

CONEX-PSD

**Two-Axis Position
& Power Sensing device**



Warranty

Newport Corporation warrants that this product will be free from defects in material and workmanship and will comply with Newport's published specifications at the time of sale for a period of one year from date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's option.

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Original instructions.

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EU Declaration of Conformity

CONEX-PSD Newport® Series - Two-axis Position & Power Sensing Device

Year C € mark affixed: 2017

EU Declaration of Conformity

The manufacturer:

MICRO-CONTROLE Spectra-Physics,
9, rue du bois sauvage
F-91055 Evry FRANCE

Hereby declares that the product:

- Description: "CONEX-PSD9 & CONEX-PSD10GE"
 - Function: Two-axis Position & Power Sensing Device
 - Type of equipment: Electrical equipment for measurement, control and laboratory use
- complies with all the relevant provisions of the Directive 2014/30/EU relating to electromagnetic compatibility (EMC).
- complies with all the relevant provisions of the Directive 2011/65/EU relating to RoHS2.
- was designed and built in accordance with the following harmonised standards:
- NF EN 61326-1:2013 « Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements »
 - NF EN 55011:2010/A1:2011 Class A
- was designed and built in accordance with the following other standards:
- NF EN 61000-4-2
 - NF EN 61000-4-3
 - NF EN 61000-4-4
 - NF EN 61000-4-5
 - NF EN 61000-4-6
 - NF EN 61000-4-11

Date : 16/05/2017

Hervé Le Cointe
Quality Director



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DC2-EN rev:A

Preface

Documentation Organization

CONEX-PSD documentation set includes 2 parts:

- **Sensor Manual** (this document) describing sensor features and measurement optimization.
- **Controller Manual** describing available commands.

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Maintenance

The CONEX-PSD Controller/Driver should only be cleaned with a lightly dampened cloth or sponge with a soapy water solution. Do not use an acetone or alcohol solution; this will damage the finish of the enclosure.

Service Information

The user should not attempt any maintenance or service of the CONEX-PSD Controller/Driver and its accessories beyond the procedures outlined in this manual.

Any problem that cannot be resolved should be referred to Newport Corporation. When calling Newport regarding a problem, please provide the Tech Support representative with the following information:

- Your contact information.
- System serial number or original order number.
- Description of problem.
- Environment in which the system is used.
- State of the system before the problem.
- Frequency and repeatability of problem.
- Can the product continue to operate with this problem?
- Can you identify anything that may have caused the problem?

Complete a copy of the Service Form as represented at the end of this document and include it with your shipment.

Newport Corporation RMA Procedures

Any CONEX-PSD Controller/Driver being returned to Newport must have been assigned an RMA number by Newport. Assignment of the RMA requires the item serial number.

Packaging

CONEX-PSD Controller/Driver being returned under an RMA must be securely packaged for shipment. If possible, reuse the original factory packaging.



Two-Axis Position & Power Sensing Device CONEX-PSD

1.0 Introduction

1.1 Definitions and Symbols

The following terms and symbols are used in this documentation and also appear on the CONEX-PSD Controller/Driver where safety-related issues occur.

1.1.1 General Warning or Caution



Figure 1: General Warning or Caution Symbol.

1.1.2 The Exclamation Symbol in General Warning or Caution



Figure 1 may appear in Warning and Caution tables in this document. This symbol designates an area where personal injury or damage to the equipment is possible.

1.1.3 Electric Shock



Figure 2: Electrical Shock Symbol.

1.1.4 The Electrical Shock Symbol in Electric Shock



Figure 2 may appear on labels affixed to the CONEX-PSD Controller/Driver. This symbol indicates a hazard arising from dangerous voltage. Any mishandling could result in irreparable damage to the equipment, in personal injury, or death.

1.1.5 European Union CE Mark



Figure 3: CE Mark.

