

Irinos-Tool users manual

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**This users manual has been optimized for an interactive web view.
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Introduction

1 Introduction

1.1 Imprint

Title	Irinos-Tool users manual
Manufacturer	Messtechnik Sachs GmbH Siechenfeldstraße 30/1 D-73614 Schorndorf Germany Phone +49 7181 99960-0 post@messtechnik-sachs.de
For use with	Measurement modules Irinos IR
Copyright note	© 2015 - 2016 Messtechnik Sachs GmbH
Trademarks	All product names used in this manual are trademarks of their respective owners.
Material-No.	785-1019
Change not	Subject to change without notice.
Release date	20/06/2016

1.2 Revision history

Version	Date	Changes
A		

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1.4 Preface

1.4.1 Purpose

	Warning
	<p>Carefully read this complete users manual and all related documentation before setup and use of the Irinos-System. This applies especially to the safety instructions.</p> <p>Misuse may lead do death, serious injury, injury or damage of man, equipment or machine.</p>

1.4.2 Scope of this manual

This manual describes the setup- and diagnostic-software "Irinos-Tool", which is used together with the industrial measurement system "Irinos".

1.4.3 Intended use

Irinos is a flexible High-Speed measurement system for the industrial production measurement technology.

The measurement device is not appropriate for use in medical fields or in explosive areas, for aerospace and for home- or office use. Other fields of application, which are not mentioned but similar, are also excluded from use.

In safety critical areas, the safety in operation must be ensured by external equipment (e.g. external emergency stop).

Please note:

	Warning
	Products from Messtechnik Sachs GmbH must only be used for applications, which are mentioned in the dataheet or in the related documentation. If third party products are used, these must be recommended or permitted by Messtechnik Sachs GmbH. Proper and safe operation of the products require appropriate transportation, storage, mounting, usage and maintenance. Environmental conditions stated in the specification must be observed as well as notes in the related documentation.

1.4.4 Required knowledge

For using the Irinos-Tool general knowledge in using Windows-based software is required.

For the Irinos-System applies:

For the mechanical integration and mounting, solid knowledge and skills in mechanics and machinery are required.

For the electrical installation and the setup, solid knowledge and skills in electrics and electrical safety are required.

For the setup of the measurement application, profound knowledge in industrial measurement technology is required as well as PC skills.

1.4.5 Further documentation

Please note the short booklet, which is delivered with each Irinos module. This applies especially to the safety warnings, which are mentioned in it. The specifications of the Irinos-Boxes can be found in the respective datasheet.

Before using the Irinos-System, please read the users manual carefully.

1.4.6 Firmware & Software version

This users manual is related to the Irinos Firmware version V1 and the Irinos-Tool V2.0.

Screenshots may show an older version. These are only updates, if the user interface has changed significantly.

1.5 About this help

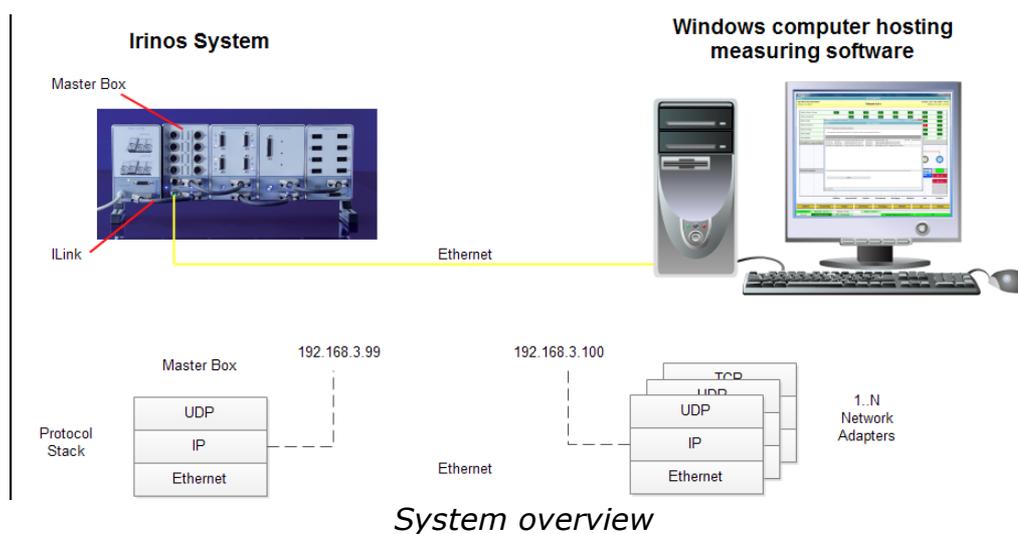
This document describes how the connection between the Irinos system and a host computer is set up. Furthermore, a detailed description of the Irinos-Tool is given. The Irinos-Tool provides a set of functions which support

- connection establishment and verification
- inventory visualization
- configuration setting
- functional tests and
- firmware updates.

Note: It is assumed that the reader is familiar with IP networking principles such as IP address handling, the concept of subnets and finally DHCP.

1.6 System overview

As shown in the following figure, the physical connection between the Irinos-System and the PC is made via an Ethernet cable. Typically it has an M12 connector for the Irinos Master-Box and a RJ45 connector for the PC.



The communication itself is based on the commonly used UDP and

IP protocols.

Basically, network devices need to be configured before a communication link can be established. In particular, IP settings are mandatory on both sides of the communication link. Both, the Irinos Master-Box and the host computer need to be equipped at least with an IP address, and a subnet mask. In some cases a default gateway is configured as well.

If set manually, IP settings on the Windows host are done in the Windows Control Panel. For the Irinos system the Irinos Tool is provided, which enables the user to execute basic network settings. Additionally it contains a broad set of utilities, which support putting the Irinos system into operation. A detailed description of the Irinos Tool is given in chapter 3.2.

Manual IP setting, however, is often cumbersome and may not necessarily lead to established communication links. A better choice is [DHCP](#) (Dynamic Host Configuration Protocol), a network protocol which handles this task more reliable and user-friendly. DHCP basically knows two roles: A DHCP server, who is responsible for handling a pool of IP addresses, and a DHCP client, who queries the server for an IP address.

The Irinos Master-Box provides such a DHCP server. The DHCP Server is active by factory defaults, so the task of providing proper IP settings can fully be delegated to the DHCP function.

As a prerequisite, the network setting on the Windows computer need to be set accordingly.

Quick start guide

2 Quick start guide

2.1 Requirements

This quick start guide is intended for the standard use case, where the

- Irinos Box is on factory defaults, i.e. the Irinos DHCP Server is on.
- Standard IP settings, as set by the Irinos DHCP Server
 - Irinos Box 192.168.3.99,
 - PC Network adapter 192.168.3.100

are compatible with the customer network policy.

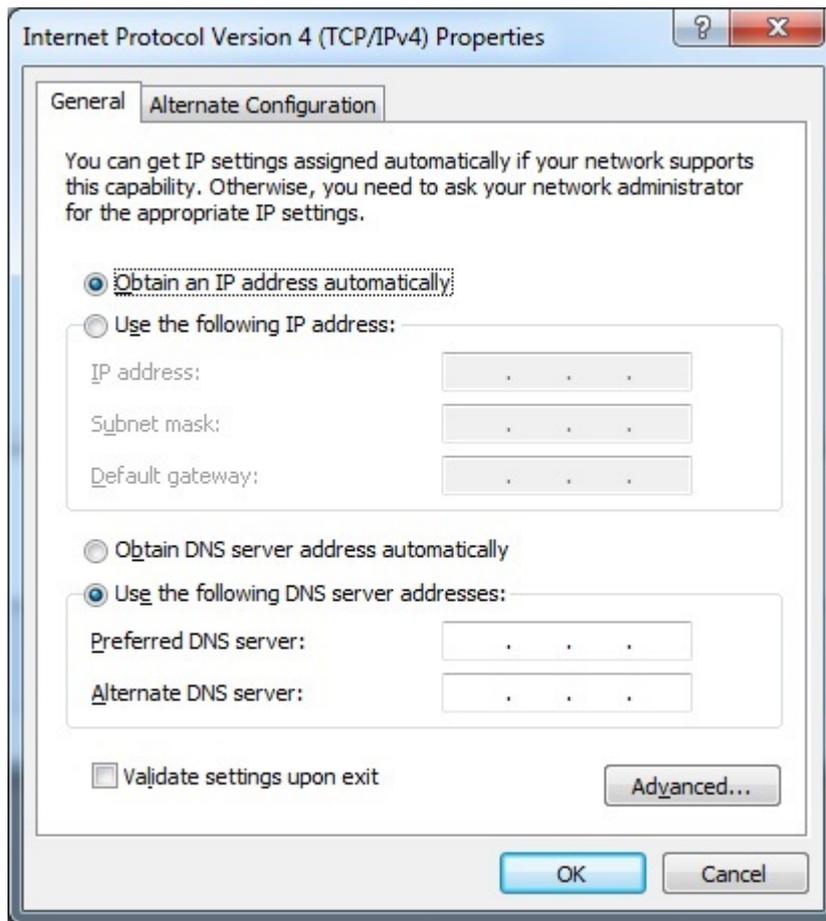
- Irinos box is linked to the host computer.
- User is familiar with the Windows operating system and the IP/DHCP settings at the local host computer.

2.2 PC network settings

As a prerequisite on the host computer, the network adapter settings need to be set to DHCP client mode. Therefore it is advisable to check these settings:

1. Open Windows Control Panel and follow Network and Internet -> View Network Status and Tasks -> Change Adapter Settings
2. Select adapter and right-click "Properties"
3. Select "Internet Protocol Version 4 (TCP/IP)" and press the "Properties" Button

The following window opens:



PC IP V4 configuration (DHCP active)

General Settings:

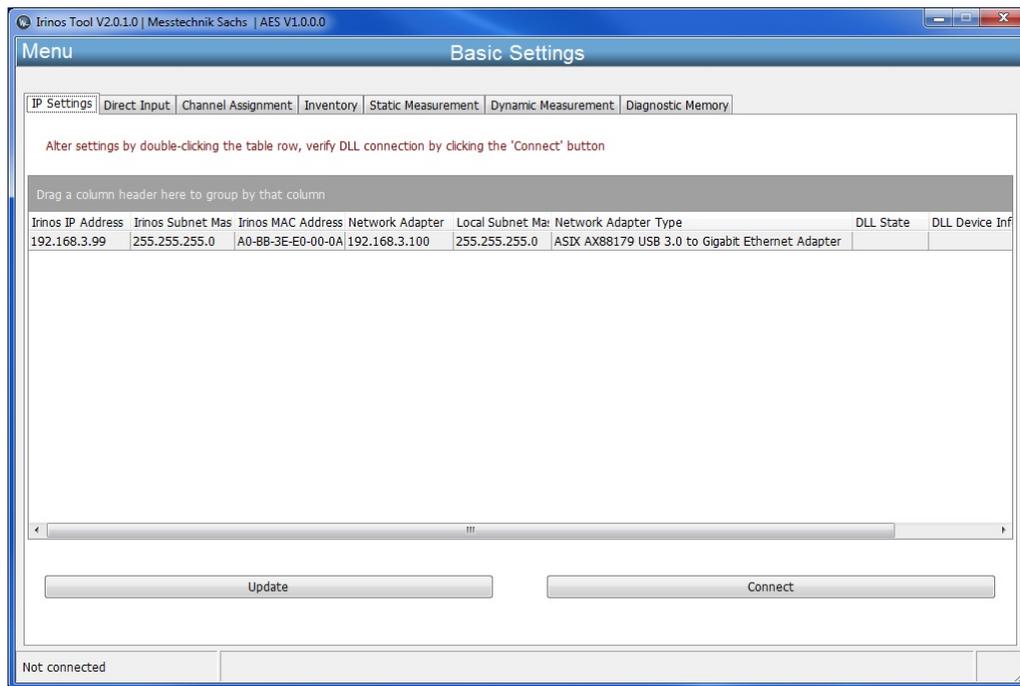
4. Select "Obtain an IP address automatically"

If the network adapter settings are configured as in the screenshot above, no further action is required.

2.3 Irinos configuration and connection check

A main benefit of the built-in DHCP server is the simplified connection setup. As the IP settings of the Master-Box are preset, no user-triggered settings are required. The Irinos-System can be connected without applying any settings.

