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**1 GENERAL**

Due to the compact frame size of the SV9000 series, all I/O-expander boards need to be installed in a separate box (SV9EXPBOX), except the encoder board (SV9IOC104). If ordered together with option board this will be preinstalled.

**1.1 SV9IOC100**

The available I/O can be increased by using the SV9IOC100 I/O-expander board:

- 5 digital inputs (standard signals)
- 2 analog inputs (standard signals)
- 3 relay outputs (standard signals)
- analog output (current programmable)
- thermistor input (can be directly connected to the motor thermistors to monitor the motor temperature)
- encoder input

Typical use: Closed Loop Vector Control

**1.2 SV9IOC101**

The available I/O can be increased by using the SV9IOC101 expander board:

- 5 digital inputs (standard signals)
- relay output (standard signal)
- thermistor input (can be directly connected to the motor thermistors to monitor the motor temperature)

Typical use: thermistor input required

**1.3 SV9IOC102**

The available I/O can be increased by using the SV9IOC102 expander board:

- 5 digital inputs (standard signals)
- 2 analog inputs (standard signals)
- 3 relay outputs (standard signals)
- analog output (voltage programmable)
- thermistor input (can be directly connected to the motor thermistors to monitor the motor temperature)
- encoder input

Typical use: Closed Loop Vector Control

**1.4 SV9IOC103**

The available I/O can be increased by using the SV9IOC103 expander board:

- 5 digital inputs (standard signals)
- 3 relay outputs (standard signals)
- analog output (programmable)
- thermistor input (can be directly connected to the motor thermistors to monitor the motor temperature)

Typical use: thermistor input and additional analog output required

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**1.5 SV9IOC104**

The available I/O can be increased by using the SV9IOC104 expander board:

- encoder input

Typical use: Closed Loop Vector Control

**1.6 Fieldbus boards**

SV9000 fieldbus boards can be installed in the SV9000 series as the I/O-expander boards. The needed information to install/commission fieldbus boards can be found in the respective SV9000 Fieldbus manual.

- SV9NCIB
- SV9NCMB
- SV9NCPB
- SV9NCLW

## 2 SPECIFICATIONS


<b>Safety</b>		Fulfills EN50178, C-UL and EN60204-1 standards
<b>Control connections</b>	Analog voltage, input	0— $\pm 10$ V, $R_i \geq 200$ k $\Omega$
	Analog current, input	0(4)—20 mA, $R_i = 250$ $\Omega$
	Digital input	24 V: "0" $\leq 10$ V, "1" $\geq 18$ V, $R_i > 5$ k $\Omega$
	Aux. voltage	24 V ( $\pm 20\%$ ), max. 50 mA
	Reference voltage	10 V $\pm 3\%$ , max. 10 mA
	Analog current, output	0(4)—20 mA, $R_L = 500$ $\Omega$ , resol. 10 bit, accuracy $\leq \pm 2\%$
	Analog voltage, output	0(2)—10 V, $R_L \geq 1$ k $\Omega$ , resol. 10 bit, accuracy $\leq \pm 2\%$
	Relay output	Max. switching voltage: 300 V DC, 250 V AC Max. switching load: 8 A / 24 V DC 0,4 A / 300 V DC 2 kVA / 250 V AC Max. continuous load: 2 A rms
	Thermistor input	$R_{trip} = 4.7$ k $\Omega$
	Encoder input	24 V: "0" $\leq 10$ V, "1" $\geq 18$ V, $R_i = 2.2$ k $\Omega$ 5 V: "0" $\leq 2$ V, "1" $\geq 3$ V, $R_i = 330$ $\Omega$

Table 2-1 Specifications.

(All the control connections are not found on every I/O-expander board, for more specific information see chapters 1 and 4.)

The control connections are isolated from the utility potential and the I/O ground is connected to the frame of the inverter via a 1-M $\Omega$  resistor and 4,7 nF capacitor\*). The control I/O ground can be connected directly to the frame by changing the position of the jumper X4 (GND ON/OFF) to the ON-position. Digital inputs and relay outputs are also isolated from the I/O ground.

\*) Default value (X4 is GND OFF- position).

