



-power in control

MULTI-LINE 2 DESCRIPTION OF OPTIONS



Option H8 External I/O modules

- Description of option
- Functional description
- Parameter list



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This description of options covers the following products:

AGC	SW version 3.3X.X
BGC	SW version 3.0X.X
GC-1F	SW version 1.2X.X

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1. Warnings and legal information

Legal information and responsibility

DEIF takes no responsibility for installation or operation of the engine set. If there is any doubt about how to install or operate the engine controlled by the unit, the company responsible for the installation or the operation of the set must be contacted.

The units are not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

Safety issues

Installing the unit implies work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.



Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

Factory settings

The unit is delivered with certain factory settings. Given the fact that these settings are based on average values, they are not necessarily the correct settings for matching the individual engine. Thus precautions must be taken to check the settings before running the engine.

Definitions

Throughout this document a number of notes and warnings will be presented. To ensure that these are noticed, they will be highlighted in order to separate them from the general text.

Notes



The notes provide general information, which will be helpful for the reader to bear in mind.

Warning



The warnings indicate a potentially dangerous situation, which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

2. Description of option

Option H8

H8 is a CANbus based serial interface for External I/O controllers. This option gives the possibility to add more inputs and outputs to ML-2 controllers via the CANbus.

ML-2 controllers support the CANopen protocol. This protocol is based on the CANopen Application Layer and Communication Profile Specification CiA Draft Standard 301 Version 4.02. It is not the purpose of this document to describe all the functionalities of the CANopen communication. The CANopen is implemented and runs according to the CANopen standards and needs no special attention from the user.



Please use the website <http://www.can-cia.com> to download a detailed explanation of the CANopen description.

AGC interface



Wiring details: please refer to the document 'Installation Instructions'.

Terminal description

The PCB for the external I/O modules are placed in slot #6 (option H8.6) and/or slot #8 (option H8.8).

Option H8.6

Terminals	Function	Description
97	CAN-H	CANbus card option H8.6
96	CAN-GND	
95	CAN-L	
94	CAN-H	
93	CAN-GND	
92	CAN-L	
91	Not used	
90	Not used	



Terminals 97 and 94 are internally connected.
Terminals 95 and 92 are internally connected.

Option H8.8

Terminals	Function	Description
133	CAN-H	CANbus card option H8.8
132	CAN-GND	
131	CAN-L	
130	CAN-H	
129	CAN-GND	
128	CAN-L	
127	Not used	
126	Not used	



Terminals 133 and 130 are internally connected.
Terminals 131 and 128 are internally connected.

BGC interface



Wiring details: please refer to the document 'Installation Instructions'.

Terminal description

The CAN terminals are placed in slot #2 (option H8.2) or slot #3 (option H8.3) in addition to the standard hardware. Both CAN buses can be mounted simultaneously.

Option H8.2 terminals

Terminals	Function	Description
47	CAN-H	CANbus card option H8.2
48	CAN-GND	
49	CAN-L	
50	CAN-H	
51	CAN-GND	
52	CAN-L	
53	Not used	
54	Not used	



Terminals 47 and 50 are internally connected.
Terminals 49 and 52 are internally connected.

Option H8.3 terminals

Terminals	Function	Description
55	CAN-H	CANbus card option H8.3
56	CAN-GND	
57	CAN-L	
58	CAN-H	
59	CAN-GND	
60	CAN-L	
61	Not used	
62	Not used	



Terminals 55 and 58 are internally connected.
Terminals 57 and 60 are internally connected.

GC-1F interface



Wiring details: please refer to the document 'Installation Instructions and Reference Handbook'.

Terminal description

The CAN #2 terminals are 57(H) and 59(L) also used for AOP-2(See option X4).

Terminals	Function	Description
57	CAN-H	CAN #2: terminals for CAN Communication
58	CAN-GND	
59	CAN-L	

Installation of Beckhoff controller (Bus coupler)

Following is step by step guide to setup the communication between the ML-2 unit and the Beckhoff modules.



Documentation regarding Beckhoff modules can be found at www.beckhoff.com

Beckhoff controller setup

1. Set Baud rate to 'AUTO'
2. Set Node ID to a value between 10 and 64
3. Connect the required I/O modules to the controller
4. Mount "End Bus Terminal": KL9010 module

CANbus wiring

5. Disconnect power to ML-2 and the Beckhoff controller
6. Connect CANbus wires to the Beckhoff controller according to 'Installations Instructions'



AGC/BGC: please refer to the document 'Installation Instructions'.



