2224

Valve controller

Nr. 2224V103-UK
From ser. no. 060223001

EAC

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1535
VALVE CONTROLLER

Type 2224

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HOW TO DISMANTLE SYSTEM 2200

Picture 1.
The back panel of the device is detached from the housing by way of a screwdriver.

Picture 2.
After this, the back panel can be pulled out together with the PCB, but please notice the position of the PCB as there is a number of different positions in the house. Do not pull the wires unnecessarily, instead pull the PCB. Switches and jumpers can now be moved. When assembling the back plate and housing, please make sure no wires are stuck.
VALVE CONTROLLER 2224

- Front-programmable
- mA, V, and Ω-programmable input
- Ramp times, jump values, reversal, chopper frequency, and deadband
- 3-digit LED display shows Ivalve % value
- 1 or 2 channels
- Modulated current output for proportional valve

Applications

- Control and regulation of single or double-coil hydraulic and pneumatic proportional valves.

- The unit is used for accurate oil flow regulation, linear soft acceleration and deceleration, modulated output signal, and programmable deadband.

- Is highly suitable for joystick regulation of A/B movements.

Technical characteristics

- The 2224 Valve Controller is a microprocessor-based unit containing ramp functions for soft start and stop and jump functions thus avoiding deadband at start and changes between A & B valves.

- The user interface of the valve controller consists of three pushbuttons and a 3-digit LED display. By using these, output currents, ramp times, jump values, chopper frequency, reversal, deadband, and on/off functions are changed.

- During operation the display shows the present output signal as a % of the Ivalve.

- All parameters are protected against unauthorised changes with a password.

- Changes between A and B valves can be made in two ways. By way of function 1, the A valve is chosen when +Vsupply is applied to terminal 2. By way of function 2, changes between A/B valves take place automatically according to the value of the input signal (no signal on terminal 2).

- The output current is enabled / disabled by a digital controlling signal. Please note that the output current is disconnected until +Vsupply is applied to terminal 3.
Input

- Programmable current or voltage input for standard signals acc. to order schedule, joystick / potentiometer or a special non-programmable input.
- Digital inputs for external control functions.

Output

- A pulsating current output prevents the connected valve from sticking.
- Optional programming of the modulation frequency (PWM) between 8 and 400 Hz.
- The internal measuring and control circuit ensures that the mean current never exceeds the entered Ivalve.
- If the peak current exceeds 7 A the output will be disabled.

Order: 2224

<table>
<thead>
<tr>
<th>Type</th>
<th>Input</th>
<th>Supply</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>2224</td>
<td>0...20 mA</td>
<td>12 V</td>
<td>Single valve (A)</td>
</tr>
<tr>
<td></td>
<td>4...20 mA</td>
<td>24 V</td>
<td>Double valve (A/B)</td>
</tr>
<tr>
<td></td>
<td>0...1 V</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.2...1 V</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0...10 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2...10 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>±10 V potentiometer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0...10 V potentiometer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Electrical specifications

Specifications range:
-20°C to +60°C

Common specifications:
Supply voltage.......................................................... 9.6...14.4 or 19.2...28.8 VDC
Internal consumption ............................................. 2 W / 24 V
                                                      1.8 W / 12 V
Communication ......................................................... Front-programmable
Updating time ........................................................... 30 ms
Temperature coefficient ........................................ 0.01%/°C
Linearity error ........................................................... 0.2%
EMC immunity influence ....................................... < 2% of span
Relative air humidity .............................................. < 95% RH (non-cond.)
Dimensions (HxWxD)............................................... 80.5 x 35.5 x 84.5 mm
Protection degree .................................................... IP50
Weight .......................................................................... 130 g

Input:
Current input.............................................................. 0/4...20 mA / 50 Ω + PTC (54 Ω)
Voltage input ............................................................. 0/0.2...1 V and 0/2...10 V / 10 MΩ
Potentiometer input ............................................... 0...10 V or ±10 V / 10 kΩ
External potentiometer ......................................... 1 kΩ ≤ potentiometer ≤ 10 kΩ
Control signals:
Operation / shutdown ............................................ PNP / 2.2 kΩ, 12 / 24 V
Imax1 & Imax2.......................................................... PNP / 2.2 kΩ, 12 / 24 V
A / B channel ............................................................. PNP / 2.2 kΩ, 12 / 24 V
Deadband .................................................................... 0...99.9% of input span

Output:
Output voltage (max.) ............................................ Supply voltage-0.5 V
Output current (max.) ............................................ 3000 mA mean
Current peak .............................................................. 7 A
Output power (max.) .............................................. 36 W
Reference voltage ................................................... 10 VDC (A valve)
                                                      ±10 VDC (A & B valve)
Ramp up & down........................................................ Time 0...10.0 s
PWM frequency ........................................................ 8...400 Hz in steps of 1 Hz

Observed authority requirements: Standard:
EMC 2004/108/EC .................................................. EN 61326-1
EAC TR-CU 020/2011 ............................................ EN 61326-1

Of span = Of the presently selected range
DIP-switch programming
Input signal and function are chosen via the DIP-switch setting.

