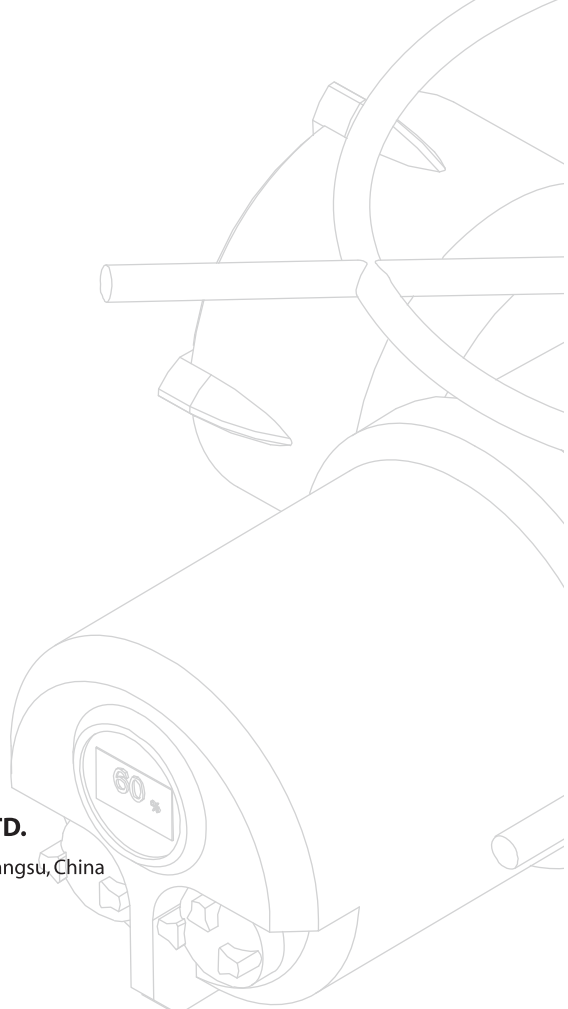

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ERM/ERQ Series Electric Actuator

MANUAL

Version: LAPOOL-EM-14-001

Note: This manual contains important safety information. Please ensure it is read and understood before installing, operating or maintaining the equipment.

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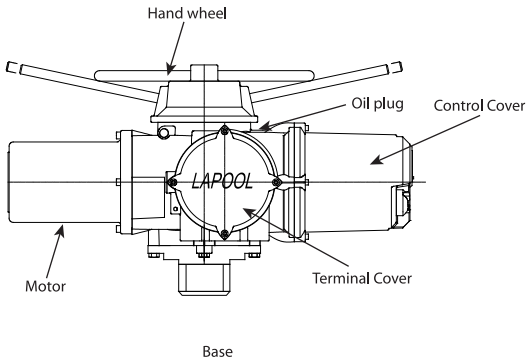
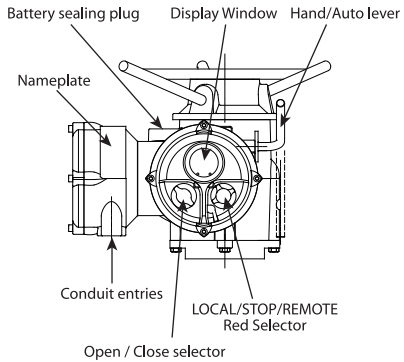
1.1 Identifying Actuator Parts





1.2 Actuator Setting Tool

The LAPOOL Actuator Tool allows actuator control, indication and protection functions to be configured to suit site requirements.

It is essential that all the actuator settings are checked for compatibility with the valve, process and control system requirements before the actuator is put into service.

Specification

Enclosure: IP52

This Setting Tool has been built in accordance with the following standards:

IECEX – Ex ia IIC T4 Ga

Amb. Temperature: -20 to 60 C

Battery replacement must be carried out in a safe area. To replace the batteries remove the six socket head caps crews in the back of the setting tool and remove the back cover.

Operating range: Infra-red 0.75m

1.3 Introduction to this manual

This manual provides instruction on:

- Manual and electrical (local and remote) operation.
- Preparation and installation of the actuator onto the valve.
- Basic Commissioning.
- Maintenance.

Using the supplied Setting Tool to access the actuator setup procedures, non-intrusive setting of torque levels, position limits and all other control and indication functions can be made safely, quickly and conveniently, even in hazardous locations. The actuator allows commissioning and adjustment to be carried out with the main power supply to the actuator.

2. Health and Safety

This manual is produced to enable a competent user to install, operate, adjust and inspect LAPOOL ERM series valve actuators. Only persons with professional training and skills should install, maintain and repair our actuators.