GC-1F: please refer to the document 'Installation Instructions and Reference Handbook'.

ML-2 unit

7. Connect power to ML-2 unit and Beckhoff controller
8. Set the baud rate (default: 50kbit/s)



GC-1F: baud rate is fixed at 50kbit/s.

9. Set the Node ID (menu 7973/7983) to the same value as selected on the Beckhoff controller.



GC-1F: Menu 7973 not available

10. Communication between the ML-2 unit and the Beckhoff controller are now established.



Communication fault: In case any LEDs on the Beckhoff controller are flashing continuously for more than 5s please refer to the chapter 'Fault finding' in this document.

11. To see the available external I/Os retrieve the parameters from the ML-2 unit with the PC USW.
12. Click on 'External I/O' in the PC USW to see or change settings for External I/O modules.

3. Functional description

Supported modules

The ML-2 units support communication with the following Beckhoff modules.

Controller (BUS coupler)

Type	Numbers of I/O's supported by ML-2
BK5120	8 analogue inputs, 16 digital inputs and 16 digital output
BK5150	8 analogue inputs, 16 digital inputs and 16 digital output
LC5100	16 digital inputs and 16 digital outputs

Analogue Input modules

KL3001	1 ch. $\pm 10V$
KL3002	2 ch. $\pm 10V$
KL3404	4 ch. $\pm 10V$
KL3061	1 ch. 0-10V
KL3062	2 ch. 0-10V
KL3064	4 ch. 0-10V
KL3011	1 ch. 0-20mA
KL3012	2 ch. 0-20mA
KL3021	1 ch. 4-20mA
KL3022	2 ch. 4-20mA
KL3041	1 ch. 0-20mA
KL3042	2 ch. 0-20mA
KL3044	4 ch. 0-20mA
KL3052	2 ch. 4-20mA
KL3202	2 ch. Pt100, Pt1000, 10-1200ohm, 10-3200ohm
KL3204	4 ch. Pt100, Pt1000, 10-1200ohm, 10-3200ohm
KL3312	2 ch. Thermocouple type K
KL3314	4 ch. Thermocouple type K
KL3444	4 ch. 0-20mA
KL3454	4 ch. 4-20mA

Analogue Output modules

KL4011	1 channel 0-20mA
KL4012	2 channel 0-20mA
KL4021	1 channel 4-20mA
KL4022	2 channel 4-20mA
KL4001	1 channel 0-10V
KL4002	2 channel 0-10V
KL4004	4 channel 0-10V
KL4031	1 channel -10-10V
KL4032	2 channel -10-10V
KL4034	4 channel -10-10V

Digital Input modules

KL1002	2 ch. 24V DC
KL1104	4 ch. 24V DC
KL1408	8 ch. 24V DC
KL1702	2 ch. 230V AC
KL1052	2 ch. p/n switching
KL1154	4 ch. p/n switching
KM1002	16 ch. 24V DC

Digital Output modules

KL2012	2 ch. 24V DC/0,5A
KL2022	2 ch. 24V DC/2,0A
KL2114	4 ch. 24V DC/0,5A
KL2408	8 ch. 24V DC/0,5A
KL2602	2 ch. 230V AC
KM2002	16 ch. 24V DC/0,5A

End Bus Terminal

KL9010	End Bus Terminal
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GC-1F: Analogue output modules not supported



Detailed specification of the Beckhoff modules can be found at www.beckhoff.com

Functional check of External I/O modules**Alarm messages in display**

Alarm message	Description
Ext. I/O unk. module	The module used is not supported by the ML-2 unit
Ext. I/O new setup	If modules are changed or have changed place in the row of modules. This error message will be active. Can be removed by reset in menu 7974 "Reset"

Module check

The module check can only take place using the PC USW.

Modules are presented in the order by which they are mounted, counting from the CANbus controller side.

External I/O's will only be shown in PC USW if they are present.

The result of the check can be read in status channels 12950-12983.

