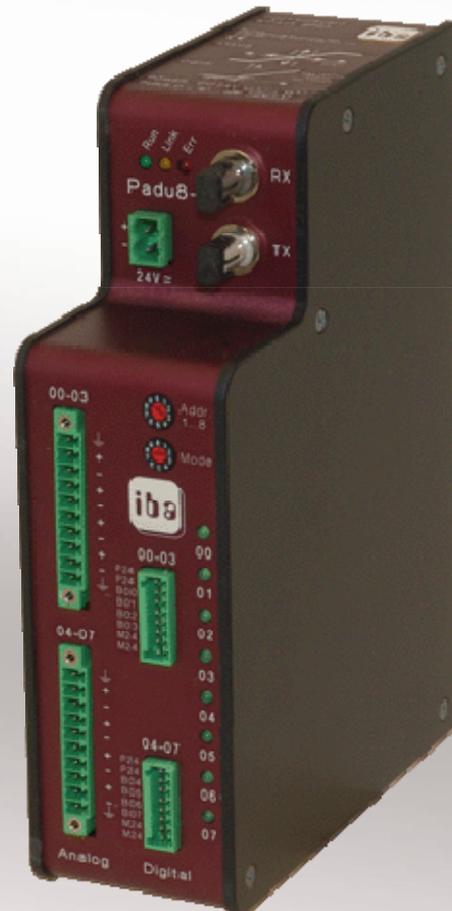


# ibaPADU-8-0

Parallel-Analog-Digital-Converter for Analog and Digital Outputs



## Manual

Issue 1.9

Measurement and Automation Systems



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The content of this publication has been checked for compliance with the described hardware and software. Nevertheless, deviations cannot be excluded completely so that the full compliance is not guaranteed. However, the information in this publication is updated regularly. Required corrections are contained in the following regulations or can be downloaded on the Internet.

The current version is available for download on our web site <http://www.iba-ag.com>.

## Protection note

Windows® is a label and registered trademark of the Microsoft Corporation. Other product and company names mentioned in this manual can be labels or registered trademarks of the corresponding owners.

## Certification

The device is certified according to the European standards and directives. This device corresponds to the general safety and health requirements. Further international customary standards and directives have been observed.

Version	Date	Revision	Chapter / pages	Author	Version HW/FW
V 1.9	03/05/2012	Chapter Accessories removed		st	

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# 1 About this manual

This manual describes in detail the configuration and use of the device ibaPADU-8-O. It serves both as a tutorial and a reference document.

## 1.1 Target group

This manual addresses in particular the qualified professionals who are familiar with handling electrical and electronic modules as well as communication and measurement technology. A person is regarded to as professional if he/she is capable of assessing safety and recognizing possible consequences and risks on the basis of his/her special training, knowledge and experience and knowledge of the standard regulations.

## 1.2 Notations

In this manual the following notations are used:

Aktion	Notation
Menu command	Menu „Logic diagram“
Call of menu command	„Step 1 – Step 2 – Step 3 – Step x“ Example: Select menu „Logic diagram – Add – New logic diagram“
Keys	<Key name> Example: <Alt>; <F1>
Press keys simultaneously	<Key name> + <Key name> Example: <Alt> + <Strg>
Buttons	<Button name> Example: <OK>; <Cancel>
File names, Paths	„File name“, „Path“ Example: „Test.doc“

## 1.3 Used symbols

If safety instructions or other notes are used in this manual, they mean:

---

### **DANGER**

The non-observance of this safety information may result in an imminent risk of death or severe injury:

- By an electric shock!
- Due to the improper handling of software products which are coupled to input and output procedures with control function!

If you do not observe the safety instructions regarding the process and the system or machine to be controlled, there is a risk of death or severe injury!

---

---

### **WARNING**

The non-observance of this safety information may result in a potential risk of death or severe injury!

---

---

### **CAUTION**

The non-observance of this safety information may result in a potential risk of injury or material damage!

---



---

#### **Note**

A note specifies special requirements or actions to be observed.

---



---

#### **Important note**

Note if some special features must be observed, for example exceptions from the rule.

---



---

#### **Tip**

Tip or example as a helpful note or insider tip to make the work a little bit easier.

---



---

#### **Other documentation**

Reference to additional documentation or further reading.

---

## 2 Introduction

The ibaPADU-8-O device (Parallel analog digital unit 8 Outputs) serves as analog and digital output for purposes of process automation or to generate output stimuli for plant simulators. The sender normally is an ibaFOB output card, e. g. ibaFOB-2io-D or iba-FOB-4i-D + ibaFOB-4o-D.

In combination with the ibaLink-SM-64-io card the device may additionally be used as IO-extension for the following Siemens PLC types:

- Simatic S5 115U (ZG und EG)
- Simatic S5 135U (ZG und EG)
- Simatic S5 150U (ZG und EG)
- Simatic S5 155U (ZG und EG)
- MMC216 (from VE216 to VE586, all sub rack types)

In combination with the ibaLink-SM-128V-i-2o card the device may additionally be used as IO-extension for standard VME-systems, such as:

- Converteam (ALSTOM/AEG) C80-A800 Logidyn D1
- Converteam (ALSTOM/AEG)ALSPA C80 HPC (Logidyn D2)
- Converteam (ALSTOM/AEG)ALSPA C80 HPCi
- VAI/SMS Vantage TCS/SMS X-Pact
- GE 9070 / 9030

The device converts the incoming optical data stream with an one millisecond accuracy in analog and binary outputs – simultaneously for all channels. In addition, the optical signal is regenerated and transmitted downstream to the other ibaPADU-8-O devices in the chain. Up to 8 devices may be cascaded on 1 fiber optic link.

## 3 Package contents

The package includes the following items:

- Device with 2-pole phoenix jack
- Manual
- 2 Phoenix spring terminal blocks for both the analog outputs and the digital outputs

## 4 System requirements

- ibaLogic Soft PLC system, running on a computer equipped with ibaFOB output card(s)
- ibaPDA-V6 system, running on a computer equipped with ibaFOB output card(s)
- PLC and control systems, with ibaLink-SM-64-io or ibaLink-SM-128V-i-2o board as sender/receiver plugged into the PLC

## 5 Mounting and dismounting

### 5.1 Mounting

Make sure the din-rail clip at the back of the device fits properly into the top edge of the DIN-rail and then lightly press the device down – back into the DIN-rail. The device will easily snap into the DIN-rail. After that, connect the power supply and all necessary connectors.

