AVTRON
ACCel500 EXPANDER I/O
AND ADAPTER I/O BOARDS

Cleveland, Ohio

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AVTRON MANUFACTURING, INC.
Cleveland, Ohio

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AVTRON ACCel500
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SECTION I

GENERAL INFORMATION

There is a wide range of expander and adapter boards that can be used to increase the I/O capacity of the ACCel500 frequency converter.

The ACCel500 frequency converter's input and output configuration is designed with modularity in mind. The total I/O is composed of option boards, each having its own input and output configuration. The boards contain not only normal analog and digital inputs and outputs, but also fieldbuses and additional application-specific hardware.

The basic, expander, and adapter boards are placed in the board slots on the control board of the frequency converter. The I/O boards are usually interchangeable between different types of ACCel500 frequency converters. However, the control boards of these types differ from each other to some extent which means that the use of some I/O boards in different ACCel500 frequency converter types may be restricted.

1-1 SLOTS ON THE ACCel500 FREQUENCY CONVERTER CONTROL BOARD

The control board is situated inside the control unit of the ACCel500 frequency converter. There are five board slots (labeled A to E) on the control board. The connectability of different option boards to different slots depends greatly on the type of the board. For more information on this, see section 1.2. See also the descriptions of the options boards in Section III.

Usually, when the frequency converter is delivered from the factory, the control unit includes at least the standard compilation of two basic boards (I/O board and relay board) which are normally installed in slots A and B. The I/O boards mounted at the factory are indicated in the type code of the frequency converter. The three expander slots (C, D and E) are available for different option boards, that is, I/O expander boards, fieldbus boards, and adapter boards.

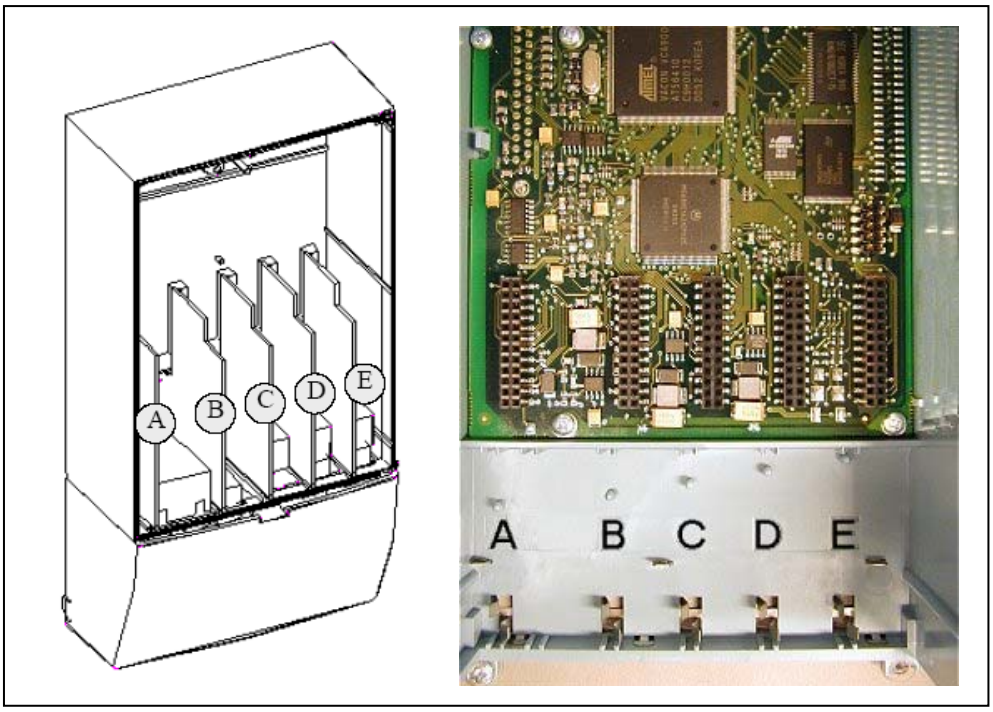


Figure 1-1. Board Slots on Control Board of the ACCel500 Frequency Converter

1-2 OPTION BOARD TYPES

The Avtron option boards are divided in four groups according to their characteristics: types A, B, C, and D. Short descriptions of the types below:

OPT-A_

- Basic boards used for basic I/O; normally pre-installed at the factory
- This board type uses slots A, B, or C.

See section 3-1 for a detailed presentation of the boards of this type. See also the principle diagram on the options boards and their equipment in Table 4-1.

OPT-B_

- Option boards used for I/O expansion
- Normally pluggable into slots B, C, D, or E

See section 3-2 for a detailed presentation of the boards of this type. See also the principle diagram on the options boards and their equipment in Table 4-1.

OPT-C_

- Fieldbus boards (e.g. Profibus or Modbus)
- These boards are connected to slots D or E.

See a separate manual on each individual Fieldbus board. Ask the factory or your nearest distributor for more information.

OPT-D_

- Adapter boards
- Boards with fiber optic adapters, for example, System Bus Fiber Optic adapter board.
- Connect the adapter boards to slots D or E (see section 3-3.3 for more information).

See section 3-3 for a detailed presentation of the boards of this type. See also the principle diagram on the options boards and their equipment in Table 4-2.

1-3 TECHNICAL DATA

The data in the table below applies to the inputs and outputs on all basic and expander boards.

TABLE 1-1. TECHNICAL DATA

Safety (all boards)	**Comply with EN50178,C-UL, and EN60204-1 Inputs/Outputs galvanically isolated; Isolation voltage rate 500V**
Input/output type	**Specification**
ANALOG inputs (AI), voltage	0 to ±10V, $R_i \geq 200$ kΩ, single-ended; Resolution 10 bits/0.1%, accuracy ±1% of the full display (–10 to +10V joystick control)
ANALOG inputs (AI), current	0(4)…20mA, $R_i = 250\Omega$, differential Resolution 10 bits/0.1%, accuracy ±1% of the full display
Digital inputs (DI), DC voltage controlled	24V: "0"≤10V, "1"≥18V, $R_i > 5k\Omega$
Digital inputs (DI), AC voltage controlled	Control voltage 42…240 VAC "0"<33V, "1">35V
Auxiliary voltage (output) (+24V) Auxiliary voltage (input) (ext. +24V)	24V (±15%), max 250mA (total summarized load from ext. +24V outputs, max. 150 mA from one board. 24VDC (±10%, max. ripple voltage 100mV RMS), max. 1A. In special applications where PLC type functions are included in the control unit the input can be used as external auxiliary power supply for control boards as well as I/O boards.
Reference voltage (output) ($+10V_{ref}$)	10V – 0% – +2%, max. 10mA
ANALOG output (AO), current (mA)	0(4) to 20mA, R_L<500Ω, resolution 10 bits/0.1%, accuracy ≤ ±2%
ANALOG output (AO), voltage (V)	0(2) to 10V, RL ≥ 1kΩ, resolution 10 bits, accuracy ≤ ±2%
Relay outputs (RO)	Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Max. continuous load 2A rms Min. switching load: 5V/10mA
Thermistor input (TI)	$R_{trip} = 4.7k\Omega$ (PTC type)
Encoder control voltage (+5V/+12V/ +15V/+24V)	See OPT-A4, OPT-A5, OPT-A7, OPT-AE and OPT-BB technical data
Encoder connections (inputs, outputs)	See OPT-A4, OPT-A5, OPT-A7, OPT-AE and OPT-BB technical data
Environment (all boards)	
Ambient operating temperature	–10 to 55°C
Storing temperature	–40 to60°C
Humidity	<95%, no condensation allowed
Altitude	Max 1000 m
Vibration	0.5 G at 9 to 200 Hz

1-3.1 ISOLATION

The control connections are isolated from the mains potential and the I/O ground is connected directly to the frame of the frequency converter. Digital inputs and relay outputs are isolated from the I/O ground. For digital input arrangements, see section 1-3.5, Digital Input Signal Conversions.

1-3.2 ANALOG INPUTS (mA/V)

ANALOG inputs of I/O boards can be used as either current inputs or voltage inputs (see detailed description of each board). The signal type is selected with a jumper block on the board. In case the voltage type input is used you still have to define the voltage range with another jumper block. The factory default value for the ANALOG signal type is given in the description of the board. For detailed information, see the description of the board in question.

1-3.3 ANALOG OUTPUTS (mA/V)

In the same way as in the analog inputs, the output signal type (current/voltage) can be selected with jumper except for some expander boards with analog outputs used only with current signals.

1-3.4 CONTROL VOLTAGE (+24V/EXT +24V)

The control voltage output +24V/EXT+24V can be used in two ways. Typically, the +24V control voltage is wired to digital inputs through an external switch. The control voltage can also be used to power-up external equipment, such as encoders and auxiliary relays.

Observe that the specified total load on all available +24V/EXT+24V output terminals may not exceed 250mA. The maximum load on the +24V/EXT+24V output per board is 150 mA. See Figure 1-2.

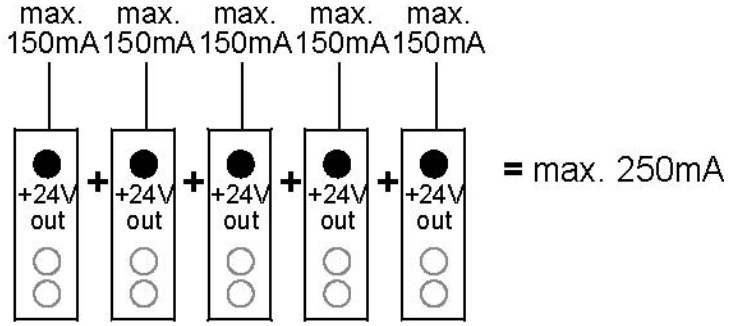


Figure 1-2. Maximum Loads on +24V/EXT+24V Output

The +24V/EXT+24V outputs can further be used to externally power-up the control board as well as the basic and expander boards. If an external power supply is connected to EXT+24V output, the control board, basic boards and expander boards remain live even if mains should be lost on the frequency converter. This ensures sufficient functioning of the control logic (not the motor control, however) and some alarms in exceptional power-loss situations. Furthermore, fieldbus links remain powered which enables, for example, the Profibus Master to read valuable data on the frequency converter. The power unit is not powered through the EXT+24V and therefore the motor control does not work if the mains is lost.

Requirements for an external power back-up:

- output voltage +24DC±10%, max. ripple voltage 100mV RMS
- max. current 1A
- 1A external fuse (no internal short-circuit protection on the control board

NOTE: ANALOG outputs and inputs do not work with only +24V supplied to the control unit.

If there is a +24V/EXT+24V output on the board, it is short-circuit protected locally. Should one of the +24V/EXT+24V outputs short circuit, the others would remain powered because of the local protection.

1-3.5 DIGITAL INPUT SIGNAL CONVERSION

The active signal level depends on which potential the common input CMA (and CMB if available) is connected to. The alternatives are +24V or Ground (0V). See Figure 1-3, Figure 1-4 and Figure 1-5.

The 24-volt control voltage and the ground for the digital inputs and the common input (CMA) can be either internal or external.

Some typical input signal conversion examples are shown below. If you use the internal +24V from the frequency converter, the following arrangements are possible:

If CMA is connected to GND with an inboard jumper, the internal +24V is used and the CMA terminal is not wired.

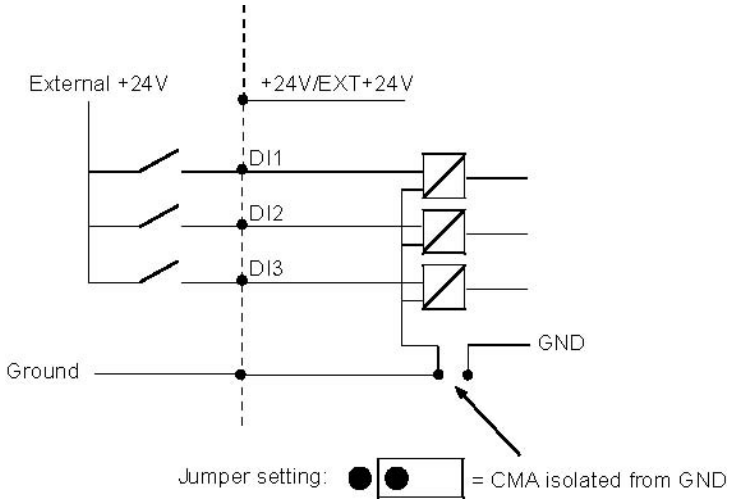


Figure 1-3. CMA is Connected to GND with Inboard Jumper

If you use an external +24V, the following arrangements are possible:

When CMA is isolated from GND using an onboard jumper, the input is active when the switch is closed.

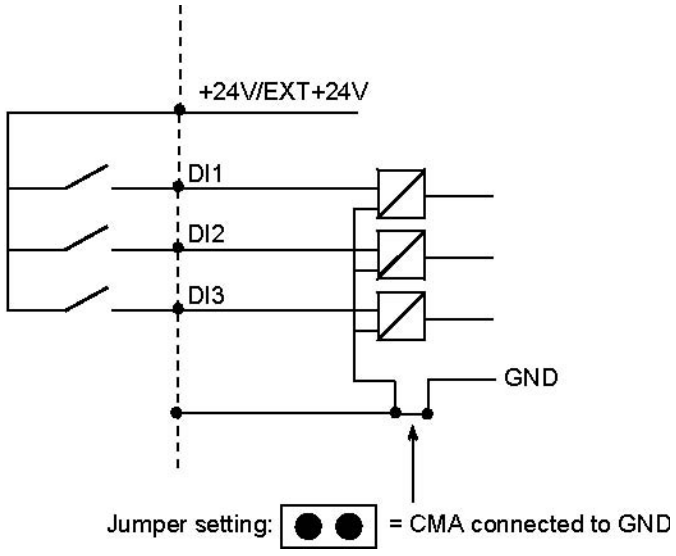


Figure 1-4. Positive Logic with External +24V

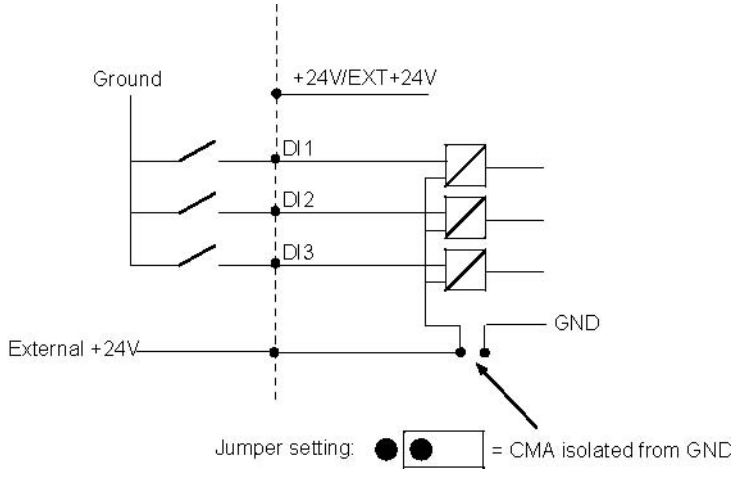


Figure 1-5. Negative logic with external +24V

You can make the positive and negative logic arrangements also with the internal +24V. Place the jumper block in the 'CMA isolated from GND' position (as above) and wire the CMA terminal to the GND terminal of the frequency converter.

1-4 HARDWARE PROTECTIONS

1-4.1 TERMINAL BLOCK CODING

In order to avoid incorrect connections of terminal blocks to boards, some terminal blocks as well as related terminal connectors on the board are uniquely coded. For more information, see the description of the individual board.

1-4.2 BOARD SLOT GUIDES AND ALLOWED SLOTS

You cannot mount an option board into any slot. Table 4-1 and Table 4-2 show which slots are allowed for which option boards. For reasons of safety, slots A and B are protected in hardware against mounting of disallowed boards. If a disallowed board is mounted in slots C, D and E, the board just will not work. There is no danger of injury to personnel or damage to equipment.

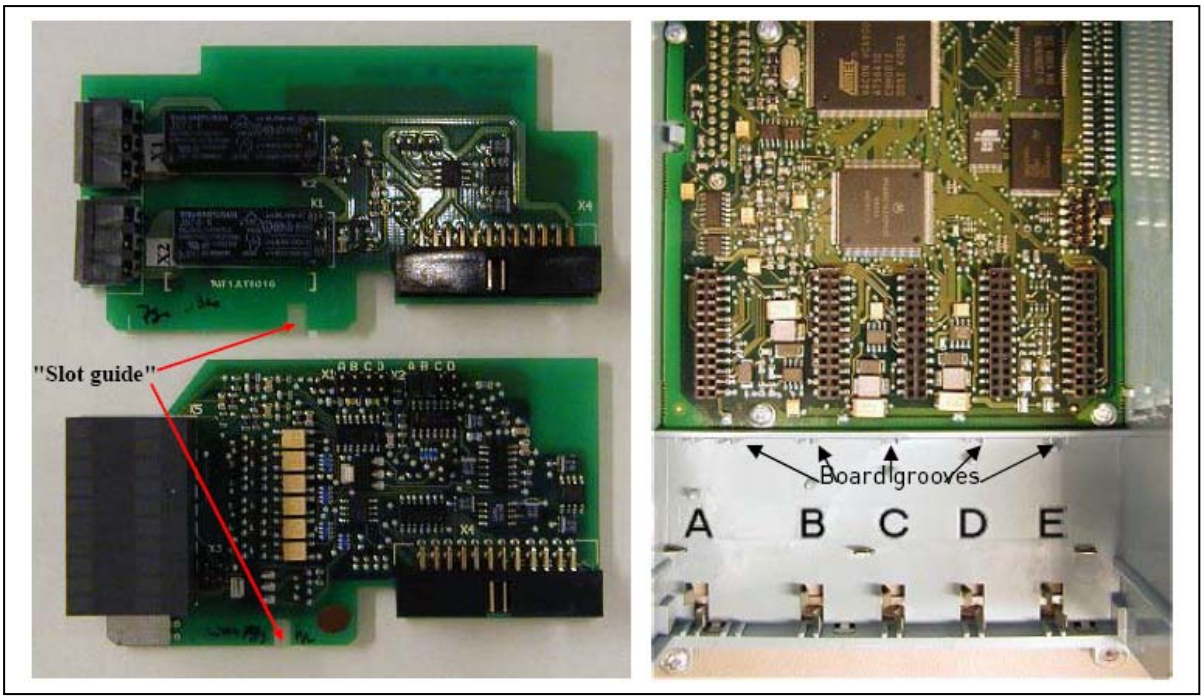


Figure 1-6. Board Guide to Prevent Incorrect Mountings

1-5 TYPE IDENTIFICATION NUMBER

Each ACCel500 option board has a unique type designation code. Besides the type designation code, each board has a unique Type identification number which is used by the system program to identify which board is plugged into which board slot. The system program and the application use the Type ID also to establish the needed connections in order to achieve the desired functionality of the available I/O boards in the control unit. The ID code is loaded in the memory of the board.