The Beckhoff module transmits a status message to the unit. This message is a HEX value for digital I/O units and decimal for controllers / analogue I/O units:

Digital I/O:

All groups	Protection	Sync	Regulation	Binary	Analag	Outputs	General	Mains	Comm	Jump	Cmd timer	VDO 1	VDO 2	VDO 3	USW	External VO
Drag a column header here to group by that column																
Category	Channel	Text	Address	Value	Unit	Timer	OutputA	OutputB	Enabled	High alarm	Level	FailClass				
External IO	12000	Ext Ana. In 1.1	999	10	mA		10	0	0	☒	Customer	Warning				
External IO	12010	Ext Ana. In 1.2	1000	10	mA		10	0	0	☒	Customer	Warning				
External IO	12030	Ext Ana. In 2.1	1001	10	mA		10	0	0	☒	Customer	Warning				
External IO	12040	Ext Ana. In 2.2	1002	10	mA		10	0	0	☒	Customer	Warning				
External IO	12060	Ext Ana. In 3.1	1003	100	C		10	0	0	☒	Customer	Warning				
External IO	12070	Ext Ana. In 3.2	1004	100	C		10	0	0	☒	Customer	Warning				
External IO	12090	Ext Ana. In 4.1	1005	100	C		10	0	0	☒	Customer	Warning				
External IO	12100	Ext Ana. In 4.2	1006	100	C		10	0	0	☒	Customer	Warning				
External IO	12120	Ext Ana. In 5.1	1007	100	C		10	0	0	☒	Customer	Warning				
External IO	12130	Ext Ana. In 5.2	1008	100	C		10	0	0	☒	Customer	Warning				
External IO	12150	Ext Ana. In 6.1	1009	100	C		10	0	0	☒	Customer	Warning				
External IO	12160	Ext Ana. In 6.2	1010	100	C		10	0	0	☒	Customer	Warning				
External IO	12180	Ext Ana. In 7.1	1011	100	C		10	0	0	☒	Customer	Warning				
External IO	12190	Ext Ana. In 7.2	1012	100	C		10	0	0	☒	Customer	Warning				
External IO	12210	Ext Ana. In 8.1	1013	100	C		10	0	0	☒	Customer	Warning				
External IO	12220	Ext Ana. In 8.2	1014	100	C		10	0	0	☒	Customer	Warning				
External IO	12540	Ext Dig. In 1	1047	N/A			10	0	0	☒	Customer	Shutdown				
External IO	12550	Ext Dig. In 2	1048	N/A			10	0	0	☒	Customer	Shutdown				
External IO	12560	Ext Dig. In 3	1049	N/A			10	0	0	☒	Customer	Shutdown				
External IO	12570	Ext Dig. In 4	1050	N/A			10	0	0	☒	Customer	Shutdown				
External IO	12580	Ext Dig. In 5	1051	N/A			10	0	0	☒	Customer	Shutdown				
External IO	12590	Ext Dig. In 6	1052	N/A			10	0	0	☒	Customer	Shutdown				
External IO	12600	Ext Dig. In 7	1053	N/A			10	0	0	☒	Customer	Shutdown				
External IO	12610	Ext Dig. In 8	1054	N/A			10	0	0	☒	Customer	Shutdown				
External IO	12620	Ext Dig. In 9	1055	N/A			10	0	0	☒	Customer	Shutdown				
External IO	12630	Ext Dig. In 10	1056	N/A			10	0	0	☒	Customer	Shutdown				
External IO	12790	Ext Dig. Out 1	1063	0			0	N/A	N/A	☐	Customer	N/A				
External IO	12800	Ext Dig. Out 2	1064	0			0	N/A	N/A	☐	Customer	N/A				
External IO	12810	Ext Dig. Out 3	1065	0			0	N/A	N/A	☐	Customer	N/A				
External IO	12820	Ext Dig. Out 4	1066	0			0	N/A	N/A	☐	Customer	N/A				
External IO	12830	Ext Dig. Out 5	1067	0			0	N/A	N/A	☐	Customer	N/A				
External IO	12840	Ext Dig. Out 6	1068	0			0	N/A	N/A	☐	Customer	N/A				
External IO	12850	Ext Dig. Out 7	1069	0			0	N/A	N/A	☐	Customer	N/A				
External IO	12860	Ext Dig. Out 8	1070	0			0	N/A	N/A	☐	Customer	N/A				
External IO	12951	Ext Module 1 Status	958	-30718			N/A	N/A	N/A	☐	Customer	N/A				
External IO	12952	Ext Module 2 Status	959	-30719			N/A	N/A	N/A	☐	Customer	N/A				
External IO	12953	Ext Module 3 Status	960	3012			N/A	N/A	N/A	☐	Customer	N/A				
External IO	12954	Ext Module 4 Status	961	3204			N/A	N/A	N/A	☐	Customer	N/A				
External IO	12955	Ext Module 5 Status	962	-32255			N/A	N/A	N/A	☐	Customer	N/A				
External IO	12956	Ext Module 6 Status	963	3312			N/A	N/A	N/A	☐	Customer	N/A				

