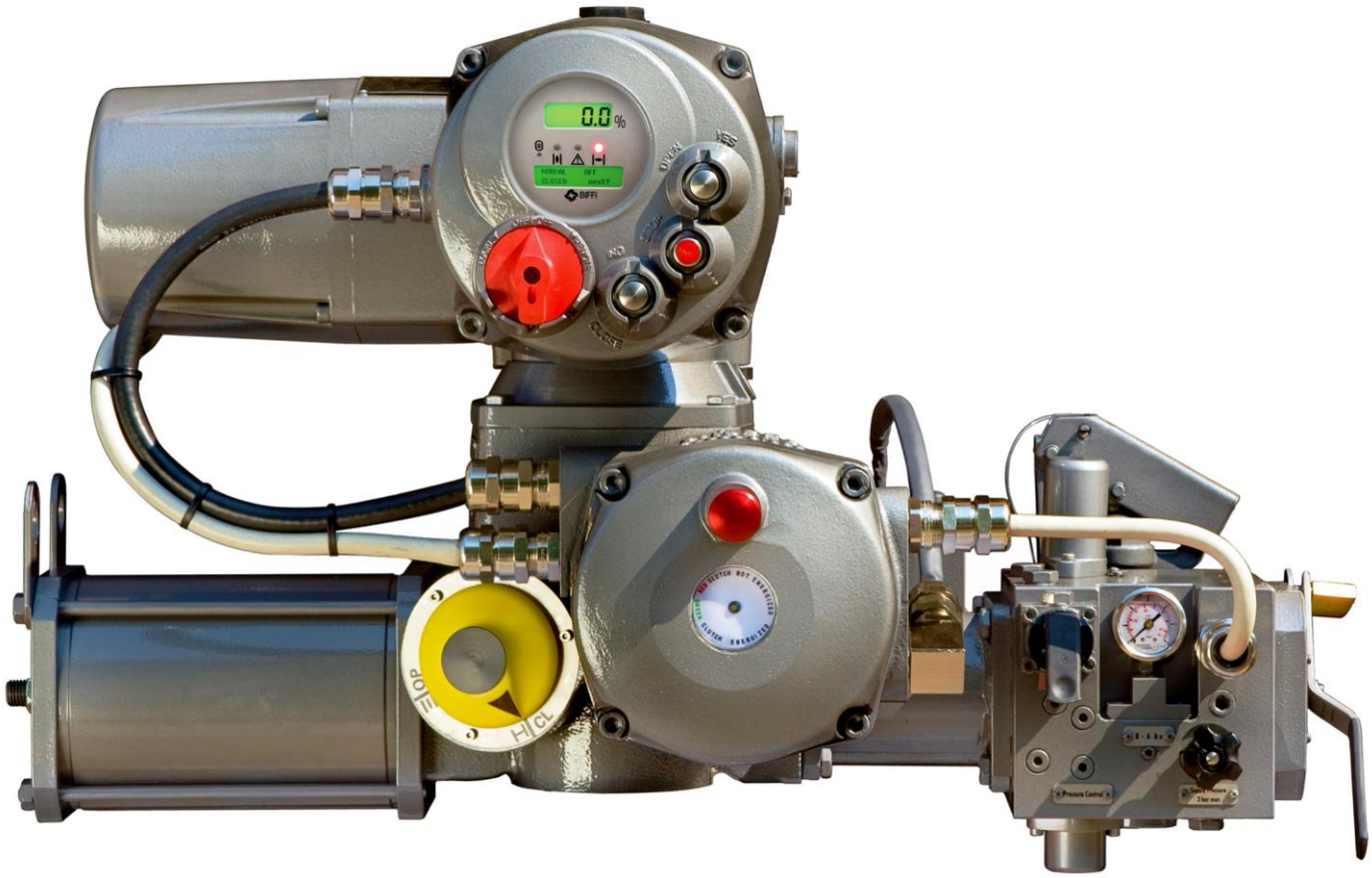
MAN 681



EFS2000v4

Instruction and Operating Manual

Rev.	Date	Description	Prepared	Approved
6	*15/07/2016*	*General Revision*	*Comelli/Esposito/ Battaglia*	*L.Vigliano*
5	*17/May/2016*	*Updated Page 80 Hydraulic control group*	*M. Rakita*	*L.Vigliano*
4	*21/Oct/2014*	*Updated Page 31 Ohm indication*	*A. Battaglia*	*L.Vigliano*
3	*08/Sept./2014*	*Updated dwg pag 105 of 109 and revised par13.1.2*	*E. Ermanni*	*L.Vigliano*
2	*11/Oct/2011*	*Updated*	*A. Affaticati*	*G. Alfieri*
1	*25/May/2009*	*Updated*	*A. Affaticati*	*G. Alfieri*
0	*08/Aug/2007*	*Issue*	*A. Affaticati*	*G. Alfieri*

BIFFI ITALIA has taken every care in collecting and verifying the documentation contained in this Instruction and Operating Manual.

INDEX

1 GENERAL SAFETY INSTRUCTIONS

1.1 Manufacturer

Manufacturer with respect to the Machinery Directive 2006/42/EC is BIFFI ITALIA, as specified on the machinery label.

1.2 Machine Intended Use

The machines to whose this Instruction and Operating Manual applies are the **EFS2000v4** Fail Safe Electric Actuators, which are designed to operate any kind of quarter-turn industrial valves for use in ESD applications in heavy industrial, chemical, petrochemical, food, water and power generating plants.
BIFFI ITALIA will not be liable for any possible damage or physical injury resulting from use in other than the designated application or by lack of care during installation, operation, adjustment and maintenance of the machinery. Such risks lie entirely with the User.
Depending on the specific working conditions, additional precautions may be required.

The **EFS2000v4** are produced by BIFFI ITALIA and identified on the proper label by the product designation: EFS xxx/yyyy-zz

Important: 	**This Manual gives basic information for EFS2000v4 setting; more detailed information for setting and control of the Electric Actuator part ICON2000 are included on the MAN 618 which form part of the mandatory instructions documentation.**

Warning: 	**It is assumed that the installation, the setting, the commissioning and the maintenance and repair works are carried out by qualified personnel and checked by responsible Specialists.**

The **EFS2000v4** are designed in accordance with the applicable International Rules and Specifications but in any case the following Regulation must be observed:

- the general installation and safety regulations
- the plant specific regulations and requirements
- the proper use of personal protective devices (glasses, clothing, gloves)
- the proper use of tools, lifting and transport equipment.

1.3 Terms and conditions

BIFFI ITALIA guarantees each single product to be free from defects and to conform with current goods specifications and regulations as applicable. The warranty period is 12 months from the date of installation by the first User or 18 months from the date of shipment to the first User, whichever occurs first. No warranty is given for products, which have been subject to damages or corrosion due to the improper storage, improper installation, misuse, or which have been modified or repaired by unauthorised personnel.
Repair work due to improper use will be charged at standard rates.

1.4 Manufacturer's Liability

Biffi Italia declines all liability in the event of:

- use of the machinery in contravention of local safety at work legislation.
- incorrect installation, disregard or incorrect application of the instructions provided on the product nameplate and in this Instruction and Operating Manual.
- modification of the product without Biffi's authorisation.
- work done on the product by unqualified or unsuitable personnel.

1.5 Applicable Standards and Regulations

EN ISO 12100-1	Safety of machinery - Basic concepts, general principles for design. Part 1-Basic terminology, methodology.
EN ISO 12100-2	Safety of machinery - Basic concepts, general principles for design. Part 2-Technical principles and specification.
EN60204/1	Electrical equipment of industrial machines. Part1-General requirements
2006/42//EC	Machinery Directive.
2014/35/EU	Low Voltage Directive
2014/30/EU	EMC Directive
2014/34/EU	ATEX Directive

1.6 Installation in hazardous area

Warning: 	**In case the EFS2000v4 are to be installed in HAZARDOUS AREA, as defined by the applicable Rules, it is mandatory to check if the nameplates of the EFS2000v4 and associated ICON2000 specify that the assembly is suitable to be installed in HAZARDOUS AREA with the indication of appropriate degree of protection.** **Maintenance and repair works must carry out by qualified personnel and checked by responsible Specialists.**

The **EFS2000v4** version suitable for installation in hazardous area, with the associated electric actuator type ICON2000/ICON2000EC and accessories, is designed according to all the applicable Standards EN/IEC 60079-0, EN/IEC 60079-1, EN/IEC 60079-7, EN/IEC 60079-11, EN/IEC 60079-31, EN 13463-1 and EN 13463-5.

Different types of protection are available, depending on the requirements of the installation site.

Specific type of protection is printed on the labels, as follows:

- Ex d IIB Txx with all enclosures in “explosion proof” version
- Ex d IIC Txx with all enclosures in “explosion proof” version
- Ex de IIB Txx with enclosures in “explosion proof” version and terminal board enclosure in “ increased safety” version. (only for enclosure of actuator ICON2000)
- Ex de IIC Txx with enclosures in “explosion proof” version and terminal board enclosure in “ increased safety” version. (only for enclosure of actuator ICON2000)
- All the above version can be equipped with an additional battery in an intrinsically safe enclosure according to IEC 60079-11. (only for actuator ICON2000)

The above versions of **EFS 2000v4** are suitable to be safely installed in hazardous areas preventing the risk of explosion in the presence of gas or ignitable dusts.

EFS 2000v4 have IP66/68 degree of protection according to EN/IEC 60529. IPX8 according to EN/IEC 60529 is defined for an immersion at a depth of 10 meters and for a duration of 48 hours.

1.7 Marking for application in hazardous area

1.7.1 Label for ICON2000/ICON2000EC

Marking description:

0080 = Notified Body for ATEX

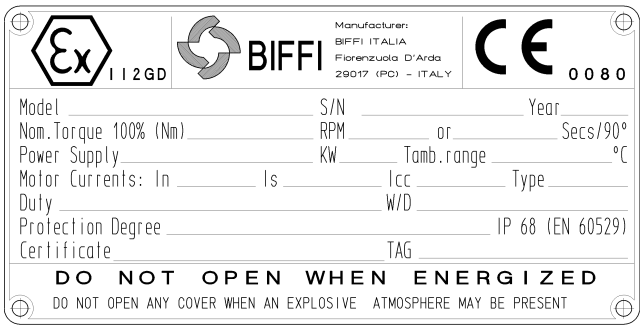
II = Group II (Surface)

2 = Category 2 apparatus

G = explosive atmosphere by gas

D = explosive atmosphere by dust

IP 66/68= degree of protection



1.7.2 Label for EFS2000v4

Marking description:

0080 = Notified Body for ATEX

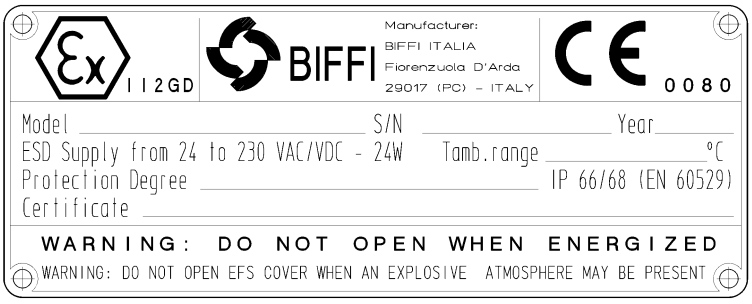
II = Group II (Surface)

2 = Category 2 apparatus

G = explosive atmosphere by gas

D = explosive atmosphere by dust

IP 66/68= degree of protection



1.8 Extract from the Standard

Type of Hazard	Classification of Zones	Categories acc. to 94/9/EC Directive
Gas, mists or vapours	Zone 0	1G
Gas, mists or vapours	Zone 1	2G
Gas, mists or vapours	Zone 2	3G
Dust	Zone 20	1D
Dust	Zone 21	2D
Dust	Zone 22	3D

2 MACHINE DESCRIPTION

2.1 General

The **EFS2000v4** (Electric Fail Safe) is an electric quarter turn spring return actuator which has the purpose to move the valve in a "fail safe" state (Fail Open or Fail Close), when the system is de-energized.
As it's described in the next sections, several modes for **EFS2000v4** are available in order to move the valve in a "fail safe" state but it's important to highlight that the "safety function" with SIL classification is only the one mentioned in the document:

- SM 020 (SIL Safety Manual – Actuator series EFS2000 v4)

which clearly defines the **EFS2000v4** "safety function" as follow:
"The actuator performs the safety function on demand if it delivers a full stroke driven by the spring, moving the valve to the safe position (either closed or open depending upon the valve to be actuated) when the system is de-energized (i.e. cutting the electric supply to the electromagnetic clutch)."
Statement above clearly specify mode of operating the actuator in order to perform the "safety function" (i.e. cutting the electric supply to the electromagnetic clutch).

NOTE:
In the next section of present IOM, only "safety function" (as it's defined here above) will be considered as an action related to an ESD (Emergency Shut-Down) command.

Any other device described in the next sections of present Instructions and Operating Manual which commands the actuator to reach its fail safe state shall not be considered as "Safety Functions".
All these device are not compliant to IEC 61508 requirements, they are not a safety system and they are not SIL classified.

All actions of Shut-Down related to these type of commands or device shall not be considered in an Emergency Condition

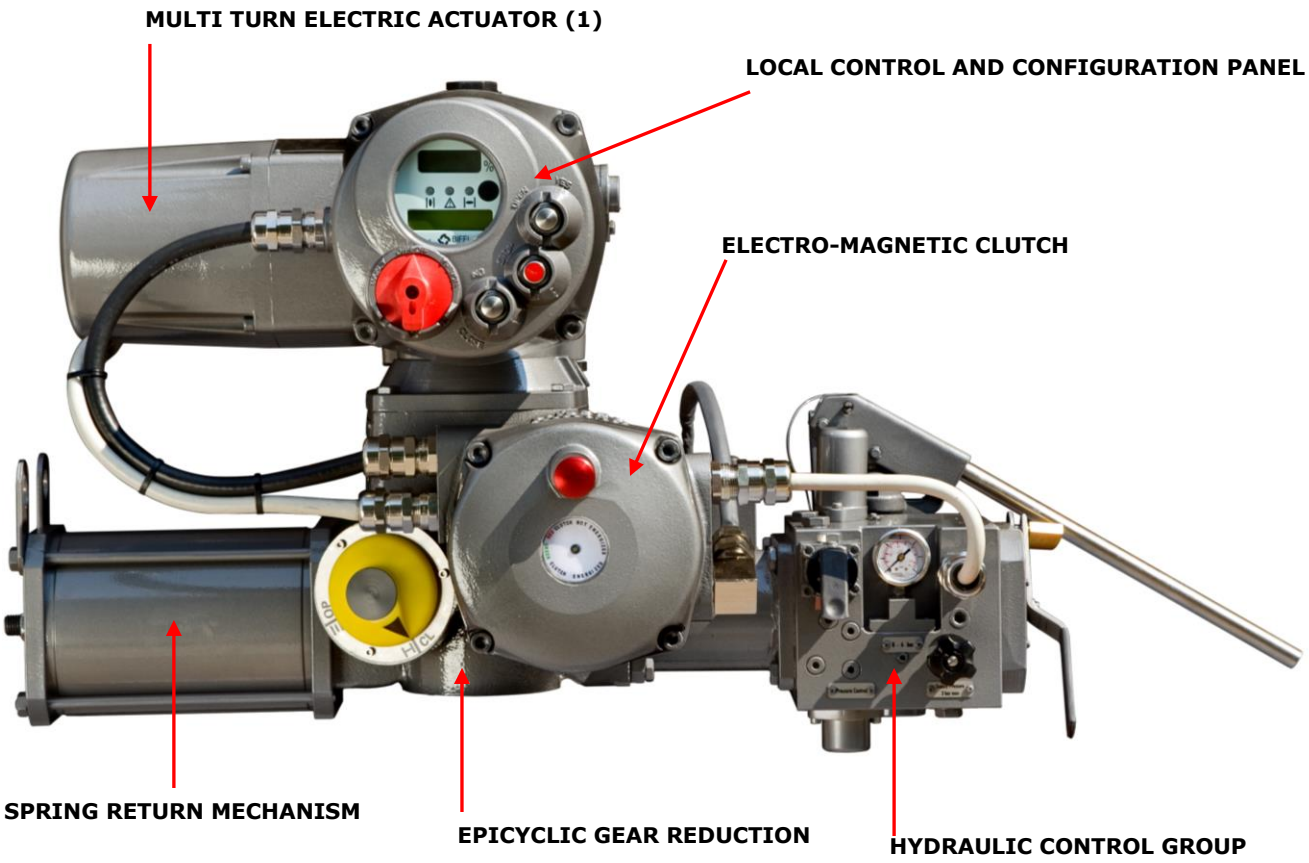
NOTE:
In order to avoid misunderstanding, in the next section of present IOM, acronym ESD without any explanation has to be intended with the meaning of Emergency Shut-Down.
Where it's specified, acronym ESD has to be intended as EFS shutdown.

The PST (Partial Stroke Test) functionality is also available integrated in the actuator control system in order to check the integrity of the actuator and valve in safety applications.
In many cases, however, there was difficulty to find out on site the pneumatic/hydraulic power, while the electric power supply is always available in every industrial plant.

2.2 Main Parts Description

The **EFS2000v4** actuator consists of six main parts:

- a spring return mechanism, which moves the valve in the foreseen fail-safe condition
- a multi-turn electric actuator which operates, through an epicyclical gearing, the valve during normal working conditions and in the mean time compress the spring when the operation is opposite to the fail safe direction;
- an epicyclical gear reduction, which increment the torque of the multi turn actuator;
- an electro-magnetic clutch which hold in position an epicyclical gearing during the normal operation and release it in case of fail-safe function;
- an hydraulic control group, which is necessary to adjust the fail-safe speed and to manually operate the actuator by means of an hand-pump in case of power failure; to prevent potential damages a manually operated switch interrupts the automatic operation during the manual operation with hand-pump;
- a local control and configuration panel, which is used to configure the parameters and to operate locally via OPEN-CLOSE-STOP push-buttons and 3-position LOCAL-OFF-REMOTE selector the actuator when electric power is present.



(1) Multi turn electric actuator ICON 2000 with separated Certificate.

2.3 Working Principles

The spring return system is kept in fail safe position by helical springs. During the normal operation the multi-turn turn electric actuator transmits the movement to the valve through the epicyclical gearing reduction and to the spring return mechanism through the rack.

Spring return mechanism is based on rack-pinion mechanism; the rack is connected in one side to the spring and in the other side to the hydraulic cylinder; pinion of rack-pinion mechanism is connected to the valve stem.

Input shaft of the epicyclical gearing reduction is connected the multi-turn actuator output shaft; output shaft of the epicyclical gearing reduction is connected to the pinion of rack-pinion mechanism. The female wheel of the epicyclical reduction is reversible: during normal operation it is kept on position by means of a electromagnetic clutch which hold the worm shaft connected to the epicyclical gearing.

The coil of the electromagnetic clutch is normally fed by a direct current from separated external power source, or derived from motor power voltage, through a supply module.

When the ESD condition occurs, the supply to the electromagnetic clutch is cut causing the disconnection of system which hold the worm shaft: in this conditions the epicyclical gearing become reversible causing the movement of the actuator on the fail condition by the effect of the spring.

To avoid dangerous shock to the valve during the ESD action, an hydraulic damper is mounted on the spring system, with an adjustable flow control orifice to be set to obtain the specified ESD times.

Position of the valve is continuously monitored both in electric mode, both in fail-safe condition, by means of a position sensor directly connected the EFS2000v4 output drive.

For the “EFS long fail safe” version the electric command in the same direction of the spring action is always inhibited.

3 STORAGE and PRE-INSTALLATION

Important:

Not performing the following procedures will invalidate the product guarantee.

3.1 Checks to be carried out on receipt of the actuator

- Check first of all if the information written on the nameplate (Models, Nominal torque, Nominal Voltage, Degree of protection,..) correspond with the data of the product which is expected.
- If the actuator arrives already assembled onto the valve, the setting of the mechanical stops and of the electric end of travel has already been made by the person who assembled the actuator onto the valve.
- If the actuator arrives separately from the valve, the setting of the mechanical stops and of the electric end of travel must be checked and, if necessary, carried out while assembling the actuator onto the valve.
- Check that the actuator has not been damaged during transport. If necessary, repair all damages to the paint-coat, etc.
- Check that the model, the serial number of the actuator and the performance data written on the data-plate are in accordance with those described on the order acknowledgement, test certificate and delivery note.
- Check that the fitted accessories comply with those listed in the order acknowledgement and the delivery note.

3.2 Storage Procedure

The actuators leave the factory in excellent working conditions and with an excellent finish (these conditions are guaranteed by an individual inspection certificate); in order to maintain these characteristics until the actuator is installed on the plant, it is necessary to observe a few rules and take appropriate measures during the storage period.

- Make sure that plugs are fitted in the air connections and in the cable entries. The plastic plugs which close the inlets do not have a weatherproof function, but are only a means of protection against the entry of foreign matter during transport. If long-term storage is necessary and especially if the storage is outdoor, the plastic protection plugs must be replaced by metal plugs, which guarantee a complete weatherproof protection.
- If the actuators are supplied separately from the valves, they must be placed onto a wooden pallet so as not to damage the coupling flange and the output shaft. In case of long-term storage, the coupling parts (flange, output shaft) must be coated with protective oil or grease; if possible, blank off the flange by a protection disk.
- In case of long-term storage, it is advisable to keep the actuators in a dry place or to provide at least some means of weather protection. If possible, it is also advisable to periodically operate the actuators with filtered, dehydrated and lubricated air; after such operations, all the threaded connections of the actuator and the valves of the control panel (if present) should be carefully plugged.

4 ASSEMBLING the ACTUATOR ONTO the VALVE

The actuator is provided with an output flange (or a spool piece and a stem extension) for coupling to the valve. The assembly position of the actuator, with reference to the valve, must comply with the plant requirements (spring cartridge axis parallel or perpendicular to the pipeline axis).

To assemble the actuator onto the valve proceed as follows:

- Check that the coupling dimensions of the valve flange and stem, or of the relevant extension, meet the actuator coupling dimensions.
- Arrange the valve in the position related to the actuator spring operation.
- Lubricate the valve stem with oil or grease in order to make the assembly easier: be careful not to contaminate with lubricant the flange surfaces with have to be connected to transmit the actuator torque.
- Clean the valve flange and remove anything that might prevent a perfect adherence to the actuator flange and especially all traces of grease, since the torque is transmitted by friction.
- Assemble the stem extension onto the valve stem.
- Bring the actuator to the position caused by the spring operation.
- Connect a sling to the support points of the actuator and lift it: make sure the sling is suitable for the actuator weight. When possible, it is easier to assemble the actuator to the valve if the valve stem is in the vertical position. In this case the actuator must be lifted while keeping the flange in the horizontal position.
- Clean the actuator flange and remove anything that might prevent a perfect adherence to the valve flange and especially all traces of grease.
- Lower the actuator onto the valve so that the shaft output drive enters into the groove of the stem extension. This coupling must take place without forcing and only with the weight of the actuator. When the actuator output shaft and the valve stem are connected, check the holes of the valve flange. If they do not meet with the holes of the spool piece flange or the stud bolts screwed into them, the actuator shaft output drive must be rotated; feed the actuator cylinder with air at the proper pressure or actuate the manual override, if existing, until coupling is possible.
- Tighten the nuts of the connecting stud bolts evenly with the torque prescribed in the table. If no different materials are specified, the stud bolts must be made of
  ASTM A 320 Grade L 7 steel, the nuts must be made of ASTM A 194 Grade 2 or better.

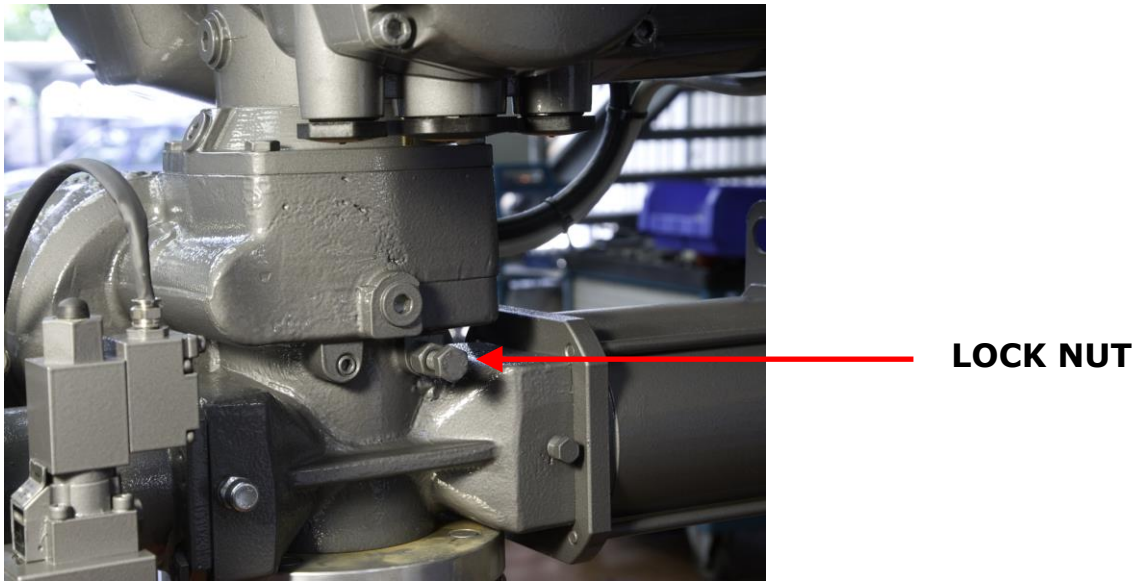
Thread size	Recommended tightening torque (Nm)
M6	8
M8	20
M10	40
M12	70
M14	110
M16	160
M20	320
M22	420
M24	550
M27	800
M30	1100

- If possible, operate the actuator to check that it moves the valve smoothly.

5 SETTING of ANGULAR STROKE

It is important that the mechanical stops of the actuator (and not those of the valve) stop the angular stroke at both extreme valve positions (fully open and fully closed), except when this is required by the valve operation (e.g. metal seated butterfly valves).

The setting of the angular stroke is performed by adjusting the travel stop screw mounted on the spring cartridge end flange and the travel stop screw mounted on the EFS2000v4 carter (see the Picture below).



For the adjustment of the stop screw proceed as follows:

- Loosen the lock nut.
- If the actuator angular stroke is stopped before reaching the end position (fully open or closed), unscrew the stop screw by turning it counter clockwise, until the valve reaches the right position. When unscrewing the stop screw, keep the lock nut still with a wrench so that the sealing washer does not withdraw together with the screw.
- Tighten the lock nut.
- If the actuator angular stroke is stopped beyond the end position (fully open or closed), screw the stop screw by turning it clockwise until the valve reaches the right position
- Tighten the lock nut.

	
Setting the stop screw positioned on the actuator's carter	Setting the stop screw positioned on the spring cartridge end flange

6 INSTALLATION

6.1 Working condition

The standard **EFS2000v4** are suitable for the following ambient temperatures:

from -20°C to +70°C (from -22°F to +158°F) or

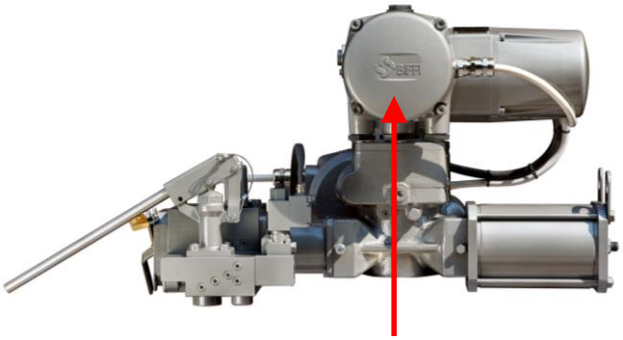
from -45°C to +70°C (from -49°F to +158°F)

Important:	**Check the "temperature ambient range" embossed on the nameplate, for the correct utilisation with respect to the ambient temperature.** **Installation in ambient with temperature range outside the specified values will invalidate the warranty.**

6.2 Removing the electrical enclosures covers

In the **EFS2000v4** is foreseen the terminal enclosure shown in the following Picture.

Using an Allen key, loosen the four screws fixing the cover and then remove it.



Main terminal enclosure for power and controls

Warning:	**Pay attention to do not damage the joint surface of the covers.**

Important:	**In case the screws of the cover must been replaced, a SS AISI 316 Class A4 must be used with minimum yield strength of 450 N/mm^2**

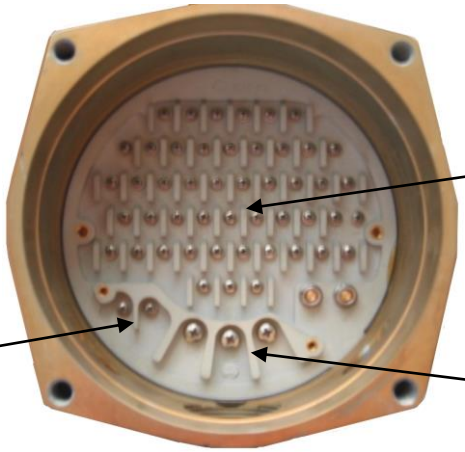
6.3 Electrical connections

Before applying voltage to the **EFS2000v4** check that the electrical parameters (supply voltage and current) shown on the nameplate and on the attached wiring diagram, are correct for the installation.

Important:	**All the accessories, which equip the EFS2000v4, in particular the cable glands, must be certified according to the Standard Directive and specific Rules, which apply to the products.**

Remove the plugs from the cable entries.

Main terminal board



For electrical connections use components (cable glands, cables, hoses, conduits) which meet the requirements and the applicable Codes of the plant specifications (mechanical protection and/or explosion-proof protection). Screw the cable glands (or the conduits) tightly into the threaded entries, in order to guarantee the weatherproof and explosion-proof protection (when applicable).

Insert the connection cables into the electrical enclosures through the cable glands (or conduits) and, according to the Wiring Diagram enclosed on the main terminal board enclosure, connect the electrical supply, the control, the signal and ESD lines to the actuator, by linking them with the terminal blocks termination as per diagram.

Replace the plastic plugs of the unused enclosure entries by metal ones, to guarantee perfect weatherproof tightness and to comply with the explosion-proof protection codes (where applicable).

Once the connections are completed, check that the controls and signals work properly.

6.4 EFS 200v4 Cable entries

The sealing of cable and conduit entry should be carried out in accordance with National Standards or the Regulatory Authorities that have certified the **EFS2000v4**. This is particularly true for units that are certified for use in hazardous areas where the method of sealing must be to an approved standard and cable glands, reducers, plugs and adapters must be approved and separately certified.

Important:

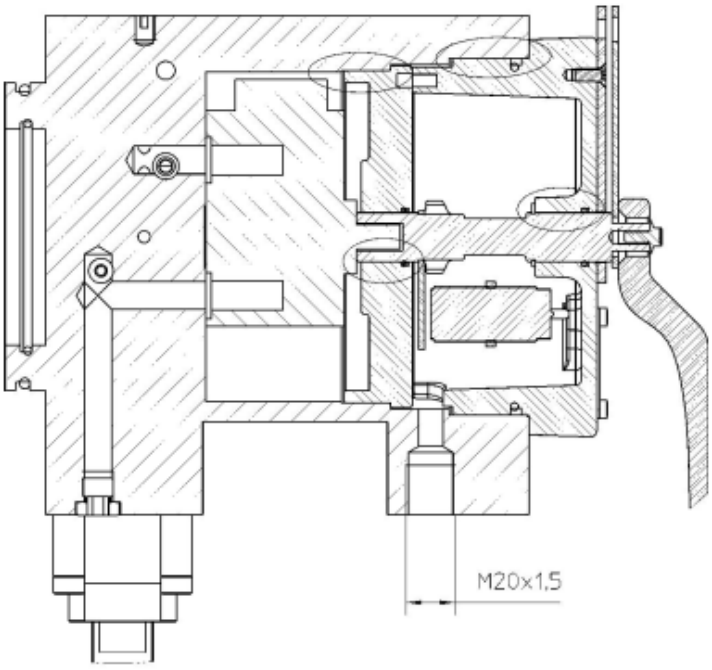
To prevent any water infiltration through the line cable conduits, be sure that the cable glands used have the minimum degree of protection required by the plant and specified on the actuator label.

Remove the cable entry plug.

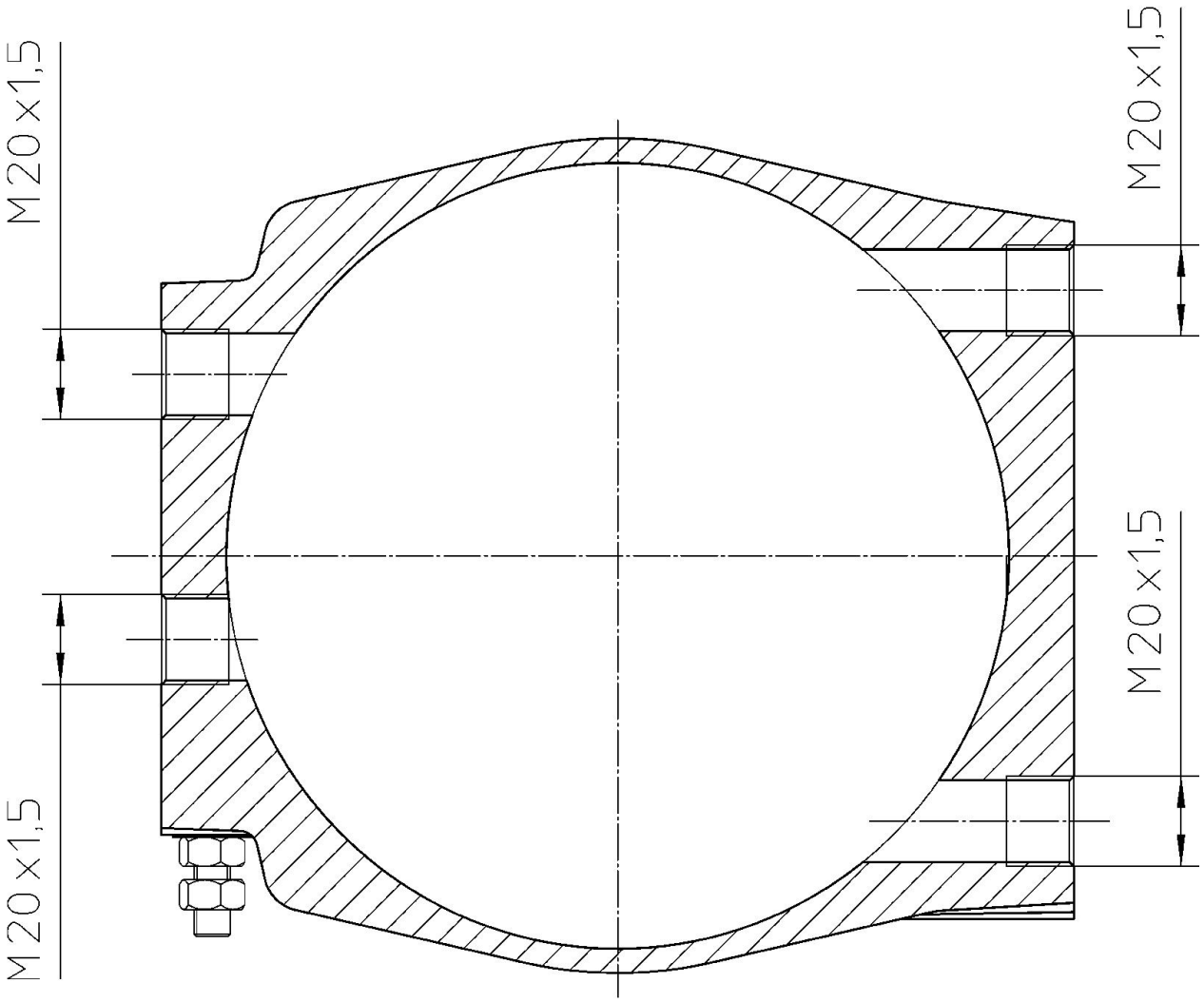
To guarantee weatherproof and explosion-proof fit, screw the cable gland tightly (at least 5 turns) and block it with a thread sealant. The use of a thread sealant is necessary in case of explosion-proof capability.

If some parts of the cable glands have been removed during work on the cable entries put them back into place now to avoid losing the dismantled parts.

6.4.1 Entries on the Manually Operated Electrical Switch enclosure



6.4.2 Entries on the Electro-Magnetic Clutch Device enclosure



6.5 Safety Instructions for installation in Hazardous Area

6.5.1 Instructions for the explosion-proof enclosures

Important: 	**Electric Actuator EFS2000v4 must be installed and maintained according to the applicable Rules regarding the electrical installation in Hazardous areas (other than mines) classified as zone 1 and/or 2 (gas) and zone 21 and/or 22 (dust) according to IEC/EN 60079-10 (hazardous area classification).** **Example: IEC/EN 60079-14 (electrical installation), IEC/EN 60079-17 (maintenance).**

During the dismantling and subsequent reassembling of the explosion-proof enclosures (covers, cable glands, joints) be careful to bring these enclosures back to their original condition to maintain their integrity. In particular, be sure the joint surfaces of all enclosures are spread with a film of recommended grease. Procedure to be followed:

- Do not damage the explosion-proof mating surfaces on the housing and on the electrical enclosure covers.
- Reinstall all the screws that go with the dismantled parts, and block them with a thread sealant after spreading them with a film of copper- or molybdenum-based grease. This will keep screws from sticking and make maintenance operations easier.

Important: 	**In case the screws of the cover or other parts relevant to the explosion-proof protection must been replaced check that new bolts and/or screws are of the same dimension and quality as the original ones as stated on the list of material included on this manual, or of a better quality. In case the screws of the cover must been replaced, a SS AISI 316 Class A4 Grade 70 must be used with minimum yield strength of 450 N/mm^2**

Warning: 	**Do not electrically operate the EFS2000v4 when the electrical enclosures are removed. Operating the unit with the electrical enclosures removed could cause personal injury.**

- Replace the weatherproof seals that may have been removed (O-Ring for the covers, O-Ring for the explosion-proof joint of the motor).

