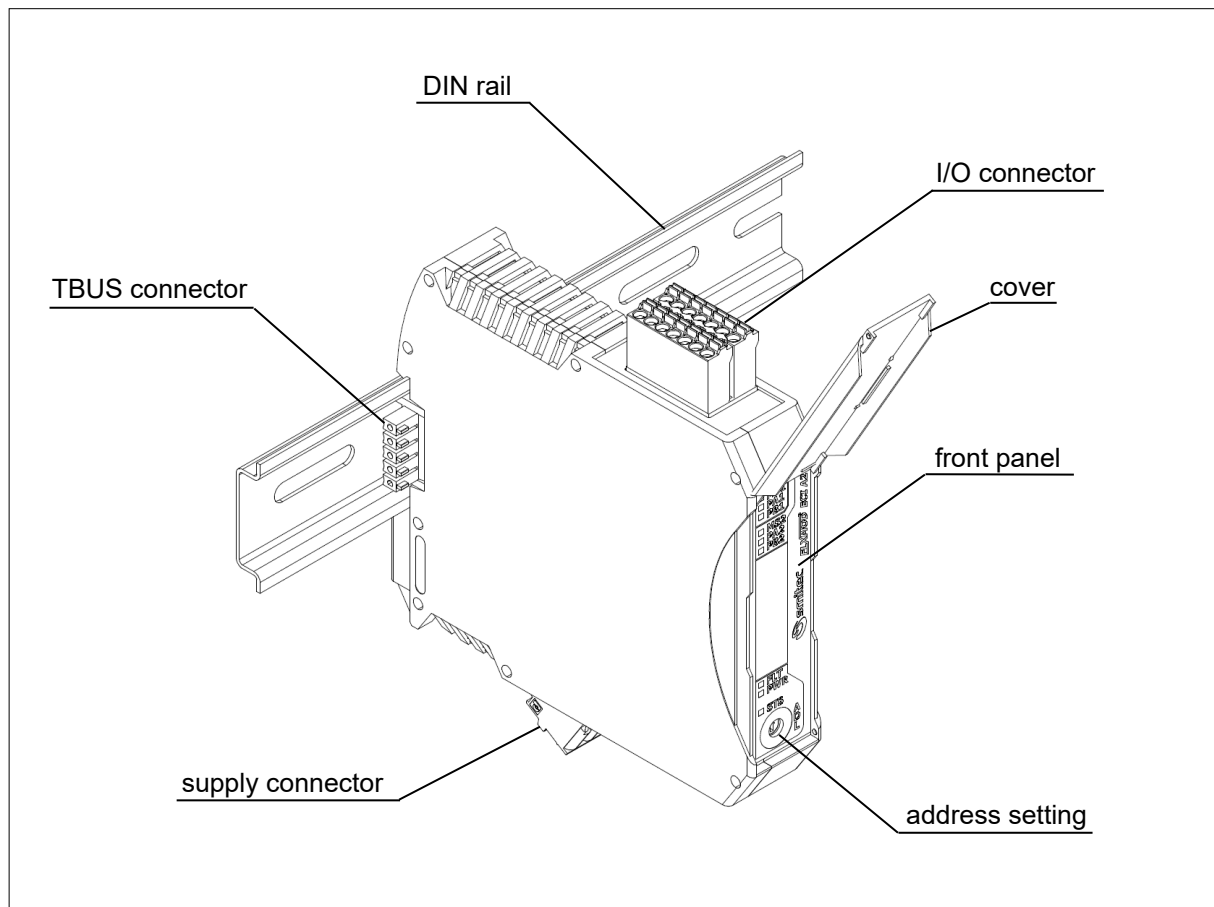# ECI A2

Dual incremental encoder reader / quad counter

Datasheet

Description

Dual incremental encoder reader / quad digital counter. Main characteristics:

- Two inputs for 24V HTL incremental encoders
- Quad channel digital counter
- Type 3 digital inputs
- Status and diagnostics LEDs

Ordering informations

Products	SMITEC part number
Module for encoder acquisition, complete with accessories (power connector, inputs connector and TBUS connector)	KZ010361

Accessories	SMITEC part number
Power supply connector (Phoenix Contact p/n 1910377)	KF100009
I/O connector (Phoenix Contact p/n 1738856)	KF101049
TBUS connector (Phoenix Contact p/n 2713722)	KF101034
Power supply fuse (Littelfuse p/n 0452 002)	KD201035