1-6 DEFINING A TERMINAL FOR A CERTAIN FUNCTION WITH ADDaptACC PROGRAMMING TOOL

If you use the ADDaptACC Programming Tool, you will have to establish the connection between the function and input/output in the same way as with the control panel. Just pick the address code from the drop-down menu in the Value column (see Figure 1-7).

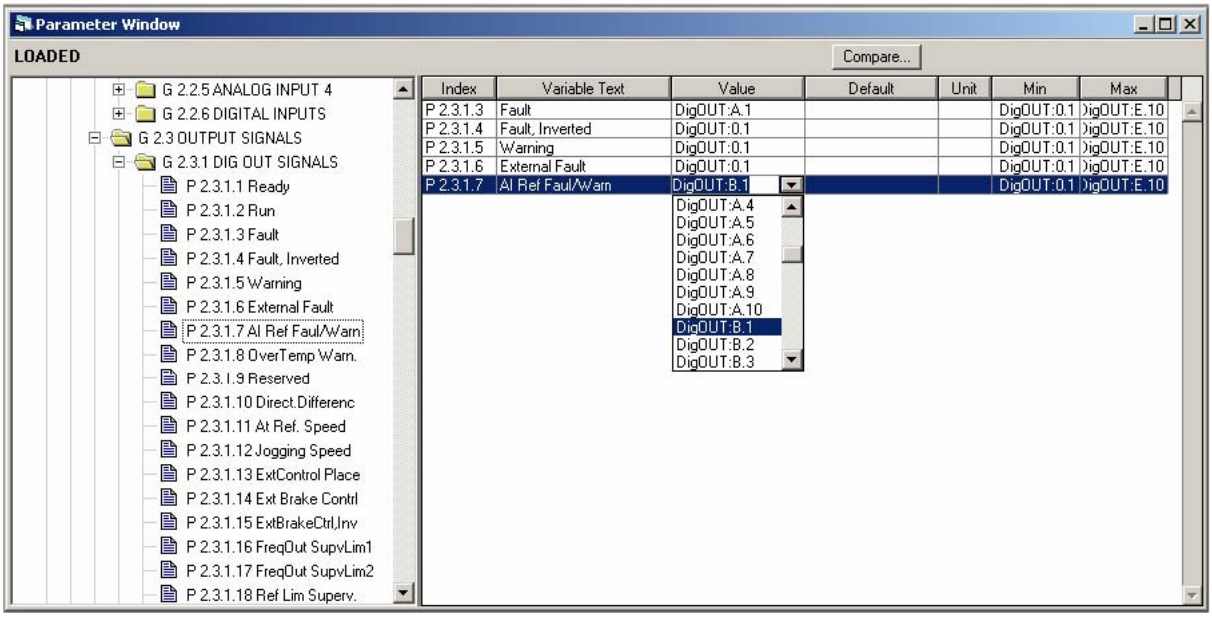


Figure 1-7. Using ADDaptACC Programming Tool to Enter the Address Code

NOTE: In order to avoid function overruns and to ensure flawless operation, do not connect two functions to the same output.

The inputs, unlike the outputs, cannot be changed in RUN state.

1-7 OPTION BOARD RELATED PARAMETERS

Some of the input and output functions of certain option boards are controlled with associated parameters. The parameters are used to set the signal ranges for ANALOG inputs and outputs as well as values for different encoder functions.

The board-related parameters can be edited in the Expander Board Menu (M7) of the control keypad.

Enter the following menu level (G#) with the Menu button right. At this level, you can browse through slots A to E with the Browser buttons to see what expander boards are connected. On the lowermost line of the display, you also see the number of parameters associated with the board. Edit the parameter value as shown below. See Figure 1-8. For more information on the keypad operation, see the ACCel500 Software Manual.

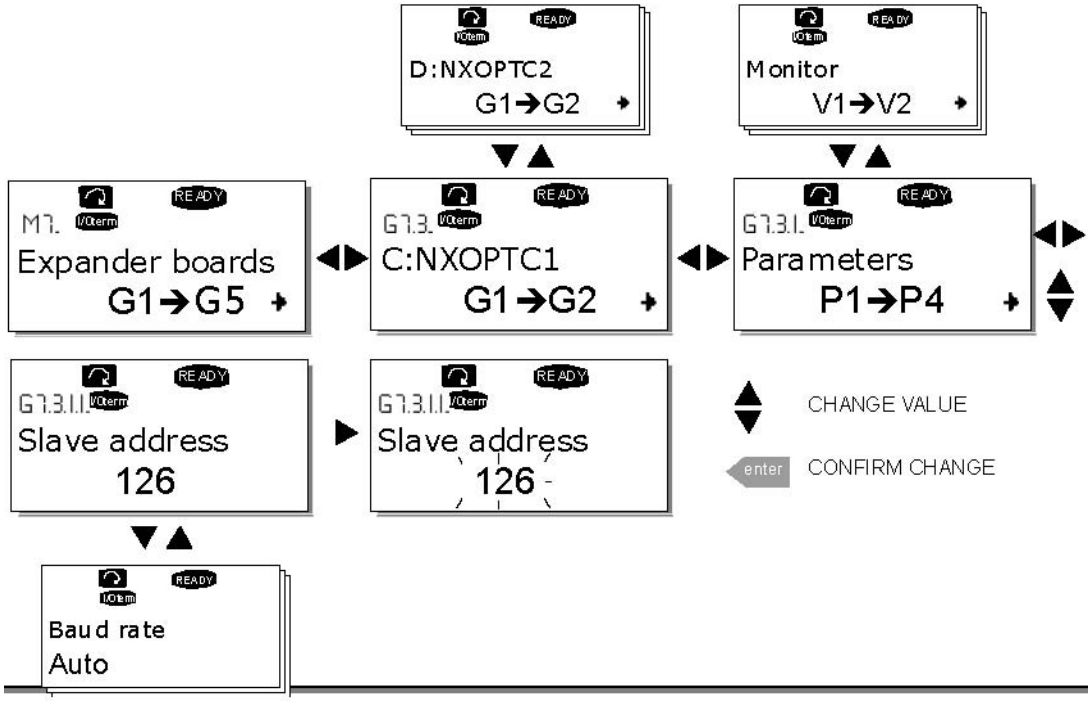


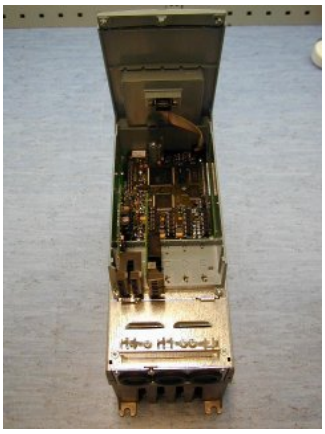
Figure 1-8. Board Parameter Value Editing

NOTE: Fieldbus boards (OPT-C_) also have fieldbus-related parameters. These boards are described in the separate fieldbus board manuals.

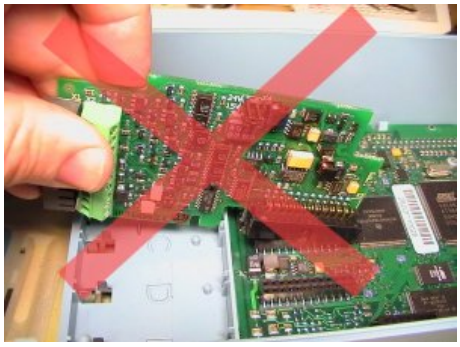
SECTION II

INSTALLATION OF OPTION BOARDS

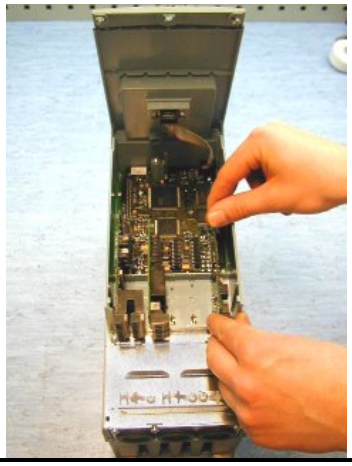
NOTE: It is not allowed to add or replace option boards or fieldbus boards on a frequency converter with the power switched on. This may damage the boards.

A	ACCel500 frequency converter	
B	Remove the cable cover.	
C	Open the cover of the control unit.	

D Install the option board in a correct slot on the control board of the frequency converter. When attaching (also removing) the board, hold it in horizontally straight position to avoid twisting the connector pins. See the photos below.



Make sure that the board (see below) fits tightly in the metal clamp and the plastic groove. If the board seems to be difficult to fit in the slot, you may have to check the allowed slots for your option board.
NOTE: Check that the jumper settings on the board correspond to you needs.
Finally, close the cover of the frequency converter and the cable cover.



2-1 CONTROL CABLES

The control cables used shall be at least 20 AWG (0.5 $mm^{2)}$ screened multicore cables. The maximum terminal wire size is 14 AWG (2.5 $mm^{2)}$ for the relay terminals and 16 AWG (1.5 $mm^{2)}$ for other terminals.

Find the tightening torques of the option board terminals in the table below.

TABLE 2-1. TIGHTENING TORQUES OF TERMINALS

Terminal Screw	**Tightening Torque**	
	Nm	**lb-in**
Relay and thermistor terminals (screw M3)	0.5	4.5
Other terminals(screw M2.6)	0.2	1.8

TABLE 2-2. CABLE TYPES REQUIRED TO MEET STANDARDS

Cable type	Level H, C	Level L
Control cable	4	4

Level H = EN 61800-3+A11, 1st environment, restricted distribution
EN 61000-6-4

Level L = EN61800-3, 2nd environment

4 = Screened cable equipped with compact low-impedance shield.

2-1.1 CABLE GROUNDING

We recommend grounding the control cables in the manner presented above.

Strip the cable at such distance from the terminal that you can fix it to the frame with the grounding clamp.

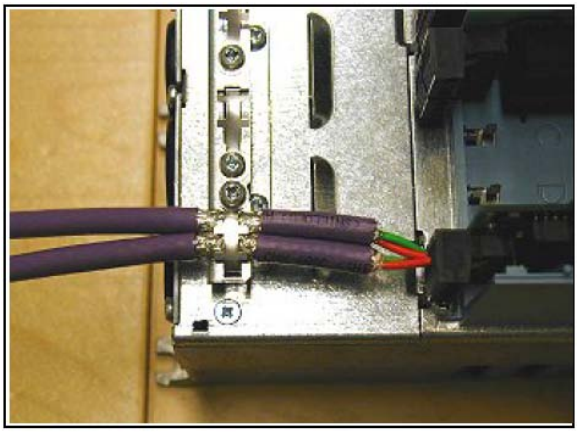
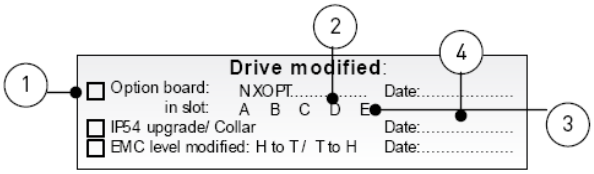


Figure 2-1. Grounding of control cable

2-2 BOARD INFORMATION STICKER

Each I/O option board package delivered by the factory includes a sticker (shown below) where possible modifications made in the frequency converter are noted. Please check Option board (1), mark the board type (2), the slot into which the board is mounted (3) and the mounting date (4) on the sticker. Finally, attach the sticker on your drive.



SECTION III

DESCRIPTIONS OF OPTION BOARDS

3-1 BASIC BOARDS OPT-A_

- Basic boards used for basic I/O; normally pre-installed at the factory
- This board type uses slots A, B and C.

The standard ACCel500 frequency converters contain two boards placed in slots A and B. The board in slot A (OPT-A1, OPT-A8 or OPT-A9) has digital inputs, digital outputs, analog inputs and an analog output. The board in slot B (OPT-A2) has two change-over relay outputs. As an alternative to OPT-A2, a board of type OPT-A3 can also be placed in slot B. In addition to the two relay outputs, this board has one thermistor input.

The boards you wish to have installed in your frequency converter have to be defined in the type designation code of the frequency converter when ordering it from the factory.

TABLE 3-1. ACCel500 BASIC BOARDS AND THEIR EQUIPMENT

I/O Board	Allowed Slots	DI	DO	AI	AO	RO	TI	Other
OPT-A1	A	6	1	2 (mA/V), incl. -10 to +10V	1 (mA/V)			+10Vref +24V/ EXT+24V
OPT-A2	B					2 (NO/NC)		
OPT-A3	B					1 (NO/NC) + 1 NO	1	
OPT-A4	C	3 DI encoder (RS-422) + 2 DI (qualifier & fast input)						+5V/+15V/+24V (progr.)
OPT-A5	C	3 DI encoder (wide range) + 2 DI (qualifier & fast input)						+15V/+24V (progr.)
OPT-A7	C	6 (enc.)	2 (enc)					+15V/+24V (progr.)
OPT-A8	A	6	1	2 (mA/V), incl. -10 to +10V (de-coupled from GND)	1 (mA/V) (decoupled from GND)			+10Vref (decoupled from GND) +24V/ EXT+24V
OPT-A9	A	6	1	2 (mA/V), incl. -10 to +10V	1 (mA/V)			+10ref (2,5 mm terminals) +24V/ EXT+24V
OPT-AE	C	3 DI encoder (wide range)	2 (Enc.)					+15V/+24V (progr.)

DI = Digital input DO = Digital output TI = Thermistor input
AI = ANALOG input AO = ANALOG output RO = Relay output

3-1.1 OPT-A1

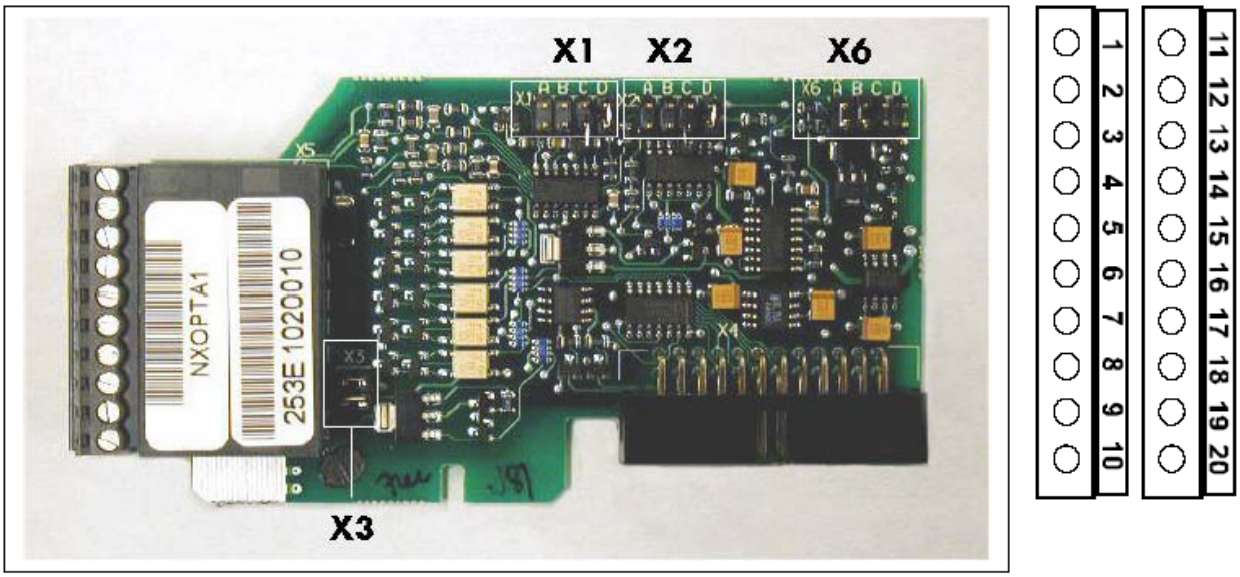


Figure 3-1. Avtron OPT-A1 Option Board

Description:	Standard I/O board with digital inputs/outputs and ANALOG inputs/outputs
Allowed slots:	A
Type ID:	16689
Terminals:	Two terminal blocks (coded = mounting of blocks in wrong order prevented, terminals #1 and #12); Screw terminals (M2.6)
Jumpers:	4; X1, X2, X3 and X6 (See Figure 3-2)
Board parameters:	Yes (see Table 3-3)

TABLE 3-2. OPT-A1 I/O TERMINALS (coded terminals grayed)

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
1	+10 Vref		Reference output +10V; Maximum current 10 mA
2	AI1+	An.IN:A.1	Selection V or mA with jumper block X1 (see page 3-4): Default: 0– +10V (Ri = 200 kΩ) (-10V..+10V Joy-stick control, selected with ajumper) 0– 20mA (Ri = 250 Ω) Resolution 0.1%; Accuracy ±1%
3	AI1–		Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
4	AI2+	An.IN:A.2	Selection V or mA with jumper block X2 (see page 3-4): Default: 0– 20mA (Ri = 250 Ω) 0– +10V (Ri = 200 kΩ) (-10V..+10V Joy-stick control, selected with a jumper) Resolution: 0.1%; Accuracy ±1%
5	AI2–		Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
6	24 Vout (bi-directional)		24V auxiliary voltage output. Short-circuit protected. ±15%, maximum current 150 mA, see 1.4.4 +24Vdc external supply may be connected. Galvanically connected to terminal #12.
7	GND		Ground for reference and controls Galvanically connected to terminals #13,19.
8	DIN1	DigIN:A.1	Digital input 1 (Common CMA); R_i = min. 5kΩ
9	DIN2	DigIN:A.2	Digital input 2 (Common CMA); R_i = min. 5kΩ
10	DIN3	DigIN:A.3	Digital input 3 (Common CMA); R_i = min. 5kΩ
11	CMA		Digital input common A for DIN1, DIN2 and DIN3. Connection by default to GND. Selection with jumper block X3 (see page 3-4):
12	24 Vout (bi-directional)		Same as terminal #6 Galvanically connected to terminal #6.
13	GND		Same as terminal #7 Galvanically connected to terminals #7 and 19
14	DIN4	DigIN:A.4	Digital input 4 (Common CMB); R_i = min. 5kΩ
15	DIN5	DigIN:A.5	Digital input 5 (Common CMB); R_i = min. 5kΩ
16	DIN6	DigIN:A.6	Digital input 6 (Common CMB); R_i = min. 5kΩ
17	CMB		Digital input common B for DIN4, DIN5 and DIN6. Connection by default to GND. Selection with jumper block X3 (see page 3-4):
18	AO1+	AnOUT:A.1	ANALOG output Output signal range: Current 0(4)–20mA, RL max 500Ω or Voltage 0—10V, RL >1kΩ Selection with jumper block X6 (see page 3-4): Resolution: 0.1% (10 bits); Accuracy ±2%
19	AO1–		
20	DO1	DigOUT:A.1	Open collector output Maximum U_{in} = 48VDC Maximum current = 50 mA

Jumper Selections

There are four jumper blocks on the OPT-A1 board. The factory defaults and other available jumper selections are presented below.

