

# CONEX-IOD

Analog/Digital  
I/O Module



Compliant

 **Newport**<sup>®</sup>

**Controller  
Documentation**

V1.0.x

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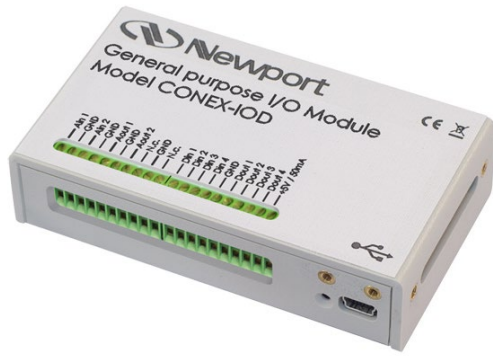
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# Analog/Digital I/O Module CONEX-IOD

## 1.0 System Overview

### 1.1 General Description

The CONEX-IOD is a highly versatile I/O module that can interface with multiple third party devices. It comes with many general-purpose input and output functions, including both digital input and output lines, and 12-bit analog input and outputs.

Communication with the CONEX-IOD is achieved via an USB port (requires Windows™ operating system). A Windows™ based software enables basic motion. Advanced application programming is simplified by an ASCII command interface and a set of two letter mnemonic commands.

## 1.2 CONEX-IOD

### 1.2.1 Contents of Delivery

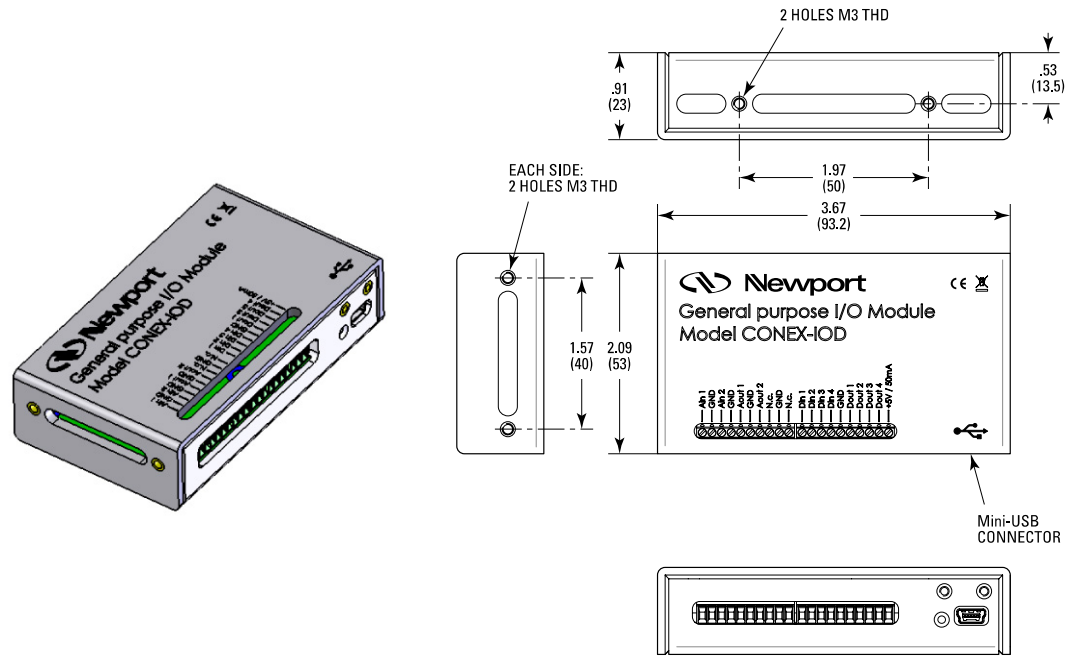
- CONEX-IOD Controller box.
- CONEX-USB USB cable, 1.8 m length.
- CONEX-MOTION CD-ROM.



### 1.2.2 Specifications

General Description	I/O module with analog and digital inputs and outputs
Digital I/O	– 4 TTL inputs. 3.3 V compatible, 5 V tolerant – 4 Open collector outputs (50 Vmax, 100 mA max) with 100k pull-up resistors connected to the internal 5 V
Analog I/O	– 2 analog outputs with range selectable by user 12 bits, 2 modes ( $\pm 10$ V, 0–10 V) – 2 analog inputs with range selectable by user 12 bits, 4 modes ( $\pm 10$ V, 0–10 V, $\pm 1$ V, 0–1 V)
Supply output	– Supplies are available on the connectors to power external user electronics. +5 V (200 mA), +12 V and -12 V (20 mA)
Computer interface	– USB (requires Windows™ operating system)
Programming	– 20+ intuitive, 2-letter ASCII commands – Command set includes gain and offset configuration, input and output setting and reading.
Status display	One color LED
Communication rate	50 Hz Max. (USB)
Internal safety feature	Watchdog timer
Consumption	+5 V (USB): < 0.5 A

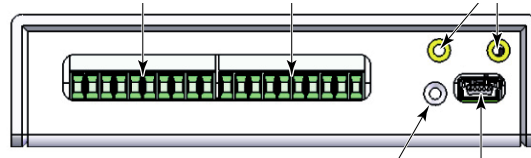
1.2.3 Controller Dimensions



1.3 System Environmental Specifications

Operating temperature	5 °C to 40 °C
Operating humidity	20% to 85% relative humidity, non-condensing
Location	Indoor use only

