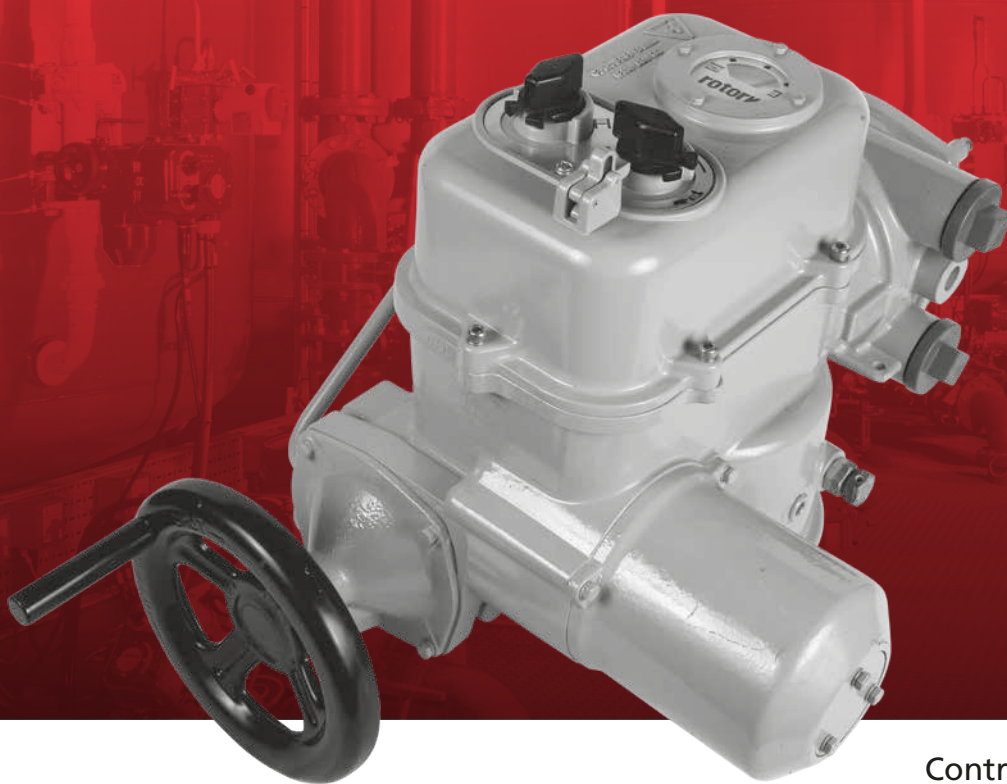


# rotork®

Keeping the World Flowing  
for Future Generations

Q Range



Control and Monitoring Facilities



Section	Page
<b>Basic specification, control and indication specification</b>	<b>3</b>
<b>1-Phase Q Standard</b>	
Control Circuit	4
Optional Features	5
<b>3-Phase Q Standard</b>	
Control Circuit	6
Optional Features	7
<b>1-Phase Q Pak</b>	
Control Circuit	8
Optional Features	9
<b>3-Phase Q Pak</b>	
Control Circuit	10
Optional Features	11
<b>Remote control circuits for Q Pak</b>	<b>12</b>
<b>Monitoring circuits for Q Pak</b>	<b>14</b>

Rotork actuators have been in use all around the world for over 60 years. In this time Rotork has grown to become the market 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 60 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.

## Q Range actuators are available in various electrical configurations:

### Q Standard

Suitable for external motor control centres.

- 1-phase or 3-phase power supply
- AC squirrel cage motor with reduction gearing
- Torque limit protection and position switches
- Adjustable stop bolts
- Double sealed IP68 enclosure
- Optional pushbuttons

### Q Pak

Comprises all the features of Q Standard with the following additional benefits.

- Integral motor starter switchgear
- Electronic control interface with customer supply output
- Discrete hardwired control inputs
- Status monitoring relay outputs
- Standard pushbuttons

# Basic specification, control and indication specification

## Power Supply

Supply Type	50 Hz	60 Hz
3-phase	380	440
	400	460
	415	480
1-phase	110	110
	115	115
	120	120
	220	220
	230	230
	240	240

All the above voltages are subject to a  $\pm 10\%$  tolerance.

3-phase duty - Class A & B (EN 15714-2) or S2 - 20% (IEC 60034-1) maximum 60 starts per hour.

1-phase duty - Class A & B (EN 15714-2) or S2 - 20% (IEC 60034-1) restricted to a maximum of 5 consecutive operations and 60 starts per hour.

## Torque/limit switches

Two normally closed switches, one for each direction to provide open and closed protection. Torque measurement is derived from the self locking output worm and wheel gearing. Two auxiliary change-over position switches.

Switch ratings for 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

Motors are high torque, low inertia squirrel cage design induction type. Thermal protection is embedded within the motor windings. Temperature rise is limited to class B and standard motor insulation is class F. Class H insulation is available as an option.

1-phase motors are capacitor run. 1-phase Q Standard units require a minimum delay of 2 seconds when reversing motor direction.

## Terminal connection

The watertight terminal compartment contains the following terminals:-

- 18 for control: M4 (6-32 UNC)
- 2 or 3\* for power: M5 (10-24 UNC)
- 1 for earth: M5 (10-24 UNC)

Conduit Entries: 2 off M32 x 1.5p or 2 off 1" NPT.

\*2 power terminals for 1-phase and 3 power terminals for 3-phase.

## Q Standard

### Optional extras

- Two auxiliary position switches each independently adjustable to any point in the valve travel
- Anti condensation heater: 12 Watt externally supplied
- One Watt potentiometer with alternative resistance values of 5K and 25K Ohms
- Current position transmitter (CPT) provides a loop powered (24 VDC nominal) 4-20 mA analogue position indication signal
- Integrally mounted local selectors offering open/close input and local/stop/remote mode selection.

## Q Pak

### Control interface module features:

- Reliable PCB logic control
- 24 VDC customer output
- Monitor relay - change-over, potential free contact
- Motor running relay - normally open, potential free contact.
- Integrally mounted local selectors offering open / close input and local / stop / remote mode selection

In LOCAL mode, control can be push-to-run or maintained. Operation type must be specified in the order.

In REMOTE mode, control is via hardwired inputs using the 24 VDC customer supply or an external 20 - 120 VAC / VDC supply.

Remote control can be maintained or push-to-run by making or breaking the signal connection on the stop / maintain input.

Remote signals should have a minimum duration of 300 ms to ensure actuator response.

Control signal threshold voltages require a minimum of 20 V for ON and maximum of 3 V OFF.

A remote emergency shut down (ESD) signal to the actuator will override any existing signal in LOCAL or REMOTE with the exception of STOP mode. The ESD action can be set to open or close the actuator. ESD signal must be maintained and the actuator thermostat can be bypassed during ESD.

