

Irinos IR-INC

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 contains 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.



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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 Vpp) 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 be 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 recommended 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).



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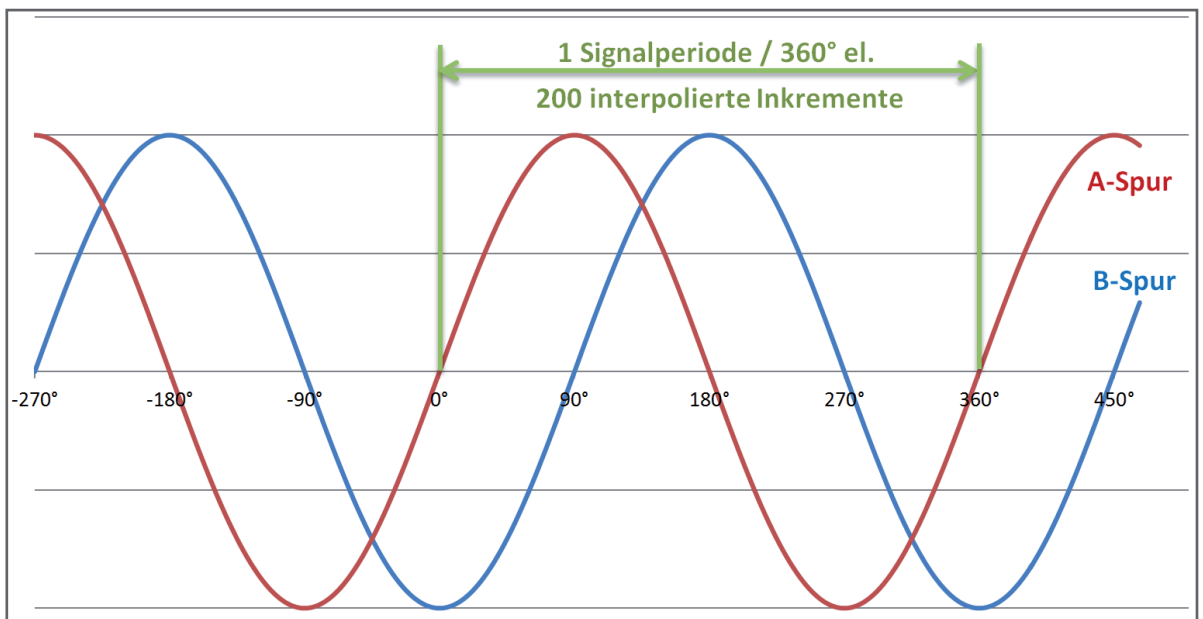
Application notes for 1 Vpp

Interpolation

An incremental encoder with 1 Vpp - 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

$1.800 \text{ divisions/revolution} * 200 \text{ increments/division} = 360.000 \text{ increments/revolution.}$



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 Vpp.
- The signal offset is 0, i.e. at 0° the signal always provides the same value.
- The phase shift between both sine 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 limiting 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.



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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 insufficient 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 insufficient shielding or a cable with a wrong impedance may lead to insufficient 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 limiting 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).



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Specifications

Common specification of the measurement inputs	
Applicable probes	Inkremental probes, linear or rotray encoders providing 1Vpp- 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	Using the box types -SEL1VSS- and -SELTTL-, each channel can be configured for the other type independently. An Irinos-Box is either preconfigured for one probe type (1Vpp or TTL). Each channel configuration can be changed individually Using the Box-Type -TTL-, no reconfiguration to 1Vpp is possible.

Inputs for incremental encoders 1 Vpp	
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)



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Inputs for incremental encoders TTL / RS422 (Box types SELTTL and SEL1VSS)

Counter range	-26843545 .. 26843544 increments (30 Bit / 20)
Counter mode	Quadrature decoder, forward and backward counting Count mode selectable: - 4x counts per encoder increment - 1x count per encoder increment
Input frequency	0 .. 400 kHz
Input signals	according to EIA standard RS 422
Input resistors	integrated (120 Ohm)

Inputs for incremental encoders TTL / RS422 (HighSpeed type; Box type TTL)

Counter range	32 Bit
Counter mode	Quadrature decoder, forward and backward counting Count mode selectable: - 4x counts per encoder increment - 1x count per encoder increment
Input frequency	0 .. 18 MHz using RS422
Input signals	Selectable: - according to EIA standard RS 422 - 5V TTL single ended (not recommended for industrial applications)
Input resistors	integrated (120 Ohm) between RS422 signals.

