



- power in control



MULTI-LINE DESCRIPTION OF OPTIONS



Option H8.x and H12.x External I/O modules

- Description of option
- Functional description



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1. Delimitation

1.1 Scope of option H8

This description of options covers the following products:

AGC-3	SW version 3.4x.x
AGC-4	SW version 4.0x.x
AGC 100 series	SW version 4.0x.x
AGC 200 series	SW version 3.5x.x
APU 200 series	SW version 3.53.x
GC-1F	SW version 1.2x.x and 2.0x.x or later
GPC/GPU/GPU Hydro/PPU	SW version 3.08.x or later
PPM	SW version 3.0x.x

2. General information

2.1 Warnings, legal information and safety

2.1.1 Warnings and notes

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

Warnings



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

Notes



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

2.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator controlled by the Multi-line 2 unit, the company responsible for the installation or the operation of the set must be contacted.



The Multi-line 2 unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

2.1.3 Safety issues

Installing and operating the Multi-line 2 unit may imply 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.

2.1.4 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.

2.1.5 Factory settings

The Multi-line 2 unit is delivered from factory with certain factory settings. These are based on average values and are not necessarily the correct settings for matching the engine/generator set in question. Precautions must be taken to check the settings before running the engine/generator set.

3. Description of option

3.1 Description of option H8.x

3.1.1 Option H8.x

H8.x 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.

 **AGC-3/AGC-4/GPC/GPU/GPU Hydro/PPM/PPU: The option hardware is placed in slot #2 (H8.2) or slot #8 (H8.8).**

 **AGC 200: CANbus A, B or C is used. AGC 100: CANbus B is used. GC-1F: CANbus 2 is used.**

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 CAN-open description.**

3.2 Description of option H12.x

3.2.1 Option H12.x

H12.x 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.

 **AGC-4: The option hardware is placed in slot #2 (H12.2) or slot #8 (H12.8).**

 **The option H12.x is not available for AGC 200, AGC 100 and GC-1F.**

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 CAN-open description.**

3.3 AGC-3/AGC-4/GPC/GPU/GPU Hydro/PPM/PPU interface

3.3.1 Interface

 **Wiring details: Please refer to the document "Installation Instructions".**

3.3.2 Terminal description, AGC-3, AGC-4, GPC, GPU, GPU Hydro, PPM, PPU

The PCB for the external I/O modules is placed in slot #2 (option H8.2 and H12.2) or slot #8 (option H8.8 and H12.8).

Option H8.2

Terminals	Function	Description
29	CAN-H	CANbus card option H8.2 Terminals 29-31: CAN C Terminals 32-34: See note below
30	CAN-GND	
31	CAN-L	
32	CAN-H	
33	CAN-GND	
34	CAN-L	
35	Not used	
36	Not used	



Terminals 29 and 32 are internally connected.
Terminals 31 and 34 are internally connected.

Option H8.8

Terminals	Function	Description
133	CAN-H	CANbus card option H8.8 Terminals 131-133: CAN E Terminals 128-130: See note below
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.

Option H12.2 dual CAN

Terminals	Function	Description
29	CAN-H	H12 dual CANbus card includes the following options: H5 (engine interface communication) H8 (external I/O) It is configurable which terminals that are used Terminals 29-31: CAN C Terminals 32-34: CAN D
30	CAN-GND	
31	CAN-L	
32	CAN-H	
33	CAN-GND	
34	CAN-L	
35	Not used	
36	Not used	

Option H12.8 dual CAN

Terminals	Function	Description
133	CAN-H	H12 dual CANbus card includes the following options: H5 (engine interface communication) H8 (external I/O) It is configurable which terminals that are used Terminals 131-133: CAN E Terminals 128-130: CAN F
132	CAN-GND	
131	CAN-L	
130	CAN-H	
129	CAN-GND	
128	CAN-L	
127	Not used	
126	Not used	

 Option H12 is a dual CAN card that includes option H5 (engine interface communication) and option H8 (external I/O). The PCB can be ordered so it fits to slot #2 OR slot #8. It is possible to configure which terminals should be used; when the PCB is placed in slot #2, the configuration is done in the parameters 7843 and 7844, and when the PCB is placed in slot #8, the configuration is done in the parameters 7845 and 7846.

