



Inspired by temperature

EtherCAT® Gateway

Technical Bulletin

huber

EtherCAT® Gateway

VALID IN CONJUNCTION WITH:

Huber temperature control unit with Pilot ONE

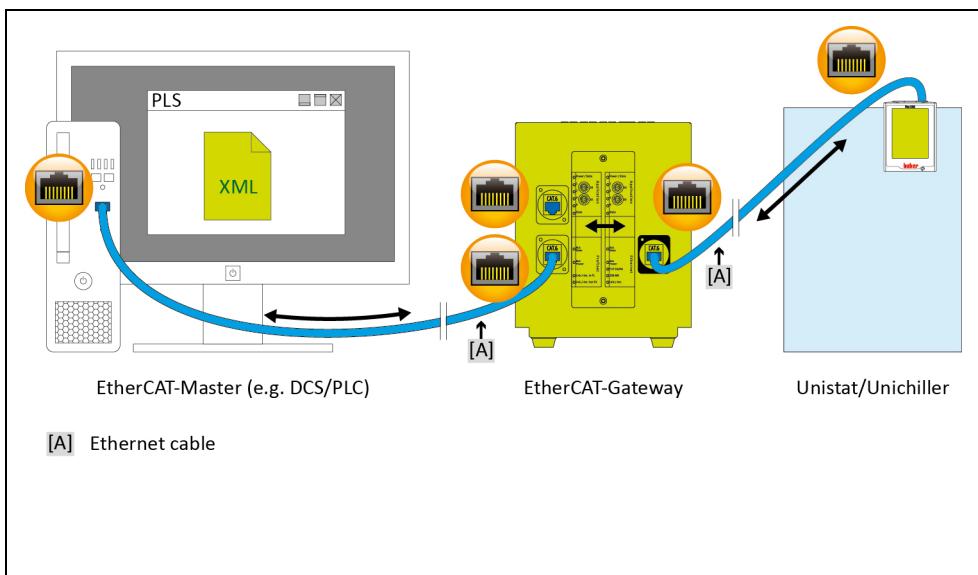
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1 Description

Schematic structure



EtherCAT is used in many industrial applications. The excellent standardization of EtherCAT results in very short start-up times in the field. The EtherCAT Gateway enables Huber temperature control units to be integrated into automation solutions in a simple, flexible and process-oriented way. The corresponding GSDML file is used to integrate the EtherCAT Gateway with the configuration software.

The operating company can specify the functionality of the EtherCAT Gateway. On Huber temperature control units with Pilot ONE, this can be done via the menu "PB-Package". The desired parameters that should be transmitted via EtherCAT can be configured at the Pilot ONE controller. The number of the desired parameters is then configured in the EtherCAT Gateway accordingly.

Please note the inherent restrictions of the different E-grade versions ("Basic", "Exclusive" and "Professional"). For more information, please refer to the data in the Data Transmission Manual at www.huber-online.com.

INFORMATION

Prerequisite for using the EtherCAT Gateway: Huber temperature control unit with Pilot ONE.

2 Information on the functioning of the EtherCAT Gateway

2.1 Position of the EtherCAT Gateway within the data communication

There are two participants from the viewpoint of the EtherCAT Gateway: The EtherCAT master (e. g. DCS, PLC) on the EtherCAT side and the temperature control unit on the Ethernet side.

The temperature control unit receives the information from the EtherCAT Gateway. The EtherCAT Master does not directly access the temperature control unit.

3 Installation instructions

3.1 On-site installation

The EtherCAT Gateway is installed in a stainless-steel housing with mains socket for free-standing installation. The EtherCAT Gateway is connected via an Ethernet cable to the RJ45 interface of the temperature control unit.

The EtherCAT cable is routed directly from the EtherCAT Master to the EtherCAT Gateway. Please note: There is an input and an output connection at the EtherCAT side. The user must guarantee compliance with the EtherCAT parameters. The customer must comply with the applicable standards for the internal wiring of the device. This applies in particular to an electrically conductive functional earth and the potential equalization.

