8AC140.61-3

1 General information

The AC110 plug-in module can be used in an ACOPOS slot (requires two slots).

The CPU module makes it possible to operate an ACOPOS servo drive without an external PLC and is also available with an integrated "Soft CNC" system.

The ACOPOS servo drive in which the AC140 is plugged into is connected via emulation of an AC110 CAN interface plug-in module in slot 1. All other CAN stations are connected via the IF2 CAN interface.

The module offers interchangeable application memory in the form of a CompactFlash card as well as a separate backup battery for the module. [1)]

It is equipped with up to four application interfaces:

- One RS232 interface (IF1) for programming and configuring using B&R Automation Studio™
- One CAN interface (IF2) for connecting to a CAN network
- one PROFIBUS DP slave interface (IF3) for connecting to a PROFIBUS network
- one Ethernet interface (IF6) for connecting to an Ethernet network

In addition, a maximum of three digital inputs / outputs are provided as well as one analog input (±10 V differential input).

The digital inputs and outputs can be configured individually as input or output. Additional functions such as a counter function with direction switching (stepper motor) or period and gate measurement are integrated.
The inputs and outputs are scanned directly by the CPU module; the ACOPOS servo drive does not have direct access to these inputs and outputs.

The analog input has a resolution of 12 bits and an analog input filter with 10 kHz (3rd-order low pass).

2 Order data

Model number	Short description	Figure
	Plug-in modules	
8AC140.61-3	ACOPOS plug-in module, CPU, ARNC0, x86 100 MHz Intel compatible, 32 MB DRAM, 32 kB SRAM, removable application memory: CompactFlash, 1 CAN interface, 1 Ethernet interface 100 Base-T, 1 PROFIBUS DP slave interface, 1 RS232 interface, 3 digital I/O points configurable as 24 VDC input or 500 mA output, 1 analog input ±10 V, order program memory and 0TB708 terminal block separately	
	Required accessories	
	CompactFlash cards	
0CFCRD.0128E.01	CompactFlash 128 MB WD extended temp.	
0CFCRD.0512E.01	CompactFlash 512 MB WD extended temp.	
5CFCRD.0064-03	CompactFlash 64 MB Western Digital (SLC)	
5CFCRD.0128-03	CompactFlash 128 MB Western Digital (SLC)	
5CFCRD.0256-03	CompactFlash 256 MB Western Digital (SLC)	
5CFCRD.0512-03	CompactFlash 512 MB Western Digital (SLC)	
5CFCRD.1024-03	CompactFlash 1 GB Western Digital (SLC)	
5CFCRD.2048-03	CompactFlash 2 GB Western Digital (SLC)	
5CFCRD.4096-03	CompactFlash 4 GB Western Digital (SLC)	
5CFCRD.8192-03	CompactFlash 8 GB Western Digital (SLC)	
	Terminal blocks	
0TB704.9	Accessory terminal block, 4-pin, screw clamps 2.5 mm²	
0TB704.91	Accessory terminal block, 4-pin, cage clamps 2.5 mm²	
0TB708:91-02	Accessory terminal block, 8 pins, 20 pieces cage clamp 1,5 mm²	
0TB708.91	Accessory terminal block, 8-pin, cage clamps 1.5 mm²	
	Optional accessories	
	Batteries	

Table 1: 8AC140.61-3 - Order data

1) Application memory must be ordered separately.

Model number	Short description	Figure
0AC201.91	Lithium batteries 4 pcs., 3 V / 950 mAh button cell We hereby state that the lithium cells contained in this shipment qualify as "partly regulated". Handle with care. If the package is damaged, inspect the cells, repack intact cells and protect cells against short circuits. For emergency information, call RENATA SA at + 41 61 319 28 27	
	Cables	
0G0001.00-090	PC - PLC/PW cable, RS232, online cable	
	Infrastructure components	
0AC912.9	Bus adapter, CAN, 1 CAN interface	
0AC913.92	Bus adapter, CAN, 2 CAN interfaces, including 30 cm attachment cable (DSUB)	
0G1000.00-090	Bus connector, RS485, for PROFIBUS networks	
7AC911.9	Bus connector, CAN	