6.5.2 Installation in ambient with explosive dusts

Important: 	**Electric Actuator EFS2000v4 must be installed and maintained according to the applicable Rules regarding the electrical installation in Hazardous areas (other than mines) classified as zone 21 and/or 22 (dust) according to IEC/EN 60079-10 (hazardous area classification). Example: installation and maintenance according to IEC/EN 50281-1-2.**

Special attention must to these following points:

- before the assembly the joint surfaces must be greased with silicon oil or equivalent.
- the cable glands must have a protection degree at minimum IP6X (EN 60529).
- periodically verify the quantity of dust deposited on the enclosure and clean it in the case the quantity becoming more than 5mm.

7 EFS OPERATION

7.1 Operating the EFS 2000v4 for the first time

Before connecting electrical power to the actuator and ESD clutch, check that the voltages are correct. ESD clutch can be supplied by any voltage in the range 24Vdc-240Vac, actuator should be supplied according to indication in the nameplate. Wrong power supply could cause permanent damage to the electrical components. Check of phase rotation is not necessary since the unit is provided with automatic phase rotation correction. Check that the valve is in SAFE POSITION and the manual override selector is in AUTO. Place the 3-position selector in OFF and then power actuator and ESD clutch. The alphanumeric display of actuator shows the following message for about 3 seconds:

Biffi Italia EFS2000 v4 ntb

Then the new message should be:

INT EFS OFF STOP

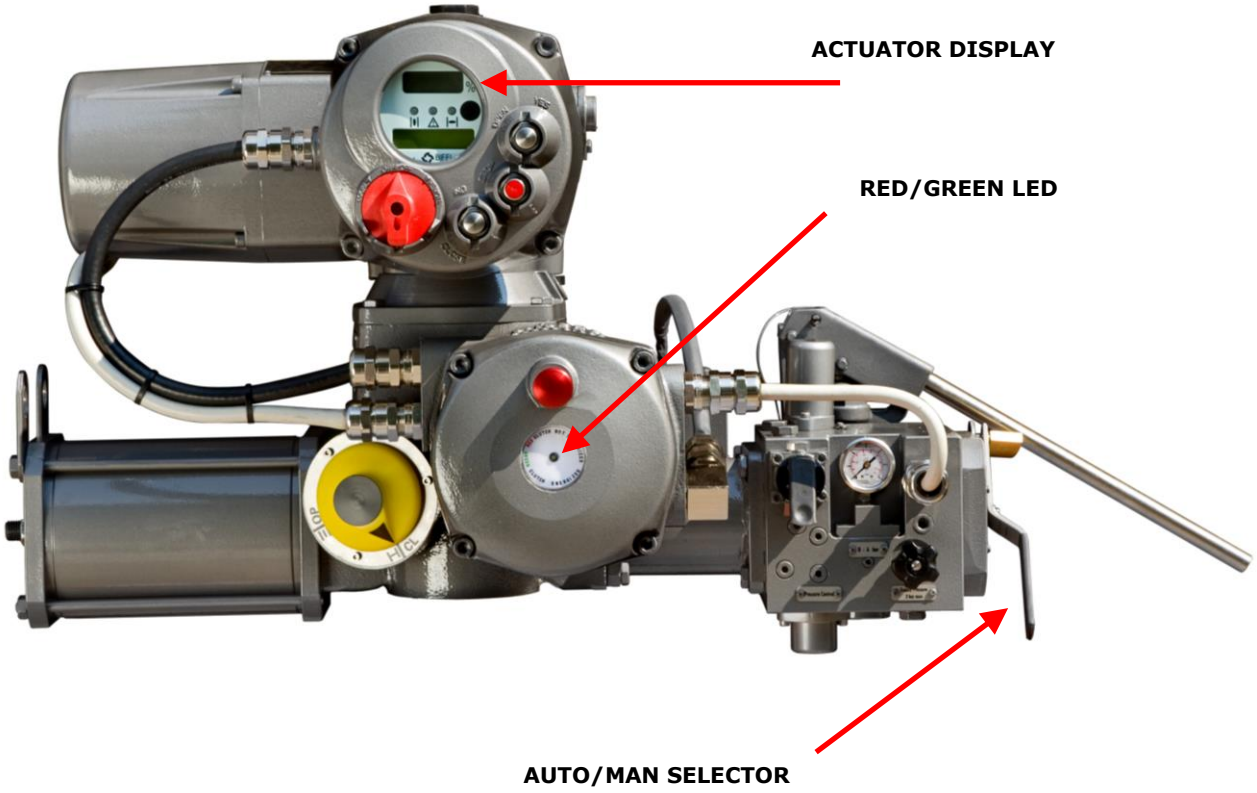
or

INT EFS OFF R%: xxx.x

according to the configuration present in the memory. If the upper line of the display shows "ALARM", remove the alarm before going ahead (see chap. MAINTENANCE and TROUBLE-SHOOTING). If the upper line of the display shows "WARNING", a warning condition is present. You can go ahead since the EFS2000 is working well, but some data is not according to the configured parameters (see chap. MAINTENANCE and TROUBLE-SHOOTING). If the upper line of the display shows "INT", an Interlock input is active. If the upper line of the display shows "INT EFS", the clutch is not energized and the actuator cannot be electrically controlled. If the upper line of the display shows "NORMAL" the actuator can be electrically controlled.
Do not operate the actuator without first checking that the configuration is according to the required application by using the "VIEW and SET-UP" features (see chap. VIEW MENU, SETUP MENU, VIEW ROUTINES, SETUP ROUTINES). In particular the following parameters have to be set:

- ICON power-fail: enabled or disabled
- Selector in OFF: enabled or disabled
- Autoreset: enabled or disabled
- Reset Delay: from 1 to 255sec. The recommended value is greater than 1.5 time the maximum valve stroke time during EFS action

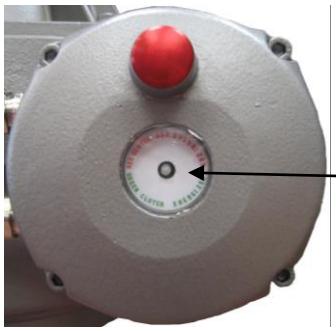
ESD clutch cannot be energized until the manual override selector is in MANUAL.
If AUTORESET was configured "enabled", wait until the LED, in the clutch enclosure, is green and the INT EFS message on local display disappears. Place the local selector in LOCAL and electrically drive the actuator to open and close. If AUTORESET was configured "disabled", wait until the LED in the clutch enclosure is red and then push the red mushroom pushbutton. When the above LED is green, the INT EFS message on local display disappears. Place the actuator local selector in LOCAL and electrically drive the actuator to open and close by means of the OPEN/YES and CLOSE/NO pushbutton. Set torque limits and position limits by means of the "stroke limits routine" in the "actuator set-up" menu . When the strokes limits and the configurations are correct, move the 3-position selector to LOCAL and drive the actuator to either open or closed position . Move the 3-position selector to REMOTE, to remotely control the actuator.



7.2 ESD clutch status

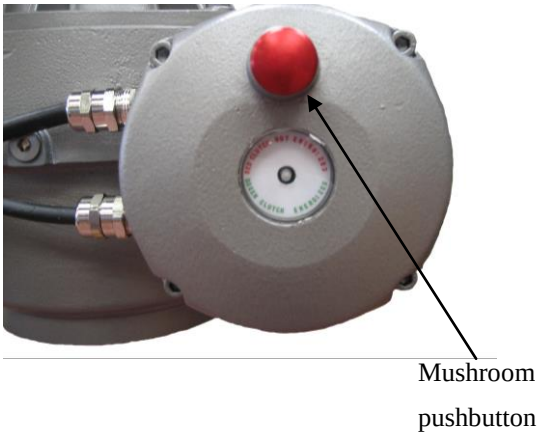
One red/green LED on the clutch enclosure indicates the status of the ESD electrical clutch as follows:

- Off: clutch not supplied
- Green: clutch coil energized
- Red: clutch coil not energized.
- Green flashing: clutch coil will be energized at the end of the configured RESET DELAY time



7.3 Local Shut-Down command, Reset and Autoreset

One red mushroom pushbutton is available as Local Shut-Down command and EFS reset. If clutch is energized, the LED in the clutch enclosure is green and the mushroom pushbutton works as Local Shut Down command to de-energize the coil clutch and perform the action operated by the spring. If clutch is not energized, the above LED is red and the mushroom pushbutton works as EFS reset , to energize the clutch coil and allow electrical open/close operation. AUTORESET function works only if it was configured "enabled". The above function performs an automatic EFS reset and energizes the clutch coil after the configured RESET DELAY time. The configured RESET DELAY time must be greater than the stroke time during Local Shut-Down operation.



7.4 EFS Shut-Down action

The EFS ESD action is carried out in case of loss of voltage supply of clutch coil (as it's described in SM 020 (SIL Safety Manual – Actuator series EFS2000 v4)
The Local Shut-Down actions are carried out if the Local red mushroom pushbutton is pressed
According to actuator configuration , the EFS action can be carried out also in case of :

- loss of actuator main power supply
- 3-position selector in OFF: *the start of EFS action is delayed 20 sec from switching to OFF of the selector to allow the operator to enter view and setup mode. In VIEW and SETUP mode the Shut-Down action is not carried out.*

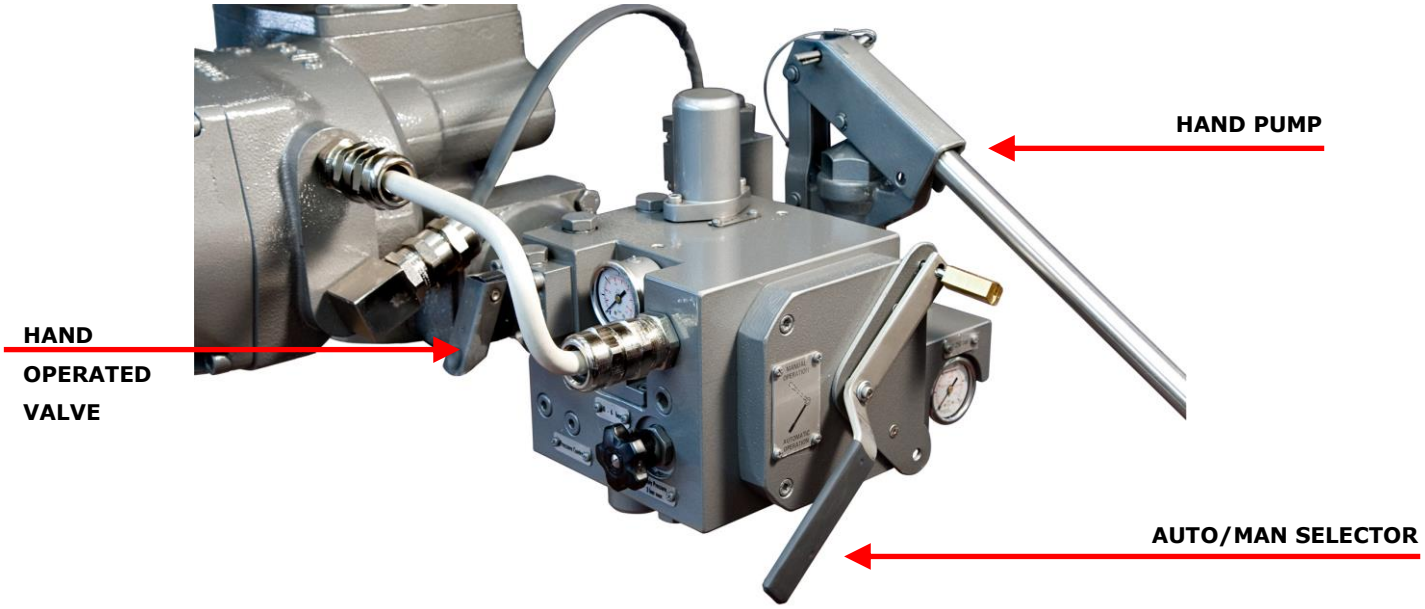
The condition EFS action in progress can be configured to switch-over the monitor relay for remote signalling by means of VIEW and SETUP menu ("ESD – EFS" parameter). If SAFE POSITION is not reached after a predetermined time, an alarm of EFS MID TRAVEL is generated. The alarm is locally indicated by the yellow LED of the actuator and remotely by the change over of the monitor relay and one of the auxiliary relay As1,…,As8 , according to the configuration done in the VIEW and SETUP menu.
After the EFS action has been carried out, the local display shows the message "INT EFS" and actuator electrical commands are inhibited. If AUTORESET function is ON (enabled), the EFS reset is performed after the RESET DELAY time and the electrical actuator commands are available. If the AUTORESET function is OFF (disabled) it needs to push the red mushroom pushbutton to perform EFS reset and enable electrical actuator commands.
During the Shut-Down action the time corresponding to 1% of position change is memorized . Up to 16 Shut-Down action profiles can be memorized. When a new set of data is available the oldest one is cancelled and the new set is stored. The command "SET ESD REFERENCE" (to be intended as "Set EFS Shut-Down Reference") available in the VIEW and SETUP menu allows to make a copy of 1 off 16 "ESD curves" in the "ESD reference". The "Shut-Down reference" will not be updated until a new "SET ESD REFERENCE" (to be intended as "Set EFS Shut-Down

Reference")" command is entered. Via Bluetooth, the data can be read by a PDA or PC with A-manager tool and the Shut Down curves and reference, Position versus Time, can be visualized and compared.

NOTE:
In this case, ESD is simply a firmware parameter related to a Shut-Down action which is not related to the EFS 2000v4 "safety function"

7.5 MANUAL override operation

The AUTO / MANUAL selector allows to select between MANUAL and AUTO mode.
In MANUAL mode the clutch is de-energized, the actuator remains in stayput, electrical commands are inhibited, the LED in the clutch enclosure is red, the message on the actuator display is INT EFS and the actuator can be manually moved by means of the hand pump and the hand operated spring return valve (Hydraulic Control Group). To re-energize the clutch and to be ready to perform EFS action , press 10 sec the red mushroom pushbutton and then switch the AUTO/MANUAL selector to AUTO within 30 sec to switch to AUTO mode. The actuator remains in stayput and is available to be driven by electrical commands. If the selector is still in MANUAL mode after 30 sec the clutch is de-energized again. If the selector is switched to AUTO without performing the above procedure, the actuator carries out the Local Shut-Down action since the clutch is not energized. The condition EFS in MANUAL can be configured to switch-over the monitor relay for remote signalling by means of VIEW and SETUP menu ("output relays, "ESD" (to be intended as "EFS Shut-Down Reference") parameter). The above condition can be also signalled by an auxiliary relay As1,…,As8 by configuring the parameter "EFS in manual" in the VIEW and SETUP features, Output relays.
In AUTO mode the EFS works under control of electrical actuator as described in previous paragraphs.



7.6 Partial Stroke Test (PST)

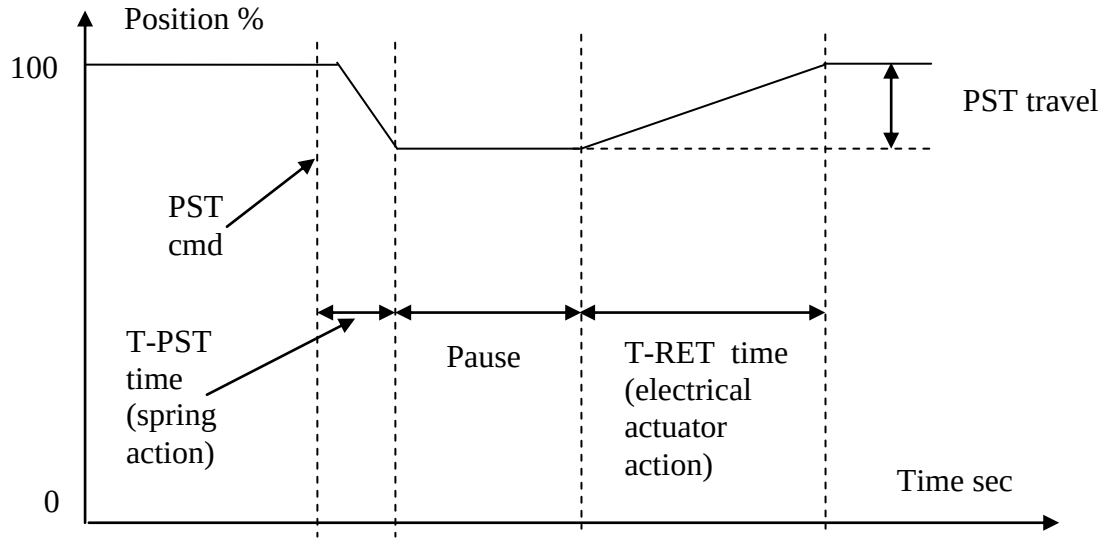
The PST function is available to check the functionality of the essential parts and to achieve the EFS safety function while the valve is in line and in service. The test consists in de-energizing the clutch to move the valve to the configured position (PST TRAVEL) by action of spring and then re-energizing the clutch to stop the valve moving. After the PAUSE time the valve is moved to initial position by the actuator. The following parameters are available in the VIEW and SETUP menu , ACTUATOR SETUP, EFS SETUP, PST SETUP routine, to set PST function behaviour:

1. PST mode: OFF, AUTO, MANUAL
   - OFF: PST not used
   - AUTO: PST cycle carried out automatically and cyclically with time interval set by the parameter PERIOD and at the time set by the parameter HOUR of DAY

- MANUAL: PST cycle carried out on receiving of a remote hardwired or bus command or by a local command available in the VIEW and SETUP menu, Maintenance functions.
- MAN-AUTO: both automatic and manual mode are available

2. SPRING action: spring to open or spring to close
3. PERIOD: time interval between PST, in days from 0 to 1000, in PST AUTO mode
4. HOUR of DAY: hour of PST, in hour from 0 to 23, in PST AUTO mode.
5. PST TRAVEL: position change during PST cycle, in % of position from 10 to 40
6. MAX T-PST: max time allowed to change the position of PST TRAVEL due to spring action, measured in %, from 1 to 1000% of relevant BASELINE time
7. MAX PST T-RET: max time to return to initial position by the electrical actuator, measured in %, from 1 to 1000% of relevant BASELINE time
8. PAUSE: time of stayput of actuator after spring action and before command to return to initial position, measured in sec, from 2 to 255 sec.
9. MAX PST OV-TR: max position over-travel allowed during PST cycle, in percentage of position , from 1 to 100.

The following figure shows the PST curve for EFS with close safe position



7.6.1 COMMAND TO INITIATE PST CYCLE

PST cycle is initiated only if the actuator is in the correct end of travel (fully open with spring to close or fully close with spring to open). In PST AUTO mode, the test is performed at a configurable period of time and hour of day according to configured parameters if the actuator local selector is in LOCAL or REMOTE .
In PST MANUAL mode, the test is performed on receiving of remote hardwired or bus command if the actuator local selector is in REMOTE. The test can be also be performed on receiving of local command available in the VIEW and SETUP menu, SETUP, MAINTENANCE routines, PST command. Select option “new baseline” to save the collected data in the BASELINE curve, select option “normal” to save the data as a normal PST curve.
In PST MAN-AUTO, the test is performed automatically and on receiving of a local or remote command according to above description.

7.6.2 RESET OF PST CYCLE

PST cycle aborts on the following condition:

- Actuator local selector switched during PST execution
- EFS action during PST execution
- Switch of manual override selector to MANUAL

- Failure of solenoid valve used to perform PST cycle (except of the "EFS long fail safe" version please refer to the hydraulic diagram)
- Alarm of electrical actuator
- Position does not change in a predetermined time during the spring action phase

7.6.3 PST REPORT AND WARNING

At the end of PST cycle the following status and warnings are available:

- Passed: test OK
- Reset: test aborted. The warning "PST" is generated.
- T-PST: failed time T-PST, time needed to change the position of the PST TRAVEL by the spring action. The warning "T-PST" is generated.
- T-RET: failed time T-RET, time to return to position before test. The warning "T-PST" is generated.
- OV-TR: PST over-travel, position change greater than allowable. The warning "OV-TR" is generated.
- Failed: at least two of the T-PST, T-RET, OV-TR conditions failed. The warning "Failed" is generated.

The data can be viewed by the local operator interface or by a PC/PDA connected via Bluetooth interface. Warnings are recorded in the warning log registers (see maintenance routines of VIEW and SETUP menu)

7.6.4 PST CURVES AND PST BASELINE

During the PST cycle the time corresponding to 1% of position change is memorized . Up to 16 PST profiles can be memorized. When a new set of data is available the oldest one is cancelled and the new set is stored. The command "SET PST REFERENCE" available in the VIEW and SETUP menu allows to make a copy of 1 off 16 "PST curves" in the "PST BASELINE". The "PST BASELINE" will not be updated until a new "SET PST BASELINE" command is entered.
The BASELINE curve can also be done by the PST command, available in the VIEW and SETUP menu, SETUP, MAINTENANCE routines. By selecting the option "BASELINE" the PST command cause the PST cycle execution and the collected data are saved in the PST BASELINE.
Via Bluetooth, the data can be read by a PDA or PC with A-manager tool and PST curves and BASELINE, Position versus Time, can be visualized and compared.

7.7 Remote signalling

The parameter "ESD" (to be intended as "EFS Shut-Down Reference") , in the VIEW and SETUP menu, Actuator setup, Output Relays, can be used to configure the monitor relay to switch over if the following conditions occur:

- Clutch de-energized and AUTO/MANUAL selector in AUTO. It means that the EFS action is in progress
- AUTO/MANUAL selector in MANUAL. It means that EFS is not available

The following conditions can be individually configured to switch the auxiliary relays As1,…,As8.

- PST active: PST cycle in progress
- EFS in MANUAL: manual override active
- EFS mid travel alarm: FAILSAFE position not reached in the predetermined time
- PST failed: it summarizes the conditions T-PST, T-RET, OV-TR, PST reset . The status of relay can be reset by a manual reset via actuator local operator interface or alternatively by a new PST command.

7.8 EFS local report

By the VIEW and SETUP menu of the local operator interface the status of the EFS module can be viewed (see chap. LOCAL CONTROLS, EFS report). The following data are available:

- EFS card code
- EFS card manufacturing week and year
- EFS status : ready, not ready
- Base-EFS error counter
- Coil of clutch status : ON,OFF
- Manual override selector status : AUTO, MANUAL
- Last PST result : passed, reset, failed, OV-TR (over-travel failed), T-PST (time of spring action failed), T-RET (time of return to initial position failed)
- Next PST: date of next PST cycle, in AUTO PST mode

- Temperature : °C
- Mushroom push button status : ON, OFF
- Heater status : ON, OFF
- T-PST : (T-PST-baseline), last-T-PST, in sec
- T-RET : (T-RET-baseline), last-T-RET, in sec
- OV-TR : (OV-TR-baseline), last-OV-TR, in % of opening

7.9 Entering the VIEW and SETUP menu mode

If option "SELECTOR in OFF: enabled" is configured, move the selector to OFF and **within 20 sec**, press simultaneously OPEN/YES and STOP pushbuttons to enter in the VIEW and SETUP menu. If VIEW and SETUP operation are not entered a new Local Shut-Down action will be carried out.
If option "SELECTOR in OFF: disabled" is configured, move the selector to OFF and then press simultaneously OPEN/YES and STOP pushbuttons to enter in the VIEW and SETUP menu.
It is possible to enter in VIEW and SETUP menu after than Local Shut-Down action has been carried out, but the actuator cannot be electrically operated.

8 ACTUATOR OPERATION

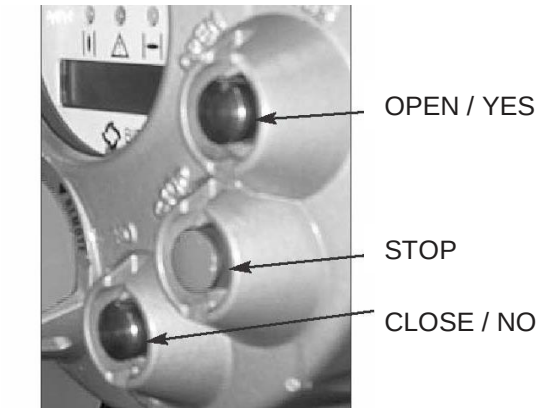
8.1 Actuator local controls

For EFS "standard" version

After configuring the actuator, if no alarm is present, place the 3-position selector in LOCAL and control the actuator by OPEN, CLOSE and STOP push-buttons. If "push-to-run" was selected the actuator can be driven to the desired position by pressing and holding the OPEN/YES or CLOSE push-button. As the push-button is released, the motor is de-energised. If "latched" was selected, as the OPEN or CLOSE push-button is pressed the motor is energised, and it runs on also after the push-button is released. To stop the motor, press the STOP push-button. To reverse the direction, press the STOP push-button and then press the push-button relevant to the opposite direction. In "latched with instant reverse" mode, the local controls work as in the "latched" mode, but to reverse the motor direction you only need to press the push-button relevant to the opposite direction.

For EFS long fail safe version:

After configuring the actuator, if no alarm is present, place the 3-position selector in LOCAL and control the actuator by OPEN or CLOSE (the same direction against the spring action), If "push-to-run" was selected the actuator can be driven to the desired position (only to the direction against the spring action) by pressing and holding the OPEN/YES or CLOSE push-button. As the push-button is released, the motor is de-energised. If "latched" was selected, as the OPEN or CLOSE push-button is pressed the motor is energised, and it runs on also after the push-button is released. To stop the motor, press the STOP push-button. To reverse the direction (the same direction of spring action), press the STOP push-button and then press the red mushroom push-button (Local Shut-Down action).



According to the position of the local selector, the OPEN/YES and CLOSE/NO push-buttons work as follows:

- Open/Close commands if the selector is in Local position
- Yes/No, to answer prompts in the menu, if the selector is in Off or Remote positions.

8.2 Local indication

The upper display indicates the valve position as a percentage of opening (open = 100%).
The lower display has two alphanumeric lines.
The upper line indicates the actuator status and the 3-position selector status. The lower line indicates the actuator operation, or the position request % value, according to the configuration. Two LED's indicate the actuator position / operation, while a third LED indicates alarms

8.3 Lock of the 3-position selector

The 3-position selector can be locked in any of its three positions by means of a padlock.

8.4 Remote control

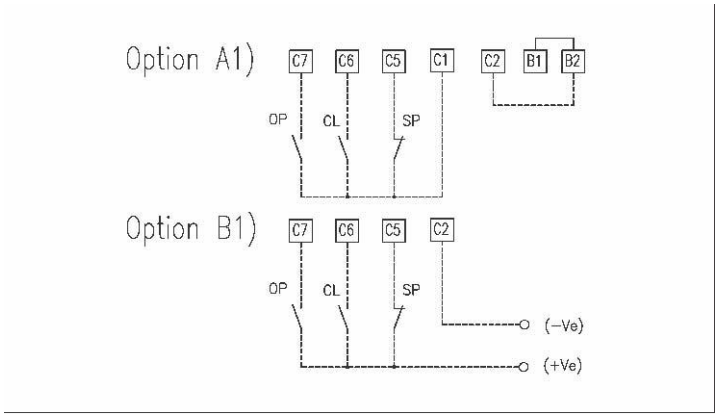
Place the 3-position selector in REMOTE to transfer the actuator control to a remote device. Local OPEN or CLOSE operation will be inhibited. Only local STOP control remains active. Using the "VIEW and SET-UP" features may configure different control modes. The remote controls are opto-coupled. A non-regulated 24VDC voltage (variable from 23 to 27 VDC, max. 4W) is available on the actuator terminal board to supply the remote controls or external devices.

8.4.1 REMOTE COMMANDS

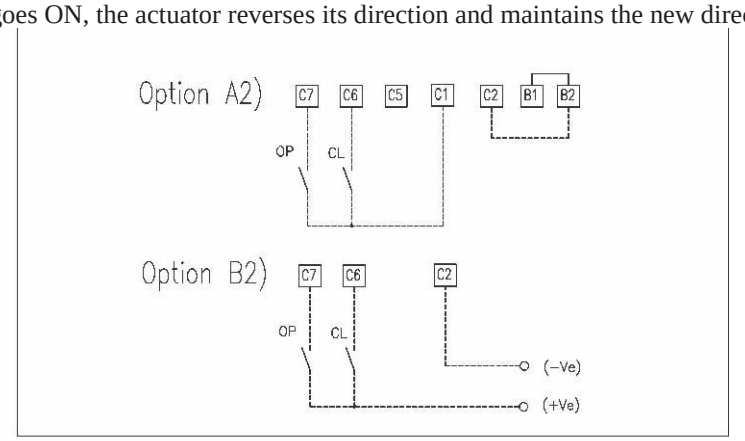
For EFS “standard” version

Using the "VIEW and SET-UP" features may configure different control modes.

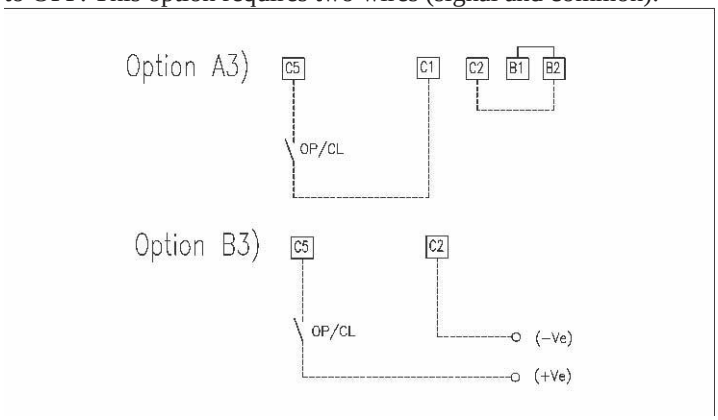
4 WIRES (see the remote connections diagram shown below)
In “4 wires latched” (OPEN, CLOSE, STOP, COMMON) mode, with the OPEN or CLOSE signal switched to ON, the motor is energised, and it runs on after the signal returns to OFF. To stop the motor, press STOP. To reverse the direction, press STOP and then press the button relevant to the opposite direction. The action of the STOP signal (stop with signal ON or stop with signal OFF) may be reversed using the VIEW and SET-UP features , see chap. SET-UP ROUTINES, par. “Remote controls”.



3 WIRES (see the remote connections diagram shown below) With option "3 wires" (OPEN, CLOSE, COMMON), the actuator can be driven in either "push-to-run" or "latched with instant reverse" mode. In " push-to-run " mode, the actuator can be driven to the desired position by switching the OPEN or CLOSE signal to ON. As the signal returns to OFF, the motor is de-energised. In "latched with instant reverse" mode, when the OPEN or CLOSE signal switches to ON, the motor is energised, and it runs on after the signal returns to OFF. If the signal relevant to the opposite direction goes ON, the actuator reverses its direction and maintains the new direction also if the signal returns to OFF.



2 WIRES (see the remote connections diagram shown below) With the "2 wires" option, 2 different activities may be selected: In "2 wires, signal ON to open", the actuator opens if the signal switches to ON and closes if the signal goes to OFF. In "2 wires, signal ON to close", the actuator closes if the signal switches to ON and opens if the signal switches to OFF. This option requires two wires (signal and common).



The circuits associated to the inputs are opto-coupled and be supplied by the internally generated 24VDC or by an external 20-125VDC or 20-120VAC (50/60Hz). The signal levels are the following:

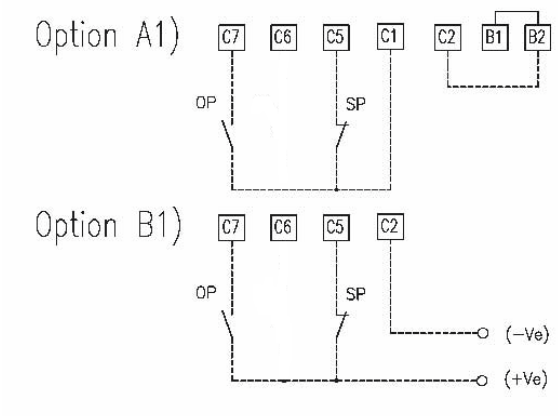
- Minimum ON signal > 20 VDC or 20 VAC (50/60Hz)
- Maximum ON signal < 125 VDC or 120 VAC (50/60Hz)

- Maximum OFF signal < 3V
- Minimum signal duration > 500 ms.
- Total current drawn from remote controls < 25mA

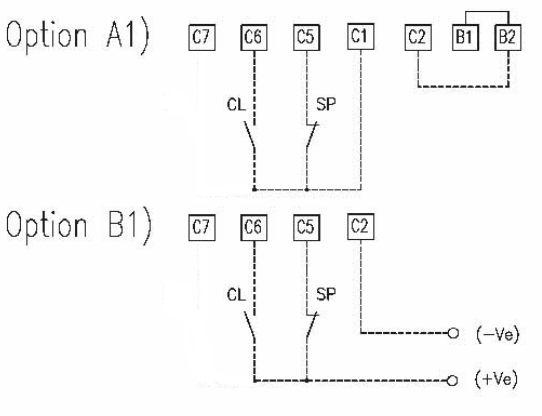
For EFS long fail safe version:

Using the "VIEW and SET-UP" features may configure different control modes.

4 WIRES (see the remote connections diagram shown below)
In “4 wires latched” (OPEN or CLOSE, STOP, COMMON) mode, with the OPEN or CLOSE signal switched to ON, the motor is energised, and it runs on after the signal returns to OFF. To stop the motor, press STOP. To reverse the direction, press STOP and then de-energize the terminals “R1” and “R2” (CLOSE or OPEN command – Spring action). The action of the STOP signal (stop with signal ON or stop with signal OFF) may be reversed using the VIEW and SET-UP features , see chap. SET-UP ROUTINES, par. “Remote controls”.

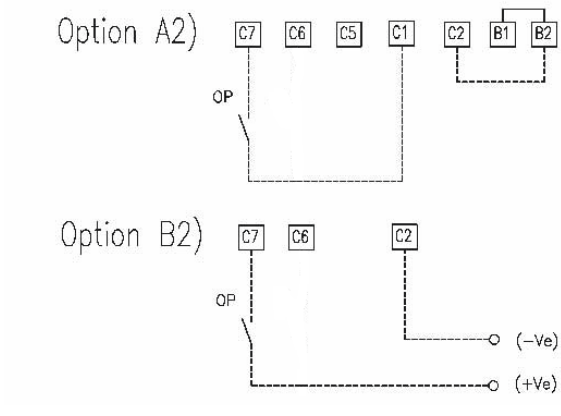


Configuration: Spring action to close the actuator

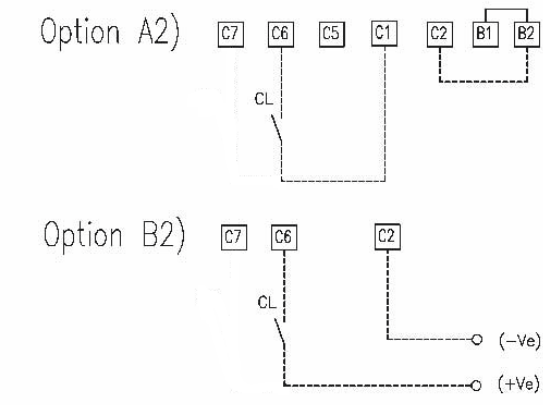


Configuration: Spring action to open the actuator

3 WIRES (see the remote connections diagram shown below)
With option "3 wires" (OPEN or CLOSE, COMMON), the actuator can be driven in either "push-to-run” mode or “latched with instant reverse”. In “ push-to-run ” mode, the actuator can be driven to the desired position by switching the OPEN or CLOSE signal to ON. As the signal returns to OFF, the motor is de-energised. In “latched with instant reverse” mode, when the OPEN or CLOSE signal switches to ON, the motor is energised, and it runs on after the signal returns to OFF.



Configuration: Spring action to close the actuator

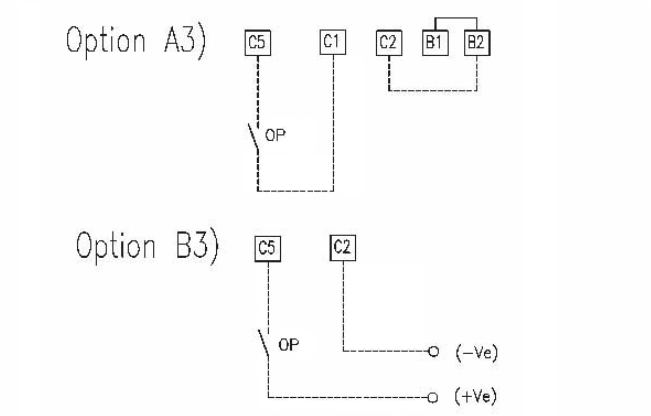


Configuration: Spring action to open the actuator

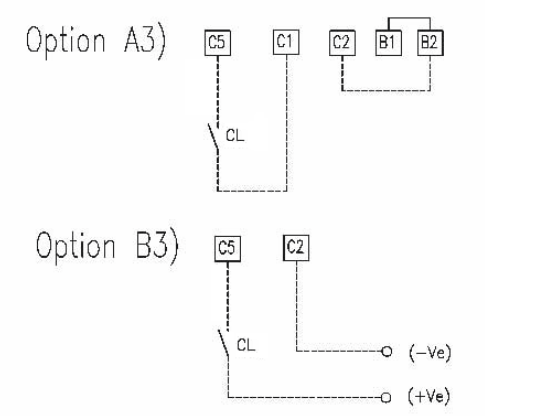
2 WIRES (see the remote connections diagram shown below)
This option requires two wires (signal and common).

Spring action to close:
With the "2 wires" option, if the option “2 wires, signal ON to open" is selected, the actuator opens if the signal switches to ON and stop if the signal goes to OFF.
With the "2 wires" option, if the option “2 wires, signal ON to close" is selected, the actuator opens if the signal switches to OFF and stop if the signal switches to ON.

Spring action to open:
With the "2 wires" option, if the option “2 wires, signal ON to open" is selected, the actuator closes if the signal switches to OFF and stop if the signal goes to ON.
With the "2 wires" option, if the option “2 wires, signal ON to close" is selected, the actuator closes if the signal switches to ON and stop if the signal switches to OFF.



