8BAC0123.001-1

1 General information

Incremental encoder plug-in module 8BAC0123.001-1 can be used in an ACOPOSmulti slot. The module contains an incremental encoder interface for encoders with +5 V encoder power supply.

The module is suitable for the following:

- Incremental encoders with push, pull or push-pull outputs with no complementary signal
- Incremental encoders with symmetrical push-pull outputs that cannot handle such high loads

The plug-in module is primarily used to evaluate encoders installed in external motors as well as external axis encoders (i.e. encoders that detect any machine movement).

Information:

Only incremental encoders with square wave signals phase-shifted electrically by 90° can be evaluated. Evaluation of incremental encoders with sine/cosine output or pulse direction outputs is not possible!

B&R recommends the use of encoders with RS422 signals and 5 V encoder power supply. These provide maximum immunity at lower power consumption and are best suited for high counter frequencies. The plug-in module 8BAC0123.000-1 should be used to evaluate these encoders!

The plug-in module is not equipped with line terminating resistors. For this reason, it is possible to connect encoders with low output current; nevertheless, the module is suitable only for low counter frequencies or short encoder cables due to possible line reflections.

The plug-in module offers a connection option for a motor temperature sensor (T+, T-) to integrate third-party motors without problems. [1)]

This module is equipped with a configurable digital input filter. In this way, the filter effect and edge interval monitoring can be adjusted in 4 steps according to the maximum frequency required by the application. The lowest maximum frequency is set by default!

1) **ACOPOSmulti plug-in module in SLOT1:**
The temperature sensor connections (T+, T-) on the ACOPOSmulti plug-in module can be evaluated for all ACOPOSmulti power supply and inverter modules.

ACOPOSmulti plug-in module in SLOT2:
The temperature sensor connections (T+, T-) on the ACOPOSmulti plug-in module can only be evaluated for ACOPOSmulti 2-axis inverter modules (8BVIxxxxHxD0.000-1).

2 Order data

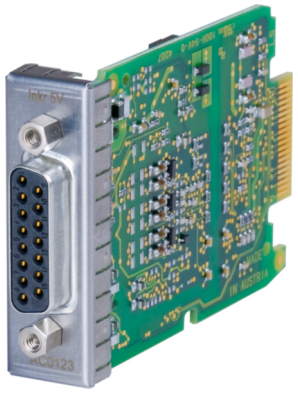
Model number	Short description	Figure
	Plug-in modules	
8BAC0123.001-1	ACOPOSmulti plug-in module, incremental encoder interface for 5 V single-ended and 5 V differential signals	

Table 1: 8BAC0123.001-1 - Order data

3 Technical data

Model number	8BAC0123.001-1
General information	
Module type	ACOPOSmulti plug-in module
B&R ID code	0xA37E
Slot [1]	Slots 1 and 2
Max. power consumption [2]	P_{Module} [mW] = 25 V * ($I_{Encoder}$ [mA] * 0.42 + 48 mA)
Certifications	
CE	Yes
KC	Yes
UL	cULus E225616 Power conversion equipment
Encoder connection [3]	
Module-side connection	15-pin male DSUB connector
Status indicators	UP/DN LEDs
Electrical isolation	
Encoder - ACOPOSmulti	Yes
Max. encoder cable length	
Incremental encoder	25 m
Encoder power supply 5 V	
Output voltage	5 V ±5%
Load capacity	350 mA [4]
Sense lines	
Quantity	2
Max. compensation	2x 1.5 V
Protective measures	
Overload protection	Yes
Short circuit protection	Yes
Inputs A, B, R	
Single-ended signals	
Input voltage for low	<1.0 V (against COM)
Input voltage for high	>2.4 V (against COM)
Maximum input voltage	-10 V / +13 V (against COM)
Differential signals	
Differential voltage	±0.8 V to ±23 V [5]
Maximum input voltage	-10 V / +13 V (against COM)
Input resistance	See block diagram.
Incremental encoder operation	
Signal form	Square wave pulse
Evaluation	4x
Input frequency [6]	Max. 25 / 50 / 100 / 200 kHz
Counter frequency	Max. 100 / 200 / 400 / 800 kHz
Reference frequency	Max. 25 / 50 / 100 / 200 kHz
Distance between edges [7]	Min. 2.6 / 1.3 / 0.7 / 0.4 µs