### 1.4 Connector Identification



USB	Mini-USB connector
LED	Status LED
Sensor	Sensor entry cable
Cable retainer	2 x M3 threaded hole to attach cable retainer

### 1.5 USB Communication Settings

Communication parameters are preset in the CONEX-IOD controller and do not require any configuration:

Bits per second	921,600
Data bits	8
Parity	None
Stop bits	1
Flow control	None
Terminator	C <sub>R</sub> L <sub>F</sub>

**NOTE**

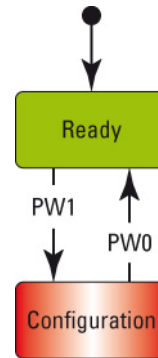
**USB communication allows Inputs reading and outputs setting up to 50 times/s.**



## 2.0 Programming

### 2.1 State Diagram

For a consistent operation, the CONEX-IOD uses 2 different operation states: Ready and configuration. In each state, only specific commands are accepted by the CONEX-IOD. Therefore, it is important to understand the state diagram below and which commands and actions cause transition between the different states. Also see section 2.5 for command/state information:



#### LED display

CONFIGURATION: **SLOW BLINK RED.**

READY: **SOLID GREEN.**

When connecting the CONEX-IOD to power, the controller initializes (see section 0). When the initialization is successful, the controller gets to the READY state. From the READY state, the controller can go to the CONFIGURATION state with the PW1 command. In CONFIGURATION stage, the CONEX-IOD allows changing configuration parameters like analog input offset and gain. The PW0 command saves all changes to the controller's memory and returns the controller back to the READY state.

### 2.2 Initialization

For more information about system errors during initialization, refer to the TS command in section 2.5.

## 2.3 Command Syntax

The CONEX-IOD is a command driven controller. The general format of a command is a two-letter ASCII character preceded and followed by parameters specific to the command:

### Command format

<b>nn</b>	<b>AA</b>	<b>xx</b>
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**nn** — Optional or required controller address.

**AA** — Command name.

**xx** — Optional or required value or “?” to query current value.

Both, upper and lower case characters are accepted. Depending on the command, it can have an optional or required prefix (**nn**) for the controller address and/or a suffix (**xx**) value or a “?”.

### Blank spaces

Blanks are allowed and ignored in any position, including inside a numerical value. The following two commands are equivalent, but the first example might be confusing and uses more memory:

2P A1.43 6

2PA1.436

### Decimal separator

A dot (“.”) is used as decimal separator for all numerical values.

### Command terminator

Commands are executed as the command terminator  $C_{RLF}$  (carriage-return line-feed, ASCII 13 and ASCII 10) is received. The controller will analyze the received string. If the command is valid and its parameters are in the specified range, it will be executed. Otherwise it will memorize an error.

After the execution of the command, all remaining characters in the input string, if any, will be ignored. In particular, it is not possible to concatenate several commands on a single string from the PC to the CONEX-IOD.

Each command will handle properly the memorization of related errors that can be accessed with the TE command. Please refer to the command set in section 2.5 for details.

## 2.4 Command Execution Time

The CONEX-IOD controller interprets commands continuously as received. The typical execution time for a "tell position command" (nTP?) is about 10 ms for the first controller (controller address number 1) and about 16 ms for the other controllers. Here, command execution time means the time from sending the command until receive of the answer.

## 2.5 Command Set

This section describes the supported two-letter ASCII commands used to configure and operate the CONEX-IOD. The general command format is:

### Command format

<b>nn</b>	<b>AA</b>	<b>xx</b>
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**nn** — Optional or required controller address.

**AA** — Command name.

**xx** — Optional or required value or “?” to query current value.

Most commands can be used to set a value (in that case the command name is followed by the value “**xx**”) or to query the current value (in that case the command name is followed by a “?”). When querying a value, the controller responds with the command it received followed by the queried value. For example, a 1IX0.1 sets the X offset of the controller #1 to 0.01. A 1IX? reads the response 1IX0.1.

Not every command can be executed in all states of the CONEX-IOD and some commands have different meaning in different states. It is therefore important to understand the state diagram of the controller, see section 2.1.

	Ready	Config.	Description
CA	<input type="checkbox"/>	<input type="radio"/>	Set/Get value of analog output 1
CB	<input type="checkbox"/>	<input type="radio"/>	Set/Get value of analog output 2
CI	<input type="checkbox"/>	<input type="radio"/>	Set/Get analog inputs mode
CO	<input type="checkbox"/>	<input type="radio"/>	Set/Get analog outputs mode
GA	<input type="checkbox"/>	<input type="radio"/>	Set/Get gain on DAC output 1
GB	<input type="checkbox"/>	<input type="radio"/>	Set/Get gain on DAC output 2
ID	<input type="checkbox"/>	<input type="radio"/>	Set/Get controller identifier
IX	<input type="checkbox"/>	<input type="radio"/>	Set/Get offset on ADC input 1
IY	<input type="checkbox"/>	<input type="radio"/>	Set/Get offset on ADC input 2
LF	<input type="checkbox"/>	<input type="radio"/>	Set/Get low pass filter frequency
OA	<input type="checkbox"/>	<input type="radio"/>	Set/Get offset on DAC output 1
OB	<input type="checkbox"/>	<input type="radio"/>	Set/Get offset on DAC output 2
PX	<input type="checkbox"/>	<input type="radio"/>	Set/Get gain on ADC input 1
PY	<input type="checkbox"/>	<input type="radio"/>	Set/Get gain on ADC input 2
PW	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Enter/Leave CONFIGURATION state
RA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Get raw analog input values
RB	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Get digital inputs
RC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Get corrected analog input values
RS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Reset controller
RS##	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Reset controller's address to 1
SA	-	<input type="radio"/>	Set/Get controller's address
SB	<input type="checkbox"/>	<input type="radio"/>	Set/Get digital outputs
TB	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Get command error string
TE	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Get last command error
TS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Get positioner error and controller state
VE	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Get controller revision information
ZT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Get current modes parameters