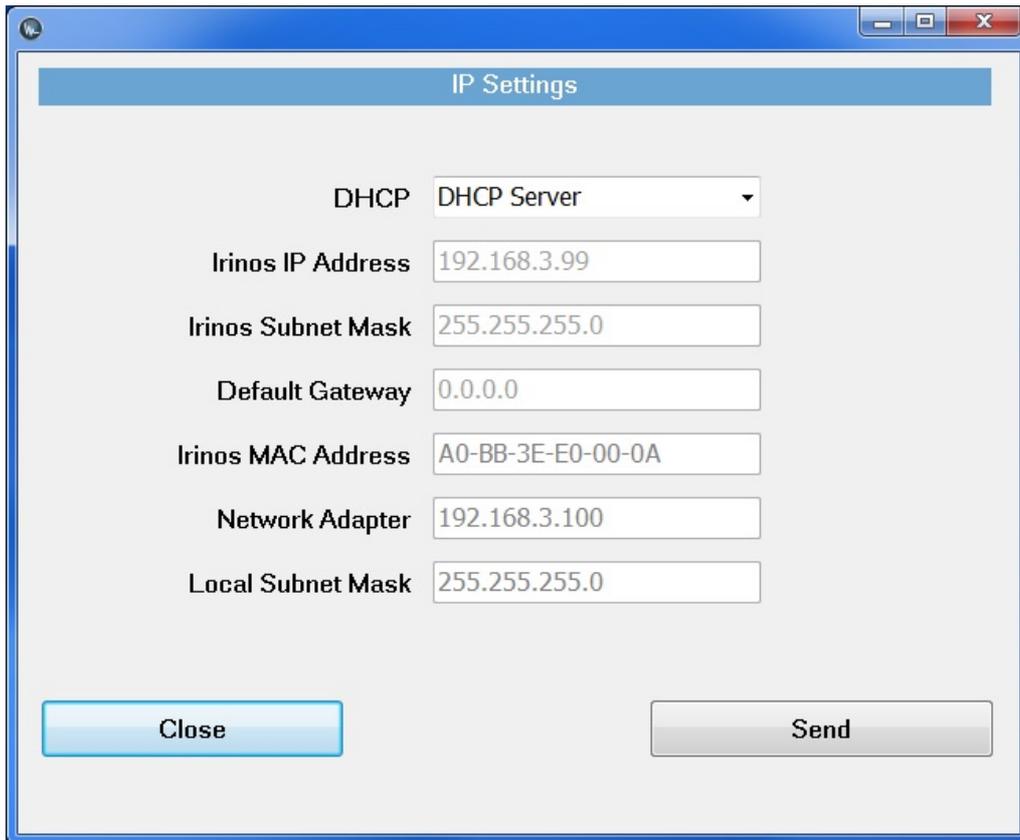
Once the Irinos-System is supplied with power and connected to the host computer, the Irinos Tool should be able to identify the box in the network. Every box found will be presented as one row in the main window of the Irinos Tool:



Start screen of the Irinos-Tool

A double-click on the table row will open the IP Settings window.

It can be used to review the IP settings of the Master-Box, or to modify the settings. As long as the DHCP server is active (Setting 'DHCP' is on selection 'DHCP Server') no modification is necessary.



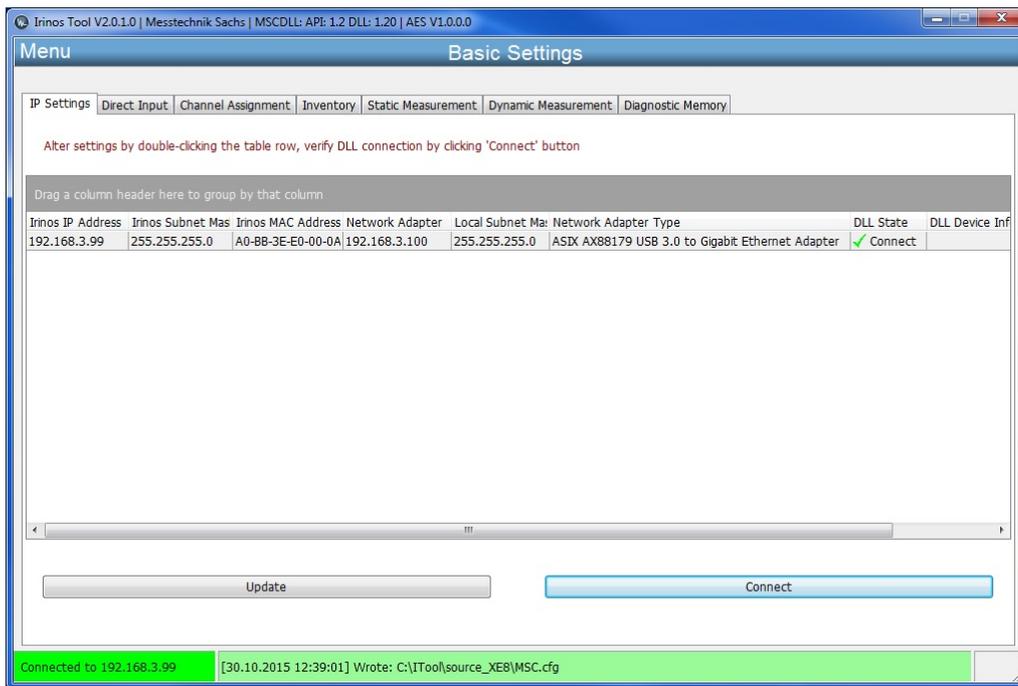
DHCP	DHCP Server
Irinos IP Address	192.168.3.99
Irinos Subnet Mask	255.255.255.0
Default Gateway	0.0.0.0
Irinos MAC Address	A0-BB-3E-E0-00-0A
Network Adapter	192.168.3.100
Local Subnet Mask	255.255.255.0

Close Send

IP configuration window

As a final test, a verification of the interface access by means of the provided MscDll should be executed. This is triggered by selecting the appropriate table row and pressing the 'Connect Button'.

A successful connection check is indicated as shown in following figure:



Connection Test via the MscDll

The connection check result is displayed in the column 'DLL State', the same applies for the returned DLL Device Info.

Along with the verification of the DLL connection, the configuration file MSC.cfg is created automatically. This file is necessary to specify the IP address for the MscDll.dll.

The file location of the file MSC.cfg is displayed in the bottom status bar. From this location it can be copied to the measurement software application.

PC network connection

3 PC network connection

3.1 Ethernet connection

A standard LAN is used to interconnect the Irinos Master-Box and the PC. State of the art network adapters support Auto-MDI(X), a feature to detect the type of cabling used (direct, cross-over) and thereby can work with both types.

However, some very old legacy network adapters, which do not support Auto-MDI(X), might require a cross-over cable to connect the Irinos box.

3.2 Network interfaces

Basic network settings need to be configured before a PC is able to communicate with any other network device. Adopting these settings is done by opening the Windows Control Panel. In the Windows Control Panel follow Network and Internet -> View Network Status and Tasks -> Change Adapter Settings.

Network Adapters are displayed as depicted in the following screenshot. Each icon represents a network adapter and displays the connection status: a red cross is shown if no network cable is plugged in. It is removed as soon as a cable connected to another network device is plugged in.



All network adapters not connected

Determining the assignment of the network adapter

Following it is illustrated, how network connections and corresponding LAN sockets can be identified by plugging in or removing the network cable.

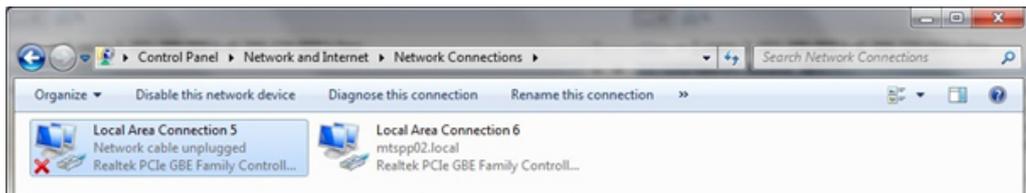
1. No network cable plugged in

All network adapters are shown with a red cross:



2. Using the first network adapter

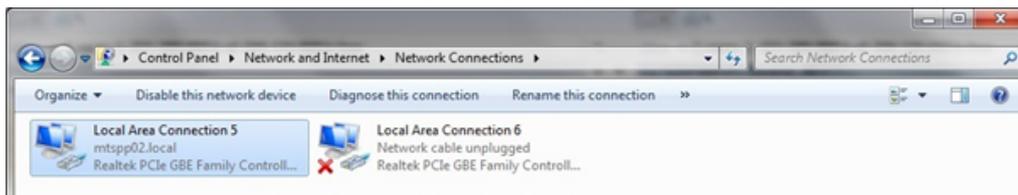
The network cable is plugged into LAN1. Hence one of the connections is shown without the red cross:



3. Using the second network adapter

The network cable is plugged into LAN2. Hence one of the connections is shown without the red cross::





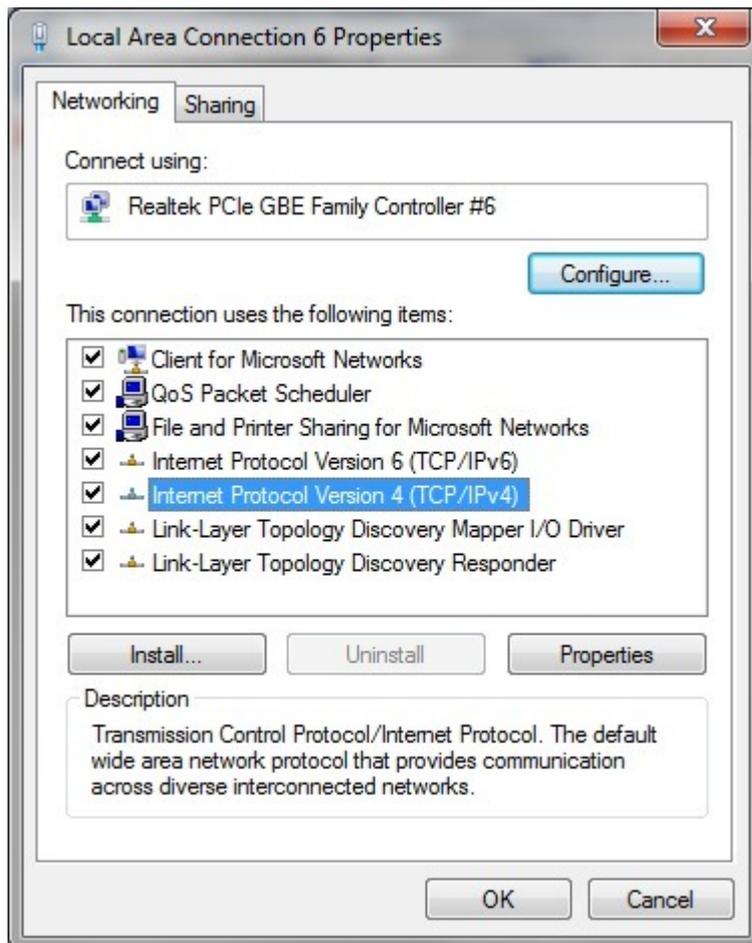
3.3 Network settings

3.3.1 IP configuration using DHCP

The Irinos System supports easy-to-use connection establishment by a built-in DHCP server. As a factory default, the DHCP server is active and provides basic settings for the network adapter. However, if needed, the DHCP server may be [switched off](#)^[33] by the Irinos Tool and IP settings can be configured [manually](#)^[27].

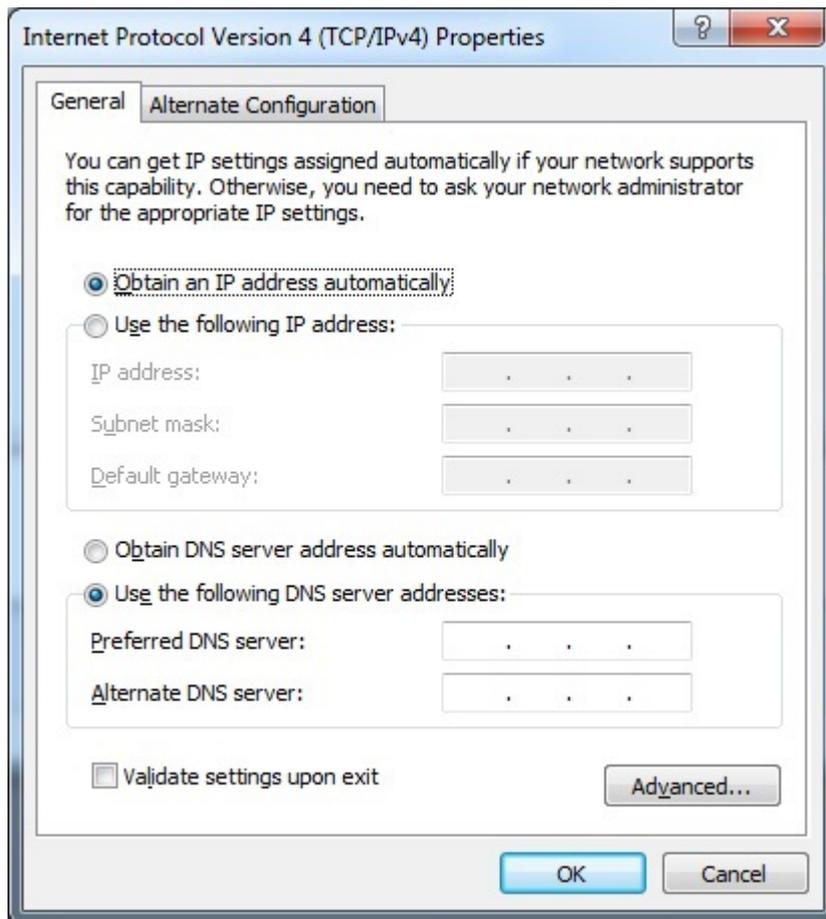
If DHCP is to be used, it is mandatory that the network adapter settings are set to DHCP mode, too. To verify these settings, right-click onto the "Local Area Connection x" item, then selecting the "Properties" item.

An input mask is opening:



-> Select "Internet Protocol Version 4 (TCP/IP)" and press the "Properties" Button.