Table 2: 8BAC0123.001-1 - Technical data

Model number	8BAC0123.001-1
Environmental conditions	
Temperature	
Operation	
Nominal	5 to 40°C
Maximum	55°C
Storage	-25 to 55°C
Transport	-25 to 70°C
Relative humidity	
Operation	5 to 85%
Storage	5 to 95%
Transport	Max. 95% at 40°C

Table 2: 8BAC0123.001-1 - Technical data

1) The 8BAC0123.001-1 is an encoder module. Two encoder modules can also be connected. In this case, the encoder module in the first slot automatically serves as motor feedback for the first axis; the encoder module in the second slot serves as motor feedback for the second axis. In 1-axis mode, the second slot can be used for other purposes.
2) $I_{Encoder}$ ... Current consumption of the incremental encoder. The current consumption of the terminating resistors is already taken into account in the formula. A voltage drop on the encoder channel of max. 2x 1.5 V is also taken into consideration.
3) The encoder must be wired using a single shielded cable with twisted pair signal lines (e.g. 4x 2x 0.14 mm² + 2x 0.5 mm²).
4) An additional reserve of 60 mA is available for terminating resistors.
5) With open circuit monitoring disabled, ±0.5 V is sufficient.
6) Input filter configurable with software.
7) Automatically adjusted to the selected input filter.

4 Wiring

4.1 Pinout

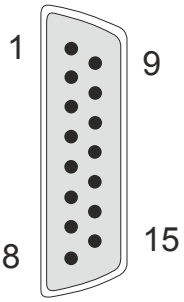
Figure	X11	Pin	Description	Function
		1	A	Channel A
		2	A\	Channel A inverted
		3	B	Channel B
		4	B\	Channel B inverted
		5	RD	Reference pulse
		6	RD\	Reference pulse inverted
		7	n.c.	---
		8	n.c.	---
		9	+5 V Out	Encoder power supply +5 V
		10	Sense +5 V	Sense input +5 V
		11	Sense COM	Sense input 0 V
		12	COM (1 - 6, 9)	Encoder power supply 0 V
		13	n.c.	---
		14	T+	Temperature sensor +
		15	T-	Temperature sensor -

Table 3: Incremental encoder interface 8BAC0123.001-1 - Pinout

Danger!

The connections for the motor temperature sensor and encoder are safely isolated circuits. These connections are therefore only permitted to be connected to devices or components that have sufficient isolation per IEC 60364-4-41 or EN 61800-5-1.

Warning!

Temperature sensors are only permitted to be connected to T+ and T- on an ACOPOSmulti plug-in module under the following conditions:

- **The ACOPOSmulti plug-in module is connected in SLOT1 of an ACOPOSmulti module and no temperature sensor is connected to connectors X4A/T+ and X4A/T- of this ACOPOSmulti module.**
- **Only for 8BVIxxxxHxD0.xxx-x inverter modules:**
  The ACOPOSmulti plug-in module is connected in SLOT2 of an ACOPOSmulti module and no temperature sensor is connected to connectors X4B/T+ and X4B/T- of this ACOPOSmulti module.

Otherwise, the temperature monitoring functions on the ACOPOSmulti module may become ineffective, which in extreme cases can cause the hardware (e.g. motors) connected to the ACOPOSmulti module to be destroyed!

