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 Produced by : - CTC Technical support
 Travellers Lane, Hatfield, Herts, AL10 8XB, UK
 Author: Andy Matthews

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FR-A7AP Encoder Option Quick Setup Guide

This guide is intended to help the first time user quickly setup the FR-A7AP Encoder option card. The dedicated manual should be consulted if further information is required.

The FR-A7AP can be used with the A700 with the following serial numbers:

Model	SERIAL (Serial No.)	Model	SERIAL (Serial No.)
FR-A720-0.4K/0.75K	P50000000	FR-A740-0.4K	L50000000
FR-A720-1.5K/2.2K	Q50000000	FR-A740-0.75K	K50000000
FR-A720-3.7K	N50000000	FR-A740-1.5K/2.2K	J50000000
FR-A720-5.5K to 11K	L50000000	FR-A740-3.7K	H50000000
FR-A720-15K to 22K	M50000000	FR-A740-5.5K/7.5K	G50000000
FR-A720-30K	Q50000000	FR-A740-11K to 22K	F50000000
FR-A720-37K	M50000000	FR-A740-30K to 55K	E50000000
FR-A720-45K	L50000000	FR-A740-75K/90K	G50000000
FR-A720-55K	K50000000	FR-A740-110K to 160K	E50000000
FR-A720-75K/90K	E50000000	FR-A740-185K to 500K	C50000000

Rating plate example

<u>□</u>	<u>5</u>	<u>0</u>	<u>000000</u>
Symbol	Year	Month	Control number
SERIAL (Serial No.)			

The serial numbers are made up of 1 version symbol, 2 numeric characters or 1 alphabet letter and 2 numeric characters including year and month with 6 numeric characters indicating control number. Month is indicated as 1 to 9, X (October), Y (November), Z (December).

Mount the option card in one of the option card slots making sure the drive is powered down.

Never remove the card with the power on as this could damage the drive and option card.

