OPERATING INSTRUCTIONS

FOR

EMTORK

MARSH

THREE PHASE ELECTRIC ACTUATORS

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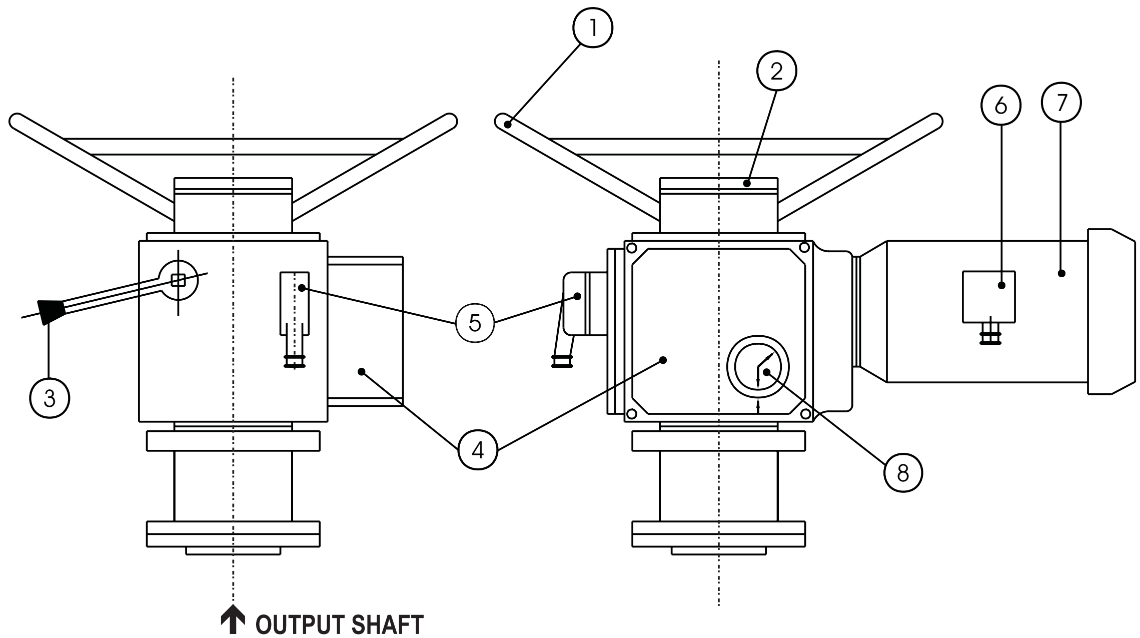
NOTE : It is advisable & recommended to cover the actuator by a canopy to protect it from rain water & heating by sun.

BLOCK DIAGRAM FOR MARSH ELECTRIC ACTUATORS



1) Hand Wheel	3) Hand Lever	5) Plug & Socket / Electrical box	7) Motor
2) Spindle Cover	4) Limit Switch Compartment	6) Motor Terminal box	8) Local Position Indicator

STEPS TO BE TAKEN TO INSTALL & COMMISSION THE THREE PHASE ELECTRIC ACTUATORS

I) INSPECTION & KNOWING THE PRODUCT :

* After receiving the unit inspect for the physical damages, if any. Check the model specifications given on the actuator name plate with respect to the order and it's expected functions.
* Read the instructions carefully, given on the actuator in the form of anodised / engraved plates.
* Check the correctness of wiring diagram, terminal numbers, & various functions with respect to the control panel.
* The Electric Actuators are supplied with following accessories :

A) STANDARD ACCESSORIES : (Ref. Fig. No. 1)

Travel limit switches	:	1 NO+1 NC OR 2 NO+2 NC (Optional)
(Part No. 5)		Qty. : 2 Nos (Std.); 4/6/8 Nos (Optional)
Torque limit switches	:	1 NO+1 NC OR 2 NO+2 NC (Optional)
(Part No. 1 & 2)		Qty.: 2 Nos
Local Position Indicator	:	Adjustable OR Non adjustable
(Part No. 3)		
Handwheel with clutch	:	-

