



User Manual

LucidControl DO4/DO8

4/8 Channel Digital Output USB Module

1 Introduction

This document describes the functionality of the LucidControl DO4/DO8 USB module providing 4 digital outputs controllable via Universal Serial Bus.

A general description of the complete LucidControl product family can be found in the document *LucidControl User Manual*.

This document explains the topics that are specific to the DO4/DO8 module.

2 Setup and Installation

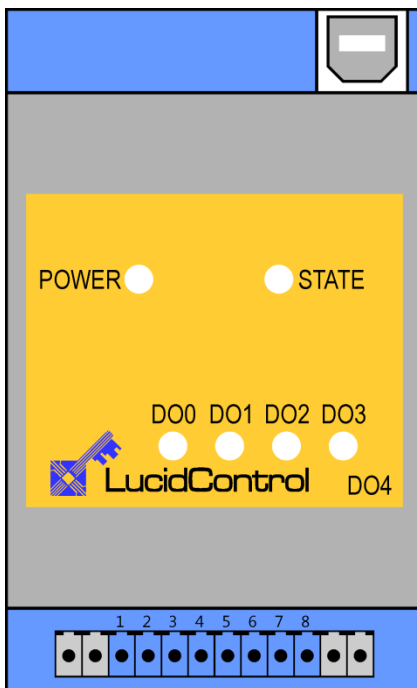


Fig. 1 Digital Output Module DO4

Fig. 1 shows the sketch of the Digital Output DO4 module with 4 digital outputs channels (DO0 to DO3).

DO4 modules are available in different configurations (see 2.1) and because of this the IO Connector may have different pinouts.

The DO4-I configuration has 4 solid state relays (IO1 to IO8).

The DO-S configuration has a 12 way connector including the 4 gray highlighted IOs. Enumeration from left to right: IO1 to IO12.

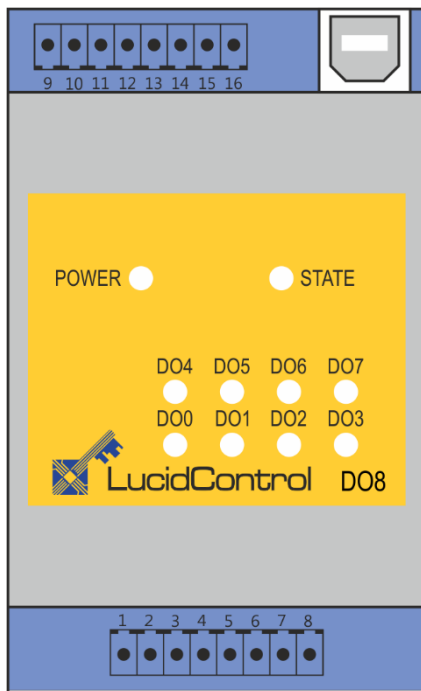


Fig. 2 Digital Output Module DO8-I

Fig. 2 shows the Digital Output DO8-I module 8 solid state relays.

The IO channels are split into the lower and the upper IO connectors.

The lower IO connector (IO1 to IO8) provides terminals for the channels DO0 to DO3.

The upper IO connector (IO9 to IO16) is available on the DO8 module only. It provides terminals for the channels DO8 to DO7.

The intended use of the digital output module is switching of digital output and analog and digital signal lines. The module must only be used for the intended use.



For the digital output module it is explicitly stated that no potential of more than 30V must be applied to any connector of the module. The modules must only be used within the specified conditions.

2.1 Configurations

In order to fit most applications three different configurations of the DO4 module are available which are described in the following.

2.1.1 4 Solid State Relay Outputs (DO4-I/DO8-I)

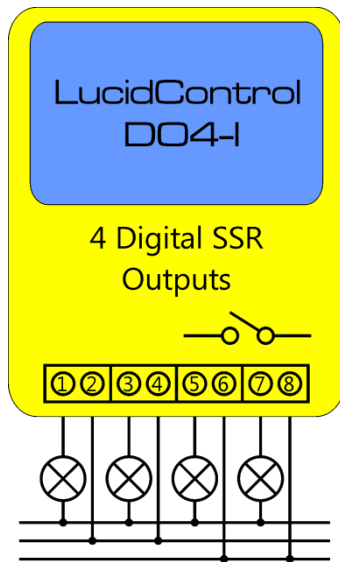


Fig. 3 DO4-I Module with Solid State Relays

Fig. 3 shows the DO4-I/DO8-I module which is recommended for standard applications. The module can control lamps as well as pumps and it can be used to generate general purpose opto-insulated and potential-free digital outputs.

The employed solid state relays (SSR) are perfect to generate pulse-width-modulation (PWM) which allows e.g. controlling the power of a pump by switching power on and off periodically.

Despite to mechanical relays SSR are not limited in switching cycles and are suited for periodical switching as well as for static switching.

A detailed description of solid state relay outputs can be found in section 2.2.2.1.

2.1.2 4 Open Collector Transistor Outputs (DO4-O)

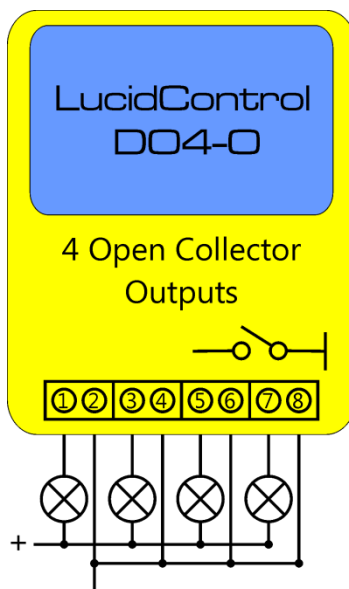


Fig. 4 DO4-O Open Collector Module

While DO4-I modules are preferable for many applications because of their opto-insulation they are limited in switching timing.

The DO4-O module shown in Fig. 4 is similar to the DO4-I module but uses transistors instead of solid state relays which allow faster switching cycle times.

A detailed description of open-collector outputs can be found in section 2.2.2.2.

2.1.3 4 Mechanical Relay SPDT Outputs (DO4-S)

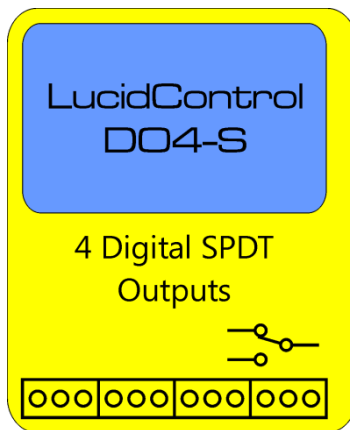


Fig. 5 DO4-S Module with relays

The DO4-S module uses 4 mechanical “single pole double throw” (SPDT) relays. This relays have the advantage of behaving like mechanical switches closing a circuit. This allows not only switching of electrical power but also switching of measurement signals e.g. from a temperature sensor which would be distorted by using solid state relays.

An additional advantage of the DO4-S module is that it can toggle between two signals.

The DO4-S module should not be considered for periodical switching (e.g. PWM) since the relays are limited in number of switching cycles. Because of this the DO4-S module does not support the Duty-Cycle Mode (see 3.1.2).

A detailed description of SPDT outputs can be found in section 2.2.2.3.

2.2 Interface and Interconnection

2.2.1 USB Connection

LucidControl USB modules are connected to the computer by using a standard USB cable, which must not extend a length of 5 m. They are “bus powered” which means that the host computer supplies the module with power.

The DO4-S module is rated with a maximum current of 250mA.