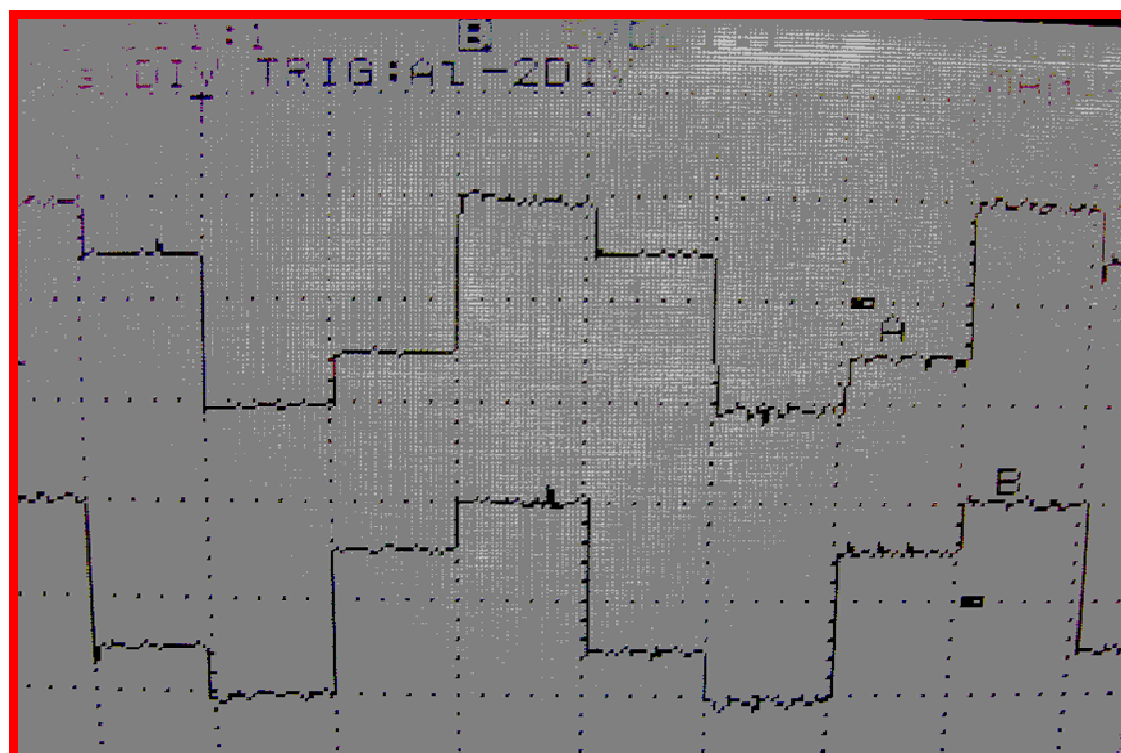
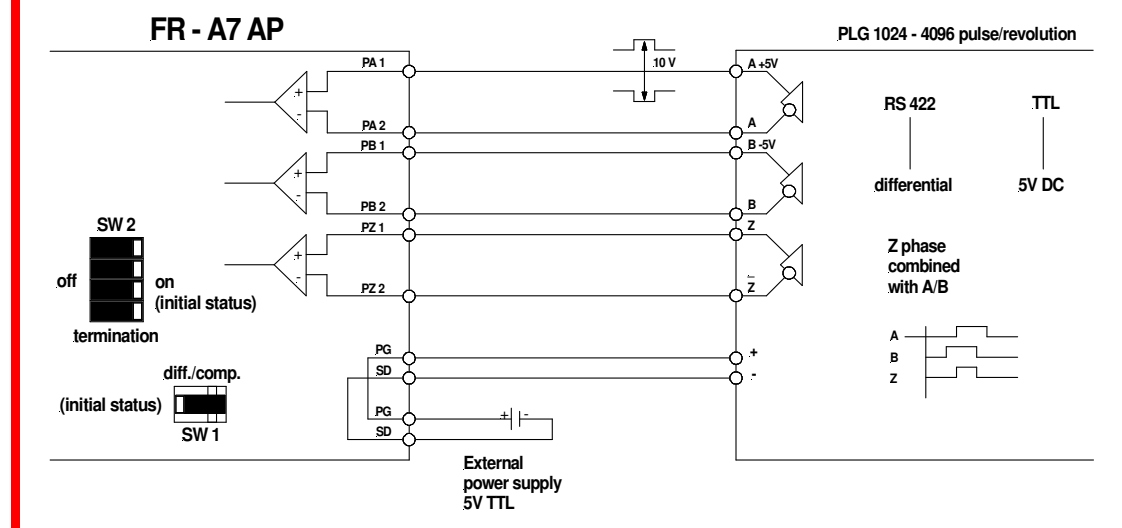
Two different types of encoder are available on the market, which are compatible with the FR-A7AP Encoder option card. These are 'Differential' and 'Complementary'. Differential encoders use the same theory as RS485 serial communications, where there is an inverse signal. The receivers of the encoder signal will only respond to 'differential' signals, i.e. the signal voltages are potential differences between the two conductors, which then ignore any noise between them. This mode can only work with TTL 5 volts, limiting the voltage of the encoder used.

