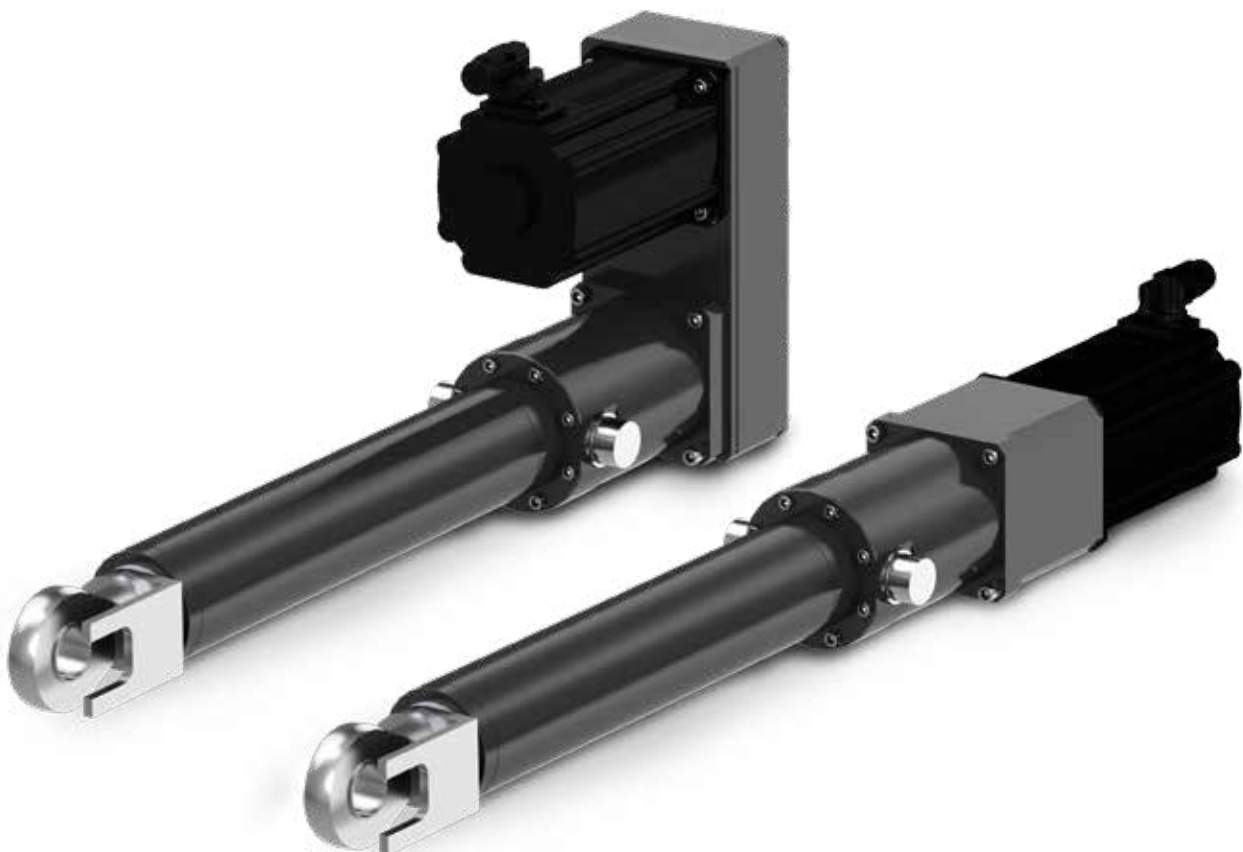


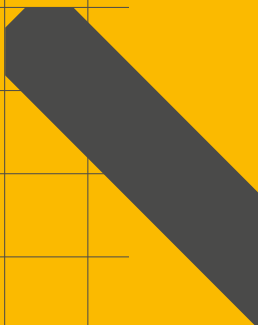
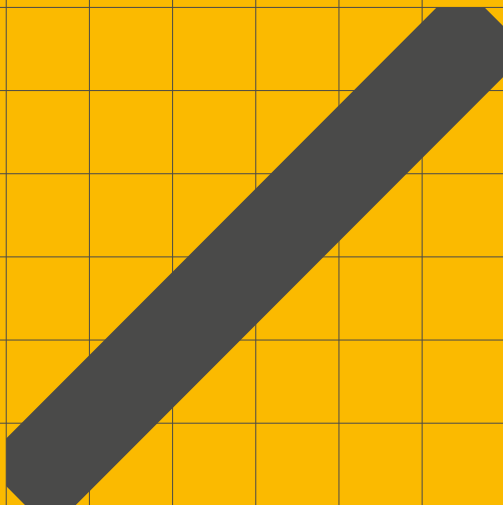
EWELLIX

MAKERS IN MOTION

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Electric cylinders SRSA, SVSA and SLSA





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1.0 Introduction – general safety instructions

1.1 Structure of safety instructions

To best warn the user, depending on the nature of the danger, safety instructions will be written as follows.

1.2 Manual use

This manual gives information and advice for the commissioning and maintenance of Ewellix modular cylinders from the SRSA, SLSA, SVSA range of products that will minimize the risk of injury and property damage.

This document is intended for all persons who are involved with the installation, commissioning or maintenance of these products.



NOTE

In the electronic document, hypertext links have been created to allow faster browsing inside the manual. To use these, please press CTRL key and while CTRL key is pressed, click on the hypertext link. To come back, please press ALT key and while ALT key is pressed, press on “left arrow” key. Generally, all titles from table of contents are hypertext links. All other hypertext links are pointed out in blue.

DANGER

Indicates an imminently hazardous situation. If precautionary measures aren't taken, it could result in death, serious injury or property damage.

WARNING

Indicates a potentially hazardous situation. If precautionary measures aren't taken, it could result in death, serious injury or property damage.

CAUTION

Indicates a potentially hazardous situation. If precautionary measures aren't taken, it could result in minor or moderate injury.



NOTE

Points to note, tips, advice or information for efficient operation without any problem.

1.3 General safety instructions

DANGER

In operation, Ewellix cylinders could make parts move and could have hot surfaces or parts fed by electrical current, depending on the situation. Serious or fatal injuries or property damage will occur if the information or precautionary measures given in this manual aren't followed.

Generally, all works related to transportation, setup/mounting (mechanical and electrical), startup, maintenance or storage have to be carried out by qualified personnel in full compliance with relevant regulations.

1.4 Exclusion of liability

Ewellix does not assume liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, any liability is excluded.

1.5 Future changes to user manual

To constantly improve the quality of its products, Ewellix reserves the right to modify this manual without informing its customers. It is the responsibility of the customer to have the current release of the manual so that the user will benefit from the latest information and advice. For more details, please contact your Ewellix sales representative.

In any event, Ewellix won't be liable for any adverse consequences to the Ewellix product user or any property because of user manual modification.

2.0 General notes

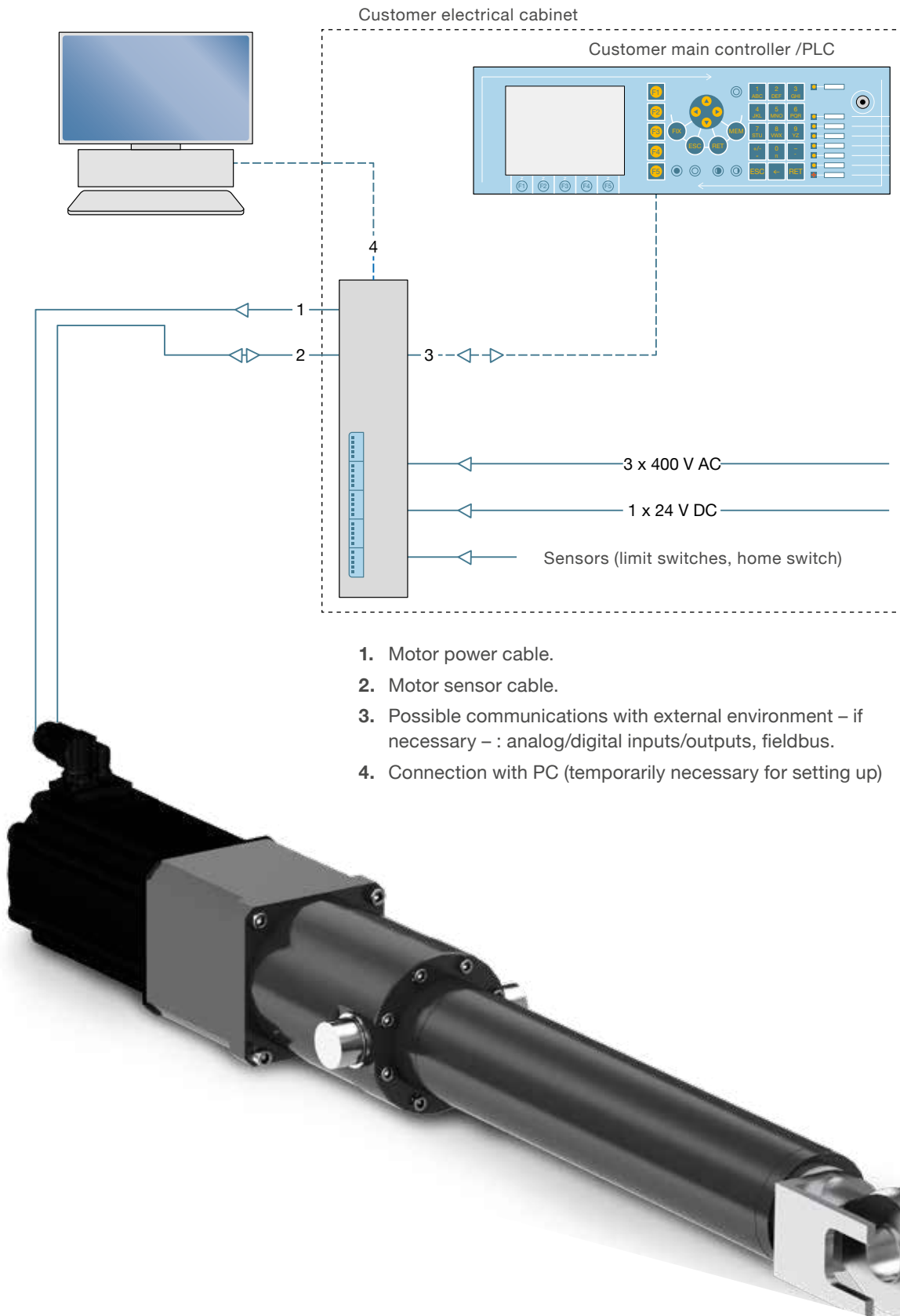
2.1 General description of system components

Generally, the scope of supply of Ewellix cylinders includes:

- Cylinder
- Motor power cable
- Motor sensor cable
- Motion controller
- Electronic interface to make connection between PC and motion controller.