1. digit: 8 for digital
2. digit: Number of input/output (2, 4 or 8)
3. digit: Not used (0)
4. digit: Input [1] or output [2]

In the PC USW, all values are presented as decimal values, so the HEX values for the digital I/O modules are translated as follows:

Inputs:

0x8201h = -32255d

0x8401h = -31743d

0x8801h = -30719d

Outputs:

0x8202h = -32254d

0x8402h = -31742d

0x8802h = -30718d

Examples for digital I/O modules:

Module	Hex Value	Dec Value
KL2012	8202	-32254
KL2022	8282	-32254
KL2114	8402	-31742
KL2408	8802	-30718
KL1052	8201	-32255
KL1002	8201	-32255
KL1702	8201	-32255
KL1154	8401	-31743
KL1104	8401	-31743

Analogue I/O:

A 4-digit decimal value is presented.

This number represents the module version used.

Examples for analogue I/O modules:

Module	Value
KL4004	4004
KL3312	3312
LK3202	3202
KL3204	3204



The module check is only carried out when resetting the communication (parameter 7974 or 7984)

4. Parameter list

Communication setup

7930 CAN1 comm error

No.	Setting		Min. setting	Max. setting	Factory setting
7931	CAN1 comm error	Delay	2.0 s	600.0 s	10.0 s
7932	CAN1 comm error	Relay output A	Not used	Option dependent	R0 (none)
7933	CAN1 comm error	Relay output B	Not used		R0 (none)
7934	CAN1 comm error	Enable	OFF	ON	OFF



GC-1F: Menu 7930 not available

7940 CAN2 comm error

No.	Setting		Min. setting	Max. setting	Factory setting
7941	CAN2 comm error	Delay	2.0 s	600.0 s	10.0 s
7942	CAN2 comm error	Relay output A	Not used	Option dependent	R0 (none)
7943	CAN2 comm error	Relay output B	Not used		R0 (none)
7944	CAN2 comm error	Enable	OFF	ON	OFF



AGC and BGC: If both options H8.x are present, an error on any of these will activate the alarms in 7930 and 7940.

7970 CAN 1

No.	Setting		Min. setting	Max. setting	Factory setting
7971	CAN 1	Type	OFF AOP-2 Beckhoff		OFF
7972	CAN 1	Baud	50 k 125 k 250 k		125 k
7973	CAN 1	ID	1	64	1
7974	CAN 1	Reset	NO	YES	NO



GC-1F: Menu 7970 not available



AGC: This menu is only activated if option H8.6 is activated.
BGC: This menu is only activated if option H8.2 is activated.



AGC: AOP-2 selection in menu 7971 not available



Menu 7974 is for re-establishing communication after a fault/disconnection.



After changing type, the parameter list in the PC USW must be uploaded again.

7980 CAN 2

No.	Setting		Min. setting	Max. setting	Factory setting
7981	CAN 2	Type	OFF AOP-2 Beckhoff		OFF
7982	CAN 2	Baud	50 k 125 k 250 k		125 k
7983	CAN 2	ID	1	64	1
7984	CAN 2	Reset	NO	YES	NO



GC-1F: Menu 7981 and 7982 not available.



AGC: This menu is only activated if option H8.8 is activated.
BGC: This menu is only activated if option H8.3 is activated.



AGC: AOP-2 selection in menu 7981 not available



Menu 7984 is for re-establishing communication after a fault/disconnection.



After changing type, the parameter list in the PC USW must be uploaded again.

7950 KL320x Config

No.	Setting		Type	Factory setting
7951	KL320x config	Module 1	Pt100 (2/3-wire)	Pt100 (2/3-wire)
7952	KL320x config	Module 2	Pt1000 (2/3-wire)	
7953	KL320x config	Module 3	10-3200 Ω (2-wire)	
7954	KL320x config	Module 4	10-1200 Ω (2-wire)	



The above selections for KL 3202/3204 cannot be changed.



After changing module type, the parameter list in the PC USW must be uploaded again.