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FR - A7 AP

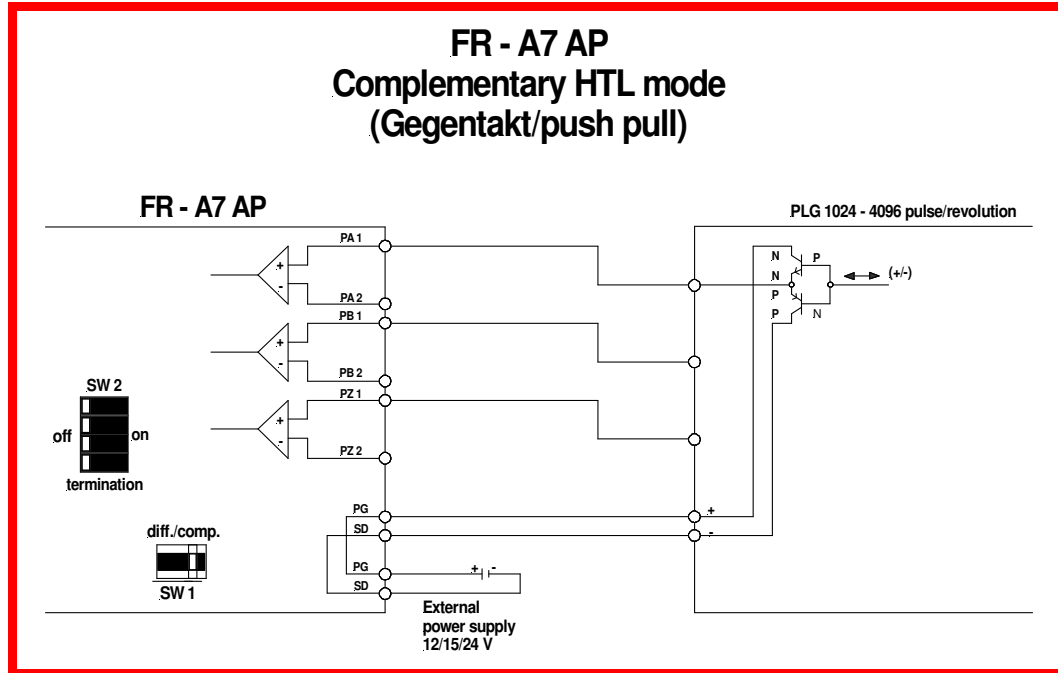
Differential TTL mode



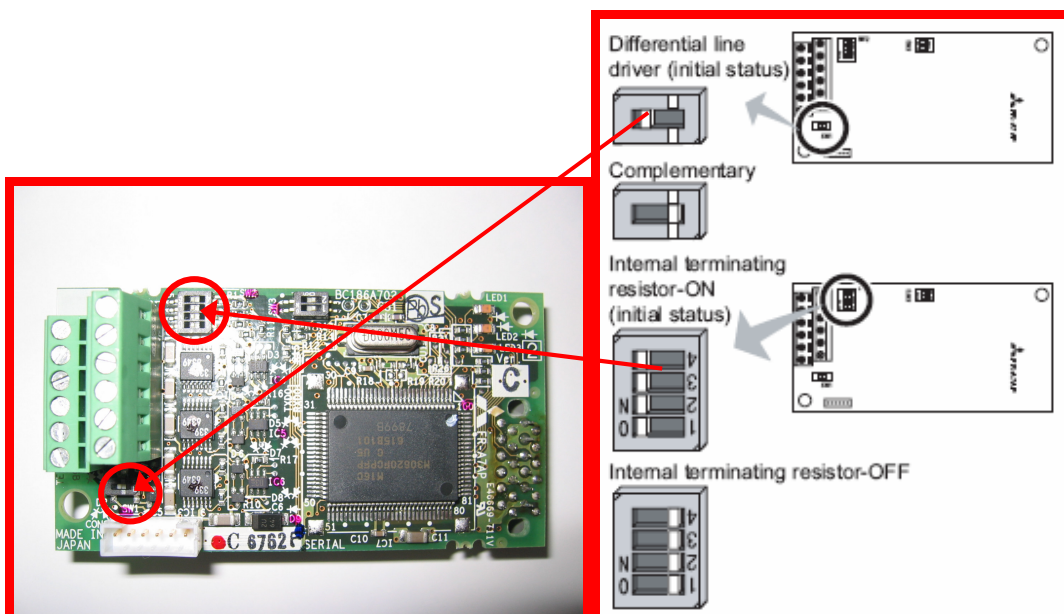
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In the Complementary mode the signal is derived from a 'push pull' transistor configuration and can be used with a range of voltages from 5-30volts in the case of FR-A7AP Encoder option card.