### 5.2 Dismounting

First remove all connectors from the device.

With one hand press the top of the device slightly down to ensure that the device later will be secure between both hands.

Place two fingers of the other hand under the bottom of the device and slightly push the device upward. The device will easily remove from the DIN-rail.

## 6 Product properties

### 6.1 Device

The device provides the following features:

- DC 24 V power supply (18 V to 32 V input voltage, not stabilized)
- Rugged EMI resistant metal chassis with DIN-rail snap mount
- 3 status LEDs (Run, Link, Error)
- 1 fiber optic input and one fiber optic output for transmitting the signal values downstream within the ibaPADU-8-O chain of max. 8 devices
- 8 analog outputs 14 Bit  $\pm 10$  V ( $\pm 20$  mA on request), galvanic isolation between channels and between channels and ground
- 8 digital outputs, galvanically isolated, with output status LEDs
- RJ11 jack to connect a notebook computer in order to monitor the data (this output shows all incoming data within the output chain)
- Communication watchdog (if communication fails, the device will automatically go in the save output state within 20 ms max. (analog outputs = 0 V; digital outputs = log "0").
- Service port for later firmware updates
- The update rate for the whole fiber optic chain is 1 ms
- Shield connector
- Digital output #0 can be used as pulse generator in mode #2

### 6.2 PC-side connection with ibaFOB-cards

- In order to connect a PC with the device an ibaFOB-D output card should be used
- The card is activated by ibaLogic or ibaPDA-V6
- Each card has the ability to send 64 analog plus 64 digital signals per FO-link:
 

ibaFOB-io-D.....	1 link	= 64 a/d signals
ibaFOB-2io-D.....	2 links	= 128 a/d signals
ibaFOB-2i-D + ibaFOB-4o-D...	2 links	= 128 a/d signals
ibaFOB-4i-D + ibaFOB-4o-D....	4 links	= 256 a/d signals

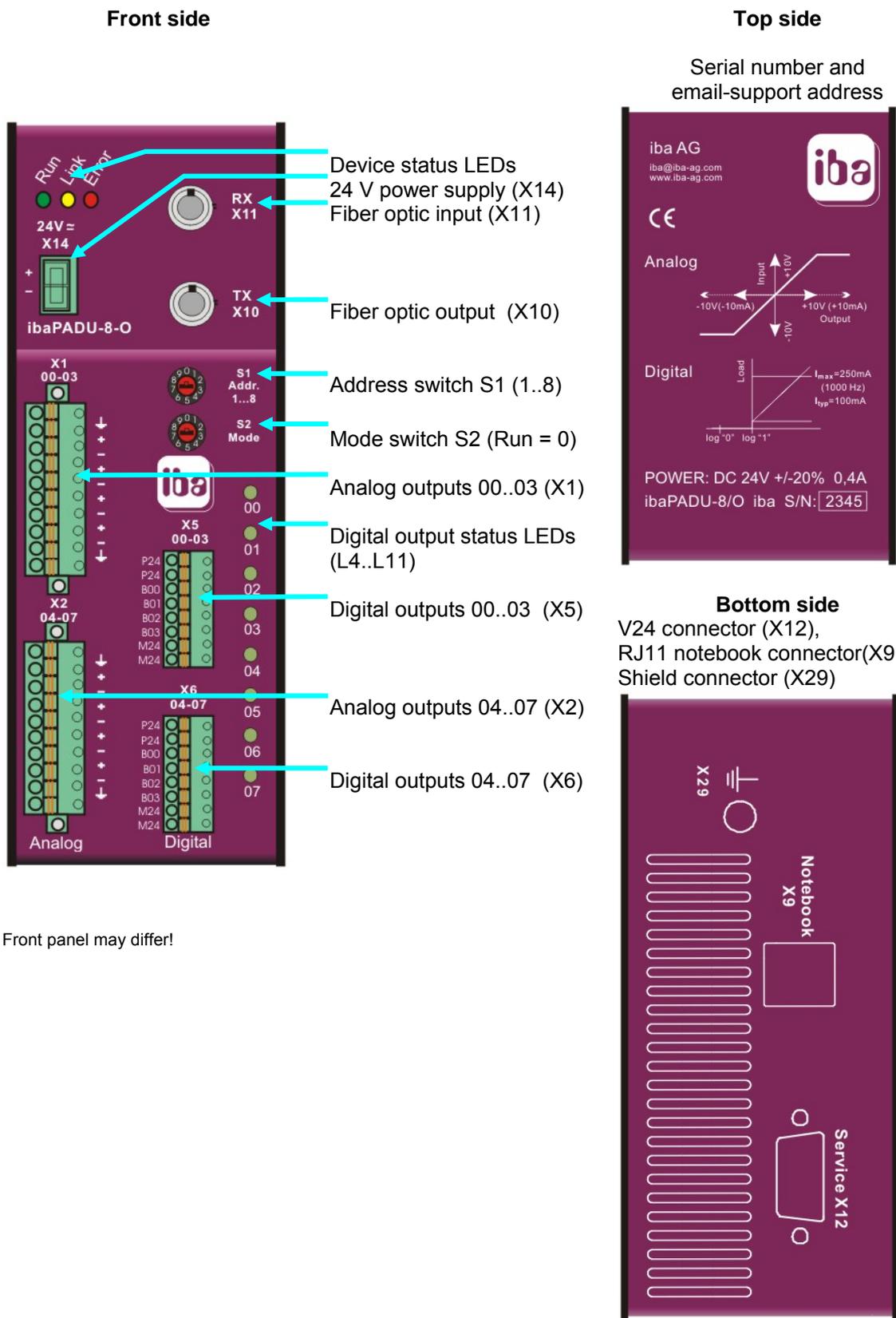
### 6.3 PLC side connection with ibaLink-SM-64-io/ ibaLink-SM-128V-i-2o

The ibaLink-SM-64-io and ibaLink-SM-128V-i-2o boards are also designed to work with up to 8 ibaPADU-8-O devices in a chain over 1 FO-link. They offer one, respectively 2 fiber optic ports for connecting ibaPADU-8-O chains. This gives a new ability especially when revamping older systems, because only 1 slot is needed to add 64 A + 64 D output signals, respectively 128 A + 128 D outputs.