Power supply

Rated voltage	24 V DC \pm 10 %
Reverse voltage protection	yes
Power consumption	< 4 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



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Digital Inputs (only available for type -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	<ul style="list-style-type: none">○ 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: 0 - 50 °C / storage: 0 - 70 °C
Status indication	Numeric display (types -EPI and -IL) showing box-number and/or error. Status LED (type-ETHIL).
Channel indication	Signalling of input type 1 Vss or TTL/RS422 via LED (available independently for each channel). LED 1 Vss: blue LED TTL/RS422: yellow LED TTL SingleEnded: green
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

Three basic types are available. They differ in the connection of the power supply, the network cabling and the bus system. The measurement technology is always the same.



Typ -EPI

Master-Box with Ethernet interface

- Exactly one Box with ethernet interface is allowed per system.
- Power supply 24V DC via M12 L-coded.
- For use with power supply: IR-PU-...-**CUS**-..
- Numeric status display
- Software compatible with type -ETHIL



Typ -IL

Slave-Box for system expansion

- Max. 31 slave boxes are possible
- Power supply via bus system
- Numeric status display



Typ -ETHIL

Master-Box with Ethernet interface

- **Legacy Product:** This product remains available without any restrictions. However, using the new type -EPI is recommended.
- Exactly one Box with ethernet interface is allowed per system.
- Power supply 24V DC via DSUB15
- For use with power supply: IR-PU-...-**HWS**-..
- 2 digital inputs
- Software compatible with type -EPI



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Overview of most common types

Typ	1Vpp reconfigurable to TTL/RS422 Input frequency ≤ 400kHz	TTL/RS422 HighSpeed Input Input frequency ≤ 18MHz
-EPI Master	828-5047	828-5085
-IL Slave	828-5014	828-5084

Complete overview

Irinos-Boxes IR-INC for incremental encoders Input type selectable 1Vpp or TTL/RS422, max. input frequency: 400 kHz		
Order- No.	Description	Status
828-5047	IR-INC-4-SEL1VSS-DSUB15F-EPI (*) 4 channels for incremental encoders, pre-configured for 1 Vpp (reconfigurable to TTL/RS422 via software), including Ethernet -Interface for direct connection to a PC, power supply via M12 L-coded, protection class IP65 if appropriate connectors are used.	Preferred type
828-5014	IR-INC-4-SEL1VSS-DSUB15F-IL 4 channels for incremental encoders, pre-configured for 1 Vpp (reconfigurable to TTL/RS422 via software), without Ethernet -Interface (additional Irinos-Box), without digital inputs, protection class IP65 if appropriate connectors are used.	Preferred type
828-5013	IR-INC-4-SEL1VSS-DSUB15F-ETHIL (*) 4 channels for incremental encoders, pre-configured for 1 Vpp (reconfigurable 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.	Legacy product: remains available
828-5048	IR-INC-4-SELTTL-DSUB15F-EPI (*) 4 channels for incremental encoders, pre-configured for TTL/RS422 (reconfigurable to 1 Vpp via software), including Ethernet -Interface for direct connection to a PC, power supply via M12 L-coded, protection class IP65 if appropriate connectors are used.	Available
828-5016	IR-INC-4-SELTTL-DSUB15F-IL 4 channels for incremental encoders, pre-configured for TTL/RS422 (reconfigurable to 1 Vpp via software), without Ethernet -Interface (additional Irinos-Box), without digital inputs, protection class IP65 if appropriate connectors are used.	Available
828-5015	IR-INC-4-SELTTL-DSUB15F-ETHIL (*) 4 channels for incremental encoders, pre-configured for TTL/RS422 (reconfigurable to 1 Vpp via software), including Ethernet -Interface for direct connection to a PC, including 2 digital Inputs, protection class IP65 if appropriate connectors are used.	Legacy product: remains available