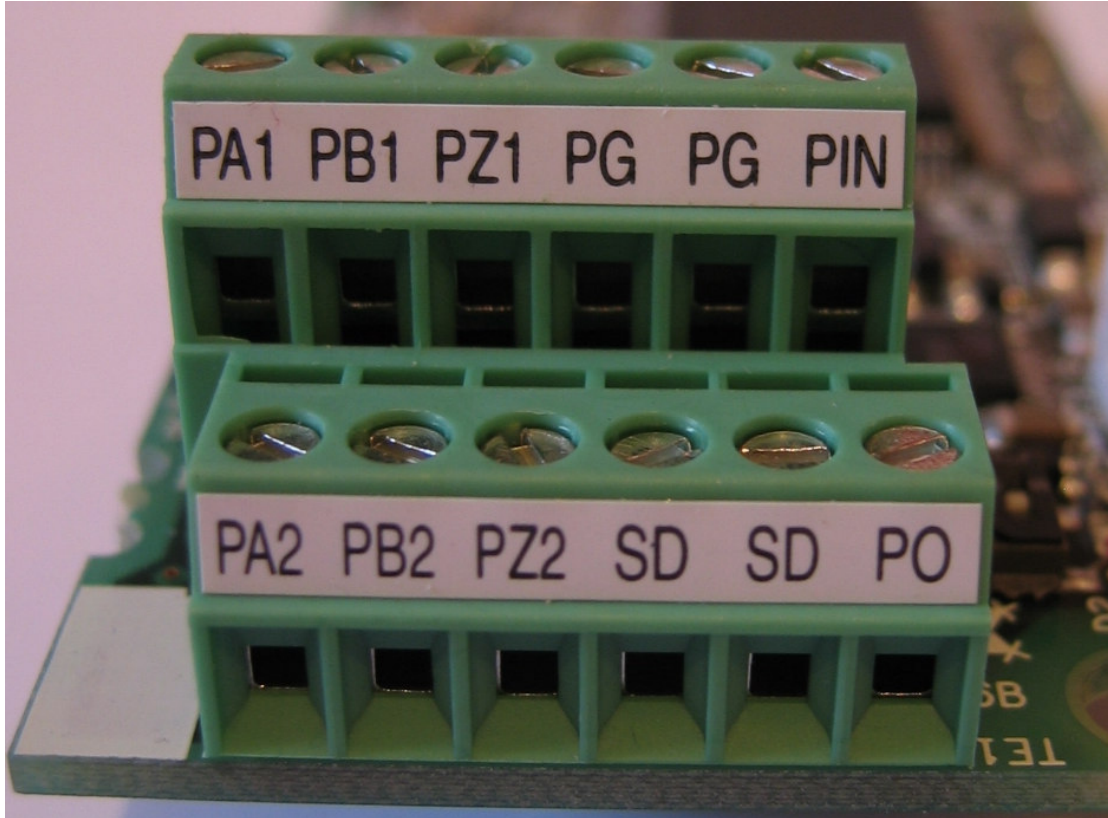
These settings can be selected by DIP switches on the FR-A7AP Encoder option card shown below. Switch 1 selects the Complementary or Differential encoder type. Switch 2 selects a terminating resistor and should be set to ON when using the differential type and OFF when using Complementary. Switch 3 should not be adjusted.



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After mounting the card the encoder should be wired to the option card. The connection terminals are shown below.