### Optional extras

- Two auxiliary position switches each independently adjustable to any point in valve travel
- Anti-condensation heater: 12 Watt externally supplied
- One Watt potentiometer with alternative resistance values of 5 K and 25 K Ohms
- Folomatic proportional positioning controller
- Pakscan™ 2 wire control field unit (See PUB059-020)
- Current position transmitter (CPT) to provide an internally or loop powered (24 VDC nominal) 4-20 mA analogue position indication signal

Zero and Span adjustments are provided over the following ranges:

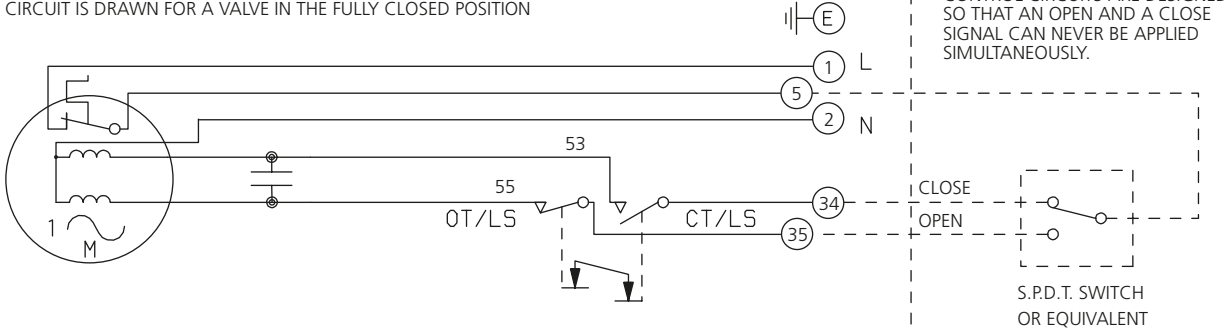
- Zero: 3.33 - 5.5 mA
- Span: 17.7 - 34.34 mA

The maximum total external impedance must not exceed 200 Ohms.

# 1-Phase Q Standard - Control Circuit

## Q Standard basic - 2S00Q00

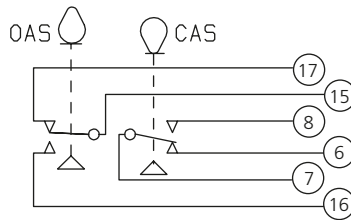
CIRCUIT IS DRAWN FOR A VALVE IN THE FULLY CLOSED POSITION



**WARNING**  
IT IS ESSENTIAL THAT REMOTE CONTROL CIRCUITS ARE DESIGNED SO THAT AN OPEN AND A CLOSE SIGNAL CAN NEVER BE APPLIED SIMULTANEOUSLY.

S.P.D.T. SWITCH OR EQUIVALENT

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

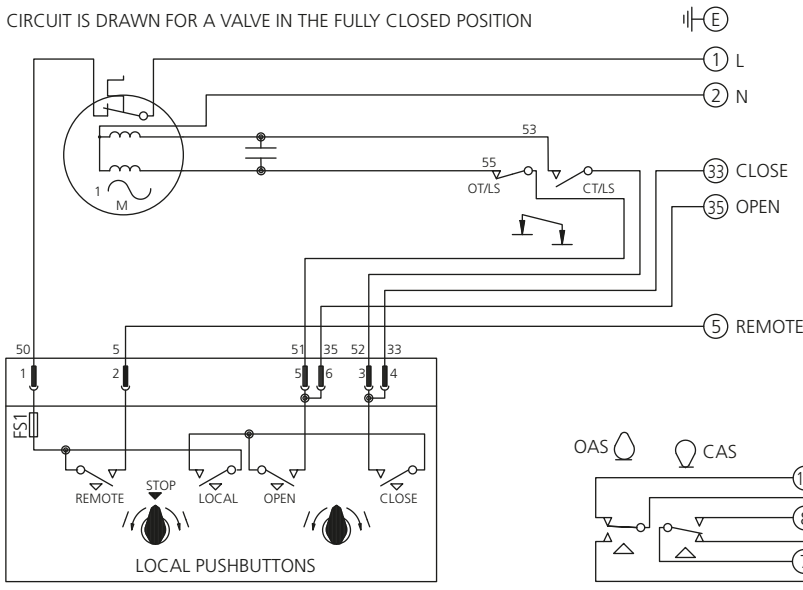


WIRES ARE IDENTIFIED AT EACH END BY TERMINAL NUMBER OR NUMBER SHOWN.

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

## Q Standard with integral pushbuttons - 2P00Q00

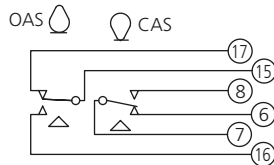
CIRCUIT IS DRAWN FOR A VALVE IN THE FULLY CLOSED POSITION



**WARNING**  
IT IS ESSENTIAL THAT REMOTE CONTROL CIRCUITS ARE DESIGNED SO THAT AN OPEN AND A CLOSE SIGNAL CAN NEVER BE APPLIED SIMULTANEOUSLY.

S.P.D.T. SWITCH OR EQUIVALENT

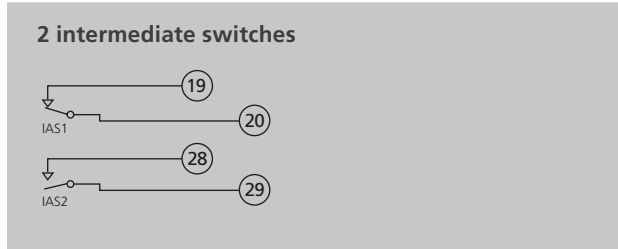
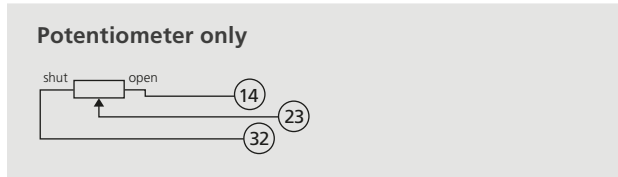
OT/LS - OPEN TORQUE/LIMIT SWITCH.  
CT/LS - CLOSE TORQUE/LIMIT SWITCH.  
OAS - OPEN AUXILIARY SWITCH.  
CAS - CLOSE AUXILIARY SWITCH.



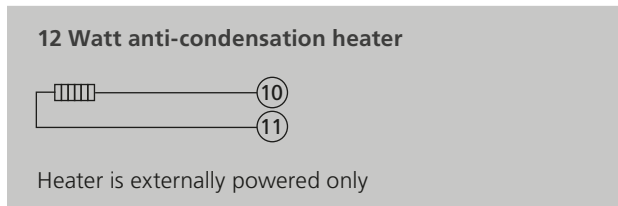
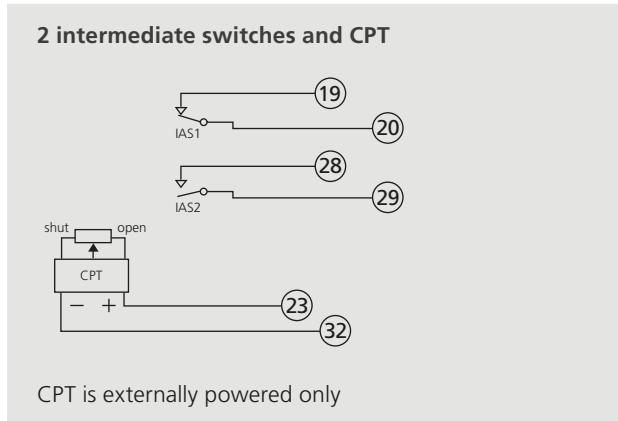
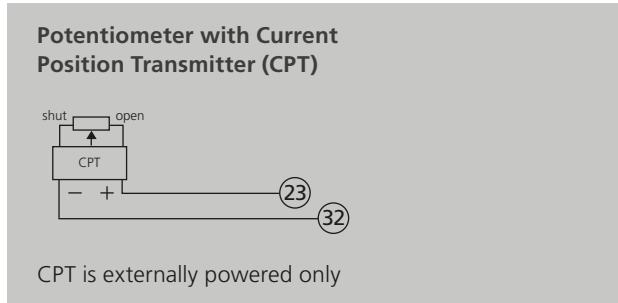
WIRES ARE IDENTIFIED AT EACH END BY TERMINAL NUMBER OR NUMBER SHOWN.  
ALLOW MINIMUM 2 SECOND DELAY WHEN CONTROL SIGNALS ARE REVERSED TO ENSURE MOTOR REVERSAL.  
FS1 - 6.3A

