
Application Bulletin

Of interest to:	General analytical chemistry, input and output, controller, I/O, devices, peristaltic pump, alarm, remote, pcs, process control system, terminal, module, KL, 1104, 2424, 2612, 3054, 3204, 4022, 4022, 9190, 9010, BC, 9000, 9100	P 1
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The ProcessLab I/O controller

Principle

To enable a seamless integration into the process environment the ProcessLab at-line analyzer includes a so-called I/O controller. Equipped with functional terminals it allows to connect a large variety of equipment and offers various communication possibilities. It is the heart of the ProcessLab process integration and thanks to its high flexibility it can be adapted to all modern process plant surroundings.

The functionality is completely integrated into the *tiamo* for ProcessLab software from where all devices of a system are controlled.

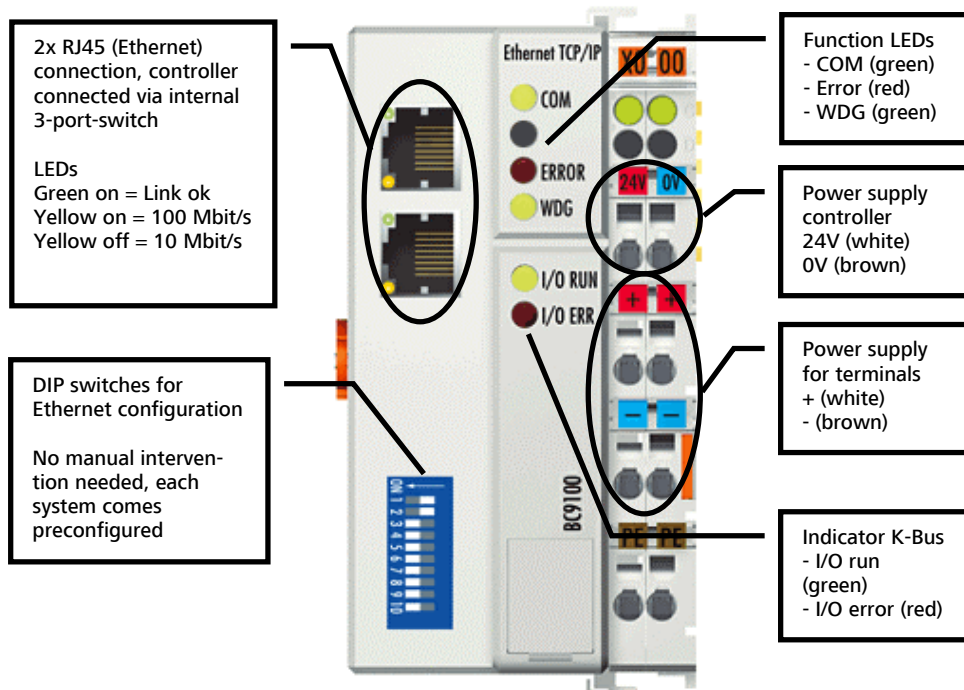
Devices which can be controlled using the I/O controller

- Pumps and valves
- Request of reagent check/refill
- Pushbuttons, e.g. to select method
- Level sensors of reagent containers
- Level sensor for measuring cell
- Optical or acoustical alarm equipment, e.g. signal towers or sirens
- 2-way communication via 4...20 mA lines
- Signaling via remote lines to any device
- Read-in of 4 ...20 mA signals from external equipment
- Read-in of temperatures from Pt 100 or Pt 1000 sensors
- ...any devices supporting the specifications of the I/O terminals

Process integration

- Transmission of any result to a process control system using 4...20 mA lines
- Read-in of results from 4 ... 20 mA devices like
 - Density meter
 - Refractometer
 - Viscosimeter
 - Pressure sensor
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- Read-in of a Pt100 or Pt1000 can be used to calculate and compensate the volume expansion of non-aqueous media
- Acquired data such as e.g. density or refractive index are read-in and stored in the same report or database for documentation.
- In combination with *tiamo* the supervisor can be informed actively about the actual condition of a bath. Either it is replenished automatically (using pumps and valves) or the replenishment is carried out manually. The amount of reagents to be added can be calculated automatically by *tiamo* for ProcessLab.
- Monitoring, handling and storing of all relevant process parameters
- Request of manual intervention using a signal tower or a siren
- All types of criteria can be set to react on different process conditions

BC9100 I/O controller details



Functional description

The BC9100 interprets the signals received from the industrial PC (IPC) and sends them via the internal bus to the corresponding terminal. In the opposite way the controller reads out the signals and sends it to the IPC (*tiamo*). The communication is handled using the TCP/IP protocol with a static IP configuration. The integrated 3-port-switch allows cascading of 2 or more controllers. For a more flexible use an extension module for ProcessLab could contain a second I/O controller.