### 6.4 ibaBM-FOX-i-3o fiber optic splitting device

A fiber optical data stream may be multiplied (tripled) by the ibaBM-FOX-i-3o device. This feature helps to realize redundant outputs as well a parallel measuring the output devices with ibaPDA.

## 6.5 Device views, connectors and switches



Front panel may differ!

Figure 1: Device views, Connectors and Switches

### 6.5.1 Power supply input X14

The 2-pole connector serves as power supply input. A non-stabilized DC power supply (with a voltage range between 18 V and 32 V) may be connected.

### 6.5.2 Fiber optic connectors TX (X10) and RX (X11)

The 2 fiber optic jacks (ST types) are used to connect to fiber optic communication links. X11 of the first device in a chain must be connected to a fiber optic output of the ibaFOB-board. The output X10 once again is connected to input X11 of the next device downstream and so on until all devices (max. 8) are wired in a chain.

### 6.5.3 Adjusting the device address with switch S1

Select the desired device address with this switch by turning it into the right position with a small screw driver. Valid addresses are 1...8. The position of the device in the chain may differ from the address setting of the device, but it may be helpful for later diagnostics to keep position and number the same.

### 6.5.4 Adjusting the device mode with switch S2

This switch sets the device operation mode.

The following settings can be used (all others are reserved!):

- Switch setting = 0: Mode Run (standard operation)
- Switch setting = 2: Activates the pulse generator mode for binary output #0

For more information about pulse generator mode, please refer to chapter 7.

## 6.5.5 Connector pin outs X14, X1, X2, X5, X6



### Note

The counting order is always top down starting on top with #1.

### Power supply X14

Pin	Connection
1	+24 V
2	0 V

### Analog outputs X1 and X2

Pin	Signal (X1)	Signal (X2)
1	Shield	Shield
2	+ Channel 0	+ Channel 4
3	- Channel 0	- Channel 4
4	+ Channel 1	+ Channel 5
5	- Channel 1	- Channel 5
6	+ Channel 2	+ Channel 6
7	- Channel 2	- Channel 6
8	+ Channel 3	+ Channel 7
9	- Channel 3	- Channel 7
10	Shield	Shield

### Digital outputs X5 and X6

Pin	Signal (X5)	Signal (X5)
1	P24	P24
2	P24	P24
3	Digital output 0	Digital output 4
4	Digital output 1	Digital output 5
5	Digital output 2	Digital output 6
6	Digital output 3	Digital output 7
7	M24	M24
8	M24	M24

P24 and M24: Load power supply

### 6.5.6 Status LEDs

The 3 LEDs can be interpreted as follows:

LED	Status	Interpretation
L1 :Run (green)	Blinking	The device under power is running (device status = o.k.)
	Off	No power
L2: Link (yellow)	On	Shows that a data stream with valid data is coming via on the fiber optic input
	Off	No valid data the input fiber (link broken)
L3: Err (red)	On	Device error
	Off	No error (LED is cancelled if error disappears)

### 6.5.7 LEDs L00...L07

LED	Status	Interpretation
Ln : (green)	On	Digital output active (log „1“)
	Off	Digital output inactive (log „0“)

n = 0...07

### 6.5.8 Service interface connector (X12)

A 9-pin D-SUB port, found on the bottom side of the device, may be used to load new firmware for the device. New firmware is loaded via a V.24 interface.



**Note**

Please contact iba support regarding loading new firmware. You will get the required files and further information about the loading procedure.



In normal operation mode the V.24-cable must not be connected!

### 6.5.9 Shield connector

To reduce unwanted electromagnetic interference, it is required to use shielded IO cabling and connect the shield one time at the ibaPADU-8-O side with the connector X9.



The DIN-rail must be always earthed to provide a good shielding quality.

## 7 Selecting the mode of operation

The switch S2 is used to change operating modes of the device. Only 2 mode switch settings are valid. All other positions are reserved!

### 7.1 Mode 0-standard operation mode

In this mode all outputs run in the same operational mode.

### 7.2 Mode 2-impulse generator for binary output #0

This setting activates the impulse generator for the binary output #0 (Bin Out #0).

---

**⚠ CAUTION**

The analog output #0 (Ana Out #0) cannot be used as standard output in this mode!

---

#### Functional description: (see Figure 2)

To create impulse (-s) of a defined length the binary output #0 can operate as a pulse generator. 2 parameters are defined to control the pre delay of the pulse (P\_DLY) and the pulse length (P\_LEN). The analog output #0 (Ana Out #0) is used for parameterization. The 2 parameters are coded in the following way within the 16 bit data word of Ana Out #0:

- ❑ The lower byte (D0...D7) contains the pre delay (P\_DLY) in steps of 100  $\mu$ s
- ❑ The higher byte (D8...D15) contains the pulse length (P\_LEN) in steps of 100  $\mu$ s

