13.6. Encoder board ES836

Board for incremental, bidirectional encoder to be used as a speed feedback for inverters of the SINUS K series with VTC control and LIFT control. Two versions are available: one fitting encoders with power supply ranging from 5 to 15VDC with complementary outputs and allowing output voltage fine-tuning; the other version fits encoders with 24VDC power supply with both complementary and single-ended outputs.

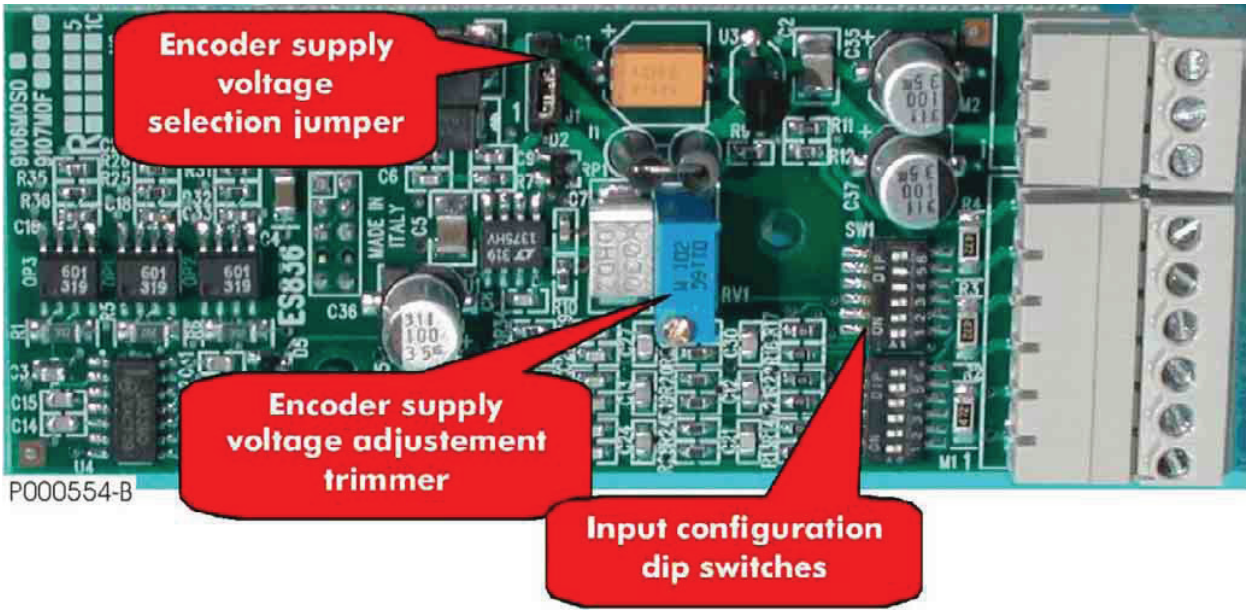

Fig. 62: Encoder Board ES836

DESCRIPTION	CODE	COMPATIBLE ENCODERS	
		POWER SUPPLY	OUTPUT
Encoder board ES836 (5…15V encoders)	ZZ0095831	5VDC, 12VDC, 15VDC	LINE DRIVER, PNP, complementary PUSH-PULL outputs
Encoder board ES836 (24V encoders)	ZZ0095832	24VDC	NPN, PNP, complementary PUSH-PULL outputs and NPN, PNP, single-ended PUSH-PULL outputs

13.6.1. Environmental Requirements

Operating temperature	0 to + 50° C ambient temperature (contact Elettronica Santerno for higher ambient temperatures)
Relative humidity	5 to 95% (non condensing)
Max. operating altitude	4000 (a.s.l.)

13.6.2. ELECTRICAL FEATURES

Features of 24VDC encoder board – ZZ0095832	Value			
	Min.	Type	Max.	Unit
Encoder supply current, + 24 V, protected with self-resetting fuse			200	mA
Input channels	Three channels: A, B and zero notch Z			
Type of input signal	Complementary or single-ended			
Voltage range for encoder input signals	4		24	V
Pulse max. frequency with noise filter setting on	77kHz (1024imp @ 4500rpm)			
Pulse max. frequency with noise filter setting off	155kHz (1024imp @ 9000rpm)			
Input impedance in NPN or PNP mode (pull-up or pull-down external resistors are required)		15k		Ω
Input impedance in push-pull mode or PNP and NPN mode with connection to internal load resistors (at max. frequency)		3600		Ω

Features of 5.....15VDC encoder board – ZZ0095831	Value			
	Min.	Type	Max.	Unit
Electronically protected encoder supply current, +12V			350	mA
Electronically protected encoder supply current, +5V			900	mA
Adjustment range for encoder supply voltage (5V mode)	4.4	5.0	7.3	V
Adjustment range for encoder supply voltage (12V mode)	10.3	12.0	17.3	V
Input channels	Three channels: A, B and zero notch Z			
Type of input signal	Complementary			
Voltage range for encoder input signals	4		15	V
Pulse max. frequency with noise filter setting on	77kHz (1024imp @ 4500rpm)			
Pulse max. frequency with noise filter setting off	155kHz (1024imp @ 9000rpm)			
Input impedance in complementary push-pull or line driver mode (at max. frequency)		780		Ω

ISOLATION:

The encoder supply line and inputs are galvanically isolated from the inverter control board grounding for a 500 VAC test voltage for 1 minute. Encoder supply grounding is in common with control board digital inputs available in the terminal board.

13.6.3. INSTALLING THE ENCODER BOARD ON THE INVERTER

1) Remove voltage from the inverter and wait at least 5 minutes.
   1) Remove the cover allowing to gain access to the inverter control terminals. The mounting columns for the encoder board and signal connector are located on the left.