All other DO4/DO8 modules are rated with a maximum current of 50mA.

Note

Please consider that the total power of one USB port is limited to 500 mA.

Note

Using an active USB-Hub with its own power supply allows the connection of additional devices in the case that the host is not able to supply them.

2.2.2 IO Connection

2.2.2.1 DO4-I/DO8-I (SSR)

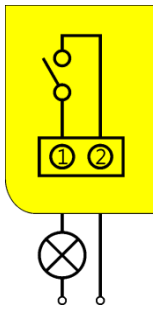


Fig. 6 SSR Output

Fig. 6 shows the connection of the first of the four solid state relay (SSR) outputs as they are used in the DO4-I/DO8-I module.

When the output is activated the SSR connects terminal 1 with terminal 2, closing the circuit and switching the lamp in the depicted application on.

For the DO4-I/DO8-I module the polarity of the signal does not play a role. The positive polarity can be connected to either terminal 1 or terminal 2.

One characteristic of the SSR output is the opto-insulation protecting the electronic behind the SSR (e.g. the host computer). Moreover the outputs are potential-free i.e. the terminals 1 and 2 are not related to the terminals of any other output.

The outputs connected to the terminals 3/4, 5/6 and 7/8 (and 9/10, 11/12, 13/14, 15/16) are identical to 1/2 and each is able to switch 0,75A / 30V DC.



The outputs are not protected against overcurrent. It must be ensured that the current does not extend I_{SSRMax} . Otherwise the output may be damaged.

The DO4-I/DO8-I module supports the Reflect Mode, Duty-Cycle Mode and On-Off Mode.

For Duty-Cycle and On-Off Modes the minimum on and off times are limited to T_{SSRMin} .

2.2.2.2 DO4-O (OC)

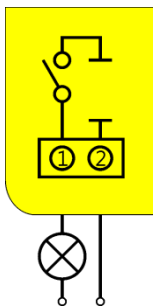


Fig. 7 Open Collector Output

Fig. 7 shows the connection of the first of the four open collector (OC) outputs of the DO4-O module.

When the output is activated the transistor connects terminal 1 with ground and switches the lamp of this application on.

The outputs are not opto-isolated and not potential-free and it is important that the positive polarity is connected to the terminals 1, 3, 5 or 7. The terminals 2, 4, 6 and 8 are internally connected to ground which means that all Outputs are connected to the same ground namely the ground of the host computer.

Due to this characteristic it is possible to switch the outputs much faster on and off.

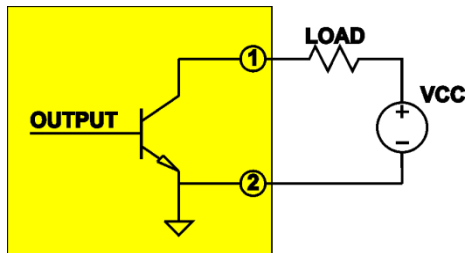


Fig. 8 Open Collector Principle

The principle of open collector outputs is shown in Fig. 8. While solid state relays create a connection between two terminals of the IO-Connector (e.g. 1 and 2) an open collector output connects one terminal (e.g. 1) to ground.

In this application an external power supply VCC and an external load are connected to terminal 1 and 2 of an output. The negative Terminal of the power supply VCC must be connected to the terminal 2 (resp. 4, 6 or 8) of the DO4-O module. The load must be connected to terminal 1 (resp. 3, 5 or 7) of the DO4-O module.

If the physical output is set, the transistor is switched on, connecting terminal 1 to ground.

The biggest advantage of Open Collector outputs is the very fast switching time. DO4-O modules are best suited for applications where fast switching is required e.g. switching or dimming of lamps especially LEDs with PWM cycles of 100 Hz or faster.

Note:

As Fig. 8 shows the output is not floating, but it is connected to internal ground. In contrast to solid state relays it must be considered that there is one common ground for all outputs.



The output is not protected against overcurrent. It must be ensured that the current does not extend I_{OCMax} . Otherwise the output may be damaged.



The output is not protected against wrong polarization of the input voltages. Connecting a negative voltage to a positive output pin may damage the output.

The DO4-O module supports Reflect Mode, Duty-Cycle Mode and On-Off Mode.

For Duty Cycle and On-Off Modes the minimum on and off times are limited to T_{OCMin} .

2.2.2.3 DO4-S (SPDT)

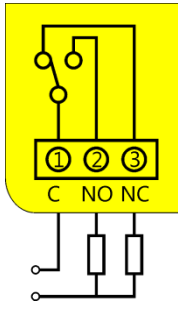


Fig. 9 Relay Output

Fig. 9 shows the connection of the first of the four single pole rouble throw (SPDT) relay outputs with its terminals 1, 2 and 3. The DO4-S module has 12 IO terminals instead of 8.

In the example the common contact "C" can be toggled between two resistors. While the output is deactivated the contact "C" is connected to the contact "NC" (Normally Close). When the output is activated the Contact "C" is connected to the contact "NO" (Normally Open).

The terminals 1/4/7/10, 2/5/8/11 and 3/6/9/12 are identical.

All outputs of the DO4-S modules are galvanically-insulated and potential-insulated and therefore can be seen as separate units without interference.

The polarity can be disregarded i.e. it does not play a role which IO is connected to positive or negative polarity.

If an output is cleared it disconnects the C contact from the NO contact and connects it with the NC contact. This behavior is called "single pole double throw" (SPDT) and allows the selection of two different signals (toggling).

Fig. 5 shows that the IO-Connector of the module has not 8 but 12 terminals.



The output is not protected against overcurrent. It must be ensured that the current does not extend $I_{SPDTMax}$. Otherwise the output may be damaged.

The DO4-S module supports Reflect Mode and On-Off Mode only. Because of limited number of switching Duty-Cycle Mode is not supported.

For On-Off Mode the minimum on and off times are limited to T_{SSRMin} .

2.2.3 Isolation of USB Interface (-ISO option)

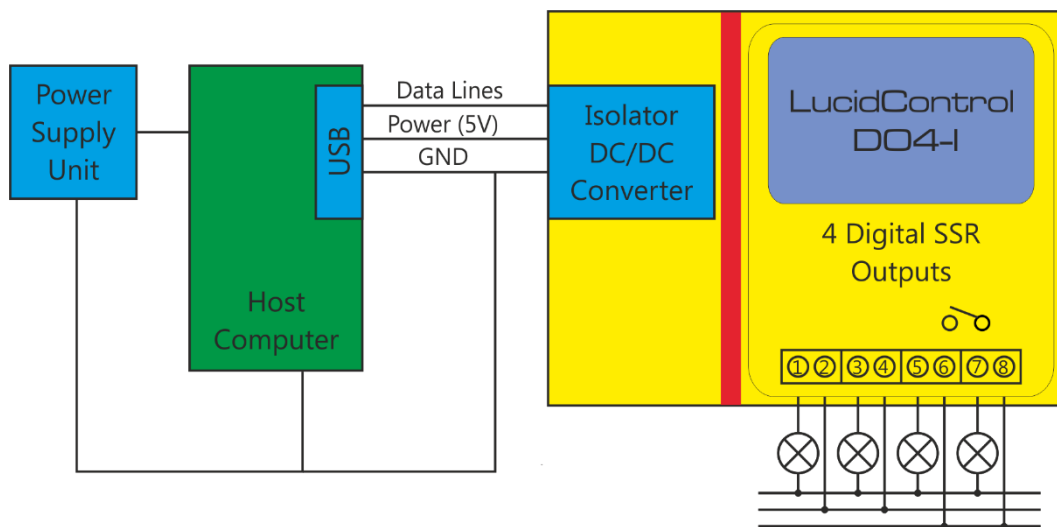


Fig. 10 DO4-I Module with isolated USB Interface

DO4 and DO8 modules are optionally available with isolated USB interface (-ISO option) Fig. 10 shows the DO4-I module with isolated USB interface.

