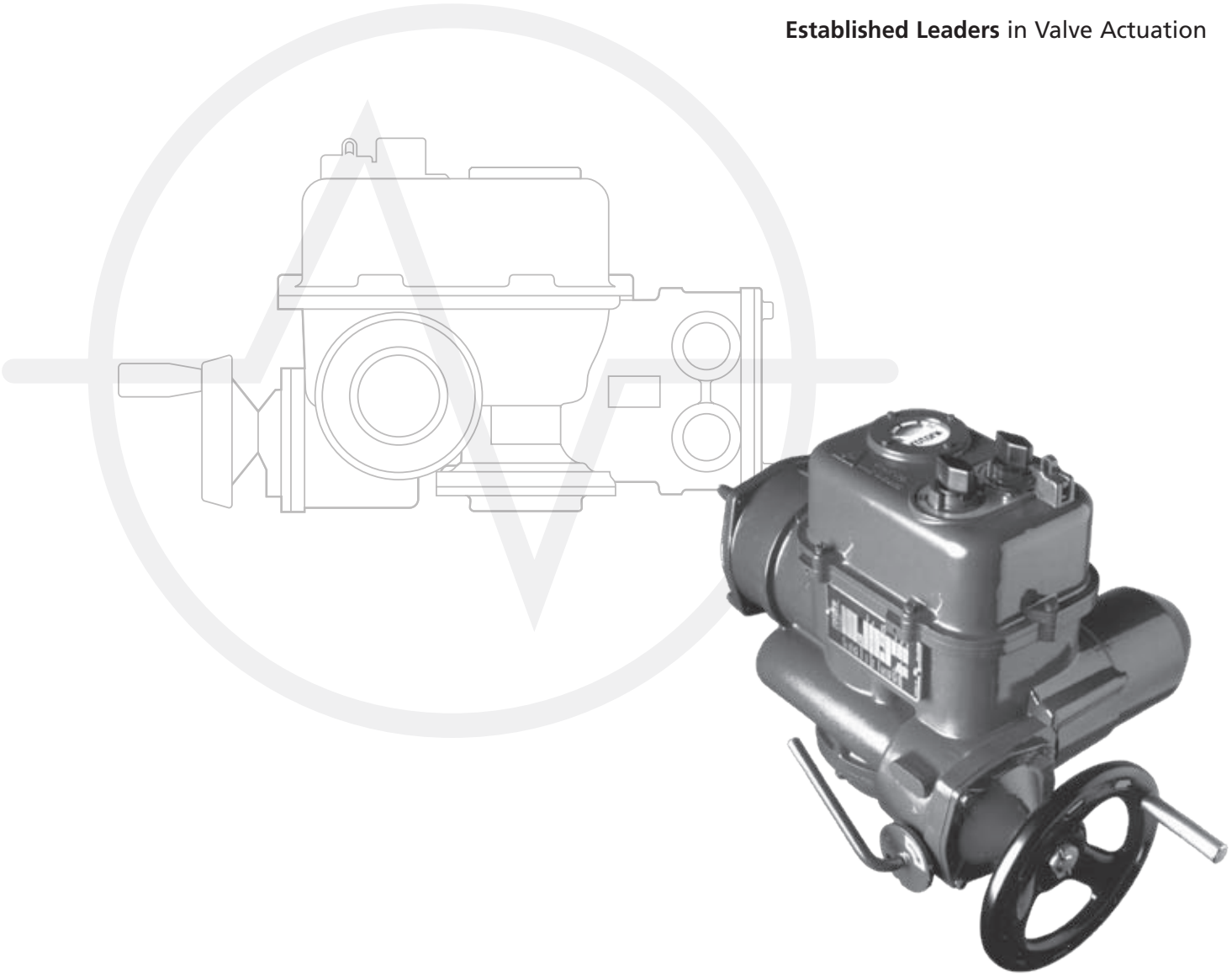
Electric Actuators and Control Systems

rotork®
Controls

Established Leaders in Valve Actuation



Q Range

Valve Actuator Electrical Specifications

Publication E620E Issue 04/09

rotork®

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Contents

Rotork actuators have been in use all around the world for over 50 years. In this time Rotork has grown to become the leader in the valve automation industry. With manufacturing, service centres, offices and representatives throughout the world, Rotork is able to offer global service solutions to your company.

In the 50 years since the company was founded, Rotork has become a byword for excellence in the field of valve, sluice gate and damper actuation products for the oil, gas, power, water and waste treatment industries - worldwide.

We owe our success to an uncompromising focus on quality at every stage - and at every level - of Rotork's operations.

From initial site survey, specification and design, through to materials, manufacturing and testing, installation, commissioning and after-sales service we accept nothing but the best.

Rotork. Established leaders in valve actuation technology.

The 'Q' Range is available in 2 electrical specifications, each with a double sealed IP68 watertight enclosure.

The Q-standard version comprises motor and limit switches and is suitable for open/close quarter turn operation without the need for a reversing contactor.

The Q-pak version contains an electronic control interface to enable remote control from internally or externally derived signals and provides actuator status monitoring outputs.

rotork® Controls

rotork® Fluid Systems

rotork® Gears

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Basic specification, control and indication specification

Power Supply

Single Phase

- 50 Hz:- 110 V, 220 V, 240 V.
- 60 Hz:- 110 V, 115 V, 120 V
  127 V, 220 V, 240 V.

