basicCAN 61 PLUS

USB Controller

User Manual
(Translation of Original docu)
Document Version 2.0

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1 Notes on the EC Declaration of Conformity

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With the EC Declaration of Conformity we declare the compliance of the GOEPEL electronic GmbH product described in this Manual with the requirements of the Directive
2006/95/EG – Low Voltage Directive and with the Directive 2004/108/EG about the Electromagnetic Compatibility.
Any modification to the product, not authorized by us, will invalidate the corresponding declaration.

The product is marked with the symbol CE

2 Installation

2.1 Hardware Installation

We recommend to install/ update the driver software before connecting the device to the PC/ Laptop (see Driver Installation/ USB chapter).

As a rule hardware installation for basicCAN 61 PLUS means to connect the power supply cable and the USB or Ethernet cable to the control PC.

Please use the supplied USB cable to connect the basicCAN 61 PLUS stand-alone device to the PC's USB interface.
Other cables may be inapplicable.

2.2 Driver Installation

2.2.1 USB

To install the GOEPEL electronic USB drivers on your system, execute the G-USB driver setup.
For this, start the *G-USB-Setup-*.exe* setup program (the asterisk stands for the version number) of the delivered CD and follow the instructions.

Your basicCAN 61 PLUS can be operated under Windows® XP as well as under Windows® 7/ 32 bit and Windows® 7/ 64 bit.

Before connecting the basicCAN 61 PLUS stand-alone hardware to a USB port of your PC, please ensure that the external power supply of the device is ready for operation (the hardware of basicCAN 61 PLUS is NOT supplied via USB). Then, connect the device by the supplied USB cable to a USB port of your PC.

Due to the plug and play capability of Windows®, the operating system will recognize the device automatically. As soon as it has been detected, the Windows® "Hardware wizard" will start and guide you through the device driver installation process.
Select the "Install software automatically" option and click "Next" to continue.

On completion of the installation process, Windows® will request you to reboot your computer.
For safe and reliable operation this step is strongly recommended.

After the installation, you can check whether the unit is properly embedded by the system.
As an example, the following figure shows the successful embedding of four basicCAN 61 PLUS devices
(each device appears as USB 6153 in the Device Manager):

Figure 2-1: basicCAN 61 PLUS installed

Please note that the Device Manager shows ALL USB controllers supported by this driver.

2.2.2 Ethernet

If the Ethernet interface is used for communication with the control PC, there is no driver installation required.

After the Hardware Installation, the device can directly be addressed via the IP Address (see also Addressing).
This IP Address can be changed by the HardwareExplorer. The newly set IP Address becomes effective after a restart.

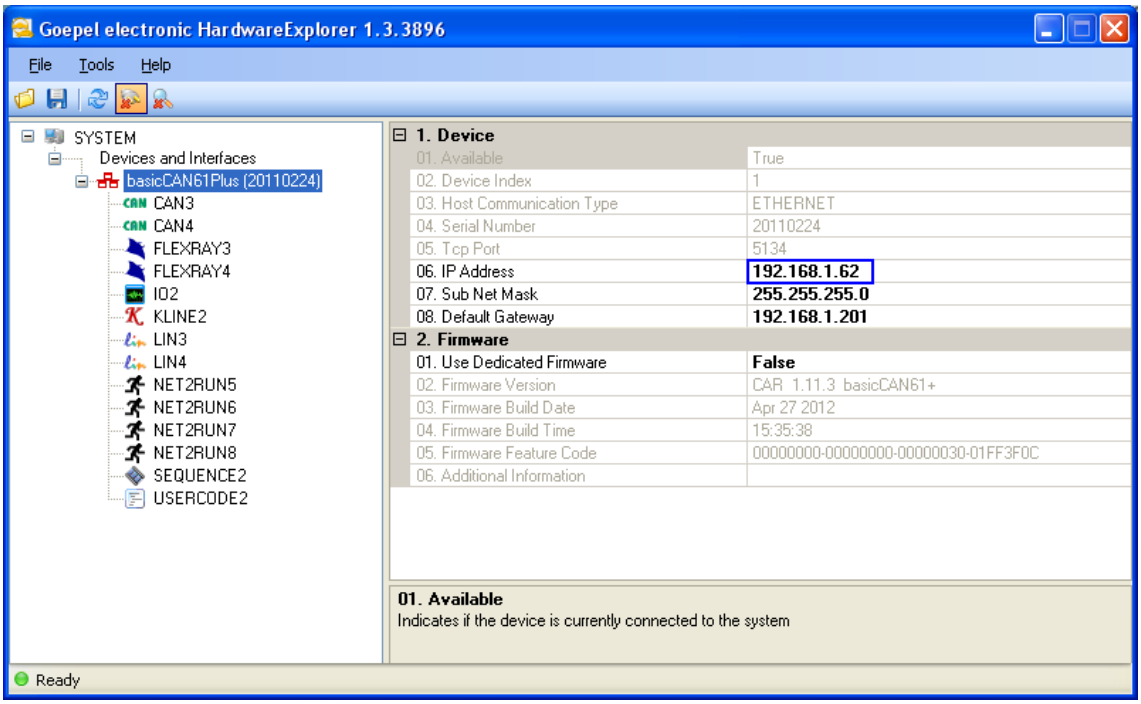

Figure 2-2: IP Address in the GOEPEL electronic HardwareExplorer

2.3 Notes on the Firmware

2.3.1 Firmware Update

In the course of the technical progress, it can be necessary from time to time “to treat” your hardware to a new Firmware release.
Proceed as follows:

- Download the current Firmware Update-File (see Firmware Variants) from *genesis.goepel.com*
- Open the GOEPEL HardwareExplorer
- On “Devices...” (basicCAN61Plus), select “Flash Firmware” with the right mouse button
- On “Flash Firmware”, select the Update-File (see Firmware Variants) with the left mouse button and execute it (e.g. by double clicking)
- After finishing of the progress bar in the “Flashing...” window, press the “OK” button in the following “Success” window with the left mouse button

Please ensure that you use the right Firmware Variant when updating the Firmware (see Firmware Variants).
Installing the wrong Firmware Variant may result in the loss of functionality and can cause your application to malfunction.

In such events, reinstallation of the correct Firmware Variant will restore the functionality.

2.3.2 Firmware Variants

With the introduction of CAN-FD support for the Series 61 communication controller family, also Firmware Variants have been introduced. Because of the increased IP footprint of the CAN-FD IP core, the LIN and K-Line Interfaces have been removed from the CAN-FD Firmware.

The Firmware Variant is coded into the Firmware version string as well as in the file name of the update file.

Example:

Version: CAR 1.16.1 basicCAN61+ VAR1
Update-File: CAR32_6100_VAR1__1_16_1__2015_05_19.update

Version: CAR 1.16.1 basicCAN61+ VAR2
Update-File: CAR32_6100_VAR2__1_16_1__2015_05_19.update

Please refer to the table below for the interface options supported by each Firmware Variant.

		CAR32 Firmware Variant	
Software Interface	Hardware Interface (Plug-in position)	VAR1 (CAN 2.0)	VAR2 (CAN-FD)
CAN1	Node 1 (TRX 1)	x	x
CAN2	Node 2 (TRX 2)	x	x
CAN3	Node 3 (TRX 3)	x	x
CAN4	Node 4 (TRX 4)	x	x
CAN5/ 6	Node B (FlexRay 2)	x	-
LIN1	Node 1 (TRX 1)	x	-
LIN2	Node 2 (TRX 2)	x	-
LIN3	Node 3 (TRX 3)	x	-
LIN4	Node 4 (TRX 4)	x	-
K-Line1	Node 1 (TRX 1)	x	-
K-Line2	Node 2 (TRX 2)	x	-
K-Line3	Node 3 (TRX 3)	x	-
K-Line4	Node 4 (TRX 4)	x	-
FlexRay1	Node A (FlexRay 1)	x	x
FlexRay2	Node B (FlexRay 2)	x	x
IO1	Node IO (A/D-IO)	x	x
FS1	-	x	x
Sequence1	-	x	x
UserCode1	-	x	x
Net2Run1	-	x	x
Net2Run2	-	x	x
Net2Run3	-	x	x
Net2Run4	-	x	x

Please note: Not all interfaces are useable at the same time.
Some interfaces are optional and require specific transceivers or expansion modules to be installed on the device, as well as the corresponding licensing option to be unlocked, in order to use them.

For example, CAN-FD is an additional licensing option.
If this option is not installed on your controller device, all available CAN interfaces will function according to CAN 2.0 specification regardless of the Firmware Variant installed.

Please contact our sales department or technical support for questions to the available license and hardware options.

