TAC 228R, RL

Room Temperature Controller with Built-in Room Sensor

C-32-10

1 Feb 2002

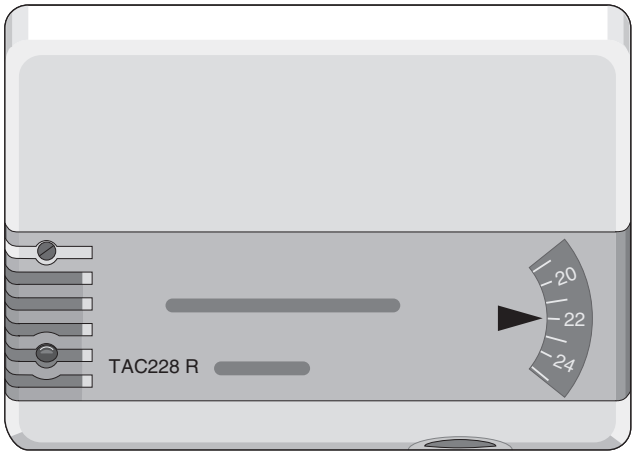
TAC 228R, RL controls room temperature in air handling systems with heating or cooling coils and in VAV systems.

The controller has a 2–10 V DC analog output, for controlling one or several heating/cooling motorized valves, or for connection to an air flow controller where it resets the setpoint for the air speed (pressure independent VAV system). However, the output signal can also directly control the damper actuator in the VAV box (pressure dependent control). In TAC 228RL the output signal also has adjustable high and low limits.

In order to satisfy the high demand for comfort, the built-in sensor not only senses the temperature of the surrounding air but also radiant heat in the room.

The desired room temperature is set with a thumb wheel, which is clearly marked, in degrees. If desired, the setting range can be locked or limited within a certain range.

The SPC (Setpoint control) function makes it possible to increase or decrease remotely the setpoints of all controllers in a building. The response of each individual controller to the SPC signal can easily be adjusted.



The controller has PI action, which provides high accuracy of control. Any permanent proportional (P) offset is completely eliminated by the integral (I) action.

The controller is intended for mounting directly on a wall or on a wall box.

The controller is supplied with 16 V DC or 24 V AC.

TECHNICAL DATA

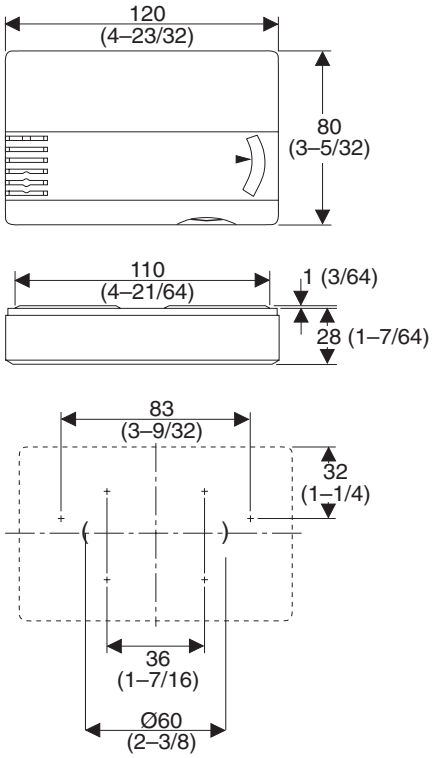
Part number:
- TAC 228R 228-1084-000
- TAC 228RL 228-1064-000

Supply voltage ..... 16 V DC ±0,3 V
24 V AC ±20%, 50–60 Hz
Power consumption ..... 10 mA
Ambient temperature:
- Operation ..... ±0 – +50 °C
- Storage ..... –40 – +70 °C

Ambient humidity ..... max 90% R.H.
Material, enclosure ..... ABS plastic
Enclosure rating ..... IP 31
Temperature sensor ..... thermistor, 1800 at 25 °C, radiant heat compensated
Input Z1:
- Permissible voltage ..... 2–10 V DC
- Current ..... max 0,1 mA

Output Y:
- Voltage ..... 2–10 V DC
- Load ..... max 2 mA, short-circuit proof

Color ..... white
Weight ..... 0,2 kg



CONTROL EXAMPLES

Constant room temperature, hot water reheat coil
The controller maintains a constant room temperature by means of its built-in, radiant heat compensated temperature sensor and an actuator. The preset room temperature can be controlled remotely via the SPC input.

