Quickstart Manual

CANio 500

I/O-to-CAN Gateway

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1 General information

The CANio 500 is a universal interface for analog and digital signals.

This manual is intended to help you to learn more about the CANio 250. Please read this manual before using the CANio 250 for the first time. Therefore it is restricted to the essential topics. For further details – mainly with respect to the application software – the corresponding manuals are provided online.

1.1 Highlights

- Power supply 6 - 32 V DC
- CAN bus connection according to ISO 11898-2 with galvanic isolation
- Communication as CAN node or CANopen device
- 4 digital inputs
- 4 digital outputs, high-side switch, short-circuit protection
- 4 analog inputs, 12-bit, device variants:
  - 0 … +10 V
  - -5 … +5 V
  - -100 … +100 mA
- 4 analog outputs, 12-bit, output ranges programmable via software:
  - 0 … +5 V
  - 0 … +10 V
  - -5 … +5 V
  - -10 … +10 V
  - -10.8 … +10.8 V
- Monitoring of the power supply
- Additional digital input on power supply connector
- All inputs are protected for voltages up to 60 V
- 2 LEDs (both two-colored) controllable via software
- 1 LED for the CAN bus status
- 1 LED for the power supply
- Robust aluminum housing
- Temperature range -40 °C to 70 °C

1.2 Designs and device variants

The CANio 500 is available in the following variants of the analog inputs:

Order number	Designs and device versions
1.01.0098.00000	CANio 500 with 4 analog inputs 0 … +10 V
1.01.0098.00001	CANio 500 with 4 analog inputs -5 … +5 V
1.01.0098.00002	CANio 500 with 4 analog inputs -100 … +100 mA

2 Connector assignments

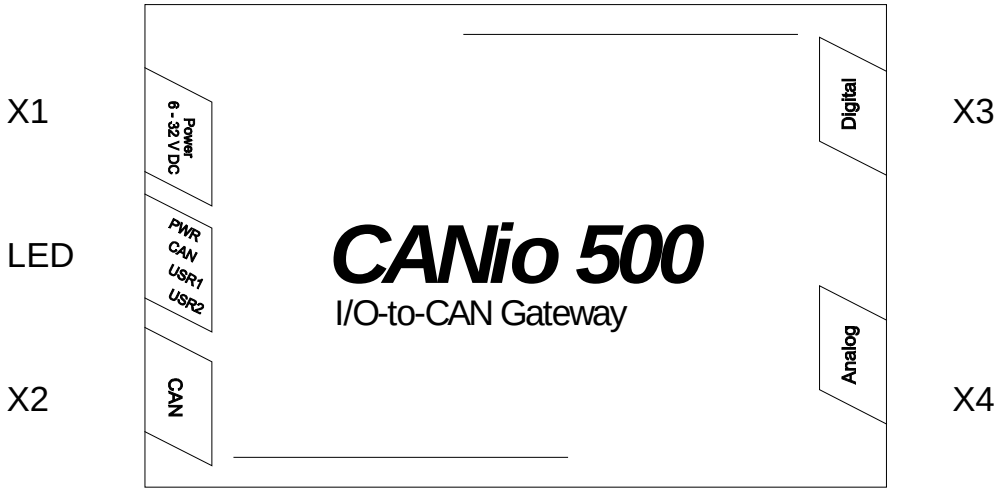


Figure 2-1: Connector assignments

2.1 Connector (X1) power supply 6-32 V DC

The CANio 500 is supplied with DC voltage of 6 V – 32 V The scope of supply includes made-up cable for power supply. The terminal assignment is given in table 2-1.

The type of connector is: Binder cable socket 99-0976-100-03

The CANio 500 is protected against reverse polarity, undervoltage and over-voltage. It is switched off in the case of reverse polarity or undervoltage. The CANio survives overvoltage up to 60 V and load dump undamaged. In the event of voltages above this, an internal fuse may be tripped. If the internal fuse is tripped, the CANio 500 is no longer operational and must be returned to IXXAT for repair.

The additional digital input is also connected on this connector.

Pin no. X1	Signal	Wire color
1	PWR (+)	white
2	GND (-)	brown
3	Additional digital input on power supply connector	Shield

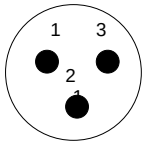


Table 2-1: Pin assignment power supply

2.2 Connector (X2) CAN

CAN is available on connector X2 with a bus connection according to ISO 11898-2. The signals of the bus connection are available on the 9-pin D-Sub connector (pins, male) (see table 2-2).