The isolation consists of a galvanic barrier (red area) that isolates the IO module entirely from the USB data lines and power supply lines. An isolated DC/DC converter separates the power supply.

The main purpose of the isolated LucidControl module is the separation of the IO module from the data processing equipment (e.g. the host computer). Non-Isolated IO modules are conductive connected to the USB port also sharing a common ground line.

Harsh or noisy environments (e.g. with disturbances or long cables) may cause measurement errors or malfunction of the data processing equipment or the IO module caused by ground loops. This can be solved by the isolation of the USB port.

Another aspect is the protection of the data processing equipment from overvoltage. If for example a voltage above the limits of the module is applied to the terminals this can damage the module and the data processing equipment also.

The isolation limits the possible damage to the IO module itself.

USB isolation can be an option if a higher protection level required or if LucidControl IO modules are operating in harsh environments.



Even when the isolation protects the data processing equipment from overvoltage damage it does not protect from voltages > 50V!

Note:

All outputs of the DO4-I/DO8-I module are isolated by an opto-coupler.

2.3 Setup of Hard- and Software

Setting up LucidControl hardware is very easy:

- 1 Ensure that no signal is applied to the IO Connector
- 2 Connect LucidControl via USB with the computer
- 3 Applies for Microsoft Windows older than Windows 10 only: The system asks for an installation file. This is not a driver but only an information file (INF). The file can be downloaded from our website www.lucid-control.com/downloads

That's all. LucidControl switches the green power LED on and the module is ready for usage.

2.3.1 Windows

As mentioned the installation under Microsoft Windows (older than Windows 10) requires the information file.

After finished installation the Windows Device Manager contains a new serial port (COM). The module can be accessed using this port.

Note

Even if more than one module is connected to a computer Windows ensures that the same serial port number is assigned to the module(s) after restart.

2.3.2 Linux

Despite to Windows installation under Linux the module is usable immediately after connection without any additional steps. Linux installs /dev/ttyACM devices for any module connected to the computer.

Note

By default Linux cannot ensure that the same /dev/ttyACM device is assigned to the same module on restart. But as long as only one module is connected to the computer it is ensured that it is accessible via /dev/ttyACM0.

This problem can be solved by the LucidIoCtrl command line tool which can create static devices always pointing to a specific module. Moreover the device can be given useful names e.g. dev/digitalIoKitchen.

2.3.3 Get command line LucidIoCtrl

LucidIoCtrl command line tool can be downloaded from our website:

www.lucid-control.com/downloads

This page provides the command line tool LucidIoCtrl for different architectures.

After downloading the program can be stored in a folder of choice.

Please see the section 3 of the general LucidControl User Manual for more information about this helpful tool.

2.3.4 Ready for Take-Off

After the module was installed successfully (if it was necessary at all) the green Power LED is switched on signaling that the module is ready for use.

Since the module was preconfigured for standard input mode, it can be used without further configuration. The following examples demonstrate the functionality of the module by using the LucidIoCtrl command line tool.

Windows Examples

For all examples it is assumed that the module is connected to COM1.

Setting output channel number 0 to "1"

```
LucidIoCtrl -dCOM1 -tL -c0 -w1 [ENTER]
```

Resetting output channel number 0 to "0"

```
LucidIoCtrl -dCOM1 -tL -c0 -w0 [ENTER]
```

Reading the outputs of all 4 channels back

```
LucidIoCtrl -dCOM1 -tL -c0,1,2,3 -r [ENTER]
-> CH0:00 CH1:00 CH2:00 CH3:00
```

Linux Examples:

For all examples it is assumed that the module is connected to /dev/ttyACM0.

Setting output channel number 0 to "1"

```
LucidIoCtrl -d/dev/ttyACM0 -tL -c0 -w1 [ENTER]
```

Resetting output channel number 0 to "0"

```
LucidIoCtrl -d/dev/ttyACM0 -tL -c0 -w0 [ENTER]
```

Reading the outputs of all 4 channels back

```
LucidIoCtrl -d/dev/ttyACM0 -tL -c0,1,2,3 -r [ENTER]
```

-> CH0:00 CH1:00 CH2:00 CH3:00

3 Module Operation

3.1 Operation Modes

This section describes the operation of the different output modes and gives examples how the outputs can be controlled.

Each of the outputs of the module can work in one of the following modes:

- Reflect Mode
- Duty-Cycle Mode
- On-Off Mode

Physical output value inversion:

Digital outputs distinguish between physical and logical state. The logical state is the current internal state of the output which can be "0" (cleared) or "1" (set). The logical state is calculated by the output handling and is normally identical to the physical output state.

Normally, setting the logical output state to "1" sets the physical output state to "1" which results in an output being enabled.

In the case that the output inversion is activated by setting *outDiInverted* to "on" the logical and physical states are inverted which means that the physical output is inverted in relation to the logical output value. Setting the logical output to "1" clears the physical output state to "0" which results in an output being disabled.

All output modes support inversion of physical state.

3.1.1 Reflect Mode

Reflect Mode is the most simple output mode and links the value written to an output with the physical output directly.

Writing "1" to the output causes the output being set immediately.

Writing "0" to the output causes the output being cleared immediately.

By setting and clearing outputs in Reflect Mode any pattern of the output signal can be generated, but the timing is limited by the communication protocol and the host computer.

This means e.g. that switching an output on and off every 1ms would need 1000 commands per second. This is not realistic because common operating systems do not

allow such a fast timing. Moreover the communication (e.g. via USB) takes some time. Altogether this would lead into an inaccurate and non-deterministic timing of the signal.

Duty-Cycle Mode and On-Off Mode prevent this by implementing the critical timing in the module.

LucidIoCtrl Command Line Tool Example

Configure output channel 0 for Reflect mode

```
LucidIoCtrl -dCOM4 -c0 -soutDiMode=reflect [ENTER]
```

Set output channel 0 to "1"

```
LucidIoCtrl -dCOM4 -c0 -tL -w1 [ENTER]
```

... and Set the channel 0 back to "0"

```
LucidIoCtrl -dCOM4 -c0 -tL -w0 [ENTER]
```

3.1.2 Duty-Cycle Mode and PWM

In Duty-Cycle Mode the module switches outputs on and off in a periodical sequence which is also referred to as PWM (pulse-width-modulation).

By switching an output on and off periodically it is e.g. possible to control the power consumed by a device and can be used for e.g. controlling the power of a pump or a heating element. By adding a temperature sensor connected to a LucidControl RI4 module a temperature control loop can be realized.

Switching a lamp or a LED very fast ($T_{\text{Cycle}} < 10 \text{ ms}$) allows the dimming of them very easily.

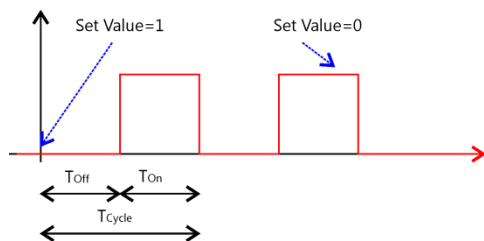


Fig. 11 Duty-Cycle Mode

Fig. 11 shows the typical periodical signal generated in Duty-Cycle Mode.