Table 1: 8AC140.61-3 - Order data

3 Technical data

Product ID	8AC140.61-3
General information	
Module type	ACOPOS double-width plug-in module
B&R ID code	0x2276
Slot [1)]	Slots 1 + 2
Power consumption	Max. 4.5 W
ACOPOS capability	Yes
Visual Components support	Yes
Certification	
CE	Yes
cULus	Yes
KC	Yes
Controller	
Operating system	AC140 (version V2.67 and higher)
Processor clock	100 MHz
DRAM	32 MB
SRAM	32 kB
Inputs/Outputs	
Module-side connection	8-pin connector
Configuration of digital inputs/outputs	Individually configurable as inputs or outputs
Interfaces	
IF1 interface	
Type	RS232
Design	9-pin male DSUB connector
Status indicators	X1 LED
Electrical isolation	No
Max. baud rate	115.2 kbaud
Max. distance	15 m / 19200 Baud
IF2 interface	
Type	CAN bus
Design	9-pin male DSUB connector
Status indicators	RX / TX LEDs
Bus terminating resistor	Externally wired
Electrical isolation	Yes
Max. distance	1000 m
Network-capable	Yes
Max. transfer rate	
Bus length ≤60 m	500 kbit/s
Bus length ≤200 m	250 kbit/s
Bus length ≤1000 m	50 kbit/s

Table 2: 8AC140.61-3 - Technical data

Product ID	8AC140.61-3
IF3 interface	
Type	RS485
Design	9-pin female DSUB connector
Status indicators	PB LED
Bus terminating resistor	External T-connector
Controller	ASIC SPC3
Electrical isolation	Yes
RAM	1.5 kB
Max. distance	1000 m
Network-capable	Yes
Transfer protocol	PROFIBUS DP
Max. transfer rate	
Bus length ≤100 m	12 Mbit/s
Bus length ≤200 m	1.5 Mbit/s
Bus length ≤400 m	500 kbit/s
Bus length ≤1000 m	187.5 kbit/s
IF5 interface	
Type	Ethernet
Design	Male RJ45 connector
Status indicators	ACT LED
Baud rate	10/100 Mbit/s
Electrical isolation	Yes
Max. distance	100 m
Network-capable	Yes
Incremental encoder	
Counter size	16-bit
Input frequency	Max. 20 kHz
Evaluation	4x
Signal form	Square wave pulse
Encoder monitoring	No
Counter frequency	Max. 80 kHz
Reference frequency	Max. 20 kHz
Distance between edges	Min. 5 µs
Inputs	
Input 1	Channel A
Input 2	Channel B
Input 3	Reference pulse R
Digital inputs [2)]	
Quantity	Max. 3
Modulation compared to ground potential	Max. ±30 V
Wiring	Sink
Input current at nominal voltage	Approx. 4.2 mA
Input delay	<5 µs
Switching threshold	
Low	<5 V
High	>15 V
Input voltage	
Nominal	24 VDC
Maximum	30 VDC
Electrical isolation	
Channel - ACOPOS	Yes
Channel - Channel	No
Event counter	
Signal form	Square wave pulse
Input frequency	Max. 100 kHz
Pulse length	Min. 5 µs
Counter size	32-bit
Inputs	
Input 1	Counter 1
Gate measurement	
Signal form	Square wave pulse
Counter frequency	
Internal	31.25 kHz or 4 MHz
External	Max. 100 kHz
Pulse length	Min. 5 µs
Gate frequency	Max. 100 kHz
Period measurement	
Signal form	Square wave pulse
Input frequency	Max. 100 kHz
Pulse length	Min. 5 µs

Table 2: 8AC140.61-3 - Technical data

Product ID	8AC140.61-3
Counter frequency	
Internal	31.25 kHz or 4 MHz
External	Max. 100 kHz
Analog inputs	
Digital converter resolution	12-bit
Conversion time	<50 µs
Output format	INT 16 $8001 - $7FFF LSB = $0010 = 4.88 mV
Design	Differential input
Electrical isolation	
Input - ACOPOS [3]	No, max. modulation: ±13 V
Input signal	
Nominal	-10 to +10 V
Maximum	-13 to +13 V
Operating modes	Cyclic measurement non-synchronous to 50 µs ACOPOS clock
Conversion procedure	Successive approximation
Input filter	Analog low pass 3rd-order Cutoff frequency: 10 kHz
Common-mode rejection	
DC	Min. 73 dB
50 Hz	Min. 73 dB
Nonlinearity	±2 LSB
Differential input impedance	20 MΩ
Digital outputs	
Quantity	Max. 3
Readable outputs	Yes
Continuous short circuit current at 24 V	Typ. 4 A
Continuous current	Max. 500 mA
Switching frequency (resistive load)	Max. 100 Hz
Switching delay	Max. 500 µs (typ. 250 µs)
Type	High-side transistor outputs
Electrical isolation	
Output - ACOPOS	Yes
Output - Output	No
Switching voltage	
Minimum	18 VDC
Nominal	24 VDC
Maximum	30 VDC
Protection	
Short circuit protection	Yes
Overload protection	Yes
Environmental conditions	
Temperature	
Operation	
Nominal	5 to 40°C
Maximum	55°C
Storage	-25 to 55°C
Transport	-25 to 70°C
Relative humidity	
Operation	5 to 85%
Storage	5 to 95%
Transport	Max. 95% at 40°C