<b>NOTE!</b>  	<i>Internal components and circuit boards (except the isolated I/O terminals) are at utility potential when the drive is connected to the utility. This voltage is extremely dangerous and may cause death or severe injury if contact is made with it.</i>
	<i>The control I/O terminals are isolated from the utility potential, but the relay outputs and other I/O's may have dangerous voltage connected even if the power is disconnected from the drive.</i>

### 3 INSTALLATION

#### 3.1. General

Check that you have received all the required parts (figure 3-1):

- I/O-repeater board (1) and 10-pole shielded data cable (2)
- check that you have also received the jumper for I/O-repeater board terminal X5 (3)
- 4-pole power cable (4)
- protection foil under (5) and above (6) the I/O-repeater board
- stand sleeve (7)
- screw for fixing the I/O-repeater board (8)
- 12-pole communication cable (9)
- option box (10)
- I/O-expander board (11) (check that the typecode matches your order)
- I/O-interface board (12)
- 10-pole data cable (13)
- 4-pole power cable (14)
- screws for I/O-expander board (15)
- screws for I/O-interface board (16)

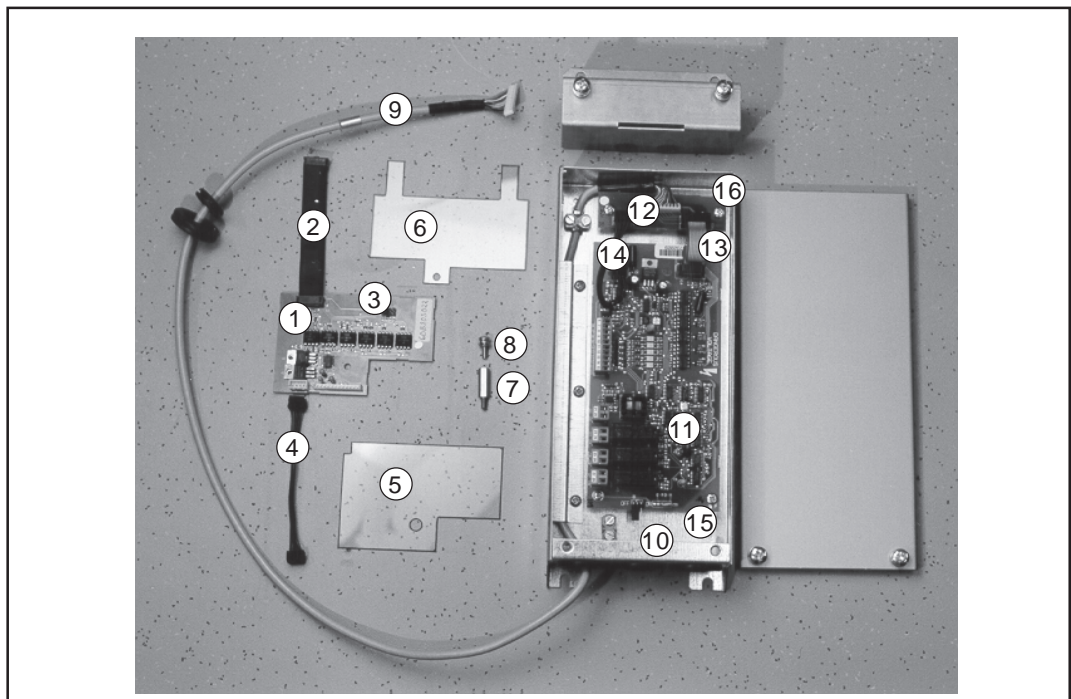


Figure 3-1. I/O-expander board parts.

If the delivery is not what you have ordered, please contact the supplier immediately. Only a competent electrician should carry out the electrical installation.



Before doing any commissioning actions, carefully read the safety instructions in "USERS MANUAL, SV9000", chapter 1, SAFETY.

Disconnect the drive from the utility. Note: also the control circuits! Wait a further 5 minutes before opening the cover of the drive. Verify by measuring that the drive is safe to touch.

## 3.2 INSTALLATION

I/O-repeater board (1) should be installed above the control board inside the drive. The I/O-expander board (10) and I/O-interface board (11) should be installed in the option box. Follow the instructions below (see table 3-2).

