

HARDWARE MANUAL

Expert Key – Installation and start-up



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Expert Key

Expert Key is Delphin's new product series for PC-supported measurement technology and test stand automation.

The entire functioning of an Expert device is incorporated onto a single circuit board, giving it an extremely compact format. Expert Key devices are equipped with both USB and network interfaces that can be used as required.

The fold-down **Expert Key L** model with plug-in screw terminals is for laboratory and experiment use. The **Expert Key C** model, with a robust metal housing, is intended for cabinet mounting. The **Expert Key M*** model, a measurement case, is equipped with flexible connection options.



Expert Key 100L
Expert Key 200L



Expert Key 100C
Expert Key 200C

The devices are supplied with ProfiSignal Go software for the quick-start of measurement and automation procedures. Functions range from data storage, both in record and continuous database format, right through to online and offline analyses and monitoring in trends. There are also functions for monitoring, alarm-management and data-export.

* Not illustrated

1 Device versions

Device versions input / output channels

Expert Key L	Expert Key 100L 	Expert Key 200L 
Expert Key C	Expert Key 100C 	Expert Key 200C 
Analog inputs		
Number	14	28
Power supply for RTD / Number	Yes / 4	Yes / 8
Temperature Reference Junction / Number	Yes / 1	Yes / 2
Analog outputs		
Number	2	2
Digital inputs		
Number	12 to 8	1
with counter function	2	1
Digital outputs		
Number	4 to 8	1
with PWM function	4	1

2 First steps

The *First steps* section contains information on standard delivery, safety information and system requirements.

The following pages provide further information on device functions and their operation.

Standard delivery

Please check that the delivery is complete:

- Device in tabletop housing with wall bracket, or device in metal housing
- Power supply connector with 3-pole screw connector (for tabletop housing only)
- USB cable (for PC connection)
- CD containing ProfiSignal Go software and all manuals in electronic format
- Introductory manual (hard copy)
- Thermocouple
- Screwdriver
- Two screws
- 5 x 50 W shunt resistors

Safety Advice

The device's connections (also internal) are operated at a voltage of $\leq 50 \text{ V}_{\text{DC}}$. This voltage is categorized as safe for human handling.

Only the external power supply has a 230V_{AC} or 110V_{AC} connection. Use only the delivered power supply connector with protective insulation.

The protective insulation is labelled as .

2.1 System requirements

The following hardware requirements are the minimum requirements to ensure problem-free operation of the **Delphin** products.

- **Operating System**
Microsoft Windows XP 32-bit, Windows Vista and Windows 7 in the 32-bit- or 64-bit versions,
either the English or German versions.
- **Main memory**
At least 1024 MB*
Recommended: 2 ... 3 GB for 32-bit systems, 4 ... 8 GB for 64-bit-systems
- **Monitor**
At least 1024 x 768 pixel, 96 dpi resolution
- **CPU**
A PC with at least 1.6-GHz*
Recommended: Systems with dual or 4-core processors from 2.5 GHz or greater
- **Hard disk**
for ProfiSignal-Go at least 70 MB of free hard disk space
for ProfiSignal-Viewer at least 70 MB of free hard disk space
for ProfiSignal-Klicks at least 500 MB of free hard disk space
for other ProfiSignal-- versions at least 200 MB of free hard disk space

2.2 Software installation

Install the CD **ProfiSignal Go**. Please ensure that the DataService Configurator is installed as a *Program* (and not as a *Service*).

Following installation from the CD of the program ProfiSignal Go the following icons will be displayed:

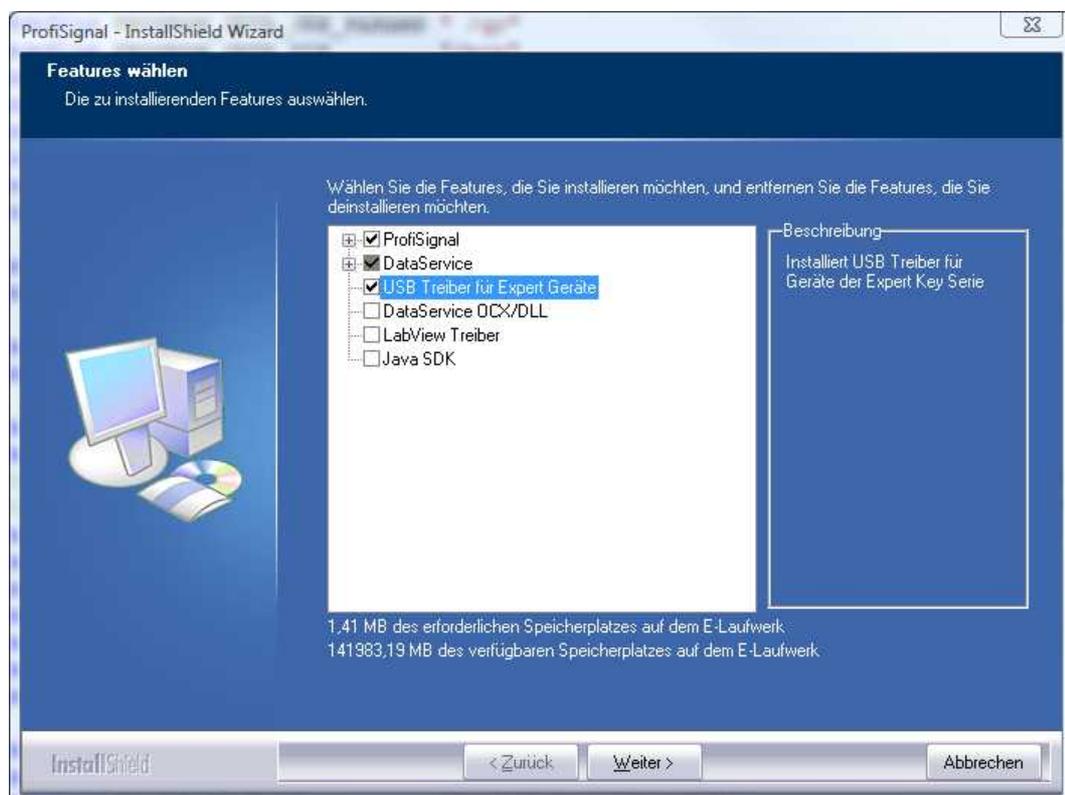


The **DataService Configurator** is a device driver and tool for configuring the Expert device (settings for sensor / actuator connections).

The **ProfiSignal** program provides evaluation and visualisation functions for measurement data.

USB connection

To connect the **Expert Key** via the USB, the USB driver needs to be installed via Setup. Select Setup *USB driver for Expert devices*. Connect the **Expert Key** device only after USB driver installation has been performed at a PC.



2.3 Power supply / Switching device on

The device operates with an external power supply in the 9...24 V_{DC} range. Power input is 6 W maximum.

Expert Key L:

Use the power supply connector to connect the device to the mains power supply.

Expert Key C:

Connect an external power supply to the device.

The device is now on. The blue *Power* LED lights.

After a few seconds the blue *Run* LED also lights. Pulsation of one second the LED indicates that the device is operating normally.

2.4 Connecting

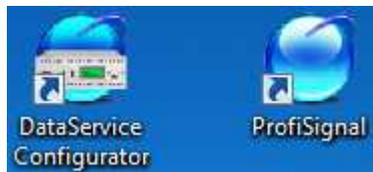
Cable connections to PC

Connecting device to PC.

Use either the supplied USB cable or network cable.

Create data link to device

Use the DataService Configurator program to create a data link to the device.
Select *Connections*.



1. USB connection



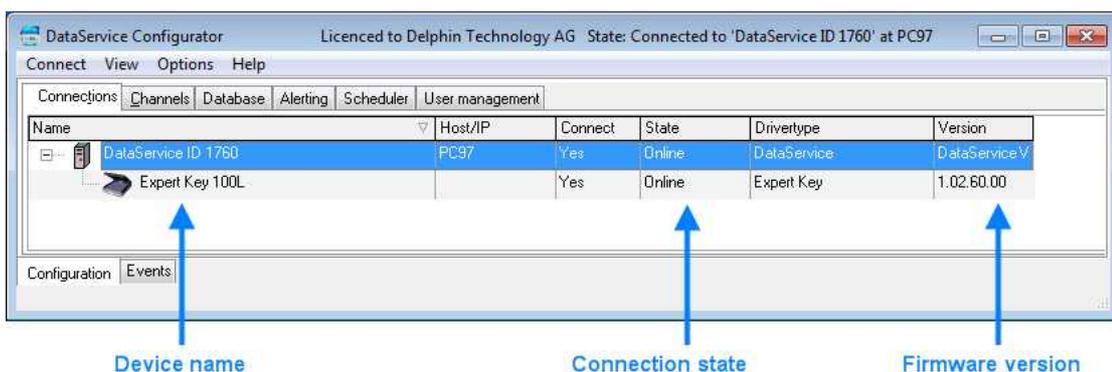
Info:

Ensure that the USB driver is installed before connecting device for the first time with a USB cable. The USB driver is installed during installation from the ProfiSignal CD (= V3.0).

Connect the device to the PC using the USB cable.

Data connection now takes place automatically.

A successful USB connection will then appear as follows:



Name	Host/IP	Connect	State	Drivertype	Version
DataService ID 1760	PC97	Yes	Online	DataService	DataService.V
Expert Key 100L		Yes	Online	Expert Key	1.02.60.00

Device name

Connection state

Firmware version

2. LAN connection

The device is supplied ex-works with the fixed IP address of 192.168.251.252.

The service is also DHCP activated.

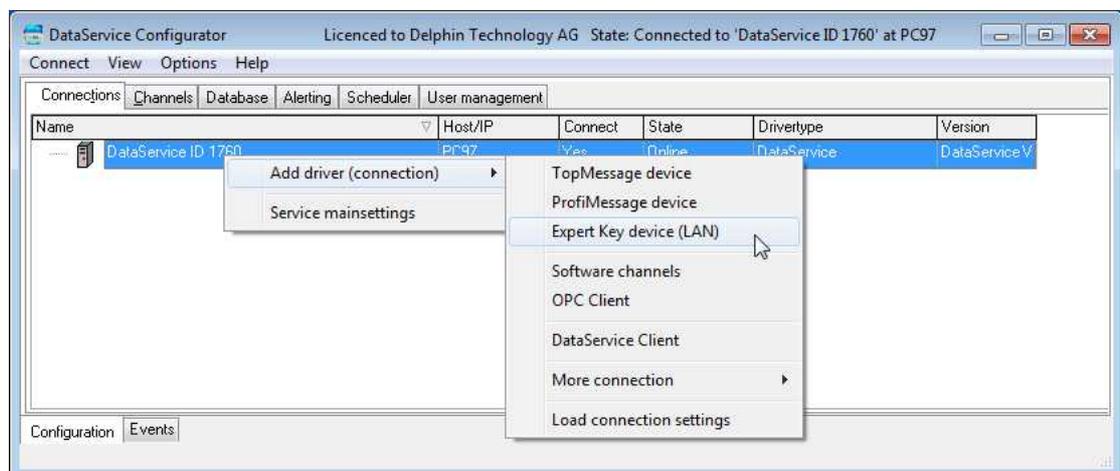


Info:

DHCP enables the automatic set up for a network participant. The new participant is then automatically assigned an available IP address.

Connect the device to the PC using a network cable (crossover cable) or via a network hub / switch (1:1 cable).

Select the *Connections* tab in the *DataService Configurator* ► *Context menu* ► *Add driver (connection)*

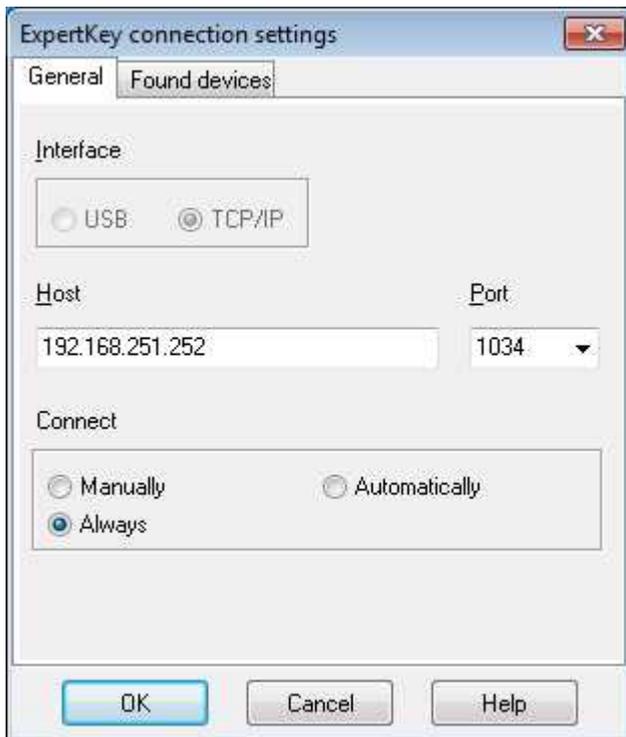


An available valid IP address is now assigned to the device by the (customer's) DHCP-server.

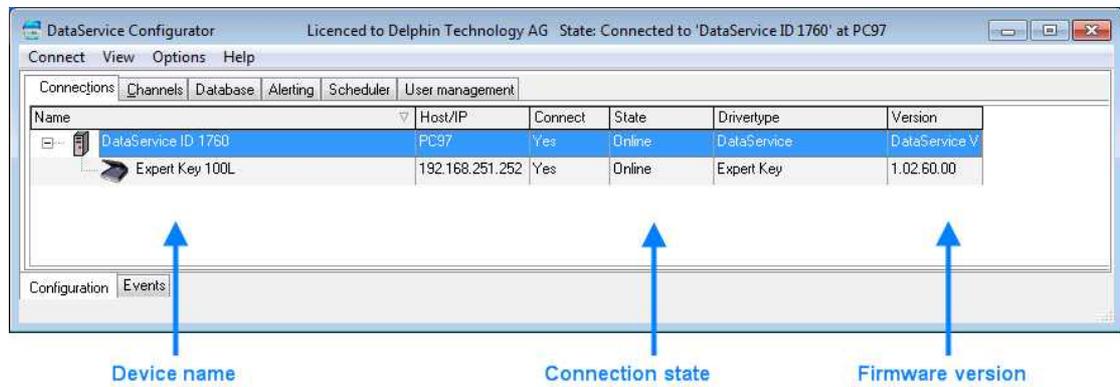
Select the device from ► Found devices



The IP address can be input manually.



A successful LAN connection will then appear as follows:



3 Expert Key L - Description

Opening



Power supply connection

The device operates with an external power supply with a range of 9...24 V_{DC}.

Maximum input is 6 W.



Use only with the supplied power supply connector.

The connector is suitable for mains supplies of either 230V/50Hz or 110V/60Hz. This range covers the European region. Versions are also available for regions with different connecting plugs.

3.1 Displays / LEDs

At the front:



Blue LED: Power

Permanently *on* during normal operation.

Indicates that the power supply (via external supply) is on.

Blue LED: Run

On in normal operation and pulsates at a rate of 1 s.

Indicates that the processor is operating normally.

Special situations:

The LED flashes at ca. 5 Hz during a firmware download / update.

Red LED: Error

Is *off* during normal operation.

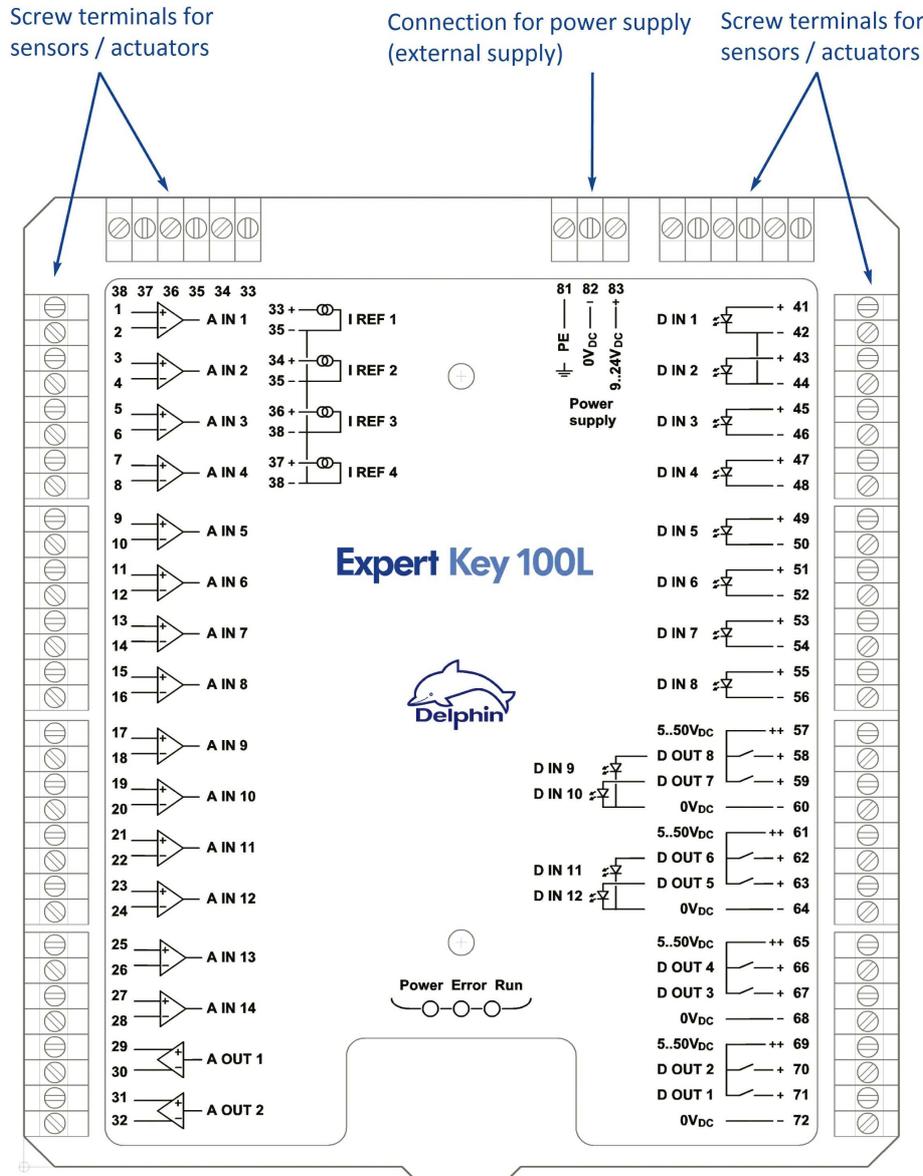
A short flash indicates a tolerable error has occurred.