Table 2: 8AC140.61-3 - Technical data

1) The AC140 is a double-width module that occupies slots 1 and 2.
2) Shielded cables must be used for inputs 1 - 3.
3) External electrical isolation of the connected sensors is recommended since the analog input is not electrically isolated.

4 Indicators

Image	LED	Product ID	Color	Description
	❶	Status (RUN)	Red Red with orange blinking Red/green blinking (1 Hz) Orange Green Green with orange blinking	ERROR/RESET Load/unload and start BOOT AR Startup of BOOT or CF - AR SERVICE/DIAG/BOOT mode RUN RUN - BATTERY LOW
	❷	RS232 (X1)	Orange blinking	Data transfer to application interface IF1 (RS232)
	❸	PROFIBUS (PB)	Orange	Data transfer on application interface IF3 (PROFIBUS)
	❹	Ethernet (ACT)	Orange Orange blinking	Ethernet LINK (IF6) Ethernet ACTIVE (IF6)
	❺	CAN (RX)	Orange	Receive data on application interface IF2 (CAN)
	❻	CAN (TX)	Orange	Send data to application interface IF2 (CAN)

Table 3: Indicators - 8AC140.60-3, 8AC140.61-3

5 Firmware

The firmware is part of the operating system for the ACOPOS servo drives. Firmware is updated by updating the ACOPOS operating system.

6 Setting the CAN node number (IF2)

The CAN node number can be set using two HEX code switches:

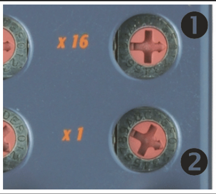
Image	Code switch	Description
	❶	CAN node number 16s position (high)
	❷	CAN node number 1s position (low)
	The settings $00, and $FF are reserved for special functions. **$00:** In this switch position, the operating system can be programmed via the online interface. User Flash is only deleted after the update begins. **$FF:** Diagnostics mode.	

Table 4: Setting the CAN node number

A changed CAN node number will take effect the next time the ACOPOS servo drive is switched on.

There must be a terminating resistor (120 Ω, 0.25 W) between CAN_H and CAN_L at the beginning and end of the CAN bus.

Information:

The CAN bus IF2 is always made up of at least two stations that are integrated in the AC140. These are the AC140 CPU and an AC110 emulation, which the ACOPOS uses for communication. Therefore, the AC140 CPU prevents a potential error in which no other stations are found on the CAN bus. This is why the AC140 CPU does not register a hardware error if there is no physical connection to external CAN devices.

7 Setting the PROFIBUS node number (IF3)

The PROFIBUS node number can be set using two HEX code switches:

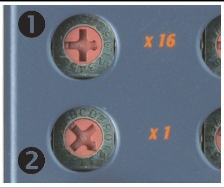
Image	Code switch	Description
	❶	PROFIBUS node number 16s position (high)
	❷	PROFIBUS node number 1s position (low)

Table 5: Setting the PROFIBUS node number

A changed PROFIBUS node number will take effect the next time the ACOPOS servo drive is switched on.

8 Setting the Ethernet network address (IF6)

The Ethernet network address can be set using software (B&R Automation Studio).

9 Reset button

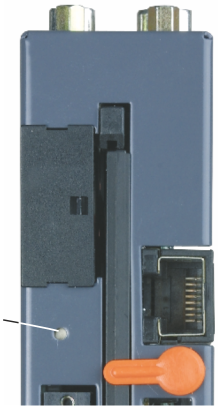
View (view from below)	Description
 8AC140.60-3  8AC140.61-3	The reset button can be pressed with any small pointed object (e.g. paper clip). Pressing the reset button triggers a hardware reset, which means: • all application programs are stopped. • all outputs are set to zero. The AC140 then switches to SERVICE mode.