# 1-Phase Q Standard - Optional Features

**Basic**



**2 intermediate switches and Potentiometer**



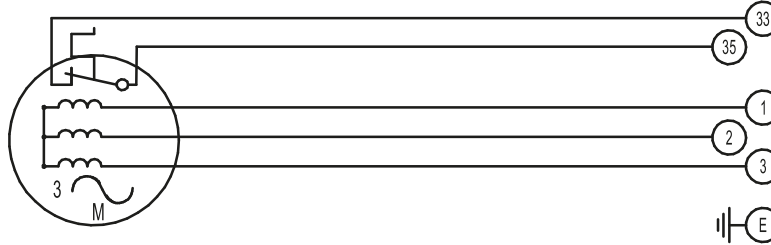
Without Pushbuttons	With Pushbuttons
2S00Q00	2P00Q00
2S02Q00	2P02Q00
2S05Q00	2P05Q00
2S06Q00	2P06Q00
2S02Q30	2P02Q30
2S06Q30	2P06Q30

Any of the above with 3 as the third character in the wiring diagram code.  
e.g. 2S30Q00 and 2P35Q00.

# 3-Phase Q Standard - Control Circuit

## Q Standard basic - 5S00Q00

CIRCUIT IS DRAWN FOR A VALVE IN THE FULLY CLOSED POSITION



### WARNING

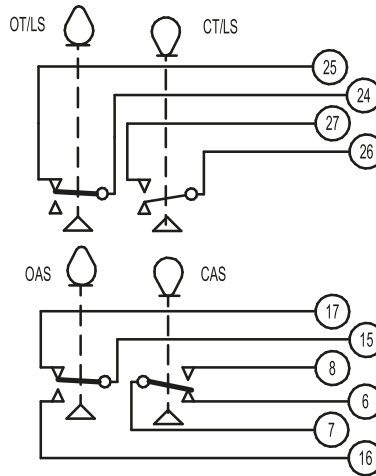
IT IS ESSENTIAL THAT REMOTE CONTROL CIRCUITS ARE DESIGNED SO THAT AN OPEN AND A CLOSE SIGNAL CAN NEVER BE APPLIED SIMULTANEOUSLY.

THERMOSTAT

3 PHASE SUPPLY

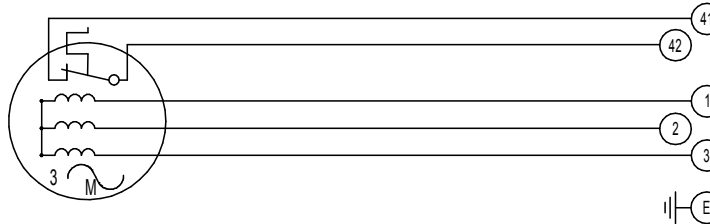
OT/LS - OPEN TORQUE/LIMIT SWITCH.  
 CT/LS - CLOSE TORQUE/LIMIT SWITCH.  
 OAS - OPEN AUXILIARY SWITCH.  
 CAS - CLOSE AUXILIARY SWITCH.

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.



## Q Standard with integral pushbuttons - 5P00Q00

CIRCUIT IS DRAWN FOR A VALVE IN THE FULLY CLOSED POSITION



THERMOSTAT

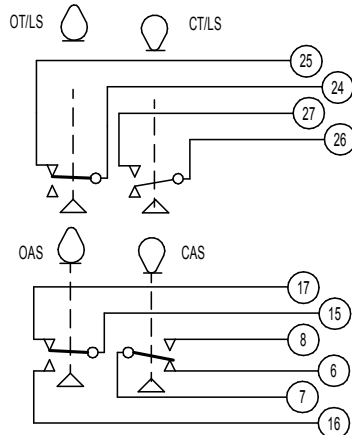
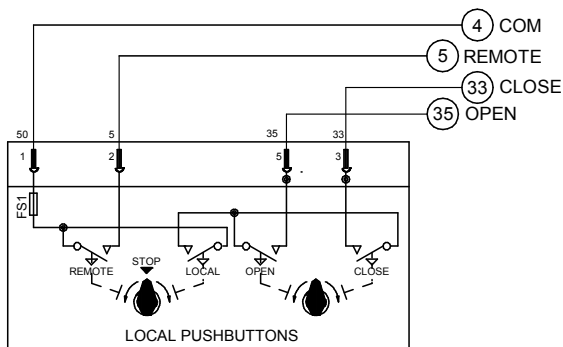
3 PHASE SUPPLY

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.

### WARNING

IT IS ESSENTIAL THAT REMOTE CONTROL CIRCUITS ARE DESIGNED SO THAT AN OPEN AND A CLOSE SIGNAL CAN NEVER BE APPLIED SIMULTANEOUSLY.

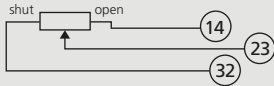


## 3-Phase Q Standard - Optional Features

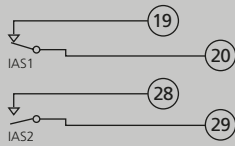
	Without Pushbuttons	With Pushbuttons
Basic	5S00Q00	5P00Q00
Potentiometer only	5S02Q00	5P02Q00
2 intermediate switches	5S05Q00	5P05Q00
2 intermediate switches and Potentiometer	5S06Q00	5P06Q00
Potentiometer with Current Position Transmitter (CPT)	5S02Q30	5P02Q30
2 intermediate switches and CPT	5S06Q30	5P06Q30
12 Watt anti-condensation heater	Any of the above with a 3 as the third character in the wiring diagram code. e.g. 5S30Q00 and 5P35Q00.	