Pin no. X2	Signal
1	-
2	CAN Low
3	GND_GND
4	-
5	-
6	-
7	CAN High
8	-
9	-

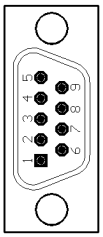
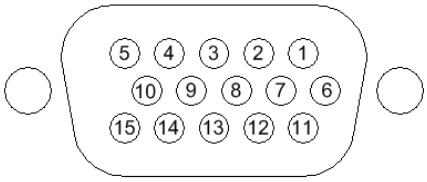


Table 2-2: Pin assignment CAN connector D-Sub 9

2.3 Connector (X3) digital

The digital signals are available on connector X3. Connector X3 is designed as a 15-pin high density D-Sub HDF15 (socket, female) (see table 2-3).

The functions of the digital inputs and outputs are described in chapters 4.3 and 4.4.

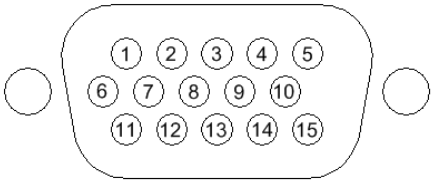


Pin no. X2	Signal	Description
1	DIG_IN1	Digital input 1
2	DIG_IN2	Digital input 2
3	GND	Ground
4	DIG_OUT1	Digital output 1, high-side switch supplied with VBAT_IN.
5	DIG_OUT2	Digital output 2, high-side switch supplied with VBAT_IN.
6	VREF_IN	Reference input for digital inputs
7	VREF_OUT	Output. Here a voltage is available according to the power supply PWR(+). This output can be connected to the VREF_IN input.
8	Reserved	This connection must remain open
9	VBAT_IN	Power supply for the high-side switches of the digital outputs.
10	VBAT_OUT	Output (1 A protected). Here a voltage is available according to the power supply PWR(+). This output can be connected to the VBAT_IN input.
11	DIG_IN3	Digital input 3
12	DIG_IN4	Digital input 4
13	GND	Ground
14	DIG_OUT3	Digital output 3, high-side switch supplied with VBAT_IN.
15	DIG_OUT4	Digital output 4, high-side switch supplied with VBAT_IN.

Table 2-3: Pin assignment digital interface connector D-Sub HDF15

2.4 Connector (X4) analog

The analog signals are available on connector X4. Connector X4 is designed as a 15-pin high density D-Sub HDM15 (pins, male) (see table 2-4).



The functions of the analog inputs and outputs are described in chapters 4.5 and 4.6.

Pin no. X4	Signals	Description
1	ANA_IN1_P	Analog input 1 positive (+)
2	ANA_IN2_P	Analog input 2 positive (+)
3	GNDA	Analog ground
4	ANA_IN3_P	Analog input 3 positive (+)
5	ANA_IN4_P	Analog input 4 positive (+)
6	ANA_IN1_M	Analog input 1 negative (-)
7	ANA_IN2_M	Analog input 2 negative (-)
8	GNDA	Analog ground
9	ANA_IN3_M	Analog input 3 negative (-)
10	ANA_IN4_M	Analog input 4 negative (-)
11	ANA_OUT1	Analog output 1
12	ANA_OUT2	Analog output 2
13	GNDA	Analog ground
14	ANA_OUT3	Analog output 3
15	ANA_OUT4	Analog output 4

Table 2-4: Pin assignment analog interface connector D-Sub HDM15

3 LED displays

The CANio 500 has four two-colored LEDs (see Figure 2-1). The LEDs react as follows according to the operating mode of the CANio 500.

3.1 PWR - LED

The Power-LED (PWR) is lit green when the CANio 500 is connected to the power supply. The Power-LED (PWR) is lit red when the power supply is connected with reverse polarity.

3.2 CAN - LED

The CAN-LED displays the status of the CANopen State Machine (green) and the error status. In the 'CAN BUS OFF' status, no more communication is possible and the CAN - LED is permanently lit red.

3.3 USR 1/2 - LED

The User-LEDs (USR 1/2-LED), which can be freely programmed by the user, can be switched via CAN messages. More information is given in chapters 5.1.3 and 0.

4 Description of functions

4.1 Introduction

The CANio 500 allows monitoring or setting of analog and digital signals via a CAN network.

4.2 Galvanic isolation

In the case of galvanic isolation, the ground of CAN (GND_CAN) is isolated from the rest of the circuit.

The ground of the power supply [GND (-)] and of the digital and analog interfaces are connected to each other.

4.3 Digital outputs

High-side switches are used for the 4 digital outputs. The digital outputs can be switched with a CAN message. More information is given in chapter 5.1.3.

