

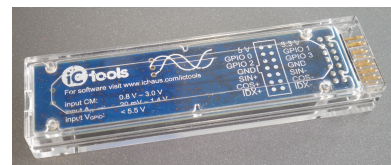
FEATURES

- Small and portable design
- Standard header for flexible interface
- Multi-channel capable with easy to use software
- Input frequency of up to 70 kHz
- Input amplitude: 10 mV to 0.7 V
- Common mode input voltage: 0.8 V to 3.0 V
- Automatic SIN/COS signal quality measurement: Offset, Amplitude, Phase and Common Mode
- USB bus powered 5 V and 3.3 V supply outputs to power encoder or sensor of up to 250 mA
- Processing of reference (index) marker

APPLICATIONS

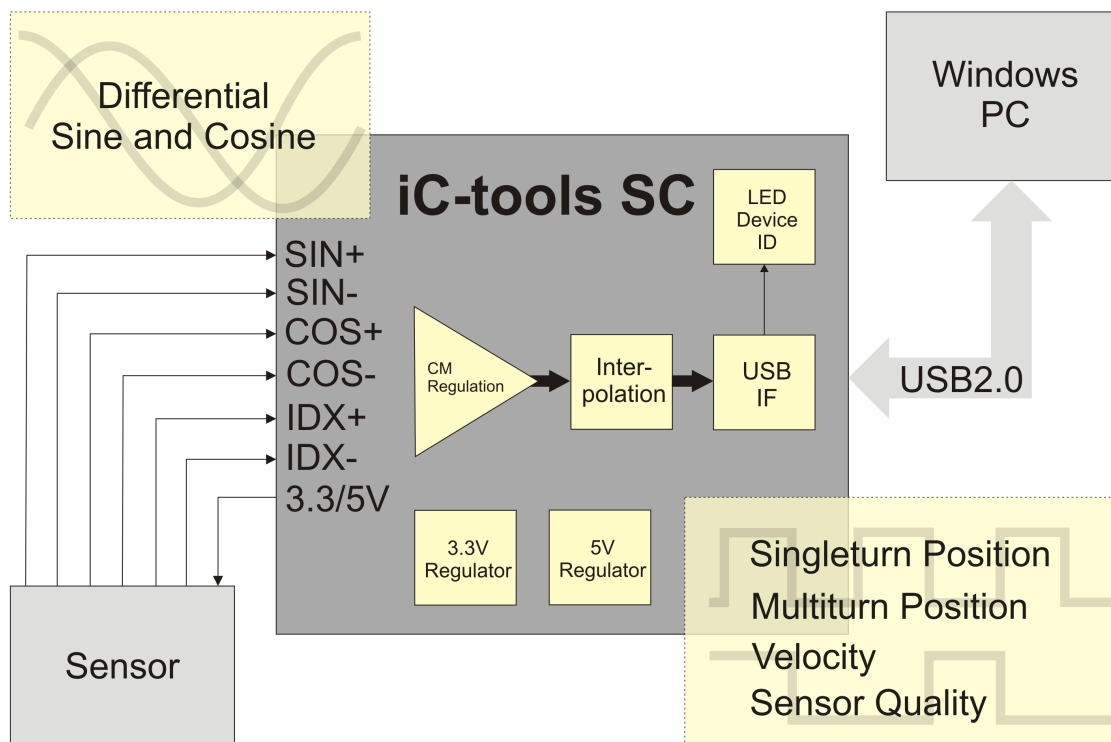
- PC based machine control system
- Portable, easy to use field tool
- R&D Lab tool

PACKAGES



USB mini interface with 14-pin connector

SYSTEM VIEW



DESCRIPTION

The iC-tools SC is an easy to use and portable SIN/COS encoder measurement system. It is particularly suited for development labs and for in-field system maintenance to quickly assess the quality of encoder SIN/COS signals. The iC-tools SC automatically measures and reports the SIN/COS offsets, amplitude and phase mismatch and calculates the angular position (Figure 1 and Figure 2). The common mode is also measured to provide a quick overall view of the encoder integrity.

