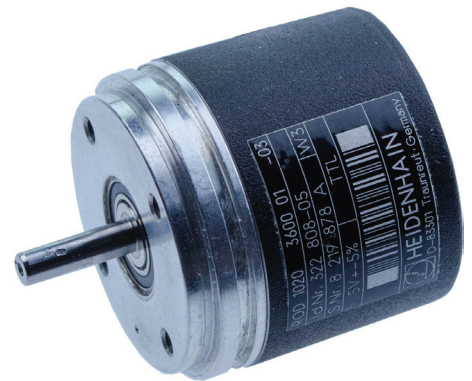


Irinos SC-INC

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



- Interface for 4 incremental encoders with 1Vpp- or TTL/RS422-Interface
- 200x interpolation with 1Vpp-Interface
- Integrated error detection
- Synchronous data acquisition up to 4.000 measurement values / s (all channels simultaneously)
- Expandable with other Irinos-Boxes via SCLink-Interface
- Available with integrated ethernet interface for direct connection to PC



Messtechnik Sachs GmbH
Siechenfeldstr. 30/1
73614 Schorndorf / Germany
www.messtechnik-sachs.de

Phone +49 7181 26935-0
Fax +49 7181 26935-49
post@messtechnik-sachs.de

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Expansion

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

The SCLink interface combines the data exchange between the Irinos boxes, their time synchronization and the forwarding of the power supply. Cascading takes place via a single connection cable. A maximum of 12 Irinos-Boxes can thus be connected in a line to form a complete measuring system.

The number of Irinos boxes is irrelevant for reading out the measured values on the PC. Only the number of available channels changes when cascading. The PC always communicates with the system via a single Ethernet connection.

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 SC-INC, it is possible to get 4.000 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 $32 * 4.000 \text{ values/s} = 128.000 \text{ measurement values / s}$ 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 SCLink-Interface has galvanic isolation, which allows for a robust communication between multiple Irinos-Boxes. Further it avoids ground loops or similar negative effects.

Labelling

Each measurement channel can be labelled via an optional label carrier. It is suitable for 8 plastic-labels, which are widely used in switch cabinet construction. They can be printed with many commercially available plastic-label printers.



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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 SC-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 SC-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 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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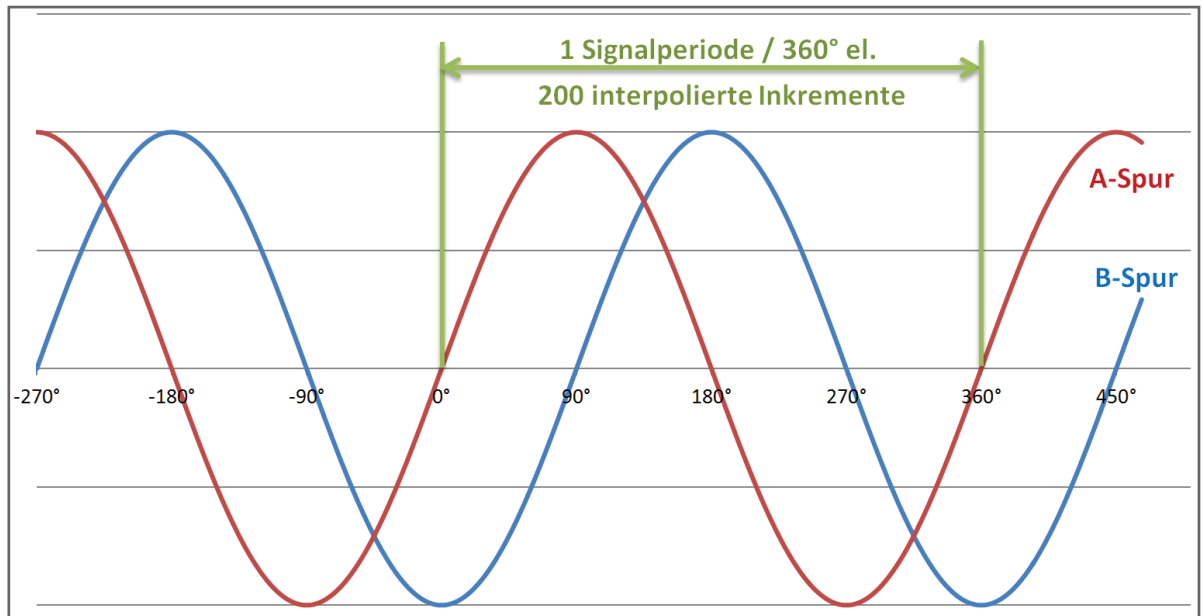
Application notes for 1 Vpp

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 SC-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 SC-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 SC-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).