Constant room temperature, with a variable, room temperature dependent air flow
By operating a room controller and an air flow controller in cascade, an accurate, stable room temperature can be obtained, without the risk of fluctuations or stability problems—even in the event of major load variations. Otherwise, it can be very difficult to maintain a constant temperature in large spaces and in spaces where the load varies rapidly due to solar radiation, varying number of occupants, equipment, etc.

The room temperature controller controls the room temperature, by means of its built-in sensor and an air flow controller, which has a built-in air speed sensor.

The output signal from the room temperature controller resets the air speed setpoint of the air flow controller. The setpoint is compared with the measured value from the air speed sensor and any offset will result in a corrective signal to the damper actuator.

A constant room temperature will be maintained, by a varying air flow, which is determined by the room temperature. When the temperature exceeds its setpoint, air flow will increase and in the same way, the air flow will decrease when the temperature drops below the setpoint, see figure 3.

High and low limitation of the air speed setpoint is done either in the room temperature controller (TAC 228RL) or in the air flow controller (TAC 224VL).

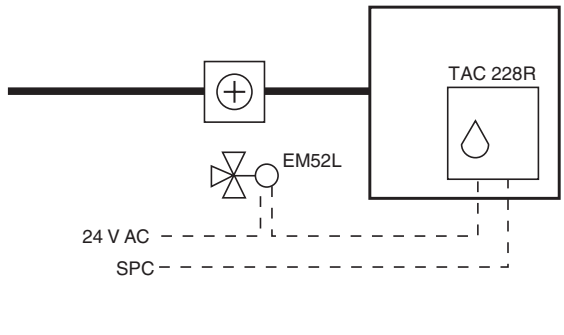


Figure 1

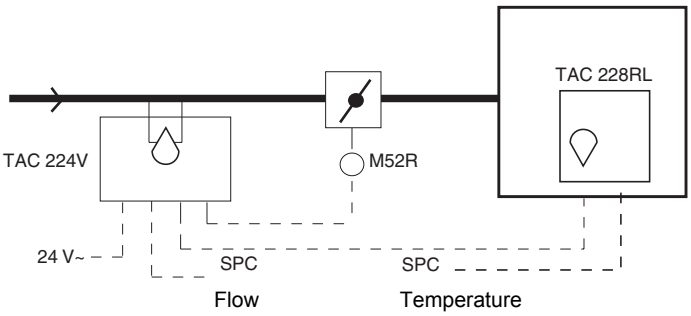


Figure 2

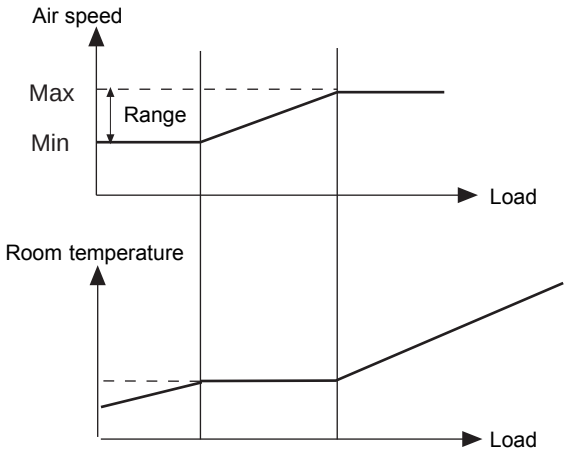


Figure 3

ROOM SENSOR

The controller monitors the temperature conditions in the room with its built-in sensor, which not only takes into account the temperature of surrounding air, but also to radiant heat within the room. Thus, the sensor compensates for such factors as hot and cold windows, heat emitted by equipment, etc., all of which affect the human perception of the temperature in a room.