The LED lights permanently when a serious error has occurred.

3.2 Connections

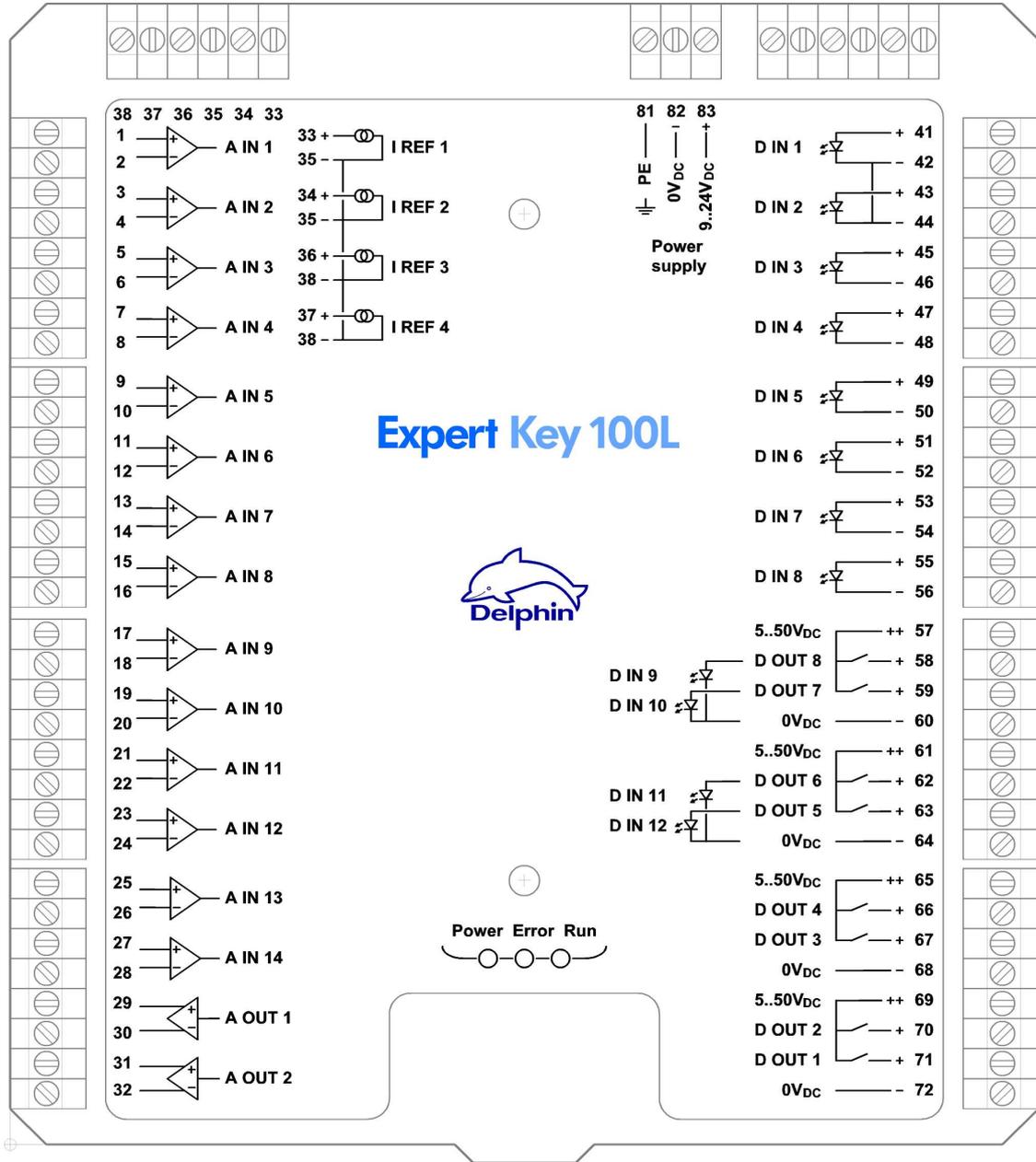


When the lid is opened, the following screw terminals are then accessible:

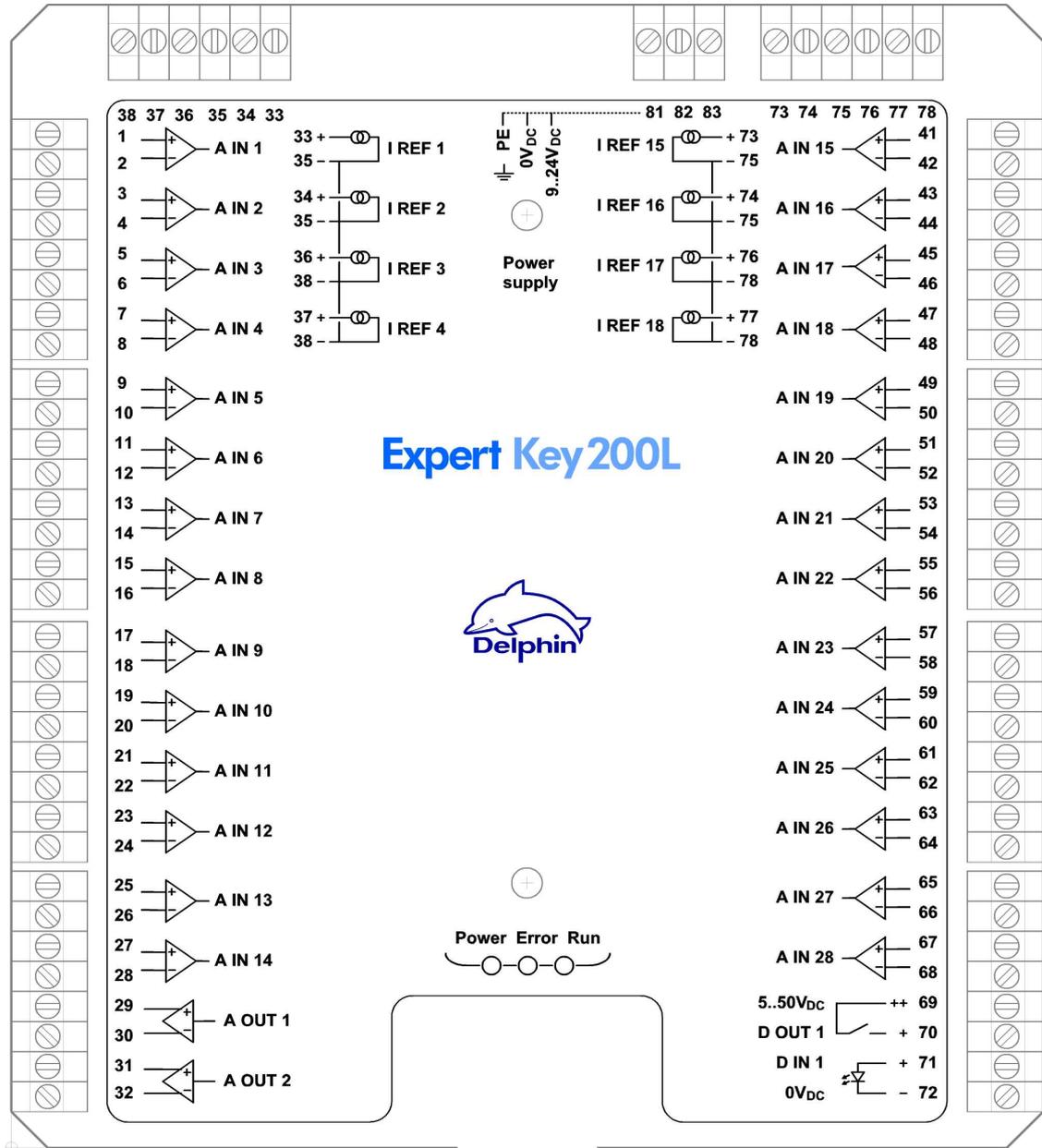


3.2.1 Connection information

Connection diagram Expert Key 100L



Connection diagram Expert Key 200L

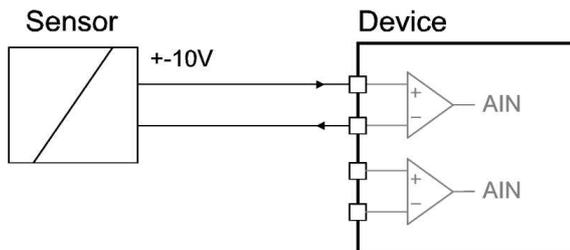


3.2.2 Connecting sensors

This section uses examples to give advice on connections.

1. Analog input sensor / voltage

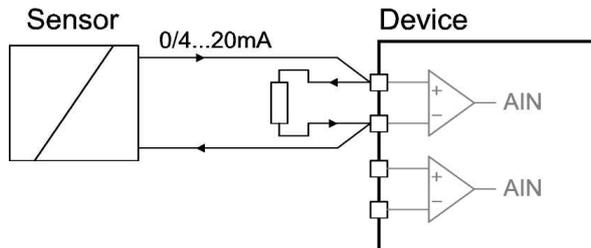
Sensors with voltage signals can be connected directly.

**Info:**

The largest measurement range is $\pm 10V$.
The smallest measuring range is $\pm 100mV$.

2. Analog input sensor / current, 20mA

For sensors with current signals, a load resistor is intended for the input terminals. The appropriate resistors can be supplied as accessories.

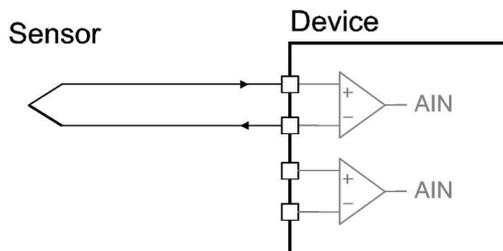
**Info:**

Load resistance must be in the range 10Ω to 500Ω .

3. Analog input sensor / temperature, thermocouple

Thermocouple-temperature sensors can be connected directly.

Any normal type of thermocouple can be used.

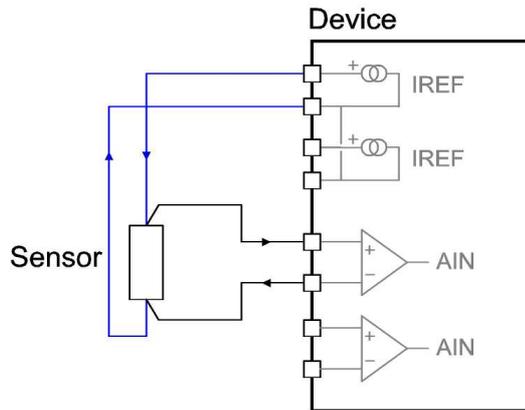
**Info:**

The required reference junction is integrated in the device. Refer to TRJ measuring point.

4. Analog input sensor / temperature, RTD

4-wire type RTD temperature sensors are recommended for connection.

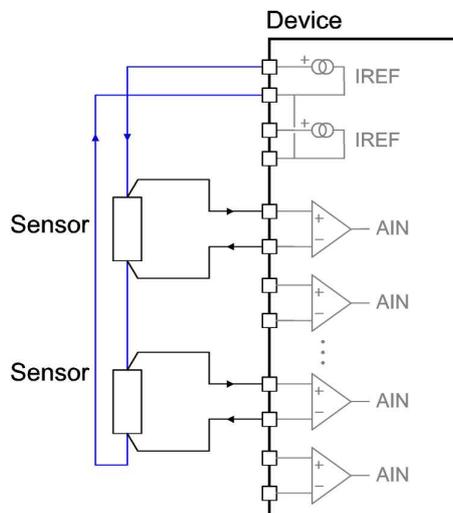
The device offers several sources for constant current.



Info:

Constant current is at 0.2 mA.
 The IREF1...4 constant current sources are assigned to the AIN1...4 analog inputs.

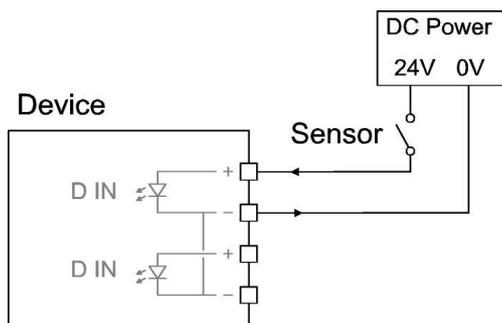
When connecting a series of sensors, there may be more sensors than available constant current sources. Source IREF1 is then assigned to the analog inputs AIN1, AIN5, AIN9, AIN13 and source IREF2 to the analog inputs AIN2, AIN6, AIN10, AIN14, etc.



5. Digital input sensor

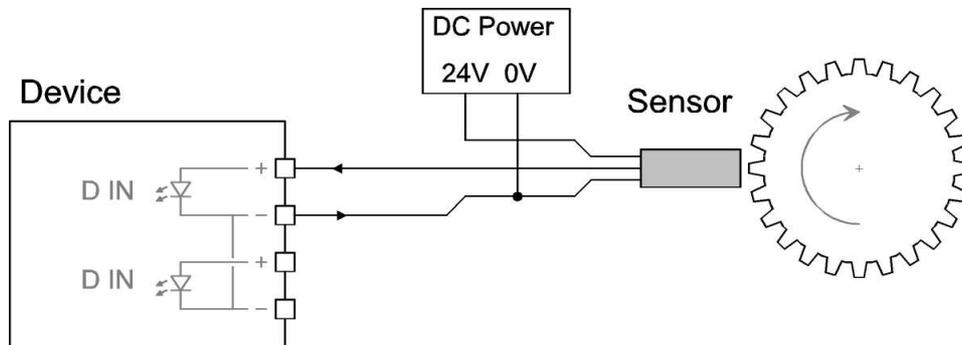
Specific digital inputs are intended for level detection, others for extra frequency measuring and counting.

a) Level detection



Info:

The input signal should be a right-angle signal.
The input signal must have an High-level in the 5...50V range.
Maximum frequency is 10 kHz.

b) Frequency measuring / counting**Info:**

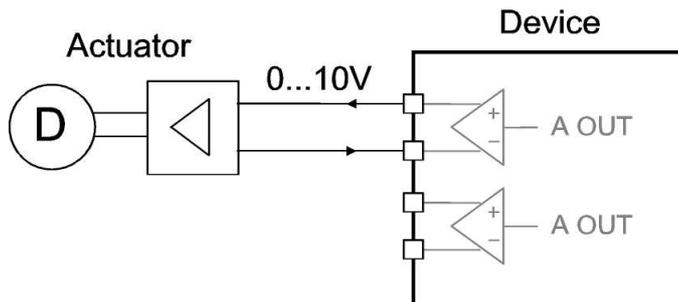
The input signal should be a right-angle signal.
The input signal must have an High-level in the 5...50V range.
Maximum frequency is 1 MHz.

3.2.3 Connecting actuators

This section uses examples to provide information on connections.

1. Analog output actuator

As an output signal, either a voltage signal (0...10V or $\pm 10V$) or a current signal (0...20mA, 4...20mA or $\pm 20mA$) can be used.

**Info:**

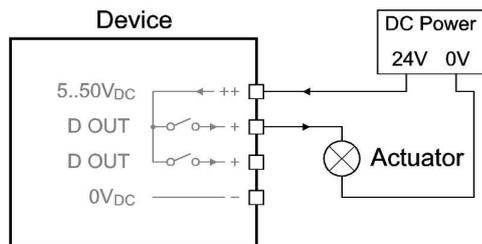
For a voltage signal, the maximum current is 20mA.
The output is controlled using an interconnected PC.

2. Digital output actuator, resistive (ohmic) load

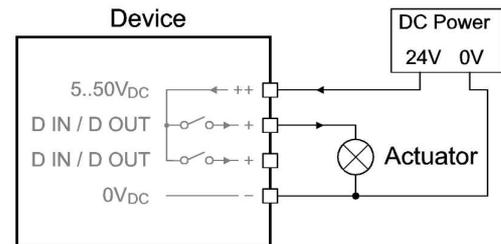
The digital output requires an external feed in the $5...50V_{DC}$ range.

The device contains an electronic switch (FET). There is a defined current flow direction from terminal "++" to terminal "+".

a. 2-wire connection



b. 3-wire connection



Info:

For the 100 model, the 3-wire connection must be used for the DOUT5...8 outputs.

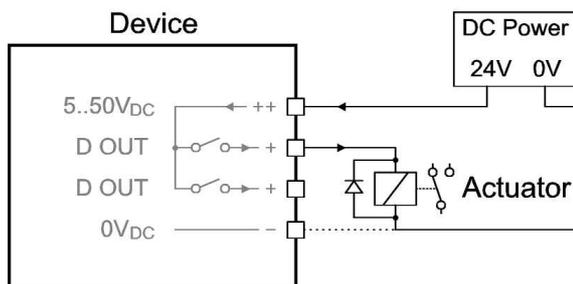
Maximum switching capacity is 30W. Maximum switching current is 1A.
The output is controlled using an interconnected PC.

3. Digital output actuator, inductive load

The digital output requires an external feed in the $5...50V_{DC}$ range.

The device contains an electronic switch (FET). There is a defined current flow direction from terminal "++" to terminal "+".

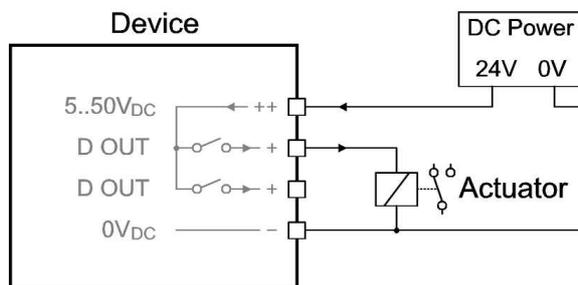
a. 2-wire connection



Info:

An integrated inverse diode, external to the actuator (e.g. relay), is intended here.