Documentation	SMITEC part number
Installing instructions	DK400042
Datasheet for ECI A2	DK400129
FLXIO and FLXMOD system integration manual	DK400076

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Technical data

General data	
Housing dimensions (width x height x depth)	22.5 mm x 99.0 mm x 114.5 mm
Weight	107 g (without connectors), 126 g (with connectors)
Connection method for connectors	Spring cage terminals
Conductor cross-section (power connector)	0.2 to 2.5 mm^2 (24 – 12 AWG)
Conductor cross-section (inputs connector)	0.2 to 1.5 mm^2 (24 – 16 AWG)
Functional earth connection	To the DIN rail by spring contact
Mode state visual indicators	Fault (FLT), status (STS), power (PWR), and six application dependent LED lamps

Environment data	
Permissible operating temperature	+5° to +55°C
Permissible storage and transport temperature	-25° to +85°C
Permissible humidity	10% to 95%, not condensing
Permissible air pressure (operation)	80 to 106 kPa (up to 2000 m above sea level)
Permissible air pressure (storage and transport)	70 to 106 kPa (up to 3000 m above sea level)
Degree of protection (CE)	IP20 according to IEC 60529
Degree of protection (UL)	Open Type
Overvoltage category	II
Pollution degree	2
Means of protection (UL)	Class III SELV power supply

Power supply	
Main power supply V_M	24 V DC ⎓ (-15% ÷ + 20% according to IEC 61131-2)
Maximum allowed ripple on V_M	5% of supply voltage (according to IEC 61131-2)
Current consumption from main supply	1.5 A max., depending on external loads absorption
Supply overvoltage protection on V_M	Unidirectional Zener clamp ($V_z > 30$ V)
Supply reverse polarity protection on V_M	Input antiparallel diode
Supply fuse	2 A, not replaceable by the user
Local bus power supply	5 V DC (from local bus)
Power presence visual indicators	Green LED lamp, lighted if main supply is present (PWR)
Power load from local bus at 5V DC	Approx. 0,3W
Power load from local bus at 24V DC	None
Total power dissipation	Approx. 0,3W

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Encoder inputs

Number of inputs	2
Encoder type	Incremental quadrature encoder with single-ended 24V HTL outputs
Max. input frequency	50 kHz
Counts register width	32 bit

Counter inputs

Number of inputs	4
Inputs type	24V digital inputs, type 3 compatible according to IEC 61131-2
Max. input frequency	50 kHz
Counts register width	16 bit

Interface

Local bus	Proprietary FLXIO™
Module address setting	By rotary switch on front panel
Bus connections	By TBUS connectors on DIN rail
Interface circuitry protections	ESD protections
Level of ESD protection	±8 kV (IEC 61000-4-2, contact discharge)

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Connections

The module has two connectors: a power connector and an I/O connector. They allow easy "plug and play" of the module, and also a fast replacement of a faulty unit.

⚠️ **Warning**: Use a cable with cross-section suited to the current involved. A wire smaller than necessary could cause risk of fire and unwanted voltage drops.

⚠️ **Warning**: To ensure conformance with EMC directive 2014/30/UE, the length of the cables must not exceed 30 m!

⚠️ **Warning**: If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired

Power connector

The power connector is located on the bottom wall of the module. For the pinout, refer to the illustration at right.

Its function is to provide the supply for the I/O circuitry, whilst the CPU of the module is fed by the TBUS connector on the back of the unit.

Refer to the FLXIO and FLXMOD System Integration Manual for power connections topology.
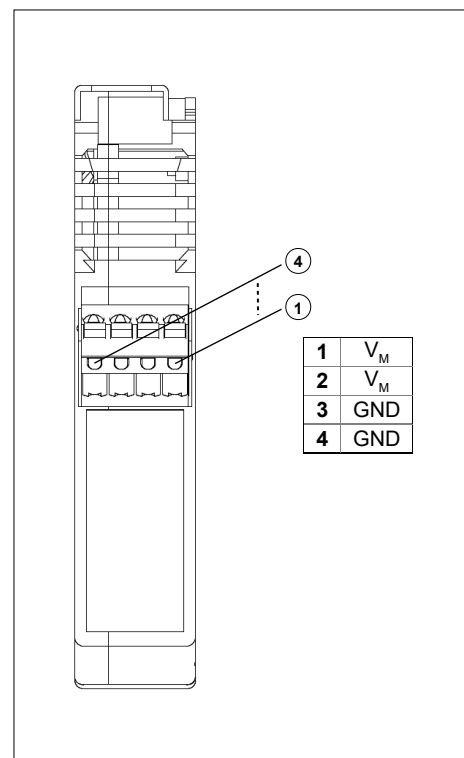
1	V_M
2	V_M
3	GND
4	GND