- Changes configuration parameters. Those changes will be stored in the controller's memory with the PW1 command and remain available after switching off the controller.
  - Changes working parameters only. Those changes will get lost when switching off the controller.
  - Accepted command.
  - Write command not accepted (will return an error).
- Command** Command passed without preceding controller number applies to all controllers.

## CA — Set/Get the value of analog output 1

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>
	□	○
<b>Syntax</b>	<b>xxCA<sub>nn</sub> or xxCA?</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Controller address.
<b>Range</b>	<b>xx</b>	— <b>1 to 31</b>
	<b>nn</b> [float]	— > -10.0 to < 10.0 in Mode 1, > 0.0 to < 10.0 in Mode 2
<b>Units</b>	<b>xx</b>	— None
	<b>nn</b>	— Volts
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
<b>Description</b>	This command sets the analog inputs mode of operation. One of four modes can be selected for each input.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
<b>Rel. Commands</b>	<b>CO</b>	— Set/Get the operating mode of analog outputs
	<b>OA</b>	— Set/Get offset on DAC output 1.
	<b>GA</b>	— Set/Get gain on DAC output 1.
<b>Example</b>	1CA5.33	<i>Set the channel 1 analog output to 5.33V.</i>

## CB — Set/Get the value of analog output 2

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>
	□	○
<b>Syntax</b>	xxCBnn or xxCB?	
<b>Parameters</b>		
<b>Description</b>	xx [int]	— Controller address.
<b>Range</b>	xx	— 1 to 31
	nn [float]	— > -10.0 to < 10.0 in Mode 1, > 0.0 to < 10.0 in Mode 2
<b>Units</b>	xx	— None
	nn	— Volts
<b>Defaults</b>	xx Missing:	Error B.
	Out of range:	Error B.
<b>Description</b>	This command sets the analog inputs mode of operation. One of four modes can be selected for each input.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
<b>Rel. Commands</b>	CO	— Set/Get the operating mode of analog outputs
	OB	— Set/Get offset on DAC output 2.
	GB	— Set/Get gain on DAC output 2.
<b>Example</b>	1CB4.75	<i>Set the channel 1 analog outputs to 4.75 V.</i>

## CI — Set/Get analog inputs mode

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>	
	□	○	
<b>Syntax</b>	<b>xxCIab</b> or <b>xxCI?</b>		
<b>Parameters</b>			
<b>Description</b>	<b>xx</b> [int]	—	Controller address.
<b>Range</b>	<b>xx</b>	—	<b>1 to 31</b>
	<b>a</b>	—	1 to 4
	<b>b</b>	—	1 to 4
<b>Units</b>	<b>xx</b>	—	None
	<b>a &amp; b</b>	—	None
<b>Defaults</b>	<b>xx</b> Missing:		Error B.
	Out of range:		Error B.
<b>Description</b>	This command sets the analog inputs mode of operation. One of four modes can be selected for each input.		
	Mode 1 : ±10 V		
	Mode 2 : 0–10 V		
	Mode 3 : ±1 V		
	Mode 4 : 0–1 V		
<b>Errors</b>	<b>A</b>	—	Unknown message code or floating point controller address.
	<b>B</b>	—	Controller address not correct.
<b>Rel. Commands</b>	<b>RA</b>	—	Get raw analog inputs.
	<b>RC</b>	—	Get corrected analog inputs.
	<b>PX</b>	—	Set/Get gain on ADC input 1.
	<b>PY</b>	—	Set/Get gain on ADC input 2.
	<b>IX</b>	—	Set/Get offset on ADC input 1.
	<b>IY</b>	—	Set/Get offset on ADC input 2.
<b>Example</b>	1CI23		<i>Set the channel 1 mode to ±1V and channel 2 to 0–10 V.</i>

## CO — Set/Get analog outputs mode

Usage	Ready	Config.
	□	○
<b>Syntax</b>	xxCOab or xxCO?	
<b>Parameters</b>		
<b>Description</b>	xx [int]	— Controller address.
<b>Range</b>	xx	— 1 to 31
	a	— 1 or 2
	b	— 1 or 2
<b>Units</b>	xx	— None
	a & b	— None
<b>Defaults</b>	xx Missing:	Error B.
	Out of range:	Error B.
<b>Description</b>	This command sets the analog outputs mode of operation. One of two modes can be selected for each output. Mode 1 : ±10 V Mode 2 : 0–10 V	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
<b>Rel. Commands</b>	CA	— Set analog output 1.
	CB	— Set analog output 2.
	GA	— Set/Get gain on DAC output 1.
	GB	— Set/Get gain on DAC output 2.
	OA	— Set/Get offset on DAC output 1.
	OB	— Set/Get offset on DAC output 2.
<b>Example</b>	1CO21	<i>Set the channel 1 mode to 0–10 V and the channel 2 to ±10 V.</i>