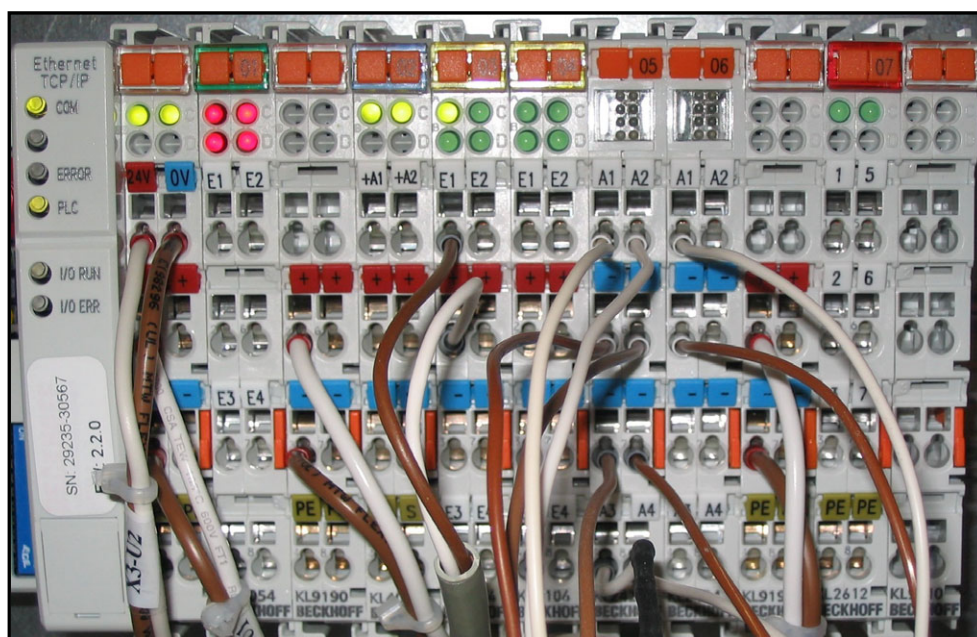
PLC controlled

A PLC firmware on the controller makes sure that all commands received from the control PC via the Ethernet interface are carried out in real time. The firmware comes preinstalled and needs no further configuration or settings.

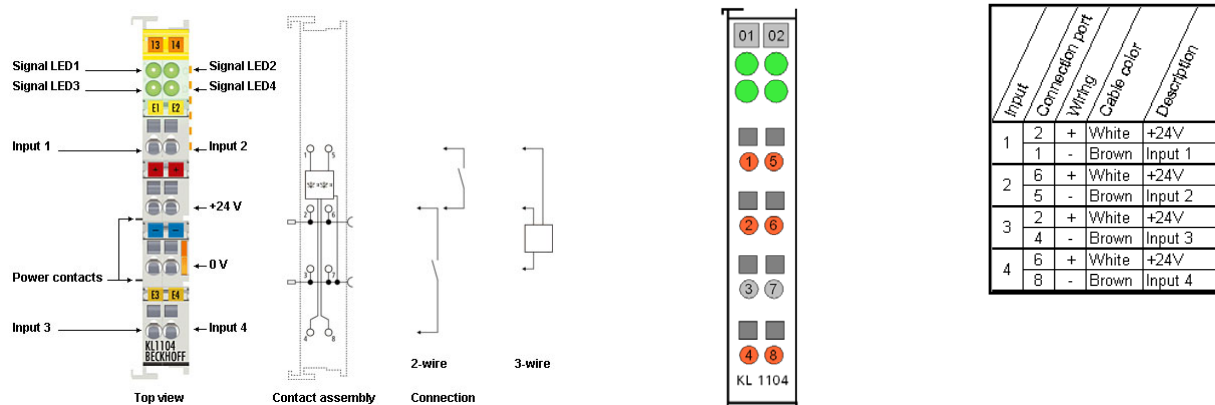
Available terminals

- KL 1104: Digital input
- KL 2424: Digital output
- KL 2612: Relay output
- KL 3054: Analog input 4...20 mA
- KL 3204: Analog input temperature module
- KL 4022: Analog output 4...20 mA
- KL 9190: Power feed terminal (comes with every BC9100)
- KL 9010: End terminal (comes with every BC9100)

Example of a typical controller setup



Digital input terminal KL1104 (6.7202.100)



Function

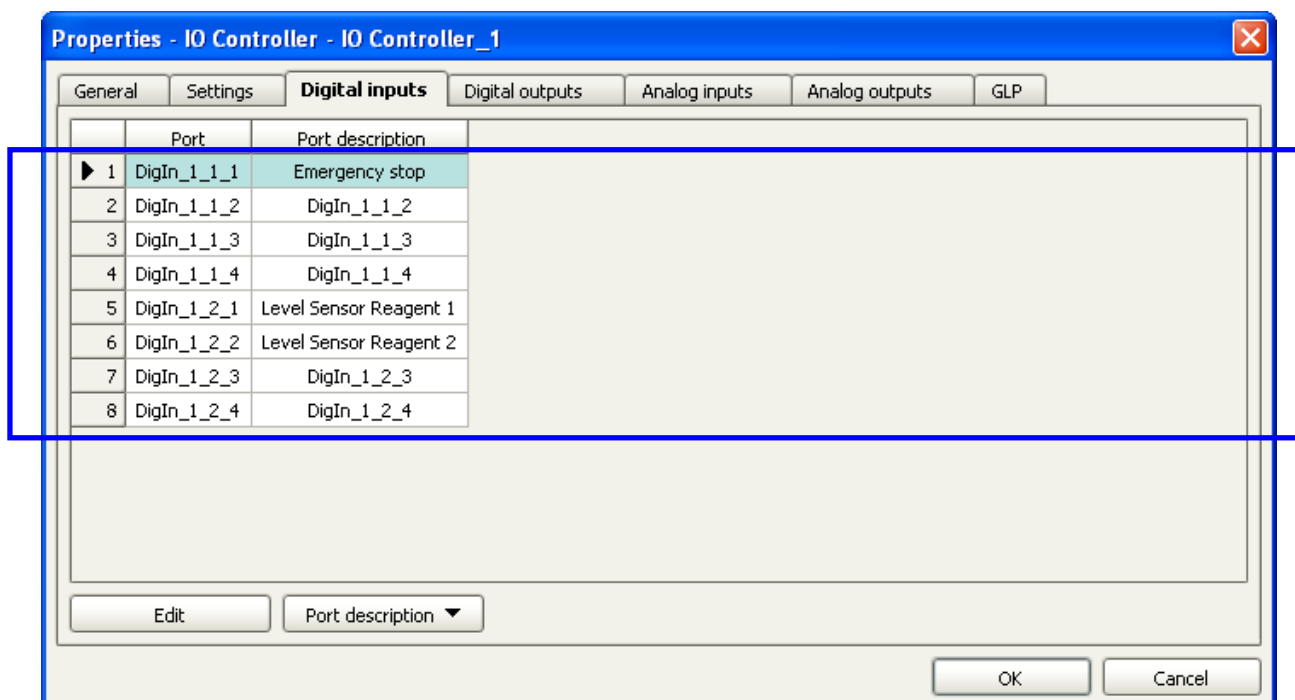
The KL 1104 acquires the digital input signals from any kind of contact closures and forwards them to the BC9100 I/O controller. This terminal has 4 connections, inputs 1 and 3 respectively 2 and 4 share the +24 V port.