All the above voltages are subject to a ± 10% tolerance. The motor is S2 rated for a 20% duty cycle according to IEC 34.2 with a maximum of 60 starts an hour.

Torque/limit switches

One each for open and closed with normally closed contacts. The torque measurement is derived from the self locking output worm and wheel gearing. One auxiliary limit switch with a change-over contact is provided for end of travel in each direction.

The ratings of the switches on inductive loads are as follows:-

- 110/240 VAC - 15 A.
- 110 VDC - 0.25 A.
- 50 VDC - 2.5 A.
- 24 VDC - 3 A.

Motor

Single phase capacitor run motors are used with 2, 4 or 6 pole class F insulated windings have an embedded thermostat for overload protection. Note: for Q-standard units a minimum delay of 2 seconds must be allowed when control signals are reversed to ensure motor reversal.

Q-standard

Terminals

The watertight terminal compartment contains the following terminal.

- 18 for control (6-32 UNC).
- 2 for power (10-24 UNC).
- 1 for earth (10-24 UNC).

Conduit Entries: 2 off M32 (1.5 p) or 2 off 1 inch NPT.

Optional Extras

- Two auxiliary limit switches each independently adjustable to any point in the valve travel.
- Anti condensation heater: 12 Watt heater to suit motor supply voltage. Internally connected to line and neutral.
- One Watt potentiometer with alternative resistance values of 5 K and 25 K Ohms.
- Current position transmitter CPT) potentiometer with electronic transducer which provides a 4-20 mA analogue position indication signal from an externally fed 15-40 Volt supply.
- Integrally mounted open/close control switch with local/ stop/remote selector.

Q-pak

Terminals

The following terminals are provided in the watertight terminal compartment.

- 44 for (6-32 UNC).
- 2 for power (10-24 UNC).
- 1 for earth (10-24 UNC).

Conduit entries: 2 off M32 (1.5 p) or 2 off 1 inch NPT**.**

Control interface module

This is housed in the cover of the switch compartment and consists of:

- A printed circuit board with logic circuits. Transformer to power the logic circuits and provide a 24 Volt DC supply for the remote control.
- Monitor relay with change-over Volt free contact.
- Motor running relay with N/O Volt free contact.
- Integrally mounted control switches for open/close control and local/stop/remote selection.

The actuator is suitable for local and remote control as selected by the local/ stop/remote switch.

In “local”, control may be push-to-run or maintained and the required mode should be specified at the order stage.

In “remote”, the control circuit may be powered by the actuator 24 Volts DC internal supply or be fed from an external supply of 20 to 120 Volts AC or DC. Remote control may be push-to-run or actuator maintained by suitable remote connections to the actuator terminals.

Remote signals should have a minimum duration of 300 ms to ensure actuator response. The guaranteed time for maximum length of signal which will be ignored is 5 ms.

Control Signal Threshold Voltages to be a minimum for ‘ON’ 20 V, maximum for ‘OFF’ 3 V.

Emergency shut down (ESD): A terminal is provided for connection of a remote ESD signal to the actuator which will over-ride any existing signal other than local stop whether the actuator is in local or remote mode. The actuator can be supplied either for opening or closing on ESD signal, which must make on ESD and be self maintained. The thermostat can be by-passed during ESD.

Optional extras

- Two auxiliary limit switches each independently adjustable to any point in valve travel.
- Anti-condensation heater: 12 Watt heater to suit motor supply voltage internally connected to line and neutral.
- One Watt potentiometer with alternative resistance values of 5 K and 25 K Ohms.
- Folomatic proportional controller.
- Pak-Scan 2 wire control field unit *(See publication AE1/10).*
- Current position transmitter (CPT) potentiometer with electronic transducer to provide a 4-20 mA analogue position indication signal fed from the internal 24 Volts DC supply. Alternatively, the CPT can be supplied suitable for an external 15-40 Volts DC supply.

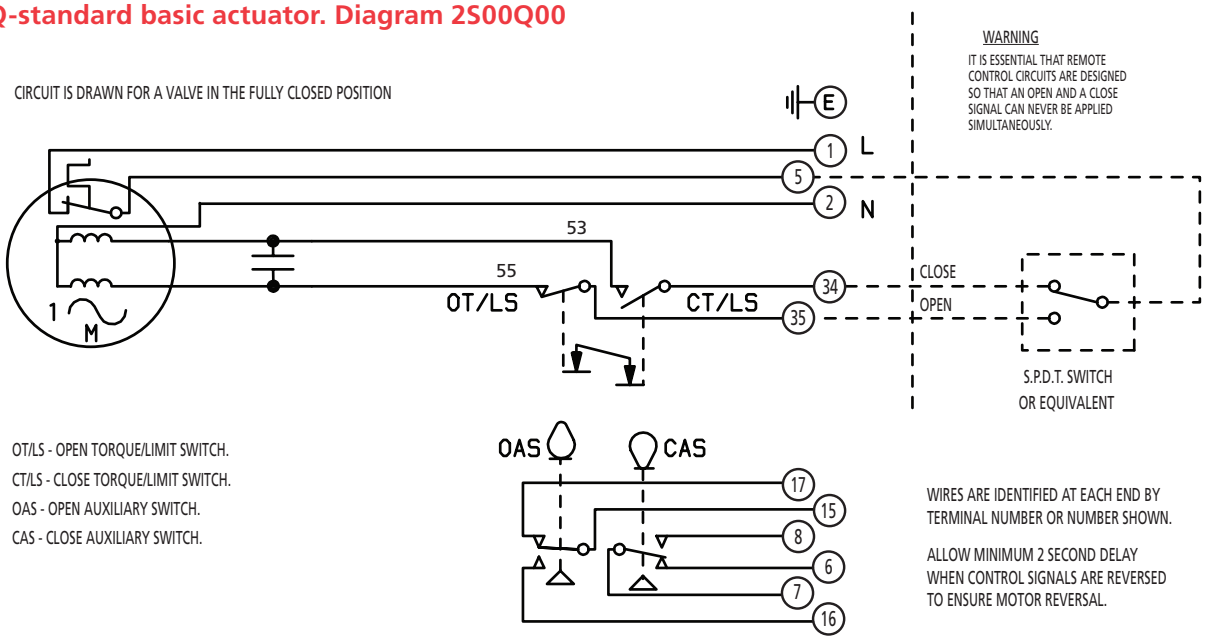
Zero and Span adjustments are provided over the following ranges:

- Zero: 3.33 - 5.5 mA.
- Span: 17.7 - 34.34 mA.

The maximum total external impedance must not exceed 200 Ohms.

Actuator control circuits

Q-standard basic actuator. Diagram 2S00Q00

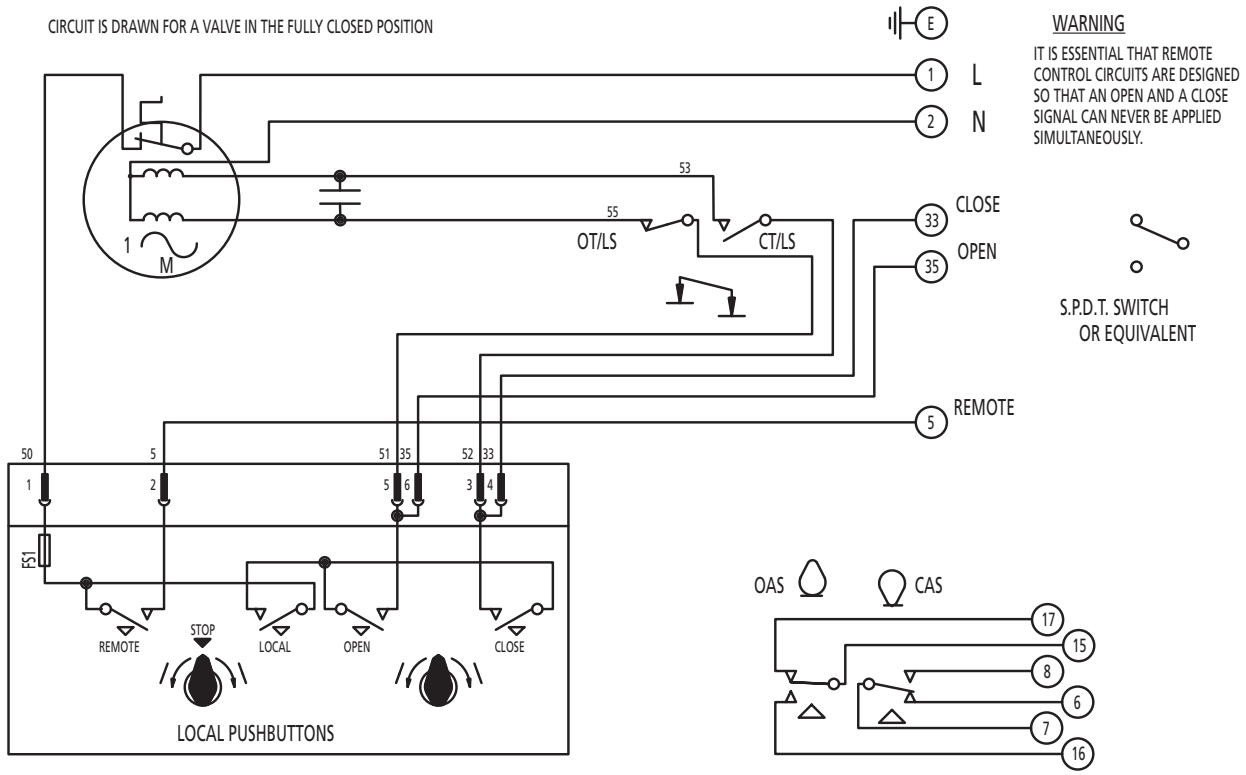


OT/LS - OPEN TORQUE/LIMIT SWITCH.
CT/LS - CLOSE TORQUE/LIMIT SWITCH.
OAS - OPEN AUXILIARY SWITCH.
CAS - CLOSE AUXILIARY SWITCH.

WIRES ARE IDENTIFIED AT EACH END BY TERMINAL NUMBER OR NUMBER SHOWN.

ALLOW MINIMUM 2 SECOND DELAY WHEN CONTROL SIGNALS ARE REVERSED TO ENSURE MOTOR REVERSAL.

Basic actuator with integral pushbuttons. Diagram 2P00Q00



OT/LS - OPEN TORQUE/LIMIT SWITCH.
CT/LS - CLOSE TORQUE/LIMIT SWITCH.
OAS - OPEN AUXILIARY SWITCH.
CAS - CLOSE AUXILIARY SWITCH.