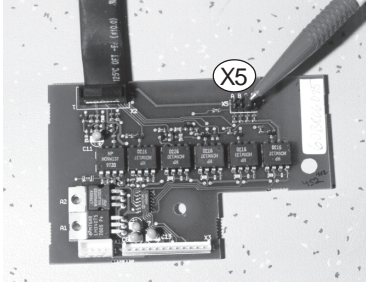

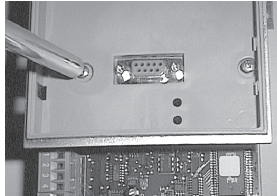
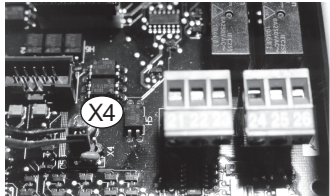
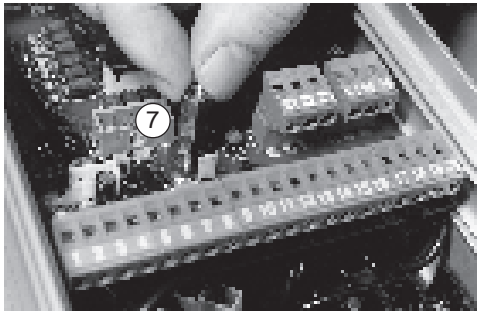
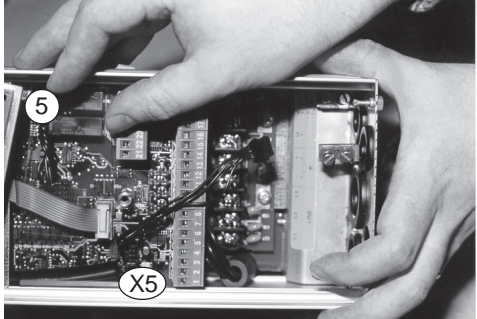
1	<p>Check that the jumper for I/O-repeater board (1) is in the right position in terminal X5 (3). The position of the jumper must be chosen according the I/O-expander board (11):</p>  <ul style="list-style-type: none"> <li>- If I/O-expander board SV9IOC101 or SV9IOC103 is in use, jumper must be in position A.</li> <li>- If I/O-expander board SV9IOC100 or SV9IOC102 is in use, jumper must be in position B.</li> <li>- If one of the following fieldbus boards is in use: SV9NCIB, SV9NCMB, SV9NCPB or SV9NCLW, jumper must be in position C. (Position D is not in use).</li> </ul>
2	<p>Remove the control panel, control panel cover (4 screws) and the jumper X4 from the control board.</p>   
3	<p>Remove the fixing screw from the control board and replace it with a stand sleeve (7).</p> 
4	<p>Make sure that the cable of the control panel cover is connected to the control board X1 terminal. Connect the 4-pole power cable (4) to the control board X5 terminal (The power cable can also be connected to the X6-terminal, if the power cable from the power board is connected to the X5-terminal.)</p> <p>Set the protection foil (5) above the control board as shown in the picture. Make sure that the protection foil is correctly located, the hole in the foil will must be located above the stand sleeve.</p> 

Table 3-2. I/O-expander board installation (continues ...)