The presence of the CE Mark on Newport Corporation equipment means that it has been designed, tested and certified as complying with all applicable European Union (CE) regulations and recommendations.

1.2 Warnings and Cautions

The following are definitions of the Warnings, Cautions and Notes that may be used in this manual to call attention to important information regarding personal safety, safety and preservation of the equipment, or important tips.



WARNING

Situation has the potential to cause bodily harm or death.



CAUTION

Situation has the potential to cause damage to property or equipment.

NOTE

Additional information the user or operator should consider.

1.3 General Warnings and Cautions

The following general safety precautions must be observed during all phases of operation of this equipment.

Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment.

- Heed all warnings on the unit and in the operating instructions.
- To prevent damage to the equipment, read the instructions in this manual.
- Route power cords and cables where they are not likely to be damaged.
- Keep air vents free of dirt and dust.
- Keep liquids away from unit.
- Do not expose equipment to excessive moisture (>85% humidity)
- Do not operate this equipment in an explosive atmosphere.
- Disconnect power before cleaning the CONEX-PSD unit. Do not use liquid or aerosol cleaners.
- Do not open the CONEX-PSD Controller. There are no user-serviceable parts inside.
- Return equipment to Newport Corporation for service and repair.
- Follow precautions for static-sensitive devices when handling electronic circuits.

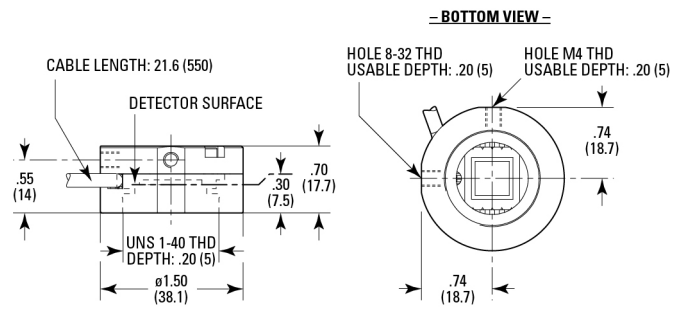
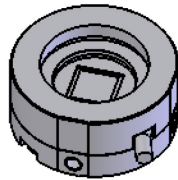
2.0 General Description

2.1 Part Number

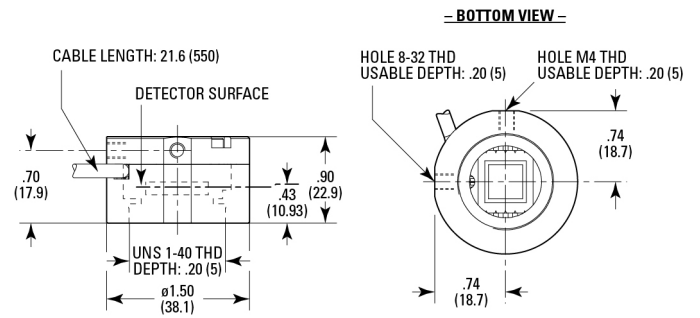
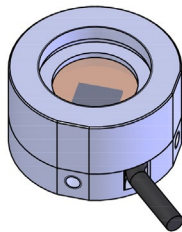
Product	Description
PSD9-SI	9 x 9 mm sensor for wavelength from 320 to 1100 nm
PSD10-GE	10 x 10 mm sensor for wavelength from 800 to 1700 nm

2.2 Dimensions

2.2.1 Silicon Sensor



2.2.2 Germanium Sensor



2.3 System Environmental Specifications

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

2.4 Sensor Characteristics

NOTE

The values are estimated based on the sensor manufacturer's typical values at ambient temperature. They are not calibrated to each unit.