Work undertaken must be carried out in accordance with the instructions in this and any other relevant manuals. The user and those persons working in this equipment should be familiar with their responsibilities under any statutory provisions relating to the Health and Safety of their workplace. Due consideration of additional hazards should be taken when using the ERM range of actuators with other equipment. Should further information and guidance relating to the safe use of the LAPOOL actuators be required, it will be provided on request.

The electrical installation, maintenance and use of the these actuators should be carried out in accordance with the National Legislation and Statutory Provisions relating to the safe use of this equipment, applicable to the site of installation.

The mechanical installation should be carried out as outlined in this manual and also in accordance with relevant standards such as China Standard Codes of Practice, If the actuator has nameplates indicating that it is suitable for installation in hazardous areas then the actuator may be installed in Zone1, Zone21, Zone2 and Zone 22(or Div 1 orDiv2, Class I or Class II) classified hazardous area locations only. It should not installed in hazardous areas locations with ignition temperature less than 120 ℃, unless suitability for lower ignition temperatures has been indicated on the actuator nameplate. It should only be installed in hazardous area locations compatible with the gas and dust groups stated on the nameplate.

The electrical installation, maintenance and the use of the actuator should be carried out in accordance with the code of practice relevant for that particular Hazardous Area certification.

No inspection or repair should be undertaken unless it conforms to the specific hazardous area certification requirements. Under no circumstances should any modification or alteration be carried out on the actuator as this could invalidate the actuators hazardous area approval certification. Access to live electrical conductors is forbidden in the hazardous area unless this is done under a special permit to work, otherwise all power should be isolated and the actuator moved to a non-hazardous area for repair or attention.

⚠ **WARNING: Nominal Power Supply voltage should be within AC 380V+10%(when three phases), AC 220V+10%(when single phase),working frequency should be 50HZ. Any special power requirement should be agreed between manufacturer and purchaser.**

⚠ **WARNING: To ensure safety, the actuator' s metal cover should be connected to the EARTH via related indicated terminator.**

⚠ **WARNING: Motor Temperature**

Under normal operation the temperature of actuator' s motor cover surfaces can exceed 50 oC above ambient.

⚠ **WARNING: Surface Temperature**

The installer/user must ensure that the actuator surface temperature rating is not influenced by external heating/cooling effect (e.g. valve/pipeline process temperatures).

⚠ **WARNING: Control and Indication**

Where the actuator build allows remote control and indication supplies higher than 150VAC but below 300VAC (refer to actuator wiring diagram), the actuator installation altitude must be restricted to less than 2,000m as defined by IEC 61010 (safety Requirements for Electrical Equipment for Measurement, control and laboratory use).

WARNING: Enclosure Materials

ERM series of actuator are manufactured from aluminum alloy with stainless steel fasteners and the thrust bases are manufactured in cast iron.

The cover window is toughened glass which is retained with a 2-part silicone cement and the battery plug will be either stainless steel.

The user must ensure that the operating environment and any materials surrounding the actuator cannot lead to reduction in the safe use of the protection afforded by, the actuator. Where appropriate the user must ensure the actuator is suitably protected against its operating environment.

WARNING: Operating by Hand

With respect to hand wheel operation of LAPOOL electrical actuators, refer to section4.1.

WARNING: Actuator may start and operate when remote is selected. This will be dependent on remote control signal status and actuator configuration.

WARNING: Actuator may start and operate when remote is selected. This will be dependent on remote control signal status and actuator configuration.

3. Storage

If your actuator cannot be installed immediately. Store it in a dry place until you are ready to connect incoming cables.

If the actuator has to be installed but cannot be cabled it is recommended that the solid clutched metal transit cable entry plugs are replaced with metal plugs which are sealed with PTFE tape.

It is not necessary to remove any electrical compartment covers in order to commission the actuator.

LAPOOL cannot accept responsibility for deterioration caused on-site once the covers are removed.

Every our actuator has been fully tested before leaving the factory to give years of trouble free operation, providing it is correctly commissioned, installed and sealed.

4. Operating your Actuator

4.1 Operating by hand

WARNING: with respect to hand wheel operation of LAPOOL electrical actuators, under no circumstances should any additional lever device such a wheel-key or wrench be applied to the hand wheel in order to develop more force when closing or opening the valve as this may cause damage to the valve and/or actuator or may cause the valve to become stuck in the seated/ back seated position.

Keep clear of the hand wheel when engaging hand operation. Actuator driving valves via extension shafts may be subject to retained shaft torsion which can cause the hand wheel to rotate when hand operation is engaged.