For connector ratings and the applicable wiring refer to the following table

Connector type: Phoenix Contact FKC 2,5/ 4-ST (1910377) Order code: KF100009			
Technical data		**Conductor cross section**	
Nominal voltage (CE)	250V	Solid (CE)	0,2÷2,5mm²
Nominal voltage (UL)	300V	Solid (UL)	26÷12AWG - 75°C
Nominal current (CE)	12A	Flexible (CE)	0,2÷2,5mm²
Nominal current (UL)	10A	Flexible (UL)	26÷12AWG - 75°C
		Flexible, with ferrule without plastic sleeve	0,25÷2,5mm²
Stripping length	10mm	Flexible, with ferrule with plastic sleeve	0,25÷2,5mm²
Screwdriver to open contacts	0,6 x 3,5mm	2 flexible conductors with same cross section, stranded, TWIN ferrules with plastic sleeve	0,5÷1,5mm²

Warning: Pay attention to NOT supply the module with reverse polarity. This is to not blow internal fuse and/or damage the connected devices and/or burn the module itself.

Inputs connector

Located on the upper side of the module, this connector (see illustration below) permits the wiring of encoders or sensors.
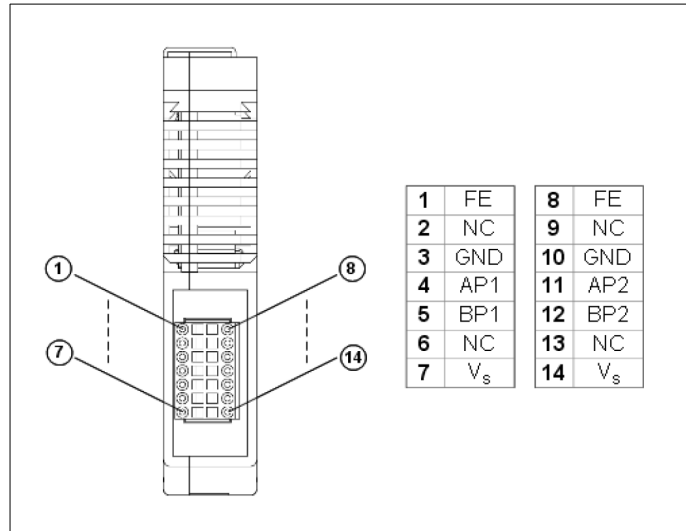
For connector ratings and the applicable wiring refer to the following table

Connector type: Phoenix Contact FMCD 1,5/7-ST-3,5 (1738856) Order code: KF101049			
Technical data		**Conductor cross section**	
Nominal voltage (CE)	160V	Solid (CE)	0,2÷1,5mm²
Nominal voltage (UL)	150V	Solid (UL)	24÷16AWG - 75°C
Nominal current (CE)	8A	Flexible (CE)	0,2÷1,5mm²
Nominal current (UL)	8A	Flexible (UL)	24÷16AWG - 75°C
Stripping length	10mm	Flexible, with ferrule without plastic sleeve	0,25÷1,5mm²
Screwdriver to open contacts	0,4 x 2,5mm	Flexible, with ferrule with plastic sleeve	0,25÷0,75mm²

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The following paragraphs describe how to connect encoders and sensor to the module.

Encoders

This module can read incremental encoders having 24V HTL single-ended outputs; these devices, very common in industrial environment, exhibit two digital outputs usually named A and B. When the shaft is revolving, two square waves are generated on channel A and B, with signals in quadrature.