2.4.1 Silicon Sensor

2.4.1.1 Absolute Maximum Rating (Ta = 25 °C)

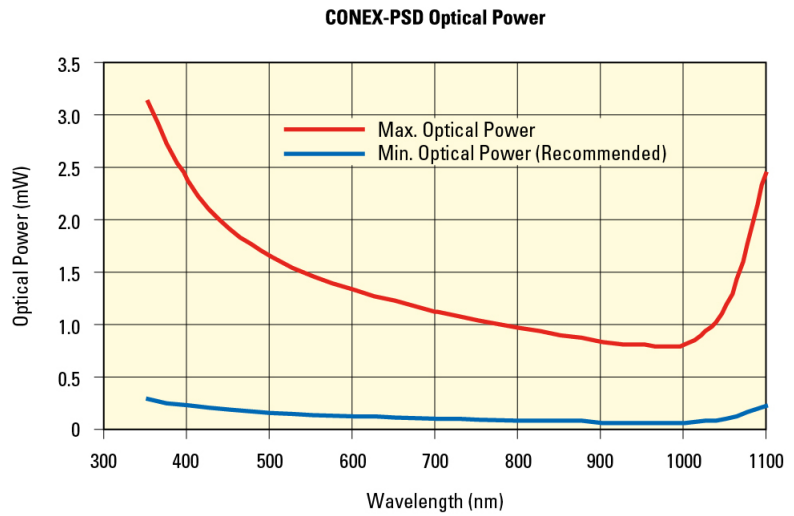
Parameter	Symbol	Value	Unit
Reverse Voltage	V_R Max.	20	V
Operating Temperature	T_{opr}	-20 to + 60	°C
Storage Temperature	T_{stg}	-20 to + 80	°C

2.4.1.2 Electrical and Optical Characteristics (Ta = 25 °C)

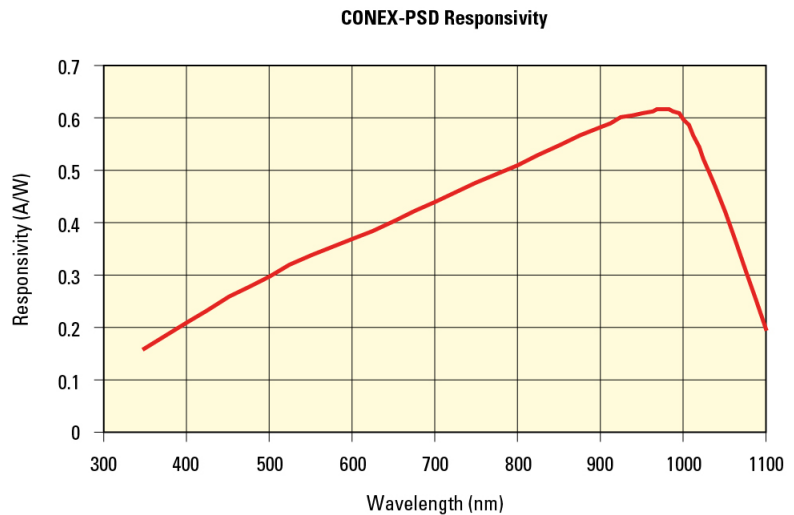
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range	λ		–	320 to 1100	–	Nm
Peak sensitivity wavelength	λ_p		–	960	–	Nm
Photo sensitivity	S	$\lambda = \lambda_p$	–	0.6	–	A/W
Interelectrode resistance	R_{ie}	$V_b = 0.1$ V	5	7	15	k Ω
Position detector error	E	$\lambda = 900$ nm $V_R = 5$ V Spot size = 0.2 mm	–	± 150	± 250	μ m
Dark current	I_D	$V_R = 5$ V	–	1	50	nA
Saturation photocurrent	I_{st}	$\lambda = 900$ nm $V_R = 5$ V	–	500	–	μ A
Rise time	t_r	$R_L = 1$ k Ω	–	2	–	μ s
Terminal capacitance	C_t	$V_R = 5$ V F = 10 kHz	–	500	1000	pF
Position resolution	ΔR	$I_O = 1$ μ A F = 10 kHz	–	1.5	–	μ m