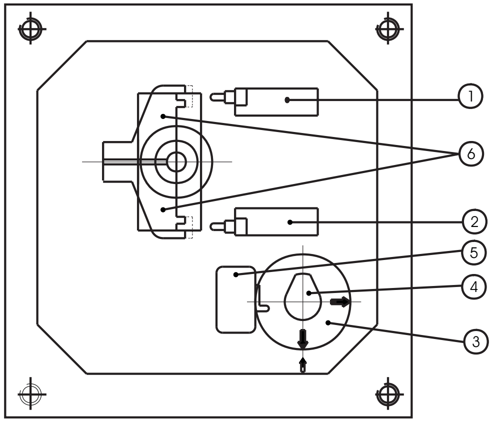


FIG. NO. 1

1) Torque Switch
2) Torque Switch
3) Local Position Indicator
4) Travel Switch Operating Cam
5) Travel Switches
6) Torque Switch Operating Levers

B) SPECIAL ACCESSORIES : (Supplied only on customer's specific requirement)

*	Feed back potentiometer	: 1Turn / 10 Turns
*	Remote Position indicator	: Analogue / Digital
*	Two wire Transmitter (Model PPT-200)	: Field/Panel Mounted
*	Transmitter Source (Model PP 400)	: Panel Mounted
*	Positioner (Model PP300)	: Panel Mounted
*	Control Panel	: Local / Remote
*	Push button Station	: Local / Remote
*	Locking arrangement for hand lever.	
*	Local starter with or without Positioner Unit	: M-Pac model

Customer is requested check and verify as to which of the above special accessories have been supplied alongwith his actuator.
The most correct source of this information are the actuator test certificates

C) The unit is supplied with commissioning spares, gasket compound & special tools.

II) NO LOAD FUNCTIONAL TESTS OF ACTUATOR

1) Check the functions of Travel, Torque switches & other accessories by means of continuity tester/ multimeter as per the wiring diagram.

2) Connect the actuator & motor terminals to the panel terminals as per the wiring diagram and connect the proper supply to the panel.

3) **Hand Operation : Ref.Fig.2**

Hand wheel with clutch mechanism is provided with the actuator to operate the unit manually. The clutch lever can be taken out & refixed in any other suitable operating position as it has been provided with a square hole for mounting purposes.

The clutch lever should be pressed in the direction of arrow fixed on the actuator. The indication of the proper engagement of the clutch is that, that the clutch lever will remain in the position & will not slip back.

If any obstruction is felt while pressing the clutch lever into hand mode then rotate the hand wheel slightly i.e. through say 30° and repeat the operation.

When the clutch gets engaged into hand mode the actuator output shaft can be driven by the hand wheel. The hand wheel has an idle movement of about 180° while rotating in the reverse direction.

When a locking arrangement is provided for the clutch lever then the same is to be used accordingly.

After the completion of manual operation the CLUTCH LEVER SHOULD NOT BE PRESSED BACK TO MOTOR MODE. The lever will automatically go back to it's normal position when the motor is started. This will happen due to motor over riding mechanism.

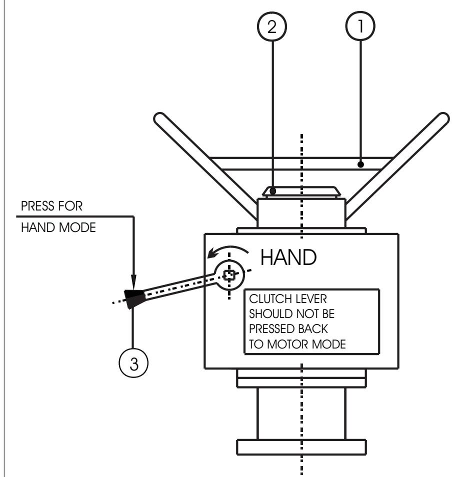


FIG NO 2

1) Hand Wheel
2) Spindle Cover
3) Hand Lever

4) Bring the actuator output shaft in the 50 % position of the complete travel so that it can move freely in either direction. This can be done through Hand Wheel mechanism as detailed above.