3.4 AGC 200 interface

3.4.1 Interface


 Wiring details: Please refer to the document "Installation Instructions".


3.4.2 Terminal description, AGC 200

Terminals			Function	Description
CAN A	CAN B	CAN C		
7	10	13	CAN-H	CAN A: Terminals for CAN communication
8	11	14		
9	12	15	CAN-L	

3.5 AGC 100 and GC-1F interface

3.5.1 Interface

 Wiring details for AGC 100: Please refer to the document "Installation Instructions".

 Wiring details for GC-1F: Please refer to the document "Installation Instructions and Reference Handbook".

 AGC 100 and GC-1F: Analogue output modules are not supported.

3.5.2 Terminal description, GC-1F

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

Terminals	Function	Description
57	CAN-H	AGC 100, CAN B: Terminals for CAN communication GC-1F, CAN #2: Terminals for CAN communication
58	CAN-GND	
59	CAN-L	

3.6 Installation of ext. I/O

3.6.1 About the step-by-step guide

The following example is a step-by-step guide to set up the communication between the ML-2 unit and the Beckhoff modules.

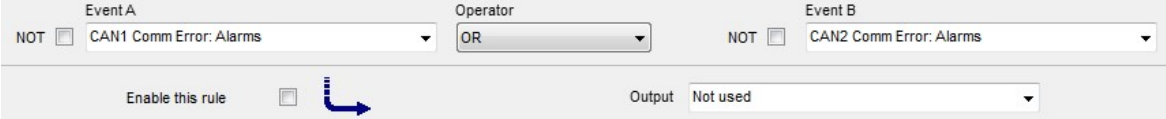
3.6.2 Beckhoff controller setup

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

 **For external modules like Beckhoff, communication error alarms are reserved in M-Logic. They are named CAN1 Comm. Error and CAN2 Comm. Error and can be activated in the event list.**

The communication error alarms CAN1 Comm. Error and CAN2 Comm. Error are activated when communication to the Beckhoff I/O modules is lost. These alarms can be used to verify the digital input state in M-Logic. See the screenshot below.

Example: CAN1/CAN2 Comm. Error alarm for Beckhoff I/O modules.



The screenshot shows a configuration window for a logic rule. It features two event triggers: 'Event A' (CAN1 Comm Error: Alarms) and 'Event B' (CAN2 Comm Error: Alarms). Both have 'NOT' checkboxes that are unchecked. The operator between them is 'OR'. Below the triggers, there is an 'Enable this rule' checkbox (unchecked) and an 'Output' dropdown menu set to 'Not used'. A blue arrow icon is visible between the enable checkbox and the output dropdown.

3.6.3 CAN bus wiring

5. Disconnect power to the ML-2 and the Beckhoff controller.
6. Connect the CAN bus wires to the Beckhoff controller according to the "Installation Instructions".

 **AGC-3/AGC-4/AGC 100/AGC 200/GPC/GPU/GPU Hydro/PPM/PPU: Refer to the document "Installation Instructions".**

 **GC-1F: Refer to the document "Installation Instructions and Reference Handbook".**

3.6.4 ML-2 unit H8 setup

7. Connect power to the ML-2 unit and the Beckhoff controller.

8. The different ML-2 units:

AGC 100: Set CAN A/CAN B protocol (menu 7841/7842 = H8) to "External I/O".

AGC 200: Set CAN A/CAN B/CAN C (menu 7841/7842/7843 = H8) to "External I/O".