4 Commissioning of the EtherCAT Gateway

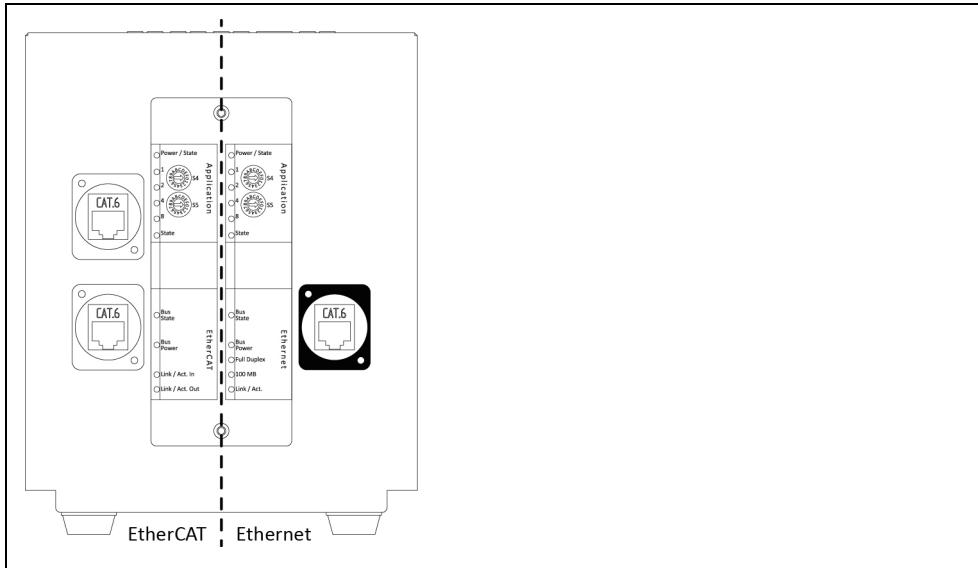
No information can be provided on the structure and configuration of the EtherCAT side as it is beyond Huber's control.

INFORMATION

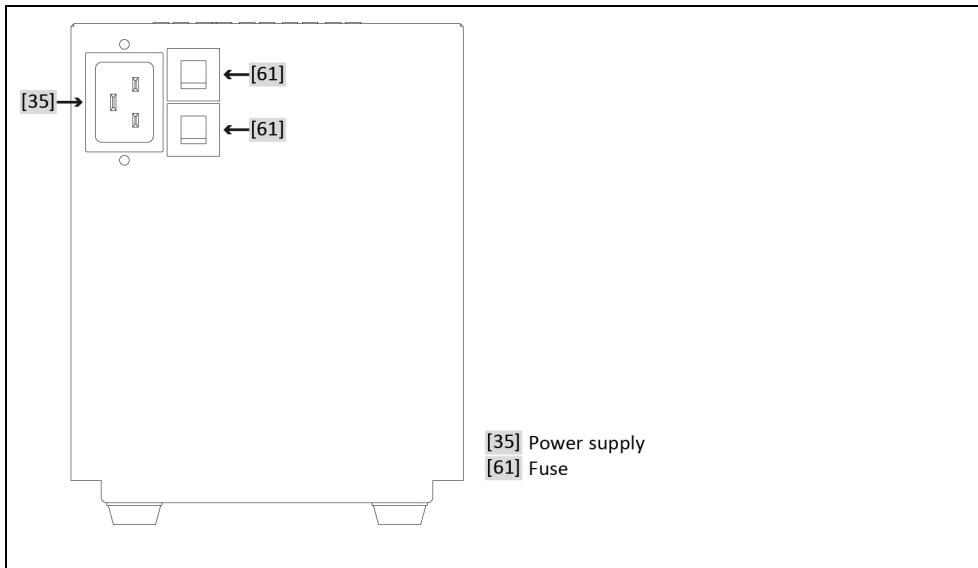
You must read the documentation for the temperature control unit, the EtherCAT Gateway and the EtherCAT Master before connecting the EtherCAT Gateway. You must observe all instructions and regulations in the respective documentation.