5) **RYB PHASE SEQUENCE :**

It is very important to check the correctness of the RYB phase sequence of the supply going to the motor. The motor will stop through the operation of torque switches, only if the phase sequence is correct. Check the correctness of phase sequence as follows:

a) Remove the round spindle cover located at the centre of the hand wheel (Ref. Fig. 2) so that the direction of rotation of the central spindle can be observed. Give a short command from the control panel to the actuator & check the direction of rotation of the main spindle at the centre of the hand wheel. If the spindle is rotating in clock-wise direction, operate the switch No.2 [The switch located in the middle portion of the control compartment] as shown in the Fig. I, to stop the motor. The switch has to be operated by pressing the knob by some external means like a screwdriver. If the above mentioned shaft is rotating in the anti-clockwise direction the switch No. I. (Ref. Fig. 1) [The switch located in the outer portion of the control compartment] is to be operated to stop the motor. In either of the above cases the motor will stop only if the RYB Phase Sequence is correct. If the motor does not stop by the respective torque switches it is an indication that the sequence of RYB Phases going to the motor is incorrect. Interchange at motor terminal box any one of the phases to make the phase sequence correct & repeat the operation.

b) The explanation given in 'a' above is suitable for "clockwise closing valves" only. For "Anti-clockwise closing valves" the positions of Torque switches No 1 & No 2 will be interchanged without changing their wire connections & hence RYB phase sequence should be choosen (one phase has to be interchanged as against 'a' above) by following the same procedure i.e. by observing clockwise rotation of the main spindle & operating the switch located in the middle portion of the control compartment to stop the motor.

c) Ensure the correctness of phase sequence throughout the operation of the actuator whenever the wiring is reconnected.

d) Please note that if the Phase sequence protector is provided in the panel it will only show the correctness of RYB phase sequence - between the main supply and the control panel. The phase sequence wiring between the panel & the actuator has to be checked by the method explained above. The phase sequence protector provided in the panel can not protect wrong phase sequence going to the motor from the panel.

6) Check finally the functions of actuator travel switches & other accessories by giving respective commands from the panel & ensure the correctness of desired functions of actuator & panel.

III) INSTALLATION & COMMISSIONING :

* Check the mounting and coupling dimensions of the actuator with respect to final control element valve / damper.
* Make provisions for the necessary hardware, set of tools, lifting arrangement, gaskets for the mating surfaces, lubricating oil for application on mating surfaces etc.
* Bring the final control element to about 50% opening position. Also bring the actuator to about 50% of full travel position & couple it to the final control element.
* Check the proper mechanical alignment and tighten the fixing hardware evenly from all the sides. Check the free rotation of the system through hand wheel, while tightening the bolts.
* Connect all the wires properly from the actuator & motor terminals to the panel & check their performance for respective functions through short commands.
* Ensure that the system is ready in all respects for commissioning.
* Ensure correctness of RYB phase sequence as per the procedure explained earlier.

SETTING OF TORQUE LIMIT SWITCHES : Fig. No. 3

A) When lhe actuator is given the short commands of forward & reverse alternately, a slight rotary movement of the Torque bracket “1” can be observed which indicates that the mechanism is in operation.

B) When the operating torque of the actuator increases, the Torque switch operating lever '2' hits the respective switch & stops the motor.

C) Remove the locking plate '3' from its' place.

D) Eccentric pin '4' can be rotated by means of a screw driver. Through this the torque operating lever '2' can be brought nearer or away from the switch knob.

E) Torque setting indicators '5' have graduation markings of short to long lines. The eccentric pin '4' has an arrow marking which when coincides with any graduation marking will indicate the setting of the actuator output torque. A calibration chart is fixed inside the actuator cover and also given in Test reports.