## GA — Set/Get gain on DAC output 1

Usage	Ready	Config.
	□	○
<b>Syntax</b>	xxGAnn or xxGA?	
<b>Parameters</b>		
<b>Description</b>	xx [int]	— Controller address.
<b>Range</b>	xx	— 1 to 31
	nn	— > 0.5 and < 1.5
<b>Units</b>	xx	— None
	nn	— None
<b>Defaults</b>	xx Missing:	Error B.
	Out of range:	Error B.
<b>Description</b>	This command sets the gain of the analog output 1.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
<b>Rel. Commands</b>	CO	— Set analog output mode.
	OA	— Set/Get offset on DAC input 1
<b>Example</b>	1GA0.994	<i>Set the gain of the analog output 1 to 0.994.</i>

## GB — Set/Get Gain on DAC input 2

Usage	Ready	Config.
	□	○
<b>Syntax</b>	<b>xxGBnn or xxGB?</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx [int]</b>	— Controller address.
<b>Range</b>	<b>xx</b>	— 1 to 31
	<b>nn [float]</b>	— > 0.5 and < 1.5
<b>Units</b>	<b>xx</b>	— None
	<b>nn</b>	— None
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
<b>Description</b>	This command sets the gain of the analog output 2.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
<b>Rel. Commands</b>	<b>CO</b>	— Set analog output mode.
	<b>OB</b>	— Set/Get offset on DAC output 2.
<b>Example</b>	1GB0.994	<i>Set the gain of the analog output 1 to 0.994</i>

## ID — Set/Get controller identifier

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>	
	□	○	
<b>Syntax</b>	<b>xxIDnn or xxID?</b>		
<b>Parameters</b>			
<b>Description</b>	<b>xx</b> [int]	—	Controller address.
	<b>nn</b>	—	Controller identifier
<b>Range</b>	<b>xx</b>	—	<b>1 to 31</b>
	<b>nn</b>	—	<b>1 to 31</b> ASCII characters.
<b>Units</b>	<b>xx</b>	—	None
	<b>nn</b>	—	None
<b>Defaults</b>	<b>xx</b> Missing:		Error B.
	Out of range:		Error B.
	Floating point:		Error A.
	<b>nn</b> Missing:		Error C.
	Out of range:		Error C.
<b>Description</b>	The ID command sets the controller identifier string.		
<b>Returns</b>	If the sign “?” takes place of <b>nn</b> , this command returns the current programmed value.		
<b>Errors</b>	A	—	Unknown message code or floating point controller address.
	B	—	Controller address not correct.
	C	—	Parameter missing or out of range.
	K	—	Execution not allowed in READY state.
<b>Rel. Commands</b>	<b>ZT</b>	—	Get all parameters.
<b>Example</b>	IID?		<i>Get sensor identifier for controller #1.</i>
	CONEX-IOD		<i>Controller returns identifier: CONEX-IOD</i>

## IX — Set/Get offset on ADC input 1

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>
	□	○
<b>Syntax</b>	<b>xxIXnn or xxIX?</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Controller address.
<b>Range</b>	<b>xx</b>	— 1 to 31
	<b>nn</b> [float]	— > -0.5 and < 0.5
<b>Units</b>	<b>xx</b>	— None
	<b>nn</b>	— Volts
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	In CONFIGURATION state, this command will set and save the offset for the ADC input 1 for the current mode of operation.	
<b>Returns</b>	If the sign “?” takes place of <b>nn</b> , this command returns the current programmed value.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Rel. Commands</b>	<b>CI</b>	— Set/Get analog inputs mode
	<b>PX</b>	— Set/Get gain on ADC input 1
	<b>RC</b>	— Get corrected analog inputs values
	<b>ZT</b>	— Get current modes parameters.
<b>Example</b>	1IX0.010	Sets the ADC input offset to 0.010 for channel 1 of controller #1.

## IY — Set/Get offset on ADC input 2

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>
	□	○
<b>Syntax</b>	<b>xxIYnn or xxIY?</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Controller address.
<b>Range</b>	<b>xx</b>	— 1 to 31
	<b>nn</b> [float]	— > -0.5 and < 0.5
<b>Units</b>	<b>xx</b>	— None
	<b>nn</b>	— Volts
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	In CONFIGURATION state, this command will set and save the offset for the ADC input 2 for the current mode of operation.	
<b>Returns</b>	If the sign “?” takes place of <b>nn</b> , this command returns the current programmed value.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Rel. Commands</b>	<b>CI</b>	— Set/Get analog inputs mode
	<b>PY</b>	— Set/Get gain on ADC input 2
	<b>RC</b>	— Get corrected analog inputs values
	<b>ZT</b>	— Get current modes parameters.
<b>Example</b>	1IY0.010	<i>Sets the ADC input offset to 0.010 for channel 2 of controller #1.</i>

