

EWIKON



pro CONTROL

Data communication

Supplement for
operating manual

1	Introduction	3
1.1	Digital control inputs (24V) and relay contact outputs.....	3
1.2	Data communication.....	3
2	Digital input / relay output.....	4
2.1	Digital inputs	4
2.1.1	Wiring digital inputs	4
2.1.2	Configuring digital inputs	5
2.2	Digital outputs (contacts).....	6
2.2.1	Wiring digital outputs.....	6
2.2.2	Configuring digital outputs.....	6
3	Data Communication via RS485	7
3.1	Controller settings.....	7
3.1.1	Protocol	7
3.1.2	Baud rate.....	7
3.1.3	Address	7
3.2	Wiring of a RS485 connection in general.....	8
3.3	FE3 Protocol (RS485).....	9
3.3.1	Wiring an pro CONTROL controller to a Feller SI13u.....	9
3.3.2	Protocol Features	9
3.4	ARBURG Protocol	10
3.4.1	Wiring to an ARBURG IMM.....	10
3.4.2	Protocol Features	10
3.5	FANUC Protocol	11
3.5.1	Wiring to a FANUC IMM	11
3.5.2	Protocol features.....	11
3.6	ENGEL Protocol.....	12
3.6.1	Wiring to an ENGEL IMM	12
3.6.2	Protocol features.....	12
4	Data communication via ethernet.....	13
4.1	Controller settings.....	13
4.1.1	IP address / subnet mask.....	13
4.2	FE3 Protocol (UDP).....	14
4.3	OPC UA (EUROMAP 82.2 resp. OPC 40082-2)	14

1 Introduction

The connection of a temperature controller to an injection moulding machine has become increasingly important in recent years.

Just a few advantages of such a connection are:

- If the **temperature controller** detects any disturbance (eg. broken sensor), the machine can react to stop production automatically.
- In case of a **moulding machine** malfunction, the controller can react automatically, for example, by lowering the temperatures (“standby”).
- The user can conveniently operate the injection moulding machine and temperature controller on the **same display**. For this purpose, the injection moulding machine manufacturer offers a special user interface for operating the zones of the hot runner controller.

In principle, the pro CONTROL controller supports two different methods of coupling to a machine:

1.1 Digital control inputs (24V) and relay contact outputs

The controller evaluates 24V DC signals from the moulding machine. The digital inputs are used for the remote activation of functions such as “standby” or “locking the outputs”.

The controller also has two potential-free relay contacts to transmit a warning and/or alarm status to the injection moulding machine.

Both of these input/output methods are not able to transmit any process values (e.g. temperature values) to the machine and it is also not possible to change any controller settings. This requires real data communication.

1.2 Data communication

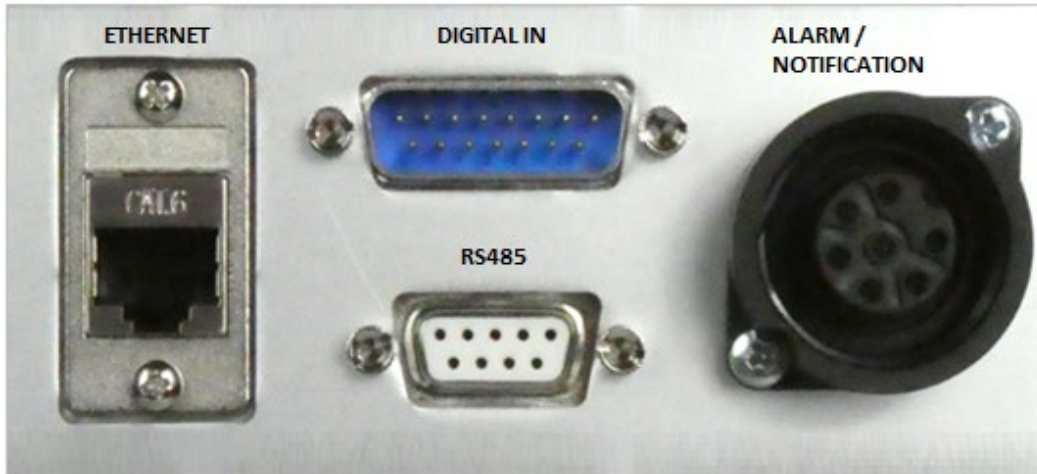
With data communication it is possible to get process values from the controller (temperature values, zone alarms, heating current...) and also to change controller settings.