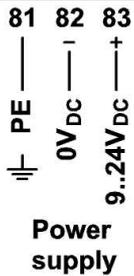
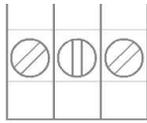
The output is controlled using an interconnected PC.

b. 3-wire connection**Info:**

An integrated inverse diode is used here (not shown in illustration).
A 3-wire connection is now also required.
The output is controlled using an interconnected PC.

3.3 Grounding

The device is equipped with an earth connection, labelled as **PE**, and has contact to the aluminium cover plate and the USB-/LAN-metal coverings. This connector has no direct link to the 0V DC of the voltage supply.



The supplied power supply connector has protective insulation and therefore no earthing.

It is recommended to attach an earth connection (2.5 mm²) at the PE terminal in order to,

- avoid potential differences occurring between the device and earthed sensors / actuators
- to create a shield connection when required for shielded sensor cables
- to improve EMC properties
- to discharge static electrical discharges (generated externally).

3.4 Galvanic isolation

The groups

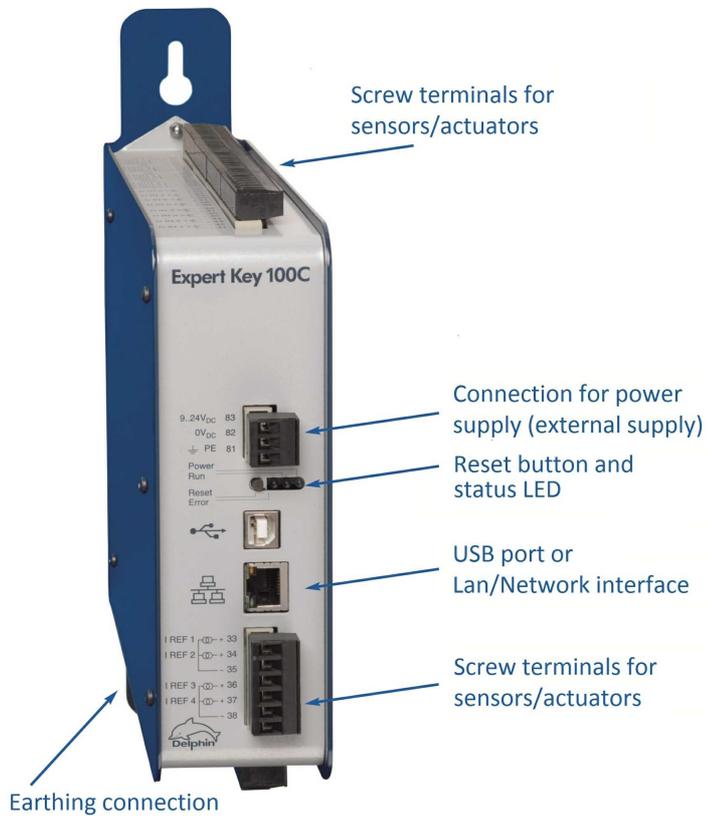
- analog inputs (with constant current)
- analog outputs
- digital inputs
- digital outputs

are galvanically isolated from each other, the rest of the system and from the PC.

More can be found in the next section.

4 Expert Key C - Description

Description



Power supply connector

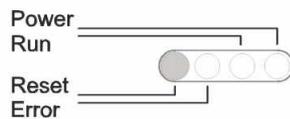
The device operates with an external power supply with a range of 9...24 V_{DC}.

Maximum input is 6 W.



When a power supply connector is delivered with the device it should be used whenever possible.

4.1 Displays / LEDs



Blue LED: Power

Permanently *on* during normal operation.

Indicates that the powers supply (via external supply) is on.

Blue LED: Run

On in normal operation and gently pulsates at a rate of 1 s.

Indicates that the processor is operating normally.

Special situations:

The LED flashes at ca. 5 Hz during a firmware download / update.

Red LED: Error

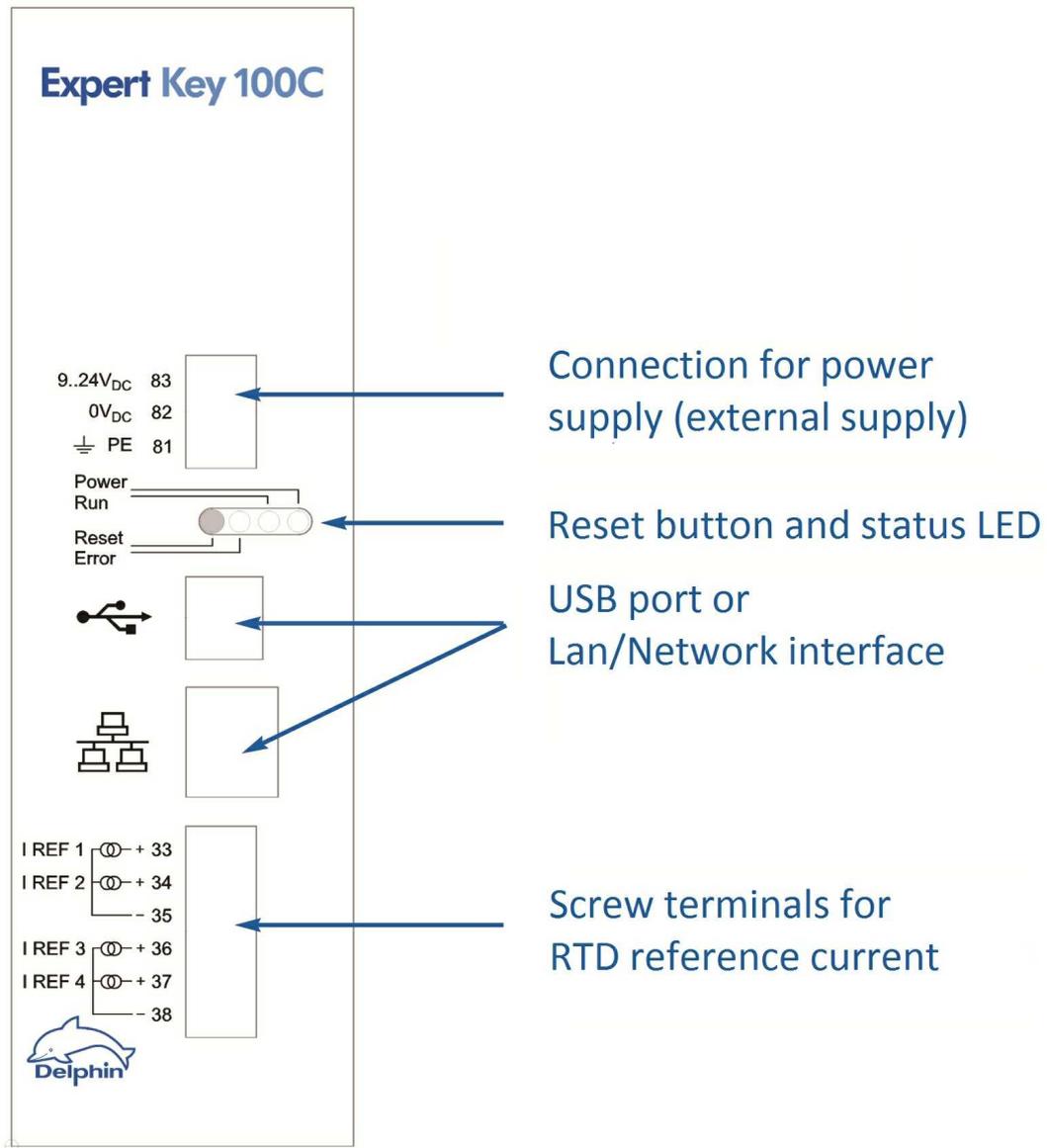
Is *off* during normal operation.

A short flash indicates a tolerable error has occurred.

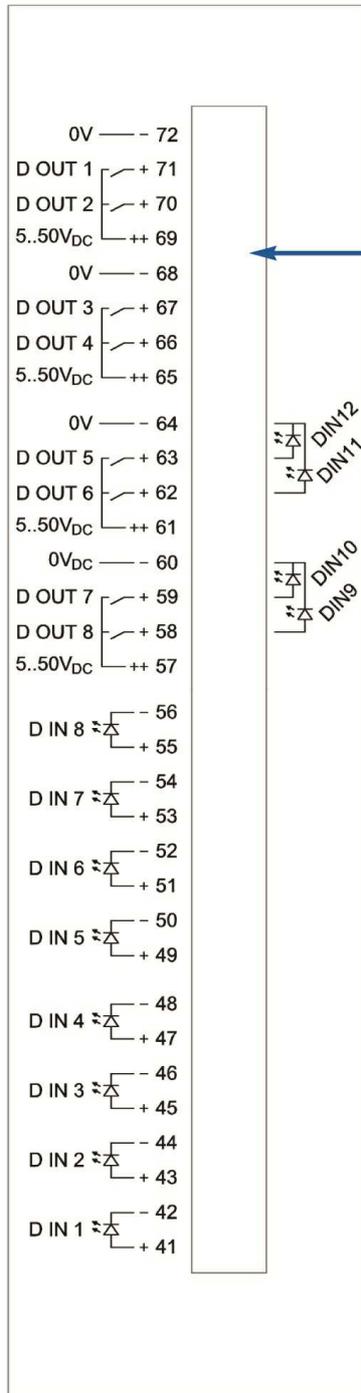
The LED lights permanently when a serious error has occurred.

4.2 Connections

Front connections

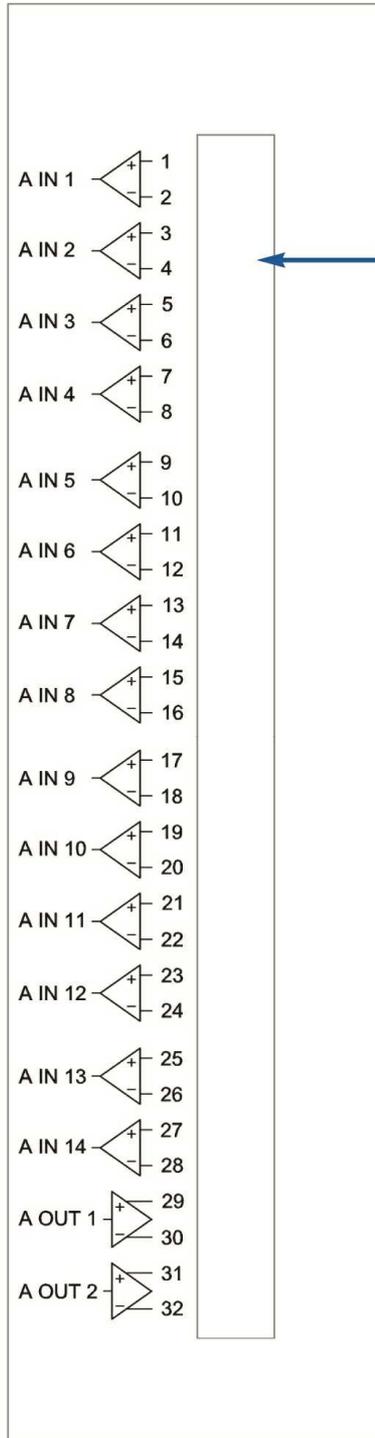


Lower connections



Screw terminals for sensors / actuators

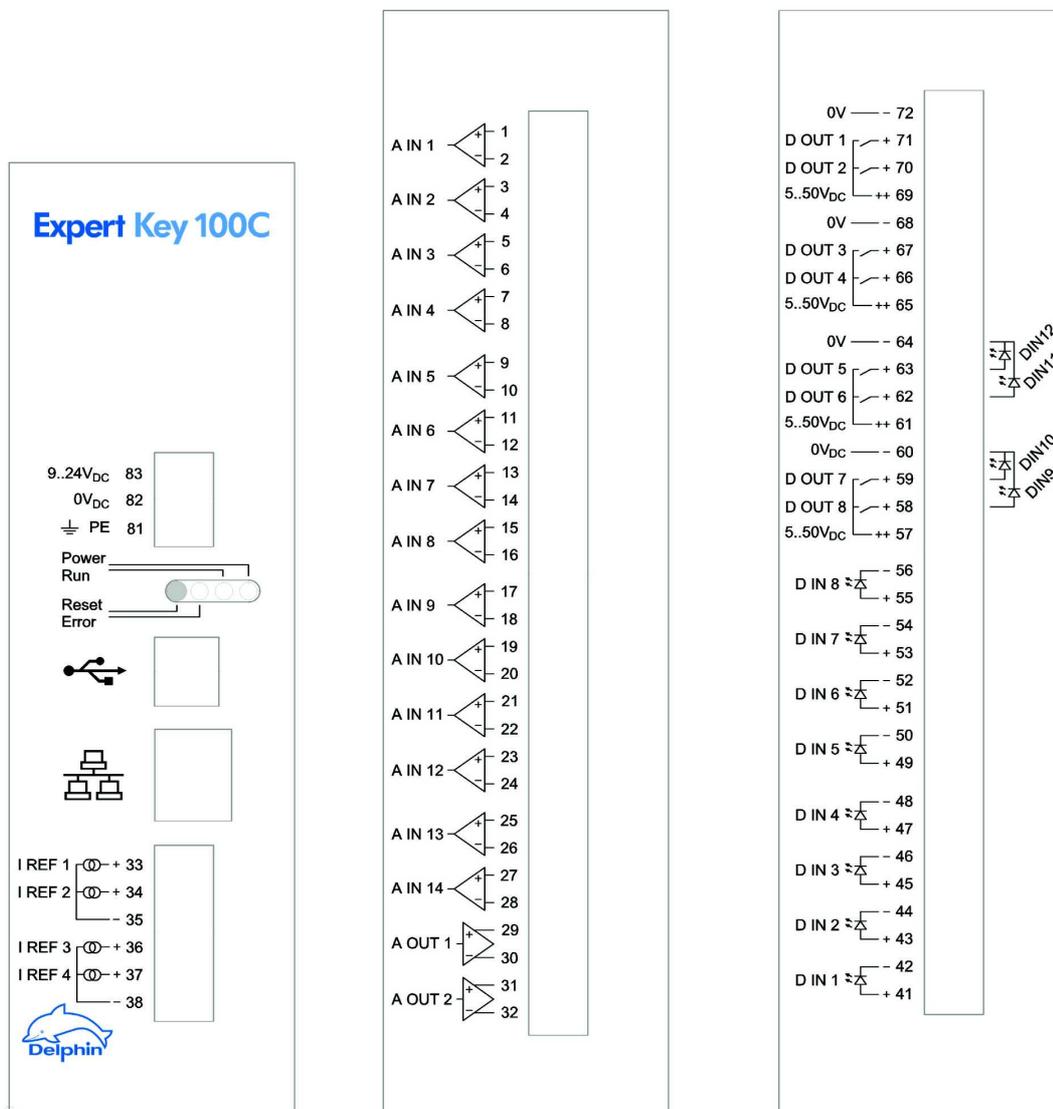
Upper connections



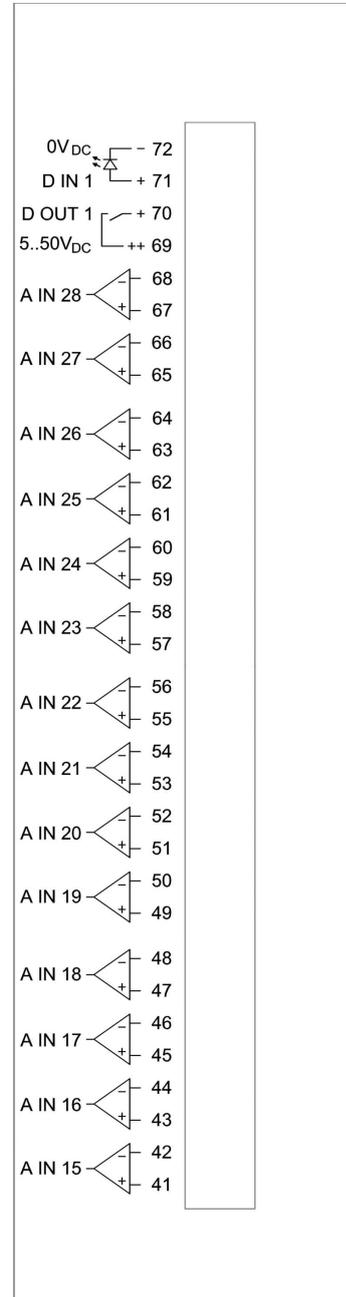
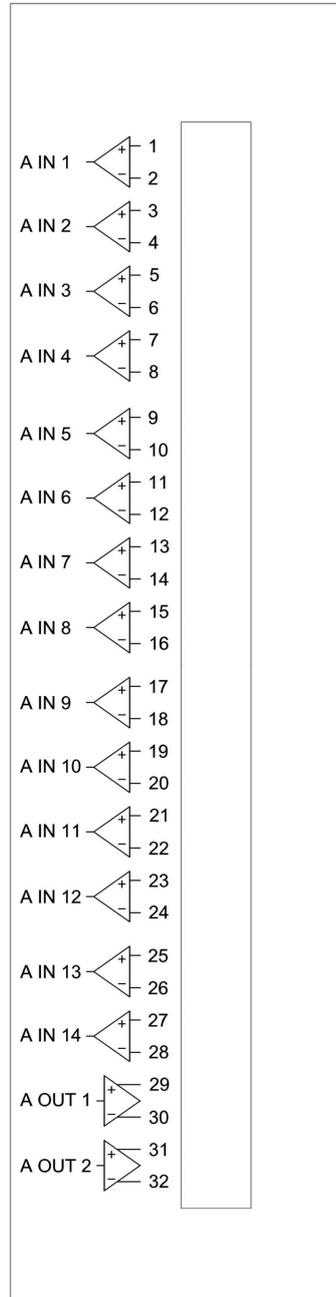
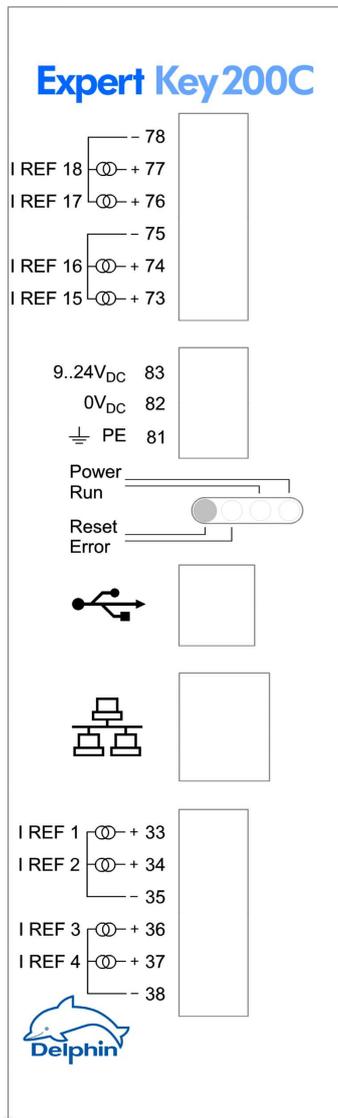
Screw terminals for sensors / actuators