Configuration: Spring action to close the actuator



Configuration: Spring action to open the actuator

The circuits associated to the inputs are opto-coupled and be supplied by the internally generated 24VDC or by an external 20-125VDC or 20-120VAC (50/60Hz). The signal levels are the following:

- Minimum ON signal > 20 VDC or 20 VAC (50/60Hz)
- Maximum ON signal < 125 VDC or 120 VAC (50/60Hz)
- Maximum OFF signal < 3V
- Minimum signal duration > 500 ms.
- Total current drawn from remote controls < 25mA

8.4.2 OUTPUT CONTACTS

Standard version:

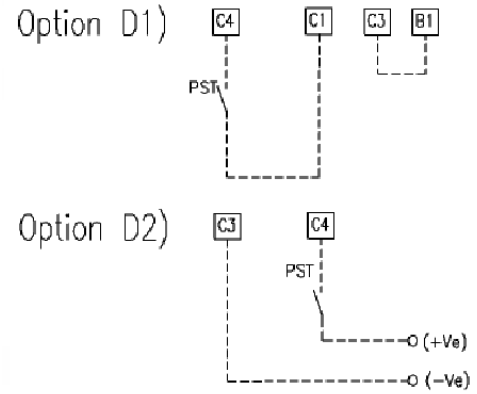
- Monitor relay: on the terminal board, the voltage-free, change-over contacts of the monitor relay are available. The monitor relay indicates that the actuator can be remotely controlled or that there is a problem or condition which prevents remote control of the valve. The conditions that cause the relay to switch over are listed in chapter SET-UP ROUTINES, paragraph “Output relays”.
- AS1,2,3,4,5,6,7 relays: on the terminal board, the voltage-free contacts of 7 latching relays are available. The status (make or break) and the conditions that cause the switching of the relay can be viewed and configured by using the “VIEW and SET-UP” features. The status of the latching relays is immediately updated as the associated conditions for change occur. Moreover, the status of the above contacts is cyclically updated (every second).
- AS8 relay: a further voltage-free, change-over contact is available on the terminal board. The conditions that cause the switching of the relay can be viewed and configured by using the “VIEW and SET-UP” features.
- Contact rating: Max. voltage 250VAC/30VDC; max. current 5A; Min. voltage 5VDC; min. current 5mA

Special version with highly sensitive golden plate contact relays supplied on request:

- Monitor relay: voltage-free , change-over , gold-cap silver palladium contacts.
- AS1,2,3 relays: voltage-free, change-over, latching, gold-cap silver palladium contacts.
- AS4 relay: voltage-free, latching, gold-cap silver palladium contacts, configurable N.O or N.C in the " SET-UP ROUTINES, Output relays" menu.
- AS5,6 relays: voltage-free, change-over, gold-cap silver palladium contacts.
- The condition that cause the switch-over of the monitor relay and auxiliary relays AS1,…,AS6 are the same of the standard version and are configurable in the "Output relays" menu.
- AS7,8 relays: not available
- Contact rating: Max. voltage 250VAC; max. current 2A; Min. switching capability 10microA, 10mVDC.

8.4.3 PST INPUT

The PST input is available as remote command to initiate the PST cycle. PST is activated when signal in PST input is present. The "VIEW and SET-UP" features, chap SET-UP ROUTINES, par. EFS SETUP, can configure the characteristic of PST function

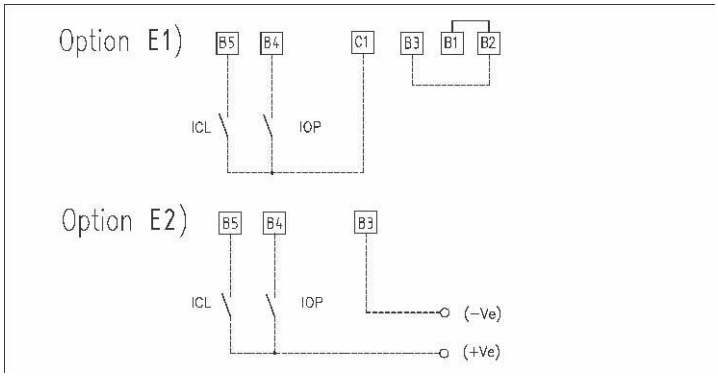


The PST input is opto-coupled. The circuits associated to the input can be supplied by the internally generated 24VDC or by an external 20-125VDC or 20-120VAC (50/60Hz). The signal levels are the following:

- Minimum ON signal > 20 VDC or 20 VAC (50/60Hz)
- Maximum ON signal < 125 VDC or 120 VAC (50/60Hz)
- Maximum OFF signal < 3V
- Current drawn from ESD controls < 15mA
- Min signal duration: 1 sec

8.4.4 INTERLOCK INPUTS

Two additional inputs are available to inhibit actuator movement in open or close direction. The controls are momentary, and the inhibit action continues until the relevant signal is present. The interlock controls work when the Local Selector is in either LOCAL or REMOTE positions. The "VIEW and SET-UP" features can configure the polarity of INTERLOCK signal as described in chap. SETUP ROUTINES, paragraph "INTERLOCK controls".



The interlock inputs are opto-coupled and can be supplied by the internally generated 24VDC or by an external 20-125VDC or 20-120VAC (50/60Hz).
The signal levels are the following:

- Minimum ON signal > 20 VDC or 20 VAC (50/60Hz)
- Maximum ON signal < 125 VDC or 120 VAC (50/60Hz)
- Maximum OFF signal < 3
- Total current drawn from remote controls < 20mA

Place the 3-position selector in REMOTE to transfer the actuator control to a remote device. Local OPEN or CLOSE operation will be inhibited. Only local STOP control remains active.
Using the "VIEW and SET-UP" features may configure different control modes. The remote controls are opto-coupled.
A non-regulated 24VDC voltage (variable from 23 to 27 Vdc, max. 4W) is available on the actuator terminal board to supply the remote controls or external devices.
For the "EFS long fail safe" version the electric command in the same direction of the spring action is always inhibited.

9 OPTIONAL MODULES

Additional modules can be plugged in the base card of the ICON2000 to provide the following functions:

9.1 FIELDBUS INTERFACE FOR REMOTE CONTROL VIA FIELDBUS

This card allows to connect the ICON2000 to FIELDBUS. The following bus interface cards are available:

- Profibus DPVO
- Profibus DPV1 with or without redundancy
- Foundation Fieldbus
- LonWorks
- Modbus RTU

A Hardware alarm is generated if the EFS2000 was set to be equipped with BUS card, but the card is damaged or missing. A BUS REPORT is also present in the list of reports if the card is present (see chap. LOCAL CONTROLS, par. Description of variables and reports). See the specific manuals for instructions and the setting of the above modules.

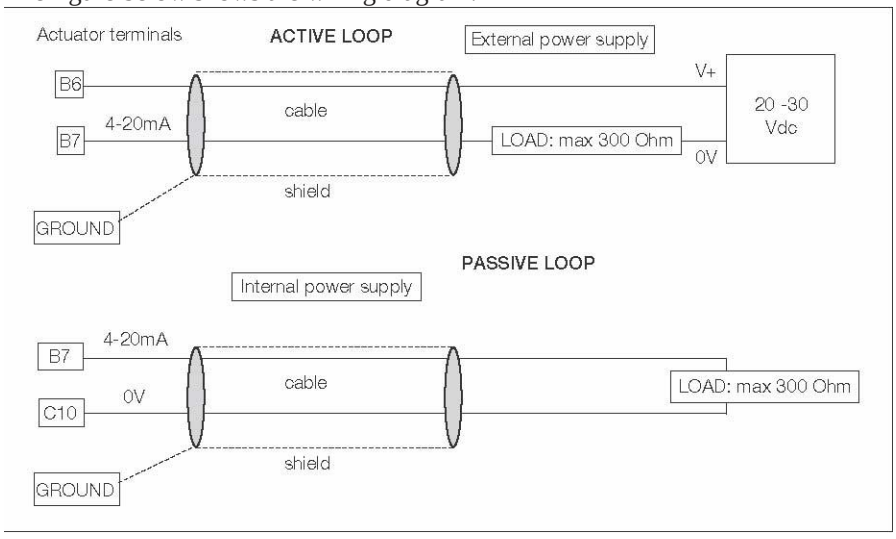
9.2 AIN / AOUT CARD

With the above card the ICON2000 is provided with a 4-20 analogue input and a 4-20mA analogue output. This card should be plugged on the base card, replacing the "TERMINAL BOARD ADAPTOR" card supplied as standard. A Hardware alarm is generated if the ICON2000 was set to be equipped with an Ain/Aout card, and the card is damaged or missing. An Ain/Aout REPORT is also present in the list of reports if the card is present (see chap. LOCAL CONTROLS, par. Description of variables and reports).

9.2.1 4-20mA ANALOGUE OUTPUT

The 4-20mA output can be configured to provide a signal proportional to either "position" or "torque". The polarity option allows to reverse the relationship between the position or torque and the 4-20mA output signal. See "VIEW and SET-UP" features (chap. SETUP ROUTINESI, paragraph "OUT 4-20mA").
The 4-20mA output is opto-coupled. It should be powered by a 20-30 VDC voltage (externally or internally generated) and the maximum load, including the cable resistance, should be less than 300 Ohm.

The figure below shows the wiring diagram:



The behaviour in case of loss of main voltage is different if the power supply of the 4-20mA output stage is internally or externally generated:

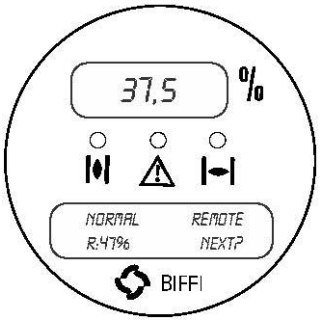
- Internal power supply (or passive loop): In case of loss of main voltage the output 4-20mA drops to 0. The correct output will be restored when the main voltage returns.

- External power supply (or active loop): If the actuator is provided with a lithium battery (or supplied by the auxiliary 24VDC) and if the main voltage fails, the output 4-20mA maintains the last value. If the actuator is moved by handwheel, the output 4-20mA will be updated. If the actuator is not provided with a lithium battery (or not supplied by the auxiliary 24VDC) and if the main voltage fails, the output 4-20mA maintains the last value. If the actuator is moved by handwheel, the output 4-20mA will not be updated.

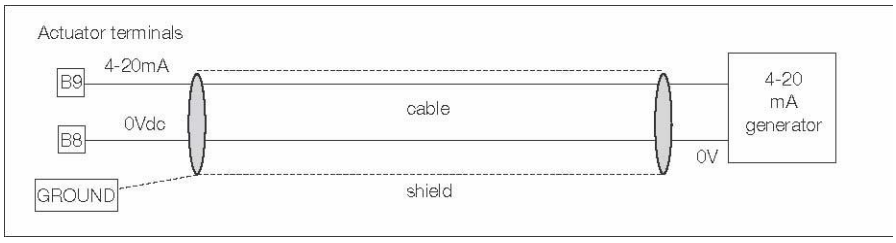
9.2.2 4-20mA ANALOGUE INPUT

The 4-20mA analogue input is the position request R% signal and is used by the ICON2000 to position the valve in inching and modulating actuators. The “POSITIONER” routine processes the input signal, compares the present actuator position % with the position request R% and if the difference is greater than the dead band, the actuator is driven to reach the requested position. 4mA corresponds to request R% = 0% = valve closed and 20mA corresponds to request R%= 100% = valve open. The relationship between position and request signals can be reversed by the “Polarity” function. The 4-20mA input is opto-coupled. The input impedance is less than 500 ohm. The loss of the 4-20mA input signal is indicated as follows:

- Change-over of the monitor relay
- Alarm LED on
- List of ALARMS (see MAINTENANCE and TROUBLESHOOTING, “Diagnostic messages”)
- Alarm log



The figure below shows the wiring diagram:



The "VIEW and SET-UP" features can configure different options which are described in chap. SETUP ROUTINES, paragraph “POSITIONER”.

If the POSITIONER function is active the alpha-numeric display indicates the value of the position request in % (R%: xxx.x).

9.3 BLUETOOTH™ CARD

The ICON2000 can be provided with a radiofrequency wireless connection based on a qualified BLUETOOTH™ class 1 module. This allows to establish a connection and exchange data with a PDA or PC with built-in BLUETOOTH™ technology. Special PDA’s are available for application in hazardous areas. The following tasks can be wirelessly performed:

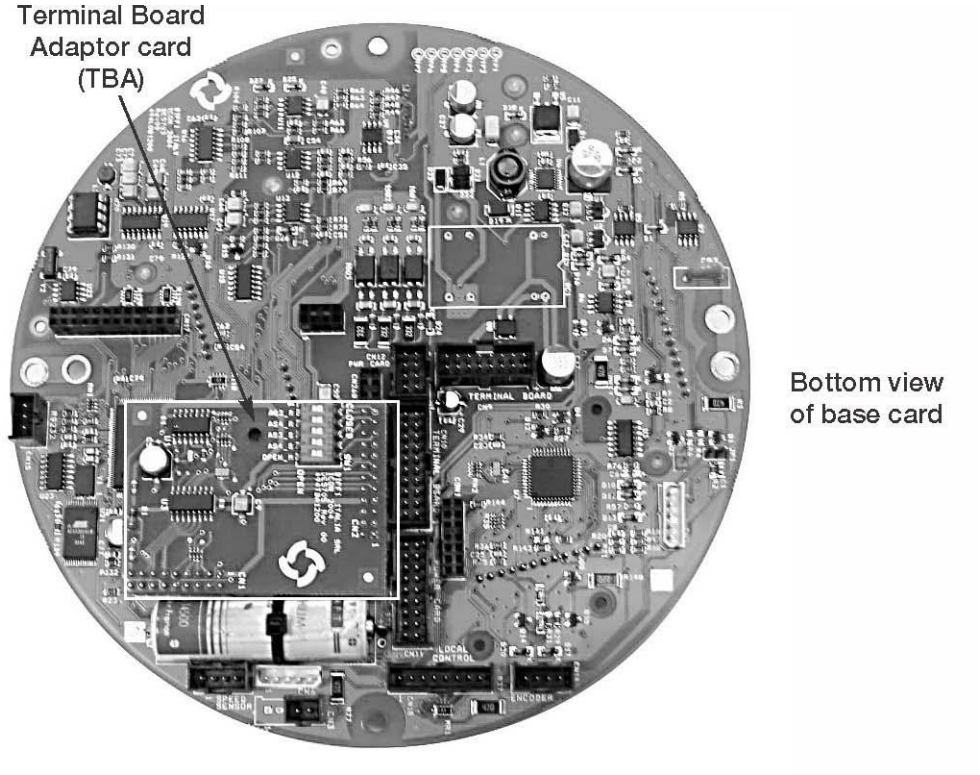
- View and change configuration
- Set maintenance function
- Read maintenance data
- Download new firmware to the ICON2000

A WIRELESS REPORT is present in the list of reports when the card is present (see chap. LOCAL CONTROLS, Description of variables and reports).

9.4 Base card of EFS 2000v4

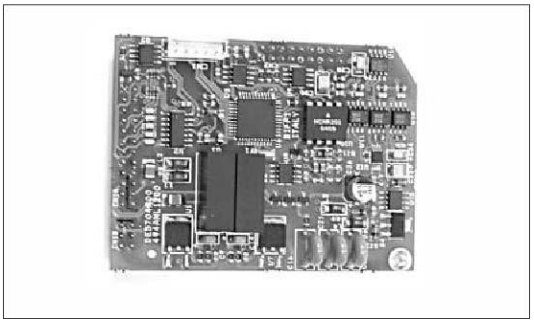
The following figures shows the “base card” of cards of EFS 2000 and its different option cards

Base card of the EFS 2000v4

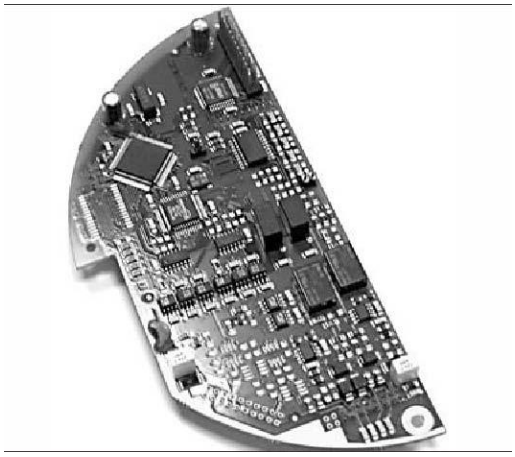


Ain / Aout card

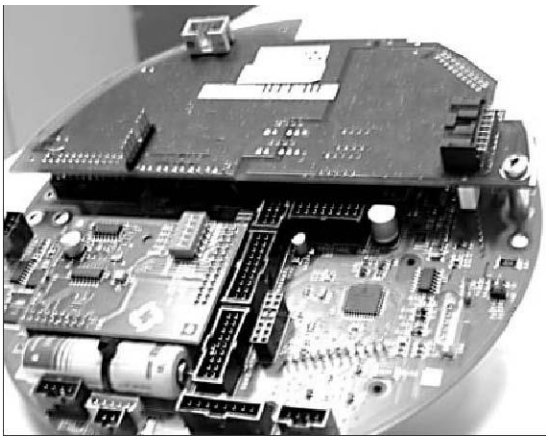
This optional card is used in place of the Terminal Board Adaptor (TBA) card when an analogue 4-20mA input and output signal is requested.



Fieldbus interface card



The type of card depends on the fieldbus present in the plant.

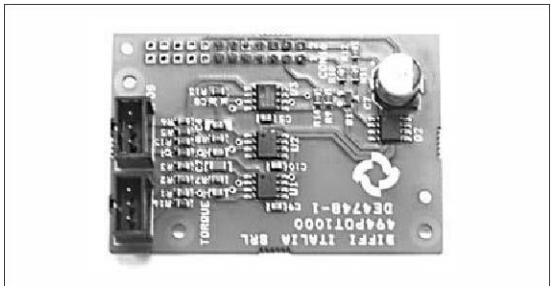


Top view of base card equipped with Fieldbus Interface

BLUETOOTH™ card

BLUETOOTH™ card

Potentiometer /4-20mA position card



POTENTIOMETER /4-20mA card: with this card properly set trough the VIEW and SET-UP menu, the base card reads the position from a potentiometer or from a 4-20mA transmitter.

10 LOCAL CONTROLS

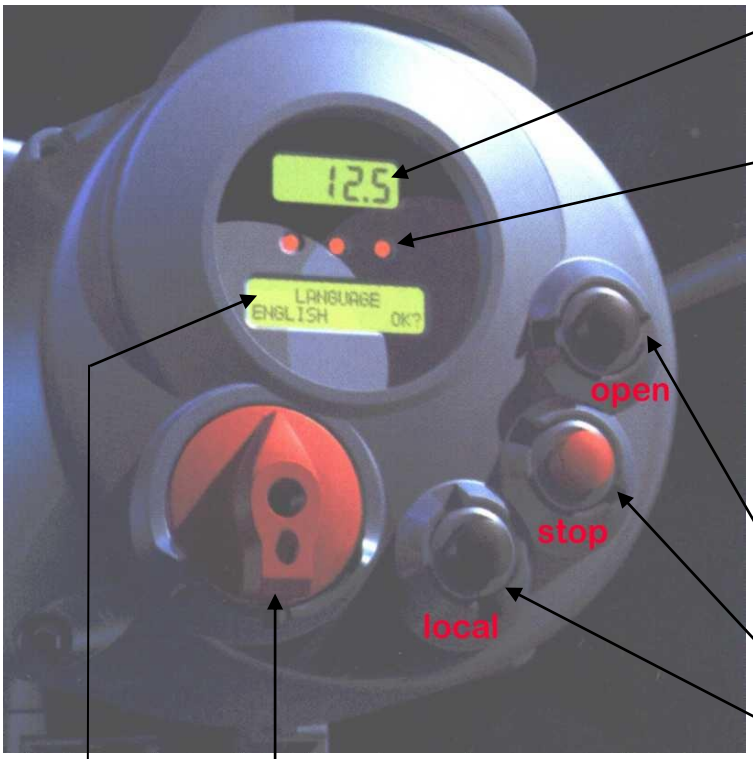
10.1 Description of the local operator interface

The following functions are available by the EFS2000v4 local operator interface:

- actuator control
- actuator configuration
- actuator status visualisation
- EFS action control

The figures on the following pages describe the function of each component of the local operator interface

10.2 Local Operator Interface



Numeric display to indicate the present valve position as a % of the opening. Display resolution 0.1%

Three LED's to indicate the actuator status according to the following logic:

- green ON/ red OFF: the actuator is stopped in open position
- green OFF/ red ON: the actuator is stopped in closed position
- green OFF/ red flashing: the actuator is running in closing direction
- green flashing/ red OFF: the actuator is running in opening direction
- green ON/ red ON: the actuator is stopped in intermediate position
- yellow ON: alarm
- yellow flashing: warning

The above colour combination is supplied as standard, but it may be changed (red with green, green with red, and yellow with red), during actuator setting operations

Local controls: OPEN/YES, CLOSE/NO, and STOP push-buttons.

The STOP push-button resets any existing command and is active both in local and remote.

If the 3-position selector is in LOCAL, the OPEN / YES, and CLOSE /NO push-buttons work as OPEN and CLOSE commands.

If the 3-position selector is in REMOTE or in OFF, the OPEN / YES and CLOSE / NO push-buttons work as YES and NO to answer the prompt (next? OK? view?, change? exit?) of the alphanumeric display.

In OFF, the OPEN / YES and CLOSE / NO push-buttons allow to scroll down the menu, to view and change the actuator configuration or to scroll the list of variables, status, and alarms. In REMOTE, the above push-buttons allow scrolling the list of variables, status, alarms and reports but the actuator configuration cannot be viewed or changed.

3-position selector to set the following operation modes:

- LOCAL: for local control only
- OFF: no control is active but the actuator is still connected to the mains
- REMOTE: for remote control only

Alphanumeric display: during normal operation the alphanumeric display shows the present status (NORMAL, INT EFS, ALARM, WARNING, INTERLOCK), the 3-position selector status (LOCAL, OFF, REMOTE) and the actuator action (OPEN, OPENING, CLOSED, CLOSING, STOP or R% : xxx.x). If the local selector is in OFF or REMOTE, pressing the YES push-button it is possible to scroll the list of variables, alarms and reports:

- Output torque
- Motor speed
- Main voltage
- Current
- Temperature
- Time
- Date
- Alarm
- Warning
- Ktemp
- Mot temp
- Term temp
- Log status
- Wireless report
- Node report*
- FDI report*
- Base report
- Term report
- Ain/Aout report*
- EFS report

The data with * are only present if the relevant modules are present.

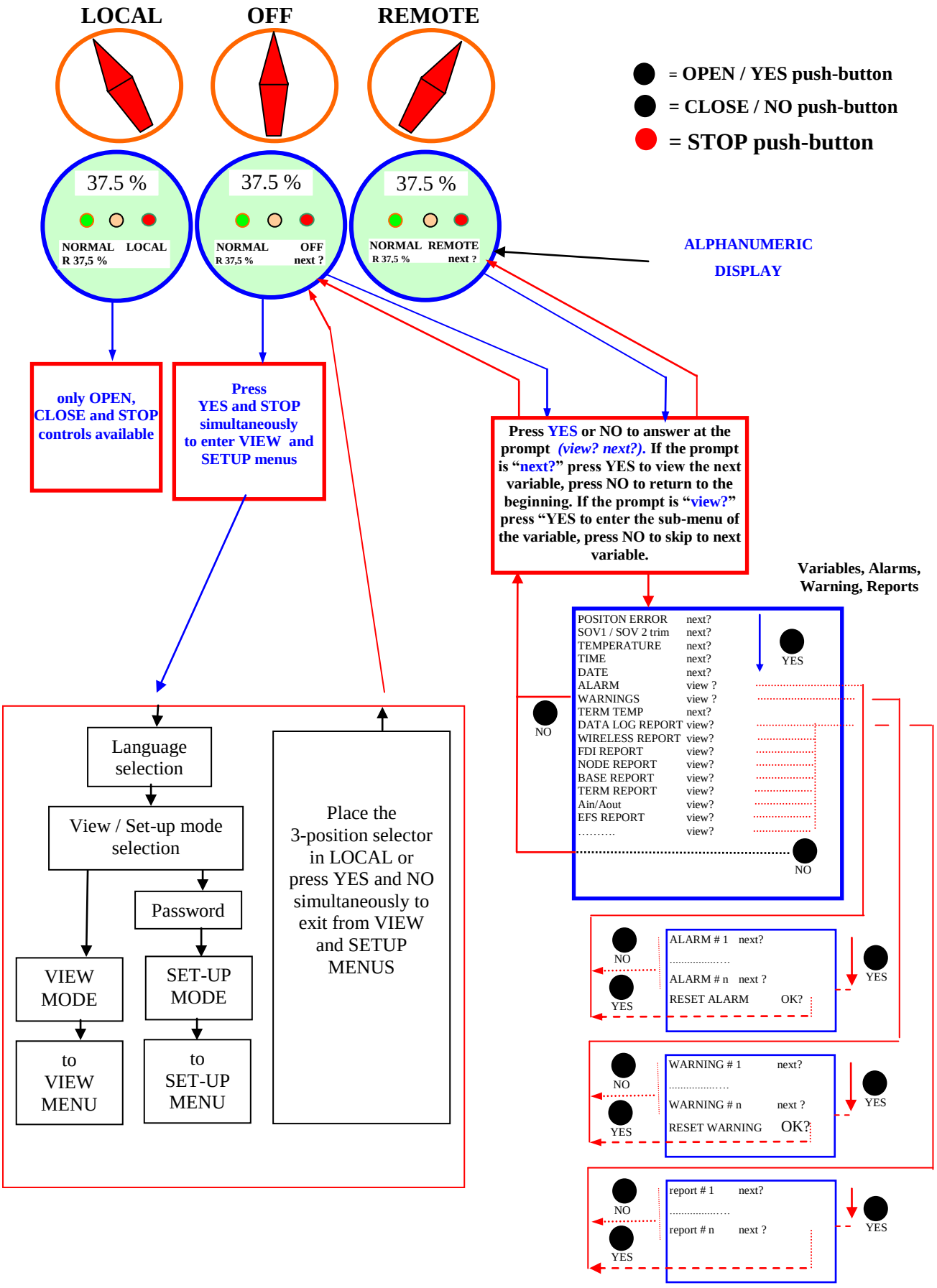
10.3 Description of variables and reports

- ❑ torque: output torque in % of the nominal torque stated in the NAMEPLATE menu
- ❑ motor speed: RPM of electrical motor
- ❑ main voltage: voltage (V) and frequency (Hz) of mains
- ❑ current: current (A) absorbed by the motor
- ❑ temperature: temperature (°C), inside the electronic compartment
- ❑ time: present time
- ❑ date: present date
- ❑ alarm: list of present alarms (see chap. MAINTENANCE and TROUBLESHOOTING)
- ❑ warning: list of present warnings (see chap. MAINTENANCE and TROUBLESHOOTING)
- ❑ Ktemp: temperature factor
- ❑ mot temp: temperature (°C) of the electrical motor
- ❑ term temp: temperature (°C) inside the terminal board compartment
- ❑ log status: data logger status (off, ready, in progress: E: event number - n° of memory cycle or R: sample number - n° of memory cycle)
- ❑ wireless report: BluetoothTM interface status (available, not available)
- ❑ node report: report of BUS interface card (only present if the bus card is present) (see the relevant instruction manual)
- ❑ FDI report: report of FDI function (only present if the LonWorks bus card is present) (see the relevant instruction manual)
- ❑ base report: base card report
  - card code
  - manufacturing week and year
  - electrical diagram, etc
- ❑ term report: terminal board card report
  - card code
  - manufacturing week and year
  - electrical diagram, etc
- ❑ Ain/Aout report: Ain/Aout card report (only present if the card is present)
  - card code
  - manufacturing week and year
  - electrical diagram, etc.
- ❑ EFS report: EFS card report
  - card code
  - manufacturing week and year
  - electrical diagram, etc
  - EFS status : ready, not ready

- Base-EFS error counter
- Coil of clutch : ON,OFF
- Manual switch : AUTO, MANUAL
- Last PST result : passed, reset, failed, OV-TR, T-PST, T-RET
- Next PST: date
- Temperature : °C
- Mushroom push button : ON, OFF
- Heater : ON, OFF
- T-PST : (T-PST-baseline), last-T-PST, in sec
- T-RET : (T-RET-baseline), last-T-RET, in sec
- OV-TR : (OV-TR-baseline), last-OV-TR, in % of opening

The warning condition occurs when a variable reaches a critical value and/or a maintenance action is required, but the actuator control functions are still available. The alarm condition occurs when a variable is out of the acceptable range and the actuator control functions are not available. The alarm and warning lists only contain the present alarms and warnings. When the fault condition disappears, the corresponding alarm or warning disappears from the list. A reset routine is provided to clear the type of alarm / warning that are memorised (over-torque, jammed valve, etc.).

The following drawing shows the use of the OPEN / YES, CLOSE / NO and STOP push-buttons in function of the local selector position.



10.4 Configuration options

The EFS2000 actuator can be totally configured from the local interface by means of a series of menus that can be selected from the alphanumeric display. The operator is guided through the different displays by answering YES or NO to the appropriate prompt (change? OK?, view?, next?, etc.) in the right corner of the lower row of the alphanumeric display.
To access the menus:

- If option "SELECTOR in OFF: enabled" is configured, move the selector to OFF and **within 20 sec**, press simultaneously OPEN/YES and STOP pushbuttons to enter in the VIEW and SETUP menu. If VIEW and SETUP operation are not entered a new ESD action will be carried out.
- If option "SELECTOR in OFF: disabled" is configured, move the selector to OFF and then press simultaneously OPEN/YES and STOP pushbuttons to enter in the VIEW and SETUP menu.

It is possible to enter in VIEW and SETUP menu after than ESD action has been carried out, but the actuator cannot be electrically operated.
The alphanumeric display will now show the present language. Press YES if the language is correct, press NO to scroll the list of available languages and then press YES to select.
After choosing the language, the next step is the selection among view and set-up mode. Use view mode to see the actuator configuration, and use set-up mode to change the present configuration. Unauthorised access to the set-up mode is prevented by a 4-character alphanumeric password. The actuator is supplied by BIFFI with the default password " 0 0 0 0 ".
Once the correct password has been entered, the actuator parameters can be configured. The present password can also be modified by way of the "set password" routine in the maintenance menu. After entering the new password, the old one ceases to be valid, so it is important to record the password in a secure location for future retrieval.

The configuration functions (view and set-up mode) are grouped in 4 main menus: Actuator set-up, Nameplate, Valve data, Maintenance.

10.4.1 ACTUATOR SET-UP

This menu includes the routines that allow the actuator to be configured according to the requested control mode and to the valve it is mounted on.

List of routines:

- stroke limits
- torque set-up
- EFS setup
- remote controls
- local controls
- output relays
- positioner *
- fail safe *
- out 4-20mA *
- interlock
- 2-speed timer
- bus *
- miscellaneous

The routines with * are only available if the relevant modules are present. If bus interface is LonWorks, the "bus" routine changes to "FDI control".

10.4.2 NAME PLATE

This menu includes a series of data identifying the actuator characteristics, service, and utilisation mode. The data are entered by the manufacturer and can only be viewed. (i.e., this menu is only available in View mode).

List of routines:

- serial number
- actuator type
- torque/thrust
- actuator speed
- power supply
- motor data
- test date
- wiring diagram
- enclosure
- certificate
- lubricant
- revision
- torque sensor

10.4.3 VALVE DATA

It includes a series of data relevant to the valve. The valve manufacturer and end user should enter the data.

List of routines:

- *tag name*
- *break-OP torque*
- *flange type*
- *serial number*
- *break-CL torque*
- *manufacturer*
- *max stem thrust*

10.4.4 MAINTENANCE

This menu includes all diagnostic and historic data which can help the operator in case of failure or during maintenance operations. The Maintenance menu also includes the "Set new password" routine.

List of routines:

SET-UP MODE

- set new password
- clear alarm log
- set torque profile reference
- set torque curve reference
- clear recent data log
- set maintenance date
- set data logger
- set PST reference
- PST command (normal or baseline)
- Set ESD reference (to be intended as "EFS Shut-Down Reference")

VIEW MODE

- alarm log
- torque profile
- torque curve
- operation log
- maintenance date
- data logger

The parameters appear on the alphanumeric display in the same order both in view and set-up mode. At the end of each routine the program will automatically return to the beginning of the routine, and the operator can choose to either re-enter (by pressing YES) or to move on to a next routine (by pressing NO). PST and EFS curves cannot be viewed by VIEW menu. They can only be viewed by PDA or PC connected by Bluetooth interface.

10.4.5 ENTERING THE VIEW MODE

The existing actuator configuration should be checked before commissioning. The parameters are configured in factory according to a standard setting, or to customer requirements. In view mode, no password is requested, but no change of parameters can be made.
If option "SELECTOR in OFF: disabled" is configured, move the selector to OFF and then press simultaneously OPEN/YES and STOP pushbuttons to enter in the VIEW and SETUP menu.
It is possible to enter in VIEW and SETUP menu after than Shut-Down action has been carried out, but the actuator cannot be electrically operated.

- Ensure the electrical main power is applied.
- Move the 3-position selector to OFF and then
  - if option "SELECTOR in OFF: enabled" is configured, **within 20 sec,** press simultaneously OPEN/YES and STOP pushbuttons to enter in the VIEW and SETUP menu. If VIEW and SETUP operation are not entered a new Shut-Down action will be carried out.
  - If option "SELECTOR in OFF: disabled" is configured, press simultaneously OPEN/YES and STOP pushbuttons to enter in the VIEW and SETUP menu. Shut-Down action will not carried out
  - It is possible to enter in VIEW and SETUP menu after than Shut-Down action has been carried out, but the actuator cannot be electrically operated.
- The display shows the present language. Press YES to confirm or NO to scroll the list of available languages. Press YES to select a new language. Press YES to confirm.
- Press NO to scroll the list of available menus (actuator set-up, nameplate, valve data, maintenance) and then press YES to select the desired menu.
- Press NO to scroll the list of available routines and press YES to select the routine where the parameter to be viewed is located.
- Press NO to scroll the list of parameters and press YES to view the value.

10.4.6 ENTERING THE SET-UP MODE

To change the existing settings or to set the stroke limits it is necessary to enter the correct password.

- Ensure the electrical main power (or the external auxiliary supply) is applied.
- Move the 3-position selector to OFF and then
  - if option "SELECTOR in OFF: enabled" is configured, **within 20 sec,** press simultaneously OPEN/YES and STOP pushbuttons to enter in the VIEW and SETUP menu. If VIEW and SETUP operation are not entered a new Shut-Down action will be carried out.
  - If option "SELECTOR in OFF: disabled" is configured, press simultaneously OPEN/YES and STOP pushbuttons to enter in the VIEW and SETUP menu. Shut-Down action will not carried out
  - It is possible to enter in VIEW and SETUP menu after than Shut-Down action has been carried out, but the actuator cannot be electrically operated.
- The display shows the present language. Press YES to confirm or NO to scroll the list of available languages. Press YES to select. Press YES to confirm the chosen language.
- Press NO when the message is "VIEW MODE OK? ". Press YES to answer prompt "ENTER PASSWORD OK?"
- Enter password. Enter one digit at a time. Press YES if digit is correct, press NO to scroll the list of available characters and then press YES when the character is correct. Enter 4 digits. After entering the last digit, the

microprocessor checks the password. If it is correct the messages “PASSWORD CORRECT” and then “SET-UP MODE OK?” appear. Press YES.

- Press NO to scroll the list of available menus (actuator set-up, valve data, maintenance) and press YES to select the desired menu
- Press NO to scroll the list of available routines and press YES to select the routine where the parameter to be changed is located.
- Press YES and NO to answer the prompt on the display and change the parameter.
- If the password is wrong the message “PASSWORD WRONG” appears and set-up mode will not available.

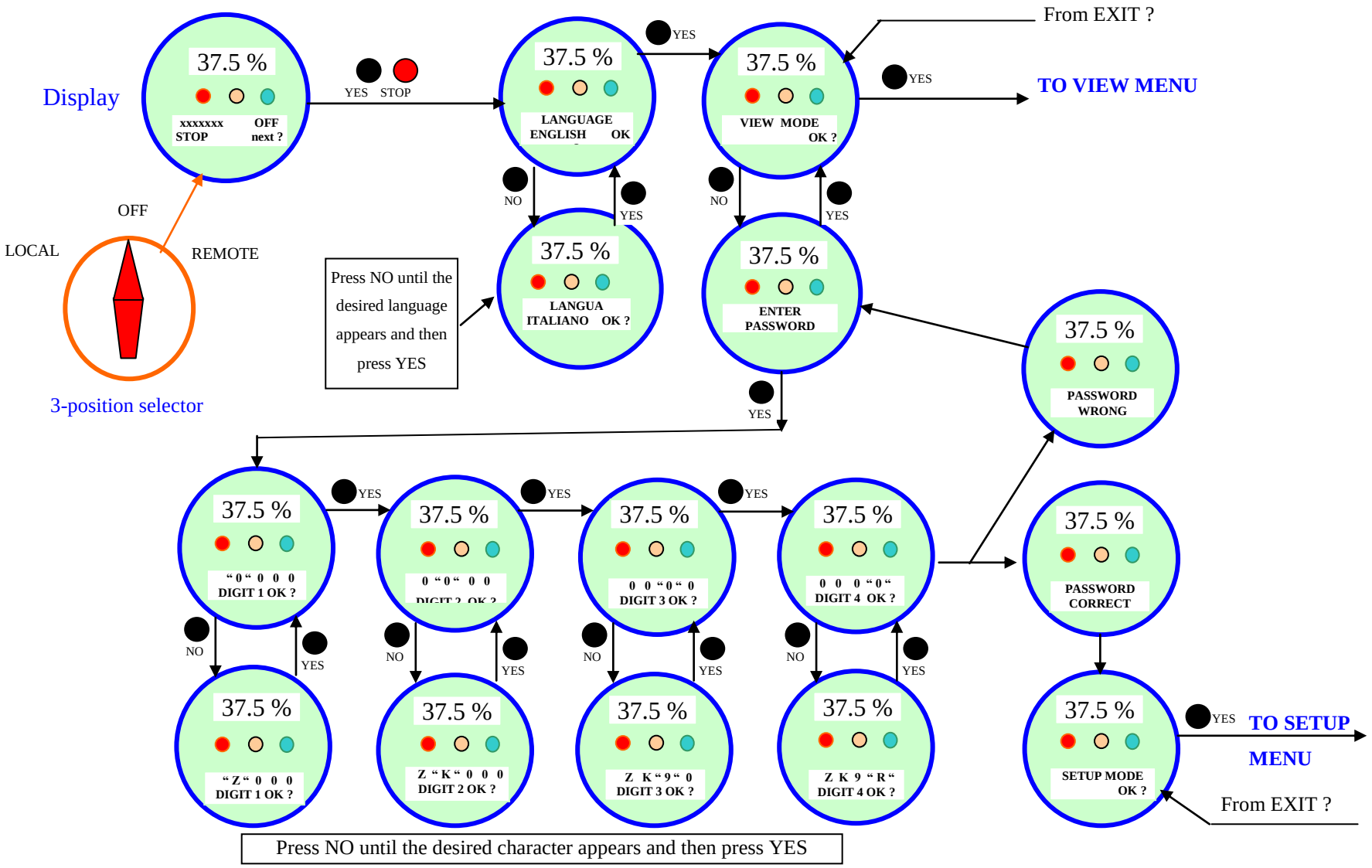
All settings are automatically saved to a non-volatile memory and retained also if the electrical power is removed from the actuator. All EFS2000 actuators are configured before shipping with a standard default setting unless alternatives were requested on order. In case of difficulty during commissioning, the default setting can be re-instated by the appropriate function in the routine ”miscellaneous” of the actuator set-up menu. The actuator returns to its original configuration and commissioning can be resumed.