To know the exact definition of Ewellix supply, please read paragraph 2.3 Detailed description of supplied product.

The general drawing below illustrates the Ewellix electromechanical cylinder's relationship with the user's environment:

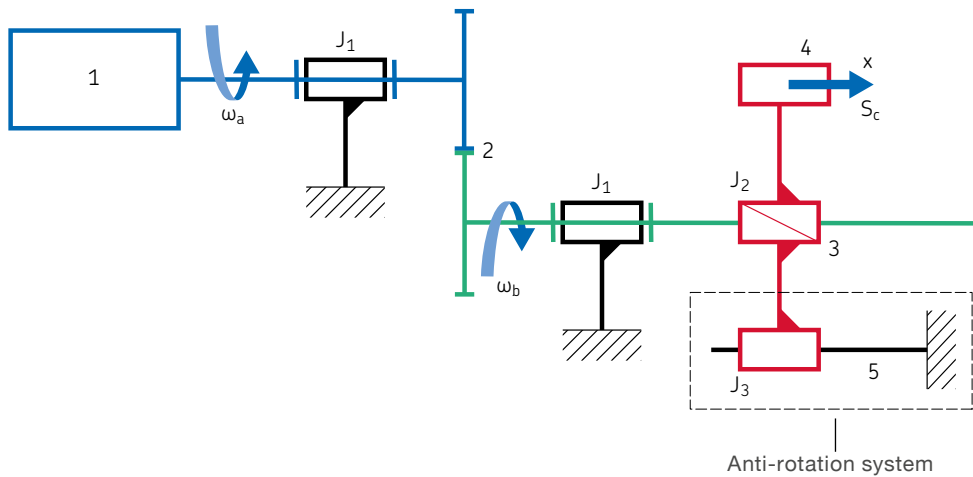


1. Motor power cable.
2. Motor sensor cable.
3. Possible communications with external environment – if necessary – : analog/digital inputs/outputs, fieldbus.
4. Connection with PC (temporarily necessary for setting up)

2.2 Operating principle

The operating principle of Ewellix electromechanical cylinders is described by the cinematic drawing below (established in accordance with NF EN ISO 3952-1 standard).

The operating principle of Ewellix electromechanical cylinders



Comments

- 1 Motor rotor
- ω_a Rotating speed of motor shaft
- ω_b Rotating speed of roller screw or ball screw
- 2 Gear system between motor shaft and roller screw (or ball screw) shaft. r is gear ratio.

$$r = \frac{\omega_a}{\omega_b}$$
- 3 Roller screw or ball screw = screw gear changing rotation of screw (green color) into translation of nut and pushing tube of cylinder (red color).
- 4 Pushing tube of cylinder
- S_c Translation speed of pushing tube
- x Translation move of pushing tube
- 5 Anti-rotation of pushing tube. Depending on cylinder definition, this system is integrated into the cylinder or located on the customer's machine.



J_1



J_2



J_3

Description of kinematic joints

- J_1 Revolute joint
- J_2 Screw joint
- J_3 Prismatic joint

Relationships to be known

For each motor revolution cylinder moves x millimetres, x defined as follows:

$$x = \frac{p_h}{r}$$

x Cylinder move

p_h Roller or ball screw lead

Depending on case, r definition can change:

- Cylinder with motor in line without gear
 $r = 1$
- Cylinder with motor in line and gear
 $r = r_g$ with r_g gear ratio
- Cylinder with motor in parallel without gear
 $r = r_b$ with r_b belt system ratio
- Cylinder with motor in parallel and gear
 $r = r_b \cdot r_g$

2.3 Detailed description of supplied product

Generally, a detailed description of the supplied product is given by the two following documents (called “documents for approval”):

- Technical description
- Cylinder drawing

IMPORTANT:

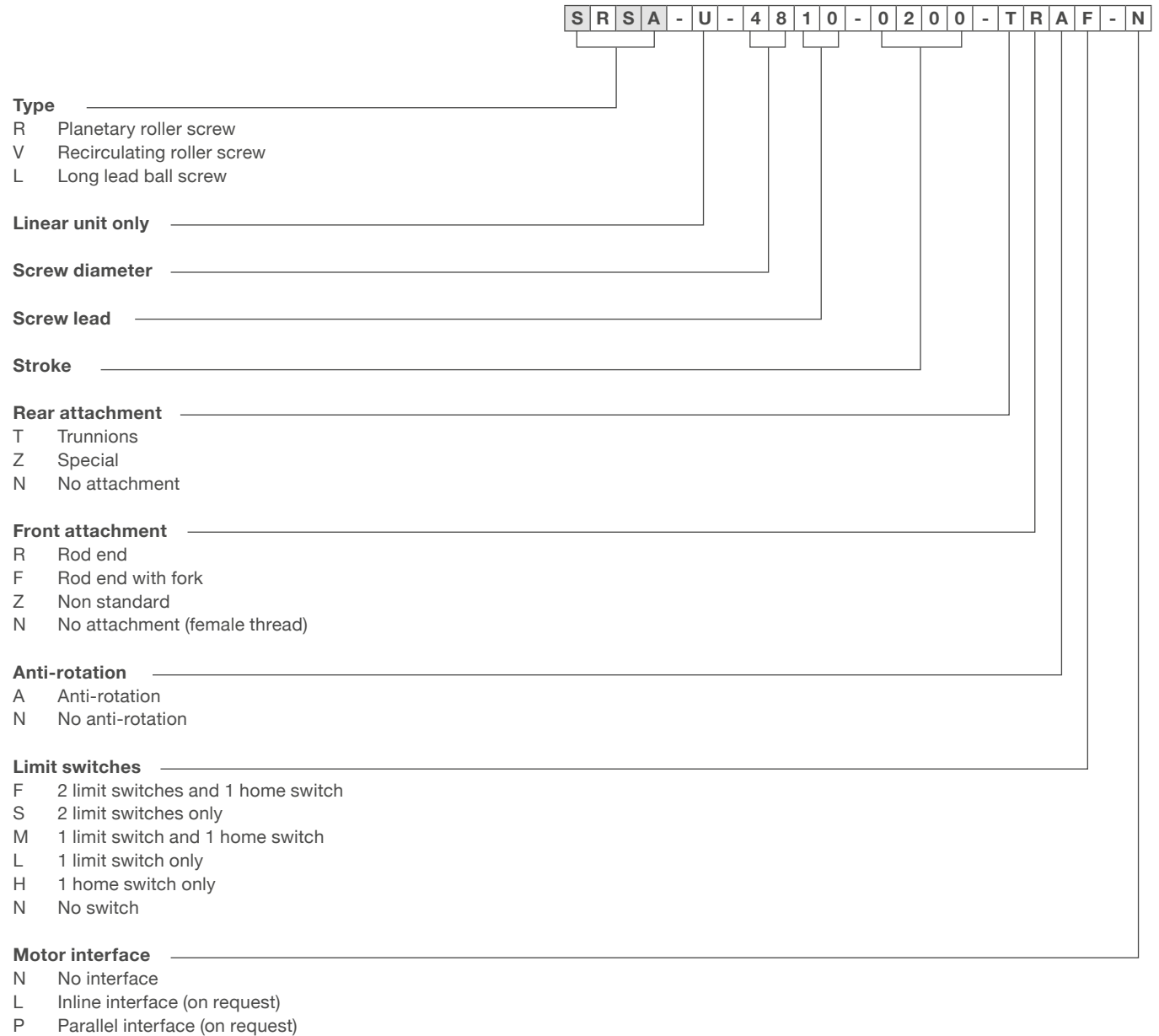
Before starting cylinder commissioning, these two documents must be read. If there is a problem, please make contact with your local Ewellix representative.