The sensor is located in the controller in such a way that it is not affected by the temperature of the wall on which it is mounted.

Changes in temperature within the room are monitored continuously, with the shortest time constant possible.

CONTROL FUNCTION

Block diagrams of the operation and the design of the controller are shown in figure 4.

The controller setpoint is calculated as the sum of the selected room temperature setpoint and any SPC signal. This sum is compared with the measured value of the room temperature, giving the control offset.

The control offset is first compared with the ±0,5 °C dead band, in order to prevent small temperature variations from affecting the control signal.

The control offset is then corrected by means of the PI stage, which results in a control signal of between 2 and 10 V DC.

The control signal can be direct acting, i.e. the control signal will be reduced as the room temperature drops, or reverse acting. Reverse action is selected by means of the SW5 jumper.

Finally, in TAC 228RL the maximum and minimum limits of the control signal can be set to a desired range.

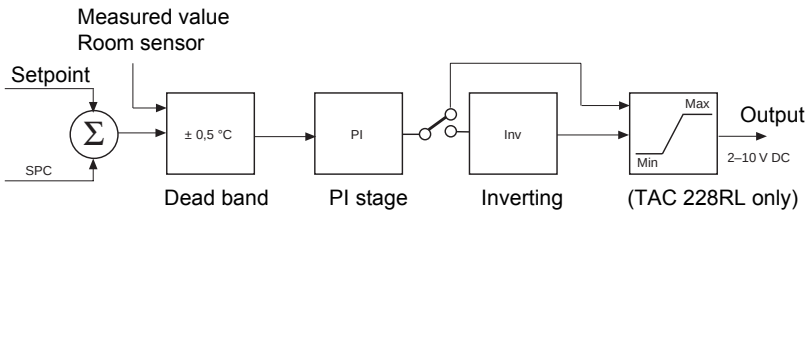


Figure 4

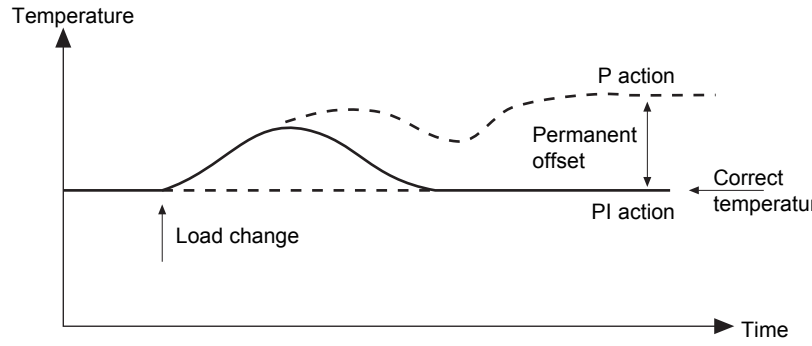


Figure 5

The PI stage
To ensure high control accuracy, the controller has PI action, i.e. both proportional and integral action.

The P action takes care of coarse offset corrections. However, when only P control is used, there will be a permanent proportional offset in the room temperature, i.e. the temperature will be kept constant—but at a higher or lower value than the setpoint. This is corrected by the built-in integral action (I).

The I action senses both the magnitude and the duration of any offset and can, therefore, modulate the control signal, so that any permanent offset is completely eliminated.

The PI characteristics can be set to either of two fixed combinations:

P band 2 °C/I time 50 minutes or

P band 4 °C/I time 25 minutes.

In special applications, where only P control is desired, the I action can be eliminated, and a fixed P-band of 2 °C or 4 °C is obtained.

SPC FUNCTION

The controller features an SPC function (Setpoint control) which makes it possible to control remotely the setpoint of the controller, from a master setpoint control.

For instance, all controllers in a building can be connected to the master set-point control, from which a common signal can be sent to all controllers, to increase or decrease their room temperature setpoint.

The degree of influence of the SPC control signal can be set individually, in each controller. This means that certain controllers can be made to make a large change of the setpoint, while others make a smaller change and, perhaps, some controllers are set not to react at all.