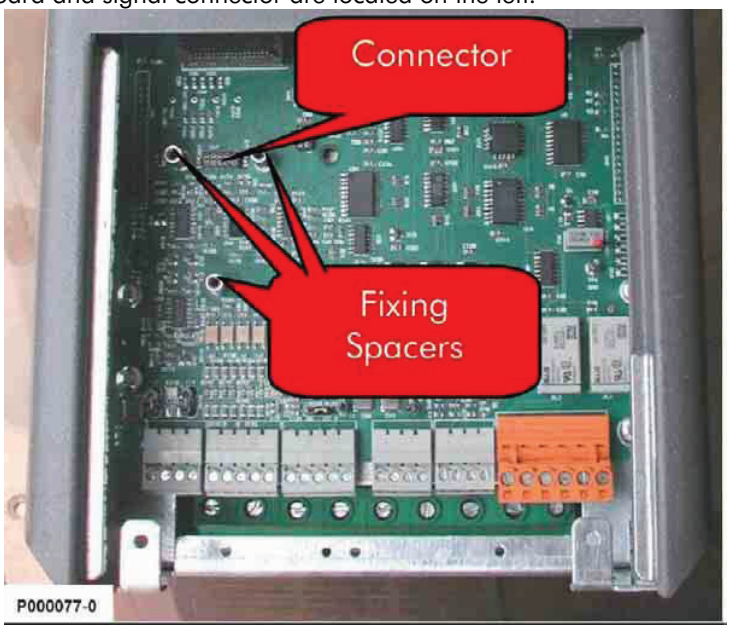

Fig. 63: Position of the Slot for the Encoder Board Fitting

3) Fit the encoder board and make sure that all contacts enter the relevant housing in the signal connector. Fasten the encoder board to the metal columns using the screws supplied.
4) Configure the dip-switch and the jumper located on the encoder board based on the type of encoder being used. Check that supply voltage in terminal board output is correct.
5) Turn on the inverter and set the parameters relating to the encoder feedback (see Programming Manual).

Fig. 64: Encoder board fastened to its slot

13.6.4. ENCODER BOARD TERMINALS

A 9-pole terminal board is located on the front side of the encoder board.

Terminal board with 3.81 mm pitch - two separate sections (6-pole section and 3-pole section)		
Terminal no.	**Signal**	**Type and features**
1	CHA	Channel A encoder input (true)
2	$\overline{\text{CHA}}$	Channel A encoder input (false)
3	CHB	Channel B encoder input (true)
4	$\overline{\text{CHB}}$	Channel B encoder input (false)
5	CHZ	Channel Z (zero notch) encoder input (true)
6	$\overline{\text{CHZ}}$	Channel Z (zero notch) encoder input (false)
7	+VE	Output for encoder supply 5V….15V or 24V
8	GNDE	Encoder supply ground
9	GNDE	Encoder supply ground

For the encoder connection to the encoder board, see wiring diagrams (following pages).

13.6.5. DIP-SWITCH

Encoder board ES836 requires two dip-switch banks to be set depending on the type of encoder being used. Dip-switches are located in the top left corner of encoder board ES836 (see figure below).

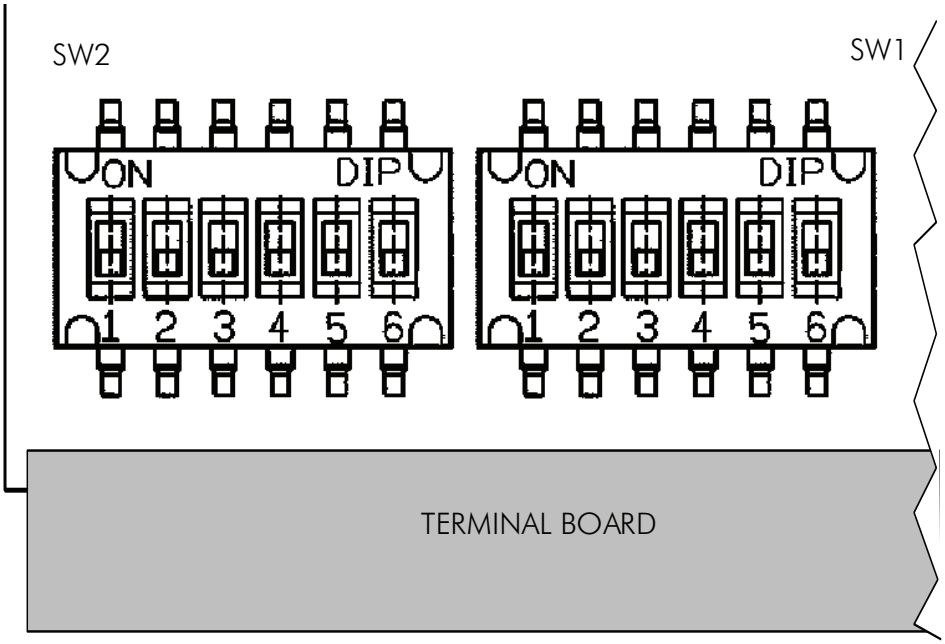

Fig. 65: Dip-switch Position

Dip-switch functions:

Switch	*OFF - open*	*ON - closed*
SW2 – 1	Channel Z with no band limit	Channel Z with band limit
SW2 – 2	Channel Z with complementary signals	Channel Z with only one single-ended signal
SW2 – 3	Channel Z type NPN (24V only) or PNP	Channel Z Line driver or Push Pull
SW2 – 4	Channel B with no band limit	Channel B with band limit
SW2 – 5	Channel B with complementary signals	Channel B with only one single-ended signal
SW2 – 6	Channel B type NPN (24V only) or PNP	Channel B Line driver or Push Pull
SW1 – 1	Channel A with no band limit	Channel A with band limit
SW1 – 2	Channel A with complementary signals	Channel A with only one single-ended signal
SW1 – 3	Channel A type NPN (24V only) or PNP	Channel A type Line driver or Push Pull
SW1 – 4	Not used	Not used
SW1 – 5	Not used	Not used
SW1 – 6	Supply voltage 12 V (J1 in pos. 2-3)	Supply voltage 5 V (J1 in pos. 2-3)

13.6.6. JUMPER FOR ENCODER SUPPLY

Two-position jumper J1 installed on control board ES836 and allows to set the encoder supply voltage. It is factory-set based on the encoder board version. Set jumper J1 to position 1-2 to select non-tuned, 24V encoder supply voltage.
Set jumper J1 to position 2-3 to select tuned, 5/12V encoder supply voltage. Supply values of 5V or 12V are to be set through dip-switch SW1-6 (see table above).