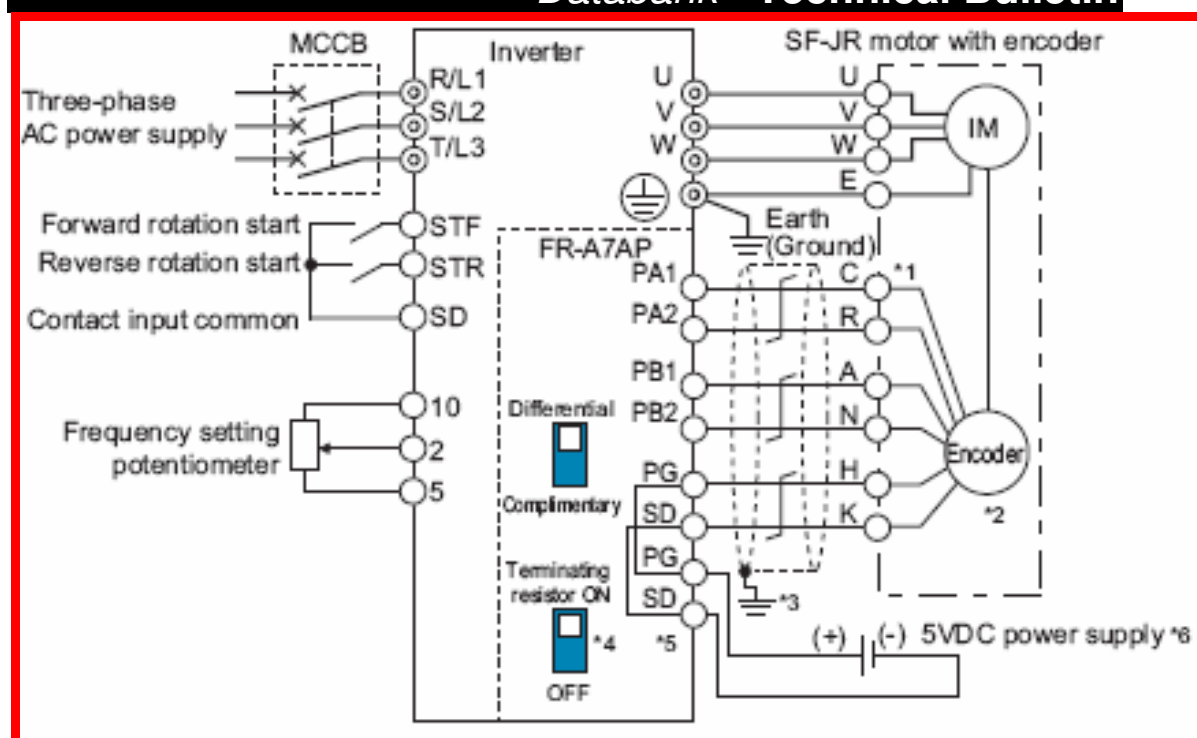


Terminal	Terminal Name	Application Explanation
PA1	Encoder A-Phase signal input	A
PA2	Encoder A-phase inverse signal	A BAR
PB1	Encoder B-phase signal input	B
PB2	Encoder B-Phase inverse signal input	B BAR
PZ1	Encoder Z-phase signal	MARKER
PZ2	Encoder Z-phase inverse signal	MARKER BAR
PG	Power supply positive input	+VE Connect the external power supply 5V, 12V, 15V, 24V and the encoder power cable.*
SD	Power supply ground	0V

*Note there is no on-board power supply, so an external supply has to be connected to PG and SD and then the encoder connected to the same terminals, hence there are 2 sets of PG and SD. Make sure to check whether you have TTL selected and the correct voltage. There is no connection to 'PIN' and 'PO'. The connections should now look similar to the diagram below.

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After setting the hardware up it is necessary to set a few parameters within the drive, so after double checking the connections power up the drive.

The following table shows the parameters which need to be set to allow the correct functionality of the card. The parameters only become valid when the FR-A7AP Encoder option card is fitted.

Parameter Number	Name	Setting Range	Increments	Initial Value
359	Encoder rotation direction	0, 1	1	1
367	Speed feedback time	0 to 400Hz, 9999	0.01Hz	9999
368	Feedback gain	0 to 100	0.1	1
369	Number of encoder pulses	0 to 4096	1	1024
374	Overspeed detection level	0 to 400Hz	0.01Hz	140Hz
376	Encoder signal loss detection enable/disable selection	0, 1	1	0

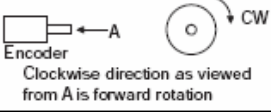
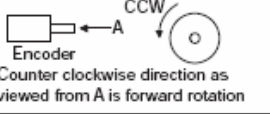
Parameter 359 allows the reversal of the phase order without disconnecting the encoder. If the encoder direction is incorrect with respect to the motor shaft direction then the motor will continue to turn, even after a stop command or will eventually trip on an overload as it cannot determine the direction and thinks the motor is stalled. If this condition arises, e-stop the drive and reverse Parameter 359.

It is recommended that after selecting Vector or Position mode via Parameter 800 that an online autotune be performed, this will automatically check the phase rotation of the encoder.

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The following parameters are made available after inserting the A7AP card and the following settings are recommended:

359 2	Encoder rotation direction	1	0	 <p>Clockwise direction as viewed from A is forward rotation</p>
			1	 <p>Counter clockwise direction as viewed from A is forward rotation</p>

Parameter 367 Should be set to

$$= ((50 \times 120 / \text{NoPoles}) - \text{Rated speed}) / 50 \text{Hz}$$

$$= (\text{Synchronous speed} - \text{Rated speed}) / 50$$

$$= (1500 - 1460) / 50 \quad (\text{where } 1460 \text{ is the speed stamped on the motor name plate.})$$

$$= 0.8 \text{Hz}$$

Parameter 368 should only be adjusted if the response of the application is slow and increased performance is required.

Parameter 369 should contain the number of encoder pulses per revolution before the number is multiplied by 4 in the case of a quadrature encoder.

Parameter 374 should be set slightly above the maximum speed required. This is particularly useful when using torque control. Normally 10% above the maximum speed to allow for over-shoot.

Parameter 376 enables signal loss detection.

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Specifications:

Speed control	Speed control range	1:1500 (both driving/regeneration *1)
	Speed variation ratio	$\pm 0.01\%$ (100% means 3000r/min)
	Speed response	300rad/s Note that the internal response is 600rad/s (with model adaptive speed control)
	Maximum speed	120Hz
Torque control	Torque control range	1:50
	Absolute torque accuracy	$\pm 10\%$ *2
	Repeated torque accuracy	$\pm 5\%$ *2
Function		<ul style="list-style-type: none">Setting of speed feedback rangeSetting of feedback gainSetting of encoder rotation direction

*1 Regeneration unit (option) is necessary for regeneration

*2 With online auto tuning (adaptive magnetic flux observer), dedicated motor, rated load