An input mask is opening:

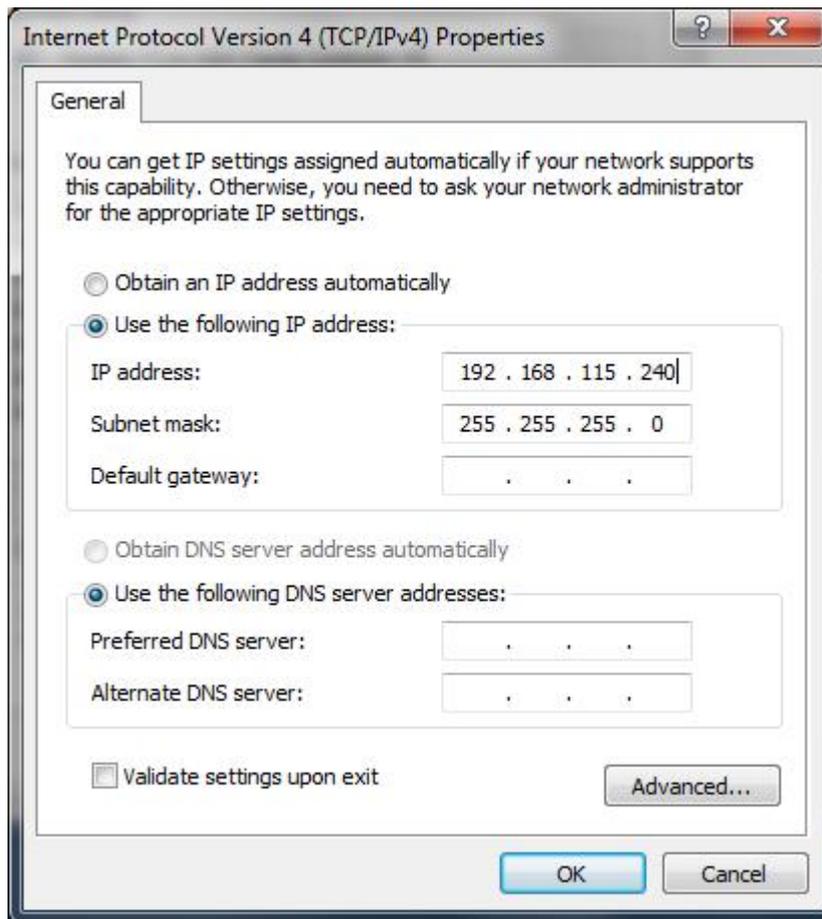


-> **Select "Obtain an IP address automatically".**

3.3.2 IP configuration without DHCP

If the built-in DHCP server of the Irinos-System shall not be used, it can be [switched off](#)^[33] by means of the Irinos Tool.

If no DHCP server is used, the IP settings of the network adapter need to be configured manually. An example is given below.



--> **Select "Use the following IP address".**

Then enter IP address and Subnet mask:

Subnet mask 255.255.255.0 is recommended

The IP address needs to be in the same subnet as the device. For example, if the subnet mask is chosen as above, the IP address may be in the range from

192.168.115.1

..

192.168.115.254.

However, it must be different from the one that is used in the Irinos master box.

The settings for the Default Gateway may be left blank. The same applies for the DNS settings.

Finally press "OK" to adopt these settings.

The IP address of the Irinos master box is set in the MSC.cfg file. This file can be [generated automatically](#)^[37] using the Irinos-Tool.

Irinos-Tool

4 Irinos-Tool

4.1 General

The Irinos Tool provides a set of utilities which support installation, interconnection and start-up of the Irinos system. It is used to [discover and identify](#)^[32] Irinos-Systems in an IP network and to [configure network settings](#)^[33].

It supports [connection establishment and verification](#)^[37], [inventory visualization](#)^[40], [measuring channel modifications](#)^[39], [basic functional tests](#)^[44] and [firmware updates](#)^[50].

Furthermore it is gathering information from the master box and [generates appropriate configuration](#)^[37] files needed for the measurement system.

4.2 Installation

The Irinos Tool is delivered as a self-extracting compressed archive. To install, double-click onto the archive-file and select a **writeable file location** on your disk (referred to as 'YourFolder' in this document). It is advisable to create a shortcut for the executable file ITool.exe in YourFolder/ITool/source_XE8) and move this shortcut to the windows desktop.

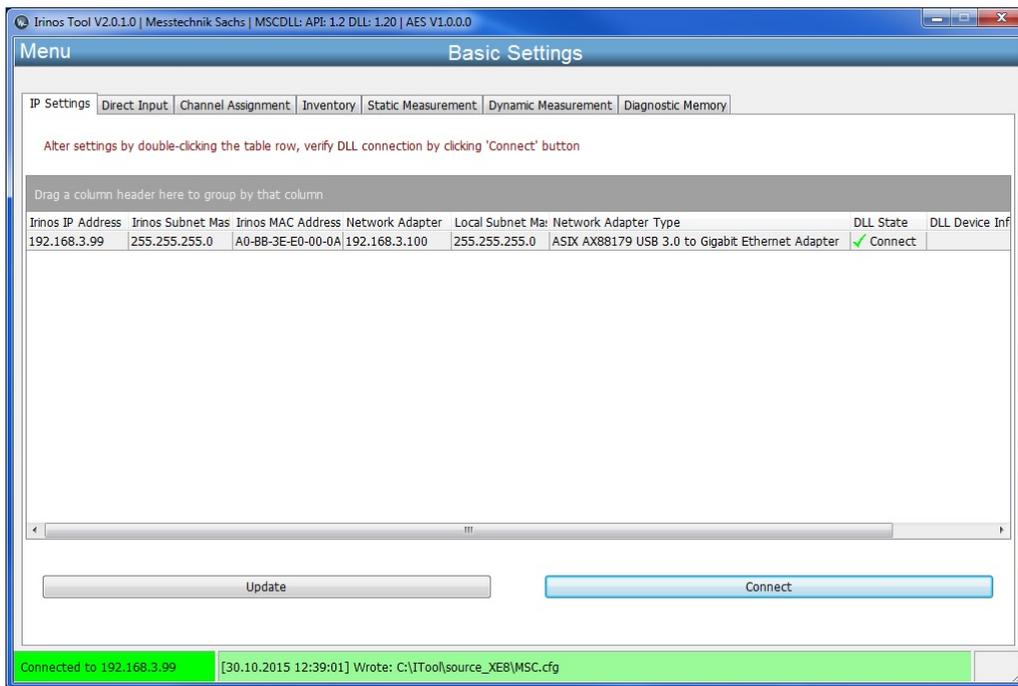
When the Irinos Tool is started the first time, a Windows **firewall security alert** will pop-up and ask for an access decision. Please press '**Allow access**'.

4.3 Starting the Irinos-Tool

The Irinos V2.0 Irinos Tool is started by a double click on the desktop shortcut created during [installation](#)^[32].

During startup the Irinos Tool software is querying all activated network adapters and sending broadcast messages to the attached network. Any Irinos box connected to the network is responding with an appropriate response message.

Thereby, the Irinos Tool is able to present a list of all found boxes in the network right after start-up. Typically only 1 Irinos-System is found:



Startfenster des Irinos-Tools

Each table row represents one Irinos master box and contains

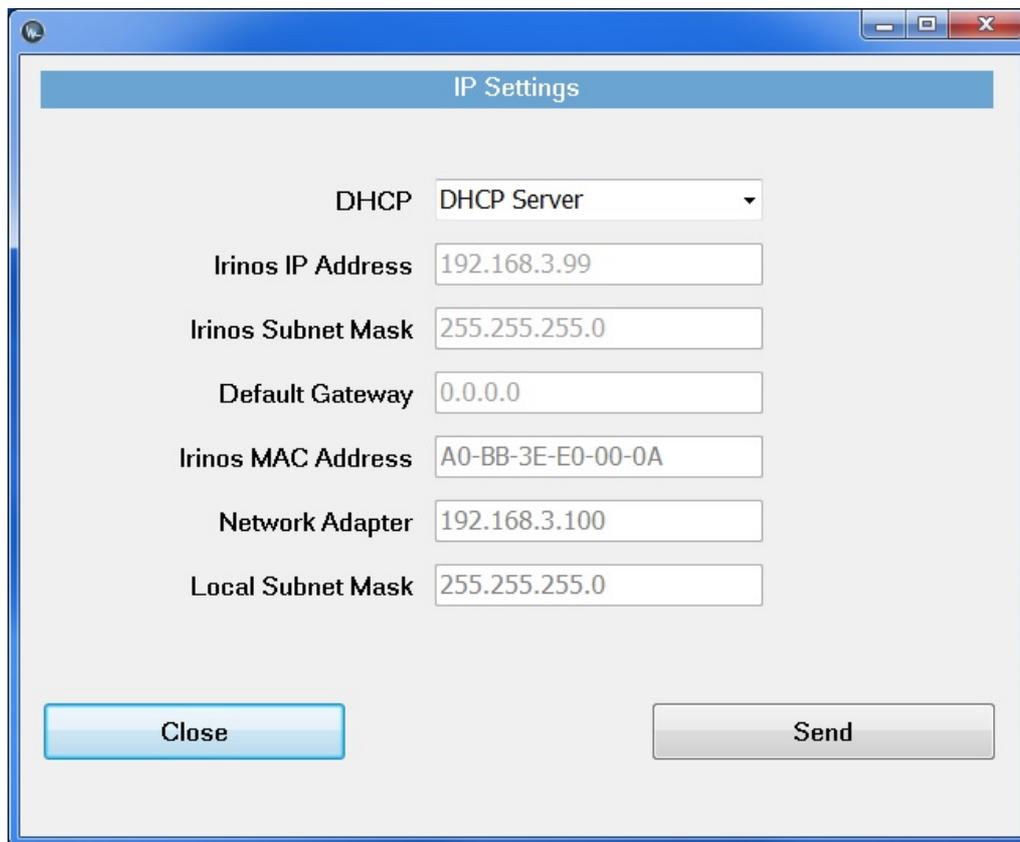
- Irinos Box IP Address
- Irinos Box Subnet Mask
- Irinos Box MAC Address
- IP Address of the network adapter the box is connected to
- Subnet Mask of the network adapter
- Network adapter type.

Changes within the network can be obtained by pressing the "Update" button.

4.4 IP configuration

As the Irinos boxes are delivered with an activated DHCP server, in most cases there will be no need to alter the IP configuration.

If the IP configuration needs to be changed, a double-click on a particular row in the main window will open the IP Settings window. Initially the window will open up as shown below, with an active DHCP server.

--> Setting DHCP: DHCP Server

IP Settings

DHCP DHCP Server

Irinos IP Address 192.168.3.99

Irinos Subnet Mask 255.255.255.0

Default Gateway 0.0.0.0

Irinos MAC Address A0-BB-3E-E0-00-0A

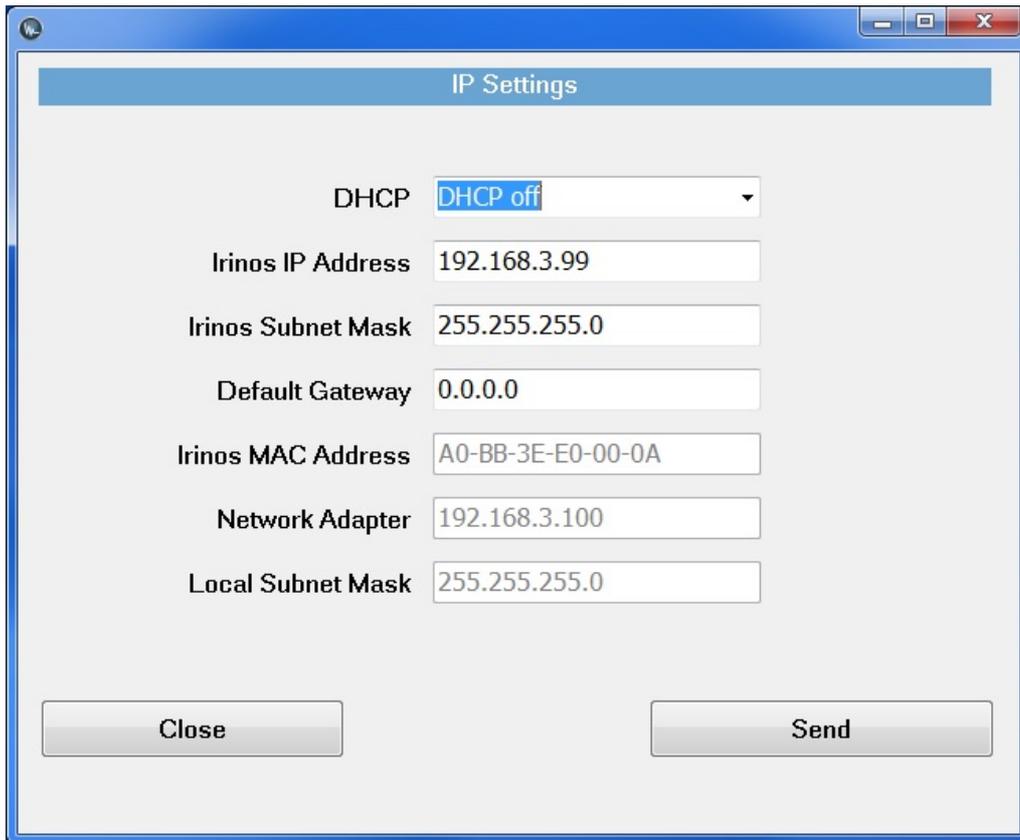
Network Adapter 192.168.3.100

Local Subnet Mask 255.255.255.0

Close Send

If the DHCP setting is altered to "DHCP off", the window will enable input fields for

- Irinos IP Address
- Irinos Subnet Mask
- Default Gateway



The screenshot shows a window titled "IP Settings" with the following fields and values:

Field	Value
DHCP	DHCP off
Irinos IP Address	192.168.3.99
Irinos Subnet Mask	255.255.255.0
Default Gateway	0.0.0.0
Irinos MAC Address	A0-BB-3E-E0-00-0A
Network Adapter	192.168.3.100
Local Subnet Mask	255.255.255.0

Buttons: Close, Send

The Irinos MAC address and the [local computer's network adapter IP address and subnet mask](#)^[27] are shown for guidance reasons only and cannot be modified here.