13.6.7. TRIMMER

Trimmer RV1 installed on board ES836 (5..15V version) allows to adjust the encoder supply voltage. This can be useful for encoders with intermediate voltage values if compared with factory-set voltage and can compensate voltage drops in case of long distance between the encoder and the encoder board.
Adjustment procedure:

- put a tester on the encoder supply connector (encoder side of the connecting cable); make sure the encoder is on.
- rotate the trimmer clockwise to increase supply voltage. Trimmer is factory-reset to obtain 5V and 12V voltage (depending on dip-switch setting) in supply terminals. 5V configuration: power supply can range from 4.4V to 7.3V; 12V configuration: power supply can range from 10.3V to17.3V.

NOTE Output voltage cannot be adjusted by trimmer RV1 for 24V encoder board.

CAUTION: Power supply values exceeding the encoder ratings may damage the encoder. Always use a tester to check voltage delivered from board ES836 before wiring.

CAUTION: Do not use the encoder supply output to power other devices. Failure to do so would increase the hazard of control interference and short-circuits with possible uncontrolled motor operation due to the lack of feedback.

CAUTION: The encoder supply output is isolated from the common terminal of the analog signals incoming to the terminals of the control board (CMA). Do not link the two common terminals together.

13.6.8. ENCODER WIRING AND CONFIGURATION EXAMPLES

The figures below illustrate the electrical schematics and the dip-switch setup for the most popular encoder models.

CAUTION	A wrong encoder-board connection may damage both the encoder and the board.
NOTE	In all figures, dip-switches SW2-1, SW2-4 and SW1-1 are ON (77kHz band limit is on). Set dip-switches to OFF if encoders generating greater output frequency are used.
NOTE	The maximum length of the encoder cable depends on the encoder output control capacity, not on encoder board ES836. See technical features of the component.
NOTE	Dip-switch SW1-6 is not shown in the figures because its setting depends on the supply voltage required by the encoder. Dip-switch SW1-6 is to be used only for 5..12V encoder board. Refer to the dip-switch setting table to set SW1-6.
NOTE	Zero notch connection is optional and is required for particular software applications only. However, zero notch connection does not affect software applications that do not require this type of connection. See SINUS K's Programming Manual.