The angular data can be displayed in several units, such as mm, inch, mil, deg, etc. (Figure 3). The flexibility and ease of use allows the iC-tools SC to be directly used for machine measurement tasks, appli-

cations traditionally served by dedicated display and measurement units.

The iC-tools SC is flexible and scalable. Multiple USB devices can be connected to the host PC each independently processing one SIN/COS channel, yet integrated into one graphical control software.

The iC-tools SC can process input amplitudes between 10 mV to 0.7 V. The common mode range is 0.8 V to 3 V. The maximum input frequency is 70 kHz.

The iC-tools SC is USB bus powered and provides stable and regulated 5 V and 3.3 V supplies of up to 250 mA for powering the connected encoder or sensor.

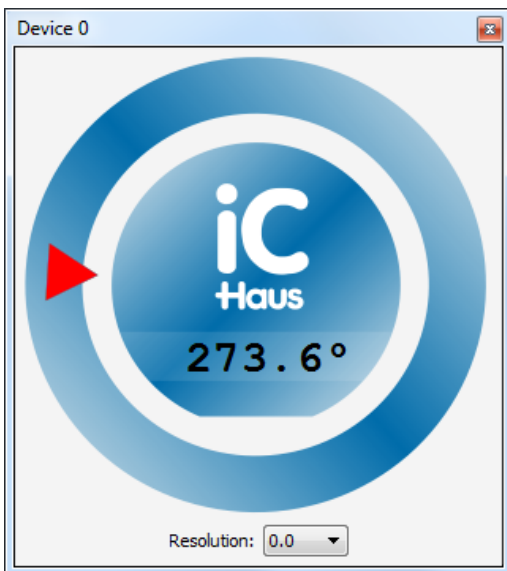


Figure 1: Angular Position

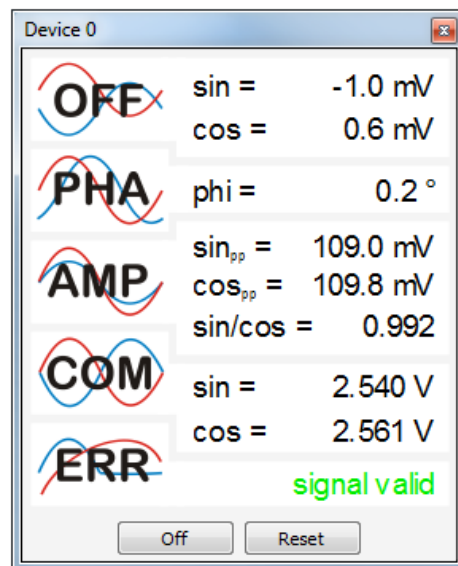


Figure 2: Analog Signal Measurement

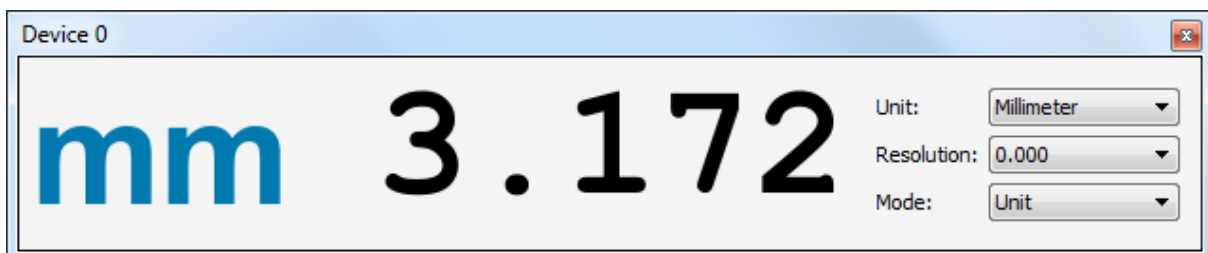
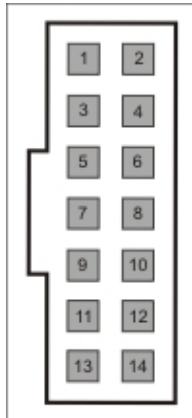