⚠ To engage hand wheel drive, depress the Hand/Auto lever into "Hand" position and turn the hand wheel to engage the clutch. The lever can now be released where it will return to its original position. The hand wheel will remain engaged until the actuator is operated electrically when it will automatically disengage and return to motor drive.
If required for local lockout purposes the Hand/Auto lever can be locked in either position using a padlock with a 6.5mm hasp.
Locking the lever in the "hand" position prevents electrical operation of the actuator moving the valve.

4.2 Operating Electrically

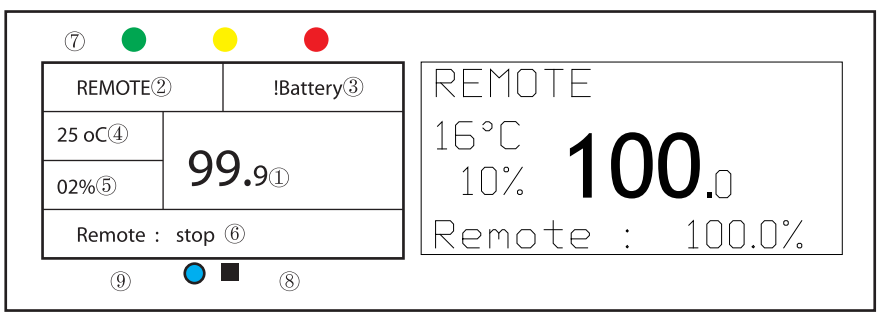
Check that power supply voltage agrees with that on the actuator nameplate. Switch on power supply. It is not necessary to check phase rotation.

⚠ **WARNING: Do not operate the actuator electrically without first checking, using the infra-red Setting Tool, that at least the Basic Settings have been made.**

Selecting LOCAL/STOP/REMOTE status Operation
The red selector enables either LOCAL or REMOTE control, lockable in each position using a padlock with a 6.5mm hasp.
When the selector is locked in the LOCAL or REMOTE Positions the STOP facility is still available. The selector can also be locked in the STOP position to prevent electrical operation by LOCAL or REMOTE control.

LOCAL control
With the red selector positioned at LOCAL (anti-clockwise) the adjacent black knob and be turned to select Open or Close. For Stop, turn red knob clockwise.
REMOTE control
Turn the red selector to the REMOTE position status (clockwise), this allows remote signals to operate the actuator. LOCAL STOP can still be used by rotating the red knob anti-clockwise.

4.3 Display – Local Indication



4.3.1 Position display

This is the main LCD display for recent actual position. Its unit is percentage (%).when valve is full-CLOSED LIMIT, it will be 0.0; while it will be 100.0 when valve is full-OPENED LIMIT.

4.3.2 Working status

This indicates the recent status of the electrical actuator, it could be REMOTE/STOP/LOCAL according to rotating of the selector on the control cover. If there is any abnormal situation, it will be "PanelErr, which indicates the actuator in is error working status.

4.3.3 Alarm Indicating

This text zone utilize to indicate the alarm status of the Actuator, for instance "!Battery" indicates it is lack of battery energy.

4.3.4 Temperature

This is the temperature value of the internal atmosphere of the Motor.

4.3.5 Torque

This is the output thrust drive to the valve, its value means (% of rated).

4.3.6 Recent command to the actuator

When actuator locates in any working status above, the executed command to the actuator control system will be display here. For example, Regard of the on/off series Actuator, when the actuator is selected by "REMOTE", there will be "Remote: stop "when not any outside opening or closing signal has been send.

4.3.7 Position LEDs

To indicate the position of the valve, there are 3 different color (Green, Yellow, Red) LEDs to indicating recent actually position. Green LED means the valve is located in full-close limit position, and Red LED means the valve is located in full-open limit position, while Yellow LED means valve is located in the mid-travel position.

4.3.8 Infra-Red Receiver

Used for setting tool to alter the parameter of the Actuator via infrared REMOTE.

4.3.9 Infra-red LED

This led will flash when keys of setting tool pressed.

4.4 Display Status Indication

The actuator provides real-time status indication. The top-left line of the text area is reserved for Control mode indication. The top-right line of the text area is reserved for any alarm info indication, if more than one is present, each alarm will be displayed in sequence. The bottom line of the text area is reserved for control command or signal indication.

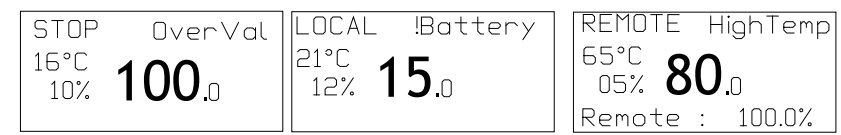


Figure 4.4.1 examples of alarm warning in text format

5. Preparing the Drive Bush

ERM/ERQ serial Actuator includes two types of different Drive Bush. Type A thrust base and Type B non-thrust base.