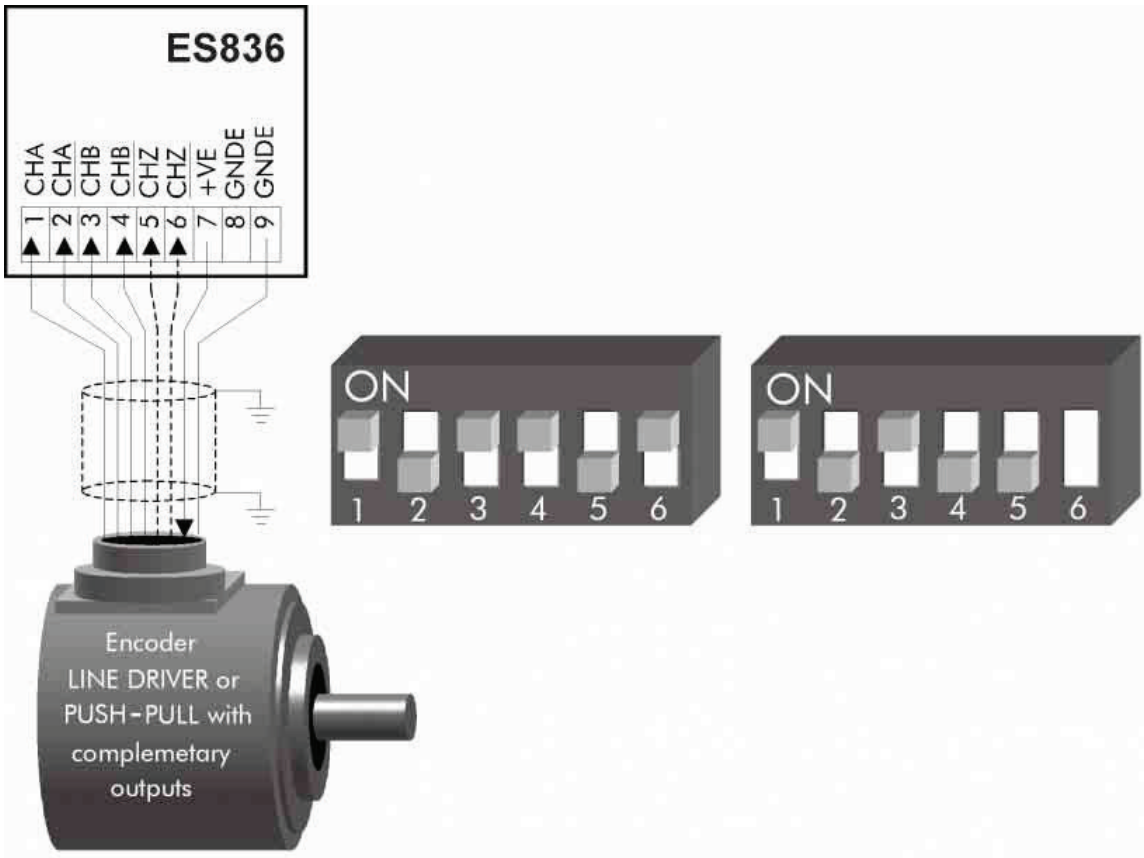

Fig. 66: LINE DRIVER or PUSH-PULL Encoder with Complementary Outputs

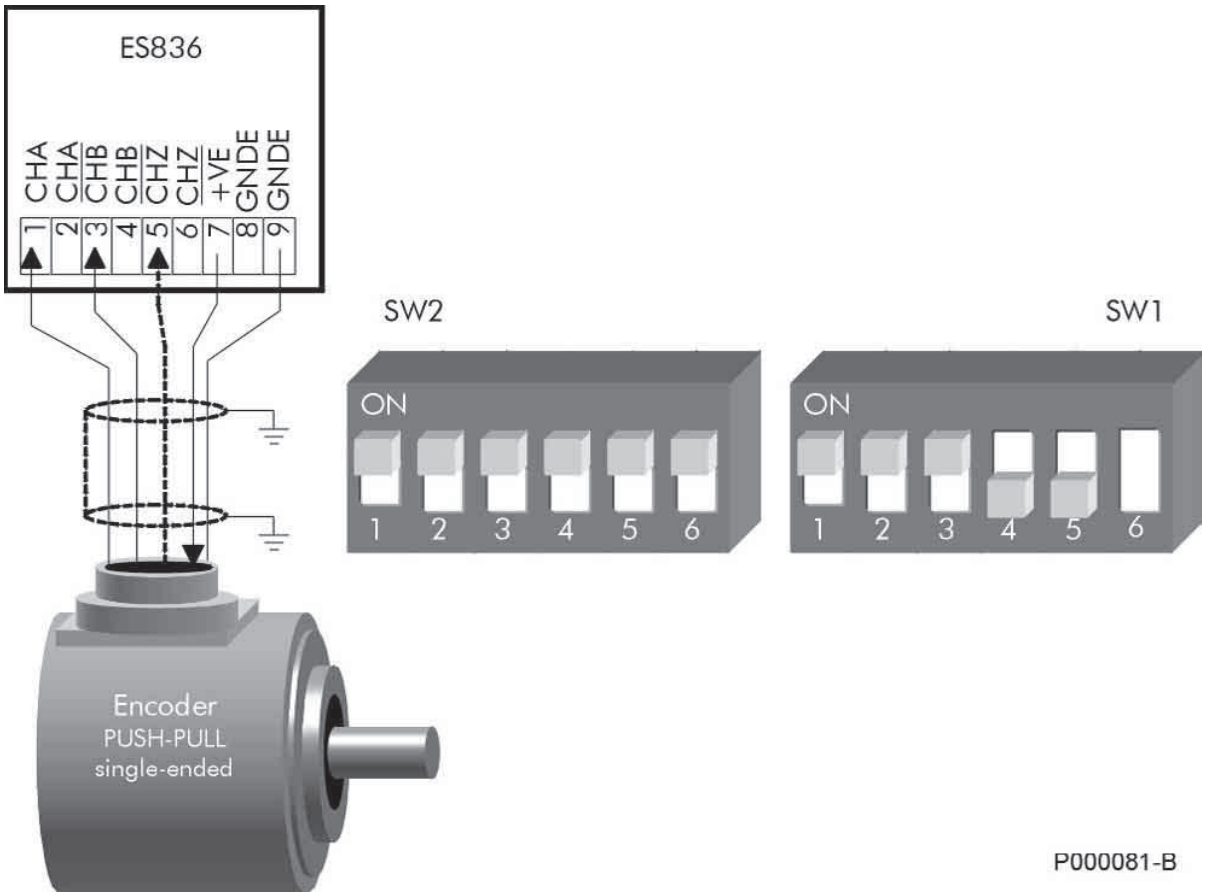

Fig. 67: PUSH-PULL Encoder with Single-ended Outputs (with 24VDC board only)

CAUTION

Because settings required for a single-ended encoder—which is made possible with a 24V board only (dip-switches SW2-1, SW2-5, SW1-2 closed)—deliver a reference voltage to terminals 2, 4, 6, the latter are not to be connected. Failures will occur if terminals 2, 4, 6 are connected to encoder conductors or to other conductors.

NOTE

Only push-pull, single-ended encoders may be used, with an output voltage equal to the supply voltage. Only differential encoders may be connected if their output voltage is lower than the supply voltage

NOTE

Some manufacturers use the acronym HTL for push-pull outputs with a power supply ranging from 18 VDC to 30VDC. For the acquisition of this type of encoder, the same configuration used for push-pull inverters shall be used for the encoder board.