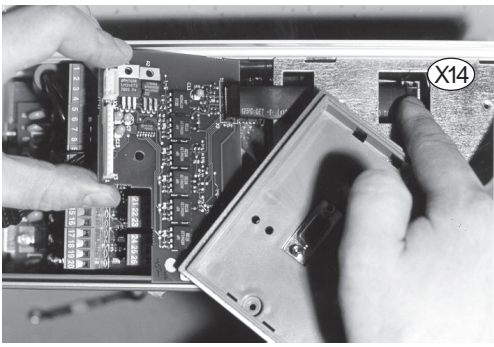
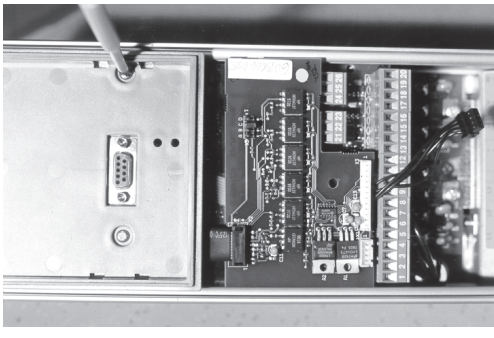
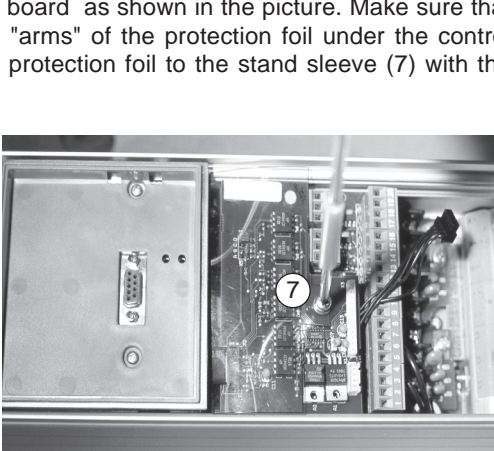
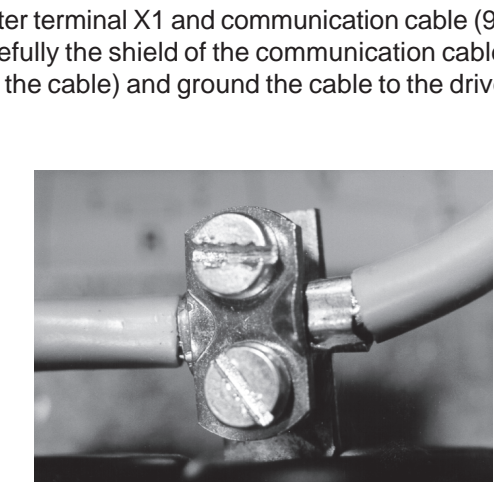
5	<p>Connect the shielded data cable for I/O-repeater board (2) to the control board X14 terminal.</p>	
6	<p>Install the control panel cover with 4 screws.</p>	
7	<p>Set the protection foil (6) above the I/O-repeater board as shown in the picture. Make sure that the protection foil is correctly located, push the "arms" of the protection foil under the control panel cover. Fasten the I/O-repeater board and protection foil to the stand sleeve (7) with the screw.</p>	
8	<p>Connect the power cable (4) to the I/O-repeater terminal X1 and communication cable (9) to the I/O-repeater terminal X3. Uncover carefully the shield of the communication cable (max. 1,5 cm), tight up to the metal clamp (in the cable) and ground the cable to the drive ground as shown in the picture.</p>	

Table 3-2. I/O-expander board installation (continues ...)

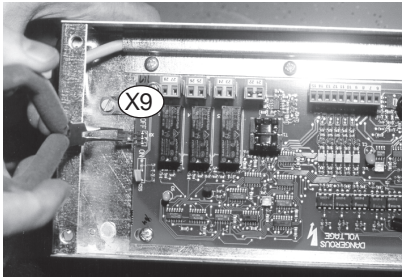
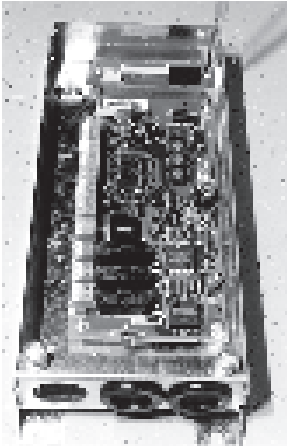
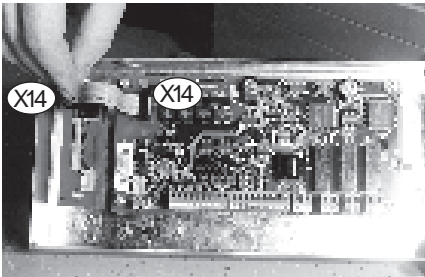
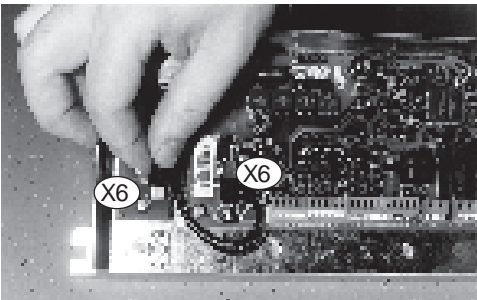
9	<p>Check the connections and make sure that there are no foreign objects inside the drive.</p> <p>Close the cover of the drive.</p>
10	<p>Install the jumper removed from the control board X4 terminal on the I/O-expander board terminal X9. Note: the jumper can be connected in the ON or OFF position, see the SV9000 User's manual, chapter 6.2.2.</p> 
11	<p>If you have the option box in which the I/O-expander (11) and I/O-interface board (12) are preinstalled, jump to section 17.</p> <p>Install I/O-expander board (11) and I/O-interface board (12) in the option box (10) with the screws.</p> 
12	<p>Connect data cable (13) between terminal X14 on the I/O-interface board (12) and terminal X14 on the I/O-expander board (11)).</p> 
13	<p>Connect power cable (14) between terminal X6 in the I/O-interface board (12) and terminal X6 in the I/O-expander board (11).</p> 