4.1 Control elements of the EtherCAT Gateway

Exemplary representation of the front



Exemplary representation of the back



There are 2 control elements each for “Ethernet” and “EtherCAT” at the front of the EtherCAT Gateway. These have the following functions:

Table 1:
Function of control elements

Element	Function
Ethernet	
S4	Selection IP address (Ethernet side to the temperature control unit)
S5	Not used
EtherCAT	
S4	Parameter mode
S5	Test mode Ethernet, the EtherCAT communication is not active

The respective position of switches S4 and S5 determines the configuration of the two interfaces of the gateway. The two switches are described separately. The switch position is read only when the module is turned on. To change the parameters: Disconnect EtherCAT Gateway from the power supply, set switch, connect PROFINET Gateway with the power supply.

Table 2:
Ethernet - Function of switch S4

Position	Function
0	Use of the standard IP address between EtherCAT Gateway and Pilot ONE Pilot ONE: 172.16.105.20; subnet mask: 255.255.255.0 EtherCAT Gateway: 172.16.105.10
1*	User-defined IP address

*During start-up the switch position must ALWAYS be set to 0.

Table 3:
EtherCAT - Function of switch S4

Position	Function
0	Number of parameters 11 (standard)
1*	User-defined number of parameters

*At every start of the EtherCAT Gateway (network ON), the EtherCAT Master must specify the number of parameters. The number of parameters must agree with the number configured in the Pilot ONE ([Categories Menu] → [Interfaces] → [PB-Package]). Pilot ONE supports a maximum of 61 parameters.

Table 4:
EtherCAT - Function of switch S5

Position	Function
0	EtherCAT mode
8*	Test mode Ethernet, the EtherCAT communication is not active

* This mode is exclusively used to check the connection between Pilot ONE and the EtherCAT Gateway.

4.2 Default setting des EtherCAT Gateway

Make the following settings before connecting the EtherCAT gateway to the temperature control unit:

At the Pilot ONE®:

- Static IP address and subnet mask – [Categories Menu] → [Interfaces] → [Ethernet] → [IP Address] → [Static IP] (172.16.105.20) → [Subnet Mask] (255.255.255.0).
- Enabling of commands – [Categories Menu] → [Interfaces] → [Ethernet] → [Command Release] (always on (PLC)).

At the EtherCAT-Gateway:

- Ethernet - Select the standard IP address with switch S4.
- Ethernet - Switch S5 is not used.
- EtherCAT - Select the standard parameter mode using the switch S4.
- EtherCAT - Activate EtherCAT mode using the switch S5.

If the EtherCAT Gateway is connected to the power supply, the initialization phase starts. LEDs 1 and 2 or 4 and 8 are blinking in pairs. Initialization is complete when LEDs 1, 2, 4 and 8 remain permanently off. As soon as the EtherCAT Master has made the connection to the EtherCAT Gateway, the EtherCAT Gateway starts communicating with the temperature control unit.

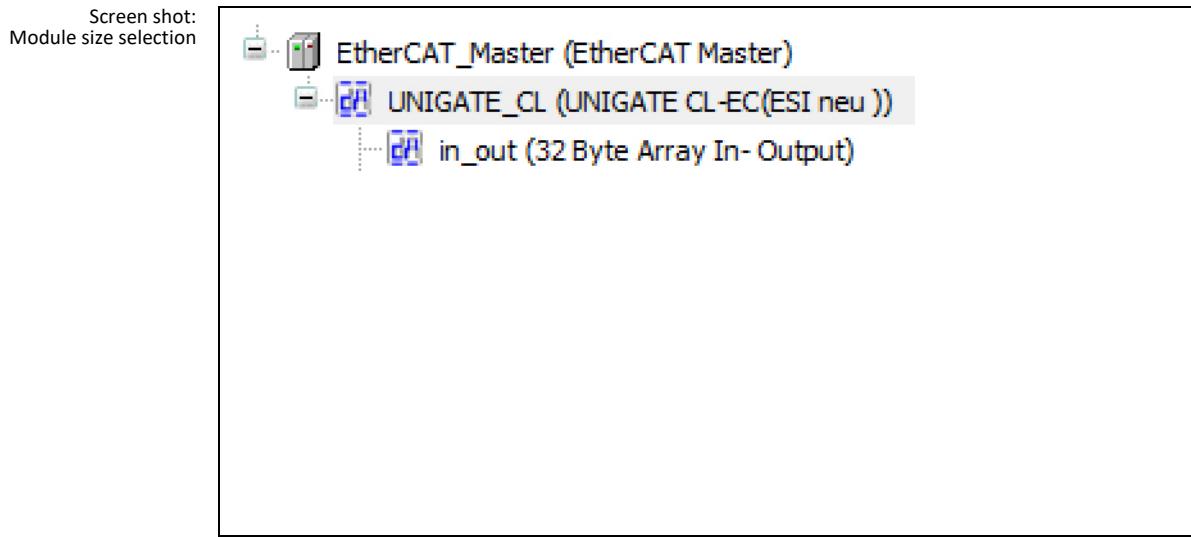
5 Integration into the process automation system