Setting the output value to "1" starts the processing of output handling until the output value is set to "0" which ends the processing after finishing the running cycle.

The timing of the generated signal is configured by two parameters:

- T_{Cycle} defines the cycle time (period) of the signal and can be configured by the IO Configuration Parameter *outDiCycleTime*.
- The IO Configuration Parameter *outDiDutyCycle* defines the relation of the on-time T_{on} and the off-time T_{off}

- On-time equals to
$$T_{\text{on}} = \frac{T_{\text{Cycle}}}{1000} * \text{DutyCycle}$$

- Off-time equals to $T_{Off} = T_{Cycle} - \frac{T_{Cycle}}{1000} * DutyCycle$

The resolution of the generated signal is $\frac{T_{Cycle}}{1000}$ which means that on-time and off-time have a resolution of 1 ‰.

Changing the Configuration Parameters *outDiCycleTime* or *outDiDutyCycle* while processing of the Duty-Cycle outputs is running updates the values immediately.

Physical Output Value Inversion:

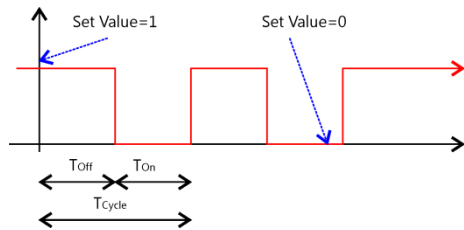


Fig. 12 Duty-Cycle Mode Output Inversion

Fig. 12 shows the physical output state of the example above in the case that physical output inversion is activated by setting the IO Configuration Parameter *outDiInverted* to "on".

While the processing of the outputs of both examples is identical, the figure shows the inverted physical output.

Cancelation of On-Phase:

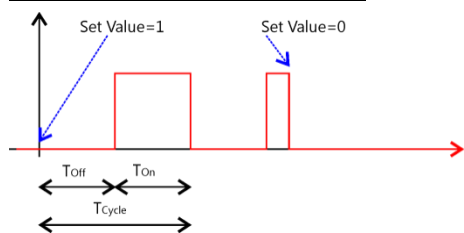


Fig. 13 Duty-Cycle Mode Cancel On-Phase

In the examples above setting the output value to "0" causes the end of the Duty-Cycle processing.

As long as the logic output is "0" value the running cycle can be interrupted immediately by setting the logic value to "0". But in the case that the logic output value is "1" the processing can earliest stop after the on-state has finished as shown in Fig. 11.

Fig. 13 shows the behavior of the output if the IO Configuration Parameter *outDiCanCancel* is set to "on". This allows stopping the logic on-phase immediately returning to "0" when the output processing is stopped by setting the output value to "0".

Updating of Parameters

While output processing is running the IO Configuration Parameters *outDiCycleTime* and *outDiDutyCycle* can be updated at any time. The changed values will be used immediately i.e. for the running cycle also.

Note:

Mechanical relays have a limited switching capability of approx. 1.000.000 on-off cycles. Because of this the Duty-Cycle Mode is not available for DO4-S module.

LucidIoCtrl Command Line Tool Example

Configure output channel 0 for Duty-Cycle mode

```
LucidIoCtrl -dCOM4 -c0 -soutDiMode=dutyCycle [ENTER]
```

Start processing of PWM signal for output channel 0

```
LucidIoCtrl -dCOM4 -c0 -tT -w1 [ENTER]
```

Since the module was preconfigured with $T_{\text{Cycle}} = 1$ s and $\text{DutyCycle} = 50\%$ the output is switched 500 ms to "1" and 500 ms to "0"

Changing T_{Cycle} to 2 s

```
LucidIoCtrl -dCOM4 -c0 -soutCycleTime=2000000 [ENTER]
```

The output is now 1 s switched on and 1 s switched of

Increase $\text{DutyCycle} = 75\%$

```
LucidIoCtrl -dCOM4 -c0 -soutDutyCycle=750 [ENTER]
```

... and disable processing of output channel 0

```
LucidIoCtrl -dCOM4 -c0 -tT -w0 [ENTER]
```

3.1.3 On-Off Mode

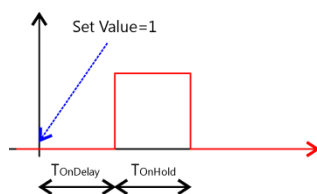


Fig. 14 On-Off Mode

In On-Off Mode the output generates a one-time sequence pattern shown in Fig. 14.

By using On-Off Mode time controlled switching functions (e.g. used in timing relays) can be realized.

Setting the logic value of the output to "1" starts processing of the output handling by starting the T_{OnDelay} interval. After T_{OnDelay} has passed the logic output value changes to "1" and T_{OnHold} interval starts. After T_{OnHold} time has passed the logic value returns to initial "0" state and the sequence finishes.

In On-Off Mode the following two IO Configuration Parameters are relevant for timing configuration:

- Time T_{OnDelay} is specified by the parameter *outDiOnDelay*
- Time T_{OnHold} is specified by the parameter *outDiOnHold*

Physical Output Value Inversion:

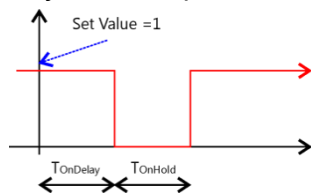


Fig. 15 On-Off Mode Output Inversion

Fig. 15 shows the inverted physical output value of the example above in the case that physical output inversion is activated by setting the IO Configuration Parameter *outDiInverted* to "on".

Cancellation of On-Phase:

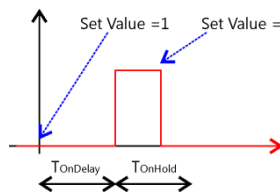


Fig. 16 On-Off Mode Cancel On Phase

Fig. 16 shows the behavior of the output value in the case that IO Configuration Parameter *outDiCanCancel* is set to "on" and the logical output value is set to "0" before T_{OnHold} has passed.

While in the previous Figures the on-phase finishes after T_{OnHold} has passed *outDiCanCancel* allows canceling the on-phase immediately by setting the output value to "0".

Retrigger of On-Phase:

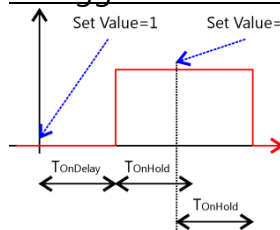


Fig. 17 On-Off Mode Retrigger

Fig. 17 shows the output timing sequence with IO Configuration Parameter *outDiCanRetrigger* set to "on".

This setting allows retriggering the on-phase before the logical output returns to initial "0" value.

Setting the logical output value to "1" before T_{OnHold} has passed restarts the T_{OnHold} interval again.

Note:

It is save to combine IO Configuration Parameters *outDiCanRetrigger*="on" and *outDiCanCancel*="on". This allows retriggering of on-phase as well as on-phase cancelation.

LucidIoCtrl Command Line Tool Example

Configure output channel 0 for On-Off mode

```
LucidIoCtrl -dCOM4 -c0 -soutDiMode=onOff [ENTER]
```

Since the module was preconfigured with $T_{OnDelay} = 1$ s and $T_{OnHold} = 1$ after writing a "1" to output value of channel 0 will set the output after 1 s for 1 sec returning to "0" finally.

Start processing of output channel 0

```
LucidIoCtrl -dCOM4 -c0 -tT -w1 [ENTER]
```

3.2 Timing Limits

The module uses high resolution hardware timers when Duty-Cycle Mode or On-Off Mode is active.