Figure 3: Numerical Display

CONNECTORS

PIN CONFIGURATION SIN/COS Sensor Interface

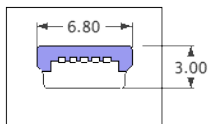


PIN FUNCTIONS

No. Name Function

1	V5	+5.0 V Field Supply Output (250 mA max.)
2	V3	+3.3 V Field Supply Output (250 mA max.)
3	GPIO0	General Purpose InOut
4	GPIO1	General Purpose InOut
5	GPIO2	General Purpose InOut
6	GPIO3	General Purpose InOut
7	GND	USB Ground (0 V)
8	GND	USB Ground (0 V)
9	SIN+	Pos.-going Sine Input
10	SIN-	Neg.-going Sine Input
11	COS+	Pos.-going Cosine Input
12	COS-	Neg.-going Cosine Input
13	IDX+	Pos.-going Index Input
14	IDX-	Neg.-going Index Input

PIN CONFIGURATION Mini-B USB 5-pole



PIN FUNCTIONS

No. Name Function

1	VCC	5 V USB Supply Input
2	D-	Data Line
3	D+	Data Line
4	ID	Identifier: A = GND, B n.c.
5	GND	USB-Ground (0 V)

ABSOLUTE MAXIMUM RATINGS

Beyond these values damage may occur; device operation is not guaranteed.

Item No.	Symbol	Parameter	Conditions			Unit
				Min.	Max.	
G001	PIN1-14	All Input Pins		-0.3	5.8	V

THERMAL DATA

Item No.	Symbol	Parameter	Conditions				Unit
				Min.	Typ.	Max.	
T01	Temp	Operational Temperature Range		0		55	°C

All voltages are referenced to ground unless otherwise stated.

All currents flowing into the device pins are positive; all currents flowing out of the device pins are negative.

ELECTRICAL CHARACTERISTICS

Item No.	Symbol	Parameter	Conditions	Min. Typ. Max.			Unit
				Min.	Typ.	Max.	
Power Supply Input							
001	Power USB	Maximum Power Consumption from USB Bus	see USB specifications			500	mA
Power Supply Output (V5, V3)							
101	V5	Field Power Supply		4.75	5	5.25	V
102	I(V5)	Field Power Supply	I(V3) = 0 mA			250	mA
103	V3	Field Power Supply		3.135	3.3	3.465	V
104	I(V3)	Field Power Supply	I(V5) = 0 mA			250	mA
Signal Inputs (SIN+, SIN-, COS+, COS-)							
201	Vcm()	Permissible Input Common Mode Voltage Range		0.8		3	V
202	Vin()	Permissible Input Amplitude	Can be applied differential or single ended. (see Figure 4)	10		700	mV
203	f _{in} () max	Permissible Input Frequency for Position Measurement				70	kHz
204	f _{max}	Permissible Input Frequency for Parameter Measurement				20	kHz
205	Err	Parameter Measurement Error			10		%
206	R _{in}	Input Resistance			10		MOhm
Index Inputs (IDX+, IDX-)							
301	V _{in}	Input Voltage Range		0		5	V
General IO Input (GPIO0 - GPIO3)							
401	PIN3-6	Input Voltage Range	GPIOx configured as input	0		5.5	V
General IO Output (GPIO0 - GPIO3)							
501	PIN3-6	Output Voltage High	GPIOx configured as output		3.3		V
502	PIN3-6	Output Voltage Low	GPIOx configured as output		0		V

