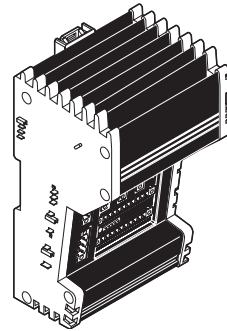


IB IL EC AR 48/10A IB IL EC AR 48/10A-PAC

Inline Servo Amplifier for DC Motors With and Without Brushgears



Data Sheet

03/2005

6976A000



The IB IL EC AR 48/10A and IB IL EC AR 48/10A-PAC only differ in the scope of supply (see "Ordering Data" on page 13). Their function and technical data are identical.

For greater clarity, the order designation IB IL EC AR 48/10A is used throughout this document.

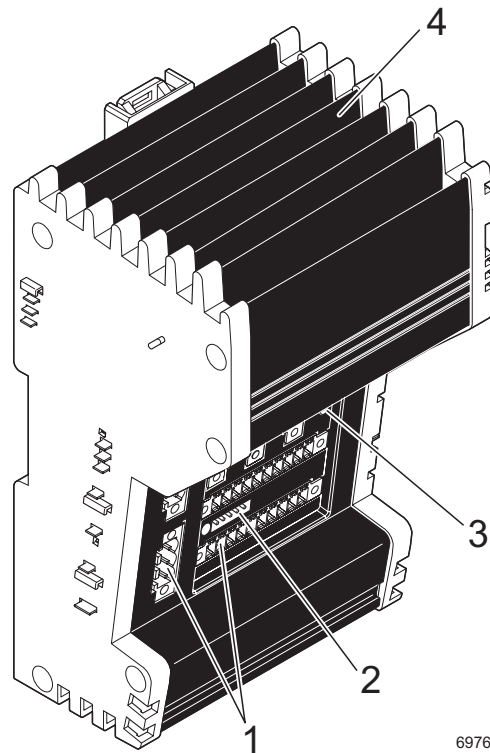


This data sheet is only valid in association with the IB IL SYS PRO UM E user manual or the Inline system manual for your bus system as well as the UM EN IB IL EC AR 48/10A user manual for the Inline servo amplifier.

Product Description

The IB IL EC AR 48/10A Inline servo amplifier is a universal position, speed or torque controller with a power output stage for permanently excited DC motors with brushgears (DC motors) and without brushgears (EC motors) with a power consumption of up to 450 W.

The Inline servo amplifier has a 4 quadrant function, i.e., it supplies power back to the power supply unit when the brake function is used.



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Figure 1 Module view

The Inline server amplifier consists of the following components:

- 1 Connections (COMBICON connectors)
- 2 RS-232 interface
- 3 Diagnostic and status indicators
- 4 Heat sink

Features

- Diagnostic and status indicators
- Use as position, torque or speed controller
- Inline device
- 4-quadrant function
- External brake chopper
- Short-circuit-proof motor output

Applications

The Inline servo amplifier is used under the following conditions:

- Permanently excited DC motors with and without brushgears
- Nominal voltages from 12 V to 48 V
- Power consumption of up to 450 W
- Motor current of up to 10A

