246-1195
Force measurement	209-143-148
Return spring	109-095-162
Shock absorber	209-013-021
HF contact block	149-246-1132
Air cylinder	149-246-1183
Measuring amplifier, 220 V	209-250-005
Linear encoder (without contact)	109-143-147
Main support	109-155-104
Regulator (precision)	149-246-1240
Pressure display, pneumatic system	149-246-1192
Solenoid valve	149-246-1182
Interface card	102-242-388
Flow control valve	149-246-1273

12 Appendix: Signal flow chart

Fig. 12-1



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