The device description file (GSDML) contains the selectable input and output module sizes. Pilot ONE currently only supports a maximum of 61 parameters; this corresponds to 122 bytes.

5.1 Standard integration at the EtherCAT Master

- Download of the EtherCAT GSDML file (format .XML) from www.huber-online.com.
- Integration of the XML file into the EtherCAT Master.
- 2 input bytes and 2 output bytes must be provided per configured parameter.
- The module size must correspond to the number of parameters configured in the EtherCAT Gateway. Thus, the parameters can be queried/sent.
Example: If 11 parameters are configured, the input/output module size must be ≥ 22 bytes.
- The size of the input module must correspond to the size of the output module. The module size may not differ.
- The maximum permissible size is 256 bytes.

The following is a screen shot of an exemplary module size selection for 11 configured parameters



INFORMATION

NOTE: The EtherCAT Gateway does not check the content of the arrays or the valid value range of the corresponding parameters. Please read our data communication manual in this regard.

IMPORTANT: The sequence and number of parameters are exclusively determined by the selection in the Pilot ONE ([Categories Menu] → [Interfaces] → [PB-Package]).

PROCEDURE

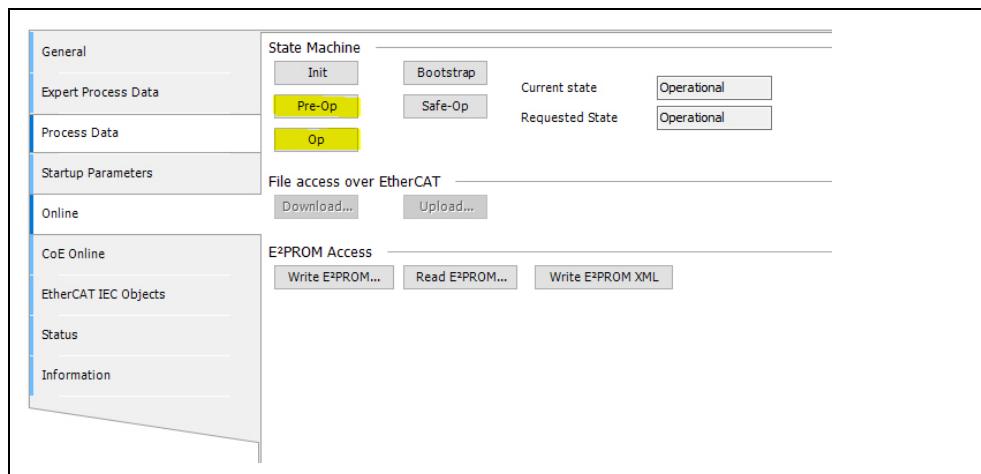
After the standard switch configuration and integration of the XML file.

- Switch on the Pilot ONE.
- Check the IP address and the number of configured parameters again.
- Connect the EtherCAT Gateway to the power supply.
- Connect the EtherCAT Gateway with the Pilot ONE. The LEDs “Full Duplex”, “100 Mb” and “Link/Act.” light up green.
- Connect the EtherCAT Gateway with the EtherCAT Master. The LED “Link/Act.” flashes green. If the configuration in the EtherCAT Master is correct, the LEDs 8 on the Ethernet and EtherCAT side start to flash.

