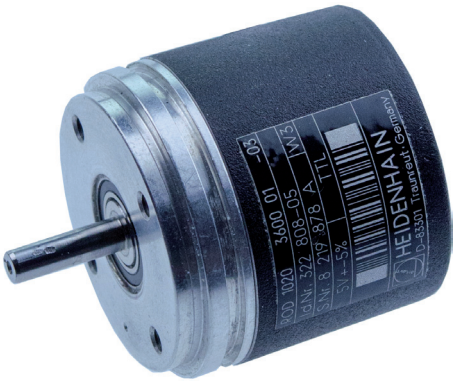
Irinos IR-INC

Digitale measurement box for incremental encoders 1Vss & TTL/RS422



- Interface for 4 incremental encoders with 1Vss- or TTL/RS422-Interface
- 200x interpolation with 1Vss-Interface
- Integrated error detecion
- Synchronous data acquisition up to 10.000 measurement values / s (all channels simultaneously)
- Expandable with other Irinos-Boxes via ILink-Interface
- Available with integrated ethernet interface for direct connection to PC

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Expansion

Multiple Irinos-Boxes can be connected via the ILink-Interface. It does not matter, whether they are of the same type IR-INC or for other measurement inputs (e.g. for inductive probes).

The ILink-Interface containes three different functionalities:

• Data-exchange between Irinos-Boxes

• Synchronisation of multiple Irinos-Boxes

• Power-supply for the Irinos-Boxes

32 Irinos-Boxes at a maximum can be connected in line topology to build up a whole measurement system.

The amount of Irinos-Boxes has no influence on reading the measurement values from the PC, except that more channels are available. All measurement values are transferred via a single ethernet connection from the Irinos-System to the PC. This allows an easy integration into Windows based measurement software (DLL available).

Synchronous HighSpeed-Measurement

Many measurement applications require the realtime acquisition of various measurement channels, allowing further calculations (e.g. concentricity measurement).

With the Irinos-Box IR-INC, it is possible to get 10.000 measurement values / s. This value is independent of the number of channels. It is for example possible to have a realtime measurement with 32 channels acquiring 32 * 10.000 values/s = 320.000 measurement values / s in total.

All measurement values are acquired synchronously and buffered in the internal memory of the Irinos-Box before they are transferred to the PC.

Galvanic Isolation

Each Irinos-Box has galvanic isolation.

The galvanic isolation from the power supply ensures that external noise will not influence the measurement electronics.

Additionally the ILink-Interface has galvanic isolation, which allows for a robust communication between multiple Irinos-Boxes. Further it avoids ground loops or similar negative effects.

General application notes

Absolute measurement / Referencing

Incremental encoders do not provide an absolute position. In order to get absolute measurement values after startup and after signal errors, it is necessary to determine a reference position. The Irinos-Box IR-INC provides two possibilities for referencing:

- Referencing via index pulse
  The position counter will be set to 0, if the index pulse is crossed.
- Referencing by software
  It is possible to set the counter by software. It is possible to set the value 0 as well as any other value.

Please note that the Irinos-Box IR-INC provides the technical possibility for referencing. The implementation of the referencing procedure depends on the measurement application. This should be taken into account during the planning phase of the measurement system.

Input frequency

The input frequency of the incremental signals (TTL / RS422) or signal periods (1 Vss) is limited. Further details can be found in the specifications section.

In most applications the theoretical input frequency is far below the threshold value. However, in reality it may exceeded by jerky movements. Examples are:

- “Cutting loose” at the beginning of a movement (crossing static friction)
- Mechanical stroke
- Jerky movement due to mechanical tensions

It is recommented to take this into account during the construction phase. If a jerky movement cannot be avoided, this must be considered in the measurement process (e.g. by referencing while moving).