The different output types of the module make it necessary to limit the timing resolution t_{Res} which is shown in Tab. 1.

Module	Timing resolution (t_{Res})
DO4-I DO8-I	10 ms
DO4-O	0.1 ms
DO4-S	100 ms

Tab. 1 Timing Resolution

The timing resolution defines the minimum interval for a single on-phase or off-phase of the output. If a specified or calculated on-time or off-time is lower than t_{Res} the void phase is skipped.

Example:

The output 0 of DO4-S module is configured for mode Duty-Cycle with $T_{Cycle}=1$ s (1.000.000 μ s) and a DutyCycle of 50%.

The resulting times are $T_{On}=50$ ms and $T_{Off}=950$ ms. Since T_{On} violates the t_{Res} constraint requesting more than 100 ms as minimum interval the on-phase of the output is skipped, causing the output staying low permanently.

Maximum timing interval

T_{Cycle} , $T_{OnDelay}$ and T_{OnHold} have a common maximum limit of 3.600.000 μ s (1 hour) for all modules.

3.3 Commands

After an output was set up correctly and configured it is possible to set the output value or to read back its state.

Accessing inputs and outputs is a very common task which is mostly identical for all Lucid Control modules. Please refer to the section 3.2.1.1, 3.2.1.2 and 4.3 of the general LucidControl manual for comprehensive information covering reading and writing of inputs and outputs in general.

The following sections describe in detail the commands which are supported by the DO4/DO8 module.

3.3.1 SetIo

This command sets one output value.

Mode	Value
Reflect	Value reflects the logic state to the output
Duty-Cycle	Status of the Duty-Cycle Mode processing. "1" refers to enabled processing, "0" to disabled processing.
On-Off	Status of the On-Off Mode processing. "1" refers to enabled processing, "0" to disabled processing.

Tab. 2 Output Values

Command	SetIo	Access	Write
Opcode	0x40		
LucidIoControl Command Line Tool			
Call (-tL)	LucidIoCtrl -d[COMx] -c[Channel] -tL -w[Value]		

Note:

When using the LucidIoCtrl command line tool the distinction between the SetIo and SetIoGroup commands is not necessary since LucidIoCtrl command line tool handles this automatically.

LucidIoCtrl Command Line Tool Example

Set output channel 0 to "1":

```
LucidIoCtrl -dCOM4 -c0 -tL -w1 [ENTER]
```

Accordingly to Tab. 2 writing of "1" means to set the output in Reflect Mode. In Duty-Cycle and On-Off Mode writing of "1" means starting of output processing.

Request Frame

OPC	P1	P2	LEN	Data Field
0x40	Channel	Value Type	Length	Value

Value	Description					
Channel	Number of input or output channel (Range: 0 to 7)					
Value Type	Value Type					
	Supported Value Types					
	<table border="1"> <thead> <tr> <th>Value Type</th> <th>Value Range</th> <th>Length</th> </tr> </thead> <tbody> <tr> <td>Digital Logic Value (0x00)</td> <td>0x00 or 0x01</td> <td>1 Byte</td> </tr> </tbody> </table>	Value Type	Value Range	Length	Digital Logic Value (0x00)	0x00 or 0x01
Value Type	Value Range	Length				
Digital Logic Value (0x00)	0x00 or 0x01	1 Byte				
Length	Length of the Values in the Data Field					
Value	Values accordingly to the Value Type					

Tab. 3 SetIo Request

Response Frame

Status	Length
Status	0

The command does not return any data. In the case of an error the command returns Execution Status Code documented in section 4.4 of the LucidControl User Manual.

3.3.2 SetIoGroup

This command sets the output values of multiple outputs of the same type at once.

Command	SetIoGroup	Access	Write
Opcode	0x42		
LucidIoControl Command Line Tool			
Call (-tL)	LucidIoCtrl -d[COMx] -c[Channels] -tL -w[Values] <u>Channels:</u> Comma separated list of channels e.g. -c0,1,3 <u>Values:</u> Comma separated list of values to set e.g. -w1,1,0		

LucidIoCtrl Command Line Tool Example

Set output channel 0 to "1", output channel 2 to "1" and output channel 3 to "0":

```
LucidIoCtrl -dCOM4 -c0,2,3 -tL -w1,1,0 [ENTER]
```

Request Frame:

OPC	P1	P2	LEN	Data Field
0x40	Channel Mask	Value Type	Length	Values

Value	Description																											
Channel Mask	Channel Mask Specifies the output channels to access																											
	<table border="1"> <thead> <tr> <th>Channel</th> <th>Bit Position</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0x01</td> </tr> <tr> <td>1</td> <td>1</td> <td>0x02</td> </tr> <tr> <td>2</td> <td>2</td> <td>0x04</td> </tr> <tr> <td>3</td> <td>3</td> <td>0x08</td> </tr> <tr> <td>4</td> <td>4</td> <td>0x10</td> </tr> <tr> <td>5</td> <td>5</td> <td>0x20</td> </tr> <tr> <td>6</td> <td>6</td> <td>0x40</td> </tr> <tr> <td>7</td> <td>P1A 0</td> <td>P1=0x80 P1A = 0x01</td> </tr> </tbody> </table>	Channel	Bit Position	Value	0	0	0x01	1	1	0x02	2	2	0x04	3	3	0x08	4	4	0x10	5	5	0x20	6	6	0x40	7	P1A 0	P1=0x80 P1A = 0x01
	Channel	Bit Position	Value																									
	0	0	0x01																									
	1	1	0x02																									
	2	2	0x04																									
	3	3	0x08																									
	4	4	0x10																									
	5	5	0x20																									
	6	6	0x40																									
7	P1A 0	P1=0x80 P1A = 0x01																										
Values are bitwise or combined																												
Size of P1 is 1 or 2 bytes. If Bit 7 of P1 is set, a subsequent P1A is expected.																												
<u>Examples:</u>																												
Accessing channel numbers:																												
0 and 3 Value = 0x01 OR 0x08 = 0x09																												
1 and 2 Value = 0x02 OR 0x04 = 0x06																												
1, 2 and 7 Value P1 = 0x02 OR 0x04 = 0x86																												
Value P1A = 0x01 (for channel 7)																												
Value Type	Value Type Supported Value Types																											
	<table border="1"> <thead> <tr> <th>Value Type</th> <th>Value Range</th> <th>Length</th> </tr> </thead> <tbody> <tr> <td>Digital Logic Value (0x00)</td> <td>0x00 oder 0x01</td> <td>1 Byte</td> </tr> </tbody> </table>	Value Type	Value Range	Length	Digital Logic Value (0x00)	0x00 oder 0x01	1 Byte																					
Value Type	Value Range	Length																										
Digital Logic Value (0x00)	0x00 oder 0x01	1 Byte																										
Length	Length of the Values in the Data Field (One Value for each channel)																											
Values	One or more values to set in ascending channel order																											

Tab. 4 SetIoGroup Request

Response Frame

Status	Length
Status	0

The command does not return any data. In the case of an error the command returns Execution Status Code documented in section 4.4 of the LucidControl User Manual.

Example of SetIoGroup

The following request frame sets:

- outputs 0 to "1"; output 1 to "1" and output 3 to "0"

Request Frame

OPC	P1	P2	LEN	Data Field		
0x42	0x0B	0x00	0x03	Byte		
				0	1	2
				0x01	0x01	0x00

Channel Mask for Param1: 0x01 OR 0x02 OR 0x08 = 0x0B
 Output Values in Data Field are sorted: Channel 0, Channel 1, Channel3

Response Frame:

Status	Length
0x00	0x00

3.3.3 GetIo

This command reads the value or state of a digital output.