Devices

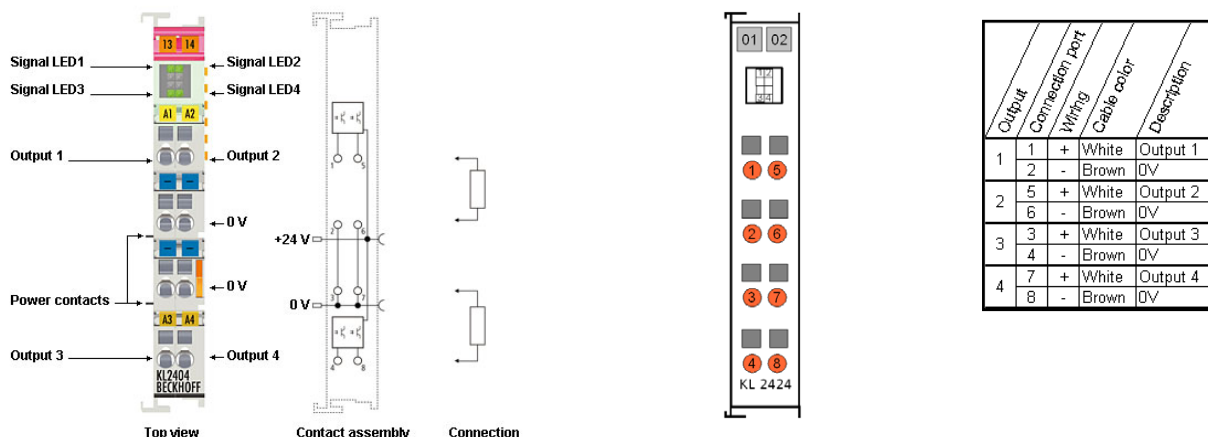
- Emergency switch*
- ProcessLab liquid level sensor (lower or upper reagent level)
- ProcessLab Level sensor for measuring vessel; 6.7204.200
- I/O devices that use contact closures for signalling

* Every base unit contains an emergency switch which must be connected to the first digital input. This is software-implemented and cannot be changed for security reasons.

Screenshot: Digital input properties of the I/O controller



Digital output terminal KL2424 (6.7202.200)



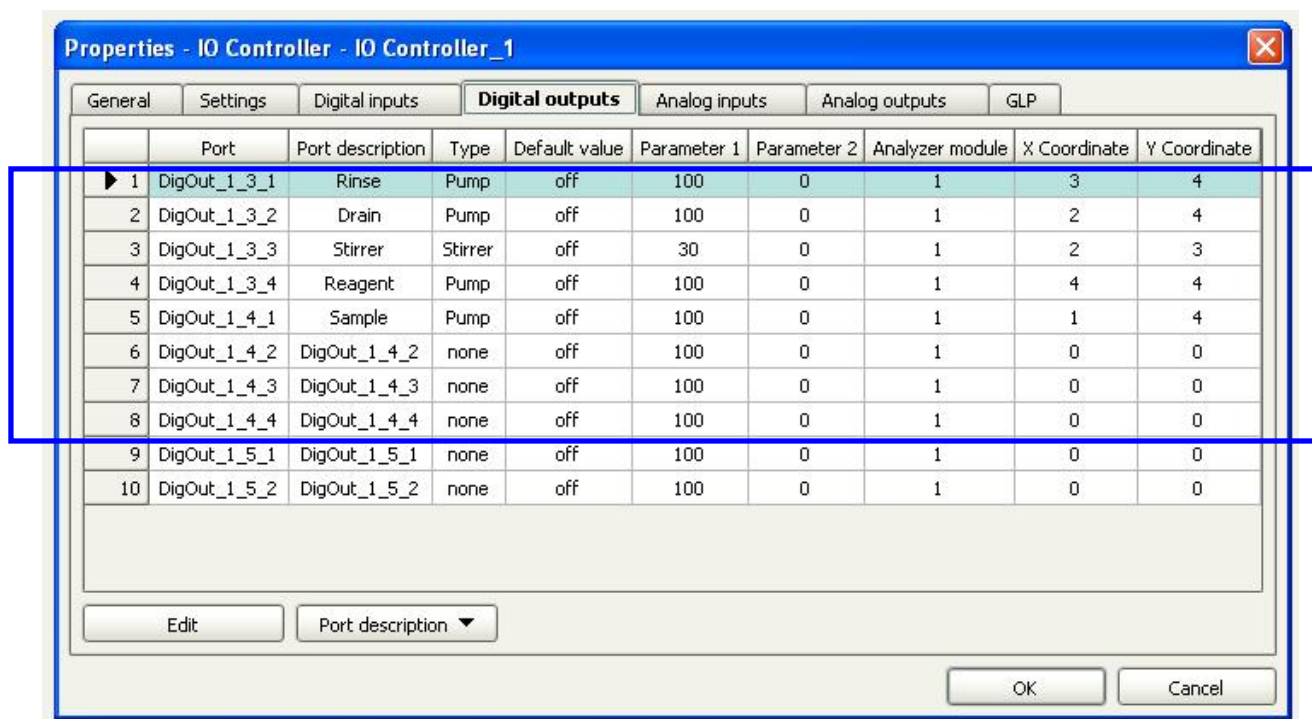
Function

The KL 2424 is used to switch devices connected ON or OFF. This terminal supports max. 4 devices. Available voltage is 24 V and a current of max. 2 A.