4.2.1 Connection information

Connection diagram Expert Key 100C



Connection diagram Expert Key 200C



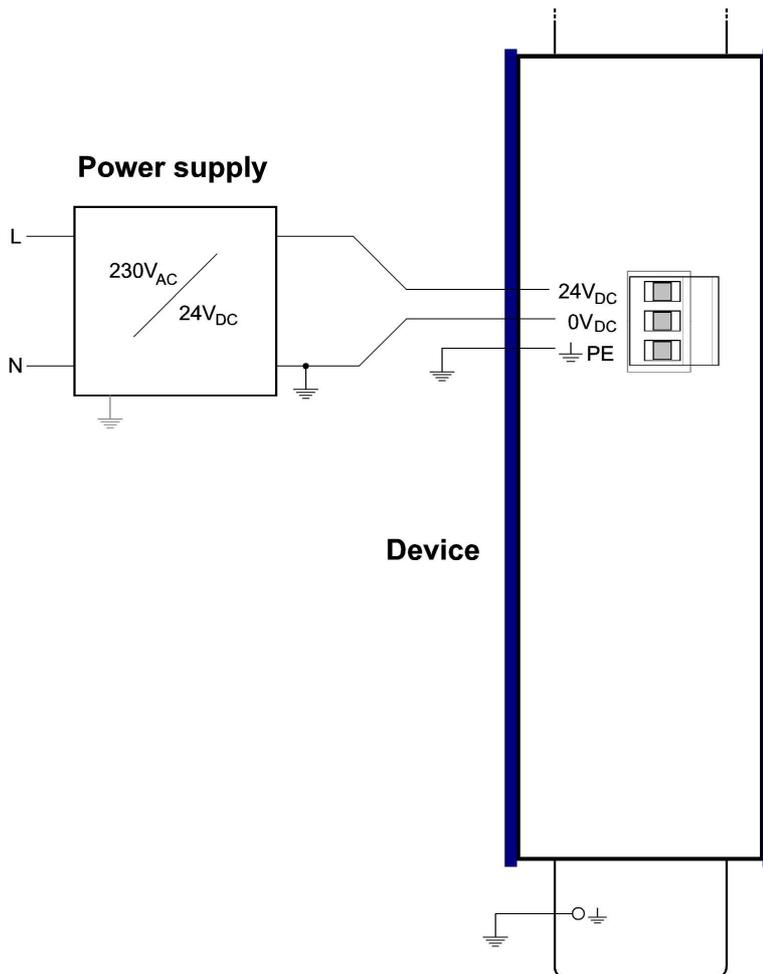
4.2.2 Connecting sensors / actuators

Connection information using examples is identical to the examples using Expert Key L.

Please refer to Connecting sensors and Connecting actuators.

4.3 Grounding

The device is equipped with a dedicated earth connection in the form of a threaded pin on the lower mounting tab. An earth connection ($=2.5 \text{ mm}^2$) is intended here to establish protective earthing.



The device also has an earthing connection labelled PE. This is connected to the metal housing and the metal coverings on the USB-/LAN connections. This connector has no direct link to the 0V DC of the voltage supply.

Both types of earthing connections are intended to

- avoid potential differences occurring between the device and earthed sensors / actuators.
- create a shield connection when required for shielded sensor cables.
- improve EMC properties.
- discharge static electrical discharges (generated externally).

4.4 Galvanic isolation

The groups

- analog inputs (with constant current)
- analog outputs
- digital inputs
- digital outputs

are galvanically isolated from each other, the rest of the system and from the PC.

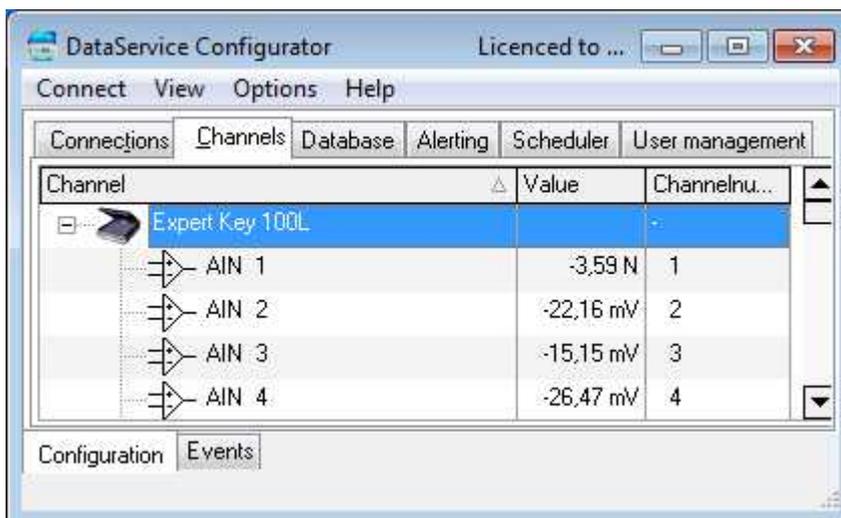
More can be found in the next section.

5 Function and Operation

Operating, general

Configuration of all connections and sensors takes place via the program *DataService Configurator*.

Select the tab ► Channels



View of all channels

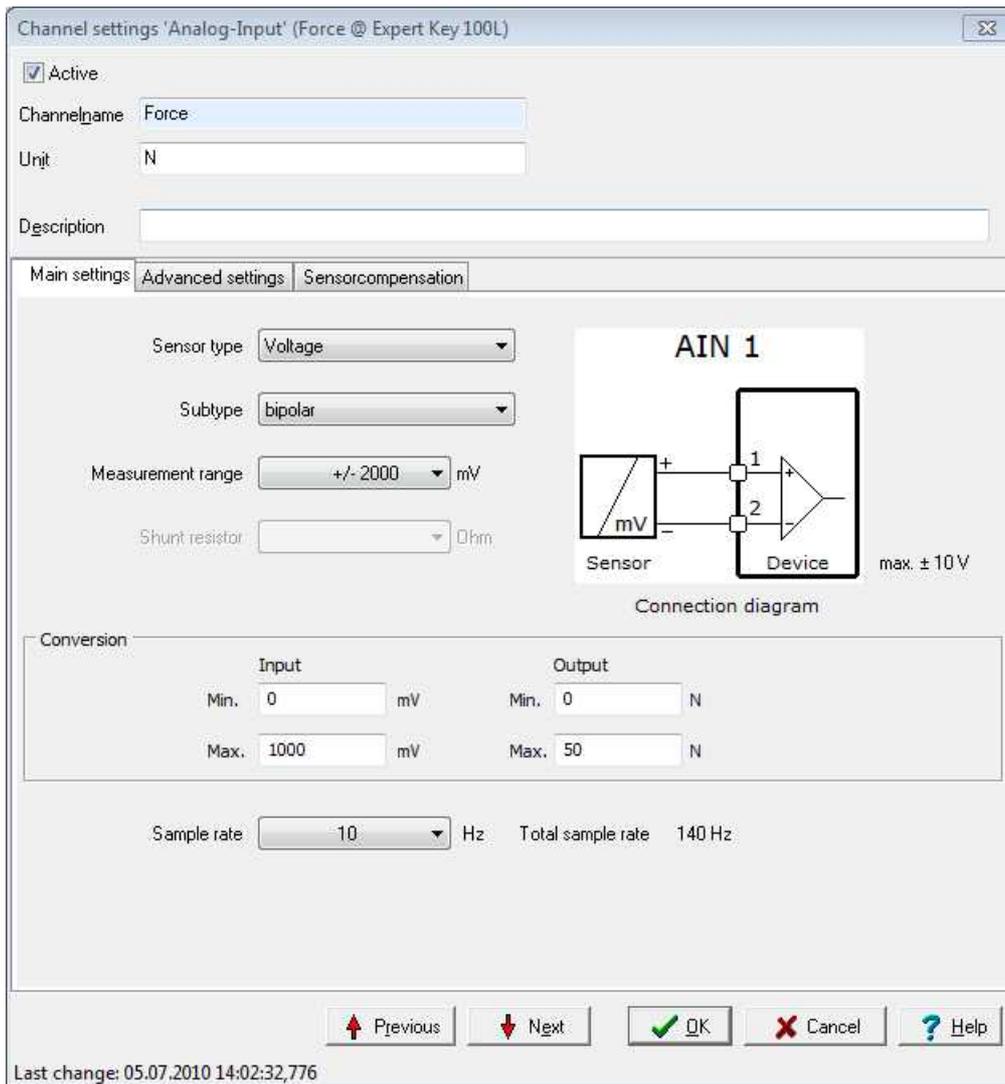
Expert Key 100L	
AIN 1	4976,70 mV
AIN 2	-33,19 mV
AIN 3	21,81 °C
AIN 4	28,42 °C
AIN 5	-
AIN 6	-
AIN 7	-
AIN 8	-
TRJ	25,7 °C
AIN 9	-
AIN 10	-
AIN 11	-
AIN 12	-
AIN 13	-
AIN 14	-
AOUT 1	-
AOUT 2	-
DIN 1	Aus
COUNT 1	2633,00
FREQ 1	24,9990 Hz
DIN 2	-
DIN 3	-
DIN 4	-
DIN 5	-
DIN 6	-
DIN 7	-
DIN 8	-
DIN 9 / DOUT 8	-
DIN 10 / DOUT 7	-
DIN 11 / DOUT 6	-
DIN 12 / DOUT 5	-
DOUT 4	-
DOUT 3	-
DOUT 2	-
DOUT 1	-

Expert Key 200L	
AIN 1	-4969,37 mV
AIN 2	14,04 mV
AIN 3	30,89 °C
AIN 4	29,47 °C
AIN 5	-
AIN 6	-
AIN 7	-
AIN 8	-
TRJ 1	31,7 °C
AIN 9	-
AIN 10	-
AIN 11	-
AIN 12	-
AIN 13	-
AIN 14	-
AOUT 1	-
AOUT 2	-
AIN 15	31,52 °C
AIN 16	-
AIN 17	-
AIN 18	-
AIN 19	-
AIN 20	-
AIN 21	-
AIN 22	-
TRJ 2	30,0 °C
AIN 23	-
AIN 24	-
AIN 25	-
AIN 26	-
AIN 27	-
AIN 28	-
DOUT 1	-
DIN 1	Ein
COUNT 1	166

5.1 Dialogue option / General

The operating elements are the same for all dialogues and are described here using *Analog Input* as an example.

Select the tab ► *Main settings*



Channel settings 'Analog-Input' (Force @ Expert Key 100L)

Active

Channelname: Force

Unit: N

Description:

Main settings | Advanced settings | Sensorcompensation

Sensor type: Voltage

Subtype: bipolar

Measurement range: +/- 2000 mV

Shunt resistor: Ohm

AIN 1

Connection diagram

max. ± 10 V

Input		Output	
Min.	0 mV	Min.	0 N
Max.	1000 mV	Max.	50 N

Sample rate: 10 Hz Total sample rate: 140 Hz

Previous Next OK Cancel Help

Last change: 05.07.2010 14:02:32,776

Operating elements from the upper dialogue area: Active

Activates this channel. Transmission of measurement data from the device is now possible.

Channelname Force

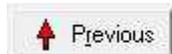
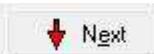
Enter a name here for the measuring point, e.g. Power1.

Unit N

Enter the physical unit for this measuring point, e.g. *N*.

Description

Enter a description (or commentary) of the measuring point, e.g. *Pump 3*.

Operating elements from the lower dialogue area: Previous  Next

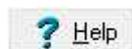
Switches between previous / next channels, determined by channel number, and displays the relevant dialogue.

 OK

Accepts all the new settings and transmits these to the device.
Closes the dialogue.

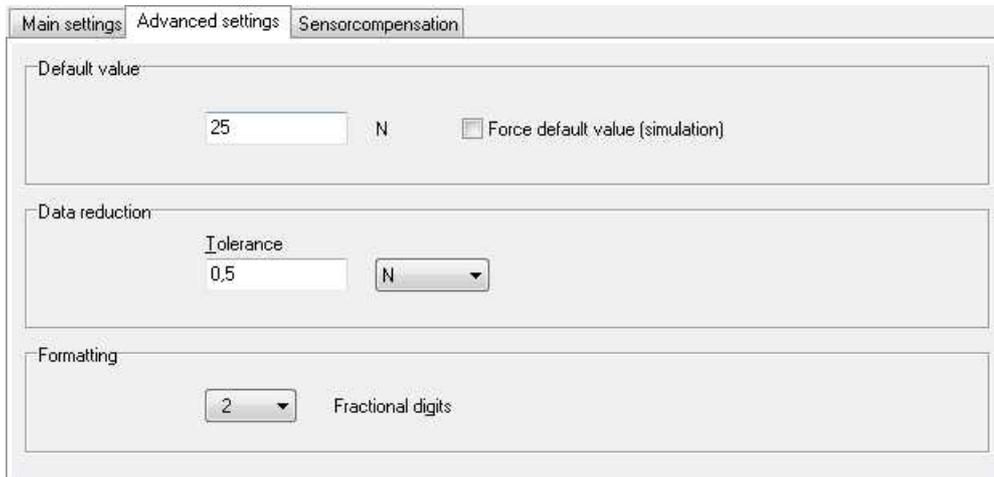
 Cancel

Ends the procedure. Closes the dialogue.

 Help

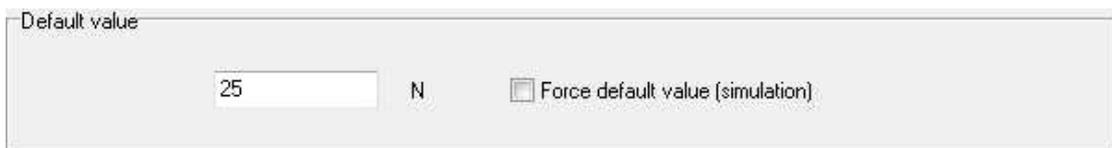
Runs *Help* i.e opens the electronic manual.

Select the tab ► *Advanced settings*



The screenshot shows the 'Advanced settings' tab selected. It contains three sections: 'Default value' with a text input '25', a unit dropdown 'N', and a checkbox 'Force default value (simulation)'; 'Data reduction' with a 'Tolerance' text input '0.5' and a unit dropdown 'N'; and 'Formatting' with a unit dropdown '2' and the text 'Fractional digits'.

Elements from the *Advanced settings* tab:



This section shows the 'Default value' input field containing '25', the unit dropdown set to 'N', and the 'Force default value (simulation)' checkbox which is currently unchecked.

For inputs:

In the event of an input failure, the default value (instead of the measured value) is transmitted from the device to the PC.

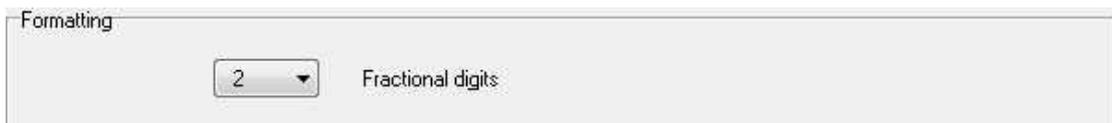
For outputs:

In the event of an output failure, the default value (instead of the measured value) is transmitted from the device to the PC.



This section shows the 'Data reduction' section with a 'Tolerance' text input field containing '0.5' and a unit dropdown menu set to 'N'.

For PC-based data recording, this element is used for setting tolerance levels for recording. In the example shown, a new measurement value is recorded only when there is a change of more than 0.5 N over the previously recorded value.



This section shows the 'Formatting' section with a unit dropdown menu set to '2' and the text 'Fractional digits'.

For setting the required accuracy for the measurement or output value.

Select the tab ► *Sensor compensation*

Main settings | Advanced settings | **Sensorcompensation**

Active

Mode
 Offset and Gradient (2 calibrationpoints) ▼

Calibration points

	Correct value (N)	Measured value (N)
1.	0	2,3
2.	100	103,4

Import
Export

Elements from the *Sensor compensation* tab:

Active

Activates sensor compensation, i.e. manual adjustment.

Mode
 Offset and Gradient (2 calibrationpoints) ▼

Select whether there are 1,2 or 3 calibration points.

Calibration points

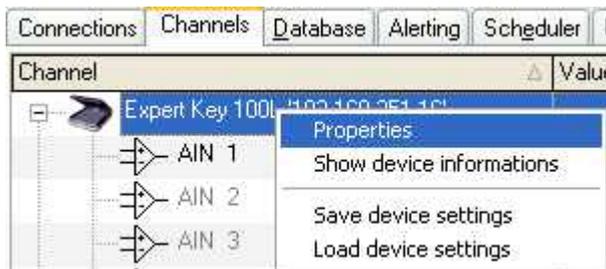
	Correct value (N)	Measured value (N)
1.	0	2,3
2.	100	103,4

Enter the calibration point (with *Correct value* and *Measured value*. The example shown concerns temperature measurement with calibration at 0°C and 100°C.