## LF — Set/Get low pass filter

Usage	Ready	Config.
	□	○
<b>Syntax</b>	xxLFnn or xxLF?	
<b>Parameters</b>		
<b>Description</b>	xx [int]	— Controller address.
<b>Range</b>	xx	— 1 to 31
	nn [float]	— > 0 and < 1000.0
<b>Units</b>	xx	— None
	nn	— Hertz
<b>Defaults</b>	xx Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	In CONFIGURATION state, this command will set the frequency of the digital first order low pass filter applied on the ADC inputs. The default value is 50Hz.	
<b>Returns</b>	If the sign “?” takes place of <b>nn</b> , this command returns the current programmed value.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Rel. Commands</b>	ZT	— Get current modes parameters.
<b>Example</b>	1LF100	Sets the low pass filter frequency to 100 Hz of controller #1.

## OA — Set/Get offset on DAC output 1

Usage	Ready	Config.
	□	○
<b>Syntax</b>	<b>xxOAnn or xxOA?</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Controller address.
<b>Range</b>	<b>xx</b>	— 1 to 31
	<b>nn</b> [float]	— > -0.5 and < 0.5
<b>Units</b>	<b>xx</b>	— None
	<b>nn</b>	— Volts
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	In CONFIGURATION state, this command will set and save the offset applied on DAC output 1 for the current mode of operation.	
<b>Returns</b>	If the sign “?” takes place of <b>nn</b> , this command returns the current programmed value.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Rel. Commands</b>	<b>CO</b>	— Set/Get analog output mode.
	<b>CA</b>	— Set/Get the value for the analog output 1.
	<b>GA</b>	— Set/Get the gain for DAC output 1.
<b>Example</b>	1OA0.034	Sets the DAC output 1 offset to 0.034V.

## OB — Set/Get offset on DAC output 2

Usage	Ready	Config.
	□	○
<b>Syntax</b>	<b>xxOBnn or xxOB?</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Controller address.
<b>Range</b>	<b>xx</b>	— 1 to 31
	<b>nn</b> [float]	— > -0.5 and < 0.5
<b>Units</b>	<b>xx</b>	— None
	<b>nn</b>	— Volts
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	In CONFIGURATION state, this command will set and save the offset applied on DAC output 2 for the current mode of operation.	
<b>Returns</b>	If the sign “?” takes place of <b>nn</b> , this command returns the current programmed value.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Rel. Commands</b>	<b>CO</b>	— Set/Get analog output mode.
	<b>CB</b>	— Set/Get the value for the analog output 2.
	<b>GB</b>	— Set/Get the gain for DAC output 2.
<b>Example</b>	1OB-0.021	Sets the DAC output 2 offset to -0.021V.



## PX — Set/Get gain on ADC input 1

Usage	Ready	Config.
	□	○
<b>Syntax</b>	xxPXnn or xxPX?	
<b>Parameters</b>		
<b>Description</b>	xx [int]	— Controller address.
<b>Range</b>	xx	— 1 to 31
	nn [float]	— > 0.5 and < 1.5
<b>Units</b>	xx	— None
	nn	— None
<b>Defaults</b>	xx Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	In CONFIGURATION state, this command will set and save the gain applied on ADC input 1 for the current mode of operation.	
<b>Returns</b>	If the sign “?” takes place of <b>nn</b> , this command returns the current programmed value.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Rel. Commands</b>	<b>CI</b>	— Set/Get operating mode of analog inputs.
	<b>IX</b>	— Set/Get offset on ADC input 1.
	<b>RC</b>	— Get corrected analog input values.
<b>Example</b>	1PX0.995	<i>Sets the ADC input gain to 0.995 for channel 1 of controller #1.</i>

## PY — Set/Get gain on ADC input 2

Usage	Ready	Config.
	□	○
<b>Syntax</b>	<b>xxPYnn or xxPY?</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Controller address.
<b>Range</b>	<b>xx</b>	— 1 to 31
	<b>nn</b> [float]	— > 0.5 and < 1.5
<b>Units</b>	<b>xx</b>	— None
	<b>nn</b>	— None
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	In CONFIGURATION state, this command will set and save the gain applied on ADC input 2 for the current mode of operation	
<b>Returns</b>	If the sign “?” takes place of <b>nn</b> , this command returns the current programmed value.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Rel. Commands</b>	<b>CI</b>	— Set/Get operating mode of analog inputs.
	<b>IY</b>	— Set/Get offset on ADC input 2.
	<b>RC</b>	— Get corrected analog input values.
<b>Example</b>	1PY0.995	<i>Sets the ADC input gain to 0.995 for channel 2 of controller #1.</i>