Now IP Address, Subnet Mask and Default Gateway may be entered according to the requirements of the customer network.

Before the settings are sent towards the Irinos System, several consistency checks are executed:

- Illegal IP addresses such as 127.0.0.1, 127.0.0.0, 255.255.255.255 are refused.
- Does the chosen IP address match the subnet of the local network adapter ?
- Is the chosen IP address the same as the local network adapter IP address ?
- Is a standard IP range used (10.0.0.0 to 10.255.255.255, 172.16.0.0 to 172.31.255.255, 192.168.0.0 to 192.168.255.255)

Illegal IP addresses cannot be sent, any other setting can be used after the user has explicitly confirmed his choice.

After the configuration settings were sent to the Irinos-System, it performs a reset. While executing the reset, the appropriate table row in the main window may disappear, if the update button is pressed within this time period. After approximately 10 seconds the Irinos-System is reachable again. Anew pressing the update button is causing the appropriate table row to show up again. If the Irinos-System setting had been modified, the new settings are now being displayed in the table row.

4.5 Direct IP settings

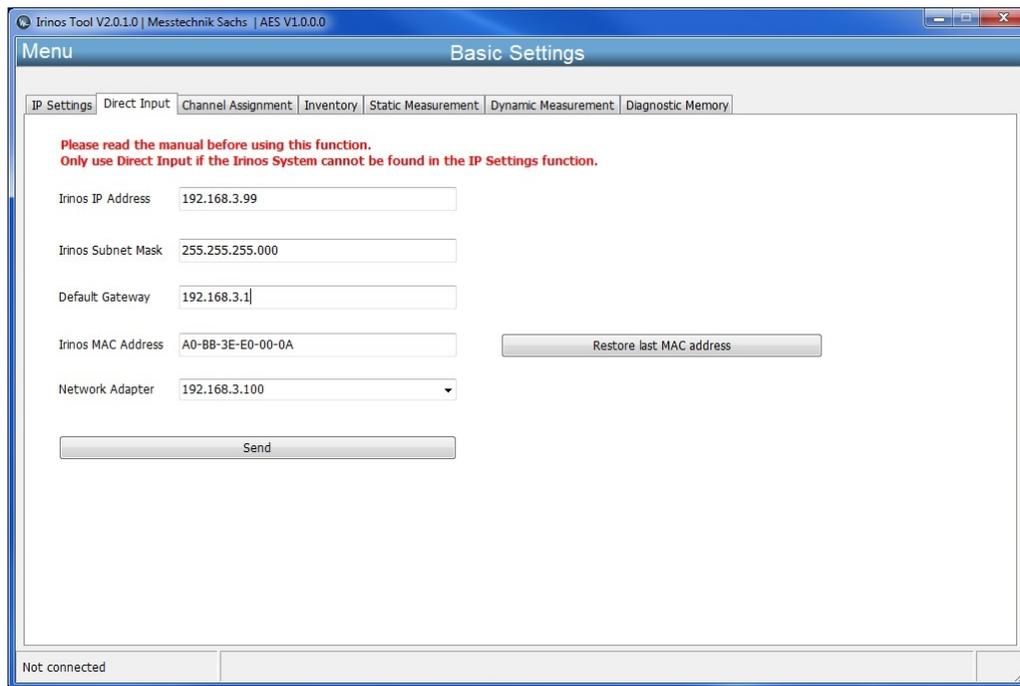
The Direct Input function is ***not needed for normal operation***. It can be used to specify IP setting directly, without picking the Irinos box from the main window list. Moreover, it requires the user to specify IP address and MAC address accurately and, if more than one, select the network adapter the Irinos box is connected to.

This function is intended for cases, where an Irinos box is not showing up in the main window although connected to the computers network adapters. This might be the case when it has been configured with an IP address which is not part of the subnet of the network adapter.

If so, the box can be reconfigured by directly entering the desired IP address and the MAC address of the box. If several network adapters are present, the appropriate network adapter needs to be selected as well.

It is possible to retrieve the last MAC address used for configuring the IP settings of a box. This is done by the "Restore last MAC address" button

By pressing the send button the IP settings are broadcasted to the network attached to the selected network adapter. If there is an Irinos box listening to the given MAC address, it is going to alter its IP address to the one specified, and performs a reset. Once it has recovered from reset, and the new IP address is part of the subnet, it is displayed in the main window again, upon pressing the update button.



4.6 Checking the connection via the MscDll

To interface any kind of measurement software with the Irinos-System, a dynamically linked library (DLL) named "MscDll.dll" is provided with the Irinos system. This DLL contains basic discovery and access methods to connect to the Irinos box and to establish measuring channels between measurement system and local host computer.

For that reason it is recommended to verify these communication principles before continuing with the final measurement software.

First, as a pre-requirement for communicating with the Irinos box, the IP address of the Irinos master box has to be set in the DLL's configuration file "MSC.cfg". From this file the IP address is read by the DLL during start-up.

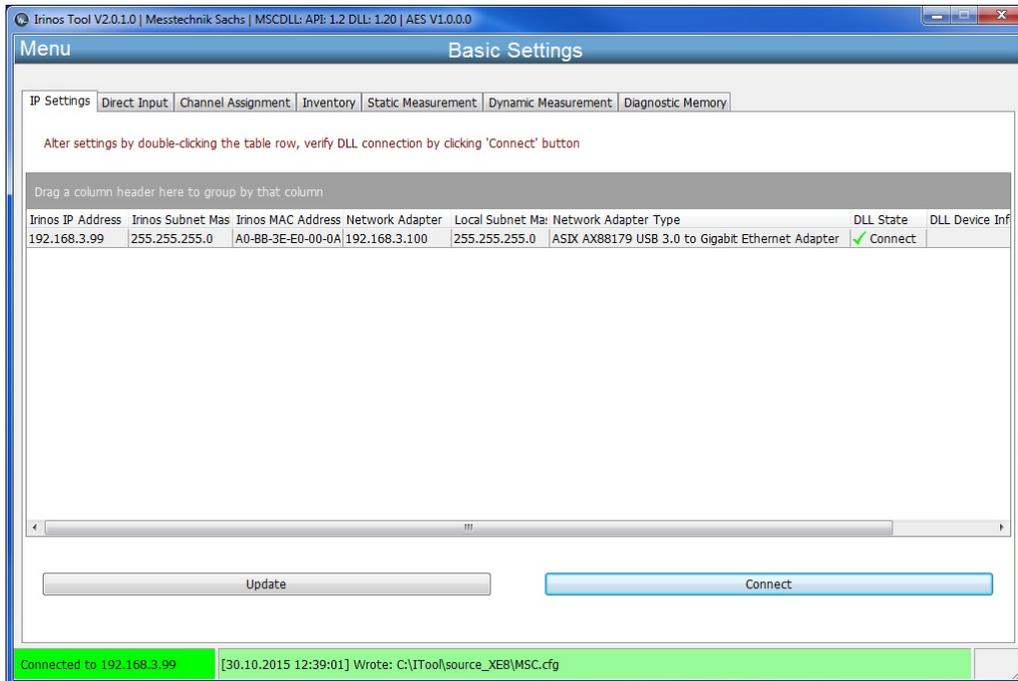
The process of writing the IP address to the configuration file is done automatically by the Irinos Tool, whenever the DLL Connection Verification is started.

Triggering the connection check is done by selecting the appropriate table row and pressing the 'Connect' button.

If the connection check turns out ok, the "DLL State" column is showing a green tic followed by a "Connect" indication. Additionally the DLL Device Info, as returned from the DLL, is inserted into the last column of the table.

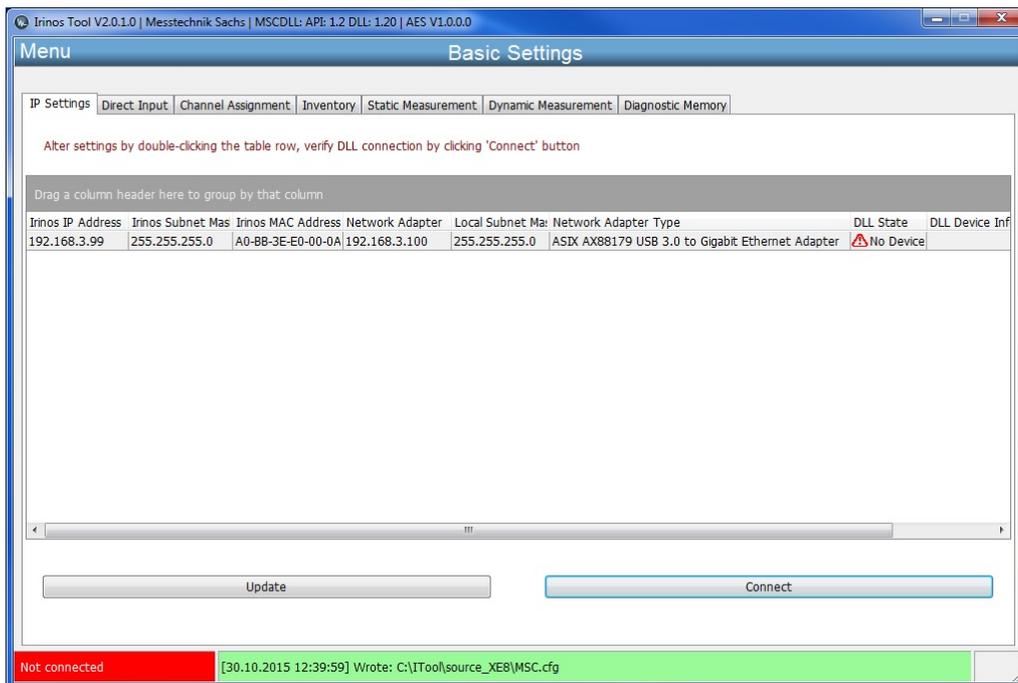
Second, the connection status is shown at the bottom status bar by a green field displaying "Connected to box- ip- address".

Third, the next field of the bottom status bar indicates the location of the DLL configuration file "MSC.cfg" at the disk and the date/time it was written.



If the connection check fails, the "DLL State" column is showing a red error sign followed by the error reason, as delivered by the DLL while trying to access the box. The connection status at the bottom status bar indicates "Not connected".

Regardless of the result of the connection check, the location of the DLL configuration file "MSC.cfg", is depicted in the second field of the bottom status bar.



Reasons for an unsuccessful connection check may be

- No physical connection
- Network adapter not enabled
- No power at the Irinos box

4.7 Channel Assignment / Selecting incremental input type

The Channel Assignment function of the Irinos Tool retrieves the measuring channel structure of the Irinos system. The channel assignment is generated by the master box directly after power-on.

It reflects the interconnection of the Irinos boxes and their respective measuring channels. Each single box contributes a certain amount of channels to this structure.

Incremental encoders are characterized by the type of signal they provide at the encoder interface. Two interface specifications are commonly used:

- Encoders providing sinusoidal 1 Volt peak-to-peak signals (referred to as '1Vpp' types) and
- Encoders delivering a square-wave TTL/RS422 signal (referred to

as 'TTL' types).

According to the type of the encoder, the corresponding Irinos box needs to be preset with the encoder types to be operational. These pre-settings are configured as factory defaults, either 1Vpp or TTL for all channels of a box.

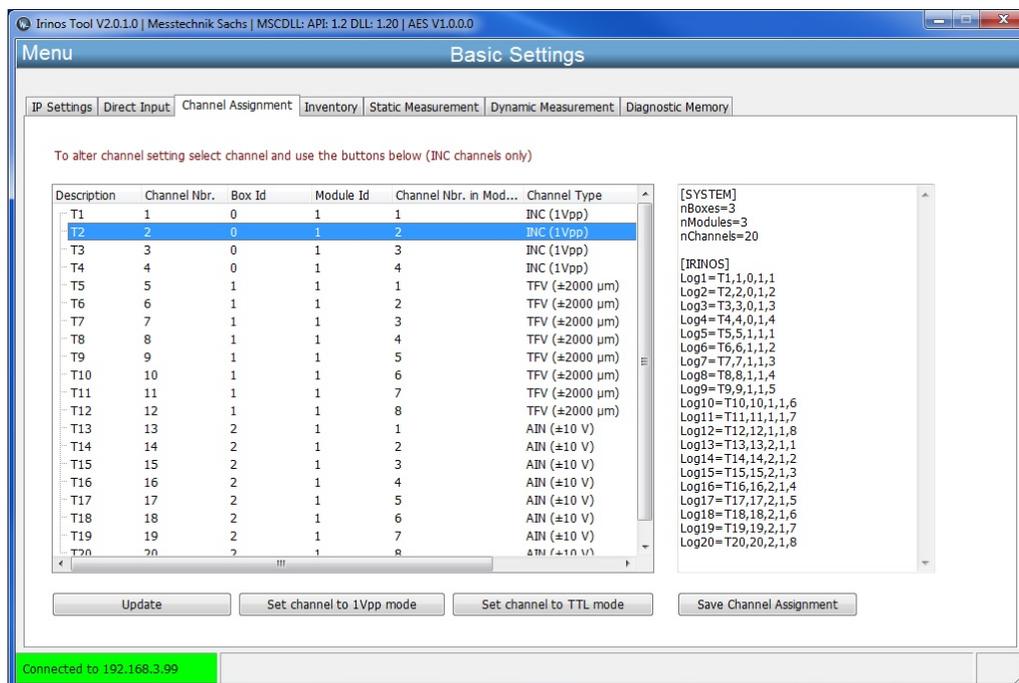
The user might want to alter this setup, for instance to adopt to a configuration which includes both types.