3 Hardware

3.1 Definition

The basicCAN 61 PLUS stand-alone device of GOEPEL electronic GmbH, based on the corresponding USB 6153 USB/ Ethernet board, should be connected to a PC or laptop. It was developed for applications out of complex test systems.
The external power supply of 7-25 VDC allows the use of this device for data acquisition and the inspection of signals for a multitude of applications, e.g. in motor vehicles.

basicCAN 61 PLUS provides the following resources:

- 2 basic CAN interfaces onboard
  (see OnBoard Interfaces)
- optionally 2 further CAN/ LIN or K-Line interfaces onboard
  (see OnBoard Interfaces)
- optionally 2 FlexRay nodes with 2 channels each
  (see FlexRay Extension board)
- optionally instead of the second FlexRay Extension board
  1 CAN Extension board with 2 CAN interfaces
- 4 digital input and output channels with TTL level onboard
  (see Digital IO)
- optionally 4 additional digital inputs and 4 outputs
  with extended voltage range
  (see IO Extension board)
- optionally 4 resp. 6 analog input and output channels
  (see IO Extension board)
- optionally up to 2 SENT outputs
  according to SAE J2716 (Jan. 2010) for Sensor simulation
  (see SENT Interfaces)
- 600MHz Power PC with 512MB RAM, 256MB Flash
- Communication interfaces and IO channels
  are galvanically separated from the user interface
- High flexibility through pluggable transceiver modules and possible versions of the IO Extension Board
- Control of the device via USB 2.0 or Ethernet
  (see Addressing and Ethernet)
- 1 Gbit Ethernet interface at the decice's rear side also useable as volume data and debug interface
- 11 front panel LEDs for status indication (see Status LEDs)

Instead of 2..4 CAN Interfaces, a basicCAN61 PLUS device can also have 2..4 CAN-FD Interfaces onboard. Currently, the options LIN/ K-Line as well as CAN5/ 6 (CAN Extension board) are not possible in this case (see also Firmware Variants).

The following figure shows a basicCAN 61 PLUS:

Figure 3-1: basicCAN 61 PLUS

3.2 Technical Data

3.2.1 Dimensions

The basicCAN 61 PLUS has the following dimensions:

- 230 mm x 169 mm x 82 mm (L x W x H)

3.2.2 Basic Characteristics

A basicCAN 61 PLUS has the following basic characteristics:

Indication	Min.	Typ.	Max.	Unit	Remarks
CAN/ LIN/ K-Line interfaces		2	4		See OnBoard Interfaces
CAN Extension			2		See CAN Extension board
FlexRay Extension			2		See FlexRay Extension board
IO Resources Extension			1		See IO Extension board

If required, the CAN Extension board with two CAN interfaces including Transceivers is plugged in at the same position as usually the second FlexRay Extension board.

3.3 Front View

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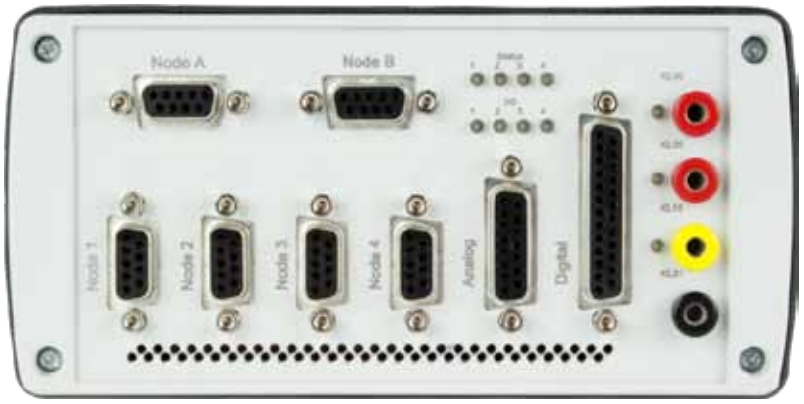

Figure 3-2: Front view

ƒ „ … † ‡ ˆ ‰

- • Node A FlexRay node 1 (optionally)
- , Node B FlexRay node 2 (optionally), or CAN 5, 6 (optionally)
- Œ Status 1, 2, 3, 4 Status LEDs 1..4
- • DO 1, 2, 3, 4 State of Digital outputs 1..4
- Ž Power 1, 2, 3 Power LEDs
- ƒ Node 1 CAN1/ CAN-FD1
- „ Node 2 CAN2/ CAN-FD2
- … Node 3 CAN3 (optionally, also LIN or K-Line possible)/ CAN-FD3
- † Node 4 CAN4 (optionally, also LIN or K-Line possible)/ CAN-FD4
- ‡ Analog Analog E/ A 1..4 (or ..6, optionally)
- ˆ Digital Digital-E/ A 1..4 (optionally ..8)
- ‰ KL30 (red) KL15 (yellow) KL31 (black) Outputs for test object supply

3.4 Rear View

Figure 3-3: Rear view

• , *f* „

- Ethernet Ethernet connection
- , USB USB 2.0 connection
- *f* ext. Power basicCAN External supply input for basicCAN 61 PLUS
- „ ext. Power Front External supply input for Test object (red - plus, black - minus)

3.5 Function

3.5.1 Status LEDs

The LEDs arranged at the front panel (see Figure 3-2) indicate several states of your basicCAN 61 PLUS:

Status 1, 2, 3, 4 Status LEDs: These LEDs indicate the current operation state of the basicCAN 61 PLUS

The operation states are explained in the following table:

LED 1	LED 2	LED 3	LED 4	Remarks
Permanently ON				Controller does not run (error!)
Alternately blinking				Bootloader software runs
	blinking			Firmware runs
ON (shortly)				State during execution of a Firmware command on the OnBoard interfaces 1..4
			ON	Ethernet connection established

DO 1..4 Digital OUT: These LEDs indicate the state of the digital outputs 1..4 (Digital connector)

Power LEDs 1..3: The two upper LEDs indicate that the KL30 test object supply is connected, while the lower LED indicates that the KL15 test object supply is switched ON

3.5.2 Supply of basicCAN 61 PLUS

For operating the basicCAN 61 PLUS, there is an external power supply of 7..25 VDC required. For this, you can use the ext. Power basicCAN connector for the delivered AC adaptor plug (12 VDC) at the device's rear side, with coaxial power plug (2.1 x 5.5 mm/ plus polarity inside).

3.5.3 Test object Supply

To supply the test object, a voltage connected to the ext.Power Front connection at the device's rear side is distributed to the KL30, KL15, KL31 sockets at the front panel.

The KL15 voltage can be switched by software by means of the Digital OUT1 digital output (G-API command G_Io_Outputs_Digital_Set):

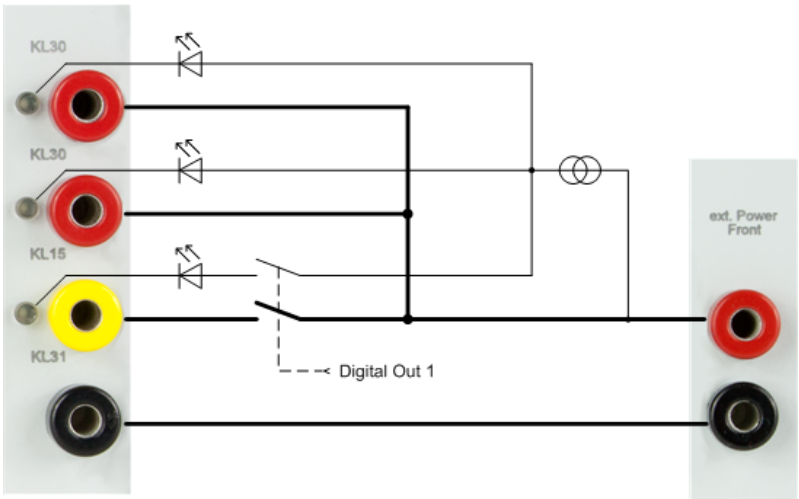

Figure 3-4: Test object Supply internal

3.5.4 Addressing

basicCAN 61 PLUS units provide a 1Gbit Ethernet interface and a USB 2.0 interface. Both interfaces can be used for the communication of the unit with the host PC.
In case of using the Ethernet interface, the device can be controlled via the default IP Address 192.168.1.62, Port 5134, which can be changed if required. In principle, there are two ways for this:

- HardwareExplorer: Select the device, under Device set the required IP Address;
  the new IP Address is effective after restart
- G API Command G_Common_Ethernet_IpAddress_Set;
  the new IP Address is effective after restart

Addressing of basicCON 61 PLUS devices controlled via the USB interface takes place exclusively according to their serial numbers: The device with the least serial number is always the device with the number 1.

To improve clarity, we recommend to connect several basicCAN 61 PLUS devices (if applicable) in the order of ascending serial numbers to the PC/ Laptop.

3.5.5 OnBoard Interfaces

The basicCAN 61 PLUS has two (optionally up to four) Communication interfaces onboard, designed as CAN 2.0B interfaces using the TJA1041A Highspeed CAN Transceiver.

Optionally it is possible to plug in different/ further transceivers (totally 4, that means not for the CAN Extension board).
By the type of the plugged-in transceivers you decide the performance of the assigned interfaces!

Warning

For changing or plugging in additional transceivers, open the stand-alone device (with the system **switched off**).

To do that, unscrew and remove the four upper screws of the frontal and rear plates, and unscrew slightly the four lower screws (until the upper cover can be removed). Please proceed extremely carefully, otherwise the device could be damaged.

When plugging in transceivers, please attend to their correct position and orientation.