To establish a connection between moulding machine and temperature controller, it is very important to use the same “**communication protocol**”. It is comparable to human language: Only two people speaking the same language can communicate with each other.

Also the communication **interface** is important. By default, pro CONTROL has two interfaces: **RS485** and **ETHERNET**.

2 Digital input / relay output

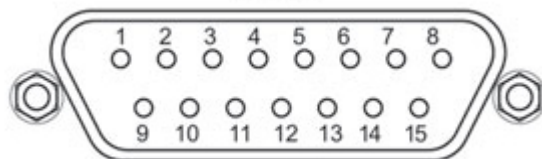
The digital input / relay contact output connectors are located - like all other interfaces - on the rear of the pro CONTROL housing. Special cables are available from EWIKON Heißkanalsysteme GmbH to allow easy connection.



The pro CONTROL controller evaluates 24V DC signals via a 15-pole D-SUB input. The digital inputs are PLC compatible, i.e. they operate over a voltage range of 13...30 VDC.

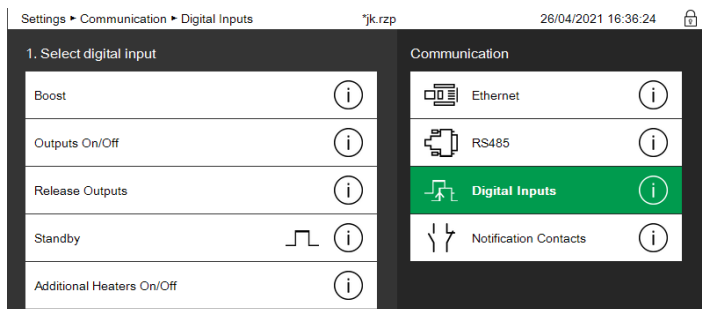
2.1.1 Wiring digital inputs

Table 1 Digital input	Function	
1	Boost	+24 V _{DC}
2	Outputs On/Off	+24 V _{DC}
3	Release Outputs	+24 V _{DC}
4	Standby	+24 V _{DC}
6 – 8	Ground	0 V _{DC}
9	Add. Heaters On/Off	+24 V _{DC}
13 – 15	Ground	0 V _{DC}



2.1.2 Configuring digital inputs

The configuration of digital inputs is available in the user interface at menu “Settings > Communication > Digital Inputs”.



For each single input function it is possible to select how the controller shall react:




- activate with 24V (high-active)
- activate with 0V (Low-active)
- change with rising edge
- change with falling edge
- Disable input

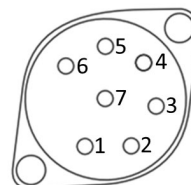
Press the respective info buttons  to get more detailed information.

2.2 Digital outputs (contacts)

2.2.1 Wiring digital outputs

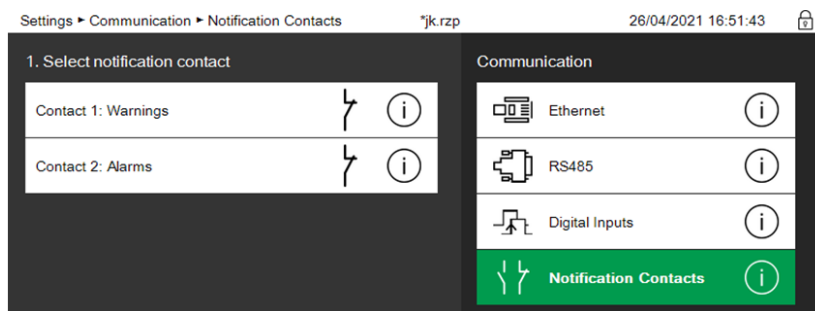
The pro CONTROL controller has the following two potential-free contacts

Table 2 Alarm/ Notification socket	Function
Pin 1  Pin 3	Collective warning
Pin 4  Pin 5	Collective alarm
Pin 2  Pin 6	Currently without function



2.2.2 Configuring digital outputs

The configuration of digital outputs is available at menu “Settings > Communication > Notification Contacts”.



For both contacts it is possible to select if they are normally opened or normally closed.