The magnitude of the change in relation to the current room temperature set-point will be determined by the magnitude of the SPC control signal and the current SPC setting, see figure 6. The SPC value (0–8) gives the setpoint displacement in degrees, when there is a 4 V change in the control signal. When no control signal is connected, the input will be at 6 V. Then the displacement is 0, independent of the SPC value.

The room temperature can also be controlled remotely, by a switch across the terminals Z1 (SPC input) and X2 (2/10 V output). If the switch is open, the controller will operate according to the current temperature setpoint. When the switch is closed, the setpoint will be increased/decreased with the SPC value. Jumper SW3 is used for selection of setpoint increase (in 10 V position) or decrease (in 2 V position).

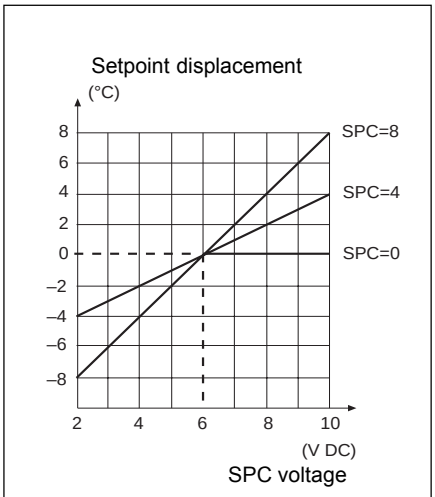


Figure 6

SETTINGS

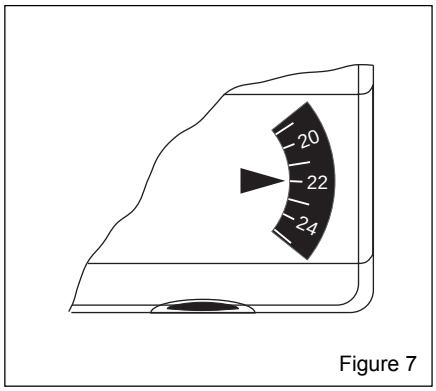


Figure 7

On the front panel:

Setpoint
Setting range: 10–30 °C
Factory setting: 20 °C

SETPOINT ADJUSTMENT

The desired room temperature is set with a partially concealed thumb wheel, which is marked in °C.

As protection against unauthorized or accidental alteration of the setpoint, the setting range of the thumb wheel can be limited or locked at the desired setting.

The setting range is limited by moving two adjustable pegs. By placing the pegs one of either side of the desired value, the thumb wheel is locked.

The pegs will be accessible when the front cover is removed.

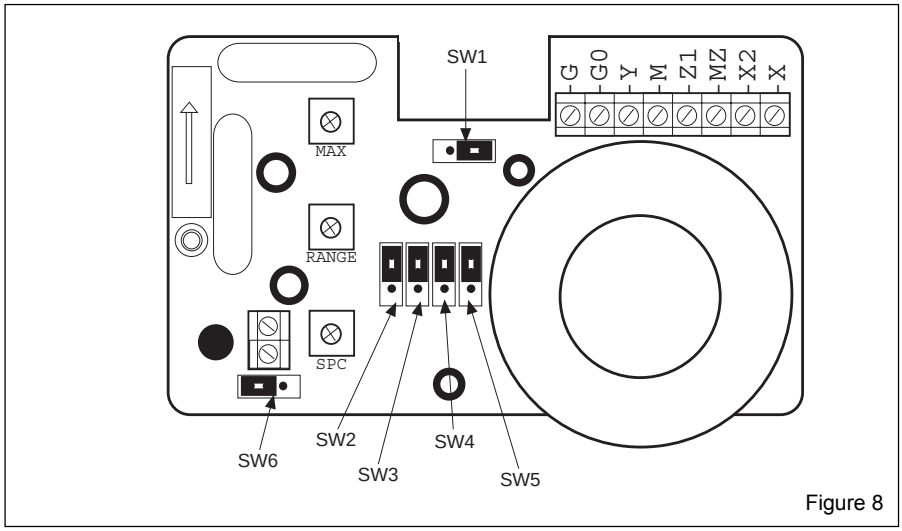


Figure 8

Under the protective cover

SW1
Power supply.