The high-side switch can switch up to 34 V. In addition, they offer current limitation, thermal monitoring and surge protection up to 60 V (load dump). They can also operate with inductive loads. The sum of the currents across all four outputs should not exceed 1 A. Otherwise current limitation may be triggered.

The high-side switch modules are operated with the voltage VBAT_IN, which is to be connected on the digital connector (X3). The power supply PWR(+) is led out again on the connector for the digital interfaces (X3) (VBAT_OUT) and can then be connected to the pin VBAT_IN via a bridge on connector (X3). If other voltages are used, the bridge remains open and any voltage between 0 to 34 V can be supplied to the pin VBAT_IN. The pin VBAT_IN is used as a power input for all 4 digital outputs. If the pin VBAT_IN remains open, the digital outputs have no function.

The voltage output VBAT_OUT is protected against overcurrent and short-circuiting via a resettable fuse. If the fuse is triggered in the event of an over-

current, first the error of the overcurrent must be eliminated or the short-circuit removed. Then the fuse switches on again automatically after a few seconds. The CANio 500 is protected by diodes against reverse polarity and return currents.

4.4 Digital inputs

The CANio 500 has 4 digital inputs and an additional digital input on the power supply connector, which can be monitored via a CAN message. More information is given in chapter 5.1.5.

4.4.1 Digital inputs 1-4

The digital inputs (1-4) are equipped with an adjustable threshold.

The external reference voltage VREF_IN is freely selectable from 0 to 60 V. The internal circuit enables a switching threshold at 50 % of the external reference voltage VREF_IN. This means, for example, that at a voltage VREF_IN of 12 V the switching threshold is approximately 6V. A hysteresis of approximately 50 mV ensures trouble-free operation of the switching threshold. The reference voltage VREF_IN is used for all 4 digital inputs simultaneously. The reference voltage VREF_IN and the digital inputs are protected for voltages of more than 60 V.

A reference voltage VREF_OUT is available on the digital connector, which corresponds to the power supply PWR(+). This reference input VREF_OUT can be connected to the external reference input VREF_IN via a bridge on the connector.

The digital inputs have a low-pass filter to minimize disturbances. The filter used is a simple grade 1 filter with an RC circuit set to a cut-off frequency $_{3\ dB}$ of approximately 1 kHz.

4.4.2 Additional digital input on connector (X1)

The additional digital input on the power supply connector (X1) has a fixed threshold of approx. 7 V and can be used, for example, in the automotive sector for the monitoring of terminal 15.

4.5 Analog outputs

Four channels are available in the CANio 500 with a resolution of 12 bits on the analog output. The analog outputs can be set with CAN messages. More information is given in chapters 5.1.4

The internal reference voltage source and the DAC itself have an accuracy of 0.2 %. The output current is limited to 20 mA. If the current is exceeded, the corresponding output is switched off and an emergency message is sent (see 5.1.11).

The following output ranges can be selected via the software for every individual analog output: +5 V, +10 V, +/-5 V, +/-10 V.

The voltages on the output can be calculated with the following formulae:

For unipolar outputs (+5 V, +10 V, +10.8V):
$U_{Ana\text{-}out}$ = AD value / 4096 * output range [V]

With:

$U_{Ana\text{-}out:}$	voltage on the analog output
AD value:	value of the analog output in the CAN message. The AD value is to be inserted with 0 to 4095 in each case.
Output range:	5, 10 or 10.8 V

For bipolar outputs (+/-5 V, +/-10 V, +/-10.8 V):
$U_{Ana\text{-}out}$ = AD value / 2048 * output range [V]

With:

$U_{Ana\text{-}out:}$	voltage on the analog output
AD value:	value of the analog output in the CAN message. The AD value is to be inserted with 0 to 2047 (0x000 to 0x7FF) in each case for positive voltages and -1 to -2048 (0xFFF to 0x800) for negative voltages.
Output range:	5, 10 or 10.8 V

4.6 Analog inputs

The CANio 500 has four analog inputs with a differential input amplifier, which can be monitored with a CAN message. More information is given in chapter 5.1.7.

The inputs ANA_INx_P[1] for the positive (+ plus) and ANA_INx_M for the negative (- minus) voltage level are connected to the analog connector (X4). The input (+ plus) should be connected to the positive voltage level and the input (- minus) to the negative voltage level. In the case of the device versions with a +/- input range, polarity reversal according to the calculation from the AD value produces a negative voltage or current value.