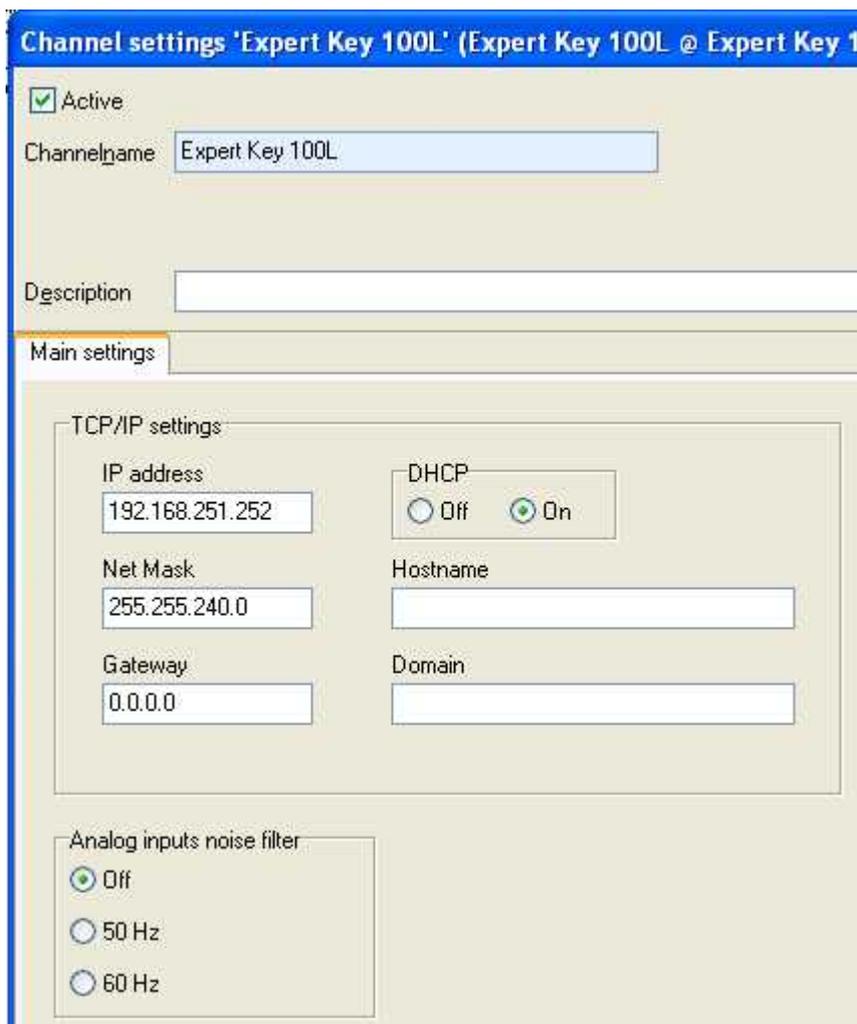
5.2 Device

Properties

Select **Properties** from the device's *context menu*.



This opens the following window.



Under **TCP/IP Settings** input the network connection settings.

The default setting is DHCP. The Expert Key connection then takes place automatically. If a DHCP server is not being used, it is possible to manually input the IP address, net mask, gateway, host name and domain settings.



Info:

When possible, use a fixed IP address for the device because, depending on the DHCP being used, the IP address is only assigned for limited time periods.

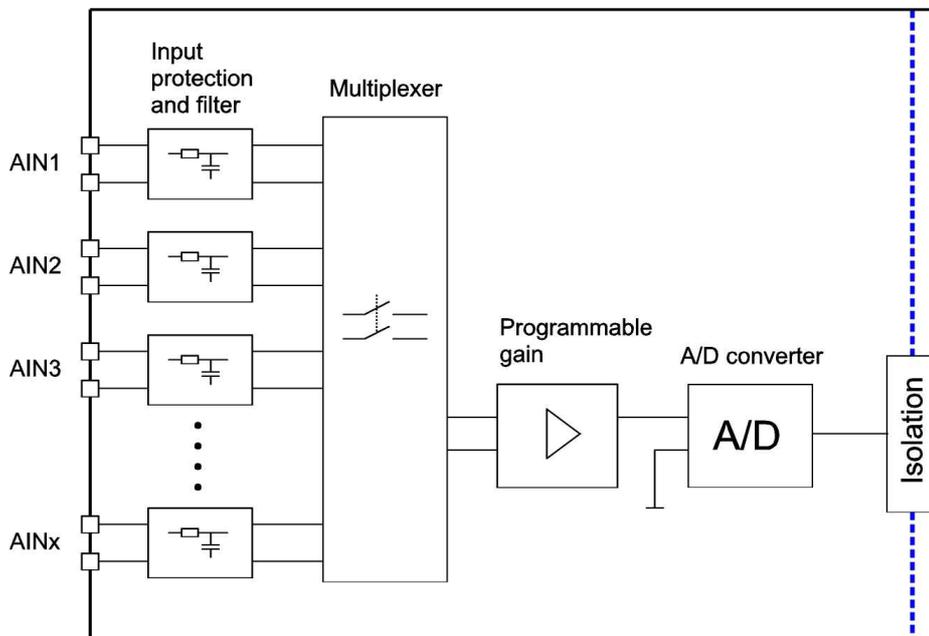
Input filter settings under **Analog inputs noise filter**.

Enter the network frequency to activate the filter. The signals being measured by the analog inputs are filtered by various methods depending on the sampling rate. Filtering is automatically deactivated when dynamic signals (e.g. jump or fast oscillating sine) are detected at the analog input.

Set filtering to *Off* for unfiltered signals.

5.3 Analog input

Block diagram



The analog inputs are galvanically isolated as a group from the rest of the system as well as from the PC.

Four dialogue options are available for the sensor type or electrical interface:

- Voltage, e.g. 0...10V
- Current, e.g. 4...20mA
- Thermocouple, e.g. type K, NiCr-NiAl
- Resistive probe, e.g. RTD PT100



Info:

For information on connections refer to Connecting sensors.
Technical data is available under Analog inputs.

5.3.1 Dialogue option / Voltage sensor type

Channel settings 'Analog-Input' (Force @ Expert Key 100L)

Active

Channelname: Force

Unit: N

Description:

Main settings | **Advanced settings** | Sensorcompensation

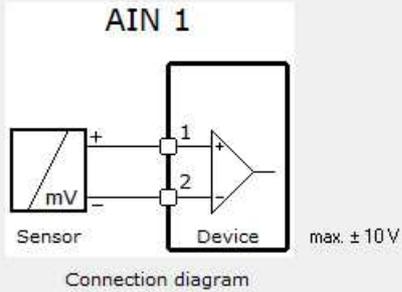
Sensor type: Voltage

Subtype: bipolar

Measurement range: +/- 2000 mV

Shunt resistor: Ohm

AIN 1



max. ± 10V

Conversion

Input		Output	
Min.	0 mV	Min.	0 N
Max.	1000 mV	Max.	50 N

Sample rate: 10 Hz Total sample rate: 140 Hz

Last change: 05.07.2010 14:02:32,776

Descriptions for the general elements are available in the previous section.

The dialogue for the *Voltage* sensor type contains the following fields:

Sensor type: Voltage

Subtype: bipolar

Select the sensor type or the relevant electrical interface as well as the subtype. The options here are:

- unipolar, i.e. positive signal only
- bipolar, i. e. positive or negative signal

Measurement range mV

Select here the smallest (most negative) and largest (most positive) measurement range appropriate to the sensor signal.

The options here are:

- Measurement range 100mV, 200mV, 500mV, ... up to 10,000mV

Conversion					
	Input		Output		
Min.	<input type="text" value="0"/>	mV	Min.	<input type="text" value="0"/>	N
Max.	<input type="text" value="1000"/>	mV	Max.	<input type="text" value="50"/>	N

Enter here the lower and upper reference points for the sensor's linear characteristics.

The example shown means that 0 mV corresponds to 0 N, and 1000 mV to 50 N.

The output range (in the example 0...50N) serves also as the default settings for graphic portrayals in ProfiSignal.

Sample rate Hz

Select the sampling rate for this measuring point.

The options here are:

- sampling frequency 0.2 Hz, 0.5 Hz, 1 Hz, ... up to 100,000 Hz

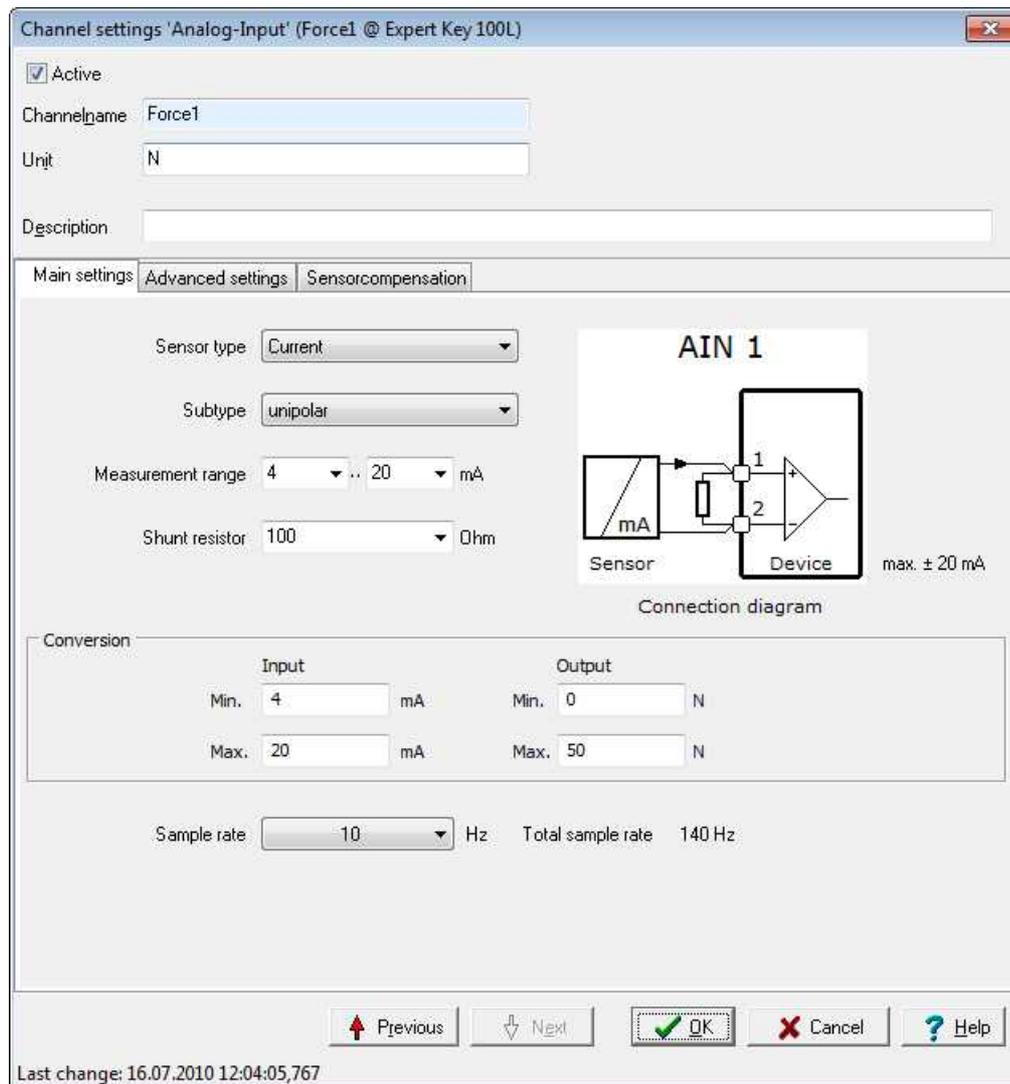
For slow-changing sensor signals, a low sample rate should be selected. This enhances evening-out/filtering.

For periodic sensor signals that change very frequently, the sample rate should be 10 times higher than the sensor signals. This enhances signal form and signal fidelity.

Total sample rate Hz

The sample rate shown here is the product of the highest sample rate set and the number of active analog inputs.

5.3.2 Dialogue option / Current sensor type



Descriptions for the general elements are available in the previous section.

The dialogue for the *Current* sensor type contains the following fields:



Select the sensor type or the relevant electrical interface.
Select also the subtype. The options here are:

- unipolar, i.e. positive signal only
- bipolar, i. e. positive or negative signal

Measurement range 4 .. 20 mA
 Shunt resistor 100 Ohm

Select here the smallest (most negative) and largest (most positive) measurement range appropriate to the sensor signal. The options here are:

- For unipolar: 0...20mA, 4...20mA, or an available range
- For bipolar: \pm 20mA, or an available range

Conversion					
	Input		Output		
Min.	4	mA	Min.	0	N
Max.	20	mA	Max.	50	N

Enter here the lower and upper reference points for the sensor's linear characteristics.

The example shown means that 4 mA corresponds to 0 N, and 20 mA to 50 N.

The output range (in the example 0...50N) serves also as the default settings for graphic portrayals in ProfiSignal.

Sample rate 10 Hz

Select the sampling rate for this measuring point.

The options here are:

- sampling frequency 0.2 Hz, 0.5 Hz, 1 Hz, ... up to 10,000 Hz

For slow-changing sensor signals, a low sample rate should be selected. This enhances evening-out/filtering.

For periodic sensor signals that change very frequently, the sample rate should be 10 times higher than the sensor signals. This enhances signal form and signal fidelity.

For consistent measurement accuracy for all active analog inputs, it is recommended that you select sampling rates that do not differ by more than 100:1 from one another.

Total sample rate 140 Hz

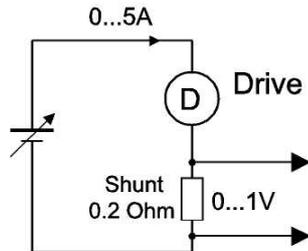
The sum of set sample rates for all active analog inputs is shown here as a guide.

Function: Measuring current in any range

Current measurement is often required where any measurement range and any load resistance can be set.

Example:

The motor current of a DC motor is to be measured in the 0...5 A range. A shunt resistor of 0.2 W is available.



Main settings | **Advanced settings** | Sensorcompensation

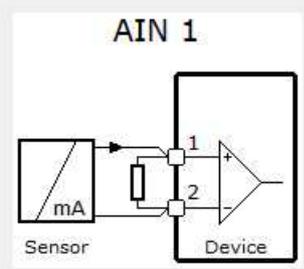
Sensor type:

Subtype:

Measurement range: .. mA

Shunt resistor: Ohm

AIN 1

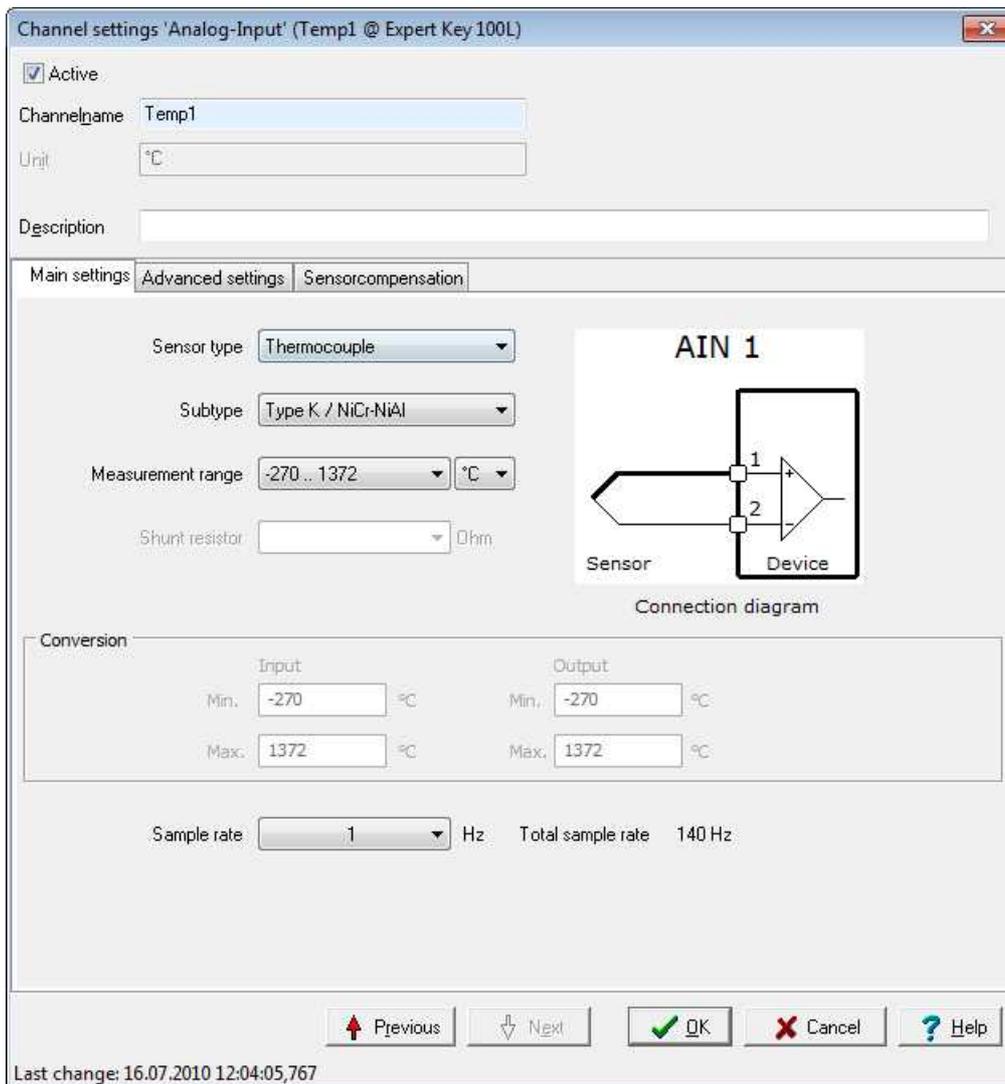


Connection diagram

Input		Output	
Min.	<input type="text" value="0"/> mA	Min.	<input type="text" value="0"/> N
Max.	<input type="text" value="5000"/> mA	Max.	<input type="text" value="5"/> N

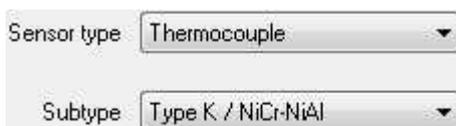
Sample rate: Hz Total sample rate: 140 Hz

5.3.3 Dialogue option / Thermocouple sensor type



Descriptions for the general elements are available in the previous section.