2.4.1.3 **Wavelength Consideration**

Power/Wavelength



Responsivity/Wavelength



2.4.2 **Germanium Sensor**

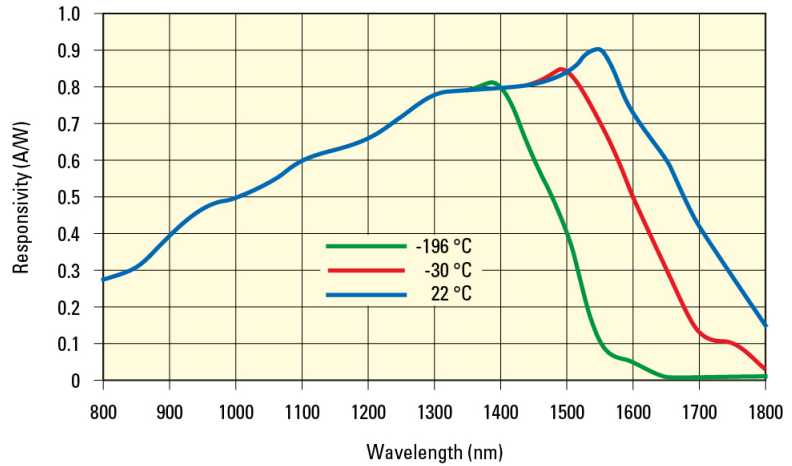
2.4.2.1 **Electrical and Optical Characteristics (Ta = 25 °C)**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range	λ		–	800 to 1700	–	nm
Peak sensitivity wavelength	λ_p		–	1550	–	nm
Photo sensitivity	S	$\lambda = \lambda_p$	–	0.9	–	A/W
Interelectrode resistance	Rie			100		Ω
Shunt resistance			1	2		k Ω
Shunt capacitance				30		nF
Position resolution	ΔR	F = 136 Hz	–	5	–	μm

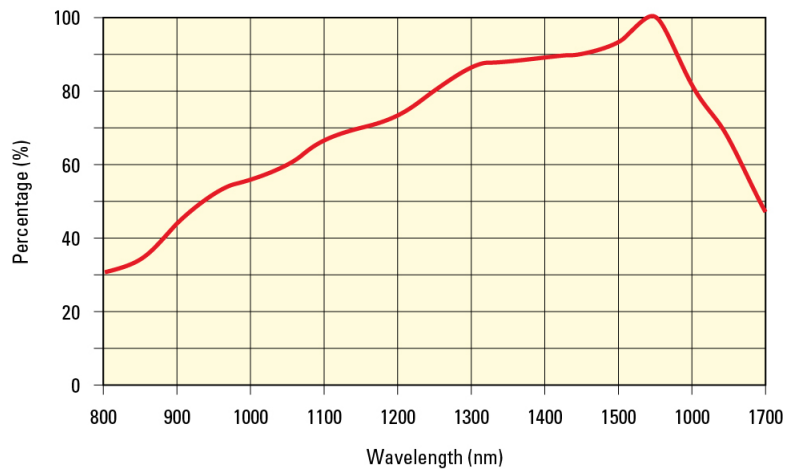
2.4.2.2 Wavelength Consideration

The sensor should be operated with beam power between 0.1mW and 1mW. Nonlinearities and saturation can occur above 1mW.

CONEX-PSD Typical Spectral Response



CONEX-PSD Maximum Percentage Returned by the GP Command for a 1 mW Beam



2.5 Sensor Care

The input window is coated with a soft silicone resin. Avoid touching the window to keep grime from accumulating or prevent surface damage that can decrease the PSD's sensitivity. External force applied to the resin surface may deform or cut off the wires.



WARNING
DO NOT TOUCH SENSOR WINDOW.

Silicone resin swells when it absorbs organic solvents, so do not use any solvent other than Alcohol.