Function 1:
Single and double valve control. By double valve control, A valve is chosen by applying +Vsupply to terminal 2.

Function 2:
Double valve control with automatic change between A and B valves (no signal on terminal 2).

Input: 0...50% = A valve 100...0%.
Input: 50...100% = B valve 0...100%.
<table>
<thead>
<tr>
<th>Signal input:</th>
<th>Function 1:</th>
<th>Function 2:</th>
<th>JP1 pos.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...20 mA</td>
<td><img src="image" alt="On/Off" /></td>
<td><img src="image" alt="On/Off" /></td>
<td>2 - 3</td>
</tr>
<tr>
<td>4...20 mA</td>
<td><img src="image" alt="On/Off" /></td>
<td>No function</td>
<td>2 - 3</td>
</tr>
<tr>
<td>0...1 V</td>
<td><img src="image" alt="On/Off" /></td>
<td><img src="image" alt="On/Off" /></td>
<td>2 - 3</td>
</tr>
<tr>
<td>0.2...1 V</td>
<td><img src="image" alt="On/Off" /></td>
<td>No function</td>
<td>2 - 3</td>
</tr>
<tr>
<td>0...10 V</td>
<td><img src="image" alt="On/Off" /></td>
<td><img src="image" alt="On/Off" /></td>
<td>2 - 3</td>
</tr>
<tr>
<td>2...10 V</td>
<td><img src="image" alt="On/Off" /></td>
<td>No function</td>
<td>2 - 3</td>
</tr>
<tr>
<td>-10...+10 V</td>
<td><img src="image" alt="On/Off" /></td>
<td><img src="image" alt="On/Off" /></td>
<td>2 - 3</td>
</tr>
</tbody>
</table>

**Joystick / potentiometer via internal reference voltage**

<table>
<thead>
<tr>
<th>Input:</th>
<th>Grounded</th>
<th>Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td><img src="image" alt="On/Off" /></td>
<td><img src="image" alt="On/Off" /></td>
</tr>
</tbody>
</table>
**WIRING DIAGRAMS FOR JOYSTICK / POTENTIOMETER INPUT**

Double valve control (A/B valves) from +/-10 VDC reference supply. DIP-switch programming: Function 2.

Double valve control (A/B valves) from +10 VDC reference supply. DIP-switch programming: Function 1 or Function 2.

Single valve control from +10 VDC reference supply. DIP-switch programming: Function 1.
Double valve control (A/B valves) from a 4...20 mA input signal. 
DIP-switch programming: Function 1 or Function 2.

Single valve control from a 4...20 mA input signal. 
DIP-switch programming: Function 1.
WIRING DIAGRAMS FOR
DC VOLTAGE INPUT

Double valve control (A/B valves) from a 0...1 VDC input signal.
DIP-switch programming: Function 1 or Function 2.

Single valve control from a 0...1 VDC input signal.
DIP-switch programming: Function 1.

Double valve control (A/B valves) from a -10...+10 VDC input signal.
DIP-switch programming: Function 1 or Function 2.
TECHNICAL DESCRIPTION

• To prevent programming during operation, two safety measures have been included: The correct password (030) must be entered in menu [PAS], and the output must give no signal (000 must be displayed). This is achieved by disconnecting +Vsupply on terminal 3.

• The 2224 Valve Controller can be controlled by a joystick / potentiometer using the internal +10 V and -10 V supply, or a process current / voltage signal. For process signals the differential amplifier (DP1 switch 6 off) will reduce disturbances from noisy signals. Joysticks / potentiometers are connected single-ended (grounded), and it is possible to connect a 10 kΩ load resistor (DP1 switch 5 on), providing a minimum potentiometer load current.

• A switch between A and B valves can be made in two ways. By way of function 1, the A valve is chosen when +Vsupply is applied to terminal 2. By way of function 2, changes between A/B valves are made automatically according to the value of the input signal (no signal on terminal 2). Input: 0...50% = A valve 100...0%. Input: 50...100% = B valve 0...100%.

• When connecting the output to a solenoid please ensure that the peak valve current = $V_{\text{supply}} / R_{\text{solenoid}}$ does not exceed 7A.

• A deadband can be programmed to avoid unintentional activation of the valve in connection with e.g. an inaccurate neutral position of joysticks. The deadband introduces a threshold which must be exceeded before any output activity will take place.

• The spring response (bias) can be adjusted to account for the valve seat travel before oil flow.

• Two current limits can be programmed (Imax1 & Imax2) for limit stop detection featuring slow motion before stop. The active current limit (Imax1 & Imax2) is selected by the PNP input signal on terminal 7.

• The 2224 Valve Controller complies with EMC data only when shielded cabling is used and the shield is connected to supply ground.
At power ON, or if no keys have been activated for a period of 2 minutes, the display returns to main menu 0.0.