Disassembly of bearing

Fig 5.1

Fig 5.2

Locate and remove the snap ring using a suitable tool. Remove the split collar. Slide the bearing off the drive bush. Keep the bearings and drive bush locating components in a safe clean place. Machine the drive bush to suit the valve stem, allowing a generous clearance on the screw thread for rising steam threads.

Reassembly

⚠ **WARNING: Failure to fully clean and grease the drive bush and O-rings before reassembly could result in damage.**

Remove all scarf from the drive bush ensuring all O-rings are undamaged, clean and greased. Slide the bearing assembly onto the drive bush and ensure it is fitted down to the drive bush shoulder. Grease and refit the drive bush bearing assembly into the thrust base housing on the actuator, ensuring that the slots in the drive bush are located into the drive dogs of the hollow output shaft. Refit the retaining plate and secure with cap headed screws.

6. Mounting the Actuator

Ensure the valve is secure before fitting the actuator as the combination may be top heavy and therefore unstable.

If it is necessary to lift the actuator using mechanical lifting equipment certified slings should be attached as indicated in figure 6.2 for vertical shafts and Fig 6.1 for horizontal shafts.

At all times trained and experienced stuff should ensure safe lifting particularly when mounting actuators.

Fig 6.1

Fig 6.2

⚠ **WARNING : The actuator should be fully supported until full valve shaft engagement is achieved and the actuator is secured onto the valve flange.**

⚠ **WARNING: Do not lift the actuator and the valve combination via the actuator. Always lift the valve/actuator assembly via the valve avoid damaging the actuator.**

Each assembly must be assessed on an individual basis for lifting.

7. Cable Connections

7.1 Terminal Block Layout

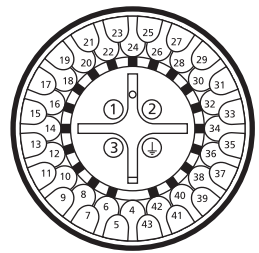


Fig7.1.1Terminal numbers refer to connections as shown on the actuator circuit diagram

⏚	Earth / Ground	13	Contact outputS4-2
1	3 Phase A (380V), L (220VAC)	14	DC Output 0V
2	3 Phase B (380V), N (220VAC)	15	DC Output 24V
3	3 Phase C (380V)	22	Remote close (dry contact) input signal
4	ESD terminal1	25	Remote close (Pair with 22)
5	ESD terminal2	30	Remote open (dry contact) input signal
6	Contact output S1-1	31	Remote open (Pair with 30)
7	Contact outputS1-2	33	Feedback Current (4-20mA)（-）
8	Contact outputS2-1	34	Feedback Current (4-20mA)（+）
9	Contact outputS2-2	41	Remote analogue signal (4~20mA)（-）
10	Contact outputS3-1	42	Remote analogue signal (4-20mA)（+）
11	Contact outputS3-2	43	Cable shielding
12	Contact outputS4-1		

⚠ **WARNING: Before Removing actuator covers, make sure that all power supplies are isolated.**

Check that the supply voltage agrees with that stamped on the actuator nameplate.

A switch or circuit breaker must be included in the wiring installation or the actuator. The switch or circuit breaker must be mounted as close to the actuator as possible and shall be marked to indicate that it is the disconnect device for that particular actuator. The actuator must be protected with overcurrent protection device .

⚠ **WARNING: Actuators for use on phase to phase voltages greater than 600V must not be used in supply systems such as floating, or earth-phase systems, where phase to earth voltages in excess of 600VAC could exist.**

7.2 Earth Connections

A lug with a 6mm diameter hole is cast adjacent to the conduit entries for attachment of an external protective earthing strap by nut and bolt. An internal earth connection is also provided however it must not be used alone as the protective Earth Connection.

7.3 Removing Terminal Cover

Using a 6mm allen key loosen the four screws evenly. Do not attempt to lever off the cover with a screw driver this will damage the O-ring seal and may damage the flame path on a certified unit.

7.4 Cable entry

Only appropriate certified explosion proof cable glands or conduit may be used in hazardous locations. the cable entries in the actuator are tapped M25 x 1.5p or M40x1.5p.

In hazardous locations, only one appropriate certified Explosion-Proof thread adaptor per entry may be used.