AGC-3/AGC-4/GPC/GPU/GPU Hydro/PPM/PPU: Set CAN C/CAN E type (menu 7843 = H8.2 or menu 7845 = H8.8) to "External I/O".



GC-1F: Menu 784x is not available as CAN type setup. Instead, proceed with the setup, because the CAN is fixed to parameter 798x.

9. The Baud rate is fixed at 50 kbit/s.

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



AGC 100: The Node ID is set in parameter 7972 named "Ext. IO ID".



GC-1F: Menu 7973 is not available.

11. Communication between the ML-2 unit and the Beckhoff controller is now established.

12. To see the available external I/Os, retrieve the parameters from the ML-2 unit with the PC USW.

13. Click "External I/O" in the PC USW to see or change settings for external I/O modules.

3.6.5 ML-2 unit H12 setup

7. Connect power to the ML-2 unit and the Beckhoff controller.

8. The different ML-2 units:

AGC-4: Set CAN C/CAN D/CAN E/CAN F type (menu 7843/7844 = H12.2 or menu 7845/7846 = H12.8) to "External I/O".



GC-1F/AGC 100/AGC 200: The option H12 is not available.

9. The Baud rate is fixed at 50 kbit/s.

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

11. Communication between the ML-2 unit and the Beckhoff controller is now established.

12. To see the available external I/Os, retrieve the parameters from the ML-2 unit with the PC USW.

13. Click "External I/O" in the PC USW to see or change settings for external I/O modules.

4. Functional description

4.1 Supported modules

4.1.1 Supported modules

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

4.1.2 Controller (bus coupler)

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

4.1.3 Analogue input modules

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

4.1.4 Differential measurement

The option H8 and H12 provides differential measurements between two analogue input values.

The differential measurement functionality relates to the hardware supporting configurable analogue inputs or engine communication.

Setup and functional description are specified in the Designer's Reference Handbook (DRH) for the respective products listed below.

Product	DRH doc. no.
GPC-3	4189340587
GPU-3	4189340584
PPU-3	4189340583



Differential measurements are available in GPC-3, GPU-3 and PPU-3 from version 3.08.0.

4.1.5 Analogue output modules


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


4.1.6 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

4.1.7 Digital output modules

KL2012	2 ch. 24V DC/0.5 A
KL2022	2 ch. 24V DC/2.0 A
KL2114	4 ch. 24V DC/0.5 A
KL2408	8 ch. 24V DC/0.5 A
KL2602	2 ch. 230V AC
KM2002	16 ch. 24V DC/0.5 A

 GC-1F/AGC-3/AGC-4/AGC 100/AGC 200 also support digital I/Os from WAGO, Schneider, and other brands that use the CANopen device profile CiA 401 for generic digital I/Os.

 Only analogue I/O modules from Beckhoff are supported.

4.1.8 End bus terminal

KL9010	End bus terminal
--------	------------------

 AGC 100 and GC-1F: Analogue output modules are not supported.

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

4.2 Functional check of external I/O modules

4.2.1 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 resetting in menu 7974 "Reset".

4.2.2 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/Os will only be shown in the PC USW if they are present.

 Module status is only available for Beckhoff modules.

 AGC: Status alarms are also available in display.

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.