Typical Application of the IB IL EC AR 48/10A

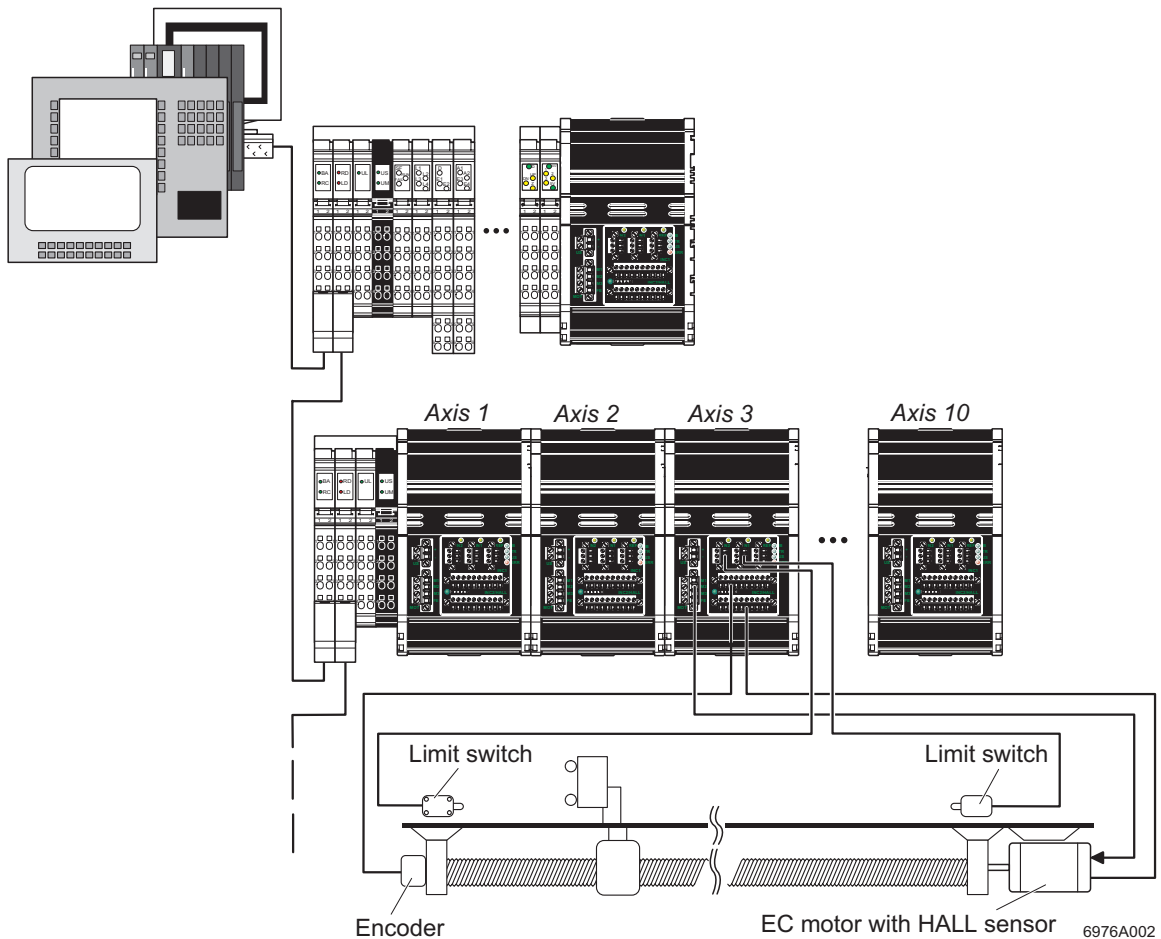
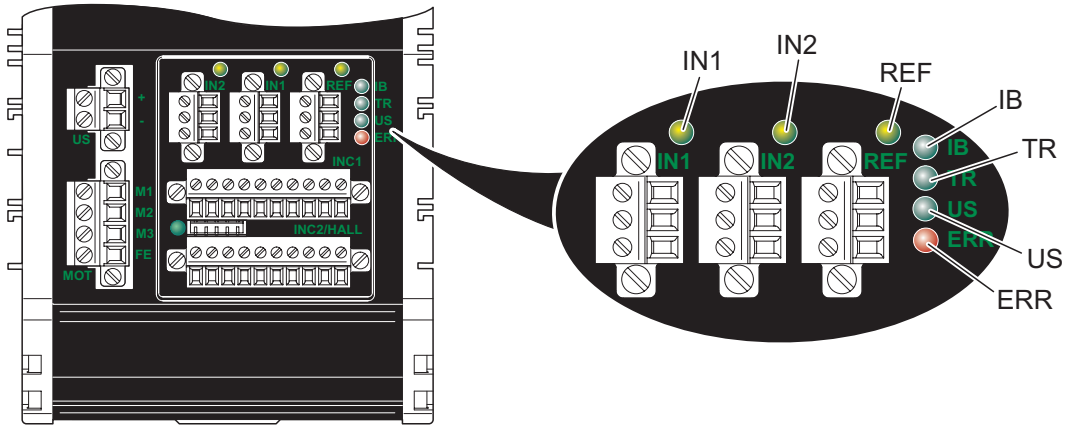


Figure 2 Typical application of the IB IL EC AR 48/10A

Local Diagnostic and Status Indicators



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Figure 3 Local diagnostic and status indicators on the IB IL EC AR 48/10A