In the case of further inquiries, please contact our support department (ats_support@goepel.com).

The position and orientation of the transceivers can be seen in the following figure:

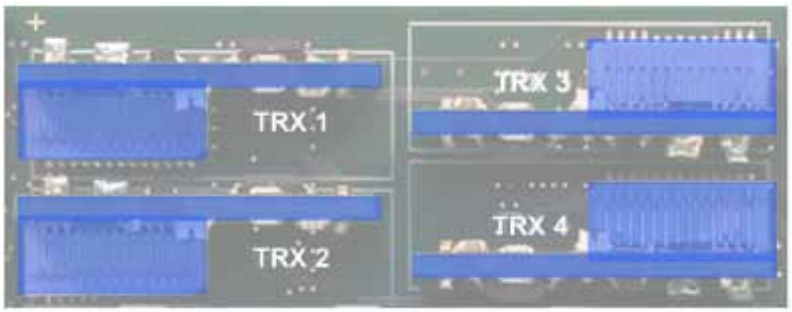

Figure 3-5: Transceiver positions

Each transceiver type is coded and can be identified clearly.
For the available types of transceivers, see Product Information.

As a rule all four interfaces are supplied by an internal voltage of 12V ($UBAT_{int}$) generated from ext. Power Supply (see Figure 3-3).

In case of using other voltages for the interfaces, this internal voltage can be switched off individually by software (G-API commands
G_Can_Node_InternalVBat_Disable
G_Lin_Node_InternalVBat_Disable or
G_KLine_Node_InternalVBat_Disable).

Then, an external voltage ($UBAT_{ext}$) must be supplied via the predefined pins of the corresponding frontal connector Node 1..4.

In case the internal power supply has to be used again later, execute the G-API commands
G_Can_Node_InternalVBat_Enable
G_Lin_Node_InternalVBat_Enable or
G_Kline_Node_InternalVBat_Enable.

When using CAN-FD, the options LIN/ KLine are currently not possible.

The CAN-FD Onboard Interfaces are based upon the “M_CAN” IP-Module (Revision 3.2.0) of Bosch company, featuring the following characteristics:

- CAN 2.0 Specification compliant (Parts A and B) as well as ISO 11898-1:2015 Standard compliant
- Transfer of up to 64 Data bytes in one CAN-FD frame
- Support of the CRC Algorithmus in the CAN-FD frame according to ISO 11898-1:2015 as well as Bosch CAN-FD Spezifikation V1.0 (Non_ISO)

Symbol	Indication	Min.	Typ.	Max.	Unit	Remarks
CAN V2.0B ISO 11898-1:2003 Interfaces, onboard, Node 1..2 (optionally ..4)						
	Transmission rate			1	Mbit/s	
$UBAT_{int}$	Internal battery voltage		12		V	detachable
$UBAT_{ext}$	External battery voltage			27	V	
R_{CAN}	Termination high-speed transceiver		120		Ω	detachable
R_{CAN}	Termination low-speed transceiver			10	kΩ	R_{CAN}
CAN-FD ISO 11898-1:2015 Interfaces, onboard, Node 1..4 (optionally)						
C	Transmission rate			10	MBit/s	depending on transceiver
$UBAT_{intern}$	internal battery voltage		12		V	detachable
$UBAT_{extern}$	external Battery voltage			27	V	
RCAN	Termination high-speed transceiver		120		Ω	detachable
R_{CAN}	Termination low-speed transceiver			10	kΩ	R_{CAN}
LIN V2.1 Interfaces, onboard, Node 3..4 (optionally)						
	Transmission rate			19.2	kbit/s	
$UBAT_{int}$	internal battery voltage		12		V	detachable
$UBAT_{ext}$	external battery voltage			27	V	
R_{LIN}	Pullup Resistor	1	30		kΩ	switchable Master/ Slave
K-Line Interfaces, onboard, Node 3..4 (optionally)						
	Transmission rate			9.6	kbit/s	
$UBAT_{ext}$	external Battery voltage		12	27	V	

Notes on R_{CAN} for the high speed transceiver:
The 120Ω bus terminating resistor can be deactivated by software (G-API command G_CAN_Node_BusTermination_Disable, activation anew by G_CAN_Node_BusTermination_Enable).

Notes on R_{CAN} for the low speed transceiver:
The internal 10kΩ bus terminating resistor can be reduced if required by adding external resistors.
Connect the external resistors, if applicable, between the pins with the signals R_{low}-CANx_H and CANx_H/ R_{low}-CANx_L and CANx_L (see Connector Pinout).

Notes on RLIN: The 1kΩ pullup resistor corresponds to the LIN Master bus termination and can be activated by software (G-API command G_Lin_PullUpResistor_Enable à Master, Deactivating by G_Lin_PullUpResistor_Disable à Slave).
If it is not active, the internal termination resistor of the LIN transceiver becomes effective (typically 30kΩ for TJA1020).

3.5.6 FlexRay Extension board

The basicCAN 61 PLUS board hast two extension sockets at its top side to plug in FlexRay Extension boards. Each board has an independent FlexRay controller and two FlexRay transceivers, providing full dual channel functionality.

For a basicCAN 61 PLUS with CAN Extension board, only one FlexRay Extension board can be plugged in.

A basicCAN 61 PLUS FlexRay Extension board provides the following features:

- FlexRay controller (Freescale MFR4310)
- FlexRay 2.1 protocol compliant
- Support of the following FlexRay transmission rates (in Mbit/s): 10 | 8 | 5 | 2.5
- 2 FlexRay Transceivers (TJA 1080)
- Wakeup detection
- Switchable termination resistors
- Full galvanic isolation
- Isolated power supply of the transceivers

The following table shows the main characteristics of a FlexRay module:

Symbol	Indication	Min.	Typ.	Max.	Unit	Remarks
FlexRay interface						
	Transmission rate	2.5		10	Mbit/s	per channel
R_{FR}	Termination resistor		100		Ω	detachable

Notes on R_{FR}:
The 100Ω bus termination resistor can be deactivated by software (G-API command G_FlexRay_Node_BusTermination_Disable, reactivation by G_FlexRay_Node_BusTermination_Enable).

When configured with two FlexRay modules, both FlexRay modules can be used jointly to startup a FlexRay cluster.
In this case one node will be the leading cold starter and the other one the following cold starter.

In cases where the ECU under test is a cold start node itself, a single module can start up the cluster.
This way the second module could be used to operate a second FlexRay cluster independently.

3.5.7 CAN Extension board

In the case there are more CAN interfaces required, a CAN Extension board for two CAN interfaces can be plugged to the position for FlexRay Node B (generally providing CAN5 and CAN6).
The highspeed transceivers TJA1041A for these two interfaces can not be exchanged by other transceiver types.
Moreover, no external supply by $UBAT_{ext}$ is possible, the supply voltage comes from $UBAT_{int}$ (12V).
The termination resistor for both transceivers is switchable.

Symbol	Indication	Min.	Typ.	Max.	Unit	Remarks
CAN V2.0B ISO 11898-1:2003 Interfaces, generally Node 5..6 (optionally)						
	Transmission rate			1	Mbit/s	
$UBAT_{int}$	Internal battery voltage		12		V	
R_{CAN}	Termination high-speed transceiver		120		Ω	detachable

When using CAN-FD, this option is currently not possible.

3.5.8 Digital IO

All in all your basicCAN 61 PLUS has up to 8 digital inputs and outputs. The 1..4 onboard inputs and outputs respectively have the following parameters:

Symbol	Indication	Min.	Typ.	Max.	Unit	Remarks
Digital inputs 1..4 (onboard)						
U_{IH}	High-level input voltage	3.5		5.5	V	
U_{IL}	Low-level input voltage			1.5	V	
I_L	Input leakage current			35	µA	
Digital outputs 1..4 (onboard)						
U_{OH}	High-level output voltage	4.8		5	V	DIGITAL_OUT1 already assigned to switch KL.15
U_{OL}	Low-level output voltage			0.5	V	
I_{OUT}	Output current			8	mA	