Table 3-2. I/O-expander board installation (continues ...)



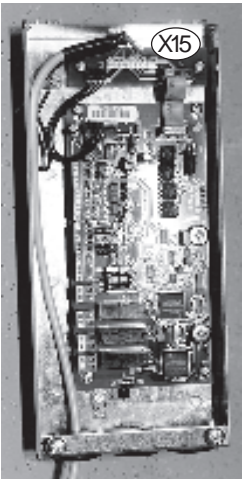
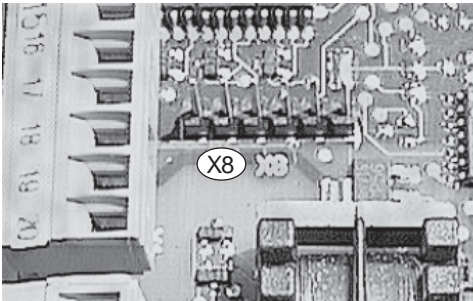
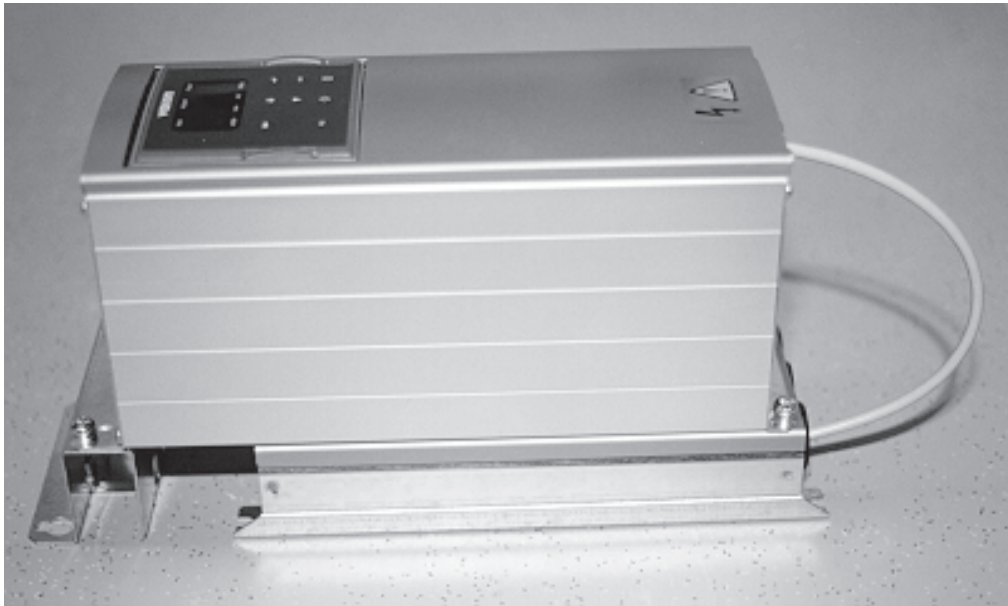
14	<p>Connect the communication cable (9) to the I/O-expander board X15 terminal (12). Ground the communication cable to the option box ground.</p>	
15	<p>Connect the necessary control signals. If a fieldbus board is in use, see separate manual for more specific information.</p>	
16	<p>If an encoder input (closed loop control) is to be used and the encoder works on a 5V level, move three jumpers from terminal X5 to terminal X8. If the encoder works on 24V, then X8-terminal should be left free.</p>	
17	<p>Check the connections and make sure that there are no foreign objects inside the option box. Before connecting the utility make sure that the cover of the option box and the drive is closed.</p>	
18	<p>Set the parameters of the I/O-expander board according to the "SVReady" -application manual (parameter group 3).</p>	