5.2 User-defined IP address

PROCEDURE

- Set switch S4 on the Ethernet side to "0".
 - Connect the EtherCAT Gateway with the temperature control unit on the basis of the standard IP address. To do so, connect the Ethernet side of the EtherCAT Gateway with the Ethernet connection at the Pilot ONE.
 - From the operational status (during the data exchange), the EtherCAT Master can change the machine status and set the EtherCAT Gateway into the pre-operational status. Only if the EtherCAT Gateway is in this pre-operational status is it possible to send the following four parameters to the EtherCAT Gateway: Number of PB commands, Pilot ONE IP, gateway IP, netmask.



- Example of how to change the number of parameters, the new IP address of the Pilot ONE, the new IP address of the EtherCAT Gateways and the subnet mask at the corresponding index addresses of the process data object. Example: To calculate the required value of a certain IP address: $172.16.105.20 \rightarrow 0xAC.0x10.0x69.0x14$ (in Hex) $\rightarrow 0xAC106914 \rightarrow 2886756628$ (in Dez)

General		<input checked="" type="checkbox"/> Read Objects		<input type="checkbox"/> Auto update	<input type="checkbox"/> Offline from ESI file	<input checked="" type="checkbox"/> Online from device
Expert Process Data	Index:Subindex	Name	Flags	Type	Value	
	... 16#1000:16#00	Device type	RO	UDINT	5001	
Process Data	... 16#1001:16#00	Error register	RO	USINT	0	
Startup Parameters	... 16#1008:16#00	Device name	RO	STRING	'UNIGATE-CL EC'	
Online	... 16#1009:16#00	Hardware version	RO	STRING	'B'	
	... 16#100A:16#00	Software version	RO	STRING	'V3.4.1'	
CoE Online	... 16#1018:16#00	Identity	RO	USINT	4	
	... 16#1600:16#00	RxPDO	RO	USINT	4	
	... 16#1A00:16#00	TxPDO	RO	USINT	4	
EtherCAT IEC Objects	... 16#1C00:16#00	Sync manager type	RO	USINT	4	
Status	... 16#1C12:16#00	rxpdo assign	RW	USINT	2	
	... 16#1C13:16#00	txpdo assign	RW	USINT	2	
Information	... 16#1C32:16#00	SM output parameter	RO	USINT	4	
	... 16#1C33:16#00	SM input parameter	RO	USINT	4	
	... 16#6000:16#00	Parameters from SPS	RO	USINT	4	
	... :16#01	Number of PB commands	RW	UDINT	12	
	... :16#02	Pilot One IP Address	RW	UDINT	2886756628	

- If only the number of PB commands is changed, this change is adopted when returning to the operational status. The number of PB commands in the Pilot ONE must also be changed accordingly beforehand. For the initial change of the number of parameters, the switch S4 must be set to "1" on the EtherCAT side. To do so, disconnect the mains cable and re-connect after changing the switch position.
 - If one or more IP addresses are changed, the Ethernet side shows a restart signal (four LEDs are flashing every two seconds). It should be noted that all values must be written at all times, even if they are not changed.
 - To carry out the restart, disconnect the mains cable from the EtherCAT Gateway.
 - Adapt the IP address of the Pilot ONE and the subnet mask to the newly configured IP address of the Pilot ONE in the EtherCAT Gateway.
 - Set the switch S4 to "1" on the Ethernet side.
 - Connect the EtherCAT Gateway to the power supply.

5.3 Errors that can NOT be read at the EtherCAT master.

There are errors on the Ethernet side that are indicated by the LEDs at the EtherCAT Gateway. These errors cannot be read via the EtherCAT Master. In these error cases, the LED "State" on the Ethernet side remains red. The green LEDs flash to indicate the corresponding error number.

Table 5:
Ethernet - error numbers

No.	Function
1	LED 1 flashes green: Switch S4 is at "0", EtherCAT Master wants to specify an IP address that deviates from the default IP address.
2	LED 2 flashes green: The user-defined IP address is specified as zero by the EtherCAT Master.
3	LED 1 and LED 2 flash green: Wrong parameter length - EtherCAT Gateway error. If this error occurs permanently there is a high likeliness that the EtherCAT Gateway must be replaced.

5.4 Errors that can be read at the EtherCAT Master

There is a total of 9 different error messages that can be read by the EtherCAT Master.