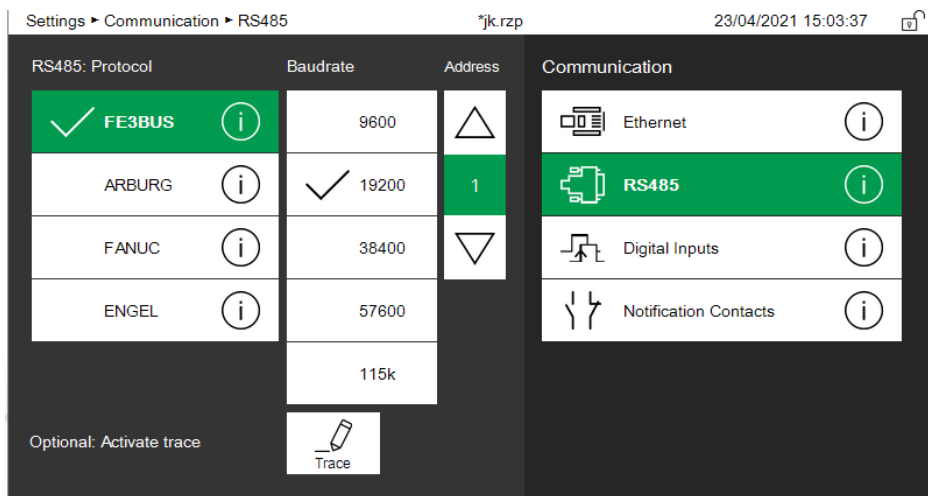
Press the respective info buttons  to get more detailed information.

3 Data Communication via RS485

RS485 is a standard defining the electrical characteristics of drivers and receivers for use in serial communications systems. Digital communication networks implementing the standard can be used effectively over long distances and in electrically noisy environments. Multiple receivers may be connected to such a network in a linear, multidrop bus system. These characteristics make RS485 useful in industrial control systems and similar applications.

3.1 Controller settings

For the RS485 interface, all settings can be selected at menu “Settings / Communication / RS485”



3.1.1 Protocol

To establish a connection to an injection moulding machine, pro CONTROL supports different data communication **protocols**.

“FE3BUS” is a proprietary protocol from Feller Engineering and allows to operate nearly all of the controller settings by remote.

All other available protocols are named by the name of the machine manufacturer. They are more or less extensive and allow only a subset of the available controller functions.

3.1.2 Baud rate

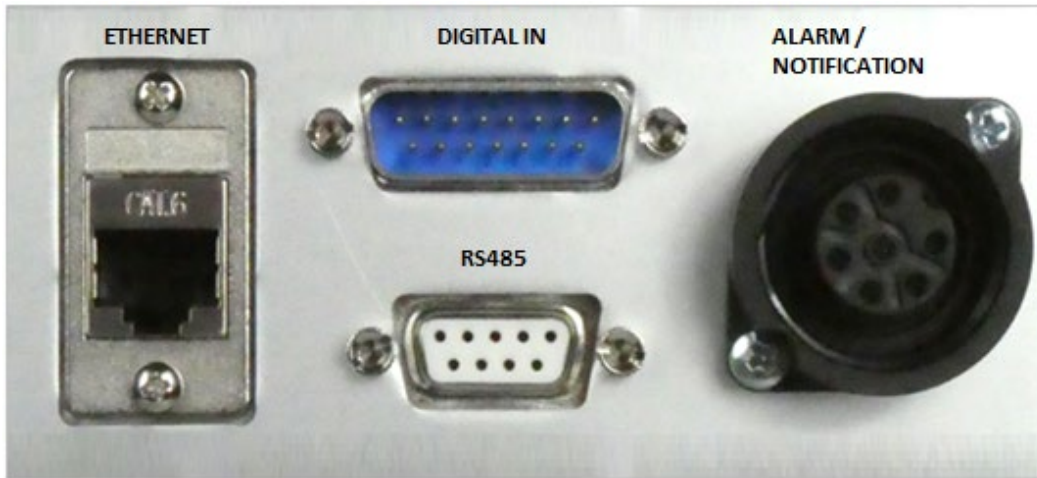
In addition to the selected protocol it is also important, that machine and controller are using the same **baud rate** (transmission speed).