2.4 Designation

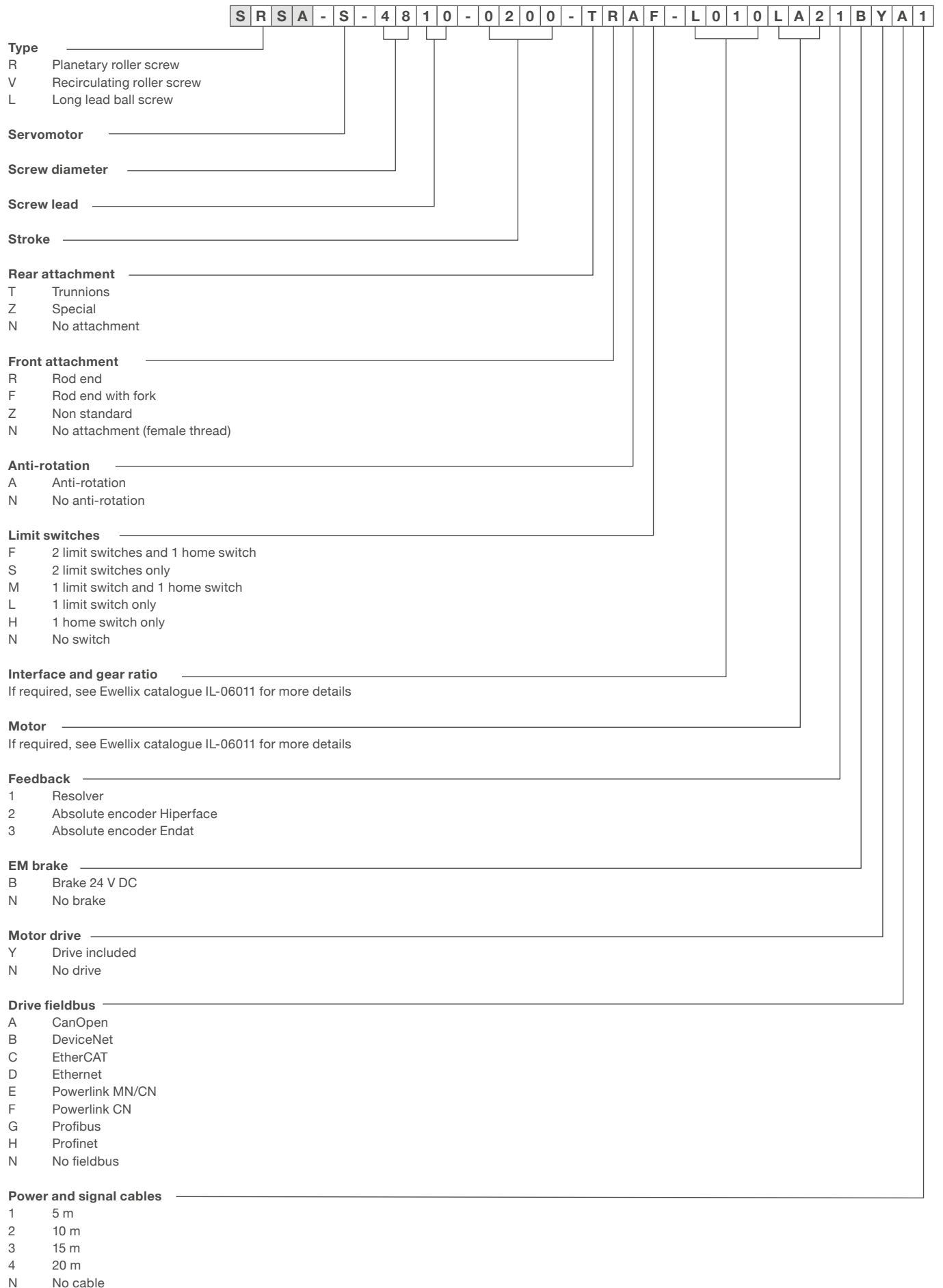
Two designations:

- Designation for linear unit (=actuator without motor).
Example: SRSA-U-4810-0200-TRAF-N
- Designation for complete actuator (=actuator with motor and servoamplifier).
Example: SRSA-U-4810-0200-TRAF-L010LA21BYA1

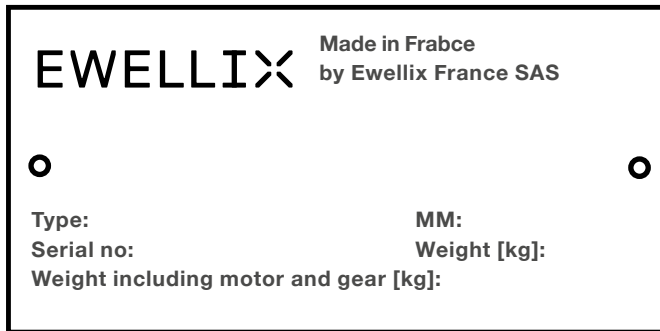
The meaning of linear unit designation is:



The meaning of complete actuator designation on the next page.



2.5 Nameplate



Type:	Cylinder reference
MM:	Manufacturing month (month/year)
Serial no:	Cylinder serial number
Weight:	Cylinder weight
Weight including motor and gear:	Cylinder weight when supplied with motor and possibly with gear

2.6 Performances, operation limits and operation environment

For more details, please read the Ewellix sales offer and other documents for approval. The cylinder's performance and operational limits and operating environment are described in the technical requirements that define the cylinder selection.

2.7 Storage conditions

If the cylinder has to be stored for a long time (example: cylinder as a spare part), the following conditions must be observed:

- Cylinder has to be stored in horizontal position indoors with an ambient temperature between 15 and 40 °C.
- Cylinder has to be packed in the retracted position inside a plastic film with desiccant to protect the cylinder from humidity and condensation.

A cylinder that has been stored under the conditions described above for less than one year could be used by following the general recommendations for use (↳ **4.2 General recommendations for use, page 23**).

If storage time exceeds one year, re-lubricate the cylinder before it is first started (please read paragraph 5 Maintenance – upkeep – routine checks, to know which parts are to be lubricated and how they are to be lubricated). Then, cylinder can be used by following general recommendations for use (↳ **4.2 General recommendations for use, page 23**).

After three years of storage, we recommend that the cylinder is returned to Ewellix and a level one maintenance service be performed (↳ **5.1 Ewellix Maintenance service, page 27**).



If an automatic lubrication system is installed, it is possible to unplug it temporarily so that re-lubrication can be done with a manual grease pump as explained on this page.

2.8 Disposal

Dispose of cylinders in accordance with applicable regulations and considering the different requirements for each material:

- Iron
- Aluminium
- Copper
- Plastic
- Electronic components
- Oil and grease (not mixed with solvents)

To know the exact definition of Ewellix supply, please read paragraph **2.3 Detailed description of supplied product**.

2.9 Warranty

IMPORTANT:

Manufacturer's warranty is null and void if the cylinder is disassembled by end-user.

For any other information concerning warranty, please contact your local Ewellix representative.

3.0 Installation – general recommendations

3.1 Important notes

⚠ DANGER

Some components integrated into the Ewellix scope of supply are “products bought on catalogue”. This means that the design and manufacturing of these components haven’t been done by Ewellix.

For all these “products bought on catalogue”, it’s the user’s responsibility to read the associated manufacturer’s user manual before starting to install or to use the product.

⚠ WARNING

Risk of serious or fatal injuries by crushing because of vertical load fall.

Do not use the brake (of the motor or an additional brake) to hold a vertical load while an operator is under the load. Generally, the holding torque of the brake is created by means of friction discs and does not provide a positive lock. In any event, lock the vertical load in position by another means or move and stop the vertical load at the bottom position which is safe.

⚠ WARNING

Risk of serious or fatal injuries by crushing because of unintentional cylinder start-up.

Before starting any work on actuator, isolate the motor, brake and fan (if installed) from the power supply and safeguard them using lockout/tagout procedures against unintentional re-start.

⚠ WARNING

During operation, the cylinder surface temperature can reach high values. There is a risk of burns or fire. Before any work on the actuator, let it cool down.

3.2 Mechanical installation

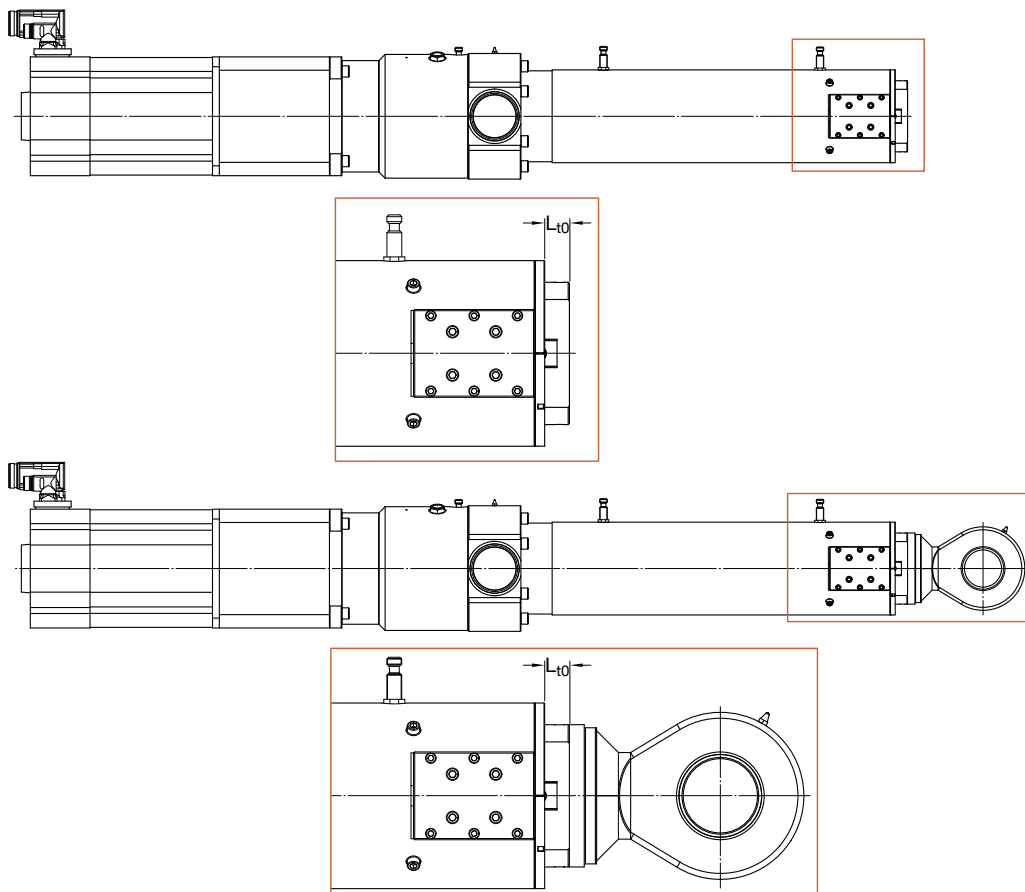
3.2.1 Cylinder dimensions – Cylinder drawing