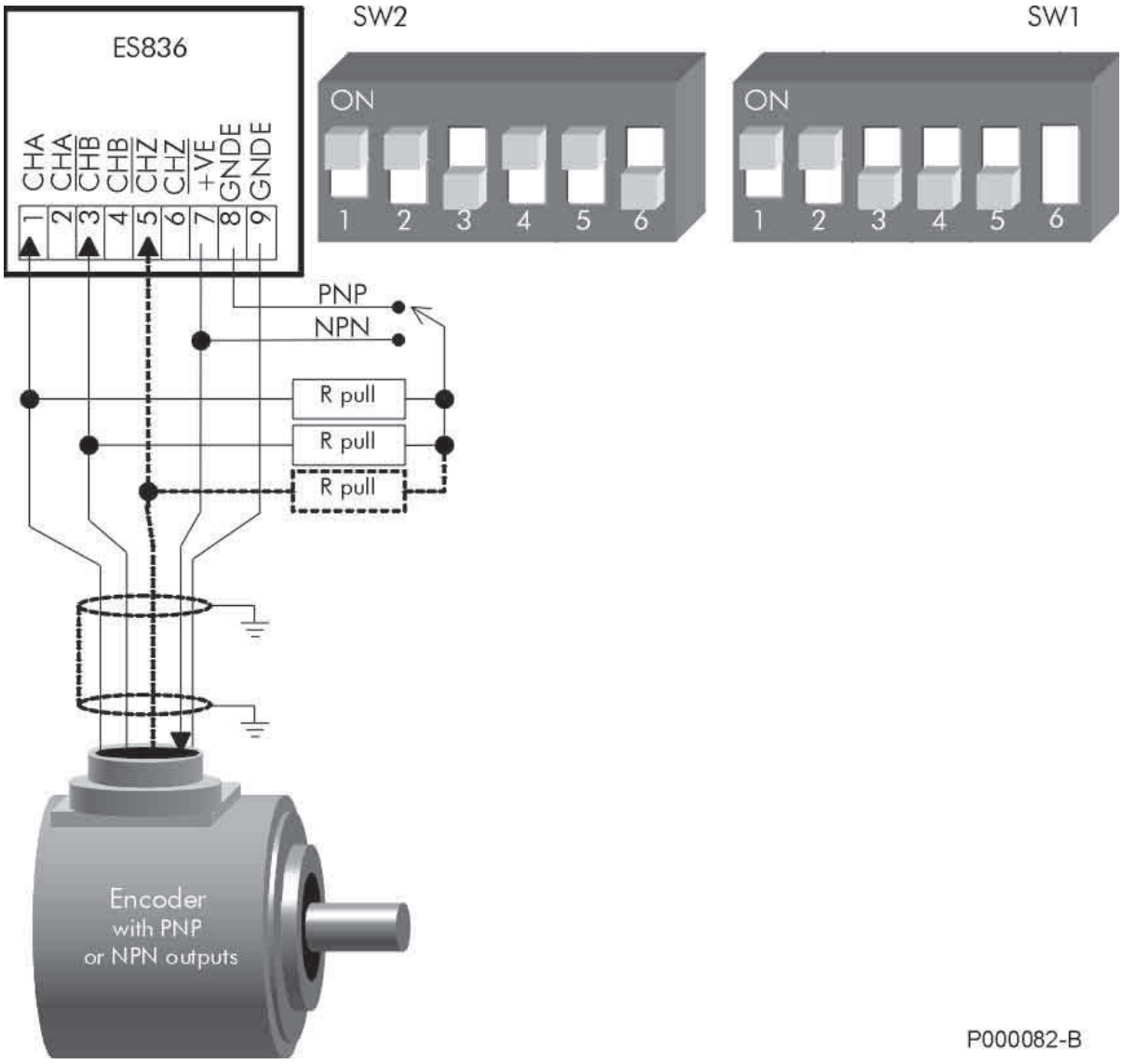

Fig. 68: PNP or NPN encoder with single-ended outputs and load resistors with external wiring (only for 24VDC encoder board)

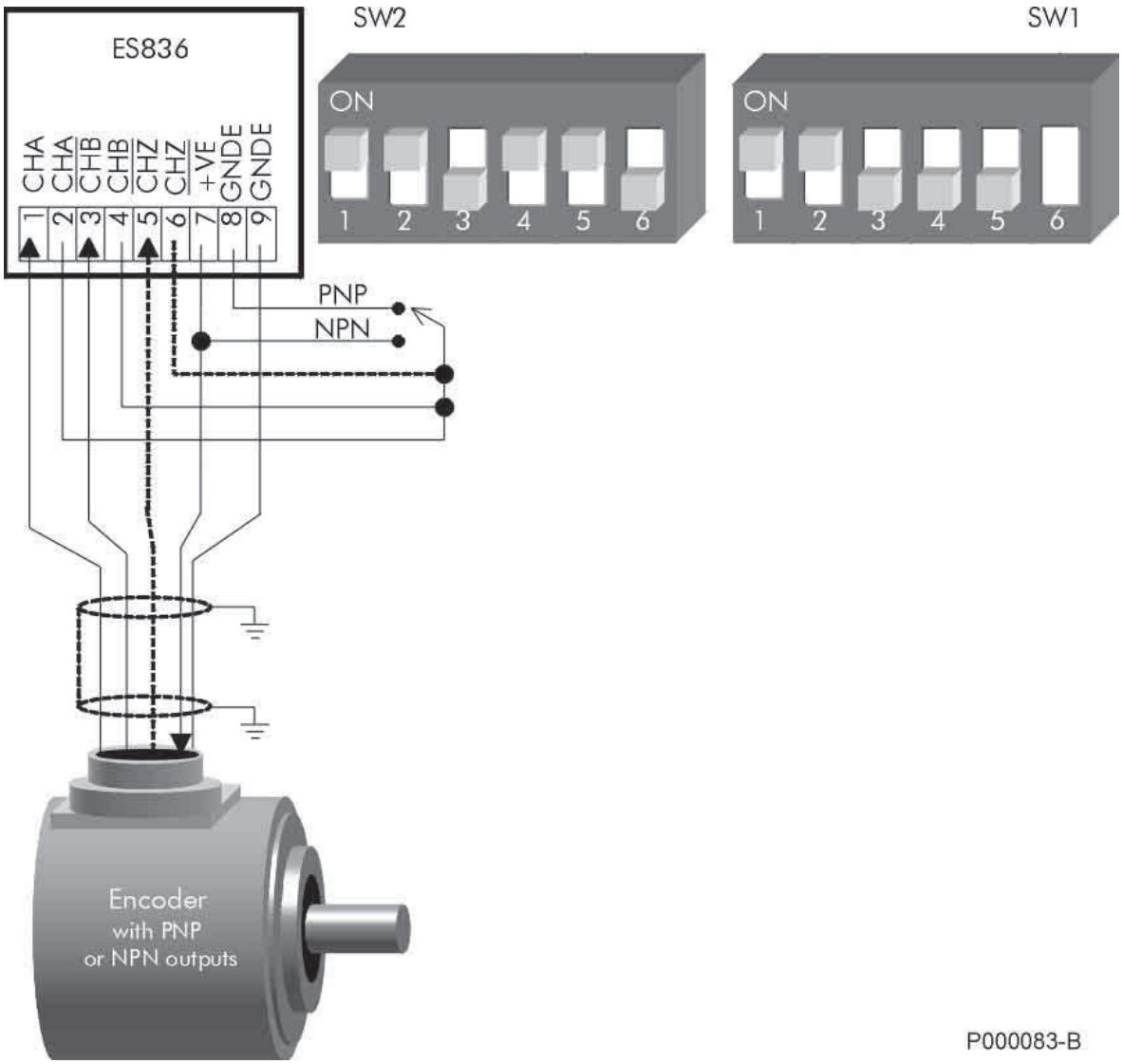

Fig. 69: PNP or NPN encoder with single-ended outputs and load resistors with internal wiring (only for 24VDC encoder board)