Table 3-2. I/O-expander board installation



*Figure 3-2. Drive and external I/O-expander box installation (unit sizes M3 and M4B, Compact Nema 1).  
I/O-expander box can also be installed next to the drive (unit sizes M3, M4B and M5B, Compact Nema 1).*

## 4 CONTROL CONNECTIONS

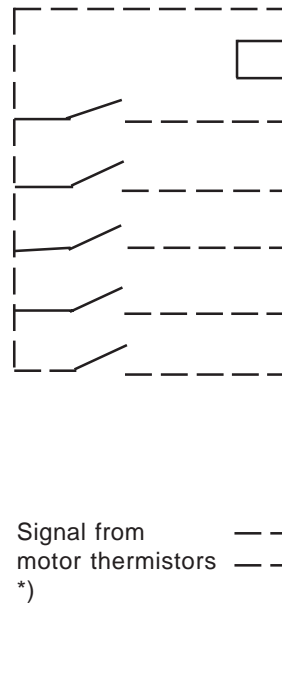
### 4.1 SV9IOC100

Terminal		Signal	Description
201	+10V <sub>ref</sub>	Reference output	Voltage for a potentiometer, etc.
202	V <sub>in</sub> +	Analog input, voltage range 0—10 V DC	Not in use
203	GND	I/O ground	Ground for reference and controls
204	I <sub>n</sub> +	Analog input, current range 0—20 mA	Not in use
205	I <sub>n</sub> -		
206	+24V	Control volt. output	Voltage for switches, etc. max. 50mA
207	GND	I/O ground	Ground for reference and controls
208	CMC	Common for DIC1-DIC5	Connect to GND or + 24 V
209	DIC1	External fault (closing contact)	Contact open = no fault Contact closed = fault
210	DIC2	Run disable	Cont. open = start of motor enabled Cont. closed = start of motor disabled
211	DIC3	Acceler./Decel. time selection	Contact open = time 1 selected Contact closed = time 2 selected
212	DIC4	Jogg. speed selection	Contact open = no action Contact closed = jogging speed
213	DIC5	Fault reset	Contact open = no action Contact closed = fault reset
214	DI6A+	Pulse input A (differential input)	
215	DI6A-		
216	DI7B+	Pulse input B (differential input)	90 degrees phase shift compared to pulse input A
217	DI7B-		
218	DI8Z+	Pulse input C (differential input)	one pulse per one revolution
219	DI8Z-		
220	I <sub>out</sub> +	Analog output 0—20 mA/R <sub>L</sub> max. 500 W	Programmable (Motor current as default value)
221	TI+	Thermistor input	
222	TI-		
223	RO3/1	Relay output 3	READY
224	RO3/2		
225	RO4/1	Relay output 4	RUN
226	RO4/2		
227	RO5/1	Relay output 5	FAULT
228	RO5/2		

Figure 4-1 Control connections of SV9IOC100.

**\*) NOTE!** Thermistor input (terminals 221 and 222) must be shorted if not used.

## 4.2 SV9IOC101



Terminal	Signal	Description
206	+24V	Control voltage output Voltage for switches, etc. max. 50 mA
207	GND	I/O ground Ground for reference and controls
208	CMC	Common for DIC1-DIC5 Connect to GND or + 24 V
209	DIC1	External fault (closing contact) Contact open = no fault Contact closed = fault
210	DIC2	Run disable Cont. open = start of motor enabled Cont. closed= start of motor disabled
211	DIC3	Acceler. / Decel. time selection Contact open = time 1 selected Contact closed = time 2 selected
212	DIC4	Jogging speed selection Contact open = no action Contact closed = jogging speed
213	DIC5	Fault reset Contact open = no action Contact closed = fault reset
214	N.C.	Not connected
215	N.C.	Not connected
221	Th+	Thermistor input
222	Th+	
225	RO4/1	Relay output 4 RUN
226	RO4/2	

Figure 4-2 Control connections of SV9IOC101.