**Basic**

**Potentiometer only**

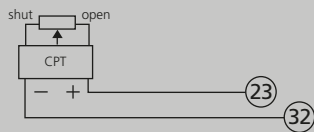


**2 intermediate switches**



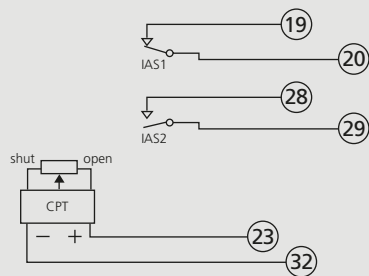
**2 intermediate switches and Potentiometer**

**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

5S00Q00

5P00Q00

5S02Q00

5P02Q00

5S05Q00

5P05Q00

5S06Q00

5P06Q00

5S02Q30

5P02Q30

5S06Q30

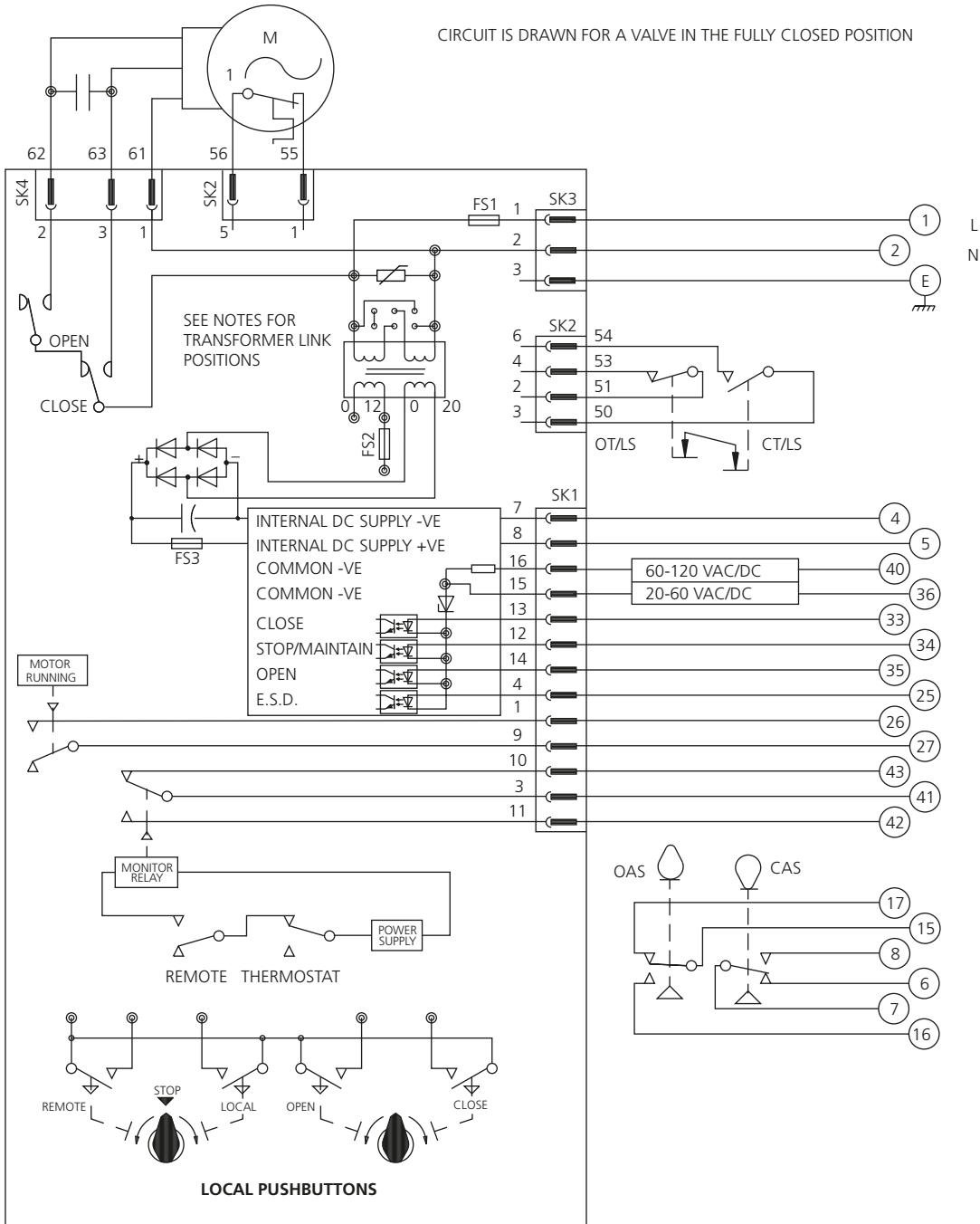
5P06Q30

Any of the above with a 3 as the third character in the wiring diagram code.  
e.g. 5S30Q00 and 5P35Q00.

# 1-Phase Q Pak - Control Circuit

## Q Pak basic - 1P00Q00

CIRCUIT IS DRAWN FOR A VALVE IN THE FULLY CLOSED POSITION



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.  
 FS1 - 6.3 A  
 FS2 - 250 mA  
 FS3 - 160 mA  
 TERMINALS 4 & 5 FUSED  
 INTERNALLY AT 100 mA

### TRANSFORMER LINKS

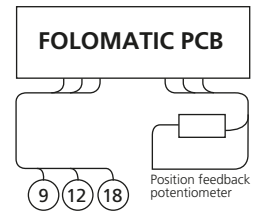
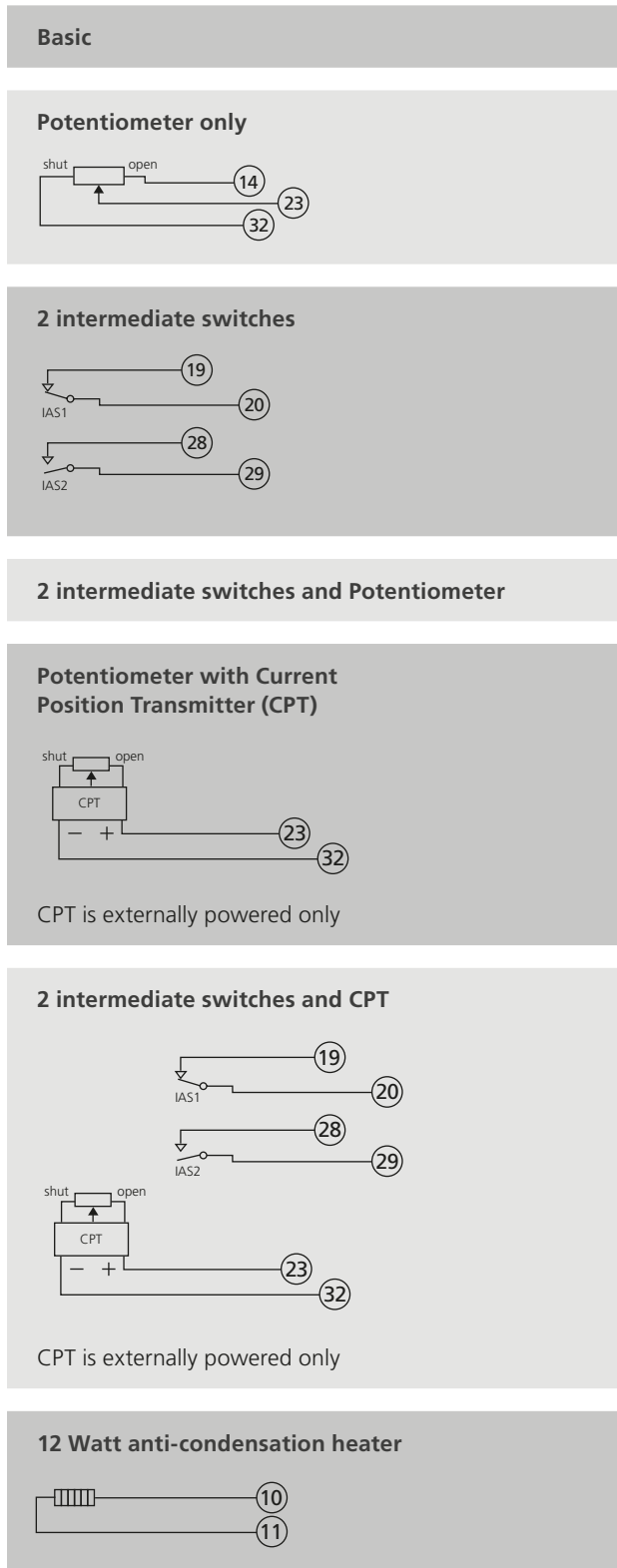
120V ○ 240 V  
 120V ○ 240 V  
 LINKS SHOWN SET FOR  
 198 V - 264 V SUPPLIES