CAUTION

The connection of NPN encoders is possible only with 24VDC encoder board; 5..15VDC encoder board is not capable of acquiring NPN encoders. Encoders with standard, 5V TTL outputs cannot be acquired.

NOTE

NPN encoders or PNP encoders are provided with special outputs requiring a resistive pull-up load or pull-down load to the mains or to the common. The load resistor rating is determined by the manufacturer of the encoder; load resistors are to be externally wired as shown in the figure. The resistor common is to be connected to the mains (NPN encoder) or to the common (PNP encoder).Incorporated resistors can be used only if the encoder can operate with 4700Ω load resistors (see connection in Figure 13.20).

NOTE

Using an NPN encoder or a PNP encoder implies pulse distortion because the duration of the rising edge is different from the duration of the dropping edge. Pulse distortion depends on the load resistor ratings and the cable parasite capacity. Do not use PNP encoders or NPN encoders for applications where the encoder output frequency is higher than a few kHz dozens. Use Push-Pull encoders or better encoders with a differential line-driver output instead.

13.6.9. WIRING

Use a screened cable to connect the encoder to the board. Screening should be grounded to both ends of the cable. Use the special clamp to fasten the encoder wire and ground the cable screening to the inverter.

Fig. 70: Wiring the Encoder

Do not stretch the encoder wire along with the motor supply cable.
Connect the encoder directly to the inverter using a cable with no intermediate devices, such as terminals or connectors.
Use a model of encoder suitable for your application (as for connection length and max. rev number).
Preferably use encoder models with complementary LINE-DRIVER or PUSH-PULL outputs. Non-complementary PUSH-PULL, PNP or NPN open collector outputs offer a lower immunity to noise.
The encoder electrical noise occurs as the difficult speed adjustment or irregular operation of the inverter; in the worst cases, it can lead to the inverter stop due to overcurrent conditions.

13.7. SERIAL ISOLATED BOARD ES822

Serial isolated board RS232/485 controlling SINUS K and SINUS PENTA inverters. It permits to connect a computer via interface RS232 or permits the multidrop connection of modbus devices via interface RS485. Interface signals are galvanically isolated with respect to the control board ground and the common of the control board terminals.