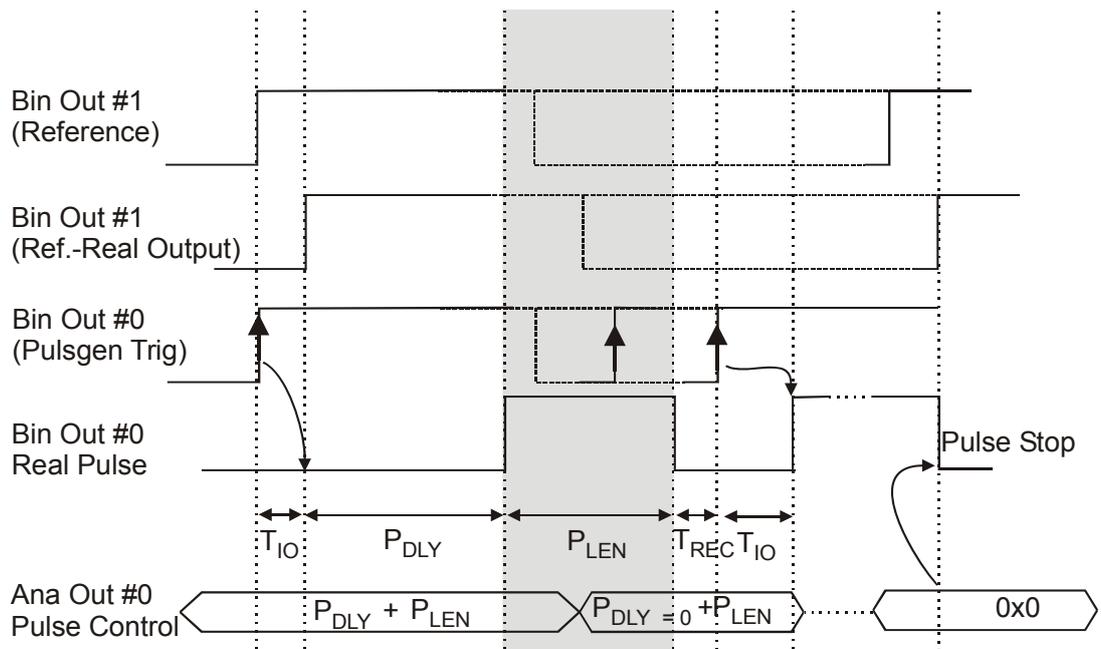
Therefore pre delays between 0 ms and 25.5 ms and pulse lengths between 100  $\mu$ s and 25.5 ms can be achieved.

The generator is activated with a rising edge on Bin Out #0n only (if Ana out #0  $\neq$  0).

Rising edges within an active pulse sequence are ignored!

After processing a pulse the ibaPADU-8-O needs a recovery time (TREC) of at least 400  $\mu$ s. If an event occurs within this period the execution is performed in the next cycle (= 1 ms later).

If Ana Out #0 = 0x0H at any time a running sequence is immediately stopped (Pulse Stop). This is also the case whenever the fiber optic connection is broken or the ibaPADU-8-O does not receive valid data anymore.



Legend:

- $T_{IO}$  System transport delay time (not constant!) until data arrival at ibaPADU-8-O device ( $\leq 1$  ms)
- $T_{DLY}$  Programmed impulse pre-delay (D0...D7 of Ana Out #0)
- $T_{LEN}$  Programmed pulse length (D8...D15 of Ana Out #0)
- $T_{REC}$  Ecovery time of ibaPADU-8-O  $\geq 40$  0 $\mu$ s
- Grey marked area In this time area trigger pulses of Bin Out #0 are ignored

Figure 2: Pulse diagram

**Remarks concerning pulse generator accuracy**

The accuracy of the programmed pulse length is  $\pm 6 \mu$ s (for max. total sequence length of 51 ms).



**Note**

The start sequence can be delayed by the following factors independent of the ibaPADU-8-O ( $T_{IO}$ ).

Remaining computing time of any process after triggering the event, task cycles of other tasks if I/O operation is done by another task.

Transportation time to peripherals (this time can be estimated with less than 1 ms depending of the phase between application and communication hardware).

The accuracy relative to other outputs of the same device is always max.  $\pm 6 \mu$ s.

## 8 System topologies

### 8.1 Single daisy-chain with ibaPADU-8-O

Daisy-chaining of up to 8 devices on 1 fiber optic link connected to an ibaFOB-card output. There are 8 valid device addresses (#1...8). The device address is independent from the position of the device within the chain.

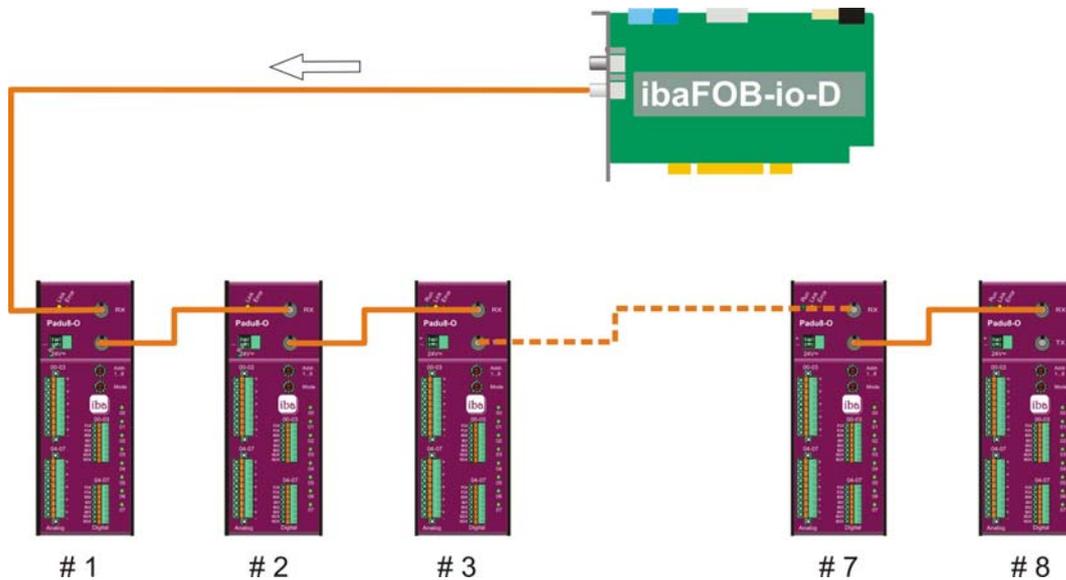


Figure 3: Single daisy-chain with ibaPADU-8-O

### 8.2 Multiple daisy-chains with ibaPADU-8-O

ibaPADU-8-O devices used as process outputs with an ibaFOB-4o (without ibaPADU-8 input devices).

