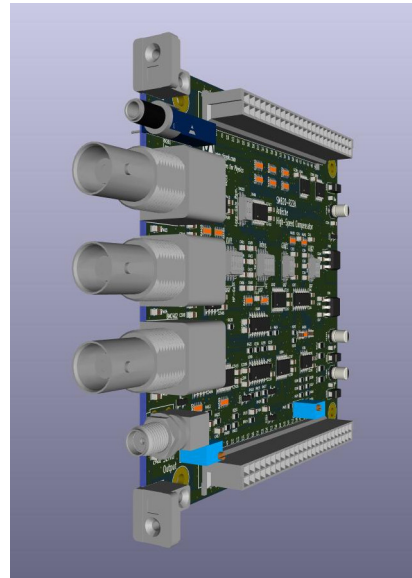


SMB20 *Ardèche* – High-Speed Compensator

- For use in OPLL
- High-speed parallel PID
- Two extra integrators for PI³D action
- Additional poles and zeros
- Ramp & Feedforward inputs
- DC-voltage controlled loop gain
- Pure analog design - free of digital noise
- Schematic diagrams included



Overview

The SMB20 module is an electronic board for use in Optical Phase-Locked Loop (OPLL) applications where the frequency detuning between two laser sources requires tight and quick control.

This board is recommended to process the phase error signal coming from the Phase Discriminator module (SMB10). Designed for the high-speed path of the phase control loop, its output signal is intended to be summed with the current source of the slave laser diode (SLD) through a passive network. In order to remove the DC component of the feedback current, a low frequency path using the piezoelectric actuator of the SLD is required (see SMB30 module).

The SMB20 module offers a high performance compensator for the OPLL designers allowing a complete control of the loop filter operation. The polarity of the error signal is set either on board or using remote control. The loop gain is adjusted over more than 60 dB using the front panel trimmer or a DC-voltage. The length of the high-speed PID has been minimized while two additional integrator stages can boost the loop gain at low frequency. For lock-acquisition purposes, the integrator output of the fast PID can be precisely controlled by the user. A ramp input is provided to sweep the SLD frequency during the open-loop operation while the feedforward input offers a useful control of the fast SLD actuator for frequency jumps.

The PID control signal is both monitored on the front panel and sent to the analog bus connector. The ramp and feedforward input signals are fed to the module using the front panel BNCs or the bus connector pins. These inputs and many other signals are controlled through analog switches by the digital bus. The several time constants of the compensator are chosen using small mechanical switches located on printed circuit board.

Like all SM-Series modules, the SMB20 is shipped with the schematic diagrams of its electronic circuitry, providing all required information for advanced users.

IMPORTANT NOTICE

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PHASE ERROR INPUT

Connector (2)	50-pin stack-through (AIO)
Impedance	1 k Ω
Range	$\pm 5\text{V}$
Noise (1)	$\leq 3\text{ nV}/\sqrt{\text{Hz}}$

- (1) Equivalent voltage noise density referred to the input, loop-gain $\geq 0\text{ dB}$ and $f \geq 1\text{ kHz}$.
- (2) The error input source from is selected between PHASE ERROR and AUX. ERROR using a set of resistors located on the printed circuit board.

AUX. ERROR INPUT

Connector (2)	50-pin stack-through (DIO)
Impedance	1 k Ω
Range	$\pm 5\text{V}$
Noise (1)	$\leq 3\text{ nV}/\sqrt{\text{Hz}}$

- (1) Equivalent voltage noise density referred to the input, loop-gain $\geq 0\text{ dB}$ and $f \geq 1\text{ kHz}$.
- (2) The error input source from is selected between PHASE ERROR and AUX. ERROR using a set of resistors located on the printed circuit board.

SERVO OUTPUT (SMA)

Connector	SMA (front panel)
Impedance (1,2)	50 Ω
	1 k Ω
Range (1,2)	$\pm 2.5\text{ V}/50\text{ mA max}$
	$\pm 5\text{ mA}$

- (1) Voltage output mode, $R_{401} = 50\ \Omega$
- (2) Current output mode, $R_{401} = 1\text{ k}\Omega$

SERVO OUTPUT (AIO)

Connector	50-pin stack-through (AIO)
Impedance	50 Ω (1)
	or 1 k Ω (2)
Range	$\pm 2.5\text{ V}/50\text{ mA max.}$ (1)
	or $\pm 5\text{ mA}$ (2)

- (1) Voltage output mode, $R_{401} = 50\ \Omega$
- (2) Current output mode, $R_{401} = 1\text{ k}\Omega$

LOOP-GAIN INPUT

Connector	50-pin stack-through (AIO)
Impedance	10 k Ω
Range	$0 \leq V \leq 5 \text{ V}$
Loop gain	$-20 \text{ dB} \leq G \leq +20 \text{ dB}$ (1)

(1) Set the switch SW203-1 on to allow remote control.