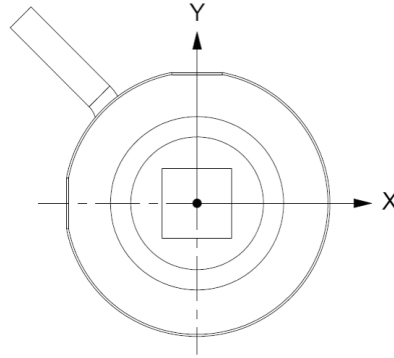


WARNING
USE ONLY ALCOHOL TO CLEAN SENSOR WINDOW.

3.0 Functional Description

3.1 Principle

Position Sensing Devices (PSDs) consist of a p-n junction photodiode in which two sides of the junction have electrically separate contacts.



X, Y positions returned by the Get Position GP command are given according to the above referential.

3.2 Sensors Outputs

For Si sensor, the cut-off frequency is at 319 Hz.

For Ge sensor, the cut-off frequency is at 136 Hz..

3.3 Beam Size Considerations

3.3.1 Max. Size

For best measurement quality, the beam should remain within the sensitive area (9 x 9 mm for Si, 10 x 10mm for Ge). If the beam is moving during measurement (ΔX , ΔY), its size should be reduced using the following formula:

Maximum Beam size for Si: $BS_x = 9 \text{ mm} - \Delta X$ and $BS_y = 9 \text{ mm} - \Delta Y$

Maximum Beam size for Ge: $BS_x = 10 \text{ mm} - \Delta X$ and $BS_y = 10 \text{ mm} - \Delta Y$

3.3.2 Min. Size

To maintain measurements quality, it is recommended to use a beam size $\geq 0.2\text{mm}$



WARNING
MINIMUM BEAM SIZE: 0.2 mm.

3.4 Beam Energy/Power Considerations

3.4.1 Max. Power

The maximum acceptable total beam power depends on the Wavelength.

The maximum current generated by the sensor is 0.5 mA for Si and 1mA for Ge.

In case of higher beam power, it is possible to mount Newport neutral density filter such as model “FBR-NDxx” on the Newport “Model 883-OH 1” filter holder.

3.4.2 Max. Density

The maximum acceptable beam intensity is limited by the device itself: 30mw/mm².



WARNING

MAXIMUM BEAM POWER DENSITY: 30 mW/mm².

3.4.3 Max. Energy

Although PSD sensors are mostly used to check continuous lasers, they can be used to check the average power of pulsed laser.

However, high energy, short pulses beam might damage the sensor. It is strongly recommended to NOT exceed the following values:

- Beam size: $\geq 1 \text{ mm}^2$.
- Beam power: $\leq 1 \text{ mW}$.
- Repetition rate: $\geq 10 \text{ kHz}$.
- Pulse duration: $\geq 5 \text{ ns}$.



WARNING

DO NOT USE TOO SHORT, TOO HIGH ENERGY PULSES.

4.0 Optimizing Measurements

This section provides general recommendations for improving light measurement setups.

4.1 Avoid Stray Light

As the sensitive area of a PSD is relatively large (81 mm² for Si, 100mm² for Ge), it may collect unwanted light on top of the beam being measured. This may affect the measurement accuracy.

PSD's are also sensitive to a large spectral range (300 to 1100 nm for Si and 800 to 1700 for Ge). Although the light to be measured might be centered on one particular wavelength, sensor will be affected by other wavelengths.

For example, stray light can easily reach 10 μW/mm² on a broad spectral range in a room. This might not be negligible, especially if a large gain was set in the controller.

There are 2 ways to minimize the effect of stray light:

- Shield the sensor from unwanted light.
- Block the unwanted wavelength.

4.1.1 Shielding the Sensor

To minimize this effect, it is recommended to shield the sensor from stray light.