Remove needed clutched plug, Make cable entries appropriate to the cable type and size.
Ensure that threaded adaptors, cable glands or conduit are tight and fully waterproof. Seal unused cable entries with steel or brass threaded plug. In hazardous areas an appropriate certified threaded blanking plug must be installed at the cable entry without the use of an interposing thread adaptor.

7.5 Connecting to terminals

Field wiring connections are by wire termination ring/spade tags secured with the supplied 4mm (control and indication) and 5mm(power)pan head screws.

⚠ **To ensure secure electrical connections, it is important that the requisite washers are used as shown in figurexx. Failure to do so may result in connections working loose or screws not clamping down on wire termination tags. Spring washers must be compressed. Screw tightening torques must not exceed 1.5NM.**

Refer to the wiring diagram inside the terminal cover to identify functions of terminals. Check the supply voltage is the same as that marked on the actuator nameplate.
Remove power terminal guard.
Begin by connecting power cables and replace guard.
When all connections are made ensure wiring diagram in replaced in the terminal compartment.

7.6 Replacing Terminal Cover

Ensure cover O-ring seal and spigot joint are in good condition and lightly greased before refitting cover.

8. Commissioning –Basic Settings

The CONTROL COVER MUST NOT BE REMOVED;NO USER CONFIGURABLE SEETINGS ARE AVAILABLE WITHIN THE CONTROL ENCLOSURE.THE CONTROL COVER IS SEALED BY A QUALITY LABEL WHICH IF BROKEN MAY INVALIDATE WARRANTY.

This instruction details the basic settings that must be completed before the actuator is put into service.

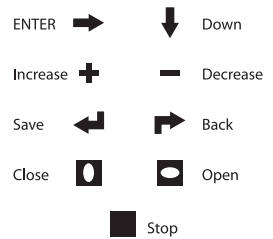
ELECTRICAL OPERATION MUST NOT TAKE PLACE UNTIL THE BASIC SEETING HAVE BEEN MADE AND CHECKED.

The basic settings affect the correct operation of the valve by the actuator. If the actuator has been supplied with the valve, the valve manufactures may have already made these settings.

⚠ Settings and operation must be verified by electrical operation and function test of the actuated valve.

8.1 Connecting to the actuator

The LAPOOL Setting Tool used to alter parameters of the actuator system. It is identified by the key symbols being yellow and a yellow seal between casings.
The LAPOOL Setting Tool with the relevant navigation and configuration keys is shown below:



→ used to enter the concrete menu, and enter the line with a line head of black point ●.

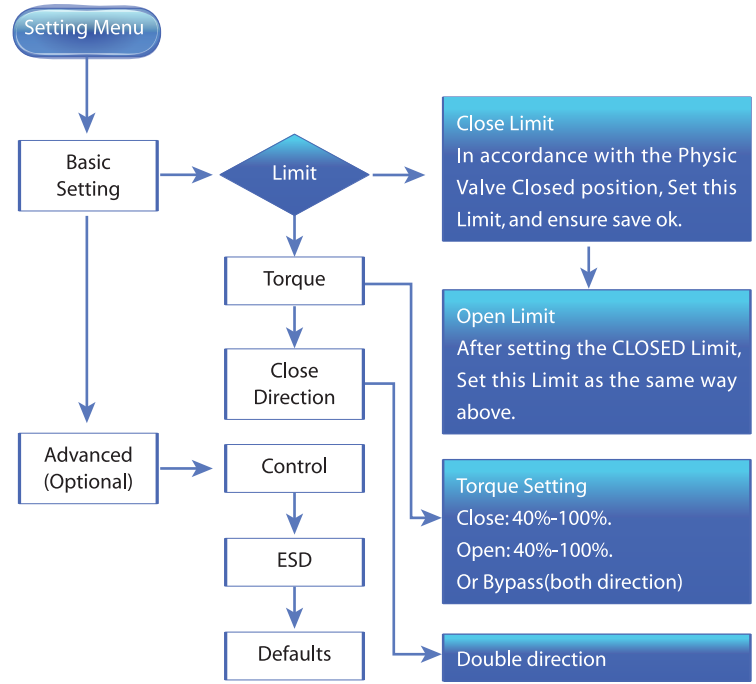
↓ used to alter the different Parameter option along with a black point ● moving as well.

Connecting to the actuator using the infra-red command. This means that the user must be in close proximity and in direct line of sight of the actuator.
Point the setting tool at the actuator display window within a range 0.25m (10inch) and Press ➡ Key. then screen will alter to the main menu screen.