[1] x stands for channel 1,2,…4

If a single-ended signal is required, the corresponding input ANA_INx_M is to be connected to ground.

The voltage is measured between the two connections (P +plus and M -minus). The common mode range is from -12 V to +24 V, i.e. both inputs may not exceed this voltage. Voltages above this lead to incorrect results.

The inputs are protected up to 60 V. The inputs have a low-pass filter to minimize disturbances. The filter used is a simple grade 1 filter with an RC circuit set to a cut-off frequency $_{3\,dB}$ of approximately 1 kHz.

The input resistance of the device versions with a voltage input is approx. 80 kΩ. In the case of the device versions with a current input, a shunt resistor of 15 Ohm is used for current measurement.

The CANio 500 is a high quality instrument to measure voltages and currents. The voltage values (or current values) must be calculated with the formulae given in the following chapters. To increase the accuracy in the application, it may be necessary to calibrate the CANio 500. For this, the user must measure and record 2 to 3 different voltage values for each channel and calculate a correction curve or table from these.

4.6.1 0 - 10 V input range

The voltage on the input with an input range of 0 - 10 V can be calculated from the AD value as follows:

$U_{ANA\text{-}IN}$ = AD value / 4095 * 3.30 * 3.3271 [V]

Simplified:

$U_{ANA\text{-}IN}$ = AD value * 2.6812 [mV]

4.6.2 ±5V input range

The voltage on the input with an input range of ±5 V can be calculated from the AD value as follows:

$U_{ANA\text{-}IN}$ = (AD value / 4095 * 3.30 * 3.3271) – 5.00 [V]

Simplified:

$U_{ANA\text{-}IN}$ = AD value * 2.6812 – 5000 [mV]

4.6.3 ±100 mA input range

A shunt resistor R = 15 Ω is integrated for current measurement with ±100mA. This results in a voltage drop of U = R * I = 15 Ω * 100 mA = 1.5 V. The load capacity at 1.5 V is given as P = U²/R = (1.5 V)² / 15 Ω = 0.15 W. The shunt resistor is protected via a resettable fuse. The permanent load of the shunt resistor of 1/2 W or a current of 0.18 A should not be exceeded.

The voltage on the input with an input range of ±100 mA can be calculated from the AD value as follows:

$I_{ANA\text{-}IN}$ = AD value / 4095 * 3.30 / 15 - 0.110 [A]

Simplified:

$I_{ANA\text{-}IN}$ = AD value * 0.05371 – 110 [mA]

4.7 Power supply PWR(+)

The power supply PWR(+) is monitored and measured with an additional analog channel. The input voltage range is between 6 and 32 V.

The voltage on the input can be calculated from the AD value as follows:

U_{IN} = AD value / 4095 * 3.30 * 10 [V]

Simplified:

U_{IN} = AD value * 8.0586 [mV]

5 Software

CANio 500 can be operated as a simple CAN module as well as as a CANopen slave.

The CANio 500 is delivered with a standard configuration. The following chapters do refer to these standard settings. Nevertheless it is possible to configure the device according to the own, specific requirements. Beside others, the following topics can be configured:

- Baudrate
- Node number, Message-IDs
- Cycle time of the messages
- Debounce time
- Value range of the analog outputs
- Behavior of the digital inputs (default value, edge triggering)
- Behavior of the analog inputs (default value, delta value)

The configuration possibilities are versatile. Details are described in the CANio 500 manual which can be downloaded from the IXXAT Homepage[1].

Dependent on the use case, the different configuration possibilities can be achieved like described below:

- Via the comfortable CANio 500 configuration tool which can be downloaded from the IXXAT homepage[1].
- In pure CAN networks with the message sequences described in the CANio 500 manual
- In CANopen networks by the corresponding LSS services or objects (see CANio 500 manual)

Should the desired functionality not be reached by the described configuration possibilities, the “Application Development Kit (ADK)[2]” to be purchased at IXXAT can be used to generate a specific application which can be executed on the CANio 500.

[1] http://www.ixxat.com/can_canio500_analog_digital_can_modul_en.html

[2] http://www.ixxat.com/can_canio500_adk_en.html

5.1 CANio 500 as a CAN module

5.1.1 CAN – Identifier

The CANio 500 supports CAN identifier with 11 bits.

5.1.2 CAN baudrate

As default, the CANio500 is delivered with the CAN baudrate 250kBit/s.

5.1.3 Node number

As default, the CANio 500 is delivered with node number 10d (0x0A). This information is requisite to determine the CAN identifiers of its transmit and receive messages respectively.