Des.	Color	Meaning
IN1	Yellow LED	Limit switch 1
	ON:	Input set
	OFF:	Input not set
IN2	Yellow LED	Limit switch 2
	ON:	Input set
	OFF:	Input not set
REF	Yellow LED	Home position switch
	ON:	Input set
	OFF:	Input not set
IB	Green LED	Diagnostics
	ON:	Bus active
	Flashing:	
	0.5 Hz:	Communications power present, bus not active
	2 Hz:	Communications power present, bus active, I/O error
	4 Hz:	Communications power present, terminal before the flashing module failed, terminal behind the flashing module not part of the configuration frame
	OFF:	Communications power not present, bus not active

Des.	Color	Meaning
TR	Green LED	PCP active
	ON:	PCP messages being transmitted to the Inline servo amplifier
	OFF:	No transmission of PCP messages
US	Green LED	Supply voltage of the power unit
	ON:	Supply voltage for the output stage is more than 75% of the nominal voltage of the power supply
	OFF:	Supply voltage for the output stage is lower than 75% of the nominal voltage of the power supply
ERR	Red LED	Error
	ON:	An error has occurred (corresponds to bit 3 in the status word). The cause of the error can be read in the "ErrorCode" parameter (index 603F _{hex}).
	OFF:	No error

Terminal Point Assignment

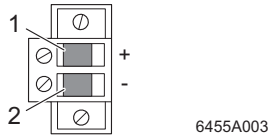


Figure 4 Terminal point assignment for power supply connection (U_S)

Power Supply Connection (US)

Terminal Point	Assignment
1	$U_S +$
2	$U_S -$

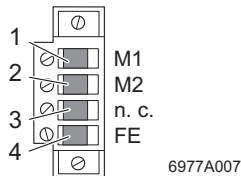


Figure 5 Terminal point assignment for DC motor connection (MOT)

DC Motor Connection (MOT)

Terminal Point	Assignment
1	M1 (Motor +)
2	M2 (Motor -)
3	Not used
4	Functional earth ground (FE)

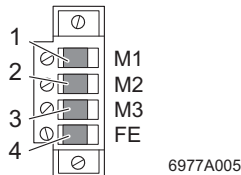


Figure 6 Terminal point assignment for EC motor connection (MOT)

EC Motor Connection (MOT)

Terminal Point	Assignment
1	M1
2	M2
3	M3
4	Functional earth ground (FE)

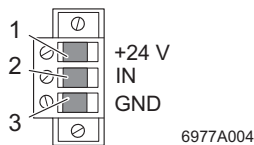


Figure 7 Terminal point assignment for limit switch and home position switch connections (IN2, IN1, REF)

Limit Switch and Home Position Switch Connections (IN2, IN1, REF)

Terminal Point	Assignment
1	+24 V
2	IN
3	GND

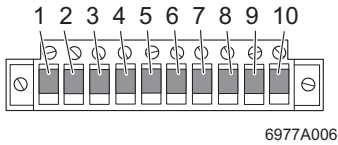


Figure 8 Terminal point assignment for incremental encoder connection (INC)

Incremental Encoder Connection (INC1)

Terminal Point	Assignment
1	A
2	\bar{A}
3	B
4	\bar{B}
5	Z
6	\bar{Z}
7	GND
8	+5 V
9	+24 V
10	Functional earth ground (FE)

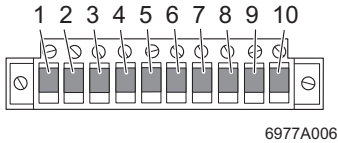


Figure 9 Terminal point assignment for Hall sensor connection (INC2/HALL)

Hall Sensor Connection (INC2/HALL)

Terminal Point	Assignment
1	1+
2	1-
3	2+
4	2-
5	3+
6	3-
7	GND
8	+5 V
9	+24 V
10	Functional earth ground (FE)



The INC2/HALL connection can also be used to connect an incremental encoder. In this case, connect the incremental encoder using the terminal point assignment of the INC1 connection.