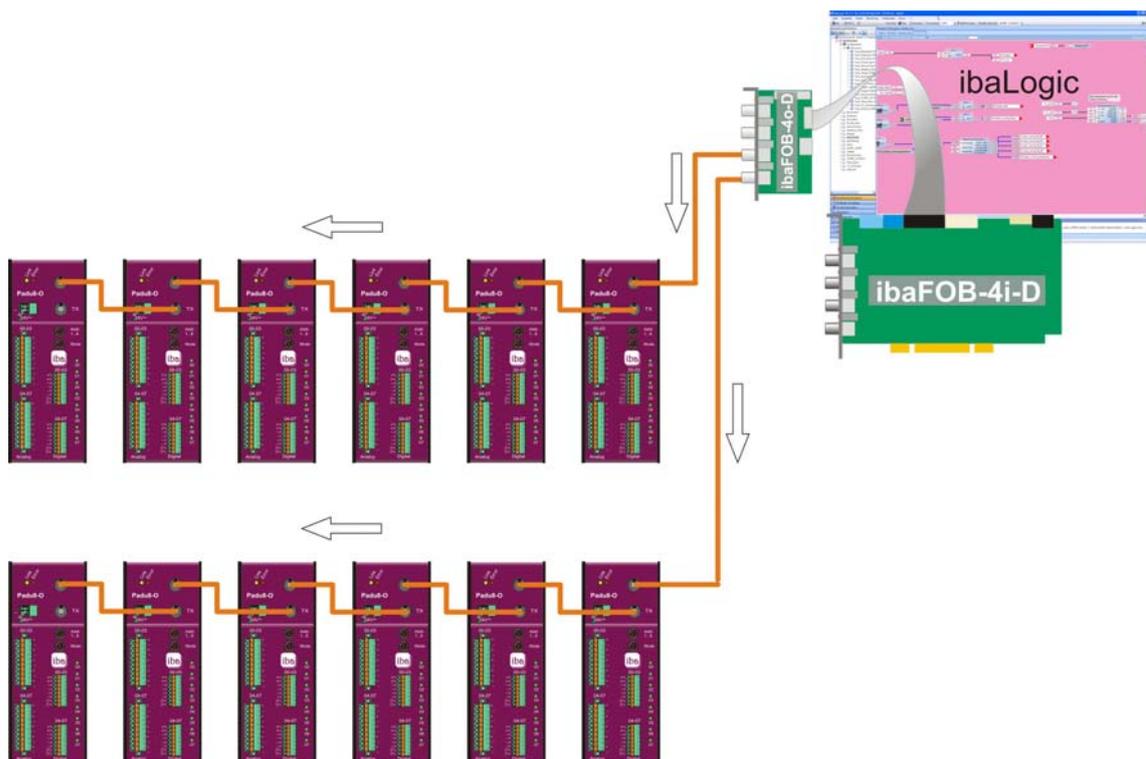


Figure 4: Multiple daisy-chains with ibaPADU-8-O

### 8.3 Daisy-chain with ibaPADU-8-O to ibaLink-SM-64-io

ibaPADU-8-O devices used as process outputs for a PLC S5 or MMC216 with an ibaLink-SM-64-io board(with ibaPADU-8 input devices).

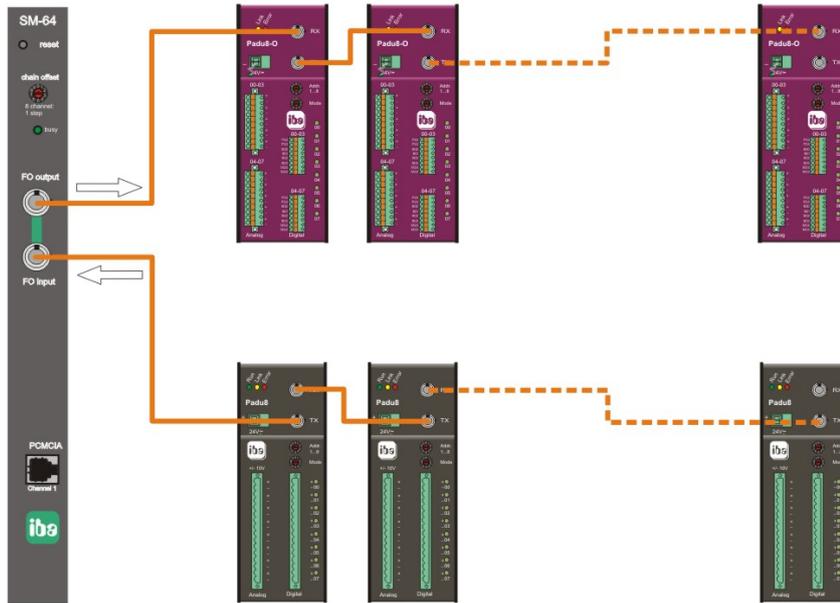


Figure 5: Daisy-chain with ibaPADU-8-O to ibaLink-SM-64-io

### 8.4 Process IO redundancy

With the ibaBM-FOX-i-3o device, optical data streams (fibers) may be multiplied. This is possible at every location within an input or output chain of ibaPADU devices, that means between ibaPADU-8-O devices also. A variety of topologies can be achieved using this device. Apart from redundant I/O-systems, the devices may be measured in parallel by ibaPDA by connecting one ibaBM-FOX-i-3o output to an ibaPDA system (ibaFOB-input card).



Figure 6: Process IO redundancy

## 9 Working with ibaPADU-8-O and ibaLogic V3

### 9.1 Hardware

The ibaPADU-8-O must be connected to an ibaFOB-card with output capability, i. e. ibaFOB-2io-S or ibaFOB-4i-S/-4o.

The ibaFOB transmits the ibaLogic V3 output image with an update rate of 1 ms to the output devices.

It is allowed to split a fiber optic wire into multiple wires with the ibaBM-FOX-i-3o device.

### 9.2 Software Application

The sending of output signals from ibaLogic to ibaPADU-8-O is done by connecting ibaFOB IO/OUT output resource channels.

The device address of the ibaPADU-8-O and the ibaFOB IO/OUT output channel number are always closely related.

Each analog and digital “module” in the output resources 3 consists of 32 output signals. 1 fiber optic output port of an ibaFOB-card can transmit 64 signals. According to the order of boards in the PC (7-segment display) the modules 1 and 2 are mapped to the first fiber optic port of the first card, the modules 3 and 4 to the second port and so on. An ibaFOB-4o card covers 8 modules; an ibaFOB-io card covers just 2 modules.