TRACKING INPUT

Connector	50-pin stack-through (AIO)
Impedance	10 k Ω
Range	$\pm 5 \text{ V}$
Time constant (1)	1500 ns, 500 ns, 150 ns.

(1) Same as the integrator time constant. Note that the integrator must operate in high-DC gain to allow tracking mode.

FEEDFORWARD INPUT (AIO)

Connector	50-pin stack-through (AIO)
Impedance	10 k Ω
Range	$\pm 5 \text{ V}$
Settling time	120 ns
Bandwidth	$\geq 3 \text{ MHz}$

RAMP INPUT (AIO)

Connector	50-pin stack-through (AIO)
Impedance	10 k Ω
Range	$\pm 5 \text{ V}$
Settling time	120 ns
Bandwidth	$\geq 3 \text{ MHz}$

FEEDFORWARD INPUT (BNC)

Connector	BNC (front panel)
Impedance	10 k Ω
Range	$\pm 5 \text{ V}$
Rise time	120 ns
Bandwidth	$\geq 3 \text{ MHz}$

RAMP INPUT (BNC)

Connector	BNC (front panel)
Impedance	10 k Ω
Range	$\pm 5 \text{ V}$
Settling time	120 ns
Bandwidth	3 MHz

PID MONITOR

Connector	BNC (front panel)
Impedance	50 Ω
Load	$\geq 1 \text{ k}\Omega$
Gain	1 V/V
Range	$\pm 5 \text{ V}$

PID OUTPUT

Connector	50-pin stack-through (AIO)
Impedance	50 Ω
Load	$\geq 1 \text{ k}\Omega$
Gain	1 V/V
Range	$\pm 5 \text{ V}$

LOOP-GAIN OUTPUT

Connector	50-pin stack-through (AIO)
Impedance	50 Ω
Load	$\geq 1 \text{ k}\Omega$
Range	$0.2 \text{ V} \leq V \leq 1.8 \text{ V}$
Loop Gain	$-20 \text{ dB} \leq G \leq +20 \text{ dB}$

LOOP-GAIN ADJUST

Interface	10-turn trimmer (front panel)
Range (1)	$-20 \text{ dB} \leq G \leq +20 \text{ dB}$

(1) If SW203-1 is on, the trimmer is useless and the gain is under control of the LOOP-GAIN INPUT.

FAST PID

Proportional	
Gain	0 dB
Bandwidth	$\geq 15 \text{ MHz}$
Integrator	
Unity-gain freq. (1)	100 kHz, 300 kHz, 1 MHz
Differentiator	
Unity-gain freq. (2)	300 kHz, 1 MHz, 3 MHz
High-freq. gain (3)	+12 dB or +20 dB

(1) Controlled by the switches located on board (SW402-1,-2,-3). C413 allows a fourth value defined by the user.

(2) Controlled by the switches located on board (SW401-1,-2,-3). C406 allows a fourth value defined by the user.

(3) Use SW401-4 switch located on board to select the differentiator HF-gain.

LOW-FREQUENCY INTEGRATORS

Integrator#1

Unity-gain freq. (1) 15 kHz, 50 kHz, 150 kHz

Integrator#2

Unity-gain freq. (2) 15 kHz, 50 kHz, 150 kHz

(1) Use SW201-1,-2 switches located on board.

(2) Use SW202-1,-2 switches located on board.

DIGITAL CONTROL INPUTS

Connector 50-pin stack-through (DIO)
 Impedance 100 k Ω pull-up
 Level 5V-CMOS

POWER REQUIREMENTS

Analog +15 V \leq 140 mA
 Analog -15 V \leq 140 mA
 Digital +5 V \leq 30 mA

PHYSICAL PROPERTIES

Length 100 mm
 Width 100 mm
 Height 17 mm
 Weight (1) 100 g
 Printed circuit board 4-layer FR4
 thickness 1.6 mm

(1) Applies for SMB20-NP-SC, see ORDERING INFORMATION.

GENERAL

This module is designed to be operated in laboratory environment.

Operating Temperature +15°C to +30°C

ORDERING INFORMATION

To order, specify:

Model	Options
SMB20-NP-SC	Standard
	no front panel 50-pin stack-through (1)
SMB20-NP-xx SMB20-FP-xx	Front panel
	none 3U/4HP
SMB20-xx-NC SMB20-xx-SC	Connector
	none 50-pin stack-through (1)

(1) Tyco Part Number: 1-173145-4

DOCUMENT REVISION HISTORY

Release	Comments
SMB20-SS02-P22A	updated sections