24 V AC: 24 V AC
16 V: 16 V DC

Factory setting: 24 V AC

SW2
Setting of P band and I time.

4C: P band 4 °C/I time 25 minutes
2C: P band 2 °C/I time 50 minutes

Factory setting: 2C

SW3
X2 output voltage.

10 V: 10 V (Setpoint increase)
2 V: 2 V (Setpoint decrease)

Factory setting: 2 V

SW4
Setting of control mode.

P: P action
PI: PI action

Factory setting: PI action

SW5
Reverse control output Y.

INV: Reverse action
NON INV: Direct action

Factory setting: NON INV

SW6
Intern or external sensor.

INT: Internal
EXT: External

Factory setting: INT

SPC
Degree of influence of an external control signal.

Setting range: 0–8
Factory setting: 8

MAX (TAC 228RL only)

Maximum limitation of output signal.

Setting range: 2–10 V
Factory setting: 10 V

RANGE (TAC 228RL only)

Minimum limitation of output signal.

Setting range: 1–8 V
Factory setting: 8 V

ADJUSTMENT OF MAX AND RANGE

(Applies only to TAC 228RL)

The control voltage range of the controller, i.e. maximum and minimum air speed, is adjusted with the MAX and RANGE potentiometers. The air speed corresponds to a 2–10 V voltage, see the curve in figure 9.

The air speed, measured in the air flow controller, can be checked by a volt meter connected between the X and M screw terminals.

Setting the MAX value

1. Read the value of the control voltage in the diagram in figure 9, e.g. 9 m/s=8 V.
2. Set the MAX potentiometer to this value.

Setting the RANGE (Min value)

1. Read the value of the control voltage in the diagram in figure 9, e.g. 2 m/s=3,5 V.
2. Calculate the difference between the MAX value and the read Min value, i.e. 8–3,5=4,5 and set the RANGE potentiometer to this value (4,5).

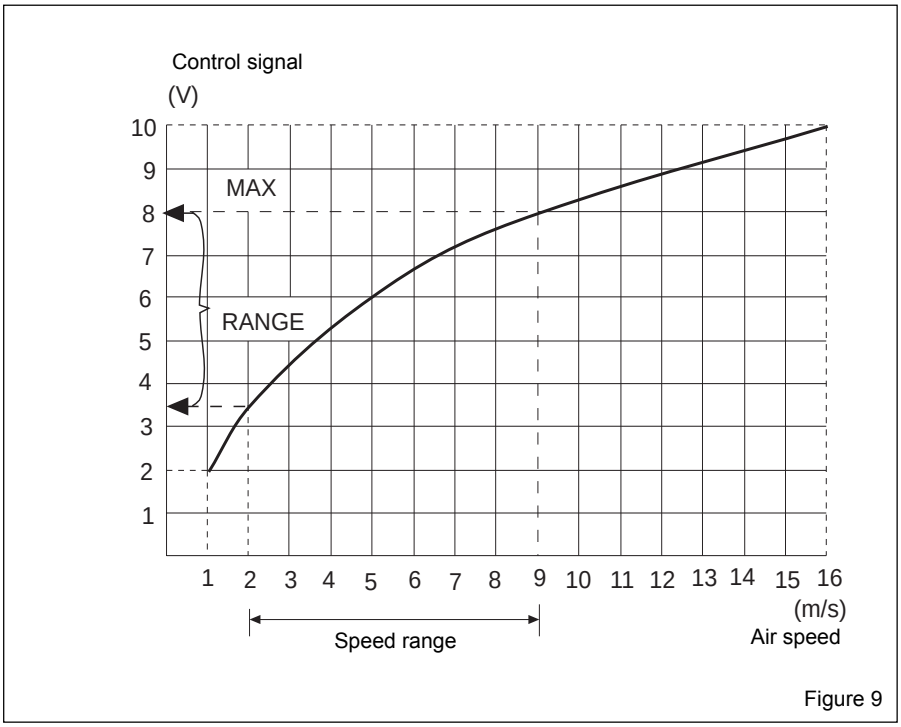


Figure 9

The control voltage range is now limited to within 3,5 to 8 V, which results in an air speed range of 2 to 9 m/s.