External I/O setup

Analogue inputs

12000 Ext. an. in 1.1

No.	Setting		Min. setting	Max. setting	Factory setting
12000	Ext. an. in 1.1	Setpoint	-20000	20000	10
		Delay	2.0 s	600.0 s	10.0 s
		Fail class	ML-2 unit dependent		Warning
		Relay output A	Not used	Option dependent	Not used
		Relay output B	Not used		Not used
		Enable	OFF	ON	OFF

12010 Ext. an. in 1.2

No.	Setting		Min. setting	Max. setting	Factory setting
12010	Ext.an. in 1.2	Setpoint	-20000	20000	10
		Delay	2.0 s	600.0 s	10.0 s
		Fail class	ML-2 unit dependent		Warning
		Relay output A	Not used	Option dependent	Not used
		Relay output B	Not used		Not used
		Enable	OFF	ON	OFF



Same order for settings 12030-12230.

Analogue outputs



The external analogue outputs are used as transducer outputs in menu 5820 to 5970. Please refer to the option E+F option description.



GC-1F does not support analogue outputs.

Digital inputs

12540 Ext. dig. in 1

No.	Setting		Min. setting	Max. setting	Factory setting
12540	Ext. dig. in 1	Delay	2.0 s	600.0 s	10.0 s
		Fail class	ML-2 unit dependent		Warning
		Relay output A	Not used	Option dependent	Not used
		Relay output B	Not used		Not used
		Enable	OFF	ON	OFF



Same order for settings 12560 - 12690

Digital outputs**12790 Ext. dig. out 1**

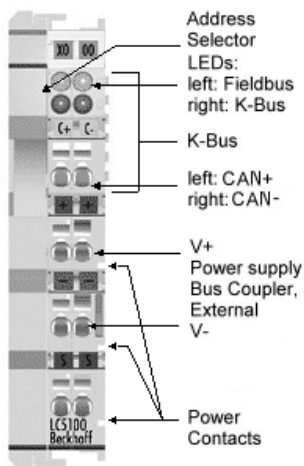
No.	Setting		Min. setting	Max. setting	Factory setting
12790	Ext digital output 1	Delay	2.0 s	600.0 s	10.0 s
		Fail class	ML-2 unit dependent		Warning
		Relay output A	Not used	Option dependent	Not used
		Relay output B	Not used		Not used
		Enable	OFF	ON	OFF



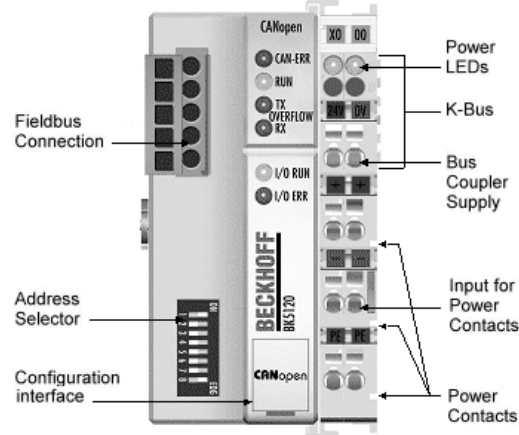
Same order for settings 12810 – 12940.

5. Fault finding

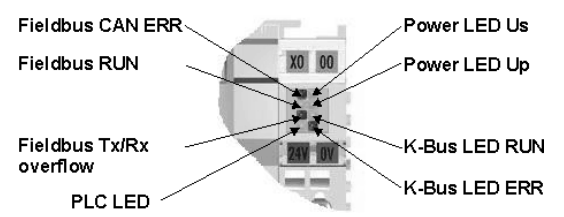
Beckhoff controllers



LC5100



BK5120



BK5150

Diagnostic LEDs

The Beckhoff Controllers has LEDs for display of status. They can be used for fault finding.

CAN-ERR blink code

CAN ERR	Meaning
off	CAN bus has no errors
Fast blinking (approx. 50ms on, approx. 50ms off; alternating with RUN LED)	Automatic baud rate detection has not yet found a valid baud rate . Not enough telegrams on the bus yet.
1 x flash (approx. 200ms on, 1s off)	CAN warning limit exceeded. There are too many error frames on the bus. Please check the wiring (e.g. termination resistors, screens, conductor length, stubs). Other possible causes for exceeding the warning limit: there are no other participating devices in the network (occurs, for instance, when the first node is started).
2 x blinking (each approx. 200ms on, 200ms off, followed by a 1s pause)	The guarding or heartbeat monitor has asserted, because either guarding telegrams or heartbeat telegrams are no longer being received. Precondition for guarding monitoring: guard time and life time factors are > 0. Precondition for heartbeat monitoring: consumer heartbeat > 0). The Bus Coupler is pre-operational (PDOs switched off), and the outputs are in the error state.
3 x blinking (each approx. 200ms on, 200ms off, followed by a 1s pause)	A synchronisation error has occurred. No sync. telegrams have been received during the set monitoring time (object 0x1006 x 1.5). The bus node is pre-operational (PDOs switched off), and the outputs are in the error state.
4 x blinking (each approx. 200ms on, 200ms off, followed by a 1s pause)	Event timer error: The Bus Coupler has not received an RxPDO within the set event time (0x1400ff sub-index 5). The bus node is pre-operational (PDOs switched off), and the outputs are in the error state.