## PW — Enter/Leave CONFIGURATION state

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>
	●	●
<b>Syntax</b>	xxPWnn or xxPW?	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Controller address.
	<b>nn</b> [float]	— State.
<b>Range</b>	<b>xx</b>	— <b>1 to 31</b>
	<b>nn</b>	— <b>1:</b> Go from READY state to CONFIGURATION state. <b>0:</b> Go from CONFIGURATION state to READY state.
<b>Units</b>	<b>xx</b>	— None.
	<b>nn</b>	— None.
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
	<b>nn</b> Missing:	Error C.
	Out of range:	Error C.
<b>Description</b>	<p>PW1 changes the controller's state from READY to CONFIGURATION. In Configuration state all parameter settings are saved in the controller's memory and remain available after switching off the controller. In addition, some settings are only possible in CONFIGURATION state (e.g. offsets or gains.).</p> <p>PW0 checks all stage parameters, and if they are acceptable, saves them in the flash memory of the controller. After that, it changes the controller's state from CONFIGURATION to READY.</p> <p>The execution of a PW0 command may take up to 10 seconds. During that time the controller will not respond to any other command.</p>	
<b>Returns</b>	If the sign "?" takes place of <b>nn</b> , this command returns the current state.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	C	— Parameter missing or out of range.
	D	— Execution not allowed.
<b>Rel. Commands</b>	<b>ZT</b>	— Get current modes parameters.
<b>Example</b>	1PW1	<i>Changes controller #1 to CONFIGURATION state.</i>

---

### NOTE

The PW command is limited to 100 writes. Unit failure due to excessive use of the PW command is not covered by warranty.

The PW command is used to change the configuration parameters that are stored in memory, and not parameters that are needed to be changed on the fly.

---

## RA — Get analog input values

Usage	Ready	Config.	
	●	●	
<b>Syntax</b>	<b>xxRA</b>		
<b>Parameters</b>			
<b>Description</b>	<b>xx</b> [int]	—	Controller address.
<b>Range</b>	<b>xx</b>	—	<b>1 to 31</b>
<b>Units</b>	<b>xx</b>	—	None.
<b>Defaults</b>	<b>xx</b> Missing:		Error B.
	Out of range:		Error B.
	Floating point:		Error A.
<b>Description</b>	The RA command returns the value of the analog inputs. The converter is a +12 bits analog to digital converter. The CONEX-IOD controller has analog input low pass filters with a cut-off frequency of xxxHz .		
<b>Errors</b>	A	—	Unknown message code or floating point controller address.
	B	—	Controller address not correct.
	D	—	Execution not allowed.
<b>Rel. Commands</b>	<b>ZT</b>	—	Get current modes parameters.
<b>Example</b>	1RA		<i>Get controller #1 analog inputs.</i>
	<i>1RA0.910,1.202   Controller returns: Ch1=0.910, Ch2=1.202</i>		

## RB — Get digital inputs

Usage	Ready	Config.
	●	●
<b>Syntax</b>	<b>xxRB?</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Controller address.
<b>Range</b>	<b>xx</b>	— <b>1 to 31</b>
<b>Units</b>	<b>xx</b>	— None
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
<b>Description</b>	The command returns the value of the TTL inputs. The returned decimal number represents the binary word made of all 4 inputs, where bit 0 is input 1, bit 1 is input 2, bit 2 is input 3, and bit 3 is input 4.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
<b>Rel. Commands</b>	<b>SB</b>	— Set/Get digital outputs.
<b>Example</b>	1RB?	<i>Get controller #1 analog inputs.</i>
	1RB9	<i>Controller returns =&gt; (input4) 1 0 0 1(input1).</i>

## RC — Get corrected analog input values

Usage	Ready	Config.
	●	●
<b>Syntax</b>	<b>xxRC</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Controller address.
<b>Range</b>	<b>xx</b>	— 1 to 31
<b>Units</b>	<b>xx</b>	— None.
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	The RC command returns the value of the corrected analog inputs. The converter is a +12 bits analog to digital converter. For channel “n”, the RC command will return the RA reading minus current mode offset ch “n” (set by the commands IX, IY) and then multiplied by current mode gain ch “n” (set by the commands PX, PY). This allows to improve the default precision of the controller.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Rel. Commands</b>	<b>ZT</b>	— Get current modes parameters.
<b>Example</b>	1RC	<i>Get controller #1 corrected analog inputs.</i>
	1RC5.932,-1.254	<i>Controller returns: Ch1=5.932, Ch2=-1.254</i>

## RS — Reset controller

Usage	Ready	Config.
	●	●
<b>Syntax</b>	<b>xxRS</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Controller address.
<b>Range</b>	<b>xx</b>	— <b>1 to 31</b>
<b>Units</b>	xx	— None.
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	<p>The RS command issues a hardware reset of the controller, equivalent to a power-up.</p> <p>To go from READY state to CONFIGURATION state, it is also needed to first reset the controller with the RS command, and then to change the controller's state with the PW1 command from READY to CONFIGURATION.</p>	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Example</b>	1RS	<i>Reset controller #1.</i>

## RS## — Reset controller's address

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>
	□	□
<b>Syntax</b>	<b>xxRS## or RS##</b>	
<b>Parameters</b>		
<b>Description</b>	<b>xx [int]</b>	— Axis number.
<b>Range</b>	<b>xx</b>	— <b>0 to 31</b>
<b>Units</b>	<b>xx</b>	— None.
<b>Defaults</b>	<b>xx</b> Missing:	Change to 0.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	The RS## command resets the controller's address to 1. This address needs to be different for each CONEX controller when connected to a RS-485 communication network.	
<b>Returns</b>		
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Example</b>	2RS##	Reset controller's #2 address to 1.