10.4.7 EXIT FROM VIEW AND SET-UP MODE

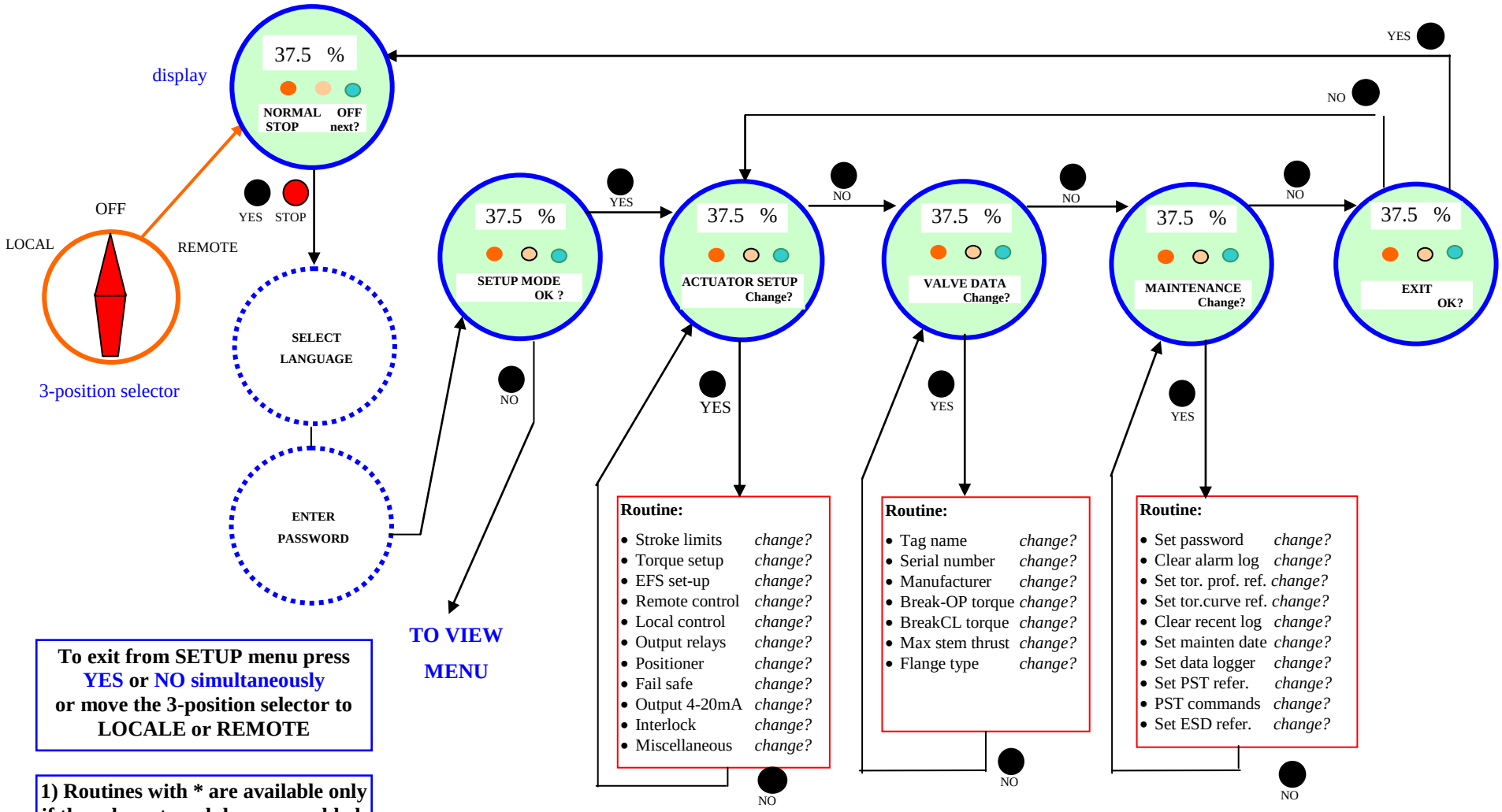
The following conditions cause the exit from view and set-up mode:

- move the 3-position selector to LOCAL or REMOTE
- answer YES when the display asks “EXIT OK? ”
- press YES and NO simultaneously
- automatic exit after 90 minutes without any parameter change or view
- remove the electrical power from the unit

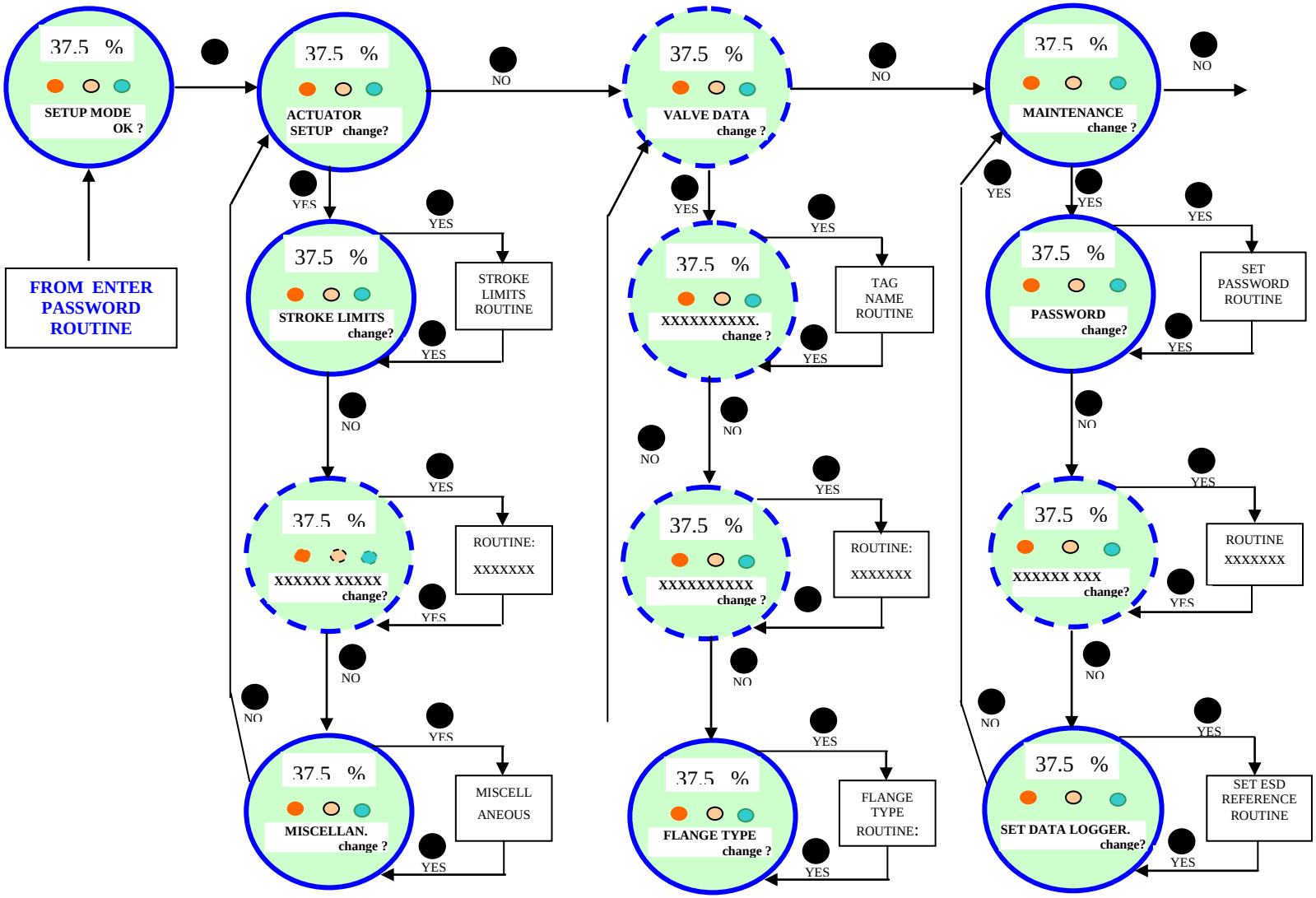
The figure below shows the procedure to enter VIEW and SET-UP mode



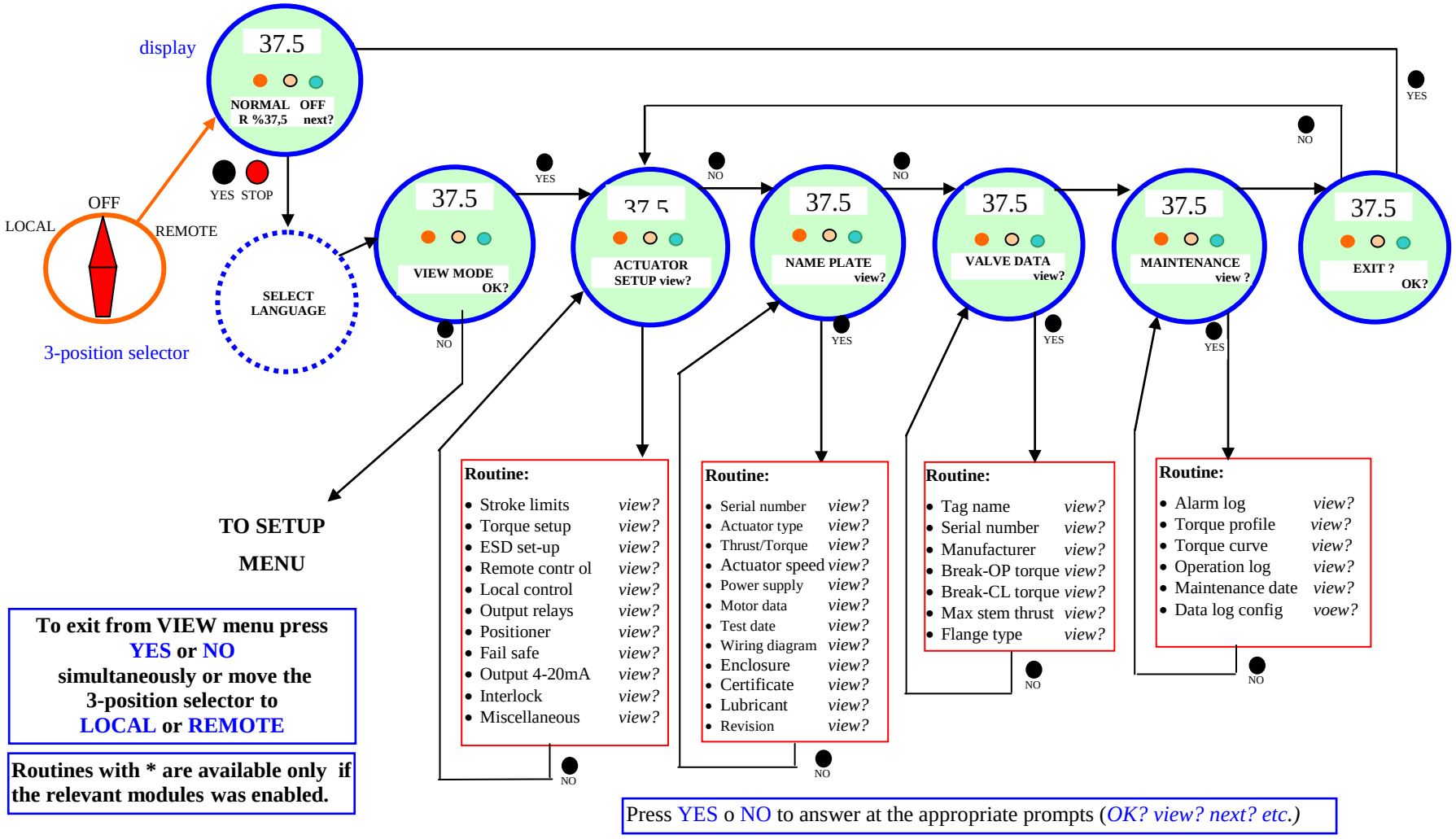
11 SET-UP MENU



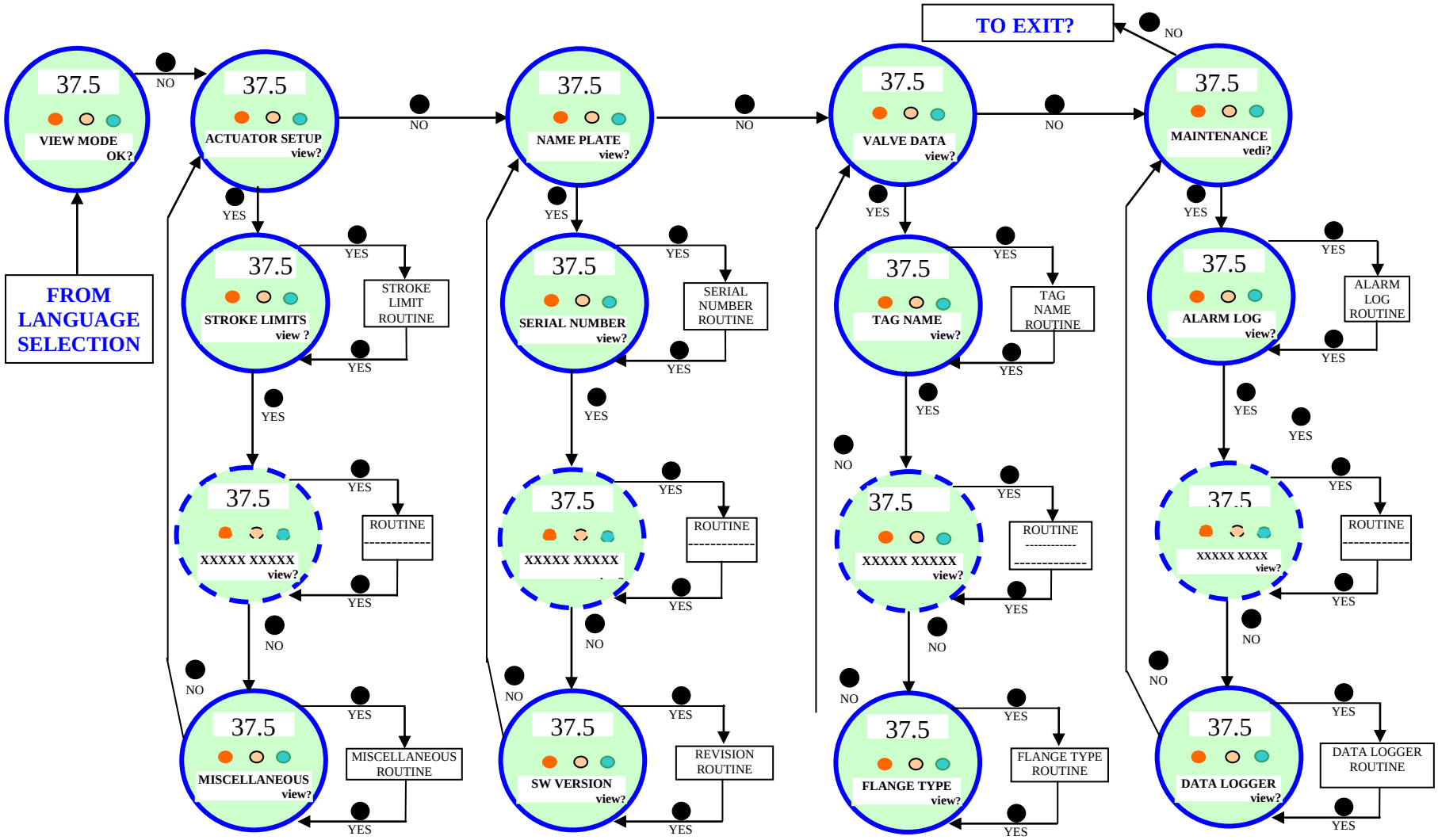
The below figure shows the procedure to move in the set-up routines



12 VIEW MENU



The below figure shows the procedure to move in the view routine



13 SET-UP ROUTINES

13.1 ACTUATOR SETUP

13.1.1 SET STROKE LIMITS

This routine allows the actuator to be configured according to the type of valve it is mounted on.

The following parameters will be set:

- opening and closing torque limits: from 40 % to 100 % of the nominal torque. The nominal torque corresponding to 100% set in-house and stored in the name plate menu for reference.
- close and open limits type: by position or by torque. Use the following table to choose:

Valve type	Close limit	Open limit
• Gate (solid, flexible and split wedge), globe, metal seated butterfly valves	• Torque	• Position
• Ball, gate (parallel slide), plug valves, metal seated butterfly valves	• Position	• Position
• Linear valves with back-seating on stem	• Torque or position	• Torque

Set-up procedure:
Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions. When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select the actuator set-up menu, and then press YES again to start with the stroke limits routine.
Press YES if the closing torque limit is correct or NO to scroll the list of available values. When the value is correct, press YES.
Press YES if the opening torque limit is correct or NO to scroll the list of available values. When the value is correct press YES.
Press YES to set the close limit, or NO and then YES to set the open limit.
Close limit type
Press YES if the close limit type is correct (torque or position), press NO to change it. Press YES when the type is correct.
Close limit by position
Move the local selector to LOCAL. The local controls can be used.
Move the valve to closed position by local electrical command
Move the local selector to OFF
Press YES to confirm
Press YES to continue with the open limit setting, or press NO and again NO to repeat the close limit setting procedure.
Press NO and then YES to exit from the stroke limits routine.
Close limit by torque
Move the local selector to LOCAL. The local controls can be used.
Press the CLOSE control. The actuator moves in closing direction and when the configured torque value is reached the motor is stopped and the new position limit is memorised.
Move the local selector to OFF
Press YES to confirm
Press YES to continue with the open limit setting, or press NO and again NO to repeat the close limit setting procedure.
Press NO and then YES to exit from the stroke limits routine.
Open limit type
Press YES if the open limit type is correct (torque or position), press NO to change it. Press YES to confirm.
Open limit by position
Move the local selector to LOCAL. The local controls become active.
Move the valve to open position

Move the local selector to OFF
Press YES to confirm
Press YES to exit, or press NO then YES to repeat the close limit setting procedure.

Open limit by torque

Move the local selector to LOCAL. The local controls become active.
Press the OPEN control. The actuator moves in opening direction and when the configured torque value is reached the motor is stopped and the new position limit is memorised.
Move the local selector to OFF
Press YES to confirm
Press YES to exit, or press NO then YES to repeat the close limit setting procedure. If parameter "direction to close" is changed, both limits (open and close) must be set. Before leaving the stroke limits routine the microprocessor calculates the new value of the position resolution. If the stroke turns are less than 2.7, the message "error re-try" appears and the stroke limits procedure must be repeated.

The above procedure can be done also in MANUAL mode by the manual override command (hand pump and the hand operated spring return valve, Hydraulic Control Group) in place of the electrical actuator commands.

13.1.2 TORQUE SET-UP

The output torque limits to close (if it is spring-to-open) or to open (if it is spring-to-close) may be configured between 40% and 100% of the nominal torque stated on the actuator nameplate.
The "Max Set Actuator Output torque" is referred to the failure manoeuvre done with electric motor set at 40% and the spring.

Set-up procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions. When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select the actuator set-up menu, press NO and then press YES to select the torque set-up routine.
- Press YES if the opening torque limit is correct, press NO to scroll the list of available values. Press YES when the value is correct.
- Press YES if the closing torque limit is correct, press NO to scroll the list of available values. Press YES when the value is correct.

13.1.3 EFS SETUP

The EFS setup routine allows to configure the parameters of EFS and of PST functions. The following parameters relevant to EFS function can be set:

- ICON power-fail: enabled or disabled .
- Selector in OFF: enabled or disabled
- Autoreset: enabled or disabled
- Reset Delay: from 1 to 255sec. The recommended value is greater than 1.5 time the maximum valve stroke time during EFS action

The following parameters relevant to PST function can be set:

- PST mode: OFF, AUTO, MANUAL
  - OFF: PST not used
  - AUTO: PST cycle carried out automatically and cyclically with time interval set by the parameter PERIOD and at the time set by the parameter HOUR of DAY
  - MANUAL: PST cycle carried out on receiving of a remote hardwired or bus command or by a local command available in the VIEW and SETUP menu, Maintenance functions.
  - MAN-AUTO: both automatic and manual mode are available
- SPRING action: spring to open or spring to close
- PERIOD: time interval between PST, in days from 1 to 1000, in PST AUTO mode
- HOUR of DAY: hour of PST, in hour from 0 to 23, in PST AUTO mode.
- PST TRAVEL: position change during PST cycle, in % of position from 10 to 40
- MAX T-PST: max time allowed to change the position of PST TRAVEL due to spring action, measured in %, from 1 to 1000% of relevant BASELINE time

- MAX PST T-RET: max time to return to initial position by the electrical actuator, measured in %, from 1 to 1000% of relevant BASELINE time
- PAUSE: time of stayput of actuator after spring action and before command to return to initial position, in sec , from 2 to 255.
- MAX PST OV-TR: max position over-travel allowed during PST cycle, in percentage of position , from 1 to 100.

The function of each parameter is described in the chap. "EFS OPERATION".

Set-up procedure:

EFS SETUP:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions. When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select the actuator set-up menu, press NO to select the list of available routines. Press YES to select "EFS SETUP".
- Press YES if the parameter "ICON power-fail" is correct, press NO to change. Press YES when the value is correct.
- Press YES if the parameter "Selector in OFF" is correct, press NO to change. Press YES when the value is correct.
- Press YES if the parameter "AUTORESET" is correct, press NO to change. Press YES when the value is correct.
- Press YES if the parameter "Reset delay" is correct, press NO to scroll the list of available values. Press YES when the value is correct.
- Press YES to enter in the PST SETUP, press NO to return to EFS SETUP. Press NO to move to next routine

PST SETUP:

- Press YES if the parameter "PST mode" is correct, press NO to scroll the list of available values. Press YES when the value is correct.
- Press YES if the parameter "SPRING ACTION" is correct, press NO to change. Press YES when the value is correct.
- Press YES if the parameter "PERIOD" is correct, press NO to scroll the list of available values. Press YES when the value is correct.
- Press YES if the parameter "HOUR of DAY PST" is correct, press NO to scroll the list of available values. Press YES when the value is correct.
- Press YES if the parameter "PST TRAVEL" is correct, press NO to scroll the list of available values. Press YES when the value is correct.
- Press YES if the parameter "MAX T-PST" is correct, press NO to scroll the list of available values. Press YES when the value is correct.
- Press YES if the parameter "MAX PST T-RET" is correct, press NO to scroll the list of available values. Press YES when the value is correct.
- Press YES if the parameter "PAUSE" is correct, press NO to scroll the list of available values. Press YES when the value is correct.
- Press YES if the parameter "MAX PST OV-TR" is correct, press NO to scroll the list of available values. Press YES when the value is correct to return to PST SETUP.
- Press NO to return to EFS SETUP. Press NO to move to next routine

13.1.4 REMOTE CONTROLS

The actuator may be remotely controlled by 4, or 3, or 2 wires depending on the connection made on the terminal board of the actuator. The following options are available:

- 4 wires latched: requires 2 momentary signals (since the control is self-maintained) to open or close and one signal to stop in mid-travel. The action of the stop signal can be reversed (stop when signal is ON (MAKE) or stop when signal is OFF (BREAK)).
- 3 wires latched instant reverse: requires 2 momentary signals (since the control is self-maintained) to open or close. Reverse momentary signal reverses the direction.
- 3 wires momentary: requires 2 push-to-run type signals (since the control is not self-maintained) to open or close
- 2 wires open if signal On: requires signal On to open and no signal to close

- 2 wires open if signal Off: requires signal Off to open and signal On to close
  By selecting the option "off", the remote controls are disabled.
  Configuration should be done during actuator set-up.

Setup procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select actuator set-up menu, press NO to scroll the list of available routines and then press YES to select Remote controls.
- Press YES if the control mode is correct or NO to scroll the list of available options: 4 wires, 3 wires, 2 wires, off. Press YES to select the desired option. If 4 wires was chosen use YES and NO to select the STOP signal: set MAKE to stop when signal is on and set BREAK to stop when signal is off. If "3 wires" was chosen, use YES or NO to answer the prompt on the display and choose among "push-to-run" or "latched instant reverse" control modes. If "2 wires" was chosen, use YES and NO to choose among "open if signal ON" or "open if signal OFF" control modes.

13.1.5 LOCAL CONTROLS

This routine allows:

- to configure the control mode by means of the local controls when the 3-position selector is in LOCAL. The available options are "push-to-run", "latched", "latched with instant reverse".
- to set the LED's colour. The following options are available: open LED: green or red; close LED: green or red; alarm LED: yellow or red.

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select the actuator set-up menu, press NO to scroll the list of available routines and then press YES to select Local controls.
- Press YES to change control mode, or press NO to proceed to LED's colour setting

Control mode

Press YES if the display shows the correct control mode or press NO to scroll the list of available options (push-to-run, latched, latched with instant reverse, push to run rel. As5-6). Press YES to confirm.
Option "push to run rel. As5-6" is used when a remote enable of local commands is required. With the local selector in LOCAL, to press the OPEN or CLOSE local pushbuttons cause the relays As5 or AS6 to switch, but no command is sent to motor. The control PLC should read the status of the above relays and send an open or close command on the remote inputs. (see chap. "remote controls, push to run mode") (see relevant electrical diagram when the option is used).

LED's colour

• Press YES if the colour of the open LED is correct. Press NO to change it, then YES to confirm
• Press YES if the colour of the close LED is correct. Press NO to change it, then YES to confirm
• Press YES if the colour of the alarm LED is correct. Press NO to change it, then YES to confirm

13.1.6 OUTPUT RELAYS

Monitor relay

The voltage-free, change-over, contacts of the monitor relay indicate that the actuator is either available for remote control or that a problem or a condition preventing remote control of the valve exists.
The monitor relay is normally energised and will be de-energised on:

- main voltage failure
- lost phase
- internal temperature alarm
- K1, K2 contactor failure
- speed sensor failure
- configuration error
- HWerror
- mid travel alarm

• position sensor failure • EFS mid-travel alarm

The following situation can be individually added to switch-over the monitor relay:

- LOCAL/STOP pressed
- LOCAL/OFF selected
- ESD- (to be intended as “EFS Shut-Down Reference”) (clutch not energized or selector in MANUAL)
- Manual operation
- Motor over-temperature
- Over-torque
- Jammed valve
- Low lithium battery (if present)

Auxiliary output relays
For status indication or diagnostic purposes, 8 voltage-free contacts of 8 relays are available to be configured individually to switch for the following conditions:

STATUS		ALARM	
• open limit	• blinker	• motor over-temperature	• low lithium battery(if present)
• closed limit	• mid-travel position	• over-torque	• warnings
• position >= xx %	• local selected	• over-torque in OP	• mid travel alarm in CL/OP
• position <= xx %	• remote selected	• over-torque in CL	• EFS in MANUAL
• closing	• local stop pressed	• valve jammed in OP	• PST failed
• opening	• PST signal active	• valve jammed in CL	• MAINS-only AS8
• motor running	• manual operation	• valve jammed	• EFS mid travel

The contacts may be configured to make or break on condition.
Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see “Entering the set-up mode”). When the message displayed is “SET-UP MODE OK?” press YES. Press YES to select actuator set-up menu, press NO to scroll the list of available routines and then press YES to select Output relays.
- Press YES to select DEFAULT #1, or press NO to change
- Press YES to select DEFAULT #2, or press NO to configure the output relays

DEFAULT # 1
Monitor relay

- main voltage failure
- speed sensor failure
- lost phase
- configuration error
- local/off selected
- HW error
- local stop pressed
- motor over-temperature
- manual operation
- over-torque
- internal temperature alarm
- jammed valve
- K1 contactor failure
- low a lithium battery (if present)
- K2 contactor failure
- mid-travel alarm
- position sensor failure

Auxiliary relays
AS1: open limit; make
AS2: close limit; make
AS3: position >90%; make
AS4: position <5%; make
AS5: motor running; make
AS6: overtorque; make
AS7: ESD active; make
AS8: motor overtemperature

DEFAULT # 2
Monitor relay

- main voltage failure
- speed sensor failure
- lost phase
- configuration error
- local/off selected
- HW error
- local stop pressed
- motor over-temperature
- manual operation
- over-torque

- internal temperature alarm
- jammed valve
- K1 contactor failure
- low lithium battery (if present)
- K2 contactor failure
- mid-travel alarm
- position sensor failure

Auxiliary relays
AS1: open limit; break
AS2: close limit; break
AS3: position >90%; break
AS4: position <5%; break
AS5: motor running; make
AS6: remote selected; make
AS7: warning; make
AS8: local selected

Configure output relays
• Press YES to change the monitor relay or NO to change auxiliary relays AS1, 2, 3, 4, 5, 6, 7, 8.

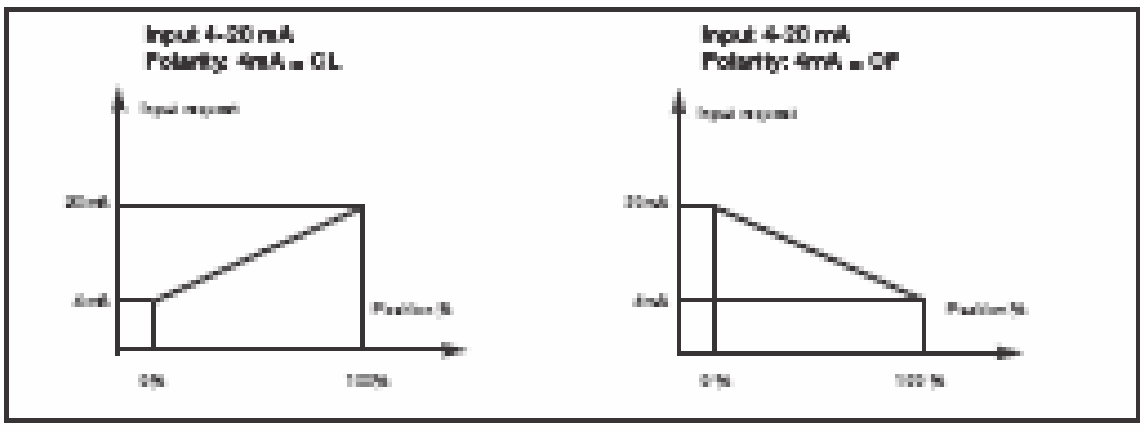
Monitor relay
• Press YES or NO to enable or disable the following situations from the conditions which de-energise the monitor relay: motor over-temperature, over-torque, jammed valve, manual override, ESD-EFS, low lithium battery (if present), local STOP pressed, LOCAL/OFF selected.

Auxiliary relays AS1, 2, 3, 4, 5, 6, 7 and 8
• Press NO to answer prompt "MONITOR RELAY change?"
• Press YES to change AS1, press NO to select the other relays
• Press YES if the condition associated to AS1 relay is correct, press NO to scrolls the list of conditions and press YES to set.
• Press YES or NO to either confirm or change the type of contact when the condition occurs (break, make). Since relay AS8 is change-over, this option is not available.
• Press NO to pass to AS2 and then repeat the procedure for the other relays
• Press NO to exit

13.1.7 POSITIONER

The positioning function is only available in inching or modulating EFS2000v4 actuators and allows to position the valve according to a "position request R%" command signal. The positioning function compares the present actuator position % with the position request R%, and if the difference is greater than the dead band the actuator is driven to reach the new requested position. The "position request R%" signal may either be received from the bus or the 4-20mA analogue input. If the ICON2000 is set to receive the position request R% from the BUS, a fieldbus interface card must be present, or a Hardware alarm will be generated. If the ICON2000 is set to receive the position request R% from the 4-20mA generator, the Ain/Aout card must be present, or a Hardware alarm will be generated. The following options can be configured via local operator interface:

- dead band: configurable from "position resolution%" to 25.5% of the maximum position error. The configured value should be great enough to avoid the hunting effect.
- Polarity of the 4-20mA position request signal: it allows to reverse the relationship between the 4-20mA input signal and the "position request R%", according to the following diagrams. The option is not available when the ICON2000 is set to receive the "position request R%" from the bus.



- Motion inhibit time: it allows to adjust the length of the delay time between two cycles of the motor. It can be configured from 1 to 255 secs and allows to set the maximum number of start/hour of the electrical motor.
- % MIN and % MAX, 4-20mA input signal range: it allows to change the relationship between the input signal and the position request R%. This function is useful when a single 4-20mA signal is used to control the position of 2 valves (e.g.: split range applications). The option is not available when the ICON2000 is set to receive the "position request R%" from the bus.

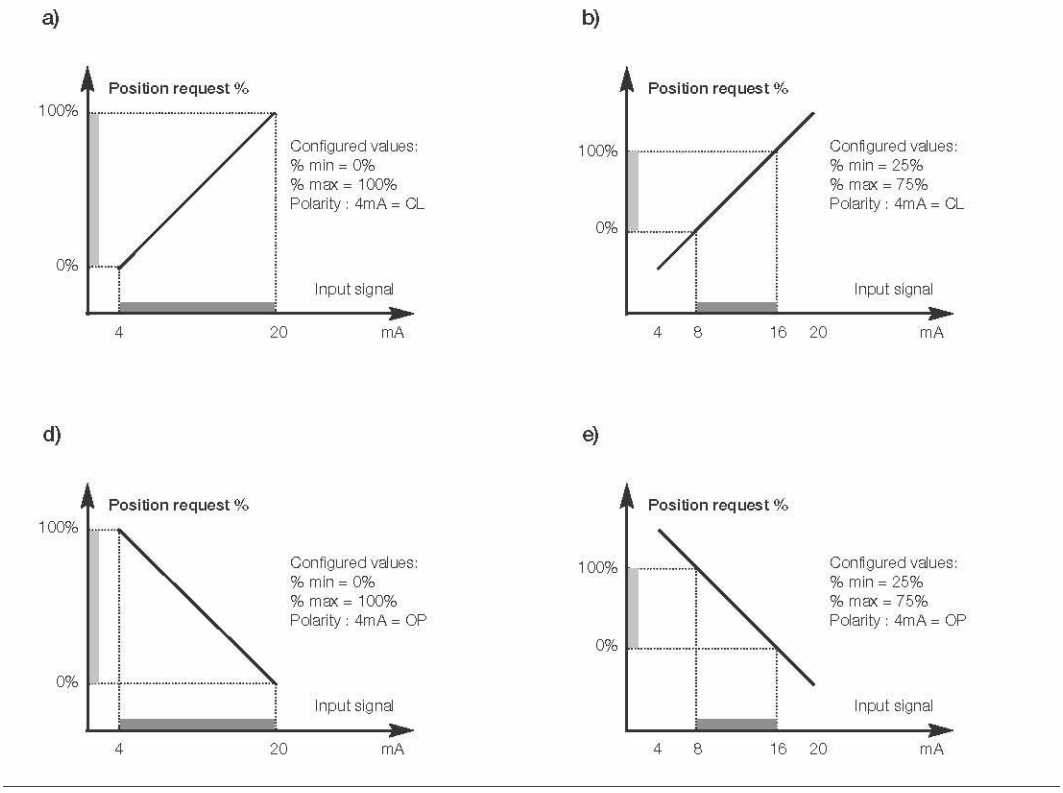
The curves below may better clarify the above option:

example a): with input signal = 4 mA, the position request is 0% and the actuator is driven to close. With input signal = 20 mA, the position request is 100% and the actuator is driven to open. With input signal = 12 mA the position request is 50% and the actuator is driven to reach position 50%.

example b): with input signal < 8 mA, the position request is 0% and the actuator is driven to close. With input signal = 16 mA, the position request is 100% and the actuator is driven to open. With input signal = 12 mA the position request is 50% and the actuator is driven to reach position 50%.

example c): with input signal = 4 mA , the position request is 100% and the actuator is driven to open. With input signal = 20 mA, the position request is 0% and the actuator is driven to close. With input signal = 12 mA the position request is 50% and the actuator is driven to reach position 50%.

example d): with input signal < 8 mA, the position request is 100% and the actuator is driven to open. With input signal = 16 mA , the position request is 0% and the actuator is driven to close. With input signal = 12 mA the position request is 50% and the actuator is driven to reach position 50%.



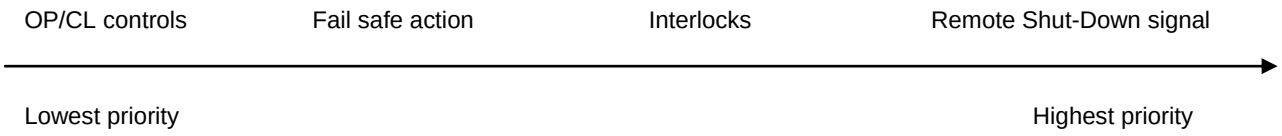
Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see Entering the set-up mode). When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select the actuator set-up menu, press NO to scroll the list of available routines and then press YES to select POSITIONER.
- Press YES if the configured value of the Dead Band is correct (from "position resolution %" to 25.5%), or press NO to change it, then press YES.
- Press YES if the configured value of the Polarity is correct (4mA=CL or 4mA=OP), or press NO to change it, then press YES.
- Press YES if the configured value of the Motion Inhibit Time is correct (from 1 to 255 sec), or press NO to change it, then press YES.
- Press YES if the configured value of the % MIN is correct (from 0 to 75%), or press NO to change it, then press YES. The standard value is 0.

- Press YES if the configured value of the % MAX is correct (from 25 to 100%), or press NO to change it, then press YES. The difference between % MAX and % MIN should be greater than 25%. The standard value is 100.