The dialogue for the *Thermocouple* sensor type contains the following fields:



Select the sensor type or the relevant electrical interface. Select also the subtype. The options here are:

- Thermocouple type: B, C, E, J, K, L, N, R, S, T, U

Measurement range -270 .. 1372 °C

By selecting the thermocouple type, the measurement range is set. Only the physical temperature unit can be selected here. The options are:

- Celsius (°C), Fahrenheit (°F) or Kelvin (K)

Sample rate 1 Hz

Select the sampling rate for this measuring point.
The options here are:

- Sampling frequency 0.2 Hz, 0.5 Hz, 1 Hz, ... up to 100 Hz

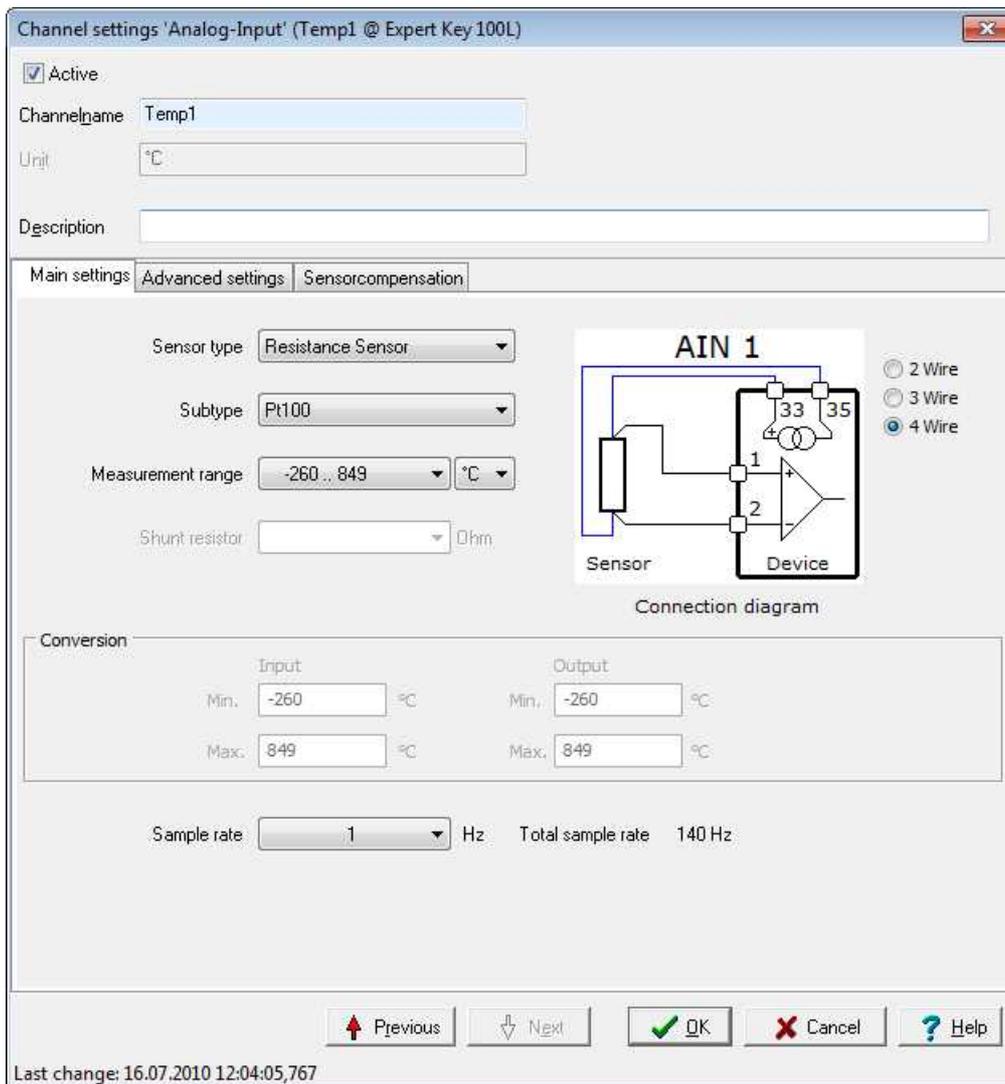
For slow-changing sensor signals, a low sample rate should be selected. This enhances evening-out/filtering.

For consistent measurement accuracy for all active analog inputs, it is recommended that you select sampling rates that do not differ by more than 100:1 from one another.

Total sample rate 140 Hz

The Total sample rate displayed here is the product of the highest set sample rate and the number of active analog inputs.

5.3.4 Dialogue option / RTD sensor type



Descriptions for the general elements are available in the previous section.

The dialogue for the resistance sensor contains the following fields:



Select the sensor type or the relevant electrical interface. Select also the subtype.

The options are:

- Sensor types: Pt100, Pt200, Pt500, Pt1000

Measurement range

Selecting the type of sensor sets the measurement range. Only the physical temperature unit can be selected here. The options here are:

- Celsius (°C), Fahrenheit (°F) or Kelvin (K)

Sample rate Hz

Select the sampling rate for this measuring point.

The options here are:

- sampling frequency 0.2 Hz, 0.5 Hz, 1 Hz, ... up to 10 Hz

For slow-changing sensor signals, a low sample rate should be selected. This enhances evening-out/filtering.

For consistent measurement accuracy for all active analog inputs, it is recommended that you select sampling rates that do not differ by more than 100:1 from one another.

Total sample rate 140 Hz

The Total sample rate displayed here is the product of the highest set sample rate and the number of active analog inputs.

5.3.5 Sample rates and measurement accuracy

Due to the **Expert Key** having a common A/D converter, the sampling rate for all analog inputs is therefore the analog input with highest sample rate setting.

The total sample rate is the product of the highest set sample rate and the number of active analog inputs. Increasing sampling rate increases signal interference with measurements becoming less accurate.

As a guide to the level of accuracy to be expected, sample rates are color classified:



Green. The sample rate is low enough to synchronize the measurement with the network frequency. Signal interference will be kept to a minimum and documented measurement accuracy will be maintained. This range is especially suited to temperature measurements.

In highly electromagnetic environments, shielding of the connecting cables is strongly recommended



Yellow. Connection cable shielding is generally recommended. The documented measurement accuracy is maintained as far as possible.

For a higher accuracy, reduce the sample rate.



Red. Connection cable shielding is essential. Signal interference increases and there are restrictions of the accuracy of measurement. For temperature measurement, this range is not recommended.

For a higher accuracy, reduce the sample rate.

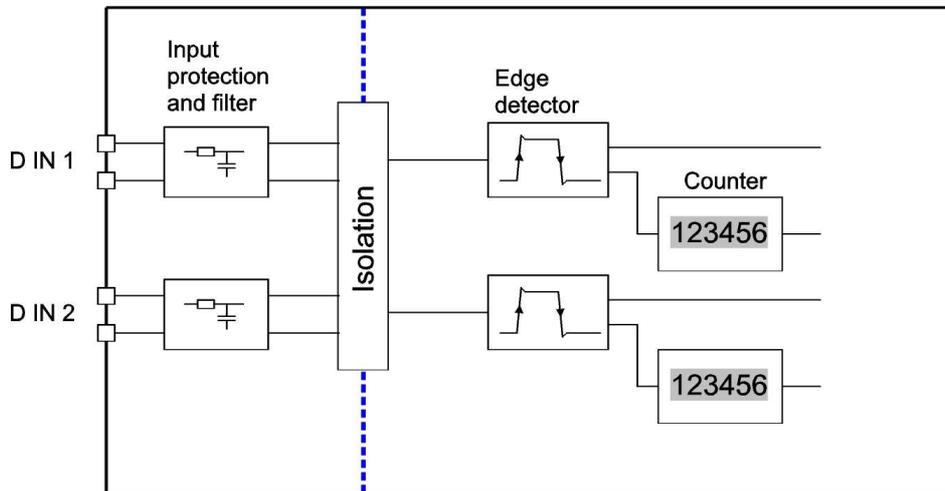


Info:

Set the network frequency in your device's settings.

5.4 Digital input with counter function

Block diagram



The digital inputs are galvanically isolated, individually or in pairs, from the rest of the system as well as from the PC. Frequency measuring, as well as counting, can also be achieved. The counter is resettable to real time accuracy.

The digital input with counter function provides the following three measurement channels



Important info:

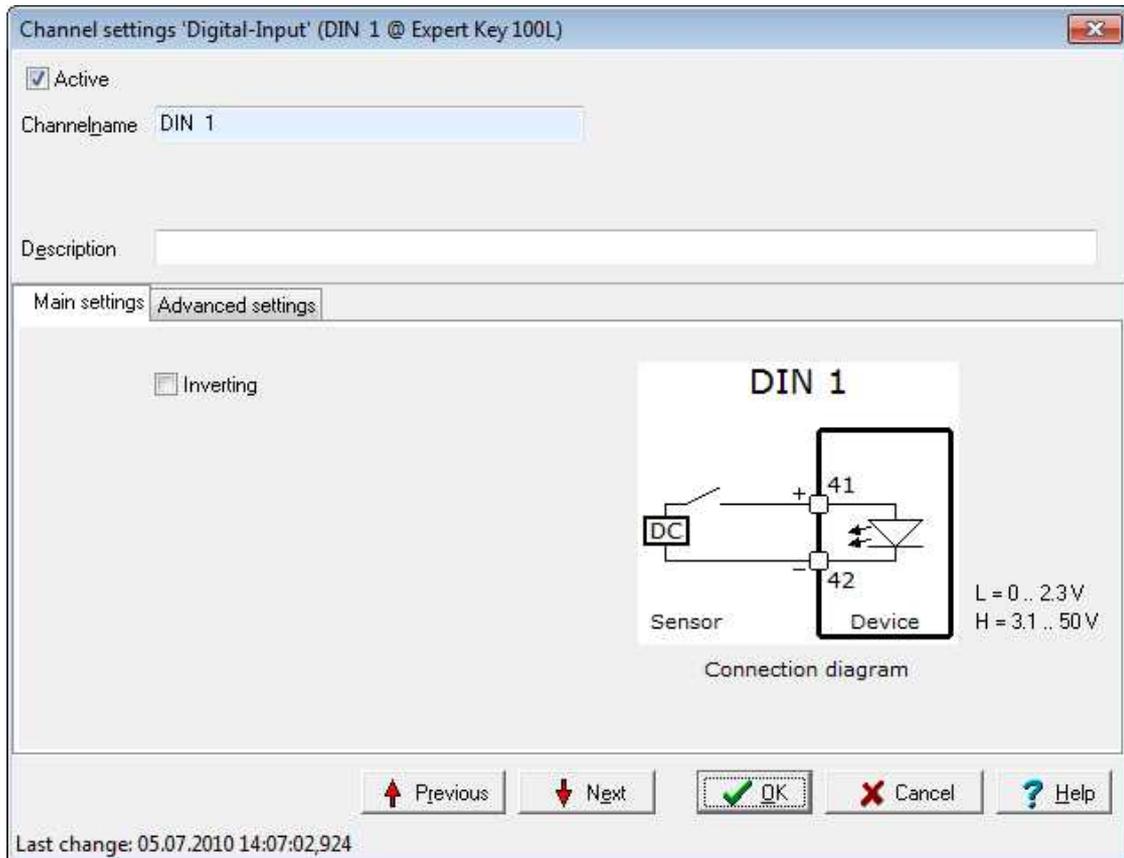
Non-required measurement information should be deactivated. For example, when the required measurement function is frequency measurement, then the two other channels should be deactivated.



Info:

For information on connections refer to Connecting sensors.
 Technical data is available under Digital input with counter function.

5.4.1 Dialogue option / Level detector

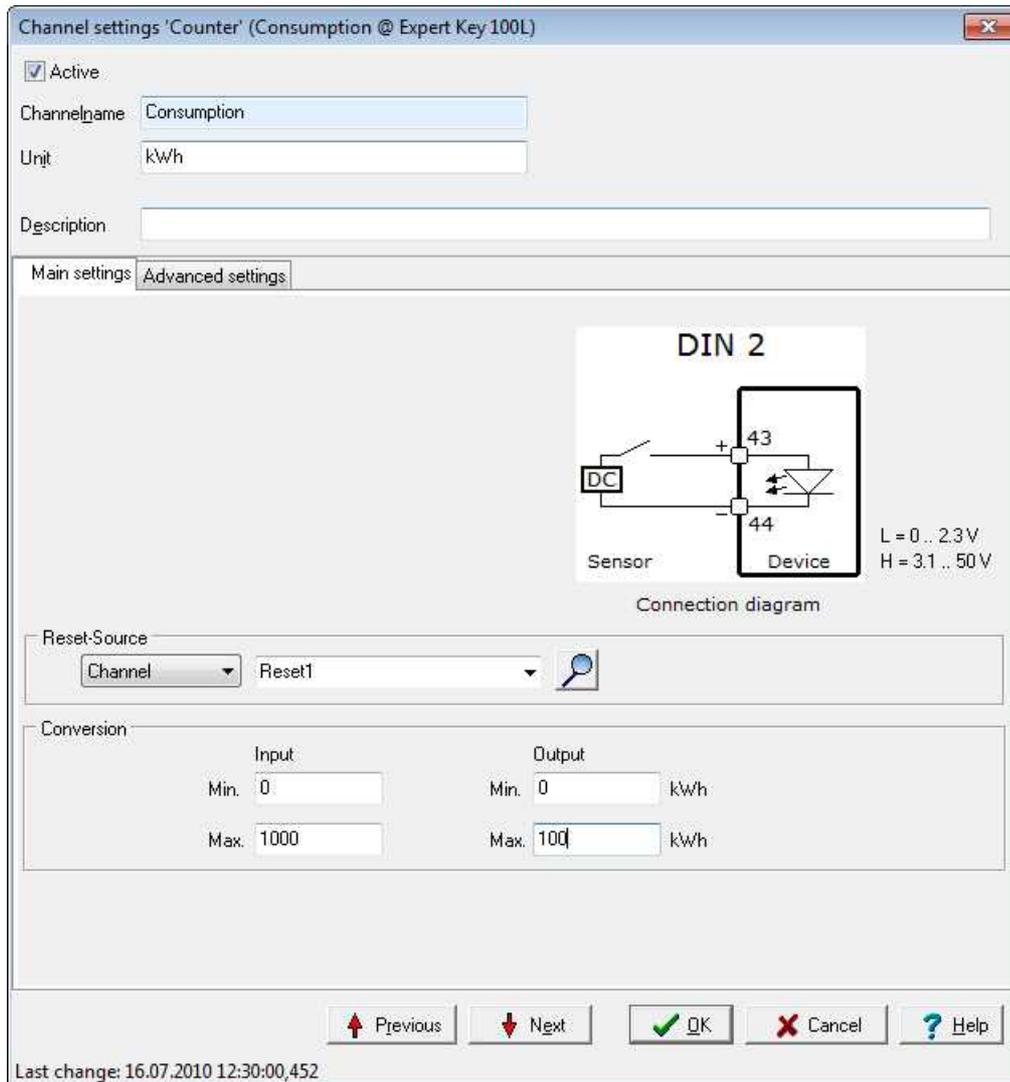


A description for the general elements are available in the previous section.

Inverting

This option enables input signal inverting, i.e. High-level and Low-level are interchanged.

5.4.2 Dialogue option / Counter



Descriptions for the general elements are available in the previous section.

Conversion	
Input	Output
Min. 0	Min. 0 kWh
Max. 1000	Max. 100 kWh

Enter here the lower and upper reference points for the sensor's linear characteristics. The example shown is for the acquisition from an energy meter. The 0 impulse setting corresponds to 0 kWh, and 1000 impulses corresponds to 100 kWh.

The output range (in the example 0...100kWh) serves also as the default settings for graphic portrayals in ProfiSignal.

Reset-Source	
Channel	Reset1

This sets a signal source for resetting the counter. The options here are:

- None
- Application: The source is a channel that is administered by the ProfiSignal software.
- Channel: The source is a channel that is administered by the DataService software.
- Channel (real time): The source is a set digital input from the device.

Only the selection of *Channel* (real-time) offers non-delayed resetting of the counter.

5.4.3 Dialogue option / Frequency measurement

Channel settings 'Frequency' (Speed @ Expert Key 100L)

Active

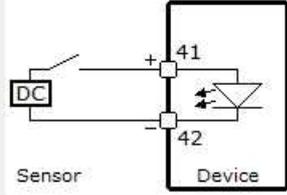
Channelname: Speed

Unit: RPM

Description:

Main settings | **Advanced settings**

DIN 1



Connection diagram

Conversion:

Input		Output	
Min.	0 Hz	Min.	0 RPM
Max.	50 Hz	Max.	3000 RPM

Last change: 05.07.2010 13:50:18,595

Descriptions for the general elements are available in the previous section.

Conversion

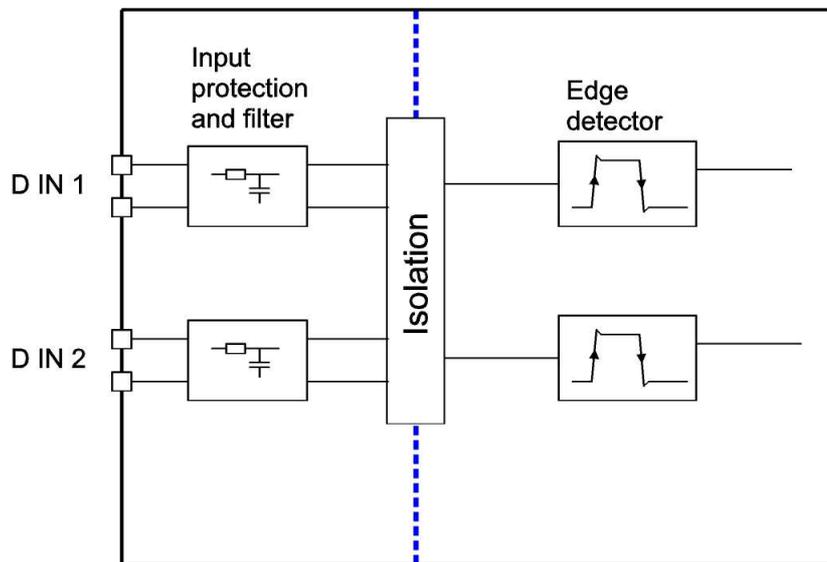
Input		Output	
Min.	0 Hz	Min.	0 RPM
Max.	50 Hz	Max.	3000 RPM

Enter here the lower and upper reference points for the sensor's linear characteristics. The example shown is for rotation acquisition. The 0 Hz setting corresponds to 0 U/min, and 50 Hz to 3000 U/min.