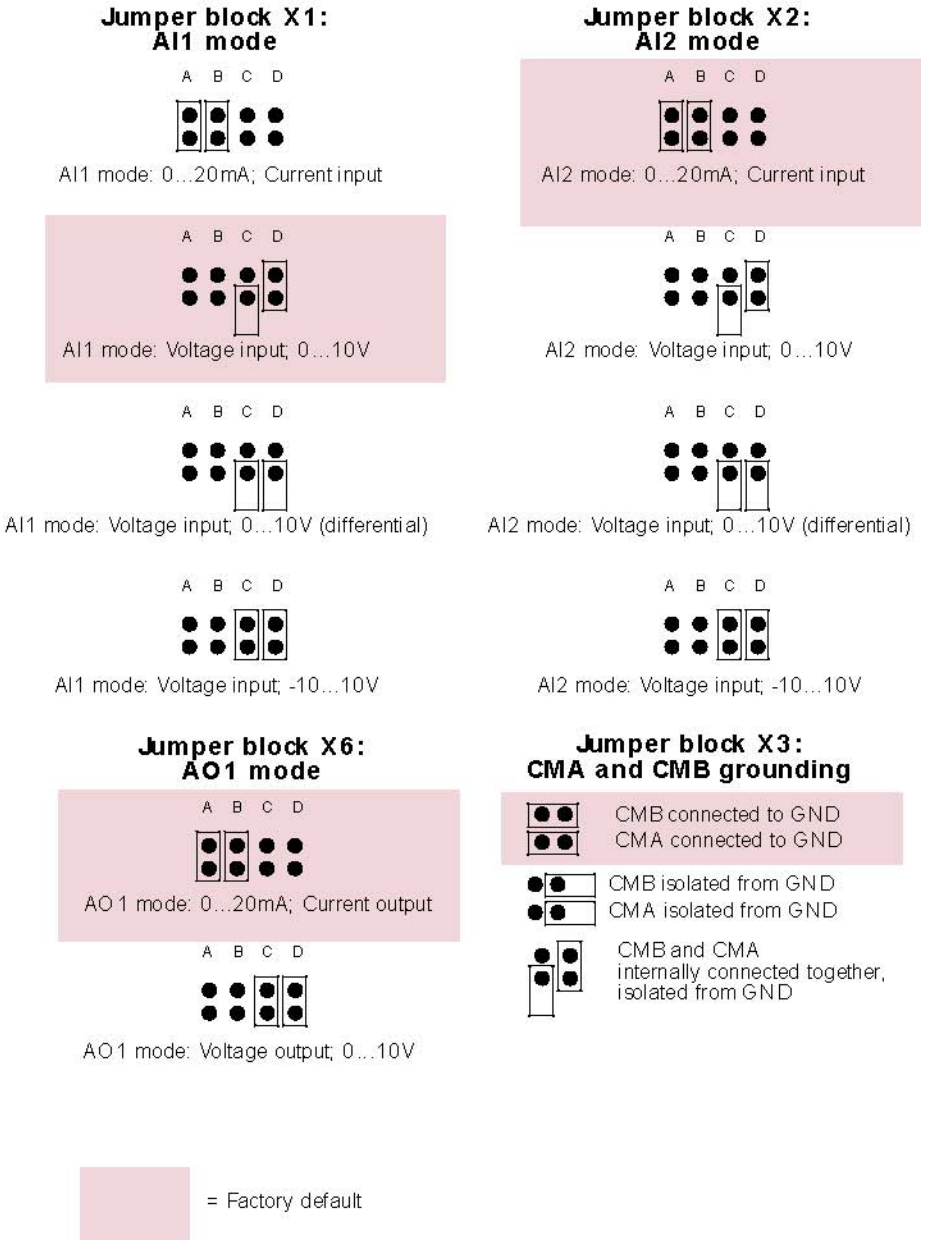


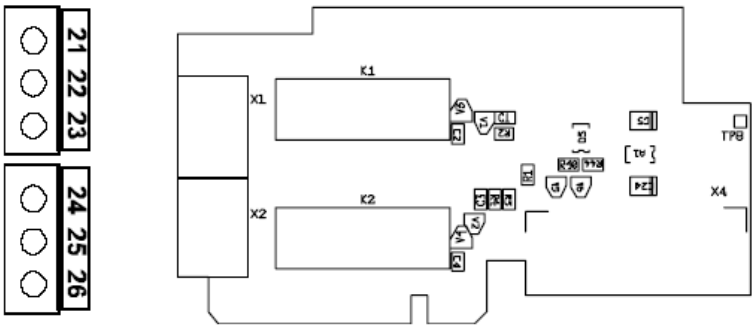
Figure 3-2. Jumper Block Selection on OPT-A1

OPT-A1 Parameters

TABLE 3-3. OPT-A1 BOARD-RELATED PARAMETERS

Number	Parameter	Min	Max	Default	Note
1	AI1 mode	1	5	3	1 = 0 to 20mA 2 = 4 to 20mA 3 = 0 to 10V 4 = 2 to 10V 5 = -10 to +10V
2	AI2 mode	1	5	1	1 = 0 to 20mA 2 = 4 to 20mA 3 = 0 to 10V 4 = 2 to 10V 5 = -10 to +10V
3	AO1 mode	1	4	1	1 = 0 to 20mA 2 = 4 to 20mA 3 = 0 to 10V 4 = 2 to 10V

3-1.2 OPT-A2

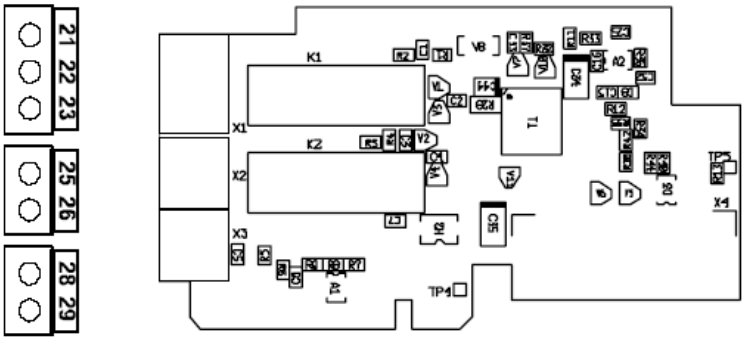


Description: Standard ACCel500 frequency converter relay board with two relay outputs
Allowed slots: B
Type ID: 16690
Terminals: Two terminal blocks; Screw terminals (M3); No coding
Jumpers: None
Board parameters: None

TABLE 3-4. OPT-A2 I/O TERMINALS

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
21 22 23	RO1/normal closed RO1/common RO1/normal open	DigOUT:B.1	Relay output 1 (NO/NC) Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA
24 25 26	RO2/normal closed RO2/common RO2/normal open	DigOUT:B.2	Relay output 2 (NO/NC) Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA

3-1.3 OPT-A3

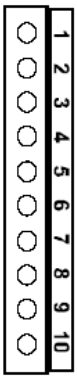


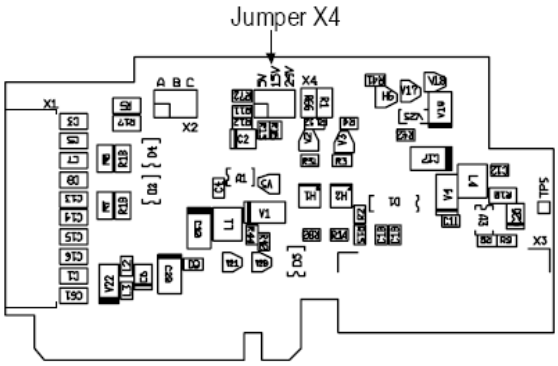
Description: Relay board with two relay outputs and one thermistor input for ACCel500 frequency converter
Allowed slots: B
Type ID: 16691
Terminals: Three terminal blocks; Screw terminals (M3); No coding.
Jumpers: None
Board parameters: None

TABLE 3-5. OPT-A3 I/O TERMINALS

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
21 22 23	RO1/normal closed RO1/common RO1/normal open	DigOUT:B.1	Relay output 1 (NO/NC) Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA
25 26	RO2/common RO2/normal open	DigOUT:B.2	Relay output 2 (NO) Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA
28 29	TI1+ TI1–	DigIN:B.1	Thermistor input; R_{trip} = 4.7 kΩ (PTC)

3-1.4 OPT-A4





Description: Encoder board for ACCel500. Encoder input board with programmable control voltage for an encoder

The encoder board OPT-A4 is for TTL type encoders (TTL, TTL(R)) providing input signal levels that meet the RS_422 interface standard. Encoder inputs A, B and Z are not galvanically isolated. The OPT-A4 board includes, too, the qualifier input ENC1Q (meant to trace the Z-pulse in certain situations) and a special/fast digital input DIC4 (used to trace very short pulses). These two inputs are used in special applications.

The TTL type encoders do not have an internal regulator and use therefore a supply voltage of +5V±5% whereas the TTL(R) type encoders have an internal regulator and the supply voltage can be e.g. +15V±10% (depending on the encoder manufacturer).

Allowed slots: C
Type ID: 16692
Terminals: One terminal block; Screw terminals (M2.6); Coding in terminal #3.
Jumpers: 2; X4 and X5 (see page 26)
Board parameters: Yes (see Table 3-7)

TABLE 3-6. OPT-A4 I/O TERMINALS (coded terminal grayed)

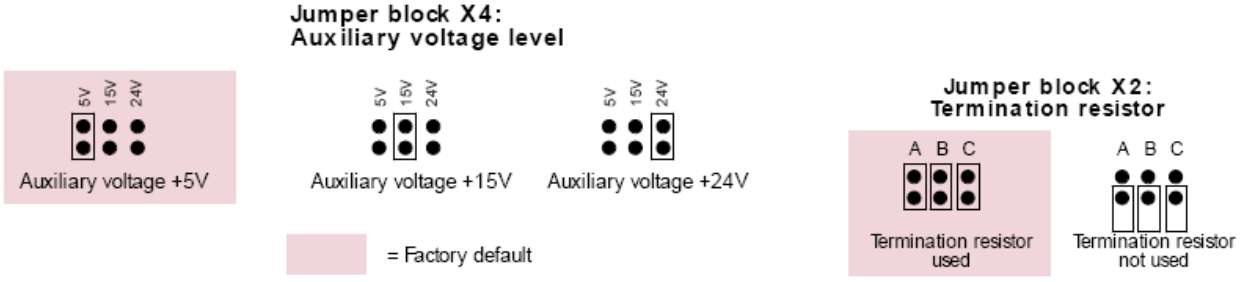
Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
1	DIC1A+		Pulse input A
2	DIC1A–		
3	DIC2B+		Pulse input B; phase shift of 90 degrees compared to Pulse input A
4	DIC2B–		
5	DIC3Z+		Pulse input Z; one pulse per revolution
6	DIC3Z–		
7	ENC1Q		Reserved for future use
8	DIC4		Reserved for future use
9	GND		Ground for control and inputs ENC1Q and DIC4
10	+5V/+15V/+24V		Control voltage (auxiliary voltage) output to encoder; Output voltage selectable with jumper X4. See chapter 1.4.4

Technical Data

Encoder control voltage, +5V/+15V/+24V	Control voltage selectable with jumper X4.
Encoder input connections, inputs A+, A–, B+, B–, Z+, Z–	Max. input frequency ≤150kHz Inputs A, B and Z are differential Encoder inputs are RS-422 interface compatible Max. load per encoder input $I_{low} = I_{high} \approx 25mA$
Qualifier input ENC1Q Fast digital input DIC1	Max. input frequency ≤10kHz Min. pulse length 50µs Digital input 24V; R_i>5kΩ Digital input is single-ended; connected to GND

Jumper Selections

There are two jumper blocks on the OPT-A4 board,. The jumper X2 is used to define the status of the termination resistor (R=135Ω). The jumper X4 is used to program the control voltage (auxiliary voltage). The factory default and other available jumper selections are presented below.



Encoder Connection – Differential

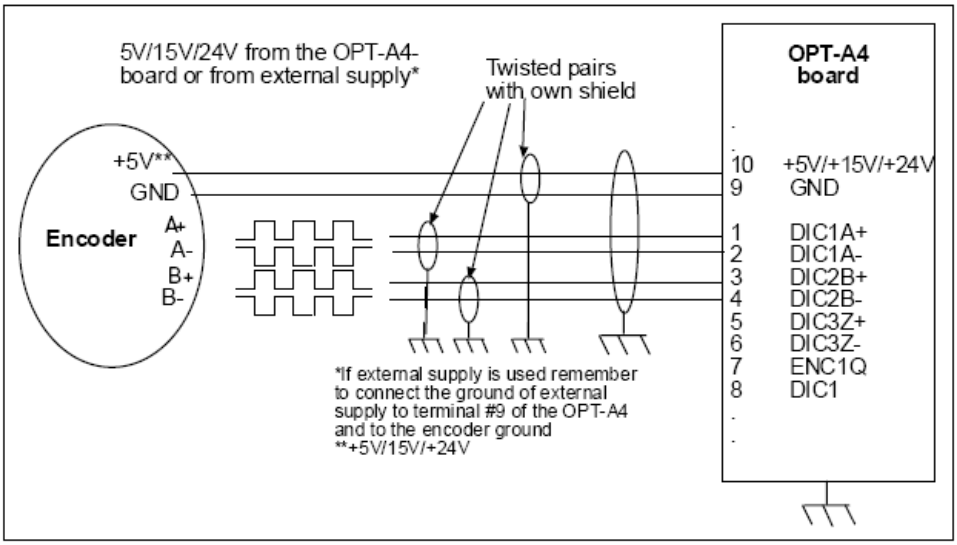
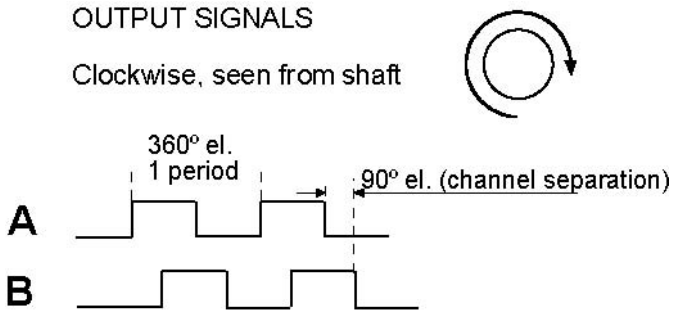


Figure 3-3. RS-422-type Encoder Connection using Differential Inputs

NOTE: The encoder pulses are handled by Avtron software as presented below:

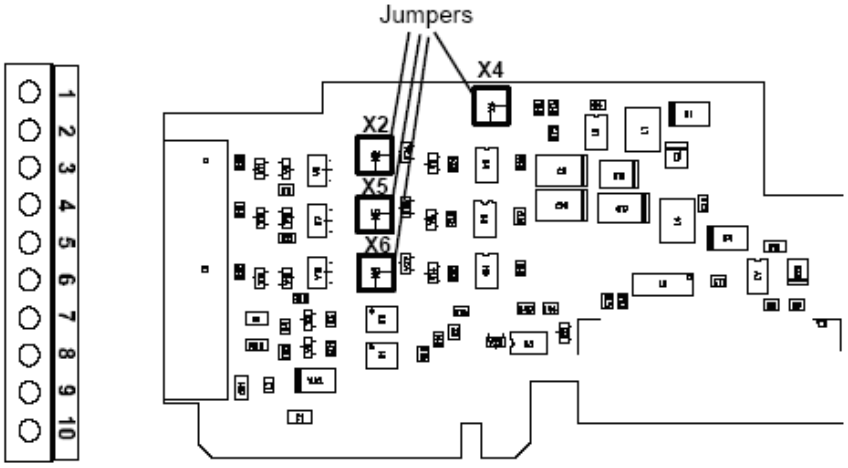


OPT-A4 parameters

TABLE 3-7. OPT-A4 BOARD-RELATED PARAMETERS

Number	Parameter	Min	Max	Default	Note
7.3.1.1	Pulse/revolution	1	65535	1024	
7.3.1.2	Invert direction	0	1	0	0 = No 1 = Yes
7.3.1.3	Reading rate	0	4	1	Time used to calculate speed actual value. Note: Use value 1 in Closed Loop mode. 0 = No 1 = 1 ms 2 = 5 ms 3 = 10 ms 4 = 50 ms

3-1.5 OPT-A5



Description: Encoder board for ACCel500. Encoder input board with programmable control voltage for an encoder.

The OPT-A5 board is designed for HTL (High voltage Transistor Logic) type encoders (voltage output type push-pull HTL, open collector output type HTL) which provide input signal levels dependent on the supply voltage of the encoder. The encoder inputs A, B and Z are galvanically isolated. The OPT-A5 board also includes the qualifier input ENC1Q (meant to trace the Z-pulse in certain situations) and a fast digital input DIC4 (used to trace very short pulses). These two inputs are used in special applications.