4.2 Input/Output circuit diagram

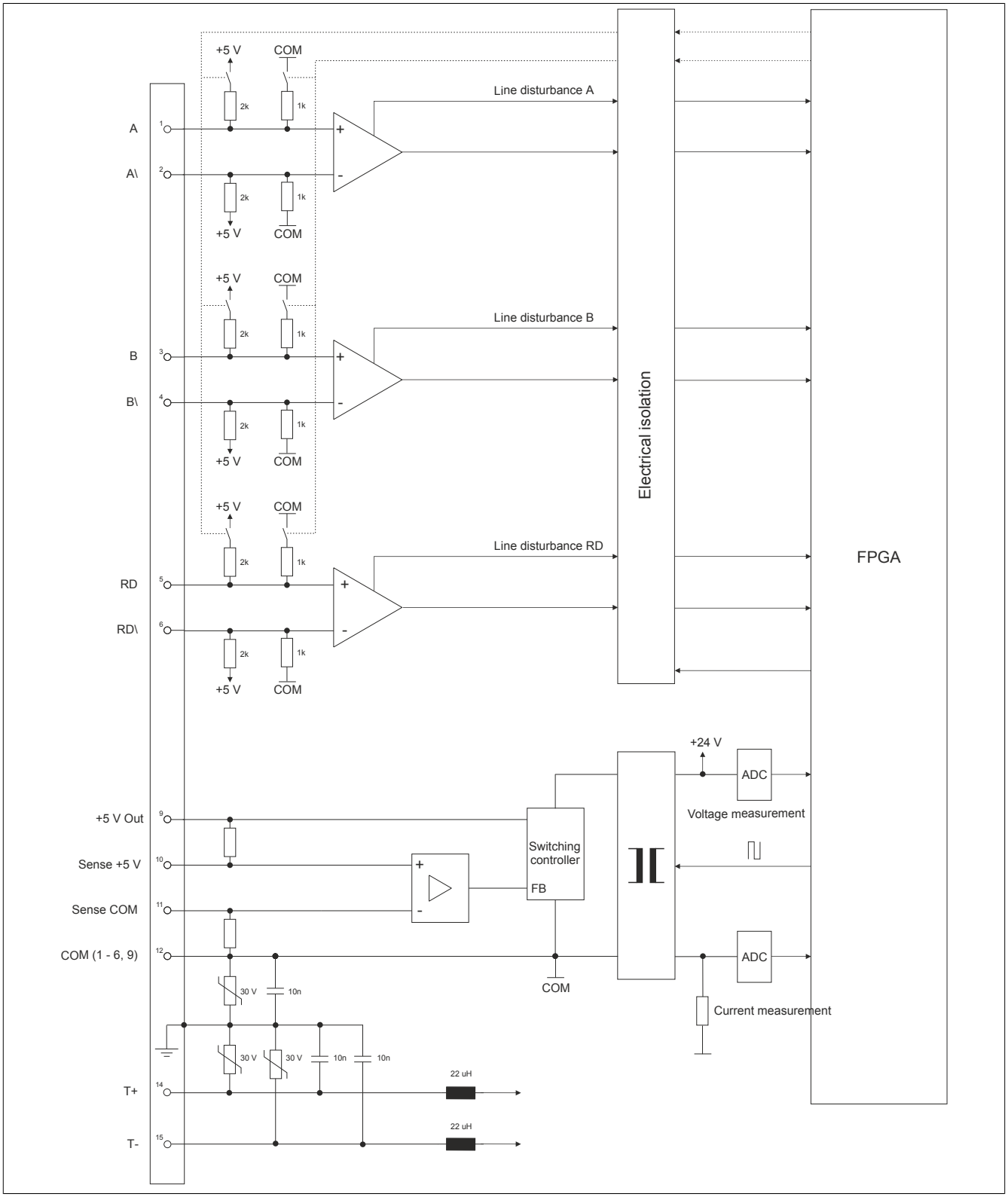


Figure 1: Incremental encoder interface 8BAC0123.001-1 - Input/Output circuit diagram

4.3 Configuration of the module-internal pull-up and pull-down resistors

The pull-up and pull-down resistors in the module can be switched using software so that encoders with different output designs can be connected. As default, the module is configured for encoders with push-pull outputs.