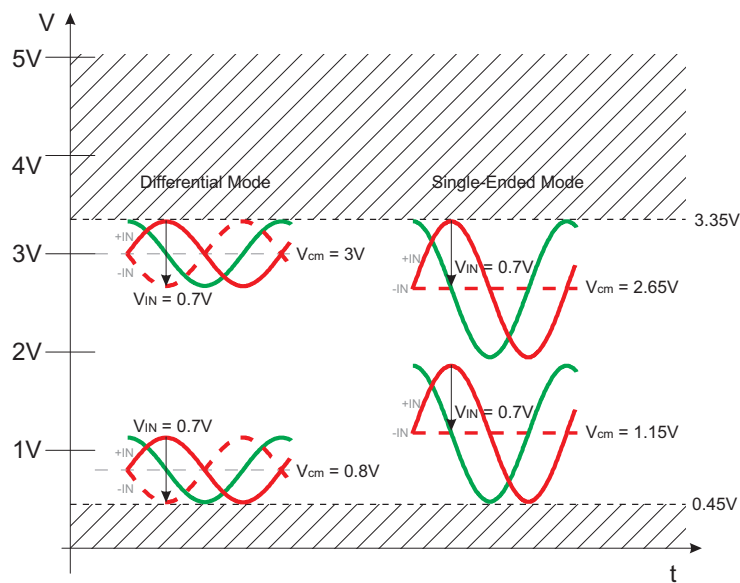


Figure 4: Permissible input amplitude (elec. char. no.: 202)

SYSTEM EXAMPLE

iC-tools SC can be used to transfer position data of a magnetic interpolator (e.g. iC-MH8) to a windows pc. The iC-MH8 offers analog pins to grip the differential sine and cosine signals generated by the built-in Hall sensor. These pins must be connected to the iC-tools SC in the following manner.

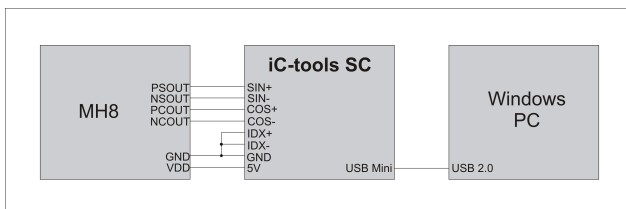


Figure 5: Connection of System Components

First, the ground pins of the iC-tools SC should be connected to the reference potential of the iC-MH8 chip. To find the correct pins, there is a short connector description at the bottom of the iC-tools SC. The field power supply (5V) can be used to power the iC-MH8. Thus, there is no need for any another power sources besides USB. As Figure 5 shows, the iC-MH8 outputs PSOUT, NSOUT, PCOUT and NCOOUT have to be connected to the corresponding pins at the iC-tools SC connector. If there is no need for the index signal, IDX- and IDX+ can be put to ground. The general I/O pins can be left floating as well.

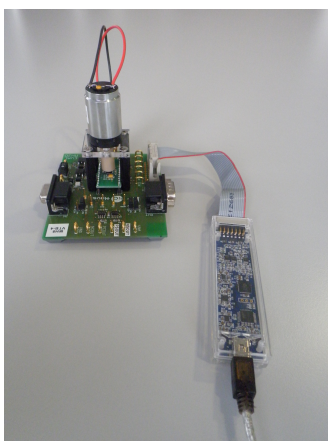


Figure 6: System Overview

Figure 6 shows a real world example of the iC-tools SC. As described above, the iC-tools SC is connected to the differential analog interface of a iC-MH8 demo board. A standard 14 pin ribbon cable is used to connect the two devices. A motor with a magnet at the

shaft is used to generate the magnetic field. The motor power is also reclaimed from the iC-tools SC.

When connected to a windows pc, the iC-tools SC is automatically installed to the operation system. There is no need for any hardware drivers! After the iC-tool SC is detected by your computer, the iC-tools SC software can be downloaded at the [iC-tools internet page](#). Setup.exe starts the easy installation process, which includes all information needed.