Irinos SC-INC

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, 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

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	$\pm 0,15$ 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 $\pm 0,6$ 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)

Power supply

Rated voltage	24 V DC $\pm$ 10 %
Connector type at Master-Box (Typ -EPI)	M12 L-coded in assignment according to industrial standard or via DSUB of the SCLink interface.
Reverse polarity protection	yes
Power consumption	$\leq$ 4 watt + encoder power
Coupling	galvanic isolation
Forwarding	When cascading several Irinos boxes, the power supply is forwarded via the SCLink interface (no separate power supply required).

Use an Irinos power supply IR-PU.

Ethernet interface at Master-Box (Typ -EPI)

Connector	M12 D-coded (industrial standard)
Speed	100 MBit/s (auto cross-over detection)
Max cable length	100 m, Recommendation: < 30m

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	IP65 when mated with suitable mating connectors (housing and communication connector), probe connector design according to common probe manufacturer standard IP40.
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 via labelling carrier.



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Miscellaneous

Temperature range	operation: 0 - 50 °C / storage: 0 - 70 °C
Status indication	Numeric display showing box-number and/or error.
Expansion	System expansion up to 12 Irinos-Boxes via SCLink-Interface (max. 96 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). Alternatively, access via a Telnet-like interface is possible.



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Irinos SC-INC

Ordering information

Two different basic types are available, the master box and the slave box. A master box is like a slave box with additional Ethernet interface and connection option for the power supply. A system consists of exactly 1 master box and optional slave boxes.

Übersicht der gängigsten Typen

Typ	1Vpp reconfigurable to TTL/RS422 Input frequency ≤ 400kHz	TTL/RS422 reconfigurable to 1Vpp Input frequency ≤ 400kHz
-EPI Master	828-3047	828-3048
-IL Slave	828-3014	828-3016

Complete overview

Irinos-Boxes SC-INC for incremental encoders Input type selectable 1Vpp or TTL/RS422, max. input frequency: 400 kHz	
Order- No.	Description
828-3047	SC-INC-4-SEL1VSS-D15F-EPI 4 channels for incremental encoders, preconfigured for 1 Vpp , via software reconfigurable to TTL/RS422, including Ethernet interface for direct connection to a PC, power supply via M12 L-coded
828-3014	SC-INC-4-SEL1VSS-D15F-IL 4 channels for incremental encoders, preconfigured for 1 Vpp , via software reconfigurable to TTL/RS422, without Ethernet interface (additional box for system expansion)
828-3048	SC-INC-4-SELTTL-D15F-EPI 4 channels for incremental encoders, preconfigured for TTL/RS422 , via software reconfigurable to 1Vpp, including Ethernet interface for direct connection to a PC, power supply via M12 L-coded
828-3016	SC-INC-4-SELTTL-D15F-IL 4 channels for incremental encoders, preconfigured for TTL/RS422 , via software reconfigurable to 1Vpp, without Ethernet interface (additional box for system expansion)



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Accessories labelling and mounting

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

Accessories power supply (1 pcs. required per system)

Type	Europe (Schuko Connector)	USA / Mexico (Nema)	India (Type D)
Power 30 W	828-5046	828-5100	828-5082
Power 80 W	828-5083	tbd	828-5088

Accessories Ethernet cable

Order No	Description
828-5050	Ethernet cable IR-CETH-RJ45-M12-010 Length 1m , Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded
828-5051	Ethernet cable IR-CETH-RJ45-M12-020 Length 2m , Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded
828-5052	Ethernet cable IR-CETH-RJ45-M12-050 Length 5m , Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded
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
828-5076	Ethernet cable IR-CETH-RJ45-M12-200 Length 20m , Cat5e, 1 x RJ45, 1 x M12 SpeedCon D-coded



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The boxes are connected via the SCLink interface using ILink type cables. **The maximum total cable length (20m) must be observed.**

Accessories ILink-cable	
Order No	Description
828-5055	ILink connection cable IR-ILINK-002-IP40 Length 0.2 m, Protection class IP40
828-5056	ILink connection cable IR-ILINK-010-IP40 Length 1 m, Protection class IP40
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
828-5079	ILink connection cable IR-ILINK-150-IP65 Length 15 m, Protection class IP65
828-5077	ILink connection cable IR-ILINK-200-IP65 Length 20 m, Protection class IP65

Unused SCLink sockets (DSUB sockets) on the Irinos boxes can be sealed via the following protective cap in IP65:

Accessories Protective Cap SCLink - Interface	
Order No	Description
828-7020	Protective cap DSUB15 Female IP65 with screws

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Subject to change without notice.



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