The graphical representation of the channel assignment, as displayed on the left-hand side of the function window, enables the user to alter these channel characteristic.

To modify this channel characteristic, select a channel by clicking the appropriate table row, then click one of the buttons

- Set channel to 1Vpp mode
- Set channel to TTL mode

Modifying a channel characteristic from given factory defaults enables the user to configure his own setup of 1Vpp and TTL channels as needed.

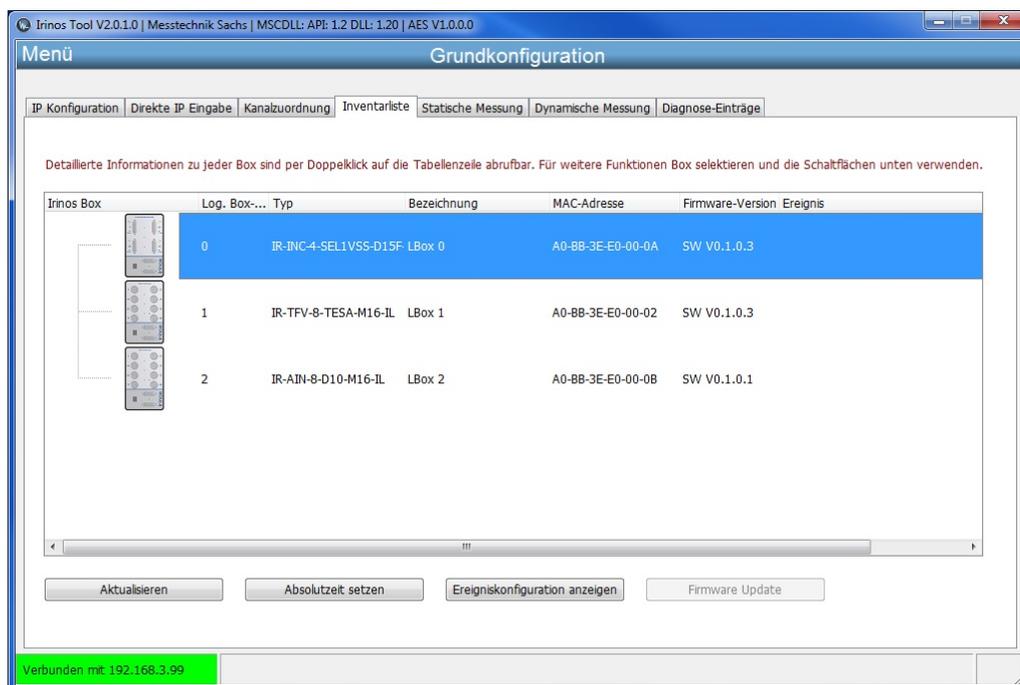


4.8 Inventory

The Inventory function of the Irinos Tool retrieves the structure of the Irinos system and displays the composition of boxes.

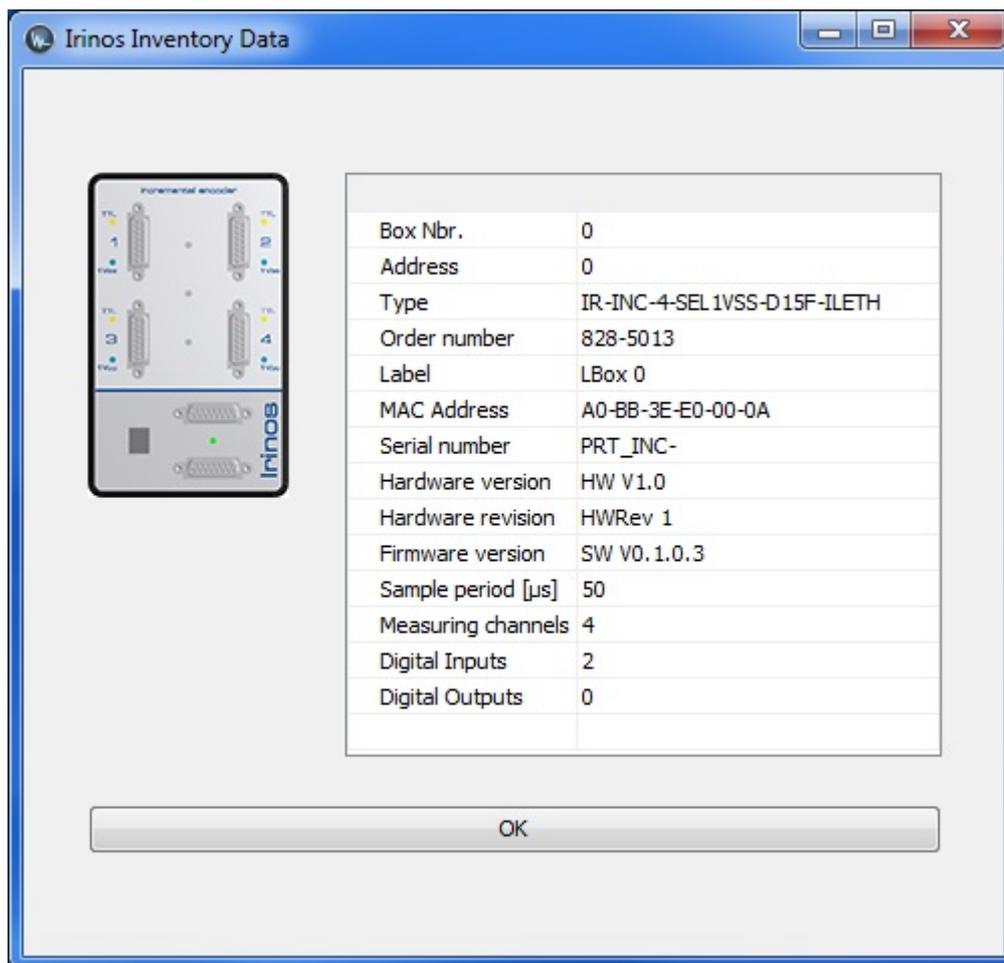
Additional module dependent data is displayed, such as

- Logical Box Number
- Box Type
- Box Label
- MAC Address
- Firmware Version
- Event (If any event is currently active in the box)



Changes can be obtained by pressing the "Update" button. However, any modification to the system setup, such as adding or removing boxes, requires a power-off-power-on cycle at the master box before it can be detected by the Irinos Tool.

By double-clicking the table row, detailed box data is displayed in a separate window:



The Inventory display serves as a basis for the functions

- [Set Time](#)^[42]
- [Firmware Update](#)^[50]
- [Event configuration](#)^[43]

All of those functions are accessible by selecting the appropriate table row in the Inventory display.

4.8.1 Setting date/time

--> *This function is only available for the Irinos Master-Box.*

By this function the current clock time and date is sent to the Irinos system. Thus, the Irinos system is able to generate an absolute time reference. The absolute time is held in the Irinos system until it is powered off or reset.

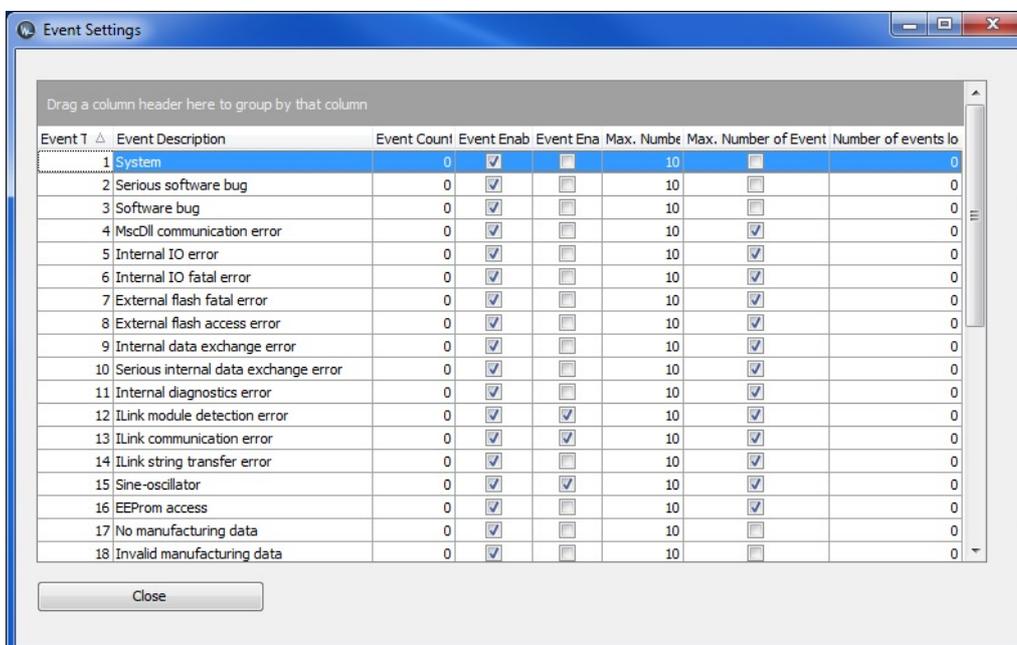
All upcoming events will be equipped with a time stamp on a clock time basis which enables an accurate correlation between event

occurrence and time of day.

Within the Irinos Tool, this function serves as a test and analysis resource. When used in measurement software this function should be used once a day to ensure sufficient time accuracy. See the MscDll reference manual for details.

4.8.2 Event configuration

The Event Setting window displays the event handling capabilities of the Irinos system per box. The Irinos System supports several configuration options regarding event handling. The behavior of some event types is user-modifiable. For each event type several configuration options are displayed:



Event Settings

Drag a column header here to group by that column

Event T	Event Description	Event Count	Event Enab	Event Ena	Max. Numbe	Max. Number of Event	Number of events lo
1	System	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input type="checkbox"/>	0
2	Serious software bug	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input type="checkbox"/>	0
3	Software bug	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input type="checkbox"/>	0
4	MscDll communication error	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
5	Internal IO error	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
6	Internal IO fatal error	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
7	External flash fatal error	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
8	External flash access error	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
9	Internal data exchange error	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
10	Serious internal data exchange error	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
11	Internal diagnostics error	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
12	ILink module detection error	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
13	ILink communication error	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
14	ILink string transfer error	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
15	Sine-oscillator	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
16	EEProm access	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input checked="" type="checkbox"/>	0
17	No manufacturing data	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input type="checkbox"/>	0
18	Invalid manufacturing data	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10	<input type="checkbox"/>	0

Close

Event Count	Number of event occurrences
Event Enabled	Event handling is generally enabled.
Event Enabled modifiable	Is the event handling user modifiable? I.e. is the user allowed to turn this event on and off?
Max. Number of Events	How often will this event be logged in the diagnostic memory.
Max. Number of Events modifiable	Is this value (Max. Number of Events) user modifiable? I.e. is the user allowed to alter this value from 10 (default) to any other value?
Number of events	Number of events of this type since system start.

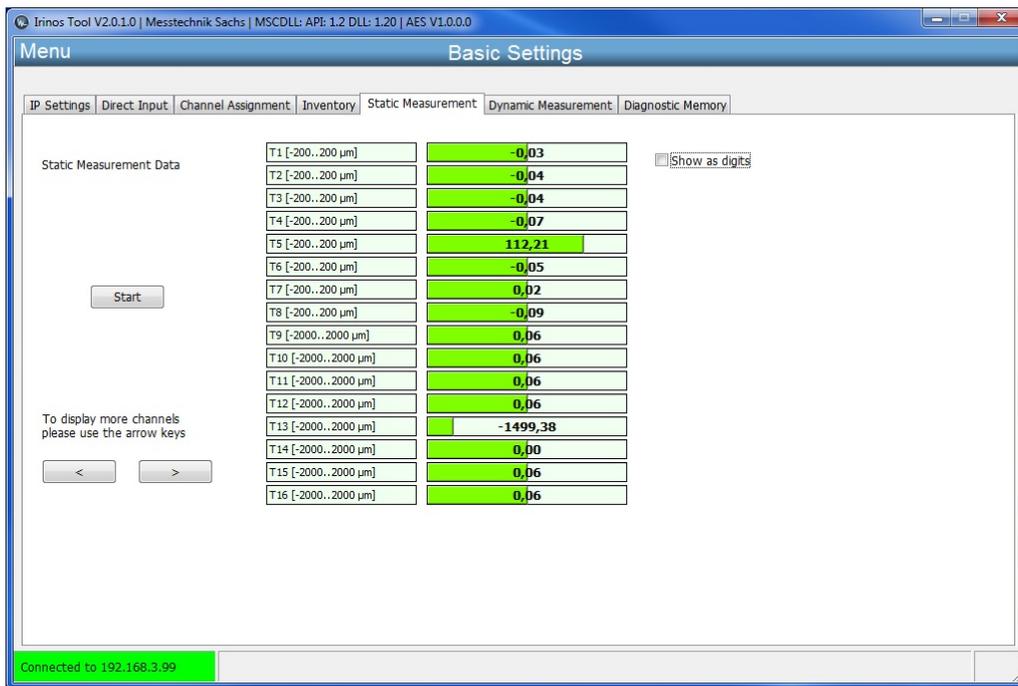
The Irinos Tool is intended **only to display these settings**. To actually modify these settings, please refer to the reference manual of the MscDll for the Irinos System.