To know the cylinder dimensions and the definition of its attachments, please look at cylinder drawing. The definition of drawing cylinder is given in paragraph ↪ **2.3 Detailed description of supplied product, page 9.**

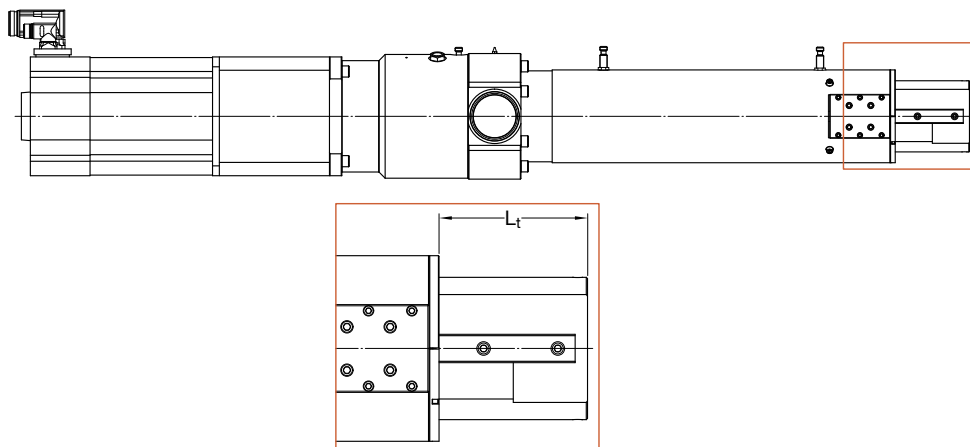
3.2.2 Visual cylinder position – L_{t0} and L_t definition

During mechanical installation or cylinder operation, it is sometimes required to know the cylinder position in relation to the “zero” position given in the cylinder drawing.

To do this, it's first required to know L_{t0} (=length of pushing tube which is visible when cylinder is in the “zero” position on the cylinder drawing – please have a look at the cylinder drawing) – as examples, see below some drawings illustrating L_{t0} definition.



Then, it's required to measure L_t : equivalent dimension of L_{t0} when cylinder is in any position.



Then, cylinder position in relation to the “zero” position given in the cylinder drawing is equal to $L_t - L_{t0}$.

3.2.3 Handling – Transportation

Observe relevant transport regulations during transportation.

When the shipment is received, immediately check that no damage has been done during transportation. If not, immediately inform the shipping company and Ewellix. If the shipment has been damaged, do not commission it.

Use suitable load suspension devices for transport and assembly.

Weights of cylinder and any gear and motor are indicated on corresponding nameplates. If not, please read the technical documentation of the corresponding manufacturer.

In case of a problem, please contact your local Ewellix representative.



NOTE

During actuator handling, please take care not to damage the limit switches and home switch (if these options have been taken).

3.2.4 General recommendations for installation

1. When mounting the cylinder, check that all parts to which it is fixed are correctly aligned. This should be done throughout the complete stroke. Note: Poor alignment will reduce the life of the cylinder.
2. Radial load or bending torque must not be applied to the cylinder pushing tube. Otherwise cylinder lifetime might be drastically reduced.
3. Avoid shocks on the pushing tube. Do not hit it with a hammer.
4. Check that cylinder can move freely and there is no obstruction over the full stroke.
5. Do not modify any part of cylinder
6. Do not add any part/component on cylinder



NOTE

If actuator has no anti-rotation on the force tube, it is possible to extend or retract by turning force tube by hand.

3.3 Electrical installation

3.3.1 Motor

Generally, please read the technical documentation from the motor manufacturer to know how to properly install the motor. The details concerning the motor can be found on its nameplate.

If the motor manufacturer doesn't supply paper documentation or documentation CD-ROM, it means that a user manual can be downloaded from the manufacturer's web site.

In case of a problem and if motor has been sold by Ewellix, please contact your local Ewellix representative. Otherwise, please contact motor supplier.

⚠ DANGER

During and after operation, some parts of the cylinder carry dangerous voltages. Electric shock hazard. Risk of serious or fatal injuries.

Strictly observe the safety instructions in this manual and the safety instructions of manuals associated with each commissioned equipment (motor, servoamplifier, etc).

Do not unplug motor connectors before switching off the power supply of the corresponding servoamplifier. First unplug the signal connector and then the power connector.

Motor rotation can create voltage. Do not touch connector pins.

3.3.2 Cables for motor

If motor cables are included in Ewellix supply, please read the motor technical documentation or servoamplifier technical documentation to find the technical description and connection drawing of supplied cables. Cable reference is written on the cable itself or on its packaging.

In case of a problem, please contact your Ewellix local representative.

3.3.3 Limit switches

3.3.3.1 Description

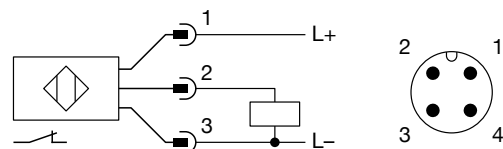
If this option has been taken, the following information will be necessary for connecting the limit switches correctly:

Manufacturer:	IFM Electronic (or equivalent)
Manufacturer reference:	IFC207 (or equivalent)
Sensor type:	Inductive
Technology:	DC PNP
Output:	Normally closed
Supply voltage (V DC):	24
Consumption (mA):	<10 (with 24 V DC)
Max. current output (mA):	100
Connection:	M12x1 plug

⚠ WARNING

All technical data given here have been extracted from manufacturer's catalogue when this manual was edited. They are given for information only.

If limit switch manufacturer changes this data, Ewellix is not responsible for any problem arising from such changes. Please check with limit switch manufacturer just before installing limit switch.

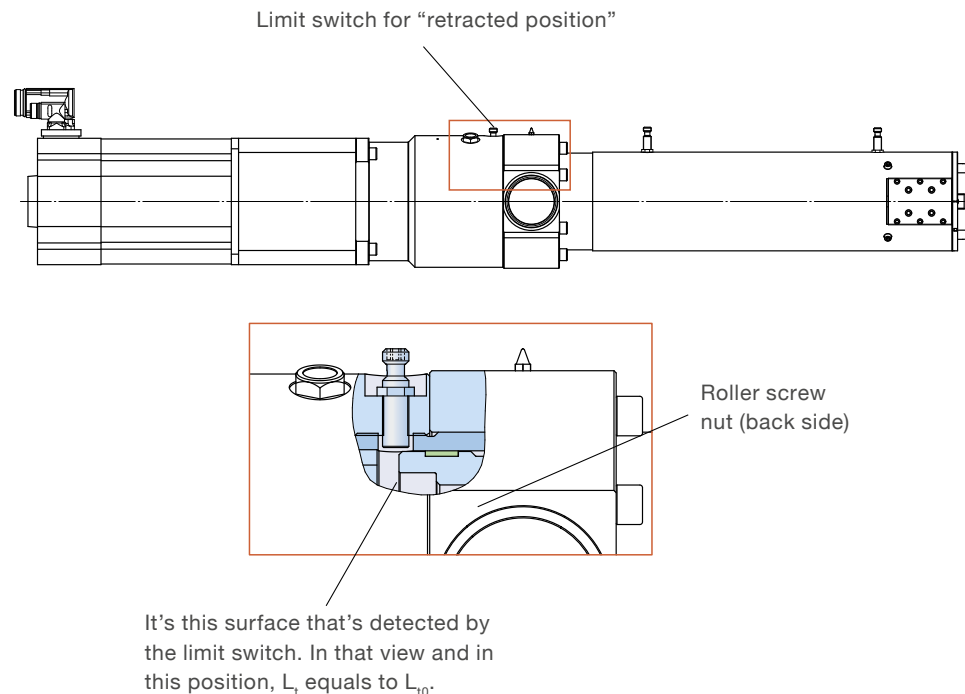


Please have a look at the servoamplifier manufacturer's technical documentation to know what digital input can be used for connecting limit switches.