The OPT-A5 is similar to the OPT-A4 in connections but the encoder inputs A, B and Z have different signal levels (voltage level). The input levels for A, B and Z of the OPT-A4 are compatible with RS-422 while those of the OPT-A5 are more general wide range inputs. Inputs ENC1Q and DIC4 are identical in both boards.

Allowed slots: C
Type ID: 16693
Terminals: One terminal block; Screw terminals (M2.6); Coding in terminal #3.
Jumpers: 4; X2, X4, X5, X6 (see Jumper Selections)
Board parameters: Yes (see Table 3-7)

TABLE 3-8. OPT-A5 I/O TERMINALS **(coded terminal grayed)**

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
1	DIC1A+		Pulse input A (differential); Voltage range 10…24V
2	DIC1A–		
3	DIC2B+		Pulse input B; phase shift of 90 degrees compared to Pulse input A (differential); Voltage range 10…24V
4	DIC2B–		
5	DIC3Z+		Pulse input Z; one pulse per revolution (differential); Voltage range 10…24V
6	DIC3Z–		
7	ENC1Q		Reserved for future use
8	DIC4		Reserved for future use
9	GND		Ground for control and inputs ENC1Q and DIC4
10	+15V/+24V		Control voltage (auxiliary voltage) output to encoder; Output voltage selectable with jumper X4. See section 1-3.4.

NOTE: Encoder inputs are wide range inputs that can be used with encoders using +15V or +24V

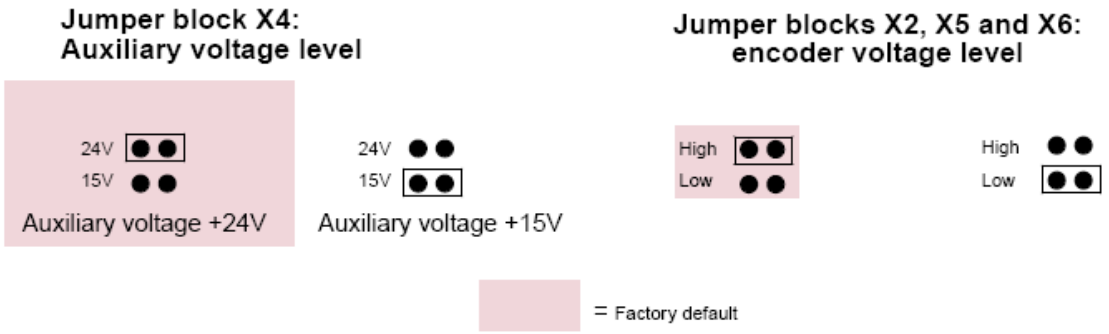
Technical Data

Encoder control voltage, +15V/+24V	Control voltage selectable with jumper X4.
Encoder input connections, inputs A+, A–, B+, B–, Z+, Z–	Max. input frequency ≤150kHz Inputs A, B and Z are differential
Qualifier input ENC1Q Fast digital input DIC1	Max. input frequency ≤10kHz Min. pulse length 50µs Digital input 24V; Ri>5kΩ Digital input is single-ended; connected to GND

NOTE: A high pulse frequency combined with a great cable capacitance places a considerable load on the encoder. Apply,therefore, as low a voltage as possible for the encoder supply, rather lower than 24V. The manufacturer also recommends placing jumper X4 to position +15V, if allowed in the voltage range specification of the encoder.

Jumper Selections

On the OPT-A5 board, there are four jumper blocks; X4 is used to program the control voltage (auxiliary voltage), X2, X5 and X6 are set according the voltage of the encoder. The factory default and other available jumper selections are presented below.



Jumper blocks X2, X5 and X6:

When these jumpers are set to High (default and typically good for 24V encoders), it means that when the voltage at the channel goes above 8V, it will acknowledge a new pulse.

When they are set to Low = 2.3 V, it means that when the voltage at the channel goes abov2.3V, it will acknowledge a new pulse.

Usage: Closed Loop Vector Control. The OPT-A5 board is mainly used in conventional industrial applications where encoder cable lengths are relatively long.

Encoder Connection – Single-Ended

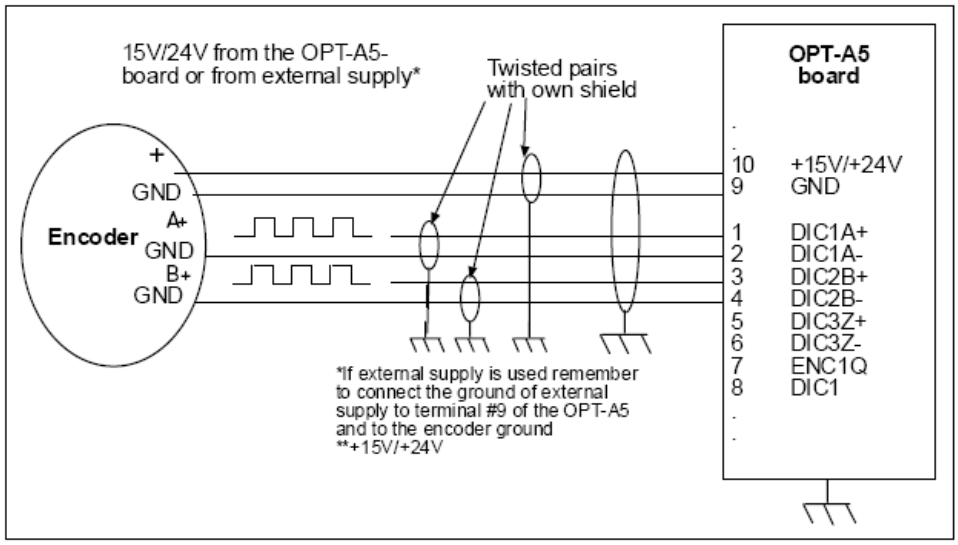


Figure 3-4. HTL type Encoder Connection (Open Source) using Single-Ended Inputs

NOTE: Grounding is to be connected only at the frequency converter to avoid circulating current in the shield. Isolate shield at the encoder.

It is recommended to use double shielded cable for encoder connection.

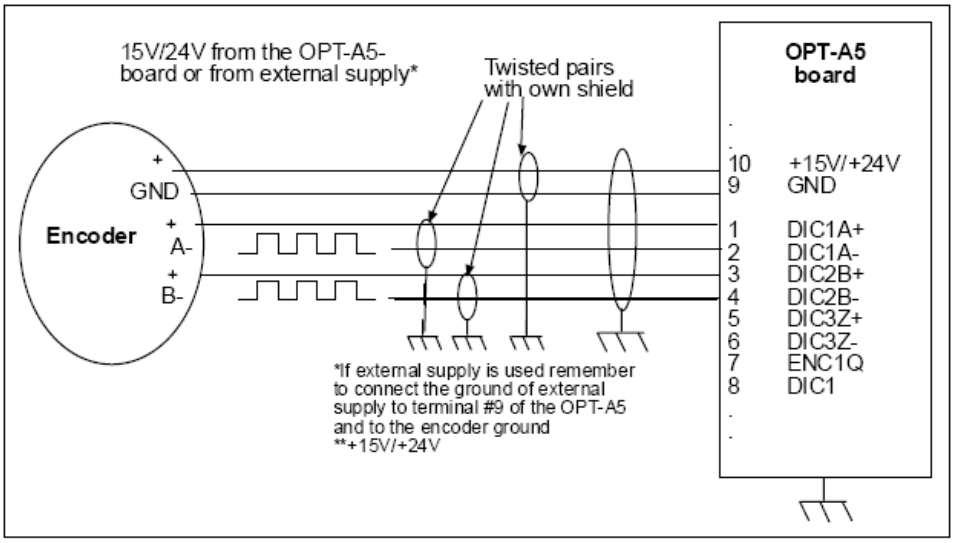


Figure 3-5. HTL type Encoder Connection (Open Collector) using Single-Ended Inputs

NOTE: Grounding is to be connected only at the frequency converter to avoid circulating current in the shield. Isolate shield at the encoder.

It is recommended to use double shielded cable for encoder connection.

Encoder Connection – Differential

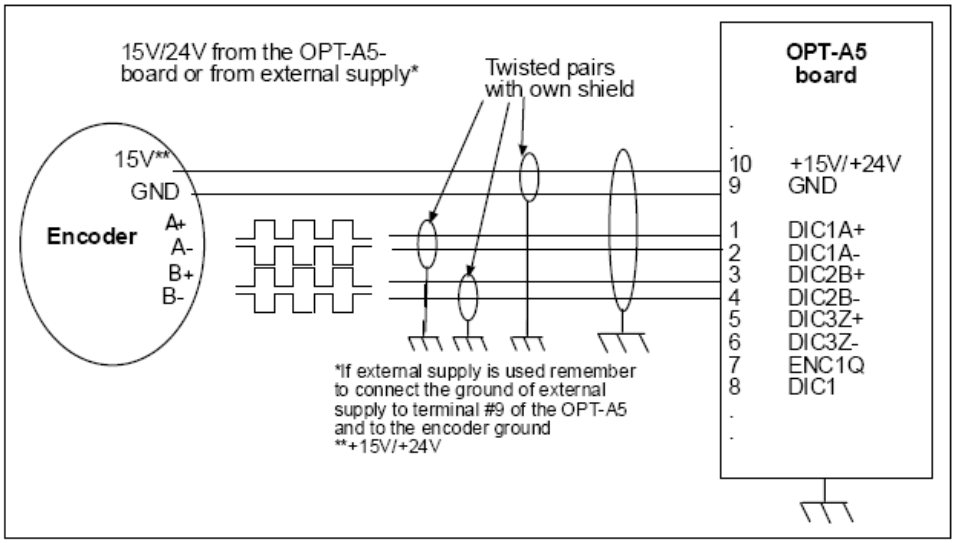
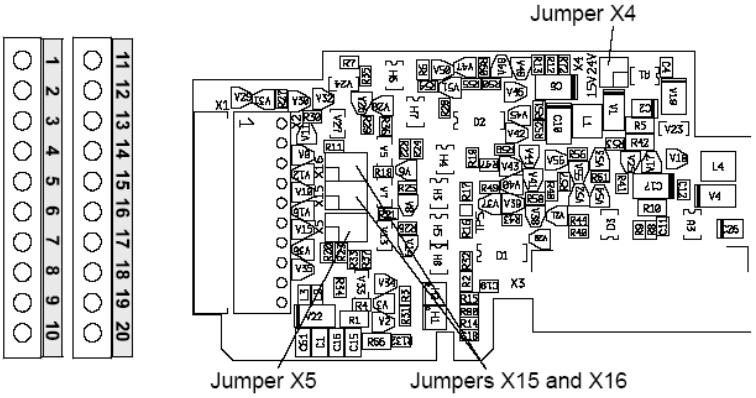


Figure 3-6. HTL type encoder connection using differential inputs

OPT-A5 Parameters

See Table 3-7.

3-1.6 OPT-A7



Description: Duplicate encoder board for ACCel500. Encoder input board with programmable control voltage for the encoder.

The OPT-A7 board is designed for HTL (High voltage Transistor Logic) type encoders (voltage output type push-pull HTL, open collector output type HTL) which provide input signal levels dependent on the supply voltage of the encoder. The encoder inputs A, B and Z are galvanically isolated. The OPT-A7 board includes, too, the qualifier inputs ENC1Q and ENC2Q meant to trace positions in positioning applications.

The board can be used as both Master and Slave device. The encoder input signal is repeated on the board and carried to the next device through the digital output.

Allowed slots: C
Type ID: 1 6695
Terminals: Two terminal blocks; Screw terminals (M2.6); Coding in terminals #3 and #14.
Jumpers: 4; X4, X5, X15 and X16 (see Jumper Selections in section 3-1.5)
Board parameters: None

TABLE 3-9. OPT-A7 I/O TERMINALS

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
1	DIC1A+		Pulse input A (differential); Voltage range 10…24V
2	DIC1A–		
3	DIC2B+		Pulse input B; phase shift of 90 degrees compared to Pulse input A (differential); Voltage range 10…24V
4	DIC2B–		
5	DIC3Z+		Pulse input Z; one pulse per revolution (differential); Voltage range 10…24V
6	DIC3Z–		
7	ENC1Q		Qualifier input. Single-ended input with GND
8	ENC2Q		Qualifier input. Single-ended input with GND
9	GND		Ground for control and inputs ENC1Q and ENC2Q
10	+15V/+24V		Control voltage (auxiliary voltage) output to encoder; Output voltage selectable with jumper X4.
11	DID1A+		Pulse input A (differential input), voltage range 10…24V
12	DID1A–		
13	DID2B+		Pulse input B; 90 degrees phase shift compared to the pulse input A (differential input), voltage range 10…24V
14	DID2B–		
15	DID3Z+		Pulse input Z; one pulse per revolution (differential input), voltage range 10…24V
16	DID3Z–		
17	DOD1A+		Pulse output A (differential), output voltage +24V. Pulse input DIC1A or DID1A is internally repeated in the card and connected to the DOD1A output.
18	DOD1A–		
19	DOD2B+		Pulse output B (differential), output voltage +24V. Pulse input DIC2A or DID2A is internally repeated in the card and connected to the DOD2A output.
20	DOD2B–		

NOTE:
Encoder inputs are wide range inputs that can be used with encoders using +15V or +24V.

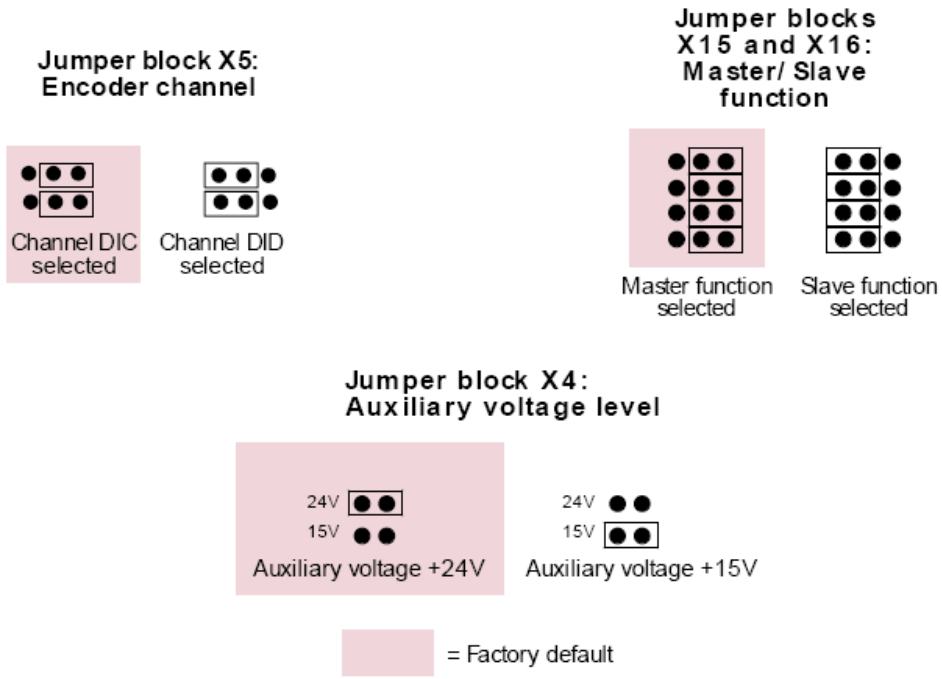
Technical Data

Encoder control voltage, +15V/+24V	**Control voltage selectable with jumper X4.**
Encoder input connections, inputs A+, A–, B+, B–, Z+, Z–	Max. input frequency ≤150kHz Inputs A, B and Z are differential
Qualifier input ENC1Q Fast digital input DIC1	Max. input frequency ≤10kHz Min. pulse length 50µs Digital input 24V; R_i>5kΩ Digital input is single-ended; connected to GND

NOTE: A high pulse frequency combined with a great cable capacitance places a considerable load on the encoder. Apply therefore as low a voltage as possible for the encoder supply, rather lower than 24V. The manufacturer also recommends placing jumper X4 to position +15V, if allowed in the voltage range specification of the encoder.

Jumper Selections

On the OPT-A7 board, there are four jumper blocks. Jumper X4 is used to program the control voltage (auxiliary voltage). The setting of jumper X5 defines the encoder channel (DIC/DID) used to carry the signal to the repeater. The setting of jumpers X15 and X16 is changed according to whether the board is used as a Master or Slave device. The factory default and other available jumper selections are presented below.



Usage: Closed Loop Vector Control, positioning applications. The OPT-A7 encoder board is mainly used in demanding system applications, e.g. when measuring the motor speed with two encoders.

Encoder Connection

The figures below present examples of a chain connection of several OPT-A7 boards (Figure 3-7) and a connection of two encoders to the OPT-A7 option board (Figure 3-8).