5.1.4 Setting the digital outputs

The digital outputs of the CANio 500 are controlled with the following CAN message:

CAN identifier	**Data field (length = 2)**	
	Byte 0	**Byte 1**
0x200 + node number of the CANio 500 *Saved configuration*: saved identifier	Digital outputs 1-4	digital outputs to control the USR 1/2 LEDs

Assignment of byte 0:

Bit number	**Meaning**
0	Value of digital output 1
1	Value of digital output 2
2	Value of digital output 3
3	Value of digital output 4
4 - 7	are ignored

Assignment of byte 1:

Bit number	Meaning	Value	Reaction
1:0	controls USR 1 LED	00	LED is switched off
		01	LED is lit green
		10	LED is lit red
		11	LED is switched off
3:2	controls USR 2 LED	00	LED is switched off
		01	LED is lit green
		10	LED is lit red
		11	LED is switched off
4 - 7	are ignored		

Factory settings of the digital outputs:

- The digital outputs are initialized with 0.
- USR 1 LED and USR 2 LED are switched off.

5.1.5 Control of the analog outputs

The analog outputs of the CANio 500 are controlled with the following CAN message:

CAN identifier	Data field (length = 8)			
	Byte 0/1	Byte 2/3	Byte 4/5	Byte 6/7
0x300 + node number of the CANio 500 *Saved configuration*: saved identifier	Data of analog output 1: LSB first	Data of analog output 2: LSB first	Data of analog output 3: LSB first	Data of analog output 4: LSB first

Only bits 0-11 are relevant for the value of an analog output. Bits 12-15 are ignored.

No check or conversion of the values is done. The received value is written directly to the analog output.

The resulting voltage on the output depends on the configuration of the analog output and is described in chapter 4.5.

Factory settings of the analog outputs:[1]

- The default analog output range is defined by the HW variant of the CANio 500 (see Info in 5.1.5):

Range of the analog inputs	Range of the analog outputs
0 - 10 V	0 - 10 V
+/- 5 V	+/- 5 V
+/- 100 mA	+/- 10 V

- After power on every output is initialized with 0 V.

5.1.6 Digital inputs

The CANio 500 transmits the values of the digital inputs 1-4 with the following CAN message:

CAN identifier	Data field (length = 2)	
	Byte 0	Byte 1
0x180 + node number of the CANio 500 *Saved configuration*: saved identifier	Values of the digital inputs 1-4	Additional digital input and HW info

Assignment of byte 0:

Bit number	Meaning
0	Value of digital input 1
1	Value of digital input 2
2	Value of digital input 3
3	Value of digital input 4
4 - 7	not relevant

[1] In case that no configuration has been saved or the saved configuration was declared as invalid, the analog outputs are initialized with these factory settings.

Assignment of byte 1:

Bit number	Value	Meaning
Additional digital input, see chapter 4.4.2		
0	0	no voltage is connected
	1	voltage is connected
HW info - Variant of the analog inputs:		
2:1	11	0 to 10 V
	01	+/- 5 V
	10	+/- 100 mA
	00	not defined
3 - 7	not relevant	

The values of the digital inputs are transmitted if at least one valid value of a digital input has changed or at the latest after 500 ms (“Msg Cycle Time”). Only valid values are transmitted and not those that were last read.

Factory setting:

- all digital inputs are interrupt triggered but not debounced

5.1.7 Digital inputs: edge events

In addition to the values of the digital inputs CANio 500 transmits the related edge events with the following CAN message:

CAN identifier	Data field (length = 4)			
	Byte 0	Byte 1	Byte 2	Byte 3
0x480 + node number of the CANio 500 *Saved configuration*: saved identifier	edge events of digital input 1	edge events of digital input 2	edge events of digital input 3	edge events of digital input 4

The single data bytes do inform about the count of detected edge events of a digital input.

5.1.8 Analog inputs

The CANio 500 transmits the values of the analog inputs 1-4 with the following CAN message:

CAN identifier	Data field (length = 8)			
	Byte 0/1	Byte 2/3	Byte 4/5	Byte 6/7
0x280 + node number of the CANio 500 *Saved configuration*: saved identifier	Data of analog input 1: LSB first	Data of analog input 2: LSB first	Data of analog input 3: LSB first	Data of analog input 4: LSB first

The analog inputs are polled cyclically.

The read values are not analyzed or processed.

The values of the analog inputs are transmitted if at least one value of the analog inputs has been changed by its delta value or at the latest after 500 ms. The conversion between the raw value and the physical value is described in section 4.6.