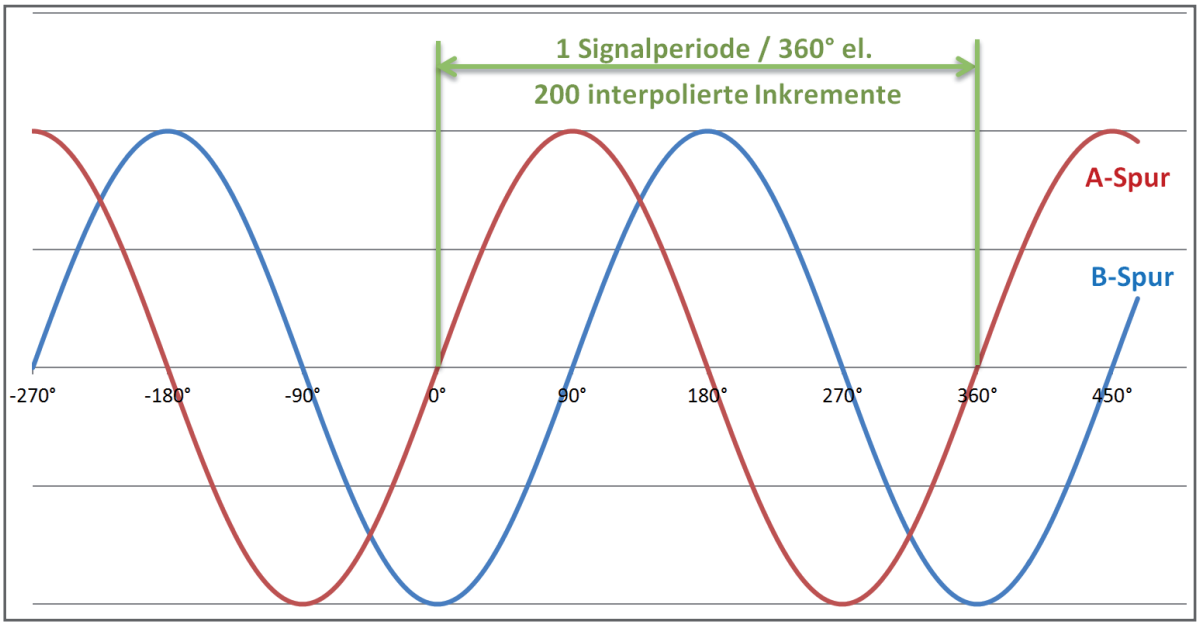
Application notes for 1 Vss

Interpolation

An incremental encoder with 1 Vss - Interface provides two sine waves, each as a differential output signal. The phase shift between these is 90°. One signal period (i.e. 360°) relates to one incremental division of the encoder. The Irinos-Box IR-INC separates a division into 200 incremental steps via analogue interpolation. Thereby the usable resolution of the encoder increases by 200.

Example: An incremental encoder has a resolution of 1.800 divisions/revolution. Via the interpolation, this results in

1.800 divisions/revolution * 200 increments/division = 360.000 increments/revolution.



The accuracy and reliability of the interpolations depends on the quality of the differential sine signals. An ideal signal has the following characteristics:

- The differential voltage is 1 Vss.
- The signal offset is 0, i.e. at 0° the signal always provides the same value.
- The phase shift between both signe signals is exactly 90°.

In reality, such a signal is rarely available. Because of this, the Irinos-Box IR-INC has an integrated gain- and offset control (patent applies). It corrects these deviations within the allowed value range (see limitting values in the specification section).

Below or above the threshold values, a reliable interpolation is not possible. An integrated signal examination detects such errors. The error status can be read by software in parallel to the measurement. In case of an error, the counter channel should be reset. The referencing procedure should be redone.

Signal quality

The signal quality depends on various factors. Important ones are:

- Actual speed of the incremental encoder
  The higher the actual speed of the incremental encoder, the lower the differential voltage. Many incremental encoders have a good signal quality while standing still or during slow movement. However, at higher speed, the signal quality decreases rapidly.
- Mechanical stability of the incremental encoder and the mechanics
- Adjustment of incremental encoder
  Some incremental encoders (e.g. glass scales) require adjustment by the user. An inappropriate adjustment may lead to unsufficient signal quality, especially at higher speed.
- Cable length and cable quality
  The longer the cable, the worse the signal quality.
  The more connectors are used, the worse the signal quality.
  An cable with unsufficient shielding or a cable with a wrong impedance may lead to unsufficient signal quality.

Very often a combination of these factors leads to measurement problems.

Recommendations

- Consider the maximum frequency of the incremental encoder. It can be found in its datasheet. Usually it also depends on cable length.
- Check the signal quality during system setup. The Irinos-Box IR-INC provides a signal live view. The signal level should have enough room to the limitting values.
- Avoid jerky movements.
- Integrate the possibility to reset the encoder and to restart the referencing procedure into your measurement application.
- Use short cable with appropriate shielding (this also applies to connectors). Avoid cable extensions.
  The Irinos concept allows placement of the Irinos-Box next to the encoder.
- Keep a big distance between the incremental encoder cabling and possible sources of noise (e.g. motor cables or frequency changers).