3.1.3 Address

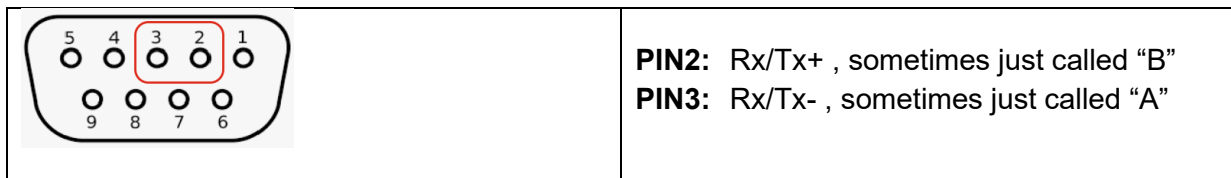
As RS485 is an interface for connecting up to 30 temperature controllers in one bus system, each of the controllers on this bus must be set to a different **address**. By default pro CONTROL is set to address 1 and if you do not have more than one controller leave this setting unchanged.

3.2 Wiring of a RS485 connection in general

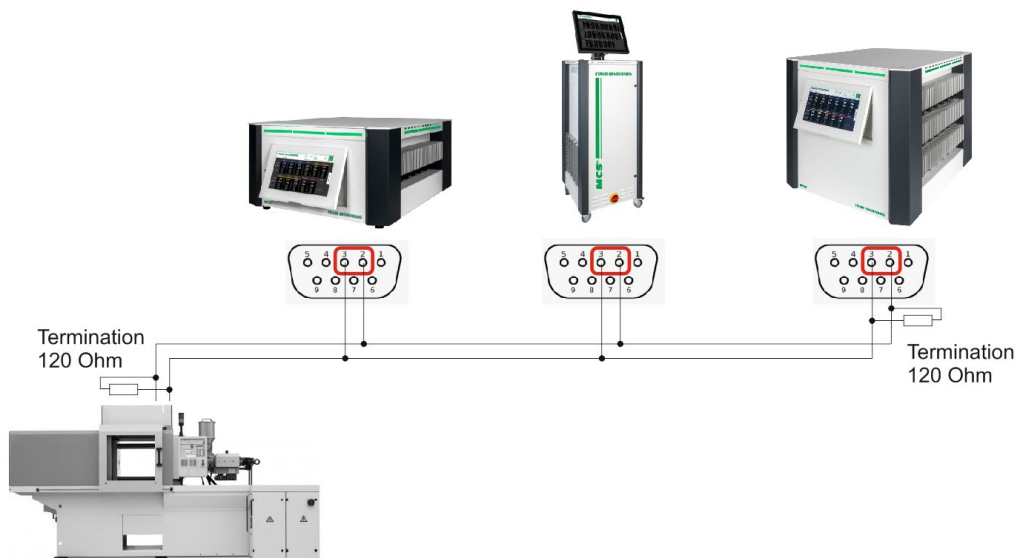
The RS485 Interface is located - like all other interfaces - on the rear of the pro CONTROL housing.



Only two pins of this female 9 pole D-SUB connector are used:



You have to use a **shielded 2-pole twisted** communication cable. Connect all RS485 serial interfaces in parallel, like shown in the picture below. Ideally, an RS485 system consists of a single linear cable (no branches) with **120 ohm resistors** connected across the two wires at each end of the cable. RS485 can handle line lengths of up to 1 km.



Please note, that the connection of RS485 is not standardised and each different injection moulding machine may have different methods to connect the two RS485 wires. Therefore please carefully refer to the manual from your machine manufacturer.

3.3 FE3 Protocol (RS485)

“FE3” is the most comprehensive RS485 protocol available and it supports most of the functions of the pro CONTROL controller. Every single Feller Engineering temperature controller supports this protocol and thus you can connect many different controller types to one single data bus. The description of this protocol is open and available as a separate document.

There are different injection machine builders who are supporting this protocol, one of them is SUMITOMO DEMAG.

3.3.1 Wiring an pro CONTROL controller to a Feller SI13u

The SI13u converter connects a USB interface to the RS485 two-wire interface. Due to the small dimensions of the housing and the low energy consumption of the SI13u, it is ideally suited for stationary use on PCs as well as for mobile use on laptops.