13.1.8 FAIL SAFE

This function configures the actuator action in case of loss of the 4-20mA input or BUS signals. This action only takes place if the local selector is in REMOTE and if the positioning function or the BUS interface are active. When the 4-20mA or BUS signal is restored, the ICON2000 resumes its normal functioning. The Interlock and Remote Shut-Down signal override the Fail Safe action according to the following diagram:



The following options can be configured:
• Action: open, close, stay-put, go to position %, no action (OFF)
• Delay: time before than the fail-safe action takes place.

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see entering the set-up mode). When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select the actuator set-up menu, press NO to scroll the list of available routines and then press YES to select FAIL SAFE.

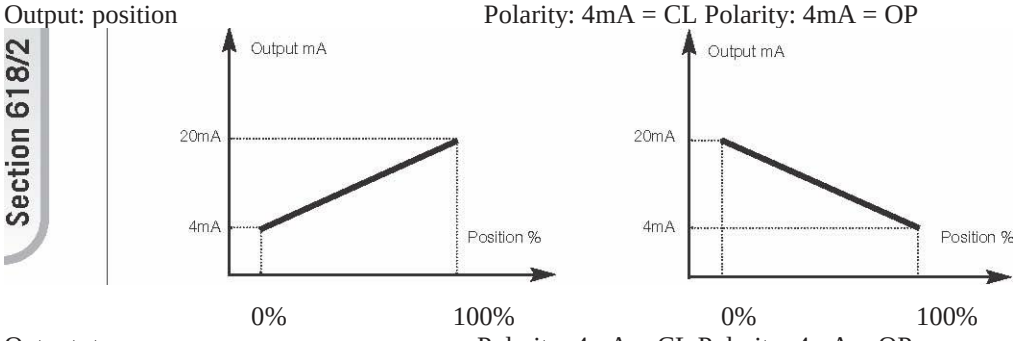
- Press YES if the configured ACTION is correct (open, close, stay-put, go to position xxx%, off), or press NO to change it, then press YES.

- Press YES if the configured value of the DELAY is correct (from 0 to 255 sec), or press NO to change it, then press YES.

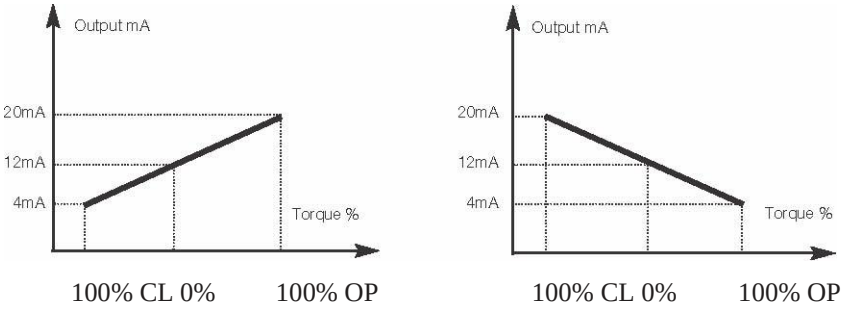
13.1.9 OUT 4-20 mA

This routine is only available if the Ain/Aout card is present. With this card the ICON2000 is provided with a 4-20mA analogue input and a 4-20mA analogue output. The 4-20mA output can be configured to provide a current proportional to either "position" or "torque". The polarity option allows to reverse the relationship between the present position or torque and the 4-20mA output signal, according to the following diagrams:

Output: position



Output: torque



Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see "entering the set-up mode"). When the message of the display is "SET-UP MODE OK?" press YES. Press YES to select the actuator set-up menu, press NO to scroll the list of available routines and then press YES to select Out 4-20mA.
- Press YES if the output is correct (POSITION or TORQUE), or press NO to change it, then press YES.
- Press YES if the polarity is correct, or press NO to change it, then press YES.

13.1.10 INTERLOCK

The interlock inputs can be used to inhibit the actuator movement in open or close direction. The controls are momentary, the inhibit action continues until the relevant signal is present. The interlock controls work when the local selector is in LOCAL or in REMOTE. The Remote Shut-Down signal overrides the interlock controls. The following options can be configured:

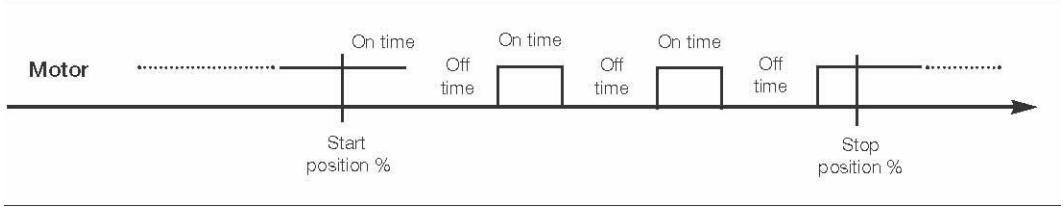
- interlock OP:active when signal is PRESENT, active when signal is ABSENT, no action (OFF)
- interlock CL:active when signal is PRESENT, active when signal is ABSENT, no action (OFF)

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see entering the set-up mode). When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select the actuator set-up menu, press NO to scroll the list of available routines and then press YES to select INTERLOCK.
- Press YES if the configured value of the Open Interlock is correct (PRESENT, ABSENT, OFF), or press NO to change it, then press YES.
- Press YES if the configured value of the Close Interlock is correct (PRESENT, ABSENT, OFF), or press NO to change it, then press YES.

13.1.11 TWO-SPEED TIMER

The "2-speed timer" routine is used to extend the actuator travelling time in opening and / or closing direction, by driving the motor by pulses which duration (ON and OFF time) is configurable. Pulsing control can be applied to full travel or only a part of it.



Start position and stop position may be adjusted from 0% - 100 % separately in opening and closing direction.
ON time and OFF time may be adjusted from 2 sec - 200 sec separately in opening and closing direction.

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select actuator set-up menu, press NO to scroll the list of available routines and then press YES to select 2-speed timer.
- Press YES to change close direction parameters, press NO and then YES to change only open direction parameters

Closing direction

- Press YES if the status is OK, or NO to change. Press YES to confirm (status = On, enables 2-speed timer operation in closing direction; status = Off, disables timer operation in closing direction).
- Press YES if the position value where pulsing control starts is correct, press NO to scroll the list of available values. Press YES when the value is correct
- Press YES if the position value where pulsing control stops is correct, press NO to scroll the list of available values. Press YES when the value is correct
- Press YES if the value of the ON time of pulsing control is correct, press NO to scroll the list of available values. Press YES when the value is correct
- Press YES if the value of the OFF time of pulsing control is correct, press NO to scroll the list of available values. Press YES when the value is correct

Opening direction

- Press YES if the status is OK, or NO to change. Press YES to confirm (status = On enables 2-speed timer operation in opening direction; status = Off, disables timer operation in opening direction).
- Press YES if the position value where pulsing control starts is correct, press NO to scroll the list of available values. Press YES when the value is correct
- Press YES if the position value where pulsing control stops is correct, press NO to scroll the list of available values. Press YES when the value is correct
- Press YES if the value of the ON time of pulsing control is correct, press NO to scroll the list of available values. Press YES when the value is correct
- Press YES if the value of the OFF time of pulsing control is correct, press NO to scroll the list of available values. Press YES when the value is correct

13.1.12 BUS (or FDI CONTROL)

This routine is only available if a fieldbus interface card is present. The routine allows setting the most important parameters (node address, termination, etc.) necessary to connect the actuator to a fieldbus. If the ICON2000 was set to work with fieldbus, but the fieldbus card is not present, a Hardware alarm will be generated. Different interfaces are available to connect the EFS2000 to different types of fieldbus. If the bus interface is LonWorks, the routine "BUS" changes in "FDI control". See the specific manuals for instruction and setting of the above modules.

13.1.13 MISCELLANEOUS

It includes different types of routines as "time and date", "factory settings", "lithium battery", "torque profile", etc. used only for special application or in particular conditions.

13.1.13.1 TIME AND DATE

Time and date are used in maintenance functions to associate the time information to the memorised event (torque profile, alarm log, maintenance request, etc.). Time and date are entered at the time of manufacture, but they can be adjusted during commissioning or maintenance operations.

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select actuator set-up menu, press NO to scroll the list of available routines and then press YES to select Miscellaneous.
- Press YES to enter the time and date routine.
- Press YES if the time is correct, press NO to change it

- Enter hours, minutes and seconds. Press NO to scroll the list of available values, press YES to select.
- Press YES when the time is correct
- Press YES if the date is correct, press NO to change
- Enter day, month, and year. Press NO to scroll the list of available values, press YES to select.
- Press YES if the date is correct

13.1.13.2 FACTORY SETTINGS

The above routine resets the present configuration and restores the default configuration as below:

stroke limits	close limit: by position
	open limit: by position
Torque set-up	Closing torque: 40%
	Opening torque: 40%
Remote controls	Control type: 4 wires latched
Locals controls	Control type: latched with instant reverse
	LED's colour: green = open / opening
	red = close / closing
	yellow = alarm / warning
Output relay	Default #1
2-speed timer	Opening direction: off
	Closing direction: off
Miscellaneous	Lithium battery : absent
	Torque profile: standard
	Torque by-pass: 4%
	Valve jammed: 4 sec.

Warning: the FACTORY SETTING routine set the parameter "close direction" to "CW". The parameter is located in the protected area of memory and it is available only by using a special password. In the EFS it must be always configured "CCW". It is necessary to call the Biffi service to modify the above parameter if FACTORY SETTING routine is used

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select the actuator set-up menu, press NO to scroll the list of available routines and then press YES to select Miscellaneous.
- Press No to scroll the list of routines and press YES to select factory configuration. Press YES to download the standard configuration, press NO to exit.

13.1.13.3 TORQUE LIMITS

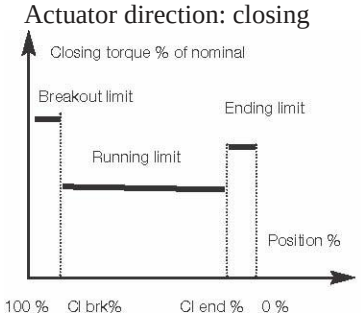
Torque limits are used as a reference for torque alarm and end of travel. With option "standard", the torque limits are constant along the full stroke. The limits can be configured in the "stroke limits" or "torque set-up" routines and determine the torque alarm or end of travel situations. In some special applications it is useful to configure 3 different

torque thresholds for each travelling direction, so as to separately limit the unseating, running and ending torque values. To select this option pick "3-point limits" and then follow the torque set-up and stroke limits routine (see figure).

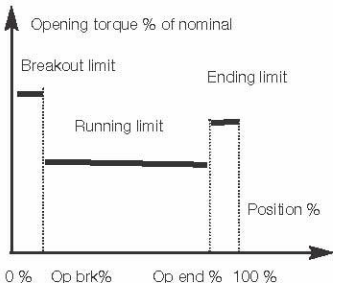
Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see "Entering the set-up mode"). When the message of the display is "SET-UP MODE OK?" press YES. Press YES to select the actuator set-up menu, press NO to scroll the list of available routines and then press YES to select Miscellaneous.
- Press NO, and then NO to select "torque mode". Press YES if the setting is correct, press NO to change it. Press YES when the value is correct.
- Repeat the "stroke limits set-up" routine.

Actuator direction: closing



Actuator direction: opening



13.1.13.4 LITHIUM BATTERY

On request, the actuator can be provided with a lithium battery to update the remote outputs (output relays status and bus messages) in case of electrical power failure and manual override operations. The program runs the functions relevant to the battery only if the appropriate flag "lithium battery" is configured with "present". If the battery is absent or if no updating of remote outputs is requested, the above flag should be configured with "absent".

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select actuator set-up menu, press NO to scroll the list of available routines and then press YES to select Miscellaneous.
- Press No to scroll the list of routines and press YES to select lithium battery. Press YES if the setting is correct, press NO to change. Press YES when the value is correct.

13.1.13.4.1 TORQUE BY-PASS (%)

Since a high torque may be required to unseat certain valves, the torque by-pass routine masks the torque alarm when an open or close command is received and the actuator is fully open or closed. The torque by-pass is expressed in % of position and is configurable from 0% to 20%. For example, if a 10% by-pass value is set, we may have:
- by-pass active in Opening: from 0% to 10%
- by-pass active in Closing: from 100% to 90%
To exclude torque by-pass configure 0%.

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select actuator set-up menu, press NO to scroll the list of available routines and then press YES to select Miscellaneous.
- Press No to scroll the list of routines and press YES to select torque by pass. Press YES if the setting is correct, press NO to change. Press YES when the value is correct.

13.1.13.5 VALVE JAMMED (TIME)

The valve jammed time is used to monitor the following situations:

1. The time passed after receiving an open or close control is greater than the "valve jammed time", but the valve position variation is smaller than 0,5%. The motor is blocked, the command is cleared and the "valve jammed" alarm indication is generated.
2. The valve is moving, but during the travel the position valve variation is smaller than 0,5% in a time equal to "valve jammed time". The motor is blocked, the command is cleared and the "mid-travel alarm" indication is generated.

The valve jammed time is expressed in seconds and can be configured from 0 to 100 sec. Configure "0" to exclude the routine.

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see "Entering the set-up mode".) When the message displayed is "SET-UP MODE OK?" press YES. Press YES to select actuator set-up menu, press NO to scroll the list of available routines and then press YES to select Miscellaneous.
- Press No to scroll the list of routines and press YES to select valve jammed. Press YES if the setting is correct, press NO to change. Press YES when the value is correct.

13.2 Valve data

The valve data allow identifying the valve and its function in the process. The valve manufacturer and the end user can enter the data. The following data can be entered:

- tag name (max. 28 char.)
- serial number (max. 28 char.)
- manufacturer (max. 28 char.)
- break-OP torque (max. 28 char.)
- break-CL torque (max. 28 char.)
- max stem thrust (max. 28 char.)
- flange type(max. 28 char.)

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press NO to scroll the list of available menus and then press YES to select valve data menu.
- Press NO to scroll the list of available routines and then press YES to select the data to be changed (Tag name, serial number, etc).
- Press YES if the 1st character of the string is correct. Press NO to scroll the list of available characters. Press YES to select the desired character.
- Enter up to 28 characters. Enter a blank character, and "….. " as end of string.

13.3 Maintenance

A large amount of data is stored in the actuator memory and is available for future analysis or to assist the operator in the maintenance program. The maintenance menu also includes the set password routine, and the possibility to modify or start the maintenance functions. The following data are available:

- set password
- clear alarm log
- set torque reference
- set curve reference
- clear recent data log
- set maintenance date
- set data logger
- set EFS baseline
- set PST baseline
- PST command (normal or baseline)

13.3.1 SET PASSWORD

The actuator is supplied by BIFFI with a default password ("0 0 0 0"). By the above routine the end user can enter a different password consisting of 4 alphanumeric characters. After entering the new password, the old one ceases to be

valid. Therefore it is mandatory "NOT TO FORGET THE PASSWORD" after the default one has been modified. Forgetting the new password makes it impossible to enter the set-up menu and to configure the actuator.

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press NO to scroll the list of available menus and then press YES to select Maintenance menu.
- Press NO to scroll the list of available routines and then press YES to select Set password. Press YES again to select Enter new password.
- Enter the new password one digit at a time. Press YES if the digit is correct, press NO to scroll the list of available characters and then press YES to select. Enter 4 digits. When the display shows the message Password changed the old password is no longer valid.

13.3.2 CLEAR ALARM LOG

Clear procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press NO to scroll the list of available menus and then press YES to select the Maintenance menu.
- Press NO to scroll the list of available routines and then press YES to select clear alarm log.
- Press YES to clear alarm log.

13.3.3 SET TORQUE REFERENCE

The set torque profile reference routine allows to transfer the last torque profile to the reference profile registers. The old reference data are lost and the new ones are used as a new reference torque profile.

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press NO to scroll the list of available menus and then press YES to select maintenance menu.
- Press NO to scroll the list of available routines and then press YES to select Set torque reference.
- Press YES to update the torque reference data.

13.3.4 SET CURVE REFERENCE

The "set curve reference" routine allows to select 1 off 100 opening and closing torque curves in the memory of the EFS2000 and to transfer them to the torque curve reference registers. The old reference data are lost and the new ones will be the new torque curves reference (see VIEW ROUTINES, Maintenance, Torque Curve).

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press NO to scroll the list of available menus and then press YES to select maintenance menu.
- Press NO to scroll the list of available routines and then press YES to select Set curve reference.
- Press NO to scroll the list and then press YES to select the desired curves (in opening and closing).
- Press YES to update the torque curve reference.

13.3.5 CLEAR RECENT DATA LOG

The clear recent data log routine allows to clear the counters of the recent operation log. This command does not affect the content of the "general operation log". The date of the "clear recent data log" is memorised and can be viewed in the maintenance date routine of the view menu.

Clear procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see "Entering the set-up mode".) When the message displayed is "SET-UP MODE OK?" press YES. Press NO to scroll the list of available menus and press YES to select the maintenance menu.
- Press NO to scroll the list of available routines and then press YES to select clear recent data log.
- Press YES
- Press YES to clear or press NO to exit.

13.3.6 SET MAINTENANCE DATE

The maintenance date routine allows the following operations:

- to set the last maintenance date
- to set the next maintenance date
- to set the start-up date

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press NO to scroll the list of available menus and then YES to select the maintenance menu.
- Press NO to scroll the list of available routines and press YES to select maintenance date.
- Press YES to set the last maintenance date. Press NO to skip to "next maintenance date".

Last maintenance date:

- Press YES if the date is correct, press NO to change it
- Enter day, month, and year. Press NO to scroll the list of available values, press YES to select
- Press YES if the date is correct

Next maintenance date:

- Press YES if the date is correct, press NO to change it
- Enter day, month, and year. Press NO to scroll the list of available values, press YES to select
- Press YES if the date is correct

Start-up date:

- Press YES if the date is correct, press NO to change it
- Enter day, month, and year. Press NO to scroll the list of available values, press YES to select
- Press YES if the date is correct

13.3.7 SET DATA LOGGER

The "data logger" routine allows to set the data logger parameters (see VIEW ROUTINES, Maintenance, Data Logger). To start the data logger the following data should be set:

❑ Logger mode:	recorder, event, off , T-recorder
❑ Sampling time:	from 1 to 3600 secs (the sampling time is only used in recorder mode)
❑ Memory mode:	stop when memory is full, continuous = stop after overwriting 5000 times (event) and 10000 times (recorder / T-recorder) the memory
❑ Start date:	date when the logger starts
❑ Start time:	time when the logger starts

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press NO to scroll the list of available menus and then press YES to select maintenance menu.
- Press NO to scroll the list of available routines and then press YES to select "data logger".
- Press YES if the mode is correct. Press NO to scroll the list of modes and press YES to select the desired value.

- Press YES if the sampling time is correct. Press NO to scroll the list of times and press YES to select the desired value.
- Press YES if the memory mode is correct (stop when full or continuous). Press NO to change and press YES to select.
- Press YES if the start time is correct. Press NO to scroll the list and press YES to select the desired sampling times (hour, min, sec).
- Press YES if the start date is correct. Press NO to scroll the list and press YES to select the desired sampling times (day, month, year)
- Press YES to confirm the above settings.

13.3.8 SET PST REFERENCE

The "Set PST reference" routine allows to select 1 off 16 PST curves in the memory of the EFS2000 and to transfer its data to the PST curve reference registers. The old reference data are lost and the new ones will be the new PST curves reference (see VIEW ROUTINES, Maintenance, PST graph).

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press NO to scroll the list of available menus and then press YES to select maintenance menu.
- Press NO to scroll the list of available routines and then press YES to select "Set PST reference".
- Press NO to scroll the list and then press YES to select the desired curve .
- Press YES to update the PST curve reference.

13.3.9 PST COMMANDS (NORMAL OR BASELINE)

The PST CMD routine allows to perform the PST cycle by the local operator interface of the actuator. Two options are available:

- New baseline
- Normal PST

If option "new baseline" is chosen the data collected in the PST cycle are used to update the PST reference curve. If option "normal" is chosen , the data collected in the PST cycle are stored in the EFS 2000 memory. Up to 16 PST curves can be memorized. When a new curve is achieved the oldest one is cancelled.

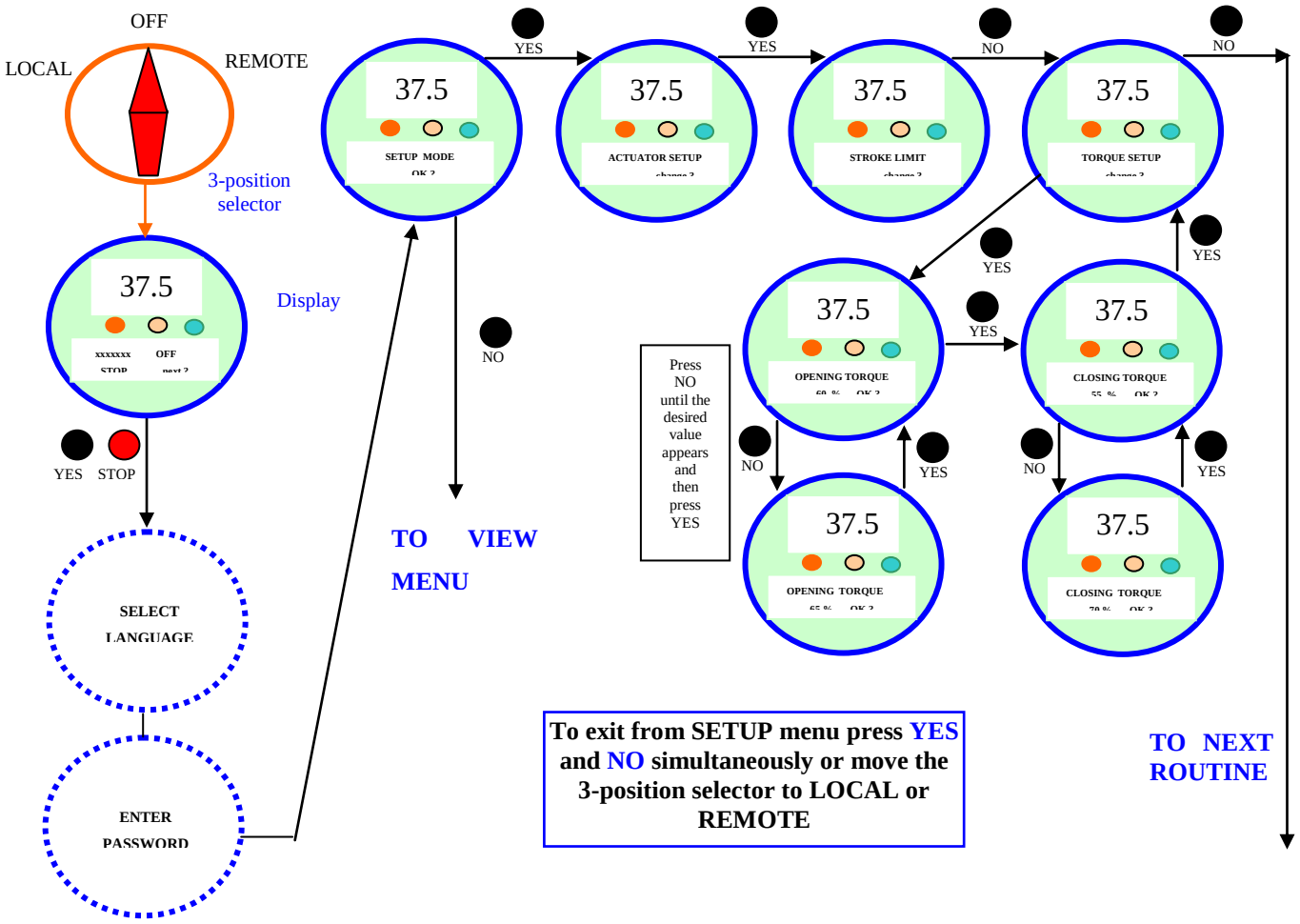
13.3.10 SET ESD REFERENCE (" to be intended as "Set EFS Shut-Down Reference")

The "Set ESD reference" routine allows to select 1 off 16 Shut-Down curves in the memory of the EFS2000 and to transfer its data to the Shut-Down curve reference registers. The old reference data are lost and the new ones will be the new ESD curves reference (see VIEW ROUTINES, Maintenance, EFS graph).

Configuration procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering the set-up mode). Select the language and then enter the password according to the instructions (see "Entering the set-up mode"). When the message displayed is "SET-UP MODE OK?" press YES. Press NO to scroll the list of available menus and then press YES to select maintenance menu.
- Press NO to scroll the list of available routines and then press YES to select " Set ESD reference".
- Press NO to scroll the list and then press YES to select the desired curve .
- Press YES to update the ESD curve reference.

13.3.11 Example of set-up routine: TORQUE SETUP



14 VIEW ROUTINES

14.1 Actuator set-up

The above menu allows to view the present actuator configuration. No change can be made to the present data. The following data can be viewed:

ROUTINE	PARAMETERS
• stroke limits	• close limit type (torque or position), open limit type (torque or position)
• torque set-up	• closing torque limit %, opening torque limit %
• EFS setup	• EFS and PST parameters
• remote controls	• control type
• local controls	• control type, LED's colour
• output relays	• monitor relay conditions, ASi conditions, contact action
• Positioner *	• dead band, motion inhibit time, polarity, %min, %max (%min and %max are present only if"position request R%" is from 4-20mA input)
• Fail Safe *	• action, delay
• Out 4-20mA *	• output signal (position or torque), polarity
• Interlock	• Signal type in OP, signal type in CL
• 2-speed timer	• close direction: status, start, stop, on time, off time • open direction: status, start, stop, on time, off time
• Bus *	• Node address, terminations, etc. depending on fieldbus type
• miscellaneous	• time and date, torque mode, lithium battery, torque by pass %, valve jammed time

The routines with * can only be viewed if the relevant electronic cards are present. If the bus interface is LonWorks, routine "BUS" changes to "FDI control".
Detailed descriptions of the above routines and their parameters can be found in Chap. SETUP ROUTINES

View procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering view and set-up mode). Select the language according to the instructions (see "Entering the view mode"). When the message displayed is "VIEW MODE OK?" press YES. Press YES to select the actuator set-up menu.
- Press NO to scroll the list of available routines and press YES to select.
- Press YES to answer at the prompt "view" or "next" and to see the data

14.2 Name plate

Use this menu to view the data identifying the actuator. The data are entered in-house and can only be changed by the manufacturer. The following data may be viewed:

- Serial number: max. 28 characters, univocal identifier of the actuator by reference to BIFFI acknowledgment.
- Actuator type: max. 28 characters, describes the type of actuator with reference to BIFFI catalogue
- Torque / Thrust: nominal torque or thrust of actuator
- Actuator speed: nominal speed of actuator
- Power supply: nominal voltage and frequency of actuator
- Motor data: includes the following data relevant to the electrical motor:
  - Power type (3ph, 1ph, dc)
  - Power rating, max. 99.9 KW
  - In, max. 99.9 A
  - Is, max. 99.9 A
  - Icc, max 999.9 A
  - Duty (S2/15min, etc.)
  - Poles (2, 4, etc.)
  - Biffi name, max 28 characters
  - Gear ratio, max 1000
- Test date: date of the in-house functional test of actuator
- Wiring diagram (WD): wiring diagram number, max 28 characters
- Enclosure: type of enclosure (Eex-d, etc), max 28 characters
- Certificate: number of certificate, max. 28 characters
- Lubricant: type of lubricant, max. 28 characters
- Revision: HW revision of base card, SW revision of H8 microprocessor, SW revision of PIC microprocessor
- Torque sensor: data relevant to the relationship between motor torque and speed. This set of data contains also the factory torque limit setting , “Torque-set CL” and “Torque-set OP”.

View procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering view and set-up mode). Select the language according to the instructions (see “Entering the view mode”). When the message displayed is “VIEW MODE OK?” press YES. Press NO to scroll the list of available menus and press YES to select the nameplate menu
- Press YES to answer the prompt “view” or “next” and see the data in the above list

14.3 Valve data

To identify the valve and its function in the process the following data can be viewed.

- tag name (max. 28 char.)
- serial number (max. 28 char.)
- manufacturer (max. 28 char.)
- break-OP torque (max. 28 char.)
- break-CL torque (max. 28 char.)
- max stem thrust (max. 28 char.)
- flange type(max. 28 char)

The data should be entered by the valve manufacturer or by the end user during set-up operations.

View procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP. Select the language according to the instructions (see “Entering the view mode”). When the message displayed is “VIEW MODE OK?” press YES. Press NO to scroll the list of available menus and press YES to select the valve data menu.
- Press YES to answer prompts “view” or “next” and see the data in the above list.

14.4 Maintenance

14.4.1 ALARM LOG

The alarm log routine is used to view the list of the latest 64 alarms and 64 warnings and the data when they occurred. The "clear alarm log" routine of the set-up menu should be used to clear the list.

View procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering view and set-up mode). Select the language according to the instructions (see "Entering the view mode"). When the message displayed is "VIEW MODE OK?" press YES. Press NO to scroll the list of available menus and press YES to select the Maintenance menu.
- Press YES to answer the prompt "Alarm log view?".
- Press YES to scroll the list of alarms ("Alarms view?").
- Press NO to move on to "Warnings view?" and then YES to scroll the list of warnings.

14.4.2 TORQUE PROFILE

The torque profile routine gives important information on the actuator working conditions in comparison with a previously memorised reference profile. It can give a summarised but significant indication of a change in the process conditions.
Details are given of the reference and latest torque expressed in % of the nominal torque.
At the end of a full stroke in opening or closing the ICON2000 stores the 3 maximum torque values in position intervals 0%-10%, 10%-90%, 90%-100% in opening, and the 3 maximum torque values in position intervals 100%-90%, 90%-10%, 10%-0% in closing. Time and date of strokes are also saved. The above data are updated at the end of every full valve stroke and the previous ones are lost. Function "set torque reference", in the SET-UP MENU, Maintenance, (Chap I), allows to save the "torque profile" data in the "torque profile reference" with date and time. The "torque profile reference" will not be updated until a new "set torque reference" command is entered. The user can compare the last torque profile relevant to the last valve stroke with the torque profile reference saved before. The following definitions will be used:

- Breakout: maximum torque % in position interval 0-10% in opening or 100%-90% in closing = max. % of torque to unseat the valve.
- Peak Running: maximum torque % in position interval 10-90% in opening or 90%-10% in closing = max. % of torque when the valve runs from Breakout to Ending (maximum midtravel).
- Ending: maximum torque % in position interval 90-100% in opening or 10%-0% in closing = max. % of torque to seat the valve.

The following data may be viewed:

Closing torque	Opening torque
breakout %	breakout %
breakout reference %	breakout reference %
peak run %	peak run %
peak run reference %	peak run reference %
ending %	ending %
ending reference %	ending reference %
date of the last stroke	date of the last stroke
date of reference (same of opening)	date of reference (same of closing)

View procedure:

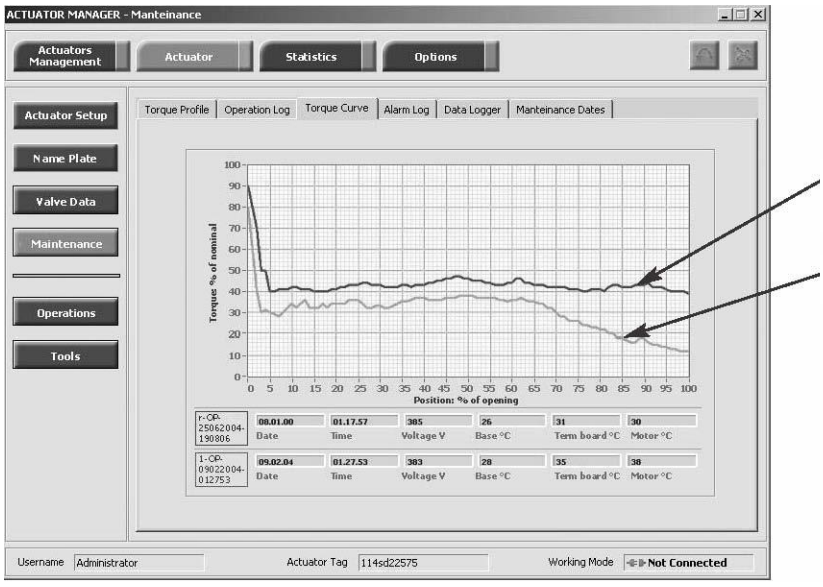
- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering view and set-up mode). Select the language according to the instructions (see "Entering the view mode"). When the message displayed is "VIEW MODE OK?" press YES. Press NO to scroll the list of available menus and press YES to select the Maintenance menu.
- Press NO to scroll the list of routines and press YES to select torque profile.
- Press YES to scroll the list of values

14.4.3 TORQUE CURVE

The torque curve routine gives important information on the actuator working conditions in comparison with a previously memorised reference torque curve. It can be used to perform a detailed analysis of a change in the process conditions. During a full valve stroke in opening or closing, the ICON2000 measures the torque values relevant to every 1% of position variation. At the end of the stroke the collected 101 values (one torque value every 1% of position change) are saved in the ICON2000 memory together with the time and date of strokes, main voltage, motor temperature, temperature inside the electronics compartment and temperature inside the terminal board compartment. Up to 100 curves in opening and 100 curves in closing can be saved. When a new curve is available the oldest one is cancelled and the new one is memorised. The above data are updated at the end of every full valve stroke. Data relevant to a partial stroke are discharged. Function "set curve reference", in the SET-UP MENU, Maintenance, chap I, allows to save the full set of data relevant to 1 off 100 "torque curves" in the "torque curve reference". The "torque curve reference" will not be updated until a new "set curve reference" command is entered. The user can compare the last 100 torque curves in opening and closing relevant to the last 200 valve strokes with the torque curve reference saved before. Below is the list of saved data for each opening or closing curve:

- Date: date of the valve stroke
- Time: time of the valve stroke
- Temperature: temperature (°C) inside the electronics compartment during the valve stroke
- Term. temp: temperature (°C) inside the terminal board compartment during the valve stroke
- Motor temp: temperature of the electrical motor (°C) during the valve stroke
- Main voltage: main voltage supply (V) during the valve stroke
- Closing / Opening time
- Torque 0: torque value in % of the nominal torque / thrust stated in the Name Plate menu. In opening "Torque 0" corresponds to position 0% and in closing "Torque 0" corresponds to position 100%
- Torque 100: torque value in % of the nominal torque / thrust stated in the Name Plate menu. In opening "Torque 100" corresponds to position 100% and in closing "Torque 100" corresponds to position 0%.

The amount of data to be viewed is large and the local display can only visualize one datum at a time. To use this function we suggest to utilize the features available with PDA's and PC through BLUETOOTH™ wireless connection. The figure below shows an example of graph available on PDA or PC screen, showing the reference opening torque curve and the latest opening torque curve.



1.1.1.1 Reference

Latest torque curve

View procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering view and set-up mode). Select the language according to the instructions (see "Entering the view mode"). When the message displayed is "VIEW MODE OK?" press YES. Press NO to scroll the list of available menus and press YES to select maintenance menu.
- Press NO to scroll the list of routines and press YES to select torque curve.

- Press NO to scroll the list of available curves (from 1 to 5 and reference). The curve 1 is the latest and the curve 5 is the oldest. Press YES to select.
- Press YES to select the opening or closing curve. Press NO to exit.
- Press YES to scroll the list values. Press NO to exit

14.4.4 OPERATION LOG

The operation log consists of different counters and routines that provide information to assist in the maintenance program. The data are grouped into 2 families: general and recent data. The general data log collects data from "test date" to "present date". The test date is set in house, can be viewed in the “name plate” menu but cannot be changed.
The recent data log collects data from the last "clear recent data log" date to "present date".
Command “clear recent data log” is available in the SET-UP MENU, maintenance, chap I. This command clears the content of the recent data log and resets the counters to 0. The old data are lost.
The main differences between “general” and “recent” data log are the following:

- The general data log gives information relevant to the full life of the actuator, starting from the manufacturing date.
- In the recent data log the same data are collected starting from a date set by the user. The date may be viewed in the MAINTENANCE DATE paragraph.

Below is the list of data collected by the general and recent data log.

GENERAL DATA LOG	RECENT DATA LOG
opening time	
closing time	
contactor cycles	contactor cycles
motor run time	motor run time
no power time	no power time
utilisation rate	utilisation rate
temperature min.	temperature min.
temperature max	temperature max
term temp min.	term temp min.
term temp max.	term temp max.
motor temp max.	motor temp max.
thermostat alarms	thermostat alarms
torque alarms	torque alarms

- Opening time: this datum is only available in the general data log. It is updated at the end of every full valve stroke of the valve in opening direction. The data of the previous stroke are lost. It gives the time necessary to the valve to move from the close position to the open position, expressed in hours, minutes and seconds.
- Closing time: this datum is only available in the general data log. It is updated at the end of every full valve stroke of the valve in closing direction. The data of the previous stroke are lost. It gives the time necessary to the valve to move from the open position to the close position, expressed in hours, minutes and seconds.
- Contactor cycles: this number counts the cycles of contactors K1 and K2. The value indicated in the general data log is also used to generate the “max. contactor cycles” warning when the maximum allowable number of cycles of the contactor is reached (see section 618/3 chap. N, Diagnostic messages). If the main power is DC or single phase and in modulating actuators, the counters (general and recent) are hold to 0.
- Motor run time: this number counts the hours with motor energized.
- No power time: this number counts the hours without electrical power.
- Utilization rate: this number % is incremented every 200 full strokes of the actuator. It reaches 100% after 20 000 full strokes.
- Temperature min.: this is the lowest temperature value (in °C) measured inside the electronics compartment.
- Temperature max.: this is the highest temperature value (in °C) measured inside the electronics compartment.
- Term. temp. min.: this is the lowest temperature value (in °C) measured inside the terminal board enclosure.
- Term. temp. max.: this is the highest temperature value (in °C) measured inside the terminal board enclosure.
- Motor temp. max.: this is the highest temperature value (in °C) measured in the electrical motor.
- Thermostat alarms: this counts the number of alarms due to the high temperature of the electrical motor and to the tripping of the motor thermostat.
- Torque alarms: this counts the number of alarms due to high torque in opening and closing.

View procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering view and set-up mode). Select the language according to the instructions (see "Entering the view mode"). When the message displayed is "VIEW MODE OK?" press YES. Press NO to scroll the list of available menus and press YES to select the Maintenance menu.
- Press NO to scroll the list of available routines and press YES to select operation log.
- Press YES to select general data or press NO to skip to recent data.
- Press YES to scroll the list of values.
- Press YES to view the recent data log or press NO to exit.
- Press YES to scroll the list of values.

14.4.5 MAINTENANCE DATE

The routine allows to view the following dates:

- last date
- next date
- start-up date
- recent log date

- Last date: this is the date of the last maintenance operation. The date should be updated by the user after all maintenance operations (see SET-UP ROUTINES, maintenance, par. set maintenance date).
- Next date: this is the date of the next scheduled actuator maintenance. When the date is reached, the EFS2000 generates a maintenance request warning. The date should be updated by the user after all maintenance operations (see SET-UP menu, maintenance, chap. I).
- Start-up date: this is the date of actuator start-up. During commissioning, the user should enter the start-up date (see SET-UP menu, maintenance, chap. I).
- Recent log date: This is updated after entering command "Clear recent data log" (see SET-UP menu, maintenance, chap. I). This command clears the "recent data log" counters. The content of "recent log" is updated starting from "recent log date".

View procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering view and set-up mode). Select the language according to the instructions (see "Entering the view mode"). When the message displayed is "VIEW MODE OK?" press YES. Press NO to scroll the list of available menus and press YES to select the Maintenance menu.
- Press NO to scroll the list of available routines and press YES to select the maintenance date routine.
- Press YES to scroll the list of dates.

14.4.6 DATA LOGGER

The "data logger" routine allows to collect different types of data useful in maintenance or in diagnostic programs. Since the amount of collected data is very large, the data logger can only be viewed by means of a PDA or PC. The data can be up-loaded from EFS2000 to PDA or PC by the BLUETOOTH™ wireless connection. The local display only allows to view the value of the configured parameters (see also SET-UP menu, Maintenance, Set data logger, chap I). The following data can be viewed on the local display:

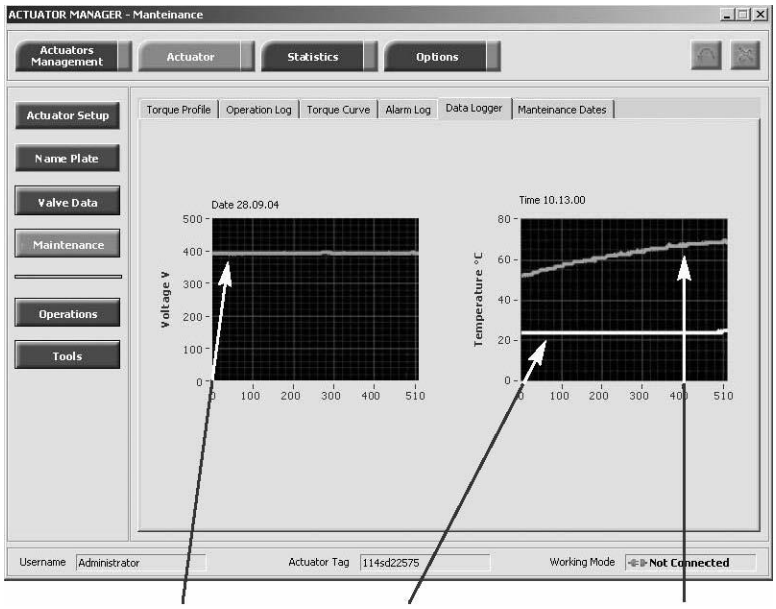
- Logger mode
- Sampling time
- Memory mode
- Date
- Time

Data logger modes:

- OFF: the data logger is not active.
- RECORDER mode: the EFS2000 measures and memorises the following 3 data:
  - main voltage supply (V)
  - motor temperature (°C)
  - temperature inside the compartment of electronics (°C)

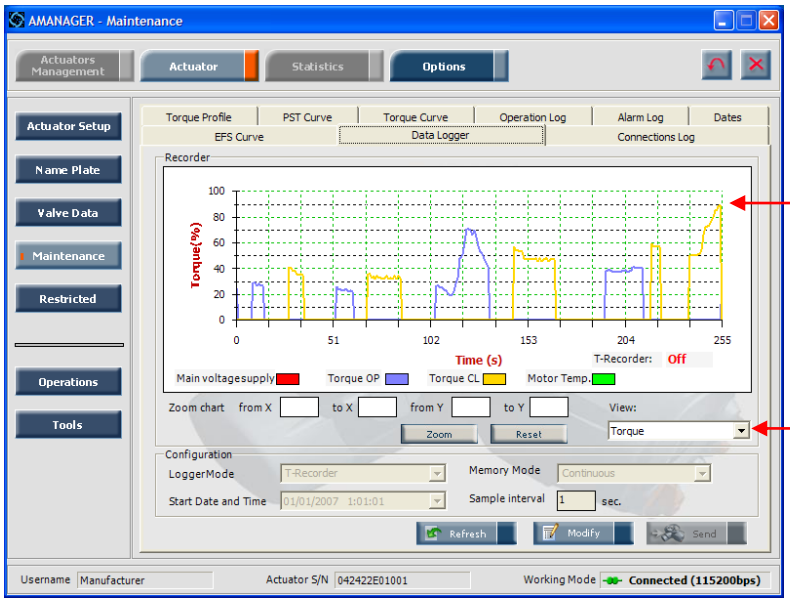
- T-RECORDER mode: the ICON2000 measures and memorises the following 3 data:
  - Torque in OP / CL
  - Motor temperature (°C)
  - Voltage

In RECORDER and T-RECORDER mode the SAMPLING TIME fixes the time interval among two sets of measures. Up to 256 sets of measures (equivalent to 256x4 samples) can be memorised. The sampling time can be configured from 1 to 3600 secs. START DATE and START TIME fix date and time to start recording operation. As the memory is full, the recorder stops recording or overwrites the previous data according to the selected MEMORY MODE ("stop when full" or "continuous"). If "continuous" was selected, as a new set of measures is achieved the oldest one is cancelled and the new one becomes the latest. Up to 10000 cycles of full memory overwriting are done, then the recorder stops.
In T-RECORDER mode, recording operation is stopped also in case of OVER-TORQUE ALARM, in opening or in closing. This additional feature allows to maintain in the memory the last 256 samples and to see the trend of torque, motor temperature and main voltage before the alarm . A new restart of T-RECORDER clear the data stored in the memory.
By a PDA or PC the recorded data can be viewed by a graph where time is on the X axis and the measured data on the Y axis.
The figure below shows a graph with sampling time 2 secs in RECORDER mode.



Main supply voltage Temperature of electronics Motor temperature

The figure below shows a graph with sampling time 1 sec in T-RECORDER mode after a recording stop due to OVER-TORQUE alarm.
Torque limit in CL is set to 90%, torque limit in OP is set to 100%. Blue graph shows Torque OP versus time, yellow graph shows Torque CL versus time. The data remain in the EFS 2000 v4 permanent memory until a new start of data logger is set.

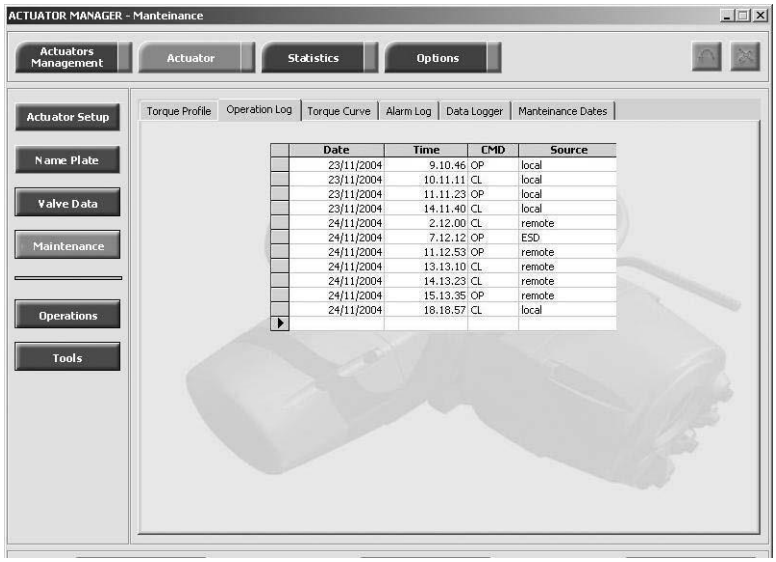


Torque limit in OP reached

Curve selector:
-torque
-motor temperature
-main voltage

- EVENT mode

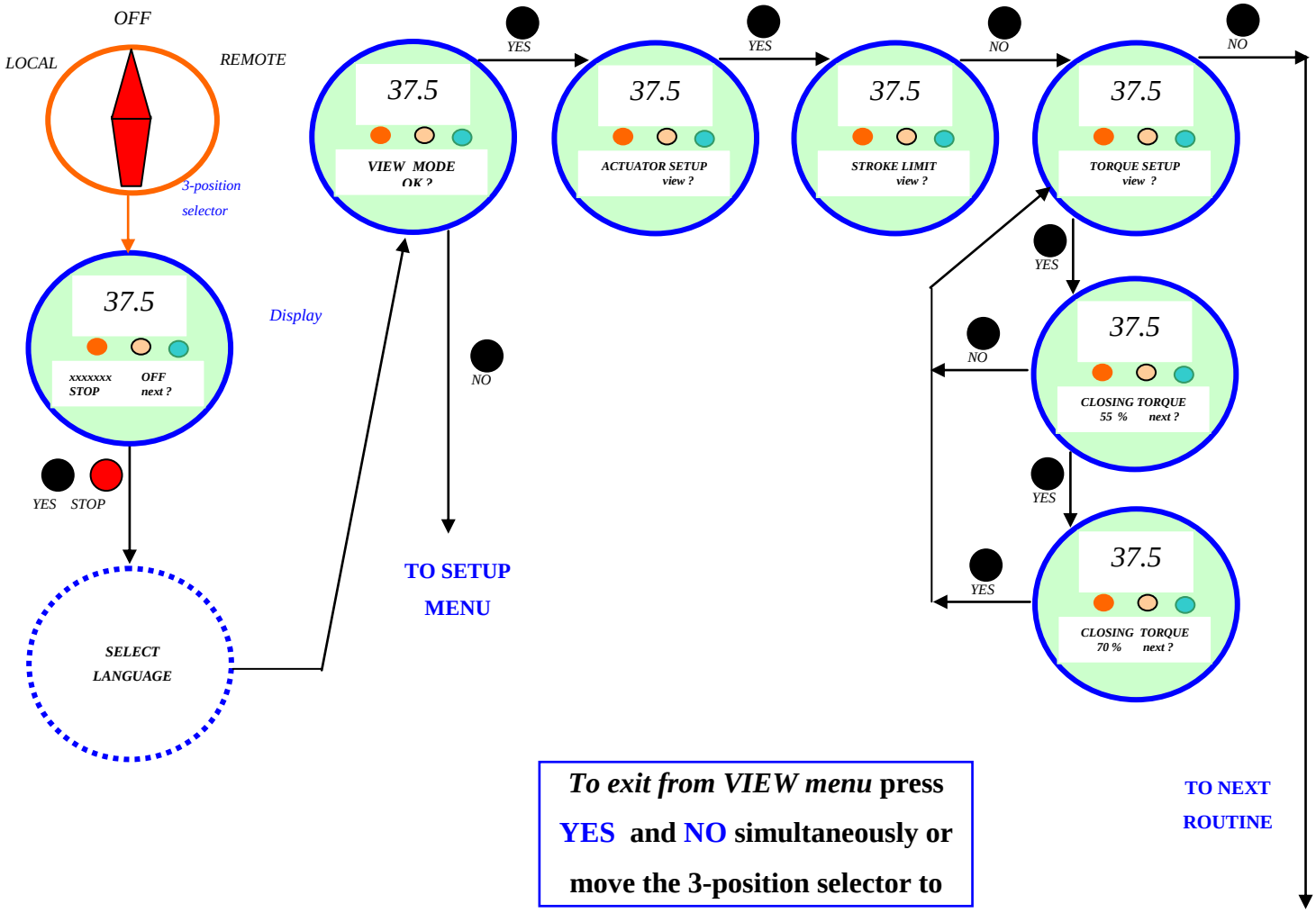
The ICON2000 detects the type of received command (OPEN or CLOSE), the source of the command (local controls, remote controls, bus, etc.) and date and time of command. Up to 128 EVENTS can be memorised. As the memory is full, the logger stops to memorise events or overwrites the previous data according to the selected MEMORY MODE ("stop when full" or "continuous"). If "continuous" was selected, as a new event is achieved the oldest one is cancelled and the new one becomes the latest. Up to 5000 cycles of full memory overwriting are done, then the logger stops. The START DATE and START TIME fix date and time to start recording operation. By a PDA or PC the collected data can be viewed by a graph or event table. Parameter "sampling time" is not used. The figure below shows an example of report in EVENT mode.



View procedure:

- Move the local selector to OFF and then simultaneously press OPEN and STOP within 20 sec (see chap. LOCAL CONTROLS, Entering view and set-up mode). Select the language according to the instructions (see "Entering the view mode"). When the message displayed is "VIEW MODE OK?" press YES. Press NO to scroll the list of available menus and press YES to select maintenance menu.
- Press NO to scroll the list of routines and press YES to select data logger.
- Press YES to view the MODE, the SAMPLING time, the MEMORY mode, the start DATE and the start TIME.
- Press YES to return data logger . Press NO to exit.

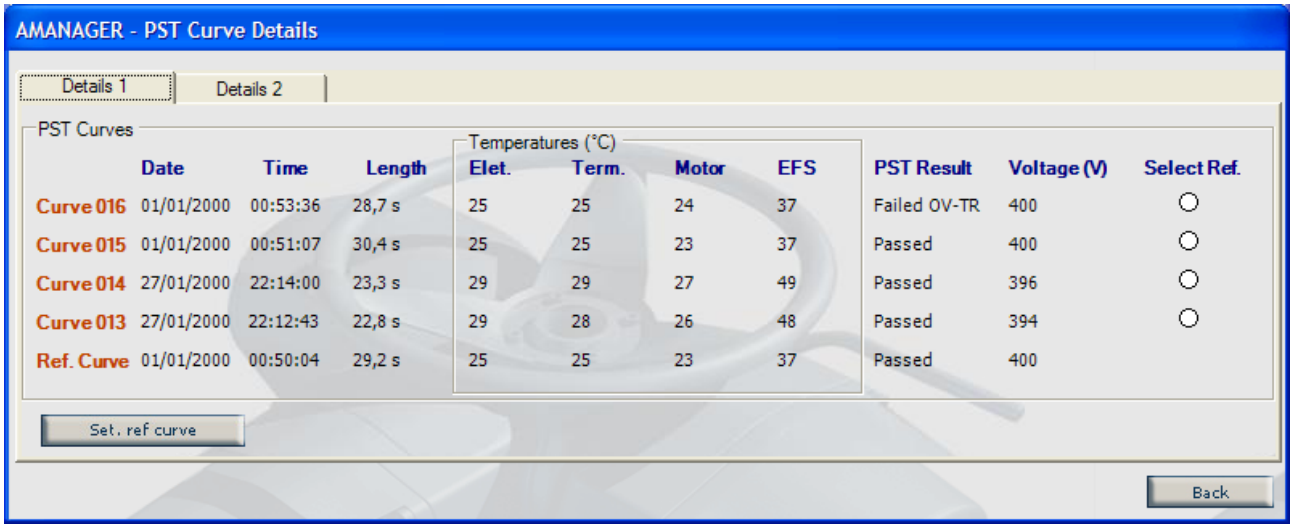
14.4.7 Example of view routine: TORQUE SETUP



To exit from VIEW menu **press YES and NO simultaneously or move the 3-position selector to**

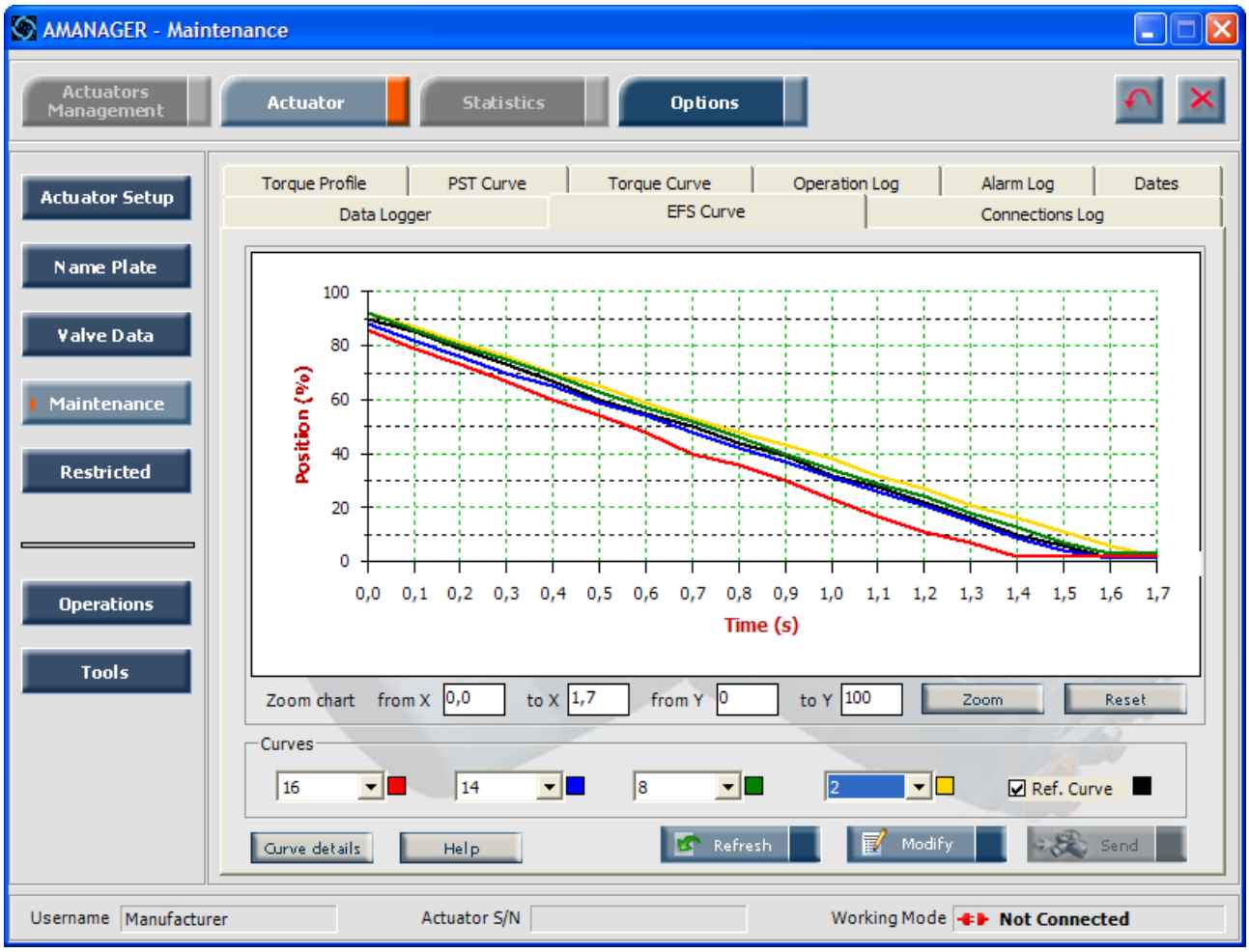
14.4.8 PST GRAPH

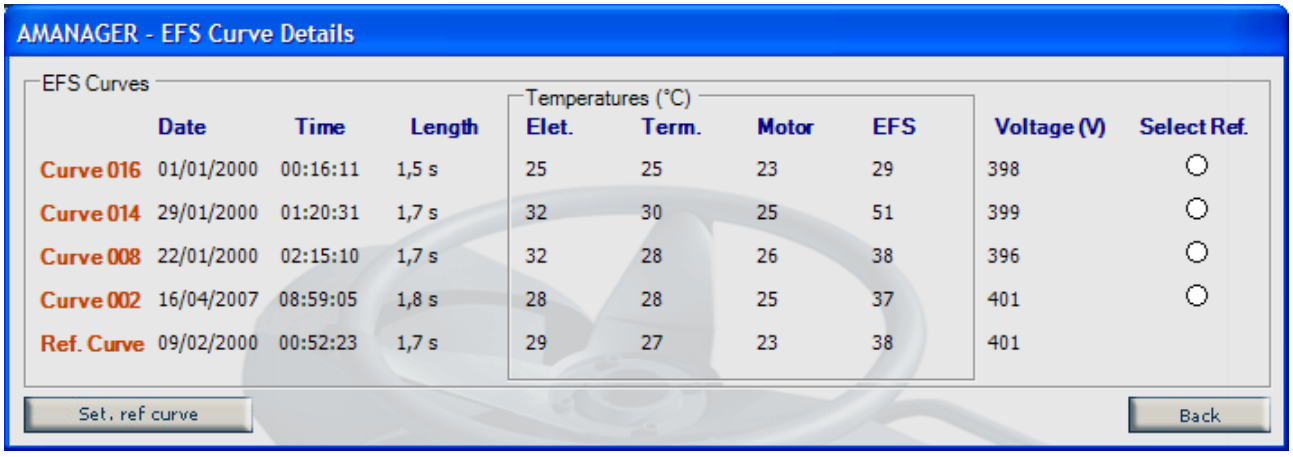
The PST curves cannot be viewed on the local operator interface of the EFS 2000. They can only be viewed by a PC or PDA connected Bluetooth interface and equipped with the A-manager SW tool.
The following figure shows the data available.



14.4.9 Shut-Down GRAPH

The ESF curves cannot be viewed on the local operator interface of the EFS 2000. They can only be viewed by a PC or PDA connected Bluetooth interface and equipped with the A-manager SW tool.
The following figure shows the data available.

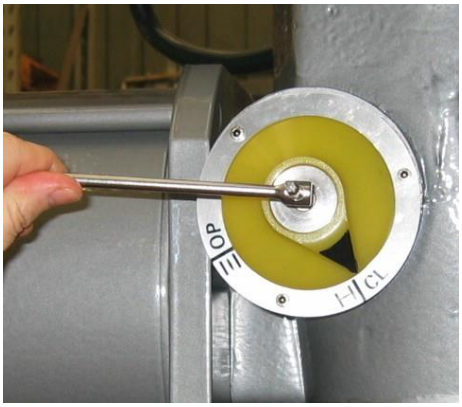




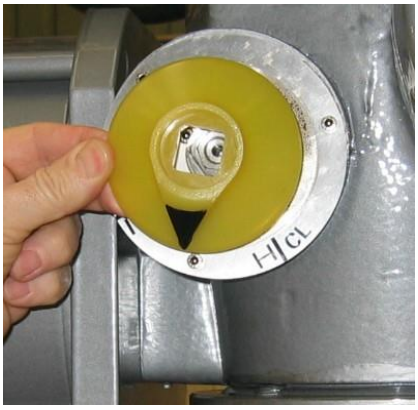
15 LOCAL INDICATOR SETTING

Move the EFS2000v4 to the fully closed position

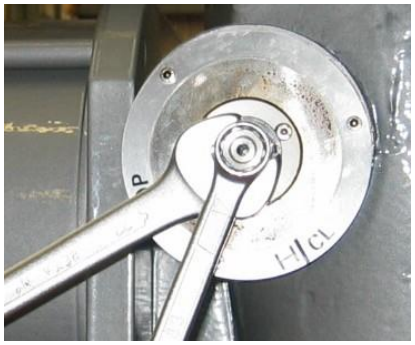
1) Remove the black plug



2) Unscrew the central screw

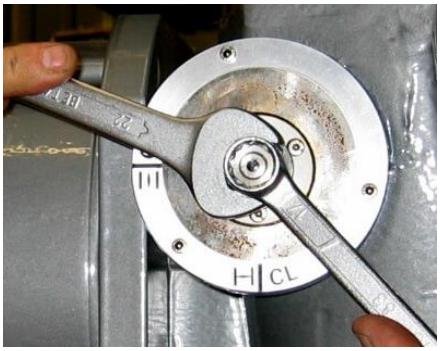


3) Remove the indicator

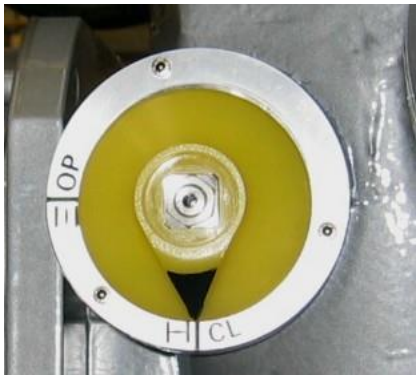


4) Unloose the counter nut

5) Rotate the indicator nut clockwise until it blocks at the end of threads; rotate a few degree counter clockwise until the flat surface is perfectly aligned with the CLOSE indication of the label.

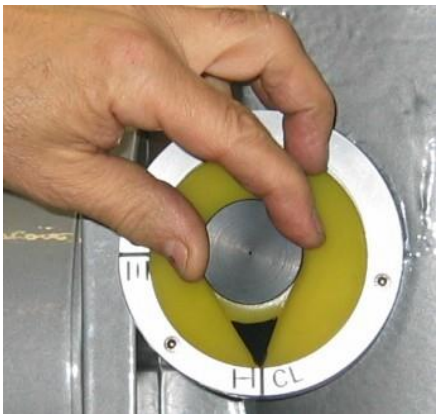


6) Fix the counter nut



7) Replace the indicator, with the arrow in correspondence to the CLOSE indication on the label

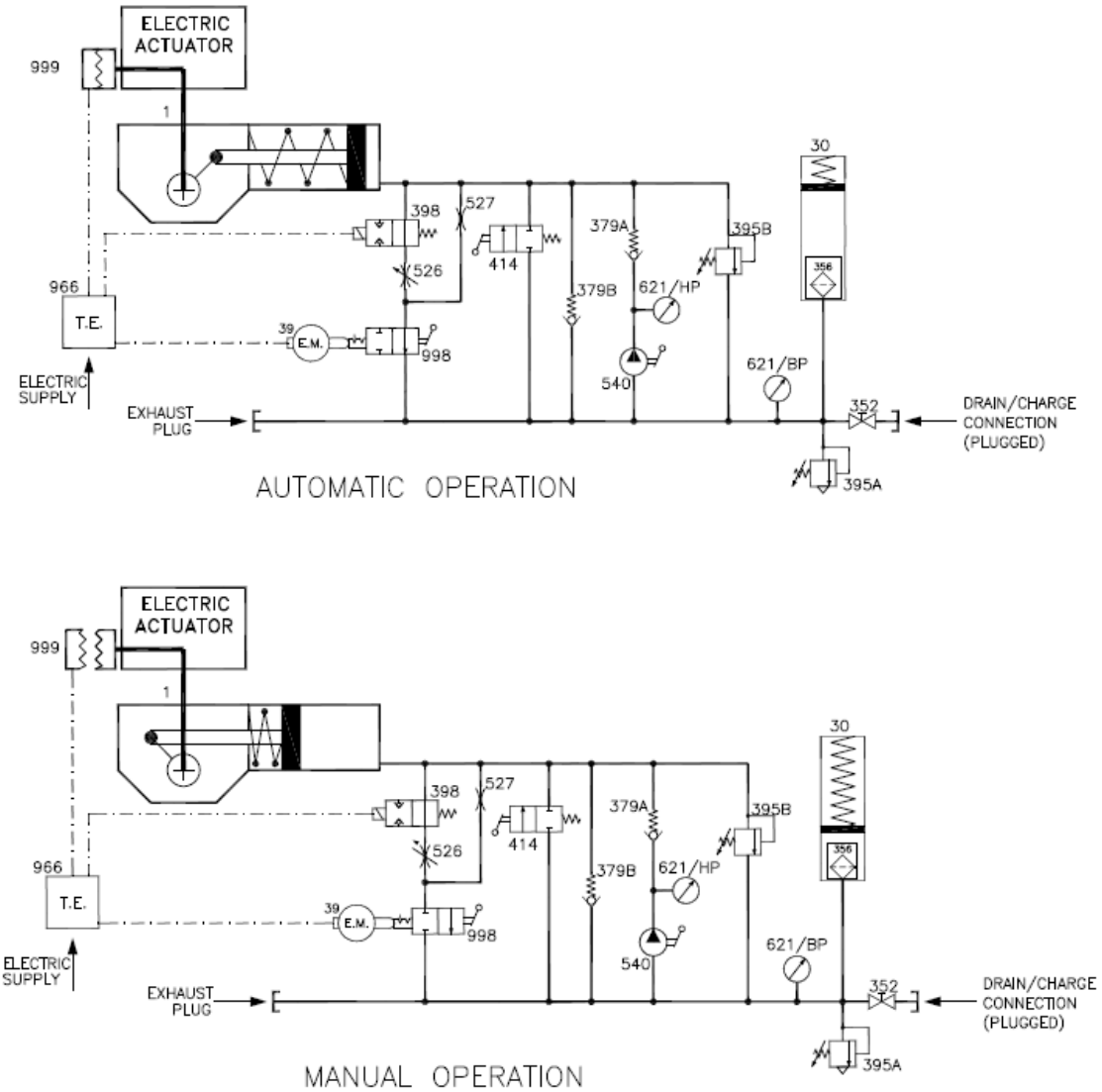
8) Fix the central screw



9) Replace the plug

16 MANUAL OPERATION and FAIL-SAFE SPEED SETTING

16.1 Hydraulic Control Group Diagram (standard version)



EMERGENCY CLOSING OPERATION
IN CASE OF ELECTRIC SUPPLY FAILURE THE ELECTROMAGNETICAL LATCH OPENS AND THE ACTUATOR MOVES THE VALVE IN CLOSING POSITION BY SPRING.

FAIL SAFE TIME REGULATION
THE CLOSING TIME IS ADJUSTABLE BY THE FLOW REGULATOR 526.

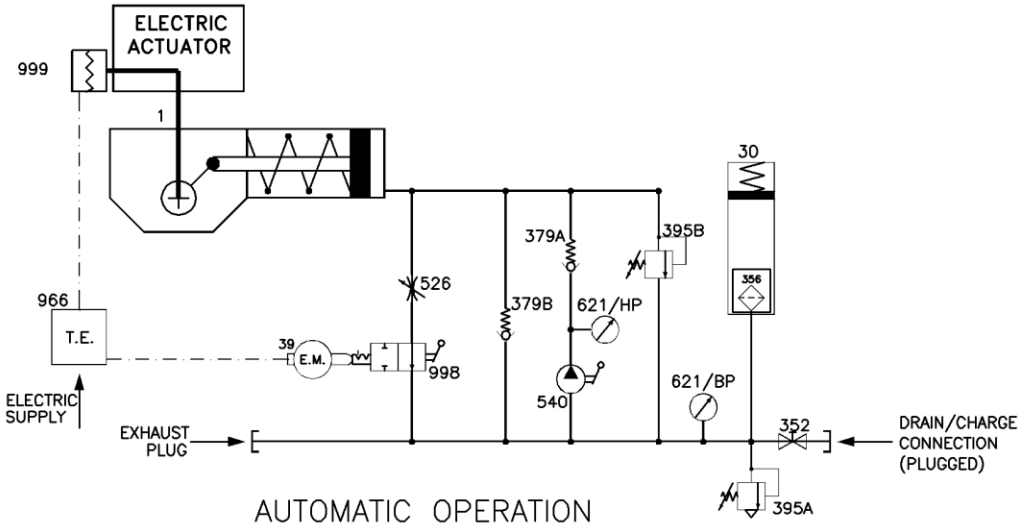
LOCAL MANUAL OPERATION TO OPEN
IN CASE OF LOSS OF ELECTRIC SUPPLY, SWITCH THE VALVE 998 IN MANUAL MODE AND ACTUATE THE HAND PUMP 540 TO OPEN THE ACTUATOR.

LOCAL MANUAL OPERATION TO CLOSE
WITH VALVE 998 IN "MANUAL" POSITION, PRESS THE LEVER OF HYDRAULIC PUSHBUTTON 414, THE ACTUATOR MOVES IN CLOSING BY SPRING.

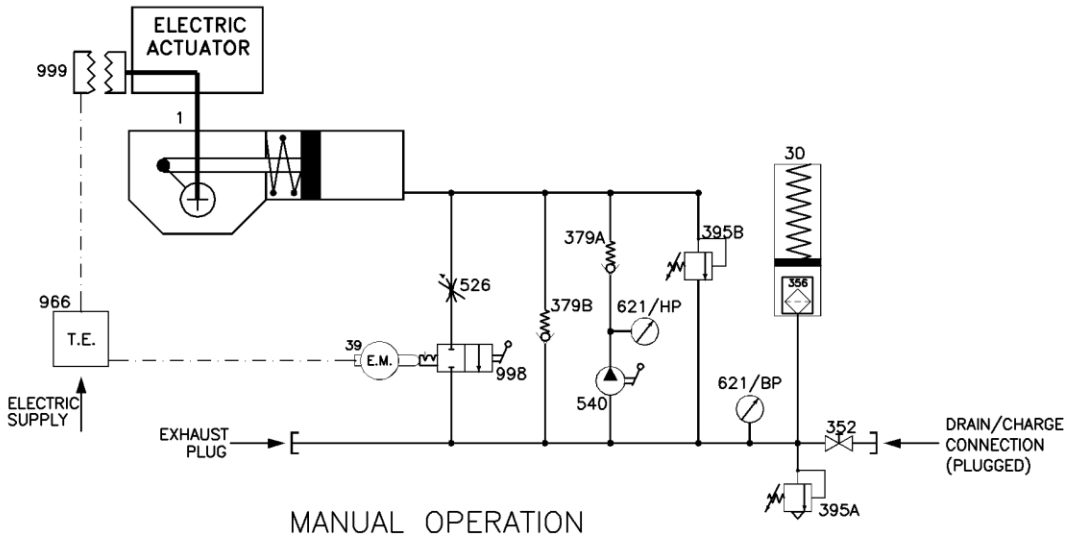
1	SINGLE ACTING SPRING RETURN HYDRAULIC ACTUATOR
30	HYDRAULIC ACCUMULATOR (PISTON TYPE / SPRING RETURN)
39	SELECTOR POSITION MICROSWITCH
352	NEEDLE VALVE
356	HYDRAULIC FILTER
379	CHECK VALVE
395	SAFETY RELIEF VALVE
398	N.O. POPPET TYPE SOLENOID VALVE (OPTIONAL)
414	2/2 N.C. HAND OPERATED–SPRING RETURN VALVE
526	BIDIRECTIONAL FLOW REGULATOR (ADJUSTABLE SETTING)
527	BIDIRECTIONAL FLOW REGULATOR
540	HANDPUMP
621	PRESSURE GAUGE
966	TERMINALS ENCLOSURE
998	2/2 N.C. HAND SELECTOR (AUTO/MANUAL)
999	ELECTROMAGNETICAL LATCH

NOTES:
1) THE DIAGRAM IS SHOWN FOR SPRING TO CLOSE ACTUATOR

16.2 Hydraulic Control Group Diagram for EFS long fail safe version:



AUTOMATIC OPERATION



MANUAL OPERATION

EMERGENCY CLOSING OPERATION
IN CASE OF ELECTRIC SUPPLY FAILURE THE ELECTROMAGNETICAL LATCH OPENS AND THE ACTUATOR MOVES THE VALVE IN CLOSING POSITION BY SPRING.

FAIL SAFE TIME REGULATION
THE CLOSING TIME IS ADJUSTABLE BY THE FLOW REGULATOR 526.

ELECTRIC CLOSING OPERATION
THE ELECTRIC CLOSING OPERATION IS INHIBITED.

LOCAL MANUAL OPERATION TO OPEN
IN CASE OF LOSS OF ELECTRIC SUPPLY, SWITCH THE VALVE 998 IN MANUAL MODE AND ACTUATE THE HAND PUMP 540 TO OPEN THE ACTUATOR.

LOCAL MANUAL OPERATION TO CLOSE
WITH VALVE 998 IN "MANUAL" POSITION, SWITCH THE VALVE 998 IN AUTOMATIC MODE, THE ACTUATOR MOVES IN CLOSING BY SPRING. THE CLOSING TIME IS EQUAL TO THE FAIL SAFE TIME.

NOTES:
1) THE DIAGRAM IS SHOWN FOR SPRING TO CLOSE ACTUATOR

1	SINGLE ACTING SPRING RETURN HYDRAULIC ACTUATOR
30	HYDRAULIC ACCUMULATOR (PISTON TYPE / SPRING RETURN)
39	SELECTOR POSITION MICROSWITCH
352	NEEDLE VALVE
356	HYDRAULIC FILTER
379	CHECK VALVE
395	SAFETY RELIEF VALVE
526	BIDIRECTIONAL FLOW REGULATOR (ADJUSTABLE SETTING)
540	HANDPUMP
621	PRESSURE GAUGE
966	TERMINALS ENCLOSURE
998	2/2 N.C. HAND SELECTOR (AUTO/MANUAL)
999	ELECTROMAGNETICAL LATCH

16.3 Control Group Functions

EFS2000v4 is equipped with an Hydraulic Control Group with two base functions:

- adjustment of fail safe time;
- manual override to operate the actuator when electrical power is not available.

16.3.1 Adjustment of fail safe time

For EFS standard version

The adjustable flow control valve (526) allows to adjust the fail safe speed. This valve is located under the aluminium cover positioned on the upper side of the hydraulic manifold.

Remove the cover by unscrewing the 2 screws in order to regulate the flow control valve: by turning clockwise the ring nut of the valve, the fail-safe speed decreases.