Command	GetIo	Access	Read
Opcode	0x46		
LucidIoControl Command Line Tool			
Call (-tL)	LucidIoCtrl -d[COMx] -c[Channel] -tL -r		
Return	CHn:LL		
	n	Input Channel	
	LL	Input Digital Value	

Note

When using the LucidIoCtrl command line tool the distinction between GetIo and GetIoGroup commands is not necessary since the program handles this automatically.

LucidIoCtrl Command Line Tool Example

Read output channel 0:

```
LucidIoCtrl -dCOM4 -c0 -tL -r [ENTER]
-> CH0:01
```

Request Frame

OPC	P1	P2	LEN
0x46	Channel	Value Type	0

Value	Description		
Channel	Number of input or output channel (Range: 0 to 3)		
Value Type	Supported Value Types		
	Value Type	Value Range	Response Len
	Digital Logic Value (0x00)	0x00 oder 0x01	1 Byte

Tab. 5 GetIo Request

Response Frame:

In case of successful execution the command returns the value of the specified channel number.

Status	LEN	Data Field
Status	Length	Value

In the case of an error, the command returns Execution Status Code documented in section 4.4 of the LucidControl User Manual.

3.3.4 GetIoGroup

This command reads the logic output values of a group of outputs of the same Value Type. See also section 3.3.3.

Command	GetIoGroup	Access	Read				
Opcode	0x48						
LucidIoControl Command Line Tool							
Call (-tL)	LucidIoCtrl -d[COMx] -c[Channels] -tL -r <u>Channels:</u> Comma separated list of channels e.g. -c0,1,3						
Return	List of values sorted from lower to higher channels CHn:LL <table border="1"> <tr> <td>n</td> <td>Input Channel</td> </tr> <tr> <td>LL</td> <td>Input Digital Value</td> </tr> </table>			n	Input Channel	LL	Input Digital Value
n	Input Channel						
LL	Input Digital Value						

LucidIoCtrl Command Line Tool Example

Read output values of channel 0, 1 and 3:

```

  LucidIoCtrl -dCOM4 -c0,1,3 -tL -r [ENTER]
-> CH0:00 CH1:01 CH3:01

```

Request Frame

OPC	P1	P2	LEN
0x48	Channel Mask	Value Type	0

Value	Description																											
Channel Mask	Channel Mask Specifies the output channels to access <table border="1" data-bbox="379 320 1031 752"> <thead> <tr> <th>Channel</th> <th>Bit Position</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0x01</td> </tr> <tr> <td>1</td> <td>1</td> <td>0x02</td> </tr> <tr> <td>2</td> <td>2</td> <td>0x04</td> </tr> <tr> <td>3</td> <td>3</td> <td>0x08</td> </tr> <tr> <td>4</td> <td>4</td> <td>0x10</td> </tr> <tr> <td>5</td> <td>5</td> <td>0x20</td> </tr> <tr> <td>6</td> <td>6</td> <td>0x40</td> </tr> <tr> <td>7</td> <td>P1A 0</td> <td>P1=0x80 P1A = 0x01</td> </tr> </tbody> </table>	Channel	Bit Position	Value	0	0	0x01	1	1	0x02	2	2	0x04	3	3	0x08	4	4	0x10	5	5	0x20	6	6	0x40	7	P1A 0	P1=0x80 P1A = 0x01
	Channel	Bit Position	Value																									
0	0	0x01																										
1	1	0x02																										
2	2	0x04																										
3	3	0x08																										
4	4	0x10																										
5	5	0x20																										
6	6	0x40																										
7	P1A 0	P1=0x80 P1A = 0x01																										
	Values are bitwise or combined Size of P1 is 1 or 2 bytes. If Bit 7 of P1 is set, a subsequent P1A is expected. <u>Examples:</u> Accessing channel numbers: 0 and 3 Value = 0x01 OR 0x08 = 0x09 1 and 2 Value = 0x02 OR 0x04 = 0x06 1, 2 and 7 Value P1 = 0x02 OR 0x04 = 0x86 Value P1A = 0x01 (for channel 7)																											
Value Type	Supported Value Types <table border="1" data-bbox="379 1211 1329 1346"> <thead> <tr> <th>Value Type</th> <th>Value Range</th> <th>Response Len</th> </tr> </thead> <tbody> <tr> <td>Digital Logic Value (0x00)</td> <td>0x00 oder 0x01</td> <td>1 Byte</td> </tr> </tbody> </table>	Value Type	Value Range	Response Len	Digital Logic Value (0x00)	0x00 oder 0x01	1 Byte																					
Value Type	Value Range	Response Len																										
Digital Logic Value (0x00)	0x00 oder 0x01	1 Byte																										

Tab. 6 GetIoGroup Request

Response Frame:

In case of successful execution the command returns the read values of the channels specified in the Channel Mask.

Status	LEN	Data Field
Status	Length	Value(s)

In the case of an error, the command returns Execution Status Code documented in section 4.4 of the LucidControl User Manual.

In the case of an error, the command returns Execution Status Code documented in section 4.4 of the LucidControl User Manual.

Example of GetIoGroup Request:

The following request frame reads outputs 0, 1 and 3

Opcode	P1	P2	Length
0x48	0x0B	0x00	0x00

Channel Mask (P1): $0x01 \text{ OR } 0x02 \text{ OR } 0x08 = 0x0B$

Response Frame:

For input 0 = "0", input 2 = "1" and input 3 = "1"

Values in Data Field are in ascending order Channel 0, Channel 1, Channel3.

Header Field		Data Field		
Status	LEN	Value Channel 0	Value Channel 1	Value Channel 3
0x00	0x03	0x00	0x01	0x01

3.4 Parameters

LucidControl modules allow configuration by a set of System Configuration Parameters and IO Configuration Parameters.

The Parameters are accessible by the commands SetParam and GetParam. The sections 4.3.5 and 4.3.6 of the LucidControl User Manual describe them in detail.

The relevance of some parameter may depend on the operation mode described in section 3.1.

3.4.1 outDiValue

This IO Configuration Parameter reflects the value or the state of the output (see Tab. 2).

In the case the output is in Reflect mode the *outDiValue* contains the logic value of the output.

In the case that the output is in Duty-Cycle or On-Off mode *outDiValue* contains "1" in the case that the output processing is running and "0" in the case that the output processing is stopped.

Parameter	outDiValue	Access	Read / Write
Address	0x1000		
Values	Output Value		
Default Value	0x00	Parameter Type	1 Byte unsigned
LucidIoControl Command Line Tool			
Parameter Name	outDiValue	Parameter Values	0x00 or 0x01
Call (Set)	LucidIoCtrl -d[COMx] -c[Channel] -soutDiValue=[Value] {-p} [--default]		
Call (Get)	LucidIoCtrl -d[COMx] -c[Channel] -goutDiValue		

LucidIoCtrl Command Line Tool Example

Set value of output channel 0 to "1" and make the setting persistent:

```
LucidIoCtrl -dCOM4 -c0 -soutDiValue=1 -p [ENTER]
```

Read value or state of output channel 0:

```
LucidIoCtrl -dCOM4 -c0 -goutDiValue [ENTER]
-> outDiValue=0
```

Note:

For normal operation it is recommended to use the functions SetIo (3.3.1) and GetIo (3.3.3) in order to write or read to an output.

Setting *outDiValue* allows to assign a persistent value by means that the output value is restored after the module is restarted.

3.4.2 outDiMode

This IO Configuration parameter configures the operation mode of the output.