Devices

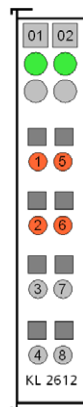
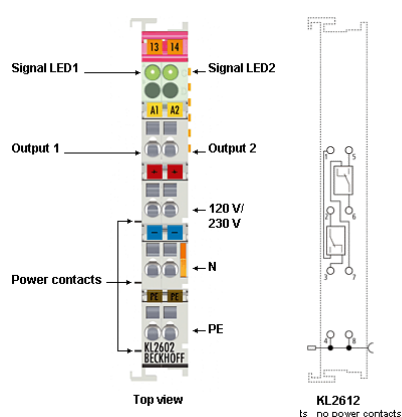
- ProcessLab peristaltic pump; 6.7205.0X0
- ProcessLab loop sampling system; 6.7206.010
- ProcessLab solenoid valve module; 6.7206.210
- Any device supporting 24 V and max 2 A

Screenshot: Digital output properties of the I/O controller*



* Digital and relay outputs appear in the same tab due to their similarity

Relay output KL2612 (6.7202.500)



Output	Connection port	Wiring	Cable color	Description
1	*	+	White	+24V
	1	(-)	Green	
2	*	+	White	+24V
	5	(-)	Green	
6	*	+	White	+24V
	6	(-)	Brown	0V

*24V can be supplied from any connection

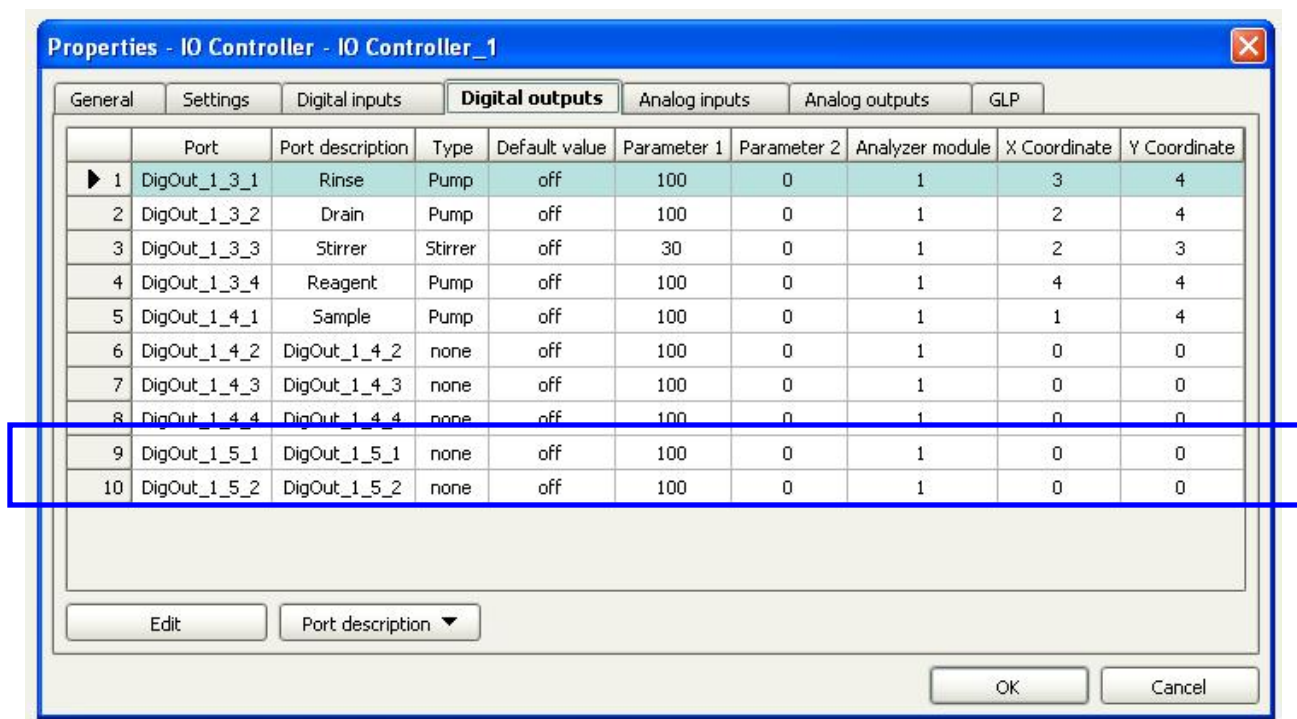
Function

The KL 2612 receives the relay signals and switches the corresponding relay output (changeover contacts). It provides 2 change-over contacts only. Each connection supports max. 0.5 A at 125 V AC or 2 A at 30 V DC (appr. 60 W).

Devices

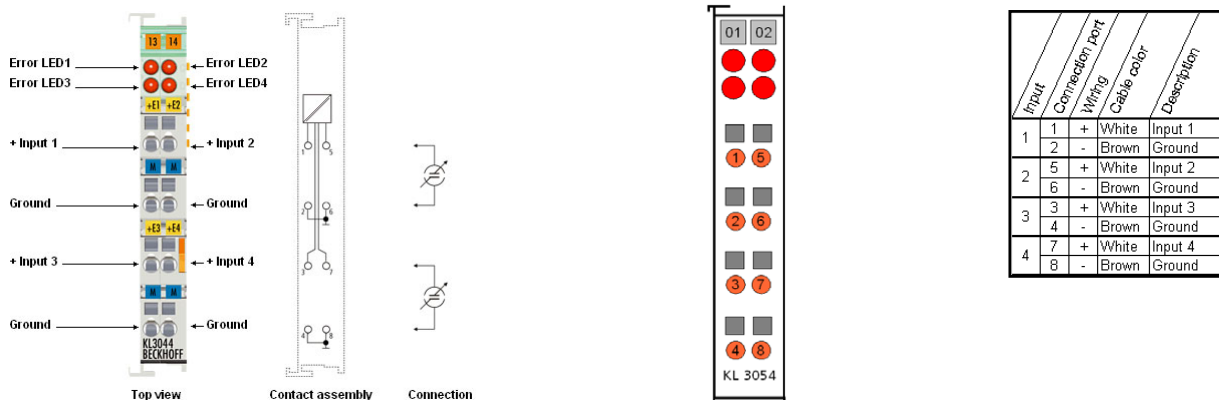
- ProcessLab loop sampling system; 6.7206.000
- Signal communication to process control system (PCS)
- External devices for alarm signal if result out of limit (acoustic or visual)
- Devices with a voltage up to 125 V AC and a max. current of 0.5 A