8.2 Security –Password

The default security level for connecting to the actuator is by infrared initiation. This requires that the user is at the actuator within 0.25m distance and in direct line of sight of the display.
All actuator settings can be merely viewed with the selected to **STOP**. otherwise, it is invalid to access the menu.
To Change an actuator setting, the actuator must be selected to STOP, and a correct password entered. In fact, with regard to the "Basic Setup" , the default code is number 1. And to the "Advanced Setup", the default code is number 2.
If the actuator user want to create a customed password, you could enter the "Advanced Setup" menu, to change a new password for security in the option of "System Setup" , " Basic code" and "Advanced code" option is alternative.

8.3 Basic Setting Menu Structure



8.4 Basic Settings-Limits and torque

⚠ **Settings and operation must be verified by electrical operation and function test of the actuated valve.**

Connect to the actuator as described in section 8.1. Press the ➡ key directly to the main position display screen. Then the menu screen will be showed.

Navigate to "Basic Setup" using the ⬇ key and key to selected.

Similarly, Navigate to "Limit Setup" using the ⬇ key and ➡ key to selected.

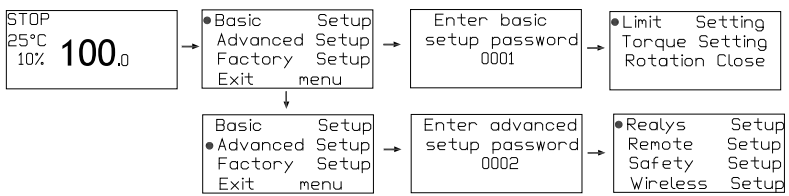


fig 8.4.1 flow diagram of menu structure

Set Closed Limit

Press ⬇ to navigate to Close Limit setup function. and press ➡ to selected it.

User could manually operate the actuator and valve to the Closed position, or take use of the electrical command to move to actuator and valve to the Closed position.the electrical command includes two methods, which is pressing ✚ ━ key to inching move, and continuous press to move continuously; the other method is using the torque way to command the actuator, in that way, ⬮ ⬭ ■ are valid. the open valve key is designed to open the valve, and once press the key, its command to the actuator

will be always existed until the actuator has accepted a new "stop" command through the infra-red remote or monitoring the thrust beyond the torque setting of the actuator.

Allow for overrun by winding the open by half to one turn.

After the physical position of the valve has been at the closed limit, Press ↵ could set the limit with a warning of "Save OK".

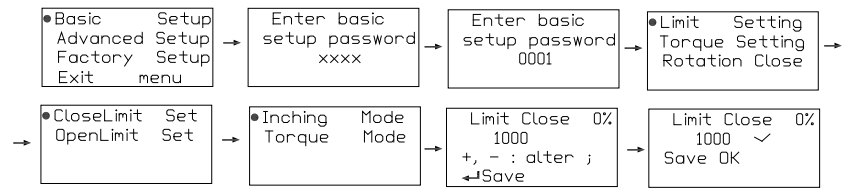


Fig 8.4.2 flow diagram of Closed-limit setting

Set torque

After the setting of the two position limit, the actuator output turns between the set Closed and Open limit position.

During the operation, the actuator will monitor the thrust whether it has been beyond the setting torque rated value. Once the actuator check its thrust rate over that parameter, it will be shut down, no more moving around this direction. While the opposite direction move may be continued and clear last over-torque record.

The default setting for opening and closing torque switch bypass is Off (torque protection active all times).Bypassing the torque allows torque up to approximately 130% of rated to be available without protection. The valve manufacturer should be consulted to confirm the valve structure and interface components can withstand the additional thrust/torque.

The value of toque parameter available to open/close the valve can be set between 40%-99% of rated. The actuator rated torque is indicated on its nameplate.

Press to navigate to torque setup function. and press to selected it. Use to increase value and to decrease value. Press key to verify and save this set, with a success warning of "Save Ok".

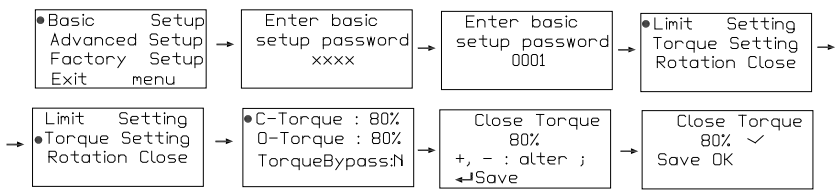


Fig 8.4.3 flow diagram of Closed-direction torque setting

9. Maintenanceand Troubleshooting

9.1 Maintenance

Every LAPOOL manufactured actuator has been fully tested before put into use to give years of trouble-free operation providing it is installed, sealed and commissioned in accordance with the instructions given in this manual.