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



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Irinos-Boxes IR-INC-TTL for incremental encoders (HighSpeed TTL) Input type TTL/RS422 or TTL Single Ended, max. input frequency: 18 MHz

Order-No.	Description	Status
828-5085	IR-INC-4-TTL-DSUB15F-EPI (*) 4 channels for incremental encoders, HighSpeed TTL/RS422 , including Ethernet-Interface for direct connection to a PC, power supply via M12 L-coded, protection class IP65 if appropriate connectors are used.	Available
828-5084	IR-INC-4-TTL-DSUB15F-IL 4 channels for incremental encoders, HighSpeed TTL/RS422 , without Ethernet-Interface (additional Irinos-Box), without digital inputs, protection class IP65 if appropriate connectors are used.	Available

Accessories labelling and mounting

Order-No.	Description	Status
828-5040	IR-MIPL-8-ABB179 Labelling carrier for 8 plastic labels	Preferred type
828-5081	IR-MIPL-8-COLOR Labelling carrier with 8 coloured labelling fields for engraving	Available
828-5041	IR-MHRM-1 Adapter for DIN rail mounting	Preferred type
828-5042	IR-MFFM-1 Front-side mounting kit	Preferred type
828-5043	IR-MITEM-40 Mounting bracket for aluminium profile 40mm (Item or similar)	Preferred type
828-5044	IR-MWIP-40 Stand for aluminium profile 40mm (Item or similar)	Available



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Ethernet cables		
Order-No.	Description	Status
828-5050	Ethernet cable IR-CETH-RJ45-M12-010 Length 1m , Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	Preferred type
828-5051	Ethernet cable IR-CETH-RJ45-M12-020 Length 2m , Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	Preferred type
828-5052	Ethernet cable IR-CETH-RJ45-M12-050 Length 5m , Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	Preferred type
828-5053	Ethernet cable IR-CETH-RJ45-M12-100 Length 10m , Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	Available
828-5054	Ethernet cable IR-CETH-RJ45-M12-150 Length 15m , Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	Available
828-5076	Ethernet cable IR-CETH-RJ45-M12-200 Length 20m , Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded	Special type



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Please note: the maximum bus length of each Irinos system is 20m.

Accessories ILink connection cable between multiple Irinos boxes		
Order-No.	Description	Status
828-5055	ILink connection cable IR-ILINK-002-IP40 Length 0,2 m, protection class IP40	Preferred type
828-5056	ILink connection cable IR-ILINK-010-IP40 Length 1 m, protection class IP40	Preferred type
828-5057	ILink connection cable IR-ILINK-020-IP40 Length 2 m, protection class IP40	Available
828-5058	ILink connection cable IR-ILINK-030-IP40 Length 3 m, protection class IP40	Preferred type
828-5059	ILink connection cable IR-ILINK-050-IP40 Length 5 m, protection class IP40	Available
828-5060	ILink connection cable IR-ILINK-100-IP40 Length 10 m, protection class IP40	Available
828-5061	ILink connection cable IR-ILINK-002-IP65 Length 0,2 m, protection class IP65	Preferred type
828-5062	ILink connection cable IR-ILINK-010-IP65 Length 1 m, protection class IP65	Available
828-5063	ILink connection cable IR-ILINK-020-IP65 Length 2 m, protection class IP65	Available
828-5064	ILink connection cable IR-ILINK-030-IP65 Length 3 m, protection class IP65	Available
828-5065	ILink connection cable IR-ILINK-050-IP65 Length 5 m, protection class IP65	Available
828-5066	ILink connection cable IR-ILINK-100-IP65 Length 10 m, protection class IP65	Available
828-5079	ILink connection cable IR-ILINK-150-IP65 Length 15 m, protection class IP65	Special type
828-5077	ILink connection cable IR-ILINK-200-IP65 Length 20 m, protection class IP65	Special type



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