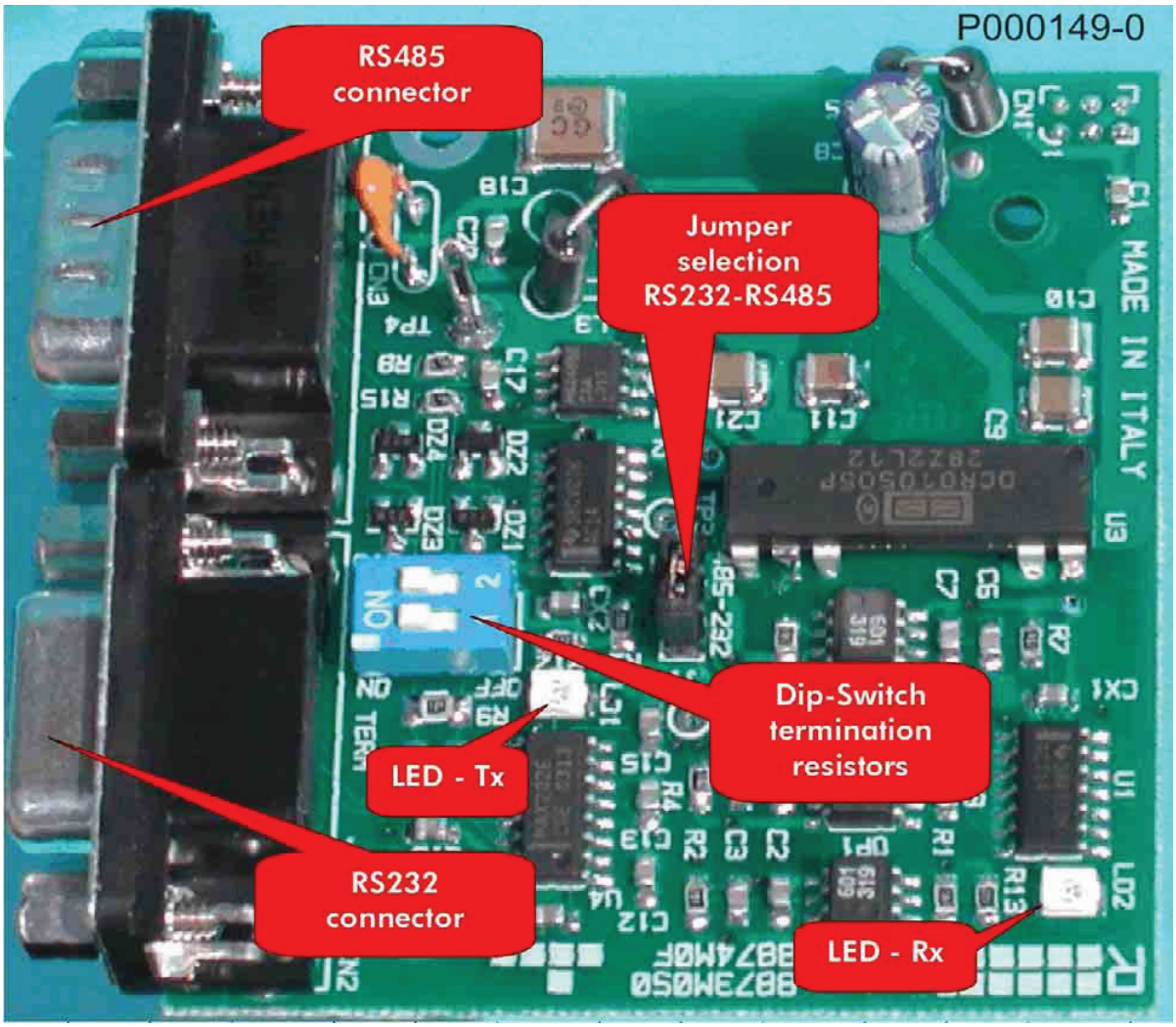

Fig. 71: Isolated Board ES822

DESCRIPTION	CODE
Serial isolated board RS 232/485	ZZ0095850

13.7.1. ENVIRONMENTAL REQUIREMENTS

Operating temperatures:	0 to + 50 °C ambient temperature (for higher temperatures, please contact Elettronica Santerno)
Relative humidity:	5 to 95% (non-condensing)
Max. operating altitude	4000 (a.s.l.)

13.7.2. ELECTRICAL FEATURES

CONNECTION:
When board ES822 is fitted, RS-485 connector automatically disables; 9-pole D connectors (male D connectors for RS-485, or female D connectors for RS-232-DTE located on board ES822) activate depending on the position of J1.

Contacts of 9-pole, male D connector CN3 (RS-485):

PIN	FUNCTION
1 – 3	(TX/RX A) Differential input/output A (bidirectional) according to standard RS485. Positive polarity with respect to pins 2 – 4 for one MARK.
2 – 4	(TX/RX B) Differential input/output B (bidirectional) according to standard RS485. Negative polarity with respect to pins 1 – 3 for one MARK.
5	(GND) control board zero volt
6 - 7	Not connected
8	(GND) control board zero volt
9	+5 V, max 100mA for power supply of optional, external converter RS-485/RS-232

Contacts of 9-pole, female D connector CN2 (RS-232-DCE):

PIN	FUNCTION
1, 9	Not connected
2	(TX A) Output according to standard RS232
3	(RX A) Input according to standard RS232
5	(GND) zero volt
4-6	Connected together for loopback DTR-DSR
7-8	Connected together for loopback RTS-CTS

13.7.3. INSTALLING ISOLATED BOARD ES822

1) Remove voltage from the inverter and wait at least 5 minutes.

2) Remove the cover allowing to gain access to the inverter control terminals. The mounting columns for the encoder board and signal connector are located on the right.

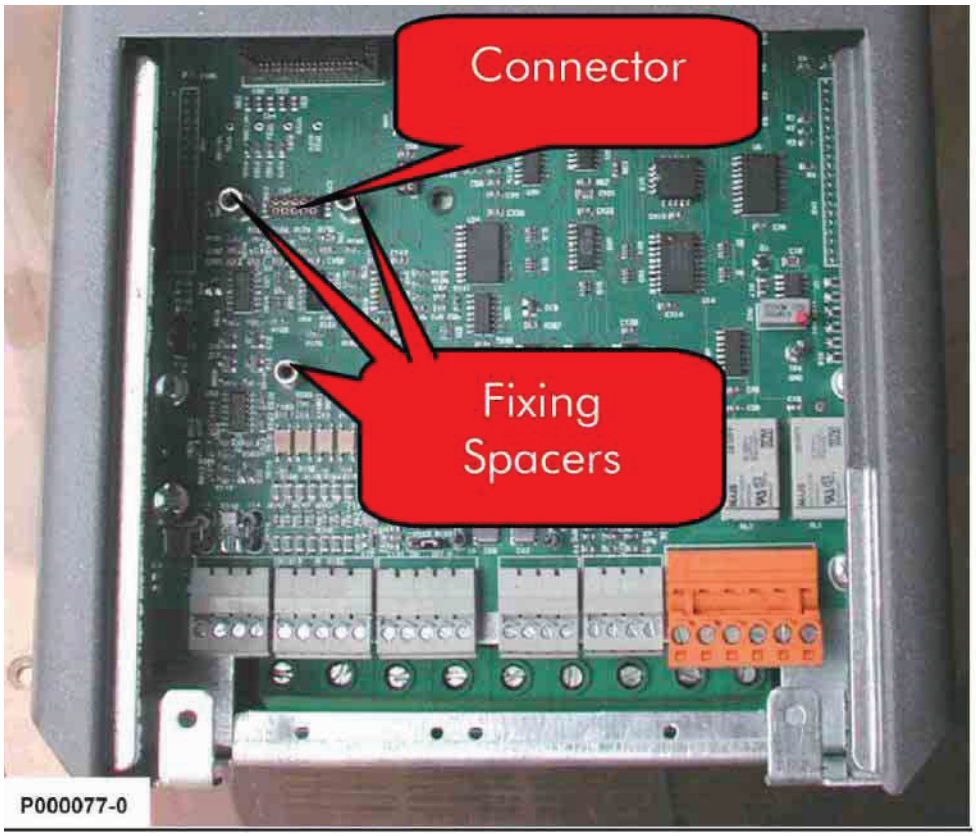

Fig. 72: Position of the slot for the installation of the serial isolated board

3) Fit the encoder board and make sure that all contacts enter the relevant housing in the signal connector. Fasten the encoder board to the metal columns using the screws supplied.

4) Configure the dip-switch and the jumper located on the board choosing the type of connection required.