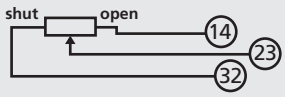
WIRES ARE IDENTIFIED AT EACH END BY TERMINAL NUMBER OR NUMBER SHOWN.

ALLOW MINIMUM 2 SECOND DELAY WHEN CONTROL SIGNALS ARE REVERSED TO ENSURE MOTOR REVERSAL.
FS1 - 6.3A

Optional features Q-standard

Basic

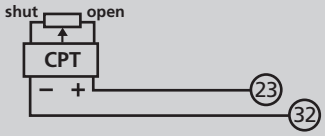
Potentiometer only



2 intermediate switches

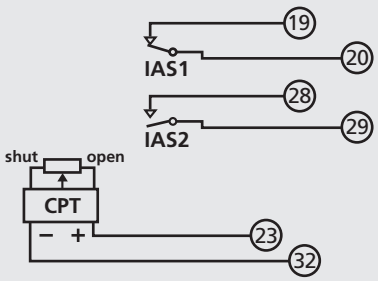
2 intermediate switches and Potentiometer

Potentiometer with Current Position Transmitter (CPT)



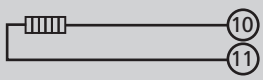
CPT is externally powered only

2 intermediate switches and CPT



CPT is externally powered only

12 Watt anti-condensation heater



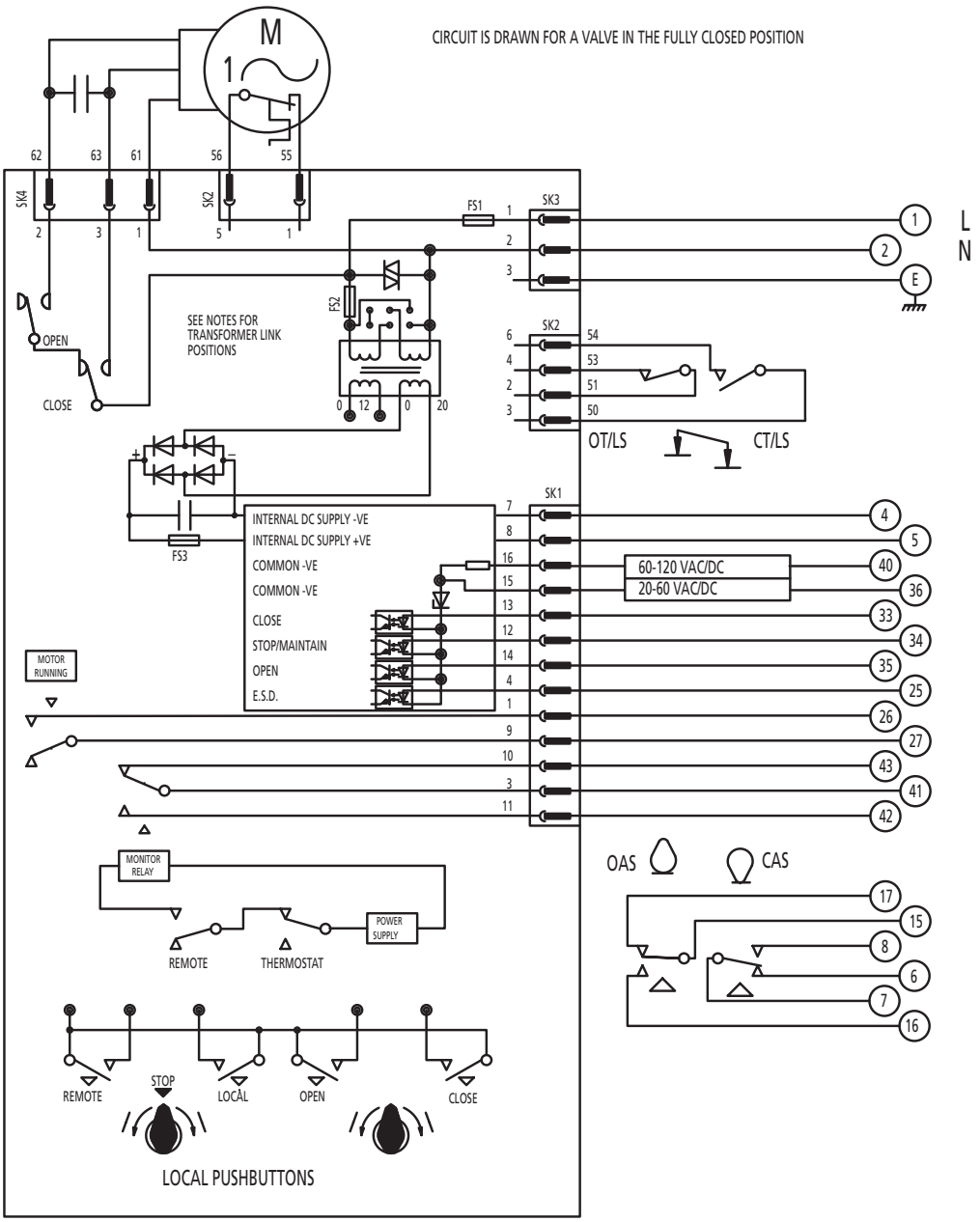
Heater is externally powered only

Without pushbuttons	With pushbuttons
2S00Q00	**2P00Q00**
2S02Q00	**2P02Q00**
2S05Q00	**2P05Q00**
2S06Q00	**2P06Q00**
2S02Q30	**2P02Q30**
2S06Q30	**2P06Q30**

Substitute '3' for '0' in third position on any of the above diagram numbers. e.g. 2S00Q00 becomes 2S30Q00

Q-pak basic actuator

Q-pak basic actuator. Diagram 1P00Q00



OT/LS - OPEN TORQUE/LIMIT SWITCH.