FELLER SI13u			pro CONTROL	
Pin #	Name		Pin #	Name
2	RS485 B /+	→	2	RS485 B /+
3	RS485 A /-	→	3	RS485 A /-

3.3.2 Protocol Features

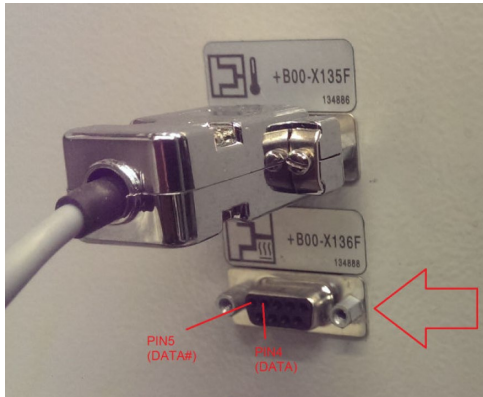
The protocol allows to operate all parameters and process values.

3.4 ARBURG Protocol

pro CONTROL communicates to ARBURG injection moulding machines based on the communication standard EUROMAP 17. The machine needs to be equipped with “Special option for 458/01: with Euromap 17”. The maximum baud rate for ARBURG machines is 9600 baud.

3.4.1 Wiring to an ARBURG IMM

This is a picture of the ARBURG RS485 interface on a machine type “270A”



On ARBURG machines the communication pins are 4 and 5 and called “DATA#” and “DATA”. Connect the communication bus to pro CONTROL as shown in the table.

ARBURG			pro CONTROL	
Pin #	Name		Pin #	Name
5	DATA#	→	2	RS485 B /+
4	DATA	→	3	RS485 A /-

Refer to ARBURG documentation how to set up the correct baudrate at their machine.

3.4.2 Protocol Features

- Receiving and setting of temperature setpoints
- Receiving and setting of standby setpoints
- Receiving and setting of power output level (%) in manual mode
- Receiving and setting of temperature tolerances
- Receiving the number of zones
- Receiving the actual temperature values
- Receiving the current power output level (%)
- Receiving the zone status
 - High temperature alarm
 - Low temperature alarm
 - Upper deviation warning
 - Lower deviation warning
 - Broken thermocouple
 - Heating current alarm
- Setting the zone operation mode

3.5 FANUC Protocol

pro CONTROL is using a special “MODBUS” variant to communicate to FANUC injection moulding machines.

3.5.1 Wiring to a FANUC IMM

The injection moulding machine needs to be equipped with a “MOXA Box”, which provides the RS85 interface. The connection scheme between controller and the Moxa Box is

FANUC (MoxaBox)			pro CONTROL	
Pin #	Name		Pin #	Name
	R+/D+	→	2	RS485 B /+
	R-/D-	→	3	RS485 A /-

A special cable “AU 0069” is available from EWIKON Heißkanalsysteme GmbH. Please refer to the FANUC manual for correct setup of the RS485 data interface.

3.5.2 Protocol features

- Receiving and setting of temperature setpoints
- Receiving and setting of temperature tolerances
- Switching zones on and off
- Receiving the actual temperature values
- Receiving the power output level (%)
- Receiving the heating current (A)
- Receiving the zone status
 - Lower deviation warning
 - Upper deviation warning
 - Heating current deviation alarm
 - Defective triac alarm
 - Broken thermocouple
 - Shut-off temperature exceeded

3.6 ENGEL Protocol

pro CONTROL uses the “HB THERM” protocol to communicate to ENGEL injection moulding machines.