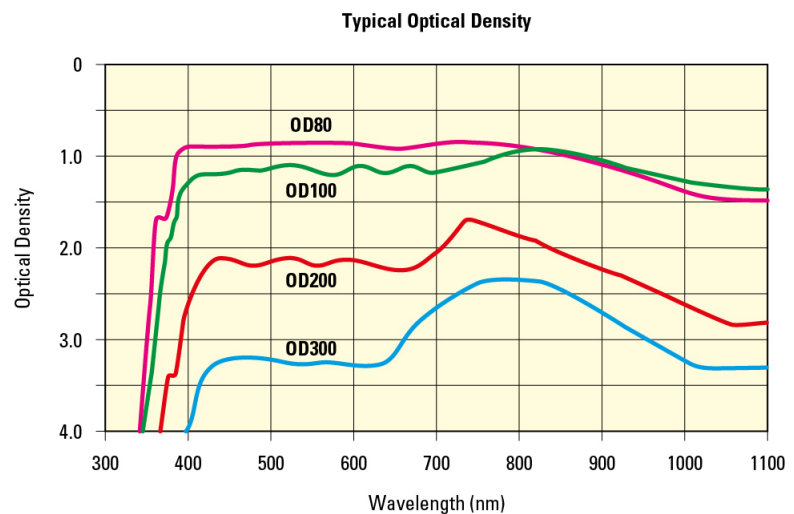
One or several Newport filter holders can be used for that.

4.1.2 Filtering and Attenuation

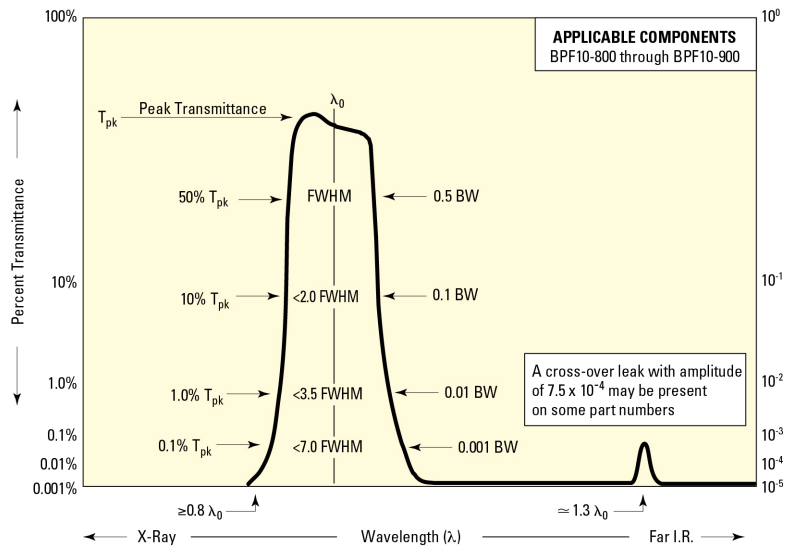
Several types Newport filter can be mounted on the Newport "Model 883-OH 1" filter holder.

For example:

Absorptive Neutral Density Filter (FSR-xxxx):



Or Bandpass Filter (10BPFx-y):



Or Mercury Line Filter (10MLFx-y):



NOTE

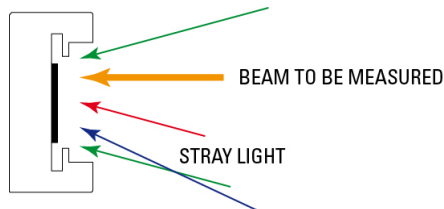
Keep in mind to take filter attenuation into account in the measurements.

4.2 Optimizing Controller Parameters

4.2.1 Offset

Controller offset can be used to compensate for stray light. Proceed as follows:

- Prepare your optical setup.



- Turn the beam OFF.