3.3.3.2 Mounting instructions of limit switch

for “retracted position”

If the limit switch for “retracted position” has been removed, please follow these instructions to mount it again correctly:

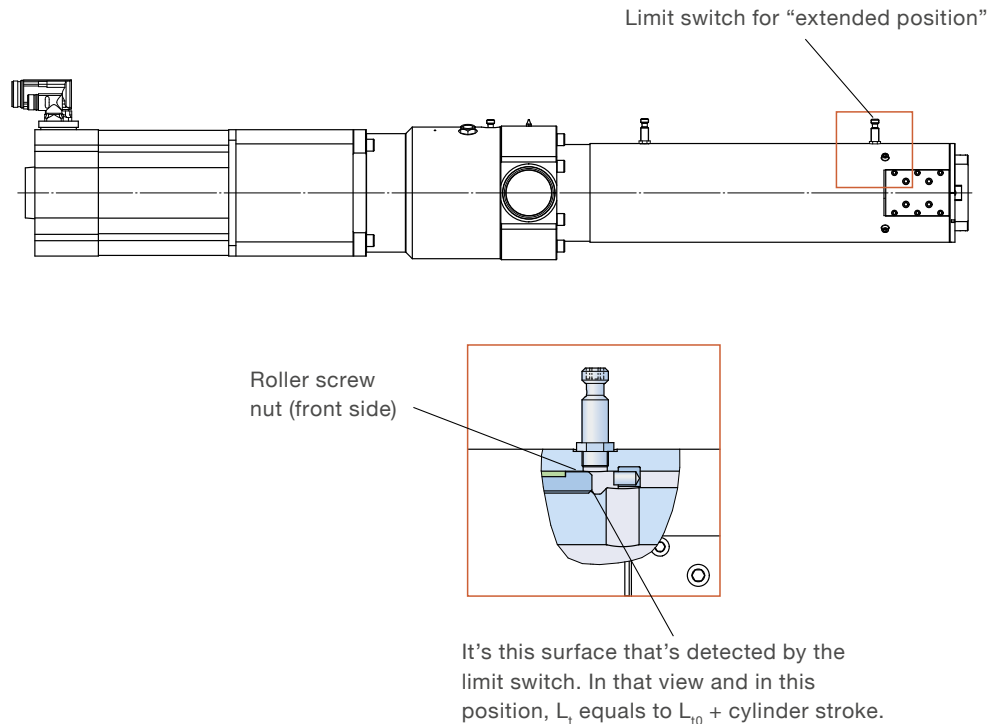


1. Move cylinder so that $L_t = L_{t0} (\pm 0,5 \text{ mm})$.
NOTE: To know the definition of L_t and L_{t0} , please look at paragraph \hookrightarrow **3.2.2 Visual cylinder position – L_{t0} and L_t definition, page 14.**
2. Screw in the limit switch with care by hand into the dedicated threaded hole until it touches the roller screw nut (see cross-section view above). Then, unscrew the limit switch to create a gap between it and the rollerscrew nut. Stop unscrewing just before the limit switch stops detecting.
3. Fix the limit switch in this position by tightening the counter-nut (tightening torque: 7 Nm).
4. In this position, check that the limit switch detects the roller screw nut.
5. Move the cylinder so that $L_t = L_t + 3 \text{ mm} (\pm 0,5 \text{ mm})$. In this position, please check that nothing is detected by the limit switch.

3.3.3.3 Mounting instructions of limit switch

for “extended position”

If the limit switch for “retracted position” has been removed, please follow these instructions to mount it again correctly:



1. Move the cylinder so that $L_t = L_{t0} + \text{cylinder stroke}$ ($\pm 0,5 \text{ mm}$).
NOTE: To know the definition of L_t and L_{t0} , please look at paragraph \hookrightarrow **3.2.2 Visual cylinder position – L_{t0} and L_t definition, page 14.**
2. Screw in the limit switch with care by hand into the dedicated threaded hole until it touches the roller screw nut (see cross-section view above). Then, unscrew the limit switch to create a gap between it and the rollerscrew nut. Stop unscrewing just before the limit switch stops detecting.
3. Fix the limit switch in that position by tightening the counter-nut (tightening torque: 7 Nm).
4. In this position, check that the limit switch detects the roller screw nut.
5. Move cylinder so that $L_t = L_t + \text{cylinder stroke} - 3 \text{ mm}$ ($\pm 0,5 \text{ mm}$). In this position, please check that nothing is detected by the limit switch.

3.3.4 Home switch

3.3.4.1 Description

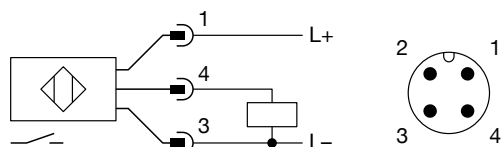
If this option has been taken, the following information will be necessary to connect the home switch correctly:

Manufacturer:	IFM Electronic (or equivalent)
Manufacturer reference:	IFC204 (or equivalent)
Sensor type:	Inductive
Technology:	DC PNP
Output:	Normally opened
Supply voltage (V DC):	24
Consumption (mA):	<10 (with 24 V DC)
Max. current output (mA):	100
Connection:	M12x1 plug

⚠ WARNING

All technical data given here have been extracted from manufacturer's catalogue when this manual was edited. They are given for information only.

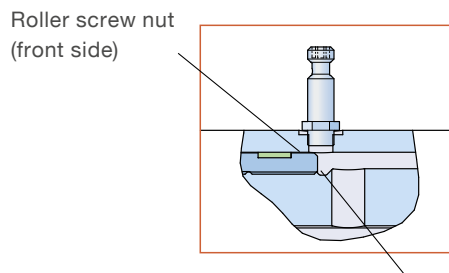
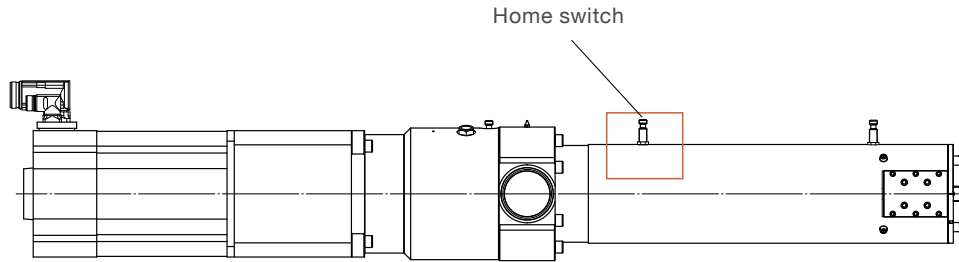
If home switch manufacturer changes this data, Ewellix is not responsible for any problem arising from such changes. Please check with home switch manufacturer just before installing home switch.



Please look at the servoamplifier manufacturer's technical documentation to know what digital input can be used for connecting the home switch.

3.3.4.2 Mounting instructions of home switch

If the home switch has been removed, please follow these instructions to mount it again correctly:



It's this surface that's detected by the home switch.
In that view and in this position, L_t equals to L_{t0} + cylinder stroke given on the cylinder drawing for home switch.

1. Move the cylinder so that $L_t = L_{t0} + \text{cylinder stroke given on cylinder drawing for home switch}$ ($\pm 0,5 \text{ mm}$).
NOTE: To know the definition of L_t and L_{t0} , please look at paragraph \hookrightarrow **3.2.2 Visual cylinder position – L_{t0} and L_t definition, page 14.**
2. Screw in the limit switch with care by hand into the dedicated threaded hole until it touches the roller screw nut (see cross-section view above). Then, unscrew the limit switch to create a gap between it and the rollerscrew nut. Stop unscrewing just before the limit switch stops detecting.
3. Fix the limit switch in that position by tightening the counter-nut (tightening torque: 7 Nm).
4. In that position, check that the home switch detects the roller screw nut.
5. Move the cylinder so that $L_t = L_{t0} + \text{cylinder stroke given on the cylinder drawing for home switch} - 3 \text{ mm}$ ($\pm 0,5 \text{ mm}$). In this position, please check that nothing is detected by the limit switch.

3.3.5 Temperature sensor

If this option has been taken, the following information will be required to make an electrical connection:

- Type of temperature sensor:** Pt100
- Internal wiring mode (=between plug and temperature sensor):** 4 wires (↳ fig. 1)
- Possible wiring modes with external environment:** 2, 3 and 4 wires (↳ fig. 1)
- Connection:** M12x1 plug
- Description of internal wiring mode (↳ fig. 2)**

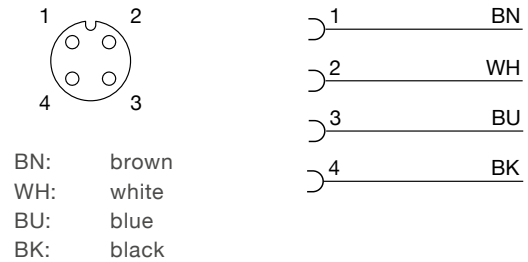


Fig. 1

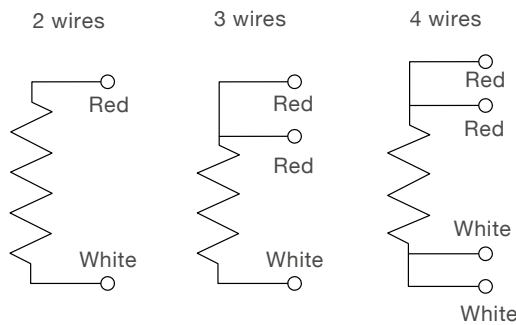
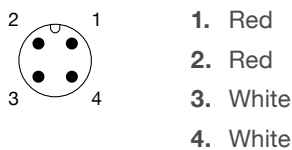


Fig. 2



3.3.6 Cables for sensors

If cables for limit switches and/or home switch and/or temperature sensor have been taken, the following information will be required to make an electrical connection:

- Manufacturer:** IFM Electronic (or equivalent)
- References:** See table below (or equivalent)

IFM Reference	Description
EVC005	PUR Cable – length 5 m
EVC006	PUR Cable – length 10 m
EVC086	PUR Cable – length 15 m
EVC087	PUR Cable – length 20 m
EVC088	PUR Cable – length 25 m

- Cable diameter:** 4,9 mm
- Bending radius:** min. 10 x diameter of cable
- Connection:**
 - On one side: M12x1 plug
 - On the other side: naked wires

3.3.7 Additional brake mounted on screw

If this option has been taken, the following information will be required to make an electrical connection:

- Manufacturer:** see user manual (specific data)
- Reference:** see user manual (specific data)
- Type:** see user manual (specific data)
- Supply:** see user manual (specific data)
- Power:** see user manual (specific data)

Wire color	Description
Green-red or red	+U (see user manual (specific data) for +U definition)
Green-blue or black	OV

⚠ WARNING

Risk of serious or fatal injuries by crushing because of vertical load fall.

