

# **SSO 130**

**(including SSO 120)**

**Optical Return Path Transmitter 1310 nm**

**Technical Documentation**

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## 1 Document STATUS

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00	30.11.98	Seidenberg	Document created

## 2 Introduction

New services like video on demand, pay per view or teleshopping are becoming important services on modern CATV-networks. All of them require the upstream transmission of signals from the customer to the headend.

In order to ensure a sufficient downstream and upstream capacity of CATV networks, it is favorable to use optical transmission systems upgrading the standard CATV network towards a hybrid fiber coax (HFC-) network. The optical fiber can be used to transmit digital or analog signals with high transmission capacity.

The optical return path transmitter SSO 120 or SSO 130 can be used in combination with the optical receiver SEO 120 to establish a 'transparent' upstream link for the transmission of digital signals in e.g. FSK, QPSK or QAM-format or analog video signals. The SEO 120 provides sufficient gain to bridge an optical link budget of up to 15 dB.

For enhanced analog performance with reduced link budget it is also possible to use the SEO 686 downstream receiver together with the SSO 130. The noise performance of the SEO 686 is significantly better for low loss links than the performance of the SEO 120. However, the bandwidth of the SEO 686 is specified to start at 47 MHz only.

## 3 Technical Description

The optical return path transmitter can be used to transmit either digital signals like e.g. set top box signals, cable modem, cable phone and network management information or, depending on the required signal quality, analog video signals. The return path transmitter is available in two versions:

- ◆ The SSO 120 uses a 1310 nm Fabry-Perot laser with optical isolator. The isolator is used to obtain a sufficient carrier to spontaneous noise relation.
- ◆ The SSO 130 uses a 1310 nm DFB laser with optical isolator. The DFB laser provides a better noise and intermodulation performance compared to the Fabry-Perot laser. Therefore this version is the recommended one for the transmission of analog TV signals. The isolator again is used to enhance the carrier to spontaneous noise performance,

Figure 1 gives the front panel view and the block diagram of the SSO 120/130.

The transmitter provides two equivalent RF which can be used to combine signals arriving from two signal sources like e.g. NMS information and cable modem signals. After the input combiner the RF signals in the frequency range 5 to 120 MHz are amplified and used to modulate the laser. The laser provides an optical DC power of  $-3$  dBm (0 dBm for the VD-version). The RF signal leads to an intensity modulation of the optical signal.

The DC optical output power is kept constant using a control loop which adjusts the laser current. The laser current is supervised. In case of a deviation from the nominal operating area a LED on the front panel lightens.

The return path transmitter has a built in pilot tone generator at 3.58 MHz. This pilot tone is used to provide a weak modulation (about 2.5% modulation index) of the optical light. The optical return path receiver SEO 120 detects this pilot tone and provides a automatic gain control to automatically adjust the return link gain. This feature avoids the need to level the link manually and guaranties a constant link gain over the full range of optical link budget of 18 dB.

The transmitter is built in a one unit wide BK-housing which can be plugged on BK-subracks or outdoor housings.