4.9 Static measurement

The Irinos Tool provides a measurement display to check and analyze measurement data from each measurement channel.

Once started, it displays "live" data received from the Irinos system. Up to 16 channels are displayed simultaneously. If the system comprises more than 16 channels the user is able to switch to the next set of 16 channels by use of the arrow keys.

Furthermore, it is possible to alter the value display from digits to physical units (such as micrometers, volt, etc.) by means of a tick-box.



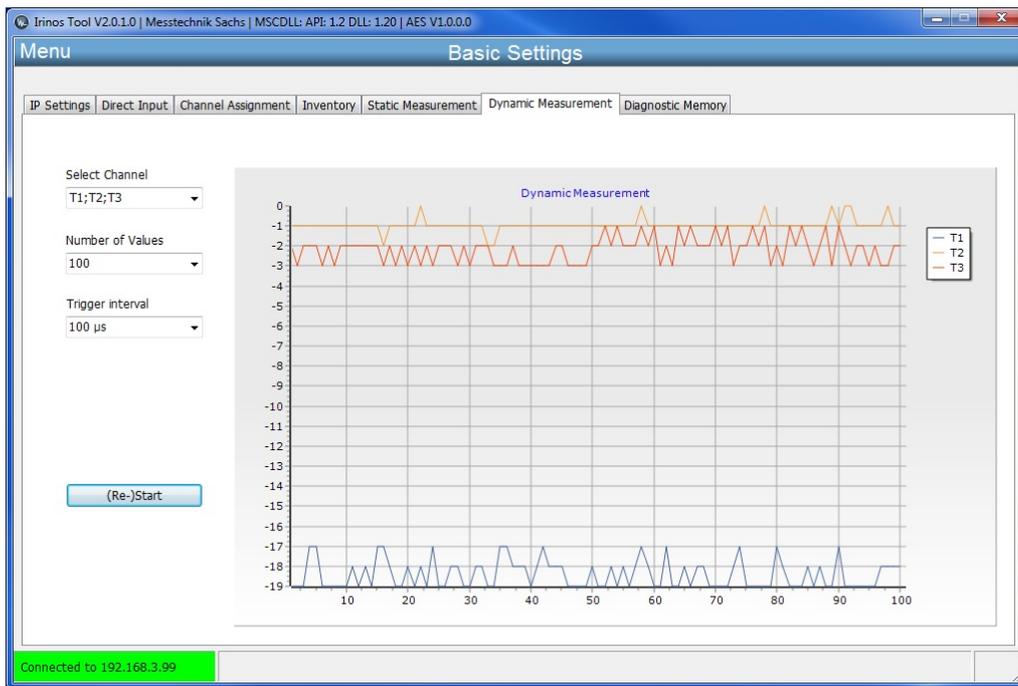
Static measurement is automatically set-up by [verifying the connection](#)^[37], as it is used as a timeout-monitoring function. Whenever the user directly enters the Static Measurement window, it might be necessary to start the static measurement by means of the "Start" button.

4.10 Dynamic measurement

Similar to the static measurement display, the Irinos Tool facilitates setup and verification of dynamic measurement.

To minimize configuration effort only time-triggered measurements are supported. The user only needs to select the desired channels, define number of measurement values and a timer trigger interval before he can start the dynamic measurement.

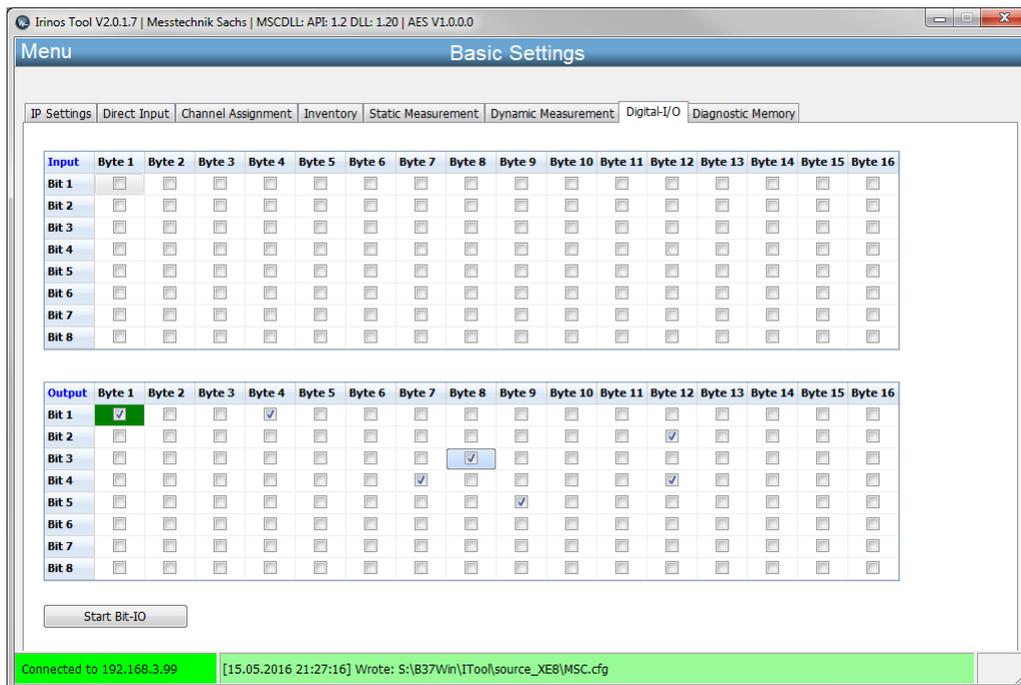
The channel selector offers a predefined list of channels for easy setup. However, it is possible to modify the list i.e. the user can add or remove channels on a textual basis, as long as the semicolon-separated format is retained (e.g. T1;T2;T3;T9).



4.11 Digital in- & outputs

Requires the IrinosTool version 2.0.1.7 or newer.

The tab Digital-I/O (Bit I/O) provides an online view for up to 128 digital inputs and allows changing the state of up to 128 digital outputs:



Digital in- & outputs

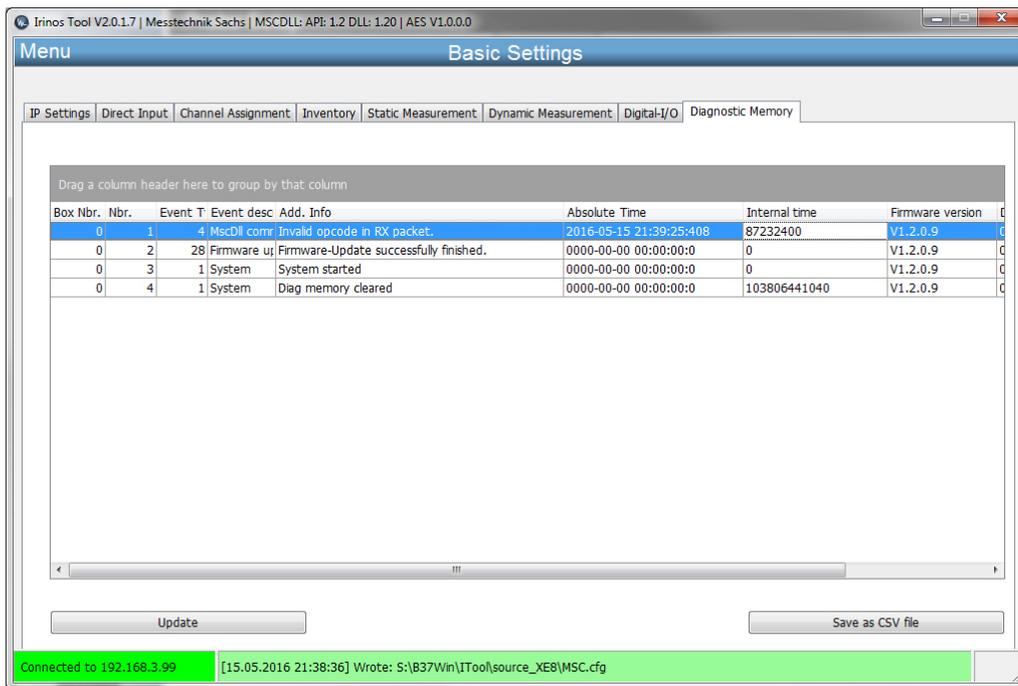
The table "input" shows the status of the digital inputs connected to the Irinos-System. A check-mark in the checkbox signals the high-level of the digital output.

The table "output" allows enabling or disabling digital outputs directly. If a checkbox is checked, the corresponding digital output will be set to high.

4.12 Diagnostic memory

For diagnostic reasons, the Irinos system gathers all events reported by the local firmware in a non-volatile event memory. Events can be visualized via the built-in web server, or alternatively upon request within the Irinos Tool.

Diagnostic events are displayed for the entire system, i.e. event data is gathered box by box and finally displayed as a system-wide view. Grouping and sorting of events is supported to facilitate easy cross-box event analysis.



The screenshot shows the 'Basic Settings' window of the Irinos-Tool V2.0.1.7. The window has a menu bar with 'Menu' and 'Basic Settings'. Below the menu bar are several tabs: 'IP Settings', 'Direct Input', 'Channel Assignment', 'Inventory', 'Static Measurement', 'Dynamic Measurement', 'Digital-I/O', and 'Diagnostic Memory'. The 'Diagnostic Memory' tab is active, displaying a table of diagnostic events. The table has columns for 'Box Nbr.', 'Nbr.', 'Event T', 'Event desc', 'Add. Info', 'Absolute Time', 'Internal time', and 'Firmware version'. The data is as follows:

Box Nbr.	Nbr.	Event T	Event desc	Add. Info	Absolute Time	Internal time	Firmware version
0	1	4	MscDll comm	Invalid opcode in RX packet.	2016-05-15 21:39:25:408	87232400	V1.2.0.9
0	2	28	Firmware up	Firmware-Update successfully finished.	0000-00-00 00:00:00:0	0	V1.2.0.9
0	3	1	System	System started	0000-00-00 00:00:00:0	0	V1.2.0.9
0	4	1	System	Diag memory cleared	0000-00-00 00:00:00:0	103806441040	V1.2.0.9

Below the table are two buttons: 'Update' and 'Save as CSV file'. At the bottom of the window, there is a status bar with the following text: 'Connected to 192.168.3.99' and '[15.05.2016 21:38:36] Wrote: S:\B37Win\ITool\source_XE8\MSC.cfg'.

A diagnostic memory entry has the followings attributes:

Box-Nbr	Number of the Irinos-Box: the event occurred at the Irinos-Box with this address.
Nbr	Event number (per Box)
Event Type	Event type (numerical value)
Event description	Event type as text
Add. Info	Additional information for the cause of the event
Absolut Time	Date/Time the event occurred (only available, if the absolute time has been set before).
Internal Time	Internal system time (ILink-Time, [μ s])
Firmware version	Firmware version at the time the event occurred.
Debug Info	Further information for manufacturer support.

Newly-created events can be obtained by the update buttons.

If required, the entire event data can be saved into a CSV file by pressing the "Save CSV file" button. After pressing the button a file selection dialogue is displayed. File name and location can be specified by the user.

4.13 Firmware update

4.13.1 Version numbers

The version number of the firmware consists of 4 parts, which are separated by a dot, e.g. V1.3.4.534. The meaning of the parts is:

Part of the version number	Meaning
1. Part, in the example: 1	"Major" version number It is incremented, if the firmware is completely redesigned (-> happens seldom).
2. Part, in the example: 3	"Minor" version number It is incremented, if new functionality has been implemented.
3. Part, in the example: 4	"Patch" It is incremented, if one or more bugs have been fixed.
4. Part, in the example: 534	"Build" Internal number for firmware identification.

In addition, firmware can be marked as "customer specific" or as "Beta version". A warning note is displayed before such a firmware can be downloaded. It must only be used after written notice by Messtechnik Sachs.

4.13.2 Executing the update

A basic feature of the Irinos Tool is to support firmware updates for the Irinos System.