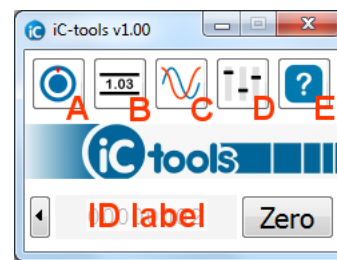


Figure 7: Main Window

When the installer is finished, the program can be started by clicking the iC-tools SC logo in the windows start menu. The iC-tools SC must be plugged into the USB port now. The iC-tools main window appears as shown in Figure 7. The iC-tools SC can be renamed by clicking into the **ID label** at the bottom. So, it is possible to choose a meaningful expression for that channel. This function helps to find a specific device, when using multiple iC-tools SC at once. Before starting analyzing sensor signals, the device has to be setup correctly. This can be done by clicking onto the arrow next to the **ID label**. The appearing system window allows to change the **Periods per revolution**. For the MH8 demoboard, it has to be changed to 1, because the magnet has one terminal pair only. The **Millimeter per period** configuration does not have to be altered. It is only important for systems with linear sensor technology. The other configuration options can be left unchanged as well.



Figure 8: Increments

First, the display window should be opened as shown in Figure 8 by clicking on the tool button **B** in Figure 7. The default configuration shows the incremental position. If the motor is running and everything is setup correctly, the increment should increase. If the value

appears in red font color, the display windows must be resized, because the number does not fit into the display window.



Figure 9: Revolution per Second

Another interesting value can be the velocity. Therefore another display window must be opened and the **Unit** has to be changed to **Revolution**. Now, the display counts the complete revolutions of the magnet. Changing the **Mode** configuration to **Unit per second** makes the display showing the velocity of the motor as revolution per second. There are other display configuration to explore. It is possible to open as many display windows as desired.



Figure 10: Dial Window

The tool button **A** opens a dial to show the actual angle position. To try this feature, the motor should be disconnected from the power source. The dial window can be resized to any desired size. When turning the shaft by hand, the display in the middle of the dial shows the actual angle. Resolution can be changed by clicking the control at the bottom of the dial window.

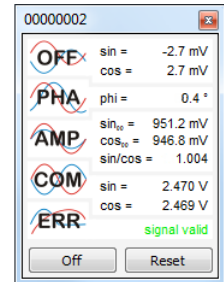
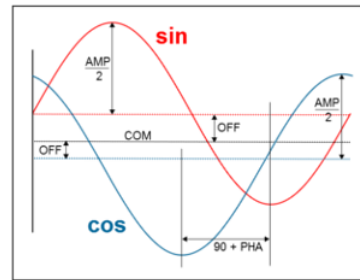


Figure 11: Sensor Window

The third tool shows information about the sensor signal quality. It can be opened by clicking on the tool button **C**. The sensor window as shown in Figure 11, displays electrical characteristic of the sine and cosine sensor signals. The signal offset, the phase angle, the signal amplitudes and the common mode voltage can be examined. These values can be used to calibrate the iC-MH8 for field application. Due to the measurement algorithm, the periods of the magnet must not differ too much to get useful information. In case of the iC-MH8 demoboard, the magnet only has one period.

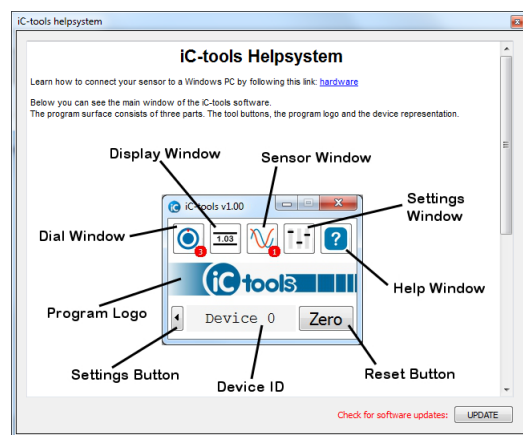


Figure 12: Helpsystem

By clicking on the tool button **E**, the screen shows the iC-tools help system. There are information about the hardware configuration and the software features available. By hitting the update button at the bottom of the help page, it is possible to check for software updates. The windows internet configuration must be setup correctly to use this feature. If there is a new software version available, a message shows where a download of the newest version can be found.

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ORDERING INFORMATION

Type	Package	Order Designation
iC-tools SC	100 mm x 27 mm x 11 mm transparent polycarbonate	iC-tools SC miniUSB-14

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