Parameter	outDiMode	Access	Read / Write										
Address	0x1100												
Values	Output Mode												
	<table border="1"> <thead> <tr> <th>Byte</th> <th>Mode</th> </tr> </thead> <tbody> <tr> <td>0x00</td> <td>Inactive</td> </tr> <tr> <td>0x01</td> <td>Reflect</td> </tr> <tr> <td>0x08</td> <td>On-Off</td> </tr> <tr> <td>0x0A</td> <td>Duty-Cycle</td> </tr> </tbody> </table>			Byte	Mode	0x00	Inactive	0x01	Reflect	0x08	On-Off	0x0A	Duty-Cycle
Byte	Mode												
0x00	Inactive												
0x01	Reflect												
0x08	On-Off												
0x0A	Duty-Cycle												
Default Value	0x00	Parameter Type	1 Byte unsigned										
LucidIoControl Command Line Tool													
Parameter Name	outDiMode	Parameter Values	inactive / reflect / onOff / dutyCycle										
Call (Set)	LucidIoCtrl -d[COMx] -c[Channel] -soutDiMode=[Value] {-p} {--default}												
Call (Get)	LucidIoCtrl -d[COMx] -c[Channel] -goutDiMode												

LucidIoCtrl Command Line Tool Example

Set operation mode of channel 0 to Duty-Cycle Mode and make the setting persistent.

```
LucidIoCtrl -dCOM4 -c0 -soutDiMode=dutyCycle -p [ENTER]
```

Read the operation mode of channel 0

```
LucidIoCtrl -dCOM4 -c0 -goutDiMode [ENTER]
-> outDiMode=dutyCycle
```

3.4.3 Bit Parameter outDiFlags

This IO Configuration Parameter groups Bit Parameters which are represented by one bit (e.g. having an "on" or "off" state only).

Parameter	outDiFlags	Access	Read / Write
Address	0x1101		
Values	The "bit container" consists of the following parameters.		
	Bit Parameter	Bit Position	
	outDiCanRetrigger	Bit 0	
	outDiCanCancel	Bit 1	
	outDiInverted	Bit 2	
Default Value	0x00	Parameter Type	1 Byte unsigned

Note:

The parameter *outDiFlags* cannot be accessed by the Command Line Tool. The Bit Parameters should be used instead.

Note:

When *outDiFlags* is changed by the SetParam command which is described in section 4.3.5 of the LucidControl User Manual the current setting of *outDiFlags* must be read before updating it in order to prevent overwriting other Bit Parameters.

3.4.3.1 outDiInverted

This Bit Parameter configures the inversion of the physical output value.

See output modes descriptions in section 3.1 for more information.

Parameter	outDiFlags	Access	Read / Write
Address	0x1101	Bit Parameter outDiFlags	
Values	Bit Parameter	Bit Position	
	outDiInverted	Bit 2	
Default Value	Off	Parameter Type	1 Bit
LucidIoControl Command Line Tool			
Parameter Name	outDiInverted	Parameter Values	on / off
Call (Set)	LucidIoCtrl -d[COMx] -c[Channel] -soutDiInverted=[Value] {-p} [--default]		
Call (Get)	LucidIoCtrl -d[COMx] -c[Channel] -goutDiInverted		

LucidIoCtrl Command Line Tool Example

Enable inversion of physical output channel 0 and make the setting persistent.

```
LucidIoCtrl -dCOM4 -c0 -soutDiInverted=on -p [ENTER]
```

Read inversion configuration of physical output channel 0

```

    LucidIoCtrl -dCOM4 -c0 -goutDiInverted [ENTER]
-> outDiInverted=on

```

3.4.3.2 outDiCanCancel

This Bit Parameter configures the output on-phase cancelation.

See the output modes descriptions in section 3.1 for more information.

Parameter	outDiFlags	Access	Read / Write				
Address	0x1101	Bit Parameter outDiFlags					
Values	<table border="1"> <thead> <tr> <th>Bit Parameter</th> <th>Bit Postion</th> </tr> </thead> <tbody> <tr> <td>outDiCanCancel</td> <td>Bit 1</td> </tr> </tbody> </table>		Bit Parameter	Bit Postion	outDiCanCancel	Bit 1	
	Bit Parameter	Bit Postion					
outDiCanCancel	Bit 1						
Default Value	Off	Parameter Type	1 Bit				
LucidIoControl Command Line Tool							
Parameter Name	outDiCanCancel	Parameter Values	on / off				
Call (Set)	LucidIoCtrl -d[COMx] -c[Channel] -soutDiCanCancel=[Value] {-p} [--default]						
Call (Get)	LucidIoCtrl -d[COMx] -c[Channel] -goutDiCanCancel						

LucidIoCtrl Command Line Tool Example

Enable output cancelation output channel 0 and make the setting persistent.

```

    LucidIoCtrl -dCOM4 -c0 -soutDiCanCancel=on -p [ENTER]

```

Read configuration of output cancelation of output channel 0

```

    LucidIoCtrl -dCOM4 -c0 -goutDiCanCancel [ENTER]
-> outDiCanCancel=on

```

3.4.3.3 outDiCanRetrigger

This Bit Parameter configures the on-phase retrigger function of the output.

See the output modes descriptions in section 3.1 for more information.

Parameter	outDiFlags	Access	Read / Write
Address	0x1101	Bit Parameter outDiFlags	
Values	Bit Parameter		Bit Postion
	outDiCanRetrigger		Bit 0
Default Value	Off	Parameter Type	1 Bit
LucidIoControl Command Line Tool			
Parameter Name	outDiCanRetrigger	Parameter Values	on / off
Call (Set)	LucidIoCtrl -d[COMx] -c[Channel] -soutDiCanRetrigger=[Value] {-p} {--default}		
Call (Get)	LucidIoCtrl -d[COMx] -c[Channel] -goutDiCanRetrigger		

LucidIoCtrl Command Line Tool Example

Enable output retrigger of channel 0 and make the setting persistent.

```
LucidIoCtrl -dCOM4 -c0 -soutDiCanRetrigger=on -p [ENTER]
```

Read output retrigger configuration of output channel 0

```
LucidIoCtrl -dCOM4 -c0 -goutDiCanRetrigger [ENTER]
-> outDiCanRetrigger=on
```

3.4.4 outDiCycleTime

This IO Configuration Parameter specifies the cycle time T_{Cycle} of an output in Duty-Cycle Mode.

Parameter	outDiCycleTime	Access	Read / Write
Address	0x1110		
Values	T_{Cycle} in μs (micro seconds) $T_{\text{Res}} \leq T_{\text{Cycle}} \leq 1 \text{ h}$		
Default Value	1,000,000 (1 s)	Parameter Type	4 Bytes unsigned
LucidIoControl Command Line Tool			
Parameter Name	outDiCycleTime	Parameter Values	Time [μs]
Call (Set)	LucidIoCtrl -d[COMx] -c[Channel] -sinDiCycleTime=[Time] {-p} {--default}		
Call (Get)	LucidIoCtrl -d[COMx] -c[Channel] -ginDiCycleTime		

LucidIoCtrl Command Line Tool Example

Set T_{Cycle} of output channel 0 to 1.5 s and make the setting persistent.

```
LucidIoCtrl -dCOM4 -c0 -sinDiCycleTime=1500000 -p [ENTER]
```

Read T_{Cycle} parameter of output channel 0

```
LucidIoCtrl -dCOM4 -c0 -ginDiCycleTime [ENTER]
-> outDiCycleTime=1500000
```

Note:

Timing limits for T_{Res} (see 3.2) have to be considered.