Do not use the brake (of the motor or an additional brake) to hold a vertical load while an operator is under the load. Generally, the holding torque of the brake is created by means of friction discs and does not provide a positive lock. In any event, lock the vertical load in position by another means or move and stop the vertical load at the bottom position which is safe.

⚠ WARNING

All technical data given here have been extracted from manufacturer's catalogue when this manual was edited. They are given for information only.

If the brake manufacturer changes this data, Ewellix is not responsible for any problem arising from such changes. Please check with the brake manufacturer just before installing the brake.

⚠ WARNING

As a general rule, the brake is not to be used in a dynamic way. Dynamic breaking will create premature wear which will generate malfunction of actuator.

3.3.8 Automatic lubrication pump

If an automatic lubrication system is supplied by Ewellix, please read the manufacturer's technical documentation in order to know how to properly install it.

The exact reference for the lubrication system can be found on the nameplate located on the pump body.

If the lubrication system manufacturer doesn't supply paper documentation or a documentation CD-ROM, it means that a user manual should be downloaded from the manufacturer's web site.

For easier searching, references in required documentations are:

951-170-203 Assembly instructions KFG, KFGS, KFGC

1-3030 Sales brochure KFG, KFGS, KFGC

In case of a problem, please contact your local Ewellix representative.

3.3.9 Servoamplifier

If the servoamplifier is supplied by Ewellix, please read the manufacturer's technical documentation for the servoamplifier in order to know how to properly install it.

The exact servoamplifier reference can be found on the nameplate located on the servoamplifier.

If the servoamplifier manufacturer doesn't supply paper documentation or a documentation CD-ROM, it means that a user manual should be downloaded from the manufacturer's web site.

In case of a problem, please contact your local Ewellix representative.

4.0 Commissioning

⚠ DANGER

During and after operation, some parts of the cylinder carry dangerous voltages. Electric shock hazard. Risk of serious or fatal injuries.

Strictly observe the safety instructions in this manual and the safety instructions of manuals associated with each commissioned equipment (motor, servoamplifier, etc). Do not unplug motor connectors before switching off the power supply of the corresponding servoamplifier. First unplug the signal connector and then the power connector. Motor rotation can create voltage. Do not touch connector pins.

⚠ WARNING

During operation, the cylinder surface temperature can reach high values. There's a risk of burns or fire. Before any work on the actuator, let it cool down.

4.1 Overview

⚠ DANGER

Customer should make sure that the commissioning steps suggested in the general procedure can't create any problems.

The described procedure assumes that mechanical and electrical installation have been done correctly.

NOTE

Actuator is greased supplied.

To perform the very first commissioning of a cylinder, the general principle is as follows:

1. On the computer, ensure installation of the software required for defining servoamplifier parameters – installation of hardware connection between computer and servoamplifier.
2. Switch on the servoamplifier (only auxiliary supply or low-level supply) to allow servoamplifier parameters definition.
3. Launch the software required for servoamplifier parameters definition. Operation checking of connection between computer and servoamplifier.
4. Definition of servoamplifier parameters. At the very least, the following information has to be entered:
 - 4.1. Cylinder motor choice (if necessary, choice of resolver or encoder associated) and associated brake choice if necessary.

4.2. Fill in the following data:

- 4.2.1. Cylinder move for each motor revolution (↳ **2.2 Operating principle for definition**).
- 4.2.2. Cylinder speed defined for application.
- 4.2.3. Cylinder acceleration defined for application.
- 4.2.4. Definition of starting control parameters (see servo-amplifier's technical documentation).

4.3. Save modifications in non-volatile memory.



NOTE

Before going on to step 5, please check that the parameters given in steps 1–4 have been correctly saved in the non-volatile memory. To do that, switch off and on the servo-amplifier. Then check that the parameter modifications have been correctly taken into account in the servoamplifier.

5. Switch on the power supply of the servoamplifier. Check the cylinder motor brake operation (for example: when the cylinder motor torque comes on, a brake clap has to be heard. Same thing when the cylinder motor torque turns off).
6. Make a small cylinder move (smaller than overstroke value which is written on cylinder drawing) in a positive direction to see the actual direction of pushing tube move (please read the end of paragraph **3.3.3.1 Description** (of limit switches) to know how positive direction is defined). Generally, the pushing tube extends when a positive move is ordered. Otherwise, please reverse the motor rotation direction.
7. Check the limit switch in the retracted position by moving the cylinder slowly and gradually to that position.
8. Check the limit switch in the extended position by moving the cylinder slowly and gradually to that position.
9. If a home switch has been installed, check its operation by moving the cylinder slowly and gradually to a position where the home switch status changes.
10. Make a program for defining the zero reference and check that this program works correctly, whatever the cylinder starting position (↳ **4.3 How to define zero reference before beginning to make a program, page 25**).
11. Measure the two extreme positions (pushing the tube in the extended position and in the retracted position) within which the cylinder could move without activating the limit switches (these two positions will be defined in relation with zero reference defined just above).

**NOTE**

Once all these steps have been achieved, it's advisable to make the cylinder move several times forward-backward slowly on the complete stroke and to check the position control behaviour while the cylinder speed and acceleration are gradually increased.

For more detailed information about how to check the position control behaviour, please read paragraph ↪ **4.4 How to check position control behaviour – first approach, page 24.**

4.2 General recommendations for use

⚠ WARNING

For whatever reason, the cylinder move must not be stopped by a stiff mechanical stop except if the speed of the motor is low (value below or equal to a few percent of the maximum speed value) and the cylinder force is limited to a low value (by defining a limitation on motor current). Otherwise, the kinetic energy stored within the internal rotating parts of the cylinder will be stopped in a very short time. This will create very high loads (inside the cylinder and in the cylinder pushing tube) which might seriously damage the cylinder and its external environment.

1. Cylinders include two internal mechanical stops: one in the retracted and one in the extended position. In all cases, these stops are only to be used manually at slow speed and under small loads. They are not designed for the cylinder to push into them with significant loads and speeds.
2. For initial operation, it is advised that the user slowly increases the cycle rate of the cylinder without overheating. As a general rule, the stabilized temperature of the cylinder should not exceed 80°C (whatever surface where measure is made). For more detailed information on that subject, please read paragraph ↪ **5.2 Lubrication – detailed description, page 29.**
3. Depending on the cycle rate, working cycle definition (load, speed, acceleration/deceleration profiles) and environmental conditions, the cylinder can heat more or less. For more detailed information on that subject, please read paragraph ↪ **5.2 Lubrication – detailed description, page 27.**

4.3 How to define zero reference

To define zero reference by using the home switch, there are two ways to do it:

- The home switch is integrated in the Ewellix cylinder.
- or:
- The home switch is fixed to the machine driven by the Ewellix cylinder.

⚠ WARNING

It is required to enable the limit switches in the servoamplifier, so that a zero reference search using the home switch can be done from any starting cylinder position.

Case “home switch is integrated in the Ewellix cylinder”

Two ways are possible to define the zero reference (choice will depend on actual opportunities offered by customer application):

- Search for the zero reference always has to begin in a direction where the pushing tube is going towards the retracted position. In that case, write the following program:
 - Make the cylinder pushing tube move up to reach the limit switch in the retracted position.
 - Then, make the cylinder pushing tube go out until the home switch detects the roller screw nut.
 - Then, launch a search for the first zero of the encoder (or resolver). Define the zero reference once the encoder (or resolver) zero has been found.
- Search for the zero reference always has to begin in a direction where the pushing tube is going towards the extended position. In that case, write the following program:
 - Make the cylinder pushing tube move up to reach the limit switch in the extended position.
 - Then, make the cylinder pushing tube go in until the home switch detects the roller screw nut.
 - Then, launch a search for the first zero of the encoder (or resolver). Define the zero reference once the encoder (or resolver) zero has been found.

**NOTE**

As a general rule, there isn't necessarily a link between the zero defined by a zero reference search and the zero position given in the cylinder drawing. Very often these two zeros correspond to two different cylinder positions.

⚠ WARNING

The zero reference defined by searching for the home switch will be reproducible for one cylinder but won't be identical between different cylinders.

Consequently, when an old cylinder is replaced by a new one, it is required to redefine all actuator positions to be reached during machine operation (in function of new cylinder zero reference). Otherwise it may occur unexpected actuator position with risk of heavy property damage.