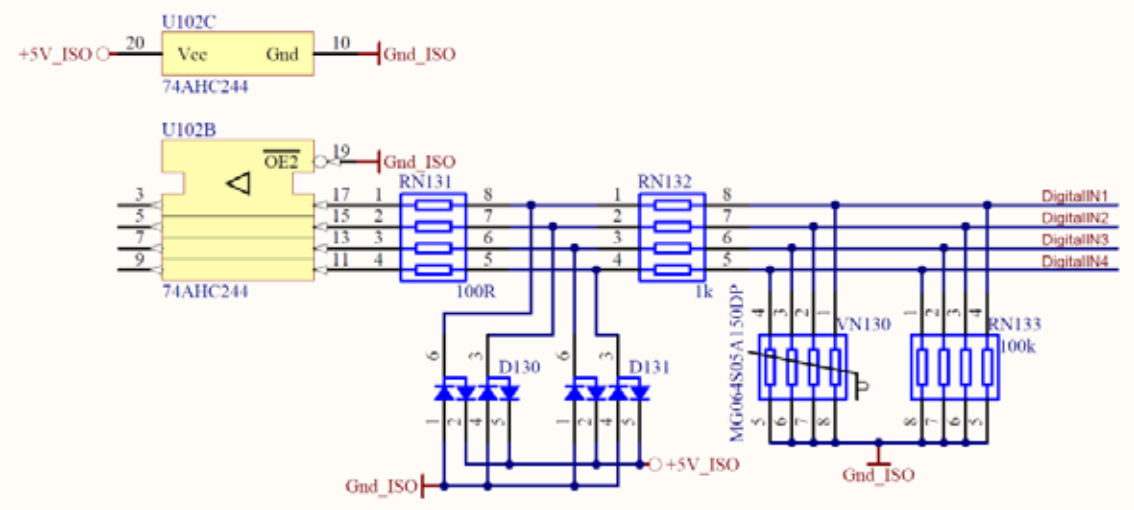

Figure 3-6: Circuit diagram extract of onboard Digital Inputs 1..4

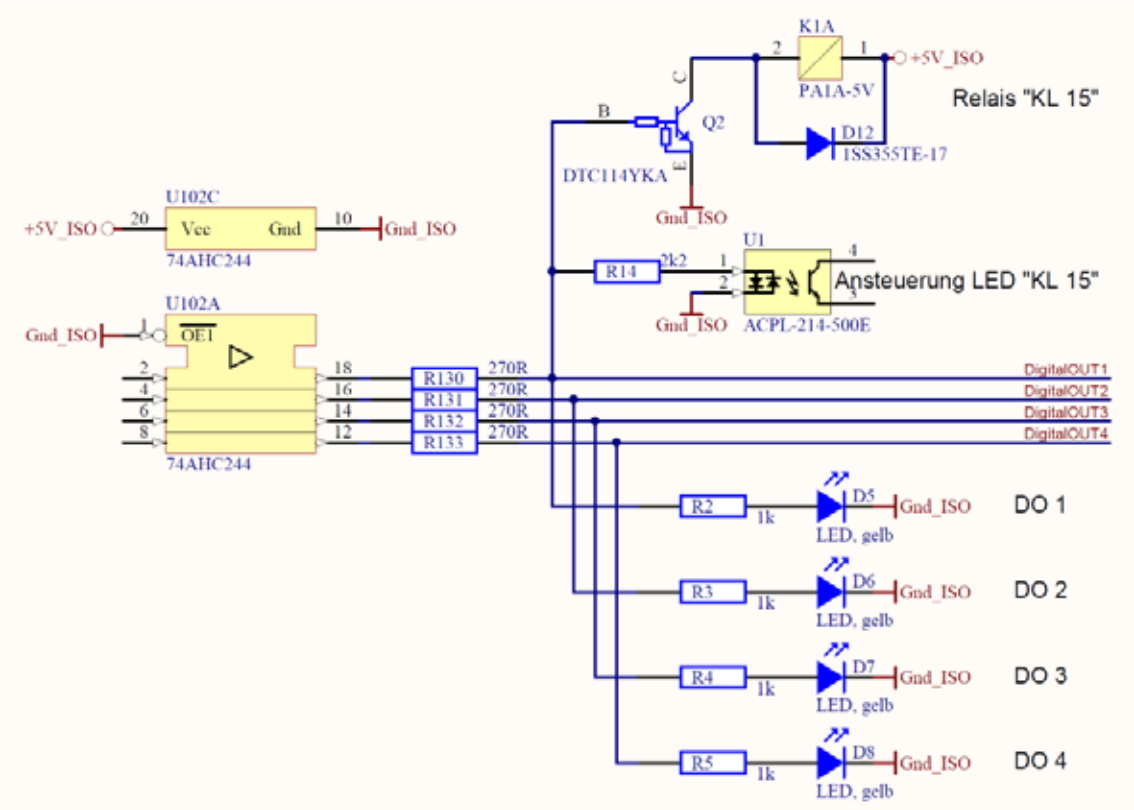

Figure 3-7: Circuit diagram extract of onboard Digital outputs 1..4

3.5.9 IO Extension board

Additional analog and digital inputs and outputs as well as various interfaces become available by plugging in an extension board.

GOEPEL electronic GmbH offers two different types: Type 1 and Type 2.

The Type 1 IO Extension board has additional resources as follows:

Symbol	Indication	Min.	Typ.	Max.	Unit	Remarks
Digital inputs 5..8						
N	Number of inputs			4		
U_{IH}	High-level input voltage	3.5		25	V	
U_{IL}	Low-level input voltage			3.0	V	
I_L	Input current			1.8	mA	
Digital outputs 5..8						
N	Number of outputs			4		
U_{OH}	High-level output voltage	4.8		5	V	
U_{OL}	Low-level output voltage			0.5	V	
I_{OUT}	Output current			8	mA	
Analog inputs						
N	Number of inputs			6		
U_{IN}	Input voltage	0		10	V	
	Resolution			10	bit	
Analog outputs						
N	Number of outputs			6		
U_{OUT}	Output voltage	0		10	V	
	Resolution			10	bit	

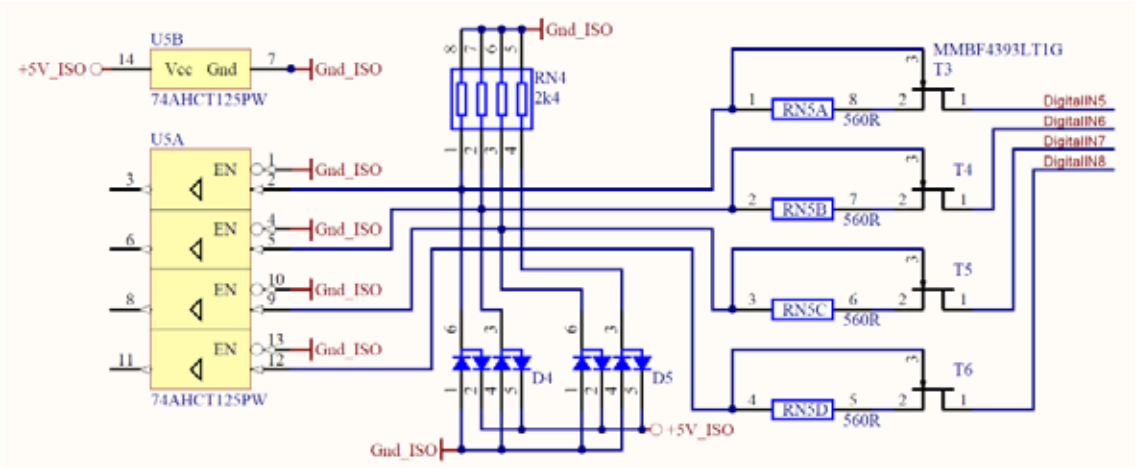

Figure 3-8: Circuit diagram extract of Digital inputs 5..8 for IO Extension board Type 1

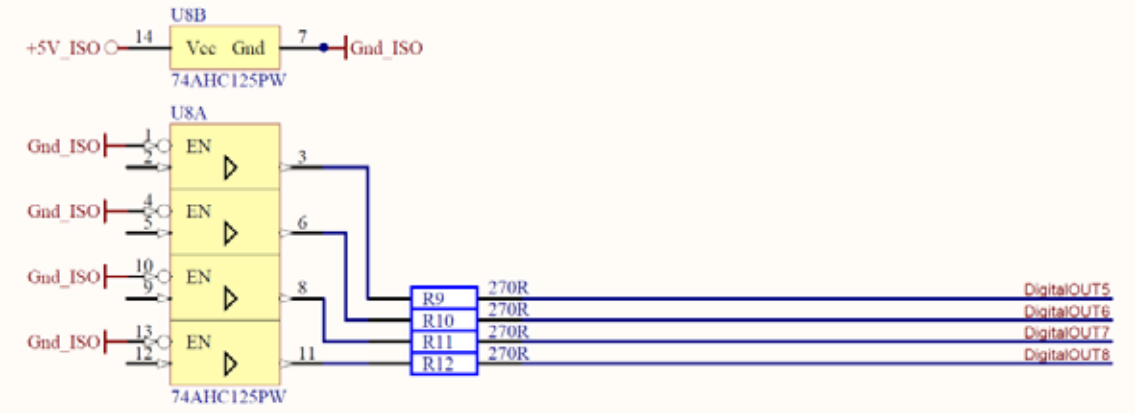

Figure 3-9: Circuit diagram extract of Digital outputs 5..8 for IO Extension board Type 1