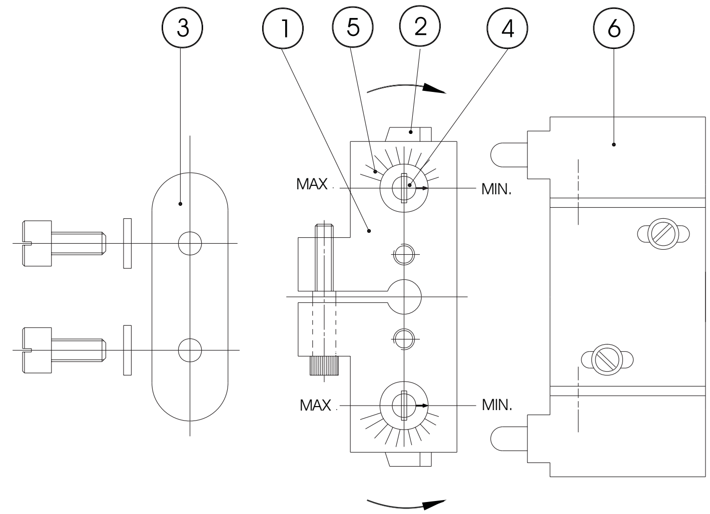


fig. no 3

1) Torque Bracket
2) Torque Switch Operating Levers
3) Locking Plate
4) Eccentric Pins
5) Torque Setting Indicators
6) Torque Switches

F) When arrow on the eccentric pin '4' coincides with the shortest line on the indicator '5', the actuator will trip at the lowest value of output torque and when the arrow coincides with the longest line of the indicator '5' the actuator will trip at the maximum rated torque. While despatching the unit from the works, the arrow position has been kept at the middle of the graduation marking range so that the actuator will trip at around 50% of rated torque.

G) During the operation under load conditions if the actuator trips due to torque switches, the torque setting can be increased as per requirements, however the setting should not exceed the maximum value. The positions of torque switches '6' and torque bracket ' 1 ' should not be disturbed.

H) Replace the locking plate '3' firmly after the setting is complete so that the setting does not get disturbed due to vibrations while in operation.

TORQUE SETTING UNIT NO

LSO		LSC	
DIV. NO	TORQUE MKG	DIV NO	TORQUE MKG
(SMALLEST) 1		(SMALLEST) 1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
11		11	
12		12	
(LARGEST) 13		(LARGEST) 13	

Torque Setting chart fixed inside the Actuator.

LSO : Torque Limit Switch - Open
LSC : Torque Limit Switch - Close

SETTING OF TRAVEL LIMIT SWITCHES : Fig. No. 4

Travel limit switches are operated by means of rotating cams. The cam projection presses the switch to stop the motor. Two travel limit switches one for opening direction - MSO and - the other for closing direction - MSC are provided with I NO + I NC or 2 NO+2 NC contacts.

The rotary movement of the indicator shaft is adjusted to maximum upto 275° rotation for the full travel of the final control element. Hence each cam will operate the switch only in one direction of rotation when the final setting is achieved.

SETTING PROCEDURE :

A) Loosen the operating cams which are tightened on the Indicator shaft by means of grub screws. Use proper allen key to loosen the grub screws of the cams.

B) Observe the rotation of the indicator shaft with respect to opening / closing movement of the final control element. Rotate the cam manually in the same direction of rotation of indicator shaft & operate the MSO Switch if the final control element is opening & MSC switch if it is closing. This will decide the "Operating direction of Cams."

C) Fully close the final control element by means of the hand wheel. 'JUST' operate the MSC i.e. closing switch through the "Operating direction of the cam" which has been identified earlier. Tighten the cam in the position & check the operation by giving commands from the panel. When the final control element stops due to the MSC operation, ensure that torque switch does not get operated simultaneously & also the closure of the final control element is complete.

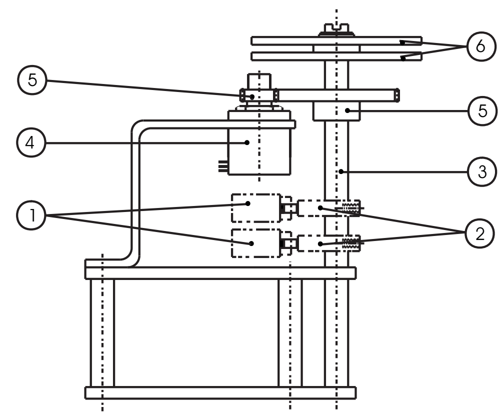


Fig no 4

1) Travel limit Switches
2) Travel limit Switch Operating cams
3) Indicator Shaft
4) Feedback Potentiometer
5) Gear Train for Potmeter
6) Local Position Indicator

D) Repeat the above procedure for the MSO-opening travel limit switch operation.