120 V ○ 240 V  
 120 V ○ 240 V  
 LINKS SHOWN SET FOR  
 99 V - 132 V SUPPLIES

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



# 1-Phase Q Pak - Optional Features



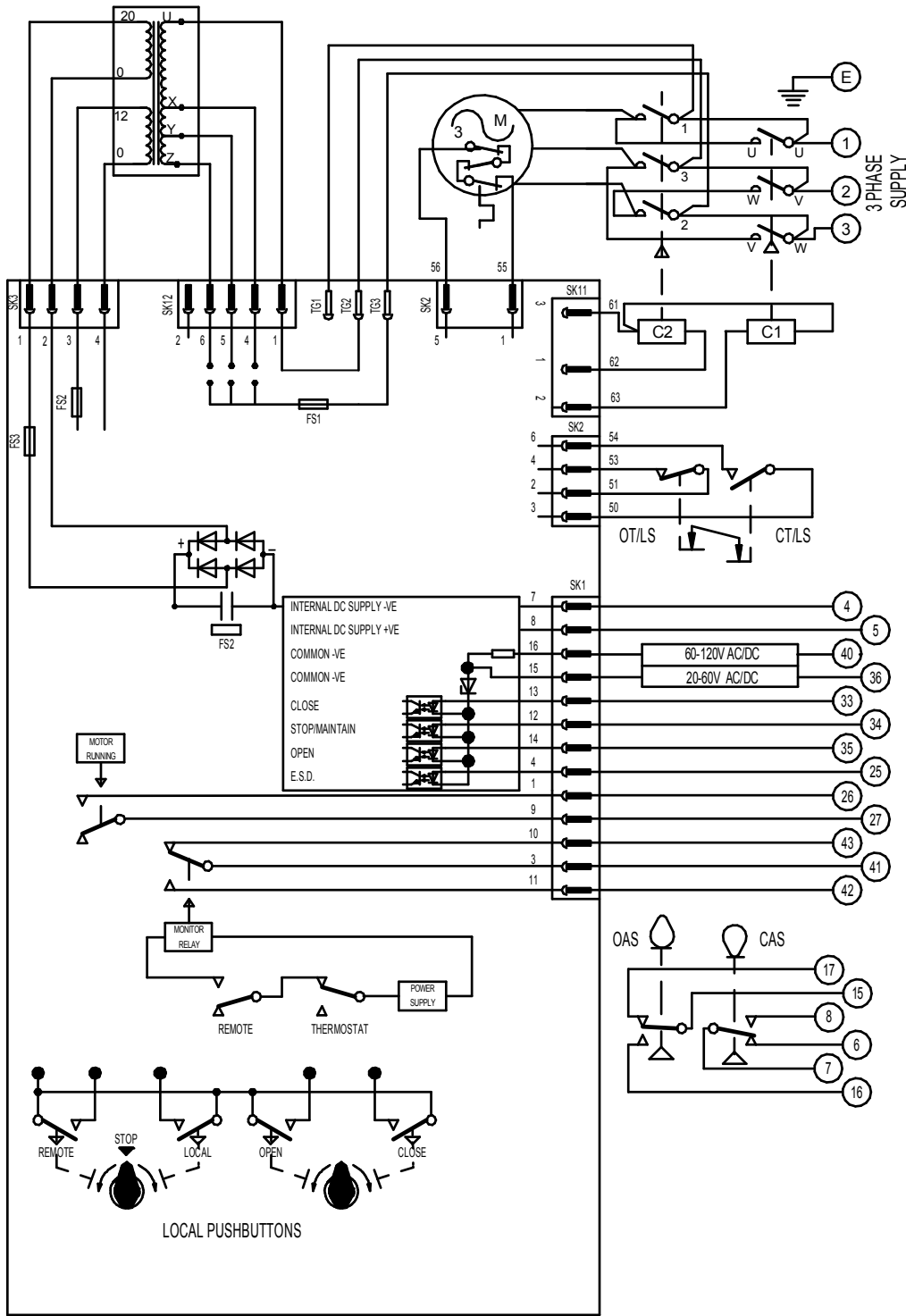
Customer's analogue signal inputs 9-ve and 12+ve or for potentiometer 9 and 18 with wiper to 12.

Basic	With Folomatic control
1P00Q00	-
1P02Q00	1P02Q70
1P05Q00	-
1P06Q00	1P06Q70
1P02Q60	1P04Q90
1P06Q60	1P03Q90

Any of the above with a 3 as the third character in the wiring diagram code.  
e.g. 1P00Q00 and 1P30Q00.