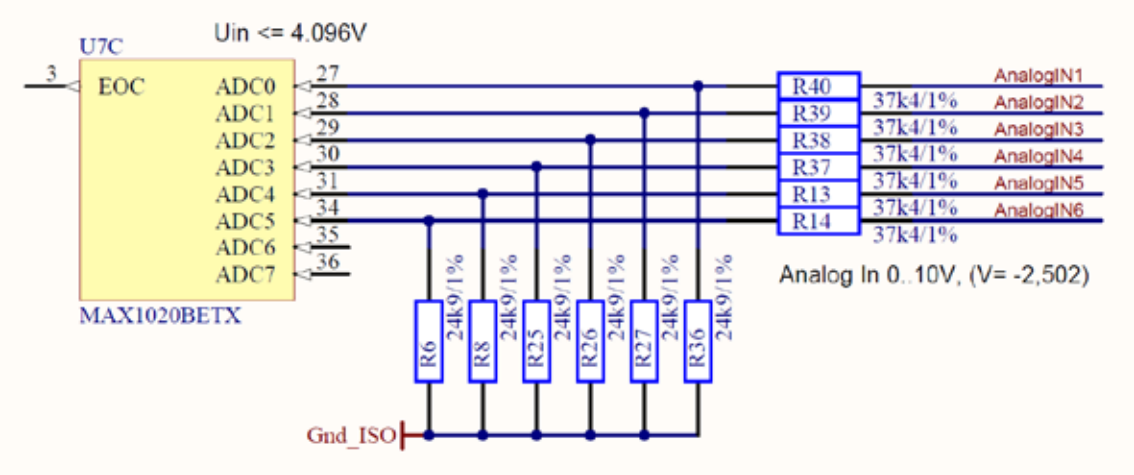

Figure 3-10: Circuit diagram extract of Analog inputs 1..6 for IO Extension board Type 1

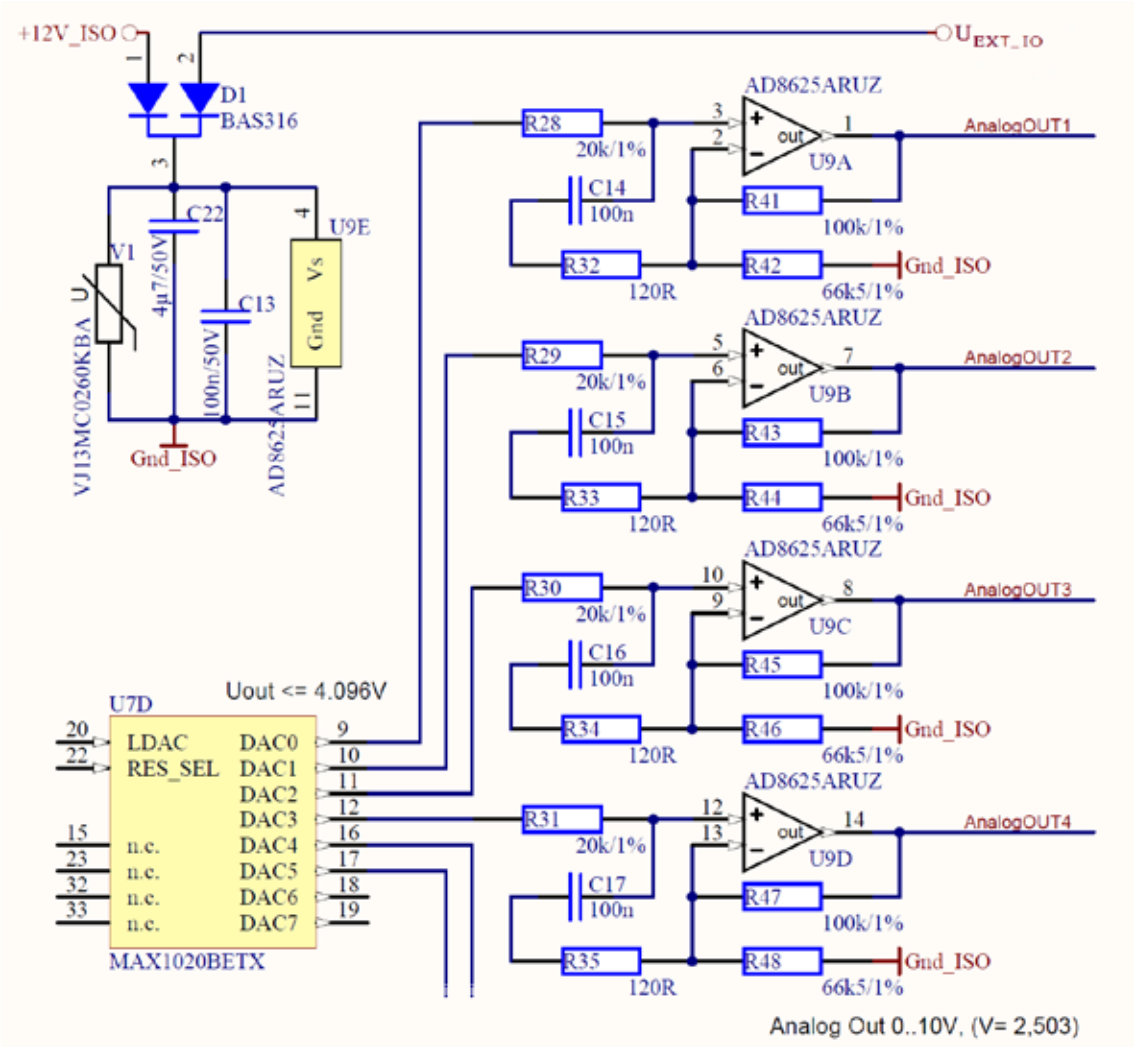

Figure 3-11: Circuit diagram extract of Analog outputs 1..6 for IO Extension board Type 1

The Type 2 IO Extension board has additional resources as follows:

Symbol	Indication	Min.	Typ.	Max.	Unit	Remarks
Digital inputs 5..8						
N	Number of inputs			4		
U_{IH}	High-level input voltage	3.5		25	V	
U_{IL}	Low-level input voltage			3.0	V	
I_L	Input current			1.8	mA	
Digital outputs 5..8						
N	Number of outputs			4		
U_{OH}	High-level output voltage			25	V	Supply via pin U_{EXT_IO}
U_{OL}	Low-level output voltage		open		V	Integrated recovery diode
I_{OUT}	Output current			200	mA	
Analog inputs						
N	Number of inputs			4		
U_{IN}	Input voltage			25	V	
	Resolution			10	bit	
R_L	Input resistance		125		kΩ	
Analog outputs						
N	Number of outputs			4		
U_{OUT}	Output voltage			25	V	Supply via pin U_{EXT_IO}
I_{OUT}	Output current per channel			10	mA	
	Resolution			10	bit	
External IO Voltage input U_{EXT_IO}						
U_{EXT_IO}	External IO Voltage	7		26	V	

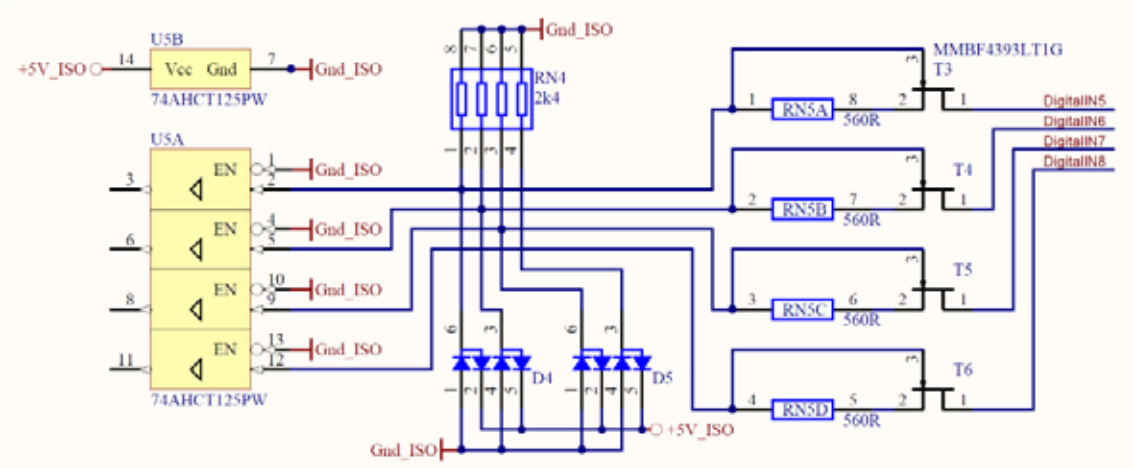

Figure 3-12: Circuit diagram extract of Digital inputs 5..8 for IO Extension board Type 2

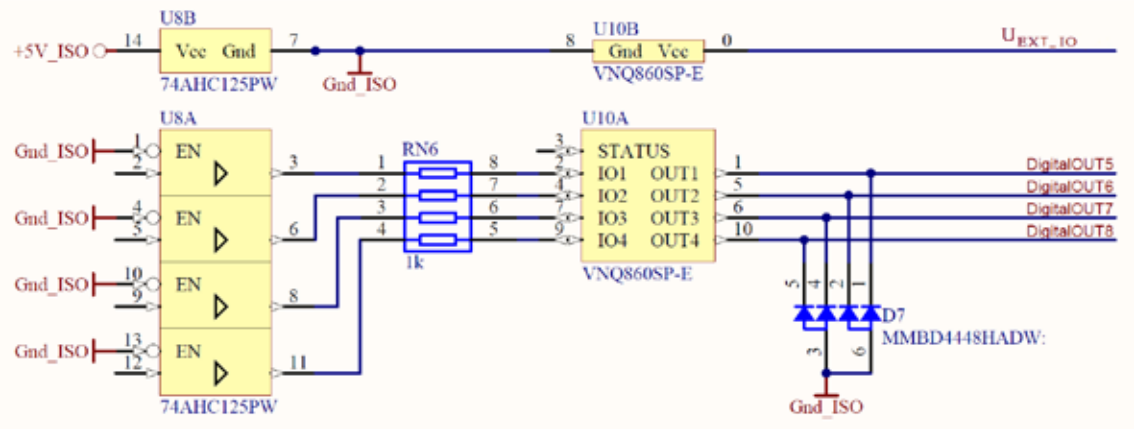

Figure 3-13: Circuit diagram extract of Digital outputs 5..8 for IO Extension board Type 2