The following table shows the relation between module no. and signal no. when using a chain of 8 ibaPADU-8-O devices.

ibaLogic V3	ibaFOB-card		ibaPADU-8-O							
Module 1	Card 0, port 0		1	2	3	4	5	6	7	8
Module 2										
	Signals on device	from	00	00	00	00	00	00	00	00
		to	07	07	07	07	07	07	07	07
	Signals in chain	from	00	08	16	24	32	40	48	56
		to	07	15	23	31	39	47	55	63
	Signals in module	from	00	08	16	24	00	08	16	24
		to	07	15	23	31	07	15	23	31
			Module 1				Module 2			

Table 1: Relation between module no. and signal no.

**Example application with ibaLogic V3**

The first 8 channels (always analog + digital channels are meant here) correspond with ibaPADU-8-O address #1 connected to the first output of ibaFOB IO-card with device ID = 0.

The following example shows the wiring to activate the analog output channels 1 and 2 of ibaPADU-8-O #1, and the analog output channel 4 of device #2 (ibaFOB IO/O M1 Ana12).

The activated binary output is output 1 of device #5 connected with output 2 of ibaFOB IO-card with the ID = 1.

**CAUTION**

The output data format for the ibaPADU-8-O is always signed integer (-32,768 to 32,767)! The output Ana12 here is connected to a float value (actually showing the value 0.54). Float values <1 in this case would always be received with the value 0 by the ibaPADU-8-O. To avoid this, always make sure the outputs have the proper signal range by conversion to integer.

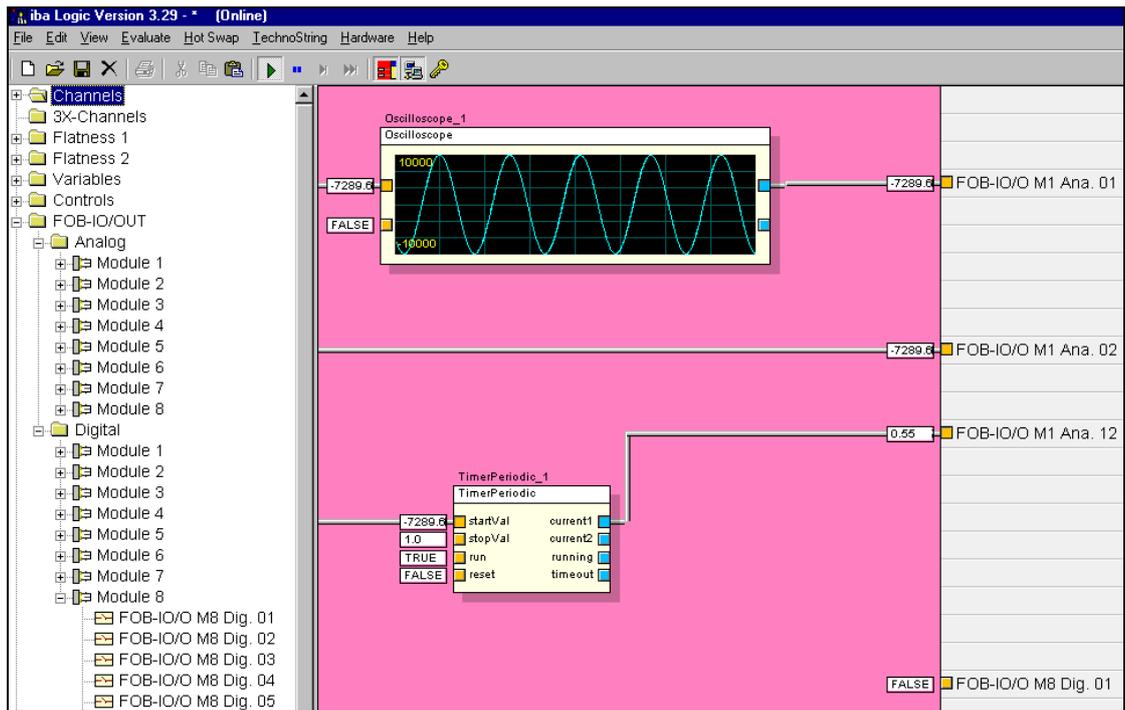


Figure 7: Example application with ibaLogic V3

## 10 Working with ibaPADU-8-O and ibaLogic V4

### 10.1 Hardware

The ibaPADU-8-O must be connected to an ibaFOB-card with output capability, i. e. ibaFOB-io-D or ibaFOB-4i-/4o-D.

The ibaFOB transmits the ibaLogic output image with an update rate of 1 ms to the output devices.

It is allowed to split a 3.3 Mbit/s fiber optic wire into multiple wires with the ibaBM-FOX-i-3o device.

### 10.2 Software Application

The sending of output signals from ibaLogic to ibaPADU-8-O is done by connecting ibaFOB IO/OUT output resource channels.

The device address of the ibaPADU-8-O and the ibaFOB IO/OUT output channel number are always closely related.

Each of the 3.3 Mbit/s output links of an ibaFOB card transmits up to 64 analog and 64 digital signals. A daisy-chain consisting of up to 8 ibaPADU-8-O devices can be connected to each link. The mapping of signals is determined by the device address 1...8.