CT/LS - CLOSE TORQUE/LIMIT SWITCH.

OAS - OPEN AUXILIARY SWITCH.

CAS - CLOSE AUXILIARY SWITCH.

E.S.D. CONTROL SIGNAL VOLTAGE MUST BE EQUAL TO OR GREATER THAN ALL OTHER CONTROL SIGNAL VOLTAGES.

WIRES ARE IDENTIFIED AT EACH END BY TERMINAL NUMBER OR NUMBER SHOWN.

FS1 - 6.3 A

FS2 - 500 mA

FS3 - 100 mA

TERMINALS 4 & 5 FUSED INTERNALLY AT 100 mA

TRANSFORMER LINKS

120V 240 V
120V 240 V

LINKS SHOWN SET FOR 198 V - 264 V SUPPLIES

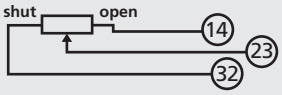
120 V 240 V
120 V 240 V

LINKS SHOWN SET FOR 99 V - 132 V SUPPLIES

Optional features Q-pak

Basic

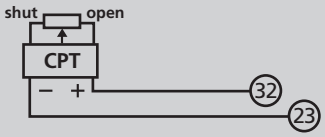
Potentiometer only



2 intermediate switches

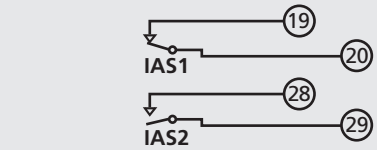
2 intermediate switches and Potentiometer

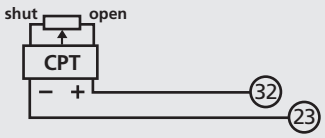
Potentiometer with Current Position Transmitter (CPT)



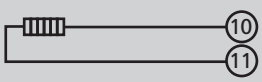
Note CPT is internally powered

2 intermediate switches and CPT



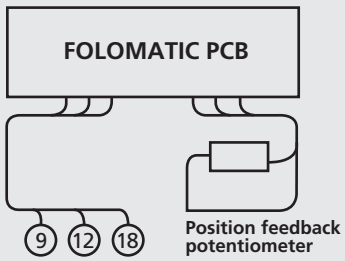


12 Watt anti-condensation heater



Basic

With Folomatic control



Customer's analogue signal inputs 9-ve and 12+ve or for potentiometer 9 and 18 with wiper to 12

IP00Q00	
IP02Q00	**IP02Q70**
IP05Q00	
IP06Q00	**IP06Q70**
IP02Q60	**IP04Q90**
IP06Q60	**IP03Q90**

Substitute '3' for '0' in third position on any of the above diagram numbers. e.g. IP00Q00 becomes IP30Q00

Remote control circuits for Q-pak

The 7-switch selector on the PCB enables various different remote control functions to be chosen. Unless specific requirements are stated with the order, actuators will be supplied with all the switches in the 'ON' position giving the functions as shown in the following table.

DIL switch	ON	OFF
1	ESD	No ESD
2	T'stat BP on ESD	No T'stat BP on ESD
3	Maintain in local	No maintain in local
4	Clockwise to close	A'clockwise to close
5	ESD close	ESD open
6 & 7	Both, close priority	Both, open priority
	Otherwise stayput	

The typical remote control circuits shown apply to actuators with switches in the 'ON' positions unless otherwise stated.

All circuits are drawn for valve fully shut.

Internally fed 24 VDC circuit

Forms 1a to 1e show typical connections for some of the remote control circuits which can be used with the 24 VDC supply available at actuator terminals 4 and 5.

Form 1a

open/close push-to-run control (Local control remains self-maintained. For local control push to run PCB selection: SW3 -> off)