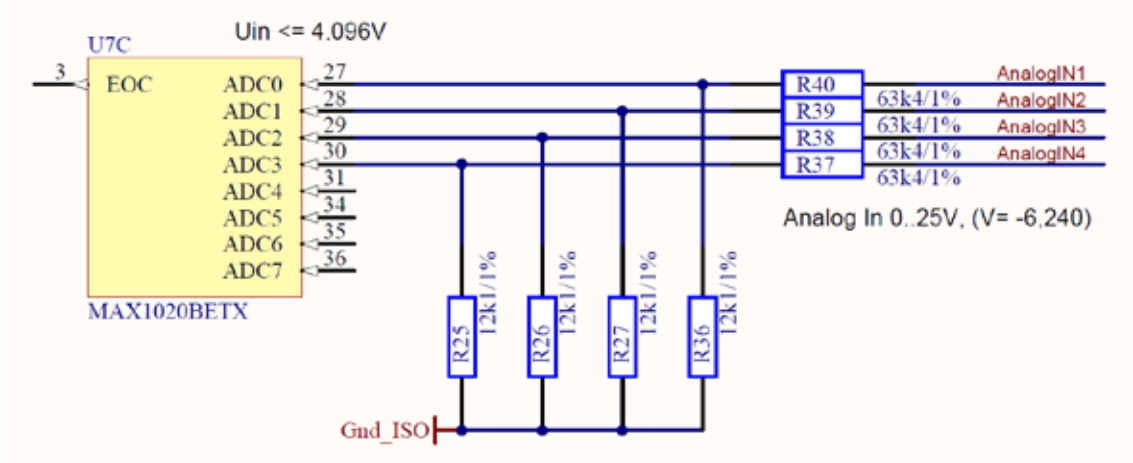

Figure 3-14: Circuit diagram extract of Analog inputs 1..4 for IO Extension board Type 2

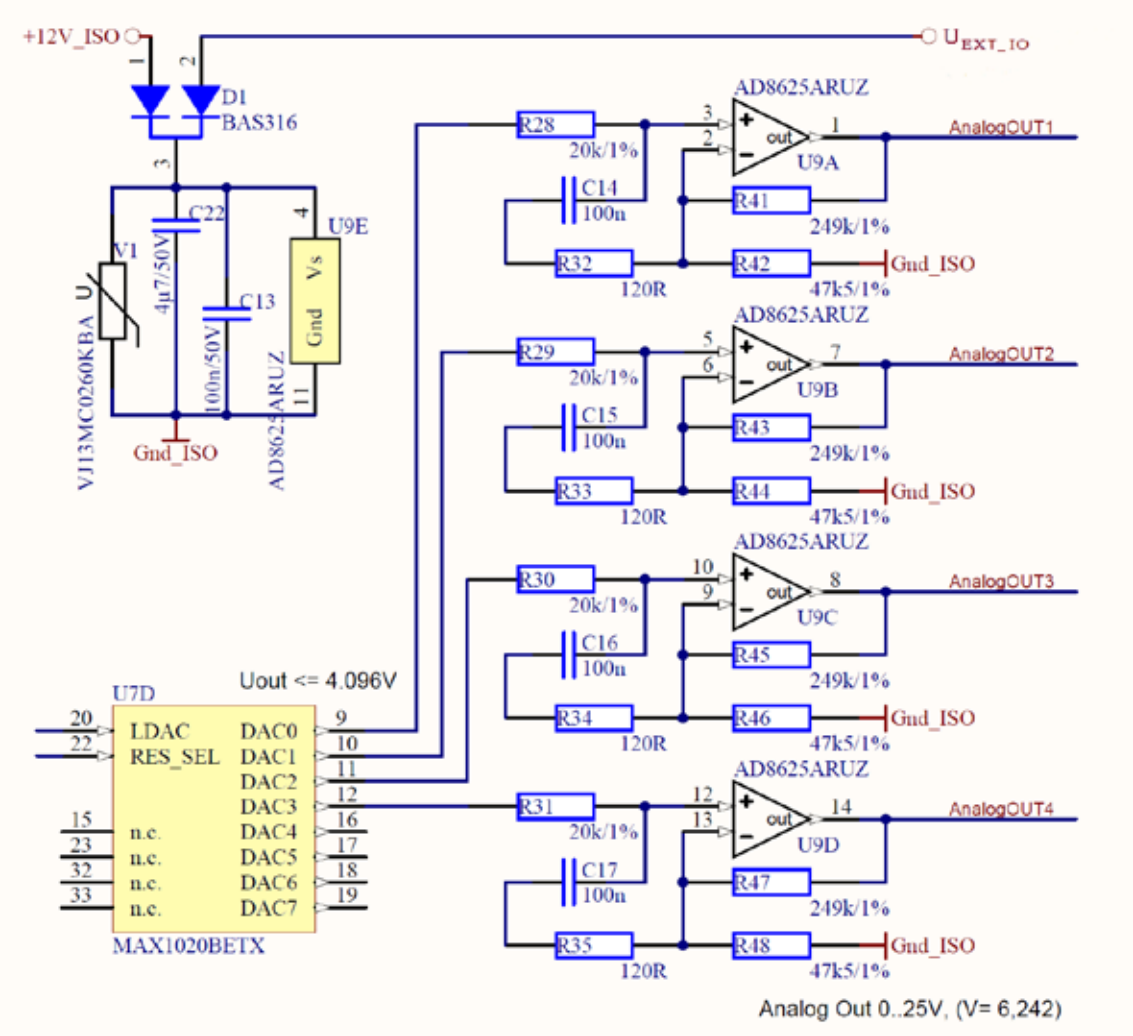

Figure 3-15: Circuit diagram extract of Analog outputs 1..4 for IO Extension board Type 2

3.5.10 SENT Interfaces

Optionally up to 2 SENT outputs according to SAE J2716 Standard (Revision Jan. 2010) are available.

The data-link layer of the SENT transmitter is implemented as programmable FPGA logic. Digital outputs of the base board or the Type 1 Extension board serve as physical layer.
The routing between the SENT transmitter and the effective digital output is defined via the Trigger matrix.

The SENT interfaces are provided by a licensing option per card.
Existing cards can be upgraded via a specific unlock code.
Please contact your sales representive for an upgrade offer.

In order to use the SENT interfaces the following software is required:

- Firmware version 1.15.5 or higher resp.
- G-API version 1.3.4635 or higher

(See section IO-Function in the G-API Help for Software Documentation.)

Please note: The SENT interfaces are part of the IO interface.
Therefore they do not appear as separate interfaces in the GOEPEL Hardware Explorer.

3.5.11 Isolation

Electric surges can harm expensive test equipment and may lead to unreliable test results. Electric isolation protects against electric surges and can help to suppress dangerous electrical transients. It also eliminates ground loops, responsible for data errors due to ground potential differences.

A basicCAN 61 PLUS unit provides electric isolation between the USB/ Ethernet system and all input and output signals of the frontal connectors. This includes the CAN, LIN/ K-Line and FlexRay communication interfaces as well as digital and analog IOs.

3.5.12 Connector Pinout

The following table shows the pinout of the CAN frontal connectors Node 1..2 (optionally ..4) (type D-SUB 9poles female):

Pin	Signal		Pin	Signal
1	R_{low}-CAN_L		6	Not used
2	CAN_L		7	CAN_H
3	GND_{ISO}		8	R_{low}-CAN_H
4	Not used		9	$UBAT_{ext}$
5	Not used			

The following table shows the pinout of the CAN frontal connector Node B (optionally assigned, type D-SUB 9poles female):

Pin	Signal		Pin	Signal
1	Not used		6	Not used
2	CAN5_L		7	CAN5_H
3	GND_{ISO}		8	CAN6_H
4	CAN6_L		9	Not used
5	Not used			

The following table shows the pinout of the LIN frontal connectors Node 3..4 (optionally assigned, type D-SUB 9poles female):

Pin	Signal		Pin	Signal
1	Not used		6	Not used
2	Not used		7	LIN
3	GND_{ISO}		8	Not used
4	Not used		9	$UBAT_{ext}$
5	Not used			

The following table shows the pinout of the K-Line frontal connectors Node 3..4 (optionally assigned, type D-SUB 9poles female):

Pin	Signal		Pin	Signal
1	Not used		6	Not used
2	L-Line		7	K-Line
3	GND_{ISO}		8	Not used
4	Not used		9	$UBAT_{ext}$
5	Not used			

The $UBAT_{ext}$ potentials on the Node 1..4 connectors are not interconnected internally.
If required, an external voltage can be supplied for each of these connectors! (Before, the internal voltage must be switched off, see OnBoard Interfaces.)