E) If the wiring diagram provided for tight shut-off closing by torque limit switch then the travel limit switch in closing direction should operate just before the actual closing of the valve & then torque limit switch should operate so that the indication on the panel will be by a "closed" indicating lamp. If only the torque switch operates the indication on panel will be of "fault". If the torque switch operates in-between the closing operation due to some obstacle then also the "fault" lamp on the panel will glow as a standard design feature.

SETTING OF LOCAL POSITION INDICATOR : Fig. No. 5

For multiturn actuators site adjustable dial indicators are supplied which can be adjusted to any degrees movement i.e. say 5° to 275°. This can be achieved by independently moving upper & lower dials. When the final control element is 'Fully Closed' adjust the Upper/Lower dial in such a way that the 'Close' indication arrow coincides with "Fix-reference mark". Repeat the procedure & set the open indication arrow for fully open position of the final control element. Check the direction of rotation of the dial while setting the above open/close arrows. For quarter-turn actuators a fixed 90° dial is provided which can be set by above procedure for the 90° movement of the final control element.

REPLACEMENT OF COVERS :

Replace all the covers firmly by putting fresh set of gaskets & apply gasket compound to ensure proper sealing.

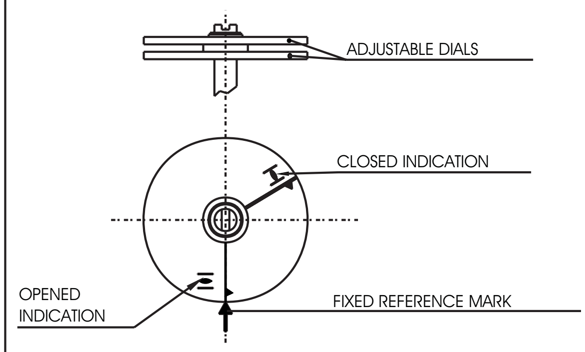


FIG NO 5

ADJUSTABLE LOCAL POSITION INDICATOR

IV. SPECIAL INSTRUCTIONS FOR QUARTER TURN AND LINEAR ACTUATORS :

Unlike the rotary actuators the quarter turn and linear actuators have a movement limitation and hence the supply to these units should be given through control panel with travel & torque switches duly interlocked as per wiring diagram and with correct RYB phase sequence. While running the actuator electrically the movement of the output end should be controlled within the prescribed limits i.e. about 100° for quarter turn actuators and the stroke length as per order specifications for linear actuators.

In the Quarter turn actuators the mechanical end stoppers are provided to arrest the over travel of the final control element. These can be set at site as a final setting. The stoppers can he adjusted few degrees after the stopping of output shaft in both directions through travel limit switches. In case of failure of travel limit switches the end stoppers will arrest the excess movement of output shaft and then the actuator motor will be stopped through torque limit switches provided the RYB phase sequence is correct and the torque setting is also within the limits. The general arrangement of end stoppers for quarter-turn models is shown in the Fig Nos 6 & 7

End Stopper arrangement for Quarter-turn Actuator

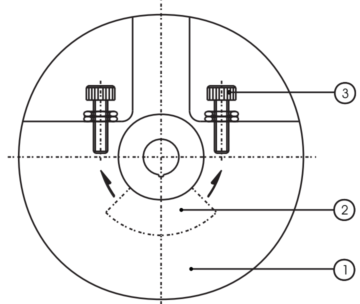


Fig No 7

1) Outer Flange
2) Sector fixed on Driving Shaft
3) End Stoppers

Quarter-Turn Worm Gear Box

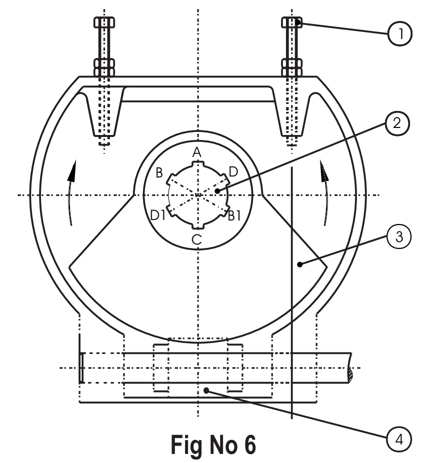


Fig No 6

1) Mechanical End Stoppers
2) Output bore & various key way positions
3) Sector Worm Wheel
4) Warm Shaft

V) SETTING OF FEED BACK POTENTIOMETER:

The potentiometer is supplied in the actuator as a special accessory to give feed back signal in terms of change in resistance with respect to the mechanical movement of the output shaft of the actuator.