**NOTE:** For USB communication, address must be set at: 1



## SA — Set/Get controller's RS-485 address

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>
	–	○
<b>Syntax</b>	xxSAnn or xxSA?	
<b>Parameters</b>		
<b>Description</b>	<b>xx</b> [int]	— Axis number.
	<b>nn</b> [int]	— Controller's axis number.
<b>Range</b>	<b>xx</b>	— <b>1</b>
	<b>nn</b>	— <b>2 to 31</b>
<b>Units</b>	<b>xx</b>	— None.
	<b>nn</b>	— None.
<b>Defaults</b>	<b>xx</b> Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
	<b>nn</b> Missing:	Error C.
	Out of range:	Error C.
<b>Description</b>	<p>The SA command sets the controller's RS-485 address. This address is ONLY used when the controller is configured for RS-485 communication.</p> <p>The SA command can only be sent to a controller configured for RS-232-C communication. In this configuration, the controller's address is 1. Only one controller can be configured for RS-232-C communication.</p> <p>Newport recommends using the supplied utility software for all controller configurations. The SA command is of practical use only when not using this software.</p>	
<b>Returns</b>	If the sign "?" takes place of <b>nn</b> , this command returns the current programmed value.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	C	— Parameter missing or out of range.
	D	— Execution not allowed.
<b>Example</b>	1SA3	<i>Set controller's RS-485 address to 3.</i>

---

### NOTE:

**Special function. Contact Newport to get additional support on this command.**

---

## SB — Set/Get digital outputs

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>	
	□	○	
<b>Syntax</b>	xxSBnn or xxSB?		
<b>Parameters</b>			
<b>Description</b>	xx [int]	—	Controller address.
<b>Range</b>	xx	—	1 to 31
	nn	—	0 to 15
<b>Units</b>	xx	—	None
<b>Defaults</b>	xx	Missing:	Error B.
		Out of range:	Error B.
<b>Description</b>	<p>This command sets the digital outputs. In CONFIGURATION state, it will set the values to which the controller will initialize on power up.</p> <p>The decimal number nn represents thereby the binary word made of all 4 outputs, where bit 0 is output 1, bit 1 is output 2, bit 2 is output 3, and bit 3 is output 4.</p> <p>A 1 closes the open collector output transistor of the output.</p> <p>A 0 blocks the open collector output transistor of the output.</p>		
<b>Errors</b>	A	—	Unknown message code or floating point controller address.
	B	—	Controller address not correct.
<b>Rel. Commands</b>	<b>RB</b>	—	Get digital inputs.
<b>Example</b>	1SB9		<i>Set the open-collector outputs =&gt; (output4) 1 0 0 1(output1).</i>

## TB — Get command error string

Usage	Ready	Config.	
	●	●	
<b>Syntax</b>	<b>xxTBnn</b>		
<b>Parameters</b>			
<b>Description</b>	<b>xx</b> [int]	—	Controller address.
<b>Range</b>	<b>xx</b>	—	<b>1 to 31</b>
	<b>nn</b> [char]	—	Error code (refer to TE command).
<b>Units</b>	<b>xx</b>	—	None.
<b>Defaults</b>	<b>xx</b> Missing:		Error B.
	Out of range:		Error B.
	Floating point:		Error A.
	<b>nn</b> Missing:		Returns explanation of current error.
	Out of range:		Error C.
<b>Description</b>	The TB command returns a string that explains the meaning of the error code <b>nn</b> (see TE command for complete list).		
<b>Errors</b>	A	—	Unknown message code or floating point controller address.
	B	—	Controller address not correct.
	C	—	Parameter missing or out of range.
	D	—	Execution not allowed.
<b>Rel. Commands</b>	<b>TE</b>	—	Get error code.
<b>Example</b>	1TB@		<i>Get explanation to error code @.</i>
	<i>1TB@ No error   Controller returns: @ meaning No error.</i>		

## TE — Get last command error

Usage	Ready	Config.
	●	●
<b>Syntax</b>	xxTE	
<b>Parameters</b>		
<b>Description</b>	xx [int]	— Controller address.
<b>Range</b>	xx	— 1 to 31
<b>Units</b>	xx	— None.
<b>Defaults</b>	xx Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	<p>The TE command returns the currently memorized error. When a command is not executable, it memorizes an error. This error can be read with the TE command. After the execution of a TE command, the error buffer gets erased and another TE command will return @, means no error. When a new command error is generated before the previous command error is read, the new command error will overwrite the current memorized error.</p> <p>For a safe program flow it is recommended to always query the command error after each command execution.</p>	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Execution not allowed.
<b>Rel. Commands</b>	TB	— Get error string.
<b>Example</b>	1TE	<i>Get last error memorized on controller #1.</i>
		<i>Controller returns: 1TE@, means no error.</i>
	List of errors and corresponding strings (see TB command):	
	@	— No error.
	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	C	— Parameter missing or out of range.
	D	— Command not allowed.
	H	— Command not allowed in READY with default parameters state.
	I	— Command not allowed in CONFIGURATION state.
	K	— Command not allowed in READY state.
	S	— Communication Time Out.
	U	— Default parameters are used.
	V	— Error during command execution.

## TS — Get positioner error and controller state

<b>Usage</b>	<b>Ready</b>	<b>Config.</b>
	●	●
<b>Syntax</b>	xxTS	
<b>Parameters</b>		
<b>Description</b>	xx [int]	— Controller address.
<b>Range</b>	xx	— 1 to 31
<b>Units</b>	xx	— None.
	nn	— None.
<b>Defaults</b>	xx Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.