Table 6: Reset button

10 Slot for application memory (CompactFlash)

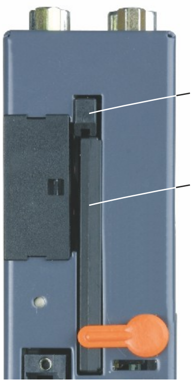
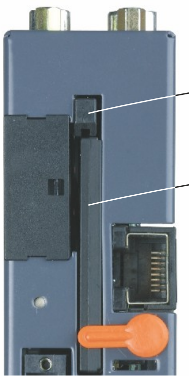
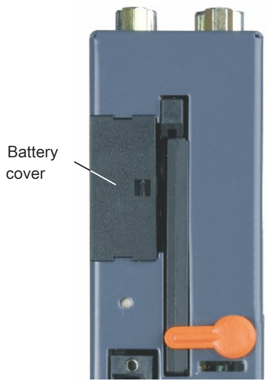
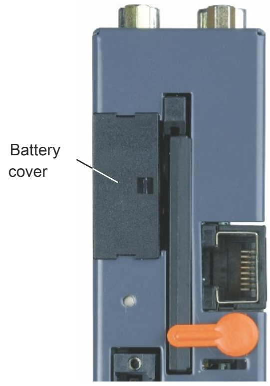
View (view from below)	Description
 8AC140.60-3  8AC140.61-3	Program memory is required to operate the AC140. The application memory is CompactFlash. This is not included with the delivery of the AC140. CompactFlash must be ordered separately as an accessory! The CompactFlash memory card is used in the slot on the bottom of the AC140. Press the eject button to remove the card. The CompactFlash memory card can be secured with the safety clip.

Table 7: Application memory

11 Backup battery AC140

<table>
<tr><th>View (view from below)</th><th colspan="2">Description</th></tr>
<tr><td rowspan="8">


8AC140.60-3


8AC140.61-3
</td><td colspan="2">The AC140 is equipped with a lithium battery. The lithium battery is placed in a separate compartment on the bottom of the module and protected by a cover.</td></tr>
<tr><td colspan="2">Backup battery data</td></tr>
<tr><td>Lithium battery</td><td>3V / 950 mAh</td></tr>
<tr><td>Model number</td><td>0AC201.91</td></tr>
<tr><td>Short description</td><td>Lithium batteries, 4 pcs., 3 V / 950 mAh, button cell</td></tr>
<tr><td>Storage temperature</td><td>-20 to +60°C</td></tr>
<tr><td>Storage time</td><td>Max. 3 years at 30°C</td></tr>
<tr><td>Relative humidity</td><td>0 to 95%, non-condensing</td></tr>
</table>

Table 8: Backup battery

Data / real-time buffering

The following areas are buffered:

- Remanent variables
- User RAM
- System RAM
- Real-time clock

Battery monitoring

The battery voltage is checked cyclically. The cyclic load test of the battery does not considerably shorten the battery life, instead it gives an early warning of weakened buffer capacity.

The status information "Battery OK" is available from the "BatteryInfo" system library function.

Battery change interval

Caution!

The battery should be changed every 4 years. The change intervals refer to the average service life and operating conditions and are recommended by B&R. It is not the maximum buffer duration.

Information:

Data stored in the AC140 RAM will be lost if the battery is changed with the PLC switched off! The battery can be changed with power applied, but this is not allowed in all countries!

Warning!

The battery must be replaced by a Type CR2477N Renata battery only. The use of another battery may present a risk of fire or explosion.

The battery may explode if handled improperly. Do not recharge, disassemble or dispose of in fire.

Procedure for changing the battery

1. Touch the mounting rail or ground connection (not the power supply!) in order to discharge any electrostatic charge from your body.
2. Remove the cover from the lithium battery holder using a screwdriver.

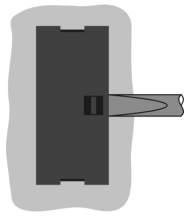


Figure 1: Remove the cover for the lithium battery

3. Remove the battery from the holder by pulling the removal strip (don't use uninsulated tools because of risk of short circuiting). The battery should not be held by its edges. Insulated tweezers may also be used for removing the battery.