The resistance output value from the potentiometer is given as per the ordering specifications or 100 to 235 Ohms when not specified in the order.

The drive to the potentiometer shaft is given through the gearing. In many cases the gear train is purposely disconnected while despatching the unit from the factory to avoid potmeter breakages during the initial commissioning.

The potmeters are supplied in single or ten turn versions as per customers requirements Ref. Fig.8. The required change in resistance of say 0 to 135 or 100 to 235 Ohms is available from the two terminals of the potmeter & hence the third terminal of the potmeter need not be connected in the circuit.

The drive of the potmeter is given through a rotary gear pair. Ref. Fig. 9.

TERMINAL DETAILS OF SINGLE & TENTURN POT-METERS

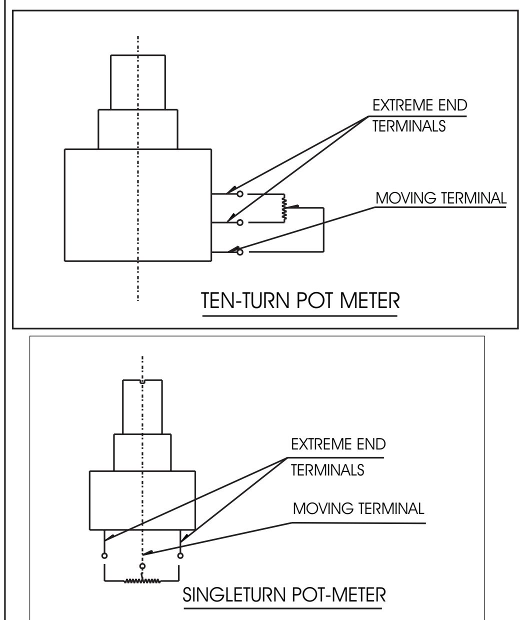


FIG.NO.8

SETTING PROCEDURE FOR POTENTIOMETER :

1) If the potmeter gear is already connected to the driving gear, then measure the potmeter output by the multimeter as per wiring diagram for the full open to close operation of the final control element. If the potmeter output is matching with the required value then the factory setting need not be disturbed. It should also be noted that the potmeter output value may not match exactly with the required one due to various mechanical limitations. The finer settings have to be done at the receiving instruments to achieve the correct end result.

2) Check the free movement of the driving gear when the potmeter gear is not connected.

3) Check the rotary movement of the driving gear with respect to the open/close movement of the final control element and decide the rotary movement it is going to impart to the potmeter gear.

4) If the potmeter output required to be set between say 100 to 235 Ohms from fully close to fully open positions of the final control element then rotate the potmeter shaft "In appropriate direction" till the output becomes 100 Ohms. Close the final control element fully and engage the potmeter gear with the driving gear. Tighten the potmeter properly as it may change its place if kept loose or break if it is over tightened.

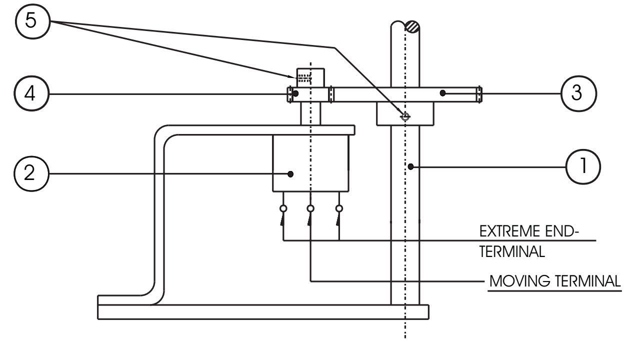


Fig No 9

1) Indicator Shaft
2) Potentiometer
3) Driving gear for pot meter
4) Driven gear for pot meter
5) Grub screw for fixing the gear

5) Measure the potmeter output by moving the final control element from fully closed position to fully open position. If the potmeter value of say 100 Ohms is set at the fully closed position of the final control element then at fully open position the potmeter will give an output of approximately say 235 Ohms (Or any other value as per order specifications)