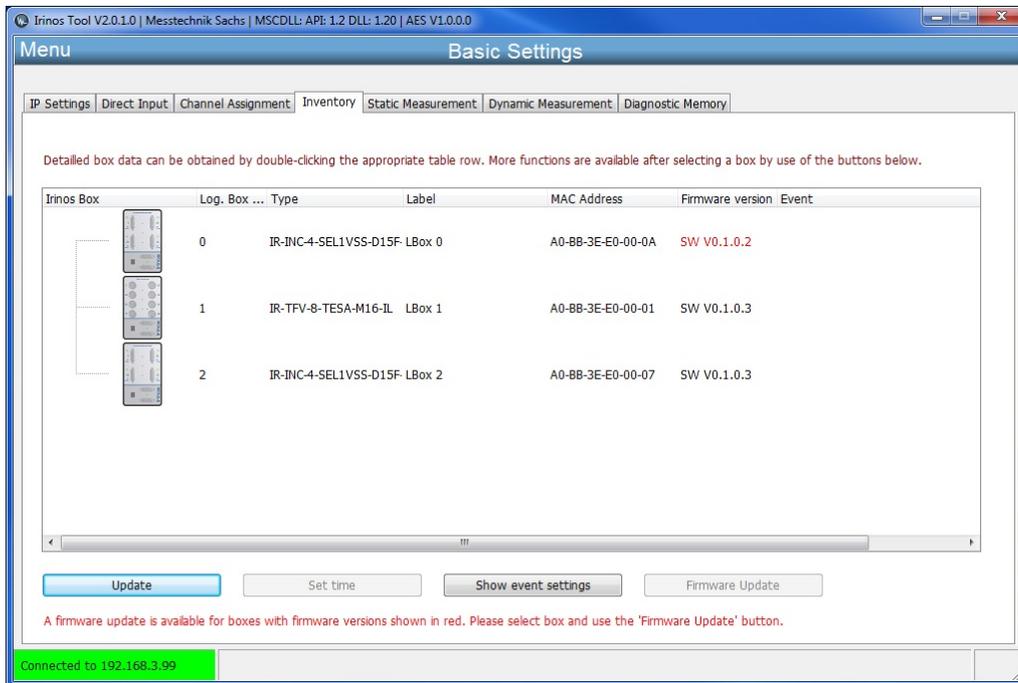
A firmware package is delivered by Messtechnik Sachs GmbH as particular type of file with the extension "SFF". Firmware Files are issued box type specific. I.e. a firmware package developed for an incremental encoder box can only be used for this type of box.

While setting up the Irinos Tool, a file folder "Firmware" is created in the "source_XEn" directory. Firmware files need to be put here to be found by the Irinos Tool.

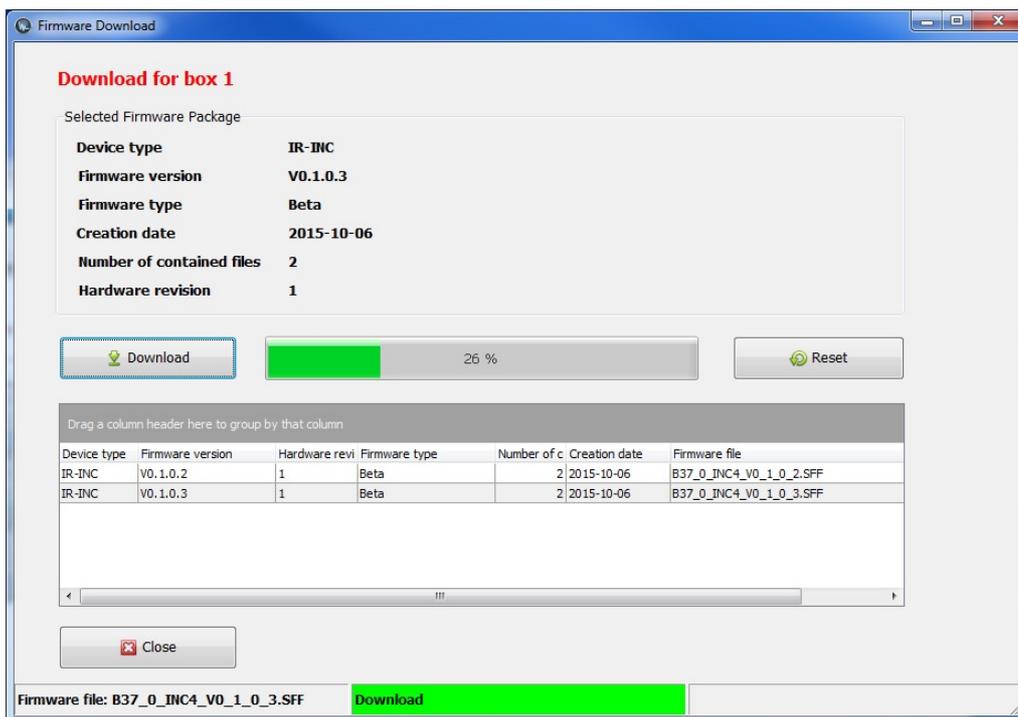
After the firmware files have been put there, the Irinos Tool needs to be restarted. During start-up the firmware files are read and evaluated.

If a new firmware package is found for a particular box type, the

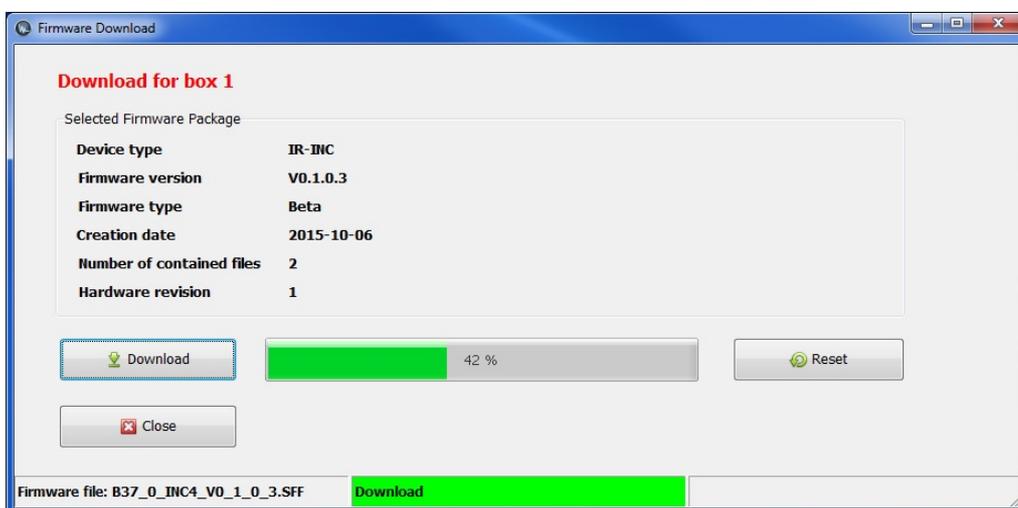
firmware version is highlighted in red in the Inventory window. Additionally, a hint is shown, indicating that a firmware update for those boxes is available. After selecting the appropriate box by clicking the table row, pressing the 'Firmware Update' button will open the firmware download window:



If more than one firmware package for a box type has been found, the Firmware Download window offers a selection table for the different firmware packages. Once the user has selected a package by clicking the appropriate entry, the download can be started by pressing the "Download" button:



If only one firmware package for the box type has been detected, the Firmware Download window automatically selects the package. The download can be started by pressing the "Download" button:



After all packages have been downloaded to the Irinos system, a system reset is required to activate the downloaded firmware. Pressing the "Reset" button sends an appropriate command to the Irinos system.

An internal algorithm ensures that slave boxes are reset first, before the master is resetting. This is necessary as the master always

requires slaves to be operational, when returning from reset.

4.14 Incremental channel diagnostics

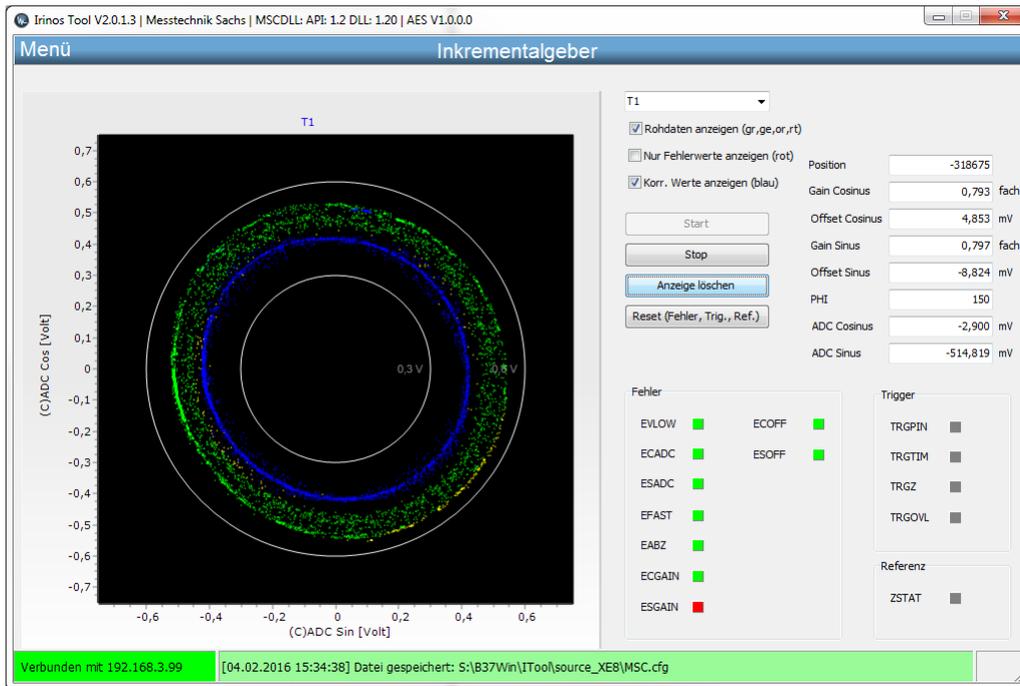
4.14.1 Live view (only 1Vpp)

If incremental encoders with 1Vpp interface are used, a high signal quality is required for an accurate and reliable position value. The incremental input channels of the Irinos-System are equipped with a sophisticated signal analysis. Therefore the Irinos-System is able to detect errors, where many other systems would deliver a possibly invalid position value.

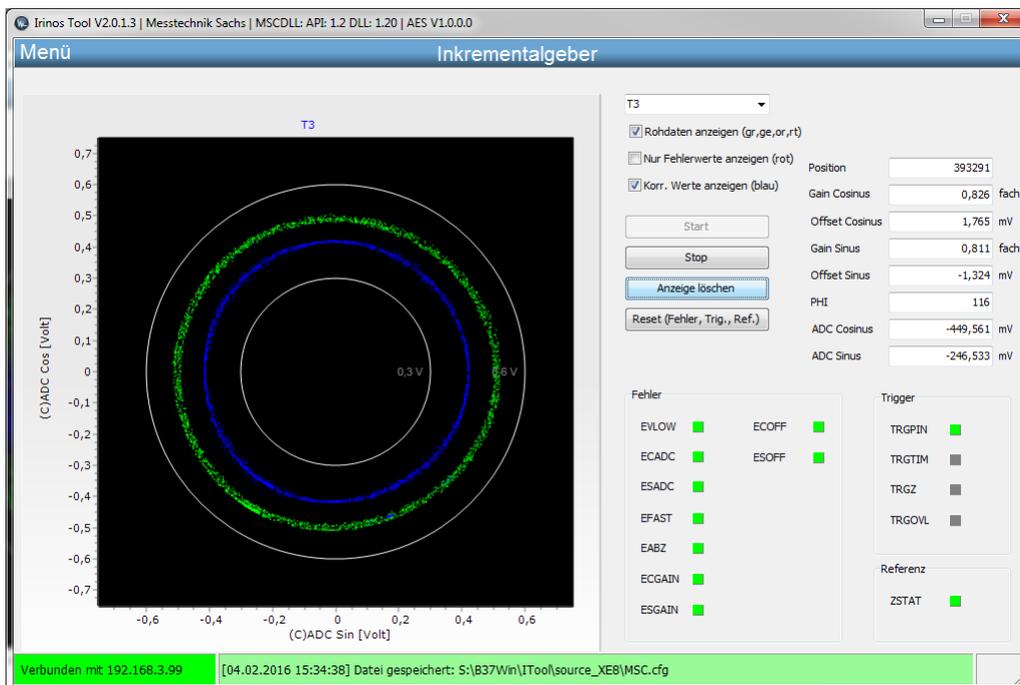
A signal level outside of the specified range may lead to an invalid position. The incremental channel will then provide an error flag in the hardware status. Further information can be found in the application notes in the users manual and in the MscDll reference manual (opcRHS).

The Irinos-Tool provides a live-view of the incremental encoder signals in a Lissajous diagram. In such a diagram, the signal level of the sine-signal is on the x-axis and the corresponding cosine-signal signal level is on the y-axis. If ideal signal levels would be available, a perfect circle would be the result if the encoder would move one electrical rotation. In reality such signals never exist.

The following examples show various signal levels:



Live view with unstable signals



Live view with very good signal levels

For technical reasons, the signals never exactly match the specified 1Vpp input level. Hence the Irinos-Box IR-INC has a tolerance range of 0.6Vpp .. 1.2Vpp.