Screenshot: Relay output properties of the I/O controller *



* Digital and relay outputs appear in the same tab due to their similarity

Analog input terminal KL3054 (6.7202.310)



Function

The KL 3054 measures the current from a corresponding device and sends it to *tiamo*. Acquired results can easily be incorporated into a *tiamo* report without the need to log it on a separate documentation system. It provides up to 4 connections. Each connection supports a current 4...20 mA and a maximum voltage of 35 V.

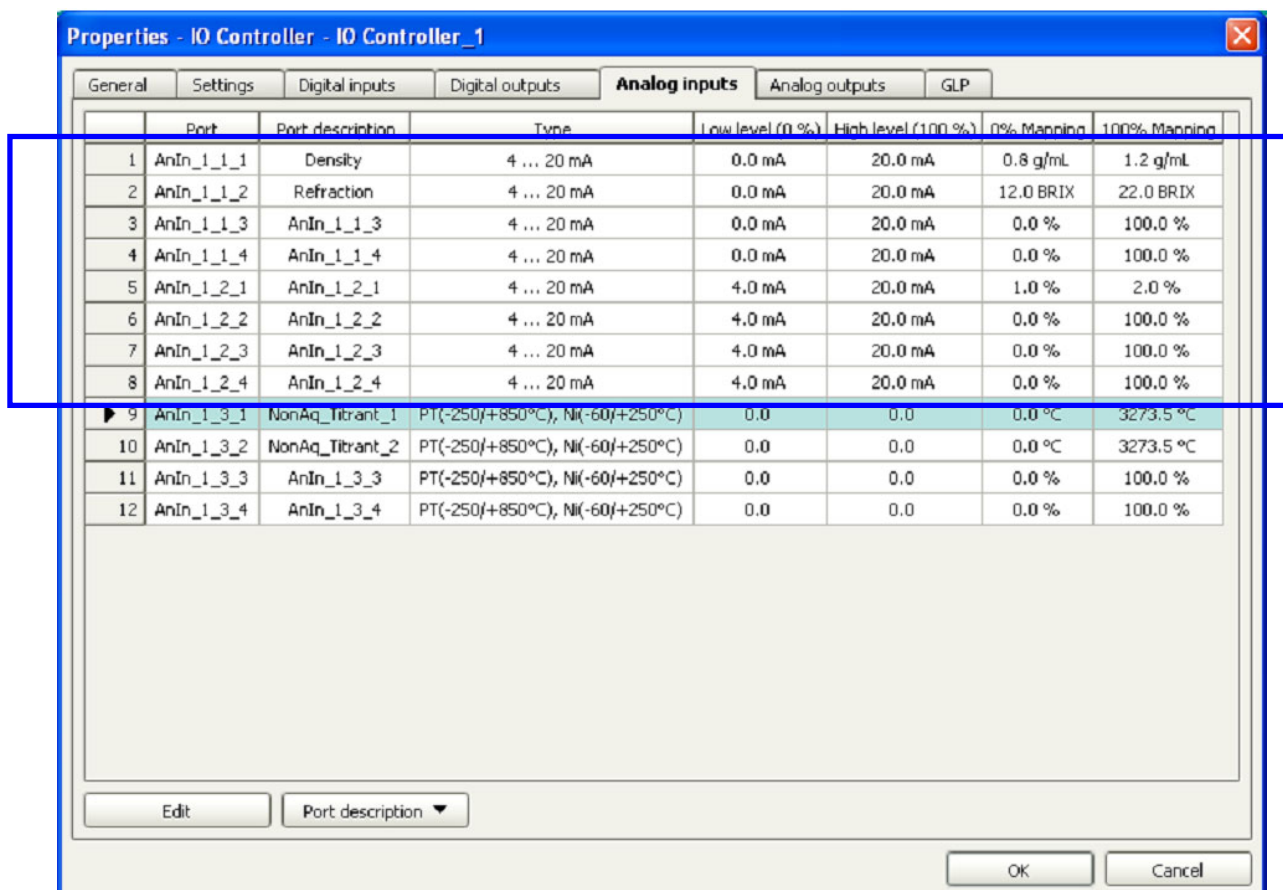
Devices

- Density meter, refractometer, pressure sensor...
- Any device that supports an output of 4...20 mA

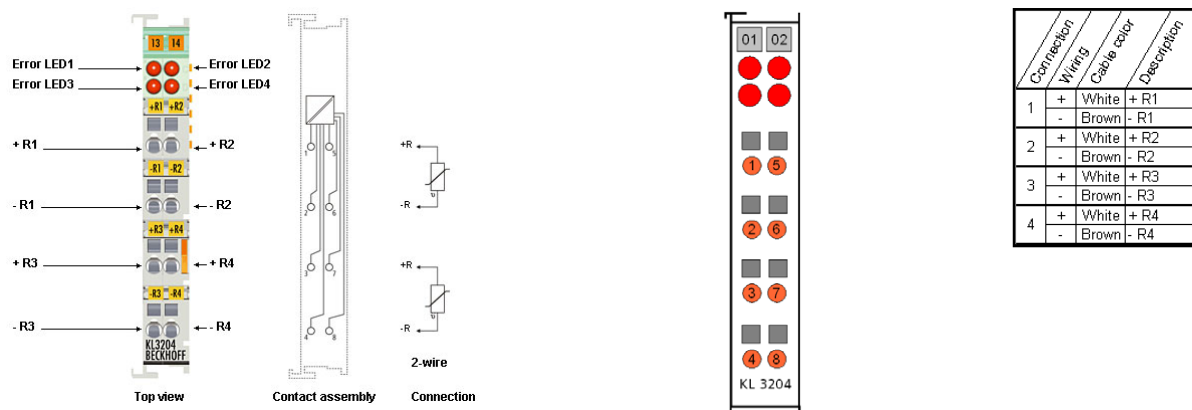
Limitation

This analog input terminal needs a special firmware on the I/O controller. It is available only factory – installed.