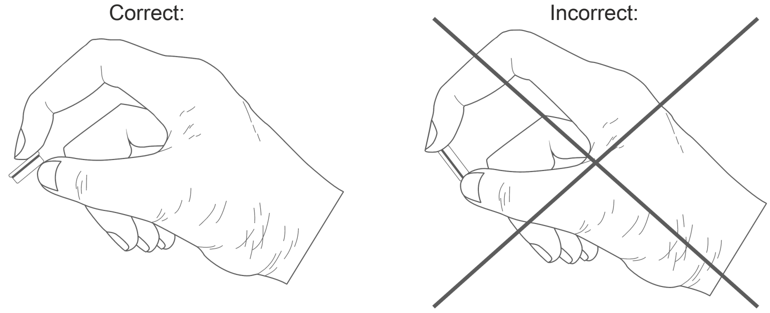


Figure 2: Hold the battery correctly

4. Insert the new battery with correct polarity. The removal strip should be pulled to the right of the battery holder and the "+" side of the battery should be facing left. In order to be able to remove the battery again in future, the removal strip **must be on the right side** of the battery.

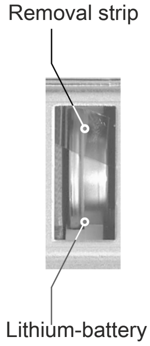


Figure 3: Removal strip should be pulled to the right

5. Now wrap the end of the removal strip over the top of the battery and insert it underneath the battery so that it does not protrude from the battery holder.
6. Replace cover. Insert the lower edge of the cover in the battery holder opening. Press the upper end of the cover home firmly.

Information:

Lithium batteries are considered hazardous waste. Used batteries should be disposed of appropriately.

12 Input/Output registers

Digital in r/- (16-bit):

Bit no.	Value	Description
0		Logical status of digital I/O 1
1		Logical status of digital I/O 2
2		Logical status of digital I/O 3
3 - 15		Reserved

Digital out r/w (16-bit):

All reserved bits must be written with 0.

Bit no.	Value	Description
0	0	Digital output 1 inactive
	1	Digital output 1 active
1	0	Digital output 2 inactive
	1	Digital output 2 active
2	0	Digital output 3 inactive
	1	Digital output 3 active
3 - 15		Reserved

Analog in (16-bit) r/-:

±10V (12 bit resolution)

Counter (32-bit) r/(w):

In addition to the typical counter modes, this counter has a "Stepper motor counter mode" (see Configuration register bits 4-6).

In stepper motor counter mode, the count direction is set using digital I/O 2 (0…increment, 1…decrement), and the counter clock is on digital I/O 1. Only one clock edge is used for counting (can be configured with bit 3 of the counter configuration register).

Counter configuration (16 bit) r/w:

All reserved bits must be written with 0.

Bit no.	Value	Description
0		Reserved
1	0	AB(R) counter mode: R input disabled
	1	AB(R) counter mode: R input enabled
2		Reserved
3	0	Measurement starts at increasing edge
	1	Measurement starts at falling edge
4 - 6	000	No counter operation
	001	AB(R) counter mode
	010	Event counter mode
	011	Period measurement mode
	100	stepper motor counter mode
	101	Gate measurement mode
	110	Not allowed
	111	Not allowed
7 - 8	00	Counter frequency 4MHz
	01	External counter frequency
	10	Counter frequency 31.25kHz
	11	Not allowed
9	0	Counter overflow recognition disabled / Reset counter overflow bit
	1	Overflow recognition of the continuous counter is enabled (value limited to $FFFF)
10 - 14		Reserved
15	0	Time / counter reset
	1	Time / counter enabled (ATTENTION: Only set bit after counter configuration is complete)