The actuator' s unique double sealed, non-intrusive enclosure provides complete protection for the actuator components.

The actuator gearing is located in an oil bath and is lubricated for life and does not need replace. Should the oil be removed or lost it must not be electrically operated as premature failure be result.

Covers should not be removed for routine inspection as this may be detrimental to the future reliability of the actuator.

All electrical power supplies to the actuator must be isolated before any maintenance or inspection is carried out to ensure security, even replacement of the battery.

Routine maintenance should include the following:

- Check actuator to valve fixing bolts for tightness.
- Ensure valve stems and drive nuts are clean and properly lubricated.
- If the motorized valve is rarely operated, a routine operating schedule should be set up.
- Check the actuator enclosure for damage, loose or missing fasteners.
- Ensure there is not an excessive buildup of dust or contaminant on the actuator.
- Check for any loss of lubrication.

The Actuator Battery

The battery provides the ability to track and display the valve position only when the main power is turned off. It ensures the current position is indicated and displayed when manual operation takes place. After several seconds without any manual operation, the LCD screen will shut up.

On power up, the correct, current position will be displayed and the actuator will operate normally.

In normal circumstances battery replacement interval should not exceed 3 years. Ambient temperature and plant operating conditions may affect battery life.
If the battery level is lower than normal situation, there will be a exactly warning in text at the top-right zone, which is "!Battery".

⚠ **WARNING:** If the actuator is located within a hazardous area permission must be obtained in the form of a "hot work permit" or other local regulation before removal and/or replacement of the battery.

Oil

Unless specially ordered for extreme climatic conditions, actuators are dispatched with gearcases filled with SAE 80EP oil which is suitable for ambient temperatures ranging from -22℉/-30℃ to 160 ℉/70℃.

9.2 TroubleShooting

During the process of operation, the Actuator will monitoring some related work status in real time, to avoid valve and actuator itself getting broken. These status parameter including motor room temperature, output torque/thrust, battery voltage, and/or valvebeing stuck or not.
If any abnormal phenomenon occurs during the process of opening or closing valve, the actuator will stop immediately until these faults has been solved/cleared, meanwhile, specific alarm/ warning will be displayed at the top-right text area, to help repairperson get rid of trouble clearly.
There are some common faults examples and solved solution that may occur during the process of installation , maintenance, operation as following figure.

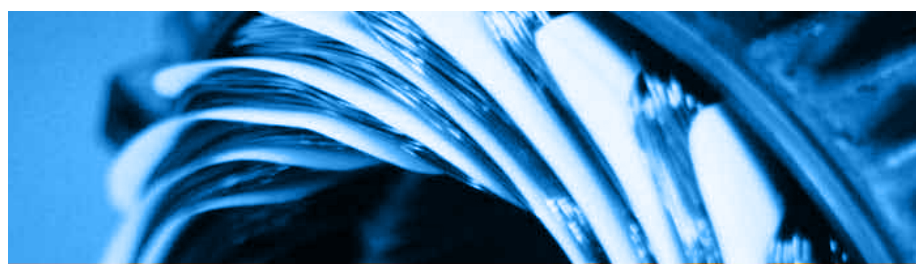
Warning	Meaning	How to solve
"!Battery"	It means the interval battery voltage is low.	Change battery
"!Stuck"	It means valve-actuator is stuck/jammed	Verify valve jammed or not. **Rotate the Red knob one cycle can clear the alarm**
"OverTemp"	It means motor interval thermal protection device is turn off.	Verify Motor normal or not. Check the valve .
"OverVal"	It means actuator has been over its setting work limit.	Ensure the closed and open limit correctly.
"Overtor"	It means the load thrust is over actuator's configuring protected parameter.	Check the valve, or increase the configuring torque protect Parameter.
"PhaseErr"	It means the three-phase checking incorrect	Repower the actuator with a time interval of 2minutes.

Note: if another specific abnormal phenomenon occurred, the control circuit hardware may fail in work.