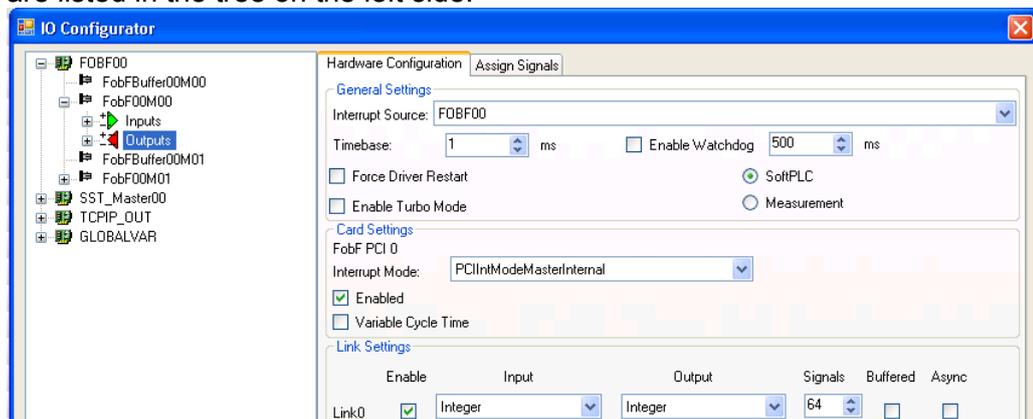
	Daisy-chain							
Analog signals	0...7	8...15	16...23	24...31	32...39	40...47	48...55	56...63
Digital signals	0...7	8...15	16...23	24...31	32...39	40...47	48...55	56...63
Device address	1	2	3	4	5	6	7	8

Table 2: Mapping of signals and device address in ibaLogic V4

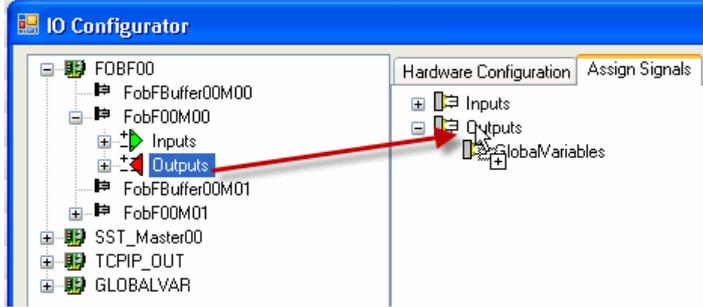
#### Sample application with ibaLogic V4

In order to create the same sample application like with ibaLogic V3 before, follow these steps:

1. Open the I/O configurator in ibaLogic-V4. The cards and input/output resources are listed in the tree on the left side.



- Click on the “Assign Signals” tab, drag the correct group of outputs from the left pane towards the branch “Outputs” of the tree in the right pane and let it drop.

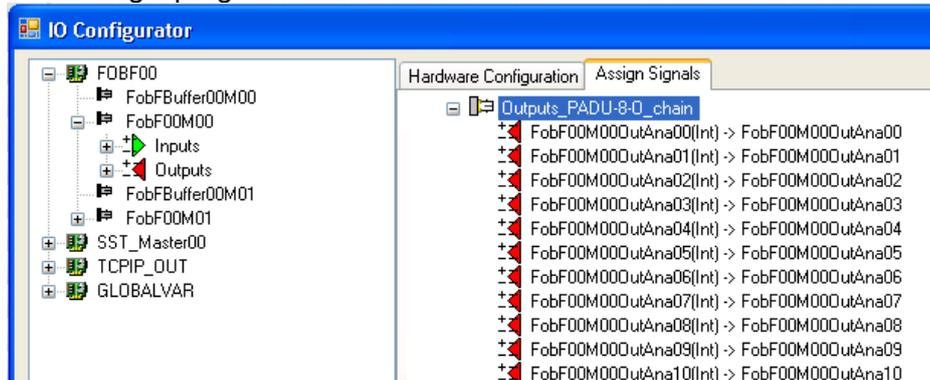


- In the dialog which opens automatically you can enter a group name if you want. If only the outputs should be assigned select “Outputs only” in the “Directions” drop-down list. If inputs and outputs are needed (e. g. in case of a ring topology) select “Inputs and outputs”.

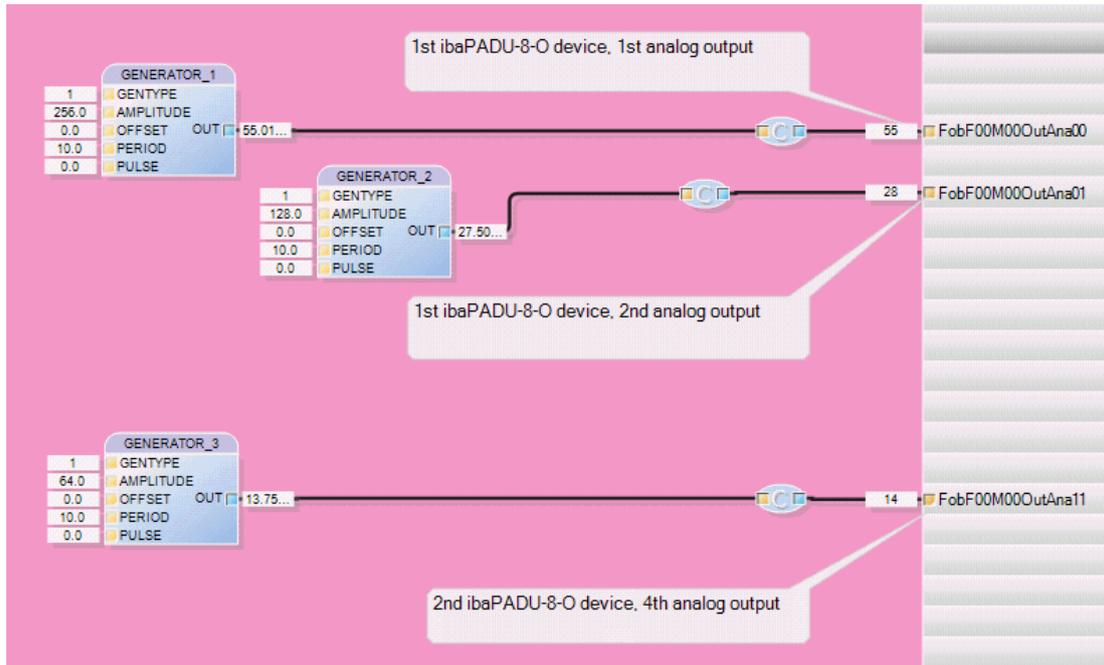


- Close the dialog with <OK>.

The physical outputs are assigned to the logical output resources which are used by the ibaLogic program.