# 3-Phase Q Pak - Control Circuit

## Q Pak basic - 6P00Q00



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 - 100 mA

FS2 - 1 A

FS3 - 250 mA

TERMINALS 4 & 5 FUSED INTERNALLY AT 160mA

### TRANSFORMER TAPPING OPTIONS

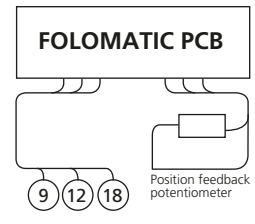
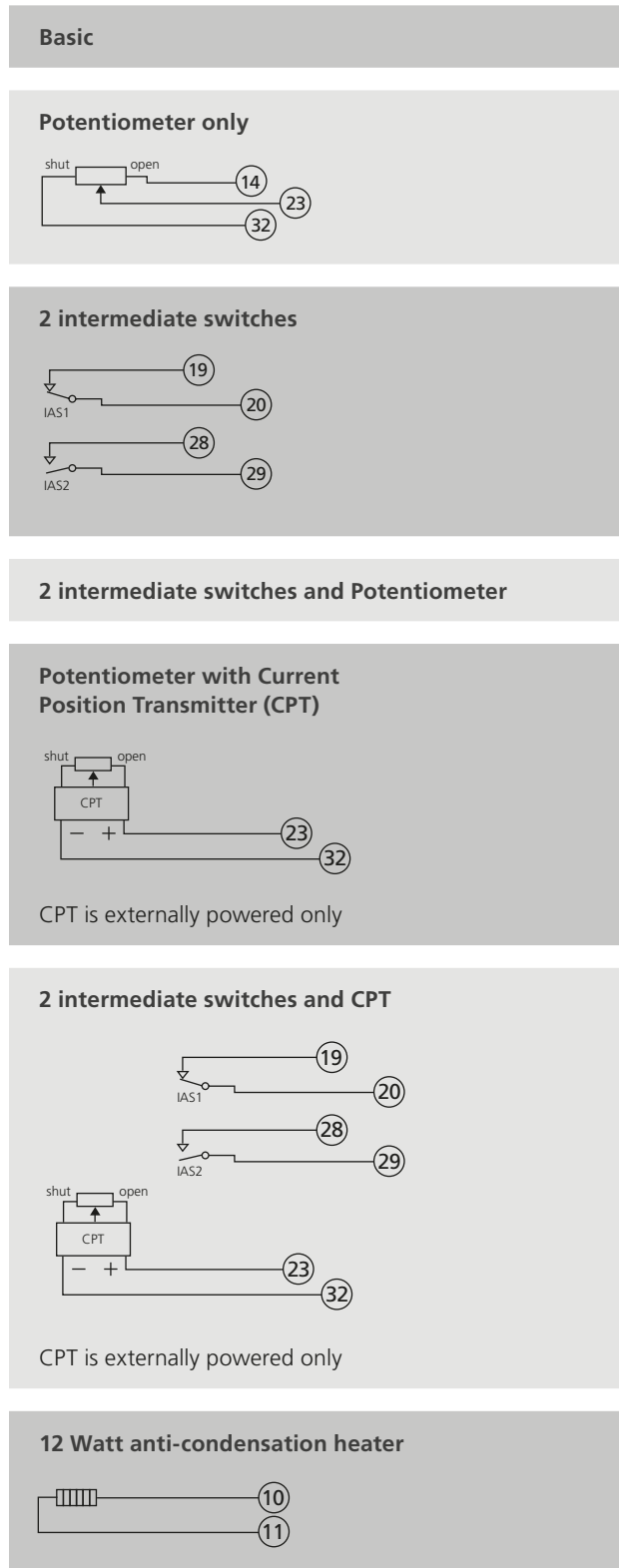
TAP	NOM50/60HZ	50HZ	60HZ
X	380/440	342-418	396-484
Y	400/460	360-440	414-506
Z	415/480	373-457	432-528

JUMPER AT LK2 FOR TAPPING X

JUMPER AT LK3 FOR TAPPING Y

JUMPER AT LK4 FOR TAPPING Z

# 3-Phase Q Pak - Optional Features



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

Basic	With Folomatic control
6P00Q00	-
6P02Q00	6P02Q70
6P05Q00	-
6P06Q00	6P06Q70
6P02Q60	6P04Q90
6P06Q60	6P03Q90

Any of the above with a 3 as the third character in the wiring diagram code.  
e.g. 6P00Q00 and 6P30Q00.

# Remote control circuits for Q Pak

The 7-switch selector on the logic PCB enables configuration of various different remote control functions. 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 adjacent table.

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

DIL switch	ON	OFF
1	ESD	No ESD
2	Thermostat bypass on ESD	No Thermostat bypass on ESD
3	Maintain in local	No maintain in local
4	Clockwise to close	Anticlockwise to close
5	ESD close	ESD open
6 & 7	Both, close priority	Both, open priority

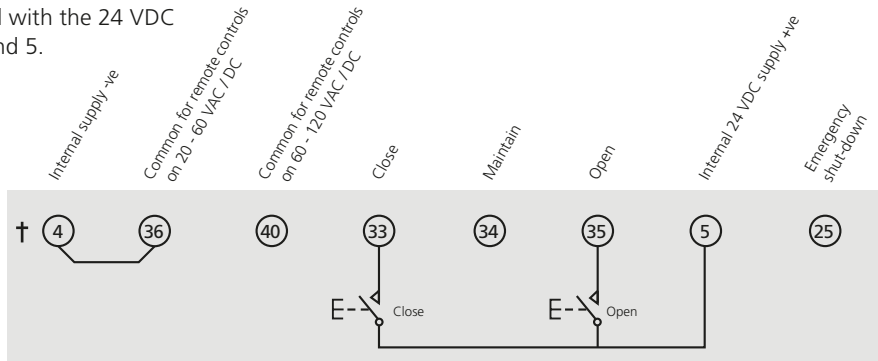
Otherwise stayput

## 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.

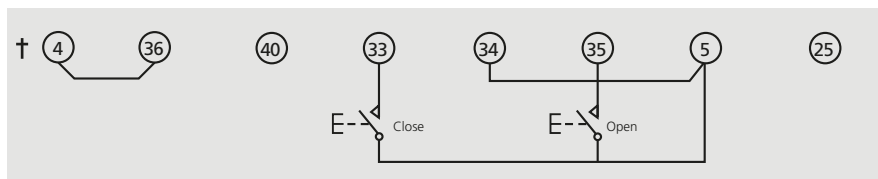
### Form 1a

Open/Close push-to-run remote control. Local control behaviour is determined by SW3 setting.



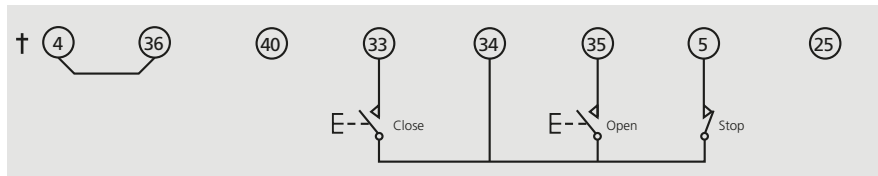
### Form 1b

Open/Close maintained remote control with mid-travel reversal. Customer to link 5 - 34.



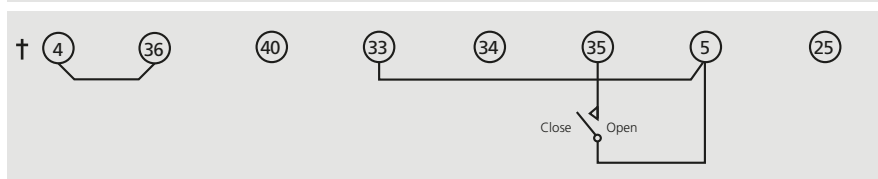
### Form 1c

Open/Close maintained remote control.



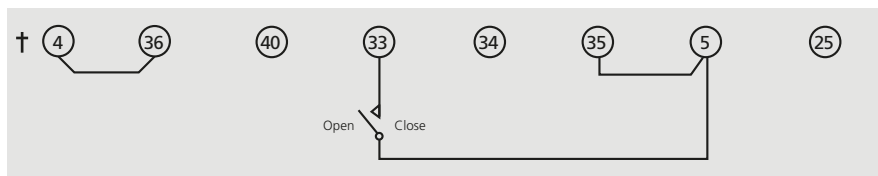
### Form 1d

Two-wire control with Open priority (PCB SW6 & SW7 set to ON). Energise to Open, de-energise to Close. Customer to link 5 - 33.



### Form 1e

Two-wire control with Close priority (PCB SW6 & SW7 set to OFF). Energise to Close, de-energise to Open. Customer to link 5 - 35.



### Form 1f

Emergency shut down to override any existing control signal in local or remote mode. This can be added to any of the circuits above and configured for either direction as per SW5 setting. Thermostat can be bypassed for the ESD action as per SW2 setting.