Function

The Inline servo amplifier is designed as an Inline terminal. It can be easily operated in the most popular control systems and can be used to create a distributed positioning control system simply by mounting Inline positioning terminals side by side (e.g., positioning CPUs, position detection terminals, and other digital and analog output terminals).

Optical status and diagnostic indicators enable quick local error diagnostics.

The following operating modes are possible:

- Point-to-point positioning with position controller (position feedback modes using an incremental encoder or Hall sensors)
- Speed control (speed feedback using an incremental encoder, Hall sensors or the motor voltage)
- Torque control (current control)
- Homing

The IB IL EC AR 48/10A Inline servo amplifier carries out positioning with position, speed or torque control of the connected motor to the value specified as the setpoint in the form of process data.

The Inline servo amplifier can be used to create simple controlled drives using cost-effective DC motors with or without brushgears. There is also flexibility when choosing feedback for the individual control functions. For example: In the "speed control" operating mode for simple applications, there is no need for a rotary encoder system.

On the one hand, this method relies on a particular aspect of the behavior of DC motors: their speed changes in proportion to the supply voltage. In this way the speed can be indirectly controlled via the motor voltage. In addition, the Inline servo amplifier uses an IxR controller, which compensates for speed variations caused by the changing load.

Hall sensors can be used for speed and position feedback when using EC motors. This also eliminates the need for a rotary encoding system.

Operation, setting the operating mode, and parameterization should be compatible with the "DRIVECOM profile 22" protocol.

The IB IL EC AR 48/10A provides protection against:

- Overcurrent
- Surge and undervoltage
- Overtemperature
- Short circuit between motor cables
- Short circuit against the voltage supply

The IB IL EC AR 48/10A Inline servo amplifier is based on digital controllers. Its task is to provide current and voltage values, which can be used to directly operate DC motors.

The Inline servo amplifier needs to be supplied externally with 12 V up to 48 V and 0 A up to 10 A because the Inline jumpering cannot supply these high currents.

The level of the current and voltage values depends on the various functions, which the Inline servo amplifier carries out in the individual operating modes.

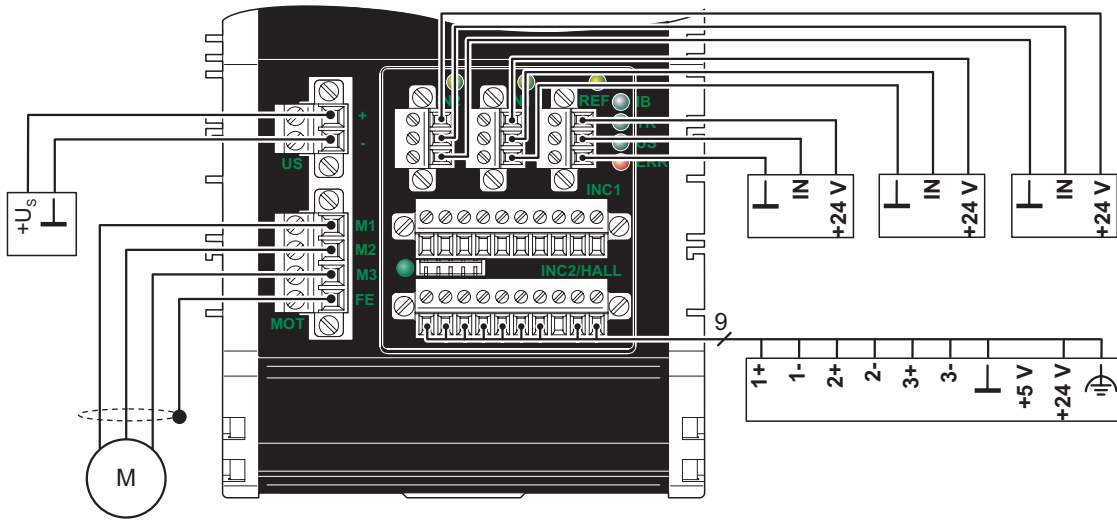


For additional information, please refer to the UM EN IB IL EC AR 48/10A user manual (Order No. 26 99 39 6).

RS-232 Interface

The RS-232 interface can be used to connect a PC with startup and diagnostic software installed. This interface also enables access to all drive parameters and functions (see user manual).