**\*) NOTE!** Thermistor input (terminals 221 and 222) must be shorted if not used.

## 4.3 SV9IOC102

Terminal		Signal	Description
201	+10V <sub>ref</sub>	Reference output	Voltage for a potentiometer, etc.
202	V <sub>in</sub> +	Analog input, voltage range 0—10 V DC	Not in use
203	GND	I/O ground	Ground for reference and controls
204	V <sub>in</sub> +	Analog input, voltage range 0—10 V DC	Not in use
205	V <sub>in</sub> -		
206	+24V	Control voltage output	Voltage for switches, etc. max. 50 mA
207	GND	I/O ground	Ground for reference and controls
208	CMC	Common for DIC1-DIC5	Connect to GND or + 24 V
209	DIC1	External fault (closing contact)	Contact open = no fault Contact closed = fault
210	DIC2	Run disable	Cont.open = start of motor enabled Cont.closed=start of motor disabled
211	DIC3	Acceler./Decel. time selection	Contact open = time 1 selected Contact closed = time 2 selected
212	DIC4	Jogg.speed selection	Contact open=no action Contact closed=jogging speed
213	DIC5	Fault reset	Contact open = no action Contact closed = fault reset
214	DI6A+	Pulse input A (differential input)	
215	DI6A-		
216	DI7B+	Pulse input B (differential input)	90 degrees phase shift compared to pulse input A
217	DI7B-		
218	DO1	Encoder direction output	
219	DO2	Encoder div. 1/64 output	
220	U <sub>out</sub> +	Analog output 0—10 V DC/R <sub>L</sub> ≥ 1 kΩ	Programmable (Motor voltage as default value)
221	TI+	Thermistor input	
222	TI-		
223	RO3/1		Relay output 3    READY
224	RO3/2		
225	RO4/1		Relay output 4    RUN
226	RO4/2		
227	RO5/1		Relay output 5    FAULT
228	RO5/2		

Figure 4-3 Control connections of SV9IOC102.

**\*) NOTE!** Thermistor input (terminals 221 and 222) must be shorted if not used.

#### 4.4 Vacon CX103OPT

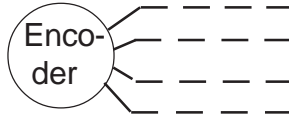
Terminal		Signal	Description
	206	+24V	Control voltage output Volt. for switches, etc. max. 50 mA
	207	GND	I/O ground Ground for reference and controls
	208	CMC	Common for DIC1-DIC5 Connect to GND or + 24 V
	209	DIC1	External fault (closing contact) Contact open = no fault Contact closed = fault
	210	DIC2	Run disable Cont.open = start of motor enabled Cont.closed= start of motor disabled
	211	DIC3	Acceler./Decel. time selection Contact open = time 1 selected Contact closed = time 2 selected
	212	DIC4	Jogg. speed selection Contact open = no action Contact closed=jogging speed
	213	DIC5	Fault reset Contact open = no action Contact closed = fault reset
	214	GND	I/O ground
	215	I <sub>out</sub> +	Analog output 0—20 mA/R <sub>L</sub> max. 500W Programmable (Motor current as default value)
Signal from motor thermistors *)	221	Ti+	Thermistor input
	222	Ti-	
	223	RO3/1	Relay output 3 READY
	224	RO3/2	
	225	RO4/1	Relay output 4 RUN
	226	RO4/2	
	227	RO5/1	Relay output 5 FAULT
	228	RO5/2	

Figure 4-4 Control connections of SV9IOC103.

**\*) NOTE!** Thermistor input (terminals 221 and 222) must be shorted if not used.



## 4.5 SV9IOC104



The diagram shows a circle labeled 'Encoder' with four lines extending from it to the left side of terminals 214, 215, 216, and 217 in the table below.

Terminal		Signal	Description
201	+5V	Control voltage output	Voltage for switches, max load 100-150 mA
203	GND	I/O ground	Ground for controls
206	+24V	Control voltage output	
207	GND	I/O ground	Ground for controls
214	DI6A+	Pulse input A (differential input)	
215	DI6A-		
216	DI7B+	Pulse input B (differential input)	
217	DI7B-		
218	DIR	Encoder direction	
219	DIV	Encoder divider 1/1024	

Figure 4-5 Control connections of SV9IOC104.