3.4.5 outDiDutyCycle

This IO Configuration Parameter specifies the Duty-Cycle of an output in Duty-Cycle mode.

Parameter	outDiDutyCycle	Access	Read / Write
Address	0x1111		
Values	Duty Cycle in ‰ (1 / 1000)		
Default Value	500 (50%)	Parameter Type	2 Bytes unsigned
LucidIoControl Command Line Tool			
Parameter Name	outDiDutyCycle	Parameter Values	Duty Cycle [‰]
Call (Set)	LucidIoCtrl -d[COMx] -c[Channel] -soutDiDutyCycle=[Value] {-p} {--default}		
Call (Get)	LucidIoCtrl -d[COMx] -c[Channel] -goutDiDutyCycle		

LucidIoCtrl Command Line Tool Example

Set Duty Cycle of output channel 0 to 20% and make the setting persistent.

```
LucidIoCtrl -dCOM4 -c0 -soutDiDutyCycle=200 -p [ENTER]
```

Read Duty Cycle setting for output channel 0

```
LucidIoCtrl -dCOM4 -c0 -goutDiDutyCycle [ENTER]
outDiDutyCycle=200
```

Note:

Timing limits (see 3.2) have to be considered.

3.4.6 outDiOnDelay

This IO Configuration Parameter specifies the on-delay time $T_{OnDelay}$ of an output in On-Off Mode.

Parameter	outDiOnDelay	Access	Read / Write
Address	0x1112		
Values	$T_{OnDelay}$ in μ s (micro seconds) $T_{Res} \leq T_{OnDelay} \leq 1 \text{ h}$		
Default Value	1,000,000 (1 s)	Parameter Type	4 Bytes unsigned
LucidIoControl Command Line Tool			
Parameter Name	outDiOnDelay	Parameter Values	Time [μ s]
Call (Set)	LucidIoCtrl -d[COMx] -c[Channel] -soutDiOnDelay=[Time] {-p} {--default}		
Call (Get)	LucidIoCtrl -d[COMx] -c[Channel] -goutDiOnDelay		

LucidIoCtrl Command Line Tool Example

Set $T_{OnDelay}$ of output channel 0 to 520 ms and make the setting persistent.

```
LucidIoCtrl -dCOM4 -c0 -soutDiOnDelay=520000 -p [ENTER]
```

Read $T_{OnDelay}$ setting for output channel 0

```
LucidIoCtrl -dCOM4 -c0 -goutDiOnDelay [ENTER]
-> outDiOnDelay=520000
```

Note:

Timing limits (see 3.2) have to be considered.

3.4.7 outDiOnHold

This IO Configuration Parameter specifies the on-hold time T_{OnHold} of an output in On-Off Mode.

Parameter	outDiOnHold	Access	Read / Write
Address	0x1113		
Values	T_{OnHold} in μ s (micro seconds) $T_{Res} \leq T_{OnHold} \leq 1$ h		
Default Value	1,000,000 (1 s)	Parameter Type	4 Bytes unsigned
LucidIoControl Command Line Tool			
Parameter Name	outDiOnHold	Parameter Values	Time [μ s]
Call (Set)	LucidIoCtrl -d[COMx] -c[Channel] -soutDiOnHold=[Time] {-p} {--default}		
Call (Get)	LucidIoCtrl -d[COMx] -c[Channel] -goutDiOnHold		

LucidIoCtrl Command Line Tool Example

Set T_{OnHold} of output channel 0 to 1200 ms and make the setting persistent.

```
LucidIoCtrl -dCOM4 -c0 -soutDiOnHold=1200000 -p [ENTER]
```

Read T_{OnHold} setting of output channel 0

```
LucidIoCtrl -dCOM4 -c0 -goutDiOnHold [ENTER]
```

```
-> outDiOnHold=1200000
```

Note:

Timing limits (see 3.2) have to be considered.

4 Specification

Parameter		Condition	Value	
Outputs				
	No of Output Channels		4/8	
Outputs - Electrical Characteristics				
Maximum Rated Load Current ^{Note1}		DO4-I/DO8-I	I_{SSRMax}	750 mA
		DO4-O	I_{OCMax}	750 mA
		DO4-S	$I_{SPDTMax}$	750 mA
Maximum Rated Load Voltage		DO4-I/DO8-I	U_{SSRMax}	30 V
		DO4-O	U_{OCMax}	30 V
		DO4-S	$U_{SPDTMax}$	30 V
Maximum On Resistance		DO4-I/DO8-I	R_{SSR}	0.25 Ω
		DO4-O	R_{OC}	tbd
		DO4-S	R_{SPDT}	0.1 Ω
Outputs – Timing Characteristic				
Minimum Resolution t_{Res}		DO4-I/DO8-I	10 ms	
		DO4-O	0.1 ms	
		DO4-S	100 ms	
	$T_{Cycle}, T_{OnDelay}, T_{OnHold}$		$t_{Res} < T < 3600$ s	
Module – Communication				
	USB		2.0 Full Speed CDC Profil	
Module – Electrical Characteristics				
	Power Supply		Supplied with +5V by USB No additional Power Supply needed.	
Maximum Rated Supply Current		DO4-I/DO8-I	40 mA	
		DO4-O	40 mA	
		DO4-S	250 mA	
Module – Environment				
Temperature		Storage	-20 °C ... +70 °C	
		Operation	0 °C ... +55 °C	
	Humidity		< 85 % RH, non-condensing	
Module – Housing				
	Dimensions L x W x H		90 x 54 x 62 mm	
	Weight (in total)		120 g	
	Assembly		Rail-Mount (EN 50022, TS35)	
	Protection Class (DIN 40050)		IP20	
Module - Interconnection				
Terminal Clamp		DO4-I/DO8-I	Plug-In Terminal 8-way 1,5 mm ² wire	
		DO4-O	Plug-In Terminal 8-way	

			1,5 mm ² wire
		DO4-S	Plug-In Terminal 12-way 1,5 mm ² wire
Module - Indicators			
	<ul style="list-style-type: none"> • Operation and Error Indicator • Communication Indicator • Indicator for Output State (Enabled / Disabled) 		
Software			
	Supported Systems	Windows [®] XP, Windows [®] Vista, Windows [®] 7 Ubuntu, Raspbian, Debian	

Note1

Outputs are able to control resistive loads only. For inductive loads a flyback diode is required.

5 Order Information and Accessories

Digital Output Devices

General format of order code

LCTR-DOn-type(-ISO)

Order Code	Product
LCTR-DO4-I	LucidControl Digital Output USB Module with 4 Channels of Solid State Relays (SSR)
LCTR-DO4-O	LucidControl Digital Output USB Module with 4 Channels of Open Collectors (OC)
LCTR-DO4-S	LucidControl Digital Output USB Module with 4 Channels of Relays (SPDT)
LCTR-DO8-I	LucidControl Digital Output USB Module with 8 Channels of Solid State Relays (SSR)

Order Code (ISO)	Product
-ISO	With galvanic isolation of USB Interface

The following accessories are available:

Order Code	Product
64.200.0005	Plug-In Terminal 8-way 1,5 mm ² wire
LCTR-AK1710-12	Plug-In Terminal 12-way 1,5 mm ² wire

6 Document Revision

Date	Rev.	
2018/08/04	2.0	<ul style="list-style-type: none">• Added documentation of DO8 module• Added documentation of USB Isolation

deciphe it GmbH
Schäferstr. 5
87600 Kaufbeuren / Germany
www.lucid-control.com