Connection Example



6976A004

Figure 10 Connection example of EC motor with Hall sensor

Programming Data/Configuration Data

INTERBUS

ID code	C3 _{hex} (195 _{dec})
Length code	03 _{hex} (03 _{dec})
Process data channel	48 bits
Input address area	3 words
Output address area	3 words
Parameter channel (PCP)	1 word
Register length (bus)	4 words

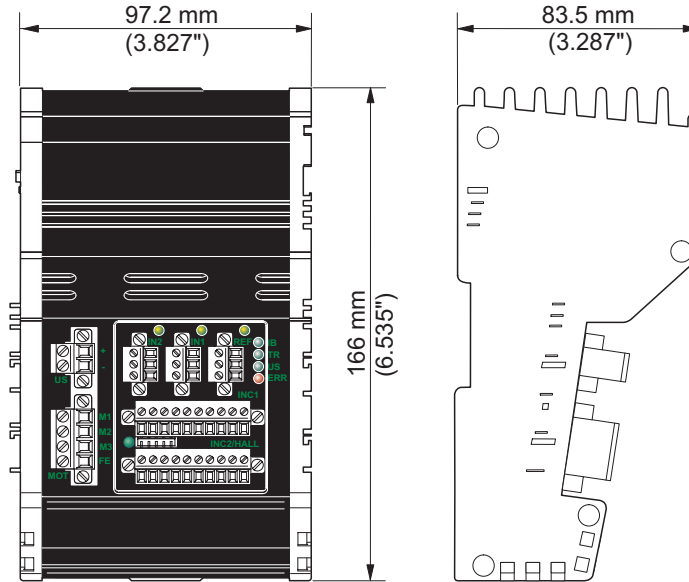
Other Bus Systems




For the configuration data of other bus systems, please refer to the corresponding electronic device data sheet (GSD, EDS) at www.download.phoenixcontact.com.

Technical Data

Housing Dimensions



6976A003

General Data	
Order Designation	(Order No.)
IB IL EC AR 48/10A	(28 19 25 7)
IB IL EC AR 48/10A-PAC	(28 19 58 7)
Housing dimensions (width x height x depth)	97.2 mm x 166 mm x 83.5 mm
Housing material	PA 6.6; black, anodized aluminum
Heat-sink material	Aluminum
Weight	
without connectors	800 g
with connectors	880 g
Permissible temperature (operation)	-25°C to +55°C
Permissible temperature (storage/transport)	-25°C to +85°C
Permissible humidity (operation)	75% permanent, 85% occasionally
Permissible humidity (storage/transport with unused interfaces [standard packaging])	75% permanent, 85% occasionally
	For a short period, slight condensation may appear on the outside of the housing if, for example, the module is brought into a closed room from a vehicle.

General Data (Continued)	
Permissible air pressure (operation)	80 kPa to 106 kPa (up to 2,000 m above sea level)
Permissible air pressure (storage/transport)	70 kPa to 106 kPa (up to 3,000 m above sea level)
Degree of protection	IP20 according to DIN 40050
Class of protection	Class 3 according to VDE 0106, IEC 60536

Mechanical Requirements	
Vibration test sinusoidal vibrations according to IEC 60068-2-6; EN 60068-2-6	2g load, 2 hours in each space direction
Shock test according to IEC 60068-2-27, EN 60068-2-27	25g for 1 ms, three shocks in each space direction
Free fall according to IEC 60068-2-32	1 m

Power Supply	
Status indication	US LED
Connection method	2-pos. COMBICON connector
Supply voltage U_S	12 V DC to 48 V DC $\pm 15\%$
Supply current	0 A to 10 A
Surge voltage shutdown	$U_S > 60$ V DC


Outputs	
Number	1
Connection	1 permanently excited DC motor with or without brushgears
Connection method	4-pos. COMBICON connector with shield connection clamp
Output voltage	\pm supply voltage $U_{S, \text{maximum}}$ Average up to 95% of U_S
Motor cable	2-wire, shielded (DC motor) 3-wire, shielded (EC motor)
Continuous current	10 A, maximum
Starting current	10 A, maximum
Motor current limiting	0 A to 10 A (can be set via bus)
Maximum motor voltage (feedback)	± 65 V DC
Function	4 quadrant servo controller
Braking	Energy fed back to the power supply unit (brake chopper may be required)
Minimum motor inductance	200 μ H at $U_S = 48$ V DC 100 μ H at $U_S = 24$ V DC