Form 1b

open/close maintained control with mid-travel reversal. Customer to link 5-34

Form 1c

open/close maintained control

Form 1d

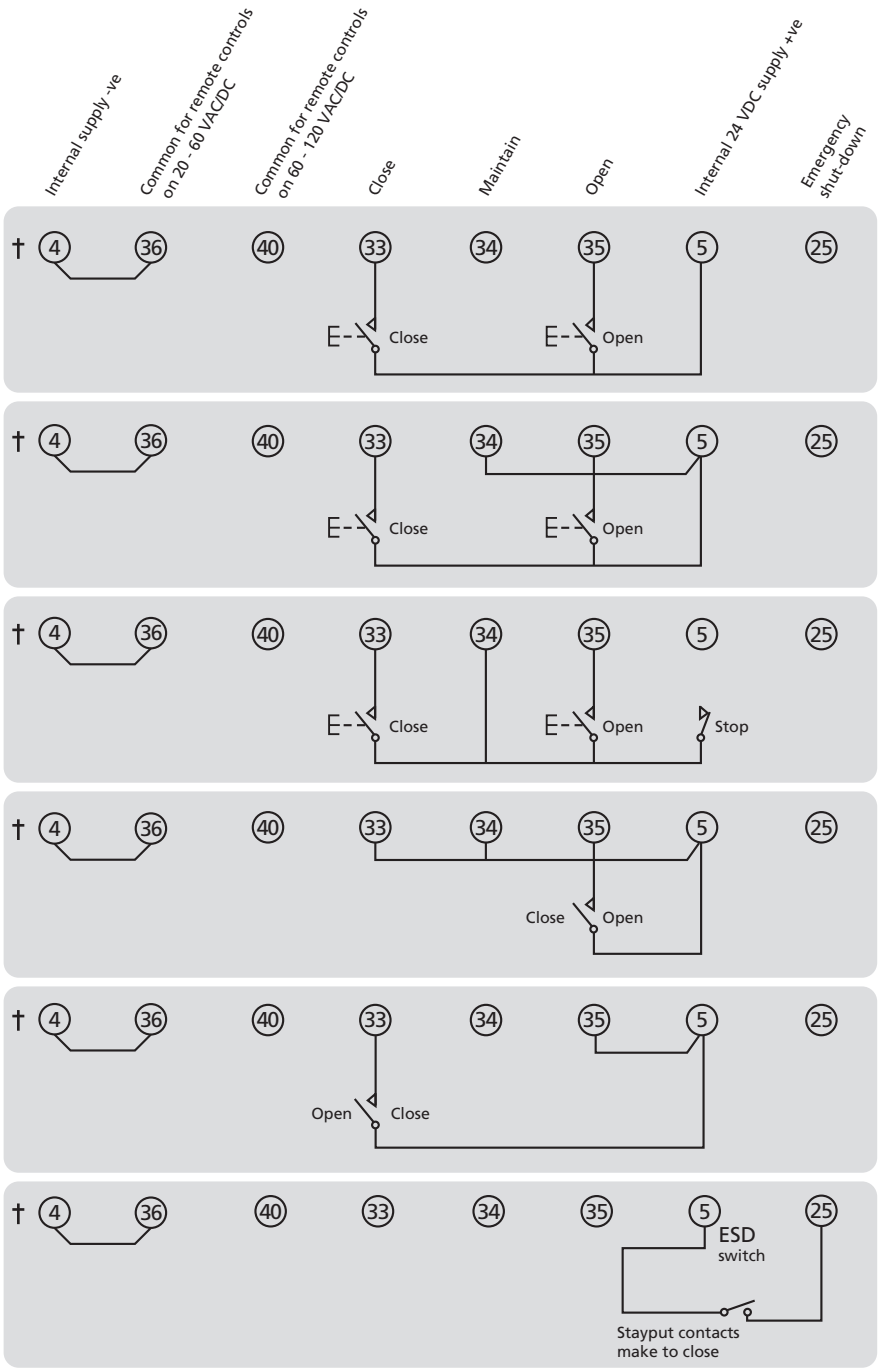
Two-wire control; energise to open, de-energise to close (PCB selection: SW6 & 7 -> off)
Customer to link 5 - 33

Form 1e

two-wire control; energise to close, de-energise to open.
Customer to link 5 - 35

Form 1f

Emergency shut-down overriding any existing signal to close valve. (May be added to any of circuits a to e above). (For ESD to open PCB selection: SW5 -> off. If thermostat is to be overridden, SW2 -> on)