To store changes press simultaneously.

Go to entry menu/Leave menu without changes.

Next digit or point.

Change of parameter.

To store changes press simultaneously.
PROGRAMMING / OPERATING
THE FUNCTION KEYS

DOCUMENTATION FOR ROUTING DIAGRAM

General:
The programming is menu-controlled. The main menus are numbered in level 0 (X.0), and the submenus are numbered in level 1 (X.1 to X.4). Each submenu has an accompanying entry menu. The menus are structured in such a way that the menus most frequently used are closer to the default menu 0.0. Please note that programming is only possible when submenu 1.1 PAS has the value 030. All changes are not permanently saved in the EEP rom, until you return to menu 0.0.

Menus and submenus are selected by the 3 function keys ⇧, ◢, and ◤ as outlined in the routing diagram.

Activating ◤ in the submenu will display the current value in the entry menu.

In entry menus, the digit that can be changed will flash.

Active digit position is shifted by the ⇧ key, and the value is changed by the ◢ key.

In parameter selection menus you switch between the parameters by using the ◢ key.

To store changes temporarily press ⇧ ◢ simultaneously.

To store changes permanently go to menu 0.0.

To return to the previous menu without changing the parameters - press ◤.

0.0. DEFAULT - Output percentage value of I_{valve} is displayed

At power ON, or if no keys have been activated for a period of 2 minutes, the display returns to default.
1.0 VAL - Enter password
   1.1 PAS - Programming access
       Accepted password is valid until power off.
       The password is 030.

2.0 CUA - Setting of currents for A valve
   2.1 LOA - Spring response for A valve
       The parameter is entered as a percentage of the $I_{\text{valve}}$.
       Valid selections are 0...99.9%.
   2.2 IA1 - Current limit $I_{\text{max}1}$
       The parameter is entered as a percentage of the $I_{\text{valve}}$.
       Valid selections are 0...99.9%.
   2.3 IA2 - Current limit $I_{\text{max}2}$
       The parameter is entered as a percentage of the $I_{\text{valve}}$.
       Valid selections are 0...99.9%.

3.0 CUB - Setting of currents for B valve
   Please see the setup of the A valve (2.0 CUA).

4.0 RAN - Setting of ramp parameters
   4.1 ON - Selection of on/off ramp
       1 = ramp enable, 0 = ramp disable.
       Valid selections are 0 or 1.
   4.2 UP - Setting of ramp time up
       The ramp time is set in seconds.
       Valid selections are 0...10 s.
   4.3 DO - Setting of ramp time down
       The ramp time is set in seconds.
       Valid selections are 0...10 s.

5.0 PAR - Setting of parameters for output
   5.1 REV - Selection of direct / inverted output
       0 = direct, 1 = inverted.
       Valid selections are 0 or 1.
   5.2 DOD - Setting of deadband for e.g. joystick
       The parameter is entered as a percentage of the input span.
       Valid selections are 0...99.9%.
5.3 FRQ - Setting of modulation frequency for output current
The frequency is set in Hz.
Valid selections are 8...400 Hz.

5.4 GA - Setting of Ivalve
The parameter is set in Ampere - with two decimals.
Valid selections are 0...3.00 A

6.0 PRO - Setting of proportional controller

6.1 PF - Setting of proportional factor (Gain)

6.2 If - Setting of integrating factor
At delivery PF is set at 0.15 and IF at 0.5. These settings will work well for most valves but may have the drawback that it will take too long before the valve reacts.

In order to optimise the control parameters the following “rule-of-thumb” can be applied (all other parameters must be set correctly).
1. Connect a DC-coupled oscilloscope directly across the coil.
2. Set IF at 0.00.
3. Increase PF until the curve on the oscilloscope starts oscillating constantly.
4. Set PF at half of the above value.
5. Increase IF until the curve on the oscilloscope starts oscillating constantly.
6. Set IF at half of the above value.

The control parameters PF and IF can now be fine-tuned using the found values. Lower values will slow the valve’s reaction time but eliminate any overshoot.
**Displays** Programmable displays with a wide selection of inputs and outputs for display of temperature, volume and weight, etc. Feature linearization, scaling, and difference measurement functions for programming via PReset software.

**Ex interfaces** Interfaces for analog and digital signals as well as HART signals between sensors / I/P converters / frequency signals and control systems in Ex zone 0, 1 & 2 and for some devices in zone 20, 21 & 22.

**Isolation** Galvanic isolators for analog and digital signals as well as HART signals. A wide product range with both loop-powered and universal isolators featuring linearization, inversion, and scaling of output signals.

**Temperature** A wide selection of transmitters for DIN form B mounting and DIN rail devices with analog and digital bus communication ranging from application-specific to universal transmitters.

**Universal** PC or front programmable devices with universal options for input, output and supply. This range offers a number of advanced features such as process calibration, linearization and auto-diagnosis.