Encoder Types	
Symmetrical Incremental Encoders	
Encoder supply	5 V DC or 24 V DC
Signal connection method	A and \bar{A} , B and \bar{B} , Z and \bar{Z}
Signal voltage level	1 V _{PP} to 6 V _{PP}
Common mode range: signal – ground	
– At 1 V _{PP} voltage level	±2 V
– At 6 V _{PP} voltage level	±4 V
Input frequency	1 MHz, maximum
Cable length (for shielded cable)	<30 m (to ensure conformance with EMC directive 89/336/EEC)
Asymmetrical Incremental Encoders	
Encoder supply	5 V DC or 24 V DC
Signal connection method	A, B, Z
Signal voltage level	Low 0 V to 2 V, high 3.5 V to 27 V
Input frequency	
– At 4 V voltage level	500 kHz, maximum
– At 20 V voltage level	100 kHz, maximum
Cable length (for shielded cable)	< 30 m (to ensure conformance with EMC directive 89/336/EEC)
Encoder Supply	
5 V encoder supply	
Voltage range	4.75 V to 5.25 V
Short-circuit protection	Electronic and thermal
Current carrying capacity	100 mA, maximum
24 V encoder supply	
Voltage range	19.2 V to 30 V
Short-circuit protection	Electronic and thermal
Current carrying capacity	100 mA, maximum
Cycle Time of Internal Digital Controllers	
Position controller	1 ms
Speed controller	500 µs
Torque / current controller	250 µs
Electrical Isolation	
Logic U _L / I/O / motor	500 V AC test voltage

Pulse Wide Modulation (PWM) (In Relation to the Motor Voltage)	
Clock frequency	10 kHz to 50 kHz

Interfaces	
Local bus	Inline potential distributor
Communications power U_L	7,5 V DC (via potential distributor)
Current consumption at U_L	30 mA, typical; 120 mA, maximum
Main voltage U_M	24 V DC (via potential distributor)
Current consumption at U_M	100 mA, typical; 150 mA, maximum
RS-232	Connection to startup and diagnostic software

Approvals	
CE	Yes
UL	Applied for

Conformance With EMC Directive 89/336/EEC	
	Conformance is only ensured if the shielded motor cable is connected to the FE terminal and the module is connected to functional earth ground via the DIN rail.

Noise Immunity Test According to EN 61000-6-2		
Electrostatic discharge (ESD)	EN 61000-4-2 IEC 61000-4-2	Criterion B 4 kV contact discharge 6 kV air discharge
Fast transients (burst)	EN 61000-4-4 IEC 61000-4-4	Criterion A Supply lines: 2 kV Signal/data lines: 2 kV
Conducted interference	EN 61000-4-6 IEC 61000-4-6	Criterion A, test voltage 10 V

Noise Emission Test According to EN 61000-6-4		
Noise emission of housing	EN 55011	Class A

Ordering Data

Description	Order Designation	Order No.
Inline servo amplifier for DC motors with and without brushgears; incl. COMBICON connectors and shield connection clamps	IB IL EC AR 48/10A-PAC	28 19 58 7
Inline servo amplifier for DC motors with and without brushgears	IB IL EC AR 48/10A	28 19 25 7



The following connector set is needed for the complete fitting of the IB IL EC AR 48/10A:

Connector set consisting of seven COMBICON connectors and three shield connection clamps	IB IL ECAR-PLSET	28 19 56 1
EC AR SW TOOL startup and diagnostic software, incl. connection cable for RS-232 interface	EC AR CAB SW TOOL	28 19 54 5
Connecting cable for the RS-232 interface, for the connection of the EC AR SW TOOL startup and diagnostic software	EC AR DIAG CAB	28 19 73 6
"Inline Servo Amplifier for DC Motors With and Without Brushgears" user manual	UM EN IB IL EC AR 48/10A	26 99 39 6
"Configuring and Installing the INTERBUS Inline Product Range" user manual	IB IL SYS PRO UM E	27 43 04 8



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A conversion table is available on the Internet at www.download.phoenixcontact.com/general/7000_en_00.pdf.

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