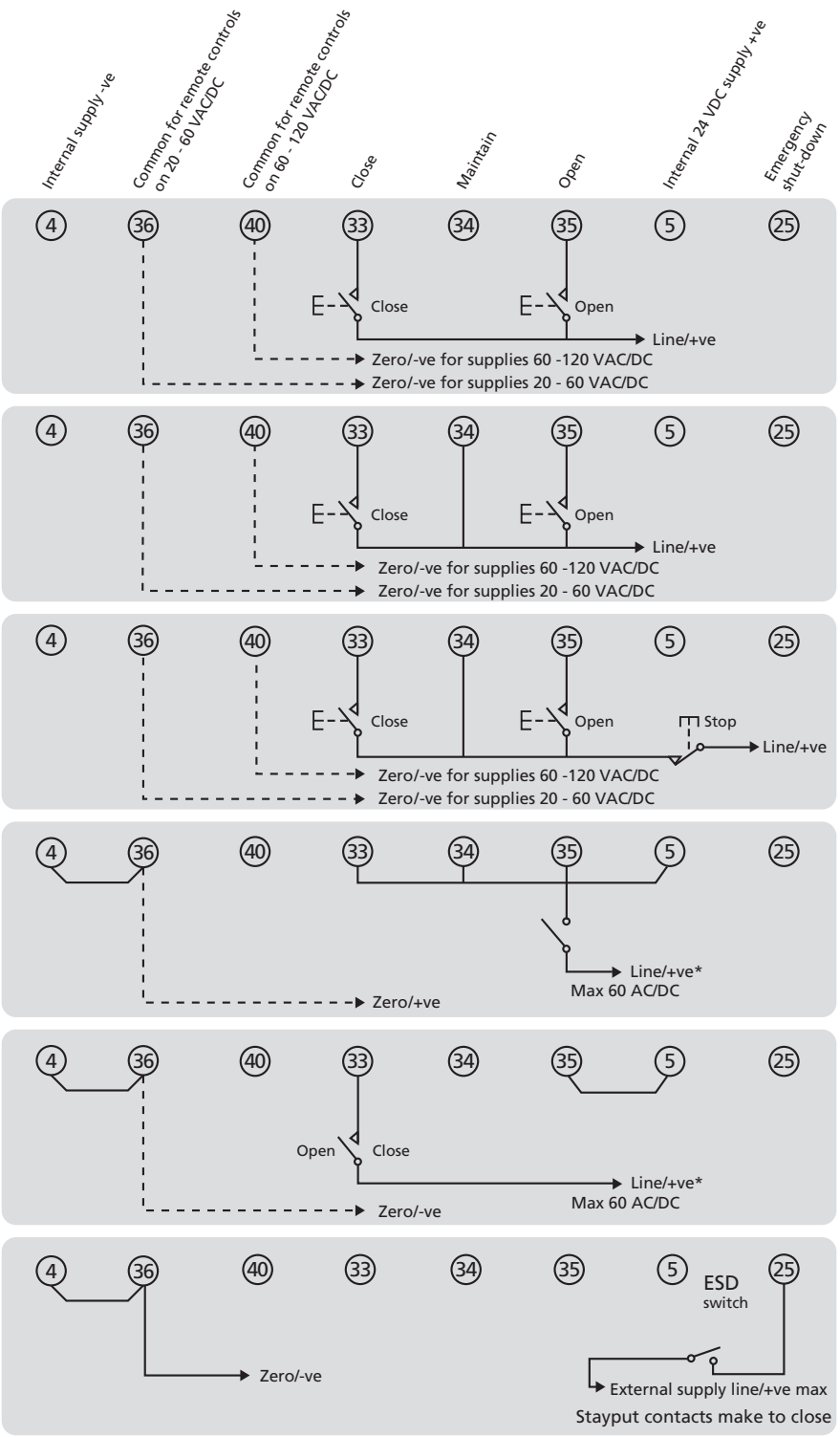
† Customer to add link 4 - 36

Fig 3

Remote control circuits for Q-pak

Externally fed circuits

Where the customer prefers to use his own external supply for the remote controls, this can be connected to the actuator as shown typically in the Form 2 circuits, depending on the voltage levels applicable.



Form 2a

open/close push-to-run control (Local control remains self-maintained. For local control push to run PCB selection: SW3 -> off)

Form 2b

open/close maintained control with mid-travel reversal

Form 2c

open/stop/close maintained control

Form 2d

Two-wire control; energise to open, de-energise to close (PCB selection: SW6 & 7 -> off)
Customer to link 4 - 36, 33 - 5

Form 2e

two-wire control; energise to close, de-energise to open.
Customer to link 4 - 36, 35-5

Form 2f

Emergency shut-down to close valve overriding thermostat and any existing signal. (May be added to any of circuits a to e above). (For ESD to open; PCB selection: SW5 -> off if thermostat to be overridden, SW2 -> on). Customer to link 4-36

Fig 4

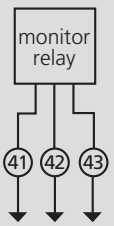
Monitoring circuits for Q-pak

Monitor relay

The monitor relay will give an alarm on the following: all of which make the actuator not available for remote control:-

Loss of power supply
Motor thermostat tripped
Local stop selected
Local/remote selector not in remote

The monitor relay has a change over contact, normally open on terminals 41-42 and one normally closed on terminals 41-42, so that availability for remote control can be monitored.



Motor running and end position indication

The 'motor running' (fig 5). 'exact end position' (fig 6) and 'sequence failure' (fig 7) indication circuits can be usually be employed without prejuduce to the control facilities or vice versa. However repeating the motor running relay and auxiliary switches by customer's relays or logic circuits when necessary will enable several facilities to be used in combination.

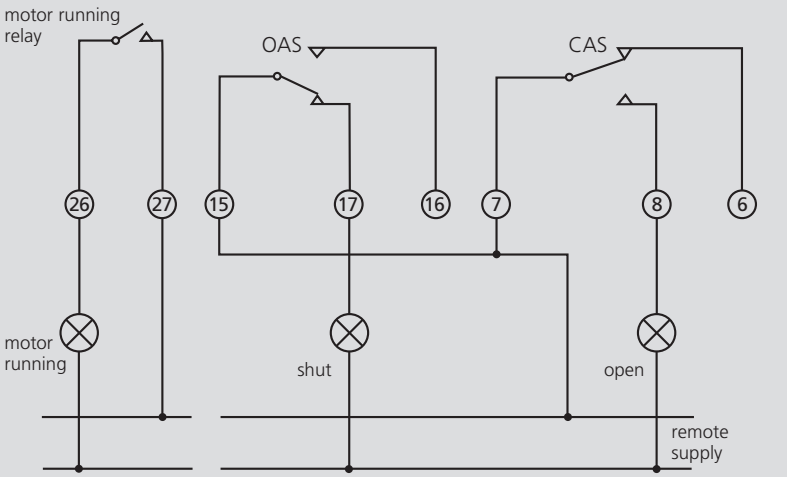


Fig 5
Connections for motor 'running' and approximate end position indication (both lamps illuminated during travel).

Exact end position indication

Particular attention is drawn to the significance of the 'exact end position' indication facility (fig 6) as compared with the normal 'approximate end position' indication (fig 5). When non-maintained push-to-run or incremental control is used, and particularly when derived from a computer, the normal end position indication from an auxiliary limit switch is inadequate. Because it must trip before the valve seats, it will cause premature disconnection of the control signal. Connecting R2 with OAS and CAS gives the required result. With the valve open, for instance, the 'open' lamp will be lit by CAS. Pressing the 'close' button will close R2 which will not affect the indication. Actuator movement will be indicated when OAS resets to 'light' the close lamp. Both lamps will be on during travel and the 'open' lamp will not go out until CAS has been tripped and R2 also drops out. This signifies the disconnection of the relay by its travel limit or torque switch and indicated the exact moment at which the control signal should be removed.