Case “home switch is fixed on the machine driven by the Ewellix cylinder”

In this case, depending on the servoamplifier definition (read servoamplifier user manual to get corresponding information), it might be necessary to make sure that the length of cam detected by the home switch will be longer than the stroke achieved by the cylinder for one motor revolution. Once this precaution has been taken, the zero reference definition opportunities offered by the servoamplifier are enough to answer all possible cases.



NOTE

To define a zero reference which will always stay the same, even when the cylinder is replaced by a new one, it is required to write a program which makes the pushing cylinder meet a mechanical stop and which defines the zero reference in relation to the reached position.

4.4 How to check position control behaviour – first approach

⚠ WARNING

At the time of first cylinder commissioning, it's advised as a first approach to check that the position control operates correctly without risk to generate a tracking error fault or overspeed fault (see the servoamplifier manufacturer's technical documentation to get more details on these two faults). These faults might generate heavy property damages (see explanation below).

Depending on the servoamplifier manufacturer, it's possible that tracking error fault or overspeed fault switch off torque on the cylinder motor (read servoamplifier documentation for more information). If this is the case and if this occurs when the cylinder is at maximum speed, the cylinder will keep moving because of the kinetic energy of the cylinders internal rotating parts. Consequently, it is very likely that the cylinder will stop suddenly against its internal mechanical stop or the machine's mechanical stop. In both cases, this might generate heavy property damage.

To avoid this from happening, it's advisable to check the behaviour of the position control.

As a first step, please read the servoamplifier technical documentation to see if there's an existing method or if specific tools have been developed by the servoamplifier manufacturer to make this check.

Otherwise, use the following method which is a simplified evaluation of position control behaviour.

Principle of evaluation method:

Position control behaviour is estimated through measurements made with the servoamplifier scope tool (see servoamplifier technical documentation for more details) while the cylinder is making forward and backward moves. The scope tool allows the user to see a value evolution of the control variables in the function of time. In this way it is, for example,

possible to see in one graph the evolution of cylinder speed and the evolution of motor current in the function of time.

To make an estimation of position control behaviour, it's required to see the speed set point, actual speed, tracking error and motor current of the cylinder (see servoamplifier technical documentation to know the corresponding variables name). Depending on observations made on the shape of acquired curves, it will be possible to estimate the risk of generating a tracking error fault or over speed fault on a scale ranging from zero to very high.

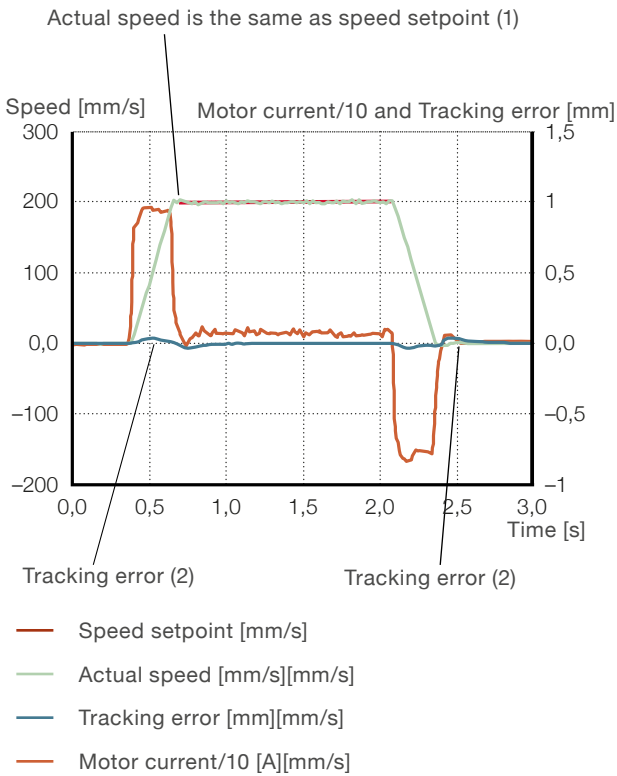
Detailed description of method:

- Put the cylinder into the final use conditions (cylinder has to be installed inside a machine and has to be able to achieve the work for which it has been designed) and decrease the maximum moving speed value (take maximum speed equal to 1/10th of maximum speed defined for the application) and acceleration/deceleration values (take value equal to 1/10th of acceleration/deceleration values defined for application).
- First, start a cylinder forward movement and then a backward movement and make scope record at the same time. Look at the acquired graph and compare it with the two example graphs given below. Conclude about risk level to generate tracking error fault and/or over speed fault.
- If the risk is low, increase speed value and acceleration/deceleration values and remake measurements with the scope tool during a forward-backward cylinder movement. Remake an estimation of risk level to generate a fault. As long as the risk stays low, repeat this step until to values of speed, acceleration and deceleration defined for application are reached.
- If the risk is becoming significant, do not keep increasing speed and/or acceleration/deceleration but try to reduce the speed overshoot value and/or tracking error value. To do that, study the servoamplifier technical documentation to identify actions to perform to reduce the risk level to generate an over speed fault and/or tracking error fault.

⚠ DANGER

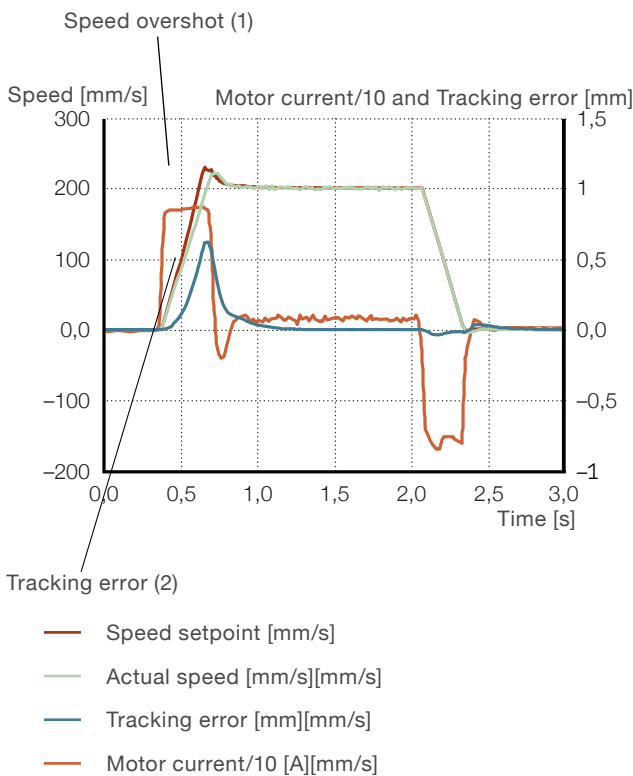
Customer should be sure that the commissioning steps suggested in method described to the left can't create any problems.

Example: Low risk of generating over speed or tracking error faults



1. In this example, there is no difference between the speed setpoint and the actual speed. If a level triggering overspeed fault is established at 230 mm/s, for example, and if this graph stays identical on several forward-backward movements, then the risk of generating an overspeed fault is very low.
2. The value of tracking error is low (max ~40 μm). If the level triggering a tracking error fault is established at 0,7 mm, for example, and if this graph stays identical on several forwardbackward moves, then the risk to generate a tracking error fault is very low.

Example: High risk to generate overspeed or tracking error faults



1. In this example, there is a big difference between the speed setpoint and the actual speed, which causes a speed overshoot phenomena (max speed near 230 mm/s) necessary to decrease tracking error. If the level triggering overspeed fault is established at 230 mm/s, for example, then the risk to generate an overspeed fault is very high.
2. The value of tracking error is significant (max ~0,6 mm). If the level triggering a tracking error is established at 0,7 mm, for example, then the risk to generate a tracking error fault is very high.

4.5 Position control parameters – to be known



NOTE

A position control that is too dynamic/stiff could generate vibrations (=control instability) which would make noise and would be damaging for the system lifetime.

Position control parameters determine the dynamic/stiffness of control but also its stability.

WARNING

In most cases, software for parameters setup and/or technical documentation supplied with the servoamplifier allow calculation or evaluation of control parameters value for current loop, speed loop and position loop. As a general rule, these parameters are adapted well enough so that the cylinder can correctly complete the tasks requested by the user. But it is the user's responsibility to confirm that it is effective in the context of its application. For more details, please read technical documentation of the servoamplifier manufacturer.

5.0 Maintenance, upkeep and routine checks

⚠ DANGER

During and after operation, some parts of the cylinder carry dangerous voltages. Electric shock hazard. Risk of serious or fatal injuries.

Strictly observe the safety instructions in this manual and the safety instructions of manuals associated with each commissioned equipment (motor, servoamplifier, etc). Do not unplug motor connectors before switching off the power supply of the corresponding servoamplifier. First unplug the signal connector and then the power connector. Motor rotation can create voltage. Do not touch connector pins.

⚠ WARNING

During operation, the cylinder surface temperature can reach high values. There's a risk of burns or fire. Before any work on the actuator, let it cool down.