The encoder is directly fed by the module; the recommended wiring is shown below.
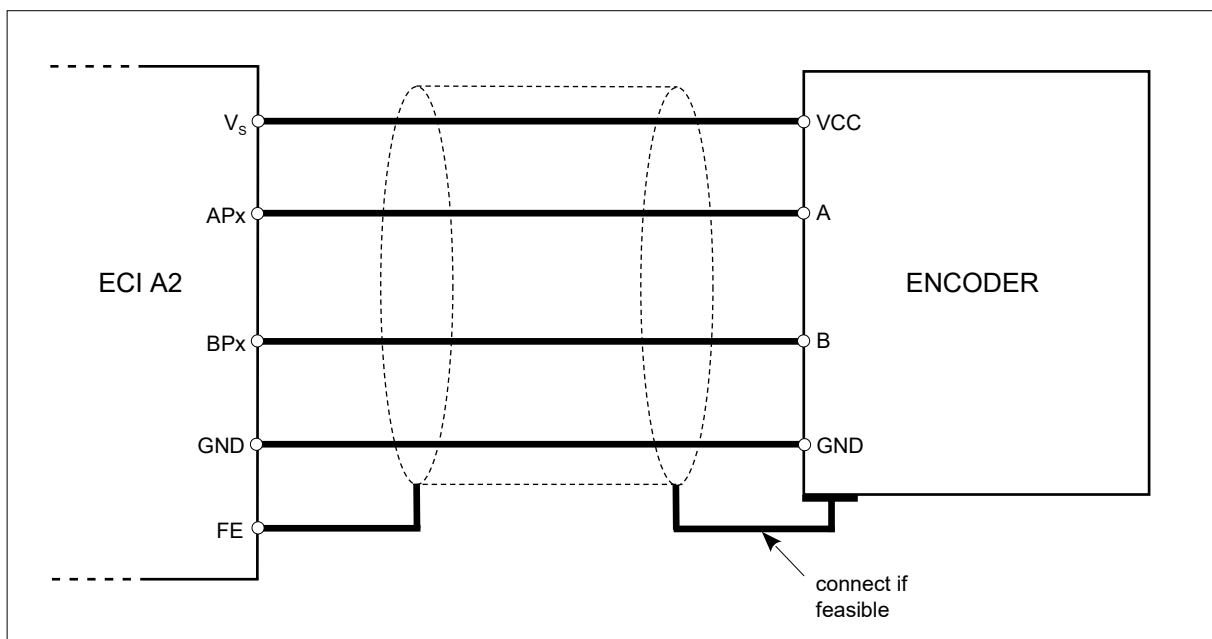
Due to high levels of noise usually found in harsh industrial environments, the use of shielded cable is highly recommended; the sheath should be tied to the FE pin available on the connector. Leaving the shield unconnected greatly impairs the shielding performances of the cable, leading to a worsening of the signal to noise ratio.
When the wiring has to be realized in more than one section, check the electrical continuity of the shield and minimize the length of the unshielded wires.
If the use of shielded cable is not feasible for cost reasons, try to route the wiring far enough from noise sources, such as switching power supplies, inverters, relays, etc..

Counter

The module is able to act as a counter for up to four 24V digital inputs; the input stages are designed to match the specifications for type 3 inputs, as defined in IEC 61131-2; this assures compatibility with standard industrial sensors.

When the unit is operating as a counter, the inputs are named as follows:

INPUT	SIGNAL NAME	PIN NUMBER
1	AP1	4
2	BP1	5
3	AP2	11
4	BP2	12

Inputs are divided in two banks: bank 1 is formed by inputs #1 and #2, and bank 2 is formed by inputs #3 and #4; enabling a bank as a counter obviously forbids its use as an encoder reader.

The wiring should be done adopting common sense precautions as stated before (see the preceding paragraph), due to the relatively high bandwidth of the signals involved; for the same reasons, the use of shielded cable is highly recommended.

See the following illustration for an example of wiring.
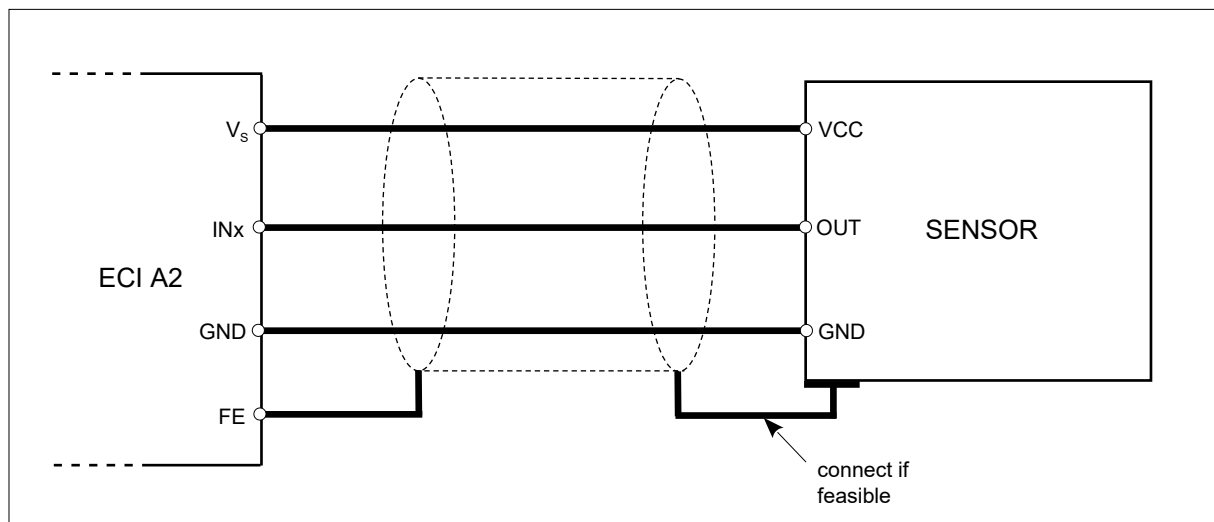
Module addressing