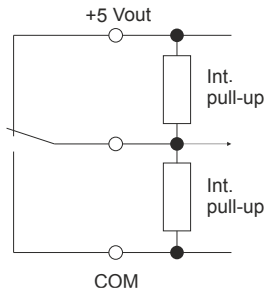
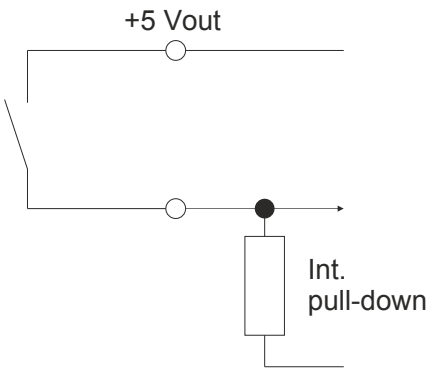
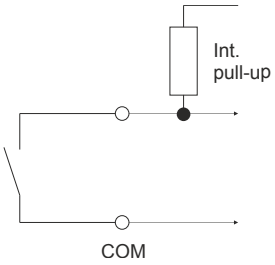
Encoders with push-pull outputs (default)	Encoders with push outputs	Encoders with pull outputs
The pull-up and pull-down resistors in the module are switched on at the same time:	Only the pull-down resistor in the module is switched on:	Only the pull-up resistor in the module is switched on:
		

Table 4: Possible configurations of the pull-up and pull-down resistors in the module

4.4 Open circuit monitoring configuration

Encoders with push-pull outputs

Open circuit monitoring is possible as default.

Encoders with push or pull outputs

Open circuit monitoring is only possible if the encoder itself is wired with pull-up or pull-down resistors (pull-up: max. 2 kΩ, pull-down: max. 560 Ω) and the module is configured for encoders with push-pull outputs.

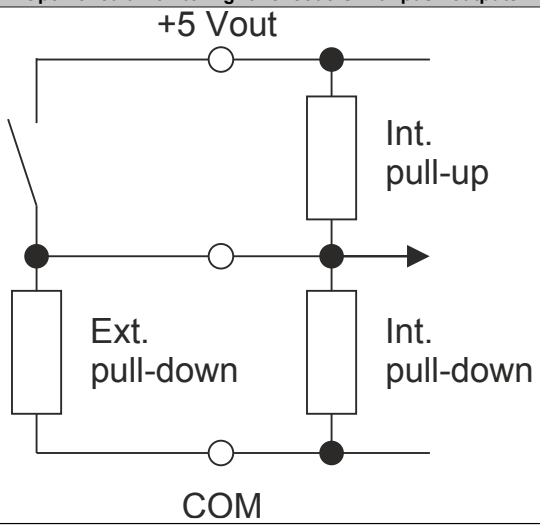
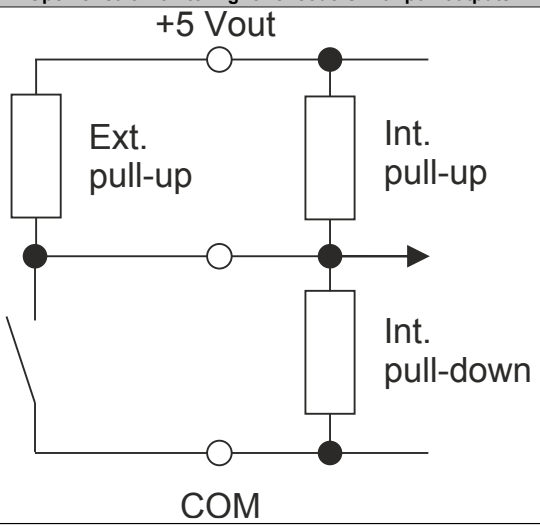
Open circuit monitoring for encoders with push outputs	Open circuit monitoring for encoders with pull outputs
	

Table 5: Configuration of open circuit monitoring for encoders with push or pull outputs

5 Status indicators

The indicators (LEDs UP/DN) are located on the front of the ACOPOSmulti drive or power supply module where the plug-in module is installed.

The UP/DN LEDs are lit depending on the rotational direction and the speed of the connected encoder. [2)]

UP LED ... indicates when the encoder position changes in the positive direction.
DN LED ... indicates when the encoder position changes in the negative direction.

[2)] The count direction of the encoder can be configured in Automation Studio. Changing the counting direction in Automation Studio does not change the actual counting direction of the encoder, however, and therefore has no effect on the UP/DN LEDs!

6 Firmware

The firmware is part of the operating system for the ACOPOSmulti drive system. Firmware is updated by updating the ACOPOSmulti operating system.