INSTALLATION

Terminal block connections

G	16 V DC input/24 V AC live
G0	16 V DC return/24 V AC neutral
Y	2–10 V output
M	Measurement neutral
Z1	SPC input
MZ	SPC return
X2	Output 2/10 V for SPC
X	Test, actual value from air flow controller
B	Sensor input, connection for external room sensor
M	Measurement neutral

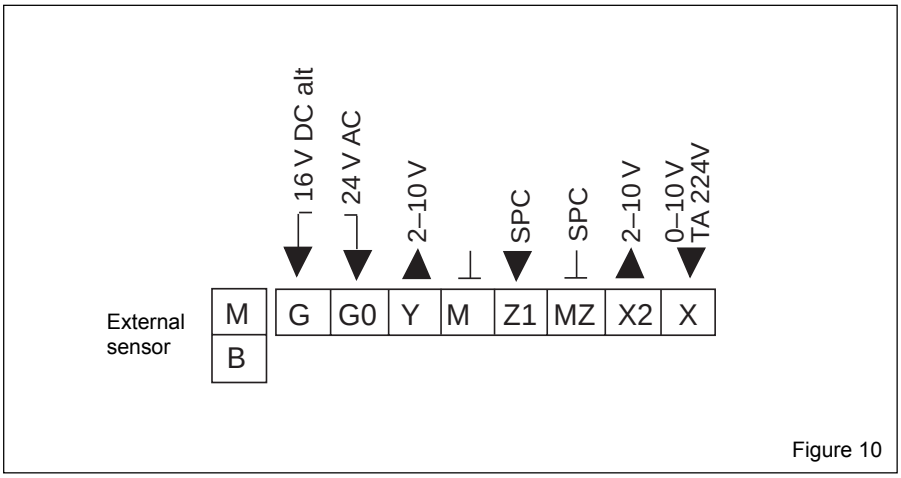


Figure 10

Length of cables

Max 200 m area 0,5 mm^2.

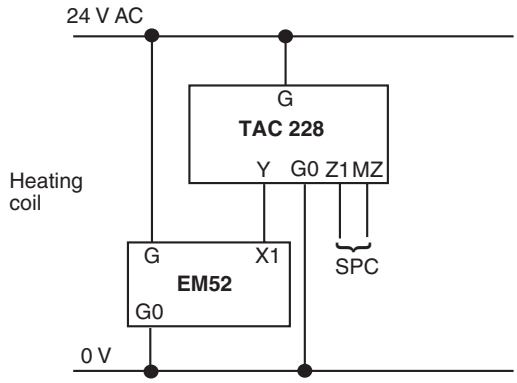
MOUNTING

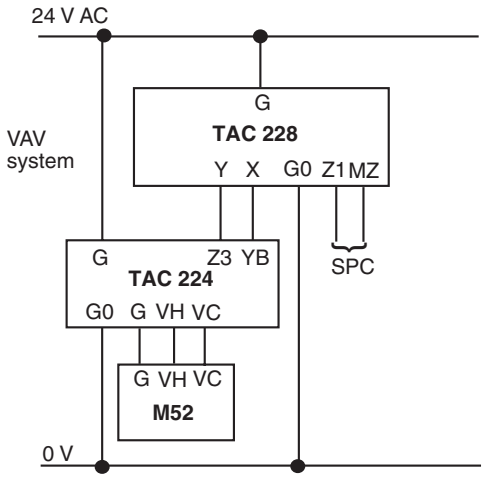
External wiring is connected to a terminal block on the circuit board.

The enclosure comprises a base section and a cover. The upper section of the cover has knockouts for making two holes, Ø 8 mm or Ø 11 mm, for cable entries. The base section can be mounted directly on a wall or on a wall box (70 mm). If mounted on a wall box, the cables should enter the enclosure via the hole in the base section.