Screenshot: Analog input properties of the I/O controller *



Analog input terminal (temperature) KL3204 (6.7202.300)



Function

The KL 3204 measures the resistance of a temperature sensor and sends the result to *tiamo*. It provides up to 4 connections. It supports various temperature sensors on the market – type of sensor will be set in the factory.

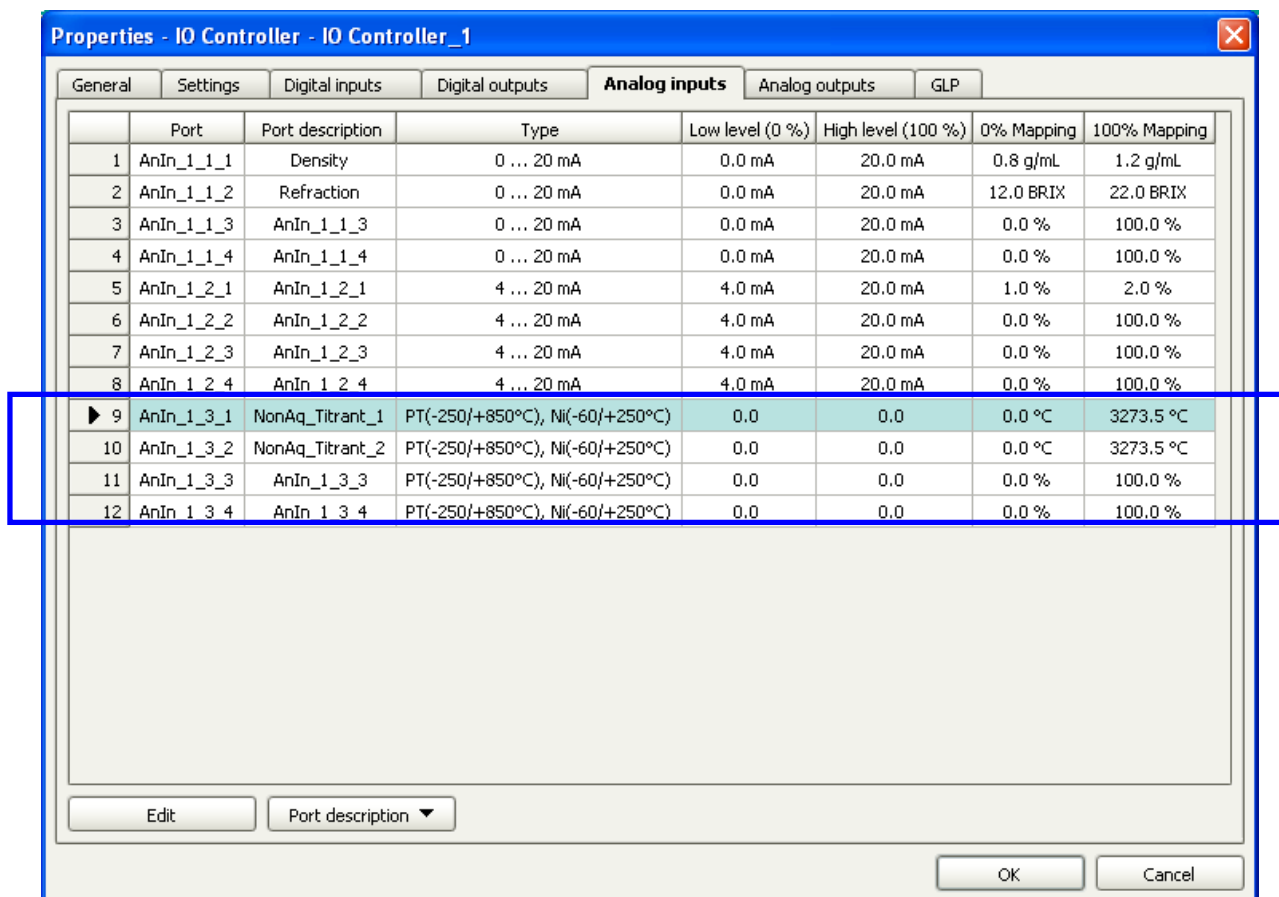
Devices

- Temperature sensor Pt 100 or Pt 1000 (e.g. for titrant temperature)

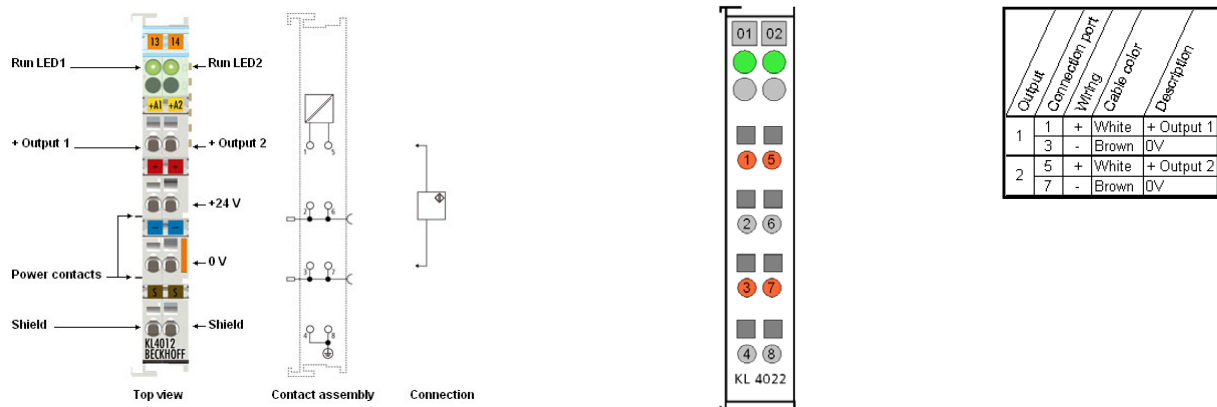
Limitation

This analog input terminal needs a special firmware on the I/O controller. It is only available factory-installed.