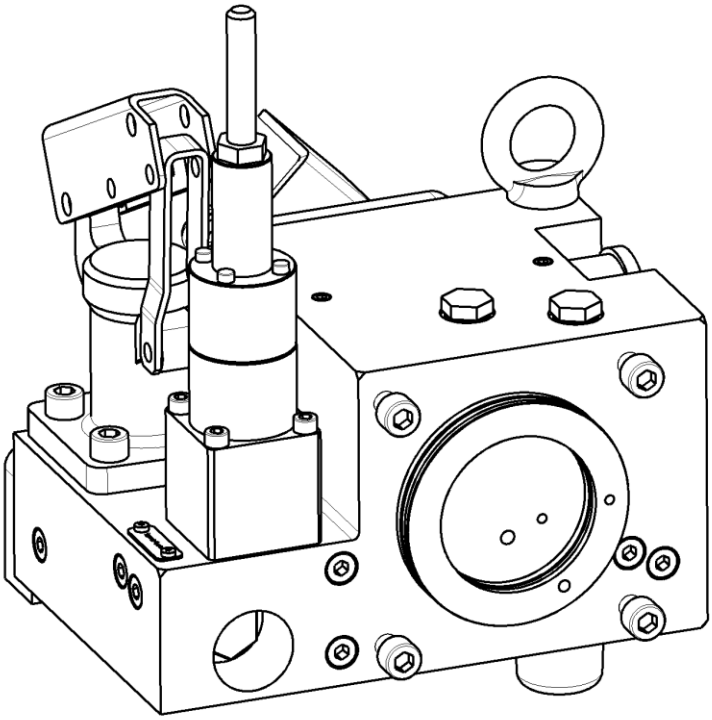
	
Remove the cover	Adjust the fail safe speed

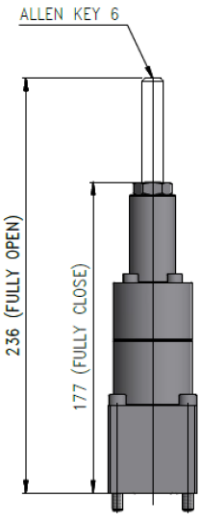
Important:	**<u>The fail safe time must be set not longer than the electric time for the full stroke.</u>** **Longer fail safe time could cause the torque alarm intervention on the electronic control of the electric actuator.**

For EFS long fail safe version:

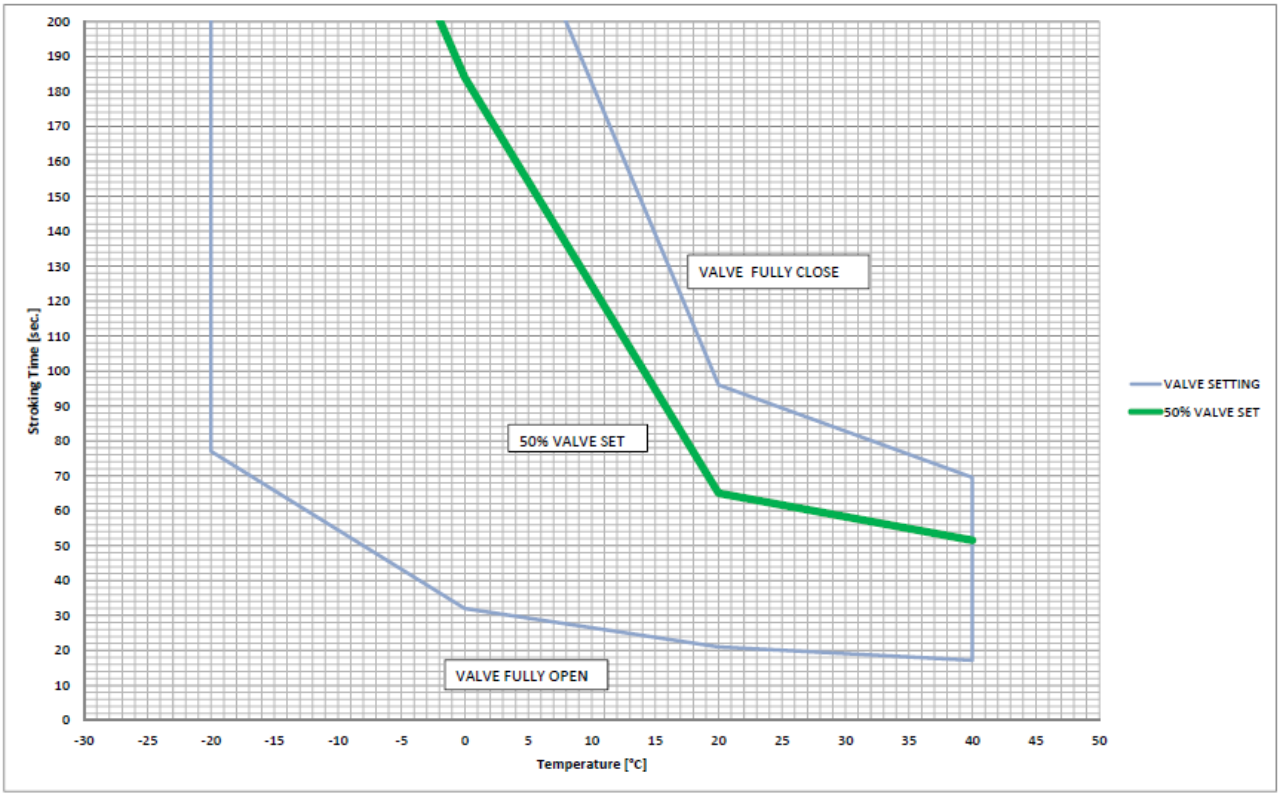
The adjustable flow control valve (526) allows to adjust the fail safe speed. This valve is located on the upper side of the hydraulic manifold near the hand pump.

To regulate the flow control valve manoeuvre the adjusting screw through an Allen key 6: by turning clockwise the screw of the valve, the fail-safe speed decreases (fail safe longer time with valve in fully closed position)



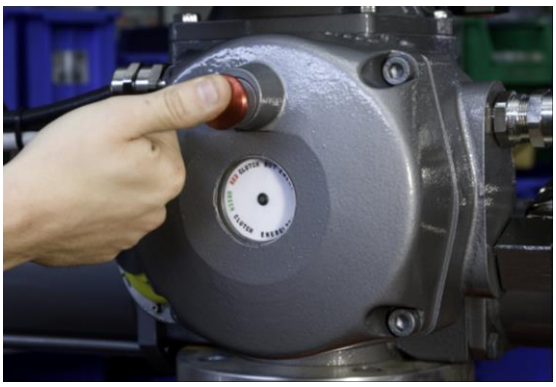


Important:	**<u>The fail safe time depends on the ambient temperature.</u>** **<u>In order to have the same fail safe time range at different ambient temperatures the flow control valve must be set.</u>** **Below is a diagram that shows the fail safe times considering the ambient temperature range from -20°C to +40°C and different valve settings (only for reference).**

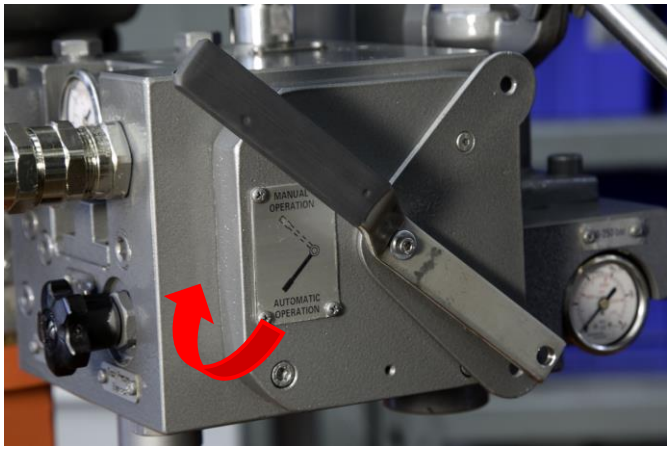

Stroking Time [sec.]
Temperature [°C]
VALVE FULLY CLOSE
50% VALVE SET
VALVE FULLY OPEN
VALVE SETTING
50% VALVE SET

16.3.2 Manual Override to operate the EFS2000 v4 when electrical power is not available

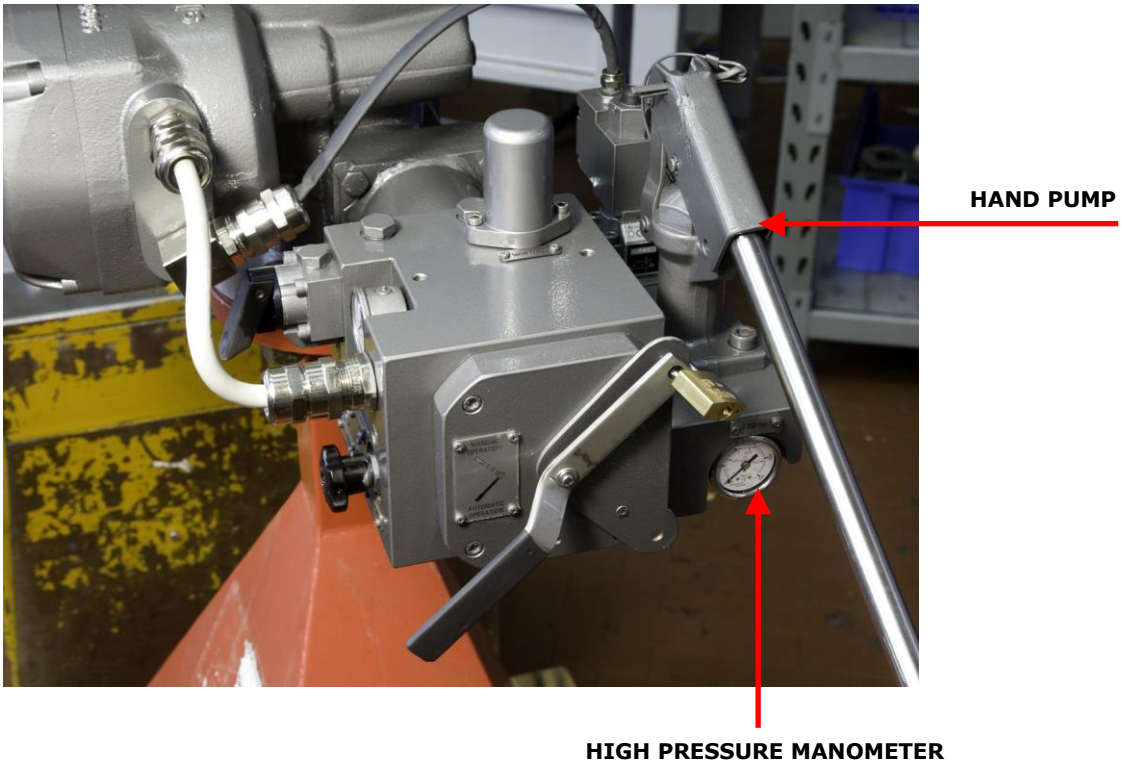
When electric power is not available, the **EFS2000v4** can be locally operated through an hydraulic hand pump (540). Before to perform the local manual operation by hand-pump, it is necessary to guarantee that the electromagnetic clutch is not energized: press the OFF pushbutton (Red mushroom) on the local control panel to be sure that the clutch is really open.



To select the MANUAL operation mode of the actuator, rotate the two-position (AUTO/MANUAL) hydraulic local selector (998).



To perform the manual operation, use the hand pump, operating it by means of the lever attached to the actuator. The pressure in the hydraulic circuit is shown in the high pressure (0-250 bar) manometer (621/HP).



Warning:	**For the safety of the personnel it is essential that at the end of operation with hand pump, the lever is removed from the hand pump yoke and yoke is fixed using the existing split pin.**

At the end of manual operation, if the actuator is required to remain in the position opposite to the spring, it is necessary to leave the hydraulic selector in MANUAL position.

To restore the electric mode function, the hydraulic selector has to be moved to AUTO position and, as soon the electrical power is available, the red mushroom push-button has to be pressed to RESET the actuator.

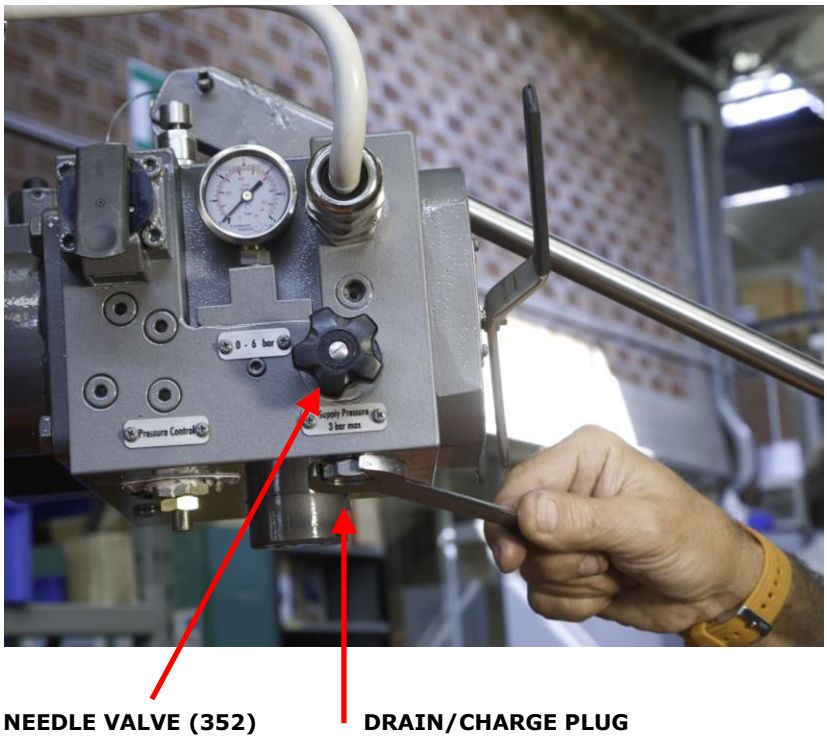
16.3.3 Accumulator Recharge

The actuator is supplied with the accumulator (30) charged at a 3 bar pressure, whit the main spring in its released position. (Fail-Safe condition).

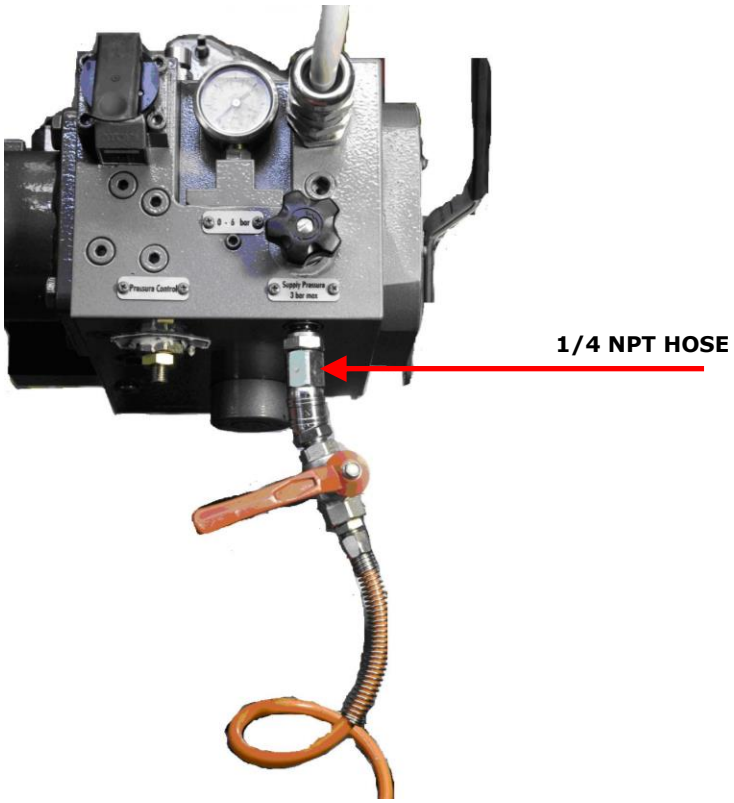
If it is necessary to recharge the accumulator during or after the field installation, or after a maintenance intervention, the following instructions have to be performed:

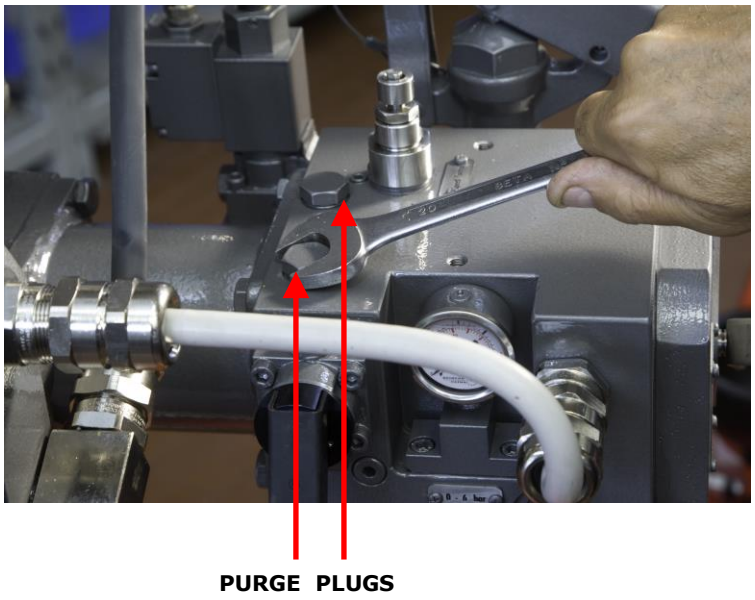
- check if the actuator is really in fail-safe condition, with the main spring released; press the RED mushroom push button to ensure that the actuator is in the correct position;
- check that the needle valve (352) is completely closed;
- remove the drain/charge plug (P) by unscrewing it;
- connect a 1/4" NPT hose to the drain/charge hole;
- open the needle valve (352);
- fill the oil until the low pressure manometer (621/BP) reaches a 3 bar pressure;
- during the filling of oil, it is possible the formation of air inside the accumulator: this air has to be leaked using the two leaking plugs on the upper part of the manifold;
- close the needle valve (352);
- remove the ¼" NPT hose and close the drain/charge hole with the drain/charge plug (P).

Type of oil to be used: **AEROSHELL FLUID 41** (SHELL) or equivalent.



NEEDLE VALVE (352) **DRAIN/CHARGE PLUG**





17 MAINTENANCE and TROUBLE-SHOOTING

Warning: 	**The EFS2000v4 contains parts whit springs, which may be compressed. Before any works for disassembling any precaution must be taken in order to be sure that the main power spring is fully released and the spring accumulator is fully discharged.**

Warning: 	**The actuator is non-intrusive. The control compartments were sealed in dry and clean conditions and contain no site serviceable components. Do not open it unless absolutely necessary. Unauthorised access will invalidate the warranty.**

Warning: 	**Since the actuator control compartment contains a 3.6V lithium battery, only open it in safe area. If the actuator is located in a hazardous area a "hot work" permit must be obtained unless the actuator can be moved to a non-hazardous area.**

Important: 	**To ensure the safety of maintenance staff, before carrying out any maintenance operation, it is essential to move the actuator to fail-safe position and disconnect both actuator electrical power , ESD line and any other service voltage connected to terminal board.**

17.1 Routine Maintenance

Important: 	**To ensure the guaranteed SIL level, according to IEC 61508, the functionality of EFS 2000v4 must be checked with a maximum interval of one year.**

It is, however, mandatory to check the actuator, within the specified period, as follows:

- **Check that the actuator operates the valve correctly and with the required operating times: it is mandatory that this check must be done performing the ESD operation with spring; electrical operation it is also recommendable.**
- Check that the signals to the remote control desk are correct.
- Check that the external components of the actuator are in good conditions.
- Check all the paint-coat of the actuator. If some areas are damaged, repair the paint-coat according to the applicable specification.
- Check all the paint-coat of the actuator. If some areas are damaged, repair the paint-coat according to the applicable specification.

17.2 Special Maintenance

In case malfunction in the mechanical / electronic components, in case of oil leaks through the seals or in case of scheduled preventive maintenance, the actuator must be disassembled: any damaged parts can be requested to BIFFI with reference to attached exploded view drawing and part list.
It is essential that for every component to be required to BIFFI the Serial Number of the actuator together with the item number of component are indicated in the request.

Important: 	**After maintenance works a few actuator operations must be done to check that movement is regular and that there is no oil leakage through the seals**

17.3 Repairs

When needed, repair must only be carried out with Manufacturer's original spare parts.

Warning: 	**The values of gaps of explosion-proof joints are lower than the maximum specified on Tables 1 and 2 of IEC/EN 60079-1 Standard. In case the maintenance should required the replacement of any component which forms part of an explosion-proof joint, only an original spare provided by BIFFI MUST be used. Direct repair or reconstruction of the above components are not permitted without the BIFFI permission. Not performing this procedure will invalidate the product safety and contractual guarantee.**

Original spare parts must be required to the Manufacturer: to ensure that right spare is provided, **serial number** printed on the EFS 2000v4 unit enclosure label must be specified when spare are ordered.

17.4 Lithium battery change

Isolate the main supply to the actuator and all other control voltages.

Warning:	**If the actuator is located in a hazardous area a "hot work" permit must be obtained unless the actuator can be moved to a non-hazardous area.**

- Open the terminal boards cover.

- Disconnect two wires (+) (-) from the main board.
- Bring the cover to a safe area. When in a safe area:

- • Remove the label.

- • Remove the battery cover.

- • Replace the battery.

Important:	**The new battery must be the same as the one provided:** **• Lithium - SAFT LS 9V**

17.5 Trouble-shooting

If the actuator does not work before trouble-shooting make sure that:

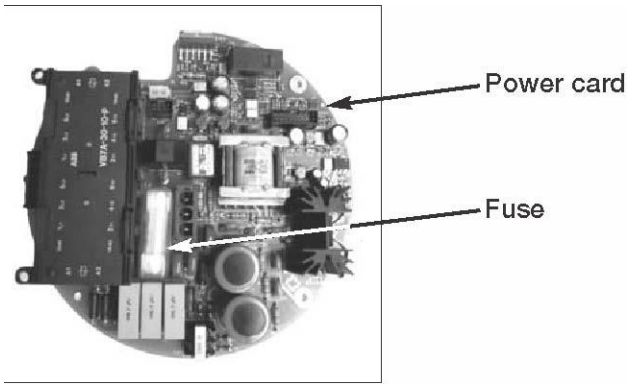
- the numeric display indicates xx.x %
- the LED of EFS card in the clutch compartment is green
- the manual override selector is in AUTO
- the local selector is not in OFF
- the main supply voltage is the same as stated in the name plate menu
- the supply of the EFS clutch is in the range 24 Vdc -240 Vac
- move the local selector to OFF and check that the upper line of the alphanumeric display shows one of the following messages:
  - "normal off"
  - "alarm off"
  - "warning off"
  - "INT EFS off"
  - "INT off"

If the above checks are satisfactory try to locate the fault using the diagnostic facilities.

17.5.1 The LED of EFS card is always OFF

Check the voltage supply of the EFS clutch . It should be in the range 24 Vdc -240 Vac.

17.5.2 The electronics of electric actuator do not switch on when powered



- Check that the value of the main voltage on terminals L1, L2, L3 is correct
- Remove the cover of the compartment where the electronic cards are located
- Check the fuse mounted on the power card. Replace it if burnt.
- If the fuse is OK, check the wires between terminals L1, L2, L3 and connector M1 of the power card. If it is correct, replace the power card.

17.5.3 DC output voltage not available at the terminals

- Switch the main power supply off and disconnect all wires from terminals B1-B2 and C1
- Switch the main power supply on and check if the voltage on the terminals B1-B2 and C1 is between 23 and 27 Vdc
- If the voltage is correct check the external wiring and the electrical load. It should not exceed 4W.
- If the voltage is not correct replace the power card

17.5.4 The actuator does not work from remote controls

- Check that manual override selector is in AUTO and the LED in the clutch compartment is green.

- If the alphanumeric display indicates “INT”, an interlock control is present. Move the 3-position selector to LOCAL and check that the actuator works from local controls.
- Move the local selector to REMOTE. Check the signal on terminals B3, B4 and B5.
- Check that:

- the wiring to terminals B1-B2 and C1 is correct
- there is no short-circuit between wires
- the electrical load does not exceed 4W
- the value is in the range 20-120 Vac 50/60Hz or 20-125 Vdc, if external voltage supply is used

17.5.5 The motor is very hot and does not start

- Check that no alarm other than motor overheating is present.
- Wait until the motor cools down and the normally closed contact of the thermal switch automatically resets before trying to operate the actuator again.
- Check that the number of operations per hour and their duration is suitable for the actuator service (see the name-plate menu).
- Check that the valve operating torque is within the range of the unit’s designed operating torque.
- Always check the causes of abnormal operation.

17.5.6 The valve does not seat correctly

- If the valve is stopped by the torque limit in closing, increase the actuator output torque limit.
- If the valve is stopped by the position limit in closing, check that the valve reaches its seat position, then readjust the setting of the position limit.
- The internal trim of the valve may be damaged.

17.5.7 Excessive torque for valve operation

- Clean, lubricate and check the valve stem.
- Valve packing too tight: loosen the gland bolt nuts.
- Coupling type “A”: tight fit between bush and stem: increase the thread clearance on the drive coupling.

- Coupling types “B1”, “B2”, “B3” and “B4”: ensure there are no axial forces on the valve stem by leaving an adequate axial clearance between the stem and the drive bush. Also check that all transmission shafts, universal joints or bulkhead passages have sufficient lubrication and check that the transmission shafts are not bent.
- Check that the internal valve trim or the reducer gears are well lubricated and not damaged.
- Check the alphanumeric display for diagnostic messages, and proceed with the suitable corrective actions as described in this Chapter, par. 11.

17.5.8 The actuator does not stop in fully open or fully closed position

- Check that the actual open and close positions of the valve respectively correspond to 100% and 0% on the actuator display
- Make sure that the torque and travel limits are correctly set (see SETUP ROUTINES, actuator setup, set stroke limits).

17.5.9 The numeric position display indicates "E01"

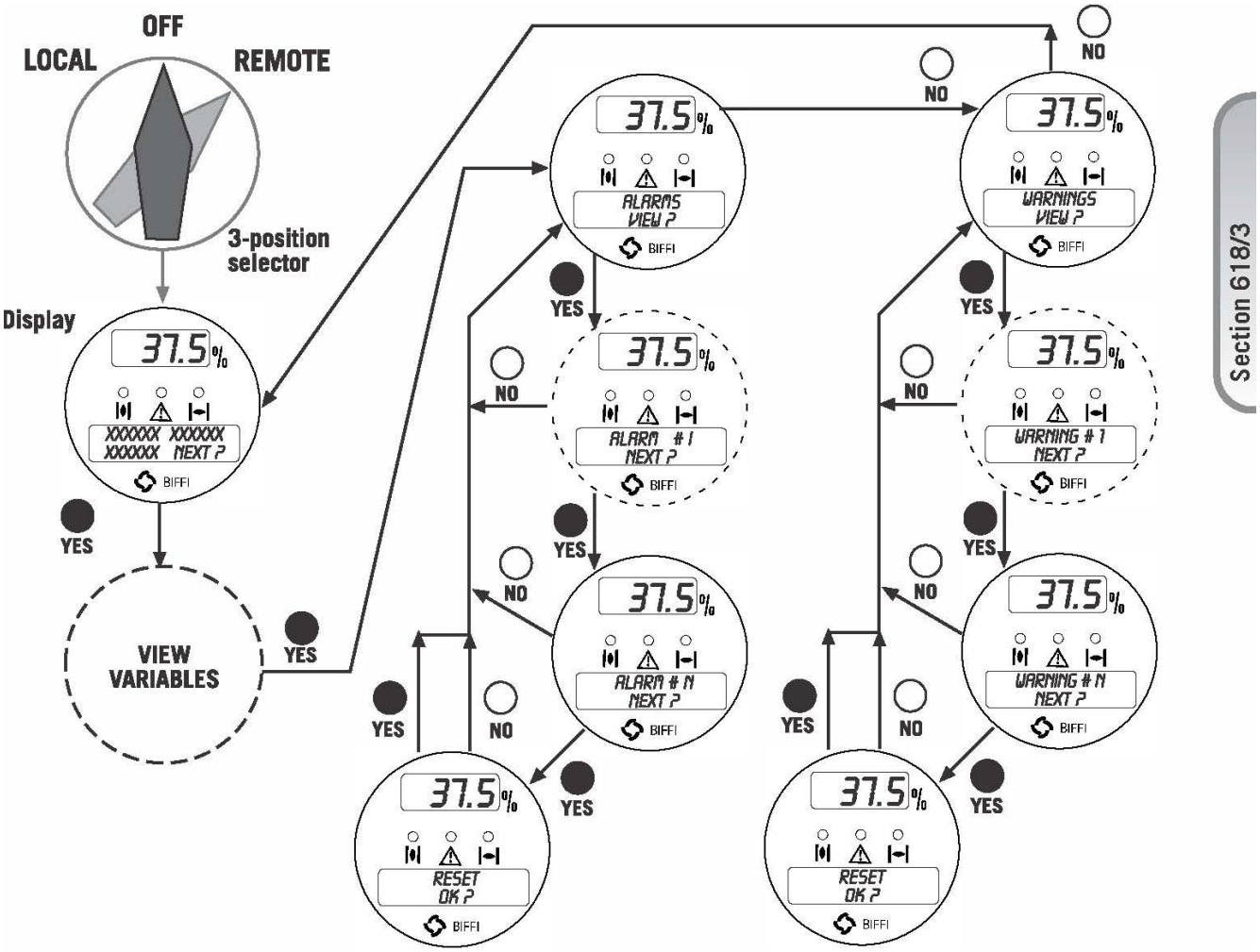
- It is necessary to re-calibrate the stroke limits (see SETUP ROUTINES, actuator setup, set stroke limits).

17.5.10 Diagnostic messages

The alarm and warning lists contain the alarms and warnings momentarily present. Warning is the condition that occurs when a variable reaches a critical value and/or when a maintenance action is required but all actuator functions are still available. The flashing of the alarm/warning LED indicates a warning condition. Alarm is the condition that occurs when a variable is outside the acceptable range and some actuator function is not available. If the alarm/warning LED is on there is an alarm condition. When the fault condition disappears, the corresponding alarm or warning also disappears from the list. A reset routine is provided to clear the types of alarms and warnings that are memorised (over-torque, jammed valve, etc.).

View procedure:

- Move the 3-position selector to either OFF or REMOTE, then press NO to scroll the list of available variables.
- Press YES when the display shows message “ALARMS view?" Press YES to scroll the list of alarms.
- Press NO when the display shows message “ALARMS view?"
- Press YES when the display shows message “WARNINGS view?" Press YES to scroll the list of warnings.
- Press YES to reset the alarms or warnings with memory.



17.5.11 ALARM TABLE

			Avaialable Controls		
DISPLAY MESSAGE	**CONDITION FOR ALARM**	**ACTION**	**Local**	**Remote**	**ALARM RESET**
HIGH TORQUE IN CLOSING	Measured torque greater than the relevant value configured in torque set-up or stroke limits routine	Operate the actuator in opening direction. Check the torque needed to operate the valve.	only open	only open	OPEN CONTROL
HIGH TORQUE IN OPENING	Measured torque greater than the relevant value configured in torque set-up or stroke limits routine	Operate the actuator in closing direction. Check the torque needed to operate the valve.	only close	only close	CLOSE CONTROL
JAMMED VALVE IN CLOSING	No position change after receiving a CLOSE control	Check status of actuator and valve mechanical parts	only open	only open	OPEN CONTROL
JAMMED VALVE IN OPENING	No position change after receiving an OPEN control	Check status of actuator and valve mechanical parts	only close	only close	CLOSE CONTROL
MOTOR THERMOSTAT	Motor thermostat open for high temperature in the motor windings	Wait until the motor cools down	not available	not available	WHEN THERMOSTAT CLOSES
INTERNAL-TEMPERATURE	Temperature inside the actuator enclosure higher than 90°C or lower than -40°C	Ambient temperature too high or too low. Verify insulation among actuator and heat source	not available	not available	CONTROL TEMPERATURE <90°C or >-40°C
POSITION SENSOR	Value of the actuator position not valid	Replace position sensor or re-calibrate both stroke limits	not available	not available	POSITION SIGNAL CORRECT
SPEED SENSOR	Measure of motor speed not valid	Replace speed sensor	not available	not available	SPEED SIGNAL CORRECT
MID TRAVEL ALARM IN OP	The valve does not move in presence of an open control	Check status of actuator and valve mechanical parts. Recalibrate both stroke limits.	only close	only close	CLOSE CONTROL
MID TRAVEL ALARM IN CL	The valve does not move in presence of a close control	Check status of actuator and valve mechanical parts. Recalibrate both stroke limits.	only open	only open	OPEN CONTROL
MAIN VOLTAGE	Main voltage lower than –20% or higher than +20% of the value stated in the nameplate menu	Check main voltage supply and frequency on terminals L1, L2 and L3. check that wires section is correct	Not available	Not available	MAIN VOLTAGE CORRECT

K1 CONTACTOR	The test routine reporta a failure of K1 (coil or auxiliary contact)	Check the contactor	Opposite direction	Opposite direction	CONTROL IN OPPOSITE DIRECTION
K2 CONTACTOR	The test routine reporta a failure of K2 (coil or auxiliary contact)	Check the contactor	Opposite direction	Opposite direction	CONTROL IN OPPOSITE DIRECTION
CONFIGURATION OBJ n°	The checksum of the EEPROM memory that contains the configuration data is wrong	Re-configure all parameters (see next page)	Not available	Not available	MEMORY OK
HARDWARE n°	The diagnostic programme detects some malfunction in the electronics controlling the actuator	Some circuit is damaged and does not work (see details next page)	Not available	Not available	HARDWARE OK
LOW LITHIUM BATTERY	The voltage of the lithium battery is too low (only detected if the battery is present and the relevant parameter of the miscellaneous routine is set to "present")	Change lithium battery	Available with main voltage	Available with main voltage	LITHIM BATTERY OK
LOST PHASE	The alarm appears only with 3-phase main supply. The alarm is generated in caseo f fault of one of the phases that supply the actuator transformer.	Check main power supply on terminals L1, L2 and L3	Not available	Not available	PHASE OK
REQUEST SIGNAL	The analogue 4-20mA signal is not correct	Check the external 4-20mA generator and wiring	available	Positioner function not available	4-20mA INPUT OK
EFS MID TRAVEL	The position is >4% after ESD action	Check reset time Check electrical stroke limits Check mechanical stops	Not available	Not available	Electrical actuator command after the clutch has been re-energized or by local operator interface

17.5.12 WARNING TABLE

DISPLAY MESSAGE	CONDITION FOR WARNING	ACTION	Local	Remote	WARNING RESET
HIGH TORQUE IN OP (NEAR MAX.)	Measured torque 10% lower than the relevant value configured in torque set-up or stroke limits routines	Check the torque necessary to move the valve	available	available	CLOSE CONTROL
HIGH TORQUE IN CL (NEAR MAX.)	Measured torque 10% lower than the relevant value configured in torque set-up or stroke limits routines	Check the torque necessary to move the valve	available	available	OPEN CONTROL
INTERNAL TEMP. (NEAR LIMITS)	Temperature inside the actuator enclosure higher than 80°C or lower than -35°C	Find the heat source and insulate the actuator	available	available	CONTROL TEMPERATURE >-35°C and <80°C
MAIN VOLTAGE (NEAR LIMITS)	Value of the main voltage out of the correct range (-15% or +10% of the value stated in the name plate menu) or wrong frequency	Check section of wires and values of voltage and frequency	available	available	MAIN VOLTAGE CORRECT
(MAX.) CONTACTOR CYCLES	Max. number of contactor cycles reached	Change contactor and reset operation log	available	available	CLEAR RECENT DATA LOG
MAINTENANCE REQUEST	Date of the next maintenance reached	Perform maintenance and set next maintenance date	available	available	CHANGE DATE
MOTOR CURRENT	Motor current greater or lower than limits	Check electrical motor	available	available	CURRENT OK
WRONG STROKE LIMITS	The routine that monitors the stroke limits detects a wrong end of travel condition	Re-calibrate both stroke limits	available	available	RE-CALIBRATE BOTH STROKE LIMITS
BUS	Fieldbus not working	Check bus communication	available	available	BUS OK
PST	PST cycle aborted	Check if condition to abort has happened	available	available	NEW PST CYCLE OR BY LOCAL OPER. INTERFACE
T-PST	T-PST value failed	Check baseline values and parameter T-PST	available	available	NEW PST CYCLE OR BY LOCAL OPER. INTERFACE
T-RET	T-RET value failed	Check baseline values and parameter T-RET	available	available	NEW PST CYCLE OR BY LOCAL OPER. INTERFACE
OV-TR	OV-TR value failed	Check PST travel and parameter OV-TR	available	available	NEW PST CYCLE OR BY LOCAL OPER. INTERFACE

CONFIGURATION OBJ n°:

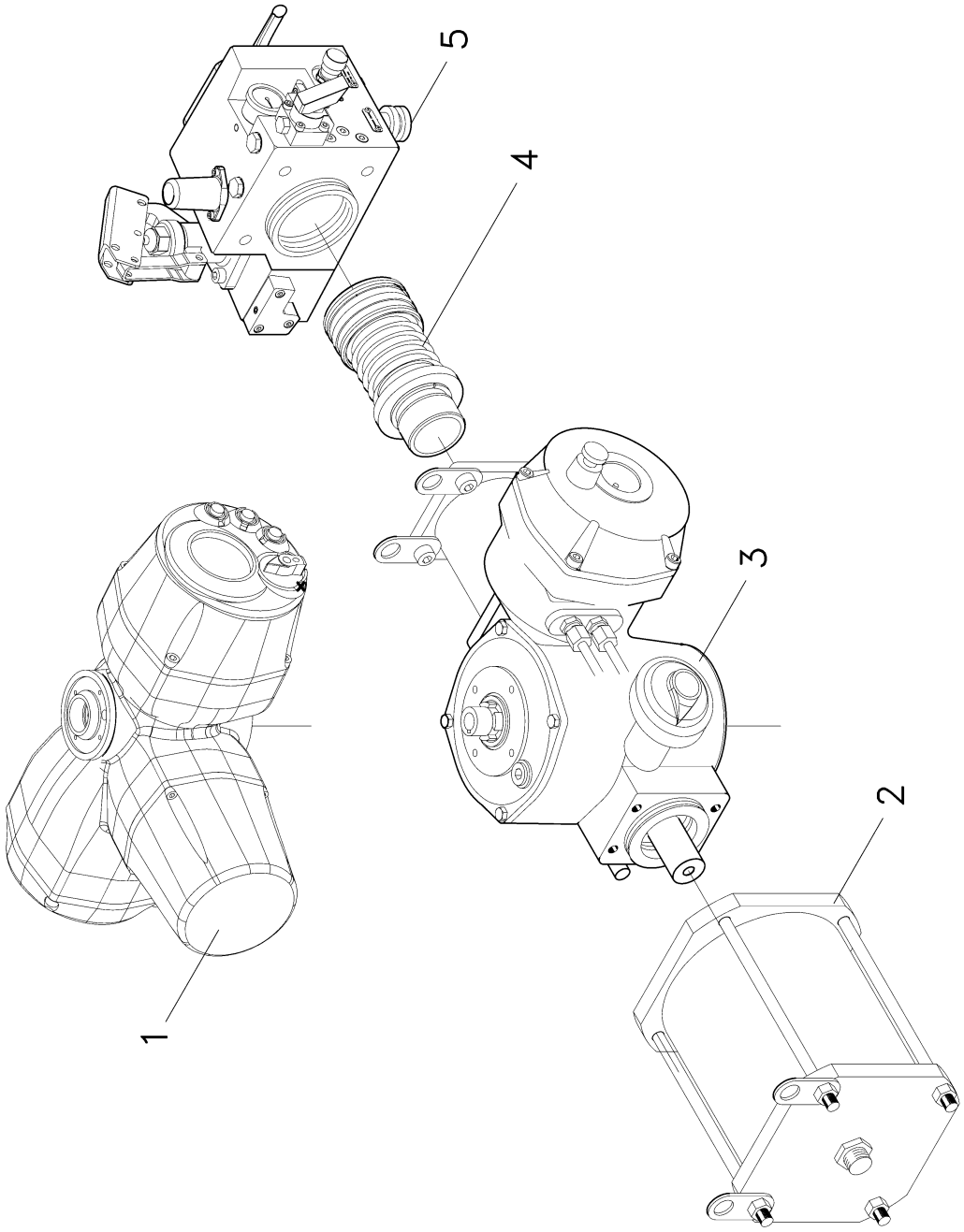
n° indicates the number of the parameter to be configured. To clear the alarm the table of all ICON2000 parameters is necessary. Call BIFFI After-sales service to solve the problem.
If the alarm message is “CONFIGURATION OBJ 9999” only one of the ICON2000 parameters needs to be changed. For instance: enter the SET-UP menu, actuator set-up, torque set-up, and either increase or decrease the closing torque by 1%. As the alarm message disappears re-enter the SET-UP menu, actuator set-up, torque set-up, and set the previous value (see section 618/2 chap. SETUP ROUTINES, Actuator set-up, Torque set-up).