Factory setting:

- Delta value for every input: 10 (0x0A)
- All inputs are read every cycle of the CANio 500

5.1.9 Value of the power supply PWR(+)

The value of the power supply PWR(+) is transmitted with the following CAN message:

CAN identifier	Data field (length = 2)
	Byte 0/1
0x380 + node number of the CANio 500 *Saved configuration*: saved identifier	Value of the power supply PWR(+): see chapter 4.7 LSB first

Note for „Value of the power supply PWR(+)“:

- It is a 16 – bit value
- Only the lower 12 bit are relevant
- The conversion from raw to physical value is described in chapter 4.7

This analog input is polled cyclically. The read value is not analyzed or processed.

The value of the power supply PWR(+) is transmitted if its value has been changed by a configurable delta value or at the latest after 500 ms.

Default configuration:

- Delta value for this input: 50 (0x32)
- The input is read every cycle of the CANio 500

5.1.10 Heartbeat message

With this CAN message, the CANio 500 signals that it is operational. This message is transmitted cyclically.

CAN identifier	**Data field**	
	Byte 0	
	Value	**Description**
0x700 + node number of the CANio 500	0x00	Bootup – Message: after power-on, the CANio 500 logs on to the CAN bus with this message
	0x05	„operational“: the CANio 500 is operational: ▪ Process data can be received and transmitted ▪ It can be configured ▪ Emergency messages are generated: see 5.1.10 ▪ Heartbeat messages are generated ▪ The state machine of the CANio 500 can be controlled by the command message: see 0.
	0x04	„stopped“: ▪ Process data is not received nor transmitted ▪ It can’t be configured ▪ No emergency messages are generated ▪ Heartbeat messages are generated ▪ The state machine of the CANio 500 can be controlled by the command message.
	0x7F	„preoperational“: ▪ Process data is not received nor transmitted ▪ It can be configured

		▪ Emergency messages are generated: see 5.1.10 ▪ Heartbeat messages are generated ▪ The state machine of the CANio 500 can be controlled by the command message.

Note:

- After Power On or a internal Reset the Bootup message is transmitted. The transmission of the Bootup message can't be switched off.

Default configuration:

- The heartbeat message is transmitted every 500 ms.

5.1.11 Emergency messages

The presence or absence of errors is displayed with the following CAN message:

CAN identifier	**Data field (length = 8)**		
	Bate 0..1	**Byte 2**	**Byte 3..7**
0x80 + node number *Saved configuration*: saved identifier	error code LSB first	general error status	details LSB first

Error code:

Value	**Meaning**	**Error Class**
0x0000	A previously detected error no longer exists: the error involved is described in bytes 3-7	
0x8000	„Interrupt Enable" of the digital inputs or „Interrupt Enable" of the analog inputs is not activated. This error code is in fact a warning: The general error state is not changed by this warning	
Communication error with the CAN bus:		
0x8100	Loss of a transmit message: at least one CAN message could not be transmitted: bytes 3-7: not relevant	0x10
0x8110	Loss of a receive message: at least one CAN message could not be received: bytes 3-7: not relevant	0x10

0x8210	The number of received data of a CAN message with which process data were transmitted was too small: bytes 3-7: not relevant	0x10
0x8140	There was previously a bus-off. The CANio 500 communicates again with the CAN-bus: bytes 3-7: not relevant	0x10
DAC specific errors:		
0x2310	Overcurrent – Alarm of an analog output: bytes 3-5: “DAC" bytes 6-7: Status of all analog outputs	0x02
0x4200	Thermal shutdown – Alarm of a DAC: bytes 3-5: “DAC" bytes 6-7: Status of all analog outputs	0x08
0x5000	Communication error between microcontroller and DAC: bytes 3-7: "SPIDA"	0x20
	Configuration of the DACs failed: bytes 3-7: "HWDAC"	

General error status:

The general error status displays the status of the error categories. The error categories are bit-encoded: 0 means free of errors, 1 not free of errors The CANio 500 is free of errors if all bits are reset.

Supported error categories:

Bit	Meaning	Comment
0	general error status	this bit is set with every error that is detected it is only reset when no more errors are active.
1	Overcurrent – alarm of an analog output	
2	reserved	= 0
3	Thermal shutdown – alarm of a DAC	
4	Communication error with the CAN bus	this error type is only reset by a power-on
5	Communication error between microcontroller and DAC	
6 - 7	reserved	= 0

Description of bytes 3-7:

A distinction must be made between the following cases:

- A new error is displayed
  The content of bytes 3 – 7 refers to the error displayed in the error code
- A error no longer exists:
  the content of bytes 3-7 states the error which no longer exists:
  the following data are possible:
  - "SPIDA":
    the communication between the microcontroller and the DACs works again
  - "HWDAC":
    the configuration of the DACs was successful. Data can be written to the analog outputs
  - "DAC" + bytes 6/7:
    Bytes 6/7 describe the status of all analog outputs

Status of the analog outputs:

The status of the analog outputs is displayed in bytes 6/7 if "DAC" is in bytes 3 - 5.