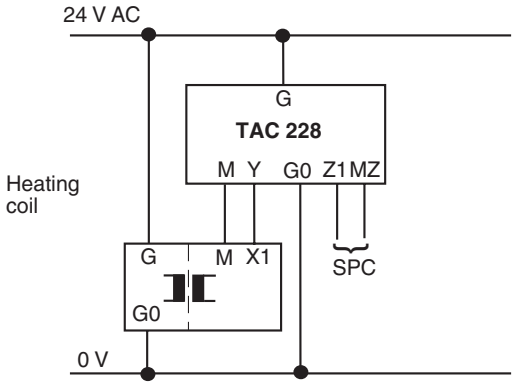
If mounted directly on a wall, the cables should enter from above.

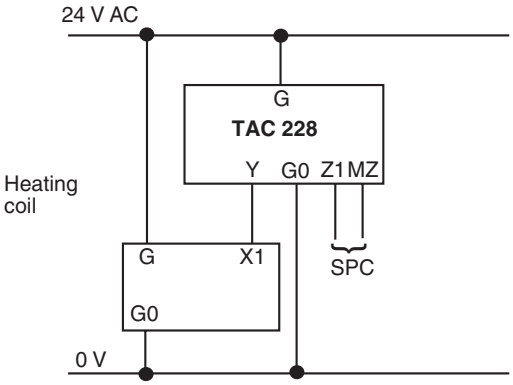
INSTALLATION EXAMPLES





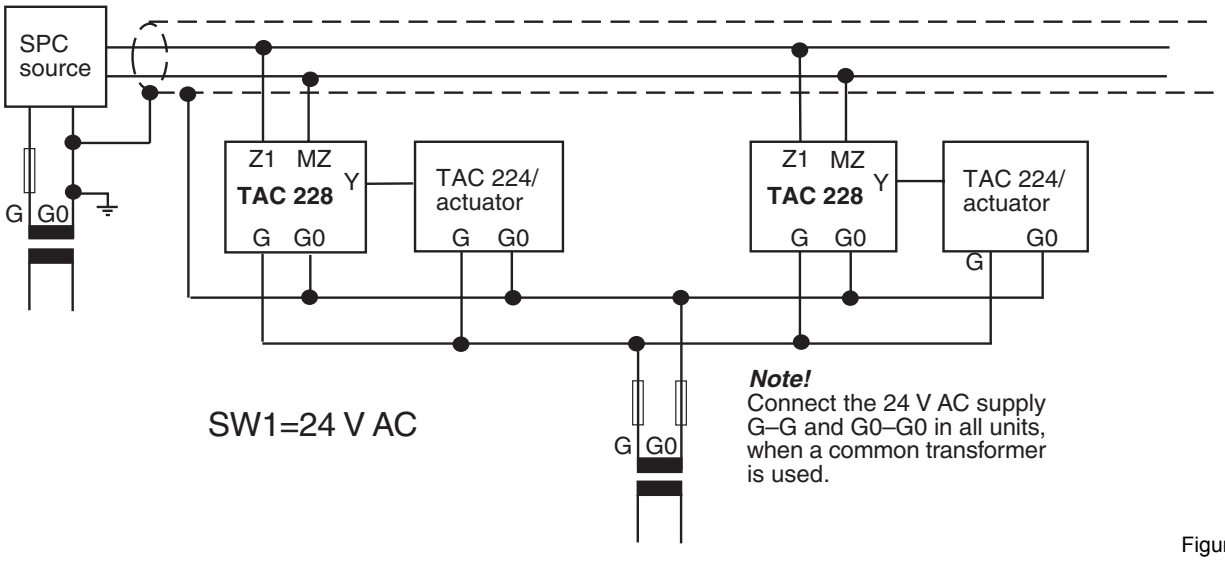
SW1=24 V AC





SW1=24 V AC

Example: Wiring diagram for system with SPC and common 24 V AC supply.



SW1=24 V AC

Note!
Connect the 24 V AC supply G–G and G0–G0 in all units, when a common transformer is used.

Figure 11