3.6.1 Wiring to an ENGEL IMM

3.6.2 Protocol features

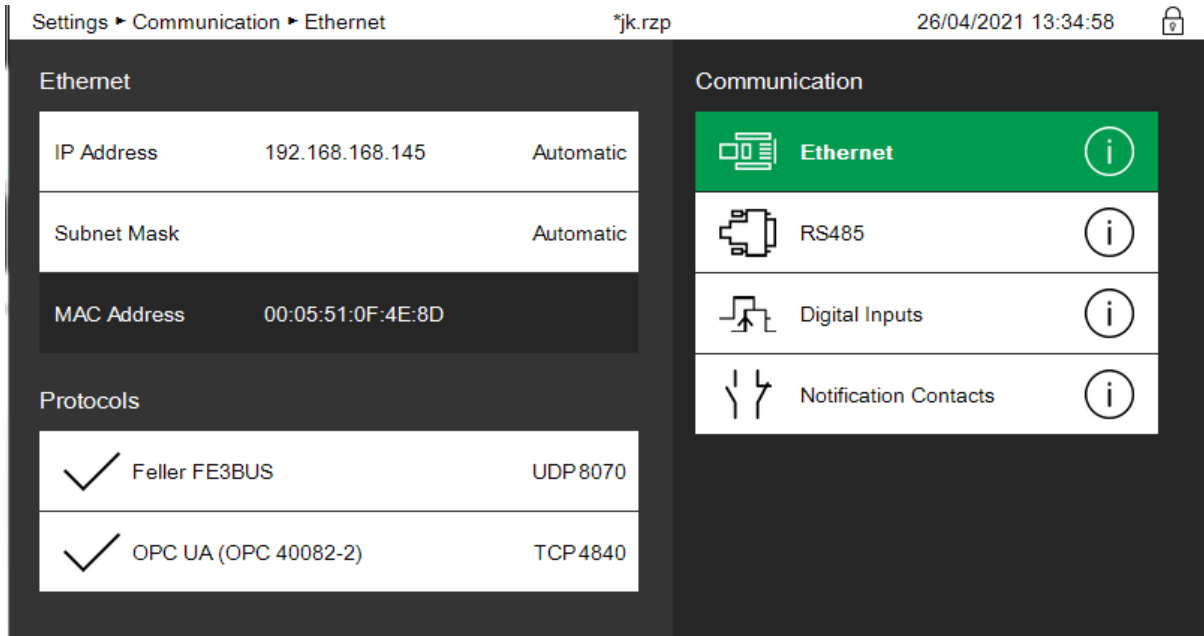
“HB Therm” is a very restricted communication protocol.

- Switching zones on and off
- Setting of temperature setpoints
- Receiving temperature values
- Receiving the zone status
 - Broken thermocouple
 - Heater failure (Fuse or triac defect, no load)
 - High temperature alarm

4 Data communication via ethernet

As already mentioned in the chapter "RS485", various protocols are also used with ethernet to enable communication with injection moulding machines.

Currently FE3BUS protocol and OPC UA (OPC 40082-2) are available and both of them are activated by default.

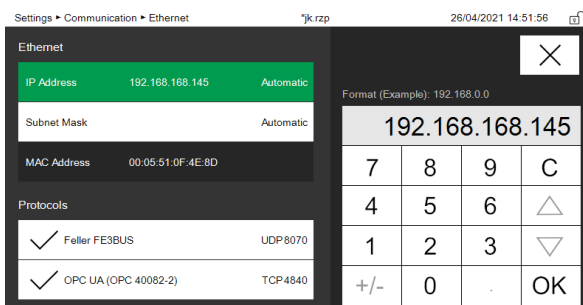


4.1 Controller settings

4.1.1 IP address / subnet mask

Each pro CONTROL controller that uses ethernet communication must be configured with its own IP address, which must be unique in the network. If the controller is connected to a network with a DHCP server available, the IP address as well as the subnet mask can be obtained automatically. **The automatic IP address setting is activated by default, see screenshot above.**

It is also possible to set the addresses manually. By selecting the IP address, changing the setting to "Manual" and confirming by the keypad button you can enter the address. Same applies to the subnet mask.



4.2 FE3 Protocol (UDP)

The protocol has been developed by Feller Engineering and is suited to operate all controller settings and process values. Please see also Chapter 3.3.

Analogous to the serial RS485 communication port, the same protocol is available via ethernet based on UDP on port 8070. The description of this protocol is open and available as a separate document.

4.3 OPC UA (EUROMAP 82.2 resp. OPC 40082-2)

OPC Unified Architecture (OPC UA) is a **standard** machine-to-machine communication protocol for industrial automation developed by the OPC Foundation.

EUROMAP, the European association of plastics and rubber machinery manufacturers, has defined various OPC UA specifications for different applications.

EUROMAP 82.2 describes the interface between injection moulding machines (IMM) and hot runner devices (HRD) for data exchange. The target of EUROMAP 82.2 is to provide an international **standard interface** for IMM and hot runner devices from different manufacturers to ensure compatibility.

A first release candidate has been published on October 10, 2018.

The following functionalities are covered:

- General information about the hot runner device
- Status information
- Process data

Safety-related signals like emergency stop are not included.

The pro CONTROL controller from EWIKON has an integrated OPC UA server by default. The user does not need to configure anything. It is always active and each OPC UA client **supporting EUROMAP 82.2** (resp. OPC 40082-2) can communicate to pro CONTROL based on that specification. The OPC UA server is available via TCP on port 4840.

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