5.1 Ewellix maintenance service

Ewellix offers a range of services for cylinder maintenance:

- **Level 1 maintenance for cylinder only (without motor)**
This service includes complete disassembly, cleaning, re-lubrication and reassembly of the cylinder. Visual inspection is done on all components. Description of roller screw or ballscrew status is given. All of the following components are replaced:
 - Bearings
 - Seals
 - Coupling star
 - Profile rail guides, if cylinder integrates an anti-rotation system
 - Bumpers
 - Guides
 - Air filter
 - Grease nipple
 - Belt, if the cylinder has an integrated pulleys-belt system
- **Level 1 maintenance for cylinder motor (only if originally sold by Ewellix)**
This service includes complete disassembly, cleaning and re-assembly of the motor. Visual inspection is done on all components. All of the following components are replaced:
 - Bearings
 - Seals

- **Level 1 maintenance for cylinder gear (only if originally sold by Ewellix)**
This service includes complete disassembly, cleaning and re-assembly of the gear. Visual inspection is done on all components. All of the following components are replaced:
 - Bearings
 - Seals
- **Level 2 maintenance for cylinder (without motor)**
This service includes level 1 maintenance service for the cylinder and replacement of the rollers of the roller screw.
- **Level 3 maintenance for cylinder (without motor)**
This service includes level 1 maintenance service for the cylinder and full replacement of roller screw.

For each level of maintenance, an organization adapted to your needs can be put in place to minimize the consequences of non-availability of Ewellix cylinder. For more information, please contact your local Ewellix representative.

5.2 Lubrication – detailed description

NOTE

In the case of very dynamic applications, it's advisable to regularly check cylinder operation and its lubrication conditions.

⚠ WARNING

In the following paragraphs, recommendations are given (type, frequency and grease quantity) for cylinder parts that need to be re-lubricated regularly. These recommendations have to be taken as a guide. In most need cases, these recommendations result in good lubrication conditions during the cylinders lifetime. But it may occur, depending on the ambient temperature, on cylinder working cycle definition (speed, acceleration, load, cycle rate) and on the way the cylinder can dissipate its heat, that it's required to adapt the grease definition to the specific conditions of the application. As most of these parameters are known only by the user, it's the responsibility of the user to check that lubrication recommendations suggested in this manual create good lubrication conditions. As a general rule, the stabilized temperature of the cylinder should not exceed 80 °C (whatever surface is measured). If it's not the case, please contact your local Ewellix representative in order to get technical support.

NOTE

To check the cylinder temperature, there is a temperature sensor option that can be ordered when cylinder is ordered or added afterwards if the cylinder is returned to Ewellix. For more information on this option, please contact your local Ewellix representative.

NOTE

During re-lubrication actions, please take the following indications into account:

- Work cleanly. Do not inject grease polluted by other products or particles.
- Too much grease generates heat inside the actuator.
- Avoid injecting air into lubrication paths.

5.2.1 Roller screw (or ball screw)

- Type:** See user manual (specific data)
Quantity: See user manual (specific data)
Period: See user manual (specific data)
Procedure:
- 1 Position the cylinder at the greasing position (see user manual (specific data)).
 - 2 Inject half the required amount of grease.
 - 3 Make ten double strokes slowly along the whole stroke to spread the grease along the screw shaft.
 - 4 Repeat steps 1, 2 and 3.

This is a closed system. Re-lubrication is most effective if the old grease is removed. The state of the old grease can be seen and the quantity and period of re-lubrication modified to suit the real operating conditions (temperature, speed, load, etc). While re-lubricating, the old grease goes into free space in the cylinder. If all free space is filled, the cylinder would overheat.

Please contact your local Ewellix representative for advice on services that Ewellix offers for cylinder maintenance.

5.2.2 Bearings

The bearings are greased for life.

5.2.3 Profile rail guides

If this option has been taken, re-lubrication data is as follows:

- Type:** See user manual (specific data)
Quantity: Until it overflows
Period: See user manual (specific data)
Procedure:
- 1 Position the cylinder in the middle of its stroke.
 - 2 Remove the two plastic covers if necessary (↳ **fig. 1 or 3**).
 - 3 Inject grease into the hole (↳ **fig. 2**), or the nipple (↳ **fig. 4, page 29**) of every rail.

- 4 Put the covers on.
- 5 Make ten double strokes slowly over the whole stroke to spread the grease along the rail.

Fig. 1



Fig. 2

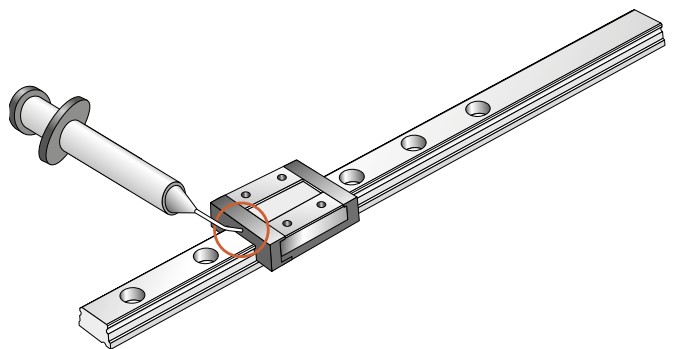
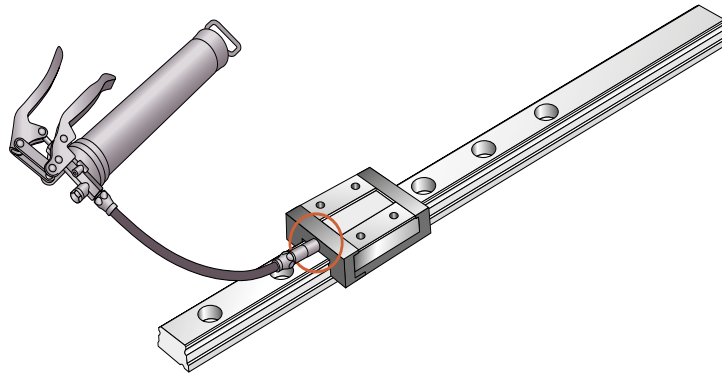


Fig. 3



Fig. 4



5.2.4 Spherical plain bearing

If this option has been taken, re-lubrication data is as follows:

Type:	See user manual (specific data)
Quantity:	Until it overflows
Period:	See user manual (specific data)

5.2.5 Gear

The gear is lubricated for life.

5.3 Routine checks – detailed description

5.3.1 Additional brake mounted on screw

If an additional brake option has been taken and in case of static use, it is advisable to check the air gap dimension every year (measured through a trap door).

Correct air gap dimension: See user manual (specific data)

Opening time: See user manual (specific data)

Closing time: See user manual (specific data)

5.3.2 Belt

If the cylinder is equipped with a belt and pulleys, visually check the condition of the belt teeth during standard maintenance operations; no surface degradation should be seen.

For more details, please read the technical documentation of the belt manufacturer.

Manufacturer: See user manual (specific data)

Type: Synchronous belt

Reference: See user manual (specific data)

Tension (new belt): See user manual (specific data)

Tension (used belt): See user manual (specific data)

6.0 Malfunctions

NOTE

When a malfunction occurs, it isn't always obvious if the problem is mechanical or electrical. For example, for a given fault (for example; cylinder doesn't move), the root cause may be mechanical (for example; motor brake blocked) or electrical (for example: electrical power not validated in the servoamplifier). Consequently, in case of malfunction, please consider all possible causes (mechanical and electrical) to identify all possible solutions.

6.1 Mechanical malfunctions

Malfunction	Possible cause(s)	Possible solution(s)
Cylinder doesn't move	Motor brake blocked	Check brake connection and supply voltage
	System moved by cylinder blocked	Check mobility of system moved by cylinder
Cylinder uses a lot of current and/or makes a noise when moving	Motor brake blocked	Check brake connection and supply voltage
	System moved by cylinder blocked	Check mobility of system moved by cylinder
Cylinder is too hot	Overloading	Measure RMS torque value on one complete cycle (including pause time before starting a new cycle). Send this information to Ewellix for analysis.
	Ambient temperature too high	Comply with permitted temperature range

6.2 Inspections prior to first operation

Malfunction	Possible cause(s)	Possible solution(s)
Cylinder doesn't move	Incorrect motor connection	Check motor connections
	Incorrect resolver connection	Check motor connections
	No electrical power on cylinder motor	Check voltage, main switch status and fuses status above the servoamplifier. Check that the servoamplifier authorizes cylinder move and cylinder motor torque on
	Incorrect definition of cylinder move	Check that all move parameters (target position, speed and acceleration) are correctly defined in servoamplifier
	Servoamplifier fault	Read the technical documentation of the servo-amplifier. In function of fault number, possible causes are suggested with associated solutions.
Cylinder moves a little and stops immediately with fault servoamplifier	Incorrect motor connection	Check motor connections
	Incorrect resolver connection	Check motor connections
	Servoamplifier fault	Read the technical documentation of the servo-amplifier. In function of fault number, possible causes are suggested with associated solutions.
Cylinder doesn't move in correct direction	Incorrect motor/resolver connection or incorrect servoamplifier parameter	Check motor connections or change direction of movement in the servoamplifier parameters
Cylinder vibrates in stop position	Position control parameters not adapted to application	Optimize the position control parameters definition in relation with the application

6.3 Before requiring Ewellix assistance

If the problem hasn't been resolved, although all the solutions given in the previous two paragraphs have been considered and implemented, get in touch with your local Ewellix representative for information on contacting technical support.

Before requiring Ewellix assistance, please have the following information:

- Serial number of the cylinder (e.g. ARxxxxx-yyyy. Ex: AR33543-0223 corresponds to cylinder no 223 with 33543 design file number).
- Malfunction nature and duration (continuous? sometimes? (estimated frequency?), malfunction occurs only one time?).
- When and in what conditions the malfunction occurs (a detailed description is required).
- If possible, take pictures or screen captures to illustrate malfunction description.



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