Specifications

Common specification of the measurement inputs	
Applicable probes	Inkremental probes, linear or rotray encoders providing 1Vss- or TTL/RS422 - signals
Number of channels	4 encoders, directly connected via 4x DSUB 15-pin
Synchronisation	Simultaneous acquisition of all measurement channels (max jitter 3µs), also applicable if multiple Irinos-Boxes are used
Linearity	no internal linearity error; linearity only depends on encoder
Stability	± 1 increment
Measurement speed	10.000 measurement values / s independent of the number of channels
Preset	Each channel can be preset by software.
Index	Index signal can be used to reset the position value (functionality can be switched on/off by software)
Encoder power supply	Each encoder can be supplied with 500 mA at 5 V. Maximum total current of all 4 channels is 1 A.
Using different input signals	Each Irinos-Box is preset for either 1 Vss or TTL/RS422. Each channel can be configured for the other type independently.

Inputs for incremental encoders **1 Vss**	
Counter range	-536870912 .. 536870911 increments (30 Bit)
Interpolation	200 x
Input frequency	0 .. 400 kHz
Range for gain control	0,6 .. 1,2 V
Range for offset control	± 0,15 V
Voltage range of sensor signal	0,35 .. 4 V
Hysteresis of index signal	0,15 V
Input resistors	integrated (120 Ohm)
Absolute error	typical ± 0,6 increments, max. 1 increment (if signal-phase between sine- and cosine is adjusted)

Inputs for incremental encoders **TTL / RS422**	
Counter range	-26843545 .. 26843544 increments (30 Bit / 20)
Counter mode	quadrature decoder, forward and backward counting
Input frequency	0 .. 400 kHz
Input signals	according to EIA standard RS 422
Input resistors	integrated (120 Ohm)

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Power supply	
Rated voltage	24 V DC ± 10 %
Reverse voltage protection	yes
Power consumption	≤ 5 Watt plus power consumption of incremental encoders Most incremental encoders have a power consumption < 0,5 watt. Please consult the datasheet of the incremental encoder for further information.
Coupling	galvanic isolation
Forwarding	If multiple Irinos-Boxes are used, the power-supply is forwarded via the ILink-Interface to all Irinos-Boxes (no separate power supply required).

Use an Irinos power supply, e.g. IR-PU50.

Ethernet-Interface (only available for types IR-INC-...-ETHIL)	
Connector	M12 D-coded (industrial standard)
Speed	10 / 100 MBit/s (auto-negotiation)
Max. cable length	100 m
	Auto-Crossover

Digital Inputs (only available for types IR-INC-...-ETHIL)	
Connector	M12 A-coded (industrial standard)
Number of inputs	2 (shared connector)
Voltage range	0 .. 26,4 V DC
Voltage levels	Similar to IEC61131-2: Low: 0 .. 5 V High: 10,8 .. 26,4 V
Input current	ca. 4 mA typical at 24V.
Coupling	galvanic isolation
Power supply	24V available for switches (e.g. push-button or foot pedal) via a high impedance resistor. No supply for external components (e.g. active sensors).

Casing	
	Aluminium designer housing, black anodized, rear plate clear anodized, front plate with cover foil
Dimensions	160 x 98 x 33 mm (H x W x D)
Protection class	Up to IP65 with the IP65 Irinos-Box type, using appropriate connectors
Mounting (standard)	2 tapped brushed M4 on the rear side
Mounting options	○ adaption for hat rail mounting ○ adaption for aluminium profile 40mm, Item or similar ○ adaption for front side mounting
Labelling	Optional label carrier for plastic labels type „Murrplastik ABB 17x9“ (order number Murrplastik: 86421020).

Miscellaneous	
Temperature range	operation: 5 - 50 °C / storage: 0 - 70 °C
Status indication	Status LED (types with integrated ethernet interface) Numeric display (types without ethernet interface) showing box-number and/or error.
Channel indication	Signalling of input type 1 Vss or TTL/RS422 via LED (available independently for each channel). LED 1 Vss: blue LED TTL: yellow
Expansion	System expansion up to 32 Irinos-Boxes via ILink-Interface (max. 256 probes possible). Combinable with other inputs, e.g. for incremental encoders, analog inputs, digital in/outputs, etc.
Connection to PC	Standard ethernet. DLL available for easy integration into PC software (Windows based).