The output range (in the example 0...3000 U/min) serves also as the default settings for graphic portrayals in ProfiSignal.

5.5 Digital input

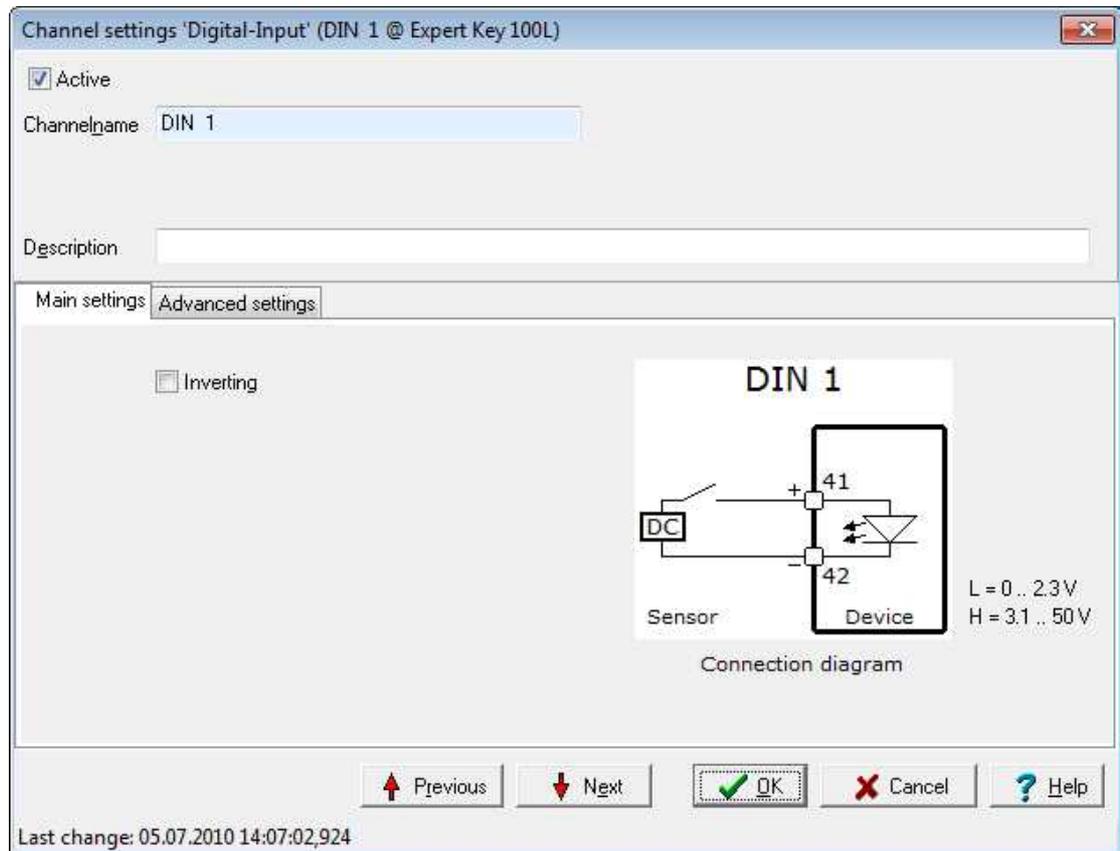
Block diagram



The digital inputs are galvanically isolated, individually or in pairs, from the rest of the system as well as from the PC.

The digital input (without counter function) provides only level detection.

Dialogue



Descriptions for the general elements are available in the previous section.

Inverting

This option enables input signal inverting, i.e. High-level and Low-level are interchanged.

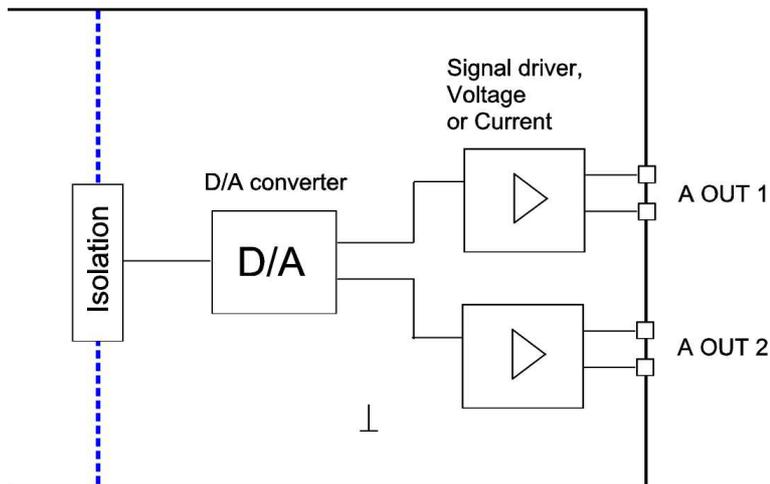


Info:

For information on connections refer to Connecting sensors.
Technical data is available under Analog inputs.

5.6 Analog output

Block diagram



The analog outputs are galvanically isolated as a group from the rest of the system as well as from the PC.

The signal driver has the following output range options:

- Voltage: 0...10V or $\pm 10V$
- Current: 0...20mA, 4...20mA or $\pm 20mA$

**Info:**

For information on connections refer to Connecting actuators.
Technical data is available under Analog outputs.

5.6.1 Dialogue option

Channel settings 'Analog-Output' (Monitor1 @ Expert Key 100L)

Active

Channelname: Monitor1

Unit: %

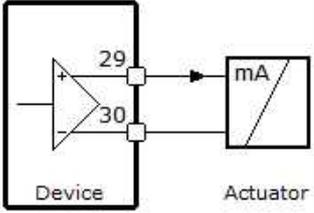
Description:

Main settings | **Advanced settings**

Output mode: Current

Output range: 4 .. 20 mA

AOUT 1



Connection diagram

Source

Channel: Channel Signal1

Initial value: 0 unit

Conversion

Input		Output	
Min.	4 %	Min.	4 mA
Max.	20 %	Max.	20 mA

Last change: 16.07.2010 12:37:20,209

Descriptions for the general elements are available in the previous section.

Output mode: Current

Select the electrical signal:

- Voltage
- Current

Output range mA

- For voltage: 0...10V or $\pm 10V$
- For current: 0...20mA, 4...20mA or $\pm 20mA$

Source

Channel 

Initial value: unit

Select here the signal source that controls the output. The options here are:

Application The source is a channel that is administered by the ProfiSignal software.

Channel The source is a channel that is administered by the DataService software.

Manual value The source is a set value (manual value).

The *Initial value* is output as long as no valid output value is available (after switching on the device).

Conversion

	Input		Output	
Min.	<input type="text" value="4"/>	%	Min.	<input type="text" value="4"/> mA
Max.	<input type="text" value="20"/>	%	Max.	<input type="text" value="20"/> mA

Enter here the lower and upper reference points for the linear output characteristics.

The example shown is for monitor output at 4...20 mA. The settings have the following meaning:

0 % corresponds to 4 mA, and 100 % to 20 mA.

The output range (in the example 0...100 %) serves also as the default settings for graphic portrayals in ProfiSignal.

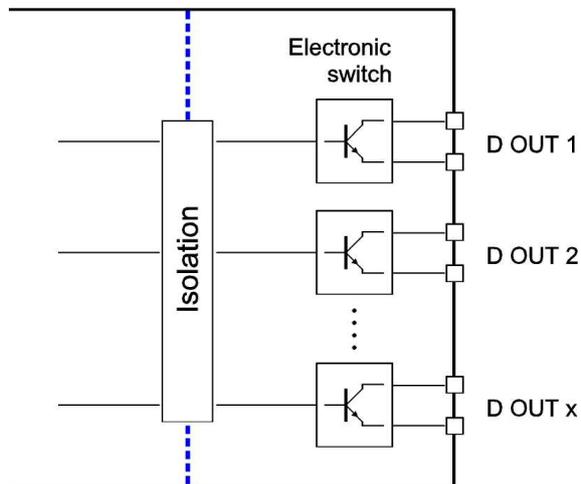


Info:

The displayed value in the **DataService Configurator** and **ProfiSignal** is the conversion *input range*! The output range is measurable only at the terminals.

5.7 Digital output

Block diagram



The digital outputs are galvanically isolated, individually or in pairs, from the rest of the system as well as from the PC.

**Info:**

For information on connections refer to Connecting actuators.
Technical data is available under Digital outputs.

5.7.1 Dialogue option

Channel settings 'Digital-In/Output' (Alarm1 @ Expert Key 100L)

Active

Channelname: Alarm1

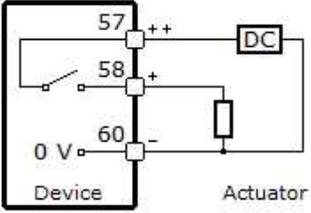
Description:

Main settings | **Advanced settings**

Mode: Output

Inverting

DIN 9 / DOUT 8



max. 50 V
max. 30 W
max. 1 A

Connection diagram

Source: Channel Signal1

Initial value: Off On

↑ Previous ↓ Next ✓ OK ✗ Cancel ? Help

Last change: 16.07.2010 12:45:25,506

Descriptions for the general elements are available in the previous section.

Inverting

This option enables output signal inverting, i.e. High-level and Low-level are interchanged.



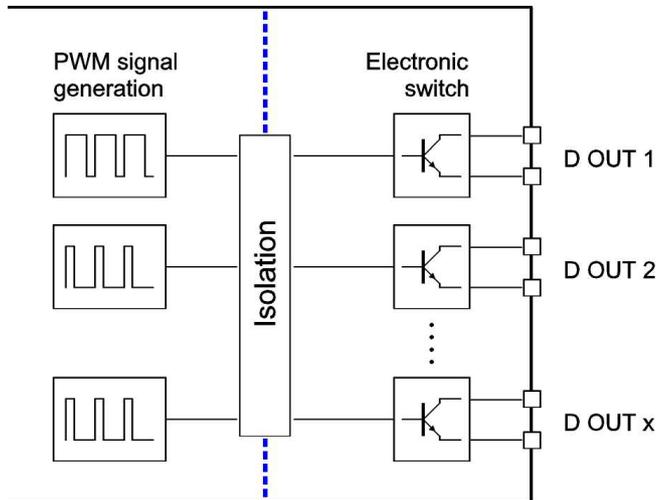
Select here the signal source that controls the output. The options here are:

- | | |
|--------------|---|
| Application | The source is a channel that is administered by the ProfiSignal software. |
| Channel | The source is a channel that is administered by the DataService software. |
| Manual value | The source is a set value (manual value). |

The *Initial value* is output as long as no valid output value is available (after switching on the device).

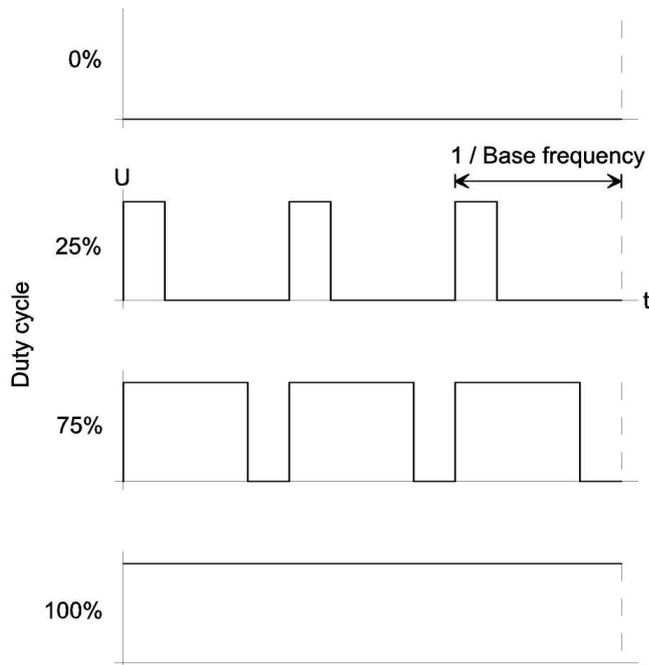
5.8 Digital output with PWM function

Block diagram



The digital outputs are galvanically isolated, individually or in pairs, from the rest of the system as well as from the PC.

PWM signal generation functions with a preset base frequency. The duty cycle is controlled.

**Info:**

For information on connections refer to Connecting actuators.
Technical data is available under Digital output with PWM function.

5.8.1 Dialogue option

Channel settings 'Digital-Output' (Dimmer1 @ Expert Key 100L)

Active

Channelname:

Unit:

Description:

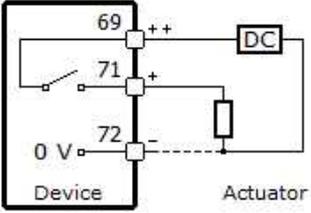
Main settings | **Advanced settings**

Switching mode:

Base frequency: Hz

Inverting

DOUT 1



max. 50 V
max. 30 W
max. 1 A

Connection diagram

Source

Initial value: lm

Conversion

	Input	Output
Min.	<input type="text" value="0"/> lm	<input type="text" value="0,0"/> %
Max.	<input type="text" value="500"/> lm	<input type="text" value="100,0"/> %

Last change: 16.07.2010 12:44:29,911

A description for the general elements are available in the previous section.

Switching mode:

Base frequency: Hz

Select the base frequency for the PWM signal.

The options here are:

- Base frequency: 5Hz, 10Hz, 20Hz, ...10000Hz

Source

Channel 

Initial value: lm

Select here the signal source that controls the output.

The options here are:

- Application The source is a channel that is administered by the ProfiSignal software.
- Channel The source is a channel that is administered by the DataService software.
- Manual value The source is a set value (manual value).

The *Initial value* is output as long as (after switching on the device) no valid output value is available.

Conversion

	Input	Output
Min.	<input type="text" value="0"/> lm	<input type="text" value="0,0"/> %
Max.	<input type="text" value="500"/> lm	<input type="text" value="100,0"/> %

Enter here the lower and upper reference points for the linear output characteristics.

The example shown is for the activation of a required luminous power. The settings have the following meaning:

0 lm corresponds to 0 %, and 500 lm to 100 %.

The input range (in the example 0...500 lm) is also the setting for the graphical portrayal in ProfiSignal.



Info:

The display value in **ProfiSignal** and the **DataService Configurator** is the conversion *input range*!

5.9 Device settings save and load

Saving a configuration

Select **Save device settings** from the device's *context menu* and save the entire settings for the **Expert Key** device.



Loading a configuration

Select **Load device settings** from the device's *context menu* and load previously saved channel settings for the **Expert Key** device.

The separate channels of the Expert device are identified in ProfiSignal by way of the unique ID. If you load a saved configuration from device A into device B on the same PC, the unique IDs will be automatically replaced.

Possible conflicts

If the same configuration is loaded from different PCs into multiple devices, the channels of the multiple devices will have the same IDs. When you connect the devices to the same PC, the channels of the last connected devices will not be displayed. When connecting additional devices, you will receive a corresponding message in the Configurator.

To resolve this conflict, do the following:

- With more than 2 devices, connect only 1 device at first and then carry out the following steps per extra device.
- If you have no saved configuration data on hand for the second device, firstly connect the second device to the PC and save the configuration data from this device.
- Reset the second device's configuration.
- Now connect both devices to the PC. Both devices are now connected, error-free, to the PC.
- Load the saved configuration into the second device. Unique IDs will then be assigned automatically.



Info:

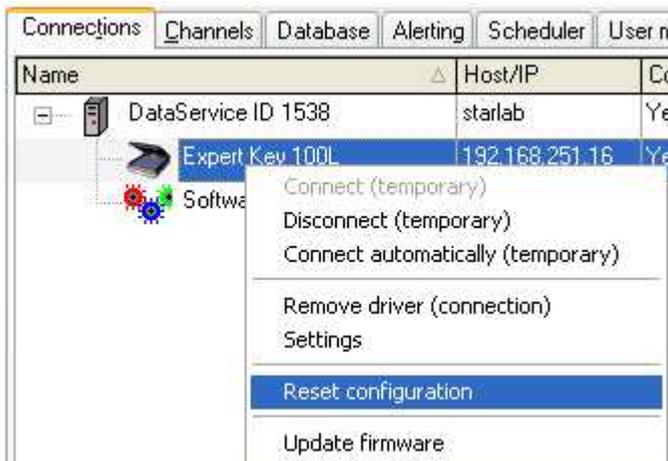
Note that only one configuration can be loaded from the same device type (**Expert Key 100** or **Expert Key 200**). The design type (L, C or M) is irrelevant.

5.10 Configuration reset

Resetting a configuration

Select **Reset configuration** from the connection's *context menu* to reset the current settings. The configuration for all channels will then be reset to the settings as at delivery.

The separate Expert device channels are identified in ProfiSignal by a unique ID. These IDs are renamed during resetting.



5.11 Device information

Displaying

Select **Show device informations** from the device's *context menu*.