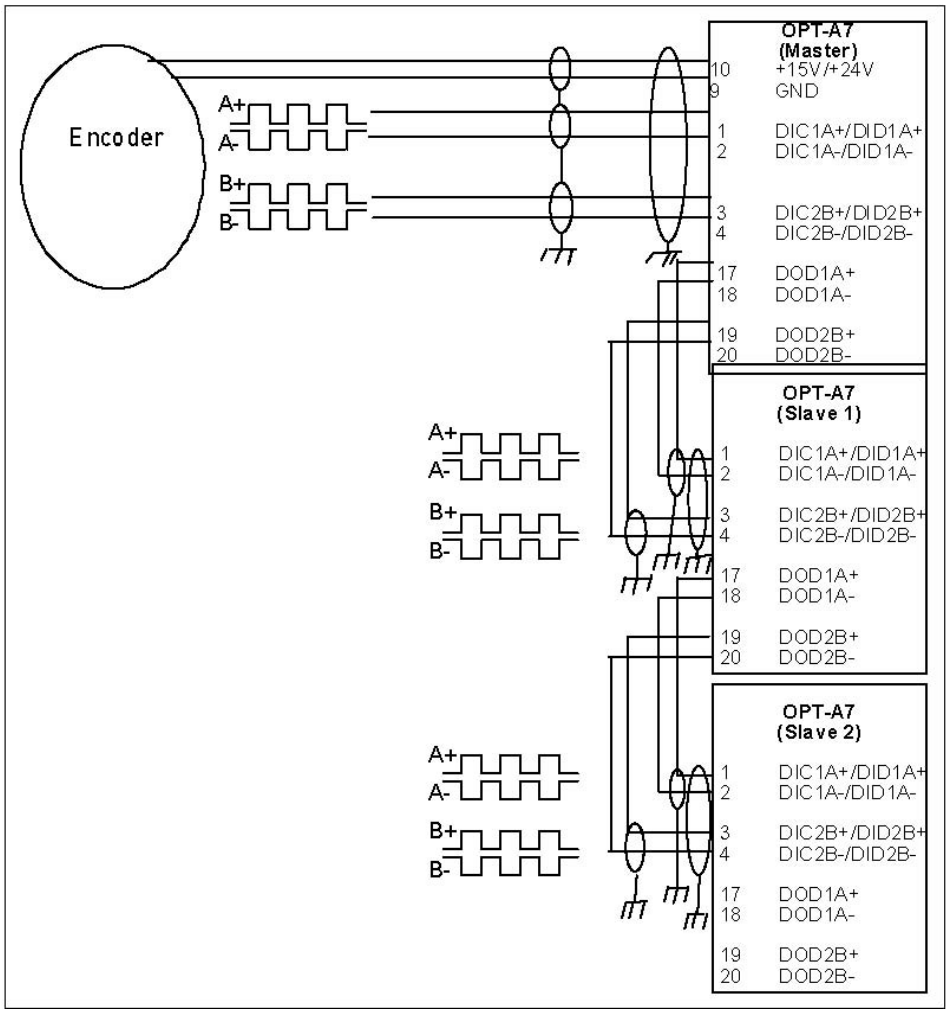


Figure3-7. Connection of Encoder and Three OPT-A7 Boards

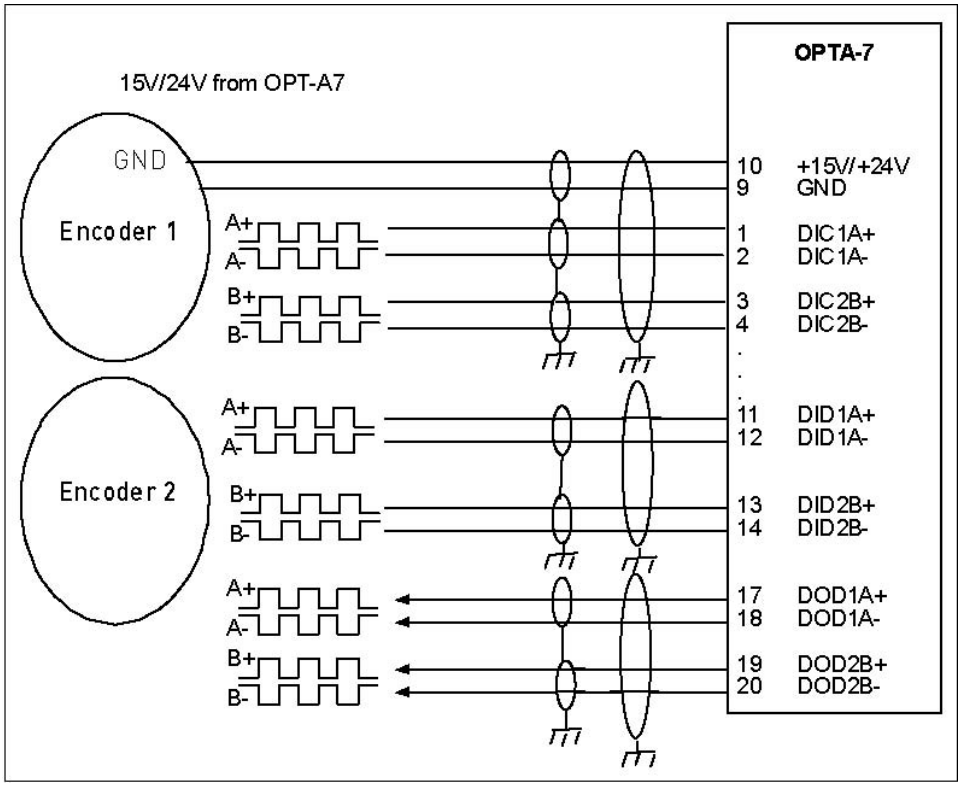
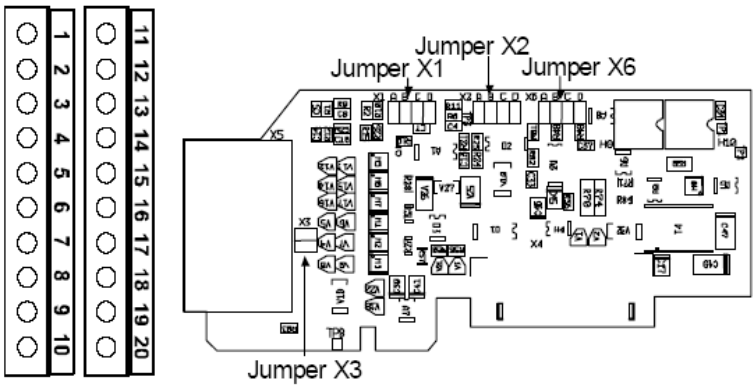


Figure 3-8. Connection of two encoders to OPT-A7 board

3-1.7 OPT-A8



Description:	ACCel500 basic I/O board similar to OPT-A1 except that the ANALOG inputs and output are galvanically isolated.
Allowed slots:	A
Type ID:	16696
Terminals:	Two terminal blocks; Screw terminals (M2.6); Coding in terminals #1 and #12.
Jumpers:	4; X1, X2, X3 and X6 (see Table 3-11)
Board parameters:	Yes (see Table 3-12)

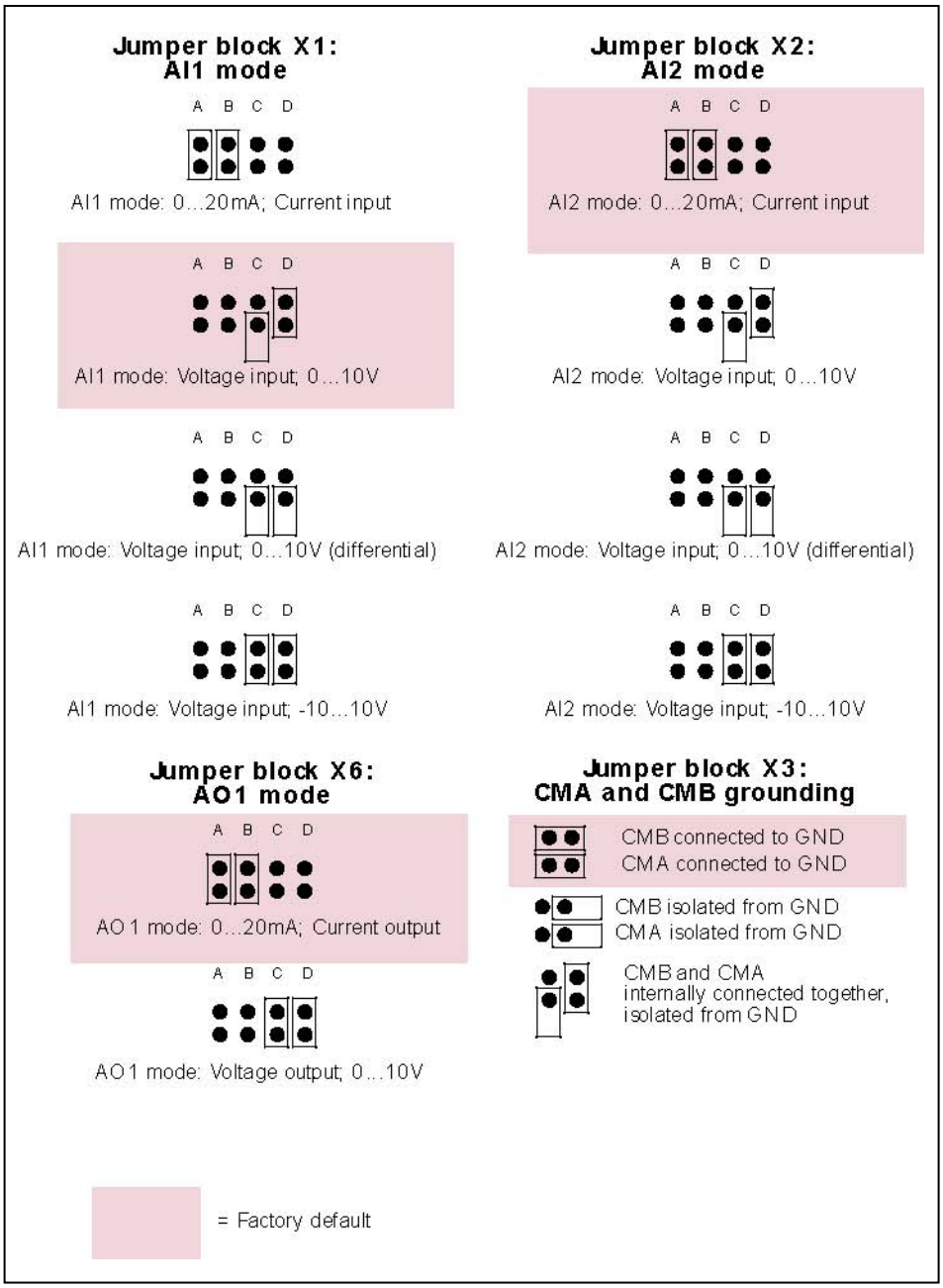
TABLE 3-10. OPT-A8 I/O TERMINALS (CODED TERMINALS GRAYED)

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
	+10 Vref		Refer.output +10V; Max. current 10mA; Decoupled from FC GND
2	AI1+	An.IN:A.1	Selection V or mA with jumper block X1: Default: 0– +10V (Ri = 200 kΩ) (-10V…..+10V Joy-stick control, selected with a jumper) 0– 20mA (Ri = 250 Ω) Resolution 0.1%; Accuracy ±1%
3	AI1– (GND ISOL)		GND ISOL/Voltage input; Connected to GND ISOL (selected with jumper)
4	AI2+	An.IN:A.2	Selection V or mA with jumper block X2): Default: 0– 20mA (Ri = 250 Ω) 0– +10V (Ri = 200 kΩ) (-10V…..+10V Joy-stick control, selected with a jumper) Resolution: 0.1%; Accuracy ±1%
5	AI2– (GND ISOL)		GND ISOL/Voltage input; Connected to GND ISOL (selected with jumper)
6	24 Vout (bidirectional		24V auxiliary voltage output. Short-circuit protected. ±15%, maximum current 150 mA, see 1.4.4 +24Vdc external supply may be connected. Galvanically connected to terminal #12.
7	GND		Ground for reference and controls Galvanically connected to terminal #13.
8	DIN1	DigIN:A.1	Digital input 1 (Common CMA); R_i = min. 5kΩ
9	DIN2	DigIN:A.2	Digital input 2 (Common CMA); R_i = min. 5kΩ
10	DIN3	DigIN:A.3	Digital input 3 (Common CMA); R_i = min. 5kΩ
11	CMA		Digital input common A for DIN1, DIN2 and DIN3. Connection by default to GND. Selection with jumper block X3 (see page 39):
12	24 Vout (bidirectional		Same as terminal #6 Galvanically connected to terminal #6.
13	GND		Same as terminal #7 Galvanically connected to terminals #7
14	DIN4	DigIN:A.4	Digital input 4 (Common CMB); R_i = min. 5kΩ
15	DIN5	DigIN:A.5	Digital input 5 (Common CMB); R_i = min. 5kΩ
16	DIN6	DigIN:A.6	Digital input 6 (Common CMB); R_i = min. 5kΩ
17	CMB		Digital input common A for DIN4, DIN5 and DIN6. Connection by default to GND. Selection with jumper block X3
18	AO1+	AnOUT:A.1	ANALOG output Output signal range: Current 0(4)–20mA, R_L max 500Ω or Voltage 0—10V, R_L >1kΩ Selection with jumper block X6 (see page 39): Resolution: 0.1% (10 bits); Accuracy ±2%;
19	AO1–		
20	DO1	DigOUT:A.1	Open collector output; Max. U_{in} = 48VDC; Max. current = 50 mA

Jumper Selections

There are four jumper blocks on the OPT-A8 board. The factory defaults and other available jumper selections are presented below.

TABLE 3-11. JUMPER POSITIONS FOR OPT-A8

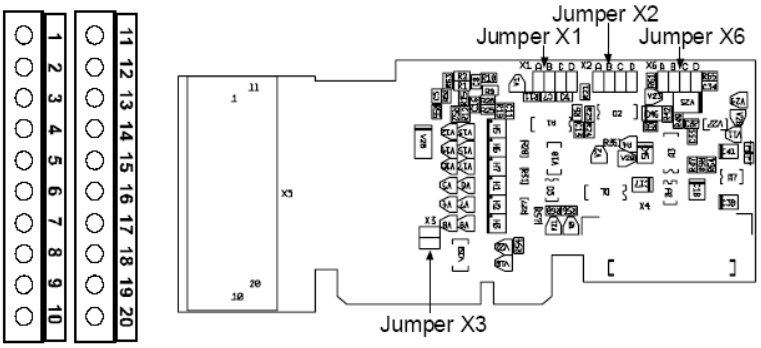


OPT-A8 Parameters

TABLE 3-12. OPT-A8 BOARD-RELATED PARAMETERS

Number	Parameter	Min	Max	Default	Note
1	AI1 mode	1	5	3	1 = 0 to 20mA 2 = 4 to 20mA 3 = 0 to 10V 4 = 2 to 10V 5 = -10 to +10V
2	AI2 mode	1	5	1	1 = 0 to 20mA 2 = 4 to 20mA 3 = 0 to 10V 4 = 2 to 10V 5 = -10 to +10V
3	AO1 mode	1	4	1	1 = 0 to 20mA 2 = 4 to 20mA 3 = 0 to 10V 4 = 2 to 10V

3-1.8 OPT-A9



Description: ACCel500 basic I/O board similar to the OPT-A1 except that the I/O terminals are bigger (for 2.5mm2 wires; M3 screws).
Allowed slots: A
Type ID: 16697
Terminals: Two terminal blocks; Screw terminals (M3); Coding in terminals #1 and #12.
Jumpers: 4; X1, X2, X3 and X6 (see Figure 3-2)
Board parameters: Yes (see Table 3-3)

I/O terminals on OPT-A9

See Table 3-2.

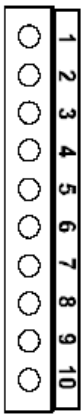
Jumper Selections

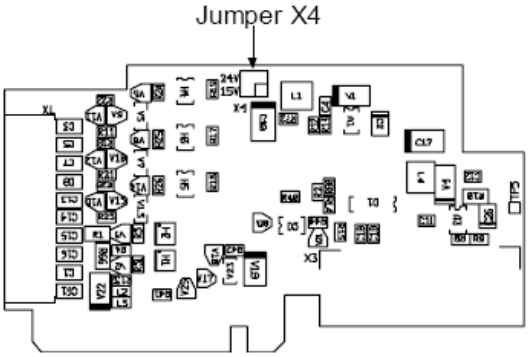
See Figure 3-2.

OPT-A9 Parameters

See Table 3-3.

3-1.9 OPT-AE





Description: Encoder board for ACCel500. Encoder input board with programmable control voltage for an encoder.

The OPT-AE board is designed for HTL (High voltage Transistor Logic) type encoders (voltage output type push-pull HTL, open collector output type HTL) which provide input signal levels dependent on the supply voltage of the encoder. The encoder inputs A, B and Z are galvanically isolated.

In addition, the board includes an Encoder Direction Signal and an Encoder Pulse Output Signal. The Encoder Direction Signal value '1' indicates a backward motor direction and '0' a forward motor direction. The Encoder Pulse Output signal is produced from The Encoder input signals (channel A) divided by the divider parameter (see Table 3-13).

Allowed slots: C
Type ID: 16709
Terminals: One terminal block; Screw terminals (M2.6); Coding in terminal #3.
Jumpers: 1; X4
Board parameters: Yes

TABLE 3-13. OPT-AE I/O TERMINALS (CODED TERMINAL GRAYED)

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
1	DIC1A+		Pulse input A (differential); Voltage range 10 to 24V
2	DIC1A–		
3	DIC2B+		Pulse input B; phase shift of 90 degrees compared to Pulse input A (differential); Voltage range 10 to 24V
4	DIC2B–		
5	DIC3Z+		Pulse input Z; one pulse per revolution (differential); Voltage range 10 to 24V
6	DIC3Z–		
7	DO1		Encoder divider output. Encoder input signals are divided by divider parameter (see Table 3-14).
8	DO2		Encoder direction output. The signal value '1' means that the motor direction is backward and '0' is forward.
9	GND		Ground for control
10	+15V/+24V		Control voltage (auxiliary voltage) output to encoder; Output voltage selectable with jumper X4.

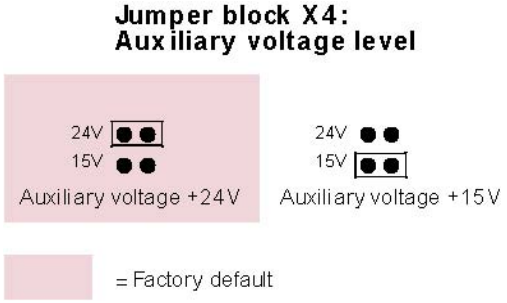
Note: Encoder inputs are wide range inputs that can be used with encoders using +15V or +24V.

Technical Data

Encoder control voltage, +15V/+24V	Control voltage selectable with jumper X4.
Encoder input connections, inputs A+, A–, B+, B–, Z+, Z–	Max. input frequency ≤150kHz Inputs A, B and Z are differential
Encoder divider output DO1, Encoder direction output DO2	Max.load voltage 60VDC Max. load current 50mA Max. output frequency ≤300kHz

Jumper Selections

On the OPT-AE board, there is one jumper block used to program the control voltage (auxiliary voltage). The factory default and other available jumper selections are presented below.



Usage: Closed Loop Vector Control. The OPT-AE board is mainly used in conventional industrial applications where encoder cable lengths are relatively long.