In the program designer the sample application of chapter 9.2 would look like as follows:



## 11 Technical data

### 11.1 Main data

Order no. iba AG	10.120800
Mechanical stability	DIN IEC 68-2-6 (if DIN rail is mounted correctly)
Operating temperature	32 °F to 122 °F (0 °C to 50 °C)
Storage temperature	-13 °F to 158 °F (-25 °C to 70 °C)
Transport temperature	-13 °F to 158 °F (-25 °C to 70 °C)
Cooling	Passive
Mounting	DIN-rail snap on mount
Humidity class	F, no condensation
Protection class	IP20
Power supply	DC 24 V $\pm$ 20 % not stabilized
Current consumption (without load power supply)	300 mA $\pm$ 20 % with analog load (10 mA/channel) Typical 220 mA without load
FO-cable Coupling	62.5/125 $\mu$ m ST Lean
Watchdog	Communication failure watchdog 20 ms
Max. length of optical cable without repeater	6,560 ft. (2000 m)
Dimensions (Width x Height x Depth)	2.13 in x 7.64 in x 6.10 in (incl. DIN-rail clip) 58 mm x 194 mm x 155 mm
Masses (incl. box and documentation)	3.70 oz (1050 g)

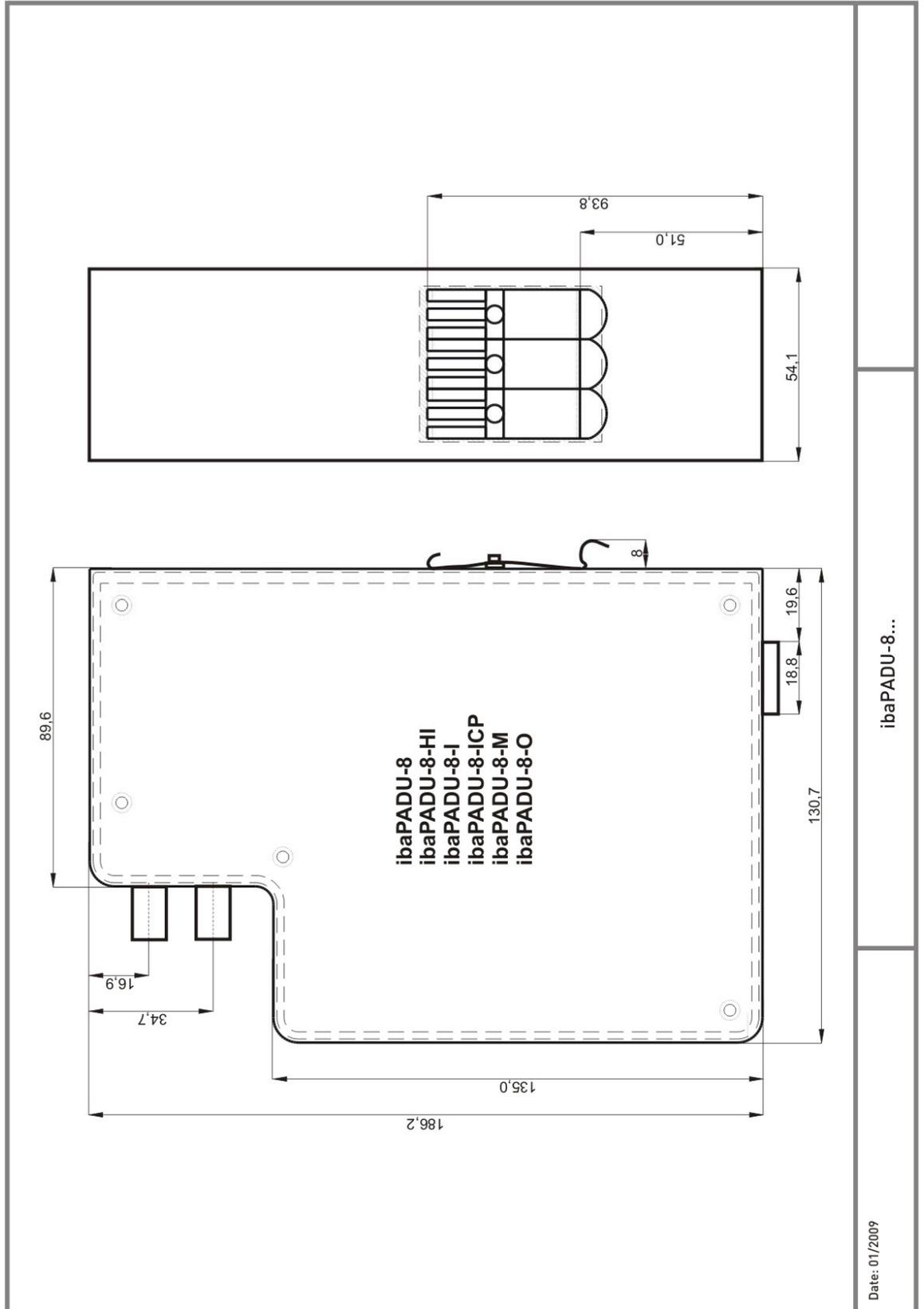
### 11.2 Analog outputs

Amount	8	Each channel with its own D/A-converter
Resolution	14 bits	
Output signal	$\pm$ 10 V $\pm$ 20 mA	Standard (safe state is 0 V after 3 ms) On request
Signal output current	10 mA (at 1 k $\Omega$ )	at 10 V
Short circuit protection	Protected	
Galvanic Isolation	Channel-Channel and Channel-Device ground	1.5 kV

### 11.3 Digital outputs

Amount	8	
Output signal	log 0; 0 V log 1; + 24 V	Load power supply external DC 24 V Save state is log „0“
Output current/output	100 mA (typ.) 250 mA (max.)	At 24 V and switching frequency 1000 Hz
Short circuit protection	Protected	
Galvanic Isolation	Channel-Channel and Channel-Device ground	1.5 kV

### 11.4 Dimensional drawing



(Dimensions given in mm)

Figure 8: Dimension drawing

## 12 Support and Contact

### Support

Phone: +49 911 97282-14

Fax: +49 911 97282-33

E-Mail: [support@iba-ag.com](mailto:support@iba-ag.com)



### Note

If you require support, specify the serial number (iba-S/N) of the product.

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### Contact

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**[www.iba-ag.com](http://www.iba-ag.com)**.