Bit	**Description**	
	Status of the analog outputs 1/2: Byte 6	**Status of the analog outputs 3/4: Byte 7**
0	Analog output 1: powered down	Analog output 3: powered down
1	Analog output 2: powered down	Analog output 4: powered down
2	Analog output 1 / 2: internal reference powered down	Analog output 3 / 4: internal reference powered down
3	Analog output 1: overcurrent alert	Analog output 3: overcurrent alert
4	Analog output 2: overcurrent alert	Analog output 4: overcurrent alert
5	Analog output 1 / 2: thermal shut down	Analog output 3 / 4: thermal shut down
6/7	not used	

A error is displayed with a '1'.

Every change in the status of an analog output is displayed with an error message.

5.1.12 Error management

In the case of a bus-off, the CAN controller is automatically restarted.

If communication between the microcontroller and the DACs fails, it is repeated with the current data.

If configuration of an analog output fails, the configuration of all analog outputs is repeated until the configuration is successful. No data are written to the analog outputs as long as the configuration of the DACs is not completed.

In the event of a power-down of an analog output, the CANio 500 attempts to restart the analog output.

5.1.13 Factory settings

The CANio 500 is delivered with the following default configuration:

- Node number: 10 (0x0A)
- CAN Baudrate: 250 kBit/s
- Digital outputs:
  - CAN Identifier: 0x200 + node number
  - Default value: 0
  - Default value User LEDs 1 / 2: off
- Digital inputs:
  - CAN Identifier: 0x180 + node number
  - Event timer: 500 ms
  - Inhibit time: 0ms
  - Interrupt enable: TRUE
  - Edge detection: falling and rising edge
  - Debounce time: 0x0000
  - CAN Identifier edge events: 0x480 + node number
- Analogue outputs:
  - CAN Identifier: 0x300 + node number
  - Default value: 0 V
- Analogue inputs:
  - CAN Identifier: 0x280 + node number
  - Event timer: 500 ms
  - Inhibit time: 0 ms
  - Interrupt enable: TRUE
  - Delta valued: 10
- Analogue input power supply:
  - CAN Identifier: 0x380 + node number
  - Event timer: 500 ms
  - Inhibit time: 0 ms
  - Delta value: 50

5.1.14 Reserved CAN identifiers

To guarantee a basic communication, the CANio 500 uses specific CAN identifiers. These identifiers can't be changed.

List of the reserved CAN identifiers:

CAN Identifier	Meaning
0x000	Command to steer the state machine of the CANio 500: see 5.1.14
0x600 + node number 0x580 + node number	These identifiers are reserved for configuration messages.
0x700 + node number	This identifier is reserved for the heartbeat message. Even in case that the CANio 500 shall not generated heartbeat messages, at the end of it's initialization it will transmit a Bootup message. The Bootup message uses this identifier.
0x7E5 0x7E4	These identifiers are reserved for messages to configure the node number and the CAN baudrate.

5.1.15 Steering the state machine of the CANio 500

The internal state machine of the CANio 500 can be steered by a specific command:

CAN identifier	Data field (length = 2)	
	Byte 0	Byte 1
0x000	Command	Node number

Description of the node number:

Node number	Consequence
0x00	Every CANio 500 in the network needs to execute this command
0x01 – 0x7F	The CANio 500 using the selected node number needs to execute the command. Else the command is ignored.
else	Is ignored

Supported commands:

Command	Meaning	Consequence
0x01	„operational“	The CANio 500 is operational: ▪ Process data is received and transmitted ▪ It can be configured ▪ Emergency messages are generated ▪ Heartbeat messages are generated. Data byte 0 contains 0x05
0x02	„stopped“	In case, that the CANio has been in a different sate than “stopped, the digital and analog outputs are initialized with their default values. The CANio 500 is conditionally operational: ▪ Process data is not received nor transmitted ▪ It can’t be configured ▪ Emergency messages are not generated ▪ Heartbeat messages are generated. Data byte 0 contains 0x04.
0x80	„preoperational“	This command has not consequence for the digital/analog outputs. The CANio 500 is conditionally operational: ▪ Process data is not received nor transmitted ▪ It can’t be configured ▪ Emergency messages are not generated ▪ Heartbeat messages are generated. Data byte 0 contains 0xff.
0x81	Reset	The CANio 500 needs to be initialized completely. The Reset is described more in detail later in this document. The CANio 500 does not communicate with the CAN bus during this initialization. After being initialized, it will announce itself with the *Bootup* message at the CAN bus. It will be in the state „operational“
0x82	Limited Reset	The CANio 500 shall only initialize these features, with which it will communicate via the CAN bus. This restricted Reset is described more in detail later in this document.