Encoder Connection - Single-Ended

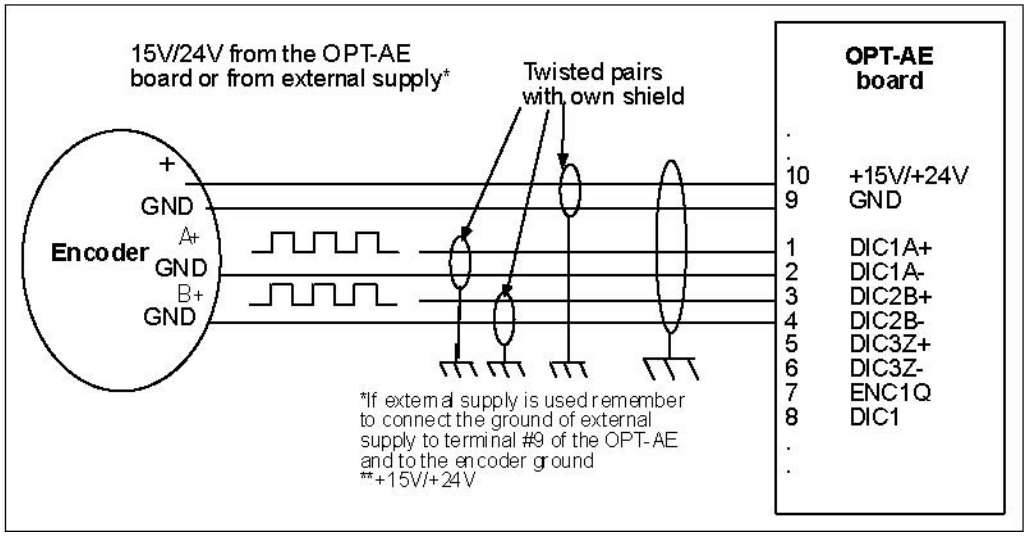


Figure 3-9. HTL-Type Encoder Connection (Open Source) Using Single-Ended Inputs

NOTE: Grounding is to be connected only at the frequency converter to avoid circulating current in the shield. Isolate shield at the encoder.

It is recommended to use double shielded cable for encoder connection.

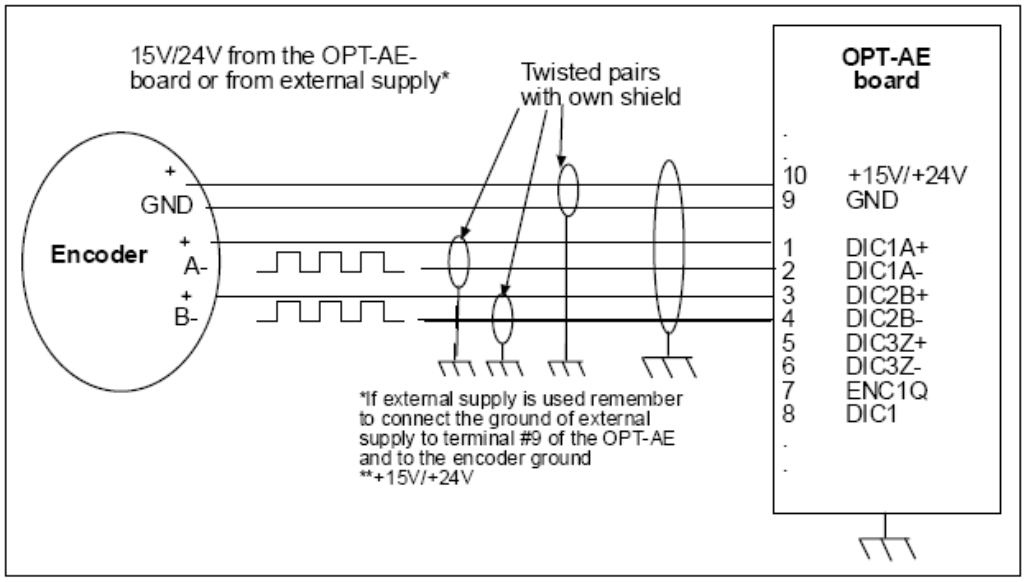


Figure 3-10. HTL-Type Encoder Connection (Open Collector Using Single-Ended Inputs)

NOTE: Grounding is to be connected only at the frequency converter to avoid circulating current in the shield. Isolate shield at the encoder.

It is recommended to use double shielded cable for encoder connection.

Encoder Connection – Differential

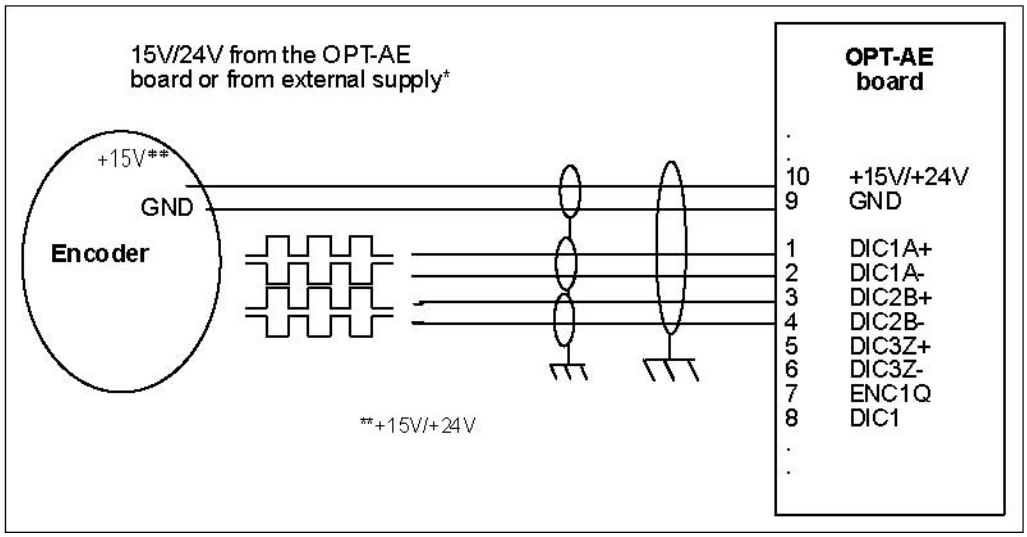


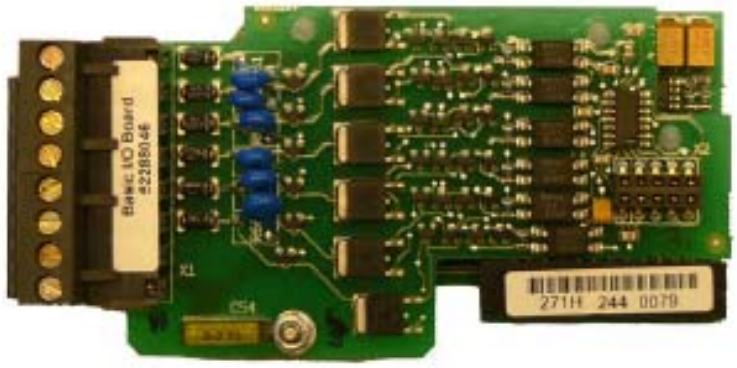
Figure 3-11. HTL-Type Encoder Connection Using Differential Inputs

OPT-AE Parameters

TABLE 3-14. OPT-AE BOARD-RELATED PARAMETERS

Number	Parameter	Min	Max	Default	Note
7.3.1.1	Pulse/revolution	1	65535	1024	
7.3.1.2	Invert direction	0	1	0	0 = No 1 = Yes
7.3.1.3	Reading rate	0	4	1	Time used to calculate speed actual value. Note: Use value 1 in Closed Loop mode. 0 = No calculation 1 = 1 ms 2 = 5 ms 3 = 10 ms 4 = 50 ms
7.3.1.4	Divider Value	1	2048	64	Input pulses / Divider = Divider Output
7.3.1.5	Hysteresis for Direction Out	0	511	8	Number of pulses before direction signal change state

3-1.10 OPT-AL



Description: Dual I/O expander board with six 42…240 VAC digital inputs, 2 analog inputs, two analog output, one digital output and 15 and 24 V out.
Allowed slots: A
Type ID: 16716
Terminals: Two terminal blocks; Screw terminals (M2.6, 1,5 mm2 wire terminals 1 – 10; M3, 2.5 mm2 wire terminals 11-18); No coding
Jumpers: None
Board parameters: None

TABLE 3-15. I/O TERMINALS ON OPT-AL

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
1	+15 V		15 V out – together with terminal 2 max 200 mA
2	+15 V		15 V out
3	AI1	An.IN:A.1	Analog input 0 – 10 V
4	AI2	An.IN:A.2	Analog input ± 10 V
5	GND		Ground for analog signals
6	AO1+	AnOUT:A.1	Analog output 0 (4) – 20 mA
7	AO2+	AnOUT:A.2	Analog output 0 – 10 V
8	DO1		Open collector digital output , 48 V, 50 mA allowed
9	GND		Ground for analog signals
10	+ 24 V		24 V out – max 200 mA
11	ACIN1	DigIN:X.1	Digital input, 42…240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
12	ACIN2	DigIN:X.2	Digital input, 42…240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
13	ACIN3	DigIN:X.3	Digital input, 42…240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
14	ACIN4	DigIN:X.4	Digital input, 42…240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
15	ACIN5	DigIN:X.5	Digital input, 42…240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
16	ACIN6	DigIN:X.6	Digital input, 42…240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
17 18	COMMON		Common input for DI1 - 6

Note: Digital input 6 can be programmed for other uses but it is also hardwired to function as a Global Stop input that directly inhibits the working of the ASIC modulator and thus stops the drive.

3-2 I/O Expander Boards OPT-B_

- Option boards used for I/O expansion
- This board type can normally be plugged into slots B, C, D or E.

The number of control inputs and outputs on your Avtron frequency converter can be increased with the I/O Expander boards. This kind of boards can usually be placed in any board slot inside the frequency converter control unit except for slot A.

There are no board-related parameters for OPT-B_ I/O expander boards (except for board OPT-BB).

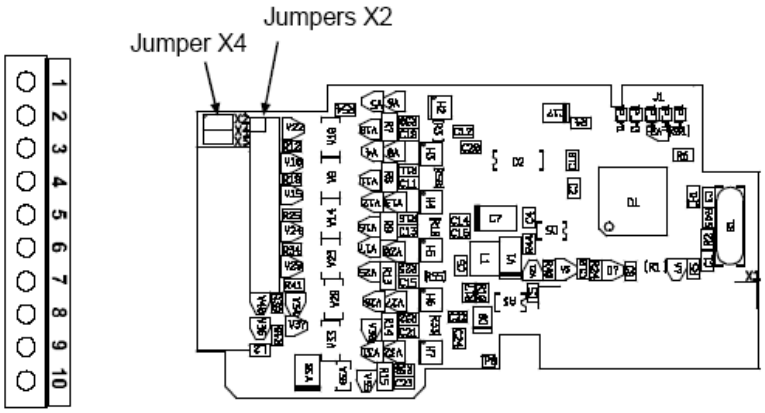
The boards you wish to have installed in your frequency converter have to be defined in the type designation code of the frequency converter when ordering it from the factory.

TABLE 3-15. ACCEL500 I/O EXPANDER BOARDS AND THEIR EQUIPMENT

I/O Board	Allowed Slots	DI	AI	TI	AO	DO	RO	Pt-100	42-240 VAC Input	Other
OPT-B1	B,C,D,E	(6)				(6)				
OPT-B2	B,C,D,E			1			2			
OPT-B4	B,C,D,E		1 (isolated) (mA)		2 (isolated) (mA)					+24V/ EXT+24V
OPT-B5	B,C,D,E						3			
OPT-B8	B,C,D,E							3		
OPT-B9	B,C,D,E						1		5	
OPT-BB	C	2 (enc)								

Pt-100 = Sensor input for Pt-100
AO = ANALOG output
RO = Relay output

3-2.1 OPT-B1



Description: ACCel500 I/O expander board with six bidirectional terminals.
Allowed slots: B, C, D, E
Type ID: 16945
Terminals: One terminal block; Screw terminals (M2.6); No coding
Jumpers: 2; X2 and X4 (see Figure 3-12)
Board parameters: None

TABLE 3-16. OPT-B1 I/O TERMINALS

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
1	DIO1	DigIN: X.1 DigOUT: X.1	Digital input: 24V; R_i>5kΩ Digital output: Open collector, 50mA/48V
2	DIO2	DigIN: X.2 DigOUT: X.2	See above.
3	DIO3	DigIN: X.3 DigOUT: X.3	See above.
4	CMA		Common for DIO1…DIO3. Note: CMA is internally connected to GND with jumper by default.
5	DIO4	DigIN: X.4 DigOUT: X.4	Digital input: 24V; R_i>5kΩ Digital output: Open collector, 50mA/48V
6	DIO5	DigIN: X.5 DigOUT: X.5	See above.
7	DIO6	DigIN: X.6 DigOUT: X.6	See above.
8	CMB		Common for DIO4…DIO6
9	GND		I/O ground; Ground for reference and controls.
10	+24V		Control voltage output; Voltage for switches etc.; max. current 150mA; Short-circuit protected.

Jumper Selections

On the OPT-B1 board, there are two jumper blocks. The jumper block X2 is used to define the bidirectional terminal as either input or output. The other jumper block, X4, is used to connect the common terminals to GND. The factory default and other available jumper selections are presented below.

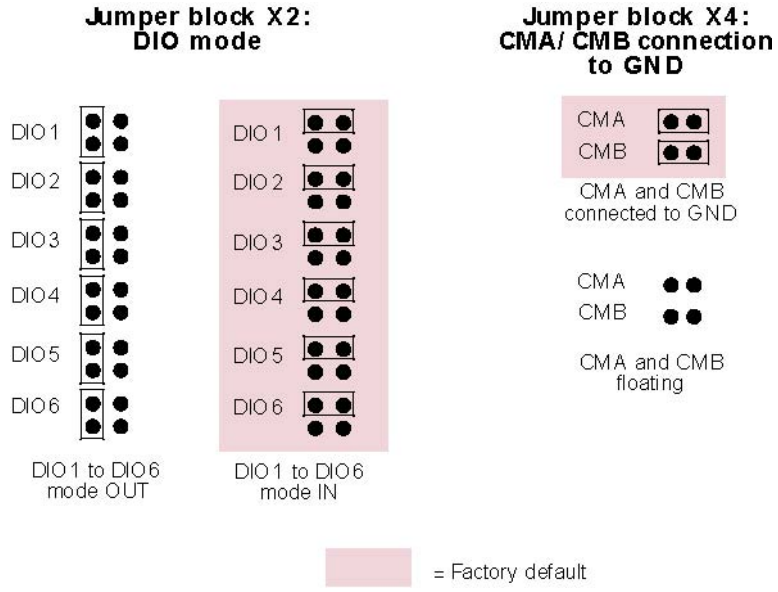
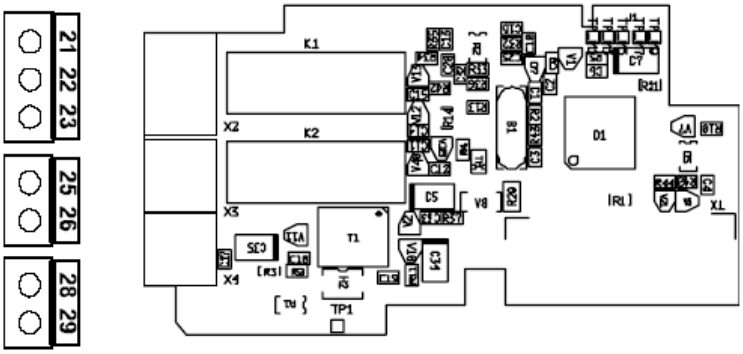


Figure 3-12. Jumper Positions for OPT-B1

3-2.2 OPT-B2



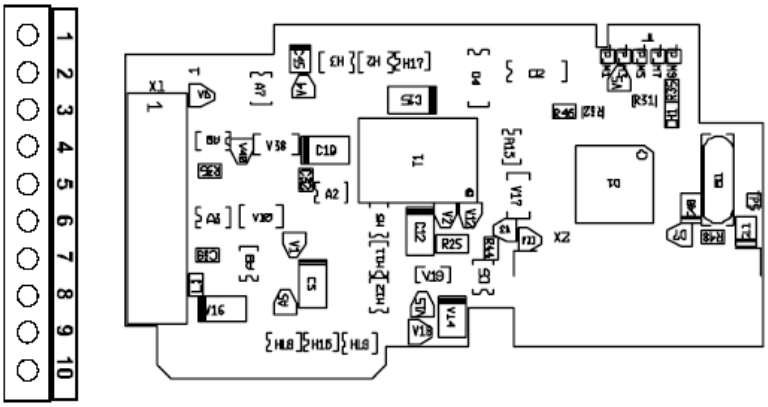
Description: ACCel500 I/O expander board with a thermistor input and two relay outputs.
Allowed slots: B, C, D, E
Type ID: 16946
Terminals: Three terminal blocks; Screw terminals (M3); No coding
Jumpers: None
Board parameters: None

TABLE 3-17. OPT-B2 I/O TERMINALS

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
21 22 23	RO1/normal closed RO1/common RO1/normal open	DigOUT:X.1	Switching capacity 24VDC/8A OPT-B2 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA
25 26	RO2/common RO2/normal open	DigOUT:X.2	Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA
28 29	TI1+ TI1–	DigIN:X.1	Thermistor input (galvanically isolated) R_{trip} = 4.7kΩ

NOTE: This expander board can be placed into four different slots on the control board. Therefore, the 'X' given in the Parameter reference shall be replaced by the slot letter (B, C, D, or E) depending on the slot which the expander board is plugged into. See section 1-7.