The following table shows the pinout of the FlexRay frontal connectors Node A/ B (optionally assigned, type D-SUB 9poles female):

Pin	Signal		Pin	Signal
1	Not used		6	Not used
2	FlexRayA_BM		7	FlexRayA_BP
3	GND_{ISO}		8	FlexRayB_BP
4	FlexRayB_BM		9	Not used
5	Not used			

The following table shows the pinout of the Analog frontal connector for IO Extension Type1
(optionally assigned, type D-SUB 15poles female):

Pin	Signal		Pin	Signal
1	ANALOG_IN1		9	ANALOG_IN2
2	ANALOG_IN3		10	ANALOG_IN4
3	ANALOG_IN5		11	ANALOG_IN6
4	GND_{ISO}		12	ANALOG_OUT1
5	ANALOG_OUT2		13	ANALOG_OUT3
6	ANALOG_OUT4		14	ANALOG_OUT5
7	ANALOG_OUT6		15	U_{EXT_IO}
8	GND_{ISO}			

The following table shows the pinout of the Analog frontal connector for IO Extension Type2
(optionally assigned, type D-SUB 15poles female):

Pin	Signal		Pin	Signal
1	ANALOG_IN1		9	ANALOG_IN2
2	ANALOG_IN3		10	ANALOG_IN4
3	Not used		11	Not used
4	GND_{ISO}		12	ANALOG_OUT1
5	ANALOG_OUT2		13	ANALOG_OUT3
6	ANALOG_OUT4		14	Not used
7	Not used		15	U_{EXT_IO}
8	GND_{ISO}			

The following table shows the pinout of the Digital frontal connector for IO Extension Type1
(partly optionally assigned, type D-SUB 25poles female):

Pin	Signal		Pin	Signal
1	**DIGITAL_IN1**		14	**DIGITAL_IN2**
2	**DIGITAL_IN3**		15	**DIGITAL_IN4**
3	DIGITAL_IN5		16	DIGITAL_IN6
4	DIGITAL_IN7		17	DIGITAL_IN8
5	**GND_{ISO}**		18	**DIGITAL_OUT1**
6	**DIGITAL_OUT2**		19	**DIGITAL_OUT3**
7	**DIGITAL_OUT4**		20	DIGITAL_OUT5
8	DIGITAL_OUT6		21	DIGITAL_OUT7
9	DIGITAL_OUT8		22	**GND_{ISO}**
10	Not used		23	Not used
11	Not used		24	Not used
12	**GND_{ISO}**		25	U_{EXT_IO}
13	**GND_{ISO}**			

The pinout of the Digital connector when the IO Extension is not mounted is indicated by **bold** characters.

The following table shows the pinout of the Digital frontal connector for IO Extension Type2
(partly optionally assigned, type D-SUB 25poles female):

Pin	Signal		Pin	Signal
1	**DIGITAL_IN1**		14	**DIGITAL_IN2**
2	**DIGITAL_IN3**		15	**DIGITAL_IN4**
3	DIGITAL_IN5		16	DIGITAL_IN6
4	DIGITAL_IN7		17	DIGITAL_IN8
5	**GND_{ISO}**		18	**DIGITAL_OUT1**
6	**DIGITAL_OUT2**		19	**DIGITAL_OUT3**
7	**DIGITAL_OUT4**		20	DIGITAL_OUT5
8	DIGITAL_OUT6		21	DIGITAL_OUT7
9	DIGITAL_OUT8		22	**GND_{ISO}**
10	Do not connect!		23	Do not connect!
11	Do not connect!		24	Do not connect!
12	**GND_{ISO}**		25	U_{EXT_IO}
13	**GND_{ISO}**			

The pinout of the Digital connector when the IO Extension is not mounted is indicated by **bold** characters.

The GND_{ISO} potentials of the Node 1..4, Node A/ B, Analog and Digital connectors are internally interconnected.

3.6 Product Information

basicCAN 61 PLUS is an intelligent, programmable CAN Controller designed as a stand-alone device with two CAN interfaces in its basic version.
It can be combined with a multitude of options.

Here is a list of available versions and options:

basicCAN 61 PLUS CAN Controller for Windows XP/ Windows 7	
	Basic version: CAN Controller with 2 CAN nodes and 2 CAN Transceiver modules as well as 4 digital inputs and 4 digital outputs (all onboard)
basicCAN 61 PLUS CAN-FD Controller for Windows XP/ Windows 7	
	CAN-FD Controller with 2..4 CAN-FD nodes and 2..4 CAN transceiver modules as well as 4 digital inputs and 4 digital outputs (all onboard) Currently, the options LIN/ K-Line and CAN5/ 6 are NOT possible in this case
Options for basicCAN 61 PLUS	
CAN node	Further CAN node for basicCAN 61 PLUS devices onboard to upgrade on 3 or 4 communication nodes, incl. transceiver module(s) Note: The total quantity of installable CAN/ LIN/ K-Line nodes at the same time amounts 4 per basicCAN 61 PLUS device without CAN Extension board
CAN Extension board	Additional board with 2 further CAN nodes, generally to upgrade on 5 or 6 CAN nodes, incl. transceiver module(s) Note: Total quantity of installable CAN Extension boards at the same time amounts 1 per basicCAN 61 PLUS (not for CAN-FD)
LIN node	Additional LIN node for basicCAN 61 PLUS devices onboard to upgrade on 3 or 4 communication nodes, incl. transceiver module(s) Note: Total quantity of installable CAN/ LIN/ K-Line nodes at the same time amounts 4 per basicCAN 61 PLUS device without CAN Extension board
K-Line node	Additional K-Line node for basicCAN 61 PLUS devices onboard to upgrade on 3 or 4 communication nodes, incl. transceiver module(s) Note: The total quantity of installable CAN/ LIN/ K-Line nodes at the same time amounts 4 per basicCAN 61 PLUS device without CAN Extension board
FlexRay node	Additional FlexRay node for basicCAN 61 PLUS devices incl. 2-channel FlexRay module, FlexRay controller MFR 4310 with 2 transceivers of TJA 1080 type (at FlexRay Extension board) Note: The total quantity of installable FlexRay nodes at the same time amounts 2 per basicCAN 61 PLUS device (1 if the CAN Extension Board is installed); This option is useable independent from and additional to options CAN/ LIN/ K-Line nodes and IO Extension board
SENT Node	Additional SENT transmitter nodes for basicCAN 61 PLUS units Note: This licensing option provides up to 2 SENT output channels via digital outputs of either the base board or the optional IO Extension board Type 1.

Options for basicCAN 61 PLUS	
IO Extension board Type 1	General Input/ Output Module for basicCAN 61 PLUS devices incl. 6 analog Inputs and 6 analog Outputs, 4 digital Inputs and 4 digital Outputs Note: The total quantity of installable IO Extension boards at the same time amounts 1 per device; this option is useable independent from and additional to options CAN/ LIN/ K-Line and FlexRay nodes
IO Extension board Type 2	General Input/ Output Module for basicCAN 61 PLUS devices incl. 4 analog Inputs and 4 analog Outputs, 4 digital Inputs and 4 digital Outputs Note: The total quantity of installable IO Extension boards at the same time amounts 1 per device; this option is useable independent from and additional to options CAN/ LIN/ K-Line and FlexRay nodes
CAN TJA1054	CAN low speed transceiver module type TJA1054
CAN TJA1041A	CAN high speed transceiver module type TJA1041A
CAN NCV7356D1G	CAN single wire transceiver module type NCV7356D1G
LIN TJA1020	LIN transceiver module type TJA1020
LIN TJA1020 Iso	LIN transceiver module type TJA1020 isolated channel selective
LIN TLE7259G	LIN transceiver module type TLE7259G
K-Line L9637D	K-Line transceiver module type L9637D
K-Line L9637D Iso	K-Line transceiver module type L9637D isolated channel selective
RS232 TRSF3221E	RS232 transceiver module type TRSF3221E

Options for basicCAN 61 PLUS	
DIAG KW2000 TP1.6	Keyword 2000 on TP1.6 on-board CAN Diagnostic software
DIAG KW2000 TP2.0	Keyword 2000 on TP2.0 on-board CAN Diagnostic software
DIAG KW2000 ISO-TP	Keyword 2000 on CAN-ISO-TP on-board CAN Diagnostic software
DIAG UDS ISO-TP	UDS on CAN-ISO-TP on board CAN Diagnostic software
DIAG GMLan	GMLan on-board CAN Diagnostic software
DIAG J1939	J1939 on-board CAN Diagnostic software
CAL CCP2.1	CAN Calibration Protocol CCP2.1
LIN adv-lib	Advanced library for Test of the LIN protocol specific. 2.0/ 2.1
Net2Run	Software tool to generate signal based Rest bus Simulation(s) in heterogeneous car networks. This software solution is based on the AUTOSAR approach. Direct signal access (reading and manipulation) is provided via G-API functions. Further Net2Run features a gateway routing editor with PDU and signal mapping functionality. Net2Run supports the automatic import of bord net data in the **.dbc*, **.ldf* and *Fibex* formats.
Net2Run Runtime	Runtime module for executing the rest bus simulation files (**.rbs* files) created by Net2Run. This option is necessary for each basicCAN 61 PLUS device.
Net2Run IDE	Software programming environment (Windows host) to build G-API based on-board UserCode programs for basicCAN 61 PLUS; includes: Net2Run IDE, QNX Neutrino CLT, G-API on-board libraries, single developer license
UserCode Runtime	UserCode runtime module for the execution of G-API based on-board UserCode programs on basicCAN 61 PLUS devices; This option is necessary for each basicCAN 61 PLUS device.