Table 6:
EtherCAT Master - error numbers

No.	Function
1	LED1 flashes: The length of the EtherCAT input module does not equal the length of the EtherCAT output module.
2	LED2 flashes: The length of the EtherCAT input and output module is incorrect; it must not exceed 256 bytes.
3	LED1 and LED2 flash: The length of the EtherCAT Slave input and output module is not sufficient for the set number of parameters; it should be at least number of parameters * 2 bytes.
4	Problems on the Ethernet side (communication with the temperature control) Possible causes: - Wrong IP address - Cable not inserted/faulty - Wrong subnet mask e.g.: 255.255.255.0 (IP address EtherCAT Gateway 172.16.17.1 IP address Pilot ONE 172.16.28.10). In this case, a correct subnet mask would be 255.255.0.0 - Switch S4 at the Ethernet side to "1".
5	The data to be sent from the EtherCAT Gateway to the Pilot ONE are longer than 255 bytes; input buffer on the EtherCAT side is full. The output buffer selected for the EtherCAT Master is too large.
6	Repeated receipt of invalid PB package commands (EtherCAT Gateway - Huber temperature control unit)
7	Unknown PB package command error
8	Number of parameters sent by the PLC does not match the number in the temperature control unit.
9	Invalid value in the block counter

6 Diagnostic functions

6.1 On starting up

The EtherCAT Gateway performs an internal self-test after connecting the voltage supply. This takes about 2 seconds. It is normal that all LEDs light up briefly.

The software in the EtherCAT gateway controls two display elements. This is the LED labeled "8" and the LED labeled "State" on the Ethernet side.

LED 8 is used as communication display between the EtherCAT Gateway and the temperature control unit. It will light up after the EtherCAT Gateway has sent data to the temperature control unit. The LED goes out when valid data have been received from the EtherCAT Gateway.

The LED "State" flashes green at approx. 1 Hz during the initialization phase. It goes out once the first valid data has been received. Valid data must have been received no later than 30 seconds after switching on.

A LED "State" flashing red-green at approx. 1 Hz indicates a communication error between the EtherCAT gateway and the temperature control unit. The PLC can read the error from the diagnostic data. → Page 12, Section »Errors that can be read at the EtherCAT Master«.

All other displays are internal EtherCAT gateway messages that can be looked up in the EtherCAT gateway manual. You can download this manual at www.deutschmann.de for free.

6.2 Communication test

Perform the listed communication test Table 4 (→ Page 8, Section »Control elements of the EtherCAT Gateway«) to check the connection between EtherCAT Gateway and temperature control unit. For this, the EtherCAT Gateway is de-energized and the connection to the EtherCAT is disconnected. Afterwards, switch S5 at the "EtherCAT" is set to switch position "1". Now the EtherCAT Gateway can be reconnected to the power supply.

If the connection between Pilot ONE and EtherCAT Gateway is working, the communication is indicated by a flashing LED 8 on the Ethernet side. In addition, under [Categories Menu] → [Interfaces] → [Ethernet] → [Ethernet Test], a display can be opened at the Pilot ONE. Here, the data sent by the EtherCAT Gateway are displayed.

6.3 During operation

If communication is ongoing, this is recognizable by the green illuminated LEDs "Bus" and "State". The communication of the EtherCAT Gateway with the Huber temperature control unit is signaled by the LED 8 on the Ethernet side of the EtherCAT Gateway.

6.4 Troubleshooting

A difference between the GSDML file and the program in the EtherCAT Gateway may cause bus errors or incorrect data content. The version is specified in the GSDML file. It can be checked with the diagnostics function.

The following information can be used for troubleshooting in case of problems during start-up or operation.

- Are all connectors correctly connected?
- Is the power supply correctly connected?
- Is the EtherCAT gateway address set correctly in the bus and exists only once?
- Is the EtherCAT gateway correctly configured?
- Is the temperature control unit correctly configured?
- Was the EtherCAT gateway configured by the PLC?

Is it possible to read but not to write values? In that case check whether analog functions of a Com.G@te were activated. For example, if a setpoint was activated via A1F, the analogue value has priority over the interface.

Inspired by **temperature** designed for you

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