Screenshot: Analog input temperature properties of the I/O controller *



Analog output terminal KL4022 (6.7202.400)



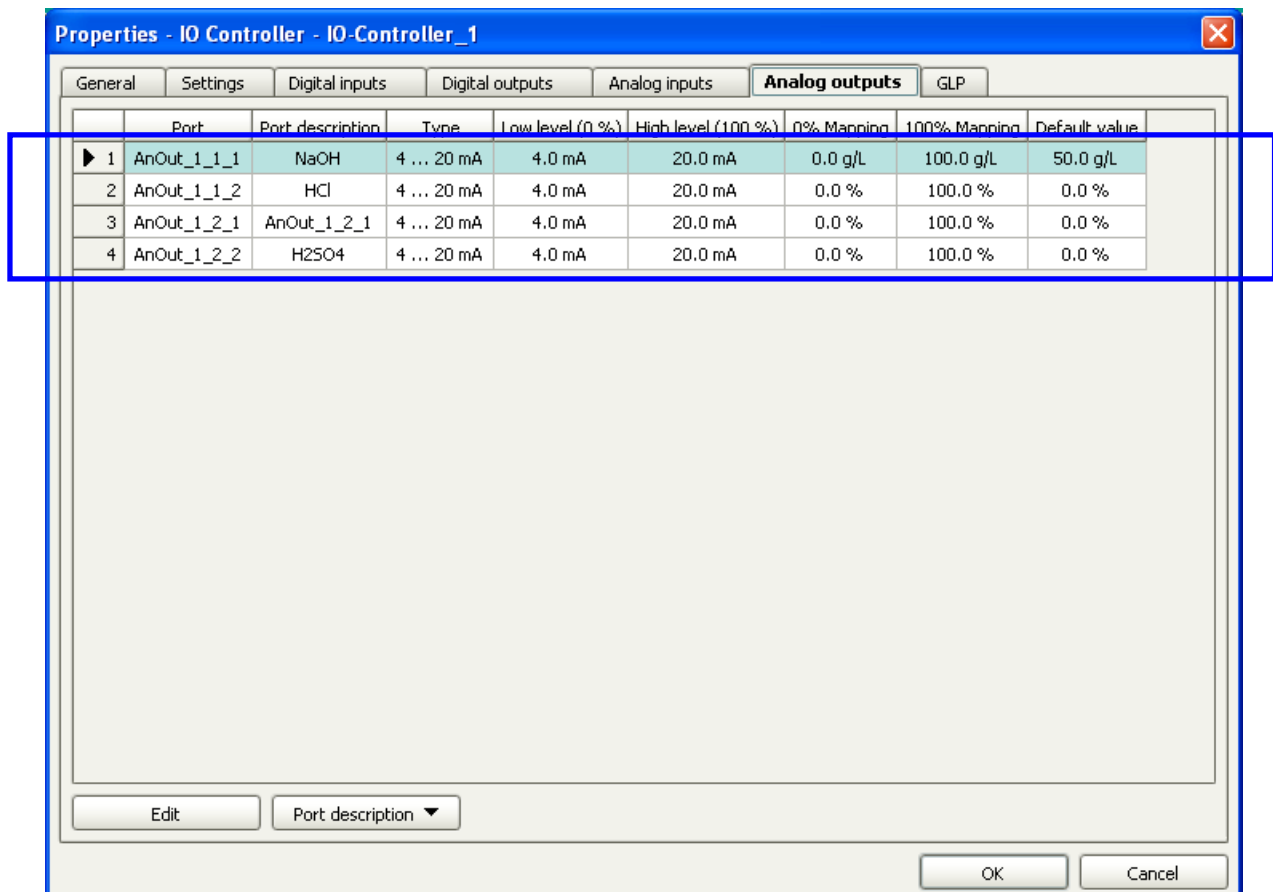
Function

The KL 4022 sends out a corresponding analog signal using the data received from *tiamo*. This signal can be used to transmit any value as a result or concentration to an external device. It provides 2 connections only.

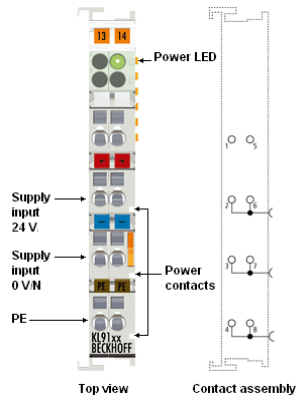
Devices

- Process control system (PCS)
- Any device which accepts current signals from 4...20 mA

Screenshot: Analog output properties of the I/O controller



Power feed terminal KL9190 (comes with every BC9100)


Function

The KL 9190 is used to create an independent potential group. It is either used in front of a relay output to ensure a proper separation of the power circuits or to supply a fresh power feed-in. It comes factory-installed and cannot be added at a later time.