† Customer to add link 4 - 36

Fig 1

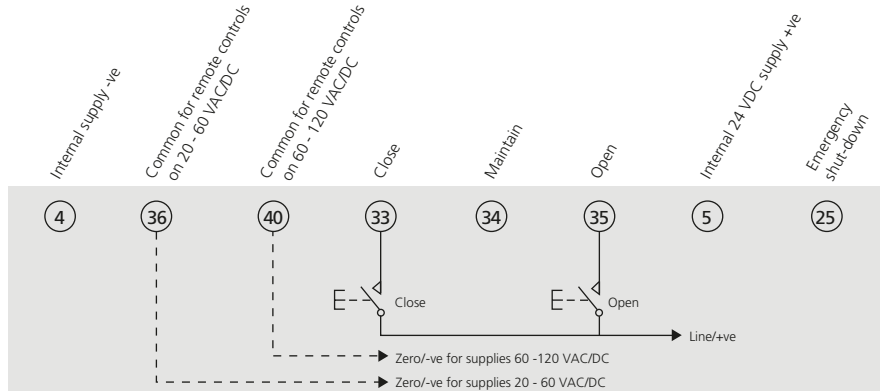
# Remote control circuits for Q Pak

## Externally fed circuits

An external voltage supply can be used to remotely control Q Pak actuators. Typical wiring forms for external voltages are shown below. The correct common connection is determined by the voltage in use.

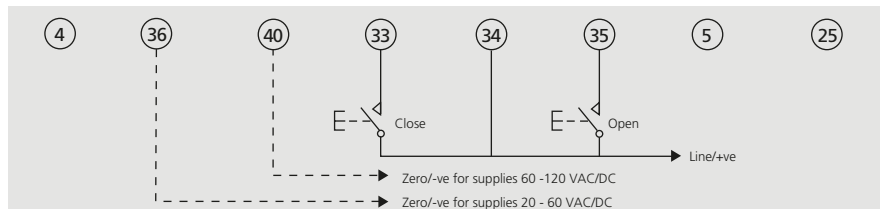
### Form 2a

Open/Close push-to-run remote control. Local control behaviour is determined by SW3 setting.



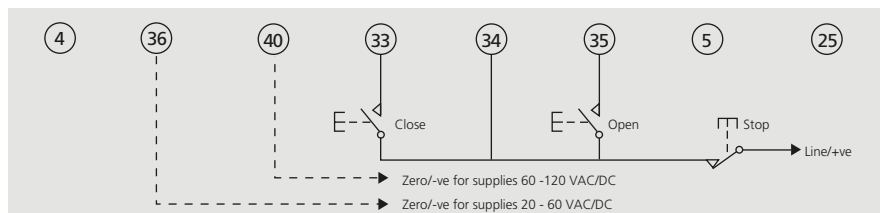
### Form 2b

Open/Close maintained remote control with mid-travel reversal.



### Form 2c

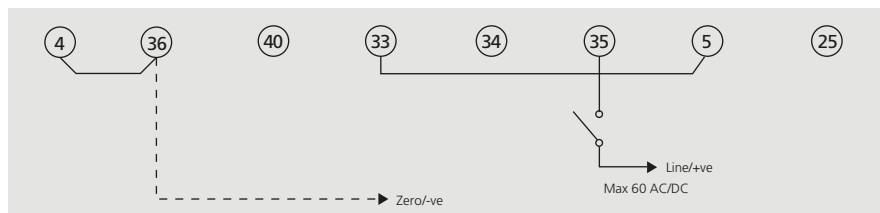
Open/Stop/Close maintained remote control.



### Form 2d

Two-wire control with Open priority (PCB SW6 & SW7 set to OFF). Energise to Open, de-energise to Close.

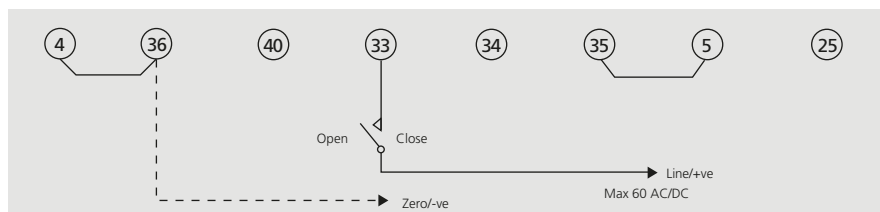
Customer to link 4 - 36, 5 - 33.



### Form 2e

Two-wire control with Close priority (PCB SW6 & SW7 set to ON). Energise to Close, de-energise to Open.

Customer to link 4 - 36, 5 - 35.



### Form 2f

Emergency shut down to override any existing control signal in local or remote mode. This can be added to any of the circuits above and configured for either direction as per SW5 setting. Thermostat can be bypassed for the ESD action as per SW2 setting.

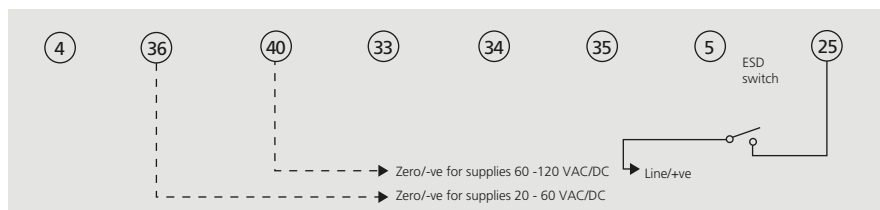


Fig 2

# Monitoring circuits for Q Pak

## Monitor relay

The monitor relay indicates when remote control of the actuator is not possible. This is true when one or more of the following conditions occurs:-

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

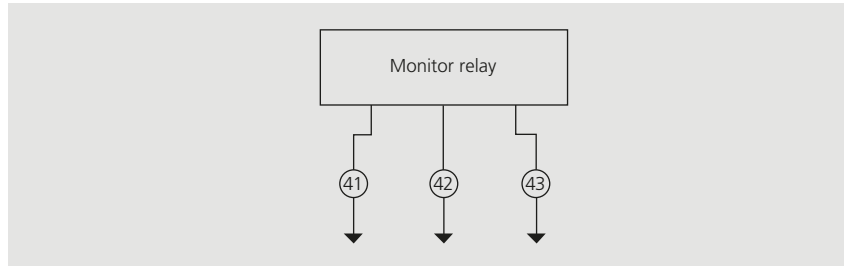
This relay is change-over type with a normally open side (41 - 42) and normally closed side (42 - 43).

## Motor Running and End Position

Indication circuits for Motor Running (Fig 3), Exact End Position (Fig 4) and Sequence Failure (Fig 5) can usually be employed without prejudice to the control facilities or vice versa. Duplicating the motor running or auxiliary position switches with customer relays or logic circuits where necessary will enable several facilities to be used in combination.

## Exact End Position indication

Particular attention is drawn to the significance of the Exact End Position indication facility (fig 4) as compared with the normal Approximate End Position indication (fig 3). When push-to-run control is used, end position indication from an auxiliary limit switch is inadequate. The auxiliary switches will trip prior to the valve seating position which results in premature disconnection of the control signal. Connecting the Motor Running contact with OAS and CAS will latch the signal until the valve seats. It is important to note that indication of this type uses a normally closed contact form. The auxiliary switch and the motor running contact must both break the circuit in order to remotely indicate the exact end position.