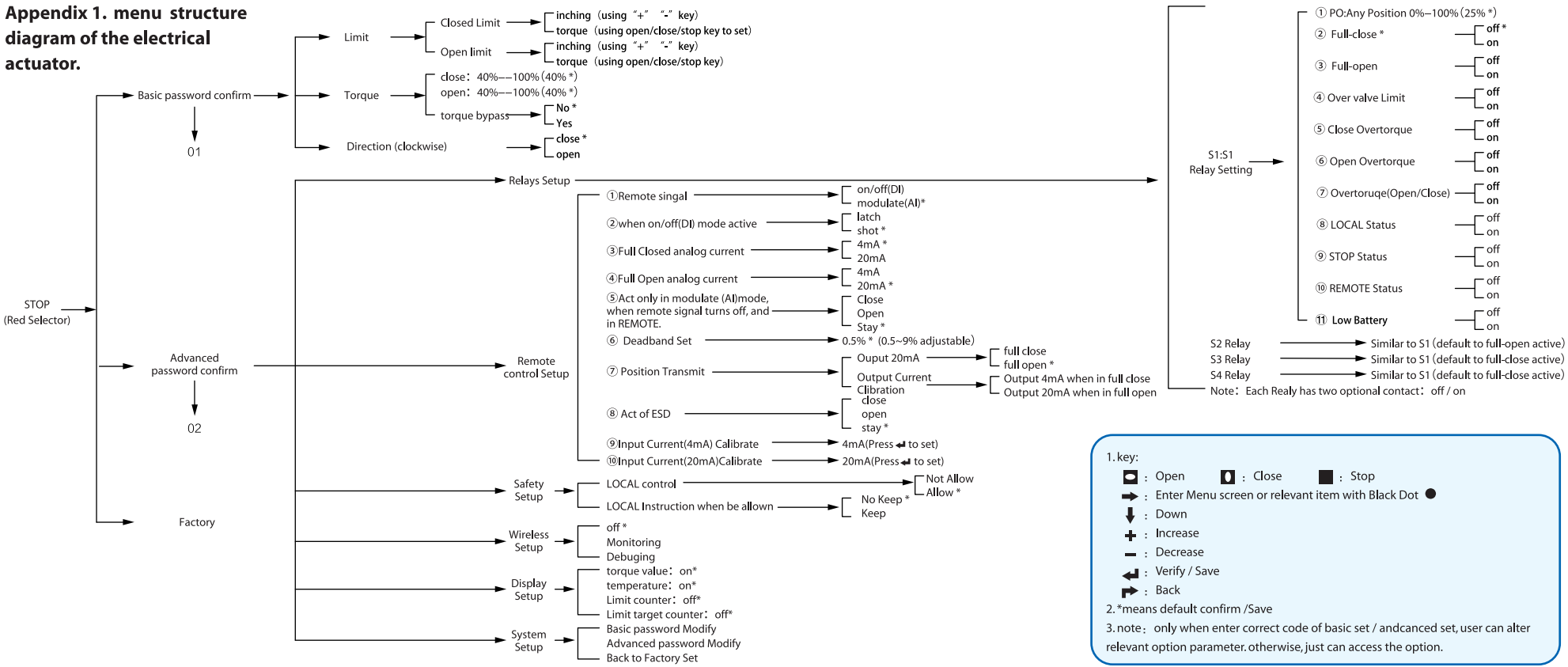
As shown in following figure, it is a statistic of some issues, which may occur during installation ,operation ,maintenance.

Trouble phenomenon	Reasons may occur	Measures
Actuator do not work (Open/Close abnormal)	Power Supply is off	Verify Power Supply
	Power Supply Voltage abnormal	Verify Power Supply in accordance with nameplate
	Cable connect wrong	Ensure all cable connect in accordance with the wiring diagram.
	Phase loss	Ensure Power supply no problem
	Input signal error	Check the remote signal
	Limit not initialize/set	Set the closed and open limit correctly
	Heavy load	Check the valve and actuator
	Motor fault	Check the Motor
Actuator work only one direction	Input signal loss	Verify signal cable correctly
	Over torque in one direction	Check the valve, Reconfigure torque protection parameter
	Control panel abnormal	Check the control cover panel
Hand/Auto lever work abnormal	Valve stuck, hand/auto lever can't work	Repair the hand/auto lever.
Actuator noise abnormal	Load heavily, internal component friction	Check valve, valve actuator attachment

Trouble phenomenon	Reasons may occur	Measures
Large Valve leak	Slow device mechanical limit screw do not set well	Readjust the slow device mechanical screw
	Actuator limit set incorrectly	Reset the closed limit and open limit
	Valve internal stuck with other objects	Clean the abnormal objects
	Valve is fully closed position, but excessive seal between the valve and the valve seat.	Repairsealing surface between valve and valve seat.
	Valve plug and seal damage	Replace the plug and seat.



Appendix 1. menu structure diagram of the electrical actuator.



1. key:
   - : Open : Close : Stop
   - : Enter Menu screen or relevant item with Black Dot ●
   - : Down
   - : Increase
   - : Decrease
   - : Verify / Save
   - : Back
2. *means default confirm /Save
3. note: only when enter correct code of basic set / andcanced set, user can alter relevant option parameter. otherwise, just can access the option.