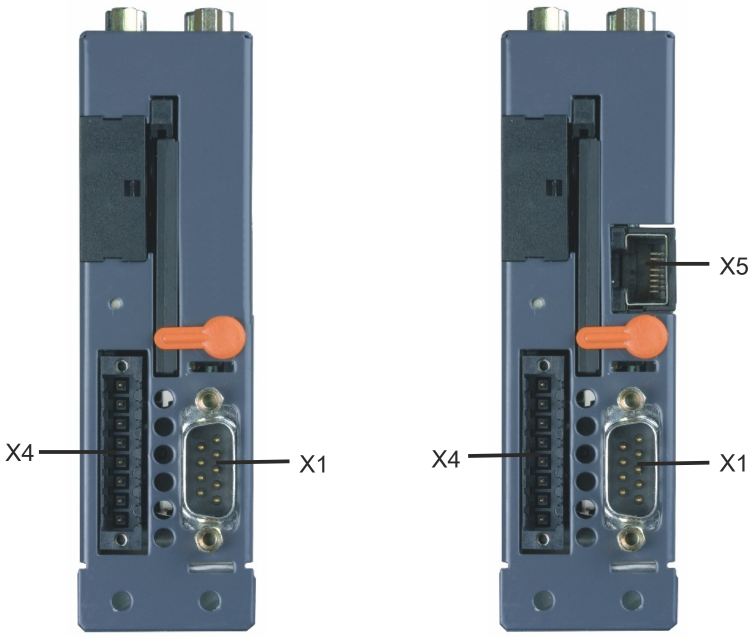
Status (16 Bit) r/- :

Bit no.	Value	Description
0 - 8		Reserved
9	0	Period or gate measurement within the counter range 0 - $FFFF (only valid if bit 9 is set in the counter configuration word)
	1	Counter overflow during period or gate measurement. Acknowledge by resetting bit 9 of the counter configuration word
10 - 14		Reserved
15	0	Output supply voltage monitoring 24 VDC - OK
	1	Output supply voltage monitoring 24 VDC error

13 Wiring

8AC140.60-2 8AC140.61-3

Figure 4: Overview of AC140 connections (view from front)



8AC140.60-2 8AC140.61-3

Figure 5: Overview of AC140 connections (view from below)

13.1.1 Pinout

13.1.1.1 X1 - Pinout (application interface IF1 - RS232)

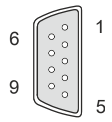
X1	Pin	Name	Function
	1	DCD	Data Carrier Detect
	2	RXD	Receive signal
	3	TXD	Transmit signal
	4	DTR	Data Terminal Ready
	5	GND	Ground
	6	DSR	Data Set Ready
	7	RTS	Request To Send
	8	CTS	Clear To Send
	9	RIN	Ring indicator

Table 9: X1 connector (RS232) - Pinout

13.1.1.2 X2 - Pinout (application interface IF2 - CAN)

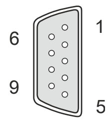
X2	Pin	Name	Function
	1	---	---
	2	CAN_L	CAN low
	3	CAN_GND	CAN 0 V
	4	---	---
	5	---	---
	6	---	---
	7	CAN_H	CAN high
	8	---	---
	9	---	---

Table 10: X2 connector (CAN) - Pinout

13.1.1.3 X3 - Pinout (application interface IF3 - PROFIBUS)

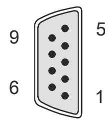
X3	Pin	Name	Function
	1	---	---
	2	---	---
	3	DATA	Data
	4	CNTRL	Transmit enable
	5	PROFIBUS_GND	PROFIBUS GND (electrically isolated)
	6	+5 V / 50 mA	+5 V supply / 50 mA (electrically isolated)
	7	---	---
	8	DATA\	Data\
	9	CNTRL\	Transmit enable\

Table 11: X3 connector (PROFIBUS) - Pinout

13.1.1.4 X4 connector (inputs/outputs) - Pinout

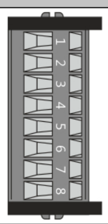
X4	Pin	Name	Function in incremental counter mode	Function in period/gate measurement mode	Function in stepper motor counter mode
	1	GND	GND		
	2	+24 VDC	Dig. supply I/O +24V [1)]		
	3	Digital I/O 1	A	Counter input	
	4	Digital I/O 2	B	---	Counting direction
	5	Digital I/O 3	R	External clock	---
	6	Shield	Shield		
	7	Analog I +	Analog Input +		
	8	Analog I -	Analog Input -		

Table 12: X4 connector (inputs/outputs) - Pinout

1) The +24 V supply is only necessary for digital I/O 1 .. 3.

13.1.1.5 X5 - Pinout (application interface IF6 - Ethernet)

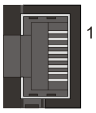
X5	Pin	Name	Function
	1	RXD	Receive signal
	2	RXD\	Receive signal inverted
	3	TXD	Transmit signal
	4	Termination	Termination
	5	Termination	Termination
	6	TXD\	Transmit signal inverted
	7	Termination	Termination
	8	Termination	Termination

Table 13: Pinout X5 (Ethernet)