RUN blink code

RUN	Meaning
off	Firmware status < C0: Bus node is in stopped state . No communication is possible with SDO or PDO.
Fast blinking (approx. 50ms on, approx. 50ms off; alternating with CAN ERR LED)	Automatic baud rate detection has not yet found a valid baud rate . Not enough telegrams on the bus yet.
1 x blinking (approx. 200 ms on, 1 s off)	Bus node is in stopped state . No communication is possible with SDO or PDO.
Blinking cyclically (approx. 200 ms on, 200 ms off)	Bus node is in pre-operational state . The node has not yet started.
on	Bus node is in Operational state .

Tx overflow blink code

Tx Overflow	Meaning
on	A <i>transmit queue overflow</i> has occurred. The bus coupler could not send its messages. Cause: e.g. excessive bus loading. A bus coupler reset must be carried out.
Blinking cyclically (approx. 200 ms on, 200 ms off)	Logical Tx queue overflow: SYNC interval too short. The coupler could not deliver all the TxPDOs before the following SYNC telegram. The TxPDOs are then, for instance, delivered in every second SYNC interval. Remedy: Lengthen the SYNC interval or raise the transmission type. In some cases it may be appropriate to reduce the I/O count at this bus station (e.g. by moving I/Os to the neighbouring station) Note: The logical Tx queue overflow is signalled for approx. 10 sec and then reset. If it keeps recurring, signalling is maintained.

Rx overflow blink code

Rx Overflow	Meaning
on	A <i>receive queue overflow</i> has occurred. The Bus Coupler loses messages. Cause: e.g. bursts of short telegrams. A bus coupler reset must be carried out.
Blinking cyclically (approx. 200 ms on, 200 ms off)	A <i>receive queue overflow</i> has occurred. The Bus Coupler has lost messages, but the overflow condition is no longer current. Cause: e.g. bursts of short telegrams, perhaps during a status transition (e.g. very short SYNC interval during transition after operational). Signalling is reset during a Bus Coupler reset.

K-Bus LEDs (local errors)

Two LEDs, the K-Bus LEDs, indicate the operational state of the Bus Terminals and the connection to these Bus Terminals. The green LED (I/O RUN) lights up in order to indicate fault-free operation. The red LED (I/O ERR) flashes with two different frequencies in order to indicate an error. The errors are displayed in the blink code in the following way:

Blink code

Fast blinking	Start of the error code
First slow sequence	Error code
Second slow sequence	Error argument (error location)

Error type

Error code	Error code argument	Description	Remedy
Persistent, continuous flashing		general K-bus error	- Check terminal strip
1 pulse	0	EEPROM checksum error	- Set manufacturer's setting with the KS2000 software - Connect fewer terminals; too many entries in the table for the programmed configuration - Software update required for the coupler
	1	Inline code buffer overflow	
	2	Unknown data type	
2 pulses	0	Programmed configuration incorrect table entry/ Bus Coupler	- Check programmed configuration for correctness - Incorrect table entry/Bus Coupler
	(n>0)	Incorrect table comparison (terminal n)	
3 pulses	0	K-Bus command error	- No terminal connected; attach terminals. - One of the terminals is defective; halve the number of terminals attached and check whether the error is still present with the remaining terminals. Repeat until the defective terminal is located.
4 pulses	0 n	K-Bus data error, break behind Bus Terminal n	Check whether the n+1 terminal is correctly connected; replace if necessary. - Check whether the end terminal 9010 is connected.
5 pulses	n	K-Bus error during register communication with Terminal	Replace terminal n.
7 pulses	n	BK5110 or LC5110: unsupported terminal detected at location n	Only use digital terminals or Bus Coupler BK5120

All information regarding error codes are related to the documentation from:
<http://www.beckhoff.com/>

DEIF A/S reserves the right to change any of the above