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Ordering information

Preferred types have shorter lead times.

Irinos-Boxes IR-INC for incremental encoders		
Order-No.	**Description**	**Preferred type**
828-5013	**IR-INC-4-SEL1VSS-DSUB15F-ETHIL** (*) 4 channels for incremental encoders, **pre-configured for 1 Vss** (changeable to TTL/RS422 via software), **including Ethernet**-Interface for direct connection to a PC, including 2 digital Inputs, protection class **IP65** if appropriate connectors are used.	
828-5014	**IR-INC-4-SEL1VSS-DSUB15F-IL** 4 channels for incremental encoders, **pre-configured for 1 Vss** (changeable to TTL/RS422 via software), **without Ethernet**-Interface (additional Irinos-Box), without digital inputs, protection class **IP65** if appropriate connectors are used.	Yes
828-5015	**IR-INC-4-SELTTL-DSUB15F-ETHIL** (*) 4 channels for incremental encoders, **pre-configured for TTL/RS422** (changeable to 1 Vss via software), **including Ethernet**-Interface for direct connection to a PC, including 2 digital Inputs, protection class **IP65** if appropriate connectors are used.	
828-5016	**IR-INC-4-SELTTL-DSUB15F-IL** 4 channels for incremental encoders, **pre-configured for TTL/RS422** (changeable to 1 Vss via software), **without Ethernet**-Interface (additional Irinos-Box), without digital inputs, protection class **IP65** if appropriate connectors are used.	

(*) Exactly one Irinos-Box with ethernet interface allowed per Irinos-System.

Accessories labelling and mounting		
Order-No.	**Description**	**Preferred type**
828-5040	**IR-MIPL-8-ABB179** Labelling carrier for 8 plastic labels	Yes
828-5041	**IR-MHRM-1** Adapter for hat rail mounting	Yes
828-5042	**IR-MFFM-1** Front-side mounting kit	Yes
828-5043	**IR-MITEM-40** Mounting bracket for aluminium profile 40mm (Item or similar)	Yes
828-5044	**IR-MWIP-40** Stand for aluminium profile 40mm (Item or similar)	Yes

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Ethernet cables		
Order-No.	**Description**	**Preferred type**
828-5050	Ethernet cable **IR-CETH-RJ45-M12-010** Length **1m**, Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	Yes
828-5051	Ethernet cable **IR-CETH-RJ45-M12-020** Length **2m**, Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	Yes
828-5052	Ethernet cable **IR-CETH-RJ45-M12-050** Length **5m**, Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	Yes
828-5053	Ethernet cable **IR-CETH-RJ45-M12-100** Length **10m**, Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	
828-5054	Ethernet cable **IR-CETH-RJ45-M12-150** Length **15m**, Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	

Accessories ILink connection cable between multiple Irinos boxes		
Order-No.	**Description**	**Preferred type**
828-5055	ILink connection cable **IR-ILINK-002-IP40** Length 0,2 m, protection class IP40	Yes
828-5056	ILink connection cable **IR-ILINK-010-IP40** Length 1 m, protection class IP40	Yes
828-5057	ILink connection cable **IR-ILINK-020-IP40** Length 2 m, protection class IP40	
828-5058	ILink connection cable **IR-ILINK-030-IP40** Length 3 m, protection class IP40	
828-5059	ILink connection cable **IR-ILINK-050-IP40** Length 5 m, protection class IP40	
828-5060	ILink connection cable **IR-ILINK-100-IP40** Length 10 m, protection class IP40	
828-5061	ILink connection cable **IR-ILINK-002-IP65** Length 0,2 m, protection class IP65	
828-5062	ILink connection cable **IR-ILINK-010-IP65** Length 1 m, protection class IP65	
828-5063	ILink connection cable **IR-ILINK-020-IP65** Length 2 m, protection class IP65	
828-5064	ILink connection cable **IR-ILINK-030-IP65** Length 3 m, protection class IP65	
828-5065	ILink connection cable **IR-ILINK-050-IP65** Length 5 m, protection class IP65	
828-5066	ILink connection cable **IR-ILINK-100-IP65** Length 10 m, protection class IP65	

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