**Description** The TS command returns the positioner error and the current controller state.

**Returns** The TS command returns six characters (1TSabcdef). The first 4 characters (abcd) represent the positioner error in Hexadecimal. The last two characters (ef) represent the controller state.

**Error code (abcd):** Convert each hexadecimal to a binary:

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
1111	1110	1101	1100	1011	1010	1001	1000	0111	0110	0101	0100	0011	0010	0001	0000

E  
Each bit represents one possible error:

A				B				C				D			
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
• Not used	• Not used	• Not used	• Not used	• Not used	• Not used	• Not used	• Not used	• Default parameters	• Not used	• Not used	• Not used	• Not used	• Not used	• Not used	• Not used

Examples:

- Error map 0080 = Controller is using default parameters

**Controller states (ef):**

- 10: READY with default parameters.
- 14: CONFIGURATION.
- 32: READY

**NOTES**

**THE ERROR BUFFER GETS UPDATED PERIODICALLY, APPROX. EVERY 1 MS.**

**THE TS COMMAND READS THE ERROR BUFFER AND CLEARS THE ERROR BUFFER AT THE SAME TIME (SAME AS FOR COMMANDS TE, TB). SO WHEN LAUNCHING THE TS COMMAND, IT IS IMPORTANT TO PROCESS THE TS FEEDBACK ACCORDINGLY.**

**THE ERROR “DEFAULT PARAMETERS” GETS ONLY DETECTED DURING THE BOOTING OF THE CONTROLLER. WHEN READ THE ERROR IS CLEARED.**

**With no errors in the error buffer the color of the LED will change from red to either green or orange depending on the controller state.**

<b>Errors</b>	A	—	Unknown message code or floating point controller address.
	B	—	Controller address not correct.
<b>Rel. Commands</b>	<b>TE</b>	—	Get last error.
<b>Example</b>	1TS		<i>Get error and state of controller #1.</i>
	ITS000032		<i>Controller returns, no errors and READY.</i>

## VE — Get controller revision information

Usage	Ready	Config.
	●	●
<b>Syntax</b>	xxVE	
<b>Parameters</b>		
<b>Description</b>	xx [int]	— Controller address.
	nn [string]	— Action.
<b>Range</b>	xx	— 1 to 31
<b>Units</b>	xx	— None.
<b>Defaults</b>	xx Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	This command returns the controller's revision information.	
<b>Errors</b>	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
<b>Example</b>	1VE	<i>Get controller #1 revision information.</i>
	<i>1VE CONEX-IOD revision 1.0.0   Controller returns revision number</i>	

## ZT — Get current configuration parameters

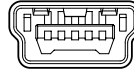
Usage	Ready	Config.
	●	●
<b>Syntax</b>	xxZT	
<b>Parameters</b>		
<b>Description</b>	xx [int]	— Controller address.
<b>Range</b>	xx	— 1 to 31
<b>Units</b>	xx	— None.
<b>Defaults</b>	xx Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
<b>Description</b>	The ZT command returns the list of all current configuration parameters. For analog inputs and outputs, the values return for the offset and gain are the ones of the current input and outputs modes	
<b>Errors</b>	A	— Unknown message code or floating point controller address
	B	— Controller address not correct
<b>Rel. Commands</b>	TE	— Get error code.
<b>Example</b>	1ZT	<i>Get controller #1 configuration data.</i>
	1PW1	
	1CO21	
	1OA0.021	
	1GA1.013	
	...	
	1SB8	
	1PW0	



## 3.0 Controller Interfaces

### 3.1 Mini-USB (Male) Connector Pinout

1 2 3 4 5



USB  
MATING CONNECTOR:  
PLUG MINI-USB B 5 CTS

PIN	DESCRIPTION
1	+5 VDC IN DO NOT CONNECT IF COMM CONNECTOR IS USED
2	DATA-
3	DATA+
4	N.C.
5	GND

## 4.0 Calibration

To improve the precision of both analog inputs and outputs, a calibration of offset and gain for each input and each mode can be done. The following table can be used to archive measured values. However, setting those offsets and gains in the controller while in CONFIGURATION state will save them into the controller's memory and will then be applied on each start up.

Mode	Analog out 1	Analog out 2
±10 V bipolar <b>CO11</b>	(OA) Offset : ... (GA) Gain : ...	(OB) Offset : ... (GB) Gain : ...
0–10 V unipolar <b>CO22</b>	(OA) Offset : ... (GA) Gain : ...	(OB) Offset : ... (GB) Gain : ...

Mode	Analog in 1	Analog in 2
±10 V bipolar <b>CI11</b>	(IX) Offset : ... (PX) Gain : ...	(IY) Offset : ... (PY) Gain : ...
0–10 V unipolar <b>CI22</b>	(IX) Offset : ... (PX) Gain : ...	(IY) Offset : ... (PY) Gain : ...
±1 V bipolar <b>CI33</b>	(IX) Offset : ... (PX) Gain : ...	(IY) Offset : ... (PY) Gain : ...
0–1 V unipolar <b>CI44</b>	(IX) Offset : ... (PX) Gain : ...	(IY) Offset : ... (PY) Gain : ...





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