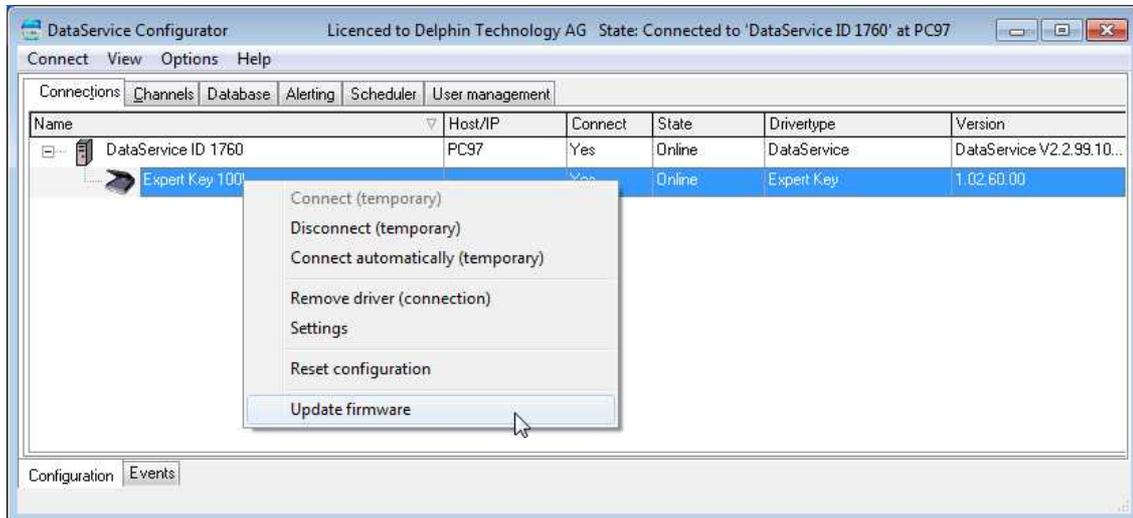
This opens the following window.



This provides an overview of useful information concerning your device. When you have technical queries concerning your device, you should access this window to acquire important information, e.g. the serial number or the firmware version.

5.12 Device firmware

Updating firmware



Select the tab ► **Connections**

The following dialogue appears after clicking Update firmware from the context menu:



Click *Select* to select the file containing the new firmware. Commence update by clicking *Start update*.



Important:

The device must **NOT** be switched off during the update (requires approx. 2 minutes)!

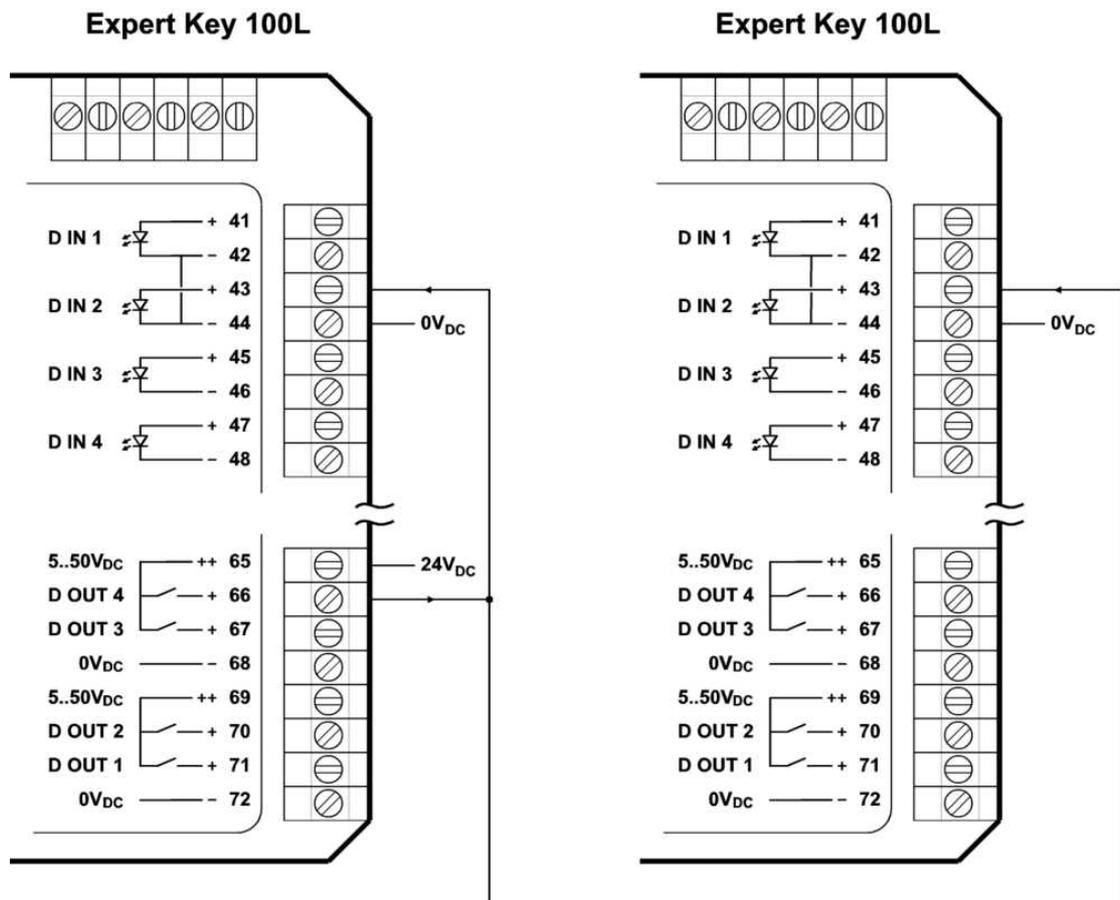
6 Device synchronization

Multiple devices can be time-synchronized for the transmission of measurement data.

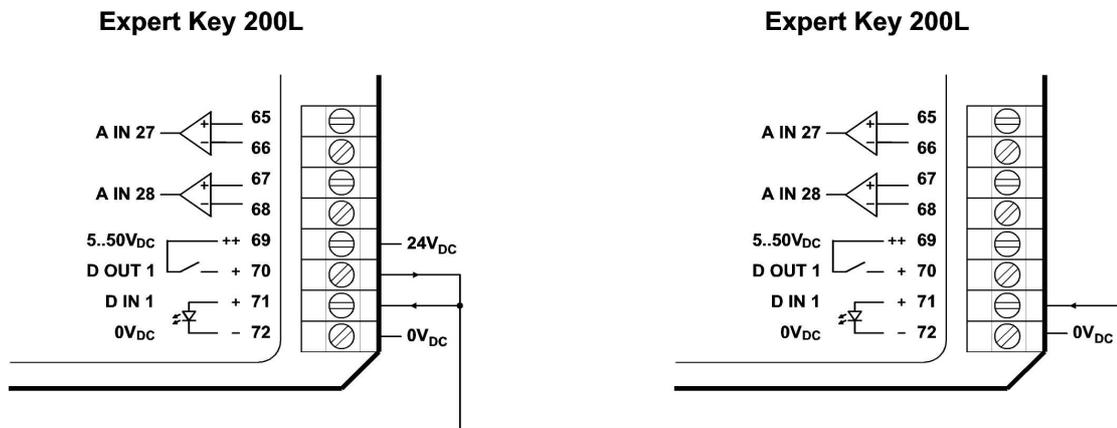
A digital reference signal is output from one of the devices and simultaneously received by all participating devices. The time-synchronization of the measurement data then takes place at a PC.

Wiring

Wiring example for two **Expert Key 100L** type devices:



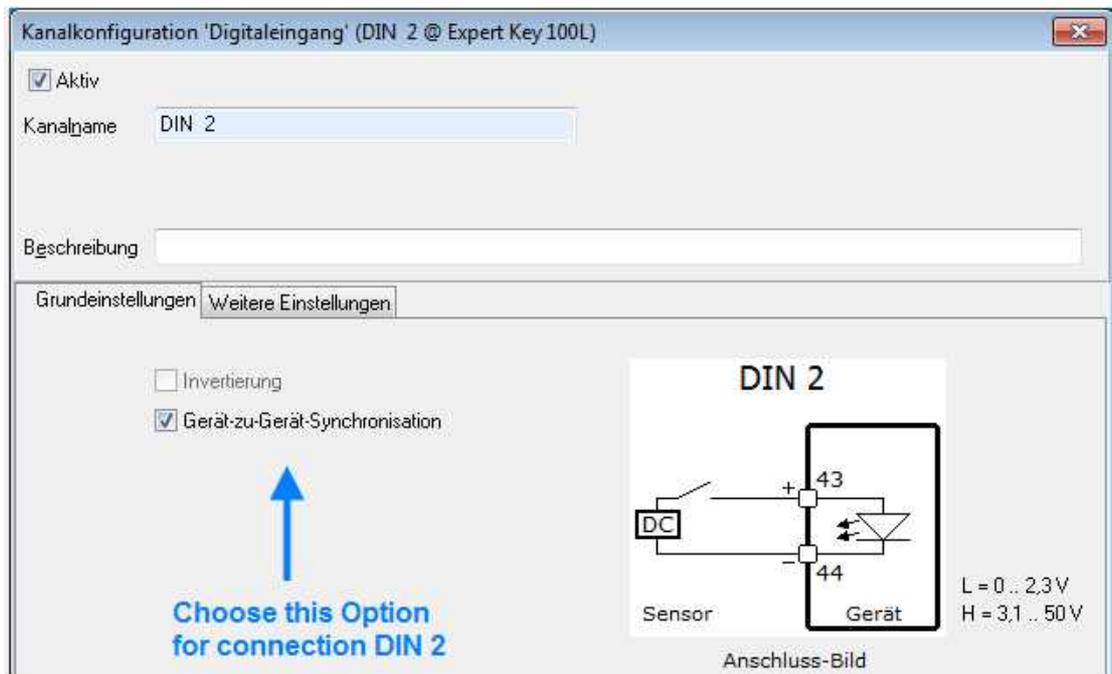
Wiring example for two **Expert Key 200L** type devices:



Configuration

For device-to-device synchronization, one digital output and one digital input are used. These connections are then no longer available for general use.

Configuration example with Expert Key 100L:



Refer also to the Synchronization section under technical data.



Info:

It is recommended that the device is connected to the PC with a **highspeed** USB. Avoid running other hardware (e.g. hard disk) from the same USB host controller. Because of possible delays within the network, LAN synchronization can not be guaranteed.

7 Technical specifications

Power supply

Voltage range:

9...24 V_{DC}

Max. power input of the device:

6 W

7.1 Analog inputs

Adjustable sample rate for each analog input:

1...5000 Hz, when all 14+1 analog inputs are active for Expert Key 100

1...2000 Hz, when all 28+2 analog inputs are active for Expert Key 200

Reducing the number of active analog inputs increases the maximum sample rate for the remaining analog inputs.

Maximum sampling rate:

100,000 measurements/s. Reduced to 10,000 measurements/s for active temperature or current measurements.

measurement range, voltage:

± 10 V	or	0...10 V
± 5 V	or	0...5 V
± 2 V	or	0...2 V
± 1 V	or	0...1 V
± 500 mV	or	0...500 mV
± 200 mV	or	0...200 mV
± 100 mV	or	0...100 mV

Measurement range, current:

0...20 mA or 4...20 mA or available value

Possible load resistance:

10/20/50...500 Ω or available value

A/D converter resolution:**18 bit**

Measurement range	Resolution
± 10 V	76 µV
± 5 V	38 µV
± 2 V	19 µV
± 1 V	9.5 µV
± 500 mV	4.7 µV
± 200 mV	2.4 µV
± 100 mV	1.2 µV

Input impedance:

2 ... 10 MΩ

Input protection against permanent voltage surge:

± 40V

ESD-input protection:

Yes

Max. sensor-impedance:

<1kΩ

Galvanic isolation:

All analog inputs (including constant current sources) are galvanically isolated. To the rest of the system as well as to the PC.

With an isolation voltage of $\geq 1,000 V_{DC}$.

Operating type/ sampling procedure:

Each individual analog input can be *active* or *inactive*.

All active analog inputs are sequentially and continuously sampled.

An automatic oversampling averages / evens-out the measurement values.

Measurement accuracy, voltage:

Measurement range	Measurement accuracy
± 10 V	0.02%
± 5 V	0.05%
± 2 V	0.05%
± 1 V	0.1%
± 500 mV	0.1%
± 200 mV	0.2%
± 100 mV	0.2%

Table applies to 14 active analog-inputs each with a sample rate of 2 Hz. DC-signal. 25° ambient temperature. Measurement accuracy in % of unipolar measurement range.

Measurement accuracy, current:

Measurement range	Measurement accuracy
0...20 mA	0.05%
4...20 mA	0.05%

Table applies to 14 active analog-inputs each with a sample rate of 2 Hz. DC signal. Load resistance with 0,05% tolerance. 25° ambient temperature. Measurement accuracy in % of end value.

Measurement accuracy, temperature, RTD:

Type	Measurement range	Measurement accuracy
Pt100	-260...849 °C	0.1%

Table applies to 14 active analog-inputs each with a sample rate of 2 Hz. 4-wire connection. 25° ambient temperature. Measurement accuracy in % of end value.

Measurement accuracy, temperature, thermocouple:

Type	Measurement range	Measurement accuracy
K / NiCr- NiAl	-270...1,372 °C	0.2%

Table applies to 14 active analog-inputs each with a sample rate of 2 Hz.
Internal compensation measuring point. 25° ambient temperature. Warm-up time > 30 min.
Measurement accuracy in % of end value - following sensor compensation procedure.

Power supply for RTD:

Constant 0.2 mA.

Compensation measuring point for thermocouple:

An additional sensor (RTD type PT100 using 4-wire-technology) is internally attached at the screw terminals.

7.2 Digital inputs with counter function

Max. input frequency for the counter:

1 MHz

Time resolution:

1 μ s

Counter breadth, hardware / software:

32 bit / 64 bit

Permissible input voltages:

Positive right-angle signal, 5 V, 12 V, 24 V or 48 V

Input current:

Type 1.5 mA

Low-level, High-level, hysteresis:

Low: <2.3V, high: >3.1V

Measurement range of frequency measurement:

0.1 Hz to 1 MHz

Accuracy of frequency measurement:

max. 0.01% of input frequency

Operating type/ sampling procedure:

All level changes (according to High or Low) are transferred as measurement values.

The counter status is updated at 10 measurement values/s.

Frequency measurement is performed via a PC.

Sum of input frequency for transmitted level-change for all active digital inputs:

10 kHz

Galvanic isolation:

All digital inputs with counter function are galvanically isolated in pairs - to the rest of the system and to the PC.

With an isolation voltage of $\geq 1000V_{DC}$.

7.3 Digital inputs

Max. input frequency:

10 kHz

Time resolution:

50 μ s

Permissible input voltages:

4.5 to 50V

Input current:

Type 2.7 mA

Low-level, High-level, hysteresis:

Low: <2.4V, high: > 2.9V

Operating type/ sampling procedure:

All level changes (according to High or Low) are transferred as measurement values.

Sum of input frequency for transmitted level-change for all active digital inputs:

10 kHz

Galvanic isolation:

All digital inputs have separate galvanic isolation - from the rest of the system as well as from the PC.

With an isolation voltage of ≥ 1000 V_{DC}.

7.4 Analog outputs

A/D converter resolution:

16 bit

Output type and range:

Voltage: 0...10 V or ± 10 V

Current: 0...20 mA or 4...20 mA or ± 20 mA

Switching: Software/automated selection of voltage/current mode

Possible load resistance:

50 ... 500 Ω

Max. output rate per analog output (controlled via DataService/ProfiSignal):

50 Hz

Galvanic isolation:

All analog inputs have galvanic isolation to the rest of the system and to the PC.
With an isolation voltage of ≥ 1000 V_{DC}.

Accuracy:

Range	Accuracy
0...10 V, ± 10 V	0.05%
0/4...20 mA, ± 10 mA	0.05%

Table applies to a 25° ambient temperature.
Accuracy in % of unipolar measurement range.

7.5 Digital outputs

Max. switching delay:

0.5 ms

Max. permanent switching frequency:

10 Hz

Max. switching capacity:

30W

Max. switching voltage and current:

30 V / 1 A

40 V / 0.75 A

50 V / 0.6 A

Inverse diode:

Integrated, max. 2 A

Galvanic isolation:

All digital outputs have separate galvanic isolation - from the rest of the system as well as from the PC.

With an isolation voltage of $\geq 1000 V_{DC}$.

7.6 Digital outputs with PWM function

PWM-basic frequency and duty cycle resolution:

10,000Hz / 1:100

5,000Hz / 1:200

2,000 Hz / 1:500

1,000 Hz / 1:500

...

10 Hz / 1:500

5 Hz / 1:500

Max. switching capacity:

30 W

Max. switching voltage and current:

30 V / 1 A

40 V / 0.75 A

50 V / 0.6 A

Inverse diode:

Integrated, max. 2 A

Max. output rate per digital output (controlled via DataService/ProfiSignal):

10 Hz

Galvanic isolation:

All digital outputs with PWM function are galvanically isolated in pairs - from the rest of the system as well as from the PC.

With an isolation voltage of $\geq 1000 V_{DC}$.

7.7 Synchronization

Synchronizing multiple devices

Max. number of devices:

4

Synchronization signal:

Right-angle, 2 Hz

Synchronization accuracy:

$\pm 10 \mu\text{s}$

7.8 Device specification

Microprocessor, FPGA, Memory

Microprocessor:

50..80 MHz, 32 bit

FPGA:

Xilinx, Spartan family

Memory:

Volatile: SDRAM, 32 MByte

Non-volatile: Flash-EPROM, 2...8 MByte

USB port

Transmission speed:

High Speed, up to 480MBit/s,
or Full Speed, 12MBit/s

Driver type and operation:

Transmission mode is *Bulk*

USB-port:

Typ B, standard

LAN/Network interface

Transmission standard:

10Base-T

Transmission speed:

10 or 100 MBit/s

Physical

Device dimensions:

Expert Key L: 50 x 185 x 215 mm (B x H x D)

Expert Key C: 280 x 57 x 208 mm (B x H x D)

Device weight:

Expert Key L: 750 g

Expert Key C: 1.5 kg

Signal cable diameter for connecting terminals:

0.14 to 2.5 mm²

Environment

Environmental compatibility:

Electronics conform to RoHS directives.

Other

Permissible ambient temperature:

0...50 °C