6) If the potmeter setting is noticed in a reverse way i.e. say 235 to 100 Ohms instead of 100 to 235 ohms for the expected movement of the final control element, then disconnect the wire at the one extreme end terminal & connect it to the other extreme end terminal of the potmeter. Repeat the setting procedure as explained in point Nos. 4 & 5 above. (It is necessary to rotate the potmeter shaft in several turns in a ten turn potmeter to get the required output value, of say 100 Ohms, when the wiring of extreme end terminal is interchanged)

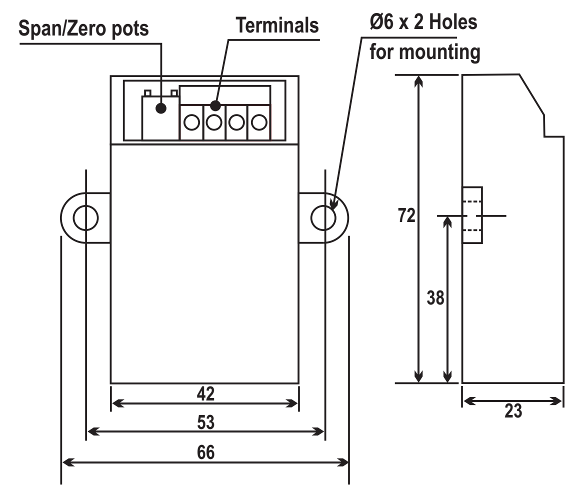
7) If the required potmeter output does not come correctly with respect to the full travel movement of the final control element then the potmeter or the gear train may have to be changed. Refer the problem to the factory.

VI) SETTING OF TWO WIRE TRANSMITTER :

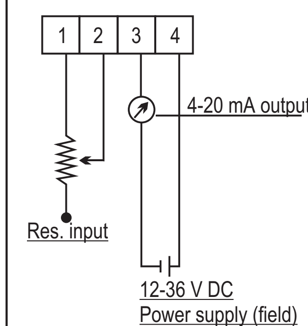
The two wire transmitter model PPT 200 when supplied with the actuator should get an input from the potentiometer fixed inside the actuator. The potmeter output is normally fixed as 100 to 235 Ohms with respect to full mechanical movement of the final control element.

The two wire transmitter needs an external supply of 12/24/36 V DC. The output of 4-20 mA is generated in the supply wire itself and can be measured by inserting an ammeter in series as shown in the wiring diagram.

DIMENSIONAL DETAILS



CONNECTION DIAGRAM



SETTING PROCEDURE:

1) Check the output from the two wires of potentiometers as 100 to 235 ohms approx. (normally) with respect to the full movement of the final control element. If the potmeter output is reverse, i.e. 235 to 100 Ohms, then change the leads of the potmeter as explained in the earlier chapter.

   The potmeter output may not be exactly accurate, however, the variation if any can be corrected by SPAN/ZERO settings provided on the transmitter.

2) Connect potmeter output to input terminals of the transmitter.

3) Connect 12/ 24 / 36 V DC supply to the output terminals of the transmitter.

4) Connect ammeter in series of supply lines as shown in wiring diagram.

5) The transmitter output will be 4-20mA corresponding to the Input of 100 to 235 Ohms.

6) Adjust SPAN & ZERO settings very slowly to get accurate output results. The span & zero settings are interdependent & hence they have to be set repeatedly to get the final accurate results.

VII) LUBRICATION :

All the units are provided with lubricating grease which is sufficient for about 15000 operations, under normal working conditions.

Procedure for second charging of grease :

* After about 15000 operations of the actuator the additional quantity of grease can be put in the actuator by removing the handwheel assembly as shown in Fig. No. 10
* Remove the four bolts which hold the handwheel assembly to the actuator main housing.
* Insert two long allen bolts in the threaded holes provided on the Hand wheel flange and tighten them evenly so that the Hand wheel assembly comes up.
* Insert sufficient Quantity of grease from the opening when the entire hand wheel assembly is removed.

Use Grease type	:	SERVOGEM EP1 of IOCL OR EQUIVALENT
Quantity (Approx)	:	4 Kgs. for basic actuator and 4 to 6 Kgs for supplementary gear boxes.