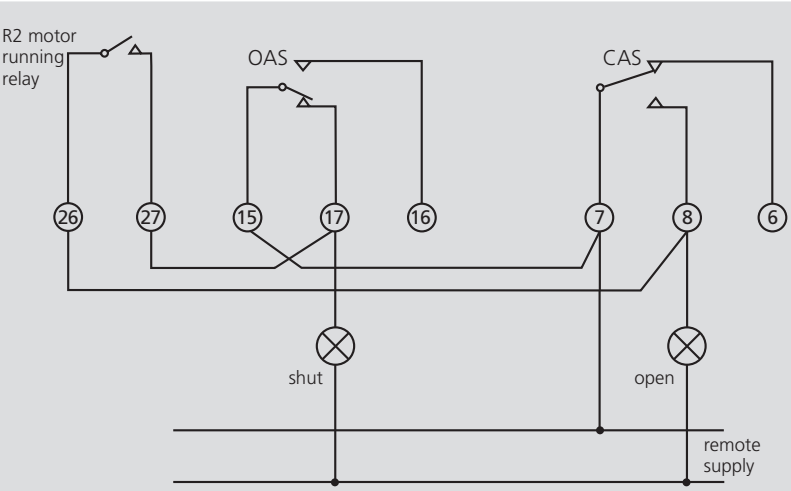


Fig 6
Exact end position indication (both lamps illuminated during travel). Customer to link 7-15, 8-26, and 17-27.

Monitoring circuits for Q-pak

Sequence failure alarm

Sequence failure alarm (valve stopped in mid-travel). With automatic sequencing it is important to know if the valve has failed to complete its travel. This may be due to a loss of power supply, loss of control supply, unauthorized local stop or, very rarely, valve obstruction causing torque switch trip in mid-travel. Connecting R2 in parallel with auxiliary limit switches OAS and CAS as shown in fig 7 enables this failure to be detected. An alarm relay normally energized through these contacts will only be de-energized in intermediate position.

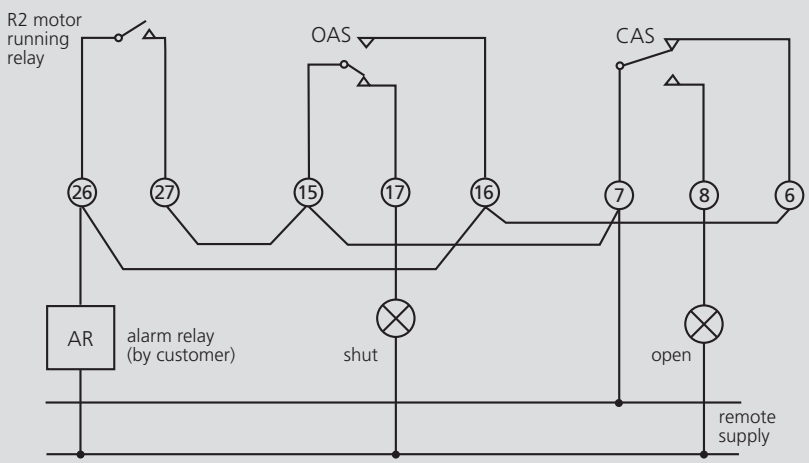


Fig 7
Connections for 'sequence failure alarm' and approximate end position indication (both lamps illuminated during travel). Customer to link 26-16, 27-15, 15-7 and 16-6.

Potentiometer position transmitter

A potentiometer, gear driven from the actuator output, provides the simplest and most economical method of transmitting an analogue electrical signal for remote valve position indication and may be connected directly to a voltmeter-type position indicating instrument (see section on CPT for Current Signals).

For analogue voltage signal applications, unstabilised AC or DC supplies may normally be used. The indicating instrument should have a full scale deflection with 75% of the nominal supply voltage and be provided with a trimming resistor to cater for the remainder, to compensate for the effects of the line drop and differing potentiometer movements.

Because the potentiometer has to be gear driven from a variable number of valve turns, scale adjustment must be possible to allow for steps of gearing, as well as voltage drops. The scale adjustment should allow for anything between 75% and 100% of full travel of the potentiometer to correspond with 100% valve travel. It is therefore important that full scale deflection of a voltmeter should not be 100% of supply voltage but 75% of it, the trimming resistor catering for the remainder. The trimmer should be located adjacent to the indicator for ease of scale setting; it is not provided as part of the actuator.

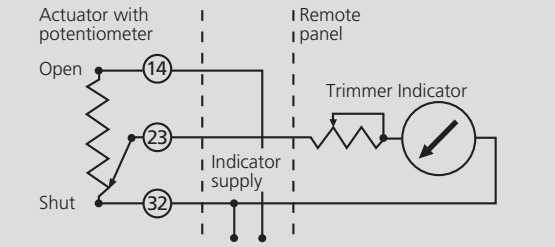


Fig 8
Standard potentiometer rated at 1 Watt with resistance values of 5 k or 25 k Ohms for a maximum voltage of 50 V or 125 V respectively.

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