HARDWARE n°:

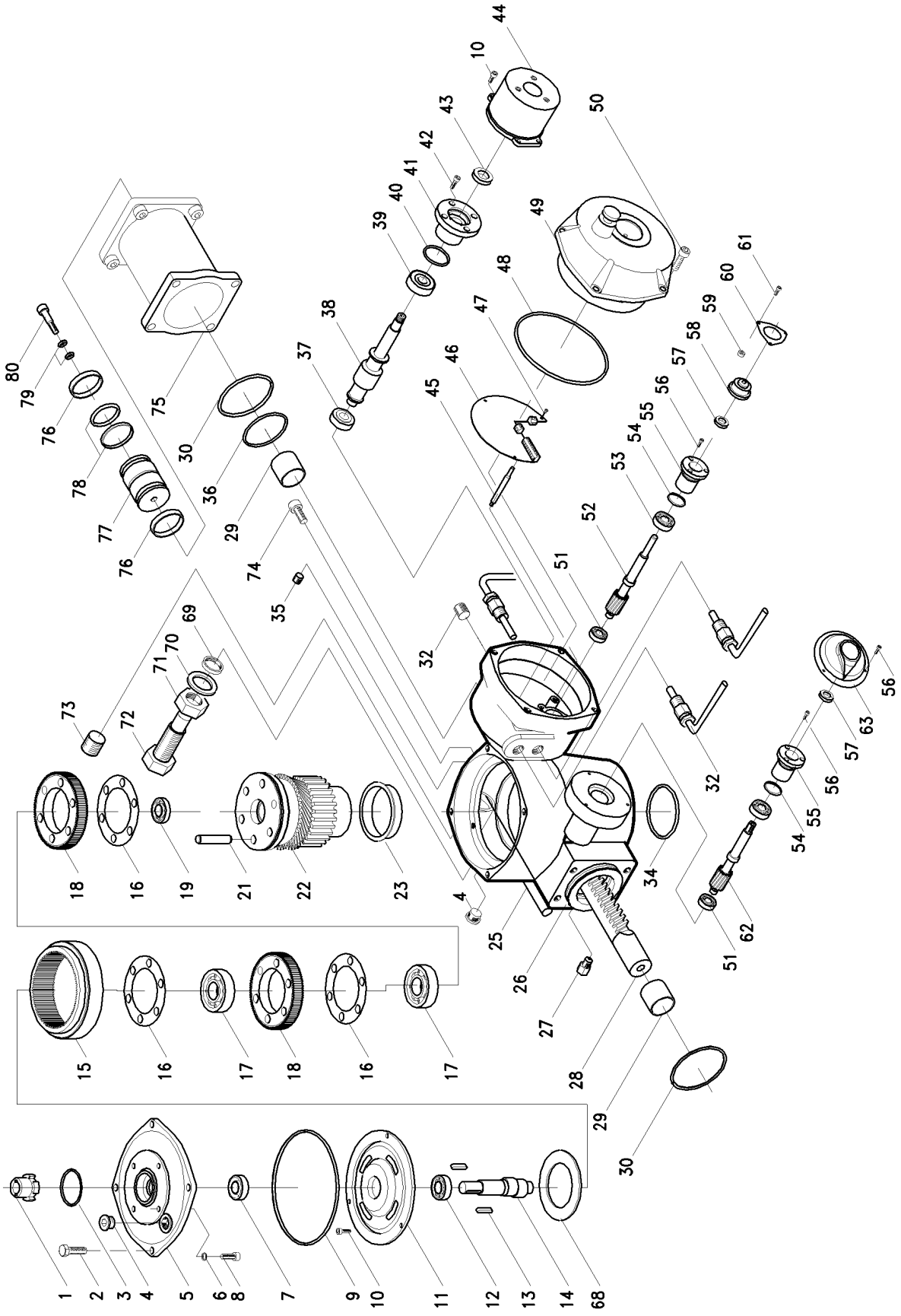
n° indicates the module that is not working. The problem may be due to a malfunction of the module, to an incorrect wiring between modules, or to an incorrect setting of the ICON2000. Call BIFFI After-sales service to solve the problem. The following hardware alarms can be detected:

- Hardware 1 = incorrect coding of local pushbuttons and selector.
- Hardware 2 = incorrect configuration of Ain/Aout optional module
- Hardware 3 = no communication between Ain/Aout optional module and base card
- Hardware 4 = incorrect configuration of type of terminal board
- Hardware 5 = no communication between terminal board and base card
- Hardware 6 = incorrect configuration ICON2000 / F01-2000
- Hardware 7 = incorrect configuration of type of bus card
- Hardware 8 = no communication between bus card and base card
- Hardware 9 = EFS clutch card failure
- Hardware 10= no communication between EFS clutch card and base card

18 EXPLODED VIEW and PARTS LIST



ITEM	Q.ty	DESCRIPTION	MATERIAL
1	1	ICON2000 Electric Actuator	--------
2	1	Spring Cartridge	--------
3	1	Electri Actuator Fail Safe	--------
4	1	Spring to Close Hydraulic Actuator	--------
5	1	Hydraulic Control Group	--------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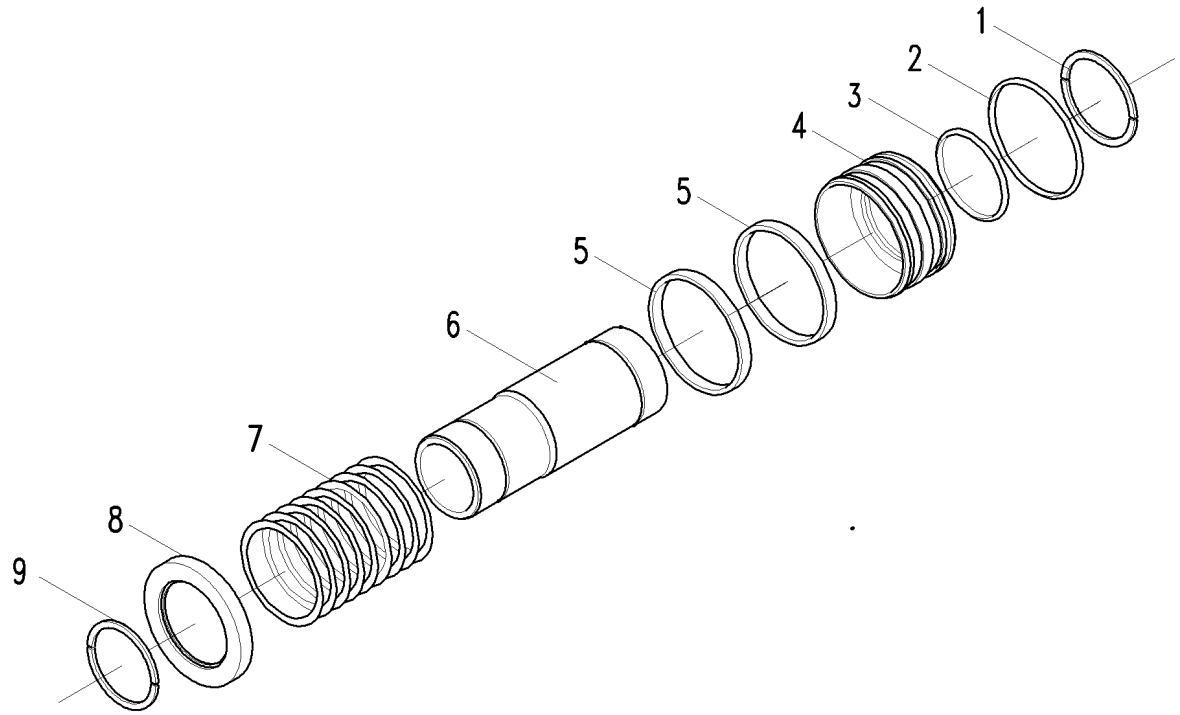
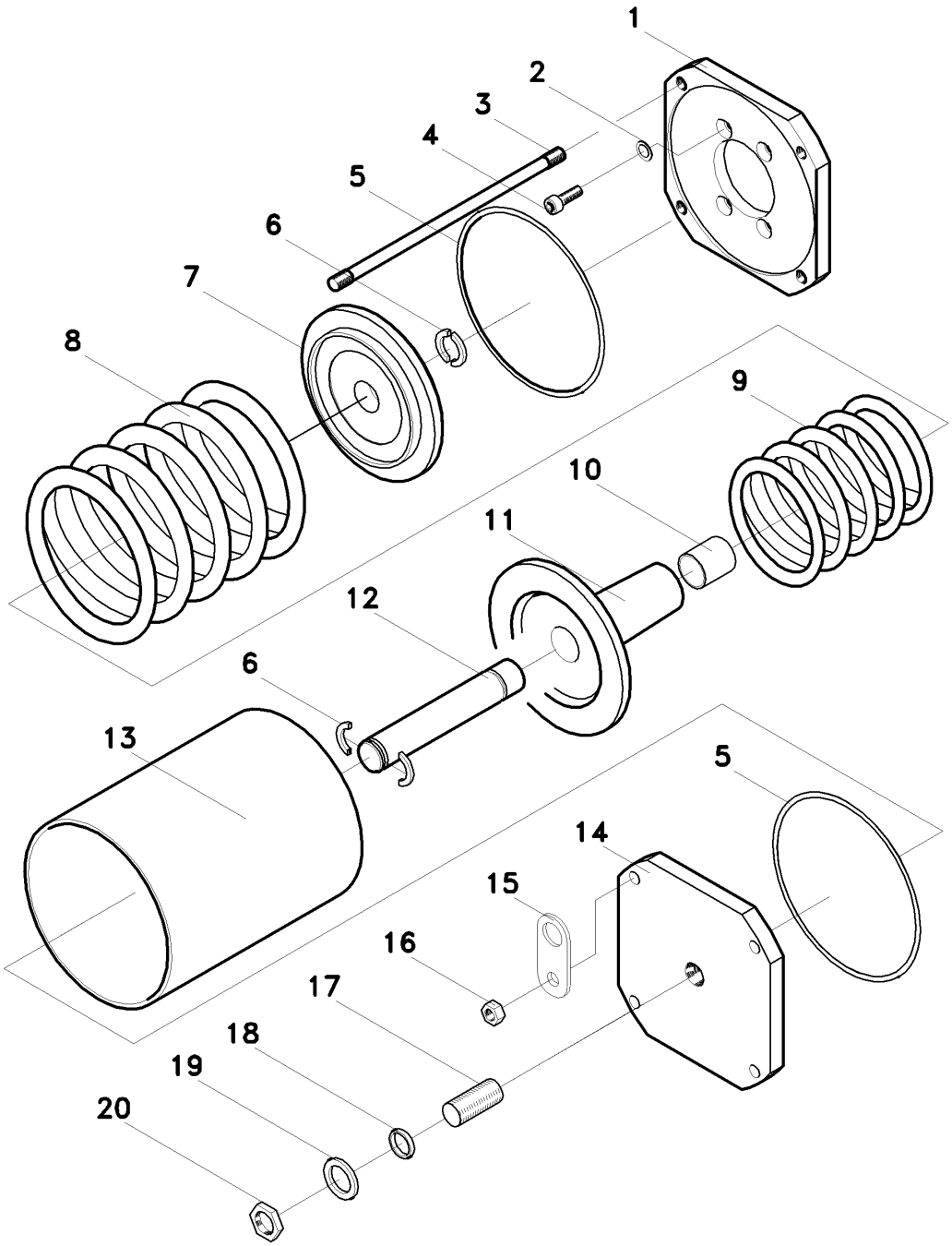
ITEM	Q.ty	DESCRIPTION	MATERIAL
1	1	Insert	Carbon steel
2	4	Screw	Stainless steel
3	1	O–Ring	NBR Rubber
4	2	Oil pug	–––––––
5	1	Housing cover	Aluminium
6	4	Seal washer	–––––––
7	1	Seal ring	NBR Rubber
8	4	Screw	Stainless steel
9	1	O–Ring	NBR Rubber
10	7	Screw	Stainless steel
11	1	Worm whell cover	Aluminium
12	1	Bearing	Carbon steel
13	2	Key	Carbon steel
14	1	Double eccentric shaft	Alloy steel
15	1	Worm wheel	Carbon steel
16	3	Seal Ring	Nylon
17	2	Bearing	Carbon steel
18	2	Gear	Alloy steel
19	1	Bearing	Carbon steel
21	6	Pin	Alloy steel
22	1	Splined bush	Alloy steel
23	1	Bush whaser	Bronze
25	1	Lever assembly	–––––––
26	1	Housing	Aluminium
27	1	Silencer	–––––––
28	1	Rack	Alloy stee
29	2	Bush	Steel–Teflon–Bronze
30	2	O–Ring	NBR Rubber
32	1	Wiring assembly	–––––––
34	1	O–Ring	NBR Rubber
35	1	Plug	Carbon steel
36	1	O–Ring	NBR Rubber
37	1	Bearing	Carbon steel
38	1	Worm shaft	Carbon steel
39	1	Bearing	Carbon steel
40	1	O–Ring	NBR Rubber
41	1	Worm shaft flange	Aluminium
42	4	Screw	Stainles steel
43	1	Seal ring	NBR Rubber
44	1	Clucth assembly	–––––––
45	4	Column	Stainless steel
46	1	EFS card	–––––––
47	3	Screw	Stainless steel
48	1	O–Ring	NBR Rubber
49	1	Cover	Aluminium
50	4	Screw	Stainless steel
51	2	Bearing	Carbon steel
52	1	Position stransmitter shaft	–––––––
53	2	Bearing	NBR Rubber

54	2	O–Ring	NBR Rubber
55	2	Position stransmisson shaft flange	Aluminium
56	9	Screw	Stainless steel
57	2	Seal ring	NBR Rubber
58	1	Potentiometer assembly	–––––––
59	3	Column	Stainless steel
60	1	Position stransmisson shaft plate	Aluminium
61	3	Screw	Stainless steel
62	1	Position shaft	Stainless steel
63	1	Position indicator	Plastic
68	1	Pin spacer	Carbon steel
69	1	Seal ring	Carbon steel
70	1	Washer	Carbon steel
71	1	Nut	Carbon steel
72	1	Adjusting screw	Carbon steel
73	1	Screw	Carbon steel
74	4	Screw	Carbon steel
76	1	Guide sliding	Teflon grapi
77	1	Piston	Carbon steel
78	1	Seal Ring	NBR Rubber
79	2	O–Ring	NBR Rubber
80	1	Piston screw	Carbon steel

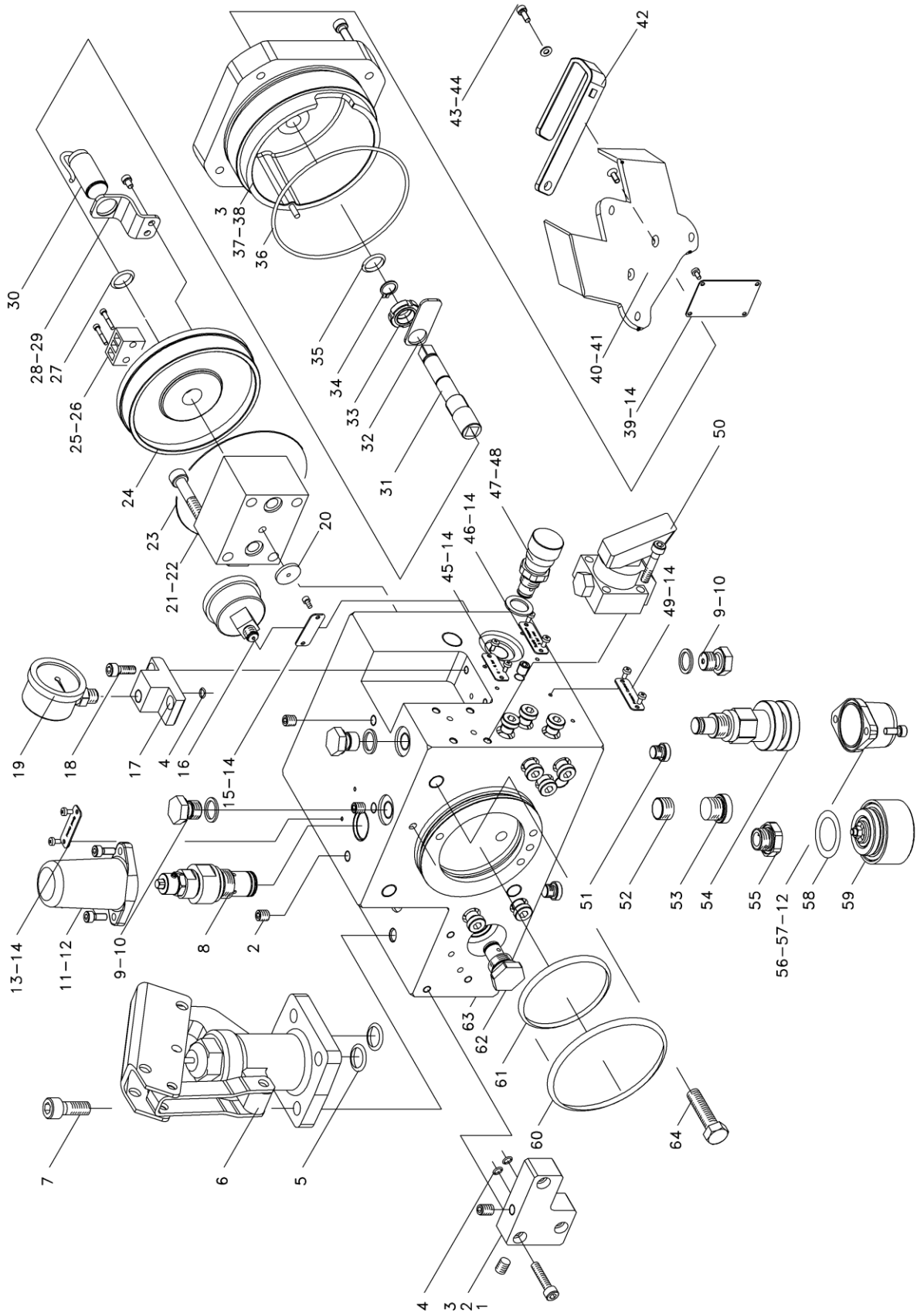


ITEM	Q.ty	DESCRIPTION	MATERIAL
1	1	Circlip	Stainless steel
2	1	Q–Ring	NBR Rubber
3	1	Q–Ring	NBR Rubber
4	1	External piston	Aluminium
5	2	Guide sliding external piston ring	Teflon–Graphite
6	1	Internal cylinder	Carbon stell
7	1	Spring	Alloy steel
8	1	Support ring	Aluminium
9	1	End ring	Stainless steel



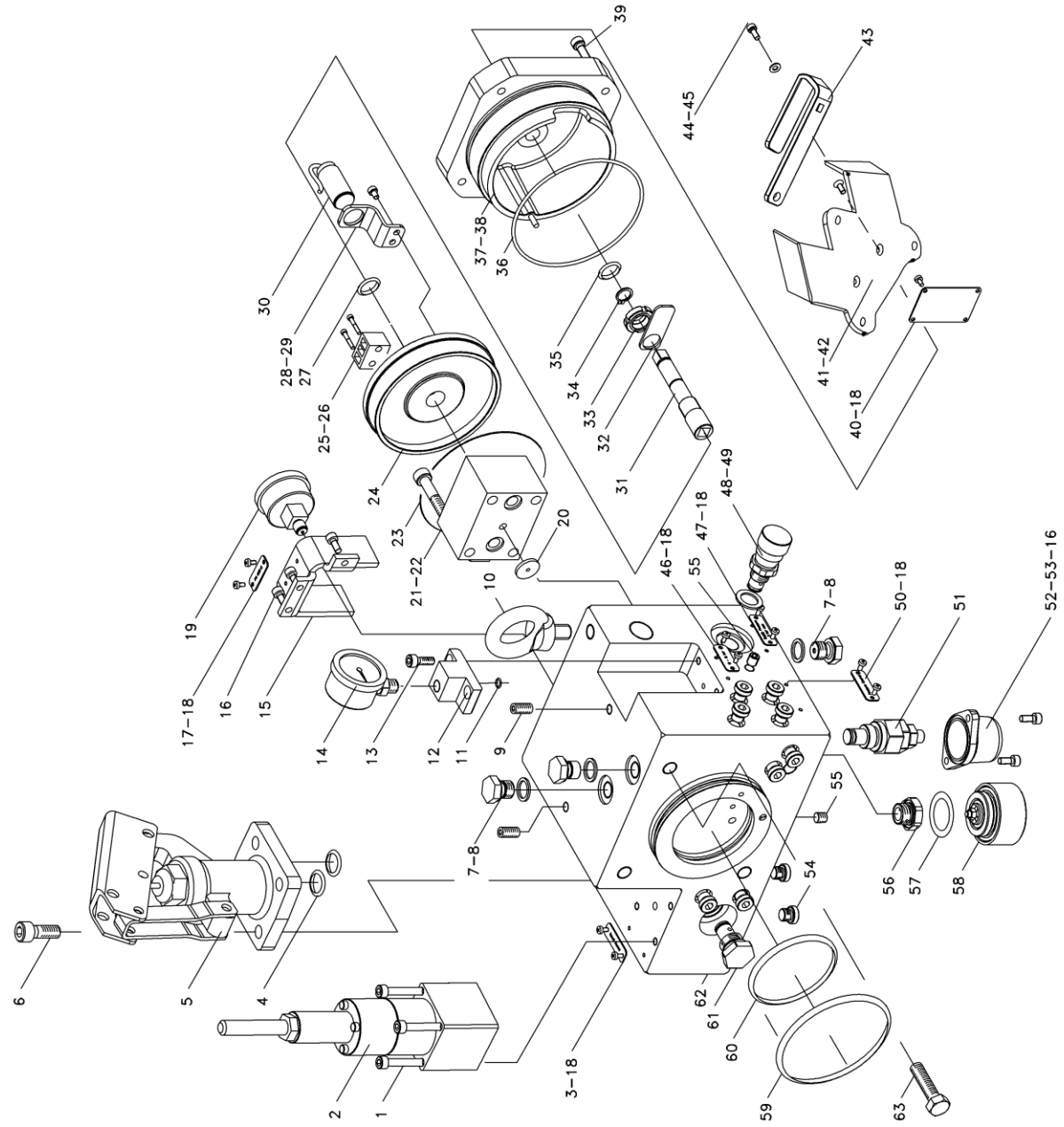
ITEM	Q.ty	DESCRIPTION	MATERIAL
1	1	Head spring flange	Carbon steel
2	4	Washer	------
3	4	Tie rod	Alloy steel
4	4	Screw	Alloy steel
5	2	Gasket	Fiber
6	4	Retainer ring	Stainless steel
7	1	Spring thrust flange	Cast iron
8	1	Spring	Alloy steel
9	1	Spring	Alloy steel
10	1	Bush	Carbon steel–Bronze–Teflon
11	1	Spring guide flange	Cast iron
12	1	Spring guide rod	Alloy steel
13	1	Spring cartridge tube	Carbon steel
14	1	Spring cartridge tube	Carbon steel
15	2	End spring flange	Carbon steel
16	4	Nut	carbon steel
17	1	Adjusting screw	Carbon steel
18	1	Gasket	NBR Rubber
19	1	Washer	Carbon steel
20	1	Nut	Carbon steel

Hydraulic Control Group For EFS "standard" version



ITEM	Q.ty	DESCRIPTION	MATERIAL
1	1	By–Pass flange	Stainless steel
2	9	Plug	Stainless steel
3	8	Screw	Stainless steel
4	3	O–Ring	NBR Rubber
5	2	O–Ring	NBR Rubber
6	1	Hand pump	–––––––
7	4	Screw	Stainless steel
8	1	Adjustable flow regulator	–––––––
9	3	Drain plug	Stainless steel
10	3	Seal washer	Stainless steel
11	1	Adjustable flow regulator cover	Aluminium
12	4	Screw	Stainless steel
13	1	Name plate	Stainless steel
14	14	Screw	Stainless steel
15	1	Name plate	Stainless steel
16	1	Gauge	–––––––
17	1	Gauger support	Stailess steel
18	2	Screw	Stailess steel
19	1	Gauge	–––––––
20	1	Centring washer	Stainless steel
21	1	Auto/Manual selector	–––––––
22	4	Screw	Stainless steel
23	1	O–Ring	NBR Rubber
24	1	Cover	Alluminium
25	1	Terminal	–––––––
26	2	Screw	Stainless steel
27	1	O–Ring	NBR Rubber
28	1	Micro support	Stainless steel
29	2	Screw	Stainless steel
30	1	Proximity micro	–––––––
31	1	Selector shaft	Stainless steel
32	1	Micro actionneur	Stainless steel
33	1	Ring nut	Stainless steel
34	1	Circlip	Stainless steel
35	1	O–Ring	NBR Rubber
36	1	O–Ring	NBR Rubber
37	1	Upper cover	Aluminium
38	1	Pin	Carbon steel
39	1	Selector name plate	Stainle steel
40	1	Selector locking flange	Stainless steel
41	2	Screw	Stainless steel
42	1	Selector locking lever	Stainless steel
43	1	Screw	Stainless steel
44	1	Washer	Stainless steel
45	1	Name plate	Stainless steel
46	1	Name plate	Stainless steel
47	1	Flow control valve	–––––––
48	1	Seal ring	–––––––
49	1	Name plate	Stainless steel
50	1	2/2 N.C. hand–operated–spring return valve	–––––––
51	18	Plug	Stainless steel
52	1	Flow regulator	–––––––
53	1	Plug	Stainless steel
54	1	Relief valve	–––––––
55	1	Check valve	–––––––
56	1	Relief valve cover	Aluminium
57	1	O–Ring	NBR Rubber
58	1	O–Ring	NBR Rubber
59	1	Relief valve	–––––––
60	1	O–Ring	NBR Rubber
61	1	O–Ring	NBR Rubber
62	1	Check valve	–––––––
63	1	Manifold	Carbon steel (Nickel plated)
64	4	Screw	Stainless steel

Hydraulic Control Group for EFS long fail safe version



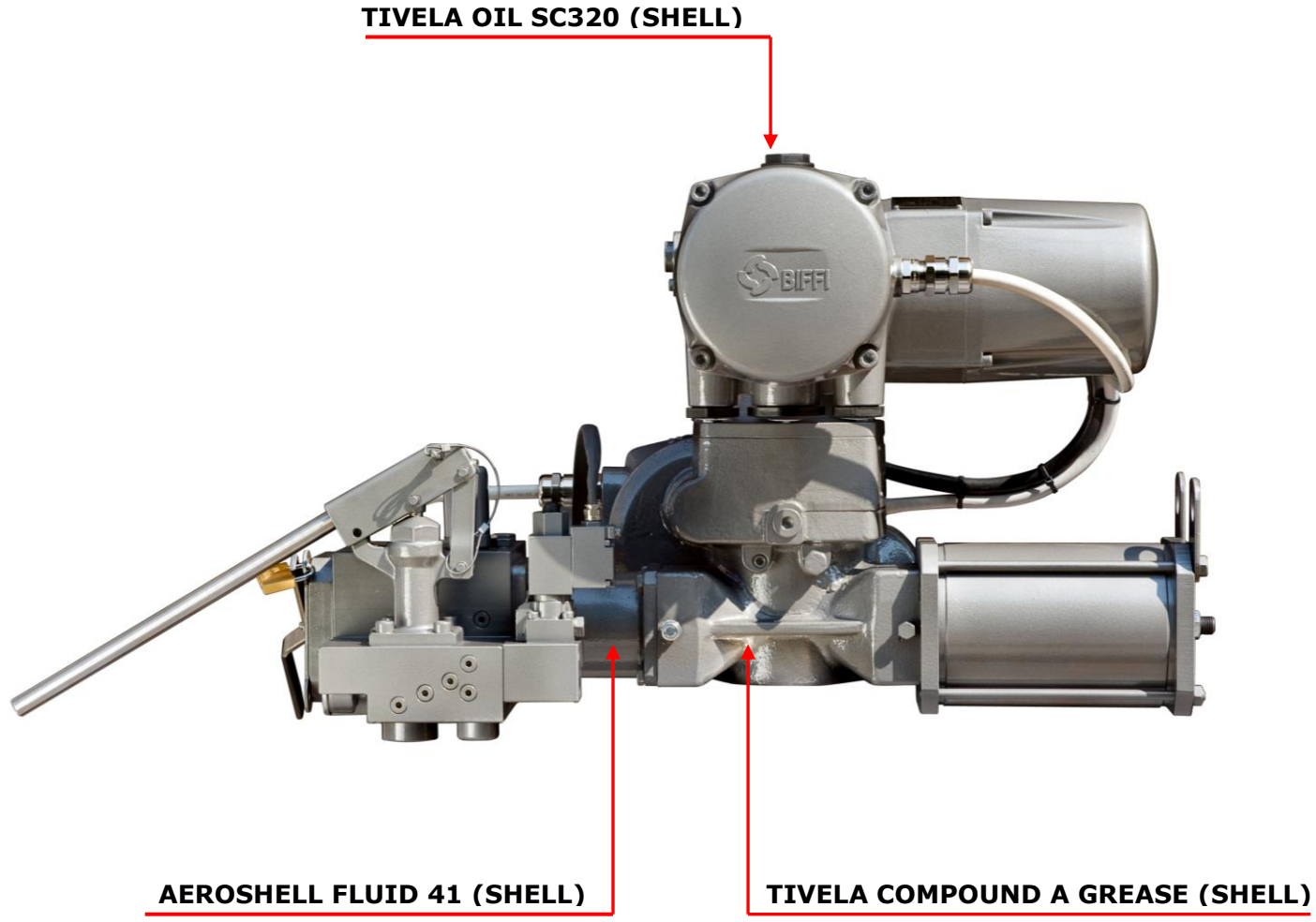
ITEM	Q.ty	DESCRIPTION	MATERIAL
1	4	Screw	Stainless steel
2	1	Adjustable flow regulator	–––––––
3	1	Name plate	Stainless steel
4	2	O–Ring	NBR Rubber
5	1	Hand pump	–––––––
6	4	Screw	Stainless steel
7	3	Drain plug	Stainless steel
8	3	Seal washer	Stainless steel
9	2	Screw	Stainless steel
10	1	Eyebolt	Galvanized steel
11	1	O–Ring	NBR Rubber
12	1	Gauger support	Stailess steel
13	2	Screw	Stailess steel
14	1	Gauge	–––––––
15	1	Bracket gauge protection	Stailess steel
16	5	Screw	Stainless steel
17	1	Name plate	Stainless steel
18	14	Screw	Stainless steel
19	1	Gauge	–––––––
20	1	Centring washer	Stainless steel
21	1	Auto/Manual selector	–––––––
22	4	Screw	Stainless steel
23	1	O–Ring	NBR Rubber
24	1	Cover	Alluminium
25	1	Terminal	–––––––
26	2	Screw	Stainless steel
27	1	O–Ring	NBR Rubber
28	1	Micro support	Stainless steel
29	2	Screw	Stainless steel
30	1	Proximity micro	–––––––
31	1	Selector shaft	Stainless steel
32	1	Micro actionneur	Stainless steel
33	1	Ring nut	Stainless steel
34	1	Circlip	Stainless steel
35	1	O–Ring	NBR Rubber
36	1	O–Ring	NBR Rubber
37	1	Upper cover	Aluminium
38	1	Pin	Carbon steel
39	5	Screw	Stainless steel
40	1	Selector name plate	Stainle steel
41	1	Selector locking flange	Stainless steel
42	2	Screw	Stainless steel
43	1	Selector locking lever	Stainless steel
44	1	Screw	Stainless steel
45	1	Washer	Stainless steel
46	1	Name plate	Stainless steel
47	1	Name plate	Stainless steel
48	1	Flow control valve	–––––––
49	1	Seal ring	–––––––
50	1	Name plate	Stainless steel
51	1	Relief valve	–––––––
52	1	Relief valve cover	Aluminium
53	1	O–Ring	NBR Rubber
54	13	Plug	Stainless steel
55	2	Screw	Stainless steel
56	1	Check valve	–––––––
57	1	O–Ring	NBR Rubber
58	1	Relief valve	–––––––
59	1	O–Ring	NBR Rubber
60	1	O–Ring	NBR Rubber
61	1	Check valve	–––––––
62	1	Manifold	Carbon steel (Nickel plated)
63	4	Screw	Stainless steel

19 LUBRICATION

For normal duty the **EFS2000v4** actuators are lubricated "for life".

The **EFS2000v4** is composed by different compartments each of them are lubricated or filled by different products.

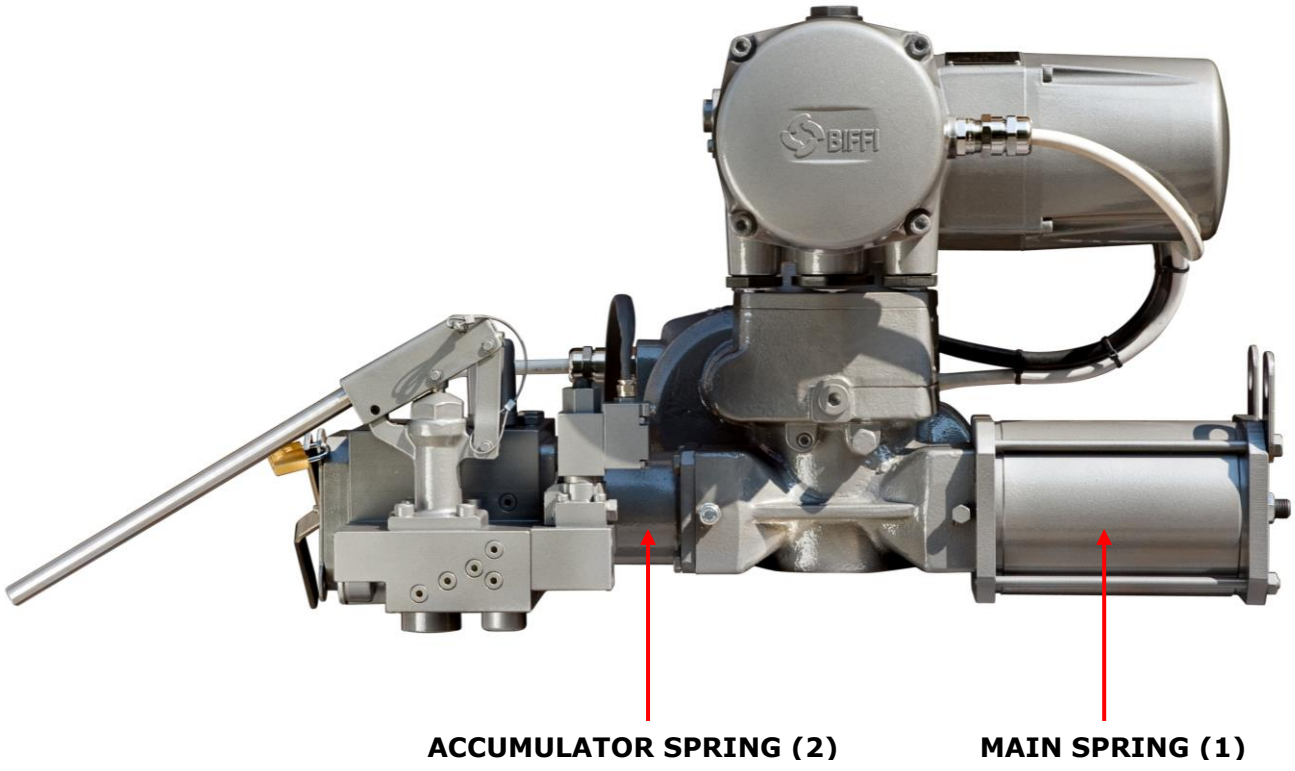
In case it shall necessary to add lubricant, the following products (or equivalent) must be used.



20 DISASSEMBLING and DEMOLITION

Warning:	**Before any works for disassembling all the electrical supply connected to the EFS2000v4 must be disconnected.**

Warning:	**The EFS2000v4 contains parts with springs, which may be under compression. Before any works for disassembling or for demolition any precaution must be taken in order to be sure that the main spring (1) and the accumulator spring (2) are fully released. To be sure that all the springs are fully released, put the Hydraulic Local Selector in MANUAL position (see paragraph 16.2.2), remove the plug P and open the Needle Valve 352 (see paragraph 16.2.3)**



Warning:	**Disassembling and demolition of springs pack MUST be done only by specialised personnel with suitable tools.**

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