Note: All schematics are drawn with the actuator in the fully closed position.

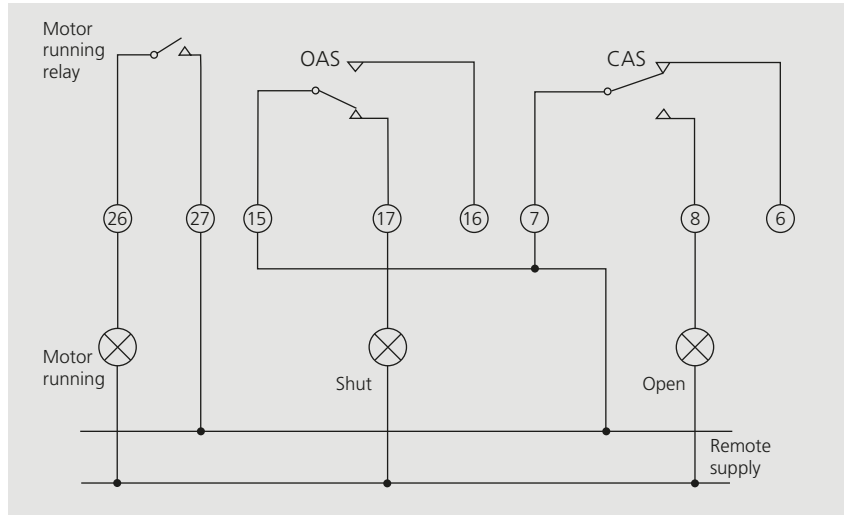


Fig 3 Motor Running and Approximate End Position indication (both lamps illuminated during travel).

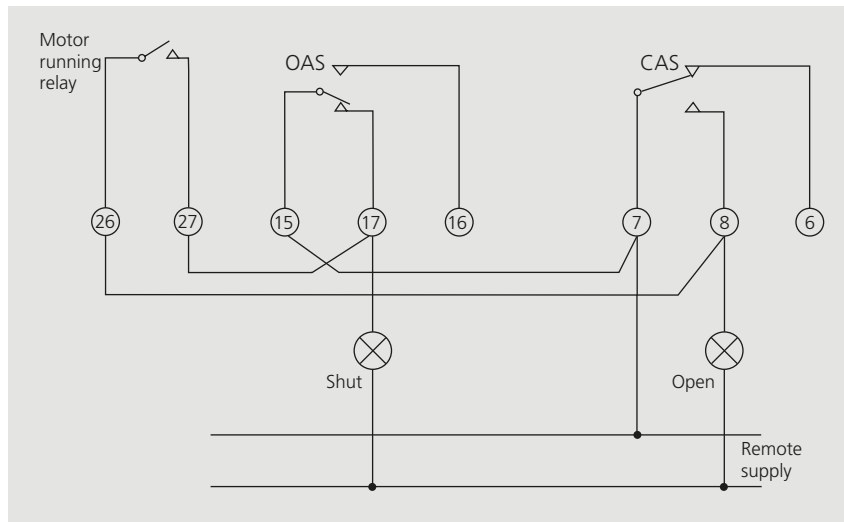


Fig 4 Exact End Position indication (both lamps illuminated during travel). Customer to link 7 - 15, 8 - 26 and 17 - 27.

## Monitoring circuits for Q Pak

### Sequence Failure Alarm

This wiring method provides indication when the actuator has failed to complete a full stroke operation (valve stopped mid-travel). This may be due to a loss of power supply, loss of control supply, unauthorized local stop or valve obstruction (torque switch trip in mid-travel). Connecting the Motor Running relay in parallel with auxiliary limit switches OAS and CAS (as shown in Fig 5) enables this failure to be detected. An alarm relay normally energised through these contacts will only be de-energised at an intermediate position.

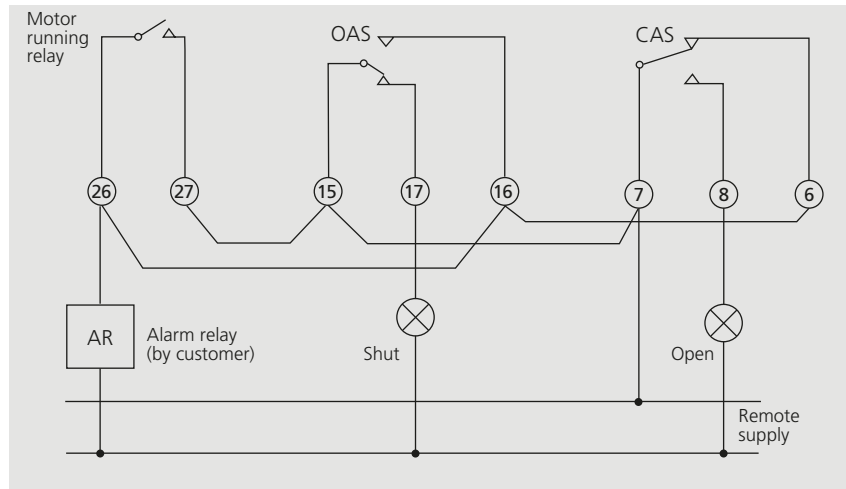


Fig 5 Sequence Failure Alarm and Approximate End Position indication (both lamps illuminated during travel). Customer to link 6 - 16 - 26 and 7 - 15 - 27.

### Potentiometer position transmitter

The optional potentiometer is the most economical method of transmitting an intermediate valve position signal. It is driven through gearing connected to the actuator output drive offering a potentiometric output directly proportional to position.

For analogue voltage signal applications, AC or DC supplies may 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 compensate for the effects of line drop and differing potentiometer movements.

To account for any variation in stroke length, scale adjustment must be possible with the connected indicating instrument. The scale adjustment should allow for anything between 75% and 100% potentiometer travel to correspond with full valve stroke. 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 shall cater for the remainder. The trimming resistor should be included with the indication instrument as this is not provided as part of the actuator.

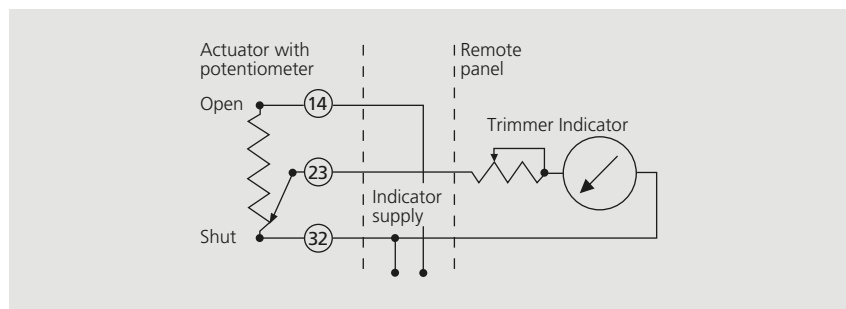


Fig 6 Standard potentiometer rated at 1 Watt with resistance values of 5 k or 25 k Ohms for a maximum voltage of 50 V or 125 V respectively.

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