Removal of Hand wheel Assembly for Lubrication

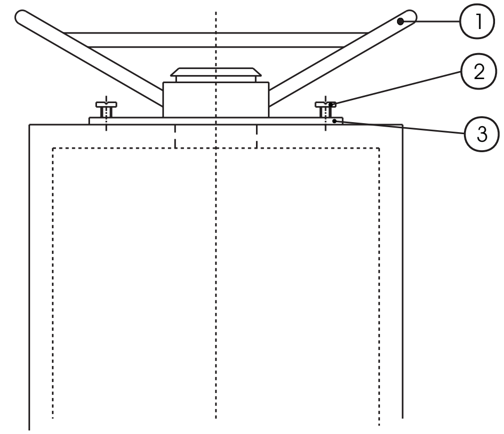


Fig No 10

1) Hand Wheel
2) Allen bolts - M8 X 100 L - 2Nos
3) Hand wheel Flange

VIII) LIKELY SITE PROBLEMS AND THEIR SOLUTIONS :-

1) ***ACTUATOR DOES NOT START IN EITHER DIRECTION FROM THE CONTROL PANEL.***

* Power supply to the motor not available — check voltages across phases & neutral.
* Neutral not available — check continuity.
* Over load relay not set properly — correct setting.
* Phase Discriminater, if provided, does not allow the motor to run due to the wrong incoming phase sequence — Interchange one of the three wires at the incoming end.
* Torque or Travel switch in the respective direction has got operated — correct the corresponding settings.
* Stop push button gets mechanically locked in pressed position — Get the lock released by slightly rotating the switch knob.
* Torque switch in respective direction operates instantaneously in forward & reverse direction — check the settings of the torque sensing mechanism. Increase the torque limits if the settings are too low. If the actuator trips even for higher values of torques then check the movement by hand operation & ensure that there is no jamming in the final control element or linkages. If the system is smooth the actuator will not stop due to torque tripping. It is also possible that the required operating torque for the final control element itself is more than the rated output torque of the actuator then the actuator selection may be wrong. Refer the case to the supplier.

* Thermostat, if provided, operates & does not allow the motor to run. — Normally the thermostat trips due to overheating of the motor, however it resets automatically as the motor cools down. It is necessary to check the reasons for overheating of the motor which may be due to excess number of starts, motor fan removed, voltage fluctuations, imbalance voltage etc.
* Incorrect wiring — check the actuator & panel wiring as per the wiring diagram and also check the functions of electrical equipment such as switches, push buttons, contactors etc.
* Gears broken — If the motor is running but the motion does not get transmitted to the out put shaft it is an indication of breakage of gear in the actuator. The actuator has to be opened & gear to be replaced. Some times, if the actuator speed is very low and if the actuator is started through panel after the hand wheel operation then it takes extra time for clutch disengagement. Allow the actuator to run for sufficient time to resume the normal operation.

2) ***TRAVEL LIMIT SWITCHES DO NOT FUNCTION PROPERLY***

* Travel switch does not get operated by cam — Loosen the switch mounting plate, shift the switch towards the cam & tighten firmly.
* Travel switch does not stop motor or give indication — check the functioning of the switch and replace if not working properly.
* Travel switch does not operate at desired position — Loosen the switch operating cam. Bring the actuator to the desired position. "Just" operate the switch by cam in the proper direction of rotation & tighten it firmly.

3) ***HAND OPERATION DOES NOT FUNCTION PROPERLY —***

* Handlever does not stay in hand mode —

— Try to fix the handlever in a convenient position so that more force can be applied in the direction of arrow fixed on the actuator.

— Rotate the hand wheel through say 90^0 before pressing hand lever.

— Press hand lever with jerk so that it rotates through the required degrees & stays in position.

* Hand lever will go back in motor mode when the motor will start. Do not try to press back the hand lever.

4) ***HANDLEVER DOES NOT GO BACK TO MOTOR MODE***

— Further rotate the handlever in the direction of hand mode & leave it instantaneously while motor is running,

— Slightly press the hand lever towards motor mode while motor is running.

* When the operational speed is very slow, it may take more time for clutch engagement hence allow the motor to run for sufficient time.