		The CANio 500 does not communicate with the CAN bus during this initialization. After being initialized, it will announce itself with the *Bootup* message at the CAN bus. It will be in the state „operational“
Else	Not defined	Will be ignored

Description of the Reset:

The CANio 500 is being initialized completely. In case that a configuration has been stored, the CANio 500 will be initialized with this configuration. In case that no configuration has been stored, or a stored one has been declared invalid, the CANio 500 will be initialized with the default values (see 5.1.12).

The digital and analog outputs will be initialized with their “configured” default values.

Description of the limited Reset:

In case of the restricted Reset, the I/O functionality will not be initialized:

- The configuration of the digital and analog inputs and outputs is not changed.
- The digital and analog outputs are not changed.

The parameters of the CAN messages the CANio 500 is using are initialized:

- CAN identifiers
- Event Timer of the CAN messages
- Inhibit Time of the CAN messages

After a configuration has been stored, these objects are initialized with the stored configuration. In case that no configuration has been stored, or a stored one has been declared invalid, the CANio 500 will be initialized with the default values (see 5.1.12).

6 General

6.1 Support

For more information on our products, FAQ lists and installation tips, please refer to the support area on our homepage (http://www.ixxat.de). There you will also find information on current product versions and available updates.

If you have any further questions after studying the information on our homepage and the manuals, please contact our support department. In the support area on our homepage you will find the relevant forms for your support request. In order to facilitate our support work and enable a fast response, please provide precise information on the individual points and describe your question or problem in detail.

If you would prefer to contact our support department by phone, please also send a support request via our homepage first, so that our support department has the relevant information available.

6.2 Returning hardware

If it is necessary to return hardware to us, please download the relevant RMA form from our homepage and follow the instructions on this form. In the case of repairs, please also describe the problem or fault in detail on the RMA form. This will enable us to carry out the repair quickly.

6.3 Note on disposal of used devices

This product is subject to the ElektroG (electrical and electronic equipment act) and is to be disposed of in accordance with this act. The products of IXXAT that are subject to the ElektroG are devices for exclusive commercial use and are marked with the symbol of the crossed out garbage can.

Based on the B2B regulation, disposal is governed separately in the Terms of Sale of IXXAT in accordance with § 10 para. 2 clause 3 of the Electrical and Electronic Equipment Act (ElektroG) in the version of 16.03.2005.

When products supplied by IXXAT are no longer used, the customer is obliged to dispose these products at his/her own expense. It is to be noted that, unlike privately used devices (B2C), they may not be disposed of at the collection centers of public disposal contractors (e.g. municipal recycling centers). The statutory regulations for disposal are to be complied with.

If products delivered were passed on to third parties, the customer is obliged to take back the delivered products at his/her expense when no longer used and to correctly dispose of them in accordance with the statutory regulations or to impose these obligations on the third parties.

The Terms of Sale and their supplements as well as further information on the disposal of used devices can be downloaded from www.ixxat.de.

6.4 Note on EMC

This product is a class A device. This means that it is designed for industrial use and meets the EMC requirements for industrial devices.

If the product is used in offices or residential areas, it may cause radio interference in extreme cases.

To ensure perfect operation of the device, the following points are to be observed for EMC reasons.

- only use the accessories and cables provided
- all cables must be shielded
- the shield of the interfaces must be connected to the device connectors and the remote station

If problems occur when operating the device despite all the points listed, the distance between possible sources of interference (e.g. motors, frequency converters) or susceptible devices (radio receivers) and the device should be increased.

6.5 FCC Compliance

Declaration of conformity

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference
2. This device must accept any interference received, including interference that may cause undesired operation

Class A digital device – instructions

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

6.6 EC DECLARATION OF CONFORMITY

IXXAT Automation declares that the product: CANio 500

with article number(s): 1.01.0098.xxxxx

complies with EC Directive 2004/108/EC.

Applicable harmonized standards EN 55022:2006 + A1:2007
EN 61000-6-2:2005

08.04.2011, Dipl.-Ing. Christian Schlegel, CEO

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