4.2.3 Digital I/O

Category	Channel	Test	Address	Value	Unit	Timer	OutputA	OutputB	Enabled	High alarm	Level	FailClass	Warning
External IO	12000	Ext. Ana. In 1.1	999	10	mA	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12010	Ext. Ana. In 1.2	1000	10	mA	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12030	Ext. Ana. In 2.1	1001	10	mA	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12040	Ext. Ana. In 2.2	1002	10	mA	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12090	Ext. Ana. In 3.1	1003	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12070	Ext. Ana. In 3.2	1004	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12090	Ext. Ana. In 4.1	1005	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12100	Ext. Ana. In 4.2	1006	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12120	Ext. Ana. In 5.1	1007	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12130	Ext. Ana. In 5.2	1008	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12150	Ext. Ana. In 6.1	1009	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12160	Ext. Ana. In 6.2	1010	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12180	Ext. Ana. In 7.1	1011	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12190	Ext. Ana. In 7.2	1012	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12210	Ext. Ana. In 8.1	1013	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12220	Ext. Ana. In 8.2	1014	100	C	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Warning
External IO	12240	Ext. Dig. In 1	1047	N/A	N/A	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Shutdown
External IO	12650	Ext. Dig. In 2	1048	N/A	N/A	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Shutdown
External IO	12560	Ext. Dig. In 3	1049	N/A	N/A	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Shutdown
External IO	12670	Ext. Dig. In 4	1050	N/A	N/A	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Shutdown
External IO	12580	Ext. Dig. In 5	1051	N/A	N/A	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Shutdown
External IO	12590	Ext. Dig. In 6	1052	N/A	N/A	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Shutdown
External IO	12600	Ext. Dig. In 7	1053	N/A	N/A	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Shutdown
External IO	12610	Ext. Dig. In 8	1054	N/A	N/A	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Shutdown
External IO	12620	Ext. Dig. In 9	1055	N/A	N/A	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Shutdown
External IO	12630	Ext. Dig. In 10	1056	N/A	N/A	10	0	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Customer	Shutdown
External IO	12790	Ext. Dig. Out 1	1063	0		0	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12800	Ext. Dig. Out 2	1064	0		0	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12810	Ext. Dig. Out 3	1065	0		0	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12820	Ext. Dig. Out 4	1066	0		0	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12830	Ext. Dig. Out 5	1067	0		0	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12840	Ext. Dig. Out 6	1068	0		0	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12850	Ext. Dig. Out 7	1069	0		0	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12900	Ext. Dig. Out 8	1070	0		0	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12951	Ext. Module 1 Status	959	-30710			N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12952	Ext. Module 2 Status	959	-30710			N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12953	Ext. Module 3 Status	960	-3072			N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12954	Ext. Module 4 Status	961	-3074			N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12955	Ext. Module 5 Status	962	-32255			N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		Customer	N/A
External IO	12956	Ext. Module 6 Status	963	3312			N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>		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

4.2.4 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
KL3202	3202
KL3204	3204



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

5. Parameters

5.1 Further information

The option H8 and H12 relates to the parameters 7930-7940, 7970-7980, 7950 and 12000-12980. Parameters 12000-12980 are only accessible via the PC utility software.

For further information, please see the separate parameter list for the Multi-line unit in question:

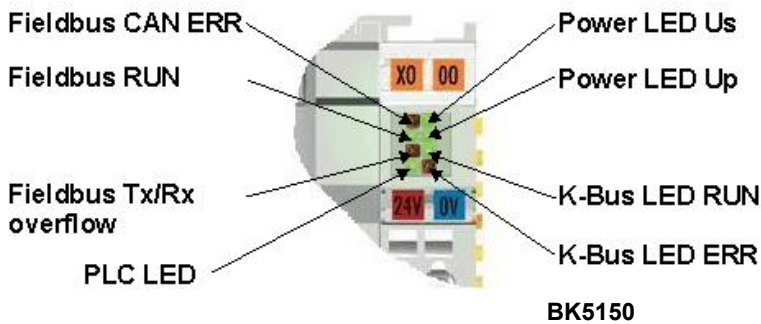
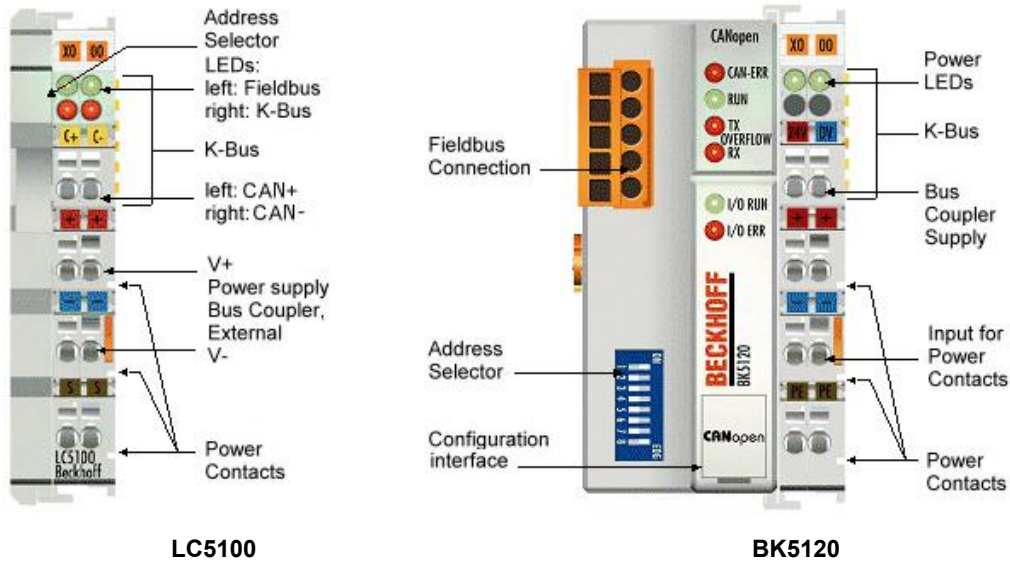
AGC-3	Document number 4189340705
AGC-4	Document number 4189340688
AGC 100	Document number 4189340764
AGC 200	Document number 4189340605
GPC-3/GPU-3 Hydro	Document number 4189340580
PPU-3/GPU-3	Document number 4189340581
PPM	Document number 4189340672

For GC-1F, please see the "Installation Instructions and Reference Handbook", document number: 4189340472.

6. Fault-finding

6.1 How to perform fault-finding

6.1.1 Beckhoff controllers



6.2 Diagnostic LEDs

6.2.1 Diagnostic LEDs

The Beckhoff controllers have LEDs for display of status. They can be used for fault-finding.

6.2.2 CAN ERR blink code

CAN ERR	Meaning
Off	CANbus has no errors
Fast blinking (Approx. 50 ms on, approx. 50 ms 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. 200 ms on, 1 s 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 e.g. when the first node is started).
2 x blinking (Each approx. 200 ms on, 200 ms off, followed by a 1 s pause).	The guarding or heartbeat monitor has alerted, because neither guarding telegrams nor heartbeat telegrams are received. Precondition for guarding monitoring: Guard time and life time factors are > 0. Precondition for heartbeat monitoring: Consumer heartbeat > 0). The bus coupler is preoperational (PDOs switched off), and the outputs are in the error state.
3 x blinking (Each approx. 200 ms on, 200 ms off, followed by a 1 s 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 preoperational (PDOs switched off), and the outputs are in the error state.
4 x blinking (Each approx. 200 ms on, 200 ms off, followed by a 1 s 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.

6.2.3 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. 50 ms on, approx. 50 ms 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 preoperational state . The node has not yet started.
On	Bus node is in operational state .

6.2.4 Tx overflow blink code

Tx overflow	Meaning
On	A transmit queue overflow 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 e.g. 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 s and then reset. If it keeps recurring, signalling is maintained.

6.2.5 Rx overflow blink code

Rx overflow	Meaning
On	A receive queue overflow 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 receive queue overflow 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.

6.2.6 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:

6.2.7 Blink code

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

6.2.8 Error type

Error code	Error code argument	Description	Remedy
Continuous flashing		General K-bus error	- Check terminal strip.
1 pulse	0	EEPROM check sum error	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Check programmed configuration for correctness. - Incorrect table entry/bus coupler.
	(n>0)	Incorrect table comparison (terminal n)	
3 pulses	0	K-bus command error	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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 is related to the documentation from: www.beckhoff.com