Before operation you must set the address of the module by the rotary switch reachable from the front panel; the operation is easily done opening the transparent plastic cover and turning the rotor with a small bladed screwdriver.

The address determination is described in the FLXIO and FLXMOD System Integration Manual.

Diagnostic and status indicators

Each module is provided with a series of LED lamps on the front panel (see illustration); they indicate the status of the unit, the configuration of the inputs (encoder or counter) and diagnostic warnings or errors. For the sake of clarity, different lamp colours are employed.

The green power (**PWR**) LED is lighted if the 24 V supply (V_M) is present and the internal fuse is not blown.

Self monitoring of supply voltage is also implemented to deliver a best self-diagnosis. The module switches in diagnostic error when $V_M > 30Vdc$ and when $V_M <$ of the value set up by the master module (low voltage check is disabled by default); this status is displayed by **STS** LED.

The **MS1** and **MS2** LEDs indicate that the channels #1 and #2 are set as counters (LED off) or as encoder readers (LED on). Please notice that each channel is configured separately and can work in a different manner.

In counter mode, each **Pxy** LED is lighted for a defined amount of time when a pulse is detected; the correspondence between LEDs and inputs is as follows:

INPUT	SIGNAL NAME	LED
1	AP1	PA1
2	BP1	PB1
3	AP2	PA2
4	BP2	PB2

In encoder mode, the **PAx** and **PBx** LEDs are lighted for a defined amount of time when a pulse is detected in forward (**PAx**) or backward (**PBx**) direction; the two lamps are never allowed to turn on simultaneously.

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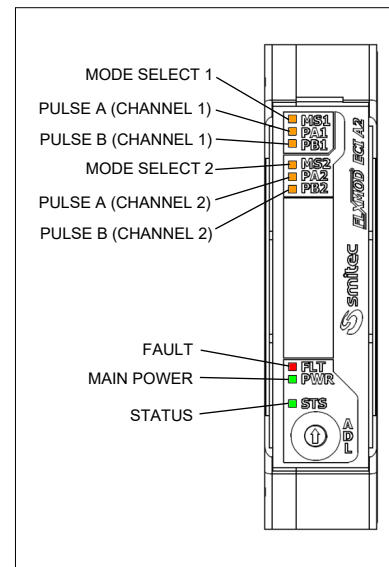
The status of the unit is indicated by both status (**STS**) and fault (**FLT**) LEDs; their behaviour is described in the following logic state chart. The exact cause of a diagnostic error can be read out by master module and the application software.

Power off

Module off
FLT=off - STS=off

Protocol HW faulty

Protocol HW functional

Module HW fault
FLT=on - STS=off

Waiting for master recognition
FLT=off - STS=on

Recognized by master

Update successed

Waiting for configuration or update by master
FLT=off - STS=off

Protocol FW needs update

Configuration by master

Updating by master
FLT=on - STS=blink 1Hz

Configurating by master
FLT=off - STS=blink 1Hz

Update failed

Configuration failed

Protocol error
FLT=off - STS=blink 2Hz

Configuration successed and application FW is updated

Configuration successed but application FW needs update

Updating by master
FLT=on - STS=blink 1Hz

Update successed

Update failed

Protocol error
FLT=off - STS=blink 2Hz

Ready to work
FLT=off - STS=on

Communication error

Diagnostic enabled by master

Regular operation
FLT=off - STS=on

Module diagnostic error
FLT=off - STS=flash 1Hz

Vm > 30Vdc (input overvoltage) or
Vm < xxVdc (programmable input undervoltage)