- Using an application software or Windows HyperTerminal (see CONEX-PSD Controller Documentation) set all gains to 1 with the following commands:
 - “1PX1”
 - “1PY1”
 - “1PS1”
- Use the 1RA? command to get the current offsets.
- On PSD9 silicon, this command will return 3 parameters: OX, OY, OS (in volts).
Set the offsets using the following commands:
 - “1IXnn” with nn = OX value
 - “1IYnn” with nn = OY value
 - “1ISnn” with nn = OS value
- On PSD10Ge, this command will return 4 parameters : offset1, offset2, offset3, offset4 (in volts).
Set the offsets using the following commands:
 - “1OFaa,bb,cc,dd” with aa = offset1 value, bb = offset2 value, cc = offset3 value and dd = offset4 value

Those 4 values correspond to electrical offsets. For optical offset compensation and full scale adjustment (section below), use OX/PX and OY/PY commands to compensate X and Y positions and scalings.
- Using the command “1GP?”, verify that the corrected positions and power are set to 0.
- Turn the beam to be measured ON.
- Using the command “1GP?”, read your beam position and power level.

4.2.2 Gain (-1 – +1)

To facilitate measurements, a gain can be used to modify the reported value of position and power.

For example:

- To change the sign of beam X position, use “1PX-1”.
- To change beam position unit from mm (default) to inches, use “1PX0.0393”.

4.2.3 Frequency (LF 0-1000)

CONEX-PSD sensor features an analog filter with a fixed cut-off frequency of 319 Hz for Si sensor and 136 for Ge sensor.

This allows an average power measurement for pulsed lasers.

An additional programmable low pass filter can be set to increase noise immunity (such as the 100~120 Hz coming from room fluorescent lights) using the command: “1LF80”.

5.0 Appendix: Firmware Version V2.2.x

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

	Ready	Config.	Description
GP	●	●	Get X, Y positions and laser power
ID	□	○	Set/Get stage identifier
IS	□	○	Set/Get Set/Get offset on ADC input Sum (Si sensor) Not used (Ge sensor)
IX	□	○	Set/Get offset on ADC input X (Si sensor) Set/Get offsets on X position (Ge sensor)
IY	□	○	Set/Get offset on ADC input Y (Si sensor) Set/Get offsets on Y position. (Ge sensor)
LF	□	○	Set/Get low pass filter frequency
OF	□	○	Not used (Si sensor) Set/Get offset on ADC inputs 1 to 4 (Ge sensor)
PS	□	○	Set/Get gain on ADC input Summ (Si sensor) Not used (Ge sensor)
PX	□	○	Set/Get gain on ADC input X Set/Get gain on X position (Ge sensor)
PY	□	○	Set/Get gain on ADC input Y (Si sensor) Set/Get gain on Y position. (Ge sensor)
PW	●	●	Enter/Leave CONFIGURATION state
RA	●	●	Get raw analog input values
RC	●	●	Get corrected analog input values
RS	●	●	Reset controller
RS##	□	□	Reset controller's address to 1
SA	–	○	Set/Get controller's address
TB	●	●	Get command error string
TE	●	●	Get last command error
TS	●	●	Get positioner error and controller state
VE	●	●	Get controller revision information

- 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.

OF — Set/Get offset on ADC inputs 1 to 4

Usage	Ready	Config.
	□	●
Syntax	xxOFnn,nn,nn,nn or xxOF?	
Parameters		
Description	xx [int]	— Controller address.
Range	xx	— 1 to 31
	nn [float]	— > -1 and < 1
Units	xx	— None
	nn	— None
Defaults	xx Missing:	Error B.
	Out of range:	Error B.
	Floating point:	Error A.
Description	This command is only available with the Ge sensor. In CONFIGURATION state, this command will set the offset for the ADC input 1 to 4.	
Errors	A	— Unknown message code or floating point controller address.
	B	— Controller address not correct.
	D	— Controller address not correct.
Rel. Commands	ZT	— Get all parameters.
Example		
	1OF0.01221,0.01221,-0.02442,-0.01221	Sets the ADC input offset of controller #1.



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