3-2.3 OPT-B4



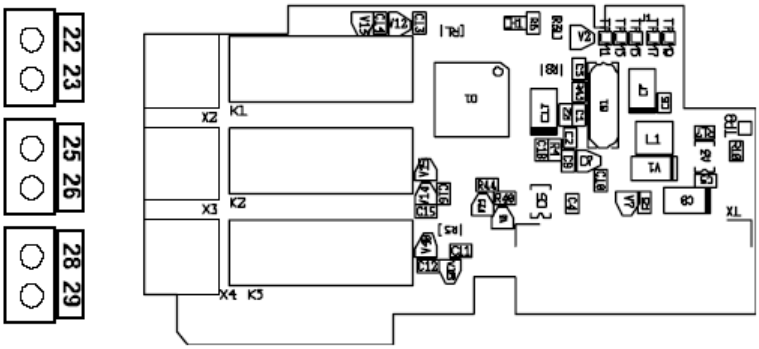
Description: ACCel500 I/O expander board with one galvanically isolated ANALOG input and two galvanically isolated ANALOG outputs (standard signals 0(4) to 20mA).
Allowed slots: B, C, D, E
Type ID: 16948
Terminals: One terminal block; Screw terminals (M2.6); No coding
Jumpers: None
Board parameters: None

TABLE 3-18. OPT-B4 I/O TERMINALS

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
1	AI1+	AnIN:X.1	0(4) to 20mA; Ri=250Ω; galvanically isolated Resolution 10 bits/0.1%; Accuracy ±1% of the full display
2	AI1–		
3	AO1+	AnOUT:X.1	0(4) to 20mA; RL<500Ω; Resolution 10 bits/0.1%; Accuracy ≤ ±2% (galvanically isolated)
4	AO1–		
5	AO2+	AnOUT:X.2	0(4) to 20mA; RL<500Ω; Resolution 10 bits/0.1%; Accuracy ≤ ±2% (galvanically isolated)
6	AO2–		
7	GND		24V (±15%); Max. load 250mA (total load from EXT+24V outputs), max. 150mA from one board. See Figure 1-2.
8	GND		
9	GND		24V (±15%), in special applications where PLC type functions are included in the control module, this input can be used as external auxiliary power supply for control boards as well as for I/O boards.
10	+24V		

NOTE: This expander board can be placed into four different slots on the control board. Therefore, the 'X' given in the Parameter reference shall be replaced by the slot letter (B, C, D, or E) depending on the slot which the expander board is plugged into. See section 1-6.

3-2.4 OPT-B5



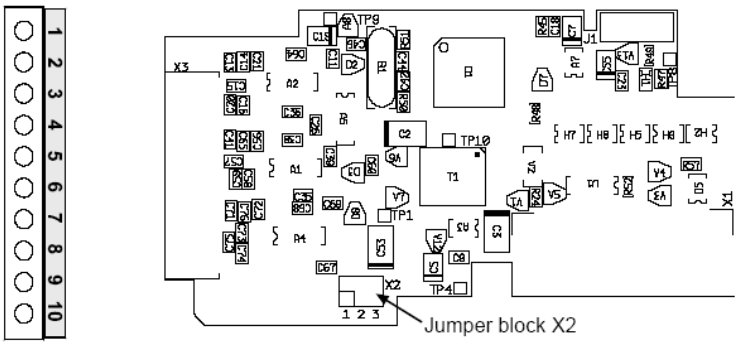
Description: I/O expander board with three relay outputs.
Allowed slots: B, C, D, E
Type ID: 16949
Terminals: Three terminal blocks; Screw terminals (M3); No coding
Jumpers: None
Board parameters: None

TABLE 3-19. OPT-B5 I/O TERMINALS

Terminal		Parameter reference Keypad/NCDrive	Technical information
22 23	RO1/common RO1/normal open	DigOUT:X.1	Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA
25 26	RO2/common RO2/normal open	DigOUT:X.2	Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA
28 29	RO3/common RO3/normal open	DigOUT:X.3	Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA

NOTE: This expander board can be placed into four different slots on the control board. Therefore, the 'X' given in the Parameter reference shall be replaced by the slot letter (B, C, D, or E) depending on the slot which the expander board is plugged into. See section 1-6.

3-2.5 OPT-B8



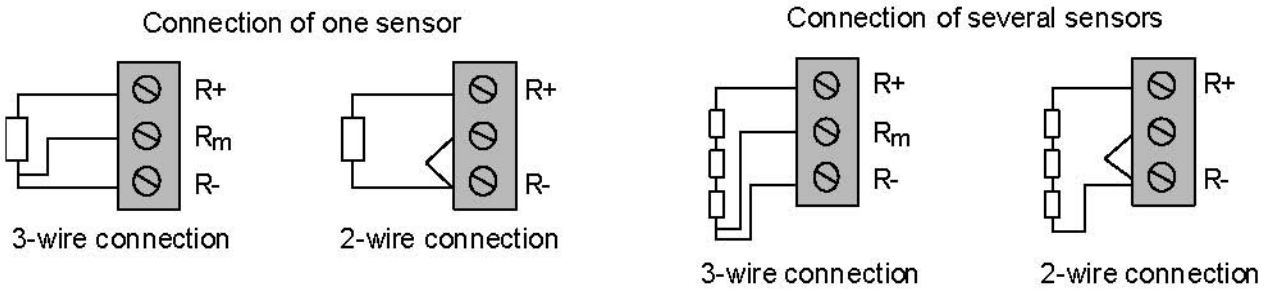
Description: Temperature measuring board with three Pt-100 sensor (3-wire) inputs. The measurable temperature range is –30 to 200 Cº on Pt-100 input. Both 3-wire and 2-wire elements can be used.
Allowed slots: B, C, D, E
Type ID: 16952
Terminals: One terminal block; Screw terminals (M2.6); No coding
Jumpers: X2
Board parameters: None

TABLE 3-20. OPT-B8 I/O TERMINALS

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
1	R1 +	AnIN:X.1	PT100 Input, -30 to 200 °C, one sensor. Accuracy < 1°C. Sensor current 10 mA.
2	Rm1		
3	R1 -		
4	R2 +	AnIN:X.2	PT100 Input, -30 to 200 °C, one sensor. Accuracy < 1°C. Sensor current 10 mA.
5	Rm2		
6	R2-		
7	R3 +	AnIN:X.3	PT100 Input, -30 to 200 °C 1 - 3 sensors (see X2 jumper selections). Accuracy < 1°C. Sensor current 10 mA.
8	Rm3		
9	R3 -		
10	NC		Not connected

Connection of PT100 Sensors

One PT100-sensor can be connected to the first two inputs (terminals 1 to 3 and 4 to 6) and up to three sensors to the third input (terminals 7 to 9). The sensors must be connected in series with a two- or three-wire connection. See selections below.

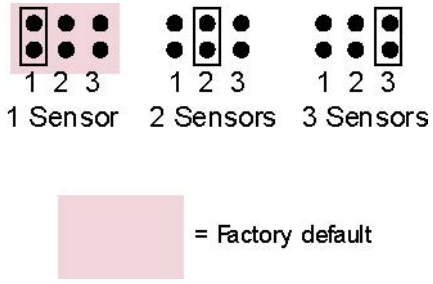


NOTE:

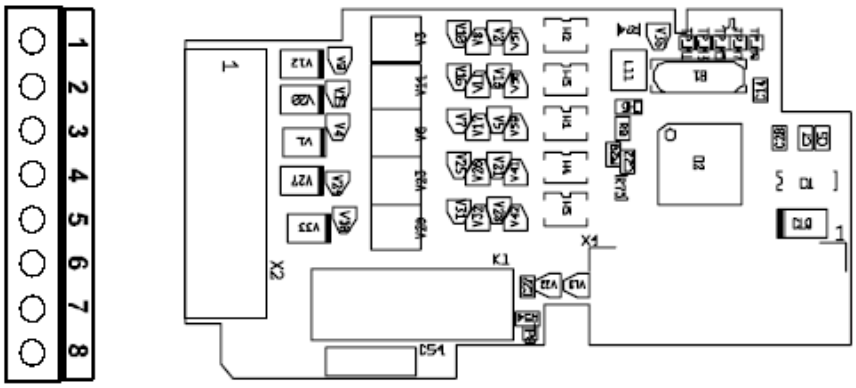
- This expander board can be placed into four different slots on the control board. Therefore, the 'X' given in the Parameter reference shall be replaced by the slot letter (B, C, D, or E) depending on the slot which the expander board is plugged into. See section 1-6.
- Insulation level 4kV/sqrt(2) (DIN VDE 01 10-1). 2kV in sensor and 2kV in option board.

Jumper Selections

Up to three PT100 sensors can be connected to the third PT100 input. You can select the number of sensors in use with jumper block X2:



3-2.6 OPT-B9



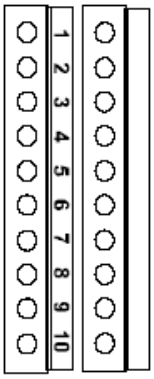
Description: I/O expander board with five 42…240 VAC digital inputs and one normal relay output.
Allowed slots: B, C, D, E
Type ID: 16953
Terminals: One terminal block; Screw terminals (M2.6); No coding
Jumpers: None
Board parameters: None

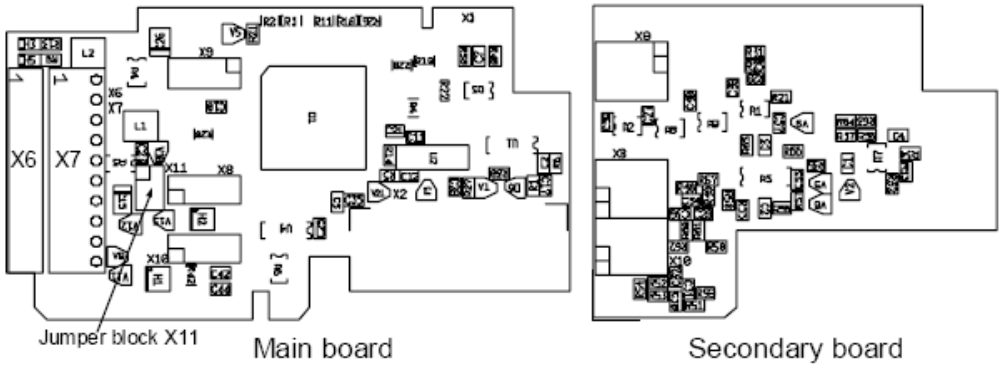
TABLE 3-21. OPT-B9 I/O TERMINALS

Terminal		Parameter Reference on Keypad and ADDaptACC	Technical information
1	ACIN1	DigIN:X.1	Digital input, 42 to 240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
2	ACIN2	DigIN:X.2	Digital input, 42 to 240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
3	ACIN3	DigIN:X.3	Digital input, 42 to 240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
4	ACIN4	DigIN:X.4	Digital input, 42 to 240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
5	ACIN5	DigIN:X.5	Digital input, 42 to 240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
6	COMA		Digital input, 42 to 240 VAC (threshold 35V) Control voltage: "0"<33V, "1">35V
7 8	RO1/common RO1/normal open	DigOUT:X.1	Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A

NOTE: This expander board can be placed into four different slots on the control board. Therefore, the 'X' given in the Parameter reference shall be replaced by the slot letter (B, C, D, or E) depending on the slot which the expander board is plugged into. See section 1-6.

3-2.7 OPT-BB





Description: Absolute encoder board for ACCel500 with inputs for an Endat type encoder. Programmable control voltage, fast digital inputs and simulation pulse output.
The output pulse is produced from sinusoidal input signals.
The galvanically isolated fast digital inputs are used to trace very short pulses.

Allowed slots: C

Type ID: 16962 (main board), 16963 (secondary board). The secondary board is mounted on top of the main board

Terminals: Two terminal blocks; Screw terminals (M2.6); No coding

Jumpers: 1; X11

Board parameters: Yes

An absolute encoder is a type of encoder capable of specifying its absolute position. The position data is retained even during a power failure or breakdown. The position data carried by the absolute encoder can be used by the frequency converter motor control in the control of a synchronous motor.

Encoder cable	Heidenhain cable; Max. length 100m
Encoder voltage	5V, 12V or 15V Max. current consumption 300mA
Measuring steps/revolution	4.2 billion (max. 32-bit)
Distinguishable revolutions	0—65535 (max. 16-bit)
Signal periods/revolution	1—65535

ENDAT is a bidirectional synchronic serial interface for absolute encoders. For example, the encoder position data can be read and encoder parameters can be set via the ENDAT connection. It also forwards the messages related to the encoder functions.

All Endat connections are available in terminal X6. The board uses Endat version 2.

I/O Terminals on OPT-BB, Encoder Terminal X6

TABLE 3-22. I/O TERMINALS ON OPT-BB, TERMINAL X6

Terminal		Heidenheim Color Code	Technical Data
1	DATA+	Grey	Data line 120Ω/RS-485
2	DATA–	Pink	
3	CLOCK+	Violet	Clock line 120Ω/RS-485 (200—400kHz)
4	CLOCK–	Yellow	
5	A+	Green/black	1Vpp (±0,5V); impedance 120Ω; Max. input 350 kHz
6	A–	Yellow/black	
7	B+	Blue/black	1Vpp (±0,5V); impedance 120Ω; Max. input 350 kHz
8	B–	Red/black	
9	GND	White/green	Input ground
10	Encoder voltage	Brown/green	Selectable encoder voltages: 5V, 12V and 15V Max. current consumption 300mA

IO Terminals on OPT-BB Terminal X7

TABLE 3-23. I/O TERMINALS ON OPT-BB, TERMINAL X7

Terminal		Technical Data
1	SimA+	Incremental pulse output A (differential), 0° (square wave, signal level RS-422); Impedance 120Ω; Input hysteresis ±5mV
2	SimA–	
3	SimB+	Incremental pulse output B (differential), 0° (square wave, signal level RS-422); Impedance 120Ω; Input hysteresis ±5mV
4	SimB–	
5	Not used	
6	Not used	
7	FDIN1	Fast digital input 1; HTL; Min. pulse length 50µs
8	CMA	Common FDIN1
9	FDIN2	Fast digital input 2; HTL; Min. pulse length 50µs
10	CMB	Common FDIN2

Jumper Selections

On the OPT-BB board, there is one jumper block used to program the control voltage (auxiliary voltage). The factory default and other available jumper selections are presented below.

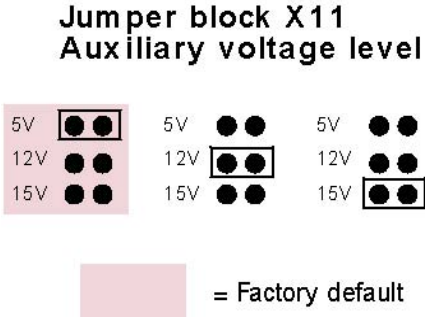


TABLE 3-24. OPT-BB BOARD PARAMETERS

Code	Parameter	Min	Max	Default	Selections	Description
7.3.1.1	Reverse	0	1	0	0=No 1=Yes	Manually selectable rotation direction
7.3.1.2	Reading rate	0	4	1	0=Not used 1=1 ms 2=5 ms 3=10 ms 4=50 ms	Incremental pulse reading rate. Note: Use value 1 in Closed Loop mode.
7.3.1.3	Interpolation	0	1	0	0=No 1=Yes	If activated, the sinusoidal incremental pulses are used to calculate the polar angle in order to optimize the encoder accuracy

TABLE 3-25. OPT-BB BOARD MONITORING VALUES

Code	Monitored Value	Unit	Description
7.3.2.1	Reverse	Hz	Motor speed in Hz calculated from encoder pulses
7.3.2.2	Encoder speed	rpm	Motor speed in rpm calculated from encoder pulses
7.3.2.3	Encoder position	-	Absolute position of encoder read from Endat
7.3.2.4	Encoder revolution		
7.3.2.5	Encoder fault		
7.3.2.6	Encoder warning		
7.3.2.7	Encoder messages		Number of messages between encoder and NXOPTBB

TABLE 3-26. OPT-BB BOARD INFORMATION PAGES

Code	Information	Unit	Description
7.3.3.1	Encoder type		0 = No encoder connected 1—4 = Incremental linear encoder 5 = Linear absolute encoder 6 = Unknown 7 = Linear absolute encoder 8 = Unknown 9—12 = Rotational incremental/angular encoder 13 = Absolute encoder (single turn) 14 = Unknown 16 = Unknown
7.3.3.2	Pulses/Revolution		Sinusoidal pulses/revolution
7.3.3.3	Position bits	bit	Accurate position 1—1024 (10bit = 210 = 1024)
7.3.3.4	Revolution bits	bit	Accurate number of revolutions 1—1024 (10bit = 210 = 1024)

OPT-BB Option Board Status LEDs

Yellow LED

LED State	Meaning
OFF	Option board not activated
ON	Option board in initialization state waiting for activation command from the frequency converter
Blinking fast (once/sec)	Option board is activated and in RUN state • Option board is ready for external communication
Blinking slow (once/5 s)	Option board is activated and in FAULT state • Internal fault of option board

Green LED

LED State	Meaning
OFF	Option board not activated
ON	Encoder is being initialized Option board is reading encoder parameters
Blinking fast (once/s)	Encoder detected by option board Option board receives data from encoder
Blinking slow (once/5 s)	Encoder detected by option board Option board cannot read encoder data or data is invalid (CRC error, broken cable etc.)

3-3 ADAPTER BOARDS OPT-D_

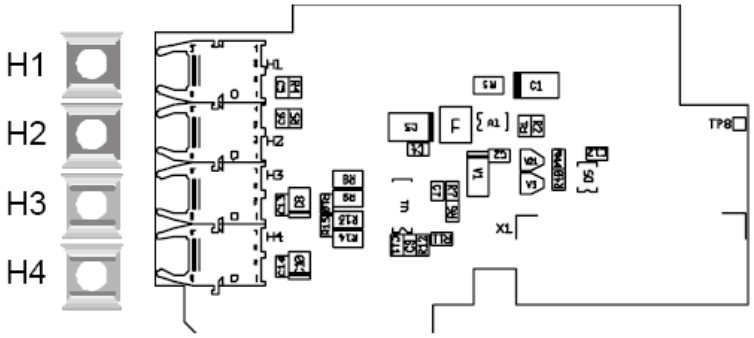
The adapter boards do not provide any additional I/O but are used to connect the frequency converter to an Avtron communication bus (System Bus, SPI, CAN). Note that if you use any of the major fieldbuses (Profibus, Modbus etc.) for communication, you will need a corresponding fieldbus board. For more information, see the specific fieldbus board manual.

NOTE: In order to avoid incompatibility problems, do not plug two adapter boards into the same control board.