Devices

- Supports connection of 24 V from the power supply only

Bus end terminal KL9010 (comes with every BC9100)

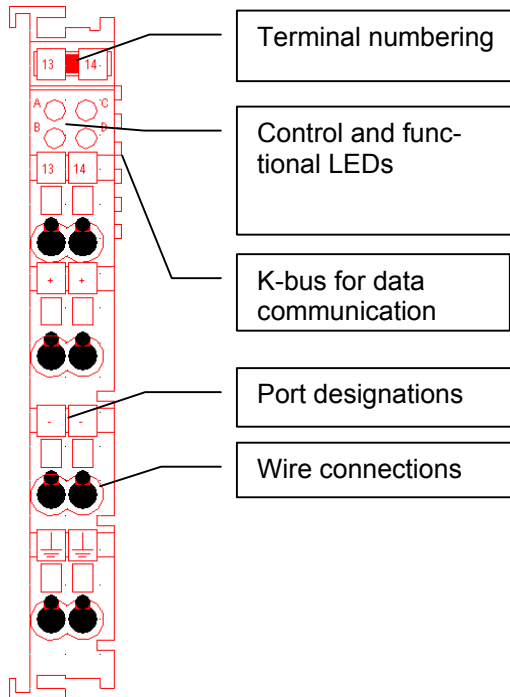

Function

The bus end terminal KL 9010 is necessary to define the end of the I/O controller terminals. It supports no cable connections and has no other functionality than terminating the so-called K-bus (internal communication bus).

Devices

- No devices can be connected to this terminal.

Technical details of the bus terminals



Technical notes

- System needs to be disconnected from the mains power if any works are carried out.
- Every single terminal can be released (pulled out) using the orange strip release. No tools are needed. Only in powerless state!
- Cable end sleeves must be used before inserting wires into a terminal. Otherwise shortcuts may occur due to lost or broken copper wire.
- Check wire cross section (mm²) to supply connected device
- Make sure that external device specifications meet all requirements like e.g. voltage and current specifications of the terminals

Naming convention for devices connected to the I/O controller

To simplify the use a unique naming system is being used. These port designations are used in *tiamo*, on the device cables in the wet part and at the cables close to the I/O controller.

Newly installed equipment should always be named and tagged uniquely and correctly to ensure the proper consistency of the system.

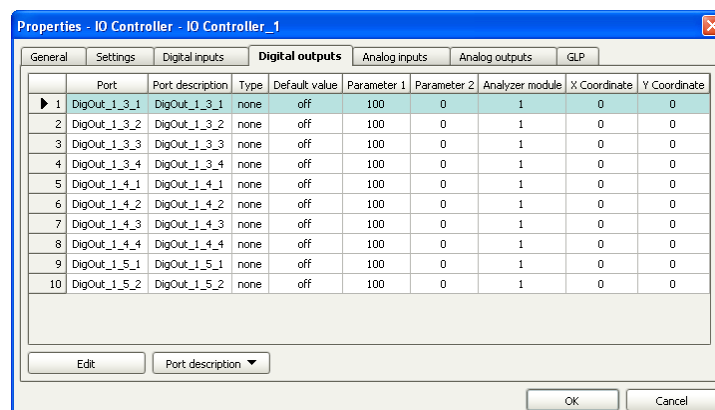
Example as tagged on wires **1_3_1**

The same port in *tiamo* **DigOut_1_3_1**

1st number I/O controller number, "one" in most cases

2nd number Terminal number, orange number on top of each I/O terminal

3rd number Connection number, the connection port at the terminal (up to 4)



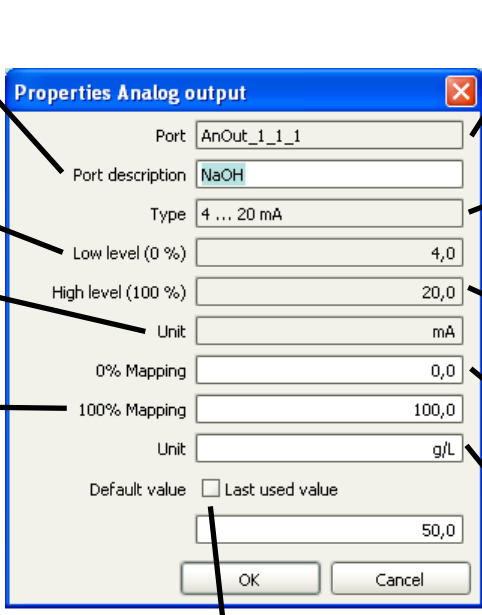
Mapping of analog in- and outputs

The mapping makes sure that a transmitted value is within a defined range. The communicating devices need to be configured the same way in order to transmit and receive the correct result. The range between a lower and upper value is proportionally converted to the 4...20 mA scale.

Example

With a lower value of 80 g/L and an upper value of 90 g/L, a measured value of 85 g/L will be converted to 12 mA.

The following screenshot illustrates the transmission of a result to the PCS. The expected NaOH content in this example ranges from 0 g/L to 100 g/L. All specifications in the white boxes must comply with the settings on the receiver side.



The screenshot shows the 'Properties Analog output' dialog box with the following fields and annotations:

- Port description or parameter to be transmitted:** Points to the 'Port description' field, which contains 'NaOH'.
- Min. current:** Points to the 'Type' field, which contains '4 ... 20 mA'.
- Unit for transmission:** Points to the 'Unit' field, which contains 'mA'.
- Upper limit of result range:** Points to the '100% Mapping' field, which contains '100,0'.
- Port used for sending the result:** Points to the 'Port' field, which contains 'AnOut_1_1_1'.
- Transmission current range:** Points to the 'Low level (0 %)' field, which contains '4,0'.
- Max. current:** Points to the 'High level (100 %)' field, which contains '20,0'.
- Lower limit of result range:** Points to the '0% Mapping' field, which contains '0,0'.
- Unit of results, irrelevant for transmission:** Points to the 'Unit' field at the bottom, which contains 'g/L'.
- If no result is present enter a standard value or set mark to use "last used value":** Points to the 'Default value' section, which includes a checkbox for 'Last used value' and a text field containing '50,0'.

Buttons at the bottom: OK, Cancel.

Note

This screenshot applies analogously for the analog input terminals. The only difference is that analog inputs cannot be added at a later time to an existing controller configuration.

Service & maintenance

The I/O controller needs no servicing or maintenance!

Appendix

Each ProcessLab system is shipped with detailed instructions for use which contain further information about the I/O controller und the terminals.