4 Software

There are the following ways to integrate basicCAN 61 PLUS hardware in your own applications:

- G-API Programming
- UserCode Programming

4.1 G-API Programming

The G-API (GOEPEL-API) is the C-based user interface for GOEPEL electronic hardware under Windows®.

It provides a wide, hardware independent command set for CAN, CAN-FD, LIN/ K-Line, MOST, FlexRay, LVDS, SENT, ADIO and Diagnostic services. No matter whether a PXI/ PCI, USB or Ethernet device is used, the commands remain the same.

The hardware abstraction introduced with the G-API gives the test application parallel access to the hardware, allowing one application to access multiple hardware interfaces; as well as multiple applications can access the same hardware interfaces in parallel.

Another feature introduced by the G-API is the asynchronous hardware access. This means no blocking execution for pending firmware commands. The command acknowledgement is provided via a callback mechanism.

With the HardwareExplorer (see also Ethernet) GOEPEL electronic provides an effective hardware configuration and management tool, offering users an easy way to manage their hardware configurations and identifying specific hardware interfaces by logical names. Using logical interface names in the application saves from rebuilding the application when porting it to another interface or controller board, as the interface can be easily reassigned in the HardwareExplorer. Furthermore, the HardwareExplorer provides a simple means of testing the interaction between hardware and software by executing the integrated self-tests.

Please consult the G-API documentation for further information. This documentation and the installation software are located in the *G-API* folder on the supplied “Product Information” CD.

4.2 UserCode Programming

basicCAN 61 PLUS devices can execute user programs direct on their PowerPC processor. This requires the UserCode run-time module being enabled.
The UserCode run-time module is an option for basicCAN 61 PLUS devices (plus other GOEPEL devices) and requires one license per unit.

Executing programs directly on the PowerPC improves the real-time performance remarkable and frees up PCI bandwidth on the host system.

Therefore GOEPEL electronic has ported and enhanced by additional on-board functionality their C-programming user interface called G-API from Windows® to the QNX Neutrino real-time operating system.
The QNX Neutrino real-time operating system is based on a micro kernel architecture, providing clear separation between the kernel and each individual application.

This allows user applications to run in a separate virtual memory space, which ensures safe test execution and improves reliability.

The UserCode run-time module uses a superset of the G-API commands for Windows® ensuring an easy migration of existing program source code. Additional functions will provide access to event notifications, timer tasks, the FLASH file system and other RT OS resources as well as standard C libraries.

The PowerPC processor uses big-endian byte order which must be taken care of when writing or porting code for the UserCode run-time module.
For smooth migration from little to big-endian, a library of conversion macros is provided with the Net2Run IDE development system.

With the Net2Run IDE development system, GOEPEL electronic provides a complete tool chain for creating UserCode programs and for their direct execution on basicCAN 61 PLUS devices.

The Net2Run IDE development system is based on Eclipse IDE and contains the QNX Neutrino Command Line Tools (CLT), including PowerPC-Compiler, Linker and Debugger.

UserCode programs can be downloaded and debugged direct from Net2Run IDE via an Ethernet connection.

The figure below shows the Net2RunIDE development system:

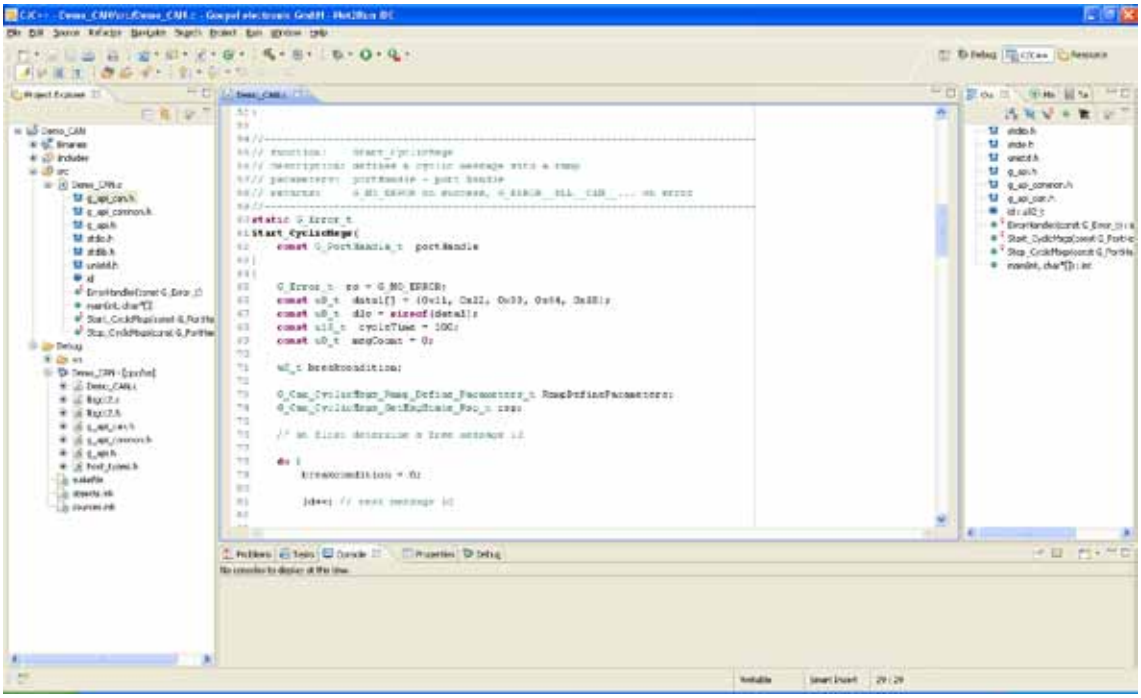

Figure 4-1: Net2Run IDE Window

Please consult the G-API documentation for further information. This documentation and the installation software are located in the *G-API* folder of the supplied “Product Information” CD.

4.3 Additional Software Interfaces

4.3.1 FS

The Software Interface “FS1” (File System) allows, amongst others, creating, copying, deleting, executing and searching of files on the hardware.
Thus, it allows uniform access to the OnBoard File System.

4.3.2 Net2Run

The Software Interface “Net2Run” (Net2Run1..Net2Run4) serves for the creation, configuration and execution of Residual bus simulation. Several bus interfaces for CAN, LIN and FlexRay networks can be simulated simultaneously and continously.
The “Net2Run” interface supports loading and executing of so-called Residual bus simulation files (*.rbs). These are preconfigured command sequences containing a static Residual bus simulation.
The corresponding files are created by means of the “Net2Run” Configurator Tool.

“Net2Run” is subdivided into several Software modules, strongly leaning to “AUTOSAR”.
The following Software modules do exist:

- COM
- PDU-Router
- CAN-Interface
- LIN-Interface
- FlexRay-Interface
- PDU-Multiplexer
- CAN-NM
- FlexRay-NM

Hence, the routing of PDUs of e.g. CAN1 to CAN2, CAN1 to LIN3 or FlexRay2 to CAN4 is possible (PDU-Gateway). The routing of individual signals can be realized by a COM-Signal-Gateway. In order that several independent Residual bus simulations can be executed on one device (e.g. one Residual bus simulation on CAN1, CAN2, CAN3 and CAN4 each), several “Net2Run” Interfaces do exist (4).

4.3.3 Sequence

The Software Interface “Sequence1” allows recording and playing of Firmware commands as a command sequence, short “Sequence”. A Sequence can also permanently stored under an arbitrary name on the device.
By using its name, this Sequence can be loaded again and played.
The automatic loading of a Sequence after switching on the device e.g. allows the automatic configuration and starting of a Residual bus simulation (in the case the required commands are included in the Sequence).

4.3.4 UserCode

The Software Interface “UserCode1” allows the OnBoard execution of user programs (see also UserCode Programming).
For the communication between OnBoard programs and the Host, Message-FIFOs do exist.
Each side (OnBoard program or Host) can create, write to or read from a Message-FIFO.
Each FIFO can be read and written from both sides. For consistancy it is recommended to have a separate FIFO for each direction. So that one side only writes to and the other side only reads from a FIFO.

4.4 Further GOEPEL Software

PROGRESS, Program Generator and myCAR of GOEPEL electronic GmbH are comfortable software programs for testing with GOEPEL hardware.

Please refer to the corresponding User Manual to get more information regarding these programs.