TABLE 3-27. ACCEL500 ADAPTER BOARDS

I/O board	Allowed slots	Description
OPT-D1	D,E	System Bus adapter board
OPT-D2	(B,)D,E	System Bus adapter board with interface to fast monitoring bus
OPT-D3	D,E	RS-232 adapter board
OPT-D6	B,D,E	Monitor Bus adapter board for ACCel500

3-3.1 OPT-D1



Description: System Bus adapter board for ACCel500
Allowed slots: D, E
Type ID: 17457
Terminals: Double optical input and output terminals. Agilent HFBR-1528 (Receiver), HFBR-2528 (Transmitter).
Jumpers: None
Board parameters: None

TABLE 3-28. OPT-D1 I/O TERMINALS

Terminal		Technical Information
1	H1	System Bus optical input 1 (RX1) Use 1-mm optical cable (e.g. Agilent HFBR-RUS500 & HFBR-4531/4532/ 4533 connectors)
2	H2	System Bus optical input 2 (RX2) Use 1-mm optical cable (e.g. Agilent HFBR-RUS500 & HFBR-4531/4532/4533 connectors)
3	H3	System Bus optical output 1 (TX1) Use 1-mm optical cable (e.g. Agilent HFBR-RUS500)
4	H4	System Bus optical output 2 (TX2) Use 1-mm optical cable (e.g. Agilent HFBR-RUS500)

NOTE: The terminals of the board are protected with a rubber pin. Be sure to leave the pin in the unused terminals in order to avoid disturbances.

Use Avtron P/N A33242-_xx (where *_xx* is cable length in meters) fiber optic cable for interconnection between drives.

Connections between Frequency Converters with OPT-D1

Basic connection:

Connect output 1 of Device 1 to input 2 of Device 2 and input of Device 1 to output 2 of Device 2. Note that, in the end devices, one terminal pair remains unused. See Figure 3-13 below.

TABLE 3-29. MAX COMMUNICATION SPEED – OPT-D1

Max. Number of Devices In Line	Max. Speed Achieved [Mbit/s]
3	12
6	6
12	3
24	1.5

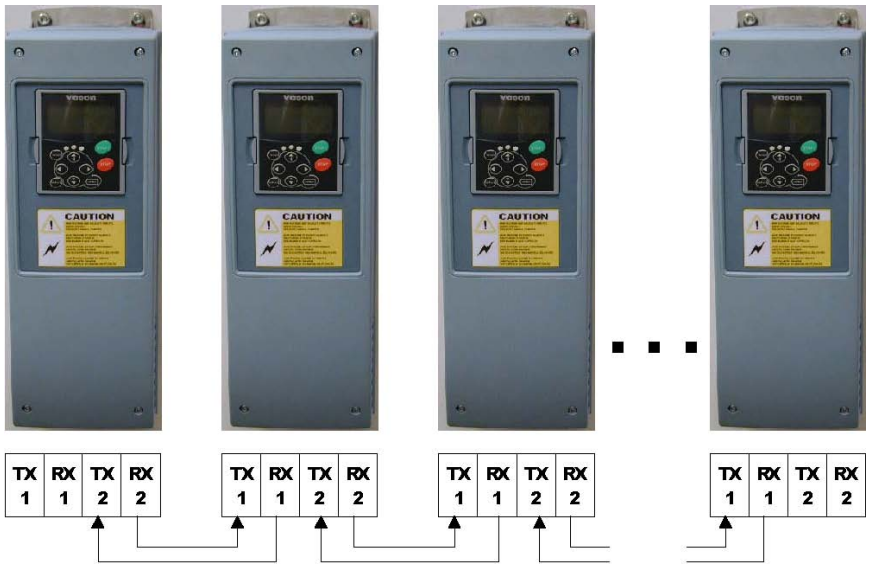
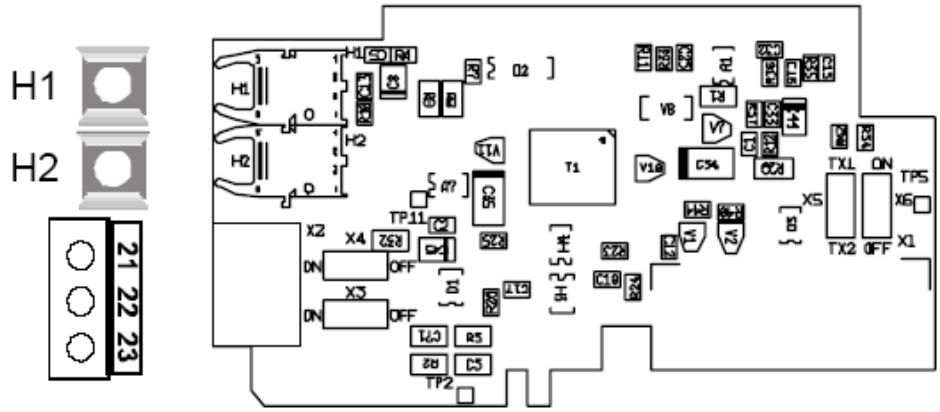


Figure 3-13. Basic Connection of Frequency Converters with OPT-D1

3-3.2 OPT-D2



Description: System Bus adapter board for ACCel500 with single optical input and output; Interface to fast monitor bus used by the ADDaptACC tool.
Allowed slots: (B,)D, E. NOTE: If only the Monitor Bus (terminals 21 to 23) will be used, the board can also be placed in slot B. The System Bus is then unavailable. Therefore, remove jumpers X5 and X6. See Figure 3-14.
Type ID: 17458
Terminals: Single optical input and output; one screw terminal block (M3), Agilent HFBR-1528 (Receiver), HFBR-2528 (Transmitter).
Jumpers: 4; X3, X4, X5 and X6. See Figure 3-14.
Board parameters: None

TABLE 3-30. OPT-D2 I/O TERMINALS

Terminal		Technical Information
1	H1	System Bus optical input 1 (RX1) Use 1-mm optical cable (e.g. Agilent HFBR-RUS500 & HFBR-4531/4532/ 4533 connectors) NOTE: Not available if the board is placed in slot B
2	H2	System Bus optical output 1/2 (TX1/TX2); Selected with jumper X5 Use 1-mm optical cable (e.g. Agilent HFBR-RUS500 & HFBR-4531/4532/4533 connectors) NOTE: Not available if the board is placed in slot B
21	CAN_L	Monitor Bus negative data
22	CAN_H	Monitor Bus positive data
23	CAN_SHIELD	Monitor Bus shield

Use Avtron P/N A33242-_xx (where *_xx* is cable length in meters) fiber optic cable for interconnection between drives.

Jumper Selections

There are four jumper blocks on the OPT-D2 board. The factory defaults and other available jumper selections are presented below.

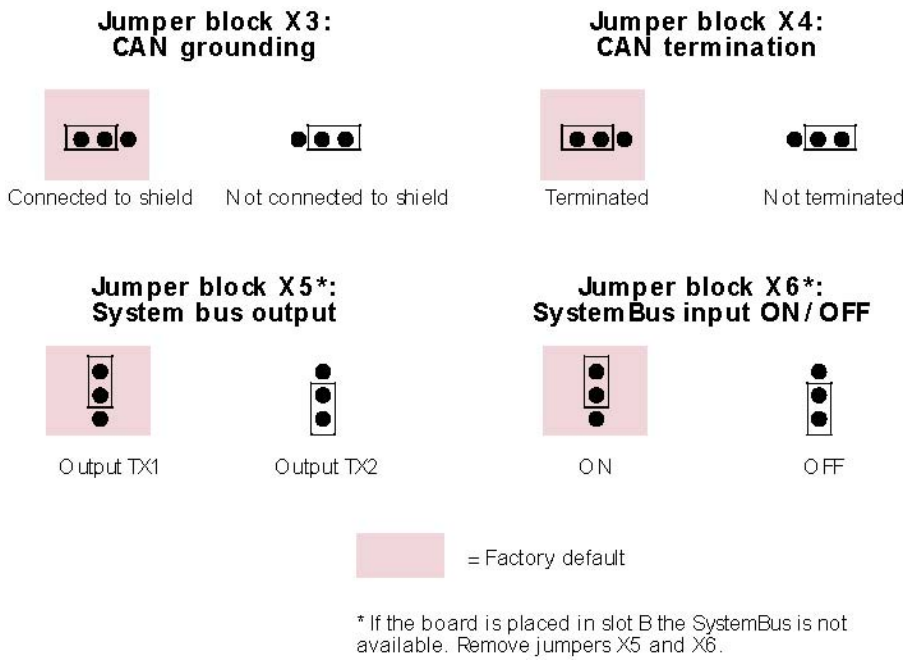


Figure 3-14. Jumper Selections for OPT-D2

Connections Between Frequency Converters with OPT-D2

Special Connection

In this connection example, the leftmost device is the Master and the others are slaves. The Master can send and receive data from the slaves. The slaves cannot communicate with each other. Changing of masters is not possible; the first device is always the Master.

The OPT-D2 board in the Master has the default jumper selections, i.e. X6:1-2, X5:1-2. The jumper positions have to be changed for the slaves: X6: 1-2, X5:2-3.

TABLE 3-31. MAX COMMUNICATION SPEED – OPT-D2

Max. Number of Devices In Line	Max. Speed Achieved [Mbit/S]
3	12
6	6
12	3
24	1.5

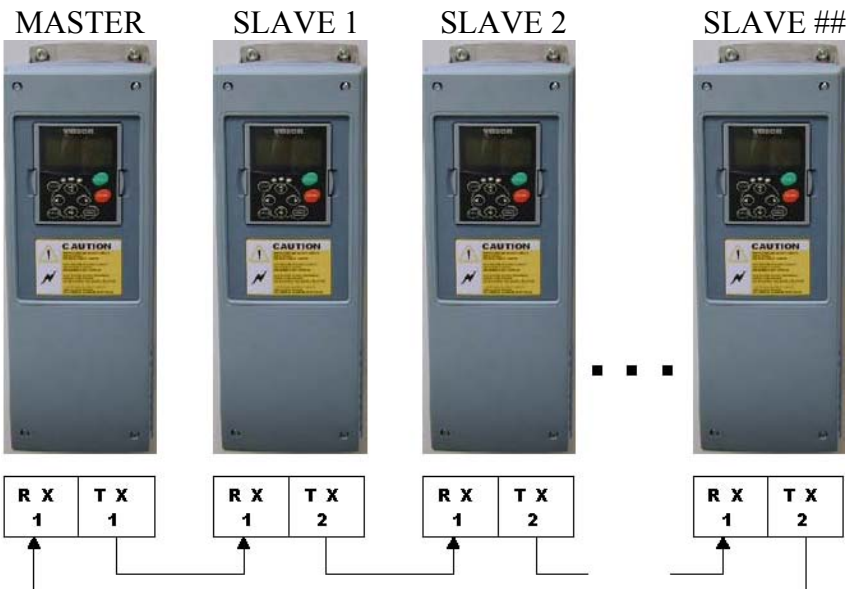
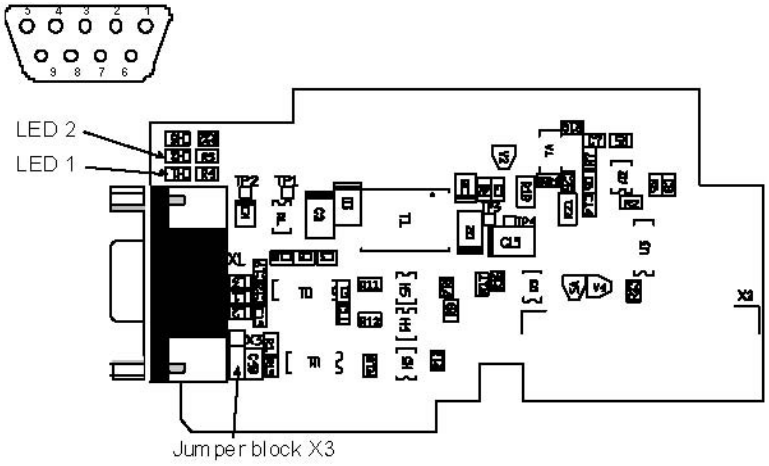


Figure 3-15. Connection Example of Frequency Converters with OPT-D2

3-3.3 OPT-D3



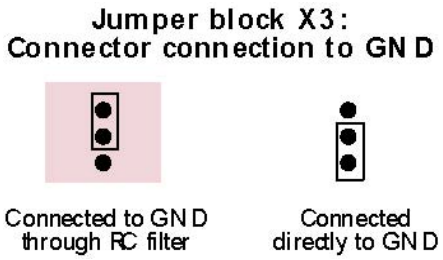
Description: RS-232 adapter board. Galvanically decoupled. Used mainly for application engineering to connect another keypad.
Allowed slots: D, E.
Type ID: 17459
Terminals: 9-pin female sub-D-connector
Jumpers: 1; X3)
Board parameters: None

TABLE 3-32. OPT-D3 I/O TERMINALS

Terminal		Technical Information
1		
2	TxD	Transmit data
3	RxD	Receive data
4		
5	GND	Ground isolated
6	+9V	+9V isolated
7		
8		
9		

Jumper Selections

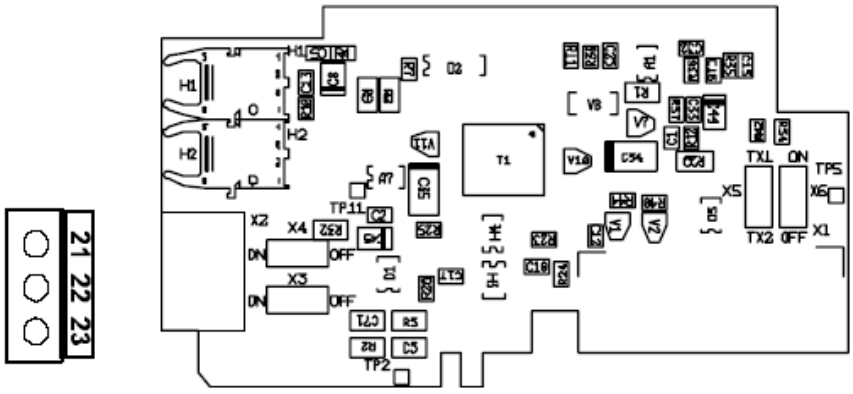
There is one jumper block on the OPT-D3 board. The factory defaults and other available jumper selections are presented below:



OPT-D3 Option Board Status LEDs

LED	Meaning
Green (LED 1)	Receiving data
Red (LED 2)	Transmitting data

3-3.4 OPT-D6



Description: Monitor Bus adapter board for ACCel500. Interface to fast monitor bus used by the ADDaptACC tool.
Allowed slots: B, D, E.
Type ID: 17462
Terminals: One screw terminal block (M3)
Jumpers: 2; X3, X4.
Board parameters: None

TABLE 3-33. OPT-D6 I/O TERMINALS

Terminal		Technical information
21	CAN_L	Monitor Bus negative data
22	CAN_H	Monitor Bus positive data
23	CAN_GND	Monitor Bus ground

Jumper Selections

There are two jumper blocks on the OPT-D6 board. The factory defaults and other available jumper selections are presented below:

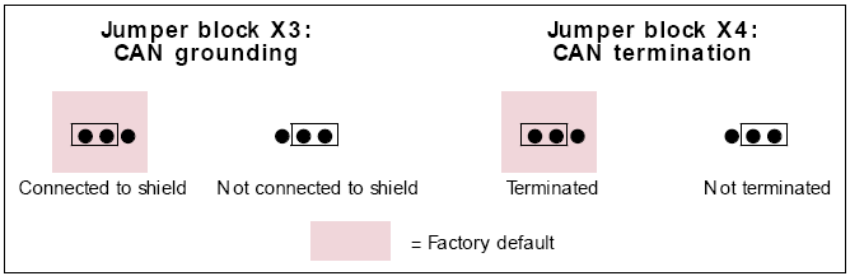


Figure 3-16. Jumper Selections for OPT-D6

SECTION IV

OPTION BOARDS -- OPERATIONAL DETAILS

TABLE 4-1. OPTION BOARDS, TYPES A AND B

Board type	Slots Allowed[6]	ID	DI	DO	AI mA/V	AI mA isol.	AO mA	AO V	AO mA/V	AO mA isol.	RO no/nc	RO no	+10V ref	TI	+24V/ EXT +24V	42-240 VAC	DI Enc. 10-24V	DI Enc. RS-422	Out +5/ +15V/ +24V	Out +15/ +24V	Pt-100
Basic boards OPT-A_																					
OPT-A1	A	16689	6	1	2				1				1		2						
OPT-A2	B	16690									2										
OPT-A3	B	16691									1	1		1							
OPT-A4[4]	C	16692																3	1		
OPT-A5[4]	C	16693															3			1	
OPT-A7	C	16695		2													6			1	
OPT-A8	A	16696	6	1	2[1]				1[1]				1[1]		2						
OPT-A9[3]	A	16697	6	1	2				1				1		2						
OPT-AE[4]	A	16709		2													3				
OPT-AL	A	16716		1	1	1	1	1								6				1	
I/O expander boards OPT-B_																					
OPT-B1	BCDE	16945	6[5]	6[5]																	
OPT-B 2	BCDE	16946									1	1		1							
OPT-B4	BCDE	16948				1[2]				2[2]					1						
OPT-B5	BCDE	16949										3									
OPT-B8	BCDE	16952																			3
OPT-B9	BCDE	16953									1					5					
OPT-BB	C	16962 16963															2				

TABLE 4-2. OPTION BOARDS, TYPE D

Adapter Baords			
OPT-D1	**D**E	17457	System Bus adapter board: 2 x fiber optic pairs
OPT-D2[1]	[B]**D**E	17458	System Bus adapter board: 1 x fiber optic pair & CAN bus adapter (galvanically decoupled)
OPT-D3	**D**E	17459	RS232 adapter card (galvanically decoupled)
OPT-D6	B**D**E	17462	MonitorBus adapter board (galvanically decoupled)

1) Analog inputs AI1 and AI2, analog output AO1 and voltage reference +10Vref galvanically decoupled (all these in same potential)
2) Analog input AI1 and analog outputs AO1 and AO2 galvanically decoupled from each other and other electronics
3) Similar to OPT-A1 only with bigger terminals for 2.5mm^2 wires
4) Special application required for use in NXS
5) Bidirectional terminals
6) In case of several optional slots, the bold slot letter indicates the factory default slot (NOTE: not applicable if several boards with the same default slot are Installed)
7) If the board is placed in slot B the SystemBus is not available; only the Monitor Bus can be used. Remove jumpers X5 and X6.