13.7.4. CONFIGURING ISOLATED BOARD ES822

13.7.4.1. JUMPER SELECTING RS232/RS485

Jumper J1 configures board ES822 as interface RS485 or RS232. Positions are silk-screened on board ES822.
Jumper between pin 1-2: CN3 is enabled (RS485)
Jumper between pin 2-3: CN2 is enabled (RS-232)

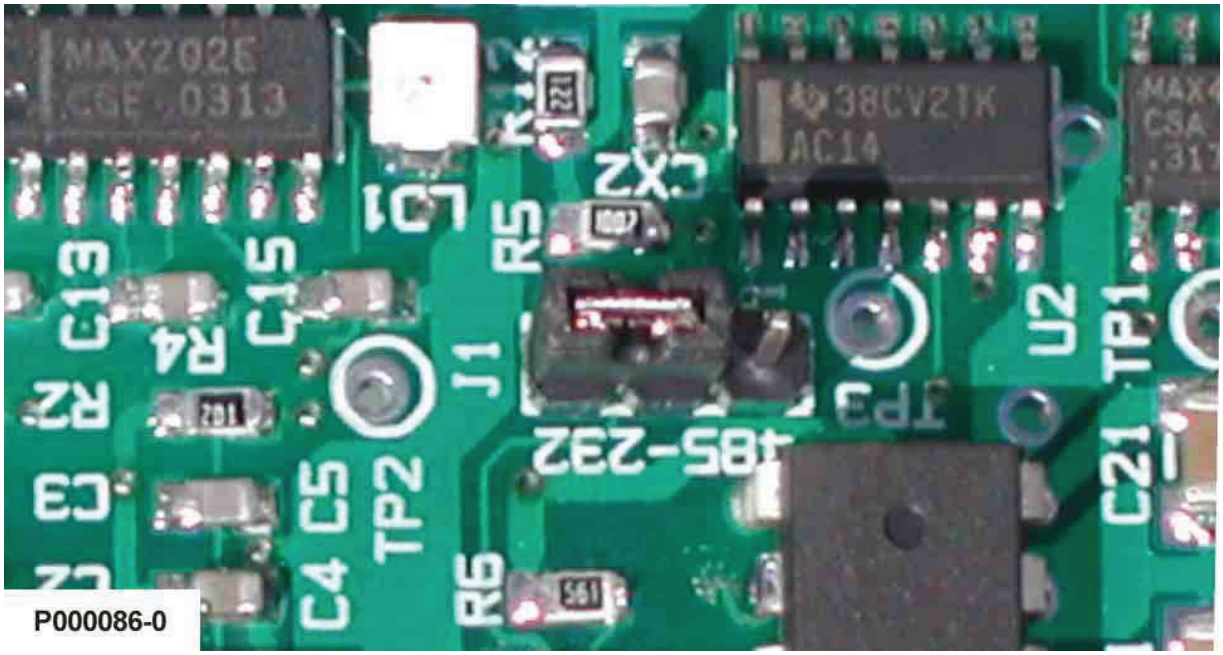

Fig. 73: Jumper Configuration for RS232/RS485.

13.7.4.2. DIP-SWITCH ENABLING TERMINATOR RS-485

(See section 11.2 relating to serial communications):
For serial link RS-485 in board ES822, terminator is selected with dip-switch SW1 as shown in the figure below.
The line terminator of the farthest inverter from the master computer (or the only inverter in case of direct connection to the master computer) shall be enabled: dip switch SW1, selector switches 1 and 2 in position ON (default setting).
The line terminator of the other inverters in intermediate positions shall be disabled: dip switch SW1, selector switches 1 and 2 in position OFF (default setting).
Serial link RS-232-DTE does not require any particular setup of dip switch SW1.

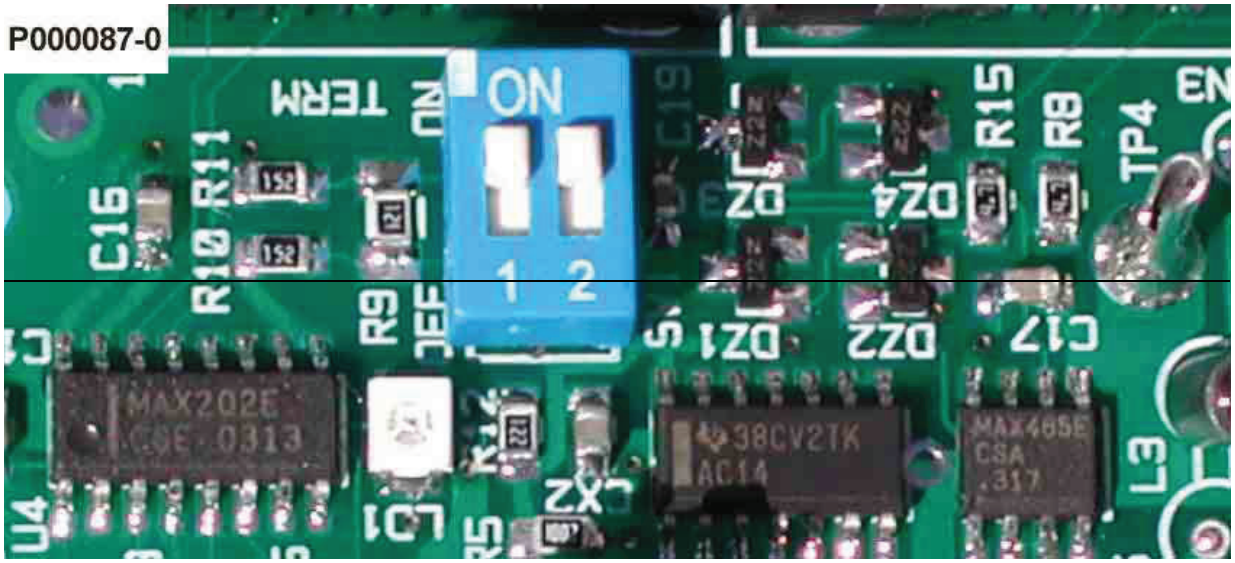

Fig. 74: Configuring Line Terminator RS485 Dip-switch