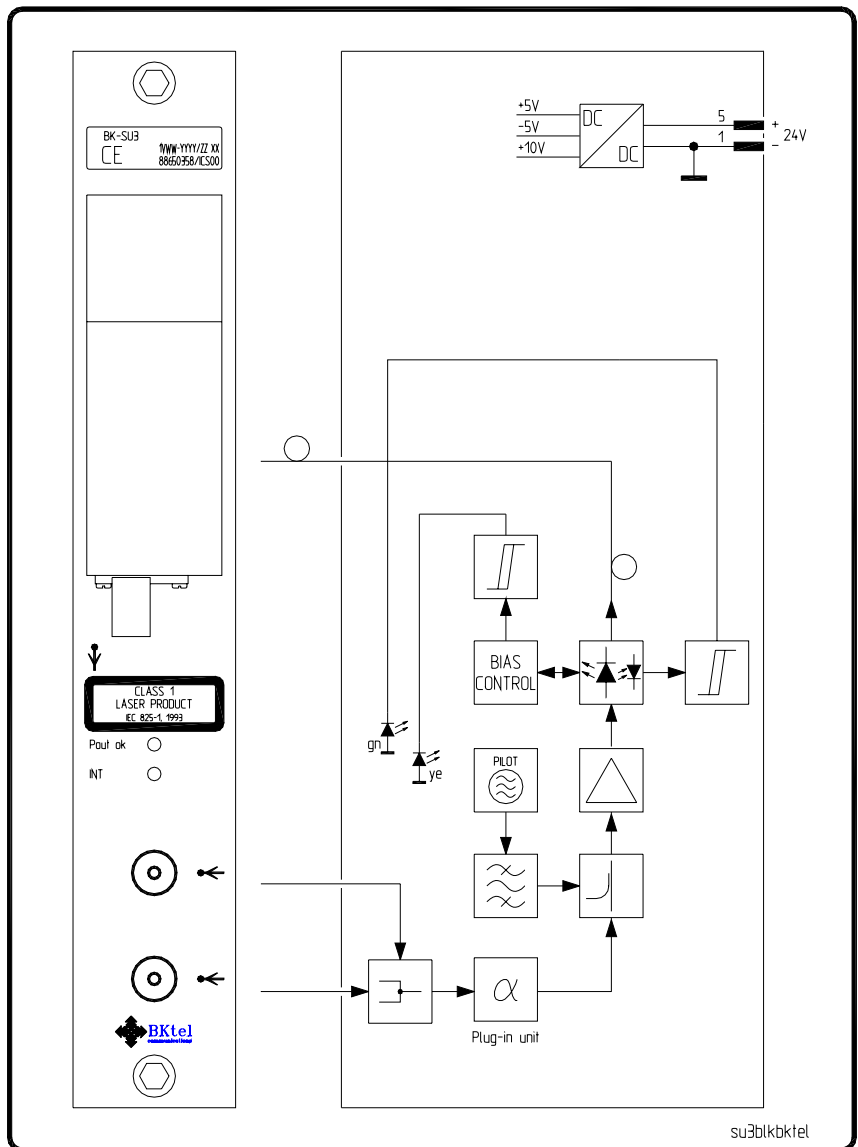


Figure 1: Front Panel View and Block Diagram of SSO 120/SSO 130

## 4 TECHNICAL SPECIFICATIONS

### 4.1 Link Specifications

The subsequent data are valid for a pair of SSO 120/130 and SEO 120.

<i>Parameter</i>	<i>min.</i>	<i>typ.</i>	<i>max.</i>	<i>unit</i>
opt. budget with SSO 120	0		18	dB
opt. budget with SSO 130	3		21	dB
link gain <sup>1)</sup>				
5 - 55MHz	7	9	11	dB
55 – 120MHz	6.5	9	11.5	dB
frequency response				
5 - 55MHz	-1		+1	dB
55 – 120MHz	-1.5		+1.5	dB
C/N (B=1Hz) <sup>2)</sup>				
5 - 55MHz	107.6	113.8		dB/Hz
55 – 120MHz	106.4	113.5		dB/Hz
C/N (B=5 MHz) <sup>3)</sup> for SSO 130 only (1 PAL-B carrier, 47 – 77 MHz) min link loss max link loss		51 48		dB dB
Intermodulations			-35 <sup>3)</sup>	dBc

<sup>1)</sup> incl. gain error and frequency response over full specified temperature range

<sup>2)</sup> 1 carrier, max. link budget, min. modulation index, max. thermal noise of SEO 120

<sup>3)</sup> m = 72% for 1 carrier, m = 18% for 4 carriers

### 4.2 Electrical Input Specifications

<i>Parameter</i>	<i>min.</i>	<i>typ.</i>	<i>max.</i>	<i>unit</i>
Input level (1 carrier) <sup>1)</sup>		88	91	dB $\mu$ V
Input level (4 carrier) <sup>1)</sup>		76	77	dB $\mu$ V
frequency response	5		120	MHz
input impedance		75		$\Omega$
return loss	15			dB
RF-input connector	IEC 169-2 (female)			

<sup>1)</sup> If one of the 2 RF inputs is not used it has to be terminated with a 75 Ohms terminator (included in delivery content).

### 4.3 Optical Output Specifications

<i>Parameter</i>	<i>min.</i>	<i>typ.</i>	<i>max.</i>	<i>unit</i>
Optical output power (SSO 120)		-3		dBm
Optical output power (SSO 130)		0		dBm
Optical wavelength	1290	1310	1330	nm
Relative Intensity Noise (SSO 120)			-120	dB/Hz
Relative Intensity Noise (SSO 130)			-140	dB/Hz
Carrier to spontaneous noise (SSO 120)	30			dB
Modulations Index ( $U_{in} = 88\text{dB}\mu\text{V}$ )	64	72	80	%
Modulations Index ( $U_{in} = 76\text{dB}\mu\text{V}$ )	16	18	20	%
Pilot tone frequency		3.58		MHz
modulation index of pilot tone		2.5		%
return loss	20			dB
optical connector	E2000			

### 4.4 Power Supply

<i>Parameter</i>	<i>min.</i>	<i>typ.</i>	<i>max.</i>	<i>Unit</i>
Power Supply Voltage	22.8	24.0	25.2	V
Current Consumption			300	mA

### 4.5 Front Panel LEDs

<i>Alarm / State</i>	<i>Pout ok (green)</i>	<i>INT (yellow)</i>
Nominal operation	on	off
opt. output power 30% below nom. power	off	on
Laser current 30% beyond nom. current / opt. output power 30% beyond nom. power	X	on

### 4.6 Pinning of SUB-D-Connector on Back Panel Side

Pin	
1	GND
2	n.c.
3	n.c.
4	n.c.
5	+24V

Pin	
6	n.c.
7	n.c.
8	n.c.
9	n.c.

#### 4.7 Mechanical Dimensions

Height	250	mm
Width	40	mm
Depth <sup>1)</sup>	100	mm
Weight	ca. 1.5	kg

<sup>1)</sup> without electrical and optical connections

#### 4.8 Ambient Climate Requirements

Operation	ETS 300 019-1-3, Class 3.1 <sup>1)</sup>
Storage	ETS 300 019-1-1, Class 1.1
Transport	ETS 300 019-1-2, Class 2.3

<sup>1)</sup> max. 15°C over temperature between subrack / outdoor housing and ambient

#### 4.9 Electromagnetic Capability and Emissions

General Requirements	ETS 300 386-1
Electromagnetic Capability	EN 50082-1 / EN 50083-2
Electromagnetic Emissions	EN 55022 / EN 50083-2

The opt. return path transmitter complies with CE-requirements.