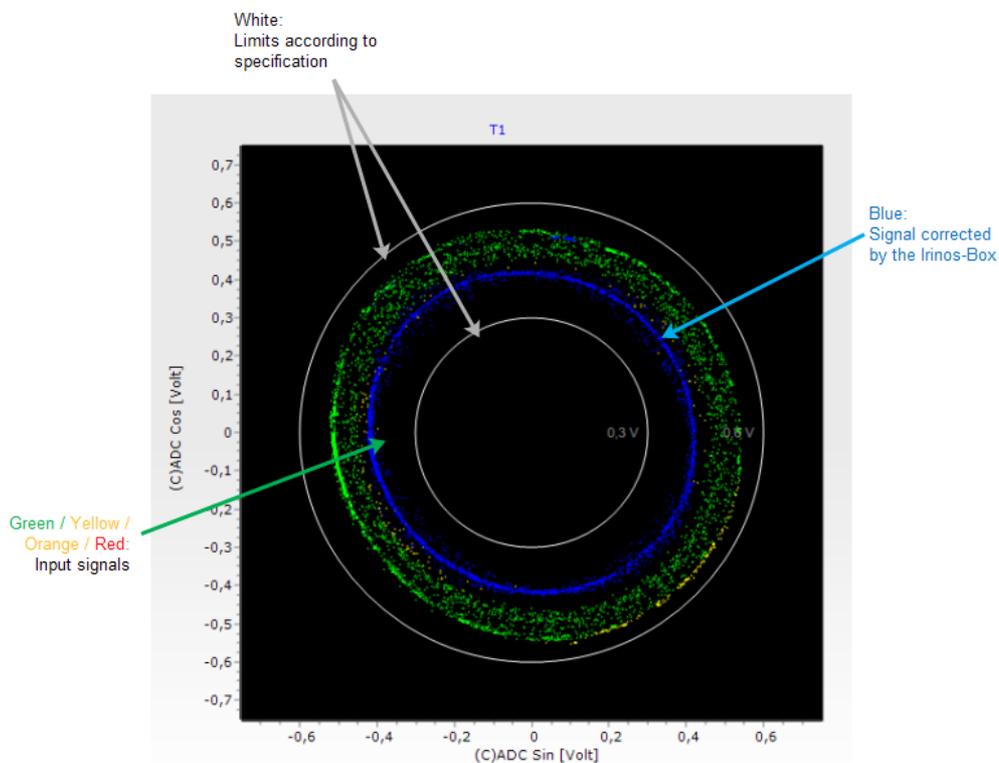
Lissajous diagram

The Lissajous diagram allows estimating the signal quality of the incremental encoder. Therefore the raw values are continuously requested from the incremental input channel of the Irinos-System. The live view can be started as follows:

1. [Connect](#)^[37] to the Irinos-System.
2. Open the Live view via Menu -> Incremental encoder.
3. Select the desired input channel (e.g. T3).
4. Press "Start".
5. Move / rotate the incremental encoder.

The resulting signal vector if the input signals ("raw values") will not be displayed. If the signal vector is next to the ideal signal level, it will be coloured green. The more it deviates, the more the colour changes to yellow, orange or red.

The inner and outer limits are displayed as a white circle.



Lissajous diagram

The Irinos-Box continuously corrects the input signal via its offset- and gain-control functionality. The corrected values are displayed in

blue. Most of the signal deviations can be corrected. However, if the signal levels become too low or too high, this is technically impossible.

This example diagram shows large deviations of the input signal. Most of the values are green, but some are yellow or orange. This diagram has been recorded during moderate speed. If the speed increases, it is likely that the input signals will be out of specification.

Numerical values

Next to the Lissajous diagram, the corresponding numerical values are displayed:

Position	<input type="text" value="-318675"/>	
Gain Cosinus	<input type="text" value="0,793"/>	fach
Offset Cosinus	<input type="text" value="4,853"/>	mV
Gain Sinus	<input type="text" value="0,797"/>	fach
Offset Sinus	<input type="text" value="-8,824"/>	mV
PHI	<input type="text" value="150"/>	
ADC Cosinus	<input type="text" value="-2,900"/>	mV
ADC Sinus	<input type="text" value="-514,819"/>	mV

Numerical values

Position

Measurement / position value of the incremental input channel

Gain Cosinus

Gain factor for the cosine signal. It is continuously updated by the internal gain control.

Offset Cosinus

Offset for the cosine signal. This value is continuously updated by the internal offset control.

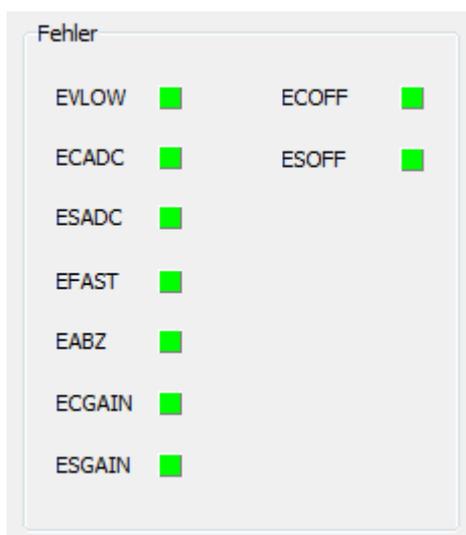
Gain Sinus

Gain factor for the sine signal. It is continuously updated by the internal gain control.

Offset Sinus	Offset for the sine signal. This value is continuously updated by the internal offset control.
PHI	Phase angle of the input signal. 0 -> 0° 200 -> 360°
ADC Cosinus	Analogue voltage measured at the cosine signal input. For an ideal signal, this value is in the range between -500mV .. +500mV.
ADC Sinus	Analogue voltage measured at the sine signal input. For an ideal signal, this value is in the range between -500mV .. +500mV.

Error

Different error statuses are displayed via the respective error bits (green = ok, red = error):



Error flags

Error-Flag

Reason

EVLOW	<p>The signal vector generated from the sinusoidal and cosinusoidal signals is smaller than 30% of the nominal amplitude. Usually, the cause is a partly or completely disconnected sensor.</p> <p>Another cause are input signals with a very large offset and a low amplitude at the same time.</p>
ECADC	<p>The A/D converter for the cosine signal is overdriven. The cause is that the signal amplitude is too high. This error may also occur with signals with very large offset at simultaneously high amplitude.</p>
ESACD	<p>The A/D converter for the sinusoidal signal is overdriven. The cause is that the signal amplitude is too high. This error may also occur with signals with very large offset at simultaneously high amplitude.</p>
EFAST	<p>The input frequency is so high that the direction can no longer be detected.</p>
EABZ	<p>Internal error flag, which is disabled for standard applications.</p>
ECGAIN	<p>The gain controller for the cosine signal has reached its limit. The cause is either that the signal amplitude is too low or the sensor is partly or fully disconnected.</p>
ESGAIN	<p>The gain controller for the sine signal has reached its limit. The cause is either that the signal amplitude is too low or the sensor is partly or fully</p>

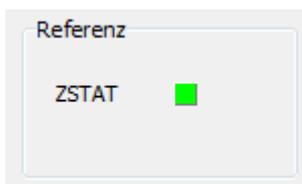
	disconnected.
ECOFF	The offset controller for the cosine signal has reached its limit. The cause is an excessive signal offset or a partly or fully disconnected sensor.
ESOFF	The offset controller for the sine signal has reached its limit. The cause is an excessive signal offset or a partly or fully disconnected sensor.

Please note regarding errors:

Because of the limited data bandwidth, the live view only shows a part of the available raw values. Therefore it may happen that an error occurs but no corresponding value is visible in the live-view.

Reference index

The Bit ZSTAT becomes enabled once the reference index has been crossed.



4.14.2 History (only 1Vpp)

Requires the IrinosTool version 2.0.1.7 or newer.

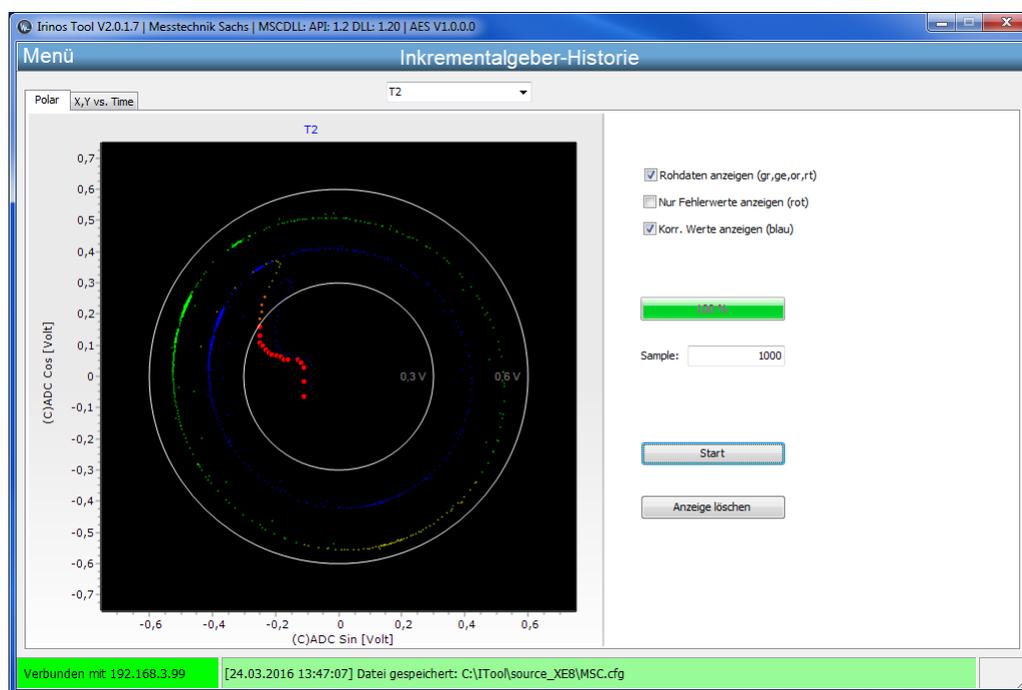
If incremental encoders with 1Vpp interface are used, the signal quality has a major impact on the reliability of the measurement system. If the signal levels are out of specification, this can lead to measurement errors, which are detected by the Irinos-System.

To get a better understanding, why an error occurred, the Irinos-

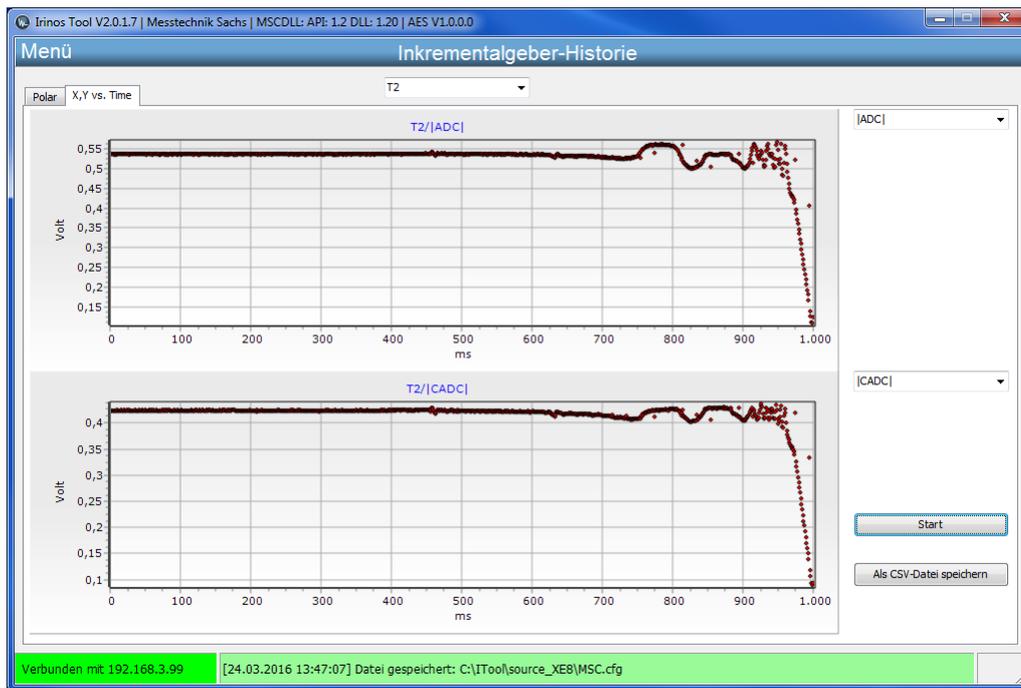
System stores the last 1000 signal values (-> 1 second) before the error. These can be readout using the incremental encoder history of the Irinos-Tool. Like in the [live view](#)^[53], they can be displayed in a Lissajous diagram. Alternatively they can be displayed over time.

The following screenshot shows an example of a Lissajous diagram (tab "Polar"). Similar to the live view, the measurement values are coloured according to the signal quality. Green ones are very good. If the signal quality becomes worse, they are coloured in yellow, orange or red (worst).

In the example, the final 16 values are displayed in red, showing a very poor signal quality.



Another possibility is displaying the values over time:



Two vertically arranged diagrams allow for a time-based correlation of different values. Via selection menus besides the diagrams, the values to be displayed can be selected:

- Absolute value of the ADC-Signals (corresponds to the signal vector)
- Absolute value of the corrected ADC signals (as shown in the example above)
- Sine value of the ADC signals
- Cosine value of the ADC signals
- Corrected sine value
- Corrected cosine value

In addition to this, the error flags can be displayed. The different error flags are listed in the [live-view](#) ⁵³ chapter.

- A -

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